

ELECTRONIC CONTROL MODULES

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ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS

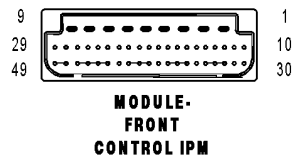
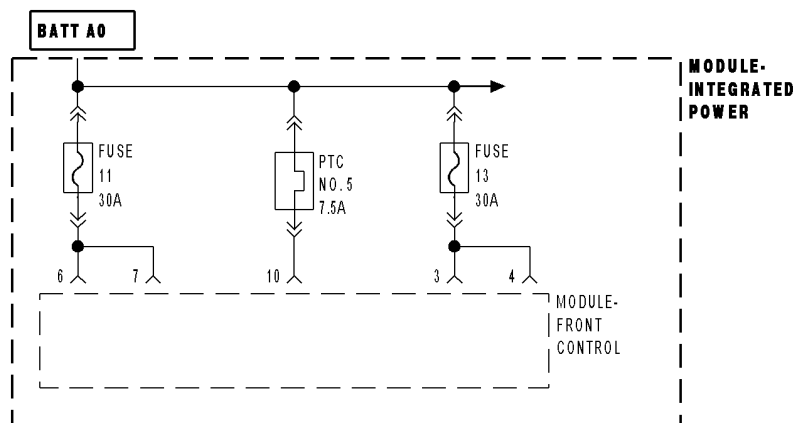
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ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS

DIAGNOSIS AND TESTING

BATTERY VOLTAGE OPEN (FCM)



BATTERY VOLTAGE OPEN (FCM) (CONTINUED)

For a complete wiring diagram Refer to Section 8W.

- **When Monitored:**
With the ignition on.
- **Set Condition:**
The FCM detects a low voltage condition.

Possible Causes
POWER DISTRIBUTION CENTER
FRONT CONTROL MODULE

Diagnostic Test**1. CHECK FOR AN ACTIVE DTC**

Turn the ignition on.

With the DRB, erase the FCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

Yes >> Go To 2

No >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. CHECK THE FUSED B+ CIRCUIT

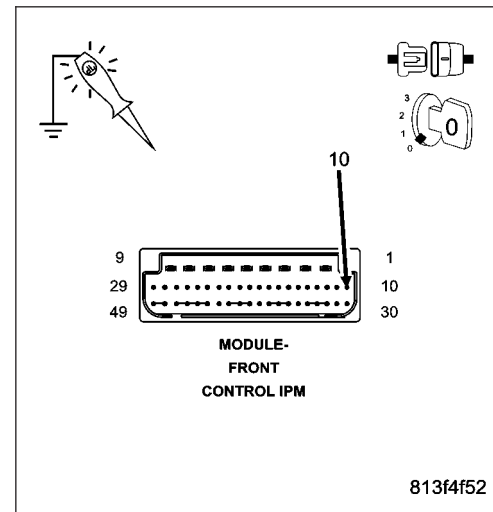
Turn the ignition off.

Remove the FCM from the IPM.

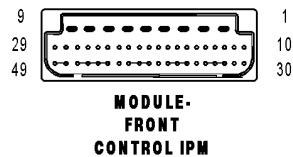
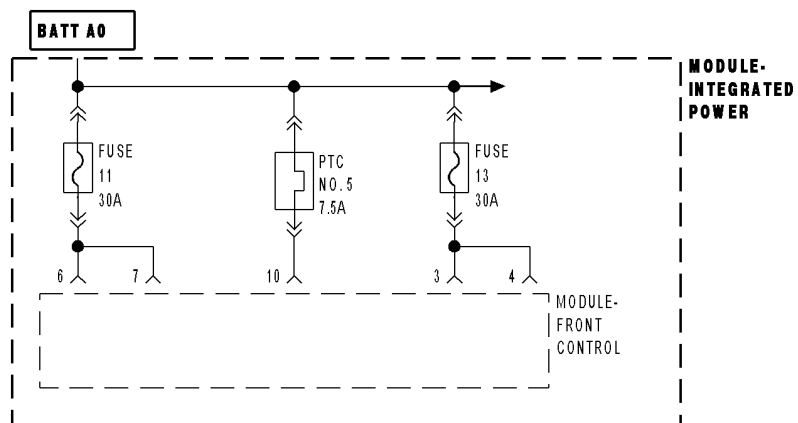
Using a 12-volt test light connected to ground, probe the Fused B+ circuit (cavity 10).

Is the test light illuminated?

- Yes** >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)
- No** >> Replace the Power Distribution Center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



BATTERY 1 VOLTAGE OPEN (FCM)



BATTERY 1 VOLTAGE OPEN (FCM) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
With the ignition on.
- **Set Condition:**
The FCM detects low voltage on battery input 1.

Possible Causes
FUSE #13 POWER DISTRIBUTION CENTER FRONT CONTROL MODULE

Diagnostic Test**1. CHECK FOR AN ACTIVE DTC**

Turn the ignition on.

With the DRB, erase the FCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

Yes >> Go To 2

No >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. CHECK FUSE #13

Turn the ignition off.

Check fuse #13 in the IPM.

Is the fuse open?

Yes >> Replace the fuse and check for a possible intermittent short to ground condition.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Go To 3

BATTERY 1 VOLTAGE OPEN (FCM) (CONTINUED)**3. CHECK THE FUSED B+ CIRCUITS**

Remove the FCM from the IPM.

NOTE: Ensure fuse #13 is installed in the IPM.

Using a 12-volt test light connected to ground, probe both Fused B+ circuits (cavities 3 and 4).

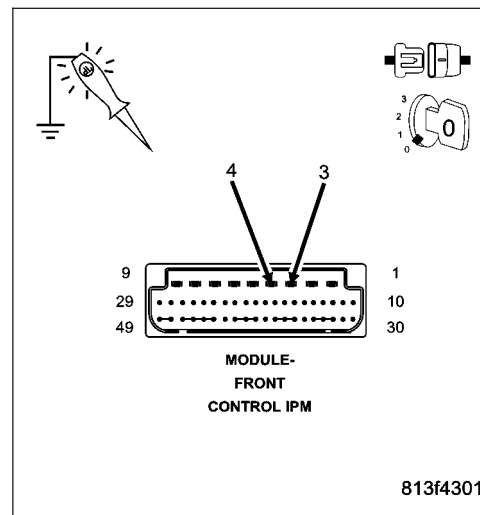
Is the test light illuminated for both circuits?

Yes >> Replace the Front Control Module in accordance with the service information.

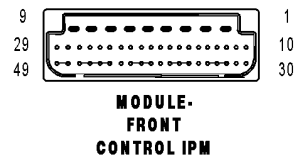
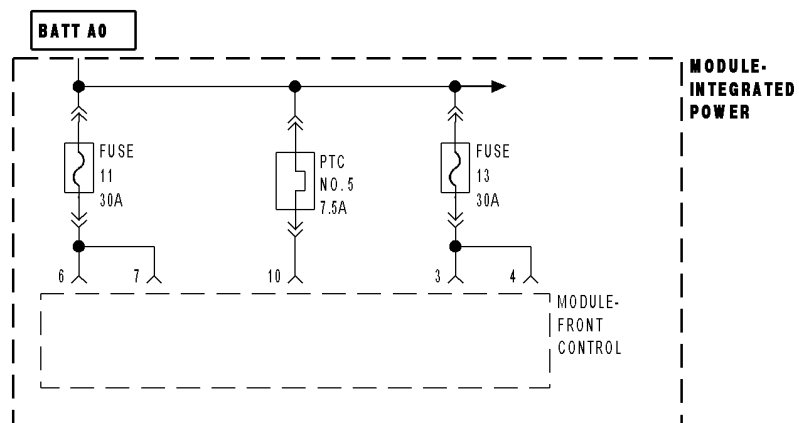
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Replace the Power Distribution Center in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



BATTERY 2 VOLTAGE OPEN (FCM)



BATTERY 2 VOLTAGE OPEN (FCM) (CONTINUED)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
With the ignition on.
- **Set Condition:**
The FCM detects low voltage on battery input 2.

Possible Causes
FUSE #11 POWER DISTRIBUTION CENTER FRONT CONTROL MODULE

Diagnostic Test**1. CHECK FOR AN ACTIVE DTC**

Turn the ignition on.

With the DRB, erase the FCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

Yes >> Go To 2

No >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

2. CHECK FUSE #11

Turn the ignition off.

Check fuse #11 in the IPM.

Is the fuse open?

Yes >> Replace the fuse and check for a possible intermittent short to ground condition.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Go To 3

BATTERY 2 VOLTAGE OPEN (FCM) (CONTINUED)**3. CHECK THE FUSED B+ CIRCUITS**

Remove the FCM from the IPM.

NOTE: Ensure fuse #11 is installed in the IPM.

Using a 12-volt test light connected to ground, probe both Fused B+ circuits (cavities 6 and 7).

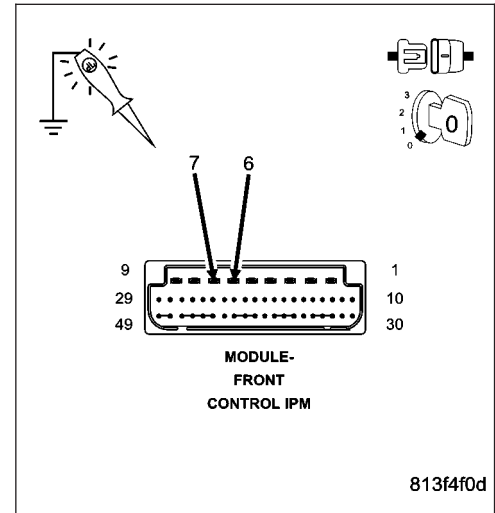
Is the test light illuminated for both circuits?

Yes >> Replace the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Replace the Power Distribution Center in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



BUS SHORTED TO BATTERY (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
Continuously
- **Set Condition:**
Anytime the FCM detects a short to battery on the PCI Bus circuit.

Possible Causes
INTERMITTENT SHORT TO BATTERY ON THE (D25) PCI BUS CIRCUIT

Diagnostic Test

1. INTERMITTENT CONDITION

NOTE: For this code to be active, the DRB will not be able to communicate with any modules on the vehicle (except the PCM/ECM).

NOTE: Clear the code. If this code continues to set and the DRB can still communicate with the FCM, it will be necessary to replace the FCM.

WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

With the engine running at normal operating temperature, wiggle the wiring harnesses. This is to try and duplicate the complete bus failure condition.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Were any of the above conditions present?

Yes >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Test Complete.

BUS SHORTED TO GROUND (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
Continuously
- **Set Condition:**
Anytime the FCM detects a short to ground on the PCI Bus circuit.

Possible Causes
INTERMITTENT SHORT TO GROUND ON THE (D25) PCI BUS CIRCUIT

Diagnostic Test

1. INTERMITTENT CONDITION

NOTE: For this code to be active, the DRB will not be able to communicate with any modules on the vehicle (except the PCM/ECM).

NOTE: Clear the code. If this code continues to set and the DRB can still communicate with the FCM, it will be necessary to replace the FCM.

WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

With the engine running at normal operating temperature, wiggle the wiring harnesses. This is to try and duplicate the complete bus failure condition.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Were any of the above conditions present?

Yes >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Test Complete.

EEPROM CHECKSUM FAILURE (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
Continuously
- **Set Condition:**
When the EEPROM memory checksum is determined to be incorrect.

Possible Causes
FRONT CONTROL MODULE

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the DRB, erase the FCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

Yes >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Test Complete.

INTERNAL BOOTLOADER CHECKSUM FAILURE (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
Continuously
- **Set Condition:**
When the bootloader checksum is determined to be incorrect.

Possible Causes
FRONT CONTROL MODULE

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the DRB, erase the FCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

Yes >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Test Complete.

INTERNAL FLASH MEMORY CHECKSUM FAILURE (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
Continuously
- **Set Condition:**
When the flash memory checksum is determined to be incorrect.

Possible Causes
FRONT CONTROL MODULE

Diagnostic Test**1. ACTIVE DTC**

Turn the ignition on.

With the DRB, erase the FCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

- Yes** >> Replace the Front Control Module in accordance with the service information.
 Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)
- No** >> Test Complete.
-

MIC MESSAGES NOT RECEIVED (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
With the ignition on.
- **Set Condition:**
The FCM does not receive any messages from the MIC for at least 5 seconds.

Possible Causes
(D25) PCI BUS CIRCUIT OPEN INSTRUMENT CLUSTER POWER AND GROUND FRONT CONTROL MODULE

Diagnostic Test

1. ATTEMPT TO COMMUNICATE WITH THE INSTRUMENT CLUSTER (MIC)

Turn the ignition on.

With the DRB, enter Body then Electro/Mech Cluster.

Was the DRB able to I/D or communicate with the Instrument Cluster (MIC)?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. FRONT CONTROL MODULE

With the DRB, erase DTC's.

Turn the ignition on and wait approximately 1 minute.

With the DRB, read DTC's.

Did this DTC reset?

Yes >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

PCI BUS INTERNAL - LOOPBACK FAILURE (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
Continuously
- **Set Condition:**
When the loopback test has failed.

Possible Causes
FRONT CONTROL MODULE

Diagnostic Test**1. ACTIVE DTC**

Turn the ignition on.

With the DRB, erase the FCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

Yes >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Test Complete.

PCM MESSAGES NOT RECEIVED (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
With the ignition on.
- **Set Condition:**
The FCM does not receive any messages from the PCM for at least 5 seconds.

Possible Causes
(D25) PCI BUS CIRCUIT OPEN POWERTRAIN CONTROL MODULE POWER AND GROUND FRONT CONTROL MODULE

Diagnostic Test

1. CHECK THE STATUS OF THE PCM ON THE PCI BUS NETWORK

Turn the ignition on.

With the DRB, enter System Monitors then J1850 Module Scan.

Is the PCM active on the bus?

Yes >> Erase the DTC, if the DTC resets replace the Front Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Go To 2

2. ATTEMPT TO COMMUNICATE WITH THE PCM

With the DRB, attempt to communicate with the PCM.

Was the DRB able to communicate with the PCM?

Yes >> Go To 3

No >> Refer to the table of contents and perform the related symptom.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

PCM MESSAGES NOT RECEIVED (FCM) (CONTINUED)

3. CHECK THE (D25) PCI BUS CIRCUIT FOR AN OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

CAUTION: If the vehicle is equipped with an NGC controller, do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install miller special tool #8815 to perform diagnosis.

Disconnect the DRB from the DLC.

Measure the resistance of the PCI Bus circuit between the PCM connector (from special tool #8815 if NGC) and the DLC.

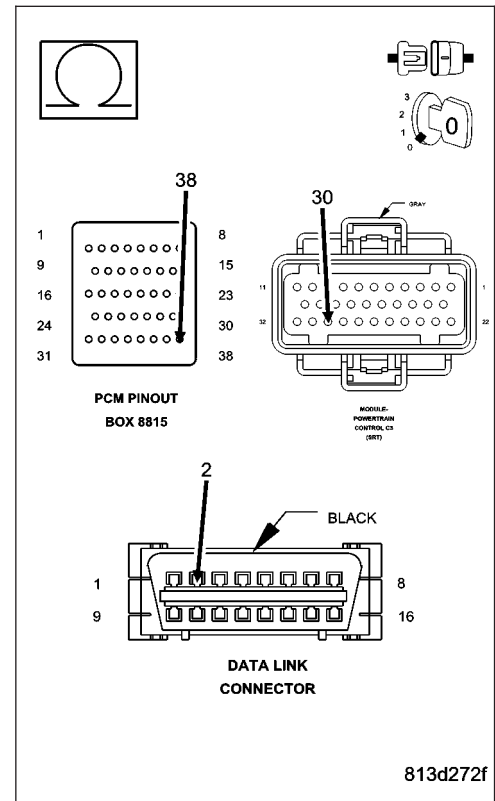
Is the resistance below 5.0 ohms?

Yes >> Replace and program the PCM in accordance with the service information.

Perform the appropriate VERIFICATION TEST.

No >> Repair the PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



VIN NOT LEARNED CORRECTLY (FCM)

For a complete wiring diagram **Refer to Section 8W.**

- **When Monitored:**
With the ignition on.
- **Set Condition:**
The VIN is programmed into the FCM via a PCI bus message from the PCM/ECM. When learning the VIN, the FCM computes a check digit to verify that the VIN learned was valid. If not valid, the DTC will set and the VIN will not be learned.

Possible Causes
FRONT CONTROL MODULE

Diagnostic Test

1. ACTIVE DTC

Turn the ignition on.

With the DRB, erase the FCM DTC's.

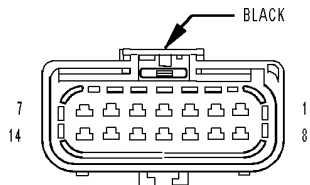
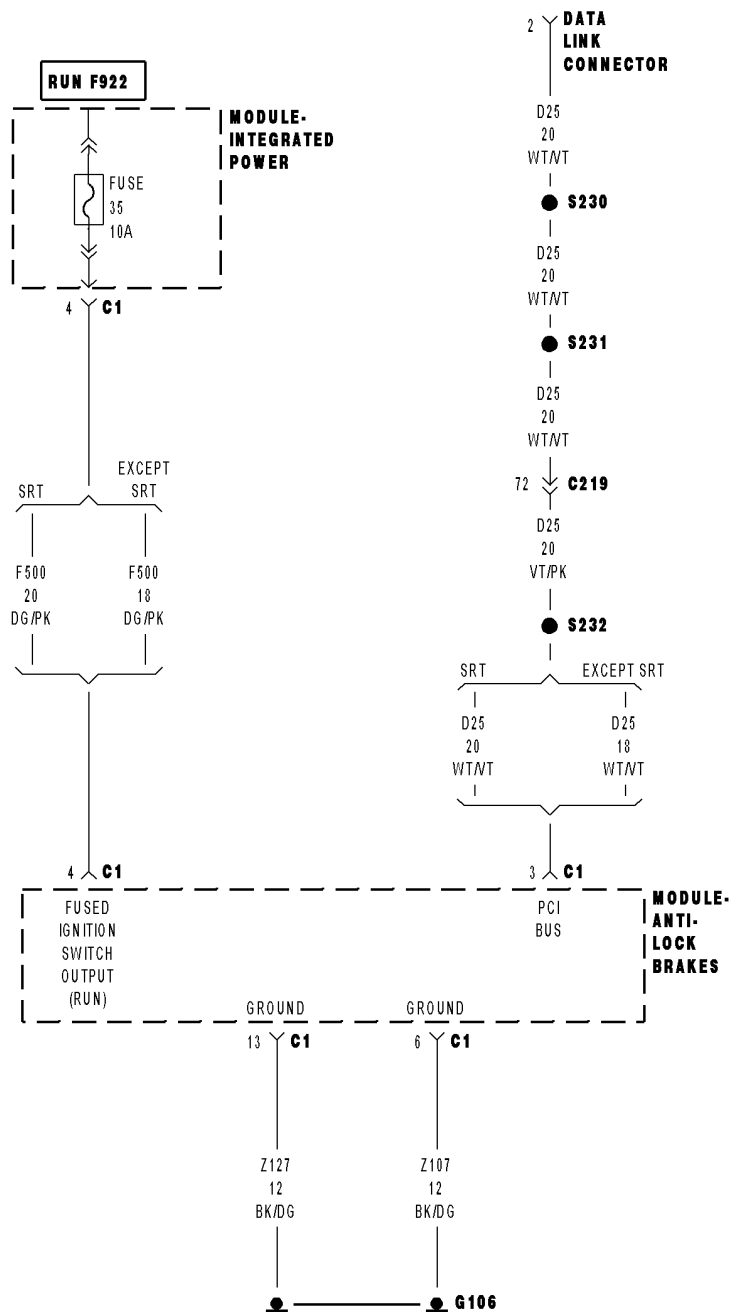
Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the DRB, read the FCM DTC's.

Did this DTC reset?

- Yes** >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)
- No** >> Test Complete.
-

***NO RESPONSE FROM ANTILOCK BRAKE MODULE**



**MODULE-
ANTI-LOCK
BRAKES C1**

***NO RESPONSE FROM ANTILOCK BRAKE MODULE (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z107) (Z127) GROUND CIRCUIT OPEN
(F500) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
(D25) PCI BUS CIRCUIT OPEN
ANTILOCK BRAKE MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH OTHER PCI BUS MODULES**

Turn the ignition on.

NOTE: As soon as one or more modules communicates with the DRB, answer the question.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the ORC.

With the DRB, attempt to communicate with the Instrument Cluster.

Was the DRB able to I/D or communicate with either of the modules?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform ABS VERIFICATION TEST - VER 1.

2. (Z107) (Z127) GROUND CIRCUIT OPEN

Turn the ignition off.

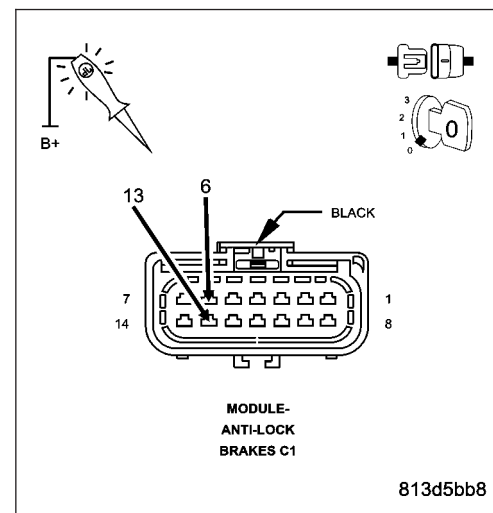
Disconnect the Antilock Brake Module C1 harness connector.

Using a 12-volt test light connected to 12-volts, probe each (Z107) (Z127, if equipped) ground circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z107) or (Z127) Ground circuit for an open.
Perform ABS VERIFICATION TEST - VER 1.



NO RESPONSE FROM ANTILOCK BRAKE MODULE (CONTINUED)*3. (F500) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

Turn the ignition on.

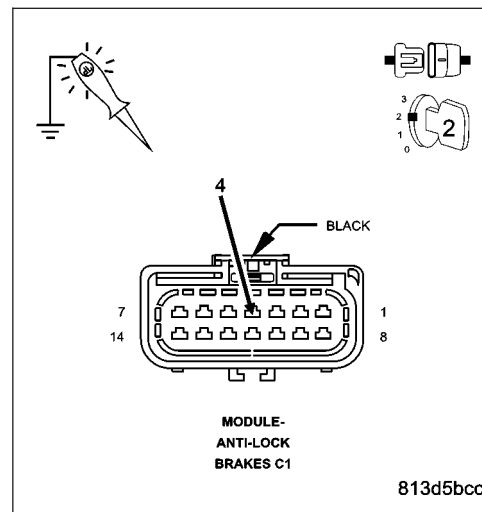
Using a 12-volt test light connected to ground, probe the (F500) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (F500) Fused Ignition Switch Output circuit for an open.

Perform ABS VERIFICATION TEST - VER 1.

**4. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

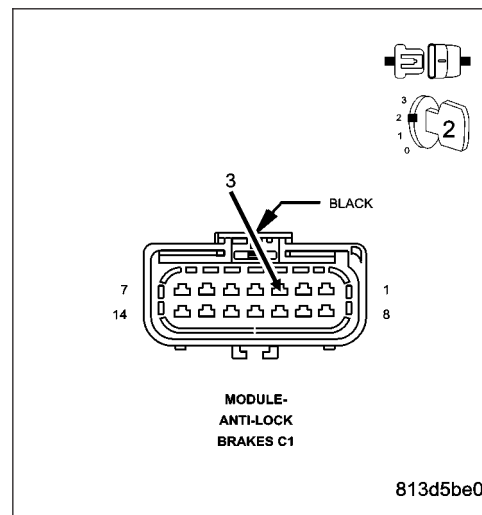
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Antilock Brake Module connector.

Observe the voltage display on the DRB Lab Scope.

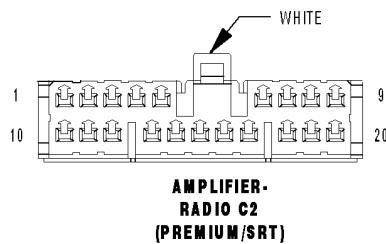
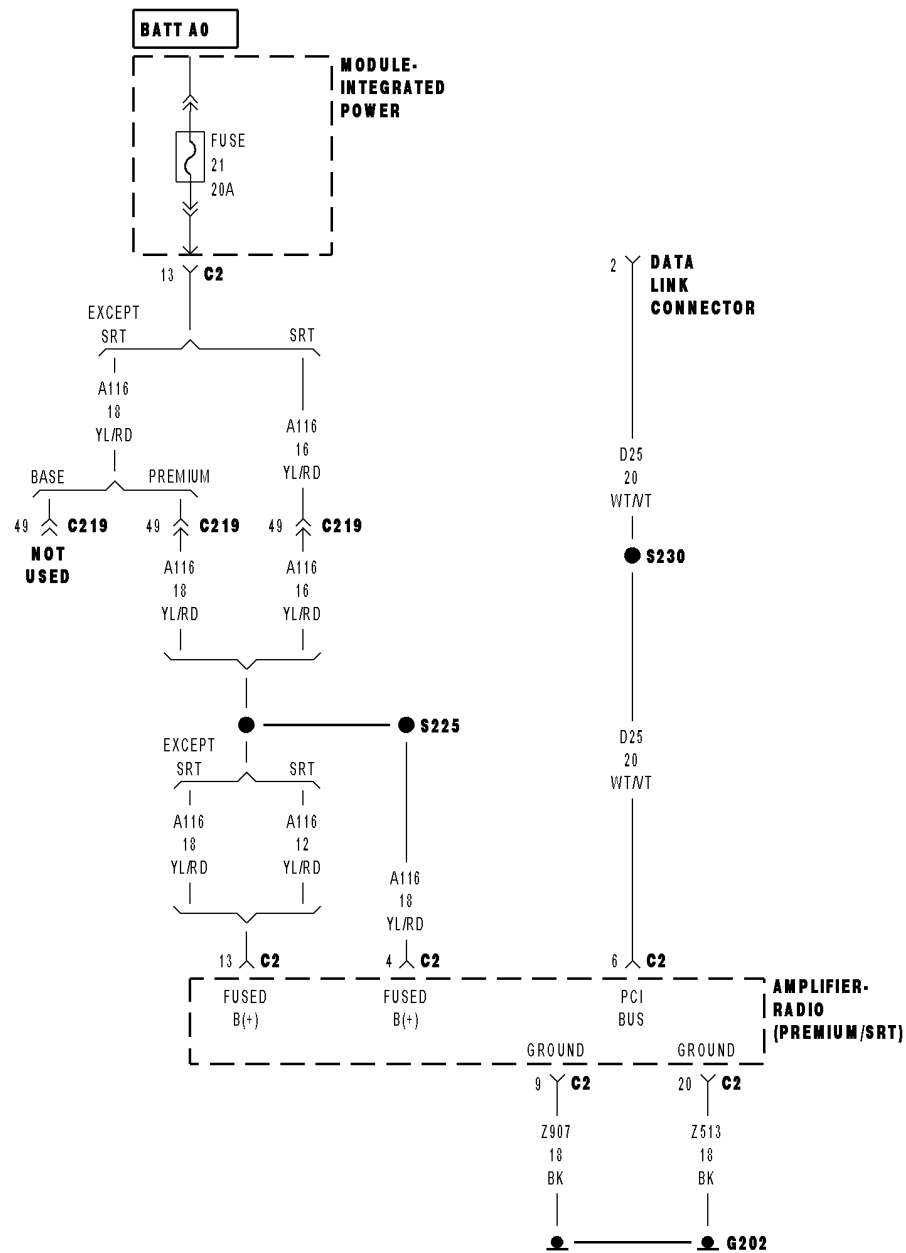


Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Antilock Brake Module in accordance with the service information.
Perform ABS VERIFICATION TEST - VER 1.

No >> Repair the (D25) PCI Bus circuit for an open.
Perform ABS VERIFICATION TEST - VER 1.

***NO RESPONSE FROM AMPLIFIER**



***NO RESPONSE FROM AMPLIFIER (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z513) (Z907) GROUND CIRCUIT OPEN (A116) FUSED B+ CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN AMPLIFIER

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE RADIO**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

NOTE: The radio must be turned on for the DRB to get a response from the amplifier.

With the DRB, attempt to communicate with the radio.

Was the DRB able to I/D or communicate with the radio?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z513) (Z907) GROUND CIRCUIT OPEN

Turn the ignition off.

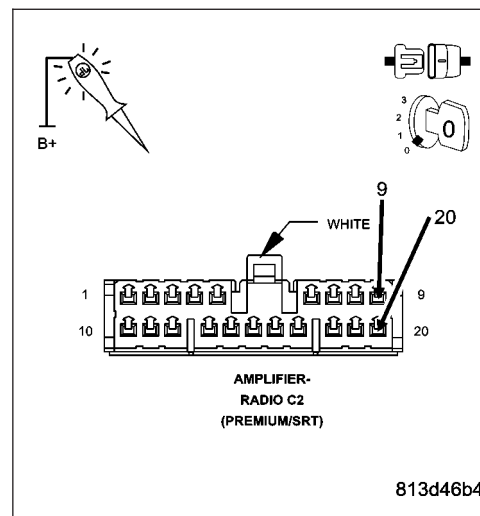
Disconnect the Amplifier C2 harness connector.

Using a 12-volt test light connected to 12-volts, probe each (Z513) (Z907) ground circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z513) or (Z907) Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



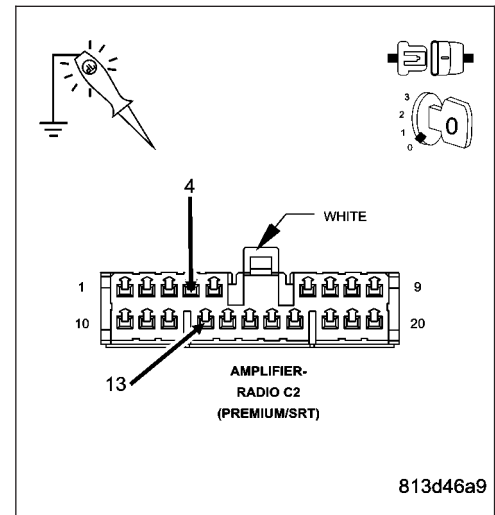
NO RESPONSE FROM AMPLIFIER (CONTINUED)*3. (A116) FUSED B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe each (A116) Fused B+ circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 4

No >> Repair the (A116) Fused B+ circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (D25) PCI BUS CIRCUIT OPEN**

Turn the ignition on.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

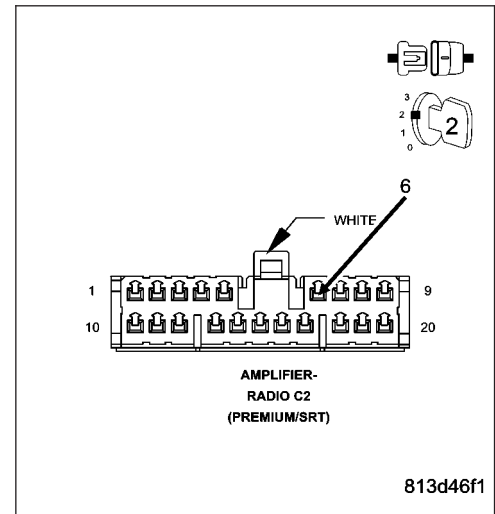
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Amplifier connector.

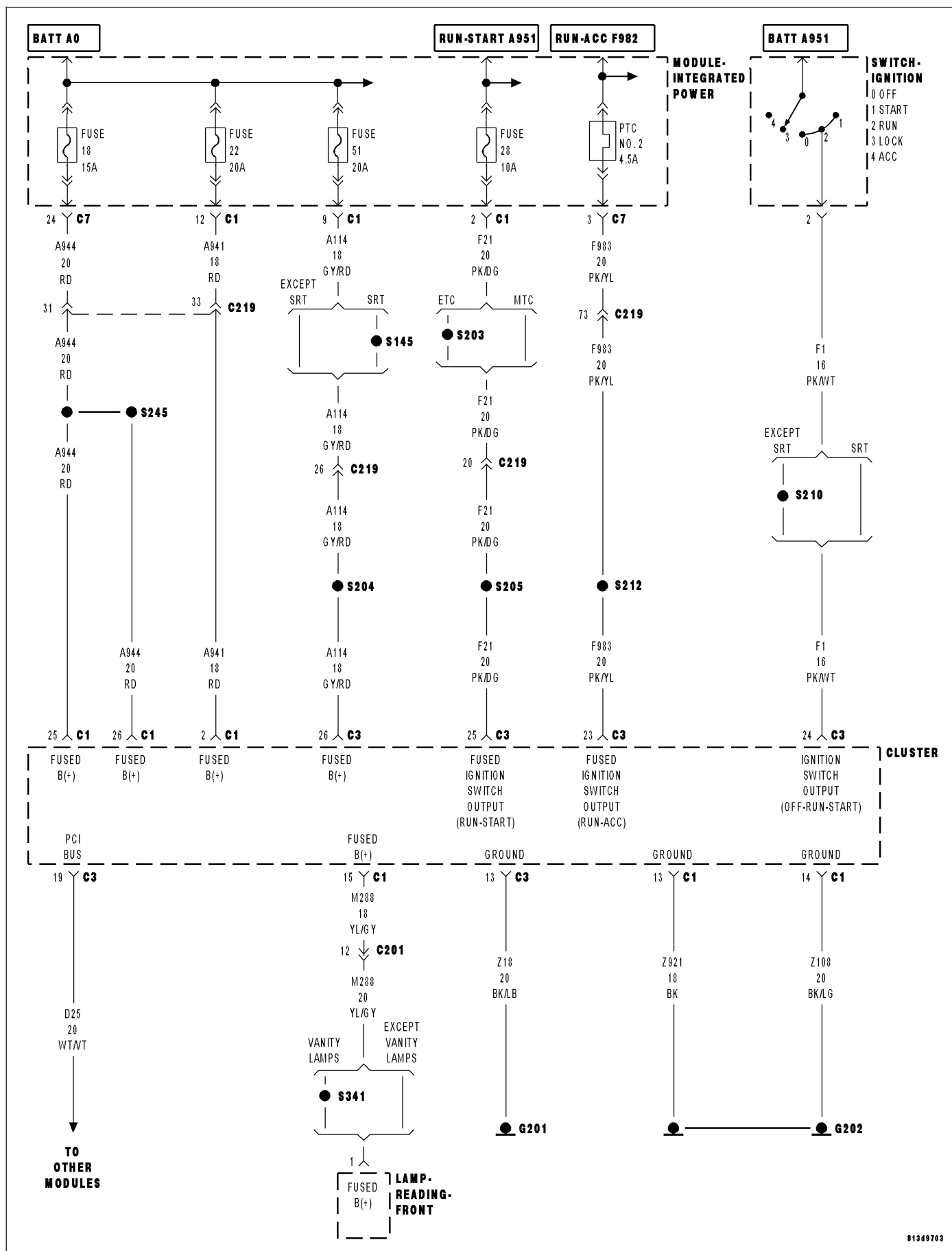
Observe the voltage display on the DRB Lab Scope.



Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Amplifier in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM CLUSTER**

***NO RESPONSE FROM CLUSTER (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z921) (Z108) (Z18) GROUND CIRCUIT OPEN
(A944) (M288) (A941) (A114) FUSED B+ CIRCUIT OPEN
(F21) (F1) (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
(D25) PCI BUS CIRCUIT OPEN
CLUSTER

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH OTHER PCI BUS MODULES**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the ORC.

With the DRB, attempt to communicate with the ABS.

Was the DRB able to I/D or communicate with either module?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z921) (Z108) (Z18) GROUND CIRCUIT OPEN

Turn the ignition off.

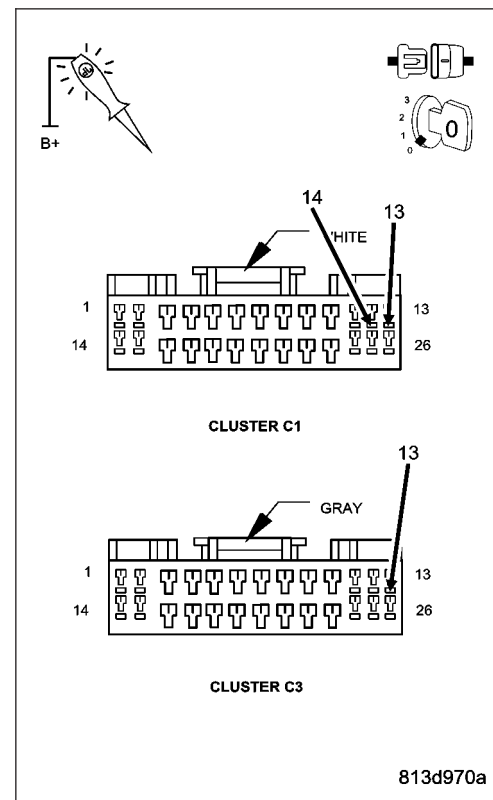
Disconnect the Cluster harness connectors.

Using a 12-volt test light connected to 12-volts, probe each (Z921) (Z108) (Z18) ground circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z921) (Z108) (Z18) Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



NO RESPONSE FROM CLUSTER (CONTINUED)*3. (A944) (M288) (A941) (A114) FUSED B+ CIRCUIT OPEN**

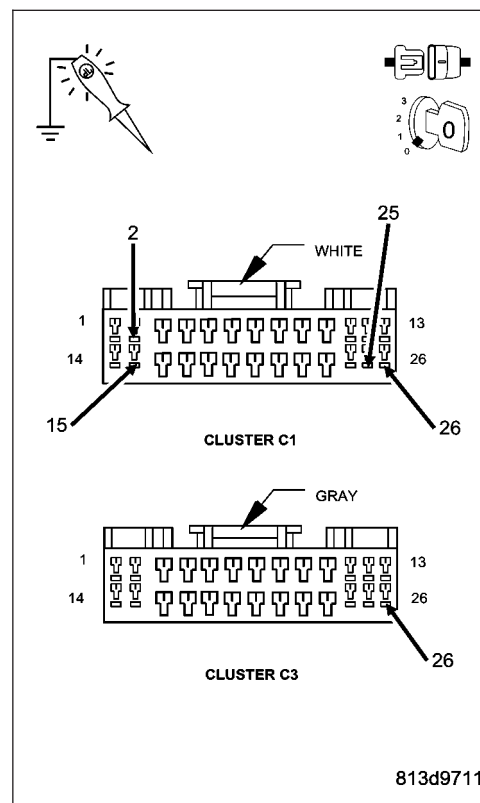
Using a 12-volt test light connected to ground, probe each (A944) (M288) (A941) (A114) Fused B+ circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 4

No >> Repair the (A944) (M288) (A941) (A114) Fused B+ circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (F21) (F1) (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

Turn the ignition on.

