

2010 ACCESSORIES & EQUIPMENT

Displays and Gauges - Equinox & Terrain

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Instrument Panel Cluster Fasteners	2.5 N.m	22 lb in

AMBIENT AIR TEMPERATURE SENSOR RESISTANCE

Temperature		Ambient Air Temp Sensor	Ambient Air Temp Sensor (Min)	Ambient Air Temp Sensor (Max)
°C	°F	(kohms)	(kohms)	(kohms)
-40	-40	169.4	158.46	181.19
-30	-22	88.74	83.39	94.47
-20	-4	48.58	47.19	50.02
-10	14	27.67	26.93	28.44
0	32	16.33	15.92	16.75
10	50	9.95	9.71	10.19
20	68	6.24	6.1	6.38
30	86	4.02	3.94	4.11
40	104	2.66	2.61	2.71
50	122	1.8	1.73	1.87
60	140	1.24	1.2	1.29

SCHEMATIC AND ROUTING DIAGRAMS

INSTRUMENT CLUSTER SCHEMATICS

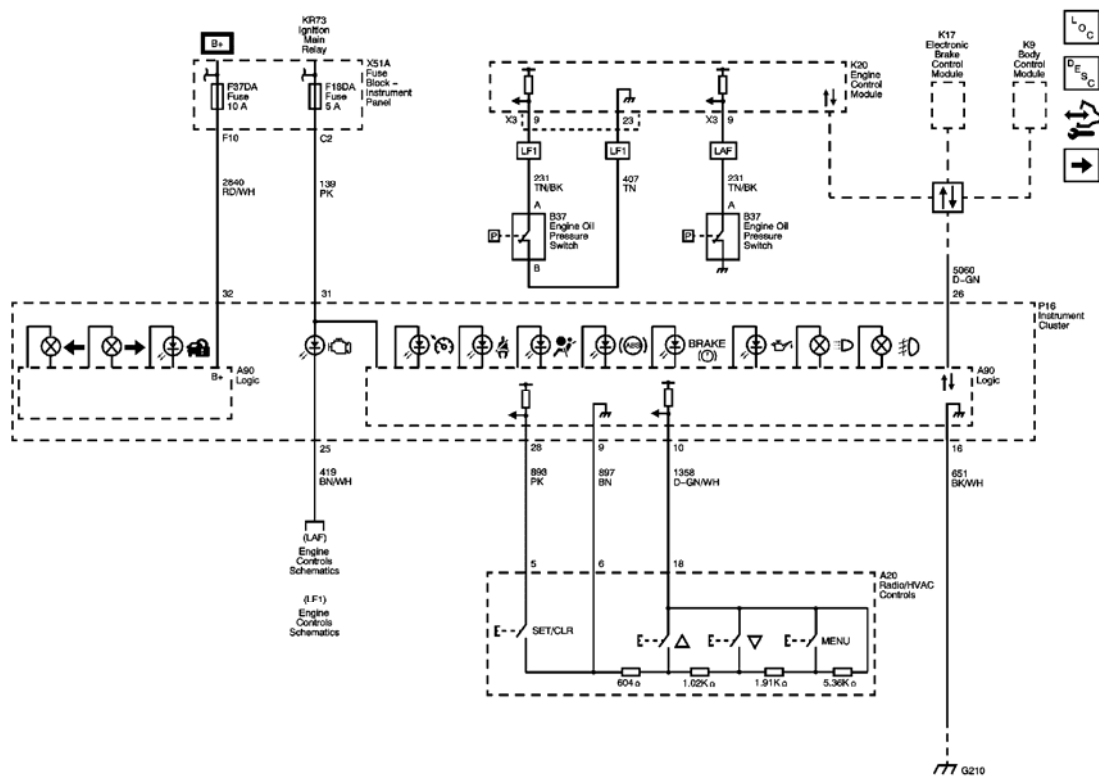


Fig. 1: Power, Ground, and Serial Data
 Courtesy of GENERAL MOTORS CORP.

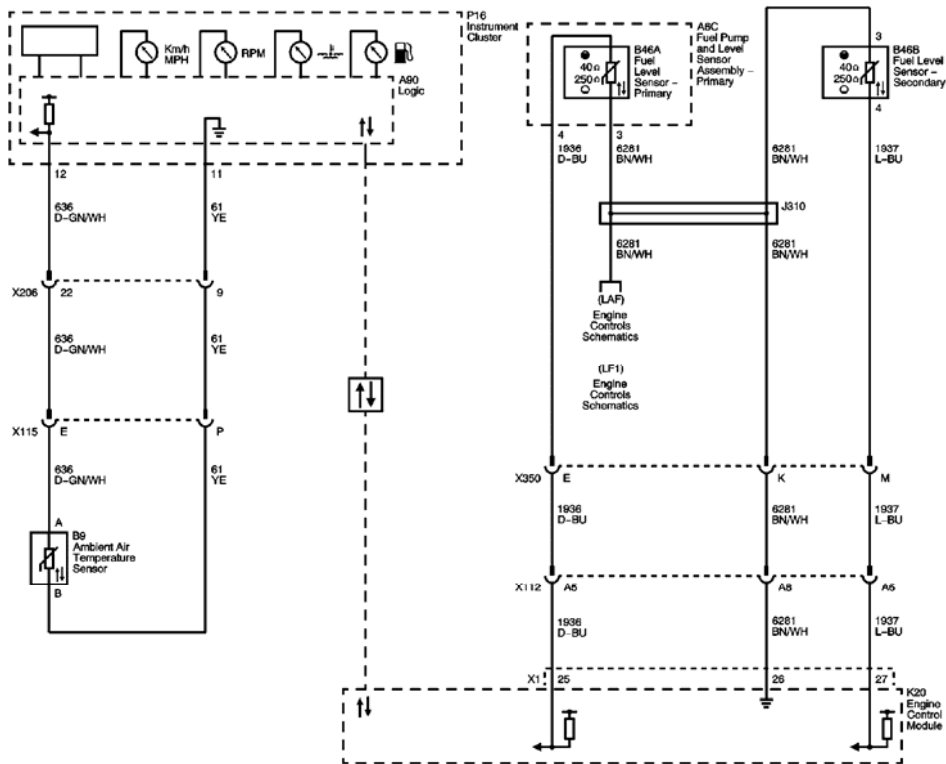


Fig. 2: Fuel and Temperature Sensors
 Courtesy of GENERAL MOTORS CORP.

DRIVER INFORMATION SYSTEM SCHEMATICS

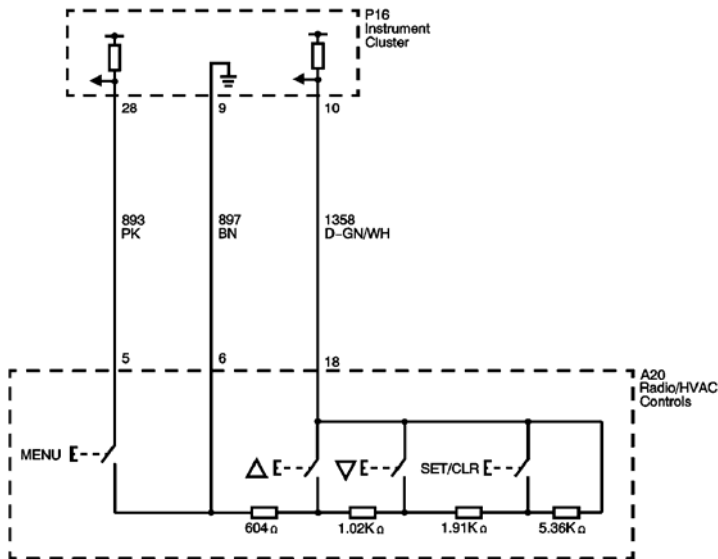


Fig. 3: Driver Information System
Courtesy of GENERAL MOTORS CORP.

