Electrics and electronics

12 Volt power supply

Lithium iron phosphate ($LiFePO_4$) battery (40 Ah)

General information and design

The Audi e-tron GT is the first Audi model that is not fitted with a lead-acid battery. Instead, it has a lithium-ion battery which functions as a starter battery and as a power source for the 12-Volt low-voltage system. This battery is a lithium iron phosphate ($LiFePO_4$) battery.

General information on lithium iron phosphate batteries

A **lithium iron phosphate battery** is a type of lithium-ion battery. The voltage of each cell is 3.3 V.

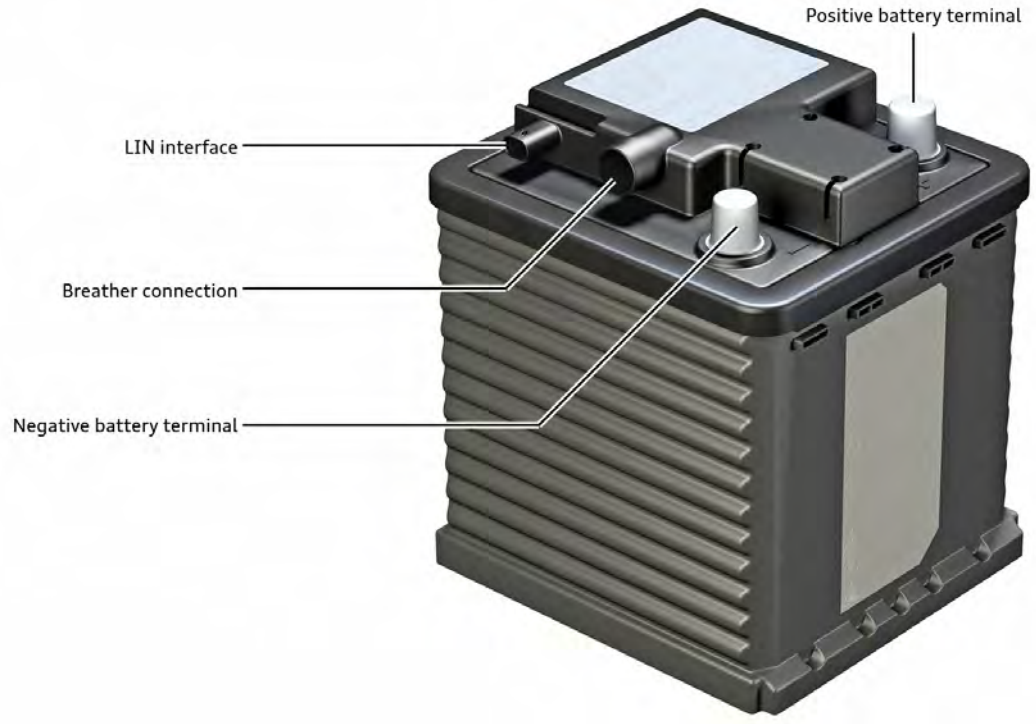
The positive electrode is made of lithium iron phosphate ($LiFePO_4$). The negative electrode is made of graphite with embedded lithium.

General advantages compared to a lead-acid battery:

- **Lightweight construction**
  Weight reduction of approx. 50 % compared to an AGM battery with the same capacity.
- **Increased recuperation capacity**
- **Less space required**
  Volume of space required reduced by approx. 20% and battery monitor control unit J367 no longer required
- **Service life**
  Service life 2.5 times as long; cycle stability 7 times as high
- **Power supply stability**
  Significantly higher voltage stability
- **Lead ban**
  Reaction to lead ban that is expected between 2021 and 2025

Design of the 12 V $LiFePO_4$ battery in the Audi e-tron GT

The housing of the 12 V $LiFePO_4$ battery contains the electronics which include a battery sensor that measures the voltage, current and temperature. The battery monitor control unit J367 that is integrated in the battery earth wire on other Audi models is not fitted on the Audi e-tron GT. Diagnosis and adaption of the battery are performed via the data bus diagnostic interface J533 (gateway). The 12 V $LiFePO_4$ battery is a LIN slave of J533. A relay is also integrated in the battery housing. It remains closed under normal conditions but can sever the connection between the battery cells and the positive battery terminal if required.



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Cell configuration

The cells in the $LiFePO_4$ battery of the Audi e-tron GT are arranged in a 4S2P configuration. This means that 4 cell groups are connected in series, while each cell group consists of 2 cells that are connected in parallel.

