

ELECTRIC VEHICLE CHARGING STATION

SERVICE MANUAL

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KEEP TO USE IN THE FUTURE

Zielona Góra 2024

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1. IMPORTANT SAFETY INFORMATION / INSTRUCTIONS IMPORTANTES CONCERNANT LA SÉCURITÉ

1.1. SAVE THESE INSTRUCTIONS/CONSERVER CES INSTRUCTIONS:

- This manual contains important instructions for Models AXON EASY that shall be followed during installation, operation and maintenance of the unit,
- The descriptions and drawings contained in this User Manual are for informational purposes only. Due to continuous product improvement, the manufacturer reserves the right to make technical changes to the product to improve the performance of the device and improve it without prior notice.
- Use of the charging station not in accordance with the recommendations of this manual, instructions for use of commercial components, inconsistent with the technical characteristics, as well as the use of factors inconsistent with the installation requirements will result in the loss of warranty rights.

1.2. COPYRIGHT PROTECTION

This service manual and the texts, drawings, photos and other elements contained therein are subject to copyright protection. Without written permission from the manufacturer, it is prohibited to reproduce the contents of the service manual in any form or manner (including excerpts) and to use and/or transfer its contents to third parties. Violation of the above shall result in the obligation to pay compensation.

1.3. PROTECTIONS SYSTEM



DANGER

Failure to take proper precautions will result in death or serious harm to health.



WARNING

Failure to take proper precautions can result in serious damage to health or loss of property.



CAUTION

Draws attention to an important piece of information about the product and its operation, the omission of which may result in improper operation of electric vehicle charging stations.

1.4. STANDARDS

- UL 2202: Electric Vehicle (EV) Charging System Equipment,
- UL 2231-1: Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements,
- UL 2231-2: Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection devices for Use in Charging Systems,
- SAEJ1772: Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler,
- SAE J3400 North American Charging System (NACS) for Electric Vehicles
- UL 991: Standard for Safety Tests for Safety-Related Controls Employing Solid-State Devices,
- UL 1998: Standard for Safety Software in Programmable Components,
- FCC class A - Standard 47 CFR Part 15: RADIO FREQUENCY DEVICES - rules and regulations for EMC,
- NFPA 70: National Electrical Code, Article 625.
- Canadian Electrical Code, Part I, CSA C22.1.

1.5. GENERAL INFORMATION



DANGER

Dangerous voltages are present in the charging station. Failure to heed this warning, or failure to act in accordance with the instructions in this documentation, could result in substantial property damage, severe personal injury, or even death by electrocution.



WARNING

Failure to take proper precautions can result in serious damage to health or loss of property.



CAUTION

Only qualified personnel may work on the charging station. Such personnel must be thoroughly familiar with all the safety instructions contained in this documentation, the conditions, the method of installation and operation of the device, and the means of maintaining the device in good condition.

- Danger of electric shock! The charging station contains large capacitance values, so electrical voltage may persist inside the unit after the supply voltage is turned off.
- Children and outsiders should be prohibited from accessing the device.
- The device may only be used for the purpose specified by the manufacturer. Any modification and use of spare parts not sold or recommended by the manufacturer may result in electric shock or damage to the device.
- Correct operation of the device is related to proper storage, safe transportation to the installation site, and professional connection and maintenance of the device. Instructions on the above aspects are given in the following section of the documentation.
- This documentation should be kept near the device and made available to all users as needed.

- If it is necessary to take measurements at a live device, observe safety rules and use technically sound measuring instruments.
- Repairs to the device can only be performed by a person with an electrical state certificate and EVITP license (authorized service centers). Self-repair can lead to electric shock and significant property damage both during repair and subsequent operation.
- The device requires an inspection every 12 months, which is a prerequisite for the safe operation of the device and the maintenance of the warranty.
- Work on electrical equipment may be performed only by personnel properly trained and authorized.



WARNING

It is forbidden to make any changes in the settings of security settings and interlocks of automation.



CAUTION

Keys to control cabinets must be in the possession of persons authorized to do so, and should be properly secured against retrieval by unauthorized persons.

1.6. SECURITY SYSTEM

The primary protection of the charging station from the power supply side is the automatic quick disconnection implemented through fuse links, additional protection in accordance with standards UL 508, UL 2231-1 is a residual current circuit breaker with characteristic A, which serves to protect people from electric shock at direct and indirect contact, also limits the consequences of damage to equipment, including the possibility of fire.

Protection against unwanted maneuvering of the fuse disconnecter is the padlock closure used in the disconnecter, which prevents accidental disconnection of the charging station's power supply.

On the charging connector side, an IT network arrangement is used in which all active parts are isolated from ground potential. In such a system, one ground fault does not pose an immediate danger. Galvanic separation is performed with transformers. An additional safety device is the output circuit insulation monitor, which checks the insulation level between the "DC+" conductor of the "DC-" conductor and the charging station ground. The electric vehicle is connected to the charging station ground when the charging connector is connected to the vehicle. The charging station monitors the insulation level of the vehicle during charging.

From the user's point of view, the basic protection is an enclosure made in the 1st class of protection (all accessible metal parts are connected to the protective PE wire).

The charging station is equipped with specialized connectors: CCS Combo1 (Type1). During charging, the plug is locked into the vehicle's socket, preventing its removal and providing protection against electric shock.

SAE J1772-compliant communication protocols are responsible for the smooth and safe operation of the charging process. It has a number of implemented functions that allow quick disconnection of the vehicle in emergency situations.

1.7. WARNINGS REGARDING EXISTING RESIDUAL RISK

Even though the manufacturer takes responsibility for the design and labeling of the device to eliminate risks when using the device, there are some parts of the risk that cannot be avoided.

When operating the device, the residual risk includes:

- Contact with a hot surface,

During inspection and maintenance work, residual risk includes:

- contact with a hot surface,
- electric shock.

1.8. DISTRIBUTION OF PICTOGRAMS INFORMING ABOUT RESIDUAL RISK

Warning labels and stickers have been placed on the charger to prevent dangerous situations during operation and maintenance work.

The table below provides explanations of each pictogram, and the drawings show the location of the markings.

Pictogram	Description of the risk
	Warning of electric voltage.
	Warning of hot surface.
	Warning of electromagnetic field.



Figure 1 Distribution of pictograms informing about residual risk

1.9. THE 5 SAFETY RULES

	CAUTION
Disconnect completely - this means that the electrical system must be disconnected from live parts on all poles.	

**CAUTION**

Protect yourself from accidental energization - effectively prevent accidental energization of the installation where work is in progress. This can be done by applying switch locks in place of unscrewed fuses.

**CAUTION**

Make sure there is no voltage in the installation - Is there actually no voltage left in the installation? Use a proper measuring/testing device, such as a voltage indicator, to check on all poles that the installation has been de-energized. Before you use the voltage indicator, make sure that the correct function is set in it.

**CAUTION**

Use grounding - if there is no voltage in the installation, connect the cables to the grounding system using a grounding device. Important: the relevant components must be grounded before they are short-circuited!

**WARNING**

Provide protection from contact with adjacent live components - According to the five safety rules, adjacent components are those in the nearby zone. If it is not possible to disconnect the electrical components located in the nearby zone, additional precautions must be taken before starting work. In this case, use insulating protective shutters or guards as protection against accidental contact.

2. INTRODUCTION

This service manual is the basic source of information for personnel conducting installation, inspection and repair activities. Scope of the use and operation conditions of the charging station have been described in the operation manual. Any user who proceeds to install, start and use the charging station, should thoroughly read this documentation and every time before starting, technical condition of the device must be checked.



WARNING

Note: The safety switch is used only to terminate charging in situations of danger to life or property. Use of the safety switch does not completely disconnect the power supply.

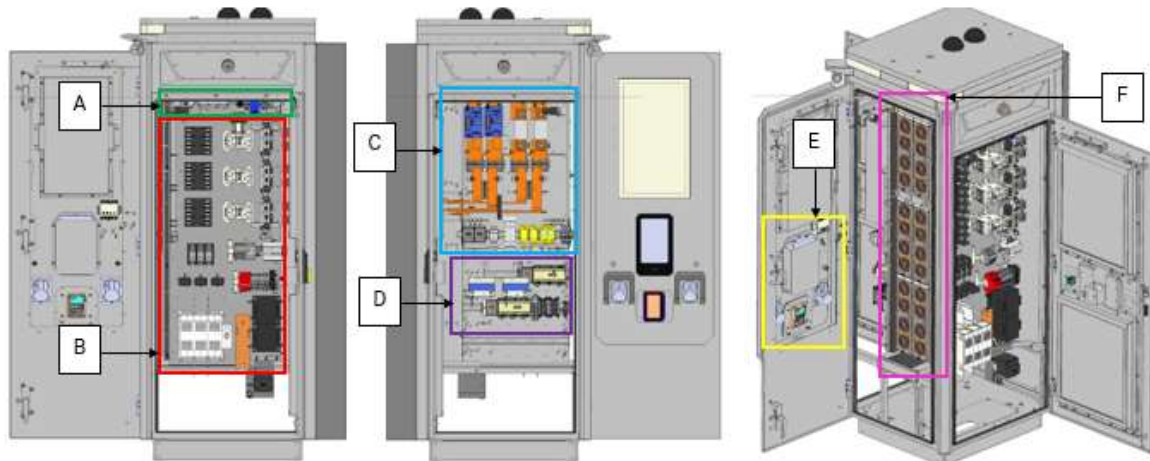


WARNING

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

3. ELECTRICAL CIRCUITS

The electrical circuits of the device can be divided into several major parts, which are shown in the figure below.



A	Charging station power supply
B	DC auxiliary power supply
C	DC output
D	Communication
E	User control panel
F	Power modules

Figure 2 General view of the charging station interior - block division

3.1. POWER SUPPLY FOR CHARGING STATIONS

The charging station is powered by 3 x 277 / 480 V AC mains. The function of main circuit protection is performed by a fuse disconnecter. Protection against electric shock for the power circuit is provided by a differential current monitor with relay LTR1, and for the control circuit the protection function is provided by a differential-overcurrent circuit breaker. The power supply of the power modules is switched on via the AC contactor. The station's AC input circuit also includes a surge arrester, a power meter and a 120V (-/+10%) service outlet, which is protected by a differential-overcurrent circuit breaker.

