

2017 ACCESSORIES AND EQUIPMENT

Displays and Gauges - Bolt EV

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

Application	Specification
	Metric (English)
NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Instrument Cluster Bolt	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	(kΩ)	(kΩ)	(kΩ)
-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 WIRING DIAGRAMS

INSTRUMENT CLUSTER WIRING SCHEMATICS

Power, Ground, Serial Data, and Subsystem References

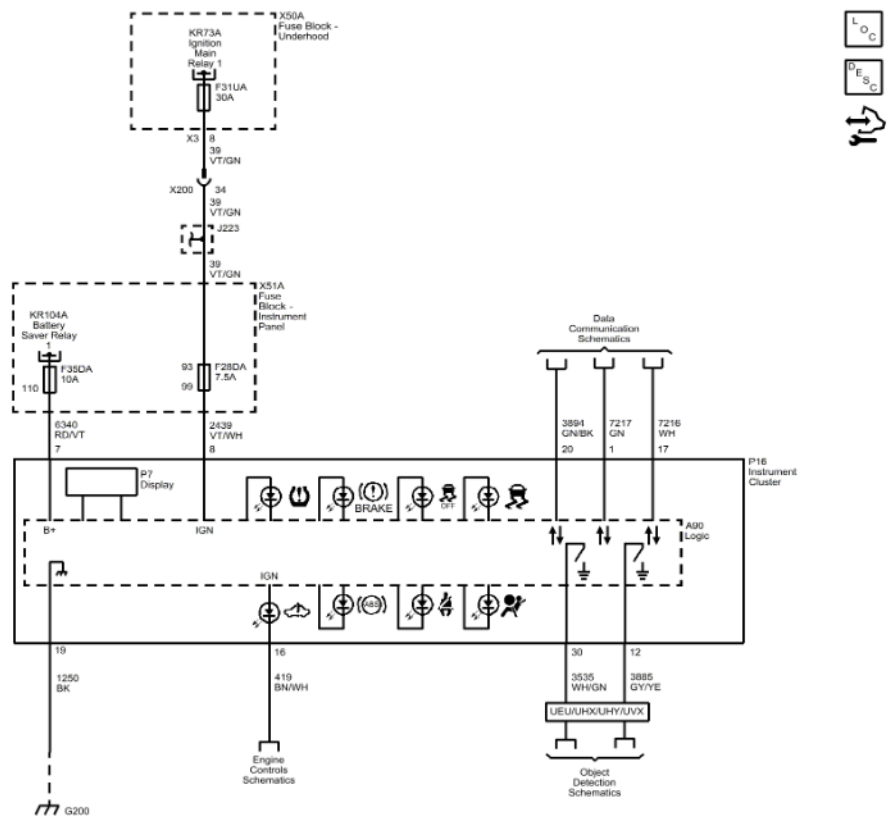


Fig. 1: Power, Ground, Serial Data, and Subsystem References
Courtesy of GENERAL MOTORS COMPANY