This results in the following:
- Voltage = 4 x 3.3 V = 13.2 V
- Capacity = 2 x 20 Ah = 40 Ah

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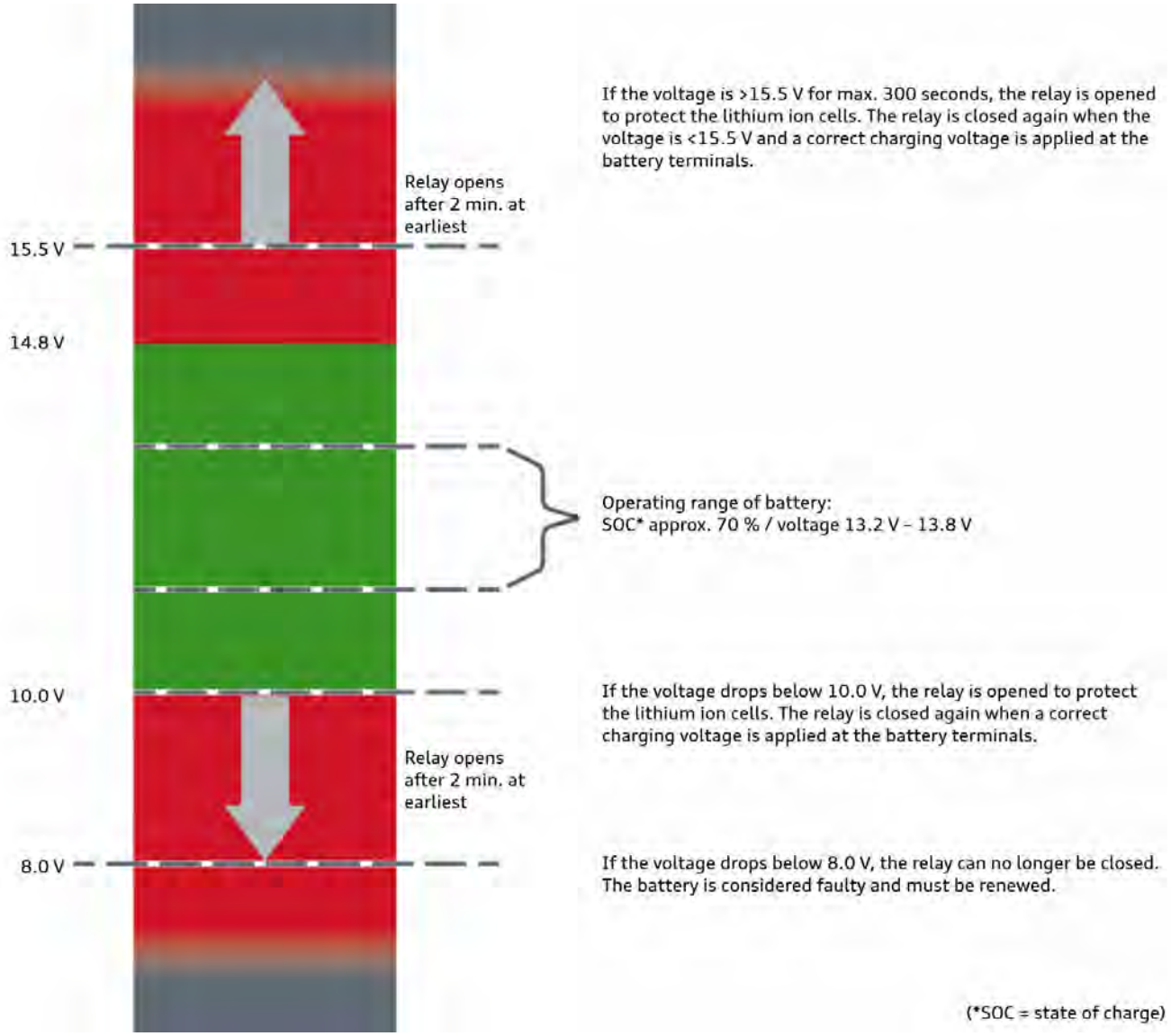
Battery operating range and special features of relay

The nominal voltage of this battery is 13.2 V. When the state of charge is 80 %, the voltage is 13.4 V, while at a state of charge of 100 % it is 13.8 V. The operating range of the battery is between 10 V and 14.8 V.

Lithium-ion batteries are sensitive to overcharging and to deep discharge. Both must be avoided to protect the lithium-ion cells.

After the relay has been opened, it closes again as soon as the state of charge returns to within the permitted limits.

