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# Voltage Supply

**Model: F01/F02**

**Production: From Start of Production**

## OBJECTIVES

After completion of this module you will be able to:

- Locate voltage supply components
- Locate fuse boxes
- Understand overall voltage supply layout

# Voltage Supply Overview

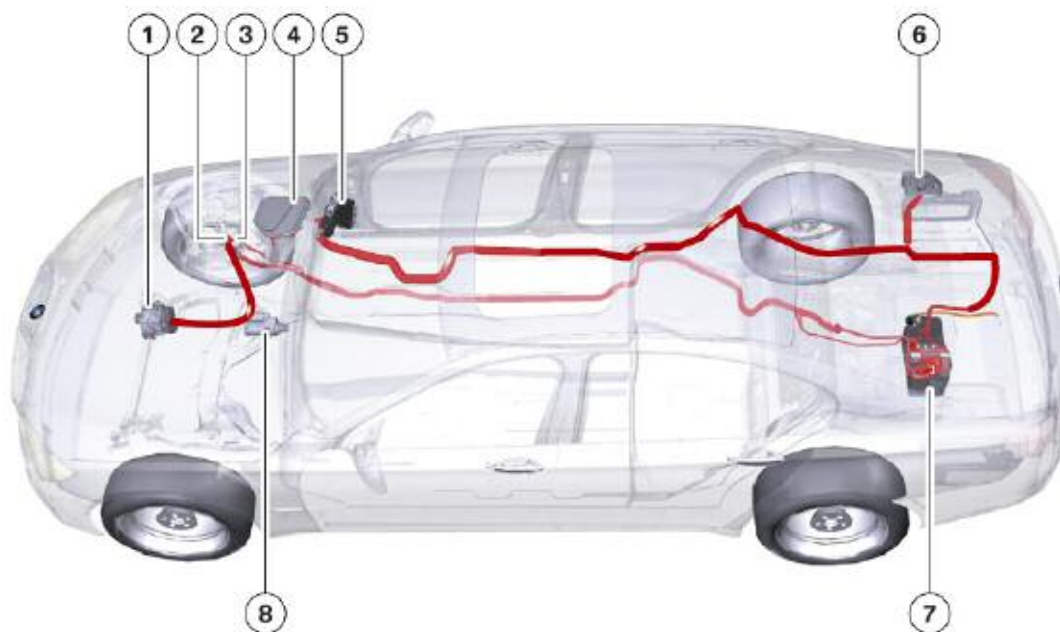
## Introduction

Due to the steady increase of electrical functions for comfort, communication and safety in BMW vehicles, the voltage supply is becoming ever more important.

In the F01/F02, there are two separate fuse carriers. The front fuse carrier is located near to the glove compartment and the rear fuse carrier is located on the right-hand side of the luggage compartment.

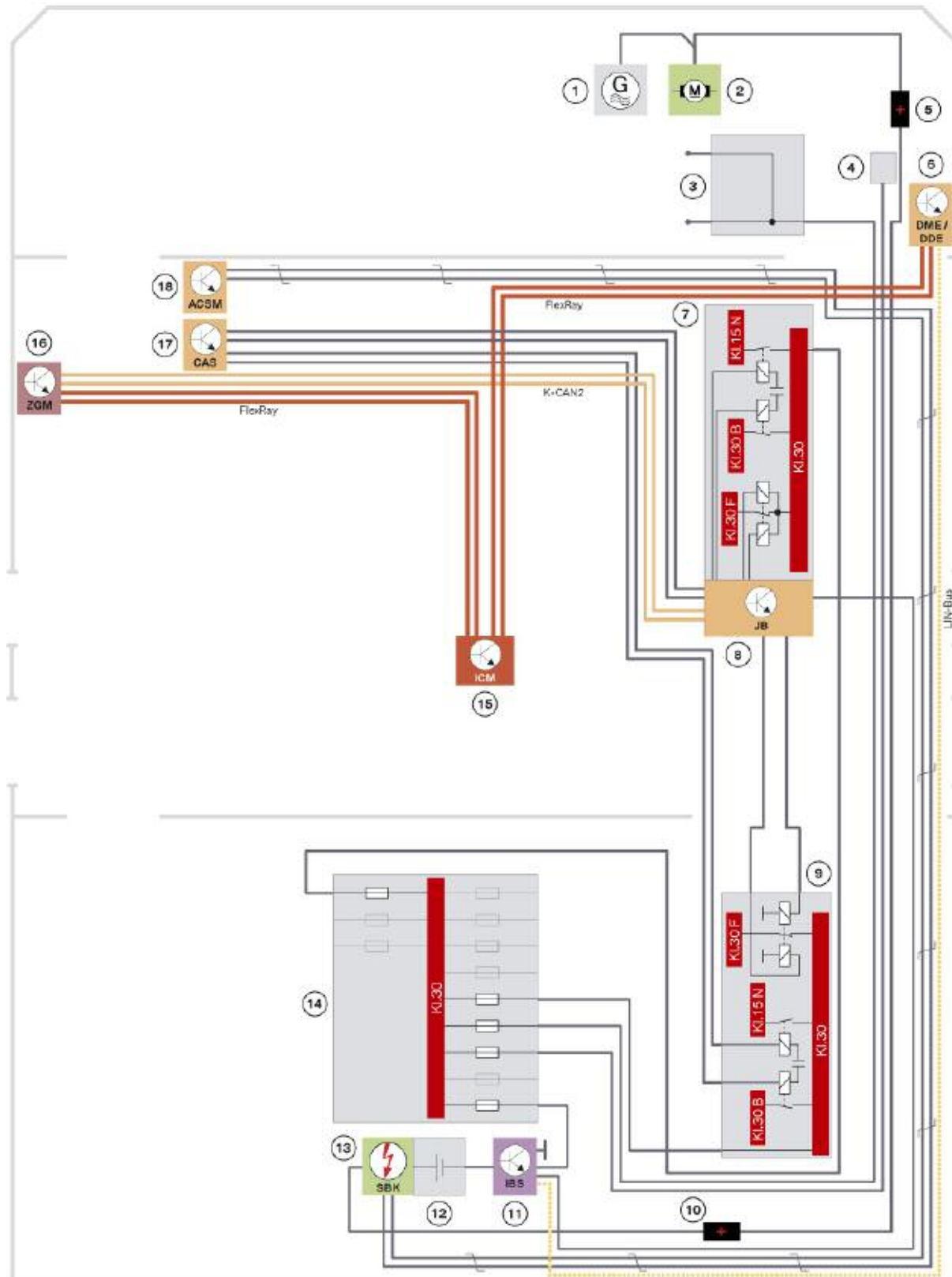
In the graphic below, you can see the layout of the most important components of the voltage supply in the F01/F02.

