Displays and Gauges

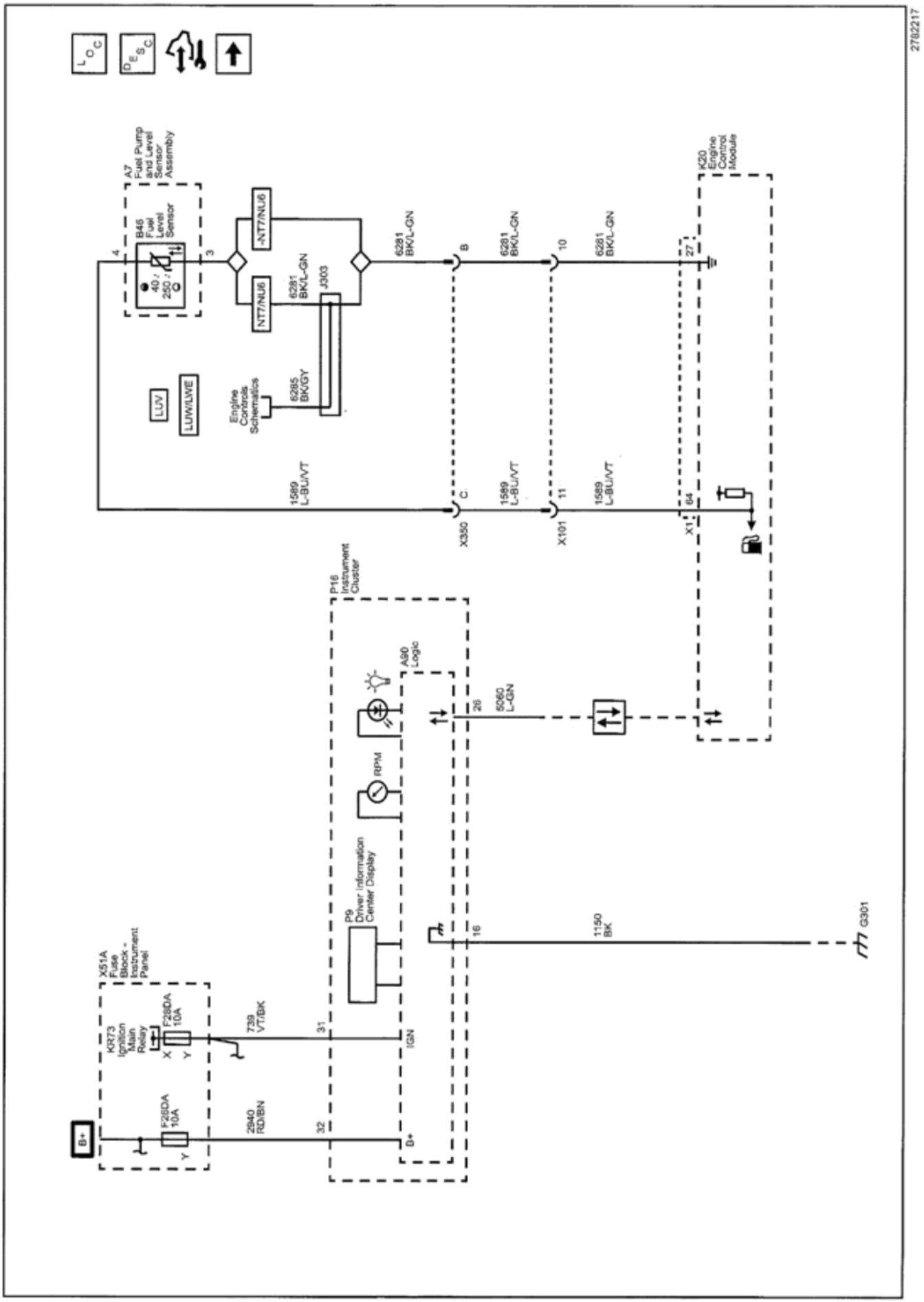
Specifications

Ambient Air Temperature Sensor Resistance

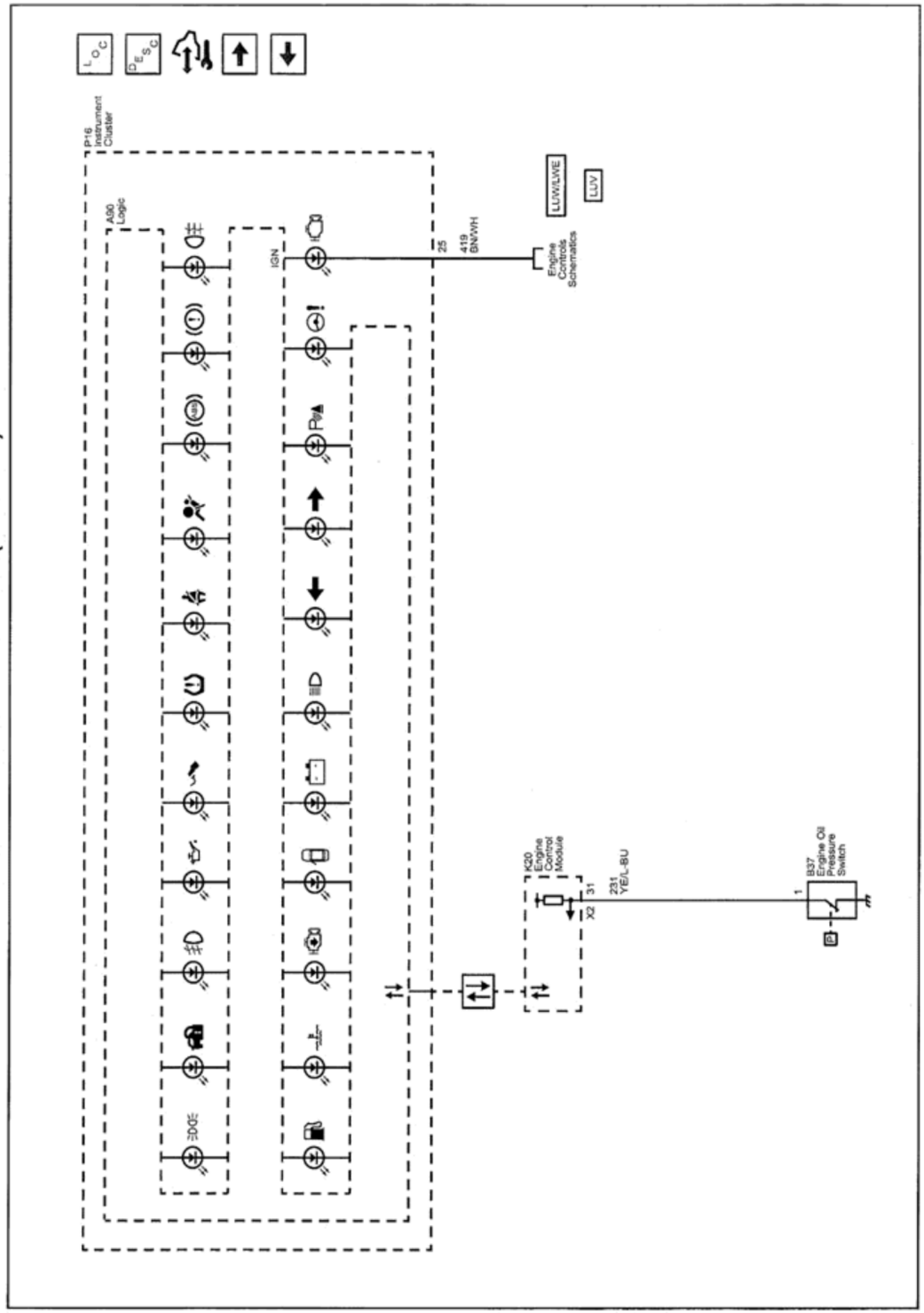
Temperature		Ambient Air Temp Sensor	Ambient Air Temp Sensor (Min)	Ambient Air Temp Sensor (Max)
°C	°F	(kΩ)	(kΩ)	(kΩ)
−40	−40	333.6	313.75	353.38
−30	−22	176.08	167.22	184.94
−20	−4	96.81	92.82	100.8
−10	14	55.25	53.38	57.13
0	32	32.64	31.74	33.54
10	50	19.9	19.6	20.2
20	68	12.49	12.35	12.64
30	86	8.06	7.96	10.1
40	104	5.32	5.25	8.15
50	122	3.6	3.54	5.4
60	140	2.49	2.44	2.54

Schematic and Routing Diagrams

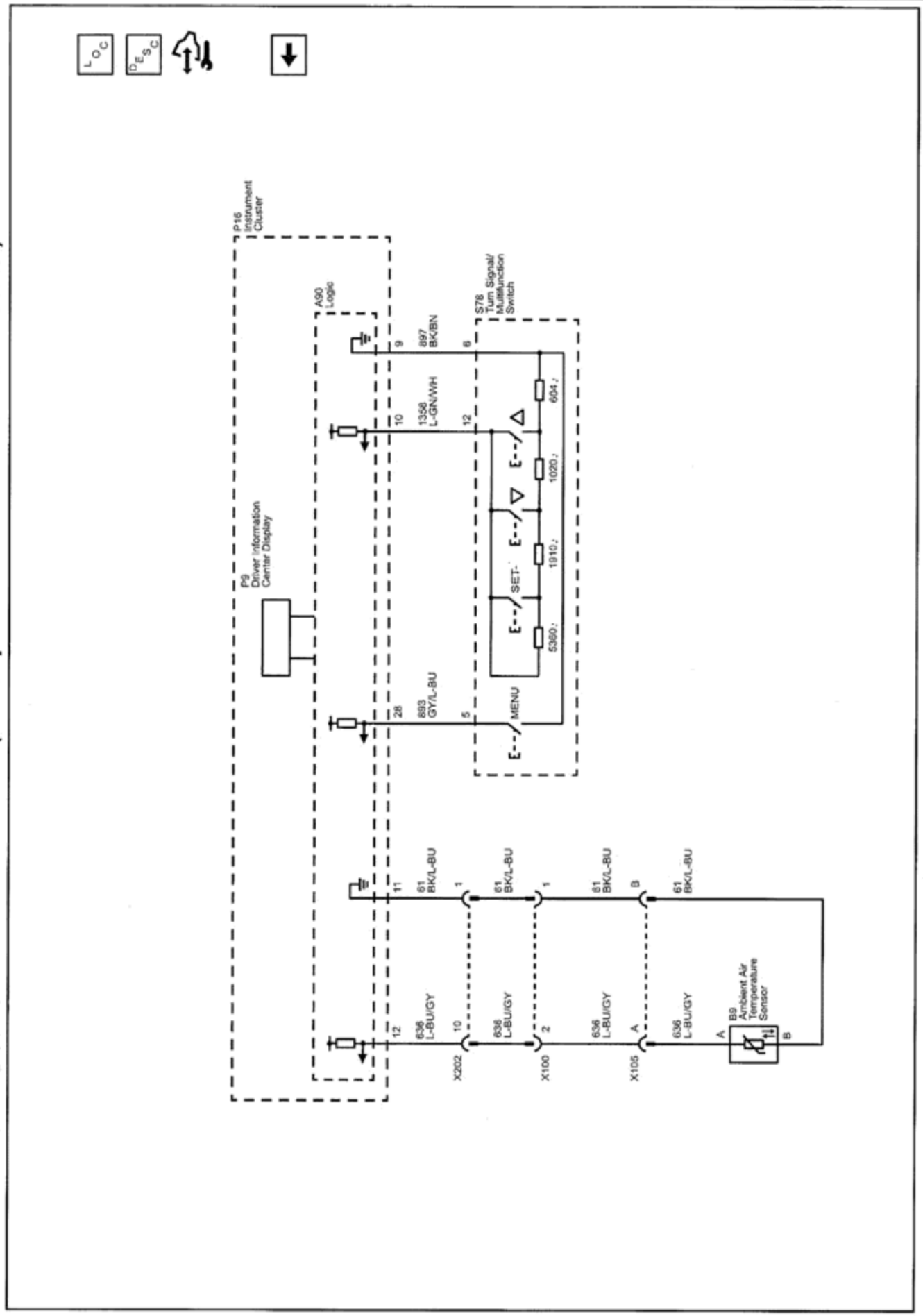
Instrument Cluster Schematics (Power, Ground, Serial Data, and Gauges)



