

Model 231
as of model year 2017

Model 231
up to model year 2017
with code B03 (ECO start/stop function)

i The subfunction "Engine start/stop energy management, function" is considered here from an energy management viewpoint. Information from the viewpoint of the engine management is given in a different function description.

Function requirements, general

- Engine running and at operating temperature
- Engine hood closed
- One-time overspeeding of $v = 15$ km/h in forward travel

Energy management for engine start/stop, general

For a stationary vehicle, the engine Start-Stop function switches the engine off automatically and starts it again, as soon as the driver wishes to drive off. Switching of the engine during standstill periods of the vehicle reduces the fuel consumption and therefore the carbon dioxide emissions.

The master control unit of the engine start/stop function is the ME-SFI [ME] control unit (N310) which records and evaluates all the influencing factors.

Conventional switching off and starting of the engine using the transmitter key (A8/1) or via the KEYLESS-GO start-stop button (S2/3) (with code 889 (KEYLESS-GO)) continues to be possible.

The engine start/stop function encompasses the following subfunctions:

- **Function sequence for engine stop**
- **Function sequence for engine start**
- **Function sequence for forced engine start**
- **Function sequence for determine condition of additional battery for ECO start/stop function**
- **Function sequence for charge ECO start/stop function additional battery**

Additional function requirement for engine stop

- Stop enable issued by ME-SFI [ME] control unit

i While the vehicle is at a standstill, the brake pedal must remain depressed or the HOLD function must be active. The blower output is reduced when the automatic blower speed function of the air conditioning is active. In high ambient temperatures the system changes into air circulation mode depending on the specified temperature adjusted.

After an engine stop a maximum of three engine starts is permitted without exceeding the speed threshold of $v = 8$ km/h.

Function sequence for engine start

The engine is started with the actuation of the accelerator pedal. During the starting procedure the on-board electrical system battery is isolated from the on-board electrical system. The power supply for the active consumers is now provided by the additional battery for the ECO start/stop function. This serves to compensate for any voltage dip as perceived by vehicle occupants when starting the engine (e.g. during radio or ventilation operation).

- System diagnosis completed
- Outside temperature $T = -10$ up to 40 °C
- Battery temperature $T = 0$ to 60 °C
- A/C regulated

By using the ECO start/stop function additional battery (G1/13) with a capacity of 12 Ah, the voltage dip perceived by the vehicle occupants when the engine is started (e.g. during radio or ventilation operation) is prevented. The additional battery for ECO start/stop function then assumes the power supply for the active consumers in the process while the on-board electrical system battery (G1) is isolated from the on-board electrical system (at engine start). Active comfort functions are not switched off.

The ME-SFI [ME] control unit performs an SD immediately after an engine start and assesses the functionality of the engine start/stop function. In addition, the front SAM control unit with fuse and relay module (N10/1) checks that all components involved in isolating the on-board electrical system battery and connecting the ECO start/stop function additional battery are functioning correctly.

i The additional battery for ECO start/stop function is actuated by the additional battery relay for ECO start/stop function (K114).

The on-board electrical system battery is decoupled from the on-board electrical system by the decoupling relay (F32k1) in the front prefuse box (F32).

Function sequence for engine stop

As the master control unit for the engine start/stop system function, the ME-SFI [ME] control unit checks the influencing factors for stop enable:

The energy management system provides information for this which describes the on-board electrical system status or the requirements for the on-board electrical system.

The following energy management information is provided by the rear SAM control unit with fuse and relay module (N10/2):

- State of on-board electrical system battery
- State of additional battery for ECO start/stop function
- On-board electrical system status
- Requirements for load-intensive consumers (e.g. A/C)

The ME-SFI [ME] control unit evaluates all the relevant data and then issues the corresponding stop enable. The engine is switched off as a result of this.

The ME-SFI [ME] control unit evaluates all relevant influencing factors and then issues the start enable (hot start signal). The front SAM control unit reads in this hot start signal over a direct line and actuates the decoupling relay in the front prefuse box, and the ECO start/stop function additional battery relay at the ECO start/stop function additional battery.

