

**Document title** Energy management for engine start/stop function

**Document number** gf5410p1040fl

**MODEL 212.0 /2 28.2.13 with CODE (B03) ECO start/stop function fuse box**

**i** The "energy management for engine start/stop function" subfunction is viewed from an energy management point-of-view. Information on the "engine timing Start-Stop function" subfunction is documented in the "Common-Rail Diesel Injection (CDI) function" description (with diesel engine) or "gasoline injection and ignition system with direct-injection function" (with gasoline engine).

**Function requirements, general**

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

Switching of the engine during standstill periods of the vehicle reduces the fuel consumption and therefore the carbon dioxide emissions.

The master control unit for the engine start/stop function is the CDI control unit (N3/9) (with diesel engine) or the ME-SFI [ME] control unit (N3/10) (with gasoline engine) that records and evaluates all influencing factors.

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

Through the use of the additional battery for ECO start/stop function (G1/13) with a capacity of 12 Ah the starting voltage dip is avoided while the engine is being started.

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 engine start/stop function encompasses the following subfunctions:

- **Function sequence for engine stop**
- **Function sequence for engine start**
- **Function sequence for a 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 the CDI control unit or the ME-SFI [ME] control unit

**Function sequence for engine stop**

As the master control unit for the engine start/stop function, the CDI control unit or the ME-SFI [ME] control unit checks the various influencing factors for the stop enable.

**i** The blower output is reduced when the automatic blower system of the A/C 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**

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.

- System diagnosis completed
- Outside temperature  $T = -10$  up to  $40$  °C (except model 212.095/098/298)  
Outside temperature  $T = -40$  up to  $60$  °C (model 212.095/098/298)
- Battery temperature  $T = 0$  up to  $60$  °C (except model 212.095/098/298)  
Battery temperature  $T = -40$  up to  $60$  °C (model 212.095/098/298)
- A/C regulated

**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.

Immediately after the cold start of the engine the CDI control unit or the ME-SFI [ME] control unit runs a system diagnosis [SD] and evaluates the functional capability of the start/stop function. In addition the front SAM control unit with fuse and relay module (N10/1) checks the function of all affected components for isolating the on-board electrical system battery and connecting the additional battery for ECO start/stop function.

**i** The additional battery for ECO start/stop function is actuated by the additional battery relay for ECO start/stop function (K114). For vehicles with manual transmission, this is designed as a mechanical relay and for vehicles with automatic transmission as an electronic relay.

The on-board electrical system battery is decoupled from the on-board electrical system on vehicles with manual transmission through the on-board electrical system decoupling relay (K19/7) and for vehicles with automatic transmission by the ECO start/stop function diode (V19).

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

The following on-board electrical system 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 CDI control unit or the ME-SFI [ME] control unit evaluates all the relevant data and then issues the stop enable. The engine is switched off as a result of this.

The front SAM control unit reads in this hot start signal over a direct line and actuates the on-board electrical system decoupling relay (manual transmission) or the ECO start/stop function diode (A/T) in the front prefuse box (F32) and the ECO start/stop function additional battery relay on the additional battery for the ECO start/stop function.

The additional battery for the ECO start/stop function is then switched through to the on-board electrical system. Shortly after this the on-board electrical system decoupling relay (manual transmission) or the ECO start/stop function diode (automatic transmission) disconnects the on-board electrical system battery from the on-board electrical system during the start procedure.

The energy requirement of the on-board electrical system is now

This serves to prevent any voltage dip as perceived by vehicle occupants when starting the engine (e.g. during radio or ventilation operation).

The CDI control unit or the ME-SFI [ME] control unit evaluates all relevant influencing factors and then issues the start enable (hot start signal).

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 [ME] control unit or CDI control unit detects an engine rpm of  $n = 400$  to 700 rpm, it stops the starting process and transmits a corresponding signal to the front SAM control unit.

As a result of this the front SAM control unit actuates the decoupling relay for on-board electrical system (manual transmission) or the diode for the ECO start/stop function (A/T) and the additional battery relay for ECO start/stop function. The decoupling relay for on-board electrical system (manual transmission) or the diode for ECO start/stop function (A/T) 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 a 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.

