5. Electrical system components 76.8V

5.1. Troubleshooting

Battery does not charge

- Anomaly in charging point/external charger cable to type 2
- Cable or connection Type 2 to Charger interrupted
- Defective internal charger

The lighting does not work

- Check whether it is a particular lighting component (see chapter 6) or the whole assembly: headlamp, rear lamp, stop lamp, indicators, horn and instrument cluster.
- Anomaly in DC/DC converter integrated in the charger → 5.4.3.
- Check circuit fuse 12V → 6.20

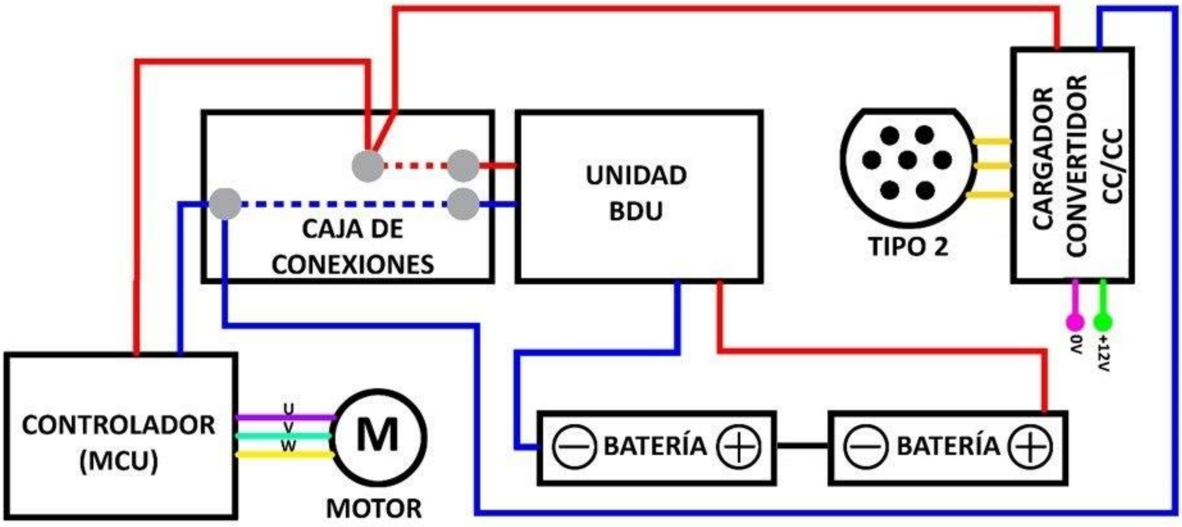
The vehicle does not work and nothing lights up

- Battery connector to BDU disconnected → 5.6
- Loose connection in circuit 76.8V
- CAN BUS cable interrupted or loose connector
- Defective BDU
- Battery problem
- Defective DC/DC converter-charger

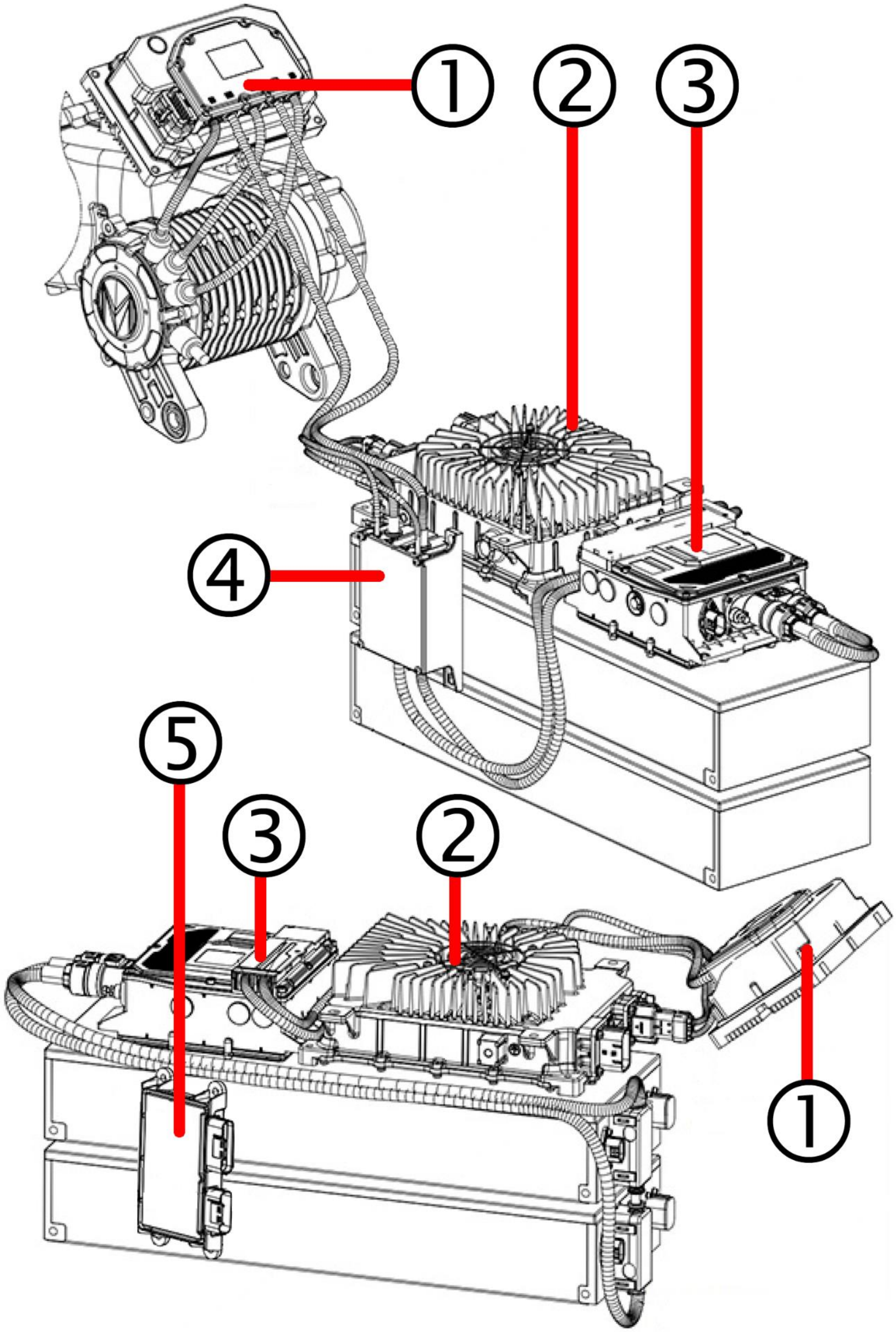
The engine does not work

- The "P" button has not been activated by switching to "D" (Direct) mode.
- Loose or interrupted phase cables
- CAN BUS cable interrupted
- Broken drive belt
- STOP message on TFT screen (this message may appear for various reasons; take the vehicle to a Nerva Service Centre).
- Defective engine.