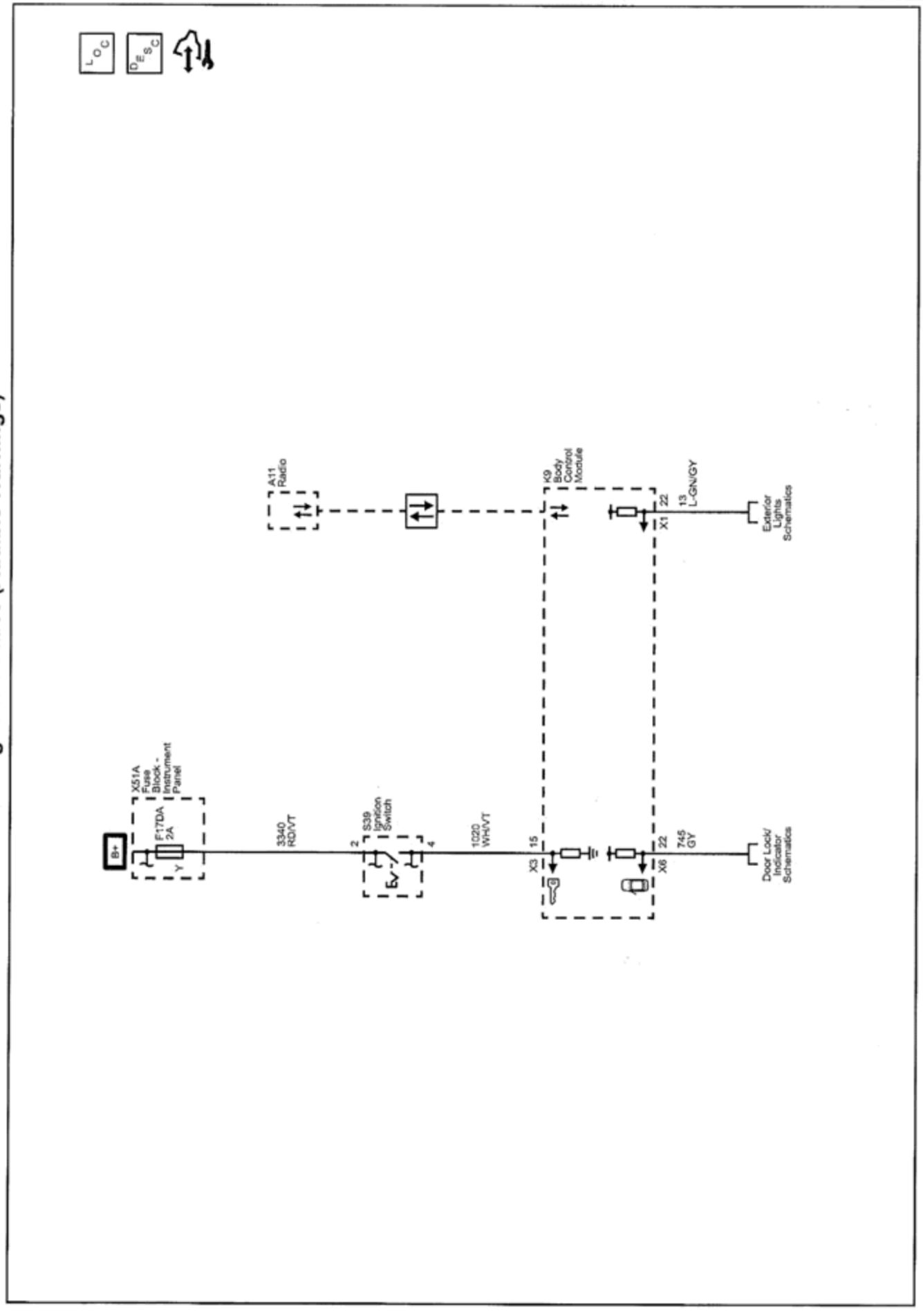
Instrument Cluster Schematics (Indicators)



Instrument Cluster Schematics (Air Temperature and Driver Information Center)



Audible Warnings Schematics (Audible Warnings)



Diagnostic Information and Procedures

DTC B0550

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

DTC Descriptor

DTC B0550 32: Odometer Circuit General Memory Malfunction

Circuit/System Description

The Instrument Cluster is equipped with odometers that indicate the distance traveled by the vehicle. One type of odometer is the season odometer where the traveled distance can not be reset by the driver. This information is also stored in the Body Control Module (BCM). In addition to storing the season odometer value for the vehicle, the Instrument Cluster and the BCM store the VIN. Software checks are performed to ensure these modules, and their stored season odometer information, can not be moved or transferred between different vehicles.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The BCM has detected an internal memory malfunction.

Action Taken When the DTC Sets

DTC B0550 32 is stored in the BCM memory.

Conditions for Clearing the DTC

The BCM no longer detects a malfunction.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Driver Information Center (DIC) Description and Operation on page 8-106

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B0550 32 is not set.

⇒ **If DTC B0550 32 is set**

2.1. Program the K9 Body Control Module.

2.2. Verify the DTC does not set.

⇒ If the DTC sets, replace the K9 Body Control Module.

⇓ If the DTC does not set

2.3. All OK.

⇓ **If DTC B0550 32 is not set**

3. All OK

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

Control Module References on page 6-3 for BCM replacement, programming and setup

DTC B1370

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

DTC Descriptors

DTC B1370 01: Control Module Ignition On and Start Circuit Short to Battery
DTC B1370 06: Control Module Ignition On and Start Circuit Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Instrument Cluster Ignition (Instrument Panel terminal 31)	B1370 06	B1370 06	B1370 01	—
Ignition Run/Crank Relay Ignition (Relay terminal 85)	B1370 06	B1370 06	—	—
Ignition Run/Crank Relay Ground (Relay terminal 86)	—	B1370 06	—	—
Ignition Run/Crank Relay B+ (Relay terminal 30)	—	B1370 06	—	—

Circuit/System Description

The vehicle power mode master is the body control module (BCM). The Ignition Switch is a low current switch with multiple discrete circuits to the BCM.

The power mode master will activate relays and other direct outputs of the power mode master as needed according to the calculated power mode. Some relays controlled by the BCM are switched ignition voltage outputs that are pass through circuits within the BCM directly from the Ignition Switch. If these circuits short to ground, the B+ circuit fuse to the Ignition Switch will open.

Conditions for Running the DTC

B1370 01

Ignition switch is in the Accessory position.

B1370 06

Ignition switch is in the Accessory, Run, or Crank positions.

Conditions for Setting the DTC

B1370 01

Ignition circuit is shorted to voltage.

B1370 06

- Ignition circuit is open.
- Ignition or run/crank relay circuit is shorted to ground.
- B+ circuit of the ignition run/crank relay is open or shorted to ground.
- Ignition run/crank relay control circuit open, including relay coil and ground.

Action Taken When the DTC Sets

The Instrument Cluster still functions except check engine light is always off.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 50 consecutive malfunction-free ignition cycles have occurred.

Reference Information

Schematic Reference

- *Instrument Cluster Schematics on page 8-78*
- *Power Distribution Schematics on page 11-128*
- *Power Moding Schematics on page 11-149*

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

- *Instrument Cluster Description and Operation on page 8-108*
- *Power Mode Description and Operation on page 11-614*

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Verify that DTC B144B is not set.

⇒ **If DTC B144B is set**

Refer to *Diagnostic Trouble Code (DTC) List - Vehicle on page 6-69*.

⇓ **If DTC B144B is not set**

2. Refer to Circuit/System Testing.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the KR74 Ignition Run Relay. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 86 and ground.

⇒ **If 10 Ω or greater**

2.1. Test for less than 2 Ω in the ground circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, repair the open/high resistance in the ground connection.

⇓ **If less than 10 Ω**

3. Verify a test lamp illuminates between the B+ circuit terminal 30 and ground.

⇒ **If the test lamp does not illuminate and the circuit fuse is OK**

3.1. Test for less than 2 Ω in the B+ circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse.

⇒ **If the test lamp does not illuminate and the circuit fuse is open**

3.1. Test for infinite resistance between the B+ circuit and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇓ If infinite resistance

3.2. Test for infinite resistance between the control circuit terminal 87 and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇒ If infinite resistance, replace the KR74 Ignition Run Relay.

⇓ **If the test lamp illuminates**

4. Ignition ON.
5. Verify that a test lamp illuminates between the ignition circuit terminal 85 and ground.

⇒ **If the test lamp does not illuminate**

5.1. Ignition OFF.

5.2. Test the for less than 2 Ω in the ignition circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the K9 Body Control Module.

⇓ **If the test lamp illuminates**

6. Ignition OFF, connect the KR74 Ignition Run Relay, disconnect the harness connector at the P16 Instrument Cluster.
7. Verify that a test lamp does not illuminate between the ignition circuit terminal 31 and ground.

⇒ **If the test lamp illuminates**

7.1. Disconnect the KR74 Ignition Run Relay

7.2. Test for less than 1 V between the ignition circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇒ If less than 1 V, replace the KR74 Ignition Run Relay.

⇓ **If the test lamp does not illuminate**

8. Ignition ON.
9. Verify that a test lamp illuminates between the ignition terminal 31 and ground.

⇒ **If the test lamp does not illuminate and the Ignition fuse is good**

9.1. Ignition OFF, disconnect the KR74 Ignition Run Relay.

9.2. Test for less than 2 Ω in the ignition circuit end to end

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the KR74 Ignition Run Relay.

