

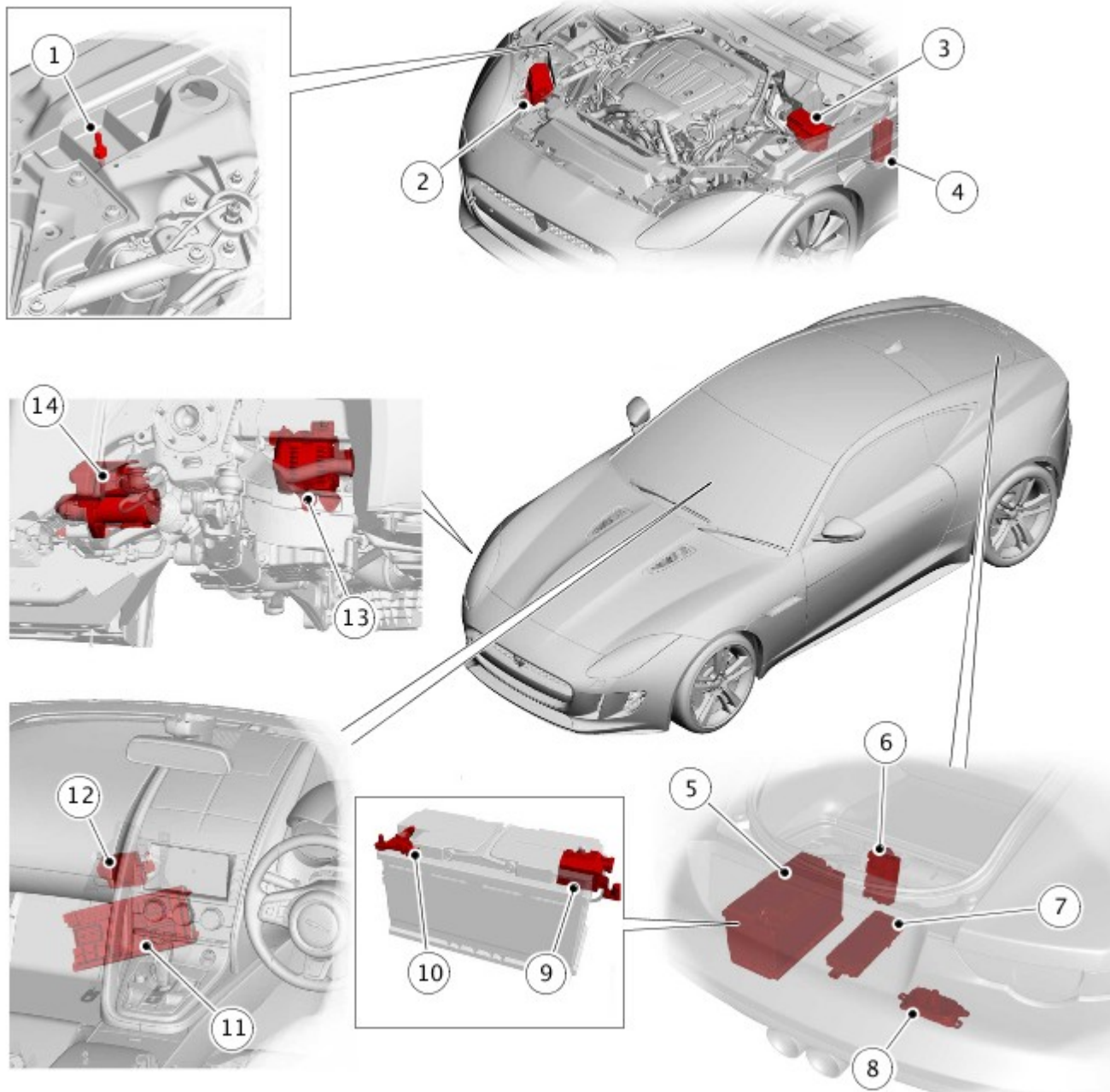
Battery, Mounting and Cables - Battery and Cables

Description and Operation

COMPONENT LOCATION



NOTE: Coupe vehicle installation shown, convertible vehicle installation is similar.



E174475

Item	Description
1	Jump start terminal - ground
2	Right Engine Junction Box (EJB)
3	Left Engine Junction Box (EJB)
4	Auxilliary Junction Box (AJB)
5	Battery
6	Quiescent Current Control Module (QCCM)
7	Battery Junction Box (BJB)
8	Voltage Quality Module (VQM) - where fitted
9	Transit relay

10	Battery Monitoring System (BMS) control module
11	Central Junction Box (CJB)
12	Gateway Module (GWM)
13	Generator
14	Starter motor

OVERVIEW

Vehicles without Stop/start system

The battery provides power to the BJB (Battery Junction Box). The BJB contains megafuses, delivering power to the AJB (Auxiliary Junction Box), the left and right EJB (Engine Junction Box) and the starter motor and generator. In addition to containing fuses and relays, the CJB (Central Junction Box) contain software to control a number of vehicle systems. These functions are covered in the appropriate sections of this manual.

A BMS (Battery Monitoring System) control module is mounted on the battery negative terminal and provides battery status information for the GWM (Gateway Module). The battery ground cable is connected to the BMS control module and is attached to a ground stud on the vehicle body.

The GWM contains the IPMS (Intelligent Power Management System) and the BMS software. Monitoring of the battery condition is controlled by the GWM.



