

## START-STOP system

in Škoda vehicles



Self-study programme



Ever increasing energy prices and tougher emission limits make it necessary to look for ways to reduce fuel consumption and exhaust emissions. The START-STOP system was developed to address these circumstances, whereby the engine is automatically switched off when the car is stopped, for example at traffic lights. The engine starts again automatically without the driver using the ignition key as soon as the journey is continued.



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START-STOP system	4
Function and operation	6
System overview	10
System requirements	14
Electrical components	18
Notes	25

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You will find the notes for the assembly and disassembly, diagnostics as well as detailed user information in the workshop manuals, the diagnosis unit VAS 505x and in the onboard literature.

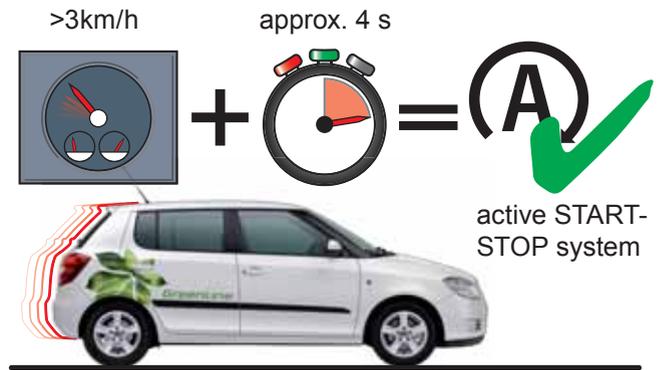
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# START-STOP system

## START-STOP system

The START-STOP system is designed to reduce fuel consumption, whereby the engine switches off automatically during the standstill phases of the vehicle and restarts automatically whenever the driver wishes to continue the journey. The START-STOP mode is automatically activated after driving off once the vehicle is driven for approx. four seconds at a speed of at least 3 km/h.



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The function of the START-STOP system is performed via the engine management and is integrated in the software of the engine control unit.

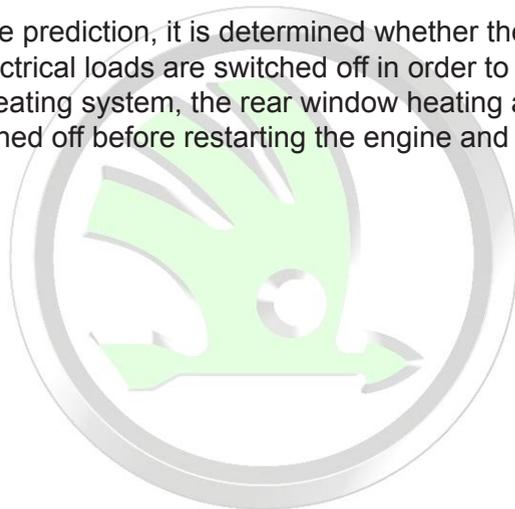
The START-STOP system is designed for the following engines:

- 1.2 ltr./55 kW TDI with Common Rail injection system
- 1.6 ltr./77 kW TDI with Common Rail injection system

A determining factor for the START-STOP system is whether the charge status of the starter battery allows the engine to restart. This procedure is referred to as start voltage prediction. It states if all the properties and values of the engine related to a restart of the engine were evaluated.

Therefore, the charge status of the battery is constantly measured.

Based on the start voltage prediction, it is determined whether the START-STOP operation can be carried out or specific electrical loads are switched off in order to maintain the power consumption. This concerns the seat heating system, the rear window heating and the mirror heating systems. These systems are switched off before restarting the engine and are blocked for the duration of the engine start.



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It was possible to implement the START-STOP system with only a few new components. These are amongst others the battery monitoring control unit J367 and the button for the START-STOP operation F416.

It was necessary, however, to adapt some components such as the starter and the alternator in order to operate the START-STOP system.

Components and systems adapted for operating the START-STOP system:

Component / system	Previous adaptation measures
Control units (in general)	- extension of programme codes of engine control units by an information bit for the START-STOP system (for control units that enable the operation of the START-STOP system or are influenced by this system)
Alternator	- LIN connection to the diagnostic interface for data bus (GATEWAY)
Battery	- fleece battery to increase the cycle durability
Starter	- higher wear resistance
Onboard supply	- battery with a battery monitoring control unit at negative terminal of battery - new battery wiring - battery monitoring control unit connected to diagnostic interface for data bus (Gateway) via LIN data bus
Gearbox	- gear recognition sensor G604 with PWM signal output

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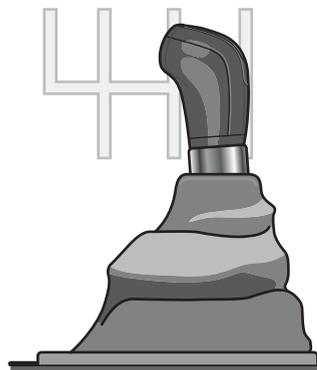
**Please always observe the valid designations in ETKA (Electronic Catalogue of Original Parts) when ordering spare parts.**

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# Function and operation

## Operating concept

The START-STOP system is available for engines with manual gearboxes.



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## Switching off the START-STOP system

If the driver does not wish to operate the START-STOP system it can be switched off using the button for START-STOP operation F416 . The deactivation of the START-STOP system is indicated when the readiness indicator of the START-STOP system in the display of the dash panel insert goes out. The function is reactivated by pressing the button once again.

button for START-STOP operation F416



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The START-STOP system is automatically switched on after the ignition key has been pulled out and reinserted. If the vehicle exceeds the speed of 3 km/h for a period of approx. four seconds, the START-STOP system becomes active.

readiness indicator of the START-STOP system



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The type of display in the display of the dash panel insert differs depending on the convenience equipment.

The position of the button F416 varies depending on the model range of the vehicle. The concept of positioning the button F416 for the individual model ranges can be found on page 18 of this self-study programme.

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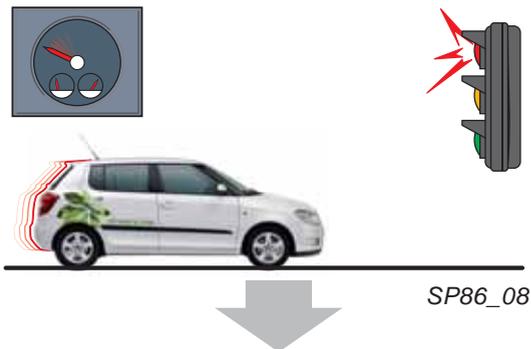
# Function and operation

## Operation of the START-STOP system

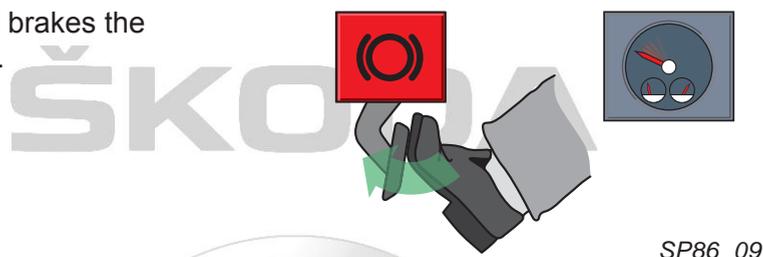
Example of the function course of the START-STOP system.