5.2. Nerva Cargo circuit diagram 76.8V



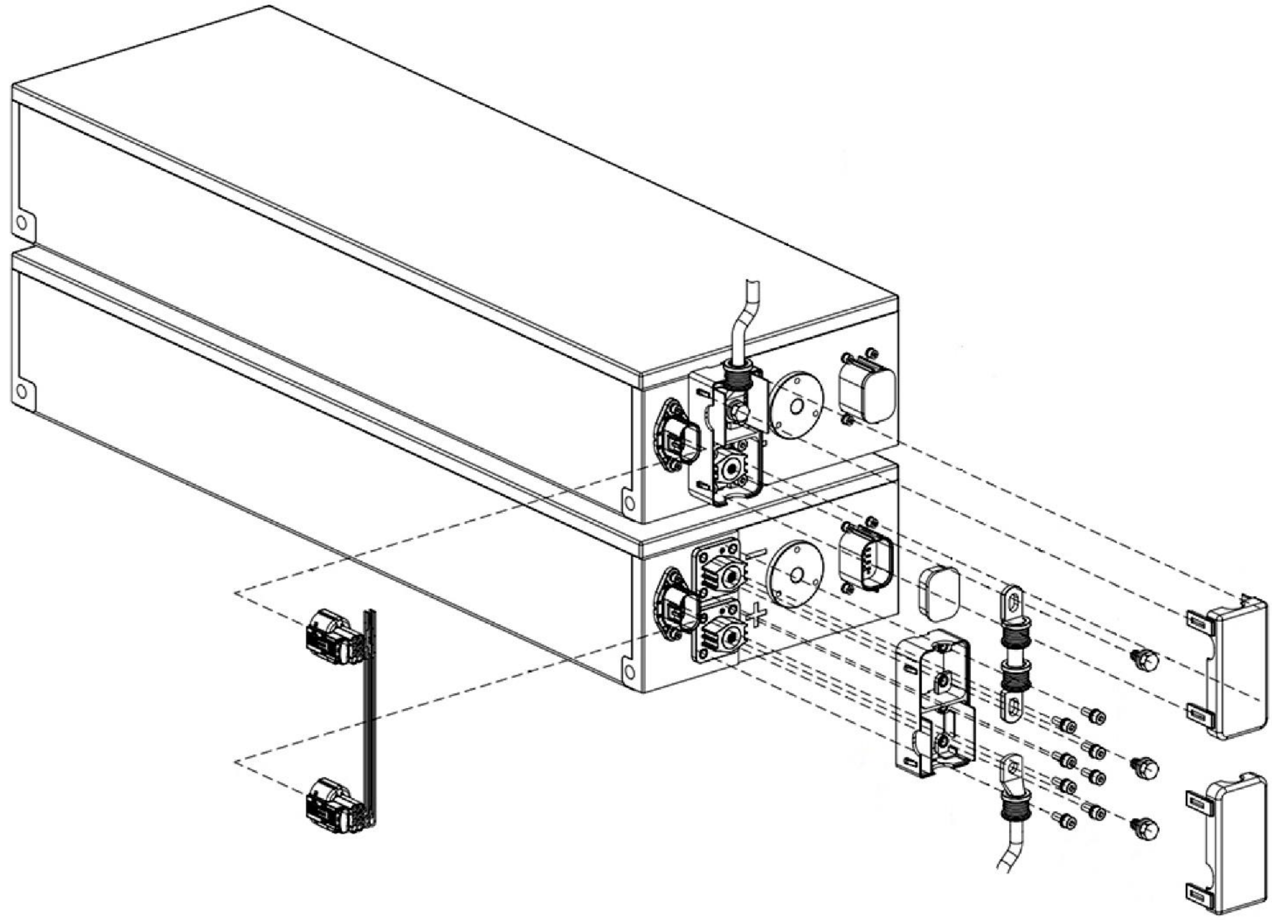
5.3. Circuit component location 76.8V



①	MCU engine controller	④	Junction box
②	DC-DC Charger and Converter	⑤	VCU
③	BDU		

5.4. Introduction of 76.8V Nerva Lift circuit components

5.4.1. Batteries (Battery)



Nerva is the only motorcycle brand with access to **BYD's Blade battery technology,** which has proven to be **the safest** to date – able to remain virtually undamaged even in accidents involving direct punctures.

With this new battery technology, Nerva takes another step towards its goal of facilitating access to sustainable mobility. Blade batteries are named for their shape, as they have a **form similar to that of a blade** and are atypically small compared to other batteries.

The Blade batteries used in the Cargo model are composed of individual cells adapted to the dimensions of the vehicle. All these cells are fitted into a kind of matrix, which significantly increases the **use of space by up to 50%.** Their **energy density** is **140 Wh/kg**, which is comparable to the same figure as NCM batteries.

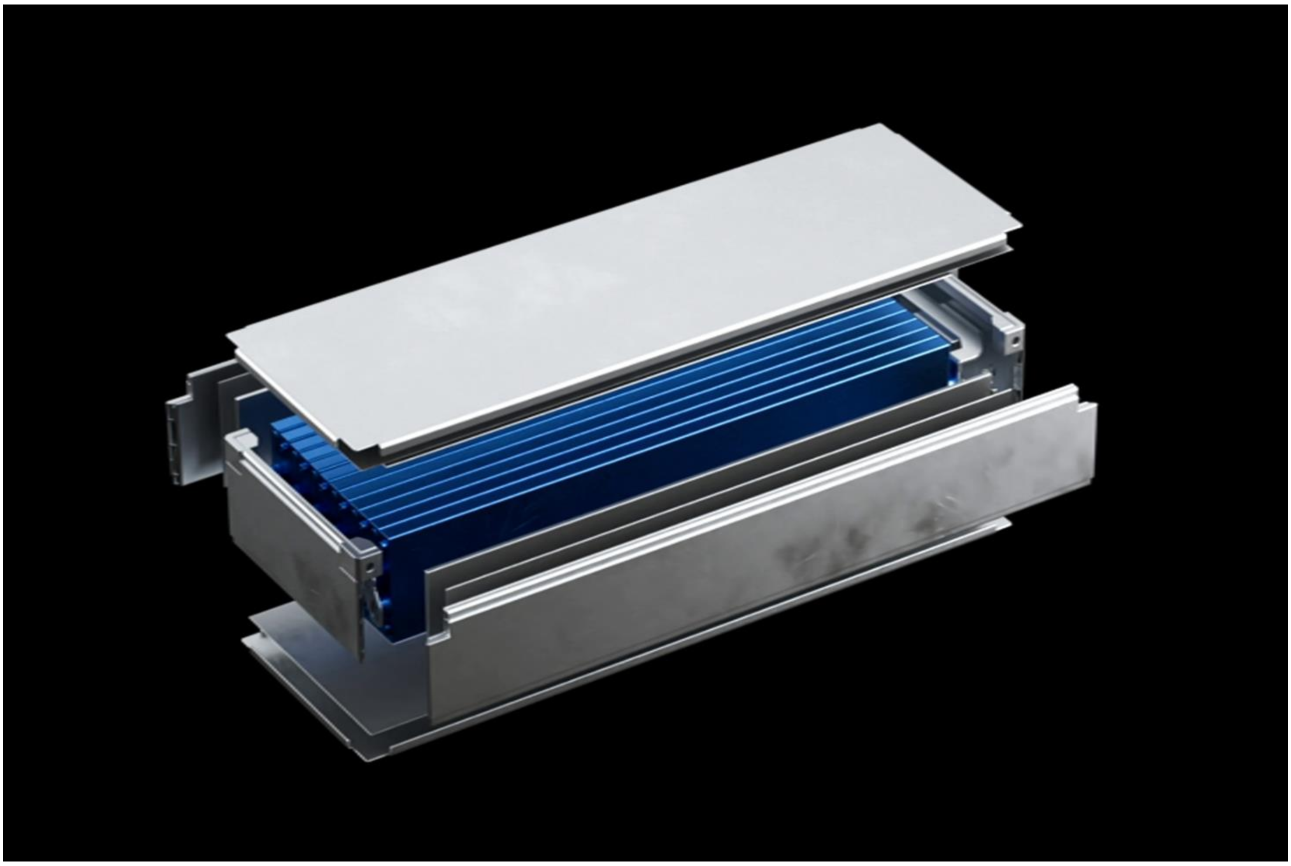
Another important feature to note is that Blade batteries offer a high **degree of safety**. This is based on their design, which makes them a very robust system, to the use of **Lithium Phosphate (LFP) itself,** which has a more stable chemical composition than other lithium batteries. This means that the Blades do not catch fire and do not suffer major damage in the event of accidents.