AUDIBLE WARNINGS SCHEMATICS

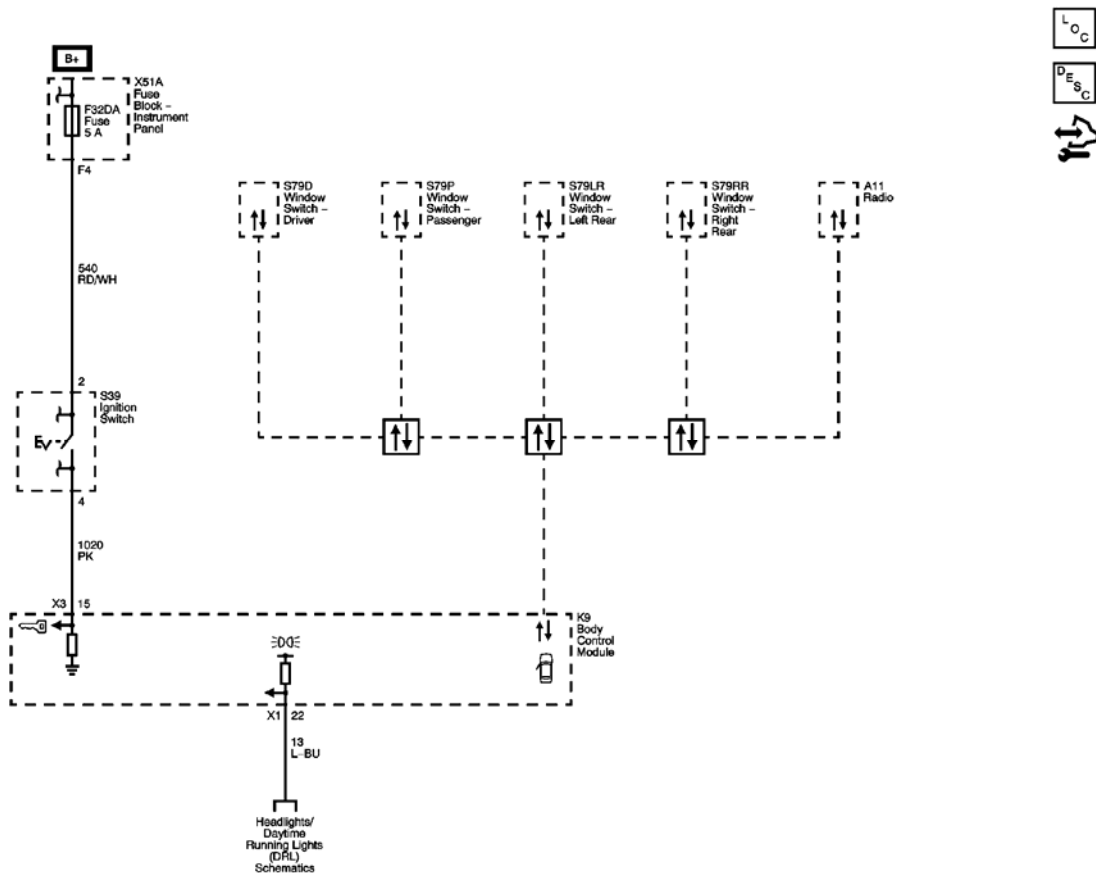


Fig. 4: Audible Warnings

Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC B0158</u>	B0158 02: Ambient Air Temperature Sensor Circuit Short to Ground B0158 05: Ambient Air Temperature Sensor Circuit High Voltage/Open
<u>DTC B0550</u>	B0550 32: Odometer Circuit General Memory Malfunction
<u>DTC B071F</u>	B071F 39: Transmission Range Indicator Internal Malfunction
<u>DTC B1370</u>	B1370 01: Control Module Ignition On and Start Circuit Short to Battery B1370 06: Control Module Ignition On and Start Circuit Open
<u>DTC B3567</u>	B3567 01: Info Display Select Switch Circuit Short to Battery B3567 02: Info Display Select Switch Circuit Short to Ground B3567 04: Info Display Select Switch Circuit Open B3567 59: Info Display Select Switch Circuit Protection Time-Out
<u>DTC P0461-P0464, P2066,</u>	P0461: Fuel Level Sensor 1 Performance

<u>P2067, or P2068</u>	P0462: Fuel Level Sensor 1 Circuit Low Voltage P0463: Fuel Level Sensor 1 Circuit High Voltage P0464: Fuel Level Sensor Circuit Intermittent P2066: Fuel Level Sensor 2 Performance P2067: Fuel Level Sensor 2 Circuit Low Voltage P2068: Fuel Level Sensor 2 Circuit High Voltage
<u>DTC P0520</u>	P0520: Engine Oil Pressure Switch Circuit Malfunction

DTC B0158

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 B0158 02

Ambient Air Temperature Sensor Circuit Short to Ground

DTC B0158 05

Ambient Air Temperature Sensor Circuit High Voltage/Open

Diagnostic Fault Information

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

Circuit/System Description

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

Conditions for Running the DTC

The system voltage is between 9-16 V

Conditions for Setting the DTC

B0158 02

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

B0158 05

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Instrument Cluster 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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool Ambient Air Temperature parameter. The reading should be between -40°C (-40°F) to +88°C (+190°F) and change with air temperature changes.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor.
2. Ignition ON, test for 4.8-5.2 V between the signal circuit terminal A and ground.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the P16 Instrument Cluster.
 - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the P16 Instrument Cluster.
3. Install a 3 A fused jumper wire between the signal circuit terminal A and the low reference circuit terminal B. Verify the scan tool Ambient Air Temperature parameter displays greater than 54 °C (130 ° F).
 - If less than the specified range, test the low reference circuit a short to voltage or an open/high resistance. If the circuit tests normal, replace the P16 Instrument Cluster.
4. If all circuits test normal, test or replace the B9 Ambient Air Temperature Sensor.

Component Testing

Static Test

1. Test the B9 Ambient Air Temperature Sensor by varying the sensor temperature while monitoring the sensor resistance.
2. Compare the readings with the **Ambient Air Temperature Sensor Resistance**.
 - If not within the specified range, replace the B9 Ambient Air Temperature Sensor.

Repair Procedures

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

- **Ambient Air Temperature Sensor Replacement**
- **Control Module References** for module replacement, programming and setup

DTC B0550

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 B0550 32

Odometer Circuit General Memory Malfunction

Circuit/System Description

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

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

B0550 32

The BCM has detected an internal memory malfunction.

Action Taken When the DTC Sets

DTC B0550 32 is stored in the BCM memory.

Conditions for Clearing the DTC

The BCM no longer detects a malfunction.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC B0550 32 is not set.
 - If the DTC is set, program the K9 Body Control Module.
2. Verify that DTC B0550 32 does not reset. If the DTC resets, replace the K9 Body Control Module.

Repair Procedures

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

Control Module References for BCM replacement, setup, and programming

DTC B071F

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 B071F 39

Transmission Range Indicator Internal Malfunction

Circuit/System Description

The body control module (BCM) receives LIN-Bus messages from the transmission range indicator module. If there is a checksum or memory malfunction in the transmission range indicator module it broadcast this message to the BCM.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

The BCM detects a checksum or memory fault in the transmission range indicator module.

Action Taken When the DTC Sets

The driver information center does not display the actual gear selector position.

Conditions for Clearing the DTC

The DTC becomes history when the condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

Component Connector End Views

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Replace the S3 Automatic Transmission Shift Lever and verify that the DTC does not reset.

