

2017 ACCESSORIES & EQUIPMENT

Displays and Gauges - Impala

SCHEMATIC WIRING DIAGRAMS

INSTRUMENT CLUSTER WIRING SCHEMATICS

Instrument Cluster Power, Ground, and Serial Data

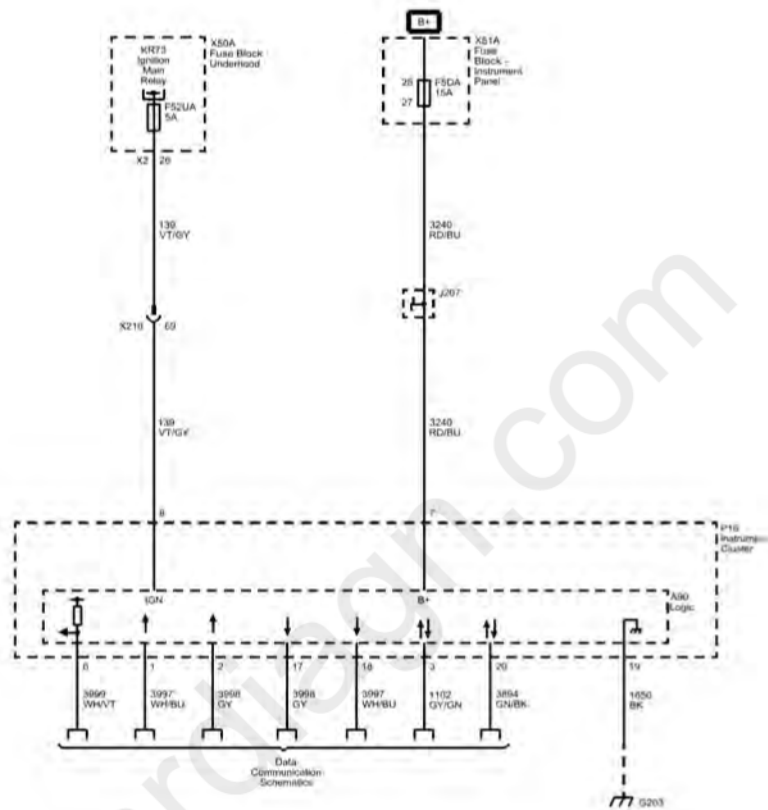


Fig. 1: Instrument Cluster Power, Ground, and Serial Data

Courtesy of GENERAL MOTORS COMPANY

Fuel Level

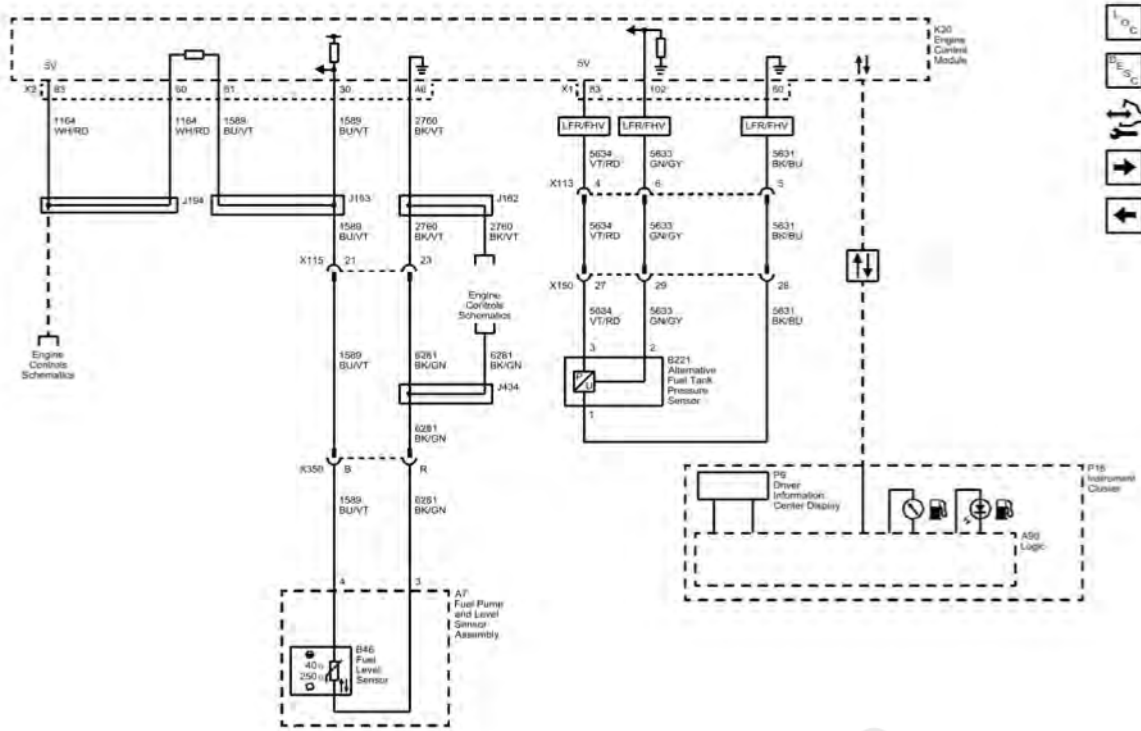


Fig. 2: Fuel Level

Courtesy of GENERAL MOTORS COMPANY

Fuel Level (LCV/LFX)

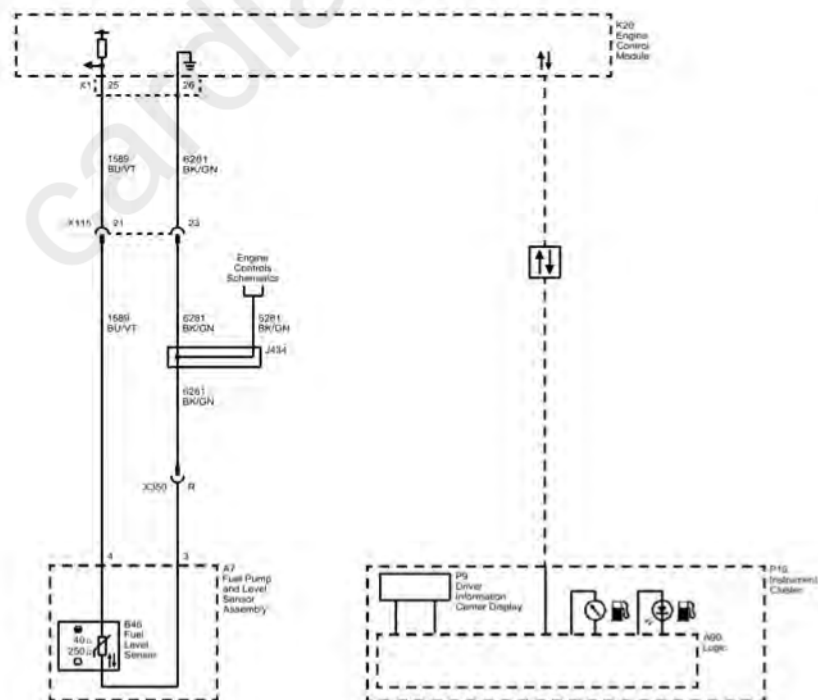


Fig. 3: Fuel Level (LCV/LFX)

