SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

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

Application	Specification Metric (English)
Human Machine Interface Control Module Bypass Module Bracket Bolt	2.5 N.m (22 lb in)
Rear Object Control Module Fastener	6 N.m (53 lb in)

SCHEMATIC WIRING DIAGRAMS

OBJECT DETECTION WIRING SCHEMATICS

Park Assist - Power, Ground, Serial Data and Control (UD7 or UD5)

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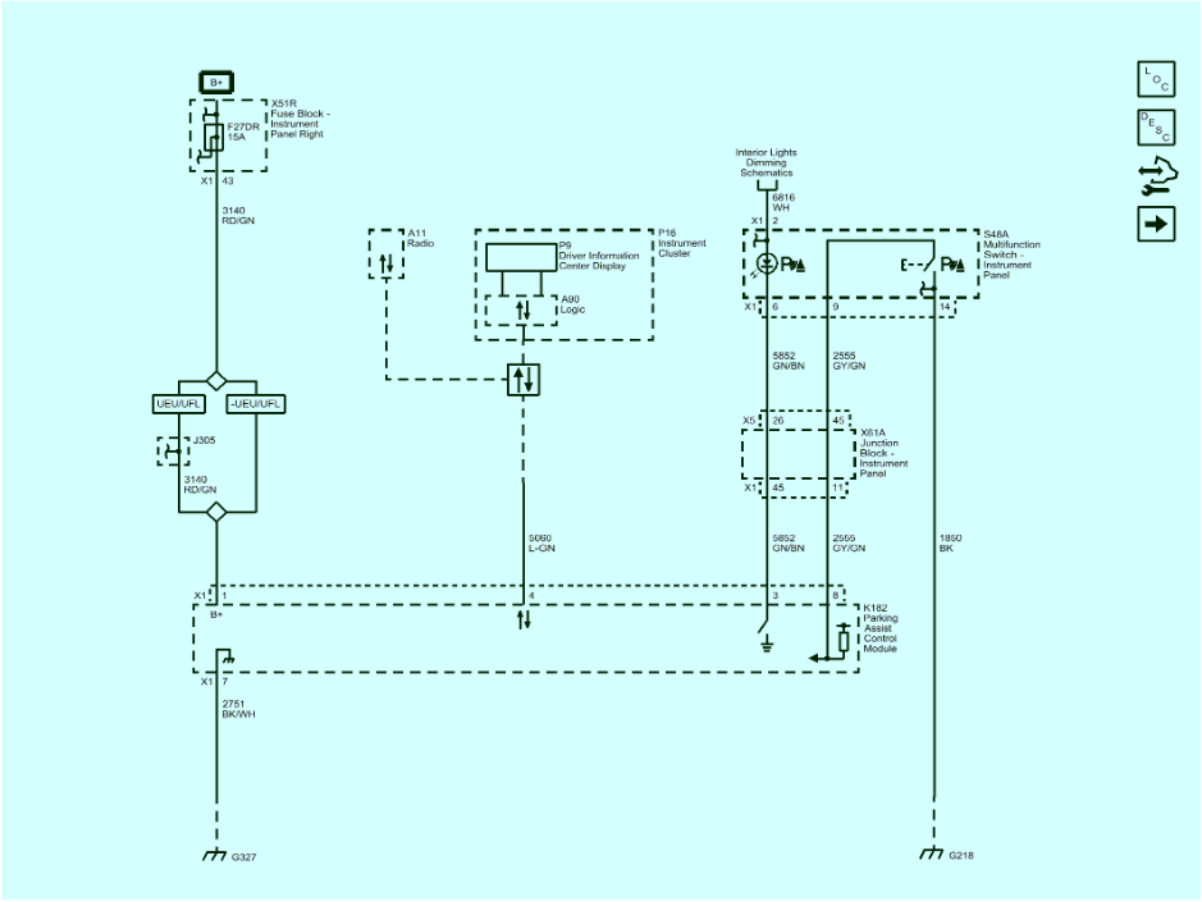


Fig. 1: Park Assist - Power, Ground, Serial Data and Control (UD7 or UD5)
Courtesy of GENERAL MOTORS COMPANY

Park Assist - Rear Sensors (UD7 or UD5)

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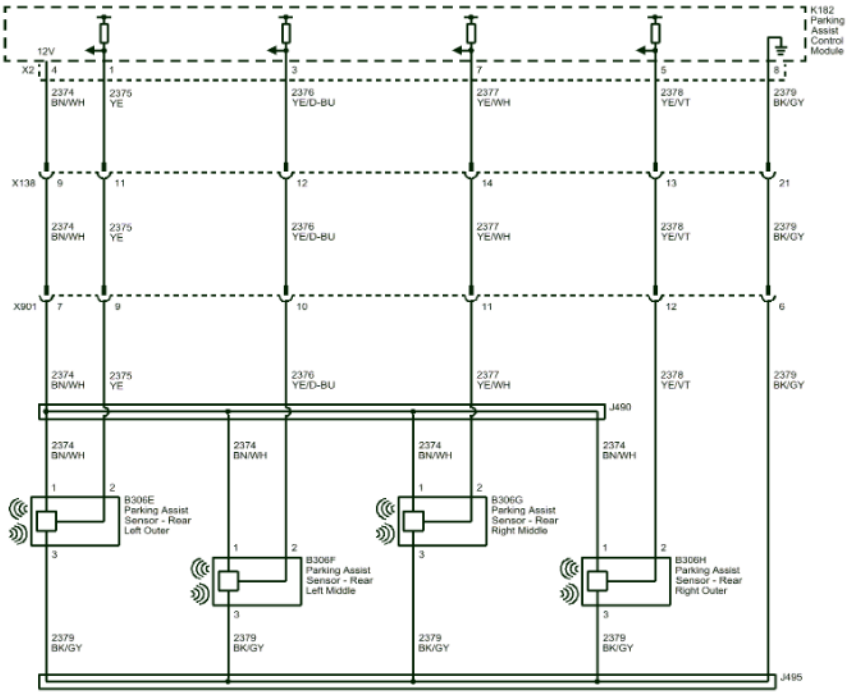


Fig. 2: Park Assist - Rear Sensors (UD7 or UD5)
Courtesy of GENERAL MOTORS COMPANY

Park Assist - Front Sensors (UD5)

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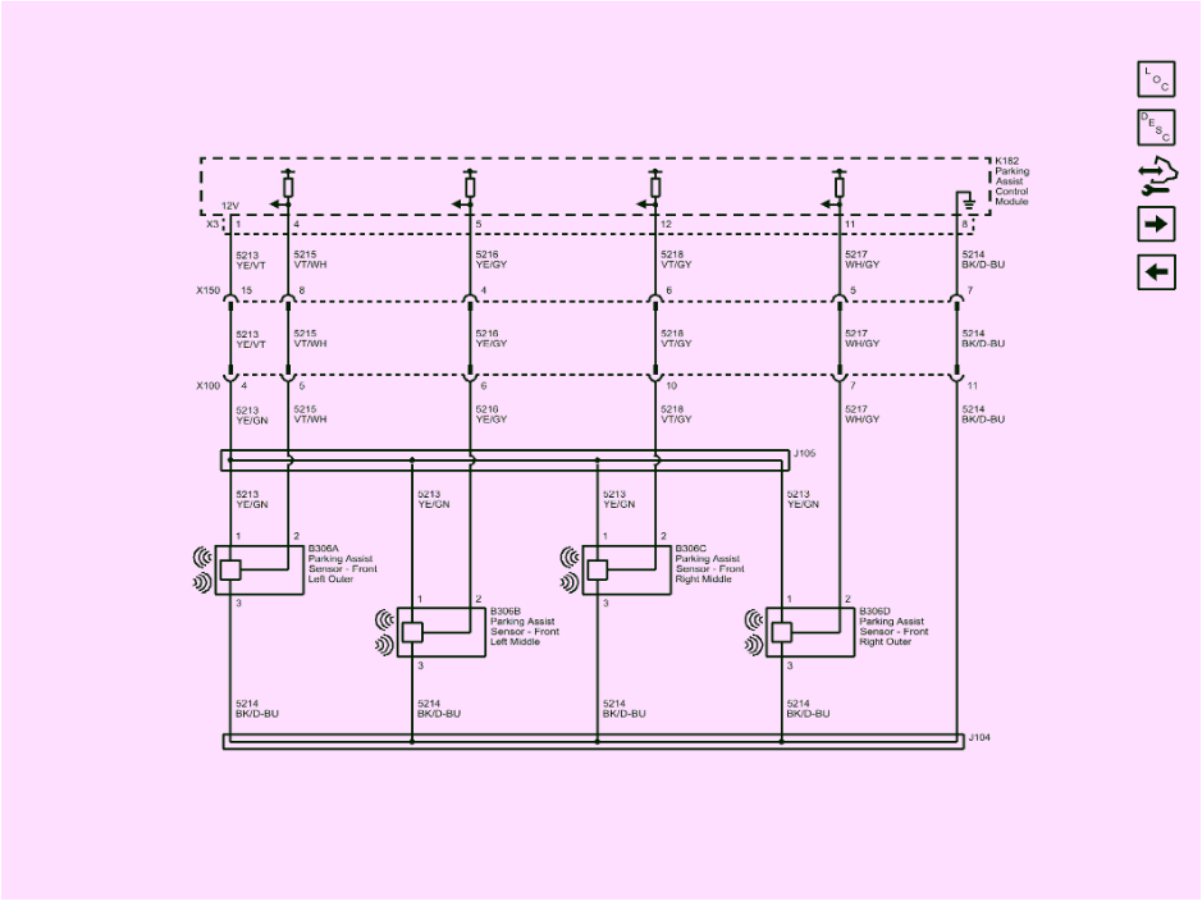


Fig. 3: Park Assist - Front Sensors (UD5)
Courtesy of GENERAL MOTORS COMPANY

Rearview Camera (UVC with IOB/IO3)

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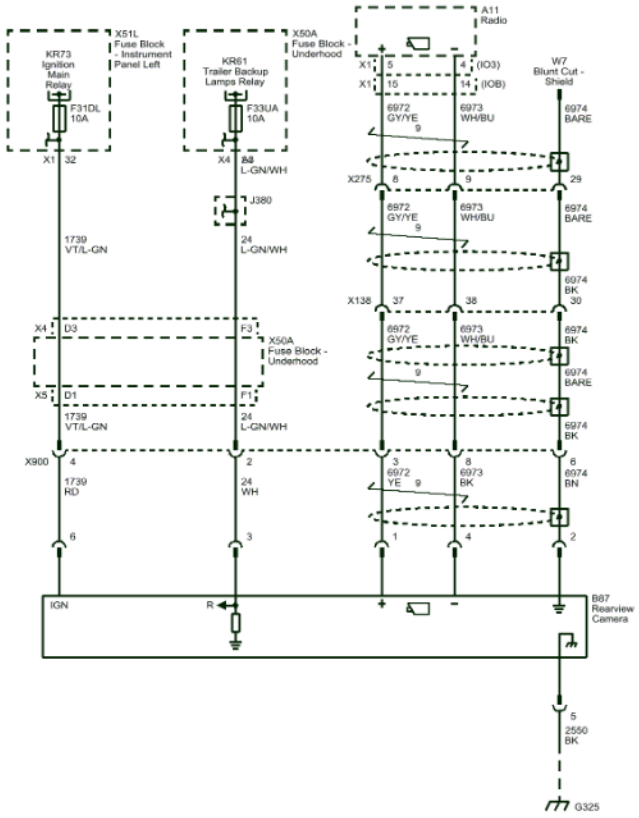


Fig. 4: Rearview Camera (UVC with IOB/IO3)
Courtesy of GENERAL MOTORS COMPANY

Rearview Camera (UVC with IO5 or IO6) (1 of 2)

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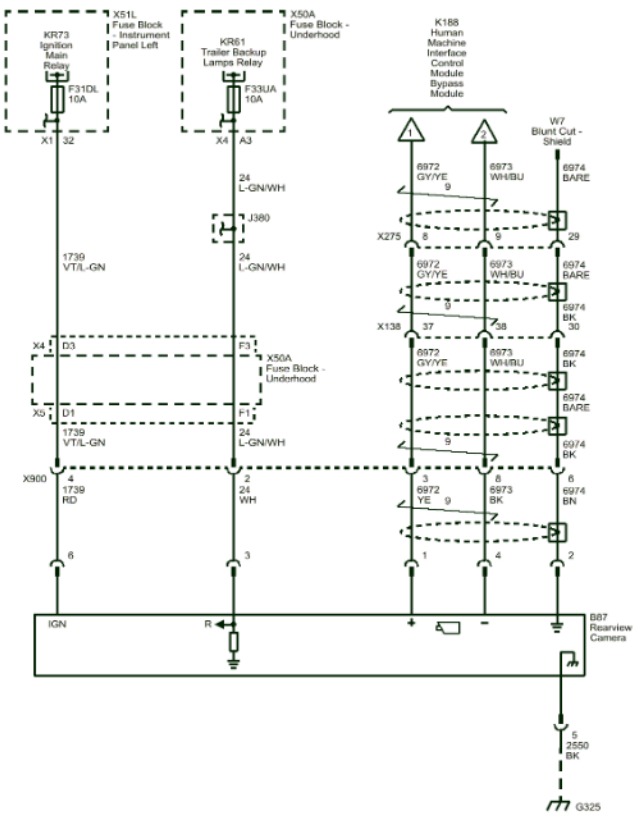


Fig. 5: Rearview Camera (UVC with IO5 or IO6) (1 of 2)
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Rearview Camera (UVC with IO5 or IO6) (2 of 2)

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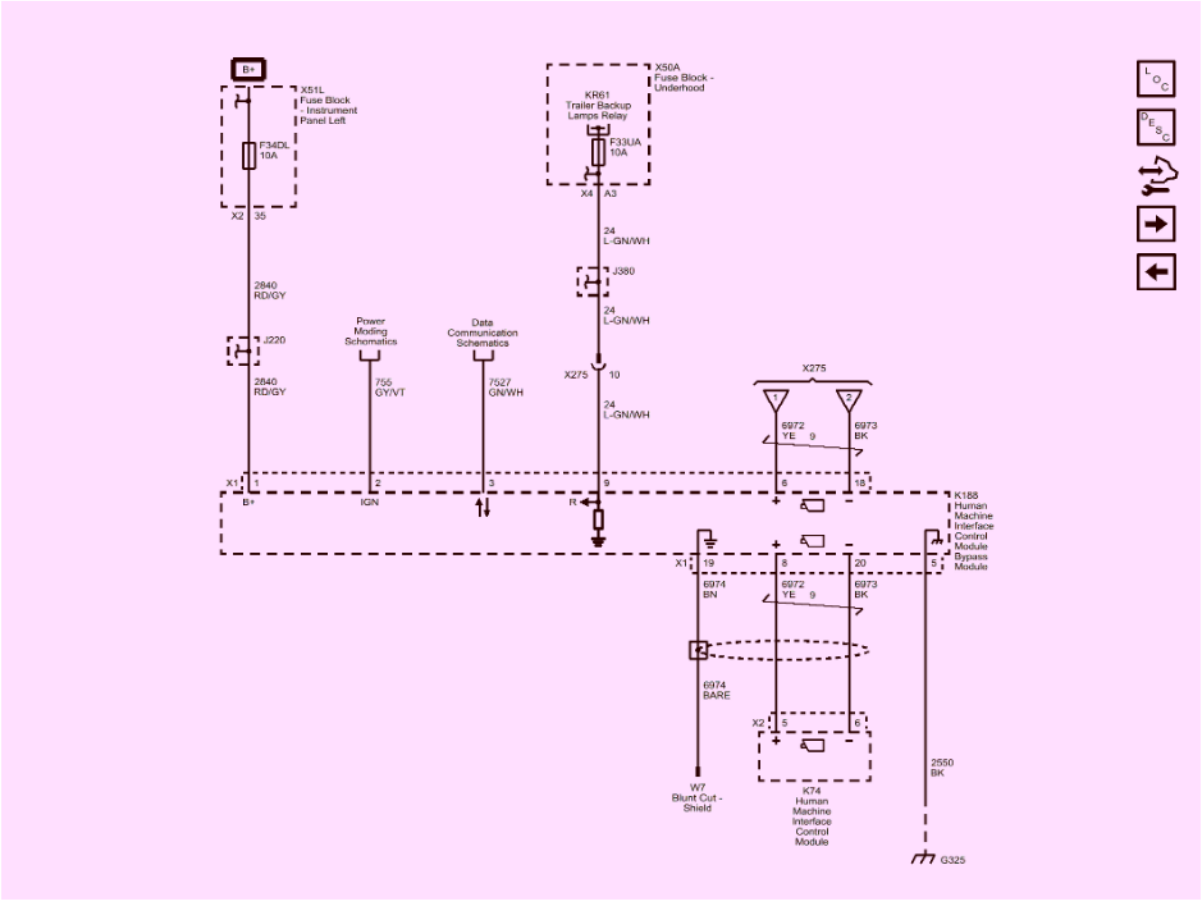


Fig. 6: Rearview Camera (UVC with IO5 or IO6) (2 of 2)
Courtesy of GENERAL MOTORS COMPANY

Safety Alert Seat (UEU, UFL or UHX)

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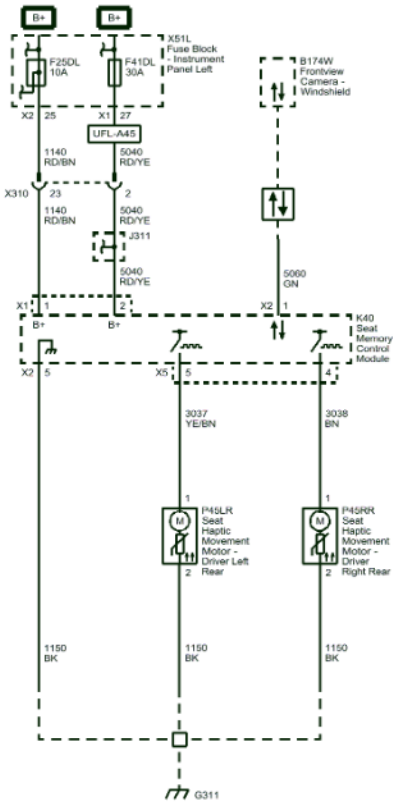


Fig. 7: Safety Alert Seat (UEU, UFL or UHX)
Courtesy of GENERAL MOTORS COMPANY

Lane Departure Warning (UFL) or Lane Active Safety Keep Assist (UHX)

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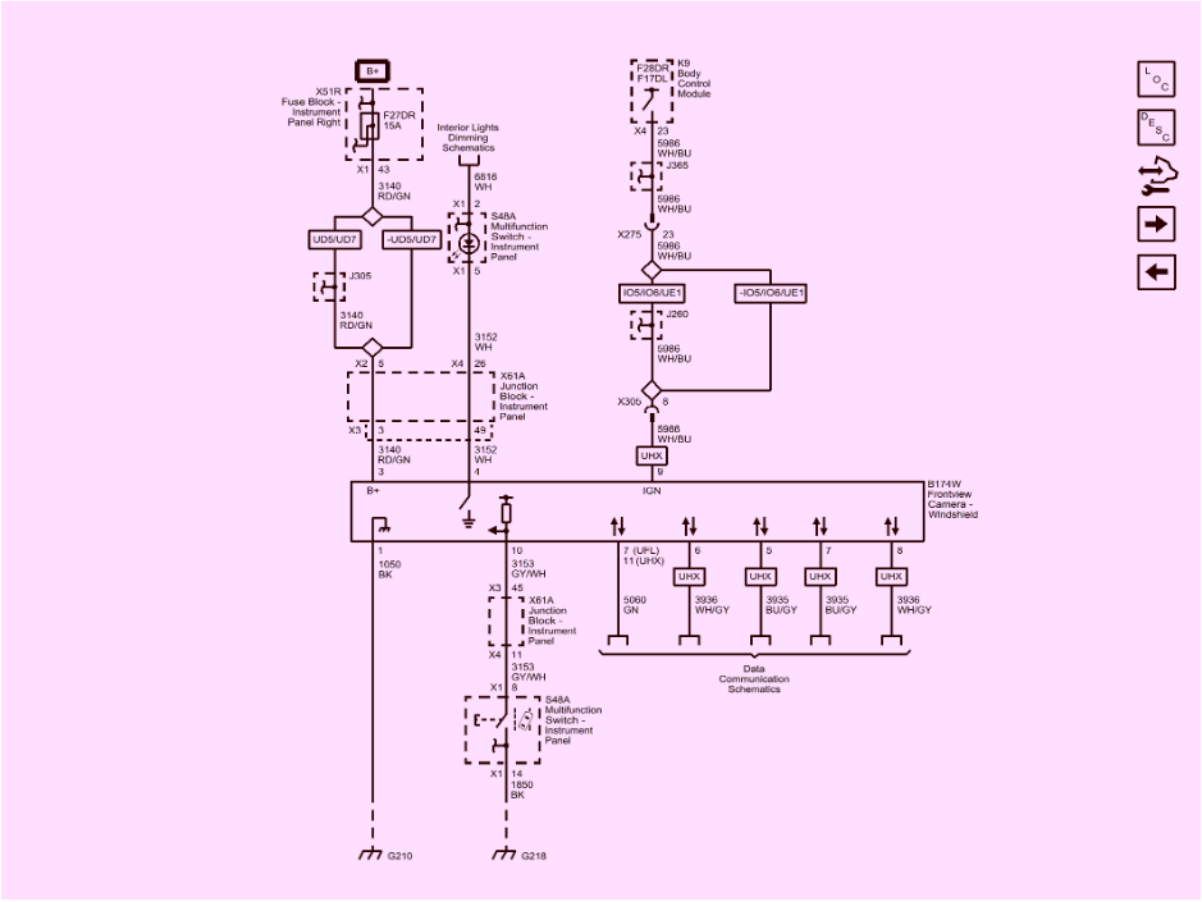


Fig. 8: Lane Departure Warning (UFL) or Lane Active Safety Keep Assist (UHX)
Courtesy of GENERAL MOTORS COMPANY

Forward Collision Alert (UEU)

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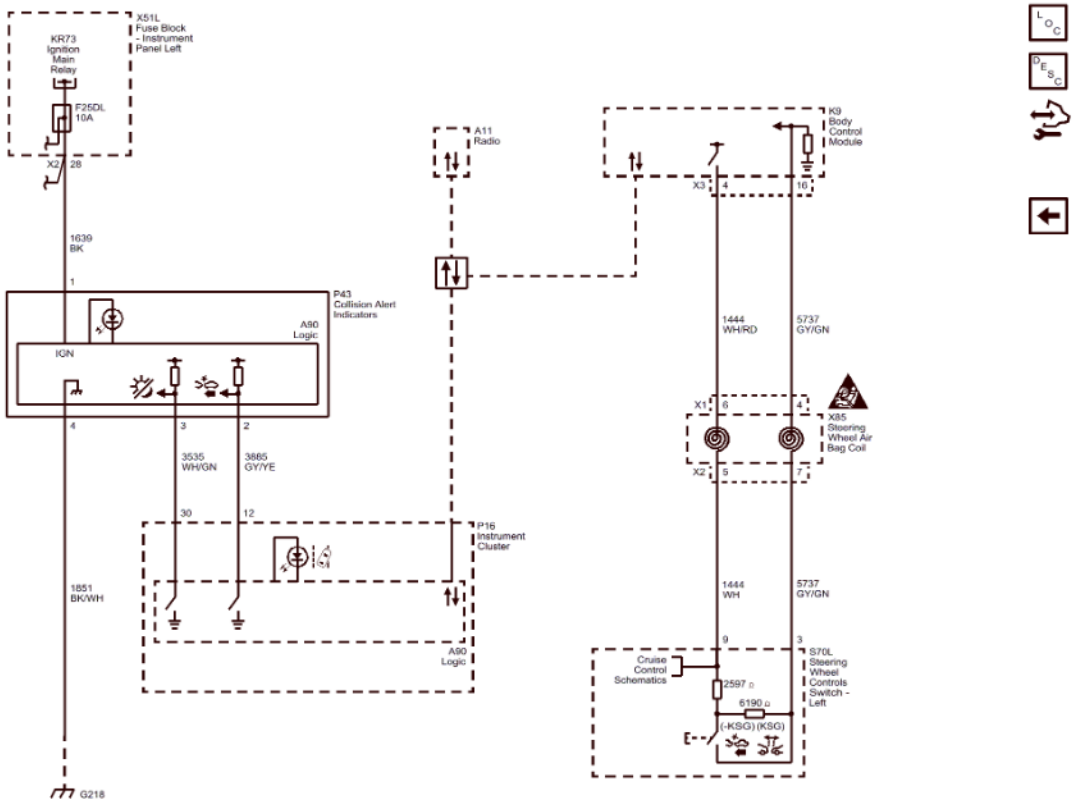


Fig. 9: Forward Collision Alert (UEU)
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC B0954, B0955, B0956, OR B0957: PARKING ASSIST FRONT 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 B0954

Parking Assist Front Sensor Left Corner Circuit

DTC B0955

Parking Assist Front Sensor Left Middle Circuit

DTC B0956

Parking Assist Front Sensor Right Middle Circuit

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DTC B0957

Parking Assist Front Sensor Right Corner Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12 V Reference	B1405 02	B0954 04, B0955 04, B0956 04, B0957 04, B0958 04, B0959 04, B0960 04, B0961 04	-	-
Left Front Object Sensor Signal	B0954 02	B0954 04	B0954 01	B0954 08, B0954 22
Left Middle Front Object Sensor Signal	B0955 02	B0955 04	B0955 01	B0955 08, B0955 22
Right Middle Front Object Sensor Signal	B0956 02	B0956 04	B0956 01	B0956 08, B0956 22
Right Front Object Sensor Signal	B0957 02	B0957 04	B0957 01	B0957 08, B0957 22
Low Reference	-	B0954 01, B0955 01, B0956 01, B0957 01, B0958 01, B0959 01, B0960 01, B0961 01	-	-

Circuit/System Description

The object sensors are 3-wire ultrasonic sensors that are used to determine the distance between the vehicle and an object. The front and rear parking assist control module supplies 12 V to the object sensors via the 12 V reference circuit and provides ground via the low reference circuit. The front and rear parking assist control module triggers the sensors in a sequential loop. After each sensor transmits, the front and rear parking assist control module uses the sensor echo received through the signal circuit to calculate the distance and position of an object.

Conditions for Running the DTC

- Ignition ON
- Parking assist is activated.

Conditions for Setting the DTC

B0954 01, B0955 01, B0956 01, or B0957 01

The front and rear parking assist control module has determined the sensor signal voltage is too high.

B0954 02, B0955 02, B0956 02, or B0957 02

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The front and rear parking assist control module has determined the sensor signal circuit is shorted to ground.

B0954 04, B0955 04, B0956 04, or B0957 04

The front and rear parking assist control module has determined the sensor signal circuit is open.