- If the DTC resets, replace the K9 Body Control Module.

Repair Procedures

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

- **Automatic Transmission Range Selector Lever Replacement**
- **Control Module References** for BCM replacement, setup and programming

DTC B1370

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 B1370 01

Control Module Ignition On and Start Circuit Short to Battery

DTC B1370 06

Control Module Ignition On and Start Circuit Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Instrument Cluster Ignition Terminal 31	B1370 06	B1370 06	B1370 01	-
Ignition Main Relay Ignition Terminal 86	B1370 06	B1370 06	-	-
Ignition Main Relay Ground Terminal 85	-	B1370 06	-	-
Ignition Main Relay B+ Terminal 87	-	B1370 06	-	-

Circuit/System Description

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

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

Conditions for Running the DTC

B1370 01

Ignition switch is in the Accessory position.

B1370 06

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

Conditions for Setting the DTC

B1370 01

Ignition circuit is shorted to voltage.

B1370 06

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

- Instrument Cluster Schematics
- Power Distribution Schematics
- Power Moding Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

- Instrument Cluster Description and Operation
- Power Mode 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

Verify that DTC B144B is not set.

- If the DTC is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

Circuit/System Testing

1. Ignition OFF, disconnect the KR73 ignition main relay.
2. Test for less than 10 ohms between the ground circuit terminal 85 and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify that a test lamp illuminates between the Ignition circuit terminal 86 and ground.
 - If the test lamp does not illuminate, test the Ignition circuit for an open/high resistance. If the circuit tests normal replace the K9 BCM.
4. Ignition OFF, reconnect the KR73 ignition main relay.
5. Disconnect the harness connector at the P16 Instrument Cluster.
6. Ignition ON, verify that a test lamp illuminates between the ignition terminal 31 and ground.
 - If the test lamp does not illuminate and the Ignition fuse is good, test the ignition circuit for an open/high resistance. If the circuit tests normal, replace the KR73 ignition main relay. If the ignition fuse is open, test the ignition circuit for a short to ground. If the circuit tests normal, replace the P16 instrument cluster.
7. If all circuits test normal, replace the P16 instrument cluster.

Repair Procedures

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

- **Instrument Cluster Replacement (Equinox)** or **Instrument Cluster Replacement (Terrain)**
- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**
- **Control Module References** for BCM replacement, setup, and programming

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

Circuit/System Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

B3567 01

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

B3567 02

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

B3567 04

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

B3567 59

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

Action Taken When the DTC Sets

The instrument cluster ignores the driver information center switch inputs.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool Driver Information Center Switch parameter, that when the A20 Radio/HVAC Controls Menu, Up, Down Set/Clr are pressed and released the scan tool parameter toggles between Menu, Up, Down, Clear and Inactive.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A20 Radio/HVAC Controls.
2. Ignition ON, test for greater than 4.8 V between the harness connector signal circuit terminal 18 and ground.

- If less than the specified range, test the signal circuit for a short to ground. If the circuit tests normal replace the P16 Instrument Cluster.
- 3. Test for greater than 11 V between the signal A20 Radio/HVAC Controls circuit terminal 18 and ground.
 - If not within the specified range, test the signal for an open/high resistance or a short to ground. If the circuit tests normal replace the P16 Instrument Cluster.
- 4. Install a 5 A fused jumper wire between the signal A20 Radio/HVAC Controls circuit terminal 18 and the low reference circuit terminal 6. Verify the scan tool Driver Information Center Switch parameter displays 0 V.
 - If not the specified value, test the low reference circuit for an open/high resistance. If the circuit tests normal replace the P16 Instrument Cluster.
- 5. If all circuits tests normal, replace the A20 Radio/HVAC Controls.

Repair Procedures

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

- **Radio Control Assembly Replacement**
- **Control Module References** for instrument cluster replacement, programming and setup

DTC P0461-P0464, P2066, P2067, OR P2068

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 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 Signal	P0462	P0463	P0463	P0461
Fuel Level Sensor 2 Signal	P2067	P2068	P2068	P2066
Low Reference	-	1	P0463, P0464, P2068	P0461, P2066
1. Fuel gauge inoperative				

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 the primary fuel level sensor and the secondary fuel level sensor in order to determine the fuel level. When the fuel tank is full, the resistances of both fuel level sensors are low and the ECM senses a low signal voltage on both the signal circuits of the primary fuel level sensor and the secondary fuel level sensor. When the fuel tank is empty, the resistances of the fuel level sensors are high and the ECM senses a high signal voltage. The ECM uses the signal circuits of the primary fuel level sensor and the secondary 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

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

Conditions for Setting the DTC

P0461 or P2066

- The ECM detects a difference between the fuel consumed by the engine and change of the fuel level signal of less than 1 L (0.26 gal) over a range of 30 L (7.92 gal) or 45.6% of the primary fuel tank.

- The above condition is present for about 300 seconds.

P0462 or P2067

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

P0463 or P2068

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

P0464

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

Action Taken When the DTC Sets

- P0461, P0462, P0463, P0464, P2066, P2067 and P2068 are Type B DTCs.
- The fuel gauge defaults to empty.
- The low fuel indicator illuminates.

Conditions for Clearing the DTC

- P0461, P0462, P0463, P0464, P2066, P2067 and P2068 are Type B DTCs.
- The DTC becomes history when the conditions for setting the DTC are no longer present.
- The history DTC clears after 40 malfunction-free warm-up cycles.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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, observe the scan tool ECM - Fuel Level Sensor parameters. The reading should be between 0.5-3.5 V and vary with fuel level.
2. Ignition ON, perform the Instrument Cluster Gauge Sweep test with the scan tool, verify that the fuel level gauge sweeps from its low to high position
 - If the fuel level gauge does not sweep, replace the P16 Instrument Cluster.
3. Command the All Indicators test ON and OFF with the scan tool, verify that the low fuel level indicator turns ON and OFF.
 - If the low fuel level indicator always stays on or always off, replace the P16 Instrument Cluster.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate fuel level sensor.
2. Test for less than 30 ohms at the low reference circuit terminal 3.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module.
3. Ignition ON, test for 4.8-5.2 V between the signal circuit terminal 4 and ground.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20 Engine Control Module.
 - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module.
4. If all circuits test normal, replace the appropriate fuel level sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification**

- **Primary Fuel Level Sensor Replacement** for LF1 or LFW
- **Primary Fuel Level Sensor Replacement** for LAF
- **Fuel Tank Fuel Pump Module Replacement - Secondary** for LF1 and LFW

- **Fuel Tank Fuel Pump Module Replacement - Secondary** for LAF
- **Control Module References** for the ECM 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	1	-
Low Reference	-	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
Low Reference	-	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 High Speed CAN-Bus to the body control module (BCM). The BCM then sends a message via Low Speed CAN-Bus to the instrument cluster requesting the engine oil pressure indicator turned ON.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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

Ignition ON, observe the scan tool Engine Oil Pressure Switch parameter with the ignition switch turned ON and the engine not running the reading should be Low, with the engine running the reading should be OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch.
2. If applicable, test for less than 30 ohms between the low reference circuit terminal B and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module.
3. Ignition ON, verify the scan tool Engine Oil Pressure Switch parameter is OK.
 - If not the specified value, test for the signal circuit terminal A for a short to ground. If the circuit tests normal, replace the K20 Engine Control Module.
4. Install a 3 A fused jumper wire between the signal circuit terminal A and ground. Verify the scan tool Engine Oil Pressure Switch parameter is Low.
 - If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module.
5. If all circuits test normal, test or replace the B37 Engine Oil Pressure Switch.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch.
2. Test for infinite resistance between the signal terminal A and the low reference terminal B with the switch in the open position.
 - If not the specified value, replace the B37 Engine Oil Pressure Switch.
3. Test for less than 5 ohms between the signal terminal A and the low reference terminal B with the switch in the closed position.
 - If greater than the specified range, replace the B37 Engine Oil Pressure Switch.