### Overview of the F01/F02 voltage supply



Index	Explanation
1	Alternator
2	Positive battery terminal
3	Power distribution box in engine compartment
4	Electronics box in the engine compartment
5	Front fuse carrier behind the glove compartment
6	Rear fuse carrier on the right-hand side of the luggage compartment
7	Battery
8	Starter

## System Circuit Diagram



Index	Explanation
1	Alternator
2	Starter
3	Power distribution box in engine compartment
4	Electronics box
5	Positive battery terminal
6	DME Digital Motor Electronics; DDE Digital Diesel Electronics
7	Front fuse carrier, behind the glove compartment
8	Junction box electronics
9	Rear fuse carrier, on the right-hand side of the luggage compartment
10	Transfer point on the luggage compartment floor
11	Intelligent battery sensor IBS
12	Vehicle battery
13	SBK safety battery terminal
14	Distribution box on the battery
15	ICM Integrated Chassis Management
16	ZGM central gateway module
17	Car Access System CAS
18	ACSM crash safety module
KL30	Continuous positive 30
KL30B	Terminal 30 basic operation
KL30F	Terminal 30 fault switched
KL 15N	Terminal 15 overrun
LIN-bus	Local Interconnect Network bus
K-CAN 2	Body controller area network 2

# System Components

## Overview of System Components

The most important new/modified features of the voltage supply in the F01/F02 are described below. The voltage supply in the F01/F02 consists of the following components:

- Vehicle battery
- Intelligent battery sensor IBS
- SBK safety battery terminal
- Distribution box on the battery
- Rear fuse carrier on the right-hand side of the luggage compartment
- Battery cables
- Front fuse carrier, behind the glove compartment
- Junction box electronics
- Power distribution box in engine compartment
- Electronics box in engine compartment
- Positive battery terminal
- Alternator

## Vehicle Battery

The vehicle battery is fitted in the center at the rear of the luggage compartment floor. The vehicle battery is always an AGM battery (**A**bsorbant **G**lass **M**att). The AGM battery has a capacity of 90 Ah.

The main advantage of the AGM battery is its higher cycle strength.

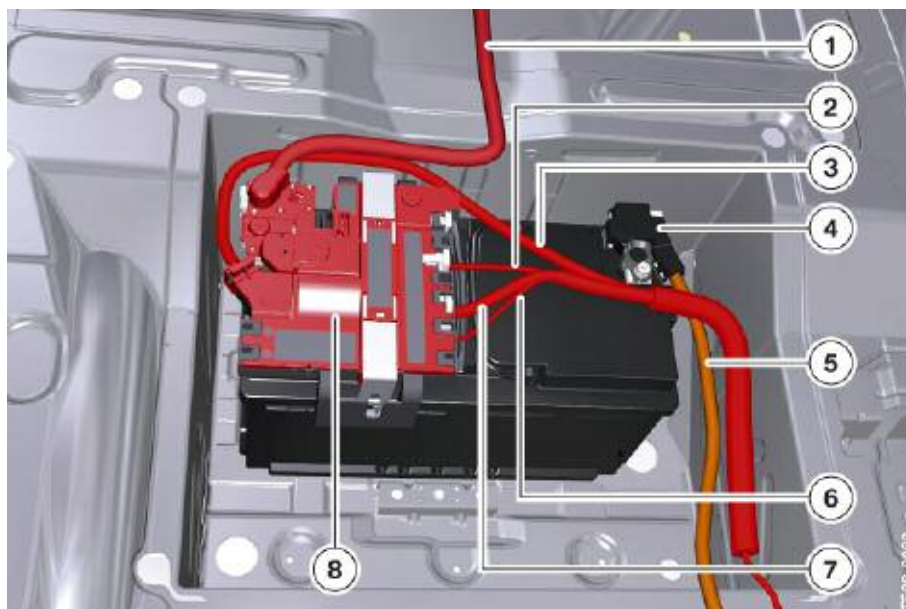


**AGM battery**

## Distribution Box on the Battery

In the F01/F02, the distribution box is located in the luggage compartment directly on top of the vehicle battery.

