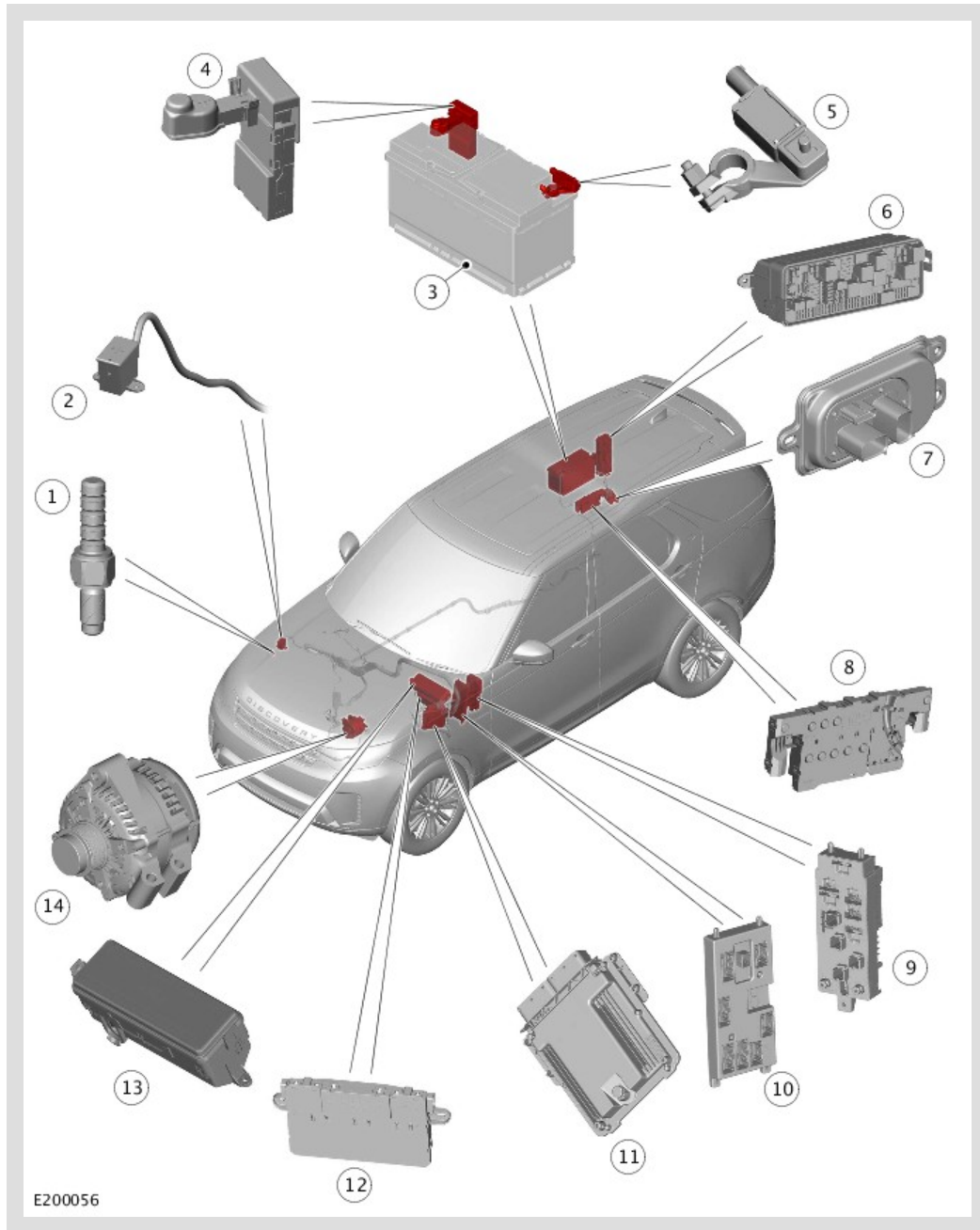


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BATTERY, MOUNTING AND CABLES

DESCRIPTION AND OPERATION

COMPONENT LOCATION



ITEM	DESCRIPTION
1	Jump start terminal - Ground
2	Jump start terminal - Positive
3	Primary battery
4	Megafuse
5	Battery Monitoring System (BMS) control module
6	Rear Junction Box (RJB)

7	Voltage Quality Module (VQM) - Stop/start system only
8	Battery Junction Box (BJB)
9	Passenger Junction Box (PJB)
10	Body Control Module/Gateway Module (BCM/GWM) assembly
11	Powertrain Control Module (PCM)
12	Auxiliary Junction Box (AJB)
13	Engine Junction Box (EJB)
14	Generator

OVERVIEW

The primary battery provides power to the Battery Junction Box (BJB) which delivering power to the:

- Passenger Junction Box (PJB)
- Rear Junction Box (RJB)
- Auxiliary Junction Box (AJB)
- Voltage Quality Module (VQM)
- Jump start terminal - Positive
- Starter motor and generator.

The junction boxes contain fusible links, fuses, and relays to distribute electrical power to various vehicle systems.