Repair Procedures

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

- **Engine Oil Pressure Switch Replacement** for LAF
- **Engine Oil Pressure Sensor and/or Switch Replacement (LF1)** for LF1
- **Control Module References** for ECM replacement, programming and setup

SYMPTOMS - DISPLAYS AND GAUGES

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

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

Gages and Odometer

- **Instrument Cluster Gauges Inoperative**
- **Fuel Gauge Inaccurate or Inoperative**
- **Odometer Trip/Reset Switch Inoperative**
- **Speedometer and/or Odometer Inaccurate or Inoperative**

Indicators

- **ABS Indicator Malfunction**
- **Air Bag Indicator Circuit Malfunction (Driver)** or **Air Bag Indicator Circuit Malfunction (Passenger)**
- **Brake Warning Indicator Malfunction**
- **Charge Indicator Malfunction**
- **Door Ajar Indicator Malfunction**
- **Park Brake System Diagnosis**
- **Engine Oil Pressure Indicator Malfunction**

- **Front Fog Lamps Malfunction**
- **Headlamps Malfunction**
- **Low Tire Pressure Indicator Malfunction**
- **Malfunction Indicator Lamp (MIL) Diagnosis** for LAF
- **Malfunction Indicator Lamp (MIL) Diagnosis** for LF1, LFW
- **Seat Belt Indicator Circuit Malfunction - Driver**
- **Security Indicator Malfunction**
- **Traction Control/Stability Control Indicator Malfunction**
- **Turn Signal Lamps and/or Indicators Malfunction**
- **Washer Malfunction**

Driver Information Center

- **Driver Information Center (DIC) Switch Malfunction**
- **Outside Air Temperature Display Inaccurate or Inoperative**

Audible Warnings

Chime Malfunction

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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. Ignition ON, engine running, verify the scan tool Battery Voltage parameter is between 12.5-15.5 V.
 - If not within the specified range, refer to Charging System Test .
2. Command the All Indicators test ON and OFF with the scan tool, verify that the charge indicator turns ON and OFF.
 - If the charge indicator always stays on or always off, replace the P16 Instrument Cluster.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for Instrument Cluster replacement, setup, and programming

CHIME 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 radio or the chime module, if not equipped with a radio, generates the audible warnings. The instrument cluster, the body control module (BCM), the inflatable restraint sensing and diagnostic module (SDM) or the object alarm module request audible warnings via Low Speed CAN-Bus signals.

Reference Information

Schematic Reference

Audible Warnings Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Audible Warnings 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

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

without Radio

Ignition ON, perform the Chime test with the scan tool, verify that all audible warnings sound normal.

- If the audible warnings do not operate properly, replace the P5 Chime Alarm Control Module.

with Radio

1. Ignition ON, radio ON, adjust the radio balance and fade to each speaker.
 - If any speaker does not operate properly, refer to Speaker Malfunction .
2. Ignition ON, buckle up driver seat belt, verify the scan tool Driver Seat Belt Status parameter is Buckled.
 - If not Buckled refer to Seat Belt Indicator Circuit Malfunction - Driver .
3. Ignition ON, headlamp switch OFF, verify the scan tool Headlamp On Switch parameter is Inactive.

- If not Inactive, refer to **Headlamps Malfunction** .
- 4. Ignition ON, parking lamp switch OFF, verify the scan tool Parklamp Switch parameter is Inactive.
 - If not Inactive, refer to **Park, License, and/or Tail Lamps Malfunction** .
- 5. Ignition ON, turn signal switch OFF, verify the scan tool Left Turn Signal Switch parameter and the scan tool Right Turn Signal Switch parameter is Inactive.
 - If not Inactive, refer to **Turn Signal Lamps and/or Indicators Malfunction** .
- 6. Ignition ON, parking brake released, verify the scan tool Park Brake Switch parameter is Inactive.
 - If not Inactive, refer to **Park Brake System Diagnosis** .
- 7. Ignition ON, doors closed, verify that all scan tool parameters listed below are Inactive.
 - Driver Door Ajar Switch
 - Passenger Door Ajar Switch
 - Left Rear Door Ajar Switch
 - Right Rear Door Ajar Switch
 - If any are not Inactive, refer to **Door Ajar Indicator Malfunction** .
- 8. Verify the scan tool Key in Ignition Status parameter is Inactive when the key is in the ignition and Active when the key is out of the ignition.
 - If the scan tool parameter does not operate properly, replace the K9 Body Control Module.
- 9. Ignition ON, verify that the scan tool Park Assist Switch parameter is Active when the parking assist is active and Inactive when the parking assist is Inactive.
 - If the scan tool parameter does not operate properly, refer to **Parking Assist System Malfunction** .
- 10. If all tests operate properly, replace the A11 Radio.

Repair Procedures

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

Control Module References for BCM, Radio or Chime Module replacement, setup and programming

DRIVER INFORMATION CENTER (DIC) SWITCH MALFUNCTION

Diagnostic Instructions

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

Circuit/System Description

The driver information center switch is a multiplexed switch. Battery power is provided to the driver information center switch via the instrument panel cluster. The driver information center switch signal circuit is pulled up to battery voltage in the instrument panel cluster. The instrument cluster also provides the driver information center switch with a low reference. The switch input to the instrument cluster is pulled low when a switch is activated. The driver information center switch is a momentary contact switch that connects a series of

resistors in a resistor ladder format. The instrument cluster monitors the driver information center switch signal circuit to determine the driver information center switch inputs. Each switch state - Menu, UP, DOWN - corresponds to a certain resistance value. The instrument cluster determines the switch pressed by the voltage drop across the resistors.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool Driver Information Center Switch parameter, that when the A20 Radio/HVAC Controls Menu, UP, DOWN, SET/CLR are pressed and released the scan tool parameter toggles between Menu, Up, Down, Clear and Inactive.

Circuit/System Testing

Set/Clr Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the A20 Radio/HVAC Controls.
2. Ignition ON, test for greater than 4.8 V between the signal circuit terminal 5 and ground.
 - If less than the specified range, test the signal circuit for an open/high resistance. If the circuit tests normal replace the P16 Instrument Cluster.
3. If all circuits tests normal, replace the A20 Radio/HVAC Controls.

UP, Down, or Menu Switch Malfunction

1. Ignition OFF, disconnect the A20 Radio/HVAC Controls.
2. While holding the A20 Radio/HVAC Controls UP arrow in the UP position, test for 0.55-0.65k ohms between the signal circuit terminal 18 and the low reference terminal 6 at the switch.
 - If not within the specified range, replace the A20 Radio/HVAC Controls.
3. While holding the A20 Radio/HVAC Controls DOWN arrow in the DOWN position, test for 1.5-1.7k ohms between the signal circuit terminal 18 and the low reference terminal 6 at the switch.
 - If not within the specified range, replace the A20 Radio/HVAC Controls.
4. While depressing the A20 Radio/HVAC Controls Menu button, test for 3.0-4.0k ohms between the signal circuit terminal 18 and the low reference terminal 6 at the switch.
 - If not within the specified range, replace the A20 Radio/HVAC Controls.
5. If all circuits tests normal, replace P16 Instrument Cluster.

Repair Procedures

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

- **Radio Control Assembly Replacement**
- **Control Module References** for the instrument cluster replacement, programming and setup

ENGINE OIL PRESSURE INDICATOR 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.