### Installation location of the distribution box on the battery in the F01/F02



Index	Explanation	Index	Explanation
1	Battery cable to the starter and alternator 5	5	Negative battery cable
2	Cable to the rear fuse carrier on the right-hand side	6	Cable to the power distribution box in the engine compartment
3	Cable to the front fuse carrier	7	Cable to the electronics box in the engine compartment
4	Intelligent battery sensor IBS	8	Distribution box on the battery

The distribution box on the battery is secured on the vehicle battery by means of a metal tab. The metal tabs must be pressed downward and outward in order to release the distribution box.

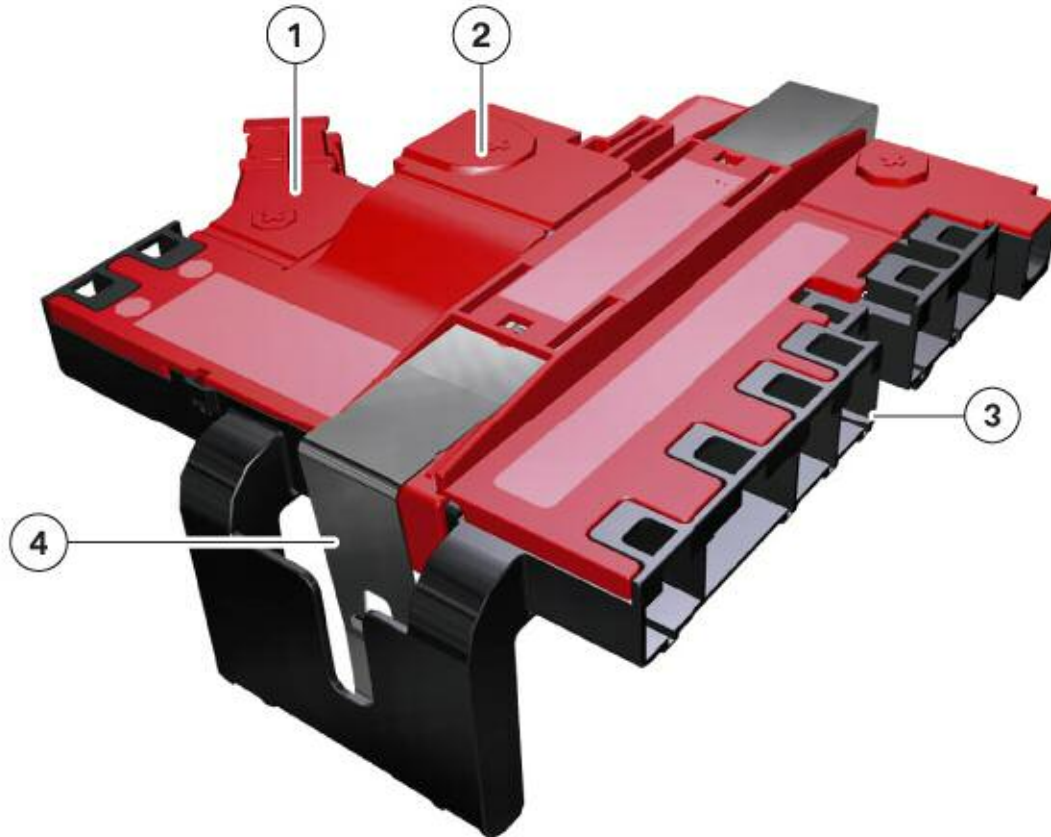
The distribution box on the battery is equipped with fuses for the following electric loads:

- Front fuse carrier (250 A)
- Rear fuse carrier (100 A)
- Engine compartment distribution box (100 A)
  - large electric fan (850 W or 1000 W)
- Electric coolant pump (100 A)
- Intelligent battery sensor IBS.

The distribution box on the battery must always be replaced as a complete unit. The fuses are integrated as a complete unit in the housing of the distribution box on the battery. The fuses differ in terms of their power rating. The distribution box additionally contains the power supply for the intelligent battery sensor IBS.

The connectors are color-coded and mechanically coded to avoid confusion. These are high power connections, therefore always ensure correct contacting!

#### Distribution box on the battery in the F01/F02



Index	Explanation	Index	Explanation
1	Connection for the battery cable to the front fuse carrier	3	High current consumer connections
2	Connection to battery terminal	4	Retaining clip

**Note:** When replacing or working on the distribution box, always make sure the plug connections and, above all, the screw connections are secured properly. Connection between battery terminal and distribution box 15 Nm.



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## Intelligent Battery Sensor (IBS)

The intelligent battery sensor (IBS) is a mechatronic component for monitoring the battery status. The following physical measurements are recorded for the battery:

- Current
- Voltage
- Terminal temperature

The term “intelligent” means that there is a microprocessor integrated in the IBS. This microprocessor calculates and analyses time-critical measured variables. The results are then forwarded to the higher-level control units (i.e. DME) via the LIN bus.