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

- Supplemental restraint system
- PRE-SAFE
- Brake assist and adaptive cruise control systems
- Air conditioning
- Steering

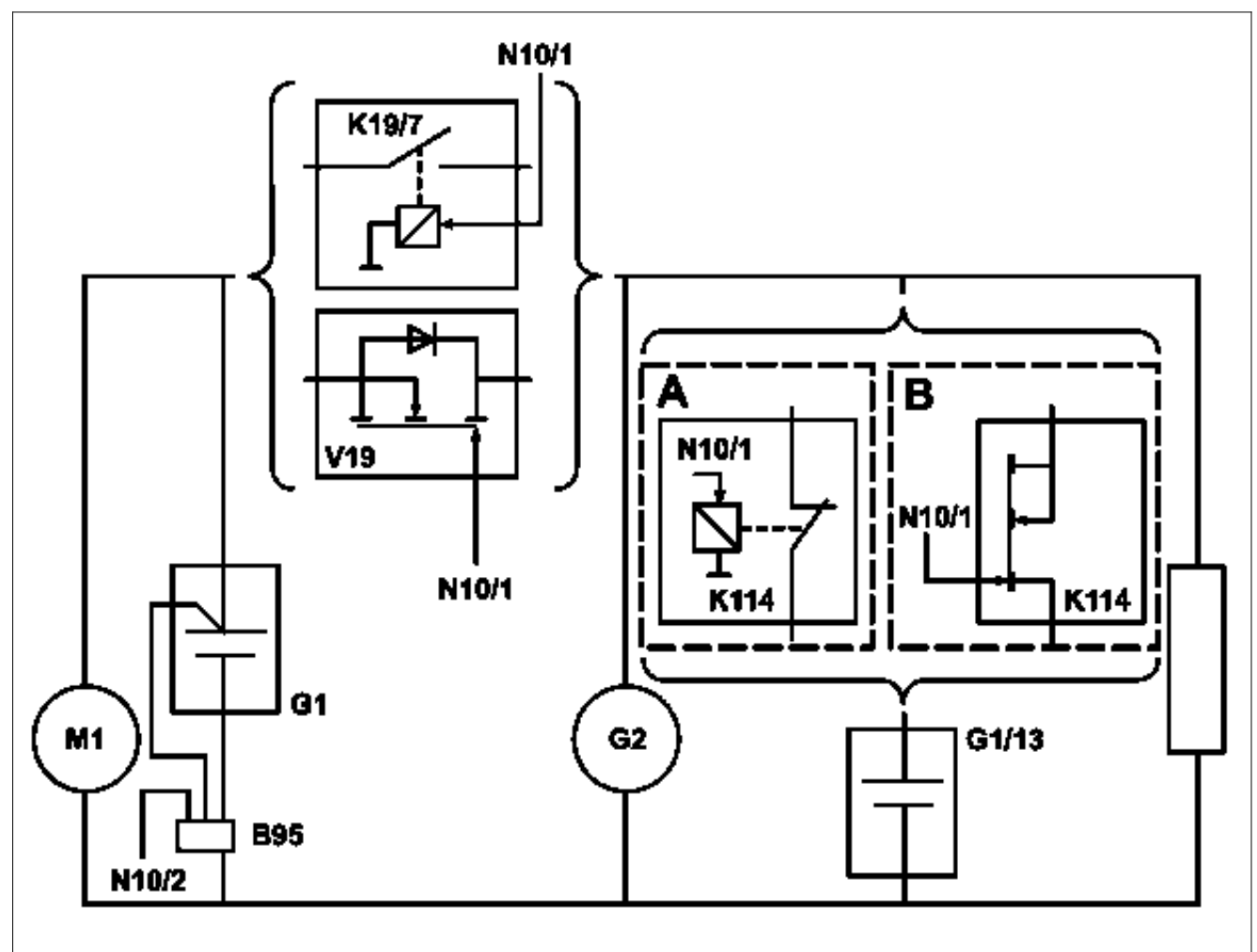
As soon as the on-board electrical system management is no longer able to ensure on-board electrical system stability, the rear SAM control unit sends an engine start request over the interior CAN (CAN B), front SAM control unit and the chassis CAN (CAN E) to the CDI control unit or the ME-SFI [ME] control unit. The CDI control unit or 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
- G1 On-board electrical system battery
- G2 Alternator (except model 212.095)
- G1/13 ECO start/stop function additional battery
- K19/7 Decoupling relay for on-board electrical system (with transmission 716.6) (relay open)
- K114 Additional battery relay for ECO start/stop function (relay closed)
- M1 Starter



