

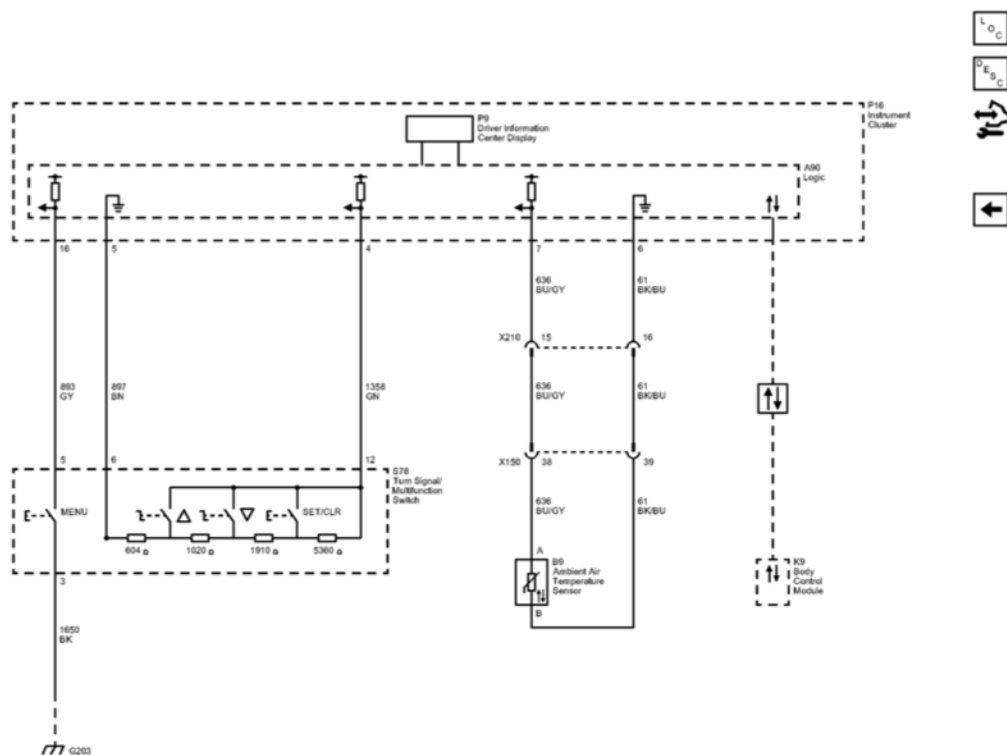


Fig. 3: Driver Information Wiring Schematics
 Courtesy of GENERAL MOTORS COMPANY

AUDIBLE WARNINGS WIRING SCHEMATICS

Audible Warnings Wiring Schematics

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

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. Ignition ON.
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 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

Control Module Ignition On and Start Circuit

For symptom byte information refer to **Symptom Byte List**

Diagnostic Fault Information

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Instrument Cluster Ignition (Instrument Panel terminal 19)	B1370 06	B1370 06	B1370 01	-

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 coil control circuit is shorted to ground.
- Ignition run/crank relay coil 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**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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

1. Verify that DTC B144B or B1380 is not set.
 - **If DTC B144B or B1380 is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- **If DTC B144B or B1380 is not set**

Refer to Circuit/System Testing below.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
2. Verify that a test lamp does not illuminate between the ignition circuit terminal 19 and ground.
 - **If the test lamp illuminates**

Repair the short to voltage on the ignition circuit.

- **If the test lamp does not illuminate**

3. Ignition ON, verify that a test lamp illuminates between the ignition terminal 19 and ground.
 - **If the test lamp does not illuminate and the Ignition fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 ohms in the ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, refer to **Power Mode Mismatch** .
 - **If the test lamp does not illuminate and the Ignition fuse is open**
 1. Ignition OFF, remove the test lamp.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the P16 Instrument Cluster.
 - **If the test lamp illuminates**
4. Replace the P16 Instrument Cluster.

Repair Instructions

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

- **Relay Replacement (Within an Electrical Center)** , **Relay Replacement (Attached to Wire Harness)**
- **Control Module References** for instrument cluster replacement, programming and setup.