The relay is opened to protect the lithium-ion cells when the following occurs:
- Overcharging (The relay is closed again as soon as the voltage remains within the range of 11 V < U < 14.8 V for approx. 30 seconds. The relay makes an audible click when it closes. If the voltage was above 16 V, the relay can no longer be closed.)
- Deep discharge (deep discharge protection) (The relay is closed again as soon as the voltage remains within the range of 11 V < U < 14.8 V for 10 to 30 seconds. There is an audible click. The battery should then be charged for at least 30 minutes.)
- Short circuit (Depending on the severity, the relay has been opened or the fuse has blown -> Faulty battery!)
- Overheating (The relay can no longer be closed -> Faulty battery!)



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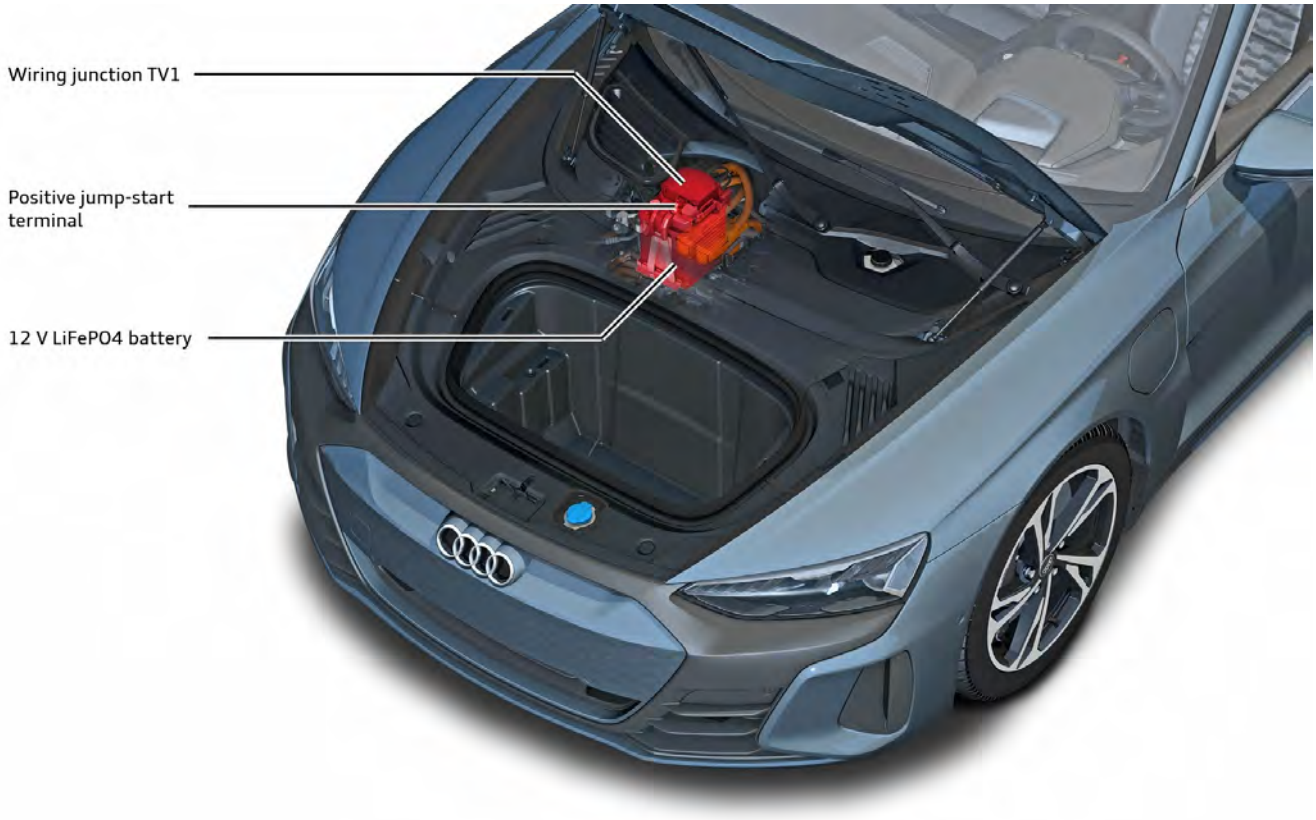
Fitting location

The 12 V $LiFePO_4$ battery is fitted in the front compartment. It is located on the right-hand side in left-hand-drive models and on the opposite side in right-hand-drive models. Wiring junction TV1 and the positive jump-start terminal are fitted on the 12 V battery. The terminal on wiring junction TV1 is for connecting an external battery charger.

