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BATTERY, MOUNTING AND CABLES – VEHICLES WITH: MHEV

STARTUP BATTERY AND CABLES – INGENIUM I6 3.0 L PETROL (G2342547)

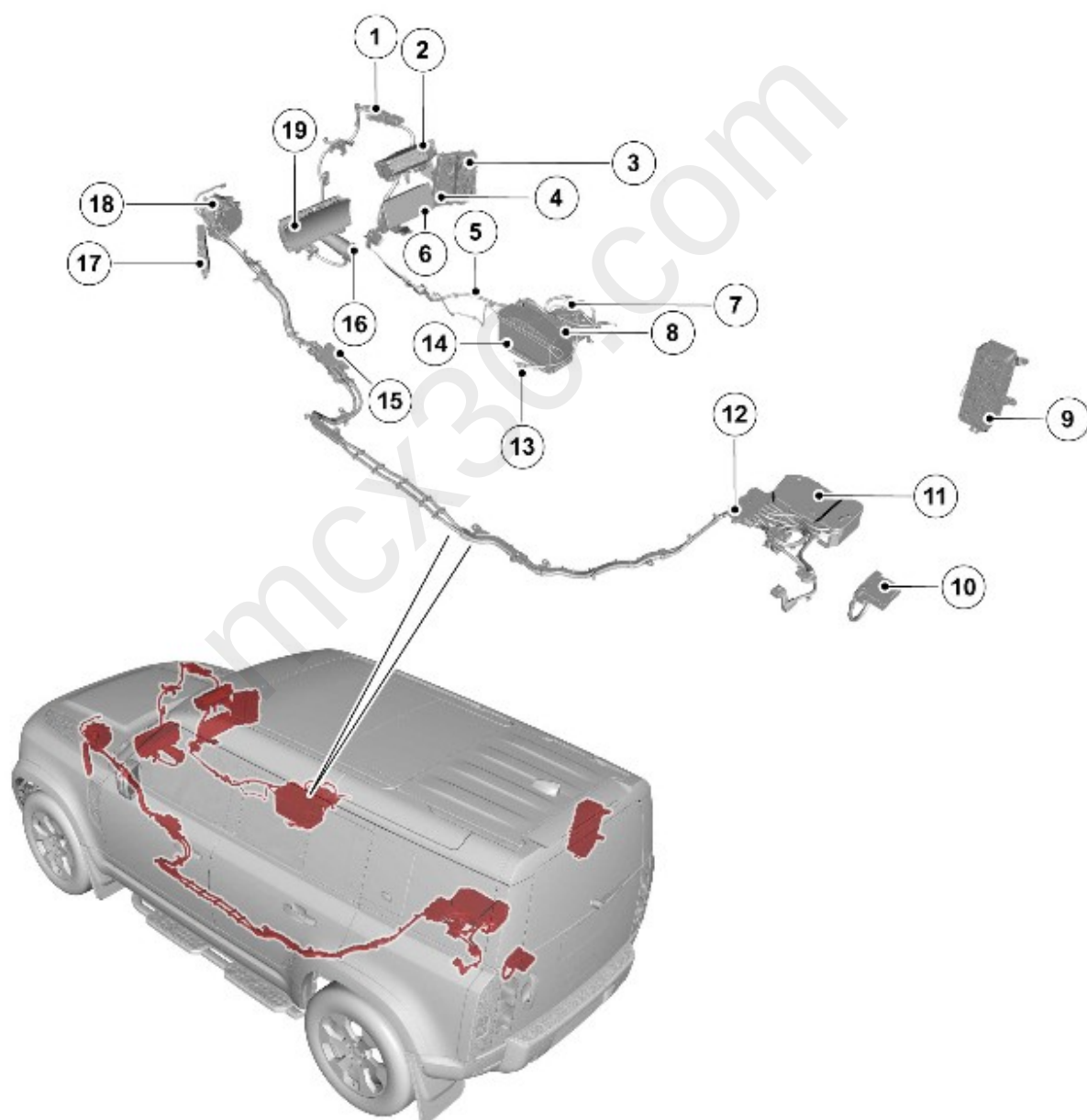
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COMPONENT LOCATION

COMPONENT LOCATION - 1 OF 1

 NOTE:

Vehicle with 5 doors is shown, vehicle with 3 doors is similar.