The Battery Monitoring System (BMS) control module is mounted on the primary battery negative terminal. The BMS control module is integral with the primary battery negative cable and is controlled by the Body Control Module/Gateway Module (BCM /GWM) assembly.

CAUTION:

When connecting a slave power supply to the vehicle, always use the ground terminal stud point on the right side top mount in the engine compartment. Never connect directly to the primary battery negative terminal, because the Battery Monitoring System (BMS) control module can be damaged.

The BCM/GWM assembly is the main controller of the vehicle body systems. The BCM /GWM assembly contains most of the software required to control the primary battery charging system and components. The BCM/GWM assembly monitors the components and can store fault related Diagnostic Trouble Codes (DTCs).

The Voltage Quality Module (VQM) is used to prevent the vehicle electrical systems being subjected to undesirably low voltages. The VQM produces a constant output voltage during engine restart operation. If the electrical systems are subject to low voltages the driver may notice degraded performance of components and systems. In this case incorrect fault DTCs may be stored.

Two jump start terminals are located adjacent to the right side top mount in the engine compartment. A cover protects the positive terminal when not in use. If jump starting is required, the cover must be removed and the positive jump lead attached securely. The cover must be equipped to the positive terminal when not in use. The negative jump lead is attached to a stud located on the right side top mount.

POWER MODES

The Body Control Module/Gateway Module (BCM/GWM) assembly controls the power supplies for the various vehicle functions. There are nine power modes available 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 on
- Power mode 7 - Engine running
- Power mode 9 - Crank before engine running.

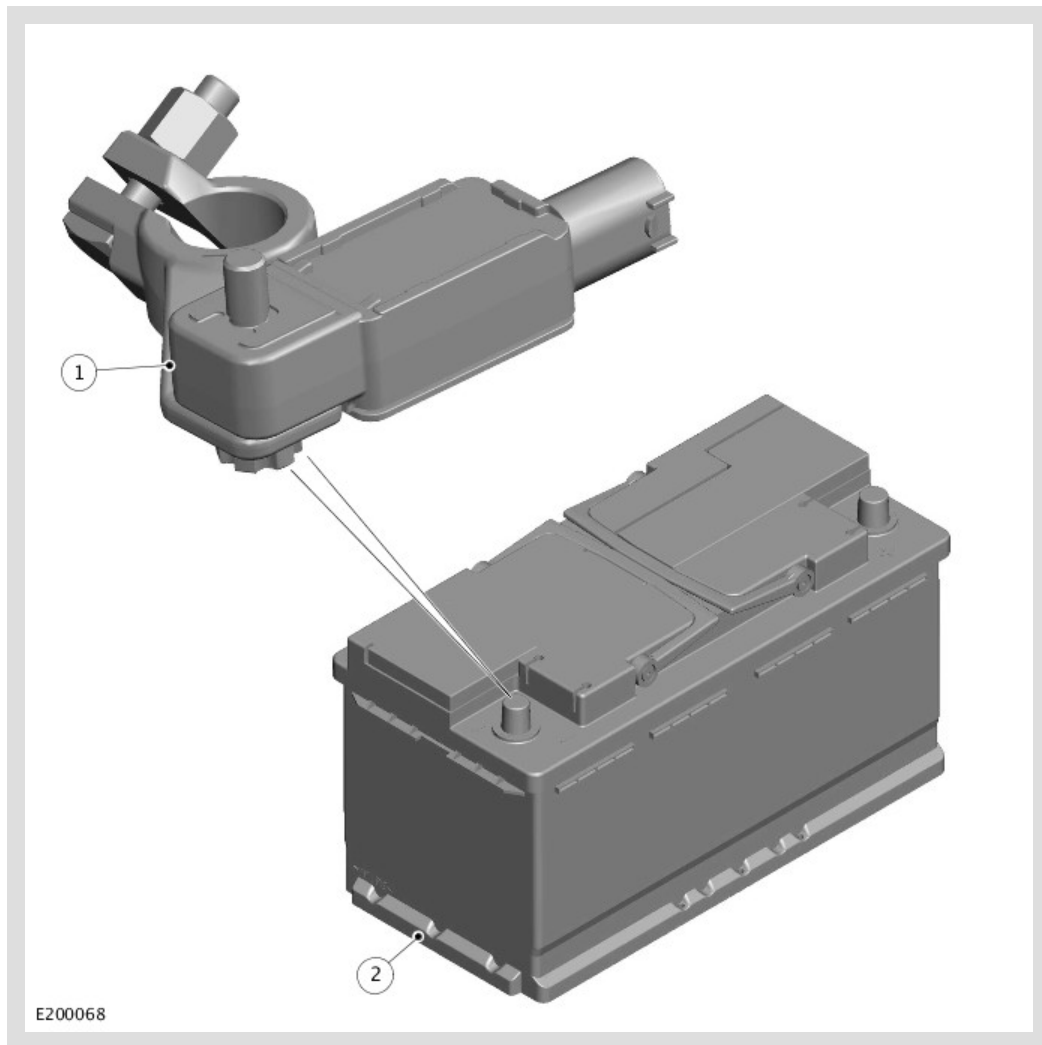
TRANSIT MODE

All new vehicles will be delivered from the factory in transit mode. Transit mode replaces the traditional transit relay. The transit mode inhibits a number of electrical systems and features to eliminate quiescent drain from the primary battery during delivery. Transit mode also inhibits some electrical loads when the engine is running to provide that the primary battery is never discharged.