The additional battery for the ECO start/stop function is then switched through to the on-board electrical system. Shortly after this, the decoupling relay isolates the on-board electrical system battery from the on-board electrical system for the duration of the starting process. The energy requirement of the on-board electrical system is now powered by the additional battery for ECO start/stop function. The on-board electrical system battery now supplies the energy required for the engine starting process.

As soon as the ME-SFI control unit detects an engine rpm of $n = 400$ to 700 rpm, it stops the starting procedure and sends a corresponding signal via chassis CAN 1 (CAN E1) to the front SAM control unit. The front SAM control unit then actuates the decoupling relay and the ECO start/stop function additional battery relay. The decoupling relay connects the on-board electrical system battery to the on-board electrical system.

The additional battery relay for ECO start/stop function disconnects the additional battery for ECO start/stop function from the on-board electrical system. The energy requirement of the on-board electrical system is now supplied again by the on-board electrical system battery.

Function sequence for forced engine start

To ensure that the on-board electrical system stability is also available during engine OFF, the ME-SFI [ME] control unit can also force the engine to start. A forced engine start is also conducted if, as a consequence of load-intensive consumers, the on-board electrical system stability can no longer be assured.

Load-intensive consumers can be requested by the following systems:

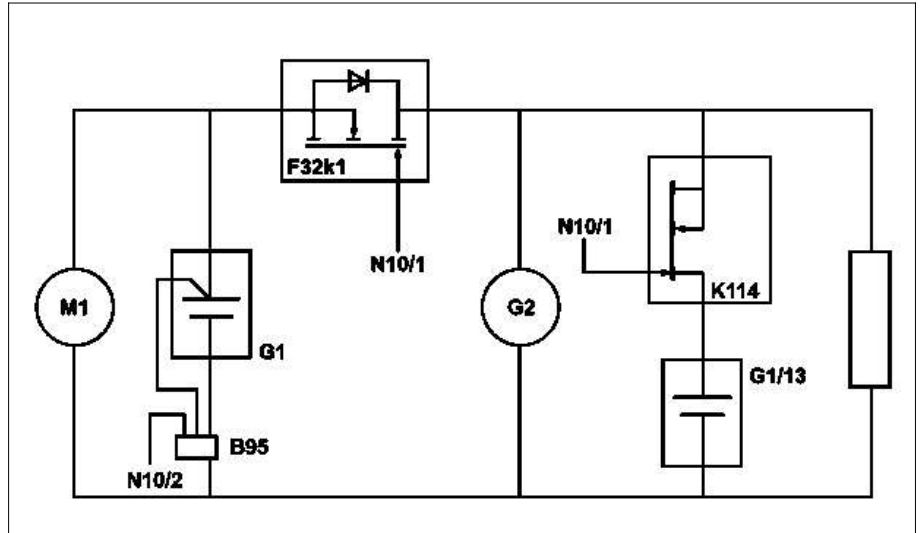
- Supplemental restraint system
- PRE-SAFE

- Brake assist and adaptive cruise control system
- Air conditioning
- Steering

As soon as the energy management is no longer able to ensure the stability of the on-board electrical system, the rear SAM control unit sends an engine start request via the interior CAN (CAN B), front SAM control unit and chassis CAN 1 to the ME-SFI control unit. The ME-SFI [ME] control unit receives this and starts the engine. If, following this, the on-board electrical system stability can still not be assured, the engine is no longer switched off. The Start-Stop function is switched off.