B0954 08, B0955 08, B0956 08, or B0957 08

The front and rear parking assist control module has received an invalid signal.

B0954 18, B0955 18, B0956 18, or B0957 18

The front and rear parking assist control module has determined the sensor signal voltage is too low.

B0954 22, B0955 22, B0956 22, or B0957 22

The front and rear parking assist control module determines no change in the position of an object while the vehicle is in motion.

B0954 3A, B0955 3A, B0956 3A, or B0957 3A

The front and rear parking assist control module determines the wrong sensor type is installed.

B0954 3B, B0955 3B, B0956 3B, or B0957 3B

The front and rear parking assist control module determines the sensor self test has not successfully completed.

Action Taken When the DTC Sets

- The parking assist system is disabled.
- A service message may be displayed on the driver information center .

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)

Electrical Information Reference

- **Circuit Testing**

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC B1405 is not set.
   - **If the DTC is set**

     Refer to **DTC B1405 (with UD5)DTC B1405 (with UD7)**

   - **If the DTC is not set**
3. Verify that DTC B0954 01, B0955 01, B0956 01, B0957 01 B0954 22, B0955 22, B0956 22 or B0957 22 is not set.
   - **If the DTC is set**
   1. Verify the B78 Front Object Sensors are not contaminated with snow, mud, dirt, slush, or ice.
      - If contaminated, clean the B78 Front Object Sensors.
      - If there is no contamination
   2. Refer to Circuit/System Testing.
   - **If the DTC is not set**
4. Verify that DTC B0954 3A, B0955 3A, B0956 3A or B0957 3A is not set.
   - **If the DTC is set**

     Replace the appropriate B78 Front Object Sensor with the correct sensor type.

   - **If the DTC is not set**
5. Ignition ON, transmission in R.
6. Verify the scan tool Parking Assist System Status parameter is Enabled.
   - **If the parameter is Disabled**

     Refer to Circuit/System Testing.

   - **If the parameter is Enabled**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness at the appropriate B78 Front Object Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 3 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF, disconnect the X3 harness connector at the K41 Front and Rear Parking Assist Control Module.

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2. Test for less than 2 Ω in the low reference circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω replace the K41 Front and Rear Parking Assist Control Module.
- **If less than 10 Ω**

3. Ignition ON.
4. Verify a test lamp illuminates between the 12 V reference circuit terminal 1 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF, disconnect the X3 harness connector at the K41 Front and Rear Parking Assist Control Module.
    2. Test for infinite resistance between the 12 V reference circuit and ground.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance
    3. Test for less than 2 Ω in the 12 V reference circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the K41 Front and Rear Parking Assist Control Module.
    - **If the test lamp illuminates**
5. Test for 10.0 - 12.0 V between the signal circuit terminal 2 and ground.
    - **If less than 10.0 V**
    1. Ignition OFF, disconnect the X3 harness connector at the K41 Front and Rear Parking Assist Control Module.
    2. Test for infinite resistance between the signal circuit and ground.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance
    3. Test for less than 2 Ω in the signal circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the K41 Front and Rear Parking Assist Control Module.
    - **If greater than 12.0 V**
    1. Ignition OFF, disconnect the X3 harness connector at the K41 Front and Rear Parking Assist Control Module, ignition ON.
    2. Test for less than 1 V between the signal circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V, replace the K41 Front and Rear Parking Assist Control Module.
    - **If between 10.0 - 12.0 V**
6. Test or replace the B78 Front Object Sensor.

Repair Instructions

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

- **Front Parking Assist Alarm Sensor Replacement (Chevrolet Outer)Front Parking Assist Alarm Sensor Replacement (GMC Outer)Front Parking Assist Alarm Sensor Replacement (Center)**
- **Control Module References** for front and rear parking assist control module replacement, programming, and setup.

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DTC B0958, B0959, B0960, OR B0961: PARKING ASSIST REAR 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 B0958

Parking Assist Rear Sensor Left Corner Circuit

DTC B0959

Parking Assist Rear Sensor Left Middle Circuit

DTC B0960

Parking Assist Rear Sensor Right Middle Circuit

DTC B0961

Parking Assist Rear Sensor Right Corner Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12 V Reference	B1405 02	B0958 04, B0959 04, B0960 04, B0961 04	-	-
Left Rear Object Sensor Signal	B0958 02	B0958 04	B0958 01	B0958 08, B0958 22
Left Middle Rear Object Sensor Signal	B0959 02	B0959 04	B0959 01	B0959 08, B0959 22
Right Middle Rear Object Sensor Signal	B0960 02	B0960 04	B0960 01	B0960 08, B0960 22
Right Rear Object Sensor Signal	B0961 02	B0961 04	B0961 01	B0961 08, B0961 22
Low Reference	-	B0958 01, B0959 01, B0960 01, B0961 01	-	-

Circuit/System Description

The object sensors are 3-wire ultrasonic sensors that are used to determine the distance between the vehicle and an object. The front and rear parking assist control module supplies 12 V to the object sensors via the 12 V reference circuit and provides ground via the low reference circuit. The front and rear parking assist control

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module triggers the sensors in a sequential loop. After each sensor transmits, the front and rear parking assist control module uses the sensor echo received through the signal circuit to calculate the distance and position of an object.

Conditions for Running the DTC

- Ignition ON
- Parking assist is activated.

Conditions for Setting the DTC

B0958 01, B0959 01, B0960 01, or B0961 01

The front and rear parking assist control module has determined the sensor signal voltage is too high.

B0958 02, B0959 02, B0960 02, or B0961 02

The front and rear parking assist control module has determined the sensor signal circuit is shorted to ground.

B0958 04, B0959 04, B0960 04, or B0961 04

The front and rear parking assist control module has determined the sensor signal circuit is open.

B0958 08, B0959 08, B0960 08, or B0961 08

The front and rear parking assist control module has received an invalid signal.

B0958 18, B0959 18, B0960 18, or B0961 18

The front and rear parking assist control module has determined the sensor signal voltage is too low.

B0958 22, B0959 22, B0960 22, or B0961 22

The front and rear parking assist control module determines no change in the position of an object while the vehicle is in motion.

B0958 3A, B0959 3A, B0960 3A, or B0961 3A

The front and rear parking assist control module determines the wrong sensor type is installed.

B0958 3B, B0959 3B, B0960 3B, or B0961 3B

The front and rear parking assist control module determines the sensor self test has not successfully completed.

Action Taken When the DTC Sets

- The parking assist system is disabled.
- A service message may be displayed on the driver information center .

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

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Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)

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 that DTC B1405 is not set.
   - **If the DTC is set**

     Refer to **DTC B1405 (with UD5)DTC B1405 (with UD7)**

   - **If the DTC is not set**
3. Verify that DTC B0958 01, B0959 01, B0960 01, B0961 01, B0958 22, B0959 22, B0960 22 or B0961 22 is not set.
   - **If the DTC is set**
   1. Verify the B78 Rear Object Sensors are not contaminated with snow, mud, dirt, slush, or ice.
      - If contaminated, clean the B78 Rear Object Sensors.
      - If there is no contamination
   2. Refer to Circuit/System Testing.
   - **If the DTC is not set**
4. Verify that DTC B0958 3A, B0959 3A, B0960 3A or B0961 3A is not set.
   - **If the DTC is set**

     Replace the appropriate B78 Rear Object Sensor with the correct sensor type.

   - **If the DTC is not set**
5. Ignition ON, transmission in R.
6. Verify the scan tool Parking Assist System Status parameter is Enabled.

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- **If the parameter is Disabled**

  Refer to Circuit/System Testing.

- **If the parameter is Enabled**

7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness at the appropriate B78 Rear Object Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 3 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF, disconnect the harness connector X2 at the K41 Front and Rear Parking Assist Control Module.
   2. Test for less than 2 Ω in the low reference circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω replace the K41 Front and Rear Parking Assist Control Module.
   - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the 12 V reference circuit terminal 1 and ground.
   - **If the test lamp does not illuminate**
   1. Ignition OFF, disconnect the X2 harness connector at the K41 Front and Rear Parking Assist Control Module.
   2. Test for infinite resistance between the 12 V reference circuit and ground.
      - If less than infinite resistance, repair the short to ground on the circuit.
      - If infinite resistance
   3. Test for less than 2 Ω in the 12 V reference circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, replace the K41 Front and Rear Parking Assist Control Module.
   - **If the test lamp illuminates**
5. Test for 10.0 - 12.0 V between the signal circuit terminal 2 and ground.
   - **If less than 10.0 V**
   1. Ignition OFF, disconnect the X2 harness connector at the K41 Front and Rear Parking Assist Control Module.
   2. Test for infinite resistance between the signal circuit and ground.
      - If less than infinite resistance, repair the short to ground on the circuit.
      - If infinite resistance
   3. Test for less than 2 Ω in the signal circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, replace the K41 Front and Rear Parking Assist Control Module.
   - **If greater than 12.0 V**
   1. Ignition OFF, disconnect the X2 harness connector at the K41 Front and Rear Parking Assist Control Module, ignition ON.

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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 K41 Front and Rear Parking Assist Control Module.
- **If between 10.0 - 12.0 V**

6. Test or replace the B78 Rear Object Sensor.

Repair Instructions

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

- **Rear Parking Assist Alarm Sensor Replacement (Outer)Rear Parking Assist Alarm Sensor Replacement (Center)**
- **Control Module References** for front and rear parking assist control module replacement, programming, and setup.

DTC B0967: PARKING ASSIST ON/OFF SWITCH

Diagnostic Instructions

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

DTC Descriptor

DTC B0967

Parking Assist On/Off Switch Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B0967 02	1	1	-
Ground	-	1	-	-
1. Parking Assist Switch Inoperative				

Circuit/System Description

The parking assist system can be activated and deactivated by pressing the parking assist switch. The front and rear parking assist control module applies voltage and monitors the parking assist switch signal circuit. The parking assist switch is a normally open switch. With the switch open, voltage seen at the front and rear front and rear parking assist control module is high. When the parking assist switch is pressed, the switch is closed and the signal circuit is pulled to ground. With the switch closed, voltage seen at the front and rear front and rear parking assist control module is low. The front and rear parking assist control module will respond to this by activating or deactivating the parking assist function.

Conditions for Running the DTC

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- Ignition ON
- Parking assist is active.

Conditions for Setting the DTC

The front and rear parking assist control module has detected a short to ground on the parking assist switch signal circuit.

Action Taken When the DTC Sets

- The parking assist system is disabled.
- The driver information center may display a system service message.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)

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 scan tool Parking Assist Switch parameter changes between Active and Inactive when cycling the parking assist switch .
    - **If the parameter does not change between Active and Inactive**

      Refer to Circuit/System Testing.

    - **If the parameter changes between Active and Inactive**

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3. All OK.

Circuit/System Testing

Chevrolet/GMC

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 14 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the ground circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 10 Ω**
3. Verify the scan tool Parking Assist Switch parameter is Inactive.
    - **If the parameter is not Inactive**
    1. Ignition OFF, disconnect the X1 harness connector at the K41 Front and Rear Parking Assist Control Module.
    2. Test for infinite resistance between the signal circuit terminal 9 and ground.
        - If less than infinite resistance, repair the short to ground on the signal circuit.
        - lf infinite resistance, replace the K41 Front and Rear Parking Assist Control Module.
    - **If the parameter is Inactive**
4. Connect a 3 A fused jumper wire between the signal circuit terminal 9 and ground.
5. Verify the scan tool Parking Assist Switch parameter is Active.
    - **If the parameter is not Active**
    1. Ignition OFF, disconnect the X1 harness connector at the K41 Front and Rear Parking Assist Control Module, ignition ON.
    2. Test for less than 1 V between the control circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit
        - If less than 1 V, replace the K41 Front and Rear Parking Assist Control Module.
    3. Ignition OFF.
    4. Test for less than 2 Ω in the signal circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the K41 Front and Rear Parking Assist Control Module.
    - **If the parameter is Active**
6. Test or replace the S48A Multifunction Switch - Instrument Panel.

Repair Instructions

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

- **Vehicle Stability Control System Switch Replacement** for multifunction switch - instrument panel replacement
- **Control Module References** for front and rear parking assist control module replacement, programming,

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and setup

DTC B0968: PARKING ASSIST ON/OFF SWITCH INDICATOR

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 B0968

Parking Assist On/Off Switch Indicator Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
High Control (Terminal 2)	1	1	-	-
Low Control (Terminal 6)	2	1	B0968 01	-
1. Parking Assist Switch Indicator Inoperative 2. Parking Assist Switch Indicator Always On				

Circuit/System Description

When the parking assist system is enabled, the front and rear parking assist control module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the front and rear parking assist control module.

Conditions for Running the DTC

- Ignition ON
- Parking assist is active.

Conditions for Setting the DTC

The front and rear parking assist control module has detected a short to battery on the parking assist indicator control circuit.

Action Taken When the DTC Sets

- The parking assist system is disabled.
- The driver information center may display a system service message.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

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Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)

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 parking assist switch indicator turns ON and OFF when turning the parking assist system on and off with the park assist switch.
    - **If the indicator does not turn ON and OFF**

      Refer to Circuit/System Testing .

    - **If the indicator turns ON and OFF**
3. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel, ignition ON.
2. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module.
    2. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, refer to **Interior Backlighting Malfunction** .
    - **If the test lamp illuminates**
3. Ignition OFF, connect the harness connector at the S48A Multifunction Switch - Instrument Panel.

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Disconnect the X1 harness connector at the K41 Front and Rear Parking Assist Control Module.

4. Verify the parking assist switch indicator is not illuminated.
    - **If the parking assist switch indicator is illuminated**
    1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel.
    2. Test for infinite resistance between the S48A Multifunction Switch - Instrument Panel control circuit terminal 6 and ground.
        - If less than infinite resistance, repair the short to ground in the circuit.
        - If infinite resistance, replace the S48A Multifunction Switch - Instrument Panel.
    - **If the parking assist switch indicator is not illuminated**
5. Connect a 3 A fused jumper wire between the control circuit terminal 3 and ground.
6. Verify the parking assist switch indicator is illuminated.
    - **If the parking assist switch indicator is not illuminated**
    1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel.
    2. Test for less than 1 V between the control circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    3. Ignition OFF.
    4. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the S48A Multifunction Switch - Instrument Panel.
    - **If the parking assist switch indicator is illuminated**
7. Replace the K41 Front and Rear Parking Assist Control Module.

Repair Instructions

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

- **Vehicle Stability Control System Switch Replacement** for multifunction switch - instrument panel replacement
- **Control Module References** for front and rear parking assist control module replacement, programming, and setup

DTC B0987: VEHICLE DIRECTION CAMERA INDICATOR

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 B0987

Vehicle Direction Camera Indicator Circuit

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Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
High Control (Terminal 5)	B0987 06, B1011 00	B0987 06, B1011 00	-	-
Low Control (Terminal 6)	B0987 06, B1011 00	B0987 06, B1011 00	B0987 01, B1011 00	-

Circuit/System Description

When the lane departure warning is enabled, the frontview camera module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the frontview camera module.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

B0987 01

The frontview camera module detects a short to voltage on the control circuit.

B0987 06

The frontview camera module detects a short to ground or an open/high resistance on the control circuit.

Action Taken When the DTC Sets

- Lane departure warning and forward collision alert features are disabled
- The driver information center may display a system service message.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning Description and Operation

Electrical Information Reference

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- **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 lane departure warning indicator turns ON and OFF when turning the lane departure warning system on and off with the lane departure warning switch.
    - **If the indicator does not turn ON and OFF**

      Refer to Circuit/System Testing.

    - **If the indictor turns ON and OFF**
3. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel, ignition ON.
2. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module.
    2. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, refer to **Interior Backlighting Malfunction** .
    - **If the test lamp illuminates**
3. Ignition OFF, connect the harness connector at the S48A Multifunction Switch - Instrument Panel. Disconnect the harness connector at the K109 Frontview Camera Module, ignition ON.
4. Verify the lane departure warning switch indicator is not illuminated.
    - **If the lane departure warning switch indicator is illuminated**
    1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel.
    2. Test for infinite resistance between the S48A Multifunction Switch - Instrument Panel control circuit terminal 5 and ground.
        - If less than infinite resistance, repair the short to ground in the circuit.
        - If infinite resistance, replace the S48A Multifunction Switch - Instrument Panel.
    - **If the lane departure warning switch indicator is not illuminated**
5. Connect a 3 A fused jumper wire between the control circuit terminal 4 and ground.
6. Verify the lane departure warning switch indicator is illuminated.
    - **If the lane departure warning switch indicator is not illuminated**

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1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel.
2. Test for less than 1 V between the control circuit and ground.
    - If 1 V or greater, repair the short to voltage on the circuit.
    - If less than 1 V
3. Ignition OFF.
4. Test for less than 2 Ω in the control circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω, replace the S48A Multifunction Switch - Instrument Panel.

- **If the lane departure warning switch indicator is illuminated**

7. Replace the K109 Frontview Camera Module.

Repair Instructions

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

- **Vehicle Stability Control System Switch Replacement** for multifunction switch - instrument panel replacement
- **Control Module References** for frontview camera module replacement, programming, and setup.

DTC B1008: CALIBRATION DATA NOT PROGRAMMED

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 B1008

Calibration Data Not Programmed

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

Circuit/System Description

When the ignition is turned ON, the frontview camera module performs a self-test to verify if a critical malfunction exists within the system. During the power-up mode, the frontview camera module checks for a valid calibration data set.

Conditions for Running the DTC

- DTC B1325 is not set
- Ignition voltage is between 9-16 volts

Conditions for Setting the DTC

- A valid calibration is not detected upon module power-up.

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- The frontview camera module has been replaced and programmed, but not calibrated.

Action Taken When the DTC Sets

- Lane departure and forward collision alert system is disabled.
- The instrument panel cluster to display SERVICE FRONT CAMERA or SERVICE LANE DEPARTURE WARNING message in the driver information center and a chime will sound.
- All functions handled by the frontview camera module are inoperative

Conditions for Clearing

- The DTC will transition to history when the fault is no longer present.
- A history DTC will clear after 50 malfunction-free ignition cycles.

Diagnostic Aids

- This DTC will be set as current while performing calibration, and will remain set as current until calibration can be completed
- The frontview camera will not calibrate if not properly installed or mounted.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning 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: **Do not diagnose this DTC if set in history**

1. Ignition ON.
2. Verify that DTC B101E 42 is not set.
    - **If DTC is set**

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Perform the **Front View Camera Module Programming and Setup** procedure.

- **If the DTC is not set**

3. Verify that DTC B1008 is not set.
   - **If DTC is set**
   1. Calibrate the front camera module. Refer to **Front View Camera Module Learn**.
   2. Verify the DTC does not set.
      - If the DTC sets, replace the frontview camera module.
      - If the DTC does not set
   3. All OK.
   - **If the DTC is not set**
4. All OK.

Repair Instructions

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

Control Module References for frontview camera module replacement, programming, and setup.

DTC B1011: SYSTEM DISABLED INFORMATION STORED

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 B1011 00

System Disabled Information Stored Malfunction

Circuit/System Description

The frontview camera module permanently monitors the serial data bus for error messages. When a malfunction is detected by the frontview camera module, the system will be disabled and an error message will be stored in the frontview camera module disable history buffer which is used to store information about the front camera features that are disabled.

Conditions for Running the DTC

- Ignition ON
- Frontview camera enabled

Conditions for Setting the DTC

The frontview camera module detects a malfunction.

Action Taken When the DTC Sets

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- The frontview camera module is disabled.
- The frontview camera module disable history buffer stores information why the system was disabled.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Diagnostic Aids

The frontview camera module disable history buffers are used to store information about the frontview camera module features that are disabled. The buffers will only update if the disable condition changes.

Example: If the data received from the steering wheel angle sensor is Invalid across many ignition cycles then it will only appear in 1 history buffer and not all history buffers. If this condition is the current reason why the frontview camera module is disabled then it will be set in frontview camera module disable history buffer 1. If a new reason occurs, such as vehicle speed validity is invalid, then the invalid steering wheel angle sensor fault will shift into disable history buffer 2 and vehicle speed validity invalid will be in disable history buffer 1. Since there are only 4 disable history buffers, the invalid steering wheel angle sensor will age out if 4 other disable reasons occur since the last invalid steering wheel angle sensor event occurred. Frontview camera module disable history buffer 1 contains the current reason that one of the frontview camera module features is disabled.

The frontview camera module disable history buffers can display the following values:

- Lane Departure Warning Indicator Malfunction
- Lane Departure Warning Switch Malfunction
- Camera Obstructed
- Accelerator Pedal Position Out of Range
- Driven Wheel Speed Signal Invalid
- Non-Driven Wheel Speed Signal Invalid
- Brake Pedal Moderate Travel Signal Invalid
- Brake Pedal Initial Travel Position Achieved
- Lost Communication with Steering Wheel Angle Sensor Module
- Invalid Data Received From Steering Wheel Angle Sensor Module
- Forward Collision Alert Switch Malfunction
- Clutch Pedal Position (CPP) Sensor Performance
- Clutch Pedal Position (CPP) Sensor Performance
- Transmission Gear Engaged
- Acceleration Sensor Longitudinal Signal
- Invalid Data Received From Yaw Rate Sensor Module
- Power Mode Controlled by Backup Device
- System Power Mode
- Overvoltage
- Undervoltage
- Undefined

Reference Information

cardiagn.com

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning 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: **Do not replace K109 Frontview Camera Module for this DTC. DTC B1011 is an information DTC.**

1. Ignition ON.
2. Verify no other DTC is set except for DTC B1011.
   - **If any other DTCs are set**

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

   - **If no other DTCs are set**

     NOTE: **When referring to Frontview Camera Disable History, some items such as Non-Driven Wheel Speed Signal Invalid and Driven Wheel Speed Signal Invalid may routinely be stored without B1011 being set. If B1011 has not set, disregard any information stored in the buffers as it is not indicative of a problem.**

3. Refer to Diagnostic Aids and Frontview Camera Disable History for what caused B1011 to set. Diagnose the system that set the malfunction.

Repair Instructions

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

Control Module References for frontview camera module programming and setup

DTC B1015: VEHICLE IDENTIFICATION NUMBER INFORMATION

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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 B1015

Vehicle Identification Number Information

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

Circuit/System Description

When the ignition is turned ON, the control module receives the vehicle identification number (VIN) from the body control module (BCM). The control module will compare the VIN received to the VIN stored in memory.

Conditions for Running the DTC

Ignition voltage is between 9-16 V.

Conditions for Setting the DTC

The stored VIN does not match the received VIN.

Action Taken When the DTC Sets

- The associated system is disabled.
- A service message may be displayed on the driver information center.

Conditions for Clearing the DTC

The stored VIN matches the VIN stored in the BCM.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

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

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B1015 is not set.
    - **If the DTC is set**
    1. Program the control module that set the DTC.
    2. Ignition ON.
    3. Verify DTC B1015 is not set.
        - If the DTC is set, replace the control module that set the DTC.
        - If the DTC is not set
    4. All OK
    - **If the DTC is not set**
3. All OK

Repair Instructions

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

Control Module References for the control module replacement, programming, and setup.

DTC B101D: ELECTRONIC CONTROL UNIT HARDWARE (DTC SET IN K109 FRONTVIEW CAMERA MODULE)

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 B101D

Electronic Control Unit Hardware

DTC B101D 3C

Electronic Control Unit Hardware Performance Internal Communications Failure

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

Circuit/System Description

The internal fault detection is handled inside the device. The symptom byte information is for engineering reference only. No external circuit diagnosis is involved.

Conditions for Running the DTC

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Ignition ON.

Conditions for Setting the DTC

B101D

The frontview camera module has detected an internal malfunction

B101D 3C

The frontview camera module has detected a software malfunction

Action Taken When the DTC Sets

- Lane departure warning is disabled
- SERVICE LANE DEPARTURE SYSTEM is displayed on the DIC.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)

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 B101D symptom byte 3C is not set as current.
    - **If DTC B101D symptom byte 3C is set as current**

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Reprogram the K109 Frontview Camera Module

- **If DTC B101D symptom byte 3C is not set as current**

2. Verify that DTC B101D is not set as current.
   - **If DTC B101D is set as current**

     Replace the K109 Frontview Camera Module

   - **If DTC B101D is not set as current**

3. All OK.

Repair Instructions

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

Control Module References for control module replacement, setup, and programming

DTC B127B: REARVIEW CAMERA INPUT SIGNAL (WITH IO5/IO6)

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

B127B

Rearview Camera Input Signal Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	B127B 2B,1	B127B 2B,1	-	-
Backup Signal	B127B 2B,1	B127B 2B,1	-	-
Camera Module signal +	B127B 2B, 3	B127B 2B,1	B127B 2B, 2	-
Camera Module signal -	B127B 2B, 3	B127B 2B,1	B127B 2B, 1	-
Ground	-	B127B 2B,1	-	-
Shield	-	3	-	-
1. Rear vision camera inoperative 2. Rear vision camera image always displayed 3. Poor Quality Image				

Circuit/System Description

When the transmission is placed into R, a 12 V signal is sent to the rearview camera indicating that camera operation is requested. Ignition voltage and ground are supplied to the rearview camera. The rearview camera sends video information to the radio through a video signal + and a video signal - circuit. A grounded shielding also wraps the video signal circuits to reduce electronic interference which may degrade the video signal and

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cause a distorted or otherwise degraded image.

Conditions for Running the DTC

- Engine running
- Transmission in R

Conditions for Setting the DTC

The video signal from the rearview camera has not been received by the human machine interface control module for 2.5 s.

Action Taken When the DTC Sets

- The human machine interface control module stores the DTC in memory.
- A service message may be displayed on the driver information center of info display module.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 40 malfunction-free ignition cycles have occurred.

Diagnostic Aids

A poor video image can be caused by ice, snow, and mud buildup on the lens of the rearview camera. Also, extreme lighting conditions can affect performance, such as operating in the dark or with bright sunlight shining on the camera. Extreme high or low temperatures can also affect the image quality. An open in the shield of the video signal circuit can also cause a distorted screen.

Terminal fretting or incorrectly seated connectors can cause a poor image displayed condition. Check the circuit terminals for fretting or incorrectly seated connector. If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Rear Vision Camera Description and Operation

Electrical Information Reference

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

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: **If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.**

1. Engine running, transmission in R.
2. Verify a clear rear vision image is displayed on the P17 Info Display Module.
   - **If a clear image is not displayed**

     Refer to Circuit/System Testing.

