BODY CONTROL MODULE (BCM) - DESCRIPTION AND OPERATION

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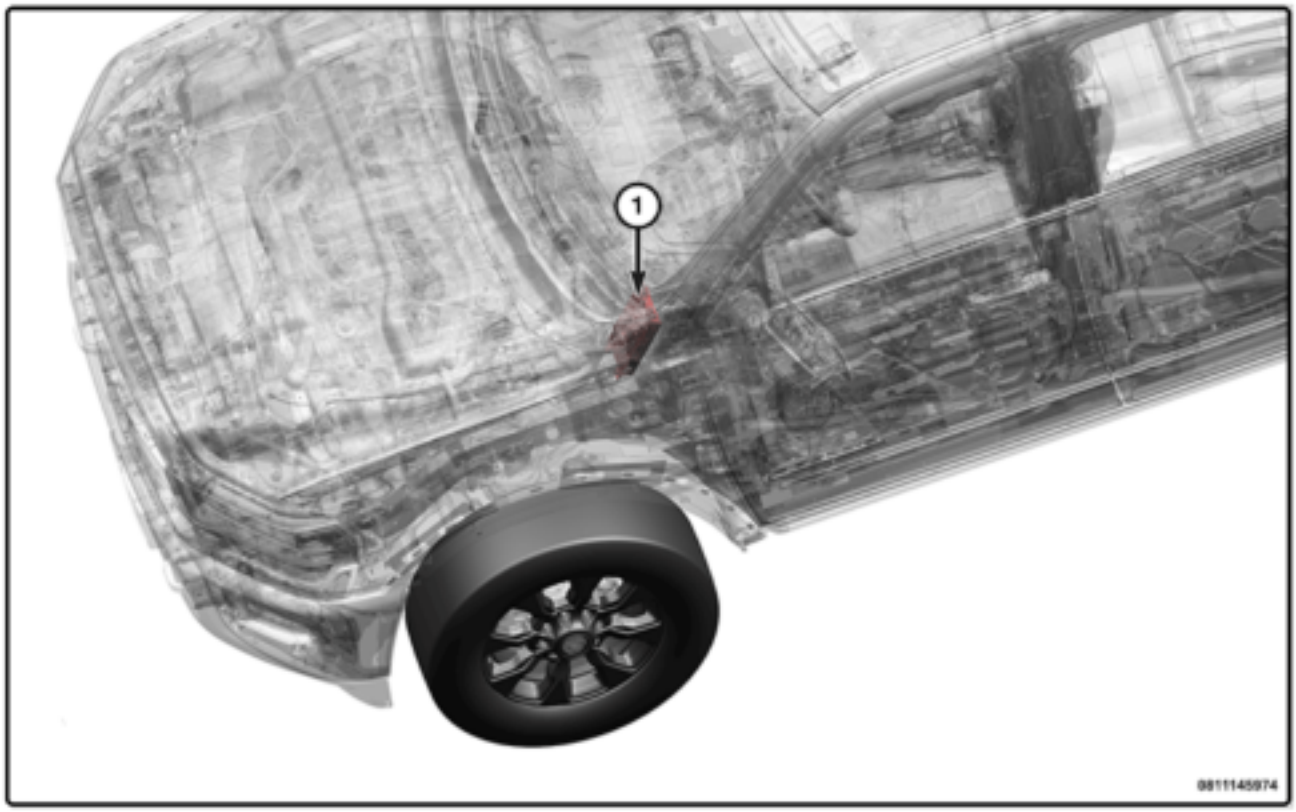

DESCRIPTION

The Body Control Module (BCM) (1) is an electronic control unit that manages the main body functions of the vehicle thus performing gateway functions between high and low speed Controller Area Networks (CAN) and between Local Interface Network (LIN) and CAN networks. Moreover, the BCM is an interconnecting unit that provides protected supply to many electrical loads by means of fuses.