Courtesy of GENERAL MOTORS COMPANY

Indicators

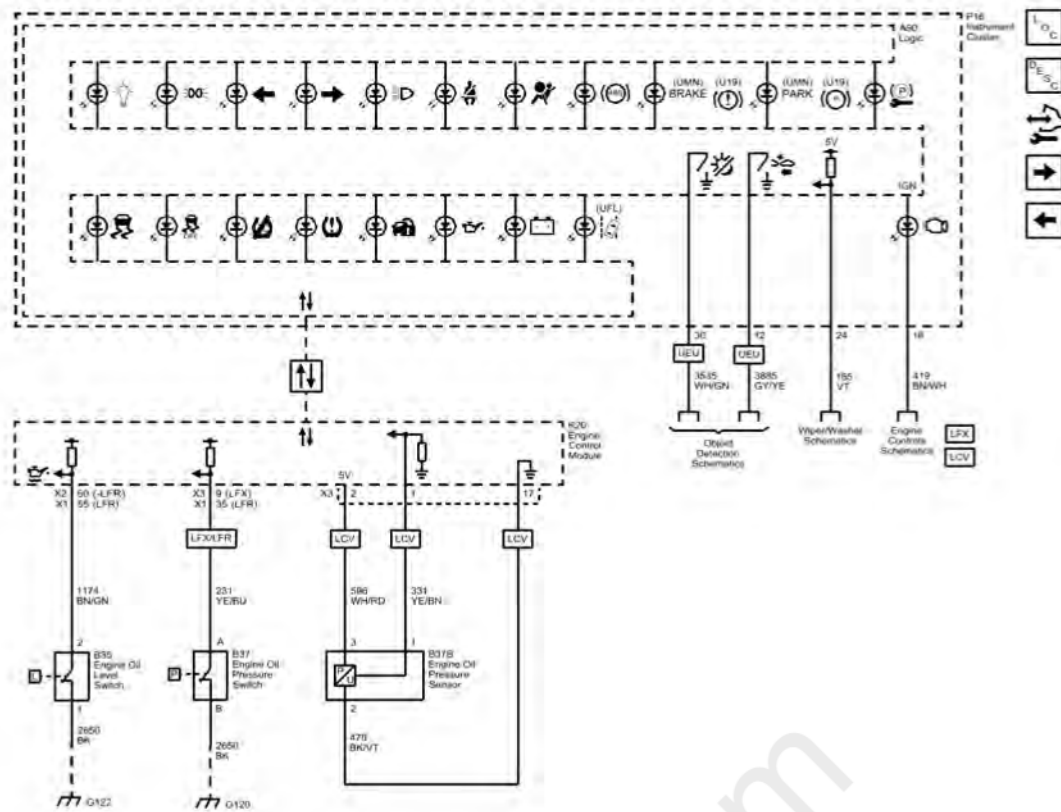


Fig. 4: Indicators

Courtesy of GENERAL MOTORS COMPANY

Driver Information

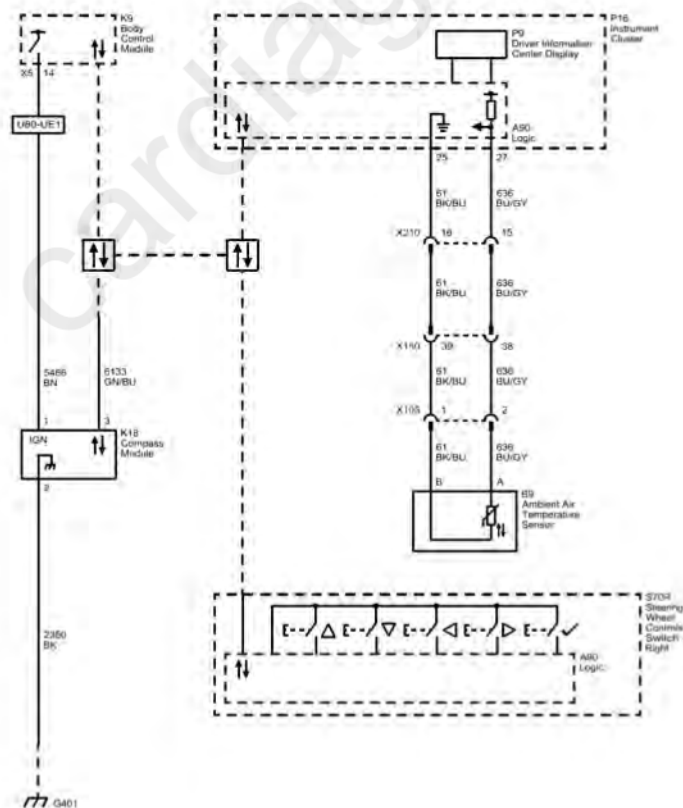


Fig. 5: Driver Information

Courtesy of GENERAL MOTORS COMPANY

Engine Oil Level

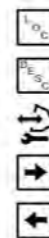
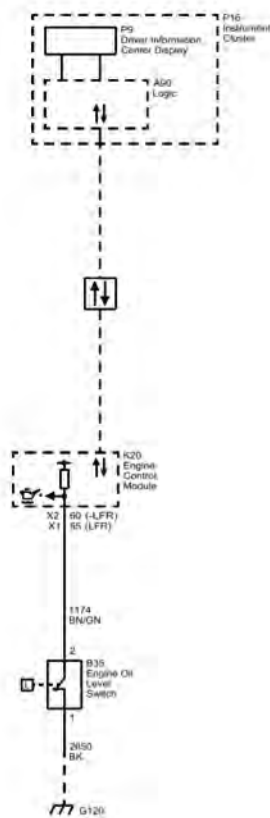


Fig. 6: Engine Oil Level

Courtesy of GENERAL MOTORS COMPANY

Shift Lever Position Indicator

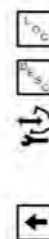
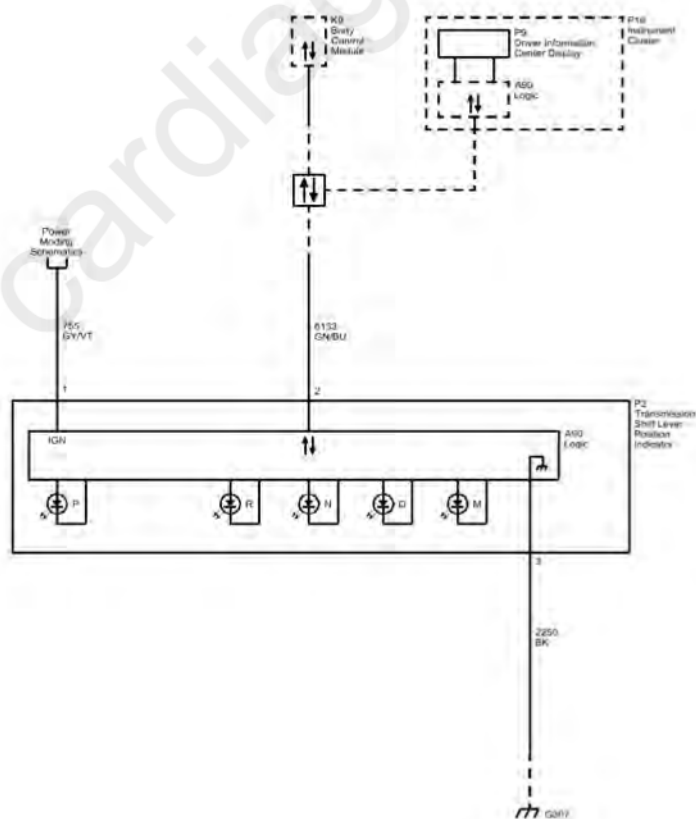


Fig. 7: Shift Lever Position Indicator

Courtesy of GENERAL MOTORS COMPANY

AUDIBLE WARNINGS WIRING SCHEMATICS

Audible Warning



Courtesy of GENERAL MOTORS COMPANY

DTC B0158: AMBIENT AIR TEMPERATURE SENSOR CIRCUIT

- 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 B0158

- Symptom Byte: 02 - Short to Ground
- Symptom Byte: 05 - Circuit High Voltage/open

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B0158 02	B0158 05	B0158 05	-
Low Reference	-	B0158 05	-	-

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

Circuit	Description

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

Component	Description
B9 Ambient Air Temperature Sensor	The temperature sensor is a negative temperature coefficient thermistor, a resistor which changes based on temperature.
P16 Instrument Cluster	The P16 control module monitors the B9 ambient air temperature sensor. The control module converts the analog voltage signal input to a temperature value.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

B0158 02

Outside Ambient Air Temperature Sensor Signal=Greater than 88 °C (190°F)

<B0158 02

Outside Ambient Air Temperature Sensor Signal=Less than -40°C (-40°F)

Actions Taken When the DTC Sets

P17 Info Display Module or P16 Instrument Cluster Displays - -°C (- -°F)

Air Conditioning Compressor Clutch=Disabled

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Diagnostic Aids

The displayed temperature is a filtered value that updates periodically while driving. The value rarely changes when the vehicle is parked.

