EXTERIOR LAMPS - OPERATION

OPERATION

Following are paragraphs that briefly describe the operation of each of the major exterior lighting systems. The lamps and the hard wired circuits between components related to the exterior lighting system may be diagnosed using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods will not prove conclusive in the diagnosis of the exterior lighting system or the electronic controls or communication between modules and other devices that provide some features of the exterior lighting system. The most reliable, efficient, and accurate means to diagnose the exterior lighting system or the electronic controls and communication related to exterior lighting system operation requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

AUTOMATIC HEADLAMPS

The automatic headlamp system includes the headlamp switch, the Body Control Module (BCM) (also known as the Common Body Controller/CBC), and the Twilight Sensor on the top of the instrument panel.

The Twilight Sensor provides an ambient light level input to the A/C - heater control whenever the ignition switch is in the ON position. The sensor is powered on by the HVAC control module. The A/C - heater control responds to this input by sending the appropriate electronic **light level** messages to the BCM over the Controller Area Network (CAN) data bus. When the **AUTO** (Automatic) position is selected with the headlamp switch, the BCM receives a hard wired multiplex input from the headlamp switch. The BCM also receives electronic messages over the CAN data bus from the PCM indicating the engine is running.

NOTE: If the truck is equipped with Light Rain Sensing Module (LRSM) and tunnel detection feature is enabled then the input for automatic headlamps is taken from the LRSM.

The BCM responds to these input conditions by automatically controlling the selected headlamp bulbs or lighting elements through the right and left low or high beam driver circuits to illuminate the headlamps. The BCM also remembers which beams (low or high) were selected when the headlamps were last turned OFF, and energizes those beams and lamps again the next time it turns the headlamps ON.

Headlights On With Wipers - When this feature is active, the headlights will turn on approximately 10 seconds after the wipers are turned on if the headlight switch is placed in the AUTO position. In addition, the headlights will turn off when the wipers are turned off, if they were turned on by this feature. The feature is programmable on/off through the Electronic Vehicle Information Center (EVIC) or through the Radio Receiver Module (RRM) screen display.

BACKUP LAMPS

The backup (or reverse) lamps have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured to the body sheet metal within the passenger compartment. The Powertrain Control Module (PCM) continually monitors a hard wired multiplex input from the Transmission Range Sensor (TRS), then sends the appropriate electronic **transmission gear selector status** messages to other electronic modules over the CAN data bus. Whenever the ignition switch is in the ON position and the Body Control Module (BCM) (also known as the Common Body Controller/CBC) receives an electronic message indicating the status of the transmission gear selector is REVERSE, it provides a battery voltage output to the backup lamps on the backup lamp control output circuit.

BRAKE LAMPS

The brake (or stop) lamps and the Center High Mounted Stop Lamp (CHMSL) each have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a ground screw to the body sheet metal within the passenger compartment. The Controller Antilock Brake (CAB) (also known as the Antilock Brake Module/ABM or Antilock Brake System/ABS module) monitors a hard wired input from the brake pedal position sensor, which is actuated by movement of the brake pedal arm. When the CAB receives an input from the brake pedal position sensor indicating movement of the brake pedal arm it responds by sending the appropriate electronic **brake lamp switch** status message to the BCM over the CAN data bus. The BCM then controls brake lamp and CHMSL illumination through High Side Drivers (HSD) on the left and right stop lamp control circuits. The brake lamp function of the trailer tow wiring is also controlled by an output from the BCM based upon the electronic **brake lamp switch** status messages received from the CAB.

DAYTIME RUNNING LAMPS

Vehicles equipped with this option or manufactured for sale in Canada illuminate multiple Light-Emitting Diode (LED) units in both front lamp units when the engine is running, the parking brake is released and the exterior lamps are turned OFF. The BCM must be programmed appropriately for this feature to be enabled. Once enabled, anytime the BCM receives electronic messages over the CAN data bus from the PCM indicating the engine is running, a hard wired multiplex input from the headlamp switch indicating the status of the headlamp switch is OFF and a hard wired input from the park brake switch indicating that the parking brake is released, the BCM provides an output to the appropriate LED units to produce illumination. If a turn signal is activated while the DRL units are active, the DRL for the same side of the vehicle as the indicated turn is extinguished until the turn signal is cancelled to permit clear signal visibility.