DTC P0520

Diagnostic Instructions

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

DTC Descriptor

DTC P0520

Engine Oil Pressure Switch Circuit

Diagnostic Fault Information

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

Typical Scan Tool Data

ECM - Engine Oil Pressure Switch

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

Circuit/System Description

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

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The ECM detects that the engine oil pressure switch signal circuit is pulled low.
- The 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 - INDEX

Description and Operation

- [Instrument Cluster Description and Operation](#)
- [Indicator/Warning Message Description and Operation](#)
- [Driver Information Center \(DIC\) Description and Operation](#)

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

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

Refer to Circuit/System Testing below.

- **If Low**
3. Engine running.
 4. Verify the scan tool Engine Oil Pressure parameter is OK.
 - **If not OK**

Refer to Circuit/System Testing below.

- **If OK**
5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B37 Engine Oil Pressure Switch, ignition ON.
2. Verify the scan tool Engine Oil Pressure Switch parameter is OK.
 - **If not OK**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If OK**

3. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
4. Verify the scan tool Engine Oil Pressure Switch parameter is Low.
 - **If not Low**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 Engine Control Module.
 - **If Low**
5. Test or replace the B37 Engine Oil Pressure Switch.

Repair Instructions

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

- **Engine Oil Pressure Switch Replacement**
- **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** .
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

- **Fuel Gauge Malfunction - DTC P0461-P0464**
- **Instrument Cluster Gauges Malfunction**
- **Speedometer and/or Odometer Malfunction**

Indicators

- **ABS Indicator Malfunction**
- **Air Bag Indicator Circuit Malfunction (Driver) , 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 or Gauge Malfunction - DTC P0521-P0523**
- **Front Fog Lamps Malfunction**
- **Headlamps Malfunction**
- **Seat Belt Indicator Malfunction - Driver**
- **Traction Control/Stability Control Indicator Malfunction**
- **Turn Signal Lamps and/or Indicators Malfunction**
- **Washer Malfunction**

Driver Information Center

Driver Information Center Switch Malfunction - DTC B3567

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 - INDEX

Description and Operation

Indicator/Warning Message Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, engine running.
2. Verify the scan tool Battery Voltage parameter is between 12.5-15.5 V.
 - **If not 12.5-15.5 V**

Refer to **Charging System Test** .

○ **If 12.5-15.5 V**

3. Verify the charge indicator turns on and off when commanding the All Indicators test ON and OFF with the scan tool.

○ **If the charge indicator always stays on or always stays off**

Replace the P16 Instrument Cluster.

○ **If the charge indicator turns on and off as commanded**

4. All OK.

Repair Instructions

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

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

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.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	1	1	-	1
Signal	1	1	1	1
1. Chime Malfunction				

Circuit/System Description

The radio generates the audible warnings. The instrument cluster, the body control module, the inflatable restraint sensing and diagnostic module or the object alarm module request audible warnings via serial data.

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

1. Ignition ON.
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** .
 - **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**

- **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 **Park, License, and/or Tail Lamps 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. Verify the scan tool Key in Ignition Status parameter is Inactive when the key is out of the ignition.

- **If not Inactive**

Refer to Circuit/System Testing below.

- **If Active**

10. All OK

Circuit/System Testing

1. Ignition ON, disconnect the harness connector at the S39 ignition switch while the ignition is ON.
2. Verify a test lamp illuminates between the B+ circuit terminal 2 and ground.

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Test for less than 2 ohms in the B+ circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, verify the fuse is not open and there is voltage at the fuse.

- **If the test lamp does not illuminate and the circuit fuse is open**

1. Test for infinite resistance between the B+ circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance
- 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K9 body control module.
 - **If the test lamp illuminates**
- 3. Verify the scan tool Key in Ignition Status parameter is Inactive.
 - **If not Inactive**
 1. Disconnect the X3 harness connector at the K9 body control module.
 2. Test for less than 1 V between the signal circuit terminal 4 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K9 body control module.
 - **If Inactive**
- 4. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the B+ circuit terminal 2.
- 5. Verify the scan tool Key in Ignition Status parameter is Active.
 - **If not Active**
 1. Ignition OFF, disconnect the X3 harness connector at the K9 body control module.
 2. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K9 body control module.
 - **If Active**
- 6. Test or replace the S39 ignition switch.

