

2018 ACCESSORIES & EQUIPMENT

Displays And Gauges - Traverse

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

NOTE:

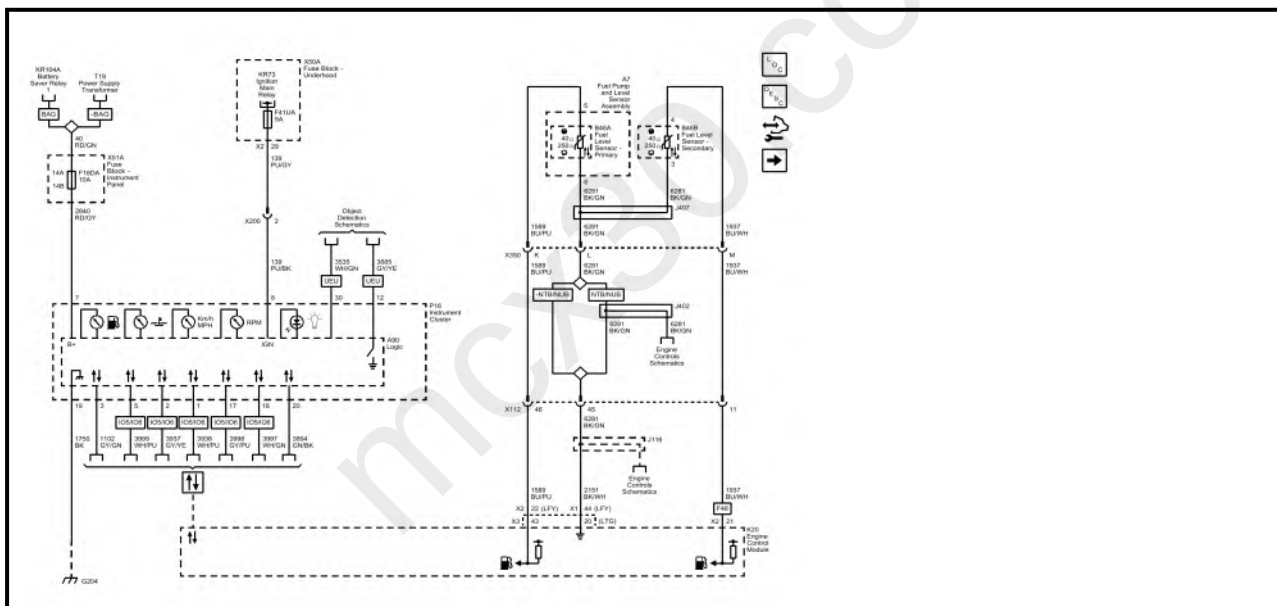
All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
Instrument Cluster Bolt	2.5 N.m (22 lb in)

