Table of Contents

1. BACK-UP LIGHTS

1.1. CIRCUIT FUNCTIONS

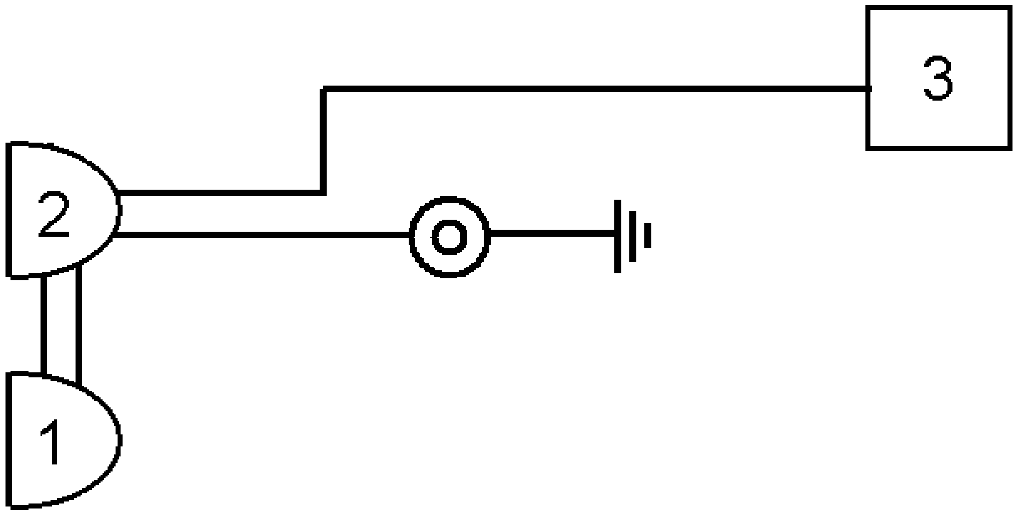

Figure 410 Back–Up Lights Function Diagram

1. RIGHT BACK–UP LIGHT
2. LEFT BACK–UP LIGHT
3. BACK–UP LIGHT SIGNAL FROM TRANSMISSION CIRCUITS (SEE TRANSMISSION SECTION)

The vehicle back-up lights come on when the vehicle transmission is shifted into reverse. Depending on the transmission installed on the vehicle, the lights are controlled by a switch on the transmission or a signal from the transmission electronic control unit (ECU). Refer to the Back–Up Lights Function Diagram.

This section only covers circuits from the back-up light turn signal splice (4810) to the tail lights. Refer to the transmission section for information on the circuits from the transmission to the back-up light turn signal splice.

1.2. DIAGNOSTICS

There are no diagnostic trouble codes (DTC's) associated with the back-up light circuits.

A fault in the back-up light circuits will be apparent when the transmission is shifted into reverse and the lights don't come on and back-up lamps are not burned out.

1.3. FAULT DETECTION MANAGEMENT

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to the Back–Up Lights Connector Diagram

Problems in the back-up light circuits can be caused by burned out lamps, a blown fuse, a short, an open, a faulty relay, a faulty switch on the transmission, or a failed transmission ECU.

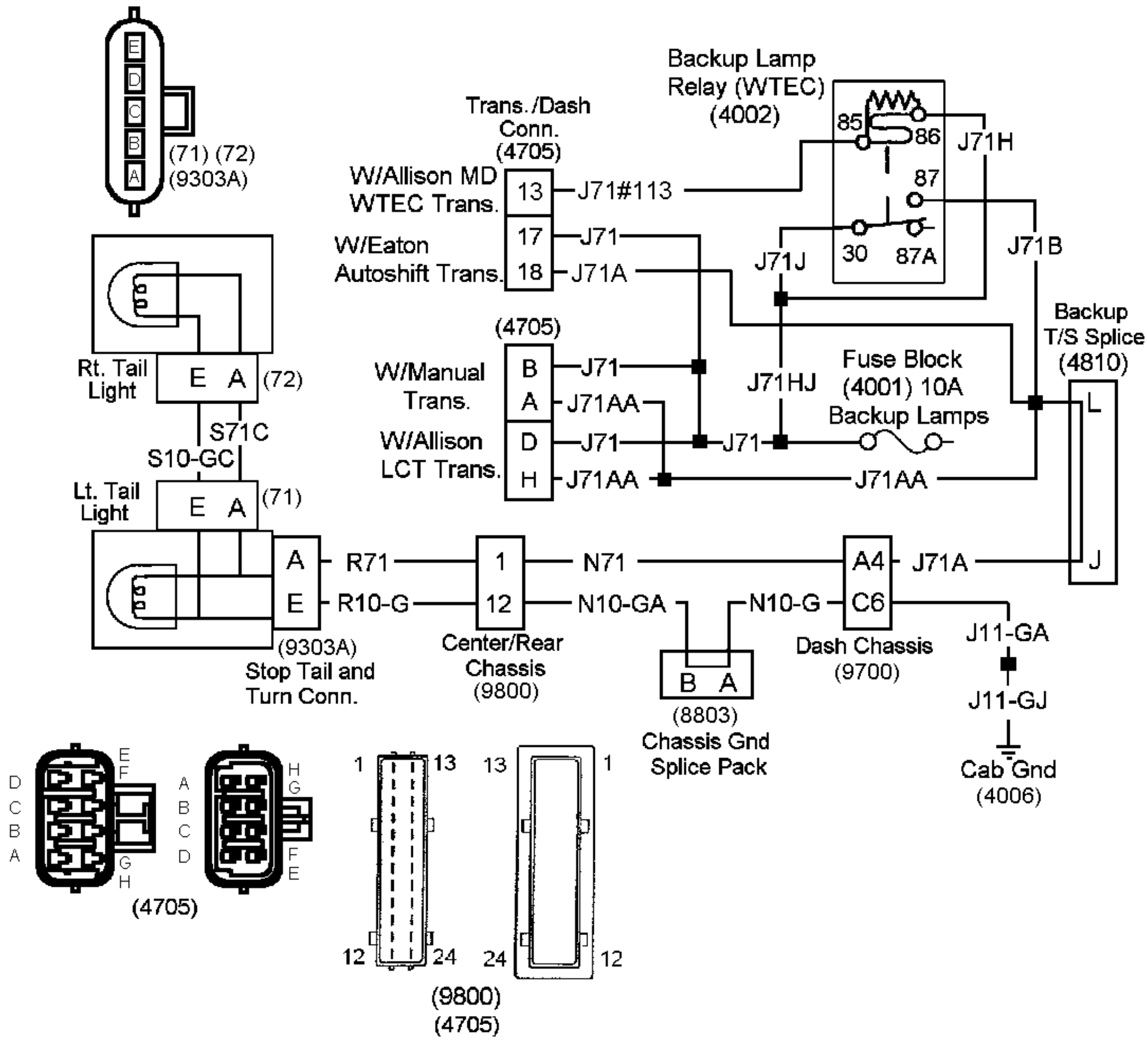

Figure 411 Back–Up Lights Connector Diagram—Always Refer to the Circuit Diagram Book for Latest Circuit Information.

(71) LEFT TAIL LIGHT CONNECTOR
(72) RIGHT TAIL LIGHT CONNECTOR
(4705) TRANSMISSION/DASH CONNECTOR (TO TRANSMISSION CIRCUITS)
LOCATED IN ENGINE COMPARTMENT BY WIPER MOTOR BRACKET
(4810) BACK–UP LIGHT TURN SIGNAL SPLICE
LOCATED NEAR ENGINE POWER DISTRIBUTION CENTER
(8803) CHASSIS GROUND SPLICE PACK
(9303) STOP TAIL AND TURN CONNECTOR
(9700) CHASSIS DASH INTERCONNECT
(9800) CENTER CHASSIS/REAR CHASSIS CONNECTOR

Table 284 Back–Up Lights Circuit Tests

Stop Tail and Turn connector (9303) Check with ignition on, transmission in reverse and (9303) disconnected.		
Test Points	Spec.	Comments
With transmission in reverse, (9303) cavity A to ground.	12 ± 1.5 volts	If voltage is missing, check for blown fuse, short or open in circuits between (9303) cavity A and transmission backup light switch circuits. Perform the Transmission/Dash Connector (4705) Transmission Backup light Switch check.
With transmission in reverse, (9303) cavity A to cavity E.	12 ± 1.5 volts	If voltage is missing, check for open in ground circuits between (9303) cavity E and Cab ground (4006). Perform the Tail Light Connector (72) Resistance and Voltage checks
With transmission in neutral, (9303) cavity A to ground.	0 volts	If voltage is present, check for faulty transmission backup circuits. (See transmission section)
Transmission/Dash Connector (4705) Transmission Backup light Switch check Check with ignition on, transmission in reverse and (9303) connected.		
Manual Transmission connector (4705), jumper terminals A to B.	Backup lights on.	If backup lights off, see transmission section for switch repair.
Allison LCT Transmission connector (4705), jumper terminals D to H.	Backup lights on.	If backup lights are off, see transmission section for switch repair.
Eaton Autoshift Transmission connector (4705), jumper terminals 18 to 19.	Backup lights on.	If backup lights are off, see transmission section for switch repair.
Allison MD WTEC Transmission connector (4705), jumper terminal 13 to Ground.	Backup lights on.	If backup lights are off, see transmission section for switch repair. Check backup lamp relay (WTEC) (4002) in the engine compartment power distribution center.
Tail Light Connector (72) Resistance checks Check with (9303) disconnected		
Harness connector (72) terminal A to ground	Resistance should read >50K ohms.	If resistance is incorrect check for shorts to ground in both tail light assemblies.
Tail Light Connector (72) Voltage checks Check with transmission in reverse and (9303) connected.		
Harness connector (72) terminal A to ground	12 ± 1.5 volts.	If voltage is incorrect check for open circuits in tail light assemblies.
Harness connector (72) terminal E to terminal A	12 ± 1.5 volts.	If voltage is incorrect check for open in ground circuits in tail light assemblies.

1.4. EXTENDED DESCRIPTION

Refer to the Back–Up Lights Connector Diagram.

When the transmission is shifted into reverse, transmission circuits will apply battery voltage to backup lamp/turn signal splice (4810) and the back-up lights.

Ground for the back-up lights is supplied from ground stud (4006) to stop tail & turn connector (9303) terminal E.

1.5. COMPONENT LOCATIONS

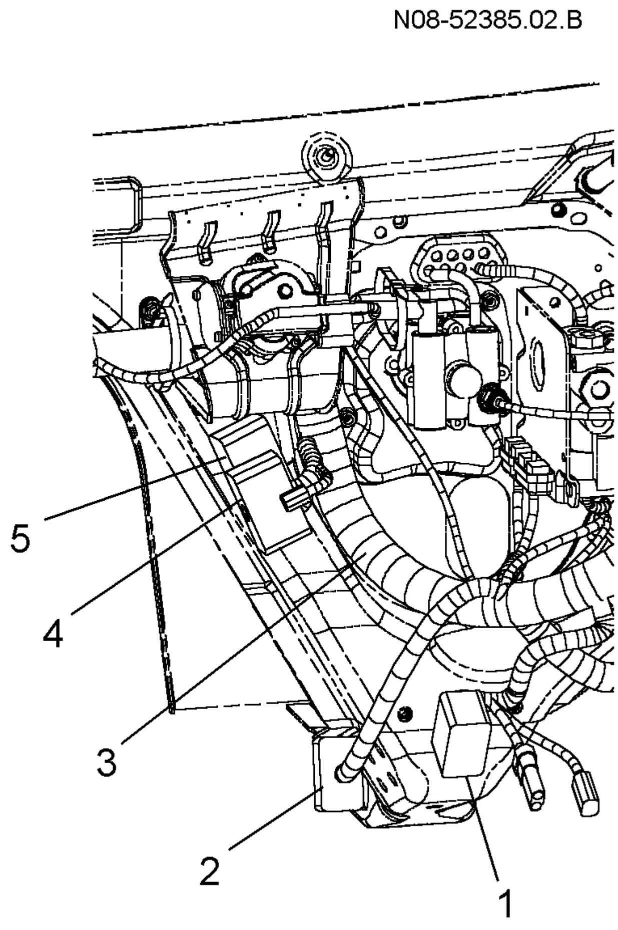

Figure 412 Stop/Turn Signal/Hazard Light Connector Locations (Engine Compartment Looking Toward Cab)

1. FORWARD CHASSIS CONNECTOR (4301)
2. DASH/CHASSIS CONNECTOR (9700)
3. TRANSMISSION CONNECTOR
4. ENGINE CONNECTOR

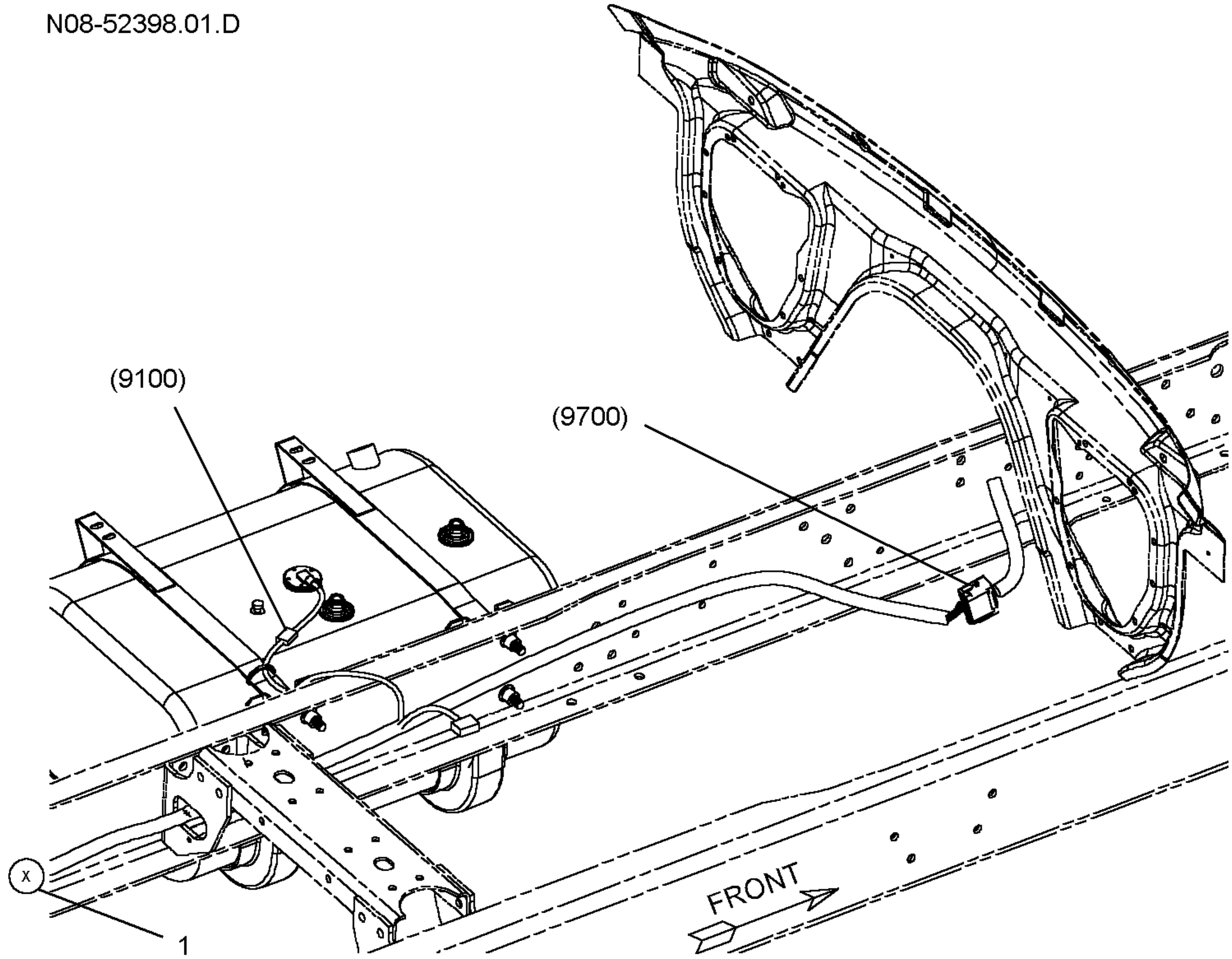

Figure 413 Rear Chassis Wiring Connector Locations

1. HARNESS TO CENTER CHASSIS WIRING
(9100) FUEL LEVEL SENDER CONNECTOR
(9700) REAR CHASSIS CONNECTOR

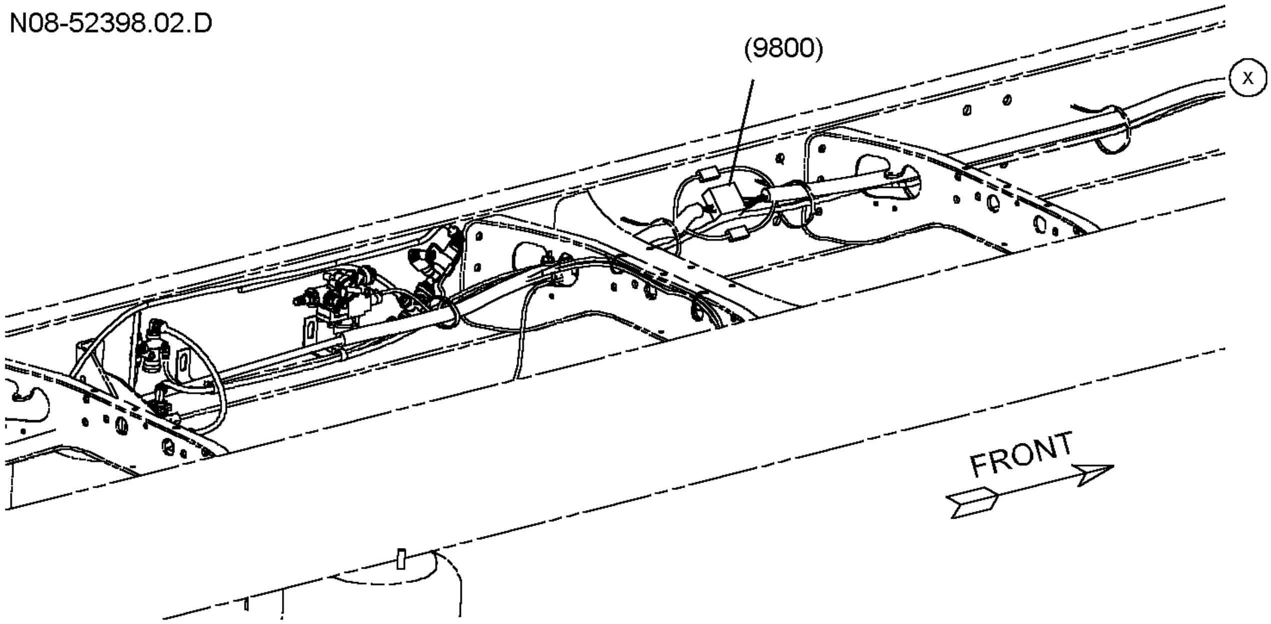

Figure 414 Rear Center Chassis Connector Locations

(9800) REAR CENTER CHASSIS CONNECTOR

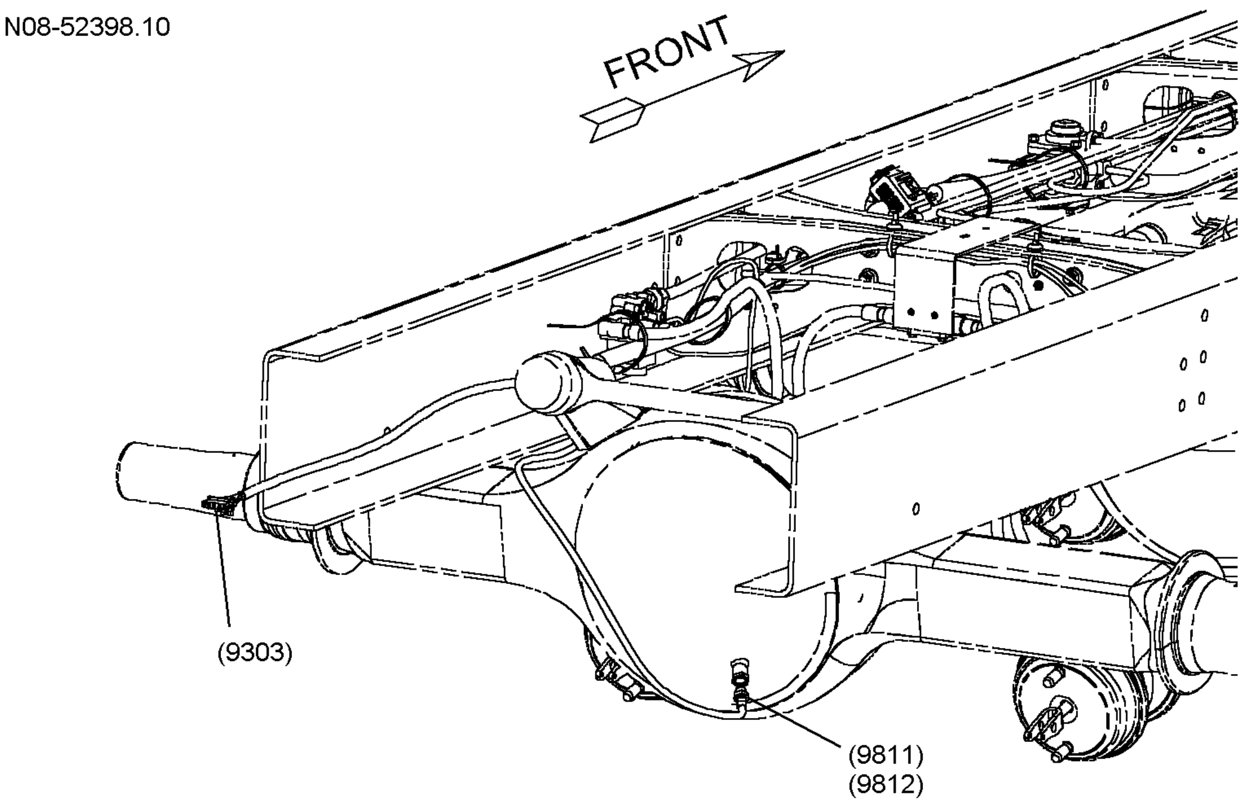

Figure 415 Stop, Tail and Turn Connector Location

(9303) STOP, TAIL AND TURN CONNECTOR

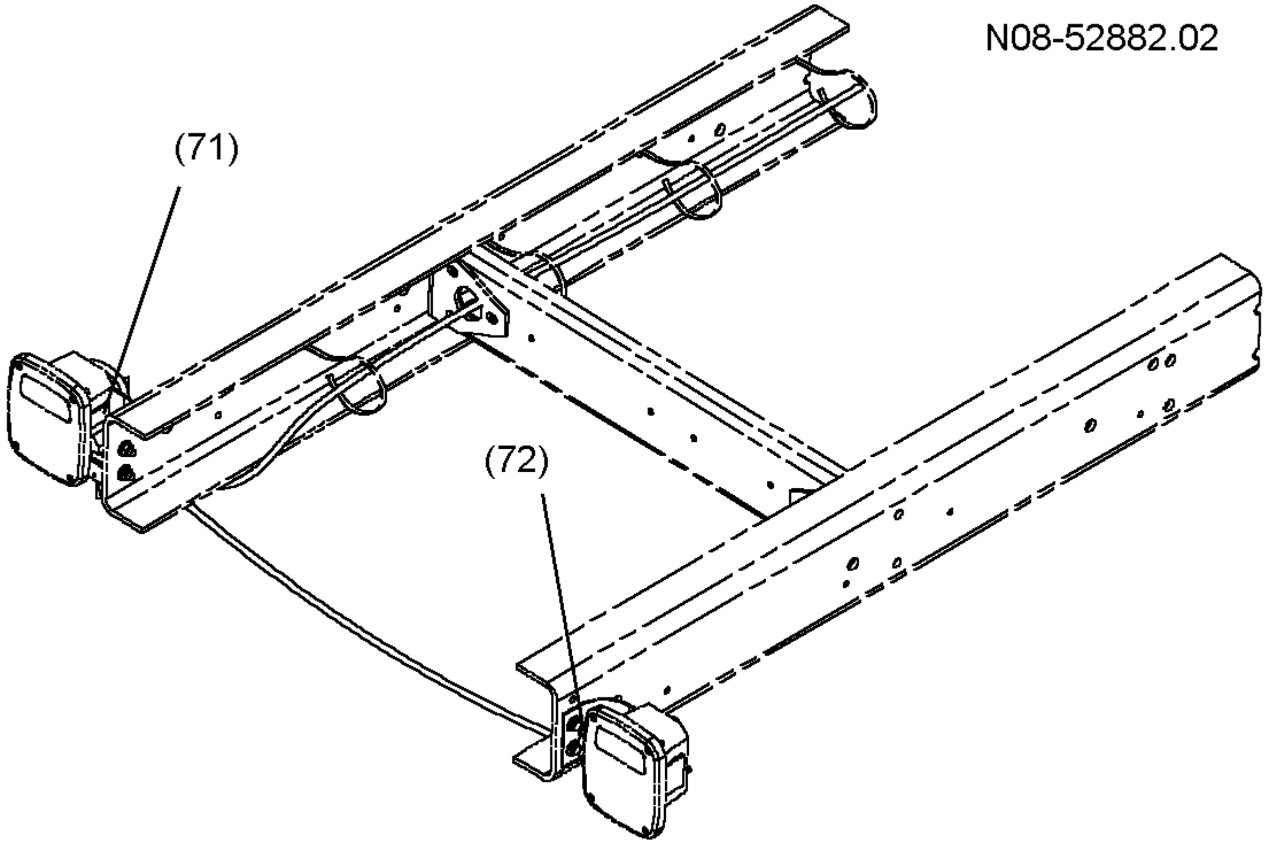

Figure 416 (Typical) Rear Signal Light Connector Locations

(71) LEFT TAIL LIGHT CONNECTOR
(72) RIGHT TAIL LIGHT CONNECTOR

2. ROOF CLEARANCE AND MARKER OR SUNSHADE LIGHTS

2.1. CIRCUIT FUNCTIONS

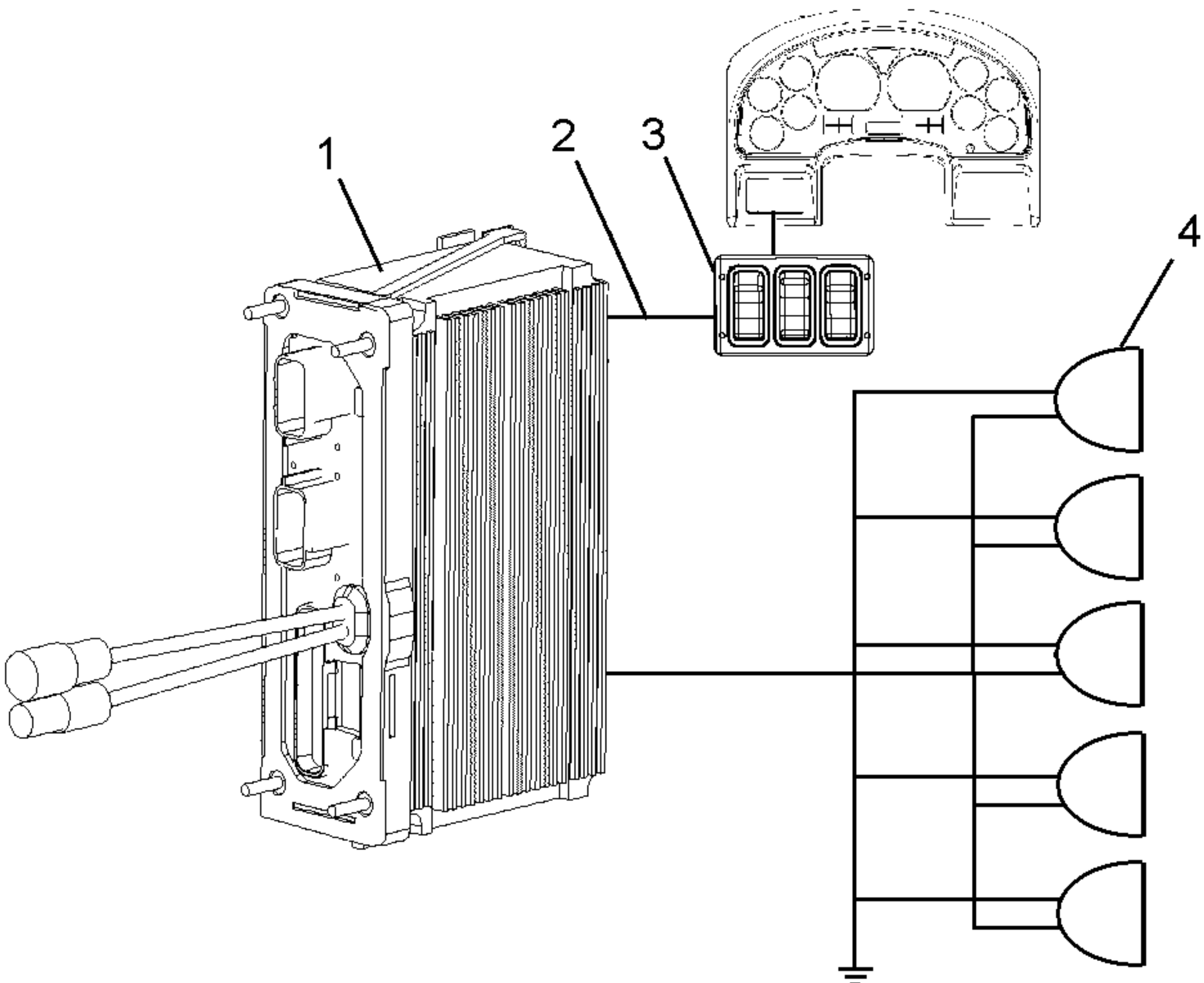

Figure 417 Roof Clearance and Marker or Sunshade Lights Function Diagram

1. ELECTRICAL SYSTEM CONTROLLER
2. DRIVETRAIN J1939 DATA LINK
3. HEADLIGHT PARK LIGHT SWITCH (MOUNTED ON ELECTRONIC GAUGE CLUSTER)
4. CAB ROOF CLEARANCE AND MARKER OR SUNSHADE LIGHTS

Refer to the Roof Clearance and Marker or Sunshade Lights Function Diagram.

NOTE – The clearance or sunshade lights are connected to the park lamp circuits in the ESC. If clearance lights and park lamps are inoperative refer to the Marker, Park and Tail lamps section (See MARKER, PARK AND TAIL LAMPS, page 838) of this manual. If the clearance lights are inoperative but the park lights are working, proceed with this section.

The standard cab roof clearance and marker lights are part of the basic cab design. If a sunshade is installed, the 5 lights are located in the sunshade.

The lights are activated when the headlight switch is in the headlight or park position. The electronic gauge cluster will send a message to the ESC to command the lights on.

The marker interrupt switch will also affect operation of the marker lights, park lights and clearance lights. The lights will turn on while the switch is held on, if the lights were previously off. The lights will turn off while the switch is held on, if the lights were previously on.

The ESC supplies battery voltage to the roof lights, marker and identification lights.

2.2. DIAGNOSTICS

If any of the other park lights are working (only the roof marker lights are inoperative) there will be no diagnostic trouble codes logged.

A short or open in the roof clearance and marker or sunshade light circuits will be apparent when the park or headlights are turned on and the clearance, marker and identification lights don't come on.

The mirror marker lights are also connected to the roof clearance and marker or sunshade light circuits.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to check operation of the park lights and monitor activation of the park light switch. See the diagnostic software manual for details on using the software.

2.3. FAULT DETECTION MANAGEMENT

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Roof Clearance and Marker or Sunshade Lights.

Problems which affect only the roof clearance or sunshade light circuits can be caused by burned out lamps, a short, an open, or a problem in the ESC.

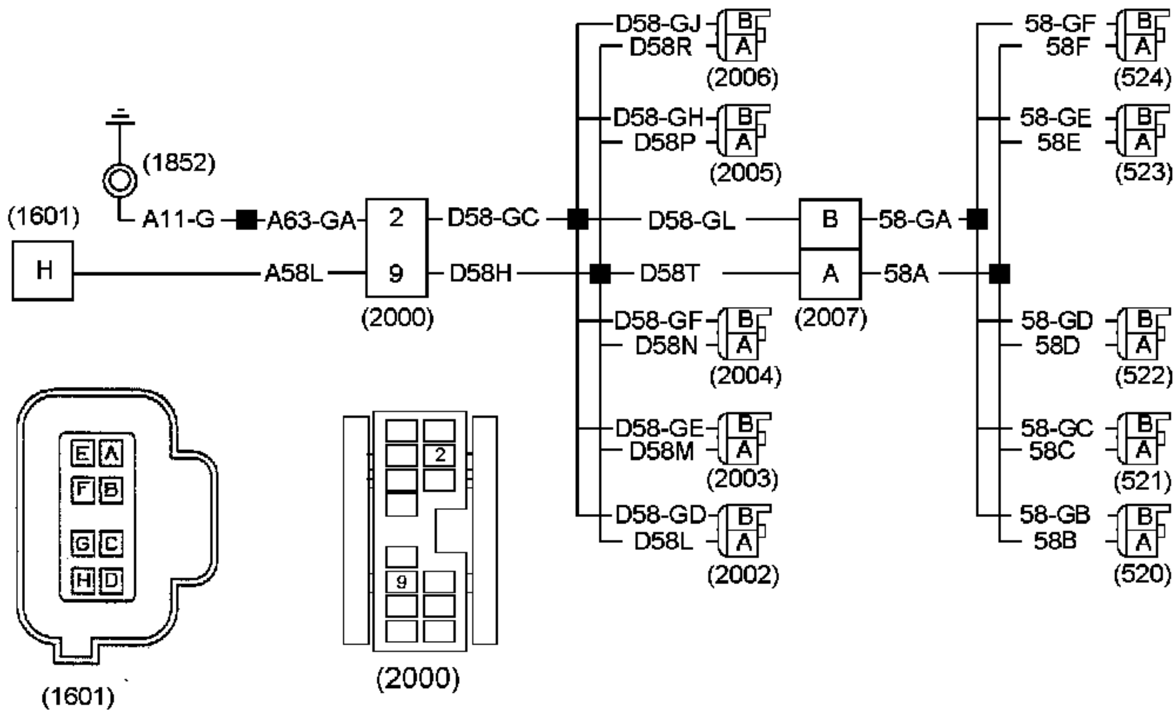

Figure 418 Roof Clearance and Marker or Sunshade Lights — Always Refer to Circuit Diagram Book for Latest Circuit Information

(520)-(524) SUNSHADE CLEARANCE LIGHT CONNECTORS
(1601) ESC BOOSTER CONNECTOR
(1851) CAB GROUND
(2000) ROOF/INSTRUMENT PANEL CONNECTOR
(2002)-(2006) MARKER AND CLEARANCE LAMP CONNECTORS
(2007) SUNSHADE CONNECTOR

Table 285 **Roof Clearance and Marker or Sunshade Lights Circuit Tests**

<table>
<tr><td colspan="3">Roof Instrument Panel Connector (2000) Voltage Checks

With (2000) disconnected and park lights on, check instrument panel harness connector

NOTE – Always check connectors for damage and pushed–out terminals. Also check turn signal assemblies for damage or corrosion.

NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.</td></tr>
<tr><td>Test Points</td><td>Spec.</td><td>Comments</td></tr>
</table>

Table 285 Roof Clearance and Marker or Sunshade Lights Circuit Tests (cont.)

(2000) Socket 9 to ground	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts	If voltage is missing, check for open or short in circuit A58L. A short in circuits A58L or A58S to the mirror lights. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
(2000) Socket 9 to Socket 2	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts	If voltage is missing, check for open in circuits A63–GA or A11–G to ground.
Roof Connector (2000) Resistance checks.		
Test Points	Spec.	Comments
Pin 9 to ground	>1000 ohms	Resistance less than 1000 ohms indicates a short to ground.
Pin 9 to pin 2	< 5 ohms	Resistance greater than 5 ohms indicates open in power circuits or ground circuits to lights.

2.4. EXTENDED DESCRIPTION

Refer to Roof Clearance and Marker or Sunshade Lights.

Roof Clearance and Marker Lights

When the ESC is commanded to turn the roof lights on, the ESC will provide 12 volts to the lights from ESC booster connector (1601) terminal H. The circuit path is from Connector (1601) terminal H through circuit A58L, through roof/IP connector (2000) terminal 9 through D58H to individual circuits splitting out to the lights.

The ground circuit path is from negative stud (1852) through circuit A11–G, circuit A63–GA, roof connector (2000) terminal 2 and circuit D58–GC to individual ground circuits splitting out to the lights.

Sunshade Lights

When the ESC is commanded to turn the roof lights on, the ESC will provide 12 volts to the lights from ESC booster connector (1601) terminal H. The circuit path is from Connector (1601) terminal H through circuit A58L, through roof/IP connector (2000) terminal 9 through D58H and D58T, through sunshade connector (2007) terminal A, through circuit 58A to individual circuits splitting out to the lights.

The ground circuit path is from negative stud (1852) through circuit A11–G, circuit A63–GA, roof connector (2000) terminal 2, through circuit D58–GC and D58–GL, through sunshade connector (2007) terminal B, through circuit 58–GA to individual ground circuits splitting out to the lights.

Marker Interrupt

When the marker interrupt is held on, the switch pack will send a message via the switch data link to the ESC. The ESC will command the lights to go and off as required.

2.5. COMPONENT LOCATIONS

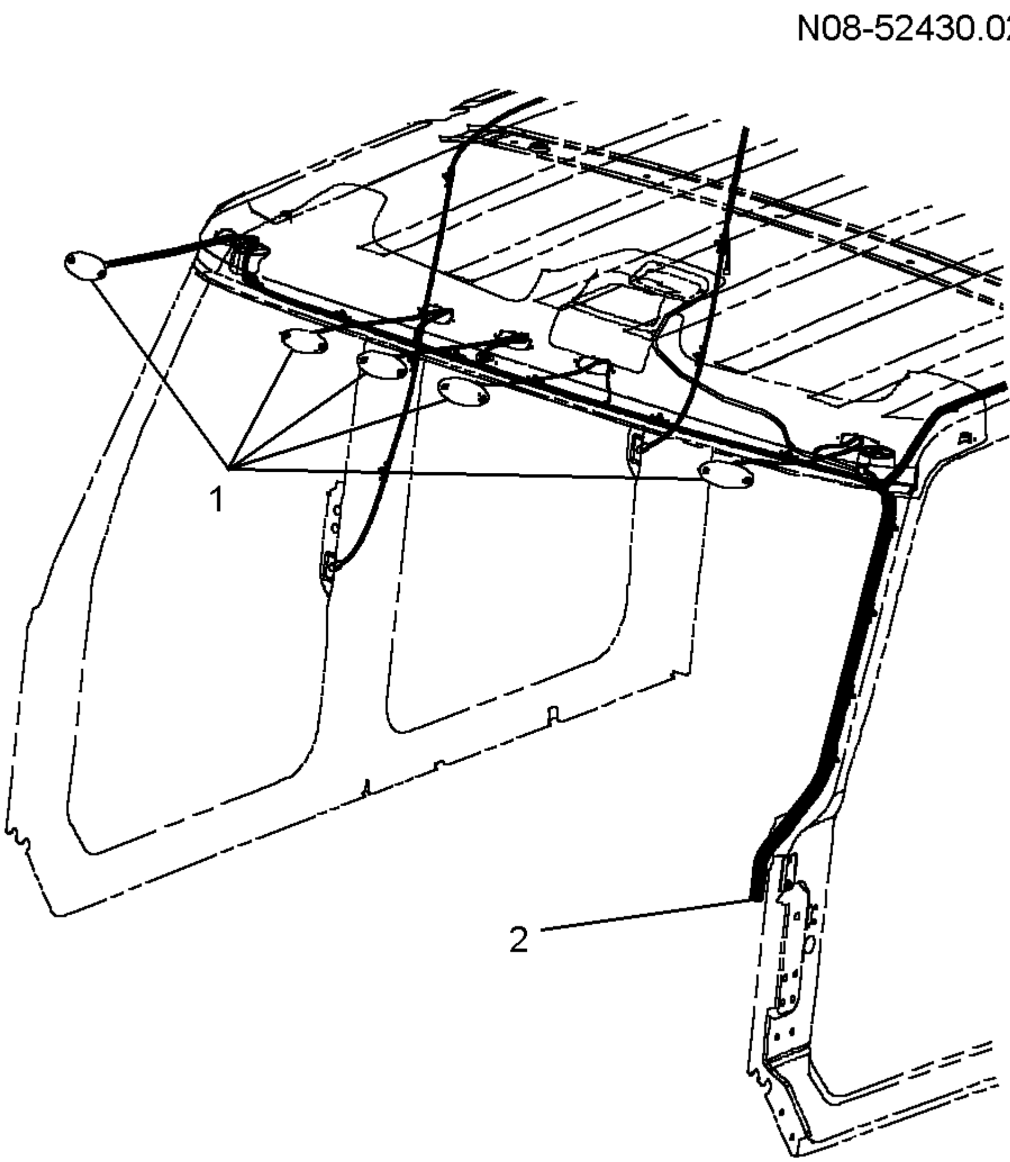

Figure 419 Roof Clearance and Marker Lights

1 CLEARANCE AND MARKER LIGHTS
2. ROOF HARNESS TO ROOF/INSTRUMENT PANEL CONNECTOR (2000)

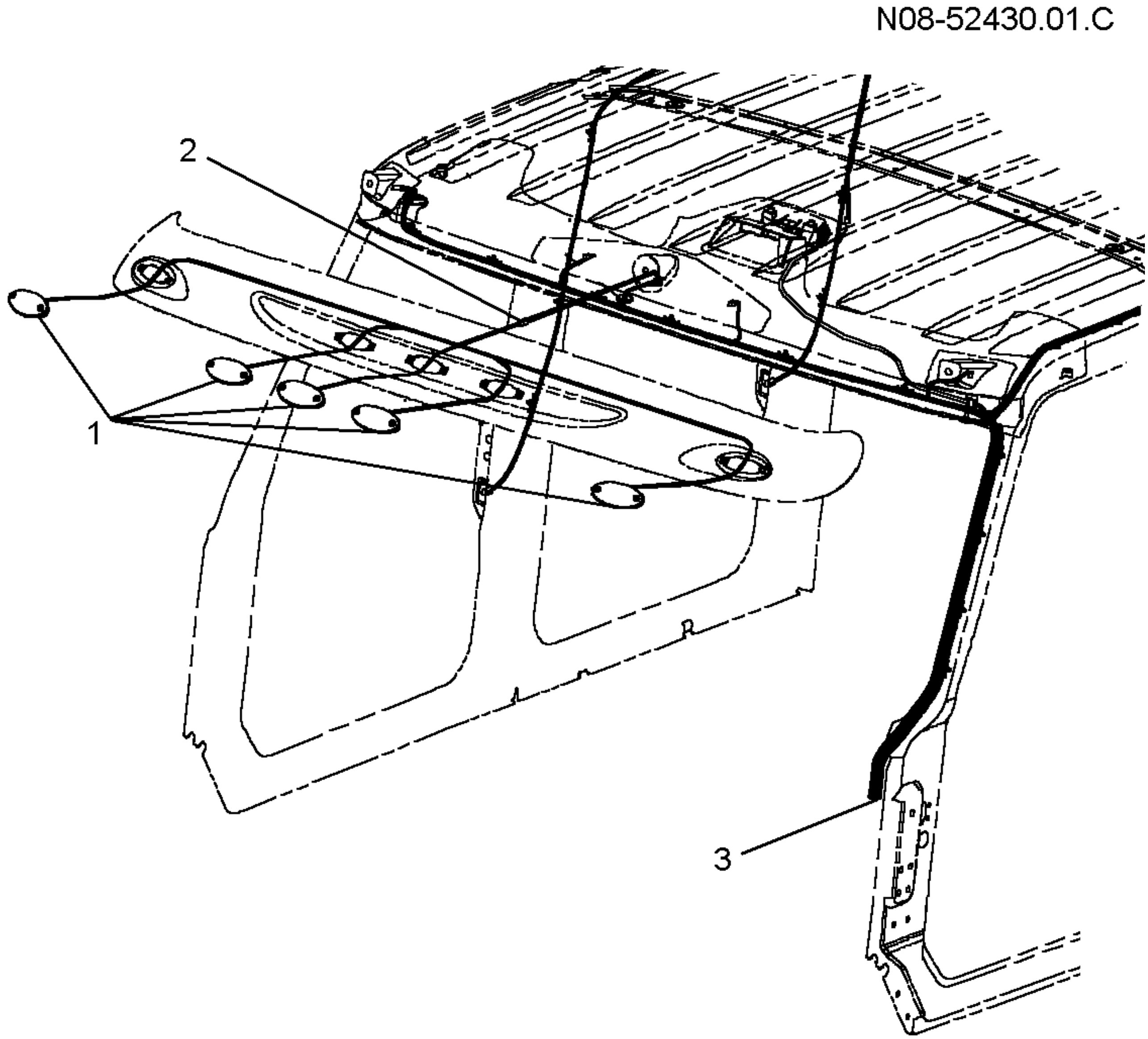

Figure 420 Sunshade Lights

1. SUNSHADE CLEARANCE LIGHTS
2. SUNSHADE CONNECTOR (2007)
3. ROOF HARNESS TO ROOF/INSTRUMENT PANEL CONNECTOR (2000)

3. MARKER, PARK AND TAIL LAMPS

3.1. CIRCUIT FUNCTIONS

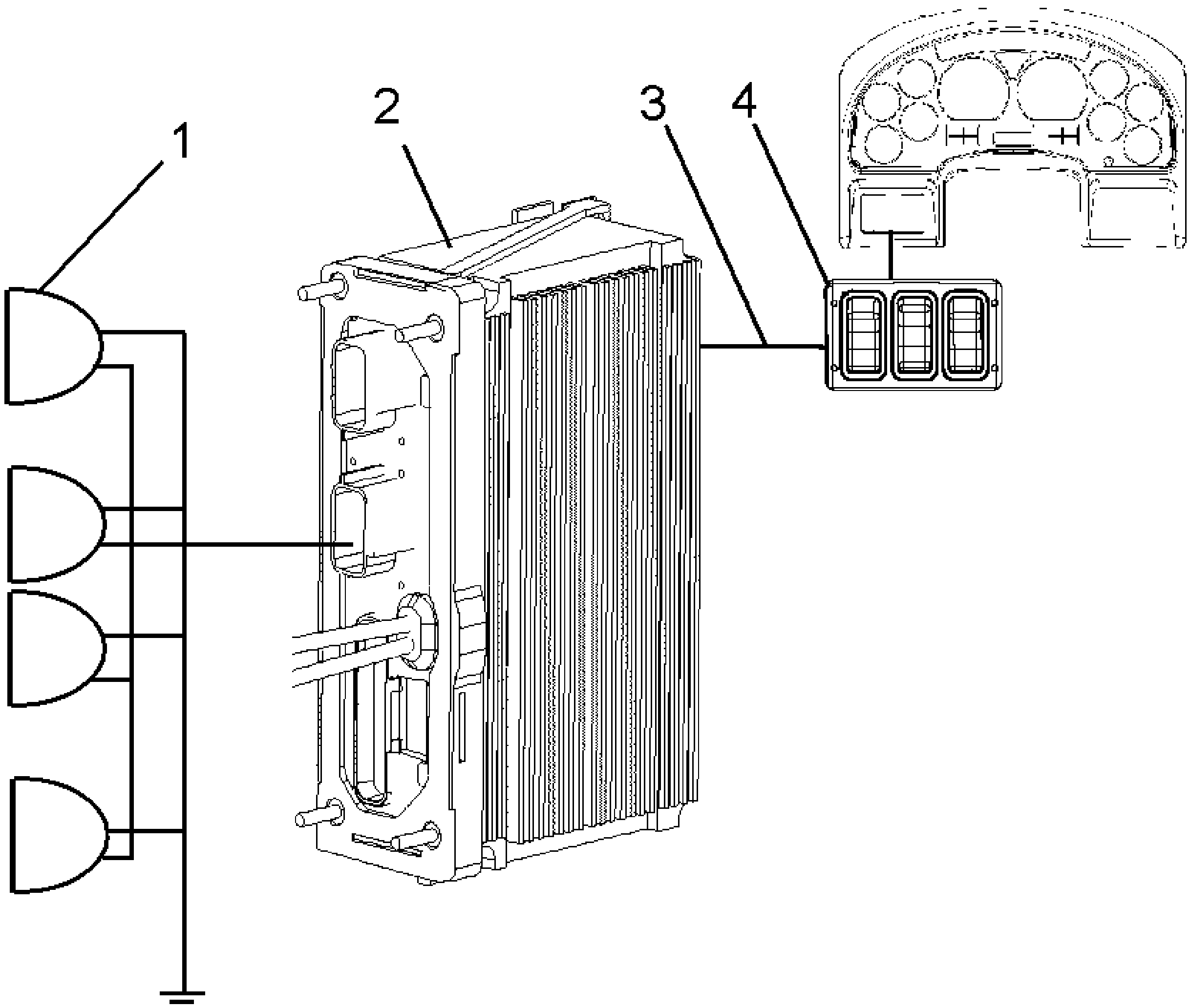

Figure 421 Marker, Park and Tail Lights

1. MARKER, PARK AND TAIL LIGHTS
2. ELECTRICAL SYSTEM CONTROLLER
3. DRIVETRAIN J1939 DATA LINK
4. HEADLIGHT PARK LIGHT SWITCH (PART OF ELECTRONIC GAUGE CLUSTER)

The marker, park and tail lamps are activated when the headlight switch is in the headlight or park position. The electronic gauge cluster will send a message to the ESC to command the lights on. The ESC supplies battery voltage for the marker, park and tail lamps.

The marker interrupt switch will also affect operation of the marker lights and park lights. The lights will turn on while the switch is held on, if the lights were previously off. The lights will turn off while the switch is held on, if the lights were previously on.

The roof clearance and marker lights or sunshade lights are directly connected to the park circuits inside the ESC. The roof or sunshade lights have a separate fuse between their circuits and the ESC. If the clearance lights are inoperative but the park lights work, refer to the Roof Clearance and Marker or Sunshade Section (See ROOF CLEARANCE AND MARKER OR SUNSHADE LIGHTS, page 832)

3.2. DIAGNOSTICS

Refer to Marker, Park and Tail Lights.

If the lights stay on when the headlight switch is in the off position, the problem is most likely a defective headlight switch, switch pack, wiring between the switch pack and the EGC, or a problem in the EGC (the system is designed to turn the park lights on when there is no input to the EGC from the switch).

Should the lights fail to come on when the headlights are on, the problem could be attributed to open or shorted output wiring between the ESC and the tail lights, side marker lights and front marker lights lamps. The ESC has an internal virtual fuse software algorithm to protect output circuits in an over current situation.

A diagnostic trouble code will be logged if there is an over current caused by a short to ground or excessive load (too many accessories) or an open in the circuits between the ESC and the tail lights, side marker lights and front marker lights.

If individual lights are inoperative the problem must be attributed to faulty lamps or open wiring to the individual lamps.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to command the ESC to turn on the lights and monitor activation of the park light switch. See the diagnostic software manual for details on using the software.

Marker, Park and Tail Lights Preliminary Check

Table 286 Marker, Park and Tail Lights Preliminary Check

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify marker, park and tail lights are inoperative.	Visually check marker, park and tail lights.	Marker, park and tail lights are inoper-ative.	Go to next step.	Marker, park and tail lights are operating. Problem does not exist or is intermittent. (Check for inactive diagnostic trouble codes.)
2.	On	Determine if any other features are malfunctioning that may have common circuits. (Example: Missing ground common to several features.)	Visually check for other malfunc-tioning features.	No other features are malfunc-tioning.	Go to next step.	Identify and repair condition causing several features to be inoperative.

Table 286 Marker, Park and Tail Lights Preliminary Check (cont.)

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
3.	On	Are all marker, park and tail lights inoperative?	Visually check if all lights are inoperative.	All lights are inoperative.	Go to next step.	Check specific circuits of the inoperative light(s) for open circuits.
4.	On	Check for marker, park and tail lights diagnostic trouble codes. (See Diagnostic Trouble Codes, page 840)	Read display on odometer.	No light diagnostic trouble codes are active.	Go to marker, park and tail lights circuit inputs to ESC. (See MARKER, PARK AND TAIL LIGHT INPUTS TO ESC, page 841)	Go to marker, park and tail lights circuit outputs from ESC. (See MARKER, PARK AND TAIL LIGHT OUTPUTS FROM ESC, page 843)

Diagnostic Trouble Codes

To display diagnostic trouble codes (DTC's), set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch simultaneously. If no faults are present, the cluster odometer will display "NO FAULTS". If faults are present, the gauge cluster display will show the number of faults and each diagnostic trouble code for 10 seconds and then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in "A" for active faults or "P" for previously active faults. Releasing the parking brake or turning the ignition key off will take the ESC and the gauge cluster out of the diagnostic mode.

After all repairs have been made, the diagnostic trouble codes may be cleared by putting the key switch in the accessory position, turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 287 Marker, Park and Tail Lights

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
NO DIAGNOSTIC TROUBLE CODE	Diagnostic trouble codes are not logged for every possible fault in the park light circuits.
If the lights stay on when the headlight switch is in the off position, the problem is most likely a defective headlight switch, switch pack, wiring between the switch pack and the EGC, or a problem in the EGC (The system is designed to turn the park lights on when there is no input to the EGC from the switch). Go to marker, park and tail lights circuit inputs to ESC. (See MARKER, PARK AND TAIL LIGHT INPUTS TO ESC, page 841)	
When the park light switch is on and an individual light or several lights, but not all lights, are inoperative there is probably a failed bulb or an on open circuit to those lights.	

Table 287 Marker, Park and Tail Lights (cont.)

The roof clearance and marker lights or sunshade lights have a separate fuse between their circuits and the ESC. Refer to the Roof Clearance and Marker or Sunshade section (See ROOF CLEARANCE AND MARKER OR SUNSHADE LIGHTS, page 832)	
611 14 4 1	Marker, park and tail lamps open circuit, 4007 pin H.
This fault is the result of an open in the circuits between the marker, park and tail lamps circuits and the ESC. Inspect marker park and tail lights (See MARKER, PARK AND TAIL LIGHT OUTPUTS FROM ESC, page 843) for proper operation	
611 14 4 2	Marker, park and tail lamps over current, 4007 pin H.
This fault is the result of a short or overload in the circuits between the marker, park and tail lamps circuits and the ESC. Inspect Marker Park And Tail Lights (See MARKER, PARK AND TAIL LIGHT OUTPUTS FROM ESC, page 843) for proper operation	
611 14 4 3	Marker, park and tail lamps, less than normal low current but more than open circuit
611 14 4 4	Marker, park and tail lamps, greater than normal high current and less than fusing current
611 14 4 6	Marker, park and tail lamps has current flow when output commanded off

3.3. MARKER, PARK AND TAIL LIGHT INPUTS TO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Park Light EGC and ESC Input Circuits.

A fault in the input circuits will be apparent when the park lights are always on and no active faults are present. The ESC will not log any faults for park light circuits in the EGC. The park light request from the EGC is communicated on the 1939 data link. Loss of the drivetrain 1939 data link between the EGC and ESC will cause several problems to occur simultaneously and the check electrical system lamp will illuminate. **Go to the section on the drivetrain 1939 data link to troubleshoot this condition.** Problems in the work light input circuits can be caused by a short circuit between the 3 switch pack and the EGC, an open circuit between the 3 switch pack and the EGC, a faulty switch, or a problem in the EGC.

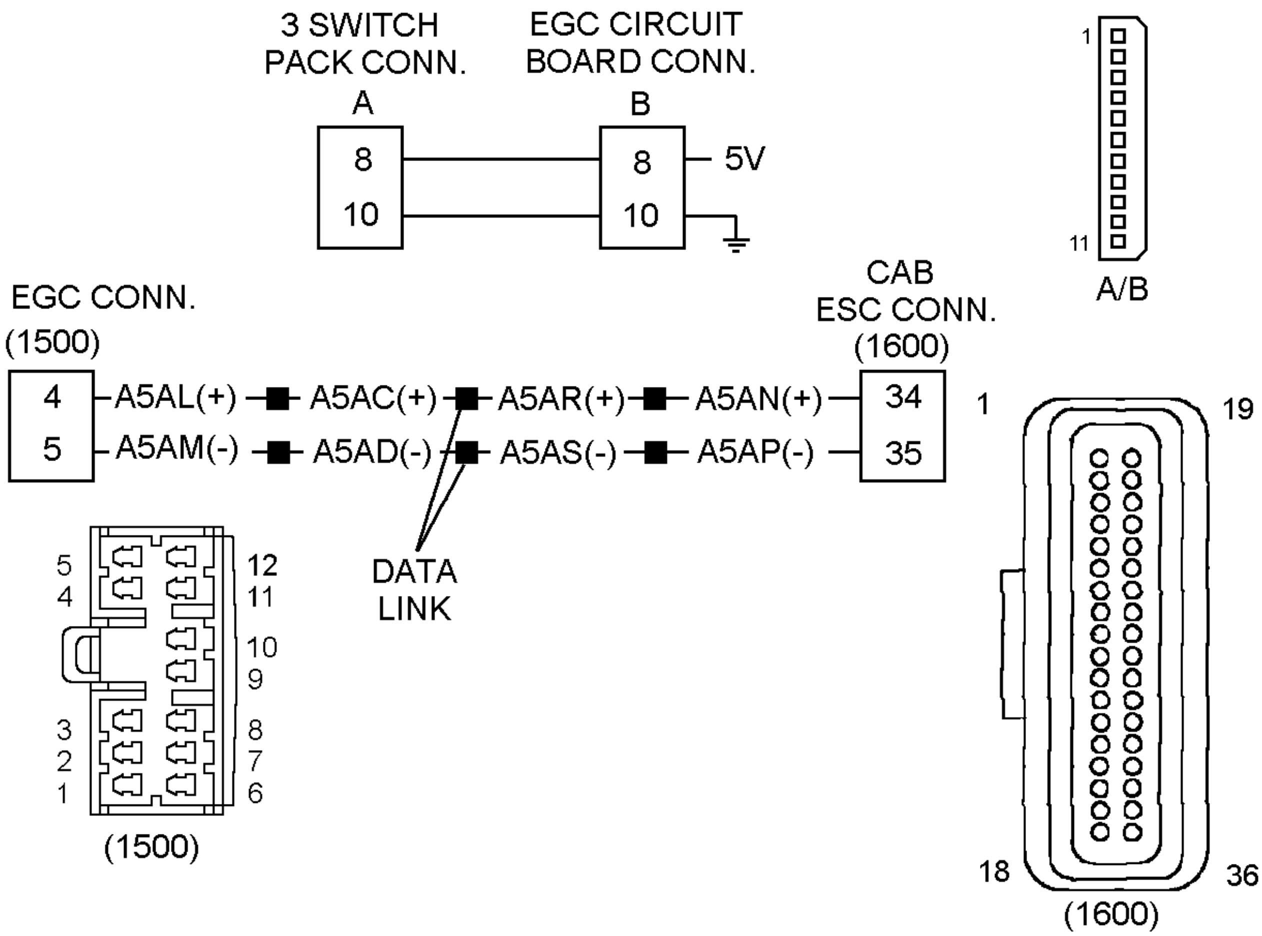

Figure 422 Park Light EGC and ESC Input Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

A. 3 SWITCH PACK CONNECTOR
B. EGC CIRCUIT BOARD CONNECTOR
(1500) EGC CONNECTOR
LOCATED BEHIND CLUSTER
(1600) ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON CAB SIDE OF ESC

Table 288 EGC, 3 Switch Pack Circuit Tests

Diagnostic Trouble Codes
There are no diagnostic trouble codes associated with the 3 switch pack in the EGC.
A mechanically defective park light switch could also prevent the park light from operating. Remove the mechanical portion of the switch and attempt to turn the switch on by pressing the top microswitch. If the park lights go out, the mechanical switch assembly should be replaced.

Table 288 EGC, 3 Switch Pack Circuit Tests (cont.)

3 Switch Pack Harness Connector Park Light Voltage Checks Check with ignition key on and 3 switch pack disconnected. **NOTE – If the EGC and switch are working correctly, disconnecting the 3 switch pack connector should cause the park lights to come on.** **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
3 switch pack harness connector, cavity 8 to ground	5 ± .5 volts	If voltage is missing, check for open or shorts in circuits between EGC connector and switch connector. Also insure proper voltage out of EGC.
3 switch pack harness connector, cavity 10 to ground	0 volts	Ground circuit from EGC If voltage is incorrect, check for shorts in circuits between EGC and switch. Also insure proper voltage out of EGC.
3 switch pack harness connector, cavity 8 to cavity 10.	5 ± .5 volts	If voltage is incorrect, check for shorts in circuits between EGC and switch.
3 Switch Pack Work Light Resistance Check **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Check resistance between pins 10 (negative probe on pin 10) and 8 of the switch pack, when the switch is off.	Approximately 1.5M ohms.	If there is no continuity, the switch pack needs replaced.

Extended Description

The park light switch is wired directly to the EGC circuit board. When the park light switch is turned off, 5 volts on pin 8 from the EGC will drop to ground. This will cause the EGC to send a message to the ESC requesting the light to be turned on.

3.4. MARKER, PARK AND TAIL LIGHT OUTPUTS FROM ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to Marker, Park and Tail Lamps.

A fault in the marker, park and tail lights will be apparent when the headlights are turned on and the marker, park and tail lamps don’t come on. The ESC will also log a diagnostic trouble code (DTC) when there is a short in any of the marker, park and tail lamp circuits. Problems in the marker, park and tail lamp circuits can be caused by burned out lamps, a short, an open, or a problem in the ESC.

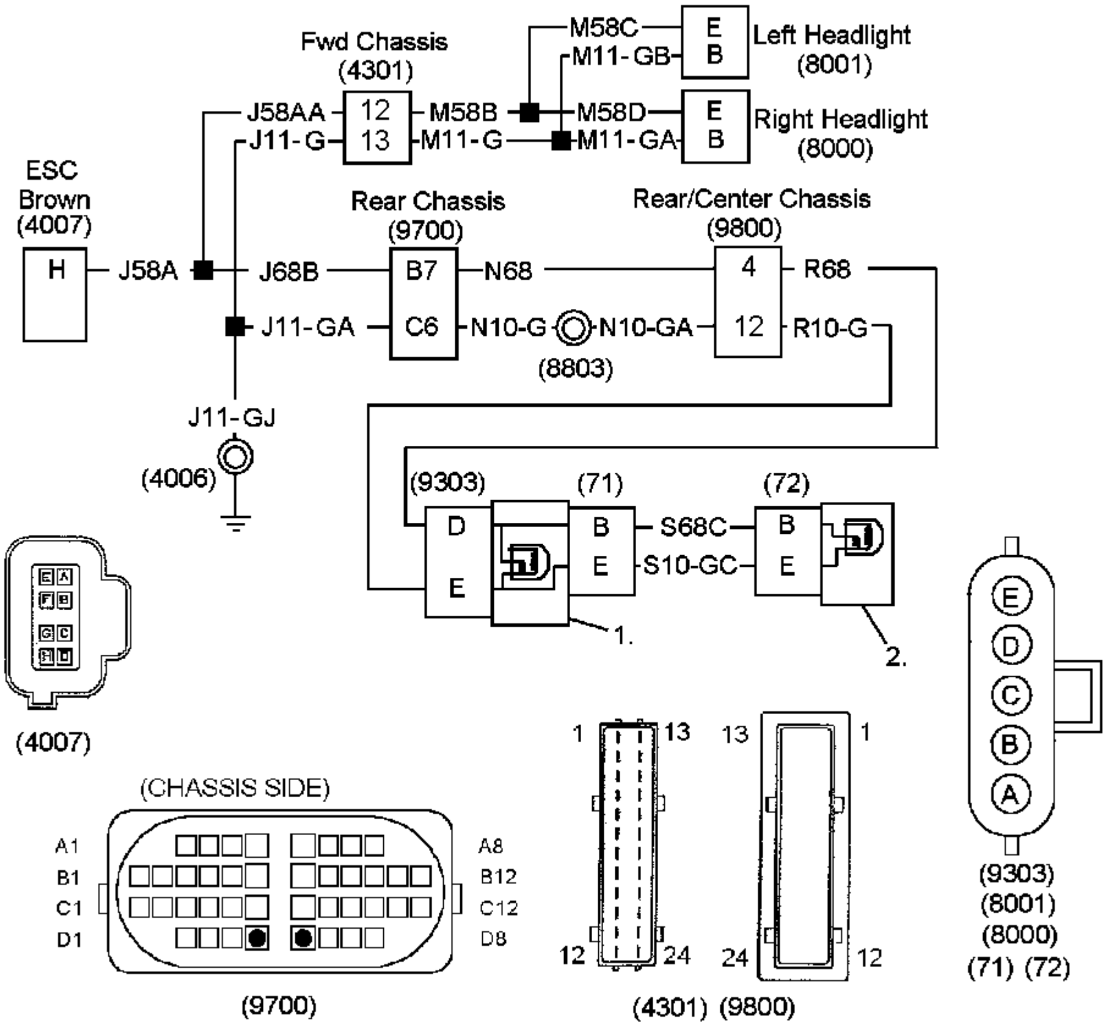

Figure 423 Marsker, Park and Tail Lamps — Always Refer to Circuit Diagram Book for Latest Circuit Information

1. LEFT REAR LIGHT ASSEMBLY
2. RIGHT REAR LIGHT ASSEMBLY

(71) LEFT TAIL LIGHT CONNECTOR
(72) RIGHT TAIL LIGHT CONNECTOR
(4007) BROWN ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON ENGINE COMPARTMENT SIDE OF ESC
(4301) FORWARD CHASSIS CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME RAIL
(9303) STOP/TAIL/TURN CONNECTOR
LOCATED ON LEFT LIGHT ASSEMBLY
(9700) REAR CHASSIS CONNECTOR
(9800) REAR/CENTER CHASSIS CONNECTOR

Table 289 Marker, Park And Tail Lights Circuit Tests

611 14 4 3	Marker, park and tail lamps, less than normal low current but more than open circuit
611 14 4 4	Marker, park and tail lamps, greater than normal high current and less than fusing current
611 14 4 6	Marker, park and tail lamps has current flow when output commanded off
611 14 4 1	Marker, park and tail lamps open circuit
This fault is the result of an open in the circuits between the marker, park and tail lamps circuits and the ESC.	
611 14 4 2	Marker, park and tail lamps over current
This fault may be the result of a short in the circuits between the marker, park and tail lamps and the ESC. It could also be caused by an excessive load on the circuits. **NOTE – Disconnecting connectors will cause new open circuit faults to be logged. Clear all faults after connections have been restored.** Clear DTC's. Disconnect stop tail and turn connector (9303), then turn on the park light switch and check for fault. If the fault has not reoccurred, there is a short or an overload in the tail lights. If the fault reoccurs, there is a short in one of the other circuits or in the ESC. **NOTE – With sealed beam headlamps, as used with Severe Service trucks, the terminals at the headlamps are not sealed - in this application the terminals of the headlamps and the terminals in the headlamp connector must be totally coated with Grafo grease 2643099R1** Clear DTC's. Disconnect left headlight harness connector (8001), then turn on the park light switch and check for fault. If the fault has not reoccurred, there is a short or an overload in the left front marker lights. If the fault reoccurs, there is a short in one of the other circuits or in the ESC. Clear DTC's. Disconnect right headlight harness connector (8000), then turn on the park light switch and check for fault. If the fault has not reoccurred, there is a short or an overload in the right front marker lights. If the fault reoccurs, there is a short in one of the other circuits or in the ESC. Clear DTC's. Disconnect brown ESC connector (4007), then turn on park lights and check for fault. If the fault has not reoccurred, there is a short in the circuits between the ESC and the marker, park and tail lamps. If the fault reoccurs, there is a short inside the ESC.	
Stop Tail and Turn Connector (9303) Voltage Checks With (9303) disconnected and park lights on. **NOTE – Always check connectors for damage and pushed–out terminals. Also check turn signal assemblies for damage or corrosion.** **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**	

Table 289 Marker, Park And Tail Lights Circuit Tests (cont.)

Test Points	Spec.	Comments
(9303) cavity D to ground	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts	If voltage is missing, check for open or short in circuits between brown ESC connector (4007) terminal H and stop tail and turn connector cavity D. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
(9303) cavity D to cavity E	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts	If voltage is missing, check for open in circuits between (9303) cavity E and ground.

Extended Description

Refer to Marker, Park and Tail Lamps.

When the ESC is commanded to turn the tail lights on, the ESC will provide 12 volts to the lights from ESC connector (4007) terminal H to left stop tail and turn connector (9303) terminal D. Voltage to right tail light connector (72) terminal B is provided on circuit S68C from left tail light connector (71) terminal B.

Ground for the tail lights is supplied from ground stud 2 (4006) to left stop tail and turn connector (9303) terminal E. Ground to right tail light connector (72) terminal E is provided on circuit S10–GC from left tail light connector (71) terminal E.

When the ESC is commanded to turn the side and front marker lights on, the ESC will provide 12 volts to the lights from ESC connector (4007) terminal H to circuit M58B. Circuit M58B is split on circuit M58D to right headlight/turn signal connector (8000) terminal E. Circuit M58B is also split to circuit M58C to left headlight/turn signal connector (8001) terminal E.

The ground circuit path is from ground stud 2 (4006) to circuit M10–GA. Circuit M10–GA is split on circuit M52–GA to right headlight /turn signal connector (8000) terminal B. Circuit M10–GA is also split to circuit M52–GB to left headlight/turn signal connector (8001) terminal E.

3.5. COMPONENT LOCATIONS

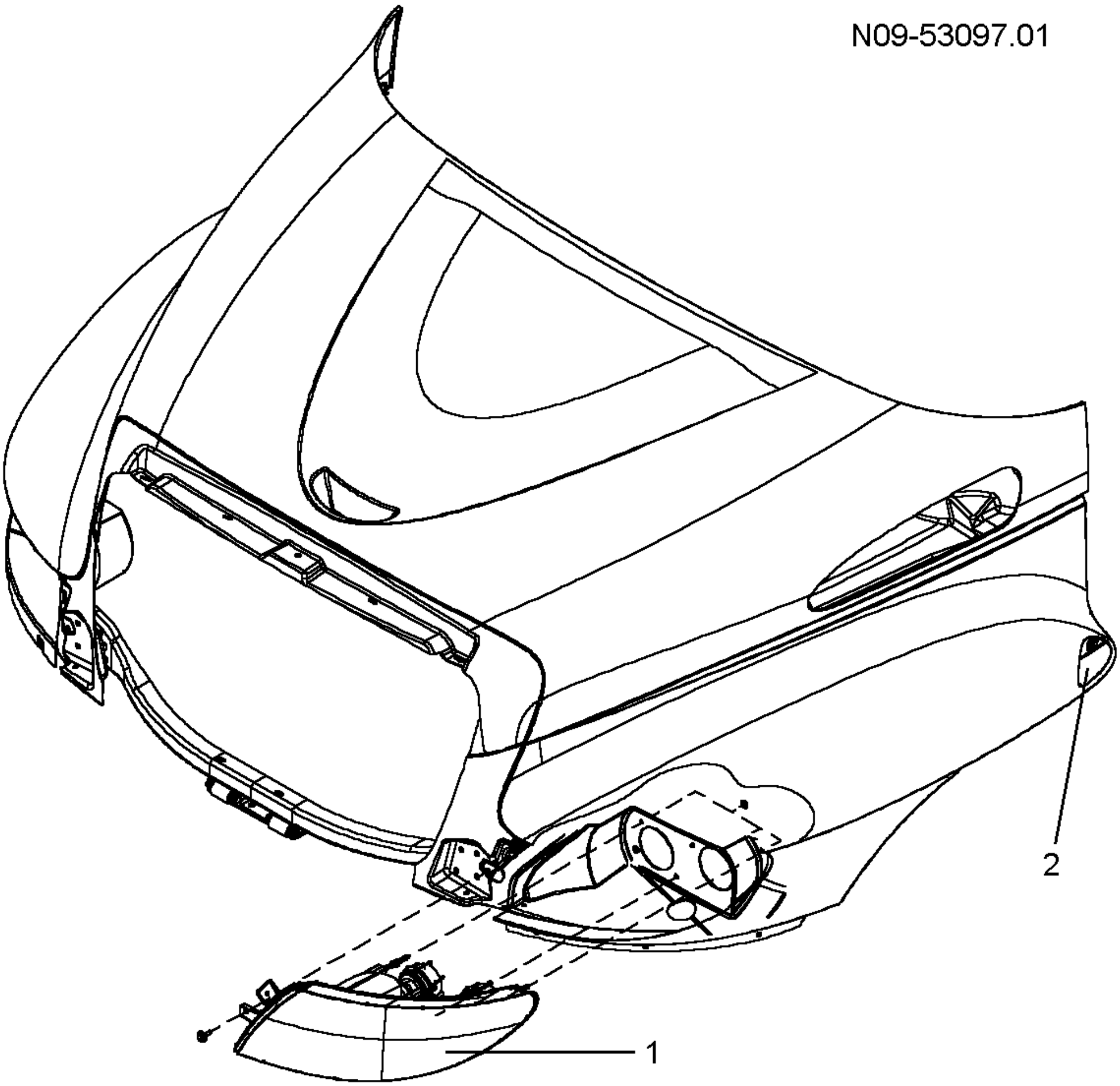

Figure 424 Headlights, Front and Side Marker Lights (Not Severe Service)

1. FRONT PARK LIGHT
2. SIDE MARKER LIGHT

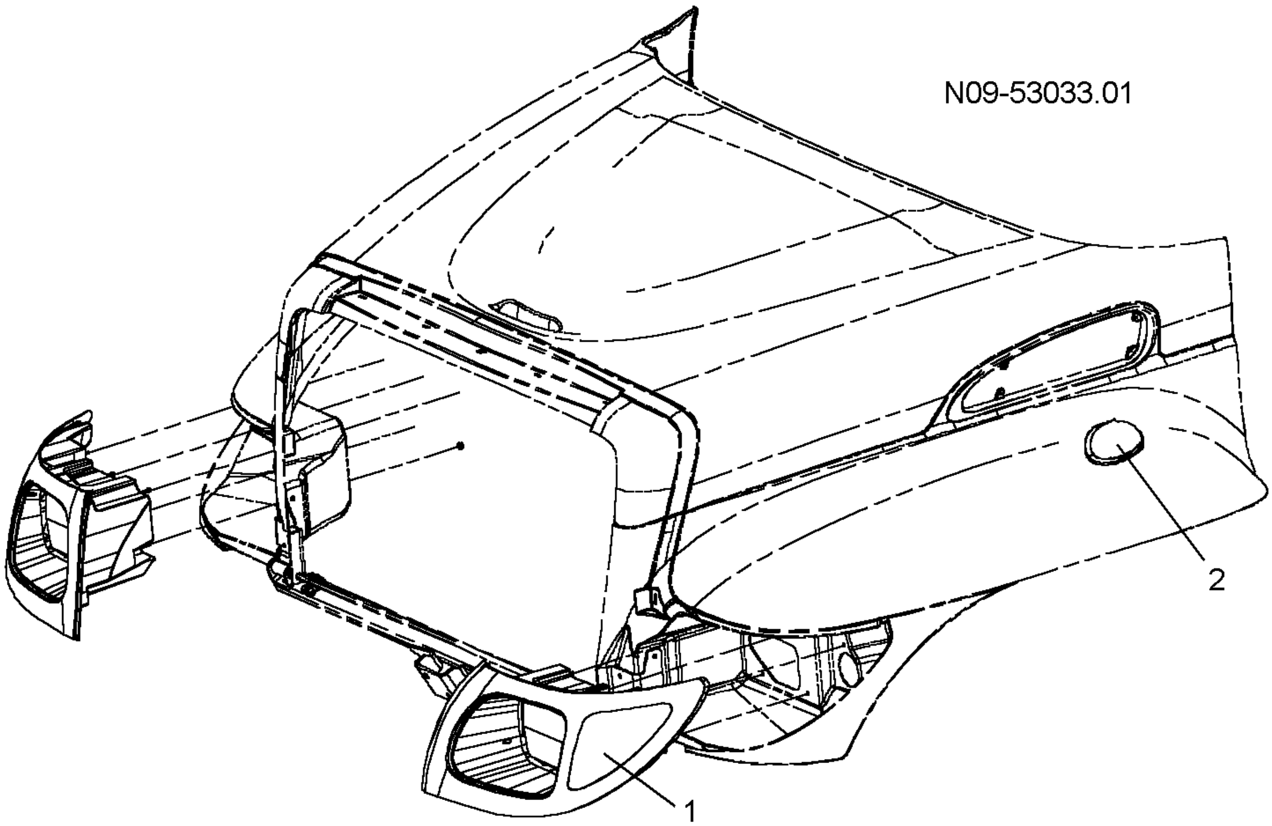

Figure 425 Headlights, Front and Side Marker Lights (Severe Service)

1. FRONT PARK LIGHT
2. STANDARD SIDE MARKER LIGHT

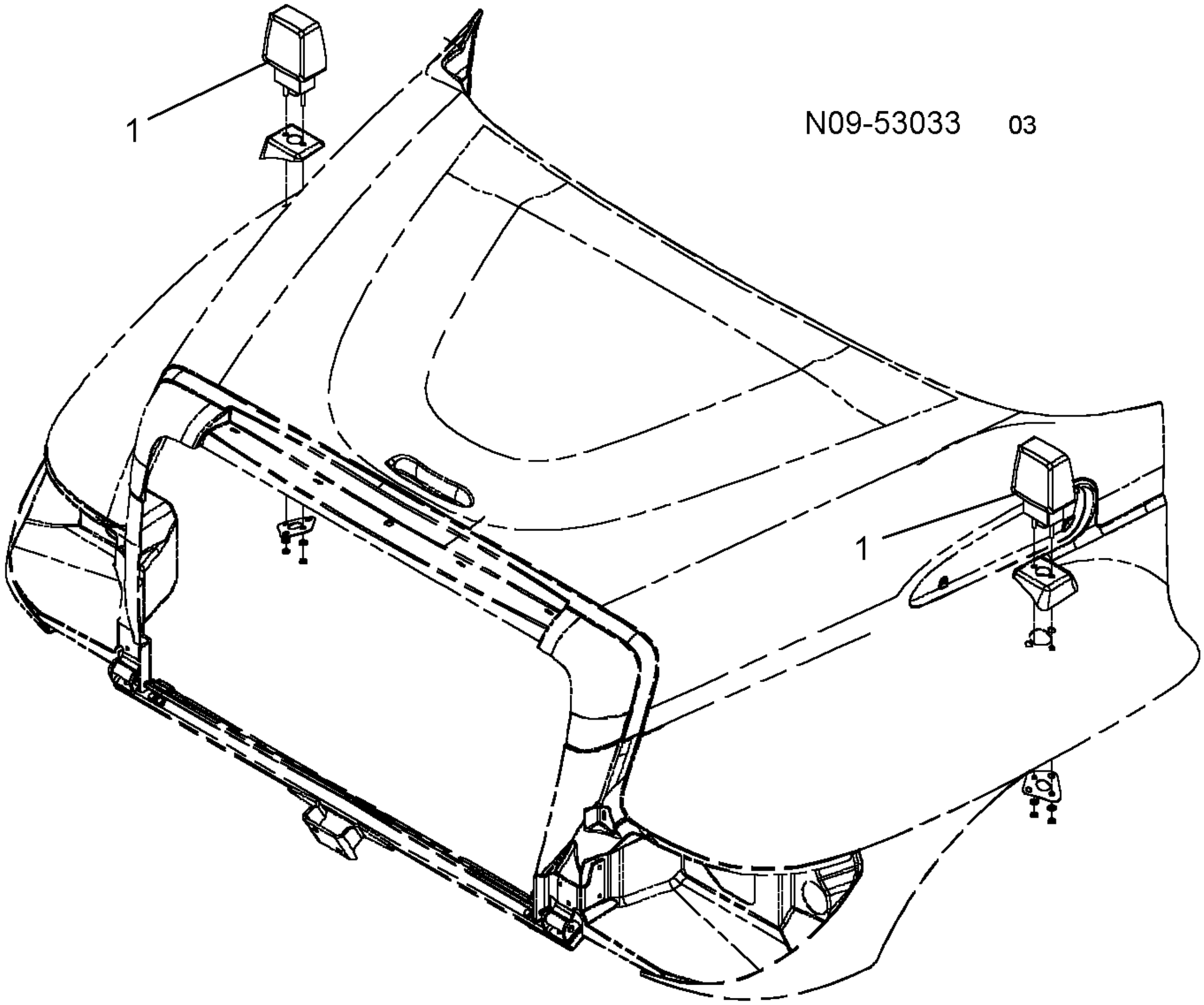

Figure 426 Optional Side Marker/Turn Signal Lights (Severe Service)

1. OPTIONAL SIDE MARKER/TURN SIGNAL LIGHT

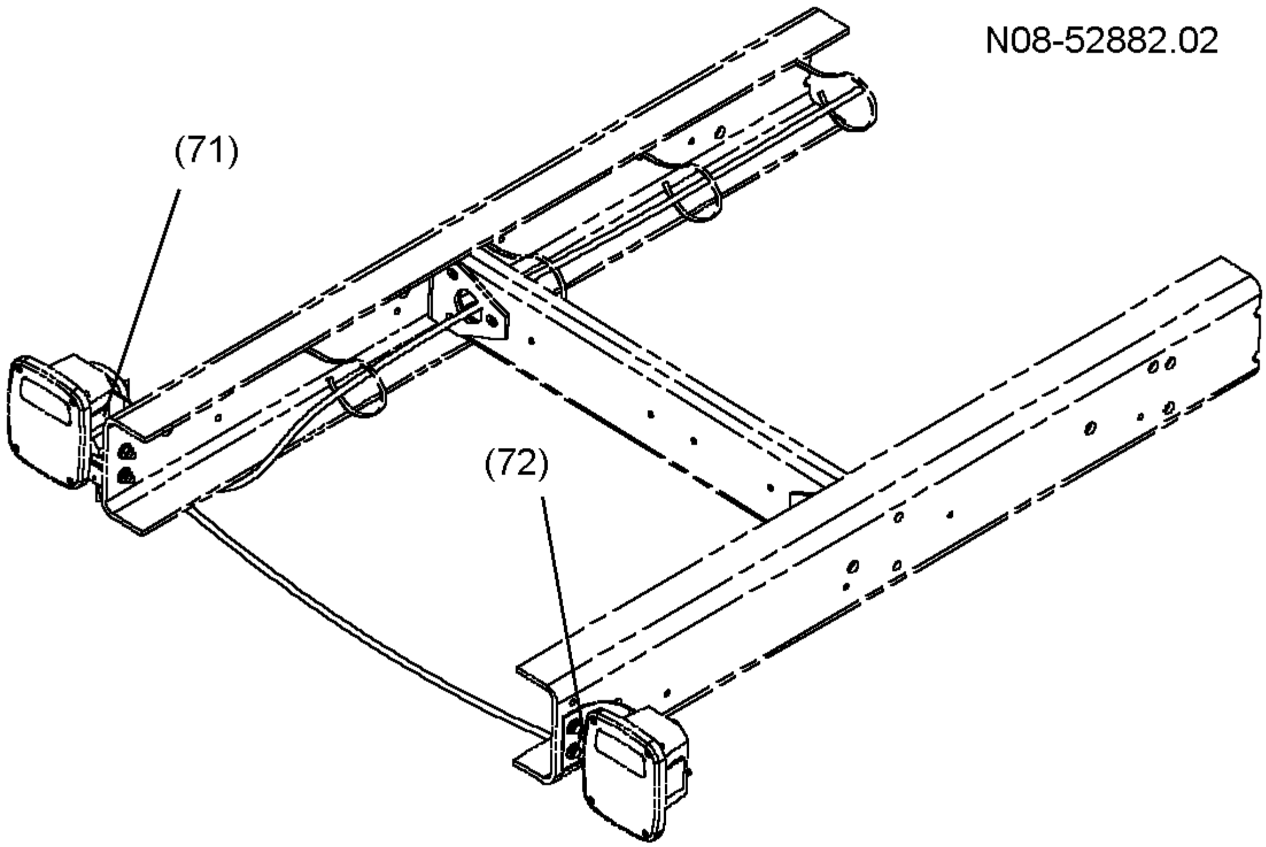

Figure 427 Rear Tail Light Connector Locations

(71) LEFT TAIL LIGHT CONNECTOR
(72) RIGHT TAIL LIGHT CONNECTOR

4. DOME AND MAP LIGHTS

4.1. CIRCUIT FUNCTIONS

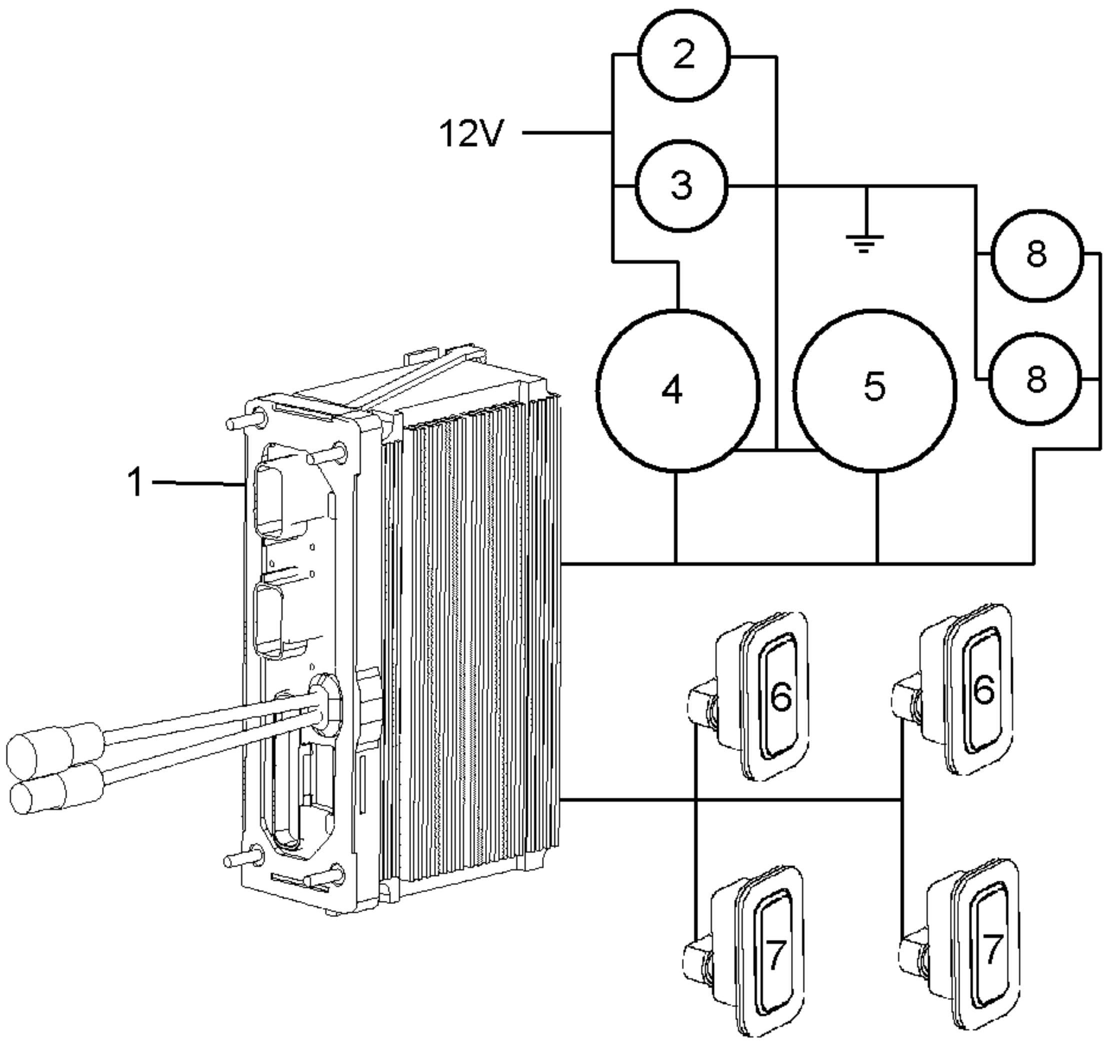

Figure 428 Dome and Map Lights Function Diagram

1. ELECTRICAL SYSTEM CONTROLLER
2. MAP LIGHT
3. MAP LIGHT
4. FRONT DOME LIGHT
5. REAR DOME LIGHT (CREW CAB ONLY)
6. FRONT DOOR SWITCHES
7. REAR DOOR SWITCHES (CREW CAB ONLY)
8. COURTESY LAMPS

Refer to Dome and Map Lights Function Diagram.