To remove the vehicle from transit mode, the Land Rover approved diagnostic equipment must be connected during the Pre-Delivery Inspection (PDI). For additional information, refer to: Preliminary (101-01A, Description and Operation).

DESCRIPTION

PRIMARY BATTERY AND BATTERY MONITORING SYSTEM CONTROL MODULE



ITEM	DESCRIPTION
1	Battery Monitoring System (BMS) control module
2	Primary battery

The primary battery is located on the right side of the luggage compartment on a primary battery support tray. The primary battery is secured with a strap, threaded rods and a clamp bolted to the tray. The primary battery is vented via a tube which passes through a grommet in rear right sidemember assembly.

The primary battery on petrol and diesel vehicles is a 90Ahr, 850A CCA Absorbed Glass Mat (AGM) Valve Regulated Lead-Acid (VRLA) battery.

Battery Monitoring System Control Module

The Battery Monitoring System (BMS) control module is clamped to the primary battery negative terminal with a bolt and nut. The primary battery ground cable is connected to the BMS control module and is attached to a ground stud point on the vehicle body.

The BMS control module is connected into the vehicle wiring harness via a multiplug. The BMS control module receives a 12 V power supply directly from the primary battery positive terminal and measures the primary battery current and voltage. This connection is used to avoid any potential voltage drop in the circuit which results in incorrect information received by the BMS control module. If this connection becomes open, the Body Control Module/Gateway Module (BCM/GWM) assembly detects a communication loss with the BMS control module. Then the BCM/GWM assembly defaults to a fail-safe fixed charging voltage of 14 V and stores a related Diagnostic Trouble Code (DTC).

A Local Interconnect Network (LIN) bus connection communicates data between the BMS control module and the BCM/GWM assembly.

Another LIN bus from the BCM/GWM assembly communicates data to the following:

- The generator
- The Voltage Quality Module (VQM).

The Battery Monitoring System (BMS) control module contains software maps that provide a mathematical model of primary battery conditions. The BMS control module constantly receives information from the Body Control Module/Gateway Module (BCM/GWM) assembly regarding the vehicle state and electrical loading.

The BMS control module monitors various primary battery parameters, which are directly measured and predictive values:

- The primary battery current and voltage are the result of direct measurement.
- While state of charge, state of function and electrolyte temperature are predicted values.

The Body Control Module/Gateway Module (BCM/GWM) assembly transmits the primary battery information over the FlexRay network system to other vehicle systems. The BCM/GWM assembly also receives generator and BMS control module output information on a LIN bus connection. Based on this information, the BCM/GWM assembly will control the output from the generator and request the switching off of electrical loads if necessary.

If a new primary battery is fitted to the vehicle, the Battery Monitoring System (BMS) control module will require re-calibrating using a Land Rover approved diagnostic equipment.

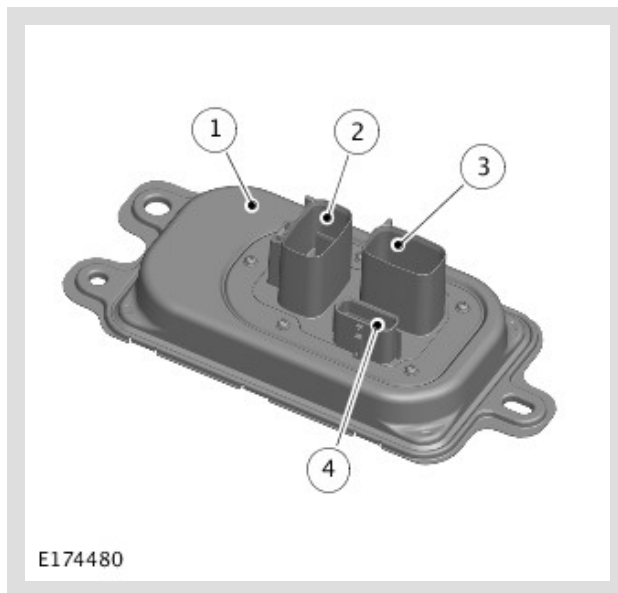


CAUTION:

Due to the self-calibration routine, it is recommended that all power supply diagnostic and testing are carried out using the Land Rover approved diagnostic equipment.

The BMS control module Diagnostic Trouble Codes (DTCs) can be used to help diagnose BMS faults. The DTCs are stored in BCM/GWM assembly. These DTCs can be read using the Land Rover approved diagnostic equipment. The Land Rover approved diagnostic equipment 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. These functions provide current flow information and will detect if the BMS control module or generator are functioning incorrectly.