⇒ **If the test lamp does not illuminate and the Ignition fuse is open**

9.1. Ignition OFF, disconnect the KR74 Ignition Run Relay.

9.2. Test for infinite resistance between the ignition circuit and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇒ If infinite resistance, replace the P16 Instrument Cluster.

⇓ **If the test lamp illuminates**

10. Replace the P16 Instrument Cluster.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

- *Relay Replacement (Within an Electrical Center) on page 11-607* or *Relay Replacement (Attached to Wire Harness) on page 11-607*
- *Control Module References on page 6-3* for Body Control Module or Instrument Cluster replacement, programming and setup

DTC P0520

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

DTC Descriptor

DTC P0520: Engine Oil Pressure Switch Circuit Malfunction

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	1	P0520	1	—
1. Engine Oil Pressure Indicator Malfunction				

Typical Scan Tool Data

ECM – Engine Oil Pressure Switch

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running **Parameter Normal Range:** OK			
Signal	Low	OK	OK

Circuit/System Description

The Engine Oil Pressure Switch is a normally closed switch that opens with the proper oil pressure. With the ignition switch turned ON and the engine not running, the Engine Control Module (ECM) should detect a low signal voltage input. With the engine running, the Engine Oil Pressure Switch opens and the ECM should detect a high signal voltage input. When the oil pressure is low, the ECM sends a message via serial data to the Body Control Module (BCM). The BCM then sends a message via serial data to the Instrument Cluster requesting the engine oil pressure indicator turned ON.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The ECM detects that the engine oil pressure switch signal circuit is pulled low.
- The above condition is present for greater than 10 seconds.

Action Taken When the DTC Sets

The Instrument Cluster illuminates the service vehicle soon indicator and the oil pressure low indicator.

Conditions for Clearing the DTC

The DTC becomes history when the conditions for setting the DTC are no longer present.

Diagnostic Aids

Low engine oil pressure will also cause this DTC to set. If low engine oil pressure is suspected, refer to *Oil Pressure Diagnosis and Testing on page 9-771* for the 1.2L or 1.4L engine or *Oil Pressure Diagnosis and Testing on page 9-954* for the 1.6L or 1.8L engine.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

- *Instrument Cluster Description and Operation on page 8-108*
- *Indicator/Warning Message Description and Operation on page 8-108*
- *Driver Information Center (DIC) Description and Operation on page 8-106*

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions on page 6-68

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Engine Oil Pressure parameter is Low.

⇒ **If not Low**

Refer to Circuit/System Testing.

⇓ **If Low**

3. Engine running.
4. Verify the scan tool Engine Oil Pressure parameter is OK.

⇒ **If not OK**

Refer to Circuit/System Testing.

⇓ **If OK**

5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch, ignition ON.
2. Verify the scan tool Engine Oil Pressure Switch parameter is OK.

⇒ **If not OK**

2.1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.

2.2. Test for infinite resistance between the signal circuit terminal 1 and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇒ If infinite resistance, replace the K20 Engine Control Module.

⇓ **If OK**

3. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.

⇒ **If not Low**

4.1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.

4.2. Test for less than 1 V between the signal circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇓ If less than 1 V

4.3. Test for less than 2 Ω in the signal circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the K20 Engine Control Module.

⇓ **If Low**

5. Test or replace the B37 Engine Oil Pressure Switch.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

- *Engine Oil Pressure Indicator Switch Replacement on page 9-251* for 1.2L or 1.4L
- *Engine Oil Pressure Indicator Switch Replacement on page 9-540* for 1.6L or 1.8L
- *Control Module References on page 6-3* for ECM replacement, programming and setup

DTC P0521

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

DTC Descriptor

DTC P0521: Engine Oil Pressure Sensor Performance Malfunction

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	1	P0521	1	P0521
1. Engine Oil Pressure Indicator Malfunction				

Typical Scan Tool Data

ECM – Engine Oil Pressure Switch

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running **Parameter Normal Range:** OK			
Signal	Low	OK	OK

Circuit/System Description

The engine oil pressure switch is a normally closed switch that opens with the proper oil pressure. With the ignition switch turned ON and the engine not running, the engine control module (ECM) should detect a low signal voltage input. With the engine running, the engine oil pressure switch opens and the ECM should detect a high signal voltage input. When the oil pressure is low, the ECM sends a message via serial data to the body control module (BCM). The BCM then sends a message via serial data to the instrument cluster requesting the engine oil pressure indicator turned ON.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The ECM detects that the engine oil pressure switch signal circuit is pulled low.
- The above condition is present for greater than 10 seconds.

Action Taken When the DTC Sets

The instrument cluster illuminates the service vehicle soon indicator and the oil pressure low indicator.

Conditions for Clearing the DTC

The DTC becomes history when the conditions for setting the DTC are no longer present.

Diagnostic Aids

Low engine oil pressure will also cause this DTC to set. If low engine oil pressure is suspected, refer to *Oil Pressure Diagnosis and Testing on page 9-771* for the 1.2L or 1.4L engine or *Oil Pressure Diagnosis and Testing on page 9-954* for the 1.6L or 1.8L engine.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

- *Instrument Cluster Description and Operation on page 8-108*
- *Indicator/Warning Message Description and Operation on page 8-108*
- *Driver Information Center (DIC) Description and Operation on page 8-106*

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions on page 6-68

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Engine Oil Pressure parameter is Low.

⇒ **If not Low**

Refer to Circuit/System Testing.

⇓ **If Low**

3. Engine running.
4. Verify the scan tool Engine Oil Pressure parameter is OK.

⇒ **If not OK**

Refer to Circuit/System Testing.

⇓ **If OK**

5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B37 engine oil pressure switch, ignition ON.
2. Verify the scan tool Engine Oil Pressure Switch parameter is OK.

⇒ **If not OK**

2.1. Ignition OFF, disconnect the harness connector at the K20 engine control module.

2.2. Test for infinite resistance between the signal circuit terminal 1 and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇒ If infinite resistance, replace the K20 engine control module.

⇓ **If OK**

3. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.

⇒ **If not Low**

4.1. Ignition OFF, disconnect the harness connector at the K20 engine control module, ignition ON.

4.2. Test for less than 1 V between the signal circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇓ If less than 1 V

4.3. Test for less than 2 Ω in the signal circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the K20 engine control module.

⇓ **If Low**

5. Test or replace the B37 engine oil pressure switch.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

- *Engine Oil Pressure Indicator Switch Replacement on page 9-251* for 1.2L or 1.4L
- *Engine Oil Pressure Indicator Switch Replacement on page 9-540* for 1.6L or 1.8L
- *Control Module References on page 6-3* for ECM replacement, programming and setup

Symptoms - Displays and Gauges

Note: The following steps must be completed before using the symptom diagnostic tables.

1. Before using the symptom diagnostic tables, perform the *Diagnostic System Check - Vehicle on page 6-66*
2. Review the system operation in order to understand the system functions. Refer to the following description and operations:
   - *Instrument Cluster Description and Operation on page 8-108*
   - *Indicator/Warning Message Description and Operation on page 8-108*
   - *Driver Information Center (DIC) Description and Operation on page 8-106*
   - *Audible Warnings Description and Operation on page 8-105*

Visual/Physical Inspection

- Inspect for aftermarket devices which can affect the operation of the instrument panel cluster or the audible warning systems. Refer to *Checking Aftermarket Accessories on page 11-525*
- Inspect the accessible system components or the visible system components for obvious damage or for obvious conditions which can cause the symptom.
- Inspect for the proper fluid levels.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to *Testing for Intermittent Conditions and Poor Connections on page 11-531*

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

Gauges and Odometer

- *Fuel Gauge Malfunction - DTC P0461-P0464 on page 8-96*
- *Odometer Trip/Reset Switch Malfunction on page 8-98*

- *Speedometer and/or Odometer Malfunction on page 8-101*
- *Tachometer Inaccurate or Inoperative on page 8-102*

Indicators

- *ABS Indicator Malfunction on page 5-36*
- *Air Bag Indicator Circuit Malfunction (Driver) on page 13-109* or *Air Bag Indicator Circuit Malfunction (Passenger) on page 13-110*
- *Brake Warning Indicator Malfunction on page 5-114*
- *Charge Indicator Malfunction on page 8-90*
- *Door Ajar Indicator Malfunction on page 4-268*
- *Engine Oil Pressure Indicator Malfunction on page 8-95*
- *Headlamps Malfunction on page 4-163*
- *Interior Backlighting Malfunction on page 4-169*
- *Malfunction Indicator Lamp (MIL) Diagnosis on page 9-227* 1.2L or 1.4L engine
- *Malfunction Indicator Lamp (MIL) Diagnosis on page 9-515* for 1.6L or 1.8L engine
- *Seat Belt Indicator Malfunction - Driver on page 13-53*
- *Turn Signal Lamps and/or Indicators Malfunction on page 4-181*
- *Washer Malfunction (without C25) on page 4-353* or *Washer Malfunction (with C25) on page 4-356*

Driver Information Center

- *Driver Information Center Display Malfunction on page 8-92*
- *Driver Information Center Switch Malfunction - DTC B3567 on page 8-93*
- *Outside Air Temperature Display Malfunction - DTC B0158 on page 8-99*

Audible Warnings

Chime Malfunction on page 8-91

Charge Indicator Malfunction

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

Circuit/System Description

The engine Control Module (ECM) uses the generator turn ON signal circuit to control the load of the generator on the engine. A high side driver in the ECM applies voltage to the voltage regulator. This signals the voltage regulator to turn the field circuit ON and OFF. The ECM monitors the state of the generator turn ON signal circuit. The ECM should detect low voltage on the generator turn on signal circuit when the ignition is ON and the engine is OFF, or when the charging system malfunctions. With the engine running, the ECM should detect high voltage on the generator turn on signal circuit. The ECM performs key ON and RUN tests to determine the status of the generator turn on signal circuit. If a malfunction is detected the ECM will illuminate the charge indicator in the instrument cluster.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Indicator/Warning Message Description and Operation on page 8-108

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON, engine running.
2. Verify the scan tool Battery Voltage parameter is between 12.5–15.5 V.

⇒ **If not 12.5–15.5 V**

Refer to *Charging System Test on page 9-707*.

⇓ **If 12.5–15.5 V**

3. Verify the charge indicator turns on and off when commanding the All Indicators test ON and OFF with the scan tool.

⇒ **If the charge indicator always stays on or always stays off**

Replace the P16 Instrument Cluster.

⇓ **If the charge indicator turns on and off as commanded**

4. All OK.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

Control Module References on page 6-3 for Instrument Cluster replacement, programming, and setup

Chime Malfunction

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

Circuit/System Description

The radio generates the audible warnings. The instrument cluster, the body control module (BCM), the inflatable restraint sensing and diagnostic module (SDM) or the object alarm module request audible warnings via serial data.