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

Reference Information

Schematic Reference

[Instrument Cluster 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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify the scan tool parameter: Ambient Air Temperature = -40 and 88°C (-40 and 190°F) and changes
 - **If not between -40 and 88°C (-40 and 190°F) or does not change**

Refer to: Circuit/System Testing
 - **If between -40 and 88°C (-40 and 190°F) and changes**
3. Perform the special tool function: Ambient Air Temperature Instant Update
4. Verify the following parameter is within 5°C (8°F) of the actual ambient air temperature: Ambient Air Temperature
 - **If not within 5°C (8°F) of the actual ambient air temperature**

Refer to: Circuit/System Testing
 - **If within 5°C (8°F) of the actual ambient air temperature**
5. 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: B9 Ambient Air Temperature Sensor
3. Test for less than 10 Ω between the test points: Low Reference circuit terminal B or 2 & Ground
 - **If 10 Ω or greater**
 1. Disconnect the electrical connector: P16 Instrument Cluster
 2. Test for less than 2 Ω between the test points: Low Reference circuit terminal B or 2 @ Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component: P16 Instrument Cluster
 - **If less than 10 Ω**
4. Ignition - On / Vehicle - In Service Mode
5. Verify the scan tool parameter: Ambient Air Temperature = If 98 % or greater
 - **If less than 98 %**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector: P16 Instrument Cluster
 3. Test for infinite resistance between the test points: Signal circuit terminal A or 1 @ Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component: P16 Instrument Cluster
 - **If 8% or greater**
6. Connect a 3 A fused jumper wire between the test points: Signal circuit terminal A or 1 & Low Reference circuit terminal B or 2
7. Verify the scan tool parameter: Ambient Air Temperature = Less than 8 %
 - **If 8 % or greater**

1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
2. Disconnect the electrical connector:P16 Instrument Cluster
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 Ω between the test points:Signal circuit@Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:P16 Instrument Cluster
- **If less than 8 %**
8. Test or replace the component:B9 Ambient Air Temperature 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 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

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.
 - **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

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

- **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:39-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 ModuleDetectedK18 Compass Module=Internal Malfunction

Actions Taken When the DTC Sets

P17 Info Display ModuleorP16 Instrument ClusterDisplays"--"

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Instrument Cluster 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
 - **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.
 - **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 B3567: INFO DISPLAY SELECT SWITCH

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 B3567 01

Info Display Select Switch Circuit Short to Battery

DTC B3567 02

Info Display Select Switch Circuit Short to Ground

DTC B3567 04

Info Display Select Switch Circuit Open

DTC B3567 59

Info Display Select Switch Circuit Protection Time-Out

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
DIC Menu Switch Signal	P3567 59	1	1 or P3567 01	1
DIC Selt/Clear Switch Signal	P3567 02	1 or P3567 04	1 or P3567 04	1
DIC Switch Low Reference	-	1 or P3567 04	-	-
DIC Switch Ground	-	1	-	-
1. Driver Information Center (DIC) Switch Malfunction				

Circuit/System Description

The driver information center switches are multiplexed switches that are part of the Turn Signal/Multifunction Switch.

The Instrument Cluster provides 5 volts to the MENU switch. The MENU switch is a momentary contact switch that is provided ground through the Turn Signal/Multifunction Switch ground circuit.

The Instrument Cluster provides battery voltage to the UP, DOWN, SET switches. The UP, DOWN, SET switch signal circuits are pulled up to battery voltage in the Instrument Cluster. The Instrument Cluster also provides the UP, DOWN, SET switches with a low reference circuit. The UP, DOWN, SET switch signal circuit is pulled low when a switch is activated. The driver information center UP, DOWN, SET switches are momentary contact switches that connect a series of resistors in a resistor ladder format. The instrument cluster monitors the driver information center UP, DOWN, SET switch signal circuit to determine the switch position. Each switch state - UP, DOWN, SET - corresponds to a certain resistance value. The instrument cluster determines the switch pressed by the voltage drop across the resistors.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B3567 01

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

B3567 02

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

B3567 04

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

B3567 59

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

Action Taken When the DTC Sets

The instrument cluster ignores the driver information center switch inputs.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

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 DTC B0158 is not set
 - **If DTC B0158 is set**

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

- **DTC B0158 is not set**

3. Verify the driver information center set, up and down function changes when pressing the set, up or down switch.

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

Refer to Set, Up and Down Switch Malfunction

- **If the driver information center changes**

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

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

Refer to Menu Switch Malfunction

- **If the driver information center changes**

5. All OK.

Circuit/System Testing

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

Menu Switch Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the S78 Turn Signal/Multifunction Switch, ignition ON.

2. Test for 4.8 - 5.2 V between the signal circuit terminal 5 and ground.

- **If less than 4.8 V**

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

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

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

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the P16 Instrument Cluster.

- **If greater than 5.2 V**

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

- **If between 4.8 - 5.2 V**

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

- **If 10 Ω or greater**

Repair the open/high resistance in the circuit

- **If less than 10 Ω**

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

Set, Up and Down Switch Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the S78 Turn Signal/Multifunction Switch, ignition ON.

2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.

- **If 10 Ω or greater**

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

2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the P16 Instrument Cluster.
- **If less than 10 Ω**
3. Test for 9.8 - 12.2 V between the signal circuit terminal 12 and ground.
 - **If less than 9.8 V**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the P16 Instrument Cluster.
 - **If greater than 12.2 V**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster, 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, replace the P16 Instrument Cluster.
 - **If between 9.8 - 12.2 V**
4. Test or replace the S78 Turn Signal/Multifunction Switch.

Repair Instructions

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

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

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

Schematic Reference

Instrument Cluster 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](#)

- **If the DTC is not set**

3. Verify DTC P0070 is not set.

- **If the DTC is not set**

All OK.

- **If DTC P0070 is set**

4. Clear DTC P0070

5. Verify the DTC does not set.

- **If the DTC is not set**

All OK.

- **If DTC P0070 is set**

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

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

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

Replace the component:B9 Ambient Air Temperature Sensor

- **If in the specified range**

7. Verify DTC P0070 is not set.

- **If the DTC is not set**

All OK.

- **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.

- **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.

- **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.

- **If DTC P0070 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 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 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/P0074
Low Reference	-	P0073	-	P0071

Circuit/System Description

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

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

Component	Description
B9 Ambient Air Temperature Sensor	The temperature sensor is a negative temperature coefficient thermistor, a resistor which changes based on temperature.
K20 Engine Control Module	The K20 control module monitors the B9 ambient air temperature sensor. The control module converts the analog voltage signal input to a temperature value.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

P0071

The difference between the following parameters is greater than a predefined value: Outside Ambient Air Temperature Sensor Signal & Intake Air Temperature Sensor Signal

P0072

Outside Ambient Air Temperature Sensor Signal=Greater than 88 Â°C (190 Â°F)

P0073

Outside Ambient Air Temperature Sensor Signal=Less than -40°C (-40°F)

P0074

Outside Ambient Air Temperature Sensor Signal=Not Plausible

Action Taken When the DTC Sets

- DTCs listed in the DTC Descriptor Category=Type B DTC
- The DIC will display SERVICE A/C SYSTEM.

Air Conditioning Compressor Clutch=Disabled

- The control module uses default replacement values.

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Diagnostic Aids

The displayed temperature is a filtered value that updates periodically while driving. The value rarely changes when the vehicle is parked.

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

Reference Information

Schematic Reference

Instrument Cluster 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: Ambient Air Temperature = -40 to 88°C (-40 to 190°F) and changes
 - If not between -40 to 88°C (-40 to 190°F) or does not change

- If between -40 to 88°C (-40 to 190°F) and changes

3. 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:B9 Ambient Air Temperature Sensor
3. Test for less than $10\ \Omega$ between the test points:Low Reference circuit terminal B or 2 & Ground
 - **If $10\ \Omega$ or greater**
 1. Disconnect the electrical connector:K20 Engine Control Module
 2. Test for less than $2\ \Omega$ between the test points:Low Reference circuit terminal B or 2 @Component harness & The other end of the circuit
 - If $2\ \Omega$ or greater - Repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$ - Replace the component:K20 Engine Control Module
 - **If less than $10\ \Omega$**
4. Ignition - On / Vehicle - In Service Mode
5. Verify the scan tool parameter:Ambient Air Temperature=Less than 34°C (-30°F)
 - **If $^{\circ}\text{C}$ 34°C (-30°F) or warmer**
 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 A or 1 @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
 - **If 35°C (-31°F) or colder**
6. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal A or 1 & Low Reference circuit terminal B or 2
7. Verify the scan tool parameter:Ambient Air Temperature=Greater than $143\ ^{\circ}\text{C}$ ($290\ ^{\circ}\text{F}$)
 - **If $143\ ^{\circ}\text{C}$ ($290\ ^{\circ}\text{F}$) or colder**
 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 $2\ \Omega$ between the test points:Signal circuit@Component harness & The other end of the circuit
 - If $2\ \Omega$ or greater - Repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$ - Replace the component:K20 Engine Control Module
 - **If $144\ ^{\circ}\text{C}$ ($291\ ^{\circ}\text{F}$) or warmer**
8. Test or replace the component: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