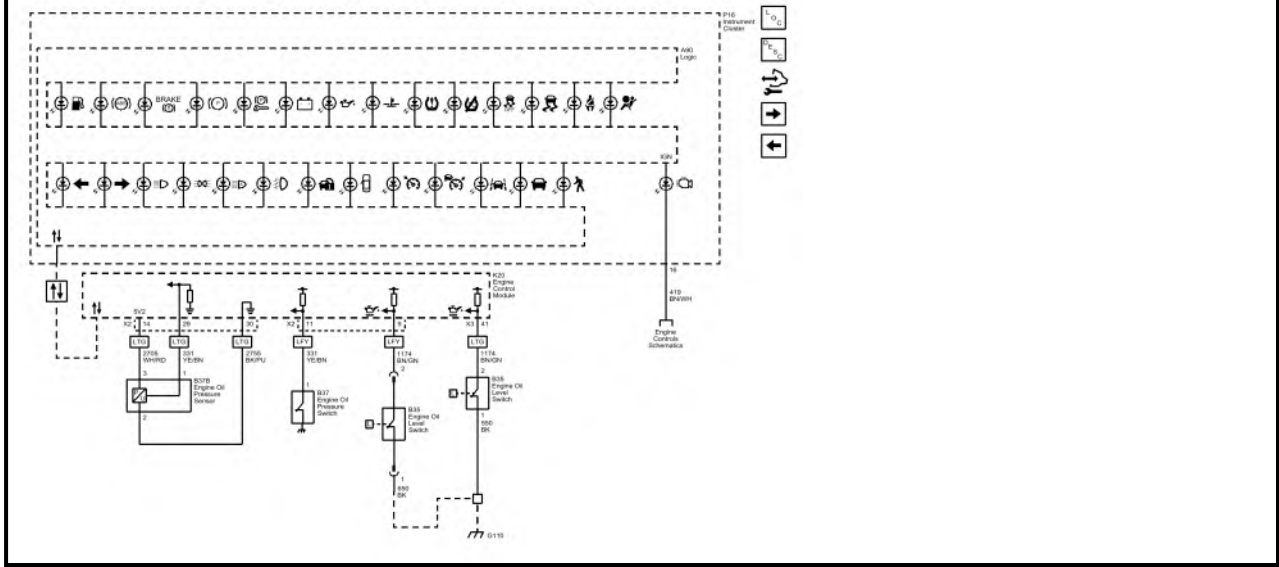
SCHEMATIC WIRING DIAGRAMS

INSTRUMENT CLUSTER WIRING SCHEMATICS

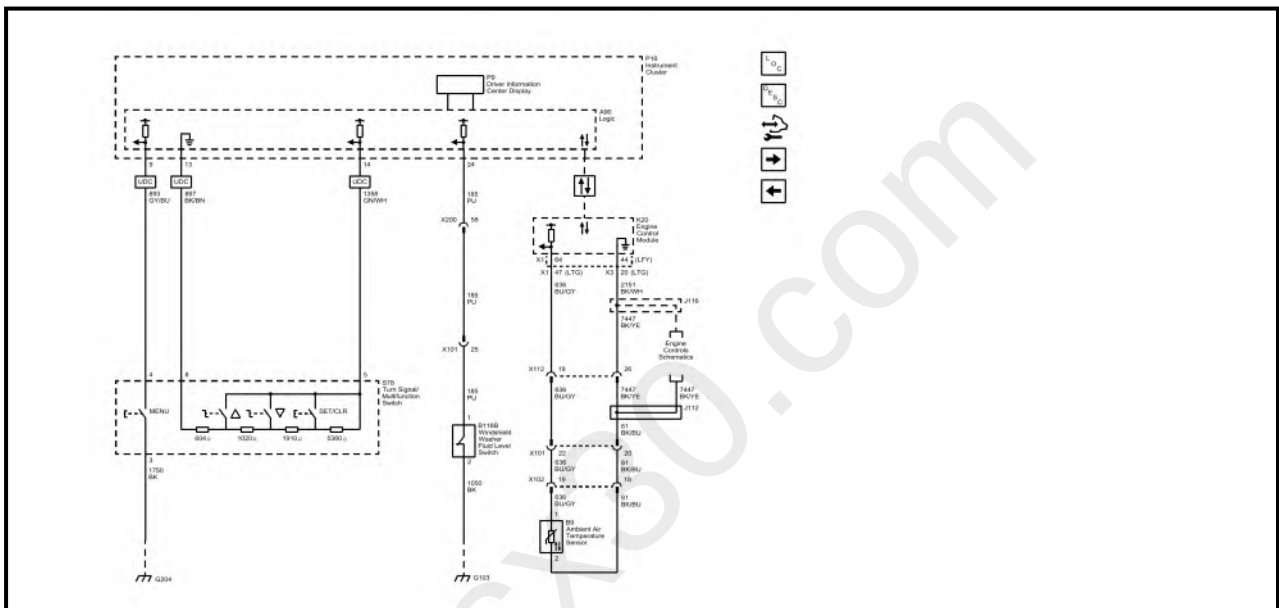
Power, Ground, Gauges, and Serial Data



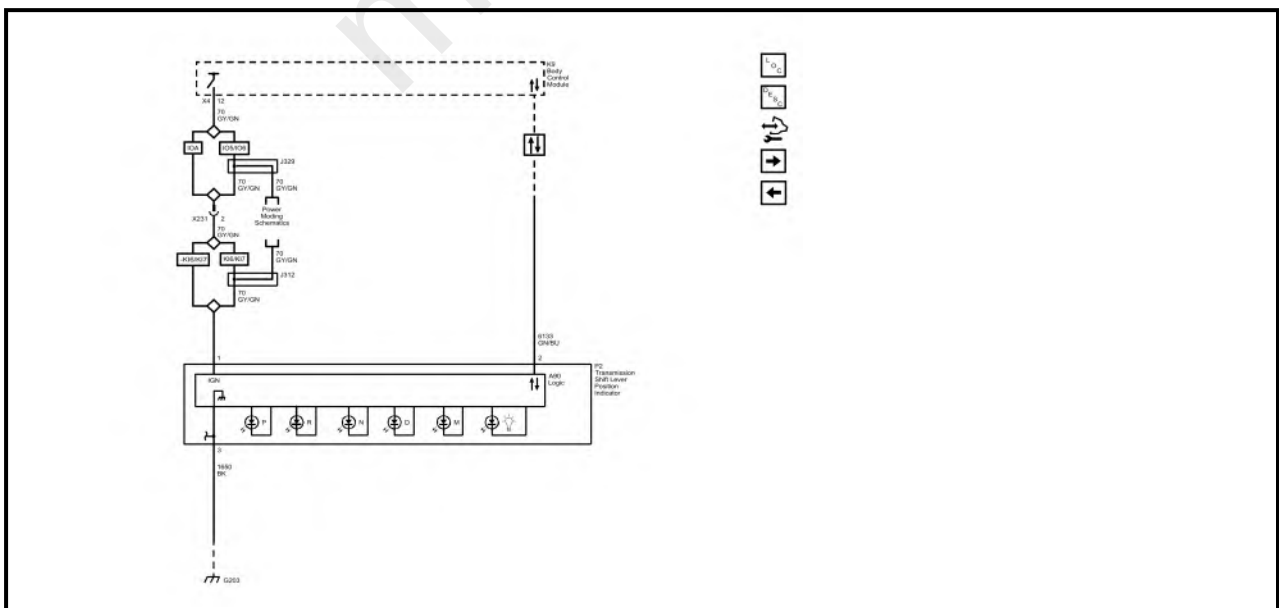
Indicators



Air Temperature, and Driver Information Center



Shift Lever Indicator (M3V)



Shift Lever Indicator (M3W)

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K9 Body Control Module = Internal Malfunction

Actions Taken When the DTC Sets

Odometer = "---"

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

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

Repair Instructions

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

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

DTC B071F

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

- Symptom Byte: 32 - Internal Malfunction

Circuit/System Description

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

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

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K9 Body Control Module Detected Transmission Range Indicator = Internal Malfunction

Actions Taken When the DTC Sets

No additional actions taken

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

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

- **If the DTC is set**

Replace the component: P2 Transmission Shift Lever Position Indicator

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

3. All OK.

Repair Instructions

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

Displays and Gauges Component Replacement Reference

DTC B0931

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 Module Detected K18 Compass Module = Internal Malfunction

Actions Taken When the DTC Sets

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

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

[Instrument Cluster Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Electrical Information Reference

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

Scan Tool Reference

[Control Module References](#)

Circuit/System Verification

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

- **If the DTC is set**

Replace the component: K18 Compass Module

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

3. All OK.

Repair Instructions

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

[Displays and Gauges Component Replacement Reference](#)

DTC B124F

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
 - Go to next step: If the DTC is not set
 3. All OK.
 - **Go to next step: If the DTC is not set**
3. All OK.

Repair Instructions

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

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

DTC B3567

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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B0158 is not set
 - **If DTC B0158 is set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: 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
 - **Go to next step: 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
 - **Go to next step: 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 4 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.
 - Go to next step: 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.

- **Go to next step: 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

- **Go to next step: 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 8 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.
 - **Go to next step: If less than 10 Ω**
3. Test for 9.8 - 12.2 V between the signal circuit terminal 5 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.
 - Go to next step: 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.
 - **Go to next step: 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 control module replacement, programming and setup

DTC P0071-P0074

Diagnostic Instructions

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

DTC Descriptors

DTC P0071

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
Low Reference	-	P0073	-	P0071

Circuit/System Description

The B9 Ambient Air Temperature Sensor is located behind the grille. The engine control module monitors the ambient air temperature sensor with a low reference circuit and signal circuit. The engine control module monitors the voltage drop across the sensor, which is inversely proportional to temperature. When the ambient air temperature is cold, the resistance of the sensor is high. When the ambient air temperature is warm, the resistance of the sensors is low. The engine control module converts the voltage value to a temperature value and sends the value to the P17 Info Display Module via serial data. The P17 Info Display Module displays the temperature.

Conditions for Running the DTC**P0071**

- Engine running
- Time between current ignition cycle and previous engine running time is greater than 8 hours.
- Vehicle Speed is greater than 25 kph (16 mph)

P0072, P0073, P0074

- The ignition is ON
- The 12 V battery voltage is greater than or equal to 10.2 V.

Conditions for Setting the DTC**P0071**

During the first 20 s of run time after the 8 hour soaking period, the difference between the outside air temperature and the engine intake air temperature is greater than 15°C (27°F).

P0072

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

P0073

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

P0074

The ECM detects an unrealistic signal variance.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostics 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 Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

[Instrument Cluster Description and Operation](#)

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON/Vehicle in Service Mode.
2. Verify DTC P0072, P0073, or P0074 is not set.
 - **If DTC P0072, P0073, or P0074 is set**
Refer to Circuit/System Testing.
 - **Go to next step: If DTC P0072, P0073, or P0074 are not set**
3. Verify any other ECM or temperature-related DTCs are not set.
 - **If other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If no other DTCs are set**
4. Allow vehicle to completely cool to ambient temperature.
5. Verify the scan tool Intake Air Temperature parameter is within 15Å,Å°C (27Å,Å°F) of actual ambient temperature.
 - **If not within 15Å,Å°C (27Å,Å°F) of actual ambient temperature**

Refer to appropriate Engine Coolant Temperature Sensor or Intake Air Temperature Sensor diagnosis.

- **Go to next step: If within 15 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$ (27 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$) of actual ambient temperature**
6. Verify the scan tool ECM Ambient Air Temperature parameter is within 15 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$ (27 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$) of actual ambient temperature.
- **If not within 15 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$ (27 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$) of actual ambient temperature**
- Refer to Circuit/System Testing.
- **Go to next step: If within 15 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$ (27 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$) of actual ambient temperature**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal B (or 2) and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the ECM scan tool Ambient Air Temperature parameter reads colder than -30 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$ (-34 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$).
 - **If -30 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$ (-34 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$) or warmer**
 1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal A (or 1) and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If colder than -30 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$ (-34 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$)**
5. Install a 3 A fused jumper wire between the signal circuit terminal A (or 1) and the low reference circuit terminal B (or 2).
6. Verify the scan tool Ambient Air Temperature parameter reads warmer than 180 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$ (82 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$).
 - **If 180 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$ (82 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$) or colder**
 1. Ignition OFF, disconnect the X1 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.
 - Go to next step: If less than 1 V
 - 3. Ignition OFF
 - 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If warmer than 180 $\tilde{A}$, $\hat{A}^{\circ}\text{F}$ (82 $\tilde{A}$, $\hat{A}^{\circ}\text{C}$)**
7. Replace the B9 Ambient Air Temperature Sensor.

