

2018 ACCESSORIES & EQUIPMENT

Displays And Gauges - Equinox & Terrain

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

NOTE:

All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
Instrument Cluster Bolt	2.5 N.m (22 lb in)
Instrument Panel Upper Compartment Bolt	2.5 N.m (22 lb in)
Radio Control Bolt	1 N.m (9 lb in)
Radio Control Bracket Bolt	2.5 N.m (22 lb in)

SCHEMATIC WIRING DIAGRAMS

INSTRUMENT CLUSTER WIRING SCHEMATICS

Power, Ground, and Serial Data

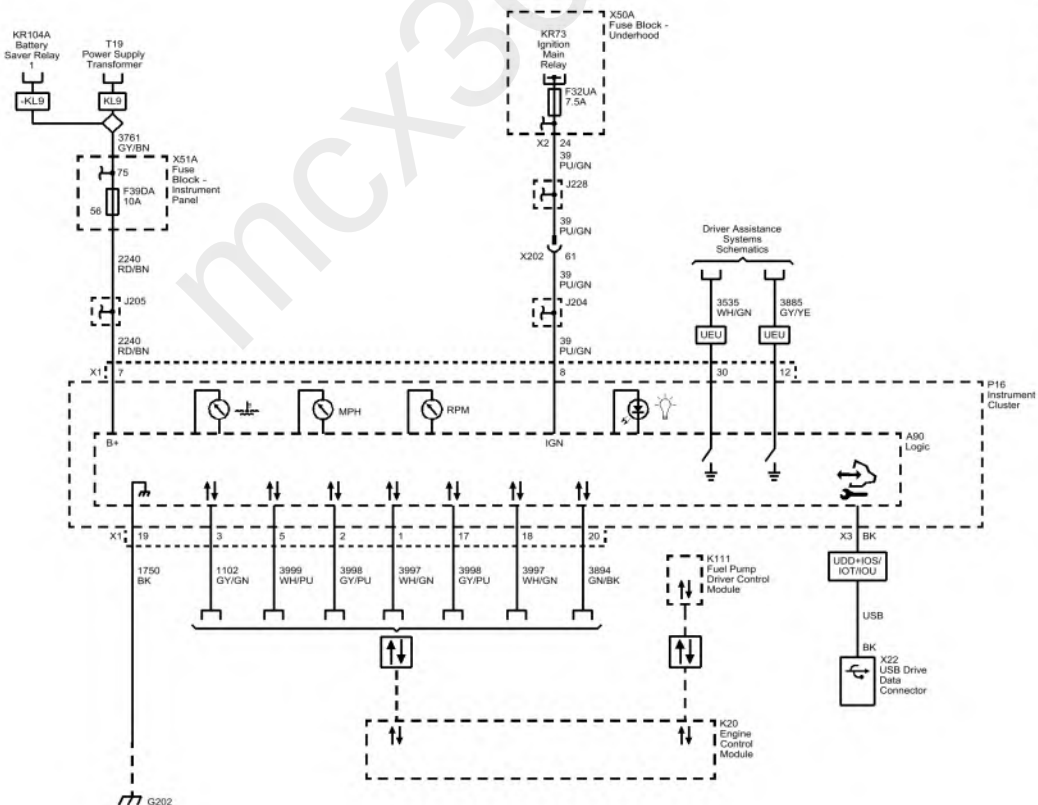


Fig. 1: Power, Ground, and Serial Data
 Courtesy of GENERAL MOTORS COMPANY

Fuel Gauge (LH7)

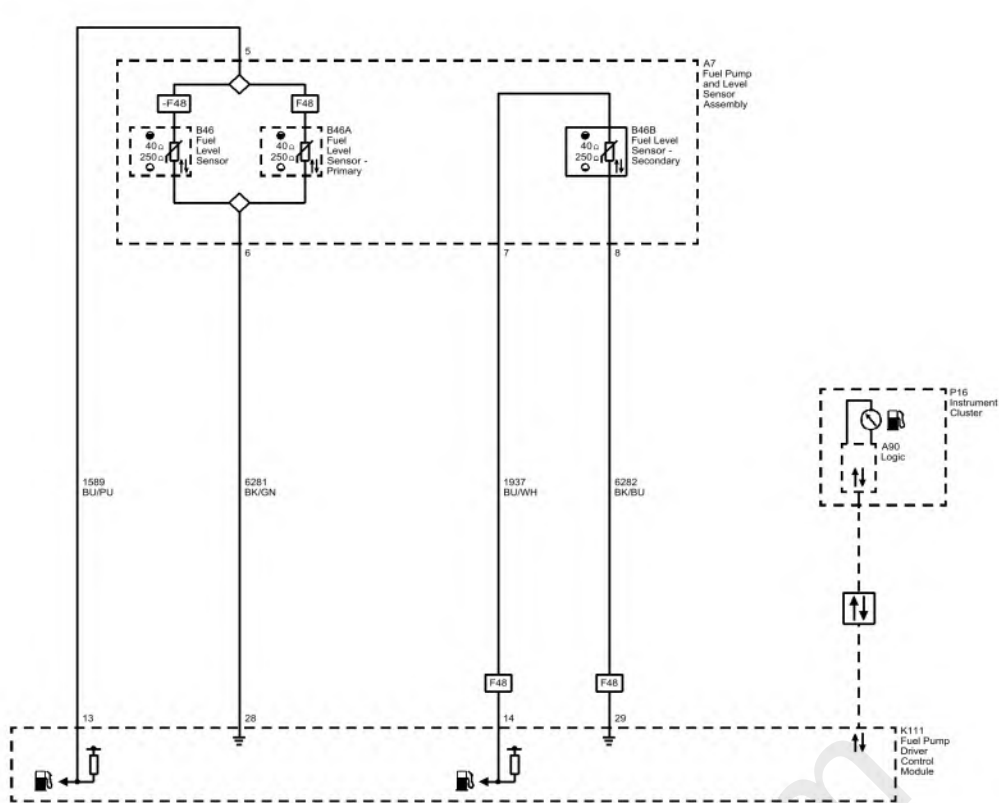


Fig. 2: Fuel Gauge (LH7)
Courtesy of GENERAL MOTORS COMPANY

Fuel Gauge (LTG or LYX)

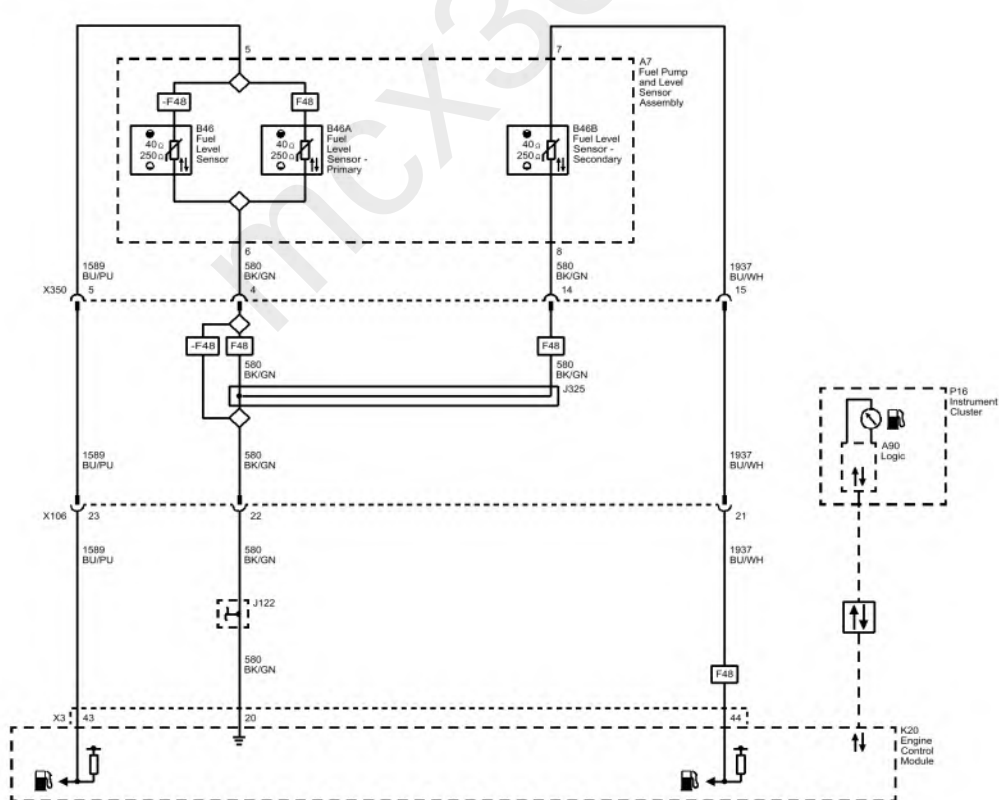


Fig. 3: Fuel Gauge (LTG or LYX)
Courtesy of GENERAL MOTORS COMPANY

Indicators

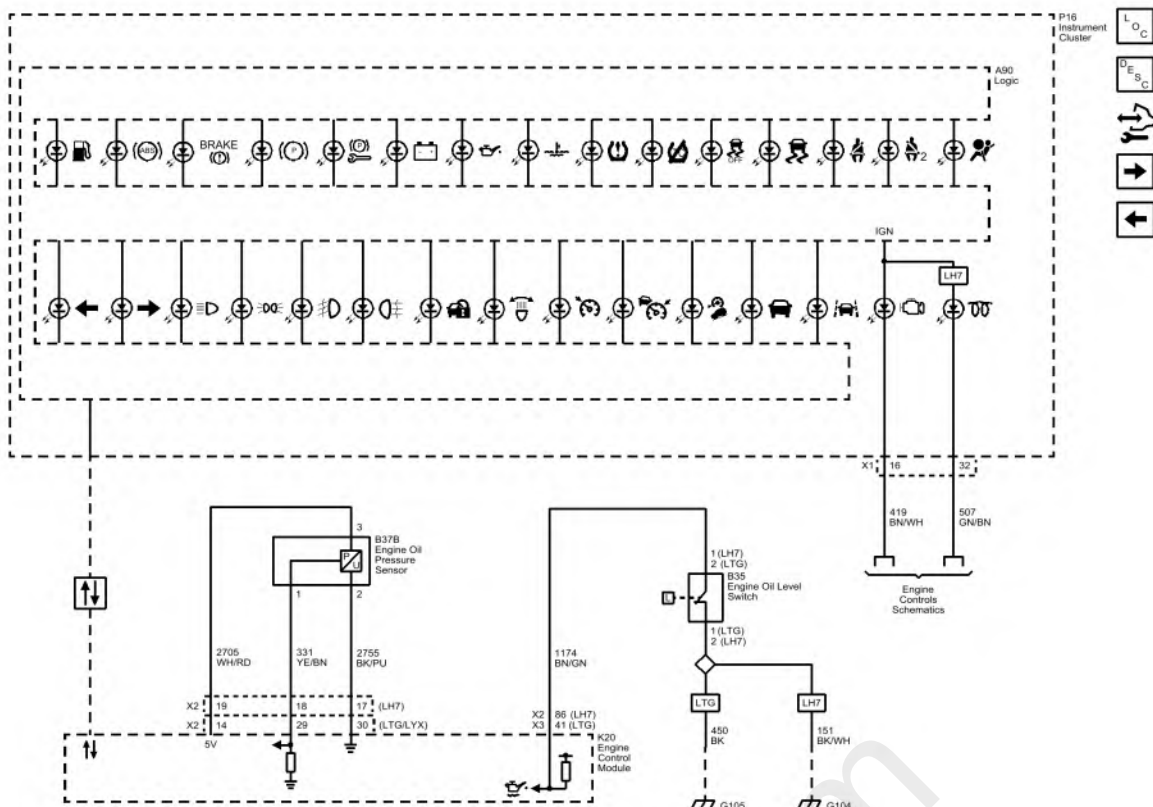


Fig. 4: Indicators

Courtesy of GENERAL MOTORS COMPANY

Air Temperature and Driver Information Center

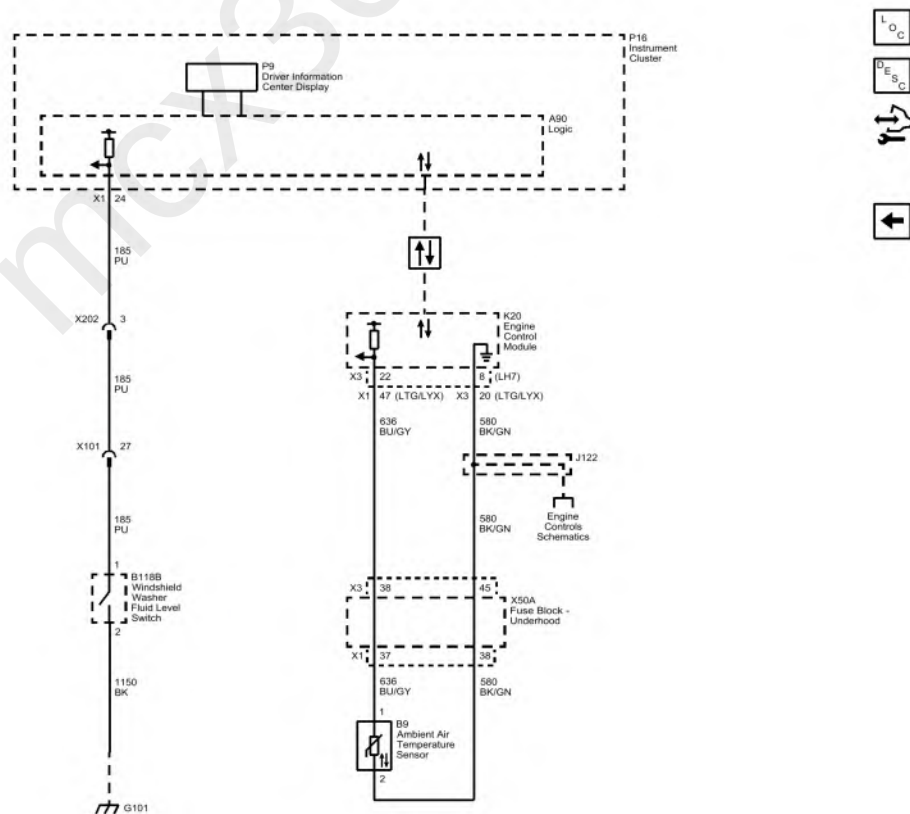


Fig. 5: Air Temperature and Driver Information Center

Courtesy of GENERAL MOTORS COMPANY

AUDIBLE WARNINGS WIRING SCHEMATICS

Audible Warning

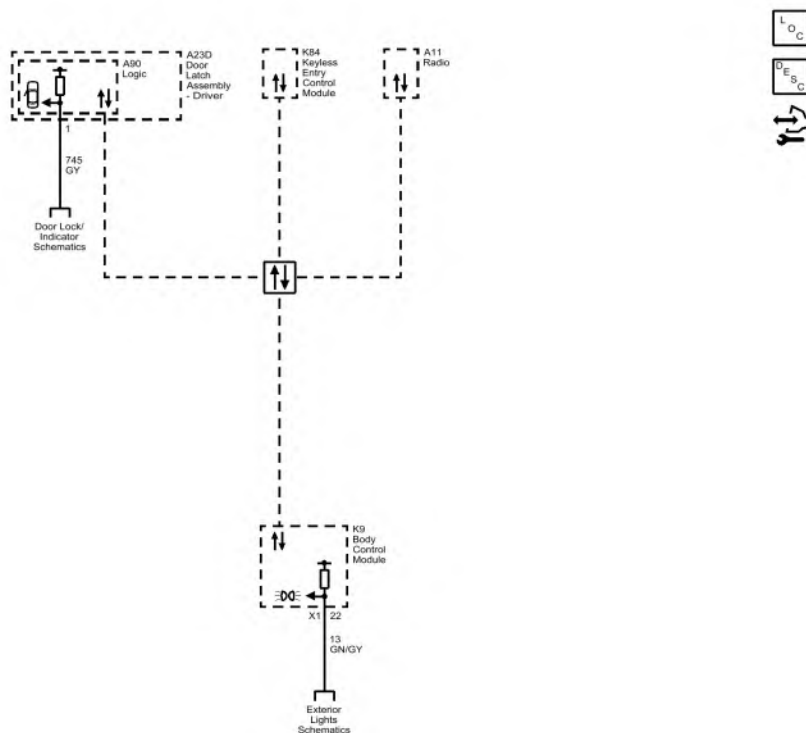


Fig. 6: Audible Warning

Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC B0550: ODOMETER CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC B0550

Odometer Circuit

- Symptom Byte: 32 - General Memory Malfunction

Circuit/System Description

For an overview of the component/system, refer to: [Instrument Cluster Description and Operation](#)

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K9 Body Control Module=Internal Malfunction

Actions Taken When the DTC Sets

Odometer = "----"

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC B0550 is not set.
 - **If the DTC is set**
 1. Perform all necessary programming and setup procedures for the control module:K9 Body Control Module
 2. Verify the DTC does not set.
 - If the DTC sets - Replace the component:K9 Body Control Module
 - If the DTC is not set
 3. All OK.
 - **Go to next step: If the DTC is not set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC B071F: TRANSMISSION RANGE INDICATOR

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure:[Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis:[Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here:[Diagnostic Procedure Instructions](#)

DTC Descriptor

Transmission Range Indicator

- Symptom Byte: 32 - Internal Malfunction

Circuit/System Description

The indicator has a series of LEDs that show in which range the transmission is. The device is controlled over a serial data bus by the body control module.

For an overview of the component/system, refer to: [Instrument Cluster Description and Operation](#)

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K9 Body Control Module Detected Transmission Range Indicator=Internal Malfunction

Actions Taken When the DTC Sets

No additional actions taken

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#)

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC B071F is not set.
 - **If the DTC is set**

Replace the component: P2 Transmission Shift Lever Position Indicator
 - **Go to next step: If the DTC is not set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

[Displays and Gauges Component Replacement Reference](#)

DTC B0931: COMPASS CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

Compass Circuit

- Symptom Byte: 32 - Internal Malfunction

Circuit/System Description

The compass module uses low-field magnetic sensing to sense vehicle directional and heading information.

For an overview of the component/system, refer to: [Instrument Cluster Description and Operation](#)

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K9 Body Control Module Detected K18 Compass Module = Internal Malfunction

Actions Taken When the DTC Sets

P17 Info Display Module or P16 Instrument Cluster Displays "--"

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC B0931 is not set.
 - **If the DTC is set**

Replace the component: K18 Compass Module
 - **Go to next step: If the DTC is not set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

Displays and Gauges Component Replacement Reference

DTC B124F: UNIVERSAL SERIAL BUS (USB) PROGRAMMING

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

Universal Serial Bus (USB) Programming

- Symptom Byte: 41 - Not Programmed
- Symptom Byte: 42 - Configuration Not Programmed
- Symptom Byte: 44 - Security Access Not Activated
- Symptom Byte: 4A - Programming Checksum Error

Circuit/System Description

The control module P16 performs software checks to validate a programming event has completed successfully. No external circuit diagnosis is involved.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

P16 Instrument Cluster=Programming Malfunction

Actions Taken When the DTC Sets

- DTCs Stored
- Some functions will not work.

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC B124F is not set.
 - **If the DTC is set**
 1. Perform all necessary programming and setup procedures for the control module: P16 Instrument Cluster

2. Verify the DTC does not set.

- If the DTC sets - Replace the component:P16 Instrument Cluster
- If the DTC is not set

3. All OK.

- **Go to next step: If the DTC is not set**

3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P0070: AMBIENT AIR TEMPERATURE SENSOR CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC? P0070

Ambient Air Temperature Sensor Circuit

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

Circuit	Description
Signal circuit	The sensor resistance varies with temperature.
Components • B9 Ambient Air Temperature Sensor • P16 Instrument Cluster	
The input voltage varies depending on the temperature of the sensor.	

Conditions for Running the DTC

Ignition On

Conditions for Setting the DTC

The internal fault detection is handled inside the control module. No external circuit diagnosis is involved.

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category=Type B DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type B DTC

Diagnostic Aids

DTC P0070 is set in case the battery was disconnected or the control module was re-programmed.

Reference Information

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC B0158 is not set.

- **If DTC B0158 is set**

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If the DTC is not set**

3. Verify DTC P0070 is not set.

- **If the DTC is not set**

All OK.