This can be amply demonstrated by what is considered to be the most demanding test for electric batteries. Namely, this is the **piercing test,** which seeks primarily to check how the battery would react to a **short circuit caused by a puncture**. While many other batteries quickly heat up to fire-causing temperatures within seconds, **Blade batteries manage to stay between 30 and 60 degrees** throughout the entire test — meaning the only damage they sustain is from the actual puncture itself. **No signs of fire are to be seen**.

In addition to this test, BYD has subjected its Blade batteries to many others, including extreme conditions where they were heated to 300 degrees without igniting, and even faced another tough challenge: **crushing**. However, even when subjected to **forces equivalent to a 46-tonne lorry driving over them,** the batteries **remain undamaged** and in good condition for installation and use.

Another advantage of these batteries is that they **can withstand more charge cycles than NMC batteries**. Thus, while NMC batteries are rated for 1,000–2,000 charge cycles, LFP batteries boast a tripled longevity of **4,000–6,000 charge cycles.**

The reliability and safety achieved by Blade batteries is leading more and more manufacturers to opt for them – with these clients including Mercedes Benz, Toyota and Tesla, among others. Currently, **Nerva is the only brand of electric motorbikes on the market that incorporates Blade batteries**. This is a stand-out selling point for this young brand, which was unveiled just over a year and a half ago.



The Nerva Cargo scooter's battery pack consists of **two units arranged in series, totalling 76.8 V with a capacity of 54 Ah**. The weight of both batteries is **35 kg** and is located in the lower centre of the chassis, contributing to its dynamic qualities with optimal mass distribution and a low centre of gravity.

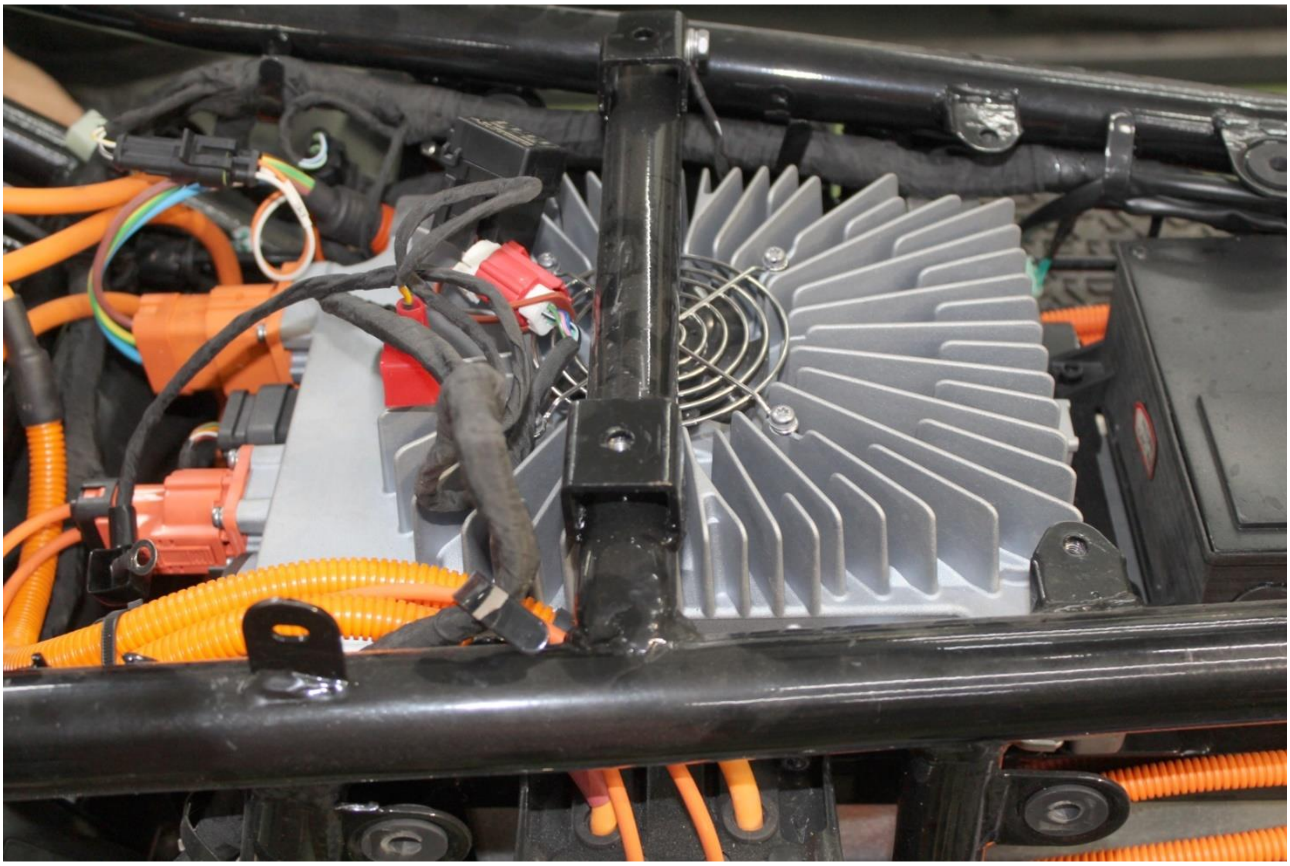
NOTE: Batteries may not be tampered with except with the consent of Nerva. Any suspicious activity involving the battery **will automatically void the warranty**.

5.4.2. Controller (MCU: Engine Controller Unit)

The controller's task is to regulate the electric engine with the DC power supplied by the batteries, according to the user's dosage via the throttle. Internally, it converts the direct current into the three-phase alternating current needed to power the engine.

It is located under the back of the seat.