Reference Information

Schematic Reference

Audible Warnings Schematics on page 8-81

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Audible Warnings Description and Operation on page 8-105

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

Note: Before performing this diagnostics, make sure no indicators are illuminated after the instrument cluster performs a lamp test. If any indicators are illuminated after the bulb test, perform the indicator diagnostics before this diagnostics.

1. Ignition ON.
2. Verify all the radio speakers operate by adjust the radio balance and fade to each speaker.

⇒ **If any speaker does not operate properly**

Refer to *Speaker Malfunction on page 8-49*.

⇓ **If the speakers operate properly**

3. Verify the scan tool Driver Seat Belt Status and Passenger Seat Belt Status parameters are Buckled when both front seat belts are buckled.

⇒ **If not Buckled**

Refer to *Seat Belt Indicator Malfunction - Driver on page 13-53*.

⇓ **If buckled**

4. Verify the scan tool Headlamp On Switch parameter is Inactive when the headlamps are OFF.

⇒ **If not Inactive**

Refer to *Headlamps Malfunction on page 4-163*.

⇓ **If Inactive**

5. Verify the scan tool Park Lamps Switch parameter is Inactive when the park lamp switch is OFF.

⇒ **If not Inactive**

Refer to *Park, License, and/or Tail Lamps Malfunction on page 4-174*.

⇓ **If Inactive**

6. Verify the scan tool Left Turn Signal Switch and Right Turn Signal Switch parameters are Inactive while the turn signal switch is OFF.

⇒ **If not Inactive**

Refer to *Turn Signal Lamps and/or Indicators Malfunction on page 4-181*.

⇓ **If Inactive**

7. Verify the scan tool Park Brake Switch parameter is Inactive when the park brake is OFF.

⇒ **If not Inactive**

Refer to *Park Brake System Diagnosis (Drum Brake) on page 5-183* or *Park Brake System Diagnosis (Disc Brake) on page 5-185*.

⇓ **If Inactive**

8. Verify that all scan tool parameters listed below are Inactive when all the doors are closed.
   - Driver Door Ajar Switch
   - Passenger Door Ajar Switch
   - Left Rear Door Ajar Switch
   - Right Rear Door Ajar Switch

⇒ **If not Inactive**

Refer to *Door Ajar Indicator Malfunction on page 4-268*.

⇓ **If Inactive**

9. Verify the scan tool Key in Ignition Status parameter is Inactive when the key is out of the ignition.

⇒ **If not Inactive**

Refer to Circuit/System Testing.

⇓ **If Active**

10. All OK

Circuit/System Testing

1. Ignition ON, disconnect the harness connector at the S39 Ignition Switch while the ignition is ON.
2. Verify a test lamp illuminates between the B+ circuit terminal 2 and ground.

⇒ **If the test lamp does not illuminate and the circuit fuse is good**

Test for less than 2 Ω in the B+ circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, verify the fuse is not open and there is voltage at the fuse.

⇒ **If the test lamp does not illuminate and the circuit fuse is open**

2.1. Test for infinite resistance between the B+ circuit and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇓ If infinite resistance

2.2. Test for infinite resistance between the signal circuit and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇒ If infinite resistance, replace the K9 Body Control Module.

⇓ **If the test lamp illuminates**

3. Verify the scan tool Key in Ignition Status parameter is Inactive.

⇒ **If not Inactive**

3.1. Disconnect the X3 harness connector at the K9 Body Control Module.

3.2. Test for less than 1 V between the signal circuit terminal 4 and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇒ If less than 1 V, replace the K9 Body Control Module.

⇓ **If Inactive**

4. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the B+ circuit terminal 2.
5. Verify the scan tool Key in Ignition Status parameter is Active.

⇒ **If not Active**

5.1. Ignition OFF, disconnect the X3 harness connector at the K9 Body Control Module.

5.2. Test for less than 2 Ω in the signal circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the K9 Body Control Module.

⇓ **If Active**

6. Test or replace the S39 Ignition Switch.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

Control Module References on page 6-3 for BCM or Radio replacement, programming and setup

Driver Information Center Display Malfunction

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

Circuit/System Description

The Instrument Cluster contains a Driver Information Center which displays vehicle information such as the engine coolant temperature, fuel level, vehicle speed, and other information based on the information received from various modules on the vehicle's serial data bus. The Driver Information Center illuminates a combination of indicators and messages to display the status of various vehicle systems.

The engine malfunction indicator lamp is provided ignition voltage to one side by the Instrument Cluster. To illuminate the engine malfunction indicator lamp, the Engine Control Module provides ground directly to the other side of the lamp.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Instrument Cluster Description and Operation on page 8-108

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify no DTC is set.

⇒ **If any DTC is set,**

Diagnose any DTCs first. Refer to *Diagnostic Trouble Code (DTC) List - Vehicle on page 6-69*.

⇓ **If no DTCs are set**

3. Verify all indicators except the engine malfunction indicator illuminate and turn off as commanded when performing the All Indicators test with the scan tool.

⇒ **If any indicators do not illuminate and turn off as commanded**

Replace the P16 Instrument Cluster.

⇓ **If all indicators respond properly**

4. Verify all segments illuminate when performing the Driver Information Center Segments test with the scan tool.

⇒ **If any segments do not illuminate**

Replace the P16 Instrument Cluster.

⇓ **If all segments illuminate properly**

5. All OK.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

Control Module References on page 6-3 for instrument cluster or ECM replacement, programming, and setup.

Driver Information Center Switch Malfunction - DTC B3567

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

DTC Descriptors

DTC B3567 01: Info Display Select Switch Circuit Short to Battery
DTC B3567 02: Info Display Select Switch Circuit Short to Ground
DTC B3567 04: Info Display Select Switch Circuit Open
DTC B3567 59: Info Display Select Switch Circuit Protection Time-Out

Circuit/System Description

The driver information center switch is a multiplexed switch which is integrated in the Turn Signal/ Multifunction Switch. Battery power is provided to the driver information center switch via the instrument cluster. The driver information center switch signal circuit is pulled up to battery voltage in the instrument cluster. The instrument cluster also provides the driver information center switch with a low reference. The switch input to the instrument cluster is pulled low when a switch is activated. The driver information center switch is a momentary contact switch that connects a series of resistors in a resistor ladder format. The instrument cluster monitors the driver information center switch signal circuit to determine the driver information center switch inputs. Each switch state Menu, Up, Down, Clear corresponds to a certain resistance value. The instrument cluster determines the switch pressed by the voltage drop across the resistors.

Conditions for Running the DTC

- The ignition is in OFF, ACCESSORY or RUN position.
- The system voltage is between 9–16 V.

Conditions for Setting the DTC

B3567 01

The instrument cluster detects that the driver information center switch signal circuit is shorted to battery.

B3567 02

The instrument cluster detects that the driver information center switch signal circuit is shorted to ground.

B3567 04

The instrument cluster detects that the driver information center switch signal circuit is open.

B3567 59

The instrument cluster detects that the driver information center switch is stuck.

Action Taken When the DTC Sets

The instrument cluster ignores the driver information center switch inputs.

Conditions for Clearing the DTC

The DTC will become history if the instrument cluster no longer detects a malfunction.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Driver Information Center (DIC) Description and Operation on page 8-106

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the driver information center set, up and down function changes when pressing the set, up or down switch.

⇒ **If the driver information center does not change**

Refer to Set, Up and Down Switch Malfunction

⇓ **If the driver information center changes**

3. Verify the driver information center menu function changes when pressing the menu switch.

⇒ **If the driver information center does not change**

Refer to Menu Switch Malfunction

⇓ **If the driver information center changes**

4. All OK.

Circuit/System Testing

Set, Up and Down Switch Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the S78 Turn Signal/ Multifunction Switch, ignition ON.
2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.

⇒ **If 10 Ω or greater**

2.1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster.

2.2. Test for less than 2 Ω in the low reference circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the P16 instrument cluster.

⇓ **If less than 10 Ω**

3. Test for 11.8–12.2 V between the signal circuit terminal 12 and ground.

⇒ **If less than 11.8 V**

3.1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster.

3.2. Test for infinite resistance between the signal circuit and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇓ If infinite resistance

3.3. Test for less than 2 Ω in the signal circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the P16 instrument cluster.

⇒ **If greater than 12.2 V**

3.1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster, ignition ON.

3.2. Test for less than 1 V between the signal circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇒ If less than 1 V, replace the P16 instrument cluster.

⇓ **If between 11.8–12.2 V**

4. Test or replace the S78 Turn Signal/ Multifunction Switch.

Menu Switch Malfunction

1. Ignition ON.
2. Test for 4.8–5.2 V between the signal circuit terminal 5 and ground.

⇒ **If less than 4.8 V**

2.1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster.

2.2. Test for infinite resistance between the signal circuit and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇓ If infinite resistance

2.3. Test for less than 2 Ω in the signal circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the P16 instrument cluster.

⇒ **If greater than 5.2 V**

2.1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster, ignition ON.

2.2. Test for less than 1 V between the signal circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇒ If less than 1 V, replace the P16 instrument cluster.

⇓ **If between 4.8–5.2 V**

3. Test or replace the S78 Turn Signal/ Multifunction Switch.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

- *Turn Signal Multifunction Switch Replacement on page 15-31*
- *Control Module References on page 6-3* for instrument cluster replacement, programming and setup

Engine Oil Pressure Indicator Malfunction

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	1	P0520, P0521	1	P0521
1. Engine Oil Pressure Indicator Malfunction				

Circuit/System Description

The engine oil pressure switch is a normally closed switch that opens with the proper oil pressure. With the ignition switch turned ON and the engine not running, the engine control module (ECM) should detect a low signal voltage input. With the engine running, the engine oil pressure switch opens and the ECM should detect a high signal voltage input. When the oil pressure is low, the ECM sends a message via serial data to the body control module (BCM). The BCM then sends a message via serial data to the instrument cluster requesting the engine oil pressure indicator turned ON.

Diagnostic Aids

Low engine oil pressure will also cause the engine oil pressure indicator to remain ON when the engine is running. If low engine oil pressure is suspected, refer to *Oil Pressure Diagnosis and Testing on page 9-771* for the 1.2L or 1.4L engine or *Oil Pressure Diagnosis and Testing on page 9-954* for the 1.6L or 1.8L engine.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Indicator/Warning Message Description and Operation on page 8-108

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the engine oil pressure indicator turns on & off when commanding the All Indicators ON and OFF with a scan tool.

⇒ **If the engine oil pressure Indicator does not turn on and off.**

Replace the P16 instrument cluster.

⇓ **If the engine oil pressure Indicator turns on and off**

3. Verify the scan tool Engine Oil Pressure Switch parameter is Low.

⇒ **If not Low**

Refer to Circuit/System Testing.

⇓ **If Low**

4. Engine running.

5. Verify the scan tool Engine Oil Pressure Switch parameter is OK.

⇒ **If not OK**

Refer to Circuit/System Testing.