The Daytime Running Lamps (DRL) are illuminated when the engine is started and the transmission is in any gear except park. The lights will illuminate at less then 50% of normal intensity. If the parking brake is applied, the DRL will turn OFF. Also, if a turn signal is activated, the DRL on the same side of the vehicle may turn off for the duration of the turn signal activation. Once that turn is completed and the turn signal depletes, the DRL lamp will illuminate once again.

FRONT FOG LAMPS

Vehicles equipped with optional front fog lamps include a front fog lamp switch integral to the headlamp switch on the instrument panel. The front fog lamps have a path to ground at all times through their connection to the headlamp and dash wire harness and a takeout with an eyelet terminal that is secured to the body sheet metal. The BCM monitors a hard wired multiplex input from the headlamp switch to determine whether the fog lamps are selected.

When the BCM input from the headlamp switch indicates the fog lamps are selected, it controls front fog lamp

operation by providing a battery voltage output to the fog lamps through the right and left front fog lamp control circuits. The BCM also sends the appropriate electronic messages to the Instrument Cluster (IC) (also known as the Common Instrument Cluster/CIC) to illuminate or extinguish the front fog lamp indicator. The BCM will automatically de-energize the front fog lamps any time the headlamp high beams are selected, except on vehicles manufactured for certain export markets.

The BCM also provides a battery saver (load shedding) feature for the front fog lamps, which will turn these lamps OFF if they are left ON for more than about eight minutes with the ignition switch in the LOCK position, if there is a charging system failure, or if the electrical system voltage falls below about 11.75 volts for more than about 30 seconds.

Each front fog lamp includes an integral adjustment screw to be used for static aiming of the fog lamp beams.

NOTE: If equipped with the stop start system, the fog lamps will turn off during a the stop event. Once the vehicle has restarted, the fog lamps will turn back on.

HAZARD WARNING LAMPS

The hazard warning system includes the IC, the BCM and the hazard switch in the instrument panel switch bank of the Integrated Center Stack (ICS) module located in the center stack area of the instrument panel. The hazard switch provides a hard wired input to the BCM. When the BCM receives an input from the hazard switch, it controls hazard warning system operation and flash rate by controlling battery voltage outputs through high side drivers on the front and rear, right and left turn signal control circuits. On vehicles manufactured for certain export markets where they are required, the BCM provides battery voltage to the repeater lamps through right and left repeater lamp control output circuits based upon the hazard switch input.

The BCM also sends the appropriate electronic messages to the IC over the CAN data bus to control the illumination and flash rate of the right and left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the IC electronic circuit board that emulates the sound emitted by a conventional electromechanical hazard warning flasher.

HEADLAMPS

The headlamp system includes the IC, the BCM, the headlamp switch on the instrument panel, the Steering Column Module (SCM), the Steering Angle Sensor (SAS) and the multi-function switch on the steering column. The headlamp bulbs have a path to ground at all times through their connection to the headlamp and dash wire harness. The headlamp and dash wire harness has takeouts with eyelet terminals that are secured to the body sheet metal. The BCM will store a Diagnostic Trouble Code (DTC) for any shorts or opens in the headlamp circuits.

The BCM monitors a hard wired multiplex input to determine the status of the headlamp switch on the instrument panel, while the SCM monitors a hard wired multiplex input from the multi-function switch to determine whether the headlamp high or low beams are selected. The SCM sends the appropriate **headlamp beam select switch status** messages to the SAS over the LIN data bus. The SAS then relays the appropriate electronic **headlamp beam request** messages to the BCM over the CAN data bus. The BCM responds to these input conditions by controlling a PWM voltage output to the headlamps through high side drivers on the right and left low and high beam feed circuits to illuminate the selected headlamp filaments. The BCM also sends the appropriate electronic messages to the IC to control the illumination of the high beam indicator.

The BCM provides a battery saver (load shedding) feature for the headlamps, which will turn these lamps OFF if they

are left ON for more than about eight minutes with the ignition switch in the LOCK position.

The SCM provides a fail-safe feature for the headlamps, which will cause the BCM to turn the low beam headlamps ON automatically if there is no input available from the multi-function switch. The BCM provides a fail-safe feature for the headlamps, which will turn the low beam headlamps ON automatically if there is no input available from the headlamp switch. The BCM also provides a fail-safe feature for the headlamps that will turn the headlamps ON automatically whenever a loss of LIN bus or CAN bus communication is detected with the ignition switch in the ON position.

Each headlamp includes integral reflector adjustment screws to be used for static aiming of the headlamps.