The vehicle approaches a red traffic light at a speed of 50 km/h.

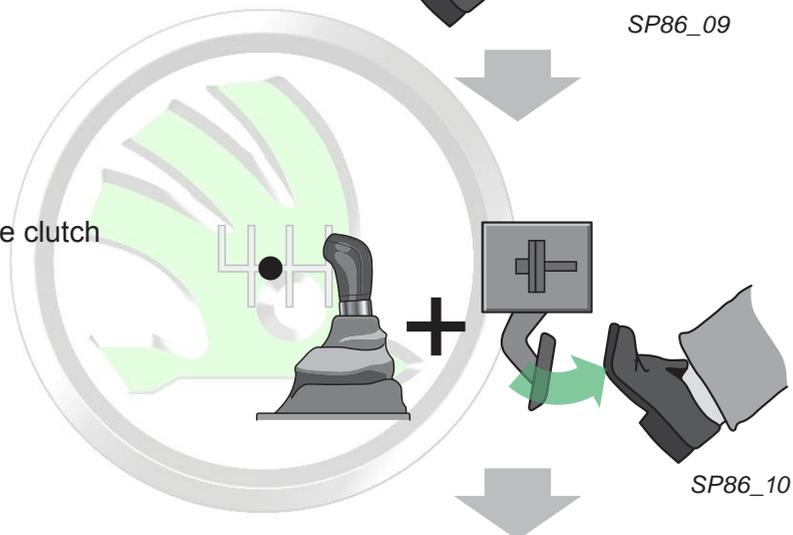
Engine stop phase



The driver shifts to a lower gear and brakes the vehicles until it comes to a standstill.

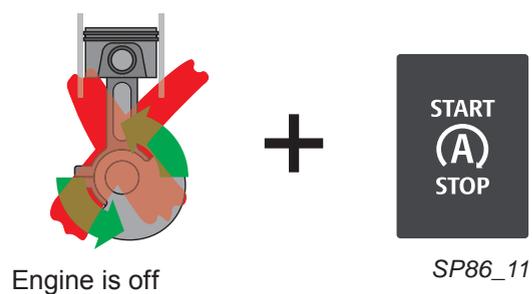


He switches to neutral and releases the clutch pedal.

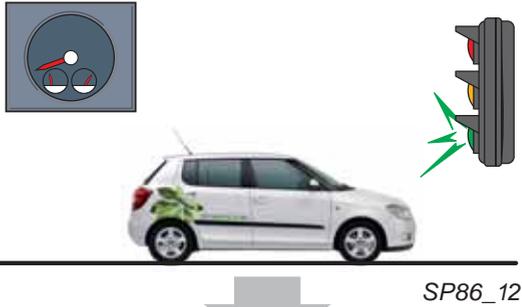


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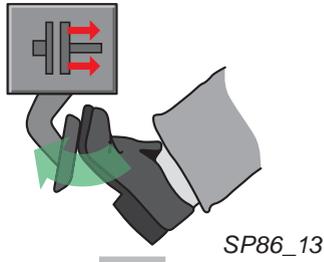
The START-STOP system switches the engine off. The START-STOP symbol in the display of the dash panel insert indicates whether the engine is ready to be switched on again.



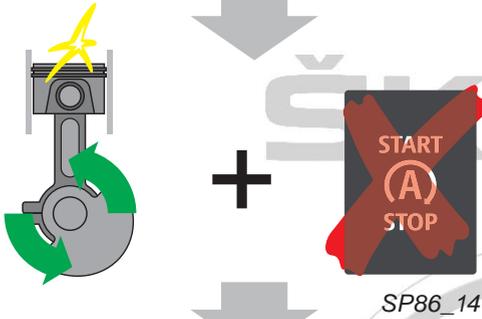
Engine start phase



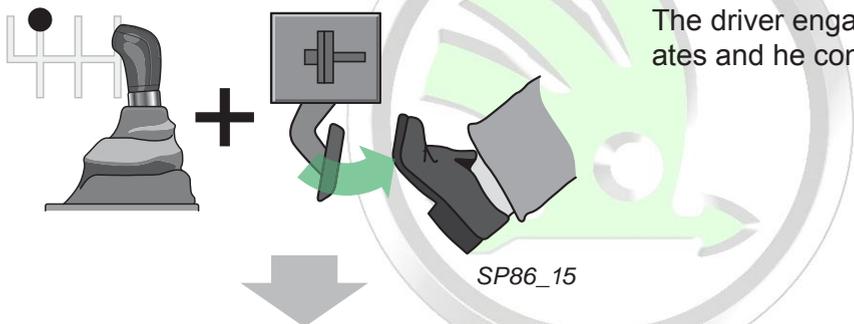
The traffic light turns green.



The driver depresses the clutch pedal.



The START-STOP system automatically switches the engine on again.  
The START-STOP symbol in the display of the dash panel insert goes out.



The driver engages a gear, the vehicle accelerates and he continues his journey.



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# System overview

## Structure of the START-STOP system

The START-STOP system is implemented in the software of the engine control unit as a function. The system itself uses a wide range of vehicle components and subsystems for the START-STOP operation.

The necessary vehicle components for the START-STOP system, some of which were specially adapted for this system, are given in the following diagram.

Much more information is required however in order to coordinate the START-STOP operation with other vehicle systems and to monitor the conditions of the START-STOP system. This information is provided on the following pages.