5.4.3. Charger + DC/DC Converter



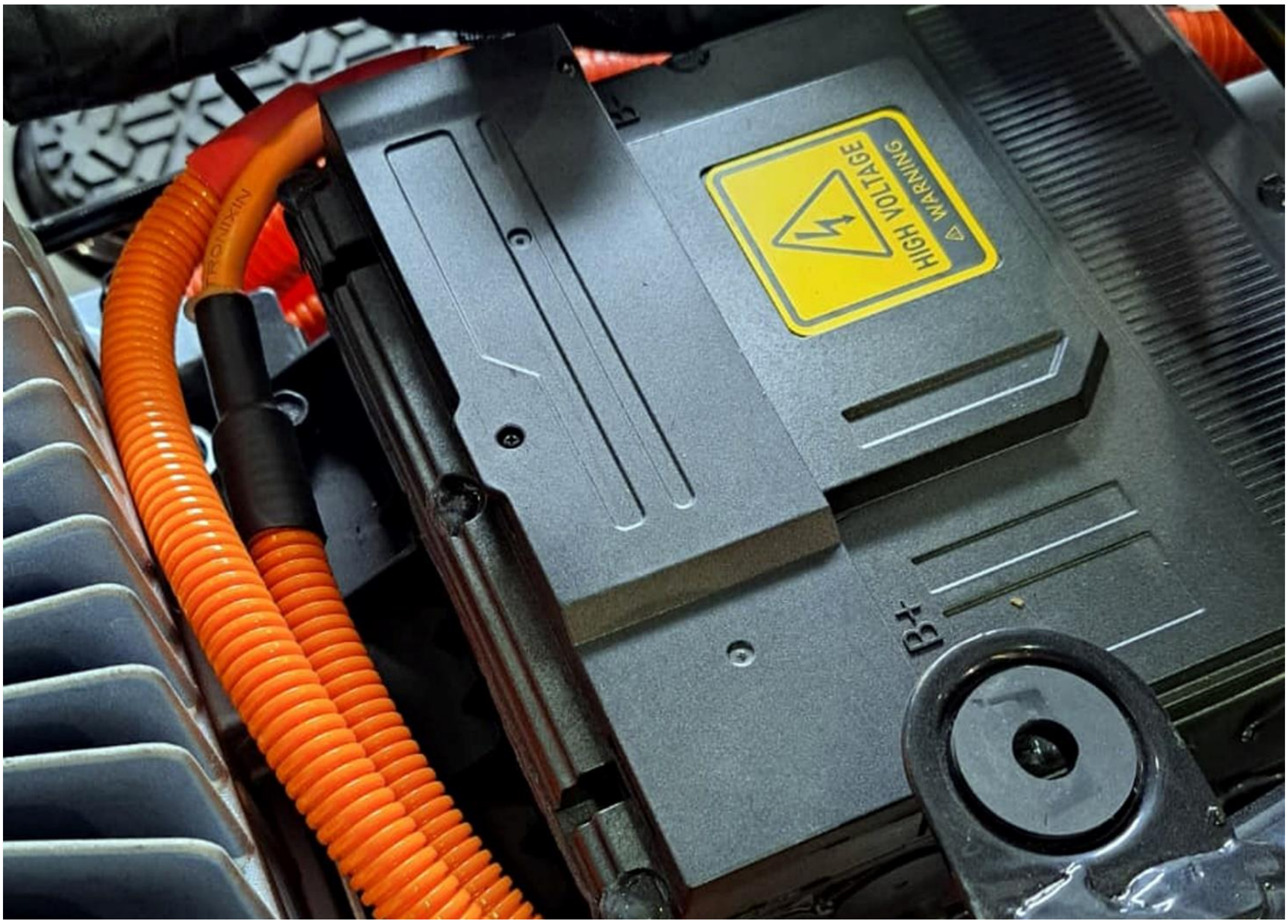
The purpose of the charger is to recharge the batteries. It starts from an input provided by the three phases of alternating current supplied by the Type 2 connector, either via the external charger connected to the domestic mains via the Shuko connector supplied with the vehicle, or by connecting it to a recharging point. The Charger is contained in a case with a heat sink, to which a fan is added to further cool the electronics inside.

In this model, the charger integrates the DC/DC converter that supplies 12V direct current to the components of the scooter's electrical system (headlight, tail light, horn and instrument panel). The task of the converter is therefore to convert the 76.8 volts of direct current supplied by the two batteries into 12 volts of direct current.

In addition, it is connected to the secondary 12V battery providing a constant power supply independent of the converter to retain the settings in the ECU's memory.

The Charger + DC/DC Converter is located under the front of the seat.

5.4.4. BDU Unit (Battery Disconnect Unit)



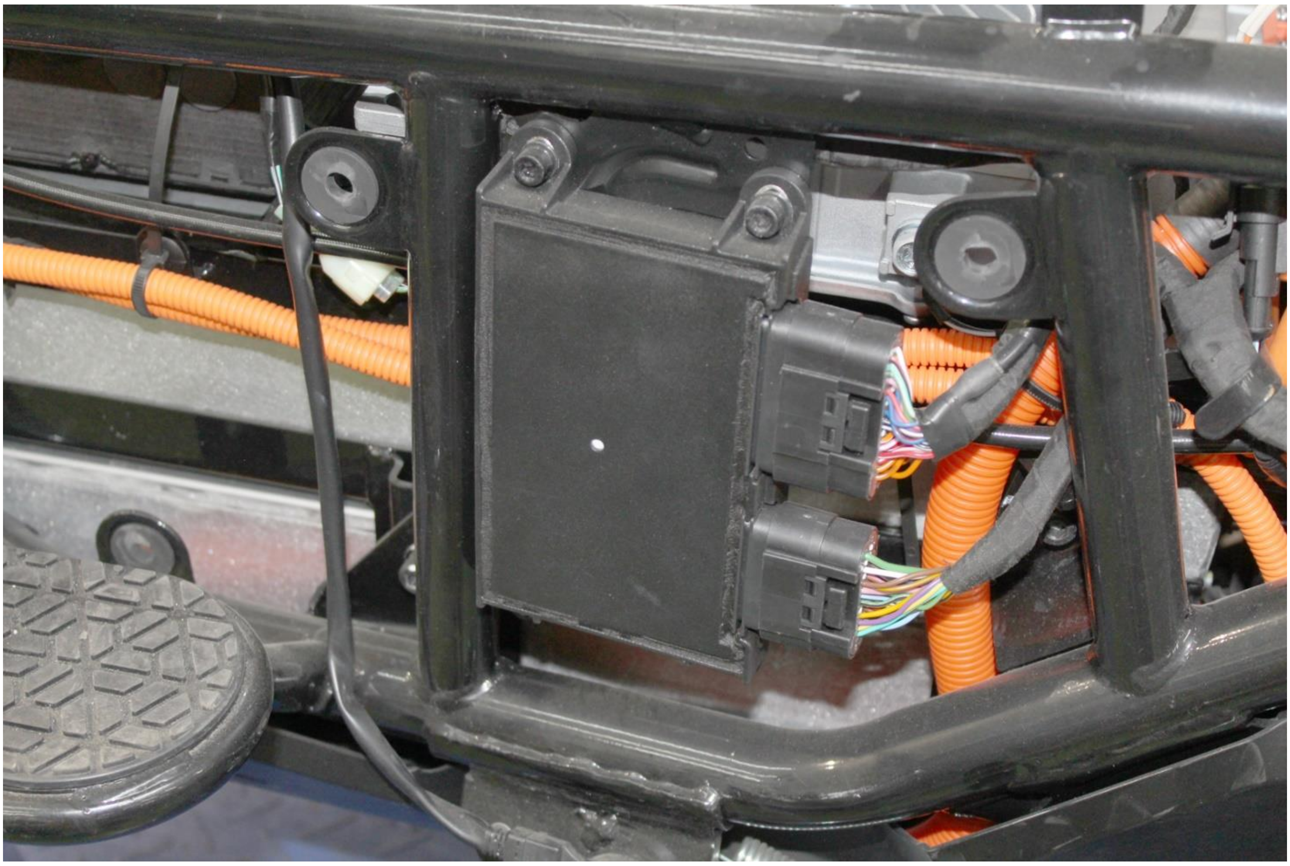
This unit acts as a main switch between the batteries and the rest of the high voltage circuit components. This unit disconnects and connects the battery if the vehicle is not in use or being used, as well as detecting overcurrents and short circuits by acting as a safety switch.

