OPERATING MANUAL
CHARGING STATION

Internship Core

STAGEV Pro

STAGEV Intelli

Version: U.1.0

Data: 29/07/2025

This manual covers models with the following model numbers:

Change log

Version	Date	Author	Changes
U.1.0	29/07/2025	K. Banaszek	Initial version

Table of contents

1 Safety instructions

1. Before installing or starting the device, read this manual thoroughly.
2. According to the Regulation of the Minister of Climate and Environment dated July 1, 2022, on the detailed rules for confirming qualifications of individuals operating devices, installations, and networks (Journal of Laws 2022, item 1392), individuals performing installation and servicing of charging stations must hold Group 1 qualifications. This includes:
3. (2) electrical power devices, installations, and networks with a rated voltage not exceeding 1 kV, and
4. (10) control and measurement equipment, as well as devices and installations for automatic regulation, control, and protection of the equipment and installations mentioned in point 2, within the scope of Operation and Supervision.
5. Installation must be carried out after disconnecting the power supply using the circuit breaker for the charging station circuit. During installation work, the electrical circuit must not be energized.
6. All activities described in this manual must be performed only after verifying with a tester or meter that there is no voltage in the power cable, as high voltage poses a life-threatening risk.
7. It is recommended to use insulated electrical tools during installation.
8. All local, regional, and national electrical installation regulations must be followed.
9. The product must be permanently installed at the target location.
10. Do not install, use, or touch the device if it is damaged or not functioning properly.
11. Do not perform installation work near explosion hazard zones or in areas where running water may be present.
12. Do not use the device near strong electromagnetic fields or in close proximity to radio transmitters.
13. Installation cables should be routed to prevent accidental mechanical or thermal damage.
14. Maintain appropriate distances between the device and heating or moving elements.
15. Do not open the device in case of malfunction; disassembly must be performed by a qualified and authorized person.
16. Before connecting a load, ensure its parameters match the device specifications.
17. After installation, thoroughly check the correctness of all connections.
18. Once everything is properly connected, the power supply can be restored and the device operation tested.

1.1 Fire procedure

In the event of a fire at the STAGEV charging station, immediate action must be taken to protect people and property. It is crucial not to use water or foam extinguishers – the device is under voltage, and their use may increase the risk of electric shock.

If safe to do so, disconnect the station's power supply as quickly as possible by switching off the circuit breakers or the main switch of the installation. Avoid contact with the burning station or cables.

To extinguish fires involving electrical devices, use only appropriate extinguishing agents, such as an ABC powder extinguisher. Under no circumstances should water be used.

Once the area is secured, immediately notify the fire department by calling the emergency number 112 or 997. When reporting, provide the exact location, type of hazard, and information about the presence of electrical installation and any connected vehicle.

After extinguishing the fire, the charging station must not be restarted until a detailed inspection is carried out by a qualified electrician. It is also recommended to report the incident to STAGEV for further guidance and possible technical support.

To reduce the risk of fire, regularly inspect the condition of the electrical installation and cable connections, ensure the station is protected with appropriate overcurrent and residual current devices, and provide adequate ventilation for the device. Avoid installation in areas prone to overheating. Additionally, using only original accessories and cables compliant with the device specifications increases operational safety.

1.2 Disposal

If it is necessary to return the charging station to the manufacturer, please register your request on the website www.stag-ev.com. After submitting the request, you will receive detailed instructions for further steps.

Electrical and electronic devices may contain components that are hazardous to the environment and human health if not properly disposed of.

Equipment marked with the symbol of a crossed-out wheeled bin should not be placed in mixed waste containers.

Dispose of electrical and electronic equipment at appropriate collection points, in accordance with Directive WEEE-2012/19/EU.

Instead, it should be taken to a designated e-waste collection point.

Information about local collection points and schedules can be obtained from the municipal office or the website of the local waste management system.

2 User instructions

1. Follow the recommendations provided in this document.
2. Select connection installation parameters according to the maximum charging parameters of the vehicle (number of phases, wire cross-section, charging cable, electrical equipment).
3. Remember that the charging power of the charger also depends on the vehicle and the quality and type of connection to the power grid.
4. Do not use the device contrary to its intended purpose.
5. Do not use the device if the housing shows visible damage.
6. Do not use the device if cables or connectors show visible mechanical damage.
7. The device must be stored and used in a way that prevents access by children and individuals unaware of the risks.
8. Do not use the device if it has been flooded with water or if such a suspicion exists.
9. Do not use the charger near explosive or flammable substances – this poses a fire hazard.
10. Installation and commissioning of the device is prohibited for individuals without appropriate qualifications.
11. Repairs and maintenance of the device must not be carried out by individuals without appropriate qualifications.
12. Modification of the device software by unauthorized persons is prohibited.
13. Use of non-original or non-approved spare parts is prohibited.

The warranty does not cover:

1. Disruptions and failures resulting from power grid operation.
2. Issues related to mobile network services.
3. Damage caused by random events beyond the manufacturer's control (e.g. natural disasters).
4. Incorrect operation of the management system on the operator's side using the OCPP protocol.
5. Damage caused to the electric vehicle.

3 Product description

3.1 Device description

Note: Throughout this document, the terms charging station, charger, and charging unit are used interchangeably and refer to the same device intended for charging electric and hybrid vehicles with alternating current (AC) in Mode 3.

The STAG EV charging station is an advanced device for charging electric vehicles, designed for full flexibility and modularity. Thanks to its thoughtful design, users can easily adjust the hardware configuration to their needs – both at the time of purchase and later through simple expansion.

The STAGEV device is a solution for both individual users and professional or industrial applications, offering high power, safety, and full control over the charging process.

Intuitive operation

- Charging authorization via: PIN, RFiD, or mobile app.
- 3-inch TFT screen with touch panel (tempered glass).
- Color LED status indicator.

Modular design

- Main board replacement without soldering.
- Expansion with additional functions without returning the charger.
- Installation of MID meters, residual current protection devices, and communication modules on a TH rail.

Advanced connectivity and integration

- Support for Ethernet, WiFi, RS485, optionally GSM/LTE.
- OCPP 1.6 protocol for integration with remote management systems.
- Dedicated mobile app for operation, charging process, and history browsing.

For any space

- Wall or post mounting options.
- Compact dimensions and modern design.
- High mechanical resistance and sealing (IK10, IP66).

3.2 Technical data

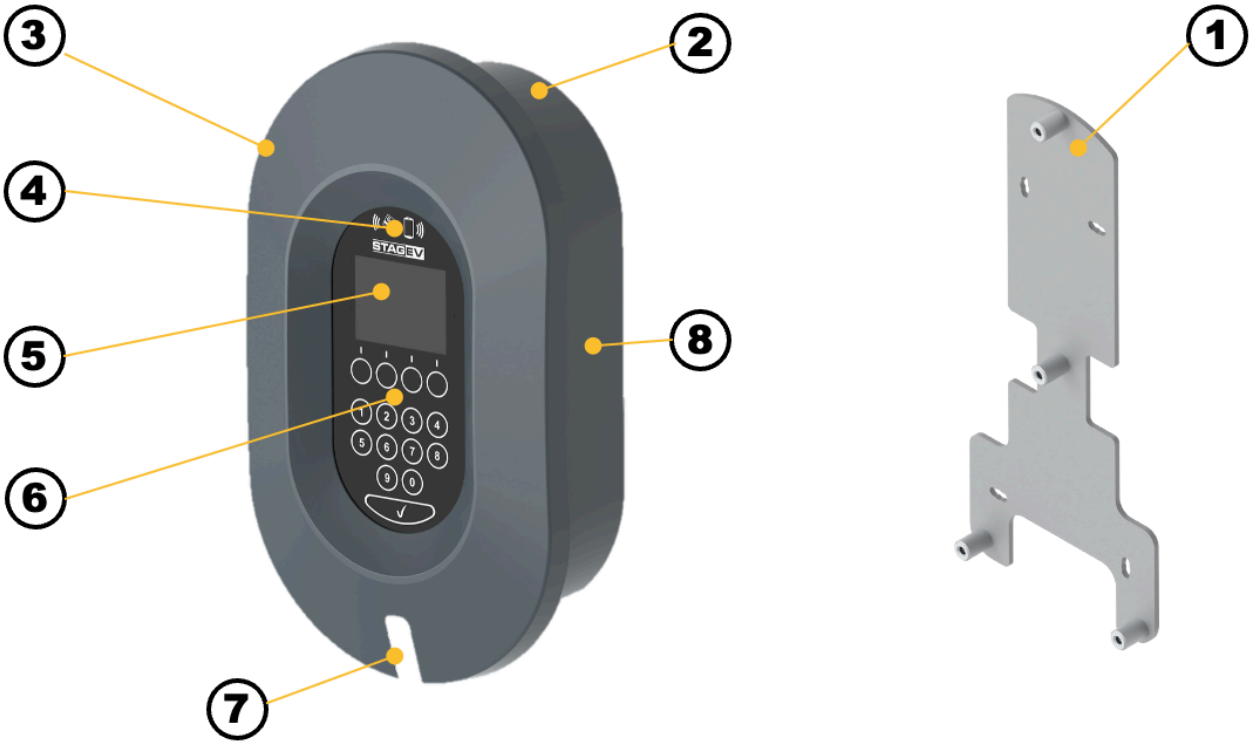
Parameter	Value
Maximum charging power	22 kW
Number of phazes	1 / 3
Input voltage	230 / 400 V_{AC}
Maximum charging current	32A
Power supply frequency	50 Hz
Charging current adjustment	8 – 32 A
Built-in residual current protection	AC: 30mA, DC: 6mA
Option to install additional RCD on TH rail	Yes
Electrical connection method	Lever quick-connect terminals
Overheat protection	Yes
Overload protection	Yes
Charging connector type	Type 2
Charging mode	Mode 3
Operating temperature	-20 ^{0}C to + 55 ^{0}C
IP protection rating	IP 66
Permissible humidity	5% - 95%
Uv resistance	Yes
Mechanical resistance	I 10
Display	TFT 3”
Touch panel	Yes, 3 mm tempered glass
Status indicator	Colored LED
PIN code authorization	Yes
Mobile app authorization	Yes
NFC card authorization	Yes
Wall mounting	Yes
Pole mounting	Yes
Ethernet	Yes
WiFi	Yes
GSM / LTE	Yes
OCPP 1.6	Option
Option to install meter on TH rail	Yes
RS485 interface	Yes
Housing	PC/ABS Tempered glass
Dimensions [cm]	39 x 23 x 12,5
Weight [kg]	2,5
Certificate	THIS
Compliance with standards and directives	2014/30/UE – EMC 2014/35/EU – LVD 2011/65/UE – RoHS II

2012/19/UE – WEEE
IEC 61851-1
IEC 61851-21-2

3.3 Model Comparison: Core, Pro, Intelli

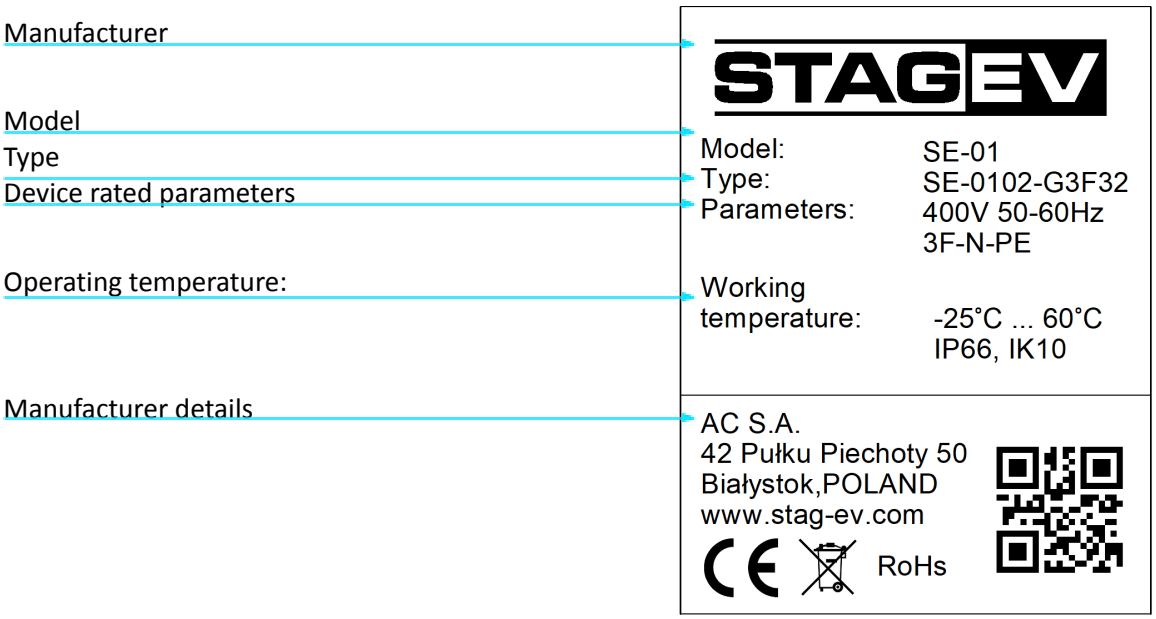
	Core	Pro	Intelli
Supported power 22kW	✅	✅	✅
Typand 2 cable – 22kW – 5m	✅	✅	✅
TFT display	✅	✅	✅
Touch panel	✅	✅	✅
Cover removal detection	✅	✅	✅
TH rail for accessories in the charger	✅	✅	✅
User application	✅	✅	✅
Mounting on dedicated post	✅	✅	✅
RFID/NFC unlocking	✅	✅	✅
WiFi communication	✅	✅	✅
Ethernet communication	✅	✅	✅
PIN code unlocking		✅	✅
Support for meter on TH rail in the charger		✅	✅
Support for OCCP 1.6 protocol		✅	✅
Installer application		✅	✅
Charging zone protection - radar			✅
230V power allocation			✅
Dynamic power allocation			✅
Painted cover (choice of 3 colors)			✅
RS 485 communication			✅
2G/LTE communication			✅

3.4 Description of External Device Components



1. Wall-mounted charger hanger
2. Enclosure
3. Cover
4. RFID/ NFC card reader
5. TFT display
6. Touch panel
7. Operation indicator
8. Identification label (nameplate)

3.5 Nameplate



4 Before installation

4.1 Basic information

1. The selection of the charging station depends on the available power of the electrical connection and its type. Details can be found in the table in section 4.3 – Electrical Installation Requirements.
2. The vehicle's charging power depends particularly on its type. Information on this can be found in the vehicle's user manual.

4.2 Installation location

1. The charging station should be installed in a location as protected from weather conditions as possible to ensure proper operation and extend the device's lifespan.
2. The installation site should be at least 5 meters away from water, gas, and other explosion hazard zones.
3. The mounting surface must be stable and resistant to swaying, e.g., due to wind.
4. The length of the charging cable should be adjusted to the location of the charging station and the position of the vehicle’s charging socket.
5. It is also possible to install the station on a dedicated mounting post available in the charger manufacturer's offer.

4.3 Electrical Installation Requirements

1. The device is intended for operation in TN-S, TN-C-S, or TT power supply systems, in single-phase or three-phase configuration.Grounding is required for both the charging station and the mounting post (if used).