- **Go to next step: If DTC P0070 is set**

4. Clear DTC P0070

5. Verify the DTC does not set.

- **If the DTC is not set**

All OK.

- **Go to next step: If DTC P0070 is set**

6. Ignition/Vehicle - Off - For greater than 3 h

Verify the following parameters are within 15 °C (59 °F) of each other:

- IAT Sensor 1
- Ambient Air Temperature
- **If not in the specified range**

Replace the component: B9 Ambient Air Temperature Sensor

- **Go to next step: If in the specified range**

7. Verify DTC P0070 is not set.

- **If the DTC is not set**

All OK.

- **Go to next step: If DTC P0070 is set**

8. Perform all necessary programming and setup procedures for the control module:P16 Instrument Cluster

9. Verify DTC P0070 is not set.

- **If the DTC is not set**

All OK.

- **Go to next step: If DTC P0070 is set**

10. Perform all necessary programming and setup procedures for the control module:K9 Body Control Module

11. Verify DTC P0070 is not set.

- **If the DTC is not set**

All OK.

- **Go to next step: If DTC P0070 is set**

12. Perform all necessary programming and setup procedures for the control module:K20 Engine Control Module

13. Verify DTC P0070 is not set.

- **If the DTC is not set**

All OK.

- **Go to next step: If DTCP0070 is set**

14. Replace the control module: K20 Engine Control Module

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P0071-P0074: AMBIENT AIR TEMPERATURE SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0071

Ambient Air Temperature Sensor Performance

DTC P0072

Ambient Air Temperature Sensor Circuit Low Voltage

DTC P0073

Ambient Air Temperature Sensor Circuit High Voltage

DTC P0074

Ambient Air Temperature Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0072	P0073	P0073	P0071 or P0074
Low Reference	-	P0073	-	P0071

Circuit/System Description

The ambient air temperature sensor is located behind the grille. The engine control module (ECM) monitors the ambient air temperature sensor utilizing a low reference circuit and signal circuit. The ECM monitors the voltage drop across the sensor, which is inversely proportional to temperature. When the ambient air temperature is cold, the resistance of the sensor is high. When the ambient air temperature is warm, the resistance of the sensor is low. The ECM converts the voltage value to a temperature value. The ECM also sends the temperature value to other control modules via serial data.

Conditions for Running the DTC

- Ignition ON/Vehicle in Service Mode
- The 12 V battery voltage is greater than or equal to 10.2 V.

Conditions for Setting the DTC

P0071

During the first 20 s of run time after the 1 hour soaking period, the difference between the outside air temperature and the engine intake air temperature is greater than 30°C(86°F).

P0072

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

P0073

The ECM detects the sensor signal is less than -40°C (-40°F).

P0074

The ECM detects an unrealistic signal variance.

Action Taken When the DTC Sets

- DTC P0071 - P0074 are type B DTCs.
- The DIC will display SERVICE A/C SYSTEM.
- The system operates using a default value.

Conditions for Clearing the DTC

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

Diagnostic Aids

Following a Ambient Air Temperature Sensor disconnect or circuit fault, the temperature displayed in the vehicle can take several ignition cycles to update to the current temperature. Driving the vehicle may also be necessary.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON/Vehicle in Service Mode.
2. Verify the scan tool ECM Ambient Air Temperature parameter is between -40°C (-40°F) and $+88^{\circ}\text{C}$ ($+190^{\circ}\text{F}$) and changes with air temperature changes.
 - **If not between -40°C (-40°F) and $+88^{\circ}\text{C}$ ($+190^{\circ}\text{F}$) or changes with air temperature changes**
Refer to Circuit/System Testing.
 - **Go to next step: If between -40°C (-40°F) and $+88^{\circ}\text{C}$ ($+190^{\circ}\text{F}$) and changes with air temperature changes**
3. Perform the ECM Ambient Air Temperature Calculation Reset special function with the scan tool
4. Verify the scan tool Ambient Air Temperature parameter is within five degrees of actual ambient air temperature.
 - **If not within five degrees of actual ambient air temperature**
Refer to Circuit/System Testing.
 - **Go to next step: If within five degrees of actual ambient air temperature**
5. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF/Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than $10\ \Omega$ between the low reference circuit terminal B (or 2) and ground.
 - **If $10\ \Omega$ or greater**
 1. Ignition OFF/Vehicle OFF, disconnect the harness connectors at the K20 Engine Control Module.
 2. Test for less than $2\ \Omega$ in the low reference circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.
 - **Go to next step: If less than $10\ \Omega$**

3. Ignition ON/Vehicle in Service Mode.
4. Verify the scan tool Ambient Air Temperature parameter is less than -39°C (-38°F).
 - **If -39°C (-38°F) or greater**
 1. Ignition OFF/Vehicle OFF, disconnect the harness connectors at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal A (or 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.
 - **Go to next step: If less than -39°C (-38°F)**
5. Install a 3 A fused jumper wire between the signal circuit terminal A (or 1) and the low reference circuit terminal B (or 2).
6. Verify the scan tool Ambient Air Temperature parameter is greater than 88°C (190°F).
 - **If 88°C (190°F) or less**
 1. Ignition OFF/Vehicle OFF, remove the jumper wire and disconnect the harness connectors at the K20 Engine Control Module, ignition ON.
 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
 3. Ignition OFF/Vehicle OFF.
 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 K20 Engine Control Module.
 - **Go to next step: If warmer than 88°C (190°F)**
7. Test or replace the B9 Ambient Air Temperature Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup

DTC P0461-P0464: FUEL LEVEL SENSOR (FWD WITH GASOLINE ENGINE)

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

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 Signal	P0462	P0463	P0463	P0461/1
Low Reference	-	P0463	P0463	-
1. Fuel Gauge=Malfunction				

Circuit/System Description

For an overview of the component/system, refer to: [Instrument Cluster Description and Operation](#)

Circuit	Description
Fuel Level Sensor Signal	The control module input circuit has an internal resistance connected to 5 V.
Low Reference	Grounded through the control module.

Component	Description
B46 Fuel Level Sensor	The resistance of the sensor changes with fluid level.
K20 Engine Control Module	The K20 Engine Control Module monitors the fuel level sensor. When the fuel tank is full, the resistances of the fuel level sensor is low and the control module 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 control module senses a high signal voltage. The K20 Engine Control Module converts the signal input to a fuel level value.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

P0461

Fuel Level Sensor SignalChange=Less than 3 - 10 L/0.8 - 2.6 Gallons US - Distance Traveled=Greater than 240 - 320 km (150 - 200 mi)

P0462

Fuel Level Sensor Signal=Less than 0.25 V

The above condition(s) must occur for greater than 5 s.

P0463

Fuel Level Sensor Signal=Greater than 4.7 V

The above condition(s) must occur for greater than 30 s.

P0464

Fuel Level Sensor Signal=Change is greater than 10 %.

The above condition(s) must occur for greater than 30 s.

The diagnostic fails 2 out of 3 test cycles.

Action Taken When the DTC Sets

- DTCs listed in the DTC Descriptor Category=Type B DTC
- Fuel Gauge=Empty
- Low Fuel Indicator=On

Conditions for Clearing the DTC

- DTCs listed in the DTC Descriptor Category=Type B DTC
- The conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive malfunction-free ignition cycles.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify the scan tool parameter: Fuel Level Sensor = 0.5 to 3.V and changes & Varies with changes in fuel level.

- **If not between 0.5 and 3.5 V or does not change**

Refer to Circuit/System Testing.

- **Go to next step: If between 0.5 and 3.5 V and changes**

3. Perform the scan tool control function:Fuel Gauge Sweep

Verify the component activates: Fuel Gauge

- **If the component does not activate**

Test or replace the component: P16 Instrument Cluster

- **Go to next step: If the component activates**

4. All OK.

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector:A7 Fuel Pump and Level Sensor Assembly
3. Test for less than 10 ohms between the test points:Low Reference circuit terminal 6 & Ground
 - **If 10 ohms or greater**
 1. Disconnect the electrical connector:K20 Engine Control Module
 2. Test for less than 2 ohms between the test points:Low Reference circuit terminal@Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If less than 10 ohms**
4. Ignition - On / Vehicle - In Service Mode
5. Verify the scan tool parameter:Remaining Fuel in Tank=Less than 5 %
 - **If 5 % or greater**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Test for infinite resistance between the test points:Signal circuit terminal 5 @Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component:K20 Engine Control Module
 - **Go to next step: If less than 5 %**
6. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6
7. Verify the scan tool parameter:Remaining Fuel in Tank=If 90 % or greater
 - **If less than 90 %**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Ignition - On / Vehicle - In Service Mode
 4. Test for less than 1 V between the test points:Signal circuit@Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 1 V
 5. Ignition/Vehicle - Off
 6. Test for less than 2 ohms between the test points:Signal circuit@Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If 90 % or greater**
8. Test or replace the component:B46 Fuel Level Sensor

Component Testing

1. Ignition/Vehicle & All vehicle systems - Off
2. Remove the fuel level sensor.
3. Test for 245 to 255 ohms between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6 - Fuel Level Sensor - Empty
 - **If not between 245 and 255 ohms**
Replace the component:Fuel Level Sensor

- **Go to next step: If between 245 and 255 ohms**

4. Test for 37 to 43 ohms between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6 - Fuel Level Sensor - Full

- **If not between 37 and 43 ohms**

Replace the component:Fuel Level Sensor

- **Go to next step: If between 37 and 43 ohms**

5. Perform a component sweep test:Fuel Level Sensor

6. Test for 37-43 to 245-255 ohms between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6

7. The value should not spike or drop out while moving the sensor through the entire range.

- **If not between 37-43 and 245-255 ohms or spikes or drops out**

Replace the component:Fuel Level Sensor

- **Go to next step: If between 37-43 to 245-255 ohms and there are no spikes or drops out**

8. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- [Displays and Gauges Component Replacement Reference](#)
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P0461-P0464: FUEL LEVEL SENSOR 1 (FWD WITH DIESEL ENGINE)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 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 Fuel Pump Driver Control Module monitors the signal circuit of the fuel level sensor and sends the signal information to the Engine Control Module (ECM) for all further handling. The ECM uses this value in order to determine the fuel level. When the fuel tank is full, the resistance 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 Fuel Pump Driver Control Module sends the fuel level percentage via High Speed CAN-Bus to the body control module (BCM). The BCM then sends the fuel level percentage via Low Speed CAN-Bus to the instrument cluster in order to control the fuel gauge.

Conditions for Running the DTC

- Ignition ON/Vehicle in Service Mode
- Battery voltage is between 11 - 32 V

Conditions for Setting the DTC

P0461

- 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 ECM detects the signal voltage is less than 0.25 V.
- The above conditions must be met for 5 s.

P0463

- The ECM detects the signal voltage is greater than 4.7 V.
- The above conditions must be met for 5 s.

P0464

- The ECM detects the fuel level change is greater than 10% for a duration lasting less than 30 seconds.
- DTC P0464 runs and fails 2 out of 3 test cycles.

Action Taken When the DTC Sets

P0461, P0462, and P0463

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

P0464

- P0464 is a Type A DTC

Conditions for Clearing the DTC

- P0461, P0462, and P0463 are Type B DTCs
- P0464 is a Type A DTC

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.
 - **If the low fuel level indicator does not turn ON and OFF**
Replace the P16 Instrument Cluster
 - **Go to next step: If the low fuel level indicator turns ON and OFF**
4. Verify the ECM scan tool Fuel Level Sensor parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
5. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with 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 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
 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 K111 Fuel Pump Driver Control Module.

- **Go to next step: If less than 10 Ω**

3. Ignition ON.

4. Verify the scan tool Fuel Level Sensor parameter is greater than 4.8 V.

- **If 4.8 V or less**

1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.

2. Test for infinite resistance between the signal circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K111 Fuel Pump Driver Control Module.

- **Go to next step: If greater than 4.8 V**

5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.

6. Verify the scan tool Fuel Level Sensor parameter is less than 0.2 V.

- **If 0.2 V or greater**

1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module, ignition ON.

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

3. Ignition OFF

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 K111 Fuel Pump Driver Control Module.

- **Go to next step: If less than 0.2 V**

7. Test or replace the B46 Primary Fuel Level Sensor.

8. Operate the vehicle within the Conditions for Running the DTC.

9. Verify the condition does not return.

- **If the condition returns**

Replace the K20 Engine Control Module.

- **Go to next step: If the condition does not return**

10. All OK.

Component Testing

1. Ignition OFF, remove the Primary Fuel Level Sender.

2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.

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 Fuel Level Sensor.

- **Go to next step: 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](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

DTC P0461-P0464, P2066, P2067, OR P2068: FUEL LEVEL SENSOR 1 (AWD WITH DIESEL ENGINE)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 Circuit Intermittent

DTC P2066

Fuel Level Sensor 2 Performance

DTC P2067

Fuel Level Sensor 2 Circuit Low Voltage

DTC P2068

Fuel Level Sensor 2 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuel Level Sensor 1/Primary/Left Signal	P0462	P0463	P0463	P0461, 1
Fuel Level Sensor 2/Secondary/Right Signal	P2067	P2068	P2068	P2066, 1
Low Reference	-	P0463, P2068	P0463, P2068	P0461, P2066, 1
1. Fuel Gauge Malfunction				

Circuit/System Description

The fuel level sensor changes resistance based on fuel level and is wired to the Fuel Pump Driver Control Module. The Fuel Pump Driver Control Module sends the fuel level sensor reading to the Engine Control Module (ECM) via serial data. The ECM monitors the fuel level sensor signal in order to determine the fuel level. When the fuel tank is full, the resistances of both fuel level sensors are low. When the fuel tank is empty, the resistances of the fuel level sensors are high. The ECM uses the signal voltages of the primary fuel level sensor and the secondary fuel level sensor 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 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 or P2066

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 or P2067

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

P0463 or P2068

- 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, P0464, P2066, P2067 and P2068 are Type B DTCs
- The fuel gauge defaults to empty
- The low fuel indicator illuminates

Conditions for Clearing the DTC

- P0461, P0462, P0463, P0464, P2066, P2067 and P2068 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)

- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.
 - **If the low fuel level indicator does not turn ON and OFF**
Replace the P16 Instrument Cluster
 - **Go to next step: If the low fuel level indicator turns ON and OFF**
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Primary Fuel Level Sensor Malfunction in Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
5. Verify the scan tool Fuel Level Sensor Right Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Secondary Fuel Level Sensor Malfunction in Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
6. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

Primary Fuel Level Sensor Malfunction

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 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
 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 K111 Fuel Pump Driver Control Module.

- **Go to next step: If less than 10 Ω**

3. Ignition ON.

4. Verify the scan tool Fuel Level Sensor Left Tank parameter is greater than 4.8 V.

- **If 4.8 V or less**

1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.

2. Test for infinite resistance between the signal circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K111 Fuel Pump Driver Control Module.

- **Go to next step: If greater than 4.8 V**

5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.

6. Verify the scan tool Fuel Level Sensor Left Tank parameter is less than 0.2 V.

- **If 0.2 V or greater**

1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module, ignition ON.

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

3. Ignition OFF

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 K111 Fuel Pump Driver Control Module.

- **Go to next step: If less than 0.2 V**

7. Test or replace the B46 Primary Fuel Level Sensor.

8. Operate the vehicle within the Conditions for Running the DTC.

9. Verify the condition does not return.

- **If the condition returns**

Replace the K20 Engine Control Module.

- **Go to next step: If the condition does not return**

10. All OK.

Secondary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B46B Fuel Level Sensor - Secondary. 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 8 and ground.

- **If 10 Ω or greater**

1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.

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 K111 Fuel Pump Driver Control Module.

- **Go to next step: If less than 10 Ω**

3. Ignition ON.

4. Verify the scan tool Fuel Level Sensor Right Tank parameter is greater than 4.8 V.

- **If 4.8 V or less**

1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.

2. Test for infinite resistance between the signal circuit terminal 7 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module.
 - **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 7 and the low reference circuit terminal 8.
 6. Verify the scan tool Fuel Level Sensor Right Tank parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module, ignition ON.
 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
 3. Ignition OFF
 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 K111 Fuel Pump Driver Control Module.
 - **Go to next step: If less than 0.2 V**
 7. Test or replace the B46B Fuel Level Sensor - Secondary.
 8. Operate the vehicle within the Conditions for Running the DTC.
 9. Verify the condition does not return.
 - **If the condition returns**
Replace the K20 Engine Control Module.
 - **Go to next step: If the condition does not return**
 10. All OK.

Component Testing

Primary Fuel Level Sensor

1. Ignition OFF, remove the Primary Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.
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 Primary Fuel Level Sensor.
 - **Go to next step: If minimum resistance is 37-43 Ω , maximum resistance is 245-255 Ω , and if there are no spikes or dropouts**
4. All OK.

Secondary Fuel Level Sensor

1. Ignition OFF, remove the Secondary Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 7 and the low reference terminal 8.
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 Secondary Fuel Level Sensor.

- Go to next step: 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](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

DTC P0461-P0464, P2066, P2067, OR P2068: FUEL LEVEL SENSOR 1 (AWD WITH GASOLINE ENGINE)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 Circuit Intermittent

DTC P2066

Fuel Level Sensor 2 Performance

DTC P2067

Fuel Level Sensor 2 Circuit Low Voltage

DTC P2068

Fuel Level Sensor 2 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuel Level Sensor 1/Primary/Left Signal	P0462	P0463	P0463	P0461, 1
Fuel Level Sensor 2/Secondary/Right Signal	P2067	P2068	P2068	P2066, 1
Low Reference	-	P0463, P2068	P0463, P2068	P0461, P2066, 1
1. Fuel Gauge Malfunction				

Circuit/System Description

The primary fuel level sensor and the secondary fuel level sensor change resistance based on fuel level. The engine control module (ECM) monitors the signal circuits of both sensor to determine the fuel level. When the fuel tank is full, the resistances of both fuel level sensors are low. When the fuel tank is empty, the resistances of the fuel level sensors are high. The ECM uses the signal voltages of the primary fuel level sensor and the secondary fuel level sensor 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 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 or P2066

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 or P2067

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

P0463 or P2068

- 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, P0464, P2066, P2067 and P2068 are Type B DTCs
- The fuel gauge defaults to empty
- The low fuel indicator illuminates

Conditions for Clearing the DTC

- P0461, P0462, P0463, P0464, P2066, P2067 and P2068 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.
 - **If the low fuel level indicator does not turn ON and OFF**
Replace the P16 Instrument Cluster
 - **Go to next step: If the low fuel level indicator turns ON and OFF**
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Primary Fuel Level Sensor Malfunction in Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
5. Verify the scan tool Fuel Level Sensor Right Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Secondary Fuel Level Sensor Malfunction in Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
6. All OK.

[Circuit/System Testing](#)

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

Primary Fuel Level Sensor Malfunction

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 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.

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.
- **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.
6. Verify the scan tool Fuel Level Sensor Left Tank parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 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
 - 3. Ignition OFF
 - 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 K20 Engine Control Module.
 - **Go to next step: If less than 0.2 V**
7. Test or replace the B46 Primary Fuel Level Sensor.

Secondary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B46B Fuel Level Sensor - Secondary. 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 8 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 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.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor Right Tank parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 7 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 7 and the low reference circuit terminal 8.
6. Verify the scan tool Fuel Level Sensor Right Tank parameter is less than 0.2 V.

- **If 0.2 V or greater**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
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
3. Ignition OFF
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 K20 Engine Control Module.
- **Go to next step: If less than 0.2 V**
7. Test or replace the B46B Fuel Level Sensor - Secondary.

Component Testing

Primary Fuel Level Sensor

1. Ignition OFF, remove the Primary Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.
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 Primary Fuel Level Sensor.

 - **Go to next step: If minimum resistance is 37-43 Ω , maximum resistance is 245-255 Ω , and if there are no spikes or dropouts**
4. All OK.

Secondary Fuel Level Sensor

1. Ignition OFF, remove the Secondary Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 7 and the low reference terminal 8.
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 Secondary Fuel Level Sensor.