The dome lights are controlled by the door switch(es). Individual dome light(s) can also be turned on by their dome light switch.

The dome light output from the ESC has theater style dimming capability, which can be disabled with programming. The lights will remain on if a door, with a switch mounted in the cab opening, is open. As soon as all doors are closed, and the dome light switch is off, the light will remain on at a modified level for 20 seconds or until the ignition has been started. At that time, the lights will dim gradually until the light is off.

With theater lighting disabled the dome light(s) will go off as soon as the doors are shut.

On January 28, 2003, the ESC software was revised. Prior to the revision, a door with a plunger type switch that was not fully latched would not turn off the dome light. If left on for an extended period of time, the dome light will drain the batteries. Now the dome light power will be cut back to 1% after 10 minutes. Cycling the door plunger or key switch will reactivate the dome light.

The remote keyless entry (RKE) also turns on the light for a timed period when the ’unlock’ button is pressed, and turns off the light when the ’lock’ button is pressed

When a door is opened or closed the courtesy lights (located under the dash) will operate the same as the dome lights.

The map lights are controlled by the switches on the lights.

4.2. DIAGNOSTICS

If the dome light(s) or map lights fail to operate from their individual switches, the problem is most likely in the power circuits or the switches to the lights.

The door with a plunger type switch that was not fully latched, the dome light power will be cut back to 1% after 10 minutes.

If the dome lights stay on when the doors are closed and the dome light switches are off, the problem is most likely a defective door switch, a short in wiring between the door switch and the EGC, or a problem in the EGC.

Should the lights fail to come on when a door is opened, the problem could be attributed to an open in the wiring between the door switches and the ESC, open or shorted output wiring between the ESC and the dome lights.

The ESC has an internal virtual fuse software algorithm to protect output circuits in an over current situation.

A diagnostic trouble code will be logged if there is an over current caused by a short to ground or excessive load (too many accessories) on the circuits between the ESC and the dome lights.

If individual lights are inoperative the problem must be attributed to faulty lamps or open wiring to the individual lamps.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to command the ESC to turn on the lights and monitor activation of the dome light switch(es). The software will also display diagnostic trouble codes. See the diagnostic software manual for details on using the software.

Dome Light Preliminary Check

Table 290 Dome Light Preliminary Check

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify the dome lights and map lights operate from their individual switches.	Visually check operation of lights.	Lights operate correctly.	Go to next step.	Locate and repair cause of inoperative light. Check for blown fuse, short circuit, open circuit or defective switch.
2.	On	Verify the dome lights operate correctly when a door is held opened.	Visually check dome light.	Dome light power will be cut back to 1% after 10 minutes. Cycling the door plunger or key switch will reactivate the dome light.	Go to next step.	Check ESC for software revision V22. Program or replace ESC.
3.	On	Verify operation of any dome light(s) from other doors.	Visually check dome light.	Dome light(s) operate correctly with other door(s).	Go to next step.	Locate open in circuits to door switch(es) which are not operating correctly.
4.	On	If more than one light is connected to dome light circuits (rear dome lights or courtesy lights), are all lights inoperative?	Visually check if all work lights are operating correctly.	All work lights are not operating correctly.	Go to next step.	Dome light feature is operating correctly. Problem does not exist or is intermittent. (Check for inactive diagnostic trouble codes.)

Table 290 Dome Light Preliminary Check (cont.)

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
5.	On	Locate open in circuits to inoperative dome lights.				
6.	On	Check for diagnostic trouble codes. (See Diagnostic Trouble Codes, page 855)	Read display on odometer.	No dome light diagnostic trouble codes are active.	Go to door switch inputs. (See DOOR SWITCH INPUTS INTO ESC, page 856)	Go to dome light circuit checks. (See DOME LIGHT CIRCUITS, page 858)

Diagnostic Trouble Codes

To display diagnostic trouble codes (DTC's), set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch simultaneously. If no faults are present, the cluster odometer will display "NO FAULTS". If faults are present, the gauge cluster display will show the number of faults and each diagnostic trouble code for 10 seconds and then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in "A" for active faults or "P" for previously active faults. Releasing the parking brake or turning the ignition key off will take the ESC and the gauge cluster out of the diagnostic mode.

After all repairs have been made, the diagnostic trouble codes may be cleared by putting the key switch in the accessory position, turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 291 Dome Light Circuits

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
NO DIAGNOSTIC TROUBLE CODE	Diagnostic trouble codes are not logged for every possible fault in the dome light circuits.
611 14 10 1	Dome Light Under Current (open circuit, 1601 pin C).
This fault is the result of an open in the circuits between the the ESC and the dome/courtesy lights. Inspect dome light circuits (See DOME LIGHT CIRCUITS, page 858) for proper operation	
A diagnostic trouble code will only be logged for shorts on circuits from the ESC to the dome/courtesy lights.	
611 14 10 2	Dome Light Over Current (Short Circuit)
This fault is the result of a short or overload on the circuits between the ESC and the dome/courtesy lights. Inspect dome light circuits (See DOME LIGHT CIRCUITS, page 858) for proper operation	
611 14 10 3	Dome Light lamps, less than normal low current but more than open circuit
611 14 10 4	Dome Light lamps, greater than normal high current and less than fusing current
611 14 10 6	Dome Light lamps has current flow when output commanded off

4.3. DOOR SWITCH INPUTS INTO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Door Switch Circuits to ESC.

Several options are available for door switches. Options range from one switch on the drivers door to switches on every door.

A problem in the door switch circuit(s) will prevent the lights from operating when one or both doors are opened. A problem in the door switch circuits could be attributed to a defective switch, a problem in the ESC, a short circuit or an open circuit.

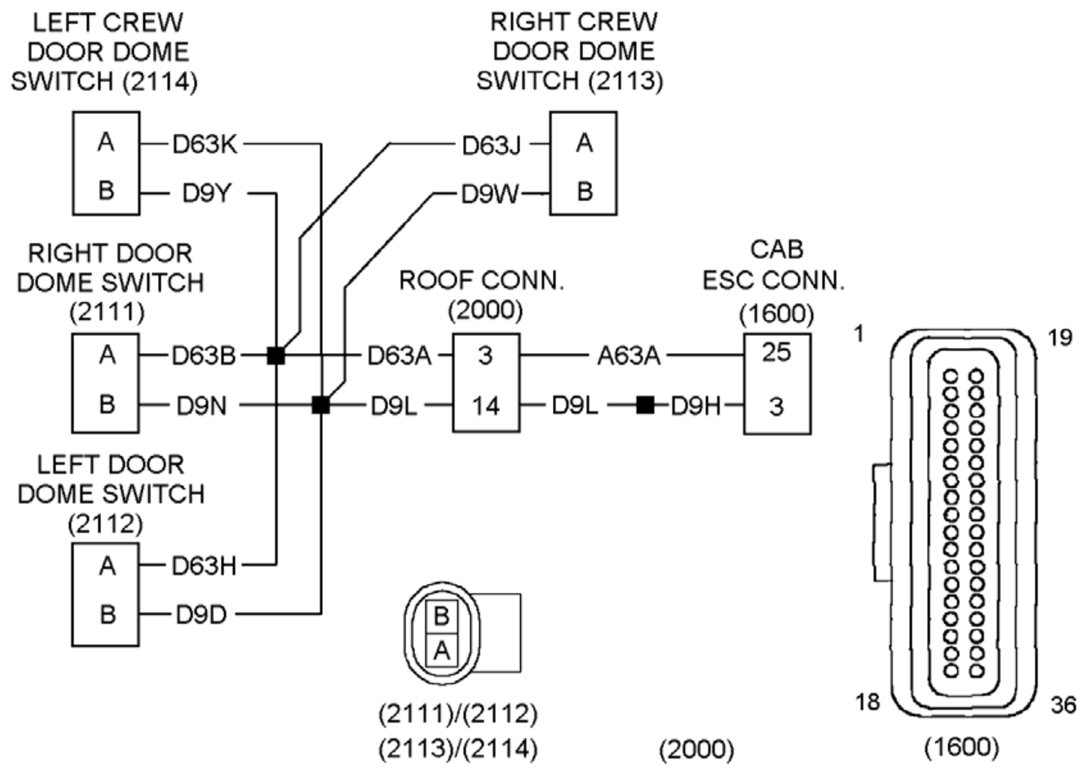

Figure 429 Door Switch Circuits to ESC (Connectors Viewed From Mating End) — Always Refer To Circuit Diagram Book For Latest Circuit Information

(1600) 36–WAY ESC CONNECTOR
LOCATED ON CAB SIDE OF ESC
(2000) ROOF CONNECTOR
LOCATED NEAR DRIVER SIDE A PILLAR
(2111) RIGHT DOOR DOME SWITCH CONNECTOR
LOCATED IN PASSENGER SIDE B PILLAR
(2112) LEFT DOOR DOME SWITCH CONNECTOR
LOCATED IN DRIVER SIDE B PILLAR
(2113) RIGHT CREW DOOR DOME SWITCH CONNECTOR
LOCATED IN PASSENGER SIDE C PILLAR (CREW CAB ONLY)
(2114) LEFT CREW DOOR DOME SWITCH CONNECTOR
LOCATED IN DRIVER SIDE C PILLAR (CREW CAB ONLY)

Table 292 Door Switch Circuit Tests

FAULTS		
There are no diagnostic trouble codes associated with door switch circuits. **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**		
Test Points	Spec.	Comments

Table 292 Door Switch Circuit Tests (cont.)

Harness connector cavity A to ground.	12 ± 1.5 volts with ignition on, 5 ± .5 with ignition off.	If voltage is missing, check for open in circuits D63A or A63A. Also check for short in circuits D63A, A63A or circuits to other door switches. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
Harness connector cavity B to ground.	<.3 volts	Zero volt reference level signal.
Harness connector cavity A to cavity B.	12 ± 1.5 volts with ignition off. 5 ± .5 with ignition off.	If voltage is missing, check for open in circuits between ESC connector (1600) cavity D and dome switch connector cavity B. A missing zero volt reference level from the ESC will cause several other features to be inoperative.
Door Switch (2112) Resistance Checks Check at door switch.		
Resistance between door switch connector pins A and B.	<1 ohm with door open. >50K ohms with piece of steel in front of switch.	If resistance is incorrect replace defective switch.
If the door switch and door switch circuits check good proceed to the dome light circuit checks (See DOME LIGHT CIRCUITS, page 858).		

Extended Description

Refer to Door Switch Circuits to ESC.

A proximity switch is used for the door switch(es). When steel passes in front of the switch it will open. When the door is opened the switch will close.

The ESC monitors the voltage at ESC connector (1600). When a door switch closes, a zero volt reference signal from the ESC will be applied through the door switch back to the ESC. This will cause the voltage to drop and the ESC will turn the dome light(s) on.

4.4. DOME LIGHT CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to Dome Light Circuits.

A fault in the dome, courtesy or map light circuits will be apparent when the lights don't come on. The ESC will also log a diagnostic trouble code (DTC) when there is a short in any of the dome light circuits from the ESC. Problems in the dome light circuits can be caused by burned out lamps, a blown fuse, a short, an open, or a problem in the ESC. Problems in the map light circuits can be caused by burned out lamps, a blown fuse, a short or an open circuit.

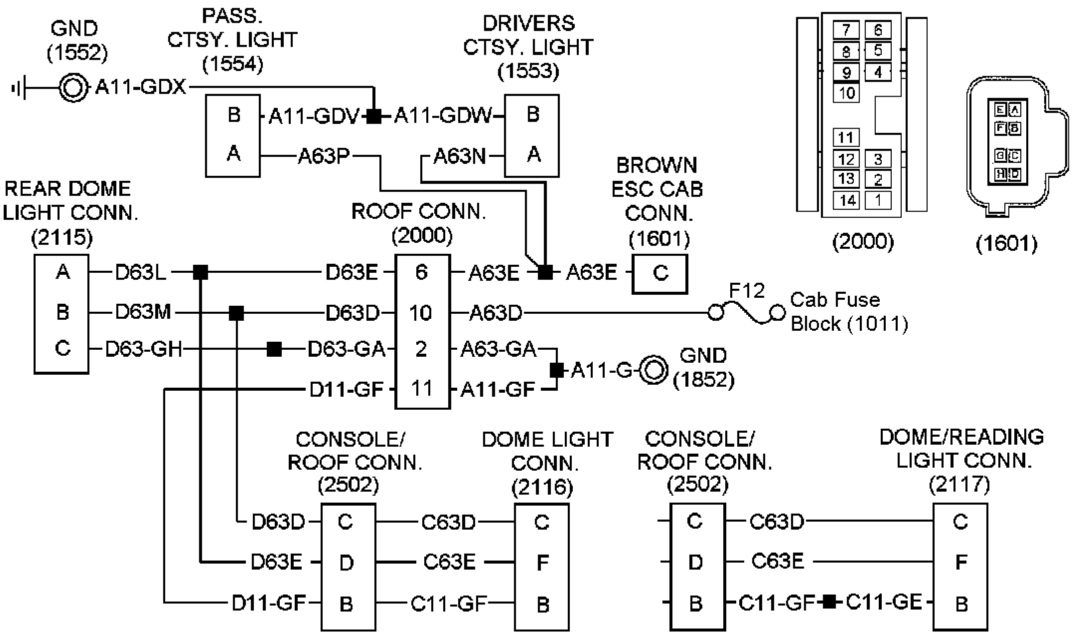

Figure 430 Dome Light Circuits (Connectors Viewed From Mating End) — Always Refer To Circuit Diagram Book For Latest Circuit Information

(F12) DOME LIGHT FUSE
LOCATED IN CAB FUSE BLOCK (1011)
(1553) DRIVERS COURTESY LIGHT CONNECTOR
LOCATED BEHIND DRIVERS COURTESY LIGHT IN INSTRUMENT PANEL
(1553) PASSENGERS COURTESY LIGHT CONNECTOR
LOCATED BEHIND PASSENGERS COURTESY LIGHT IN INSTRUMENT PANEL
(1601) BROWN ESC CONNECTOR
LOCATED ON CAB SIDE OF ESC
(2000) ROOF CONNECTOR
LOCATED NEAR DRIVER SIDE A PILLAR
(2115) REAR DOME LIGHT CONNECTOR
LOCATED NEAR DRIVER SIDE A PILLAR AT HEADLINER
(2116) DOME LIGHT CONNECTOR
LOCATED BEHIND DOME LIGHT ASSEMBLY
(2117) DOME READING LIGHT CONNECTOR
LOCATED BEHIND DOME/READING LIGHT ASSEMBLY
(2502) CONSOLE/ROOF CONNECTOR
LOCATED NEAR DRIVER SIDE A PILLAR

Table 293 **Dome and Map lights Circuit Tests**

<table>
<tr><th colspan="3">Diagnostic Trouble Codes</th></tr>
<tr><td>611 14 10 3</td><td colspan="2">Dome Light lamps, less than normal low current but more than open circuit</td></tr>
<tr><td>611 14 10 4</td><td colspan="2">Dome Light lamps, greater than normal high current and less than fusing current</td></tr>
<tr><td>611 14 10 6</td><td colspan="2">Dome Light lamps has current flow when output commanded off</td></tr>
<tr><td>611 14 10 2</td><td colspan="2">Dome Light Over Current (Short Circuit)</td></tr>
<tr><td colspan="3">NOTE – Disconnecting connectors will cause new open circuit faults to be logged. Clear all faults after connections have been restored.

Disconnect dome light connector (2116) and close all doors. Cycle key switch and clear DTC’s. Open the drivers door and check for fault. If the fault has not reoccurred, there is a short or an overload in the front dome light. If the fault reoccurs, there is a short in other dome or courtesy light circuits or in the ESC.

Perform the same procedure on the remaining dome light and courtesy light connectors until the short circuit is isolated. If the active fault remains active, there is a short in the circuits between the ESC and dome light(s) or a short inside the ESC.

Disconnect brown ESC connector (1601) and close all doors. Cycle key switch and clear DTC’s. Open the drivers door and check for fault. If the fault has not reoccurred, there is a short in the circuits between the ESC and dome light(s). If the fault reoccurs, there is a short inside the ESC.</td></tr>
<tr><td>611 14 10 1</td><td colspan="2">Dome Light Under Current (Open Circuit)</td></tr>
<tr><td colspan="3">Dome Light Connector (2116) Voltage Checks

Check with ignition on, drivers door open and dome light connector disconnected.

NOTE – Always check connectors for damage and pushed–out terminals.</td></tr>
<tr><td>Test Points</td><td>Spec.</td><td>Comments</td></tr>
<tr><td>Cavity C to ground</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for blown fuse F12 or open or short in circuits between cavity C and F12.</td></tr>
<tr><td>Cavity F to ground</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for open in circuits between cavity F and ESC connector (1601) cavity C.</td></tr>
<tr><td>Cavity C to cavity B</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for open in ground circuits between cavity B and ground stud (1852).</td></tr>
</table>

Extended Description

Refer to Dome Light Circuits.

When the front dome light or map lights are operated from the manual switches, power for the dome and map lights is provided from fuse F12 through circuit A63D, roof connector (2000) terminal 11, circuit D63D, console roof connector (2502) terminal C, circuit C63D and dome lamp connector (2116) terminal C to the switches on the dome light and map lights.

Ground for the dome light and map lights is supplied from ground terminal (1852) to the dome light and map lights.

Power to the front dome light (when a door is opened) is supplied from brown ESC connector (1601) terminal C and dome light connector (2116) terminal F to the dome light.

When the rear dome light is operated from the manual switch, power for the dome light is provided from fuse F12 and rear dome lamp connector (2115) terminal A to the switch on the dome light.

Power to the rear dome light (when a door is opened) is supplied from brown ESC connector (1601) terminal C and rear dome light connector (2115) terminal A to the dome light.

Ground for the rear dome light is supplied from ground terminal (1852) and rear dome lamp connector (2115) terminal B to the rear dome light switch.

Power to the optional courtesy lights (when a door is opened) is supplied from brown ESC connector (1601) terminal C to drivers courtesy light (1553) terminal A passenger courtesy light (1554) terminal A.

Ground for the courtesy lights is supplied from ground terminal (1552) to passenger courtesy light (1554) terminal B.

4.5. COMPONENT LOCATIONS

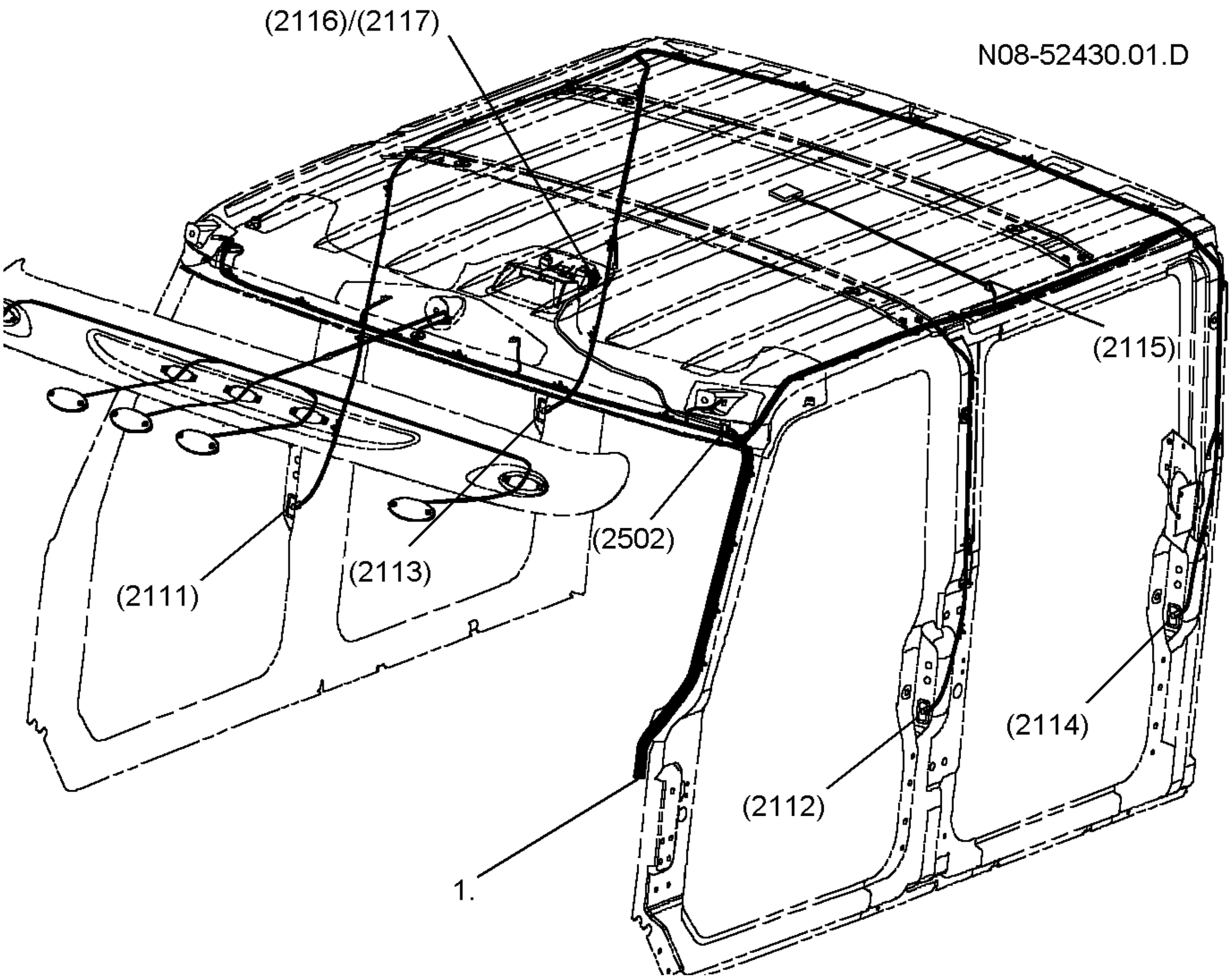

Figure 431 Dome Light Wiring

1. ROOF HARNESS TO ROOF CONNECTOR (2000)
(2111) RIGHT DOOR DOME SWITCH CONNECTOR
(2112) LEFT DOOR DOME SWITCH CONNECTOR
(2113) RIGHT CREW DOOR DOME SWITCH CONNECTOR
(2114) LEFT CREW DOOR DOME SWITCH CONNECTOR
(2115) REAR DOME LIGHT CONNECTOR
(2116)/(2117) DOME READING LIGHT CONNECTOR

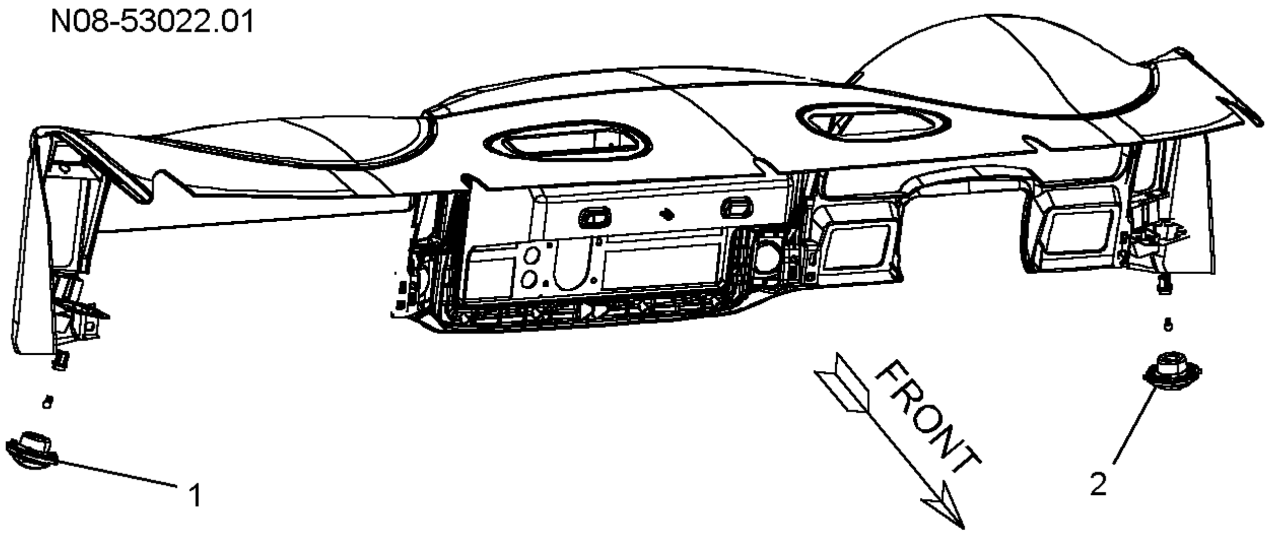

Figure 432 Courtesy Light Locations

1. PASSENGER COURTESY LIGHT
2. DRIVER COURTESY LIGHT

5. FOG LIGHT SYSTEM

5.1. CIRCUIT FUNCTIONS

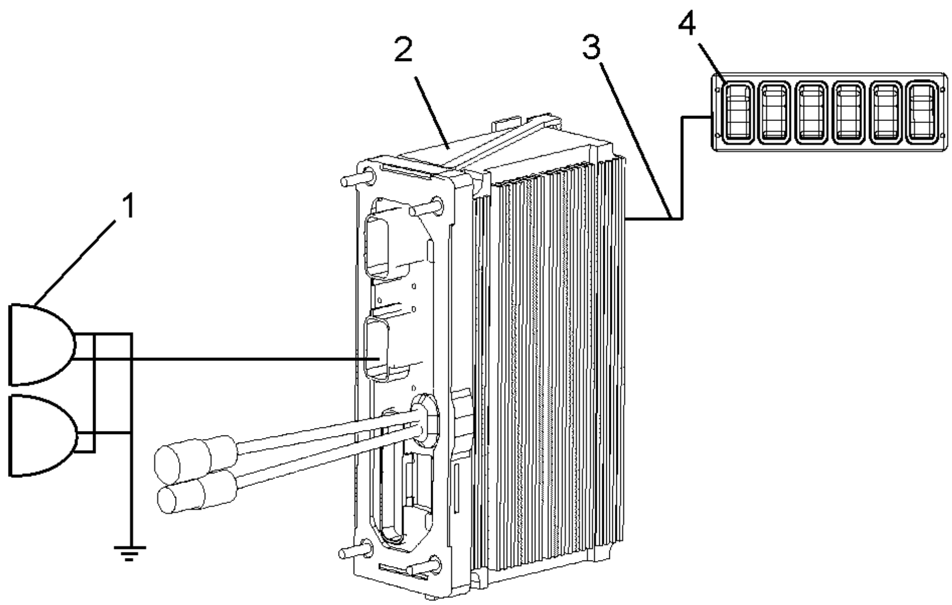

Figure 433 Fog Lights Function Diagram

1. FOG LIGHTS
2. ELECTRICAL SYSTEM CONTROLLER
3. SWITCH DATA LINK
4. FOG LIGHT SWITCH (IN SWITCH PACK)

Refer to Fog Lights Function Diagram.

Fog lights are rectangular halogen lights mounted in the bumper opening and are available with either amber or clear lenses.

When the fog light switch is turned on the switch pack will send a message, on the switch data link, to the ESC requesting the fog lights to be turned on. If the key is in the ignition position, the headlights are on and in the low beam position the ESC will provide voltage to power the fog lights. If the high beams are selected the voltage to the fog lights will be interrupted by the ESC until the low beams are turned on.

The ESC will also send a message back to the switch pack to illuminate the fog light switch “on” light.

5.2. DIAGNOSTICS

Should the fog lights fail to operate, the problem could be attributed to a faulty switch in the switch pack, a faulty switch pack or open or shorted output wiring between the ESC and the fog lights.

A problem with the mechanical portion of the switch or the switch contacts may cause the ESC to command the switch on lamp to blink.

The ESC will also log faults for switch errors or switch pack errors, identified by location. Switch locations will vary depending on vehicle configuration. The ESC is programmed to recognize the location and function of the switch.

The ESC has an internal virtual fuse software algorithm to protect output circuits in an over current situation.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

A diagnostic trouble code will be logged if there is an over current (short to ground or excessive load) or an open in the circuits between the ESC and the fog lights.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to check operation of the fog lights and monitor activation of the fog light switch. See the diagnostic software manual for details on using the software.

Fog Light Preliminary Check

Table 294 Fog Light Preliminary Check

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify fog lights are inoperative. (Ignition on, headlights on, low beam selected and fog light switch on.)	Visually check fog lights.	Fog lights are inoperative.	Go to next step.	Fog lights are operating. Problem does not exist or is intermittent. (Check for inactive diagnostic trouble codes.)
2.	On	Determine if any other features are malfunctioning that may have common circuits. (Example: Missing ground common to several features.)	Visually check for other malfunctioning features.	No other features are malfunctioning.	Go to next step.	Identify and repair condition causing several features to be inoperative.
3.	On	Are both fog lights inoperative?	Visually check if both fog lights are inoperative.	Both fog lights are inoperative.	Go to next step.	Check specific circuits of the inoperative light for open circuits.

Table 294 Fog Light Preliminary Check (cont.)

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
4.	On	Check for fog light diagnostic trouble codes. (See Diagnostic Trouble Codes, page 866)	Read display on odometer.	No fog light diagnostic trouble codes are active.	Go to next step.	Go to fault detection management. (See FAULT DETECTION MANAGEMENT, page 867)
5.		**Check for switch pack faults.** Problem may be in multiplexed switches. Check for switch diagnostic trouble codes. (See Diagnostic Trouble Codes, page 866)		No multiplexed switch diagnostic trouble codes are active.	Go to fault detection management. (See FAULT DETECTION MANAGEMENT, page 867)	

Diagnostic Trouble Codes

To display diagnostic trouble codes (DTC's), set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch simultaneously. If no faults are present, the cluster odometer will display "NO FAULTS". If faults are present, the gauge cluster display will show the number of faults and each diagnostic trouble code for 10 seconds and then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in "A" for active faults or "P" for previously active faults. Releasing the parking brake or turning the ignition key off will take the ESC and the gauge cluster out of the diagnostic mode.

After all repairs have been made, the diagnostic trouble codes may be cleared by putting the key switch in the accessory position, turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 295 Fog Light Circuits

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
Diagnostic trouble codes starting with 625	625 series diagnostic trouble codes relate to switch pack faults.
Refer to the switch pack module section.	
611 14 3 2	Fog light over current
This fault may be the result of a short in the circuits between the fog lights and the ESC. It could also be caused by an excessive load on the circuit.	
611 14 3 1	Fog light open circuit
This fault is the result of an open in circuits between the fog lights and the ESC. Check for burned out bulb.	
611 14 3 3	Fog light lamps, less than normal low current but more than open circuit

Table 295 Fog Light Circuits (cont.)

611 14 3 4	Fog light lamps, greater than normal high current and less than fusing current
611 14 3 6	Fog light lamps has current flow when output commanded off

5.3. FAULT DETECTION MANAGEMENT

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to Fog Light Circuits From ESC.

A fault in the fog light circuits will be apparent when the lights don't come on. The ESC will also log a diagnostic trouble code (DTC) when there is a short in any of the circuits to the fog light. Problems in the fog light circuits can be caused by burned out lamps, a blown fuse, a short, an open, or a problem in the ESC.

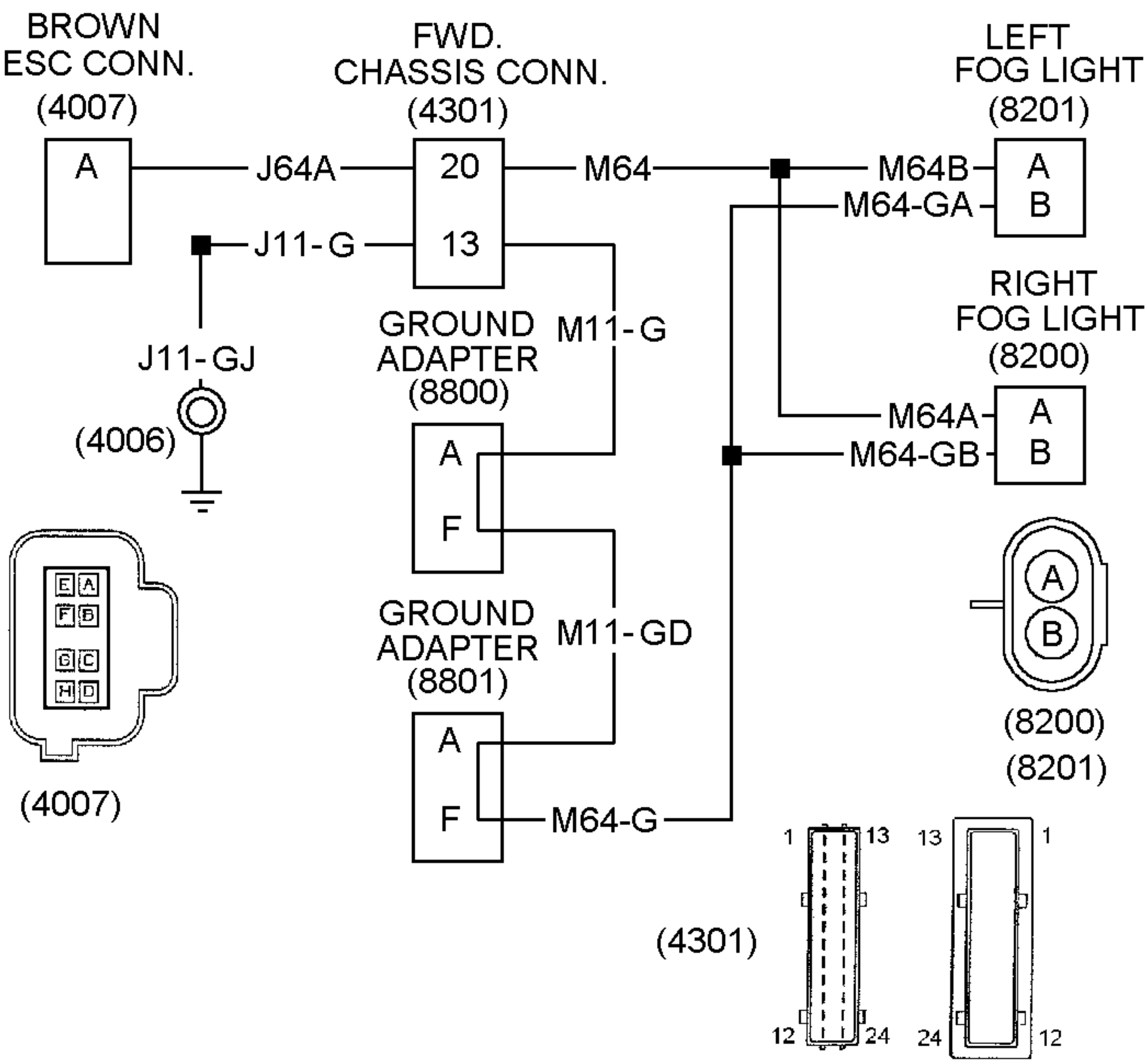

Figure 434 Fog Light Circuits From ESC (Connectors Viewed From Mating End) — Always Refer To Circuit Diagram Book For Latest Circuit Information

(4006) GROUND STUD
(4007) BROWN ESC CONNECTOR
LOCATED ON ENGINE COMPARTMENT SIDE OF ESC
(4301) FORWARD CHASSIS CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME RAIL
(8200) RIGHT FOG LIGHT CONNECTOR
LOCATED BEHIND RIGHT FOG LIGHT
(8201) LEFT FOG LIGHT CONNECTOR
LOCATED BEHIND LEFT FOG LIGHT
(8800) GROUND ADAPTER
(8801) GROUND ADAPTER

Table 296 Fog Lights Circuit Tests

<table>
<tr><th colspan="3">FAULTS</th></tr>
<tr><td>611 14 3 3</td><td colspan="2">Fog light lamps, less than normal low current but more than open circuit</td></tr>
<tr><td>611 14 3 4</td><td colspan="2">Fog light lamps, greater than normal high current and less than fusing current</td></tr>
<tr><td>611 14 3 6</td><td colspan="2">Fog light lamps has current flow when output commanded off</td></tr>
<tr><td>611 14 3 2</td><td colspan="2">Fog light over current (Short Circuit)</td></tr>
<tr><td>611 14 3 1</td><td colspan="2">Fog light under current (Open Circuit)</td></tr>
<tr><td colspan="3">Fog Light Connector (8201) Voltage Checks

Check with ignition on, headlights on, low beams selected and fog light switch on.

NOTE – Always check connectors for damage and pushed–out terminals.

The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.</td></tr>
<tr><td>Test Points</td><td>Spec.</td><td>Comments</td></tr>
<tr><td>(8201) cavity A to ground</td><td>NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.

12 ± 1.5 volts</td><td>If voltage is missing, check for open or short in circuits M64B, M64, J64A or M64A.

Also insure proper voltage out of ESC.

Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)</td></tr>
<tr><td>(8201) cavity B to ground</td><td>0 volts</td><td>Ground circuit, no voltage expected.</td></tr>
<tr><td>(8201) Pin A to cavity B</td><td>NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.

12 ± 1.5 volts</td><td>If voltage is missing, check for open in ground circuits and connectors between ground stud (4006) and the fog light connector.</td></tr>
<tr><td colspan="3">Fog Light Connector (8200) Voltage Checks

Check with ignition on, headlights on, low beams selected and fog light switch on.

NOTE – Always check connectors for damage and pushed–out terminals.</td></tr>
<tr><td>Test Points</td><td>Spec.</td><td>Comments</td></tr>
</table>

Table 296 Fog Lights Circuit Tests (cont.)

(8200) cavity B to ground	0 volts	Ground circuit, no voltage expected.
(8200) cavity A to cavity B	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts	If voltage is missing, check for open in ground circuits and connectors between ground adapter (8801) and the fog light connector.

5.4. EXTENDED DESCRIPTION

Refer to Fog Light Circuits From ESC.

The fog light switch communicates with the ESC. When it is in the on position and the headlights are in low beam the ESC will turn on the fog lights.

The ESC will supply 12 volts to system controller brown connector (4007) terminal A, circuit J86A, forward chassis connector (4301) terminal 20 and circuit M64 to a tie point. From the tie point the circuits are split on M64B to left fog light connector (8201) terminal A and M64A to right fog light connector (8200) terminal A.

Ground for the fog lights is supplied from ground stud (4006) on circuits J11–GJ, J11–G, forward chassis connector (4301) terminal 13 and circuit M10–GA to tie point CS5. From CS5 the circuits are split on M64–GA to left fog light connector (8201) terminal B and M64–G to right fog light connector (8200) terminal B.

5.5. COMPONENT LOCATIONS

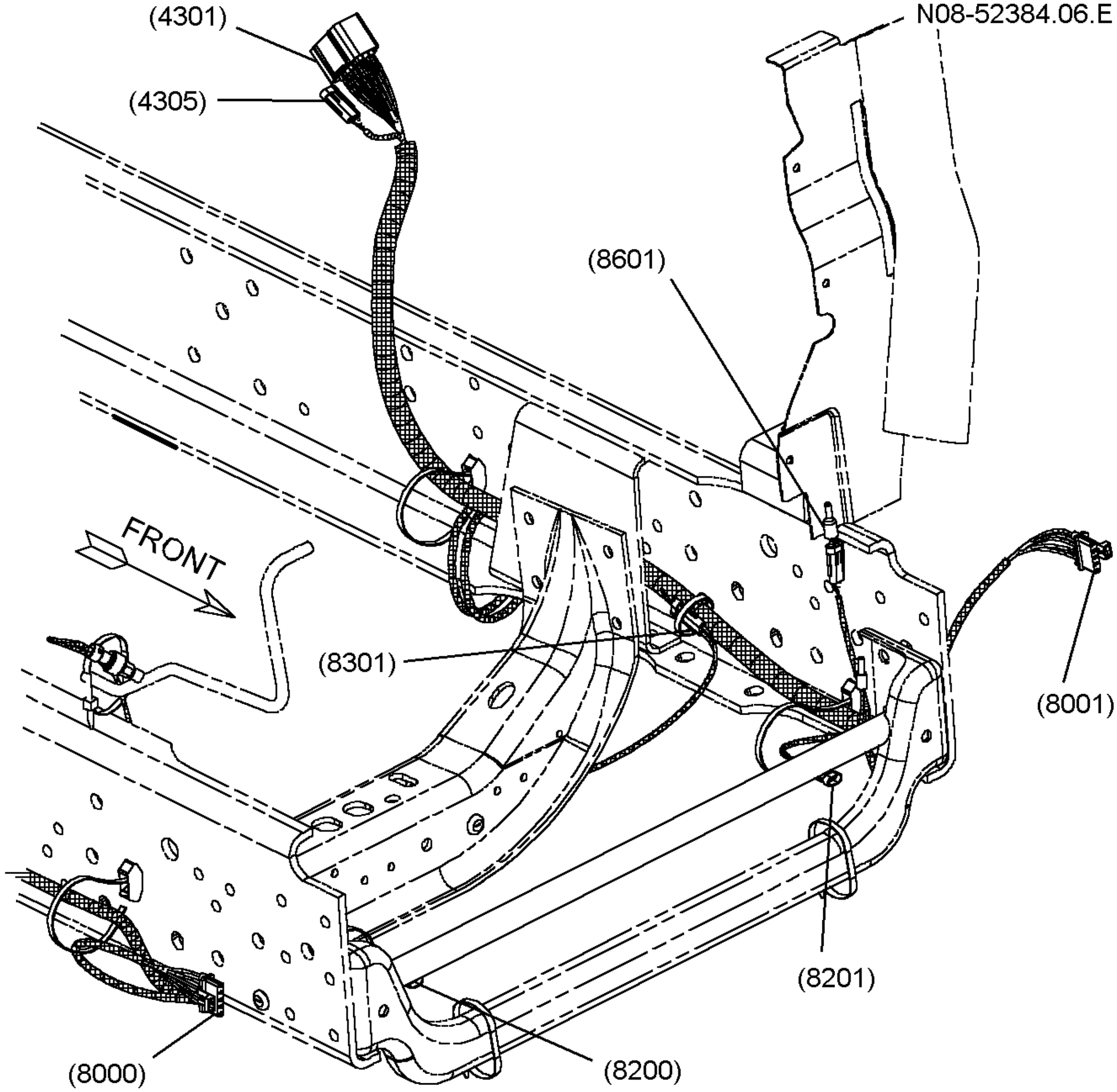

Figure 435 Fog Light Wiring

(4301) FORWARD CHASSIS CONNECTOR
(8000) RIGHT HEADLIGHT CONNECTOR
(8001) LEFT HEADLIGHT CONNECTOR
(8200) RIGHT FOG LIGHT CONNECTOR
(8201) LEFT FOG LIGHT CONNECTOR
(8302) HORN CONNECTOR

6. HEADLIGHT SYSTEM

6.1. CIRCUIT FUNCTIONS

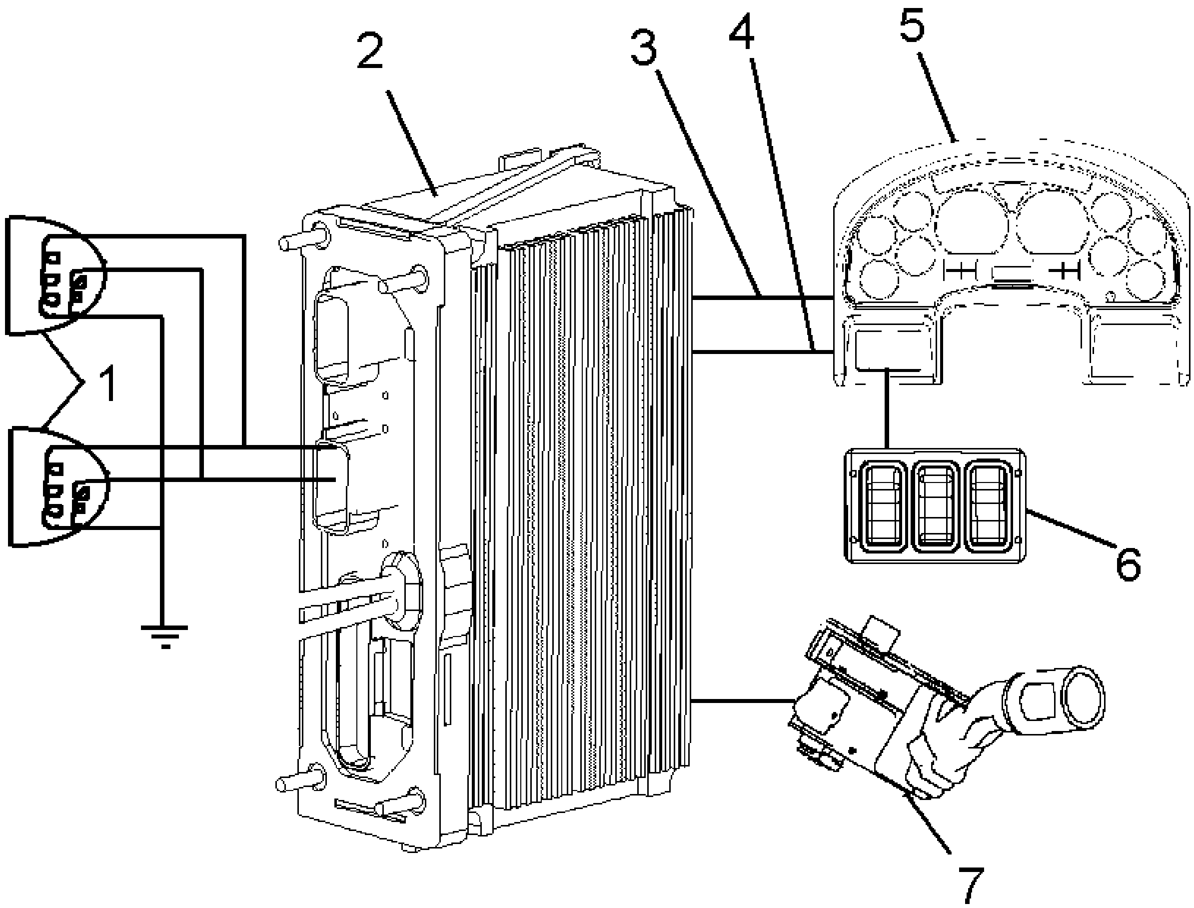

Figure 436 Headlights Function Diagram

1. HEADLIGHTS
2. ELECTRICAL SYSTEM CONTROLLER
3. DRIVETRAIN 1939 DATA LINK (FROM ELECTRONIC GAUGE CLUSTER)
4. DIRECT HEADLIGHT ENABLE CIRCUIT FROM EGC
5. ELECTRONIC GAUGE CLUSTER
6. HEADLIGHT SWITCH (IN ELECTRONIC GAUGE CLUSTER)
7. DIMMER SWITCH (PART OF TURN SIGNAL ASSEMBLY)

Refer to Headlights Function Diagram.

The headlight system consists of the headlights, headlight switch, dimmer switch, flash to pass, day time running lights (mandatory for Canada, optional for USA) and the optional “lights on with wipers feature”.

The fender mounted headlights are a one lamp system and share a molded cavity with the turn signals. The headlight switch is a 3–position (off/parking lights/headlights) rocker type located below the EGC. When the key is in the ignition position and the headlight switch is on the EGC will communicate with the ESC on the drivetrain 1939 data link. The ESC supplies voltage to the headlights as requested.

While the key is not in the ignition position, the headlights will only operate in the low beam mode. This is enabled by a direct circuit from the EGC to the ESC, which is not dependant on the data link. This also acts as a fail-safe to activate the low beam headlights when communication on the drivetrain 1939 data link is interrupted.

The dimmer and flash to pass switches are located in the turn signal assembly. Pulling the turn signal lever toward the driver as far as it will go, while the headlights are on, will switch the headlights between hi-beam and low-beam operation.

When the key is on and the headlights are off, pulling the turn signal slightly toward the driver and releasing the turn signal lever will flash the headlights.

When the key is on and the headlights are on, pulling the turn signal slightly toward the driver and releasing the turn signal lever will momentarily switch the headlights between hi-beam and low-beam operation.

The programmable day time running light feature allows the vehicle to operate in a “lights on” condition at all times without driver input. This system operates the headlights at partial illumination, but still helps to increase visibility even in bright sunshine. The daytime running lights will go off when the park brake is set or the ignition is turned off.

When the programmable “lights on with wipers feature” is enabled the low beam headlights and park lights will be turned on by the ESC anytime the windshield wipers are activated, except during momentary wash/wipe. The lights will remain on after the wipers are turned off until the headlight switch is turned on and off or the key is turned off.

If the vehicle is equipped with a remote keyless entry, the ESC will also turn the headlights on or off as required.

6.2. DIAGNOSTICS

Should the lights fail to operate, the problem could be attributed to a faulty switch in the EGC, a faulty switch pack in the EGC a faulty EGC, open circuits or shorted circuits. The ESC has an internal virtual fuse software algorithm to protect output circuits in an over current situation.

Should the lights fail to switch between high and low beams or the flash to pass fail to operate, the problem could be attributed to a faulty switch in the turn signal assembly, open circuits, shorted circuits or a problem in the ESC.

A diagnostic trouble code will be logged if there is an over current (short to ground or excessive load) or an open in the circuits between the ESC and the headlights.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to check operation of the lights and monitor activation of the turn/hazard signal switches and stop light switch(es). See the diagnostic software manual for details on using the software.

The diagnostic software will also identify if the daytime running light or lights on with wipers features are activated.

Headlight Preliminary Check

Table 297 Headlight Preliminary Check

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify headlights are malfunctioning.	Visually check headlights.	Headlights are malfunctioning.	Go to next step.	Headlights are operating correctly. Problem does not exist or is intermittent. (Check for inactive diagnostic trouble codes.)
2.	On	Determine if any other features are malfunctioning that may have common circuits. (Example: Missing ground common to several features.)	Visually check for other malfunctioning features.	No other features are malfunctioning.	Go to next step.	Identify and repair condition causing several features to be inoperative.
3.	On	Are both high beam or both low beam lights malfunctioning?	Visually check if both high beam or both low beam lights are malfunctioning?	Both high beam or both low beam lights are malfunctioning.	Go to next step.	Check specific circuits of the inoperative light for open circuits.
4.	On	Check for diagnostic trouble codes. (See Diagnostic Trouble Codes, page 874)	Read display on odometer.	Headlight diagnostic codes are present.	Go to headlight outputs from ESC (See HEADLIGHT OUTPUTS FROM ESC, page 879)	Go to Headlight circuit inputs to ESC (See HEADLIGHT CIRCUIT INPUTS TO ESC, page 875)

Diagnostic Trouble Codes

To display diagnostic trouble codes (DTC's), set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch simultaneously. If no faults are present, the cluster odometer will display "NO FAULTS". If faults are present, the gauge cluster display will show the number of faults and each diagnostic trouble code for 10 seconds and then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in "A" for active faults or "P" for previously active faults. Releasing the parking brake or turning the ignition key off will take the ESC and the gauge cluster out of the diagnostic mode.

After all repairs have been made, the diagnostic trouble codes may be cleared by putting the key switch in the accessory position, turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 298 Headlight Circuits

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
NO DIAGNOSTIC TROUBLE CODE	Diagnostic trouble codes are not logged for every possible fault in the headlight circuits.
There are no diagnostic trouble codes associated with the dimmer switch, flash to pass switch or 3 switch pack in the EGC. Open circuits to an individual headlight will not generate a fault. An open in the zero volt reference signal to the turn signal switch will cause the wipers to operate at high speed which will turn on the low beams if the “lights on with wipers” feature is enabled.	
611 14 5 1	Headlight low beam open circuit
611 14 5 2	Headlight low beam over current
611 14 5 3	Headlight low beam lamps, less than normal low current but more than open circuit
611 14 5 4	Headlight low beam lamps, greater than normal high current and less than fusing current
611 14 5 6	Headlight low beam lamps has current flow when output commanded off
611 14 7 1	Headlight high beam open circuit
611 14 7 2	Headlight high beam over current
611 14 7 3	Headlight high beam lamps, less than normal low current but more than open circuit
611 14 7 4	Headlight high beam lamps, greater than normal high current and less than fusing current
611 14 7 6	Headlight high beam lamps has current flow when output commanded off

6.3. HEADLIGHT CIRCUIT INPUTS TO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Headlight Circuit Inputs to ESC.

A fault in the headlight circuit inputs to the ESC will be apparent when the lights don’t operate correctly. There are no diagnostic trouble codes associated with headlight input circuits to the ESC. Problems in the headlight input circuits can be caused by faulty switches, a short, an open, or a problem in the ESC or EGC.

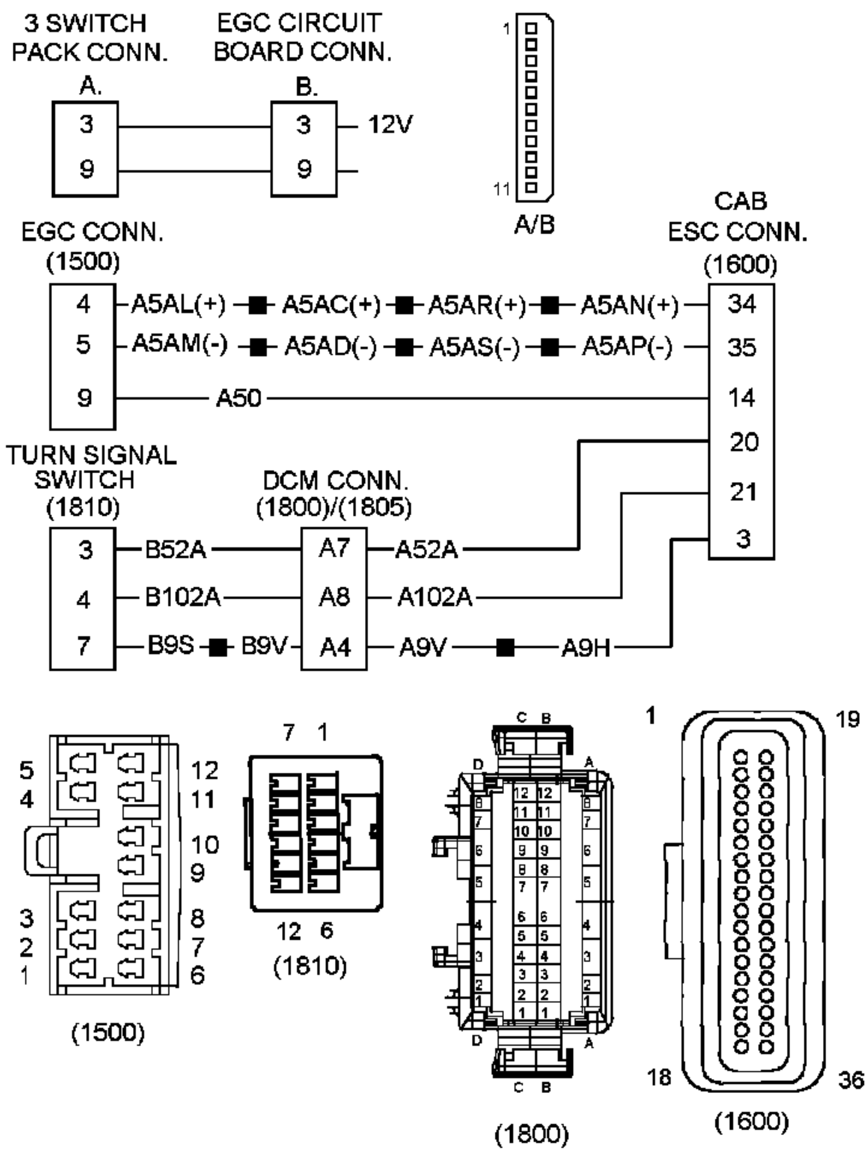

Figure 437 Headlight Circuit Inputs to ESC (Connectors Viewed From Mating End) — Always Refer To Circuit Diagram Book For Latest Circuit Information

A. 3 SWITCH PACK CONNECTOR
LOCATED ON BACK OF 3 SWITCH PACK
B. ELECTRONIC GAUGE CLUSTER (EGC) CONNECTOR
LOCATED ON EGC CIRCUIT BOARD
(1500) ELECTRONIC GAUGE CLUSTER (EGC) CONNECTOR
LOCATED ON BACK OF EGC
(1600) 36–WAY ESC CONNECTOR
LOCATED ON CAB SIDE OF ESC
(1800)/(1805) DRIVER CONTROL MODULE (DCM) CONNECTOR
LOCATED TO RIGHT OF LOWER STEERING COLUMN
(1810) TURN SIGNAL SWITCH HARNESS CONNECTOR
LOCATED BEHIND TURN SIGNAL ASSEMBLY

Table 299 Headlight Switch Inputs to ESC Circuit Tests

THERE ARE NO DIAGNOSTIC TROUBLE CODES ASSOCIATED WITH THESE CIRCUITS		
A mechanically defective headlight switch could also prevent the headlight from operating. Remove the mechanical portion of the switch and attempt to turn the switch on by pressing the bottom switch contact. If the headlights illuminate, the mechanical switch assembly should be replaced.		
ESC Harness Connector (1600) Voltage Checks Checks headlight fail-safe circuit input to ESC. **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.** Connect breakout box to harness connector (1600)		
Test Points	Spec.	Comments
Headlight switch "on", ESC connector (1600) terminal 14 to ground	12 ± 1.5 volts with headlight switch "on"	If voltage is missing, check for open or short in circuit A50. If no open or shorts are found check for voltage out of EGC.
Headlight switch "off", Terminal 14 to ground	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 0 volts with headlight switch "off"	Identify source of incorrect voltage and repair
EGC 3 Switch Pack Harness Connector Headlight Voltage Checks Check with ignition key on and 3 switch pack disconnected. **NOTE – If the EGC is working correctly, disconnecting the 3 switch pack connector should cause the park lights to come on.** **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
3 switch pack harness connector, pin 3 to ground	12 ± 1.5 volts	If voltage is missing, check for open or shorts in circuits between EGC connector and switch connector. Also insure proper voltage out of EGC.
3 switch pack harness connector, pin 9 to ground	0 –.3 volts	Low circuit from EGC If voltage is incorrect, check for open or shorts in circuits between EGC and switch. Also insure proper voltage out of EGC.

Table 299 Headlight Switch Inputs to ESC Circuit Tests (cont.)

3 Switch Pack Headlight Resistance Check **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Checking for continuity between pins 3 and 9 of the switch pack, when the switch is on.	<2 ohms.	If there is no continuity, the switch pack needs replaced.
Turn Signal Switch Harness Connector (1810) Voltage Checks Check with key in ignition position Checks high/low beam select input circuits. **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**		
(1810) Cavity 3 to ground Headlight dimmer switch input	12 ± 1.5 volts.	If voltage is missing, check for open or short in circuits B52A or A52A. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
(1810) Cavity 4 to ground Flash to pass switch input	12 ± 1.5 volts.	If voltage is missing, check for open or short in circuits B102A or A102A. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
(1810) Cavity 7 to ground	<1 volt.	Zero volt reference level circuit, no voltage expected.
Turn Signal Switch (1810) Resistance Checks Check with (1810) removed Checks dimmer and flash to pass switches in turn signal assembly.		
(1810) pin 3 to 7	Switching between >50K ohms and < 2 ohms as lever is pulled and released.	If resistance is incorrect replace turn signal switch assembly.
(1810) pin 4 to 7	Switching between >50K ohms and < 2 ohms as lever is pulled and released.	If resistance is incorrect replace turn signal switch assembly.

Extended Description

Refer to Input Circuits to ESC.

When the key is in the ignition position and the headlight switch is turned on, the EGC will communicate with the ESC through the drivetrain 1939 data link to command the lights on.

The ESC applies 12 volts to terminal 3 (headlight dimmer switch contacts) of turn signal switch (1810) through circuit A52A, connector (1800)/(1805) and circuit B52A. When the headlight dimmer switch is activated the ESC will sense this voltage drop to ground through turn signal switch connector (1810) terminal 7, circuit B9S, circuit B9V, connector (1800)/(1805), circuit A9V, circuit A9H and ESC connector (1600) terminal 3 to the zero volt reference signal.

The ESC applies 12 volts to terminal 4 (flash to pass switch contacts) of turn signal switch (1810) through circuit A102A, connector (1800)/(1805) and circuit B102A. When the flash to pass switch is activated the ESC will sense this voltage drop to ground through turn signal switch connector (1810) terminal 7, circuit B9S, circuit B9V, connector (1800)/(1805), circuit A9V, circuit A9H and ESC connector (1600) terminal 3 to the zero volt reference signal.

When the headlight switch is in the on position, 12 volts is applied from EGC connector (1500) terminal 9 to circuit A50 and ESC connector (1600) terminal 14. This signals the ESC To turn on the low beams even when the key is not in the ignition position.

6.4. HEADLIGHT OUTPUTS FROM ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Circuits From ESC to Headlights.

A fault in the circuits between the ESC and the headlights will be apparent when the lights don't operate correctly. The ESC will also log a diagnostic trouble code (DTC) when there is a short in any of the headlight circuits or an open circuit between the ESC and the headlights. Problems in the circuits between the ESC and the headlights can be caused by burned out lamps, a short, an open, or a problem in the ESC.

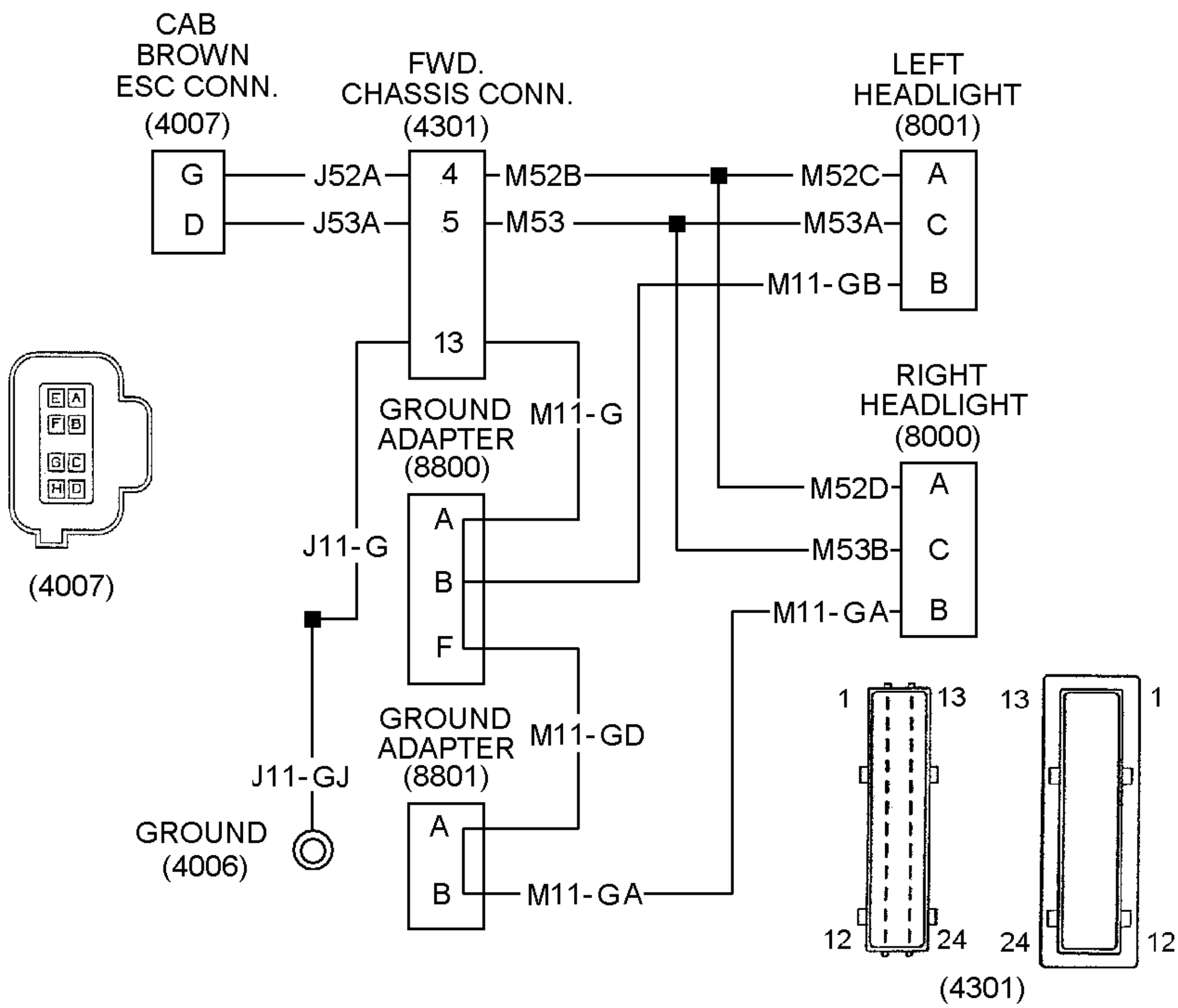

Figure 438 Circuits From ESC to Headlights (Connectors Viewed From Mating End) — Always Refer To Circuit Diagram Book For Latest Circuit Information

(4006) GROUND STUD
(4007) BROWN ESC CONNECTOR
LOCATED ON ENGINE COMPARTMENT SIDE OF ESC
(4301) FORWARD CHASSIS CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME RAIL
(8000) RIGHT HEADLIGHT CONNECTOR
LOCATED BEHIND RIGHT HEADLIGHT
(8001) LEFT HEADLIGHT CONNECTOR
LOCATED BEHIND LEFT HEADLIGHT
(8800) LEFT GROUND ADAPTER
(8801) RIGHT GROUND ADAPTER

Table 300 ESC Low Beam Outputs to Headlight Circuit Tests

FAULTS	
611 14 5 3	Headlight low beam lamps, less than normal low current but more than open circuit

Table 300 ESC Low Beam Outputs to Headlight Circuit Tests (cont.)

<table>
<tr><td colspan="2">611 14 5 4</td><td colspan="2">Headlight low beam lamps, greater than normal high current and less than fusing current</td></tr>
<tr><td colspan="2">611 14 5 6</td><td colspan="2">Headlight low beam lamps has current flow when output commanded off</td></tr>
<tr><td colspan="2">611 14 5 2</td><td colspan="2">Low beam over current</td></tr>
<tr><td colspan="4">This fault may be the result of a short in the circuits between the low beam headlight circuits and the ESC. It could also be caused by an excessive load on the circuit.</td></tr>
<tr><td colspan="2">611 14 5 1</td><td colspan="2">Low beam under current</td></tr>
<tr><td colspan="4">This fault is the result of an open in circuits between the low beam headlight circuits and the ESC.

Check for burned out bulbs.</td></tr>
<tr><td colspan="4">Left Headlight Connector (8001) Low Beam Voltage Checks

Check with key in ignition position, headlight switch on, low beams selected and connector (8001) disconnected.

With sealed beam headlamps, as used with severe service vehicles, the terminals at the headlamps are not sealed - in this application the terminals of the headlamps and the terminals in the headlamp connector must be totally coated with Grafo grease 2643099R1

NOTE – With sealed beam headlamps, as used with Severe Service trucks, the terminals at the headlamps are not sealed - in this application the terminals of the headlamps and the terminals in the headlamp connector must be totally coated with Grafo grease 2643099R1

NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.</td></tr>
<tr><td>Test Points</td><td colspan="2">Spec.</td><td>Comments</td></tr>
<tr><td>Headlights in low beam. (8001) terminal C to ground.</td><td colspan="2">NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.

12 ± 1.5 volts with headlight switch “on”</td><td>If voltage is missing, check for open or short in circuits J53A, M53, M53A or M53B.

If no open or shorts are found check for voltage out of EGC.</td></tr>
<tr><td>Headlights in low beam. (8001) terminal C to terminal B.</td><td colspan="2">NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.

12 ± 1.5 volts with headlight switch “on”</td><td>If voltage is missing, check for open in circuits between terminal B and ground.</td></tr>
</table>

Table 300 ESC Low Beam Outputs to Headlight Circuit Tests (cont.)

Headlights in low beam. (8000) terminal C to ground.	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts with headlight switch “on”	If voltage is missing, check for open in circuit M53B.
Headlights in low beam. (8000) terminal C to terminal B.	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts with headlight switch “on”	If voltage is missing, check for open in circuits between terminal B and ground adapter (8800).

Table 301 ESC High Beam Outputs to Headlight Circuit Tests

FAULTS		
611 14 7 3	Headlight high beam lamps, less than normal low current but more than open circuit	
611 14 7 4	Headlight high beam lamps, greater than normal high current and less than fusing current	
611 14 7 6	Headlight high beam lamps has current flow when output commanded off	
611 14 7 2	High beam over current	
This fault may be the result of a short in the circuits between the high beam headlight circuits and the ESC. It could also be caused by an excessive load on the circuit.		
611 14 7 1	High beam under current	
This fault is the result of an open in circuits between the high beam headlight circuits and the ESC. Check for burned out bulbs.		
Left Headlight Connector (8001) Voltage Checks Check with key in ignition position, headlight switch on, high beams selected and connector (8001) disconnected. **NOTE – With sealed beam headlamps, as used with Severe Service trucks, the terminals at the headlamps are not sealed - in this application the terminals of the headlamps and the terminals in the headlamp connector must be totally coated with Grafo grease 2643099R1** **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**		
Test Points	Spec.	Comments

Table 301 ESC High Beam Outputs to Headlight Circuit Tests (cont.)

Headlights in high beam. (8001) terminal A to ground.	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts with headlight switch “on”	If voltage is missing, check for open or short in circuits J52A, M52B, M52C or M52D. If no open or shorts are found check for voltage out of EGC.
Headlights in high beam. (8001) terminal A to terminal B.	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts with headlight switch “on”	If voltage is missing, check for open in circuits between terminal B and ground.
Headlights in high beam. (8000) terminal A to ground.	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts with headlight switch “on”	If voltage is missing, check for open in circuit M52D.
Headlights in high beam. (8000) terminal A to terminal B.	**NOTE – A load device, such as a test light, must be used in parallel with voltmeter probes to read an accurate voltage.** 12 ± 1.5 volts with headlight switch “on”	If voltage is missing, check for open in circuits between terminal B and ground adapter (8800).

Extended Description

Refer to Circuits From ESC to Headlights.

When low beams are requested, the ESC will supply 12 volts to system controller front connector (4007) terminal 5, circuit J53A, forward chassis connector (4301) terminal 5 and circuit M53 to tie point CS3. From CS3 the circuits are split on M53A to left headlight connector (8001) terminal C and M53B to right headlight connector (8000) terminal C.

When high beams are requested, the ESC will supply 12 volts to system controller front connector (4007) terminal 2, circuit J52A, forward chassis connector (4301) terminal 4 and circuit M52B to tie point CS4. From CS4 the circuits are split on M52C to left headlight connector (8001) terminal A and M52D to right headlight connector (8000) terminal A.

Ground for the headlights is supplied from ground stud (4006) on circuits J11–GJ, forward chassis connector (4301) terminal 13 and circuit M11–G to tie point CS5. From CS5 the circuits are split on M11–GB to left headlight connector (8001) terminal B and M11–GA to right headlight connector (8000) terminal B.

