

Model 213**Function requirements, general**

- Engine running and at operating temperature
- System diagnosis completed without errors
- Outside temperature -10 to 40 °C (except model 213.016/050/053/153/216) or -40 to 60 °C (model 213.016/050/053/153/216)
- Temperature of on-board electrical system battery (G1) 0 to 60 °C (except model 213.016/050/053/153/216) or -40 to 60 °C (model 213.016/050/053/153/216)
- On-board electrical system battery charged sufficiently

Energy management for ECO start/stop function in general

Switching of the engine when the vehicle is at a standstill reduces the fuel consumption and therefore the carbon dioxide emissions. The master control unit for the ECO start/stop function is the CDI control unit (N3/9) (diesel engine) or ME-SFI [ME] control unit (N3/10) (gasoline engine) which records and evaluates all influencing factors. When the vehicle is stationary, the ECO start/stop function automatically switches off the engine and, on vehicles with a conventional drive concept (except model 213.016/050/053/153/216), switches it on again as soon as the driver wants to drive off.

On vehicles with hybrid drive (model 213.016/050/053/153/216), the vehicle drives off using electric power only, depending on the charge level of the high-voltage battery (A100g1). If the charge level of the high-voltage battery is less than 30 %, the ME-SFI [ME] control unit starts the engine.

i It is still possible to stop and start the engine in the conventional way.

Additional function requirement for engine stop

- Stop enable issued by the CDI control unit or the ME-SFI [ME] control unit

Engine stop

As the master control unit for the ECO start/stop function, the CDI control unit or the ME-SFI [ME] control unit checks the various influencing factors for the 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 front SAM control unit reads in the data of the battery sensor (B95) (except code U98 (LITHIUM-ION STARTER BATTERY (LISB))) or the data of the control electronics in the on-board electrical system battery (with code U98 (LITHIUM-ION STARTER BATTERY (LISB))) over the battery sensor-LIN (LIN B15) and evaluates it. The front SAM control unit then sends information that describes the condition of the on-board electrical system or the requests to the on-board electrical system, over the interior CAN (CAN B), electronic ignition lock control unit (N73), chassis FlexRay (Flex E), powertrain control unit (N127) and the drive train CAN (CAN C1) to the CDI control unit or the ME-SFI [ME] control unit.

The following information is included in it:

- State of on-board electrical system battery

Engine start

The following events lead to an engine start:

- The clutch pedal is operated (transmission 716).
- The brake pedal is released (if HOLD function is not active and transmission is in position D or N (transmission 725)).
- The accelerator pedal is operated (transmission 725).
- The transmission mode is changed (transmission 725).
- Reverse gear "R" is engaged (transmission 725).

Vehicles with hybrid drive (model 213.016/050/053/153/216):

By using the ECO start/stop function auxiliary battery (G1/13), the voltage drop 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 is isolated from the on-board electrical system (at engine start). Active comfort functions are not switched off. The additional battery for the ECO start/stop function is activated by actuation of the ECO start/stop function additional battery relay (K114). The on-board electrical system battery is decoupled from the on-board electrical system by actuating the ECO start/stop function diode (V19) at the positive terminal on the on-board electrical system battery. The front SAM control unit (N10/6) also checks the function of the components involved in disconnecting the on-board electrical system battery and switching on the ECO start/stop function additional battery.

Vehicles with conventional drive concept (except model 213.016/050/053/153/216):

By using the voltage dip limiter (R62) (series resistor) at the positive terminal of the on-board electrical system battery, the perceivable voltage drop for the vehicle occupants when starting the engine (e.g. during operation of the radio or ventilation mode) is reduced. The voltage dip limiter reacts to the drop in voltage when the engine is started.

i The voltage dip limiter is an electronically switchable series resistor for reducing the high power consumption of the starter (M1) when the engine is started, and is connected via circuit 87 to the starter relay of circuit 50 (K40/8kH). When starting the engine, the voltage dip limiter is exposed to voltage. It thereby detects the starting procedure and switches in the series resistor. If the on-board electrical system voltage reduces too much due to the high power consumption of the starter, the voltage dip limiter switches the series resistor out again.

The ECO start/stop function encompasses the following subfunctions:

- **Engine stop**
- **Engine start**
- **Forced engine start**
- **Determine condition of ECO start/stop function auxiliary battery (model 213.016/050/053/153/216)**
- **Charge ECO start/stop function auxiliary battery (model 213.016/050/053/153/216)**

- State of ECO start/stop function auxiliary battery (model 213.016/050/053/153/216)
- Status of on-board electrical system (load requirements)

The CDI control unit or the ME-SFI [ME] control unit evaluates all the relevant data, issues the stop enable and switches the engine off. The CDI control unit or the ME-SFI [ME] control unit then sends the "Drive train operational" signal over the drive train CAN, powertrain control unit, chassis FlexRay, electronic ignition lock control unit and the interior CAN to the front SAM control unit. This prevents the energy management system from reducing or switching off consumers if the "Engine running" signal is not sent.

i If the air conditioning system automatic mode is active, the blower setting is reduced. In high ambient temperatures the system changes into air circulation mode depending on the specified temperature adjusted.

i Model 213.016/050/053/153/216

The engine can also be stopped as part of system optimization. The kinetic energy can then, for example, be converted into electrical energy (regenerative braking).