 - **Go to next step: 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](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

DTC P0521, P0522, OR P0523: ENGINE OIL PRESSURE SENSOR

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0521

Engine Oil Pressure Sensor Performance

DTC P0522

Engine Oil Pressure Sensor Circuit Low Voltage

DTC P0523

Engine Oil Pressure Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0522	P0522 or 1	P0523	P0521 or 1
Signal	P0522	P0522 or 1	P0523	P0521 or 1
Low Reference	-	P0523 or 1	-	P0521 or 1
1. Low Engine Oil Pressure Indicator=Malfunction				

Circuit/System Description

For an overview of the component/system, refer to: [Instrument Cluster Description and Operation](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to ground.
Low Reference	Grounded through the control module.

Component	Description
B37B Engine Oil Pressure Sensor	The sensor is a 3-wire capacitive pressure transducer. Electronics in the sensor convert pressure into an analog voltage signal.
K20 Engine Control Module	The K20 control module monitors the B37B Engine Oil Pressure Sensor signal circuit. The control module input circuit has an internal resistance connected to ground.

Conditions for Running the DTC

Engine Running

Conditions for Setting the DTC

P0521

- Engine Oil Pressure=The actual value is not within a predetermined range of the calculated value.
- For greater than 4 s

P0522

- Engine Oil Pressure Sensor Circuit=Less than 0.2 V - For greater than 10 s

P0523

- Engine Oil Pressure Sensor Circuit=Greater than 4.8 V - For greater than 10 s

Action Taken When the DTC Sets

- Type C DTC
- Low Engine Oil Pressure Indicator=On

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type C DTC

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify the scan tool parameter:Engine Oil Pressure Sensor= 0 kPa (0 PSI)
 - **If not the specified state**

Refer to: Circuit/System Testing
 - **Go to next step: If the specified state**
3. Verify the engine has the correct oil level and the correct oil pressure before continuing with this diagnostic.

Displays and Gauges Component Replacement Reference

4. Engine Running
5. Verify the scan tool parameter:Engine Oil Pressure Sensor = CH-48027 Digital Pressure Gauge
 - **If not the specified state**

Refer to: Circuit/System Testing
 - **Go to next step: If the specified state**
6. Verify the scan tool parameter:Engine Oil Pressure Sensor=Engine Oil Pressure - Gauge@P16 Instrument Cluster
 - **If not the specified state**

- **Go to next step: If the specified state**

7. All OK.

Circuit/System Testing

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: B37B Engine Oil Pressure Sensor
3. Test for less than 10 ohms between the test points: Low Reference circuit terminal 2 & Ground
 - **If 10 ohms or greater**
 1. Disconnect the electrical connector: K20 Engine Control Module
 2. Test for less than 2 ohms between the test points: Low Reference circuit terminal 2 @Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If less than 10 ohms**
4. Ignition - On / Vehicle - In Service Mode
5. Test for 4.8 to 5.2 V between the test points: 5 V Reference circuit terminal 3 & Low Reference circuit terminal 2
 - **If less than 4.8 V**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Test for infinite resistance between the test points: 5 V Reference circuit terminal 3 @Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 ohms between the test points: 5 V Reference circuit terminal 3 @Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **If greater than 5.2 V**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Ignition - On / Vehicle - In Service Mode
 4. Test for less than 1 V between the test points: 5V Reference circuit terminal 3 @Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 1 V - Replace the component:K20 Engine Control Module
 - **Go to next step: If between 4.8 and 5.2 V**
6. Verify the scan tool parameter:Engine Oil Pressure Sensor = 0 kPa (0 PSI)
 - **If greater than 0 kPa (0 PSI)**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Ignition - On / Vehicle - In Service Mode
 4. Test for less than 1 V between the test points:Signal circuit terminal 1 @Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.

- If less than 1 V - Replace the component:K20 Engine Control Module
 - **Go to next step: If 0 kPa (0 PSI) or less**
7. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal 1 & 5 V Reference circuit terminal 3
 8. Verify the scan tool parameter:Engine Oil Pressure Sensor =Greater than 800 kPa (116 PSI)
 - **If 800 kPa (116 PSI) or less**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Test for infinite resistance between the test points:Signal circuit terminal 1 @Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 ohms between the test points:Signal circuit terminal 1 @Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If greater than 800 kPa (116 PSI)**
 9. Test or replace the component:B37B Engine Oil Pressure Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- [Displays and Gauges Component Replacement Reference](#)
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P0654: ENGINE SPEED OUTPUT CIRCUIT LOW/HIGH VOLTAGE (WITH LTG OR LYX)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

DTC B06EE

Engine Speed Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discrete wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**

Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**

3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.

- **If tachometer display does not match the Engine Speed parameter**

Perform Circuit/System Testing.

- **Go to next step: If tachometer display matches the Engine Speed parameter**

4. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.

2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.

- **If less than 9 volts**

1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between the signal circuit terminal 42 and ground.

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

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 A11 Radio.

- **If greater than 11 volts**

1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.

2. Test for less than 1 V between the signal circuit terminal 42 and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the A11 Radio.

- **Go to next step: If 9 - 11 volts**

3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for the control module replacement, programming, and setup

DTC P0654: ENGINE SPEED OUTPUT CIRCUIT LOW/HIGH VOLTAGE (WITH LVL, LH7, OR LWW)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

Engine Speed Output Circuit High Voltage**Diagnostic Fault Information**

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discreet wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Circuit/System Verification

1. Ignition ON.
2. Verify the tachometer sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the tachometer does not sweep**

Replace the P16 Instrument Cluster
 - **Go to next step: If the tachometer sweeps**
3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.
 - **If tachometer display does not match the Engine Speed parameter**

Perform Circuit/System Testing.
 - **Go to next step: If tachometer display matches the Engine Speed parameter**
4. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.
2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.
 - **If less than 9 volts**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 44 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 A11 Radio.
 - **If greater than 11 volts**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 44 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the A11 Radio.
 - **Go to next step: If 9 - 11 volts**
3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for the control module replacement, programming, and setup

DTC P06ED: ENGINE SPEED OUTPUT CIRCUIT LOW/HIGH VOLTAGE (WITH LTG OR LYX)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.

- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

DTC B06EE

Engine Speed Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discrete wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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 Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**

Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.
 - **If tachometer display does not match the Engine Speed parameter**

Perform Circuit/System Testing.
 - **Go to next step: If tachometer display matches the Engine Speed parameter**
4. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.
2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.
 - **If less than 9 volts**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 42 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 A11 Radio.
 - **If greater than 11 volts**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 42 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the A11 Radio.
 - **Go to next step: If 9 - 11 volts**
3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for the control module replacement, programming, and setup

DTC P06ED: ENGINE SPEED OUTPUT CIRCUIT LOW/HIGH VOLTAGE (WITH LVL, LH7, OR LWW)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

DTC B06EE

Engine Speed Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discrete wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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 Wiring Schematics

Connector End View Reference

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- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the tachometer sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the tachometer does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the tachometer sweeps**
3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.
 - **If tachometer display does not match the Engine Speed parameter**
Perform Circuit/System Testing.
 - **Go to next step: If tachometer display matches the Engine Speed parameter**
4. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.
2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.
 - **If less than 9 volts**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 44 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 A11 Radio.

- **If greater than 11 volts**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, ignition ON.
2. Test for less than 1 V between the signal circuit terminal 44 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the A11 Radio.
 - **Go to next step: If 9 - 11 volts**
3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for the control module replacement, programming, and setup

DTC P06EE: ENGINE SPEED OUTPUT CIRCUIT LOW/HIGH VOLTAGE (WITH LTG OR LYX)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

DTC B06EE

Engine Speed Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discreet wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.
 - **If tachometer display does not match the Engine Speed parameter**
Perform Circuit/System Testing.
 - **Go to next step: If tachometer display matches the Engine Speed parameter**
4. All OK.

Circuit/System Testing

NOTE: Circuit/System Verification must be performed before proceeding with Circuit/System Testing.

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.
2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.
 - **If less than 9 volts**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 42 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 A11 Radio.
 - **If greater than 11 volts**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 42 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the A11 Radio.
 - **Go to next step: If 9 - 11 volts**
3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for the control module replacement, programming, and setup

DTC P06EE: ENGINE SPEED OUTPUT CIRCUIT LOW/HIGH VOLTAGE (WITH LVL, LH7, OR LWV)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

DTC B06EE

Engine Speed Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses

per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discreet wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

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- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the tachometer sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the tachometer does not sweep**

Replace the P16 Instrument Cluster
 - **Go to next step: If the tachometer sweeps**
3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.

- If tachometer display does not match the Engine Speed parameter

Perform Circuit/System Testing.

- **Go to next step: If tachometer display matches the Engine Speed parameter**

4. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.
2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.
 - **If less than 9 volts**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 44 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 A11 Radio.
 - **If greater than 11 volts**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 44 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the A11 Radio.
 - **Go to next step: If 9 - 11 volts**
3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for the control module replacement, programming, and setup

DTC P1100: FUEL LEVEL SENSOR 2 SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: **Diagnostic System Check - Vehicle**
- Review the description of Strategy Based Diagnosis: **Strategy Based Diagnosis**
- An overview of each diagnostic category can be found here: **Diagnostic Procedure Instructions**

DTC Descriptor

Fuel Level Sensor 2 Signal Message Counter Incorrect

Circuit/System Description

The signal circuit is connected to the following control module: K111 Fuel Pump Driver Control Module

The control module communicates with the engine control module via serial data.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K20 Engine Control Module=K111 Fuel Pump Driver Control Module - Message Counter Incorrect

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category=Type B DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type B DTC

Reference Information

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify no other DTCs are set.
 - **If other DTCs are set**

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **Go to next step: If no other DTCs are set**
3. Replace the component:K111 Fuel Pump Driver Control Module
4. Verify the DTC does not set.
 - **If the DTC is set**

Replace the component:K20 Engine Control Module
 - **Go to next step: If the DTC is not set**
5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P1200: FUEL LEVEL SENSOR 1 SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

Circuit/System Description

The signal circuit is connected to the following control module:K111 Fuel Pump Driver Control Module

The control module communicates with the engine control module via serial data.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K20 Engine Control Module=K111 Fuel Pump Driver Control Module - Message Counter Incorrect

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category=Type B DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type B DTC

Reference Information

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode

2. Verify no other DTCs are set.

- **If other DTCs are set**

Refer to:[Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If no other DTCs are set**

3. Replace the component:K111 Fuel Pump Driver Control Module

4. Verify the DTC does not set.

- **If the DTC is set**

Replace the component:K20 Engine Control Module

- **Go to next step: If the DTC is not set**

5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P1434: FUEL LEVEL SENSOR 1 REFERENCE FEEDBACK PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

Fuel Level Sensor 1 Reference Feedback Performance

Circuit/System Description

The signal circuit is connected to the following control module: K111 Fuel Pump Driver Control Module

The control module communicates with the engine control module via serial data.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Ignition Voltage=Greater than 11 V

Conditions for Setting the DTC

Invalid Data Received From Fuel Pump Control Module

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category=Type B DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type B DTC

Reference Information

Schematic Reference

Data Communication Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify no other DTCs are set.

- **If other DTCs are set**

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If no other DTCs are set**

3. Replace the component: K111 Fuel Pump Driver Control Module

4. Verify the DTC does not set.

- **If the DTC is set**

Replace the component: K20 Engine Control Module

- **Go to next step: If the DTC is not set**

5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P143E: FUEL LEVEL SENSOR 2 REFERENCE FEEDBACK PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

Fuel Level Sensor 2 Reference Feedback Performance

Circuit/System Description

The signal circuit is connected to the following control module: K111 Fuel Pump Driver Control Module

The control module communicates with the engine control module via serial data.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Ignition Voltage=Greater than 11 V

Conditions for Setting the DTC

Invalid Data Received From Fuel Pump Control Module

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category=Type B DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type B DTC

Reference Information

Schematic Reference

[Data Communication Wiring Schematics](#)

Connector End View Reference

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

Control Module References**Circuit/System Verification**

1. Ignition - On / Vehicle - In Service Mode
2. Verify no other DTCs are set.
 - **If other DTCs are set**

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **Go to next step: If no other DTCs are set**
3. Replace the component: K111 Fuel Pump Driver Control Module
4. Verify the DTC does not set.
 - **If the DTC is set**

Replace the component: K20 Engine Control Module
 - **Go to next step: If the DTC is not set**
5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P250A: ENGINE OIL LEVEL SWITCH CIRCUIT (WITH LTG)**Diagnostic Instructions**

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor**DTC P250A**

Engine Oil Level Switch Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Engine Oil Level Sensor Signal	2	P250A, 1	-
Engine Oil Level Sensor Ground	-	P250A, 1	-
1. DIC message Engine Oil Level Low always ON 2. DIC message Engine Oil Level Low always OFF			

Typical Scan Tool Data

Engine Oil Level Switch

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON Parameter Normal Range: OK			
Engine Oil Level Sensor/Switch Signal	OK	Low	OK
Engine Oil Level Sensor/Switch Ground	-	Low	-

Circuit/System Description

The engine oil level sensor/switch is normally-closed with proper engine oil level. The switch opens when the engine oil level drops below a calibrated level. The engine control module (ECM) monitors the engine oil level signal circuit when the ignition is ON, and the engine is OFF. With the switch in the closed position, the ECM detects a low voltage on the signal circuit. With the switch in the open position, the ECM detects a high voltage on the signal circuit. When high voltage is detected on the signal circuit, the ECM will send a serial data message to the instrument panel cluster (IPC). The IPC will then display a message on the driver information center (DIC) or illuminate a low engine oil level lamp.

The following information determines the message sent from the ECM to the IPC:

- The Low Engine Oil Level message lamp is displayed only after the ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.
- The Low Engine Oil Level message is turned OFF when the ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.

Action Taken When the DTC Sets

Engine Oil Level Low message activated.

Conditions for Clearing the DTC

The ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Indicator/Warning Message Description and Operation

Electrical Information Reference

- [Circuit Testing](#)

- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Verification

1. Verify proper engine oil level.
 - **If not at proper level**
Add oil as necessary.
 - **Go to next step: If at proper level**
2. Ignition ON, verify the scan tool Engine Oil Level parameter reads OK.
 - **If not OK**
Refer to Circuit/System Testing.
 - **Go to next step: If OK**
3. All OK.

Circuit/System Testing

NOTE: Verify proper engine oil level before continuing with diagnosis.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B35 Engine Oil Level Switch. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 1 and ground.
 - **If 5 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. 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.
 - **Go to next step: If less than 5 Ω**
3. Ignition ON.
4. Verify the scan tool Engine Oil Level Switch parameter reads Low.
 - **If the Engine Oil Level Switch parameter reads OK**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If the Engine Oil Level Switch parameter reads Low**

NOTE: If a short to voltage is found on the signal circuit, the fuse in the 3A jumper wire will open.

5. Install a 3A fused jumper wire between the signal circuit terminal 2 and the ground circuit terminal 1.
6. Verify the scan tool Engine Oil Level Switch parameter reads OK.
 - **If the Engine Oil Level Switch parameter reads Low**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 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
3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance on the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
- **Go to next step: If the Engine Oil Level Switch parameter reads OK**
7. Test or replace the B35 Engine Oil Level Switch.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

DTC P250A: ENGINE OIL LEVEL SWITCH CIRCUIT (WITH LH7)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P250A

Engine Oil Level Switch Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Engine Oil Level Sensor Signal	2	P250A, 1	-
Engine Oil Level Sensor Ground	-	P250A, 1	-
1. DIC message Engine Oil Level Low always ON 2. DIC message Engine Oil Level Low always OFF			

Typical Scan Tool Data

Engine Oil Level Switch

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON Parameter Normal Range: OK			
Engine Oil Level Sensor/Switch Signal	OK	Low	OK
Engine Oil Level Sensor/Switch Ground	-	Low	-

Circuit/System Description

The engine oil level sensor/switch is normally-closed with proper engine oil level. The switch opens when the engine oil level drops below a calibrated level. The engine control module (ECM) monitors the engine oil level signal circuit when the ignition is ON, and the engine is OFF. With the switch in the closed position, the ECM detects a low voltage on the signal circuit. With the switch in the open position, the ECM detects a high voltage on the signal circuit. When high voltage is detected on the signal circuit, the ECM will send a serial data message to the instrument panel cluster (IPC). The IPC will then display a message on the driver information center (DIC) or illuminate a low engine oil level lamp.

The following information determines the message sent from the ECM to the IPC:

- The Low Engine Oil Level message lamp is displayed only after the ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.
- The Low Engine Oil Level message is turned OFF when the ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.

Action Taken When the DTC Sets

Engine Oil Level Low message activated.

Conditions for Clearing the DTC

The ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Indicator/Warning Message Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Verification

1. Verify proper engine oil level.
 - **If not at proper level**
Add oil as necessary.
 - **Go to next step: If at proper level**
2. Ignition ON, verify the scan tool Engine Oil Level parameter reads OK.
 - **If not OK**

Refer to Circuit/System Testing.

- **Go to next step: If OK**

3. All OK.

Circuit/System Testing

NOTE: **Verify proper engine oil level before continuing with diagnosis.**

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B35 Engine Oil Level Switch. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 2 and ground.

- **If 5 Ω or greater**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
2. 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.

- **Go to next step: If less than 5 Ω**

3. Ignition ON.

4. Verify the scan tool Engine Oil Level Switch parameter reads Low.

- **If the Engine Oil Level Switch parameter reads OK**

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

- **Go to next step: If the Engine Oil Level Switch parameter reads Low**

NOTE: **If a short to voltage is found on the signal circuit, the fuse in the 3A jumper wire will open.**

5. Install a 3A fused jumper wire between the signal circuit terminal 1 and the ground circuit terminal 2.

6. Verify the scan tool Engine Oil Level Switch parameter reads OK.

- **If the Engine Oil Level Switch parameter reads Low**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
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
3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance on the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.

- **Go to next step: If the Engine Oil Level Switch parameter reads OK**

7. Test or replace the B35 Engine Oil Level Switch.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

DISPLAYS AND GAUGES COMPONENT REPLACEMENT REFERENCE

Component	Repair Instruction

Component	Repair Instruction
B9 Ambient Air Temperature Sensor	<u>Ambient Air Temperature Sensor Replacement</u>
B37 Engine Oil Pressure Sensor	{1.5L engine} <u>Engine Oil Pressure Sensor Replacement</u> {1.6L diesel engine} <u>Engine Oil Pressure Sensor Replacement (FWD)</u> , <u>Engine Oil Pressure Sensor Replacement (AWD)</u> {2.0L engine} <u>Engine Oil Pressure Sensor Replacement</u>
B46 Fuel Level Sensor	{1.5L engine} <u>Fuel Level Sensor Replacement (FWD)</u> , <u>Fuel Level Sensor Replacement (AWD)</u> {1.6L diesel engine} <u>Fuel Level Sensor Replacement (AWD)</u> , <u>Fuel Level Sensor Replacement (FWD)</u> {2.0L engine} <u>Fuel Level Sensor Replacement (AWD)</u> , <u>Fuel Level Sensor Replacement (FWD)</u>
P2 Transmission Shift Lever Position Indicator	{6T40 MNH/MNK or 6T45 MHG} <u>Automatic Transmission Control Indicator Replacement</u> {9T45 M3U or 9T50 M3D or M3H} <u>Transmission Control Replacement</u>
S39 Ignition Switch	<u>Ignition and Start Switch Replacement (Equinox)</u> , <u>Ignition and Start Switch Replacement (Terrain)</u>
Oil Pressure Diagnosis and Testing	{1.5L engine} <u>Oil Pressure Diagnosis and Testing</u> {1.6L diesel engine} <u>Oil Pressure Diagnosis and Testing</u> {2.0L engine} <u>Oil Pressure Diagnosis and Testing</u>

SYMPTOMS - DISPLAYS AND GAUGES

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

- Before using the symptom diagnostic tables, perform the [Diagnostic System Check - Vehicle](#) in order to determine that there are no DTCs set, and that the control modules can communicate via the serial data link.
- Review the system operation in order to understand the system functions. Refer to the following description and operations:
 - [Instrument Cluster Description and Operation](#)
 - [Indicator/Warning Message Description and Operation](#)
 - [Audible Warnings Description and Operation](#)

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](#).
- 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](#)

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

- [Fuel Gauge Malfunction \(FWD with gasoline engine\)](#)[Fuel Gauge Malfunction \(AWD with diesel engine\)](#)[Fuel Gauge Malfunction \(AWD with gasoline engine\)](#)[Fuel Gauge Malfunction \(FWD with diesel engine\)](#)
- [Engine Oil Pressure Gauge Inaccurate or Inoperative](#)
- [Outside Air Temperature Display Malfunction](#)
- [Instrument Cluster Programming Malfunction \(with UDD only\)](#)
- [Engine Oil Level Sensor Diagnosis \(with LTG\)](#)[Engine Oil Level Sensor Diagnosis \(with LH7\)](#)
- [Speedometer and/or Odometer Malfunction](#)
- [Tachometer Inaccurate or Inoperative \(with LTG or LYX\)](#)[Tachometer Inaccurate or Inoperative \(with LVL, LH7, or LWW\)](#)

CHIME MALFUNCTION

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

Circuit/System Description

A11 Radio - Chime - Warning

The serial data circuits are used to exchange information between the control modules.