6.5. COMPONENT LOCATIONS

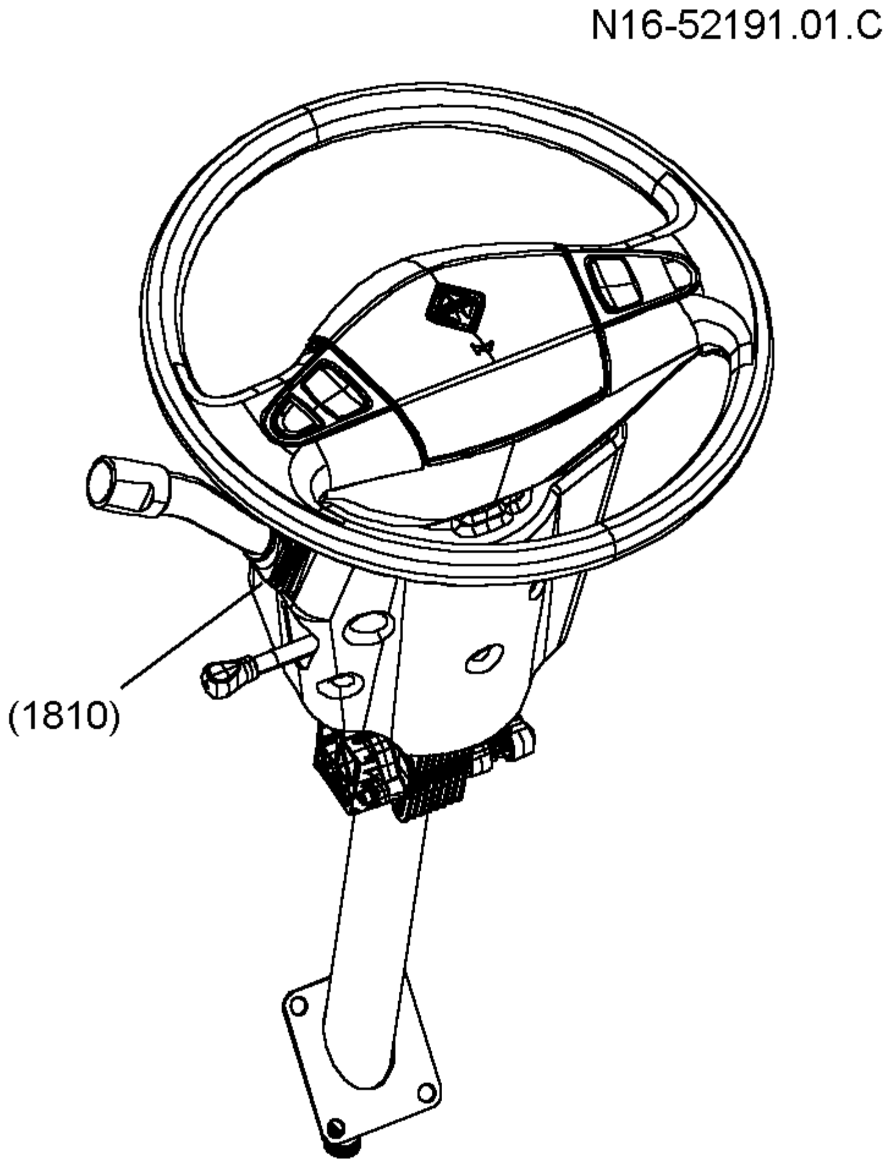

Figure 439 Turn Signal Assembly

(1810) TURN SIGNAL ASSEMBLY CONNECTOR (BEHIND STEERING COLUMN SHROUD)

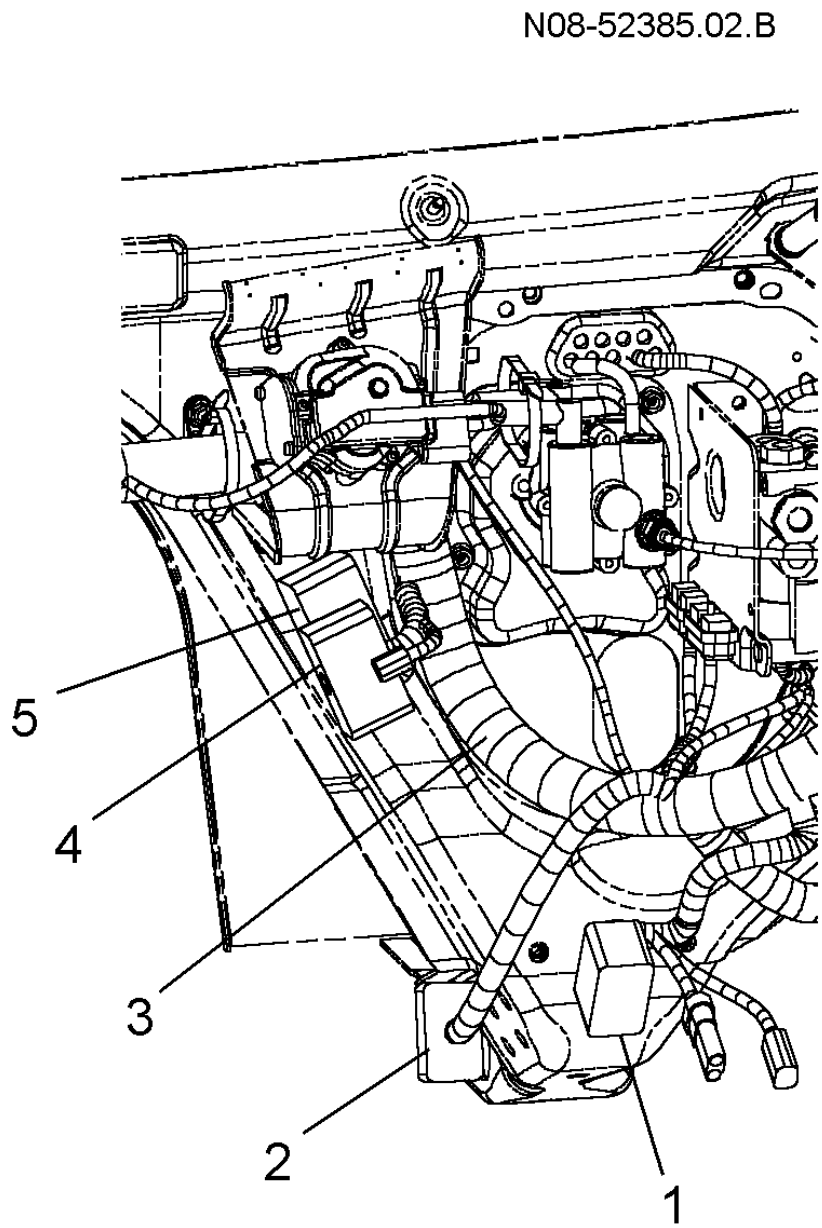

Figure 440 Headlight Connector Locations (Dash Panel From Engine Compartment)

1. FORWARD CHASSIS CONNECTOR (4301)
2. REAR CHASSIS CONNECTOR (9700)
3. CHASSIS HARNESS
4. TRANSMISSION CONNECTOR
5. ENGINE CONNECTOR

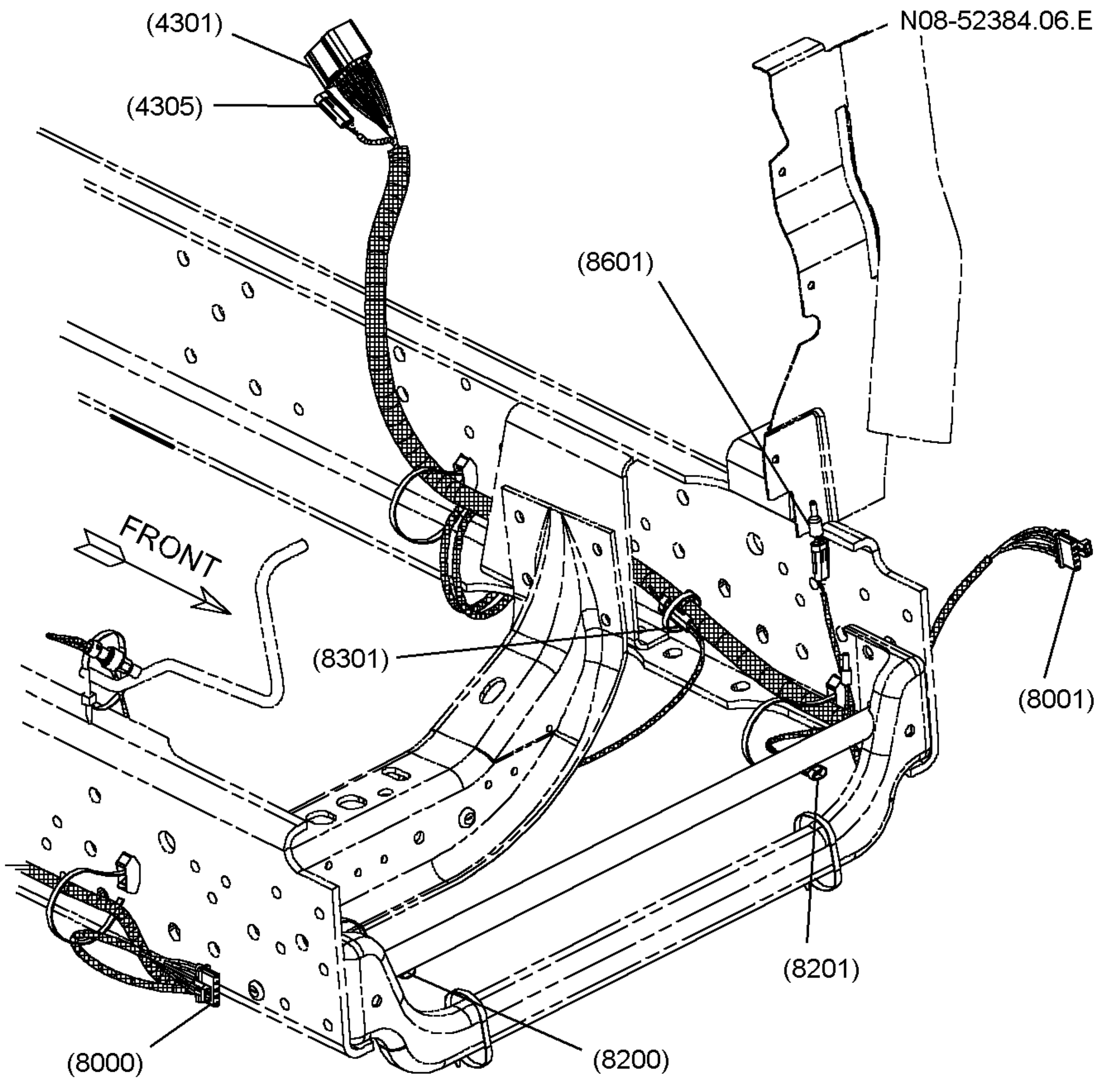

Figure 441 Headlight Wiring

(4301) FORWARD CHASSIS CONNECTOR
(8000) RIGHT HEADLIGHT CONNECTOR
(8001) LEFT HEADLIGHT CONNECTOR
(8200) RIGHT HEADLIGHT CONNECTOR
(8201) LEFT HEADLIGHT CONNECTOR
(8302) HORN CONNECTOR

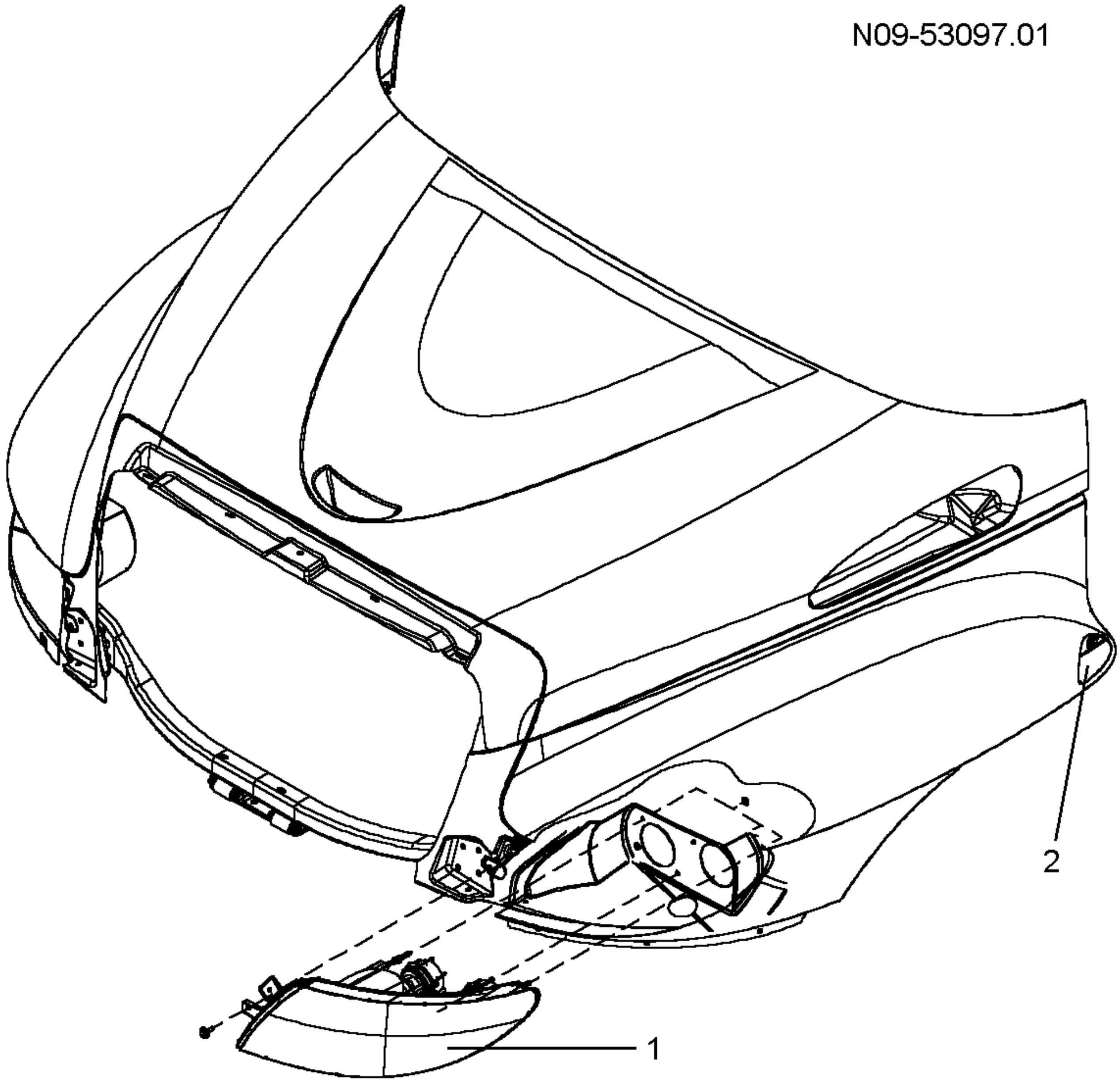

Figure 442 Headlights, Front and Side Marker Lights (Not Severe Service)

1. HEADLIGHT ASSEMBLY
2. SIDE MARKER LIGHT

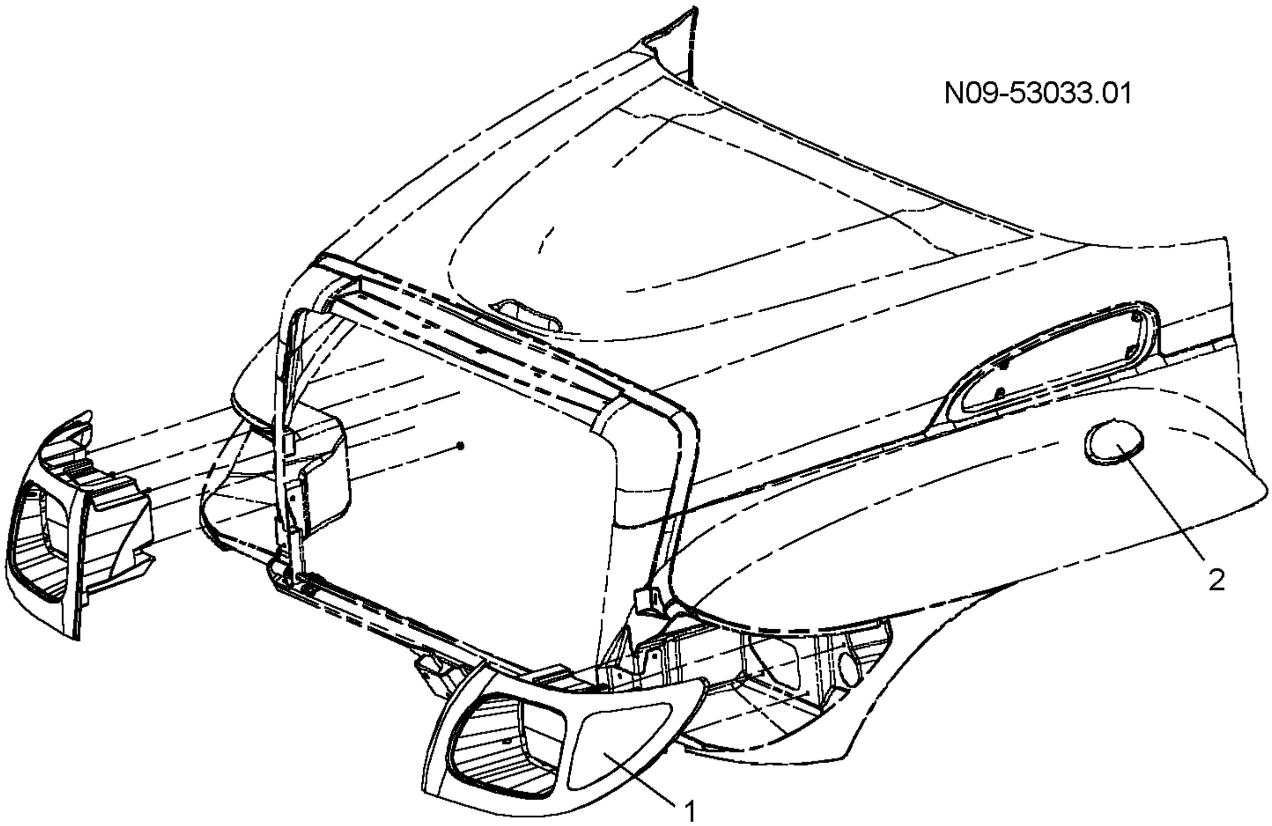

Figure 443 Headlights, Front and Side Marker Lights (Severe Service)

1. HEADLIGHT ASSEMBLY
2. STANDARD SIDE MARKER LIGHT

7. PANEL LIGHTS

7.1. CIRCUIT FUNCTIONS

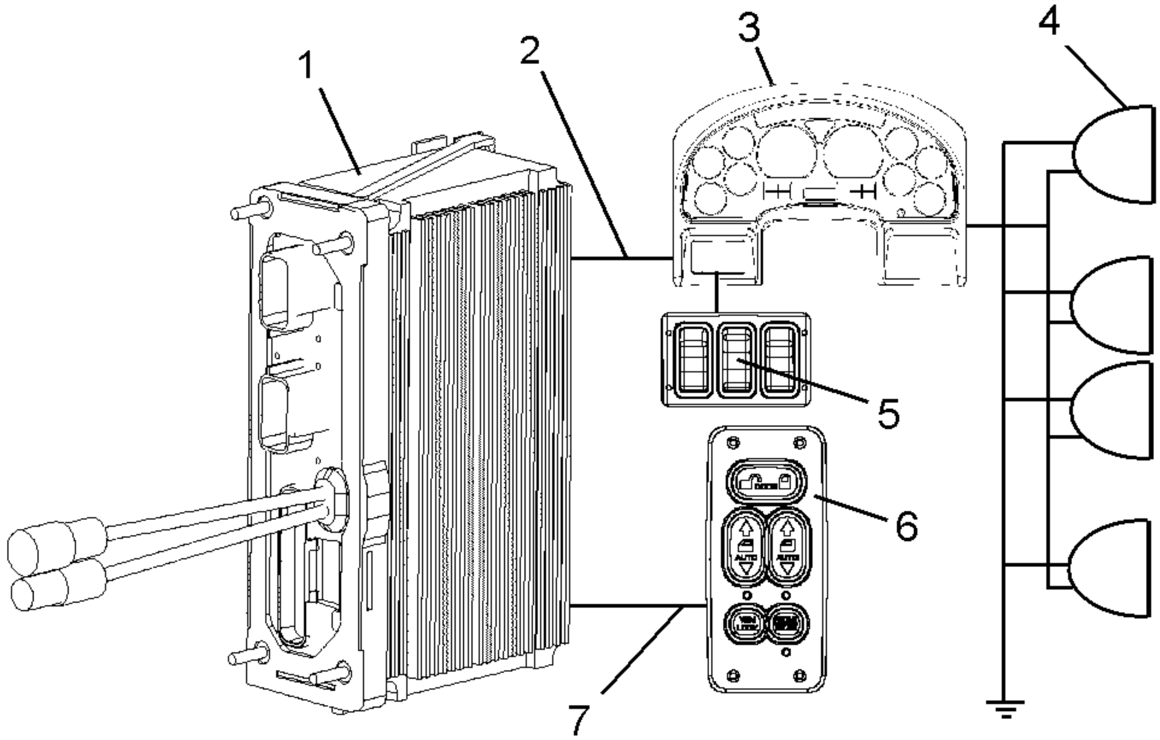

Figure 444 Panel Lights Function Diagram

1. ELECTRICAL SYSTEM CONTROLLER (ESC)
2. DRIVETRAIN 1939 DATA LINK BETWEEN ELECTRONIC GAUGE CLUSTER (EGC) AND ESC
3. EGC
4. DIMMER CIRCUITS CONTROLLED BY PANEL LIGHT SWITCH
5. DIMMER SWITCH MOUNTED IN 3 SWITCH PACK MOUNTED IN EGC
6. DOOR PODS
7. SWITCH DATA LINK

Refer to Panel Lights Function Diagram

Panel lights are low wattage bulbs that illuminate gauges and other miscellaneous items. The panel light switch provides input to the EGC which generates the voltage to dim/brighten the panel lights for the gauge clusters, speedometer/tachometer module, cigar lighter, door pods, heater control, etc.

Most panel lights receive a control voltage directly from the EGC. The door pods receive dimmer control messages from the ESC on the switch data link.

7.2. DIAGNOSTICS

If the panel lights do not respond to the dimmer switch the problem could be attributed to a faulty panel light dimmer switch, a problem in the EGC, open circuits or shorted circuits.

If the panel lights in a door pod fail to operate correctly, while the other panel lights work, the problem must be in the pod or the ESC.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to check operation of the lights and monitor activation of the turn/hazard signal switches and stop light switch(es). See the diagnostic software manual for details on using the software.

Panel Light Preliminary Check

Table 302 Panel Light Preliminary Check

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify panel lights are operating incorrectly.	Visually check panel lights.	Panel light is inoperative.	Go to next step.	Panel lights are operating correctly. Problem does not exist or is intermittent.
2.	On	Determine if any other features are malfunctioning that may have common circuits. (Example: Missing ground common to several features.)	Visually check for other malfunctioning features.	No other features are malfunctioning.	Go to next step.	Identify and repair condition causing several features to operate incorrectly.
3.	On	Are all panel lights operating incorrectly?	Visually check if all panel lights are operating incorrectly.	All panel lights are operating incorrectly.	Go to next step.	Check specific circuits of the inoperative lights for open circuits.
4.	On	Are panel lights illuminating when park lights are turned on?	Visually check if panel lights illuminate.	Panel lights illuminate.	Go to next step.	Go to panel light circuit outputs from EGC. (See PANEL LIGHT OUTPUT FROM EGC, page 894)
5.	On	Do panel lights respond correctly to activation of the panel dimmer switch?	Visually check if panel lights respond to panel dimmer switch.	Panel lights respond correctly.	Panel lights are working correctly.	Go topanel light circuit outputs from EGC.(See PANEL LIGHT SWITCH INPUTS TO EGC, page 891).

Diagnostic Trouble Codes

Table 303 Panel Light Circuits

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
There are no faults for panel light circuits	

7.3. PANEL LIGHT SWITCH INPUTS TO EGC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Panel Light EGC and ESC Input Circuits.

A problem in the panel light switch circuits will be apparent when the panel lights are always on and the switch has no effect on the intensity of the panel lights. There are no diagnostic trouble codes associated with the switch circuits in the EGC. Loss of the drivetrain 1939 data link between the EGC and ESC will cause several problems to occur simultaneously and the check electrical system lamp will illuminate. **Go to the section on the drivetrain 1939 data link to troubleshoot this condition.** Problems in the Panel light circuits in the EGC can be caused by a short circuit between the 3 switch pack and the EGC, an open circuit between the 3 switch pack and the EGC, a faulty switch, or a problem in the EGC.

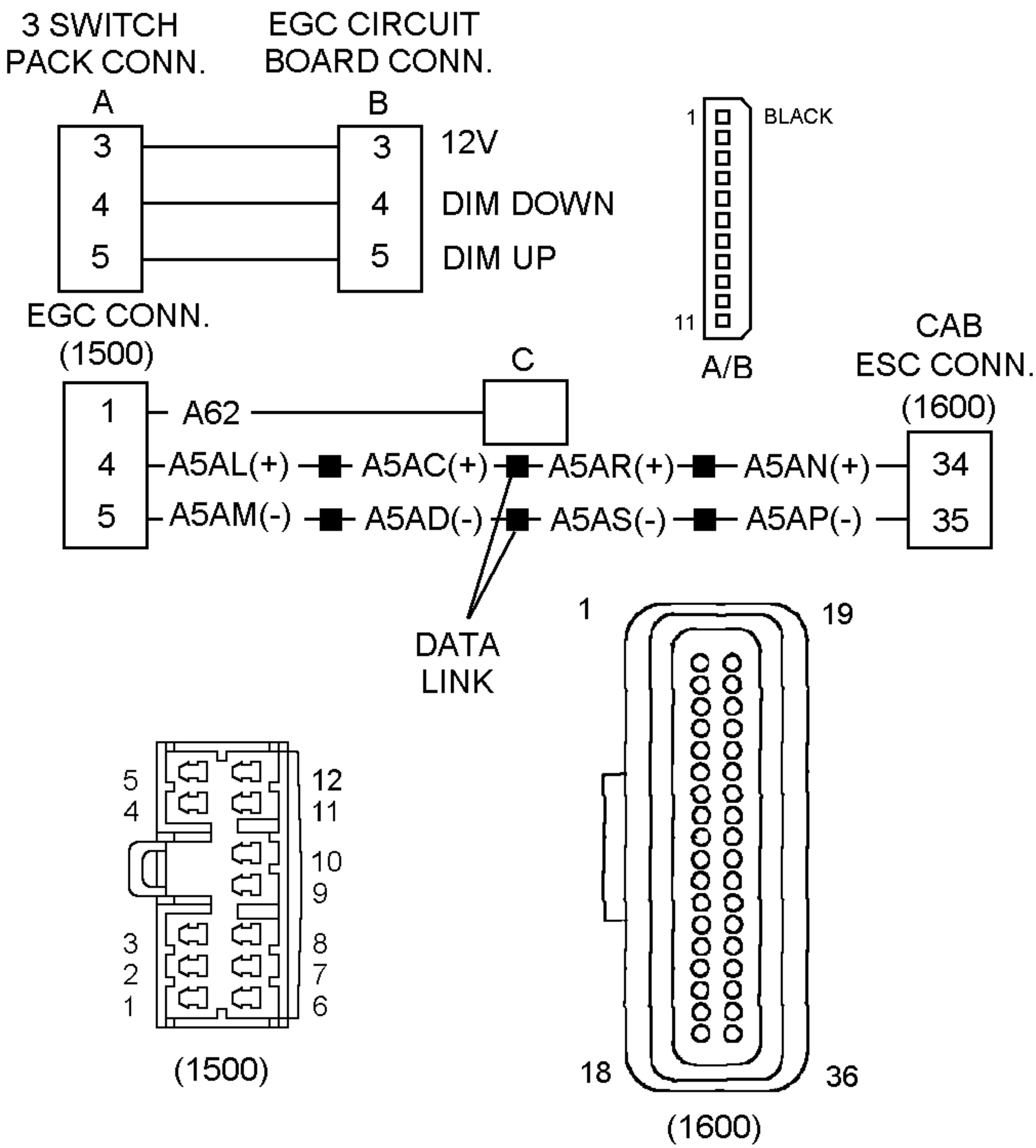

Figure 445 Panel Light EGC and ESC Input Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

A. 3 SWITCH PACK CONNECTOR
B. EGC CIRCUIT BOARD CONNECTOR
(1500) EGC CONNECTOR
LOCATED BEHIND CLUSTER
(1600) ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON CAB SIDE OF ESC

Table 304 EGC, 3 Switch Pack Circuit Tests

Diagnostic Trouble Codes		
There are no diagnostic trouble codes associated with the 3 switch pack in the EGC.		
A mechanically defective panel light switch could also prevent the panel light from operating. Remove the mechanical portion of the switch and attempt to turn the switch on by pressing the microswitches. If the panel lights respond, the mechanical switch assembly should be replaced.		
3 Switch Pack Harness Connector Panel Light Voltage Checks Check with ignition key on and 3 switch pack disconnected. **NOTE – If the EGC and switch are working correctly, disconnecting the 3 switch pack connector should cause the panel lights to come on.** **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
3 switch pack harness connector, cavity 3 to ground	12 ± 1.5 volts	If voltage is missing, check for open or shorts in circuits between EGC connector and switch connector. Also insure proper voltage out of EGC.
3 switch pack harness connector, cavity 4 to ground.	<1 volt	Dimmer down circuit between switch and EGC. If voltage is incorrect, check for shorts in circuits between EGC and switch. Also insure proper voltage out of EGC.
3 switch pack harness connector, cavity 5 to ground	<1 volt	Dimmer up circuit between switch and EGC. If voltage is incorrect, check for shorts in circuits between EGC and switch. Also insure proper voltage out of EGC.
3 Switch Pack Panel Light Resistance Check **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Check resistance between pins 3 and 4 of the switch pack, when the dimmer down switch is pressed.	<1 ohm.	If there is no continuity, the switch pack needs replaced.
Check resistance between pins 3 and 5 of the switch pack, when the dimmer up switch is pressed.	<1 ohm.	If there is no continuity, the switch pack needs replaced.

Extended Description

Refer to Panel Light EGC and ESC Input Circuits.

The panel light switch is wired directly to the EGC circuit board. When the panel light dimmer switch is pressed down, 12 volts from pin 3 from the EGC will be connected to pin 4. This will cause the EGC to lower the panel light voltage. When the panel light dimmer switch is pressed up, 12 volts from pin 3 from the EGC will be connected to pin 5. This will cause the EGC to raise the panel light voltage.

7.4. PANEL LIGHT OUTPUT FROM EGC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Panel Light Outputs from EGC.

A fault in the circuits between the EGC and the panel lights will be apparent when the lights don't operate correctly. There are no diagnostic trouble codes associated with the panel lights. Problems in the circuits between the EGC and the panel lights throughout the vehicle may be caused by burned out lamps, a short, an open, a blown fuse or a problem in the EGC.

Panel lights in the door pods are controlled by messages communicated between the EGC and the ESC on the drivetrain 1939 datalink and messages between the ESC and the door pods on the switch data link. Problems with the data links will cause more severe problems than loss of panel lights.

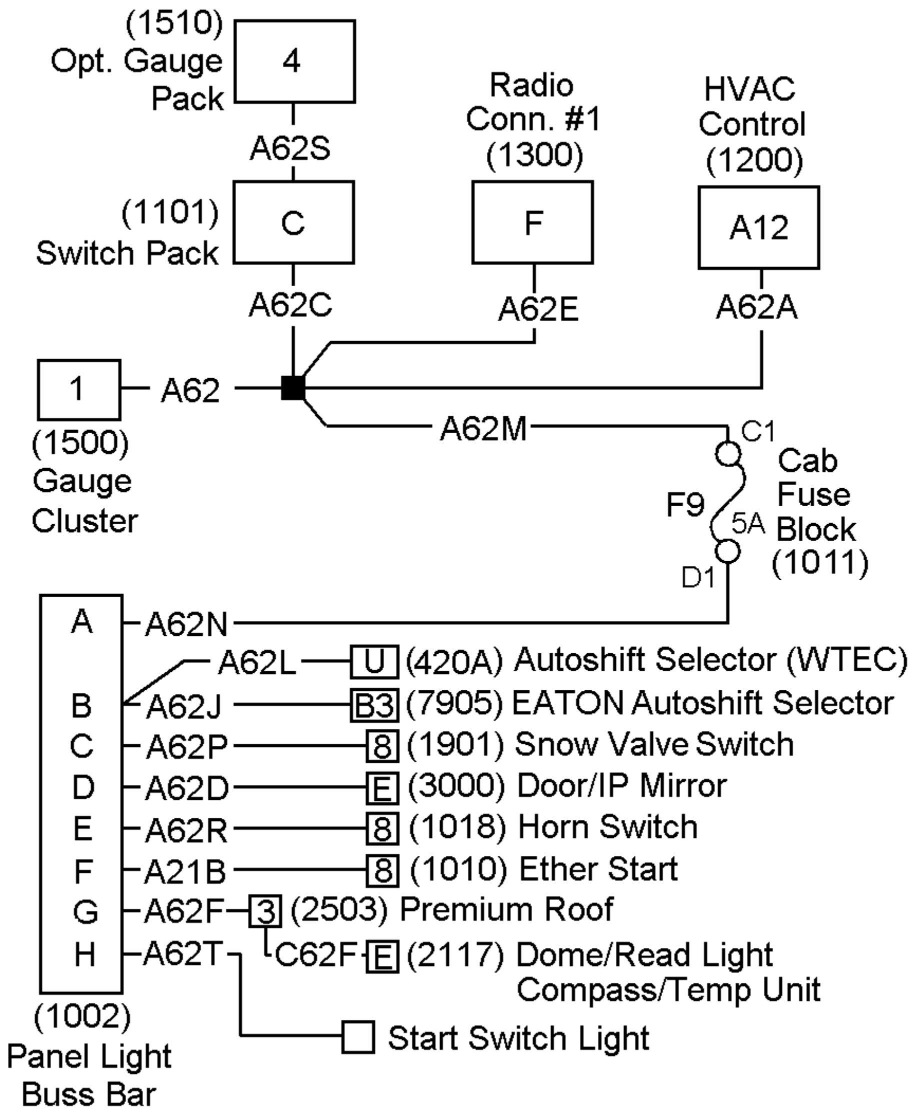

Figure 446 Panel Light Outputs from EGC (Connectors Viewed From Mating End) — Always Refer to Circuit Diagram Book for Latest Circuit Information

(1002) PANEL LIGHT ADAPTER
LOCATED IN INSTRUMENT PANEL
(1011) CAB FUSE BLOCK
LOCATED IN INSTRUMENT PANEL (PASSENGER SIDE)
(1500) ELECTRONIC GAUGE CLUSTER CONNECTOR
LOCATED ON BACK OF GAUGE CLUSTER

Table 305 Panel Light Circuit Tests

Diagnostic Trouble Codes	
No Diagnostic Trouble Codes	There are no diagnostic trouble codes for panel light circuits.

Table 305 Panel Light Circuit Tests (cont.)

Test Points	Spec.	Comments
Panel Light Fuse (1011) Voltage Checks Check with ignition key on, park lights on and fuse F9 removed. Press and hold the dimmer up button for 15 seconds to insure panel lights are at full intensity. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
(1011) fuse block 1, terminal C1 to ground.	12 ± 1.5 volts	If voltage is missing, check for open in circuit A62M or short in circuits A62N, A62C, A62E, or A62A. If no shorts or opens are present, the ESC must be faulty.
Panel Light Buss Bar (1002) Voltage Checks Check with ignition key on, park lights on, fuse F9 installed and buss bar cover removed. **NOTE – If the fuse is blown check for shorts on circuit A62N and other circuits connected to the buss bar. Repair the short and replace the fuse.** Press and hold the dimmer up button for 15 seconds to insure panel lights are at full intensity. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Panel Light Buss Bar (1002) cavity A to ground.	12 ± 1.5 volts	If voltage is missing, check for open in circuit A62N. Insure fuse F9 is not blown.

Extended Description

Refer to Panel Light Outputs from EGC.

A variable voltage, controlled by the panel dimmer switch but generated in the EGC, is supplied at gauge cluster connector (1500) terminal 1 and circuit A62 to a tie point. At the tie point the circuit splits on circuit A62C to switch pack connector (1101) terminal C, circuit A62E to radio connector (1300) terminal F, circuit A62A to the HVAC control connector (1200) terminal A12, and circuit A62M to cab fuse block (1011) terminal D1 and 5 amp fuse F9. Voltage from the fuse is applied to circuit A62N to panel light adapter (1002). The panel light adapter is the source of panel light voltage for any other features with panel lights (except the door pods).

7.5. COMPONENT LOCATIONS

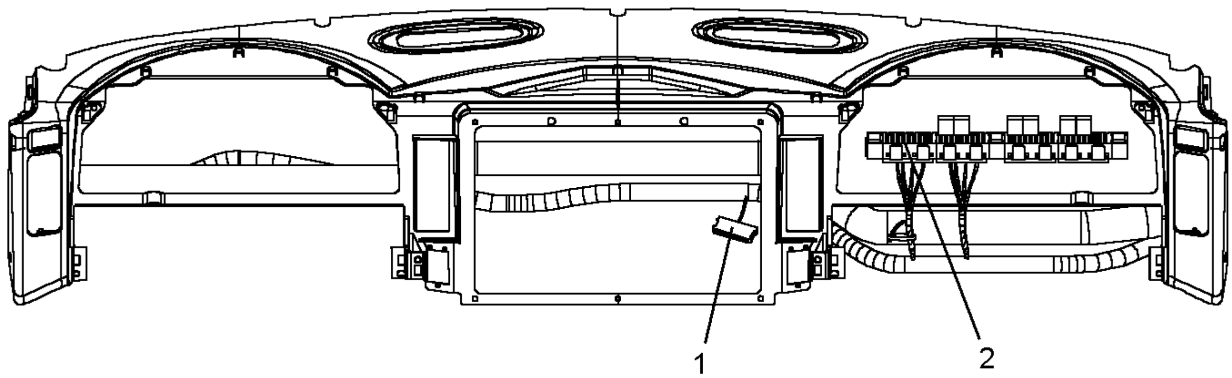

Figure 447 Panel Dimmer Wiring

1. PANEL LIGHT BUSS BAR (1002)
2. F9 PANEL LIGHT FUSE

8. TRUCK STOP/TURN SIGNAL/HAZARD LIGHT

8.1. CIRCUIT FUNCTIONS

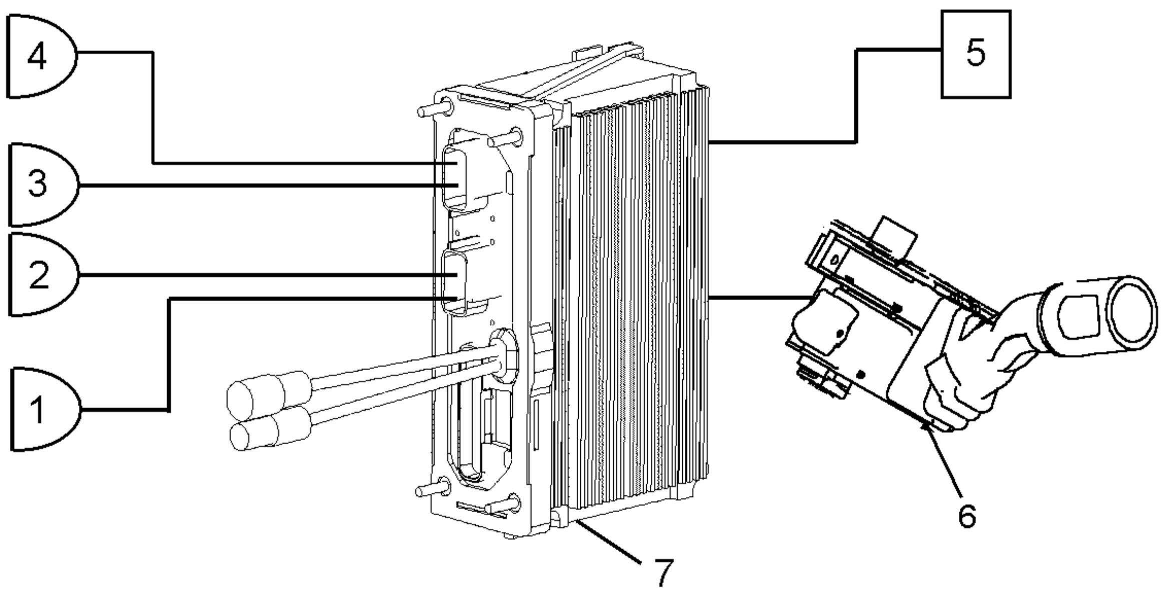

Figure 448 Stop/Turn Signal/Hazard Light Function Diagram

1. RIGHT FRONT TURN SIGNAL LIGHT
2. LEFT FRONT TURN SIGNAL LIGHT
3. LEFT REAR TURN SIGNAL LIGHT
4. RIGHT REAR TURN SIGNAL LIGHT
5. STOP LIGHT SWITCH, HYDRAULIC BRAKES OR BRAKE SWITCH, AIR BRAKES
6. TURN SIGNAL SWITCH
7. ELECTRICAL SYSTEM CONTROLLER

Refer to the Stop/Turn Signal/Hazard Light Function Diagram.

The ESC controls the turn and stop lights based on inputs from the turn signal switches and brake switch.

A combination turn/stop lamp system is standard on this vehicle. The turn signal overrides the stop lights on the rear.

The turn signal and hazard lights are selected with the turn signal lever and hazard switch on the steering column.

On vehicles with hydraulic brakes the stop light signal to the ESC comes from a switch activated by the brake pedal.

On vehicles with air brakes the stop light signal to the ESC comes from switches, connected to the air brake lines, activated by brake air pressure. Two switches are used for trucks but only one is used for tractors. The switches are located near the steering column.

The ESC has separate outputs supplying current for each front turn lamp and each rear turn/brake lamp. Additional turn lamps, which only illuminate when turn signals are selected, should be connected to the front turn signal circuits. Additional lamps required to illuminate with turn signals and brake lights should be connected to the rear turn signal circuits. The flashing of the turn signals and hazard lights is controlled by the ESC.

When the hazard lights are activated the turn signal will not affect operation of the lights. Normally, the brake switches will override the hazards. The ESC can be programmed to allow the hazard lights to override the rear brake lights.

8.2. DIAGNOSTICS

Should the lights fail to operate correctly the problem could be attributed to faulty input wiring between the ESC and turn signal/stop light switches, defective switches or faulty output wiring between the ESC and the turn signal lamps. The ESC has an internal virtual fuse software algorithm to protect output circuits in an over current situation.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

A diagnostic trouble code will be logged when there is an over current (short to ground or excessive load) or open circuit on any of the four light output circuits.

A diagnostic trouble code will be logged if there is an open or short in the brake switch or brake switch circuits.

The lower current limits, which determine when a DTC is set, are programmable. LED stop/turn lamps use far less current than incandescent lamps. If the truck configuration is changed it may be necessary to reprogram the lower current limit in the ESC before LED lamps will operate.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to check operation of the lights and monitor activation of the turn/hazard signal switches and stop light switch(es). See the diagnostic software manual for details on using the software.

Turn/Hazard Signal And Stop Light Preliminary Check

Table 306 Turn/Hazard Signal And Stop Light

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify turn/hazard signal and stop lights are inoperative.	Visually check turn/ hazard signal and stop light.	Turn/ hazard signal and stop lights operate incorrectly.	Go to next step.	Turn/hazard signal and stop lights are operating. Problem does not exist or is intermittent. (Check for inactive diagnostic trouble codes.)

Table 306 Turn/Hazard Signal And Stop Light (cont.)

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
2.	On	Determine if any other features are malfunctioning that may have common circuits. (Example: Missing ground common to several features.)	Visually check for other malfunctioning features.	No other features are malfunctioning.	Go to next step.	Identify and repair condition causing several features to be inoperative.
3.	On	If more than one turn/hazard signal and stop light is connected to a circuit, are all lights inoperative?	Visually check if all turn/hazard signal and stop lights are inoperative.	All turn/ hazard signal and stop lights are inoperative.	Go to next step.	Check specific circuits of the inoperative light for open circuits.
4.	On	Check for diagnostic trouble codes. (See Diagnostic Trouble Codes, page 900)	Read display on odometer.	No turn/ hazard signal and stop light diagnostic trouble codes are active. (See TURN SIGNAL/ HAZARD SWITCH INPUTS TO ESC, page 903)	Go to next step.	Follow directions in the turn/hazard signal and stop light diagnostic trouble code table. (See Table 307, page 901)

Diagnostic Trouble Codes

To display diagnostic trouble codes (DTC's), set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch simultaneously. If no faults are present, the cluster odometer will display "NO FAULTS". If faults are present, the gauge cluster display will show the number of faults and each diagnostic trouble code for 10 seconds and then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in "A" for active faults or "P" for previously active faults. Releasing the parking brake or turning the ignition key off will take the ESC and the gauge cluster out of the diagnostic mode.

After all repairs have been made, the diagnostic trouble codes may be cleared by putting the key switch in the accessory position, turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 307 Turn/Hazard Signal And Stop Light

<table>
<tr><th>DIAGNOSTIC TROUBLE CODE</th><th>FAULT DESCRIPTION</th></tr>
<tr><td>NO DIAGNOSTIC TROUBLE CODE</td><td>Diagnostic trouble codes are not logged for every possible fault in the turn signal/hazard circuits.</td></tr>
<tr><td colspan="2">When all left or all right signals are inoperative, and no faults are present, the turn/hazard signal switches, their circuits to the ESC, or the ESC are most likely at fault.</td></tr>
<tr><td colspan="2">If hazard flashers don’t work, but the turn signals do, the turn signal/hazard switch is defective.

If hazard flashers do work, but the turn signals don’t, the turn signal/hazard switch is defective.</td></tr>
<tr><td colspan="2">If hazard flashers and turn signals don’t work, the problem is most likely in the circuits between the switch and the ESC.

Inspect turn/hazard signal switches (See TURN SIGNAL/ HAZARD SWITCH INPUTS TO ESC, page 903) for proper operation</td></tr>
<tr><td colspan="2">When more than one bulb is connected to an ESC output circuit, the ESC will not sense that an individual bulb or the circuits to that specific bulb are open. Example: There are two bulbs on the forward turn circuit. One burned out bulb will not set a fault. If the two bulbs are the only ones on the circuit and they both burn out, an open circuit fault will be set.

When an individual light will not illuminate, check for an open circuit to the specific light.</td></tr>
<tr><td>597 14 1 0</td><td>Brake switch stuck in the open or closed position</td></tr>
<tr><td>597 14 2 0</td><td>Brake switch inputs do not match</td></tr>
<tr><td colspan="2">Sets when the vehicle has decelerated to a stop, without brake switch activation.</td></tr>
<tr><td colspan="2">The brake switch is stuck closed, is not making contact with brake pedal or being activated by air pressure, or the switch contacts are defective.

Inspect hydraulic brake switch (See HYDRAULIC BRAKE SWITCH INPUTS TO ESC, page 906)or air brake switch(See AIR BRAKE SWITCH INPUTS TO ESC, page 909) for proper operation</td></tr>
<tr><td>611 14 16 1</td><td>Right front turn lamp open circuit</td></tr>
<tr><td colspan="2">This fault is the result of an open in the circuits between the right front lamps and the ESC.

Check for burned out bulbs.

Inspect right front circuits(See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) for proper operation</td></tr>
<tr><td>611 14 16 2</td><td>Right front turn lamp over current</td></tr>
<tr><td colspan="2">This fault may be the result of a short in the circuits between the left front lamps and the ESC. It could also be caused by an excessive load (too many accessories) on the circuit.

Inspect right front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) for proper operation</td></tr>
<tr><td>611 14 16 3</td><td>Right front turn lamps, less than normal low current but more than open circuit</td></tr>
<tr><td>611 14 16 4</td><td>Right front turn lamps, greater than normal high current and less than fusing current</td></tr>
</table>

Table 307 Turn/Hazard Signal And Stop Light (cont.)

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
611 14 16 6	Right front turn lamps has current flow when output commanded off
611 14 15 1	Left front turn lamp open circuit
This fault is the result of an open in circuits between the left front lamps and the ESC. Check for burned out bulbs. Inspect left front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) for proper operation	
611 14 15 2	Left front turn lamp over current
This fault may be the result of a short in the circuits between the left front lamps and the ESC. It could also be caused by an excessive load (too many accessories) on the circuit. Inspect left front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) for proper operation	
611 14 15 3	Left front turn lamps, less than normal low current but more than open circuit
611 14 15 4	Left front turn lamps, greater than normal high current and less than fusing current
611 14 15 6	Left front turn lamps has current flow when output commanded off
611 14 14 1	Right rear turn lamp open circuit
This fault is the result of an open in the circuits between the right rear lamps and the ESC. Check for burned out bulbs. Inspect right rear circuits (See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) for proper operation	
611 14 14 2	Right rear turn lamp over current
This fault may be the result of a short in the circuits between the right rear lamps and the ESC. It could also be caused by an excessive load (too many accessories) on the circuit. Inspect right rear circuits (See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) for proper operation	
611 14 14 3	Right rear turn lamps, less than normal low current but more than open circuit
611 14 14 4	Right rear turn lamps, greater than normal high current and less than fusing current
611 14 14 6	Right rear turn lamps has current flow when output commanded off
611 14 13 1	Left rear turn lamp open circuit

Table 307 Turn/Hazard Signal And Stop Light (cont.)

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
This fault is the result of an open in the circuits between the left rear lamps and the ESC. Check for burned out bulbs. Inspect left rear circuits (See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) for proper operation	
611 14 13 2	Left rear turn lamp over current
This fault may be the result of a short in the circuits between the left rear lamps and the ESC. It could also be caused by an excessive load (too many accessories) on the circuit. Inspect left rear circuits (See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) for proper operation	
611 14 13 3	Left rear turn lamps, less than normal low current but more than open circuit
611 14 13 4	Left rear turn lamps, greater than normal high current and less than fusing current
611 14 13 6	Left rear turn lamps has current flow when output commanded off
612 14 1 1	Brake switch out of range low (Open Circuit)
Brake switch not connected or open circuit in wiring between ESC and switch.	
Inspect hydraulic brake switch (See HYDRAULIC BRAKE SWITCH INPUTS TO ESC, page 906) or air brake switch (See AIR BRAKE SWITCH INPUTS TO ESC, page 909) for proper operation. Also check wiring harness	
612 14 1 2	Brake switch out of range high (Short Circuit)
Circuit between ESC and Brake switch has been shorted to positive voltage.	
Inspect hydraulic brake switch (See HYDRAULIC BRAKE SWITCH INPUTS TO ESC, page 906)or air brake switch (See AIR BRAKE SWITCH INPUTS TO ESC, page 909) for proper operation Also check wiring harness	

8.3. TURN SIGNAL/ HAZARD SWITCH INPUTS TO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

There are no detectable faults associated with the turn signal/hazard switches or switch input circuits to the ESC.

Refer to Turn Signal/Hazard Light Inputs to ESC.

Problems in the switches or circuits will be apparent when all left, all right or all signals cannot be selected.

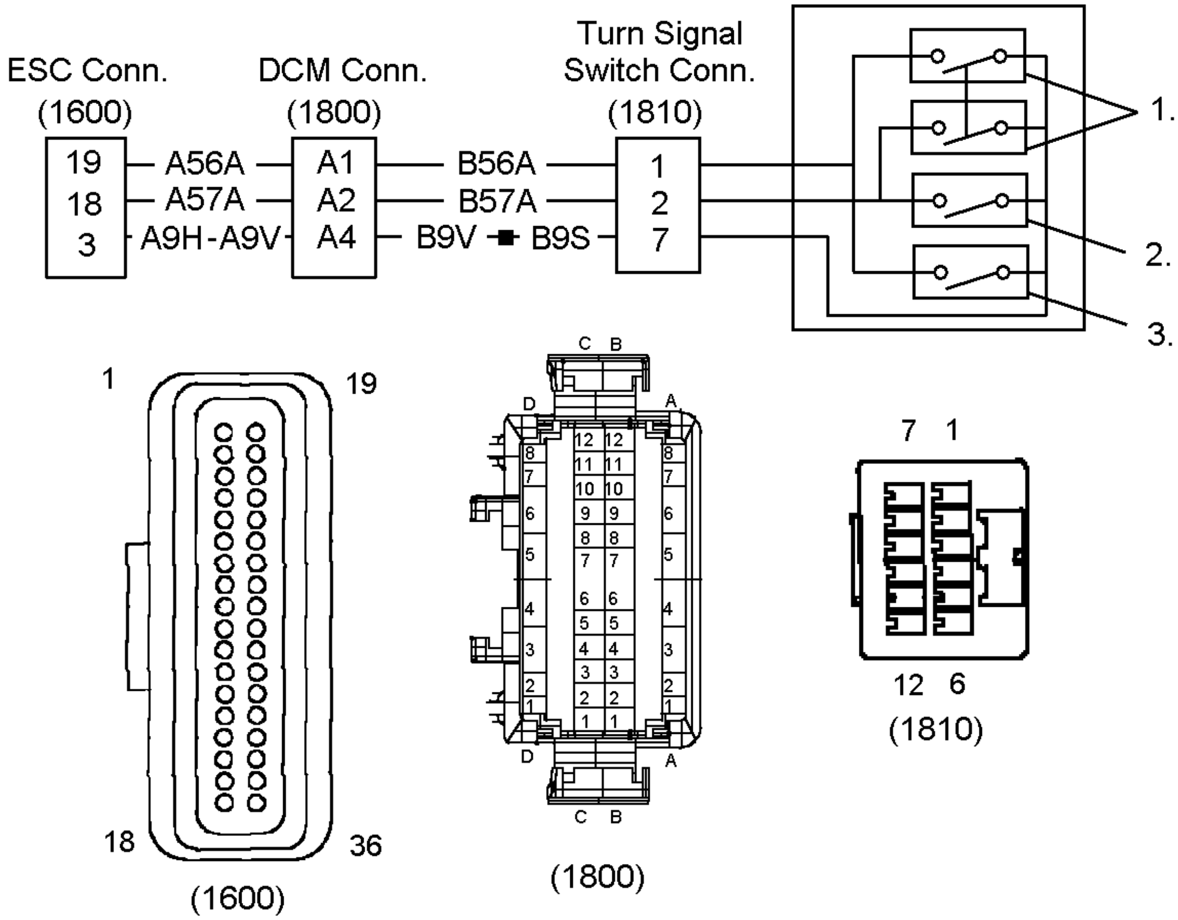

Figure 449 Turn Signal/Hazard Light Inputs to ESC (Connectors Viewed From Mating End) — Always Refer to Circuit Diagram Book for Latest Circuit Information

1. TURN SIGNAL SWITCH – HAZARD CONTACTS
2. RIGHT TURN SIGNAL CONTACTS
3. LEFT TURN SIGNAL CONTACTS

(1600) ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON CAB SIDE OF ESC

(1800) DRIVER CONTROL MODULE CONNECTOR
LOCATED TO RIGHT OF LOWER STEERING COLUMN

(1810) TURN SIGNAL SWITCH HARNESS CONNECTOR
LOCATED ON STEERING COLUMN

Table 308 Turn Signal/Hazard Light Connector Check Chart

<table>
<tr><th colspan="3">Diagnostic Trouble Codes</th></tr>
<tr><td colspan="3">No faults will be logged for problems with turn/hazard signal switch inputs to the ESC</td></tr>
<tr><td colspan="3">Turn/Hazard Signal Switch Harness Connector (1810) Voltage Checks

(Check with ignition key on and turn signal switch disconnected.)

NOTE – With the key off voltage to the switches will be approximately 5 volts

NOTE – Always check connectors for damage and pushed–out terminals.

NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.</td></tr>
<tr><td>Test Points</td><td>Spec.</td><td>Comments</td></tr>
<tr><td>Harness connector (1810), cavity 1 to ground</td><td>12 ± 1.5 volts</td><td>If voltage is incorrect, check for open or short in circuits A56A or B56A. Also insure proper voltage out of ESC.

Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)</td></tr>
<tr><td>Harness connector (1810), cavity 2 to ground</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for open or short in circuits A57A or B57A. Also insure proper voltage out of ESC.

Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)</td></tr>
<tr><td>Harness connector (1810), cavity 7 to ground</td><td>0 volts</td><td>Zero volt reference to switches.

If voltage is incorrect check for shorts to other circuits or incorrect signal out of the ESC.

NOTE – If this signal is not present at the switch connector, the wipers will also be inoperative. If this signal is incorrect from the ESC, several features will be inoperative.</td></tr>
<tr><td>Harness connector (1810), cavity 1 to cavity 7.</td><td>12 ± 1.5 volts</td><td>If voltage is incorrect, check for open in zero volt reference signal circuits B9S, B9V, A9V or A9H or incorrect zero volt reference signal from the ESC.</td></tr>
<tr><td colspan="3">Turn Signal Switch Resistance Checks

(Check with switch disconnected)</td></tr>
<tr><td>Turn signal switch, pin 2 to pin 7</td><td>With hazard switch and turn signal off, resistance should read >50K ohms.</td><td>Continuity through switch when hazard and turn lever is off, is the result of a failed switch.</td></tr>
<tr><td>Turn signal switch, pin 1 to pin 7</td><td>With hazard switch and turn signal off, resistance should read >50K ohms.</td><td>Continuity through switch when hazard and turn lever is off, is the result of a bad switch.</td></tr>
</table>

Table 308 Turn Signal/Hazard Light Connector Check Chart (cont.)

Turn signal switch, pin 2 to pin 7	With Hazard switch or turn signal on, resistance should read <2 ohms.	No continuity through switch when hazard or right turn lever is on, is the result of a failed switch.
Turn signal switch, pin 1 to pin 7	With Hazard switch or turn signal on, resistance should read < 2 ohms.	No continuity through switch when hazard or left turn lever is on, is the result of a bad switch.

Extended Description

Refer to Turn Signal/Hazard Light Inputs to ESC.

The zero volt reference signal is supplied to the turn signal switches on connector (1810) terminal 7 from the ESC connector (1600) terminal 3.

When the left turn signal is selected the zero volt reference signal is fed from turn signal switch (1810) terminal 1, to ESC connector (1600) terminal 19.

When the right turn signal is selected the zero volt reference signal is fed to ESC connector (1600) terminal 18 from turn signal switch (1810) terminal 2. This signals the ESC that the right turn signal has been requested.

When the hazard switch is selected, two additional contacts close to complete both turn signal inputs to the ESC. The zero volt reference signal will be sent to pins 18 and 19 of the ESC at the same time. This signals the ESC that the hazard lights have been requested.

8.4. HYDRAULIC BRAKE SWITCH INPUTS TO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Hydraulic Brake Switch Inputs to ESC.

While the ignition is on, the ESC will continuously monitor the brake switch(es) and circuits for an open condition or a short to ground. The ESC will also log a diagnostic trouble code (DTC) if it determines the vehicle has decelerated to 0 mph (0 kmh) without brake activation or has accelerated to 35 mph (56 kph) while the switch is closed.

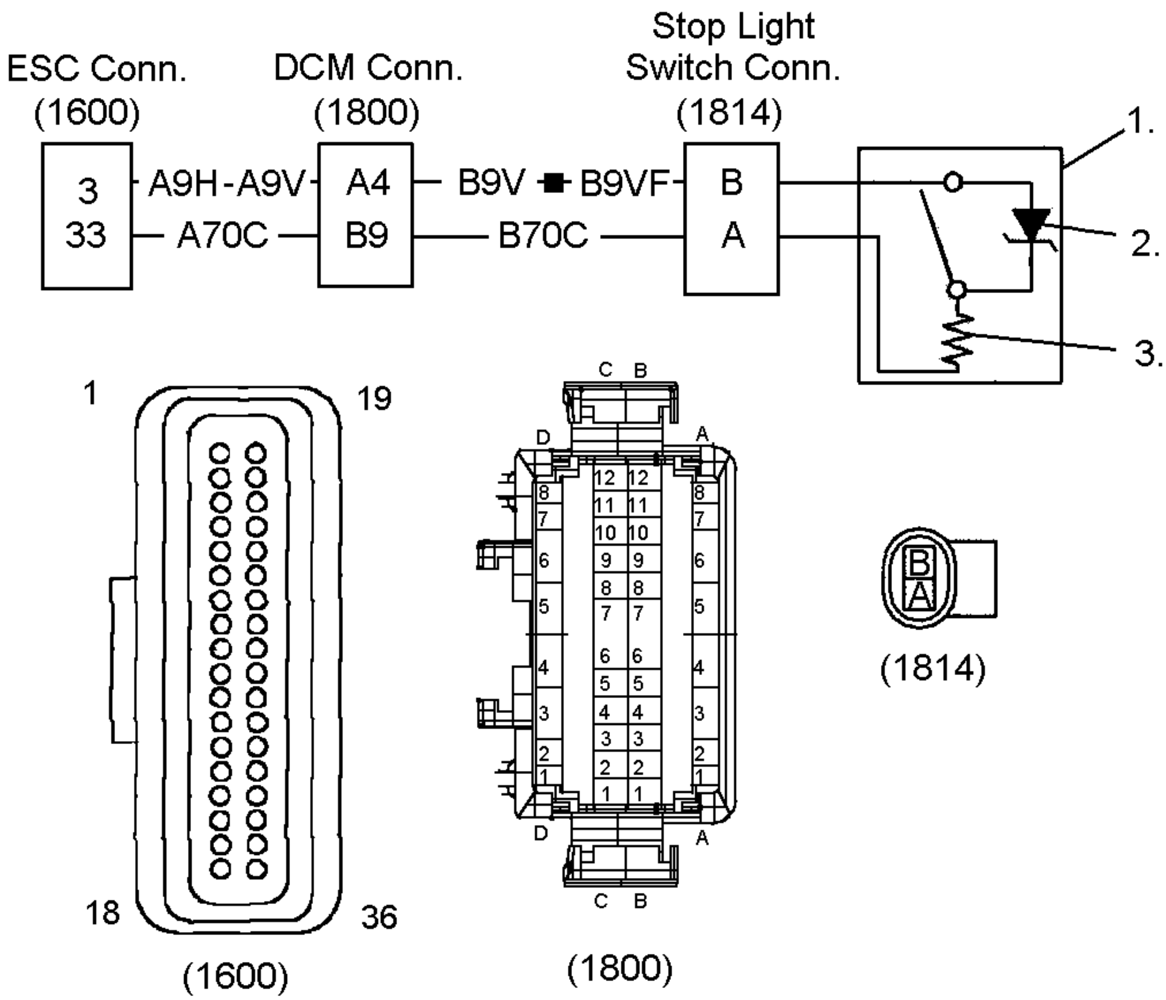

Figure 450 Hydraulic Brake Switch Inputs to ESC (Connectors Viewed From Mating End) — Always Refer to the Circuit Diagram Book for Latest Circuit Information

1. HYDRAULIC BRAKE SWITCH
   LOCATED NEAR BRAKE PEDAL LEVER
2. ZENER DIODE
3. 150 OHM RESISTOR

(1600) SYSTEM CONTROLLER CONNECTOR
LOCATED ON CAB SIDE OF ESC
(1800) DRIVER CONTROL MODULE CONNECTOR
LOCATED TO RIGHT OF LOWER STEERING COLUMN
(1814) STOP LIGHT SWITCH CONNECTOR
LOCATED TO LEFT OF LOWER STEERING COLUMN

Table 309 Hydraulic Brake Stop/Turn Signal/Hazard Light Input Check Chart

Diagnostic Trouble Codes	
597 14 1 0	Brake Switch Stuck

Table 309 Hydraulic Brake Stop/Turn Signal/Hazard Light Input Check Chart (cont.)

597 14 2 0	Brake switch inputs do not match	
612 14 1 1	Brake switch out of range low	
612 14 1 2	Brake switch out of range high	
Brake Switch Harness Connector (1814) Voltage Checks (Check with ignition key on and brake switch disconnected.) **NOTE – With the key off voltage to the switches will be approximately 5 volts** **NOTE – Always check connectors for damage and pushed–out terminals.** **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**		
Test Points	Spec.	Comments
Harness connector (1814), cavity A to ground	12 ± 1.5 volts	If voltage is missing, check for open or short in circuits A70C or B70C. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
Harness connector (1814), cavity B to ground	0 volts	Zero volt reference signal to switch. If voltage is incorrect check for shorts to other circuits or incorrect signal out of the ESC. **NOTE – If this signal is incorrect from the ESC, several features will be inoperative.**
Harness connector (1814), cavity A to cavity B	12 ± 1.5 volts	If voltage is incorrect, check for open in circuits B9VF, B9V, A9V or A9H or missing signal from ESC. **NOTE – If this signal is incorrect from the ESC, several features will be inoperative.**
Brake Switch Resistance Checks (Check with switch disconnected, negative probe of meter connected to pin B and positive probe connected to pin A)		
Brake switch, pin B to pin A	With stop light switch closed resistance should be approximately 150 ohms.	Switch has a resistor in series with contacts. If resistance is incorrect, replace the switch.
Brake switch, pin B to pin A	With stop light switch open resistance should be approximately 50K ohms.	Switch has a Zener diode in parallel with the switch contacts.

Extended Description

Refer to Hydraulic Brake Switch Inputs to ESC.

On vehicles with hydraulic brakes, the zero volt reference signal from ESC connector (1600) terminal 3, is supplied to stop light switch (1814) terminal B

When the key is in the ignition position 12 volts from ESC connector (1600) terminal 33 will be applied to stop light switch (1814) terminal A. When the key is in the off position 5 volts is supplied to stop light switch (1814) terminal A instead of 12 volts.

A 6.8 volt Zener diode, inside the switch body is wired in parallel with the switch contacts. The diode allows current to pass through it when the key is in the ignition position and 12 volts is applied to the switch. The diode prevents current from passing through it when the key is off and 5 volts is applied to the switch. When the key is on and the brake is not applied, the ESC monitors the voltage drop across the diode and resistor in the switch. If there is an open in the brake switch circuits there will be no voltage drop and the ESC will set a fault.

A 150 ohm resistor, inside the switch body, is wired in series with the switch. The ESC senses the voltage drop across this resistor to check for a short to ground in the brake switch circuits between the brake switch and the ESC. If there is a short, 12 volts from the ESC will be pulled to ground and the ESC will set a fault.

When the brake switch is closed, the voltage drop will change and the ESC will sense that the brake is applied.

8.5. AIR BRAKE SWITCH INPUTS TO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

Refer to Brake Switch Inputs to ESC With Air Brakes.

While the ignition is on, the ESC will continuously monitor the brake switch(es) and circuits for an open condition or a short to ground. The ESC will also log a diagnostic trouble code (DTC) if it determines the vehicle has decelerated to 0 mph (0 kmh) without brake activation or has accelerated to 35 mph (56 kph) while the switch is closed.

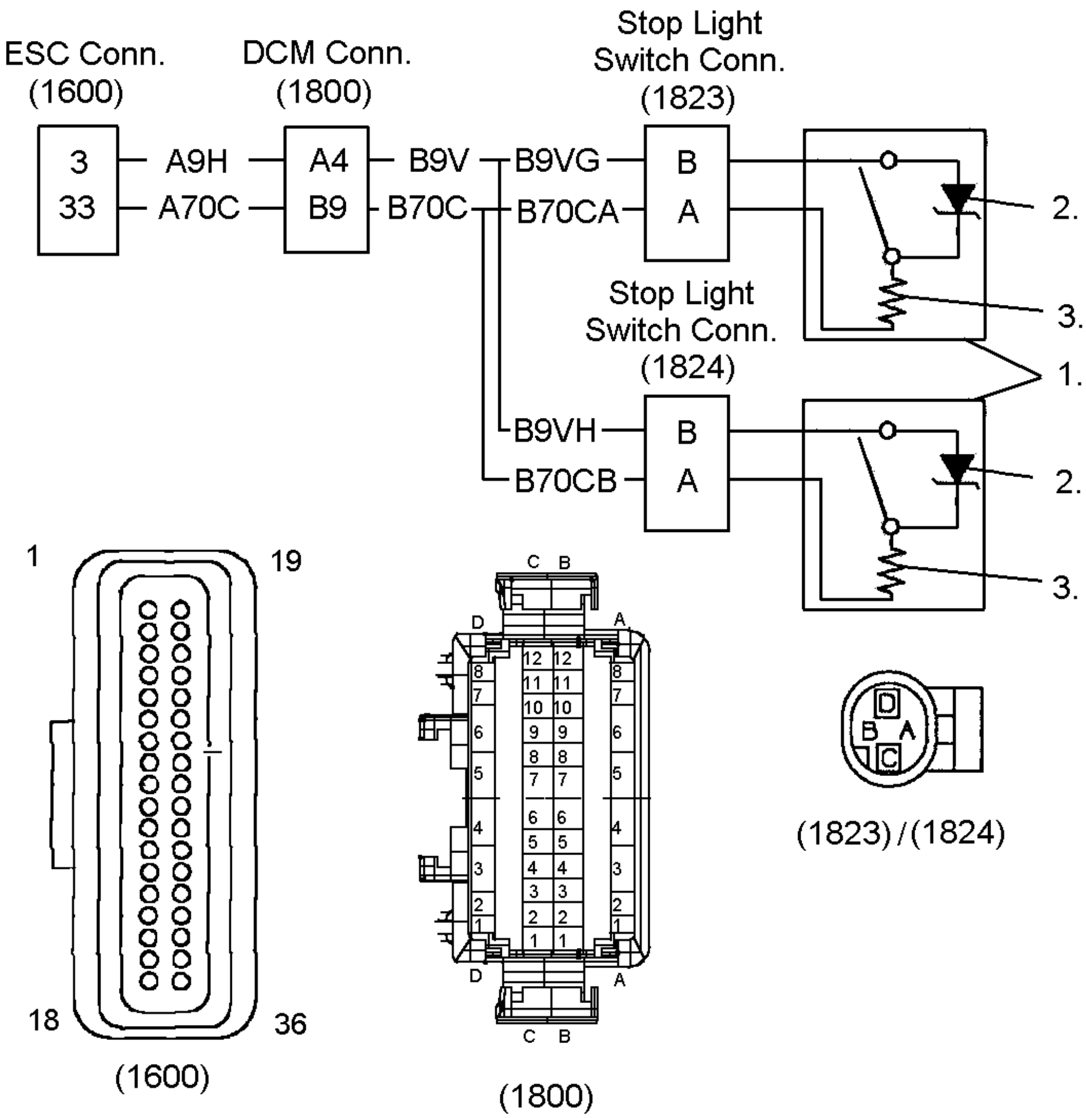

Figure 451 Brake Switch Inputs to ESC With Air Brakes (Connectors Viewed From Mating End) — Always Refer to the Circuit Diagram Book for Latest Circuit Information

1. AIR BRAKE SWITCH(ES)
   LOCATED TO LEFT OF LOWER STEERING COLUMN
2. ZENER DIODE
3. 150 OHM RESISTOR

(1600) SYSTEM CONTROLLER CONNECTOR
LOCATED ON CAB SIDE OF ESC
(1800) DRIVER CONTROL MODULE CONNECTOR
LOCATED TO RIGHT OF LOWER STEERING COLUMN
(1823) STOP LIGHT SWITCH CONNECTOR
LOCATED TO LEFT OF LOWER STEERING COLUMN
(1824) STOP LIGHT SWITCH CONNECTOR – NOT USED ON TRACTOR
LOCATED TO LEFT OF LOWER STEERING COLUMN

Table 310 **Air Brake Switch Input Check Chart**

Diagnostic Trouble Codes	
597 14 1 0	Brake Switch Stuck
597 14 2 0	Brake switch inputs do not match
612 14 1 1	Brake switch out of range low
612 14 1 2	Brake switch out of range high

Air Brake Switch Harness Connector (1823) Voltage Checks

(Check with ignition key on and brake switch disconnected.)

NOTE – With the key off voltage to the switches will be approximately 5 volts

NOTE – Always check connectors for damage or pushed–out terminals.

Always use breakout box ZTSE 4477 to take measurements on ESC connectors.

Test Points	Spec.	Comments
Harness connector (1823) cavity A to ground	12 ± 1.5 volts	If voltage is missing, check for open or short in circuits A70C, B70C, or B70CA. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
Harness connector (1823) cavity B to ground	0 volts	Zero volt reference signal to switch. If voltage is incorrect check for shorts to other circuits or incorrect signal out of the ESC. **NOTE – If this signal is missing, the wipers will be on at the high speed setting.**
Harness connector (1823) cavity A to cavity B	12 ± 1.5 volts	If voltage is incorrect, check for open in zero volt reference signal circuits B9VG, B9V or A9H or missing signal from ESC.

Air Brake Switch Harness Connector (1824) Voltage Checks

(Check with ignition key on and brake switch disconnected.)

NOTE – With the key off voltage to the switches will be approximately 5 volts

NOTE – Always check connectors for damage or pushed–out terminals.

Always use breakout box ZTSE 4477 to take measurements on ESC connectors.

Test Points	Spec.	Comments

Table 310 Air Brake Switch Input Check Chart (cont.)

Harness connector (1824) cavity A to ground	12 ± 1.5 volts	If voltage is missing, check for open or short in circuits A70C, B70C, or B70CB. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
Harness connector (1824) cavity B to ground	0 volts	Zero volt reference signal to switch. If voltage is incorrect check for shorts to other circuits or incorrect signal out of the ESC. **NOTE – If this signal is incorrect out of the ESC, several other features will also be inoperative.**
Harness connector (1824) cavity A to cavity B	12 ± 1.5 volts	If voltage is incorrect, check for open in zero volt reference signal circuits B9VH, B9V or A9H or missing signal from ESC.
Brake Switch Resistance Checks (Check with switch disconnected, negative probe of meter connected to pin B and positive probe connected to pin A)		
Pin B to pin A	With stop light switch closed resistance should be approximately 150 ohms.	Switch has a resistor in series with contacts. If resistance is incorrect, replace the switch.
Pin B to pin A	With stop light switch open resistance should be approximately 50K ohms.	Switch has a Zener diode in parallel with the switch contacts.

Extended Description

NOTE – Two brake switches are used on straight trucks. Only one is used on tractors.

Refer to Brake Switch Inputs to ESC With Air Brakes.

On vehicles with air brakes, the zero volt reference signal is supplied to brake switch 1 (1823) terminal B and brake switch 2 (1824) terminal B, from ESC connector (1600) terminal 3. (Only one switch is used in tractor applications).

When the key is in the ignition position, 12 volts will be applied to stop light switch 1 (1823) terminal A and stop light switch 2 (1824) terminal A. When the key is in the off position 5 volts is supplied to terminal A of the switch instead of 12 volts.

A 6.8 volt Zener diode, inside the switch body is wired in parallel with the switch contacts. The diode allows current to pass through it when the key is in the ignition position and 12 volts is applied to the switch. The diode prevents current from passing through it when the key is off and 5 volts is applied to the switch. When the key is on and the brake is not applied, the ESC monitors the voltage drop across the diode and resistor in the switch. If there is an open in the brake switch circuits there will be no voltage drop and the ESC will set a fault. The diode is required to block current flow when the key is off, preventing the circuits from putting a drain on the battery.

A 150 ohm resistor, inside the switch body, is wired in series with the switch. The ESC senses the voltage drop across this resistor to check for a short to ground in the brake switch circuits between the brake switch and the ESC. If there is a short, 12 volts from the ESC will be pulled to ground and the ESC will set a fault.

When the brake switch is closed the voltage drop will change and the ESC will sense that the brake is applied.

8.6. FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to Front Turn Signal/Hazard Light outputs from ESC.

When the left or right turn signal is selected, the ESC will sense if the left or right signal circuits experience an over current (short to ground or excessive load) or open circuit (fault will only be logged when there is no current path through any bulb to ground). The ESC will log an active fault for either of these conditions. The fault will remain active until the condition causing the fault has been corrected and the affected turn signal is activated.

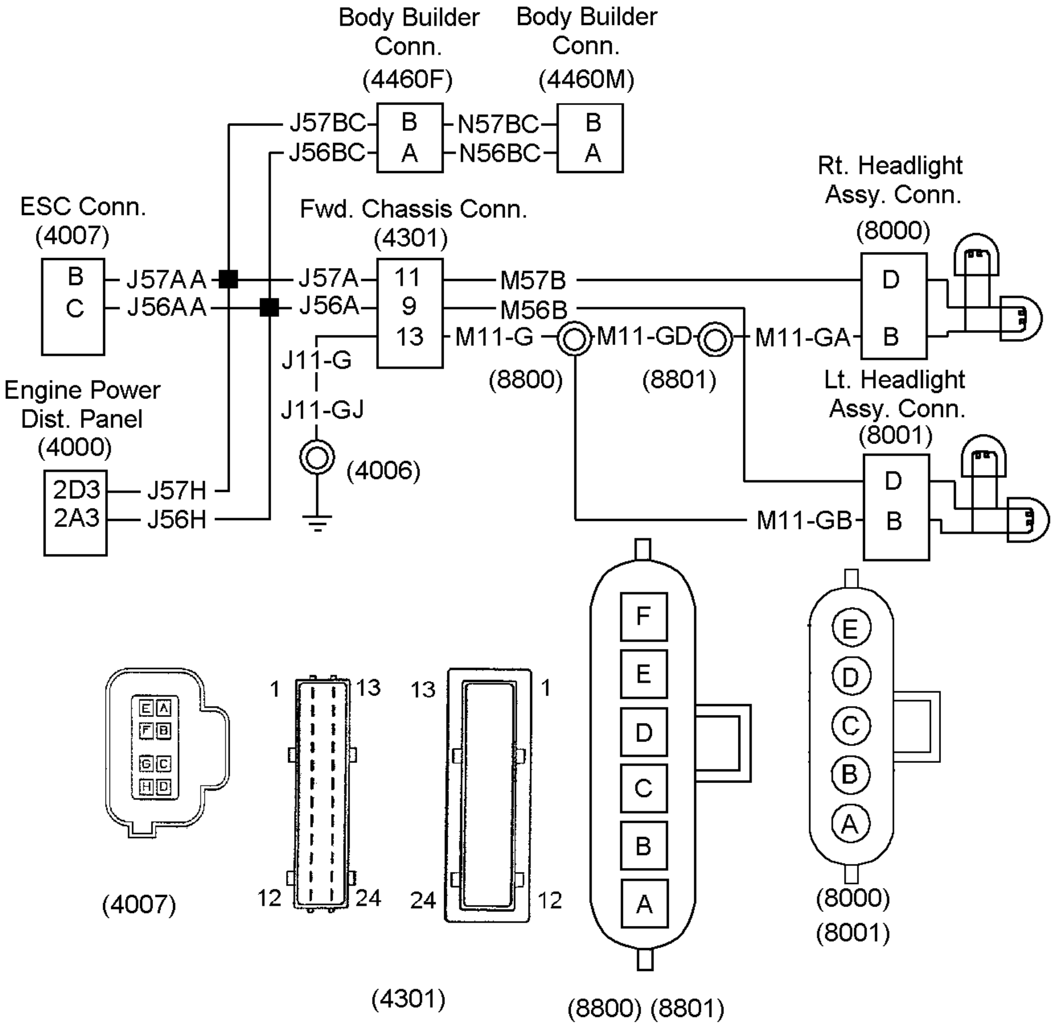

Figure 452 Front Turn Signal/Hazard Light outputs from ESC (Connectors Viewed From Mating End) — Always Refer to the Circuit Diagram Book for Latest Circuit Information

(4000) ENGINE POWER DISTRIBUTION PANEL-TRAILER TURN RELAYS
LOCATED INSIDE ENGINE COMPARTMENT POWER DISTRIBUTION PANEL
(4007) BROWN SYSTEM CONTROLLER CONNECTOR
LOCATED ON ENGINE SIDE OF ESC
(4301) FORWARD CHASSIS CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME RAIL
(4460M/F) BODY BUILDER CONNECTORS
LOCATED BACK OF CAB NEAR LEFT FRAME RAIL
(8000) RIGHT HEADLIGHT/TURN SIGNAL HARNESS
LOCATED REAR OF HEADLIGHT ASSEMBLY
(8001) LEFT HEADLIGHT/TURN SIGNAL HARNESS
LOCATED REAR OF HEADLIGHT ASSEMBLY
(8800) GROUND ADAPTER #1
(8801) GROUND ADAPTER #2

Table 311 Front Turn Signal/Hazard Light Connector Check Chart

Diagnostic Trouble Codes	
611 14 16 3	Right front turn lamps, less than normal low current but more than open circuit
611 14 16 4	Right front turn lamps, greater than normal high current and less than fusing current
611 14 16 6	Right front turn lamps has current flow when output commanded off
611 14 16 2	Right front turn lamp over current (Short Circuit)
NOTE – Disconnecting connectors will cause new open circuit faults to be logged. Clear all faults after connections have been restored. Disconnect right headlight/turn signal harness connector (8000). Cycle key switch and clear DTC's. Turn on right front turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in the turn signal light. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC. Disconnect any other connectors to components that are connected to the right front turn signal circuits. Cycle key switch and clear DTC's. Turn on right front turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in that component. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC. Disconnect brown ESC connector (4007). Cycle key switch and clear DTC's. Turn on right turn signal and check for fault. If the fault has not reoccurred, there is a short in the circuits between the ESC and turn signal light. If the fault reoccurs, there is a short inside the ESC.	
611 14 16 1	Right front turn lamp circuit open

Right Front Turn Signal/Hazard Light Voltage Checks Check with hazard flashers on and right front headlight turn signal disconnected. **NOTE – Always check connectors for damage or pushed–out terminals.** **NOTE – In an over current situation, the ESC will not supply voltage until the short or excessive load has been removed and the key switch has been cycled.** **Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**		
Test Points	Spec.	Comments
Right turn signal connector (8000), pin D to ground	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open or short in circuits M-57B, J57A or J57AA. Check for a short in circuit J57BC to body builder connectors and body builder accessories. Check for short in circuit J57H to trailer turn relays. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
Right turn signal connector (8000), pin B to ground	0 Volts	Ground circuit.

Table 311 Front Turn Signal/Hazard Light Connector Check Chart (cont.)

Right turn signal connector (8000), pin B to D	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open in ground circuits.
Diagnostic Trouble Codes		
611 14 15 3	Left front turn lamps, less than normal low current but more than open circuit	
611 14 15 4	Left front turn lamps, greater than normal high current and less than fusing current	
611 14 15 6	Left front turn lamps has current flow when output commanded off	
611 14 15 2	Left front turn lamp over current	
NOTE – Disconnecting connectors will cause new open circuit faults to be logged. Clear all faults after connections have been restored. **With sealed beam headlamps, as used with Severe Service trucks, the terminals at the headlamps are not sealed - in this application the terminals of the headlamps and the terminals in the headlamp connector must be totally coated with Grafo grease 2643099R1** Disconnect left headlight/turn signal harness connector (8001). Cycle key switch and clear DTC's. Turn on right front turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in the turn signal light. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC. Disconnect any other connectors to components that are connected to the right front turn signal circuits. Cycle key switch and clear DTC's. Turn on right front turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in that component. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC. Disconnect brown ESC connector (4007). Cycle key switch and clear DTC's. Turn on right turn signal and check for fault. If the fault has not reoccurred, there is a short in the circuits between the ESC and turn signal light. If the fault reoccurs, there is a short inside the ESC.		
611 14 15 1	Left front turn lamp circuit open	
Left Front Turn Signal/Hazard Light Voltage Checks Check with hazard flashers on and left front headlight turn signal disconnected. **NOTE – With sealed beam headlamps, as used with Severe Service trucks, the terminals at the headlamps are not sealed - in this application the terminals of the headlamps and the terminals in the headlamp connector must be totally coated with Grafo grease 2643099R1** **NOTE – Always check connectors for damage or pushed–out terminals.** **NOTE – In an over current situation, the ESC will not supply voltage until the short or excessive load has been removed and the key switch has been cycled.** **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**		

Table 311 Front Turn Signal/Hazard Light Connector Check Chart (cont.)

Left turn signal connector (8001), pin D to ground	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open or short in circuits M-56B, J56A or J56AA. Check for a short in circuit J56BC to body builder connectors and body builder accessories. Check for short in circuit J57H to trailer turn relays. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
Left turn signal connector (8001), pin B to ground	0 Volts	Ground circuit
Left turn signal connector (8001), pin B to D	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open in ground circuits.