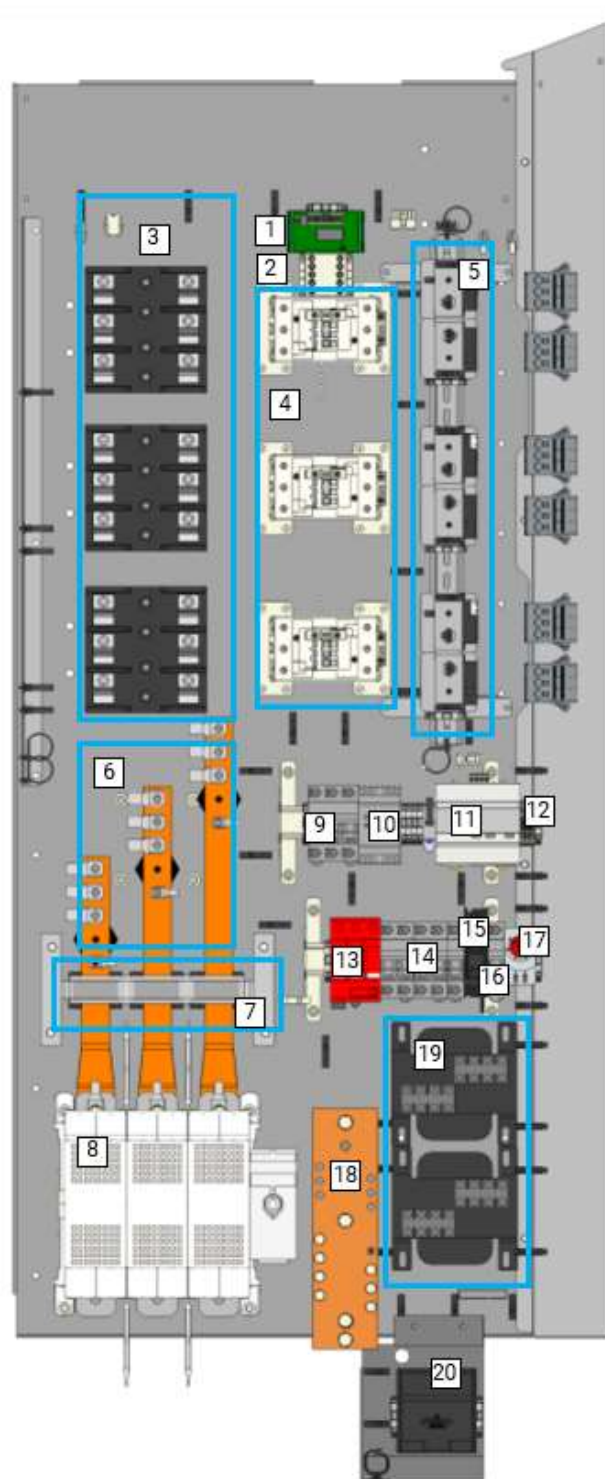


Figure 3 Charging station power supply equipment

Table 1 Overview of charging station power apparatus *

No.	Designation	Description	Quantity
1	-101K6	Latching system for RCM instruments	1
2	-101K4	Contactor Series 100-K 9A AC3 400V, 3xNO 1xNC, Coil 3.5W 24(17-30)V DC, SCCR 50kA 30A J-class or CC	1
3	-101F17 -101F14 -101F11	Reinforced fuse base type J100 A, 600 V AC/DC	3
4	-101K11 101K14 -101K18	Contactor Series 100-E 96A AC3 400V, 40VA coil, 100-250V AC/DC, SCCR 100kA 200A J-class	3
5	-101T18 -101T17.2 -101T15 -101T14 -101T12 -101T10	56mA current sensors 1 channel Current sensor Module	6
6	-101X2.1 -101X2.2 -101X2.3	L1, L2, L3 copper buses	3
7	-101T4.1 -101T4.2 -101T5	Current transformer, open 300A/5A	3
8	-101Q0	Fuse disconnecter 400A 600VAC, 250VDC, 3-pole, rotary, class J. SCCR 200kA.	1
9	-101F7	Fuse disconnecter, 3 field, fuse type CC, 30A. SCCR 200kA	1
10	-101K7	Voltage relay, 3 phases	1
11	-101P6	Energy meter iEM3255 measurement with transformer Ip/5 A Modbus MID	1
12	-101X4	WTP 2.5/4 through coupling	1
13	-101F2.2	SPD protector, T2 20kA, 277/480V AC.	1
14	-101F9.1 -101F16	Fuse disconnecter, 2 field, fuse type CC, 30A. SCCR 200kA	2
15	-101Q9	Miniature switch 1-pole 15A 120/240 V, 10KAIC	1
16	-101F18	Fuse disconnecter, 1 field, fuse type CC, 30A. SCCR 200kA	1

No.	Designation	Description	Quantity
17	-101S18	Thermostat KTO 011, 1ZR, 0..60°C	1
18	-XPE	PE rail	1
19	-101T9 -101T17.1	Control transformer, 500 VA, 240/480V(60Hz), 220/440V (50 Hz), 110V (50 Hz) /120V (60 Hz)	2
20	-101E18	CSL 028 400W solid-state blower, TH rail mounting	1

** The number of apparatuses depends on the chosen charging station variant*

3.2. POWER MODULES

The power modules are protected against overload. Each module is protected by a type J 100 A, 600 V AC/DC reinforced fuse base with a 100 A A4J fuse link. The power supply to the power modules is switched on via an AC contactor.

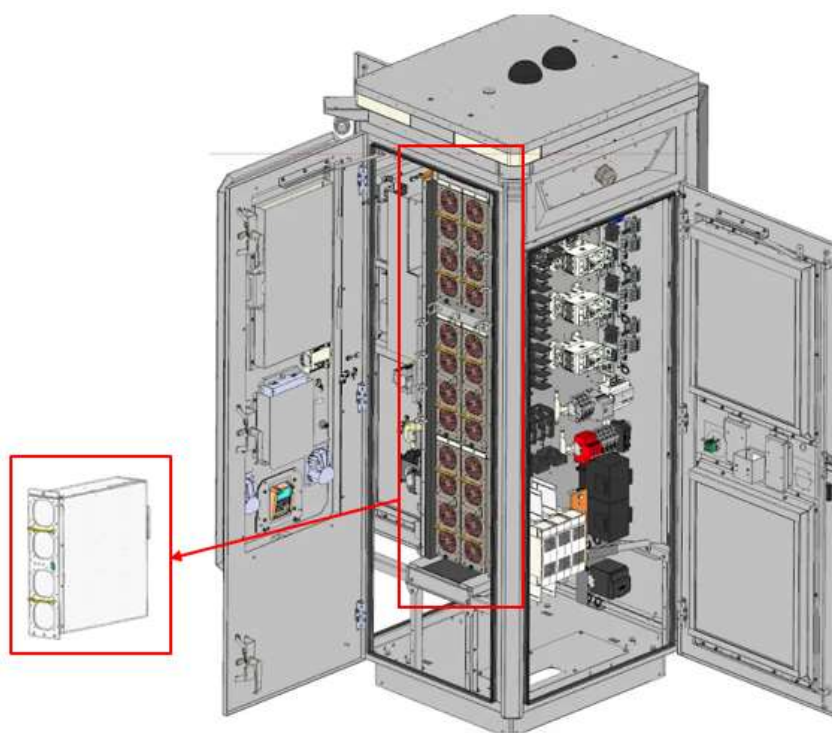


Figure 4 DC Charging station power modules

** The number of modules depends on the chosen charging station variant.*

** Depending on the number of power modules, the parameters of fuse links protecting the modules may vary.*

3.3. DC OUTPUT CIRCUIT

The output voltage from the power modules is adjustable from 150 VDC to 1000 VDC. DC circuits operate in an IT system, where there is no galvanic connection to the AC mains. The outputs of the power modules are connected in parallel on the switching buses of the DC power contactors. Switching on the DC contactor applies voltage and current to the charging connector. When using a single charging connector, the output power is combined through an additional contactor.

DC output circuits of power modules are individually protected by an internal fuse. In case of damage, the power module must be replaced. To prevent current flow in the grid direction, the power modules have built-in feedback diodes.

Additional protection of the DC circuits is provided by an insulation resistance meter, which serves to protect people from electric shock and also enhances fire safety by detecting a reduction in the insulation resistance level and signaling this condition to the charging station controller.

The DC circuit is also equipped with overcurrent protection (fusible links marked in *Figure 5 No. 2*) that protects two vehicles from short-circuiting.

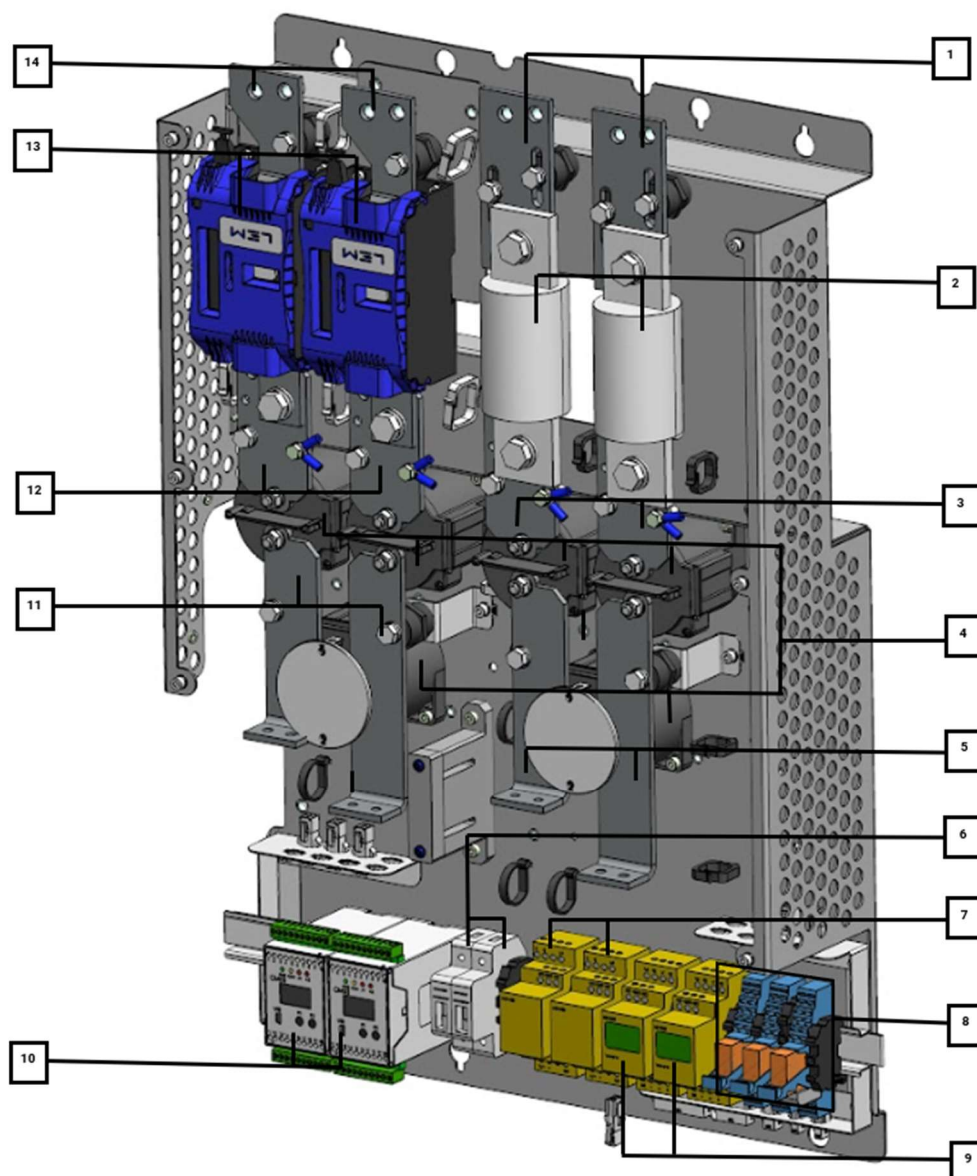


Figure 5 DC output circuit apparatus

Table 2 DC Overview of DC output circuit apparatus

No.	Designation	Description	Quantity
1	-401X11.1 -401X13.1	AE bus DC output plus	2
2	-401F11 -401F13	600A 1000V DC L/R fuse link insert	2
3	-401X11.2 -401X13.2	AE DC universal bus behind the contactor	2
4	-400K10.2 -400K14 -400K17 -400K10.1 -400K13 -400K16	DC contactor	6