- The BCM is the configuration master for the vehicle. As the configuration master, the BCM broadcasts configuration data over the bus whenever the ignition is in the RUN state.
- Receives hardwired input from sensors and switches
- Provides logic and output control of certain electrical systems
- Provides load shedding logic and control
- Supports flashing (reprogramming) of itself
- Is located behind the left kick panel

Some advantages of the BCM include:

- CAN message optimizations
- Controls all exterior lighting outputs
- Intelligent Battery Sensor (IBS) connection on LIN to BCM
- Interior Lighting and Dimmable “Mood” Lighting

OPERATION

The BCM uses semiconductors or solid-state electronics, including transistors, to perform some of its required functions.

A transistor:

- Is similar to a relay
- Is used to turn an electrical circuit ON or OFF
- Is controlled by another circuit
- Has no moving parts
- Is an integral part of the Electronic Control Unit (ECU) circuit board
- Is often referred to as a “driver”

In the case of the BCM, the following drivers are used to distribute power to various electrical circuits:

- High Side Driver (HSD)
- Low Side Driver (LSD)

If a HSD or LSD is used, it will often be indicated on the wiring diagram by the word “ELECTRONICS” or “PCB” next to a dashed-box inside the ECU.

HSD:

- Provides battery voltage (+) to power the load device requiring operation
- Can be used by an ECU to switch power (+) to an electrical circuit, which is typically grounded through its harness and associated circuitry

Some common examples of how the BCM uses a HSD include the:

- Horn
- Starter relay
- Ignition Run-Start relay
- Washer Pump

LSD:

- Provides a ground (-) for the load device requiring operation
- Can be used by an ECU to switch ground (-) to an electrical circuit, which is typically powered through its harness and associated circuitry

BCM FUNCTION

The BCM will gate messages among all modules on the following bus networks:

- CAN-Chassis (CAN-C)
- CAN-Interior High Speed (CAN-IHS)
- LIN

The BCM provides the following diagnostic features:

- Diagnoses and reports hundreds of Diagnostic Trouble Codes (DTCs)
- Monitors the CAN bus for failures and logs network DTC “U” communication codes

LIN MASTER - The BCM is a LIN master module to the following components:

- Intelligent Battery Sensor (IBS)
- Steering Wheel Switches (SWS) via the Steering Column Control Module (SCCM)
- Electronic Overhead Module (EOM)
- Humidity Light Rain Sensor Module (HLRSM)
- Integrated Center Stack (ICS) module
- Power Inverter Module (PIM)
- Heated Seat Switches
- Wireless Charging Pad Module
- Inside Rearview Mirror

OPERATION CONTROL

The BCM operates the following functions:

- Exterior lighting
- Washer and Wiper control
- Ignition control
- Horn
- Power Locks
- Interior Lighting
- Power windows motors

Several inputs are used to alert the BCM to become active. The hardware wake-up inputs include:

- Headlamp Switch
- Hazard Switch
- Vehicle Access Point (VAP) ajar switches
- Interior lamp load detection
- The BCM will also wake-up from module messages from the CAN-C, CAN-IHS, or LIN communication bus networks

STARTING SYSTEM MASTER

The BCM is the starting system master.

- Uses ignition position bus messages from the Radio Frequency Hub (RF-Hub) module to generate vehicle ignition position (commanded ignition position).
- Works with the Powertrain Control Module (PCM) and various starting system components to start the vehicle.
- Signals the RF-Hub module that the starting attempt has begun or has completed (engine may or may not be running).

MODES OF OPERATION

Customer Mode:

- All features will work as designed for the customer
- This mode is set by the dealer prior to vehicle delivery

Ship Mode:

- The BCM mode will be set to “Ship Mode” by the Certification test at the end of the vehicle assembly process
    - This mode will be set after all electrical testing is completed and the vehicle is ready to be shipped
- In Ship mode many non-critical vehicle features are disabled, minimizing any unnecessary battery drainage during shipping and storage
- The BCM will broadcast the “Ship Mode” message over the vehicle CAN bus so all other vehicle modules will receive the “Ship Mode” message and respond accordingly

The different BCM operating modes can be changed and verified using the scan tool. In addition to using the scan tool to verify and change the BCM mode, you can set a vehicle to/from Ship Mode by following these steps:

1. Place the ignition in the RUN position.
2. Turn on the four-way emergency flashers
3. Press and hold the left steering wheel “up” button for approximately 5 seconds.
4. The vehicle will switch modes.