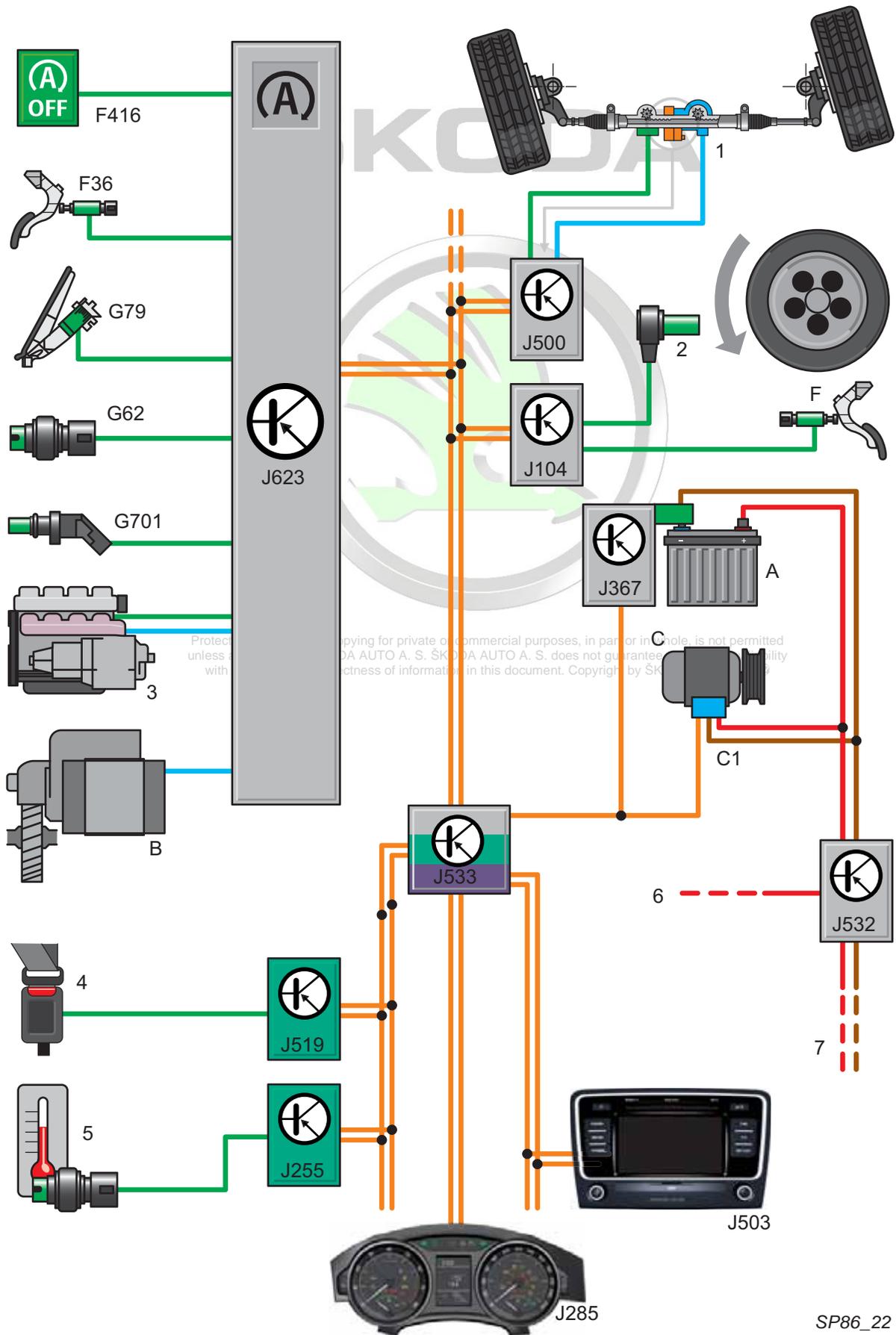
### Legend

A	Battery	1	Electromechanical power-assisted steering
C	Alternator	2	Speed signal, path recognition
C1	Voltage regulator	3	Engine management systems (e.g. ignition, fuel supply, mixture preparation, exhaust gas recirculation, secondary air injection, exhaust cleaning etc.)
B	Starter	4	Belt detection
F	Brake light switch	5	Heating, fan, air conditioning control
F36	Clutch pedal switch	6	Terminal 50R
F416	Button for START-STOP operation	7	Terminal 30 (stabilised)
G62	Coolant temperature sender		
G79	Accelerator pedal sender		
G701	Gearbox neutral position sender		
J104	ABS/ESP control unit		
J255	Climatronic control unit		
J285	Control unit in the dash panel insert		
J367	Battery monitoring control unit		
J500	Steering aid control unit		
J503	Control unit with display device for radio and navigation system		
J519	Onboard supply control unit (BCM)		
J532	Voltage stabilizer		
J533	Data bus diagnostic interface (GATEWAY)		
J623	Engine control unit		

	CAN data bus line
	LIN data bus line
	Positive line
	Earth lead
	Sensor, input signal
	Actuator, output signal
	CAN data bus drive
	CAN data bus Convenience
	CAN data bus infotainment

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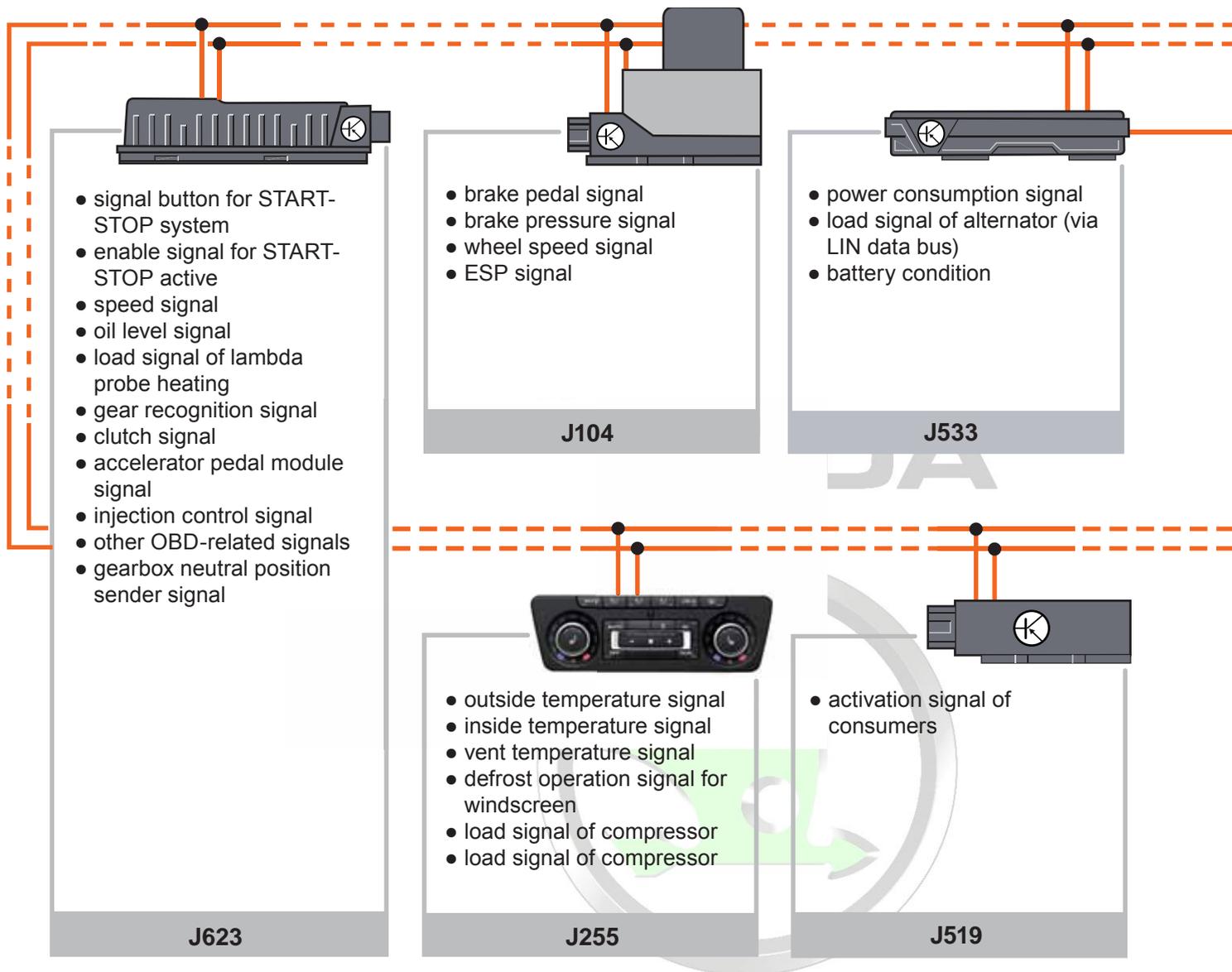
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# System overview