Repair Instructions

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

- **Ignition and Start Switch Replacement (With BTM)** , **Ignition and Start Switch Replacement (Without BTM)**
- **Control Module References** for body control module or radio replacement, programming and setup.

DRIVER INFORMATION CENTER SWITCH MALFUNCTION - DTC B3567

Diagnostic Instructions

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

DTC Descriptors

DTC B3567 01

Info Display Select Switch Circuit Short to Battery

DTC B3567 02

Info Display Select Switch Circuit Short to Ground

DTC B3567 04

Info Display Select Switch Circuit Open

DTC B3567 59

Info Display Select Switch Circuit Protection Time-Out

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Set//Up/Down Switch Signal Terminal 12	B3567 02	B3567 04	B3567 01	B3567 59
Menu Switch Signal Terminal 5	B3567 59	2	2	2
Low Reference	-	B3567 04	B3567 02	1
1. Set, Up and Down Switch Malfunction 2. Menu Switch Malfunction				

Circuit/System Description

The driver information center switch is a multiplexed switch. The up, down and set buttons are a series of momentary contact switches that connect a series of resistors in a resistor ladder format. The up, down and set buttons utilize a 12 V signal and the instrument cluster determines which button is pressed by the voltage drop across the resistors when the button is pressed. The Menu switch is supplied 5 V and is pulled to ground when the switch is pressed.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B3567 01

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

B3567 02

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

B3567 04

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

B3567 59

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

Action Taken When the DTC Sets

The instrument cluster ignores the driver information center switch inputs.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Instrument Cluster Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

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

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

Refer to Set, Up and Down Switch Malfunction

- **If the driver information center changes**

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

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

Refer to Menu Switch Malfunction below

- **If the driver information center changes**

4. All OK.

Circuit/System Testing

Set, Up and Down Switch Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S78 Turn Signal/Multifunction Switch, ignition ON.
2. Test for less than 1 V between the low reference circuit terminal 6 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
3. Test for less than 10 ohms between the low reference circuit terminal 6 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the P16 instrument cluster.
 - **If less than 10 ohms**
4. Test for 11.8-12.2 V between the signal circuit terminal 12 and ground.
 - **If less than 11.8 V**
 1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the P16 instrument cluster.

- **If greater than 12.2 V**

1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster, ignition ON.
2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the P16 instrument cluster.

- **If between 11.8-12.2 V**

5. Test or replace the S48A multifunction switch.

Menu Switch Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S78 Turn Signal/Multifunction Switch, ignition ON.
2. Test for 4.8-5.2 V between the signal circuit terminal 5 and ground.

- **If less than 4.8 V**

1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster.
2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the P16 instrument cluster.

- **If greater than 5.2 V**

1. Ignition OFF, disconnect the harness connector at the P16 instrument cluster, ignition ON.
2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the P16 instrument cluster.

- **If between 4.8-5.2 V**

3. Test for less than 10 ohms between ground circuit terminal 3 and ground.
 - If 10 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 10 ohms
4. Test or replace the S78 Turn Signal/Multifunction Switch.

Repair Instructions

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

Control Module References for instrument cluster replacement, programming and setup

ENGINE OIL PRESSURE INDICATOR OR GAUGE MALFUNCTION - DTC P0521-P0523

Diagnostic Instructions

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

DTC Descriptors

DTC P0521

Engine Oil Pressure Sensor Performance

DTC P0522

Engine Oil Pressure Sensor Circuit Low Voltage

DTC P0523

Engine Oil Pressure Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0522	P0522	P0523	P0521
Signal	P0522	P0522	P0523	P0521
Low Reference	-	P0523	-	P0521

Circuit/System Description

The engine oil pressure sensor is a 3-wire sensor comprising of a signal circuit, low reference circuit and the 5-volt reference circuit. The engine control module (ECM) supplies 5 volts to the sensor via the 5-volt reference circuit and provides ground via the low reference circuit. The ECM monitors the signal circuit to determine the sensor voltage is within the normal operating range of approximately 1-4 volts. When the engine oil pressure is high, the sensor voltage is high and the ECM senses a high signal voltage. When the engine oil pressure is low, the sensor voltage is low and the ECM senses a low signal voltage. The ECM sends the engine oil pressure information via serial data to the body control module (BCM). The BCM then sends the engine oil pressure information to the instrument panel cluster (IPC) via serial data.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

P0521

- The engine oil pressure is out of its working range.