No.	Designation	Description	Quantity
5	-401X11.3 -401X13.3	AE DC bus connecting contactors 2 plus	2
6	-402F1 -402F5	Detachable base	2
		Fuse link insert 1A 1000V DC GPV 10x38	
7	-402B1.1 -402B5.1	DC insulation status relays	2
8	-400K0 -400K2 -400K4	Relay coil surge suppressor, 24V DC, fits 700-HN	3
9	-402B1.2 -402B5.2	AGH 420	2
10	-402P5 -402P1	DC voltage and current converter	2
11	-401X1.3	DC contactor connection 1 minus	2
	-401X3.3	DC contactor connection 2 minus	
12	-401X1.2 -401X3.2	AE DC copper bus behind the contactor	2
13	-402P1.1 -402P5.1	DC meter	2
14	-401X1.1 -401X3.1	AE DC LEM bus/sidebar	2

** The number of apparatuses depends on the chosen charging station variant.*

3.4. COMMUNICATION AND CONTROL CIRCUITS

The control and signal circuits are designed to control and control the operation of the device. The control of the charging station is realized through the CLC5 modul.

The CLC5 type charging station controller is responsible for managing the vehicle charging process. The device is equipped with a CP (Control Pilot) line controller for communication with the vehicle being charged, as well as a battery backup system (UPS) for the main processor and wireless communication module, interfaces: CAN, RS485, Ethernet, and binary inputs and relay outputs. This makes it possible to control the operation of other charger components such as power modules, contactors, pushbuttons, measuring devices, etc. A version additionally equipped with a GSM LTE wireless communication module is also available.

The device responsible for information transmission and communication between the vehicle and the charging station is the PLC communication module (*Figure 8*), which converts

the information transmitted from the CLC5 main controller in accordance with IEC 61851-23, IEC 61851-24, and ISO 15118 and DIN 70121 through the PLC.

The CM03 transmitter allows measuring current, power, energy and other parameters in DC circuits. The device is equipped with CAN interface, USB-OTG and alarm relay.

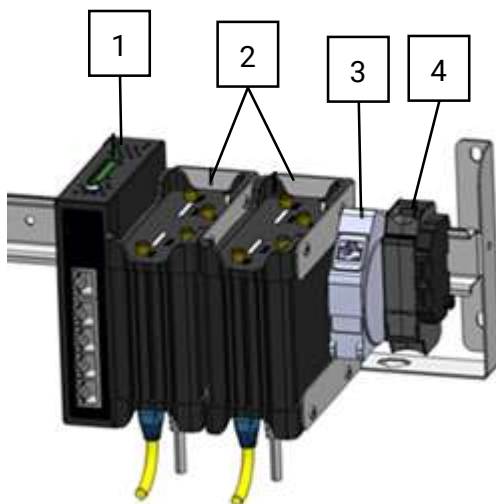


Figure 6 Communication module - overview drawing

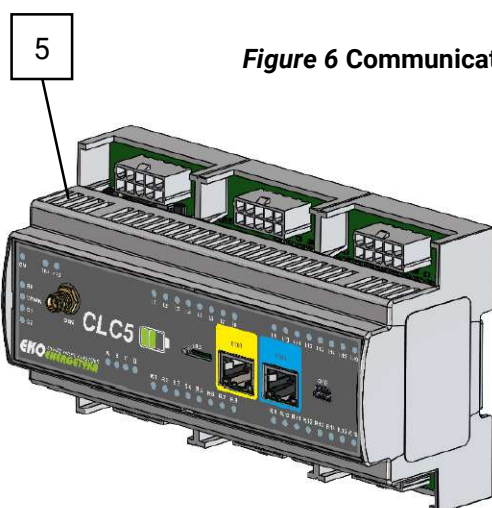


Figure 7 CLC5

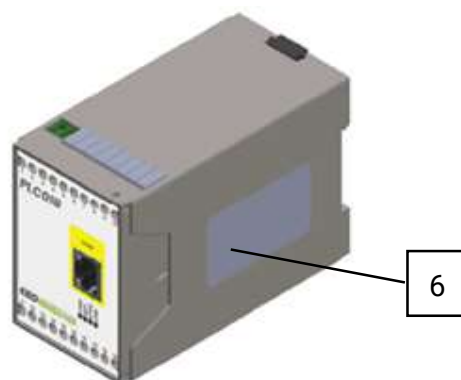


Figure 8 PLC01B

Table 3 Overview of communication and control circuit apparatus

No.	Designation	Description	Quantity
1	-1X2	Ethernet switch 5 port	1
2	-1X0 -1X0.2	Ruter RUT951	2
3	-3X5	CCAS-K6A-STP CAT 6A Keystone Module	1

No.	Designation	Description	Quantity
4	-3F5	RJ45 250MHZ protector	1
5	-1A6 -1A8	CLC5 - Charge controller module without UPS	1
6	-1X8 -1X11	PLC connector 2 CCS	1
		PLC connector 1 CCS	

** The number of apparatuses depends on the chosen charging station variant.*

The control circuits are supplied with voltage through a power supply unit. This module is responsible for protecting and supplying AC and DC power to the various devices included in the charging station. If the relays are damaged, they must be replaced according to the type and parameters of the component to be replaced.

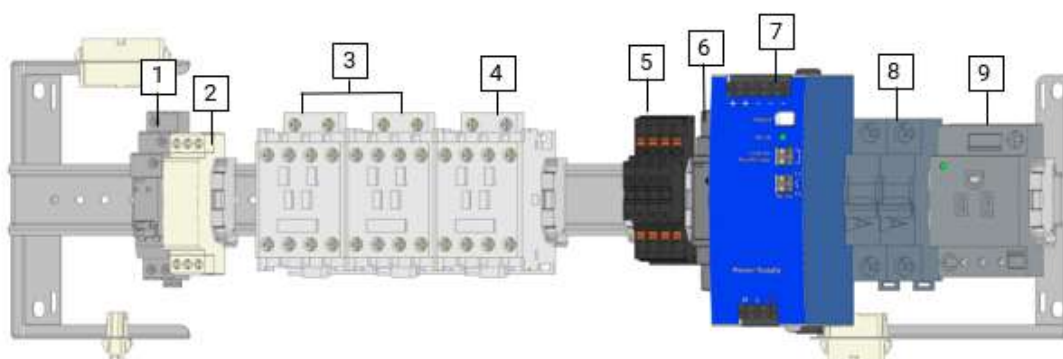


Figure 9 Auxiliary power supply

Table 4 Summary of auxiliary power apparatus

No.	Designation	Description	Quantity
1	-201K7	Hard Reset	1
2	-201K9	Timer Relay	1
3	-201K5 -201K11	Relay - type CF 4 P DC, 4 ZZ, 24VDC	2
4	-201K17	Relay - type CF 4 P AC, 4 ZZ, 120VAC	1
5	-201Q1 -201Q2 -201Q4 -201Q12	5A FF fuse	4
6	-201T3	DC/DC converter type DDR-15G-12, 12V, 1.25A, DIN	1
7	-201T4	24VDC main power supply	1
8	-201Q14 -201Q18	Overcurrent circuit breaker C, 4A, 1P	2
9	-201X19	Socket EO- AB/UT/LED/15 for DIN rail Front plug type AB 15A screw connection, 125V AC	1

** The number of apparatuses depends on the chosen charging station variant.*

The signaling circuits include a control panel consisting of the following components:



1	Advertising screen
2	Touch display integrated with RFID reader
3	Charging connector no. 2 Combo-1 (Type 1)
4	NFC payment terminal
5	Charging connector no. 1 NACS
6	Safety switch

Figure 10 Location of connectors and user interface elements on the station

The user panel is shown in *Figure 10*. Pressing the safety switch button disconnects the power supply to the AC contactor coil, DC contactor coil and control circuits. Restarting the device is possible only after unlocking the safety switch button by pressing it out.

Note! Resetting the charging station by pressing the safety switch in the event of a fault 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 is complete and only then perform a charging station reset.

4. CONNECTING INSTRUCTION

4.1. CHARGING STATION SUPPLY CABLES CONNECTING INTRODUCTION

Figure 11 shows the power connection point of the charging station. To connect the power cords, follow these steps:

- remove the terminal cover,
- insert the cables into the charging station through the connection bushing,
- connect the prepared conductors: L1, L2, L3, G.