## System communication

The system logic must determine first whether after "ignition on" the preconditions for the activation of the START-STOP operation are met. In this case, the engine control unit coordinates the operation of the START-STOP system with other vehicle systems. On a vehicle equipped with the START-STOP system, the engine is more frequently switched on and therefore the battery voltage and the charging of the alternator must be monitored. In addition, the voltage supply for the radio, possibly the navigation and the dash panel insert, is stabilised to approx. 12 volts by using a voltage stabilizer while the engine is restarted. The usual comfort of the occupants is thus maintained.

## CAN data bus communication

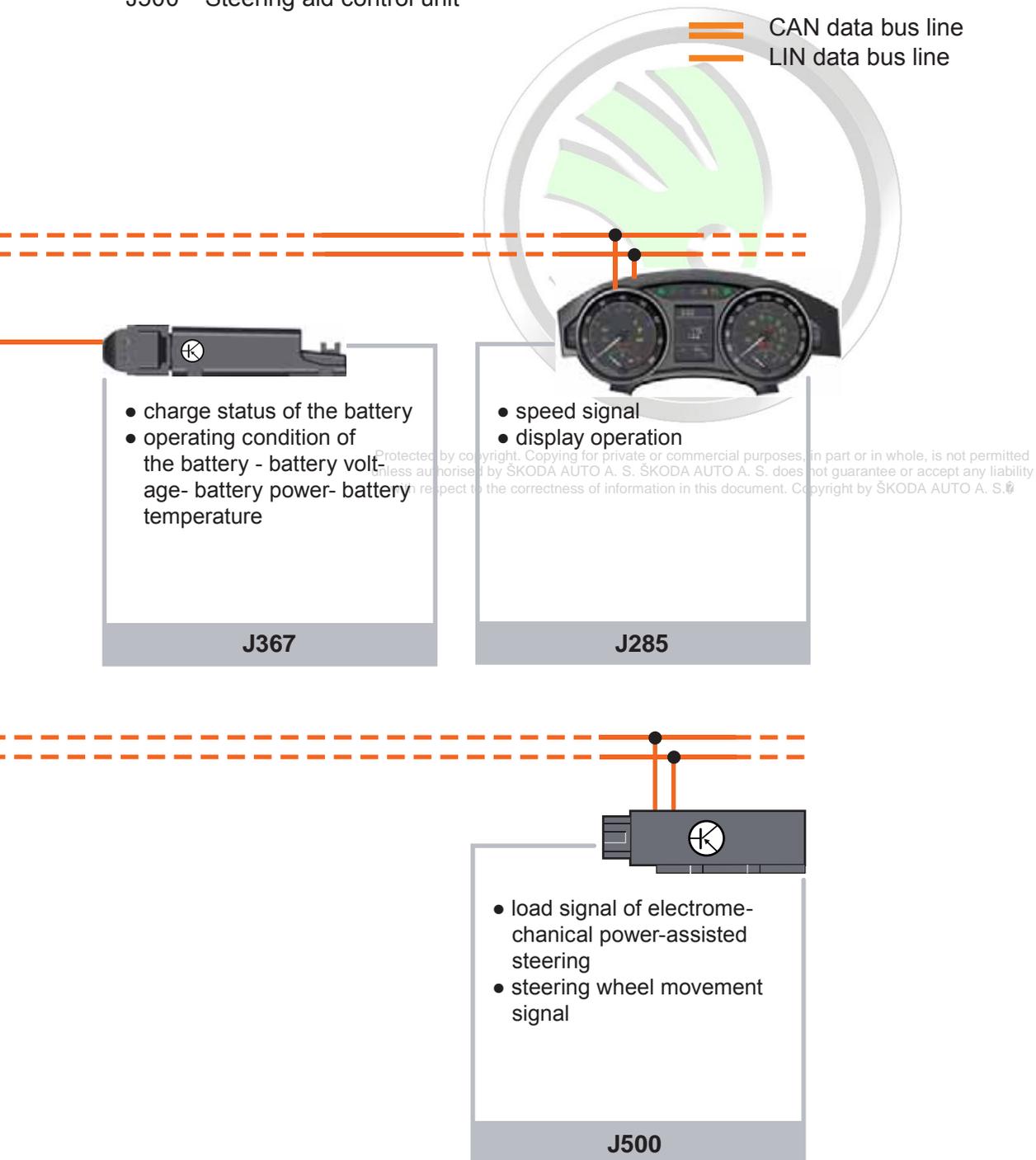


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## Legend

J104	ABS/ESP control unit	J533	Data bus diagnostic interface (GATEWAY)
J285	Control unit in the dash panel insert	J519	Onboard supply control unit (BCM)
J255	Climatronic control unit	J623	Engine control unit
J367	Battery monitoring control unit		
J500	Steering aid control unit		

 CAN data bus line  
 LIN data bus line



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# System requirements

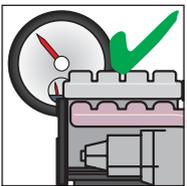
## Stopping - engine stop

Conditions related to the handling of the vehicle by the driver (switching to neutral and releasing the clutch) and additional conditions must be met so that the START-STOP system can switch off the engine.