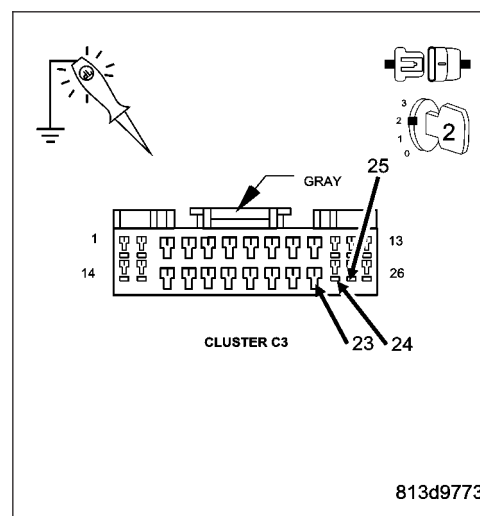
Using a 12-volt test light connected to ground, probe each (F21) (F1) (F983) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 5

No >> Repair the (F21) (F1) (F983) Fused Ignition Switch Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



NO RESPONSE FROM CLUSTER (CONTINUED)*5. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

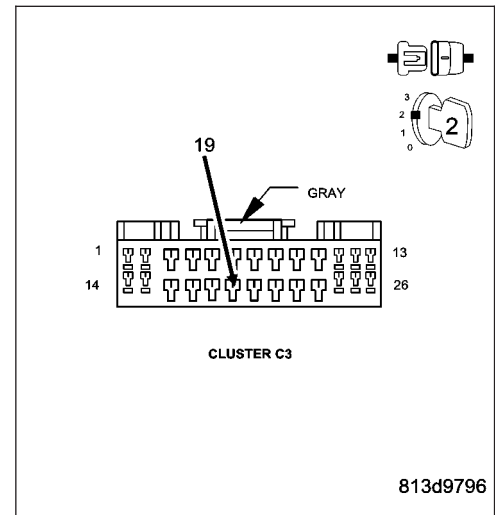
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

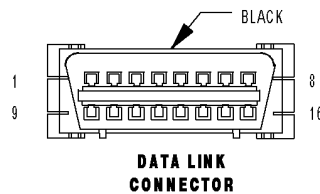
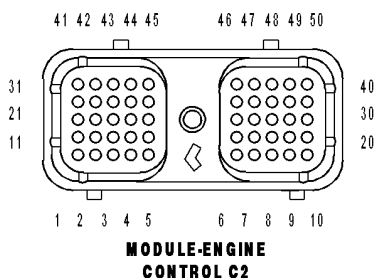
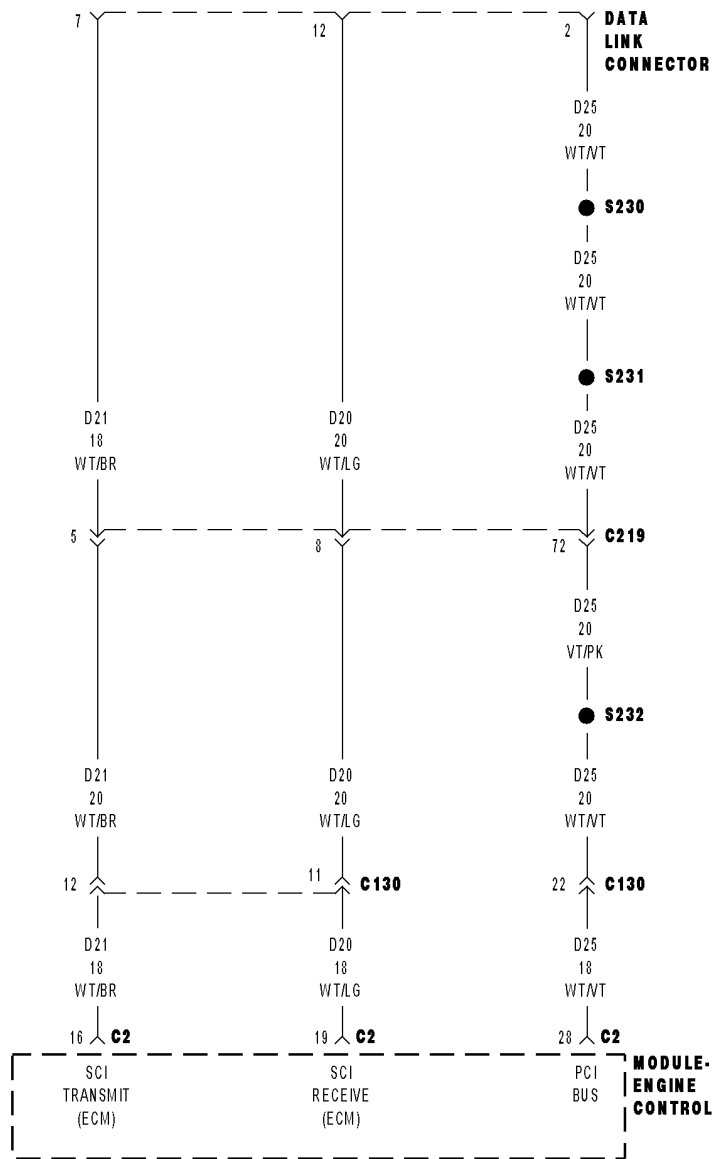
Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Cluster connector.

Observe the voltage display on the DRB Lab Scope.

**Does the voltage pulse from 0 to approximately 7.5 volts?**

- Yes** >> Replace the Cluster in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)
- No** >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM ENGINE CONTROL MODULE (PCI BUS) - DIESEL**



***NO RESPONSE FROM ENGINE CONTROL MODULE (PCI BUS) - DIESEL (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
ENGINE CONTROL MODULE POWER AND GROUND (D25) PCI BUS CIRCUIT OPEN ENGINE CONTROL MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH OTHER PCI BUS MODULES**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

NOTE: As soon as one or more modules communicates with the DRB, answer the question.

With the DRB, attempt to communicate with the ORC.

With the DRB, attempt to communicate with the Instrument Cluster.

Was the DRB able to I/D or communicate with either of the modules?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

NO RESPONSE FROM ENGINE CONTROL MODULE (PCI BUS) - DIESEL (CONTINUED)*2. (D25) PCI BUS CIRCUIT OPEN**

With the DRB, read Engine Control Module DTC's. This is to ensure power and ground to the ECM are operational.

NOTE: If the DRB will not read ECM DTC's, follow the **NO RESPONSE TO ECM (SCI ONLY)** symptom.

NOTE: If the vehicle will not start and the DRB displays a no response message, refer to the appropriate symptom in the **Engine Electrical Diagnostics - Diesel** category.

Turn the ignition off.

Disconnect the Engine Control Module C2 harness connector.

Turn the ignition on.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

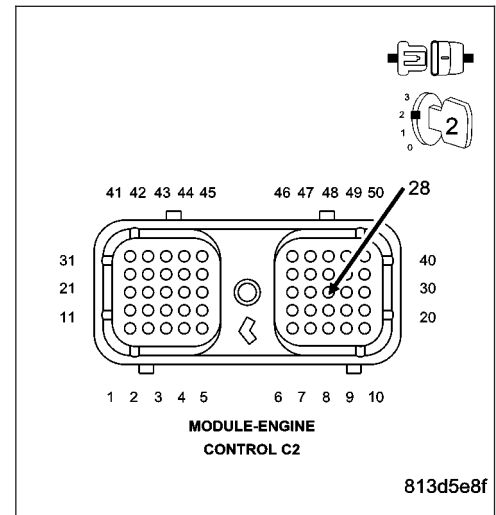
Select 12 volt square wave.

Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Engine Control Module connector.

Observe the voltage display on the DRB Lab Scope.

**Does the voltage pulse from 0 to approximately 7.5 volts?**

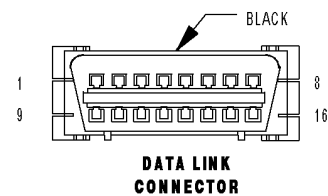
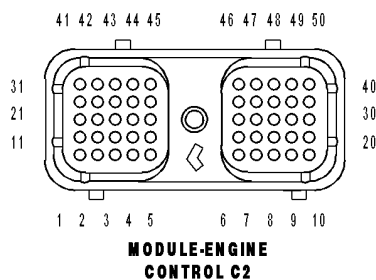
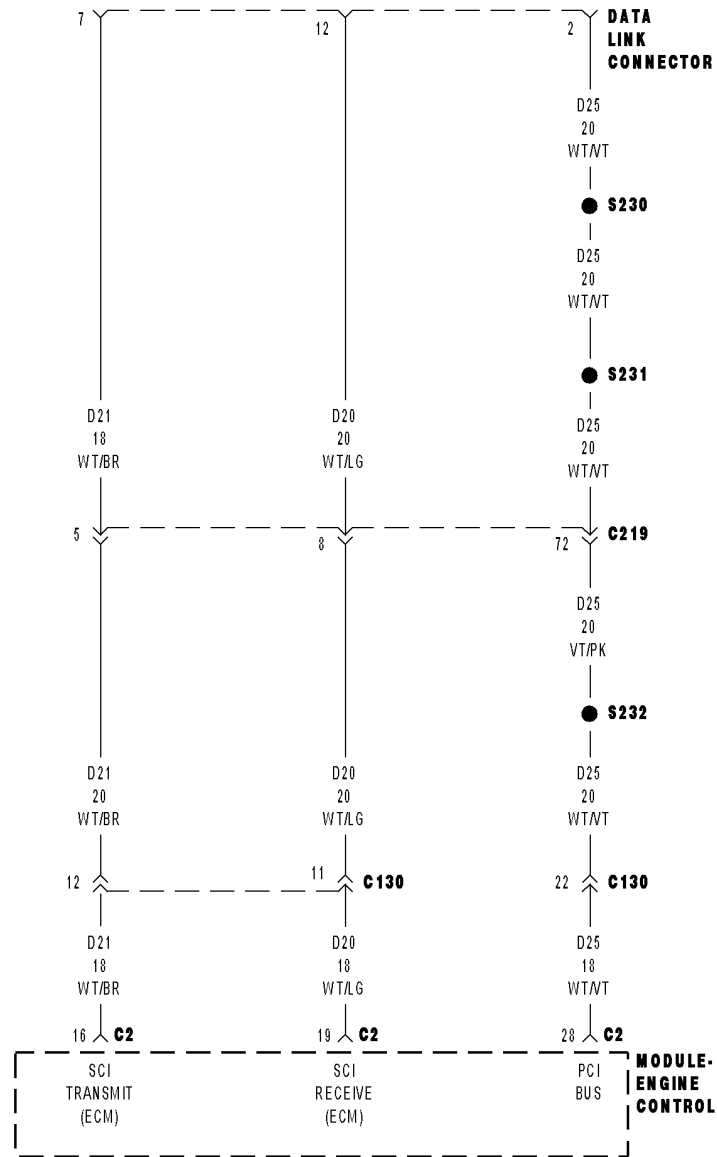
Yes >> Replace the Engine Control Module in accordance with the service information.

Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

No >> Repair the (D25) PCI Bus circuit for an open.

Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

***NO RESPONSE FROM ENGINE CONTROL MODULE (SCI ONLY) - DIESEL**



***NO RESPONSE FROM ENGINE CONTROL MODULE (SCI ONLY) - DIESEL (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
(D21) SCI TRANSMIT CIRCUIT SHORTED TO GROUND
(D20) SCI RECEIVE CIRCUIT SHORTED TO GROUND
(D21) SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE
(D20) SCI RECEIVE CIRCUIT SHORTED TO VOLTAGE
(D21) SCI TRANSMIT CIRCUIT OPEN
(D20) SCI RECEIVE CIRCUIT OPEN
(D21) SCI TRANSMIT CIRCUIT SHORTED TO THE (D20) SCI RECEIVE CIRCUIT
ENGINE CONTROL MODULE

Diagnostic Test**1. CHECK ENGINE CONTROL MODULE POWER AND GROUND**

Refer to the Engine Electrical Diagnostics - Diesel and perform the symptom Checking ECM Power and Ground Circuits.

Did the vehicle pass this test?

Yes >> Go To 2

No >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

2. SCI CIRCUITS SHORTED TO GROUND

Turn the ignition off.

Disconnect the DRB from the DLC.

Disconnect the Engine Control Module C2 harness connector.

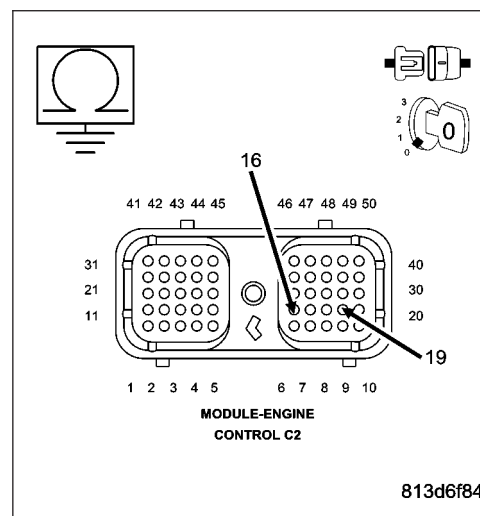
Measure the resistance between ground and the (D21) SCI Transmit circuit.

Measure the resistance between ground and the (D20) SCI Receive circuit.

Is the resistance below 10.0 ohms for either circuit?

Yes >> Repair the SCI Circuit that measured below 10.0 ohms for a short to ground.
Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

No >> Go To 3



NO RESPONSE FROM ENGINE CONTROL MODULE (SCI ONLY) - DIESEL (CONTINUED)*3. SCI CIRCUITS SHORTED TO VOLTAGE**

Turn the ignition on.

Measure the voltage of the (D21) SCI Transmit circuit.

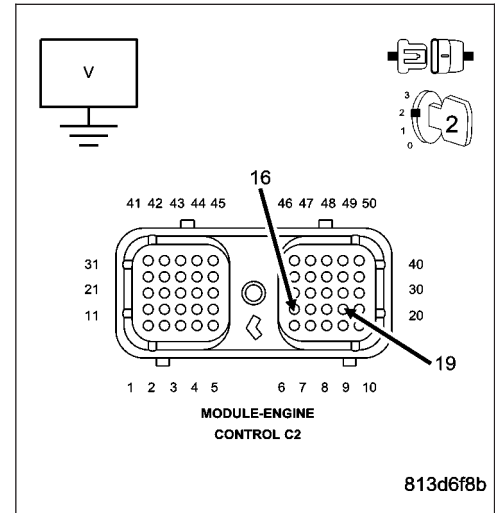
Measure the voltage of the (D20) SCI Receive circuit.

Is the voltage above 1.0 volt for either circuit?

Yes >> Repair the SCI Circuit that measured above 1.0 volt for a short to voltage.

Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

No >> Go To 4

**4. (D21) SCI TRANSMIT CIRCUIT OPEN**

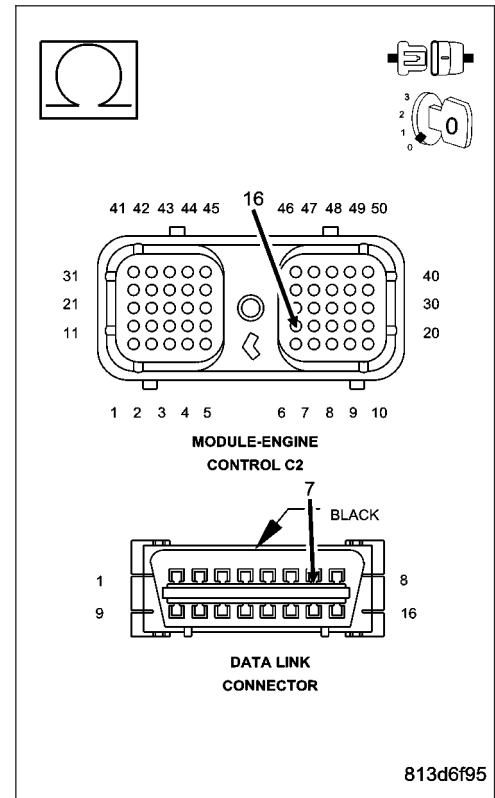
Turn the ignition off.

Measure the resistance of the (D21) SCI Transmit circuit between the ECM harness connector and the DLC.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (D21) SCI Transmit circuit for an open.
Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).



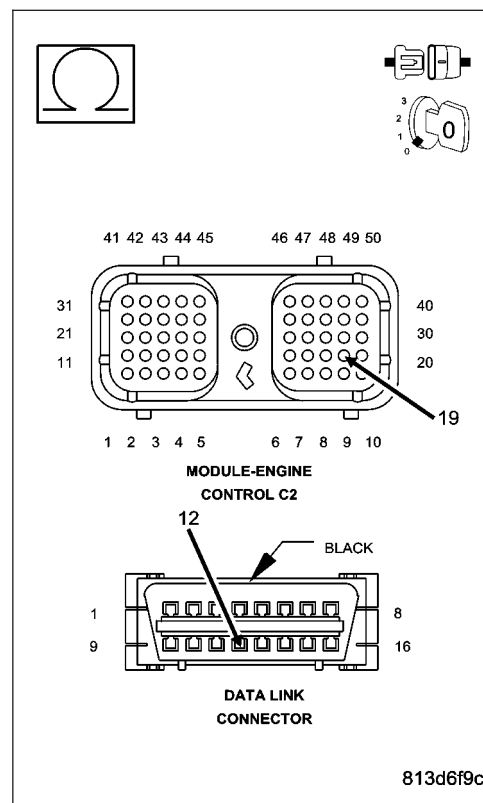
NO RESPONSE FROM ENGINE CONTROL MODULE (SCI ONLY) - DIESEL (CONTINUED)*5. (D20) SCI RECEIVE CIRCUIT OPEN**

Measure the resistance of the (D20) SCI Receive circuit between the ECM harness connector and the DLC.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the (D20) SCI Receive circuit for an open.
Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

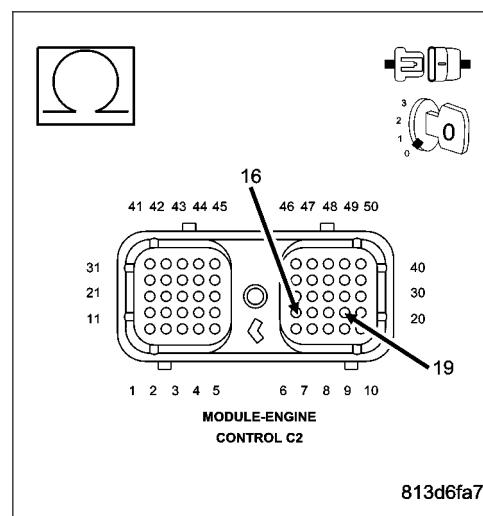
**6. (D21) SCI TRANSMIT CIRCUIT SHORTED TO THE (D20) SCI RECEIVE CIRCUIT**

Measure the resistance between the (D21) SCI Transmit and the (D20) SCI Receive circuits.

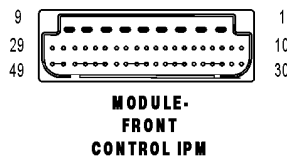
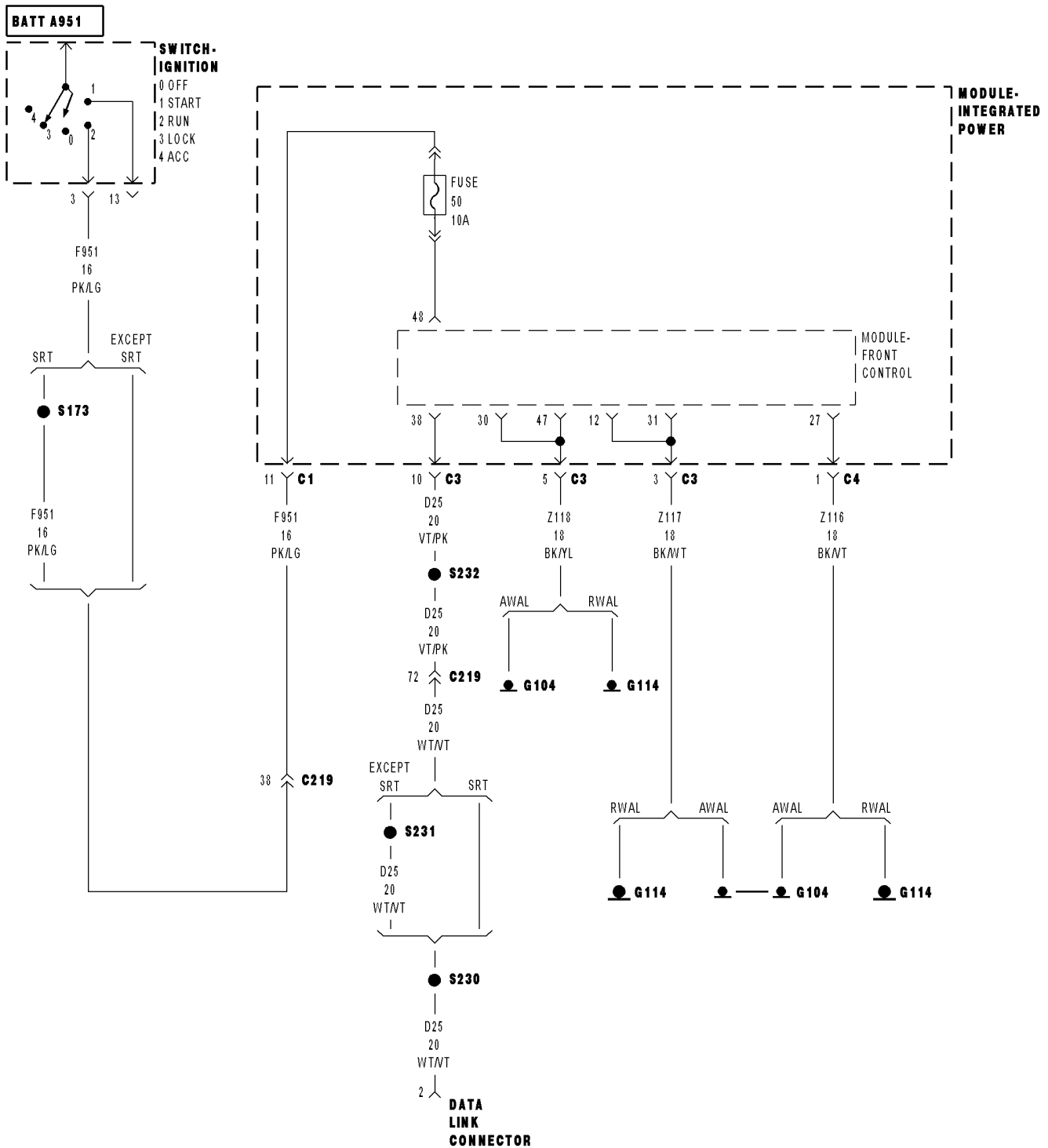
Is the resistance below 5.0 ohms?

Yes >> Repair the (D21) SCI Transmit circuit for a short to the (D20) SCI Receive circuit.
Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).

No >> Replace the Engine Control Module in accordance with the service information.
Perform POWERTRAIN VERIFICATION TEST - VER 1 (DIESEL).



***NO RESPONSE FROM FRONT CONTROL MODULE**



***NO RESPONSE FROM FRONT CONTROL MODULE (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z117) (Z118) GROUND CIRCUIT OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN FRONT CONTROL MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH OTHER PCI BUS MODULES**

Turn the ignition on.

NOTE: Check all fuses before beginning.

NOTE: As soon as one or more modules communicates with the DRB, answer the question.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the ORC.

With the DRB, attempt to communicate with the Instrument Cluster.

Was the DRB able to I/D or communicate with either of the modules?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z117) (Z118) GROUND CIRCUIT OPEN

Turn the ignition off.

Remove the Front Control Module from the IPM.

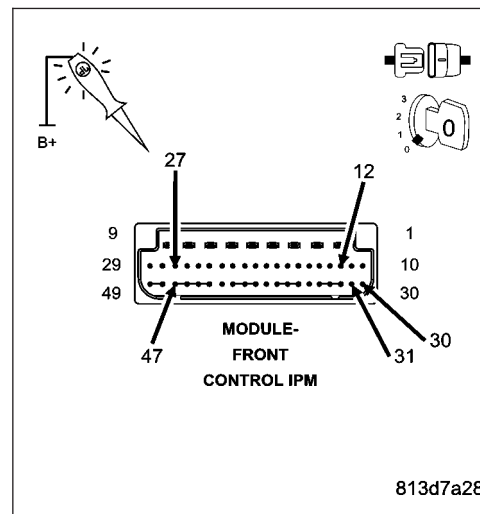
Using a 12-volt test light connected to 12-volts, probe each (Z117) and (Z118) ground circuits.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z117) or (Z118) Ground circuit for an open between the IPM connector and the grounding point. If OK, replace the power distribution center in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



NO RESPONSE FROM FRONT CONTROL MODULE (CONTINUED)*3. FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

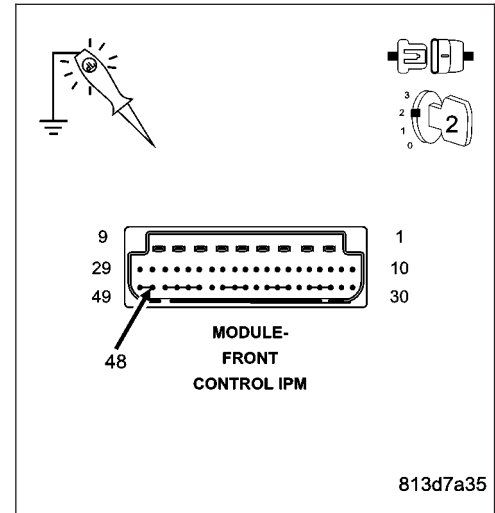
Turn the ignition on.

Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Check all IPM fuses. If OK, replace the power distribution center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

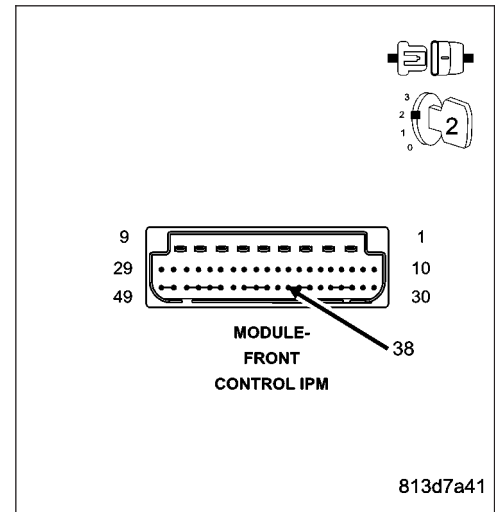
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the IPM FCM connector.

Observe the voltage display on the DRB Lab Scope.

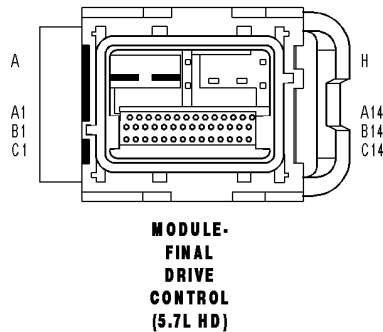
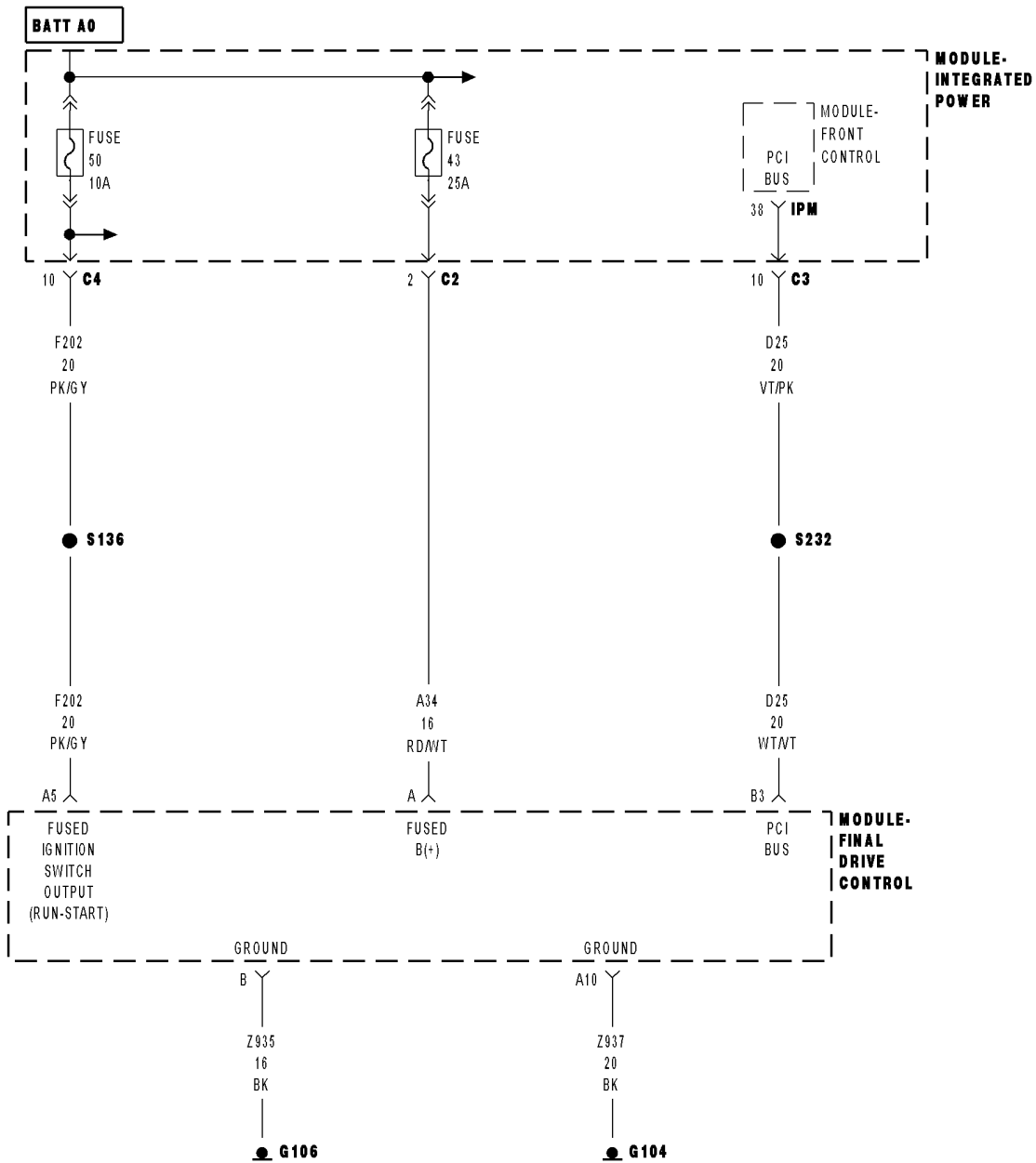


Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Front Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Repair the (D25) PCI Bus circuit for an open. If OK, replace the power distribution center in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM FINAL DRIVE CONTROL MODULE**



***NO RESPONSE FROM FINAL DRIVE CONTROL MODULE (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z935) (Z937) GROUND CIRCUIT OPEN (A34) FUSED B+ CIRCUIT OPEN (F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN FINAL DRIVE CONTROL MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE INSTRUMENT CLUSTER (MIC)**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the MIC.

Was the DRB able to I/D or communicate with the MIC?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform FDCM VERIFICATION TEST

2. (Z935) (Z937) GROUND CIRCUIT OPEN

Turn the ignition off.

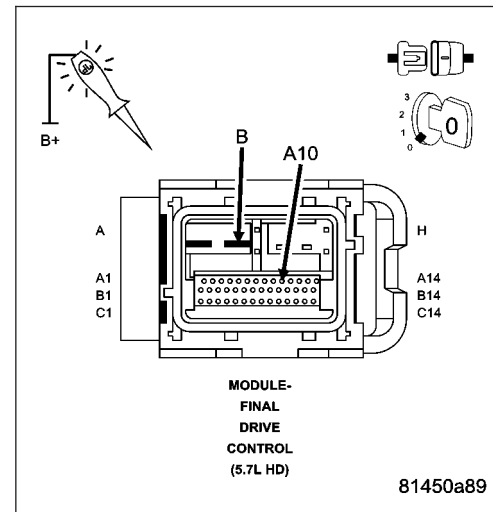
Disconnect the Final Drive Control Module harness connector.

Using a 12-volt test light connected to 12-volts, probe each (Z935) and (Z937) ground circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z935) or (Z937) Ground circuit for an open.
Perform FDCM VERIFICATION TEST



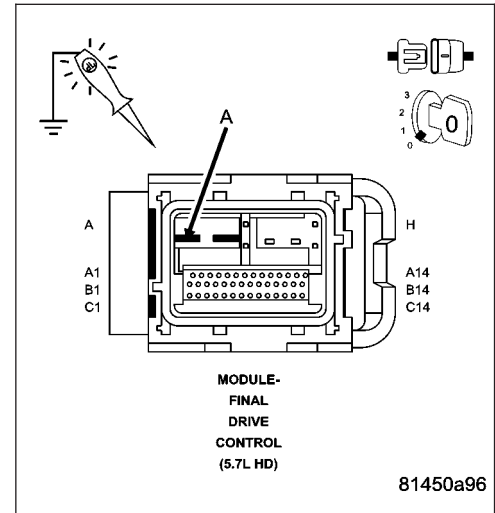
NO RESPONSE FROM FINAL DRIVE CONTROL MODULE (CONTINUED)*3. (A34) FUSED B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe the (A34) Fused B+ circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (A34) Fused B+ circuit for an open.
Perform FDCM VERIFICATION TEST

**4. (F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

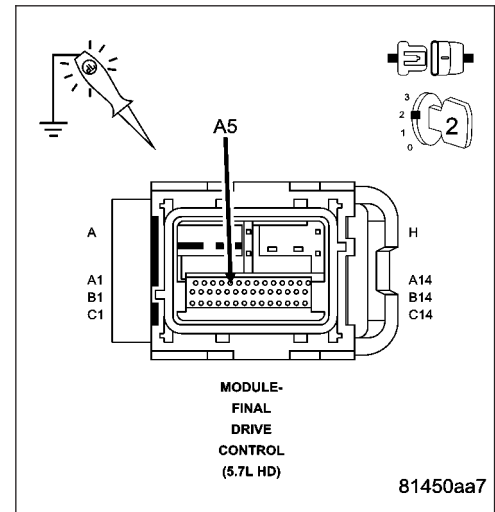
Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F202) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 5

No >> Repair the (F202) Fused Ignition Switch Output circuit for an open.
Perform FDCM VERIFICATION TEST



NO RESPONSE FROM FINAL DRIVE CONTROL MODULE (CONTINUED)*5. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

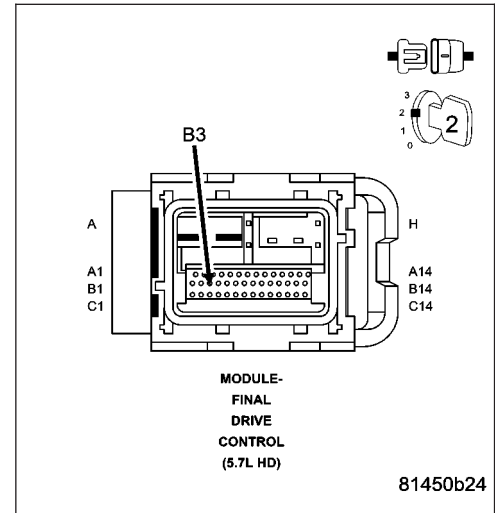
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the FDCM connector.

Observe the voltage display on the DRB Lab Scope.

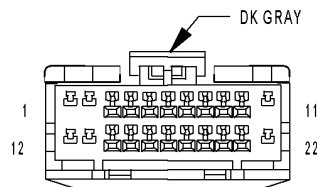
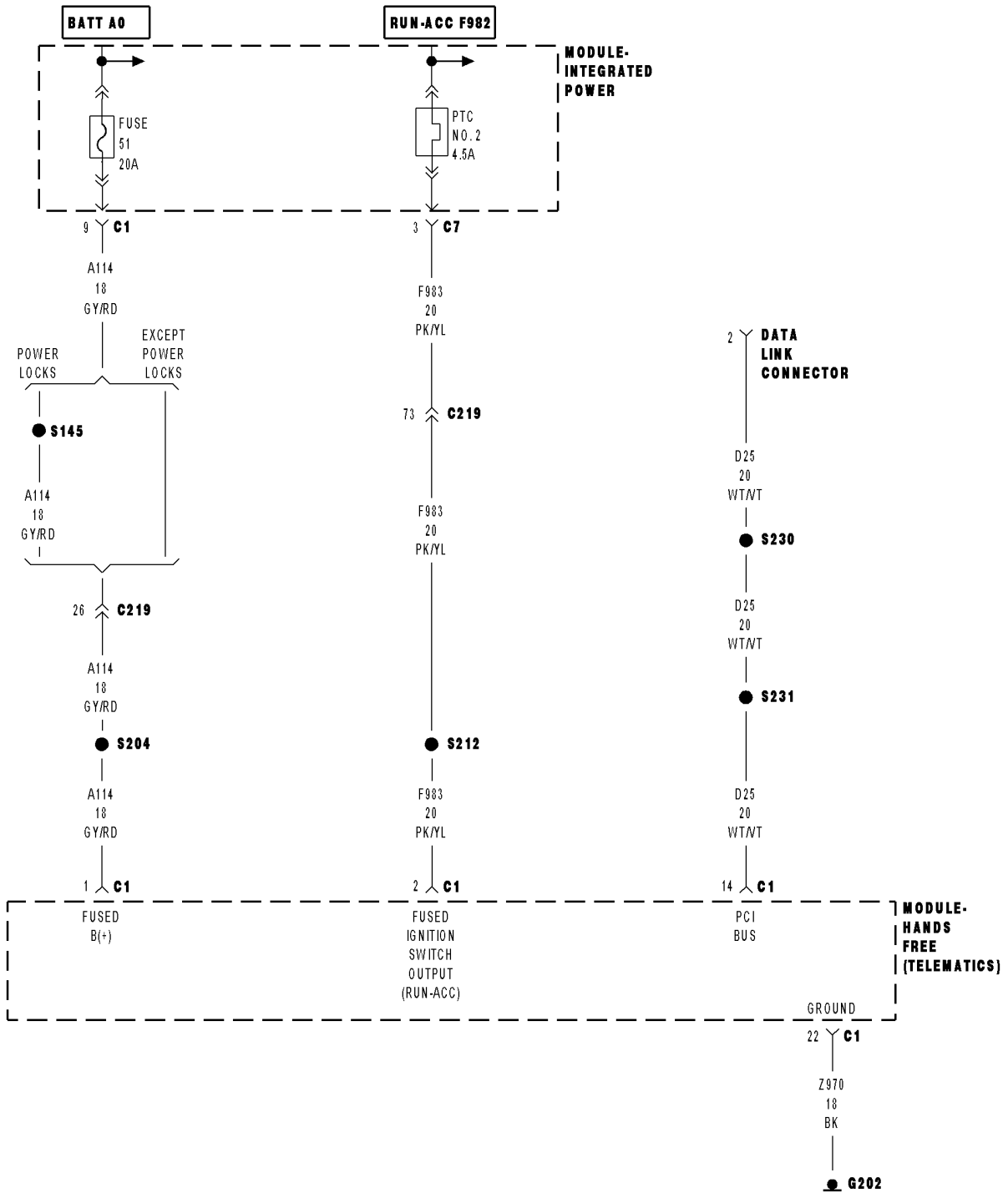


Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Final Drive Control Module in accordance with the service information.
Perform FDCM VERIFICATION TEST

No >> Repair the (D25) PCI Bus circuit for an open.
Perform FDCM VERIFICATION TEST

***NO RESPONSE FROM HANDS FREE MODULE**



MODULE-HANDS FREE C1 (TELEMATICS)

***NO RESPONSE FROM HANDS FREE MODULE (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z970) GROUND CIRCUIT OPEN (A114) FUSED B+ CIRCUIT OPEN (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN HANDS FREE MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE INSTRUMENT CLUSTER (MIC)**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the MIC.

Was the DRB able to I/D or communicate with the MIC?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z970) GROUND CIRCUIT OPEN

Turn the ignition off.

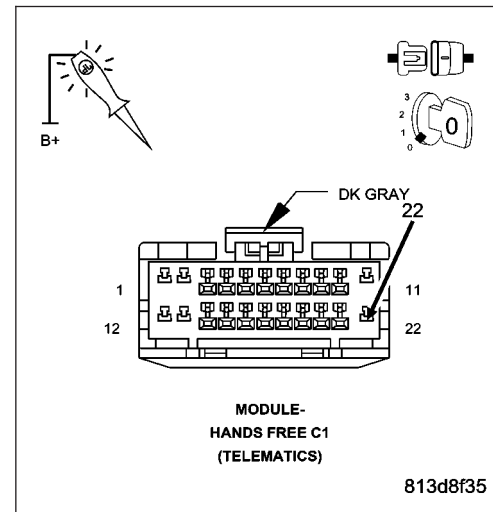
Disconnect the Hands Free Module C1 harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z970) ground circuit.

Is the test light illuminated?