⇓ **If OK**

6. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B37 engine oil pressure switch, ignition ON.
2. Verify the scan tool Engine Oil Pressure Switch parameter is OK.

⇒ **If not OK**

2.1. Ignition OFF, disconnect the harness connector at the K20 engine control module.

2.2. Test for infinite resistance between the signal circuit terminal 1 and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇒ If infinite resistance, replace the K20 engine control module.

⇓ **If OK**

3. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.

⇒ **If not Low**

4.1. Ignition OFF, disconnect the harness connector at the K20 engine control module, ignition ON.

4.2. Test for less than 1 V between the signal circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇓ If less than 1 V

4.3. Test for less than 2 Ω in the signal circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the K20 engine control module.

⇓ **If Low**

5. Test or replace the B37 engine oil pressure switch.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

- *Engine Oil Pressure Indicator Switch Replacement on page 9-251* for 1.2L or 1.4L
- *Engine Oil Pressure Indicator Switch Replacement on page 9-540* for 1.6L or 1.8L
- *Control Module References on page 6-3* for ECM replacement, programming and setup

Fuel Gauge Malfunction - DTC P0461-P0464

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

DTC Descriptors

DTC P0461: Fuel Level Sensor Performance
DTC P0462: Fuel Level Sensor Circuit Low Voltage
DTC P0463: Fuel Level Sensor Circuit High Voltage
DTC P0464: Fuel Level Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuel Level Sensor 1 Signal	P0462	P0463	P0463	P0461
Low Reference	—	1	P0463, P0464	P0461
1. Fuel Gauge Malfunction				

Circuit/System Description

The fuel level sensor changes resistance based on fuel level. The engine control module (ECM) monitors the signal circuit of the fuel level sensor in order to determine the fuel level. When the fuel tank is full, the resistances of the fuel level sensor is low and the ECM senses a low signal voltage on the signal circuit of the fuel level sensor. When the fuel tank is empty, the resistance of the fuel level sensor is high and the ECM senses a high signal voltage. The ECM uses the signal circuit of the fuel level sensor in order to calculate the percentage of remaining fuel in the tank. The ECM sends the fuel level percentage via serial data to the body control module (BCM). The BCM then sends the fuel level percentage via serial data to the instrument cluster in order to control the fuel gauge.

Conditions for Running the DTC

- The engine is running
- The system voltage is between 11–16 V

Conditions for Setting the DTC

P0461 00

The ECM detects a change in fuel level of less than a specified amount (typically 3–10 L or 0.8–2.6 gal) over a specified driving distance (typically 240–320 km or 150–200 miles).

P0462

- The signal voltage is less than 0.25 V.
- The above conditions must be met for 5 seconds.

P0463

- The signal voltage is greater than 4.7 V.
- The above conditions must be met for 5 seconds.

P0464

- The fuel level change is greater than 10%.
- The above conditions must be met for 30 seconds.
- DTC P0464 runs and fails 2 out of 3 test cycles.

Action Taken When the DTC Sets

- P0461, P0462, P0463, and P0464 are Type B DTCs
- The fuel gauge defaults to empty
- The low fuel indicator illuminates

Conditions for Clearing the DTC

- P0461, P0462, P0463, and P0464 are Type B DTCs
- The DTC becomes history when the conditions for setting the DTC are no longer present.
- The history DTC clears after 40 malfunction-free warm-up cycles.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Instrument Cluster Description and Operation on page 8-108

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions on page 6-68

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Fuel Remaining in Tank parameter is between 5–95% and varies with fuel level.

⇒ **If not between 5–95% or does not vary with fuel level**

Refer to Circuit/System Testing

⇓ **If between 5–95% and varies with fuel level**

3. Verify that all fuel level gauge segments illuminate when performing the scan tool Driver Information Center Segments control function.

⇒ **If any fuel level gauge segments do not illuminate**

Replace the P16 Instrument Cluster

⇓ **If all fuel level gauge segments illuminate**

4. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the A7 Fuel Pump and Level Sensor Assembly. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 3 and ground.

⇒ **If 10 Ω or greater**

2.1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.

2.2. Test for less than 2 Ω in the low reference circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the K20 Engine Control Module.

⇓ **If less than 10 Ω**

3. Ignition ON.

4. Test for less than 1 V between the low reference circuit and ground.

⇒ **If 1 V or greater**

Repair the short to voltage on the circuit.

⇓ **If less than 1 V**

5. Verify the scan tool Remaining Fuel In Tank parameter is greater than 95%.

⇒ **If 95% or less**

5.1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.

5.2. Test for less than 1 V between the signal circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇒ If less than 1 V, replace the K20 Engine Control Module.

⇓ **If greater than 95%**

6. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
7. Test for infinite resistance between the signal circuit terminal 4 and ground.

⇒ **If less than infinite resistance**

Repair the short to ground on the circuit.

⇓ **If infinite resistance**

8. Ignition OFF
9. Test for less than 2 Ω in the signal circuit end to end.

⇒ **If 2 Ω or greater**

Repair the open/high resistance in the circuit.

⇓ **If less than 2 Ω**

10. Test or replace the B46 Fuel Level Sensor.

Component Testing

1. Ignition OFF, remove the A7 Fuel Pump and Level Sensor Assembly.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 4 and the low reference terminal 3.
3. Test for a minimum resistance value of 37-43 Ω and a maximum value of 245-255 Ω without any spikes or dropouts.

⇒ **If minimum resistance is not 37-43 Ω, maximum resistance is not 245-255 Ω, or if there are any spikes or dropouts**

Replace the B46 Fuel Level Sensor.

⇓ **If minimum resistance is 37-43 Ω, maximum resistance is 245-255 Ω, and if there are no spikes or dropouts**

4. All OK.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

- *Fuel Tank Fuel Pump Module Replacement on page 9-261* for the 1.2L or 1.4L engine.
- *Fuel Tank Fuel Pump Module Replacement (Steel Tank) on page 9-559* for the 1.6L or 1.8L engine.
- *Control Module References on page 6-3* for the Engine Control Module replacement, programming and setup

Odometer Trip/Reset Switch Malfunction

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

Circuit/System Description

The instrument cluster displays the travelled distance based on the information from the engine control module (ECM). The ECM converts the data from the vehicle speed sensor to a distance signal. The ECM sends the distance information via serial data to the body control module (BCM). The BCM then sends the information via serial data to the instrument cluster to display the vehicle odometer and trip odometer. When the instrument cluster detects the activation of the trip stem and a press and hold of the stem, it resets the trip odometer information to zero.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Instrument Cluster Description and Operation on page 8-108

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the instrument cluster changes from odometer to trip when the odometer trip reset stem on the instrument cluster is pressed.

⇒ **If the instrument cluster does not change from odometer to trip**

Replace the P16 Instrument Cluster.

⇓ **If the instrument cluster changes from odometer to trip**

3. Verify the instrument cluster resets the trip odometer display when the odometer trip reset stem on the cluster is pressed for approximately 2 seconds.

⇒ **If the instrument cluster does not reset the trip odometer display**

Replace the P16 Instrument Cluster.

⇓ **If the instrument cluster resets the trip odometer display**

4. All OK.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

Control Module References on page 6-3 for instrument cluster replacement, programming, and setup.

Outside Air Temperature Display Malfunction - DTC B0158

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

DTC Descriptors

DTC B0158 02: Ambient Air Temperature Sensor Circuit Short to Ground

DTC B0158 05: Ambient Air Temperature Sensor Circuit High Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ambient Air Temperature Sensor Signal	B0158 02	B0158 05	B0158 05	—
Low Reference	—	B0158 05	—	—

Circuit/System Description

The instrument cluster monitors the ambient air temperature sensor with a low reference circuit and 5 V signal circuit. The instrument cluster monitors the voltage drop across the sensor, which is proportional to temperature. When the ambient air temperatures are cold, the resistance of the sensor is high and the voltage signals are high. When the ambient air temperatures are hot, the resistance of the sensors is low and the voltage signals are low. The instrument cluster converts the voltage value to a temperature value of Celsius or Fahrenheit that will be displayed by the driver information center.

Conditions for Running the DTC

The system voltage is between 9–16 V

Conditions for Setting the DTC

B0158 02

The instrument cluster detects the sensor signal circuit is more than 88°C (190°F) .

B0158 05

The instrument cluster detects the sensor signal circuit is less than −40°C (−40°F).

Action Taken When the DTC Sets

The instrument cluster uses a default air temperature value for further calculations. The driver information center displays —°C (—°F).

Conditions for Clearing the DTC

The DTC will become history if the instrument cluster no longer detects a malfunction.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

- *Instrument Cluster Description and Operation on page 8-108*
- *Driver Information Center (DIC) Description and Operation on page 8-106*

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Ambient Air Temperature parameter between −40°C (−40°F) to +88°C (+190°F) and changes with air temperature changes.

⇒ **If parameter is not between −40°C (−40°F) to +88°C (+190°F) or changes with air temperature changes**

Refer to Circuit/System Testing.

⇓ **If parameter is between −40°C (−40°F) to +88°C (+190°F) and changes with air temperature changes**

3. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 1 V between the low reference circuit terminal B and ground.

⇒ **If 1 V or greater**

Repair the short to voltage on the circuit.

⇓ **If less than 1 V**

3. Test for less than 10 Ω between the low reference circuit terminal B and ground.

⇒ **If 10 Ω or greater**

3.1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.

3.2. Test for less than 2 Ω in the low reference circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the P16 Instrument Cluster.

⇓ **If less than 10 Ω**

4. Ignition ON.
5. Verify the scan tool Ambient Air Temperature parameter is greater than 98%.

⇒ **If 98% or less**

5.1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.

5.2. Test for infinite resistance between the signal circuit and ground.

⇒ If less than infinite resistance, repair the short to ground on the circuit.

⇒ If infinite resistance, replace the P16 Instrument Cluster.

⇓ **If greater than 98%**

6. Install a 3 A fused jumper wire between the signal circuit terminal A and the low reference circuit terminal B.
7. Verify the scan tool Ambient Air Temperature parameter is less than 8%.

⇒ **If 8% or greater**

7.1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster, ignition ON.

7.2. Test for less than 1 V between the signal circuit and ground.

⇒ If 1 V or greater, repair the short to voltage on the circuit.

⇓ If less than 1 V

7.3. Ignition OFF

7.4. Test for less than 2 Ω in the signal circuit end to end.

⇒ If 2 Ω or greater, repair the open/high resistance in the circuit.

⇒ If less than 2 Ω, replace the P16 Instrument Cluster.

⇓ **If less than 8%**

8. Test or replace the B9 Ambient Air Temperature Sensor.

Component Testing

Static Test

1. Test the B9 Ambient Air Temperature Sensor by varying the sensor temperature while monitoring the sensor resistance.
2. Compare the readings with the *Ambient Air Temperature Sensor Resistance on page 8-77*

⇒ **If not within the specified range**

Replace the B9 Ambient Air Temperature Sensor.