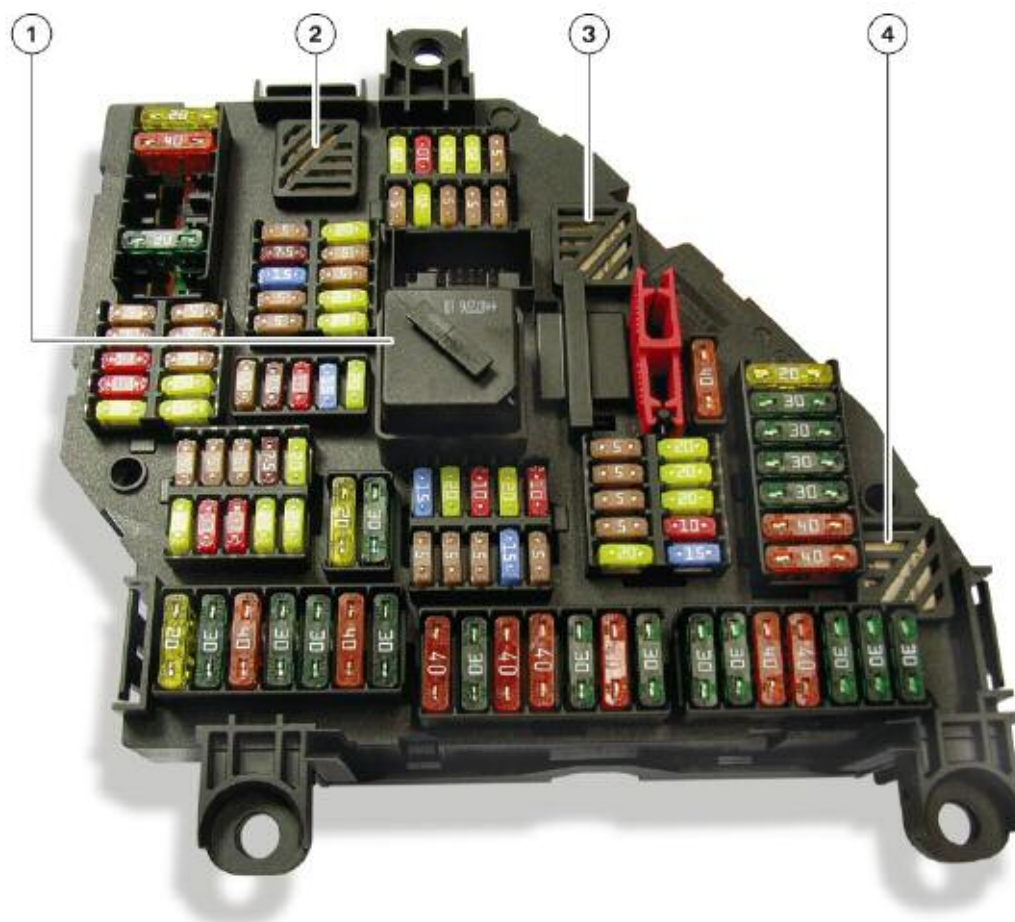
Index	Explanation
1	Negative battery terminal
2	Intelligent battery sensor
3	Negative battery cable

## Rear Fuse Carrier in the Luggage Compartment

Due to the large number of consumers and control units in the F01/F02, an additional fuse carrier has been fitted in the luggage compartment.

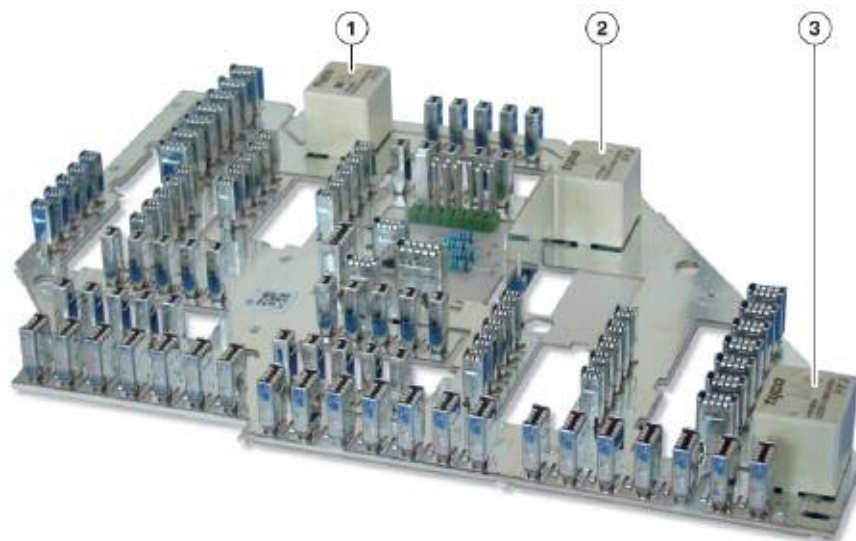
As well as the fuses, a few relays are plugged in here or soldered to the circuit board. If one of the soldered relays is faulty, the rear distribution box must be replaced as a whole unit. The connection port of the battery cable is located on the rear of the fuse carrier.

### External view of the rear fuse carrier in the F01/F02



Index	Explanation	Index	Explanation
1	Relay terminal 30B (plugged in)	3	Relay terminal 15N (soldered)
2	Relay terminal 30F (soldered)	4	Relay for the heating element in the rear window (soldered)

### Internal view of the rear fuse carrier in the F01/F02



Index	Explanation	Index	Explanation
1	Relay terminal 30F	3	Relay for the heating element in the rear window
2	Relay terminal 15N		

## Battery Cables

In the F01/F02, three main power lines on the underbody run from the distribution box at the battery to the engine compartment. One of the main power lines runs via the positive battery terminal to the starter motor and to the alternator.