Yes >> Go To 3

No >> Repair the (Z970) Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



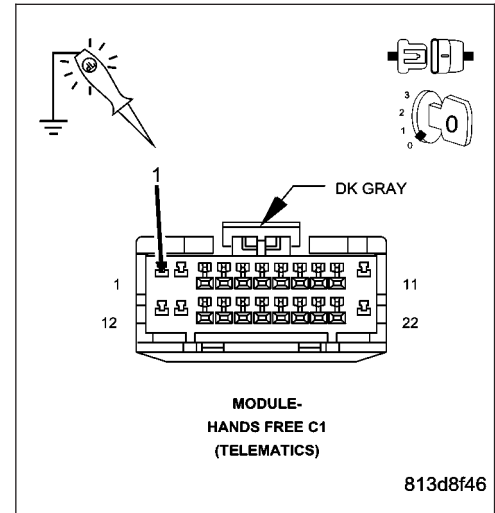
NO RESPONSE FROM HANDS FREE MODULE (CONTINUED)*3. (A114) FUSED B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe the (A114) Fused B+ circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (A114) Fused B+ circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

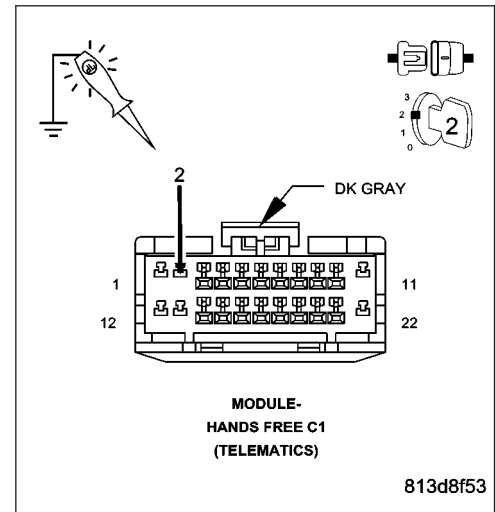
Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F983) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 5

No >> Repair the (F983) Fused Ignition Switch Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



NO RESPONSE FROM HANDS FREE MODULE (CONTINUED)*5. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

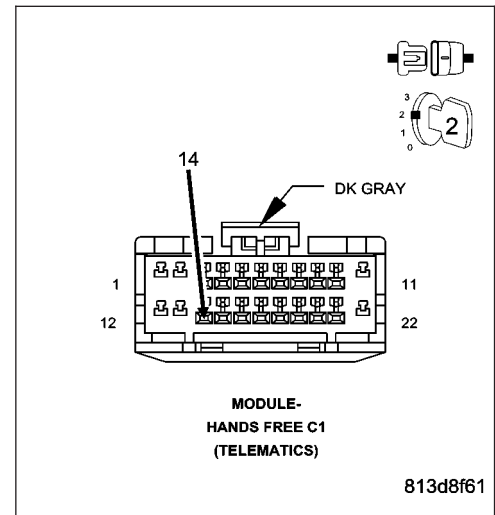
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

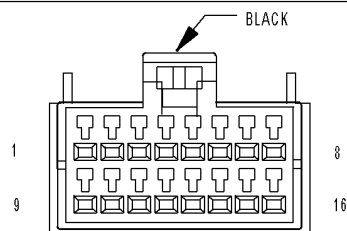
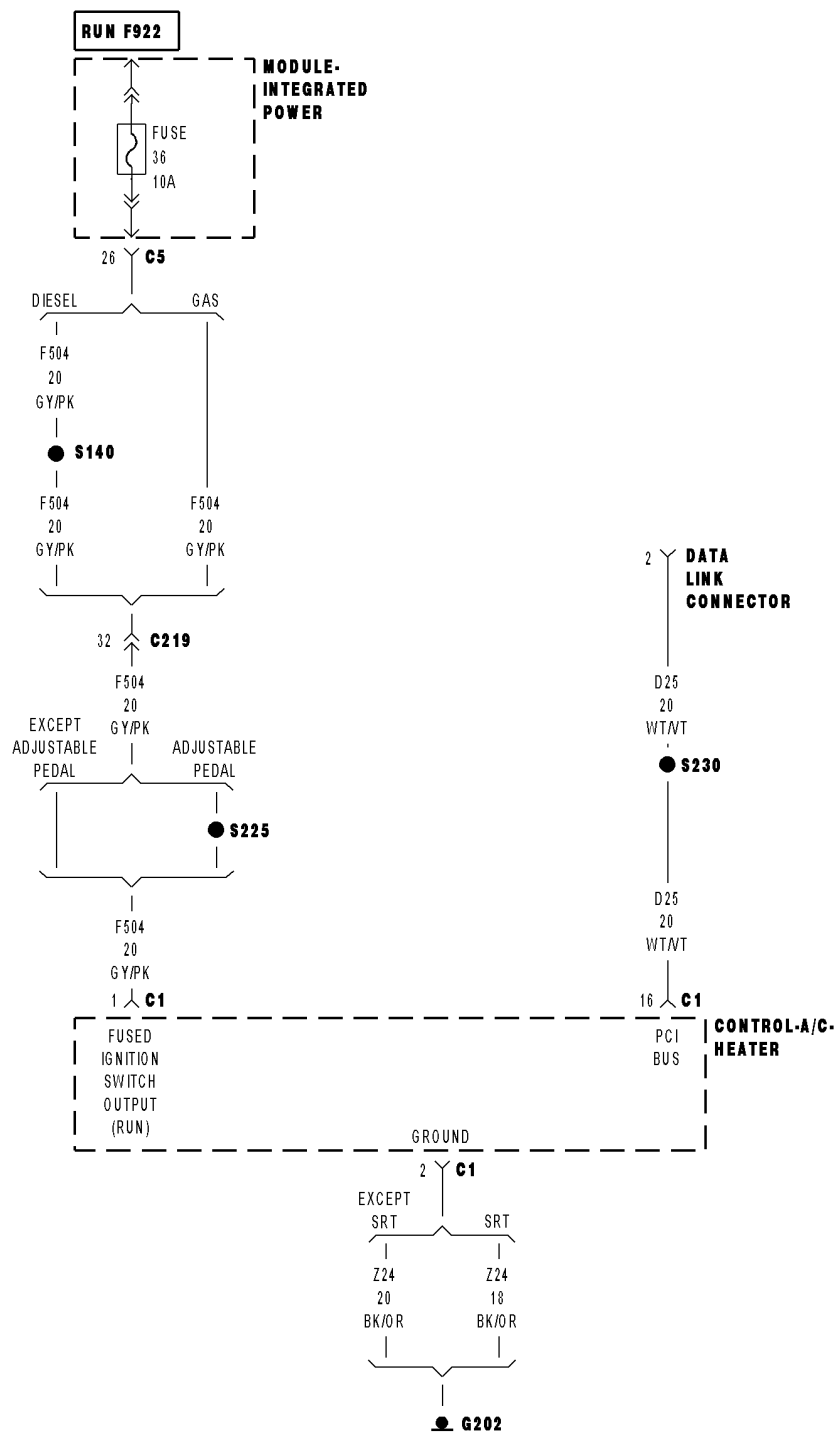
Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the HFM connector.

Observe the voltage display on the DRB Lab Scope.

**Does the voltage pulse from 0 to approximately 7.5 volts?**

- Yes** >> Replace the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)
- No** >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM HVAC**



CONTROL-A/C- HEATER C1

***NO RESPONSE FROM HVAC (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z24) GROUND CIRCUIT OPEN
(F504) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
(D25) PCI BUS CIRCUIT OPEN
A/C HEATER CONTROL

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH OTHER PCI BUS MODULES**

Turn the ignition on.

NOTE: As soon as one or more modules communicates with the DRB, answer the question.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the ORC.

With the DRB, attempt to communicate with the Instrument Cluster.

Was the DRB able to I/D or communicate with either of the modules?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z24) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the A/C Heater Control C1 harness connector.

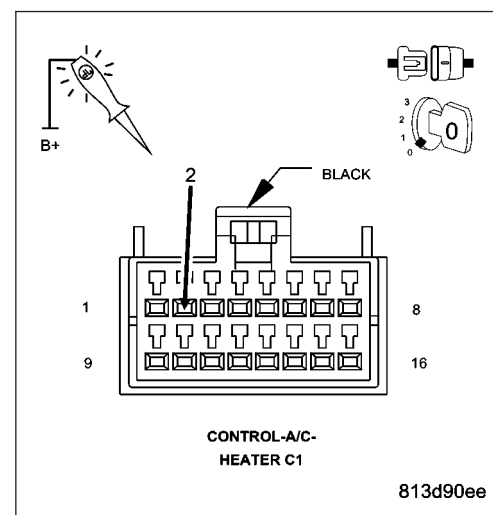
Using a 12-volt test light connected to 12-volts, probe the (Z24) ground circuit.

Is the test light illuminated?

Yes >> Go To 3

No >> Repair the (Z24) Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



NO RESPONSE FROM HVAC (CONTINUED)*3. (F504) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

Turn the ignition on.

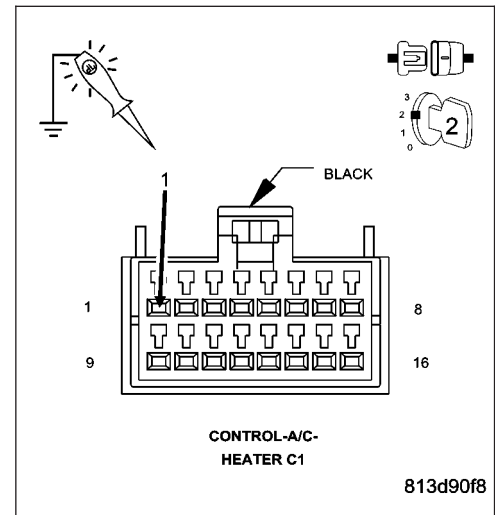
Using a 12-volt test light connected to ground, probe the (F504) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (F504) Fused Ignition Switch Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

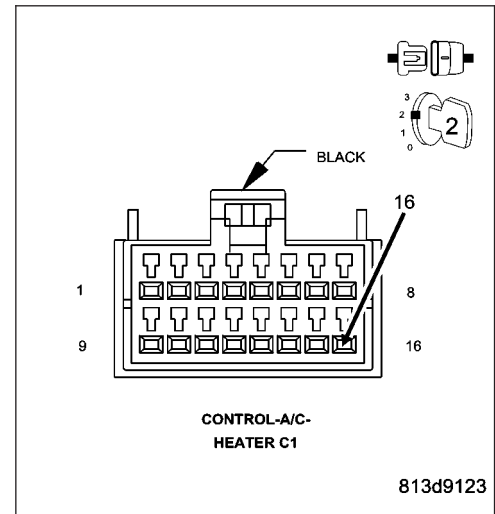
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the A/C Heater Control connector.

Observe the voltage display on the DRB Lab Scope.



Does the voltage pulse from 0 to approximately 7.5 volts?

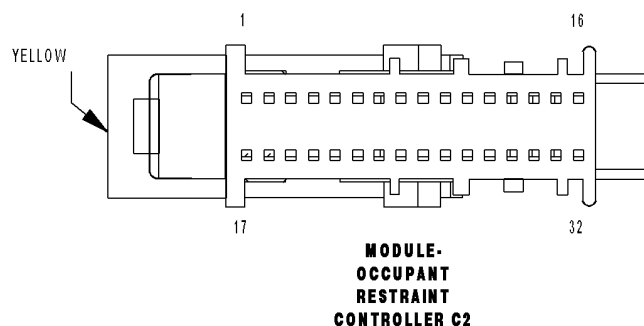
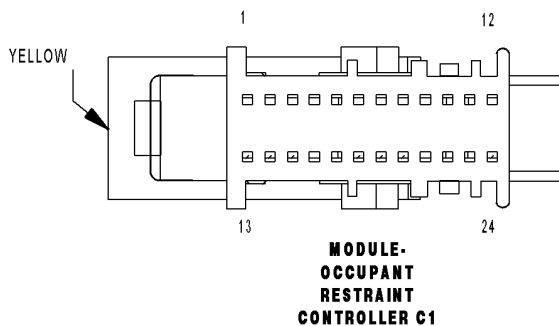
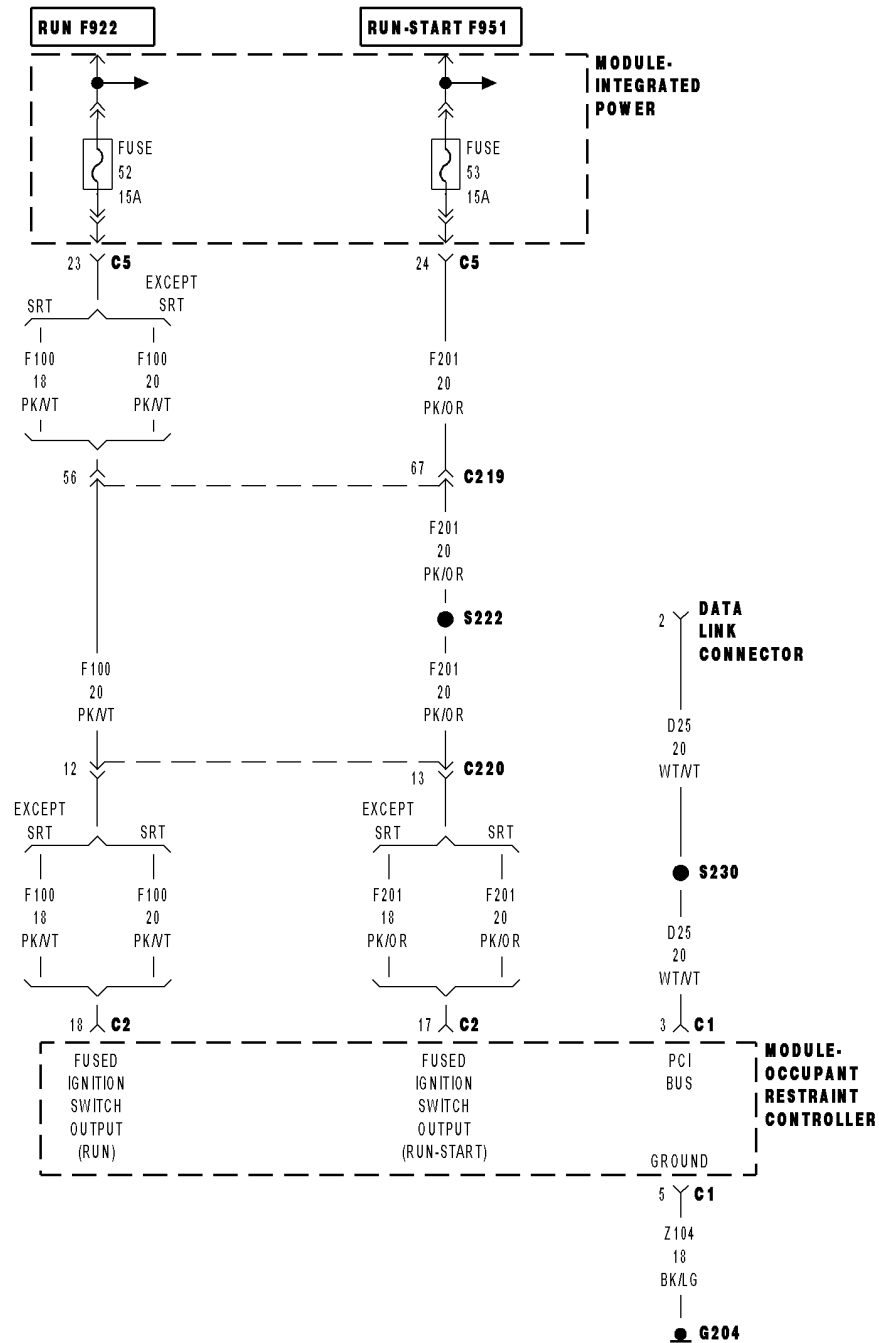
Yes >> Replace the A/C Heater Control in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM OCCUPANT RESTRAINT CONTROL MODULE**



***NO RESPONSE FROM OCCUPANT RESTRAINT CONTROL MODULE (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
(F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN
(F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN
(Z104) GROUND CIRCUIT OPEN
(D25) PCI BUS CIRCUIT OPEN
OCCUPANT RESTRAINT CONTROL MODULE

Diagnostic Test**1. CHECKING FOR VOLTAGE AT ORC**

NOTE: Ensure that the battery is fully charged.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.

Disconnect the ORC harness connectors.

Connect the appropriate Load Tool ORC Adapter to the ORC connector.

Turn the ignition on and then reconnect the Battery.

Using a 12-volt test light connected to ground, probe the (F100) Fused Ignition Switch Output (Run) Circuit and the (F201) Fused Ignition Switch Output (Run-Start) Circuit.

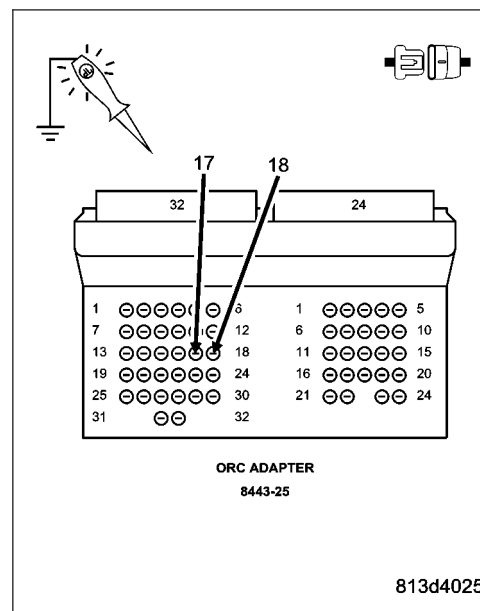
NOTE: One open circuit will not cause a **NO RESPONSE** condition.

Is the test light illuminated on both circuits?

Yes >> Go To 2

No >> Repair the (F100) Fused Ignition Switch Output (Run) and (F201) Fused Ignition Switch Output (Run/Start) circuits for an open.

Perform AIRBAG VERIFICATION TEST - VER 1.



NO RESPONSE FROM OCCUPANT RESTRAINT CONTROL MODULE (CONTINUED)*2. (Z104) GROUND CIRCUIT OPEN**

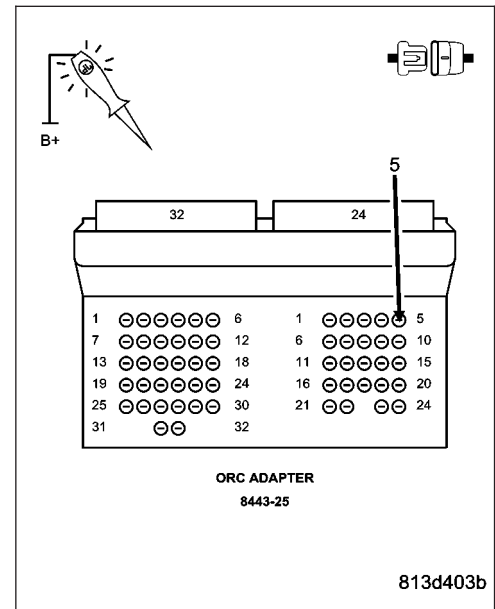
Turn the ignition off.

Using a 12-volt test light connected to 12-volts, probe the (Z104) ground circuit.

Is the test light illuminated?

Yes >> Go To 3

No >> Repair the (Z104) Ground circuit for an open.
Perform AIRBAG VERIFICATION TEST - VER 1.

**3. (D25) PCI BUS CIRCUIT OPEN**

Turn the ignition on.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

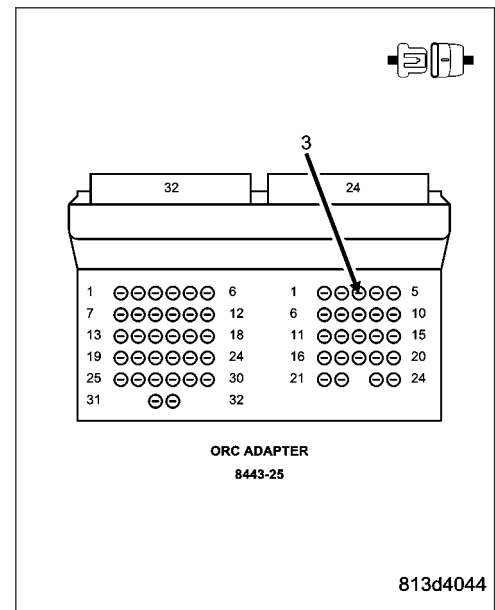
Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the ORC connector.

Observe the voltage display on the DRB Lab Scope.

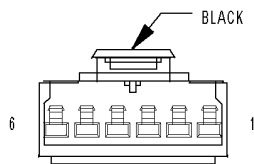
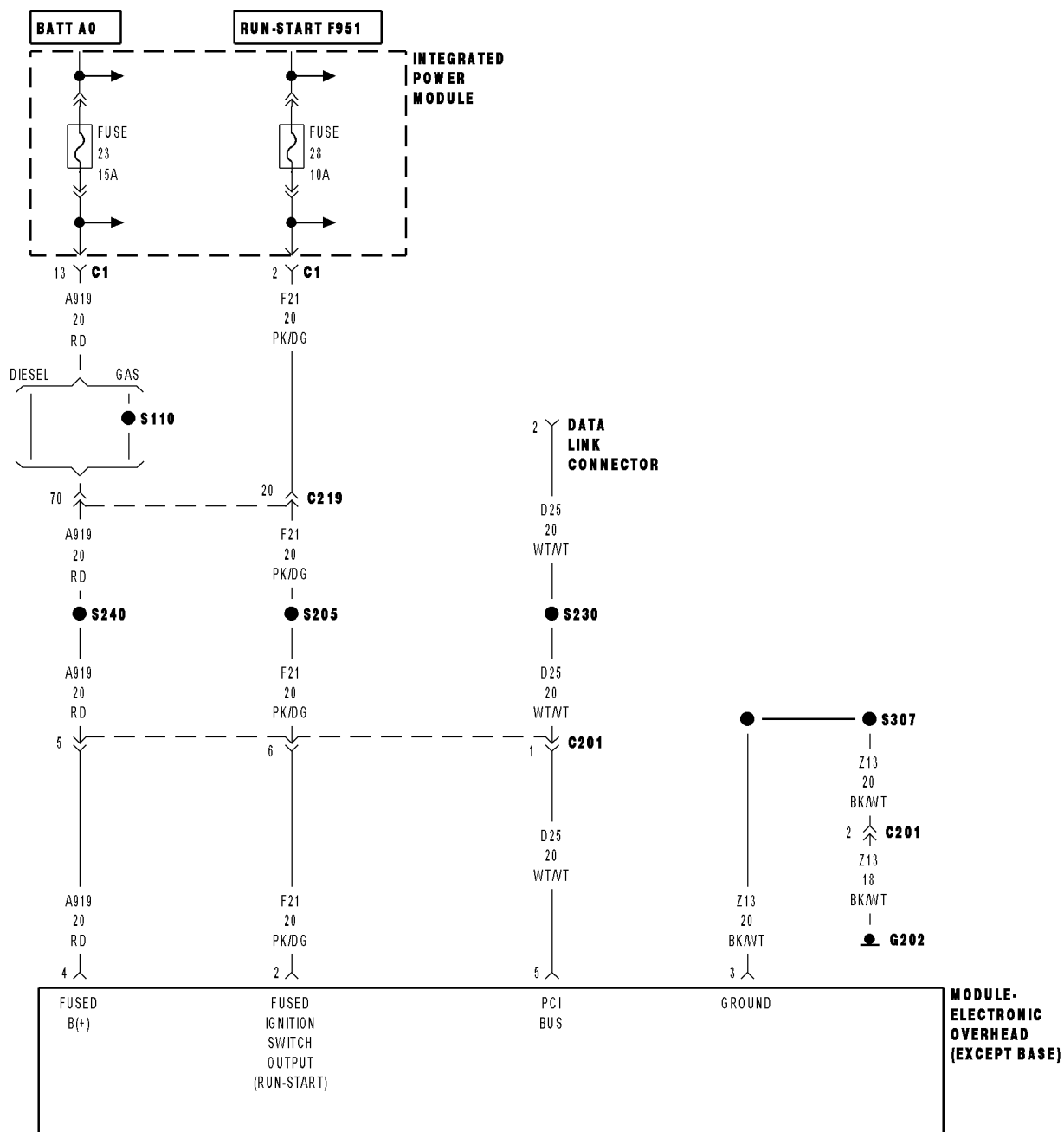
Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Occupant Restraint Control Module in accordance with the service information.
Perform AIRBAG VERIFICATION TEST - VER 1.

No >> Repair the (D25) PCI Bus circuit for an open.
Perform AIRBAG VERIFICATION TEST - VER 1.



***NO RESPONSE FROM OVERHEAD CONSOLE**



MODULE-ELECTRONIC OVERHEAD (EXCEPT BASE)

***NO RESPONSE FROM OVERHEAD CONSOLE (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z13) GROUND CIRCUIT OPEN (A919) FUSED B+ CIRCUIT OPEN (F21) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN ELECTRONIC OVERHEAD MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE INSTRUMENT CLUSTER (MIC)**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the MIC.

Was the DRB able to I/D or communicate with the MIC?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z13) GROUND CIRCUIT OPEN

Turn the ignition off.

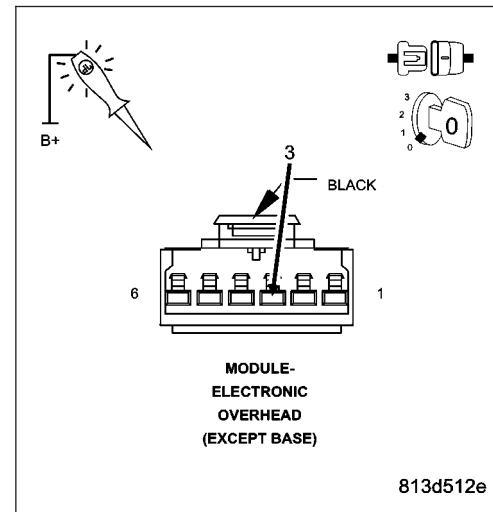
Disconnect the Electronic Overhead Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z13) ground circuit.

Is the test light illuminated?

Yes >> Go To 3

No >> Repair the (Z13) Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



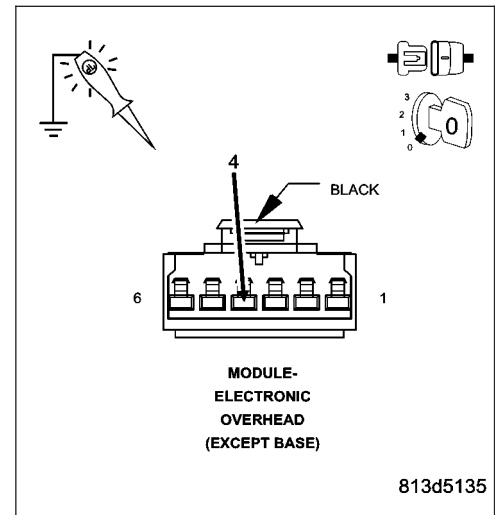
NO RESPONSE FROM OVERHEAD CONSOLE (CONTINUED)*3. (A919) FUSED B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe the (A919) Fused B+ circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (A919) Fused B+ circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (F21) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

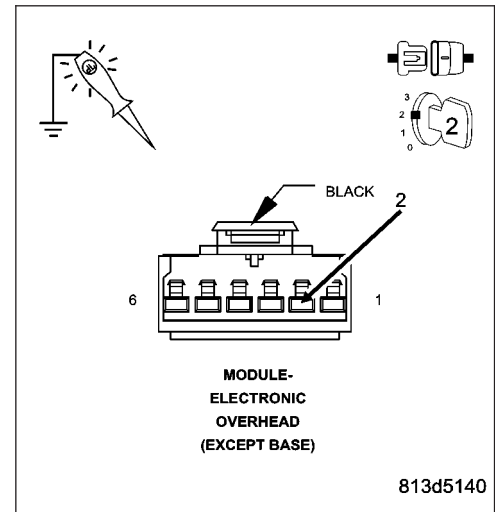
Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F21) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 5

No >> Repair the (F21) Fused Ignition Switch Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



NO RESPONSE FROM OVERHEAD CONSOLE (CONTINUED)*5. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

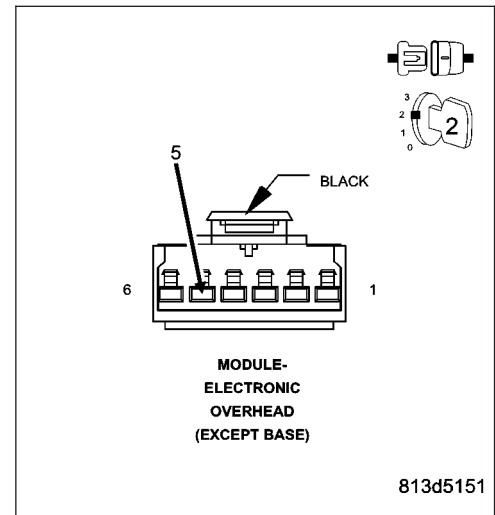
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

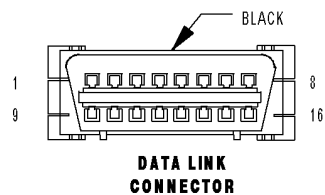
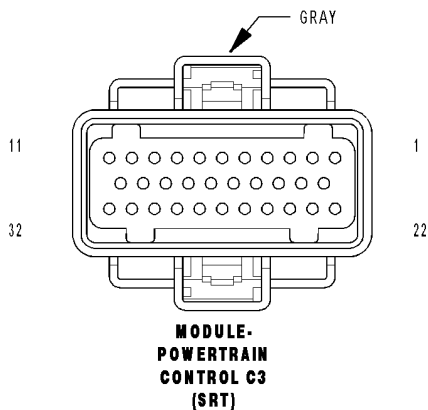
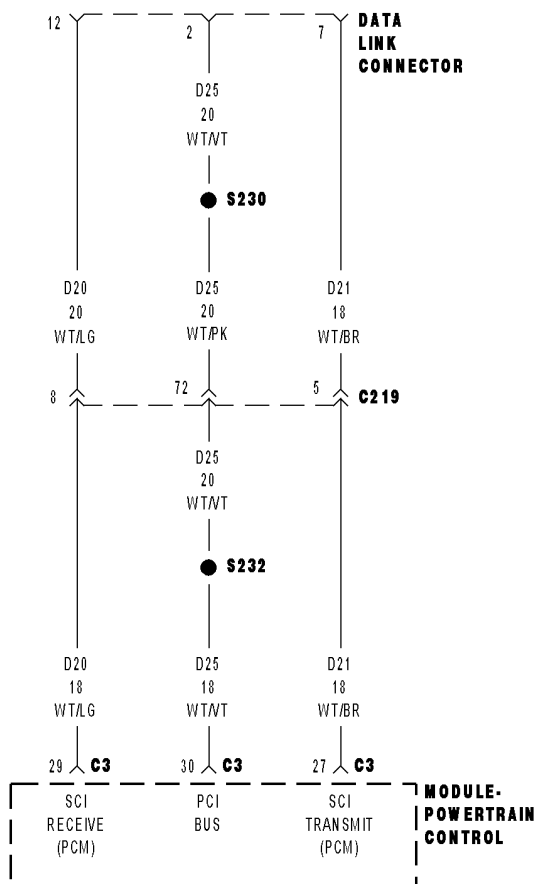
Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Electronic Overhead Module connector.

Observe the voltage display on the DRB Lab Scope.

**Does the voltage pulse from 0 to approximately 7.5 volts?**

- Yes** >> Replace the Electronic Overhead Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)
- No** >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM PCM (PCI BUS) - JTEC**



***NO RESPONSE FROM PCM (PCI BUS) - JTEC (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
POWERTRAIN CONTROL MODULE POWER AND GROUND (D25) PCI BUS CIRCUIT OPEN POWERTRAIN CONTROL MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH OTHER PCI BUS MODULES**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

NOTE: As soon as one or more modules communicates with the DRB, answer the question.

With the DRB, attempt to communicate with the ORC.

With the DRB, attempt to communicate with the Instrument Cluster.

Was the DRB able to I/D or communicate with either of the modules?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform POWERTRAIN VERIFICATION TEST - VER 1.

NO RESPONSE FROM PCM (PCI BUS) - JTEC (CONTINUED)*2. (D25) PCI BUS CIRCUIT OPEN**

With the DRB, read PCM DTC's. This is to ensure power and ground to the PCM are operational.

NOTE: If the DRB will not read PCM DTC's, follow the **NO RESPONSE TO PCM (SCI ONLY) - JTEC** symptom.

NOTE: If the vehicle will not start and the DRB displays a no response message, refer to the appropriate symptom in the **Engine Electrical Diagnostics** category.

Turn the ignition off.

Disconnect the PCM C3 harness connector.

Turn the ignition on.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

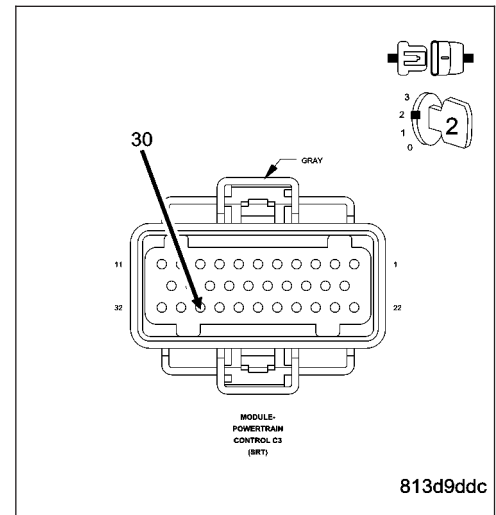
Select 12 volt square wave.

Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the PCM connector.

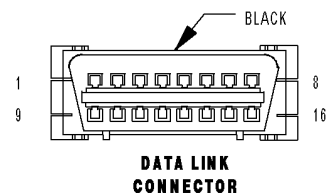
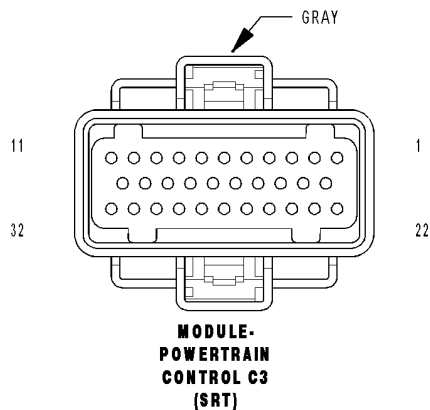
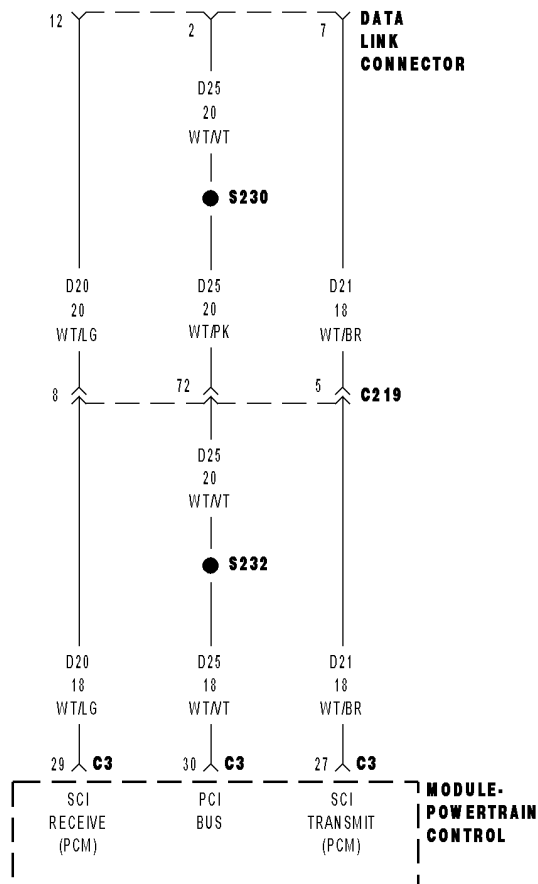
Observe the voltage display on the DRB Lab Scope.

**Does the voltage pulse from 0 to approximately 7.5 volts?**

Yes >> Replace the Powertrain Control Module in accordance with the service information.
Perform POWERTRAIN VERIFICATION TEST - VER 1.

No >> Repair the (D25) PCI Bus circuit for an open.
Perform POWERTRAIN VERIFICATION TEST - VER 1.

***NO RESPONSE FROM PCM (SCI ONLY) - JTEC**



***NO RESPONSE FROM PCM (SCI ONLY) - JTEC (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
(D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO GROUND (D20) SCI RECEIVE (PCM) CIRCUIT SHORTED TO GROUND (D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO VOLTAGE (D20) SCI RECEIVE (PCM) CIRCUIT SHORTED TO VOLTAGE (D21) SCI TRANSMIT (PCM) CIRCUIT OPEN (D20) SCI RECEIVE (PCM) CIRCUIT OPEN (D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO THE (D20) SCI RECEIVE (PCM) CIRCUIT POWERTRAIN CONTROL MODULE

Diagnostic Test**1. CHECK POWERTRAIN CONTROL MODULE POWER AND GROUND**

Refer to the Engine Electrical Diagnostics and perform the symptom Checking PCM Power and Ground Circuits.

NOTE: With the DRB in the generic scan tool mode, attempt to communicate with the PCM. If the DRB can communicate with the PCM in the generic scan tool mode, it may not be necessary to perform this step.

Did the vehicle pass this test?

Yes >> Go To 2

No >> Repair as necessary.

Perform POWERTRAIN VERIFICATION TEST - VER 1.

2. SCI CIRCUITS SHORTED TO GROUND

Turn the ignition off.

Disconnect the DRB from the DLC.

Disconnect the Powertrain Control Module C3 harness connector.

Measure the resistance between ground and the (D21) SCI Transmit (PCM) circuit.

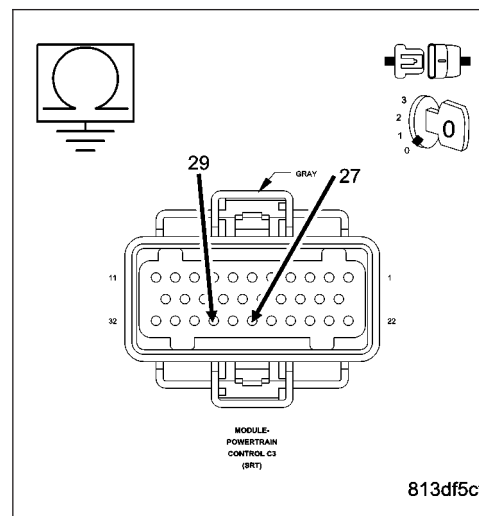
Measure the resistance between ground and the (D20) SCI Receive (PCM) circuit.

Is the resistance below 10.0 ohms for either circuit?

Yes >> Repair the SCI Circuit that measured below 10.0 ohms for a short to ground.

Perform POWERTRAIN VERIFICATION TEST - VER 1.

No >> Go To 3



813df5cf

NO RESPONSE FROM PCM (SCI ONLY) - JTEC (CONTINUED)*3. SCI CIRCUITS SHORTED TO VOLTAGE**

Turn the ignition on.

Measure the voltage of the (D21) SCI Transmit (PCM) circuit.

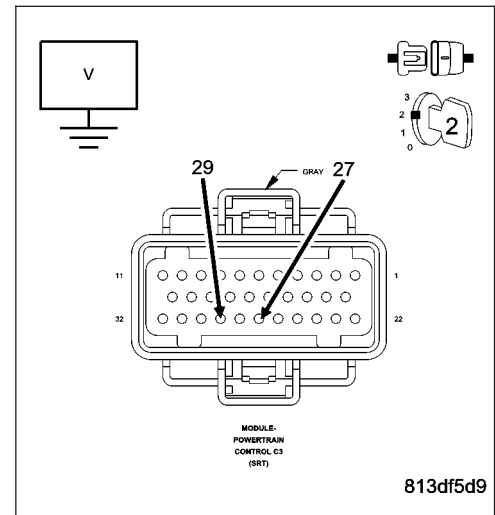
Measure the voltage of the (D20) SCI Receive (PCM) circuit.

Is the voltage above 1.0 volt for either circuit?

Yes >> Repair the SCI Circuit that measured above 1.0 volt for a short to voltage.

Perform POWERTRAIN VERIFICATION TEST - VER 1.