ITEM	DESCRIPTION
1	Jump start terminal for the jump start (positive) connection
2	Engine Junction Box (EJB)
3	Passenger Junction Box (PJB)
4	Body Control Module/Gateway Module (BCM/GWM)
5	Startup battery cable - Battery Junction Box (BJB) to the jump start (positive) terminal
6	Touch Screen (FCDIM)
7	BJB
8	Battery Monitoring System (BMS) control module
9	Rear Junction Box (BCMB)
10	Auxiliary Junction Box (AJB)
11	Direct Current to Direct Current converter (DC/DC)
12	Mild Hybrid Electric Vehicle (MHEV) battery junction box - Rear
13	Ground cable
14	Startup battery
15	MHEV battery junction box - Front
16	Starter motor
17	Powertrain Control Module (PCM)
18	Belt Integrated Starter Generator (BISG)
19	Instrument Panel Cluster (IPC)

OVERVIEW

CAUTION:

When connecting a slave startup battery to the vehicle, always use the vehicle body ground terminal in the engine compartment. Never connect directly to the startup battery ground terminal, because the BMS control module can be damaged.

NOTE:

The fusible links are installed behind a removable cover.

The startup battery supplies electrical power to the BJB. The BJB connects to the following components:

- Starter motor
 - For additional information, refer to: [Starting System](#) (303-06C Starting System - INGENIUM I6 3.0L Petrol, Description and Operation).
- DC/DC
 - For additional information, refer to: [Direct Current to Direct Current Converter](#) (414-03 Battery Charging - INGENIUM I6 3.0L Petrol, [+] MHEV, Description and Operation).
- Jump start terminal - positive.

The DC/DC supplies the power for normal operation of the 12V systems only in Power Mode 7 (engine running).

The BJB supplies power to the following:

- EJB
- AJB
- PJB
- BCMB.

The BMS control module is installed on the startup battery negative terminal. The BMS control module is connected to the vehicle body ground by a ground cable installed on the BMS control module. The BMS control module sends startup battery data to the Body Control Module (BCM)/ Gateway Control Module (GWM). When you install a new startup battery on the vehicle, you must calibrate the BMS control module with the Jaguar Land Rover (JLR) approved diagnostic equipment.

The BCM/ GWM is the main controller of the vehicle body systems. The BCM/ GWM contains the whole charging system software required to control the startup battery charging system and components. The BCM/ GWM monitors the components and stores the related Diagnostic Trouble Code(s) (DTC)s.

The DC/DC provides electrical power to support the 12V in Power Mode 7 (engine running) in MHEV vehicle. The output voltage of the DC/DC is controlled by the BCM/ GWM. The DC/DC operating mode is controlled by:

- Vehicle Supervisory Controller (VSC) or
- PCM.

For additional information, refer to: [Direct Current to Direct Current Converter](#) (414-03 Battery Charging - INGENIUM I6 3.0L Petrol, [+] MHEV, Description and Operation).

The BJB, EJB, PJB, BCMB and AJB contain fuses and relays to distribute electrical power to various vehicle systems. The junction box contains the megafuses.

- The BJB is installed under the driver seat, beside the startup battery.
- The EJB is installed in the engine compartment.
- The PJB is installed on the passengers side behind the glovebox and next to the BCM/ GWM.

- The BCMB is located on the right of the loadspace and behind the trim panel.
- The AJB is installed under the loadspace compartment floor.

The single jump start terminal is located adjacent to the right top mount in the engine compartment. A cover protects the positive terminal when not in use. When you have to jump start the vehicle, remove the cover and attach the positive jump lead to the terminal. When the positive terminal is not in use, install the cover.

TRANSIT MODE

All new vehicles are delivered from the factory in transit mode. Transit mode replaces the traditional transit relay and inhibits some electrical systems and features to eliminate quiescent drain from the startup battery during delivery. Transit mode also inhibits some electrical loads when in Power Mode 7 (engine running). Transit mode makes sure that the startup battery is never discharged while in Power Mode 7 (engine running).

To remove the vehicle from transit mode, use the JLR approved diagnostic equipment.

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

POWER MODES

The BCM/ GWM 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 5 of these modes are noticeable to the driver and technicians as follows:

- Power Mode 0 - ignition OFF.
- Power Mode 4 - Accessory (vehicle unlocked and Smart Key present).
- Power Mode 6 - Ignition ON.
- Power Mode 7 - Engine running.
- Power Mode 9 - Engine cranking.