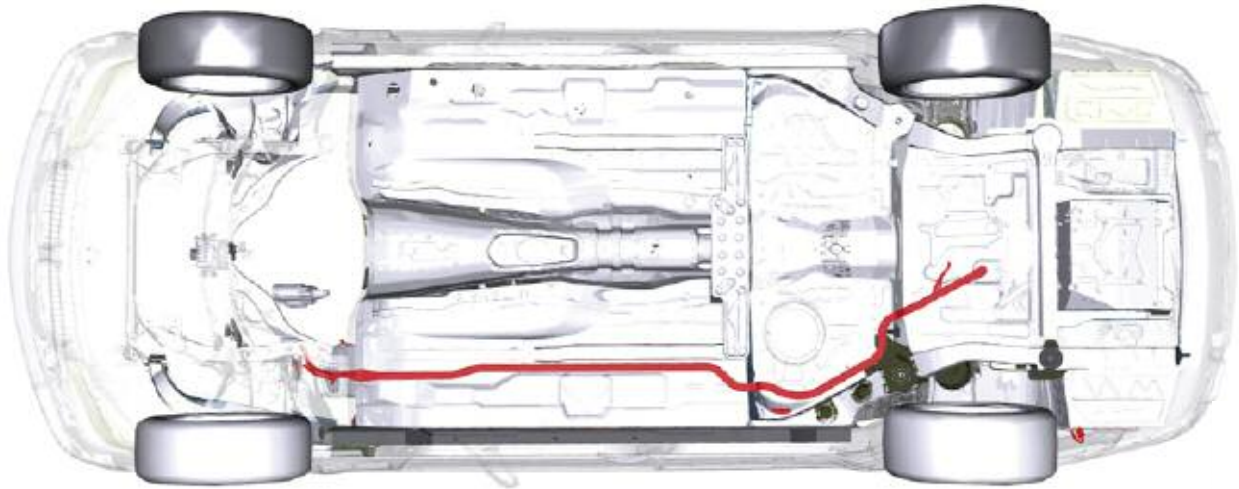
The second line powers the engine electronics (and electric coolant pump).

The third line runs to the distribution box in the engine compartment. This distribution box supplies the electric fan with power. This line is safeguarded by the high-current fuse (100 A) in the distribution box at the battery.

Cable	Cross section	Material
Cable to the starter motor and alternator	110 mm <sup>2</sup>	Aluminum
Cable to the front distribution box, behind the glove compartment	25 mm <sup>2</sup>	Copper
Cable to the rear fuse carrier	10 mm <sup>2</sup>	Copper
Cable to the power distribution box in the engine compartment	16 mm <sup>2</sup>	Copper

In addition, a battery cable is routed to the front fuse carrier through the vehicle interior. The transfer points for the main power cables are located in the luggage compartment. The main power lines on the underbody are laid in a protected area to prevent damage.

#### **Routing of battery cable on the underbody in the F01/F02**

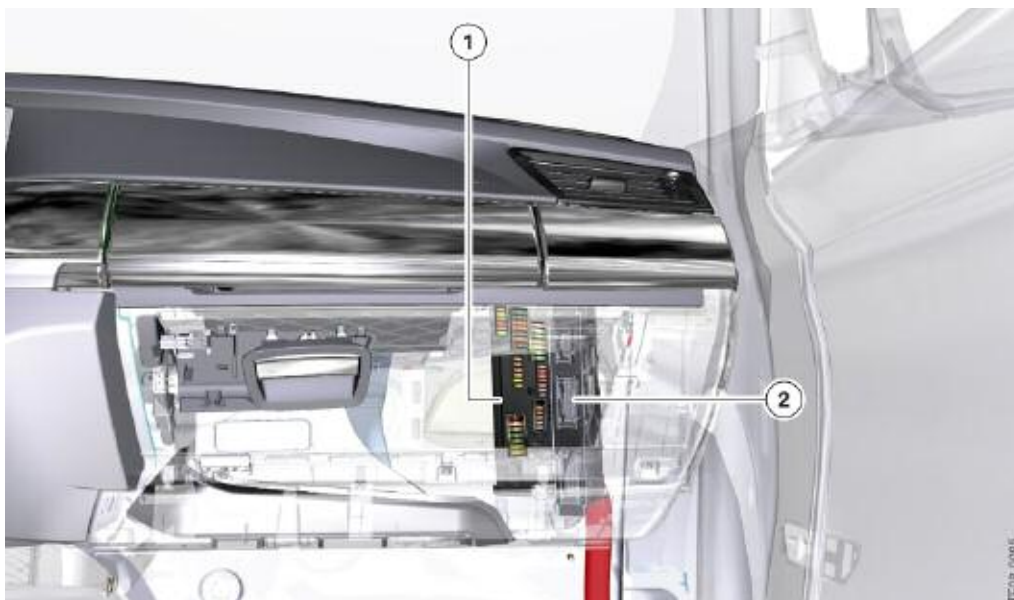


### **Front Fuse Carrier**

This section describes the front fuse carrier(1). In the right-hand part of the front fuse carrier, there is an opening through which the junction box electronics (2) are connected to the front fuse carrier.

The front fuse carrier is located underneath the dashboard on the right-hand side. In order for a fuse to be replaced, the glove compartment must be opened.

#### **Installation location of the front fuse carrier in the F01/F02**



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## Front Fuse Carrier and Junction Box Electronics

The connection between the front fuse carrier and the junction box electronics is established through the opening in the right-hand area of the fuse carrier. An internal plug connection provides the electrical connection between the two components.