No >> Go To 4

**4. (D21) SCI TRANSMIT (PCM) CIRCUIT OPEN**

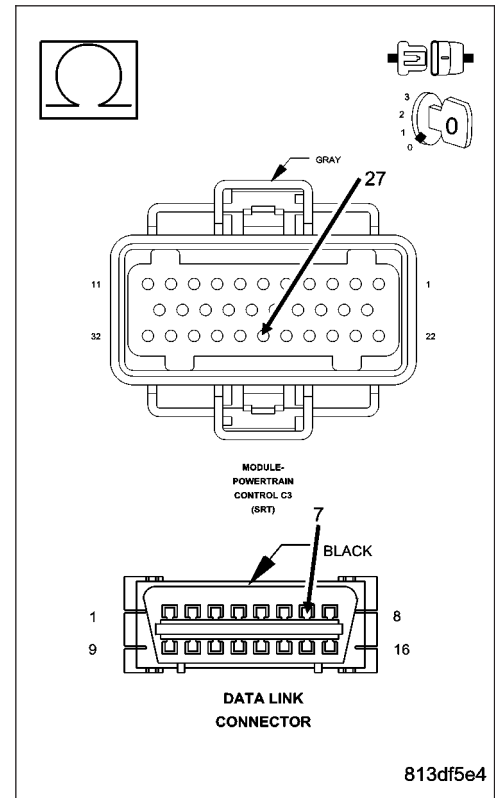
Turn the ignition off.

Measure the resistance of the (D21) SCI Transmit (PCM) circuit between the DLC and the PCM connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (D21) SCI Transmit (PCM) circuit for an open.
Perform POWERTRAIN VERIFICATION TEST - VER 1.



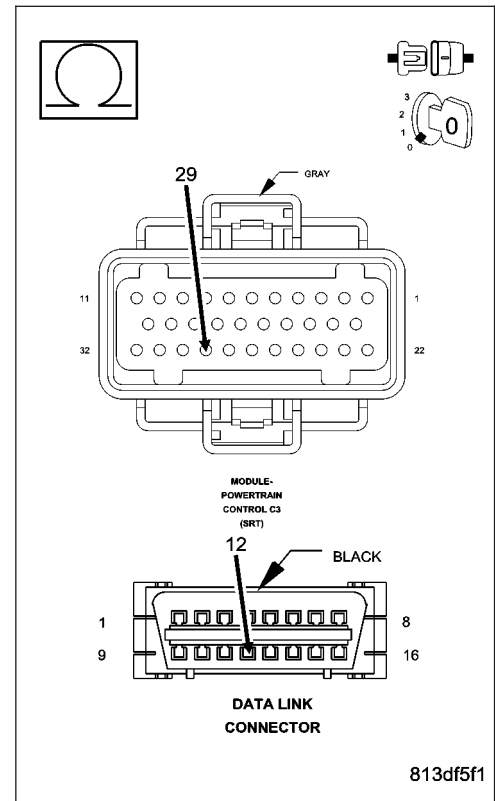
NO RESPONSE FROM PCM (SCI ONLY) - JTEC (CONTINUED)*5. (D20) SCI RECEIVE (PCM) CIRCUIT OPEN**

Measure the resistance of the (D20) SCI Receive (PCM) circuit between the DLC and the PCM connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the (D20) SCI Receive (PCM) circuit for an open.
Perform POWERTRAIN VERIFICATION TEST - VER 1.

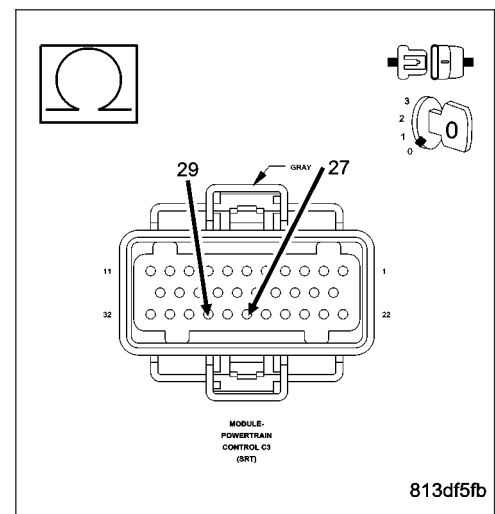
**6. (D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO THE (D20) SCI RECEIVE (PCM) CIRCUIT**

Measure the resistance between the (D21) SCI Transmit (PCM) and the (D20) SCI Receive (PCM) circuits.

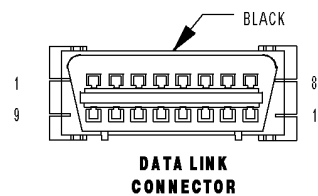
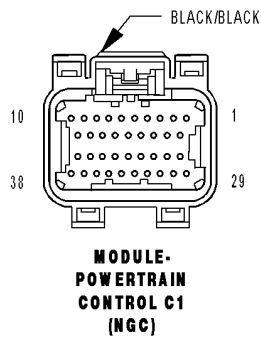
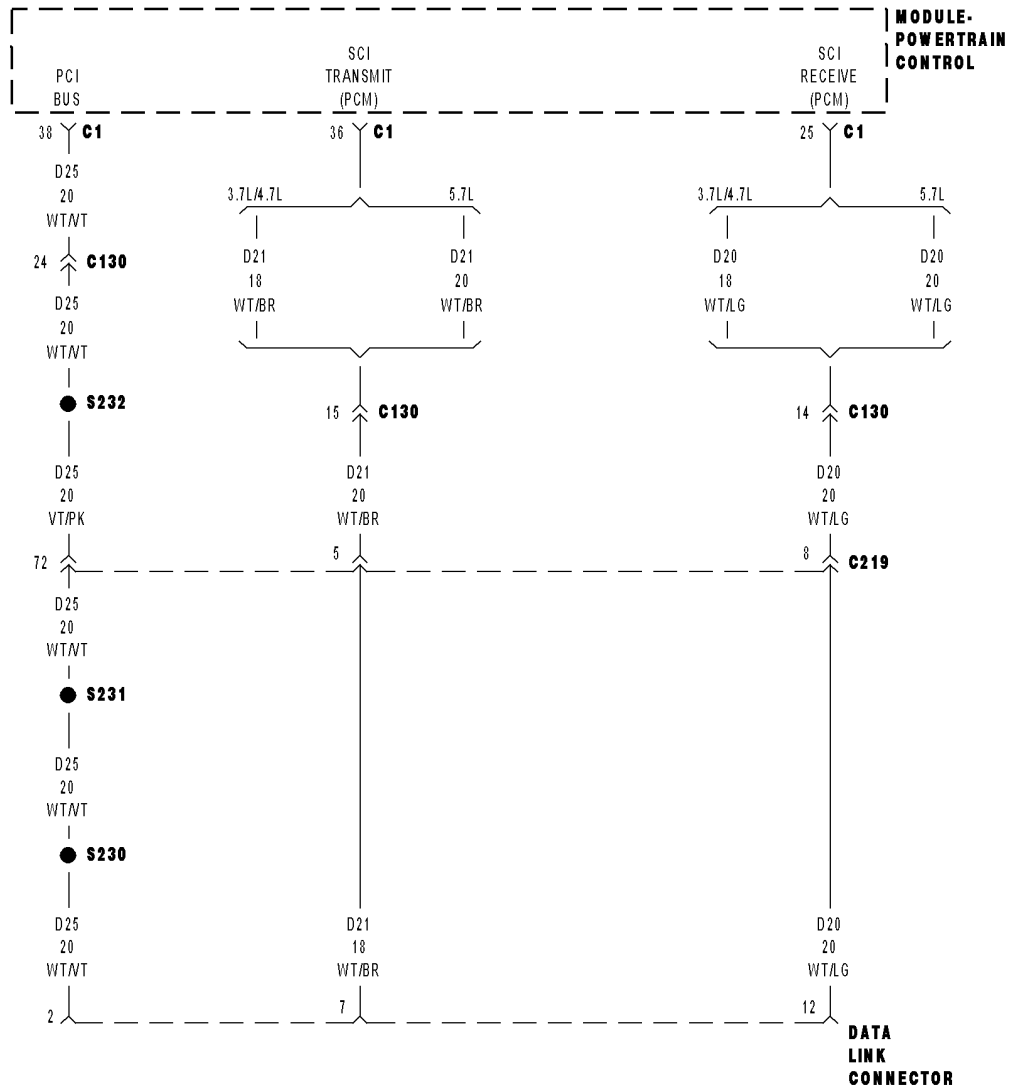
Is the resistance below 5.0 ohms?

Yes >> Repair the (D21) SCI Transmit (PCM) circuit for a short to the (D20) SCI Receive (PCM) circuit.
Perform POWERTRAIN VERIFICATION TEST - VER 1.

No >> Replace the Powertrain Control Module in accordance with the service information.
Perform POWERTRAIN VERIFICATION TEST - VER 1.



*NO RESPONSE FROM PCM (PCI BUS) - NGC



***NO RESPONSE FROM PCM (PCI BUS) - NGC (CONTINUED)**

For a complete wiring diagram **Refer to Section 8W.**

Possible Causes
POWERTRAIN CONTROL MODULE POWER AND GROUND (D25) PCI BUS CIRCUIT OPEN POWERTRAIN CONTROL MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH OTHER PCI BUS MODULES**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

NOTE: As soon as one or more modules communicates with the DRB, answer the question.

With the DRB, attempt to communicate with the ORC.

With the DRB, attempt to communicate with the Instrument Cluster.

Was the DRB able to I/D or communicate with either of the modules?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.

NO RESPONSE FROM PCM (PCI BUS) - NGC (CONTINUED)*2. (D25) PCI BUS CIRCUIT OPEN**

With the DRB, read PCM DTC's. This is to ensure power and ground to the PCM are operational.

NOTE: If the DRB will not read PCM DTC's, follow the **NO RESPONSE TO PCM (SCI ONLY) - NGC** symptom.

NOTE: If the vehicle will not start and the DRB displays a no response message, refer to the appropriate symptom in the **Engine Electrical Diagnostics** category.

Turn the ignition off.

Disconnect the PCM C1 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the appropriate terminal of special tool #8815.

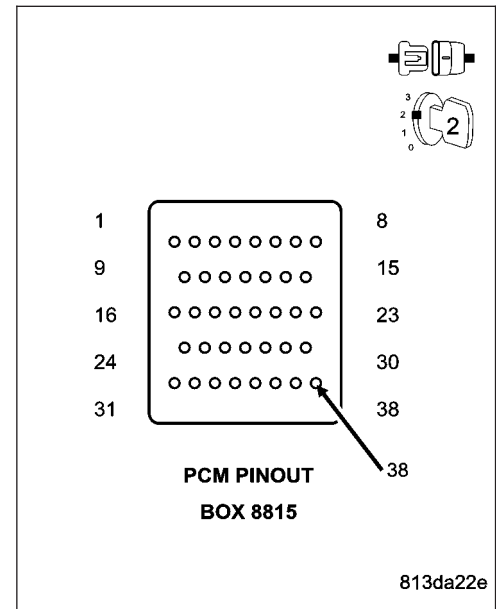
Turn the ignition on.

Observe the voltage display on the DRB Lab Scope.

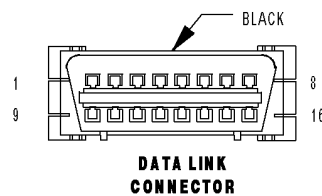
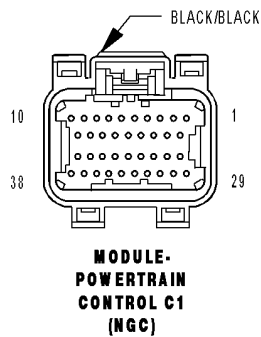
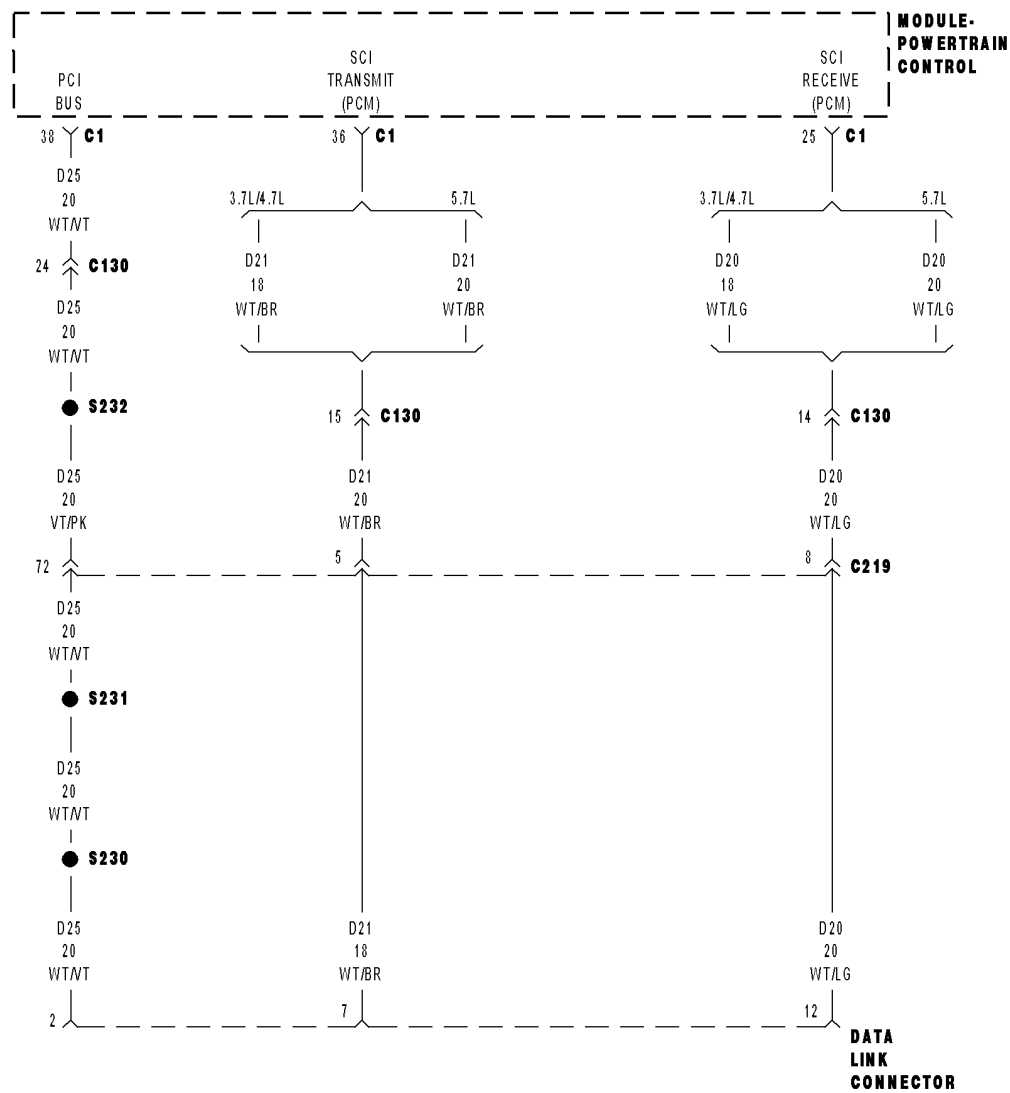
Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Powertrain Control Module in accordance with the service information.
Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.

No >> Repair the (D25) PCI Bus circuit for an open.
Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.



*NO RESPONSE FROM PCM (PCM SCI ONLY) - NGC



***NO RESPONSE FROM PCM (PCM SCI ONLY) - NGC (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO GROUND
(D20) SCI RECEIVE (PCM) CIRCUIT SHORTED TO GROUND
(D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO VOLTAGE
(D20) SCI RECEIVE (PCM) CIRCUIT SHORTED TO VOLTAGE
(D21) SCI TRANSMIT (PCM) CIRCUIT OPEN
(D20) SCI RECEIVE (PCM) CIRCUIT OPEN
(D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO THE (D20) SCI RECEIVE (PCM) CIRCUIT
POWERTRAIN CONTROL MODULE

Diagnostic Test**1. CHECK POWERTRAIN CONTROL MODULE POWER AND GROUND**

Refer to the Engine Electrical Diagnostics and perform the symptom Checking PCM Power and Ground Circuits.

NOTE: With the DRB in the generic scan tool mode, attempt to communicate with the PCM. If the DRB can communicate with the PCM in the generic scan tool mode, it may not be necessary to perform this step.

Did the vehicle pass this test?

Yes >> Go To 2

No >> Repair as necessary.

Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.

2. SCI CIRCUITS SHORTED TO GROUND

Turn the ignition off.

Disconnect the DRB from the DLC.

Disconnect the Powertrain Control Module C1 harness connector.

Measure the resistance between ground and the (D21) SCI Transmit (PCM) circuit.

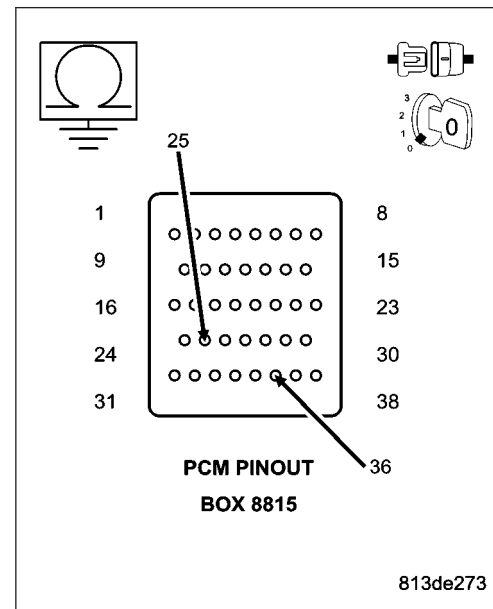
Measure the resistance between ground and the (D20) SCI Receive (PCM) circuit.

Is the resistance below 10.0 ohms for either circuit?

Yes >> Repair the SCI Circuit that measured below 10.0 ohms for a short to ground.

Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.

No >> Go To 3



NO RESPONSE FROM PCM (PCM SCI ONLY) - NGC (CONTINUED)*3. SCI CIRCUITS SHORTED TO VOLTAGE**

Turn the ignition on.

Measure the voltage of the (D21) SCI Transmit (PCM) circuit.

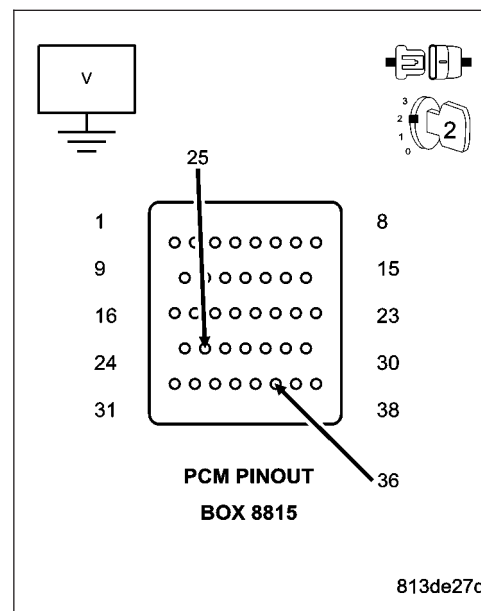
Measure the voltage of the (D20) SCI Receive (PCM) circuit.

Is the voltage above 1.0 volt for either circuit?

Yes >> Repair the SCI Circuit that measured above 1.0 volt for a short to voltage.

Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.

No >> Go To 4

**4. (D21) SCI TRANSMIT (PCM) CIRCUIT OPEN**

Turn the ignition off.

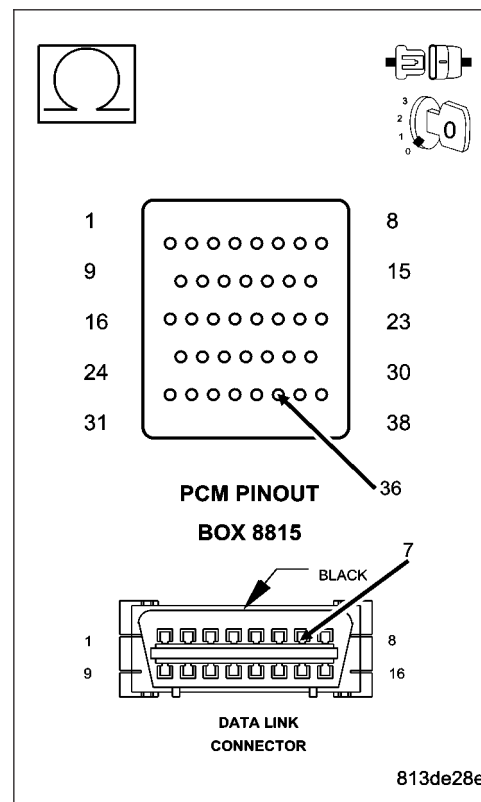
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (D21) SCI Transmit (PCM) circuit between the DLC and the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the (D21) SCI Transmit (PCM) circuit for an open. Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.



NO RESPONSE FROM PCM (PCM SCI ONLY) - NGC (CONTINUED)*5. (D20) SCI RECEIVE (PCM) CIRCUIT OPEN**

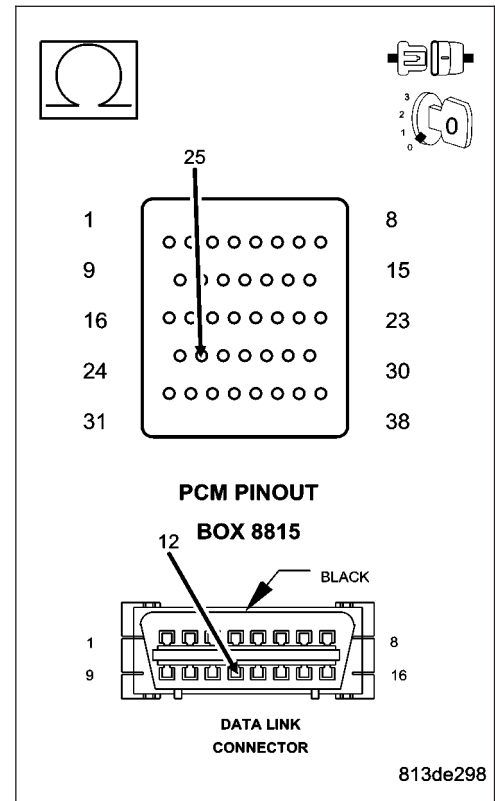
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (D20) SCI Receive (PCM) circuit between the DLC and the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the (D20) SCI Receive (PCM) circuit for an open.
Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.

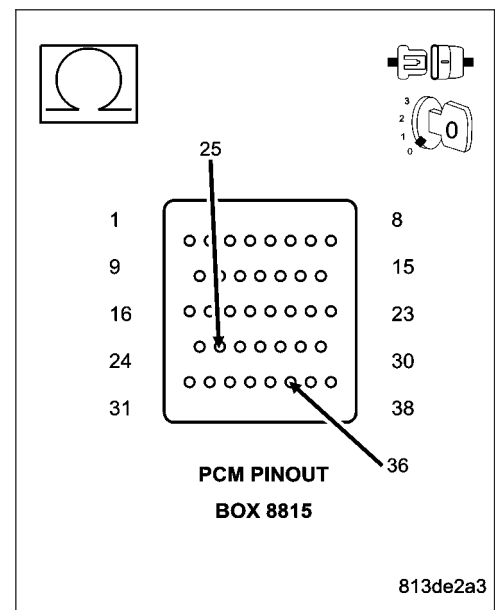
**6. (D21) SCI TRANSMIT (PCM) CIRCUIT SHORTED TO THE (D20) SCI RECEIVE (PCM) CIRCUIT**

Measure the resistance between the (D21) SCI Transmit (PCM) and the (D20) SCI Receive (PCM) circuits.

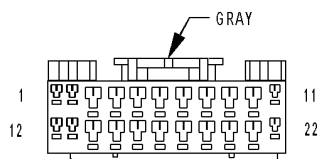
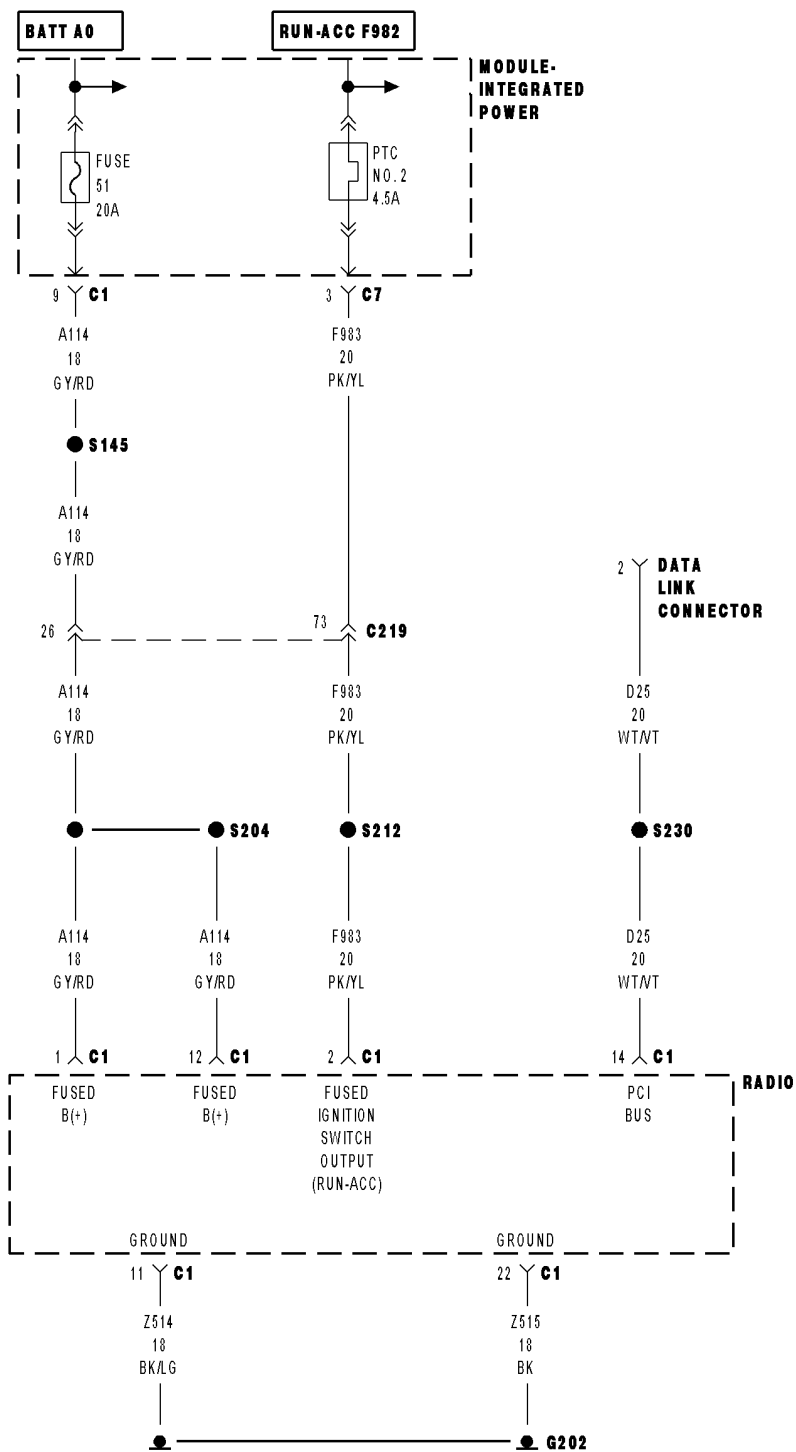
Is the resistance below 5.0 ohms?

Yes >> Repair the (D21) SCI Transmit (PCM) circuit for a short to the (D20) SCI Receive (PCM) circuit.
Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.

No >> Replace the Powertrain Control Module in accordance with the service information.
Perform (NGC) POWERTRAIN VERIFICATION TEST - VER 1.



***NO RESPONSE FROM RADIO**



RADIO C1

***NO RESPONSE FROM RADIO (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z514) (Z515) GROUND CIRCUIT OPEN (A114) FUSED B+ CIRCUIT OPEN (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN RADIO

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE INSTRUMENT CLUSTER (MIC)**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the MIC.

Was the DRB able to I/D or communicate with the MIC?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
 Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z514) (Z515) GROUND CIRCUIT OPEN

Turn the ignition off.

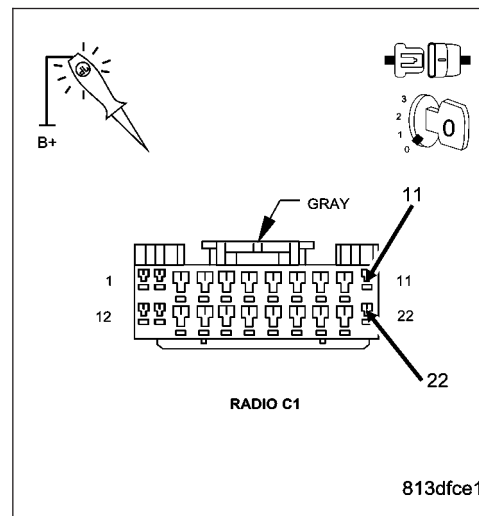
Disconnect the Radio C1 harness connector.

Using a 12-volt test light connected to 12-volts, probe each (Z514) (Z515) ground circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z514) (Z515) Ground circuit for an open.
 Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



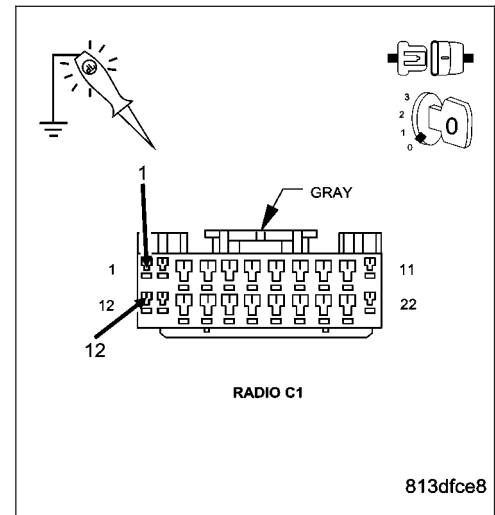
NO RESPONSE FROM RADIO (CONTINUED)*3. (A114) FUSED B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe each (A114) Fused B+ circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 4

No >> Repair the (A114) Fused B+ circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (F983) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

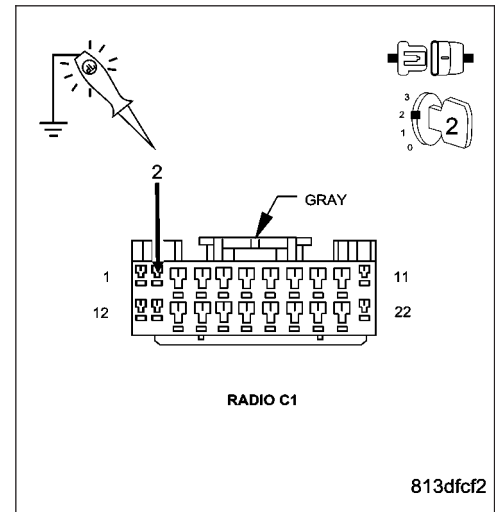
Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F983) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 5

No >> Repair the (F983) Fused Ignition Switch Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



NO RESPONSE FROM RADIO (CONTINUED)*5. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

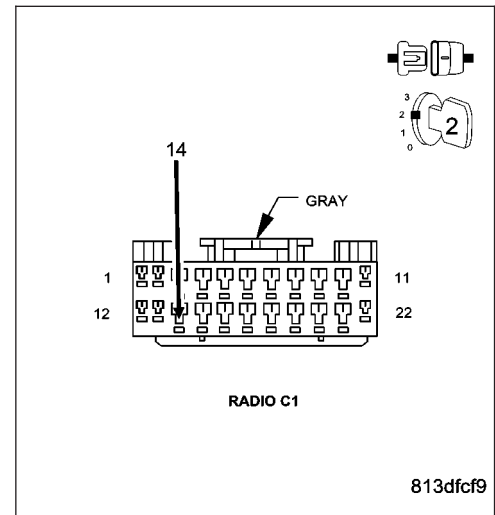
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

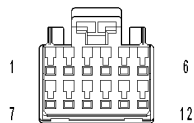
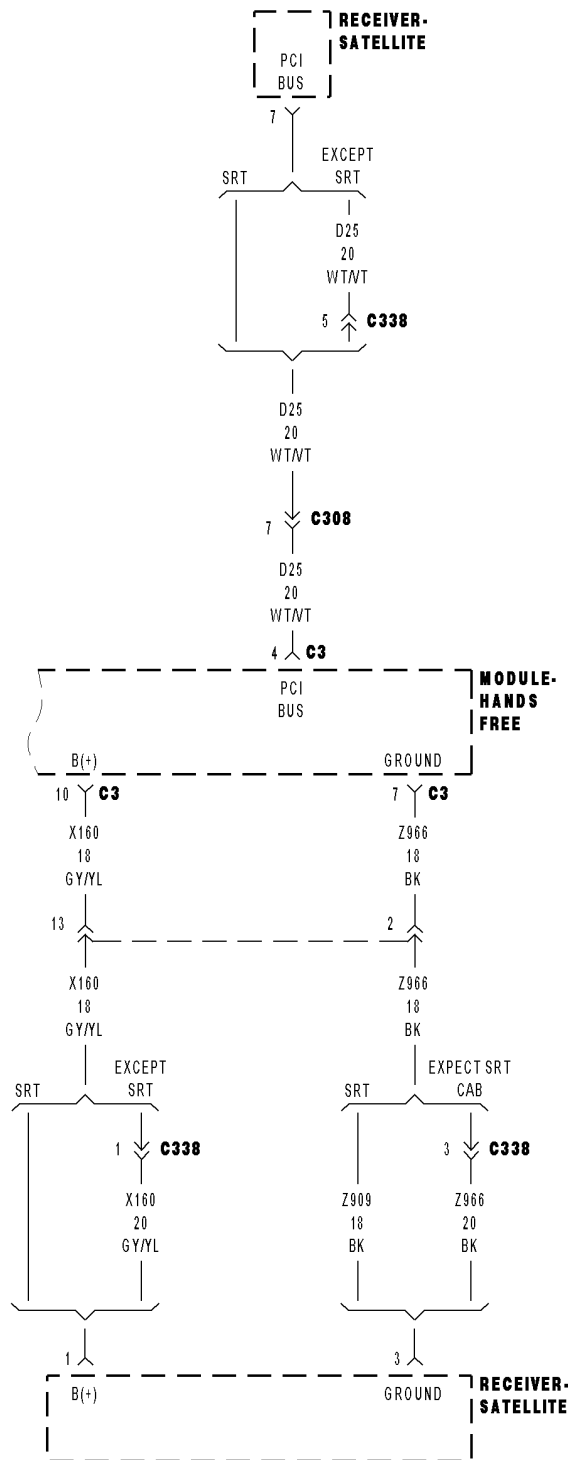
Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Radio connector.

Observe the voltage display on the DRB Lab Scope.

**Does the voltage pulse from 0 to approximately 7.5 volts?**

- Yes** >> Replace the Radio in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)
- No** >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM SATELLITE RECEIVER**



RECEIVER-SATELLITE

***NO RESPONSE FROM SATELLITE RECEIVER (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z909) (Z966) GROUND CIRCUIT OPEN (X160) B+ CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN SATELLITE RECEIVER

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE RADIO**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the radio.

With the DRB, attempt to communicate with the Hands Free Module (if equipped).

Was the DRB able to I/D or communicate with either module?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

2. (Z909) (Z966) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Satellite Receiver harness connectors.

NOTE: The Satellite Receiver circuits pass thru the Hands Free Module (if equipped) or the Radio. Ensure all connections are proper. Refer to the wiring diagrams for additional information.

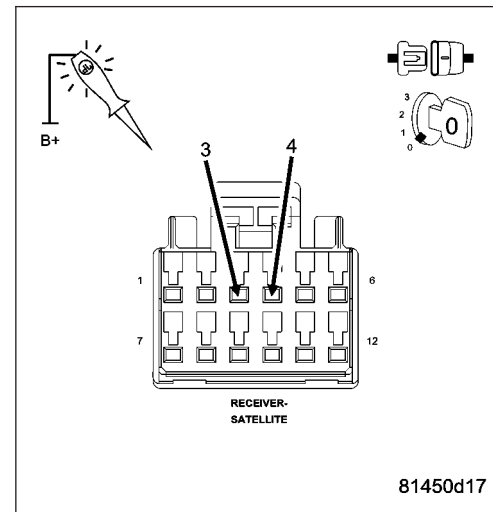
Using a 12-volt test light connected to 12-volts, probe each (Z909) and (Z966) ground circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z909) or (Z966) Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



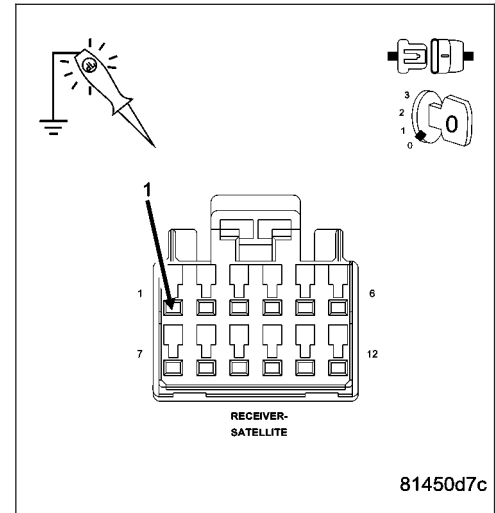
NO RESPONSE FROM SATELLITE RECEIVER (CONTINUED)*3. (X160) B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe the (X160) B+ circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (X160) B+ circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**4. (D25) PCI BUS CIRCUIT OPEN**

Turn the ignition on.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

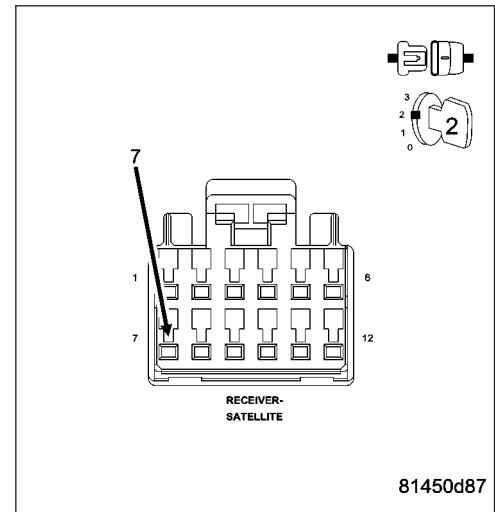
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Satellite Receiver connector.

Observe the voltage display on the DRB Lab Scope.