CAUTION: To avoid damaging the BMS control module, always use the jump start terminal - ground (negative (-)) stud point on the right side top mount and the jump start terminal - positive (+) on the right EJB (Engine Junction Box). Never connect directly to the primary battery negative and positive terminals when connecting a slave power supply to the vehicle, the BMS control module can be damaged.

If a new battery is fitted to the vehicle, the BMS control module will require re-calibrating using a Jaguar approved diagnostic system.

When the vehicle leaves the factory, a transit relay is fitted to the battery positive terminal. The transit relay is connected to the CJB which limits the electrical functions to essential items only, to reduce loads on the battery. The transit relay must be removed from the vehicle during the PDI (Pre-Delivery Inspection).

For additional information, refer to: [Preliminary](#) (101-01 Pre-Delivery Inspection Manual, Description and Operation).

A jump start terminal is located below a hinged cover, adjacent to the right EJB. An additional cover with a lanyard protects the terminal when not in use. If jump starting is required, the cover must be removed and the positive (+) jump lead attached securely. The negative (-) jump lead is attached to a jump start terminal stud located on the right side top mount. The cover must be fitted to the positive terminal when not in use.

Power Modes

The CJB controls the power supplies for the various vehicle functions. There are 9 power modes available which are used by various systems to determine the operating condition of the vehicle.

Only five of these modes will be noticeable to the driver and technicians as follows:

- Power mode 0 - Ignition off
- Power mode 4 - Accessory
- Power mode 6 - Ignition
- Power mode 7 - Engine running
- Power mode 9 - Crank.

Vehicles with Stop/start system

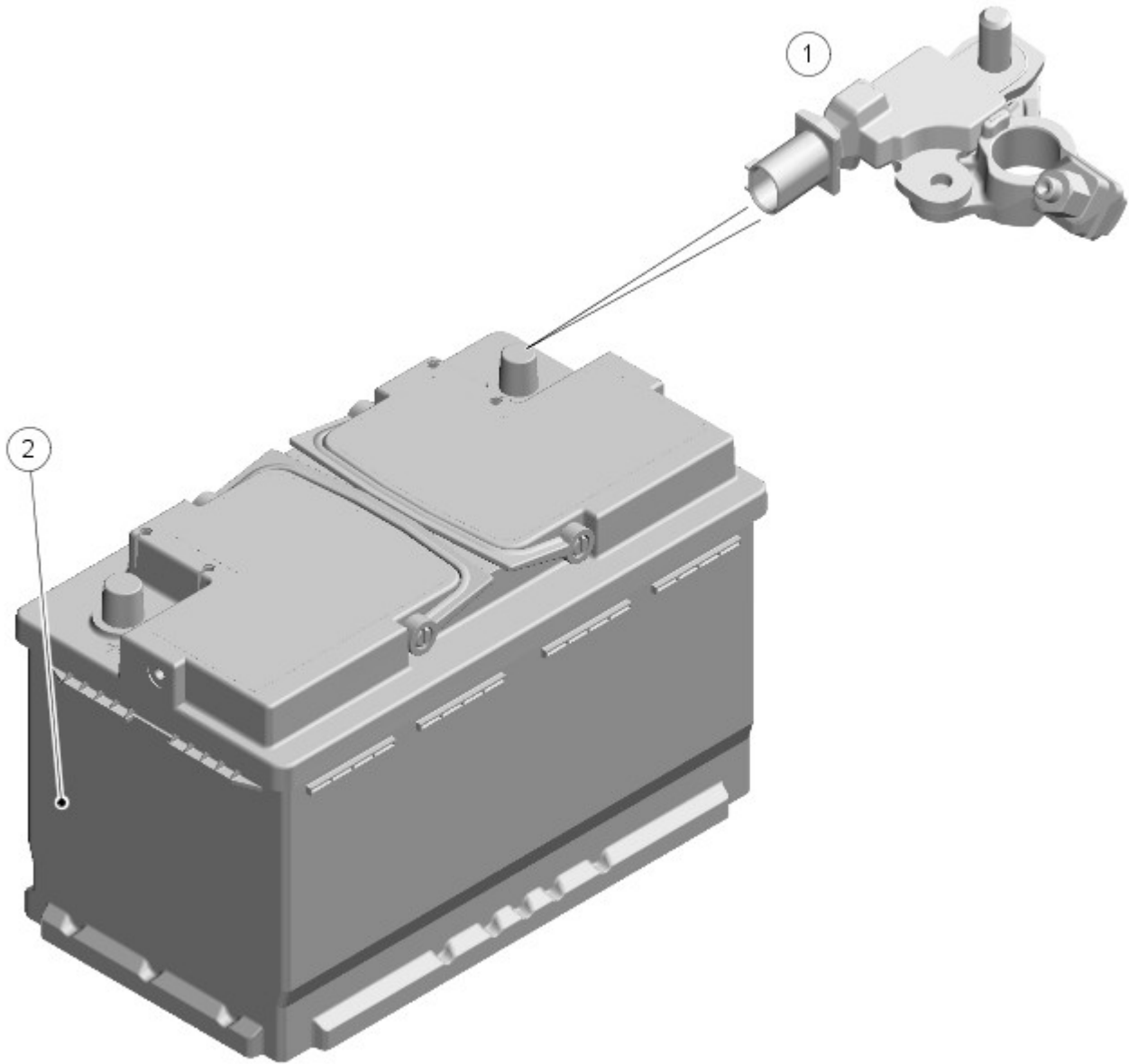
On vehicles equipped with Stop/start system, the VQM (Voltage Quality Module) is used to prevent the vehicle electrical systems being subjected to undesirably low voltages during repeated engine restarts. If the electrical systems are subject to low voltages the customer may notice degraded performance of components and systems and incorrect fault DTC (Diagnostic Trouble Code)s may be stored.