VOLTAGE QUALITY MODULE - VEHICLES WITH STOP/START SYSTEM ONLY



ITEM	DESCRIPTION
1	Voltage Quality Module (VQM)
2	Power connector
3	Ground connector
4	Signal connector

The Voltage Quality Module (VQM) is located adjacent to the Rear Junction Box (RJB) in the right side of the luggage compartment. The VQM is attached to the rear floor with

three bolts. The VQM consists of a Direct Current (DC) - DC converter and an interface. This interface provides the communication with the Body Control Module/Gateway Module (BCM/GWM) assembly.

The DC - DC converter can produce a constant 12 V output voltage from the varying input voltage supplied by the battery during an engine restart. This constant 12 V output voltage is needed for the crucial vehicle systems.

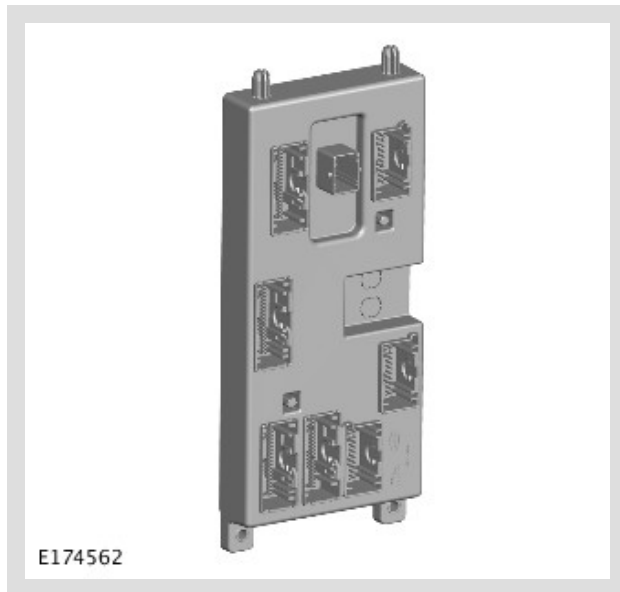
The VQM supplies a constant voltage during an engine restart for the following:

- The Instrument Cluster (IC)
- The infotainment system components - Depends on equipment
- The Rear View Mirror (RVM) - If equipped
- The Parking Assist Control Module (PACM) - If equipped
- The Rear View Camera (RVC) - If equipped
- The left and right Blind Spot Monitoring Control Module (BMCM) - If equipped.

The VQM has three connections:

- Two power connectors:
 - A primary battery feed connection from the Battery Junction Box (BJB) via a 60 A fuse
 - A power output connection to the Rear Junction Box (RJB).
- An additional connector to provide electrical connection to the following:
 - Ignition signal from the BCM/GWM assembly
 - Crank signal from the starter motor relay located in the Engine Junction Box (EJB)
 - Status and diagnostic messages to the BCM/GWM assembly via the Local Interconnect Network (LIN) bus
 - Ground.

BODY CONTROL MODULE/GATEWAY MODULE ASSEMBLY



The Body Control Module/Gateway Module (BCM/GWM) assembly is attached to a bracket, which is bolted to the passenger side of the cross-car beam, behind the instrument panel.

The BCM/GWM assembly is located adjacent to the Passenger Junction Box (PJB), and it is the main controller of the vehicle body systems.

The BCM/GWM assembly contains software to control the following functions:

- Determine condition of the primary battery.
- Generator output. Control the generator output to reach a desired system voltage or target primary battery state of charge.
- Load management. The BCM/GWM assembly monitors the vehicle electrical loads. Before an auto stop/start event the BCM/GWM assembly requests a power save on all electrical loads and set a minimum electrical value override.

- Control stop/start system functionality. The BCM/GWM assembly can only inhibit stop /start functionality depending on power system condition. The BCM/GWM assembly also provides supporting functionality via load management and Voltage Quality Module (VQM) control.

The BCM/GWM assembly communicates with other system control modules on the followings:

- High Speed (HS) Controller Area Network (CAN) powertrain systems bus
- HS CAN power mode zero systems bus
- HS CAN chassis systems bus
- HS CAN comfort systems bus
- HS CAN body systems bus
- and over the FlexRay network system.

The BCM/GWM assembly communicates with the Battery Monitoring System (BMS) control module, the Voltage Quality Module (VQM), and the generator via a Local Interconnect Network (LIN) bus.

The BCM/GWM assembly monitors the components and can store fault related Diagnostic Trouble Codes (DTC).

OPERATION

BATTERY MONITORING SYSTEM CONTROL MODULE

The Battery Monitoring System (BMS) assembly monitors the condition of the primary battery in every vehicle state.

If the primary battery state of charge falls below a set threshold from the critical start point:

- The BMS control module will wait for five minutes
- Then send a 'Warning' message on the Local Interconnect Network (LIN) bus to the Body Control Module/Gateway Module (BCM/GWM) assembly.