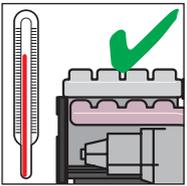
### Conditions for engine stop:



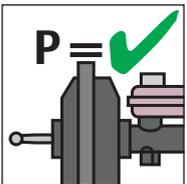
The vehicle is stationary (speed = 0 km/h).



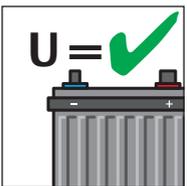
The engine speed is below 1200 rpm.



The coolant temperature is between 25 °C and 100 °C.



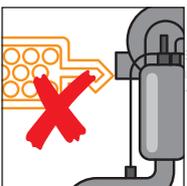
The brake pressure is greater than 55 kPa (550 mbar).



The energy consumption calculated before "engine off" and needed in order to re-start the engine can be supplied by the battery (start voltage prediction).  
The battery temperature is greater than or equal to -1 °C and less than 55 °C.



The demand on the air conditioning by the occupants is not too high.  
The difference between the specified and actual vent temperature is below 8 °C.



The diesel particle filter is not in the regeneration mode.

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## Continuing the journey - engine start

The defined conditions must be met so that the START-STOP system automatically restarts the engine.

### Conditions for engine start:



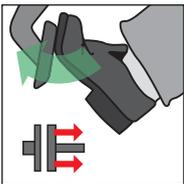
The driver is fastened (belt buckle locked).



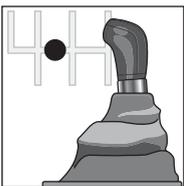
The engine hood is closed.



The driver's door is closed.



The clutch pedal is operated.



The gear lever is in neutral position.

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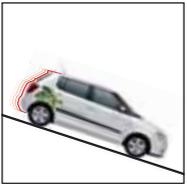
# System requirements

## Vehicle requirement - automatic engine start

The starting of the engine by the START-STOP system may also be triggered by other circumstances without conscious intervention of the driver:

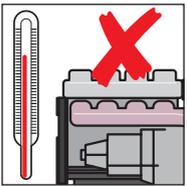
- change in the driving condition (e.g. vehicle starts to roll after releasing the brakes)
- activation of the systems within the vehicle by the occupants (e.g. Defrost activated)
- change in ambient conditions of the vehicle systems (e.g. outside temperature)

### Reasons for the engine start:

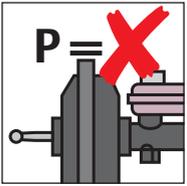


The vehicle starts to roll on a steep road so that braking and steering assistance is required.

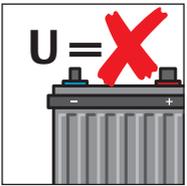
If the vehicle exceeds the speed of 3 km/h, the START-STOP system starts the engine automatically.



The coolant temperature is no longer between 25 °C and 100 °C.

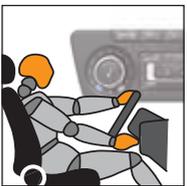


Insufficient pressure in the brake system.



The charge status of the battery is no longer sufficient.

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Operating the Defrost button for the windscreen.

Increasing the fan speed inside the vehicle by more than four stages.

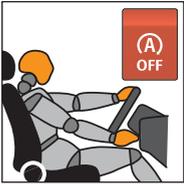
Increasing the heating or cooling requirement of the air conditioning system (the difference of the specified/actual vent temperature is greater than 12 °C).



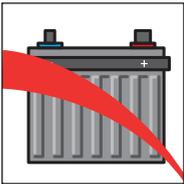
To safeguard the restart of the engine when the START-STOP operation is active certain additional consumers or convenience functions, such as for example the seat heating, can be switched off after the engine stop.

## Reasons for the interruption of the START-STOP operation

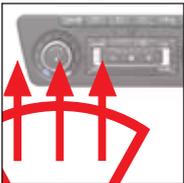
In addition to the previously described influencing variables for an engine stop or an automatic engine start, the following causes render the START-STOP operation functionless.



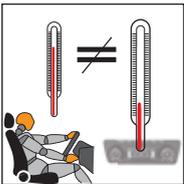
The START-STOP system is switched off using the button for the START-STOP operation.



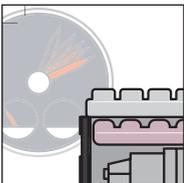
The charge status of the battery does not enable the engine to be restarted (start voltage prediction).



The defrost function (windscreen) is active.



The set temperature of the air conditioning system differs more than 8 °C from the actual temperature in the interior of the vehicle.



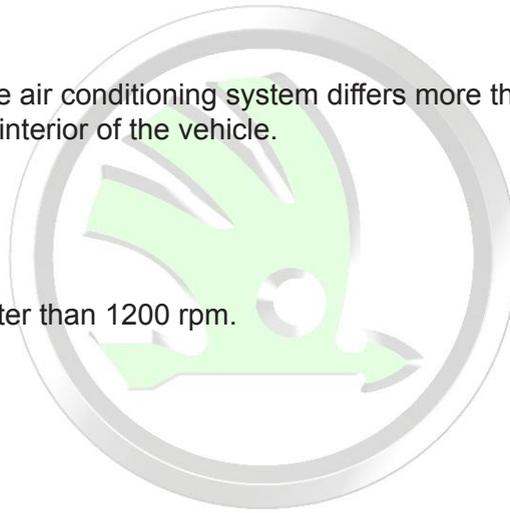
The engine speed is greater than 1200 rpm.



The alternator (generator) is defective, for example the V-belt is torn.

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# Electrical components

## Sensors and actuators

### Button for START-STOP operation F416

The button F416 is located in the centre console next to the handbrake.

#### Function

The button is used for activating and deactivating the START-STOP operation while driving. The START-STOP system is activated automatically each time the ignition is switched on. The system itself is put into operation as soon as the test for fulfilling the aforementioned operating conditions has been carried out.