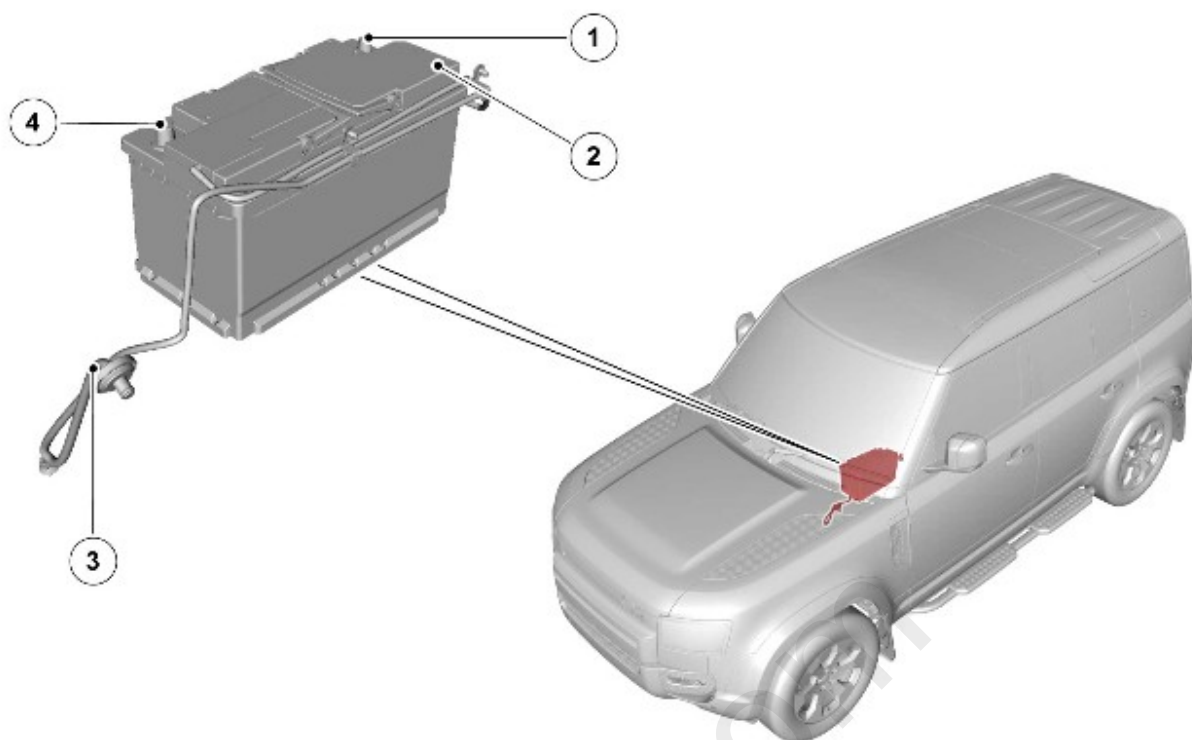
DESCRIPTION

STARTUP BATTERY



NOTE:

Vehicle with 5 doors is shown, vehicle with 3 doors is similar.



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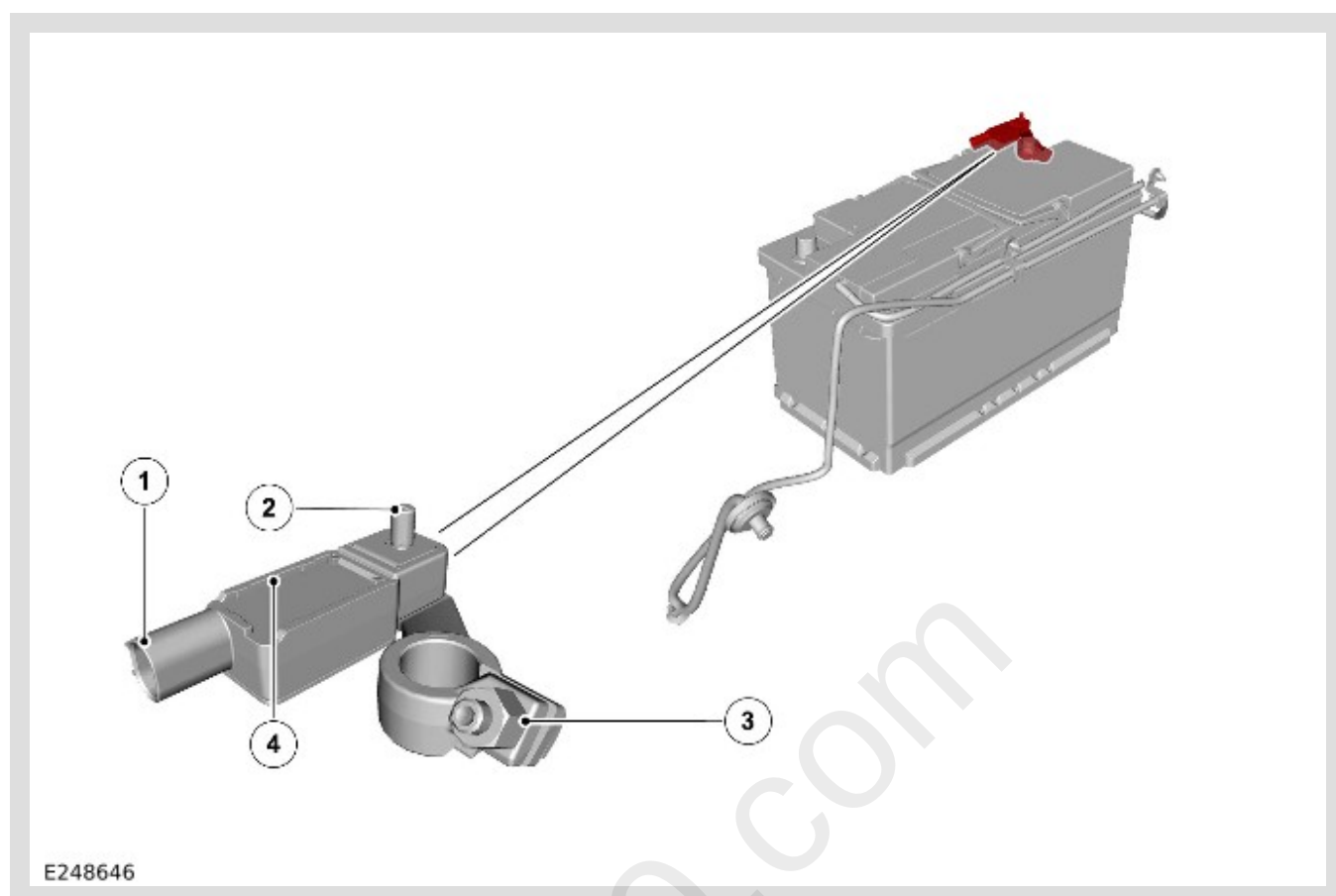
ITEM	DESCRIPTION
1	Startup battery negative terminal
2	Startup battery
3	Startup battery breather pipe
4	Startup battery positive terminal