The BMS control module will determine that the control modules are still 'awake' if the primary battery charge has continued to fall below 50 %. When this occurs the BMS control module sends a 'Shut down' message on the LIN bus to the BCM/GWM assembly. The BCM/GWM assembly then transmits a 'Shut down' message on the Controller Area Network (CAN) buses to all control modules, requesting them to shut down.

When the ignition is off (power mode 0) the BMS control module will monitor the primary battery state of charge for a further 15 minutes. The BMS control module determines if the primary battery state of charge is still dropping due to the quiescent drain current. The BMS control module sends a 'Power Disconnect' signal to the BCM /GWM assembly on the LIN bus. The BCM/GWM assembly then sends a signal to the Rear Junction Box (RJB) to open its internal relays. When the relays are open, the power supply from the primary 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 provides 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.

BATTERY MONITORING SYSTEM LOW BATTERY WARNING AND ENERGY MANAGEMENT MESSAGES

The Battery Monitoring System (BMS) control module continuously monitors the condition of the primary battery. If excessive primary battery discharge occurs, the system will begin to shut down non-essential electrical systems in order to protect the primary battery.

The BMS control module displays warning messages to inform the driver:

- The primary battery is either at a low level of charge
- The engine-off power consumption limit has been exceeded.

There are three messages that can be displayed, two on the Touch Screen (TS) and one on the message center.

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

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

Low Battery - 'Please start your engine'

This message will be displayed on the message center if the engine is not running. This indicates that the primary battery charge has fallen below a predefined threshold. As soon as the primary battery is charged above this threshold, the message will be removed. This message 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 Touch Screen (TS). This message appears if the engine is not running and system features are causing excessive primary battery discharge. After three minutes the Body Control Module/Gateway Module (BCM/GWM) assembly 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 primary battery capacity available for the driver 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 ten minutes with the engine running. This time allows to the primary battery to replace any lost charge. However, if the engine is run for less than ten minutes, the messages will only be displayed after an additional five minutes. This occurs, when the ignition is switched on but the engine is not running.

BATTERY MONITORING SYSTEM CONTROL MODULE SELF CALIBRATION

The Battery Monitoring System (BMS) control module periodically initiates a self-calibration routine. To self-calibrate, the BMS control module first charges the primary 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.

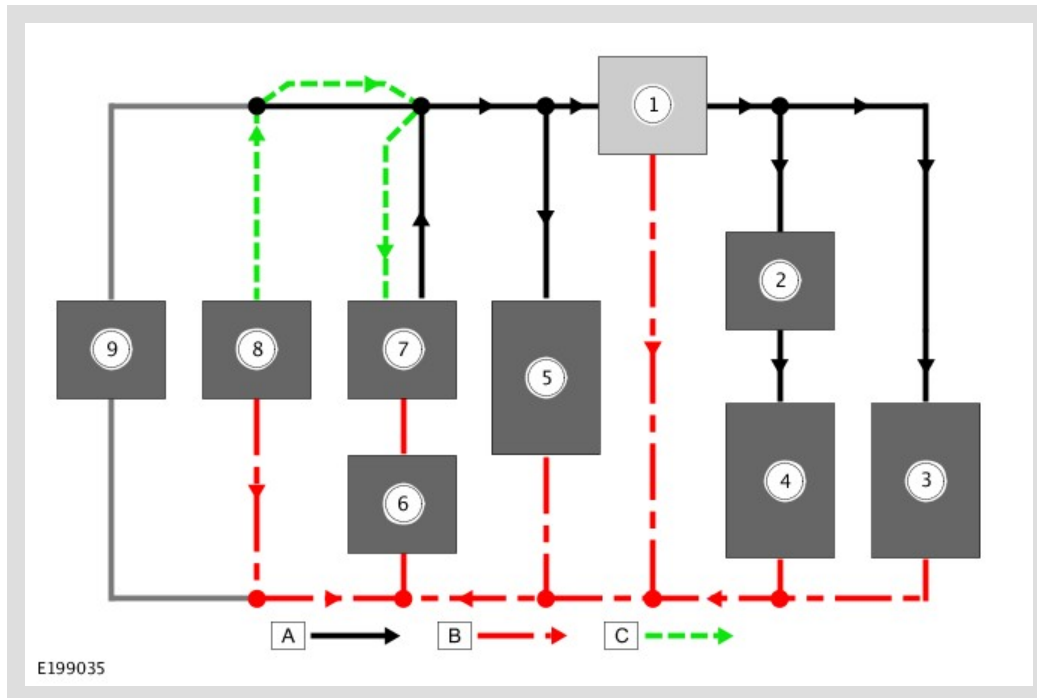
When the primary battery is fully charged the system then resumes normal charging control. The optimum level of charge will be between 12.6 V and 15 V, depending on primary battery condition, temperature and loading.

The BMS control module also monitors the primary 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 primary battery voltage.

VOLTAGE QUALITY MODULE - VEHICLES WITH STOP/START SYSTEM ONLY

The Voltage Quality Module (VQM) is a Direct Current (DC) - DC converter and produces a constant 12 V output voltage. During a warm engine restart, significant low voltage transients occur in the vehicle electrical systems. The noticeable loads require the voltage to be boosted by the VQM.