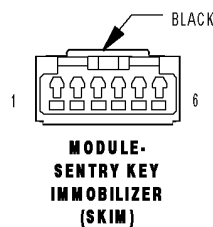
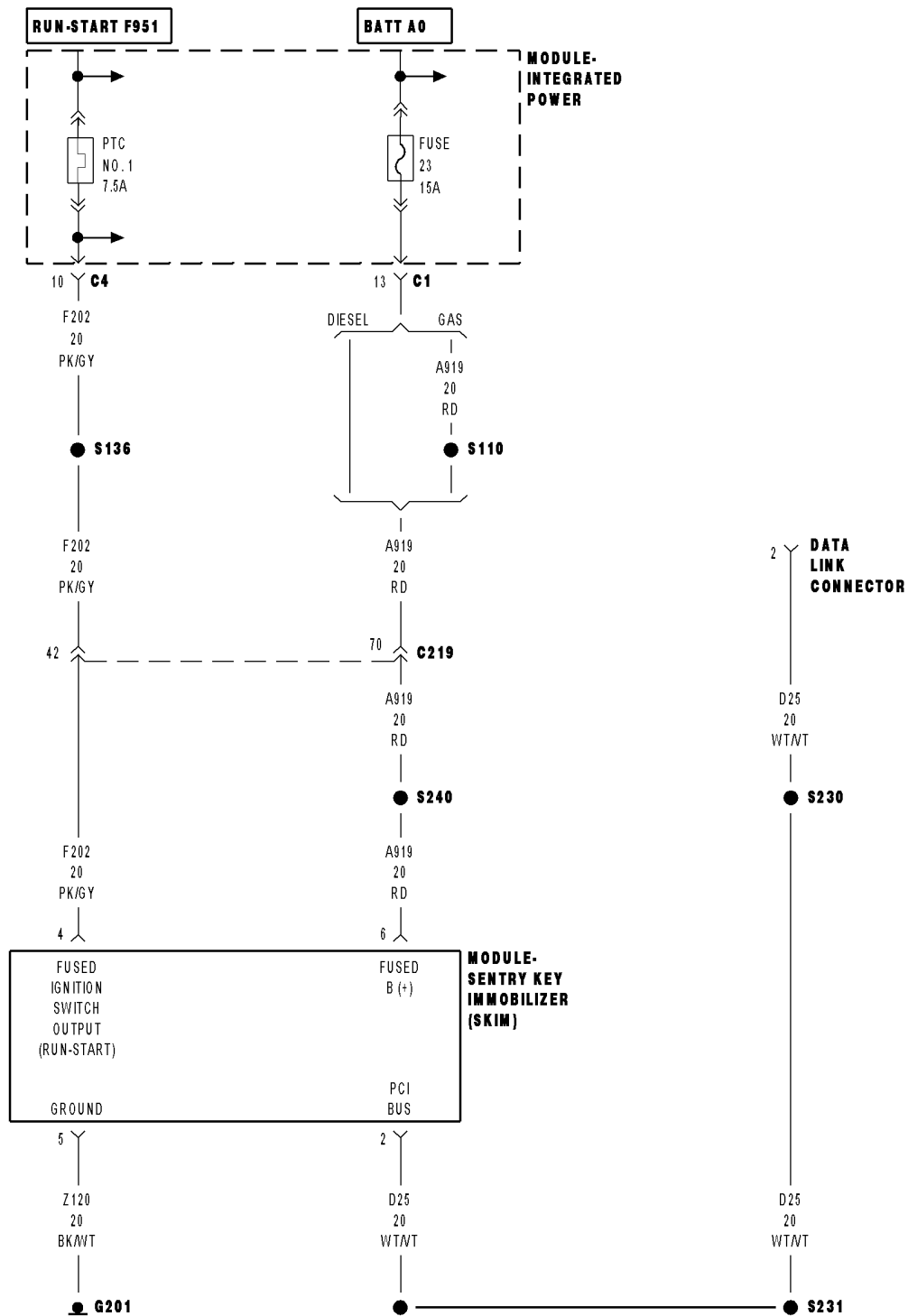


Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Satellite Receiver in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

***NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE (SKIM)**



***NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE (SKIM) (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z120) GROUND CIRCUIT OPEN (A919) FUSED B+ CIRCUIT OPEN (F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN SENTRY KEY IMMOBILIZER MODULE (SKIM)

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE INSTRUMENT CLUSTER (MIC)**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the MIC.

Was the DRB able to I/D or communicate with the MIC?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform SKIS VERIFICATION TEST

2. (Z120) GROUND CIRCUIT OPEN

Turn the ignition off.

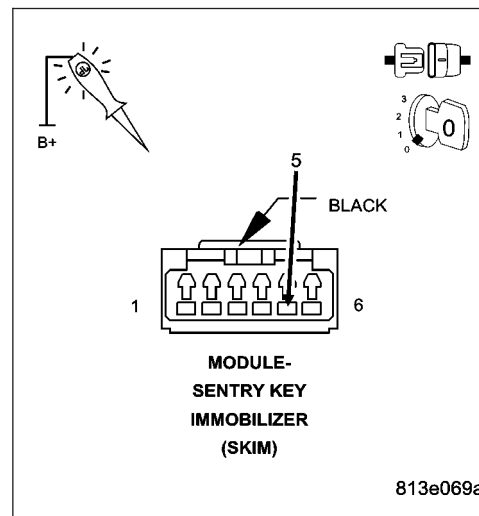
Disconnect the SKIM harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z120) ground circuit.

Is the test light illuminated?

Yes >> Go To 3

No >> Repair the (Z120) Ground circuit for an open.
Perform SKIS VERIFICATION TEST



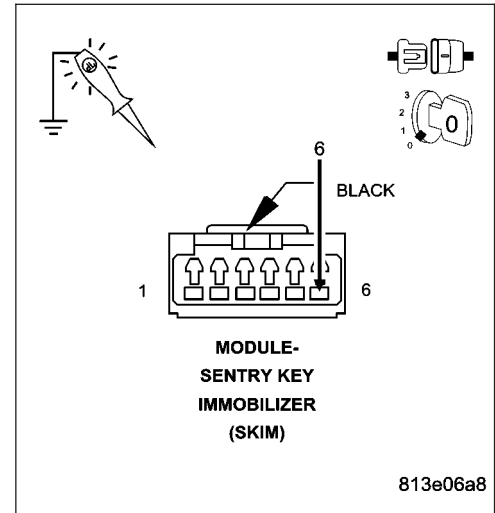
NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE (SKIM) (CONTINUED)*3. (A919) FUSED B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe the (A919) Fused B+ circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (A919) Fused B+ circuit for an open.
Perform SKIS VERIFICATION TEST

**4. (F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

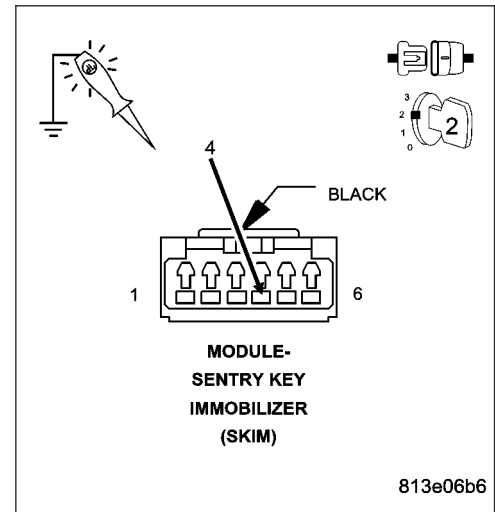
Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F202) Fused Ignition Switch Output circuit.

Is the test light illuminated?

Yes >> Go To 5

No >> Repair the (F202) Fused Ignition Switch Output circuit for an open.
Perform SKIS VERIFICATION TEST



NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE (SKIM) (CONTINUED)*5. (D25) PCI BUS CIRCUIT OPEN**

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

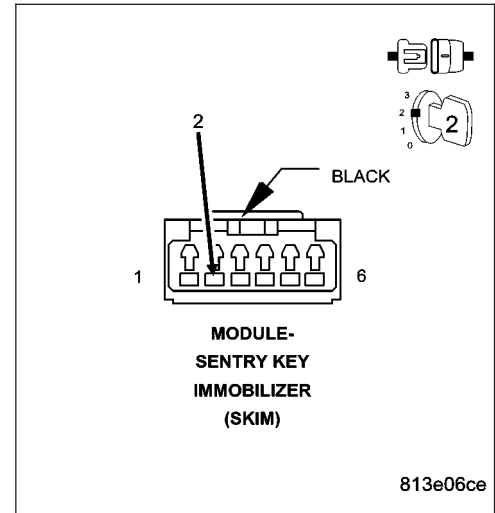
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the SKIM connector.

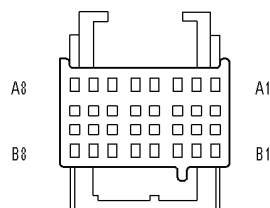
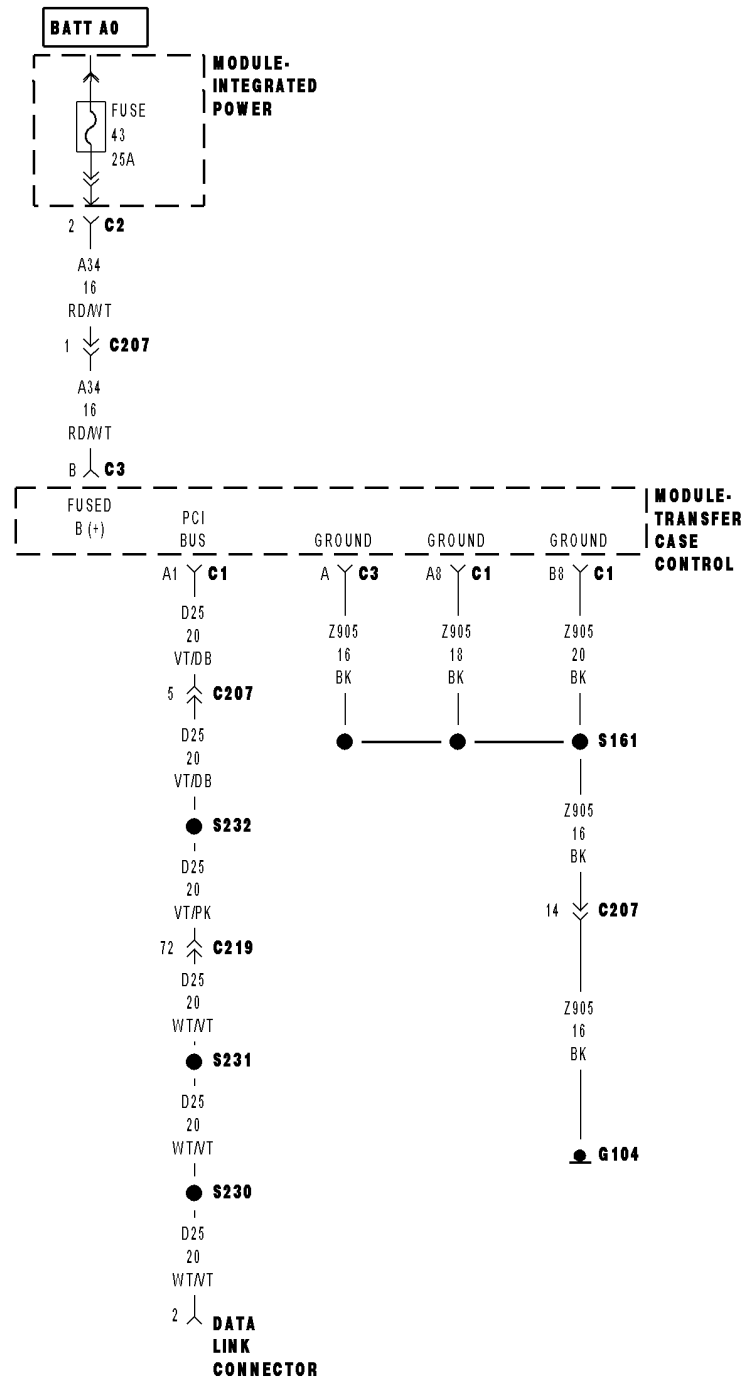
Observe the voltage display on the DRB Lab Scope.



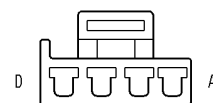
Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Sentry Key Immobilizer Module (SKIM) in accordance with the service information.
Perform SKIS VERIFICATION TEST

No >> Repair the (D25) PCI Bus circuit for an open.
Perform SKIS VERIFICATION TEST

***NO RESPONSE FROM TRANSFER CASE CONTROL MODULE**

MODULE-TRANSFER CASE CONTROL C1 (ELECTRIC 4x4)



MODULE-TRANSFER CASE CONTROL C3 (ELECTRIC 4x4)

***NO RESPONSE FROM TRANSFER CASE CONTROL MODULE (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z905) GROUND CIRCUIT OPEN (A34) FUSED B+ CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN TRANSFER CASE CONTROL MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE INSTRUMENT CLUSTER (MIC)**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the Instrument Cluster.

Was the DRB able to I/D or communicate with the Cluster?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.

Perform TRANSFER CASE VERIFICATION TEST

2. (Z905) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Transfer Case Control Module harness connectors.

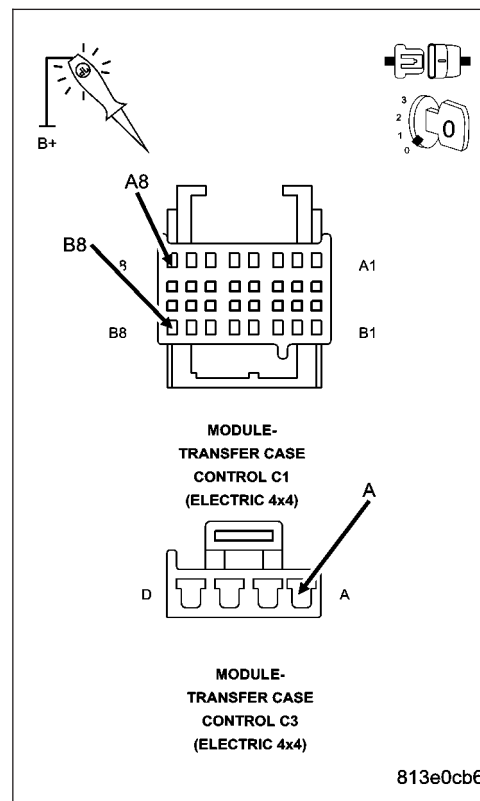
Using a 12-volt test light connected to 12-volts, probe each (Z905) ground circuit.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z905) Ground circuit for an open.

Perform TRANSFER CASE VERIFICATION TEST



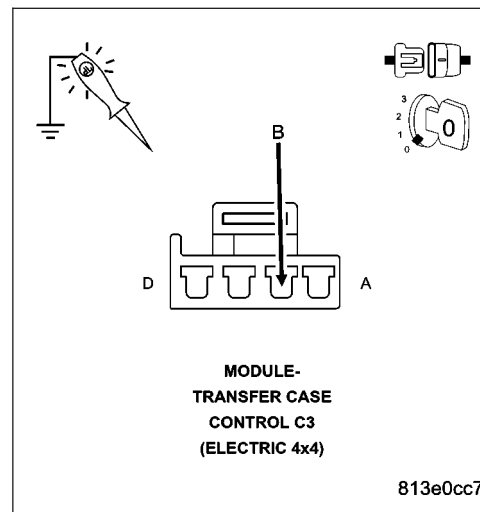
NO RESPONSE FROM TRANSFER CASE CONTROL MODULE (CONTINUED)*3. (A34) FUSED B+ CIRCUIT OPEN**

Using a 12-volt test light connected to ground, probe the (A34) Fused B+ circuit.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (A34) Fused B+ circuit for an open.
Perform TRANSFER CASE VERIFICATION TEST

**4. (D25) PCI BUS CIRCUIT OPEN**

Turn the ignition on.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

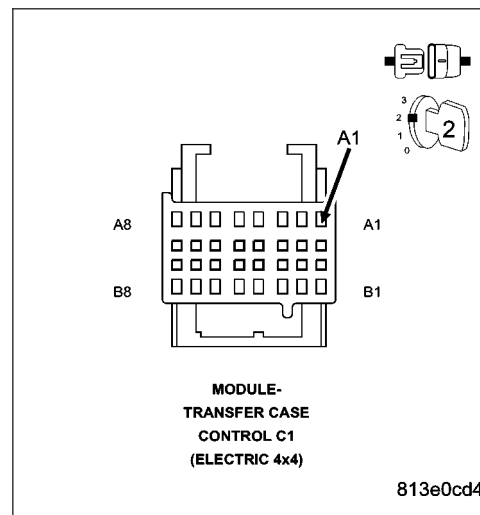
Select 12 volt square wave.

Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.
Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the TCCM connector.

Observe the voltage display on the DRB Lab Scope.

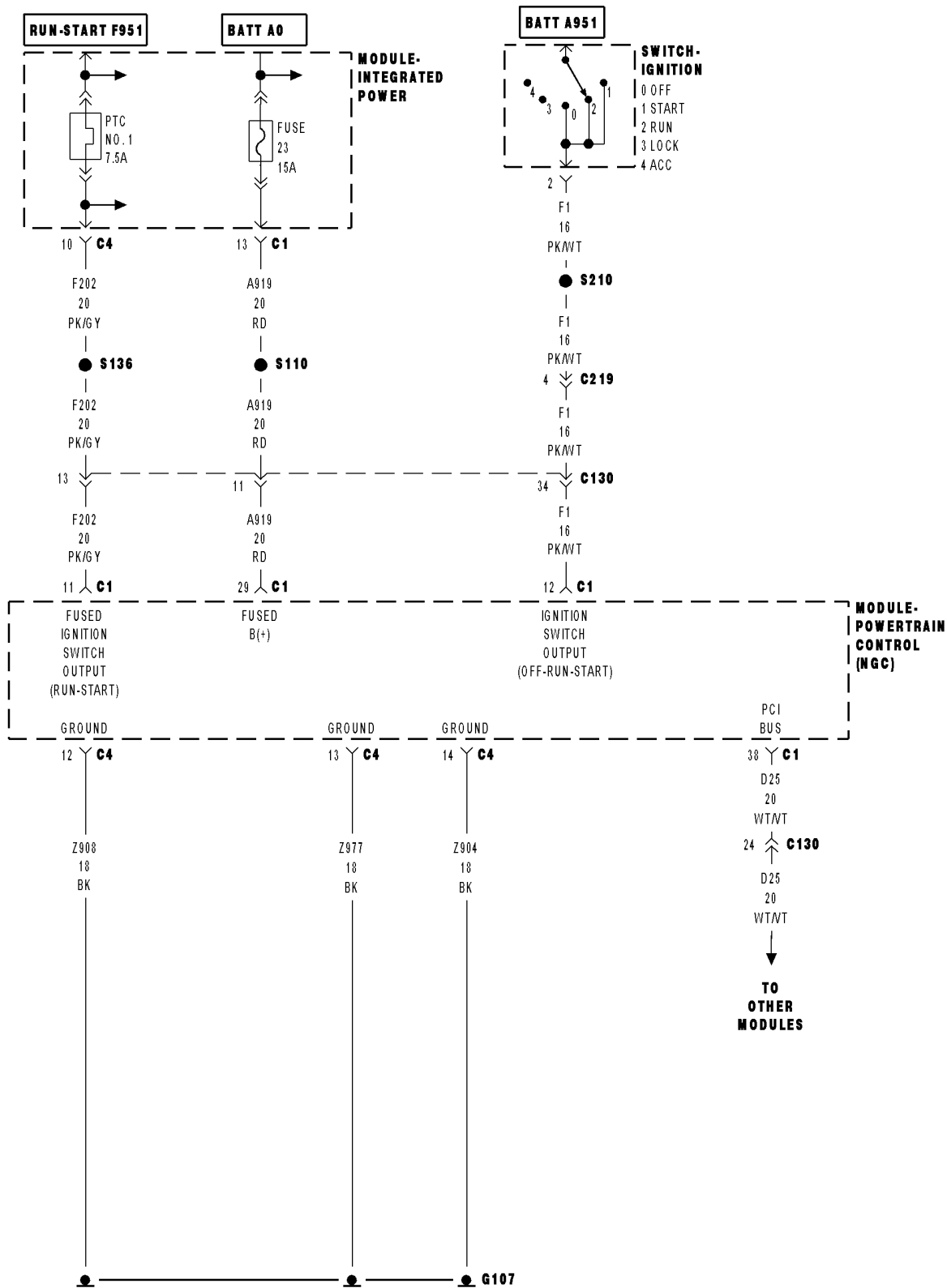


Does the voltage pulse from 0 to approximately 7.5 volts?

Yes >> Replace the Transfer Case Control Module in accordance with the service information.
Perform TRANSFER CASE VERIFICATION TEST

No >> Repair the (D25) PCI Bus circuit for an open.
Perform TRANSFER CASE VERIFICATION TEST

***NO RESPONSE FROM TRANSMISSION CONTROL MODULE - NGC**



***NO RESPONSE FROM TRANSMISSION CONTROL MODULE - NGC (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(Z908) (Z977) (Z904) GROUND CIRCUIT OPEN (A919) FUSED B+ CIRCUIT OPEN (F202) (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN (D25) PCI BUS CIRCUIT OPEN POWERTRAIN CONTROL MODULE

Diagnostic Test**1. ESTABLISH COMMUNICATIONS WITH THE INSTRUMENT CLUSTER (MIC)**

Turn the ignition on.

NOTE: Ensure there is PCI bus communication with other modules. If not, refer to the PCI Bus Communication Failure symptom and repair as necessary.

With the DRB, attempt to communicate with the MIC.

Was the DRB able to I/D or communicate with the MIC?

Yes >> Go To 2

No >> Refer to the table of contents and perform the related symptom.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST VER 1.

2. (Z908) (Z977) (Z904) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM C4 harness connector.

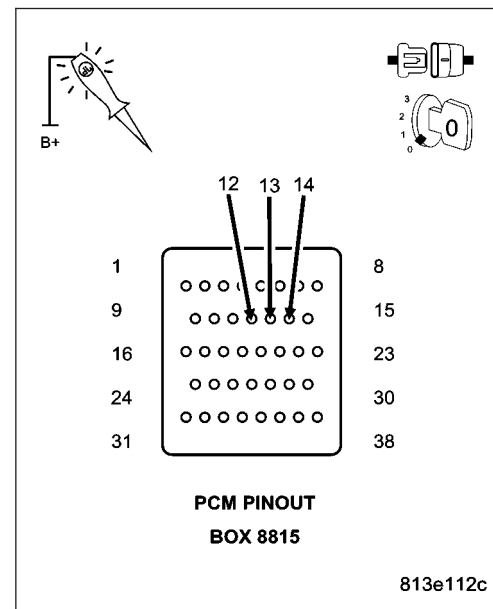
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to 12-volts, probe each (Z908) (Z977) (Z904) ground circuit in the appropriate terminal of special tool #8815.

Is the test light illuminated for each circuit?

Yes >> Go To 3

No >> Repair the (Z908) (Z977) (Z904) Ground circuit for an open.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST VER 1.



NO RESPONSE FROM TRANSMISSION CONTROL MODULE - NGC (CONTINUED)*3. (A919) FUSED B+ CIRCUIT OPEN**

Disconnect the PCM C1 harness connector.

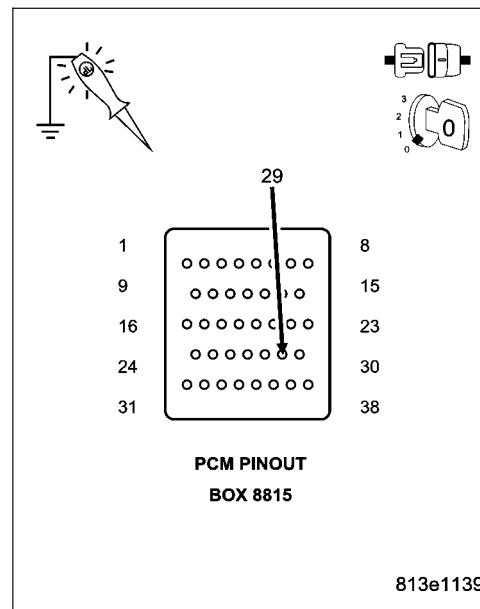
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, probe the (A919) Fused B+ circuit in the appropriate terminal of special tool #8815.

Is the test light illuminated?

Yes >> Go To 4

No >> Repair the (A919) Fused B+ circuit for an open.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST VER 1.

**4. (F202) (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN**

Turn the ignition on.

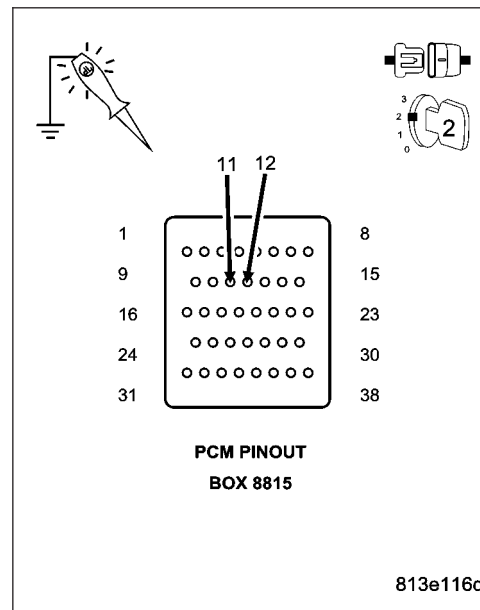
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground, probe the (F202) and (F1) Fused Ignition Switch Output circuits in the appropriate terminal of special tool #8815.

Is the test light illuminated for each circuit?

Yes >> Go To 5

No >> Repair the (F202) (F1) Fused Ignition Switch Output circuit for an open.
Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST VER 1.



NO RESPONSE FROM TRANSMISSION CONTROL MODULE - NGC (CONTINUED)*5. (D25) PCI BUS CIRCUIT OPEN**

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes.

Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable.

With the DRBIII® select Pep Module Tools.

Select lab scope.

Select Live Data.

Select 12 volt square wave.

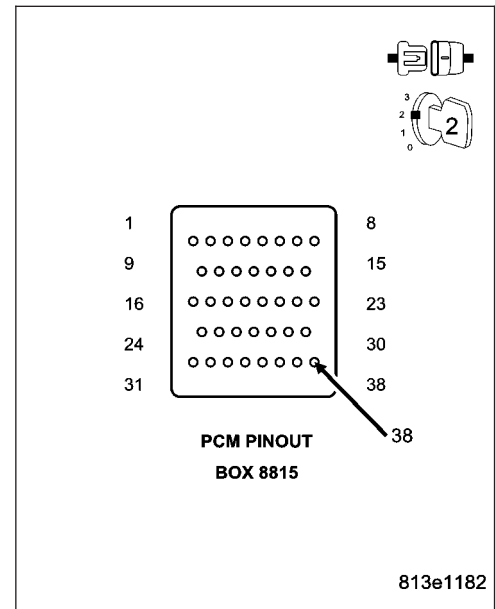
Press F2 for Scope.

Press F2 and use the down arrow to set voltage range to 20 volts.

Press F2 again when complete.

Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the appropriate terminal of special tool #8815.

Observe the voltage display on the DRB Lab Scope.

**Does the voltage pulse from 0 to approximately 7.5 volts?**

Yes >> Replace the Powertrain Control Module in accordance with the service information. With the DRB perform Quick Learn.

Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST VER 1.

No >> Repair the (D25) PCI Bus circuit for an open.

Perform (NGC) 45RFE/545RFE TRANSMISSION VERIFICATION TEST VER 1.

DATA LINK CONNECTOR

AMPLIFIER-RADIO

MODULE-OCCUPANT RESTRAINT CONTROLLER

CLUSTER

MODULE-ELECTRONIC OVERHEAD (EXCEPT BASE)

CONTROL-A/C-HEATER

RECEIVER-SATELLITE

RADIO

MODULE-HANDS FREE (TELEMATICS)

MODULE-SENTRY KEY IMMOBILIZER

MODULE-FINAL DRIVER CONTROL

MODULE-ENGINE CONTROL

MODULE-TRANSFER CASE CONTROL

MODULE-INTEGRATED POWER

MODULE-FRONT CONTROL

MODULE-ANTI-LOCK BRAKES

MODULE-POWERTRAIN CONTROL

MODULE-POWERTRAIN CONTROL

Legend:

- HD
- SRT

***PCI BUS COMMUNICATION FAILURE (CONTINUED)**

For a complete wiring diagram Refer to Section 8W.

Possible Causes
(D25) PCI BUS CIRCUIT OPEN AT DATA LINK CONNECTOR (DLC)
(D25) PCI BUS CIRCUIT SHORTED TO GROUND
(D25) PCI BUS CIRCUIT SHORTED TO VOLTAGE
ANY PCI BUS MODULE INTERNALLY SHORTED TO GROUND
ANY PCI BUS MODULE INTERNALLY SHORTED TO VOLTAGE

Diagnostic Test**1. ATTEMPT TO COMMUNICATION WITH ANY PCI BUS MODULE**

NOTE: Determine which modules this vehicle is equipped with before beginning.

NOTE: When attempting to communicate with any PCI Bus module on this vehicle, the DRB can display 1 of 2 different communication errors: a NO RESPONSE message or a BUS +/- SIGNALS OPEN message.

Turn the ignition on.

Using the DRB, attempt to communicate with the Instrument Cluster (MIC).

Using the DRB, attempt to communicate with the Front Control Module (FCM).

Using the DRB, attempt to communicate with the Occupant Restraint Controller (ORC).

Was the DRB able to communicate with one or more modules?

Yes >> Go To 2

No >> Go To 3

2. CHECK FOR A INTERMITTENT CONDITION

Turn the ignition off.

NOTE: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

NOTE: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

NOTE: If the DRB can NOT communicate with a single module, refer to the table of contents in this section for a no response condition symptom.

Were any problems found?

Yes >> Repair the wiring harness/connectors as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Test Complete.

PCI BUS COMMUNICATION FAILURE (CONTINUED)*3. (D25) PCI BUS CIRCUIT OPEN AT THE DLC**

Turn the ignition off.

Disconnect the negative battery cable

Disconnect the DRB from the DLC.

Disconnect the PCM/ECM harness connectors. If equipped with NGC follow the caution below

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the PCM/ECM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

4. CHECK THE (D25) PCI BUS CIRCUIT FOR A SHORT TO VOLTAGE

NOTE: Reconnect the PCM/ECM harness connector and the negative battery cable.

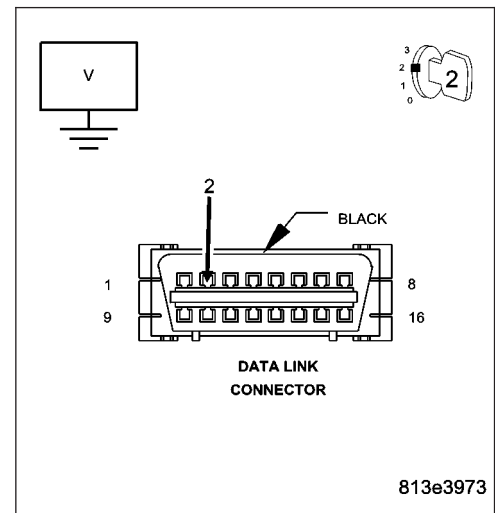
Turn the ignition on.

Measure the voltage of the (D25) PCI Bus circuit at the DLC.

Is the voltage steadily above 7.0 volts?

Yes >> Go To 5

No >> Go To 6



PCI BUS COMMUNICATION FAILURE (CONTINUED)*5. (D25) PCI BUS CIRCUIT SHORTED TO VOLTAGE**

Turn the ignition off.

Using a voltmeter, connect one end to the (D25) PCI Bus circuit at the DLC and the other end to ground.

NOTE: When performing the next step, turn the ignition off and wait one minute before disconnecting any module. When the module is disconnected, turn the ignition on to check for a short to voltage.

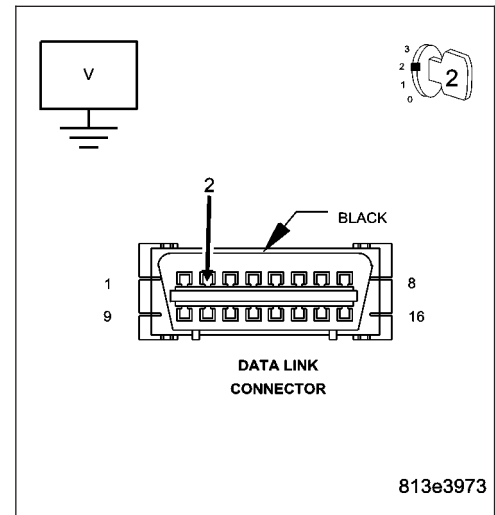
Turn the ignition on.

While monitoring the voltmeter, disconnect each module the vehicle is equipped with one at a time.

Is the voltage steadily above 7.0 volts with all the modules disconnected?

Yes >> Repair the (D25) PCI Bus circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Replace the module that when disconnected the short to voltage was eliminated.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

**6. (D25) PCI BUS CIRCUIT SHORTED TO GROUND**

Turn the ignition off.

Disconnect the negative battery cable.

Using an ohmmeter, connect one end to the (D25) PCI Bus circuit at the DLC and the other end to ground.

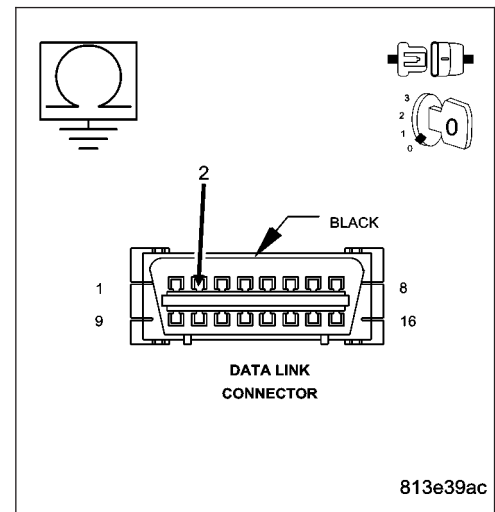
While monitoring the ohmmeter, disconnect each module the vehicle is equipped with one at a time.

NOTE: Total bus resistance to ground thru all of the modules is typically between 350 to 1000 ohms. The more modules on the PCI Bus, the lower the total resistance will be.

Is the resistance below 150.0 ohms with all the modules disconnected?

Yes >> Repair the (D25) PCI Bus circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)

No >> Replace the module that when disconnected the short to ground was eliminated.
Perform BODY VERIFICATION TEST - VER 1. (Refer to BODY VERIFICATION TEST - VER 1.)



C2100–BATTERY VOLTAGE LOW (FDCM)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
Continuously.
- **Set Condition:**
The Final Drive Control Module detects that system voltage is below 9.0 volts for 60 seconds.

Possible Causes
INTERMITTENT BATTERY VOLTAGE LOW CHARGING SYSTEM DTCS PRESENT FINAL DRIVE CONTROL MODULE POWER CIRCUITS OPEN OR HIGH RESISTANCE FINAL DRIVE CONTROL MODULE

Diagnostic Test**1. CHARGING SYSTEM DTCS PRESENT**

Ignition on.

With the scan tool, select View DTCs in the Powertrain Control Module.

Are there any Charging System or related voltage DTCs present?

Yes >> Refer to the symptom list and perform any Charging System DTC diagnostic procedures before continuing with this test.

No >> Go to 2

2. DTC IS ACTIVE

With the scan tool, select View DTCs in the Final Drive Control Module.

Is the status Active for this DTC?

Yes >> Go to 3

No >> Go to 5

C2100-BATTERY VOLTAGE LOW (FDCM) (CONTINUED)**3. (A34) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE**

Turn the ignition off.

Disconnect the Final Drive Control Module harness connector.

Turn the ignition on.

With a 12-volt test light connected to ground, check the (A34) Fused B+ circuit in the Final Drive Control Module harness connector.

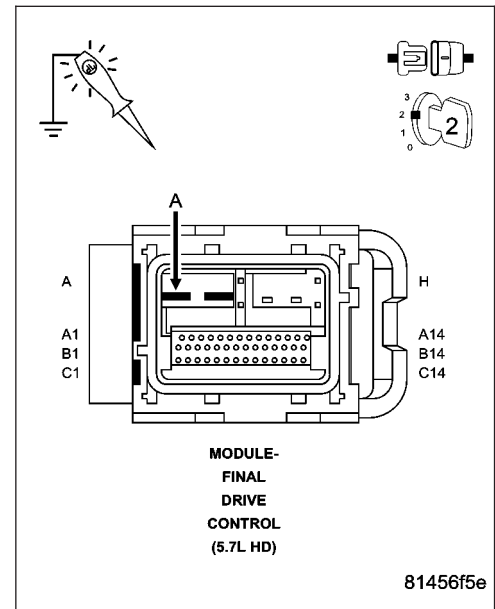
NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly?

Yes >> Go to 4

No >> Repair the (A34) Fused B+ circuit for an open circuit or high resistance.

Perform the FDCM VERIFICATION TEST. (Refer to 3 - DIFFERENTIAL & DRIVELINE - DIAGNOSIS AND TESTING)

**4. FINAL DRIVE CONTROL MODULE**

View repair.

Repair

Replace the Final Drive Control Module in accordance with the Service information.

Perform the FDCM VERIFICATION TEST. (Refer to 3 - DIFFERENTIAL & DRIVELINE - DIAGNOSIS AND TESTING)

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes >> Repair as necessary.

Perform the FDCM VERIFICATION TEST. (Refer to 3 - DIFFERENTIAL & DRIVELINE - DIAGNOSIS AND TESTING)

No >> Test complete.

C2101–BATTERY VOLTAGE HIGH (FDCM)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
Continuously.
- **Set Condition:**
The Final Drive Control Module detects that system voltage is above 16.0 volts for 10 seconds with engine RPM greater than 350.

Possible Causes
INTERMITTENT BATTERY VOLTAGE HIGH CHARGING SYSTEM DTCS PRESENT FINAL DRIVE CONTROL MODULE GROUND CIRCUITS OPEN OR HIGH RESISTANCE FINAL DRIVE CONTROL MODULE

Diagnostic Test**1. CHARGING SYSTEM DTCS PRESENT**

Ignition on.

With the scan tool, select View DTCs in the Powertrain Control Module.

Are there any Charging System or related voltage DTCs present?

Yes >> Refer to the symptom list and perform any Charging System DTC diagnostic procedures before continuing with this test.

No >> Go to 2

2. DTC IS ACTIVE

With the scan tool, select View DTCs in the Final Drive Control Module.

Is the status Active for this DTC?

Yes >> Go to 3

No >> Go to 5

C2101-BATTERY VOLTAGE HIGH (FDCM) (CONTINUED)**3. FINAL DRIVE CONTROL MODULE GROUND CIRCUITS OPEN OR HIGH RESISTANCE**

Turn the ignition off.

Disconnect the Final Drive Control Module harness connector.

Turn the ignition on.

With a 12-volt test light connected to B+, check the Ground circuits in the Final Drive Control Module harness connector.

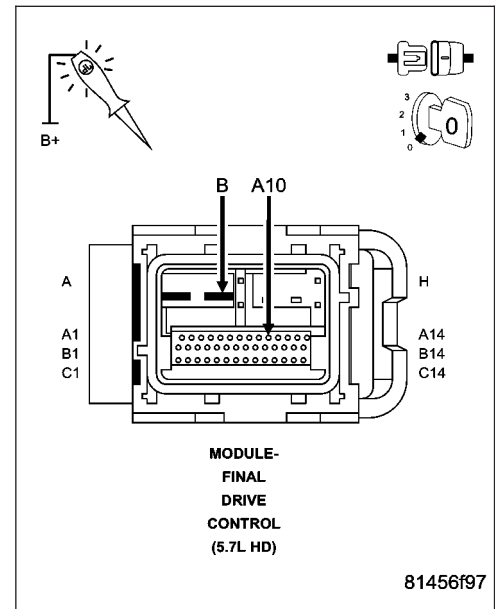
NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

Does the test light illuminate brightly for each of the Ground circuits?

Yes >> Go to 4

No >> Repair the Ground circuit(s) for an open circuit or high resistance.

Perform the FDCM VERIFICATION TEST. (Refer to 3 - DIFFERENTIAL & DRIVELINE - DIAGNOSIS AND TESTING)

**4. FINAL DRIVE CONTROL MODULE**

View repair.

Repair

Replace the Final Drive Control Module in accordance with the Service information.

Perform the FDCM VERIFICATION TEST. (Refer to 3 - DIFFERENTIAL & DRIVELINE - DIAGNOSIS AND TESTING)

5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

While monitoring the scan tool data relative to this circuit, wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Were any problems found?

Yes >> Repair as necessary.

Perform the FDCM VERIFICATION TEST. (Refer to 3 - DIFFERENTIAL & DRIVELINE - DIAGNOSIS AND TESTING)

No >> Test complete.

C2201-FDCM ECU INTERNAL (FDCM)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
With the ignition on.
- **Set Condition:**
The Final Drive Control Module has detected a failure internal to the controller.

Possible Causes
FINAL DRIVE CONTROL MODULE

1. FINAL DRIVE CONTROL MODULE

The Final Drive Control Module has detected an internal failure.

View repair

Repair

Replace the Final Drive Control Module in accordance with the Service Information.
Perform the FDCM VERIFICATION TEST. (Refer to 3 - DIFFERENTIAL & DRIVELINE - DIAGNOSIS AND TESTING)

ELECTRONIC CONTROL MODULES - SERVICE INFORMATION

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ELECTRONIC CONTROL MODULES - SERVICE INFORMATION

STANDARD PROCEDURE

PCM/ECM/SKIM PROGRAMMING

NOTE: Before replacing the Powertrain Control Module (PCM) or Engine Control Module (ECM), be certain to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM/ECM driver/control circuit failures are caused by internal component failures (i.e. relays and solenoids) and shorted circuits (i.e. pull-ups, drivers, and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has been set.