The VQM produces a constant output voltage to certain control modules during engine restart operation.

The GWM software will monitor the state of charge of the battery as well as other external parameters and will determine when a stop/start event can occur. It can also intervene to maintain vehicle systems by keeping the engine running or initiating a restart due to, for example, climate control system requirements or request for restart from the ECM. A brake pressure signal is received from the ECM which will indicate to the GWM that an engine restart is required from driver operation of the foot brake.

DESCRIPTION

BATTERY



E150009

Item	Description
1	Battery Monitoring System (BMS) control module
2	Absorption Glass Mat (AGM) battery

The battery is located in the luggage compartment floor in a metal tray and secured with a clamp.

On vehicles without Stop/start system, the battery is a 90Ahr, 800A CCA Flooded battery.

On vehicles with Stop/start system, the battery is a 90Ahr, 850A CCA AGM (Absorbent Glass Mat) VRLA (Valve Regulated Lead-Acid) battery.

A clamp secures the battery in position. The battery is vented via a tube which passes through a grommet in the luggage compartment back panel.

On new vehicles the battery positive terminal is fitted with a transit relay. The transit relay must be removed using the correct process detailed in the PDI manual.

The battery negative terminal is fitted with a BMS control module. The control module is integral with the battery negative cable and communicates with the GWM via a LIN (Local Interconnect Network) bus connection. The battery condition information is passed to the GWM which controls the generator output accordingly.

CAUTIONS:



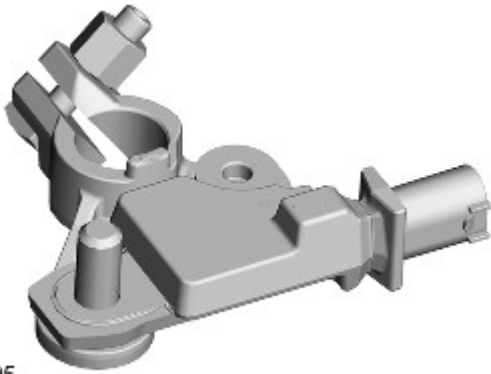
To avoid damage to the BMS control module, always use the body ground point in the engine compartment and not the battery negative terminal when connecting a slave power supply.



Failure to use the recommended ground point will lead to the setting of a DTC. Incorrect information of battery condition will be retained by the BMS control module due to the unmonitored current flow into the battery. The system will however, recognize and compensate for the change in battery status after a period of time.

If a new battery is fitted, the BMS control module will require re-calibration using a Jaguar approved diagnostic system. Replacement of the BMS control module requires no action as the control module will re-calibrate automatically.

BATTERY MONITORING SYSTEM (BMS)



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The BMS control module is located on the primary battery negative (-) terminal. The module is located on the battery post and is clamped to the post with a bolt and nut.

The primary battery negative ground cable is connected to the BMS control module and is attached to a ground stud on the vehicle body.

The BMS control module is connected into the vehicle wiring harness via a multiplug. The BMS control module receives a 12V power supply direct from the primary battery positive terminal. A LIN bus connection provides communication between the BMS control module, the GWM and the QCCM (Quiescent Current Control Module) for control and monitoring of the primary battery current drain and state of charge.

The BMS control module measures battery current and voltage, which it communicates to the GWM over a LIN bus connection. The GWM also receives generator output information on a LIN bus connection. Based on the information received from the BMS control module, the GWM will control the output from the generator and request the switching off of electrical loads if necessary.



CAUTION: Due to the self-calibration routine, it is recommended that all power supply diagnostic testing is carried out using the Jaguar approved diagnostic system rather than a digital multimeter.

The BMS control module is able to generate DTCs to help diagnose battery or generator power supply issues. These DTCs can be read using the Jaguar approved diagnostic system. The Jaguar approved diagnostic system can also be used to implement a battery and generator self-test routine.

For additional information, refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

If a fault is detected, the GWM will override the BMS control module.

The BMS control module DTCs can be used to help diagnose battery or generator power supply faults. The DTCs are stored in GWM. The Jaguar approved diagnostic system has a process for an automated power supply diagnostic procedure. The procedure provides a menu driven process to locate a fault in a logical sequence. The procedure uses the capability of the BMS control module and generator LIN bus controlled functions to provide current flow information and will detect if the BMS control module or generator are functioning correctly.

Battery Monitoring System (BMS) Low Battery Warning and Energy Management Messages

The BMS continuously monitors the condition of the battery. If excessive battery discharge occurs, the system will begin to shut down non-essential electrical systems in order to protect the battery.

If the BMS calculates that battery condition is not within set parameters, there are 3 messages that can be displayed; two on the TS (Touch Screen) and one on the IC (Instrument Cluster) message center. These inform the user that the primary battery is either at a low level of charge or the engine-off power consumption limit has been exceeded.

Low Battery - Please switch engine on or system will shutdown in 3 minutes

This message will be displayed as a warning on the TS if the engine is not running. This indicates that the battery charge has fallen below a predefined threshold. As soon as the battery is charged above this threshold, the message will be removed.