- The ECM does not detect a change in the engine oil pressure.
- The above condition is present over a predetermined variance of engine speed.

P0522

- The ECM detects a short to ground in the engine oil pressure signal circuit.
- The above condition is present for greater than 10 seconds.

P0523

- The ECM detects a short to voltage or an open circuit in the engine oil pressure signal circuit.
- 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

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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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the engine oil pressure indicator turns on & off when commanding the All Indicators ON and OFF with a scan tool.

- **If the engine oil pressure Indicator does not turn on and off.**

Replace the P16 instrument cluster.

- **If the engine oil pressure Indicator turns on and off**

3. Verify the scan tool Engine Oil Pressure parameter is Low.

- **If not Low**

Refer to Circuit/System Testing below.

- **If Low**

4. Engine running.
5. Verify the scan tool Engine Oil Pressure parameter is OK.

- **If not OK**

Refer to Circuit/System Testing below.

- **If OK**

6. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B37B engine oil pressure sensor. It may take up to 2 minutes for all vehicle systems to power down.

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

- **If 10 ohms or greater**

1. Ignition OFF, disconnect the harness connector at the K20 engine control module.
2. Test for less than 2 ohms in the low reference circuit end to end.

- If 2 ohms or greater, repair the open/high resistance in the circuit.
- If less than 2 ohms, replace the K20 engine control module.

- **If less than 10 ohms**

3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 3 and ground.

- **If less than 4.8 V**

1. Ignition OFF, disconnect the harness connector at the K20 engine control module.

2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
3. Test for less than 2 ohms in the 5 V reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 engine control module.
- **If greater than 5.2 V**
1. Ignition OFF, disconnect the harness connector at the K20 engine control module, ignition ON.
2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 engine control module.
- **If between 4.8-5.2 V**
5. Verify the scan tool Engine Oil Pressure parameter is less than 1 V.
 - **If 1 V or greater**
 - 1. Ignition OFF, disconnect the harness connector at the K20 engine control module, ignition ON.
 - 2. Test for less than 1 V between the signal circuit terminal 1 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 engine control module.
 - **If less than 1 V**
6. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the 5 V reference circuit terminal 3.
7. Verify the scan tool Engine Oil Pressure parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 - 1. Ignition OFF, disconnect the harness connector at the K20 engine control module.
 - 2. Test for infinite resistance between the signal circuit terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 - 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 engine control module.
 - **If greater than 4.8 V**
8. Test or replace the B37B engine oil pressure sensor.

Repair Instructions

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

- **Engine Oil Pressure Switch Replacement**
- **Control Module References** for instrument cluster or ECM replacement, setup, and programming

FUEL GAUGE MALFUNCTION - DTC P0461-P0464

Diagnostic Instructions

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

DTC Descriptors

DTC P0461

Fuel Level Sensor Performance

DTC P0462

Fuel Level Sensor Circuit Low Voltage

DTC P0463

Fuel Level Sensor Circuit High Voltage

DTC P0464

Fuel Level Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0462	P0463	P0463	P0461
Low Reference	-	1	P0463	P0461
1. Fuel Gauge Reads Empty				

Circuit/System Description

The fuel level sensor changes resistance based on fuel level. The engine control module (ECM) monitors the signal circuit of the fuel level sensor in order to determine the fuel level. When the fuel tank is full, the resistances of the fuel level sensor is low and the ECM senses a low signal voltage on the signal circuit of the fuel level sensor. When the fuel tank is empty, the resistance of the fuel level sensor is high and the ECM senses a high signal voltage. The ECM uses the signal circuit of the fuel level sensor in order to calculate the percentage of remaining fuel in the tank. The ECM sends the fuel level percentage via serial data to the body control module (BCM). The BCM then sends the fuel level percentage via serial data to the instrument cluster in order to control the fuel gauge. When the fuel level falls below approximately 11% the instrument cluster illuminates the low fuel level indicator.