Repair Instructions

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

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

DTC P0461-P0464 (WITHOUT F48)

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 resistance of the fuel level sensor is low and the ECM senses a low signal voltage on the signal circuit of the fuel level sensor. When the fuel tank is empty, the resistance of the fuel level sensor is high and the ECM senses a high signal voltage. The ECM uses the signal circuit of the fuel level sensor in order to calculate the percentage of remaining fuel in the tank. The 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

- 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 Wiring Schematics

Connector End View Reference

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Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the fuel level gauge sweeps when performing the scan tool Instrument Cluster Gauge Sweep control function.

- **If the fuel level gauge does not sweep**

Replace the P16 Instrument Cluster

- **Go to next step: If the fuel level gauge sweeps**

3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.

- **If the low fuel level indicator does not turn ON and OFF**

Replace the P16 Instrument Cluster

- **Go to next step: If the low fuel level indicator turns ON and OFF**

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

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

Refer to Circuit/System Testing

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

5. All OK.

Circuit/System Testing

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

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the A7 Fuel Pump and Level Sensor assembly. It may take up to 2 min for all vehicle systems to power down.

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

- **If 10 Ω or greater**

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

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

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

3. Ignition ON.

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

- **If 4.8 V or less**

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

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

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

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

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

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

- **If 0.2 V or greater**

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

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

- If 1 V or greater, repair the short to voltage on the circuit.
- Go to next step: If less than 1 V

3. Ignition OFF

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

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

7. Test or replace the fuel level sensor

Component Testing

1. Ignition OFF, remove the fuel level sender.
2. Sweep the fuel level sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.
3. Test for a minimum resistance value of 37-43 Ω and a maximum value of 245-255 Ω without any spikes or dropouts.
 - **If minimum resistance is not 37-43 Ω , maximum resistance is not 245-255 Ω , or if there are any spikes or dropouts**

Replace the fuel level sensor.

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

4. All OK.

Repair Instructions

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

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

DTC P0461-P0464, P2066, P2067, OR P2068 (WITH F48)

Diagnostic Instructions

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

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 Circuit Intermittent

DTC P2066

Fuel Level Sensor 2 Performance

DTC P2067

Fuel Level Sensor 2 Circuit Low Voltage

DTC P2068

Fuel Level Sensor 2 Circuit High Voltage

Diagnostic Fault Information

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

Circuit/System Description

The primary fuel level sensor and the secondary fuel level sensor change resistance based on fuel level. The engine control module (ECM) monitors the signal circuits of both sensor to determine the fuel level. When the fuel tank is full, the resistances of both fuel level sensors are low. When the fuel tank is empty, the resistances of the fuel level sensors are high. The ECM uses the signal voltages of the primary fuel level sensor and the secondary fuel level sensor to calculate the percentage of remaining fuel in the tank. The ECM sends the fuel level percentage via serial data to the body control module (BCM). The BCM then sends the fuel level percentage via serial data to the instrument cluster to control the fuel gauge.

Conditions for Running the DTC

- Ignition ON
- The system voltage is between 11 - 16 V

Conditions for Setting the DTC

P0461 or P2066

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

P0462 or P2067

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

P0463 or P2068

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

P0464

- The fuel level change is greater than 10% 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, P0463, P2066, P2067 and P2068 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, P0463, P2066, P2067 and P2068 are Type B DTCs
- P0464 is a Type A DTC

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

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

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

Primary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the A7 Fuel Pump and Level Sensor Assembly. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.
6. Verify the scan tool Fuel Level Sensor Left Tank parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - Go to next step: If less than 1 V
 3. Ignition OFF
 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 0.2 V**
7. Test or replace the B46 Fuel Level Sensor.

Secondary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B46B Fuel Level Sensor - Secondary. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 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.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.

4. Verify the scan tool Fuel Level Sensor Right Tank parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 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.
 - **Go to next step: If greater than 4.8 V**
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 Fuel Level Sensor Right Tank parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - Go to next step: If less than 1 V
 3. Ignition OFF
 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 0.2 V**
7. Test or replace the B46B Fuel Level Sensor - Secondary.

Component Testing

Primary Fuel Level Sensor

1. Ignition OFF, remove the appropriate Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.
3. Test for a minimum resistance value of 37-43 Ω and a maximum value of 245-255 Ω without any spikes or dropouts.
 - **If minimum resistance is not 37-43 Ω , maximum resistance is not 245-255 Ω , or if there are any spikes or dropouts**

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

Secondary Fuel Level Sensor

1. Ignition OFF, remove the appropriate Fuel Level Sender.
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 appropriate Fuel Level Sensor.
 - **Go to next step: If minimum resistance is 37-43 Ω , maximum resistance is 245-255 Ω , and if there are no spikes or dropouts**

4. All OK.

Repair Instructions

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

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

DTC P0520

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 Malfunction

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
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 80Å,Å°C (176Å,Å°F).
- Engine coolant temperature reduced more than 10Å,Å°C (16Å,Å°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.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- **Instrument Cluster Description and Operation**
- **Indicator/Warning Message Description and Operation**
- **Driver Information Center (DIC) 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 Engine Oil Pressure parameter is Low.
 - **If not Low**

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

Refer to Circuit/System Testing.
 - **Go to next step: If OK**
5. 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 and ground.

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

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

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

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

- **If not Low**

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.
- Go to next step: 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.

- **Go to next step: 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 control module replacement, programming and setup

DTC P0521 (WITH LFY)

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 P0521

Engine Oil Pressure Sensor Performance Malfunction

Diagnostic Fault Information

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

Typical Scan Tool Data

ECM - Engine Oil Pressure Switch

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

Circuit/System Description

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

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The ECM detects that the engine oil pressure switch signal circuit is pulled low.
- The engine oil pressure is outside of a calculated working range determined by engine speed and temperature.
- The above condition is present for greater than 10 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

DTC P0521 can set if engine oil pressure is outside the calculated engine oil pressure model stored in the engine control module. This can be an indication of mechanical engine issues causing lower than expected engine oil pressure.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- **Instrument Cluster Description and Operation**
- **Indicator/Warning Message Description and Operation**
- **Driver Information Center (DIC) 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

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Engine Oil Pressure parameter is Low.
 - **If not Low**

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

Refer to Circuit/System Testing.
 - **Go to next step: If OK**
5. 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 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If OK**
3. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.
 - **If not Low**
 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.
 - Go to next step: 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.
 - **Go to next step: 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 control module replacement, programming and setup

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 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	High Resistance	Open	Short to Voltage	Signal Performance
Engine Oil Pressure 5 V Reference	P0522	1	P0522	P0523	P0521
Engine Oil Pressure Sensor Signal	P0522	1	P0522	P0523	P0521
Low Reference	-	1	P0523	-	P0521
1. Engine Oil Pressure Indicator Malfunction					

Circuit/System Description

The engine oil pressure sensor changes voltage based on the engine oil pressure. The engine oil pressure sensor is a 3-wire sensor comprising of the signal circuit, the low reference circuit and the 5 V reference circuit. The engine control module (ECM) supplies 5 V to the engine oil pressure sensor via the 5 V reference circuit and provides ground via the low reference circuit. The ECM monitors the signal circuit of the engine oil pressure sensor to determine if the engine oil pressure sensor voltage is within the normal operating range of approximately 1 - 4 V. When the engine oil pressure is high, the engine oil pressure sensor voltage is high and the ECM senses a high signal voltage. When the engine oil pressure is low, the engine oil pressure sensor voltage is low and the ECM senses a low signal voltage. The ECM sends the engine oil pressure information to the instrument cluster via serial data. The instrument cluster will illuminate or display the engine oil pressure indicator when the engine oil pressure is low.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

P0521

- The ECM detects that measured oil pressure is at least 47 kPa (6.8 psi) less than or 50 kPa (7.3 psi) higher than the predicted oil pressure.
- The engine oil pressure is outside of a calculated working range determined by engine speed and temperature.
- The above condition is present for greater than 10 s.