2. The protective PE conductor must be routed between the charging station and the power connection.
3. The power connection must be equipped with a Type A residual current device (RCD) with a sensitivity of 30 mA.
4. Note: Some vehicles may not begin charging if the grounding resistance exceeds 100 Ω.
5. Grounding parameters must comply with local legal regulations and standards for electrical installations.
6. Appropriate selection of cable cross-sections and protective devices must also be considered, depending on the planned charging power (details in the table below). The cables and protective devices listed below should be used unless the electrical installation design specifies otherwise.
7. Maximum power cable cross-section: 6 mm². Larger cross-sections may be used if a component is installed on the TH35 rail that allows connection of thicker cables (e.g., RCD, meter, rail connector, etc.).

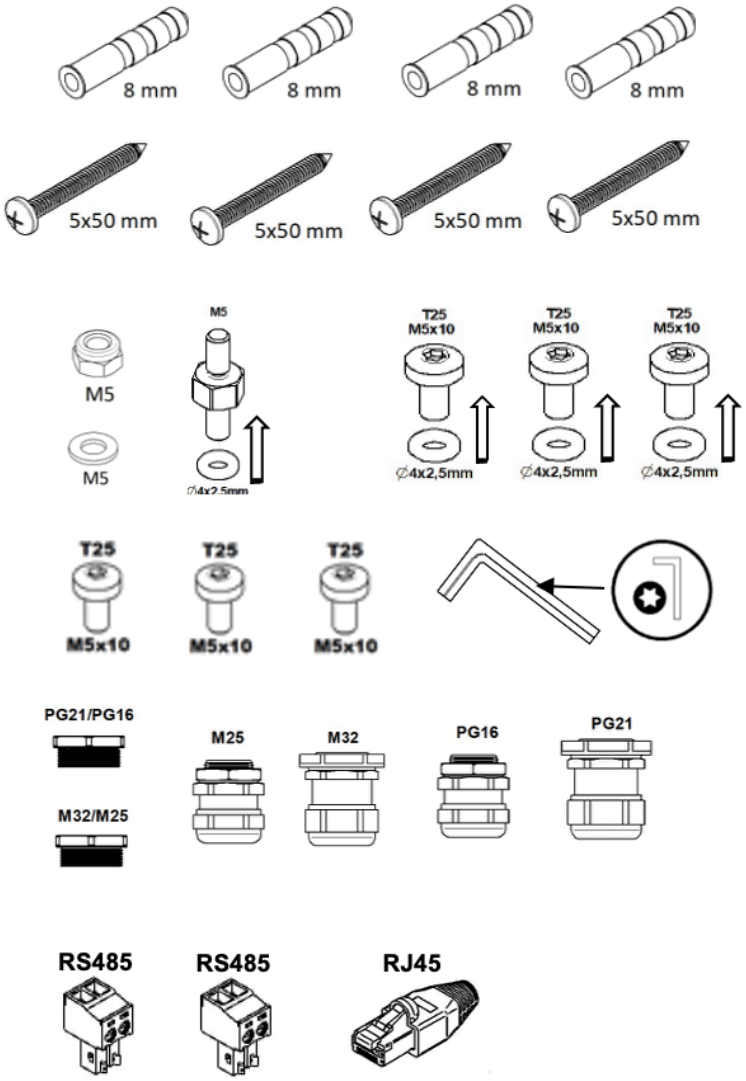
Connection	Power	Min. cable cross-section	Max. MCB Rating
1-phase	3,7 kW	3 x 4 mm^2	1 x 20 A (Char. B/C)
1-phase	7,4 kW	3 x 6 mm^2	1 x 40 A (Char. B/C)
3-phase	11 kW	5 x 4 mm^2	3 x 20 A (Char. B/C)
3-phase	22 kW	5 x 6 mm^2	3 x 40 A (Char. B/C)

5 Device Installation

5.1 Kit contents

Below is a visual list of the basic components included with the charging station.

In the extended version, the list may be supplemented with additional components such as: Type 2 charging cable, Type 2 connector holder, Other elements

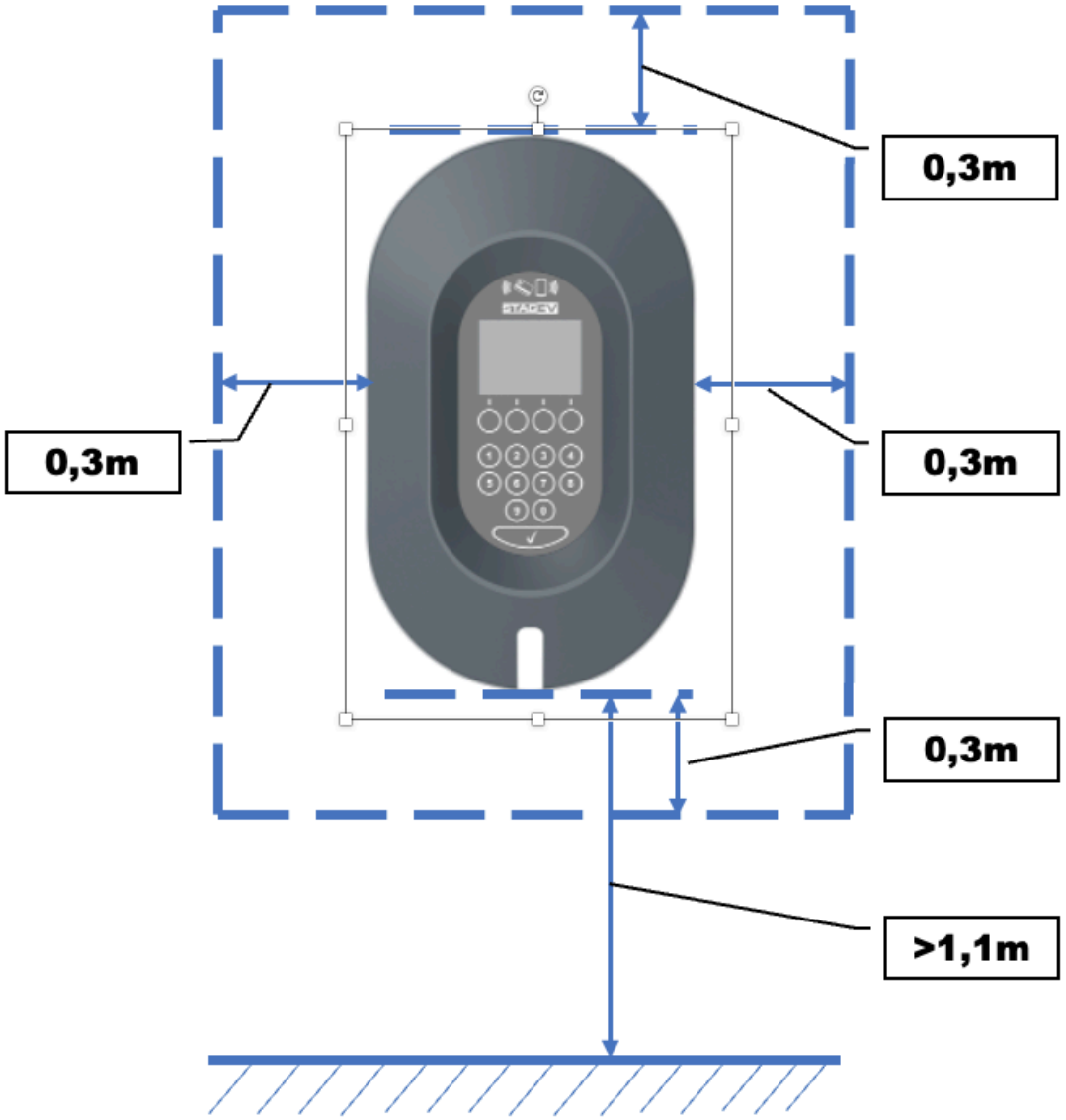


5.2 Required Tools

1. Drill with 8mm bit
2. Pencil, hammer, spirit level, measuring tape
3. PH2 screwdriver (crosshead)
4. Torx wrenches
5. Ferrule crimping tool
6. RJ45 crimping tool

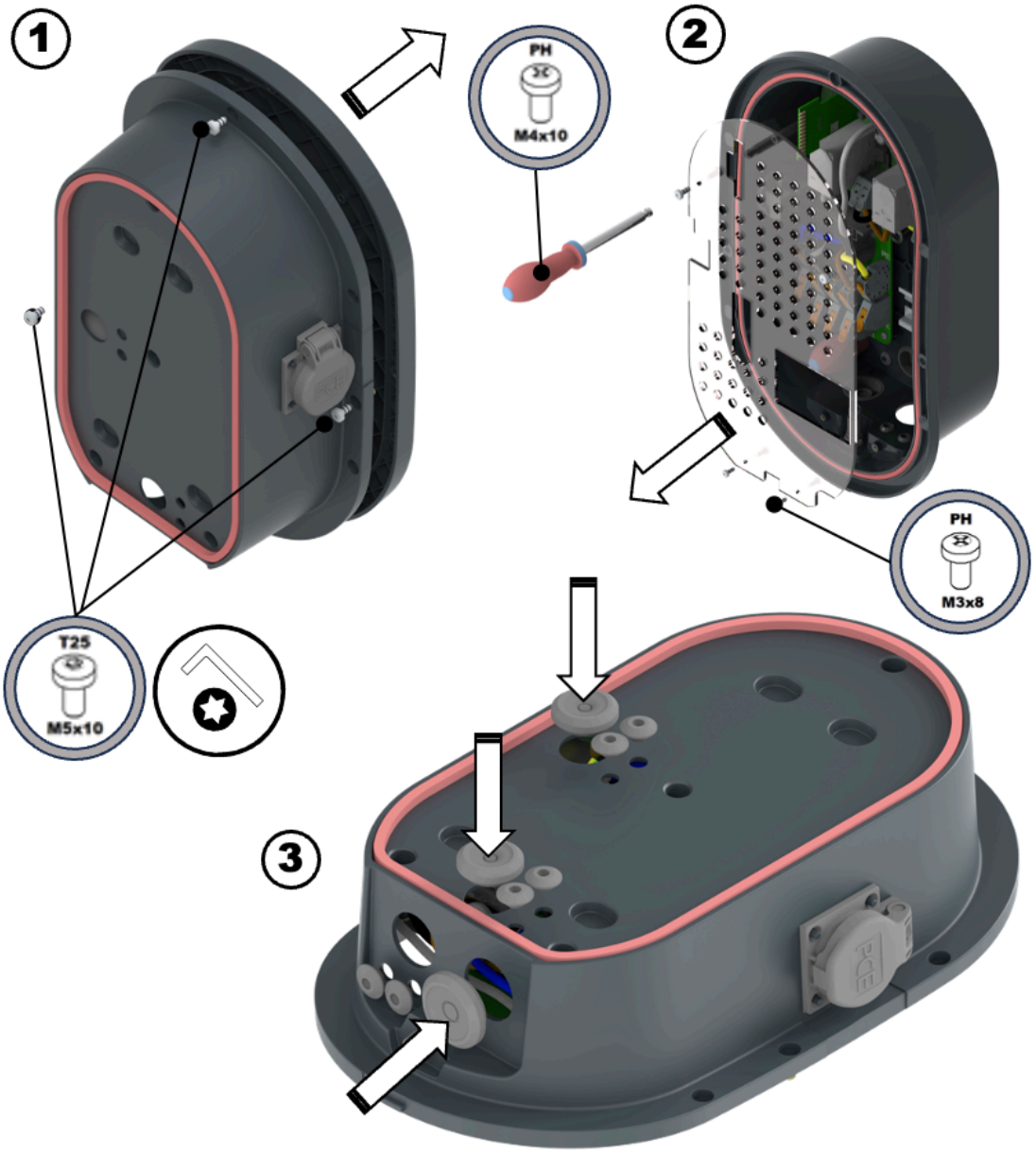
5.3 Required Installation Clearances

The required installation clearances listed below are intended to ensure user convenience, proper cooling of the charger, and to minimize interference with other electronic devices.



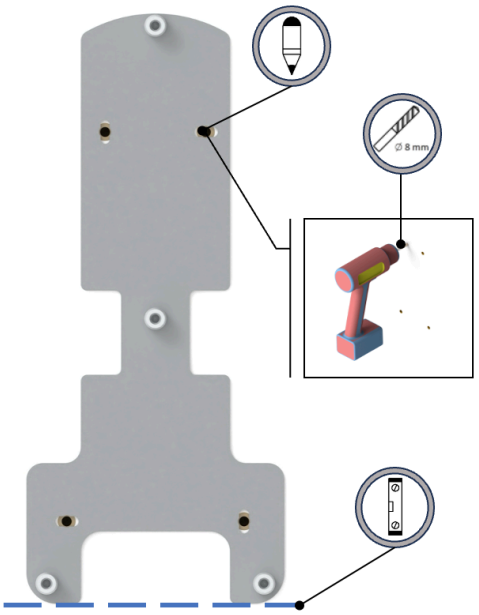
5.4 Preparing the Charger for Installation

1. Unscrew the screws located at the back of the charger.
2. Unscrew the protective cover screws.
3. Turn the charger body over and seal any unused openings.

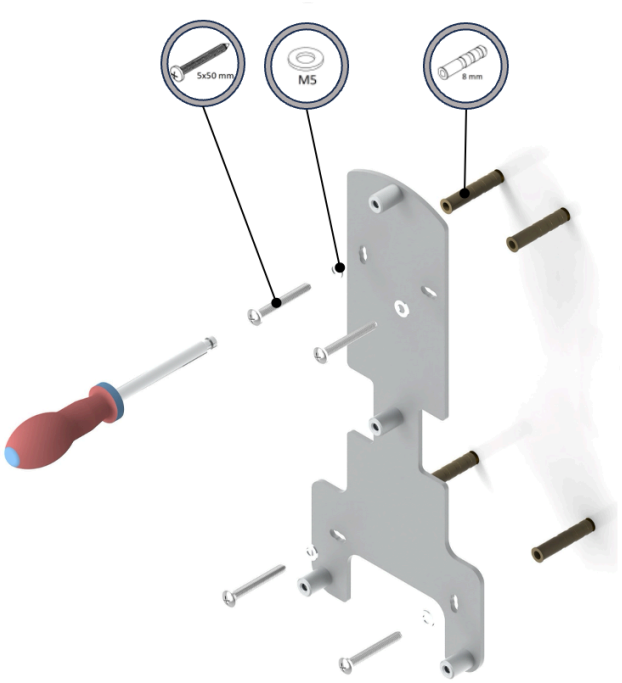


5.5 Mounting the Charger Hanger

1. Place the hanger against the wall according to the diagram below.
2. Place a spirit level at the bottom of the hanger, then mark the hole positions on the wall.
3. Remove the metal plate and drill 4 holes at the marked positions using an 8 mm drill bit.