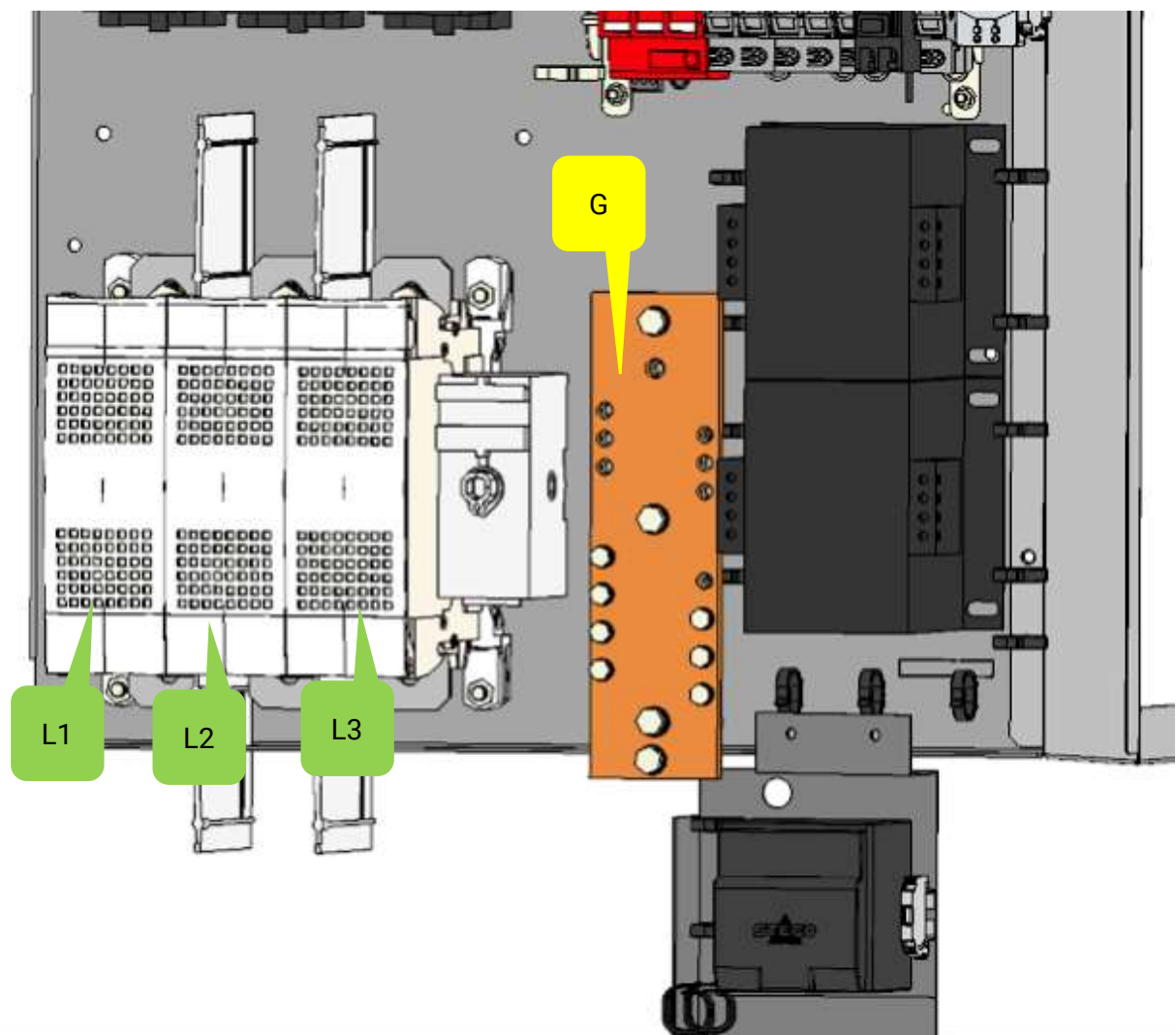


Figure 11 View of the charging station power supply point

5. DIAGNOSTICS

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

A failure during charging is indicated by an error message displayed on the screen and the ambient LED lighting illuminating red. In the event of any failure, it is necessary to discontinue use of the charging station and to follow the instructions below.

In the event of a failure or disturbance in the operation of the charging station, follow the steps below:

- Pull the plug out of the vehicle,
- Reset the vehicle,
- when the information about starting charging appears on the screen and when the ambient LED lighting illuminates green, connect the plug and try charging again.

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;
- when the information about starting charging appears on the screen and when the ambient LED lighting illuminates green, connect the plug and try charging again.

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



CAUTION

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.

6. PERIODIC CHECKS OF THE CHARGING STATION

6.1. PERIODIC CHECKS

Electric vehicles charging stations require periodic inspection conducted every 12 months by authorized service. The inspections ensure safety and proper operation of the charging station. This type of inspection must be conducted every time after any additional service works. Two people should be present during the performance of inspection.

Inspection consists of:

- detailed visual inspection of the device – visual assessment of mechanical condition on the outside of the housing and on the inside of the housing,
- examination of the electrical installation – inspection in the context of 12-months intervals allowing for the verification of proper operation and functioning of the electric and electronic installation. Every 5 years, measurements of electric shock protection must be conducted.

6.2. VISUAL INSPECTION

During visual inspection, the power supply of charging station must be turned off, unless the specific inspection points require to be checked with enabled power supply. To do this, you need to disconnect main protection i.e., isolating switch. During visual inspection of the charger, service doors should be opened to provide free access to all components inside the device.

During inspection, you need to pay particular attention to:

- technical condition of the charging cable and connector,
- the technical condition of the charging connector protection socket,
- any mechanical damages of the device housing,
- occurrence of corrosion in places particularly exposed to atmospheric conditions,
- technical condition of the locks in the inspection doors,
- technical conditions of the gaskets on inspection doors and protective walls,
- presence of water inside the housing of charging station,
- technical conditions of the cable grommets,
- presence of nameplate,
- correctness and stability of the assembly of individual components of the device,
- contamination level of filters in the ventilators and their permeability.

6.3. GUIDELINES FOR THE PERIODIC INSPECTION OF THE CHARGING STATION

As part of the periodic inspection of the charging station, check the cleanliness inside the station. To perform periodic maintenance inside the station:

- open the interior of the station in accordance with the instructions in point 9.1,
- disconnect the charging station from the power supply and wait 5 minutes to allow the device components to discharge,



DANGER

Failure to take proper precautions will result in death or serious damage to health.

- clean all dirty elements with a soft cotton cloth or materials designed for dry cleaning, remembering to avoid strong rubbing,
- clean any dirt from all insulators in the station (overview drawing of insulators below),



Figure 12 Illustrative drawing of insulators

- vacuum the floor of the charging station with an industrial vacuum cleaner without removing the covers of the power cables (although the power supply of the charging station is disconnected, voltage may still be present in the power cables). Particular care should be taken when working in close proximity to power cables,
- check the degree of contamination of the filters - replace, if necessary, in accordance with point 9.4.



WARNING

Under no circumstances should you clean the inside of the station with water or liquid solutions!

If there are gaps in the seal or other openings through which dirt can penetrate, repair and seal at the charging station.

Due to the location of the charging station in the municipal infrastructure, cleaning activities should be performed:

- once every 3 months,
- in case of heavy soiling,
- each time before the winter season.

Maintenance should be performed by authorized persons who are familiar with the guidelines.

6.4. CHECKING THE ELECTRIC INSTALLATION

During every 12-month inspection, visual and basic control of the electric installation must be conducted by electrician with operational authorization for electric devices up to 1 kV.

During inspection of the electric installation, the following elements should be carefully examined:

- condition of the wire insulation,
- condition of the electric connections.



WARNING

Failure to take proper precautions can result in serious damage to health or loss of property.

At the same time, the following elements should be checked:

- presence of all phases supplying the charging station (after enabling the voltage),
- condition of the protections of individual circuits,
- correct operation of differential current switches with the use of testing button,
- whether the voltage is correct on the service sockets inside the charging station,
- condition of the voltage of batteries sustaining the operation of main electronic module in the case of power failure (if any),

- technical condition and functioning of the safety switch- pressing of this button results in disabling of the safety, which is responsible for feeding the power to the control electronics,
- whether the automatic breakers have been replaced for the improper ones,
- whether the fuse links have been replaced for the improper ones,
- whether the modifications have been implemented that are not compliant with electric diagram of the device,
- whether the protective wires have been removed (which can exist as separate wires) in the protection system against electric shock (ground).

During the 5-year inspection, the measurements and testing of the anti-shock installation should be carried out by a person with an electrical state certificate and an EVITP license.

Range of the measurements includes:

- measurement of trigger current of differential current switch,
- measurements of insulation resistance of the device,
- measurement of the PE circuit continuity,
- measurement of earth fault loop impedance test.



WARNING

Failure to take proper precautions can result in serious damage to health or loss of property.

6.5. CHECKING THE TIGHTENING TORQUES OF THE INSTRUMENTS

For stationary charging stations, check the tightening torques of the following components once a year. Use a torque wrench for this procedure.

Table 5 Tightening torques of instruments

Symbol	Catalog	Description	Manufacturer	Quantity	Tightening Torque
-400K10.1 -400K10.2 -400K13 -400K14 -400K16 -400K17	EVHB500A-24S/G	DC contactor	YM Tech Co., Ltd.	6	3,1-4,0 Nm

Symbol	Catalog	Description	Manufacturer	Quantity	Tightening Torque
-201K9	700-FEM6TZ12	Hard Reset Timer Relay	Allen-Bradley	1	0,8 - 1,2 Nm
-201K5 -201K11	700-CF400EJ	Relay - type CF 4 P DC, 4 ZZ, 24VDC coil	Allen-Bradley	2	1 - 1,5 Nm
-201K17	700-CF400D	Relay - type CF 4 P AC, 4 ZZ, 120VAC coil	Allen-Bradley	1	1 - 1,5 Nm
-201Q14 -201Q18	278553	Overcurrent circuit breaker, C, 4A, 1P	Eaton	2	2,4 Nm
Next inspection: - once a year - stationary chargers					

For devices that are not listed in the tightening torque table, please refer to the manufacturer's documentation.

Table 6 Tightening Torque for Pressure Wire Connectors Having Screws

Size of wire that shall be used for connection of the unit		Tightening torque, N·m (pound-inches)			
		Slotted head No. 10 and larger ^a		Hexagonal head – external drive socket wrench	
AWG / kcmil	mm ²	Slot width – 1.2 mm (0.047 inch) or less and slot length 6.4 mm (1/4 inch) or less	Slot width – over 1.2 mm (0.047 inch) or slot length over 6.4 mm (1/4 inch)	Split-bolt connectors	Other Connections
18 – 10	0.82 – 5.3	2.3 (20)	4.0 (35)	9.0 (80)	8.5 (75)
8	8.4	2.8 (20)	4.5 (40)	9.0 (80)	8.5 (75)
6 – 4	13.3 – 21.2	4.0 (35)	5.1 (45)	18.6 (165)	12.4 (110)
3	26.7	4.0 (35)	5.6 (50)	31.1 (275)	16.9 (150)
2	33.6	4.5 (40)	5.6 (50)	31.1 (275)	16.9 (150)
1	42.4	–	5.6 (50)	31.1 (275)	16.9 (150)
1/0 – 2/0	53.5 – 67.4	–	5.6 (50)	43.5 (385)	20.3 (180)
3/0 – 4/0	85.0 – 107.2	–	5.6 (50)	56.5 (500)	28.2 (250)
400	203	–	5.6 (50)	93.2 (825)	36.7 (325)
500	253	–	5.6 (50)	93.2 (825)	42.4 (375)
600 – 750	304 – 380	–	5.6 (50)	113.0 (1000)	42.4 (375)
800 – 1000	406 – 508	–	5.6 (50)	124.3 (1100)	56.5 (500)
1250 – 2000	635 – 1016	–	–	124.3 (1100)	67.8 (600)
NOTE – Connectors having clamping screws with multiple tightening means (for example, a slotted, hexagonal head screw) shall be tested using both values of torque.					
^a For values of slot width or length not corresponding to those specified, select the largest torque value associated with the conductor size. Slot width is the nominal design value. Slot length shall be measured at the bottom of the slot.					

7. EQUIPMENT OF THE AUTHORIZED SERVICE FACILITY

Set of tools needed to carry out periodic inspections of the charging stations:

- set of Allen keys,
- set of flat keys,
- dynamometric key,
- set of insulated tools (flat and cross screwdrivers, side pliers, combination pliers, knife, stripping tool, voltage tester),
- a handle for replacing knife fuses,
- digital multimeter,
- crimping tool for wires up to 5 AWG [0.63 in],
- inspection machine,
- a set of cleaning agents,
- spirit level.