Audible notifications that would normally be sounded over the radio speakers are transmitted by the chime alarm control module in case no radio is installed.

For an overview of the component/system, refer to: [Audible Warnings Description and Operation](#)

Reference Information

Schematic Reference

[Audible Warnings Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#)

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify the component activates: Radio SpeakerThe balance and fade controls can be used to help isolate an inoperative speaker or poor sound condition.

- **If the component does not activate**

Refer to: [Speaker Malfunction \(UQA with IO5/IO6\)](#), [Speaker Malfunction \(UZ6\)](#), [Speaker Malfunction \(without UQA/UZ6\)](#), [Speaker Malfunction \(UQA with IOS/IOT/IOU\)](#).

- **Go to next step: If all components operate**

3. B153D Seat Belt Buckle - Driver & B153P Seat Belt Buckle - Passenger - Buckled

Verify the scan tool parameter: Driver Seat Belt Status & Passenger Seat Belt Status=Buckled

- **If not the specified state**

Refer to: [Seat Belt Indicator Malfunction - Driver](#).

- **Go to next step: If the specified state**

4. Headlamp Switch - Off

5. Verify the scan tool parameter: Headlamps On Switch=Inactive

- **If not the specified state**

Refer to: [Headlamps Malfunction](#)

- **Go to next step: If the specified state**

6. Park Lamps Switch - Off

7. Verify the scan tool parameter: Park Lamps Switch=Inactive

- **If not the specified state**

Refer to: [Park, License, and/or Tail Lamps Malfunction](#)

- **Go to next step: If the specified state**

8. Turn Signal Switch - Off

9. Verify the scan tool parameter: Left Turn Signal Switch & Right Turn Signal Switch=Inactive

- **If not the specified state**

Refer to: [Park, License, and/or Tail Lamps Malfunction](#)

- **Go to next step: If the specified state**

10. Park Brake - Off

11. Verify the scan tool parameter: Park Brake Switch=Inactive

- **If not the specified state**

Refer to: [Park Brake System Diagnosis](#)

- **Go to next step: If the specified state**

12. Close the doors and verify that the luggage compartment is empty.

13. Verify the scan tool parameter: Driver Door Ajar Switch & Passenger Door Ajar Switch & Left Rear Door Ajar Switch & Right Rear Door Ajar Switch=Inactive

- **If not the specified state**

Refer to: [Door Ajar Indicator Malfunction](#)

- **Go to next step: If the specified state**

14. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- For control module replacement, programming, and setup refer to: [Control Module References](#)

ENGINE OIL PRESSURE GAUGE INACCURATE OR INOPERATIVE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0521

Engine Oil Pressure Sensor Performance

DTC P0522

Engine Oil Pressure Sensor Circuit Low Voltage

DTC P0523

Engine Oil Pressure Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0522	P0522 or 1	P0523	P0521 or 1
Signal	P0522	P0522 or 1	P0523	P0521 or 1
Low Reference	-	P0523 or 1	-	P0521 or 1
1. Low Engine Oil Pressure Indicator=Malfunction				

Circuit/System Description

For an overview of the component/system, refer to: [Instrument Cluster Description and Operation](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to ground.
Low Reference	Grounded through the control module.

Component	Description
B37B Engine Oil Pressure Sensor	The sensor is a 3-wire capacitive pressure transducer. Electronics in the sensor convert pressure into an analog voltage signal.
K20 Engine Control Module	The K20 control module monitors the B37B Engine Oil Pressure Sensor signal circuit. The control module input circuit has an internal resistance connected to ground.

Conditions for Running the DTC

Engine Running

Conditions for Setting the DTC

P0521

- Engine Oil Pressure=The actual value is not within a predetermined range of the calculated value.
 - For greater than 4 s

P0522

- Engine Oil Pressure Sensor Circuit=Less than 0.2 V - For greater than 10 s

P0523

- Engine Oil Pressure Sensor Circuit=Greater than 4.8 V - For greater than 10 s

Action Taken When the DTC Sets

- Type C DTC
- Low Engine Oil Pressure Indicator=On

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type C DTC

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify the scan tool parameter:Engine Oil Pressure Sensor = 0 kPa (0 PSI)
 - **If not the specified state**

Refer to: Circuit/System Testing
 - **Go to next step: If the specified state**
3. Verify the engine has the correct oil level and the correct oil pressure before continuing with this diagnostic.

Displays and Gauges Component Replacement Reference

4. Engine Running
5. Verify the scan tool parameter:Engine Oil Pressure Sensor = CH-48027 Digital Pressure Gauge
 - **If not the specified state**

Refer to: Circuit/System Testing
 - **Go to next step: If the specified state**

6. Verify the scan tool parameter:Engine Oil Pressure Sensor=Engine Oil Pressure - Gauge@P16 Instrument Cluster

- **If not the specified state**

Test or replace the component:P16 Instrument Cluster

- **Go to next step: If the specified state**

7. All OK.

Circuit/System Testing

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

1. Ignition/Vehicle & All vehicle systems - Off

2. Disconnect the electrical connector: B37B Engine Oil Pressure Sensor

3. Test for less than 10 ohms between the test points: Low Reference circuit terminal 2 & Ground

- **If 10 ohms or greater**

1. Disconnect the electrical connector: K20 Engine Control Module

2. Test for less than 2 ohms between the test points: Low Reference circuit terminal 2 @Component harness & The other end of the circuit

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component:K20 Engine Control Module

- **Go to next step: If less than 10 ohms**

4. Ignition - On / Vehicle - In Service Mode

5. Test for 4.8 to 5.2 V between the test points: 5 V Reference circuit terminal 3 & Low Reference circuit terminal 2

- **If less than 4.8 V**

1. Ignition/Vehicle - Off

2. Disconnect the electrical connector:K20 Engine Control Module

3. Test for infinite resistance between the test points: 5 V Reference circuit terminal 3 @ Component harness & Ground

- If less than infinite resistance - Repair the short to ground on the circuit.
- If infinite resistance

4. Test for less than 2 ohms between the test points: 5 V Reference circuit terminal 3 @ Component harness & The other end of the circuit

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component:K20 Engine Control Module

- **If greater than 5.2 V**

1. Ignition/Vehicle - Off

2. Disconnect the electrical connector:K20 Engine Control Module

3. Ignition - On / Vehicle - In Service Mode

4. Test for less than 1 V between the test points: 5 V Reference circuit terminal 3 @Component harness & Ground

- If 1 V or greater - Repair the short to voltage on the circuit.
- If less than 1 V - Replace the component:K20 Engine Control Module

- **Go to next step: If between 4.8 and 5.2 V**

6. Verify the scan tool parameter:Engine Oil Pressure Sensor = 0 kPa (0 PSI)

- **If greater than 0 kPa (0 PSI)**

1. Ignition/Vehicle - Off

2. Disconnect the electrical connector:K20 Engine Control Module

3. Ignition - On / Vehicle - In Service Mode

4. Test for less than 1 V between the test points:Signal circuit terminal 1 @Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 1 V - Replace the component:K20 Engine Control Module
- **Go to next step: If 0 kPa (0 PSI) or less**
7. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal 1 & 5 V Reference circuit terminal 3
8. Verify the scan tool parameter:Engine Oil Pressure Sensor =Greater than 800 kPa (116PSI)
 - **If 800 kPa (116 PSI) or less**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Test for infinite resistance between the test points:Signal circuit terminal 1 @Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 ohms between the test points:Signal circuit terminal 1 @Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If greater than 800 kPa (116 PSI)**
9. Test or replace the component:B37B Engine Oil Pressure Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- [Displays and Gauges Component Replacement Reference](#)
- For control module replacement, programming, and setup refer to: [Control Module References](#)

FUEL GAUGE MALFUNCTION (FWD WITH GASOLINE ENGINE)

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis:[Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

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 Signal	P0462	P0463	P0463	P0461, P2066, 1
Low Reference	-	P0463, P2068	P0463, P2068	-
1. Fuel Gauge=Malfunction				

Circuit/System Description

For an overview of the component/system, refer to: [Instrument Cluster Description and Operation](#)

Circuit	Description
Fuel Level Sensor Signal	The control module input circuit has an internal resistance connected to 5 V.
Low Reference	Grounded through the control module.

Component	Description
B46 Fuel Level Sensor	The resistance of the sensor changes with fluid level.
K20 Engine Control Module	The K20 Engine Control Module monitors the fuel level sensor. When the fuel tank is full, the resistances of the fuel level sensor is low and the control module 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 control module senses a high signal voltage. The K20 Engine Control Module converts the signal input to a fuel level value.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

P0461

Fuel Level Sensor SignalChange=Less than 3-10 L /0.8-2.6 Gallons US - Distance Traveled=Greater than 240-320 km (150-200 mi)

P0462

Fuel Level Sensor Signal=Less than 0.25V

The above condition(s) must occur for greater than 5 s.

P0463

Fuel Level Sensor Signal=Greater than 4.7 V

The above condition(s) must occur for greater than 30 s.

P0464

Fuel Level Sensor Signal=Change is greater than 10 %.

The above condition(s) must occur for greater than 30 s.

The diagnostic fails 2 out of 3 test cycles.

Action Taken When the DTC Sets

- DTCs listed in the DTC Descriptor Category=Type B DTC
- Fuel Gauge=Empty
- Low Fuel Indicator=On

Conditions for Clearing the DTC

- DTCs listed in the DTC Descriptor Category=Type B DTC
- The conditions for setting the DTC no longer exist.
- A history DTC will clear after 40 consecutive malfunction-free ignition cycles.

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Instrument Cluster Wiring Schematics

Connector End View Reference

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Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify the scan tool parameter:Fuel Level Sensor= 0.5 to 3.5 V and changes & Varies with changes in fuel level.
 - **If not between 0.5 and 3.5 V or does not change**

Refer to Circuit/System Testing.

- **Go to next step: If between 0.5 and 3.5 V and changes**
3. Perform the scan tool control function:Fuel Gauge Sweep

Verify the component activates:Fuel Gauge

- **If the component does not activate**

Test or replace the component:P16 Instrument Cluster

- **Go to next step: If the component activates**

4. All OK.

Circuit/System Testing

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector:A7 Fuel Pump and Level Sensor Assembly
3. Test for less than 10 ohms between the test points:Low Reference circuit terminal 6 & Ground
 - **If 10 ohms or greater**
 1. Disconnect the electrical connector:K20 Engine Control Module
 2. Test for less than 2 ohms between the test points:Low Reference circuit terminal@Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If less than 10 ohms**
4. Ignition - On / Vehicle - In Service Mode
5. Verify the scan tool parameter:Remaining Fuel in Tank=Less than 5 %
 - **If 5 % or greater**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Test for infinite resistance between the test points:Signal circuit terminal 5 @Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component:K20 Engine Control Module
 - **Go to next step: If less than 5 %**
6. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6
7. Verify the scan tool parameter:Remaining Fuel in Tank=If 90 % or greater
 - **If less than 90 %**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Ignition - On / Vehicle - In Service Mode
 4. Test for less than 1 V between the test points:Signal circuit@Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 1 V
 5. Ignition/Vehicle - Off
 6. Test for less than 2 ohms between the test points:Signal circuit@Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If 90 % or greater**
8. Test or replace the component:B46 Fuel Level Sensor

Component Testing

1. Ignition/Vehicle & All vehicle systems - Off
2. Remove the fuel level sensor.
3. Test for 245 to 255 ohms between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6 - Fuel Level Sensor - Empty
 - **If not between 245 and 255 ohms**

Replace the component:Fuel Level Sensor
 - **Go to next step: If between 245 and 255 ohms**

4. Test for 37 to 43 ohms between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6 - Fuel Level Sensor - Full
 - **If not between 37 and 43 ohms**

Replace the component:Fuel Level Sensor

 - **Go to next step: If between 37 and 43 ohms**
5. Perform a component sweep test:Fuel Level Sensor
6. Test for 37-43 to 245-255 ohms between the test points:Signal circuit terminal 5 & Low Reference circuit terminal 6
7. The value should not spike or drop out while moving the sensor through the entire range.
 - **If not between 37-43 and 245-255 ohms or spikes or drops out**

Replace the component:Fuel Level Sensor

 - **Go to next step: If between 37-43 and 245-255 ohms and there are no spikes or drops out**
8. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- [Displays and Gauges Component Replacement Reference](#)
- For control module replacement, programming, and setup refer to: [Control Module References](#)

FUEL GAUGE MALFUNCTION (AWD WITH DIESEL ENGINE)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 Circuit Intermittent

DTC P2066

Fuel Level Sensor 2 Performance

DTC P2067

Fuel Level Sensor 2 Circuit Low Voltage

DTC P2068

Fuel Level Sensor 2 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuel Level Sensor 1/Primary/Left Signal	P0462	P0463	P0463	P0461, 1
Fuel Level Sensor 2/Secondary/Right Signal	P2067	P2068	P2068	P2066, 1
Low Reference	-	P0463, P2068	P0463, P2068	P0461, P2066, 1
1. Fuel Gauge Malfunction				

Circuit/System Description

The fuel level sensor changes resistance based on fuel level and is wired to the Fuel Pump Driver Control Module. The Fuel Pump Driver Control Module sends the fuel level sensor reading to the Engine Control Module (ECM) via serial data. The ECM monitors the fuel level sensor signal in order to determine the fuel level. When the fuel tank is full, the resistances of both fuel level sensors are low. When the fuel tank is empty, the resistances of the fuel level sensors are high. The ECM uses the signal voltages of the primary fuel level sensor and the secondary fuel level sensor 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 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 or P2066

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 or P2067

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

P0463 or P2068

- 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, P0464, P2066, P2067 and P2068 are Type B DTCs
- The fuel gauge defaults to empty
- The low fuel indicator illuminates

Conditions for Clearing the DTC

- P0461, P0462, P0463, P0464, P2066, P2067 and P2068 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 Wiring Schematics

Connector End View Reference

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Description and Operation

Instrument Cluster Description and Operation

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- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.
 - **If the low fuel level indicator does not turn ON and OFF**
Replace the P16 Instrument Cluster
 - **Go to next step: If the low fuel level indicator turns ON and OFF**
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Primary Fuel Level Sensor Malfunction in Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
5. Verify the scan tool Fuel Level Sensor Right Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Secondary Fuel Level Sensor Malfunction in Circuit/System Testing

- **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**

6. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

Primary Fuel Level Sensor Malfunction

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 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
 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 K111 Fuel Pump Driver Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
 2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module.
 - **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.
6. Verify the scan tool Fuel Level Sensor Left Tank parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module, ignition ON.
 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
 3. Ignition OFF
 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 K111 Fuel Pump Driver Control Module.
 - **Go to next step: If less than 0.2 V**
7. Test or replace the B46 Primary Fuel Level Sensor.
8. Operate the vehicle within the Conditions for Running the DTC.
9. Verify the condition does not return.
 - **If the condition returns**

Replace the K20 Engine Control Module.
 - **Go to next step: If the condition does not return**
10. All OK.

Secondary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B46B Fuel Level Sensor - Secondary. 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 8 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
 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 K111 Fuel Pump Driver Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor Right Tank parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
 2. Test for infinite resistance between the signal circuit terminal 7 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module.
 - **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 7 and the low reference circuit terminal 8.
6. Verify the scan tool Fuel Level Sensor Right Tank parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module, ignition ON.
 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
 - 3. Ignition OFF
 - 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 K111 Fuel Pump Driver Control Module.
 - **Go to next step: If less than 0.2 V**
7. Test or replace the B46B Fuel Level Sensor - Secondary.
8. Operate the vehicle within the Conditions for Running the DTC.
9. Verify the condition does not return.
 - **If the condition returns**

Replace the K20 Engine Control Module.
 - **Go to next step: If the condition does not return**
10. All OK.

Component Testing

Primary Fuel Level Sensor

1. Ignition OFF, remove the Primary Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.

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 Primary Fuel Level Sensor.

- **Go to next step: If minimum resistance is 37-43 Ω , maximum resistance is 245-255 Ω , and if there are no spikes or dropouts**

4. All OK.

Secondary Fuel Level Sensor

1. Ignition OFF, remove the Secondary Fuel Level Sender.

2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 7 and the low reference terminal 8.

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 Secondary Fuel Level Sensor.

- **Go to next step: 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](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

FUEL GAUGE MALFUNCTION (AWD WITH GASOLINE ENGINE)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 Circuit Intermittent

DTC P2066

DTC P2067

Fuel Level Sensor 2 Circuit Low Voltage

DTC P2068

Fuel Level Sensor 2 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuel Level Sensor 1/Primary/Left Signal	P0462	P0463	P0463	P0461, 1
Fuel Level Sensor 2/Secondary/Right Signal	P2067	P2068	P2068	P2066, 1
Low Reference	-	P0463, P2068	P0463, P2068	P0461, P2066, 1
1. Fuel Gauge Malfunction				

Circuit/System Description

The primary fuel level sensor and the secondary fuel level sensor change resistance based on fuel level. The engine control module (ECM) monitors the signal circuits of both sensor to determine the fuel level. When the fuel tank is full, the resistances of both fuel level sensors are low. When the fuel tank is empty, the resistances of the fuel level sensors are high. The ECM uses the signal voltages of the primary fuel level sensor and the secondary fuel level sensor 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 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 or P2066**

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 or P2067

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

P0463 or P2068

- 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, P0464, P2066, P2067 and P2068 are Type B DTCs
- The fuel gauge defaults to empty
- The low fuel indicator illuminates

Conditions for Clearing the DTC

- P0461, P0462, P0463, P0464, P2066, P2067 and P2068 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

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Instrument Cluster Wiring Schematics

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.
 - **If the low fuel level indicator does not turn ON and OFF**
Replace the P16 Instrument Cluster
 - **Go to next step: If the low fuel level indicator turns ON and OFF**
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**

Refer to Primary Fuel Level Sensor Malfunction in Circuit/System Testing

- **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**

5. Verify the scan tool Fuel Level Sensor Right Tank parameter is between 0.5 - 3.5 V and varies with fuel level.

- **If not between 0.5 - 3.5 V or does not vary with fuel level**

Refer to Secondary Fuel Level Sensor Malfunction in Circuit/System Testing

- **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**

6. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

Primary Fuel Level Sensor Malfunction

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 6 and ground.

- **If 10 Ω or greater**

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

- **Go to next step: If less than 10 Ω**

3. Ignition ON.

4. Verify the scan tool Fuel Level Sensor Left Tank parameter is greater than 4.8 V.

- **If 4.8 V or less**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.

- **Go to next step: If greater than 4.8 V**

5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.

6. Verify the scan tool Fuel Level Sensor Left Tank parameter is less than 0.2 V.

- **If 0.2 V or greater**

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

3. Ignition OFF

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 K20 Engine Control Module.

- **Go to next step: If less than 0.2 V**

7. Test or replace the B46 Primary Fuel Level Sensor.

Secondary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B46B Fuel Level Sensor - Secondary. 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 8 and ground.

- **If 10 Ω or greater**

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

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.

- **Go to next step: If less than 10 Ω**

3. Ignition ON.

4. Verify the scan tool Fuel Level Sensor Right Tank parameter is greater than 4.8 V.

- **If 4.8 V or less**

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

2. Test for infinite resistance between the signal circuit terminal 7 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K20 Engine Control Module.

- **Go to next step: If greater than 4.8 V**

5. Install a 3 A fused jumper wire between the signal circuit terminal 7 and the low reference circuit terminal 8.

6. Verify the scan tool Fuel Level Sensor Right Tank parameter is less than 0.2 V.

- **If 0.2 V or greater**

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

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

3. Ignition OFF

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 K20 Engine Control Module.