Extended Description

Refer to Front Turn Signal/Hazard Light outputs from ESC.

The ESC supplies battery voltage to the front turn signal lights.

Voltage for the right front turn signal light is supplied directly from ESC connector (4007) terminal B.

Ground for the light is supplied from ground stud (4006) to right headlight turn signal harness connector (8000) terminal B.

Voltage for the left front turn signal light is supplied directly from the ESC connector (4007) terminal C to left headlight turn signal harness connector (8001) terminal D.

Ground for the light is supplied from ground stud (4006) to left headlight turn signal harness connector (8001) terminal B.

8.7. REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC.

When the brake light or left or right front turn signal lights are selected, the ESC will sense if the left or right signal circuits experience an over current (short to ground or excessive load) or open circuit (fault will only be logged when there is no current path through any bulb to ground). The ESC will log an active fault for either of these conditions. The fault will remain active until the condition causing the fault has been corrected and the affected brake or turn signal is activated.

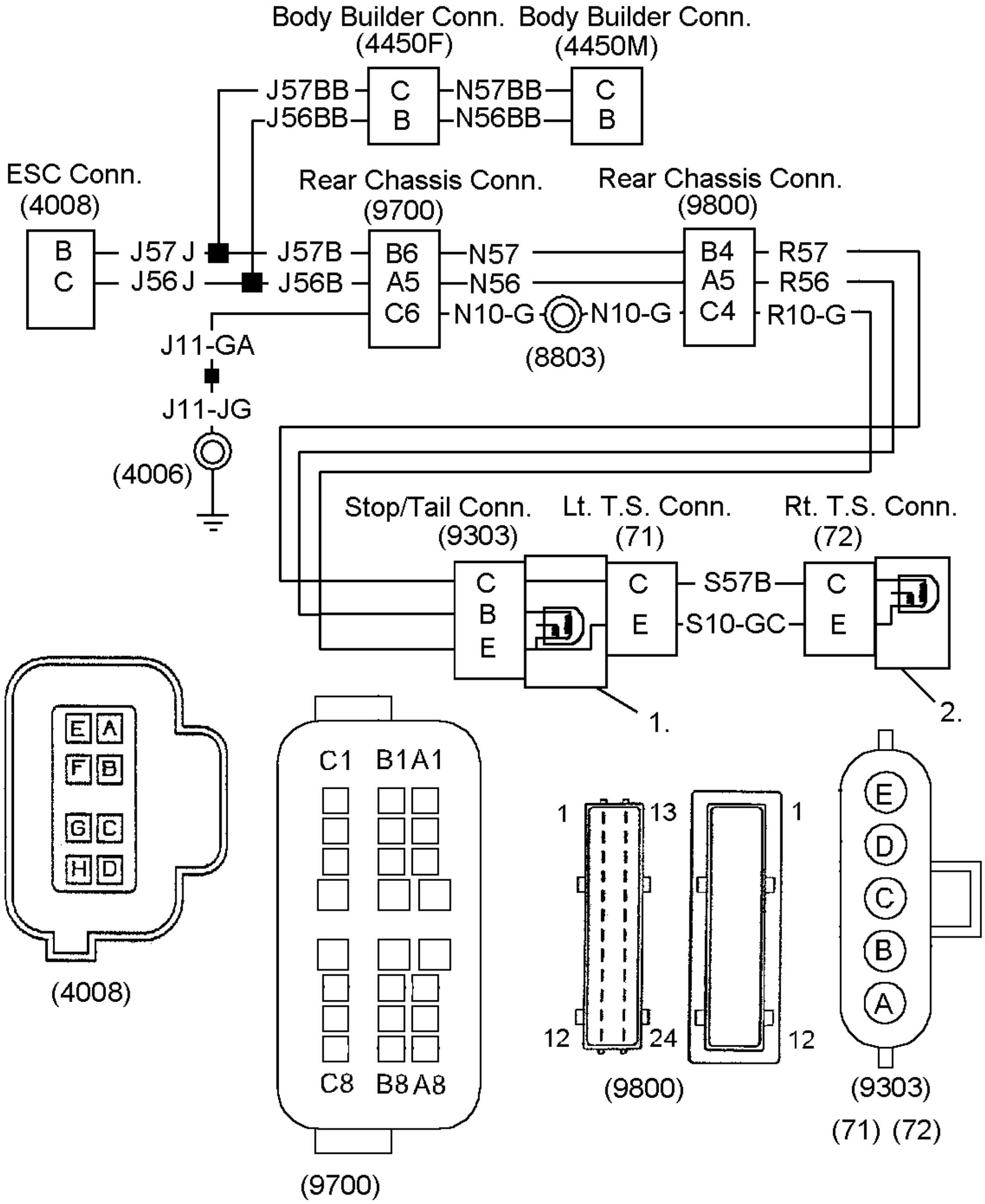

Figure 453 Rear Stop/Turn Signal/Hazard Light Outputs From ESC (Connectors Viewed From Mating End) — Always Refer to the Circuit Diagram Book for Latest Circuit Information

1. LEFT REAR LIGHT ASSEMBLY
2. RIGHT REAR LIGHT ASSEMBLY
(71) LEFT TAIL LIGHT CONNECTOR
(72) RIGHT TAIL LIGHT CONNECTOR
(4008) BLUE ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON ENGINE COMPARTMENT SIDE OF ESC
(4450M/F) BODY BUILDER CONNECTORS
LOCATED BACK OF CAB NEAR LEFT FRAME RAIL
(8803) CHASSIS GROUND SPLICE PACK
(9303) STOP/TAIL/TURN CONNECTOR
LOCATED ON LEFT LIGHT ASSEMBLY
(9700) DASH/CENTER CHASSIS CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME
(9800) CENTER/REAR CHASSIS CONNECTOR
LOCATED BY LEFT FRAME RAIL NEAR REAR AXLES

Table 312 Rear Stop/Turn Signal/Hazard Light Connector Check Chart

Diagnostic Trouble Codes	
611 14 13 3	Left rear turn lamps, less than normal low current but more than open circuit
611 14 13 4	Left rear turn lamps, greater than normal high current and less than fusing current
611 14 13 6	Left rear turn lamps has current flow when output commanded off
611 14 13 2	Left rear turn lamp over current (Short Circuit)
NOTE – Disconnecting connectors will cause new open circuit faults to be logged. Clear all faults after connections have been restored. **NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.** Turn key “OFF”. Disconnect stop tail and turn connector (9303). Turn on ignition and clear DTC’s, then turn on left turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in the turn signal light. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC. Turn key “OFF”. Disconnect any other connectors to components that are connected to the left rear turn signal circuits. Turn on ignition and clear DTC’s, then turn on left turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in that component. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC. Turn key “OFF”. Disconnect blue ESC connector (4008). Turn on ignition, then turn on left turn signal and check for fault. If the fault has not reoccurred, there is a short in the circuits between the ESC and right rear turn signal light. If the fault reoccurs, there is a short inside the ESC.	
611 14 13 1	Left rear turn lamp circuit open

Table 312 Rear Stop/Turn Signal/Hazard Light Connector Check Chart (cont.)

Left Rear Stop/Turn Signal/Hazard Light Voltage Checks

Check with hazard flashers on left rear stop tail and turn disconnected.

NOTE – Always check connectors for damage and pushed–out terminals. Also check turn signal assemblies for damage or corrosion.

NOTE – In an over current situation, the ESC will not supply voltage until the short or excessive load has been removed and the key switch has been cycled.

NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.

Test Points	Spec.	Comments
(9303) Pin B to ground	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open in circuits R-56B, N56, J56B or J56J. Check for a short or excessive loads in circuit J56BB to body builder connectors and body builder accessories. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
(9303) Pin E to ground	0 Volts	Ground circuit.
(9303) Pin B to E	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open in ground circuits.

Diagnostic Trouble Codes

611 14 14 3	Right rear turn lamps, less than normal low current but more than open circuit
611 14 14 4	Right rear turn lamps, greater than normal high current and less than fusing current
611 14 14 6	Right rear turn lamps has current flow when output commanded off
611 14 14 2	Right rear turn lamp over current (Short Circuit)

NOTE – Disconnecting connectors will cause new open circuit faults to be logged. Clear all faults after connections have been restored.

The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Disconnect right tail light connector (72). Cycle ignition and clear DTC’s. Turn on right turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in the turn signal light. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC.

Disconnect any other connectors to components that are connected to the right rear turn signal circuits. Cycle ignition and clear DTC’s. Turn on right turn signal and check for fault. If the fault has not reoccurred, there is a short or an overload in that component. If the fault reoccurs, there is a short in the circuits between the ESC and turn signal light or in the ESC.

Table 312 Rear Stop/Turn Signal/Hazard Light Connector Check Chart (cont.)

Disconnect blue ESC connector (4008). Cycle ignition and clear DTC's. Turn on right turn signal and check for fault. If the fault has not reoccurred, there is a short in the circuits between the ESC and right rear turn signal light. If the fault reoccurs, there is a short inside the ESC.		
611 14 14 1	Right rear turn lamp Under Current (Circuit Open)	
Right Rear Stop/Turn Signal/Hazard Light Voltage Checks Check with hazard flashers on and right rear tail light disconnected. **NOTE – Always check connectors for damage and pushed–out terminals. Also check turn signal assemblies for damage or corrosion.** **NOTE – In an over current situation, the ESC will not supply voltage until the short or excessive load has been removed and the key switch has been cycled.** **NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.**		
(72) Pin C to ground	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open in circuit S57B, left rear light assembly and circuits R57, N57, J57B, and J57J. Check for a short in circuit J57BB to body builder connectors and body builder accessories. Also insure proper voltage out of ESC. Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)
(72) Pin E to ground	0 Volts	Ground circuit
(72) Pin C to E	Voltage switching from 12 ± 1.5 volts to 0 volts	If voltage is missing, check for open in ground circuits.

Extended Description

Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC.

Voltage for the right rear turn/stop light is supplied from ESC connector (4008) terminal B to the right turn light connector (72) terminal C.

Ground for the right rear turn/stop light is supplied from ground stud (4006) to the right turn light connector (72) terminal C.

Voltage for the left rear turn/stop light is supplied from ESC connector (4008) terminal C to stop tail and turn connector (9303) terminal B.

Ground for the left rear turn/stop light is supplied from ground stud (4006) to stop tail and turn connector (9303) terminal E.

8.8. COMPONENT LOCATIONS

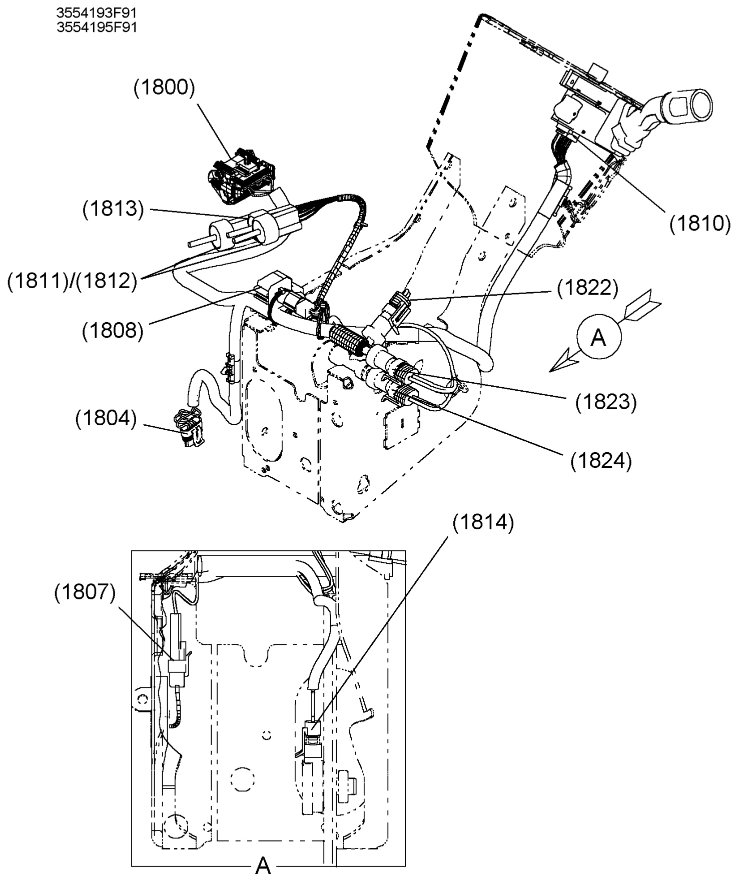

Figure 454 Stop/Turn Signal/Hazard Light Connector Locations (Steering Column Support View)

(1800) DCM CONNECTOR
(1804) THROTTLE POSITION SENSOR
(1807) CLUTCH SWITCH CONNECTOR
(1808) BAP SENSOR
(1810) TURN SIGNAL ASSEMBLY CONNECTOR (BEHIND STEERING COLUMN SHROUD)
(1811)/(1812) AIR PRESSURE TRANSDUCERS FOR GAUGES
(1813) PARK INDICATION PRESSURE SWITCH
(1814) HYDRAULIC BRAKE STOP LIGHT SWITCH (NOT USED WITH AIR BRAKES)
(1822) BRAKE APPLIED AIR SWITCH
(1823) AIR BRAKE STOP LIGHT SWITCH (NOT USED WITH HYDRAULIC BRAKES)
(1824) AIR BRAKE STOP LIGHT SWITCH (NOT USED WITH HYDRAULIC BRAKES OR TRACTOR BRAKE SYSTEM)

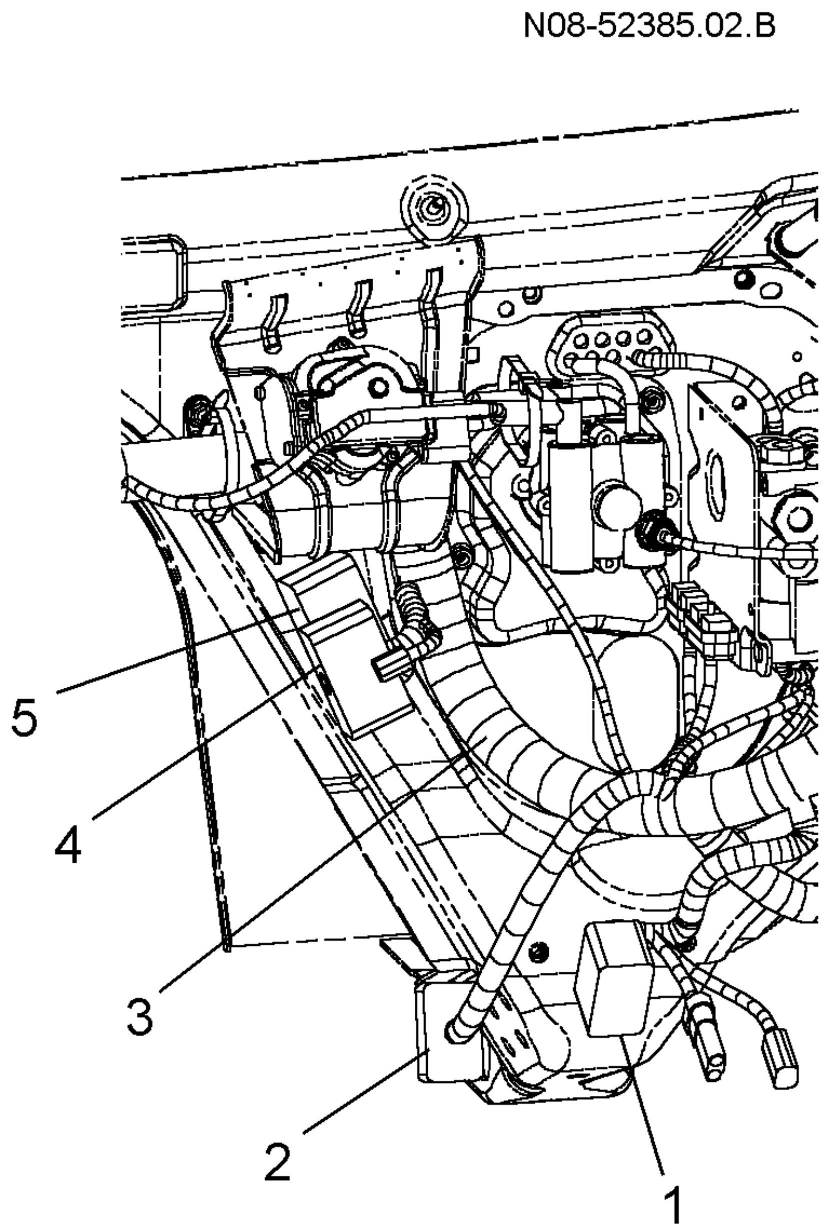

Figure 455 Stop/Turn Signal/Hazard Light Connector Locations (Dash Panel From Engine Compartment)

1. FORWARD CHASSIS CONNECTOR (4301)
2. REAR CHASSIS CONNECTOR (9700)
3. DASH HARNESS
4. TRANSMISSION CONNECTOR
5. ENGINE CONNECTOR

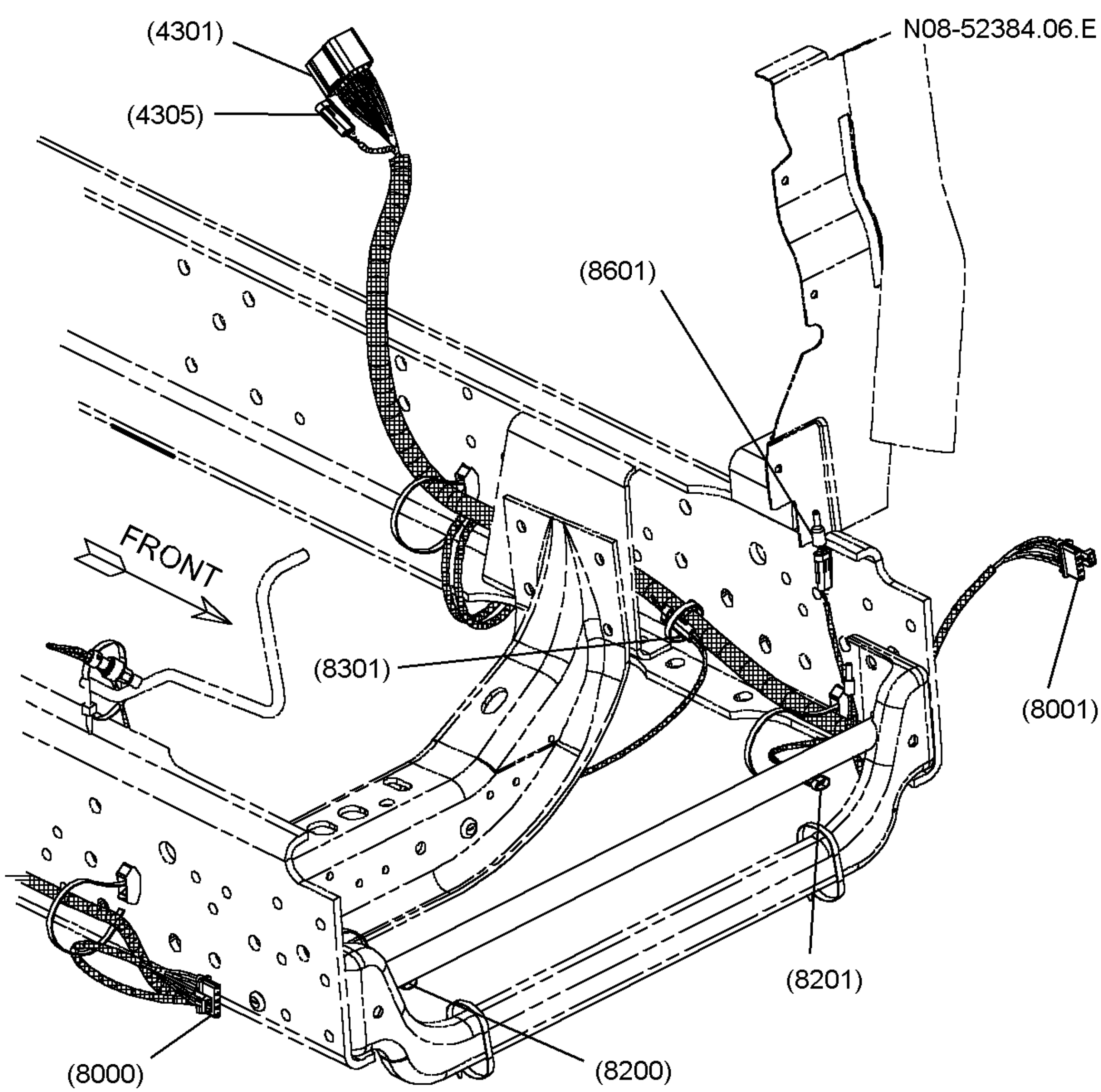

Figure 456 Stop/Turn Signal/Hazard Light Connector Locations

(4301) FORWARD CHASSIS CONNECTOR
(8000) RIGHT HEADLIGHT CONNECTOR
(8001) LEFT HEADLIGHT CONNECTOR
(8200) RIGHT FOG LIGHT CONNECTOR
(8201) LEFT FOG LIGHT CONNECTOR
(8302) HORN CONNECTOR

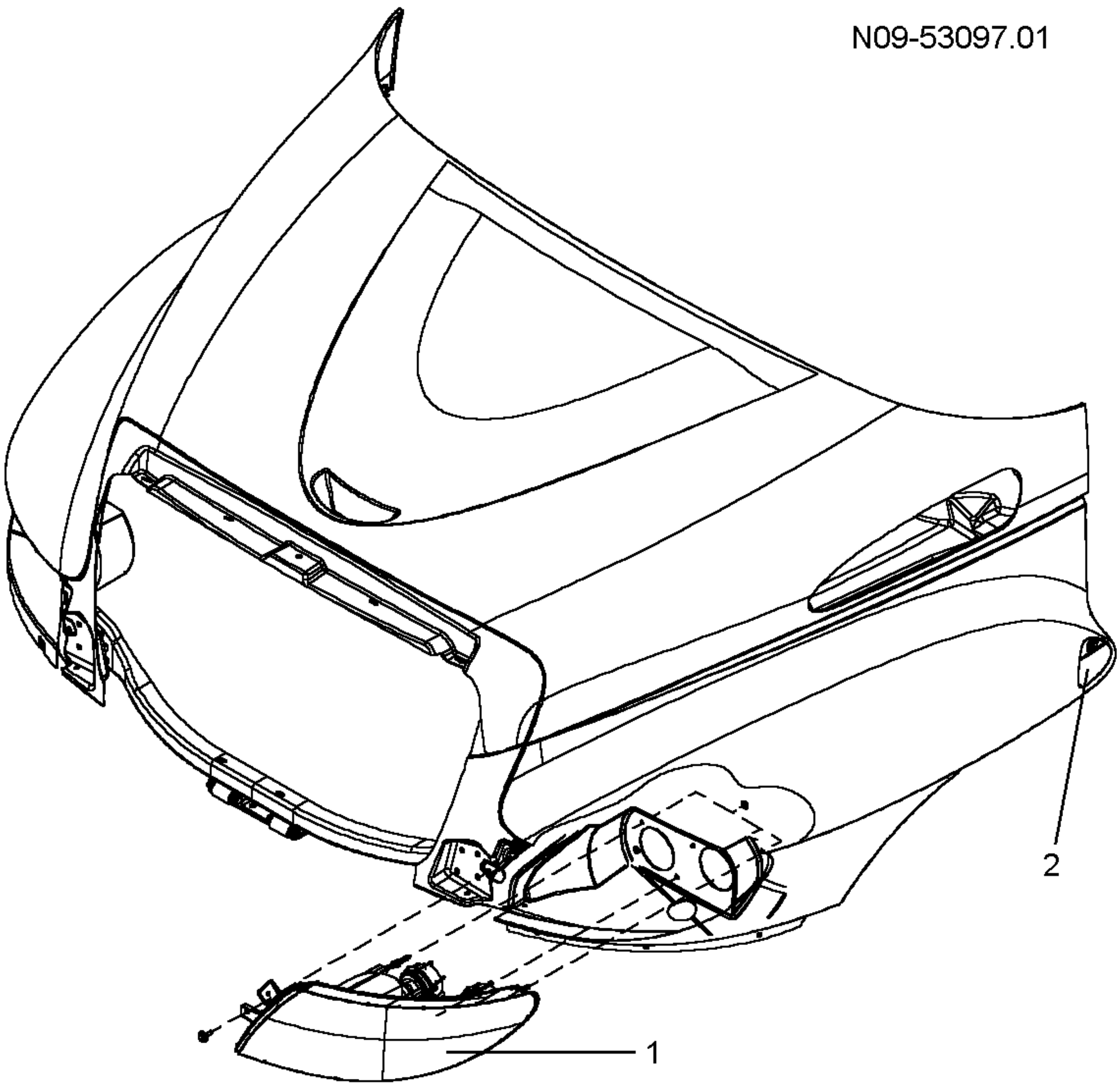

Figure 457 Headlights, Front and Side Marker Lights (Not Severe Service)

1. FRONT PARK LIGHT
2. SIDE MARKER LIGHT

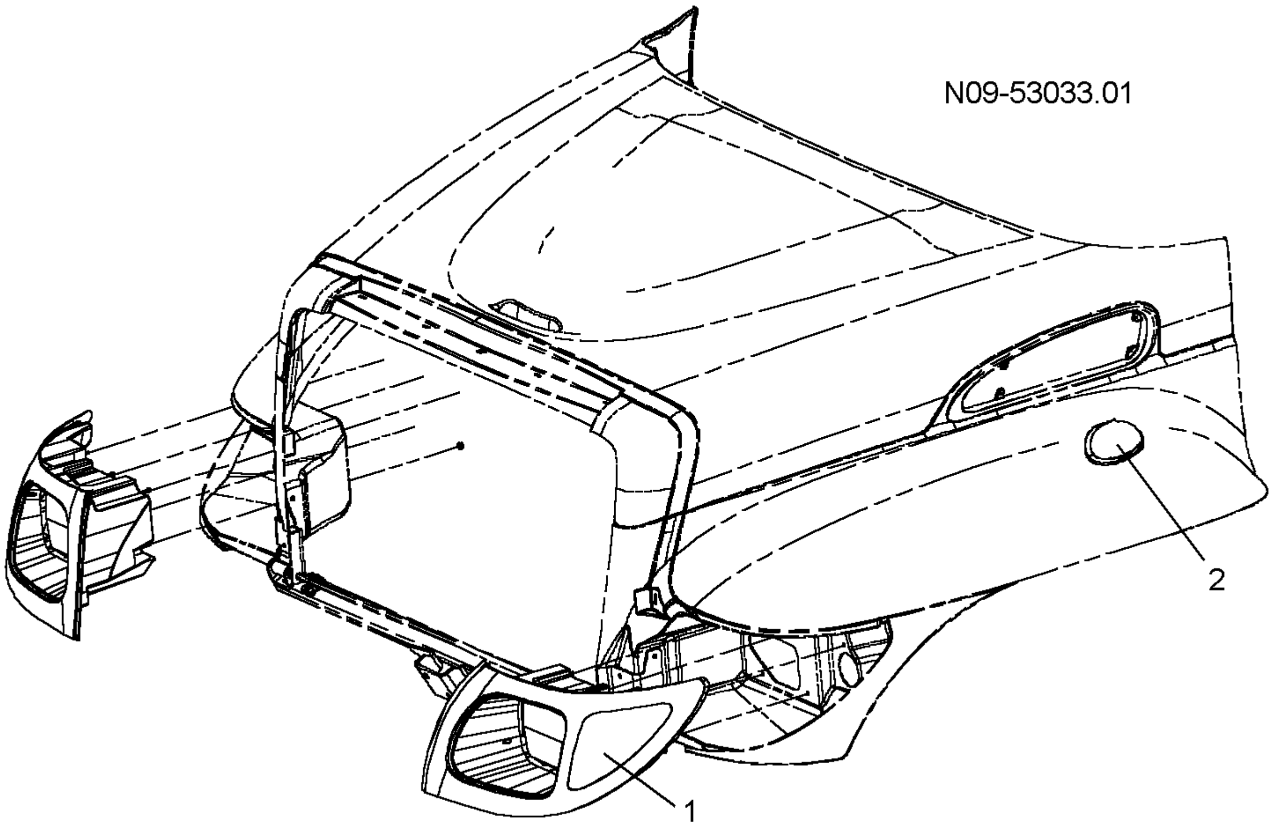

Figure 458 Headlights, Front and Side Marker Lights (Severe Service)

1. FRONT PARK LIGHT
2. STANDARD SIDE MARKER LIGHT

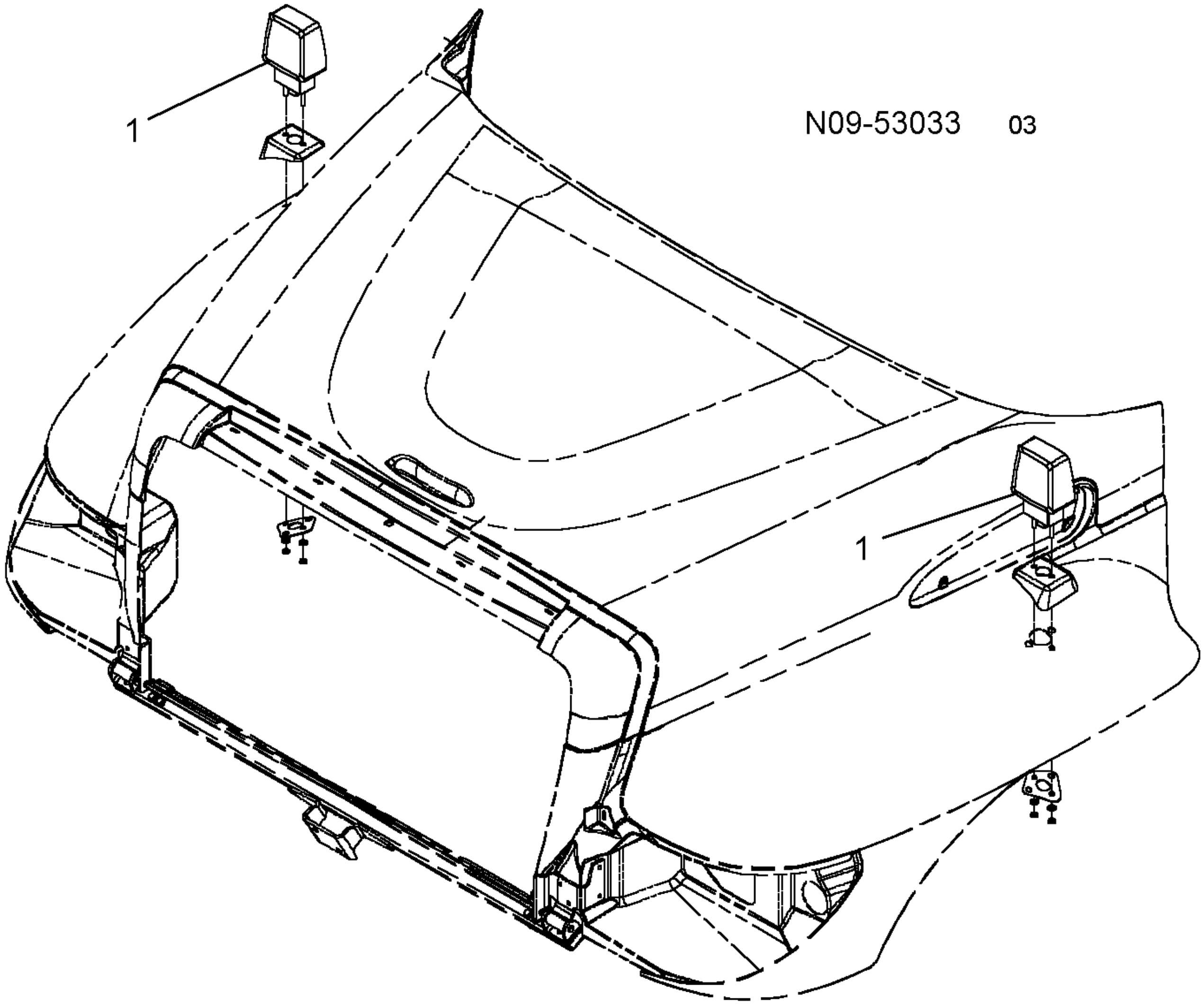

Figure 459 Optional Side Marker/Turn Signal Lights (Severe Service)

1. OPTIONAL SIDE MARKER/TURN SIGNAL LIGHT

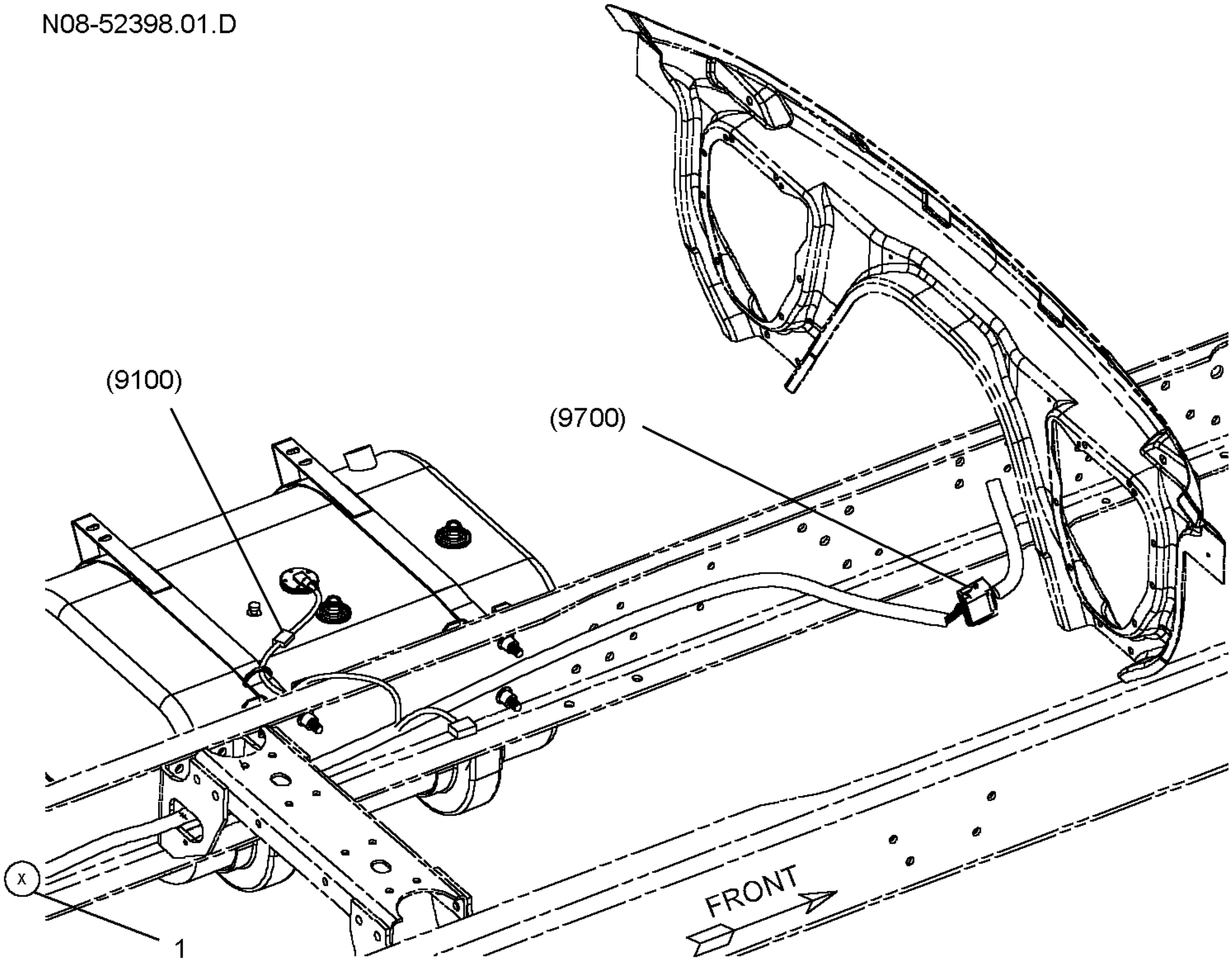

Figure 460 Rear Chassis Wiring Connector Locations

1. HARNESS TO CENTER CHASSIS WIRING
(9100) FUEL LEVEL SENDER CONNECTOR
(9700) REAR CHASSIS CONNECTOR

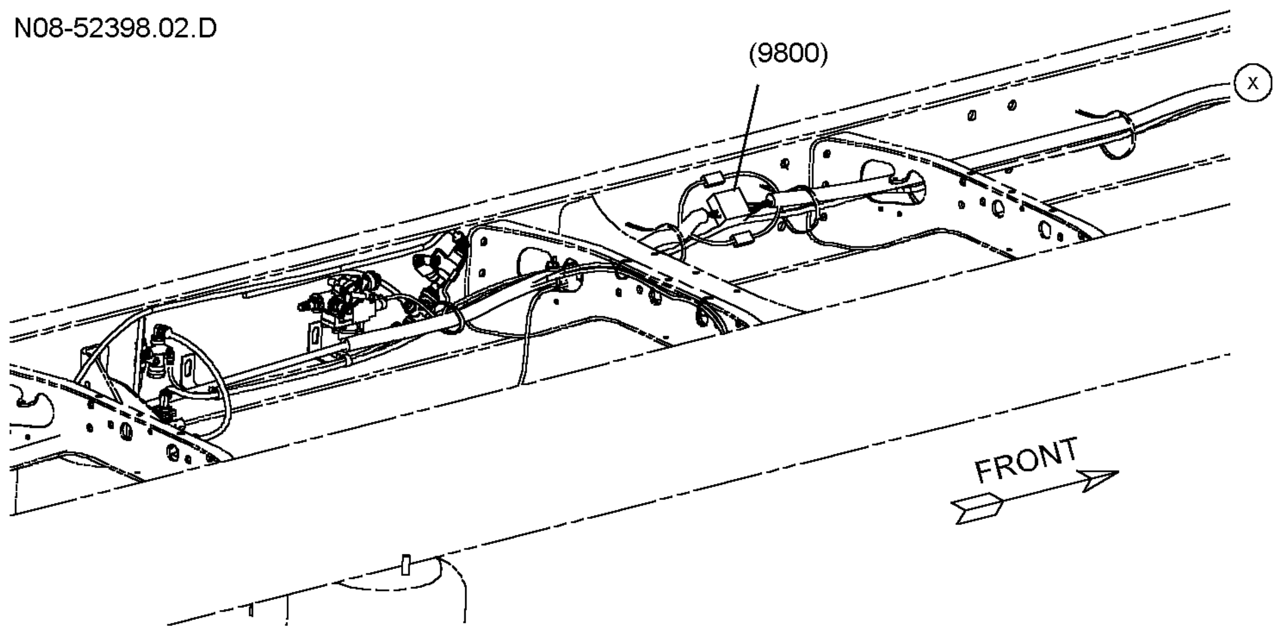

Figure 461 Rear Center Chassis Connector Locations

(9800) REAR CENTER CHASSIS CONNECTOR

N08-52398.10

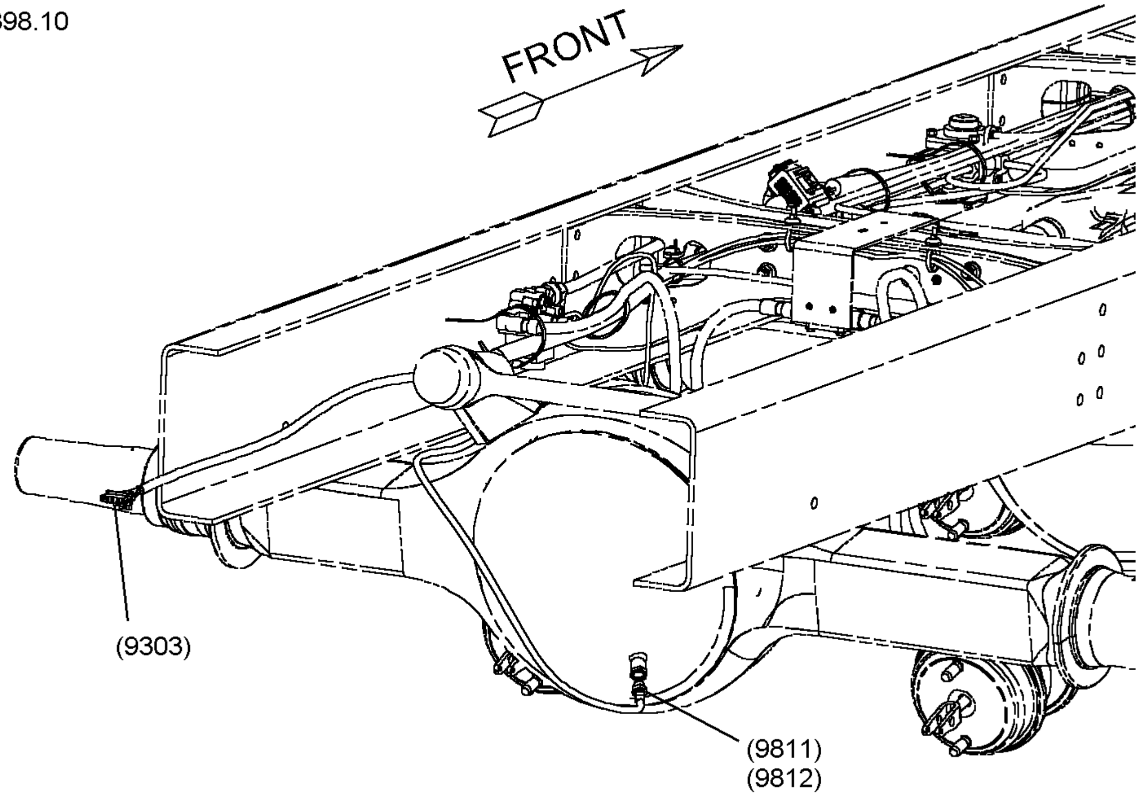

Figure 462 Stop, Tail and Turn Connector Location

(9303) STOP, TAIL AND TURN CONNECTOR
(9812) AXLE TEMPERATURE SENSOR

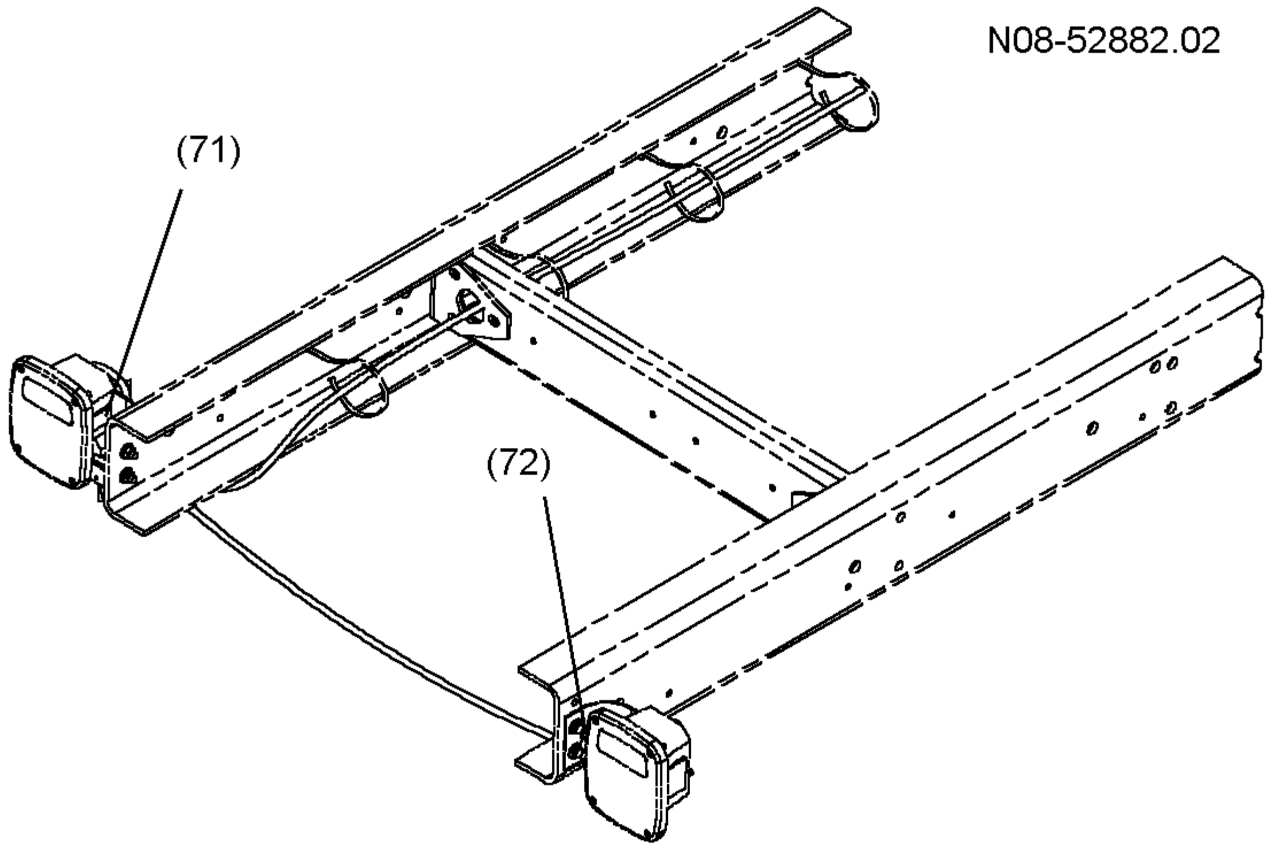

Figure 463 (Typical) Rear Signal Light Connector Locations

(71) LEFT TAIL LIGHT CONNECTOR
(72) RIGHT TAIL LIGHT CONNECTOR

9. WORK LIGHTS

9.1. CIRCUIT FUNCTIONS

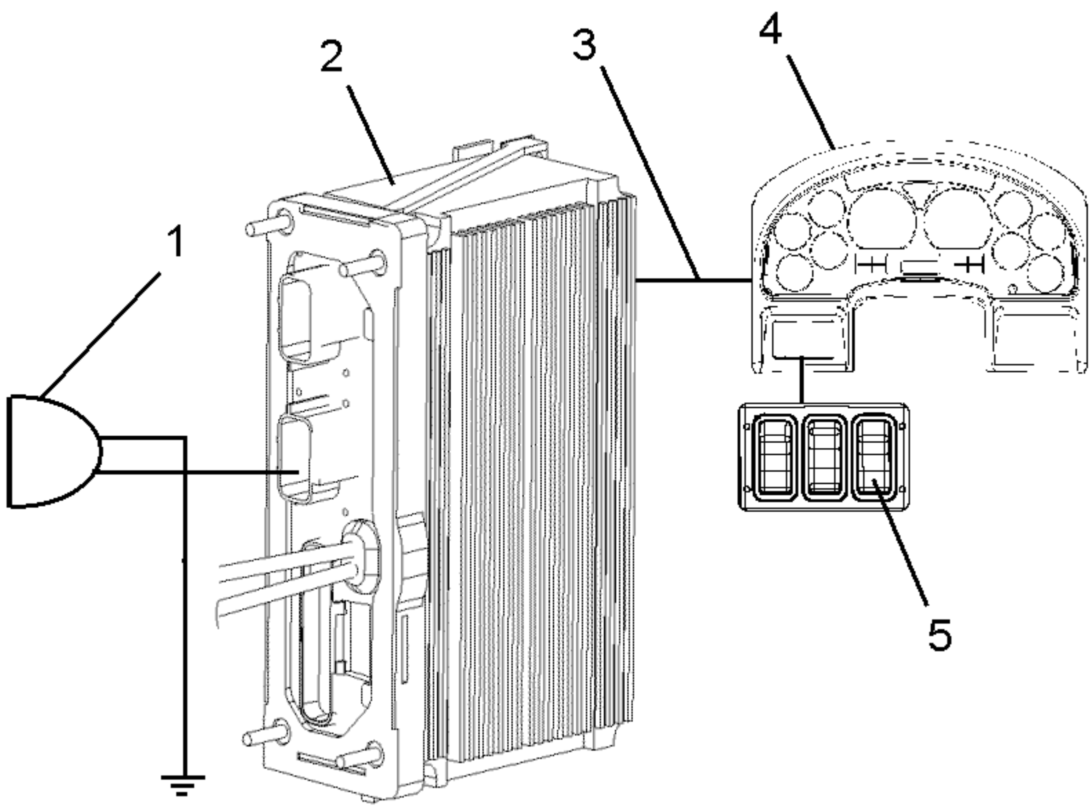

Figure 464 Work Light Function Diagram

1. WORK LIGHT
2. ELECTRICAL SYSTEM CONTROLLER
3. DRIVETRAIN 1939 DATA LINK
4. EGC
5. WORK LIGHT SWITCH (IN 3 SWITCH PACK ON EGC)

Refer to the Work Light Function Diagram.

The work light illuminates the fifth wheel area for easier trailer hook-up.

The momentary work light switch is wired directly to the EGC circuit board. When the work light momentary switch is pushed “on” the electronic gauge cluster will send a message to the ESC, on the drivetrain 1939 data link, to command the light on and light the switch indicator. The ESC provides power to the work light. When the switch is pushed “off”, the ESC will turn the light off.

The auxiliary button on the remote key fob will also activate/deactivate this feature.

This feature utilizes a timer function option to turn the work light off after a set amount of time.

9.2. DIAGNOSTICS

Should the light fail to operate, the problem could be attributed to a faulty switch in the EGC, a faulty switch pack in the EGC, a problem in the EGC, open or shorted wiring between the ESC and the work light or an open circuit between the work light and ground.

The ESC has an internal virtual fuse software algorithm to protect output circuits in an over current situation.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

A diagnostic trouble code (DTC) will be logged if there is an over current (short to ground or excessive load) or an open in the circuits between the ESC and the work light.

A diagnostic trouble code will also be logged if there is a burned out bulb (as long as there is only one lamp connected to the circuit).

An electronic service tool, running the "INTUNE" diagnostic software, can be used to check operation of the work light and monitor activation of the work light switch. See the diagnostic software manual for details on using the software.

Work Light Preliminary Check

Table 313 Work Light Preliminary Check

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify work light is inoperative.	Visually check work light.	Work light is inoperative.	Go to next step.	Work light is operating. Problem does not exist or is intermittent. (Check for inactive diagnostic trouble codes.)
2.	On	Determine if any other features are malfunctioning that may have common circuits. (Example: Missing ground common to several features.)	Visually check for other malfunctioning features.	No other features are malfunctioning.	Go to next step.	Identify and repair condition causing several features to be inoperative.
3.	On	If more than one work light is connected to this circuit, are all lights inoperative?	Visually check if all work lights are inoperative.	All work lights are inoperative.	Go to next step.	Check specific circuits of the inoperative light for open circuits.
4.	On	Check for diagnostic trouble codes. (See Diagnostic Trouble Codes, page 934)	Read display on odometer.	No work light diagnostic trouble	Go to work light input	Go to work light circuit outputs from ESC. (See WORK LIGHT CIRCUIT OUTPUTS

Table 313 Work Light Preliminary Check (cont.)

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
				codes are active.	circuits to the ESC. (See WORK LIGHT CIRCUIT INPUTS TO ESC, page 935).	FROM ESC, page 937)

Diagnostic Trouble Codes

To display diagnostic trouble codes (DTC's), set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch simultaneously. If no faults are present, the cluster odometer will display "NO FAULTS". If faults are present, the gauge cluster display will show the number of faults and each diagnostic trouble code for 10 seconds and then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in "A" for active faults or "P" for previously active faults. Releasing the parking brake or turning the ignition key off will take the ESC and the gauge cluster out of the diagnostic mode.

After all repairs have been made, the diagnostic trouble codes may be cleared by putting the key switch in the accessory position, turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 314 Work Light Diagnostic Trouble Codes carl

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
611 14 11 1	Work light open circuit Refer to Work Lights in the Light Systems section of this manual. (See WORK LIGHT CIRCUIT OUTPUTS FROM ESC, page 937)
611 14 11 2	Work light over current Refer to Work Lights in the Light Systems section of this manual. (See WORK LIGHT CIRCUIT OUTPUTS FROM ESC, page 937)
611 14 11 3	Work light lamps, less than normal low current but more than open circuit
611 14 11 4	Work light turn lamps, greater than normal high current and less than fusing current
611 14 11 6	Work light turn lamps has current flow when output commanded off

9.3. WORK LIGHT CIRCUIT INPUTS TO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to the Work Light EGC and ESC Input Circuits.

A fault in the input circuits will be apparent when the lights don't come on and no active faults are present. The ESC will not log any faults for work light input circuits to the ESC.

Loss of the drivetrain 1939 data link between the EGC and ESC will cause several problems to occur simultaneously and the check electrical system lamp will illuminate. **Go to the section on the drivetrain 1939 data link to troubleshoot this condition.**

Problems in the work light input circuits can be caused by a short circuit between the 3 switch pack and the EGC, an open circuit between the 3 switch pack and the EGC, a faulty switch, or a problem in the EGC.

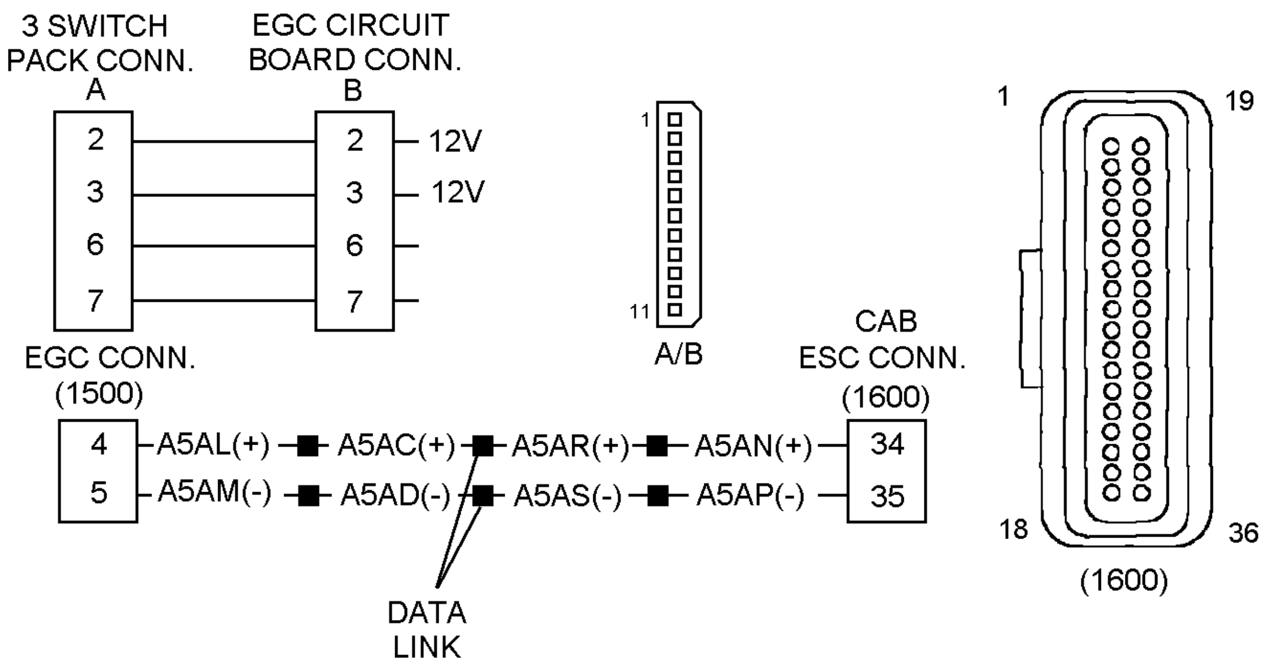

Figure 465 Work Light EGC and ESC Input Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

A. 3 SWITCH PACK CONNECTOR
B. EGC CIRCUIT BOARD CONNECTOR
(1500) EGC CONNECTOR
LOCATED BEHIND CLUSTER
(1600) ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON CAB SIDE OF ESC

Table 315 EGC, 3 Switch Pack Circuit Tests

Diagnostic Trouble Codes		
There are no diagnostic trouble codes associated with the 3 switch pack in the EGC.		
A mechanically defective work light switch could also prevent the work light from operating. Remove the mechanical portion of the switch and attempt to turn the switch on by pressing the bottom switch contact. If the work lights illuminate, the mechanical switch assembly should be replaced.		
3 Switch Pack Harness Connector Work Light Voltage Checks Check with ignition key on and 3 switch pack disconnected. **NOTE – If the EGC is working correctly, disconnecting the 3 switch pack connector should cause the park lights to come on.** **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments

Table 315 EGC, 3 Switch Pack Circuit Tests (cont.)

3 switch pack harness connector, pin 3 to ground	12 ± 1.5 volts	If voltage is missing, check for open or shorts in circuits between EGC connector and switch connector. Also insure proper voltage out of EGC.
3 switch pack harness connector, pin 7 to ground	0 –.3 volts	Low circuit from EGC If voltage is incorrect, check for open or shorts in circuits between EGC and switch. Also insure proper voltage out of EGC.
3 Switch Pack Work Light Resistance Check **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Checking for continuity between pins 3 and 7 of the switch pack, when the switch is on.	<1 ohm.	If there is no continuity, the switch pack needs replaced.

Extended Description

Refer to the Work Light EGC and ESC Input Circuits.

The work light switch is wired directly to the EGC circuit board. When the work light switch is turned on, 12 volts on pin 3 from the EGC will pass through the switch to pin 7 back to the EGC. This will cause the EGC to send a message to the ESC requesting the light to be turned on.

9.4. WORK LIGHT CIRCUIT OUTPUTS FROM ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer toWork Light Outputs from ESC.

A fault in the work light output circuits from the ESC will be apparent when the lights don't come on and an active work light fault is active. The ESC will log a diagnostic trouble code (DTC) when there is a short in any of the circuits between the ESC and the work light or when there is an open in a circuit between the work light and ground. Problems in the work light circuits can be caused by burned out lamps, a short, an open, a faulty switch, a problem in the ESC or a problem in the EGC.

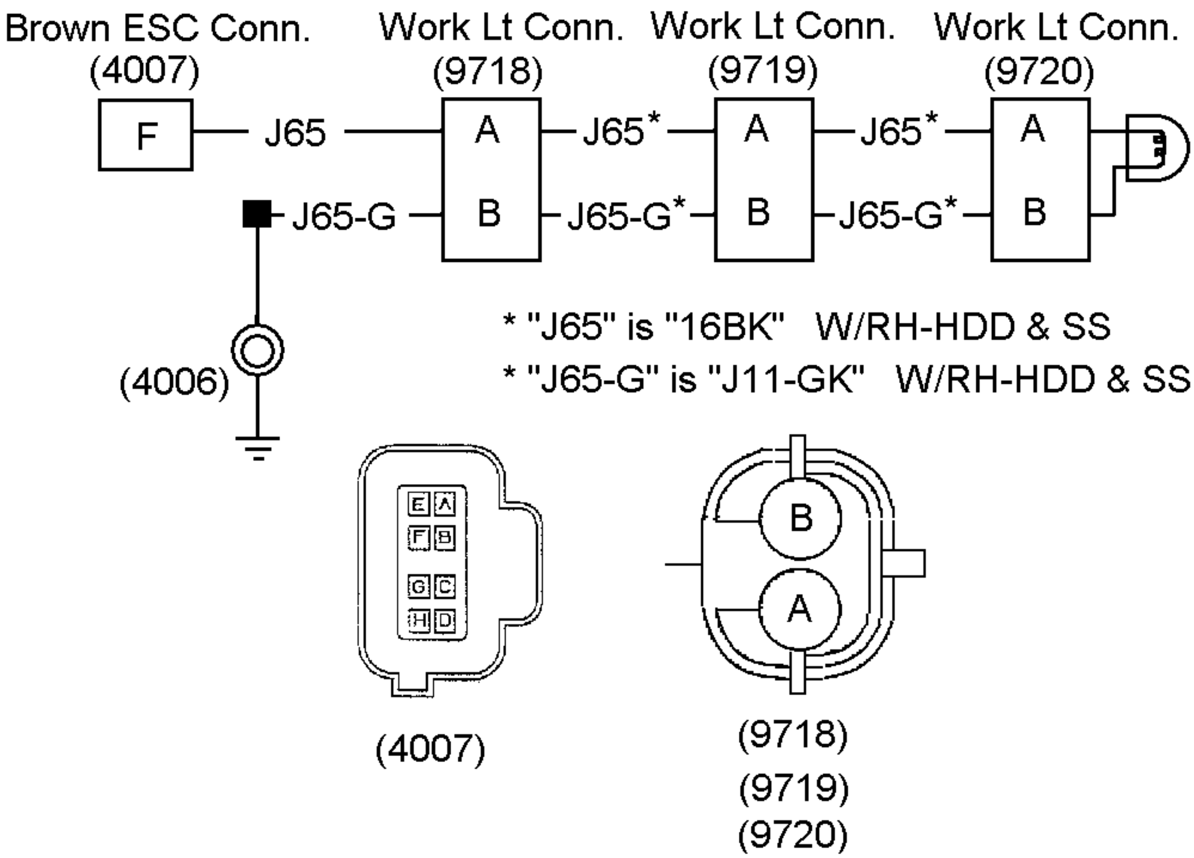

Figure 466 Work Light Outputs from ESC (Connectors Viewed From Mating End) — Always Refer to Circuit Diagram Book for Latest Circuit Information

(4006) GROUND STUD
(4007) BROWN ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON ENGINE COMPARTMENT SIDE OF ESC
(9718) WORK LIGHT CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME
(9719) WORK LIGHT CONNECTOR
LOCATED BELOW BACK OF CAB NEAR LEFT FRAME
(9720) WORK LIGHT CONNECTOR
LOCATED ON LIGHT MOUNTED ON BACK OF CAB

Table 316 Work Light Circuit Tests

Diagnostic Trouble Codes	
611 14 11 3	Work light lamps, less than normal low current but more than open circuit
611 14 11 4	Work light lamps, greater than normal high current and less than fusing current
611 14 11 6	Work light lamps has current flow when output commanded off
611 14 11 2	Work light over current

Table 316 Work Light Circuit Tests (cont.)

<table>
<tr><td colspan="3">This fault is logged when there is a short in the circuits between the work light and the ESC or an excessive load on the circuit caused by too many accessories on the work light circuits.

NOTE – Disconnecting connectors will cause new open circuit faults to be logged. Clear all faults after connections have been restored.

Disconnect work light connector (9720). Cycle key switch and clear DTC's. Turn on work light switch and check for fault. If the fault has not reoccurred, there is a short or an overload in the work light. If the fault reoccurs, there is a short in the circuits between the ESC and work light or in the ESC.

Disconnect brown ESC connector (4007). Cycle key switch and clear DTC's. Then turn on work light switch and check for fault. If the fault has not reoccurred, there is a short in the circuits between the ESC and work light. If the fault reoccurs, there is a short inside the ESC.</td></tr>
<tr><td>611 14 11 1</td><td colspan="2">Work light open circuit</td></tr>
<tr><td colspan="3">This fault is the result of an open in circuits between the work light output of the ESC and ground.

Check for open circuits</td></tr>
<tr><td colspan="3">Work Light Harness Connector (9720) Voltage Checks

Check with ignition key on, work light on, and work light connector (9720) disconnected.

NOTE – Always check connectors for damage and pushed–out terminals.

NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.</td></tr>
<tr><td>Test Points</td><td>Spec.</td><td>Comments</td></tr>
<tr><td>(9720) Harness connector, pin A to ground</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for open in circuit J65.

Also insure proper voltage out of ESC.

Refer to ESC Replacement in this manual. (See ESC REPLACEMENT, page 123)</td></tr>
<tr><td>(9720) Harness connector, pin B to ground</td><td>0 volts</td><td>Ground circuit. No voltage expected.</td></tr>
<tr><td>(9720) Harness connector, pin A to pin B</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for open in ground circuit J65–G.</td></tr>
</table>

Extended Description

Refer to Work Light Outputs from ESC.

The ESC will supply 12 volts from system controller brown connector (4007) terminal F to work light connector (9720) terminal A.

Ground for the work light is supplied from ground stud (4006) to work light connector (9720) terminal B.

9.5. COMPONENT LOCATIONS

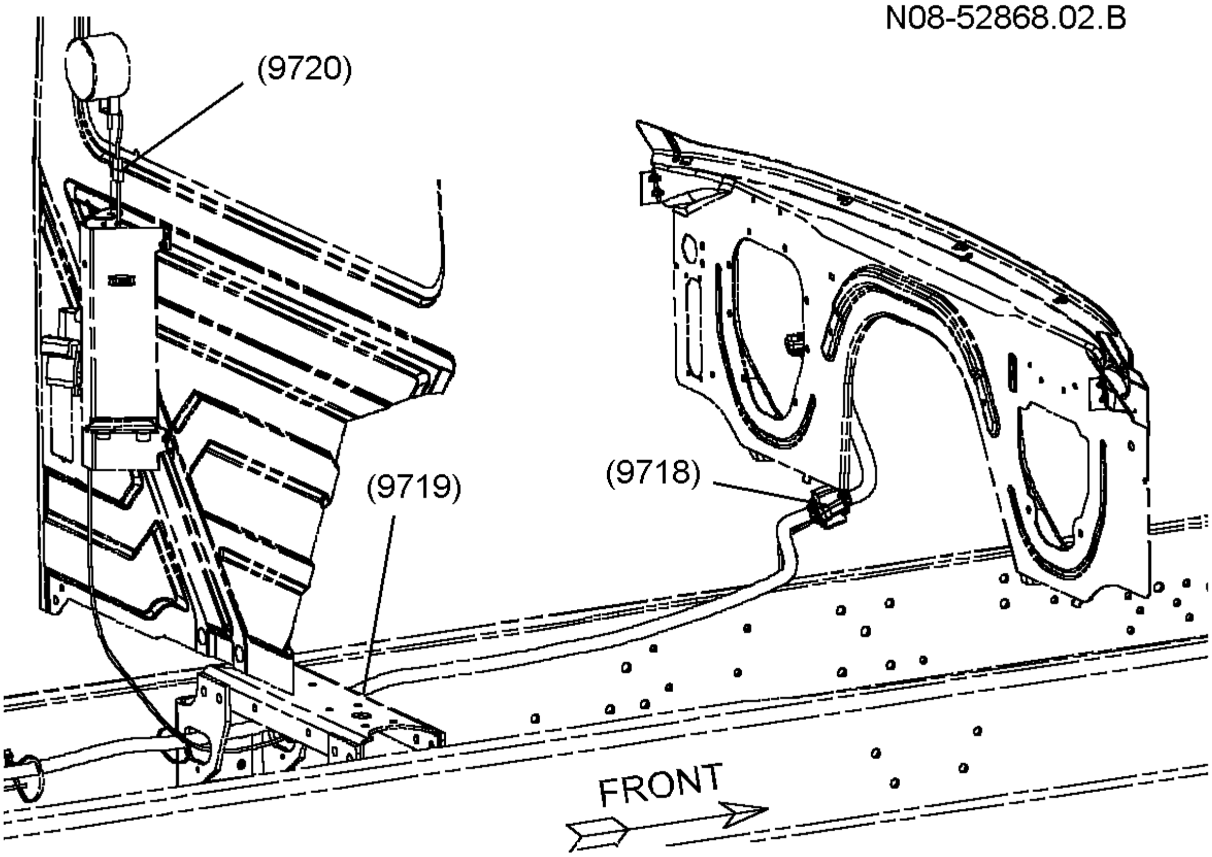

Figure 467 Work Light Wiring

(9718) WORK LIGHT CONNECTOR
(9719) WORK LIGHT CONNECTOR
(9720) WORK LIGHT CONNECTOR

10. AUXILIARY HEADLIGHTS

10.1. CIRCUIT FUNCTIONS

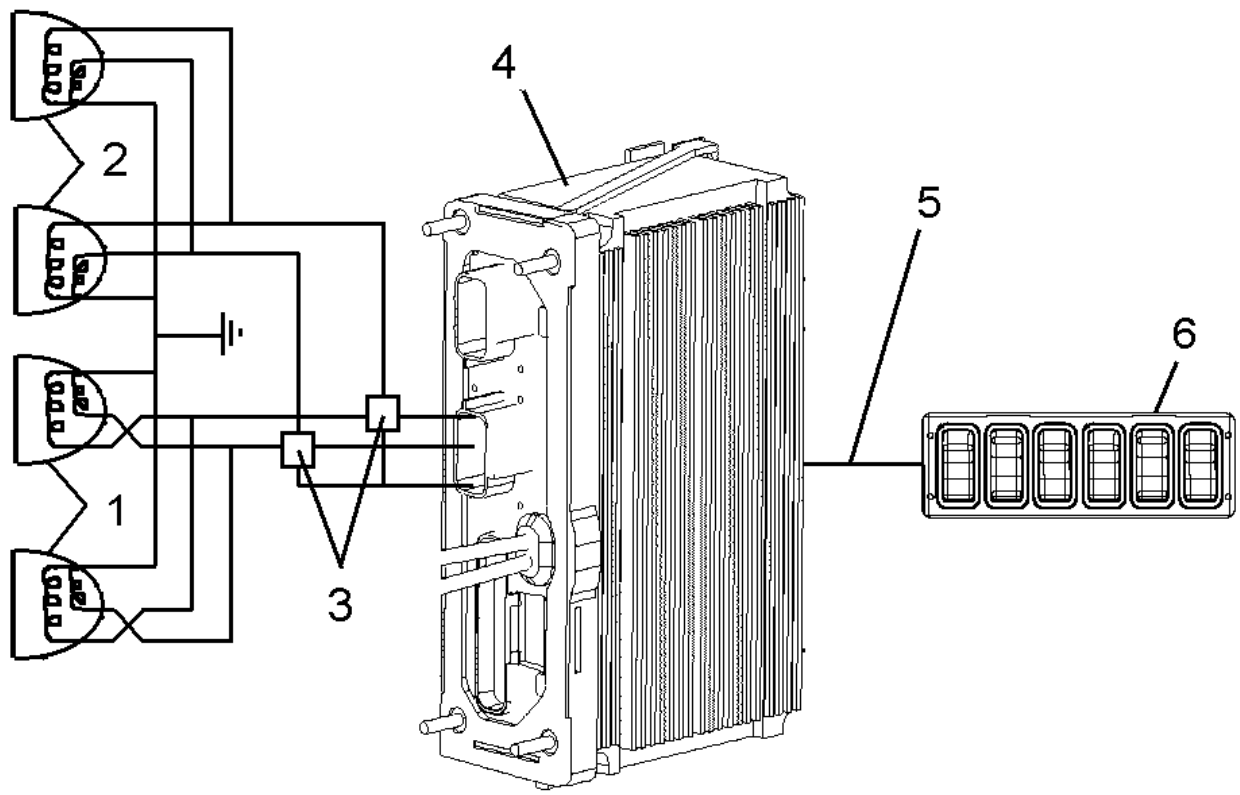

Figure 468 Auxiliary Headlights Function Diagram

1. AUXILIARY HEADLIGHTS
2. STANDARD HEADLIGHTS
3. AUXILIARY HEADLIGHT RELAYS
4. ELECTRICAL SYSTEM CONTROLLER
5. SWITCH DATA LINK
6. AUXILIARY HEADLIGHT SWITCH (IN SWITCH PACK)

Refer to Auxiliary Headlights Function Diagram.

The Auxiliary headlights system allows the driver to switch between standard headlights and auxiliary headlights mounted above a snowplow. Switching between the lights can only be performed when the key is on. If the key is turned off while the lights are on they will remain in that state until the key is turned on.

Relays, controlled by the ESC, are used to switch headlight current between the standard headlights and the auxiliary headlights. The auxiliary headlight switch mounted in a switch pack will communicate with the ESC to request the lights to be switched.

A separate relay is used for high beam and low beam auxiliary headlight operation.

All auxiliary lights, other than the headlights, are connected to splices. No switching between standard and auxiliary headlights occurs on these circuits.

10.2. DIAGNOSTICS

Should the auxiliary headlight system fail to switch from standard to auxiliary headlights, the problem could be attributed to a faulty switch in the switch pack, a faulty switch pack, failed relays, open circuits or shorted circuits.

An electronic service tool, running the "INTUNE" diagnostic software, can be used to check operation of the auxiliary headlights and monitor activation of the auxiliary headlight switch. See the diagnostic software manual for details on using the software.

Auxiliary Headlights Preliminary Check

Table 317 Auxiliary Headlights Preliminary Check

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
1.	On	Verify standard headlights lights are operating correctly.	Visually check standard headlights.	Standard lights are operating correctly.	Go to next step.	If standard headlights are not functioning correctly, Go to Headlight System. (See HEADLIGHT SYSTEM, page 872)
2.	On	Check if either high or low beam headlights switch from standard to auxiliary when selected by auxiliary headlights switch. (Lights may not work correctly. Just look for change from standard to auxiliary.)	Visually check switching of headlights.	At least some lights switch from standard to auxiliary.	Go to next step.	Go to Auxiliary Headlights Circuits To ESC. (See AUXILIARY HEADLIGHTS CIRCUITS TO ESC, page 944)
3.	On	Are both high beam or both low beam auxiliary headlights inoperative?	Visually check if both auxiliary headlights are inoper-ative.	Both high beam or both low beam auxiliary headlights inoperative.	Go to next step.	Check specific circuits of the inoperative light for open circuits.
4.	On	With the auxiliary headlights selected,check for diagnostic trouble codes. (See	Read display on odometer.	No diagnostic trouble codes are active.	Go to auxiliary headlights circuit outputs	Go to auxiliary headlights circuit outputs to ESC. (See AUXILIARY HEADLIGHTS

Table 317 Auxiliary Headlights Preliminary Check (cont.)

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES - IN SPEC.	NO - OUT OF SPEC.
		Diagnostic Trouble Codes, page 943)			from ESC. (See AUXILIARY HEADLIGHTS CIRCUITS FROM ESC, page 946)	CIRCUITS TO ESC, page 944)

Diagnostic Trouble Codes

To display diagnostic trouble codes (DTC's), set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch simultaneously. If no faults are present, the cluster odometer will display "NO FAULTS". If faults are present, the gauge cluster display will show the number of faults and each diagnostic trouble code for 10 seconds and then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in "A" for active faults or "P" for previously active faults. Releasing the parking brake or turning the ignition key off will take the ESC and the gauge cluster out of the diagnostic mode.

After all repairs have been made, the diagnostic trouble codes may be cleared by putting the key switch in the accessory position, turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 318 Auxiliary Headlights Circuits

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
611 14 5 1	Headlight low beam open circuit
611 14 5 2	Headlight low beam over current
611 14 5 3	Headlight low beam lamps, less than normal low current but more than open circuit
611 14 5 4	Headlight low beam lamps, greater than normal high current and less than fusing current
611 14 5 6	Headlight low beam lamps has current flow when output commanded off
611 14 7 1	Headlight high beam open circuit
611 14 7 2	Headlight high beam over current
611 14 7 3	Headlight high beam lamps, less than normal low current but more than open circuit
611 14 7 4	Headlight high beam lamps, greater than normal high current and less than fusing current
611 14 7 6	Headlight high beam lamps has current flow when output commanded off

10.3. AUXILIARY HEADLIGHTS CIRCUITS TO ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to Auxiliary Headlights Circuits To ESC.

A fault in the headlight switching circuits will be apparent when the lights will not switch between normal and auxiliary headlights. The ESC will log a diagnostic trouble code (DTC) when there is a short or overload in the switching circuit between the ESC and the switching relays. Problems in the switching circuits may be the result of a shorted circuit, an open circuit, failed relays, or a problem in the ESC.

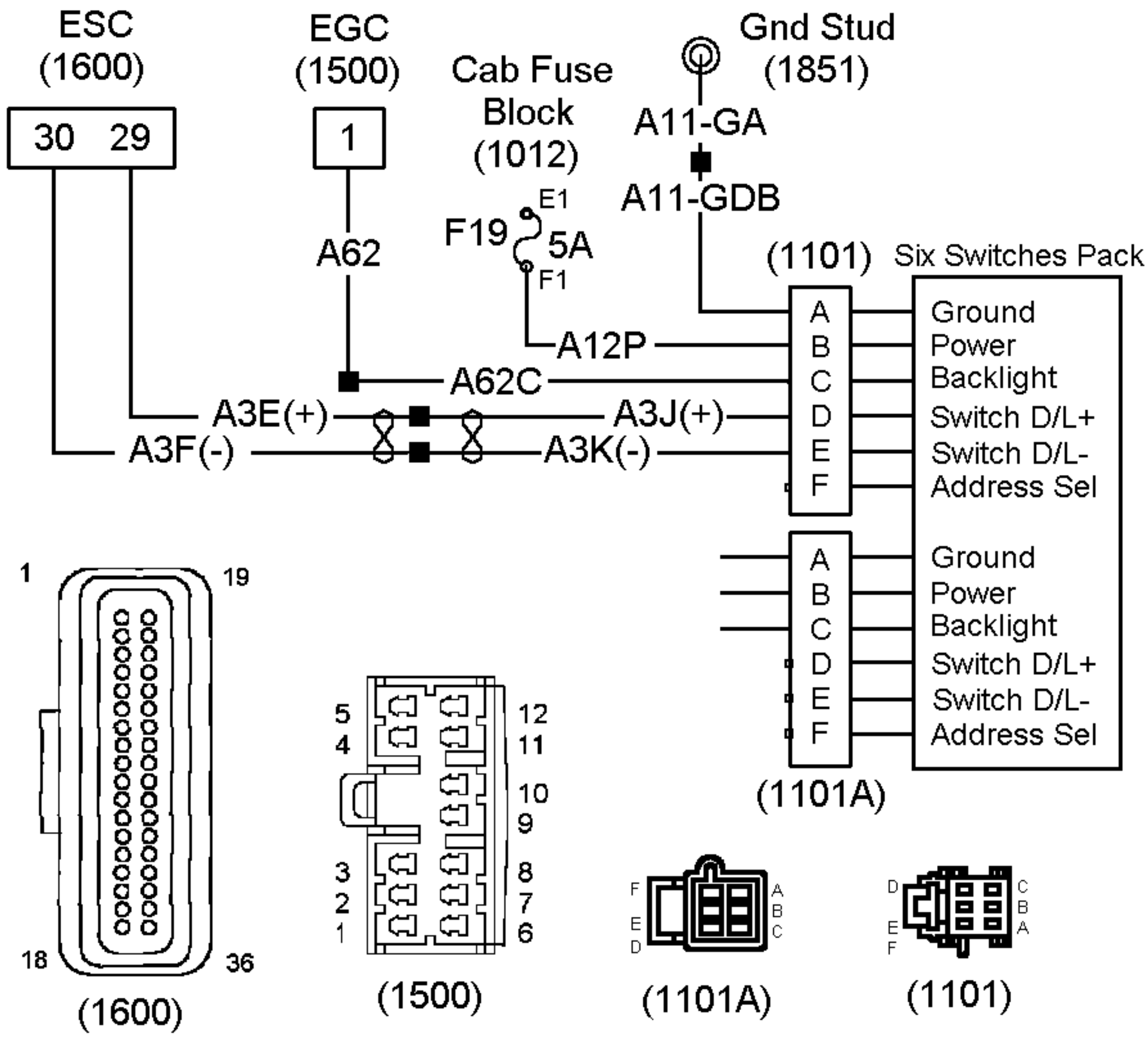

Figure 469 Auxiliary Headlights Circuits To ESC (Connectors Viewed From Mating End) — Always Refer To Circuit Diagram Book For Latest Circuit Information

(1012) F19 SWITCH PACK FUSE
LOCATED IN CAB POWER DISTRIBUTION CENTER
(1101) 6 SWITCHES PACK CONNECTOR (TO INSTRUMENT PANEL HARNESS OR PREVIOUS SWITCH PACK)
LOCATED BEHIND SWITCH PACK
(1101A) 6 SWITCHES PACK CONNECTOR (TO NEXT SWITCH PACK)
LOCATED BEHIND SWITCH PACK
(1500) ELECTRONIC GAUGE CLUSTER (EGC) CONNECTOR
LOCATED ON BACK OF EGC
(1600) 36–WAY ESC CONNECTOR
LOCATED ON CAB SIDE OF ESC
(1851) GROUND STUD CONNECTOR

Table 319 **Auxiliary Headlights Circuits To ESC 6 Switches Pack Connector Check Chart**

Auxiliary Headlights Circuits To ESC 6 Switches Pack Connector (1101) Voltage Checks This chart assumes there is power to cab fuse block (1012) from the mega fuse.		
Test Points	Spec.	Comments
(1101) Pin B to ground	12 ± 1.5 volts	If voltage is missing, check for blown fuse (F19) or open or short in circuits A12P.
(1101) Pin A to ground	0 volts	Ground circuit to pod.
(1101) Pin D to ground	Approximately 4.5 volts	(+) data link circuit. If voltage is low check for open or short in circuit A3J(+) or shorted components on data link.
(1101) Pin E to ground	Approximately .2 volt	(-) data link circuit. If voltage is low check for open in circuit A3K(-) or shorted components on data link. If voltage is high check for crossed data link wires.
If voltage and data link circuits to the pod are good, and a communication fault is still active, the switch pack should be replaced.		
(1101) Pin C to pin A	12 ± 1.5 volts (with park lights on and panel dimmer at maximum).	Panel dimmer voltage from electronic gauge cluster (EGC). If voltage is missing check circuits between switch pack and EGC.
Inoperative panel lights in individual switches should be replaced. If the panel light voltage to the switch pack is correct, but none of the panel lights operate, the switch pack should be replaced.		