The startup battery is located in a tray under the driver seat. The startup battery is secured in position with a clamp plate and a bolt assembly.

The startup battery is an H8 90 Ah, 850 CCA Absorbed Glass Mat (AGM) battery on all vehicles.

The startup battery negative terminal has the BMS control module located on it. The startup battery positive terminal connector contains the megafuse and connects to the BJB.

BATTERY MONITORING SYSTEM CONTROL MODULE



ITEM	DESCRIPTION
1	BMS control module startup battery negative terminal clamp
2	BMS control module
3	Wiring harness connector
4	BMS control module terminal for the BMS plate

The BMS control module is located on the startup battery negative terminal. The BMS control module is clamped to the startup battery negative terminal with a bolt and nut. The BMS control module has a ground terminal for the ground cable connection secured with a nut.

The ground cable connects to a vehicle body ground connection.

The BMS control module has a single 2-pin connector to the wiring harness. The 2-pin connector has the following electrical connections:

- Positive startup battery feed directly from the startup battery positive terminal.
- Local Interconnect Network (LIN) hardwired to the BCM/ GWM.

The BCM/ GWM controls the startup battery current drain and State of Charge. The BMS control module measures the startup battery current and voltage, which it communicates to the BCM/ GWM on the LIN. The BCM/ GWM transmits the startup battery information over the Controller Area Network (CAN) systems buses to other vehicle systems. Based on the information received from the BMS control module, the BCM/ GWM controls the output from the DC/DC. The BCM/ GWM requests that specific modules are switched OFF to decrease electrical loads when necessary.

The BMS control module contains software maps that provide a mathematical model of startup battery conditions. The BMS control module constantly receives information from the BCM/ GWM regarding the vehicle state and electrical loading.

When you install a new startup battery on the vehicle, you must calibrate the BMS control module with the JLR approved diagnostic equipment.

 CAUTION:

- Always make sure the battery clamps are installed correctly as this can cause miscalculations by the BMS.
- Due to the self-calibration routine, it is a must that all power supply diagnostic testing is done using the JLR approved diagnostic equipment.

When an error occurs, the BMS control module sends a message to the BCM/ GWM through the LIN. The DTC is stored in the BCM/ GWM. The DTC is read using the JLR approved diagnostic equipment.

The JLR 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 the LIN of generator controlled functions to provide current flow information. The procedure uses the controlled functions of the following, to provide current flow information:

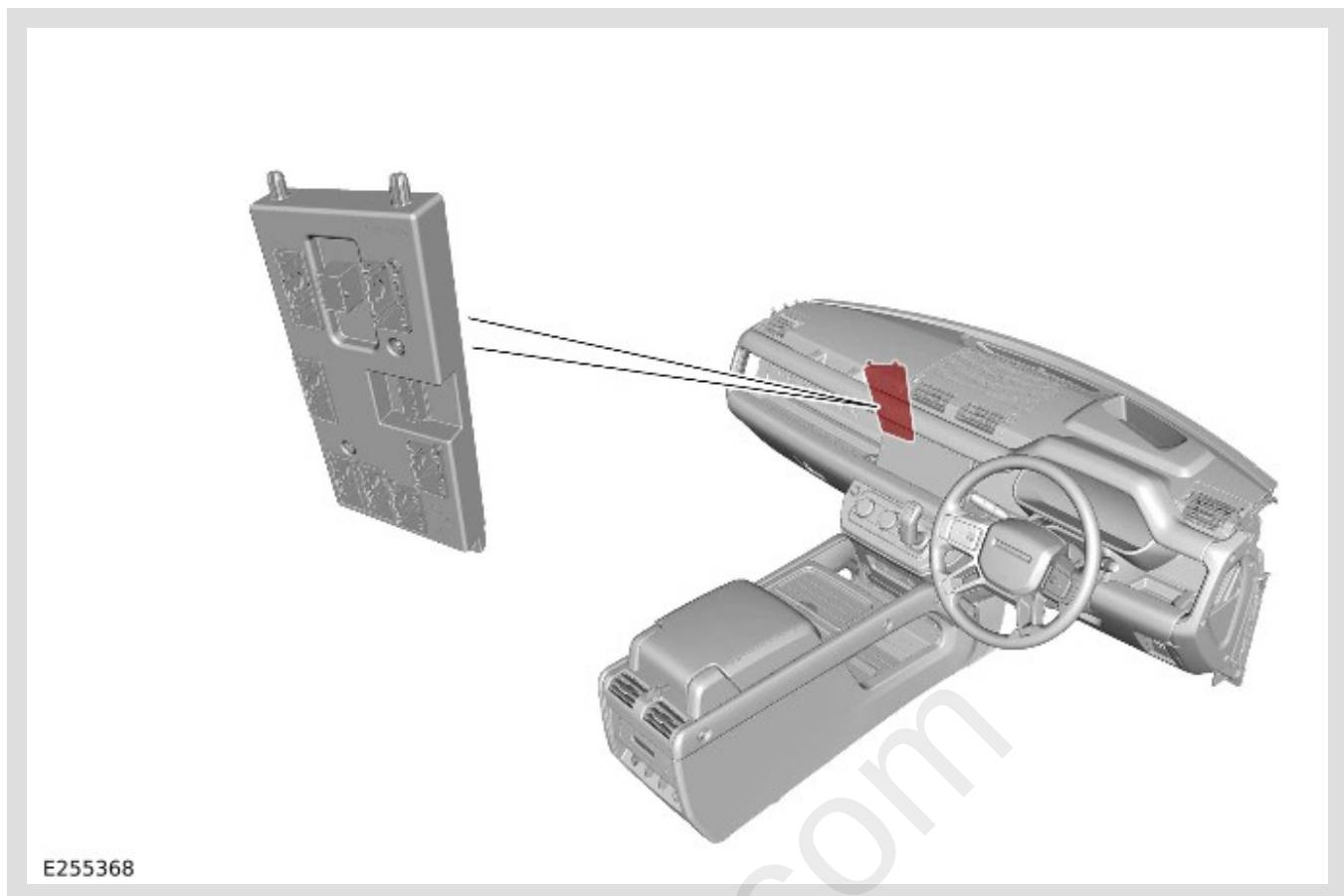
- BMS control module through the LIN.
- DC/DC through the High Speed (HS) CAN power mode zero systems bus.

For additional information, refer to: MHEV Battery and Cables (414-01 Battery, Mounting and Cables - Vehicles With: Non-Electric Vehicles, Description and Operation).

BCM/ GWM

 NOTE:

Right Hand Drive (RHD) vehicle is shown, Left Hand Drive (LHD) vehicle is similar.



The BCM/ GWM is attached to a bracket and bolted to the passenger side of the cross-car beam, behind the glovebox.

The BCM/ GWM is located adjacent to the PJB, and it is the main controller of the vehicle body systems.

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

- Determine the condition of the startup battery.
- DC/DC output:
 - Control the DC/DC output to reach a desired system voltage.
 - Control the DC/DC output to reach a target startup battery State of Charge.
- Load management:
 - Load management controls the 12V power system to make sure that the system is not overloaded. In certain events, for example, during engine stop/start, some systems can be switched OFF.
- Control stop/start system functionality:
 - The BCM/ GWM can only inhibit stop/start functionality depending on the power system condition.
 - The BCM/ GWM also provides supporting functionality through load management.