Conditions for Running the DTC

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

Conditions for Setting the DTC

P0461 00

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

P0462

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

P0463

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

Conditions for Clearing the DTC

- P0461, P0462, P0463, and P0464 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 - 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 Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B46 fuel level sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 ohms between the low reference circuit terminal 3 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 engine control module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 engine control module.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify the scan tool Remaining Fuel In Tank parameter is less than 5%.
 - **If 5% or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 engine control module.
 2. Test for infinite resistance between the signal circuit terminal 4 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 engine control module.
 - **If less than 5%**
5. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the low reference circuit terminal 3.

6. Verify the scan tool Remaining Fuel In Tank is greater than 90%.
 - **If 90% or less**
 1. Ignition OFF, disconnect the harness connector at the K20 engine control module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF
 4. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 engine control module.
 - **If greater than 90%**
7. Test or replace the B46 fuel level sensor.

Component Testing

1. Ignition OFF, remove the fuel level sender.
2. Sweep the fuel level sensor through its full range of motion while measuring resistance between the signal terminal 4 and the low reference terminal 3.
3. Test for a minimum resistance value of 37-43 ohms and a maximum value of 245-255 ohms without any spikes or dropouts.
 - **If minimum resistance is not 37-43 ohms, maximum resistance is not 245-255 ohms, or if there are any spikes or dropouts**

Replace the fuel level sensor.
 - **If minimum resistance is 37-43 ohms, maximum resistance is 245-255 ohms, and if there are no spikes or dropouts**
4. All OK.

Repair Instructions

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

- **Fuel Level Sensor Replacement** for 2.0L or 2.5L.
- **Fuel Level Sensor Replacement** for 2.4L.
- **Control Module References** for the ECM replacement, programming and setup

INSTRUMENT CLUSTER GAUGES 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 a 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.

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. Verify no DTC is set.

- If any DTC is set

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- If no DTCs are set

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.

- **If all gauges sweep**

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.

- **If the values match the scan tool**

4. All OK.

Repair Instructions

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

Control Module References for Instrument Cluster or ECM replacement, programming, and setup.

OUTSIDE AIR TEMPERATURE DISPLAY MALFUNCTION - DTC B0158

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** Strategy Based Diagnosis for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** 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
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 signal circuit. The instrument cluster monitors the voltage drop across the sensor, which is inversely 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 display.

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 is more than 88°C (190°F).

B0158 05

The instrument cluster detects the sensor signal 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 no ambient air temperature information.

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 Instrument Cluster Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Driver Information Center (DIC) Description and Operation Driver Information Center (DIC) Description and Operation

Electrical Information Reference

- **Circuit Testing** Circuit Testing

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

Scan Tool Reference

Control Module References Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B9 Ambient Air Temperature Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 1 V between the low reference circuit terminal B and ground.
 - **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**
3. Test for less than 10 ohms between the low reference circuit terminal B and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the P16 Instrument Cluster.
 - **If less than 10 ohms**

4. Ignition ON.
5. Verify the scan tool Ambient Air Temperature parameter is greater than 98%.
 - **If 98% or less**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the P16 Instrument Cluster.
 - **If greater than 98%**

6. Install a 3 A fused jumper wire between the signal circuit terminal A and the low reference circuit terminal B.
7. Verify the scan tool Ambient Air Temperature parameter is less than 8%.
 - **If 8% or greater**
 1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.

- If less than 1 V
- 3. Ignition OFF
- 4. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the P16 Instrument Cluster.
- **If less than 8%**
- 8. Test or replace the B9 Ambient Air Temperature Sensor.

Repair Instructions

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

- **Ambient Air Temperature Gauge Sensor Replacement**
- **Control Module References** for instrument cluster 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. Verify no DTC is set.

- **If any DTC is set**

Diagnose DTCs first. Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- **If no DTCs are set**

2. Ignition ON.

3. Verify the speedometer sweeps from low to high position when performing the Speedometer Sweep Test with the scan tool.