Low Battery - Please start your engine

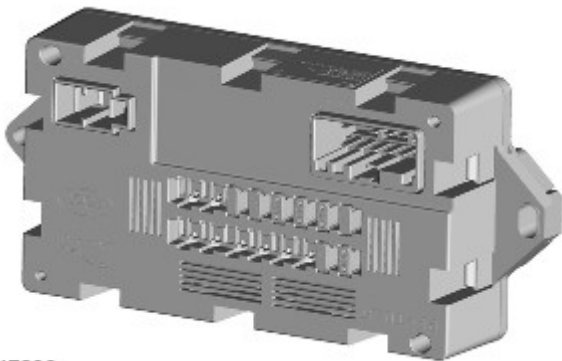
This message will be displayed on the IC message center if the engine is not running. This indicates that the battery charge has fallen below a predefined threshold. As soon as the battery is charged above this threshold, the message will be removed or it can be manually removed by pressing the 'OK' switch on the steering wheel switchpack.

System will shut down in 3 minutes

This message will be displayed as an energy management message on the TS if the engine is not running, and system features are causing excessive battery discharge. After 3 minutes the GWM will begin shutting down vehicle systems. Normal system operation will resume when the engine is started.

These messages are based on a percentage of the battery capacity available for the customer to use the vehicle systems with the engine off. The percentage can change based upon several factors. Once activated, the resetting of these messages will not occur until the vehicle is driven for 10 minutes with the engine running (to allow the battery to replace any lost charge). However, if the engine is run for less than 10 minutes, the messages will only be displayed after an additional 5 minutes with the ignition is switched on but the engine is not running.

QUIESCENT CURRENT CONTROL MODULE (QCCM)



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The QCCM is located adjacent to the BJB (Battery Junction Box) in the luggage compartment and attached to a bracket with two nuts.

An addition to the BMS, and using the battery condition messages transmitted by the BMS control module and the GWM via a LIN bus connection, the QCCM cuts the power supply to other non-essential control modules to avoid excessive discharge of the battery. The systems supplied via the QCCM are the audio/entertainment systems and the climate control systems. The QCCM contains a number of fuses which supply and protect the audio/entertainment systems, and the climate systems.

Some control modules can cause unnecessary battery drain due to the module staying awake after the vehicle electrical system has been shut down. The QCCM, in conjunction with the GWM, monitor and control the systems to prevent battery drain.

The system consists of three components:

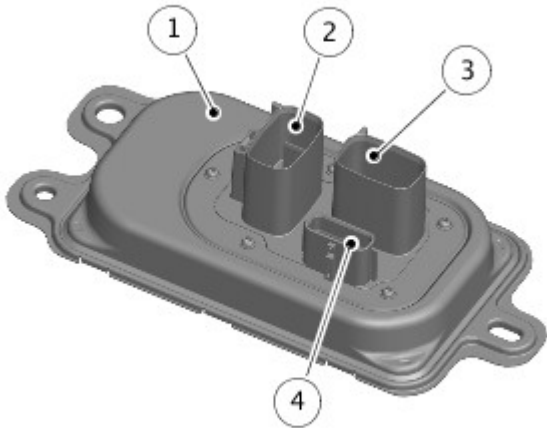
- The BMS control module
- The GWM
- The QCCM.

The BMS checks the battery health by analyzing battery quiescent current, battery current drain or state of charge, and determines if any action is required to protect the battery. If action is required this is communicated to the GWM. The GWM control logic uses this information to determine if action is required to assist the battery protection. The QCCM control software is contained within the GWM. The QCCM receives open and close command messages from the GWM via the LIN bus and reacts accordingly.

The system will be set in 'Transit mode' on delivery. 'Transit mode' has no QCCM operation and the relays remain closed. Therefore battery drain could occur and the system will not react to it. The PDI process requires that the system have to be set from 'Transit mode' to 'Normal mode', which enables the QCCM operation before handing over the vehicle to the customer.

The QCCM has a routine to clean the relay contacts if required. This routine is performed using the Jaguar approved diagnostic system and, if unsuccessful, the unit will require replacement.

VOLTAGE QUALITY MODULE (VQM)



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Item	Description
1	Voltage Quality Module (VQM)
2	Power connector
3	Ground connector
4	Signal connector

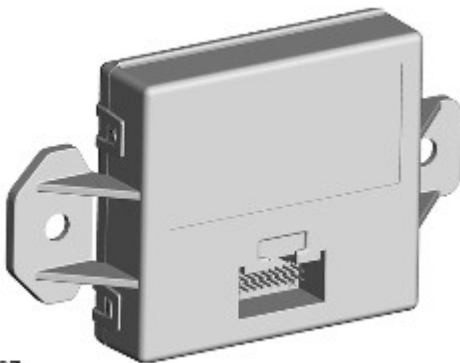
A VQM is fitted on stop/start system equipped vehicles only. The VQM is located adjacent to the BJB in the luggage compartment and attached to a bracket with three bolts. The VQM consists of a DC - DC (Direct Current) converter and an interface which controls its operation and provides the communication with other vehicle systems. The DC-DC converter can produce a constant 12V output voltage to crucial vehicle systems from the varying input voltage supplied by the battery during an engine restart.

The VQM supplies a constant voltage during an engine restart for the following:

- GWM (Gateway Module)
- IC (Instrument Cluster)
- QCCM (Quiescent Current Control Module)
- Infotainment system components
- RVM (Rear View Mirror) (where fitted)
- PACM (Parking Aid Control Module) (where fitted)
- RVC (Rear View Camera) (where fitted)
- BMCM (Blindspot Monitoring Control Module) left and right (where fitted)

The VQM has two power connectors which provide a battery feed connection from the BJB via a 60A fuse, and a power output connection to the QCCM and the AJB. An additional connector is located on the VQM to provide electrical connection to other modules and ground. The VQM receives an ignition signal from the ignition relay located in the CJB, and a crank signal from the starter motor relay located in the left EJB. The VQM sends status and diagnostic messages to the GWM via a LIN bus connection.