P0522

- The ECM detects that the engine oil pressure sensor signal circuit is less than 0.2 V.
- The above condition is present for greater than 10 s.

P0523

- The ECM detects that the engine oil pressure sensor signal circuit is greater than 4.8 V.
- The above condition is present for greater than 10 s.

Action Taken When the DTC Sets

- The ECM records the operating conditions at the time the diagnostics test fails. The ECM displays this information in the Failure Records on the scan tool.
- The instrument cluster illuminates the engine oil pressure indicator.

Conditions for Clearing the DTC

- The DTC becomes history when the conditions for setting the DTC are no longer present.
- The history DTC clears after 40 malfunction-free warm-up cycles.

Diagnostic Aids

DTC P0521 can set if engine oil pressure is outside the calculated engine oil pressure model stored in the engine control module. This can be an indication of improper engine oil level, poor engine oil condition, or mechanical engine issues causing lower than expected engine oil pressure.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- [Indicator/Warning Message Description and Operation](#)
- [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

With UDD

1. Verify correct engine oil level and condition.
2. Ignition ON.
3. 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.
 - **Go to next step: If the engine oil pressure indicator turns on and off**
4. Verify the scan tool Engine Oil Pressure Sensor parameter is 0 psi (0 kPa).

- **If not 0 psi (0 kPa)**

Refer to Circuit/System Testing.

- **Go to next step: If 0 psi (0 kPa)**

5. Engine running.

6. Verify actual engine oil pressure is within specified range. Refer to *Oil Pressure Diagnosis and Testing* in **Displays and Gauges Component Replacement Reference**.

7. Verify the scan tool Engine Oil Pressure parameter is within specified range.

- **If not within specified range**

Refer to Circuit/System Testing.

- **Go to next step: If within specified range**

8. Verify the engine oil pressure displayed on Instrument Cluster is within specified range.

- **If not within specified range**

Test or replace the P16 Instrument Cluster.

- **Go to next step: If within specified range**

9. All OK.

With UDV or UHS

1. Verify correct engine oil level and condition.

2. Ignition ON.

3. Verify the scan tool Engine Oil Pressure Sensor parameter is 0 psi (0 kPa).

- **If not 0 psi (0 kPa)**

Refer to Circuit/System Testing.

- **Go to next step: If 0 psi (0 kPa)**

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 within specified range.

- **If not within specified range**

Refer to Circuit/System Testing.

- **Go to next step: If within specified range**

7. Verify the engine oil pressure displayed on Instrument Cluster is within specified range.

- **If not within specified range**

Test or replace the P16 Instrument Cluster.

- **Go to next step: If within specified range**

8. 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 B37B Engine Oil Pressure Sensor. 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 2 and ground.

- **If 10 Ω or greater**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
- **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. 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.
 - Go to next step: 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.
 - **Go to next step: If between 4.8 - 5.2 V**
5. Verify the scan tool Engine Oil Pressure parameter is less than 35kPa (5psi).
 - **If 35kPa (5psi) or above**
 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 terminal 1 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.
 - **Go to next step: If below 35kPa (5psi)**
6. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the 5 V reference circuit terminal 3.
7. Engine running.
8. Verify the scan tool Engine Oil Pressure parameter is greater than 800kPa (116psi).
 - **If 800kPa (116psi) or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - Go to next step: 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.
 - **Go to next step: If greater than 800kPa (116psi)**
9. Test or replace the B37B Engine Oil Pressure 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 P250A

Diagnostic Instructions

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

DTC Descriptor

DTC P250A

Engine Oil Level Switch Circuit

Diagnostic Fault Information

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

Typical Scan Tool Data

Engine Oil Level Switch

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

Circuit/System Description

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

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

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

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

Engine Oil Level Low message activated.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Indicator/Warning Message Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

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

Circuit/System Testing

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

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B35 Engine Oil Level Switch. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 1 and ground.
 - **If 5 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.

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

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

3. Ignition ON.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- If 2 Ω or greater, repair the open/high resistance on the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

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

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

Repair Instructions

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

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

DISPLAYS AND GAUGES COMPONENT REPLACEMENT REFERENCE

Component	Repair Instruction
B9 Ambient Air Temperature Sensor	<u>Ambient Air Temperature Sensor Replacement</u>
Engine Oil Level Switch	{2.0L LTG engine} <u>Engine Oil Level Indicator Switch Replacement</u> {3.6L LFY engine} <u>Engine Oil Level Indicator Switch Replacement</u>
B37 Engine Oil Pressure Switch or B37D Engine Oil Pressure Sensor	{2.0L LTG engine} <u>Engine Oil Pressure Sensor Replacement</u> {3.6L LFY engine} <u>Engine Oil Pressure Sensor and/or Switch Replacement</u>
B46 Fuel Level Sensor	{2.0L LTG engine} <u>Fuel Level Sensor Replacement</u> {3.6L LFY engine} <u>Fuel Level Sensor Replacement (AWD)</u> <u>Fuel Level Sensor Replacement (FWD)</u>

Component	Repair Instruction
B46/B46A/B46B Fuel Level Sensor	{2.0L LTG engine} Fuel Level Sensor Replacement {3.6L LFY engine} Fuel Level Sensor Replacement (AWD) Fuel Level Sensor Replacement (FWD) , Fuel Tank Fuel Pump Module Replacement (FWD) Fuel Tank Fuel Pump Module Replacement (AWD)
P2 Transmission Shift Lever Position Indicator	Transmission Control Replacement
S39 Ignition Switch	Ignition and Start Switch Replacement
Oil Pressure Diagnosis and Testing	{2.0L LTG engine} Oil Pressure Diagnosis and Testing {3.6L LFY engine} Oil Pressure Diagnosis and Testing

SYMPTOMS - DISPLAYS AND GAUGES

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

- Before using the symptom diagnostic tables, perform the [Diagnostic System Check - Vehicle](#) in order to determine that there are no DTCs set, and that the control modules can communicate via the serial data link.
- Review the system operation in order to understand the system functions. Refer to the following description and operations:
 - [Instrument Cluster Description and Operation](#)
 - [Indicator/Warning Message Description and Operation](#)
 - [Driver Information Center \(DIC\) 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 \(FWD\)](#)[Fuel Gauge Malfunction \(AWD\)](#)
- [Engine Oil Pressure Indicator Malfunction \(with LTG\)](#)[Engine Oil Pressure Indicator Malfunction \(with LFY\)](#)
- [Outside Air Temperature Display Malfunction](#)

DRIVER INFORMATION CENTER SWITCH MALFUNCTION (WITH UDC)

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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B0158 is not set
 - **If DTC B0158 is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **Go to next step: 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
 - **Go to next step: 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**

- **Go to next step: 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 4 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.
 - Go to next step: 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.
 - **Go to next step: 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
 - **Go to next step: 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 8 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.
 - **Go to next step: If less than 10 Ω**
3. Test for 9.8 - 12.2 V between the signal circuit terminal 5 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.
 - Go to next step: 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.