Voltage Quality Module Bypass Mode

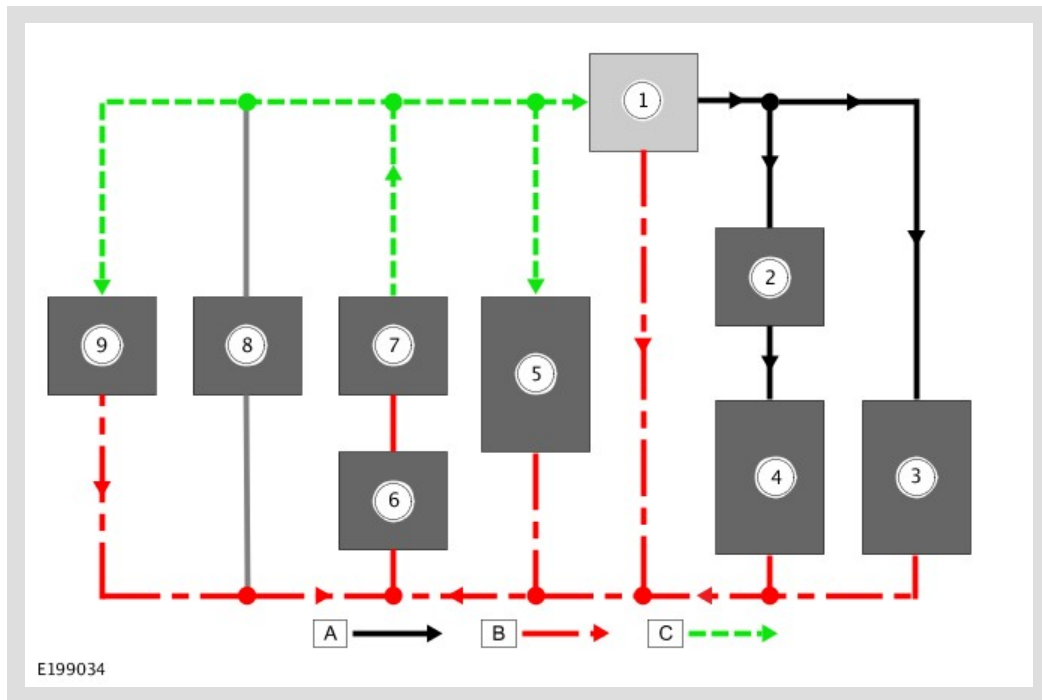


A = BATTERY VOLTAGE: B = GROUND: C = BATTERY CHARGING VOLTAGE.

ITEM	DESCRIPTION
1	Voltage Quality Module (VQM)
2	Rear Junction Box (RJB)
3	Voltage sensitive loads 1
4	Voltage sensitive loads 2
5	Electric loads
6	Battery Monitoring System (BMS) control module
7	Primary battery
8	Generator
9	Starter motor

Bypass mode is the Voltage Quality Modules (VQMs) normal operating mode. In this mode the power from the primary battery to the voltage sensitive loads passes through on the VQM without any intervention. The VQM can support 600 W of continuous power in bypass mode.

Voltage Quality Module Boost Mode



A = BATTERY VOLTAGE: B = GROUND: C = BATTERY CHARGING VOLTAGE.

ITEM	DESCRIPTION
1	Voltage Quality Module (VQM)
2	Rear Junction Box (RJB)
3	Voltage sensitive loads 1
4	Voltage sensitive loads 2
5	Electric loads
6	Battery Monitoring System (BMS) control module
7	Primary battery
8	Generator
9	Starter motor

During a warm engine restart a hardwired connection from the starter motor relay provides the crank signal to the Voltage Quality Module (VQM). At this point the VQM switches into boost mode, and activates the Direct Current (DC) - DC converter. The DC - DC converter maintains a constant output voltage between 11 V and 14 V (depending on the input voltage) to the voltage sensitive loads for five seconds. The VQM can support 450 W 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 (32 °F), when stop/start function is disabled.

ELECTRICAL LOAD MANAGEMENT

The Body Control Module/Gateway Module (BCM/GWM) assembly contains the electrical load management. The electrical load management uses the Intelligent Power Management System (IPMS) functionality and is based on Battery Monitoring System (BMS) control module inputs. The BCM/GWM assembly will monitor the vehicle system power loads before and during an auto engine stop.

Before an auto engine stop, the BCM/GWM assembly will transmit a signal to the system control modules on all Controller Area Network (CAN) buses. The BCM/GWM assembly requests a power save on all electrical loads and set a minimum electrical value override. The BCM/GWM assembly monitors the vehicle electrical loads. It will inhibit an auto stop/start until the load current is at a value low enough to be supported by the primary battery. If the electrical loads cannot be reduced sufficiently, the BCM/GWM assembly will inhibit the auto stop/start.