   - **If a clear image is displayed**
3. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X900 harness connector. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 7 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ground circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, repair the open/high resistance in the ground connection.
   - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 4 and ground.
   - **If the test lamp does not illuminate and the circuit fuse is good**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ignition circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
   - **If the test lamp does not illuminate and the circuit fuse is open**
   1. Ignition OFF.
   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 B87 Rearview Camera.
   - **If the test lamp illuminates**

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5. Engine running, park brake applied, transmission in R.
6. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
    - **If the test lamp illuminates**
7. Ignition OFF, disconnect the X2 harness connector at the K74 Human Machine Interface Control Module, ignition ON.
8. Test for less than 1 V between the signal circuit terminals listed below and ground:
    - K74 Human Machine Interface Control Module signal (+) circuit terminal 5 X2
    - K74 Human Machine Interface Control Module signal (-) circuit terminal 6 X2
    - **If 1 V or greater**

      Repair the short to voltage on the circuit.

    - **If less than 1 V**
9. Test for infinite resistance between the signal circuit terminals listed below and ground:
    - K74 Human Machine Interface Control Module signal (+) circuit terminal 5 X2
    - K74 Human Machine Interface Control Module signal (+) circuit terminal 6 X2
    - **If less than infinite resistance**

      Repair the short to ground on the circuit.

    - **If infinite resistance**
10. Test for less than 2 Ω between the K74 Human Machine Interface Control Module signal (+) circuit terminal 5 X2 and the X900 signal (+) circuit terminal 3.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
11. Test for less than 2 Ω between the K74 Human Machine Interface Control Module signal (-) circuit terminal 6 X2 and the X900 signal (-) circuit terminal 8.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
12. Replace the B87 Rearview Camera.
13. Engine running, transmission in R,
14. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a clear rear vision image is not displayed**

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Replace the K74 Human Machine Interface Control Module.

- **If a clear rear vision image is displayed**

15. All OK.

Repair Instructions

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

- **Rearview Driver Information Camera Replacement**
- **Control Module References** for control module replacement, programming, and setup.

DTC B127B: REARVIEW CAMERA INPUT SIGNAL (WITH IO3)

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

B127B

Rearview Camera Input Signal Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	B127B 08,1	B127B 08,1	-	-
Backup Signal	B127B 08,1	B127B 08,1	-	-
Camera Module signal +	B127B 08,1	B127B 08,1	B127B 08, 2	-
Camera Module signal -	B127B 08, 3	B127B 08,1	B127B 08,1	-
Ground	-	B127B 08,1	-	-
Shield	-	3	-	-
1. Rear vision camera inoperative 2. Rear vision camera image always displayed 3. Poor Quality Image				

Circuit/System Description

When the transmission is placed into R, a 12 V signal is sent to the rearview camera indicating that camera operation is requested. Ignition voltage and ground are supplied to the rearview camera. The rearview camera sends video information to the radio through a video signal + and a video signal - circuit. A grounded shielding also wraps the video signal circuits to reduce electronic interference which may degrade the video signal and cause a distorted or otherwise degraded image.

Conditions for Running the DTC

- Engine running

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- Transmission in R

Conditions for Setting the DTC

The video signal from the rearview camera has not been received by the Radio for 2.5 s.

Action Taken When the DTC Sets

- The Radio stores the DTC in memory.
- A service message may be displayed on the driver information center of info display module.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 40 malfunction-free ignition cycles have occurred.

Diagnostic Aids

A poor video image can be caused by ice, snow, and mud buildup on the lens of the rearview camera. Also, extreme lighting conditions can affect performance, such as operating in the dark or with bright sunlight shining on the camera. Extreme high or low temperatures can also affect the image quality. An open in the shield of the video signal circuit can also cause a distorted screen.

Terminal fretting or incorrectly seated connectors can cause a poor image displayed condition. Check the circuit terminals for fretting or incorrectly seated connector. If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Rear Vision Camera 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

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Circuit/System Verification

NOTE: **If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.**

1. Verify P17 Info Display Module displays infotainment system information properly.
    - **If infotainment system information does not display properly**

      Refer to **Radio Information Display Malfunction (IO3)** .

    - **If infotainment system information displays properly**
2. Verify there is no debris on the B87 Rearview Camera lens and that the bezel and bezel seal are not damaged.
    - **If debris is found on the lens**

      Clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.

    - **If there is no debris on the lens**
3. Engine running, transmission in R.
4. Verify the backup lamps are illuminated.
    - **If the backup lamps are not illuminated**

      Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

    - **If the backup lamps are illuminated**
5. Engine running, transmission in R.
6. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a clear image is not displayed**

      Refer to Circuit/System Testing.

    - **If a clear image is displayed**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X900 harness connector. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 7 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 10 Ω**
3. Ignition ON.

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4. Verify a test lamp illuminates between the ignition circuit terminal 4 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    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 B87 Rearview Camera.
    - **If the test lamp illuminates**
5. Engine running, park brake applied, transmission in R.
6. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
    - **If the test lamp illuminates**
7. Ignition OFF, disconnect the X1 harness connector at the A11 Radio, ignition ON.
8. Test for less than 1 V between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 5 X1
    - A11 Radio signal (-) circuit terminal 4 X1
    - **If 1 V or greater**

      Repair the short to voltage on the circuit.

    - **If less than 1 V**
9. Test for infinite resistance between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 5 X1
    - A11 Radio signal (-) circuit terminal 4 X1
    - **If less than infinite resistance**

      Repair the short to ground on the circuit.

    - **If infinite resistance**
10. Test for less than 2 Ω between the A11 Radio signal (+) circuit terminal 5 X1 and the X900 signal (+) circuit terminal 3.
    - **If 2 Ω or greater**

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Repair the open/high resistance on the circuit.

- **If less than 2 Ω**

11. Test for less than 2 Ω between the A11 Radio signal (-) circuit terminal 4 X1 and the X900 signal (-) circuit terminal 8.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
12. Add Nyogel lubricant 760G to electrical terminals.
13. Reconnect all electrical connections.
14. Engine running, park brake applied, transmission in R.
15. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a blank blue screen or distorted image is displayed**
    1. Replace the B87 Rearview Camera.
    2. Engine running, transmission in R,
    3. Verify a clear rear vision image is displayed on the P17 Info Display Module.
        - **If a clear rear vision image is not displayed**

          Replace the A11 Radio.

        - **If a clear rear vision image is displayed**
    4. All OK.
    - **If a blank black screen is displayed**

      Replace the A11 Radio.

    - **If a clear rear vision image is displayed**
16. All OK.

Repair Instructions

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

- **Rearview Driver Information Camera Replacement**
- **Control Module References** for control module replacement, programming, and setup.

DTC B127B: REARVIEW CAMERA VIDEO SIGNAL (WITH IOB)

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	Open/High	Short to	Signal

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	Ground	Resistance	Voltage	Performance
Ignition	B127B 08,1	B127B 08,1	-	-
Backup Signal	B127B 08,1	B127B 08,1	-	-
Camera Module signal +	B127B 08,1	B127B 08,1	B127B 08, 2	-
Camera Module signal -	B127B 08, 3	B127B 08,1	B127B 08,1	-
Ground	-	B127B 08,1	-	-
Shield	-	3	-	-
1. Rear vision camera inoperative 2. Rear vision camera image always displayed 3. Poor Quality Image				

Circuit/System Description

When the transmission is placed into R, a 12 V signal is sent to the rearview camera indicating that camera operation is requested. Ignition voltage and ground are supplied to the rearview camera. The rearview camera sends video information to the radio through a video signal + and a video signal - circuit. A grounded shielding also wraps the video signal circuits to reduce electronic interference which may degrade the video signal and cause a distorted or otherwise degraded image.

Conditions for Running the DTC

- Engine running
- Transmission in R

Conditions for Setting the DTC

The video signal from the rearview camera has not been received by the Radio for 2.5 s.

Action Taken When the DTC Sets

- The Radio stores the DTC in memory.
- A service message may be displayed on the driver information center of info display module.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 40 malfunction-free ignition cycles have occurred.

Diagnostic Aids

A poor video image can be caused by ice, snow, and mud buildup on the lens of the rearview camera. Also, extreme lighting conditions can affect performance, such as operating in the dark or with bright sunlight shining on the camera. Extreme high or low temperatures can also affect the image quality. An open in the shield of the video signal circuit can also cause a distorted screen.

Terminal fretting or incorrectly seated connectors can cause a poor image displayed condition. Check the circuit terminals for fretting or incorrectly seated connector. If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.

Reference Information

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Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Rear Vision Camera 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: **If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.**

1. Verify P17 Info Display Module displays infotainment system information properly.
   - **If infotainment system information does not display properly**

     Refer to **Radio Information Display Malfunction (IOB)** .

   - **If infotainment system information displays properly**
2. Verify there is no debris on the B87 Rearview Camera lens and that the bezel and bezel seal are not damaged.
   - **If debris is found on the lens**

     Clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.

   - **If there is no debris on the lens**
3. Engine running, transmission in R.
4. Verify the backup lamps are illuminated.
   - **If the backup lamps are not illuminated**

     Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

   - **If the backup lamps are illuminated**
5. Engine running, transmission in R.

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6. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a clear image is not displayed**

      Refer to Circuit/System Testing.

    - **If a clear image is displayed**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X900 harness connector. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 7 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 4 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    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 B87 Rearview Camera.
    - **If the test lamp illuminates**
5. Engine running, park brake applied, transmission in R.
6. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
    - **If the test lamp illuminates**

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7. Ignition OFF, disconnect the X1 harness connector at the A11 Radio, ignition ON.
8. Test for less than 1 V between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 15 X1
    - A11 Radio signal (-) circuit terminal 14 X1
    - **If 1 V or greater**

      Repair the short to voltage on the circuit.

    - **If less than 1 V**
9. Test for infinite resistance between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 15 X1
    - A11 Radio signal (-) circuit terminal 14 X1
    - **If less than infinite resistance**

      Repair the short to ground on the circuit.

    - **If infinite resistance**
10. Test for less than 2 Ω between the A11 Radio signal (+) circuit terminal 15 X1 and the X900 signal (+) circuit terminal 3.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
11. Test for less than 2 Ω between the A11 Radio signal (-) circuit terminal 14 X1 and the X900 signal (-) circuit terminal 8.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
12. Add Nyogel lubricant 760G to electrical terminals.
13. Reconnect all electrical connections.
14. Engine running, park brake applied, transmission in R.
15. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a blank blue screen or distorted image is displayed**
    1. Replace the B87 Rearview Camera.
    2. Engine running, transmission in R,
    3. Verify a clear rear vision image is displayed on the P17 Info Display Module.
        - **If a clear rear vision image is not displayed**

          Replace the K74 Human Machine Interface Control Module.

        - **If a clear rear vision image is displayed**
    4. All OK.
    - **If a blank black screen is displayed**

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Replace the K74 Human Machine Interface Control Module.

- **If a clear rear vision image is displayed**

16. All OK.

Repair Instructions

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

- **Rearview Driver Information Camera Replacement**
- **Control Module References** for control module replacement, programming, and setup.

DTC B1405: CONTROL MODULE VOLTAGE REFERENCE OUTPUT 2 (WITH UD5)

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 B1405

Control Module Voltage Reference Output 2 Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12 V Reference	B1405 02	B0954 04, B0955 04, B0966 04, B0967 04, B0958 04, B0959 04, B0960 04, B0961 04	-	-

Circuit/System Description

The object sensors are 3-wire ultrasonic sensors that are used to determine the distance between the vehicle and an object. The front and rear parking assist control module supplies 12 V to the object sensors via the 12 V reference circuit and provides ground via the low reference circuit. The front and rear parking assist control module triggers the sensors in a sequential loop. After each sensor transmits, the front and rear parking assist control module uses the sensor echo received through the signal circuit to calculate the distance and position of an object.

Conditions for Running the DTC

Ignition ON

Conditions for Setting the DTC

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B1405 02

The front and rear parking assist control module has detected the 12 V reference circuit is shorted to ground.

B1405 03

The front and rear parking assist control module has detected the 12 V reference circuit is low.

B1405 07

The front and rear parking assist control module has detected the 12 V reference circuit is high.

Action Taken When the DTC Sets

- Parking assist is disabled.
- The driver information center may display a system service message.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD5)

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 Testing

1. Ignition OFF, disconnect the X2 and X3 harness connectors at the K41 Front and Rear Parking Assist Control Module.
2. Test for infinite resistance between the 12 V reference circuit terminal 4 X2 and ground.
    - **If less than infinite resistance**
    1. Ignition OFF, disconnect the harness connector at each of the B78 Rear Object Sensors.

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2. Test for infinite resistance between the 12 V reference circuit and ground.
    - If less than infinite resistance, repair the short to ground on the circuit.
    - If less than 2 Ω, replace the appropriate B78 Rear Object Sensor.
- **If infinite resistance**

3. Test for infinite resistance between the 12 V reference circuit terminal 1 X3 and ground.
- **If less than infinite resistance**

1. Ignition OFF, disconnect the harness connector at each of the B78 Front Object Sensors.
2. Test for infinite resistance between the 12 V reference circuit and ground.
    - If less than infinite resistance, repair the short to ground on the circuit.
    - If less than 2 Ω, replace the appropriate B78 Front Object Sensor.
- **If infinite resistance**

4. Ignition ON.
5. Test for less than 1 V between the 12 V reference circuit terminal 4 X2 and ground.
- **If greater than 1 V**

1. Ignition OFF, disconnect the harness connector at each of the B78 Rear Object Sensors.
2. Test for less than 1 V between the 12 V reference circuit and ground.
    - If greater than 1 V, repair the short to voltage on the circuit.
    - If less than 1 V, replace the appropriate B78 Front Object Sensor.
- **If less than 1 V**

6. Test for less than 1 V between the 12 V reference circuit terminal 1 X3 and ground.
- **If greater than 1 V**

1. Ignition OFF, disconnect the harness connector at each of the B78 Front Object Sensors.
2. Test for less than 1 V between the 12 V reference circuit and ground.
    - If greater than 1 V, repair the short to voltage on the circuit.
    - If less than 1 V, replace the appropriate B78 Front Object Sensor.
- **If less than 1 V**

7. Connect the X2 and X3 harness connector at the K41 Front and Rear Parking Assist Control Module, ignition ON.
8. Verify DTC B1405 is not set.
- **If DTC B1405 is set**

1. Ignition OFF, disconnect the harness connector at each of the B78 Object Sensors.
2. Verify DTC B1405 is not set.
    - If DTC B1405 is set

      Replace the K41 Front and Rear Parking Assist Control Module.

    - If DTC B1405 is not set.
3. Verify the DTC B1405 does not set while connecting the harness connector at each B78 Object Sensor, one at a time.

- If DTC B1405 does set

  Replace the B78 Object Sensor that was connected immediately before DTC B1405 .

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- If DTC B1405 does not set.

9. All OK.
    - **If DTC B1405 is not set.**
10. All OK.

Repair Instructions

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

- **Rear Parking Assist Alarm Sensor Replacement (Outer)Rear Parking Assist Alarm Sensor Replacement (Center)**
- **Front Parking Assist Alarm Sensor Replacement (Chevrolet Outer)Front Parking Assist Alarm Sensor Replacement (GMC Outer)Front Parking Assist Alarm Sensor Replacement (Center)**
- **Control Module References** for front and rear parking assist control module replacement, programming, and setup.

DTC B1405: CONTROL MODULE VOLTAGE REFERENCE OUTPUT 2 (WITH UD7)

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 B1405

Control Module Voltage Reference Output 2 Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12 V Reference	B1405 02	B0958 04, B0959 04, B0960 04, B0961 04	-	-

Circuit/System Description

The object sensors are 3-wire ultrasonic sensors that are used to determine the distance between the vehicle and an object. The front and rear parking assist control module supplies 12 V to the object sensors via the 12 V reference circuit and provides ground via the low reference circuit. The front and rear parking assist control module triggers the sensors in a sequential loop. After each sensor transmits, the front and rear parking assist control module uses the sensor echo received through the signal circuit to calculate the distance and position of an object.

Conditions for Running the DTC

Ignition ON

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Conditions for Setting the DTC

B1405 02

The front and rear parking assist control module has detected the 12 V reference circuit is shorted to ground.

B1405 03

The front and rear parking assist control module has detected the 12 V reference circuit is low.

B1405 07

The front and rear parking assist control module has detected the 12 V reference circuit is high.

Action Taken When the DTC Sets

- Parking assist is disabled.
- The driver information center may display a system service message.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)

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 Testing

1. Ignition OFF, disconnect the X2 harness connector at the K41 Front and Rear Parking Assist Control Module.
2. Test for infinite resistance between the 12 V reference circuit terminal 4 and ground.

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- **If less than infinite resistance**

1. Ignition OFF, disconnect the harness connector at each of the B78 Rear Object Sensors.
2. Test for infinite resistance between the 12 V reference circuit and ground.
    - If less than infinite resistance, repair the short to ground on the circuit.
    - If less than 2 Ω, replace the appropriate B78 Rear Object Sensor.

- **If infinite resistance**

3. Connect the X2 harness connector at the K41 Front and Rear Parking Assist Control Module, ignition ON.
4. Verify DTC B1405 is not set.
    - **If DTC B1405 is set.**

    1. Ignition OFF, disconnect the harness connector at each of the B78 Rear Object Sensors.
    2. Verify DTC B1405 is not set.
        - If DTC B1405 is set.

          Replace the K41 Front and Rear Parking Assist Control Module.

        - If DTC B1405 is not set.
    3. Verify DTC B1405 is not set while connecting the harness connector at each B78 Rear Object Sensor, one at a time.
    - If DTC B1405 does set

      Replace the B78 Rear Object Sensor that was connected immediately before DTC B1405 set.

    - If DTC B1405 does not set.
5. All OK.
    - **If DTC B1405 is not set.**
6. All OK.

Repair Instructions

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

- **Rear Parking Assist Alarm Sensor Replacement (Outer)Rear Parking Assist Alarm Sensor Replacement (Center)**
- **Control Module References** for control module replacement, programming, and setup.

DTC B172E OR B172F: DRIVER SEAT CUSHION LEFT/RIGHT REAR HAPTIC ALERT MOTOR

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 B172E

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Driver Seat Cushion Left Rear Haptic Alert Motor Control Circuit

DTC B172F

Driver Seat Cushion Right Rear Haptic Alert Motor Control Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Haptic Alert Motor Control	B172E 02	B172E 01 or B172E 02	B172E 01	-
Left Haptic Alert Motor Ground	-	B172E 01 or B172E 02	-	-
Right Haptic Alert Motor Control	B172F 02	B172F 01 or B172F 02	B172F 01	-
Right Haptic Alert Motor Ground	-	B172F 01 or B172F 02	-	-

Circuit/System Description

The haptic seats, also known as safety alert seats, provide a vibration to alert the driver in certain circumstances. There are two motors in the driver seat cushion. Either the right or left motor can run or both depending on the alert. The seat memory control module provides the output voltage for the motors. The seat memory control module receives serial data requests from other modules to activate the appropriate seat motors with the number of pulses requested. While the motors are activated, the seat memory control module checks for either shorts to voltage or shorts to ground. Due to the nature of the PWM signal, if a motor circuit is open, it may be reported as either a short to voltage or short to ground.

Conditions for Running the DTC

- Engine ON.
- Haptic seat motor commanded ON.

Conditions for Setting the DTC

DTC B172E 01

The seat memory control module has detected a short to voltage on the left haptic seat motor control circuit.

DTC B172E 02

The seat memory control module has detected a short to ground on the left haptic seat motor control circuit.

DTC B172F 01

The seat memory control module has detected a short to voltage on the right haptic seat motor control circuit.

DTC B172F 02

The seat memory control module has detected a short to ground on the right haptic seat motor control circuit.

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Action Taken When the DTC Sets

- "Service Driver Assist" will be displayed on the Driver Information Center.
- Alerts will be communicated with beeps.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Safety Alert Seat 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 P45LR Seat Haptic Movement Motor - Driver Left Rear turns ON and OFF when commanding the Driver Seat Cushion Left Rear Haptic Movement On and Off with a scan tool.
    - **If the motor does not turn ON and OFF**

      Refer to Circuit/System Testing.

    - **If the motor turns ON and OFF**
3. Verify the P45RR Seat Haptic Movement Motor - Driver Right Rear turns on and off when commanding the Driver Seat Cushion Right Rear Haptic Movement On and Off with a scan tool.
    - **If the motor does not turn ON and OFF**

      Refer to Circuit/System Testing.

    - **If the motor turns ON and OFF**

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4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the X5 harness connector at the K40D Seat Memory Control Module - Driver, ignition ON.
2. Test for less than 1 V between the appropriate control circuit terminal listed below and ground:
    - P45LR Seat Haptic Movement Motor - Driver Left Rear terminal 5
    - P45RR Seat Haptic Movement Motor - Driver Right Rear terminal 4
    - **If 1 V or greater**

      Repair the short to voltage on the circuit.

    - **If less than 1 V**
3. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
4. Test for 27-51 Ω between the appropriate control circuit terminal listed below and ground:
    - P45LR Seat Haptic Movement Motor - Driver Left Rear terminal 5
    - P45RR Seat Haptic Movement Motor - Driver Right Rear terminal 4
    - **If less than 27 Ω**

      Test or replace the appropriate P45 Seat Haptic Movement Motor - Driver.

    - **If greater than 51 Ω**
    1. Verify the circuit ground connection is clean and secure.
        - If the ground connector is not clean or secure, repair as necessary.
        - If the circuit ground connection is clean and secure
    2. Replace the appropriate P45 Seat Haptic Movement Motor - Driver.
    - **If between 27-51 Ω**
5. Install a 3 A fused jumper wire between the appropriate control circuit terminal listed below and B+.
    - P45LR Seat Haptic Movement Motor - Driver Left Rear terminal 5
    - P45RR Seat Haptic Movement Motor - Driver Right Rear terminal 4
6. Verify the appropriate P45 Seat Haptic Movement Motor - Driver is active.
    - **If the P45 Seat Haptic Movement Motor - Driver is not active**

      Replace the appropriate P45 Seat Haptic Movement Motor - Driver.

    - **If the P45 Seat Haptic Movement Motor - Driver is active**
7. Ignition OFF, connect the harness connector at the K40 Seat Memory Control Module, ignition ON.
8. Verify the P45LR Seat Haptic Movement Motor - Driver Left Rear turns ON and OFF when commanding the Driver Seat Cushion Left Rear Haptic Movement On and Off with a scan tool.
    - **If the motor does not turn ON and OFF**

      Replace the K40 Seat Memory Control Module.

    - **If the motor turns ON and OFF**
9. Verify the P45RR Seat Haptic Movement Motor - Driver Right Rear turns on and off when commanding

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the Driver Seat Cushion Right Rear Haptic Movement On and Off with a scan tool.

- **If the motor does not turn ON and OFF**

  Replace the K40 Seat Memory Control Module.

- **If the motor turns ON and OFF**

10. All OK.

Repair Instructions

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

- **Front Seat Lane Departure Warning Actuator Replacement**
- **Control Module References** for control module replacement, programming, and setup.

DTC B356A: VEHICLE DIRECTION WARNING SWITCH

Diagnostic Instructions

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

DTC Descriptors

DTC B356A

Vehicle Direction Warning Switch Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B356A 02	1	B356A 05	-
Ground	-	1	-	-
1. Lane Departure Warning Switch Malfunction				

Circuit/System Description

The frontview camera module monitors the lane departure warning switch signal circuit. The frontview camera module applies voltage and monitors the switch signal circuit. The lane departure warning switch is normally open switch. With the switches open, voltage seen at the frontview camera module is high. When a switch is pressed, the signal circuit is pulled to ground and the voltage seen by the frontview camera module is low. The frontview camera module will respond to this by activating or deactivating the lane departure warning feature.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

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DTC B356A 02

The frontview camera module has detected a short to ground for more than 10 s.

DTC B356A 05

The frontview camera module has detected a short to voltage for more than 10 s.

Action Taken When the DTC Sets

- Lane departure warning is disabled.
- The driver information center may display a service message.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- **Lane Departure Warning Description and Operation**
- **Forward Collision Alert Description and Operation (without UGN)**

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 scan tool Lane Departure Warning Switch Status parameter changes between Open and Closed when pressing and releasing the lane departure warning switch.
    - **If the parameter does not change between Active and Inactive**

      Refer to Circuit/System Testing.

    - **If the parameter changes between Active and Inactive**

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3. All OK.

Circuit/System Testing

1. Ignition ON and all vehicle systems OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 14 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the ground circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 10 Ω**
3. Verify the scan tool Lane Departure Warning Switch Status parameter is Open.
    - **If not Inactive**
    1. Ignition OFF, disconnect the harness connector at the K109 Frontview Camera Module.
    2. Test for infinite resistance between the K109 Frontview Camera Module signal circuit terminal 10 and ground.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance, replace the K109 Frontview Camera Module.
    - **If Inactive**
4. Install a 3 A fused jumper wire between the signal circuit terminal 8 and ground.
5. Verify the scan tool Lane Departure Warning Switch Status parameter is Closed.
    - **If not Closed**
    1. Ignition OFF, disconnect the harness connector at the K109 Frontview Camera Module, ignition ON.
    2. Test for less than 1 V between the signal circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    3. Ignition OFF
    4. Test for less than 2 Ω in the signal circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the K109 Frontview Camera Module.
    - **If Closed**
6. Test or replace the S48A Multifunction Switch - Instrument Panel.

Repair Instructions

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

- **Vehicle Stability Control System Switch Replacement** for multifunction switch - instrument panel. replacement
- **Control Module References** for frontview camera module replacement, programming, and setup.

DTC P15F6: FRONT OBJECT DETECTION CONTROL MODULE TORQUE REQUEST SIGNAL

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MESSAGE COUNTER

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 P15F6

Front Object Detection Control Module Torque Request Signal Message Counter Incorrect

Circuit/System Description

The Frontview Camera Module communicates with the Engine Control Module (ECM), requesting engine speed or torque reduction as necessary.

Conditions for Running the DTC

Engine running.

Conditions for Setting the DTC

The ECM detects that the engine speed and torque modification messages from the Frontview Camera Module are either corrupted or intermittently missing.

Action Taken When the DTC Sets

- The Frontview Camera Module sends a serial data message to display the appropriate indicator message
- The Frontview Camera Module features are unavailable.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The engine control module clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Diagnostic Aid

This is an informational DTC set by the engine control module. It is set to provide an indication that the Frontview Camera Module will not be able to perform as intended. Diagnose any other DTCs first. During normal diagnostic and/or repair verification technicians may find that a "Service Driver Assist System" message may be displayed by the Frontview Camera Module. Do not replace the Frontview Camera Module for this condition.

If the Service Driver Assist System message is displayed with no DTCs set, perform the following steps:

1. Remove the key from the ignition, open and close the driver's door to turn off retained accessory power, and wait 60 s.
2. Ignition ON, if the Service Driver Assist message is still present, operate the vehicle at speeds greater than 15 km/h (10 mph) to complete the self test. The Frontview Camera Module should request the

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message to turn off.