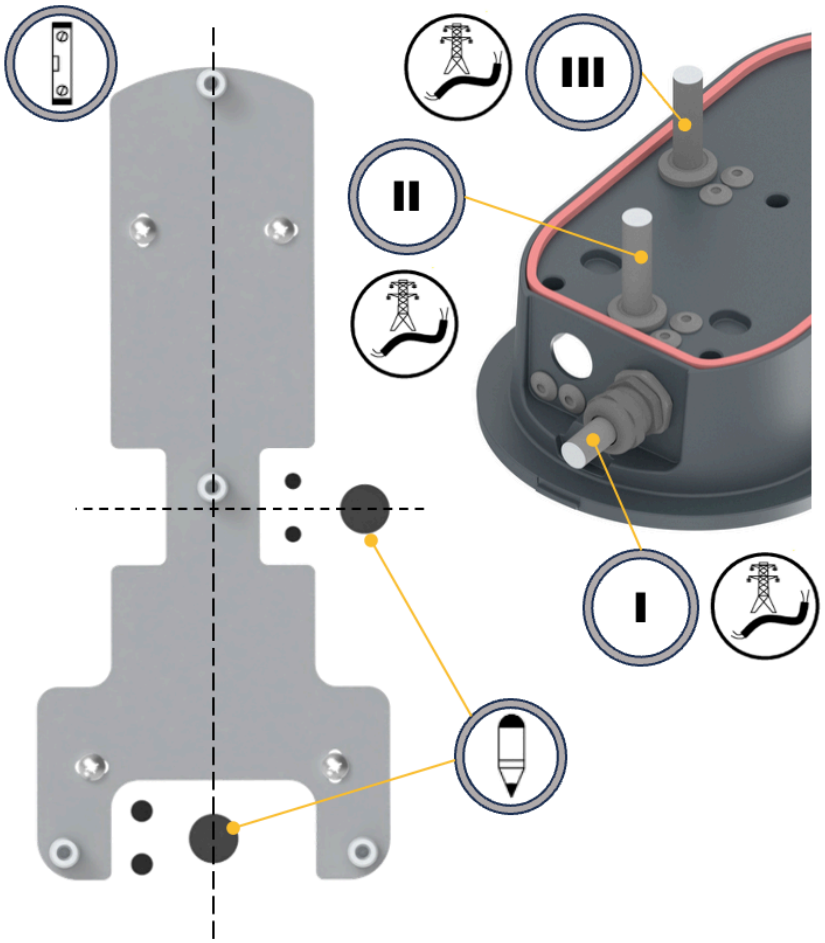


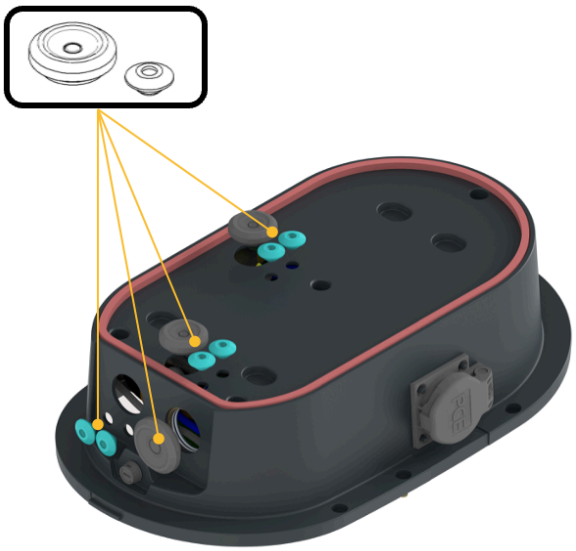
4. Insert 8 mm wall plugs into the drilled holes.
5. Position the hanger against the wall so that the holes in the plugs align with the holes in the metal plate.
6. Place washers on each screw, then insert them into the holes to prevent them from falling out.
7. Tighten all screws using a screwdriver or power drill.
8. Check the level and make adjustments if necessary.



5.6 Power Cable Routing

1. If the power cable is to exit the wall and enter the charger, mark the wall at the point that aligns with opening II or III on the charger. Then drill a hole in the wall with a diameter appropriate to the cross-section of the connection cable used.
2. If the power cable is to enter the charger from below, do not drill any holes in the wall for the power cable.
3. **All unused openings must be sealed with the plugs included in the kit.**

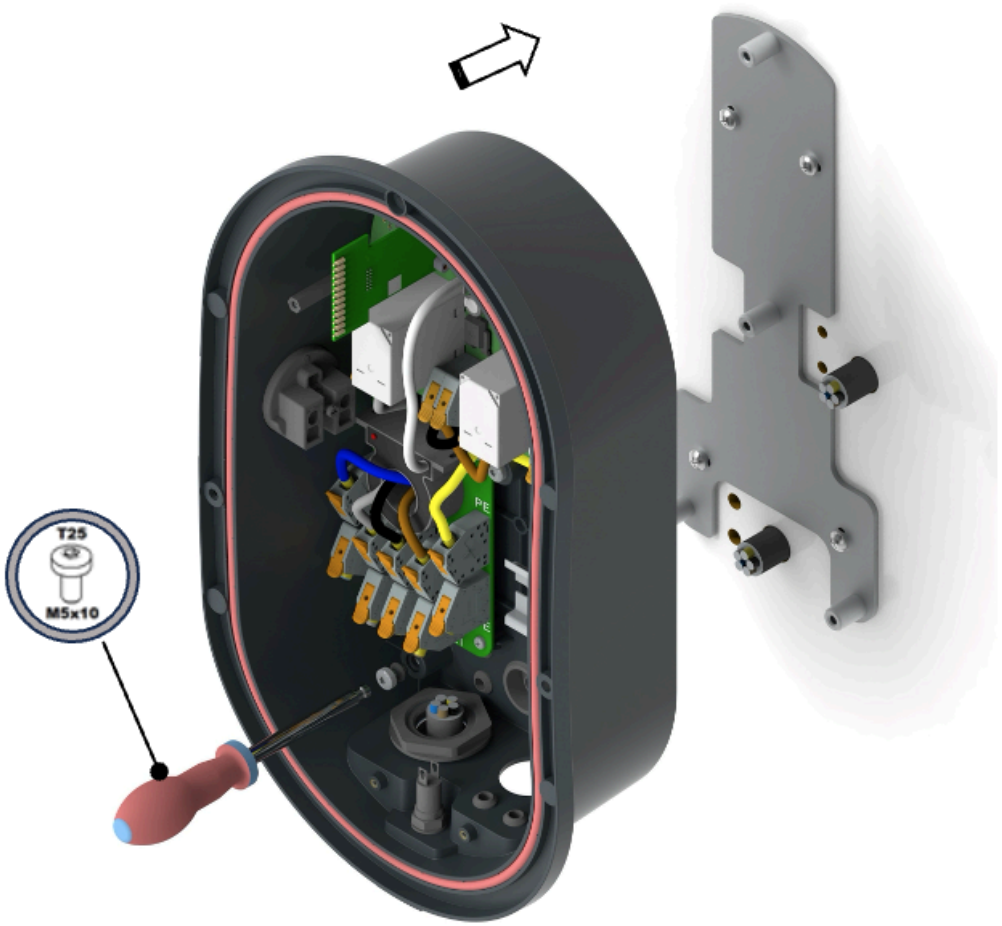




5.7 Mounting the Charger on the Hanger

1. Gently press the charger body onto the hanger.
2. Tighten the 3 mounting screws to secure the charger to the hanger.

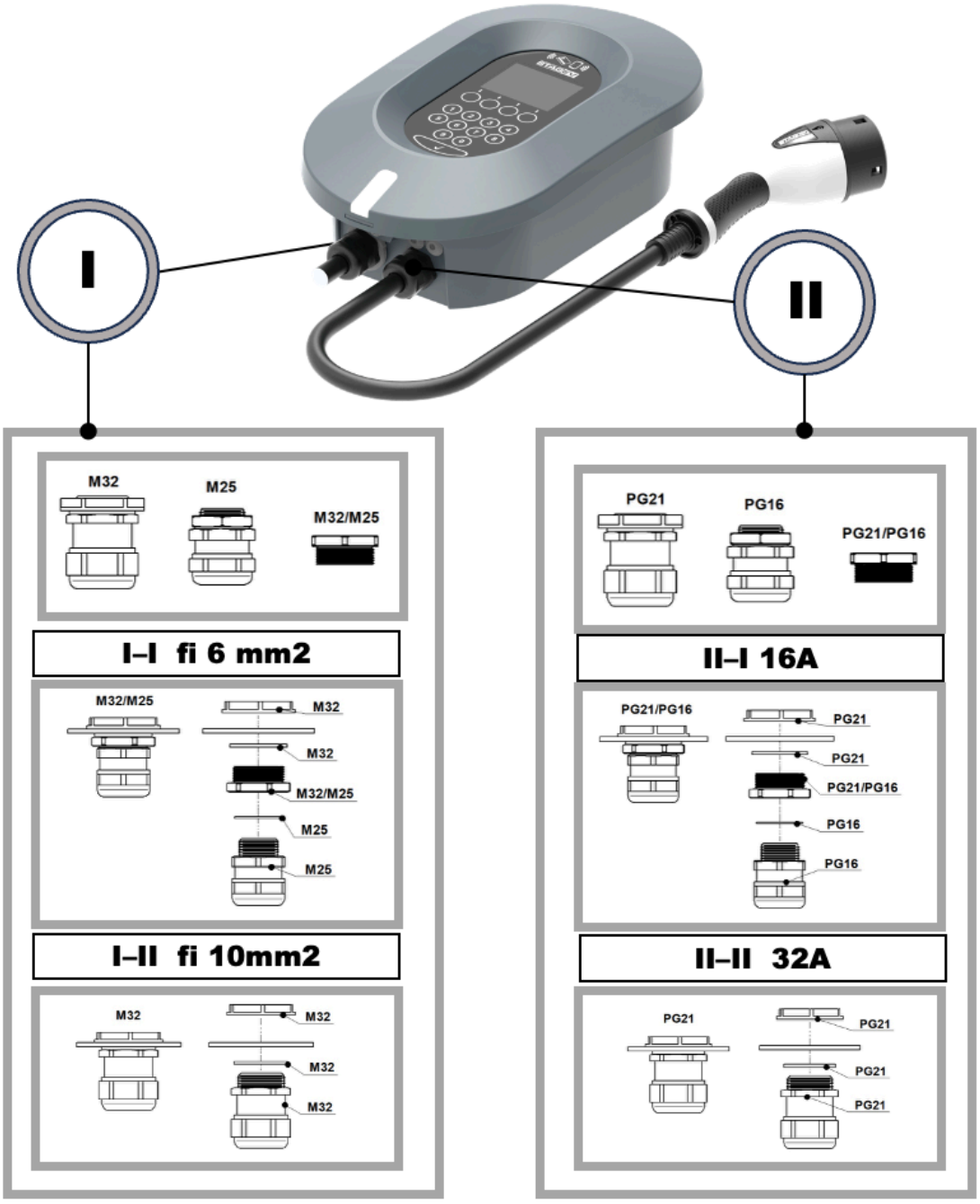
Note: The screws should be fitted with O-rings to maintain the enclosure's seal, especially when operating in harsh environmental conditions.



5.8 Selection of Cable Glands for Power Cables

The charger body is designed to accommodate various diameters of both the power supply cable and the charging cable. The table below provides the configuration of cable glands depending on the diameter of the cables used.

1. Section I: Cable gland configuration for the power supply cable
2. Section II: Cable gland configuration for the charging cable



6 Device Connection

6.1 Mounting Variants

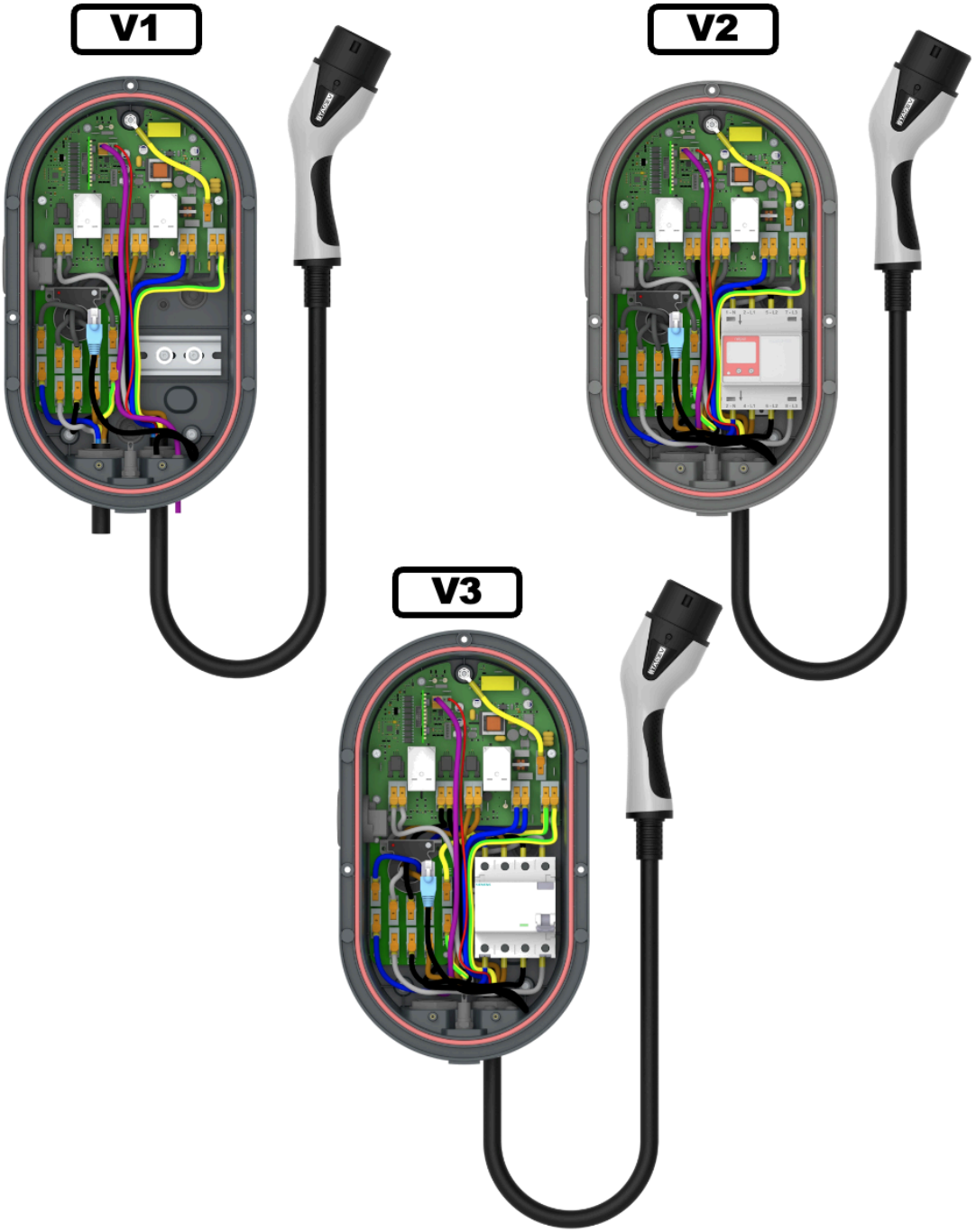
The charger is equipped with a TH rail for connecting electrical components.