The BDU integrates the functions of the BMS, or Battery Management System, providing many safety measures to protect the integrity of the batteries that impact on their longevity. Its purpose is to monitor the charge and discharge currents not only of the battery as a whole, but also internally with each of the cells that make up the battery.

The BDU parameterises the temperatures, voltages and currents of the individual cells at all times and makes decisions based on the current state of the battery. It is also responsible for calculating the remaining battery percentage (SOC) during discharge or adjusting the SOC during charging. It also includes a passive balancing functionality which allows to keep the battery in optimal condition so that the autonomy is not affected.

The BDU is located in the central part of the vehicle, between the seat and the charging socket.

5.4.5. VCU (Vehicle Control Unit)



This is the brain of the vehicle's electrical system, monitoring and regulating all components such as the engine controller, battery management, component temperatures, energy regeneration system, diagnostics, safety measures and energy efficiency.

It is based on a microprocessor that receives data from the vehicle's various sensors and executes control algorithms. It includes analogue-to-digital and digital-to-analogue converters for signal conversion, CAN bus communication interfaces, RAM and ROM memories for data storage and the management software with preset instructions.

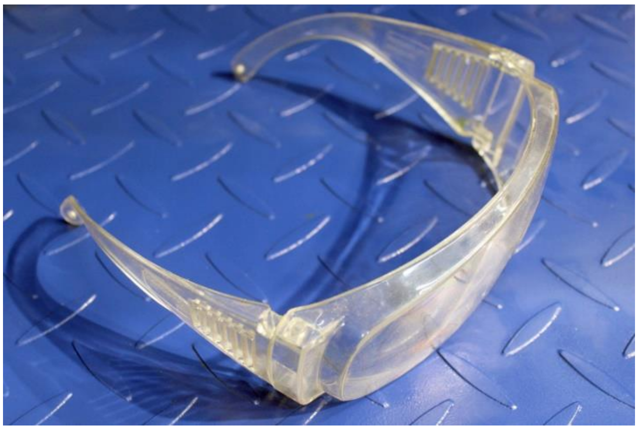
To access the VCU, the left-hand side bodywork must be removed, just behind the left-hand footboard.

5.4.6. Junction box

It is a simple box where the positive and negative wires of all the components of the 76.8 V electrical system are connected together, thus facilitating the independent disconnection of any of them.

To access the junction box, the right-hand side of the bodywork must be removed.

5.5. Personal Protection Equipment (PPE).



Before starting any maintenance or repair work on the Nerva Exe scooter, it is important to address safety precautions when handling components of the 76.8-volt electrical system: due to the high capacity of the batteries, the mechanic may be exposed to currents of up to 200 amps – the same as the rating of the two blade fuses that protect this circuit.

Basic Personal Protective Equipment (PPE) for the mechanic consisting of gloves and goggles. The gloves must have category 00 dielectric protection capable of insulating up to 750 volts direct current, and must be visually checked for holes and cuts prior to use.

The goggles must protect the field of vision (at least in the eyes) against impacts caused by short circuits or electric arcs.

Other recommended equipment includes footwear with dielectric protection, and insulating overalls covering the operator's chest.

An additional preventive measure is to use tools with insulation in the handle area of the tool.

5.6. Disconnecting the BDU (Battery Disconnect Unit)

HAZARD
• Wear dielectric gloves to protect against short circuits or electric shock. • Before handling any component of the high-voltage electrical system, you must disconnect the dual output connector of the BDU unit to isolate the battery voltage from the rest of the components. • Even if you have disconnected the BDU you must, as a precaution, continue to at least use gloves to handle the components of the high-voltage circuit, as the capacitors of some components may have become charged.

Required prior operations:

- Disconnect the auxiliary battery (→ 1.4.1. Dismantling auxiliary battery)
- Remove the right and left sides of the bodywork (→ See 1.9. Dismantling of the side bodywork)
- Remove the upper centre bodywork (→ See 1.5. Disassembly of the upper central bodywork)
- Remove the right and left underbody skirts (→ See 1.10.1. Dismantling of the skirts)
- Disassemble the front wheel arch (→ See 1.10.2. Disassembly of the front wheel arch

Necessary tools

8 and 10 mm socket spanners

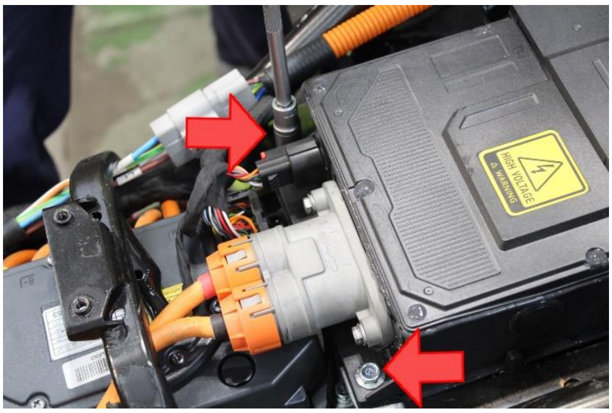
Phillips screwdriver, tip #0

Polymeter

Insulating tape

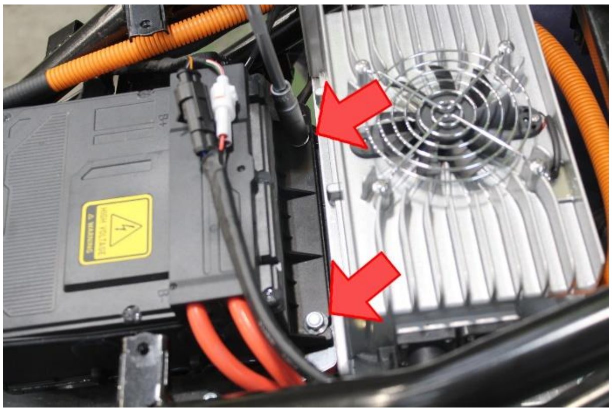
Before disconnecting the BDU, ensure that the entire vehicle is in a de-energised off state by allowing it to stand for more than 60 seconds.