When a Powertrain Control Module (PCM) for a gasoline engine, or a Engine Control Module for a diesel engine and the Sentry Key Immobilizer Module (SKIM) on vehicles equipped with the Sentry Key Immobilizer System (SKIS) are replaced at the same time, perform the following steps in order:

1. Program the new PCM/ECM.
2. Program the new SKIM.
3. Replace all ignition keys and program them into the new SKIM.

PROGRAMMING THE PCM/ECM/SKIM

The SKIS Secret Key is an ID code that is unique to each SKIM. This code is programmed and stored in the SKIM, the PCM/ECM, and each ignition key transponder chip. When the PCM/ECM or SKIM is replaced, it is necessary to program the Secret Key into the new modules using a diagnostic scan tool. Follow the programming steps outlined in the diagnostic scan tool menu for the module being replaced as appropriate.

NOTE: Be certain to enter the correct country code for the SKIM. If the incorrect country code is programmed into the SKIM, it cannot be changed and the SKIM must be replaced.

NOTE: If the PCM/ECM and the SKIM are replaced at the same time, all vehicle ignition keys will need to be replaced and the new keys programmed into the new SKIM.

NOTE: Programming the PCM/ECM or SKIM is done using a diagnostic scan tool and a PIN to enter secure access mode. If three attempts are made to enter secure access mode using an incorrect PIN, secure access mode will be locked out for one hour. To exit this lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. (Ensure all accessories are turned OFF. Also monitor the battery state and connect a battery charger if necessary).

PROGRAMMING IGNITION KEYS TO THE SKIM

Each ignition key transponder also has a unique ID code that is assigned at the time the key is manufactured. When a key is programmed into the SKIM, the transponder ID code is learned by the module and the transponder acquires the unique Secret Key ID code from the SKIM. To program ignition keys into the SKIM, follow the programming steps outlined in the diagnostic scan tool for "Program Ignition Keys or Key FOBs" under the "SKIM" menu item.

NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM, that key has acquired the Secret Key for that SKIM and cannot be transferred to any other SKIM or vehicle.

If ignition key programming is unsuccessful, the scan tool will display one of the following error messages:

- **Programming Not Attempted** - The scan tool attempts to read the programmed key status and there are no keys programmed into SKIM memory.
- **Programming Key Failed (Possible Used Key From Wrong Vehicle)** - SKIM is unable to program an ignition key transponder due to one of the following:
 - The ignition key transponder is faulty.
 - The ignition key transponder is or has been already programmed to another vehicle.
- **8 Keys Already Learned, Programming Not Done** - The SKIM transponder ID memory is full.

- **Learned Key In Ignition** - The ID for the ignition key transponder currently in the ignition lock cylinder is already programmed into SKIM memory.

COMMUNICATION

DESCRIPTION

The DaimlerChrysler Programmable Communication Interface (PCI) data bus system is a single wire multiplex system used for vehicle communications on many DaimlerChrysler Corporation vehicles. Multiplexing is a system that enables the transmission of several messages over a single channel or circuit. All DaimlerChrysler vehicles use this principle for communication between various microprocessor-based electronic control modules. The PCI data bus exceeds the Society of Automotive Engineers (SAE) J1850 Standard for Class B Multiplexing.

Many of the electronic control modules in a vehicle require information from the same sensing device. In the past, if information from one sensing device was required by several controllers, a wire from each controller needed to be connected in parallel to that sensor. In addition, each controller utilizing analog sensors required an Analog/Digital (A/D) converter in order to "read" these sensor inputs. Multiplexing reduces wire harness complexity, sensor current loads and controller hardware because each sensing device is connected to only one controller, which reads and distributes the sensor information to the other controllers over the data bus. Also, because each controller on the data bus can access the controller sensor inputs to every other controller on the data bus, more function and feature capabilities are possible.

In addition to reducing wire harness complexity, component sensor current loads and controller hardware, multiplexing offers a diagnostic advantage. A multiplex system allows the information flowing between controllers to be monitored using a diagnostic scan tool. The DaimlerChrysler system allows an electronic control module to broadcast message data out onto the bus where all other electronic control modules can "hear" the messages that are being sent. When a module hears a message on the data bus that it requires, it relays that message to its microprocessor. Each module ignores the messages on the data bus that are being sent to other electronic control modules.

OPERATION

Data exchange between modules is achieved by serial transmission of encoded data over a single wire broadcast network. The wire colors used for the PCI data bus circuits are yellow with a violet tracer, or violet with a yellow tracer, depending upon the application. The PCI data bus messages are carried over the bus in the form of Variable Pulse Width Modulated (VPWM) signals. The PCI data bus speed is an average 10.4 Kilo-bits per second (Kbps). By comparison, the prior two-wire Chrysler Collision Detection (CCD) data bus system is designed to run at 7.8125 Kbps.

The voltage network used to transmit messages requires biasing and termination. Each module on the PCI data bus system provides its own biasing and termination. Each module (also referred to as a node) terminates the bus through a terminating resistor and a terminating capacitor. There are two types of nodes on the bus. The dominant node terminates the bus through a 1 KW resistor and a 3300 pF capacitor. The Powertrain Control Module (PCM) is the only dominant node for the PCI data bus system. A standard node terminates the bus through an 11 KW resistor and a 330 pF capacitor.

The modules bias the bus when transmitting a message. The PCI bus uses low and high voltage levels to generate signals. Low voltage is around zero volts and the high voltage is about seven and one-half volts. The low and high voltage levels are generated by means of variable-pulse width modulation to form signals of varying length. The Variable Pulse Width Modulation (VPWM) used in PCI bus messaging is a method in which both the state of the bus and the width of the pulse are used to encode bit information. A "zero" bit is defined as a short low pulse or a long high pulse. A "one" bit is defined as a long low pulse or a short high pulse. A low (passive) state on the bus does not necessarily mean a zero bit. It also depends upon pulse width. If the width is short, it stands for a zero bit. If the width is long, it stands for a one bit. Similarly, a high (active) state does not necessarily mean a one bit. This too depends upon pulse width. If the width is short, it stands for a one bit. If the width is long, it stands for a zero bit.

In the case where there are successive zero or one data bits, both the state of the bus and the width of the pulse are changed alternately. This encoding scheme is used for two reasons. First, this ensures that only one symbol per transition and one transition per symbol exists. On each transition, every transmitting module must decode the symbol on the bus and begin timing of the next symbol. Since timing of the next symbol begins with the last transition detected on the bus, all of the modules are re-synchronized with each symbol. This ensures that there are no accumulated timing errors during PCI data bus communication.

The second reason for this encoding scheme is to guarantee that the zero bit is the dominant bit on the bus. When two modules are transmitting simultaneously on the bus, there must be some form of arbitration to determine which module will gain control. A data collision occurs when two modules are transmitting different messages at the same time. When a module is transmitting on the bus, it is reading the bus at the same time to ensure message integrity. When a collision is detected, the module that transmitted the one bit stops sending messages over the bus until the bus becomes idle.

Each module is capable of transmitting and receiving data simultaneously. The typical PCI bus message has the following four components:

- **Message Header** - One to three bytes in length. The header contains information identifying the message type and length, message priority, target module(s) and sending module.
- **Data Byte(s)** - This is the actual message that is being sent.
- **Cyclic Redundancy Check (CRC) Byte** - This byte is used to detect errors during a message transmission.
- **In-Frame Response (IFR) byte(s)** - If a response is required from the target module(s), it can be sent during this frame. This function is described in greater detail in the following paragraph.

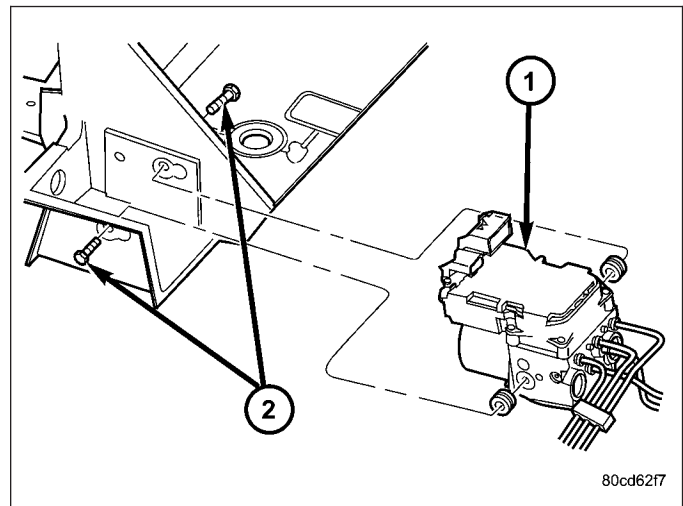
The IFR consists of one or more bytes, which are transmitted during a message. If the sending module requires information to be received immediately, the target module(s) can send data over the bus during the original message. This allows the sending module to receive time-critical information without having to wait for the target module to access the bus. After the IFR is received, the sending module broadcasts an End of Frame (EOF) message and releases control of the bus.

The PCI data bus can be monitored using a diagnostic scan tool. It is possible, however, for the bus to pass all diagnostic scan tool tests and still be faulty if the voltage parameters are all within the specified range and false messages are being sent.

MODULE-ANTI-LOCK BRAKES

DESCRIPTION

The Antilock Brake Module (ABM) is mounted to the Hydraulic Control Unit (HCU) and operates the ABS system.



OPERATION

The ABM voltage source is through the ignition switch in the RUN position. The ABM contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the DRB III scan tool. ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

NOTE: If the ABM is being replaced with a new ABM it must be reprogrammed with the use of a DRB III.

REMOVAL

1. Remove the negative battery cable from the battery.
2. Pull up on the ABM harness connector release and remove connector.
3. Remove the ABM mounting bolts.
4. Remove the pump connector from the ABM.
5. Remove the ABM from the HCU.

INSTALLATION

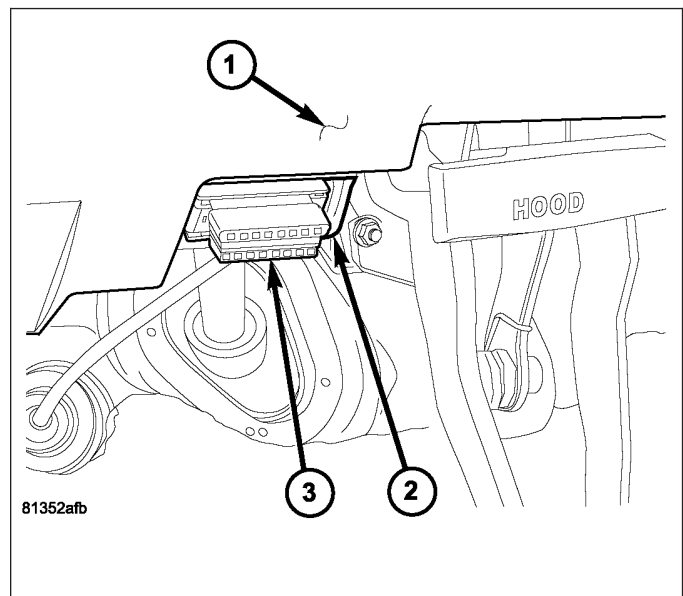
NOTE: If the ABM is being replaced with a new ABM it must be reprogrammed with the use of a DRB III.

1. Install ABM to the HCU.
2. Install the pump connector to the ABM.
3. Install mounting bolts. Tighten to 2 N·m (16 in. lbs.).
4. Install the wiring harness connector to the ABM and push down on the release to secure the connector.
5. Install negative battery cable to the battery.

DATA LINK CONNECTOR

DESCRIPTION

The Data Link Connector (DLC) (3) is a 16-way molded plastic connector insulator on a dedicated take out of the instrument panel wire harness. This connector is located at the lower edge of the instrument panel, outboard of the steering column. The connector insulator is retained by integral snap features within a rectangular cutout in the stamped metal lower instrument panel reinforcement (2), just below the lower edge of the instrument panel steering column opening cover (1).

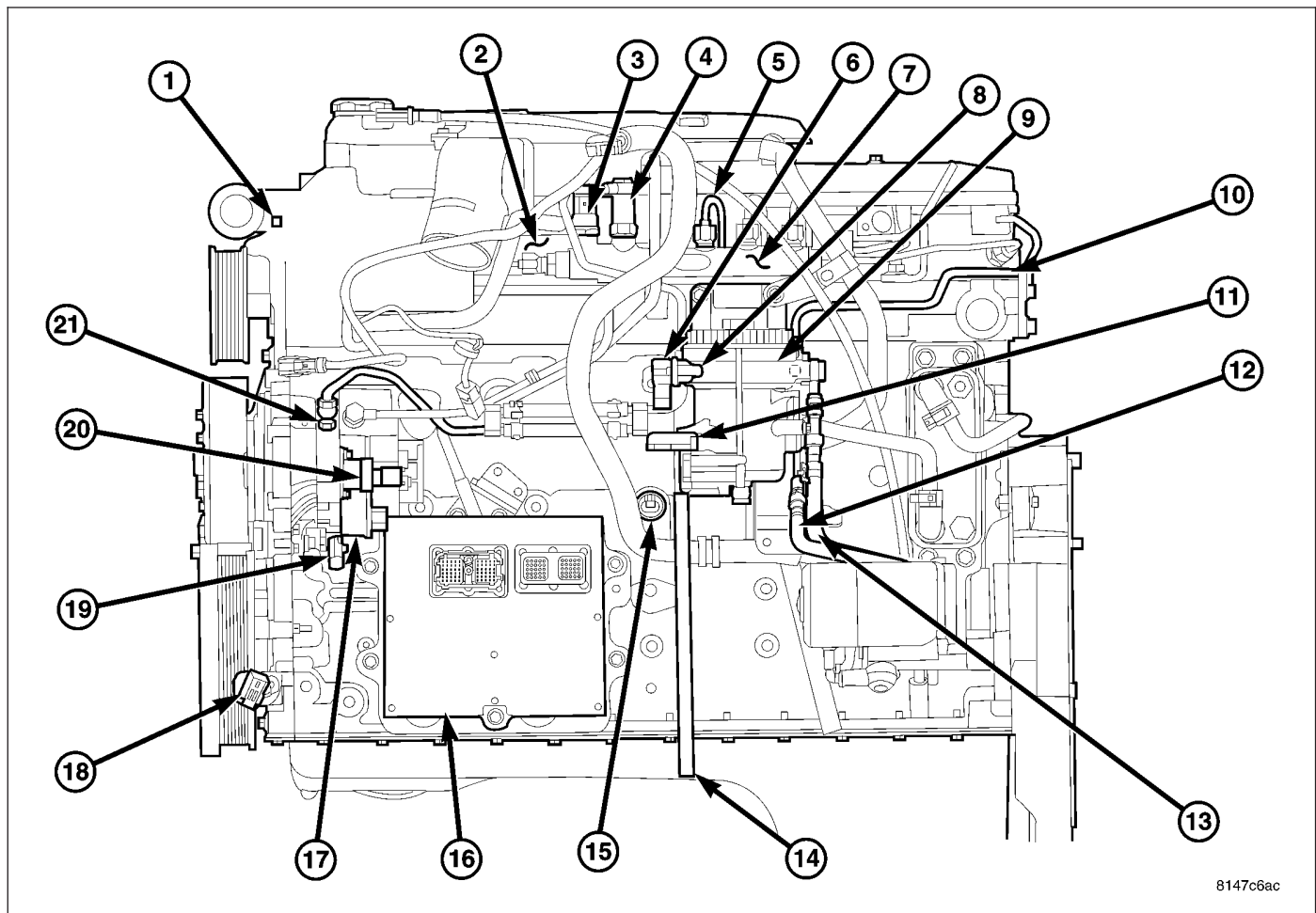


OPERATION

The Data Link Connector (DLC) is an industry-standard 16-way connector that permits the connection of a diagnostic scan tool to the Programmable Communications Interface (PCI) data bus for interfacing with, configuring, and retrieving Diagnostic Trouble Code (DTC) data from the electronic modules that reside on the data bus network within the vehicle.

MODULE-ENGINE CONTROL - DIESEL

DESCRIPTION - ECM



8147c6ac

CUMMINS FUEL SYSTEM COMPONENTS

- | | |
|---|--|
| 1 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR | 14 - FUEL DRAIN TUBE |
| 2 - INTAKE MANIFOLD AIR HEATER/ELEMENTS | 15 - OIL PRESSURE SWITCH |
| 3 - FUEL PRESSURE SENSOR | 16 - ENGINE CONTROL MODULE (ECM) |
| 4 - FUEL PRESSURE LIMITING VALVE | 17 - FUEL INJECTION PUMP |
| 5 - HIGH-PRESSURE FUEL LINES | 18 - CRANKSHAFT POSITION (ENGINE SPEED) SENSOR |
| 6 - FUEL HEATER | 19 - CAMSHAFT POSITION SENSOR (CMP) |
| 7 - HIGH-PRESSURE FUEL RAIL | 20 - FUEL CONTROL ACTUATOR (FCA) |
| 8 - FUEL HEATER TEMPERATURE SENSOR (THERMOSTAT) | 21 - CASCADE OVERFLOW VALVE |
| 9 - FUEL FILTER/WATER SEPARATOR | |
| 10 - FUEL DRAIN MANIFOLD (CYLINDER HEAD FUEL RETURN LINE) | |
| 11 - DRAIN VALVE | |
| 12 - FUEL RETURN LINE CONNECTION (TO FUEL TANK) | |
| 13 - FUEL SUPPLY LINE (LOW-PRESSURE, TO ENGINE) | |

The Engine Control Module (ECM) for the 5.9L diesel engine (16) is bolted to the left side of the engine below the intake manifold.

OPERATION - ECM

The main function of the Engine Control Module (ECM) is to electrically control the fuel system. The ECM also controls certain transmission and other functions previously controlled by the Powertrain Control Module (PCM).

The ECM can adapt its programming to meet changing operating conditions.

The ECM receives input signals from various switches and sensors. Based on these inputs, the ECM regulates various engine and vehicle operations through different system components. These components are referred to as **ECM Outputs**. The sensors and switches that provide inputs to the ECM are considered **ECM Inputs**.

NOTE: ECM Inputs:

- Accelerator Pedal Position Sensor (APPS) Signals #1 and #2
- AC system pressure
- Auto shutdown (ASD) sense
- Battery temperature
- Battery temperature sensor
- Battery voltage
- Brake switch
- Camshaft Position Sensor (CMP)
- Crankshaft Position Sensor (CKP)
- Data link connection for DRB scan tool
- Engine Coolant Temperature (ECT) sensor
- EATX module (if equipped)
- Fuel level
- Fuel pressure sensor
- Fan speed (engine cooling fan)
- Generator (battery voltage) output
- Governor pressure (Auto. trans.)
- Ground circuits
- Inlet air temperature sensor/pressure sensor
- Intake air temperature sensor/MAP sensor
- J1850 bus (+) circuits
- J1850 bus (-) circuits
- Key switch (ignition)
- Oil Pressure switch
- Overdrive switch (automatic transmission only)
- Park/neutral switch (auto. trans. only)
- Power ground
- SCI datalink bus (+) circuits
- SCI datalink bus (-) circuits
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Transfer case switch (4WD range position)
- Transmission governor psi (automatic transmission only)
- Transmission OSS (automatic transmission only)
- Transmission oil pressure (automatic transmission only)
- Transmission oil temperature (automatic transmission only)
- Transmission throttle valve position (automatic transmission only)
- Vehicle speed signal
- Water-In-Fuel (WIF) sensor

NOTE: ECM Outputs:

After inputs are received by the ECM, certain sensors, switches and components are controlled or regulated by the ECM. These are considered **ECM Outputs**. These outputs are for:

- A/C clutch relay
- Auto shutdown (ASD) relay
- Data link connection for DRB scan tool
- Fan clutch PWM
- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel control actuator
- Fuel injector driver circuits
- Fuel transfer (lift) pump
- Generator field driver (-)
- Generator field driver (+)
- Governor pressure (VFS solenoid)
- Intake manifold air heater relays #1 and #2 control circuits
- J1850 bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Malfunction indicator lamp (Check engine lamp). Driven through J1850 circuits.
- Oil pressure switch/warning lamp (databus)
- Overdrive/3–4 shift solenoid (automatic transmission only)
- SC source
- SCI datalink bus (+) circuits
- SCI datalink bus (-) circuits
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through J1850 circuits.
- TCC solenoid (automatic transmission only)
- Transmission battery relay (automatic transmission only)
- Transmission throttle valve actuator (automatic transmission only)
- Transmission governor psi solenoid (automatic transmission only)
- Wait-to-start warning lamp (databus)
- Turbo wastegate solenoid
- Water-In-Fuel (WIF) warning lamp (databus)

DIAGNOSIS AND TESTING

POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL)

Diagnostic Test

1. POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL)

1. Clear the DTC before continuing.
2. Check if any of the following conditions exist.
3. The ECM has been disconnected or replaced.
4. The battery power has been disconnected.
5. If the ECM has been replaced, do the following: (Other go to step 12).

NOTE: 8. If the Engine Control Module has been replaced and the correct VIN and mileage have not been programmed, a DTC will be set in the ABS, Airbag Modules and SKIM module.

6. For ABS and Airbag Systems: Action: Enter correct VIN and Mileage in PCM. Erase ABS and Airbag Module codes.
7. If the ECM has not been replaced, do the following.
8. Inspect the vehicles to ensure that all engine components are connected. Reassemble and reconnect components as necessary.
9. Attempt to start the engine.
10. If the engine is unable to start, look for any Technical Service Bulletins that may relate to this condition. Return to Symptom list if necessary.
11. If there are no DTCs present and all components are functional, the repair is complete.

Are any DTC(s) present?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL)

Diagnostic Test

1. POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL)

1. Check if any of the following conditions exist.
2. The ECM has been disconnected or replace.
3. The Battery power has been disconnected.
4. If the PCM has been replaced, do the following: (Otherwise go to step 12)

NOTE: 5. If the Engine Control Module has been changed and the correct VIN and mileage have not been programmed, a DTC will be set in the ABS and Airbag Module.

6. For ABS and Airbag Systems: Action: Enter correct VIN and Mileage in the ECM. Erase ABS and Airbag Module codes.
7. If the ECM has been replace, do the following.
8. If this verification procedure is being performed after a No Trouble Code repair, do the following.
9. Check to see if the initial symptom still exists. If the initial or another symptom exists, the repair is not complete. Check all pertinent Technical Service Bulletins and return to the Symptom list if necessary.
10. If this verification procedure is being performed after a Trouble Code repair, do the following.
11. Connect the scan tool to the data link connector and erase trouble codes.
12. With the scan tool, reset all memory values.
13. If this test is for an A/C trouble code, ensure it is operating during the following road test.
14. Drive the vehicle for at least five minutes, For some of the drive, go at least 40 MPH; at some point stop the vehicle and turn the engine off for 10 seconds or more; then restart and continue. Ensure the transmission shifts through all gears.
15. Upon completion of the road test, turn the engine off and read trouble codes with the scan tool. If a trouble code has been set, return to the Symptom list and follow the path specified.

Is there any DTC(s) present?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST VER - 4 (DIESEL)

1. POWERTRAIN VERIFICATION TEST VER - 4 (DIESEL)

1. Check if any of the following conditions exist.
2. The ECM has been disconnected or replaced.
3. The Battery power has been disconnected.
4. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
5. With the DRBIII®, erase DTCs.
6. If the ECM has been replaced, perform steps 11 through 13, then continue with the verification.
7. If ECM has been changed and correct VIN and mileage have not been programmed, a DTC will be set in ABS and Air bag modules. In addition, if vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start.
8. For ABS and Air Bag systems: Enter correct VIN and Mileage in ECM. Erase codes in ABS and Air Bag modules.
9. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM
10. Turn the speed control ON (if equipped, cruise light will be on).
11. Depress and release the SET Switch. If the speed control did not engage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
12. Depress and hold the RESUME/ACCEL Switch. If the vehicle speed did not increase by at least 2 mph, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
13. Press and hold the COAST switch. The vehicle speed should decrease. If it did not decrease, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
14. Using caution, depress and release the brake pedal. If the speed control did not disengage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
15. Bring the vehicle speed back up to 35 MPH.
16. Depress the RESUME/ACCEL switch. If the speed control did not resume the previously set speed, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
17. Hold down the SET switch. If the vehicle did not decelerate, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
18. Ensure vehicle speed is greater than 35 mph and release the SET Switch. If vehicle did not adjust and set a new vehicle speed, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
19. Depress and release the CANCEL switch. If the speed control did not disengage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
20. Bring the vehicle speed back up above 35 mph and engage speed control.
21. Depress the OFF switch to turn OFF, (Cruise light will be off). If the speed control did not disengage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.
22. If the vehicle successfully passed all of the previous tests, the speed control system is now functioning as designed. The repair is now complete.
23. NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET.
24. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as "lift foot set"), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h).
25. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.
26. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths.

POWERTRAIN VERIFICATION TEST VER - 4 (DIESEL) (CONTINUED)

27. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly.
28. If the "lift foot sets" are continually used, a speed control overshoot/undershoot condition will develop.
29. To "unlearn" the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating).
30. Then turning the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds.
31. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition.

Did the Speed Control pass the above test?

- Yes** >> Repair is not complete, refer to appropriate symptom.
- No** >> Repair is complete.
-

POWERTRAIN VERIFICATION TEST VER - 5 (DIESEL)

Diagnostic Test

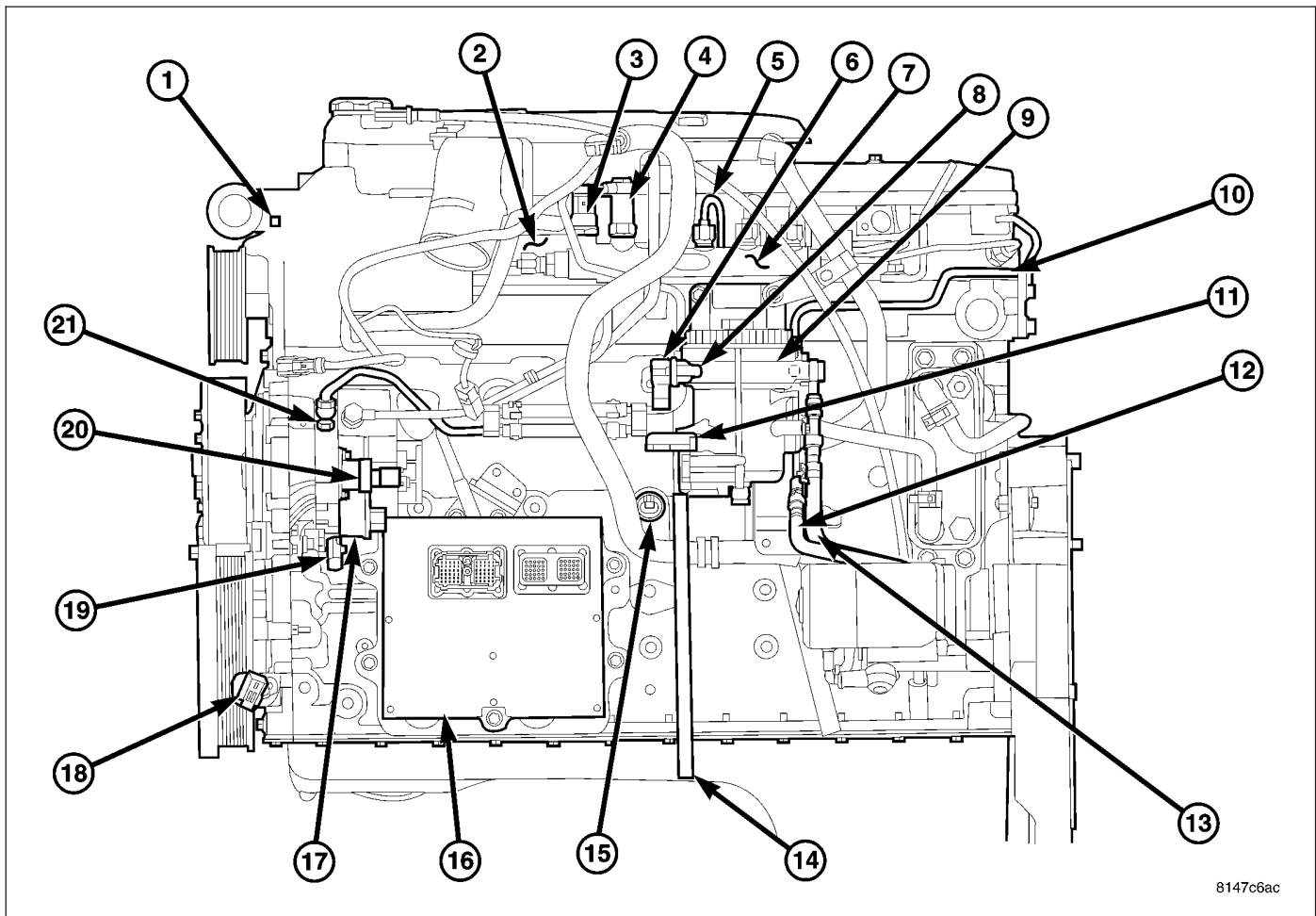
1. POWERTRAIN VERIFICATION TEST VER - 5 (DIESEL)

1. Check if any of the following conditions exist.
2. The ECM has been disconnected or replaced.
3. The Battery power has been disconnected.
4. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
5. If any existing diagnostic trouble codes have not been repaired, go to Symptom List and follow path specified.
6. Connect the scan tool to the data link connector.
7. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.
8. Perform steps 15 through 17 if the PCM has been replaced. Then proceed with the verification. If the ECM has not been replaced skip those steps and continue verification.
9. If ECM has been changed and correct VIN and mileage have not been programmed, a DTC will be set in ABS and Air bag modules. In addition, if vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start.
10. For ABS and Air Bag systems: Enter correct VIN and Mileage in ECM. Erase codes in ABS and Air Bag modules.
11. For SKIM theft alarm: Connect scan tool to data link connector to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode by using appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM.
12. If a Comprehensive Component DTC was repaired, perform steps 10-13. If a Major OBDII Monitor DTC was repaired skip those steps and continue verification.
13. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes.
14. If there are no new DTC's, the repair was successful and is now complete. Erase DTC's and disconnect the scan tool.
15. If the repaired DTC has reset, the repair is not complete. Check for any related TSB's or flash updates and return to the Symptom list.
16. If another DTC has set, return to the Symptom List and follow the path specified for that DTC.
17. With the scan tool, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running).
18. If the monitor ran, the repair was successful and is now complete. Erase DTC's and disconnect the scan tool.
19. If the repaired OBDII trouble code has reset or was seen in the monitor while on the road test, the repair is not complete. Check for any related technical service bulletins or flash updates and return to Symptom List.
20. If another DTC has set, return to the Symptom List and follow the path specified for that DTC.

Is any DTC(s) present?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

REMOVAL**CUMMINS FUEL SYSTEM COMPONENTS**

- | | |
|---|--|
| 1 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR | 14 - FUEL DRAIN TUBE |
| 2 - INTAKE MANIFOLD AIR HEATER/ELEMENTS | 15 - OIL PRESSURE SWITCH |
| 3 - FUEL PRESSURE SENSOR | 16 - ENGINE CONTROL MODULE (ECM) |
| 4 - FUEL PRESSURE LIMITING VALVE | 17 - FUEL INJECTION PUMP |
| 5 - HIGH-PRESSURE FUEL LINES | 18 - CRANKSHAFT POSITION (ENGINE SPEED) SENSOR |
| 6 - FUEL HEATER | 19 - CAMSHAFT POSITION SENSOR (CMP) |
| 7 - HIGH-PRESSURE FUEL RAIL | 20 - FUEL CONTROL ACTUATOR (FCA) |
| 8 - FUEL HEATER TEMPERATURE SENSOR (THERMOSTAT) | 21 - CASCADE OVERFLOW VALVE |
| 9 - FUEL FILTER/WATER SEPARATOR | |
| 10 - FUEL DRAIN MANIFOLD (CYLINDER HEAD FUEL RETURN LINE) | |
| 11 - DRAIN VALVE | |
| 12 - FUEL RETURN LINE CONNECTION (TO FUEL TANK) | |
| 13 - FUEL SUPPLY LINE (LOW-PRESSURE, TO ENGINE) | |

The Engine Control Module (ECM) (16) is bolted to a support bracket near the fuel filter. The support bracket mounts to the block with four capscrews and vibration isolators. A ground wire is fastened to the bracket. The other end of the wire is fastened to the engine block.

1. Record any Diagnostic Trouble Codes (DTC's) found in the ECM.

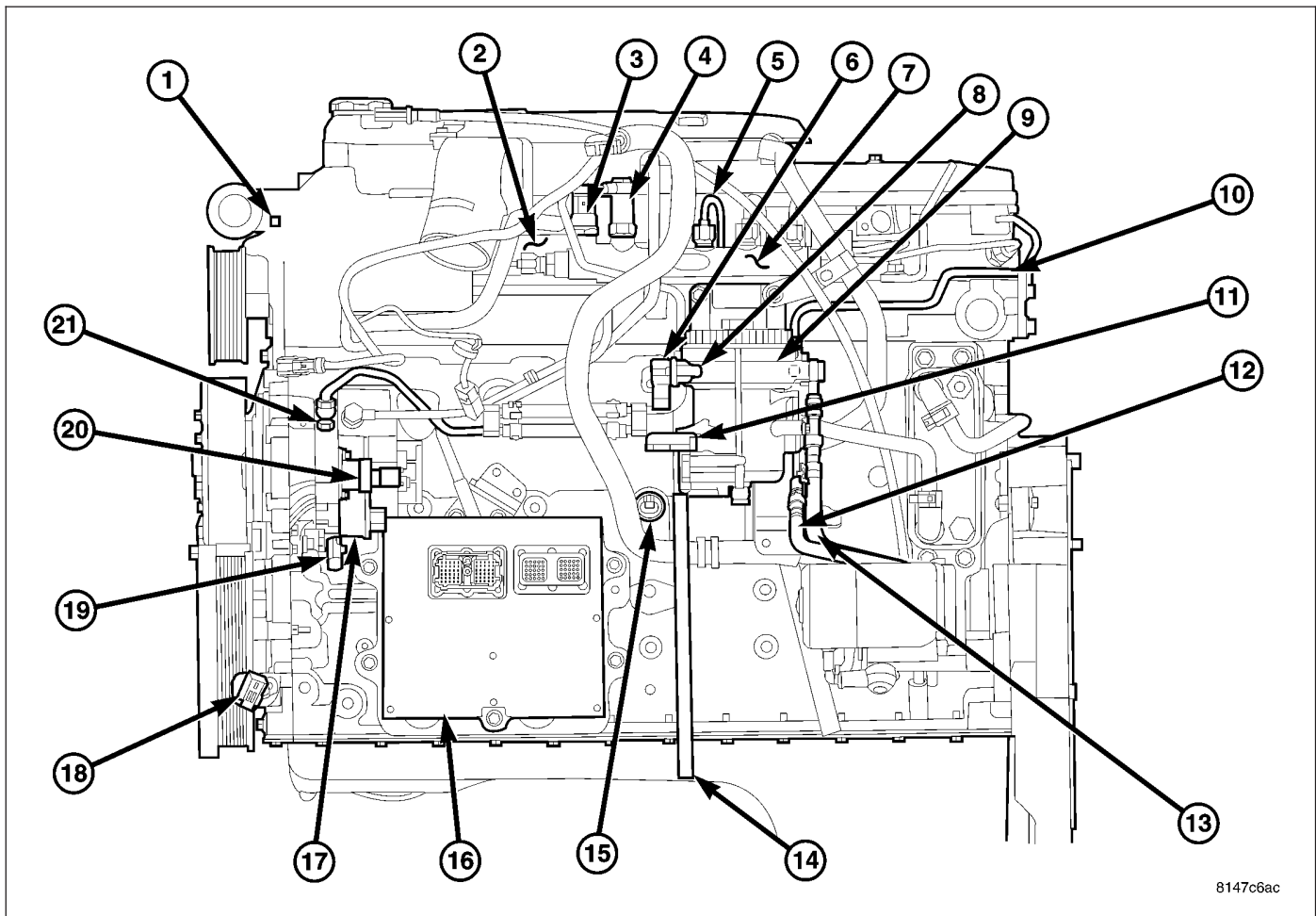
To avoid possible voltage spike damage to the ECM, ignition key must be off, and both negative battery cables must be disconnected before unplugging ECM connectors.

2. Disconnect both negative battery cables at both batteries.

3. Remove the 50-way and 60-way connector bolts at the ECM. Note: The connector bolt is a female allen head. As bolt is being removed, very carefully remove connectors from the ECM.

4. Remove five ECM mounting bolts and remove ECM from vehicle.

INSTALLATION



8147c6ac

CUMMINS FUEL SYSTEM COMPONENTS

- | | |
|---|--|
| 1 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR | 14 - FUEL DRAIN TUBE |
| 2 - INTAKE MANIFOLD AIR HEATER/ELEMENTS | 15 - OIL PRESSURE SWITCH |
| 3 - FUEL PRESSURE SENSOR | 16 - ENGINE CONTROL MODULE (ECM) |
| 4 - FUEL PRESSURE LIMITING VALVE | 17 - FUEL INJECTION PUMP |
| 5 - HIGH-PRESSURE FUEL LINES | 18 - CRANKSHAFT POSITION (ENGINE SPEED) SENSOR |
| 6 - FUEL HEATER | 19 - CAMSHAFT POSITION SENSOR (CMP) |
| 7 - HIGH-PRESSURE FUEL RAIL | 20 - FUEL CONTROL ACTUATOR (FCA) |
| 8 - FUEL HEATER TEMPERATURE SENSOR (THERMOSTAT) | 21 - CASCADE OVERFLOW VALVE |
| 9 - FUEL FILTER/WATER SEPARATOR | |
| 10 - FUEL DRAIN MANIFOLD (CYLINDER HEAD FUEL RETURN LINE) | |
| 11 - DRAIN VALVE | |
| 12 - FUEL RETURN LINE CONNECTION (TO FUEL TANK) | |
| 13 - FUEL SUPPLY LINE (LOW-PRESSURE, TO ENGINE) | |

Do not apply paint to ECM or a poor ground will result.

1. Position the ECM (16) to the ECM support bracket and install the five mounting bolts. Tighten bolts to 24 N·m (18 ft. lbs.).
2. Check pin connectors in ECM, 50-way and 60-way connectors for corrosion or damage. Repair as necessary.
3. Clean pins in the 50-way and 60-way electrical connectors with a electrical contact cleaner.
4. Install the 50-way and 60-way connectors to ECM. Tighten connector bolts to 3 N·m (27 in. lbs.).
5. Reconnect both negative battery cables.
6. Use a diagnostic scan tool to erase any Diagnostic Trouble Codes (DTC's) from ECM.

MODULE-FRONT CONTROL

DESCRIPTION

The Front Control Module (FCM) is a micro controller located in the left front corner of the engine compartment. It is necessary to position the Integrated Power Module (IPM) aside in order to access the front control module on this vehicle. The FCM mates to the Power Distribution Center (PDC) to form the IPM. The IPM connects directly to the battery and provides the primary means of circuit protection and power distribution for all vehicle electrical systems. The FCM controls power to some of the vehicle systems electrical and electromechanical loads based on inputs received from hard wired switch inputs and data received on the PCI bus circuit.

(Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTELLIGENT POWER MODULE - DESCRIPTION) for additional information on the IPM.

OPERATION

As messages are sent over the Programmable Communications Interface (PCI) data bus circuit, the Front Control Module (FCM) reads these messages and controls power to some of the vehicles electrical systems by completing the circuit to ground (low side driver) or completing the circuit to 12 volt power (high side driver). The following functions are **Controlled** by the FCM:

- Headlamp Power with Voltage Regulation
- Windshield Wiper "ON/OFF" Relay Actuation
- Windshield Wiper "HI/LO" Relay Actuation
- Windshield Washer Pump Motor
- Fog Lamp Relay Actuation
- Park Lamp Relay Actuation
- Horn Relay Actuation

The following inputs are **Received/Monitored** by the FCM:

- B+ Connection Detection
- Power Ground
- Ambient Temperature Sensing
- Ignition Switch Run
- Washer Fluid Level Switch
- Windshield Wiper Park Switch
- PCI Data Bus Circuit

DIAGNOSIS AND TESTING

FRONT CONTROL MODULE

The Front Control Module (FCM) is a printed circuit board based module with a on-board micro-processor. The FCM interfaces with other electronic modules in the vehicle via the Programmable Communications Interface (PCI) data bus. In order to obtain conclusive testing the PCI data bus network and all of the electronic modules that provide inputs to, or receive outputs from the FCM must be checked. All PCI communication faults must be resolved prior to further diagnosing any FCM related issues.