The modes can be switched back and forth by using this method.

POWER ACCESSORY DELAY:

The BCM manages the Power Accessory Delay (PAD) system for the vehicle.

The PAD feature provides power to some accessory features such as power windows and sunroofs so that they can remain active after the ignition is cycled off. This allows the customer to finish closing windows, sun roofs etc. without having to keep the ignition system active. On vehicles equipped with a customer selectable options, the PAD time is programmable. The feature will time out after a specified period of time and is terminated when either front door is opened. PAD does not function when the vehicles ship mode feature is active.

BATTERY SAVER MODE

The Intelligent Battery Sensor (IBS) communicates with the Body Control Module (BCM) over the Local Interface Network (LIN) bus and provides the BCM with battery voltage, current temperature, and State Of Charge (SOC) information. The BCM uses SOC and voltage of the battery, directly measured by the IBS, to determine load shedding strategies.

When the load shed criteria are met, load shed level messages are broadcast by the BCM on the Controller Area Network (CAN) bus. The BCM turns off loads under its control, and passes on the message to a secondary control device to turn off loads. All load shedding is conducted in an orderly and progressive manner to avoid electrical power system instability and to minimize customer anxiety and concerns.

To enter the load shed operation, three conditions must be met:

1. The engine must be running
2. The battery SOC must be less than or equal to 70%
3. The battery voltage measured by the IBS must be less than, or equal to 12.2 V

When these three conditions are met, the load shed operation begins. The Battery Saver On message is displayed on the Instrument Panel Cluster (IPC) to inform the driver that actions are being taken to save the battery. Below is a list of prioritized loads that are shed in sequence.

- Load Shed Level 1 - None (reserved by engineering for future developments)
- Load Shed Level 2 - When there is a net charge loss of 7.5 amp hours (Ah), the heated seats and heated steering wheel system take load reduction actions (when equipped).
- Load Shed Level 3 - When there is a net charge loss of 10 Ah, the heated cooled cupholders are turned off (if equipped).
- Load Shed Level 4 - When there is a net charge loss of 12.5 Ah, the rear defroster and heated mirrors are turned off.
- Load Shed Level 5 - When there is a net charge loss of 15 Ah, the Heating, Ventilation, and Air Conditioning (HVAC) system takes load reduction actions.
- Load Shed Level 6 - When there is a net charge loss of 17.5 Ah, the power inverter system is turned off (if equipped).
- Load Shed Level 7 - When there is a net charge loss of 20 Ah, the audio and telematics system takes load reduction actions.

Charging System:

- The charging system is independent from load reduction. The charging system performs a diagnostic on the charging system continuously.
- If the Charging System Light is on it may indicate a problem with the charging system.

Loss of the battery charge may indicate one or more of the following conditions:

- The charging system cannot deliver enough electrical power to the vehicle system because the electrical loads are larger than the capability of charging system. The charging system is still functioning properly.
- Turning on all possible vehicle electrical loads (HVAC to max settings, exterior and interior lights, overloaded power outlets +12V, 115V Alternating Current (AC), Universal Serial Bus (USB) ports) during certain driving conditions such as city driving, towing, and frequent stopping.
- Installing options like additional lights, up-fitters, audio systems, alarms and similar devices.
- Unusual driving cycles (short trips separated by long parking periods).
- The battery aging.
- The vehicle was parking for extended period of time (weeks, months).
- The battery was recently replaced and was not charged completely.
- The battery was discharged by an electrical load left on when the vehicle is parked.
- The battery was used during parking time to supply radio, lights, chargers, +12V portable appliances like vacuum cleaner's, game consoles and similar devices.

BACKUP ALARM

The backup alarm is a BCM controlled customer selectable option that sounds off when the vehicle is in reverse gear. The BCM receives the PRND state from the Transmission Control Module (TCM), and if **R**everse is engaged, the BCM activated the backup alarm relay via a hardwired signal. When the transmission is no longer engaged in the **R**everse gear, the BCM deactivates the relay.