• **Go to next step: 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 control module replacement, programming and setup

ENGINE OIL PRESSURE INDICATOR MALFUNCTION (WITH LTG)

Diagnostic Instructions

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

DTC Descriptors

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	High Resistance	Open	Short to Voltage	Signal Performance
Engine Oil Pressure 5 V Reference	P0522	1	P0522	P0523	P0521
Engine Oil Pressure Sensor Signal	P0522	1	P0522	P0523	P0521
Low Reference	-	1	P0523	-	P0521
1. Engine Oil Pressure Indicator Malfunction					

Circuit/System Description

The engine oil pressure sensor changes voltage based on the engine oil pressure. The engine oil pressure sensor is a 3-wire sensor comprising of the signal circuit, the low reference circuit and the 5 V reference circuit. The engine control module (ECM) supplies 5 V to the engine oil pressure sensor via the 5 V reference circuit and provides ground via the low reference circuit. The ECM monitors the signal circuit of the engine oil pressure sensor to determine if the engine oil pressure sensor voltage is within the normal operating range of approximately 1 - 4 V. When the engine oil pressure is high, the engine oil pressure sensor voltage is high and the ECM senses a high signal voltage. When the engine oil pressure

is low, the engine oil pressure sensor voltage is low and the ECM senses a low signal voltage. The ECM sends the engine oil pressure information to the instrument cluster via serial data. The instrument cluster will illuminate or display the engine oil pressure indicator when the engine oil pressure is low.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

P0521

- The ECM detects that measured oil pressure is at least 47 kPa (6.8 psi) less than or 50 kPa (7.3 psi) higher than the predicted oil pressure.
- The engine oil pressure is outside of a calculated working range determined by engine speed and temperature.
- The above condition is present for greater than 10 s.

P0522

- The ECM detects that the engine oil pressure sensor signal circuit is less than 0.2 V.
- The above condition is present for greater than 10 s.

P0523

- The ECM detects that the engine oil pressure sensor signal circuit is greater than 4.8 V.
- The above condition is present for greater than 10 s.

Action Taken When the DTC Sets

- The ECM records the operating conditions at the time the diagnostics test fails. The ECM displays this information in the Failure Records on the scan tool.
- The instrument cluster illuminates the engine oil pressure indicator.

Conditions for Clearing the DTC

- The DTC becomes history when the conditions for setting the DTC are no longer present.
- The history DTC clears after 40 malfunction-free warm-up cycles.

Diagnostic Aids

DTC P0521 can set if engine oil pressure is outside the calculated engine oil pressure model stored in the engine control module. This can be an indication of improper engine oil level, poor engine oil condition, or mechanical engine issues causing lower than expected engine oil pressure.

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- [Indicator/Warning Message Description and Operation](#)
- [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

With UDD

1. Verify correct engine oil level and condition.
2. Ignition ON.
3. 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.
 - **Go to next step: If the engine oil pressure indicator turns on and off**
4. Verify the scan tool Engine Oil Pressure Sensor parameter is 0 psi (0 kPa).
 - **If not 0 psi (0 kPa)**
Refer to Circuit/System Testing.
 - **Go to next step: If 0 psi (0 kPa)**
5. Engine running.
6. Verify actual engine oil pressure is within specified range. Refer to *Oil Pressure Diagnosis and Testing* in [Displays and Gauges Component Replacement Reference](#).
7. Verify the scan tool Engine Oil Pressure parameter is within specified range.
 - **If not within specified range**
Refer to Circuit/System Testing.
 - **Go to next step: If within specified range**
8. Verify the engine oil pressure displayed on Instrument Cluster is within specified range.
 - **If not within specified range**
Test or replace the P16 Instrument Cluster.
 - **Go to next step: If within specified range**
9. All OK.

With UDV or UHS

1. Verify correct engine oil level and condition.
2. Ignition ON.
3. Verify the scan tool Engine Oil Pressure Sensor parameter is 0 psi (0 kPa).
 - **If not 0 psi (0 kPa)**
Refer to Circuit/System Testing.
 - **Go to next step: If 0 psi (0 kPa)**
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 within specified range.

- **If not within specified range**

Refer to Circuit/System Testing.

- **Go to next step: If within specified range**

7. Verify the engine oil pressure displayed on Instrument Cluster is within specified range.

- **If not within specified range**

Test or replace the P16 Instrument Cluster.

- **Go to next step: If within specified range**

8. 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 B37B Engine Oil Pressure Sensor. 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 2 and ground.

- **If 10 Ω or greater**

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

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

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

3. Ignition ON.

4. 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.
- Go to next step: 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.

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

5. Verify the scan tool Engine Oil Pressure parameter is less than 35kPa (5psi).

- **If 35kPa (5psi) or above**

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 terminal 1 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.

- **Go to next step: If below 35kPa (5psi)**

6. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the 5 V reference circuit terminal 3.
7. Engine running.
8. Verify the scan tool Engine Oil Pressure parameter is greater than 800kPa (116psi).
 - **If 800kPa (116psi) or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - Go to next step: 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.
 - **Go to next step: If greater than 800kPa (116psi)**
9. Test or replace the B37B Engine Oil Pressure 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

ENGINE OIL PRESSURE INDICATOR MALFUNCTION (WITH LFY)

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 Malfunction

Diagnostic Fault Information

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

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- [Instrument Cluster Description and Operation](#)
- [Indicator/Warning Message Description and Operation](#)
- [Driver Information Center \(DIC\) 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 Engine Oil Pressure parameter is Low.
 - **If not Low**

Refer to Circuit/System Testing.
 - **Go to next step: If Low**
3. Engine running.
4. Verify the scan tool Engine Oil Pressure parameter is OK.

- **If not OK**

Refer to Circuit/System Testing.

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

5. 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 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If OK**
3. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.
 - **If not Low**
 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.
 - Go to next step: 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.
 - **Go to next step: 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 control module replacement, programming and setup

FUEL GAUGE MALFUNCTION (FWD)

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

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 resistance of the fuel level sensor is low and the ECM senses a low signal voltage on the signal circuit of the fuel level sensor. When the fuel tank is empty, the resistance of the fuel level sensor is high and the ECM senses a high signal voltage. The ECM uses the signal circuit of the fuel level sensor in order to calculate the percentage of remaining fuel in the tank. The 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**

- 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 Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

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

Refer to Circuit/System Testing

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

5. All OK.

Circuit/System Testing

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

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the A7 Fuel Pump and Level Sensor assembly. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If greater than 4.8 V**
5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and the low reference circuit terminal 6.
6. Verify the scan tool Fuel Level Sensor parameter is less than 0.2 V.
 - **If 0.2 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - **Go to next step: If less than 1 V**
 - 3. Ignition OFF
 - 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 0.2 V**
7. Test or replace the fuel level sensor

Component Testing

1. Ignition OFF, remove the fuel level sender.
2. Sweep the fuel level sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.
3. Test for a minimum resistance value of 37-43 Ω and a maximum value of 245-255 Ω without any spikes or dropouts.
 - **If minimum resistance is not 37-43 Ω , maximum resistance is not 245-255 Ω , or if there are any spikes or dropouts**

Replace the fuel level sensor.