HEADLAMP TIME DELAY

The headlamp delay feature includes the headlamp switch and the BCM. In vehicles with the optional EVIC, this feature is customer programmable using the EVIC switch pod and the EVIC electronic display unit to select delay intervals of 0 seconds (disabled), 30 seconds, 60 seconds and 90 seconds. If the headlamp switch remains in the headlamp **AUTO** (Automatic) position until after the ignition switch status transitions to OFF, then the headlamps will remain illuminated until after the selected delay interval has elapsed. The park lamps will not stay ON during the headlamp time delay interval. The default delay interval is 90 seconds, but can be reprogrammed by the customer using the EVIC switch pod.

PARK LAMPS

The park lamps system includes the EMIC, the BCM and the headlamp switch on the instrument panel. The front park lamp and side marker lamp bulbs each have a path to ground at all times through their connection to the FEM wire harness. The FEM wire harness has takeouts with eyelet terminals that are secured by ground screws to the body sheet metal within the engine compartment. The rear park lamp, side marker lamp and license plate lamp bulbs have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a ground screw to the body sheet metal.

The EMIC monitors a hard wired multiplex input from the headlamp switch, then sends the appropriate electronic **headlamp switch status** messages to the BCM over the CAN data bus. The BCM responds to these messages by providing a battery voltage output to the appropriate lamp bulbs through high side drivers on the front and rear, right and left park lamp feed circuits.

The BCM provides a battery saver (load shedding) feature for the park lamps, which will turn these lamps OFF if they are left ON for more than about eight minutes after the electronic **ignition switch status** messages from the WIN indicate the ignition LOCK position is selected. The EMIC provides a fail-safe feature for the park lamps, which will send an electronic message to the BCM to turn these lamps ON automatically if it detects no input from the headlamp switch. The BCM also provides a fail-safe feature for the park lamps that will turn the headlamps and park lamps ON automatically whenever a loss of CAN bus communication is detected when the electronic **ignition switch status** messages from the WIN indicate the ignition ON position is selected.

TRAILER TOW WIRING

Vehicles equipped with an optional trailer tow preparation package are shipped from the factory with a trailer tow wiring harness and 4-pin trailer connector that is packaged with an instruction card and placed in the glove box of the vehicle. The trailer tow harness includes three relays designed to isolate the trailer park lamps as well as right and left turn signal and stop lamp lighting from the rear vehicle lighting and prevent overloading of the park, turn

signal and stop lamp lighting drivers in the BCM. These vehicles also include a dedicated trailer tow park lamp control output circuit protected by a 15 ampere fuse located in the BCM.

In case of any electrical failure, the BCM will store a Diagnostic Trouble Code (DTC) for this condition.

TURN SIGNAL LAMPS

The turn signal lamps system includes the multi-function switch on the steering column, the SCM, the EMIC and the BCM. The front turn signal lamp bulbs each have a path to ground at all times through their connection to the FEM wire harness. The FEM wire harness has takeouts with eyelet terminals that are secured by ground screws to the left inner fender support within the engine compartment. The rear turn signal lamp bulbs have a path to ground at all times through a takeout and eyelet terminal of the body wire harness that is secured by a ground screw to the body sheet metal or the frame. On vehicles with the optional outside rear view mirror lamp modules, the lamp modules receive a path to ground from their respective driver or passenger door module.

The SCM monitors a hard wired multiplex input from the multi-function switch to determine the status of the turn signal switch, then sends the appropriate electronic **turn signal switch status** messages to the EMIC over the LIN data bus. Then the EMIC relays an electronic **turn signal request** message to the BCM over the CAN data bus. The BCM responds to these messages by controlling a battery voltage output and the flash rate for either the right or left turn signal lamps through high side drivers on the appropriate front and rear, right or left turn signal feed circuits. The BCM also sends the appropriate electronic messages back to the EMIC to control the illumination and flash rate of the right or left turn signal indicators, as well as to control the click rate of an electromechanical relay soldered onto the EMIC electronic circuit board that emulates the sound emitted by a conventional turn signal flasher. On vehicles with the optional outside rear view mirror lamp modules, the EMIC also sends the appropriate electronic messages over the LIN bus to the driver and passenger door modules to control the illumination and flash rate of those lamps.

The EMIC also provides a **turn signal ON warning** that will generate repetitive chimes to indicate that a turn signal has been active continuously for 1.6 kilometers (1 mile) with the vehicle speed greater than 22 kilometers-per-hour (15 miles-per-hour).