- **Go to next step: If less than 0.2 V**

7. Test or replace the B46B Fuel Level Sensor - Secondary.

Component Testing

Primary Fuel Level Sensor

1. Ignition OFF, remove the Primary Fuel Level Sender.

2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.

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 Primary Fuel Level Sensor.

- **Go to next step: If minimum resistance is 37-43 Ω , maximum resistance is 245-255 Ω , and if there are no spikes or dropouts**

4. All OK.

Secondary Fuel Level Sensor

1. Ignition OFF, remove the Secondary Fuel Level Sender.

2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 7 and the low reference terminal 8.

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 Secondary Fuel Level Sensor.

- **Go to next step: 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](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

FUEL GAUGE MALFUNCTION (FWD WITH DIESEL ENGINE)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 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 Fuel Pump Driver Control Module monitors the signal circuit of the fuel level sensor and sends the signal information to the Engine Control Module (ECM) for all further handling. The ECM uses this value in order to determine the fuel level. When the fuel tank is full, the resistance 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 Fuel Pump Driver Control Module sends the fuel level percentage via High Speed CAN-Bus to the body control

module (BCM). The BCM then sends the fuel level percentage via Low Speed CAN-Bus to the instrument cluster in order to control the fuel gauge.

Conditions for Running the DTC

- Ignition ON/Vehicle in Service Mode
- Battery voltage is between 11 - 32 V

Conditions for Setting the DTC

P0461

- 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 ECM detects the signal voltage is less than 0.25 V.
- The above conditions must be met for 5 s.

P0463

- The ECM detects the signal voltage is greater than 4.7 V.
- The above conditions must be met for 5 s.

P0464

- The ECM detects the fuel level change is greater than 10% for a duration lasting less than 30 seconds.
- DTC P0464 runs and fails 2 out of 3 test cycles.

Action Taken When the DTC Sets

P0461, P0462, and P0463

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

P0464

- P0464 is a Type A DTC

Conditions for Clearing the DTC

- P0461, P0462, and P0463 are Type B DTCs
- P0464 is a Type A DTC

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.
 - **If the low fuel level indicator does not turn ON and OFF**
Replace the P16 Instrument Cluster
 - **Go to next step: If the low fuel level indicator turns ON and OFF**
4. Verify the ECM scan tool Fuel Level Sensor parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**
Refer to Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
5. All OK.

[Circuit/System Testing](#)

NOTE: **Circuit/System Verification must be performed before proceeding with 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 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
 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 K111 Fuel Pump Driver Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor parameter is greater than 4.8 V.
 - **If 4.8 V or less**

1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module.
- **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.
6. Verify the scan tool Fuel Level Sensor parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module, ignition ON.
 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
 3. Ignition OFF
 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 K111 Fuel Pump Driver Control Module.
 - **Go to next step: If less than 0.2 V**
7. Test or replace the B46 Primary Fuel Level Sensor.
8. Operate the vehicle within the Conditions for Running the DTC.
9. Verify the condition does not return.
 - **If the condition returns**

Replace the K20 Engine Control Module.
 - **Go to next step: If the condition does not return**
10. All OK.

Component Testing

1. Ignition OFF, remove the Primary Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.
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 Fuel Level Sensor.
 - **Go to next step: 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](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

INSTRUMENT CLUSTER PROGRAMMING MALFUNCTION (WITH UDD ONLY)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

Circuit/System Description

The X22 USB Drive Data Connector is connected to the Instrument Cluster via a USB cable. The X22 USB Drive Data Connector is only used for programming the Instrument Cluster via SPS programming.

Reference Information

Schematic Reference

[Instrument Cluster Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

[Instrument Cluster Description and Operation](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

EL-50334-50 GM Infotainment Tester Kit

Circuit/System Testing

NOTE: This procedure should only be completed when the Instrument Cluster fails to read the USB thumb drive during a USB programming event.

1. Verify the USB cable is properly connected and there is no damage to the cable or connections.
 - **If connection problems or cable damage is noted.**
Perform the appropriate repair or replacement to correct any issues.
 - **Go to next step: If no connection problems or cable damage is noted.**
2. Connect the EL-50334-50 to the X22 USB Drive Data Connector and the Instrument Cluster connector X2.
3. Ignition ON.
4. Verify the Instrument Cluster completes USB Programming properly following SPS instructions..
 - **If Instrument Cluster does not program properly**
 1. Replace the X22 USB Drive Data Connector.
 2. Verify the Instrument Cluster completes USB Programming properly following SPS instructions.
 - **If Instrument Cluster does not operate properly**

Replace the P16 Instrument Cluster.

- **Go to next step: If Instrument Cluster programs properly**

All OK

- **Go to next step: If Instrument Cluster programs properly**

5. Replace the USB harness.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup.

ENGINE OIL LEVEL SENSOR DIAGNOSIS (WITH LTG)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P250A

Engine Oil Level Switch Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Engine Oil Level Sensor Signal	2	P250A, 1	-
Engine Oil Level Sensor Ground	-	P250A, 1	-
1. DIC message Engine Oil Level Low always ON 2. DIC message Engine Oil Level Low always OFF			

Typical Scan Tool Data

Engine Oil Level Switch

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON Parameter Normal Range: OK			
Engine Oil Level Sensor/Switch Signal	OK	Low	OK
Engine Oil Level Sensor/Switch Ground	-	Low	-

Circuit/System Description

The engine oil level sensor/switch is normally-closed with proper engine oil level. The switch opens when the engine oil level drops below a calibrated level. The engine control module (ECM) monitors the engine oil level signal circuit when the ignition is ON, and the engine is OFF. With the switch in the closed position, the ECM detects a low voltage on the signal circuit. With the switch in the open position, the ECM detects a high voltage on the signal circuit. When high voltage is detected on the signal circuit, the ECM will send a serial data message to the instrument panel cluster (IPC). The IPC will then display a message on the driver information center (DIC) or illuminate a low engine oil level lamp.

The following information determines the message sent from the ECM to the IPC:

- The Low Engine Oil Level message lamp is displayed only after the ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.

- The Low Engine Oil Level message is turned OFF when the ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.

Action Taken When the DTC Sets

Engine Oil Level Low message activated.

Conditions for Clearing the DTC

The ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Indicator/Warning Message Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Verification

1. Verify proper engine oil level.
 - **If not at proper level**
Add oil as necessary.
 - **Go to next step: If at proper level**
2. Ignition ON, verify the scan tool Engine Oil Level parameter reads OK.
 - **If not OK**
Refer to Circuit/System Testing.
 - **Go to next step: If OK**
3. All OK.

NOTE: Verify proper engine oil level before continuing with diagnosis.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B35 Engine Oil Level Switch. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 1 and ground.
 - **If 5 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. 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.
 - **Go to next step: If less than 5 Ω**
3. Ignition ON.
4. Verify the scan tool Engine Oil Level Switch parameter reads Low.
 - **If the Engine Oil Level Switch parameter reads OK**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If the Engine Oil Level Switch parameter reads Low**

NOTE: If a short to voltage is found on the signal circuit, the fuse in the 3A jumper wire will open.

5. Install a 3A fused jumper wire between the signal circuit terminal 2 and the ground circuit terminal 1.
6. Verify the scan tool Engine Oil Level Switch parameter reads OK.
 - **If the Engine Oil Level Switch parameter reads Low**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 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
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance on the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If the Engine Oil Level Switch parameter reads OK**
7. Test or replace the B35 Engine Oil Level Switch.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

ENGINE OIL LEVEL SENSOR DIAGNOSIS (WITH LH7)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P250A

Engine Oil Level Switch Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Engine Oil Level Sensor Signal	2	P250A, 1	-
Engine Oil Level Sensor Ground	-	P250A, 1	-
1. DIC message Engine Oil Level Low always ON 2. DIC message Engine Oil Level Low always OFF			

Typical Scan Tool Data

Engine Oil Level Switch

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON Parameter Normal Range: OK			
Engine Oil Level Sensor/Switch Signal	OK	Low	OK
Engine Oil Level Sensor/Switch Ground	-	Low	-

Circuit/System Description

The engine oil level sensor/switch is normally-closed with proper engine oil level. The switch opens when the engine oil level drops below a calibrated level. The engine control module (ECM) monitors the engine oil level signal circuit when the ignition is ON, and the engine is OFF. With the switch in the closed position, the ECM detects a low voltage on the signal circuit. With the switch in the open position, the ECM detects a high voltage on the signal circuit. When high voltage is detected on the signal circuit, the ECM will send a serial data message to the instrument panel cluster (IPC). The IPC will then display a message on the driver information center (DIC) or illuminate a low engine oil level lamp.

The following information determines the message sent from the ECM to the IPC:

- The Low Engine Oil Level message lamp is displayed only after the ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.
- The Low Engine Oil Level message is turned OFF when the ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The ECM detects a high voltage on the signal circuit for three consecutive ignition cycles, followed by an ignition OFF event from 15 minutes to greater than 50 minutes, depending on engine oil temperatures.

Action Taken When the DTC Sets

Engine Oil Level Low message activated.

Conditions for Clearing the DTC

The ECM detects a low voltage on the signal circuit after an ignition OFF event for greater than 90 seconds, followed by an ignition ON event for less than 1 second.

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Indicator/Warning Message Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Verify proper engine oil level.
 - **If not at proper level**
Add oil as necessary.
 - **Go to next step: If at proper level**
2. Ignition ON, verify the scan tool Engine Oil Level parameter reads OK.
 - **If not OK**
Refer to Circuit/System Testing.
 - **Go to next step: If OK**
3. All OK.

Circuit/System Testing

NOTE: **Verify proper engine oil level before continuing with diagnosis.**

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B35 Engine Oil Level Switch. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 2 and ground.
 - **If 5 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. 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.
 - **Go to next step: If less than 5 Ω**
3. Ignition ON.
4. Verify the scan tool Engine Oil Level Switch parameter reads Low.
 - **If the Engine Oil Level Switch parameter reads OK**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 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.
- **Go to next step: If the Engine Oil Level Switch parameter reads Low**

NOTE: If a short to voltage is found on the signal circuit, the fuse in the 3A jumper wire will open.

5. Install a 3A fused jumper wire between the signal circuit terminal 1 and the ground circuit terminal 2.
6. Verify the scan tool Engine Oil Level Switch parameter reads OK.
 - **If the Engine Oil Level Switch parameter reads Low**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 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
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance on the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If the Engine Oil Level Switch parameter reads OK**
7. Test or replace the B35 Engine Oil Level Switch.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming, and setup

OUTSIDE AIR TEMPERATURE DISPLAY MALFUNCTION

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0071

Ambient Air Temperature Sensor Performance

DTC P0072

Ambient Air Temperature Sensor Circuit Low Voltage

DTC P0073

Ambient Air Temperature Sensor Circuit High Voltage

DTC P0074

Ambient Air Temperature Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0072	P0073	P0073	P0071 or P0074
Low Reference	-	P0073	-	P0071

Circuit/System Description

The ambient air temperature sensor is located behind the grille. The engine control module (ECM) monitors the ambient air temperature sensor utilizing a low reference circuit and signal circuit. The ECM monitors the voltage drop across the sensor, which is inversely proportional to temperature. When the ambient air temperature is cold, the resistance of the sensor is high. When the ambient air temperature is warm, the resistance of the sensor is low. The ECM converts the voltage value to a temperature value. The ECM also sends the temperature value to other control modules via serial data.

Conditions for Running the DTC

- Ignition ON/Vehicle in Service Mode
- The 12 V battery voltage is greater than or equal to 10.2 V.

Conditions for Setting the DTC

P0071

During the first 20 s of run time after the 1 hour soaking period, the difference between the outside air temperature and the engine intake air temperature is greater than 30Â°C(86Â°F).

P0072

The ECM detects the sensor signal is more than 88Â°C (190Â°F).

P0073

The ECM detects the sensor signal is less than -40Â°C (-40Â°F).

P0074

The ECM detects an unrealistic signal variance.

Action Taken When the DTC Sets

- DTC P0071 - P0074 are type B DTCs.
- The DIC will display SERVICE A/C SYSTEM.
- The system operates using a default value.

Conditions for Clearing the DTC

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

Diagnostic Aids

Following a Ambient Air Temperature Sensor disconnect or circuit fault, the temperature displayed in the vehicle can take several ignition cycles to update to the current temperature. Driving the vehicle may also be necessary.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON/Vehicle in Service Mode.
2. Verify the scan tool ECM Ambient Air Temperature parameter is between -40°C (-40°F) and $+88^{\circ}\text{C}$ ($+190^{\circ}\text{F}$) and changes with air temperature changes.
 - **If not between -40°C (-40°F) and $+88^{\circ}\text{C}$ ($+190^{\circ}\text{F}$) or changes with air temperature changes**

Refer to Circuit/System Testing.
 - **Go to next step: If between -40°C (-40°F) and $+88^{\circ}\text{C}$ ($+190^{\circ}\text{F}$) and changes with air temperature changes**
3. Perform the ECM Ambient Air Temperature Calculation Reset special function with the scan tool
4. Verify the scan tool Ambient Air Temperature parameter is within five degrees of actual ambient air temperature.
 - **If not within five degrees of actual ambient air temperature**

Refer to Circuit/System Testing.
 - **Go to next step: If within five degrees of actual ambient air temperature**
5. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF/Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than $10\ \Omega$ between the low reference circuit terminal B (or 2) and ground.
 - **If $10\ \Omega$ or greater**
 1. Ignition OFF/Vehicle OFF, disconnect the harness connectors at the K20 Engine Control Module.
 2. Test for less than $2\ \Omega$ in the low reference circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.
 - **Go to next step: If less than $10\ \Omega$**
3. Ignition ON/Vehicle in Service Mode.
4. Verify the scan tool Ambient Air Temperature parameter is less than -39°C (-38°F).

- **If -39Â°C (-38Â°F) or greater**
- 1. Ignition OFF/Vehicle OFF, disconnect the harness connectors at the K20 Engine Control Module.
- 2. Test for infinite resistance between the signal circuit terminal A (or 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.
- **Go to next step: If less than -39Â°C (-38Â°F)**
- 5. Install a 3 A fused jumper wire between the signal circuit terminal A (or 1) and the low reference circuit terminal B (or 2).
- 6. Verify the scan tool Ambient Air Temperature parameter is greater than 88Â°C (190Â°F).
 - **If 88Â°C (190Â°F) or less**
 - 1. Ignition OFF/Vehicle OFF, remove the jumper wire and disconnect the harness connectors at the K20 Engine Control Module, ignition ON.
 - 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
 - 3. Ignition OFF/Vehicle OFF.
 - 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 K20 Engine Control Module.
 - **Go to next step: If warmer than 88Â°C (190Â°F)**
- 7. Test or replace the B9 Ambient Air Temperature Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup

SPEEDOMETER AND/OR ODOMETER MALFUNCTION

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) 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 itself. 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

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON/Vehicle in Service Mode.
2. Verify no DTC is set.
 - **If any DTC is set**

Diagnose DTCs first. Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If no DTCs are set**
3. If applicable, verify the speedometer sweeps from low to high position when performing the Instrument Cluster Gauge Sweep with the scan tool.
 - **If speedometer does not sweep**

Replace the P16 Instrument Cluster.
 - **Go to next step: If speedometer sweeps properly**
4. Verify the speedometer gauge value matches the scan tool Vehicle Speed parameter while driving the vehicle.
 - **If the values do not match**

Replace the P16 Instrument Cluster.
 - **Go to next step: 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.
 - **Go to next step: If speedometer sweeps and displays the correct value, and the odometer display counts up**
6. All OK.

Circuit/System Testing

NOTE:

- Circuit/System Verification must be performed before proceeding with Circuit/System Testing.
- If there are multiple modules not original to the vehicle and they are used or incorrectly configured service parts, SPS may not be able to properly read or recover the vehicle odometer value. Follow government rules and documentation (including vehicle identification) regarding inaccurate/unknown odometer values.

Correcting VIN mismatch: Instrument Cluster is Showing "----" (Dashes), odometer is still unlocked

1. Ignition ON/Vehicle in Service Mode.
2. Verify the scan tool Odometer Status parameter is Unlocked.
 - **If the reading is Locked**

Refer to correcting VIN mismatch - odometer locked.
 - **Go to next step: If the reading is Unlocked**
3. 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.
 - **Go to next step: If the VIN matches**
4. Verify the scan tool Instrument Cluster Vehicle Identification Number (VIN) parameter matches the vehicle's VIN placard.
 - **If the VIN does not match**

Reprogram the instrument cluster. Then proceed with step 4.
 - **Go to next step: If the VIN matches**
5. Verify the instrument cluster is displaying the correct value.
 - **If the instrument cluster is still displaying "----" (dashes)**

Replace the P16 Instrument Cluster.
 - **Go to next step: If the instrument cluster is displaying the correct value**
6. All OK.

Correcting VIN mismatch: Instrument Cluster is Showing "----" (Dashes), odometer is locked

1. Ignition ON/Vehicle in Service Mode.
2. Verify the scan tool Odometer Status parameter is Locked.
 - **If the reading is Unlocked**

Refer to Correcting VIN mismatch - odometer unlocked.
 - **Go to next step: If the reading is Locked**
3. Verify the scan tool Instrument Cluster Vehicle Identification Number (VIN) parameter matches the vehicle's VIN placard.
 - **If the VIN does not match**

Reprogram the Instrument Cluster. Then proceed with step 3.
 - **Go to next step: If the VIN matches**
4. Perform the BCM setup procedure in SPS.
5. Verify the instrument cluster is displaying the correct value.
 - **If the instrument cluster is still displaying "----" (dashes)**

Replace the P16 Instrument Cluster.

- **Go to next step: If instrument cluster is displaying the correct value**

6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for instrument cluster, BCM or ECM replacement, programming, and setup.

TACHOMETER INACCURATE OR INOPERATIVE (WITH LTG OR LYX)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

DTC B06EE

Engine Speed Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discrete wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the fuel level gauge does not sweep**

Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.
 - **If tachometer display does not match the Engine Speed parameter**

Perform Circuit/System Testing.
 - **Go to next step: If tachometer display matches the Engine Speed parameter**
4. All OK.

Circuit/System Testing

NOTE: **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.
2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.
 - **If less than 9 volts**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between the signal circuit terminal 42 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
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 A11 Radio.
- **If greater than 11 volts**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 42 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the A11 Radio.
 - **Go to next step: If 9 - 11 volts**
 3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for the control module replacement, programming, and setup

TACHOMETER INACCURATE OR INOPERATIVE (WITH LVL, LH7, OR LWW)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0654

Engine Speed Output Circuit

DTC P06ED

Engine Speed Output Circuit Low Voltage

DTC B06EE

Engine Speed Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Engine Speed Signal	P06ED	1	P0654	P06EE
1. Tachometer Inaccurate or Inoperative				

Circuit/System Description

The engine control module (ECM) creates the engine speed signal by pulsing the engine speed signal circuit to ground at a rate of 2 pulses per engine revolution. The Instrument Cluster converts the 2 pulses per engine revolution signal to a tachometer position indicating the engine speed. The engine speed is sent to the Instrument Cluster over a discreet wire from the ECM. The tachometer signal is pulled up to B+ in the IPC. The ECM monitors the voltage at the engine speed signal circuit to determine when the voltage is out of the normal operating range.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 9 - 18 volts.

Conditions for Setting the DTC

- The ECM detects that the commanded state of the driver and the actual state of the signal circuit do not match.
- The above condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The ECM records the operating conditions at the time the diagnostic fails. The ECM displays the failure information in the Failure Records on the scan tool.

Conditions for Clearing the DTC

- 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

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Instrument Cluster Wiring Schematics

Connector End View Reference

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- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the tachometer sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.
 - **If the tachometer does not sweep**
Replace the P16 Instrument Cluster
 - **Go to next step: If the tachometer sweeps**
3. Engine running, verify the tachometer display matches the scan tool Engine Speed parameter in the ECM Engine Data List.
 - **If tachometer display does not match the Engine Speed parameter**
Perform Circuit/System Testing.
 - **Go to next step: If tachometer display matches the Engine Speed parameter**
4. All OK.

NOTE: Circuit/System Verification must be performed before proceeding with Circuit/System Testing.