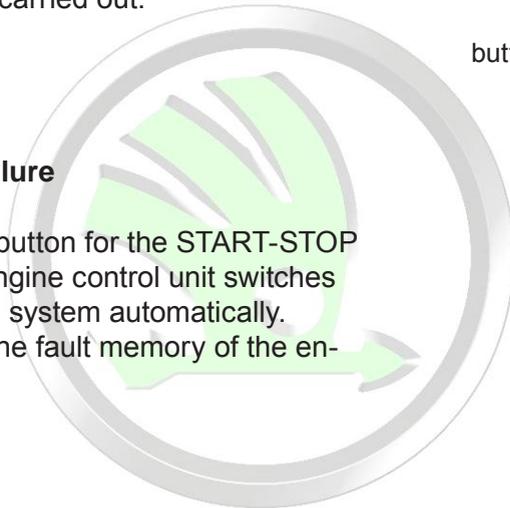


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button for START-STOP operation F416

#### Effects of signal failure

If the function of the button for the START-STOP operation fails, the engine control unit switches off the START-STOP system automatically. A fault is entered in the fault memory of the engine control unit.



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## battery monitoring control unit J367

The information that the battery has enough electric power for restarting the engine, is an essential requirement for the operation of the START-STOP system. Therefore, vehicles with the START-STOP system are equipped with a battery monitoring control unit with integrated battery sensor.

The battery monitoring control unit is located directly on the negative connection terminal of the ground cable and is connected to the data bus diagnostic interface (Gateway) J533 via the LIN data bus.



SP86\_03

battery monitoring control unit J367

### Use of signal

The battery sensor integrated in the battery control unit J367 determines:

- the battery temperature
- the battery voltage
- the charging current

The battery temperature is determined at the negative terminal of the battery and the inside temperature of the battery is evaluated using the performance map.

The charge control (charging potential) can be adapted to the charge and operating condition of the battery by means of the obtained data. The aim is to increase the availability of the START-STOP system based on the detailed data evaluation of the battery.

### Effects of signal failure

In the event of a signal failure of the battery sensor, the operating condition of the battery can no longer be accurately determined and monitored.

An entry is made in the fault memory of the data bus diagnostic interface (Gateway) J533. The START-STOP system is deactivated.

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# Electrical components

## Display concept

The notice and warning messages of the START-STOP system are presented in various ways depending on the equipment of the dash panel insert.



The overview of the notice and warning messages for the individual versions of the dash panel inserts can be found in the user manual of the vehicle.

## Specially adapted components and systems

As already mentioned, it was necessary to technically adapt certain components for the operation of the START-STOP system:

- fleece battery
- gearbox neutral position sender G701 (gear recognition)
- generator (alternator) with LIN line
- starter
- voltage stabilizer

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**You will find the correct designation of the spare parts for the repair in ETKA (Electronic Catalogue of Original Parts).**

**The parts adapted for the START-STOP system are not specifically designated and do not differ at all or only slightly from the usual parts.**

## Fleece battery (AGM - Absorbent Glass Mat)

On vehicles with the START-STOP system, only a fleece battery must be used as a starter battery because of its higher cycle durability instead of the usual lead-acid batteries.

In addition to gel batteries, fleece batteries represent a technological breakthrough in the development of advanced batteries. The essential difference to the lead battery is that the acid (electrolyte) is fully absorbed by a glass mat which separates the lead grid electrodes from each other.

Further advantages of the fleece battery are:

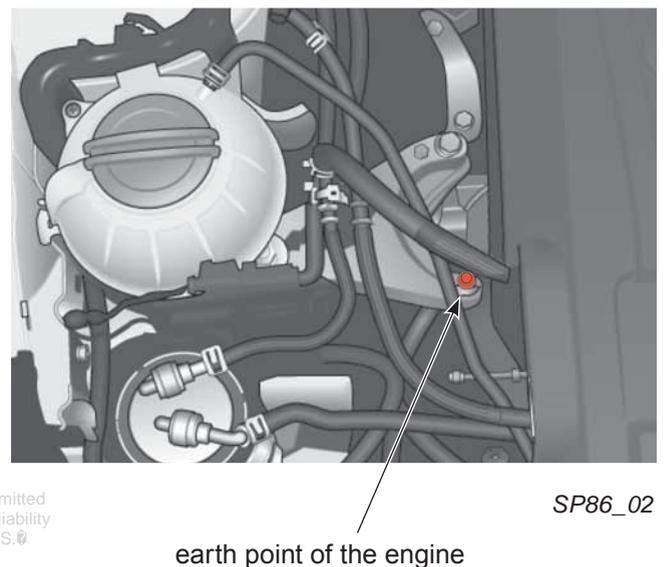
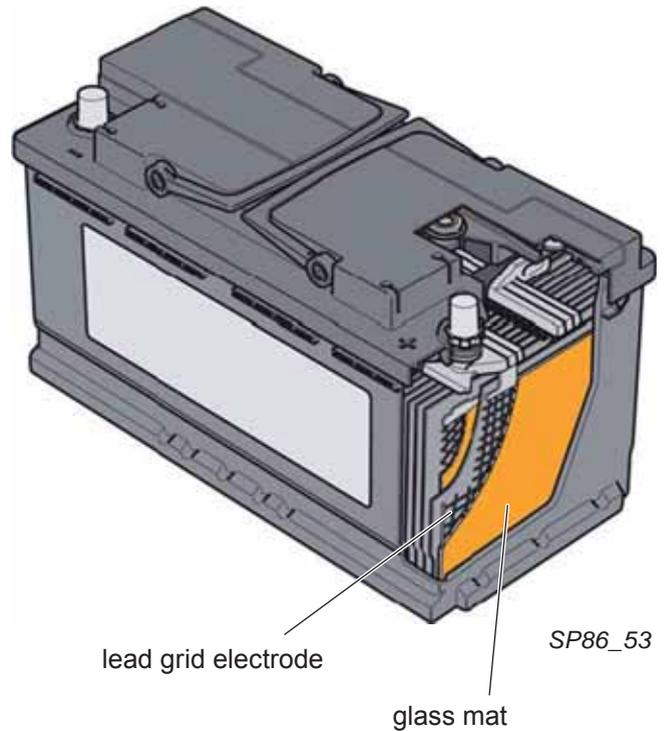
- high cold start performance
- high deep discharge resistance/capability
- high cycle durability
- tilt resistance and protection against leakage also in the event of breakage of the battery case
- maintenance-free

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### Charging the battery

On vehicles with the START-STOP system, the terminal clamps of the battery charger must not be directly connected to the negative terminal of the battery, but only to the engine mass. This ensures that the battery sensor which is integrated in the battery monitoring control unit J367 is not bypassed.

If the battery is directly charged by connecting to the negative terminal, this would result in the bypass of the battery sensor and in turn the sensor would not register its data while the battery is charging. Then the battery values stored in the data bus diagnostic interface (Gateway) J533 would not correspond to the values of the charged battery.