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

- FlexRay
- HS CAN powertrain systems bus

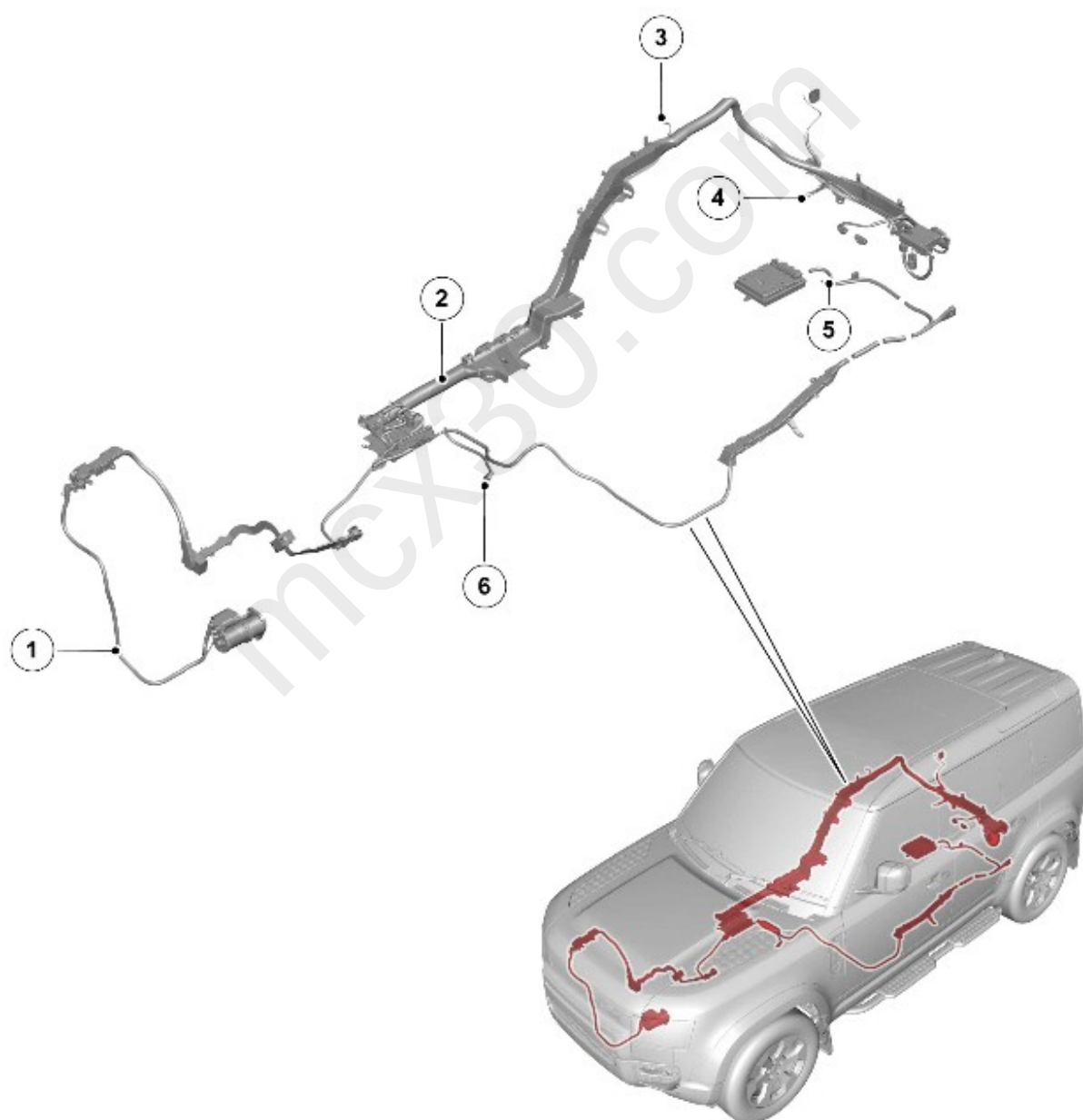
- HS CAN power mode zero systems bus
- HS CAN Underbody (UN) systems bus
- HS CAN Human Machine Interface (HMI) systems bus
- HS CAN body systems bus.

The BCM/ GWM communicates with the BMS control module through a LIN.

STARTUP BATTERY CABLES

NOTE:

Vehicle with 5 doors is shown, vehicle with 3 doors is similar.



E249504

ITEM	DESCRIPTION
1	Startup battery cable (positive) from the jump start terminal (positive) to the starter motor
2	Main wiring harness
3	Ground cable from the BCMB to the vehicle engine ground connection
4	Ground cable from the AJB to a vehicle body ground connection
5	Ground cable from the DC/DC to a vehicle body ground connection
6	Ground cable from the BMS plate to the vehicle engine ground connection

The startup battery cables (positive) are for the high current connections between the following:

- Startup battery
- DC/DC
- Starter motor
- BJB
- EJB
- AJB
- PJB
- BCMB.