- **If speedometer does not sweep**

Replace the P16 Instrument Cluster.

- **If speedometer sweeps properly**

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

- **If the values do not match**

Replace the P16 Instrument Cluster.

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

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

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

Refer to Circuit/System Testing below.

- **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: If there are multiple modules not original to the vehicle and are not new correctly configured service parts, SPS may not be able to properly read or recover the vehicle odometer value. Follow government rules and documentation (including vehicle identification) regarding inaccurate/unknown odometer values.

Perform circuit/system verification first.

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 below- 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. Ignition ON.

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

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

Replace the P16 Instrument Cluster.

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 below.

- **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. Ignition ON.

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

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

Replace the P16 Instrument Cluster.

- **If instrument cluster is displaying the correct value**

6. All OK.

Repair Instructions

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

Control Module References for Instrument Cluster, BCM or ECM replacement, programming and setup

REPAIR INSTRUCTIONS

DRIVER INFORMATION DISPLAY REPLACEMENT (UAG)

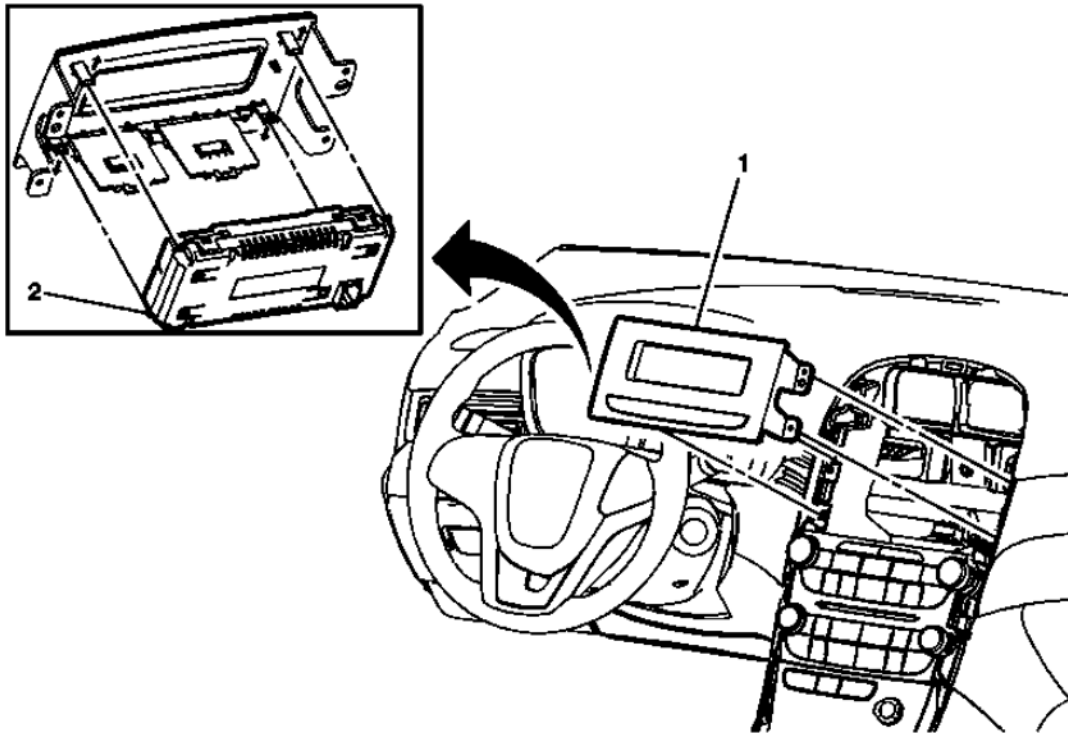


Fig. 5: Driver Information Display (UAG)
 Courtesy of GENERAL MOTORS COMPANY

Driver Information Display Replacement (UAG)

Callout	Component Name
1	Instrument Panel Accessory Trim Plate Refer to <u>Instrument Panel Accessory Trim Plate Replacement (UAG)</u> .
2	Driver Information Display Assembly Procedures 1. Release the four tabs, remove the driver information display. 2. Refer to <u>Control Module References</u> for programming and set up information.