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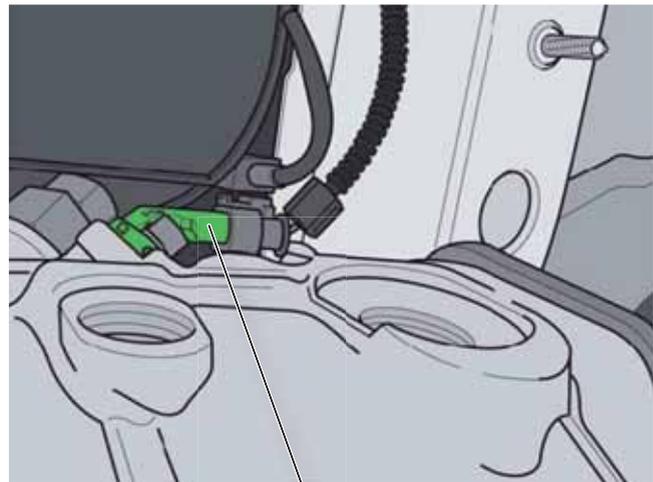
# Electrical components



When starting the vehicle in case of emergency using the starter cable, the negative terminal of the starter cable must also abut against the earth point of the engine.

## Gearbox neutral position sender G701

To ensure the function of the START-STOP system, the gearbox had to be further equipped with another sensor, which allows the system to register the position of the shift lever when in the neutral position - gearbox neutral position sender G701. The sensor is screwed into the gearbox housing at the top and registers the position of the shift lever without making contact.



SP86\_51

gearbox neutral position sender G701

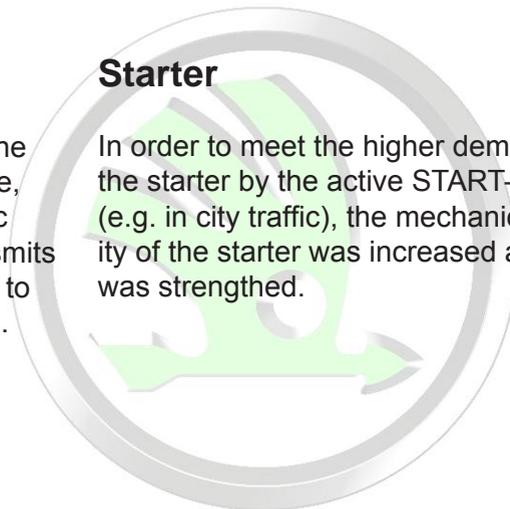
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## Alternator

On vehicles with the START-STOP system, the information is transmitted via the LIN data line, which is connected to the data bus diagnostic interface (Gateway) J533. The gateway transmits this information to the other control units (e.g. to the engine control unit) via the CAN data bus.

## Starter

In order to meet the higher demands imposed on the starter by the active START-STOP system (e.g. in city traffic), the mechanical cycle durability of the starter was increased and the ring gear was strengthened.



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## Voltage stabilizer J532

The voltage stabilizer is essentially a DC/DC\* voltage converter which ensures that all multimedia and information systems of the vehicle (radio, navigation, UHV unit, dash panel insert) are active at all times when stopping the vehicle in the START-STOP mode.

The voltage stabilizer is located in the floor of the vehicle under the front passenger's seat and has a power output of 200 W.

### Function

Its task is to stabilise the 12 V on-board voltage of the vehicle (terminal 30) at approx. 12 V in certain situations (e.g. when starting the engine). A strong voltage fluctuation might occur on some electrical consumers in the vehicle due to the high starting current.

### Effects of signal failure

In case of a function failure of the voltage stabilizer an initiation of the electrical consumers such as radio, possibly navigation, dash panel insert or UHV unit is performed, provided their own supply is not sufficient due to the use of the starter. If it becomes apparent that the above mentioned electrical consumers must be initialised at each engine start, while operating the START-STOP system, this indicates that the stabilizer is defective.

Therefore, if no voltage stabilizer is present, the systems would be initialised and entries would be made in the fault memory of the respective control units (for example "on-board voltage, signal is too weak").



SP86\_52

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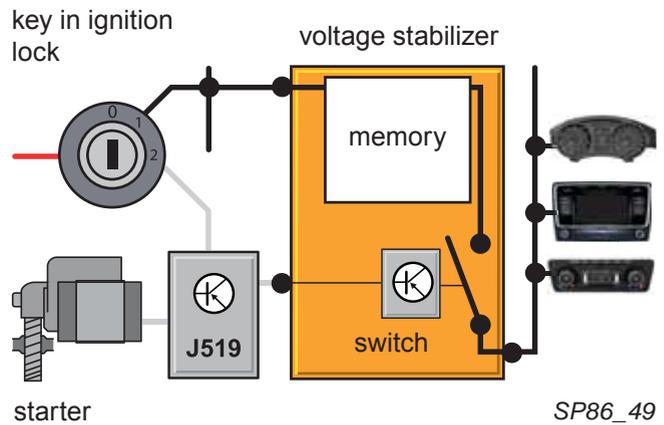
SP86\_54

\*DC = Direct Current

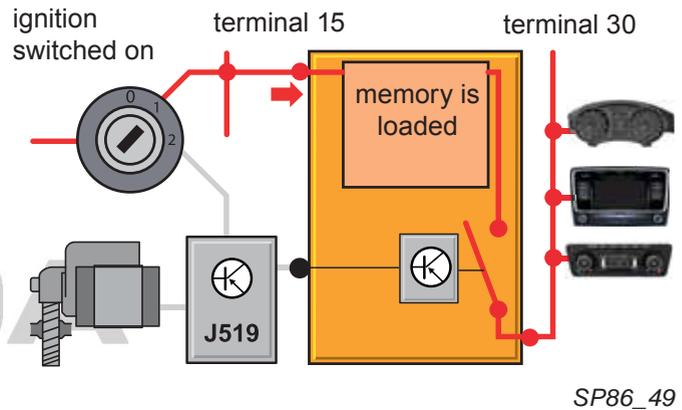
# Electrical components

## Function

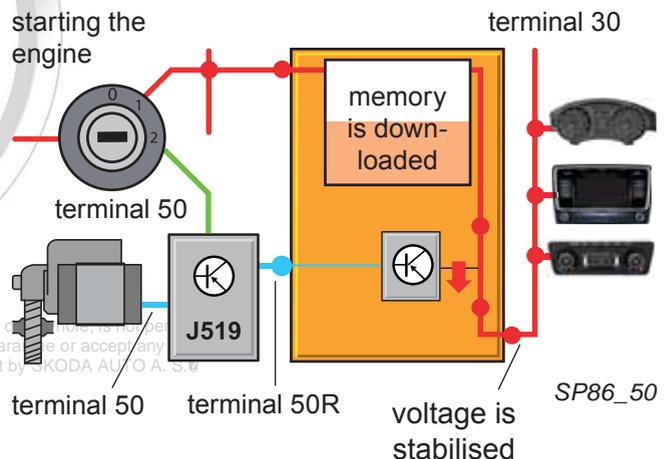
The voltage stabilizer is essentially a DC/DC voltage converter. The core of a voltage converter is an electronic memory (capacitor), which can store the electrical energy for a specific period of time. Furthermore, an internal switch (transistor) is required, which controls the outflow of the electrical energy from the memory.