Driver Information Center

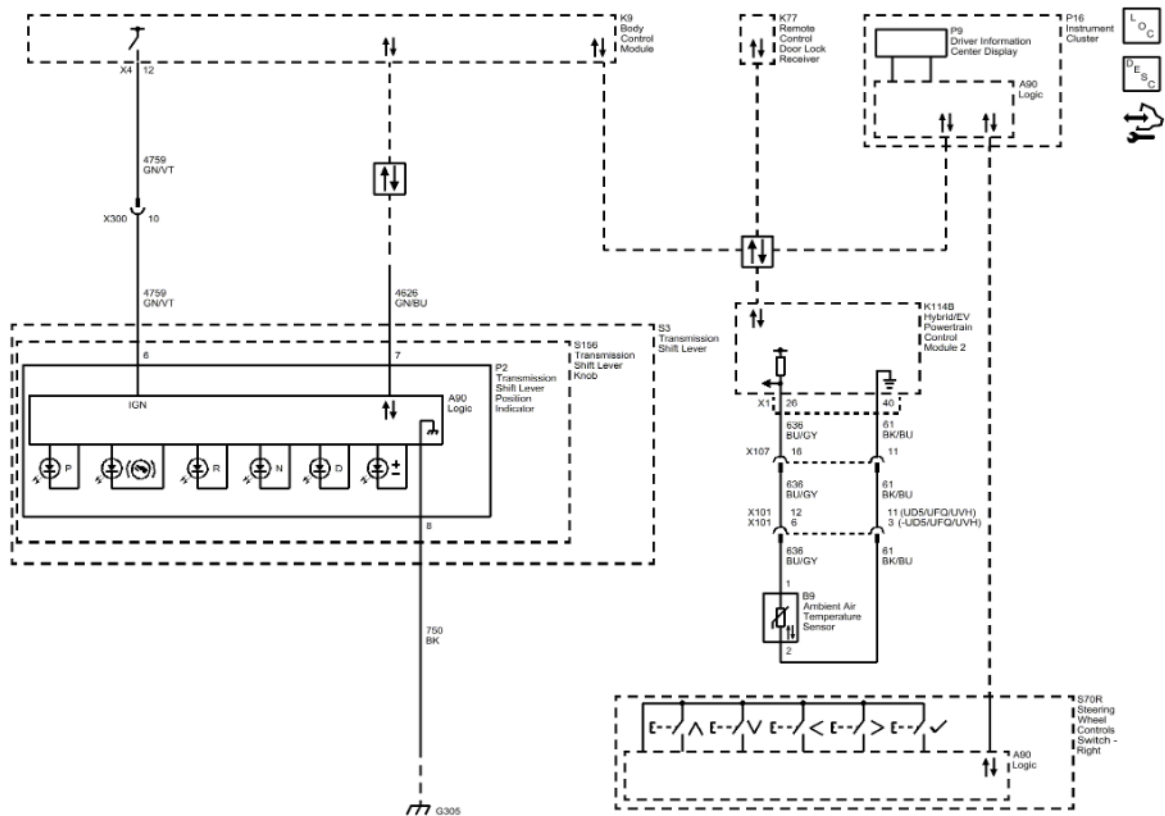


Fig. 2: Driver Information Center
Courtesy of GENERAL MOTORS COMPANY

DRIVER INFORMATION SYSTEM WIRING SCHEMATICS

Shift Lever Position Indicator

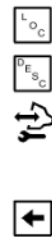
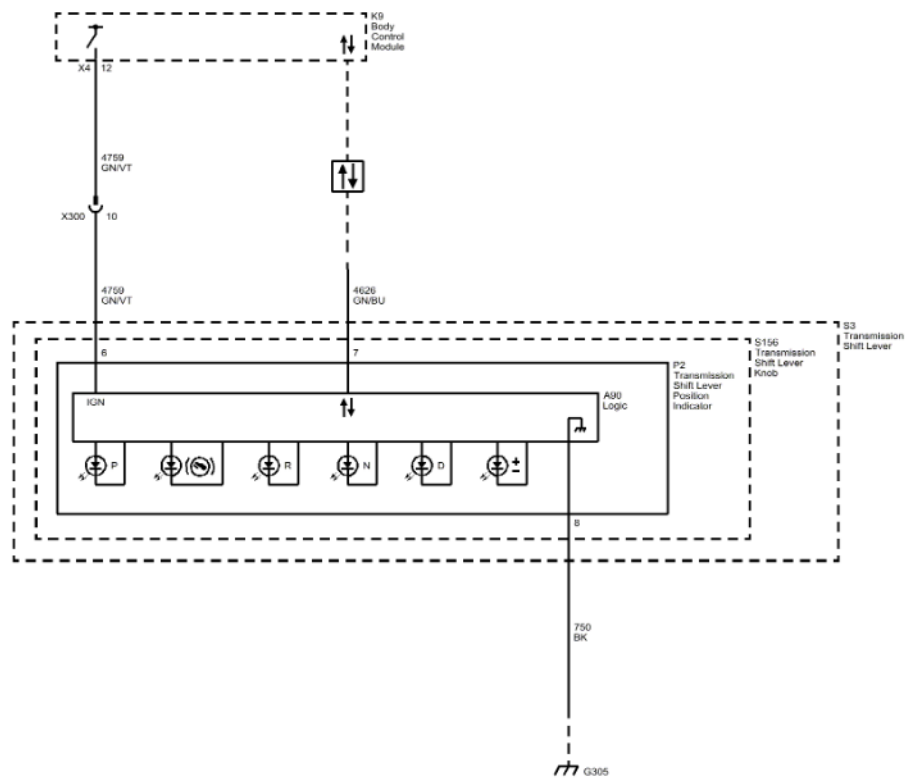