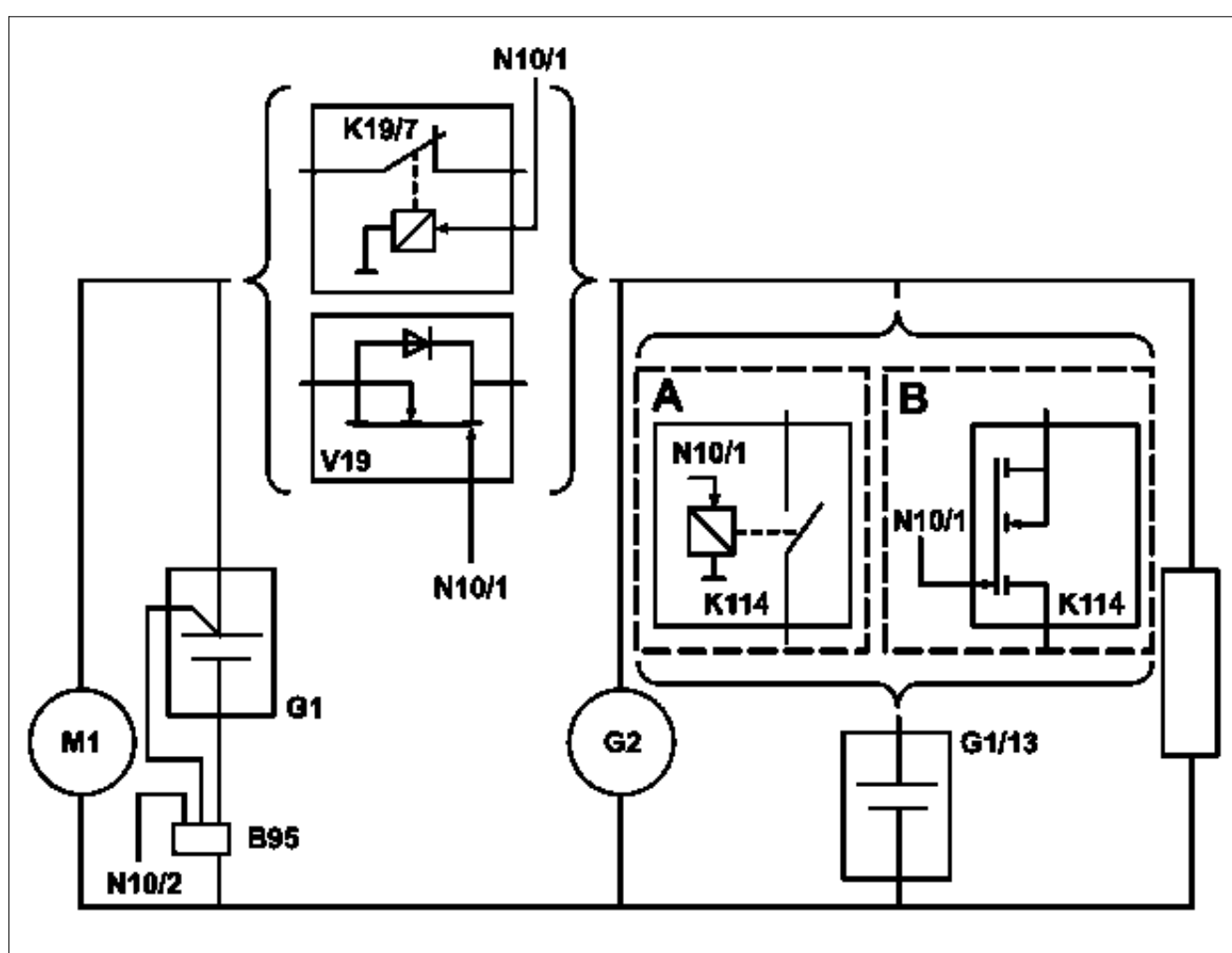
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- N10/1 Front SAM control unit with fuse and relay module
- N10/2 Rear SAM control unit with fuse and relay module
- V19 ECO start/stop function diode (with transmission 722) (diode open)

- A Mechanical relay with transmission 716.6
- B Electronic relay with transmission 722

**Illustration of power supply when engine running principle**

- B95 Battery sensor
- G1 On-board electrical system battery
- G2 Alternator (except model 212.095)
- G1/13 ECO start/stop function additional battery
- K19/7 Decoupling relay for on-board electrical system (with transmission 716.6) (relay closed)
- K114 Additional battery relay for ECO start/stop function (relay open)
- M1 Starter



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- N10/1 Front SAM control unit with fuse and relay module
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- V19 ECO start/stop function diode (with transmission 722) (diode closed)

- A Mechanical relay with transmission 716.6
- B Electronic relay with transmission 722

**Function sequence for determine condition of ECO start/stop function additional battery**

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**

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.

If the open circuit voltage ( $U > 12.5$  V) of the additional battery for ECO start/stop function is too low, the alternator's power limit (alternator management) (except model 212.095) is deactivated so that the additional battery for ECO start/stop function can be charged.

If the voltage dip ( $U < 11$  V) at engine start is too large, an engine stop is deactivated for  $t = 5$  min. (up to 31.5.12),  $t = 1$  min. (as of 1.6.12) 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 ( $U > 13$  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.

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