Diagnostic Fault Information

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

Circuit/System Description

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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

Ignition ON, observe the scan tool Engine Oil Pressure Switch parameter with the ignition switch turned ON and the engine not running the reading should be Low, with the engine running the reading should be OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch.
2. If applicable, test for less than 30 ohms between the low reference circuit terminal B and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module.
3. Ignition ON, verify the scan tool Engine Oil Pressure Switch parameter is OK.
 - If not the specified value, test for the signal circuit terminal A for a short to ground. If the circuit tests normal, replace the K20 Engine Control Module.
4. Install a 3 A fused jumper wire between the signal circuit terminal A and ground. Verify the scan tool Engine Oil Pressure Switch parameter is Low.
 - If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module.
5. Command the All Indicators test ON and OFF with the scan tool. The engine oil pressure indicator should turn ON and OFF when changing between the commanded states.

- If the engine oil pressure indicator always on or always off, replace the P16 Instrument Cluster
- 6. If all circuits test normal, test or replace the B37 Engine Oil Pressure Switch.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch.
2. Test for infinite resistance between the signal terminal A and the low reference terminal B with the switch in the open position.
 - If not the specified value, replace the B37 Engine Oil Pressure Switch.
3. Test for less than 5 ohms between the signal terminal A and the low reference terminal B with the switch in the closed position.
 - If greater than the specified range, replace the B37 Engine Oil Pressure Switch.

Repair Procedures

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

- **Engine Oil Pressure Switch Replacement** for LAF
- **Engine Oil Pressure Sensor and/or Switch Replacement (LF1)** for LF1
- **Control Module References** for instrument cluster or ECM replacement, programming and setup

FUEL GAUGE INACCURATE OR INOPERATIVE

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 fuel level based on the information from the engine control module (ECM). The ECM converts the data from the fuel level sensors to a fuel level signal. The ECM sends the fuel level signal via a High Speed CAN-Bus signal to the body control module (BCM). The BCM then sends the information via a Low Speed CAN-Bus signal to the instrument cluster to display the fuel level. When the fuel level falls below 11% the instrument cluster illuminates the low fuel level indicator.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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, perform the Instrument Cluster Gauge Sweep test with the scan tool, verify that the fuel level gauge sweeps from its low to high position.
 - If the fuel level gauge does not sweep, replace the P16 Instrument Cluster.
2. Command the All Indicators test ON and OFF with the scan tool, verify that the low fuel level indicator turns ON and OFF.
 - If the low fuel level indicator does not turn ON or OFF as commanded, replace the P16 Instrument Cluster.
3. Observe the scan tool ECM Fuel Level Sensor parameter. The reading should be 0.5-3.5 V and vary with fuel level.
 - If the reading does not vary with fuel level, refer to **DTC P0461-P0464, P2066, P2067, or P2068**.
4. If the fuel level gauge does sweep and the low fuel level indicator turns ON and OFF, replace the K20 Engine Control Module.

Repair Procedures

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

- **Primary Fuel Level Sensor Replacement** for LF1 and LFW
- **Primary Fuel Level Sensor Replacement** for LAF
- **Fuel Tank Fuel Pump Module Replacement - Secondary** for LF1 and LFW
- **Fuel Tank Fuel Pump Module Replacement - Secondary** For LAF
- **Control Module References** for instrument cluster or ECM replacement, programming and setup

INSTRUMENT CLUSTER GAUGES INOPERATIVE

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

Diagnostic Aids

Verify the fuel level sensor is able to move through the entire range and does not stuck at any pipe or wire.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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. Verify no DTC is set.
 - If any DTC is set, diagnose this first.
2. Ignition ON, perform the Instrument Cluster Gauge Sweep test with the scan tool, verify that all gauges sweep from their low to high position.
 - If any gauge does not sweep, replace the P16 Instrument Cluster.
3. Drive the vehicle, verify the gauge values matches the values on the scan tool.
 - If the values do not match, replace the P16 Instrument Cluster.
4. Verify the fuel level sensor arm is able to move through the entire range and does not stuck at any pipe or wire.
5. If all gauges do sweep and display the correct value, and the odometer display counts up, replace the K20 Engine Control Module.

Repair Procedures

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

Control Module References for instrument cluster or ECM replacement, setup and programming

ODOMETER TRIP/RESET SWITCH INOPERATIVE

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 travelled distance based on the information from the engine control module (ECM). The ECM converts the data from the vehicle speed sensor to a distance signal. The ECM sends the distance information via a High Speed CAN-Bus signal to the body control module (BCM). The BCM then sends the information via a Low Speed CAN-Bus signal to the instrument cluster to display the vehicle odometer and trip odometer. The instrument cluster detects the activation of the trip reset switch and a press and hold of the trip reset switch resets the trip odometer information to zero.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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

Ignition ON, verify the odometer trip reset switch resets the trip odometer display when the switch is pressed.

- If the odometer trip reset switch does not reset the trip odometer, replace the P16 Instrument Cluster.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for instrument cluster replacement, setup, and programming

OUTSIDE AIR TEMPERATURE DISPLAY INACCURATE OR INOPERATIVE

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.

Diagnostic Fault Information

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

Circuit/System Description

The instrument cluster monitors the ambient air temperature sensor with a low reference circuit and 5 V signal

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool Ambient Air Temperature parameter. The reading should be between -40°C (-40°F) to +88°C (+190°F) and change with air temperature changes.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor.
2. Ignition ON, test for 4.8-5.2 V between the signal circuit terminal A and ground.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the P16 Instrument Cluster.
 - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the P16 Instrument Cluster.
3. Install a 3 A fused jumper wire between the signal circuit terminal A and the low reference circuit terminal B. Verify the scan tool Ambient Air Temperature parameter displays greater than 54°C (130°F).

- If less than the specified range, test the low reference circuit a short to voltage or an open/high resistance. If the circuit tests normal, replace the P16 Instrument Cluster.
- 4. Verify the accuracy of the B9 Ambient Air Temperature Sensor. Refer to **Ambient Air Temperature Sensor Resistance**.
 - If not within the specified range, replace the B9 Ambient Air Temperature Sensor.
- 5. If all circuits test normal, test the P16 Instrument Cluster.

Repair Procedures

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

- **Ambient Air Temperature Sensor Replacement**
- **Control Module References** for instrument cluster or display replacement, programming and setup

SPEEDOMETER AND/OR ODOMETER INACCURATE OR INOPERATIVE

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 a High Speed CAN-Bus signal to the body control module (BCM). The BCM then sends the information via a Low Speed CAN-Bus signal to the instrument cluster to display the engine coolant temperature, fuel level, the engine speed, the vehicle speed and the distance travelled, either in kilometers or miles, based on the vehicle requirements. The instrument cluster will display dashes when its VIN does not match the VIN received from the BCM.

Diagnostic Aids

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

Component Connector End Views

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. Verify no DTC is set.
 - If any DTC is set, diagnose this first.
2. Ignition ON, perform the Instrument Cluster Gauge Sweep test with the scan tool, verify that all gauges sweep from their low to high position.
 - If any gauge does not sweep, replace the P16 Instrument Cluster.
3. Drive the vehicle, verify the speedometer gauge value matches the Vehicle Speed parameter on the scan tool.
 - If the value do not match, replace the P16 Instrument Cluster.
4. Drive the vehicle, verify the odometer display, the displayed distance counts up while driving.
 - If the odometer displays only "----" (dashes), go to circuit/system testing.
 - If the odometer display does not count up, verify the K9 Body Control Module and K20 Engine Control Module are functioning correctly. If the K9 Body Control Module and K20 Engine Control Module are working correctly, replace the P16 Instrument Cluster.
5. If all gauges do sweep and display the correct value, and the odometer display counts up, replace the K20 Engine Control Module.