8. SUMMARY OF THE BASIC CONTROL AND SERVICE ACTIVITIES ALONG WITH INFORMATION REGARDING APPLICABLE TOOL AND MEANS OF PERSONAL PROTECTION



CAUTION

All the following procedures must be carried out with the use of technically operational tools and they must be used as intended. During each step, you need to take all necessary precautions and focus on the conducted activity.

Table 7 Summary of control and service activities

Periodic checks of the charging station			
Tasks	Necessary tools	Protection measure	Remarks
Opening the service doors	Keys for locks	none	none
Disconnection of security.	none	none	The switch disconnecter's knob enables safe disconnection of the circuit without the use of additional tools. Be careful when switching on and off.
Visual inspection: - mechanical damage of the housing, - occurrence of corrosion - condition of the door locks, - presence of water within the housing, - condition of the cable gland, - presence of the nameplate, - presence of electric diagrams, - condition of the charging station equipment installation,	Flash light inspection	Protective gloves are recommended here.	none

Periodic checks of the charging station			
Tasks	Necessary tools	Protection measure	Remarks
- functioning of the external and internal illumination (when the power is on), - control of signalization on the operator panel (when power is on).			
Visual inspection (service activity): - the level of filter contamination by ventilation grilles and its replacement.	Socket wrench or flat spanners	none	In order to inspect the filter, unscrew the cover.
Visual inspection of electrical charging stations: - condition of electrical connections. - condition of the short-circuit, - checking the correctness of security, - checking the presence of all compensatory connections, - security status of each circuit, - RCD test using the 'test' button.	Flash light inspection	Protective gloves are recommended here.	none
Checking the operation of the electrical system (with the power on): - presence of the supply phases. - voltage at the service socket inside the charging station, - state of the battery voltage supporting the functioning of the control modules, - functioning of the safety switch.	Voltage tester, digital multimeter	none	These measurement procedures should be carried out with technically proficient insulated tools. Use extreme caution when working with the power on!
Replacement of a faulty DC contactor.	Set of wrenches, Insulated tool set.	For the described activity it is recommended to use protective gloves.	none

9. REPAIR INSTRUCTIONS



DANGER

Before making any service work make sure that the charging station is disconnected from the power supply, then wait 5 minutes for the capacity to discharge and check that there are no dangerous voltages on the terminals.

9.1. OPENING SERVICE DOORS

To open the side service door, use the supplied keys to open the locks by turning the key to the right. Then tilt the handle towards you, turn it to the left and pull the door (*Figure 13*).

If the lock is not locked with the key, the door can be reopened at any time.

To close the door, follow the steps described above in reverse order.



Figure 13 Opening the service door

9.2. REPLACEMENT OF THE POWER MODULE

In order to replace a single module, disconnect the charging station and wait 5 minutes for the wiring to discharge, then open the interior of the device, as described in item 9.1 and proceed as follows:

- undo the bolts securing the module (marked red) and remove the module, by pulling the handles,
- put a new power module in the holder and screw the bolts back in.

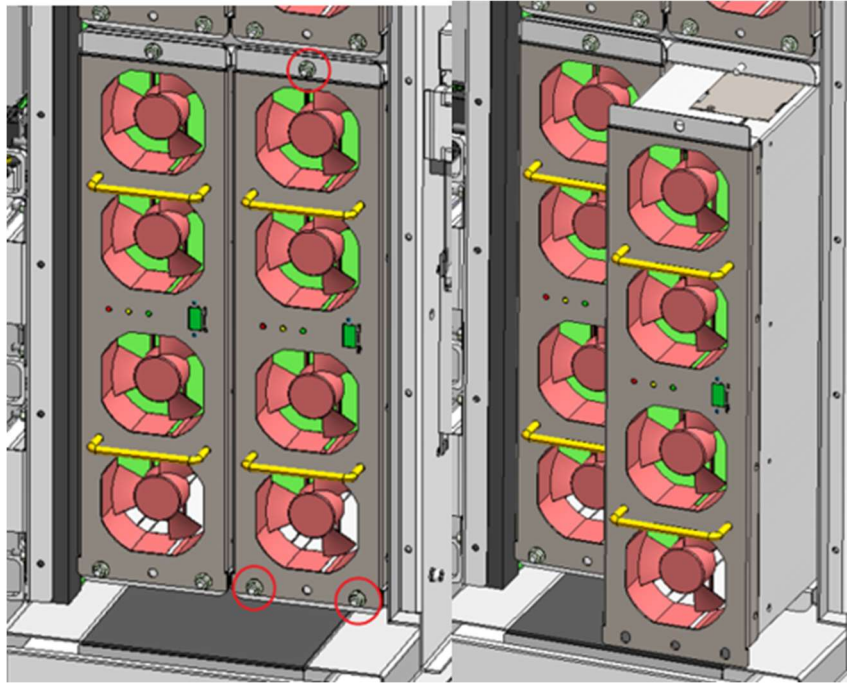


Figure 14 Installation of power modules

9.3. PARTICLES FILTERS CHANGING

In order for the unit to function properly, it is necessary to change the filter mats regularly, which should be replaced at least every 6 months or when they become heavily soiled.

9.3.1. REPLACING THE FILTER MAT ON THE SIDE DOORS

To replace the filter mat, perform the following steps:

- open the side door (*Figure 15*),

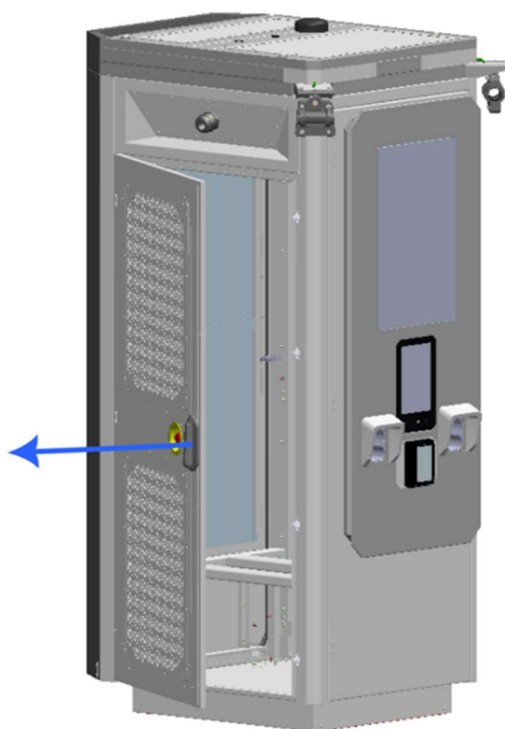


Figure 15 Opening the side doors

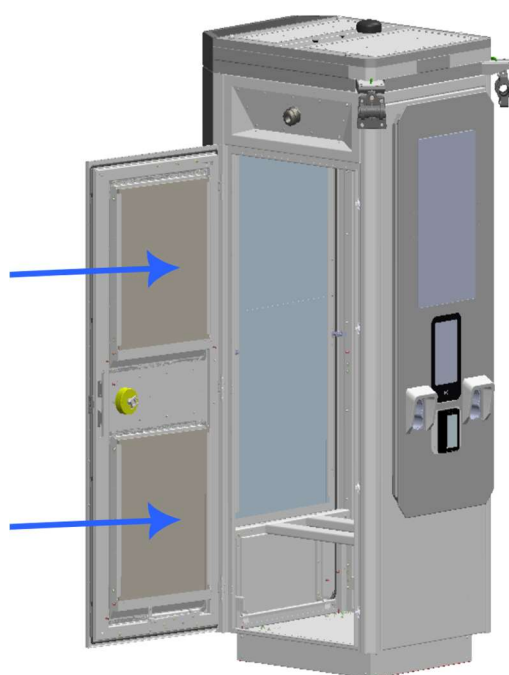
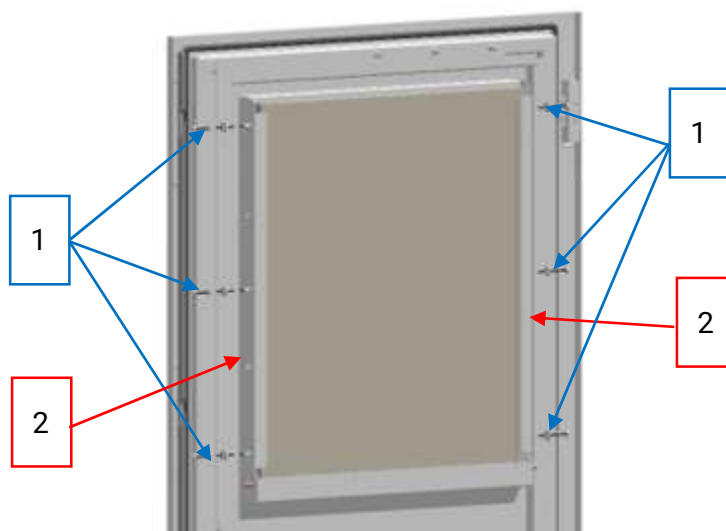


Figure 16 Location of filter mats

- dismantle the mounting brackets by unscrewing the nuts (*Figure 17*),



1	Butterfly nut M5, A2 with expanded washer M5 (6 pieces each)
2	Fixing angle (2 pcs.)

Figure 17 Removal of filter mats

After dismantling the filters, clean the installation place for the new filters. Before installation, pay attention to the gasket located on the filter. The gasket must face towards the the door ventilation grills. The new filters (4 x Mann + Hummel M+H 1566296P02 CPMC panel filter (right door + left door) with dimensions of 19.69 x 22.60 x 1.02 inches should be installed in reverse order of removal. Replacing the bottom filter looks the same as the top filter.