DRIVER INFORMATION DISPLAY REPLACEMENT (UDY)

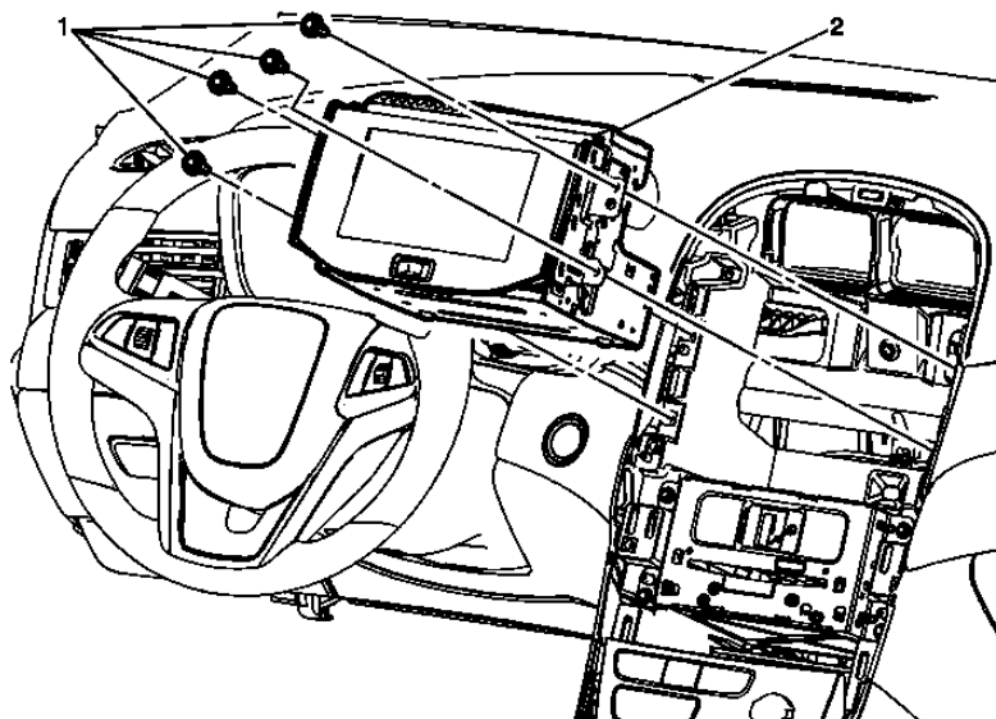


Fig. 6: Driver Information Display (UDY)
 Courtesy of GENERAL MOTORS COMPANY

Driver Information Display Replacement (UDY)

Callous	Component Name
Preliminary Procedures 1. Remove the instrument panel accessory bezel. Refer to <u>Instrument Panel Accessory Bezel Replacement</u>. 2. Remove the radio control assembly. Refer to <u>Radio Control Assembly Replacement</u>.	
1	Drivers Information Display Fastener (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> .
2	Drivers Information Display Assembly Procedure 1. Disconnect the electrical connections. 2. Refer to <u>Control Module References</u> for programming and set up information.