### Junction box electronics and front fuse carrier in the F01/F02

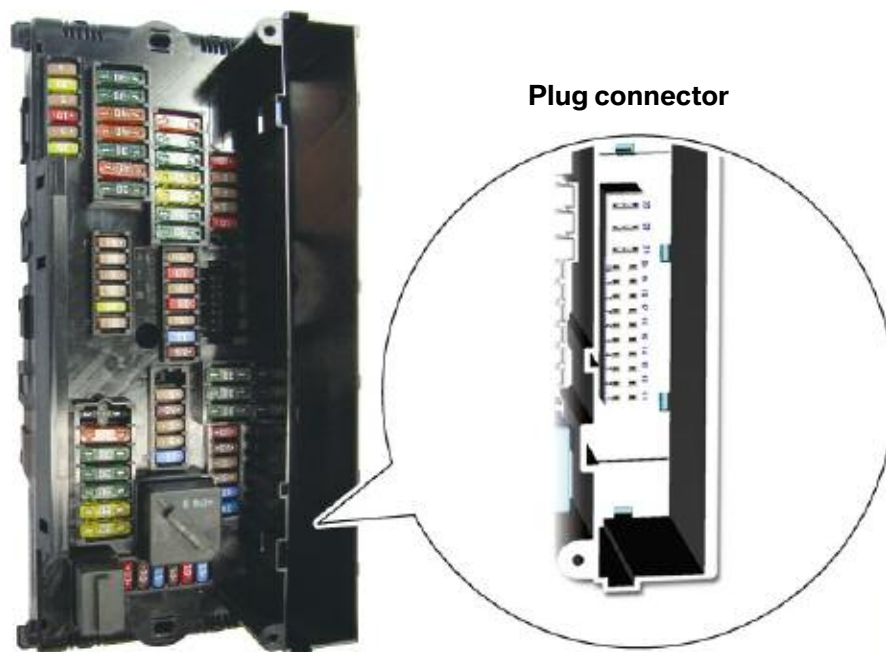


When assembled, the two components form a single unit (junction box) consisting of the junction box electronics and the front fuse carrier.

The fuse carrier and junction box electronics components must be replaced separately. In addition to the corresponding test modules in the diagnostics, diagnosis cables are also available with which electrical measurements can be made directly on the control-unit plugs and on the internal interface.

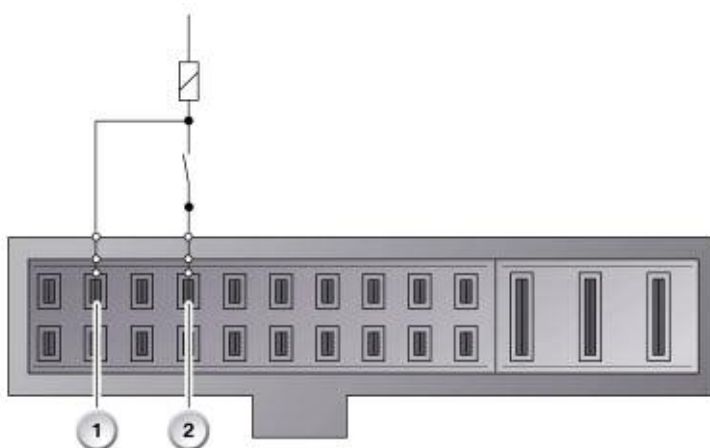


## Internal Plug Connection



The internal plug connection is located on the right hand side, inside the opening for the junction box electronics.

### Internal plug connection for the junction box electronics in the F01/F02



Index	Explanation	Index	Explanation
1	Monitoring connection	2	Actuation connection

The internal plug connection is responsible for Relays in the front fuse carrier activating the relays in the front fuse carrier. In addition, the correct functioning of these relays is monitored by the junction box electronics

There are a few relays in the front fuse carrier. One of these is plugged in, the others are soldered to the circuit board.

## Connected Relay



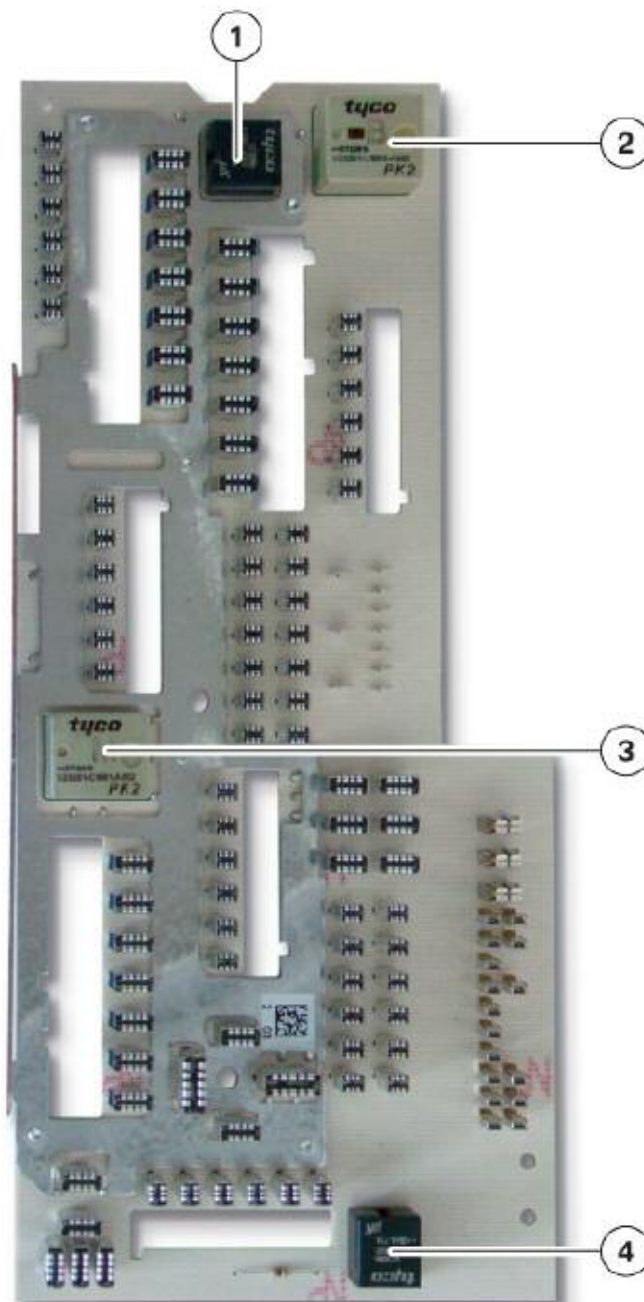
Front view of the front fuse carrier in the F01//F02