⇓ **If within specified range**

3. All OK.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

- *Ambient Air Temperature Sensor Replacement on page 8-103*
- *Control Module References on page 6-3* for instrument cluster replacement, programming and setup.

Speedometer and/or Odometer Malfunction

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

Circuit/System Description

The instrument cluster displays the engine coolant temperature, fuel level, vehicle speed and the engine speed based on the information from the engine control module (ECM). The ECM sends information via serial data to the body control module (BCM). The BCM then sends the information via serial data to the instrument cluster to display the engine coolant temperature, fuel level, the engine speed, the vehicle speed and the distance travelled, either in kilometers or miles, based on the vehicle requirements. The instrument cluster will display dashes when its VIN does not match the VIN received from the BCM.

Diagnostic Aids

If the VIN mismatch is corrected the odometer will once again be displayed in the instrument cluster. If the vehicle is driven for a calibrated distance with a VIN mismatch, it will cause the instrument cluster odometer to enter into an error mode and lock it from being displayed. When this occurs the dashes will remain on the display even after correcting the VIN mismatch. The vehicle odometer status data display on the scan tool can be used to identify a locked odometer. The only way to unlock the instrument cluster (clear the dashes from the display) is to perform an SPS programming event. Failure to follow the diagnostic and programming procedures may result in either an improper odometer value or a module replacement.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Instrument Cluster Description and Operation on page 8-108

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Verify no DTC is set.

⇒ **If any DTC is set**

Diagnose DTCs first. Refer to *Diagnostic Trouble Code (DTC) List - Vehicle on page 6-69.*

⇓ **If no DTCs are set**

2. Ignition ON.
3. Verify the speedometer sweeps from low to high position when performing the Speedometer Sweep Test with the scan tool.

⇒ **If speedometer does not sweep**

Replace the P16 Instrument Cluster.

⇓ **If speedometer sweeps properly**

4. Verify the speedometer gauge value matches the Vehicle Speed parameter on the scan tool while driving the vehicle.

⇒ **If the values do not match**

Replace the P16 Instrument Cluster.

⇓ **If the speedometer value matches the scan tool parameter**

5. Verify the odometer display and the displayed distance counts up while driving the vehicle.

⇒ **If the odometer displays only "——" (dashes)**

Refer to Circuit/System Testing.

⇒ **If the odometer display does not count up**

Replace the P16 Instrument Cluster.

⇓ **If speedometer sweeps and displays the correct value, and the odometer display counts up**

6. All OK.

Circuit/System Testing

Note: If there are multiple modules not original to the vehicle and are not new correctly configured service parts, SPS may not be able to proper read or recover the vehicle odometer value. Follow government rules and documentation (including vehicle identification) regarding inaccurate/unknown odometer values.

Perform circuit/system verification first.

Correcting VIN mismatch: Instrument Cluster is Showing "——" (Dashes) odometer lock status is inactive

1. Verify the scan tool IPC Odometer Lock Status parameter is Inactive.

⇒ **If the reading is Active**

Refer to correcting VIN mismatch – Odometer Lock Status Active.

⇓ **If the reading is Inactive**

2. Verify the scan tool BCM VIN parameter matches the vehicle's VIN placard.

⇒ **If the VIN does not match**

Reprogram the BCM, then proceed to Step 3.

⇓ **If the VIN matches**

3. Verify the scan tool Instrument Cluster VIN parameter matches the vehicle's VIN placard.

⇒ **If the VIN does not match**

Reprogram the instrument cluster. Then proceed with step 4.

⇓ **If the VIN matches**

4. Ignition ON.
5. Verify the instrument cluster is displaying the correct value.

⇓ **If the instrument cluster is still displaying "——" (dashes)**

Replace the P16 Instrument Cluster.

6. All OK.

Correcting VIN mismatch: Instrument Cluster is Showing "——" (Dashes) odometer lock status is Active

1. Verify the scan tool Odometer Lock Status parameter is Active.

⇒ **If the reading is Inactive**

Refer to Correcting VIN mismatch – Odometer Lock Status Inactive

⇓ **If the reading is Active**

2. Verify the scan tool Instrument Cluster VIN parameter matches the vehicle's VIN placard.

⇒ **If the VIN does not match**

Reprogram the Instrument Cluster. Then proceed with step 3.

⇓ **If the VIN matches**

3. Perform the BCM setup procedure in SPS.
4. Ignition ON.
5. Verify the instrument cluster is displaying the correct odometer value.

⇒ **If the instrument cluster is still displaying "——" (dashes)**

Replace the P16 Instrument Cluster.

⇓ **If instrument cluster is displaying the correct value**

6. All OK.

Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

Control Module References on page 6-3 for Instrument Cluster, BCM or ECM replacement, programming, and setup.

Tachometer Inaccurate or Inoperative

Diagnostic Instructions

- Perform the *Diagnostic System Check - Vehicle on page 6-66* prior to using this diagnostic procedure.
- Review *Strategy Based Diagnosis on page 6-58* for an overview of the diagnostic approach.
- *Diagnostic Procedure Instructions on page 6-59* provides an overview of each diagnostic category.

Circuit/System Description

The instrument cluster displays the engine coolant temperature, fuel level, vehicle speed and the engine speed based on the information from the engine control module (ECM). The ECM sends information via a High Speed CAN-Bus signal to the body control module (BCM). The BCM then sends the information via a Low Speed CAN-Bus signal to the instrument cluster to display the engine coolant temperature, fuel level, the engine speed, the vehicle speed and the distance travelled, either in kilometers or miles, based on the vehicle requirements.

Reference Information

Schematic Reference

Instrument Cluster Schematics on page 8-78

Connector End View Reference

Component Connector End Views on page 11-269

Description and Operation

Instrument Cluster Description and Operation on page 8-108

Electrical Information Reference

- *Circuit Testing on page 11-526*
- *Connector Repairs on page 11-548*
- *Testing for Intermittent Conditions and Poor Connections on page 11-531*
- *Wiring Repairs on page 11-537*

Scan Tool Reference

Control Module References on page 6-3 for scan tool information

Circuit/System Verification

1. Verify no DTC is set.

⇒ **If any DTC is set**

diagnose DTCs first.

⇓ **If no DTCs are set**

2. Ignition ON, perform the Tachometer Gauge Sweep test with the scan tool, verify tachometer sweeps from low to high position.

⇒ **If tachometer does not sweep**

replace the P16 Instrument Cluster.

⇓ **If tachometer sweeps properly**

3. Engine running, verify the tachometer value matches the Engine Speed parameter on the scan tool.

⇒ **If the value does not match**

replace the P16 Instrument Cluster.

⇓ **If the tachometer value matches the value displayed on the scan tool**

4. Replace the K20 Engine Control Module.

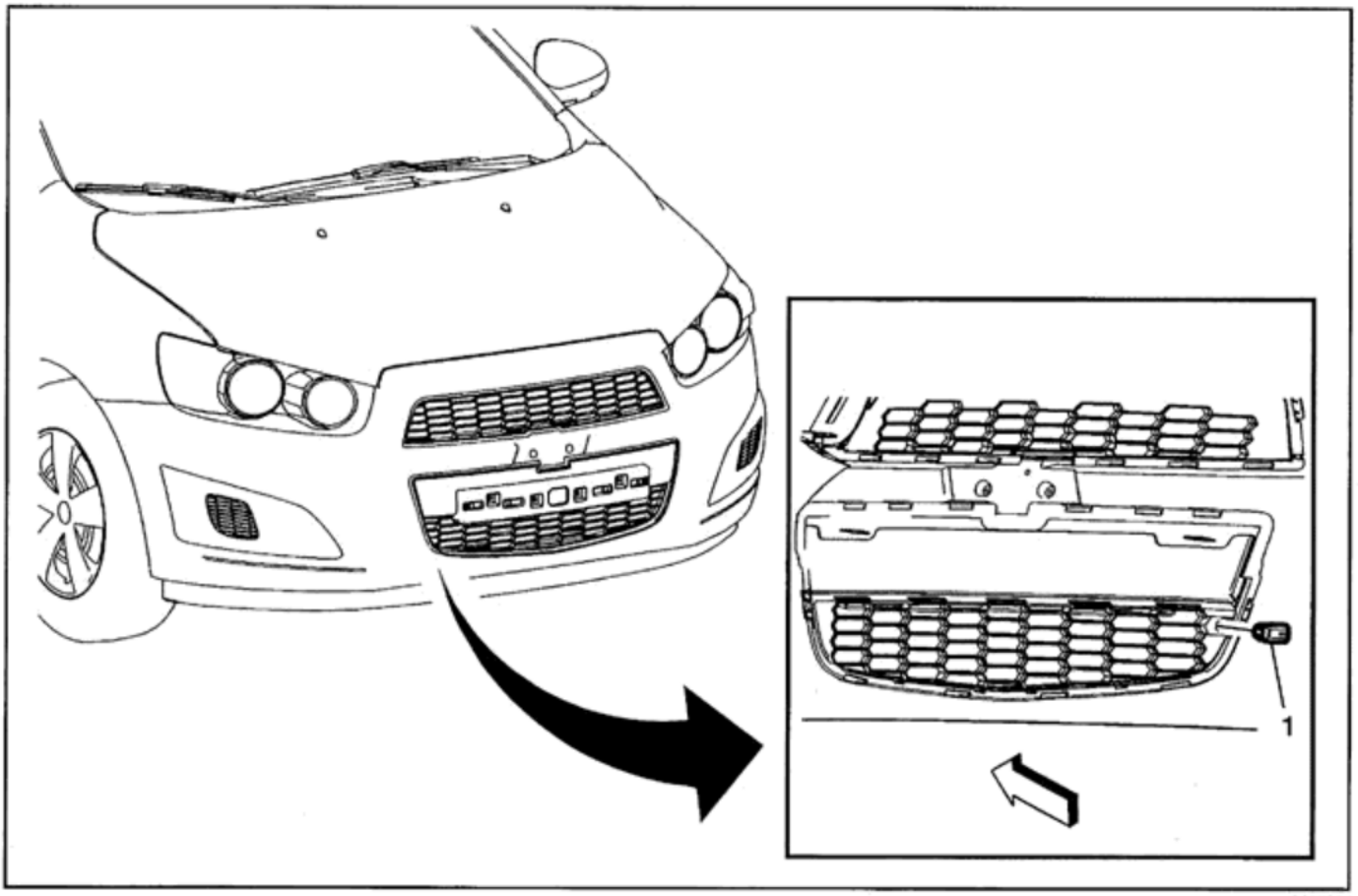
Repair Instructions

Perform the *Diagnostic Repair Verification on page 6-92* after completing the repair.

Control Module References on page 6-3 for instrument cluster or ECM replacement, programming, and setup.