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

The BCM/GWM assembly contains most of the software required to control the primary battery charging system and components. The BCM/GWM assembly monitors the components and the status of the stop/start system, and can store fault related Diagnostic Trouble Codes (DTCs). The BCM/GWM assembly contains the Intelligent Power Management System (IPMS). The BMS software is contained within the BMS module and communicates with the IPMS on the Local Interconnect Network (LIN) bus. The IPMS uses information from the BMS in order to determine the condition of the primary battery.

The BCM/GWM assembly software will monitor the state of charge of the primary battery and will determine when an auto stop/start event can occur. It can also intervene to maintain vehicle systems by keeping the engine running or initiating a restart. For example, climate control system requirements or request for restart from the Powertrain Control Module (PCM). A brake pressure signal is received from the PCM which will indicate to the BCM/GWM assembly that an engine restart is required. The foot brake pedal is operated by the driver.

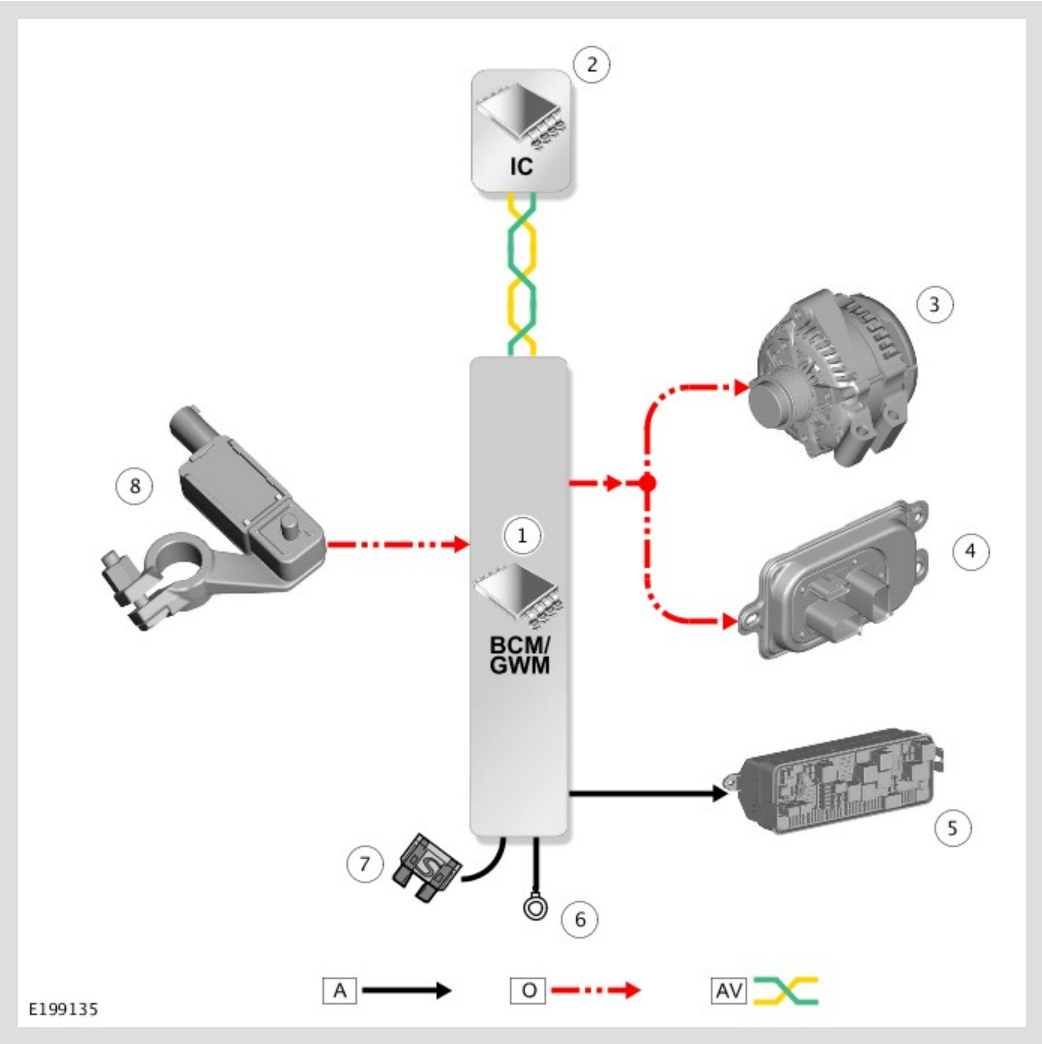
SYSTEM INHIBITS

The auto stop/start inhibit monitoring of the primary battery is performed by the Body Control Module/Gateway Module (BCM/GWM) assembly. If the primary battery voltage is too low to support an auto stop/start, then the BCM/GWM assembly will suspend auto stop/start.

The BCM/GWM assembly monitors the primary battery and the Voltage Quality Module (VQM). Any fault found will cause the BCM/GWM assembly to inhibit auto stop/start and the BCM/GWM assembly will record a Diagnostic Trouble Code (DTC).