Illustration of power supply at engine start principle

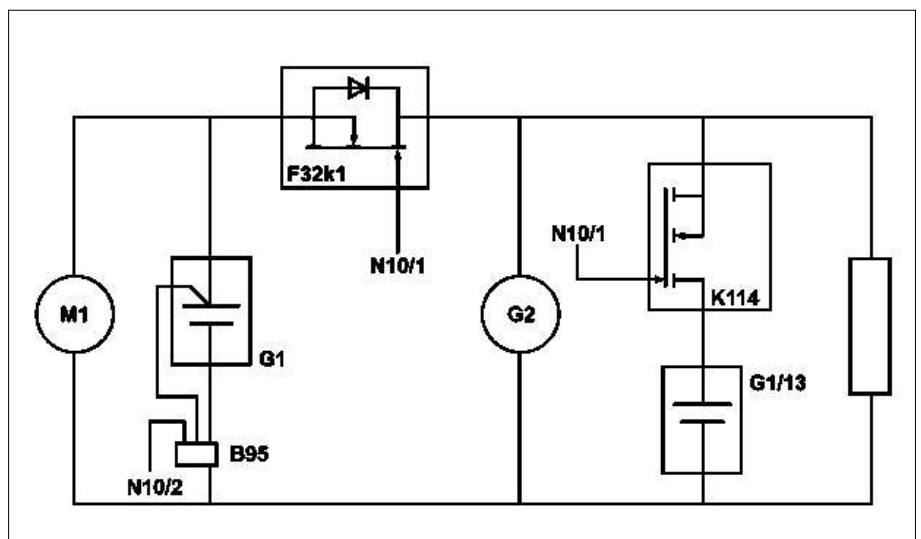
- B95 Battery sensor
- F32k1 Decoupling relay (relay open)
- G1 On-board electrical system battery
- G1/13 ECO start/stop function additional battery
- G2 Alternator
- K114 Additional battery relay for ECO start/stop function (relay closed)
- M1 Starter
- N10/1 Front SAM control unit with fuse and relay module
- N10/2 Rear SAM control unit with fuse and relay module



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Illustration of power supply when engine running principle

- B95 Battery sensor
- F32k1 Decoupling relay (relay closed)
- G1 On-board electrical system battery
- G1/13 ECO start/stop function additional battery
- G2 Alternator
- K114 Additional battery relay for ECO start/stop function (relay open)
- M1 Starter
- N10/1 Front SAM control unit with fuse and relay module
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Function sequence for determine condition of additional battery for ECO start/stop function

The front SAM control unit runs a battery state recognition immediately after the engine is started. This provides information regarding the availability of electrical power to the additional battery for the ECO start/stop function. If the engine is switched off during the battery state recognition, the SAM control unit switches this off and discards the previous results.

In addition to battery state recognition, the voltage of the additional battery for ECO start/stop function mode in the start-stop function mode is tested after every engine start.

i The battery state recognition can be started by means of a diagnosis tester.

The additional battery relay for the ECO start/stop function is no longer actuated under the following conditions:

- Additional battery for ECO start/stop function deep discharged
- Internal short circuit
- Short circuit in positive line of additional battery for ECO start/stop function

In order to establish this, the voltage of the ECO start/stop function additional battery is compared with an internal value. A corresponding fault message is shown in the multifunction display (A1p13) of the IC (A1). The front SAM control unit transmits the data required for this to the instrument cluster via the interior CAN.

Function sequence for charge ECO start/stop function additional battery

If the open circuit voltage ($U > 12.5 \text{ V}$) of the additional battery for ECO start/stop function is too low, the alternator's power limit (alternator

The charging strategy of the additional battery for ECO start/stop function must take two requirements into account:

- The ECO start/stop function additional battery must always be sufficiently charged.
- The number of additional battery relay for the ECO start/stop function actuations and the related load on the additional battery for the ECO start/stop function must be minimized as far as possible.

management) is deactivated so that the additional battery for ECO start/stop function can be charged.

If the voltage dip ($U < 11 \text{ V}$) at engine start is too large, an engine stop is deactivated for $t = 1$ minute to recharge the additional battery for the ECO start/stop function.

The additional battery for ECO start/stop function is only connected when the alternator's power limit (alternator management) is not active and the on-board electrical system voltage ($U > 13 \text{ V}$) is high enough. It is cleared again when the alternator's power limit is active or the on-board electrical system is severely overloaded.

	Electrical function schematic for energy management for engine start/stop		PE54.10-P-2070-97RKA
	Overview of energy management system components		GF54.10-P-9990RK