Gateway Module (GWM)



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The GWM is located behind the instrument panel adjacent to the CJB and attached to a bracket with two nuts which is secured to the bulkhead panel on the passenger compartment side.

The GWM communicates with other system modules on the HS (High Speed) CAN (Controller Area Network) powertrain and chassis system buses and MS (Medium Speed) body and comfort system buses, and provides the communication between the control modules on different CAN bus. The GWM also has a LIN bus connection which provides communication with the generator, the BMS control module, the QCCM and the VQM on vehicles with Stop/start system.

The GWM contains software to control the following functions:

- Determine the condition of the battery
- Control the output from the generator via the voltage regulator using load management software
- Control the charge warning indicator on the IC
- Control the QCCM to enable or disable electrical loads if necessary
- Controls ECO stop/start using power management to inhibit unnecessary electrical loads.

OPERATION

BATTERY MONITORING SYSTEM AND QUIESCENT CURRENT CONTROL - Vehicles Without Stop/start System

When the ignition is switched off, the BMS control module records the battery state of charge and begins to monitor the battery condition from this point.

If the battery state of charge falls by 7%, the BMS control module will start to monitor the battery for 5 minutes and sends a 'Warning' message on the LIN bus to the GWM. If the battery charge has continued to fall below 50% due to the high quiescent drain current after the 5 minute monitoring period, the BMS control module will determine that some control modules are still 'awake'. The BMS control module sends a 'Shutdown' message on the LIN bus to the GWM. The GWM then transmits a 'Shutdown' message on both MS and HS CAN buses to all control modules, requesting them to shutdown.

The BMS control module will monitor the battery state of charge for a further 15 minutes and determine if the battery state of charge is still dropping due to the quiescent drain current. The BMS control module sends a 'Power Disconnect' signal to the GWM on the LIN bus. The GWM then sends a signal to the QCCM via the LIN bus to open its internal relays. When the QCCM relays are open, the power supply from the battery to non-critical control modules is removed. The non-critical control modules are any modules associated with the infotainment system and also the climate control system.

The use of the LIN bus communication ensures that no other control modules are 'woken' during this process. If CAN bus communication was used, all modules on the CAN bus would be woken by the message.

BMS Control Module Self Calibration

The BMS control module periodically initiates a self-calibration routine. To self-calibrate, the battery monitoring system first charges the battery to its full condition.



NOTE: If the vehicle is only driven for short periods the charging process could take a number of days to complete.

Once the battery is fully charged, the BMS control module will discharge the battery to approximately 75% of its full state of charge, but never lower than 12.2 V. The time taken to complete this part of the routine is dependent on the electrical load on the vehicle.

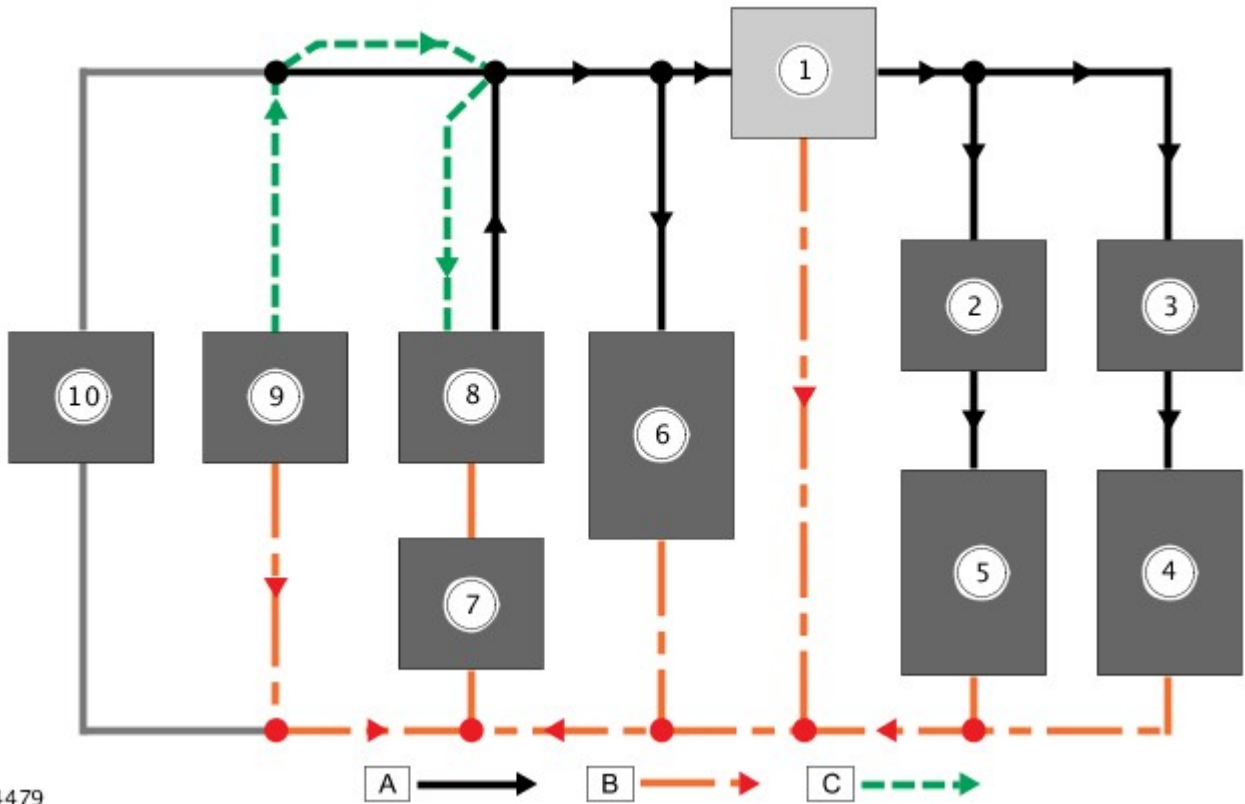
When the second part of the routine has been successfully completed, the BMS control module will return the battery to its optimum level of charge. The optimum level of charge will be between 12.6 V and 15 V, depending on battery condition, temperature and loading.