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 Performance

DTC P0462

Fuel Level Sensor Circuit Low Voltage

DTC P0463

Fuel Level Sensor Circuit High Voltage

DTC P0464

Fuel Level Sensor Circuit Intermittent

Diagnostic Fault Information

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

Circuit/System Description

The fuel level sensor changes resistance based on fuel level. The engine control module (ECM) monitors the signal circuit of the fuel level sensor in order to determine the fuel level. When the fuel tank is full, the resistances of the fuel level sensor is low and the ECM senses a low signal voltage on the signal circuit of the fuel level sensor. When the fuel tank is empty, the resistance of the fuel level sensor is high and the ECM senses a high signal voltage. The ECM uses the signal circuit of the fuel level sensor in order to calculate the percentage of remaining fuel in the tank. The ECM sends the fuel level percentage via 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
- Battery voltage is between 11 - 32 V

Conditions for Setting the DTC

P0461 00

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

P0462

- The signal voltage is less than 0.25 V.

- The above conditions must be met for 5 s.

P0463

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

P0464

- 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 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 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

- **If between 0.5 - 3.5 V and varies with fuel level**

3. 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

- **If the level gauge sweeps**

4. 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 X1 harness connector at the A7 Fuel Pump and Level Sender Assembly. It may take up to 2 min for all vehicle systems to power down.

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

- **If 10 Ω or greater**

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.

- **If less than 10 Ω**

3. Ignition ON.

4. Verify the scan tool Remaining Fuel In Tank parameter is less than 5%.

- **If 5% or greater**

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

2. Test for infinite resistance between the signal circuit terminal 4 and ground.

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

- **If less than 5%**

5. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the low reference circuit terminal 3.

6. Verify the scan tool Remaining Fuel In Tank is greater than 90%.

- **If 90% or less**

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.

- **If greater than 90%**

7. Test or replace the B46 Fuel Level Sensor.

Component Testing

1. Ignition OFF, remove the A7 Fuel Pump and Level Sender Assembly.
2. Sweep the fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 4 and the low reference terminal 3.
3. Test for a minimum resistance value of 37-43 Ω and a maximum value of 245-255 Ω without any spikes or dropouts.
 - **If minimum resistance is not 37-43 Ω , maximum resistance is not 245-255 Ω , or if there are any spikes or dropouts**
 Replace the B46 Fuel Level Sensor.
 - **If minimum resistance is 37-43 Ω , maximum resistance is 245-255 Ω , and if there are no spikes or dropouts**
4. All OK.

Repair Instructions

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

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

DTC P0520: ENGINE OIL PRESSURE SWITCH CIRCUIT (LFX)

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 P0520

Engine Oil Pressure Switch Circuit

Diagnostic Fault Information

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

Circuit/System Description

The engine oil pressure switch is a two wire switch that opens and closes based on engine oil pressure. The engine control module (ECM) supplies a 12 volt signal to the switch. The switch also has a ground. The ECM monitors the signal circuit to determine if the switch is opened or closed. When the engine oil pressure is low, the switch is closed and voltage on the signal circuit is low. When the engine oil pressure is normal, the switch is open and voltage on the signal circuit is high. The ECM sends the engine oil pressure information via serial data to the body control module (BCM). The BCM then sends the engine oil pressure information to the instrument cluster via serial data. The instrument cluster will illuminate the oil pressure indicator when engine oil pressure is low.

Conditions for Running the DTC

- Engine coolant temperature at last engine stop was greater than 80 $^{\circ}$ C (176 $^{\circ}$ F).
- Engine coolant temperature reduced more than 10 $^{\circ}$ C (16 $^{\circ}$ F) since engine off.
- Engine was off more than 60s.
- Ignition on, engine off

Conditions for Setting the DTC

- The ECM detects a high signal voltage of the engine oil pressure switch signal circuit.
- The above condition is present for greater than 5 seconds.

Action Taken When the DTC Sets

The instrument cluster illuminates the oil pressure indicator.

Conditions for Clearing the DTC

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

Diagnostic Aids

Low engine oil pressure will also cause this DTC to set. If low engine oil pressure is suspected, refer to [Oil Pressure Diagnosis and Testing](#) .

Reference Information

Schematic Reference

Instrument Cluster 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 engine oil pressure indicator turns on and off when commanding the All Indicators ON and OFF with a scan tool.
 - **If the engine oil pressure indicator does not turn on and off.**

Replace the P16 Instrument Cluster.
 - **If the engine oil pressure indicator turns on and off**
3. Verify the scan tool Engine Oil Pressure parameter is Low.
 - **If not Low**

Refer to Circuit/System Testing.
 - **If Low**
4. Engine running.
5. Verify the scan tool Engine Oil Pressure parameter is OK.
 - **If not OK**

Refer to Circuit/System Testing.

- **If OK**

6. 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 B37 Engine Oil Pressure Switch. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal B and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 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.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Engine Oil Pressure parameter is OK.
 - **If not OK**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal A and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If OK**
5. Install a 3 A fused jumper wire between the signal circuit terminal A and the ground circuit terminal B.
6. Verify the scan tool Engine Oil Pressure parameter is Low.
 - **If not 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 in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If Low**
7. Test or replace the B37 Engine Oil Pressure 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 P0520: ENGINE OIL PRESSURE SWITCH CIRCUIT (LUK)

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 P0520

Engine Oil Pressure Switch Circuit

Diagnostic Fault Information

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

Typical Scan Tool Data

ECM - Engine Oil Pressure Switch

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

Circuit/System Description

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

Conditions for Running the DTC

- Engine coolant temperature at last engine stop was greater than 80°C (176°F).
- Engine coolant temperature reduced more than 10°C (16°F) since engine off.
- Engine was off more than 60s.
- Ignition on, engine off

Conditions for Setting the DTC

- The ECM detects a high signal voltage of the engine oil pressure switch signal circuit.
- The above condition is present for greater than 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

DTC P0520 can set due to inadequate engine oil pressure. This can be an indication of mechanical engine issues causing lower than expected engine oil pressure.

Reference Information

Schematic Reference

Instrument Cluster Schematics

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- **Instrument Cluster 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**

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. Command the All Indicators test ON and OFF with the scan tool, verify that the engine oil pressure indicator turns ON and OFF.
 - **If the engine oil pressure indicator does not turn ON or OFF as commanded**
Replace the P16 Instrument Cluster.
 - **If the engine oil pressure indicator turns ON and OFF as commanded**
3. Verify the scan tool Engine Oil Pressure parameter is Low.
 - **If not Low**
Refer to Circuit/System Testing.
 - **If Low**
4. Engine running.
5. Verify actual engine oil pressure is within specified range. Refer to Oil Pressure Diagnosis and Testing in **Displays and Gauges Component Replacement Reference**.
6. Verify the scan tool Engine Oil Pressure parameter is OK.
 - **If not OK**
Refer to Circuit/System Testing.
 - **If OK**
7. All OK.

Circuit/System Testing

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

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch, ignition ON.
2. Verify the scan tool Engine Oil Pressure Switch parameter is OK.
 - **If not OK**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
2. Test for infinite resistance between the signal circuit terminal 1 (or A) and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
- **If OK**
3. Install a 3 A fused jumper wire between the signal circuit terminal 1 (or A) and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.
 - **If not 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 in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If Low**
5. Test or replace the B37 Engine Oil Pressure Switch.