After the engine has been switched off, a maximum of three engine starts within one minute (maximum idle time 3 min) without exceeding the speed threshold of 8 km/h are permitted.

- The windshield is fogged (A/C system switched on).

Vehicles with hybrid drive (model 213.016/050/053/153/216):

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 prevent any voltage drop being noticed by vehicle occupants when starting the engine (e.g. during radio or ventilation operation).

- The transmission is shifted out of position "P" (transmission 725).
- The vehicle moves off.
- The temperature in the vehicle interior leaves the selected range.

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 the hot start signal over a direct line and actuates the ECO start/stop function additional battery relay and the ECO start/stop function diode.

The additional battery for the ECO start/stop function is then switched through to the on-board electrical system. The ECO start/stop function diode disconnects the on-board electrical system battery from the on-board electrical system during the starting procedure. The energy requirement of the on-board electrical system is now solely provided by the ECO start/stop function auxiliary battery. 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 speed of 400 to 700 rpm, it stops the start procedure and sends the signal "Engine running" over the drive CAN, powertrain control unit, suspension FlexRay, electronic ignition lock control unit and the interior CAN to the front SAM control unit. The front SAM control unit then actuates the ECO start/stop function diode and the additional battery relay for the ECO start/stop function.

The ECO start/stop function diode then switches the on-board electrical system battery through 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.

Vehicles with conventional drive concept (except model 213.016/050/053/153/216):

By using the voltage dip limiter (series resistor) at the positive terminal of the on-board electrical system battery, the perceivable voltage drop for the vehicle occupants when starting the engine (e.g. during operation of the radio or ventilation mode) is reduced.

The CDI control unit or the ME-SFI control unit evaluates all relevant variables and starts the engine. As soon as the CDI control unit or the ME-SFI control unit detects an engine speed of 400 to 700 rpm, it terminates the starting procedure and sends the "engine running" signal via the drive train CAN, powertrain control unit, chassis FlexRay, electronic ignition lock control unit and interior CAN to the front SAM control unit.

Forced engine start

To ensure that the on-board electrical system stability is also given during engine OFF, the CDI control unit or 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.

The following events also lead to a forced engine start:

- Brake Assist or the distance control is active.
- The driver seat belt is released.
- Driver door is open.

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- The ECO start/stop function is switched off.

i Model 213.016/050/053/153/216

The engine can also be forced to start as part of system optimization. For example when the charge level of the high-voltage battery drops below a defined limit .

As soon as the energy management system is no longer able to ensure the stability of the on-board electrical system or one of the above-mentioned events occurs, the front SAM control unit sends the "Start engine" request via the interior CAN, electronic ignition lock control unit, chassis FlexRay, powertrain control unit and drive train CAN to the CDI control unit or to the ME-SFI control unit. The CDI control unit or the ME-SFI [ME] control unit then 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 ECO start/stop function is switched off.

Except model 213.016/050/053/153/216


The front SAM control unit uses the data from the battery sensor or the data from the control electronics in the on-board electrical system battery to calculate the required alternator voltage and sends this via the interior CAN, electronic ignition lock control unit, chassis FlexRay, powertrain control unit, and drive train CAN to the CDI control unit or to the ME-SFI control unit. This makes the CDI control unit or the ME-SFI [ME] control unit start the alternator regulation (alternator management). For this purpose, the CDI control unit or the ME-SFI control unit evaluates the operating rate of the alternator (G2) and requests the corresponding specified voltage. The alternator and the CDI control unit or the ME-SFI [ME] control unit communicate with each other via the drive train LIN (LIN C1). The CDI control unit or the ME-SFI [ME] control unit also sends information on the alternator operating rate over the drive train CAN, powertrain control unit, chassis FlexRay, electronic ignition lock control unit and the interior CAN to the front SAM control unit.

Determine condition of ECO start/stop function auxiliary battery (model 213.016/050/053/153/216)

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- Additional battery for ECO start/stop function deep discharged

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 in an active ECO start/stop function is tested after every engine start.

 The battery state recognition can be started using a diagnosis tester.

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

Charge ECO start/stop function auxiliary battery (model 213.016/050/053/153/216)

The charging strategy of the ECO start/stop function auxiliary battery must take into account two criteria:

- The ECO start/stop function auxiliary battery must always be sufficiently charged.

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

A corresponding fault message is indicated in the instrument cluster (A1). The front SAM control unit sends the data required for this over the interior CAN, electronic ignition lock control unit and user interface CAN (CAN HMI) to the instrument cluster.

- 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.

If the voltage drop at engine start is too large ($U < 11\text{ V}$), an engine stop is not permitted for one minute so as to allow recharging of the ECO start/stop function auxiliary battery. The ECO start/stop function auxiliary battery is only switched in when the on-board electrical system voltage is high enough ($U > 13\text{ V}$). It is disconnected again when the alternator management is active or the on-board electrical system is severely overloaded.

	Electrical function schematic for energy management, ECO start/stop function		PE54.10-P-2075-97DBA
	Overview of energy management system components		GF54.10-P-9990FG