1. Ignition OFF, disconnect the X1 harness connector at the A11 Radio.
2. Ignition ON, test for 9 - 11 volts between the engine speed signal circuit terminal 23 and ground.
 - **If less than 9 volts**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 44 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 A11 Radio.
 - **If greater than 11 volts**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 44 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the A11 Radio.
 - **Go to next step: If 9 - 11 volts**
3. Test or replace the K20 Engine Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[Control Module References](#) for the control module replacement, programming, and setup

REPAIR INSTRUCTIONS

AMBIENT AIR TEMPERATURE CALCULATION RESET (WITH AMBIENT AIR TEMPERATURE SENSOR WIRED TO ECM)

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

This procedure resets the control module learned values of the component/system: B9 Ambient Air Temperature SensorHardwired : K20 Engine Control Module

When to Perform the Procedure

NOTE: Failure to perform this procedure may result in poor system performance, DTCs being set, or customer dissatisfaction.

Perform this procedure when the following component has been serviced: B9 Ambient Air Temperature Sensor or K20 Engine Control Module or Battery - Replaced

Conditions for Running the Procedure

Engine=Off

Ignition=Run/Crank

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition - On / Vehicle - In Service Mode
2. Select:Module Diagnostics
3. Select:Engine Control Module
4. Select:Configuration/Reset Functions
5. Select:Reset Functions
6. Select:Ambient Air Temperature Calculation Reset
7. Follow the instructions on the scan tool.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

AMBIENT AIR TEMPERATURE SENSOR REPLACEMENT

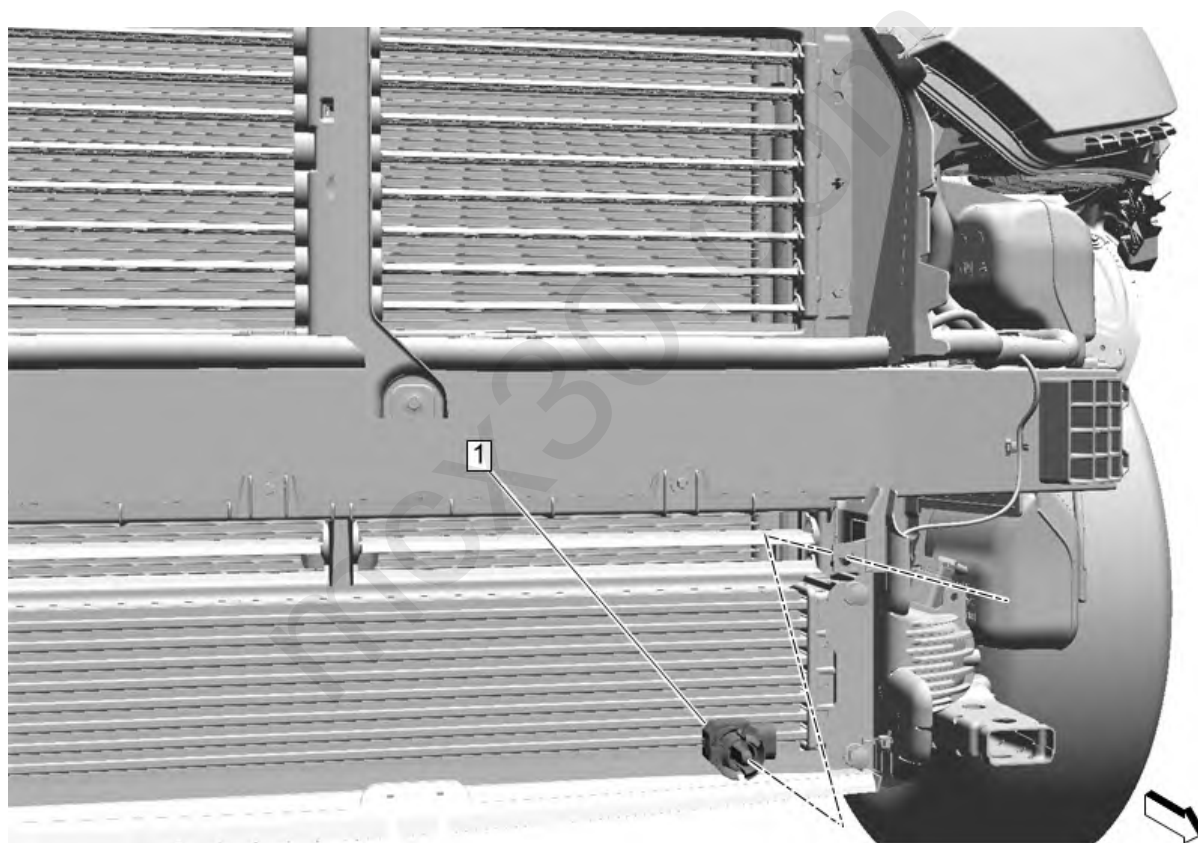


Fig. 7: Ambient Air Temperature Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
<u>Front Bumper Fascia Replacement (Equinox) Front Bumper Fascia Replacement (Terrain)</u>	
1	Ambient Air Temperature Sensor
	Procedure 1. Squeeze the tabs on the ambient air temperature sensor, and push ambient air temperature sensor back out of the radiator lower air baffle. 2. Disconnect the electrical connector.

Removal Procedure

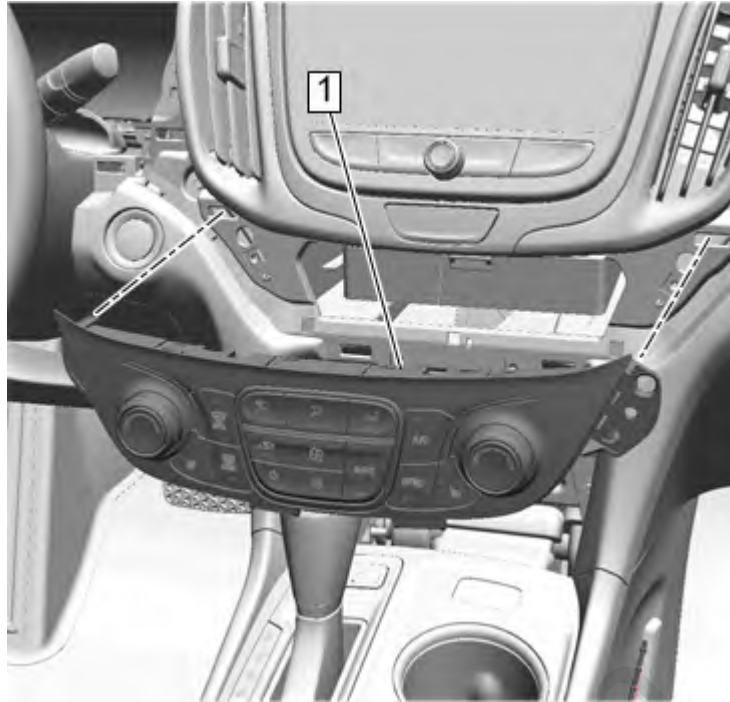


Fig. 8: Heater And Air Conditioning User Interface Control

Courtesy of GENERAL MOTORS COMPANY

1. Remove Heater and Air Conditioning User Interface Control (1) - [Heater and Air Conditioning User Interface Control Replacement \(Equinox\)](#).

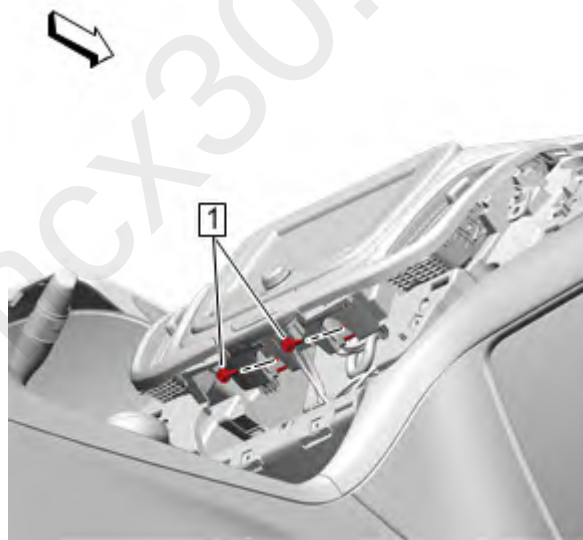


Fig. 9: Radio Control Bracket Bolt

Courtesy of GENERAL MOTORS COMPANY

2. Remove Radio Control Bracket Bolt (1)

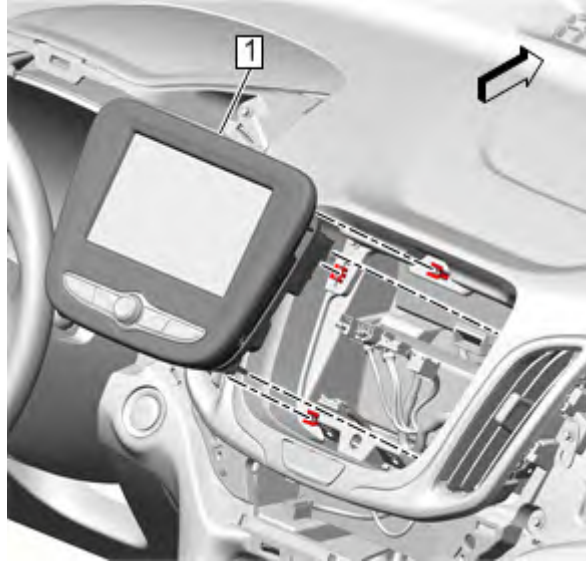


Fig. 10: Radio Control Assembly
Courtesy of GENERAL MOTORS COMPANY

3. Remove Radio Control Assembly (1)
4. Use a plastic trim tool if necessary.
5. Disconnect all electrical connectors.

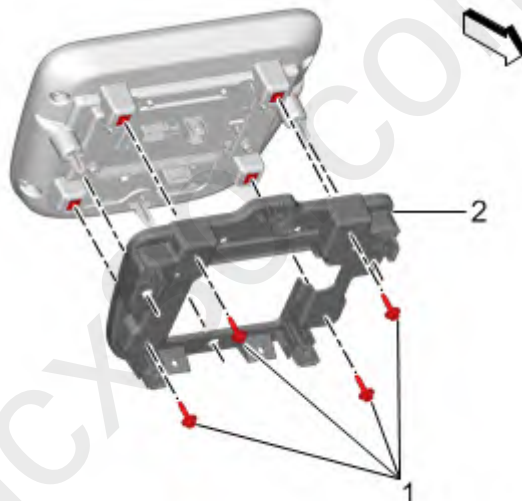


Fig. 11: Radio Control Bracket And Bolt
Courtesy of GENERAL MOTORS COMPANY

6. Remove Radio Control Bracket Bolt (1)
7. Remove Radio Control Bracket (2)

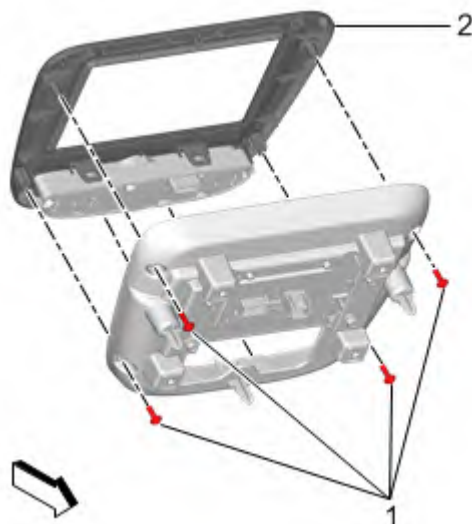


Fig. 12: Instrument Panel Radio Front Trim Plate And Panel Upper Compartment Bolt
Courtesy of GENERAL MOTORS COMPANY

8. Remove Instrument Panel Upper Compartment Bolt (1)
9. Release the retaining tabs.
10. Remove Instrument Panel Radio Front Trim Plate (2)

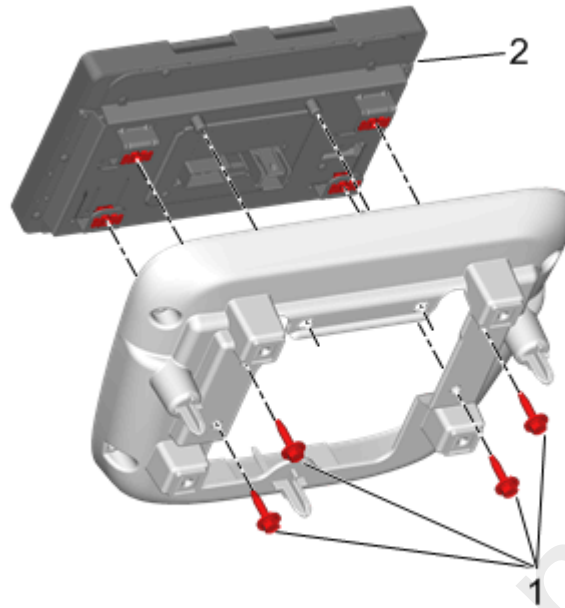


Fig. 13: Install Driver Information Display
Courtesy of GENERAL MOTORS COMPANY

11. Remove Radio Control Bolt (1)
12. Remove Driver Information Display (2)

Installation Procedure

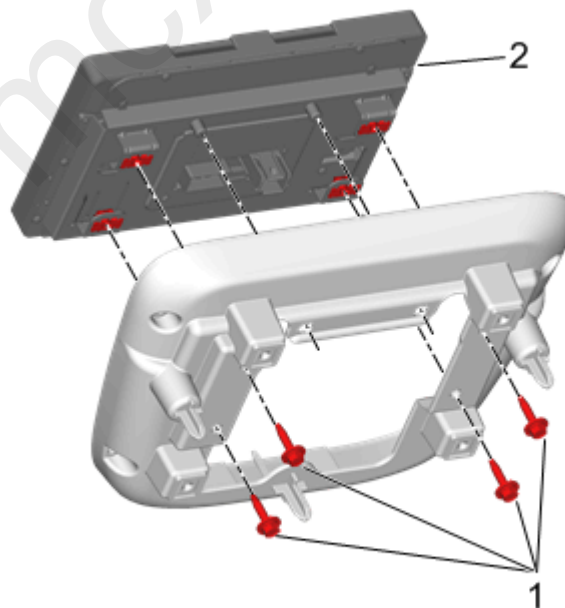


Fig. 14: Install Driver Information Display
Courtesy of GENERAL MOTORS COMPANY

1. Install Driver Information Display (2)

CAUTION: Refer to **Fastener Caution** .

2. Install Radio Control Bolt (1) and tighten [4x] 2.5 N.m (22 lb in)

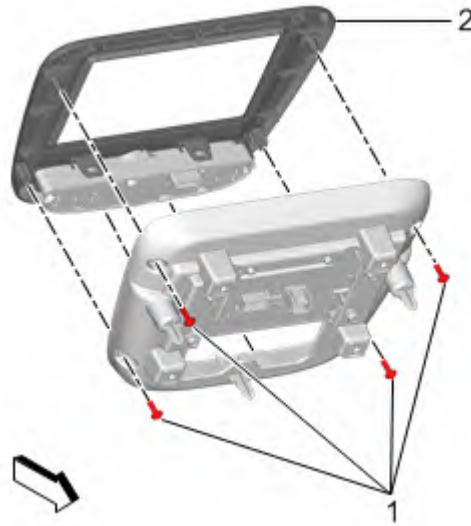


Fig. 15: Instrument Panel Radio Front Trim Plate And Panel Upper Compartment Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Install Instrument Panel Radio Front Trim Plate (2)

4. Instrument Panel Upper Compartment Bolt (1) and tighten [4x] 1N.m (9 lb in)

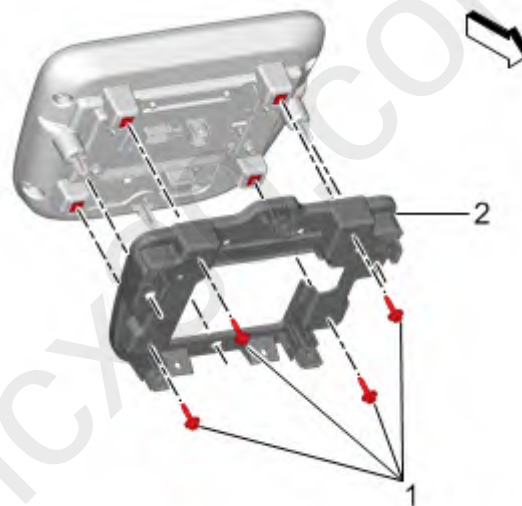


Fig. 16: Radio Control Bracket And Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Install Radio Control Bracket (2)

6. Install Radio Control Bracket Bolt (1) and tighten {4x} 2.5 N.m (22 lb in)

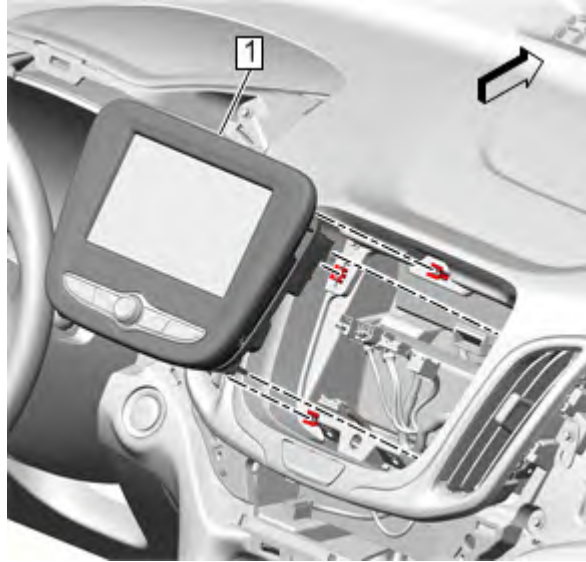


Fig. 17: Radio Control Assembly
Courtesy of GENERAL MOTORS COMPANY

7. Connect the electrical connectors.
8. Install Radio Control Assembly (1)



Fig. 18: Radio Control Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

9. Install Radio Control Bracket Bolt (1) and tighten [2x] 2.5 N.m (22 lb in)



Fig. 19: Heater And Air Conditioning User Interface Control

Courtesy of GENERAL MOTORS COMPANY

10. Install Heater and Air Conditioning User Interface Control (1) **Heater and Air Conditioning User Interface Control Replacement (Equinox)**

DRIVER INFORMATION DISPLAY REPLACEMENT (TERRAIN)

Removal Procedure

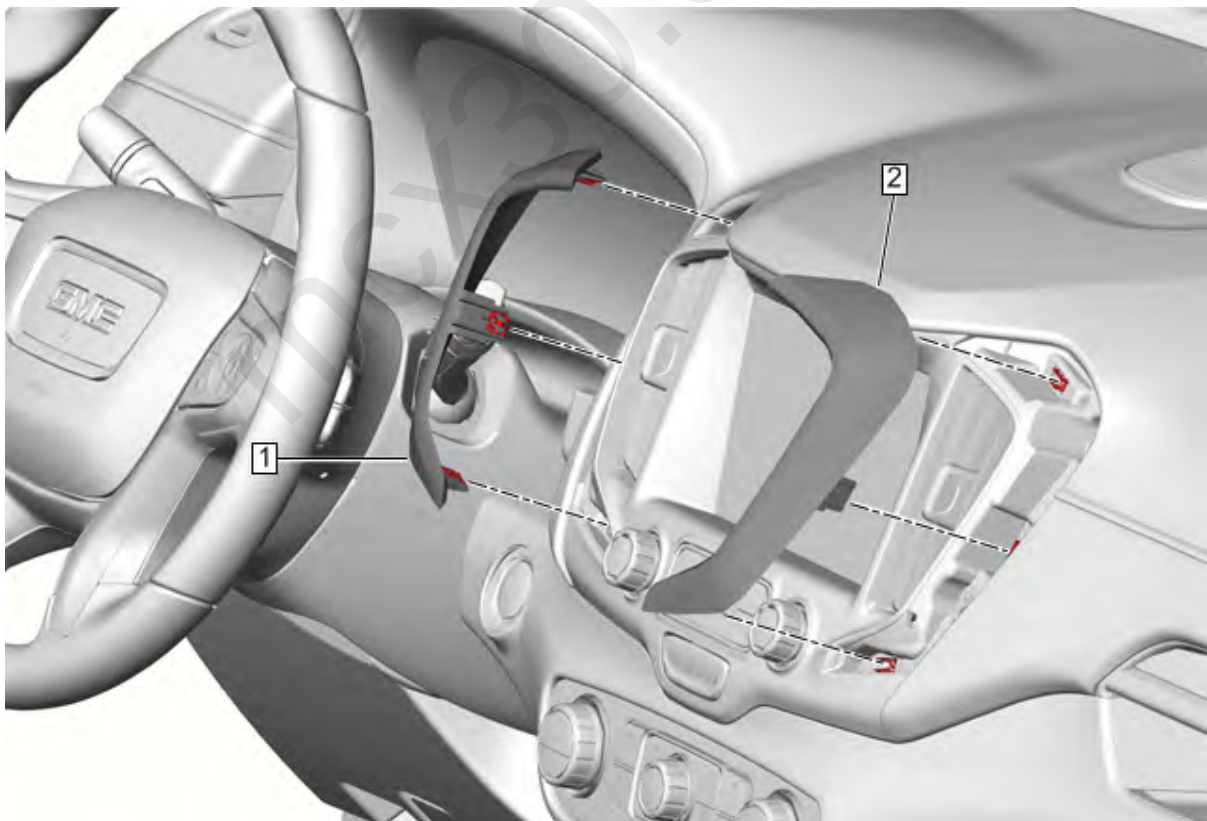


Fig. 20: Instrument Panel Center Trim Plate Applique

Courtesy of GENERAL MOTORS COMPANY

1. Remove Instrument Panel Center Trim Plate Applique (1, 2) **Instrument Panel Center Trim Plate Applique Replacement (Terrain)**