9.3.2. REPLACING THE FILTER ON THE REAR PANEL

To replace the filter mats on the rear panel:

- dismantle the exhaust duct sheet (unscrew the 5 M5 Allen screws shown in *Figure 18*),

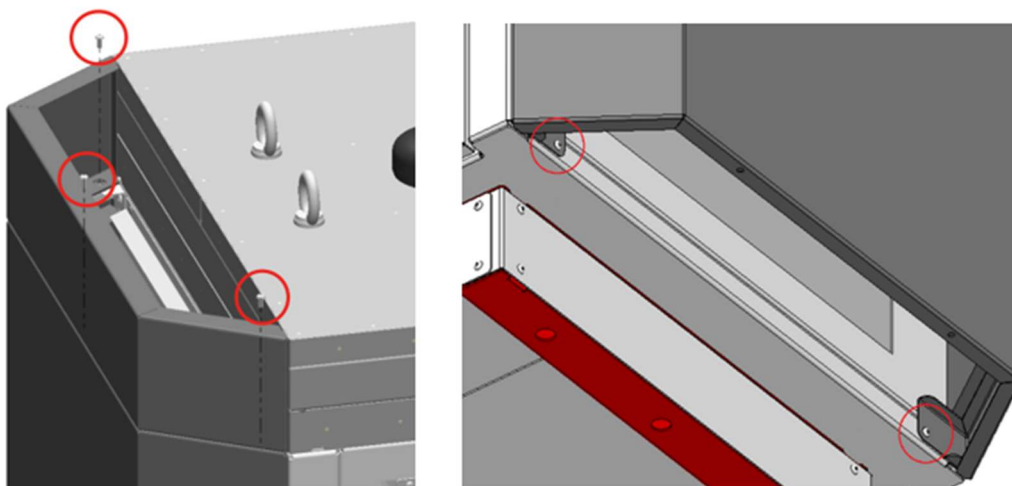


Figure 18 Dismantling the exhaust duct sheet metal

- lift the exhaust duct panel and then remove the sheet towards you to access the rear door where the filter mats are located,
- open the lock with the key (blue arrow), then press locks (black arrow),

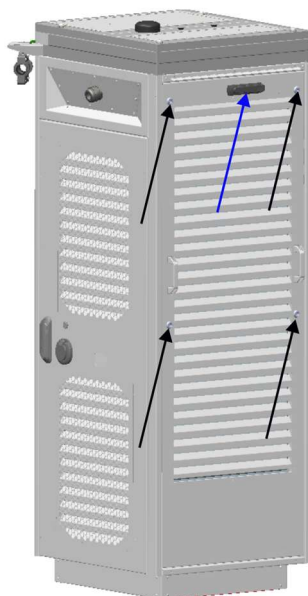


Figure 19 Locks on the rear doors

- holding the handles, lift the rear doors and pull them towards you (*Figure 20*).

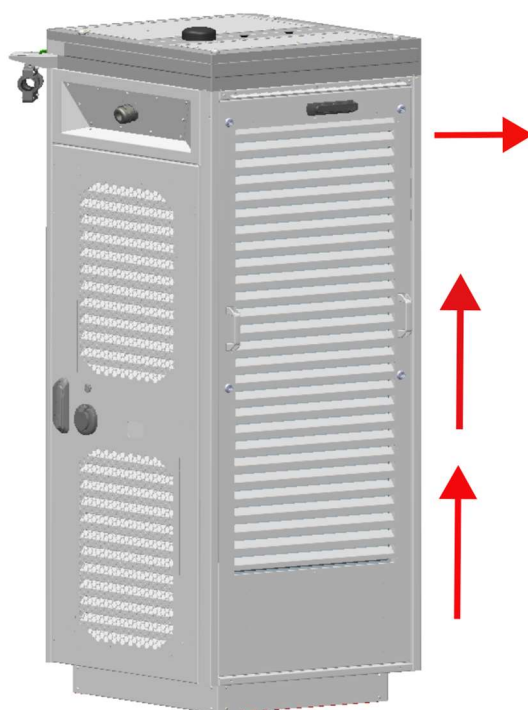


Figure 20 Removing the rear door

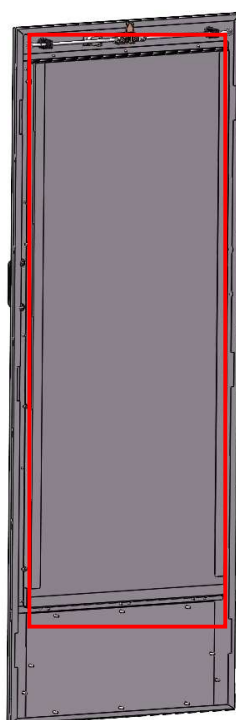
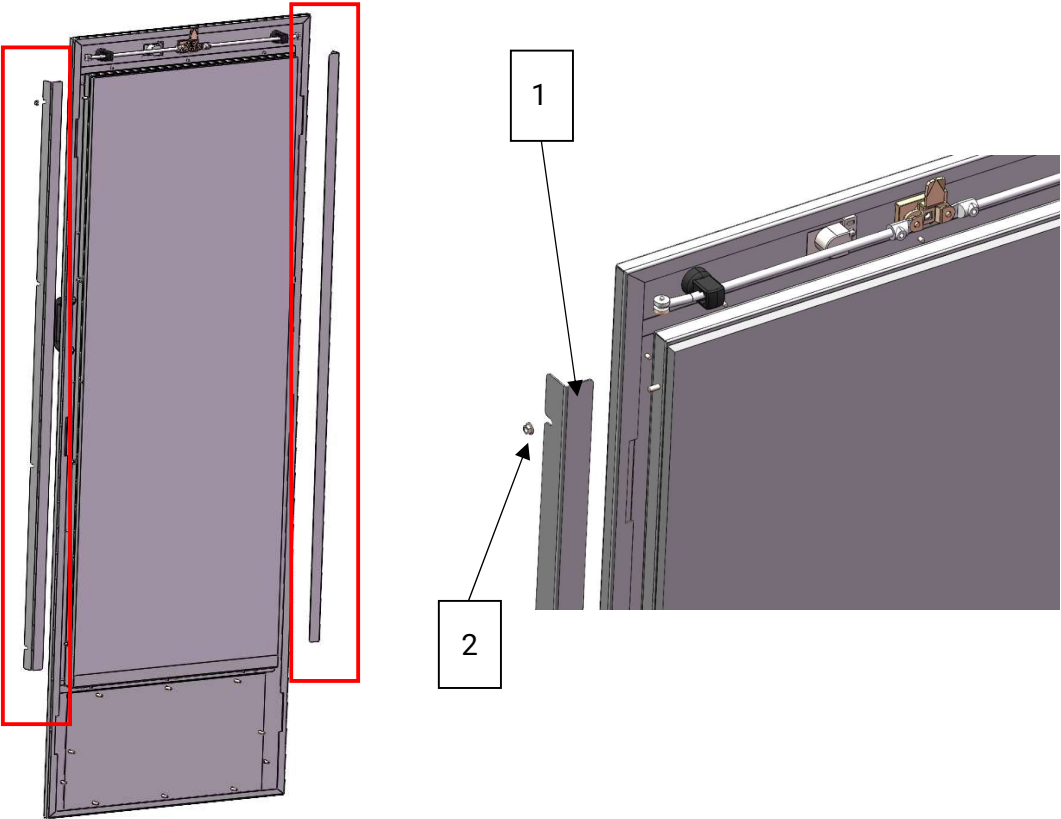


Figure 21 Location of filter in the rear doors

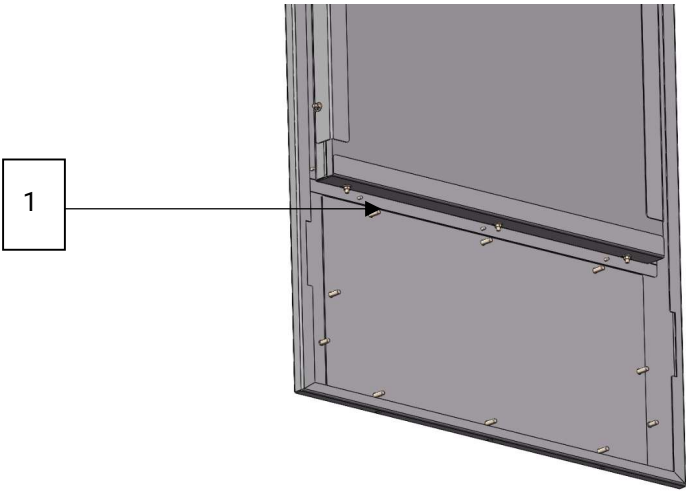
- loosen the marked nuts on both sides of the filter,



1	Side mount rear panel (2 pcs.)
2	M5 nut (8 pcs.)

Figure 22 Filter mounting in the rear panel

- slide out the side mounting of the filters and, if necessary, loosen the lower support (Figure 23) and replace the filters.



1	Filter support
---	----------------

Figure 23 Bottom support

New filters (1 x Mann + Hummel M+H panel filter 1566464P02 NA) with a dimension of 23.23 x 56.30 x 0.50 inches should be installed in the reverse order of removal.



CAUTION

Attention! When placing new filters, pay special attention to the surface of the filter frame on which the gasket is located - it should be directed towards the door ventilation grilles.

After installing the new filters, reinstall everything in the reverse order of removal.



CAUTION

Attention! When installing the door, reconnect the cable grounding. Pay special attention to this wire in this process - it cannot be pressed against the door.

9.4. INSTALLATION OF CMS IN THE HOUSTING



CAUTION

Two people should be present when replacing the balancer.

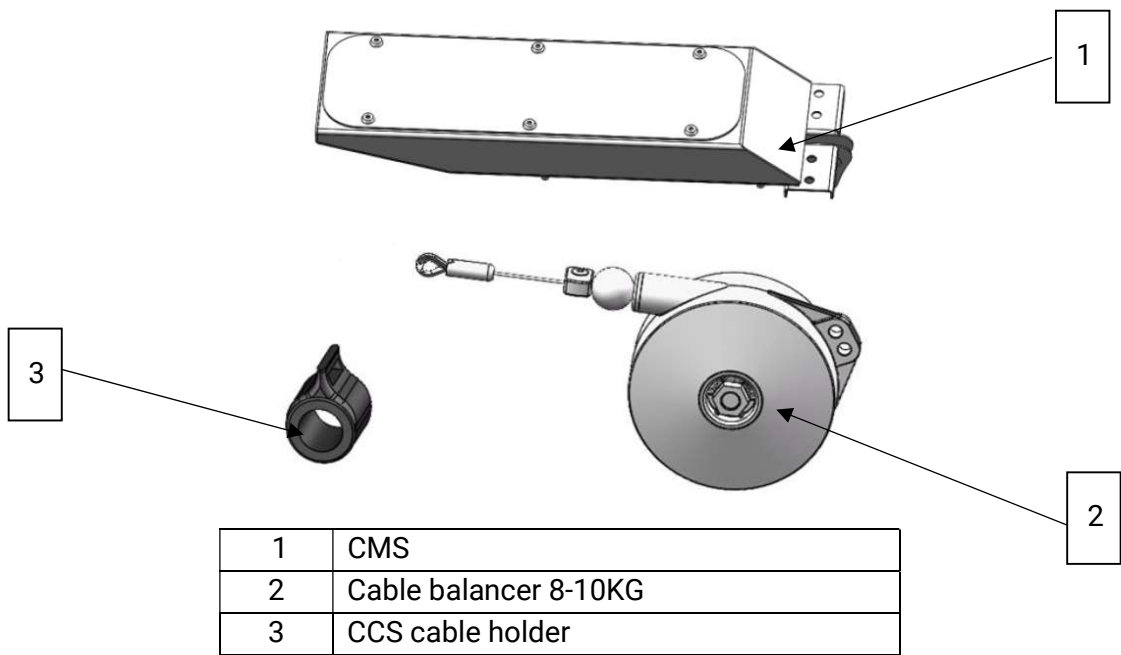


Figure 24 CMS components

To install the CMS, you need to:

1. fix the balancer under the roof of the housing.