Extended Description

Refer to Auxiliary Headlights Circuits To ESC.

Battery voltage to 6 switches pack connector (1101) terminal B is provided from fuse block (1012), fuse F19 on circuit A12P.

System ground to 6 switches pack connector (1101) terminal A is provided from negative stud (1850) on circuit A11–GA and A11–GDB.

The switch data link is connected to switch pack connector (1101) terminal D and E from ESC connector (1600) terminals 29 and 30 on twisted pair A3F(-)/A3E(+), to a splice and on A3K(-)/A3J(+).

Panel light voltage to switch pack connector (1101) terminal C is supplied from EGC connector (1500) on circuits A62 and A62C.

The Auxiliary headlights switch selects the auxiliary headlights mounted above a snowplow.

10.4. AUXILIARY HEADLIGHTS CIRCUITS FROM ESC

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

NOTE – The virtual fuse in the ESC will trip during a short. To reset the fuse, the key switch must be cycled.

Refer to Auxiliary Headlights Circuits From ESC.

A fault in the auxiliary headlight circuits between the ESC and the headlights will be apparent when the lights don’t operate correctly. The ESC will also log a diagnostic trouble code (DTC) when there is a short in any of the headlight circuits or an open circuit between the ESC and the headlights. Problems occurring in the auxiliary headlights (not affecting normal headlights) can be caused by burned out lamps, a short to ground or an open circuit.

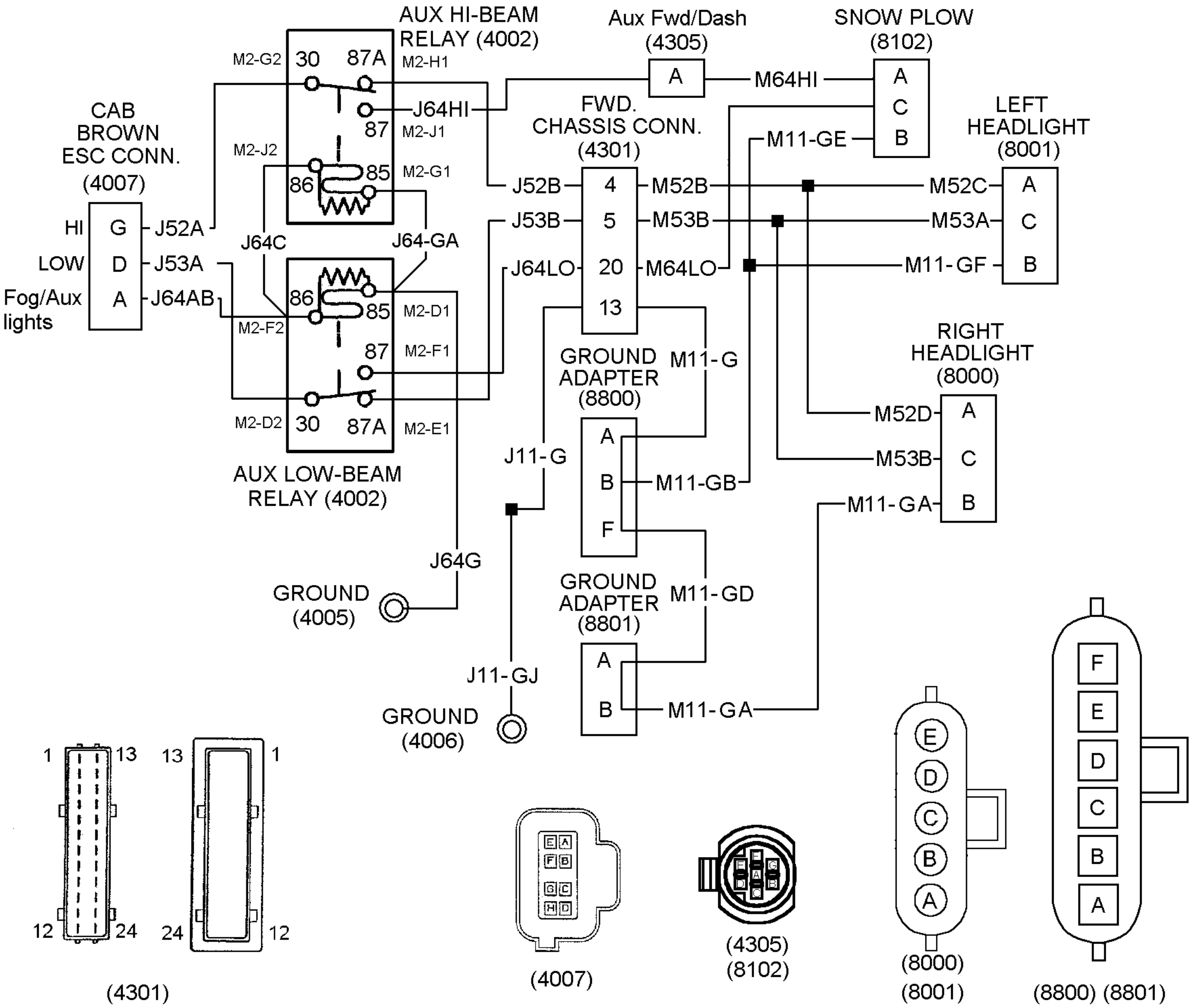

Figure 470 Auxiliary Headlights Circuits From ESC (Connectors Viewed From Mating End) — Always Refer To Circuit Diagram Book For Latest Circuit Information

(4005), (4006) GROUND STUDS
(4007) BROWN ESC CONNECTOR
LOCATED ON ENGINE COMPARTMENT SIDE OF ESC
(4301) FORWARD CHASSIS CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME RAIL
(4305) AUX FORWARD/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR LEFT FRAME RAIL
(8000) RIGHT HEADLIGHT CONNECTOR
LOCATED BEHIND RIGHT HEADLIGHT
(8001) LEFT HEADLIGHT CONNECTOR
LOCATED BEHIND LEFT HEADLIGHT
(8102) SNOW PLOW HARNESS CONNECTOR
LOCATED NEAR LEFT HEADLIGHT CONNECTOR
(8800) LEFT GROUND ADAPTER
(8801) RIGHT GROUND ADAPTER

Table 320 Auxiliary Headlight Switching Circuits Tests

Auxiliary High and Low Beam Relay Checks		
Check with auxiliary high beam and low beam relays removed, key in ignition position, headlight switch on and auxiliary headlight switch on.		
NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.		
Test Points	Spec.	Comments
Bench check auxiliary high and low beam relays. Refer to Bench Checking Relays. (See BENCH TESTING RELAYS, page 29)	Relays energize and there is continuity thorough the closed contacts.	If a relay tests bad, replace it.
Measure voltage between aux low beam relay socket cavity M2–F2 and ground.	12 ± 1.5 volts with auxiliary headlight switch “on”.	If voltage is missing, check for open or short in circuit J64AB or short to ground in circuit J64C.
Measure voltage between aux high beam relay socket cavity M2–J2 and ground.	12 ± 1.5 volts with auxiliary headlight switch “on”.	If voltage is missing, check for open or short in circuit J64AB or short to ground in circuit J64C.
Measure voltage between aux high beam relay socket cavity M2–J2 and M2–G1	12 ± 1.5 volts with auxiliary headlight switch “on”.	If voltage is missing, check for open in circuit J64–GA or J64–G to ground stud (4005).

Table 321 Auxiliary Low Beam Headlight Circuit Tests

FAULTS		
611 14 5 3	Headlight low beam lamps, less than normal low current but more than open circuit	
611 14 5 4	Headlight low beam lamps, greater than normal high current and less than fusing current	
611 14 5 6	Headlight low beam lamps has current flow when output commanded off	
611 14 5 2	Low beam over current	
This fault may be the result of a short in the circuits between the low beam headlight circuits and the ESC. It could also be caused by an excessive load on the circuit.		
611 14 5 1	Low beam under current	
This fault is the result of an open in circuits between the low beam headlight circuits and the ESC. Check for burned out bulbs.		
Snow Plow Connector (8102) Low Beam Voltage Checks		
NOTE – Verify headlight bulbs are not burned out before proceeding.		
Check with key in ignition position, headlight switch on, low beams selected and connector (8102) disconnected.		
Test Points	Spec.	Comments

Table 321 Auxiliary Low Beam Headlight Circuit Tests (cont.)

Headlights in low beam. (8102) terminal C to ground.	12 ± 1.5 volts with headlight low beams switched “on”	If voltage is missing, check for open or short to ground in circuits J64LO or M64LO. If no open or shorts are found check circuits between (8102) and the auxiliary headlamps
Headlights in low beam. (8102) terminal C to terminal B.	12 ± 1.5 volts with headlight low beams switched “on”	If voltage is missing, check for open in circuits between terminal B and ground.

Table 322 Auxiliary High Beam Headlight Circuit Tests

FAULTS	
611 14 7 3	Headlight high beam lamps, less than normal low current but more than open circuit
611 14 7 4	Headlight high beam lamps, greater than normal high current and less than fusing current
611 14 7 6	Headlight high beam lamps has current flow when output commanded off
611 14 7 2	High beam over current
This fault may be the result of a short in the circuits between the high beam headlight circuits and the ESC. It could also be caused by an excessive load on the circuit.	
611 14 7 1	High beam under current
This fault is the result of an open in circuits between the high beam headlight circuits and the ESC. Check for burned out bulbs.	

Snow Plow Connector (8102) High Beam Voltage Checks **NOTE – Verify headlight bulbs are not burned out before proceeding.** Check with key in ignition position, headlight switch on, high beams selected and connector (8102) disconnected.		
Test Points	Spec.	Comments
Headlights in high beam. (8102) terminal A to ground.	12 ± 1.5 volts with headlight high beams switched “on”	If voltage is missing, check for open or short to ground in circuits J64HI or M64HI. If no open or shorts are found check circuits between (8102) and the auxiliary headlamps
Headlights in high beam. (8102) terminal A to terminal B.	12 ± 1.5 volts with headlight low beams switched “on”	If voltage is missing, check for open in circuits between terminal B and ground.

Extended Description

Refer to Auxiliary Headlights Circuits From ESC.

When low auxiliary headlights are requested, the ESC will supply 12 volts to the coils of auxiliary high beam micro relay (4002) and auxiliary low beam micro relay (4002).

This will cause both relays to energize switching headlight voltage to the auxiliary headlights.

Ground for the auxiliary headlights is supplied from ground stud (4006) to ground adapter (8800) and cavity B of snowplow connector (8102).

10.5. COMPONENT LOCATIONS

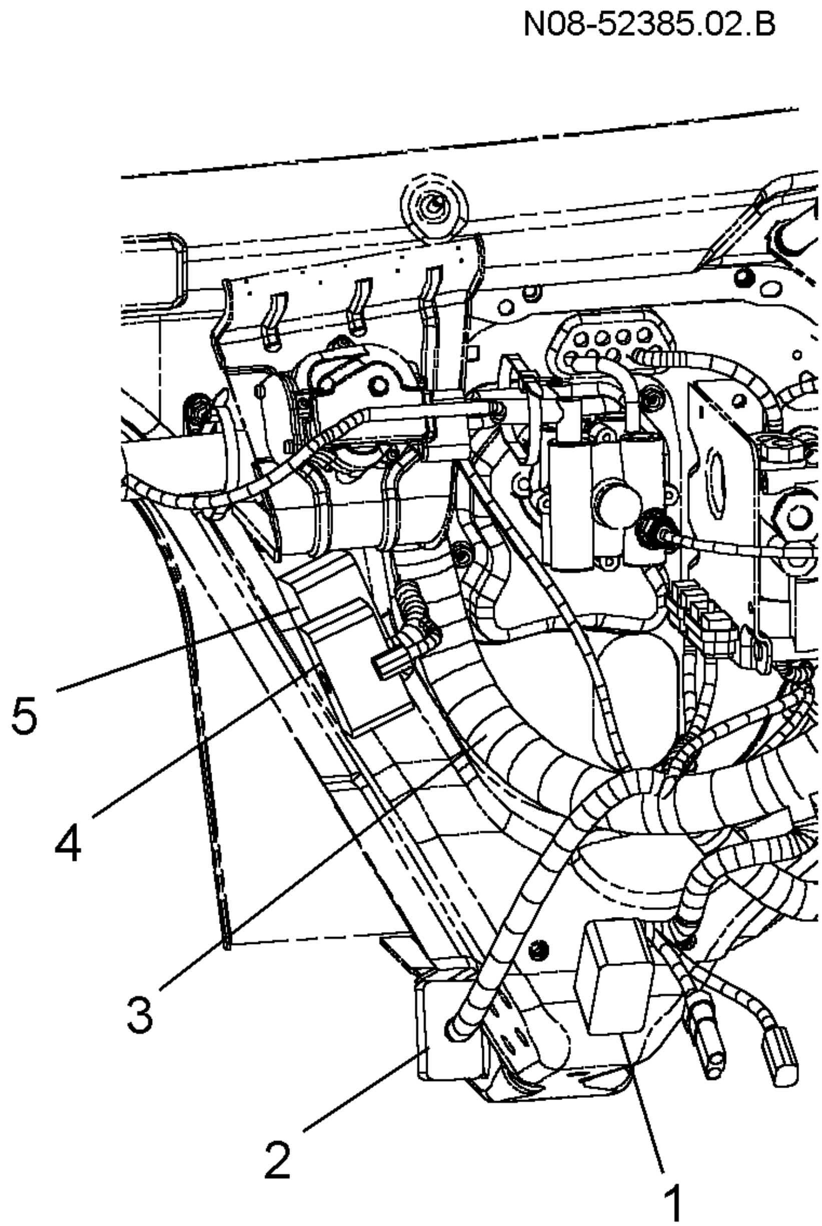

Figure 471 Headlight Connector Locations (Dash Panel From Engine Compartment)

1. FORWARD CHASSIS CONNECTOR (4301) AND AUX FORWARD/DASH CONNECTOR (4305)
2. REAR CHASSIS CONNECTOR (9700)
3. CHASSIS HARNESS
4. TRANSMISSION CONNECTOR
5. ENGINE CONNECTOR

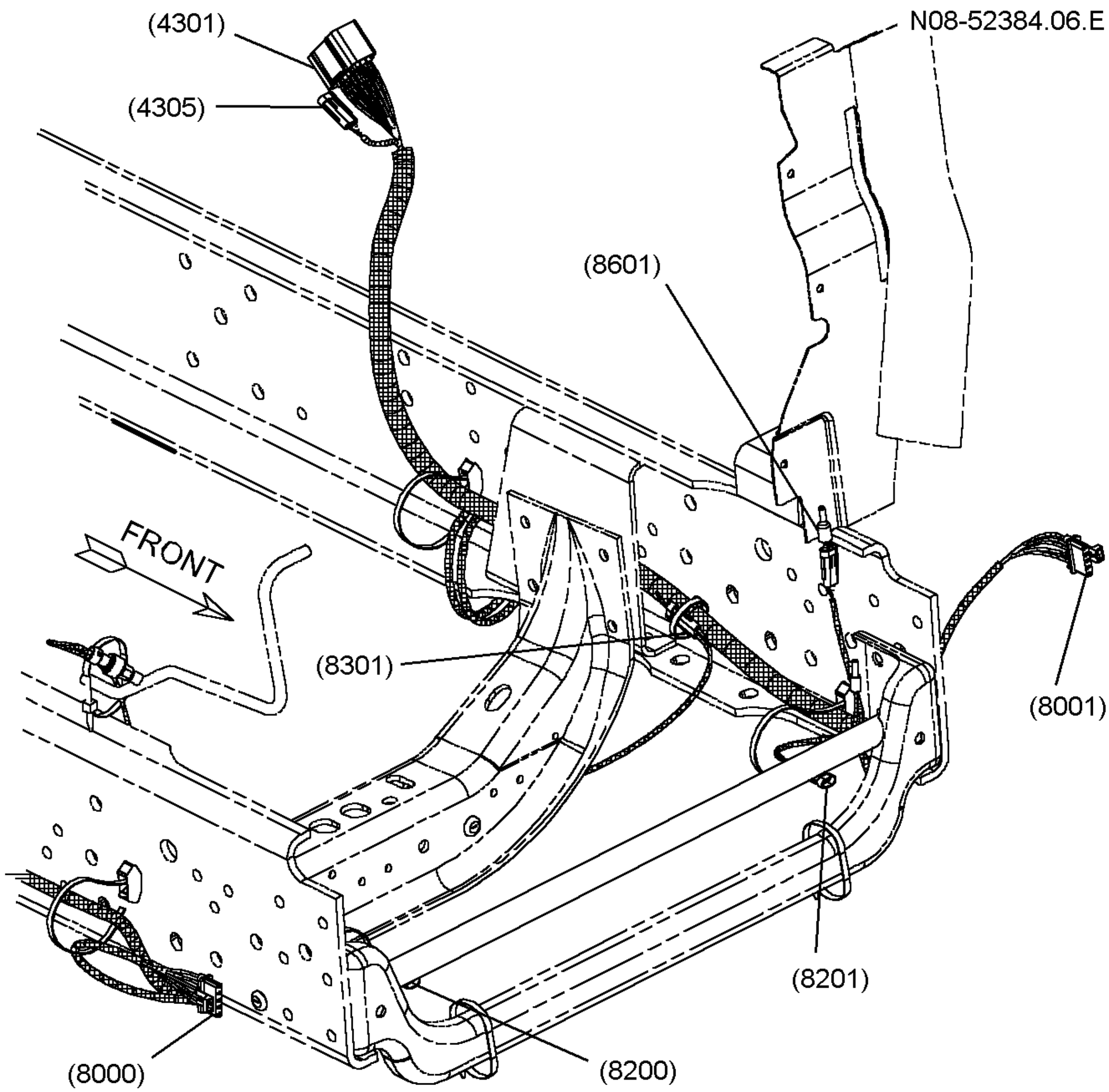

Figure 472 Headlight Wiring

(4301) FORWARD CHASSIS CONNECTOR
(4305) AUX FORWARD/DASH CONNECTOR
(8000) RIGHT HEADLIGHT CONNECTOR
(8001) LEFT HEADLIGHT CONNECTOR
(8200) RIGHT HEADLIGHT CONNECTOR
(8201) LEFT HEADLIGHT CONNECTOR
(8302) HORN CONNECTOR

Table of Contents

1. MANUAL TRANSMISSIONS

1.1. CIRCUIT FUNCTIONS

The manual transmission interfaces with the vehicle electrical system through a vehicle speed sensor, and back-up light switch.

Vehicles with a transmission temperature gauge will also have a temperature sensor on the transmission.

1.2. DIAGNOSTICS

The ESC will set a diagnostic trouble code for a short to ground in the transmission temperature sensor circuits. It is not able to detect an open circuit.

The ESC is not able to detect faults in the back-up light circuits. A fault in the back-up light circuits will be apparent when the transmission is shifted into reverse and the lights don't come on.

The engine controller will monitor the vehicle speed circuits for failures. A fault in the vehicle speed sensor circuits will be apparent when the speedometer is inoperative and the yellow "ENGINE" warning lamp is on.

1.3. BACK-UP LIGHT SWITCH

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

When the transmission is shifted into reverse, the back up light switch should close to provide voltage for the back up lamps.

A fault in the back-up circuits should be suspected if the back-up lights do not come on when the transmission is shifted into reverse. Problems in the back–up light circuits can be caused by open or short circuits, a blown fuse, or failed switch.

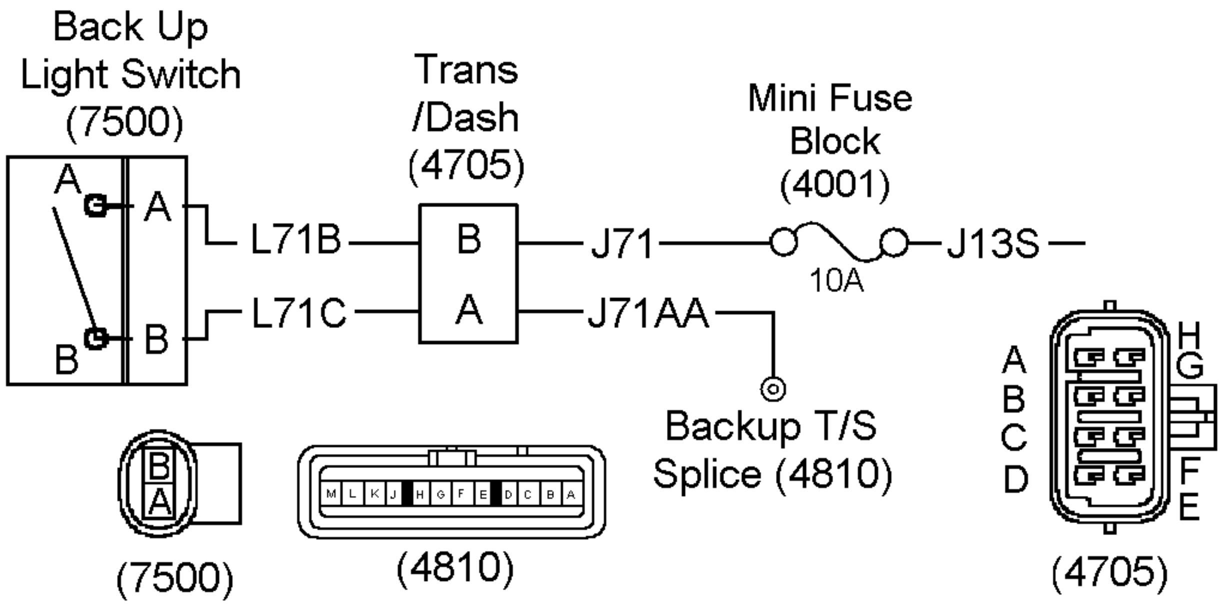

Figure 473 Back Up Switch Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(4810) BACKUP LIGHT TURN SIGNAL SPLICE CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR PDC
(7500) BACK UP LIGHT SWITCH CONNECTOR
LOCATED ON MANUAL TRANSMISSION

Table 323 Back Up Light Circuit Checks

Back Up Light Switch Connector (7500) Power Checks Check with ignition on and (7500) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Back up switch harness connector (7500), cavity A to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit J71B or J71.
Back up switch harness connector (7500), cavity A to cavity B.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L71C or J71AA to back up/turn signal splice (4810). Also check circuits through back up lamps to ground.
If voltages are correct, consider replacing the back up switch.		

Extended Description

Ignition voltage is supplied to the back up light switch connector (7500), terminal A, from the 10 amp back up light fuse in the engine compartment power distribution center (PDC).

When the transmission is shifted into reverse, the switch will close supplying ignition voltage to the lamp circuits.

1.4. VEHICLE SPEED SENSOR

Refer to Speedometer (See SPEEDOMETER, page 250) for procedures to isolate speedometer problems to the sensor circuits.

Refer to the applicable engine manual for troubleshooting circuits from the engine controller to the sensor.

Circuit Function

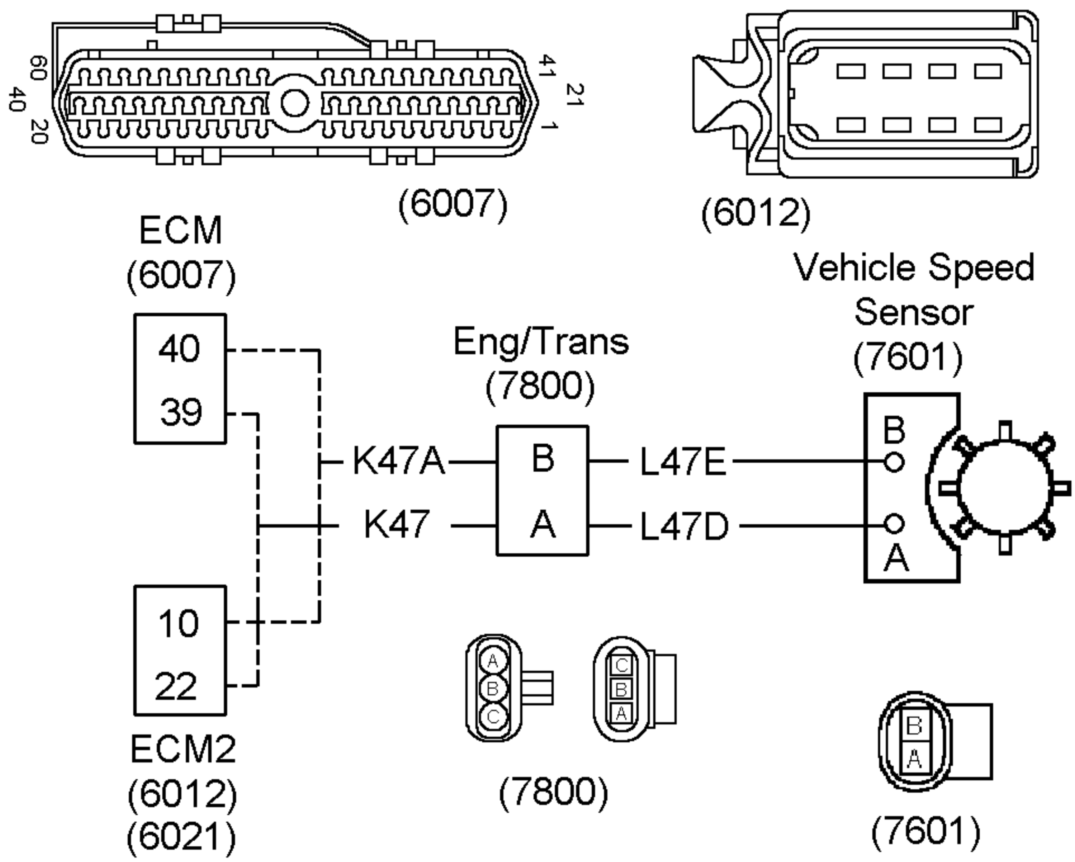

Figure 474 Transmission Vehicle Speed Sensor Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(6007) I6 ENGINE ECM BLACK CONNECTOR
LOCATED ON ENGINE CONTROLLER
(6012) (6021) V8 ENGINE ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(7601) TRANSMISSION SPEED SENSOR
LOCATED ON MANUAL TRANSMISSION
(7800) ENGINE/TRANSMISSION
LOCATED IN ENGINE COMPARTMENT NEAR ENGINE CONTROLLER

Testing Vehicle Speed Sensor

Construct test leads using terminals (International Part No. 1680205C1), short length of 16 gauge wire and alligator clips.

WARNING – A jack must never be used alone to support vehicle. The jack may lower and serious injury could result. Always support vehicle with floor jacks. Always block wheels to prevent vehicle from moving.

WARNING – EXTREME CAUTION should be used to prevent personal injury resulting from contact with rotating vehicle wheels when connecting test leads.

Table 324 Testing Vehicle Speed Sensor

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
1.	Off	Inspect VSS for damage before performing this test.			Go to next step.	
2.	Off	Disconnect engine harness (7601) from VSS and use test leads to measure resistance between terminal A and B of sensor connector.	VSS, terminal A to B.	600 to 800 ohms.	Go to next step.	Replace the vehicle speed sensor (VSS).
3.	Off	Measure resistance to ground at both sensor terminals.	VSS, term. 1 and 2 to ground.	>100K ohms.	Go to next step.	Replace the vehicle speed sensor (VSS).
4.	Off	Block front wheels and place rear axles on floor stands.			Go to next step.	

Table 324 Testing Vehicle Speed Sensor (cont.)

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
5.	Off	Use AC voltmeter with sufficient length leads to avoid personal contact with rotating vehicle wheels during test. Connect meter leads to test leads.			Go to next step.	
6.	Off	Run engine at idle speed, with transmission in high gear. Measure voltage across the two sensor terminals.	VSS, across terminals.	>2.0 volts AC	VSS checks good.	Replace the VSS.

1.5. TRANSMISSION TEMPERATURE SENSOR

Refer to Transmission Oil Temperature Gauge (See TRANSMISSION OIL TEMPERATURE GAUGE, page 264) for troubleshooting procedures.

1.6. COMPONENT LOCATIONS

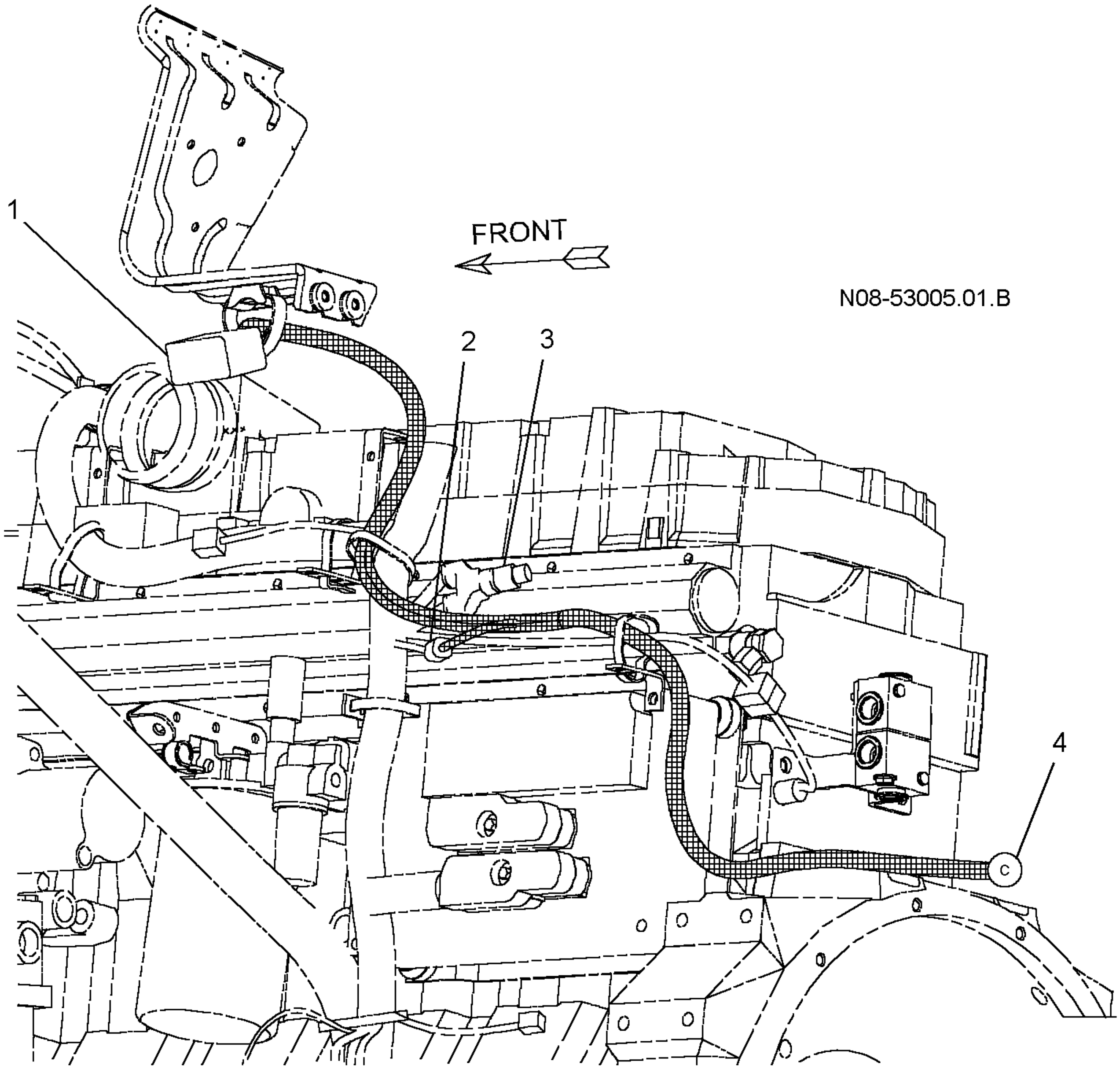

Figure 475 Transmission Harness

1. TRANSMISSION DASH CONNECTOR (4705)
2. ENGINE/TRANSMISSION CONNECTOR (7800)
3. DRIVETRAIN 1939 TERMINATOR
4. TO TRANSMISSION

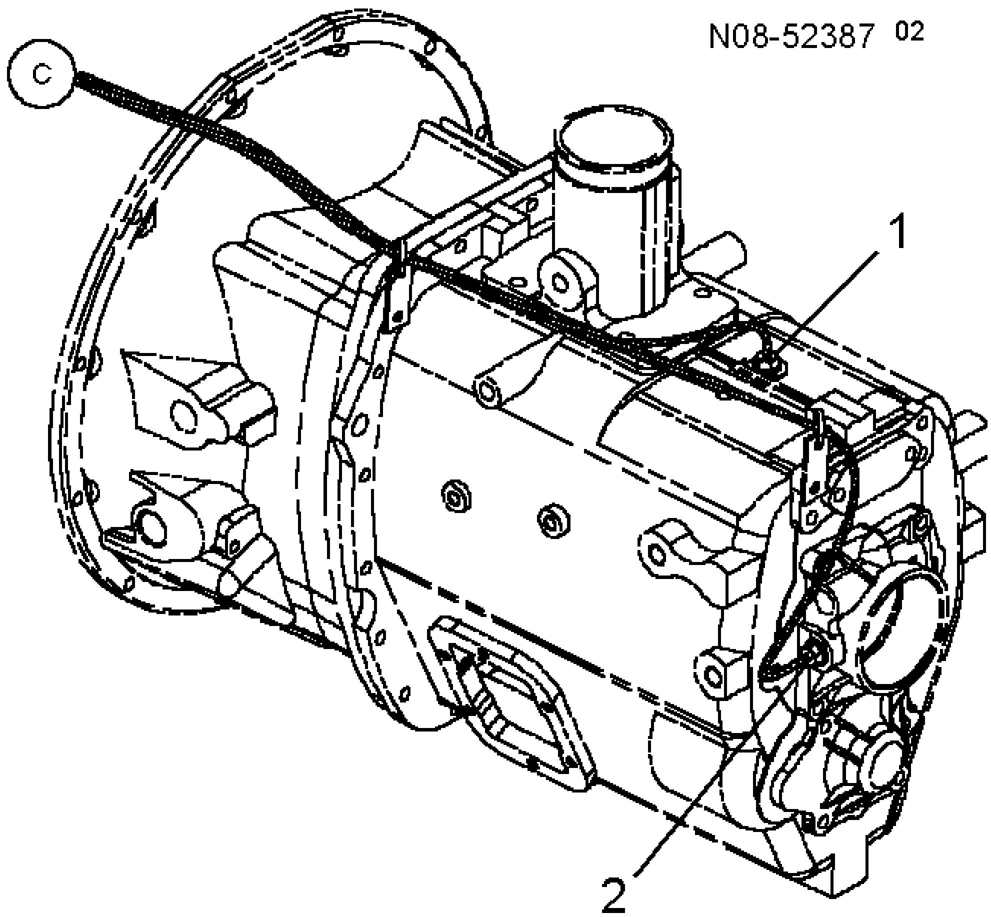

Figure 476 Typical Manual Transmission Wiring

1. (7500) BACK-UP LIGHT SWITCH
2. (7601) VEHICLE SPEED SENSOR

2. ALLISON® MD TRANSMISSION

Discussion of the MD transmission In this section is limited to the transmission electronic control unit (ECU) power circuits and data link connectivity. For detailed information on transmission diagnostics, refer to the Allison service manual.

2.1. CIRCUIT FUNCTIONS

The MD transmission ECU interfaces with the vehicle on the Drive Train 1939 Data Link and several discrete circuits.

A backup lamp relay converts the low backup signal from the ECU to a 12 volt signal and powers the back up lamps.

The ECU receives power from a clean battery feed in the battery box.

A backup lamp relay converts the low backup signal from the ECU to a 12 volt signal and powers the back up lamps.

The neutral signal from the transmission ECU is communicated to the ESC and the engine controller.

The vehicle speed signal is provided by the ECU on circuits to the engine controller.

2.2. DIAGNOSTICS

The ESC will log a DTC and command the “CHECK TRANS” lamp on if communication with the transmission ECU is lost.

The transmission ECU has its own diagnostic system which will turn on the “CHECK TRANS” lamp when there is a detectable fault. Diagnostic codes can be read from the lamps on the transmission shift selector or with the Allison Transmission Diagnostic Tool (ATDT) software. Refer to the applicable troubleshooting manual for details. If the diagnostic software is unable to communicate with the ECU there may be circuit problems in the 1708 data link. Refer to 1708 Data Link. (See 1708 DATA LINK, page 75)

There are no diagnostic trouble codes (DTC’s) associated with the back-up light circuits. A fault in the back-up light circuits will be apparent when the transmission is shifted into reverse and the lights don’t come on.

Table 325 MD Preliminary Check

STEP	KEY	ACTION	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
1.	On	Does the engine crank when the transmission is in neutral?	Engine cranks when the transmission is in neutral.	Go to next step.	Refer to Engine Cranking. (See ENGINE CRANKING, page 379)
2.	On	Does the “CHECK TRANS” lamp turn off after the vehicle is started.	Lamp turns off after vehicle is started.	Go to next step.	Refer to the applicable transmission service manual.
3.	On	Are there any active DTC’s associated with the transmission? Refer to Diagnostic Trouble Codes. (See DIAGNOSTIC TROUBLE CODES (DTC), page 967)	Transmission communication DTC is not active (no codes).	Go to next step.	Go to ECU Power and Data Link Circuits. (See ECU POWER AND DATA LINK CIRCUITS, page 967)
4.	On	Does the Check Transmission Warning Lamp remain illuminated.	Warning lamp remains on after bulb check	Refer to the applicable Allison service manual.	Go to next step.
5.	On	Does the shift selector appear to be malfunctioning?	Check shift selector for correct operation.	Go to next step.	Go to Shift Selector Circuits. (See SHIFT SELECTOR CIRCUITS, page 974)

Table 325 MD Preliminary Check (cont.)

STEP	KEY	ACTION	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
6.	On	Do the back-up lights come on when the transmission is shifted into reverse?	Back-up lights come on when in reverse.	Transmission circuits are functioning. Go to next step.	Go to Neutral Signal Light Circuits. (See NEUTRAL SIGNAL CIRCUITS , page 970) Go to Back-Up Light Circuits. (See BACK-UP LIGHT CIRCUITS , page 972)
If transmission is still not operating correctly, refer to the appropriate Allison service manual.					

2.3. DIAGNOSTIC TROUBLE CODES (DTC)

To display ESC diagnostic codes, put the vehicle in diagnostic mode. Set the parking brake and turn the Ignition key “ON”. Then press the Cruise “ON” switch and the Cruise “Resume” switch. If no diagnostic trouble codes are present, the cluster odometer will display “NO FAULT”. If diagnostic trouble codes are present, the gauge cluster will display the total number of faults and cycle to the next diagnostic trouble code after 10 seconds. To manually cycle through the diagnostic trouble code list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in “A” for active diagnostic trouble codes or “P” for previously active diagnostic trouble codes. Turning the ignition key off or releasing the park brake will take the ESC and the gauge cluster out of the diagnostic mode.

The previously active diagnostic trouble codes may be cleared, while in the diagnostic mode, by turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 326 Transmission Communication Diagnostic Trouble Codes

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
639 14 2 240	Electronic transmission controller communication has not been received

2.4. ECU POWER AND DATA LINK CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the power or data link circuits to the ECU will be apparent when the instrument cluster display does not correspond to the shift selector position and the check electrical system lamp is illuminated. Problems in the power and data link circuits can be caused by open or short circuits, a blown fuse, failed switch, a problem in the ESC, a problem in circuits between the ESC and the solenoid module or a problem in the solenoid module.

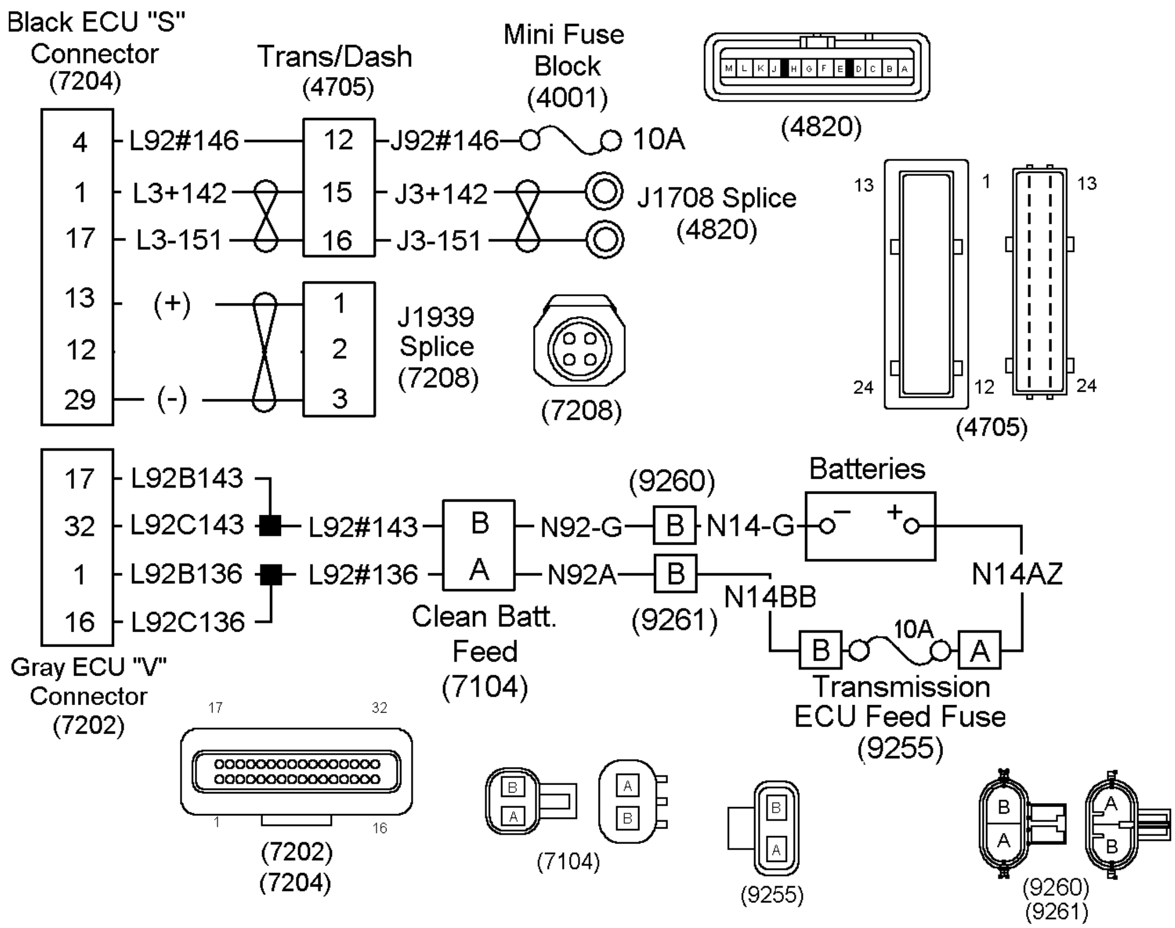

Figure 477 MD ECU Power and Data Link Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4001) MINI FUSE BLOCK 10 AMP TRANSMISSION FUSE
LOCATED IN ENGINE COMPARTMENT PDC
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(4820) J1708 & 5 VOLT REF SPLICE CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7104) CLEAN BATTERY FEED
LOCATED IN BATTERY HARNESS
(7202) GRAY ECU “V” CONNECTOR
LOCATED ON ALLISON WTEC TRANSMISSION CONTROL MODULE
(7204) BLACK ECU “S” CONNECTOR
LOCATED ON ALLISON WTEC TRANSMISSION CONTROL MODULE
(7208) J1939 DATA LINK SPLICE CONNECTOR
LOCATED IN ENGINE HARNESS
(9255) TRANSMISSION ECU FEED FUSE CONNECTOR
LOCATED IN BATTERY COMPARTMENT
(9260) BATTERY ECM NEGATIVE CONNECTOR
LOCATED IN BATTERY COMPARTMENT
(9261) BATTERY ECM POSITIVE CONNECTOR
LOCATED IN BATTERY COMPARTMENT

Table 327 ECU Power and Data Link Checks

ECU Connector (7204) Power Check Check with ignition on and (7204) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
TCM harness connector (7204), cavity 4 to ground	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit L13#104, L13M4 or J13M. Also check for short to ground in circuit L13M3 to the NSBU.
ECU Connector (7202) Power Check Check with ignition on and (7202) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
ECU harness connector (7202), cavity 16 to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission feed fuse or open or short to ground in circuit N14BB, N92A, L92#136 or L92C136.
ECU harness connector (7202), cavity 1 to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission feed fuse or open or short to ground in circuit N14BB, N92A, L92#136 or L92B136.
ECU harness connector (7202), cavity 1 to cavity 17.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit N14–GA, N92–G, L92–G, L92#143 or L92B143.
ECU harness connector (7202), cavity 1 to cavity 32.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit N14–GA, N92–G, L92–G, L92#143 or L92C143.
If voltages are correct and ECU communication DTC is still active, refer to Drivetrain Data Link. (See DRIVETRAIN 1939 DATA LINK, page 60)		

Extended Description

Ignition voltage is supplied to the black ECU connector (7204), terminal 4, from the 10 amp transmission fuse in the engine compartment PDC.

Battery voltage to the gray ECU connector (7202) cavities 1 and 16, from the 10 amp transmission feed fuse in the battery compartment.

Ground is supplied to the gray ECU connector (7202) cavities 17 and 32 from the battery negative terminal.

The drivetrain data link is connected to the black ECU connector (7204) cavities 29, 12 and 13 from the data link "Y" connector (7208).

The 1708 data link is connected to the black ECU connector (7204) cavities 17 and 1.

2.5. NEUTRAL SIGNAL CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

When the transmission is shifted into neutral, the ECU will apply 12 volts from the gray ECU connector (7202) terminal 6, to ESC connector (4004) and engine controller connector (6007) pin 26 or (6020) pin 8. The voltage will cause the engine controller to enable engine cranking as long as the engine isn't already running.

A fault in the neutral signal circuits should be suspected when the engine will not crank. Problems in the neutral circuits can be caused by open or short circuits, a failure in the engine controller, or a failure in the ECU.

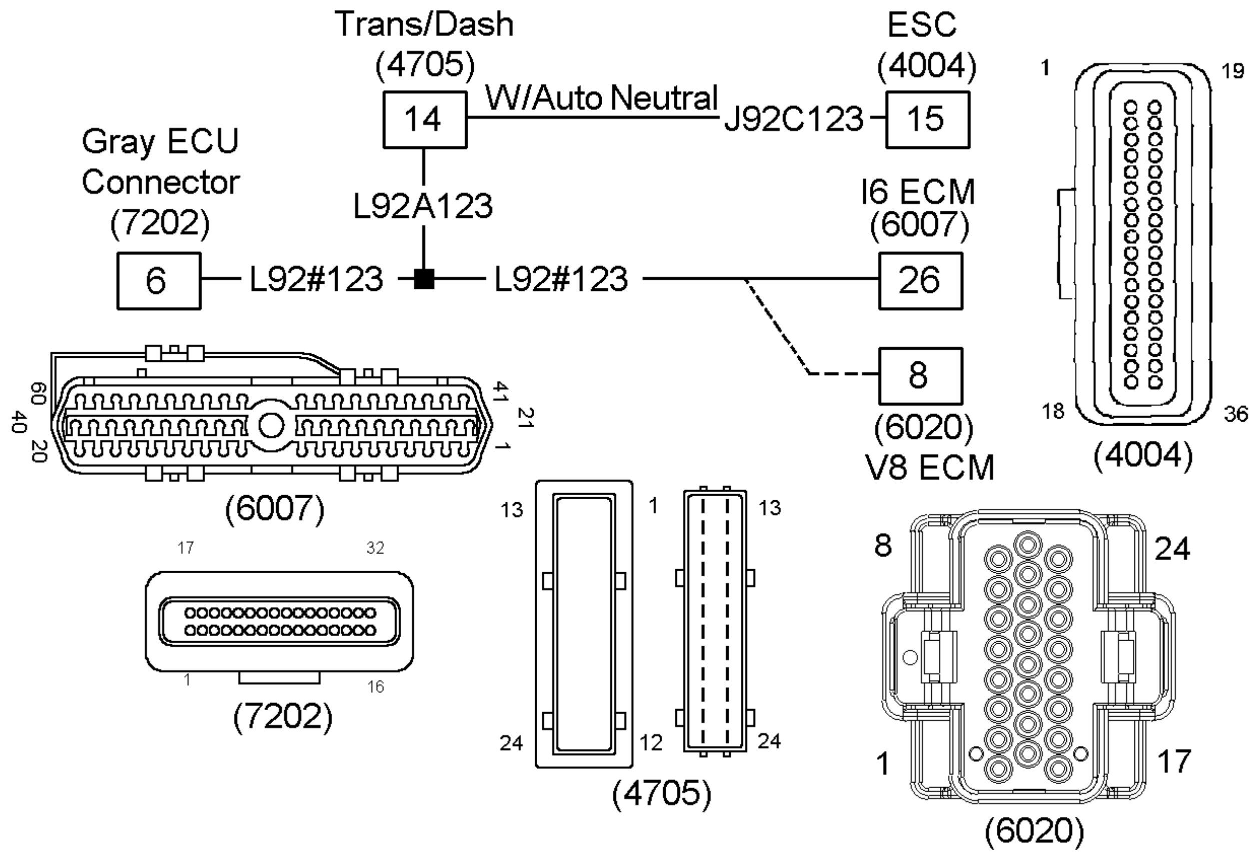

Figure 478 Neutral Signal Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4004) ELECTRICAL SYSTEM CONTROLLER CONNECTOR
LOCATED ON ENGINE SIDE OF ELECTRICAL SYSTEM CONTROLLER
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(6007) I6 ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(6020) V8 ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(7202) GRAY ECU “V” CONNECTOR
LOCATED ON TRANSMISSION ECU

Table 328 **Neutral Signal Circuit Checks**

Neutral Signal Circuit Checks		
Check with ignition on, transmission in neutral and ESC connector (4004) removed.		
NOTE – Always check connectors for damage and pushed–out terminals.		
Test Points	Spec.	Comments
Remove engine connector (6007) or (6020). Voltage from ESC Connector (4004) cavity 15 to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuit L92#123, L92A123 or J92C123. If circuits check good consider replacing transmission ECU.
Voltage from (6007) pin 26 or (6020) pin 8, to 12 volts.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L92#123 to the engine controller. If circuit checks good, consider replacing engine controller. Refer to the applicable engine troubleshooting manual.

Extended Description

When the transmission is shifted into neutral the ECU will apply a 12 volt signal from the gray ECU connector (7202) terminal 6 to the ESC and the engine controller

This signal will notify the engine controller that the transmission is in neutral. If the engine is not running the engine controller will enable the starter to operate.

2.6. BACK-UP LIGHT CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

When the transmission is shifted into reverse gear, the ECU will apply a ground from the gray ECU connector (7202) terminal 4, to the coil of the back up lamp relay causing it to energize. The energized relay will supply power to the backup lights.

A fault in the back up light relay circuits should be suspected when the back-up lights do not come on when the transmission is shifted into reverse. Problems in the back–up light circuits can be caused by open or short circuits, a blown fuse, or a failure in the ECU.

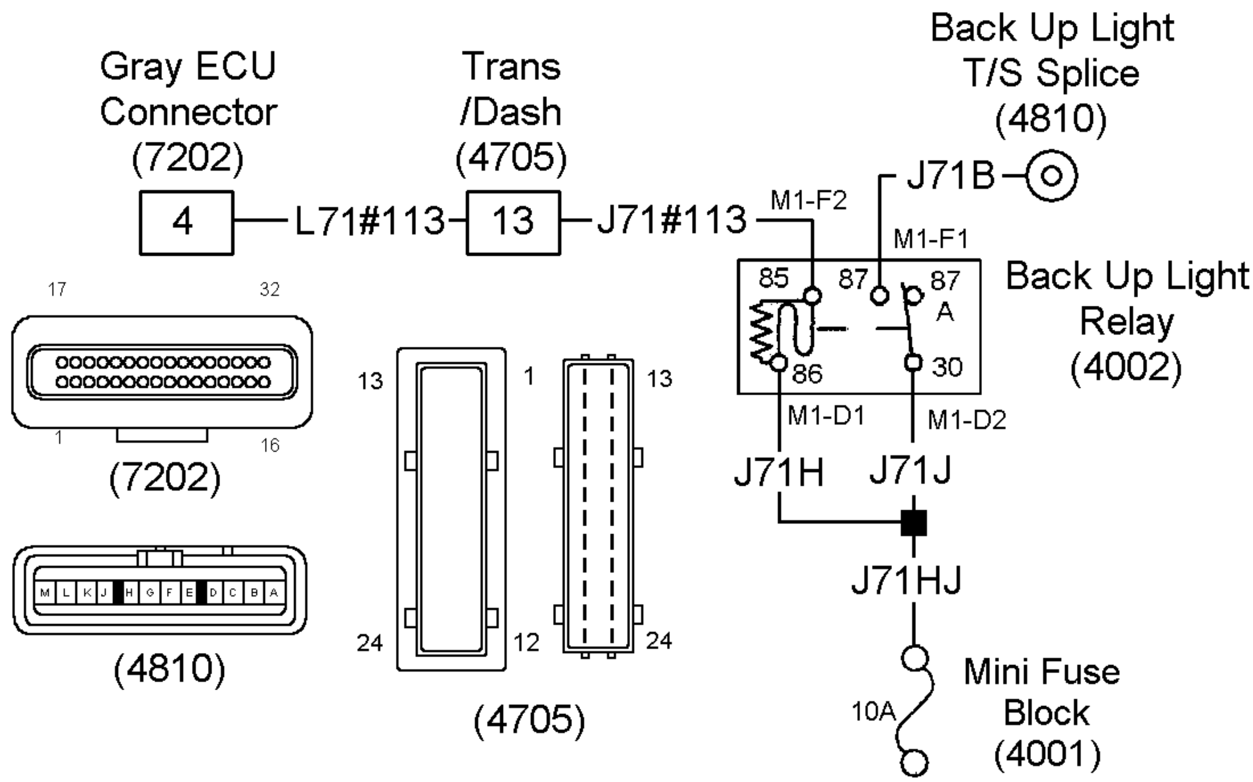

Figure 479 Back Up Light Relay Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4001) MINI FUSE BLOCK 10 AMP TRANSMISSION FUSE
LOCATED IN ENGINE COMPARTMENT PDC
(4002) BACK UP LIGHT RELAY
LOCATED IN ENGINE COMPARTMENT PDC
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(4810) BACK UP LIGHT TURN / SIGNAL SPLICE
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7202) GRAY ECU “V” CONNECTOR
LOCATED ON TRANSMISSION ECU

Table 329 **Back-Up Light Relay Circuit Checks**

Back-Up Light Relay Circuit Power Checks Check with ignition on and Back Up Light Relay (4002) removed. Bench check relay and replace if it has failed. Refer to Bench Checking Relays. (See BENCH TESTING RELAYS, page 29) **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Back Up Light Relay (4002), socket cavity M1–D2 to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit J71HJ, J71H or J71J.
Back Up Light Relay (4002), socket cavity M1–D1 to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit J71HJ, J71H or J71J.
Transmission in neutral. Back Up Light Relay (4002), socket cavity M1–D1 to M1–F2.	0 volts.	If voltage is incorrect, check for short to ground in circuit L71#113. Also check for incorrect signal from ECU.
Transmission in reverse. Back Up Light Relay (4002), socket cavity M1–D1 to M1–F2.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L71#113. Also check for incorrect signal from ECU.

Extended Description

Power to the back up light relay coil and common contact is supply from the 10 amp transmission fuse.

When the transmission is shifted into reverse, the ECU will apply a ground from the gray ECU connector (7202) terminal 4, to the coil of the back up lamp relay causing it to energize. The energized relay will supply power from the normally open contact to the back up lights.

2.7. SHIFT SELECTOR CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

The shift selector contains the microprocessor that communicates driver input to the transmission ECU. The transmission shift selector (420) receives battery power at all times (ignition key on or off) from the transmission ECU (7204) on pin R. The shift selector (420) receives a ground from the transmission ECU (7204) on pin P. A chassis ground is also supplied on (420) pins T and V. Circuits connected to shift selector connector (420) pins A, B, C, D, and E provide signals between the shift selector and the ECU. Panel light voltage is supplied to (420) pin U.

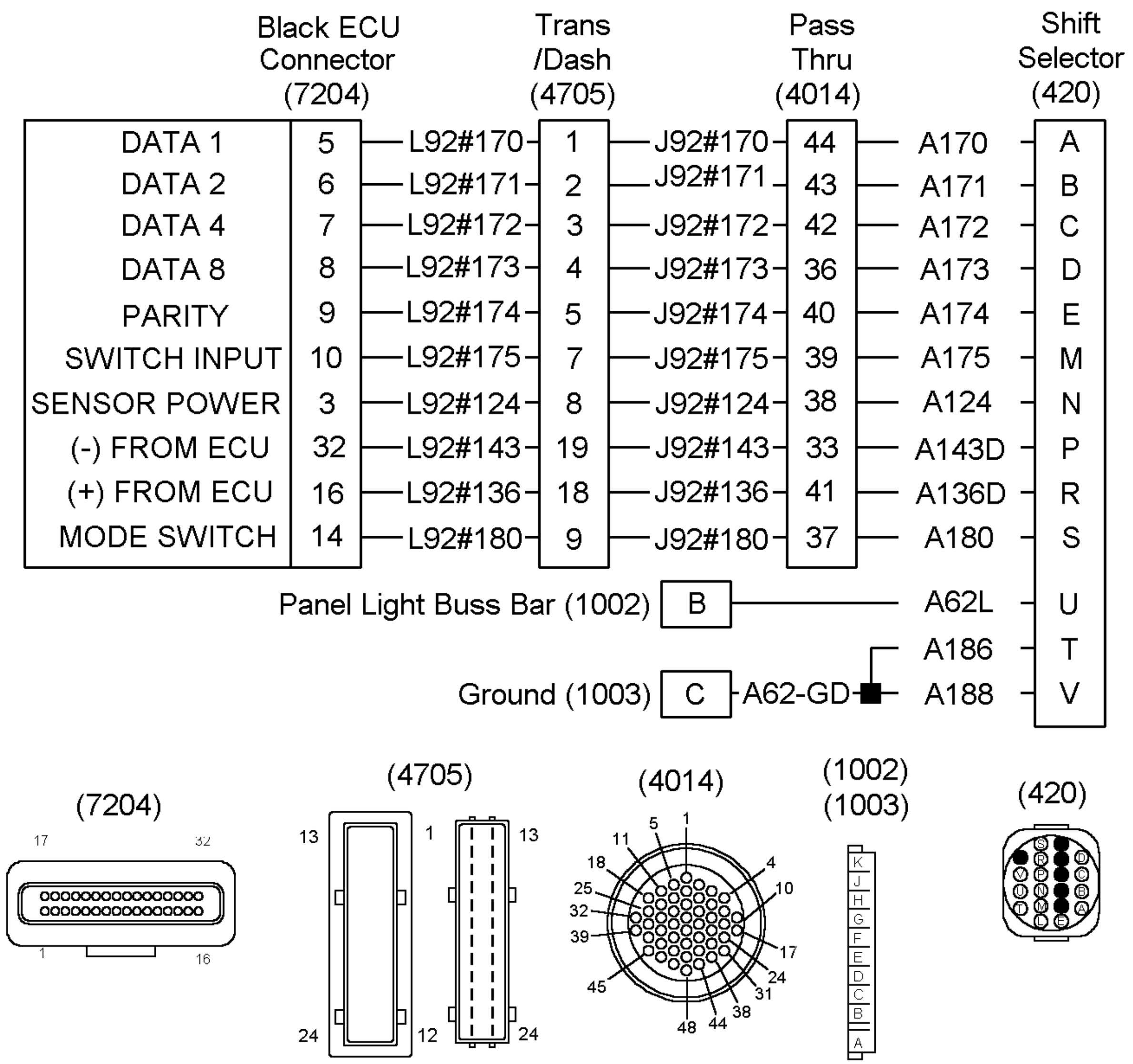

Figure 480 Shift Selector Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(420) SHIFT SELECTOR
(1002) PANEL LIGHT BUSS BAR
LOCATED BEHIND INSTRUMENT PANEL
(1003) GROUND BUSS BAR
LOCATED BEHIND INSTRUMENT PANEL
(4014) PASS THROUGH CONNECTOR
LOCATED ABOVE ESC
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7204) BLACK ECU “S” CONNECTOR
LOCATED ON TRANSMISSION

Table 330 Shift Selector Circuit Checks

Shift Selector Circuit Checks		
Check with ignition on, transmission in neutral and shift selector connector (420) removed.		
NOTE – Always check connectors for damage and pushed–out terminals.		
Test Points	Spec.	Comments
Harness connector (420) cavity R to ground	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuits between (420) cavity R and black ECU connector (7204) cavity 16. If circuits check good, ECU may be malfunctioning. Refer to the applicable Allison manual.
Harness connector (420) cavity R to P	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuits between (420) cavity P and black ECU connector (7204) cavity 32. If circuits check good, ECU may be malfunctioning. Refer to the applicable Allison manual. If voltages are correct the shift selector may need replaced.

2.8. COMPONENT LOCATIONS

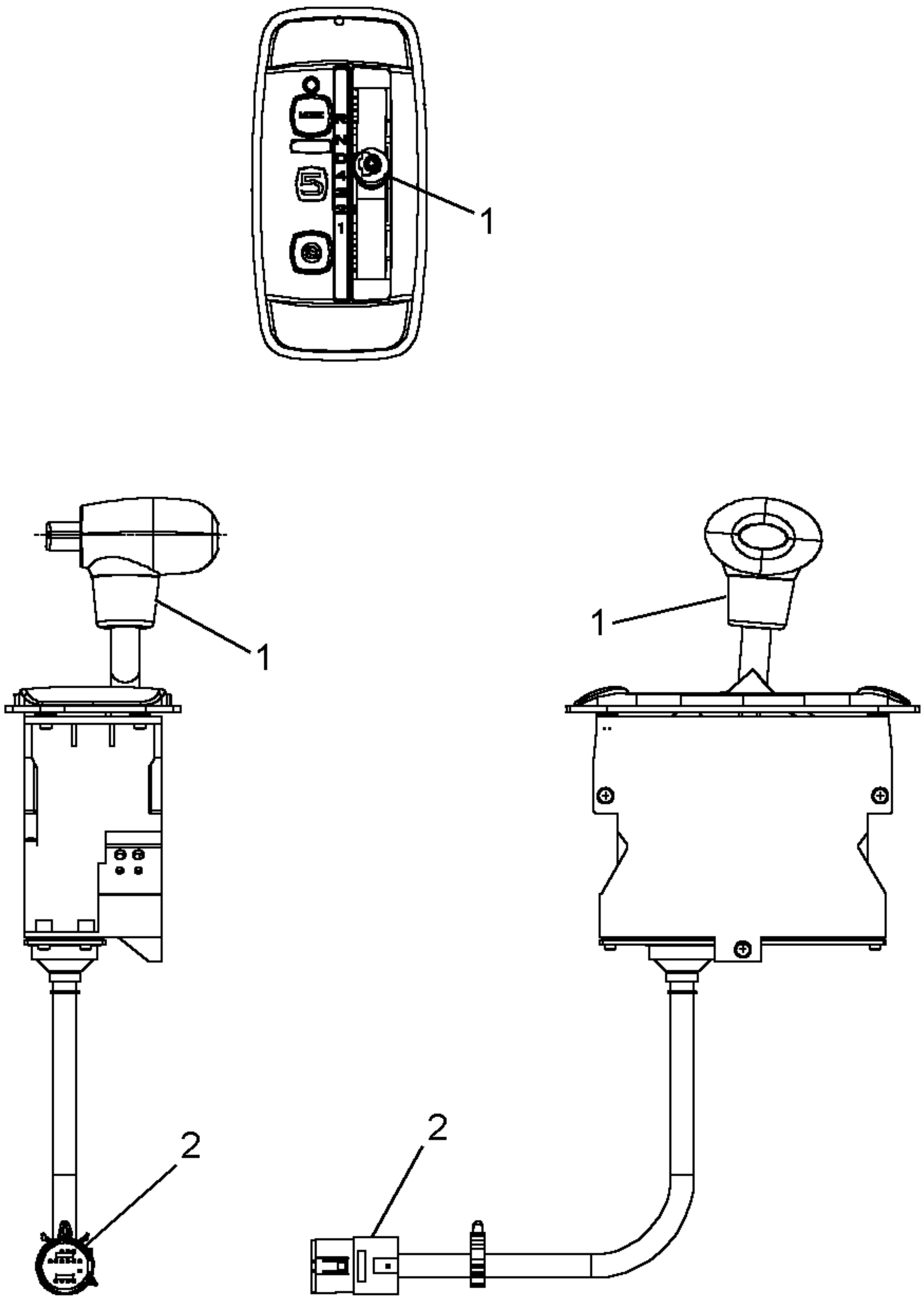

Figure 481 MD T-Bar Shift Control

1. SHIFT CONTROL LEVER
2. (420) SHIFT SELECTOR CONNECTOR

S082504

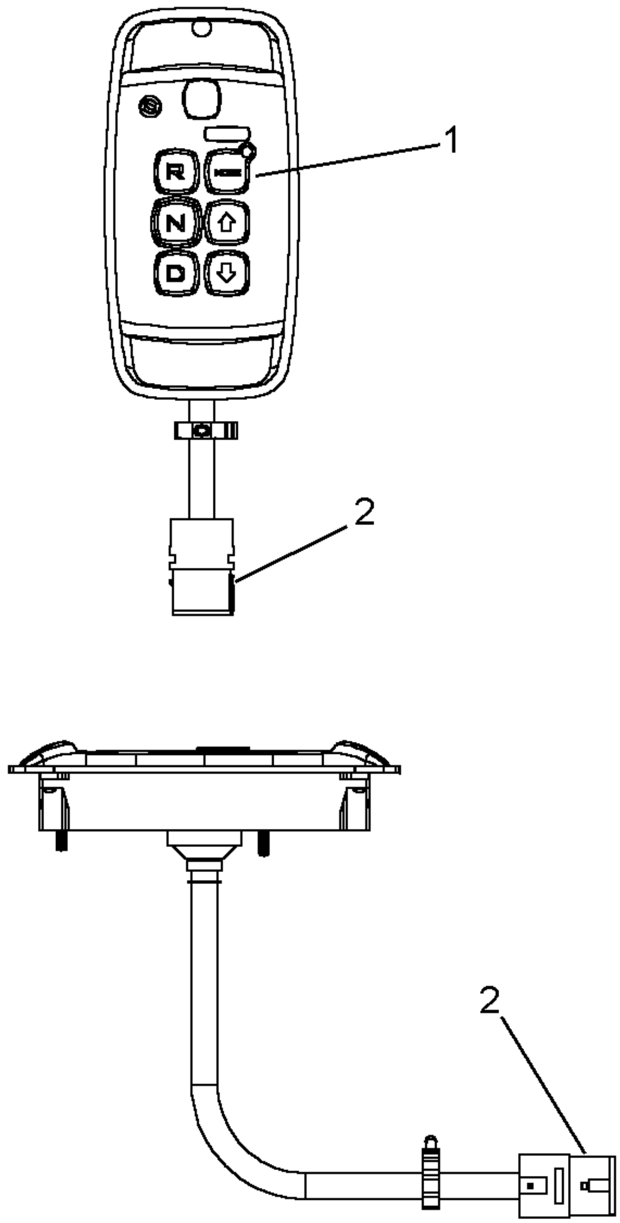

Figure 482 MD Push Button Shift Control

1. SHIFT CONTROL PUSH BUTTONS
2. (420) SHIFT SELECTOR CONNECTOR

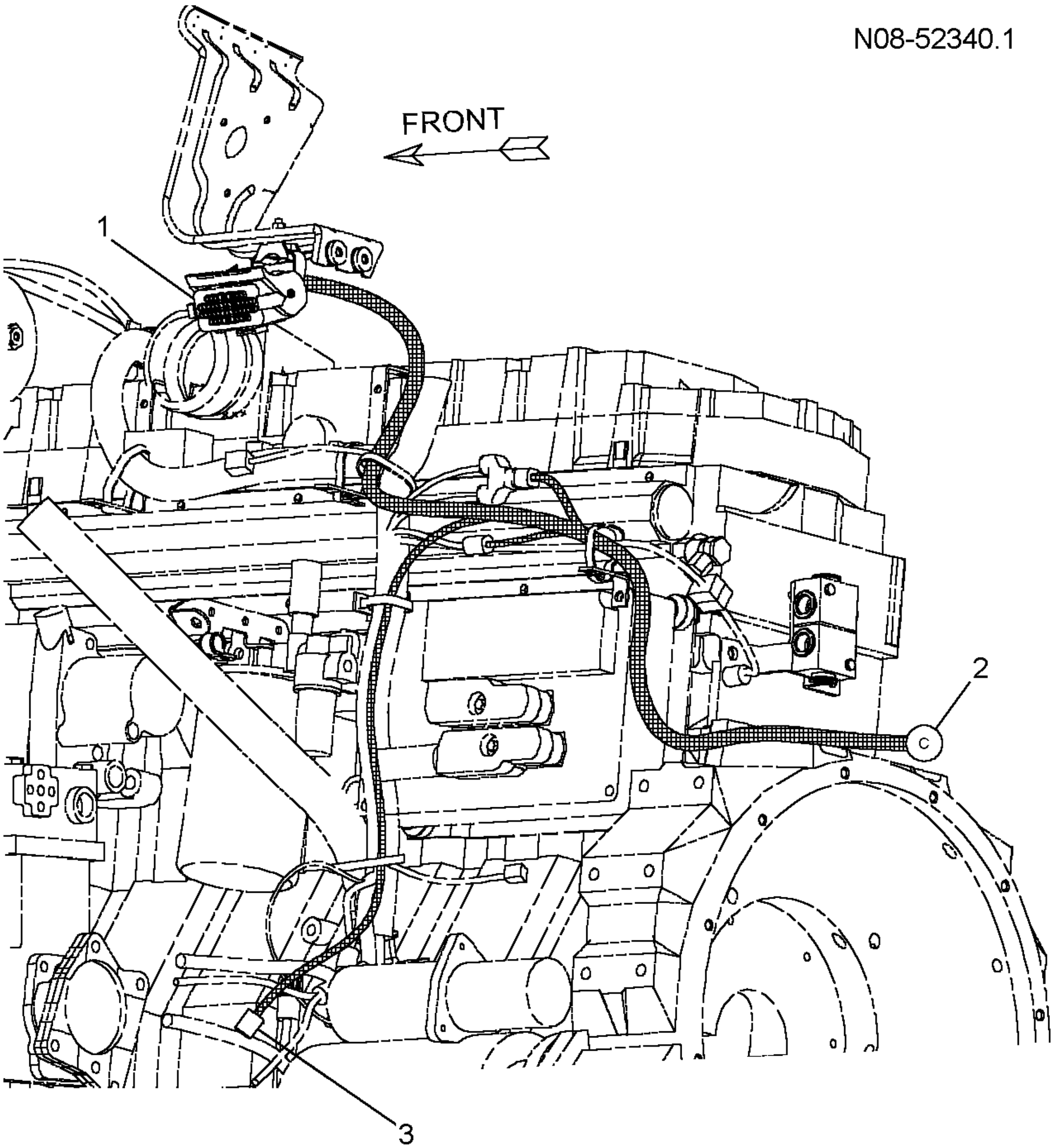

Figure 483 MD Transmission Harness (I6 Engine Shown)

1. TRANSMISSION/DASH HARNESS (4705)
2. TRANSMISSION HARNESS
3. CLEAN BATTERY FEED CONNECTOR (7104)

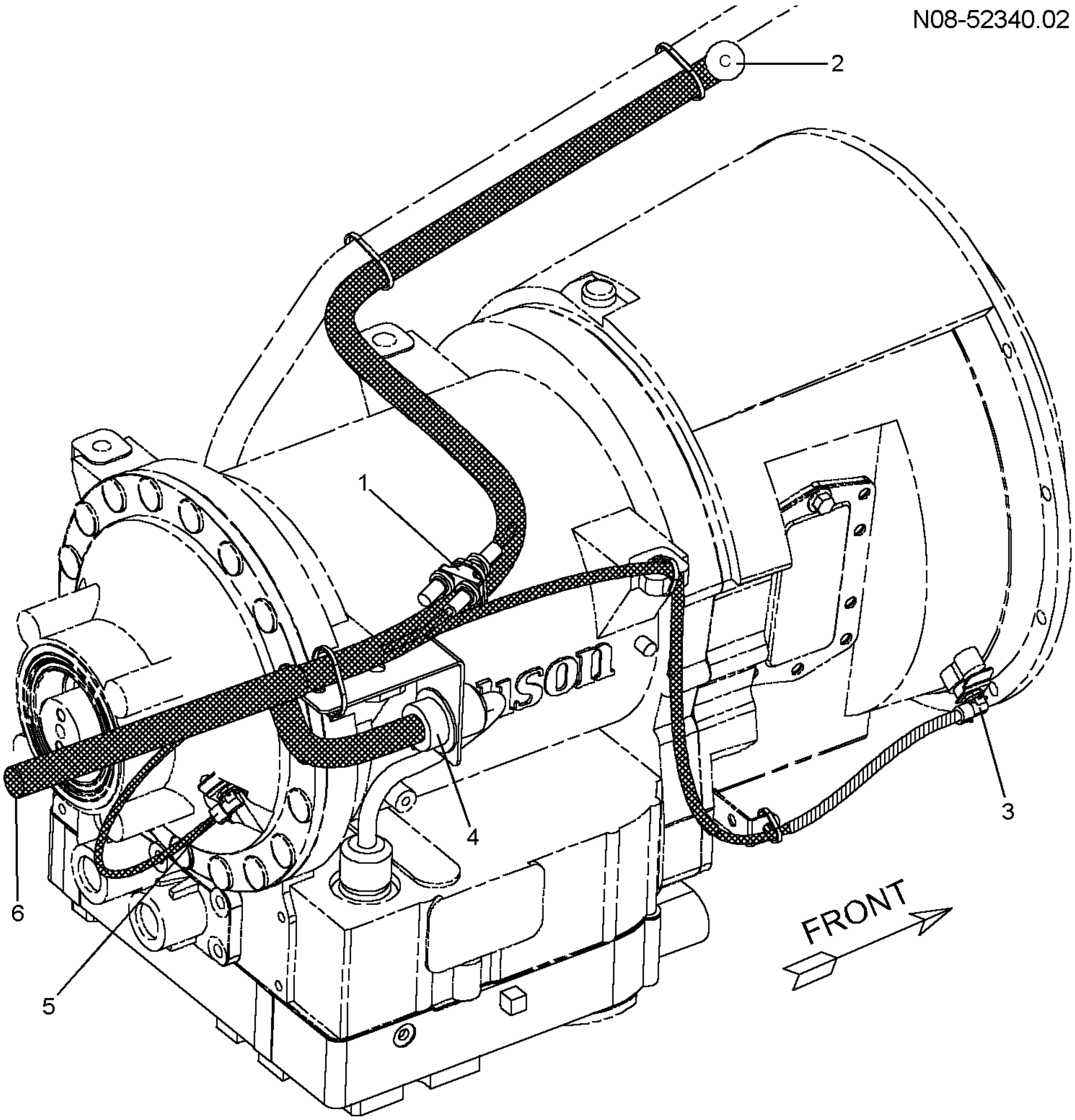

Figure 484 MD Transmission Wiring

1. DRIVETRAIN 1939 "Y" CONNECTOR (7208) AND TERMINATOR
2. TRANSMISSION HARNESS
3. ENGINE SPEED SENSOR (7603)
4. TRANSMISSION BULKHEAD CONNECTOR (7200)
5. OUTPUT SPEED SENSOR (7605)
6. TO ECU

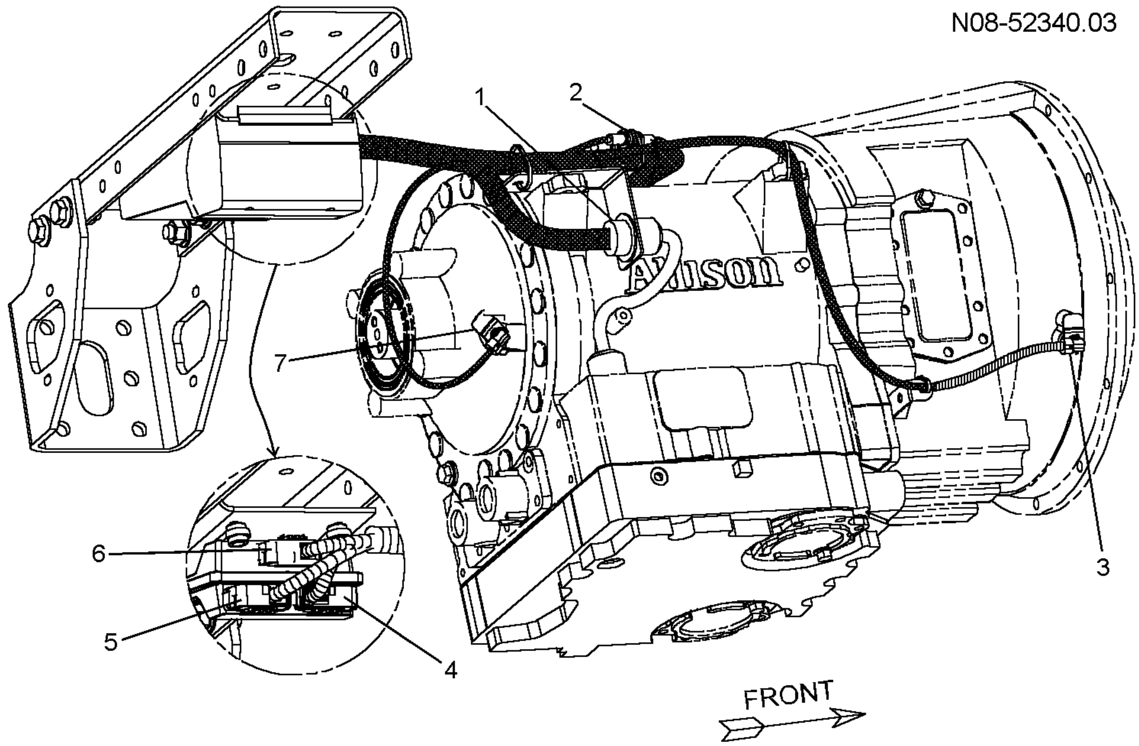

Figure 485 MD Transmission ECU Location

1. TRANSMISSION BULKHEAD CONNECTOR (7200)
2. DRIVETRAIN 1939 "Y" CONNECTOR (7208) AND TERMINATOR
3. ENGINE SPEED SENSOR (7603)
4. ECU “S” CONNECTOR BLACK (7204)
5. ECU “V” CONNECTOR GREY (7202)
6. ECU “T” CONNECTOR BLUE (7203)
7. OUTPUT SPEED SENSOR (7605)

3. AUTO NEUTRAL

3.1. CIRCUIT FUNCTIONS

While the auto neutral feature is activated the transmission will automatically shift into neutral when the park brake is applied. A warning light in the instrument cluster will illuminate when the shift selector is not in neutral but the transmission is in neutral.

The auto neutral feature, from the factory, is only available with the Allison MD transmissions. Auto neutral, using the LCT (Allison 2000 series) transmission, can be installed by body builders. See the Body Builder book for circuits and information.

Auto neutral is selected with a switch in the switch pack. When the switch is on, the ESC will be requested to enable auto neutral. The switch indicator will light when the ESC has received the request and will remain illuminated until the switch is turned off. The switch indicator will flash and auto neutral will be disabled if there is a switch error.