V1 – Charger without components on the TH rail

V2 – Charger with an energy meter on the TH rail, direct measurement system, RS485

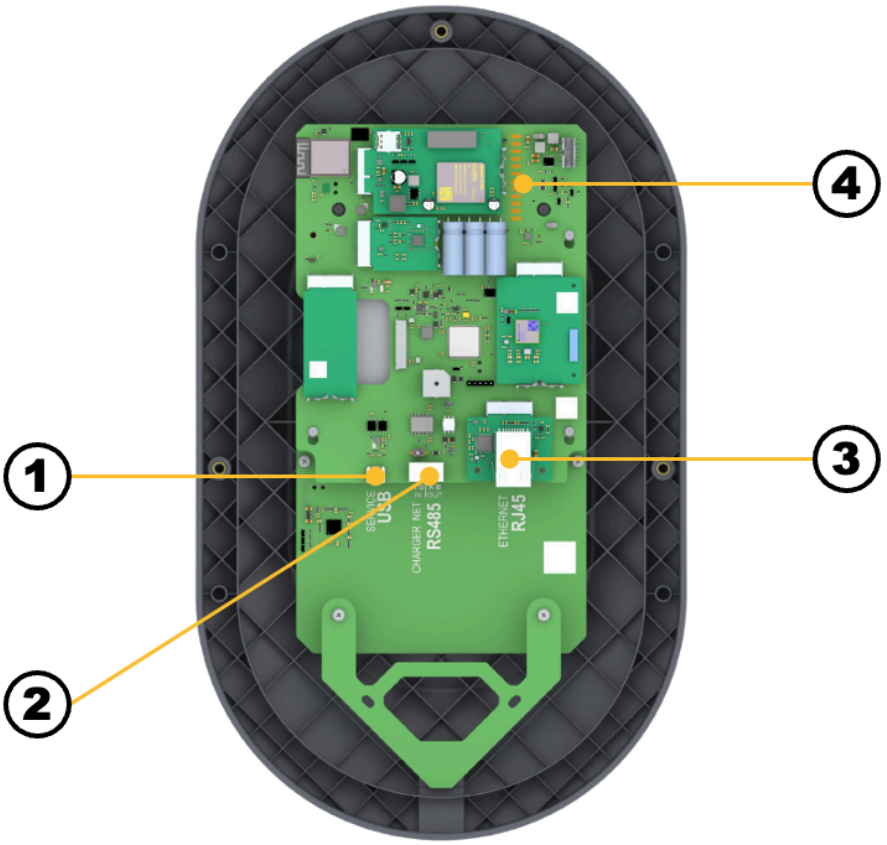
V3 – Charger with a residual current protection system, Type A, 30 mA

If the Type A residual current protection is installed in the main distribution board, the vehicle charging station will have free space on the TH mounting rail. In that case, other electrical components, such as an energy meter, can be installed.


V1
V2
V3

6.2 Communication board

View of the reversed charger panel showing the communication board with the following wired communication ports.



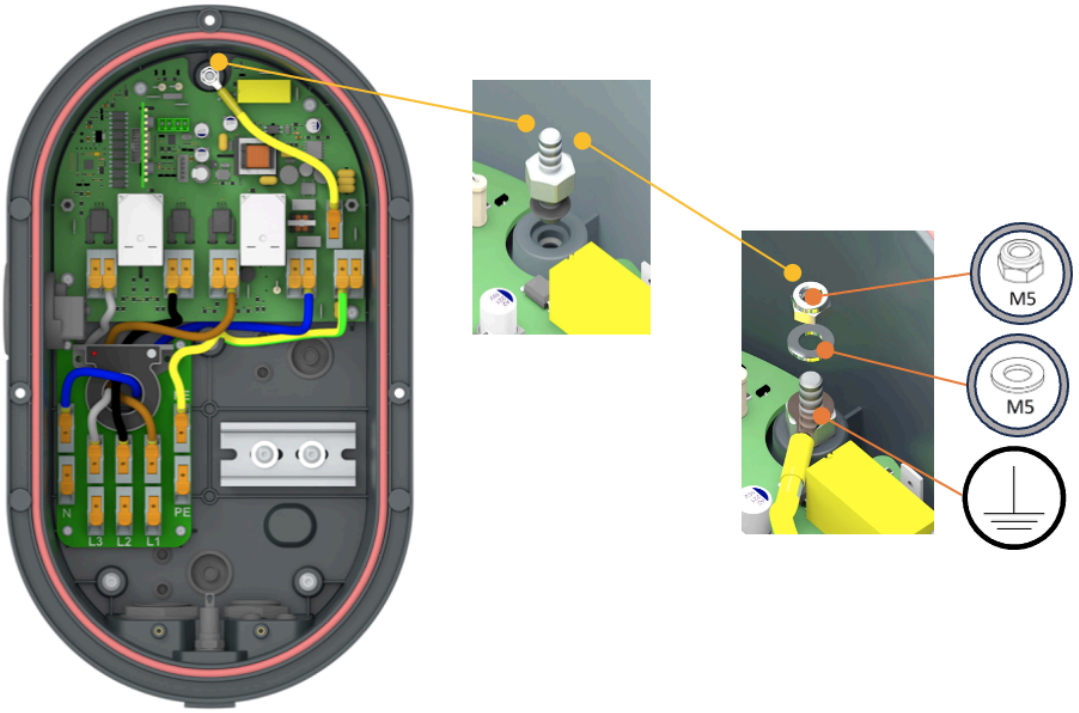
1. USB port for installer/diagnostic use.
2. RS485 port for wired communication with the charger or between chargers.
3. Ethernet port for wired Internet connection.
4. Internal communication port between the main board and the communication board..

6.3 Connection of additional grounding

The connection of an additional PE grounding wire should be made according to the diagram below. The wire, terminated with a so-called eyelet, should be placed on an M5 screw and tightened with a nut using a washer. The other end of the wire should be inserted into the quick-connector socket and snapped in.

Additional grounding may be required when mounting on a metal post or a conductive wall. The use of additional grounding is not required under normal operating conditions.

V1 V2 V3



6.4 Power cable connection – Variant V1

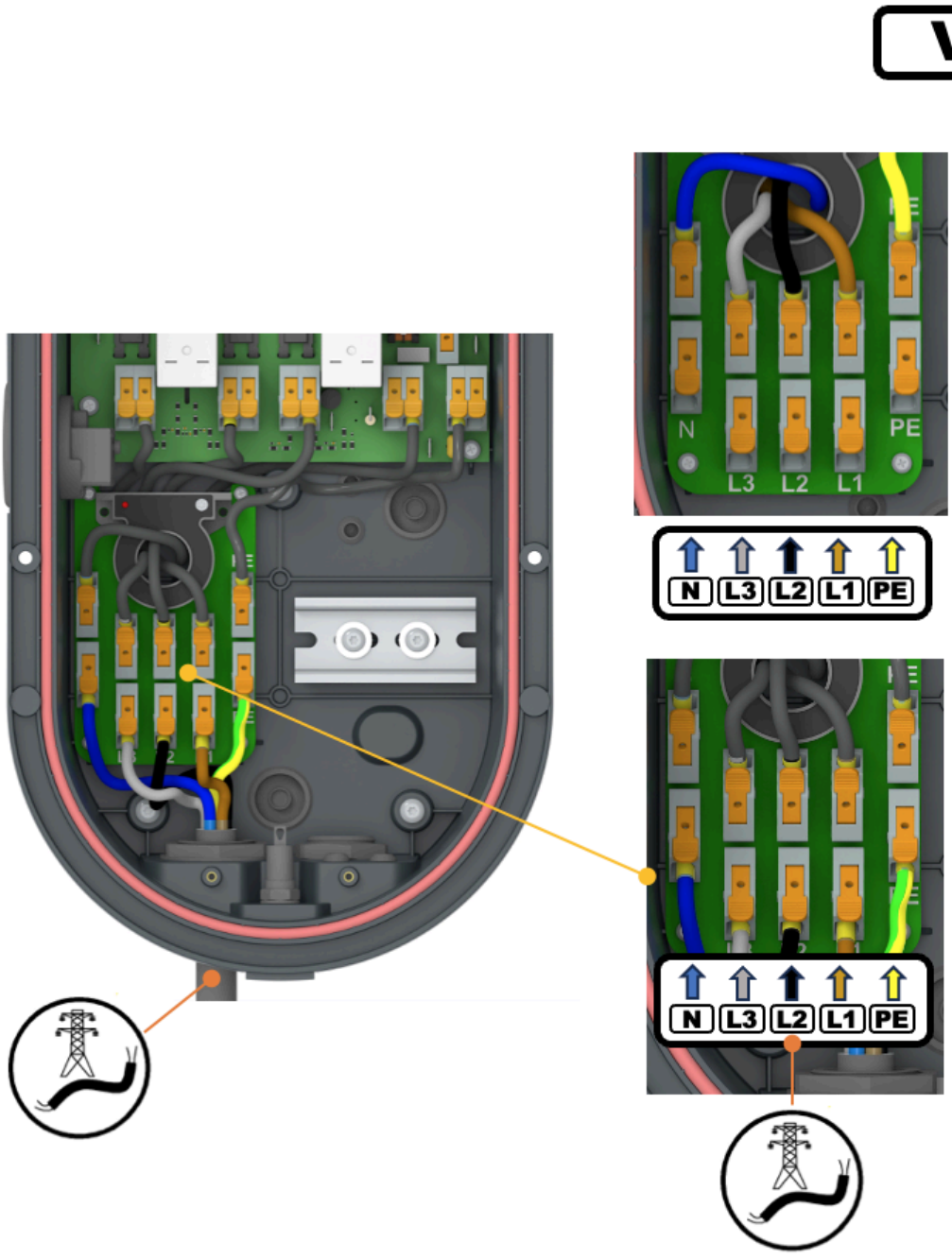
In the case of the installation variant without additional equipment on a DIN rail, the following connection diagram applies. The charger supports 1-phase, 2-phase, or 3-phase connections. Connect the number of phases available in your power cable according to the diagram below.

a) Lift the levers of the quick connectors.

b) Insert the individual wires according to the connection markings, following the color coding below.

c) Lower the levers of the quick connectors.

NOTE: Before switching on the power, carefully check that the wires are connected correctly and that the color coding is followed: L1 – Brown, L2 – Black, L3 – Grey, N – Blue, PE – Yellow-green.



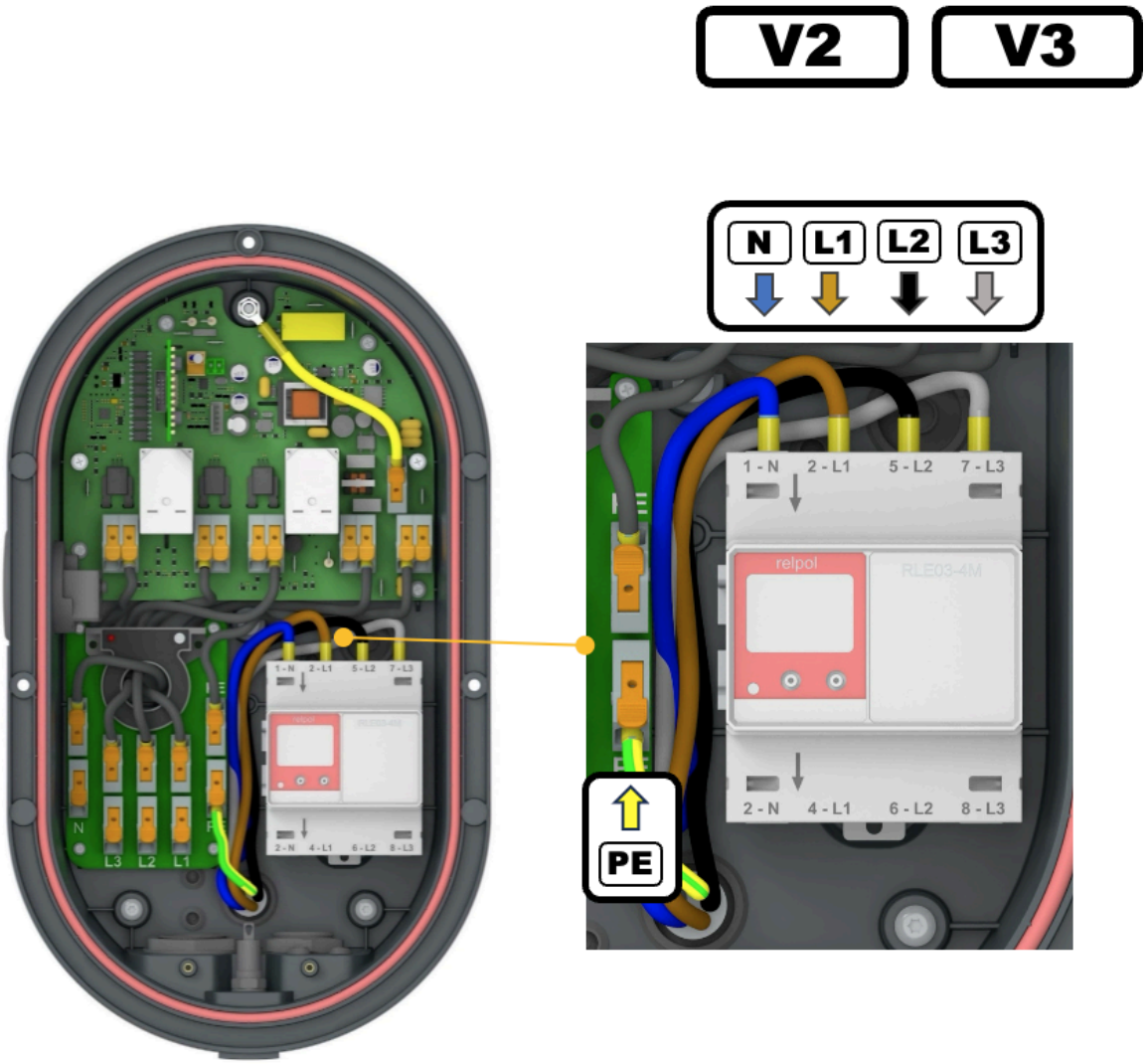
6.5 Power cable connection – Variants V2 and V3

In the case of the installation variant with equipment mounted on a DIN rail, the following connection diagram applies. The charger supports 1-phase, 2-phase, or 3-phase connections. Connect the number of phases available in your power cable according to the diagram below.