!	**Note** The vehicle cannot be operated if the 12 V $LiFePo_4$ battery is discharged. The Audi e-tron GT must NOT be used to jump-start other vehicles!



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External charging

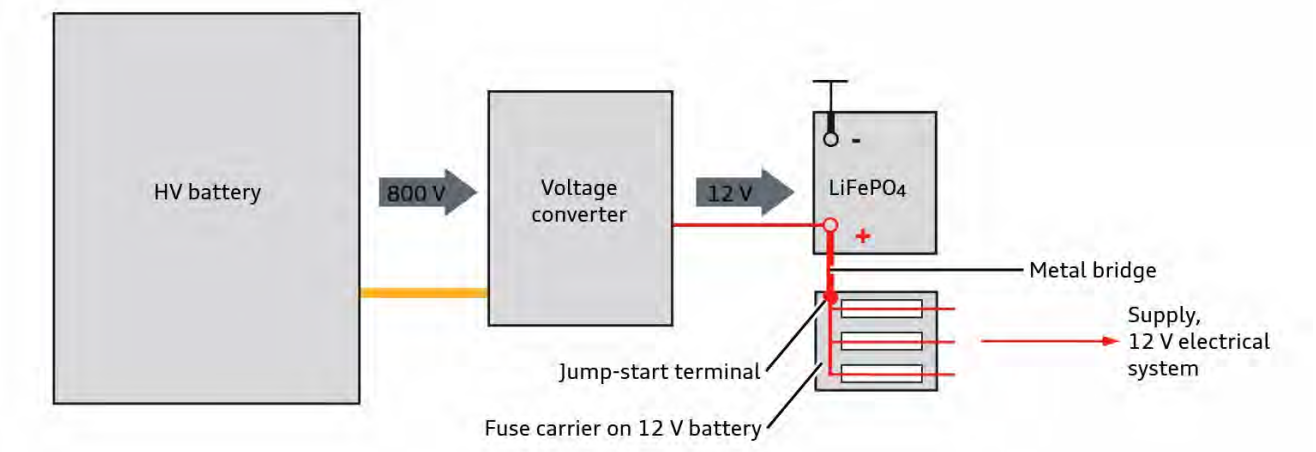
Like all other Audi models, the Audi e-tron GT depends on an intact power supply to the electrical system from the 12 V battery. As a result, if an Audi e-tron GT is in the showroom or in a workshop, an external battery charger needs to be connected. All battery chargers that are approved by Audi may be used to charge the battery in the Audi e-tron GT. Particularly when performing diagnostic work, it is important to use a charger that has a maximum charging current of at least 90 A.

If the charger is too small, the 12 V battery could become so discharged during diagnostic work – or, in the worst case scenario, during a software update – that the internal relay is opened.

Charging the battery while driving

While driving, the 12 V $LiFePO_4$ battery is supplied with power from the high-voltage battery via the voltage converter.

A separate 50 mm^2 aluminum wire (terminal 30 positive) leads to the positive battery terminal, then on to the battery and via a metal bridge to wiring junction TV1. TV1 is located directly on top of the 12 V battery. The positive jump-start terminal is also fitted here (12 V electrical system).