Repair Instructions

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

- [Displays and Gauges Component Replacement Reference](#)
- [Control Module References](#) for ECM 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 or1	P0523	P0521 or1
Signal	P0522	P0522 or1	P0522	P0521 or1
Low Reference	-	P0523 or1	-	P0521 or1
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 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**](#)

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
 - **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
 - **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
 - **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 Ω between the test points: Low Reference circuit terminal 2 & Ground
 - **If 10 Ω or greater**
 1. Disconnect the electrical connector: K20 Engine Control Module
 2. Test for less than 2 Ω between the test points: Low Reference circuit terminal 2 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:K20 Engine Control Module
 - **If less than 10 Ω**
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 Ω between the test points: 5 V Reference circuit terminal 3 @ Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω s - 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
- **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
 - **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 Ω between the test points:Signal circuit terminal 1 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:K20 Engine Control Module
 - **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](#)

DISPLAYS AND GAUGES COMPONENT REPLACEMENT REFERENCE

Component	Repair Instruction
B9 Ambient Air Temperature Sensor	<u>Ambient Air Temperature Gauge Sensor Replacement</u>
B37 Engine Oil Pressure Switch or B37D Engine Oil Pressure Sensor	{2.5L LKW engine} <u>Engine Oil Pressure Sensor Replacement</u> {3.6L LFX engine} <u>Engine Oil Pressure Sensor and/or Switch Replacement</u>
B46 Fuel Level Sensor	{2.5L LKW engine} <u>Fuel Level Sensor Replacement</u> {3.6L LFX engine} <u>Fuel Level Sensor Replacement</u>
K18 Compass Module	<u>Electronic Compass Module Replacement</u>
K20 Engine Control Module	{2.5L LKW engine} <u>Engine Control Module Replacement</u> {3.6L LFX engine} <u>Engine Control Module Replacement (LFX)</u>
P2 Transmission Shift Lever Position Indicator	{6T40 MHH or 6T45 MH7} <u>Transmission Control Lever Knob Replacement</u> {6T70 M7W } <u>Transmission Control Lever Knob Replacement</u>
S39 Ignition Switch	<u>Ignition and Start Switch Replacement (Without BTM)</u> <u>Ignition and Start Switch Replacement (With BTM)</u>
Oil Pressure Diagnosis and Testing	{2.5L LKW engine} <u>Oil Pressure Diagnosis and Testing</u> {3.6L LFX 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.

1. 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.
2. 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](#)

Symptom List

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

- [Fuel Gauge Malfunction \(Gasoline Fuel Gauge\)](#)[Fuel Gauge Malfunction \(CNG Fuel Gauge\)](#)
- [Engine Oil Pressure Indicator Malfunction \(LKW\)](#)[Engine Oil Pressure Indicator Malfunction \(LFX\)](#)[Engine Oil Pressure Indicator Malfunction \(LUK\)](#)
- [Outside Air Temperature Display Malfunction](#)

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 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 Speaker
The 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](#) .

- **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](#) .

- **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](#)

- **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](#)

- **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](#)

- **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](#)

- **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](#)

- **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](#)

DRIVER INFORMATION CENTER SWITCH 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 B3567 01

Info Display Select Switch Circuit Short to Battery

DTC B3567 02

Info Display Select Switch Circuit Short to Ground

DTC B3567 04

Info Display Select Switch Circuit Open

DTC B3567 59

Info Display Select Switch Circuit Protection Time-Out

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
DIC Menu Switch Signal	P3567 59	1	1 or P3567 01	1
DIC Selt/Clear Switch Signal	P3567 02	1 or P3567 04	1 or P3567 04	1
DIC Switch Low Reference	-	1 or P3567 04	-	-
DIC Switch Ground	-	1	-	-
1. Driver Information Center (DIC) Switch Malfunction				

Circuit/System Description

The driver information center switches are multiplexed switches that are part of the Turn Signal/Multifunction Switch.

The Instrument Cluster provides 5 volts to the MENU switch. The MENU switch is a momentary contact switch that is provided ground through the Turn Signal/Multifunction Switch ground circuit.

The Instrument Cluster provides battery voltage to the UP, DOWN, SET switches. The UP, DOWN, SET switch signal circuits are pulled up to battery voltage in the Instrument Cluster. The Instrument Cluster also provides the UP, DOWN, SET switches with a low reference circuit. The UP, DOWN, SET switch signal circuit is pulled low when a switch is activated. The driver information center UP, DOWN, SET switches are momentary contact switches that connect a series of resistors in a resistor ladder format. The instrument cluster monitors the driver information center UP, DOWN, SET switch signal circuit to determine the switch position. Each switch state - UP, DOWN, SET - corresponds to a certain resistance value. The instrument cluster determines the switch pressed by the voltage drop across the resistors.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B3567 01

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

B3567 02

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

B3567 04

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

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

Action Taken When the DTC Sets

The instrument cluster ignores the driver information center switch inputs.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

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 DTC B0158 is not set
 - **If DTC B0158 is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **DTC B0158 is not set**
3. Verify the driver information center set, up and down function changes when pressing the set, up or down switch.
 - **If the driver information center does not change**

Refer to Set, Up and Down Switch Malfunction
 - **If the driver information center changes**
4. Verify the driver information center menu function changes when pressing the menu switch.
 - **If the driver information center does not change**

Refer to Menu Switch Malfunction
 - **If the driver information center changes**
5. All OK.

Circuit/System Testing

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

Menu Switch Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the S78 Turn Signal/Multifunction Switch, ignition ON.
2. Test for 4.8 - 5.2 V between the signal circuit terminal 5 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the P16 Instrument Cluster.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster, 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, replace the P16 Instrument Cluster.
 - **If between 4.8 - 5.2 V**
3. Test for less than 10 Ω between the ground circuit terminal 3 and ground.
 - **If 10 Ω or greater**

Repair the open/high resistance in the circuit
 - **If less than 10 Ω**
4. Test or replace the S78 Turn Signal/Multifunction Switch.

Set, Up and Down Switch Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the S78 Turn Signal/Multifunction Switch, ignition ON.
2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the P16 Instrument Cluster.
 - **If less than 10 Ω**
3. Test for 9.8 - 12.2 V between the signal circuit terminal 12 and ground.
 - **If less than 9.8 V**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the P16 Instrument Cluster.
 - **If greater than 12.2 V**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster, 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, replace the P16 Instrument Cluster.

- **If between 9.8 - 12.2 V**

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

Repair Instructions

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

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

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
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.

Component	Description
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 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

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

- **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

- **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

- **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 Ω between the test points: Low Reference circuit terminal 2 & Ground

- **If 10 Ω or greater**

1. Disconnect the electrical connector: K20 Engine Control Module
2. Test for less than 2 Ω between the test points: Low Reference circuit terminal 2 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:K20 Engine Control Module

- **If less than 10 Ω**

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 Ω between the test points: 5 V Reference circuit terminal 3 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - 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
- **If between 4.8 and 5.2V**
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
 - **If 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 Ω between the test points:Signal circuit terminal 1 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:K20 Engine Control Module
 - **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](#)

ENGINE OIL PRESSURE INDICATOR MALFUNCTION (LKW)

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

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
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 4 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

Reference Information

Schematic Reference

Instrument Cluster 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
 - **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
 - **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
 - **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 Ω between the test points: Low Reference circuit terminal 2 & Ground
 - **If 10 Ω or greater**
 1. Disconnect the electrical connector: K20 Engine Control Module
 2. Test for less than 10 Ω between the test points: Low Reference circuit terminal 2 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:K20 Engine Control Module
 - **If less than 10 Ω**
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 5 @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 Ω between the test points: 5 V Reference circuit terminal 3 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - 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
 - **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
 - **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 Ω between the test points:Signal circuit terminal 1 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:K20 Engine Control Module
- **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](#)

ENGINE OIL PRESSURE INDICATOR MALFUNCTION (LFX)

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 P0520

Engine Oil Pressure Switch Circuit

Diagnostic Fault Information

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

Circuit/System Description

The engine oil pressure switch is a two wire switch that opens and closes based on engine oil pressure. The engine control module (ECM) supplies a 12 volt signal to the switch. The switch also has a ground. The ECM monitors the signal circuit to determine if the switch is opened or closed. When the engine oil pressure is low, the switch is closed and voltage on the signal circuit is low. When the engine oil pressure is normal, the switch is open and voltage on the signal circuit is high. The ECM sends the engine oil pressure information via serial data to the body control module (BCM). The BCM then sends the engine oil pressure information to the instrument cluster via serial data. The instrument cluster will illuminate the oil pressure indicator when engine oil pressure is low.