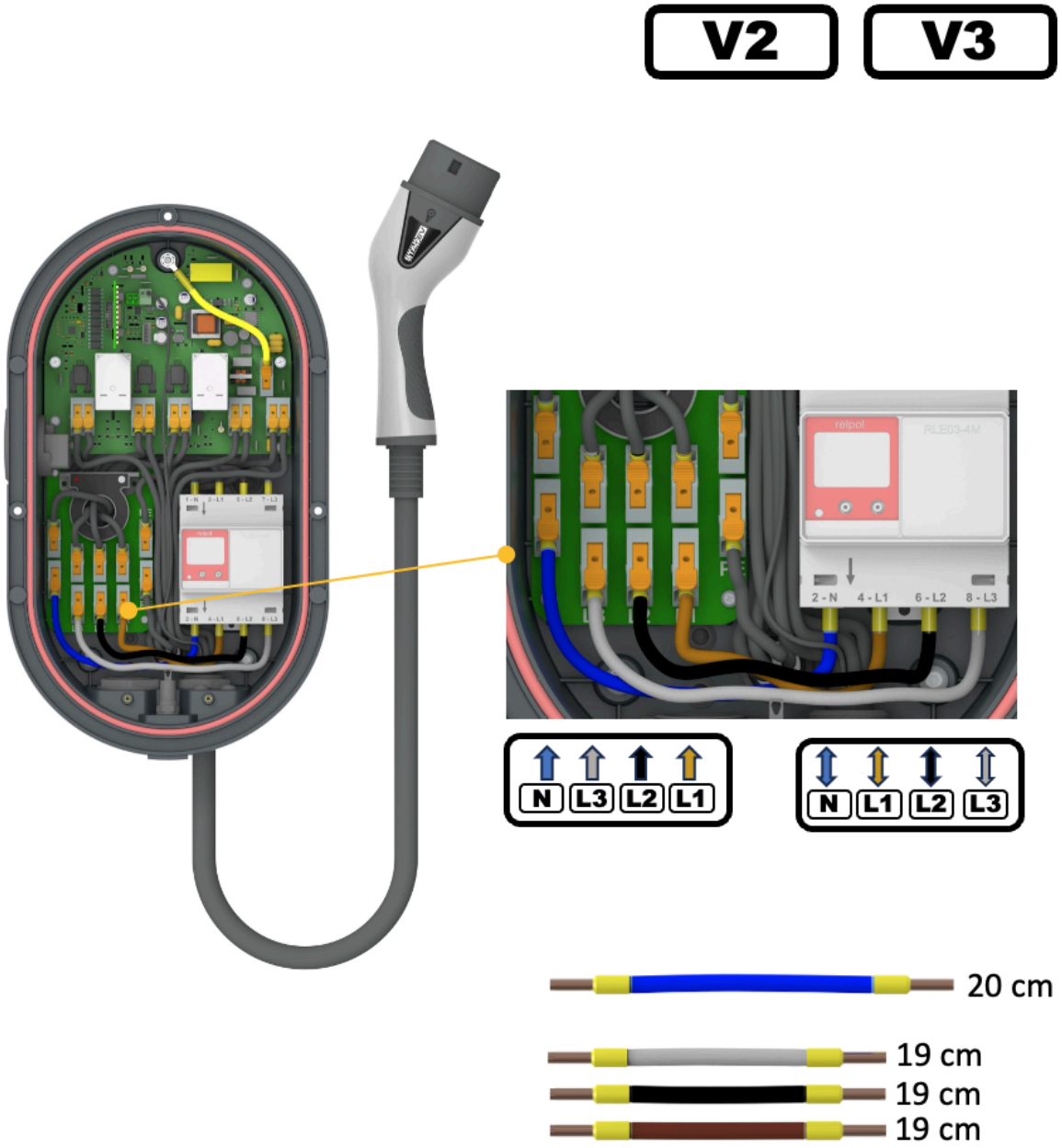
a) Connect the power cables to the input terminals of the meter or the RCD switch.

b) Insert the individual wires according to the connection markings, following the color coding below.

NOTE: Before switching on the power, carefully check that the wires are connected correctly and that the color coding is followed: L1 – Brown, L2 – Black, L3 – Grey, N – Blue, PE – Yellow-green.



a) Insert one end of each wire coming from the meter or RCD switch according to the connection markings on the main board and following the color coding below.
b) Insert the other end of these wires into the quick connectors and lower the levers of the quick connectors.



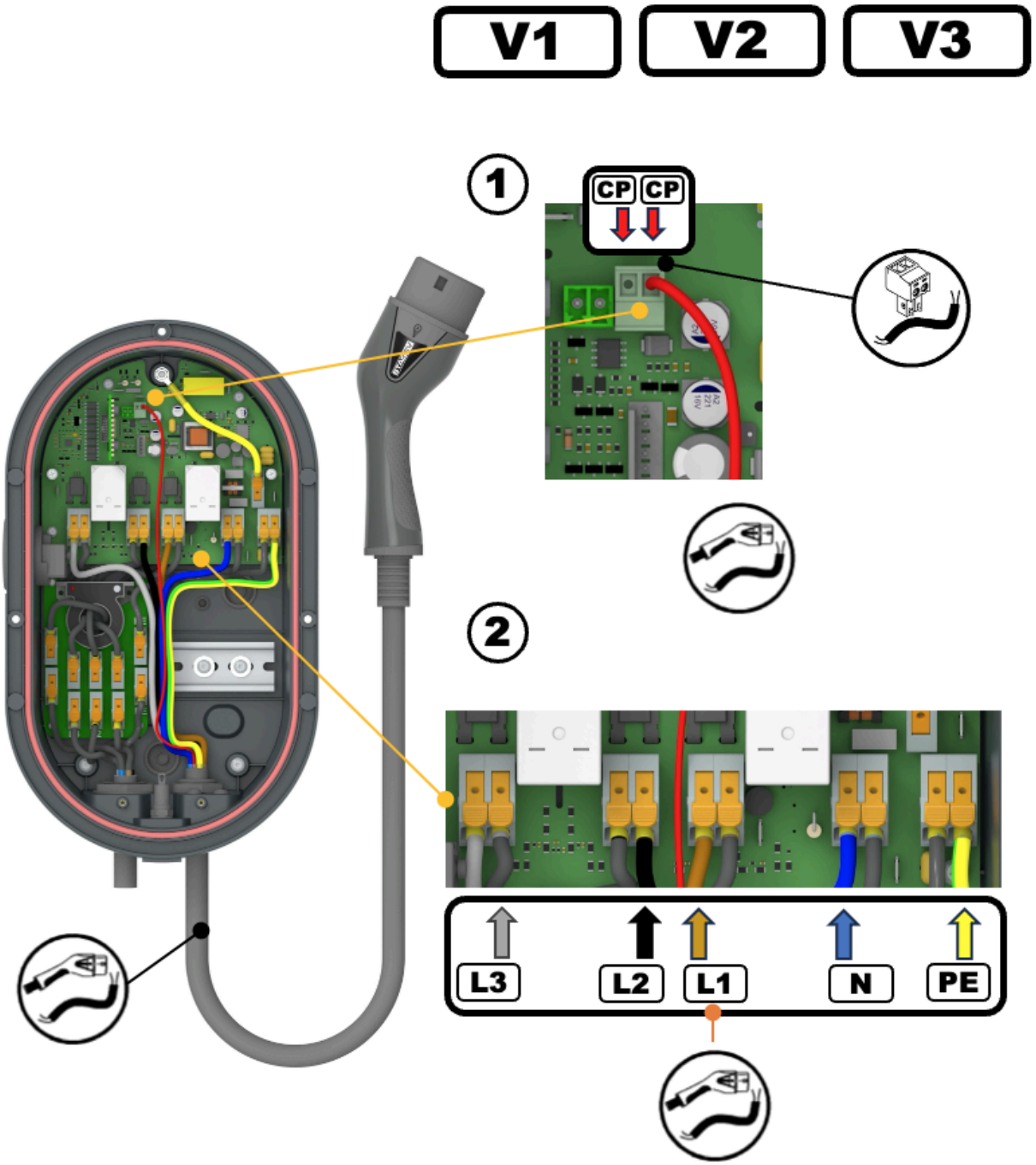
6.6 Charging cable connection

All installation variants use the same connection scheme for the vehicle charging cable.

a) Connect the communication wire coming from the charging cable to the screw terminal in either of the two CP-marked slots (any one). The connection point is marked as number 1 in the diagram below.

b) Connect the individual “power” wires to the quick connectors, following the color coding shown in the diagram marked as number 2.

NOTE: Before switching on the power, carefully check that the wires are connected correctly and that the color coding is followed: L1 – Brown, L2 – Black, L3 – Grey, N – Blue, PE – Yellow-green.

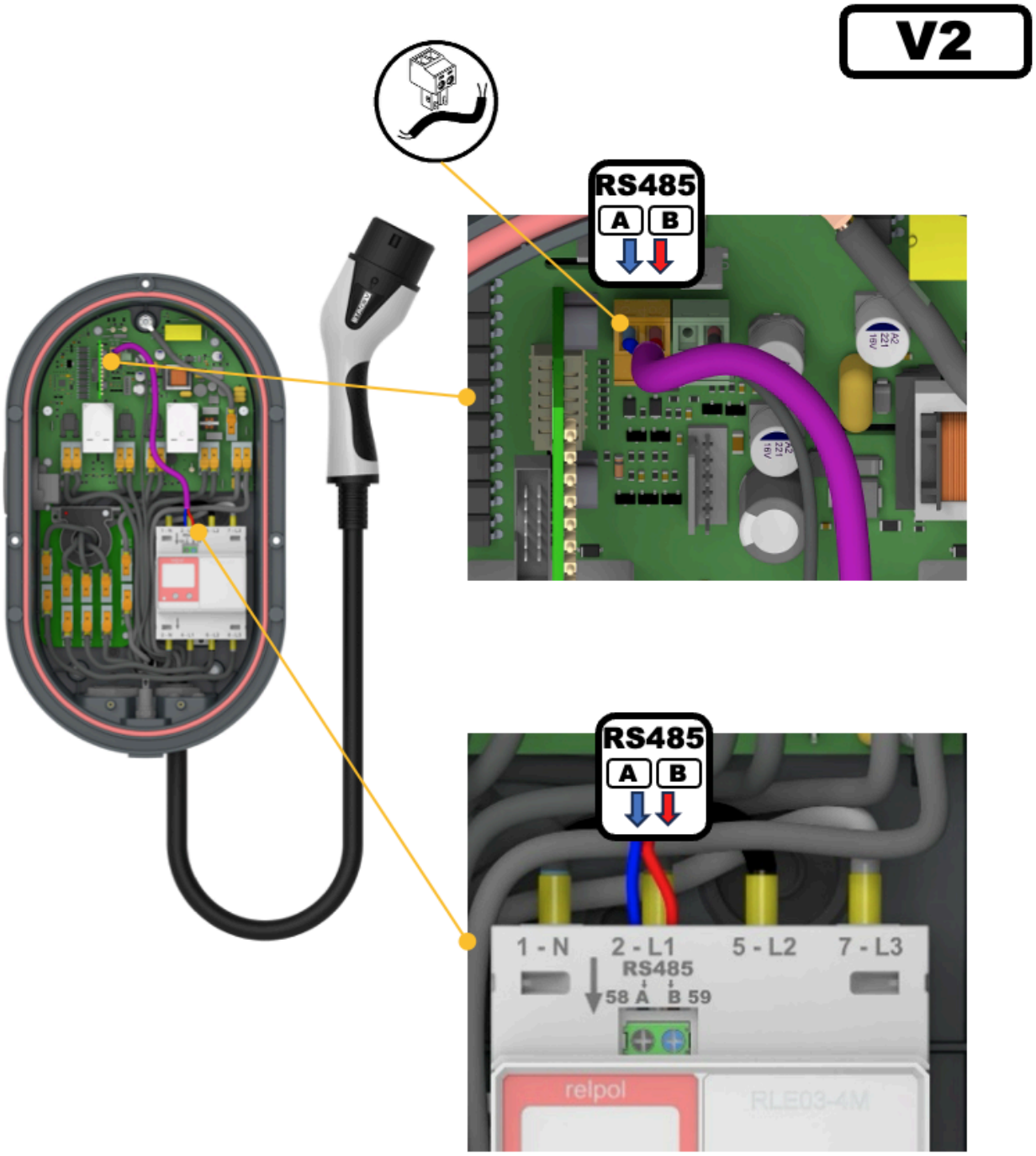

V1
V2
V3
1
CP
CP
2
L3
L2
L1
N
PE

6.7 Communication connection with the meter on the DIN rail

In addition to measuring energy consumption via the built-in microcontroller, the charger can be connected to a certified (MID) meter for even more accurate measurement of energy usage during vehicle charging.

a) A meter supported by the charger must be purchased — the list of supported meters can be found in the charger's technical specifications section of this manual.

b) Connect the wires according to the diagram below, following the correct markings: connect one end of the wire to the charger terminal marked A, and the other end to the meter terminal also marked A. Repeat the same for the second wire, connecting it to the terminals marked B.



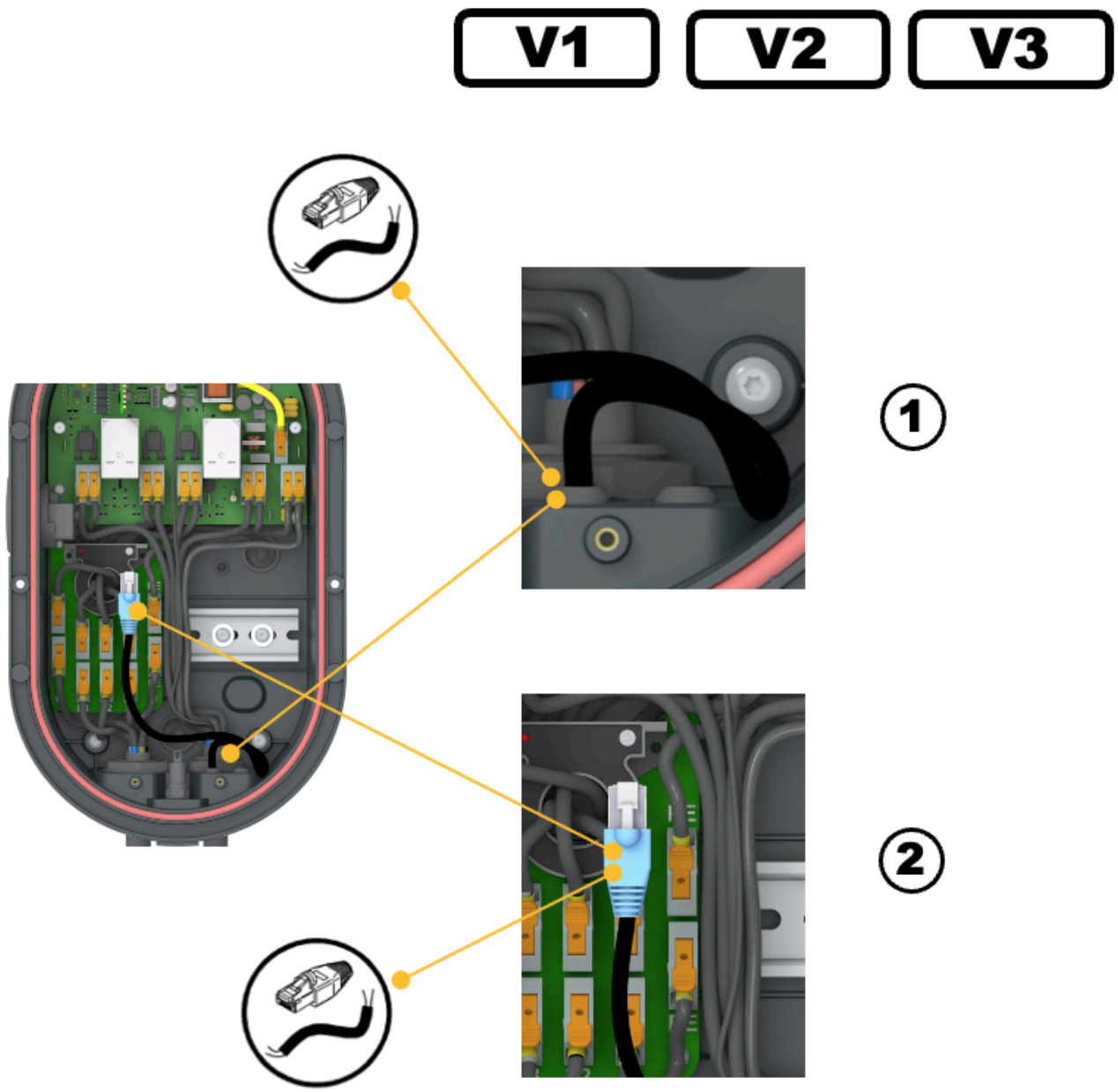
6.8 Ethernet and RS485 cable connection

The charger allows for the connection of an Ethernet network cable for communication with a data exchange server. To do this:

a) Pass the Ethernet cable through one of the housing openings (1).

b) Measure the required cable length, keeping in mind that the connection point is located on the cover — see the next page.

Crimp the RJ45 connector onto the cable inserted into the charger (2).