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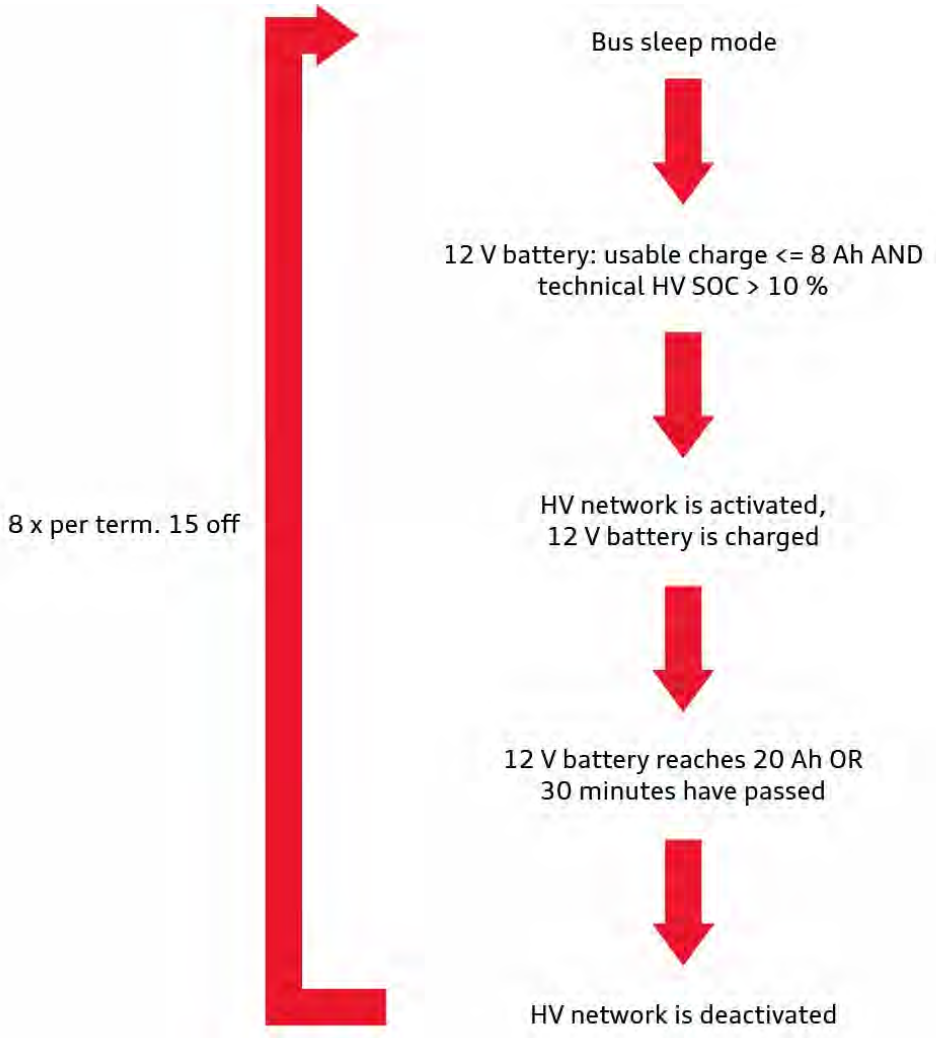
Re-charging concept

If the 12 V $LiFePO_4$ battery is discharged while the vehicle is stationary, a specific re-charging concept is implemented under certain conditions.

Example: The vehicle is stationary and has entered bus sleep mode. If the 12 V $LiFePO_4$ battery is discharged so much that its usable charge drops below 8 Ah and the state of charge of the high-voltage battery is higher than 10 %, the high-voltage network is activated and the 12 V battery is charged. This process continues until the 12 V battery has reached a capacity of 20 Ah or 30 minutes have passed. The high-voltage network is then deactivated again and the vehicle enters bus sleep mode. This process can be repeated 8 times per terminal 15 cycle.

Important

- The high-voltage system of an Audi e-tron GT may be active even though the vehicle is parked and locked.



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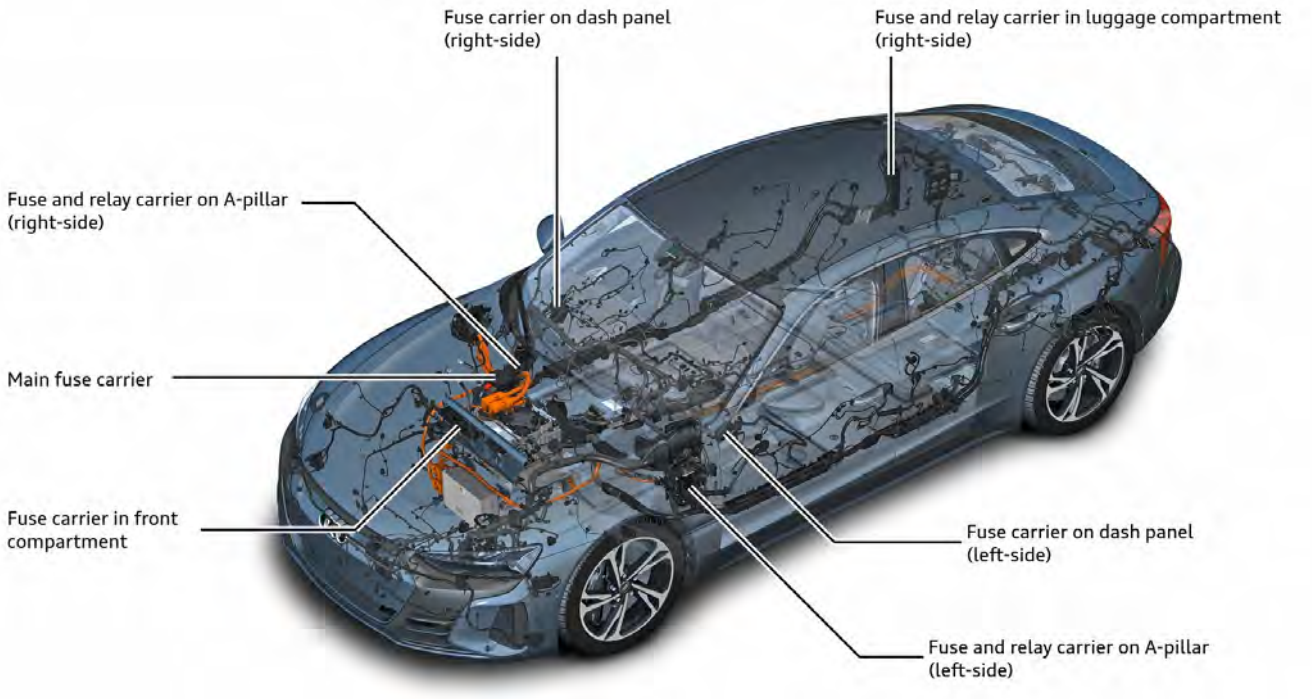
HV	High-voltage
SOC	State of charge