Conditions for Running the DTC

- Engine coolant temperature at last engine stop was greater than 80°C (176°F).
- Engine coolant temperature reduced more than 10°C (16°F) since engine off.
- Engine was off more than 60s.
- Ignition on, engine off

Conditions for Setting the DTC

- The ECM detects a high signal voltage of the engine oil pressure switch signal circuit.
- The above condition is present for greater than 5 seconds.

Action Taken When the DTC Sets

The instrument cluster illuminates the oil pressure indicator.

Conditions for Clearing the DTC

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

Diagnostic Aids

Low engine oil pressure will also cause this DTC to set. If low engine oil pressure is suspected, refer to [Oil Pressure Diagnosis and Testing](#).

Reference Information

Schematic Reference

Instrument Cluster 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 engine oil pressure indicator turns on and off when commanding the All Indicators ON and OFF with a scan tool.
 - **If the engine oil pressure indicator does not turn on and off.**
Replace the P16 Instrument Cluster.
 - **If the engine oil pressure indicator turns on and off**
3. Verify the scan tool Engine Oil Pressure parameter is Low.
 - **If not Low**
Refer to Circuit/System Testing.
 - **If Low**
4. Engine running.
5. Verify the scan tool Engine Oil Pressure parameter is OK.
 - **If not OK**
Refer to Circuit/System Testing.

- **If OK**

6. 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 B37 Engine Oil Pressure Switch. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal B and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 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.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Engine Oil Pressure parameter is OK.
 - **If not OK**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal A and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If OK**
5. Install a 3 A fused jumper wire between the signal circuit terminal A and the ground circuit terminal B.
6. Verify the scan tool Engine Oil Pressure parameter is Low.
 - **If not 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 in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If Low**
7. Test or replace the B37 Engine Oil Pressure 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 PRESSURE INDICATOR MALFUNCTION (LUK)

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 P0520

Engine Oil Pressure Switch Circuit

Diagnostic Fault Information

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

Typical Scan Tool Data

ECM - Engine Oil Pressure Switch

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

Circuit/System Description

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

Conditions for Running the DTC

- Engine coolant temperature at last engine stop was greater than 80Â°C (176Â°F).
- Engine coolant temperature reduced more than 10Â°C (16Â°F) since engine off.
- Engine was off more than 60s.
- Ignition on, engine off

Conditions for Setting the DTC

- The ECM detects a high signal voltage of the engine oil pressure switch signal circuit.
- The above condition is present for greater than 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

DTC P0520 can set due to inadequate engine oil pressure. This can be an indication of mechanical engine issues causing lower than expected engine oil pressure.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Description and Operation

- [Instrument Cluster 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](#)

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. Command the All Indicators test ON and OFF with the scan tool, verify that the engine oil pressure indicator turns ON and OFF.
 - **If the engine oil pressure indicator does not turn ON or OFF as commanded**
Replace the P16 Instrument Cluster.
 - **If the engine oil pressure indicator turns ON and OFF as commanded**
3. Verify the scan tool Engine Oil Pressure parameter is Low.
 - **If not Low**
Refer to Circuit/System Testing.
 - **If Low**
4. Engine running.
5. Verify actual engine oil pressure is within specified range. Refer to Oil Pressure Diagnosis and Testing in [Displays and Gauges Component Replacement Reference](#).
6. Verify the scan tool Engine Oil Pressure parameter is OK.
 - **If not OK**
Refer to Circuit/System Testing.
 - **If OK**
7. All OK.

Circuit/System Testing

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

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch, ignition ON.
2. Verify the scan tool Engine Oil Pressure Switch parameter is OK.
 - **If not OK**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between the signal circuit terminal 1 (or A) and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
- **If OK**
3. Install a 3 A fused jumper wire between the signal circuit terminal 1 (or A) and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.
 - **If not 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 in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If Low**
5. Test or replace the B37 Engine Oil Pressure Switch.

Repair Instructions

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

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

FUEL GAUGE MALFUNCTION (GASOLINE FUEL GAUGE)

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 Performance

DTC P0462

Fuel Level Sensor Circuit Low Voltage

DTC P0463

Fuel Level Sensor Circuit High Voltage

DTC P0464

Fuel Level Sensor Circuit Intermittent

Diagnostic Fault Information

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

Circuit/System Description

The fuel level sensor changes resistance based on fuel level. The engine control module (ECM) monitors the signal circuit of the fuel level sensor in order to determine the fuel level. When the fuel tank is full, the resistances of the fuel level sensor is low and the ECM senses a low signal voltage on the signal circuit of the fuel level sensor. When the fuel tank is empty, the resistance of the fuel level sensor is high and the ECM senses a high signal voltage. The ECM uses the signal circuit of the fuel level sensor in order to calculate the percentage of remaining fuel in the tank. The ECM sends the fuel level percentage via 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
- Battery voltage is between 11 - 32 V

Conditions for Setting the DTC

P0461 00

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

P0462

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

P0463

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

P0464

- 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 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 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
 - **If between 0.5 - 3.5 V and varies with fuel level**
3. 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
 - **If the level gauge sweeps**
4. 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 X1 harness connector at the A7 Fuel Pump and Level Sender Assembly. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 3 and ground.
 - **If 10 Ω or greater**
 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.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Remaining Fuel In Tank parameter is less than 5%.
 - **If 5% or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 4 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If less than 5%**
5. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the low reference circuit terminal 3.
 6. Verify the scan tool Remaining Fuel In Tank is greater than 90%.
 - **If 90% or less**
 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.
 - **If greater than 90%**
 7. Test or replace the B46 Fuel Level Sensor.

Component Testing

1. Ignition OFF, remove the A7 Fuel Pump and Level Sender Assembly.
2. Sweep the fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 4 and the low reference terminal 3.
3. Test for a minimum resistance value of 37-43 Ω and a maximum value of 245-255 Ω without any spikes or dropouts.
 - **If minimum resistance is not 37-43 Ω , maximum resistance is not 245-255 Ω , or if there are any spikes or dropouts**
Replace the B46 Fuel Level Sensor.
 - **If minimum resistance is 37-43 Ω , maximum resistance is 245-255 Ω , and if there are no spikes or dropouts**
4. All OK.

Repair Instructions

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

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

FUEL GAUGE MALFUNCTION (CNG FUEL GAUGE)

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 alternative fuel tank pressure sensor is a 3-wire sensor comprising of the signal circuit, the low reference circuit and a 5 V reference circuit. The Engine Control Module monitors the signal of the pressure sensor to determine the amount of pressure in the tank. When the engine is running on CNG, the Engine Control Module uses this signal in order to calculate the percentage of remaining gas in the

tank. The Engine Control Module sends the fuel level to the instrument cluster via serial data. The instrument cluster then displays the approximate level on the fuel level gauge.

When the engine is in gasoline mode: The instrument cluster displays gasoline fuel level on the fuel gauge and CNG fuel level can be viewed on the Driver Information Center.

When the engine is in CNG mode: The instrument cluster displays CNG fuel level on the fuel gauge and gasoline fuel level can be viewed on the Driver Information Center.

Reference Information

Schematic Reference

Instrument Cluster 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
 - **If the fuel level gauge sweeps**
3. Verify the scan tool Alternative 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.
 - **If between 0.5 - 3.5 V and varies with fuel level**
4. 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. It may take up to 2 minutes for all vehicle systems to power down. Disconnect the harness connector at the B257 Alternative Fuel Pressure Sensor. Test for less than 10 Ω between the low reference circuit terminal 1 and ground
 - **If 10 Ω or greater**

1. 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.
 - **If less than 10 Ω**
2. Ignition ON.
3. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 3 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the 5 V reference circuit 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 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
4. Test for 4.0 - 6.0V between the signal circuit terminal 2 and ground.
 - **If less than 4.0 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 6.0 V**
 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, replace the K20 Engine Control Module.
 - **If between 4.0 - 6.0V**
5. Start engine and let idle at operating temperature in CNG mode.
6. Verify scan tool Alternative Fuel Tank Pressure Sensor parameter is 0 Volts.
 - **If Alternative Fuel Tank Pressure Sensor parameter is 0 Volts**

Replace the B257 Alternative Fuel Tank Pressure Sensor.
 - **If Alternative Fuel Tank Pressure Sensor parameter is not 0 Volts**
7. Ignition OFF.
8. Connect the harness connector at the B257 Alternative Fuel Tank Pressure Sensor, ignition ON.
9. Start engine and let idle at operating temperature in CNG mode.
10. Verify fuel gauge is reading accurately.
 - **If CNG fuel gauge is displaying accurately**

All OK.