Remove the two front screws securing the BDU with a 10 mm socket spanner.



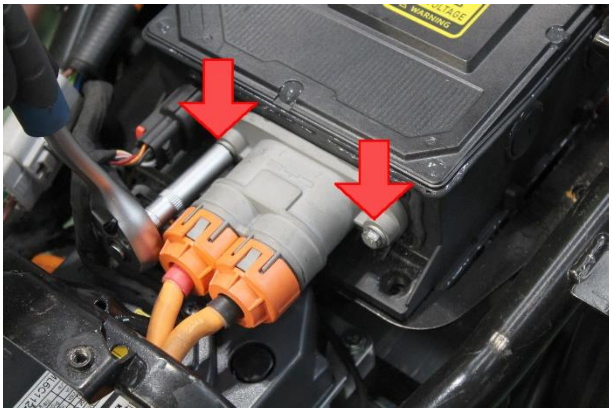
Remove the two rear screws securing the BDU with a 10 mm socket spanner.

Tightening torque:
BDU fixing screws: 9±2 Nm.



Remove the 2 screws securing the battery connector with an 8 mm socket spanner.

Tightening torque:
Screws for fixing the battery cable connector to the BDU: 3±0.6 Nm.



Remove the battery connector.

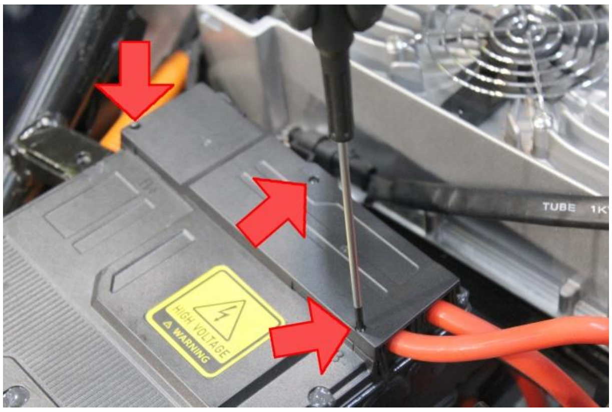
Slide out the red latch on the data connector.

Remove the data connector.

Remove the three cover screws covering the output wires with a #0 Phillips screwdriver.

Tightening torque:

BDU cover screws: 0.2±0.1 Nm.

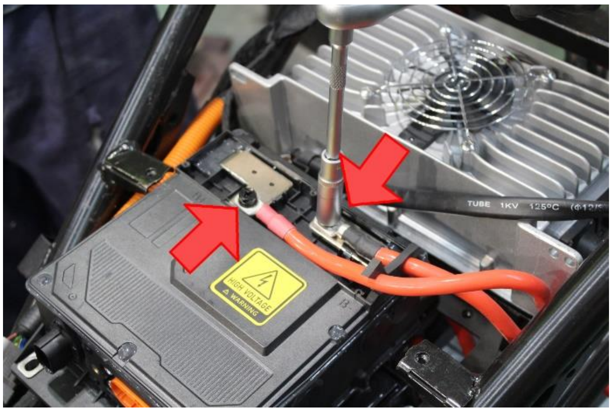


Remove the cover and check with a multimeter (voltmeter on 200V DC scale) that there is no load on the output terminals.

Use a 10 mm socket spanner to remove the two black screws securing the output terminals.

Tightening torque:

BDU power cable fixing screws: 9±2 Nm.



Remove the output terminals.

Insulate the output terminals with insulating tape.

Pull the BDU out of its housing by hand.

5.7. Disconnection of the engine cables from the Controller

Required prior operations:

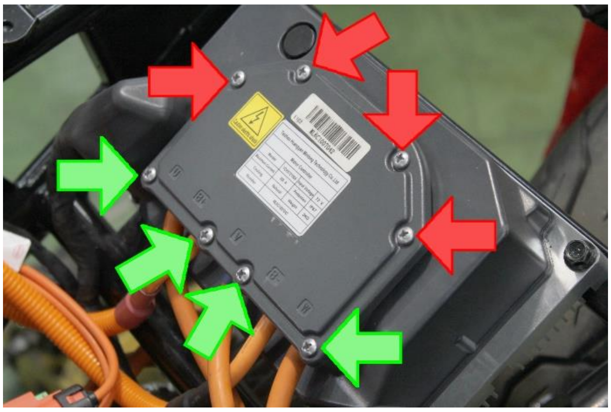
- Remove the auxiliary battery (→ See 1.4.1. Disassembly of the auxiliary battery)
- Remove the load compartment (→ See 1.4.2. Disassembly of the load compartment)
- Remove the upper centre bodywork (→ See 1.5. Disassembly of the upper central bodywork)
- Remove the seat and its base (→ See 1.6. Disassembly of seat base and seat)
- Disconnect only the dual connector of the BDU to the remainder of the 76.8 V circuit (See 5.6. Disconnection of the BDU)

Necessary tools

Phillips screwdriver #2 tip

10 mm socket spanner

Remove the screws from the top cover of the controller with a #2 Phillips screwdriver. Screws marked with green arrows are short, while those marked with red arrows are long.



Tightening torque:

Controller cover fixing screws: 1±0.4 Nm.

Remove the controller cover.

Remove the screws securing the U (orange), V (blue) and W (yellow) cables using a 10 mm socket spanner.

Tightening torque:

Screws for fixing power supply cables and engine phases: 4.8±0.2 Nm

Remove the U, V, and W cables from the controller by pulling them outwards. Avoid dragging the yellow cable guide to make assembly easier.

5.8. Removal of the Controller

Required prior operations:

- Remove the auxiliary battery (→ See 1.4.1. Disassembly of the auxiliary battery)
- Remove the load compartment (→ See 1.4.2. Disassembly of the load compartment)
- Remove the upper centre bodywork (→ See 1.5. Disassembly of the upper central bodywork)
- Remove the seat and its base (→ See 1.6. Disassembly of seat base and seat)
- Disconnect only the dual connector of the BDU to the remainder of the 76.8 V circuit (See 5.6. Disconnection of the BDU)
- Remove the engine cables from the controller (→ See 5.7. Disconnection of the engine cables from the Controller)

Necessary tools

Phillips screwdriver #2 tip

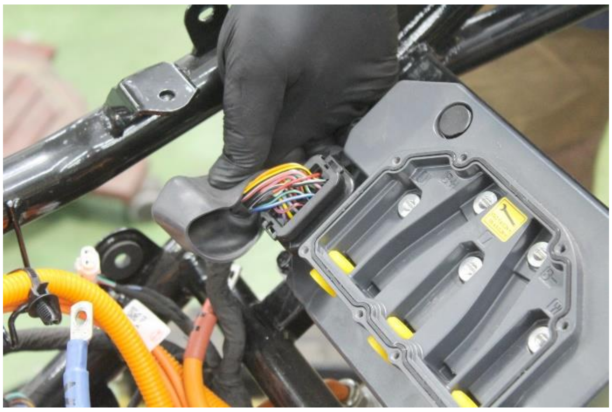
10 mm socket spanner

Using a 10 mm socket, remove the screws securing the B+ (battery positive) and B- (battery negative) cables. Remove the B+ (red) and B- (black) wires by pulling them outwards.