If the ignition lock is turned to "Ignition on", the terminal 15 is thus energised and the voltage stabilizer is switched on. The memory accumulates energy so that the voltage stabilizer has its full electrical output of 200 W available in order to compensate for the voltage drop. The internal switch, which controls the downloading of the memory, is in the open position. The voltage stabilizer is now ready.



When switching on the starter (terminal 50 energised) the voltage stabilizer receives an activation signal (trigger) for the start-up circuit via terminal 50R (R = feedback). The switch is closed by the activation signal. The stored energy flows from the memory and compensates for the voltage fluctuations. Afterwards, the switch opens and the memory starts loading again.



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## Overview of the previously edited self-study programmes

### No. Designation

- 1 Mono-Motronic
- 2 Central locking
- 3 Vehicle alarm
- 4 Working with wiring diagrams
- 5 ŠKODA FELICIA
- 6 Safety of the ŠKODA vehicles
- 7 Principles of ABS - were not published
- 8 ABS - FELICIA
- 9 System for safe start-up with transponder
- 10 Air conditioning in the vehicle
- 11 Air conditioning FELICIA
- 12 1.6 engine - MPI 1AV
- 13 Four-cylinder diesel engine
- 14 Power-assisted steering
- 15 ŠKODA OCTAVIA
- 16 1.9 ltr. TDI diesel engine
- 17 ŠKODA OCTAVIA Convenience electronic system
- 18 ŠKODA OCTAVIA Manual gearbox 02K, 02J
- 19 1.6 ltr. and 1.8 ltr. petrol engines
- 20 Automatic gearbox - fundamentals
- 21 Automatic gearbox 01M
- 22 1.9 ltr./50 kW SDI, 1.9 ltr./81 kW TDI diesel engines
- 23 1.8 ltr./110 kW and 1.8 ltr./92 kW petrol engines
- 24 OCTAVIA, CAN BUS
- 25 OCTAVIA - CLIMATRONIC
- 26 OCTAVIA - safety of the vehicle
- 27 OCTAVIA - 1.4 ltr./44 kW engine and gearbox 002
- 28 OCTAVIA - ESP - fundamentals, design, function
- 29 OCTAVIA 4 x 4 - all-wheel drive
- 30 2.0 ltr. 85 kW and 88 kW petrol engines
- 31 Radio navigation system - design and functions
- 32 ŠKODA FABIA - technical information
- 33 ŠKODA FABIA - electrical systems
- 34 ŠKODA FABIA - electro-hydraulic power-assisted steering
- 35 1.4 ltr. - 16 V 55/74 kW petrol engines
- 36 ŠKODA FABIA - 1.9 ltr. TDI Unit injection
- 37 Manual gearbox 02T and 002
- 38 ŠkodaOctavia; model 2001
- 39 Euro-On-Board-Diagnosis
- 40 Automatic gearbox 001
- 41 6-Speed gearbox 02M
- 42 ŠkodaFabia - ESP
- 43 Exhaust emissions
- 44 Extended service intervals
- 45 Three-cylinder petrol engines 1.2 ltr.
- 46 ŠkodaSuperb; Vehicle presentation; part I
- 47 ŠkodaSuperb; Vehicle presentation; part II
- 48 ŠkodaSuperb; 2.8 ltr./142 kW V6 petrol engine
- 49 ŠkodaSuperb; 2.5 ltr./114 kW TDI V6 petrol engine
- 50 ŠkodaSuperb; automatic gearbox 01V

### No. Designation

- 51 2.0 ltr./85 kW petrol engine with balancing shafts and two-stage intake manifold
- 52 ŠkodaFabia; 1.4 ltr. TDI engine with unit injection system
- 53 ŠkodaOctavia; Vehicle presentation
- 54 ŠkodaOctavia; Electrical Components
- 55 FSI petrol engines; 2.0 ltr./110 kW and 1.6 ltr./85 kW
- 56 Automatic gearbox DSG-02E
- 57 Diesel engine; 2.0 ltr./103 kW TDI with pump-nozzle units, 2.0 ltr./100 kW TDI with pump-nozzle units
- 58 ŠkodaOctavia, Chassis and electromechanical power-assisted steering
- 59 ŠkodaOctavia RS, 2.0 ltr./147 kW FSI turbo engine
- 60 2.0 ltr./103 kW 2V TDI diesel engine; particle filter with additive
- 61 Radio navigation systems in the Škoda
- 62 ŠkodaRoomster; Vehicle presentation part I
- 63 ŠkodaRoomster; Vehicle presentation part II
- 64 ŠkodaFabia II; Vehicle presentation
- 65 ŠkodaSuperb II; Vehicle presentation part I
- 66 ŠkodaSuperb II; Vehicle presentation part II
- 67 Diesel engine; 2.0 ltr./125 kW TDI with Common Rail injection system
- 68 1.4 ltr./92 kW TSI petrol engine with turbocharger
- 69 3.6 ltr./191 kW FSI petrol engine
- 70 All-wheel drive with Haldex coupling of the IV generation
- 71 ŠkodaYeti; Vehicle presentation part I
- 72 ŠkodaYeti; Vehicle presentation part II
- 73 LPG system in Škoda vehicles
- 74 1.2 ltr./77 kW TSI petrol engine with turbocharger
- 75 7-speed dual-clutch automatic gearbox 0AM
- 76 Green Line vehicles
- 77 Geometry
- 78 Passive safety
- 79 Additional heating
- 80 2.0 ltr., 1.6 ltr., 1.2 ltr. diesel engines with Common Rail injection system
- 81 Bluetooth in Škoda vehicles
- 82 Sensors in Škoda vehicles
- 83 1.4 ltr./132 kW TSI petrol engine with dual-charging (compressor, turbocharger)
- 84 ŠkodaFabia II RS; Vehicle presentation
- 85 KESSY system in Škoda vehicles
- 86 START-STOP system in Škoda vehicles

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