INSTRUMENT CLUSTER REPLACEMENT

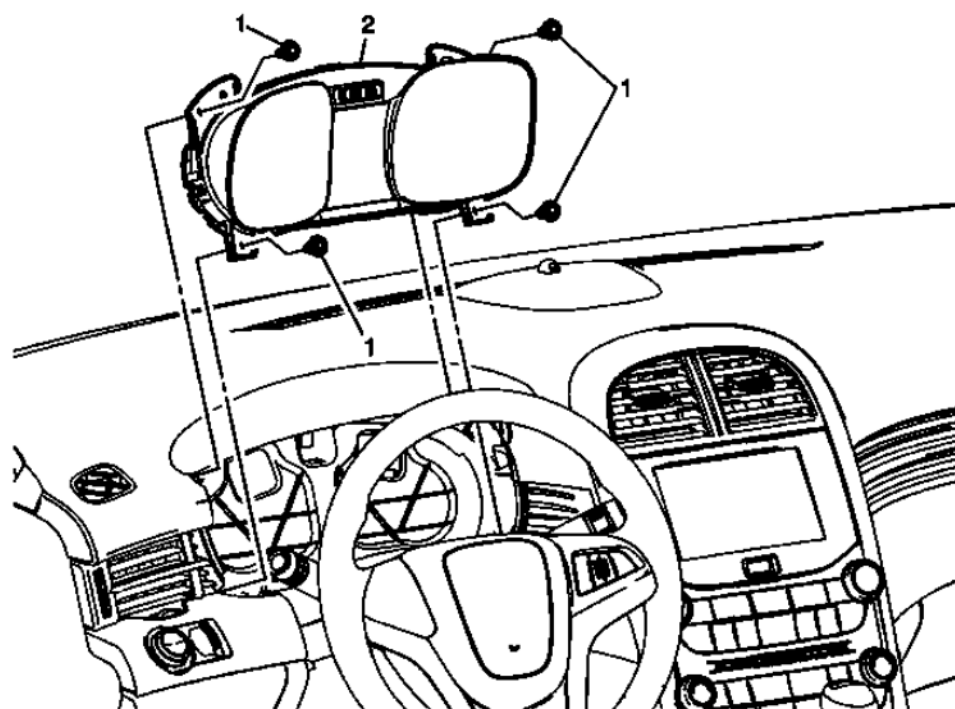


Fig. 7: Instrument Cluster

Courtesy of GENERAL MOTORS COMPANY

Instrument Cluster Replacement

Callout	Component Name
Preliminary Procedure Remove the instrument panel cluster trim plate. Refer to <u>Instrument Panel Cluster Trim Plate Replacement</u> .	
1	Instrument Cluster Fasteners (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> .
2	Instrument Cluster Assembly Procedures 1. Disconnect the electrical connections. 2. Refer to <u>Control Module References</u> for programming and set up information.

DESCRIPTION AND OPERATION

AUDIBLE WARNINGS DESCRIPTION AND OPERATION

The audible warnings alert the driver of a system concern or a critical vehicle condition. 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. The radio 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 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.

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**.

There are 4 switch functions for the driver information center:

- Menu
- Set/CLR
- Up
- Down

Menu

The Menu switch is used to navigate between the Vehicle Information Menu and the Trip/Fuel Information Menu. Cycle through the following vehicle parameters by successive pressing of the Menu switch.

Up and Down

The Up and the Down switches are used to navigate within the menus. Cycle through the following menu parameters by successive pressing of the Down switch.

Vehicle Information Menu

- Remaining Oil Life
- Units Menu
- Tire Pressure Menu
- Battery Voltage
- Speed Warning

Trip/Fuel Information Menu

- Season Odometer
- Trip 1
- Trip 2

- Average Fuel Economy
- Fuel Range
- Average Vehicle Speed
- Timer

Trip 1/2

The trip odometer 1 or 2 can be accessed through the driver information center switch Up/Down function.

Trip Display

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

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.

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 Vehicle Speed

Average speed is calculated using the equation: Average Speed = Average Speed Distance/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

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.

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).

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

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 Monitor

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.

Compass

The vehicle may have a compass display on the Driver Information Center (DIC). On most vehicles, the compass receives its heading and other information from the Global Positioning System (GPS) antenna, StabiliTrak, and vehicle speed information. On vehicles without a telematics communication interface control module, a dedicated compass module is used to perform the same function as the telematics communication interface module.

Avoid covering the GPS antenna for long periods of time with objects that may interfere with the antenna's ability to receive a satellite signal.

Battery Voltage

The battery voltage can be accessed through the driver information center Trip/Fuel switch function. The driver information center shows the battery voltage measured at the B+ input circuit.

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. 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.

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 battery indicator illuminates briefly.
- The brake indicator illuminates briefly.
- The electric park brake on indicator illuminates briefly.
- The electric park brake service indicator illuminates briefly.
- The fuel level low indicator illuminates briefly.
- The oil pressure low indicator illuminates briefly.
- The park assist service indicator illuminates briefly.
- The rain sense indicator illuminates briefly.
- The security indicator illuminates briefly.
- The tire pressure low indicator illuminates briefly.
- The electronic stability control service 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**.