The FCM was designed to be diagnosed with an appropriate diagnostic scan tool. The most reliable, efficient, and accurate means to diagnose the FCM requires the use of an appropriate scan tool and the proper Diagnostic Procedures manual.

Before any testing of the FCM is attempted, the battery should be fully charged and all wire harness and ground connections inspected around the affected areas on the vehicle.

BODY VERIFICATION TEST - VER 1

Diagnostic Test

1. PERFORM BODY VERIFICATION TEST

NOTE: If the SKIM, PCM or FCM was replaced, refer to the service information for proper programming procedures.

1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors.
2. Ensure that all accessories are turned off.
3. Ensure that the battery is fully charged.
4. If the Instrument Cluster was replaced, disconnect the negative battery cable for 5 seconds to power down the FCM. Then, reconnect the battery negative cable and turn the ignition on for 15 seconds to allow the Instrument Cluster to learn the VIN.
5. If the Instrument Cluster was replaced and the vehicle is equipped with VTSS, cycle the key in the driver door cylinder lock switch to enable VTSS.
6. Program the tire size, the country code, the radio EQ setting, all of the RKE transmitters (if RKE Module was replaced), and all other options as necessary.
7. If any HVAC door actuator circuits were repaired, run the Actuator Circuit Test by selecting the following from the DRBIII® menu: Select HVAC, System Tests, and Actuator Circuit Test. Allow the test to run to completion before proceeding.
8. If any HVAC door actuators were replaced/door linkage was repaired, run the HVAC Door Recalibration by selecting the following from the DRBIII® menu: Select HVAC, System Tests, and HVAC Door Recalibration. Allow the test to run to completion before proceeding.
9. With the DRBIII®, record and erase all DTC's from ALL modules.
10. Start and run the engine for 2 minutes while operating all functions of the system that caused the original concern.
11. Turn the ignition off, wait 5 seconds, then turn the ignition on. Using the DRBIII®, read DTC's from ALL modules.

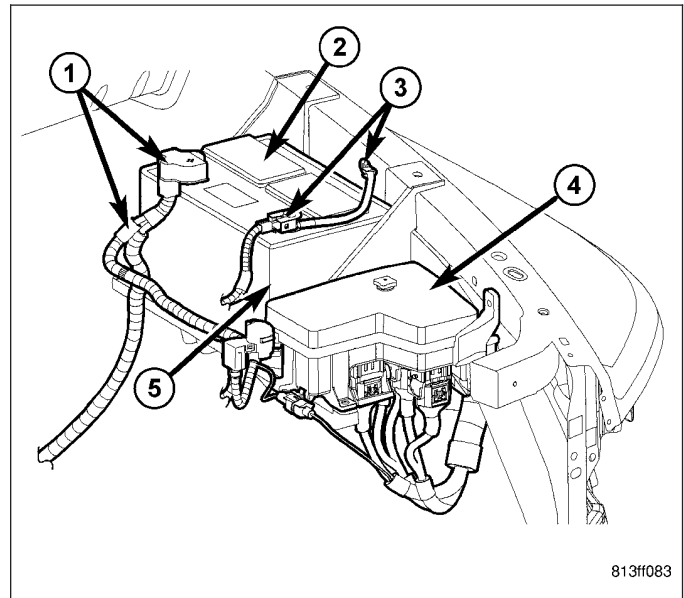
Are DTCs present in any module or is the original condition still present?

Yes >> The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

No >> The repair is complete.

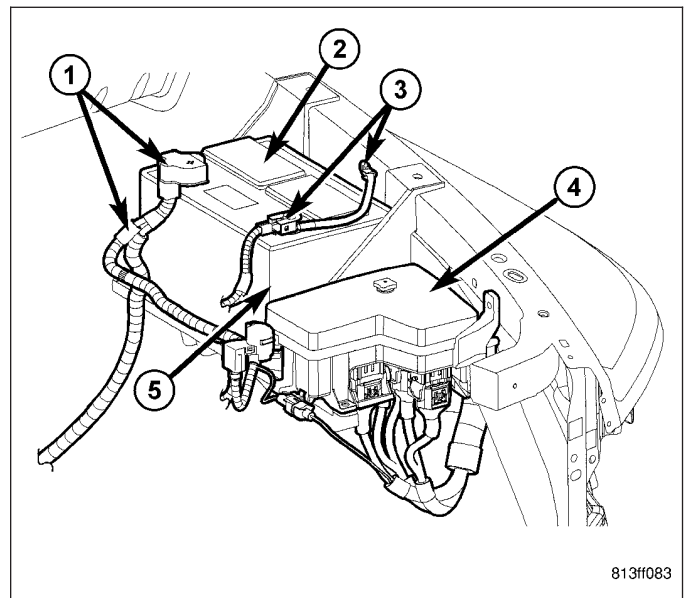
REMOVAL

1. Disconnect and isolate the battery negative cable (3).
2. Partially remove the Integrated Power Module (IPM) (4) from the engine compartment (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - REMOVAL).
3. Remove the Front Control Module (FCM) retaining screws.
4. Using both hands, separate the FCM from the IPM assembly disengaging the 49-way electrical connector and remove the FCM from the vehicle.



INSTALLATION

1. Install the Front Control Module (FCM) onto the Integrated Power Module (IPM) (4) by pushing the 49-way electrical connector straight in.
2. Install the FCM retaining screws. Torque the screws to 7 in. lbs.
3. Install the IPM (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - INSTALLATION).
4. Connect the battery negative cable.
5. Verify normal vehicle operation.



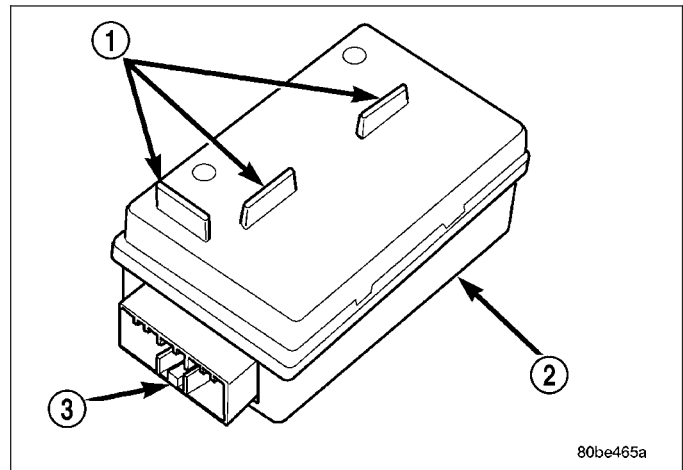
MODULE-HEATED SEATS

DESCRIPTION

The heated seat module (2) is also known as the Seat Heat Interface Module. The heated seat module is located under the drivers front seat cushion, where it is secured to a mounting bracket. The heated seat module has a single connector receptacle (3) that allows the module to be connected to all of the required inputs and outputs through the seat wire harness.

The heated seat module is an electronic microprocessor controlled device designed and programmed to use inputs from the battery, the two heated seat switches and the two heated seat sensors to operate and control the heated seat elements in both front seats and the two heated seat indicator lamp Light-Emitting Diodes (LEDs) in each heated seat switch. The heated seat module is also programmed to perform self-diagnosis of certain heated seat system functions and provide feedback of that diagnosis through the heated seat switch indicator lamps.

The heated seat module cannot be repaired. If the heated seat module is damaged or faulty, the entire module must be replaced.



OPERATION

The heated seat module operates on fused battery current received from the integrated power module. Inputs to the module include a resistor multiplexed heated seat switch request circuit for each of the two heated seat switches and the heated seat sensor inputs from the seat cushions of each front seat. In response to those inputs the heated seat module controls battery current feeds to the heated seat elements and sensors, and controls the ground for the heated seat switch indicator lamps.

When a heated seat switch (Driver or Passenger) is depressed a signal is received by the heated seat module, the module energizes the proper indicator LED (Low or High) in the switch by grounding the indicator lamp circuit to indicate that the heated seat system is operating. At the same time, the heated seat module energizes the selected heated seat sensor circuit and the sensor provides the module with an input indicating the surface temperature of the selected seat cushion.

The Low heat set point is about 36° C (96.8° F), and the High heat set point is about 42° C (107.6° F). If the seat cushion surface temperature input is below the temperature set point for the selected temperature setting, the heated seat module energizes an N-channel Field Effect Transistor (N-FET) within the module which energizes the heated seat elements in the selected seat cushion and back. When the sensor input to the module indicates the correct temperature set point has been achieved, the module de-energizes the N-FET which de-energizes the heated seat elements. The heated seat module will continue to cycle the N-FET as needed to maintain the selected temperature set point.

If the heated seat module detects a heated seat sensor value input that is out of range or a shorted or open heated seat element circuit, it will notify the vehicle operator or the repair technician of this condition by flashing the High and/or Low indicator lamps in the affected heated seat switch. (Refer to 8 - ELECTRICAL/HEATED SEATS - DIAGNOSIS AND TESTING) for flashing LED diagnosis and testing procedures. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/MEMORY HEATED SEAT/MIRROR MODULE - DIAGNOSIS AND TESTING) for heated seat module diagnosis and testing procedures.

DIAGNOSIS AND TESTING

HEATED SEAT MODULE

If a heated seat fails to heat and one or both of the indicator lamps on a heated seat switch flash, (Refer to 8 - ELECTRICAL/HEATED SEATS - DIAGNOSIS AND TESTING) for flashing LED diagnosis and testing procedures. If a heated seat heats but one or both indicator lamps on the heated seat switch fail to operate, test the heated seat switch. (Refer to 8 - ELECTRICAL/HEATED SEATS/DRIVER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING) for heated seat switch diagnosis and testing procedures. If the heated seat switch checks OK, proceed as follows.

1. Check the heated seat element (Refer to 8 - ELECTRICAL/HEATED SEATS/HEATED SEAT ELEMENT - DIAGNOSIS AND TESTING).
2. Check the heated seat sensor (Refer to 8 - ELECTRICAL/HEATED SEATS/HEATED SEAT SENSOR - DIAGNOSIS AND TESTING).
3. Check the heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/DRIVER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING).

NOTE: Refer to Wiring for the location of complete heated seat system wiring diagrams and connector pin-out information.

4. Using a voltmeter, backprobe the heated seat module connector, do not disconnect. Check for voltage at the appropriate pin cavities. 12v should be present. If OK go to Step 5, if Not, Repair the open or shorted voltage supply circuit as required.
5. Using a ohmmeter, backprobe the appropriate heated seat module connector, do not disconnect. Check for proper continuity to ground on the ground pin cavities. Continuity should be present. If OK replace the heated seat module with a known good unit and retest system, if Not OK, Repair the open or shorted ground circuit as required.

REMOVAL

1. Position the driver seat to the full rearward and inclined position.
2. Working under the driver front seat, remove the two heated seat module retaining screws. Due to the fact that the retaining screws are installed with the seat cushion pan removed, a small right angle screwdriver will be required to access and remove the screws.
3. Disconnect the seat wire harness connector from the connector receptacle on the back of the heated seat module. Depress the connector retaining tab and pull straight apart.
4. Remove the heated seat module from under the front seat.

INSTALLATION

1. Position the heated seat module under the front seat.
2. Connect the seat wire harness connector on the connector receptacle on the back of the heated seat module.
3. Working under the driver front seat, install the heated seat module retaining screws.
4. Re-position the driver seat.

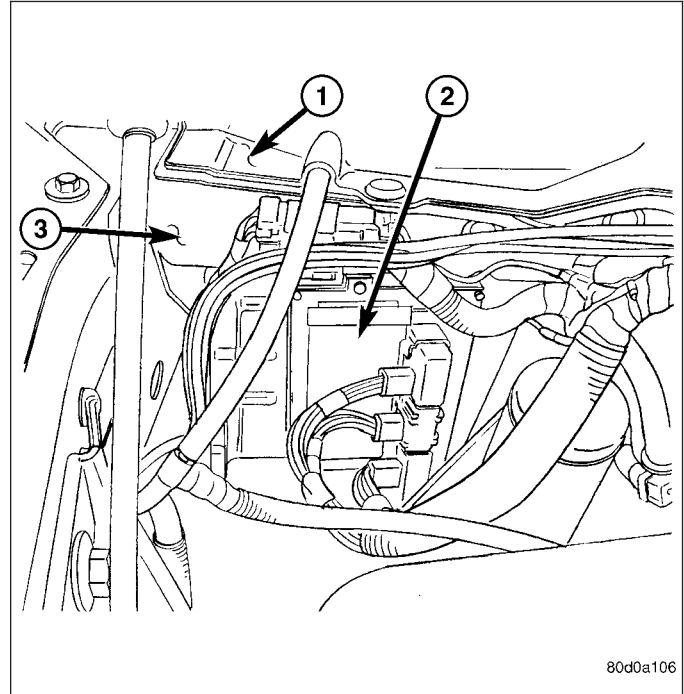
MODULE-POWERTRAIN CONTROL

DESCRIPTION

DESCRIPTION - PCM

The Powertrain Control Module (PCM) is located in the right-rear section of the engine compartment under the cowl.

Two different PCM's are used (JTEC and NGC). These can be easily identified. JTEC's use three 32-way connectors, NGC's use four 38-way connectors



DESCRIPTION - MODES OF OPERATION

As input signals to the Powertrain Control Module (PCM) change, the PCM adjusts its response to the output devices. For example, the PCM must calculate different injector pulse width and ignition timing for idle than it does for wide open throttle (WOT).

The PCM will operate in two different modes: **Open Loop and Closed Loop.**

During Open Loop modes, the PCM receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensors is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensors input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)
- Engine warm-up
- Idle
- Cruise
- Acceleration
- Deceleration
- Wide open throttle (WOT)
- Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:

- The PCM pre-positions the idle air control (IAC) motor.
- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
- Intake manifold air temperature sensor input is monitored.
- Throttle position sensor (TPS) is monitored.
- The auto shutdown (ASD) relay is energized by the PCM for approximately three seconds.
- The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
- The O2S sensor heater element is energized via the ASD or O2S heater relay. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The PCM receives inputs from:

- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within 3 seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the PCM receives inputs from:

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)

Based on these inputs the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM adjusts engine idle speed through the idle air control (IAC) motor and adjusts ignition timing.
- The PCM operates the A/C compressor clutch through the A/C compressor clutch relay. This is done if A/C has been selected by the vehicle operator and specified pressures are met at the high and low-pressure A/C switches. Refer to Heating and Air Conditioning for additional information.

- When engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by increasing and decreasing spark advance.
- The PCM operates the A/C compressor clutch through the A/C compressor clutch relay. This is done if A/C has been selected by the vehicle operator and specified pressures are met at the high and low-pressure A/C switches. Refer to Heating and Air Conditioning for additional information.

CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen (O2S) sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by turning the ground path to the coil(s) on and off.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

ACCELERATION MODE

This is an Open Loop mode. The PCM recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the PCM receives the following inputs.

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Vehicle speed

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply a ground to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the idle air control (IAC) motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the PCM receives the following inputs.

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal

During wide open throttle conditions, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
- The PCM adjusts ignition timing by turning the ground path to the coil(s) on and off.

IGNITION SWITCH OFF MODE

When ignition switch is turned to OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

DESCRIPTION - 5 VOLT SUPPLIES

Two different Powertrain Control Module (PCM) five volt supply circuits are used; primary and secondary.

DESCRIPTION - IGNITION CIRCUIT SENSE

This circuit ties the ignition switch to the Powertrain Control Module (PCM).

DESCRIPTION - POWER GROUNDS

The Powertrain Control Module (PCM) has 2 main grounds. Both of these grounds are referred to as power grounds. All of the high-current, noisy, electrical devices are connected to these grounds as well as all of the sensor returns. The sensor return comes into the sensor return circuit, passes through noise suppression, and is then connected to the power ground.

The power ground is used to control ground circuits for the following PCM loads:

- Generator field winding
- Fuel injectors
- Ignition coil(s)
- Certain relays/solenoids
- Certain sensors

DESCRIPTION - SENSOR RETURN

The Sensor Return circuits are internal to the Powertrain Control Module (PCM).

Sensor Return provides a low-noise ground reference for all engine control system sensors. Refer to Power Grounds for more information.

OPERATION

OPERATION - PCM

The PCM operates the fuel system. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed, power steering pump pressure, and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

NOTE: PCM Inputs:

- ABS module (if equipped)
- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- A/C pressure transducer
- Auto shutdown (ASD) sense
- Battery temperature sensor
- Battery voltage
- Brake switch
- J1850 bus (+) circuits
- J1850 bus (-) circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connection for DRB scan tool

- EATX module (if equipped)
- Engine coolant temperature sensor
- Fuel level (through J1850 circuitry)
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Knock sensors (2 on 3.7L engine)
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Power steering pressure switch (if equipped)
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transfer case switch (4WD range position)
- Vehicle speed signal

NOTE: PCM Outputs:

- A/C clutch relay
- Auto shutdown (ASD) relay
- J1850 bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Data link connection for DRB scan tool
- EGR valve control solenoid (if equipped)
- EVAP canister purge solenoid
- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Idle air control (IAC) motor
- Ignition coil(s)
- Leak detection pump (if equipped)
- Malfunction indicator lamp (Check engine lamp). Driven through J1850 circuits.
- Oxygen sensor heater relays
- Oxygen sensors (pulse width modulated)
- Radiator cooling fan relay (pulse width modulated)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through J1850 circuits.
- Transmission convertor clutch circuit. Driven through J1850 circuits.

OPERATION - 5 VOLT SUPPLIES

Primary 5-volt supply:

- supplies the required 5 volt power source to the Crankshaft Position (CKP) sensor.
- supplies the required 5 volt power source to the Camshaft Position (CMP) sensor.

- supplies a reference voltage for the Manifold Absolute Pressure (MAP) sensor.
- supplies a reference voltage for the Throttle Position Sensor (TPS) sensor.

Secondary 5-volt supply:

- supplies the required 5 volt power source to the oil pressure sensor.
- supplies the required 5 volt power source for the Vehicle Speed Sensor (VSS) (if equipped).
- supplies the 5 volt power source to the transmission pressure sensor (certain automatic transmissions).

OPERATION - IGNITION CIRCUIT SENSE

The ignition circuit sense input tells the PCM the ignition switch has energized the ignition circuit.

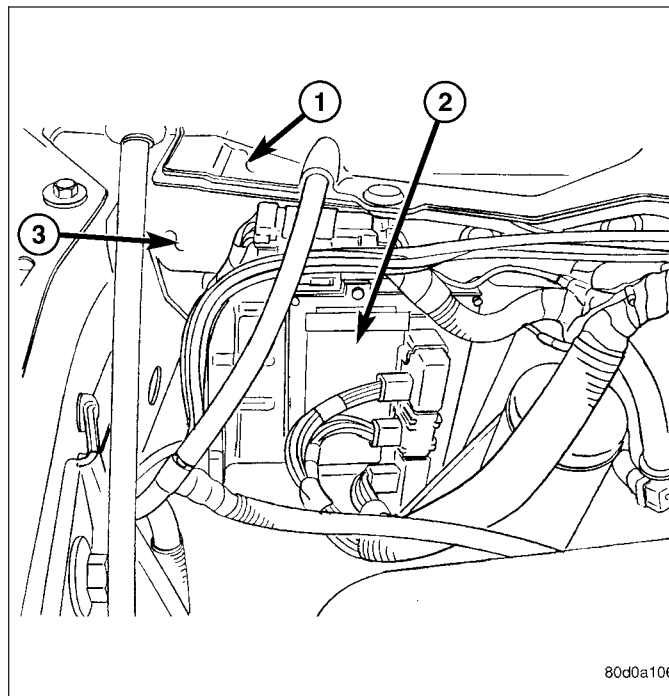
Battery voltage is also supplied to the PCM through the ignition switch when the ignition is in the RUN or START position. This is referred to as the "ignition sense" circuit and is used to "wake up" the PCM. Voltage on the ignition input can be as low as 6 volts and the PCM will still function. Voltage is supplied to this circuit to power the PCM's 8-volt regulator and to allow the PCM to perform fuel, ignition and emissions control functions.

REMOVAL

CAUTION: Certain ABS systems rely on having the Powertrain Control Module (PCM) broadcast the Vehicle Identification Number (VIN) over the bus network. To prevent problems of DTCs and other items related to the VIN broadcast, it is recommend that you disconnect the ABS CAB (controller) temporarily when replacing the PCM. Once the PCM is replaced, write the VIN to the PCM using the DRB scan tool. This is done from the engine main menu. Arrow over to the second page to "1. Miscellaneous". Select "Check VIN" from the choices. Make sure it has the correct VIN entered before continuing. When the VIN is complete, turn off the ignition key and reconnect the ABS module connector. This will prevent the setting of DTCs and other items associated with the lack of a VIN detected when you turn the key ON after replacing the PCM.

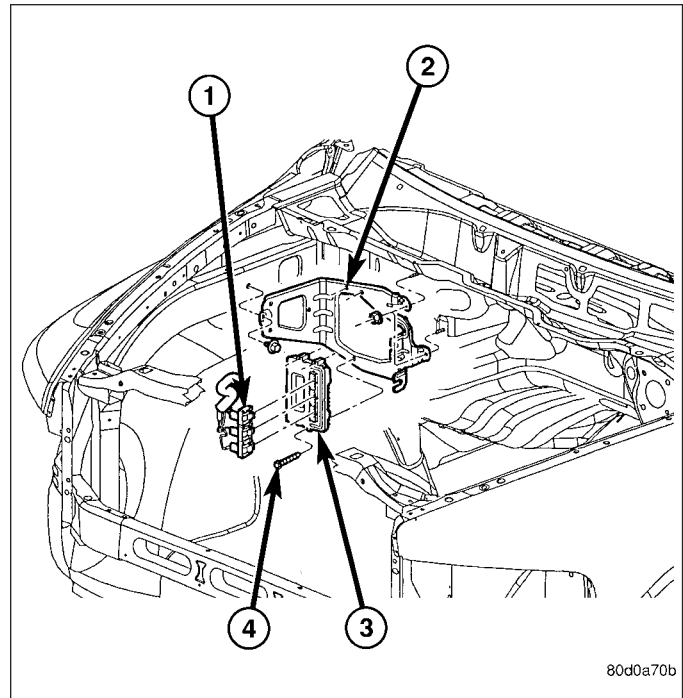
CAUTION: Use the DRB scan tool to reprogram the new PCM with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

The PCM (1) is located in the engine compartment attached to the dash panel (3).



To avoid possible voltage spike damage to the PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

1. Disconnect negative battery cable at battery.
2. Remove cover over electrical connectors. Cover snaps onto PCM.
3. Carefully unplug the three 32-way connectors (four 38-way connectors if equipped with NGC) from PCM (1).
4. Remove three PCM mounting bolts (3) and remove PCM from vehicle.



INSTALLATION

CAUTION: Certain ABS systems rely on having the Powertrain Control Module (PCM) broadcast the Vehicle Identification Number (VIN) over the bus network. To prevent problems of DTCs and other items related to the VIN broadcast, it is recommended that you disconnect the ABS CAB (controller) temporarily when replacing the PCM. Once the PCM is replaced, write the VIN to the PCM using the DRB scan tool. This is done from the engine main menu. Arrow over to the second page to "1. Miscellaneous". Select "Check VIN" from the choices. Make sure it has the correct VIN entered before continuing. When the VIN is complete, turn off the ignition key and reconnect the ABS module connector. This will prevent the setting of DTCs and other items associated with the lack of a VIN detected when you turn the key ON after replacing the PCM.

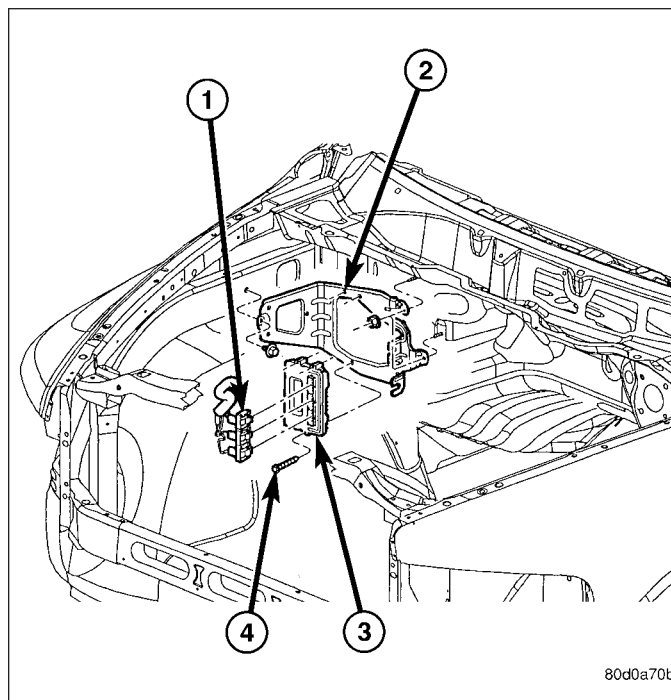
CAUTION: Use the DRB scan tool to reprogram the new PCM with the vehicle's original identification number (VIN) and the vehicle's original mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

1. Install PCM (3) and 3 mounting bolts (4) to vehicle.
2. Tighten bolts. Refer to torque specifications.
3. Check pin connectors in the PCM and the three 32-way connectors (four 38-way connectors if equipped with NGC) for corrosion or damage. Also, the pin heights in connectors should all be same. Repair as necessary before installing connectors.
4. Install three 32-way connectors (four 38-way connectors if equipped with NGC).
5. Install cover over electrical connectors. Cover snaps onto PCM.
6. Install negative battery cable.
7. **The 5.7L V-8 engine is equipped with a fully electronic accelerator pedal position sensor. If equipped with a 5.7L, also perform the following 3 steps:**

- a. Connect negative battery cable to battery.
- b. Turn ignition switch ON, but do not crank engine.
- c. Leave ignition switch ON for a minimum of 10 seconds. This will allow PCM to learn electrical parameters.
- d. The DRB III® Scan Tool may also be used to learn electrical parameters. Go to the Miscellaneous menu, and then select ETC Learn.

8. If the previous step is not performed, a Diagnostic Trouble Code (DTC) will be set.

9. If necessary, use DRB III® Scan Tool to erase any Diagnostic Trouble Codes (DTC's) from PCM. Also use the DRB scan tool to reprogram new PCM with vehicles original Vehicle Identification Number (VIN) and original vehicle mileage.

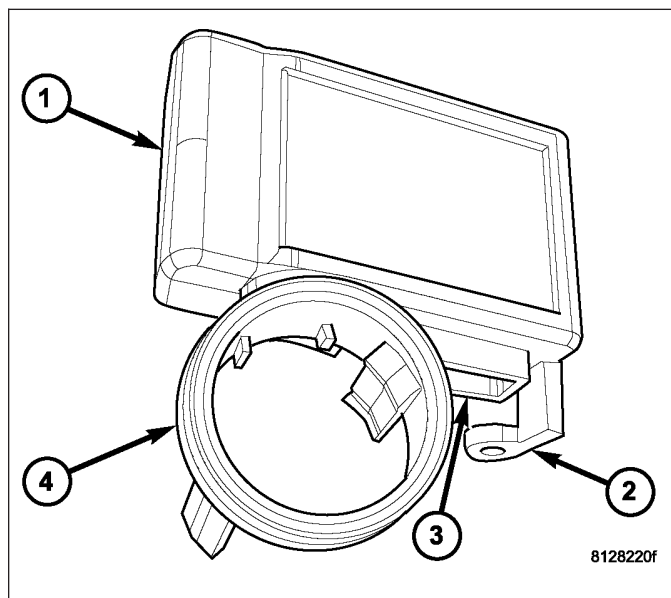


MODULE-SENTRY KEY IMMOBILIZER

DESCRIPTION

The Sentry Key Immobilizer Module (SKIM) (1) is the primary component of the Sentry Key Immobilizer System (SKIS). This module contains a Radio Frequency (RF) transceiver and a central processing unit, which includes the Sentry Key Immobilizer System (SKIS) program logic. The SKIM is located on the right side of the steering column, near the ignition lock cylinder housing and is concealed beneath the steering column shrouds. The molded black plastic housing for the SKIM has an integral molded plastic halo-like antenna ring (4) that extends from the bottom. When the SKIM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing.

A single integral connector receptacle (3) is located just behind the antenna ring on the bottom of the SKIM housing. An integral molded plastic mounting tab (2) on the rear corner of the SKIM housing has a hole in the center through which a screw passes to secure the unit to the steering column. The SKIM is



connected to the vehicle electrical system through a single take out and connector of the instrument panel wire harness.

OPERATION

The Sentry Key Immobilizer Module (SKIM) transmits Radio Frequency (RF) signals to, and receives RF signals from the Sentry Key transponder through a tuned antenna enclosed within the molded plastic antenna ring. If this antenna ring is not mounted properly around the ignition lock cylinder housing, communication problems between the SKIM and the transponder may arise. These communication problems will result in Sentry Key transponder-related faults. The SKIM also communicates over the Programmable Communications Interface (PCI) data bus with the Powertrain Control Module (PCM) for gasoline engines or the Engine Control Module (ECM) for diesel engines, the ElectroMechanical Instrument Cluster (EMIC) and/or a diagnostic scan tool.

The SKIM and the PCM/ECM both use software that includes a rolling code algorithm strategy, which helps to reduce the possibility of unauthorized Sentry Key Immobilizer System (SKIS) disarming. The rolling code algorithm ensures security by preventing an override of the SKIS through the unauthorized substitution of the SKIM or the PCM/ECM. However, the use of this strategy also means that replacement of either the SKIM or the PCM/ECM units will require a system initialization procedure to restore system operation.

The SKIM retains in memory the ID numbers of any Sentry Key transponder that is programmed into it. A maximum of eight Sentry Key transponders can be programmed into the SKIM. For added system security, each SKIM is programmed with a unique Secret Key code. This code is stored in memory, sent over the PCI data bus to the PCM or ECM, and is encoded to the transponder of every Sentry Key that is programmed into the SKIM. Therefore, the Secret Key code is a common element that is found in every component of the SKIS.

Another security code called a PIN, is used to gain access to the SKIM Secured Access Mode. The Secured Access Mode is required during service to perform the SKIS initialization and Sentry Key transponder programming procedures. The SKIM also stores the Vehicle Identification Number (VIN) in its memory, which it learns through a PCI data bus message from the PCM or ECM during SKIS initialization.

In the event that a SKIM replacement is required, the Secret Key code can be transferred to the new SKIM from the PCM using a diagnostic scan tool and the SKIS initialization procedure. Proper completion of the SKIS initialization will allow the existing Sentry Keys to be programmed into the new SKIM so that new keys will not be required. In the event that the original Secret Key code cannot be recovered, SKIM replacement will also require new Sentry Keys. The diagnostic scan tool will alert the technician during the SKIS initialization procedure if new Sentry Keys are required.

When the ignition switch is turned to the On or Start positions, the SKIM transmits an RF signal to excite the transponder in the ignition key. The SKIM then listens for a return RF signal from the transponder. If the SKIM receives an RF signal with a valid "Secret Key" and transponder identification codes, the SKIM sends a "valid key" message to the PCM/ECM over the PCI bus. If the SKIM receives an invalid RF signal or no response, it sends "invalid key" messages to the PCM/ECM. The PCM/ECM will enable or disable engine operation based upon the status of the SKIM messages. It is important to note that the default condition in the PCM or ECM is an invalid key. Therefore, if no message is received from the SKIM by the PCM or ECM, the engine will be disabled and the vehicle immobilized after two seconds of running.

The SKIM also sends electronic messages to the EMIC which control the VTSS indicator. The SKIM sends messages to the EMIC to turn the indicator on for about three seconds when the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the indicator off for a duration of about one second. Then the SKIM sends messages to turn the indicator on or off based upon the results of the SKIS self-tests. If the VTSS indicator comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative.

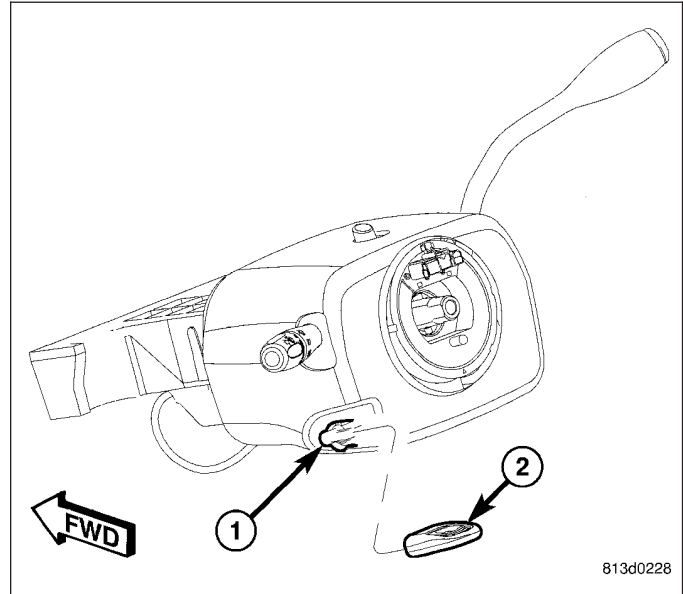
If the SKIM detects an invalid key when the ignition switch is turned to the On position, it sends messages to flash the VTSS indicator. The SKIM can also send messages to flash the indicator and to generate a single audible chime whenever the Customer Learn programming mode is being utilized. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING).

The SKIS will store fault information in the form of Diagnostic Trouble Codes (DTC's) in SKIM memory if a system malfunction is detected. For diagnosis or initialization of the SKIM and the PCM/ECM, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

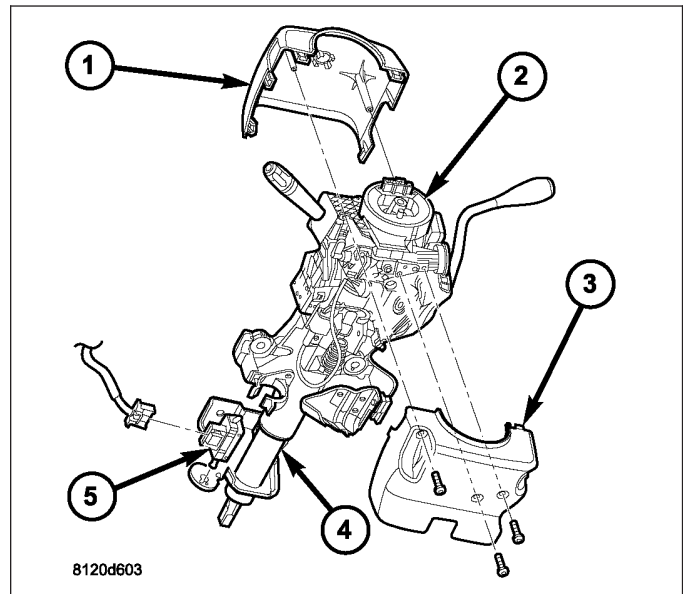
REMOVAL

WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.

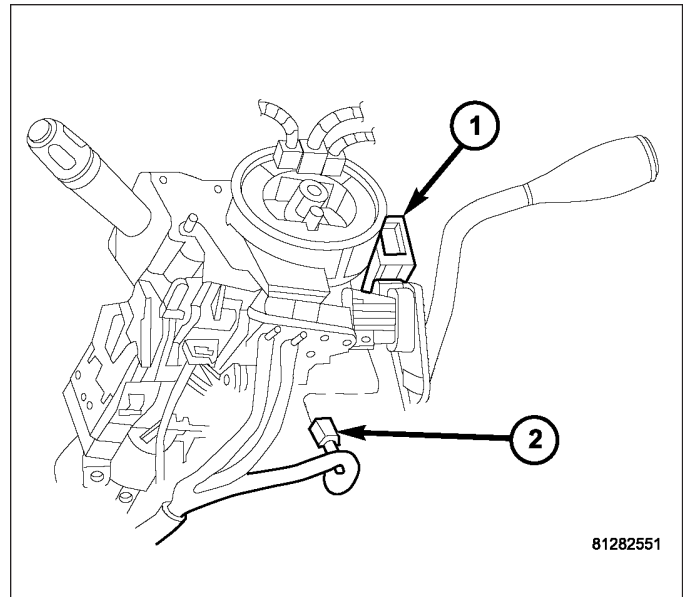
1. Disconnect and isolate the battery negative cable.
2. Grasp the tilt steering column knob (2) firmly and pull it straight rearward to remove it from the tilt adjuster lever (1) on the left side of the column.



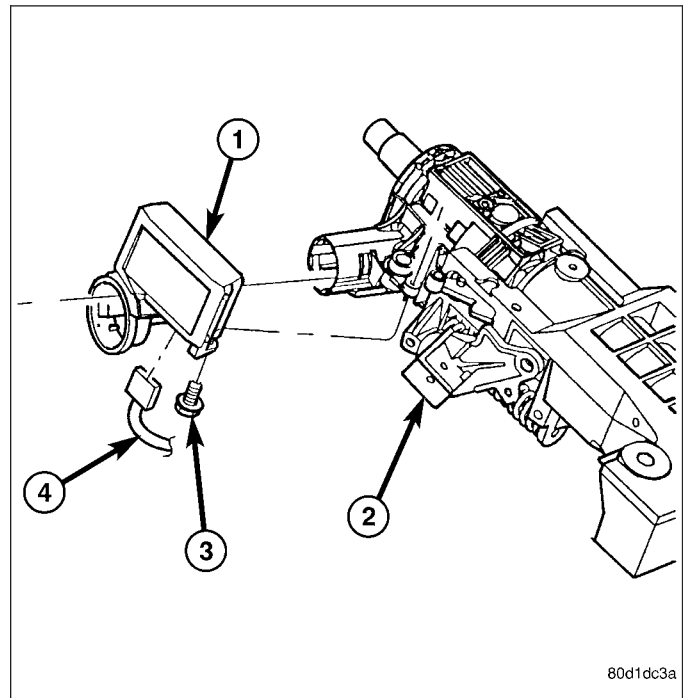
3. From below the steering column, remove the two outboard screws that secure the upper column shroud (1) to the lower shroud (3).
4. Using hand pressure, push inward on both sides of the upper shroud above the parting line of the lower shroud to release the snap features that secure the two shroud halves to each other.
5. Remove the upper shroud from the lower shroud and the steering column.
6. Remove the one center screw that secures the lower shroud to the steering column (4).
7. Remove the lower shroud from the steering column.



8. Disconnect the wire harness connector (2) from the Sentry Key Immobilizer Module (SKIM) (1).



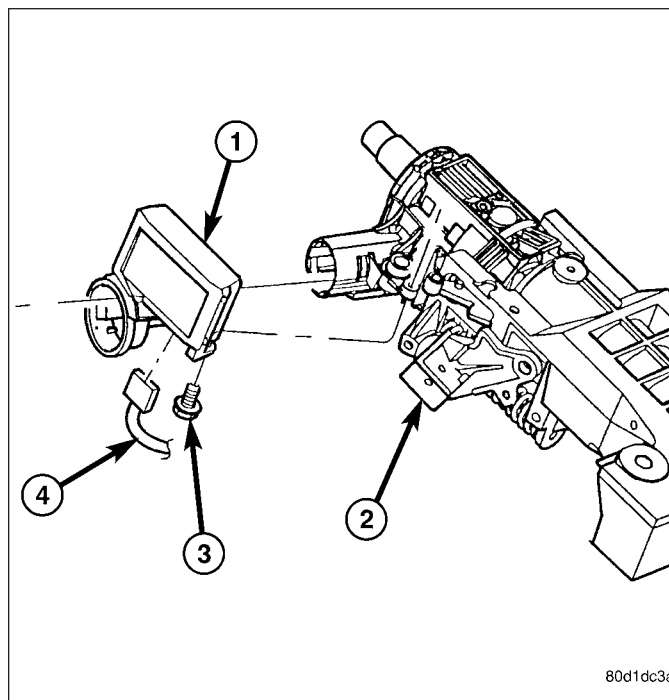
9. Remove the screw (3) that secures the SKIM (1) to the steering column (2).
10. Disengage the antenna ring from around the ignition lock cylinder housing and remove the SKIM.