Refer to the Switch Pack Module section of this manual.(See SWITCH PACK MODULES, page 124)

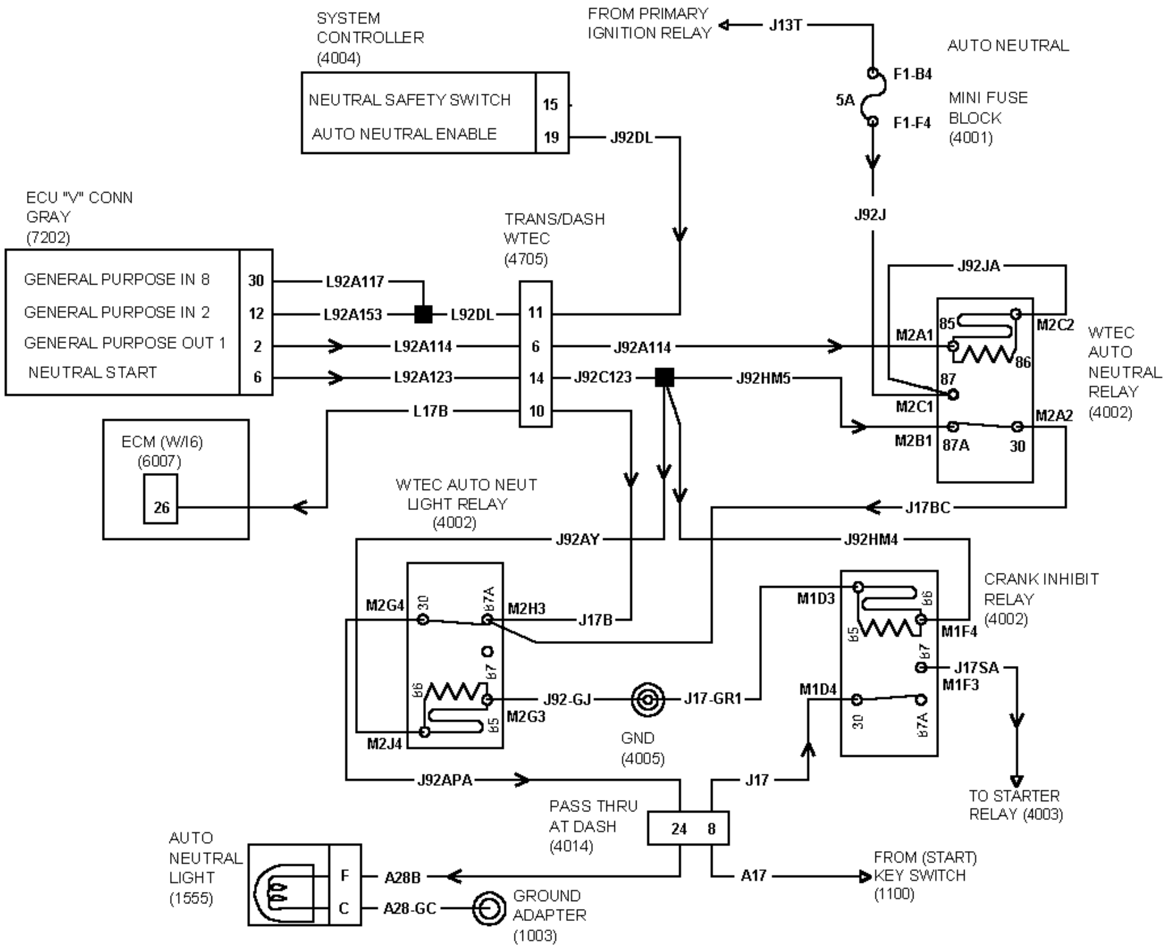

Figure 486 Auto Neutral Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(1555) AUTO NEUTRAL WARNING LIGHT
LOCATED IN CAB INSTRUMENT CLUSTER

(4001) AUTO NEUTRAL WARNING LIGHT FUSE BLOCK
LOCATED IN ENGINE POWER DISTRIBUTION CENTER

(4002) WTEC AUTO NEUTRAL RELAY, WTEC AUTO NEUTRAL LIGHT RELAY, CRANK INHIBIT RELAY BLOCK
LOCATED IN ENGINE COMPARTMENT POWER DISTRIBUTION CENTER (PDC)

(4004) ELECTRICAL SYSTEM CONTROL (ESC) CONNECTOR
LOCATED IN ENGINE COMPARTMENT SIDE OF ESC

(4014) PASS THROUGH CONNECTOR
LOCATED ON DASH PANEL ABOVE ESC

(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET

(6007) I6 ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER

(7202) ECU "V" GRAY CONNECTOR
LOCATED ON MD TRANSMISSION

3.2. AUTO NEUTRAL ENABLE

Fault Detection Management

Refer to Auto Neutral Circuits (See Figure 486, page 982).

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the auto neutral enable circuits from the ESC to the ECU will be apparent when a DTC is set.

Problems in the auto neutral enable could be the result of open circuits, shorted circuits a failure in the ECU or a failure in the ESC.

The auto enable signal, from ESC connector (4004) pin 19, should be generated when the park brake is on and the auto neutral switch is on.

Table 331 Auto Neutral Enable Circuit Tests

<table>
<tr><th colspan="3">ESC DTC’s</th></tr>
<tr><td>2033 14 7 1</td><td colspan="2">Auto Neutral Enable circuit overloaded. Connector 4004 pin 19 current overload. Too much load attached.</td></tr>
<tr><td>2033 14 7 2</td><td colspan="2">Auto Neutral Enable circuit open. Connector 4004 pin 19 open.</td></tr>
<tr><td>2033 14 7 3</td><td colspan="2">Auto Neutral Enable circuit shorted to ground. Connector 4004 pin 19 shorted to ground.</td></tr>
<tr><td colspan="3">Auto Neutral Enable Circuit Tests

Check with Gray ECU connector (7202) removed.

NOTE – Always check connectors for damage and pushed–out terminals.

NOTE – Always use breakout box ZTSE 4477 to take measurements on ESC connectors.</td></tr>
<tr><td>Test Points</td><td>Spec.</td><td>Comments</td></tr>
<tr><td>Auto neutral switch off and park brake off. Harness connector (7202) cavity 30 to ground.</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for open or shorts in circuits J92DL, L92DL, L92A117 to the ESC (4004) cavity 19.

Also check for missing signal from ESC.</td></tr>
<tr><td>Auto neutral switch off and park brake off. Harness connector (7202) cavity 12 to ground.</td><td>12 ± 1.5 volts</td><td>If voltage is missing, check for open or shorts in circuits J92DL, L92DL, L92A153 to the ESC (4004) cavity 19.</td></tr>
<tr><td>Auto neutral switch on and park brake on. Harness connector (7202) cavity 12 to ground.</td><td>0 volts</td><td>If voltage is incorrect, ESC is not creating enable signal. Check for missing auto neutral command from switch pack or missing park brake signal.</td></tr>
<tr><td colspan="3">Reconnect (7202). If voltages are correct and DTC is still active consider replacing transmission ECU.</td></tr>
</table>

Extended Description

The auto neutral enable signal will be a ground when auto neutral is on and the park brake is applied. The ESC provides this signal from (4004) pin 19 to ECU “V” Gray connector pins 30 and 12.

3.3. AUTO NEUTRAL RELAY CIRCUITS

Fault Detection Management

Refer to Auto Neutral Circuits (See Figure 486, page 982).

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

The de-energized auto neutral relay completes the circuit path for the transmission ECU neutral start signal to the engine controller DDS input. This signal is 12 volts when the shifter is in neutral and 0 volts when the transmission is in drive. This inhibits engine cranking while the transmission is not in neutral.

The relay is energized, by a signal from the transmission ECU, when the engine is running and the transmission is in neutral. The energized relay applies 12 volts to the engine controller DDS input. This allows engine speed to be changed when the engine is running and the transmission is in neutral (for PTO operations). The output is also applied to the normally closed contact of the neutral light relay and the neutral safety switch input to the ESC.

A fault in the auto neutral relay circuits may be present when the engine will not crank while auto neutral is selected or will crank when transmission is not in neutral. A failure in relay circuits could also prevent the engine from increasing RPM during PTO operations. Problems in the auto neutral relay circuits could be attributed to open or short circuits, a blown fuse, a failure in the transmission ECU or a failure in the engine controller.

Table 332 Auto Neutral Relay Power Checks

Auto Neutral Relay Socket (4002) Power Checks Check with ignition on and auto neutral relay (4002) removed. Bench check relay and replace if it has failed. Refer to Bench Checking Relays. (See BENCH TESTING RELAYS, page 29) **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Relay socket cavity M2–C1 to ground.	12 ± 1.5 volts	If voltage is missing, check for open or shorts in circuit J92J or open auto neutral fuse.
Relay socket cavity M2–C2 to ground.	12 ± 1.5 volts	If voltage is missing, check for open in circuit J92JA.
Relay socket cavity M2–C2 to M2-A1.	With engine on and transmission in neutral, 12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit J92A114 or L92A114. Also check for missing signal from ECU.

Table 332 Auto Neutral Relay Power Checks (cont.)

Relay socket cavity M2–B1 to ground.	With shifter in neutral and transmission in neutral, 12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit J92HM5, J92C123 or L92A123. Also check for short to ground in circuits J92HM5, J92C123, L92A123, J92HM4 or J92AY. Insure signal from ECU is present.
Relay socket cavity M2–A2 to ground.	With transmission in neutral and, 12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit J17BC. Also check for short to ground in circuits J17BC, J17BD, J17B or L17B. Insure signal from ESC is present.
If voltage is missing from the ESC consider replacing the ESC.		

Extended Description

Power to the auto neutral relay coil and common contact is supply from the 5 amp auto neutral fuse.

The relay is energized by a low signal from ECU “V” gray connector (7202) pin 2. The low signal is generated when the engine is running and the transmission is in neutral.

The de-energized relay provides a circuit path for the neutral start signal from the ECU. This will be 12 volts when the transmission is in neutral or 0 volts when the transmission is in gear. The signal is applied to the engine controller drive line disengagement switch (DDS) input. 12 volts will signal the engine controller that the transmission is in neutral.

The energized relay applies 12 volts to the engine controller DDS input when the engine is on and the transmission is in neutral. This will allow the engine to increase RPM when a power take off is engaged.

3.4. AUTO NEUTRAL LIGHT RELAY CIRCUITS

Fault Detection Management

Refer to Auto Neutral Circuits (See Figure 486, page 982).

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

The output on the common contact of the auto neutral light relay is 12 volts when the shifter is in not in neutral (auto neutral active) and the transmission is in neutral. The output is 0 volts when the transmission is in drive. The output is applied to the engine controller ECM input to inhibit engine cranking while the transmission is not in neutral. The output is also applied to the normally closed contact of the neutral light relay.

A fault in the auto neutral light relay circuits may be present when the auto neutral warning light does not illuminate when auto neutral is active. Problems in the auto neutral light relay circuits could be attributed to open or short circuits or a failure in the transmission ECU.

Table 333 Auto Neutral Light Relay Power Checks

Auto Neutral Light Relay Socket (4002) Power Checks Check with ignition on and auto neutral light relay (4002) removed. Bench check relay and replace if it has failed. Refer to Bench Checking Relays. (See BENCH TESTING RELAYS, page 29) **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Relay socket cavity M2–H3 to ground.	With transmission in neutral, 12 ± 1.5 volts	If voltage is missing, check for open in circuit J17BD. Check for shorts in circuit J17BD, J17BC, J17B or L17B.
Relay socket cavity M2–H3 to M2–G3.	With transmission in neutral, 12 ± 1.5 volts	If voltage is missing, check for open in circuit J92–GJ.
Relay socket cavity M2–H3 to M2–G3.	With transmission in neutral, 12 ± 1.5 volts	If voltage is missing, check for open in circuit J92APA, circuit A28B, Auto neutral lamp or circuit A28–GC.
Relay socket cavity M2–H3 to ground.	With shifter in neutral and transmission in neutral, 12 ± 1.5 volts	If voltage is missing, check for open in circuit J92AY, J92C123 or L92A123 Also check for short to ground in circuits J92HM5, J92C123, L92A123, J92HM4 or J92AY. Insure signal from ECU is present.
If signal from ECU is missing, consider replacing the ECU. Refer to the Allison transmission manual.		

Extended Description

The de-energized relay will pass the 12 volt neutral safety switch signal from ESC connector (4004) pin 15 to illuminate the auto neutral light.

Ground for the relay coil is supplied from ground stud (4005).

The relay is energized by the 12 volt neutral start signal from the transmission ECU. This will turn off the auto neutral light. It will only be illuminated when the transmission is in neutral and the shifter is not in neutral.

3.5. CRANK INHIBIT RELAY CIRCUITS

Fault Detection Management

Refer to Auto Neutral Circuits (See Figure 486, page 982).

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

The crank inhibit relay insures there is no chance of cranking the engine when the transmission shift lever is not in neutral. The relay contacts are installed in series with the starter switch circuits to the coil of the starter relay. The relay is energized by the neutral start signal from the transmission ECU.

A fault in the auto neutral light relay circuits may be present when the auto neutral warning light does not illuminate when auto neutral is active. Problems in the auto neutral light relay circuits could be attributed to open or short circuits or a failure in the transmission ECU.

Table 334 Crank Inhibit Relay Power Checks

Crank Inhibit Relay Socket (4002) Power Checks Check with ignition on and crank inhibit relay (4002) removed. Bench check relay and replace if it has failed. Refer to Bench Checking Relays. (See BENCH TESTING RELAYS, page 29) **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Relay socket cavity M1–F4 to ground.	With shifter in neutral and transmission in neutral, 12 ± 1.5 volts	If voltage is missing, check for open in circuit J92HM4, J92C123 or L92A123 Also check for short to ground in circuits J92HM5, J92C123, L92A123, J92HM4 or J92AY. Insure signal from ECU is present.
Relay socket cavity M1–F4 to M1–D3.	With transmission in neutral, 12 ± 1.5 volts	If voltage is missing, check for open in circuit J17–GR1 to ground.
Relay socket cavity M1–D4 to ground.	With shifter in neutral, transmission and key in start position, 12 ± 1.5 volts	If voltage is missing, check for open in circuit J17 or A17 to key switch circuits.
Relay socket cavity M1–D4 to M1–F3.	With shifter in neutral, transmission and key in start position, 12 ± 1.5 volts	If voltage is missing, check for open or shorts to ground in circuit J17SA, starter relay coil, circuit J17S or starter circuits.

Extended Description

The relay is installed in between the key switch circuits and the starter relay circuits to insure the engine cannot be cranked when the transmission is in gear.

Ground is supplied to the relay coil from ground stud (4005).

The relay is energized by the 12 volt neutral start signal from the transmission ECU when the shifter is in neutral and the transmission is in neutral.

The energized relay will connect the key switch start circuits and the starter relay circuits to allow engine cranking.

3.6. COMPONENT LOCATIONS

Refer to MD T-Bar Shift Control (See Figure 481, page 977), MD Push Button Shift Control (See Figure 482, page 978) MD Transmission Harness (I6 Engine Shown) (See Figure 483, page 979), MD Transmission Wiring (See Figure 484, page 980) and MD Transmission ECU Location (See Figure 485, page 981).

4. LCT (ALLISON® 2000 SERIES™) TRANSMISSION

Discussion of the LCT (Allison 2000 Series) transmission In this section is limited to the transmission control module (TCM) power circuits, data link connectivity, signals from the neutral safety back up (NSBU) switch and circuits to the shift selector control. For detailed information on transmission diagnostics, refer to the Allison service manual.

4.1. CIRCUIT FUNCTIONS

The LCT transmission interfaces with the vehicle electrical system via the transmission control module (TCM), the neutral safety back up (NSBU) switch and the shift selector control.

The TCM communicates on the drivetrain 1939 data link to interface with the engine controller, electrical system controller and the air ABS controller.

The NSBU, mounted on the transmission, is controlled by the gear select cable. It interfaces with the vehicle electrical system to provide a neutral signal to the engine controller. It also provides voltage for the back-up lights.

The shift selector has an integral economy switch. The switch will light when economy mode is selected.

4.2. DIAGNOSTICS

The ESC will log a DTC if communication with the TCM is lost.

The transmission control unit has its own diagnostic system which will turn on the “CHECK TRANS” lamp when there is a detectable fault. Diagnostic codes can only be read with the Allison Transmission Diagnostic Tool (ATDT) software. There are no provisions for flash codes. Refer to Allison troubleshooting manual TS3192EN for details.

A problem in the neutral start circuits will prevent the engine from cranking. Refer to Engine Cranking. (See ENGINE CRANKING, page 379)

There are no diagnostic trouble codes (DTC’s) associated with the back-up light circuits. A fault in the back-up light circuits will be apparent when the transmission is shifted into reverse and the lights don’t come on.

Table 335 LCT Preliminary Check

STEP	KEY	ACTION	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
1.	On	Does the engine crank when the transmission is in neutral?	Engine cranks when the transmission is in neutral.	Go to next step.	Refer to Engine Cranking. (See ENGINE CRANKING, page 379)
2.	On	Are there any active DTC’s associated with the transmission? Refer to Diagnostic Trouble Codes. (See DIAGNOSTIC TROUBLE CODES (DTC), page 989)	Transmission communication DTC is active.	Go to next step.	Go to TCM Power and Data Link Circuits. (See TCM POWER AND DATA LINK CIRCUITS, page 989)

Table 335 LCT Preliminary Check (cont.)

STEP	KEY	ACTION	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
3.	On	Does the “CHECK TRANS” lamp turn off after the vehicle is started.	Lamp turns off after vehicle is started.	Go to next step.	Refer to the applicable transmission service manual.
4.	On	Do the back-up lights come on when the transmission is shifted into reverse?	Back-up lights come on when in reverse.	Go to next step.	Go to Neutral And Back-Up Light Circuits. (See NEUTRAL AND BACK-UP LIGHT CIRCUITS , page 992)
5.	On	Is the economy mode indicator in the economy switch illuminating when economy is selected.	Economy mode indicator illuminates when economy mode is selected.	Transmission circuits are functioning.	Go to Shift Selector Circuits. (See SHIFT SELECTOR CIRCUITS , page 994)

4.3. DIAGNOSTIC TROUBLE CODES (DTC)

To display diagnostic codes, put the vehicle in diagnostic mode. Set the parking brake and turn the Ignition key “ON”. Then press the Cruise “ON” switch and the Cruise “Resume” switch. If no diagnostic trouble codes are present, the cluster odometer will display “NO FAULT”. If diagnostic trouble codes are present, the gauge cluster will display the total number of faults and cycle to the next diagnostic trouble code after 10 seconds. To manually cycle through the diagnostic trouble code list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in “A” for active diagnostic trouble codes or “P” for previously active diagnostic trouble codes. Turning the ignition key off or releasing the park brake will take the ESC and the gauge cluster out of the diagnostic mode.

The previously active diagnostic trouble codes may be cleared, while in the diagnostic mode, by turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 336 Transmission Communication Diagnostic Trouble Codes

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
639 14 2 240	Electronic transmission controller communication has not been received

4.4. TCM POWER AND DATA LINK CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the power or data link circuits to the TCM will be apparent when the instrument cluster display does not correspond to the shift selector position and the check electrical system lamp is illuminated. Problems in the power and data link circuits can be caused by open or short circuits, a blown fuse, failed switch, a problem in the ESC, a problem in circuits between the ESC and the solenoid module or a problem in the solenoid module.

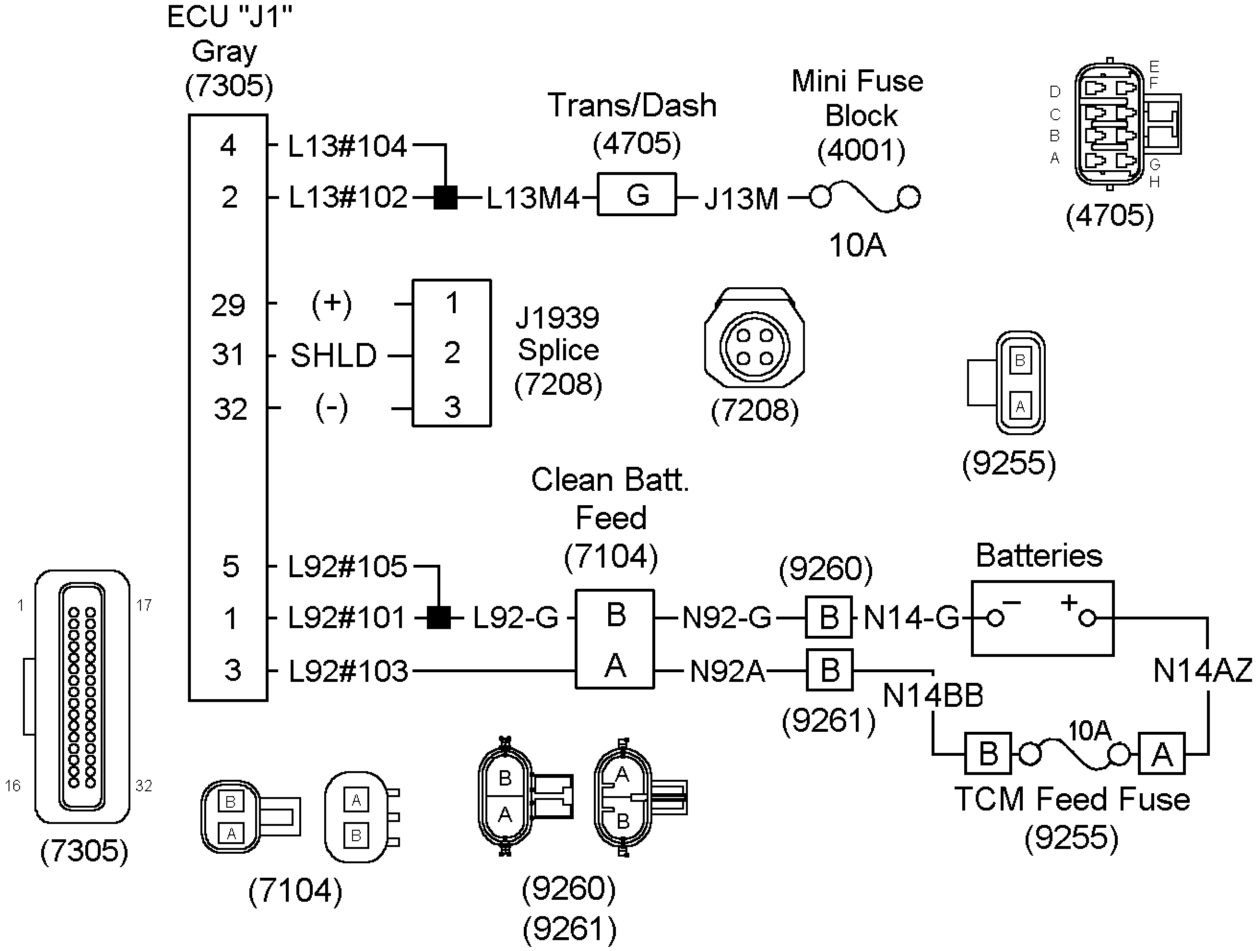

Figure 487 TCM Power and Data Link Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4001) MINI FUSE BLOCK 10 AMP TRANSMISSION FUSE
LOCATED IN ENGINE COMPARTMENT PDC
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7104) CLEAN BATTERY FEED
LOCATED IN BATTERY HARNESS
(7208) J1939 DATA LINK SPLICE CONNECTOR
LOCATED IN ENGINE HARNESS
(7305) GRAY ECU “J1” CONNECTOR
LOCATED ON ALLISON LCT TRANSMISSION CONTROL MODULE
(9255) TRANSMISSION ECU FEED FUSE CONNECTOR
LOCATED IN BATTERY COMPARTMENT
(9260) BATTERY ECM NEGATIVE CONNECTOR
LOCATED IN BATTERY COMPARTMENT
(9261) BATTERY ECM POSITIVE CONNECTOR
LOCATED IN BATTERY COMPARTMENT

Table 337 TCM Power and Data Link Checks

Test Points	Spec.	Comments
TCM Connector (7305) Power Checks Check with ignition on and (7305) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
TCM harness connector (7305), cavity 4 to ground	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit L13#104, L13M4 or J13M. Also check for short to ground in circuit L13M3 to the NSBU.
TCM harness connector (7305), cavity 2 to ground	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit L13#102, L13M4 or J13M. Also check for short to ground in circuit L13M3 to the NSBU switch.
TCM harness connector (7305), cavity 3 to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission feed fuse or open or short to ground in circuit N14BB, N92A or L92#103.
TCM harness connector (7305), cavity 3 to cavity 5.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit N14–GA, N92–G, L92–G or L92#105.
TCM harness connector (7305), cavity 3 to cavity 1.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit N14–GA, N92–G, L92–G or L92#101.
TCM Connector (7305) Data Link Checks Check with ignition on and (7305) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
TCM harness connector (7305), cavity 29 to ground.	Approximately 2.5 volts.	If voltage is missing check for open or short to ground in (+) data link circuits between harness connector and J1939 splice (7208).
TCM harness connector (7305), cavity 32 to ground.	Approximately 2.5 volts.	If voltage is missing check for open or short to ground between harness connector and J1939 splice (7208).
If voltages are correct and TCM is not operating correctly, refer to the Allison 2000 service manual .		

Extended Description

Ignition voltage to TCM connector (7305) cavity 4 and 2 from the 10 amp transmission fuse in the engine compartment PDC.

Battery voltage to TCM connector (7305) cavity 3 from the 10 amp transmission feed fuse in the battery compartment.

Ground for the TCM is supplied to TCM connector (7305) cavities 1 and 5 from the battery negative terminal.

The drivetrain data link is connected to TCM connector (7305) cavities 29, 31 and 32.

4.5. NEUTRAL AND BACK-UP LIGHT CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A shift cable connects the shift selector to the transmission gear select shaft. The NSBU is mounted on the shaft. When the shaft is in the neutral position the neutral contacts off the NSBU switch should close. When the shaft is in the reverse position, the back up light contacts of the NSBU should close.

A fault in the back-up circuits should be suspected when the back-up lights do not come on when the transmission is shifted into reverse. Problems in the back–up light circuits can be caused by open or short circuits, a blown fuse, or failed NSBU.

A fault in the neutral circuits should be suspected when the engine will not start. Problems in the neutral circuits can be caused by open or short circuits, a blown fuse, a failed NSBU, or a problem in the engine controller.

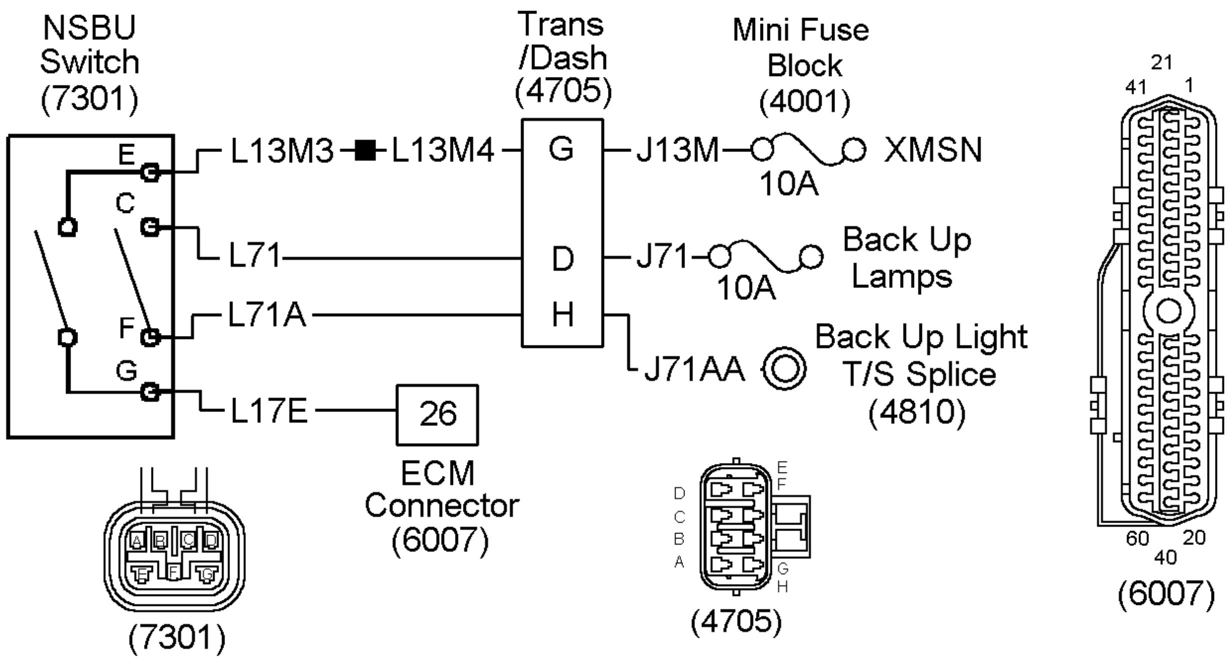

Figure 488 Neutral Safety Back Up (NSBU) Switch Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4001) MINI FUSE BLOCK 10 AMP XMSN FUSE
LOCATED IN ENGINE COMPARTMENT PDC
(4001) MINI FUSE BLOCK 10 AMP BACKUP LAMPS FUSE
LOCATED IN ENGINE COMPARTMENT PDC
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(4810) BACK UP LIGHT TURN / SIGNAL SPLICE CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(6007) ECM CONNECTOR (I6 ENGINE)
LOCATED ON I6 ENGINE
(7301) NEUTRAL SAFETY BACK UP (NSBU) SWITCH
LOCATED ON TRANSMISSION

Table 338 **Neutral And Back-Up Light Circuit Checks**

NSBU Connector (7301) Power Checks Check with ignition on and (7301) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
NSBU harness connector (7301), cavity E to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit J13M, L13M4 or L13M3.
NSBU harness connector (7301), cavity E to G.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L17E to the engine controller.
NSBU harness connector (7301), cavity C to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A back up light fuse or open or short to ground in circuit L71 or J71.
NSBU harness connector (7301), cavity C to F.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L71A or J71AA to the back up light and turn signal splice 4810.
If voltages are correct, consider replacing NSBU switch. Refer to the Allison 2000 Service manual		

Extended Description

Ignition voltage is supplied to the NSBU switch connector (7301), terminal E, neutral contacts from the 10 amp transmission fuse in the engine compartment PDC.

When the transmission is shifted into neutral, the neutral switch will close supplying ignition voltage to the engine controller. The engine controller will use this signal to enable the engine to crank.

Ignition voltage is supplied to the NSBU switch connector (7301), terminal C, back up light contacts from the 10 amp back up light fuse in the engine compartment PDC.

When the transmission is shifted into reverse, the back up light switch will close supplying ignition voltage to power the back up lights.

4.6. SHIFT SELECTOR CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

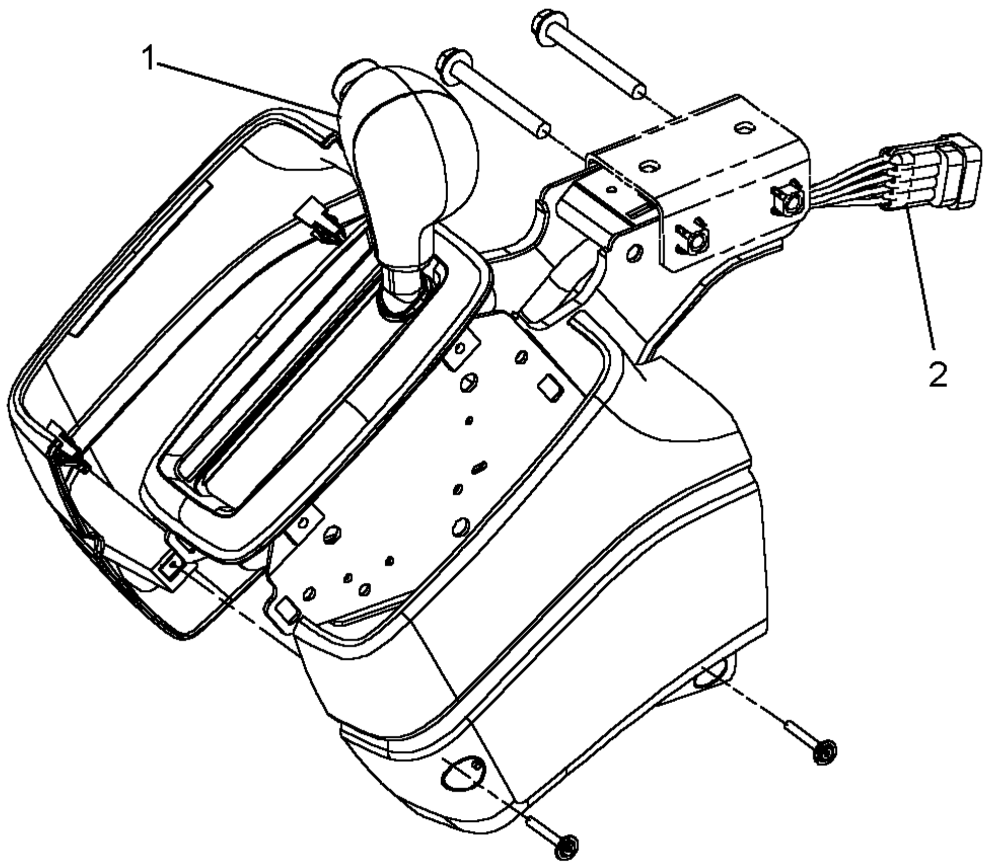

Figure 489 LCT Dash Mounted Shift Selector

1. SHIFT CONTROL LEVER
2. (1828) SHIFT SELECTOR CONNECTOR

A shift cable connects the shift selector to the transmission gear select shaft.

The shift selector contains an economy switch used to enable the economy mode of the transmission. The selector also contains a lock out solenoid used for some models that will prevent the selector from being moved out of park unless the foot brake is applied.

When the economy switch in the shift selector is closed the signal ground from the TCM will be applied to the economy mode enable input to the TCM. The switch will also illuminate the indicator in the switch.

A fault in the economy mode switch circuits should be suspected when the economy mode indicator does not illuminate when economy mode is selected.

Problems in the economy mode circuits can be caused by open or short circuits, a blown fuse, or failure in the TCM.

The Interlock for Shifter with Park Position feature will be controlled by the presence of the ignition signal, service brake applied signal, and transmission in park signal.

When the ignition signal is present, the transmission is in the ’Park’ position, and the service brake is depressed, the relay driver, which sinks current through the shifter interlock solenoid, will be activated and the shifter interlock solenoid will unlock. When the shifter interlock solenoid unlocks, the transmission can be shifted out of the ’Park’ position.

If the ignition signal is present and a loss of J1939 data occurs from the transmission to the ESC, then the relay driver that controls the shifter interlock solenoid will become active.

If the ignition signal is present and the service brake switch is defective or stuck, then the relay driver that controls the shifter interlock solenoid will become active.

A fault in the selector circuits should be suspected when the economy switch doesn’t illuminate when it is selected. Problems in the selector circuits can be caused by open or short circuits, a blown fuse, or failure in the selector assembly.

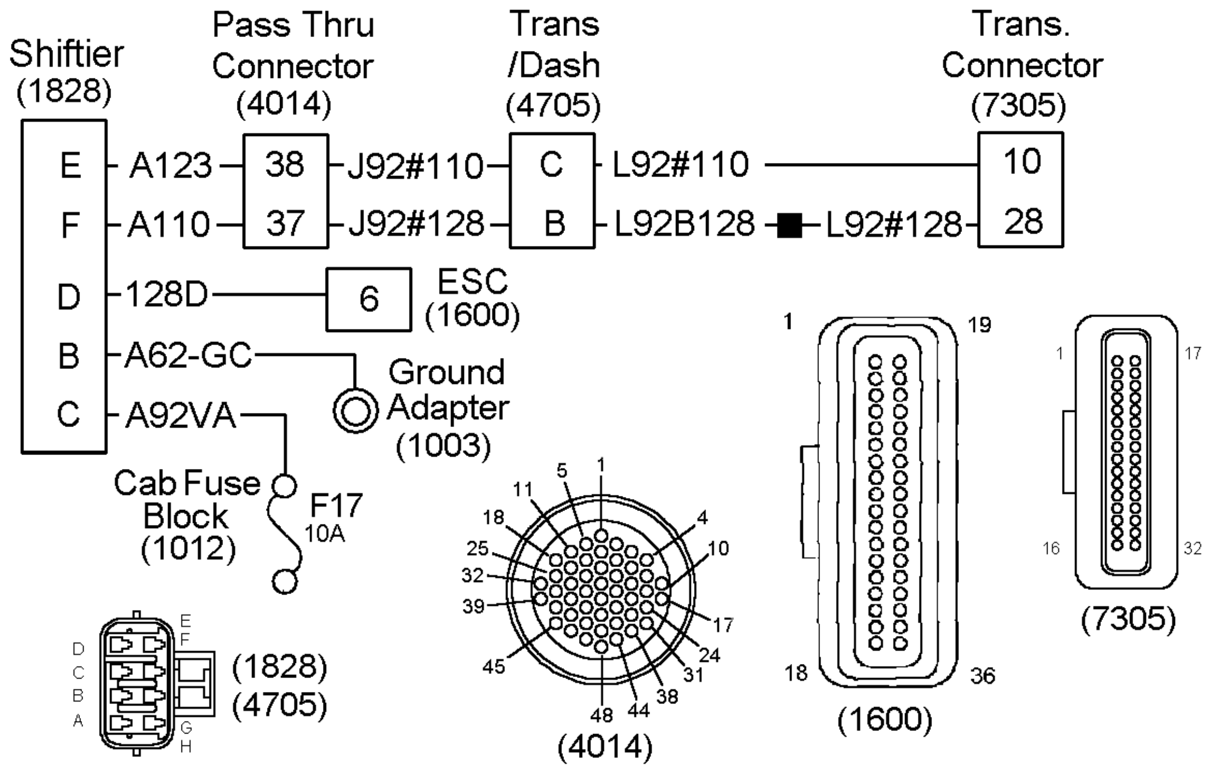

Figure 490 Shift Selector Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(1003) GROUND ADAPTER
LOCATED IN INSTRUMENT PANEL
(1012) CAB FUSE BLOCK F17 10 AMP FUSE
LOCATED IN CAB PDC
(1600) ELECTRICAL SYSTEM CONTROLLER
LOCATED ON CAB SIDE OF ELECTRICAL SYSTEM CONTROLLER
(1828) LCT TRANSMISSION SHIFTER SELECTOR CONNECTOR
LOCATED ON BACK OF LCT SHIFT SELECTOR
(4014) PASS THROUGH CONNECTOR
LOCATED ABOVE ELECTRICAL SYSTEM CONTROLLER
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7305) TRANSMISSION CONNECTOR
LOCATED ON TRANSMISSION

Table 339 Shift Selector Circuit Checks

Shift Selector Connector (1828) Power Checks Check with ignition on and (1828) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments

Table 339 Shift Selector Circuit Checks (cont.)

Shift selector harness connector (1828), cavity C to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown fuse F17 or open or short to ground in circuit A92VA.
Shift selector harness connector (1828), cavity C to B.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit A62–GC to ground splice (1003).
If voltages are correct and shift selector is not powered, consider replacing shift selector.		

Extended Description

Power to the shift selector is provided to (1828) terminal C from cab fuse F17.

Ground for the shift selector is provided to (1828) terminal B from ground adapter (1003).

Ground from the ESC (1600) terminal 6 is provided to shift selector (1828) terminal D, when the ignition key is on, the service brake pedal is depressed, and the transmission in park signal.

4.7. COMPONENT LOCATIONS

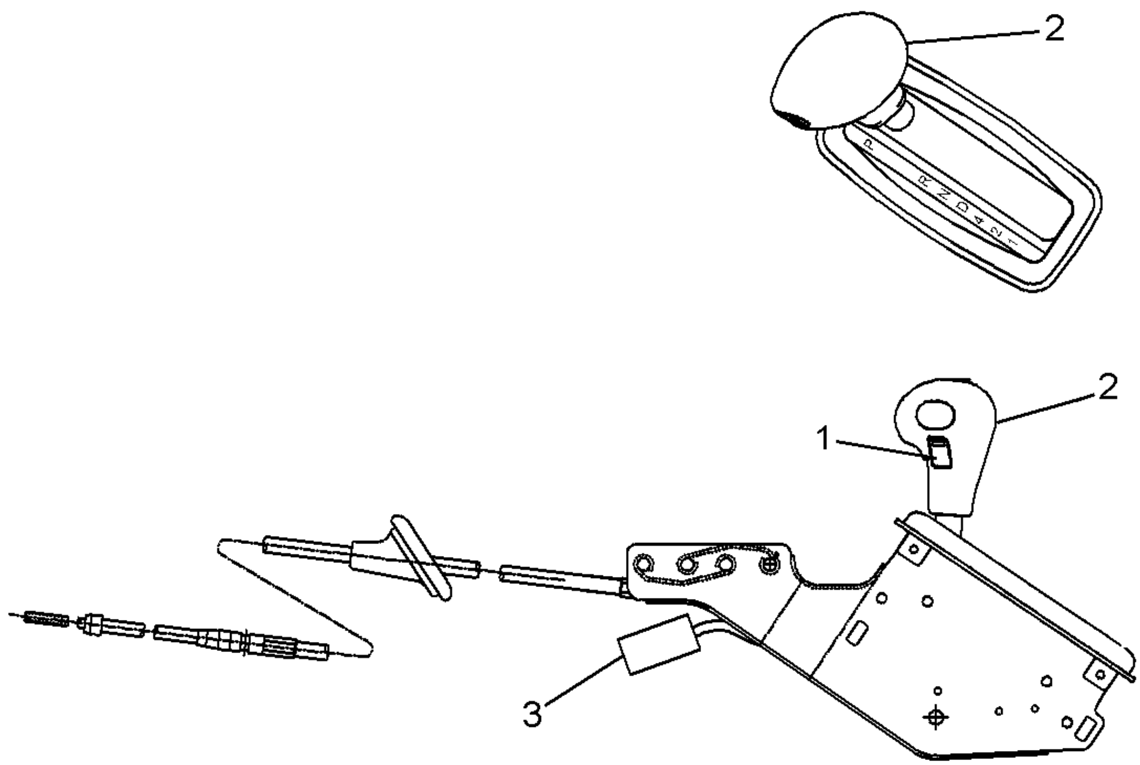

Figure 491 LCT Shift Control

1. ECONOMY MODE SWITCH
2. SHIFT CONTROL LEVER
3. (1828) SHIFT SELECTOR CONNECTOR

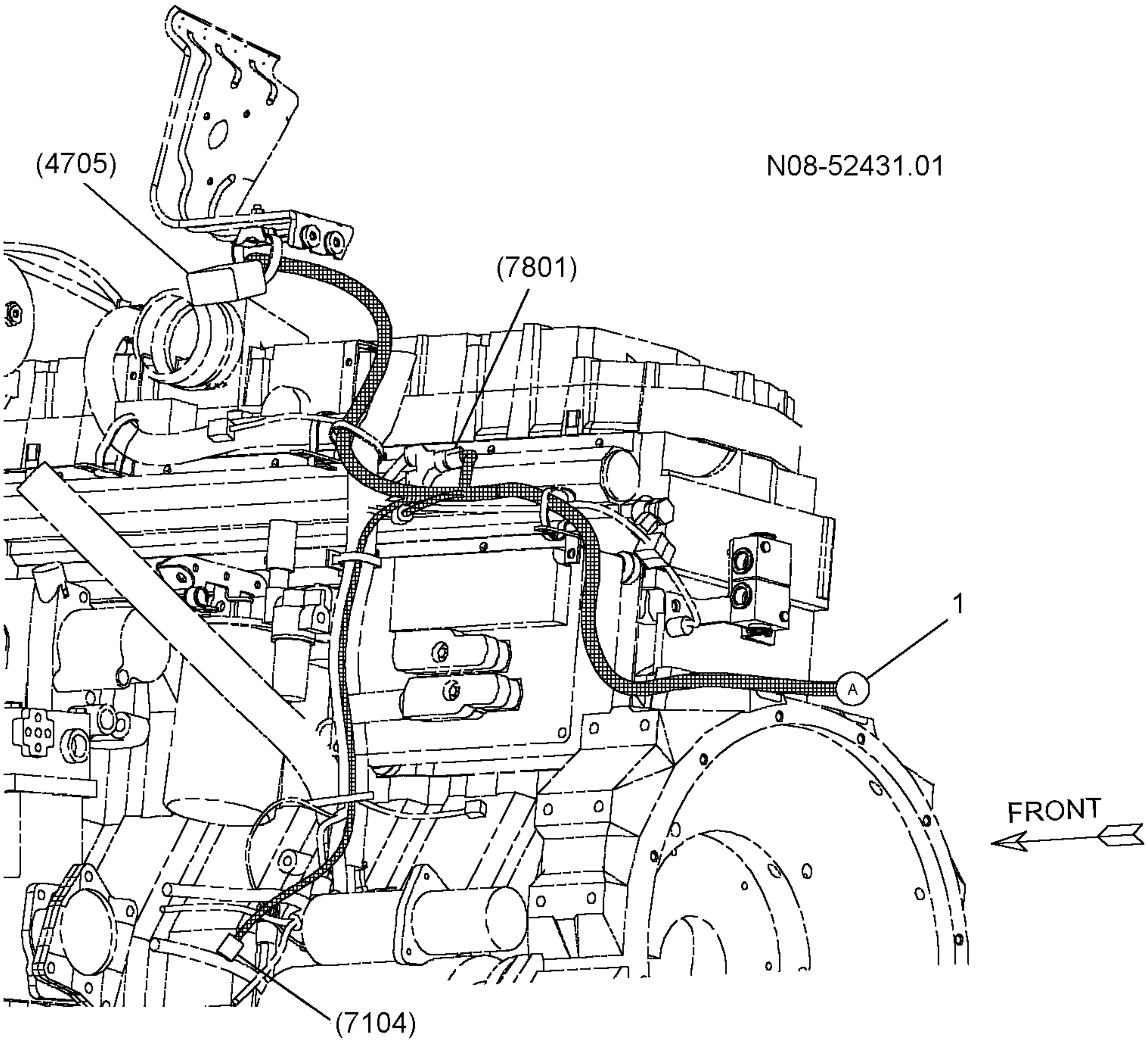

Figure 492 LCT Transmission Harness

1. HARNESS TO TRANSMISSION
(4705) TRANSMISSION / DASH CONNECTOR
(7104) CLEAN BATTERY FEED
(7801) DRIVE TRAIN DATA LINK "Y" TO TRANSMISSION "Y"

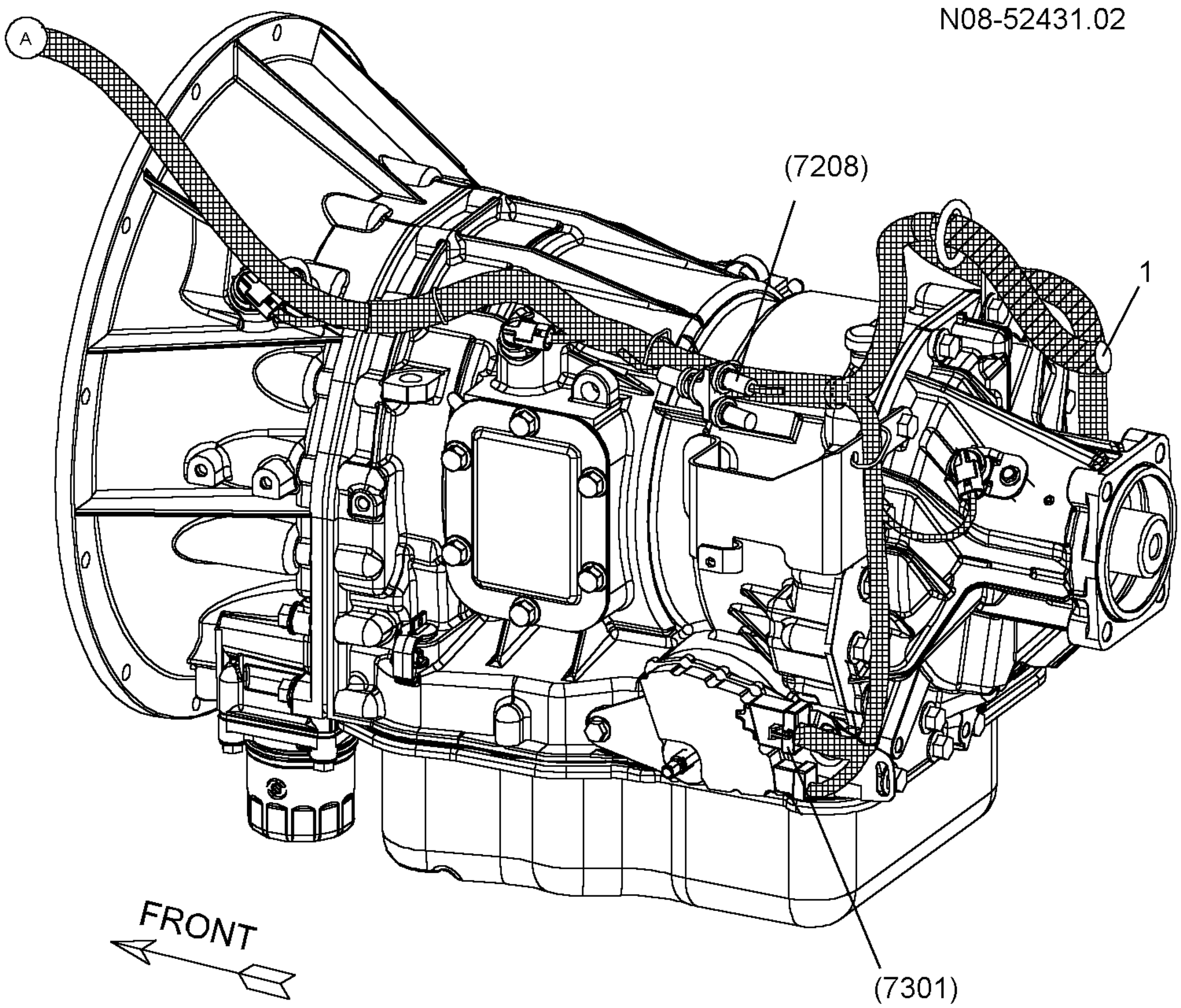

Figure 493 LCT Transmission Wiring

1. HARNESS TO TCM
(7208) TRANSMISSION DATA LINK CONNECTOR AND TERMINATOR
(7301) NSBU CONNECTOR

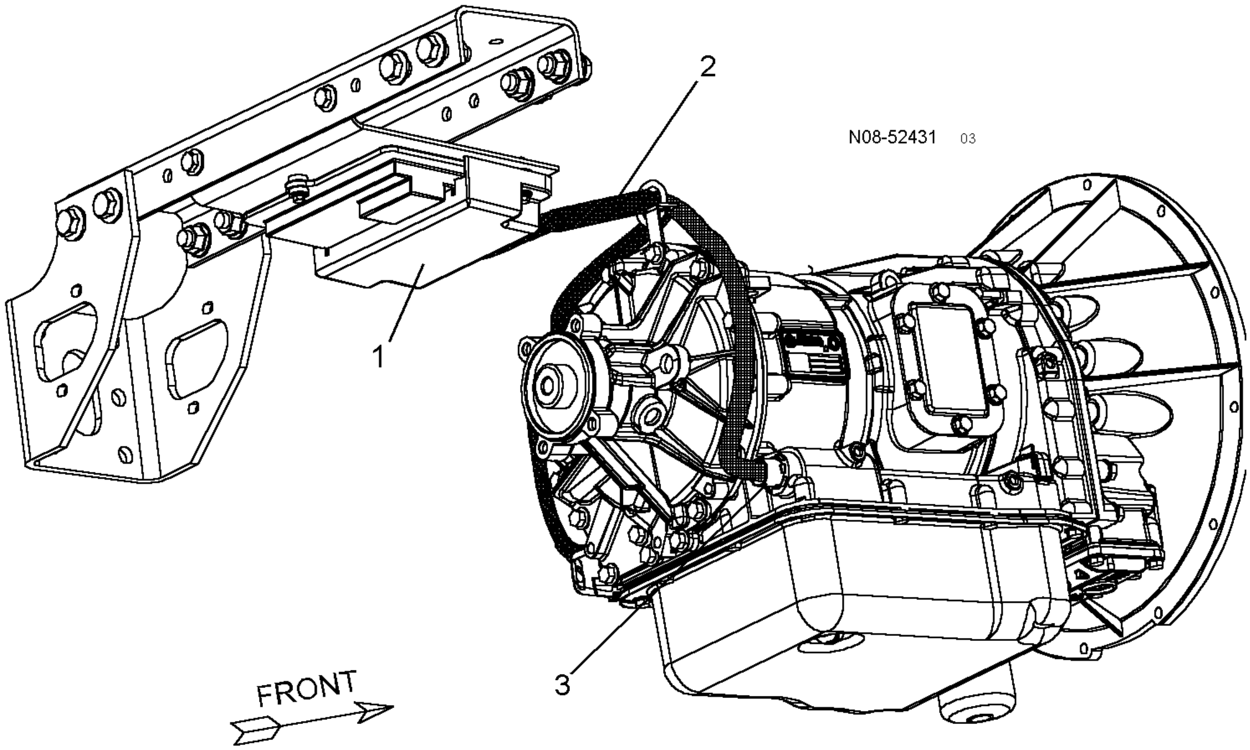

Figure 494 LCT Transmission TCM Location

1. LCT TRANSMISSION CONTROL MODULE (TCM)
2. HARNESS TO TCM (7305)
3. HARNESS TO OUTPUT SPEED SENSOR (7600)

5. EATON® AUTOSHIFT™ TRANSMISSION

Discussion of the EATON AUTOSHIFT transmission In this section is limited to the transmission ECU power circuits, power circuits to the shift selector control and drive train 1939 data link connectivity. For detailed information on transmission diagnostics, refer to the appropriate EATON service manual.

5.1. CIRCUIT FUNCTIONS

The autoshift transmission interfaces with the vehicle electrical system via the ECU, the shift selector control, back up light switch and an Eaton Autoshift relay.

The transmission communicates on the drivetrain 1939 data link to interface with the engine controller, electrical system controller and the air ABS controller. The drivetrain 1939 data link is connected to the shift control in the cab.

5.2. DIAGNOSTICS

The ESC will log a DTC if data link communication with the transmission shifter is lost.

The transmission has its own diagnostic system which will turn on the “SERVICE” lamp on the autoshift display when there is a detectable fault. Diagnostic codes can be read with flash codes on the display. Refer to the appropriate EATON service manual for details.

There are no diagnostic trouble codes (DTC's) associated with the back-up light circuits. A fault in the back-up light circuits will be apparent when the transmission is shifted into reverse and the lights don't come on.

Table 340 Autoshift Preliminary Check

STEP	KEY	ACTION	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
1.	On	Does the engine crank when the transmission is in neutral?	Engine cranks when the transmission is in neutral.	Go to next step.	Refer to Engine Cranking. (See ENGINE CRANKING, page 379)
2.	On	Does the autoshift display appear to have power?	Autoshift display has power.	Go to next step.	Refer to Autoshift selector Power Circuits. (See AUTOSHIFT SELECTOR POWER CIRCUITS, page 1003)
3.	Off	Are there any active DTC's associated with the transmission? Refer to Diagnostic Trouble Codes. (See DIAGNOSTIC TROUBLE CODES (DTC), page 1002)	Transmission communication DTC is not active.	Go to next step.	Go to Autoshift selector data link circuits. (See AUTOSHIFT SELECTOR DATA LINK CIRCUITS, page 1006) Go to Autoshift ECU Power Circuits. (See AUTOSHIFT ECU POWER CIRCUITS, page 1007) Go to Autoshift Relay Circuits. (See AUTOSHIFT RELAY CIRCUITS, page 1009)
4.	Off	Is the transmission warning light in the EGC illuminated?	Transmission warning lamp is not illuminated.	Go to next step.	Refer to the Eaton Autoshift service manual.
5.	On	Do the back-up lights come on when the transmission is shifted into reverse?	Back-up lights come on when in reverse.	Transmission circuits are functioning. Go to next step.	Go to Back-Up Autoshift Light Circuits. (See Autoshift BACK-UP LIGHT CIRCUITS, page 1011)

5.3. DIAGNOSTIC TROUBLE CODES (DTC)

To display diagnostic codes, put the vehicle in diagnostic mode. Set the parking brake and turn the Ignition key "ON". Then press the Cruise "ON" switch and the Cruise "Resume" switch. If no diagnostic trouble codes are present, the cluster odometer will display "NO FAULT". If diagnostic trouble codes are present, the gauge cluster will display the total number of faults and cycle to the next diagnostic trouble code after 10 seconds. To manually cycle through the diagnostic trouble code list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in “A” for active diagnostic trouble codes or “P” for previously active diagnostic trouble codes. Turning the ignition key off or releasing the park brake will take the ESC and the gauge cluster out of the diagnostic mode.

The previously active diagnostic trouble codes may be cleared, while in the diagnostic mode, by turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 341 Transmission Communication Diagnostic Trouble Codes

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
639 14 2 240	Electronic transmission controller communication has not been received.

5.4. AUTOSHIFT SELECTOR POWER CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the power circuits to the Autoshift selector will be apparent when the autoshift display does not respond to shift selections. Problems in the selector circuits could be attributed to open or short circuits, a blown fuse, a failed EATON Autoshift relay or a failure in the selector assembly.

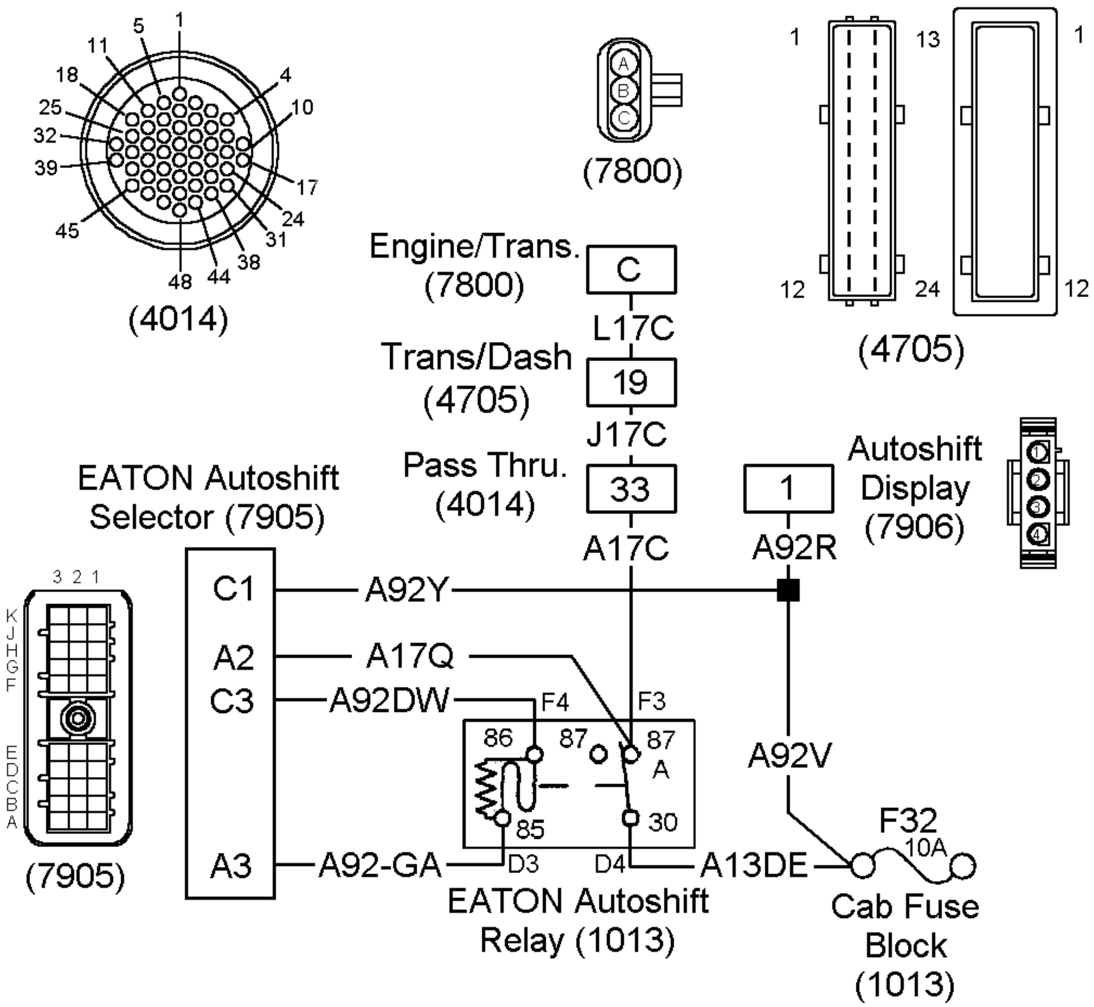

Figure 495 Autoshift Selector Power Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(1012) CAB FUSE BLOCK (EATON AUTOSHIFT RELAY)
LOCATED IN CAB POWER DISTRIBUTION CENTER
(1013) CAB FUSE BLOCK #3, F29, 5 AMP FUSE
LOCATED IN CAB POWER DISTRIBUTION CENTER
(4014) PASS THROUGH CONNECTOR
LOCATED ON DASH PANEL ABOVE ESC
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7800) ENGINE/TRANSMISSION
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7905) EATON AUTOSHIFT SELECTOR CONNECTOR
LOCATED ON AUTOSHIFT SELECTOR
(7906) EATON AUTOSHIFT DISPLAY CONNECTOR
LOCATED ON AUTOSHIFT DISPLAY

Table 342 **Autoshift Selector Power Checks**

Autoshift Selector Power Connector (7905) Power Checks		
Check with ignition on and (7905) disconnected.		
NOTE – Always check connectors for damage and pushed–out terminals.		
Test Points	Spec.	Comments
Selector harness connector (7905), cavity C1 to ground	12 ± 1.5 volts.	If voltage is incorrect, check for blown 5A transmission fuse F29 or open or short to ground in circuit A49E or A92Y. Also check for short to ground in circuit A49C or A92R.
EATON Autoshift Relay Checks		
Check with ignition on and EATON Autoshift relay removed.		
NOTE – Always check connectors for damage and pushed–out terminals.		
Bench check relay and replace if it has failed. Refer to Bench Checking Relays. (See BENCH TESTING RELAYS, page 29)		
Test Points	Spec.	Comments
Relay socket cavity A4 (relay 30) to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for open or short in circuit A49C to fuse F29.
Relay socket cavity C4 (relay 86) to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit A92DW to Autoshift selector (7905) cavity C3.
Relay socket cavity A4 (relay 30) to A3 (relay 85.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit A92–GA to Autoshift selector (7905) cavity A3.
Relay socket cavity A4 (relay 30) to C3 (relay 87).	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit A17Q to Autoshift selector (7905) cavity A2.
If voltages or circuits are correct and Autoshift selector is not powering up, refer to the EATON Autoshift manual.		

Extended Description

Autoshift display connector (7906) cavity 1 is supplied ignition voltage from fuse F29 in the cab PDC.

Autoshift selector connector (7905) cavity C1 is supplied ignition voltage from fuse F29 in the cab PDC.

EATON Autoshift relay, common terminal 30, is supplied Ignition voltage from fuse F29 in the cab PDC.

The autoshift relay is energized by signals from the selector. When the relay energizes it supplies ignition voltage to the selector and to the clutch switch.

5.5. AUTOSHIFT SELECTOR DATA LINK CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the data link circuits to the Autoshift selector will be apparent when communication DTC is active. Problems in the data link circuits could be attributed to open or short circuits, or a failure in the selector assembly.

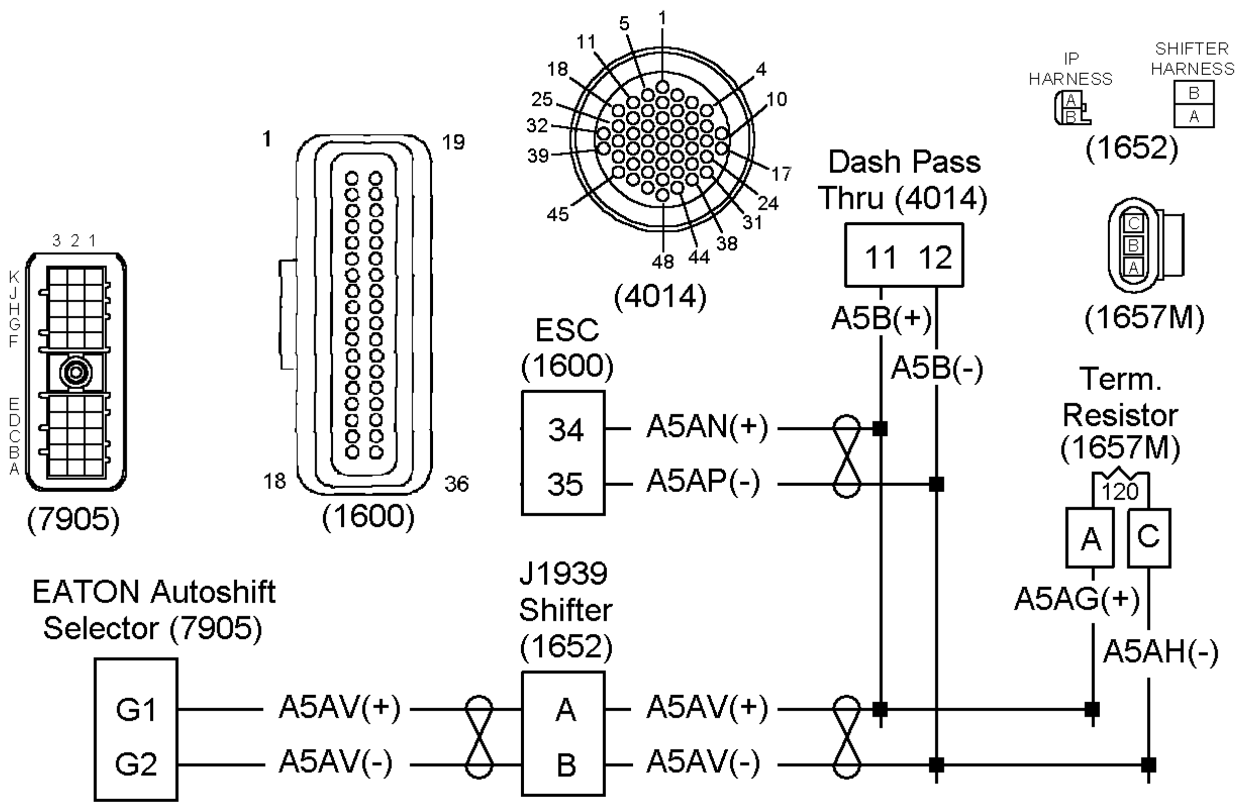

Figure 496 Autoshift Selector Data Link Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(1600) ELECTRICAL SYSTEM CONTROLLER (ESC) CONNECTOR
LOCATED ON CAB SIDE OF ELECTRICAL SYSTEM CONTROLLER
(1652) DRIVETRAIN J1939 EATON AUTOSHIFT SHIFTER CONNECTOR
LOCATED ON EATON AUTOSHIFT
(1657M) DRIVETRAIN J1939 TERM. RESISTOR CONNECTOR
LOCATED ON DASH PANEL
(4014) PASS THROUGH CONNECTOR
LOCATED ON DASH PANEL ABOVE ESC
(7905) EATON AUTOSHIFT SELECTOR CONNECTOR
LOCATED ON AUTOSHIFT SELECTOR

Table 343 Autoshift Selector Data Link Checks

Autoshift Selector Data Link Connector (7905) Voltage Checks Check with ignition on and (7905) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Selector harness connector (7905), cavity G1 to ground	Approximately 3 volts.	If voltage is missing, check for open or short to ground in circuit A5AV(+).
Selector harness connector (7905), cavity G2 to ground	Approximately 3 volts.	If voltage is missing, check for open or short to ground in circuit A5AV(-).
If voltages are correct and EATON Autoshift ECU communication DTC is still active, refer to Drivetrain Data Link. (See DRIVETRAIN 1939 DATA LINK, page 60)		

Extended Description

The drivetrain data link is connected to the EATON Autoshift selector connector (7905) cavities G1 and G2 from the J1939 EATON Autoshift shifter connector (1652).

5.6. AUTOSHIFT ECU POWER CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the power circuits to the autoshift ECU might be present when the autoshift display “SERVICE” warning lamp illuminates. Problems in the ECU power circuits could be attributed to open or short circuits, a blown fuse, or a failed ECU.

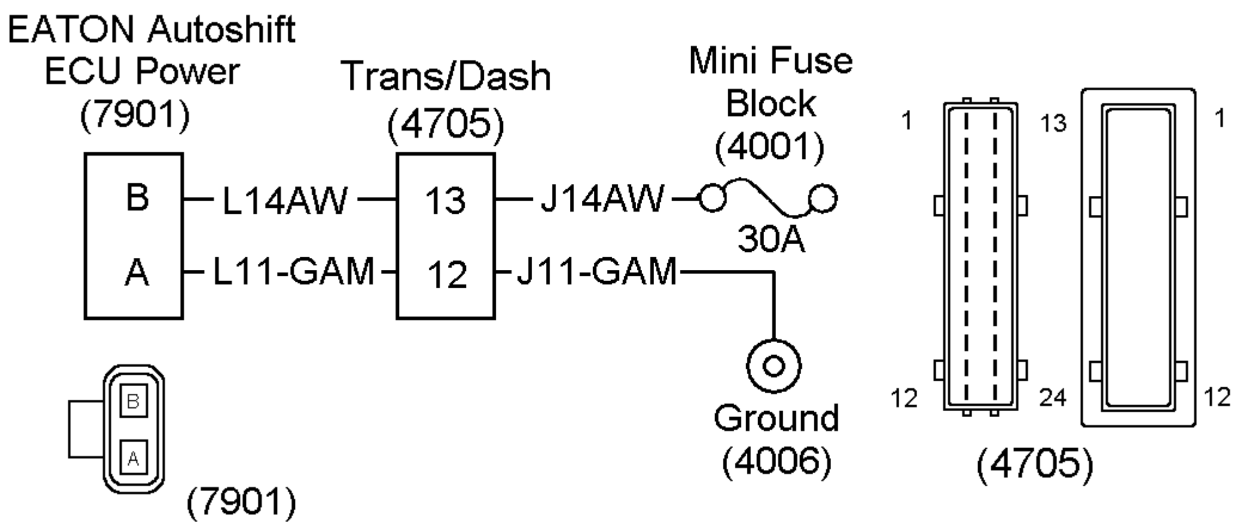

Figure 497 Autoshift ECU Power Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4001) MINI FUSE BLOCK 30 AMP EATON AUTOSHIFT FUSE
LOCATED IN ENGINE POWER DISTRIBUTION CENTER
(4006) GROUND STUD
LOCATED ON ENGINE
(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7901) AUTOSHIFT ECU POWER
LOCATED ON TRANSMISSION ECU

Table 344 ECU Power Checks

ECU Power Connector (7901) Power Checks Check with ignition on and (7901) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
ECU power harness connector (7901), cavity B to ground	12 ± 1.5 volts.	If voltage is incorrect, check for blown 30A EATON autoshift fuse or open or short to ground in circuit L14AW or J14AW.
ECU power harness connector (7901), cavity B to A	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L11–GAM or J11–GAM.
If voltages are correct and ECU is not operating correctly, refer to the EATON Autoshift service manual .		

Extended Description

Battery voltage is supplied to ECU power connector (7901) cavity B from the 30 amp EATON Autoshift fuse in the engine compartment PDC.

Ground for the ECU is supplied to ECU power connector (7901) cavity A from the engine ground stud.

5.7. AUTOSHIFT RELAY CIRCUITS

Fault Detection Management

The EATON Autoshift relay provides an input to the engine controller signalling that the transmission is in neutral. The Autoshift selector will energize the relay when the transmission is in neutral. The energized relay supplies 12 volts to the drive line disengagement signal (DDS) input to the engine controller. This signals the engine controller that the transmission is not in gear causing the engine controller to provide a ground to the starter relay coil.

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A problem in the EATON Autoshift relay circuit could be attributed to open or short circuits, a blown fuse, or a failed ECM.

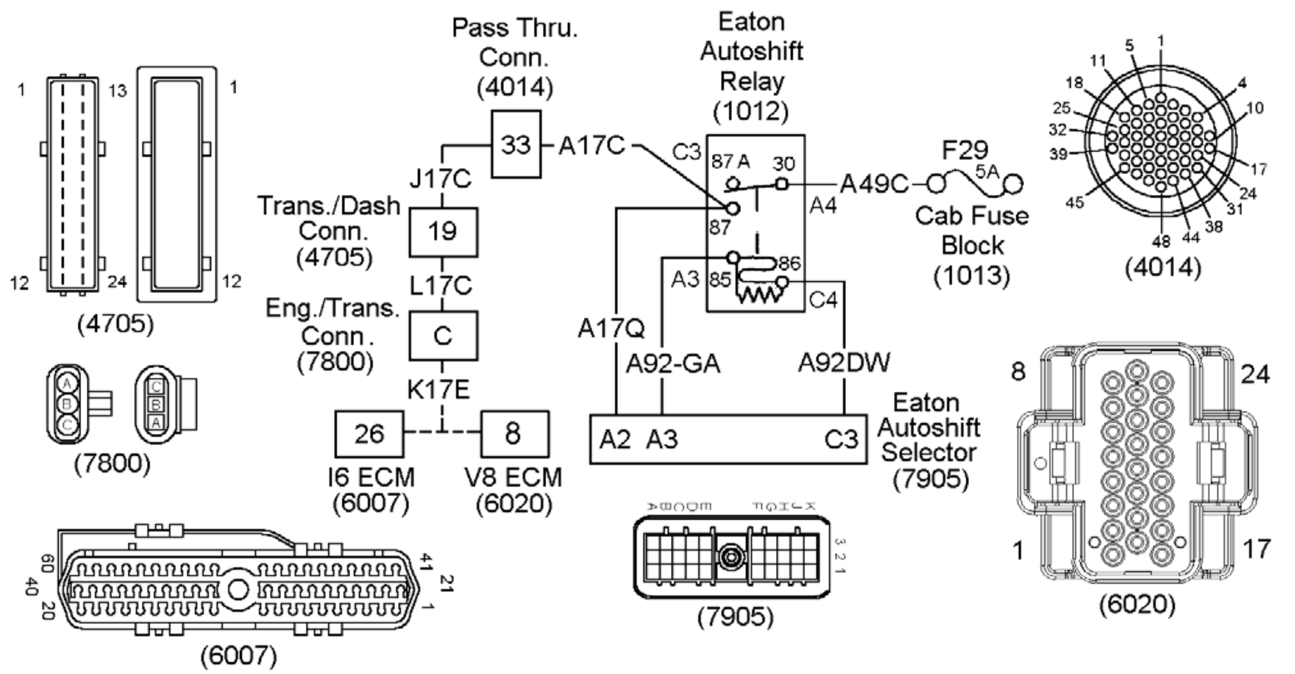

Figure 498 Eaton Autoshift Relay Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(1012) CAB FUSE BLOCK (EATON AUTOSHIFT RELAY)
LOCATED IN CAB POWER DISTRIBUTION CENTER
(1013) CAB FUSE BLOCK #3, F29, 5 AMP FUSE
LOCATED IN CAB POWER DISTRIBUTION CENTER
(4014) PASS THROUGH CONNECTOR
LOCATED ABOVE ELECTRICAL SYSTEM CONTROLLER IN DASH PANEL
(4705) TRANSMISSION DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(6007) I6 ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(6020) V8 ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(7800) ENGINE/TRANSMISSION CONNECTOR
LOCATED NEAR ENGINE CONTROLLER
(7905) AUTOSHIFT SELECTOR CONNECTOR
LOCATED BEHIND AUTOSHIFT SELECTOR

Table 345 Autoshift Relay Circuit Voltage Check Chart

Autoshift Relay Circuit Voltage Checks
Check with ignition key on and autoshift relay removed.
NOTE – Always check connectors for damage and pushed–out terminals.

Table 345 Autoshift Relay Circuit Voltage Check Chart (cont.)

Bench check relay and replace if it has failed. Refer to Bench Checking Relays. (See BENCH TESTING RELAYS, page 29)		
Relay socket cavity A4 (relay 30) to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown fuse F29, short to ground or open in circuit A49C to fuse F29.
Transmission in gear, relay socket cavity C4 (relay 86) to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuit A92DW or missing voltage from Autoshift selector.
Transmission in gear, relay socket cavity C4 (relay 86) to cavity A3 (relay 85).	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit A92–GA or missing ground signal from Autoshift selector.
Relay socket cavity C3 (relay 87) to cavity A3 (relay 85).	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuit A17C, A17Q, J17C, L17C, or K17E to engine controller. Also check for missing voltage from engine controller.

Extended Description

Refer to the Eaton Autoshift Relay Circuits.

When the key switch is in the ignition position and the transmission is in neutral, battery voltage will be applied to the relay common contact 30 and normally closed contact 87 to the ECM DDS circuit.

The autoshift selector provides ground to the relay coil contact 85.

When the transmission is shifted out of neutral, the autoshift selector will apply 12 volts from connector (7905) terminal C3 to relay coil contact 86. This will energize the relay.

The energized relay will remove voltage from the ECM DDS circuits. This will cause the ECM to disable engine cranking.

5.8. AUTOSHIFT BACK-UP LIGHT CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

When the transmission is shifted into reverse, the back up light switch should close to provide voltage for the back up lamps.

A fault in the back-up circuits should be suspected if the back-up lights do not come on when the transmission is shifted into reverse. Problems in the back–up light circuits can be caused by open or short circuits, a blown fuse, or failed switch.

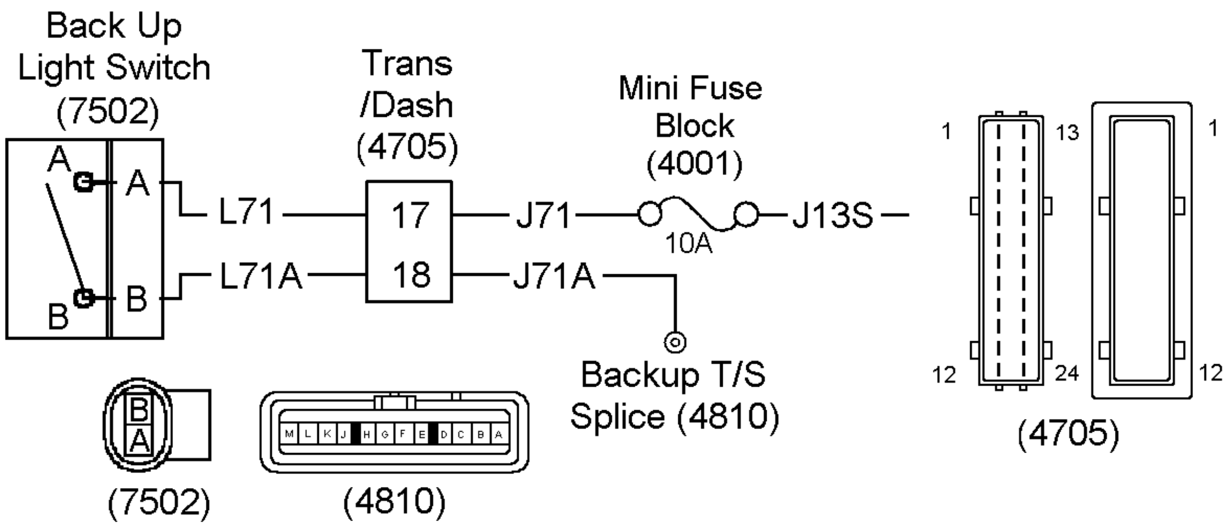

Figure 499 Back Up Switch Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4705) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(4810) BACKUP LIGHT TURN SIGNAL SPLICE CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR PDC
(7502) BACK UP LIGHT SWITCH CONNECTOR
LOCATED ON AUTOSHIFT TRANSMISSION

Table 346 Back Up Light Circuit Checks

Back Up Light Switch Connector (7502) Power Checks Check with ignition on and (7502) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Back up switch harness connector (7502), cavity A to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit J71 or L71.
Back up switch harness connector (7502), cavity A to cavity B.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L71A or J71A to back up/turn signal splice (4810). Also check circuits through back up lamps to ground.
If voltages are correct, consider replacing the back up switch.		

Extended Description

Ignition voltage is supplied to the back up light switch connector (7502), terminal A, from the 10 amp back up light fuse in the engine compartment power distribution center (PDC).

When the transmission is shifted into reverse, the switch will close supplying ignition voltage to the lamp circuits.

5.9. VEHICLE SPEED SENSOR

Refer to Speedometer (See SPEEDOMETER, page 250) for procedures to isolate speedometer problems to the sensor circuits.

Refer to the applicable engine manual for troubleshooting circuits from the engine controller to the sensor

Circuit Function

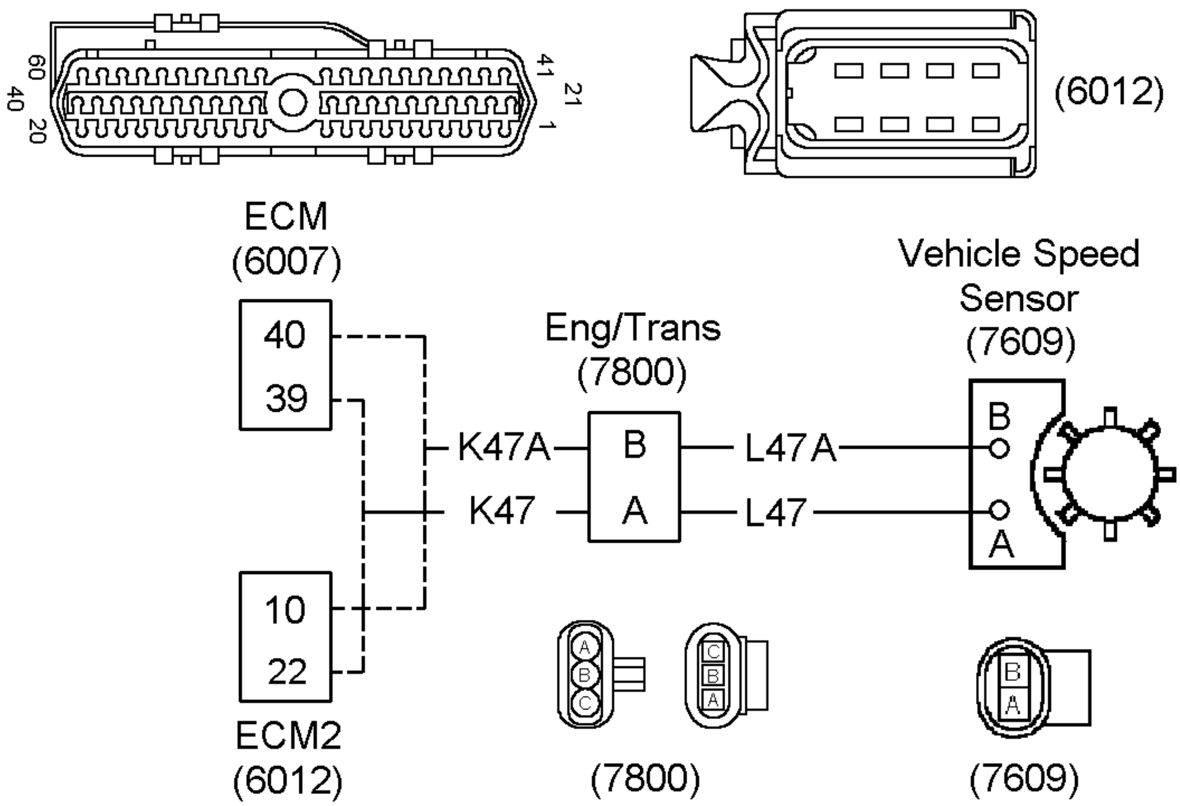

Figure 500 Transmission Vehicle Speed Sensor Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(6007) I6 ENGINE ECM BLACK CONNECTOR
LOCATED ON ENGINE CONTROLLER
(6012), (6021) V8 ENGINE ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(7609) TRANSMISSION SPEED SENSOR
LOCATED ON TRANSMISSION
(7800) ENGINE/TRANSMISSION
LOCATED IN ENGINE COMPARTMENT NEAR ENGINE CONTROLLER

Testing Vehicle Speed Sensor

Construct test leads using terminals (International Part No. 1680205C1), short length of 16 gauge wire and alligator clips.