Fig. 3: Shift Lever Position Indicator

Courtesy of GENERAL MOTORS COMPANY

AUDIBLE WARNINGS WIRING SCHEMATICS

Audible Warnings

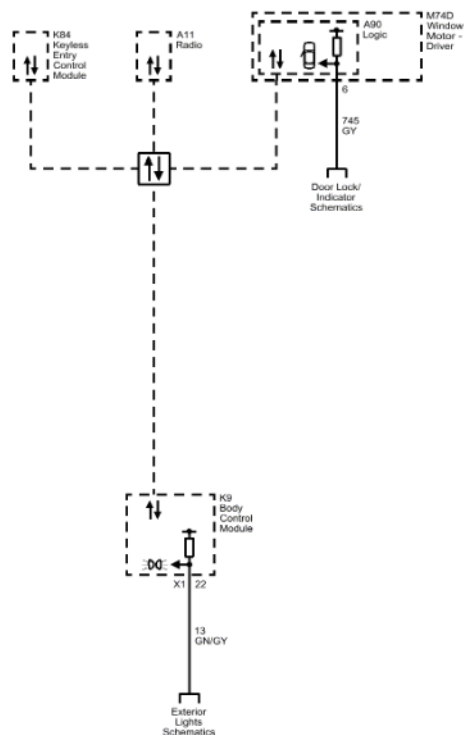


Fig. 4: Audible Warnings

Courtesy of GENERAL MOTORS COMPANY

DTC B0550: ODOMETER CIRCUIT GENERAL MEMORY 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 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 vehicle is ON.

Conditions for Setting the DTC

The BCM has detected an internal memory malfunction.

Action Taken When the DTC Sets

DTC B0550 32 is stored in the BCM memory.

Conditions for Clearing the DTC

The BCM no longer detects a malfunction.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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. Vehicle in Service Mode.
2. Verify DTC B0550 32 is not set.
 - **If DTC B0550 32 is set**
 1. Program the K9 Body Control Module.
 2. Verify the DTC does not set.
 - If the DTC sets, replace the K9 Body Control Module
 - If the DTC does not set
 3. All OK.
 - **If DTC B0550 32 is not set**
3. All OK

Repair Instructions

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

[Control Module References](#) for BCM replacement, programming and setup

DTC B071F: TRANSMISSION RANGE INDICATOR INTERNAL 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 Descriptor

DTC B071F 39

Transmission Range Indicator Internal Malfunction

Circuit/System Description

The transmission shift lever position indicator 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.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The BCM has detected an internal malfunction in the transmission shift lever position indicator.

Action Taken When the DTC Sets

No action is taken.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

[Driver Information System Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

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. Vehicle in Service Mode.
2. Verify DTC B071F 39 is not set.
 - **If the DTC is set**

Replace the P2 Transmission Shift Lever Position Indicator.
 - **If the DTC is not set**
3. All OK.

Repair Instructions

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

Displays and Gauges Component Replacement Reference

DTC P0071-P0074: AMBIENT AIR TEMPERATURE SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P0071

Ambient Air Temperature Sensor Performance

DTC P0072

Ambient Air Temperature Sensor Circuit Low Voltage

DTC P0073

Ambient Air Temperature Sensor Circuit High Voltage

DTC P0074

Ambient Air Temperature Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0072	P0073	P0073	P0071, P0074

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

Circuit/System Description

The ambient air temperature sensor is located behind the grille. The Hybrid/EV Powertrain Control Module 2 monitors the ambient air temperature sensor utilizing a low reference circuit and signal circuit. The Hybrid/EV Powertrain Control Module 2 monitors the voltage drop across the sensor, which is inversely proportional to temperature. When the ambient air temperature is cold, the resistance of the sensor is high. When the ambient air temperature is warm, the resistance of the sensor is low. The Hybrid/EV Powertrain Control Module 2 converts the voltage value to a temperature value. The Hybrid/EV Powertrain Control Module 2 also sends the temperature value to other control modules via serial data.

Conditions for Running the DTC

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

Conditions for Setting the DTC

P0071

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

P0072

The Hybrid/EV Powertrain Control Module 2 detects the sensor signal is more than 60Â°C (140Â°F).