Repair Instructions

Ambient Air Temperature Sensor Replacement

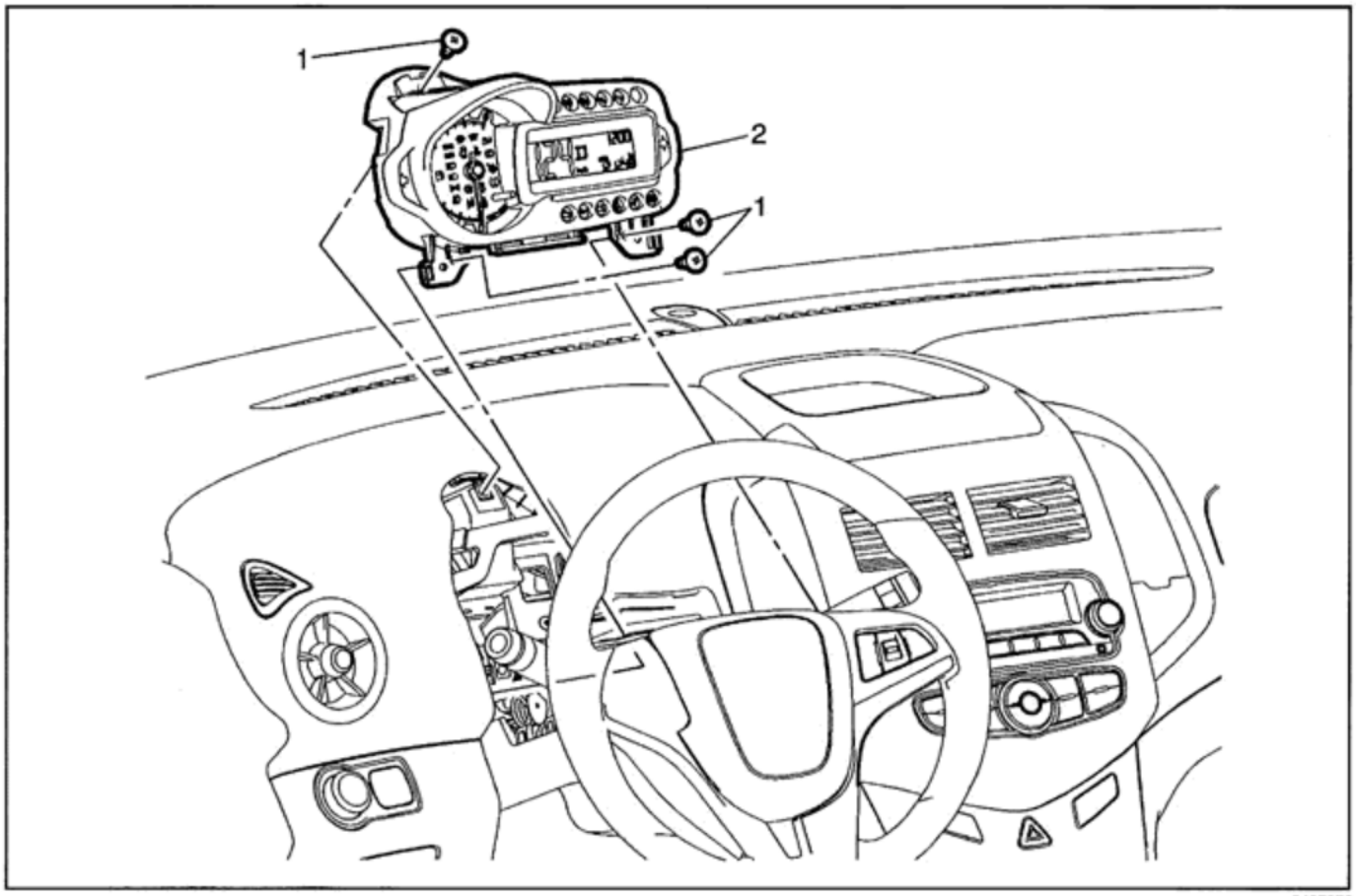


2497964

Ambient Air Temperature Sensor Replacement

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle on page 1-31*. 2. Remove the front bumper fascia opening lower cover. Refer to *Front Bumper Fascia Opening Lower Cover Replacement on page 3-58*.	
1	Ambient Air Temperature Sensor **Procedure** 1. Disconnect the electrical connector. 2. Unsnap the sensor from the front grill assembly.

Instrument Cluster Replacement

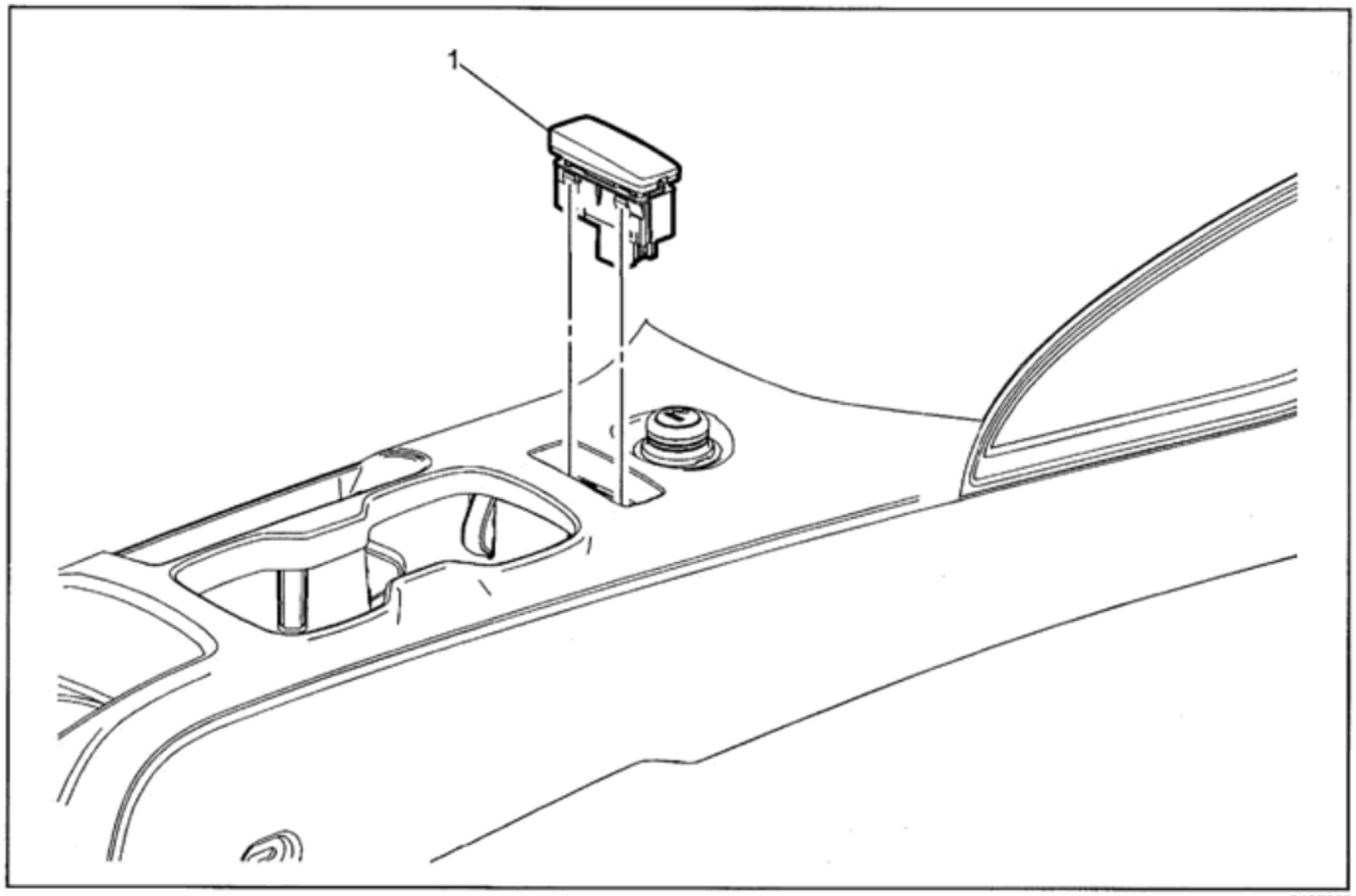


2497973

Instrument Cluster Replacement

Callout	Component Name
Preliminary Procedure 1. Remove the instrument panel cluster upper bezel. Refer to *Instrument Cluster Upper Bezel Replacement on page 2-39*. 2. Remove the instrument panel steering column upper trim cover. Refer to *Steering Column Upper Trim Cover Replacement on page 15-28*.	
1	Instrument Cluster Fasteners (Qty: 3) **Caution:** Refer to *Fastener Caution on page 0-8*.
2	Instrument Cluster Assembly **Procedure** 1. Disconnect the electrical connector. 2. Refer to *Control Module References on page 6-3* for programming and set up information.

Front Floor Console Multifunction Switch Replacement



2497625

Front Floor Console Multifunction Switch Replacement

Callout	Component Name
Preliminary Procedure Remove the front floor console. Refer to *Front Floor Console Replacement on page 2-61*	
1	Accessory Switch 1. Disconnect electrical connector. 2. Depressing four tabs, remove switch forward of console.

Description and Operation

Audible Warnings Description and Operation

The audible warnings alert the driver of a system concern or a critical vehicle condition. The radio generates the audible warnings through the speakers. The radio receives audible warning requests via the serial data circuit. If the radio receives multiple audible warning requests, the warning with the highest priority sounds first. The radio is the chime producer. The following lists the audible warning sounds:

1. Single pulse gong
2. Multiple pulse gong
3. Single pulse beep
4. Multiple pulse beep
5. Click
6. Clack

Fasten Safety Belt Warning

The chime producer activates the fasten safety belt audible warning as requested by the body control module (BCM). The BCM sends a serial data message to the chime producer indicating the chime as a multiple gong. The fasten safety belt warning sounds and the fasten safety belt indicator illuminates when the following occurs:

- The ignition switch transitions to ON.
- The inflatable restraint sensing and diagnostic module (SDM) detects that the drivers seat belt is not buckled and the signal is low. The SDM sends a serial data message to the BCM indicating the seat belt status. The instrument cluster receives a serial data message from the BCM indicating the driver seat belt status.

If the seat belt is buckled when the ignition is turned ON, the chime does not sound. If the seat belt is buckled while the chime is sounding, the chime stops. If the seat belt is unbuckled after the initial transition to ON, the chime does not sound.

Lights On Warning

The chime producer activates the lights on warning as requested by the BCM. The BCM sends a serial data message to the chime producer indicating the chime as a multiple gong. The lights on warning sounds when the following occurs:

- The ignition is OFF.
- The BCM determines that the driver door is open and the signal circuit is low.
- The BCM determines that the headlamp switch is in the park or head position.