WARNING – A jack must never be used alone to support vehicle. The jack may lower and serious injury could result. Always support vehicle with floor jacks. Always block wheels to prevent vehicle from moving.

WARNING – EXTREME CAUTION should be used to prevent personal injury resulting from contact with rotating vehicle wheels when connecting test leads.

Table 347 Testing Vehicle Speed Sensor

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
1.	Off	Inspect VSS for damage before performing this test.			Go to next step.	
2.	Off	Disconnect engine harness (7609) from VSS and use test leads to measure resistance between terminal A and B of sensor connector.	VSS, terminal A to B.	600 to 800 ohms.	Go to next step.	Replace the vehicle speed sensor (VSS).
3.	Off	Measure resistance to ground at both sensor terminals.	VSS, term. 1 and 2 to ground.	>100K ohms.	Go to next step.	Replace the vehicle speed sensor (VSS).
4.	Off	Block front wheels and place rear axles on floor stands.			Go to next step.	
5.	Off	Use AC voltmeter with sufficient length leads to avoid personal contact with rotating vehicle wheels during test. Connect meter leads to test leads.			Go to next step.	
6.	Off	Run engine at idle speed, with transmission in high gear. Measure voltage across the two sensor terminals.	VSS, across terminals.	>2.0 volts AC	VSS checks good.	Replace the VSS.

5.10. COMPONENT LOCATIONS

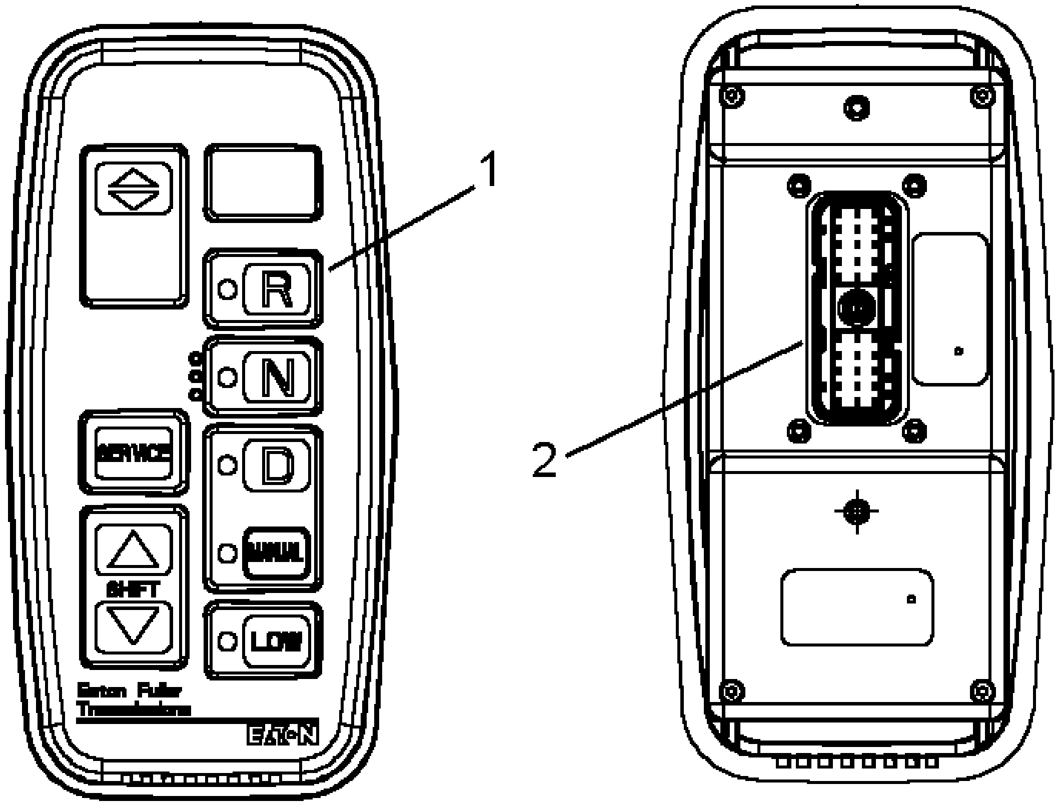

Figure 501 Eaton Autoshift Shift Selector

1. SHIFT CONTROL BUTTONS
2. (420) SHIFT SELECTOR CONNECTOR

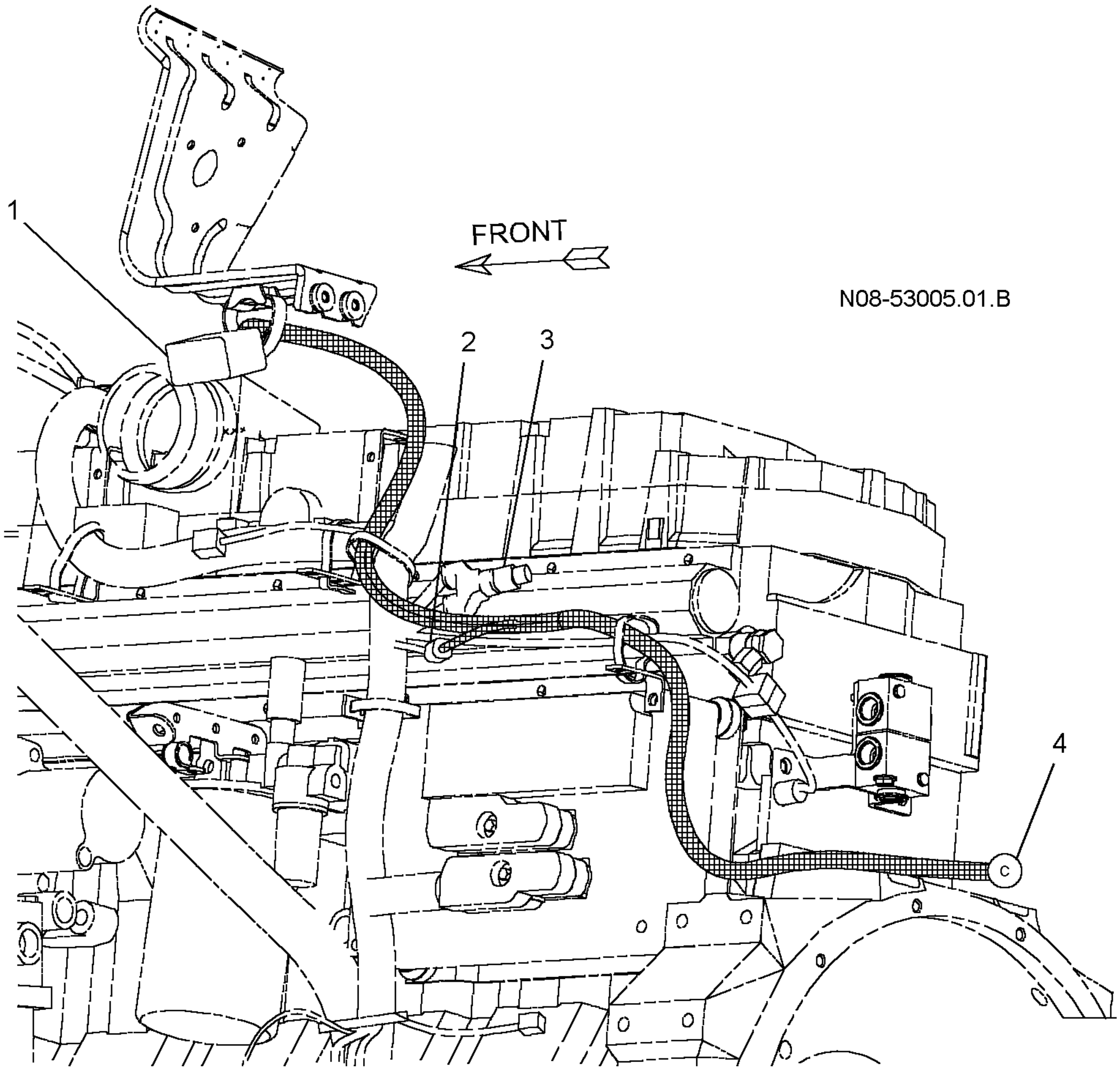

Figure 502 Eaton Autoshift Transmission Harness

1. TRANSMISSION/DASH CONNECTOR (4705)
2. ENGINE/TRANSMISSION CONNECTOR (7800)
3. DRIVETRAIN 1939 DATA LINK TERMINATING RESISTOR (DATA LINK CONNECTION FOR TRANSMISSION IS AT SELECTOR)
4. TO TRANSMISSION HARNESS

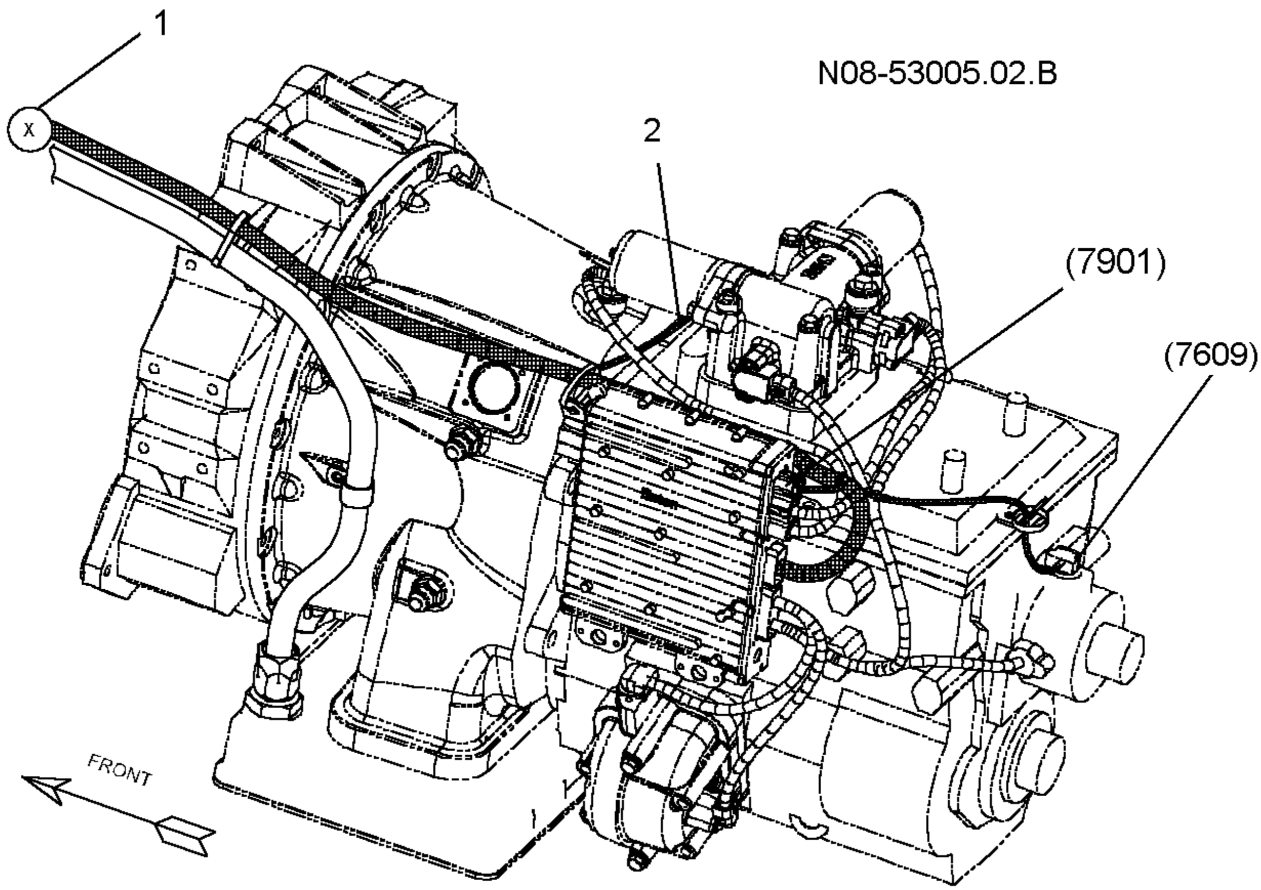

Figure 503 Eaton Autoshift Manual Transmission Wiring

1. FROM ENGINE HARNESS
2. HARNESS TO BACK UP SWITCH (7502)

(7609) TRANSMISSION SPEEDOMETER SENSOR
(7901) ECU POWER CONNECTOR

6. EATON® LIGHTNING™ TRANSMISSION

Discussion of the EATON LIGHTNING transmission In this section is limited to the transmission ECU power circuits, power circuits to the shift Lightning ECM and drive train 1939 data link connectivity. For detailed information on transmission diagnostics, refer to the appropriate EATON service manual.

6.1. CIRCUIT FUNCTIONS

The lightning transmission interfaces with the vehicle electrical system via the Eaton Lightning ECM, the shift control lever, back up light switch and the engine ECU.

The transmission communicates on the drivetrain 1939 data link to interface with the engine controller, electrical system controller and the air ABS controller. The drivetrain 1939 data link is connected to the shift control in the cab.

6.2. DIAGNOSTICS

The ESC will log a DTC if data link communication with the transmission shifter is lost.

The transmission has its own diagnostic system which will turn on the “SERVICE” lamp on the lightning display when there is a detectable fault. Diagnostic codes can be read with flash codes on the display. Refer to the appropriate EATON service manual for details.

There are no diagnostic trouble codes (DTC’s) associated with the back-up light circuits. A fault in the back-up light circuits will be apparent when the transmission is shifted into reverse and the lights don’t come on.

Table 348 Lightning Preliminary Check

STEP	KEY	ACTION	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
1.	On	Does the engine crank when the transmission is in neutral?	Engine cranks when the transmission is in neutral.	Go to next step.	Refer to Engine Cranking. (See ENGINE CRANKING, page 379)
2.	On	Does the lightning display appear to have power?	Lightning display has power.	Go to next step.	Refer to Lightning Shifter Power Circuits. (See Lightning Shifter POWER CIRCUITS, page 1019)
3.	Off	Are there any active DTC’s associated with the transmission? Refer to Diagnostic Trouble Codes. (See DIAGNOSTIC TROUBLE CODES (DTC), page 1018)	Transmission communication DTC is not active.	Go to next step.	Go to Lightning data link circuits. (See Lightning DATA LINK CIRCUITS, page 1021) Go to Lightning ECU Power Circuits. (See Lightning ECU POWER CIRCUITS, page 1023)
4.	Off	Is the transmission warning light in the EGC illuminated?	Transmission warning lamp is not illuminated.	Go to next step.	Refer to the Eaton Lightning service manual.
5.	On	Do the back-up lights come on when the transmission is shifted into reverse?	Back-up lights come on when in reverse.	Transmission circuits are functioning. Go to next step.	Go to Lightning Back-Up Light Circuits. (See LIGHTNING BACK-UP LIGHT CIRCUITS, page 1024)

6.3. DIAGNOSTIC TROUBLE CODES (DTC)

To display diagnostic codes, put the vehicle in diagnostic mode. Set the parking brake and turn the Ignition key “ON”. Then press the Cruise “ON” switch and the Cruise “Resume” switch. If no diagnostic trouble codes are present, the cluster odometer will display “NO FAULT”. If diagnostic trouble codes are present, the gauge cluster will display the total number of faults and cycle to the next diagnostic trouble code after 10 seconds. To manually cycle through the diagnostic trouble code list, press the cluster display select/reset button. The last character of the diagnostic trouble code will end in “A” for active diagnostic trouble codes or “P” for previously active diagnostic trouble codes. Turning the ignition key off or releasing the park brake will take the ESC and the gauge cluster out of the diagnostic mode.

The previously active diagnostic trouble codes may be cleared, while in the diagnostic mode, by turning on the left turn signal and pressing the cruise on and set switches simultaneously.

Table 349 Transmission Communication Diagnostic Trouble Codes

DIAGNOSTIC TROUBLE CODE	FAULT DESCRIPTION
639 14 2 240	Electronic transmission controller communication has not been received.

6.4. LIGHTNING SHIFTER POWER CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the power circuits to the Lightning shifter will be apparent when the lightning display does not respond to shift selections. Problems in the shifter circuits could be attributed to open or short circuits, a blown fuse, a failed EATON Lightning jumper or a failure in the shifter assembly.

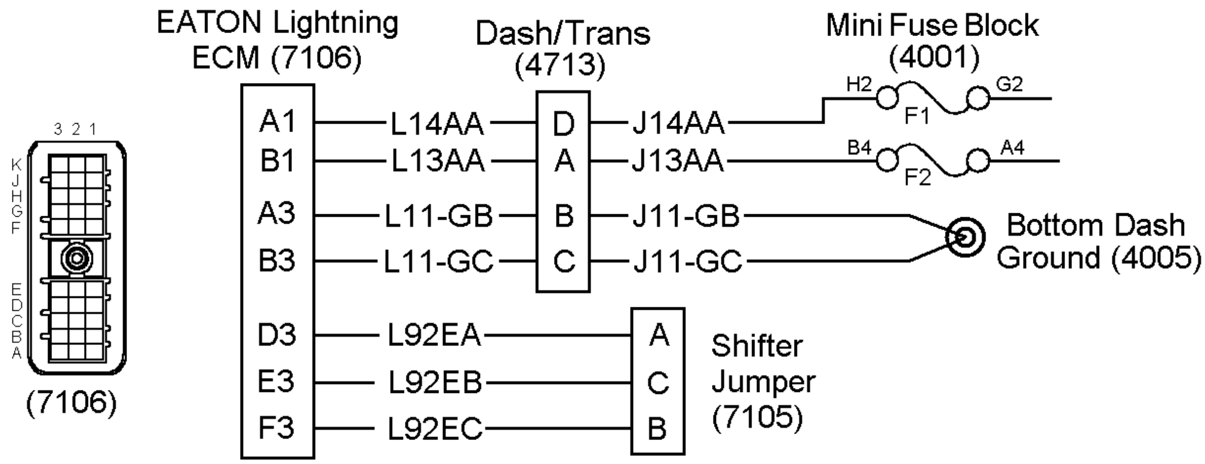

Figure 504 Lightning Shifter/ECM Power Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4001) MINI FUSE BLOCK, F1 & F2, EATON LIGHTNING FUSES
LOCATED IN ENGINE POWER DISTRIBUTION CENTER
(4005) BOTTOM DASH GROUND
LOCATED IN CAB DASH
(4713) DASH/TRANSMISSION CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7105) EATON LIGHTNING SHIFTER JUMPER CONNECTOR
LOCATED ON LIGHTNING TRANSMISSION
(7106) EATON LIGHTNING ECM POWER CONNECTOR
LOCATED ON LIGHTNING TRANSMISSION

Table 350 Lightning Shifter Power Checks

Lightning Shifter Jumper Connector (7105) Power Checks Check with ignition on and (7105) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Shifter Jumper harness connector (7105), cavity A to ground	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuit L92EA.
Shifter Jumper harness connector (7105), cavity C to ground	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuit L92EB.
Shifter Jumper harness connector (7105), cavity B to ground	12 ± 1.5 volts.	If voltage is incorrect, check for open or short to ground in circuit L92EC.
If voltages or circuits are correct and Lightning Shifter is not powering up, refer to the EATON Lightning service manual.		

Extended Description

Lightning Shifter jumper connector (7105) cavity A is supplied voltage from Lightning ECM power connector (7106) cavity D3.

Lightning Shifter jumper connector (7105) cavity C is supplied voltage from Lightning ECM power connector (7106) cavity E3.

Lightning Shifter jumper connector (7105) cavity B is supplied voltage from Lightning ECM power connector (7106) cavity F3.

6.5. LIGHTNING DATA LINK CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the data link circuits to the Lightning ECM will be apparent when communication DTC is active. Problems in the data link circuits could be attributed to open or short circuits, or a failure in the shifter assembly.

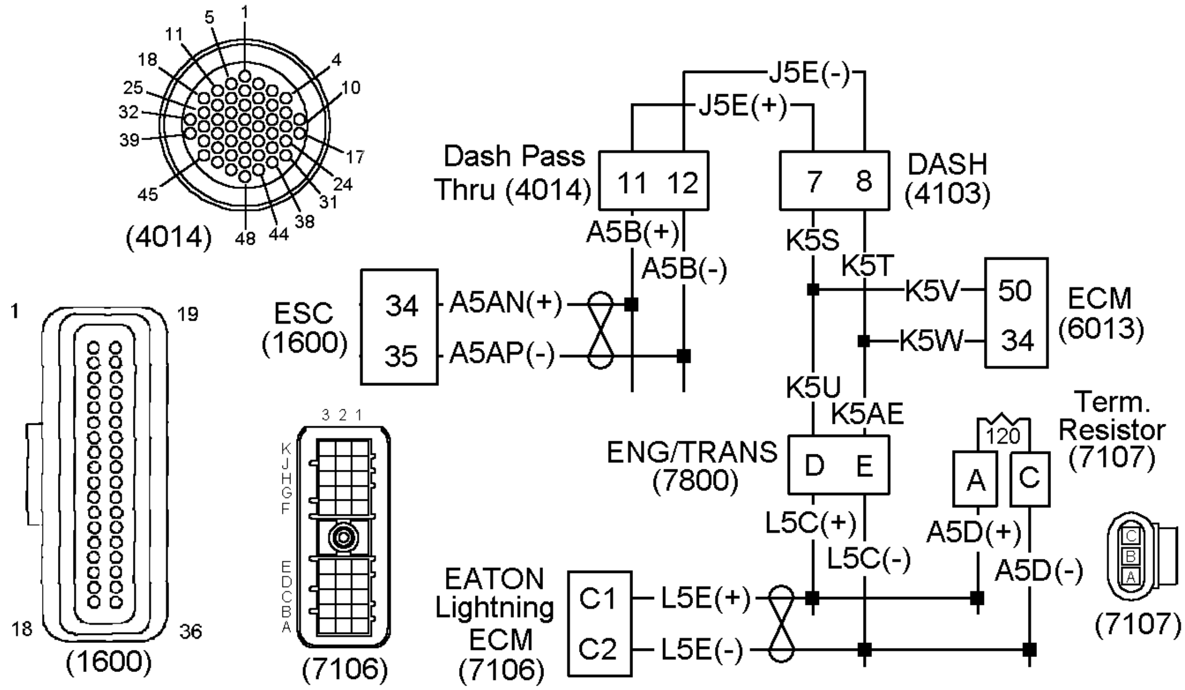

Figure 505 Lightning Data Link Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(1600) ELECTRICAL SYSTEM CONTROLLER (ESC) CONNECTOR
LOCATED ON CAB SIDE OF ELECTRICAL SYSTEM CONTROLLER
(4014) PASS THROUGH CONNECTOR
LOCATED ON DASH PANEL ABOVE ESC
(4103) DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT ABOVE ESC
(6013) CAT ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(7106) EATON LIGHTNING ECM CONNECTOR
LOCATED ON LIGHTNING TRANSMISSION
(7107) DRIVETRAIN J1939 TERM. RESISTOR CONNECTOR
LOCATED ON DASH PANEL
(7800) ENGINE/TRANSMISSION CONNECTOR
LOCATED NEAR ENGINE CONTROLLER

Table 351 Lightning Data Link Checks

Lightning ECM Data Link Connector (7106) Voltage Checks Check with ignition on and (7106) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments

Table 351 Lightning Data Link Checks (cont.)

Lightning ECM harness connector (7106), cavity C1 to ground	Approximately 3 volts.	If voltage is missing, check for open or short to ground in circuit L5E(+).
Lightning ECM harness connector (7106), cavity C2 to ground	Approximately 3 volts.	If voltage is missing, check for open or short to ground in circuit L5E(-).
If voltages are correct and EATON Lightning ECU communication DTC is still active, refer to Drivetrain Data Link. (See DRIVETRAIN 1939 DATA LINK, page 60)		

Extended Description

The drivetrain data link is connected to the EATON Lightning ECM connector (7106) cavities C1 and C2 from the J1939 EATON Lightning shifter jumper connector (7105).

6.6. LIGHTNING ECU POWER CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

A fault in the power circuits to the lightning ECU might be present when the lightning display “SERVICE” warning lamp illuminates. Problems in the ECU power circuits could be attributed to open or short circuits, a blown fuse, or a failed ECU.

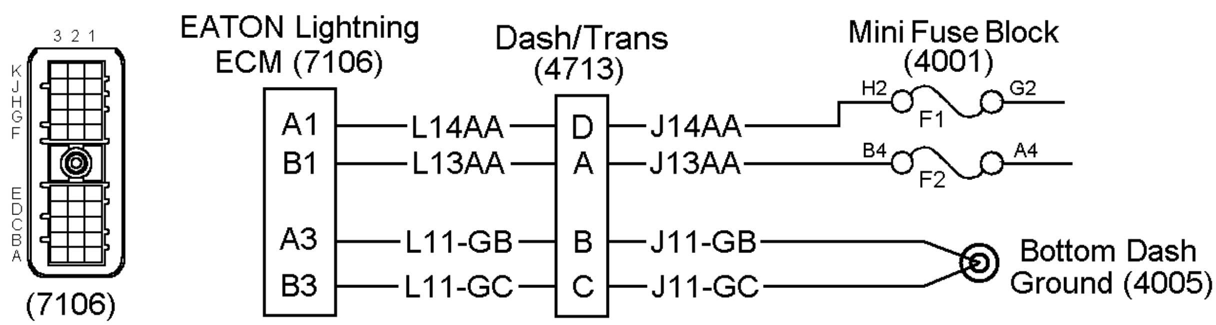

Figure 506 Lightning ECU Power Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4001) MINI FUSE BLOCK, F1 & F2, EATON LIGHTNING FUSES
LOCATED IN ENGINE POWER DISTRIBUTION CENTER
(4005) BOTTOM DASH GROUND
LOCATED IN CAB DASH
(4713) DASH/TRANSMISSION CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(7106) EATON LIGHTNING ECM POWER CONNECTOR
LOCATED ON LIGHTNING TRANSMISSION

Table 352 ECU Power Checks

ECU Power Connector (7106) Power Checks Check with ignition on and (7106) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
ECU power harness connector (7106), cavity A1 to ground	12 ± 1.5 volts.	If voltage is incorrect, check for blown transmission fuse F1 or open or short to ground in circuit L14AA or J14AA. Also check for short to ground in circuit L14AA or J14AA.
ECU power harness connector (7106), cavity B1 to ground	12 ± 1.5 volts.	If voltage is incorrect, check for blown transmission fuse F2 or open or short to ground in circuit L13AA or J13AA. Also check for short to ground in circuit L13AA or J13AA.
ECU power harness connector (7106), cavity A1 to A3	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L11–GB or J11–GB.
ECU power harness connector (7106), cavity B1 to B3	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L11–GC or J11–GC.
If voltages are correct and ECU is not operating correctly, refer to the EATON Lightning service manual .		

Extended Description

Battery voltage is supplied to ECU power connector (7106) cavity B1 from the EATON Lightning fuse F2 in the engine compartment PDC.

Battery voltage is supplied to ECU power connector (7106) cavity A1 from the EATON Lightning fuse F1 in the engine compartment PDC.

Ground for the ECU is supplied to ECU power connector (7106) cavity A3 from the engine ground stud.

Ground for the ECU is supplied to ECU power connector (7106) cavity B3 from the engine ground stud.

6.7. LIGHTNING BACK-UP LIGHT CIRCUITS

Fault Detection Management

NOTE – The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

When the transmission is shifted into reverse, the back up light switch should close to provide voltage for the back up lamps.

A fault in the back-up circuits should be suspected if the back-up lights do not come on when the transmission is shifted into reverse. Problems in the back–up light circuits can be caused by open or short circuits, a blown fuse, or failed switch.

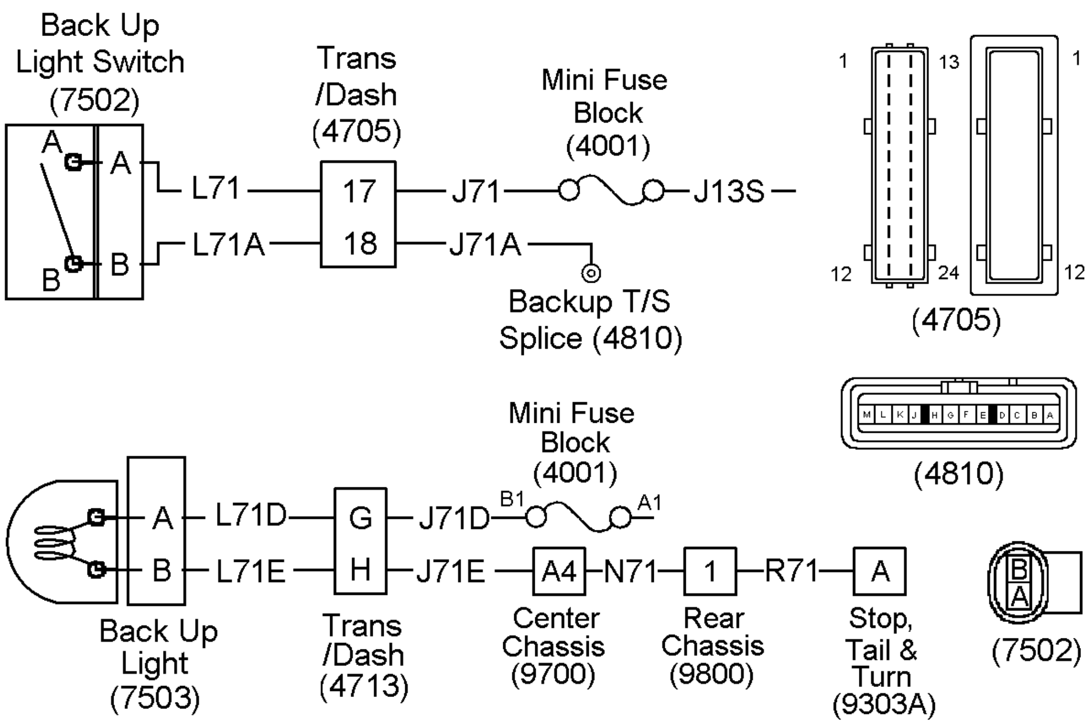

Figure 507 Lightning Back Up Switch Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(4713) TRANSMISSION/DASH CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR WIPER MOTOR BRACKET
(4810) BACKUP LIGHT TURN SIGNAL SPLICE CONNECTOR
LOCATED IN ENGINE COMPARTMENT NEAR PDC
(7502) BACK UP LIGHT SWITCH CONNECTOR
LOCATED ON LIGHTNING TRANSMISSION
(7503) BACK UP LIGHT CONNECTOR
LOCATED ON LIGHTNING TRANSMISSION

Table 353 Back Up Light Circuit Checks

Back Up Light Switch Connector (7502) Power Checks Check with ignition on and (7502) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Back up switch harness connector (7502), cavity A to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown 10A transmission fuse or open or short to ground in circuit J71 or L71.

Table 353 Back Up Light Circuit Checks (cont.)

Back up switch harness connector (7502), cavity A to cavity B.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L71A or J71A to back up/turn signal splice (4810). Also check circuits through back up lamps to ground.
If voltages are correct, consider replacing the back up switch.		
Back Up Light Connector (7503) Power Checks Check with ignition on and (7503) disconnected. **NOTE – Always check connectors for damage and pushed–out terminals.**		
Test Points	Spec.	Comments
Back up light harness connector (7503), cavity A to ground.	12 ± 1.5 volts.	If voltage is incorrect, check for blown transmission fuse or open or short to ground in circuit J71D or L71D.
Back up light harness connector (7503), cavity A to cavity B.	12 ± 1.5 volts.	If voltage is incorrect, check for open in circuit L71E, J71E, N71 or R71 to stop, tail & turn signal (9303A). Also check circuits through back up lamps to ground.
If voltages are correct, consider replacing the back up switch.		

Extended Description

Ignition voltage is supplied to the back up light switch connector (7502), terminal A, from the 10 amp back up light fuse in the engine compartment power distribution center (PDC).

Ignition voltage is supplied to the back up light connector (7503), terminal A, from the back up light fuse in the engine compartment power distribution center (PDC).

When the transmission is shifted into reverse, the switch will close supplying ignition voltage to the lamp circuits.

6.8. VEHICLE SPEED SENSOR

Refer to Speedometer (See SPEEDOMETER, page 250) for procedures to isolate speedometer problems to the sensor circuits.

Refer to the applicable engine manual for troubleshooting circuits from the engine controller to the sensor

Circuit Function

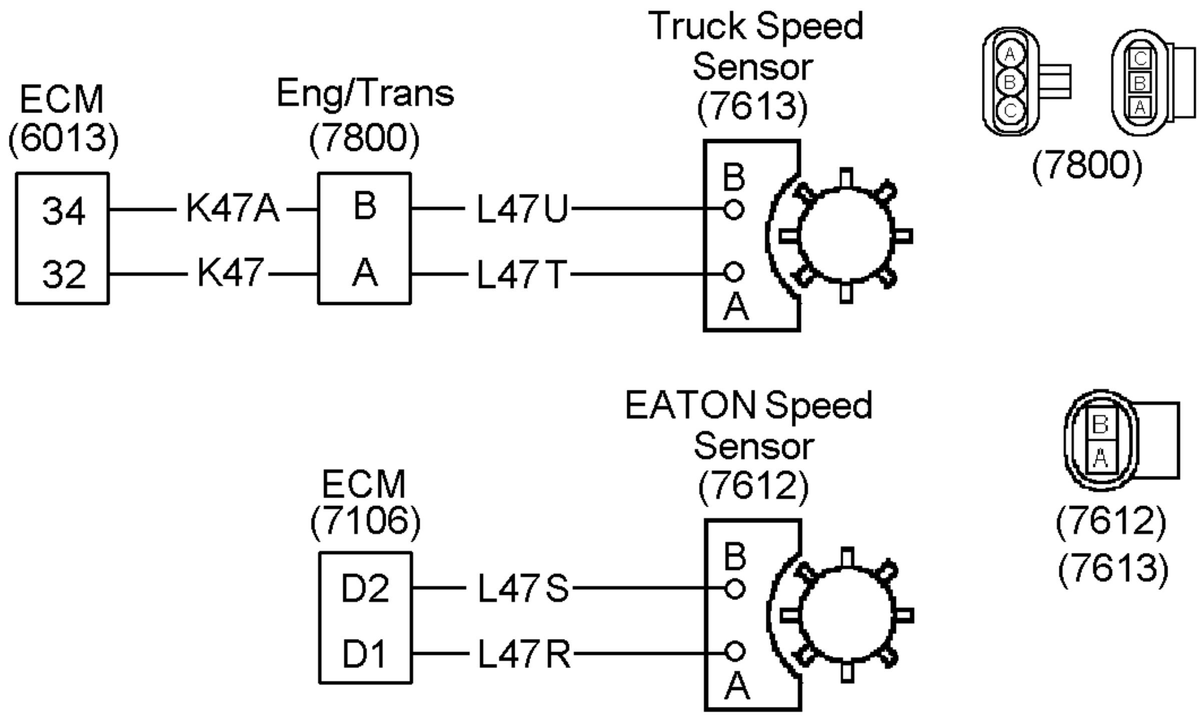

Figure 508 Lightning Transmission Vehicle Speed Sensor Circuits—Always Refer to Circuit Diagram Book for Latest Circuit Information

(6013) ENGINE ECM CONNECTOR
LOCATED ON ENGINE CONTROLLER
(7106) EATON LIGHTNING ECM POWER CONNECTOR
LOCATED ON LIGHTNING TRANSMISSION
(7612) EATON SPEED SENSOR
LOCATED ON TRANSMISSION
(7613) TRUCK SPEED SENSOR
LOCATED ON TRANSMISSION
(7800) ENGINE/TRANSMISSION
LOCATED IN ENGINE COMPARTMENT NEAR ENGINE CONTROLLER

Testing Vehicle Speed Sensor

Construct test leads using terminals (International Part No. 1680205C1), short length of 16 gauge wire and alligator clips.

> **WARNING – A jack must never be used alone to support vehicle. The jack may lower and serious injury could result. Always support vehicle with floor jacks. Always block wheels to prevent vehicle from moving.**

WARNING – EXTREME CAUTION should be used to prevent personal injury resulting from contact with rotating vehicle wheels when connecting test leads.

Table 354 Testing Vehicle Speed Sensor

STEP	KEY	ACTION	TEST POINTS	SPEC.	YES-IN SPEC.	NO-OUT OF SPEC.
1.	Off	Inspect VSS for damage before performing this test.			Go to next step.	
2.	Off	Disconnect engine harness (7613) from VSS and use test leads to measure resistance between terminal A and B of sensor connector.	VSS, terminal A to B.	600 to 800 ohms.	Go to next step.	Replace the vehicle speed sensor (VSS).
3.	Off	Measure resistance to ground at both sensor terminals.	VSS, term. 1 and 2 to ground.	>100K ohms.	Go to next step.	Replace the vehicle speed sensor (VSS).
4.	Off	Block front wheels and place rear axles on floor stands.			Go to next step.	
5.	Off	Use AC voltmeter with sufficient length leads to avoid personal contact with rotating vehicle wheels during test. Connect meter leads to test leads.			Go to next step.	
6.	Off	Run engine at idle speed, with transmission in high gear. Measure voltage across the two sensor terminals.	VSS, across terminals.	>2.0 volts AC	VSS checks good.	Replace the VSS.

6.9. TRANSMISSION OIL TEMPERATURE SENSOR

Refer to Transmission Oil Temperature Gauge (See TRANSMISSION OIL TEMPERATURE GAUGE, page 264) for troubleshooting procedures.

6.10. COMPONENT LOCATIONS

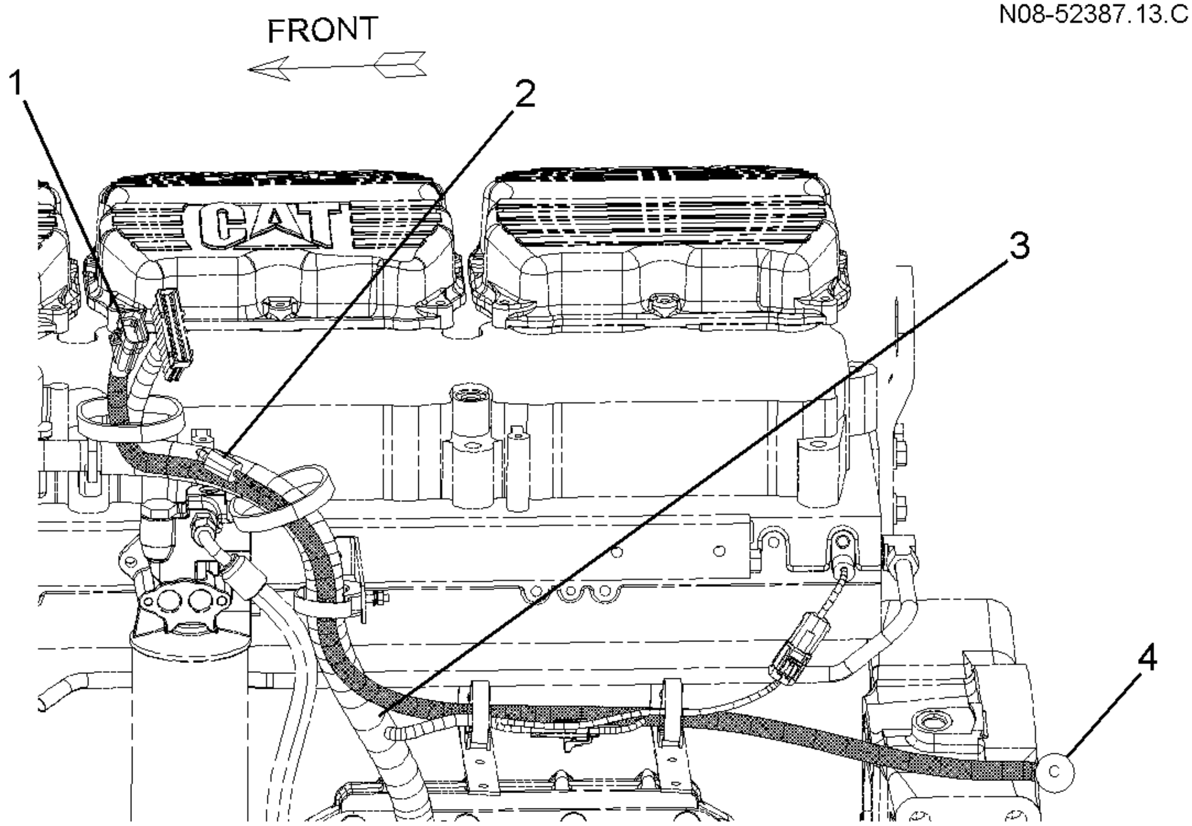

Figure 509 Eaton Lightning Transmission Harness

1. TRANSMISSION/DASH CONNECTOR (4713)
2. ENGINE/TRANSMISSION CONNECTOR (7800)
3. DRIVETRAIN 1939 DATA LINK TERMINATING RESISTOR
4. TO TRANSMISSION HARNESS

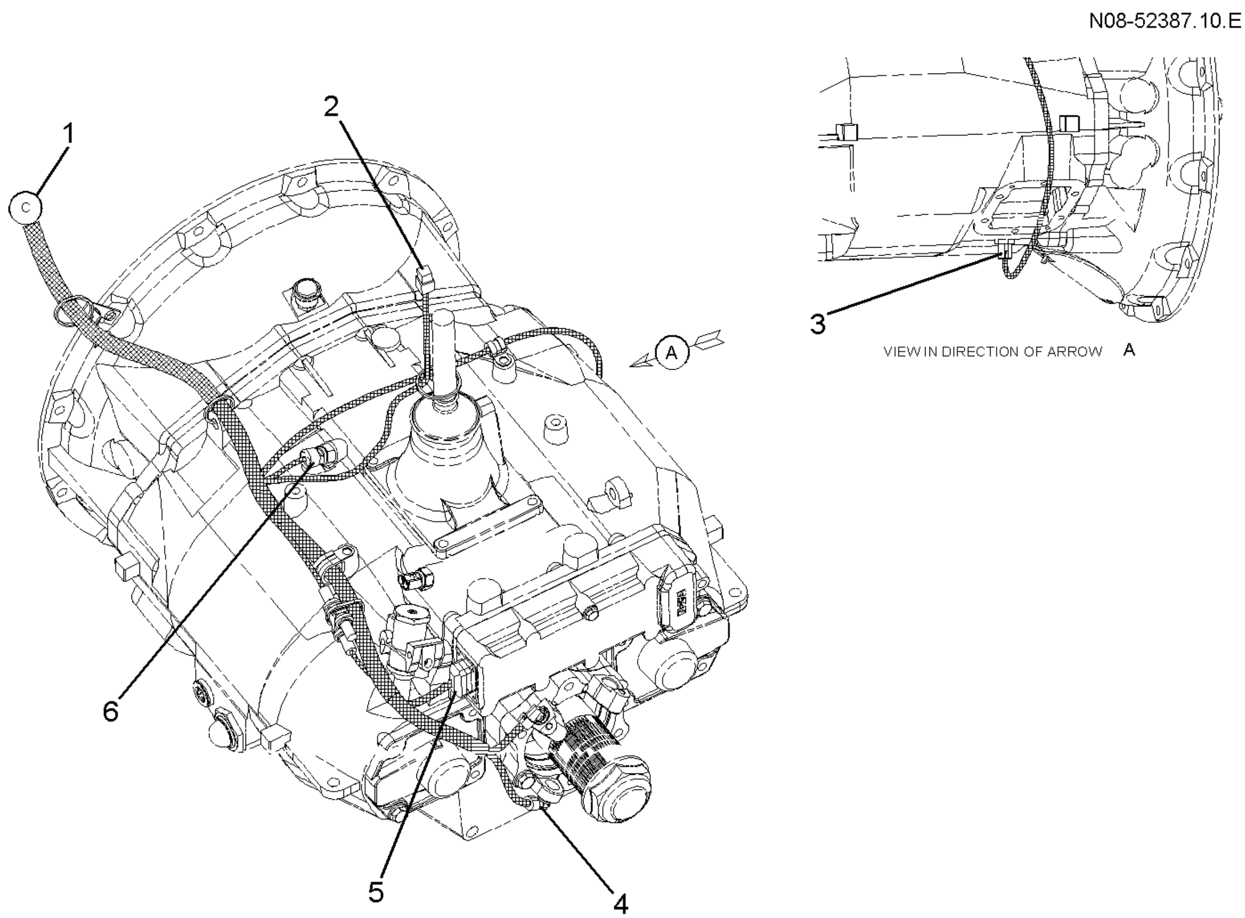

Figure 510 Eaton Lightning Manual Transmission Wiring

1. FROM ENGINE HARNESS
2. (7105) EATON LIGHTNING SHIFTER JUMPER
3. (7703) TRANSMISSION OIL TEMP SENSOR
4. (7612) EATON SPEED SENSOR
5. (7106) EATON LIGHTNING ECM
6. (7502) BACK UP LIGHT SWITCH

Table of Contents

Refer to theHVAC service manual section S16025 for information on the HVAC electrical system.

Table of Contents

1. DIAGNOSTICS

1.1. ON-LINE DIAGNOSTICS

On-line Diagnostics are automatically performed while the key is in the accessory or ignition position. Any faults encountered will be entered in the active diagnostic trouble code list.

Check Electrical System Light

The check electrical system light will turn on for 5 seconds after the gauge sweep, on power up. If there is an active fault the light will stay on for an extra minute. If a fault occurs during operation of the vehicle the light will come on for 1 minute. This will alert the driver that an active fault exists.

If the check electrical system light comes on and stays on after the gauge sweep is completed there is an active diagnostic trouble code (DTC) or there is no communication between the EGC and ESC.

If the EGC loses communication with the ESC or engine controller the check electrical system light will turn on and stay on. The light will be accompanied by 10 short beeps from the EGC alarm.

Gauges

Gauge warning lamps will illuminate and be accompanied by the appropriate alarm when gauge readings exceed preset limits. Gauges will also respond when the ESC is not receiving input from sensors.

Flashing Switch Lamps

Several features activated by switches in the switch packs are programmed to flash the indicator lamp in the switch when there is a switch malfunction or a malfunctioning feature.

Not all switches will respond the same. Generally a malfunctioning switch will cause the indicator to flash at a slow rate. A problem with the feature will cause the indicator to flash at a fast rate. Refer to the section on the particular feature for details on how the switch indicator responds to failures.

1.2. OFF- LINE DIAGNOSTICS

NOTE – Diagnostic messages from the engine controller, antilock brake system or transmission are not displayed on the electronic gauge cluster (EGC) digital display.

Placing the electronic gauge cluster (EGC) in diagnostic mode will allow the EGC to display active and previously active diagnostic messages from the electrical system controller (ESC) or from the EGC itself.

To engage the diagnostic mode turn the Ignition key ON (or in accessory), then press the Cruise ON switch and the Cruise RESUME switch simultaneously. If no faults are present, the gauge cluster display will read NO FAULTS. If faults are present, the gauge cluster will display a message with the number of faults, followed by the diagnostic codes. Refer to Diagnostic Trouble Code Display. This procedure will also initiate the diagnostic flash codes for the engine controller and the hydraulic ABS controller. The display will show each DTC for 10 seconds, then automatically scroll to the next entry and continue to cycle through the faults. To manually cycle through the fault list, press the cluster SELECT/RESET button.

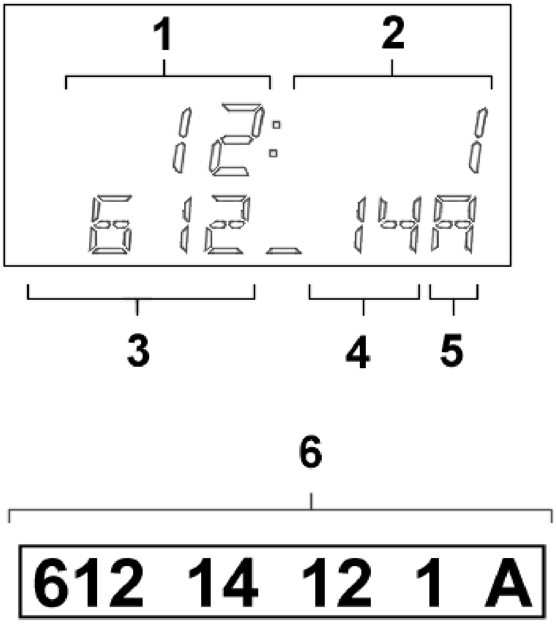

Figure 511 Diagnostic Trouble Code Display

1. BYTE 7 FIELD
2. BYTE 8 FIELD
3. SPN FIELD
4. FMI FIELD
5. ACTIVE/PREVIOUSLY ACTIVE STATUS INDICATOR
6. COMPILED FORMAT OF DIAGNOSTIC TROUBLE CODE

Diagnostic trouble codes (DTC) will end with an “A” while the code is active. The code will remain active as long as the feature affected is active and the fault is present. If the feature is turned off or the fault is removed, the trouble code will be moved to the “previously active” list and the code will end with a “P”. For example: when the work light is turned on and there is an open an active circuit fault code (611 14 11 1 A) will be logged. When the light is turned off the code will become previously active. The fault still exists, but the code will not go active until the light is turned on.

While in the diagnostic mode, previously active diagnostic trouble codes may be cleared by turning the left turn signal ON and pressing the Cruise ON switch and the Cruise SET switch simultaneously.

Diagnostic codes for the engine controller and hydraulic ABS controller will not be cleared with this procedure.

To exit the diagnostic mode, cycle the key switch or release the parking brake.

1.3. OFF-BOARD DIAGNOSTICS

The diagnostic service tool, running the INTUNE software, can be used to view and clear ESC diagnostic trouble codes (DTC). Other diagnostic software can be used to view and clear engine controller, ABS and transmission diagnostic trouble codes. Refer to the applicable supplier service manual for information on their diagnostic software and tools.

1.4. DIAGNOSTIC TROUBLE CODE (DTC) LIST

Table 355 Diagnostic Trouble Code (DTC) List

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
70	14	1	0	1600/4004/ Bus 1602 16/32/16	Connector #4004 Pin 32 MD — Air Powered Park Brake is stuck. Connector #1600 & 1602 Pin 16 Bus Redundant Door Occurs when the park brake switch does not match the spring apply air release (SAAR) chamber travel sensor. This indicates the park brake cannot be applied or cannot be released. Refer to Service Park Brake warning lamp (See SERVICE PARK BRAKE WARNING LAMP, page 219)in the Electronic Gauge Cluster section of this manual. Refer to Air Actuated Park Brake (See Diagnostic Trouble Codes, page 811)in the Chassis Accessories section of this manual.
70	14	1	1	1600/4004/ Bus 1602 16/32/16	Connector #4004 Pin 32 MD — Air Powered Park Brake is not operating. Connector #1600 & 1602 Pin 16 Bus Redundant Door Occurs when the park brake switch is not set within 5 seconds of the receipt of the Park as the requested gear. This failure would indicate a failure in the auto apply relay or in the air lines between the auto apply relay and the Park Brake switch. Refer to Service Park Brake warning lamp (See SERVICE PARK BRAKE WARNING LAMP, page 219)in the Electronic Gauge Cluster section of this manual. Refer to Air Actuated Park Brake (See Diagnostic Trouble Codes, page 811)in the Chassis Accessories section of this manual.
597	14	1	0	Hyd or Air n/4091 – 1600 Air w/4091 — 4004 Bus – 1602/33	Brake switch is stuck in the open or closed position Occurs if the wheel based vehicle speed increases from 0 kph to 72 kph two times without the brake switch opening or decreases from 72 kph to 0 kph two times without the brake switch closing. Defective brake switch Refer to hydraulic brake switch (See HYDRAULIC BRAKE SWITCH INPUTS TO ESC, page 906) or air brake switch (See AIR BRAKE SWITCH INPUTS TO ESC, page 909) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
597	14	2	0	Hyd or Air n/4091 – 1600 Air w/4091 — 4004 Bus – 1602/33	Brake switch inputs do not match Occurs if the comparison of the inputs indicates a mismatch in the analog and digital signals. Occurs if there is a high resistance in the wire harness, defective brake switch or a defective Electronic System Controller (ESC). Refer to hydraulic brake switch (See HYDRAULIC BRAKE SWITCH INPUTS TO ESC, page 906) or air brake switch (See AIR BRAKE SWITCH INPUTS TO ESC, page 909) in the Light Systems section of this manual.
598	14	1	0	1600/17	Upper Clutch Switch stuck in the open or closed position Occurs if the vehicle speed increases from 0 kph to 72 kph without a change in state of the clutch switch. Defective upper clutch switch Refer to Clutch Switch(See CLUTCH SWITCH, page 558) in the Cab Features section of this manual.
610	14	1	0	1600/12	Ignition feed error. Loss of Ignition feed for 10 seconds while the engine is running Refer to ESC Power and Ground. (See ESC POWER AND GROUND, page 91)
610	14	2	0	1600/2	Accessory feed error. Loss of Accessory feed for 10 seconds while the engine is running Refer to ESC Power and Ground. (See ESC POWER AND GROUND, page 91)
611	14	1	1	1601/G	Connector #1601 Pin #G Mirror heat under current Connector #1601 Pin #G Bus Left Front and Rear Red Flashers under current The Current from this output is below 0.5 A Open circuit Refer to Heated Mirrors in the Cab Features section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	1	2	1601/G	Connector #1601 Pin #G Mirror heat over current Connector #1601 Pin #G Bus Left Front and Rear Red Flashers over current The output behaves like a 20 amp type III circuit breaker. Short to ground or overload Refer to Heated Mirrors in the Cab Features section of this manual.
611	14	1	3	1601/G	Connector #1601 Pin #G Mirror heat less than normal low current but more than open circuit Connector #1601 Pin #G Bus Left Front and Rear Red Flashers less than normal low current but more than open circuit Refer to Heated Mirrors in the Cab Features section of this manual.
611	14	1	4	1601/G	Connector #1601 Pin #G Mirror heat greater than normal high current and less than fusing current Connector #1601 Pin #G Bus Left Front and Rear Red Flashers greater than normal high current and less than fusing current Refer to Heated Mirrors in the Cab Features section of this manual.
611	14	1	6	1601/G	Connector #1601 Pin #G Mirror heat has current flow when output commanded off Connector #1601 Pin #G Bus Left Front and Rear Red Flashers has current flow when output commanded off Refer to Heated Mirrors in the Cab Features section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	2	1	4008/Bus 1604 A	Connector #4008 Pin #A Solenoid power under current Connector # 1604 Pin #A Bus (Left Front Amber PWL) under current The current from this output is below 0.5 A Open circuit Refer to Air Solenoid Modules(See ESC– SOLENOID POWER CIRCUIT, page 731) in the Chassis Features section of this manual.
611	14	2	2	4008/Bus 1604 A	Connector #4008 Pin #A Solenoid power over current Connector # 1604 Pin #A Bus (Left Front Amber PWL) over current The output behaves like a 20 amp type III circuit breaker. Short to ground or overload Refer to ESC-Solenoid Power Circuit(See ESC– SOLENOID POWER CIRCUIT, page 731) in the Chassis Features section of this manual.
611	14	2	3	4008/Bus 1604 A	Connector #4008 Pin #A Solenoid power less than normal low current but more than open circuit Connector # 1604 Pin #A Bus (Left Front Amber PWL) less than normal low current but more than open circuit Refer to ESC-Solenoid Power Circuit(See ESC– SOLENOID POWER CIRCUIT, page 731) in the Chassis Features section of this manual.
611	14	2	4	4008/Bus 1604 A	Connector #4008 Pin #A Solenoid power greater than normal high current and less than fusing current Connector #1604 Pin #A (Left Front Amber PWL) greater than normal high current and less than fusing current Refer to ESC-Solenoid Power Circuit(See ESC– SOLENOID POWER CIRCUIT, page 731) in the Chassis Features section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	2	6	4008/Bus 1604 A	Connector #4008 Pin #A Solenoid power has current flow when output commanded off Connector #4008 Pin #A BUS (Left Front Amber PWL) has current flow when output commanded off Refer to ESC-Solenoid Power Circuit(See ESC– SOLENOID POWER CIRCUIT, page 731) in the Chassis Features section of this manual.
611	14	3	1	4007/Bus 1603 A	Connector #4007 Pin #A Fog light / Spare 1 under current Connector #1603 Pin #A Bus Right Front and Rear Red Flashers under current The Current from this output is below 0.5 A Open circuit Refer to Fog Lights(See FOG LIGHT SYSTEM, page 864) in the Light Systems section of this manual.
611	14	3	2	4007/Bus 1603 A	Connector #4007 Pin #A Fog light / Spare 1 over current Connector #1603 Pin #A Bus Right Front and Rear Red Flashers over current The output behaves like a 20 amp type III circuit breaker. Short to ground or overload Refer to Fog Lights(See FOG LIGHT SYSTEM, page 864) in the Light Systems section of this manual.
611	14	3	3	4007/Bus 1603 A	Connector #4007 Pin #A Fog light / Spare 1 less than normal low current but more than open circuit Connector #1603 Pin #A Bus Right Front and Rear Red Flashers less than normal low current but more than open circuit Refer to Fog Lights(See FOG LIGHT SYSTEM, page 864) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	3	4	4007/Bus 1603 A	Connector #4007 Pin #A Fog light / Spare 1 greater than normal high current and less than fusing current Connector #1603 Pin #A Bus Right Front and Rear Red Flashers greater than normal high current and less than fusing current Refer to Fog Lights(See FOG LIGHT SYSTEM, page 864) in the Light Systems section of this manual.
611	14	3	6	4007/Bus 1603 A	Connector #4007 Pin #A Fog light / Spare 1 has current flow when output commanded off Connector #1603 Pin #A Bus Right Front and Rear Red Flashers has current flow when output commanded off Refer to Fog Lights(See FOG LIGHT SYSTEM, page 864) in the Light Systems section of this manual.
611	14	4	1	4007/Bus 1603 H	Connector #4007 Pin #H Park light under current The Current from this output is below 0.5 A Open circuit Refer to Marker, Park and Tail Lamps(See MARKER, PARK AND TAIL LAMPS, page 838) in the Light Systems section of this manual.
611	14	4	2	4007/Bus 1603 H	Connector #4007 Pin #H Park light over current The output behaves like a 20 amp type III circuit breaker. Short to ground or overload Refer to Marker, Park and Tail Lamps(See MARKER, PARK AND TAIL LAMPS, page 838) in the Light Systems section of this manual.
611	14	4	3	4007/Bus 1603 H	Connector #4007 Pin #H Park light less than normal low current but more than open circuit Refer to Marker, Park and Tail Lamps(See MARKER, PARK AND TAIL LAMPS, page 838) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	4	4	4007/Bus 1603 H	Connector #4007 Pin #H Park light greater than normal high current and less than fusing current Refer to Marker, Park and Tail Lamps(See MARKER, PARK AND TAIL LAMPS, page 838) in the Light Systems section of this manual.
611	14	4	6	4007/Bus 1603 H	Connector #4007 Pin #H Park light has current flow when output commanded off Refer to Marker, Park and Tail Lamps(See MARKER, PARK AND TAIL LAMPS, page 838) in the Light Systems section of this manual.
611	14	5	1	4007/Bus 1603 D	Connector #4007 Pin #D Low beam under current The current from this output is below 0.5 A Open circuit Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	5	2	4007/Bus 1603 D	Connector #4007 Pin #D Low beam over current The output behaves like a 20 amp type I circuit breaker Short to ground or overload Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	5	3	4007/Bus 1603 D	Connector #4007 Pin #D Low beam less than normal low current but more than open circuit Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	5	4	4007/Bus 1603 D	Connector #4007 Pin #D Low beam greater than normal high current and less than fusing current Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	5	6	4007/Bus 1603 D	Connector #4007 Pin #D Low beam has current flow when output commanded off Refer to Headlight System in the Light Systems section of this manual. (See HEADLIGHT SYSTEM, page 872)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	6	1	4008/Bus 1604 F	Connector #4008 Pin #F Wiper power under current Connector #1604 Pin #F Bus (Wiper power) output under current The Current from this output is below 0.5 A Open circuit Refer to Wiper Motor Circuits (See WIPER MOTOR CIRCUITS, page 545) in the Cab Feature section of this manual.
611	14	6	2	4008/Bus 1604 F	Connector #4008 Pin #F Wiper power over current Connector #1604 Pin #F Bus (Wiper power) output over current The output behaves like a 20 amp type I circuit breaker Short to ground or overload Refer to Wiper Motor Circuits (See WIPER MOTOR CIRCUITS, page 545) in the Cab Feature section of this manual.
611	14	6	3	4008/Bus 1604 F	Connector #4008 Pin #F Wiper power less than normal low current but more than open circuit Connector #1604 Pin #F Bus (Wiper power) less than normal low current but more than open circuit Refer to Wiper Motor Circuits (See WIPER MOTOR CIRCUITS, page 545) in the Cab Feature section of this manual.
611	14	6	4	4008/Bus 1604 F	Connector #4008 Pin #F Wiper power greater than normal high current and less than fusing current Connector #1604 Pin #F Bus (Wiper power) greater than normal high current and less than fusing current Refer to Wiper Motor Circuits (See WIPER MOTOR CIRCUITS, page 545) in the Cab Feature section of this manual.
611	14	6	6	4008/Bus 1604 F	Connector #4008 Pin #F Wiper power has current flow when output commanded off Connector #1604 Pin #F Bus (Wiper power) has current flow when output commanded off Refer to Wiper Motor Circuits (See WIPER MOTOR CIRCUITS, page 545) in the Cab Feature section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	7	1	4007/Bus 1603 G	Connector #4007 Pin #G High beam under current The Current from this output is below 0.5 A Open circuit Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	7	2	4007/Bus 1603 G	Connector #4007 Pin #G High beam over current The output behaves like a 20 amp type I circuit breaker Short to ground or overload Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	7	3	4007/Bus 1603 G	Connector #4007 Pin #G High beam less than normal low current but more than open circuit Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	7	4	4007/Bus 1603 G	Connector #4007 Pin #G High beam greater than normal high current and less than fusing current Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	7	6	4007/Bus 1603 G	Connector #4007 Pin #G High beam has current flow when output commanded off Refer to Headlight System(See HEADLIGHT SYSTEM, page 872) in the Light Systems section of this manual.
611	14	9	1	4008/Bus 1604 G	Connector #4008 Pin #G A/C Clutch under current Connector #1604 Pin #G (Left Rear Amber Flashers) under current The Current from this output is below 0.5 A Open circuit Refer to AC Compressor Circuits in the HVAC service manual section S16025.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	9	2	4008/Bus 1604 G	Connector #4008 Pin #G A/C Clutch over current Connector #1604 Pin #G (Left Rear Amber Flashers) over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to AC Compressor Circuits in the HVAC service manual section S16025.
611	14	9	3	4008/Bus 1604 G	Connector #4008 Pin #G A/C Clutch less than normal low current but more than open circuit Connector #1604 Pin #G (Left Rear Amber Flashers) less than normal low current but more than open circuit Refer to AC Compressor Circuits in the HVAC service manual section S16025.
611	14	9	4	4008/Bus 1604 G	Connector #4008 Pin #G A/C Clutch greater than normal high current and less than fusing current Connector #1604 Pin #G (Left Rear Amber Flashers) greater than normal high current and less than fusing current Refer to AC Compressor Circuits in the HVAC service manual section S16025.
611	14	9	6	4008/Bus 1604 G	Connector #4008 Pin #G A/C Clutch has current flow when output commanded off Connector #1604 Pin #G (Left Rear Amber Flashers) has current flow when output commanded off Refer to AC Compressor Circuits in the HVAC service manual section S16025.
611	14	10	1	1601/C	Connector #1601 Pin #C Dome light under current Connector #1601 Pin #C (BUS Right Rear Amber PWL) under current The Current from this output is below 0.5 A Open circuit Refer to dome light circuits (See DOME LIGHT CIRCUITS, page 858) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	10	2	1601/C	Connector #1601 Pin #C Dome light over current Connector #1601 Pin #C (BUS - Right Rear Amber PWL) over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to dome light circuits (See DOME LIGHT CIRCUITS, page 858) in the Light Systems section of this manual.
611	14	10	3	1601/C	Connector #1601 Pin #C Dome light less than normal low current but more than open circuit Connector #1601 Pin #C (BUS - Right Rear Amber PWL) less than normal low current but more than open circuit Refer to dome light circuits (See DOME LIGHT CIRCUITS, page 858) in the Light Systems section of this manual.
611	14	10	4	1601/C	Connector #1601 Pin #C Dome light greater than normal high current and less than fusing current Connector #1601 Pin #C (BUS - Right Rear Amber PWL) greater than normal high current and less than fusing current Refer to dome light circuits (See DOME LIGHT CIRCUITS, page 858) in the Light Systems section of this manual.
611	14	10	6	1601/C	Connector #1601 Pin #C Dome light has current flow when output commanded off Connector #1601 Pin #C (BUS - Right Rear Amber PWL) has current flow when output commanded off Refer to dome light circuits (See DOME LIGHT CIRCUITS, page 858) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	11	1	4007/Bus 1603 F	Connector #4007 Pin #F Work light under current Connector #1603 Pin #F (Right Front Amber PWL's) under current The Current from this output is below 0.5 A Open circuit Refer to Work Lights (See WORK LIGHT CIRCUIT OUTPUTS FROM ESC, page 937) in the Light Systems section of this manual.
611	14	11	2	4007/Bus 1603 F	Connector #4007 Pin #F Work light over current Connector #1603 Pin #F (Right Front Amber PWL's) over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to Work Lights (See WORK LIGHT CIRCUIT OUTPUTS FROM ESC, page 937) in the Light Systems section of this manual.
611	14	11	3	4007/Bus 1603 F	Connector #4007 Pin #F Work light less than normal low current but more than open circuit Connector #1603 Pin #F (Right Front Amber PWL's) less than normal low current but more than open circuit Refer to Work Lights (See WORK LIGHT CIRCUIT OUTPUTS FROM ESC, page 937) in the Light Systems section of this manual.
611	14	11	4	4007/Bus 1603 F	Connector #4007 Pin #F Work light greater than normal high current and less than fusing current Connector #1603 Pin #F (Right Front Amber PWL's) greater than normal high current and less than fusing current Refer to Work Lights (See WORK LIGHT CIRCUIT OUTPUTS FROM ESC, page 937) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	11	6	4007/Bus 1603 F	Connector #4007 Pin #F Work light has current flow when output commanded off Connector #1603 Pin #F (Right Front Amber ’s) has current flow when output commanded off Refer to Work Lights (See WORK LIGHT CIRCUIT OUTPUTS FROM ESC, page 937) in the Light Systems section of this manual.
611	14	12	1	4007/Bus 1603 E	Connector #4007 Pin #E Electric horn under current The Current from this output is below 0.5 A Open circuit Refer to Electric Horn (See ELECTRIC HORN CIRCUIT OUTPUTS FROM ESC, page 494) in the Cab Feature section of this manual.
611	14	12	2	4007/Bus 1603 E	Connector #4007 Pin #E Electric horn over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to Electric Horn (See ELECTRIC HORN CIRCUIT OUTPUTS FROM ESC, page 494) in the Cab Feature section of this manual.
611	14	12	3	4007/Bus 1603 E	Connector #4007 Pin #E Electric horn less than normal low current but more than open circuit Refer to Electric Horn (See ELECTRIC HORN CIRCUIT OUTPUTS FROM ESC, page 494) in the Cab Feature section of this manual.
611	14	12	4	4007/Bus 1603 E	Connector #4007 Pin #E Electric horn greater than normal high current and less than fusing current Refer to Electric Horn (See ELECTRIC HORN CIRCUIT OUTPUTS FROM ESC, page 494) in the Cab Feature section of this manual.
611	14	12	6	4007/Bus 1603 E	Connector #4007 Pin #E Electric horn has current flow when output commanded off Refer to Electric Horn (See ELECTRIC HORN CIRCUIT OUTPUTS FROM ESC, page 494) in the Cab Feature section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	13	1	4008/Bus 1604 C	Connector #4008 Pin #C Left rear turn lamp under current Connector #1604 Pin #C (Left rear turn lamp) under current The Current from this output is below 0.5 A Blown bulb or open circuit Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC (See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	13	2	4008/Bus 1604 C	Connector #4008 Pin #C Left rear turn lamp over current Connector #1604 Pin #C (Left rear turn lamp) over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	13	3	4008/Bus 1604 C	Connector #4008 Pin #C Left rear turn lamp less than normal low current but more than open circuit Connector #1604 Pin #C (Left rear turn lamp) less than normal low current but more than open circuit Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	13	4	4008/Bus 1604 C	Connector #4008 Pin #C Left rear turn lamp greater than normal high current and less than fusing current Connector #1604 Pin #C (Left rear turn lamp) greater than normal high current and less than fusing current Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	13	6	4008/Bus 1604 C	Connector #4008 Pin #C Left rear turn lamp has current flow when output commanded off Connector #1604 Pin #C (Left rear turn lamp) has current flow when output commanded off Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	14	1	4008/Bus 1604 B	Connector #4008 Pin #B Right rear turn lamp under current Connector #1604 Pin #B (Right rear turn lamp) under current The Current from this output is below 0.5 A Blown bulb or open circuit Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	14	2	4008/Bus 1604 B	Connector #4008 Pin #B Right rear turn lamp over current Connector #1604 Pin #B (Right rear turn lamp) over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	14	3	4008/Bus 1604 B	Connector #4008 Pin #B Right rear turn lamp less than normal low current but more than open circuit Connector #1604 Pin #B (Right rear turn lamp) less than normal low current but more than open circuit Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	14	4	4008/Bus 1604 B	Connector #4008 Pin #B Right rear turn lamp greater than normal high current and less than fusing current Connector #1604 Pin #B (Right rear turn lamp) greater than normal high current and less than fusing current Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	14	6	4008/Bus 1604 B	Connector #4008 Pin #B Right rear turn lamp has current flow when output commanded off Connector #1604 Pin #B (Right rear turn lamp) has current flow when output commanded off Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See REAR STOP/TURN SIGNAL/HAZARD LIGHT OUTPUTS FROM ESC, page 917) in the Light Systems section of this manual.
611	14	15	1	4007/Bus 1603 C	Connector #4007 Pin #C Left front turn lamp under current The Current from this output is below 0.5 A Blown bulbs or open circuit Refer to Rear Stop/Turn Signal/Hazard Light Outputs From ESC(See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
611	14	15	2	4007/Bus 1603 C	Connector #4007 Pin #C Left front turn lamp over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to left front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
611	14	15	3	4007/Bus 1603 C	Connector #4007 Pin #C Left front turn lamp less than normal low current but more than open circuit Refer to left front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	15	4	4007/Bus 1603 C	Connector #4007 Pin #C Left front turn lamp greater than normal high current and less than fusing current Refer to left front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
611	14	15	6	4007/Bus 1603 C	Connector #4007 Pin #C Left front turn lamp has current flow when output commanded off Refer to left front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
611	14	16	1	4007/Bus 1603 B	Connector #4007 Pin #B Right front turn lamp under current The Current from this output is below 0.5 A Blown bulb or open circuit Refer to right front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
611	14	16	2	4007/Bus 1603 B	Connector #4007 Pin #B Right front turn lamp over current The output behaves like a 10 Amp type III circuit breaker. Short to ground or overload Refer to right front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
611	14	16	3	4007/Bus 1603 B	Connector #4007 Pin #B Right front turn lamp less than normal low current but more than open circuit Refer to right front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
611	14	16	4	4007/Bus 1603 B	Connector #4007 Pin #B Right front turn lamp greater than normal high current and less than fusing current Refer to right front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
611	14	16	6	4007/Bus 1603 B	Connector #4007 Pin #B Right front turn lamp has current flow when output commanded off Refer to right front circuits (See FRONT TURN SIGNAL/HAZARD AND SEPARATE TURN SIGNAL LIGHT OUTPUTS FROM ESC, page 913) in the Light Systems section of this manual.
612	14	0	1	1600/2	Connector #1600 Pin #2 Ignition out of range low Shorted to ground or open Refer to ESC Power and Ground.(See ESC POWER AND GROUND, page 91)
612	14	0	2	1600/2	Connector #1600 Pin #2 Ignition out of range high Shorted high Refer to ESC Power and Ground.(See ESC POWER AND GROUND, page 91)
612	14	1	1	1600/33	Connector #1600 Pin #33 Brake switch out of range low Shorted to ground. Refer to hydraulic brake switch (See HYDRAULIC BRAKE SWITCH INPUTS TO ESC, page 906) or air brake switch (See AIR BRAKE SWITCH INPUTS TO ESC, page 909) in the Light Systems section of this manual.
612	14	1	2	1600/33	Connector #1600 Pin #33 Brake switch out of range high Shorted high or open circuit Refer to hydraulic brake switch (See HYDRAULIC BRAKE SWITCH INPUTS TO ESC, page 906) or air brake switch (See AIR BRAKE SWITCH INPUTS TO ESC, page 909) in the Light Systems section of this manual.
612	14	2	1	1600/17	Connector #1600 Pin #17 Upper Clutch Switch out of range low Shorted to ground. Refer to Clutch Switch (See CLUTCH SWITCH, page 558) in the Cab Features section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	2	2	1600/17	Connector #1600 Pin #17 Upper Clutch Switch out of range high Shorted high or open circuit Refer to Clutch Switch (See CLUTCH SWITCH, page 558) in the Cab Features section of this manual.
612	14	3	1	1600/16	Connector #1600 Pin #16 Secondary Air Sensor / Spare out of range low Short to ground, open circuit Secondary Air Pressure Gauge (See SECONDARY AIR PRESSURE GAUGE, page 289)
612	14	3	2	1600/16	Connector #1600 Pin #16 Secondary Air Sensor / Spare out of range high Shorted high Secondary Air Pressure Gauge (See SECONDARY AIR PRESSURE GAUGE, page 289)
612	14	4	1	1600/15	Connector #1600 Pin #15 Primary Air Sensor / Auxiliary Air Sensor out of range low Short to ground, open circuit For vehicles with air brakes, refer to Primary Air Pressure Gauge (See PRIMARY AIR PRESSURE GAUGE, page 281). For vehicles with hydraulic brakes, refer to Auxiliary Air Pressure Gauge (See AUXILIARY AIR PRESSURE GAUGE, page 296).
612	14	4	2	1600/15	Connector #1600 Pin #15 Primary Air Sensor / Auxiliary Air Sensor out of range high Shorted high For vehicles with air brakes, refer to Primary Air Pressure Gauge (See PRIMARY AIR PRESSURE GAUGE, page 281). For vehicles with hydraulic brakes, refer to Auxiliary Air Pressure Gauge (See AUXILIARY AIR PRESSURE GAUGE, page 296).

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	5	1	1600/10	Connector #1600 Pin #10 Analog cruise switch input out of range low Connector #1600 Pin #10 (Bus - Diags/flashers/Entrance Door Input) out of range low Shorted to ground or open circuit Refer to Cruise Control . The EGC cannot be put in diagnostic mode when there is a fault in these circuits. The INTUNE software must be used to view this DTC.
612	14	5	2	1600/10	Connector #1600 Pin #10 Analog cruise switch input out of range high Connector #1600 Pin #10 (Bus - Diags/flashers/Entrance Door Input) out of range high Shorted high Refer to Cruise Control . The EGC cannot be put in diagnostic mode when there is a fault in these circuits. The INTUNE software must be used to view this DTC.
612	14	23	1	4004/Bus 1602 4	Connector #4004/Bus 1602 Pin #4 Fuel level sensor out of range low Bus — Not Used This code is associated with a short to ground on the fuel level sensor on the storage tank for dual tank vehicles. Shorted to ground. Refer to Fuel Transfer System (See FUEL TRANSFER PUMP SYSTEM, page 681) in the Chassis Features section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	23	2	4004/Bus 1602 4	Connector #4004/Bus 1602 Pin #4 Fuel level sensor out of range high Bus — Not Used This code is associated with a short to accessory or open circuit on the fuel level sensor on the storage tank for dual tank vehicles. Shorted high or open circuit Refer to Fuel Transfer System (See FUEL TRANSFER PUMP SYSTEM, page 681) in the Chassis Features section of this manual.
612	14	24	1	4004/Bus 1602 23	Connector #4004 Pin #23 Hydraulic ABS warning lamp input out of range low Connector #1602 Pin #23 (Bus Wheel Chair Lift Solenoid) open circuit Open circuit Refer to ABS indicator (See ABS WARNING LAMP, page 224) in the Electronic Gauge Cluster section of this manual.
612	14	24	2	4004/Bus 1602 23	Connector #4004 Pin #23 Hydraulic ABS warning lamp input out of range high Connector #1602 Pin #23 (Bus Wheel Chair Lift Solenoid) shorted to battery Shorted high Refer to ABS indicator (See ABS WARNING LAMP, page 224) in the Electronic Gauge Cluster section of this manual.
612	14	25	1	4004/Bus 1602 5	Connector #4004/Bus 1602 Pin #5 Fuel level sensor out of range low This code is associated with a short to ground on the fuel level sensor on the draw tank for both single tank and dual tank vehicles. Shorted to ground. Refer to Fuel Level Gauge (See FUEL LEVEL GAUGE, page 256) in the Electronic Gauge Cluster section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	25	2	4004/Bus 1602 5	Connector #4004/Bus 1602 Pin #5 Fuel level sensor out of range high. This code is associated with a short to accessory or open circuit on the fuel level sensor on the draw tank for both single tank and dual tank vehicles. Shorted high or open circuit. Refer to Fuel Level Gauge (See FUEL LEVEL GAUGE, page 256) in the Electronic Gauge Cluster section of this manual.
612	14	27	1	4004/Bus 1602 6	Connector #4004/Bus 1602 Pin #6 Outlet HVAC thermistor out of range low Bus — Not Used Shorted to ground. Refer to AC Refrigerant Thermistors in the HVAC Troubleshooting in S16025.
612	14	27	2	4004/Bus 1602 6	Connector #4004/Bus 1602 Pin #6 Outlet HVAC thermistor out of range high Bus — Not Used Thermistor open circuit. Refer to AC Refrigerant Thermistors in the HVAC Troubleshooting in S16025.
612	14	29	1	4004/Bus 1602 7	Connector #4004/Bus 1602 Pin #7 Inlet HVAC thermistor out of range low Bus — Not Used Shorted to ground. Refer to AC Refrigerant Thermistors in the HVAC Troubleshooting in S16025.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	29	2	4004/Bus 1602 7	Connector #4004/Bus 1602 Pin #7 Inlet HVAC thermistor out of range high Bus — Not Used Thermistor open circuit. Refer to AC Refrigerant Thermistors in the HVAC Troubleshooting in S16025.
612	14	30	1	4004/Bus 1602 27	Connector #4004/Bus 1602 Pin #27 Switched 5 volt sensor supply out of range low Shorted to ground or open circuit All air gauges and air brake switches will be inoperative. Refer to ESC Switched 5 Volt Sensor Supply. (See ESC SWITCHED 5 VOLT SENSOR SUPPLY, page 93)
612	14	30	2	4004/Bus 1602 27	Connector #4004/Bus 1602 Pin #27 Switched 5 volt sensor supply out of range high Shorted high All air gauges and air brake switches will be inoperative. Refer to ESC Switched 5 Volt Sensor Supply. (See ESC SWITCHED 5 VOLT SENSOR SUPPLY, page 93)
612	14	31	1	4004/Bus 1602 8	Connector #4004/Bus #1602 Pin #8 (MD)HVAC high side pressure sensor out of range low Connector #1602 Pin #8 (Bus Crossing gate disable) out of range low Short to ground or open circuit Refer to AC Pressure Transducer in the HVAC Troubleshooting in S16025. Refer to Bus Crossing gate in the BUS Troubleshooting in S08290..