P0073

The Hybrid/EV Powertrain Control Module 2 detects the sensor signal is less than -40Â°C (-40Â°F).

P0074

The Hybrid/EV Powertrain Control Module 2 detects an unrealistic signal variance.

Action Taken When the DTC Sets

- DTC P0071 - P0074 are type B DTCs.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

- Circuit Testing

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

DTC Type Reference

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

Scan Tool Reference

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

[Circuit/System Verification](#)

1. Vehicle in Service Mode.
2. Verify the scan tool Hybrid/EV Powertrain Control Module 2 Ambient Air Temperature parameter is between -40°C (-40°F) and $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$) and changes with air temperature changes.
 - **If not between -40°C (-40°F) and $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$) or changes with air temperature changes**
Refer to Circuit/System Testing.
 - **If between -40°C (-40°F) and $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$) and changes with air temperature changes**
3. All OK.

[Circuit/System Testing](#)

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

1. Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than $10\ \Omega$ between the low reference circuit terminal B (or 2) and ground.
 - **If $10\ \Omega$ or greater**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than $2\ \Omega$ in the low reference circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than $10\ \Omega$**
3. Vehicle in Service Mode.
4. Verify the Hybrid/EV Powertrain Control Module 2 scan tool Ambient Air Temperature parameter is less than -39°C (-38°F).
 - **If -39°C (-38°F) or greater**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than -39°C (-38°F)**
5. Install a 3 A fused jumper wire between the signal circuit terminal A (or 1) and the low reference circuit terminal B (or 2).
6. Verify the Hybrid/EV Powertrain Control Module 2 scan tool Ambient Air Temperature parameter is 57°C ($+135^{\circ}\text{F}$) or greater.
 - **If less than 57°C ($+135^{\circ}\text{F}$)**

1. Vehicle OFF, remove the jumper wire and disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.
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. Vehicle OFF.
4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 57 $\hat{A}$ $^{\circ}$ C (135 $\hat{A}$ $^{\circ}$ F) or greater**
7. Test or replace the B9 Ambient Air Temperature Sensor.

Repair Instructions

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

- [Ambient Air Temperature Sensor Replacement](#)
- [Control Module References](#) for control module replacement, programming and setup

DISPLAYS AND GAUGES COMPONENT REPLACEMENT REFERENCE

Component	Repair Instruction
B9 Ambient Air Temperature Sensor	Ambient Air Temperature Sensor Replacement
P2 Transmission Shift Lever Position Indicator	Transmission Electronic Control Replacement
S16 Driver Information Center Switch	Turn Signal Switch Replacement

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](#) .
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:

Gauges and Odometer

- [Instrument Cluster Display Malfunction](#)
- [Speedometer and/or Odometer Malfunction](#)

Audible Warnings

[Chime Malfunction](#)

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 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 - INDEX](#)

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.

1. Vehicle in Service Mode.
2. Verify all the radio speakers operate by adjust the radio balance and fade to each speaker.
 - **If any speaker does not operate properly**

Refer to [Speaker Malfunction \(UQA\)](#) [Speaker Malfunction \(without UQA\)](#) .

- **If the speakers operate properly**
3. Verify the scan tool Driver Seat Belt Status and Passenger Seat Belt Status parameters are Buckled when both front seat belts are buckled.

- **If not Buckled**

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

- **If buckled**

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

- **If not Inactive**

Refer to [Headlamps Malfunction](#) .

- **If Inactive**

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

- **If not Inactive**

Refer to [Park, License, and/or Tail Lamps Malfunction \(MBM\)](#) [Park, License, and/or Tail Lamps Malfunction \(MAH/MBC/MAW/MCX\)](#) .

- **If Inactive**

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

- **If not Inactive**

Refer to [Turn Signal Lamps and/or Indicators Malfunction](#) .

- **If Inactive**

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

- **If not Inactive**

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

- **If Inactive**

8. Verify that all scan tool parameters listed below are Inactive when all the doors are closed.

- Driver Door Ajar Switch
- Passenger Door Ajar Switch
- Left Rear Door Ajar Switch
- Right Rear Door Ajar Switch
- **If not Inactive**

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

- **If Inactive**

9. All OK

Repair Instructions

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

[Control Module References](#) for BCM or Radio replacement, programming and setup

INSTRUMENT CLUSTER 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.