3. If the telltales remain on with no DTCs set after the drive cycle, disconnect the battery for at least 60 s, then reconnect the battery.
4. Operate the vehicle at speeds greater than 40 km/h (25 mph), the Frontview Camera Module should request all indicators to turn off.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning 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:

- **DTC P15F6 is an informational DTC.**
- **Diagnose all other K20 Engine Control Module DTCs prior to DTC P15F6.**

1. Verify there are no other DTCs set in the K20 Engine Control Module and that there are no communication DTCs set in the vehicle.
   - **If any DTCs are set**

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

   - **If no DTCs are set**
2. Clear DTCs and operate the vehicle in the conditions that the customer experienced.
3. Verify DTC P15F6 does not set.
   - **If the DTC sets**

     Replace K109 Frontview Camera Module

   - **If the DTC does not set**

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4. All OK.

Repair Instructions

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

Control Module References for control module replacement, programming, and setup.

DTC P15F7: REAR OBJECT DETECTION CONTROL MODULE TORQUE REQUEST SIGNAL MESSAGE COUNTER

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 P15F7

Rear Object Detection Control Module Torque Request Signal Message Counter Incorrect

Circuit/System Description

The rear parking assist control module is constantly sending a serial data message to the engine control module requesting engine speed or torque reduction. The engine control module sets DTC P15F7 when it detects a discrepancy in the structure of the message causing the integrity of the message to be questioned. An intermittent fault in the serial data circuits will cause the engine control module to set DTC P15F7.

Conditions for Running the DTC

Engine running.

Conditions for Setting the DTC

The engine control module detects that the engine speed and torque modification messages from the rear parking assist control module are either corrupted or intermittently missing.

Action Taken When the DTC Sets

- The rear parking assist control module sends a serial data message to display the appropriate indicator message
- The rear parking assist control module features are unavailable.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present.
- The engine control module clears the history DTC when a current DTC is not detected in 40 consecutive drive cycles.

Diagnostic Aid

This is an informational DTC set by the engine control module. It is set to provide an indication that the rear

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parking assist control module will not be able to perform as intended. Diagnose any other DTCs first.

NOTE: **During normal diagnostic and/or repair verification technicians may find that a "Service Adaptive Cruise Control" message may be displayed by the rear parking assist control module. Do not replace the rear parking assist control module for this condition.**

If the Service Driver Assist System message is on with no DTCs set, perform the following steps:

1. Remove the key from the ignition, open and close the driver's door to turn off retained accessory power, and wait 60 seconds.
2. Ignition ON, if the Service Driver Assist message is still present, operate the vehicle at speeds greater than 15 km/h (10 mph) to complete the self test. The rear parking assist control module should request the message to turn OFF.
3. If the telltales remain ON with no DTCs set after the drive cycle, disconnect the battery for at least 60 seconds then reconnect the battery.
4. Operate the vehicle at speeds greater than 40 km/h (25 mph), the rear parking assist control module should request all telltale indicators to turn OFF.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)

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:

- **DTC P15F7 is an informational DTC.**
- **Diagnose all other K20 Engine Control Module DTCs prior to DTC P15F7.**

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1. Verify there are no other K20 Engine Control Module or communication DTCs set.
    - **If a DTC is set**

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

    - **If a DTC is not set**
2. Complete the diagnosis by looking for an intermittent serial data circuit fault. Refer to **Scan Tool Does Not Communicate with High Speed GMLAN Device** .
    - **If an intermittent serial data circuit fault is found**

      Repair as necessary.

    - **If an intermittent serial circuit fault is not found**
3. Clear DTCs and operate the vehicle in the conditions that the customer experienced.
4. Verify DTC P15F7 does not set.
    - **If the DTC sets**

      Replace K41R Rear Parking Assist Control Module.

    - **If the DTC does not set**
5. All OK.

Repair Instructions

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

Control Module References for control module replacement, programming, and setup.

SYMPTOMS - OBJECT DETECTION

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

1. Perform the **Diagnostic System Check - Vehicle** before using the Symptom Tables in order to verify that all of the following are true: before using the Symptom Tables in order to verify that all of the following are true:
    - There are no DTCs set.
    - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions:
    - **Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)**
    - **Lane Departure Warning Description and Operation**
    - **Forward Collision Alert Description and Operation (without UGN)**
    - **Rear Vision Camera Description and Operation**
    - **Safety Alert Seat Description and Operation**

Visual/Physical Inspection

- Inspect for aftermarket devices which may affect the operation of the system. Refer to **Checking Aftermarket Accessories** .

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- Inspect the easily accessible or visible system components for obvious damage or conditions which may cause the symptom.
- Make sure the parking assist sensors located on the vehicle front and rear bumper are clear. Remove any snow, mud or ice that is blocking the sensors.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

- **Seat Haptic Signal Motor Malfunction**
- **Forward Collision Alert System Malfunction**
- **Parking Assist System Malfunction**
- **Rear Vision Camera System Malfunction (with IO3)Rear Vision Camera System Malfunction (with IO5/IO6 without Rear Seat Enterainment)Rear Vision Camera System Malfunction (with IO5/IO6 with Rear Seat Entertainment)Rear Vision Camera System Malfunction (with IOB)**
- **Lane Departure Warning System Malfunction**

SEAT HAPTIC SIGNAL MOTOR 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 B172E

Driver Seat Cushion Left Rear Haptic Alert Motor Control Circuit

DTC B172F

Driver Seat Cushion Right Rear Haptic Alert Motor Control Circuit

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Haptic Alert Motor Control	B172E 02	B172E 01 or B172E 02	B172E 01	-
Left Haptic Alert Motor Ground	-	B172E 01 or B172E 02	-	-
Right Haptic Alert Motor Control	B172F 02	B172F 01 or B172F 02	B172F 01	-

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Right Haptic Alert Motor Ground	-	B172F 01 or B172F 02	-	-

Circuit/System Description

The haptic seats, also known as safety alert seats, provide a vibration to alert the driver in certain circumstances. There are two motors in the driver seat cushion. Either the right or left motor can run or both depending on the alert. The seat memory control module provides the output voltage for the motors. The seat memory control module receives serial data requests from other modules to activate the appropriate seat motors with the number of pulses requested. While the motors are activated, the seat memory control module checks for either shorts to voltage or shorts to ground. Due to the nature of the PWM signal, if a motor circuit is open, it may be reported as either a short to voltage or short to ground.

Conditions for Running the DTC

- Engine ON.
- Haptic seat motor commanded ON.

Conditions for Setting the DTC

DTC B172E 01

The seat memory control module has detected a short to voltage on the left haptic seat motor control circuit.

DTC B172E 02

The seat memory control module has detected a short to ground on the left haptic seat motor control circuit.

DTC B172F 01

The seat memory control module has detected a short to voltage on the right haptic seat motor control circuit.

DTC B172F 02

The seat memory control module has detected a short to ground on the right haptic seat motor control circuit.

Action Taken When the DTC Sets

- "Service Driver Assist" will be displayed on the Driver Information Center.
- Alerts will be communicated with beeps.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

Reference Information

Schematic Reference

Object Detection Schematics

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Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Safety Alert Seat 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 P45LR Seat Haptic Movement Motor - Driver Left Rear turns ON and OFF when commanding the Driver Seat Cushion Left Rear Haptic Movement On and Off with a scan tool.
    - **If the motor does not turn ON and OFF**

      Refer to Circuit/System Testing.

    - **If the motor turns ON and OFF**
3. Verify the P45RR Seat Haptic Movement Motor - Driver Right Rear turns on and off when commanding the Driver Seat Cushion Right Rear Haptic Movement On and Off with a scan tool.
    - **If the motor does not turn ON and OFF**

      Refer to Circuit/System Testing.

    - **If the motor turns ON and OFF**
4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the X5 harness connector at the K40D Seat Memory Control Module - Driver, ignition ON.
2. Test for less than 1 V between the appropriate control circuit terminal listed below and ground:
    - P45LR Seat Haptic Movement Motor - Driver Left Rear terminal 5
    - P45RR Seat Haptic Movement Motor - Driver Right Rear terminal 4
    - **If 1 V or greater**

      Repair the short to voltage on the circuit.

    - **If less than 1 V**

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3. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
4. Test for 27-51 Ω between the appropriate control circuit terminal listed below and ground:
    - P45LR Seat Haptic Movement Motor - Driver Left Rear terminal 5
    - P45RR Seat Haptic Movement Motor - Driver Right Rear terminal 4
    - **If less than 27 Ω**

      Test or replace the appropriate P45 Seat Haptic Movement Motor - Driver.

    - **If greater than 51 Ω**
    1. Verify the circuit ground connection is clean and secure.
        - If the ground connector is not clean or secure, repair as necessary.
        - If the circuit ground connection is clean and secure
    2. Replace the appropriate P45 Seat Haptic Movement Motor - Driver.
    - **If between 27-51 Ω**
5. Install a 3 A fused jumper wire between the appropriate control circuit terminal listed below and B+.
    - P45LR Seat Haptic Movement Motor - Driver Left Rear terminal 5
    - P45RR Seat Haptic Movement Motor - Driver Right Rear terminal 4
6. Verify the appropriate P45 Seat Haptic Movement Motor - Driver is active.
    - **If the P45 Seat Haptic Movement Motor - Driver is not active**

      Replace the appropriate P45 Seat Haptic Movement Motor - Driver.

    - **If the P45 Seat Haptic Movement Motor - Driver is active**
7. Ignition OFF, connect the harness connector at the K40 Seat Memory Control Module, ignition ON.
8. Verify the P45LR Seat Haptic Movement Motor - Driver Left Rear turns ON and OFF when commanding the Driver Seat Cushion Left Rear Haptic Movement On and Off with a scan tool.
    - **If the motor does not turn ON and OFF**

      Replace the K40 Seat Memory Control Module.

    - **If the motor turns ON and OFF**
9. Verify the P45RR Seat Haptic Movement Motor - Driver Right Rear turns on and off when commanding the Driver Seat Cushion Right Rear Haptic Movement On and Off with a scan tool.
    - **If the motor does not turn ON and OFF**

      Replace the K40 Seat Memory Control Module.

    - **If the motor turns ON and OFF**
10. All OK.

Repair Instructions

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

- **Front Seat Lane Departure Warning Actuator Replacement**
- **Control Module References** for control module replacement, programming, and setup.

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FORWARD COLLISION ALERT SYSTEM 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
Forward Collision Alert Indicators Ignition	1	1	-	-
Forward Collision Alert Indicators Control (Terminal 2)	2	1	1	-
Forward Collision Alert Indicators Control (Terminal 3)	1	1	1	-
Forward Collision Alert Indicators Ground	-	1	-	-
1. Forward collision alert indicators inoperative 2. Forward collision alert indicators always illuminated				

Circuit/System Description

The forward collision alert system is controlled by the frontview camera module mounted on the windshield. The system is designed to detect vehicles directly ahead, within a distance of approximately 60 m (197 ft). The forward collision alert system operates at speeds above 40 km/h (25 mph). When the system detects a vehicle in the path ahead, the green vehicle ahead alert indicator in the driver information center is illuminated. When approaching another vehicle too rapidly, the collision alert symbol will flash and the radio will beep or the haptic seat will pulse, depending on user configuration. The red collision alert display will stay continuously illuminated if the vehicle ahead remains much too close. These actions are requested by the frontview camera module via serial data. The forward collision alert switch is part of the left steering wheel controls and is used to adjust the timing sensitivity of the front collision alert system.

Diagnostic Aids

Certain factors will affect the operation of the forward collision alert system. Forward collision alert is intended to detect vehicles. It is not intended to warn the driver of any objects that are not detected as a vehicle such as pedestrians, animals, signs, guard rails, bridges, construction barrels or other stationary or slow moving objects. In few cases the camera may inadvertently detect a vehicle that is not in the path ahead, or the system may occasionally provide unrealistic alerts. This could occur with a turning vehicle ahead, guard rails, traffic signs, or other stationary objects. This is normal operation, the vehicle does not need service. When the system is operating properly, the green vehicle ahead alert indicator will illuminate on the vehicle direction display when the system detects a vehicle in the path ahead. This indicates that all of the required operating conditions are met. The green vehicle ahead alert indicator will not appear when the system is having difficulty seeing other vehicles on the road. This can occur if the front view camera is blocked with mud, dirt, snow, ice, slush, if the windshield is damaged, or when weather limits visibility, such as while driving in fog, rain, or snow conditions. This is normal operation, the vehicle does not need service.

The scan tool Frontview Camera Disable History parameters should be used as a starting point when diagnosis

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an intermittent customer complaint concerning the forward collision alert system. The parameters will identify the last four reasons the forward collision alert system was disabled.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Forward Collision Alert Description and Operation (without UGN)

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 scan tool Forward Collision Alert Function Status parameter is not Malfunction.
   - **If the parameter is Malfunction**

     Refer to Circuit/System Testing - Frontview Camera Module Malfunction

   - **If parameter is not Malfunction**
3. Verify the forward collision alert indicators turn on and off when commanding the instrument cluster All Indicators On and Off with a scan tool.
   - **If the indicators do not illuminate**

     Refer to Circuit/System Testing - Forward Collision Alert Indicator Malfunction

   - **If the indicators illuminate**
4. Verify the forward collision alert distance on the driver information center toggles between far, medium, near and off when cycling the forward collision alert distance switch.
   - **If the setting does not change**

     Test or replace the S70L Steering Wheel Controls Switch - Left.

   - **If the setting changes**

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5. Verify the area of the K109 Frontview Camera Module is not contaminated.
    - **If contaminated**

      Clean the windshield

    - **If not contaminated**
6. All OK.

Circuit/System Testing

Frontview Camera Module Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the K109 Frontview Camera Module. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 1 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 10 Ω**
3. Verify a test lamp illuminates between the B+ circuit terminal 3 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the B+ circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, 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. Ignition OFF.
    2. 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, replace the K109 Frontview Camera Module.
    - **If the test lamp illuminates**
4. Replace the K109 Frontview Camera Module.

Forward Collision Alert Indicator Malfunction

1. Ignition OFF, and all vehicle systems OFF, disconnect the harness connector at the P43 Collision Alert Indicators. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 4 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.

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- **If less than 10 Ω**

3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 1 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    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 P43 Collision Alert Indicators.
    - **If the test lamp illuminates**
5. Verify a test lamp illuminates between the control circuit terminal 2 and B+
    - **If the test lamp does not illuminate**
    1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster, ignition ON.
    2. Test for less than 1 V between the control circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    3. Ignition OFF.
    4. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the P16 Instrument Cluster.
    - **If the test lamp illuminates**
6. Verify a test lamp illuminates between the control circuit terminal 3 and B+
    - **If the test lamp does not illuminate**
    1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster, ignition ON.
    2. Test for less than 1 V between the control circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    3. Ignition OFF.
    4. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the P16 Instrument Cluster.
    - **If the test lamp illuminates**
7. Ignition OFF, connect the harness connector at the P43 Collision Alert Indicators, ignition ON.
8. Verify the P43 Collision Alert Indicators are not illuminated.
    - **If the P43 Collision Alert Indicators are illuminated**
    1. Ignition OFF, disconnect the harness connector at the P43 Collision Alert Indicators and the P16

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Instrument Cluster.

2. Test for infinite resistance between the P43 Collision Alert Indicators control circuit terminal 2 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 P43 Collision Alert Indicators are not illuminated**

9. Test or replace the P43 Collision Alert Indicators.

Repair Instructions

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

- **Cruise Control Switch Replacement**
- **Forward Collision Alert Display Replacement**
- **Control Module References** for frontview camera module replacement, programming, and setup.

PARKING ASSIST SYSTEM 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
High Control (Terminal 2)	2	2	-	-
Low Control (Terminal 6)	3	2	B0968 01	-
Signal	B0967 02	1	1	-
Ground	-	1	-	-
1. Parking Assist Switch Inoperative 2. Parking Assist Switch Indicator Inoperative 3. Parking Assist Switch Indicator Always On				

Circuit/System Description

The parking assist system can be activated and deactivated by pressing the parking assist switch. The front and rear parking assist control module applies voltage and monitors the parking assist switch signal circuit. The parking assist switch is a normally open switch. With the switch open, voltage seen at the front and rear front and rear parking assist control module is high. When the parking assist switch is pressed, the switch is closed and the signal circuit is pulled to ground. With the switch closed, voltage seen at the front and rear front and rear parking assist control module is low. The front and rear parking assist control module will respond to this by activating or deactivating the parking assist function.

When the parking assist system is enabled, the front and rear parking assist control module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the front and rear parking assist control module.

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Diagnostic Aids

The following is a brief description of potential causes which may aid in diagnosis:

- Manual Disable - The parking assist system has been disabled through the parking assist switch.
- Hitch/Object Attached - The front and rear parking assist control module is detecting an object that is attached to the vehicle. Common items such as a hitch receiver, trailer, or a bicycle rack may cause this concern. Additionally, damage to the rear of the vehicle or a misaligned sensor may cause this concern. If the vehicle is damaged in a manner that causes the sensor to detect the fascia itself, the front and rear parking assist control module will interpret this as an attached object and disable the system. Carefully inspect the fascia, fascia mounting surface, and sensor retainers before continuing with normal diagnosis. After the detected cause has been addressed the vehicle must be driven at speed greater than 40 km/h (25 mph).
- Vehicle Overspeed - The vehicle is travelling too fast in reverse at speeds of greater than 8 km/h (5 mph).
- Inhibit - The front and rear parking assist control module has lost or received invalid GMLAN signal(s).
- Sensor Disturbance - An outside interference is causing sensor movement. Such interference may be caused a heavy pounding, like that of a nearby jackhammer, or large changes in pressure, such as a large truck air brakes.
- Sensor Ring Time - If the sensor fails its own diagnostic initialization the front and rear parking assist control module will set this error. After the detected cause has been addressed the vehicle must be driven at speed greater than 40 km/h (25 mph). The following is a list of reasons this cause may have set:
    - One or more of the sensors may be blocked by snow, mud, ice, or other debris. This might happen after going through a car wash in cold weather.
    - Silicone insulator surrounding sensor maybe missing, cut, or twisted.
    - Improperly installed sensor, sensor maybe be crooked due to a tight wire harness.
    - One or more of the sensors may be scratched or the paint maybe chipped.
    - Excessive paint thickness on a sensor may cause an excessive sensor ring time. When replacing or refinishing a sensor, do not apply an excessive amount of paint or clear coat.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (with UD7)Parking Assist Description and Operation (with UD5)

Electrical Information Reference

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

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Park Assist Switch parameter changes between Active and Inactive while pressing and releasing the parking assist switch.
   - **If the parameter does not change between Active and Inactive**

     Refer to Circuit/System Testing - Parking Assist Switch Circuit Malfunction.

   - **If the parameter changes between Active and Inactive**
3. Engine running, parking brake applied, transmission in R.
4. Verify the reverse lamps are illuminated.
   - **If the reverse lamps are not illuminated**

     Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

   - **If the reverse lamps are illuminated**
5. Verify the scan tool Parking Assist System Status parameter is Enabled.
   - **If the parameter is not Enabled**

     Refer to Diagnostic Aids to determine the cause of the inhibit.

   - **If the parameter is Enabled**
6. Verify the parking assist switch indicator turns ON and OFF when turning the parking assist system on and off with the park assist switch.
   - **If the indicator does not turn ON and OFF**

     Refer to Circuit/System Testing - Parking Assist Switch Indicator Circuit Malfunction.

   - **If the indicator turns ON and OFF**
7. All OK.

Circuit/System Testing

Parking Assist Switch Circuit Malfunction

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 14 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ground circuit end to end.

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

- **If less than 10 Ω**

3. Verify the scan tool Parking Assist Switch parameter is Inactive.
   - **If the parameter is not Inactive**
   1. Ignition OFF, disconnect the X1 harness connector at the K41 Front and Rear Parking Assist Control Module.
   2. Test for infinite resistance between the signal circuit terminal 9 and ground.
      - If less than infinite resistance, repair the short to ground on the signal circuit.
      - lf infinite resistance, replace the K41 Front and Rear Parking Assist Control Module.
   - **If the parameter is Inactive**
4. Connect a 3 A fused jumper wire between the signal circuit terminal 9 and ground.
5. Verify the scan tool Parking Assist Switch parameter is Active.
   - **If the parameter is not Active**
   1. Ignition OFF, disconnect the X1 harness connector at the K41 Front and Rear Parking Assist Control Module, ignition ON.
   2. Test for less than 1 V between the control circuit and ground.
      - If 1 V or greater, repair the short to voltage on the circuit
      - If less than 1 V, replace the K41 Front and Rear Parking Assist Control Module.
   3. Ignition OFF.
   4. Test for less than 2 Ω in the signal circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, replace the K41 Front and Rear Parking Assist Control Module.
   - **If the parameter is Active**
6. Test or replace the S48A Multifunction Switch - Instrument Panel.

Parking Assist Switch Indicator Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel, ignition ON.
2. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
   - **If the test lamp does not illuminate**
   1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module.
   2. Test for less than 2 Ω in the control circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, refer to **Interior Backlighting Malfunction** .
   - **If the test lamp illuminates**
3. Ignition OFF, connect the harness connector at the S48A Multifunction Switch - Instrument Panel. Disconnect the X1 harness connector at the K41 Front and Rear Parking Assist Control Module.
4. Verify the parking assist switch indicator is not illuminated.
   - **If the parking assist switch indicator is illuminated**
   1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument

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Panel.

2. Test for infinite resistance between the S48A Multifunction Switch - Instrument Panel control circuit terminal 6 and ground.
    - If less than infinite resistance, repair the short to ground in the circuit.
    - If infinite resistance, replace the S48A Multifunction Switch - Instrument Panel.

- **If the parking assist switch indicator is not illuminated**

5. Connect a 3 A fused jumper wire between the control circuit terminal 6 and ground.
6. Verify the parking assist switch indicator is illuminated.
    - **If the parking assist switch indicator is not illuminated**

    1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel.
    2. Test for less than 1 V between the control circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    3. Ignition OFF.
    4. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the S48A Multifunction Switch - Instrument Panel.

    - **If the parking assist switch indicator is illuminated**

7. Replace the K41 Front and Rear Parking Assist Control Module.

Repair Instructions

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

- **Vehicle Stability Control System Switch Replacement** for multifunction switch - instrument panel replacement
- **Control Module References** for front and rear parking assist control module replacement, programming, and setup.

REAR VISION CAMERA SYSTEM MALFUNCTION (WITH IO3)

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

B127B

Rearview Camera Input Signal Circuit

Diagnostic Fault Information

Circuit	Short to	Open/High	Short to	Signal

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	Ground	Resistance	Voltage	Performance
Ignition	B127B 08,1	B127B 08,1	-	-
Backup Signal	B127B 08,1	B127B 08,1	-	-
Camera Module signal +	B127B 08,1	B127B 08,1	B127B 08, 2	-
Camera Module signal -	B127B 08, 3	B127B 08,1	B127B 08,1	-
Ground	-	B127B 08,1	-	-
Shield	-	3	-	-
1. Rear vision camera inoperative 2. Rear vision camera image always displayed 3. Poor Quality Image				

Circuit/System Description

When the transmission is placed into R, a 12 V signal is sent to the rearview camera indicating that camera operation is requested. Ignition voltage and ground are supplied to the rearview camera. The rearview camera sends video information to the radio through a video signal + and a video signal - circuit. A grounded shielding also wraps the video signal circuits to reduce electronic interference which may degrade the video signal and cause a distorted or otherwise degraded image.

Conditions for Running the DTC

- Engine running
- Transmission in R

Conditions for Setting the DTC

The video signal from the rearview camera has not been received by the Radio for 2.5 s.

Action Taken When the DTC Sets

- The Radio stores the DTC in memory.
- A service message may be displayed on the driver information center of info display module.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 40 malfunction-free ignition cycles have occurred.

Diagnostic Aids

A poor video image can be caused by ice, snow, and mud buildup on the lens of the rearview camera. Also, extreme lighting conditions can affect performance, such as operating in the dark or with bright sunlight shining on the camera. Extreme high or low temperatures can also affect the image quality. An open in the shield of the video signal circuit can also cause a distorted screen.

Terminal fretting or incorrectly seated connectors can cause a poor image displayed condition. Check the circuit terminals for fretting or incorrectly seated connector. If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.

Reference Information

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Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Rear Vision Camera 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: **If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.**

1. Verify P17 Info Display Module displays infotainment system information properly.
   - **If infotainment system information does not display properly**

     Refer to **Radio Information Display Malfunction (IO3)** .

   - **If infotainment system information displays properly**
2. Verify there is no debris on the B87 Rearview Camera lens and that the bezel and bezel seal are not damaged.
   - **If debris is found on the lens**

     Clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.

   - **If there is no debris on the lens**
3. Engine running, transmission in R.
4. Verify the backup lamps are illuminated.
   - **If the backup lamps are not illuminated**

     Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

   - **If the backup lamps are illuminated**
5. Engine running, transmission in R.

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6. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a clear image is not displayed**

      Refer to Circuit/System Testing.

    - **If a clear image is displayed**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X900 harness connector. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 7 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 4 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    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 B87 Rearview Camera.
    - **If the test lamp illuminates**
5. Engine running, park brake applied, transmission in R.
6. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
    - **If the test lamp illuminates**

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7. Ignition OFF, disconnect the X1 harness connector at the A11 Radio, ignition ON.
8. Test for less than 1 V between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 5 X1
    - A11 Radio signal (-) circuit terminal 4 X1
    - **If 1 V or greater**

      Repair the short to voltage on the circuit.

    - **If less than 1 V**
9. Test for infinite resistance between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 5 X1
    - A11 Radio signal (-) circuit terminal 4 X1
    - **If less than infinite resistance**

      Repair the short to ground on the circuit.

    - **If infinite resistance**
10. Test for less than 2 Ω between the A11 Radio signal (+) circuit terminal 5 X1 and the X900 signal (+) circuit terminal 3.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
11. Test for less than 2 Ω between the A11 Radio signal (-) circuit terminal 4 X1 and the X900 signal (-) circuit terminal 8.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
12. Add Nyogel lubricant 760G to electrical terminals.
13. Reconnect all electrical connections.
14. Engine running, park brake applied, transmission in R.
15. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a blank blue screen or distorted image is displayed**
    1. Replace the B87 Rearview Camera.
    2. Engine running, transmission in R,
    3. Verify a clear rear vision image is displayed on the P17 Info Display Module.
        - **If a clear rear vision image is not displayed**

          Replace the A11 Radio.

        - **If a clear rear vision image is displayed**
    4. All OK.
    - **If a blank black screen is displayed**

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Replace the A11 Radio.

- **If a clear rear vision image is displayed**

16. All OK.

Repair Instructions

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

- **Rearview Driver Information Camera Replacement**
- **Control Module References** for control module replacement, programming, and setup.