Relay and fuse carriers

Location of relay and fuse carriers



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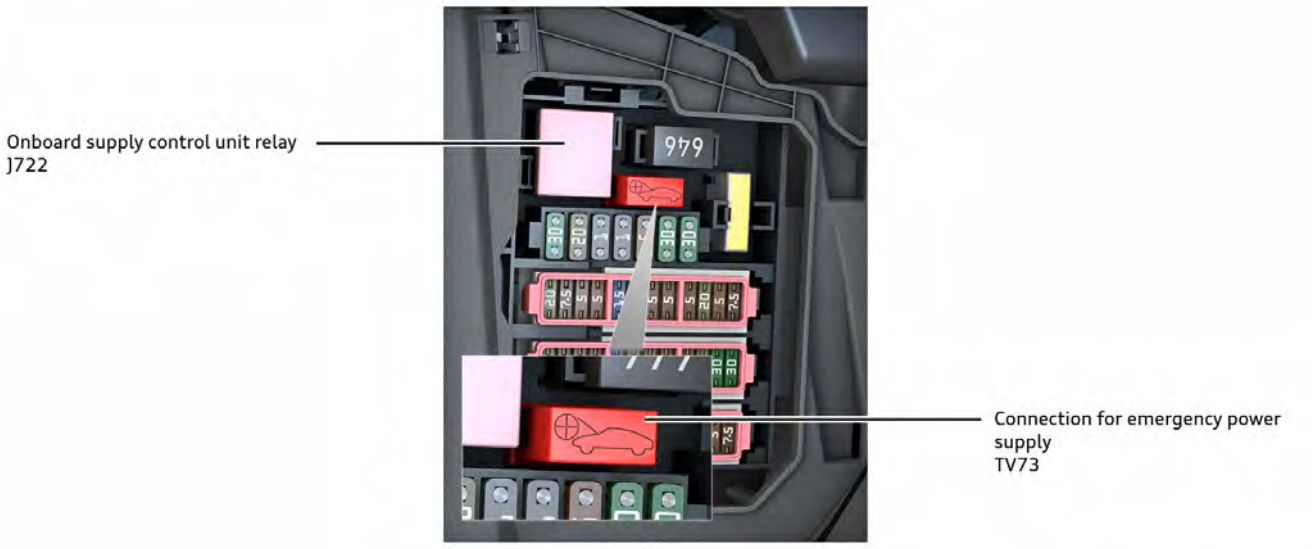
As shown in the illustration, the relay and fuse carriers are fitted in various locations on the Audi e-tron GT.

The main fuse carrier is fitted on the $LiFePO_4$ battery. The fuses inside it protect the electrical circuits for the components that use the most power, as well as the power supply lines of the other relay and fuse carriers in the vehicle. Additional relay and fuse carriers are located in the front compartment, on the A-pillars (both sides), on the dash panel (both sides) and in the luggage compartment (right-side).

Fuse and relay carrier on A-pillar (driver's side)



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The relay and fuse carrier with the connection for an emergency power supply is a special component. It is fitted on the A-pillar on the driver's side; in this illustration showing a left-hand drive vehicle, that means on the left A-pillar.

Connection for emergency power supply TV73 is protected by a red cover. On the cover is a plus symbol and the outline of a vehicle with the hood open. Onboard supply control unit relay J722 is fitted to the left of it.