The startup battery cables (positive) from the BJB to the other junction boxes and modules are all in the main wiring harness.

OPERATION

The startup battery State of Charge is monitored by the BCM/ GWM with the BMS control module. In Power Mode 7 (engine running) the startup battery State of Charge is maintained by the DC/DC. The BCM/ GWM communicates with the DC/DC through the HS CAN power mode zero systems bus.

For additional information, refer to: [Direct Current to Direct Current Converter](#) (414-03 Battery Charging - INGENIUM I6 3.0L Petrol, [+] MHEV, Description and Operation).

The power from the startup battery and the DC/DC is distributed to all the vehicle 12V systems from the BJB.

BATTERY MONITORING SYSTEM

The BMS control module monitors the condition of the startup battery in all Power Modes.

The BMS control module sends the startup battery State of Charge to the BCM/ GWM on a LIN. When the startup battery State of Charge is less than a set threshold from the critical start point, the BMS control module sends a message. The warning message is transmitted to the BCM/ GWM.

The BMS control module determines that the control modules are still active when the startup battery State of Charge continuously decreased to less than 50%. When this occurs, the BMS control module sends a shutdown message on the LIN to the BCM/ GWM. The BCM/ GWM then transmits a shutdown message on the CAN systems buses to all control modules, requesting them to shut down.

When in Power Mode 0 (ignition OFF), the BMS control module monitors the startup battery State of Charge for a further 15 minutes. The BMS control module determines when the startup 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 on the LIN. The BCM/ GWM then sends a signal to the PJB on the hardwired connections to open its internal relays. When the PJB relays are open, the power supply from the startup 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 communication makes sure that no other control modules 'wake' during this process. When CAN systems bus communication was used, all modules on the CAN systems bus would be woken by the message.

BATTERY MONITORING SYSTEM CONTROL MODULE LOW BATTERY WARNING AND ENERGY MANAGEMENT MESSAGES

The BMS control module continuously monitors the condition of the startup battery. When excessive startup battery discharge occurs, the system begins to shut down non-essential electrical systems in order to protect the startup battery.

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

- The startup battery is at a low level of charge.
- Power consumption limit has been exceeded in Power Mode 0 (ignition OFF).

DISPLAY SCREEN	MESSAGE
FCDIM	'Energy Management'
IPC	Low Battery - 'Please start engine'

'Energy Management'

The message is displayed as a warning on the FCDIM when in Power Mode 6 (ignition ON) or less. The message indicates that the startup battery State of Charge is less than a predefined threshold. The message displays until the startup battery State of Charge is greater than the predefined threshold. The Power Mode 7 (engine running) must be for a minimum of 10 minutes.

Low Battery - 'Please start engine'

The message is displayed on the IPC message center when in Power Mode 6 (ignition ON) or less. The message indicates that the startup battery State of Charge is less than a predefined threshold. As soon as the startup battery State of Charge is greater than this threshold, the message is removed. The message can be manually removed by pressing the 'Menu/OK' switch on the left Steering Wheel Switch (SWS).

The messages are based on a percentage of the startup battery capacity. The percentage can change based upon several factors. The messages reset after the vehicle is driven for 10 minutes in Power Mode 7 (engine running). The time allows the startup battery to replace any lost charge. However, when in Power Mode 7 (engine running) for less than 10 minutes, the messages are displayed after an additional 5 minutes.

The messages are available for the driver to use the vehicle systems within Power Mode 0 (ignition OFF). The messages only occur when in Power Mode 6 (ignition ON).

BATTERY MONITORING SYSTEM CONTROL MODULE SELF CALIBRATION

The BMS control module periodically initiates a self-calibration routine. The self calibration requires that the startup battery is fully charged.

To self-calibrate, the BMS control module sends a signal to the BCM/ GWM.



NOTE:

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

When the startup battery is fully charged, the system then resumes normal charging control. The optimum level of charge is between 12.3V to 15.2V, depending on startup battery condition, temperature and loading.

The BMS control module also monitors the startup battery condition within Power Mode 0 (ignition OFF). When a low voltage condition is detected, the BMS control module can request the infotainment system is switched OFF to protect startup battery voltage.

ELECTRICAL LOAD MANAGEMENT

The BCM/ GWM contains the electrical load management. The BCM/ GWM monitors the vehicle system power loads in all Power Modes.

Engine Stop/Start Operation with The Starter Motor

For additional information, refer to: Belt Intergrated Starter Generator (414-03 Battery Charging - INGENIUM I6 3.0L Petrol, [+] MHEV, Description and Operation).

When the engine is stopped, the BCM/ GWM continues to monitor the startup battery State of Charge. When the startup battery voltage is less than 11.2V, the BCM/ GWM initiates an engine start. A startup battery voltage of less than 11.2V, results in degraded starting performance or possible startup battery damage.