REAR VISION CAMERA SYSTEM MALFUNCTION (WITH IO5/IO6 WITHOUT REAR SEAT ENTERAINMENT)

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
Camera Ignition/RAP voltage	1	1	-	-
Camera Backup Signal	1	1	-	-
Camera Module signal +	1	1	1	-
Camera Module signal -	1	1	1	-
Camera Ground	-	1	-	-
Bypass Module B+	B127E 00,2,4	B127E 00,2,4	-	-
Bypass Module Ignition	5	5	-	-
Bypass Module Backup Signal	5	5	-	-
Bypass Module signal +	B127B 2B, 3	B127B 2B, 3	B127B 2B, 3	-
Bypass Module signal -	B127B 2B, 3	B127B 2B, 3	B127B 2B, 3	-
Bypass Module Ground	-	2,4	-	-
Shield	-	-	-	-
LIN serial Data	B127E 00	6	-	-
USB harness (K74 to K188)	B127E 00	B127E 00, 3	-	-
USB harness (K188 to P17)	-	4	-	-
1. Rear vision camera inoperative 2. No radio information display on P17 Info Display Module 3. Rear vision camera image lacks projection lines and object detection symbols 4. No rear camera or radio information display on P17 Info Display Module 5. Possible delayed rear vision displayed on Info Display Module 6. No start up animation on the P17 Info Display Module.				

Circuit/System Description

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When the transmission is placed into R, a 12 V signal is sent to the Rearview Camera indicating that camera operation is requested. Ignition voltage and ground are supplied to the Rearview Camera. The Rearview Camera sends video image to the K188 Human Machine Interface Control Module Bypass Module through a video signal + and a video signal - circuit. The K188 Human Machine Interface Control Module Bypass Module passes the video image to K74 Human Machine Interface Control Module via video signal + and a video signal - circuits. The K188 Human Machine Interface Control Module Bypass Module is used to ensure the K74 Human Machine Interface Control Module produces a quality rear vision camera image to be displayed on the P17 Info Display Module when the vehicle is placed in reverse gear. In the event the K188 Human Machine Interface Control Module Bypass Module detects an issue with the camera image generated by the K74 Human Machine Interface Control Module, such as a black, solid color, frozen, or image other than the camera image, the K188 Human Machine Interface Control Module Bypass Module will assume control of the image to the P17 Info Display Module and displays a raw camera image with no park assist projection lines or object detection symbols for the entire reverse cycle.

The K188 Human Machine Interface Control Module Bypass Module is part of the video signal + and a video signal - circuits path from the B87 Rearview Camera to the K74 Human Machine Interface Control Module as well as the digital LVDS path (USB cable) between the K74 Human Machine Interface Control Module and P17 Info Display Module and needs to be active for either signal to be received by these modules. The K188 Human Machine Interface Control Module Bypass Module is not connected to serial data and uses the reverse lamp voltage input to determine the vehicle gear state.

Diagnostic Aids

A poor video image can be caused by ice, snow, and mud buildup on the lens of the Rearview Camera. Also, extreme lighting conditions can affect performance, such as operating in the dark or with bright sunlight shining on the camera. Extreme high or low temperatures can also affect the image quality. An open or high resistance in the shield of the video signal circuit can also cause a distorted screen.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Rear Vision Camera 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

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Special Tools

EL-50334-50 GM Infotainment Tester Kit

Circuit/System Verification

NOTE: **If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.**

1. Verify there is no debris on the B87 Rearview Camera lens and that the bezel and bezel seal are not damaged.
    - **If debris is found on the lens**

      Clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.

    - **If there is no debris on the lens**
2. Engine running, parking brake applied, transmission in R.
3. Verify the backup lamps are illuminated.
    - **If the backup lamps are not illuminated**

      Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

    - **If the backup lamps are illuminated**
4. Ignition ON. Verify P17 Info Display Module displays the home screen and radio information properly.
    - **If the P17 Info Display is not displaying properly**
    1. Engine running, parking brake applied, transmission in R.
    2. Verify a clear rear vision image is displayed on the P17 Info Display Module.
        - **If a clear rear vision image is displayed**

          Refer to Circuit/System Testing- A: Info Display does not Display Radio Information

        - **If a clear rear vision image is not displayed**

          Refer to Circuit/System Testing - B: Info Display Module does not Display Anything.

    - **If the P17 Info Display displays properly**
5. Engine running, parking brake applied, transmission in R.
6. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a clear image is not displayed**

      Refer to Circuit/System Testing - C: No Rear View Camera Image.

    - **If a clear image is displayed**
7. Verify a clear enhanced rear vision image, which includes projected path lines and object detection indicators, is displayed on the P17 Info Display Module.
    - **If an enhanced clear image is not displayed**

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Refer to Circuit/System Testing - D: No Enhanced Rear View Camera Image.

- **If an enhanced clear image is displayed**

8. All OK.

Circuit/System Testing

Circuit/System Testing- A: Info Display does not Display Radio Information

1. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5 and the K188 Human Machine Interface Control Module Bypass Module harness connector X2.
2. Connect the EL-50334-2 to the K74 Human Machine Interface Control Module connector X5 and EL-50334-14 to the K188 Human Machine Interface Control Module Bypass Module connector X2. Connect EL-50334-2 and EL-50334-14 together.
3. Ignition ON/Vehicle in Service Mode, infotainment system ON.
4. Verify the P17 Info Display Module displays and image.
   - **If the P17 Info Display Module does not display an image.**

     Replace the K74 Human Machine Interface Control Module.

   - **If the P17 Info Display Module displays an image.**
5. Replace the USB harness between the K74 Human Machine Interface Control Module to the K188 Human Machine Interface Control Module Bypass Module.

Circuit/System Testing - B: Info Display Module does not Display Anything

1. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the K188 Human Machine Interface Control Module Bypass Module ground circuit terminal 5 X1 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ground circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.

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

   - **If less than 10 Ω**
3. Verify a test lamp illuminates between the B+ circuit terminal 1 X1 and ground.
   - **If the test lamp does not illuminate and the circuit fuse is good**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the B+ circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse.
   - **If the test lamp does not illuminate and the circuit fuse is open**
   1. Ignition OFF.
   2. Test for infinite resistance between the B+ circuit and ground.
      - If less than infinite resistance, repair the short to ground on the circuit.

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- If infinite resistance, replace the K188 Human Machine Interface Control Module Bypass Module.

- **If the test lamp illuminates**

4. Ignition ON.
5. Verify a test lamp illuminates between the ignition circuit terminal 2 X1 and ground.
   - **If the test lamp does not illuminate and the circuit fuse is good**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ignition circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
   - **If the test lamp does not illuminate and the circuit fuse is open**
   1. Ignition OFF.
   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 K188 Human Machine Interface Control Module Bypass Module.
   - **If the test lamp illuminates**
6. Engine running, park brake applied, transmission in R.
7. Verify a test lamp illuminates between the control circuit terminal 9 X1 and ground.
   - **If the test lamp does not illuminate**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the control circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
   - **If the test lamp illuminates**
8. Reconnect the K188 Human Machine Interface Control Module Bypass Module.
9. Ignition OFF, disconnect the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.
10. Ignition OFF, connect the EL-50334-14 to the P17 Info Display Module X3 and EL-50334-2 to the K188 Human Machine Interface Control Module Bypass Module connector X3. Connect EL-50334-2 and EL-50334-14 together.
11. Engine running, parking brake applied, transmission in R.
12. Verify the rear view image displays properly.
    - **If the image displays properly**

      Replace the USB harness between the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.

    - **If the image does not display properly**
13. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5.

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14. Connect the EL-50334-2 to the K74 Human Machine Interface Control Module connector X5 and connect the EL-50334-14 to the P17 Info Display Module X3. Connect EL-50334-2 and EL-50334-14 together.
15. Engine running, parking brake applied, transmission in R.
16. Verify the rear view image displays properly.
    - **If rear view image displays properly**

      Replace the K188 Human Machine Interface Control Module Bypass Module.

    - **If the rear view image does not display properly**
17. Replace the P17 Info Display Module.
18. Engine running, parking brake applied, transmission in R.
19. Verify the rear view image displays properly.
    - **If rear view image is not displayed**

      Replace the B87 Rearview Camera.

    - **If rear view image is displayed**
20. All OK.

Circuit/System Testing - C: No Rear View Camera Image

1. Ignition OFF and all vehicle systems OFF, disconnect the B87 Rearview Camera harness connector It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 5 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.

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

    - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 6 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    2. Test for infinite resistance between the ignition circuit and ground.
        - If less than infinite resistance, repair the short to ground on the circuit.

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- If infinite resistance, replace the B87 Rearview Camera.

- **If the test lamp illuminates**

5. Engine running, park brake applied, transmission in R.
6. Verify a test lamp illuminates between the control circuit terminal 3 and ground.
   - **If the test lamp does not illuminate**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ignition circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
   - **If the test lamp illuminates**
7. Ignition OFF, disconnect the X1 harness connector at the K188 Human Machine Interface Control Module Bypass Module, ignition ON.
8. Test for less than 1 V between the signal circuit terminals listed below and ground:
   - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 6 X1
   - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 18 X1
   - **If 1 V or greater**

     Repair the short to voltage on the circuit.

   - **If less than 1 V**
9. Ignition OFF.
10. Test for infinite resistance between the signal circuit terminals listed below and ground:
    - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 6 X1
    - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 18 X1
    - **If less than infinite resistance**

      Repair the short to ground on the circuit.

    - **If infinite resistance**
11. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 6 X1 and the B87 Rearview Camera signal (+) circuit terminal 1.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
12. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 18 X1 and the B87 Rearview Camera signal (-) circuit terminal 4.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
13. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.

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14. Test for less than 10 Ω between the K188 Human Machine Interface Control Module Bypass Module ground circuit terminal 5 X1 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.

          If less than 2 Ω, repair the open/high resistance in the ground connection.
    - **If less than 10 Ω**
15. Verify a test lamp illuminates between the B+ circuit terminal 1 X1 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the B+ circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse.
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    2. 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, replace the K188 Human Machine Interface Control Module Bypass Module.
    - **If the test lamp illuminates**
16. Ignition ON.
17. Verify a test lamp illuminates between the ignition circuit terminal 2 X1 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    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 K188 Human Machine Interface Control Module Bypass Module.
    - **If the test lamp illuminates**
18. Engine running, park brake applied, transmission in R.
19. Verify a test lamp illuminates between the control circuit terminal 9 X1 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF.

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2. Test for less than 2 Ω in the control circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
- **If the test lamp illuminates**

20. Reconnect the K188 Human Machine Interface Control Module Bypass Module.
21. Ignition OFF, disconnect the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.
22. Ignition OFF, connect the EL-50334-2 to the P17 Info Display Module connector X3 and EL-50334-14 to the K188 Human Machine Interface Control Module Bypass Module connector X3. Connect EL-50334-2 and EL-50334-14 together.
23. Add Nyogel lubricant 760G to electrical terminals.
24. Reconnect all electrical connections.
25. Engine running, parking brake applied, transmission in R.
26. Verify the rear view image displays properly.
    - **If the image displays properly**

      Replace the USB harness between the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.

    - **If the image does not display properly**
27. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5.
28. Connect the EL-50334-14 to the K74 Human Machine Interface Control Module connector X5 and connect the EL-50334-2 to the P17 Info Display Module connector X3. Connect EL-50334-2 and EL-50334-14 together.
29. Engine running, parking brake applied, transmission in R.
30. Verify the rear view image displays properly.
    - **If rear view image displays properly**

      Replace the K188 Human Machine Interface Control Module Bypass Module.

    - **If the rear view image does not display properly**
31. Replace the P17 Info Display Module.
32. Engine running, parking brake applied, transmission in R.
33. Verify the rear view image displays properly.
    - **If rear view image is not displayed**

      Replace the B87 Rearview Camera.

    - **If rear view image is displayed**
34. All OK.

Circuit/System Testing - D: No Enhanced Rear View Camera Image

1. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X2 harness connector and

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K188 Human Machine Interface Control Module Bypass Module X1 harness connector. Ignition ON.

2. Test for less than 1 V between the signal circuit terminals listed below and ground:
   - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 8 X1
   - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 20 X1
   - **If 1 V or greater**

     Repair the short to voltage on the circuit.

   - **If less than 1 V**
3. Ignition OFF.
4. Test for infinite resistance between the signal circuit terminals listed below and ground:
   - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 8 X1
   - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 20 X1
   - **If less than infinite resistance**

     Repair the short to ground on the circuit.

   - **If infinite resistance**
5. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 8 X1 and the K74 Human Machine Interface Control Module signal (+) circuit terminal 5 X2.
   - **If 2 Ω or greater**

     Repair the open/high resistance on the circuit.

   - **If less than 2 Ω**
6. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 20 X1 and the K74 Human Machine Interface Control Module signal (+) circuit terminal 6 X2.
   - **If 2 Ω or greater**

     Repair the open/high resistance on the circuit.

7. Ignition ON.

NOTE: **For accurate voltage reading, disconnect the battery charger prior to performing the following test step.**

8. Test for 2-12 V between the K188 Human Machine Interface Control Module Bypass Module LIN serial data circuit terminal 3 X1 and ground.
   - **If less than 2 V**
   1. Ignition OFF.
   2. Test for infinite resistance between the serial data circuit and ground.
      - If less than infinite resistance, repair the short to ground on the circuit.
      - If infinite resistance
   3. Test for less than 2 Ω in the serial data circuit end to each end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.

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- If less than 2 Ω

4. Replace P17 Info Display Module.
5. Reconnect the K74 Human Machine Interface Control Module, ignition ON.
6. Test for 2-12 V between the LIN serial data circuit terminal and ground.
    - If less than 2 V, replace the K74 Human Machine Interface Control Module.
    - If greater than 2 V, replace the K188 Human Machine Interface Control Module Bypass Module.

- **If greater than 12 V**

1. Ignition OFF, disconnect the X1 harness connector at the P17 Info Display Module.
2. Ignition ON.
3. Test for less than 1 V between the serial data circuit and ground.
    - If 1 V or greater, repair the short to voltage on the circuit.
    - If less than 1 V
4. Replace P17 Info Display Module.
5. Ignition OFF, reconnect the K74 Human Machine Interface Control Module, ignition ON.
6. Test for 2-12 V between the LIN serial data circuit terminal and ground.
    - If greater than 12 V, replace the K74 Human Machine Interface Control Module.
    - If less than 12 V, replace the K188 Human Machine Interface Control Module Bypass Module.

- **If between 2-12 V**

9. Re-connect the K74 Human Machine Interface Control Module and the K188 Human Machine Interface Control Module Bypass Module harness connectors.
10. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5 and the K188 Human Machine Interface Control Module Bypass Module harness connector X2.
11. Connect the EL-50334-2 to the K74 Human Machine Interface Control Module connector X5 and EL-50334-14 to the K188 Human Machine Interface Control Module Bypass Module connector X2. Connect EL-50334-2 and EL-50334-14 together.
12. Engine running, parking brake applied, transmission in R.
13. Verify the enhanced rear view image displays properly.
    - **If the enhanced image displays properly**

      Replace the USB harness between the K74 Human Machine Interface Control Module X5 and the K188 Human Machine Interface Control Module Bypass Module harness connector X2.

    - **If the enhanced image does not display properly**
14. Ignition OFF, remove the EL-50334-14 from the K188 Human Machine Interface Control Module Bypass Module harness connector X2 and EL-50334-2 from the K74 Human Machine Interface Control Module connector X5.
15. Re-connect the K188 Human Machine Interface Control Module Bypass Module harness connector X2.
16. Disconnect the P17 Info Display Module harness connector X3.
17. Connect the EL-50334-2 to the K74 Human Machine Interface Control Module connector X5 and EL-50334-14 to the P17 Info Display Module X3. Connect EL-50334-2 and EL-50334-14 together.
18. Engine running, parking brake applied, transmission in R.

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19. Verify the enhanced image displays properly.
    - **If the enhanced image displays properly**

      Replace the K188 Human Machine Interface Control Module Bypass Module.

    - **If the enhanced image does not display properly**
20. Replace the K74 Human Machine Interface Control Module.
    - **If image is displayed**
21. All OK.

Repair Instructions

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

- **Rearview Driver Information Camera Replacement**
- **Control Module References** for control module replacement, programming, and setup.

REAR VISION CAMERA SYSTEM MALFUNCTION (WITH IO5/IO6 WITH REAR SEAT ENTERTAINMENT)

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
Camera Ignition/RAP voltage	1	1	-	-
Camera Backup Signal	1	1	-	-
Camera Module signal +	1	1	1	-
Camera Module signal -	1	1	1	-
Camera Ground	-	1	-	-
Bypass Module B+	B127E 00,2,4	B127E 00,2,4	-	-
Bypass Module Ignition	5	5	-	-
Bypass Module Backup Signal	5	5	-	-
Bypass Module signal +	B127B 2B, 3	B127B 2B, 3	B127B 2B, 3	-
Bypass Module signal -	B127B 2B, 3	B127B 2B, 3	B127B 2B, 3	-
Bypass Module Ground	-	2,4	-	-
Shield	-	-	-	-
LIN serial Data	B127E 00	6	-	-
USB harness (K74 to K188)	B127E 00	B127E 00, 3	-	-
USB harness (K188 to P17)	-	4	-	-
1. Rear vision camera inoperative 2. No radio information display on P17 Info Display Module 3. Rear vision camera image lacks projection lines and object detection symbols				

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
4. No rear camera or radio information display on P17 Info Display Module 5. Possible delayed rear vision displayed on Info Display Module 6. No start up animation on the P17 Info Display Module.				

Circuit/System Description

When the transmission is placed into R, a 12 V signal is sent to the Rearview Camera indicating that camera operation is requested. Ignition voltage and ground are supplied to the Rearview Camera. The Rearview Camera sends video image to the K188 Human Machine Interface Control Module Bypass Module through a video signal + and a video signal - circuit. The K188 Human Machine Interface Control Module Bypass Module passes the video image to K74 Human Machine Interface Control Module via video signal + and a video signal - circuits. The K188 Human Machine Interface Control Module Bypass Module is used to ensure the K74 Human Machine Interface Control Module produces a quality rear vision camera image to be displayed on the P17 Info Display Module when the vehicle is placed in reverse gear. In the event the K188 Human Machine Interface Control Module Bypass Module detects an issue with the camera image generated by the K74 Human Machine Interface Control Module, such as a black, solid color, frozen, or image other than the camera image, the K188 Human Machine Interface Control Module Bypass Module will assume control of the image to the P17 Info Display Module and displays a raw camera image with no park assist projection lines or object detection symbols for the entire reverse cycle.

The K188 Human Machine Interface Control Module Bypass Module is part of the video signal + and a video signal - circuits path from the B87 Rearview Camera to the K74 Human Machine Interface Control Module as well as the digital LVDS path (USB cable) between the K74 Human Machine Interface Control Module and P17 Info Display Module and needs to be active for either signal to be received by these modules. The K188 Human Machine Interface Control Module Bypass Module is not connected to serial data and uses the reverse lamp voltage input to determine the vehicle gear state.

Diagnostic Aids

A poor video image can be caused by ice, snow, and mud buildup on the lens of the Rearview Camera. Also, extreme lighting conditions can affect performance, such as operating in the dark or with bright sunlight shining on the camera. Extreme high or low temperatures can also affect the image quality. An open or high resistance in the shield of the video signal circuit can also cause a distorted screen.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Rear Vision Camera Description and Operation

Electrical Information Reference

- **Circuit Testing**

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

Scan Tool Reference

Control Module References for scan tool information

Special Tools

EL-50334-15 Mini B Male USB to Mini B Male USB test harness

EL-50334-50 GM Infotainment Tester Kit

Circuit/System Verification

NOTE: **If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.**

1. Verify there is no debris on the B87 Rearview Camera lens and that the bezel and bezel seal are not damaged.
   - **If debris is found on the lens**

     Clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.

   - **If there is no debris on the lens**
2. Engine running, parking brake applied, transmission in R.
3. Verify the backup lamps are illuminated.
   - **If the backup lamps are not illuminated**

     Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

   - **If the backup lamps are illuminated**
4. Ignition ON. Verify P17 Info Display Module displays the home screen and radio information properly.
   - **If the P17 Info Display is not displaying properly**
   1. Engine running, parking brake applied, transmission in R.
   2. Verify a clear rear vision image is displayed on the P17 Info Display Module.
      - **If a clear rear vision image is displayed**

        Refer to Circuit/System Testing- A: Info Display does not Display Radio Information

      - **If a clear rear vision image is not displayed**

        Refer to Circuit/System Testing - B: Info Display Module does not Display Anything.

   - **If the P17 Info Display displays properly**
5. Engine running, parking brake applied, transmission in R.
6. Verify a clear rear vision image is displayed on the P17 Info Display Module.

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- **If a clear image is not displayed**

  Refer to Circuit/System Testing - C: No Rear View Camera Image.

- **If a clear image is displayed**

7. Verify a clear enhanced rear vision image, which includes projected path lines and object detection indicators, is displayed on the P17 Info Display Module.
   - **If an enhanced clear image is not displayed**

     Refer to Circuit/System Testing - D: No Enhanced Rear View Camera Image.

   - **If an enhanced clear image is displayed**
8. All OK.

Circuit/System Testing

Circuit/System Testing- A: Info Display does not Display Radio Information

1. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5 and the K188 Human Machine Interface Control Module Bypass Module harness connector X2.
2. Connect the EL-50334-2 to the K74 Human Machine Interface Control Module connector X5 and EL-50334-14 to the K188 Human Machine Interface Control Module Bypass Module connector X2. Connect EL-50334-2 and EL-50334-14 together.
3. Ignition ON/Vehicle in Service Mode, infotainment system ON.
4. Verify the P17 Info Display Module displays and image.
   - **If the P17 Info Display Module does not display an image.**

     Replace the K74 Human Machine Interface Control Module.

   - **If the P17 Info Display Module displays an image.**
5. Replace the USB harness between the K74 Human Machine Interface Control Module to the K188 Human Machine Interface Control Module Bypass Module.

Circuit/System Testing - B: Info Display Module does not Display Anything

1. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the K188 Human Machine Interface Control Module Bypass Module ground circuit terminal 5 X1 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ground circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.

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

   - **If less than 10 Ω**
3. Verify a test lamp illuminates between the B+ circuit terminal 1 X1 and ground.
   - **If the test lamp does not illuminate and the circuit fuse is good**
   1. Ignition OFF.

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2. Test for less than 2 Ω in the B+ circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse.
- **If the test lamp does not illuminate and the circuit fuse is open**

1. Ignition OFF.
2. 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, replace the K188 Human Machine Interface Control Module Bypass Module.
- **If the test lamp illuminates**

4. Ignition ON.
5. Verify a test lamp illuminates between the ignition circuit terminal 2 X1 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**

    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**

    1. Ignition OFF.
    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 K188 Human Machine Interface Control Module Bypass Module.
    - **If the test lamp illuminates**

6. Engine running, park brake applied, transmission in R.
7. Verify a test lamp illuminates between the control circuit terminal 9 X1 and ground.
    - **If the test lamp does not illuminate**

    1. Ignition OFF.
    2. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
    - **If the test lamp illuminates**

8. Reconnect the K188 Human Machine Interface Control Module Bypass Module.
9. Ignition OFF, disconnect the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.
10. Ignition OFF, connect the EL-50334-15 orange end to the P17 Info Display Module connector X3 and EL-50334-15 B1 end (short end) to the K188 Human Machine Interface Control Module Bypass Module connector X3.
11. Engine running, parking brake applied, transmission in R.

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12. Verify the rear view image displays properly.
    - **If the image displays properly**

      Replace the USB harness between the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.

    - **If the image does not display properly**
13. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5.
14. Connect the EL-50334-15 B1 end (short end) to the K74 Human Machine Interface Control Module connector X5 and connect the EL-50334-15 orange end to the P17 Info Display Module connector X3.
15. Engine running, parking brake applied, transmission in R.
16. Verify the rear view image displays properly.
    - **If rear view image displays properly**

      Replace the K188 Human Machine Interface Control Module Bypass Module.

    - **If the rear view image does not display properly**
17. Replace the P17 Info Display Module.
18. Engine running, parking brake applied, transmission in R.
19. Verify the rear view image displays properly.
    - **If rear view image is not displayed**

      Replace the B87 Rearview Camera.

    - **If rear view image is displayed**
20. All OK.

Circuit/System Testing - C: No Rear View Camera Image

1. Ignition OFF and all vehicle systems OFF, disconnect the B87 Rearview Camera harness connector It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 5 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.

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

    - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 6 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.

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- If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .

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

1. Ignition OFF.
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 B87 Rearview Camera.

- **If the test lamp illuminates**

5. Engine running, park brake applied, transmission in R.
6. Verify a test lamp illuminates between the control circuit terminal 3 and ground.
   - **If the test lamp does not illuminate**

   1. Ignition OFF.
   2. Test for less than 2 Ω in the ignition circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the circuit.
      - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

   - **If the test lamp illuminates**

7. Ignition OFF, disconnect the X1 harness connector at the K188 Human Machine Interface Control Module Bypass Module, ignition ON.
8. Test for less than 1 V between the signal circuit terminals listed below and ground:
   - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 6 X1
   - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 18 X1
   - **If 1 V or greater**

     Repair the short to voltage on the circuit.

   - **If less than 1 V**
9. Ignition OFF.
10. Test for infinite resistance between the signal circuit terminals listed below and ground:
    - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 6 X1
    - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 18 X1
    - **If less than infinite resistance**

      Repair the short to ground on the circuit.

    - **If infinite resistance**
11. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 6 X1 and the B87 Rearview Camera signal (+) circuit terminal 1.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
12. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module

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signal (-) circuit terminal 18 X1 and the B87 Rearview Camera signal (-) circuit terminal 4.

- **If 2 Ω or greater**

  Repair the open/high resistance on the circuit.

- **If less than 2 Ω**

13. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
14. Test for less than 10 Ω between the K188 Human Machine Interface Control Module Bypass Module ground circuit terminal 5 X1 and ground.
    - **If 10 Ω or greater**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ground circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.

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

    - **If less than 10 Ω**
15. Verify a test lamp illuminates between the B+ circuit terminal 1 X1 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the B+ circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse.
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    2. 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, replace the K188 Human Machine Interface Control Module Bypass Module.
    - **If the test lamp illuminates**
16. Ignition ON.
17. Verify a test lamp illuminates between the ignition circuit terminal 2 X1 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    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 K188 Human Machine Interface Control Module Bypass

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Module.

- **If the test lamp illuminates**

18. Engine running, park brake applied, transmission in R.
19. Verify a test lamp illuminates between the control circuit terminal 9 X1 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
    - **If the test lamp illuminates**
20. Reconnect the K188 Human Machine Interface Control Module Bypass Module.
21. Ignition OFF, disconnect the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.
22. Ignition OFF, connect the EL-50334-15 orange end to the P17 Info Display Module connector X3 and EL-50334-15 B1 end (short end) to the K188 Human Machine Interface Control Module Bypass Module connector X3.
23. Engine running, parking brake applied, transmission in R.
24. Verify the rear view image displays properly.
    - **If the image displays properly**

      Replace the USB harness between the P17 Info Display Module connector X3 and the K188 Human Machine Interface Control Module Bypass Module connector X3.