- If CNG fuel gauge is not reading accurately

11. Replace the K20 Engine Control Module.

Repair Instructions

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

- [Control Module References](#) for engine control module or instrument cluster replacement, programming, and setup

OUTSIDE AIR TEMPERATURE DISPLAY 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](#)

DTC Descriptor

DTC B0158

Ambient Air Temperature Sensor Circuit

- Symptom Byte: 02-Short to Ground
- Symptom Byte: 05-Circuit High Voltage/open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B0158 02	B0158 05	B0158 05	-
Low Reference	-	B0158 05	-	-

Circuit/System Description

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

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

Component	Description
B9 Ambient Air Temperature Sensor	The temperature sensor is a negative temperature coefficient thermistor, a resistor which changes based on temperature.
P16 Instrument Cluster	The P16 control module monitors the B9 ambient air temperature sensor. The control module converts the analog voltage signal input to a temperature value.

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

B0158 02

Outside Ambient Air Temperature Sensor Signal=Greater than 88 Â°C (190 Â°F)

B0158 02

Outside Ambient Air Temperature Sensor Signal=Less than -40Â°C (-40Â°F)

Actions Taken When the DTC Sets

P17 Info Display Module or P16 Instrument Cluster Displays - -Â°C (- -Â°F)

Air Conditioning Compressor Clutch=Disabled

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Diagnostic Aids

The displayed temperature is a filtered value that updates periodically while driving. The value rarely changes when the vehicle is parked.

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

Reference Information

Schematic Reference

Instrument Cluster 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: Ambient Air Temperature= - 40 to 88 Â°C (- 40 to 190Â°F) and changes
 - **If not between - 40 to 88 Â°C (- 40 to 190Â°F) or does not change**
Refer to: Circuit/System Testing
 - **If between - 40 to 88 Â°C (- 40 to 190Â°F) and changes**
3. Perform the special tool function: Ambient Air Temperature Instant Update
4. Verify the following parameter is within 5Â°C (8Â°F) of the actual ambient air temperature: Ambient Air Temperature
 - **If not within 5Â°C (8Â°F) of the actual ambient air temperature**

- **If within 5Â°C (8Â°F) of the actual ambient air temperature**

5. 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:B9 Ambient Air Temperature Sensor
3. Test for less than 10 Ω between the test points:Low Reference circuit terminal B or 2 & Ground
 - **If 10 Ω or greater**
 1. Disconnect the electrical connector:P16 Instrument Cluster
 2. Test for less than 2 Ω between the test points:Low Reference circuit terminal B or 2 @Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:P16 Instrument Cluster
 - **If less than 10 Ω**
4. Ignition - On / Vehicle - In Service Mode
5. Verify the scan tool parameter:Ambient Air Temperature=If 98 % or greater
 - **If less than 98 %**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:P16 Instrument Cluster
 3. Test for infinite resistance between the test points:Signal circuit terminal A or 1 @Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component:P16 Instrument Cluster
 - **If 98 % or greater**
6. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal A or 1 & Low Reference circuit terminal B or 2
7. Verify the scan tool parameter:Ambient Air Temperature=Less than 8 %
 - **If 8 % or greater**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector:P16 Instrument Cluster
 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 Ω between the test points:Signal circuit@Component harness & The other end of the circuit
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component:P16 Instrument Cluster
 - **If less than 8 %**
8. Test or replace the component:B9 Ambient Air Temperature 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](#)

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

Schematic Reference

Instrument Cluster 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](#) .

- **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.

- **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.

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

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

- **If the odometer displays only "----" (dashes)**

Refer to Circuit/System Testing.

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

Replace the P16 Instrument Cluster.

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

6. All OK.

Circuit/System Testing

NOTE:

- **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 proper 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.

- **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.

- **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.

- **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.

- **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.

- **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.

- **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.

- **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.

REPAIR INSTRUCTIONS

AMBIENT AIR TEMPERATURE GAUGE SENSOR REPLACEMENT

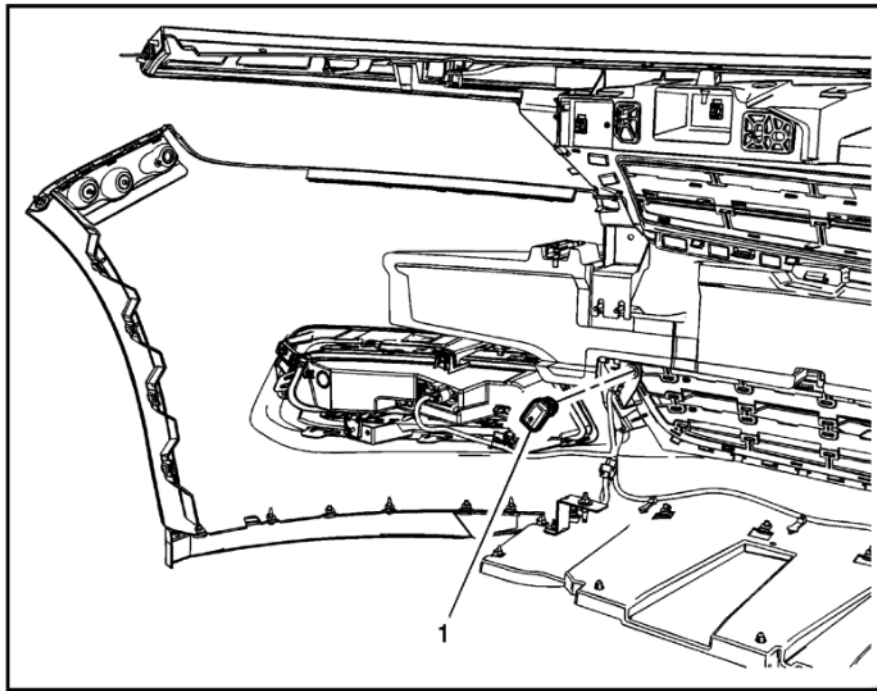


Fig. 9: Ambient Air Temperature Gauge Sensor
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the front bumper fascia assembly. Refer to Front Bumper Fascia Replacement .	
1	Ambient Air Temperature Gauge Sensor Procedures 1. Disconnect the ambient air temperature gauge sensor. 2. Squeeze the ambient air temperature gauge sensor tabs, to release the sensor.

ELECTRONIC COMPASS MODULE REPLACEMENT

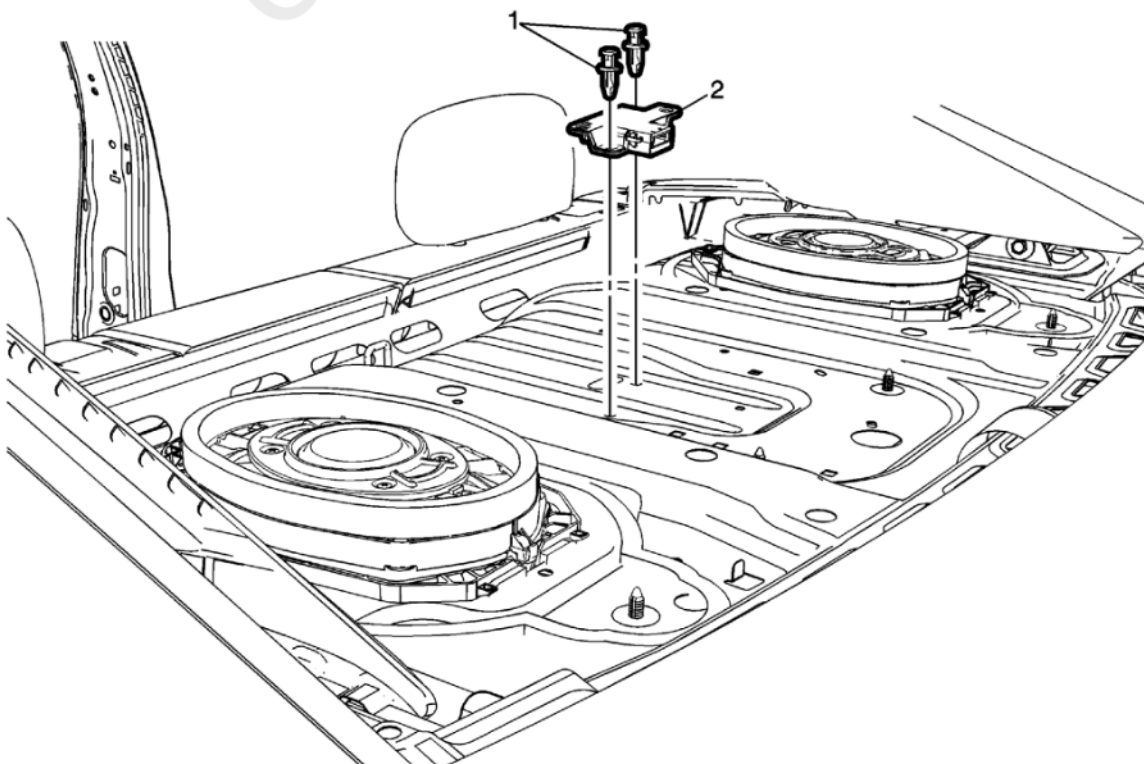


Fig. 10: Electronic Compass Module
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the rear window panel trim. Refer to Rear Window Panel Trim Replacement .	
1	Electronic Compass Module Fastener (Qty: 2) CAUTION: Refer to Fastener Caution .
2	Electronic Compass Module Procedure 1. Disconnect the electrical connector. 2. For programming and set up, refer to Control Module References .