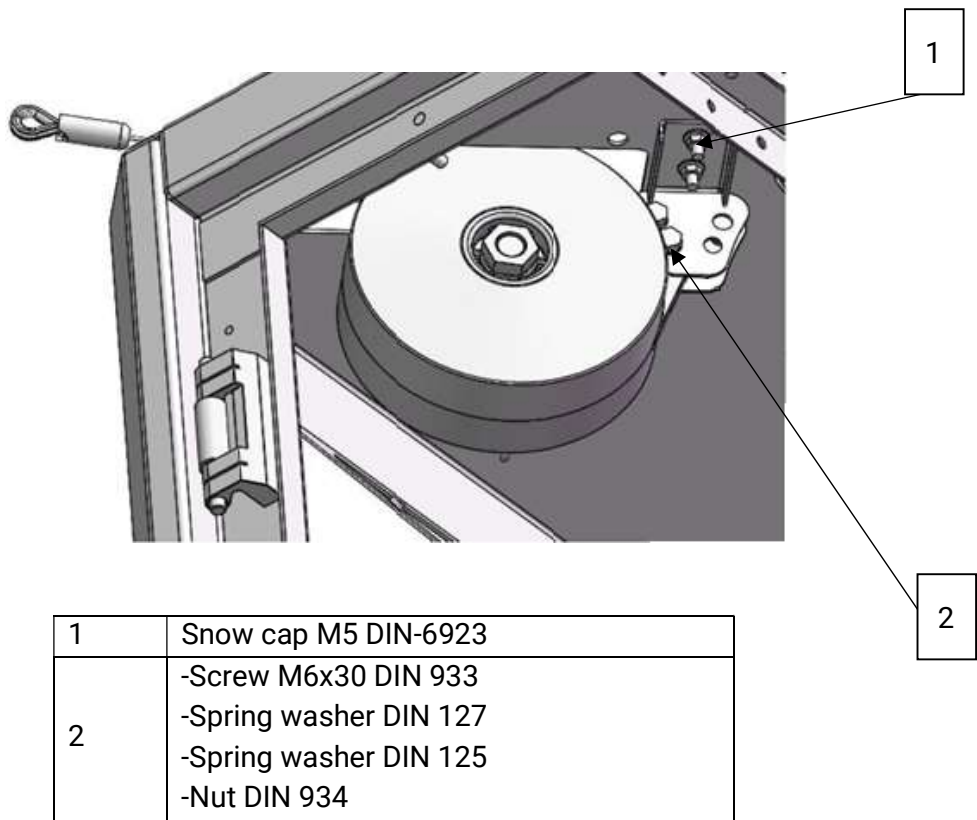


Figure 25 Installation of the balancer under the roof of the housing

2. Place the gaskets on the CMS housing and cover.

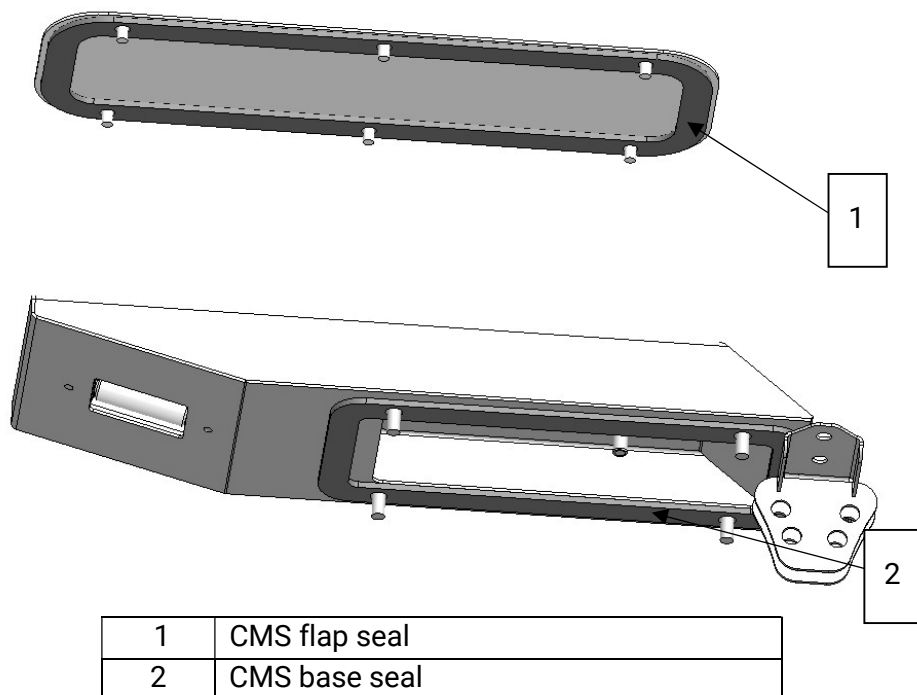


Figure 26 Seal installation location

3. Attach the CMS body and feed the balancer cable through the CMS rollers.

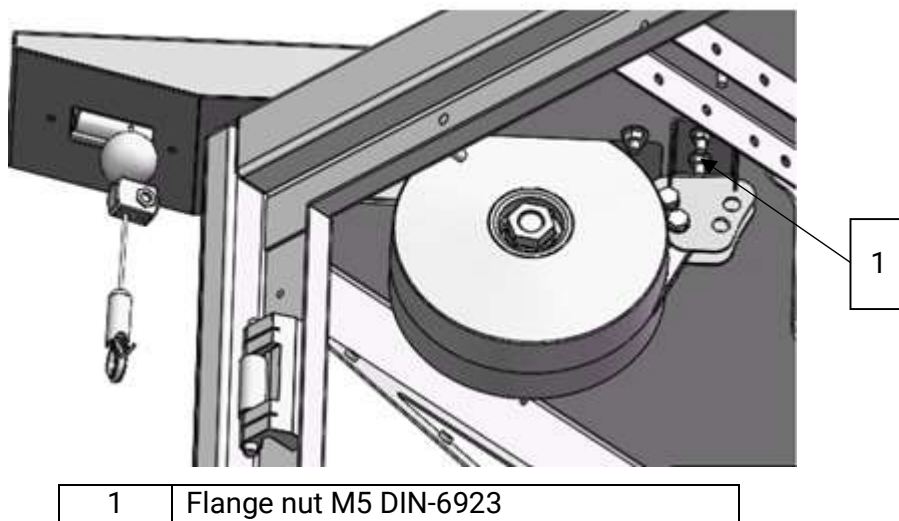


Figure 27 Installation site

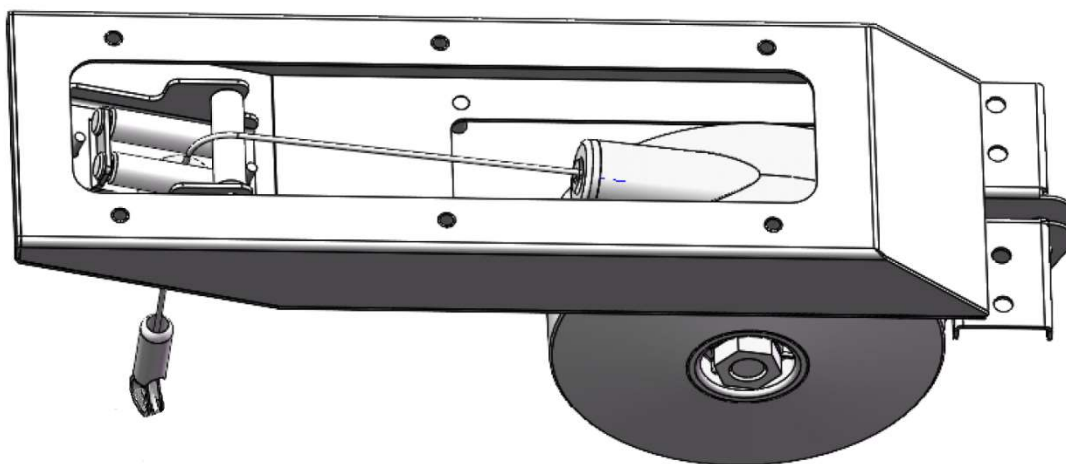


Figure 28 Method of feeding balancer cable through CMS rollers

4. Attach the CMS cap (screws supplied with 0-001330 - CMS from the supplier) the cable holder should be attached to the CCS cable, then this holder should be attached to the balancer.

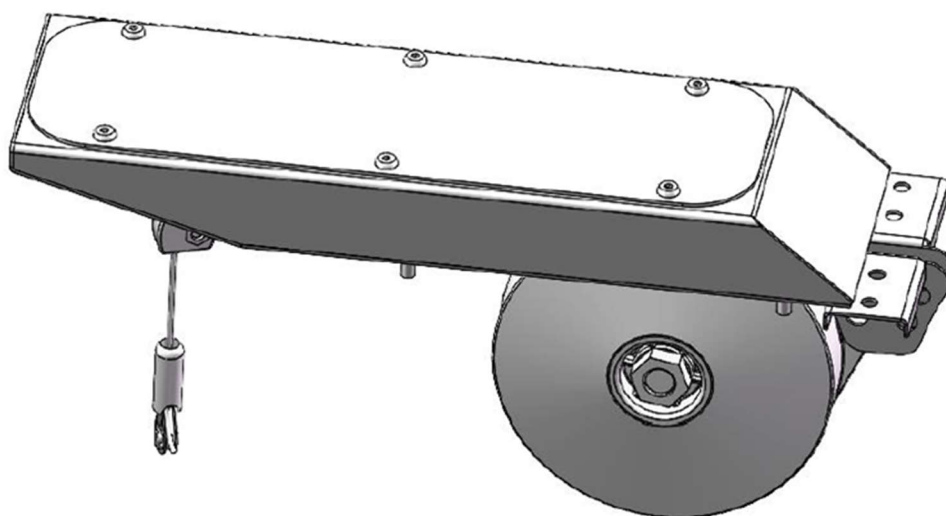


Figure 29 CMS cap installation method



Figure 30 Mounting the CCS cable holder to the balancer



CAUTION

The balancer should be set to a load capacity of 22,05 lb (maximum load capacity), adjustment instructions are on the balancer.



WARNING

All operations should be performed carefully, taking special care!

To remove the balancer for replacement with a new one, repeat all steps in reverse order.

9.5. TESTS OF SAFETY DEVICES

In order to perform the **safety switch** efficiency test, follow these steps:

- run the charging process,
- press the safety switch,
- check whether the screen displays information that the charging process has been interrupted and whether the Ambient LED lighting is red.

If the display shows a message about the interrupted charging process and ambient LED lighting turns red, it means that charging has stopped and the safety switch is working properly.

9.6. MEASURING OF RESISTANCE INSULATION

To test the effectiveness of the **insulation resistance meter**, open the inside of the instrument as described in chapter 9.1., then proceed as follows:

- start the charging proces,
- connect the resistors at the test points and perform the tests (*Figure 31*).