    - **If the image does not display properly**
25. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5.
26. Connect the EL-50334-15 B1 end (short end) to the K74 Human Machine Interface Control Module connector X5 and connect the EL-50334-15 orange end to the P17 Info Display Module connector X3.
27. Engine running, parking brake applied, transmission in R.
28. Add Nyogel lubricant 760G to electrical terminals.
29. Reconnect all electrical connections.
30. Verify the rear view image displays properly.
    - **If rear view image displays properly**

      Replace the K188 Human Machine Interface Control Module Bypass Module.

    - **If the rear view image does not display properly**
31. Replace the P17 Info Display Module.
32. Engine running, parking brake applied, transmission in R.
33. Verify the rear view image displays properly.
    - **If rear view image is not displayed**

      Replace the B87 Rearview Camera.

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- **If rear view image is displayed**

34. All OK.

Circuit/System Testing - D: No Enhanced Rear View Camera Image

1. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X2 harness connector and K188 Human Machine Interface Control Module Bypass Module X1 harness connector. Ignition ON.
2. Test for less than 1 V between the signal circuit terminals listed below and ground:
   - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 8 X1
   - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 20 X1
   - **If 1 V or greater**

     Repair the short to voltage on the circuit.

   - **If less than 1 V**
3. Ignition OFF.
4. Test for infinite resistance between the signal circuit terminals listed below and ground:
   - K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 8 X1
   - K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 20 X1
   - **If less than infinite resistance**

     Repair the short to ground on the circuit.

   - **If infinite resistance**
5. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module signal (+) circuit terminal 8 X1 and the K74 Human Machine Interface Control Module signal (+) circuit terminal 5 X2.
   - **If 2 Ω or greater**

     Repair the open/high resistance on the circuit.

   - **If less than 2 Ω**
6. Test for less than 2 Ω between the K188 Human Machine Interface Control Module Bypass Module signal (-) circuit terminal 20 X1 and the K74 Human Machine Interface Control Module signal (+) circuit terminal 6 X2.
   - **If 2 Ω or greater**

     Repair the open/high resistance on the circuit.

7. Ignition ON.

NOTE: **For accurate voltage reading, disconnect the battery charger prior to performing the following test step.**

8. Test for 2-12 V between the K188 Human Machine Interface Control Module Bypass Module LIN serial data circuit terminal 3 X1 and ground.
   - **If less than 2 V**
   1. Ignition OFF.

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2. Test for infinite resistance between the serial data circuit and ground.
    - If less than infinite resistance, repair the short to ground on the circuit.
    - If infinite resistance
3. Test for less than 2 Ω in the serial data circuit end to each end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω
4. Replace P17 Info Display Module.
5. Reconnect the K74 Human Machine Interface Control Module, ignition ON.
6. Test for 2-12 V between the LIN serial data circuit terminal and ground.
    - If less than 2 V, replace the K74 Human Machine Interface Control Module.
    - If greater than 2 V, replace the K188 Human Machine Interface Control Module Bypass Module.

- **If greater than 12 V**

1. Ignition OFF, disconnect the X1 harness connector at the P17 Info Display Module.
2. Ignition ON.
3. Test for less than 1 V between the serial data circuit and ground.
    - If 1 V or greater, repair the short to voltage on the circuit.
    - If less than 1 V
4. Replace P17 Info Display Module.
5. Ignition OFF, reconnect the K74 Human Machine Interface Control Module, ignition ON.
6. Test for 2-12 V between the LIN serial data circuit terminal and ground.
    - If greater than 12 V, replace the K74 Human Machine Interface Control Module.
    - If less than 12 V, replace the K188 Human Machine Interface Control Module Bypass Module.

- **If between 2-12 V**

9. Re-connect the K74 Human Machine Interface Control Module and the K188 Human Machine Interface Control Module Bypass Module harness connectors.
10. Ignition OFF, disconnect the K74 Human Machine Interface Control Module X5 and the K188 Human Machine Interface Control Module Bypass Module harness connector X2.
11. Connect the EL-50334-2 to the K74 Human Machine Interface Control Module connector X5 and EL-50334-14 to the K188 Human Machine Interface Control Module Bypass Module connector X2. Connect EL-50334-2 and EL-50334-14 together.
12. Engine running, parking brake applied, transmission in R.
13. Verify the enhanced rear view image displays properly.
    - **If the enhanced image displays properly**

      Replace the USB harness between the K74 Human Machine Interface Control Module X5 and the K188 Human Machine Interface Control Module Bypass Module harness connector X2.

    - **If the enhanced image does not display properly**
14. Ignition OFF, remove the EL-50334-14 from the K188 Human Machine Interface Control Module Bypass Module harness connector X2 and EL-50334-2 from the K74 Human Machine Interface Control Module connector X5.

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15. Re-connect the K188 Human Machine Interface Control Module Bypass Module harness connector X2.
16. Disconnect the P17 Info Display Module harness connector X3.
17. Connect the EL-50334-15 B1 end (short end) to the K74 Human Machine Interface Control Module connector X5 and EL-50334-15 orange end to the P17 Info Display Module X3.
18. Engine running, parking brake applied, transmission in R.
19. Verify the enhanced image displays properly.
    - **If the enhanced image displays properly**

      Replace the K188 Human Machine Interface Control Module Bypass Module.

    - **If the enhanced image does not display properly**
20. Replace the K74 Human Machine Interface Control Module.
    - **If image is displayed**
21. All OK.

Repair Instructions

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

- **Rearview Driver Information Camera Replacement**
- **Control Module References** for control module replacement, programming, and setup.

REAR VISION CAMERA SYSTEM MALFUNCTION (WITH IOB)

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
Ignition	B127B 08,1	B127B 08,1	-	-
Backup Signal	B127B 08,1	B127B 08,1	-	-
Camera Module signal +	B127B 08,1	B127B 08,1	B127B 08, 2	-
Camera Module signal -	B127B 08, 3	B127B 08,1	B127B 08,1	-
Ground	-	B127B 08,1	-	-
Shield	-	3	-	-
1. Rear vision camera inoperative 2. Rear vision camera image always displayed 3. Poor Quality Image				

Circuit/System Description

When the transmission is placed into R, a 12 V signal is sent to the rearview camera indicating that camera operation is requested. Ignition voltage and ground are supplied to the rearview camera. The rearview camera sends video information to the radio through a video signal + and a video signal - circuit. A grounded shielding

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also wraps the video signal circuits to reduce electronic interference which may degrade the video signal and cause a distorted or otherwise degraded image.

Conditions for Running the DTC

- Engine running
- Transmission in R

Conditions for Setting the DTC

The video signal from the rearview camera has not been received by the Radio for 2.5 s.

Action Taken When the DTC Sets

- The Radio stores the DTC in memory.
- A service message may be displayed on the driver information center of info display module.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 40 malfunction-free ignition cycles have occurred.

Diagnostic Aids

A poor video image can be caused by ice, snow, and mud buildup on the lens of the rearview camera. Also, extreme lighting conditions can affect performance, such as operating in the dark or with bright sunlight shining on the camera. Extreme high or low temperatures can also affect the image quality. An open in the shield of the video signal circuit can also cause a distorted screen.

Terminal fretting or incorrectly seated connectors can cause a poor image displayed condition. Check the circuit terminals for fretting or incorrectly seated connector. If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Rear Vision Camera Description and Operation

Electrical Information Reference

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

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: **If the condition is intermittent or cannot be duplicated, disconnect the connectors and add Nyogel lubricant 760G. This procedure will correct the high resistance condition due to terminal fretting corrosion.**

1. Verify P17 Info Display Module displays infotainment system information properly.
   - **If infotainment system information does not display properly**

     Refer to **Radio Information Display Malfunction (IOB)** .

   - **If infotainment system information displays properly**
2. Verify there is no debris on the B87 Rearview Camera lens and that the bezel and bezel seal are not damaged.
   - **If debris is found on the lens**

     Clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.

   - **If there is no debris on the lens**
3. Engine running, transmission in R.
4. Verify the backup lamps are illuminated.
   - **If the backup lamps are not illuminated**

     Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .

   - **If the backup lamps are illuminated**
5. Engine running, transmission in R.
6. Verify a clear rear vision image is displayed on the P17 Info Display Module.
   - **If a clear image is not displayed**

     Refer to Circuit/System Testing.

   - **If a clear image is displayed**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X900 harness connector. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 7 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF.

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2. Test for less than 2 Ω in the ground circuit end to end.
    - If 2 Ω or greater, repair the open/high resistance in the circuit.
    - If less than 2 Ω, repair the open/high resistance in the ground connection.
- **If less than 10 Ω**

3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 4 and ground.
    - **If the test lamp does not illuminate and the circuit fuse is good**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is OK and there is voltage at the fuse. Refer to **Power Mode Mismatch** .
    - **If the test lamp does not illuminate and the circuit fuse is open**
    1. Ignition OFF.
    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 B87 Rearview Camera.
    - **If the test lamp illuminates**
5. Engine running, park brake applied, transmission in R.
6. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF.
    2. Test for less than 2 Ω in the ignition circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, verify the fuse is good and there is voltage at the fuse. Refer to **Backup Lamps Malfunction (Manual Transmission)** **Backup Lamps Malfunction (Automatic Transmission)** .
    - **If the test lamp illuminates**
7. Ignition OFF, disconnect the X1 harness connector at the A11 Radio, ignition ON.
8. Test for less than 1 V between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 15 X1
    - A11 Radio signal (-) circuit terminal 14 X1
    - **If 1 V or greater**

      Repair the short to voltage on the circuit.

    - **If less than 1 V**
9. Test for infinite resistance between the signal circuit terminals listed below and ground:
    - A11 Radio signal (+) circuit terminal 15 X1
    - A11 Radio signal (-) circuit terminal 14 X1
    - **If less than infinite resistance**

      Repair the short to ground on the circuit.

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- **If infinite resistance**

10. Test for less than 2 Ω between the A11 Radio signal (+) circuit terminal 15 X1 and the X900 signal (+) circuit terminal 3.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
11. Test for less than 2 Ω between the A11 Radio signal (-) circuit terminal 14 X1 and the X900 signal (-) circuit terminal 8.
    - **If 2 Ω or greater**

      Repair the open/high resistance on the circuit.

    - **If less than 2 Ω**
12. Add Nyogel lubricant 760G to electrical terminals.
13. Reconnect all electrical connections.
14. Engine running, park brake applied, transmission in R.
15. Verify a clear rear vision image is displayed on the P17 Info Display Module.
    - **If a blank blue screen or distorted image is displayed**
    1. Replace the B87 Rearview Camera.
    2. Engine running, transmission in R,
    3. Verify a clear rear vision image is displayed on the P17 Info Display Module.
        - **If a clear rear vision image is not displayed**

          Replace the K74 Human Machine Interface Control Module.

        - **If a clear rear vision image is displayed**
    4. All OK.
    - **If a blank black screen is displayed**

      Replace the K74 Human Machine Interface Control Module.

    - **If a clear rear vision image is displayed**
16. All OK.

Repair Instructions

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

- **Rearview Driver Information Camera Replacement**
- **Control Module References** for control module replacement, programming, and setup.

LANE DEPARTURE WARNING SYSTEM MALFUNCTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

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- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B356A 02	1	B356A 05	-
Ground	-	1	-	-
High Control (Terminal 2)	B0987 06, B1011 00	B0987 06, B1011 00	-	-
Low Control (Terminal 6)	B0987 06, B1011 00	B0987 06, B1011 00	B0987 01, B1011 00	-
1. Lane departure warning switch malfunction.				

Circuit/System Description

The frontview camera module monitors the lane departure warning switch signal circuit. The frontview camera module applies voltage and monitors the switch signal circuit. The lane departure warning switch is normally open switch. With the switches open, voltage seen at the frontview camera module is high. When a switch is pressed, the signal circuit is pulled to ground and the voltage seen by the frontview camera module is low. The frontview camera module will respond to this by activating or deactivating the lane departure warning feature.

When the lane departure warning is enabled, the frontview camera module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the frontview camera module.

Diagnostic Aids

Certain factors will affect the operation of the lane departure warning system. When the system is operating properly, the green lane departure warning indicator will illuminate on the instrument cluster. This indicates that all of the required operating conditions to permit lane departure warning have been met. The green lane departure warning indicator will not appear when the system is having difficulty seeing the lines on the road or if the view of the front view camera is blocked with mud, dirt, snow, ice, or slush, if the windshield is damaged, or when weather limits visibility, such as while driving in fog, rain, or snow conditions. This is normal operation, the vehicle does not need service. Additionally, lane departure warnings may occasionally occur in a properly operating vehicle due to tar marks, shadows, cracks in the road, or other road imperfections. This is normal system operation and the vehicle does not require service. The driver information center may also display Lane Departure System Unavailable due to the temporary conditions listed above.

The driver information center may also display LANE DEPARTURE WARNING SYSTEM UNAVAILABLE when the front camera module and bracket assembly is not properly installed. It may be helpful to verify the correct installation of the front camera and bracket assembly. Calibrate the front camera module after repair. Refer to **Front View Camera Module Learn**

Additionally, the Front View Camera Disable History can give useful hints about what affected the operation of the lane departure warning system. For the Front View Camera Disable History, refer to **DTC B1011**.

Reference Information

Schematic Reference

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Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning 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: **Refer to Diagnostic Aids before performing Circuit/System Verification.**

1. Ignition ON.
2. Verify the K43 Power Steering Control Module (if equipped) and the K17 Electronic Brake Control Module do not have any DTCs set.
   - **If any DTC is set**

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

   - **If the DTC is not set**
3. Verify that DTC B356A is not set.
   - **If the DTC is set**

     Refer to **DTC B356A**.

   - **If the DTC is not set**
4. Verify that DTC B0987 is not set.
   - **If the DTC is set**

     Refer to **DTC B0987**.

   - **If the DTC is not set**
5. Verify that DTC B1011 is not set.
   - **If the DTC is set**

     Refer to **DTC B1011**.

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- **If the DTC is not set**

6. Verify the scan tool Frontview Camera Disable History 1 parameter does not have a current Malfunction
   - **If the parameter is Malfunction**

     Refer to Diagnostic Aids.

   - **If the parameter is Normal**
7. Verify the scan tool Frontview Camera System Status parameter is Normal.
   - **If the parameter is Undefined or Malfunction**

     Refer to Diagnostic Aids.

   - **If the parameter is Normal**
8. Verify the scan tool Lane Departure Warning Switch Status parameter changes between Open and Closed while pressing and releasing the lane departure warning switch.
   - **If the parameter does not change between Open and Closed**

     Refer to Lane Departure Warning Switch Malfunction in Circuit/System Testing.

   - **If the parameter changes between Open and Closed**
9. Verify the scan tool Lane Departure Warning Switch indicator turns on and off while pressing and releasing the lane departure warning switch.
   - **If the indicator does not turn on and off**

     Refer to Lane Departure Warning Switch Indicator Malfunction in Circuit/System Testing.

   - **If the indicator turns on and off**
10. Verify the area of the K109 Frontview Camera Module for contamination.
    - **If it needs to be cleaned**

      Clean the windshield.

    - **If it does not need to be cleaned**
11. All OK.

Circuit/System Testing

Lane Departure Warning Switch Circuit Malfunction

1. Ignition ON and all vehicle systems OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 14 and ground.
   - **If 10 Ω or greater**
   1. Ignition OFF.
   2. Test for less than 2 Ω in the ground circuit end to end.
      - If 2 Ω or greater, repair the open/high resistance in the ground circuit.
      - If less than 2 Ω, repair the open/high resistance in the ground connection.
   - **If less than 10 Ω**

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3. Verify the scan tool Lane Departure Warning Switch Status parameter is Open.
    - **If not Inactive**
    1. Ignition OFF, disconnect the harness connector at the K109 Frontview Camera Module.
    2. Test for infinite resistance between the signal circuit terminal 8 and ground.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance, replace the K109 Frontview Camera Module.
    - **If Inactive**
4. Install a 3 A fused jumper wire between the signal circuit terminal 8 and ground.
5. Verify the scan tool Lane Departure Warning Switch Status parameter is Closed.
    - **If not Closed**
    1. Ignition OFF, disconnect the harness connector at the K109 Frontview Camera Module, ignition ON.
    2. Test for less than 1 V between the signal circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    3. Ignition OFF
    4. Test for less than 2 Ω in the signal circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the K109 Frontview Camera Module.
    - **If Closed**
6. Test or replace the S48A Multifunction Switch - Instrument Panel.

Lane Departure Warning Switch Indicator Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel, ignition ON.
2. Verify a test lamp illuminates between the control circuit terminal 2 and ground.
    - **If the test lamp does not illuminate**
    1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module.
    2. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, refer to **Interior Backlighting Malfunction** .
    - **If the test lamp illuminates**
3. Ignition OFF, connect the harness connector at the S48A Multifunction Switch - Instrument Panel. Disconnect the X1 harness connector at the K109 Frontview Camera Module, ignition ON.
4. Verify the lane departure warning switch indicator is not illuminated.
    - **If the lane departure warning switch indicator is illuminated**
    1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel.
    2. Test for infinite resistance between the S48A Multifunction Switch - Instrument Panel control circuit terminal 5 and ground.
        - If less than infinite resistance, repair the short to ground in the circuit.

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- If infinite resistance, replace the S48A Multifunction Switch - Instrument Panel.

- **If the lane departure warning switch indicator is not illuminated**

5. Connect a 3 A fused jumper wire between the control circuit terminal 5 and ground.
6. Verify the lane departure warning switch indicator is illuminated.
    - **If the lane departure warning switch indicator is not illuminated**
    1. Ignition OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel.
    2. Test for less than 1 V between the control circuit and ground.
        - If 1 V or greater, repair the short to voltage on the circuit.
        - If less than 1 V
    3. Ignition OFF.
    4. Test for less than 2 Ω in the control circuit end to end.
        - If 2 Ω or greater, repair the open/high resistance in the circuit.
        - If less than 2 Ω, replace the S48A Multifunction Switch - Instrument Panel.
    - **If the lane departure warning switch indicator is illuminated**
7. Replace the K109 Frontview Camera Module.

Repair Instructions

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

- **Vehicle Stability Control System Switch Replacement** for multifunction switch - instrument panel. replacement
- **Control Module References** for frontview camera module replacement, programming, and setup.

REPAIR INSTRUCTIONS

FRONT SEAT LANE DEPARTURE WARNING ACTUATOR REPLACEMENT

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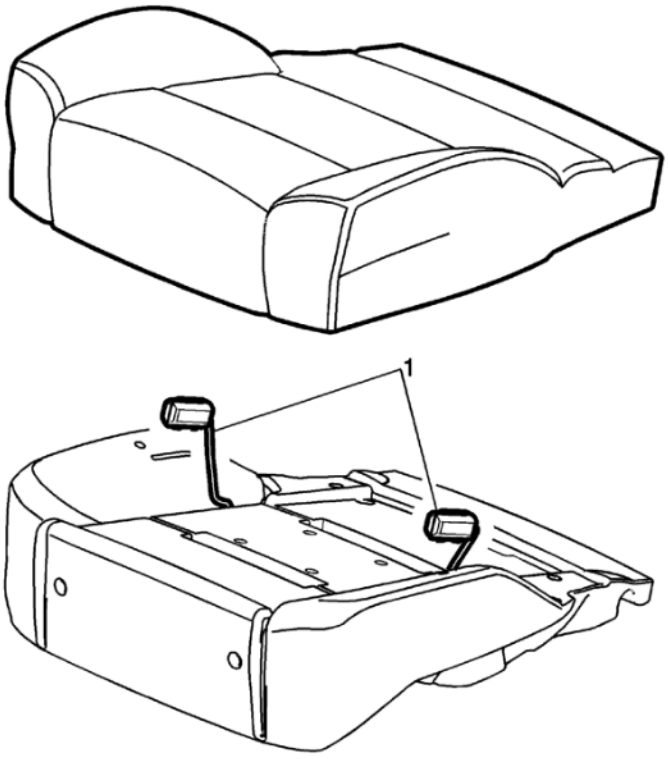


Fig. 10: Front Seat Lane Departure Warning Actuator
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: **Refer to SIR Warning .** **Preliminary Procedure** 1. Remove the driver or passenger seat. Refer to **Driver or Passenger Seat Removal and Installation** . 2. Remove the front seat cushion cover and pad. Refer to **Front Seat Cushion Cover and Pad Replacement** .	
1	Driver Front Seat Cushion Haptic Motor **Procedure** 1. Reposition the heater element as needed to gain access to the actuator wire. 2. Disconnect the electrical connector.

FORWARD COLLISION ALERT DISPLAY REPLACEMENT

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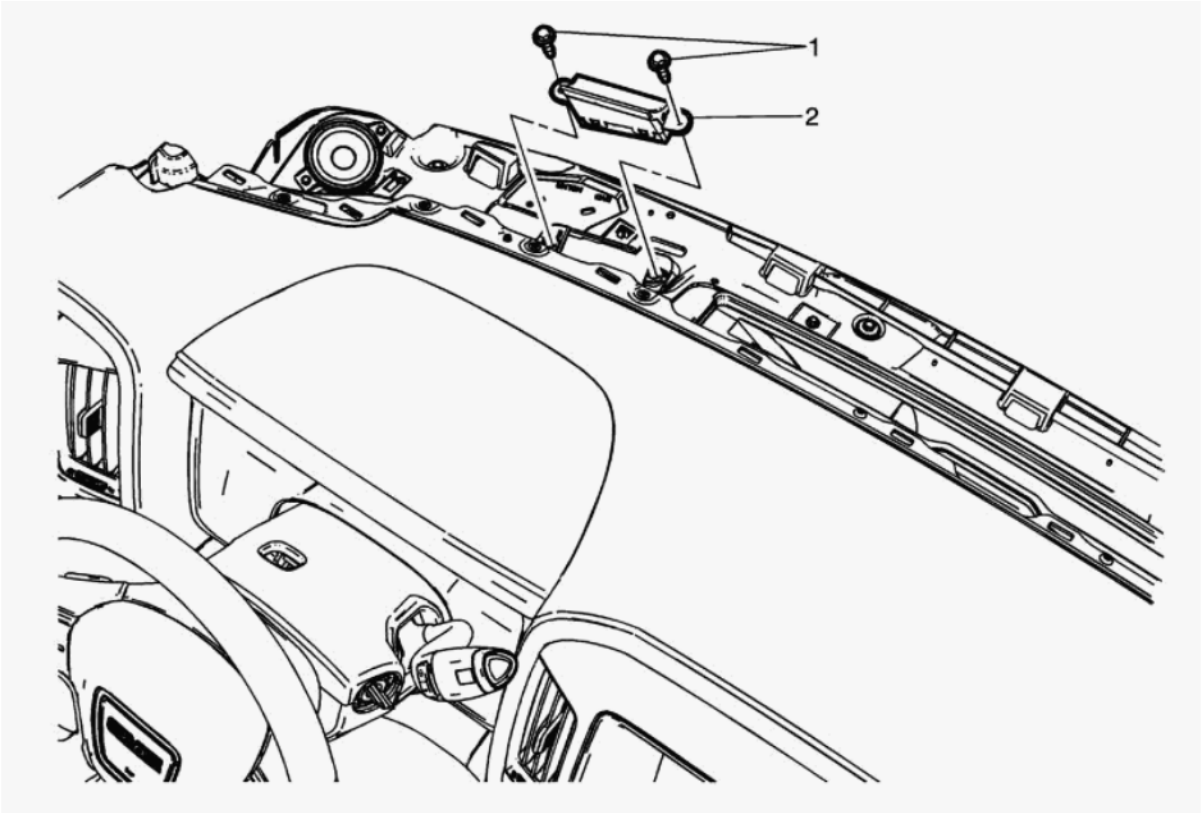


Fig. 11: Forward Collision Alert Display
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the instrument panel extension assembly. Refer to **Instrument Panel Extension Replacement** .	
1	Forward Collision Alert Display (Qty: 2) **CAUTION:** **Refer to** **Fastener** **Caution** .
2	Forward Collision Alert Display **Procedure** Disconnect the electrical connector.

PARKING ASSIST CONTROL MODULE REPLACEMENT

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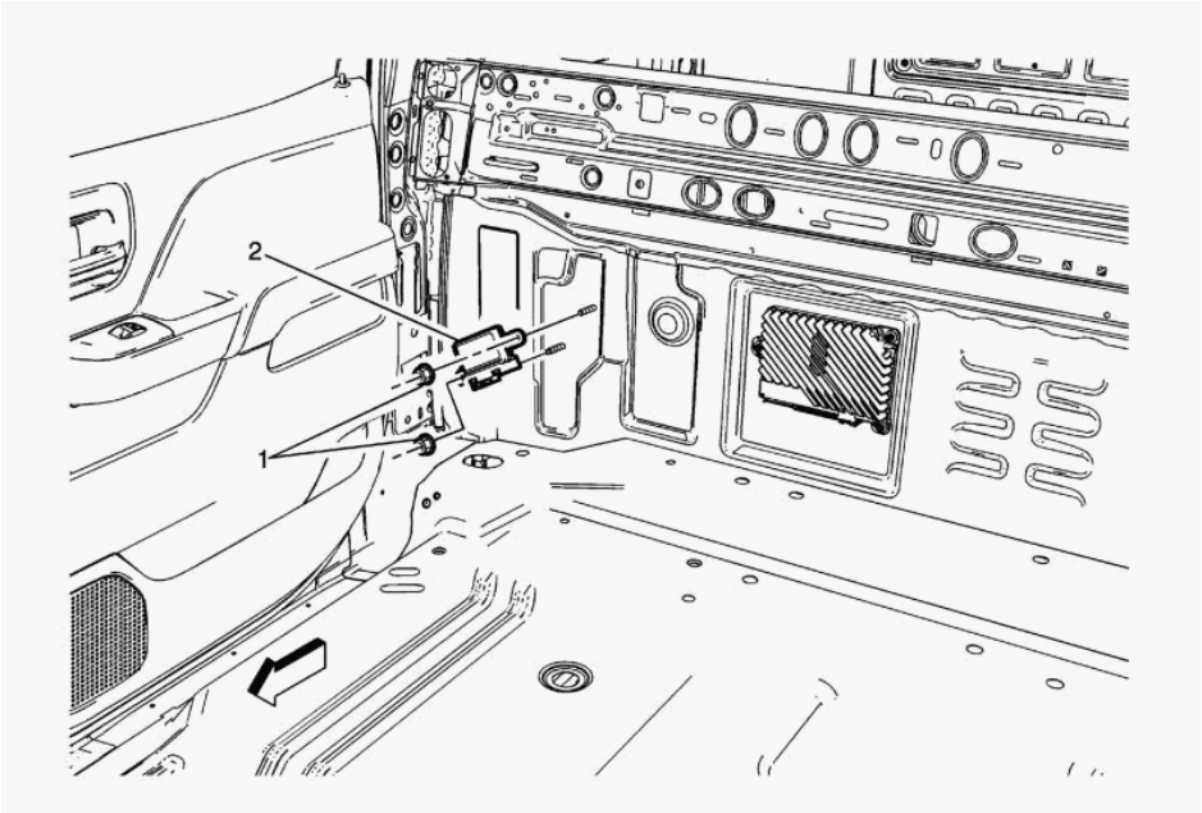


Fig. 12: Rear Object Alarm Control Module
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure 1. Remove the rear seat. Refer to **Rear Seat Removal and Installation (Extended Cab with AM7)** **Rear Seat Removal and Installation (Heavy Duty Crew Cab with A68)** **Rear Seat Removal and Installation (Light Duty Crew Cab with A68)** **Rear Seat Removal and Installation (Extended Cab with A68)** . 2. Remove the body rear panel insulator. Refer to **Body Rear Panel Insulator Replacement** .	
1	Rear Object Control Module Fasteners (Qty: 2) **CAUTION:** **Refer to** **Fastener Caution** . **Tighten** 6 N.m (53 lb in)
2	Rear Object Control Module **Procedure** 1. Disconnect the electrical connections. 2. For programming and set up, refer to **Control Module References** .