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

4. All OK.

Repair Instructions

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

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

FUEL GAUGE MALFUNCTION (AWD)

Diagnostic Instructions

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

DTC Descriptors

DTC P0461

Fuel Level Sensor 1 Performance

DTC P0462

Fuel Level Sensor 1 Circuit Low Voltage

DTC P0463

Fuel Level Sensor 1 Circuit High Voltage

DTC P0464

Fuel Level Sensor 1 Circuit Intermittent

DTC P2066

Fuel Level Sensor 2 Performance

DTC P2067

Fuel Level Sensor 2 Circuit Low Voltage

DTC P2068

Fuel Level Sensor 2 Circuit High Voltage

Diagnostic Fault Information

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

Circuit/System Description

The primary fuel level sensor and the secondary fuel level sensor change resistance based on fuel level. The engine control module (ECM) monitors the signal circuits of both sensor to determine the fuel level. When the fuel tank is full, the resistances of both fuel level sensors are low. When the fuel tank is empty, the resistances of the fuel level sensors are high. The ECM uses the signal voltages of the primary fuel level sensor and the secondary fuel level sensor to calculate the percentage of remaining fuel in the tank. The ECM sends the fuel level percentage via serial data to the body control module (BCM). The BCM then sends the fuel level percentage via serial data to the instrument cluster to control the fuel gauge.

Conditions for Running the DTC

- Ignition ON
- The system voltage is between 11 - 16 V

Conditions for Setting the DTC

P0461 or P2066

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

P0462 or P2067

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

P0463 or P2068

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

P0464

- The fuel level change is greater than 10% 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, P0463, P2066, P2067 and P2068 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, P0463, P2066, P2067 and P2068 are Type B DTCs
- P0464 is a Type A DTC

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

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Instrument Cluster Description and Operation

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

DTC Type Reference

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

Scan Tool Reference

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

[Circuit/System Verification](#)

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

Replace the P16 Instrument Cluster
 - **Go to next step: If the fuel level gauge sweeps**
3. Verify the low fuel level indicator turns ON and OFF when commanding the scan tool All Indicators control function ON and OFF.
 - **If the low fuel level indicator does not turn ON and OFF**

Replace the P16 Instrument Cluster
 - **Go to next step: If the low fuel level indicator turns ON and OFF**
4. Verify the scan tool Fuel Level Sensor Left Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**

Refer to Primary Fuel Level Sensor Malfunction in Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
5. Verify the scan tool Fuel Level Sensor Right Tank parameter is between 0.5 - 3.5 V and varies with fuel level.
 - **If not between 0.5 - 3.5 V or does not vary with fuel level**

Refer to Secondary Fuel Level Sensor Malfunction in Circuit/System Testing
 - **Go to next step: If between 0.5 - 3.5 V and varies with fuel level**
6. All OK.

[Circuit/System Testing](#)

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

Primary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the A7 Fuel Pump and Level Sensor Assembly. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.

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

Secondary Fuel Level Sensor Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B46B Fuel Level Sensor - Secondary. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 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.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Fuel Level Sensor Right Tank parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 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.
 - **Go to next step: If greater than 4.8 V**
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 Fuel Level Sensor Right Tank parameter is less than 0.2 V.

- **If 0.2 V or greater**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - Go to next step: If less than 1 V
3. Ignition OFF
4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
- **Go to next step: If less than 0.2 V**
7. Test or replace the B46B Fuel Level Sensor - Secondary.

Component Testing

Primary Fuel Level Sensor

1. Ignition OFF, remove the appropriate Fuel Level Sender.
2. Sweep the Fuel Level Sensor through its full range of motion while measuring resistance between the signal terminal 5 and the low reference terminal 6.
3. Test for a minimum resistance value of 37-43 Ω and a maximum value of 245-255 Ω without any spikes or dropouts.
 - **If minimum resistance is not 37-43 Ω , maximum resistance is not 245-255 Ω , or if there are any spikes or dropouts**

Replace the appropriate Fuel Level Sensor.

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

Secondary Fuel Level Sensor

1. Ignition OFF, remove the appropriate Fuel Level Sender.
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 appropriate Fuel Level Sensor.

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

Repair Instructions

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

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

ENGINE OIL LEVEL SENSOR DIAGNOSIS

Diagnostic Instructions

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

DTC Descriptor

DTC P250A

Engine Oil Level Switch Circuit

Diagnostic Fault Information

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

Typical Scan Tool Data

Engine Oil Level Switch

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

Circuit/System Description

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

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

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

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

Engine Oil Level Low message activated.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Wiring Schematics

Connector End View Reference

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Indicator/Warning Message Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

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

Circuit/System Testing

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

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B35 Engine Oil Level Switch. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 1 and ground.
 - **If 5 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 5 Ω**
3. Ignition ON.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- If 2 Ω or greater, repair the open/high resistance on the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

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

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

Repair Instructions

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

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

OUTSIDE AIR TEMPERATURE DISPLAY MALFUNCTION

Diagnostic Instructions

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

DTC Descriptors

DTC P0071

Ambient Air Temperature Sensor Performance

DTC P0072

Ambient Air Temperature Sensor Circuit Low Voltage

DTC P0073

Ambient Air Temperature Sensor Circuit High Voltage

DTC P0074

Ambient Air Temperature Sensor Circuit Intermittent

Diagnostic Fault Information

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

Circuit/System Description

The B9 Ambient Air Temperature Sensor is located behind the grille. The engine control module monitors the ambient air temperature sensor with a low reference circuit and signal circuit. The engine control module monitors the voltage drop across the sensor, which is inversely proportional to temperature. When the ambient air temperature is cold, the resistance of the sensor is high. When the ambient air temperature is warm, the resistance of the sensors is low. The engine control module converts the voltage value to a temperature value and sends the value to the P17 Info Display Module via serial data. The P17 Info Display Module displays the temperature.

Conditions for Running the DTC

P0071

- Engine running
- Time between current ignition cycle and previous engine running time is greater than 8 hours.
- Vehicle Speed is greater than 25 kph (16 mph)

P0072, P0073, P0074

- The ignition is ON
- The 12 V battery voltage is greater than or equal to 10.2 V.

Conditions for Setting the DTC

P0071

During the first 20 s of run time after the 8 hour soaking period, the difference between the outside air temperature and the engine intake air temperature is greater than 15Å,Å°C (27Å,Å°F).

P0072

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

P0073

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

P0074

The ECM detects an unrealistic signal variance.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostics 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 Wiring Schematics](#)

Connector End View Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON/Vehicle in Service Mode.
2. Verify DTC P0072, P0073, or P0074 is not set.
 - **If DTC P0072, P0073, or P0074 is set**
Refer to Circuit/System Testing.
 - **Go to next step: If DTC P0072, P0073, or P0074 are not set**
3. Verify any other ECM or temperature-related DTCs are not set.
 - **If other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If no other DTCs are set**
4. Allow vehicle to completely cool to ambient temperature.
5. Verify the scan tool Intake Air Temperature parameter is within 15 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (27 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) of actual ambient temperature.
 - **If not within 15 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (27 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) of actual ambient temperature**
Refer to appropriate Engine Coolant Temperature Sensor or Intake Air Temperature Sensor diagnosis.
 - **Go to next step: If within 15 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (27 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) of actual ambient temperature**
6. Verify the scan tool ECM Ambient Air Temperature parameter is within 15 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (27 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) of actual ambient temperature.
 - **If not within 15 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (27 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) of actual ambient temperature**
Refer to Circuit/System Testing.
 - **Go to next step: If within 15 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (27 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) of actual ambient temperature**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal B (or 2) and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the ECM scan tool Ambient Air Temperature parameter reads colder than -30 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$ (-34 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$).
 - **If -30 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$ (-34 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$) or warmer**
 1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal A (or 1) and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If colder than -30 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$ (-34 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$)**
5. Install a 3 A fused jumper wire between the signal circuit terminal A (or 1) and the low reference circuit terminal B (or 2).
6. Verify the scan tool Ambient Air Temperature parameter reads warmer than 180 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$ (82 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$)
 - **If 180 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$ (82 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$) or colder**
 1. Ignition OFF, disconnect the X1 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.
 - Go to next step: If less than 1 V
 - 3. Ignition OFF
 - 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If warmer than 180 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$ (82 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$)**
7. Replace the B9 Ambient Air Temperature Sensor.