CONTROL DIAGRAM

CONTROL DIAGRAM - 1 OF 2 - PRIMARY BATTERY SYSTEM

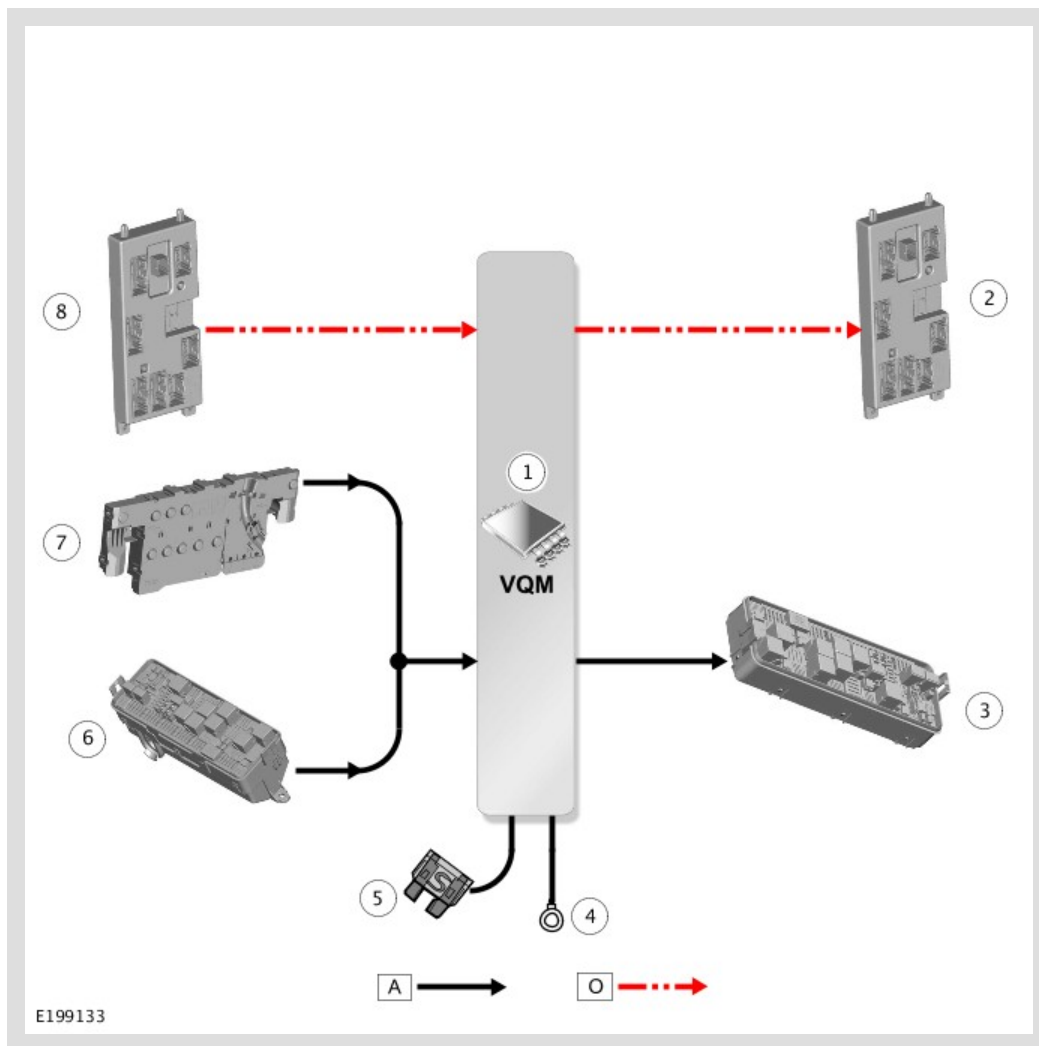


A = HARDWIRED: O = LOCAL INTERCONNECT NETWORK (LIN) BUS: AV = HIGH SPEED (HS) CONTROLLER AREA NETWORK (CAN) COMFORT SYSTEM BUS.

ITEM	DESCRIPTION
1	Body Control Module/Gateway Module (BCM/GWM) assembly
2	Instrument Cluster (IC)
3	Generator

4	Voltage Quality Module (VQM) - Vehicles with stop/start system only
5	Rear Junction Box (RJB)
6	Ground
7	Power supply
8	Battery Monitoring System (BMS) control module

CONTROL DIAGRAM - 2 OF 2 - VOLTAGE QUALITY MODULE



A = HARDWIRED: O = LOCAL INTERCONNECT NETWORK (LIN) BUS.

ITEM	DESCRIPTION
1	Voltage Quality Module (VQM)
2	Status and diagnostic messages to the Body Control Module/Gateway Module (BCM/GWM) assembly
3	Rear Junction Box (RJB)
4	Ground

5	Power supply
6	Crank signal from the starter motor relay located in the Engine Junction Box (EJB)
7	Battery Junction Box (BJB)
8	Ignition signal from the Body Control Module/Gateway Module (BCM/GWM) assembly