Circuit/System Testing

NOTE: If there are multiple modules not original to the vehicle and are not new correctly configured service parts, SPS may not be able to proper read or recover the vehicle odometer value. Follow government rules and

documentation (including vehicle identification) regarding inaccurate/unknown odometer values.

Perform Circuit/System Verification first.

Instrument Cluster is Showing "----" (Dashes)

Correcting VIN mismatch - Odometer is still unlocked

1. Verify the vehicle odometer status with a scan tool. The reading should be Unlocked.
 - If the reading is Locked, go to correcting VIN mismatch - odometer locked.
2. Using the scan tool, verify the BCM VIN matches the vehicle's VIN placard.
 - If the VIN does not match, reprogram the BCM. Then proceed with step 3.
3. Using the scan tool, verify the instrument cluster VIN matches the vehicle's VIN placard.
 - If the VIN does not match, reprogram the instrument cluster. Then proceed with step 4.
4. Ignition ON, verify the instrument cluster is displaying the correct value.
 - If the instrument cluster is still displaying "----" (dashes), replace the P16 Instrument Cluster.

Repair Procedures

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

Control Module References for instrument cluster, BCM or ECM replacement, setup and programming

REPAIR INSTRUCTIONS

DRIVER INFORMATION DISPLAY REPLACEMENT

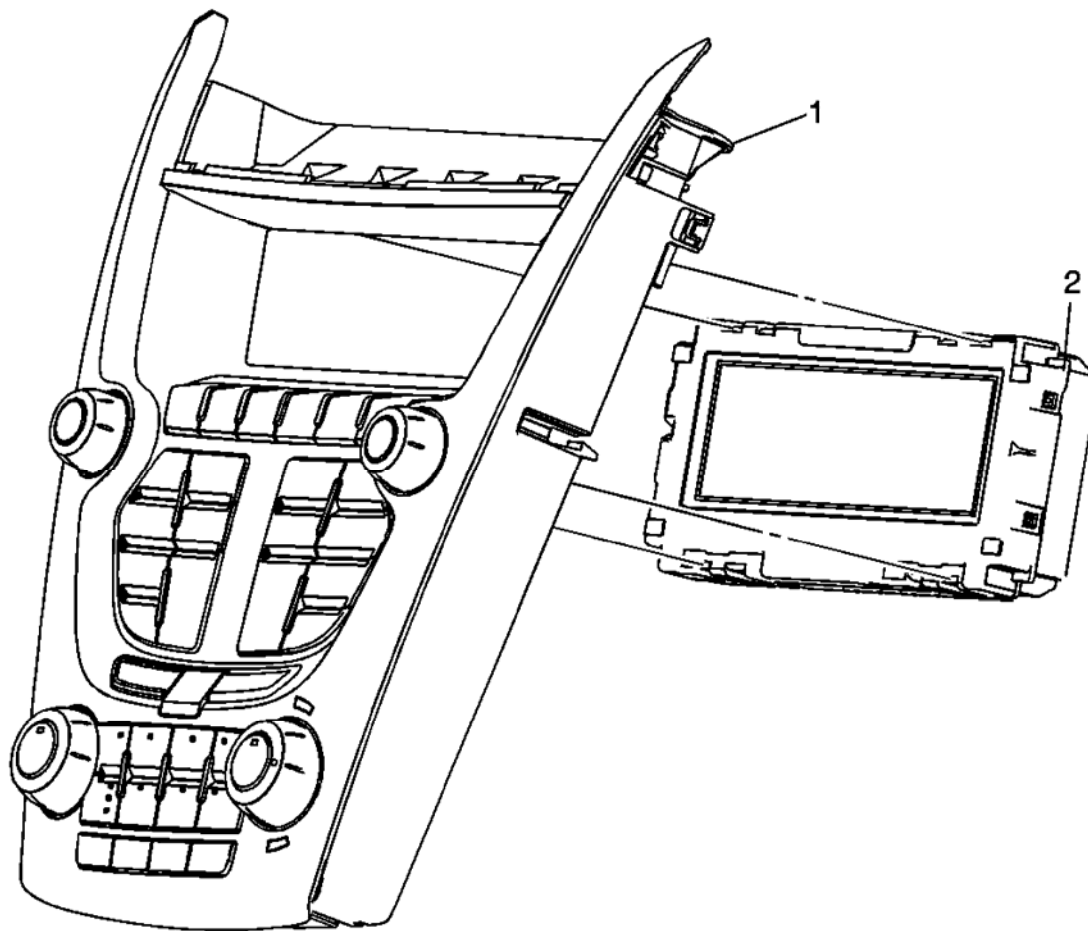


Fig. 5: Driver Information Display
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Radio Control Assembly Refer to <u>Radio Control Assembly Replacement</u> .
2	Drivers Information Display Procedure 1. Unsnap the drivers information display assembly from the radio control assembly. 2. Refer to <u>Control Module References</u> for programming and setup information.

INSTRUMENT CLUSTER REPLACEMENT (EQUINOX)

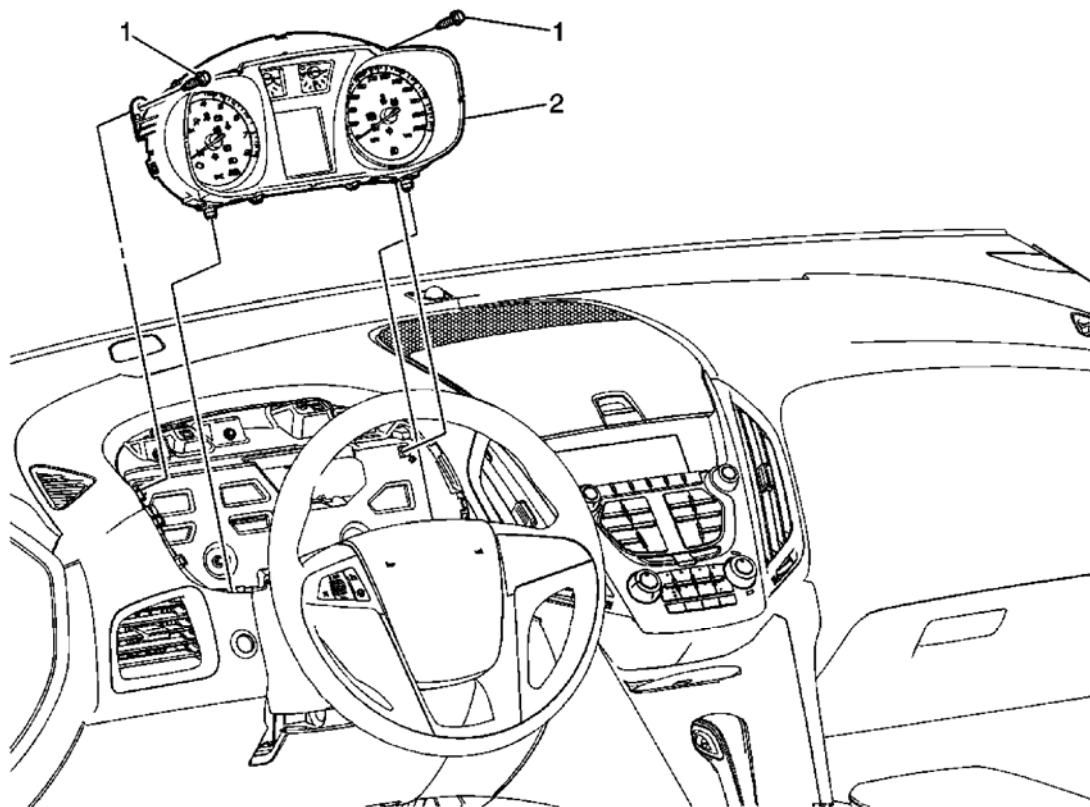


Fig. 6: Instrument Cluster (Equinox)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the instrument panel cluster trim plate bezel. Refer to <u>Instrument Panel Cluster Trim Plate Bezel Replacement (Equinox)</u> or <u>Instrument Panel Cluster Trim Plate Bezel Replacement (Terrain)</u> .	
1	Instrument Panel Cluster Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 2.5 N.m(22 lb in)
2	Instrument Panel Cluster Procedure 1. Disconnect the electrical connections. 2. Refer to <u>Control Module References</u> for programming and setup information.