The BMS control module also monitors the battery condition with the engine switched off. If a low voltage condition is detected, the BMS control module can request the infotainment system is switched off to protect battery voltage.

VOLTAGE QUALITY MODULE (VQM) - Vehicles With Stop/start System

The VQM is a DC-DC converter and produce a constant 12V output voltage from a varying (and lower) input voltage. During a warm engine restart, significant low voltage transients occur in the vehicle electrical systems, and customer noticeable loads require the voltage to be boosted by the VQM.

VQM Bypass Mode



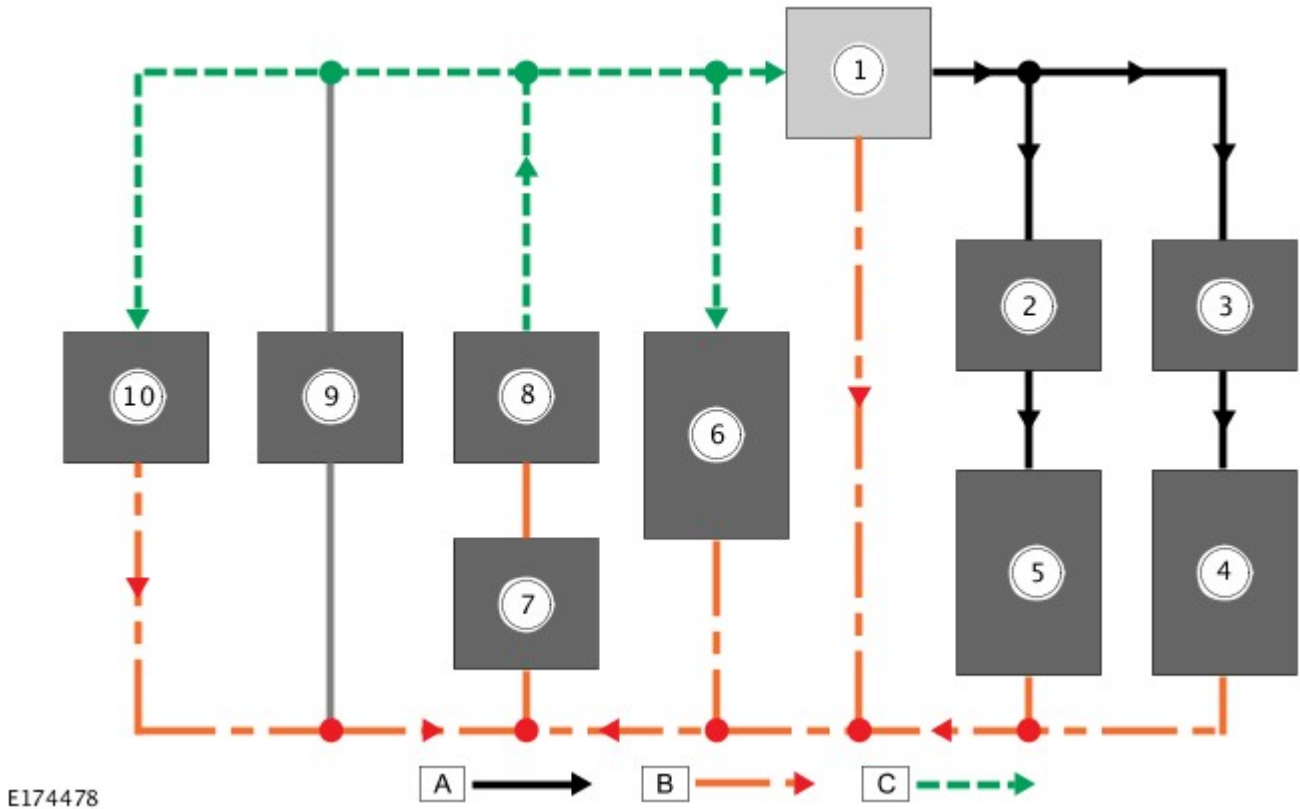
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A = Battery voltage; B = Ground; C = Battery charging voltage.

Item	Description
1	Voltage Quality Module (VQM)
2	Auxiliary Junction Box (AJB)
3	Quiescent Current Control Module (QCCM)
4	Voltage sensitive loads 1
5	Voltage sensitive loads 2
6	Electric loads
7	Battery Monitoring System (BMS) control module
8	Battery
9	Generator
10	Starter motor

Bypass mode is the VQM's normal operating mode. In this mode the power from the battery to the voltage sensitive loads passes through on the VQM without any intervention. The VQM can support 600W of continuous power in Bypass mode.

VQM Boost Mode



E174478

A = Constant output voltage; B = Ground; C = Fluctuating battery voltage.