After crimping the RJ45 connector onto the network cable:

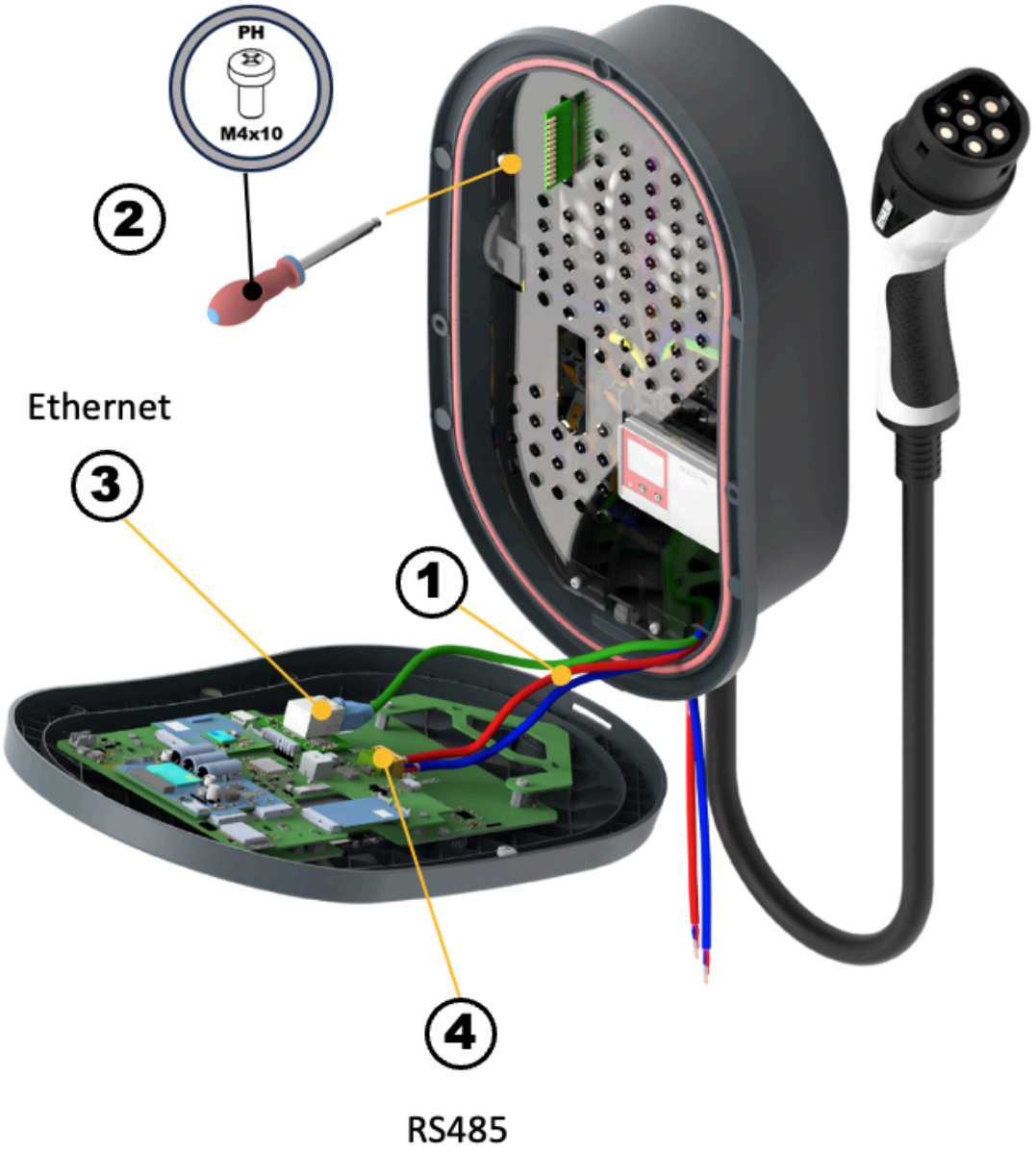
a) Route the Ethernet and/or RS485 cable through the bottom of the protective cover (1).

b) Install and screw on the protective cover (2).

c) Insert the RJ45 plug of the Ethernet cable into the socket located on the cover (3).

d) Connect the two wires to the RS485 socket, making sure they are correctly assigned to terminals A and B (4).

V1 V2 V3



6.9 Closing the enclosure

Before closing the cover, check all electrical connections for correctness.

The cover should be closed according to the following steps, and it is essential to follow their order:

a) Insert the bottom of the cover into the protruding latch in the enclosure (1).

b) Press the top of the cover against the enclosure and do not release it (2).

c) Tighten the top screw using the key included in the set (3).

d) If the charger operates in an open environment, additionally tighten the side screws on both sides of the charger (4).

7 First startup

Supply power to the charging station.

After powering on, a screen will appear prompting you to enter a PIN code.

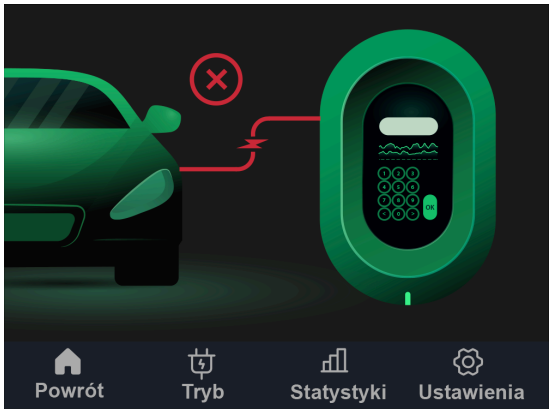
Enter PIN code: **1234**

Then **confirm.**

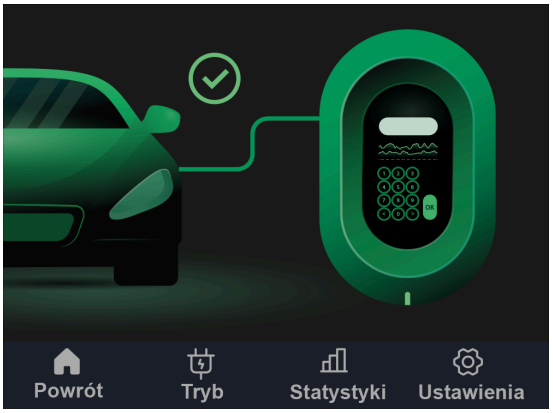
After unlocking the charger, it is recommended to change the factory PIN to your own. This option is available in the settings.

The charger's menu is intuitive. Below are the main screens:

Waiting for vehicle connection

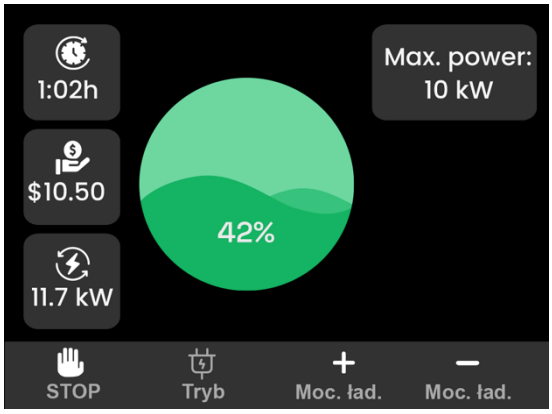


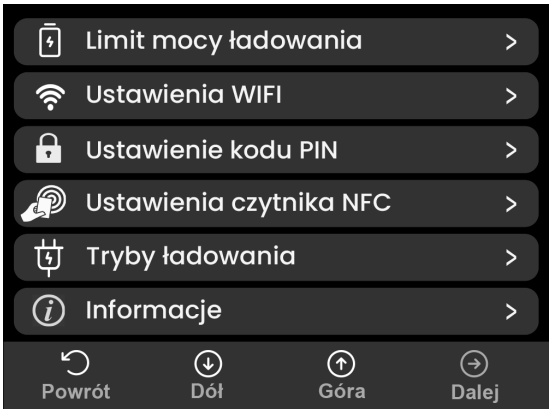
Vehicle connected



Charging in progress

Settings





7.1 Operating status indicator

The charger's status indicator may emit a steady or pulsing light depending on the current state of the charger. Below is a list of colors and their meanings:

White (steady) – charger is idle, waiting for connection

White (pulsing) – vehicle connected, not charging

Green (steady) – charging completed

Green (pulsing) – charging in progress

Red (pulsing) – error

7.2 Emergency stop

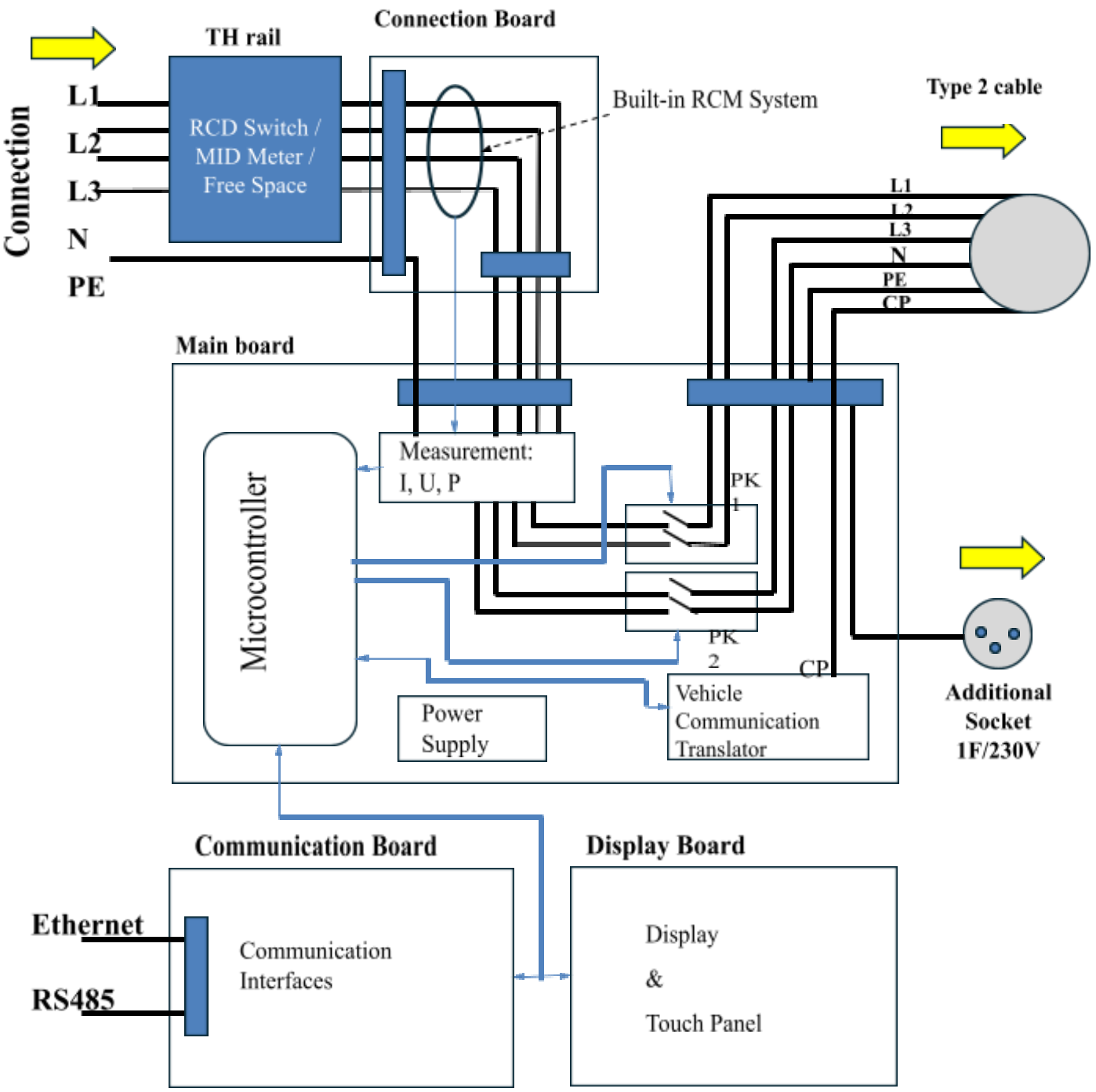
The charging process can be interrupted in one of the following ways:

- – by holding an RFID card up to the reader,
- – by stopping the session via the mobile app,
- – by unlocking the vehicle (e.g. using the key – be sure to consult the vehicle's charging manual),
- – by disconnecting the power supply to the charging station using a protective device (e.g. RCD, MCB, RCBO).

7.3 Quick charging guide

1. Connect the charging cable to the vehicle.
2. Authorization (if required) – if the charger is locked, enter the PIN code and confirm, hold the RFID card up to the reader, or authorize the charging session via the mobile app.
3. Start charging – after successful authorization, the charging process will start automatically, and the LED indicators on the charger will signal its status.
4. End charging – to stop charging, unlock the session in the app or hold the RFID card up to the reader, then disconnect the cable from the vehicle and the station.
5. The session can also be ended by unlocking the cable in the vehicle (e.g. by opening the door). Return the charging cable to its holder.

8 Electrical schematic



9 Device maintenance

9.1 Maintenance schedule for STAGEV Core, Pro, Intelli

To ensure long and trouble-free operation of the device, it is recommended to perform regular maintenance according to the following guidelines.

1. **Visual inspection (every 6 months)**
   - Check the condition of the enclosure and charging connector for visible damage, cracks, or excessive wear.
   - Regularly inspect the condition of caps protecting unused connectors or service openings. Make sure they are not cracked, brittle, or loose.
   - Ensure the charging cable is not twisted, frayed, or damaged.
   - Check that all labels and markings are legible and intact.
2. **Device cleaning (every 6 months)**
   - Disconnect the charging station from the power supply before cleaning.
   - Use a slightly damp cloth to clean the enclosure – do not use solvents, detergents, or abrasive agents.
   - Avoid using high-pressure water jets or pressure washers.
   - Clean the touch panel with a soft microfiber cloth. Do not use strong detergents, alcohol, or abrasive products. Avoid excessive pressure during cleaning.
3. **Connection and network check (every 12 months)**
   - For Ethernet connections, ensure network cables are properly connected and undamaged.
   - If STAGEV operates on WiFi, check the stability of the internet connection.
4. **Software updates (recommended regularly)**
   - Check the STAG app for available charger software updates.
   - Regular updates provide security patches and performance optimizations.
5. **Electrical installation check (every 12 months)**
   - Perform the required electrical measurements once a year, as described in the “Electrical Measurements” section.

Additional recommendations

- If you notice abnormal charger behavior, such as frequent charging interruptions, RFID authorization issues, or flashing LEDs, contact technical support.
- During planned electrical work in the building, disconnect STAGEV from the power supply to avoid voltage spikes.
- After storms or power surges, check whether the device is operating correctly and has not been damaged.

9.2 Functional tests of STAGEV Core, Pro, Intelli

Testing the STAGEV charging device using an EVSE simulator allows verification of the charger's correct operation in various states according to the IEC 61851-1 protocol. The tests include switching between states A, B, C, and E, which reflect different stages of connection between the charger and the electric vehicle.