Repair Instructions

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

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

SHIFT INDICATOR 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

Transmission Range Indicator

- Symptom Byte: 32 - Internal Malfunction

Circuit/System Description

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

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

Conditions for Running the DTC

Ignition - On / Vehicle - In Service Mode

Conditions for Setting the DTC

K9 Body Control Module Detected Transmission Range Indicator = Internal Malfunction

Actions Taken When the DTC Sets

No additional actions taken

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

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

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

Repair Instructions

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

Displays and Gauges Component Replacement Reference

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 Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

[Instrument Cluster Description and Operation](#)

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

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

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

- **Go to next step: If no DTCs are set**
3. If applicable, verify the speedometer sweeps from low to high position when performing the Instrument Cluster Gauge Sweep with the scan tool.
 - **If speedometer does not sweep**

Replace the P16 Instrument Cluster.

- **Go to next step: If speedometer sweeps properly**

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

- **If the values do not match**

Replace the P16 Instrument Cluster.

- **Go to next step: If the speedometer value matches the scan tool parameter**

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

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

Refer to Circuit/System Testing.

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

Replace the P16 Instrument Cluster.

- **Go to next step: If speedometer sweeps and displays the correct value, and the odometer display counts up**

6. All OK.

Circuit/System Testing

NOTE:

- **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**
- **If there are multiple modules not original to the vehicle and they are used or incorrectly configured service parts, SPS may not be able to 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.

- **Go to next step: If the reading is Unlocked**

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

- **If the VIN does not match**

Reprogram the BCM, then proceed to Step 3.

- **Go to next step: If the VIN matches**

4. Verify the scan tool Instrument Cluster Vehicle Identification Number (VIN) parameter matches the vehicle's VIN placard.

- **If the VIN does not match**

Reprogram the instrument cluster. Then proceed with step 4.

- **Go to next step: If the VIN matches**

5. Verify the instrument cluster is displaying the correct value.

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

Replace the P16 Instrument Cluster.

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

6. All OK.

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

1. Ignition ON/Vehicle in Service Mode.
2. Verify the scan tool Odometer Status parameter is Locked.
 - **If the reading is Unlocked**
Refer to Correcting VIN mismatch - odometer unlocked.
 - **Go to next step: If the reading is Locked**
3. Verify the scan tool Instrument Cluster Vehicle Identification Number (VIN) parameter matches the vehicle's VIN placard.
 - **If the VIN does not match**
Reprogram the Instrument Cluster. Then proceed with step 3.
 - **Go to next step: If the VIN matches**
4. Perform the BCM setup procedure in SPS.
5. Verify the instrument cluster is displaying the correct value.
 - **If the instrument cluster is still displaying "----" (dashes)**
Replace the P16 Instrument Cluster.
 - **Go to next step: If instrument cluster is displaying the correct value**
6. All OK.

Repair Instructions

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

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

REPAIR INSTRUCTIONS

AMBIENT AIR TEMPERATURE CALCULATION RESET (LTG ONLY)

Diagnostic Instructions

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

Description

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

When to Perform the Procedure

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

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

Conditions for Running the Procedure

Engine = Off

Ignition = Run/Crank

Reference Information

Scan Tool Reference

Control Module References

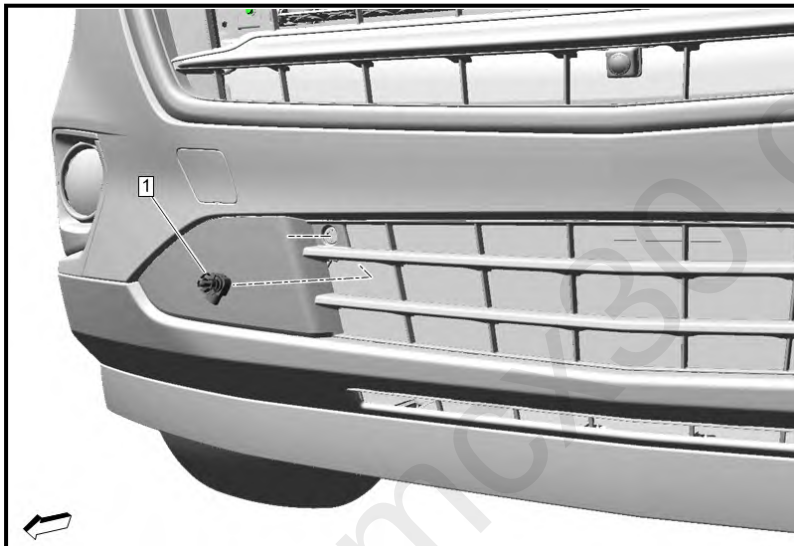
With Scan Tool

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

Repair Instructions

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

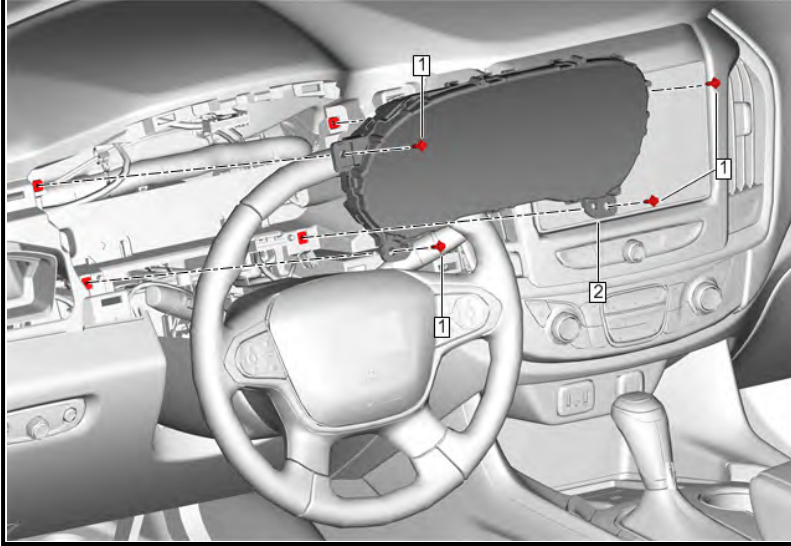
AMBIENT AIR TEMPERATURE SENSOR REPLACEMENT



Callout	Component Name
1	Ambient Air Temperature Sensor Procedures 1. Squeeze the ambient air temperature sensor retaining tabs to remove from the front bumper fascia assembly. 2. Disconnect the electrical connector.