Circuit/System Description

The instrument cluster is a multifunction module that provides the vehicle operator with information using an interactive LCD display. Because the instrument cluster is an LCD display, driver information center elements are located in various zones of the display, depending on how the display is configured. The instrument cluster displays vehicle information based on the information received via serial data from other modules.

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify all indicators illuminate when performing the Instrument Cluster All Indicators test with the scan tool.
 - **If all indicators do not illuminate**
Replace the P16 Instrument Cluster.
 - **If all indicators illuminate**
3. Verify Instrument Cluster dimming changes from 0 - 100% when performing the Instrument Cluster Dimming test with the scan tool.
 - **If Instrument Cluster dimming does not change properly**
Replace the P16 Instrument Cluster.
 - **If Instrument Cluster dimming changes properly**
4. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

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, P0074
Low Reference	-	P0073	-	P0071, P0074

Circuit/System Description

The ambient air temperature sensor is located behind the grille. The Hybrid/EV Powertrain Control Module 2 monitors the ambient air temperature sensor utilizing a low reference circuit and signal circuit. The Hybrid/EV Powertrain Control Module 2 monitors the voltage drop across the sensor, which is inversely proportional to temperature. When the ambient air temperature is cold, the resistance of the sensor is high. When the ambient air temperature is warm, the resistance of the sensor is low. The Hybrid/EV Powertrain Control Module 2 converts the voltage value to a temperature value. The Hybrid/EV Powertrain Control Module 2 also sends the temperature value to other control modules via serial data.

Conditions for Running the DTC

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

Conditions for Setting the DTC

P0071

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

P0072

The Hybrid/EV Powertrain Control Module 2 detects the sensor signal is more than 60Â°C (140Â°F).

P0073

The Hybrid/EV Powertrain Control Module 2 detects the sensor signal is less than -40Â°C (-40Â°F).

P0074

The Hybrid/EV Powertrain Control Module 2 detects an unrealistic signal variance.

Action Taken When the DTC Sets

- DTC P0071 - P0074 are type B DTCs.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify the scan tool Hybrid/EV Powertrain Control Module 2 Ambient Air Temperature parameter is between -40°C (-40°F) and $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$) and changes with air temperature changes.
 - **If not between -40°C (-40°F) and $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$) or changes with air temperature changes**

Refer to Circuit/System Testing.
 - **If between -40°C (-40°F) and $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$) and changes with air temperature changes**
3. All OK.

Circuit/System Testing

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

1. Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than $10\ \Omega$ between the low reference circuit terminal B (or 2) and ground.
 - **If $10\ \Omega$ or greater**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than $2\ \Omega$ 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 10 Ω**
3. Vehicle in Service Mode.
 4. Verify the Hybrid/EV Powertrain Control Module 2 scan tool Ambient Air Temperature parameter is less than -39 $^{\circ}\text{C}$ (-38 $^{\circ}\text{F}$).
 - **If -39 $^{\circ}\text{C}$ (-38 $^{\circ}\text{F}$) or greater**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than -39 $^{\circ}\text{C}$ (-38 $^{\circ}\text{F}$)**
 5. Install a 3 A fused jumper wire between the signal circuit terminal A (or 1) and the low reference circuit terminal B (or 2).
 6. Verify the Hybrid/EV Powertrain Control Module 2 scan tool Ambient Air Temperature parameter is 57 $^{\circ}\text{C}$ (+135 $^{\circ}\text{F}$) or greater.
 - **If less than 57 $^{\circ}\text{C}$ (+135 $^{\circ}\text{F}$)**
 1. Vehicle OFF, remove the jumper wire and disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.
 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. Vehicle OFF.
 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 57 $^{\circ}\text{C}$ (135 $^{\circ}\text{F}$) or greater**
 7. Test or replace the B9 Ambient Air Temperature Sensor.