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FRONT PARKING ASSIST ALARM SENSOR REPLACEMENT (CHEVROLET OUTER)

Removal Procedure

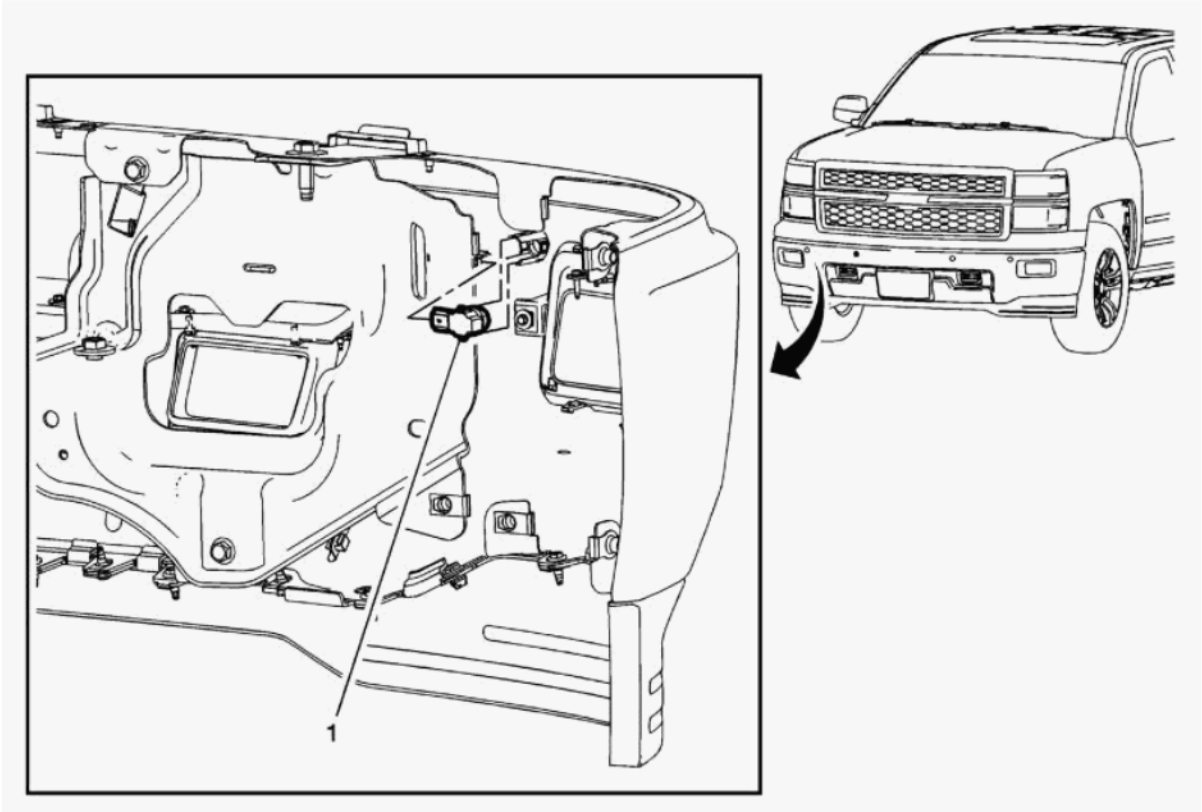


Fig. 13: Front Bumper Impact Bar
Courtesy of GENERAL MOTORS COMPANY

1. Raise and support the Vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Disconnect the electrical connector from the front parking assist alarm sensor.

NOTE: **The front parking assist alarm sensor is a one piece design. Do NOT twist the sensor cap to try and remove the painted cap. Replacement sensor requires painting to match fascia/bumper body color.**

3. Lift the locking tabs on the bracket and remove the front parking assist alarm sensor.

Installation Procedure

NOTE: **Do not refinish previously painted sensors. Excess paint build up will cause the sensor to be inoperative.**

1. Paint the front parking assist alarm sensor. Refer to **Basecoat/Clearcoat Paint Systems** .
2. Ensure the paint does not exceed 6 mils. Use a paint thickness gauge suitable for non-ferrous metals. Refer to **Paint Gauges** .

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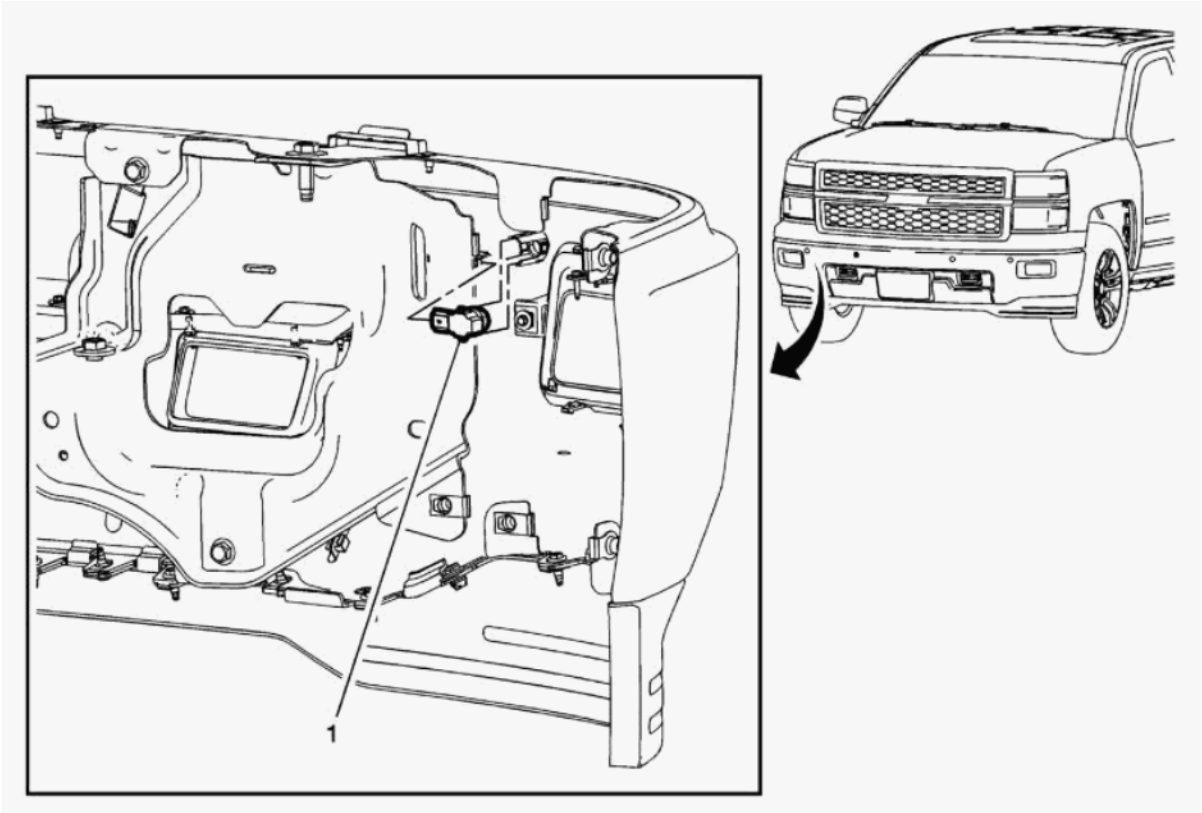


Fig. 14: Front Bumper Impact Bar
Courtesy of GENERAL MOTORS COMPANY

3. Insert the front parking assist alarm sensor into the bracket.
4. Connect the electrical connector to the front parking assist alarm sensor.

FRONT PARKING ASSIST ALARM SENSOR REPLACEMENT (GMC OUTER)

Removal Procedure

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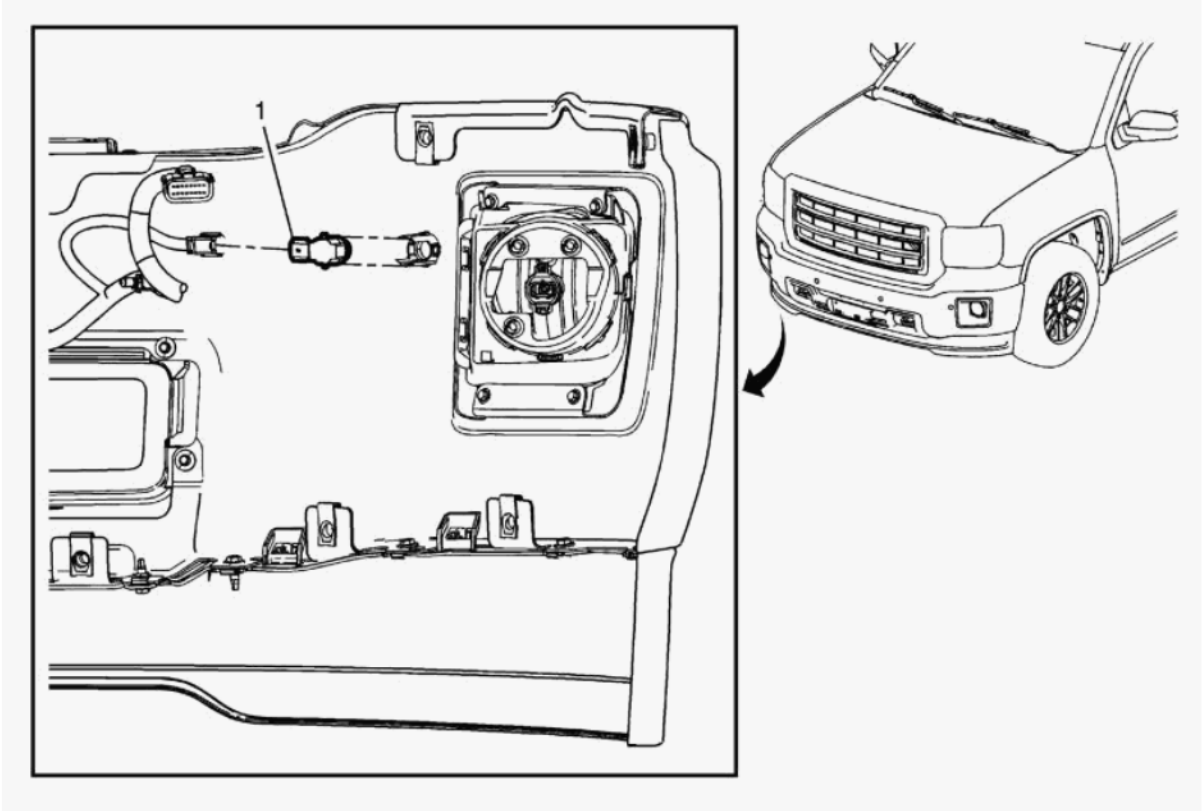


Fig. 15: Front Bumper Impact Bar
Courtesy of GENERAL MOTORS COMPANY

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Disconnect the electrical connector from the front parking assist alarm sensor.

NOTE: **The front parking assist alarm sensor is a one piece design. Do NOT twist the sensor cap to try and remove the painted cap. Replacement sensor requires painting to match fascia/bumper body color.**

3. Lift the locking tabs on the bracket and remove the front parking assist alarm sensor (1).

Installation Procedure

NOTE: **Do not refinish previously painted sensors. Excess paint build up will cause the sensor to be inoperative.**

1. Paint the front parking assist alarm sensor. Refer to **Basecoat/Clearcoat Paint Systems** .
2. Ensure the paint does not exceed 6 mils. Use a paint thickness gauge suitable for non-ferrous metals. Refer to **Paint Gauges** .

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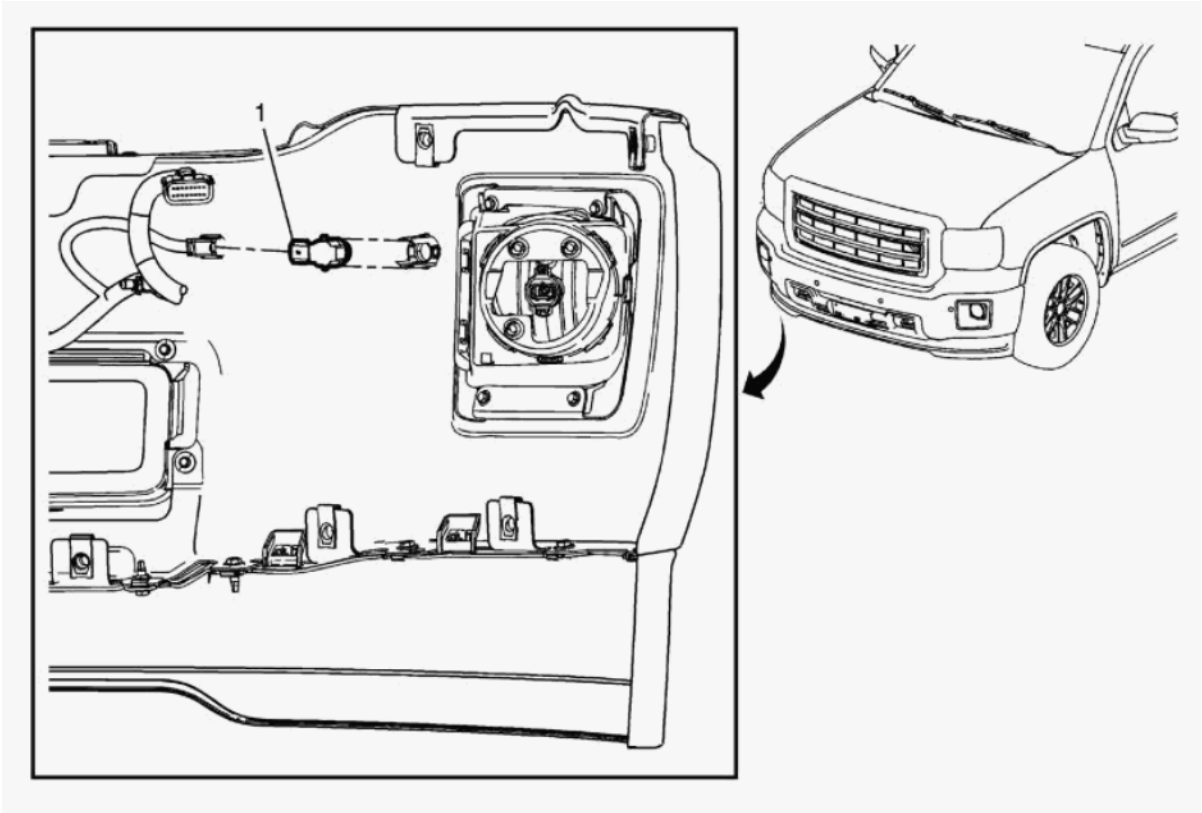


Fig. 16: Front Bumper Impact Bar
Courtesy of GENERAL MOTORS COMPANY

3. Insert the front parking assist alarm sensor into the bracket (1).
4. Connect the electrical connector to the front parking assist alarm sensor.

FRONT PARKING ASSIST ALARM SENSOR REPLACEMENT (CENTER)

Removal Procedure

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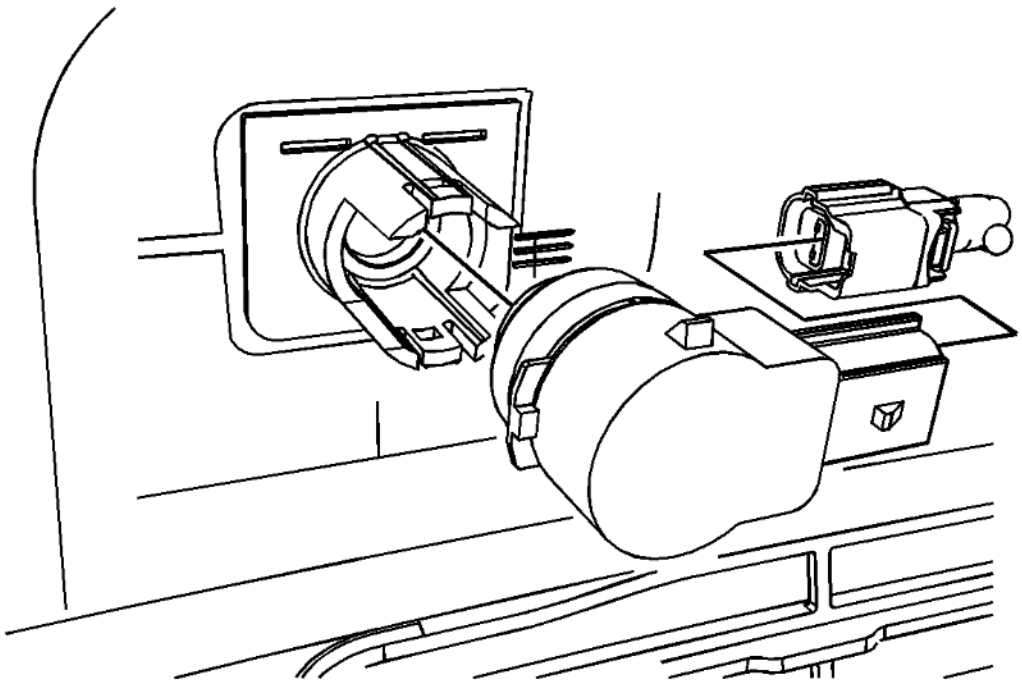


Fig. 17: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

1. Access the front parking assist alarm sensor from under the front impact bar.
2. Disconnect electrical from the front object alarm sensor.
3. Lift the locking tabs on the housing and remove the front object alarm sensor.

Installation Procedure

NOTE: **Do not refinish previously painted sensors. Excess paint build up will cause the sensor to be inoperative.**

1. Paint the front object alarm sensor. Refer to **Basecoat/Clearcoat Paint Systems** .
2. Ensure the paint does not exceed 6 mils. Use a paint thickness gauge suitable for non-ferrous metals. Refer to **Paint Gauges** .

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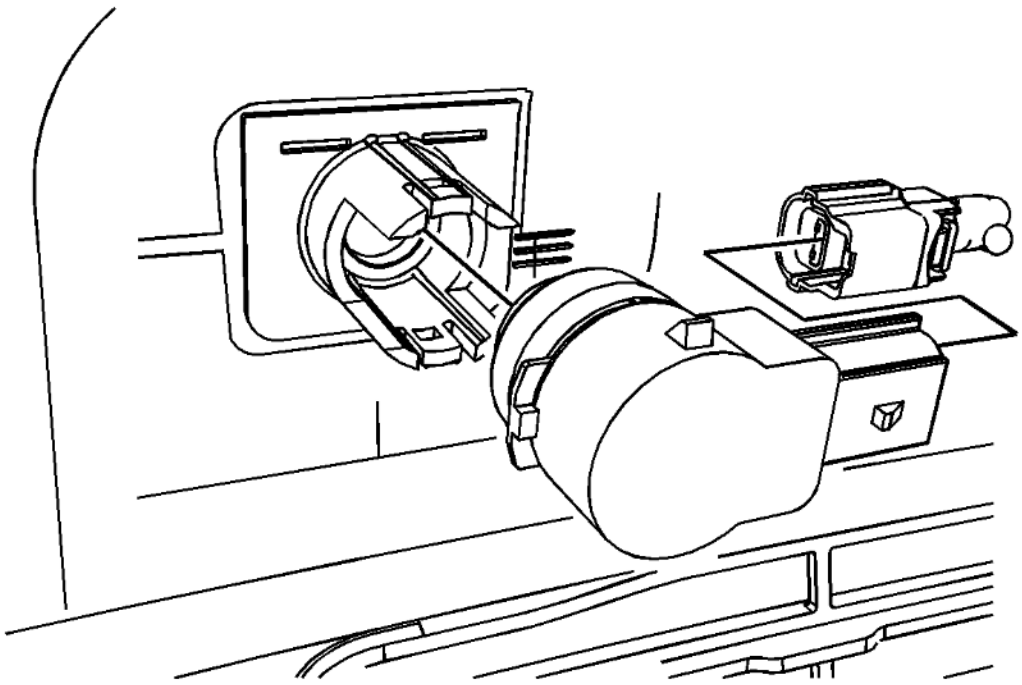


Fig. 18: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

3. Insert the sensor into the housing.
4. Connect the electrical connector to the front object alarm sensor.

FRONT PARKING ASSIST ALARM SENSOR BRACKET REPLACEMENT (CHEVROLET)

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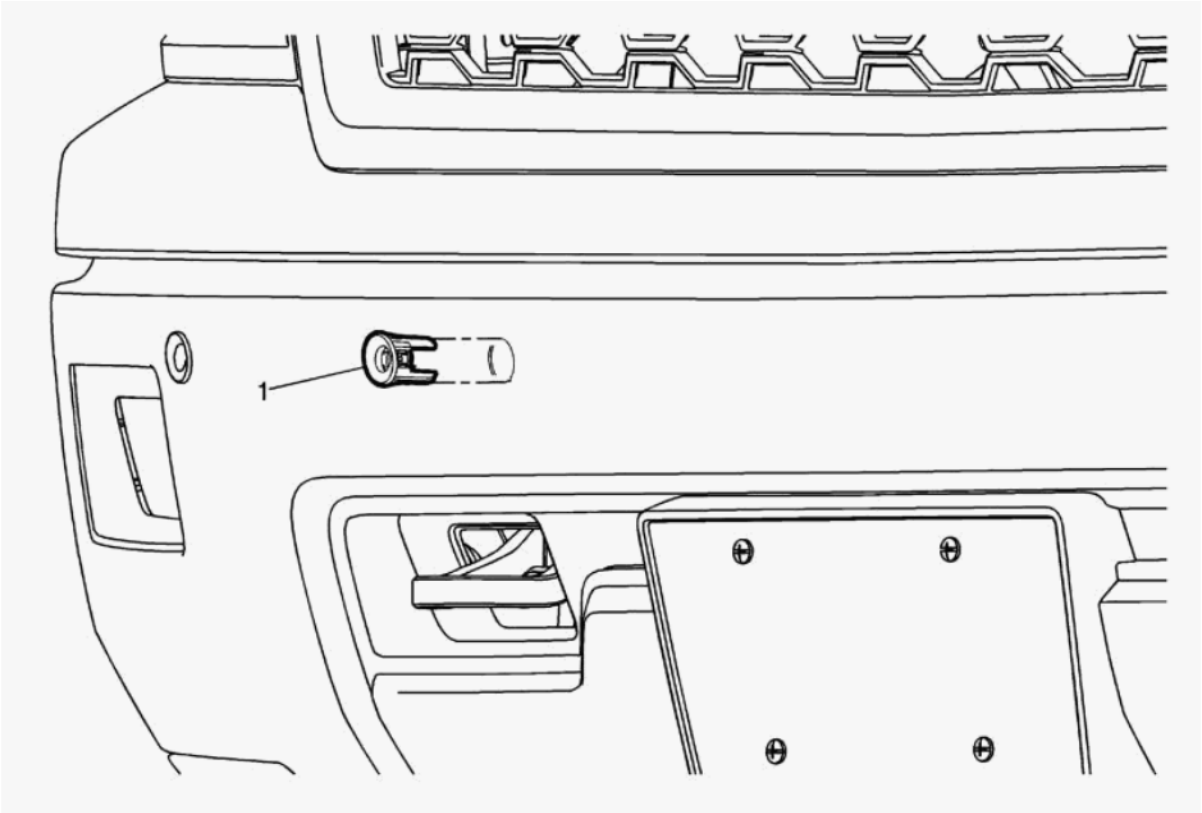


Fig. 19: Front Parking Assist Alarm Sensor Bracket (Chevrolet)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the front parking assist alarm sensor. Refer to **Front Parking Assist Alarm Sensor Replacement (Chevrolet Outer)Front Parking Assist Alarm Sensor Replacement (Center)**.	
1	Front Parking Assist Alarm Sensor Bracket **Procedure** Release the 2 tabs behind the rear parking assist alarm sensor bracket to remove.

FRONT PARKING ASSIST ALARM SENSOR BRACKET REPLACEMENT (GMC)

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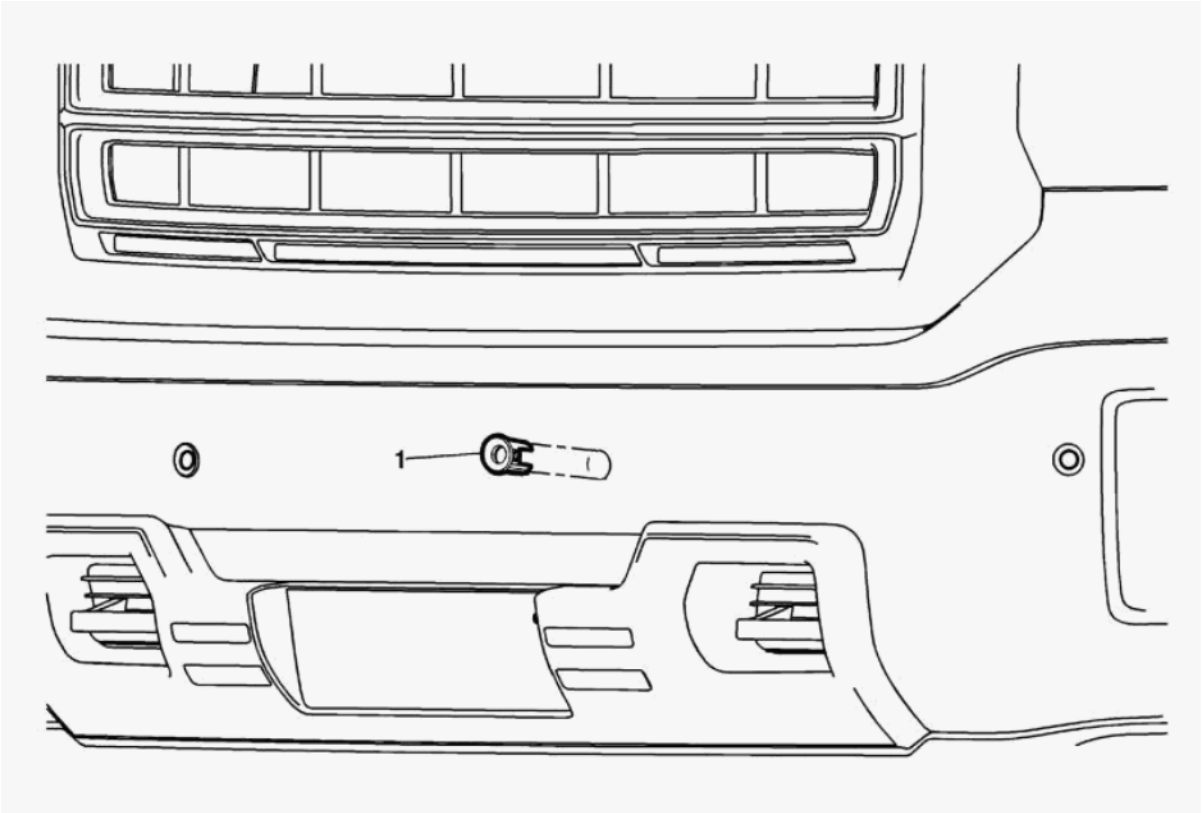


Fig. 20: Front Parking Assist Alarm Sensor Bracket (GMC)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the front parking assist alarm sensor. Refer to **Front Parking Assist Alarm Sensor Replacement (GMC Outer)Front Parking Assist Alarm Sensor Replacement (Center)**.	
1	Front Parking Assist Alarm Sensor Bracket **Procedure** Release the 2 tabs behind the rear parking assist alarm sensor bracket to remove.