Tightening torque:

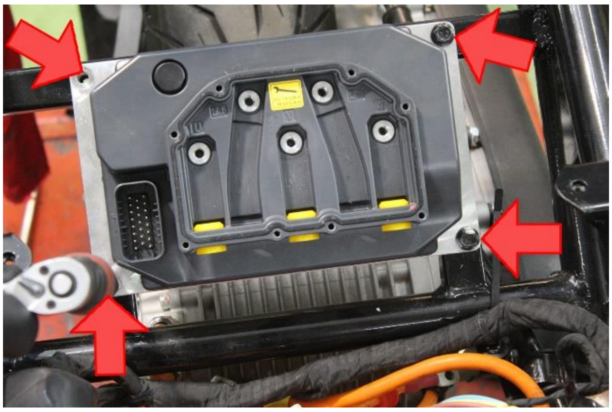
Screws for fixing power supply cables and engine phases: 4.8±0.2 Nm

Remove the protective rubber covering the signal cable connector.



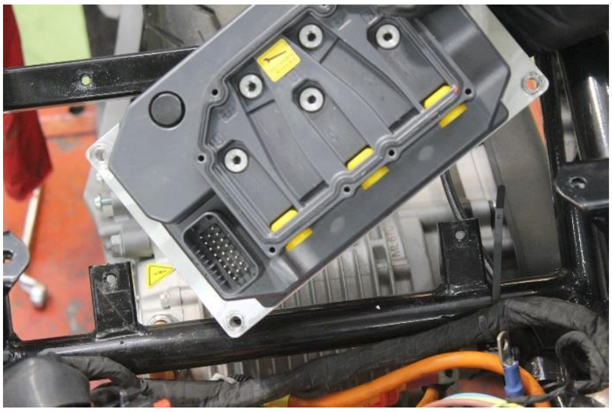
Insert a screwdriver into the hole in the locking tab of the signal wires connector to press the tab and disconnect the signal wires connector.

Using a 10 mm socket spanner, remove the four rear screws securing the controller.



Remove the controller by hand.

Follow the reverse order of disassembly to reassemble the controller.



5.9. Removing the DC-DC Charger/Converter

Required prior operations:

- Remove the auxiliary battery (→ See 1.4.1. Disassembly of the auxiliary battery)
- Remove the load compartment (→ See 1.4.2. Disassembly of the load compartment)
- Remove the upper centre bodywork (→ See 1.5. Disassembly of the upper central bodywork)
- Remove the seat and its base (→ See 1.6. Disassembly of seat base and seat)
- Disconnect only the dual connector of the BDU to the remainder of the 76.8 V circuit (See 5.6. Disconnection of the BDU)
- Remove the engine cables from the controller (→ See 5.7. Disconnection of the engine cables from the Controller)
- Remove the controller (→ See 5.8. Removal of the controller)

Necessary tools

13 mm open-end spanner

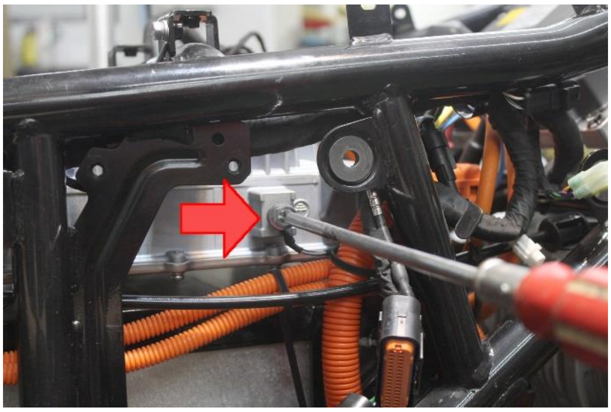
Flat-blade screwdriver fine tip

Phillips screwdriver with #2 tip

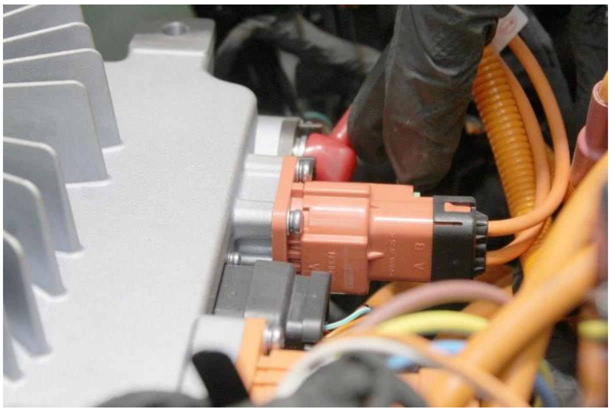
5 mm Allen key

On the left side of the Charger/DC-DC Converter, locate the screw that secures the ground (negative) cable of the 12V circuit (green circle). You may find it more convenient to disconnect the top connector from the VCU.

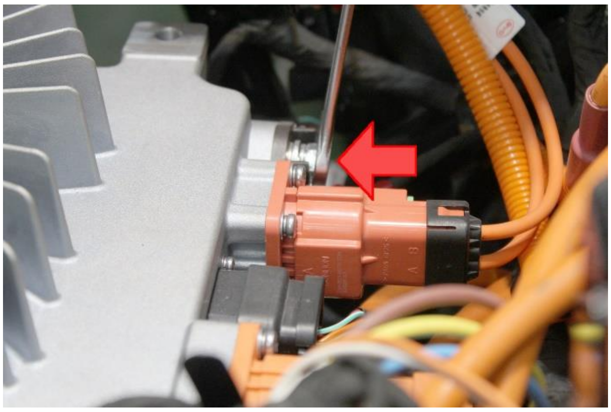
Remove the screw with a #2 Phillips screwdriver. You can also use a 13 mm open-ended spanner.



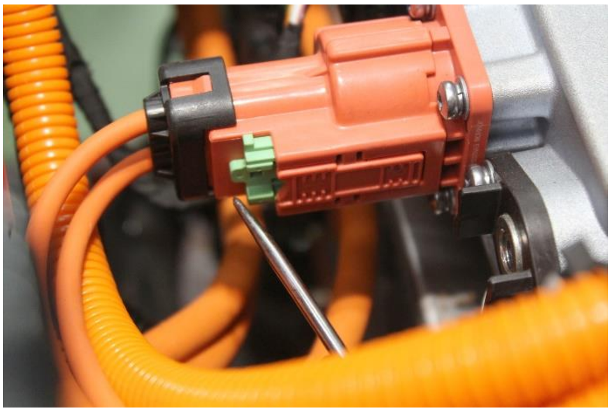
Remove the red rubber sleeve covering the positive output of the 12V circuit.