It is recommended to use 1.5W 200k Ω and 5W 50k Ω resistors to measure the insulation

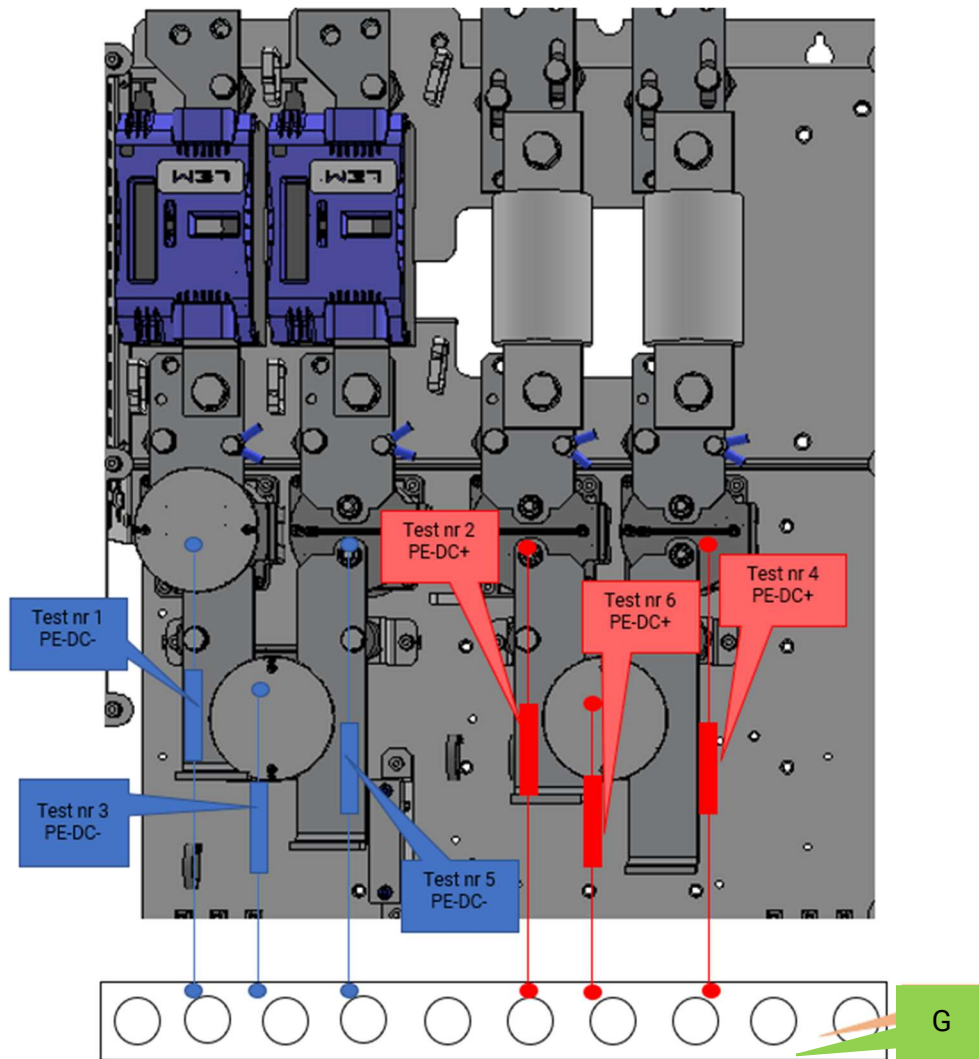


Figure 31 Insulation resistance tester performance test

The insulation meter has two alarm threshold:

- 1st threshold - 500k Ω - warning about insulation drop,
- 2nd threshold - 100k Ω – alarm, stops the charging process.

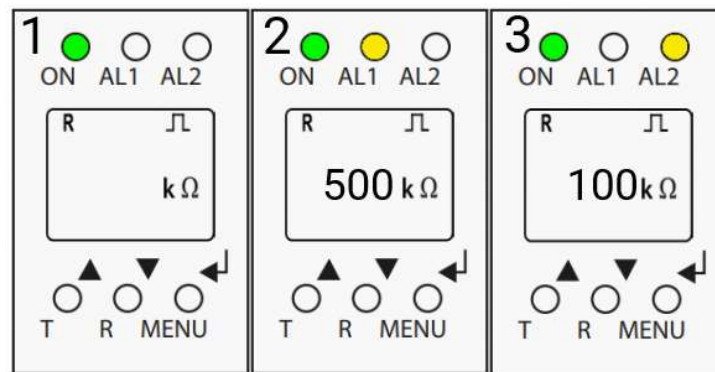


Figure 32 Operating states of insulation resistance meter: 1 - device is operating, 2 – 500 k Ω warning on, 3 – 100 k Ω alarm on.

10. CHECKING THE INSULATION

10.1. TEST FOR ISULATION MONITOR/INTERRUPTERS



DANGER

When measuring the insulation resistance, the device must not be live!

Electrical measurements may only be performed by an electrician with operating licenses for electrical devices up to 1kV.

The measurement should be performed in accordance with the UL 2231-2 / CSA 281.2.

Measurement of insulation resistance should be performed in accordance with the instruction manual of the measuring instrument used, the measurement result is read after the indication becomes stable.

Before taking measurements:

- disconnect the charging station from the power supply,
- remove the power modules (-2F14, -2F15, -2F16, -2F17, -2F18, -2F19),
- short the current terminals of the AC (-101K11, -101K14, -101K18) (1-2, 3-4, 5-6),
- short-circuit the current terminals of the DC contactors (-400K10.2, -400K14 -400K17, -400K10.1, -400K13, -400K16) (A1+, A2-),
- disable security (-101Q0, -401F11, -401F13),
- remove all surge arresters from the device (-101F2.2),
- disconnect the wires L1/+ and L2/- from insulation metres (-402B1.1, -402B1.2, -402B5.1, -402B5.2).

**The number of components depends on the charging station variant selected*

Measurement of the insulation resistance of the AC side should be performed with a test voltage of 500V.

The AC side insulation resistance measurement must be at least 1MΩ ($R_{ISO} \geq 1M\Omega$). This value is considered to be the limit (acceptable) value.

Measurement of the DC side insulation resistance should be performed with a test voltage 1000V.

The result of the measurement of the insulation resistance of the DC side must be at least 1MΩ ($R_{ISO} \geq 1M\Omega$). This value is considered to be the limit (acceptable) value.

The test should be performed according to the measuring points marked in the wiring diagram, in the order presented in the table below:

No.	Circuit name	Measurement point 1	Measurement point 2
1	Side AC	MP_L1	MP_G
2		MP_L2	MP_G
3		MP_L3	MP_G
4		MP_L1	MP_L2
5		MP_L1	MP_L3
6		MP_L2	MP_L3
7	Connector 1 NACS	MP_P1_DC-	MP_P1_G
8		MP_P1_DC+	MP_P1_G
9		MP_P1_DC+	MP_P1_DC-
10	Connector 2 Plug-in CCS COMBO T1	MP_P2_DC-	MP_P2_G
11		MP_P2_DC+	MP_P2_G
12		MP_P2_DC+	MP_P2_DC-

The completed insulation resistance measurement protocol with the results should be attached to the performed measurements.

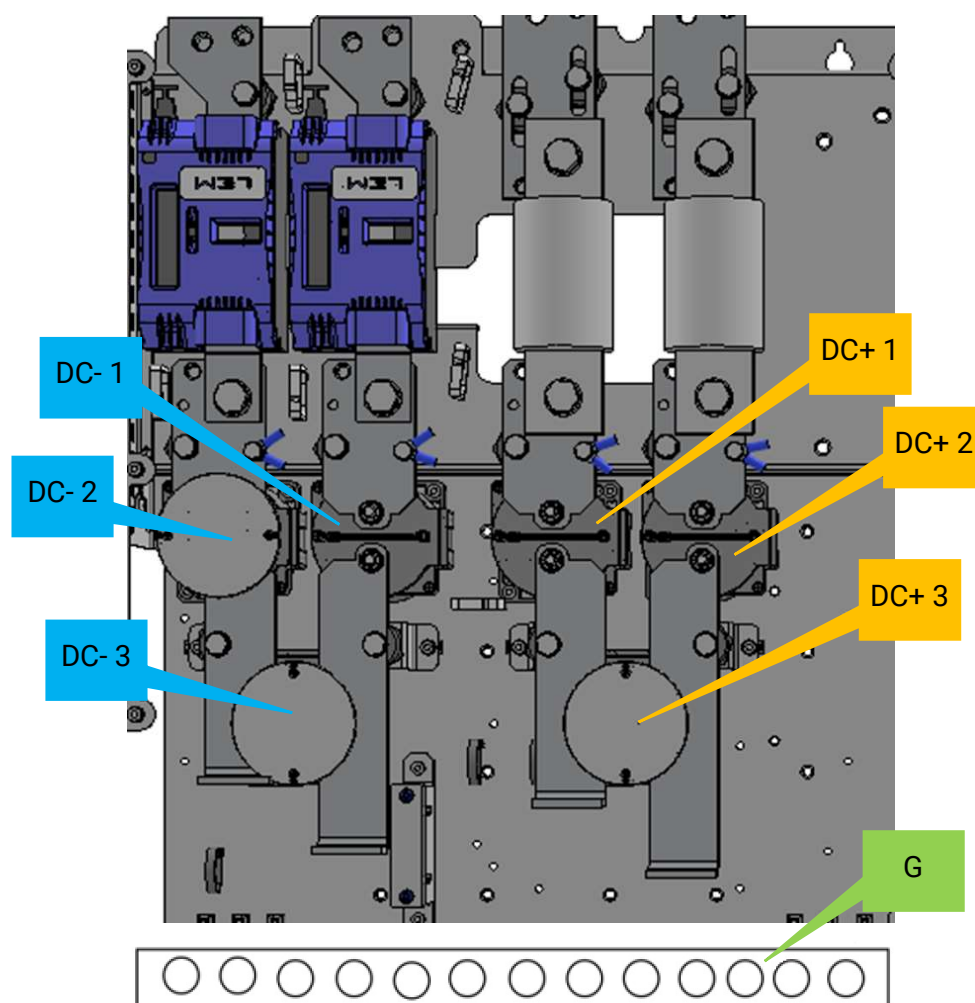


Figure 33 Insulation resistance test

11. REGISTER OF CONDUCTED SERVICE INSPECTIONS

Date	Signature	Visual inspection of the housing	Technical condition of power cables	Technical condition of the charging cable	Conductor insulation condition	Condition of electrical connections	Security status of individual circuits	The correctness of the voltage at the service sockets	Another / Remarks

12. REGISTER OF CONDUCTED MEASUREMENTS

Date	Insulation resistance measurement	Short circuit loop impedance measurement	Measurement of tripping of RCDs	Measurement of continuity of protective conductors	Signature

13. FAILURE REGISTER

Date	Description of the failure

14. REPAIR / REPLACEMENT REGISTER

Date	Description of repair / replacement	Signature

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