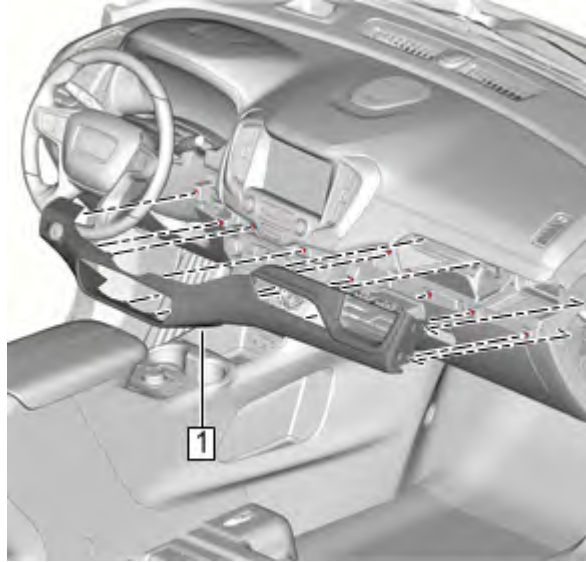


Fig. 21: Instrument Panel Trim Pad - Right Side
 Courtesy of GENERAL MOTORS COMPANY

2. Remove Instrument Panel Trim Pad - Right Side (1) **Instrument Panel Trim Pad Replacement - Right Side (Terrain)**

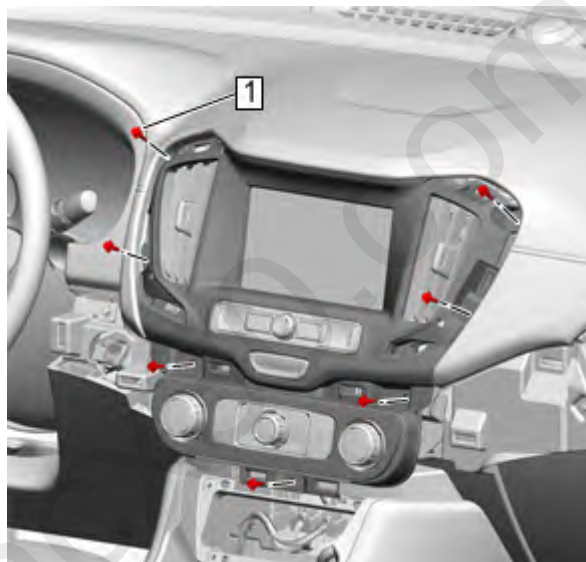


Fig. 22: Radio Control Bolt
 Courtesy of GENERAL MOTORS COMPANY

3. Remove Radio Control Bolt (1)

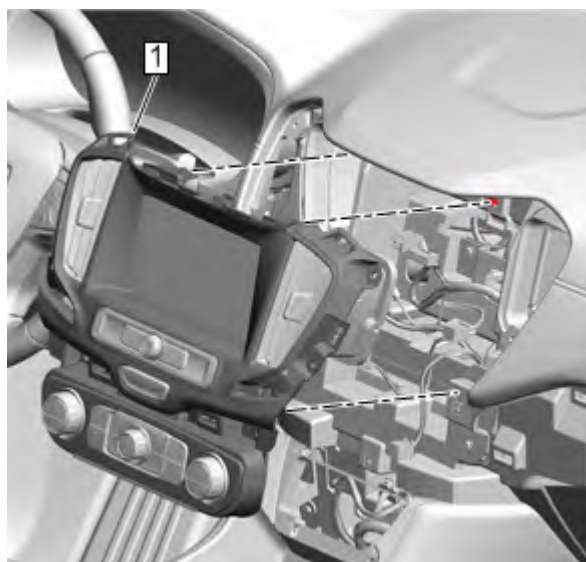


Fig. 23: Instrument Panel Radio Front And Rear Trim Plate Assembly
 Courtesy of GENERAL MOTORS COMPANY

NOTE:

The instrument panel radio front and rear trim plate, driver information display, heater and air conditioning user interface control, and instrument panel center air outlets comes off as one unit.

4. Remove Instrument Panel Radio Front and Rear Trim Plate Assembly (1)
5. Use a plastic trim tool if necessary.
6. Disconnect the electrical connectors.

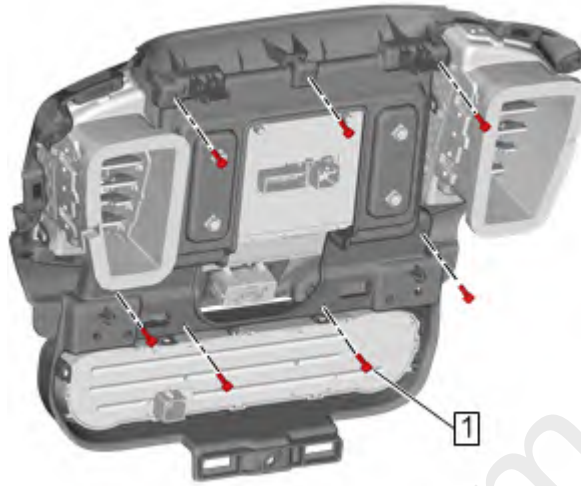


Fig. 24: Radio Control Bolt

Courtesy of GENERAL MOTORS COMPANY

7. Remove Radio Control Bolt (1)

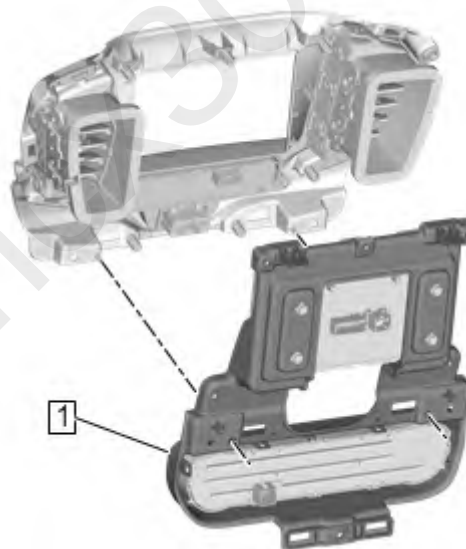


Fig. 25: Instrument Panel Radio Rear Trim Plate

Courtesy of GENERAL MOTORS COMPANY

8. Remove Instrument Panel Radio Rear Trim Plate (1)

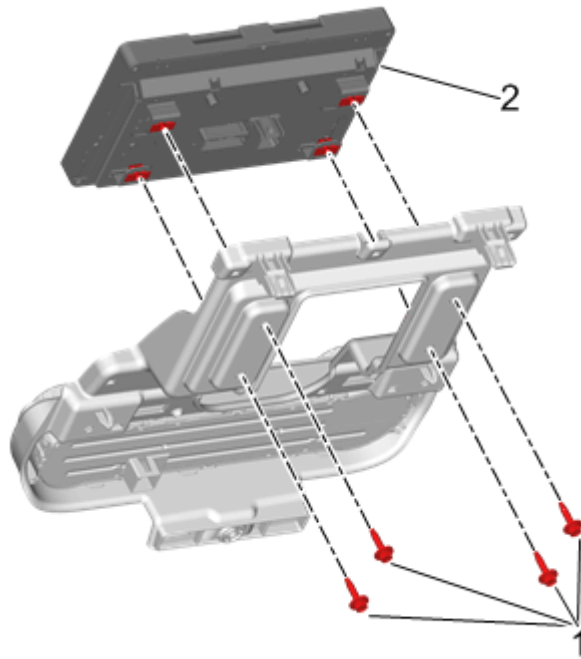


Fig. 26: Driver Information Display

Courtesy of GENERAL MOTORS COMPANY

9. Remove Radio Control Bolt (1)
10. Remove Driver Information Display (2)

Installation Procedure

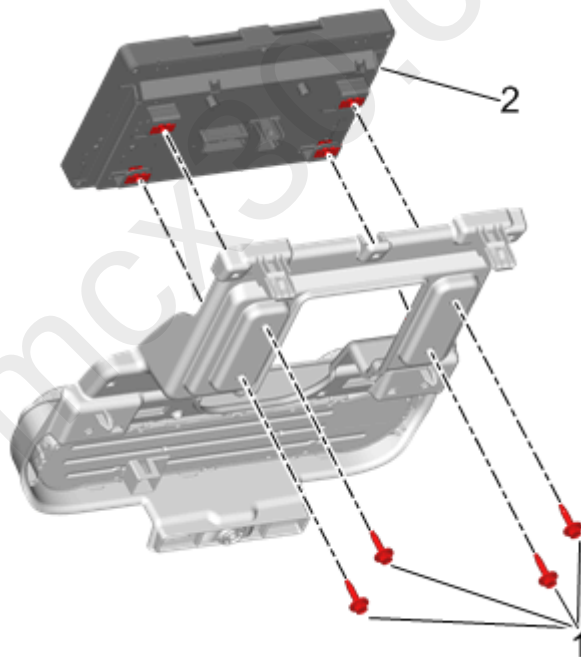


Fig. 27: Driver Information Display

Courtesy of GENERAL MOTORS COMPANY

1. Install Driver Information Display (2)

CAUTION: Fastener Caution

2. Install Radio Control Bolt (1) and tighten [4x] 2.5 N.m (22 lb in)

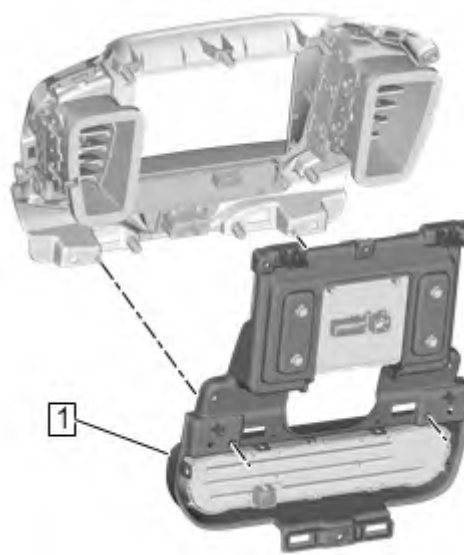


Fig. 28: Instrument Panel Radio Rear Trim Plate
 Courtesy of GENERAL MOTORS COMPANY

3. Install Instrument Panel Radio Rear Trim Plate (1)

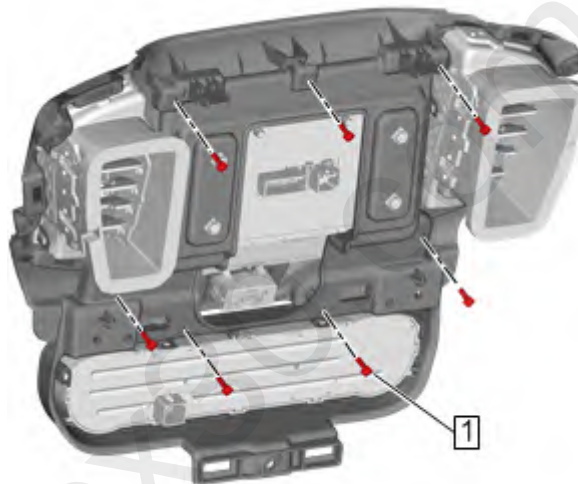


Fig. 29: Radio Control Bolt
 Courtesy of GENERAL MOTORS COMPANY

4. Install Radio Control Bolt (1) and tighten [7x] 2.5 N.m (22 lb in)

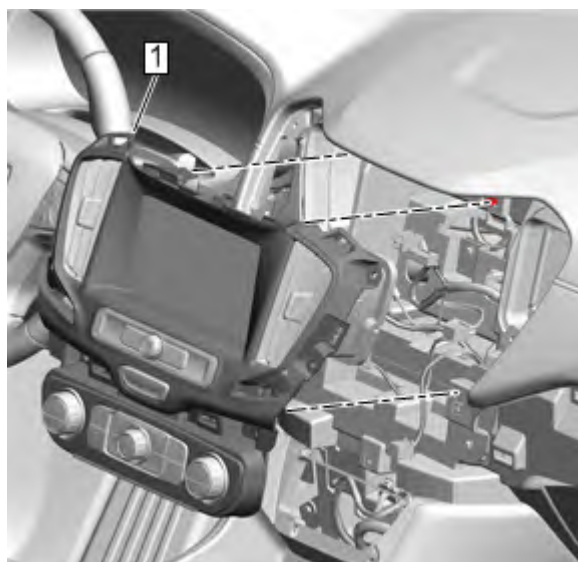


Fig. 30: Instrument Panel Radio Front And Rear Trim Plate Assembly
 Courtesy of GENERAL MOTORS COMPANY

5. Connect the electrical connectors.

6. Install Instrument Panel Radio Front And Rear Trim Plate Assembly (1)



Fig. 31: Radio Control Bolt

Courtesy of GENERAL MOTORS COMPANY

7. Install Radio Control Bolt (1) and tighten [7x] 2.5 N.m (22 lb in)

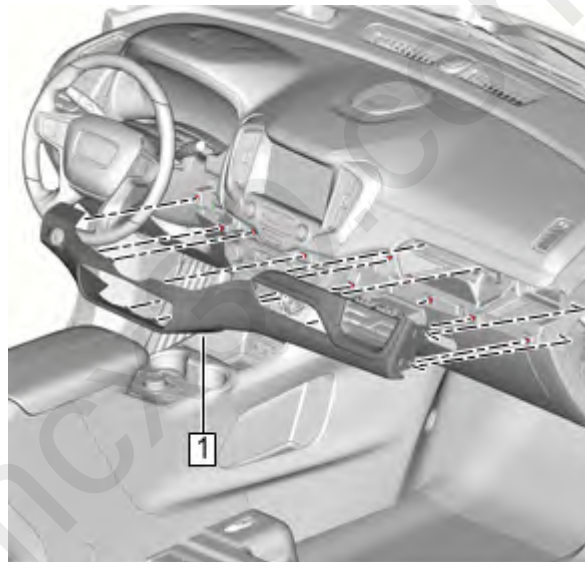


Fig. 32: Instrument Panel Trim Pad - Right Side

Courtesy of GENERAL MOTORS COMPANY

8. Install Instrument Panel Trim Pad - Right Side (2) - **Instrument Panel Trim Pad Replacement - Right Side (Terrain)**

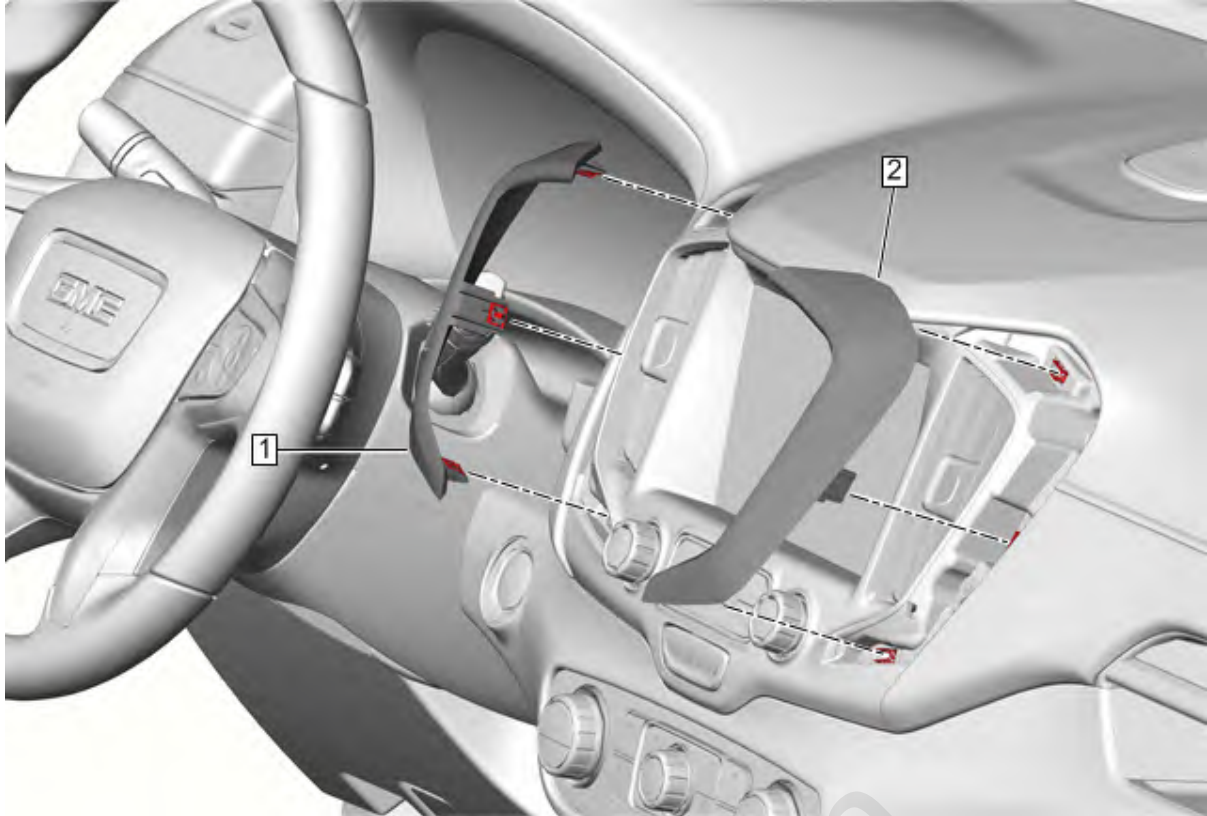


Fig. 33: Instrument Panel Center Trim Plate Applique
 Courtesy of GENERAL MOTORS COMPANY

9. Install Instrument Panel Center Trim Plate Applique (1, 2) **Instrument Panel Center Trim Plate Applique Replacement (Terrain).**

INSTRUMENT CLUSTER REPLACEMENT (EQUINOX)