Emergency power supply

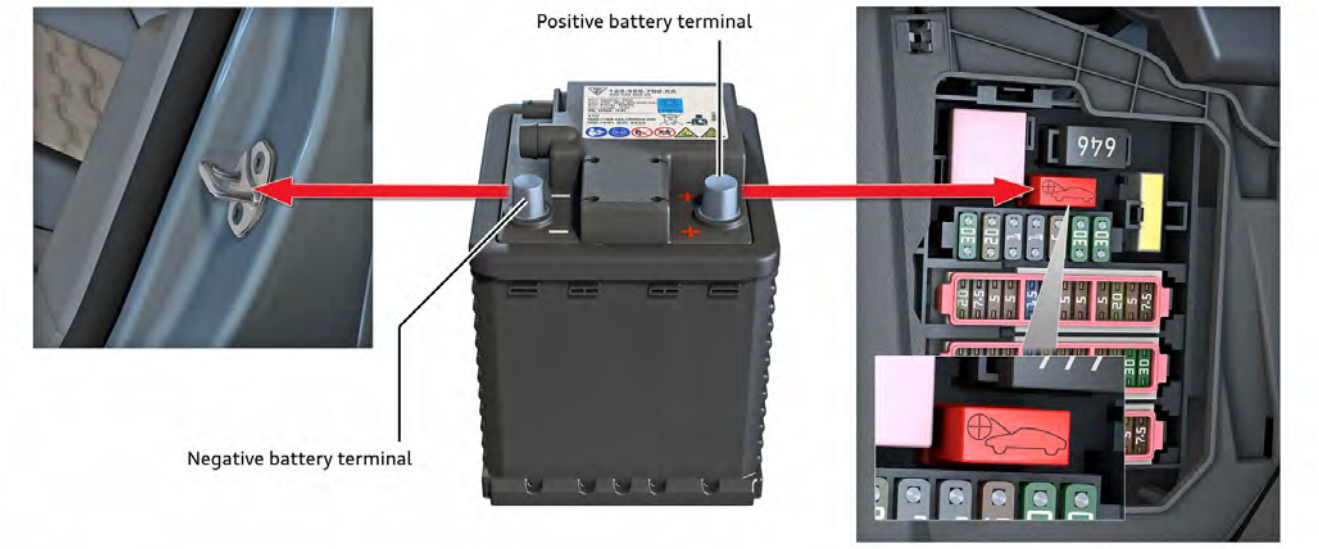
Why an emergency power supply is necessary

The 12 V battery is fitted in the vehicle's front compartment. The hood of the Audi e-tron GT is unlocked via a button on the end face of the driver's door. If the electrical system has no power (e.g. if the 12 V battery is discharged or faulty), it is not possible to unlock the hood. For this reason, a special procedure is required to establish an emergency power supply in order to open the hood and access the 12 V battery.

Using the connection for emergency power supply

If the electrical system of the Audi e-tron GT has no power, the driver's door must first be unlocked manually using the emergency key. After opening the driver's door, the relay and fuse carrier on the A-pillar must be exposed. The connection for emergency power supply can then be pulled slightly out of the fuse carrier and connected to the positive terminal of the external power source. The negative terminal of the external power source must be connected to the striker of the driver's door lock on the B-pillar. On vehicles with an anti-theft alarm system, the horn of the alarm system will sound after this is done. It can be switched off by pressing the main unlock button on the remote control key. The unlock button for the hood must then be pressed for at least 2 seconds in order to open the hood.

This procedure is also described in the Owner's Manual.



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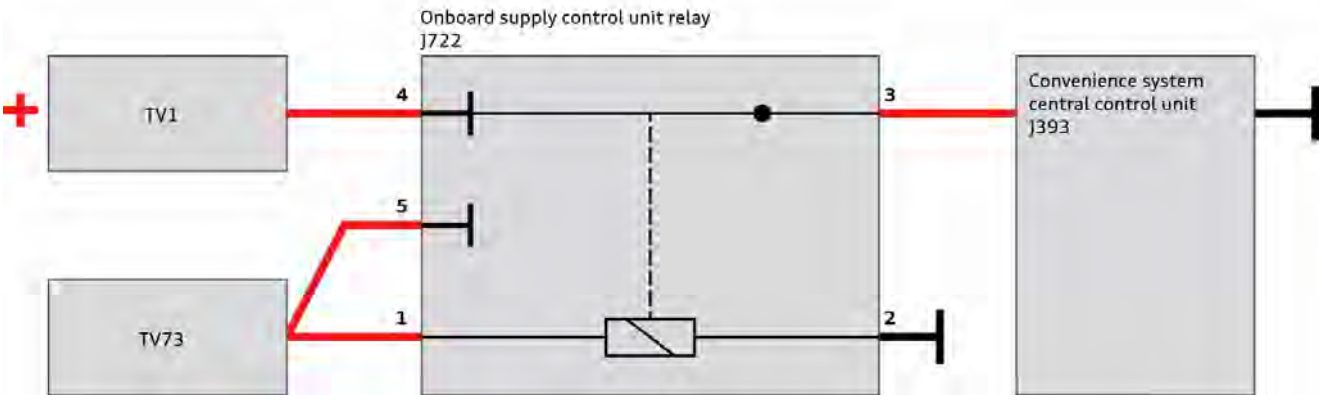
Onboard supply control unit relay J722