INSTRUMENT CLUSTER REPLACEMENT





Callout	Component Name
Preliminary Procedure <u>Instrument Panel Trim Pad Replacement - Left Side</u>	
1	Instrument Cluster Bolt [4x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 2.5 N.m (22 lb in)
2	Instrument Cluster Procedure 1. Disconnect the electrical connector. 2. Perform the necessary programming and setup procedure: <u>Control Module References</u>

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

Additional Warnings

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

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

Backup Alarm (with 8S3)

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

DRIVER INFORMATION CENTER (DIC) DESCRIPTION AND OPERATION

Driver Information Center (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 distinct display zones. In the middle is an interactive application display zone. The application display zone allows access to the navigation application, audio application, phone application, or settings application. To the left and right are interactive information display zones. The information display zone contains multiple pages that display traditional vehicle information. The vehicle odometer and PRNDL are displayed at all times in the lower portion of each information display zone.

Each of the displays zones can be selected and their associated pages scrolled through using the steering wheel mounted driver information display switch.

Driver Information Center (with RPO UDV)

The driver information center is an integrated function of the instrument cluster. Depending the instrument cluster configuration, the information traditionally displayed in the driver information center will be located in various information and application displays.

For more information, refer to [Instrument Cluster Description and Operation](#).

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

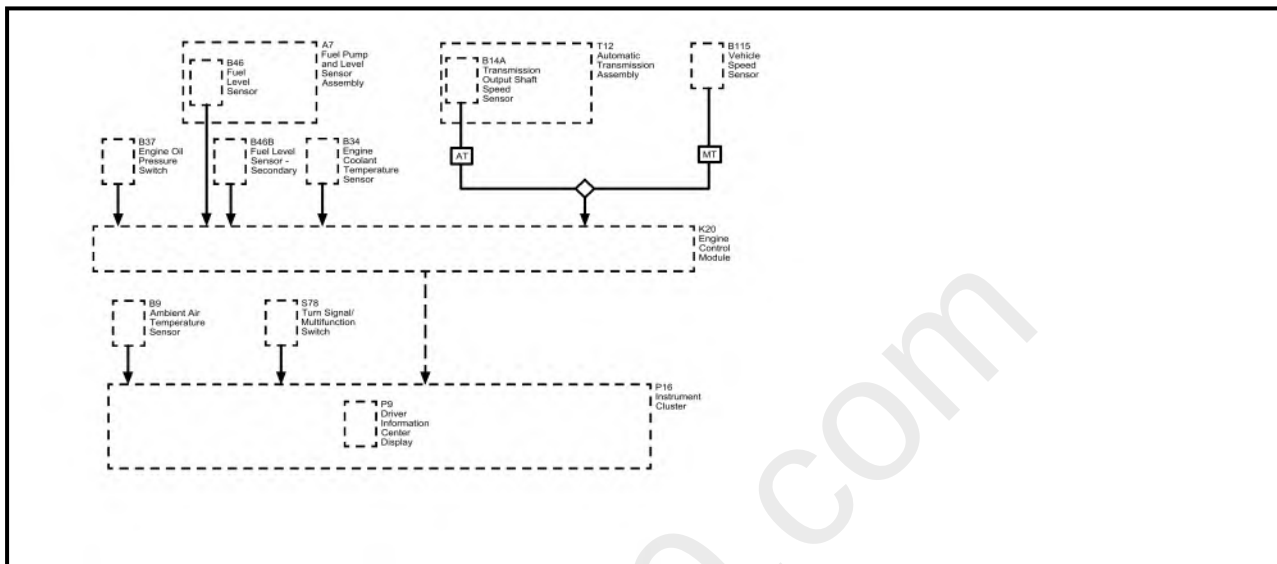
Instrument Cluster (with RPO UDD)

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, and coolant temperature, using

analog gauges. The instrument cluster also provides the operator with operational warnings and message through various indicators and the driver information center. The driver information center is a full color multifunction display that is located in the instrument cluster. The driver information center is also tightly integrated with the vehicle's infotainment system and is highly reconfigurable.

Instrument Cluster (with RPO UDV)

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, and coolant temperature, using an interactive LCD display. The instrument cluster is highly reconfigurable, with four different themes available for selection. The instrument cluster also provides the operator with operational warnings and message through various indicators and the driver information center. Because the instrument cluster is an LCD display, driver information center elements are located in various zones of the display, depending on how the instrument panel is configured.



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

Indicators and Warning Messages

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

Engine Coolant Temperature Gauge

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.

Fuel Level Gauge

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

Speedometer

The instrument cluster displays the vehicle speed based on the information from the ECM. The ECM sends the vehicle speed information via serial data to the BCM. The BCM then sends the vehicle speed information via serial data to the instrument cluster to display the vehicle speed.

Odometer

The instrument cluster displays the vehicle odometer in the driver information center. The ECM send a distance rolling count message via serial data to the body control module (BCM). The BCM uses this information to calculate the vehicle odometer. This odometer value is then sent to the instrument cluster. The instrument cluster does not calculate the odometer.

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

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

Tachometer

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

Compass (with UE1)

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

Compass (without UE1)

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

Driver Information Center Display (with RPO UDD)

The driver information center is located In the lower middle of the instrument cluster. Its is a multifunction full-color LCD intended to display additional information, such as an odometer or messages. The driver information center is divided into three displays zones and is controlled using the steering wheel mounted driver information center select switch. For further information, refer to [Driver Information Center \(DIC\) Description and Operation](#).

Instrument Cluster Configuration (with RPO UDV)

The instrument cluster is highly interactive and reconfigurable. The operator can select from four different display configures and each of these configuration may contain one, two, or three separate display zones. Regardless of which configuration is selected, the vehicle odometer and PRNDL are always displayed in the lower left and lower right corners of the display.

The different display configurations are:

- **Simple** - The most basic of the available configurations, the Simple configuration includes four static information display zones and one interactive information display zone. The infotainment display zone is located on the left side of the display and displays phone, turn-by-turn navigation, and audio information. The speedometer and compass are located in the upper middle of the display. On the right side of the display is a graphical representation of the fuel level and fuel range.

Below the speedometer, in the lower middle of the display, is the interactive information display zone. The information display zone contains multiple pages that can be scrolled through and selected using the steering wheel mounted driver information center switch.

- **Performance** - The Performance configuration contains three static information zones, one interactive information display zone, and one interactive application display zone. The speedometer and tachometer/fuel level gauge are located on the left and right of the display. In between the speedometer and tachometer is a static information display zone that displays current information while the operator scrolls through other pages in the interactive application display zone.

In the middle of the speedometer is an interactive information display zone. This display zone has a limited number of selection and will only display a digital speedometer, a navigation map, a settings page with sub-menus, or a blank page.

Below the tachometer and extending into the lower middle of the display is an interactive application display zone. The application display zone allows access to the navigation application, audio application, phone application, settings application, or information application. Unlike the information display zone that is located within the speedometer, the information application is fully featured and allows access to all available information pages.

- **Balanced** - The Balanced configuration contains three static information zones, two interactive information display zones, and one interactive application display zone. The tachometer is located on the left side of the display, the speedometer in the middle, and the coolant temperature/fuel level gauge on the right.

Located in the tachometer is an interactive information display zone.

In the speedometer is an interactive information display zone. This display zone has a limited number of selection and will only display a digital speedometer, a navigation map, a settings page with sub-menus, or a blank page.

An interactive application display zone is located in the coolant temperature/fuel level gauge. The application display zone allows access to the navigation application, audio application, phone application, or settings application.

- **Enhanced** - The Enhanced configuration contains four static information zones, two interactive information display zones, and one interactive application display zone. The speedometer in the upper middle of the display, a navigation map or compass in located on the upper left, and a fuel level gauge and fuel range display on the right.

Located on the left and right lower portion of the display are interactive information display zones.

An interactive application display zone is located in the middle of the display. The application display zone allows access to the navigation application, audio application, phone application, or settings application.