Item	Description
1	Voltage Quality Module (VQM)
2	Auxiliary Junction Box (AJB)
3	Quiescent Current Control Module (QCCM)
4	Voltage sensitive loads 1
5	Voltage sensitive loads 2
6	Electric loads
7	Battery Monitoring System (BMS) control module
8	Battery
9	Generator
10	Starter motor

During a warm engine restart a hardwired connection from the starter motor relay provides the crank signal to the VQM. At this point the VQM switches into Boost mode, and activates the DC-DC converter. The DC-DC converter maintains a constant output voltage between 11V and 14V (depending on the input voltage) to the voltage sensitive loads for 5 seconds. The VQM can support 450W of continuous power in Boost mode. After the engine has restarted, and the voltage at the battery terminal will ramp up, the VQM returns to Bypass mode.

Boost mode is inhibited at ambient temperatures below 0°C, when Stop/start function is disabled.

Electrical Load Management

The electrical load management is hosted in the GWM using IPMS functionality and is based on BMS control module inputs. The GWM will monitor the vehicle system power loads before and during an ECO engine stop.

Before an ECO engine stop, the GWM will transmit a signal to the system control modules on all CAN buses to request a power save on all electrical loads and set a minimum electrical value override. The GWM monitors the vehicle electrical loads and will inhibit an ECO engine stop until the load current is at a value low enough to be supported by the battery. If the electrical loads cannot be reduced sufficiently, the GWM will inhibit the ECO engine stop.

When the engine is stopped after an ECO engine stop, the GWM will continue to monitor the battery state of charge. If battery voltage falls below 11.0V, a level which will result in degraded starting performance or possible battery damage, the GWM will initiate an engine start.

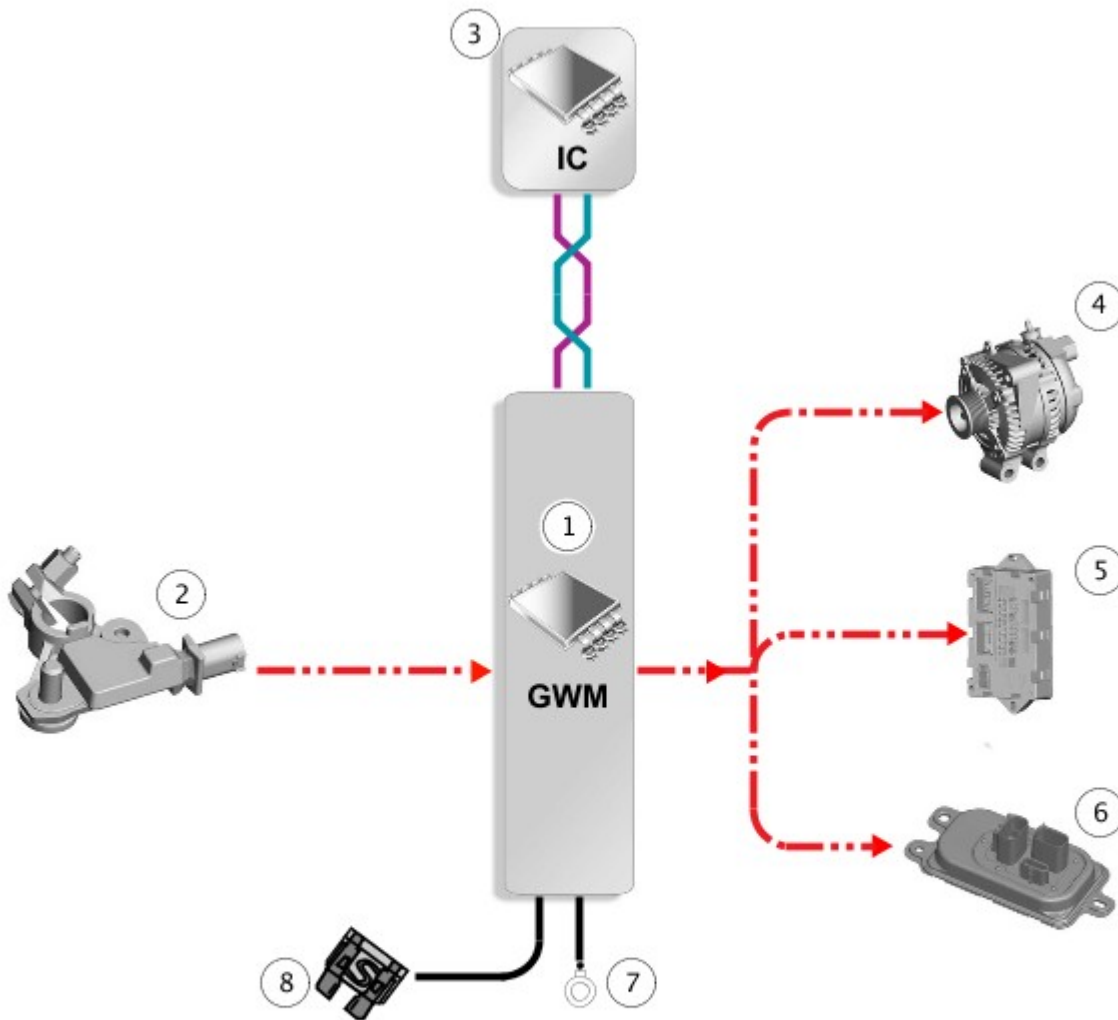
System Inhibits

The ECO stop/start system is inhibited if the battery system is not be capable of preventing electrical loads on the vehicle being subject to unacceptably low voltage levels during ECO stop/start operations due to a fault.