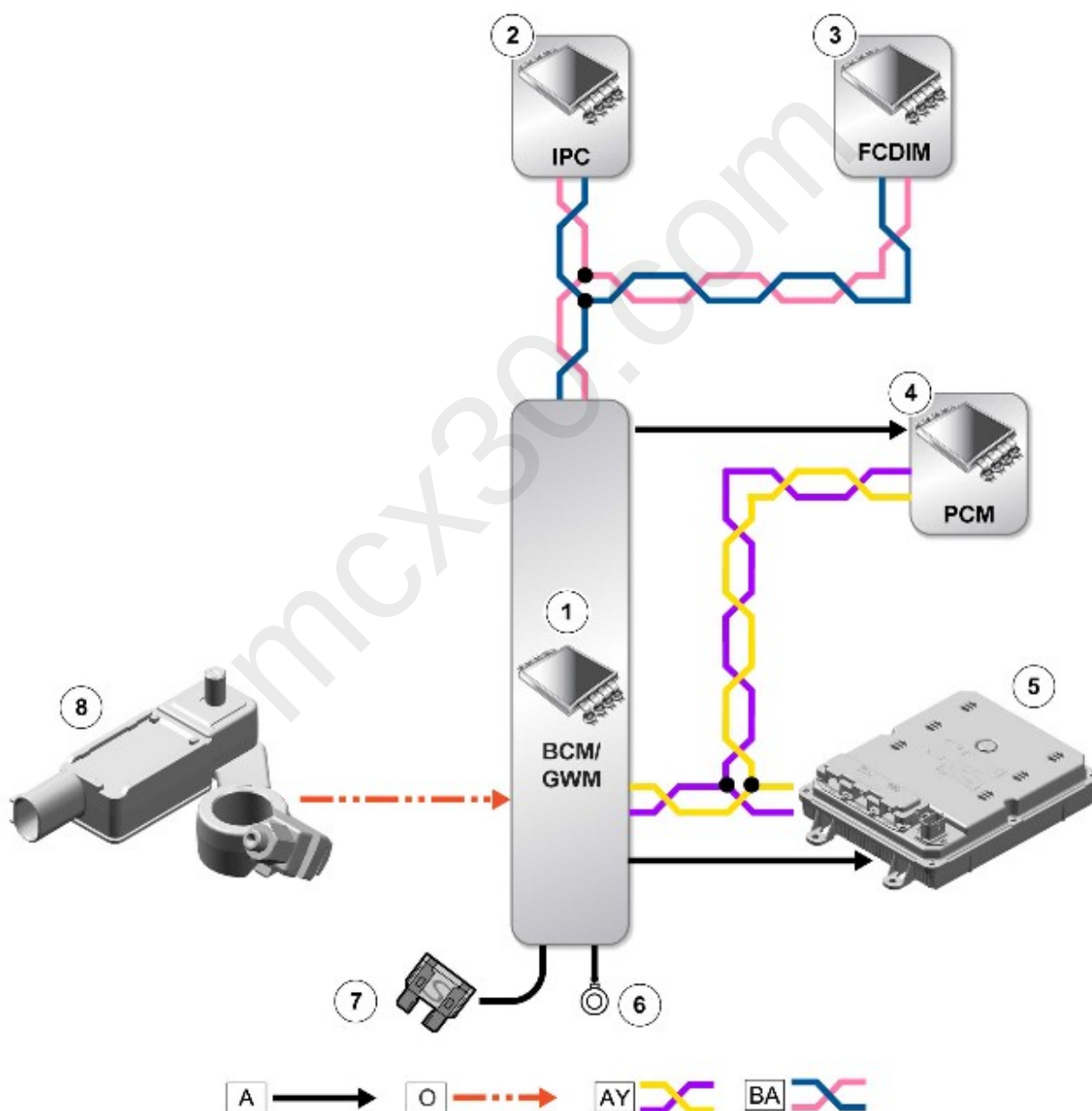
DIAGNOSTICS

The BCM/ GWM records any DTCs and related data. Read the DTCs and related data with the JLR approved diagnostic equipment.

The JLR approved diagnostic equipment can read live data and activate certain components.

CONTROL DIAGRAM

CONTROL DIAGRAM - 1 OF 1



E249505

A = HARDWIRED: O = LIN: AY = HS CAN POWER MODE ZERO SYSTEMS BUS: BA = HS CAN HMI SYSTEMS BUS.

ITEM	DESCRIPTION
1	BCM/ GWM
2	IPC
3	FCDIM
4	PCM
5	DC/DC
6	Ground
7	Power supply
8	BMS control module

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