Repair Instructions

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

- [Ambient Air Temperature Sensor Replacement](#)
- [Control Module References](#) for control module replacement, programming and setup

SPEEDOMETER AND/OR ODOMETER MALFUNCTION

Diagnostic Instructions

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

Circuit/System Description

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

Diagnostic Aids

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Instrument Cluster Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify all gauge segments illuminate when performing the Driver Information Center Segments test with the scan tool.
 - **If any gauge segments do not illuminate**

Replace the P16 instrument cluster
 - **If all gauge segments illuminate**
3. Drive the vehicle.
4. Verify the displayed Instrument Cluster speedometer value matches the vehicle speed parameter on the scan tool.
 - **If the values do not match**

Replace the P16 Instrument Cluster.
 - **If the values match**
5. Verify the odometer display and the displayed distance counts up while driving the vehicle.
 - **If the odometer displays only "----" (dashes)**

Refer to Circuit/System Testing.
 - **If the odometer display does not count up**

Replace the P16 Instrument Cluster.
 - **If speedometer sweeps and displays the correct value, and the odometer display counts up**

6. All OK.

Circuit/System Testing

NOTE:

- **Circuit/System Verification must be performed before proceeding with Circuit/System Testing.**
- **If there are multiple modules not original to the vehicle and 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.**

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

1. Verify the scan tool Odometer Status parameter is Unlocked.
 - **If the reading is Locked**
Refer to correcting VIN mismatch - odometer locked.
 - **If the reading is Unlocked**
2. Verify the scan tool BCM VIN parameter matches the vehicle's VIN placard.
 - **If the VIN does not match**
Reprogram the BCM, then proceed to Step 3.
 - **If the VIN matches**
3. Verify the scan tool Instrument Cluster VIN parameter matches the vehicle's VIN placard.
 - **If the VIN does not match**
Reprogram the instrument cluster. Then proceed with step 4.
 - **If the VIN matches**
4. Vehicle in Service Mode.
5. Verify the instrument cluster is displaying the correct value.
 - **If the instrument cluster is still displaying "----" (dashes)**
Replace the P16 Instrument Cluster.
 - **If the instrument cluster displays the correct value**
6. All OK.

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

1. Verify the scan tool Odometer Status parameter is Locked.
 - **If the reading is Unlocked**
Refer to Correcting VIN mismatch - odometer unlocked.
 - **If the reading is Locked**
2. Verify the scan tool Instrument Cluster VIN parameter matches the vehicle's VIN placard.
 - **If the VIN does not match**
Reprogram the Instrument Cluster. Then proceed with step 3.
 - **If the VIN matches**
3. Perform the BCM setup procedure in SPS.
4. Vehicle in Service Mode.

5. Verify the instrument cluster is displaying the correct value.
 - If the instrument cluster is still displaying "----" (dashes)
 Replace the P16 Instrument Cluster.
 - If instrument cluster is displaying the correct value
6. All OK.

Repair Instructions

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

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

REPAIR INSTRUCTIONS

AMBIENT AIR TEMPERATURE SENSOR REPLACEMENT



Fig. 5: Ambient Air Temperature Sensor
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Front Bumper Fascia Replacement (North America)</u> <u>Front Bumper Fascia Replacement (Europe, Korea)</u>	
1	Ambient Air Temperature Gauge Sensor Procedure 1. Disconnect the electrical connectors. 2. Unlock the retaining tabs.