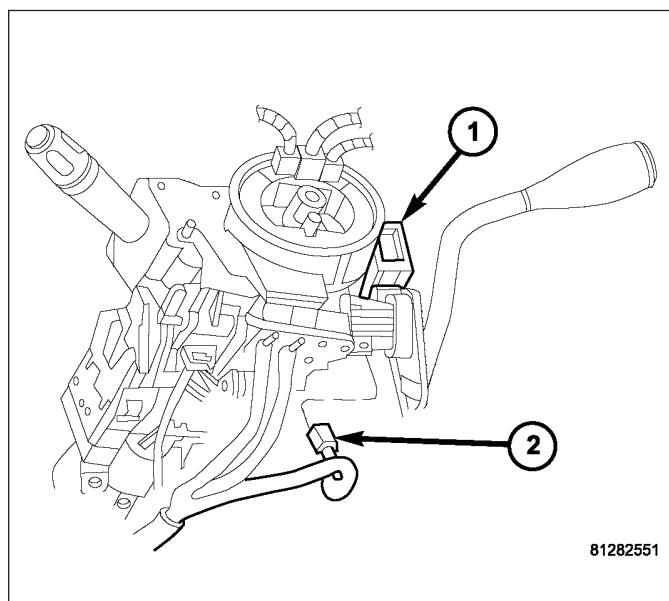
INSTALLATION

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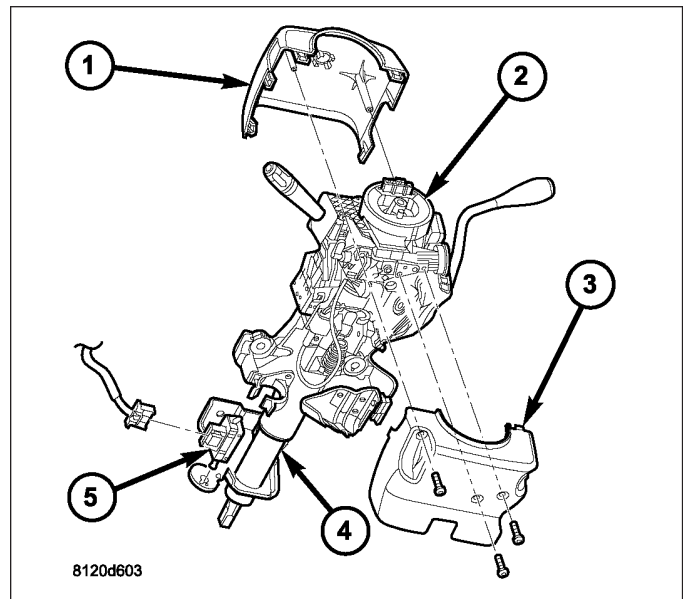
1. Position the Sentry Key Immobilizer Module (SKIM) (1) onto the steering column (2) with the antenna ring oriented around the ignition lock cylinder housing.
2. Install and tighten the screw (3) that secures the SKIM to the steering column housing. Tighten the screw to 2 N·m (20 in. lbs.).



3. Reconnect the wire harness connector (2) to the SKIM (1).

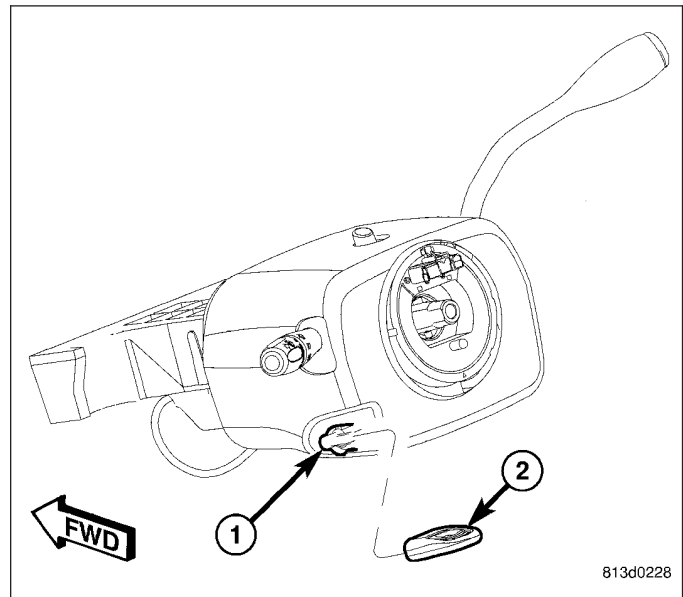


4. Position the lower shroud (3) onto the steering column (4).
5. From below the steering column, install and tighten the one center screw that secures the lower shroud to the steering column. Tighten the screw to 2 N·m (20 in. lbs.).
6. Position the upper shroud (1) onto the steering column over the lower shroud. On vehicles equipped with an automatic transmission, be certain to engage the gearshift lever gap hider into the opening in the right side of both shroud halves.
7. Align the snap features on the upper shroud with the receptacles in the lower shroud and apply hand pressure to snap them together.
8. Install and tighten the two outboard screws that secure the upper shroud to the lower shroud. Tighten the screws to 2 N·m (20 in. lbs.).



9. Align the tilt steering column knob (2) with the tilt adjuster lever (1) on the left side of the steering column and use hand pressure to snap it back into place.
10. Reconnect the battery negative cable.

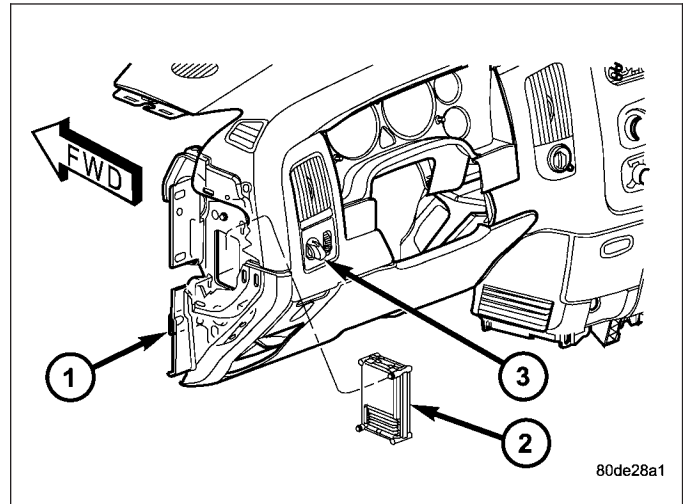
NOTE: If the SKIM is replaced with a new unit, a diagnostic scan tool **MUST** be used to initialize the new SKIM and to program at least two Sentry Key transponders before the vehicle can be operated. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SKIS INITIALIZATION).



MODULE-TRANSFER CASE CONTROL

DESCRIPTION

The Transfer Case Control Module (TCCM) (2) is a microprocessor-based assembly, controlling the 4X4 transfer case shift functions via the actuation of a shift motor and utilizing the feedback of a mode sensor assembly. Communication is via the PCI serial bus. Inputs include user selectable 4X4 modes that include 2WD, AWD, 4HI, 4LO, and Neutral. The logic and driver circuitry is contained in a molded plastic housing with an embedded heat-sink and is located behind the left side of the lower instrument panel (1).



OPERATION

The Transfer Case Control Module (TCCM) utilizes the input from the transfer case mounted mode sensor, the instrument panel mounted selector switch, and the following information from the vehicle's PCI serial bus to determine if a shift is allowed.

- Engine RPM and Vehicle Speed
- Diagnostic Requests
- Manual Transmission and Brake Applied
- PRNDL
- Ignition Status
- ABS Messages

Once the TCCM determines that a requested shift is allowed, it actuates the bi-directional shift motor as necessary to achieve the desired transfer case operating mode. The TCCM also monitors the mode sensor while controlling the shift motor to determine the status of the shift attempt.

Several items can cause the requested shift not to be completed. If the TCCM has recognized a fault (DTC) of some variety, it will begin operation in one of four Functionality Levels. These levels are:

- **Level Zero** - Normal Operation.
- **Level One** - Only Mode Shifts Are Allowed.
- **Level Two** - Only Mode Shifts and Shifts Into LOW Are Allowed (No Neutral Shifts Are Allowed).
- **Level Three** - No Shifts Are Allowed

The TCCM can also be operating in one of three possible power modes. These power modes are:

- **Full Power Mode** is the normal operational mode of the module. This mode is achieved by normal PCI bus traffic being present and the ignition being in the RUN position.
- **Reduced Power Mode** will be entered when the ignition has been powered off. In this state, the module will shut down power supplied to external devices, and to electronic interface inputs and outputs. From this state the module can enter either Sleep Mode or Full Power Mode. To enter this mode, the module must receive an ignition message denoting that the ignition is off, or not receive any messages for 5 ± 0.5 seconds. To exit this mode, the module must receive one ignition message that denotes that the ignition is in the RUN position.
- **Sleep Mode** will be entered, from the Reduced Power Mode, when no PCI traffic has been sensed for 20 ± 1 seconds. If during Sleep Mode the module detects PCI bus traffic, it will revert to the Reduced Power mode while monitoring for ignition messages. It will remain in this state as long as there is traffic other than run or start messages, and will return to Sleep mode if the bus goes without traffic for 20 ± 1 seconds.

SHIFT REQUIREMENTS

If the TCCM is in full power mode and at functionality level zero, it uses the following criteria to determine if a shift is allowed.

If any of the driver controllable conditions are not met once the shift request is recognized, the TCCM will solidly illuminate the source position's LED and flash the desired position's LED for all shifts except NEUTRAL. The NEUTRAL shift LED strategy will be discussed later.

Mode shifts will be allowed regardless of transmission gear or vehicle speed, whenever the following conditions are met:

- Front and rear wheel speed are within 21 km/hr (13 mph).
- A change in the Selector switch state indicates that a mode shift has been requested.
- A valid mode sensor signal is being sensed by the TCCM.
- Proper transmit/receive messages are occurring on the PCI bus.
- Ignition key switch is in the RUN position.

Range shifts will be allowed only if all of the following conditions are met:

- Front and rear wheel speed are within 21 km/hr (13 mph).
- A change in the Selector Switch state indicating a range shift has been requested.
- Transmission in NEUTRAL signal must be recognized for at least 1.5 seconds ± 100 msec. (Automatic transmissions only)
- Proper transmit/receive messages are occurring on the PCI bus.
- Clutch signal is recognized for 500 msec ± 50 msec (Manual transmissions only).
- Vehicle speed is less than or equal to 4.8 km/hr (3 miles per hour).
- Ignition key switch is in the RUN position.
- A valid mode sensor signal is being sensed by the TCCM.

A **shift into transfer case Neutral** will be allowed only if all of the following conditions are met:

- Front and rear wheel speed are within 21 km/hr (13 mph).
- The recessed Neutral Selection switch has been depressed continuously for 4.0 seconds ± 100 msec while all shift conditions have been continuously met.
- Transmission in NEUTRAL signal recognized from the bus. (Automatic transmissions only)
- Clutch signal is recognized from the bus (Manual transmissions only).
- Proper message transmissions/receptions are occurring on the PCI bus.
- Vehicle speed is less than or equal to 4.8 km/hr (3 miles per hour).
- Ignition key switch is in the RUN position, engine off.
- Foot Brake is applied.
- A valid mode sensor signal is being sensed by the TCCM.

A **shift out of transfer case Neutral** will be allowed only if all of the following conditions are met:

- Front and rear wheel speed are within 21 km/hr (13 mph).
- The recessed Neutral Selection switch has been depressed continuously for 1.0 seconds ± 100 msec while all shift conditions have been continuously met.
- Transmission in NEUTRAL signal recognized from the bus. (Automatic transmissions only)
- Clutch signal is recognized from the bus (Manual transmissions only).
- Proper message transmissions/receptions are occurring on the PCI bus.
- Vehicle speed is less than or equal to 4.8 km/hr (3 miles per hour).
- Ignition key switch is in the RUN position.
- Foot Brake is applied.
- A valid mode sensor signal is being sensed by the TCCM.

SHIFT SEQUENCES

Once all the driver controllable conditions for the requested shift have been met, the TCCM begins a shift timer with a maximum duration of 1 second per 'D' channel transition. If the shift timer expires before the TCCM recognizes to correct mode sensor code, the shift is considered to have been blocked. The blocked shift will increment the blocked shift counter by one. The TCCM strategy for handling blocked shifts will be described later. The process the TCCM performs for the various shifts will be described first.

RANGE AND MODE SHIFTS

The process for performing all the range and mode shifts are the same. The following steps describe the process.

- Allow time for Selector Switch debounce; 250 msec $\pm$ 50 msec.
- Extinguish the source gear's LED while flashing desired transfer case position's LED.
- Engage the shift motor for a maximum of 1 second $\pm$ 100 msec per 'D' channel transition in the destination gear's direction while monitoring the mode sensor channel transitions.
- Disengage the shift motor when the correct mode sensor code is recognized.
- Solidly illuminate the selected gear's LED.
- Transmit a bus message that the transfer case shift is complete.
- If the desired mode sensor code is not received after the shift timer expires (ie. a blocked or other condition exists), stop driving the motor and wait for 200 msec $\pm$ 50 msec. The shift motor is then reversed in the direction back toward the source gear for up to 1.0 seconds $\pm$ 100 msec. per 'D' channel. The TCCM waits for 2.0 seconds $\pm$ 50 msec. and repeats the attempt to shift to the desired position.

The exception to the preceding sequence is when a shift from 4L to 2WD/AWD is requested. If 2WD/AWD is requested from the 4L position, the transfer case is first driven to the 4H position. If the 4H position is reached, the transfer case is then driven back to the 2WD/AWD position and the shift is considered complete. If the transfer case does not reach any the 4H position, but is in the 2WD/AWD 'D' channel, or the 2WD/AWD between gear position on the 4H side of 2WD/AWD, the shift is also considered complete.

SHIFT OUT OF NEUTRAL

The following steps describe the process for a shift out of NEUTRAL.

- Extinguish the Neutral LED.
- Engage the shift motor for a maximum of 1 second $\pm$ 100 msec toward the transfer case 4H mode position while monitoring the mode sensor channel transitions.
- Disengage the shift motor when the correct mode sensor code is recognized.
- Extinguish the Neutral LED.
- Transmit a bus message that the transfer case shift is complete.
- If the desired mode sensor code is not received after the shift timer expires (ie. a blocked or other condition exists), stop driving the motor and wait for 200 msec $\pm$ 50 msec. The shift motor is then reversed in the direction back toward the source gear for up to 1.0 seconds 100 msec. The TCCM waits for 2.0 seconds $\pm$ 50 msec. and repeats the attempt to shift to the desired position.
- When the Neutral button is released, if the 4H position is the desired position, the shift is complete. Illuminate the 4H LED.
- Otherwise when the Neutral button is released, if all of the shift requirements are being met then engage the shift motor towards the desired position for 1 second $\pm$ 100 msec per 'D' channel. (if requirements for shifting are not met, illuminate the 4H LED and flash the destination LED as an indication to the driver that all of the driver controllable shift conditions are not being met). If this requires another range or mode shift, begin the range/mode shift process.
- If the desired mode sensor code is not received after the shift timer expires (i.e. a blocked or other condition exists), refer to the section on Blocked Shift Strategy.

BLOCKED SHIFT STRATEGY

When a shift is commanded, the shift motor will be driven towards its destination position, except in the case of shifting out of Neutral if 4L was selected (the transfer case will shift to the 4H position first, before proceeding to 4L). If the shift is blocked on the way to the destination, the TCCM may attempt to drive the motor back to the original position. This process will be allowed to occur 5 times. If the transfer case has reached a non-NEUTRAL 'D' channel during the shift re-attempts, the LED for the achieved gear position is illuminated and the shift attempts are

stopped. To re-attempt the desired shift, the selector switch will need to be rotated to the current position until the switch debounce timer expires then a shift will need to be requested again.

At the end of the 5th blocked attempt, the shift motor is driven towards the last known 'D' channel position. If this motor drive allows the transfer case to reach the 2WD/AWD 'D' channel, or the 2WD/AWD between gear position on the 4H side of 2WD/AWD, the shift is considered complete and the shift attempts are ended.

If the mode sensor is in the NEUTRAL region at the expiration of the shift timer, the TCCM will continue to make the shift attempts according to the blocked shift strategy independent of whether or not the driver controlled conditions are met.

For shifts from NEUTRAL, if all 5 attempts fail to reach the desired position (which by default is 4H), the motor will be driven to stall in the direction of 4H or 4L, depending on the achieved position. If the transfer case has reached the 2WD/AWD or 4L between gear position nearest the NEUTRAL positions and the shift conditions are no longer being met, the transfer case will be driven toward the corresponding 'D' channel. Otherwise, the transfer case will be driven in the direction opposite the last attempt with the desired target being 4H or 4L.

If the transfer case reaches the 2WD/AWD 'D' channel when being driven in the 4H direction, then one final 1.0 second drive toward 4H is attempted. If the transfer case then reaches any of the 4H positions, the shift is considered complete and the 4H LED is illuminated. If the transfer case is still the 2WD/AWD position, the shift is considered complete and the 2WD/AWD LED is illuminated.

NOTE: If after the 5th blocked shift and reversal attempt, if the transfer case position is in the NEUTRAL region, shift attempts will continue until a non-NEUTRAL 'D' channel is reached.

SHIFT REVERSAL TARGETS

If the shift timer expires (1 second per 'D' channel) and the transfer case has not reached the desired position, all shifts will attempt to return to their original position with the exceptions of:

- If the intended shift is going to the High rail from Low and can't make it, but it can make the 2WD/AWD position, the motor stops at that position. The TCCM will not attempt to cross back over NEUTRAL if it does not have to. This means that there was a block on the first attempt to go to 4H and the transfer case has made it through NEUTRAL to a known good position, then the motor will go back only to the 2WD/4WD position and execute the remainder of the attempts from there.
- For shifts out of NEUTRAL, any time a shift is commanded out of NEUTRAL, the system needs to get out. The TCCM should never go to NEUTRAL unless the driver is commanding it and all required conditions are being met

ENCODER DRIFT CORRECTION

Whenever a shift is completed, the TCCM stores the position in memory as the transfer case's intended position. The TCCM continuously monitors the mode sensor and if the mode sensor drifts toward into a NEUTRAL region sensor position for 2.0 seconds, the TCCM will perform a motor drive to correct the drift. The transfer case will be driven toward the intended position for 1.0 seconds 100 msec. The TCCM will wait for 2.0 seconds ± 50 msec. and repeat the attempt to shift to the desired position. This will continue until the intended position is reached.

SHIFT MOTOR BRAKING

Two modes of shift motor braking are employed to improve shift performance, static and dynamic. Static shift motor braking is utilized under the following conditions:

- Whenever the transfer case is in the 2WD/AWD or 4L 'D' channel position.
- Whenever an invalid mode sensor code is present.

Static motor braking is achieved by applying +12V on both shift motor wires.

NOTE: Static Shift Motor Braking is independent of ignition key position.

SHIFT ATTEMPT LIMIT

To protect the transfer case system, the TCCM will impose a limit on the number of shifts that can occur over a calibrated time period. The system will monitor the number of 'D' channel segment transitions that occur in any 30 second time period. If the number of segment transitions is 30 or greater, the system will go into a default mode. The default mode of operation for shifting is that the number of allowed 'D' channel transitions permitted to occur will be 3 over each 15 second ± 100 msec calibrated window of time. After 5 minutes ± 100 msec, the motor can be assumed to have cooled down and the system will revert to normal operation. The following rules also apply to the shift limit:

- The attempt limit will not prevent shifts coming out of NEUTRAL, they will be allowed regardless of the counter/timer.
- Any shift that is in progress when the counter reaches a maximum count in time will be allowed to complete before the default mode is entered. D-channel transitions during this period will not be counted towards the default mode limit.
- A block, regardless of the direction, whether towards destination or back towards reversal target (shift timer expiring), will count as a value of 2 transitions towards the 30 segment transitions to go into default mode as defined above. Current attempt limit values are 30 transitions in 30 seconds and default mode values are 3 transitions every 15 seconds for 5 minutes.

DIAGNOSIS AND TESTING

TRANSFER CASE VERIFICATION TEST VER 1

Diagnostic Test

1. TRANSFER CASE VERIFICATION TEST— VER 1

Disconnect all jumper wires and reconnect all previously disconnected components and connectors.

With the scan tool, Clear DTCs.

Make sure that all accessories are turned off and that the battery is fully charged.

Move the Transfer Case Selector Switch to the desired position.

Test drive the vehicle in each Transfer Case range and verify proper operation in each range.

NOTE: To select or deselect 2WD, AWD or 4HI mode, vehicle speed must be below 55 MPH (88 KM/H) with all wheels at vehicle speed.

NOTE: Shifts will not take place with a wheel speed difference of greater than 13 MPH between the front and rear wheels.

NOTE: To select or deselect 4LO (if equipped), vehicle speed must be below 3 MPH (5 KM/H) with the ignition ON and the transmission in neutral (auto trans) or the clutch pedal pressed (man trans).

NOTE: To select or deselect Transfer Case Neutral, vehicle speed must be 0 MPH with the ignition ON, engine OFF, the brake pedal applied, and the transmission in neutral (auto trans) or the clutch pedal pressed (man trans). Press the Neutral button (if equipped) on the Transfer Case Selector Switch until the Neutral Indicator is illuminated.

WARNING: Apply the parking brake. The vehicle may roll with the Transfer Case in neutral.

NOTE: To verify that the Transfer Case is in Neutral, shift the automatic transmission into reverse and release the brake pedal for three seconds or shift the manual transmission into gear and slowly release the clutch pedal. There should be no vehicle movement if the Transfer Case is in Neutral.

With the scan tool, read DTCs in the Front Control Module (FCM) and the Instrument Cluster Module (CCN).

Are there any Transfer Case DTCs present in the Front Control Module (FCM) or the Instrument Cluster Module (CCN)?

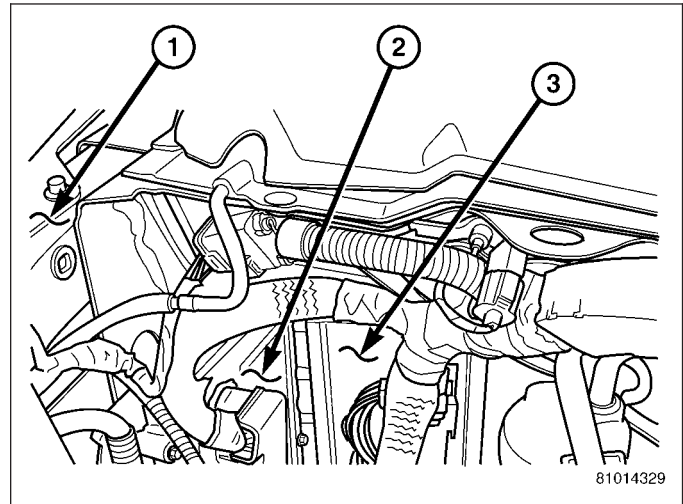
Yes >> Return to the symptom list and perform the appropriate diagnostic test.

No >> Repair is complete.

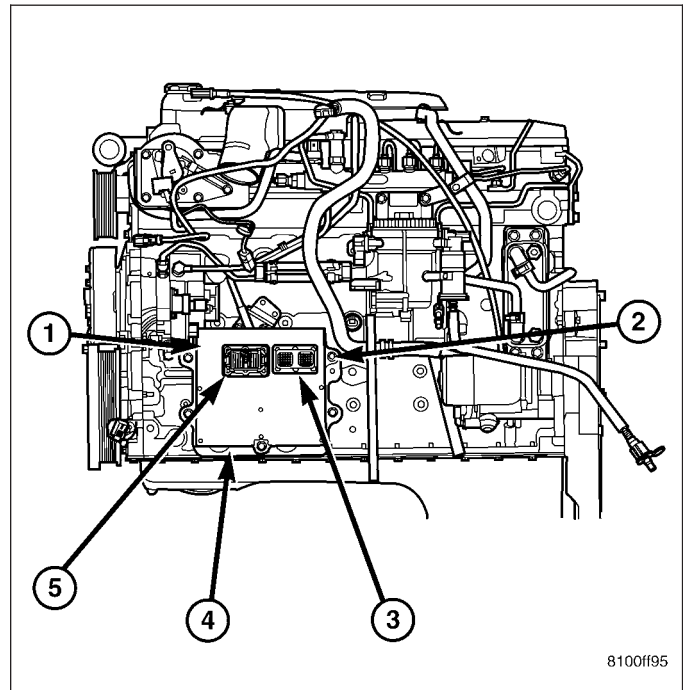
MODULE-TRANSMISSION CONTROL

DESCRIPTION

The Transmission Control Module (TCM) (2) may be sub-module within the Powertrain Control Module (PCM) (3).



Or, for vehicles with a diesel engine, the Engine Control Module (ECM) (1). The PCM, and TCM when equipped, is located at the right rear of the engine compartment, near the right inner fender.



OPERATION

The Transmission Control Module (TCM) controls all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hard wired to, and used specifically by the TCM. Indirect inputs are shared with the TCM via the vehicle communication bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition "ON" voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor

- Transmission Range Sensor
- Pressure Switches
- Transmission Temperature Sensor
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- Line Pressure Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids
- Torque Reduction Request

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to cluster/CCN)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indexes (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with scan tool)

NOTE: If the TCM has been replaced, the “Quick Learn Procedure” must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

BATTERY FEED

A fused, direct battery feed to the TCM is used for continuous power. This battery voltage is necessary to retain memory in the TCM. When the battery (B+) is disconnected, this memory is lost. When the battery (B+) is restored, this memory loss is detected by the TCM and a Diagnostic Trouble Code (DTC) is set.

CLUTCH VOLUME INDEXES (CVI)

An important function of the TCM is to monitor Clutch Volume Indexes (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

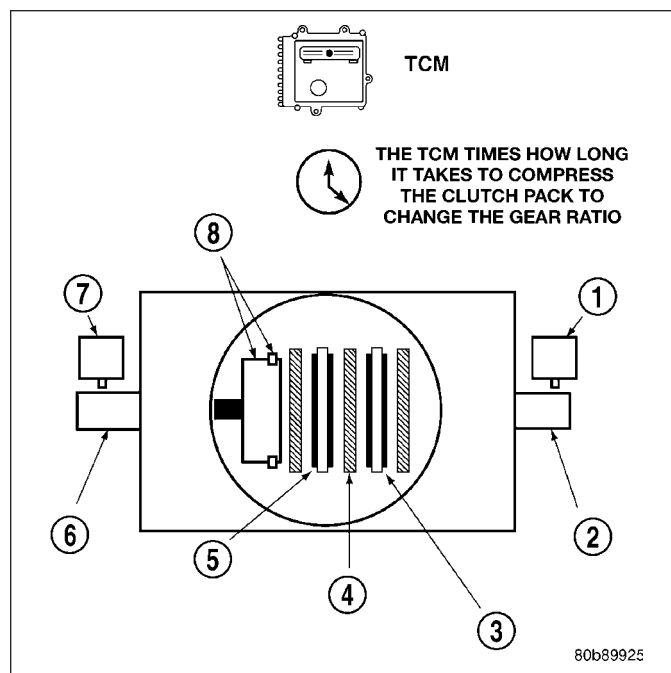
By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur.

Gear ratios can be determined by using the Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:



CLUTCH VOLUMES		
Clutch	When Updated	Proper Clutch Volume
L/R	2-1 or 3-1 downshift	45 to 134
2C	3-2 kickdown shift	25 to 85
OD	2-3 upshift	30 to 100
4C	3-4 upshift	30 to 85
UD	4-3 kickdown shift	30 to 100

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature below -16° F	-Park, Reverse, Neutral and 1st and 3rd gear only in D position, 2nd gear only in Manual 2 or L -No EMCC
Super Cold	Oil temperature between -12° F and 10° F	- Delayed 2-3 upshift - Delayed 3-4 upshift - Early 4-3 coastdown shift - High speed 4-2, 3-2, 2-1 kickdown shifts are prevented -Shifts at high throttle openings will be early. - No EMCC
Cold	Oil temperature between 10° F and 36° F	-Shift schedule is the same as Super Cold except that the 2-3 upshifts are not delayed.
Warm	Oil temperature between 40° F and 80° F	- Normal operation (upshift, kickdowns, and coastdowns) - No EMCC
Hot	Oil temperature between 80° F and 240° F	- Normal operation (upshift, kickdowns, and coastdowns) - Normal EMCC operation
Overheat	Oil temperature above 240° F or engine coolant temperature above 244° F	- Delayed 2-3 upshift - Delayed 3-4 upshift - 3rd gear FEMCC from 30-48 mph - 3rd gear PEMCC above 35 mph - Above 25 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made

DIAGNOSIS AND TESTING

PRE-DIAGNOSTIC CHECK OUT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING).

For a complete wiring diagram Refer to Section 8W.

Diagnostic Test

1. PRE-DIAGNOSTIC CHECK OUT

NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the service information.

NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.

With the scan tool, read the engine DTC's. Check and repair all Engine DTC's prior to performing Transmission symptom diagnostics.

With the scan tool, read Transmission DTC's. Record all DTC's and 1 Trip Failures.

NOTE: Diagnose 1 Trip Failures as a fully matured DTC.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary.

Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal.

For Gear Ratio DTC's, check and record all CVI's.

Most DTC's set on start up but some must be set by driving the vehicle to ensure that all diagnostic monitors have run.

NOTE: Verify flash level of Powertrain Controller. Some problems are corrected by software upgrades to the Transmission and Engine Systems.

NOTE: Due to the integration of the Powertrain and Transmission control modules - if a controller flash is performed it is necessary to perform Quick Learn and the Drive Learn procedures with the scan tool. Failure to do so may result in shift quality complaints.

NOTE: Check for applicable Service Bulletins that may apply.

Were any repairs made that fixed the customer's complaint?

Yes >> Testing complete.

No >> Refer to the diagnostic test procedure related to the DTC.

PRE-DIAGNOSTIC CHECKOUT (DIESEL)

For a complete wiring diagram **Refer to Section 8W**

1. PRE-DIAGNOSTIC CHECKOUT

NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.

NOTE: Low fluid level can be the cause of many transmission problems. If the fluid level is low locate and repair the leak then check and adjust the fluid level per the Service Information.

With the scan tool, read engine DTC's. Check and repair all engine DTCs prior to performing transmission symptom diagnostics.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary.

Verify the flash level of the Engine Control Module. Some problems are corrected by software upgrades.

Check for any Service Information Tune-ups or Technical Service Bulletins that may apply.

Did any of the above checks or procedures correct the symptom?

Yes >> Refer to the Transmission category and perform the appropriate symptom(s). (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 48RE - DIAGNOSIS AND TESTING)

No >> Repair is complete.
Perform RE TRANSMISSION VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - DIAGNOSIS AND TESTING)

TRANSMISSION VERIFICATION TEST VER - 1 (GAS)

1.

1. Inspect the vehicle to ensure that all engine and transmission components are properly installed and connected. Reassemble and reconnect components as necessary.
2. If any existing diagnostic trouble codes have not been repaired, go to Symptom List and follow path specified.
3. Connect a scan tool to the data link connector.
4. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.
5. Start and run the engine until the transmission temperature is above 43°C (110°F).
6. Check the transmission fluid level per the Service Information. Adjust if necessary.
7. Road test the vehicle. Make 15 to 20 1-2, 2-3 and 3-4 up shifts. Perform these shifts from a standing start to 72 km/h (45 MPH) with a constant throttle opening of 20-25%.
8. Below 40 km/h (25 MPH), make 5 to 8 wide open throttle kick downs to 1st gear. Allow at least 5 seconds each in 2nd and 3rd between each kick down.
9. For a specific DTC, drive the vehicle in accordance with the Symptom's When Monitored and Set Conditions to verify the repair.
10. If a DTC sets during the road test, return to the Symptom List and follow the path. If no DTC sets, the repair is complete.

Are there any DTCs or symptoms remaining?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

TRANSMISSION VERIFICATION TEST VER - 1 (DIESEL)

1.

1. Inspect the vehicle to ensure that all engine and transmission components are properly installed and connected. Reassemble and reconnect components as necessary.
2. If any existing diagnostic trouble codes have not been repaired, go to Symptom List and follow path specified.
3. Connect a scan tool to the data link connector.
4. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.
5. Start and run the engine until the transmission temperature is above 43°C (110°F).
6. Check the transmission fluid level per the Service Information. Adjust if necessary.
7. Road test the vehicle. Make 15 to 20 1-2, 2-3 and 3-4 up shifts. Perform these shifts from a standing start to 72 km/h (45 MPH) with a constant throttle opening of 20-25%.
8. Below 40 km/h (25 MPH), make 5 to 8 wide open throttle kick downs to 1st gear. Allow at least 5 seconds each in 2nd and 3rd between each kick down.
9. For a specific DTC, drive the vehicle in accordance with the Symptom's When Monitored and Set Conditions to verify the repair.
10. If a DTC sets during the road test, return to the Symptom List and follow the path. If no DTC sets, the repair is complete.

Are there any DTCs or symptoms remaining?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1

For the Transmission circuit diagram (Refer to)(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram Refer to Section 8W.

45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1

1. 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1

NOTE: 1. After completion of the Transmission Verification Test, the Powertrain Verification Test must be performed.

2. Connect the scan tool to the Data Link Connector (DLC).

3. Reconnect any disconnected components.

NOTE: 4. If the PCM has been replaced or if the transmission has been repaired or replaced it is necessary to perform the scan tool Quick Learn Procedure.

5. With the scan tool, erase all Transmission and Engine DTC's.

6. With the scan tool, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT, above 43° C or 110° F.

7. Check the Transmission fluid level and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure.

8. Road test the vehicle.

9. Perform the following shifts from a standing start with a constant throttle opening of 20 to 25 degrees to the speeds of 97 Km/h or 60 MPH; make fifteen to twenty 1 to 2, 2 to 3, 3 to 4 upshifts and for 545RFE, 4 to 4-prime.

10. Perform the following shifts with speeds below 40 Km/h or 25 MPH; make five to eight wide open throttle kick-downs to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown.

11. Check for DTC's during the road test.

NOTE: 12. Use the EATX OBDII task manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.

13. With the scan tool, perform a BATTERY DISCONNECT, this will clear the EATX DTC EVENT DATA

Were there any Diagnostic Trouble Codes (DTCs) set during the road test?

Yes >> Refer to the Symptom List for the appropriate diagnostic tests.

No >> Repair is complete.

STANDARD PROCEDURE

TCM QUICK LEARN

The quick learn procedure requires the use of the scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the proper transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay in PARK until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the scan tool indicates the procedure is complete.
- The calculated oil temperature must be above 60° and below 200°

DRIVE LEARN

When a transmission is repaired and a Quick Learn procedure has been performed on the Transmission Control Module (TCM), the following Drive Learn procedure can be performed to fine tune any shifts which are particularly objectionable.

NOTE: It is not necessary to perform the complete Drive Learn procedure every time the TCM is Quick Learned. Perform only the portions which target the objectionable shift.

LEARN A SMOOTH 1ST NEUTRAL TO DRIVE SHIFT

Perform this procedure only if the complaint is for a delayed or harsh shift the first time the transmission is put into gear after the vehicle is allowed to set with the engine not running for at least 10 minutes. Use the following steps to have the TCM learn the 1st N-D UD CVI.

NOTE: The transmission oil temperature must be between 80 - 110°F (27 - 43°C).

1. Start the engine only when the engine and ignition have been off for at least ten (10) minutes.
2. With the vehicle at a stop and the service brake applied, record the 1st N-D UD CVI while performing a Neutral to Drive shift. The 1st N-D UD CVI accounts for air entrapment in the UD clutch that may occur after the engine has been off for a period of time.
3. Repeat Step 1 and Step 2 until the recorded 1st N-D UD CVI value stabilizes.

NOTE: It is important that this procedure be performed when the transmission temperature is between 80 - 110°F (27 - 43°C). If this procedure takes too long to complete fully for the allowed transmission oil temperature, the vehicle may be returned to the customer with an explanation that the shift will improve daily during normal vehicle usage. The TCM also learns at higher oil temperatures, but these values (line pressure correction values) are not available for viewing on the scan tool.

LEARN A SMOOTH NEUTRAL TO DRIVE GARAGE SHIFT

Perform this procedure if the complaint is for a delayed or harsh shift when the transmission is put into gear after the vehicle has had its first shift. Use the following steps to have the TCM learn the Norm N-D UD CVI.

NOTE: The transmission oil temperature must be between 80 - 110°F (27 - 43°C) to learn the UD CVI. Additional learning occurs at temperatures as low as 0°F and as high as 200°F. This procedure may be performed at any temperature that experiences poor shift quality. Although the UD CVI may not change, shift quality should improve.

1. Start the vehicle engine and shift to drive.

2. Move the vehicle forward to a speed of at least 16 km/h (10 MPH) and come to a stop. This ensures no air is present in the UD hydraulic circuit.
3. Perform repeated N-D shifts at a stop while pausing in Neutral for at least 2-3 seconds and monitor Norm N-D UD CVI volume until the value stabilizes. The value will change during the N-D shift. This is normal since the UD value is different for the N-D shift than the normal value shown which is used for 4-3 coastdown and kickdowns. Perform repeated shifts in this temperature range until the Norm N-D UD CVI value stabilizes and the N-D shifts become smooth.

LEARN THE 1ST 2-3 SHIFT AFTER A RESTART OR SHIFT TO REVERSE

Use the following steps to have the TCM learn the 1st 2-3 shift OD CVI.

NOTE: The transmission oil temperature must be above 80°F (27°C).

1. With the vehicle engine running, select reverse gear for over 2 seconds.
2. Shift the transmission to Drive and accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform a 2-3 shift while noting the 1st 2-3 OD CVI.
3. Repeat Step 1 and Step 2 until the 1st 2-3 upshift becomes smooth and the 1st 2-3 OD CVI stabilizes.

LEARN A SMOOTH 2-3 AND 3-4 UPSHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the OD and 4C CVI's.

1. Accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform multiple 1-2, 2-3, and 3-4 upshifts. The 2nd 2-3 shift following a restart or shift to reverse will be shown during the shift as a value between the 1st 2-3 OD CVI and the normal OD CVI. Updates to the normal OD CVI will occur after the 2nd shift into 3rd gear, following a restart or shift to reverse.
2. Repeat Step 1 until the 2-3 and 3-4 shifts become smooth and the OD and 4C CVI become stable.

LEARN A SMOOTH 4-3 COASTDOWN AND PART THROTTLE 4-3 KICKDOWN

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the UD shift volume.

1. At a vehicle speed between 64-97 km/h (40-60 MPH), perform repeated 4-3 kickdown shifts.
2. Repeat Step 1 until the UD volume becomes somewhat stable and the shift becomes smooth.

LEARN A SMOOTH 1-2 UPSHIFT AND 3-2 KICKDOWN

Use the following steps to have the TCM learn the 2C shift volume.

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. With a vehicle speed below 48 km/h (30 MPH) and the transmission in 3rd gear, perform multiple 3-2 kickdowns.
2. Repeat Step 1 until the 3-2 kickdowns become smooth and the 2C CVI becomes stable.

LEARN A SMOOTH MANUAL 2-1 PULLDOWN SHIFT AS WELL AS A NEUTRAL TO REVERSE SHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the LR volume.

1. With the vehicle speed around 40-48 km/h (25-30 MPH) in Manual 2nd, perform manual pulldowns to Low or 1st gear at closed throttle.
2. Repeat Step 1 until the LR CVI becomes stable and the manual 2-1 becomes smooth.

LEARN A SMOOTH NEUTRAL TO REVERSE SHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

1. With the vehicle at a stop, perform Neutral to Reverse shifts until the shift is smooth. An unlearned Neutral to Reverse shift may be harsh or exhibit a double bump.
2. If any of the shifts are still not smooth after the clutch volume stabilizes, an internal transmission problem may be present.

LEARN A SMOOTH 4-5 UPSHIFT

NOTE: The transmission oil temperature must be above 110°F (43°C).

Use the following steps to have the TCM learn the Alt 2C CVI.

1. Accelerate the vehicle through 88 km/h (55mph) at a steady 10-15 degree throttle opening and perform multiple 4-5 upshifts.
2. Repeat Step 1 until the 4-5 shift become smooth and the Alt 2C CVI become stable. There is a separate 2C volume used and learned for 4-5 shifts, 2CA. It is independent of the 2C CVI learned on 3-2 kickdowns.