Brake Warning

The chime producer activates the brake audible warning as requested by multiple control modules. The BCM, electronic brake control module or the parking brake control module sends a serial data message to the chime producer indicating the chime as a multiple gong. The brake warning sounds and the BRAKE indicator illuminates when the following occurs:

- The ignition is ON.
- The vehicle speed is greater than 8 km/h (4.9 MPH). The instrument cluster receives a serial data message from the engine control module (ECM) indicating the vehicle speed.
- The BCM determines that the parking brake is engaged and the signal circuit is low.
- The brake fluid is low.

Key-In-Ignition Warning

The chime producer activates the key-in-ignition audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer indicating the chime as a multiple gong. The key-in-ignition warning sounds when the following occurs:

- The ignition switch is OFF.
- The BCM determines that the driver door is open and the signal circuit is low.

Door Ajar Warning

The chime producer activates the door ajar audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer indicating the chime frequency of a medium rate and continuous duration. The door ajar warning sounds and the appropriate door ajar indicator illuminates in the driver information center when the BCM determines that a door (driver door, passenger door, left rear door, right rear door) is open and the signal circuit is low. The instrument cluster also receives a serial data message from the BCM indicating the door ajar status.

Object Detection

The chime producer activates the object detection audible warning as requested by the object alarm module. When an object is within the measuring range of the sensor, the ultrasonic pulse is reflected and is received by the sending or a neighboring sensor. The sensor converts this signal into a voltage signal and sends this signal to the object alarm module. The object alarm module evaluates the received sensor signals. As soon as an object is within the measuring range, the object alarm module sends a message via CAN-Bus to the chime producer in order to give out the acoustic distance signal. The measuring range is between 30–120 cm (11.81–47.24 in). From a distance of 120 cm (47.24 in), the acoustic signal is active. The frequency of the beep sound increases with decreasing distance. From a distance less than 30 cm (11.81 in), the sound becomes continuous.

Additional Warnings

The following warnings have an associated instrument cluster indicator or driver information center message:

- Turn Signal Indicators—The chime producer activates the audible warning as requested by the BCM. The chime produces two different chimes, one when the turn signal turns off and another when the turn signal turns on.
- Vehicle Overspeed Message—The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.
- Fuel Level Low Message—The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.
- Oil Pressure Indicator—The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.
- Park Assist Fault Clean Rear Bumper Message—The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.
- Tire Pressure Low Indicator—The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.

Refer to *Indicator/Warning Message Description and Operation on page 8-108.*

Driver Information Center (DIC) Description and Operation

In the lower middle of the instrument cluster, an additional display is installed. Its task is to give additional information, such as an odometer or error codes/warning messages. Refer to *Indicator/Warning Message Description and Operation on page 8-108.*

There are 4 switch functions for the driver information center:

- Menu
- Set/Clear
- Up
- Down

Menu

The Menu switch is used to navigate between the Vehicle Information Menu and the Trip/Fuel Information Menu. Cycle through the following vehicle parameters by successive pressing of the Menu switch.

Up and Down

The Up and the Down switches are used to navigate within the menus. Cycle through the following menu parameters by successive pressing of the Down switch.

Vehicle Information Menu

- Units Menu
- Speed Warning

Trip/Fuel Information Menu

- Trip A
- Fuel Range
- Average Fuel Economy
- Instantaneous Fuel Economy
- Average Vehicle Speed

Trip A

The trip odometer can be accessed through the driver information center switch Up/Down function.

Trip Display

Driver Information Center Trip Display	Range		
	Europe-SI	USA	GB
TRIP A	####.#km	####.# miles	####.# miles

Fuel Range

This message indicates the estimated distance that the vehicle can travel under the current fuel economy and fuel level conditions since the last battery connection to the instrument cluster. Fuel Range is calculated using the equation: Fuel Range = Range Distance/Range Fuel Used.

- Range Distance = The accumulated distance travelled since the last reset of this value.
- Fuel Used = The accumulated fuel delivered since the last reset of this value

The engine control module (ECM) sends the fuel range value to the instrument cluster. The instrument cluster receives a serial data message with fuel information. The fuel range value is retained during ignition OFF and can be changed between Europe-SI, USA and GB units by accessing the driver information center Units menu. The Fuel Range display cannot be reset. LOW is displayed when fuel range is below a predetermined value.

Average Fuel Economy

Average fuel economy is calculated using the equation: Average Fuel Economy = Distance/Fuel

- Distance = The accumulated distance travelled since the last reset of this value
- Fuel = The accumulated fuel consumption since the last reset of this value

The ECM sends the average fuel economy serial data message to the instrument cluster. The value of this mode is retained during ignition OFF and can be changed between English units and metric units by selecting from the driver information center options menu.

Instantaneous Fuel Economy

The ECM sends the instantaneous fuel economy serial data message to the instrument cluster. The value of this mode can be changed between English units and metric units by selecting from the driver information center options menu.

Average Vehicle Speed

Average speed is calculated using the equation: Average Speed = Average Speed Distance/Average Speed Time

- Distance = The accumulated distance travelled since the last reset of this value
- Ignition ON = The accumulated ignition on time since the last reset of this value

Outside Air Temperature

The outside air temperature can be accessed through the driver information center Trip/Fuel switch function. The driver information center shows the outside air temperature as a damped value. The time and rate of the temperature update is based on an algorithm in the instrument cluster. Factors such as last temperature reading, current temperature reading, length of time the vehicle was off, current vehicle speed, and the distance driven effect when the displayed temperature is updated. To get the vehicle to display the most accurate temperature faster, drive the vehicle. Constant moving traffic will update the display to the correct temperature more quickly than stop and go traffic.

Units Menu

The unit mode is used to toggle between Europe-SI, USA and GB units and can be accessed through the driver information center Menu switch and the driver information center Set/Reset switch.

Compass

The vehicle may have a compass display on the Driver Information Center. The compass receives its heading and other information from the Global Positioning System (GPS) antenna. If applicable, the GPS antenna is located with the telematics communication interface control module.

Odometer

The instrument cluster displays the vehicle odometer in the driver information center. The ECM send a distance rolling count message on GMLAN to the body control module (BCM). The BCM uses this information to calculate the vehicle odometer. This odometer value is then sent to the instrument cluster on GMLAN. The instrument cluster does not calculate the odometer. The odometer displays miles or kilometers as selected in the Units menu.

The odometer value is stored in multiple modules. The instrument cluster is a secondary storage module for the odometer, while the BCM is the primary storage and accumulator.

In addition to storing the odometer value for the vehicle, the instrument cluster and the BCM store the VIN. Software checks are performed to ensure these modules, and their stored odometer information, can not be move or transferred between different vehicles.

If the VINs do not match, the instrument cluster will go into an error mode and display "----" (dashes). If the VIN mismatch exists over a calibrated distance, the instrument cluster will "lock" the odometer display and only show dashes, even if the VIN mismatch is subsequently correct. The only way to clear or "unlock" the instrument cluster is to perform a BCM programming event using SPS.

Language

The driver information center is capable of displaying in different languages, corresponding to the radio language settings. The instrument cluster receives a serial data message with language information from the radio. This message is only sent one time, after a new language is selected. To set the language, see the owners manual.

Indicator/Warning Message Description and Operation

Indicator LIGHT ON

Refer to the owner's manual for the descriptions and explanations of all indicator lights.

For diagnosis and repair information related to an indicator light, refer to the System Diagnosis and the Description of Operation that the message relates to.

Message Displayed

Refer to the owner's manual for descriptions and explanations of all messages displayed.

For diagnosis and repair information related to a displayed message, refer to the System Diagnosis and the Description of Operation that the message relates to.

Instrument Cluster Description and Operation

Displays Test

Certain instrument cluster features are tested when the ignition is turned on in order to verify the features are working properly. The following occurs when the ignition is turned on:

- The ABS indicator illuminates briefly.
- The airbag indicator illuminates briefly.
- The battery indicator illuminates briefly.
- The brake indicator illuminates briefly.
- The door ajar indicator illuminates briefly.
- The fuel level low indicator illuminates briefly.
- The oil pressure low indicator illuminates briefly.
- The park assist service indicator illuminates briefly.
- The press clutch indicator illuminates briefly.
- The security indicator illuminates briefly.
- The service vehicle soon indicator illuminates briefly.
- The vehicle dynamic caution service indicator illuminates briefly.
- The vehicle dynamics caution off indicator illuminates briefly.

Indicators and Warning Messages

Refer to *Indicator/Warning Message Description and Operation on page 8-108*

Engine Coolant Temperature Gauge

The instrument cluster displays the engine coolant temperature as determined by the engine control module (ECM). The ECM sends the engine coolant temperature information via a High Speed CAN-Bus signal to the body control module (BCM). The BCM then sends the information via a Low Speed CAN-Bus signal to the instrument cluster to display the engine coolant temperature. The engine coolant temperature gauge defaults to 40°C (104°F) or below if:

- The ECM detects a malfunction in the engine coolant temperature sensor circuit.
- The BCM detects a loss of serial data communications with the ECM.
- The instrument cluster detects a loss of serial data communications with the BCM.

Fuel Level Gauge

The instrument cluster displays the fuel level based on the information from the ECM. The ECM converts the data from the fuel level sensors to a fuel level signal. The ECM sends the fuel level signal via a High Speed CAN-Bus signal to the BCM. The BCM then sends the information via a Low Speed CAN-Bus signal to the instrument cluster to display the fuel level. If the fuel level falls under 11% the instrument cluster switches on the low fuel level indicator. The fuel gauge defaults to empty if:

- The ECM detects a malfunction in the fuel level sensor circuit.
- The BCM detects a loss of serial data communications with the ECM.
- The instrument cluster detects a loss of serial data communications with the BCM.

Speedometer

The instrument cluster displays the vehicle speed based on the information from the ECM. The ECM sends the vehicle speed information via a High Speed CAN-Bus signal to the BCM. The BCM then sends the vehicle speed information via a Low Speed CAN-Bus signal to the instrument cluster in order to display the vehicle speed, either in kilometers or miles, based on the vehicle requirements. The speedometer defaults to 0 km/h (0 MPH) if:

- The BCM detects a loss of serial data communications with the ECM.
- The instrument cluster detects a loss of serial data communications with the BCM.

Tachometer

The instrument cluster displays the engine speed based on the information from the ECM. The ECM converts the data from the engine speed sensor to an engine revolution signal. The ECM sends the engine speed information via a High Speed CAN-Bus signal to the BCM. The BCM then sends the information via a Low Speed CAN-Bus signal to the instrument cluster to display the engine speed. The tachometer defaults to 0 RPM if:

- The ECM detects a malfunction in the engine speed sensor circuit.
- The BCM detects a loss of serial data communications with the ECM.
- The instrument cluster detects a loss of serial data communications with the BCM.

Driver Information Center Display

In the lower middle of the instrument cluster, an additional display is installed. Its task is to give additional information, such as an odometer or error codes. This part of the instrument cluster is available in 4 different variants, mostly depending on the assembled engine. For further information refer to *Driver Information Center (DIC) Description and Operation on page 8-106*.