State A – No vehicle connected

Conditions:

- **The EVSE simulator does not simulate the presence of a vehicle**
- STAGEV indicates **readiness for charging** (LED in standby mode)

Expected result:

- No activation of the power relay (the charger does not supply voltage to the output)
- LED status indicates readiness (steady green light**)**

State B – Vehicle connected but not ready for charging

Conditions:

- **The EVSE simulator simulates the presence of a vehicle**
- Charging does not occur

Expected result:

- The charger detects the connected vehicle but does not close the power relay
- In socket-based stations, the cable is locked
- LED status indicates vehicle connected (blinking green-blue light)

State C – Vehicle ready for charging

Conditions:

- **The EVSE simulator simulates the presence of a vehicle**
- Note: Authorization may be required for STAGEV to supply voltage

Expected result:

- In socket-based stations, the cable is locked
- **STAGEV activates the power relay, supplying voltage to the output**
- LED status indicates charging (blue light)
- Current draw measurement – confirmation that the vehicle is actually drawing power

State E – Fault

Conditions:

- **The EVSE simulator simulates a vehicle fault**
- Charging does not occur

Expected result:

- The charging station enters error mode
- **STAGEV disconnects the power relay**, no voltage is supplied
- LED status indicates error (red light)
- If there is a delay in entering the error state, short CP – PE on the simulatorrze.

10 Electrical measurements

Electrical measurements and inspections may only be performed by qualified electricians who hold the appropriate certifications and technical knowledge regarding STAGEV devices.

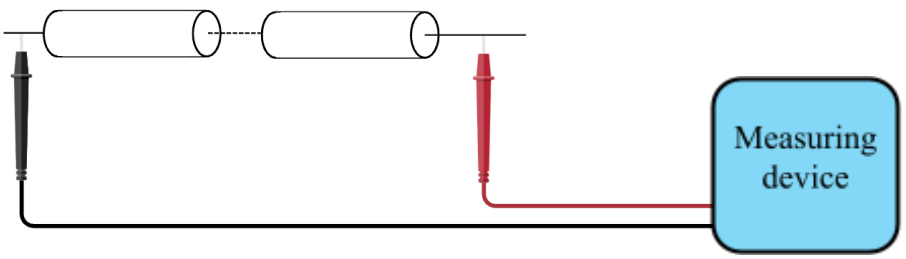
According to the Regulation of the Minister of Climate and Environment of July 1, 2022, on the detailed rules for confirming the qualifications of persons operating equipment, installations, and networks (Journal of Laws 2022, item 1392), Group 1 certification is required. This includes power equipment, installations, and networks generating, storing, converting, transmitting, and consuming electrical energy in the scope of: power equipment, installations, and networks with a rated voltage not exceeding 1 kV, as well as measuring and control equipment and automatic control, monitoring, and protection systems for the above-mentioned installations and devices, in the scope of Operation and Supervision.

10.1 Continuity test of equipotential bonding conductors

The open-circuit voltage should be between 4 and 24 V (AC or DC). The continuity test should be performed with a current of at least 200 mA.

Possible connection points for the test probe:

The method of performing the measurement is shown in the diagram below:



Continuity is considered acceptable if the resistance of the connection does not exceed 1 Ω.

10.2 Insulation resistance measurement of power supply cables

During the test, the charging station must be disconnected from the power supply. The test should be performed in a 3- or 5-wire configuration, depending on the type of installation used. Only instruments dedicated to this type of testing should be used for measuring insulation resistance.

Before starting the measurements, disconnect the power cable from the input terminals of the charging station and secure the exposed wire ends for the duration of the test.

If the installation is equipped with surge protection devices, it is necessary to disconnect the L1, L2, L3, and N wires from the surge protector before testing, and reconnect them after the measurements are completed.

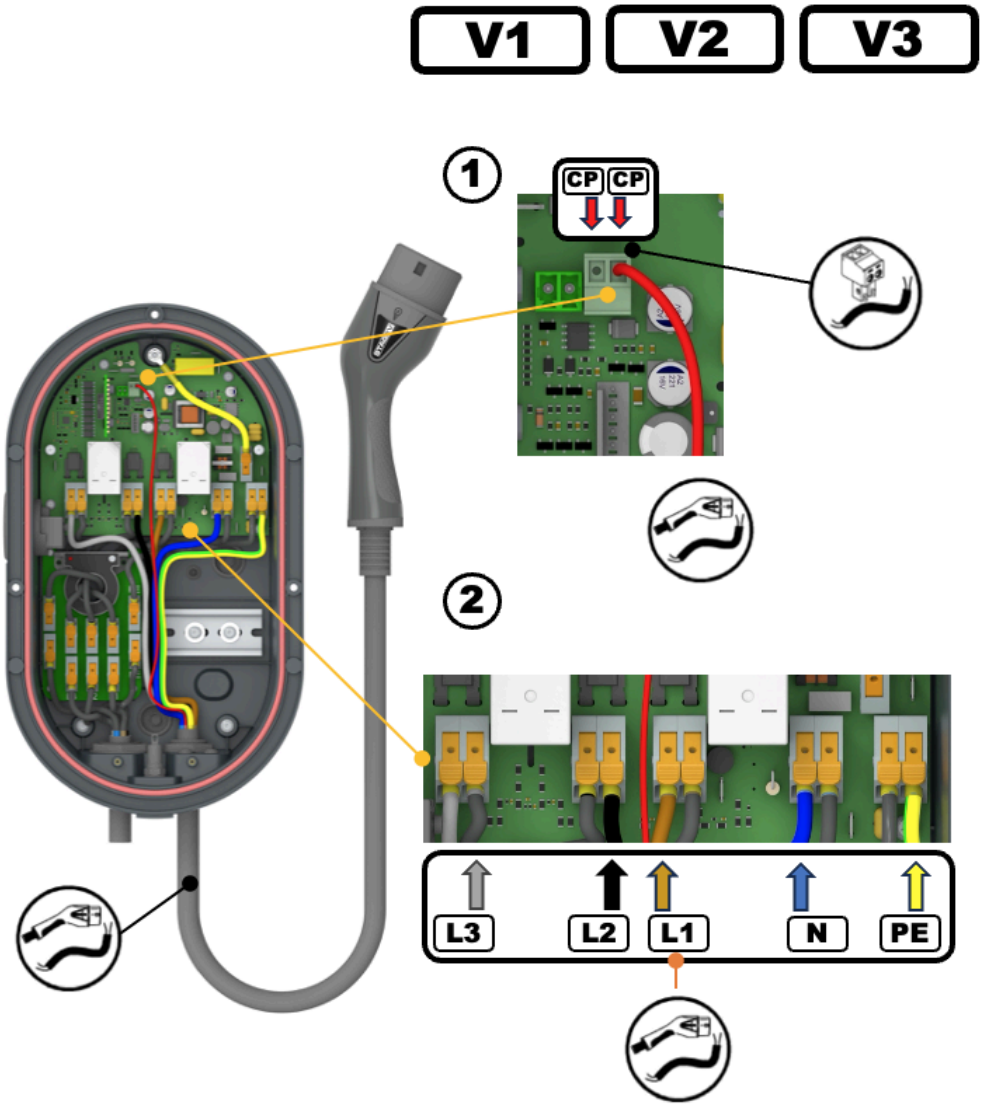
Insulation resistance measurements should be performed using a test voltage of 500 V DC. The minimum acceptable insulation resistance value is 1 MΩ.

The test should be carried out in accordance with the requirements of the PN-HD 60364-6:2016-07 standard, by measuring between individual phase conductors (L1/L2, L1/L3, L2/L3), between phase conductors and the neutral conductor (L1–N, L2–N, L3–N), and also between live conductors and the protective conductor.

10.3 Insulation resistance measurement of the charging cable

RISO measurement procedure for the charging cable

1. Disconnect the charging station from the power supply.
2. Ensure that the charging station is not under voltage.
3. Disconnect the charging cable from the power terminals.



1. Measure the insulation resistance between all conductors (L1/L2, L1/L3, L2/L3) and between the conductors (L1, L2, L3) and the neutral conductor (N) for each wire, as well as between the live conductors and the protective conductor (PE).
2. Use a test voltage of 500 V DC.
3. The measured insulation resistance must be greater than 1 MΩ.

10.4 Measurement of electric shock protection effectiveness

Network type: TN

The effectiveness of protective measures in the event of a fault, implemented through automatic disconnection of the power supply in TN systems, is verified based on:

a) measurement of the fault loop impedance Lx–PE

b) assessment of the characteristics and effectiveness of the applied protective device coordination

For a TN system, the following condition must be met:

$$WITH_S * I_a \leq IN_{the}$$

where:

$WITH_s$ - is the fault loop impedance

I_a - is the current causing automatic disconnection of the power supply within the time specified in the table below

IN_{the} - is the nominal AC or DC voltage to earth

Maximum disconnection times

System	50 V < Uo ≤ 120V		**120 V < Uo ≤ 230V**		230 V < Uo ≤ 400V		Uo > 400V	
	AC	DC	**AC**	DC	AC	DC	AC	DC
TN	0,8	-	**0,4**	1	0,2	0,4	0,1	0,1
TT	0,3	-	0,2	0,4	0,07	0,2	0,04	0,1

In TN systems, for distribution circuits and circuits with a rated current up to 32 A, the maximum permissible disconnection time is 0.4 s.

Network type: TT

In TT systems, the effectiveness of protective measures in the event of a fault, implemented through automatic disconnection of the power supply, is verified by:

a) performing a fault loop impedance measurement Lx–PE

b) assessing the characteristics and effectiveness of the applied protective device coordination

$$WITH_S * I_a \leq IN_{the}$$

where:

$WITH_s$ - is the fault loop impedance,

I_a - Current causing automatic disconnection of the power supply within the time specified in the table below,

IN_{the} - is the nominal AC or DC voltage to earth

Maximum disconnection times

System	50 V < Uo ≤ 120V		**120 V < Uo ≤ 230V**		230 V < Uo ≤ 400V		Uo > 400V	
	AC	DC	**AC**	DC	AC	DC	AC	DC
TN	0,8	-	0,4	1	0,2	0,4	0,1	0,1
TT	0,3	-	**0,2**	0,4	0,07	0,2	0,04	0,1

In TT systems, for distribution circuits and circuits with a rated current not exceeding 32 A, the maximum permissible disconnection time is 0.2 s.

In TT systems, achieving sufficiently low fault loop impedance may be problematic. According to the PN-HD 60364-6:2016 standard, it is then permissible to use a residual current device (RCD) as a means of protection against electric shock. When an RCD is used as the protective device, it is necessary to verify that the condition for limiting touch voltage to a safe value over time is met, using the following formula:

$$R_A \leq \frac{IN_L}{I_a}$$

where:

R_A – resistance of the protective conductor grounding, in ohms (Ω) (it is acceptable to measure grounding resistance using the fault loop impedance method);

IN_L – permissible long-term touch voltage, in volts (V) (50V);

I_a – disconnection current of the protective device, in amperes (A). If the protective device is an RCD, the disconnection current is the rated residual current $I_{\Delta N}$.

Maximum permissible R_A values depending on the RCD used

Rated residual current of RCD $I_{\Delta N}$	**30 mA**	100 mA	300 mA	500 mA
Maximum R_A value	**1667 Oh**	500 Ohms	167 Oh	100 Ohms

10.5 Residual current device (RCD) testing

Measurement procedure (for an RCD installed in the charging station):

1. Open the charging station
2. Switch on the power supply to the charging station
3. Turn on the RCD (switch up)
4. Connect the RCD testing device to the RCD output terminals
5. Follow the tester's instructions during RCD measurements

Measurement procedure (for an RCD installed in an external distribution board):

1. Turn on the RCD (switch up)
2. Connect the RCD testing device to the RCD output terminals
3. Follow the tester's instructions during RCD measurements

Measurement of RCD tripping time

Tripping time is defined as the period from the appearance of residual current to the moment the RCD contacts open.

Measurement procedure:

- Gain access to the RCD under test
- Switch on the RCD power supply
- Perform the measurement according to the instrument manufacturer's instructions
- Carry out tripping time tests for sinusoidal, pulsed, and pulsed with DC component currents

For non-delayed RCDs with a rated residual current IΔN = 30 mA, the maximum permissible tripping times are shown below

Maximum tripping time [ms]

$0{,}5\ I_{\Delta N}$	$I_{\Delta N}$	$2\ I_{\Delta N}$	$5\ I_{\Delta N}$
no tripping	< 300 ms	< 150 ms	< 40 ms

Measurement of RCD tripping residual current

The purpose of this test is to determine the actual residual current value at which the RCD trips.

Measurement procedure:

- Gain access to the RCD under test
- Switch on the device power supply
- Perform the measurement according to the instrument manufacturer's instructions
- Carry out tests for sinusoidal, pulsed, and pulsed with DC component currents

For non-delayed RCDs with a rated residual current IΔN = 30 mA, the acceptable ranges of residual current values are given in the table below

Residual current	Verification criteria
Sinusoidal current	15 – 30 mA
Pulsed current	10,5 – 42 mA
Pulsed current with DC component	max. 42 mA

The effectiveness of residual current protective devices should be assessed in accordance with the requirements of the current standard PN-HD 60364-6:2016-07

10.6 Verification of protection against DC leakage current < 6mA

To ensure protection against DC leakage current in the charging station, an RCM system is used. Verifying its correct operation requires the station to initiate the charging process and for voltage to appear at the output. An EVSE simulator should be used for this purpose.

Measurement procedure:

- Turn on the power supply to the charging station.
- Connect the EVSE tester in "C" mode to initiate the charging process.
- If the station requires authorization, perform the authorization.
- Ensure that voltage appears at the station's output (as indicated in the EVSE tester user manual).
- Connect the RCD meter to the EVSE tester.
- Perform the measurement according to the meter manufacturer's recommendations.

IEC 62955 standard specifies the maximum detectable DC leakage current as 6 mA with a current rise rate of 1 mA/s. Note that not all meters allow setting this rise rate.

For multifunction meters, it is recommended to set IΔN = 10 mA before starting the measurement.

If the measuring device does not offer this option, set IΔN = 30 mA, being aware that the result may be overestimated (reading above 7 mA instead of the expected <6 mA).

A **positive test result** is considered to be the interruption of the charging process during the DC leakage current measurement.

The detection time should not exceed 300 ms.

10.7 Ground resistance measurement

Ground resistance measurement should be carried out when a separate grounding has been made for the charging station. The test can be performed using the technical method, compensation method, clamp method, or another method permitted by applicable regulations – in accordance with the PN-EN 61557-5 standard.

The parameters of the obtained grounding must meet the requirements specified in local legal regulations and standards for electrical installations.

11 Device Servicing

The charger can be repaired on-site by a person with appropriate qualifications.

Before any intervention in the device, be sure to read the manual.

The device has a modular design, allowing easy replacement of selected components without the need for specialized service tools. Individual PCBs are connected via quick connectors, enabling disassembly and assembly using a standard screwdriver. The device does not contain soldered connections that require external service intervention.