Index	Explanation
1	Relay terminal 30B

## Soldered Relay

Various relays are soldered to the circuit board in the front fuse carrier. In the event of a fault, the fuse carrier must be replaced as a complete unit.

### Internal view of the front fuse carrier, F01/F02



Index	Explanation	Index	Explanation
1	Relay, terminal 30F (bistable)	3	Relay, terminal 15N
2	Relay for the headlight cleaning system	4	Horn relay



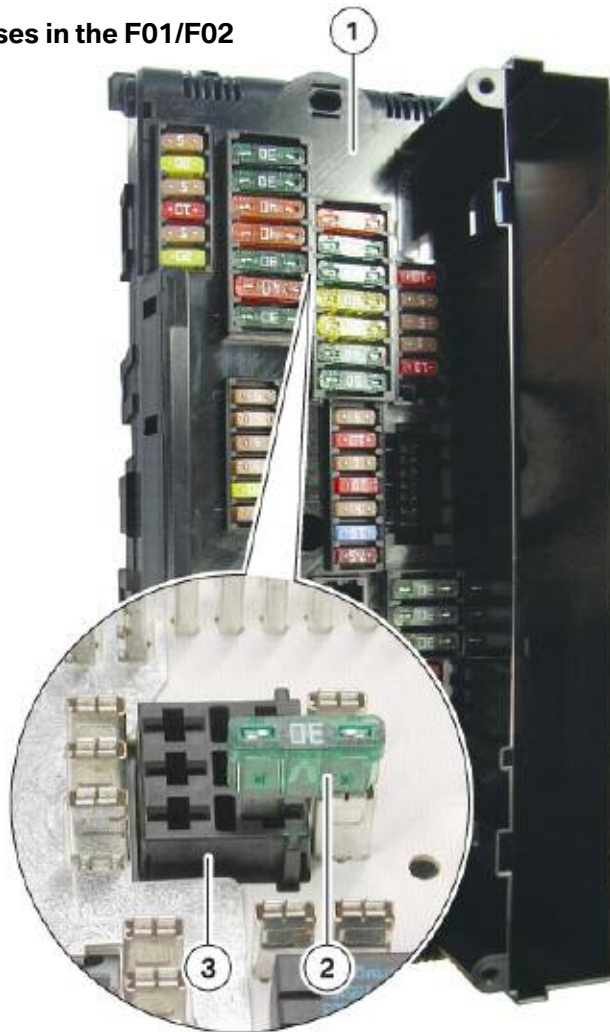
## Direct Contacting

On the distribution boxes, direct contacting to the fuses is carried out. The fuses are plugged into the plug connections on the circuit board with a connection. The other plug connections are directly connected to the connecting plugs on the wiring harness.

The advantages of this design modification are:

- Improved package space utilization
- Improved heat dissipation.