INSTRUMENT CLUSTER REPLACEMENT

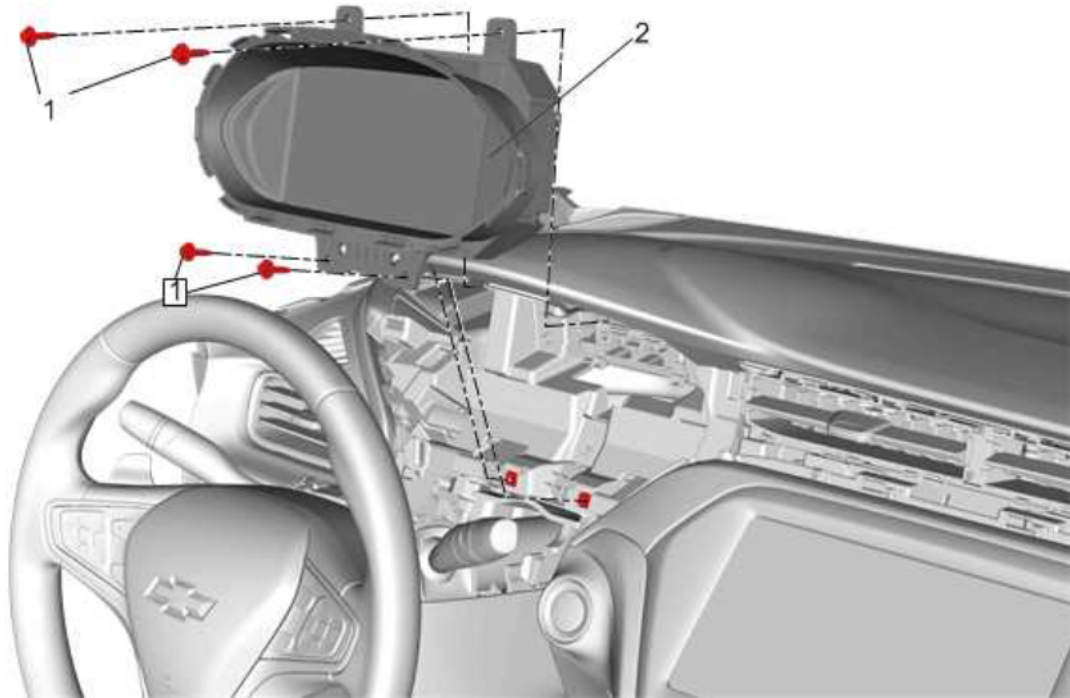


Fig. 6: Instrument Cluster

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Steering Column Upper Trim Cover Replacement</u>	
1	Instrument Cluster Bolt 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. Refer to <u>Control Module References</u> for programming and set up information, if required.

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

Auto Stop Mode

The chime producer activates when the vehicle comes to a stop and the driver or passenger door is opened as requested by the body control module.

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 driver's 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.

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/BCMdiag.com 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

The Driver Information Center display is in the instrument cluster. The Driver Information Center displays information about the vehicle. It also displays warning messages if a system problem is detected. For more information on Indicators and Warning messages, refer to [Indicator/Warning Message Description and Operation](#).

There are 3 switch functions for the driver information center:

- CONFIG: Press to select either the Simple or Enhanced instrument cluster configuration display.
- BACK: Press to return to the previous screen, exit a screen, or return to the main menu. Press BACK to minimize the DIC menu display.
- SELECT: Press the center of the knob to select the highlighted item. Turn the knob to scroll through the menu items.

Menu

Turn the SELECT knob to scroll through the possible menus. Press the center of the SELECT knob when a menu is highlighted to enter that menu. The possible Driver Information Center menu's are:

- Trip A
- Trip B
- Tire Pressure
- Vehicle Messages
- Units
- Tutorial Mode

Trip A and Trip B

The trip displays show fuel used and distance traveled since the last trip reset.

Reset the trip data by pressing and holding the SELECT button when either Trip A or Trip B is displayed.

Outside Air Temperature

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

Tire Pressure

The display will show a vehicle with the approximate pressures of all four tires. Tire pressure is displayed in either kilopascal (kPa) or in pounds per square inch (psi).

If a low or high tire pressure is detected, a message is displayed advising to check the tire pressure in the specified tire.

Vehicle Messages

Turn the SELECT knob to scroll through any active warning messages. Press SELECT to review the messages.

Units

Turn the SELECT knob to change the unit display to METRIC or US when the display is active. Press SELECT to confirm the setting. This will change the displays on the cluster and DIC to either metric or English (US) measurements.

Tutorial Mode

Select this menu item to view a screen that explains some of the unique features of the cluster.

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. This message is only sent one time, after a new language is selected. To set the language, see the owners manual.

INDICATOR/WARNING MESSAGE DESCRIPTION AND OPERATION

Indicator LIGHT ON

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

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

Message Displayed

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

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

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

Displays Test

The instrument cluster displays a preview of information that includes electric range, charging, odometer, and battery status. This happens when the driver door is first opened, and following the welcome animation before starting the vehicle.

A CHARGING OVERRIDE/INTERRUPTION OCCURRED message may display on the lower left of the screen to indicate that a charging override or interruption has occurred due to:

- Override of charging settings by vehicle owner via OnStar.
- Unintended interruption of AC power at the vehicle's charge port.
- Interruption of charging by the utility company via OnStar as authorized by vehicle owner.

Refer to the owners manual for a complete list of vehicle charging status screen messages.

Indicators and Warning Messages

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

Battery and Driver Efficiency Gauges

Refer to the owner's manual for descriptions and explanations of Battery and Driver Efficiency Gauges.

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.

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. cardiagn.com

Compass

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

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 configuration. For further information refer to **Driver Information Center (DIC) Description and Operation**.