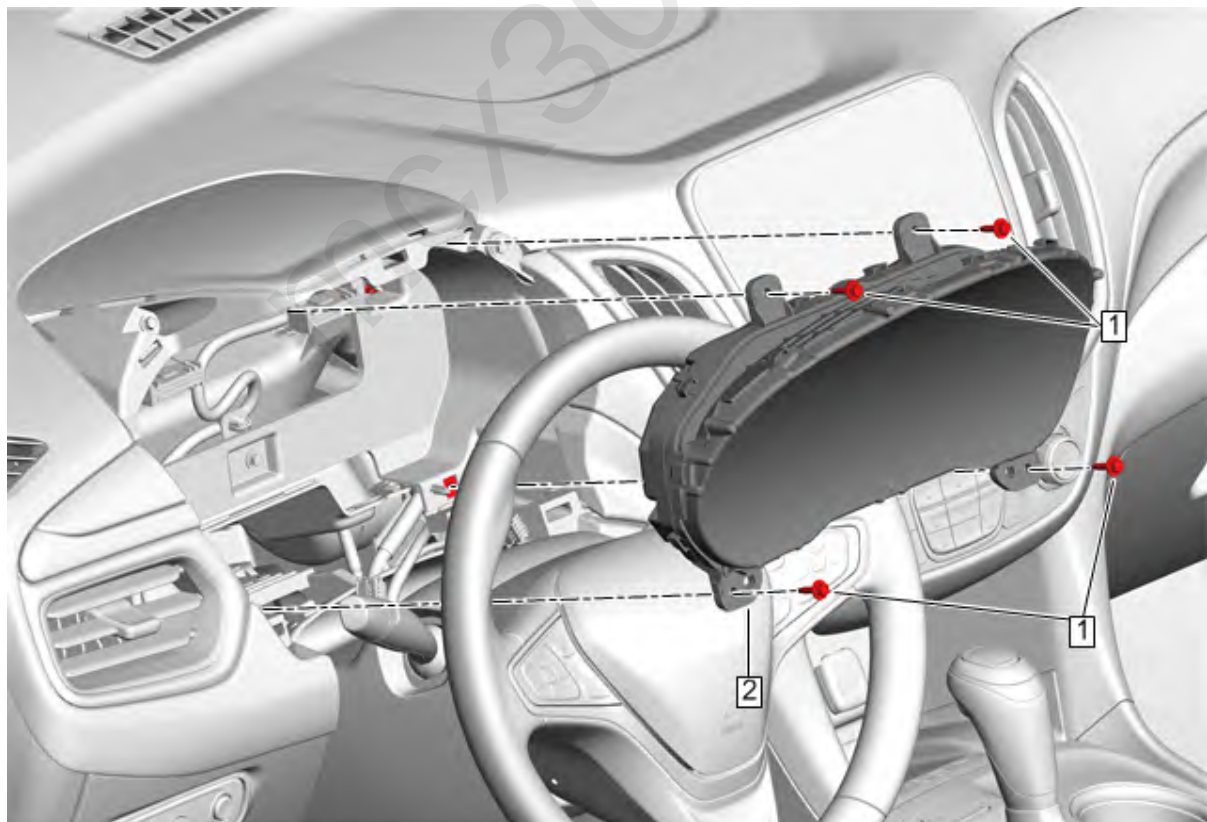


Fig. 34: Instrument Cluster (Equinox)
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
<u>Instrument Panel Cluster Trim Plate Replacement (Equinox).</u>	

Callout	Component Name
1	Instrument Cluster Bolt [4x] CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)
2	Instrument Cluster Procedure 1. Disconnect the electrical connector. 2. Perform the necessary programming and setup procedure: Control Module References

INSTRUMENT CLUSTER REPLACEMENT (TERRAIN)

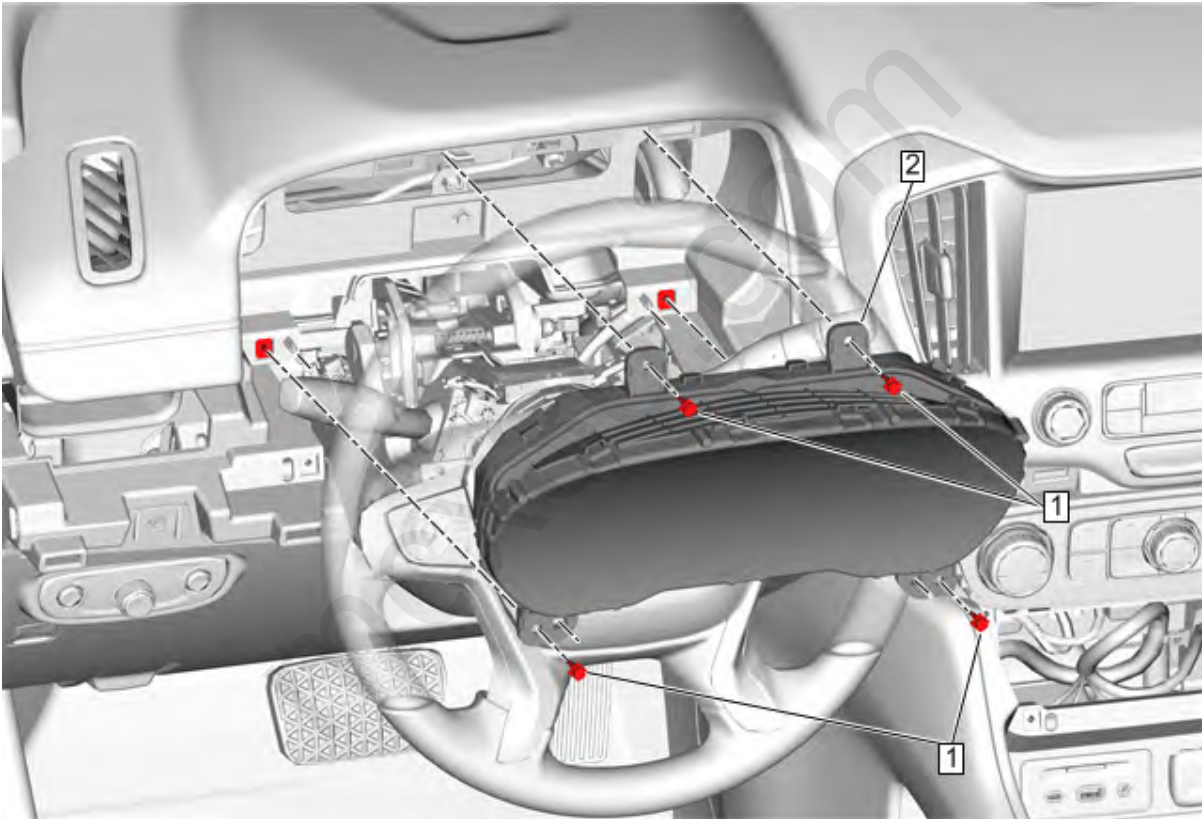


Fig. 35: Instrument Cluster (Terrain).
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Instrument Panel Cluster Trim Plate Replacement (Terrain)	
1	Instrument Cluster Bolt [4x] CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)

Callout	Component Name
2	Instrument Cluster Procedure 1. Disconnect the electrical connector. 2. Perform the necessary programming and setup procedure: Control Module References

DESCRIPTION AND OPERATION

AUDIBLE WARNINGS DESCRIPTION AND OPERATION

The audible warnings alert the driver of a system concern or a critical vehicle condition. If equipped with an serial data communicating audio amplifier, the audio amplifier generates the audible warnings through the speakers. If not equipped with an audio amplifier, the radio generates the audible warnings through the speakers. The radio or audio amplifier receives audible warning requests via serial data. If the radio or audio amplifier receives multiple audible warning requests, the warning with the highest priority sounds first. Different audible warnings may sound with a different frequency or a different chime pattern, depending on the system or module making the request. The chime volume may be selectable through vehicle personalization.

Audible Warnings or Chimes

The following is a list of common audible warnings or chimes. For additional chimes or complete system description, refer to the appropriate system's Description and Operation or the vehicle owner's manual.

- Driver Seat Belt Reminder - If the vehicle is started and the seat belt is unbuckled, the BCM requests the radio or audio amplifier sound a chime to indicated that the belt is unbuckled. This is accompanied by a flashing driver seat belt indicator on the instrument cluster. If the belt remains unbuckled, the chime cycle may continue multiple times if the vehicle is driven and the indicator will remain on solid.
- Passenger Seat Belt Reminder - If the passenger presence system determines that their is an occupant in the passenger seat and the vehicle is started with the passenger seat belt unbuckled, the BCM requests the radio or audio amplifier sound a chime to indicated that the belt is unbuckled. This is accompanied by a flashing passenger seat belt indicator. If the belt remains unbuckled, the chime cycle may continue multiple times if the vehicle is driven and the indicator will remain on solid. If an object is placed on the passenger seat, the passenger presence system may interpret this as a passenger occupying the seat. Because the passenger seat belt is unbuckled, the passenger seat belt reminder chime will sound. To correct this, remove the object from the passenger seat.
- Exterior Lamps On Warning - If the exterior lamps are left on after the ignition is turned off and the driver door is opened, the BCM will request the radio or audio amplifier sound a chime as an indicator that the exterior lamps are on.
- Electric Parking Brake (if equipped) - If the electric parking brake switch is pressed while the vehicle is in motion, the parking brake control module will request the radio or audio amplifier sound a chime. To release the parking brake, the brake pedal must be pressed when the electric parking brake switch is pressed. If the brake pedal is not pressed, the parking brake control module will request the radio or audio amplifier sound a chime. A message will also appear on the driver information center.
- Delayed Locking - If the keyless entry transmitter is not in the vehicle and the door lock switch is pressed with the driver door open, the BCM will request the radio or audio amplifier sound a chime three times to indicate that the vehicle has entered a delayed locking state. The doors will automatically lock five seconds after the last door is closed.
- Object Detection - The object detection system sends various chime requests to the radio or audio amplifier during normal operation.

Additional Warnings

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

- Turn Signal Indicators - The radio or audio amplifier activates the audible warning as requested by the BCM.
- Vehicle Overspeed Message - The radio or audio amplifier activates the audible warning as requested by the BCM.
- Fuel Level Low Message - The radio or audio amplifier activates the audible warning as requested by the BCM.
- Oil Pressure Indicator - The radio or audio amplifier activates the audible warning as requested by the BCM.
- Tire Pressure Low Indicator - The radio or audio amplifier activates the audible warning as requested by the BCM.
- Antilock Brake Indicator - The radio or audio amplifier activates the audible warning as requested by the electronic brake control module.
- Engine Cooling System Messages - The radio or audio amplifier activates the audible warning as requested by the engine control module.
- Transmission Messages - The radio or audio amplifier activates the audible warning as requested by the transmission control module.

Backup Alarm (with 8S3)

When transmission placed in reverse, the Body Control Module (BCM) activates the KR61 Trailer Backup Lamps Relay which supplies 12V to the reverse lamps and the Backup Alarm simultaneously.

DRIVER INFORMATION CENTER (DIC) DESCRIPTION AND OPERATION

The driver information center is located in the lower middle portion of the instrument cluster, between the speedometer and the tachometer. The driver information center displays information about the vehicle and allows the operator to access applications. It also displays warning messages if a system problem is detected.

The driver information center is made up of three zones. The left zone is a list of the applications that can be displayed. The right zone contains choices to customize what information is displayed for the respective application chosen. In the middle is the interactive application display zone. The application display zone allows access to the navigation application, audio application, phone application, or settings applications. The information display zone contains multiple pages that display vehicle information. The compass and PRNDL are displayed at all times in the lower portion of the display zone.

The driver information center can also be configured with several different themes. Changing the theme is accomplished using the infotainment system faceplate settings page. The chosen theme is used for both the faceplate and the driver information center displays.

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.

CHANGE TIMING BELT MESSAGE

The Instrument Cluster monitors the odometer mileage to determine when timing belt (if equipped) replacement may be necessary. After the vehicle has accumulated approximately 100,000 miles (160,000 kilometers), the Instrument Cluster may display the CHANGE TIMING BELT message. After the engine timing belt has been replaced, reset the CHANGE TIMING BELT message by locating and removing the fuses that supply power to the Instrument Cluster for two minutes.

BRAKES OVERHEATED

The Electronic Brake Control Module monitors brake usage and compares it to an internal thermal model to determine if the brakes could become overheated. If the Electronic Brake Control Module determines the brakes pads have exceeded a desirable temperature based on the thermal model, it sends a serial data message to the Instrument Cluster to display the BRAKES OVERHEATED message. The message remains displayed until the estimated temperature returns to a desirable range.

Transmission Shift Lever Position Indicator

The Transmission Shift Lever Position Indicator (if equipped) is located on the center console and indicates the current transmission shift lever position. The Transmission Shift Lever Position Indicator receives power and ground and is controlled by the Body Control Module (BCM) via serial data. The Transmission Control Module determines transmission shift lever position based on signals from the Transmission Internal Mode Switch and sends the shift lever position information to the BCM via serial data.

INSTRUMENT CLUSTER DESCRIPTION AND OPERATION

Instrument Cluster (with RPO UDC)

The instrument cluster is a multifunction module that provides the vehicle operator with information that is critical to vehicle operation, such as vehicle speed, engine RPM, oil pressure, battery voltage, fuel level, and coolant temperature, using analog gauges. The instrument cluster also provides the operator with operational warnings and message through various indicators and the driver information center. The driver information center is a one color multifunction display that is located in the instrument cluster. The driver information center has several screens that can be scrolled through by twisting the trip reset stem.

Instrument Cluster (with RPO UDD)

The instrument cluster is a multifunction module that provides the vehicle operator with information that is critical to vehicle operation, such as vehicle speed, engine RPM, oil pressure, battery voltage, fuel level, and coolant temperature, using analog gauges. The instrument cluster also provides the operator with operational warnings and message through various indicators and the driver information center. The driver information center is a full color multifunction display that is located in the instrument cluster. The driver information center is also tightly integrated with the vehicle's infotainment system and is highly reconfigurable.

Instrument Cluster (with RPO UHS)

The instrument cluster is a multifunction module that provides the vehicle operator with information such as vehicle speed and engine RPM using analog gauges. Oil pressure, battery voltage, fuel level, and coolant temperature can also be displayed using an interactive LCD display. The instrument cluster is highly reconfigurable, with four different themes available for selection. The instrument cluster also provides the operator with operational warnings and message through various indicators and the driver information center. Because the instrument cluster is an LCD display, driver information center elements are located in various zones of the display, depending on how the instrument panel is configured.

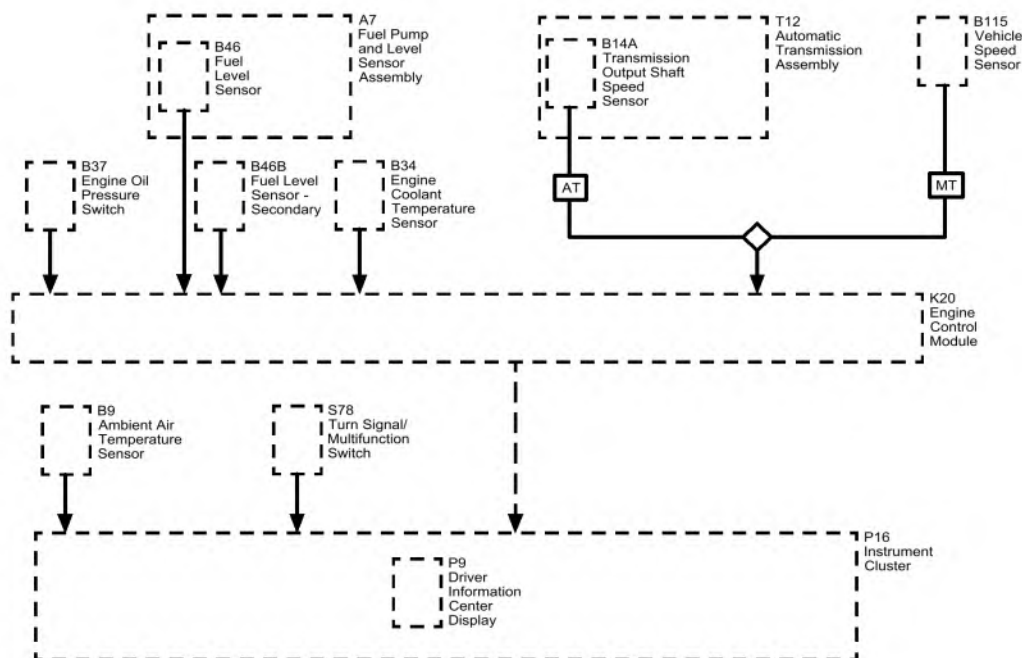


Fig. 36: Displays and Gauges Block Diagram
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
AT	Automatic Transmission
MT	Manual Transmission
P16	P16 Instrument Cluster
P9	P9 Driver Information Center Display
S78	S78 Turn Signal/Multifunction Switch
B9	B9 Ambient Air Temperature Sensor
B14A	B14A Transmission Output Shaft Speed Sensor
T12	T12 Automatic Transmission Assembly
B115	B115 Vehicle Speed Sensor
K20	K20 Engine Control Module
B46	B46 Fuel Level Sensor
A7	A7 Fuel Pump and Level Sensor Assembly
B37	B37 Engine Oil Pressure Switch
B46B	B46B Fuel Level Sensor - Secondary
B34	B34 Engine Coolant Temperature Sensor

Indicators and Warning Messages

Refer to [Indicator/Warning Message Description and Operation](#).

Engine Coolant Temperature Gauge (if equipped)

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 serial data to the body control module (BCM). The BCM then sends the information via a serial data to the instrument cluster to display the engine coolant temperature.

Engine Oil Pressure Gauge (if equipped)

The IPC displays the engine oil pressure as determined by the ECM. The engine oil pressure sensor changes voltage based on the engine oil pressure. The engine oil pressure sensor is a 3-wire sensor comprising of the signal circuit, the low reference circuit and the 5 V reference circuit. The ECM

supplies 5 V to the engine oil pressure sensor via the 5 V reference circuit and provides ground via the low reference circuit. The ECM monitors the signal circuit of the engine oil pressure sensor to determine if the engine oil pressure sensor voltage is within the normal operating range of approximately 1 - 4 V. When the engine oil pressure is high, the engine oil pressure sensor voltage is high and the ECM senses a high signal voltage. When the engine oil pressure is low, the engine oil pressure sensor voltage is low and the ECM senses a low signal voltage. The ECM sends the engine oil pressure information to the instrument cluster via serial data. The instrument cluster will illuminate or display the engine oil pressure indicator when the engine oil pressure is low. The engine oil pressure gauge defaults to 0 kPa (0 psi) if:

- The ECM detects a malfunction in the engine oil pressure sensor signal circuit.
- The IPC detects a loss of serial data communication with the ECM.

Fuel Level Gauge

The K20 Engine Control Module monitors the fuel level sensor. When the fuel tank is full, the resistances of the fuel level sensor is low and the control module 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 control module senses a high signal voltage. The K20 Engine Control Module converts the signal input to a fuel level value. The ECM sends the fuel level signal via serial data to the BCM. The BCM then sends the information via serial data to the instrument cluster to display the fuel level.

The instrument cluster displays the fuel level based on the information from the ECM. If the fuel level falls under 11% the instrument cluster will illuminate 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 serial data to the BCM. The BCM then sends the vehicle speed information via serial data to the instrument cluster to display the vehicle speed.

Odometer

The instrument cluster displays the vehicle odometer in the driver information center. The ECM send a distance rolling count message via serial data 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. The instrument cluster does not calculate the odometer.

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.

Tachometer

The instrument cluster displays the engine speed based on the information from the ECM. The ECM converts the data from the crankshaft position sensor to an engine revolution signal. The ECM sends the engine speed information via serial data to the BCM. The BCM then sends the information via serial data to the instrument cluster to display the engine speed.

Compass (with UE1)

If equipped with this option, the vehicle compass information is gathered through the Telematics Communication Interface Control Module. The Telematics Communication Interface Control Module determines vehicle direction and communicates this with the BCM through serial data. The BCM sends the compass information to the Instrument Cluster via serial data, where it is displayed.

If equipped with this option, the vehicle compass information is gathered through the Compass Module. The Compass Module determines vehicle direction and communicates this with the BCM through serial data. The BCM sends the compass information to the instrument cluster via serial data, where it is displayed.

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 or ECM. 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.

Driver Information Center Display

The driver information center is located in the lower middle portion of the instrument cluster, between the speedometer and the tachometer. The driver information center displays information about the vehicle and allows the operator to access applications. It also displays warning messages if a system problem is detected.

The driver information center is made up of three zones. The left zone is a list of the applications that can be displayed. The right zone contains choices to customize what information is displayed for the respective application chosen. In the middle is the interactive application display zone. The application display zone allows access to the navigation application, audio application, phone application, or settings applications. The information display zone contains multiple pages that display vehicle information. The compass and PRNDL are displayed at all times in the lower portion of the display zone.

The driver information center can also be configured with several different themes. Changing the theme is accomplished using the infotainment system faceplate settings page. The chosen theme is used for both the faceplate and the driver information center displays.