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	31	2	4004/Bus 1602 8	Connector #4004/Bus #1602 Pin #8 (MD)HVAC high side pressure sensor out of range high Connector #1602 Pin #8 (Bus Crossing gate disable) out of range high Shorted high Refer to AC Pressure Transducer in the HVAC Troubleshooting in S16025. Refer to Bus Crossing gate in the BUS Troubleshooting in S08290..
612	14	32	1	4004/Bus 1602 1	Connector #4004/Bus #1602 Pin #1 Rear Axle Oil Temperature out of range low Bus — Not Used Shorted to ground or open circuit. Refer to Rear-Rear Axle Temperature Gauge(See REAR-REAR AXLE OIL TEMPERATURE GAUGE, page 270).
612	14	32	2	4004/Bus 1602 1	Connector #4004/Bus #1602 Pin #1 Rear Axle Oil Temperature out of range high Bus — Not Used Shorted high. Refer to Rear-Rear Axle Temperature Gauge(See REAR-REAR AXLE OIL TEMPERATURE GAUGE, page 270) .
612	14	33	1	4004/Bus 1602 10	Connector #4004/Bus #1602 Pin #10 Engine Oil Temperature/Power Park Brake out of range low Bus — Not Used Short to ground or open circuit Refer to Engine Oil Temperature Gauge(See ENGINE OIL TEMPERATURE GAUGE, page 247) in the Electronic Gauge Cluster section of this manual. Refer to Air Application Gauge(See AIR APPLICATION GAUGE, page 312) in the Electronic Gauge Cluster section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	33	2	4004/Bus 1602 10	Connector #4004/Bus #1602 Pin #10 Engine Oil Temperature/Power Park Brake out of range high Bus — Not Used Shorted high Refer to Engine Oil Temperature Gauge(See ENGINE OIL TEMPERATURE GAUGE, page 247) in the Electronic Gauge Cluster section of this manual. Refer to Air Application Gauge(See AIR APPLICATION GAUGE, page 312) in the Electronic Gauge Cluster section of this manual.
612	14	34	1	4004/Bus 1602 2	Connector #4004/Bus 1602 Pin #2 Forward Rear Axle Temperature out of range low Bus — Not Used Shorted to ground. Refer to Forward-rear axle temperature gauge (See FORWARD-REAR AXLE OIL TEMPERATURE GAUGE, page 275)
612	14	35	1	4004/Bus 1602 13	Connector #4004/Bus 1602 Pin #13 (Brake Application Air) out of range low Bus — Not Used Short to ground or open circuit Refer to Air Application Gauge(See AIR APPLICATION GAUGE, page 312) in the Electronic Gauge Cluster section of this manual.
612	14	35	2	4004/Bus 1602 13	Connector #4004/Bus 1602 Pin #13 (Brake Application Air) out of range high Bus — Not Used Shorted high Refer to Air Application Gauge(See AIR APPLICATION GAUGE, page 312) in the Electronic Gauge Cluster section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
612	14	36	1	4004/Bus 1602 3	Connector #4004/Bus 1602 Pin #3 (Transmission Oil Temp/Spare) out of range low Shorted to ground. Refer to Transmission Oil Temperature Gauge (See TRANSMISSION OIL TEMPERATURE GAUGE, page 264)
613	14	1	1	N/A	HVAC Control Head air inlet fault This is a motor fault in the evaporator module. This motor controls the door in the evaporator module duct. Motor in the wrong position or jammed. Refer to Recirculation Motor in the HVAC service manual section S16025.
613	14	1	2	N/A	HVAC Control Head hot/cold temp. mix control fault This is a motor fault in the heater module. This motor controls the door in the heater module/blower scroll. Motor in the wrong position or jammed. Refer to Temperature Actuator in the HVAC service manual section S16025.
613	14	1	3	N/A	HVAC Control Head mode control fault. This is a motor fault in the kinematic network. This motor controls the doors in the kinematic network of the heater module. Motor in the wrong position or jammed. Refer to Mode Actuator in the HVAC service manual section S16025.
613	14	1	4	N/A	HVAC Control Head multiple motor faults. 2 or more motor faults. Motor in the wrong position or jammed. Refer to HVAC Control Head in the HVAC service manual section S16025.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
613	14	1	5	N/A	HVAC Control Head diagnostic circuit loss of communication with the ESC. Open circuit, short to ground or shorted high. Refer to HVAC Control Head in the HVAC service manual section S16025.
613	14	1	6	N/A	AC service soon At the current operating ambient temperature the system has lost enough charge that service should be performed to insure continued AC performance. Refer to HVAC Diagnostics in the HVAC service manual section S16025.
613	14	1	7	N/A	AC service now - low charge At the current operating ambient temperature the system has lost so much charge that the compressor must be shut off to prevent damage to it or other system components. Refer to HVAC Diagnostics in the HVAC service manual section S16025.
613	14	1	8	N/A	AC service now - very low charge At the current operating ambient temperature the system has lost so much charge that the compressor must be shut off to prevent damage to it or other system components. Refer to HVAC Diagnostics in the HVAC service manual section S16025.
613	14	1	9	N/A	AC service now - burst pipe An almost complete loss of charge has occurred due to pipe or other component rupture. The compressor is shut off so that no damage will occur. Refer to HVAC Diagnostics in the HVAC service manual section S16025.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
613	14	1	10	N/A	AC service now - fan problem/clogged pipe At the current operating ambient temperature the engine fan isn't working, one of the AC lines has become plugged or the system is over-charged. The compressor is shut off to prevent damage. Refer to HVAC Diagnostics in the HVAC service manual section S16025.
613	14	1	11	N/A	AC service now - compressor failure The compressor is not functioning Refer to HVAC Diagnostics in the HVAC service manual section S16025.
613	14	1	12	N/A	AC service now - rapid cycling The compressor clutch is cycling faster than once every 15 seconds. The compressor is not allowed to operate. Refer to HVAC Diagnostics in the HVAC service manual section S16025.
614	14	1	1	1600/ 34,35,36	Electronic Gauge Cluster #1 checksum error fixed by reteach. The configuration checksum in the cluster did not match the teach/reteach checksum in the ESC. This situation was corrected by the teach/reteach operation. Refer to EGC section.
614	14	1	2	1600/ 34,35,36	Electronic Gauge Cluster #1 checksum error could not be fixed. The configuration checksum in the cluster did not match the teach/reteach checksum in the ESC. This situation could not be corrected by the teach/reteach operation. Defective cluster Refer to EGC section.
614	14	23	1	1600/ 34,35,36	Electronic Gauge Cluster #1 checksum error fixed by reteach. The configuration checksum in the cluster did not match the teach/reteach checksum in the ESC. This situation was corrected by the teach/reteach operation. Refer to EGC section.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
614	14	23	2	1600/ 34,35,36	Electronic Gauge Cluster #1 checksum error could not be fixed. The configuration checksum in the cluster did not match the teach/reteach checksum in the ESC. This situation could not be corrected by the teach/reteach operation. Defective cluster Refer to EGC section.
614	14	40	1	1600/ 34,35,36	Auxiliary Gauge Switchpack #1 checksum error fixed by reteach. The configuration checksum in the AGSP did not match the teach/reteach checksum in the ESC. This situation was corrected by the teach/reteach operation. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
614	14	40	2	1600/ 34,35,36	Auxiliary Gauge Switchpack #1 checksum error could not be fixed. The configuration checksum in the AGSP did not match the teach/reteach checksum in the ESC. This situation could not be corrected by the teach/reteach operation. Defective AGSP Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
625	14	5	0	1600/ 29,30	Switch Pack #4 not communicating with the ESC (Lower half of 12 pack) The ESC sets the status of the switches in switch pack #4 to there default values. Switch data link fault. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	17	1600/ 29,30	Switch Pack #4 Switch #1, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #4 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	18	1600/ 29,30	Switch Pack #4 Switch #1, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #4 switch #1 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	19	1600/ 29,30	Switch Pack #4 Switch #1, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #4 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	20	1600/ 29,30	Switch Pack #4 Switch #1, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #4 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	21	1600/ 29,30	Switch Pack #4 Switch #1. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of Switch Pack #4 Switch #1 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	33	1600/ 29,30	Switch Pack #4 Switch #2, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #4 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	34	1600/ 29,30	Switch Pack #4 Switch #2, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #4 switch #2 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	35	1600/ 29,30	Switch Pack #4 Switch #2, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #4 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	36	1600/ 29,30	Switch Pack #4 Switch #2, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #4 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	37	1600/ 29,30	Switch Pack #4 Switch #2. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of Switch Pack #4 Switch #2 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	49	1600/ 29,30	Switch Pack #4 Switch #3, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of Switch Pack #4 Switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	50	1600/ 29,30	Switch Pack #4 Switch #3, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of Switch Pack #4 Switch #3 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	51	1600/ 29,30	Switch Pack #4 Switch #3, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #4 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	52	1600/ 29,30	Switch Pack #4 Switch #3, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of Switch Pack #4 Switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	53	1600/ 29,30	Switch Pack #4 Switch #3. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of Switch Pack #4 Switch #3 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	65	1600/ 29,30	Switch Pack #4 Switch #4, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of Switch Pack #4 Switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	66	1600/ 29,30	Switch Pack #4 Switch #4, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of Switch Pack #4 Switch #4 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	67	1600/ 29,30	Switch Pack #4 Switch #4, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of Switch Pack #4 Switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	68	1600/ 29,30	Switch Pack #4 Switch #4, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #4 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	69	1600/ 29,30	Switch Pack #4 Switch #4. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of Switch Pack #4 Switch #4 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	81	1600/ 29,30	Switch Pack #4 Switch #5, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of Switch Pack #4 Switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	82	1600/ 29,30	Switch Pack #4 Switch #5, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of Switch Pack #4 Switch #5 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	83	1600/ 29,30	Switch Pack #4 Switch #5, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of Switch Pack #4 Switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	84	1600/ 29,30	Switch Pack #4 Switch #5, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of Switch Pack #4 Switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	85	1600/ 29,30	Switch Pack #4 Switch #5. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of Switch Pack #4 Switch #5 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	97	1600/ 29,30	Switch Pack #4 Switch #6, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of Switch Pack #4 Switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	98	1600/ 29,30	Switch Pack #4 Switch #6, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of Switch Pack #4 Switch #6 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	99	1600/ 29,30	Switch Pack #4 Switch #6, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of Switch Pack #4 Switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	5	100	1600/ 29,30	Switch Pack #4 Switch #6, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of Switch Pack #4 Switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	5	101	1600/ 29,30	Switch Pack #4 Switch #6. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #4 switch #6 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	0	1600/ 29,30	Switch Pack #3 not communicating with the ESC (Upper half of 12 pack) The ESC sets the status of the switches in switch pack #3 to there default values Switch data link fault Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	17	1600/ 29,30	Switch Pack #3 Switch #1, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #3 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	6	18	1600/ 29,30	Switch Pack #3 Switch #1, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #3 switch #1 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	19	1600/ 29,30	Switch Pack #3 Switch #1, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #3 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	20	1600/ 29,30	Switch Pack #3 Switch #1, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #3 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	21	1600/ 29,30	Switch Pack #3 Switch #1. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #3 switch #1 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	6	33	1600/ 29,30	Switch Pack #3 Switch #2, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #3 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	34	1600/ 29,30	Switch Pack #3 Switch #2, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #3 switch #2 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	35	1600/ 29,30	Switch Pack #3 Switch #2, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	36	1600/ 29,30	Switch Pack #3 Switch #2, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	37	1600/ 29,30	Switch Pack #3 Switch #2. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #3 switch #2 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	6	49	1600/ 29,30	Switch Pack #3 Switch #3, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #3 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	50	1600/ 29,30	Switch Pack #3 Switch #3, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #3 switch #3 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	51	1600/ 29,30	Switch Pack #3 Switch #3, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #3 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	52	1600/ 29,30	Switch Pack #3 Switch #3, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #3 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	6	53	1600/ 29,30	Switch Pack #3 Switch #3. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #3 switch #3 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	65	1600/ 29,30	Switch Pack #3 Switch #4, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #3 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	66	1600/ 29,30	Switch Pack #3 Switch #4, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #3 switch #4 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	67	1600/ 29,30	Switch Pack #3 Switch #4, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #3 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	6	68	1600/ 29,30	Switch Pack #3 Switch #4, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #3 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	69	1600/ 29,30	Switch Pack #3 Switch #4. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #3 switch #4 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	81	1600/ 29,30	Switch Pack #3 Switch #5, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #3 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	82	1600/ 29,30	Switch Pack #3 Switch #5, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #3 switch #5 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	6	83	1600/ 29,30	Switch Pack #3 Switch #5, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #3 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	84	1600/ 29,30	Switch Pack #3 Switch #5, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #3 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	85	1600/ 29,30	Switch Pack #3 Switch #5. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #3 switch #5 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	97	1600/ 29,30	Switch Pack #3 Switch #6, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #3 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	6	98	1600/ 29,30	Switch Pack #3 Switch #6, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #3 switch #6 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	99	1600/ 29,30	Switch Pack #3 Switch #6, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #3 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	100	1600/ 29,30	Switch Pack #3 Switch #6, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #3 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	6	101	1600/ 29,30	Switch Pack #3 Switch #6. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #3 switch #6 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	0	1600/ 29,30	Switch pack #2 not communicating with the ESC The ESC sets the status of the switches in switch pack #2 to there default values Switch data link fault Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	17	1600/ 29,30	Switch Pack #2 Switch #1, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #2 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	18	1600/ 29,30	Switch Pack #2 Switch #1, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #2 switch #1 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	19	1600/ 29,30	Switch Pack #2 Switch #1, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #2 switch #1 to its default value. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	20	1600/ 29,30	Switch Pack #2 Switch #1, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #2 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	21	1600/ 29,30	Switch Pack #2 Switch #1. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #2 switch #1 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	33	1600/ 29,30	Switch Pack #2 Switch #2, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #2 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	34	1600/ 29,30	Switch Pack #2 Switch #2, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #2 switch #2 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	35	1600/ 29,30	Switch Pack #2 Switch #2, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #2 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	36	1600/ 29,30	Switch Pack #2 Switch #2, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #2 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	37	1600/ 29,30	Switch Pack #2 Switch #2. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #2 switch #2 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	49	1600/ 29,30	Switch Pack #2 Switch #3, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #2 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	50	1600/ 29,30	Switch Pack #2 Switch #3, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #2 switch #3 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	51	1600/ 29,30	Switch Pack #2 Switch #3, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #2 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	52	1600/ 29,30	Switch Pack #2 Switch #3, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #2 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	53	1600/ 29,30	Switch Pack #2 Switch #3. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #2 switch #3 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	65	1600/ 29,30	Switch Pack #2 Switch #4, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #2 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	66	1600/ 29,30	Switch Pack #2 Switch #4, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #2 switch #4 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	67	1600/ 29,30	Switch Pack #2 Switch #4, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #2 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	68	1600/ 29,30	Switch Pack #2 Switch #4, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #2 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	69	1600/ 29,30	Switch Pack #2 Switch #4. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #2 switch #4 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	81	1600/ 29,30	Switch Pack #2 Switch #5, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #2 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	82	1600/ 29,30	Switch Pack #2 Switch #5, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #2 switch #5 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	83	1600/ 29,30	Switch Pack #2 Switch #5, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #2 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	84	1600/ 29,30	Switch Pack #2 Switch #5, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #2 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	85	1600/ 29,30	Switch Pack #2 Switch #5. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #2 switch #5 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	97	1600/ 29,30	Switch Pack #2 Switch #6, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #2 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	98	1600/ 29,30	Switch Pack #2 Switch #6, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #2 switch #6 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	7	99	1600/ 29,30	Switch Pack #2 Switch #6, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #2 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	100	1600/ 29,30	Switch Pack #2 Switch #6, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #2 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	7	101	1600/ 29,30	Switch Pack #2 Switch #6. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #2 switch #6 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	0	1600/ 29,30	Switch pack #1 not communicating with the ESC The ESC sets the status of the switches in switch pack #1 to there default values Switch data link fault Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	17	1600/ 29,30	Switch Pack #1 Switch #1, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #1 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	18	1600/ 29,30	Switch Pack #1 Switch #1, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #1 switch #1 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	19	1600/ 29,30	Switch Pack #1 Switch #1, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #1 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	20	1600/ 29,30	Switch Pack #1 Switch #1, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #1 switch #1 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	21	1600/ 29,30	Switch Pack #1 Switch #1. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #1 switch #1 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	33	1600/ 29,30	Switch Pack #1 Switch #2, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #1 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	34	1600/ 29,30	Switch Pack #1 Switch #2, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #1 switch #2 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	35	1600/ 29,30	Switch Pack #1 Switch #2, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #1 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	36	1600/ 29,30	Switch Pack #1 Switch #2, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #1 switch #2 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	37	1600/ 29,30	Switch Pack #1 Switch #2. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #1 switch #2 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	49	1600/ 29,30	Switch Pack #1 Switch #3, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #1 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	50	1600/ 29,30	Switch Pack #1 Switch #3, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #1 switch #3 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	51	1600/ 29,30	Switch Pack #1 Switch #3, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #1 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	52	1600/ 29,30	Switch Pack #1 Switch #3, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #1 switch #3 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	53	1600/ 29,30	Switch Pack #1 Switch #3. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #1 switch #3 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	65	1600/ 29,30	Switch Pack #1 Switch #4, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #1 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	66	1600/ 29,30	Switch Pack #1 Switch #4, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #1 switch #4 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	67	1600/ 29,30	Switch Pack #1 Switch #4, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #1 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	68	1600/ 29,30	Switch Pack #1 Switch #4, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #1 switch #4 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	69	1600/ 29,30	Switch Pack #1 Switch #4. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #1 switch #4 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	81	1600/ 29,30	Switch Pack #1 Switch #5, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #1 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	82	1600/ 29,30	Switch Pack #1 Switch #5, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #1 switch #5 to its default value. Faulty microswitch Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	83	1600/ 29,30	Switch Pack #1 Switch #5, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #1 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	84	1600/ 29,30	Switch Pack #1 Switch #5, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #1 switch #5 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	85	1600/ 29,30	Switch Pack #1 Switch #5. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #1 switch #5 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	97	1600/ 29,30	Switch Pack #1 Switch #6, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of switch pack #1 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	98	1600/ 29,30	Switch Pack #1 Switch #6, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of switch pack #1 switch #6 to its default value. Faulty microswitch Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	99	1600/ 29,30	Switch Pack #1 Switch #6, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of switch pack #1 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	15	100	1600/ 29,30	Switch Pack #1 Switch #6, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of switch pack #1 switch #6 to its default value. Switch actuator Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	15	101	1600/ 29,30	Switch Pack #1 Switch #6. The switch should be empty but one or both microswitches is pressed. The ESC sets the status of switch pack #1 switch #6 to its default value. Switch actuator or faulty microswitch. Refer to the Switch Pack Module section of this manual. (See SWITCH PACK MODULES, page 124)
625	14	64	0	1600/ 29,30	Front passenger side Door Pod not communicating with the ESC The status message from the door pod has not been received by the ESC Switch data link fault Refer to the Front Power Windows and Locks section of this manual.
625	14	64	7	1600/ 29,30	Front passenger side Door Pod window motor failure The window motor drive circuit is not functioning This could be a short in the window motor, an open in the window motor or a jammed window. Refer to the Front Power Windows and Locks section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	64	8	1600/ 29,30	Front passenger side Door Pod door lock motor failure The Door Lock Actuation Solenoid is not functioning This could be a short in the solenoid, open in the solenoid, or a jammed solenoid. Refer to the Front Power Windows and Locks section of this manual.
625	14	64	9	1600/ 29,30	Front passenger side Door Pod module failure A failure has occurred in the Door Pod module circuitry. Defective door pod. Refer to the Front Power Windows and Locks section of this manual.
625	14	65	0	1600/ 29,30	Rear passenger side Door Pod not communicating with the ESC The status message from the door pod has not been received by the ESC Switch data link fault Refer to the Crew Cab Rear Power Windows And Locks section of this manual.
625	14	65	7	1600/ 29,30	Rear passenger side Door Pod window motor failure The window motor drive circuit is not functioning This could be a short in the window motor, an open in the window motor or a jammed window. Refer to the Crew Cab Rear Power Windows And Locks section of this manual.
625	14	65	8	1600/ 29,30	Rear passenger side Door Pod door lock motor failure The Door Lock Actuation Solenoid is not functioning This could be a short in the solenoid, open in the solenoid, or a jammed solenoid. Refer to the Crew Cab Rear Power Windows And Locks section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	65	9	1600/ 29,30	Rear passenger side Door Pod module failure A failure has occurred in the Door Pod module circuitry. Defective door pod. Refer to the Crew Cab Rear Power Windows And Locks section of this manual.
625	14	66	0	1600/ 29,30	Rear driver side Door Pod not communicating with the ESC The status message from the door pod has not been received by the ESC Switch data link fault Refer to the Crew Cab Rear Power Windows And Locks section of this manual.
625	14	66	7	1600/ 29,30	Rear drivers side Door Pod window motor failure The window motor drive circuit is not functioning This could be a short in the window motor, an open in the window motor or a jammed window. Refer to the Crew Cab Rear Power Windows And Locks section of this manual.
625	14	66	8	1600/ 29,30	Rear drivers side Door Pod door lock motor failure The Door Lock Actuation Solenoid is not functioning This could be a short in the solenoid, open in the solenoid, or a jammed solenoid. Refer to the Crew Cab Rear Power Windows And Locks section of this manual.
625	14	66	9	1600/ 29,30	Rear drivers side Door Pod module failure A failure has occurred in the Door Pod module circuitry. Defective door pod Refer to the Crew Cab Rear Power Windows And Locks section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
625	14	130	0	1600/ 29,30	Front drivers side Door Pod not communicating with the ESC The status message from the door pod has not been received by the ESC Switch data link fault Refer to the Front Power Windows and Locks section of this manual.
625	14	130	7	1600/ 29,30	Front drivers side Door Pod window motor failure The window motor drive circuit is not functioning This could be a short in the window motor, an open in the window motor or a jammed window. Refer to the Front Power Windows and Locks section of this manual.
625	14	130	8	1600/ 29,30	Front drivers side Door Pod door lock motor failure The Door Lock Actuation Solenoid is not functioning This could be a short in the solenoid, open in the solenoid, or a jammed solenoid. Refer to the Front Power Windows and Locks section of this manual.
625	14	130	9	1600/ 29,30	Front drivers side Door Pod module failure A failure has occurred in the Door Pod module circuitry. Defective door pod Refer to the Front Power Windows and Locks section of this manual.
627	14	1	1	4010/ A	ESC power supply #1 open circuit Open Circuit Refer to the ESC Power and Ground(See ESC POWER AND GROUND, page 91) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
639	14	0	240	1600/ 34,35,36	Engine retarder torque not being communicated from the ECM or transmission retarder torque not being communicated from Allison WTEC transmission PGN 61440–SA 15 or 16 Refer to the appropriate Allison manual or engine diagnostic manual. Refer to the Transmission section of this manual.
639	14	1	240	1600/ 34,35,36	ABS controller not communicating with the ESC PGN 61441–SA 11 Refer to the Air ABS Power and Data Link section of this manual. (See AIR ABS POWER AND DATA LINK CIRCUITS, page 631)
639	14	2	240	1600/ 34,35,36	Electronic transmission controller communication has not been received PGN 61442–SA 3 Refer to the Transmission section of this manual.
639	14	3	240	1600/ 34,35,36	Accelerator position not communicated to the ESC PGN 61443–SA 0 Refer to information for the engine in this vehicle in Engine section of this manual.
639	14	4	240	1600/ 34,35,36	Engine speed not communicated to the ESC PGN 61444–SA 0 Refer to information for the engine in this vehicle in Engine section of this manual.
639	14	5	240	1600/ 34,35,36	Current gear, range inhibit and check transmission lamps not communicated to the ESC. PGN 61445–SA 3 Refer to the applicable transmission manual for this vehicle. Refer to the Transmission section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
639	14	8	240	1600/ 34,35,36	Electronic pressure mode indicator not communicated to the ESC PGN 61448–SA 0 Refer to information for the engine in this vehicle in Engine section of this manual.
639	14	33	239	1600/ 34, 35, 36	EGC not communicating with the ESC or AGSP not communicating with the ESC PGN 61148–DA 33 —SA 23 or 40 Refer to EGC Power and Data Link Troubleshooting. (See EGC POWER AND DATA LINK CIRCUITS, page 164)
639	14	82	254	1600/ 34,35,36	Pyrometer Ammeter not communicating to the ESC PGN 65106–SA 10 Refer to information for the Pyrometer Ammeter module (PAM) in this vehicle in Chassis Features section of this manual.
639	14	192	254	1600/ 34,35,36	Fuel filter status not communicated to the ESC PGN 65216–SA 00 Refer to information for the Fuel filter in this vehicle in Chassis Features section of this manual.
639	14	202	254	1600/ 34,35,36	Engine Lamp information not communicated to the ESC PGN 65226–SA 0 Refer to information for the engine in this vehicle in Engine section of this manual.
639	14	228	254	1600/ 34,35,36	Wait to start lamp information not communicated to the ESC PGN 65252–SA 0 Refer to information for the engine in this vehicle in Engine section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
639	14	230	253	1600/ 34,35,36	Full Power Park Brake information not communicating to the ESC PGN 64998–SA 08 Refer to information for the Full Power Park Brake in this vehicle in Chassis Features section of this manual. Refer to Full Power Park Brake in the Full Power Park Brake Troubleshooting in S04048.
639	14	241	254	1600/ 34,35,36	Cruise control enable, active, state and vehicle speed not communicated to the ESC PGN 65265–SA 0 Refer to information for the engine in this vehicle in Engine section of this manual.
639	14	250	254	1600/ 34,35,36	Brake message is not being communicated to the ESC PGN 65274–SA 08 Refer to information for the brake in this vehicle in Chassis Features section of this manual. Refer to Full Power Brake in the Full Power Brake Troubleshooting in S04048.
639	14	251	254	1600/ 34,35,36	Retarder overheat lamp information not communicated to the ESC PGN 65275–SA 3 Refer to the applicable manual for the transmission on this vehicle. Refer to the Transmission section of this manual.
639	14	255	254	1600/ 34,35,36	Water in fuel indicator not communicating to the ESC PGN 65279–SA 0 Refer to information for the Water in fuel indicator in this vehicle in Chassis Features section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1231	14	**0–255**	3	4004/Bus 1602 34, 35,36	Unconfigured Source Address Something with the source address in Byte 7 is broadcasting on the data link and the ESC is not configured to expect it. Unexpected or incorrectly addressed module is on the data link. Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
1231	14	34	1	4004/Bus 1602 34, 35,36	RASM #1 not communicating with the ESC Failed Source Address/Message Time-out PGN 65441–SA 34 Drivetrain J1939 data link, an improperly addressed RASM module, or a missing RASM module that the ESC is expecting Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
1231	14	34	2	4004/Bus 1602 34, 35,36	More than one RASM responds back as RASM #1 Multiple Source Address PGN 65441–SA 234 Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
1231	14	209	1	4004/Bus 1602 34, 35,36	Remote engine speed control module is not communicating with the ESC Failed Source Address/Message Time-out PGN 65441–SA 234 Drivetrain J1939 data link, an improperly addressed RESCM module, or a missing RESCM module that the ESC is expecting Refer to Remote Engine Speed Control Module(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750).

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1231	14	209	2	4004/Bus 1602 34, 35,36	More than one Remote engine speed control module with the same source address is responding to the ESC. Multiple Source Address PGN 65441–SA 234 Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
1231	14	225	1	4004/Bus 1602 34, 35,36	RPM #1 not communicating with the ESC Failed Source Address/Message Time-out PGN 65313–SA 225 Drivetrain J1939 data link, an improperly addressed RPM module, or a missing RPM module that the ESC is expecting Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
1231	14	225	2	4004/Bus 1602 34, 35,36	More than one RPM responds back as RPM #1 Multiple Source Address PGN 65313–SA 225 Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
1231	14	226	1	4004/Bus 1602 34, 35,36	RPM #2 not communicating with the ESC Failed Source Address/Message Time-out PGN 65313–SA 226 Drivetrain J1939 data link, an improperly addressed RPM module, or a missing RPM module that the ESC is expecting Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1231	14	226	2	4004/Bus 1602 34, 35,36	More than one RPM responds back as RPM #2 Multiple Source Address PGN 65313–SA 226 Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
1231	14	228	1	4004/Bus 1602 34, 35,36	RPM #4 not communicating with the ESC Failed Source Address/Message Time-out PGN 65313–SA 228 Drivetrain J1939 data link, an improperly addressed RPM module, or a missing RPM module that the ESC is expecting Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
1231	14	228	2	4004/Bus 1602 34, 35,36	More than one RPM responds back as RPM #4 Multiple Source Address PGN 65313–SA 228 Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
1231	14	231	1	4004/Bus 1602 34, 35,36	RPM #7 not communicating with the ESC Failed Source Address/Message Time-out PGN 65313–SA 231 Drivetrain J1939 data link, an improperly addressed RPM module, or a missing RPM module that the ESC is expecting Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
1231	14	231	2	4004/Bus 1602 34, 35,36	More than one RPM responds back as RPM #7 Multiple Source Address PGN 65313–SA 231 Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1231	14	234	1	4004/Bus 1602 34, 35,36	RASM #2 not communicating with the ESC Failed Source Address/Message Time-out PGN 65441–SA 234 Drivetrain J1939 data link, an improperly addressed RASM module, or a missing RASM module that the ESC is expecting Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
1231	14	234	2	4004/Bus 1602 34, 35,36	More than one RASM responds back as RASM #2 Multiple Source Address PGN 65441–SA 234 Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
1542	14	1	1	4009/ A	ESC power supply #2 open circuit Open Circuit Refer to the ESC Power and Ground(See ESC POWER AND GROUND, page 91) section of this manual.
1557	0	1	1	N/A	ESC internal fault software main loop time exceeded. There are too many features and the main loop is exceeding its maximum execution time. Truck may work partially or not at all. This indicates ESC is incapable of handling this configuration. Software configuration too big. Refer to the Electrical System Controller(See ELECTRICAL SYSTEM CONTROLLER, page 85) section of this manual.
1705	14	101	3	N/A	EGC gauge location 1 (tachometer) out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	101	4	N/A	EGC gauge location 1 (tachometer) out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to Tachometer (See TACHOMETER, page 253)
1705	14	101	5	N/A	EGC gauge location 1 (tachometer) sensor fault There is a problem with the sensor that provides the data for this gauge. Refer to Tachometer (See TACHOMETER, page 253)
1705	14	101	6	N/A	EGC gauge location 1 (tachometer) data unavailable The data that this gauge displays should be, but is not available at this time. Refer to Tachometer (See TACHOMETER, page 253)
1705	14	102	3	N/A	EGC gauge location 2 (speedometer) out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to Speedometer (See SPEEDOMETER, page 250)
1705	14	102	4	N/A	EGC gauge location 2 (speedometer) out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to Speedometer (See SPEEDOMETER, page 250)
1705	14	102	5	N/A	EGC gauge location 2 (speedometer) sensor fault There is a problem with the sensor that provides the data for this gauge. Refer to Speedometer (See SPEEDOMETER, page 250)
1705	14	102	6	N/A	EGC gauge location 2 (speedometer) data unavailable The data that this gauge displays should be, but is not available at this time. Refer to Speedometer (See SPEEDOMETER, page 250)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	103	3	N/A	EGC gauge location 3 (engine coolant temperature) out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to Engine Coolant Temperature Gauge. (See ENGINE COOLANT TEMPERATURE GAUGE, page 241)
1705	14	103	4	N/A	EGC gauge location 3 (engine coolant temperature) out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to Engine Coolant Temperature Gauge. (See ENGINE COOLANT TEMPERATURE GAUGE, page 241)
1705	14	103	5	N/A	EGC gauge location 3 (engine coolant temperature) sensor fault There is a problem with the sensor that provides the data for this gauge. Refer to Engine Coolant Temperature Gauge. (See ENGINE COOLANT TEMPERATURE GAUGE, page 241)
1705	14	103	6	N/A	EGC gauge location 3 (engine coolant temperature) data unavailable The data that this gauge displays should be, but is not available at this time. Refer to Engine Coolant Temperature Gauge. (See ENGINE COOLANT TEMPERATURE GAUGE, page 241)
1705	14	104	3	N/A	EGC gauge location 4 out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	104	4	N/A	EGC gauge location 4 out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. The gauge in this location can be any optional gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	104	5	N/A	EGC gauge location 4 sensor fault The gauge in this location can be any optional gauge. There is a problem with the sensor that provides the data for this gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	104	6	N/A	EGC gauge location 4 data unavailable The data that this gauge displays should be, but is not available at this time. The gauge in this location can be any optional gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	105	3	N/A	EGC gauge location 5 (oil pressure) out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to Engine Oil Pressure Gauge. (See ENGINE OIL PRESSURE GAUGE, page 244)
1705	14	105	4	N/A	EGC gauge location 5 (oil pressure) out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to Engine Oil Pressure Gauge. (See ENGINE OIL PRESSURE GAUGE, page 244)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	105	5	N/A	EGC gauge location 5 (oil pressure) sensor fault There is a problem with the sensor that provides the data for this gauge. Refer to Engine Oil Pressure Gauge. (See ENGINE OIL PRESSURE GAUGE, page 244)
1705	14	105	6	N/A	EGC gauge location 5 (oil pressure) data unavailable The data that this gauge displays should be, but is not available at this time. Refer to Engine Oil Pressure Gauge. (See ENGINE OIL PRESSURE GAUGE, page 244)
1705	14	106	3	N/A	EGC gauge location 6 out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	106	4	N/A	EGC gauge location 6 out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	106	5	N/A	EGC gauge location 6 sensor fault There is a problem with the sensor that provides the data for this gauge. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	106	6	N/A	EGC gauge location 6 data unavailable The data that this gauge displays should be, but is not available at this time. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	107	3	N/A	EGC gauge location 7 (fuel level) out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to Fuel Level Gauge. (See FUEL LEVEL GAUGE, page 256)
1705	14	107	4	N/A	EGC gauge location 7 (fuel level) out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to Fuel Level Gauge. (See FUEL LEVEL GAUGE, page 256)
1705	14	107	5	N/A	EGC gauge location 7 (fuel level) sensor fault There is a problem with the sensor that provides the data for this gauge. Refer to Fuel Level Gauge. (See FUEL LEVEL GAUGE, page 256)
1705	14	107	6	N/A	EGC gauge location 7 (fuel level) data unavailable The data that this gauge displays should be, but is not available at this time. Refer to Fuel Level Gauge. (See FUEL LEVEL GAUGE, page 256)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	108	3	N/A	EGC gauge location 8 out of range high On vehicles with air brakes this is the primary air gauge. On vehicles with hydraulic brakes this can be any optional gauge Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	108	4	N/A	EGC gauge location 8 out of range low On vehicles with air brakes this is the primary air gauge. On vehicles with hydraulic brakes this can be any optional gauge Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	108	5	N/A	EGC gauge location 8 sensor fault On vehicles with air brakes this is the primary air gauge. On vehicles with hydraulic brakes this can be any optional gauge There is a problem with the sensor that provides the data for this gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	108	6	N/A	EGC gauge location 8 data unavailable On vehicles with air brakes this is the primary air gauge. On vehicles with hydraulic brakes this can be any optional gauge The data that this gauge displays should be, but is not available at this time. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	109	3	N/A	EGC gauge location 9 (volts) out of range high Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to Voltmeter. (See VOLTMETER, page 238)
1705	14	109	4	N/A	EGC gauge location 9 (volts) out of range low Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to Voltmeter. (See VOLTMETER, page 238)
1705	14	109	5	N/A	EGC gauge location 9 (volts) sensor fault There is a problem with the sensor that provides the data for this gauge. Refer to Voltmeter. (See VOLTMETER, page 238)
1705	14	109	6	N/A	EGC gauge location 9 (volts) data unavailable The data that this gauge displays should be, but is not available at this time. Refer to Voltmeter. (See VOLTMETER, page 238)
1705	14	110	3	N/A	EGC gauge location 10 out of range high On vehicles with air brakes this is the secondary air gauge. On vehicles with hydraulic brakes this can be any optional gauge Data for this gauge is above the value that the gauge can display. For example: a value exceeding the gauge maximum scale value. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	110	4	N/A	EGC gauge location 10 out of range low On vehicles with air brakes this is the secondary air gauge. On vehicles with hydraulic brakes this can be any optional gauge Data for this gauge is below the minimum value the gauge can display. For example: the lowest scale value on the gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	110	5	N/A	EGC gauge location 10 sensor fault On vehicles with air brakes this is the secondary air gauge. On vehicles with hydraulic brakes this can be any optional gauge There is a problem with the sensor that provides the data for this gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	110	6	N/A	EGC gauge location 10 data unavailable On vehicles with air brakes this is the secondary air gauge. On vehicles with hydraulic brakes this can be any optional gauge The data that this gauge displays should be, but is not available at this time. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
1705	14	150	1	N/A	ESC not communicating with the EGC. Loss of communication in excess of 10 seconds. Drivetrain J1939 data link. Refer to the Electrical System Controller(See ELECTRICAL SYSTEM CONTROLLER, page 85) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
1705	14	150	2	N/A	Engine Controller not communicating with the EGC. Loss of communication in excess of 10 seconds. Drivetrain J1939 data link. Refer to the Electronic Engine Controls section of this manual.
2023	14	101 or 201	5	N/A	EGC gauge location 1 (tachometer) sensor fault to primary EGC (101) or secondary EGC (201) There is a problem with the sensor that provides the data for this gauge. Refer to Tachometer (See TACHOMETER, page 253)
2023	14	101 or 201	6	N/A	EGC gauge location 1 (tachometer) data unavailable to primary EGC (101) or secondary EGC (201) The data that this gauge displays should be, but is not available at this time. Refer to Tachometer (See TACHOMETER, page 253)
2023	14	101 or 201	7	N/A	EGC gauge location 1 (tachometer) data missing to primary EGC (101) or secondary EGC (201) The data for this gauge is not being transmitted on the datalink. Refer to Tachometer (See TACHOMETER, page 253)
2023	14	102 or 202	5	N/A	EGC gauge location 2 (speedometer) sensor fault to primary EGC (102) or secondary EGC (202) There is a problem with the sensor that provides the data for this gauge. Refer to Speedometer (See SPEEDOMETER, page 250)
2023	14	102 or 202	6	N/A	EGC gauge location 2 (speedometer) data unavailable to primary EGC (102) or secondary EGC (202) The data that this gauge displays should be, but is not available at this time. Refer to Speedometer (See SPEEDOMETER, page 250)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	102 or 202	7	N/A	EGC gauge location 2 (speedometer) data missing to primary EGC (102) or secondary EGC (202) The data for this gauge is not being transmitted on the datalink. Refer to Speedometer (See SPEEDOMETER, page 250)
2023	14	103 or 203	5	N/A	EGC gauge location 3 (engine coolant temperature) sensor fault to primary EGC (103) or secondary EGC (203) There is a problem with the sensor that provides the data for this gauge. Refer to Engine Coolant Temperature Gauge. (See ENGINE COOLANT TEMPERATURE GAUGE, page 241)
2023	14	103 or 203	6	N/A	EGC gauge location 3 (engine coolant temperature) data unavailable to primary EGC (103) or secondary EGC (203) The data that this gauge displays should be, but is not available at this time. Refer to Engine Coolant Temperature Gauge. (See ENGINE COOLANT TEMPERATURE GAUGE, page 241)
2023	14	103 or 203	7	N/A	EGC gauge location 3 (engine coolant temperature) data missing to primary EGC (103) or secondary EGC (203) The data for this gauge is not being transmitted on the datalink. Refer to Engine Coolant Temperature Gauge. (See ENGINE COOLANT TEMPERATURE GAUGE, page 241)
2023	14	104 or 204	5	N/A	EGC gauge location 4 sensor fault to primary EGC (104) or secondary EGC (204) The gauge in this location can be any optional gauge. There is a problem with the sensor that provides the data for this gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	104 or 204	6	N/A	EGC gauge location 4 data unavailable to primary EGC (104) or secondary EGC (204) The data that this gauge displays should be, but is not available at this time. The gauge in this location can be any optional gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	104 or 204	7	N/A	EGC gauge location 4 data missing to primary EGC (104) or secondary EGC (204) The data for this gauge is not being transmitted on the datalink. The gauge in this location can be any optional gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	105 or 205	5	N/A	EGC gauge location 5 (oil pressure) sensor fault to primary EGC (105) or secondary EGC (205) There is a problem with the sensor that provides the data for this gauge. Refer to Engine Oil Pressure Gauge. (See ENGINE OIL PRESSURE GAUGE, page 244)
2023	14	105 or 205	6	N/A	EGC gauge location 5 (oil pressure) data unavailable to primary EGC (105) or secondary EGC (205) The data that this gauge displays should be, but is not available at this time. Refer to Engine Oil Pressure Gauge. (See ENGINE OIL PRESSURE GAUGE, page 244)
2023	14	105 or 205	7	N/A	EGC gauge location 5 (oil pressure) data missing to primary EGC (105) or secondary EGC (205) The data for this gauge is not being transmitted on the datalink. Refer to Engine Oil Pressure Gauge. (See ENGINE OIL PRESSURE GAUGE, page 244)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	106 or 206	5	N/A	EGC gauge location 6 sensor fault to primary EGC (106) or secondary EGC (206) There is a problem with the sensor that provides the data for this gauge. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	106 or 206	6	N/A	EGC gauge location 6 data unavailable to primary EGC (106) or secondary EGC (206) The data that this gauge displays should be, but is not available at this time. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	106 or 206	7	N/A	EGC gauge location 6 data missing to primary EGC (106) or secondary EGC (206) The data for this gauge is not being transmitted on the datalink. The gauge in this location is optional. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	107 or 207	5	N/A	EGC gauge location 7 (fuel level) sensor fault to primary EGC (107) or secondary EGC (207) There is a problem with the sensor that provides the data for this gauge. Refer to Fuel Level Gauge. (See FUEL LEVEL GAUGE, page 256)
2023	14	107 or 207	6	N/A	EGC gauge location 7 (fuel level) data unavailable to primary EGC (107) or secondary EGC (207) The data that this gauge displays should be, but is not available at this time. Refer to Fuel Level Gauge. (See FUEL LEVEL GAUGE, page 256)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	107 or 207	7	N/A	EGC gauge location 7 (fuel level) data missing to primary EGC (107) or secondary EGC (207) The data for this gauge is not being transmitted on the datalink. Refer to Fuel Level Gauge. (See FUEL LEVEL GAUGE, page 256)
2023	14	108 or 208	5	N/A	EGC gauge location 8 Primary/Auxiliary Air Pressure Gauge sensor fault to Primary EGC (108) or Secondary EGC (208) On vehicles with air brakes this is the primary air gauge. On vehicles with hydraulic brakes this can be any optional gauge There is a problem with the sensor that provides the data for this gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	108 or 208	6	N/A	EGC gauge location 8 Primary/Auxiliary Air Pressure Gauge data unavailable to Primary EGC (108) or Secondary EGC (208) On vehicles with air brakes this is the primary air gauge. On vehicles with hydraulic brakes this can be any optional gauge The data that this gauge displays should be, but is not available at this time. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	108 or 208	7	N/A	EGC gauge location 8 Primary/Auxiliary Air Pressure Gauge data missing to Primary EGC (108) or Secondary EGC (208) On vehicles with air brakes this is the primary air gauge. On vehicles with hydraulic brakes this can be any optional gauge The data for this gauge is not being transmitted on the datalink. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	109 or 209	5	N/A	EGC gauge location 9 Voltmeter sensor fault to primary EGC (109) or secondary EGC (209) There is a problem with the sensor that provides the data for this gauge. Refer to Voltmeter. (See VOLTMETER, page 238)
2023	14	109 or 209	6	N/A	EGC gauge location 9 Voltmeter data unavailable to primary EGC (109) or secondary EGC (209) The data that this gauge displays should be, but is not available at this time. Refer to Voltmeter. (See VOLTMETER, page 238)
2023	14	109 or 209	7	N/A	EGC gauge location 9 Voltmeter data missing to primary EGC (109) or secondary EGC (209) The data for this gauge is not being transmitted on the datalink. Refer to Voltmeter. (See VOLTMETER, page 238)

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	110 or 210	5	N/A	EGC gauge location 10 Secondary Air Pressure Gauge sensor fault to Primary EGC (110) or Secondary EGC (210) On vehicles with air brakes this is the secondary air gauge. On vehicles with hydraulic brakes this can be any optional gauge There is a problem with the sensor that provides the data for this gauge. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	110 or 210	6	N/A	EGC gauge location 10 Secondary Air Pressure Gauge data unavailable to Primary EGC (110) or Secondary EGC (210) On vehicles with air brakes this is the secondary air gauge. On vehicles with hydraulic brakes this can be any optional gauge The data that this gauge displays should be, but is not available at this time. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.
2023	14	110 or 210	7	N/A	EGC gauge location 10 Secondary Air Pressure Gauge data missing to Primary EGC (110) or Secondary EGC (210) On vehicles with air brakes this is the secondary air gauge. On vehicles with hydraulic brakes this can be any optional gauge The data for this gauge is not being transmitted on the datalink. Refer to the Electronic Gauge Cluster(See Table 23, page 146) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	150 or 250	1	N/A	Loss of data link from ESC to primary EGC (150) or secondary EGC (250) Loss of communication in excess of 10 seconds. Drivetrain J1939 data link. Refer to the Electrical System Controller(See ELECTRICAL SYSTEM CONTROLLER, page 85) section of this manual.
2023	14	150 or 250	2	N/A	Engine Controller not communicating with the primary EGC (150) or secondary EGC (250) Loss of communication in excess of 10 seconds. Drivetrain J1939 data link. Refer to the Electronic Engine Controls section of this manual.
2023	14	150 or 250	8	N/A	ABS warning light malfunction on primary EGC (150) or secondary EGC (250) Refer to the ABS warning light(See ABS WARNING LAMP, page 224) section of this manual.
2023	14	150 or 250	9	N/A	Trailer ABS warning light malfunction on primary EGC (150) or secondary EGC (250) Refer to the Trailer ABS Lamp (See TRAILER ABS LAMP, page 199) section of this manual.
2023	14	50, 40, 30, or 20	1	N/A	ESC not communicating with AGSP 1 (50), AGSP 2 (20), AGSP 3 (30), or AGSP 4 (40). Loss of communication in excess of 10 seconds. Drivetrain J1939 data link. Refer to the Electrical System Controller(See ELECTRICAL SYSTEM CONTROLLER, page 85) section of this manual.
2023	14	50, 40, 30, or 20	10	N/A	Ignition signal from datalink from ESC does not match hardwired ignition signal on AGSP 1 (50), AGSP 2 (20), AGSP 3 (30), or AGSP 4 (40). Ignition Circuit to ESC/AGSP. Refer to the Electronic Engine Controls section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	1, 11, 21, 31	5	N/A	Gauge location 1 sensor fault on AGSP 1 (1), AGSP 2 (11), AGSP 3 (21), or AGSP 4 (31). There is a problem with the sensor that provides the data for this gauge. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2023	14	1, 11, 21, 31	6	N/A	Gauge location 1 data unavailable on AGSP 1 (1), AGSP 2 (11), AGSP 3 (21), or AGSP 4 (31). The data that this gauge displays should be, but is not available at this time. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2023	14	1, 11, 21, 31	7	N/A	Gauge location 1 data missing on AGSP 1 (1), AGSP 2 (11), AGSP 3 (21), or AGSP 4 (31). The data for this gauge is not being transmitted on the datalink. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2023	14	2, 12, 22, 32	5	N/A	Gauge location 2 sensor fault on AGSP 1 (2), AGSP 2 (12), AGSP 3 (22), or AGSP 4 (32). There is a problem with the sensor that provides the data for this gauge. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2023	14	2, 12, 22, 32	6	N/A	Gauge location 2 data unavailable on AGSP 1 (2), AGSP 2 (12), AGSP 3 (22), or AGSP 4 (32). The data that this gauge displays should be, but is not available at this time. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2023	14	2, 12, 22, 32	7	N/A	Gauge location 2 data missing on AGSP 1 (2), AGSP 2 (12), AGSP 3 (22), or AGSP 4 (32). The data for this gauge is not being transmitted on the datalink. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2023	14	3, 13, 23, 33	5	N/A	Gauge location 3 sensor fault on AGSP 1 (3), AGSP 2 (13), AGSP 3 (23), or AGSP 4 (33). There is a problem with the sensor that provides the data for this gauge. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2023	14	3, 13, 23, 33	6	N/A	Gauge location 3 data unavailable on AGSP 1 (3), AGSP 2 (13), AGSP 3 (23), or AGSP 4 (33). The data that this gauge displays should be, but is not available at this time. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2023	14	3, 13, 23, 33	7	N/A	Gauge location 3 data missing on AGSP 1 (3), AGSP 2 (13), AGSP 3 (23), or AGSP 4 (33). The data for this gauge is not being transmitted on the datalink. Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2033	14	1	0	1601/A	Connector 1601 pin A, ((MD), (BUS) Stop Arm Cmd). There is a load on this pin that has been configured as Unused. Connector 1601 pin A is drawing current and it is configured as Unused. An unexpected load is attached to this pin.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	1	1	1601/A	Connector 1601 pin A, ((MD), (BUS) Stop Arm Cmd). Output overloaded Connector 1601 pin A current overload. Too much load attached.
2033	14	1	2	1601/A	Connector 1601 pin A, ((MD), (BUS) Stop Arm Cmd). Output open circuit. Connector 1601 Pin A open Open circuit.
2033	14	1	3	1601/A	Connector 1601 pin A, ((MD), (BUS) Stop Arm Cmd). Output shorted to ground. Connector 1601 Pin A shorted to ground. Shorted to ground.
2033	14	2	0	1601/E	Connector 1601 pin E, ((MD)/(BUS) Lamp test reverse lamps) There is a load on this pin that has been configured as Unused. Connector 1601 pin E is drawing current and it is configured as Unused. An unexpected load is attached to this pin.
2033	14	2	1	1601/E	Connector 1601 pin E, ((MD)/(BUS) Lamp test reverse lamps) Output overloaded Connector 1601 pin E current overload. Too much load attached.
2033	14	2	2	1601/E	Connector 1601 pin E, ((MD)/(BUS) Lamp test reverse lamps) Output open circuit. Connector 1601 Pin E open. Open circuit.
2033	14	2	3	1601/E	Connector 1601 pin E, ((MD)/(BUS) Lamp test reverse lamps) Output shorted to ground. Connector 1601 Pin E shorted to ground. Shorted to ground.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	3	0	1600/11	Connector 1600 pin 11. There is a load on this pin that has been configured as Unused. Connector 1600 Pin#11. Bus - Electric Door Control Open Command, there is a load on this pin that has been configured as Unused Connector 1600 pin 11 is drawing current and it is configured as Unused. Connector 1600 Pin#11. Bus - Electric Door Control Open Command, is drawing current and it is configured as unused An unexpected load is attached to this pin.
2033	14	3	1	1600/11	Connector 1600 pin 11. Output overloaded Connector 1600 Pin#11. BUS - Electric Door Open Output overloaded Connector 1600 pin 11 current overload. Connector 1600 Pin#11. BUS - Electric Door Open current overloaded Too much load attached.
2033	14	3	2	1600/11	Connector 1600 pin 11. Output open circuit. Connector 1600 Pin#11. BUS - Electric Door Open Output open circuit Connector 1600 Pin 11 open. Connector 1600 Pin#11. BUS - Electric Door Open circuit open Open circuit.
2033	14	3	3	1600/11	Connector 1600 pin 11. Output shorted to ground. Connector 1600 Pin#11. BUS - Electric Door Open Output shorted to ground Connector 1600 Pin 11 shorted to ground. Connector 1600 Pin#11. BUS - Electric Door Open shorted to ground Shorted to ground.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	4	0	1600/6	Connector 1600 pin 6. There is a load on this pin that has been configured as Unused. Connector 1600 Pin#6. BUS - Fog Light Command Connector 1600 pin 6 is drawing current and it is configured as Unused. Connector 1600 Pin#6. BUS - Fog Light Command is drawing current and it is configured as unused An unexpected load is attached to this pin.
2033	14	4	1	1600/6	Connector 1600 pin 6. MD — Park Position Solenoid Output overloaded Connector 1600 Pin#6. BUS - Fog Light Command Output overloaded Connector 1600 pin 6 current overload Connector 1600 Pin#6, BUS - Fog Light Command Output, current overload Too much load attached.
2033	14	4	2	1600/6	Connector 1600 pin 6. MD — Park Position Solenoid Output open circuit. Connector 1600 Pin#6. BUS - Fog Light Command Output open circuit Connector 1600 Pin 6 open. Connector 1600 Pin#6, BUS - Fog Light Command Output, open Open circuit.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	4	3	1600/6	Connector 1600 pin 6. MD — Park Position Solenoid Output shorted to ground. Connector 1600 Pin#6. BUS - Fog Light Command Output shorted to ground Connector 1600 Pin 6 shorted to ground. Connector 1600 Pin#6, BUS - Fog Light Command Output, shorted to ground Shorted to ground.
2033	14	5	0	1600/4	Connector 1600 Pin#4. (Bus - Park Brake Relay) There is a load on this pin that has been configured as Unused Connector 1600 pin 4 is drawing current and it is configured as Unused. An unexpected load is attached to this pin.
2033	14	5	1	1600/4	Connector 1600 Pin#4. (Bus - Park Brake Relay) Output overloaded Connector 1600 pin 4 current overload Too much load attached.
2033	14	5	2	1600/4	Connector 1600 Pin#4. (Bus - Park Brake Relay) Output open circuit Connector 1600 Pin 4 open. Open circuit.
2033	14	5	3	1600/4	Connector 1600 Pin#4. (Bus - Park Brake Relay) Output shorted to ground Connector 1600 Pin 4 shorted to ground. Shorted to ground.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	6	0	4004/Bus 1602 17	Connector 4004 pin 17. There is a load on this pin that has been configured as Unused. BUS Connector 1602 Pin#17. Electric Door Control Closed, there is a load on this pin that has been configured as Unused Connector 4004/Bus 1602 pin 17 is drawing current and it is configured as Unused. Bus Connector 1602 pin 17, Bus Electric Door Control, is drawing current and it is configured as unused An unexpected load is attached to this pin.
2033	14	6	1	4004/Bus 1602 17	Connector 4004 pin 17. MD — Body Trailer Marker & Tail lamp relay is Output overloaded Bus Connector 1602 pin 17, Bus Electric Door Control, is Output overloaded Connector 4004/Bus 1602 pin 17 current overload Bus Connector 1602 pin 17, Bus Electric Door Control, current overload Too much load attached.
2033	14	6	2	4004/Bus 1602 17	Connector 4004 pin 17. MD — Body Trailer Marker & Tail lamp relay is Output open circuit. Bus Connector 1602 pin 17. Bus Electric Door Control, Output open circuit Connector 4004/Bus 1602 Pin 17 open. Bus Connector 1602 pin 17. Bus Electric Door Control, open Open circuit.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	6	3	4004/Bus 1602 17	Connector 4004 pin 17. MD — Body Trailer Marker & Tail lamp relay is Output shorted to ground. Bus Connector 1602 pin 17. Bus Electric Door Control, Output shorted to ground. Connector 4004/Bus 1602 Pin 17 shorted to ground. Bus Connector 1602 pin 17. Bus Electric Door Control, shorted to ground Shorted to ground.
2033	14	7	0	4004/Bus 1602 19	Connector 4004/Bus 1602 pin 19. There is a load on this pin that has been configured as Unused. Connector #1602 Pin # 19. (Bus - Air solenoid power) There is a load on this pin that has been configured as Unused Connector 4004 pin 19 is drawing current and it is configured as Unused. An unexpected load is attached to this pin.
2033	14	7	1	4004/Bus 1602 19	Connector 4004/Bus 1602 pin 19. Output overloaded. Connector #1602 Pin # 19. (Bus - Air solenoid power) Output overloaded Connector 4004 pin 19 current overload. Too much load attached.
2033	14	7	2	4004/Bus 1602 19	Connector 4004/Bus 1602 pin 19. Output open circuit. Connector #1602 Pin # 19. (Bus - Air solenoid power) Output open circuit Connector 4004 Pin 19 open. Open circuit.
2033	14	7	3	4004/Bus 1602 19	Connector 4004/Bus 1602 pin 19. Output shorted to ground. Connector #1602 Pin # 19. (Bus - Air solenoid power) Output shorted to ground Connector 4004 Pin 19 shorted to ground. Shorted to ground.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	8	0	4004/Bus 1602 20	Connector 4004/Bus 1602 pin 20. There is a load on this pin that has been configured as Unused. Bus Connector 1602 Pin#20. Wiper high speed relay, there is a load on this pin that has been configured as Unused Connector 4004/Bus 1602 pin 20 is drawing current and it is configured as Unused. Bus Connector 1602 Pin#20. Wiper high speed relay, is drawing current and it is configured as unused An unexpected load is attached to this pin.
2033	14	8	1	4004/Bus 1602 20	Connector 4004/Bus 1602 pin 20. Output overloaded. Bus Connector 1602 Pin#20. Wiper high speed relay, Output overloaded Connector 4004/Bus 1602 pin 20 current overload. Bus Connector 1602 Pin#20 Wiper high speed relay current overloaded Too much load attached.
2033	14	8	2	4004/Bus 1602 20	Connector 4004/Bus 1602 pin 20. Output open circuit. Bus Connector 1602 Pin#20. Wiper high speed relay Output open circuit Connector 4004/Bus 1602 Pin 20 open. Bus Connector 1602 Pin#20. Wiper high speed relay Output open circuit Open circuit.
2033	14	8	3	4004/Bus 1602 20	Connector 4004/Bus 1602 pin 20. Output shorted to ground. Bus Connector 1602 Pin#20. Wiper high speed relay Output, Output shorted to ground Connector 4004/Bus 1602 Pin 20 shorted to ground. Bus Connector 1602 Pin#20. Wiper high speed relay Output, Output shorted to ground Shorted to ground.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	9	0	4004/Bus 1602 21	Connector 4004/Bus 1602 pin 21. There is a load on this pin that has been configured as Unused. Connector #1602 Pin #21 (Bus - Stop Relay) There is a load on this pin that has been configured as Unused Connector 4004 pin 21 is drawing current and it is configured as Unused. An unexpected load is attached to this pin.
2033	14	9	1	4004/Bus 1602 21	Connector 4004/Bus 1602 pin 21. Output overloaded. Connector #1602 Pin #21 (Bus - Stop Relay) Output overloaded Connector 4004 pin 21 current overload. Too much load attached.
2033	14	9	2	4004/Bus 1602 21	Connector 4004/Bus 1602 pin 21. Output open circuit. Connector #1602 Pin #21 (Bus - Stop Relay) Output open circuit Connector 4004 Pin 21 open. Open circuit.
2033	14	9	3	4004/Bus 1602 21	Connector 4004/Bus 1602 pin 21. Output shorted to ground. Connector #1602 Pin #21 (Bus - Stop Relay) Output shorted to ground Connector 4004 Pin 21 shorted to ground. Shorted to ground.
2033	14	10	0	4004/Bus 1602 22	Connector 4004/Bus 1602 pin 22. There is a load on this pin that has been configured as Unused. (4 Pack Air Solenoid Channel 3) Connector 4004/Bus 1602 pin 22 is drawing current and it is configured as Unused. An unexpected load is attached to this pin. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	10	1	4004/Bus 1602 22	Connector 4004/Bus 1602 pin 22. Output overloaded. (4 Pack Air Solenoid Channel 3) Connector 4004/Bus 1602 pin 22 current overload. Too much load attached, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	10	2	4004/Bus 1602 22	Connector 4004/Bus 1602 pin 22. Output open circuit. (4 Pack Air Solenoid Channel 3) Connector 4004/Bus 1602 Pin 22 open Open circuit, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	10	3	4004/Bus 1602 22	Connector 4004/Bus 1602 pin 22. Output shorted to ground. (4 Pack Air Solenoid Channel 3) Connector 4004/Bus 1602 Pin 22 shorted to ground. Shorted to ground, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	10	4	4004/Bus 1602 22	Connector 4004/Bus 1602 Pin 22. Power to solenoid pack has been disabled due to this solenoid being shorted to ground. This condition causes all solenoids in the solenoid pack to report as being shorted to ground. This fault indicates the true cause of the solenoid pack shut-down. Connector 4004/Bus 1602 Pin 22 shorted to ground. Power to the solenoid pack has been turned off due to a short in solenoid 3. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	11	0	4004/Bus 1602 23	Connector 4004/Bus 1602 pin 23. There is a load on this pin that has been configured as Unused. Bus connector 1602 pin#23. Wheelchair Lift solenoid, there is a load on this pin that has been configured as Unused Connector 4004/Bus 1602 pin 23 is drawing current and it is configured as Unused. Bus connector 1602 pin#23, Wheelchair Lift solenoid, is drawing current and it is configured as unused An unexpected load is attached to this pin.
2033	14	11	1	4004/Bus 1602 23	Connector 4004/Bus 1602 pin 23. Output overloaded. Bus connector 1602 pin#23, Wheelchair Lift solenoid, Output Overloaded Connector 4004/Bus 1602 pin 23 current overload. Bus connector 1602 pin#23, Wheelchair Lift solenoid, current Overloaded Too much load attached.
2033	14	11	2	4004/Bus 1602 23	Connector 4004/Bus 1602 pin 23. Output open circuit. Bus connector 1602 pin#23, Wheelchair Lift solenoid, Out put open circuit Connector 4004/Bus 1602 Pin 23 open. Bus connector 1602 pin#23, Wheelchair Lift solenoid, open Open circuit.
2033	14	11	3	4004/Bus 1602 23	Connector 4004/Bus 1602 pin 23. Output shorted to ground. Bus connector 1602 pin#23, Wheelchair Lift solenoid, Output shorted to ground Connector 4004/Bus 1602 Pin 23 shorted to ground. Bus connector 1602 pin#23, Wheelchair Lift solenoid, shorted to ground Shorted to ground.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	12	0	4004/Bus 1602 24	Connector 4004/Bus 1602 pin 24. There is a load on this pin that has been configured as Unused. (4 Pack Air Solenoid Channel 2) Connector 4004/Bus 1602 pin 24 is drawing current and it is configured as Unused. An unexpected load is attached to this pin. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	12	1	4004/Bus 1602 24	Connector 4004/Bus 1602 pin 24. Output overloaded. (4 Pack Air Solenoid Channel 2) Connector 4004/Bus 1602 pin 24 current overload. Too much load attached, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	12	2	4004/Bus 1602 24	Connector 4004/Bus 1602 pin 24. Output open circuit. (4 Pack Air Solenoid Channel 2) Connector 4004/Bus 1602 Pin 24 open Open circuit, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	12	3	4004/Bus 1602 24	Connector 4004/Bus 1602 pin 24. Output shorted to ground. (4 Pack Air Solenoid Channel 2) Connector 4004/Bus 1602 Pin 24 shorted to ground. Shorted to ground. Defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module (See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	12	4	4004/Bus 1602 24	Connector 4004/Bus 1602 Pin 24. Power to solenoid pack has been disabled due to this solenoid being shorted to ground. This condition causes all solenoids in the solenoid pack to report as being shorted to ground. This fault indicates the true cause of the solenoid pack shut-down. Connector 4004/Bus 1602 Pin 24 shorted to ground. Power to the solenoid pack has been turned off due to a short in solenoid 2. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	13	0	4004/Bus 1602 25	Connector 4004/Bus 1602 pin 25. There is a load on this pin that has been configured as Unused. Bus connector 1602 pin#25, Park Position Unlock solenoid, there is a load on this pin that has been configured as Unused Connector 4004/Bus 1602 pin 25 is drawing current and it is configured as Unused. Bus connector 1602 pin#25, Park Position Unlock solenoid, is drawing current and it is configured as unused An unexpected load is attached to this pin.
2033	14	13	1	4004/Bus 1602 25	Connector 4004/Bus 1602 pin 25. Output overloaded. Bus connector 1602 pin#25, Park Position Unlock solenoid, Output overloaded Connector 4004/Bus 1602 pin 25 current overload Bus connector 1602 pin#25, Park Position Unlock solenoid current overload Too much load attached.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	13	2	4004/Bus 1602 25	Connector 4004/Bus 1602 pin 25. Output open circuit Bus connector 1602 pin#25, Park Position Unlock solenoid, Output open circuit Connector 4004/Bus 1602 Pin 25 open. Bus connector 1602 pin#25, Park Position Unlock solenoid, open Open circuit.
2033	14	13	3	4004/Bus 1602 25	Connector 4004/Bus 1602 pin 25. Output shorted to ground. Bus connector 1602 pin#25, Park Position Unlock solenoid, Output Shorted to ground Connector 4004/Bus 1602 Pin 25 shorted to ground. Bus connector 1602 pin#25, Park Position Unlock solenoid, Shorted to ground Shorted to ground.
2033	14	14	0	4004/Bus 1602 29	Connector 4004/Bus 1602 pin 29. There is a load on this pin that has been configured as Unused. Connector 4004/Bus 1602 pin 29 is drawing current and it is configured as Unused. An unexpected load is attached to this pin.
2033	14	14	1	4004/Bus 1602 29	Connector 4004/Bus 1602 pin 29. Output overloaded. Connector 4004/Bus 1602 pin 29 current overload. Too much load attached.
2033	14	14	2	4004/Bus 1602 29	Connector 4004/Bus 1602 pin 29. Output open circuit. Connector 4004/Bus 1602 Pin 29 open. Open circuit.
2033	14	14	3	4004/Bus 1602 29	Connector 4004/Bus 1602 pin 29. Output shorted to ground Connector 4004/Bus 1602 Pin 29 shorted to ground. Shorted to ground.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	15	0	4004/Bus 1602 30	Connector 4004/Bus 1602 pin 30. There is a load on this pin that has been configured as Unused. (4 Pack Air Solenoid Channel 4) Connector 4004/Bus 1602 pin 30 is drawing current and it is configured as Unused. An unexpected load is attached to this pin. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	15	1	4004/Bus 1602 30	Connector 4004/Bus 1602 pin 30. Output overloaded. (4 Pack Air Solenoid Channel 4) Connector 4004/Bus 1602 pin 30 current overload. Too much load attached, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	15	2	4004/Bus 1602 30	Connector 4004/Bus 1602 pin 30. Output open circuit. (4 Pack Air Solenoid Channel 4) Connector 4004/Bus 1602 Pin 30 open Open circuit, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	15	3	4004/Bus 1602 30	Connector 4004/Bus 1602 pin 30. Output shorted to ground. (4 Pack Air Solenoid Channel 4) Connector 4004/Bus 1602 Pin 30 shorted to ground. Shorted to ground, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	15	4	4004/Bus 1602 30	Connector 4004/Bus 1602 Pin 30. Power to solenoid pack has been disabled due to this solenoid being shorted to ground. This condition causes all solenoids in the solenoid pack to report as being shorted to ground. This fault indicates the true cause of the solenoid pack shut-down. Connector 4004/Bus 1602 Pin 30 shorted to ground. Power to the solenoid pack has been turned off due to a short in solenoid 4. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	16	0	4004/Bus 1602 31	Connector 4004/Bus 1602 pin 31. There is a load on this pin that has been configured as Unused. (4 Pack Air Solenoid Channel 1) Connector 4004/Bus 1602 pin 31 is drawing current and it is configured as Unused. An unexpected load is attached to this pin. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	16	1	4004/Bus 1602 31	Connector 4004/Bus 1602 pin 31. Output overloaded. (4 Pack Air Solenoid Channel 1) Connector 4004/Bus 1602 pin 31 current overload. Too much load attached, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	16	2	4004/Bus 1602 31	Connector 4004/Bus 1602 pin 31. Output open circuit. (4 Pack Air Solenoid Channel 1) Connector 4004/Bus 1602 Pin 31 open. Open circuit, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2033	14	16	3	4004/Bus 1602 31	Connector 4004/Bus 1602 pin 31. Output shorted to ground. (4 Pack Air Solenoid Channel 1) Connector 4004/Bus 1602 Pin 31 shorted to ground. Shorted to ground, defective relay or 4 pack air solenoid module. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2033	14	16	4	4004/Bus 1602 31	Connector 4004/Bus 1602 Pin 31. Power to solenoid pack has been disabled due to this solenoid being shorted to ground. This condition causes all solenoids in the solenoid pack to report as being shorted to ground. This fault indicates the true cause of the solenoid pack shut-down. Connector 4004/Bus 1602 Pin 31 shorted to ground. Power to the solenoid pack has been turned off due to a short in solenoid 1. Refer to the 4– pack air solenoid module(See AIR SOLENOID MODULE (4–PACK), page 737) section of this manual.
2034	14	1	1	N/A	Remote Air Solenoid Module #1 - Output #1 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	1	2	N/A	Remote Air Solenoid Module #1 - Output #1 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	1	3	N/A	Remote Air Solenoid Module #1 - Output #1 - Open Circuit coil or valve not installed. Install solenoid or refer to theTesting Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2034	14	1	4	N/A	Remote Air Solenoid Module #1 - Output #1 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Remove solenoid or reprogram ESC to recognize the solenoid. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2034	14	2	1	N/A	Remote Air Solenoid Module #1 - Output #2 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	2	2	N/A	Remote Air Solenoid Module #1 - Output #2 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	2	3	N/A	Remote Air Solenoid Module #1 - Output #2 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	2	4	N/A	Remote Air Solenoid Module #1 - Output #2 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Remove solenoid or reprogram ESC to recognize the solenoid. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2034	14	3	1	N/A	Remote Air Solenoid Module #1 - Output #3 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2034	14	3	2	N/A	Remote Air Solenoid Module #1 - Output #3 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	3	3	N/A	Remote Air Solenoid Module #1 - Output #3 - Open Circuit coil or valve not installed. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	3	4	N/A	Remote Air Solenoid Module #1 - Output #3 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Remove solenoid or reprogram ESC to recognize the solenoid. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2034	14	4	1	N/A	Remote Air Solenoid Module #1 - Output #4 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	4	2	N/A	Remote Air Solenoid Module #1 - Output #4 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	4	3	N/A	Remote Air Solenoid Module #1 - Output #4 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2034	14	4	4	N/A	Remote Air Solenoid Module #1 - Output #4 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Remove solenoid or reprogram ESC to recognize the solenoid. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2034	14	5	1	N/A	Remote Air Solenoid Module #1 - Output #5 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	5	2	N/A	Remote Air Solenoid Module #1 - Output #5 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	5	3	N/A	Remote Air Solenoid Module #1 - Output #5 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	5	4	N/A	Remote Air Solenoid Module #1 - Output #5 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Remove solenoid or reprogram ESC to recognize the solenoid. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2034	14	6	1	N/A	Remote Air Solenoid Module #1 - Output #6 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2034	14	6	2	N/A	Remote Air Solenoid Module #1 - Output #6 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	6	3	N/A	Remote Air Solenoid Module #1 - Output #6 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	6	4	N/A	Remote Air Solenoid Module #1 - Output #6 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Remove solenoid or reprogram ESC to recognize the solenoid. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2034	14	7	1	N/A	Remote Air Solenoid Module #1 - Output #7 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	7	2	N/A	Remote Air Solenoid Module #1 - Output #7 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2034	14	7	3	N/A	Remote Air Solenoid Module #1 - Output #7 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2034	14	7	4	N/A	Remote Air Solenoid Module #1 - Output #7 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Remove solenoid or reprogram ESC to recognize the solenoid. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2040	14	1	1	N/A	AGSP #1 Switch #1, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of AGSP #1 Switch #1 to the default value. Replace switch acturator Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	1	2	N/A	AGSP #1 Switch #1, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of AGSP #1 Switch #1 to the default value. Replace faulty microswitch Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	1	3	N/A	AGSP #1 Switch #1, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of AGSP #1 Switch #1 to the default value. Replace switch acturator Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2040	14	1	4	N/A	AGSP #1 Switch #1, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of AGSP #1 Switch #1 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	1	5	N/A	AGSP #1 Switch #1, This switch should be empty but one or both of the microswitches is pressed. The ESC sets the status of AGSP #1 Switch #1 to the default value. Replace switch actuator or faulty microswitch Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	2	1	N/A	AGSP #1 Switch #2, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of AGSP #1 Switch #2 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	2	2	N/A	AGSP #1 Switch #2, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of AGSP #1 Switch #2 to the default value. Replace faulty microswitch Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2040	14	2	3	N/A	AGSP #1 Switch #2, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of AGSP #1 Switch #2 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	2	4	N/A	AGSP #1 Switch #2, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of AGSP #1 Switch #2 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	2	5	N/A	AGSP #1 Switch #2, This switch should be empty but one or both of the microswitches is pressed. The ESC sets the status of AGSP #1 Switch #2 to the default value. Replace switch actuator or faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	3	1	N/A	AGSP #1 Switch #3, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of AGSP #1 Switch #3 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2040	14	3	2	N/A	AGSP #1 Switch #3, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of AGSP #1 Switch #3 to the default value. Replace faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	3	3	N/A	AGSP #1 Switch #3, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of AGSP #1 Switch #3 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	3	4	N/A	AGSP #1 Switch #3, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of AGSP #1 Switch #3 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	3	5	N/A	AGSP #1 Switch #3, This switch should be empty but one or both of the microswitches is pressed. The ESC sets the status of AGSP #1 Switch #3 to the default value. Replace switch actuator or faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2040	14	4	1	N/A	AGSP #1 Switch #4, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of AGSP #1 Switch #4 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	4	2	N/A	AGSP #1 Switch #4, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of AGSP #1 Switch #4 to the default value. Replace faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	4	3	N/A	AGSP #1 Switch #4, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of AGSP #1 Switch #4 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	4	4	N/A	AGSP #1 Switch #4, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of AGSP #1 Switch #4 to the default value. Replace switch acturator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2040	14	4	5	N/A	AGSP #1 Switch #4, This switch should be empty but one or both of the microswitches is pressed. The ESC sets the status of AGSP #1 Switch #4 to the default value. Replace switch actuator or faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	5	1	N/A	AGSP #1 Switch #5, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of AGSP #1 Switch #5 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	5	2	N/A	AGSP #1 Switch #5, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of AGSP #1 Switch #5 to the default value. Replace faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	5	3	N/A	AGSP #1 Switch #5, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of AGSP #1 Switch #5 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2040	14	5	4	N/A	AGSP #1 Switch #5, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of AGSP #1 Switch #5 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	5	5	N/A	AGSP #1 Switch #5, This switch should be empty but one or both of the microswitches is pressed. The ESC sets the status of AGSP #1 Switch #5 to the default value. Replace switch actuator or faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	6	1	N/A	AGSP #1 Switch #6, microswitch inputs are in an invalid state. Both microswitches are not depressed. The ESC sets the status of AGSP #1 Switch #6 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	6	2	N/A	AGSP #1 Switch #6, microswitch inputs are in an invalid state. Both microswitches are depressed. The ESC sets the status of AGSP #1 Switch #6 to the default value. Replace faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2040	14	6	3	N/A	AGSP #1 Switch #6, microswitch inputs are in an invalid state. Top microswitch depressed, bottom microswitch not depressed. The ESC sets the status of AGSP #1 Switch #6 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	6	4	N/A	AGSP #1 Switch #6, microswitch inputs are in an invalid state. Top microswitch not depressed, bottom microswitch depressed. The ESC sets the status of AGSP #1 Switch #6 to the default value. Replace switch actuator Refer to the AGSP Preliminary System Check (See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2040	14	6	5	N/A	AGSP #1 Switch #6, This switch should be empty but one or both of the microswitches is pressed. The ESC sets the status of AGSP #1 Switch #6 to the default value. Replace switch actuator or faulty microswitch Refer to the AGSP Preliminary System Check(See AGSP PRELIMINARY SYSTEM CHECK, page 162) section of this manual.
2209	14	1	1	N/A	Remote Engine Speed Control Module Digital Output #1 - Output failure Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	1	4	N/A	Remote Engine Speed Control Module Digital Output #1 - Data mismatch Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2209	14	2	1	N/A	Remote Engine Speed Control Module Digital Output #2 - Output failure Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	2	4	N/A	Remote Engine Speed Control Module Digital Output #2 - Data mismatch Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	3	1	N/A	Remote Engine Speed Control Module Digital Output #3 - Output failure Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	3	4	N/A	Remote Engine Speed Control Module Digital Output #3 - Data mismatch Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	4	2	N/A	Remote Engine Speed Control Module Analog Input #1 - Shorted to Battery Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	4	3	N/A	Remote Engine Speed Control Module Analog Input #1 - shorted to ground. Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	5	2	N/A	Remote Engine Speed Control Module Analog Input #2 - Shorted to Battery Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	5	3	N/A	Remote Engine Speed Control Module Analog Input #2 - shorted to ground. Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2209	14	5	4	N/A	Remote Engine Speed Control Module Analog Input #2 - Data mismatch Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2209	14	6	1	N/A	Remote Engine Speed Control Module Vbat Supply-Output Failure Refer to Remote Engine Speed Control Module(See REMOTE ENGINE SPEED CONTROL MODULE (RESCM), page 412).
2225	14	1	1	N/A	RPM #1 output pin A over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - connected to zero volt reference) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2225	14	2	1	N/A	RPM #1 output pin B over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - connected to zero volt reference) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2225	14	3	1	N/A	RPM #1 output pin C over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - connected to zero volt reference) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2225	14	4	1	N/A	RPM #1 output pin D over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - connected to zero volt reference) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2225	14	5	1	N/A	RPM #1 output pin E over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - connected to zero volt reference) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2225	14	6	1	N/A	RPM #1 output pin H over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - connected to zero volt reference) Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2226	14	1	1	N/A	RPM #2 output pin A over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - connected to zero volt reference, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2226	14	2	1	N/A	RPM #2 output pin B over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - connected to zero volt reference, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2226	14	3	1	N/A	RPM #2 output pin C over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - connected to zero volt reference, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2226	14	4	1	N/A	RPM #2 output pin D over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - connected to zero volt reference, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2226	14	5	1	N/A	RPM #2 output pin E over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - connected to zero volt reference, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2226	14	6	1	N/A	RPM #2 output pin H over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - connected to zero volt reference, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2228	14	1	1	N/A	RPM #4 output pin A over current The output behaves like a 20 amp type III circuit breaker. (MS3 - connected to zero volt reference, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2228	14	2	1	N/A	RPM #4 output pin B over current The output behaves like a 20 amp type III circuit breaker. (MS3 - connected to zero volt reference, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2228	14	3	1	N/A	RPM #4 output pin C over current The output behaves like a 20 amp type III circuit breaker. (MS3 - connected to zero volt reference, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2228	14	4	1	N/A	RPM #4 output pin D over current The output behaves like a 20 amp type III circuit breaker. (MS3 - connected to zero volt reference, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2228	14	5	1	N/A	RPM #4 output pin E over current The output behaves like a 20 amp type III circuit breaker. (MS3 - connected to zero volt reference, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2228	14	6	1	N/A	RPM #4 output pin H over current The output behaves like a 20 amp type III circuit breaker. (MS3 - connected to zero volt reference, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2231	14	1	1	N/A	RPM #7 output pin A over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2231	14	2	1	N/A	RPM #7 output pin B over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2231	14	3	1	N/A	RPM #7 output pin C over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2231	14	4	1	N/A	RPM #7 output pin D over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2231	14	5	1	N/A	RPM #7 output pin E over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.
2231	14	6	1	N/A	RPM #7 output pin H over current The output behaves like a 20 amp type III circuit breaker. (MS3 - open circuit, MS2 - open circuit, MS1 - open circuit) Short to ground or overload Refer to the Remote Power Module(See REMOTE POWER MODULE, page 761) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2234	14	1	1	N/A	Remote Air Solenoid Module #2 - Output #1 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	1	2	N/A	Remote Air Solenoid Module #2 - Output #1 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	1	3	N/A	Remote Air Solenoid Module #2 - Output #1 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	1	4	N/A	Remote Air Solenoid Module #2 - Output #1 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2234	14	2	1	N/A	Remote Air Solenoid Module #2 - Output #2 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	2	2	N/A	Remote Air Solenoid Module #2 - Output #2 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	2	3	N/A	Remote Air Solenoid Module #2 - Output #2 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2234	14	2	4	N/A	Remote Air Solenoid Module #2 - Output #2 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2234	14	3	1	N/A	Remote Air Solenoid Module #2 - Output #3 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	3	2	N/A	Remote Air Solenoid Module #2 - Output #3 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	3	3	N/A	Remote Air Solenoid Module #2 - Output #3 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	3	4	N/A	Remote Air Solenoid Module #2 - Output #3 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2234	14	4	1	N/A	Remote Air Solenoid Module #2 - Output #4 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	4	2	N/A	Remote Air Solenoid Module #2 - Output #4 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2234	14	4	3	N/A	Remote Air Solenoid Module #2 - Output #4 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	4	4	N/A	Remote Air Solenoid Module #2 - Output #4 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2234	14	5	1	N/A	Remote Air Solenoid Module #2 - Output #5 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	5	2	N/A	Remote Air Solenoid Module #2 - Output #5 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	5	3	N/A	Remote Air Solenoid Module #2 - Output #5 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	5	4	N/A	Remote Air Solenoid Module #2 - Output #5 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2234	14	6	1	N/A	Remote Air Solenoid Module #2 - Output #6 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.

Table 355 Diagnostic Trouble Code (DTC) List (cont.)

SPN	FMI	Byte 7	Byte 8	ESC Connector and Pin #	Condition Description/Comments/Probable Cause(s)
2234	14	6	2	N/A	Remote Air Solenoid Module #2 - Output #6 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	6	3	N/A	Remote Air Solenoid Module #2 - Output #6 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	6	4	N/A	Remote Air Solenoid Module #2 - Output #6 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.
2234	14	7	1	N/A	Remote Air Solenoid Module #2 - Output #7 - Valve ON when commanded OFF. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	7	2	N/A	Remote Air Solenoid Module #2 - Output #7 - Valve OFF when commanded ON. Refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	7	3	N/A	Remote Air Solenoid Module #2 - Output #7 - Open Circuit coil or valve not installed. Install solenoid or refer to the Testing Individual Solenoids(See TESTING INDIVIDUAL SOLENOIDS, page 754) section of this manual.
2234	14	7	4	N/A	Remote Air Solenoid Module #2 - Output #7 - Unknown remote air solenoid. An air Solenoid is installed in this position but is not configured. Refer to the Air Solenoid (7–Pack)(See REMOTE AIR SOLENOID MODULE (7–PACK), page 750) section of this manual.

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