INSTRUMENT CLUSTER REPLACEMENT

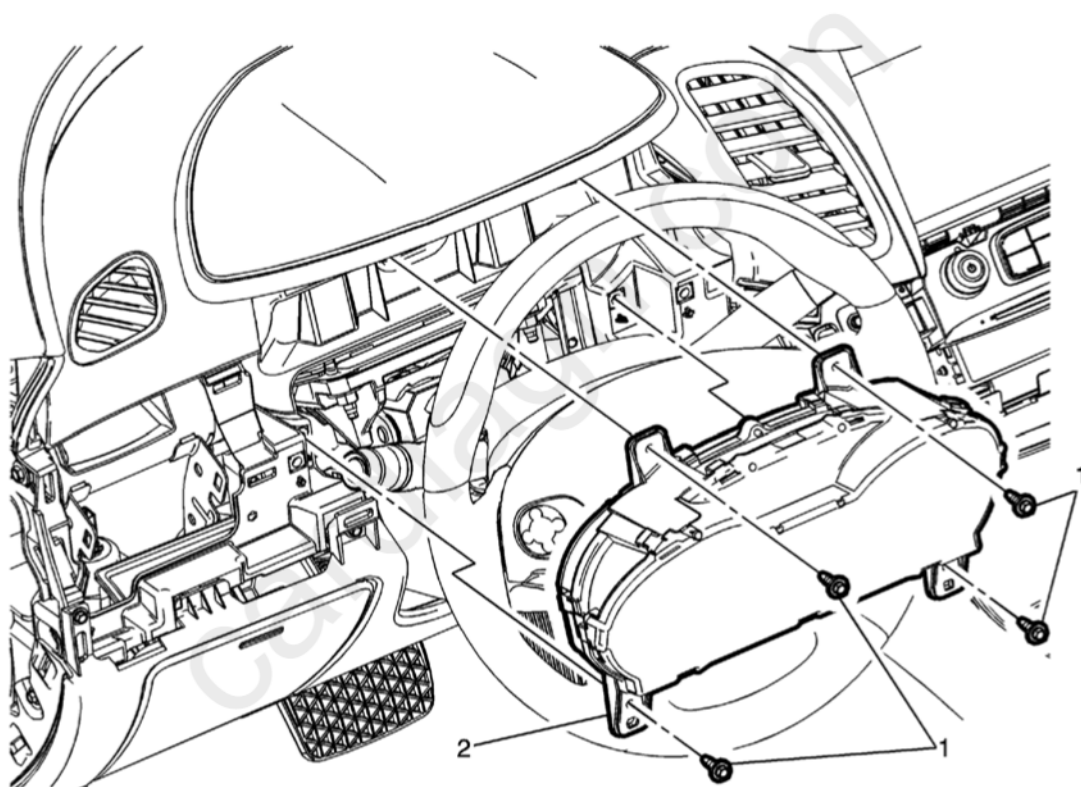


Fig. 11: Instrument Cluster Assembly
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the instrument panel cluster trim plate. Refer to Instrument Panel Cluster Trim Plate Replacement .	
1	Instrument Cluster Bolt (Qty: 4) CAUTION: Refer to Fastener Caution .

Callout	Component Name
2	Instrument Cluster Assembly Procedure 1. Disconnect the electrical connector. 2. Refer to Control Module References for programming and set up information.

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.

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 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.

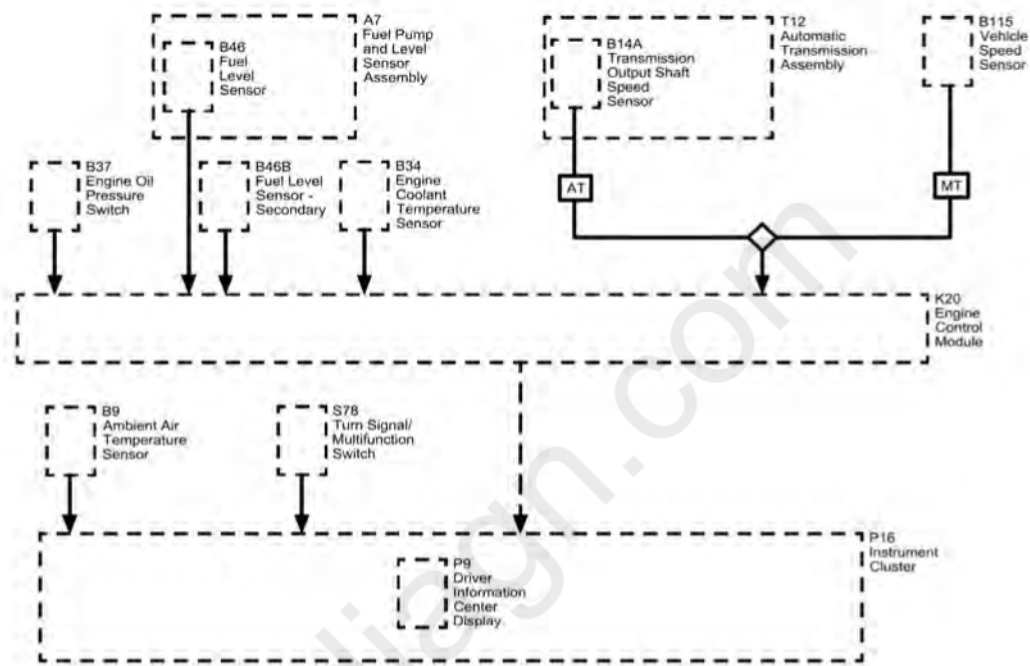


Fig. 12: Displays and Gauges Block Diagram

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

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

Engine Coolant Temperature Gauge

The instrument cluster displays the engine coolant temperature as determined by the engine control module (ECM). The ECM sends the engine coolant temperature information via 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 ECM monitors the engine oil pressure sensor. The IPC receives a serial data message from the ECM indicating the engine oil pressure. The engine oil pressure gauge defaults to 0 kPa (0 psi) or below 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 Gauge (Gasoline)

The instrument cluster displays the fuel level based on the information from the ECM. The ECM converts the data from the fuel level sensors to a fuel level signal. The ECM sends the fuel level signal via serial data to the BCM. The BCM then sends the information via serial data to the instrument cluster to display the fuel level. 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.

Fuel Gauge (CNG)

The Engine Control Module monitors the signal of the pressure sensor to determine the amount of pressure in the tank. The Engine Control Module uses this signal in order to calculate the percentage of remaining CNG in the tank. The Engine Control Module sends the fuel level to the instrument cluster via serial data. The instrument cluster then displays the approximate level on the fuel level gauge.

When the engine is in gasoline mode: The instrument cluster displays gasoline fuel level on the fuel gauge and CNG fuel level can be viewed on the Driver Information Center.

When the engine is in CNG mode: The instrument cluster displays CNG fuel level on the fuel gauge and gasoline fuel level can be viewed on the Driver Information Center.

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.

Outside Air Temperature

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

Compass

The vehicle compass information is gathered through the compass module or vehicle communication interface module (VCIM). The compass module or VCIM 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.

Driver Information Center Display (with RPO UDD)

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.