INSTRUMENT CLUSTER REPLACEMENT (TERRAIN)

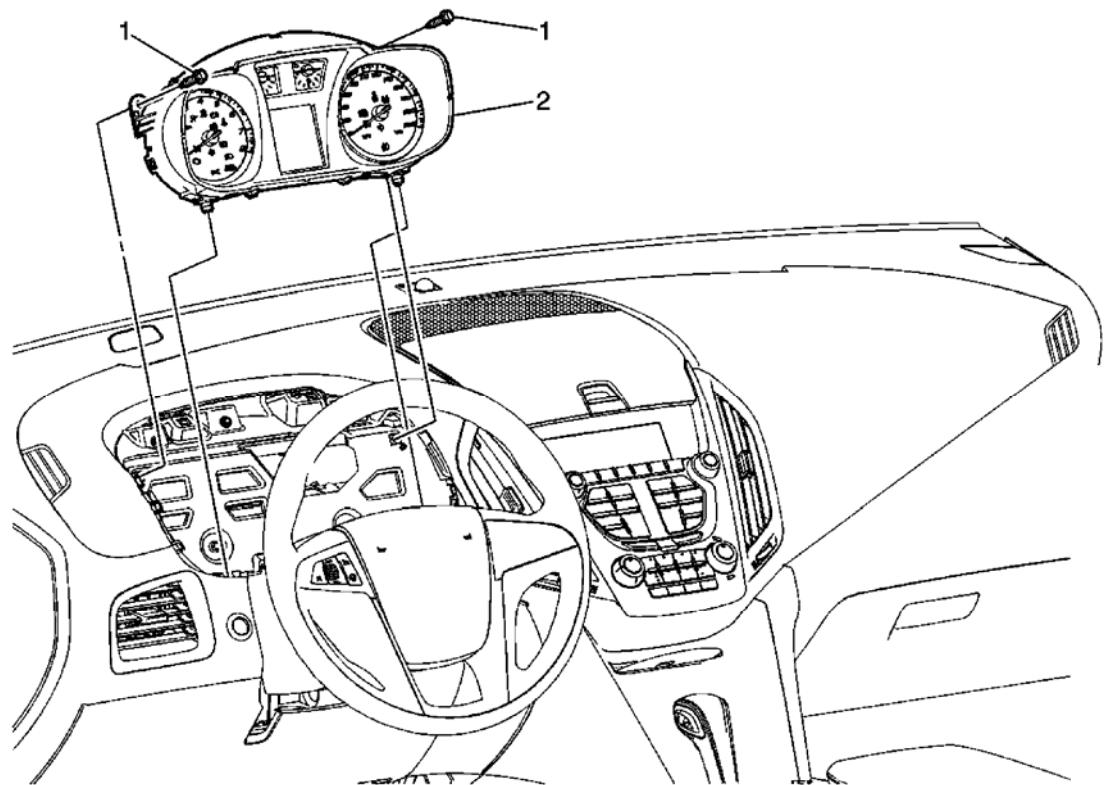


Fig. 7: Instrument Cluster (Terrain)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the instrument panel cluster trim plate bezel. Refer to <u>Instrument Panel Cluster Trim Plate Bezel Replacement (Equinox)</u> or <u>Instrument Panel Cluster Trim Plate Bezel Replacement (Terrain)</u> .	
1	Instrument Panel Cluster Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 2.5 N.m(22 lb in)
2	Instrument Panel Cluster Procedure 1. Disconnect the electrical connections. 2. Refer to <u>Control Module References</u> for programming and setup information.

FUEL ECONOMY INDICATOR SWITCH REPLACEMENT

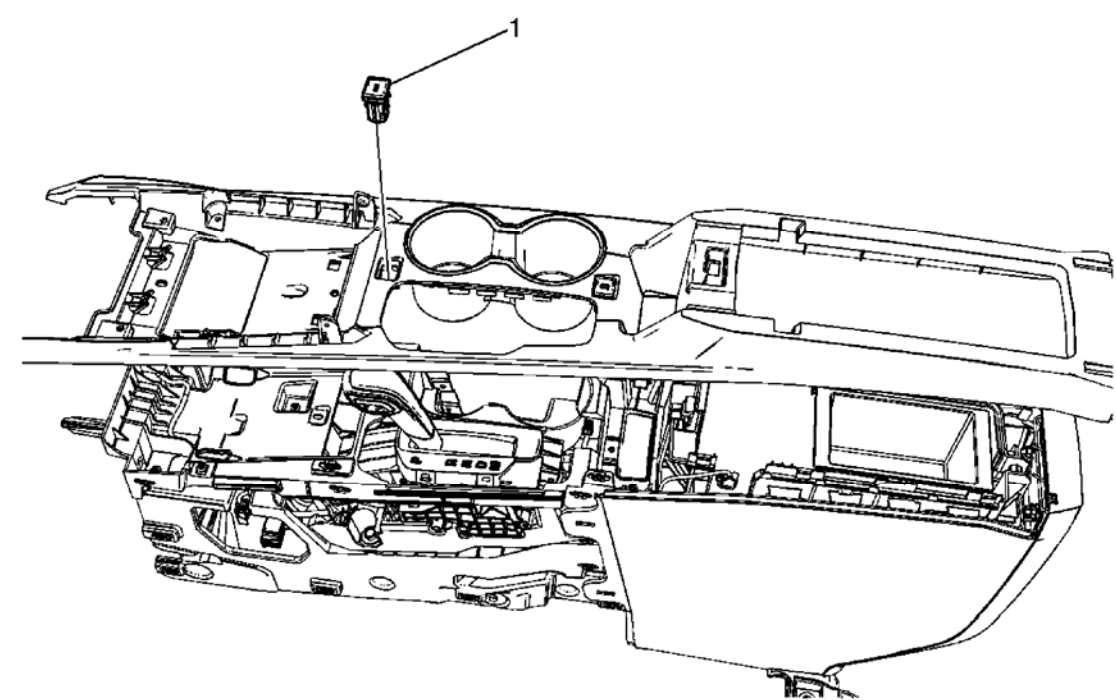


Fig. 8: Fuel Economy Indicator Switch
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the front floor lower console side finish cover, right side. Refer to Front Floor Lower Console Side Finish Cover Replacement - Right Side (Equinox) or Front Floor Lower Console Side Finish Cover Replacement - Right Side (Terrain) .	
1	Fuel Economy Indicator Switch Procedure 1. Reach under the economy switch and apply a firm upward pressure on it to release the fastening tabs. 2. Disconnect the electrical connector.

DESCRIPTION AND OPERATION

AUDIBLE WARNINGS DESCRIPTION AND OPERATION

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

vehicles without a radio, a chime module generates the audible warnings and receives audible warning requests via the serial data circuit. Either the radio or the chime module is the chime producer. The following lists the audible warning sounds:

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

Fasten Safety Belt Warning

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

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

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

Lights On Warning

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

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

Brake Warning

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

- The ignition is ON.
- The vehicle speed is greater than 8 km/h (4.9 MPH). The instrument cluster receives a serial data message

from the engine control module (ECM) indicating the vehicle speed.