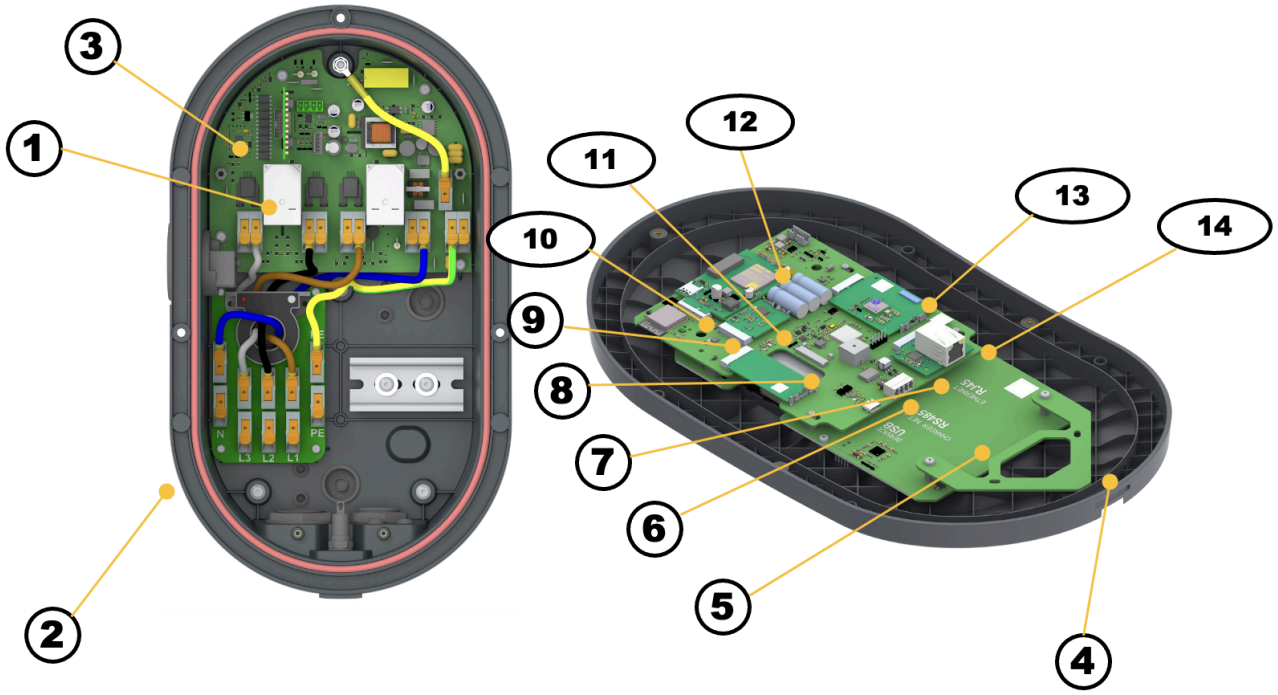
Additionally, the charger's functionality can be expanded by adding an extra module. This upgrade also does not require sending the charger to a service center—it can be performed directly at the installation site.

The following boards are intended for replacement by qualified technical personnel:

- **Connection board**
- **Main board**
- **Communication board**
- **Display and touch board**

Replacement of individual components on these boards is not possible outside the manufacturer's authorized service.

11.1 Charger Construction



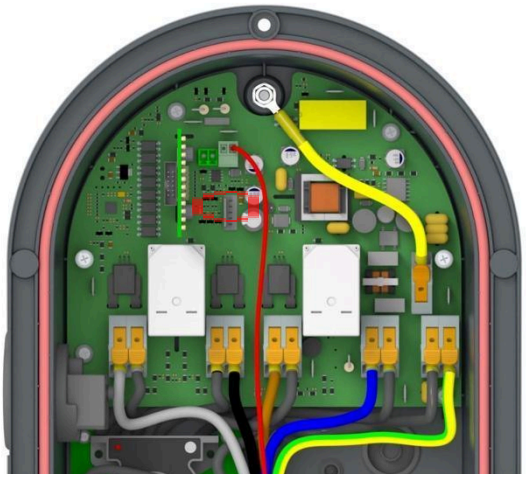
1. Main board
2. Connection board
3. Connector for communication with meter on TH rail
4. LED indicator board
5. Display and touch board
6. USB diagnostic connector
7. RS485 connector
8. Radar module
9. Communication board
10. Built-in WiFi module
11. RFID/NFC module
12. 2G/LTE module
13. Smart home module
14. Ethernet communication module

11.2 Replacement of Consumables

The manufacturer does not foresee any consumable replacements.

11.3 Connection Board Replacement

1. Open the charging station.
2. Disconnect the power supply to the station circuit.
3. Lift the current clamp levers and disconnect all wires.
4. Disconnect the harness connecting the RCM system to the main board.



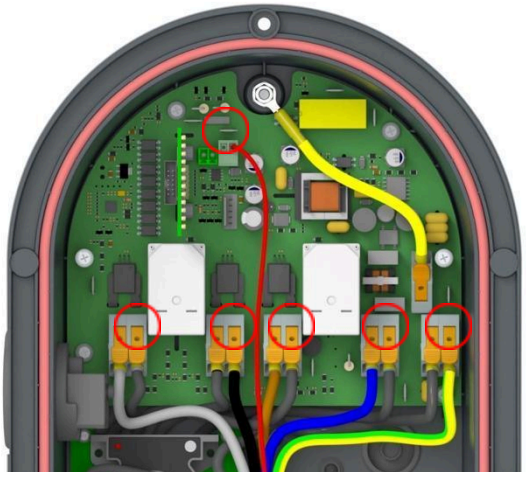
5. Unscrew the 4 screws securing the connection board.

6. Remove the connection board.
7. Install the new connection board by following the steps in reverse order.

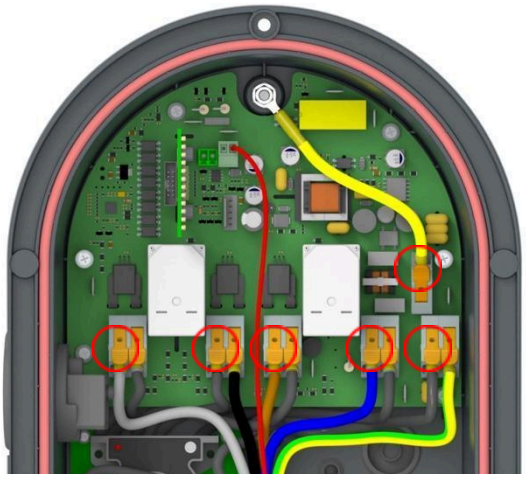
⚠ **Note:** When installing the new connection board, ensure that the wires (L1, L2, L3, N) between the connection board and the main board pass through the ring of the RCM device – which detects AC leakage current: 30mA and DC leakage current: 6mA.

11.4 Main Board Replacement

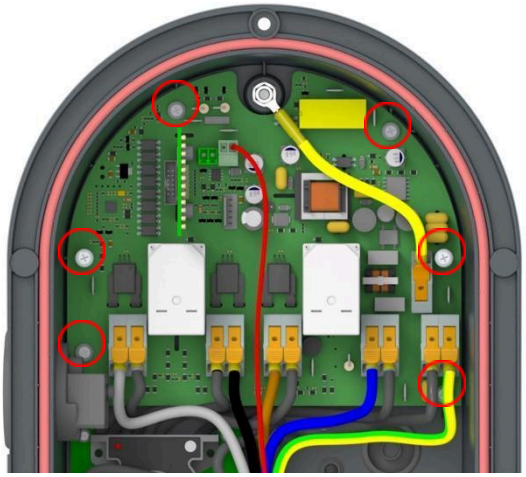
1. Open the charging station.
2. Disconnect the power supply to the station circuit.
3. Disconnect the charging cable from the main board.



4. Disconnect the power supply wires from the main board.



5. Unscrew the screws securing the main board.

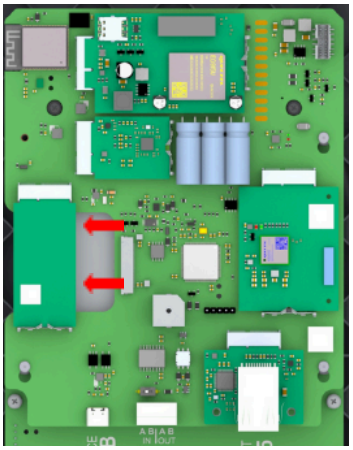


6. Replace the damaged main board.

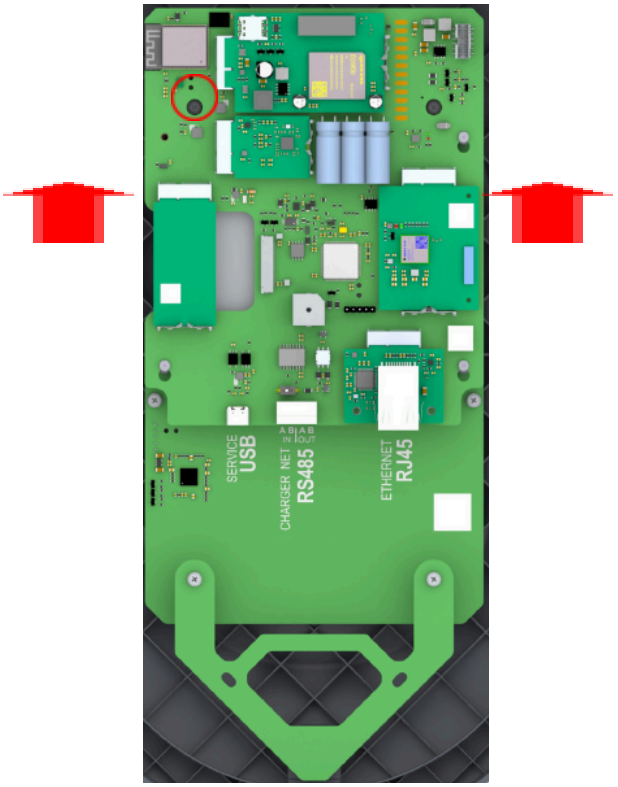
7. Install the new main board by following the steps in reverse order.

11.5 Communication Board Replacement

1. Open the charging station.
2. Disconnect the power supply to the station circuit.
3. The communication board is located on the front panel.
4. Disconnect the communication ribbon between the screen and the communication board by sliding aside the two locking elements and gently pulling out the ribbon.



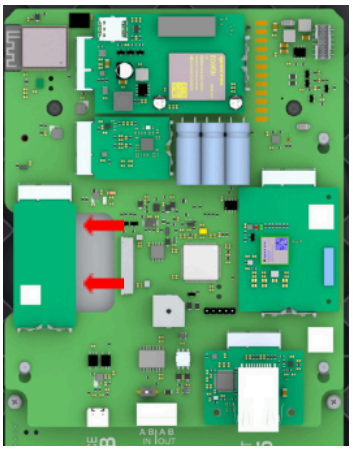
5. Unscrew the screw securing the communication board and slide the board forward.



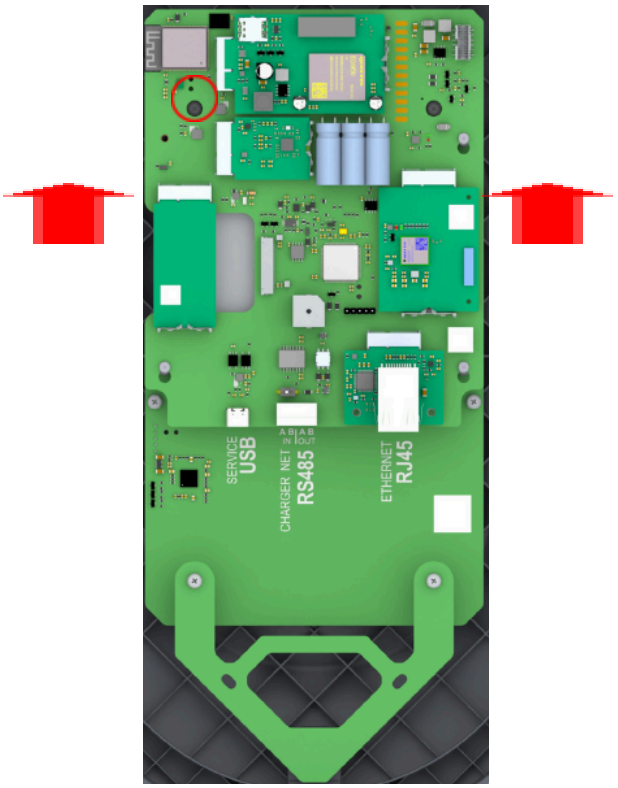
6. Replace the communication board.
7. Install the new communication board by following the steps in reverse order.

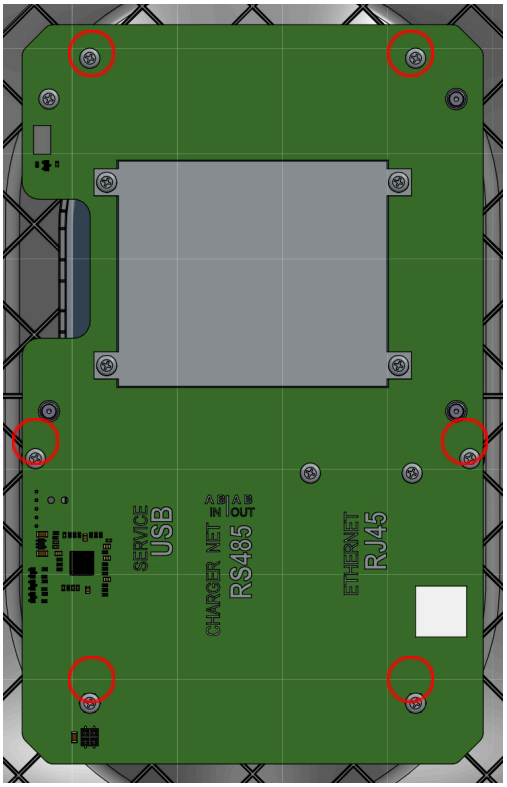
11.6 Display and Touch Board Replacement

1. Open the charging station.
2. Disconnect the power supply to the station circuit.
3. The communication board is located on the front panel.
4. Disconnect the communication ribbon between the screen and the communication board by sliding aside the two locking elements and gently pulling out the ribbon.



5. Unscrew the screw securing the communication board and slide the board forward.



6. Unscrew the screws securing the display and touch board. The screws are located in the areas marked below.
7. 

8. Install the new display and touch board by following the steps in reverse order.

12 Error codes

Error Code	Error Description	Module / Cause	Service Recommendation
E01	No communication with vehicle (EV)	EV vehicle	Check the charger cable, plug, and socket
E02	RCD protection triggered	Power module / main board	Check the charging cable. If the issue persists, replace the connection board
E03	No communication with main board	Main board	Check power supply, replace the board
E04	No communication with communication board	Communication board	Check power supply, replace the board
E05	No signal from display / touch	TFT Touch board	Check the connector, test touch functionality, replace the board
E06	No communication with DIN rail meter	TH-Bus connector	Check connection to the meter, verify correct meter type
E07	No communication via RS485	RS485 port	Check wires and bus. Ensure only one Master is selected
E08	No WiFi communication	WiFi module	Check antenna and network configuration
E09	No communication with RFID/NFC	RFID/NFC module	Check antenna, wiring, and card functionality
E10	No communication via 2G/LTE	GSM/LTE module	Check SIM card, network coverage, and APN settings
E11	No Ethernet signal	Ethernet module	Check LAN connector and IP configuration
E12	Charging current exceeded	Power module / main board	Check installation, vehicle, and protections
E13	Excessive temperature detected	Temperature sensors / electronics	Check charging current, power supply, and modules
E14	CP signal shorted to PE	Main board	Disconnect vehicle charging cable and check for short between CP and PE using a meter. If shorted, replace the cable. If the cable is fine, replace the main board

13 List of Compatible Electricity Meters

1. Relpol RLE03-4M
2. F&F LE-03MW

Manufacturer:

AND S.A.

50, 42nd Infantry Regiment Street

15-181 Bialystok

Poland

www.stag-ev.com