When the power supply for the electrical system is intact, convenience system central control unit J393 is supplied with power via main fuse carrier TV1. The power flows via contacts 4 and 3 of onboard supply control unit relay J722, which are bridged in the rest state.



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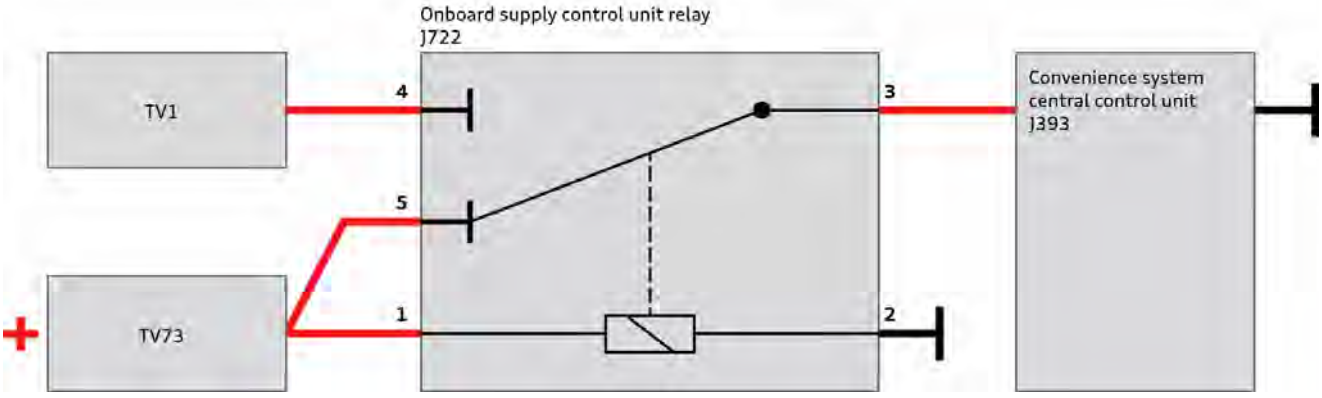
When the electrical system is without power, an external power source can be connected to connection for emergency power supply TV73. Doing so switches the relay. Convenience system central control unit J393 is now supplied with power by the external power source.



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Networking

Data transmission, fitting locations and topology of control units

Bus systems used on the Audi e-tron GT

Bus systems	Wire colour	Method	Data transfer rate
Convenience CAN		Electrical bus system	500 kbit/s
Convenience CAN 2		Electrical bus system	500 kbit/s
Extended CAN		Electrical bus system	500 kbit/s
Hybrid CAN		Electrical bus system	500 kbit/s
Dash panel insert CAN		Electrical bus system	500 kbit/s
Infotainment CAN		Electrical bus system	500 kbit/s
Connect CAN		Electrical bus system	500 kbit/s
Diagnostics CAN		Electrical bus system	500 kbit/s
Information electronics 1 CAN		Electrical bus system	500 kbit/s
FlexRay		Electrical bus system	10 Mbit/s
MOST bus		Fibre optic bus system	150 Mbit/s
LIN bus		Electrical single wire bus system	20 kbit/s
Sub-bus systems		Electrical bus system	500 kbit/s 1 Mbit/s
Ethernet		Electrical bus system	100 Mbit/s

Fitting locations and topology of control units

Notes on illustrations

The following illustrations are sorted according to the different bus systems on the Audi e-tron GT (type F8) and provide information on:

- The location of the control unit in the vehicle
- The bus system via which the control unit participates in communication
- The control unit code
- The diagnostic address
- The power supply
- The bus termination resistor

The following illustrations show all control units which may be connected to the various bus systems.

Some control units are the result of optional or country-specific equipment.