### Direct contacting of fuses in the F01/F02

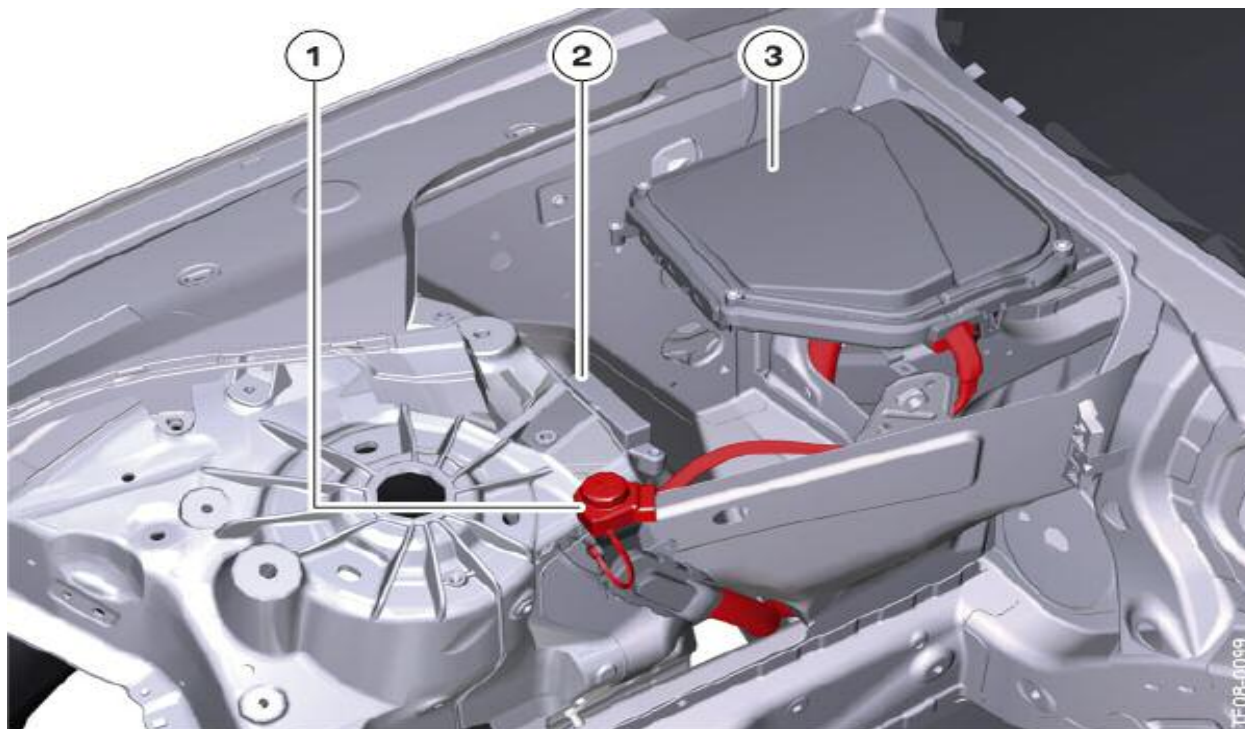


Index	Explanation	Index	Explanation
1	Front fuse carrier housing	3	Wiring harness connector
2	Fuse		

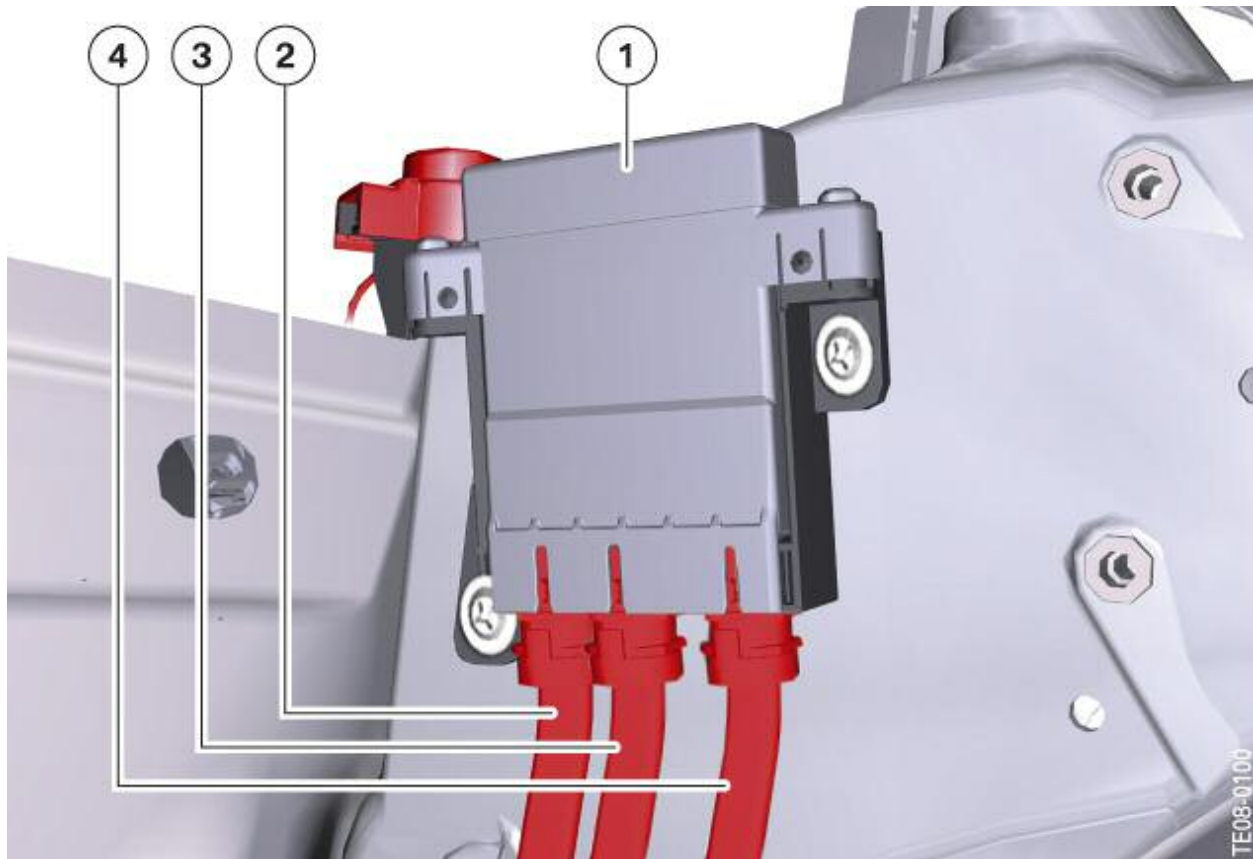
Particular care must be taken to ensure that the fuses are fitted firmly when unplugging and reconnecting the connectors for the wiring harness. The fuses must be braced when plugging in the wiring harness.

## Power Distribution Box in Engine Compartment

There are no fuses in the engine compartment distribution box.



Index	Explanation	Index	Explanation
1	Positive battery terminal	3	Electronics Box
2	Power distribution box in engine compartment		



Index	Explanation	Index	Explanation
1	Power distribution box in engine compartment	3	Cable to electric fan
2	Cable from distribution box to battery	4	Not for US market