- The BCM determines that the parking brake is engaged and the signal circuit is low.
- The brake fluid is low.

Key-In-Ignition Warning

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

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

Door Ajar Warning

The chime producer activates the door ajar audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer indicating the chime frequency of a medium rate and continuous duration. The door ajar warning sounds and the appropriate door ajar indicator illuminates in the driver information center when the following occurs:

- The BCM determines that a door (driver door, passenger door, left rear door, right rear door) is open and the signal circuit is low. The instrument cluster also receives a serial data message from the BCM indicating the door ajar status.
- The vehicle is not in PARK. The BCM receives a serial data message from the ECM/BCM indicating the gear position.

Object Detection

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

Additional Warnings

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

- Turn Signal Indicators - The chime producer activates the audible warning as requested by the BCM. The chime produces two different chimes, one when the turn signal turns off and another when the turn signal turns on.
- Vehicle Overspeed Message - The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.

- Fuel Level Low Message - The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.
- Oil Pressure Indicator - The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.
- Park Assist Fault Clean Rear Bumper Message - The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.
- Tire Pressure Low Indicator - The chime producer activates the audible warning as requested by the BCM. The BCM sends a serial data message to the chime producer.

Refer to **Indicator/Warning Message Description and Operation**.

DRIVER INFORMATION CENTER (DIC) DESCRIPTION AND OPERATION

In the lower middle of the instrument cluster, an additional display is installed. Its task is to give additional information, such as an odometer, select gear or error codes/warning messages. Refer to **Indicator/Warning Message Description and Operation**. Use the driver information center buttons located in the center of the instrument panel to access different displays.

There are 4 switch functions for the driver information center.

- Menu
- Up
- Down
- Set/CLR

Driver Information Center Buttons

The Menu switch is used to navigate between the Vehicle Information Menu and the Trip/Fuel Information Menu. Use the Up and Down buttons to scroll through the following items in each menu. vehicle parameters by successive pressing of the Set/CLR button. Use the Set/CLR button to set or clear the menu item when it is displayed.

Trip/Fuel Information Menu

- Trip1
- Trip2
- Fuel Range
- Average Fuel Economy
- Instantaneous Fuel Economy
- Average Vehicle Speed
- Timer
- Digital Speedometer
- Navigation Turn-by-Turn
- Blank

Vehicle Information Menu

- Units Menu
- Tire Pressure Menu
- Remaining Oil Life
- Language
- Blank

Trip 1/2

The trip odometer 1 or 2 can be accessed through the driver information center switch Up/Down function. The trip odometer can be reset to zero by pressing the trip reset stem or while the trip odometer display is showing.

Trip Display

Driver Information Center Trip Display	Range		
	Europe-SI	USA	GB
TRIP 1	#####.km	#####.miles	#####.miles
TRIP 2	#####.km	#####.miles	#####.miles

Fuel Range

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

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

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

Average Fuel Economy

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

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

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

Instantaneous Fuel Economy

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

Average Vehicle Speed

Average speed is calculated using the equation: $\text{Average Speed} = \frac{\text{Average Speed Distance}}{\text{Average Speed Time}}$.

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

Timer

The timer records elapsed time starting from activation. When the driver information center displays the timer, pressing the Set/Reset switch for longer than 1 s the driver information center resets the timer. Pressing the Set/Reset button on the driver information center switch for approximately 1 s starts and stops the timer. The driver information center displays the timer in one of the following formats:

The driver information center displays the timer in the following format: XX: XX:XX:

The first XX represents hours elapsed, the second XX represents minutes elapsed, and the third XX represents seconds elapsed. The maximum range of the timer is 99 h, 59 min, and 59 s. After the maximum range is reached, the timer displays zeros in all positions. (00:00:00).

Digital Speedometer

The speedometer shows how fast the vehicle is moving in either kilometers per hour (km/h) or miles per hour (MPH). The speedometer cannot be reset.

Turn-by-Turn

This display is used for the Navigation System Turn-by-Turn guidance. See the Navigation manual, if the vehicle has navigation, for more information.

Blank Display

This display shows no information.

Units Menu

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

Tire Pressure Menu

The instrument cluster receives a GMLAN message from the tire pressure monitoring system for front and rear tire pressure data. The driver information center will display the pressure for each of the front and rear tires.

When a tire with low air pressure is present, the driver information center displays a warning, CHECK XX TIRE PRESSURE.

Oil Life Remaining

The ECM sends the oil life remaining percentage to the instrument cluster via a GMLAN message. The instrument panel cluster receives a GMLAN message indicating the engine oil life remaining. The driver information center displays the current percentage of the GM Oil Life System as determined by the ECM. When the oil life remaining percentage drops below 5%, the driver information center displays CHANGE ENGINE OIL SOON. When the engine oil is changed, reset the GM Oil Life System. Refer to **GM Oil Life System Resetting**.

Language

Depending on the variant, the vehicle may have a language menu. Press to enter the language menu. Then press or to scroll through the available languages when the Language display is active. Press to confirm the setting. This will change the displays on the driver information center to the language you have selected.

Blank Display

This display shows no information.

Odometer

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

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

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

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

Gear Indication

If the vehicle is equipped with an automatic transmission the driver information center displays the actual gear. The instrument cluster receives a GMLAN message with actual gear information from the automatic transmission module.

Park Assist Menu

If the parallel parking assistant is activate, the parallel parking assist menu is displayed in the driver information center. The driver information center displays the current state of the parallel parking assist until the instrument cluster receives a message indicating otherwise.

Language

The driver information center is capable of displaying in different languages, corresponding to the radio language settings. The instrument cluster receives a GMLAN message with language information from the radio.

INDICATOR/WARNING MESSAGE DESCRIPTION AND OPERATION

INDICATOR LIGHT ON

Refer to the OWNER'S MANUAL for the descriptions and explanations of all indicator lights.

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

MESSAGE DISPLAYED

Refer to the OWNER'S MANUAL for descriptions and explanations of all messages displayed.

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

INSTRUMENT CLUSTER DESCRIPTION AND OPERATION

Displays Test

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

- The ABS indicator illuminates briefly.
- The active front steering failure indicator illuminates briefly.
- The battery indicator illuminates briefly.
- The brake indicator illuminates briefly.
- The door ajar indicator illuminates briefly.
- The electric park brake on indicator illuminates briefly.
- The electric park brake service/failure indicator illuminates briefly.
- The fuel level low indicator illuminates briefly.
- The lane departure warning indicator illuminates briefly.
- The oil pressure low indicator illuminates briefly.

- The park assist service indicator illuminates briefly.
- The press clutch indicator illuminates briefly.
- The rain sense indicator illuminates briefly.
- The security indicator illuminates briefly.
- The service vehicle soon indicator illuminates briefly.
- The smart beam indicator illuminates briefly.
- The tire pressure low indicator illuminates briefly.
- The electronic stability control service indicator illuminates briefly.
- The electronic stability control off indicator illuminates briefly.

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

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

Fuel Level Gauge

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

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

Speedometer

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

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

Tachometer

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

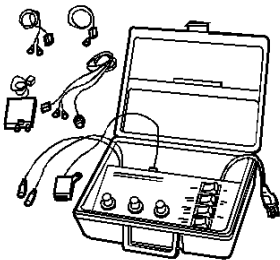
- The ECM detects a malfunction in the engine speed sensor circuit.
- The BCM detects a loss of serial data communications with the ECM.
- The instrument cluster detects a loss of serial data communications with the BCM.

Driver Information Center Display

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

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J-33431-C Signal Generator and Instrument Panel Tester