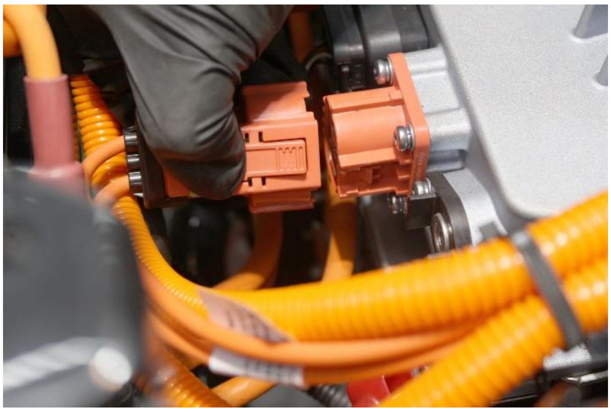
Remove the screw securing the positive terminal of the 12V circuit using a 13mm open-end spanner.



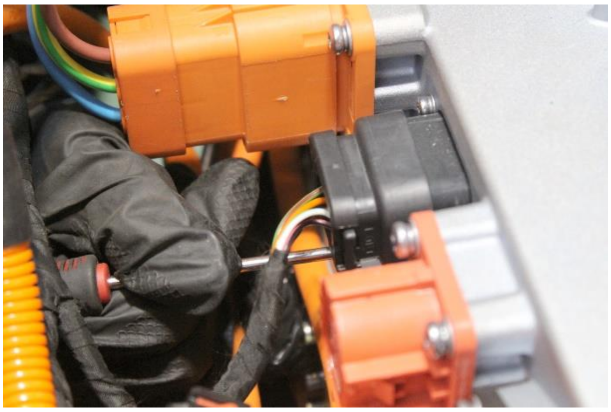
To disconnect the charging connector from the battery, release the green lock outwards using a fine-tipped flat-head screwdriver.



Disconnect the connector by pulling it out and pressing the locking tab at the same time.



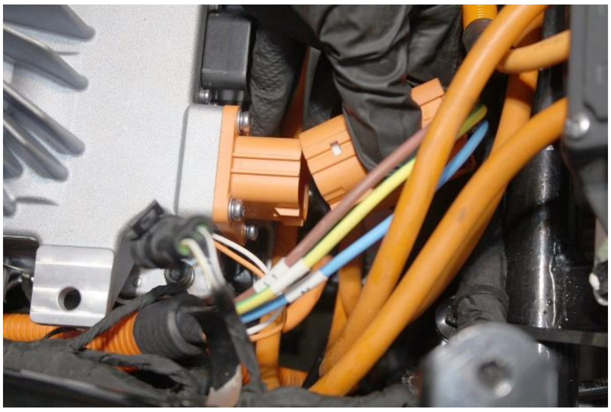
To disconnect the CAN Bus connector, use the fine-tipped flat-blade screwdriver to push down the safety tab located underneath the connector.



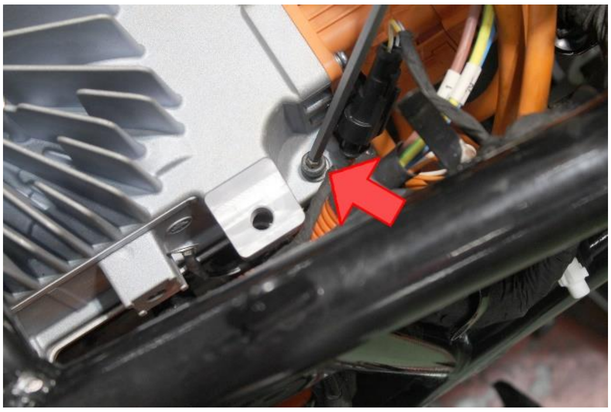
Remove the CAN bus connector by pulling it outwards.

To disconnect the charger input connector (from Type 2), release the red lock outwards with the help of a fine-tipped flat-head screwdriver (yellow circle).

Disconnect the connector by pulling it out and pressing the locking tab at the same time.



Remove the four screws at the corners of the charger that secure it to the frame using a 5 mm Allen key.



Remove the DC-DC Charger/Converter by sliding it backwards through the gap left by the controller.

5.10. Removal of the VCU

Required prior operations:

- Remove the auxiliary battery (→ See 1.4.1. Disassembly of the auxiliary battery)
- Remove the left side of the bodywork (→ See 1.9. Dismantling of the side bodywork)
- Disconnect only the dual connector of the BDU to the remainder of the 76.8 V circuit (See 5.6. Disconnection of the BDU)

Necessary tools

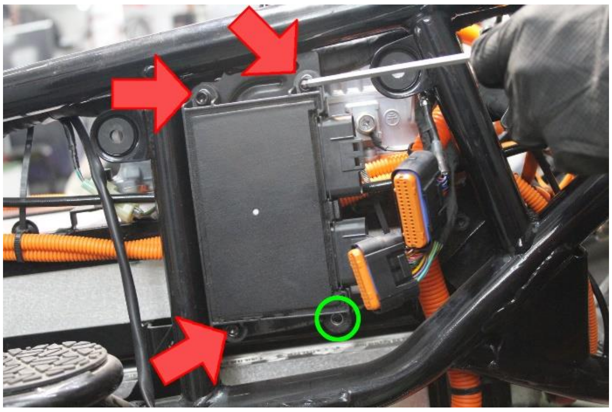
5 mm Allen key

Disconnect the upper connector of the VCU by pressing the tab while simultaneously pulling the connector outward.

Disconnect the lower connector of the VCU by pressing the tab while simultaneously pulling the connector outward.

Remove the three screws securing the VCU to the beater with a 5 mm Allen key.

Note that the lower right corner, marked with the green circle, has no screw.



Remove the VCU unit.

5.11. Junction box

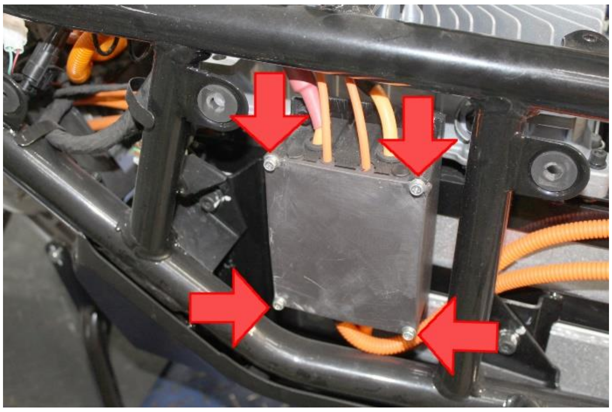
Required prior operations:

- Remove the right side of the bodywork (→ See 1.9. Dismantling of the side bodywork)
- Disconnect only the dual connector of the BDU to the remainder of the 76.8 V circuit (See 5.6. Disconnection of the BDU)

Necessary tools

Phillips screwdriver with #2 tip

To access the inside of the junction box, remove the four screws securing the cover with a #2 Phillips screwdriver.



Tightening torque:

Screws for fixing the junction box cover: 2±0.4 Nm

Disconnect the connection cable to be isolated.

Tightening torque:

Connection fixing screws: 9±1 Nm