ECO stop/start inhibit monitoring of the battery is performed by the BMS control module. If the battery voltage is too low to support an ECO stop/start, then the BMS control module will send a message to the GWM on the LIN bus to suspend ECO stop/start.

The GWM monitors the battery and the VQM. Any fault found will cause the GWM to inhibit ECO stop/start and the GWM will record a DTC.

INPUT/OUTPUT DIAGRAM - SHEET 1 OF 2 - BATTERY SYSTEM



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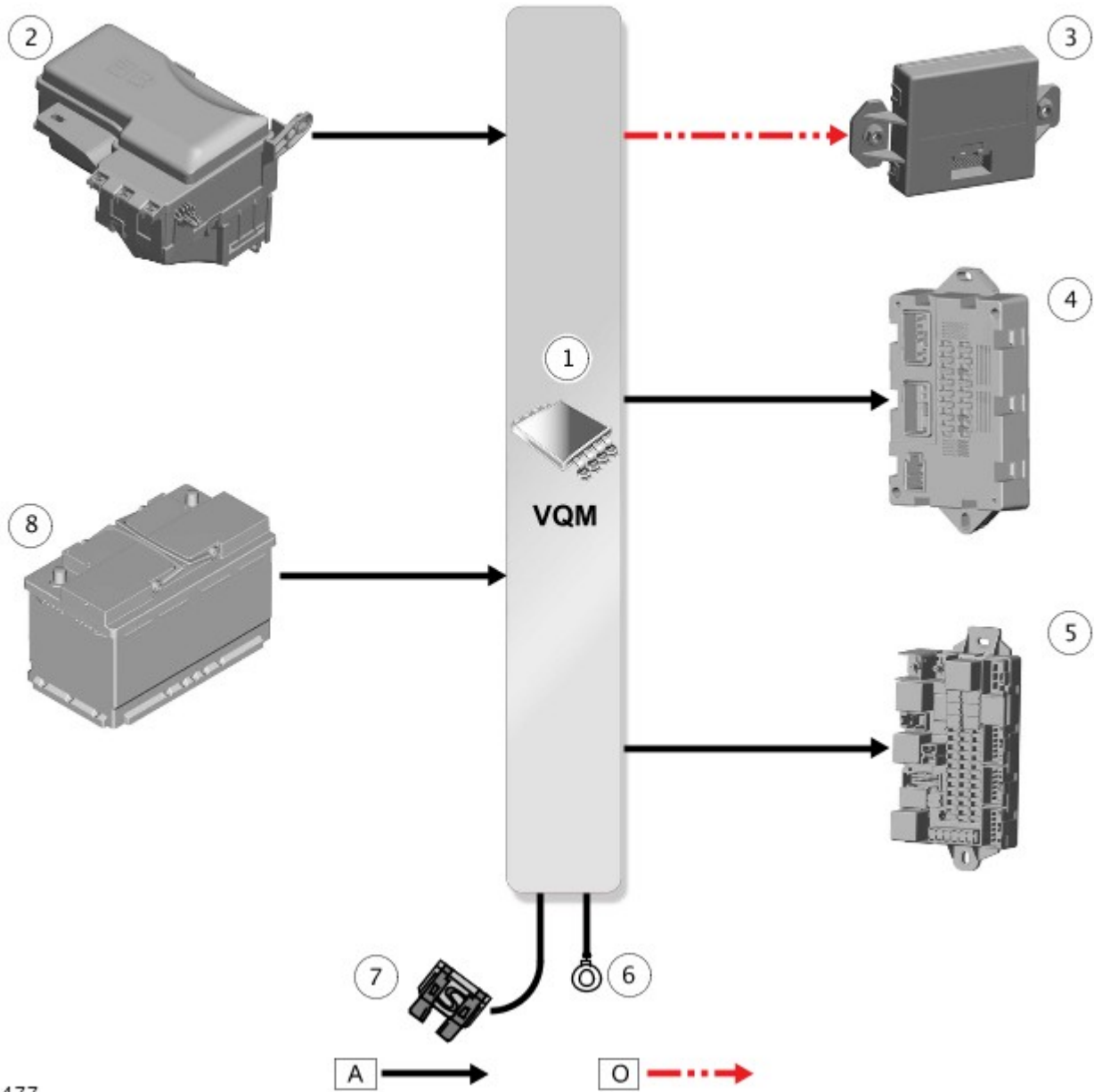


A = Hardwired; O = LIN (Local Interconnect Network) bus; AP = MS (Medium Speed) CAN (Controller Area Network) comfort systems bus.

Item	Description
1	Gateway Module (GWM)
2	Battery Monitoring System (BMS) control module
3	Instrument Cluster (IC)
4	Generator
5	Quiescent Current Control Module (QCCM)
6	Voltage Quality Module (VQM) - where fitted

7	Ground
8	Power supply - Central Junction Box (CJB)

INPUT/OUTPUT DIAGRAM - SHEET 2 OF 2 - VOLTAGE QUALITY MODULE (VQM)



E174477

A = Hardwired; O = LIN (Local Interconnect Network) bus.

Item	Description
1	Voltage Quality Module (VQM)
2	Crank signal - Left Engine Junction Box (EJB)
3	Gateway Module (GWM)
4	Quiescent Current Control Module (QCCM)
5	Auxiliary Junction Box (AJB)
6	Ground
8	Power supply - Central Junction Box (CJB)
8	Battery