REAR PARKING ASSIST ALARM SENSOR REPLACEMENT (OUTER)

Removal Procedure

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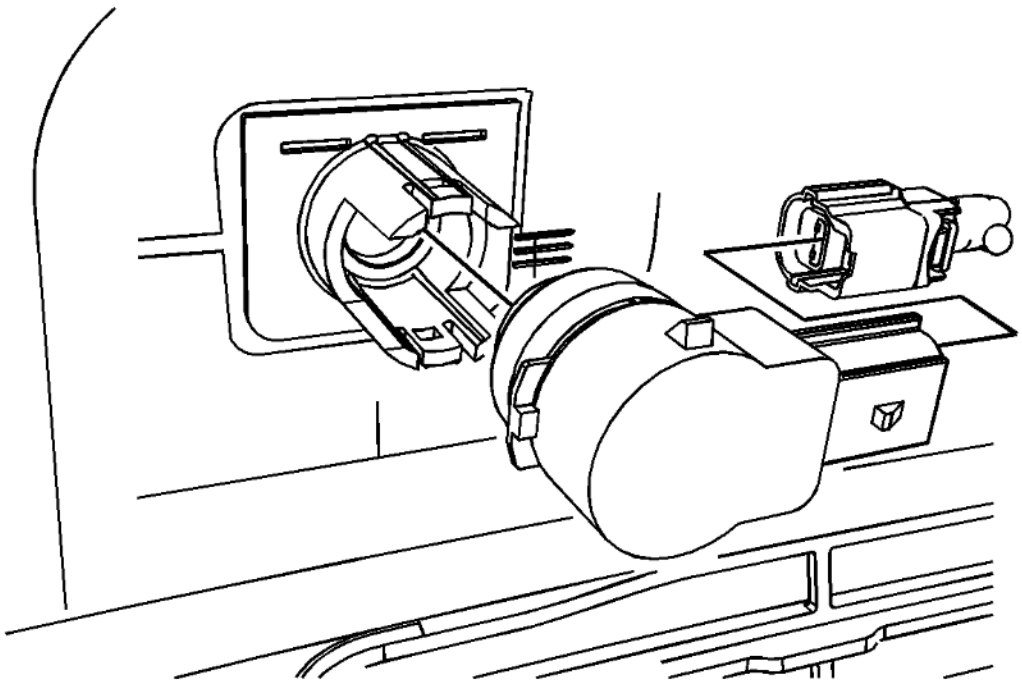


Fig. 21: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

1. Remove rear bumper impact bar . Refer to **Rear Bumper Impact Bar Replacement** .
2. Disconnect electrical from the rear object sensor.

NOTE: **The rear object sensor is a one piece design. Do NOT twist the sensor cap to try and remove the painted cap. Replacement sensor requires painting to match fascia/bumper body color.**

3. Lift the locking tabs on the housing and remove the rear object sensor.

Installation Procedure

NOTE: **Do not refinish previously painted sensors. Excess paint build up will cause the sensor to be inoperative.**

1. Paint the rear object sensor. Refer to **Basecoat/Clearcoat Paint Systems** .
2. Ensure the paint does not exceed 6 mils. Use a paint thickness gauge suitable for non-ferrous metals. Refer to **Paint Gauges** .

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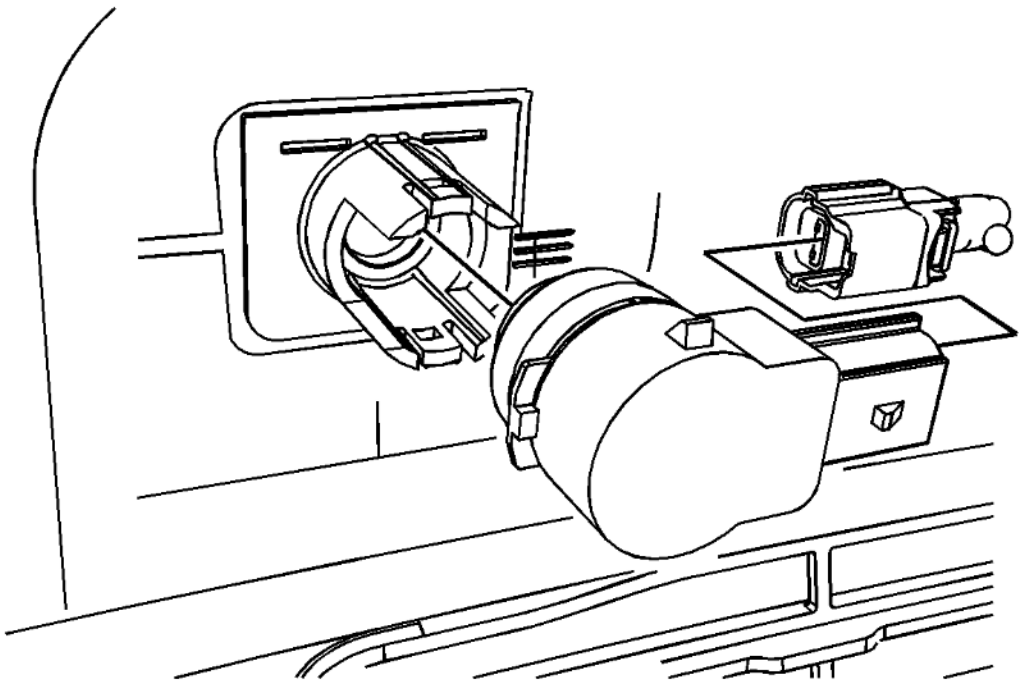


Fig. 22: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

3. Insert the sensor into the housing.
4. Connect the electrical connector to the rear object sensor.
5. Install the rear bumper impact bar. Refer to **Rear Bumper Impact Bar Replacement** .

REAR PARKING ASSIST ALARM SENSOR REPLACEMENT (CENTER)

Removal Procedure

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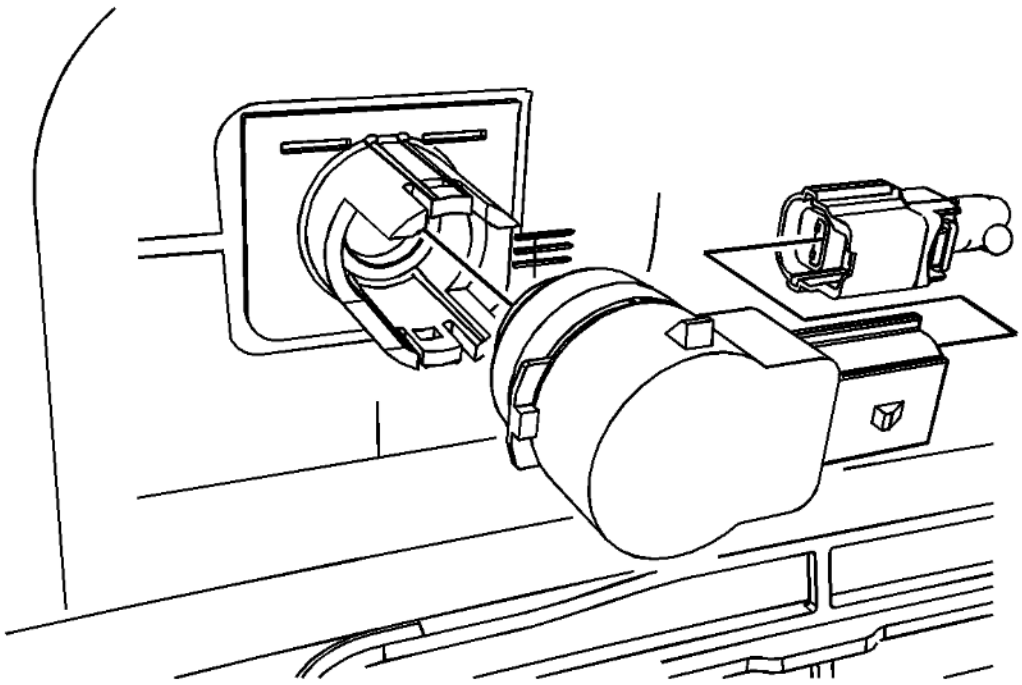


Fig. 23: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

1. Disconnect electrical from the rear parking assist sensor.

NOTE: **The rear parking assist sensor is a one piece design. Do NOT twist the sensor cap to try and remove the painted cap. Replacement sensor requires painting to match fascia/bumper body color.**

2. Lift the locking tabs on the housing and remove the rear parking assist sensor.

Installation Procedure

NOTE: **Do not refinish previously painted sensors. Excess paint build up will cause the sensor to be inoperative.**

1. Paint the rear parking assist sensor. Refer to **Basecoat/Clearcoat Paint Systems** .
2. Ensure the paint does not exceed 6 mils. Use a paint thickness gauge suitable for non-ferrous metals. Refer to **Paint Gauges** .

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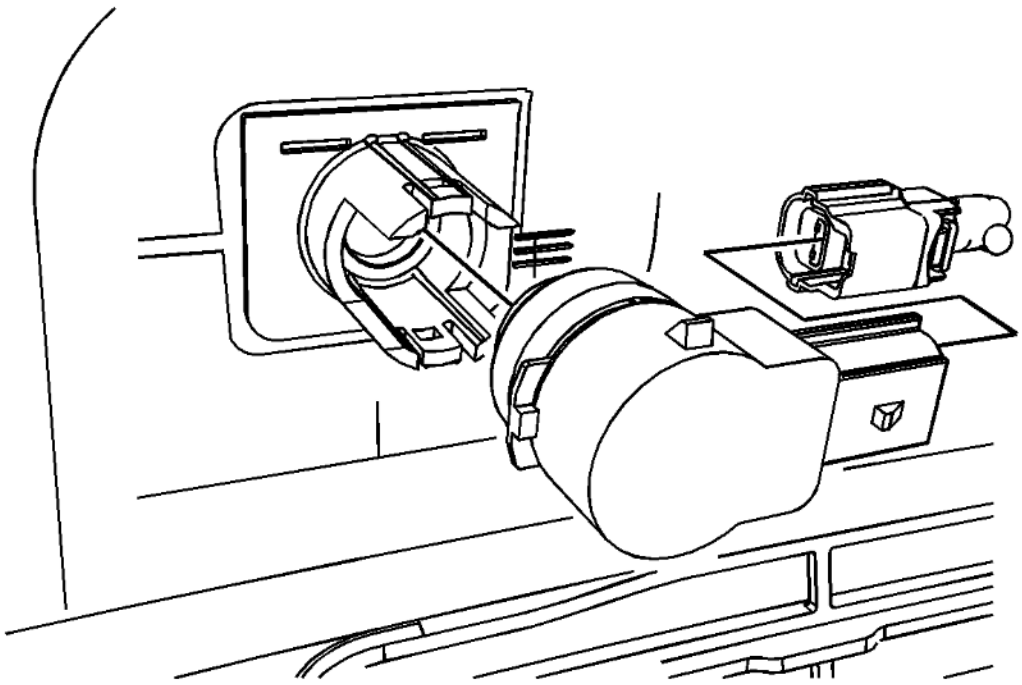


Fig. 24: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

3. Insert the rear parking assist sensor into the housing.
4. Connect the electrical connector to the rear parking assist sensor.

REAR PARKING ASSIST ALARM SENSOR BRACKET REPLACEMENT

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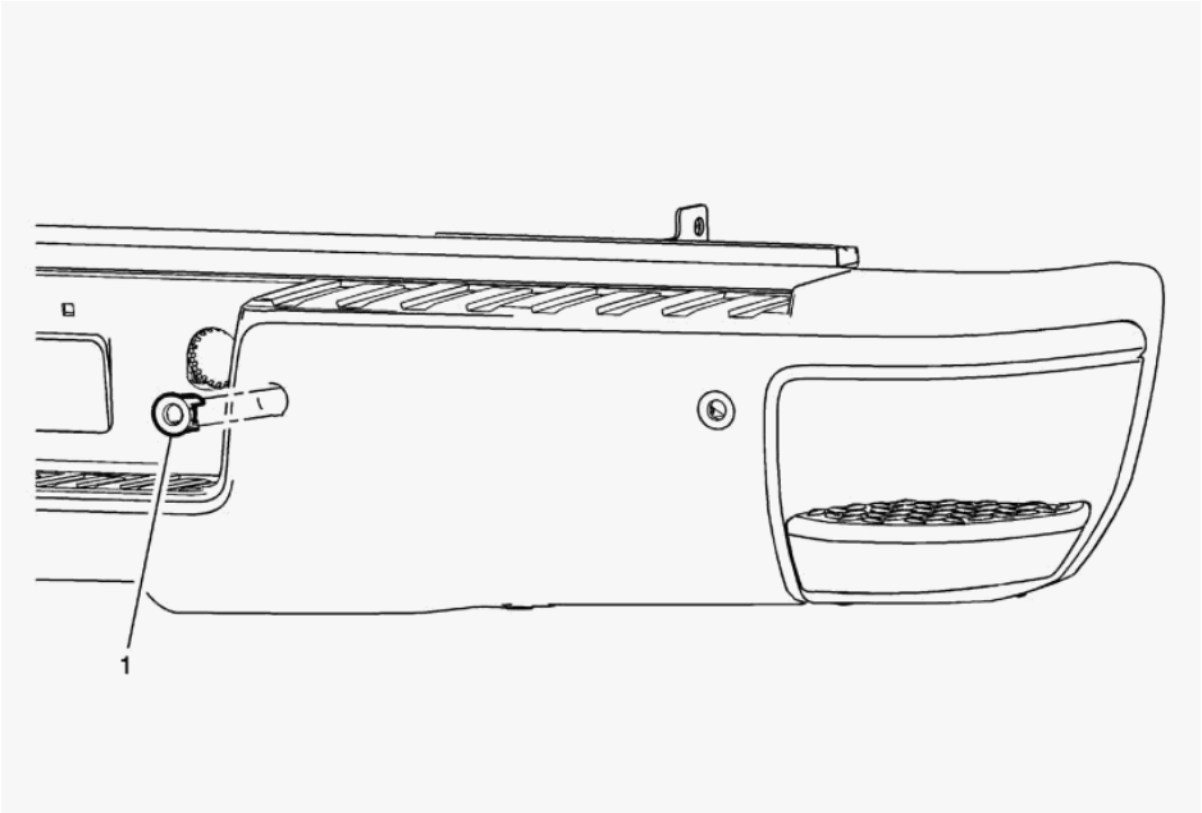


Fig. 25: Rear Parking Assist Alarm Sensor Bracket
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the rear parking assist alarm sensor. Refer to **Rear Parking Assist Alarm Sensor Replacement (Outer)Rear Parking Assist Alarm Sensor Replacement (Center)**.	
1	Rear Parking Assist Alarm Sensor Bracket **Procedure** Release the 2 tabs behind the rear parking assist alarm sensor bracket to remove.

PARKING ASSIST ALARM SENSOR RING REPLACEMENT

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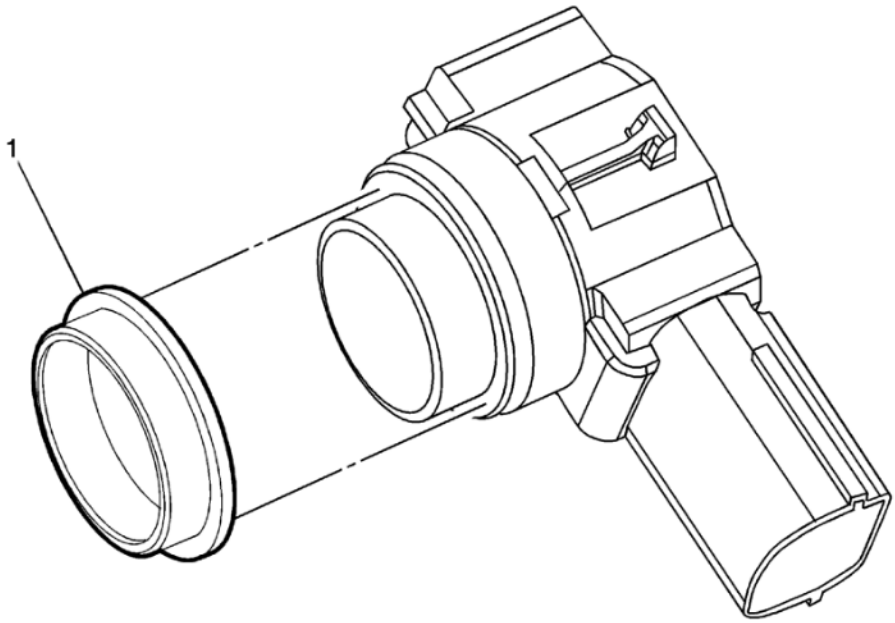


Fig. 26: Parking Assist Alarm Sensor Ring
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove either the front or rear parking assist alarm sensor. Refer to **Front Parking Assist Alarm Sensor Replacement (Chevrolet Outer)Front Parking Assist Alarm Sensor Replacement (GMC Outer)Front Parking Assist Alarm Sensor Replacement (Center)**, **Rear Parking Assist Alarm Sensor Replacement (Outer)Rear Parking Assist Alarm Sensor Replacement (Center)**.	
1	Front Parking Assist Alarm Sensor Ring **Procedure** Pull the parking assist alarm sensor ring from the parking assist alarm sensor

FRONT VIEW CAMERA REPLACEMENT

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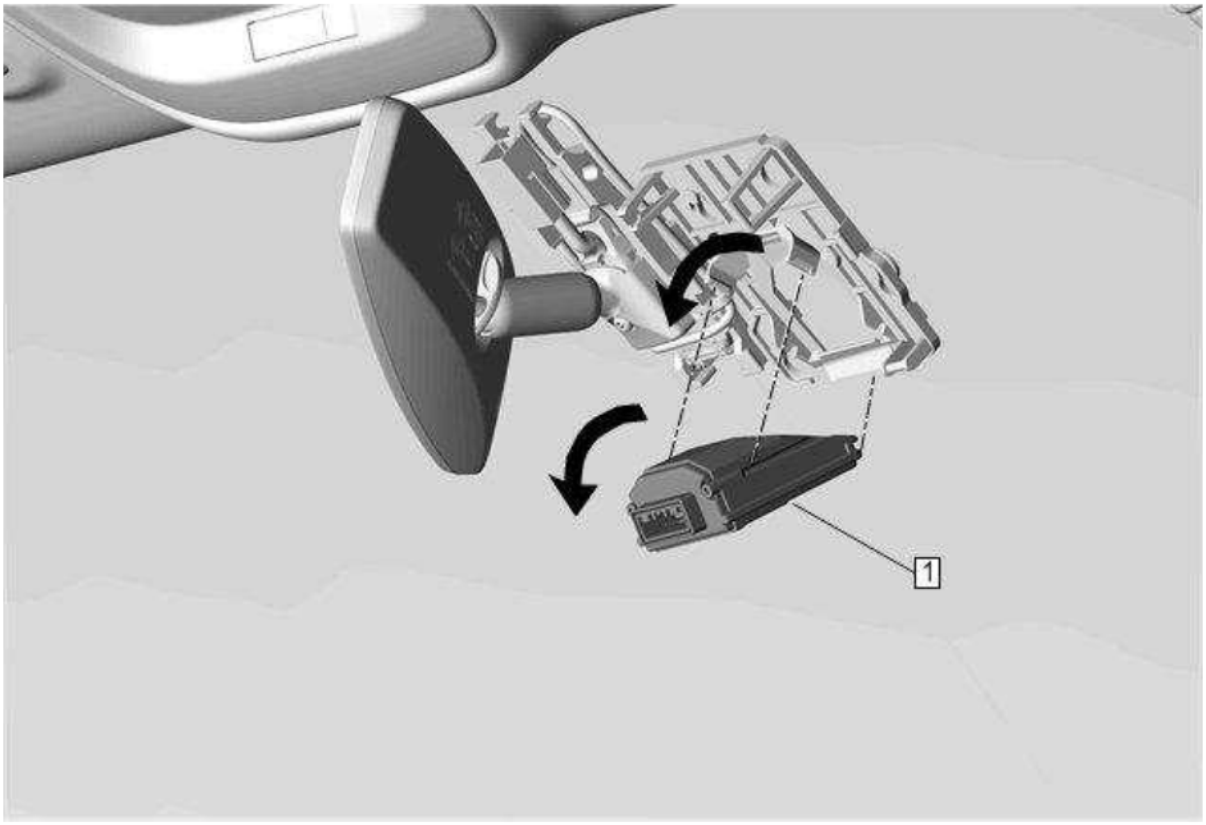


Fig. 27: Front View Camera
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the windshield multifunction sensor mounting bracket cover. Refer to **Windshield Multifunction Sensor Mount Bracket Cover Replacement** .	
1	Front View Camera **Procedure** 1. Using a suitable plastic tool, insert the tool between the edge of the front view camera retainers, turn the tool to release the retainers and the camera and rotate downward. 2. Disconnect the electrical connector. 3. After replacement of the front view camera, program the front view camera. Refer to **Control Module References** .

REARVIEW DRIVER INFORMATION CAMERA REPLACEMENT

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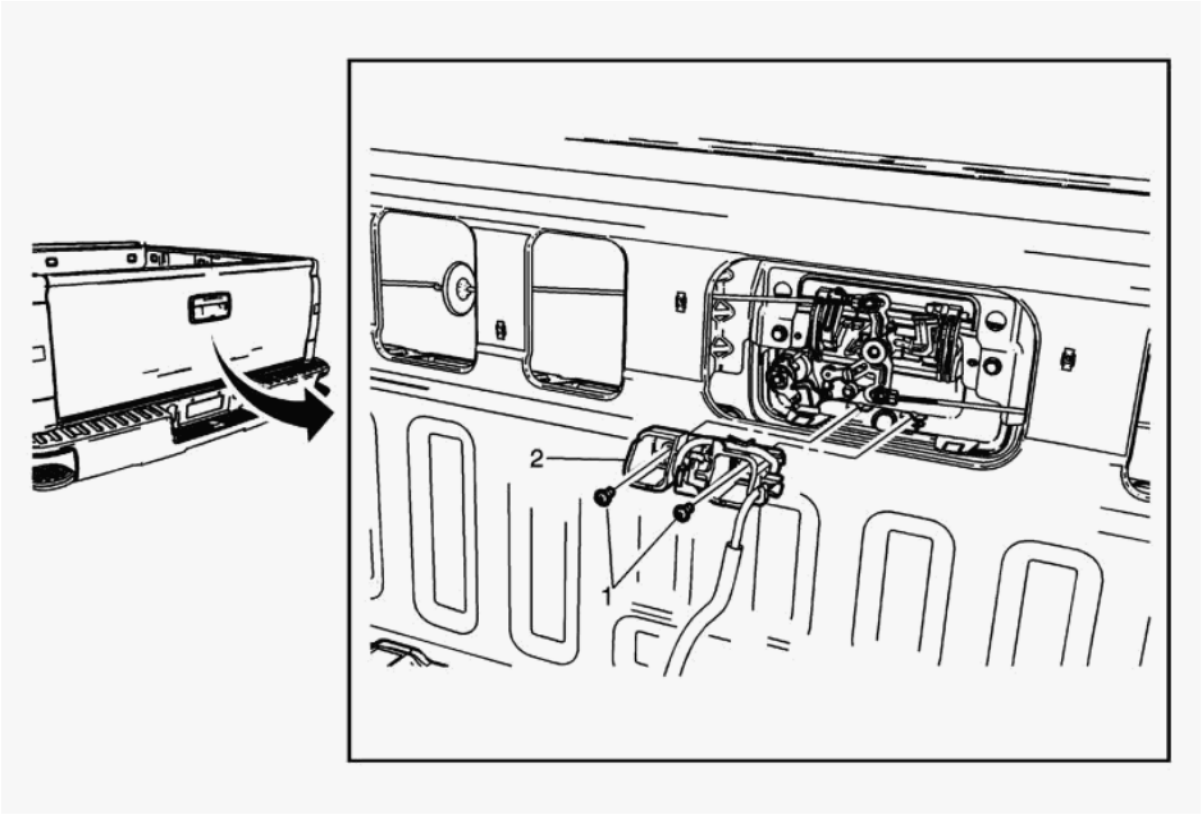


Fig. 28: Rearview Driver Information Camera
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove the pickup box endgate access hole cover panel. Refer to **Pickup Box Endgate Access Hole Cover Panel Replacement** .	
1	Rearview Driver Information Camera Fastener (Qty: 2) **CAUTION:** **Refer to Fastener Caution .**
2	Rearview Driver Information Camera **Procedure** Disconnect the electrical connector. **NOTE:** **The connector is plugged into a junction center under the rear of the pickup box. Attach a leader wire**

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Callout	Component Name
	or string to the old connector before removing the harness and use this to route the harness for the replacement camera.

FRONT VIEW CAMERA MODULE LEARN

Calibration

For North American SPS users, **Calibration will NOT start automatically** and will need to be initiated with GDS2. For European SPS users, **Calibration will start automatically** and will not need to be initiated with GDS2.

The calibration process for the front view camera system is necessary when a front view camera module is replaced by a new one. **This process is required when only replacing the windshield** and the frontview camera module has been mounted again properly. This process shall be completed within 3-5 minutes when the correct driving conditions are met. If conditions are not met, the front view camera module shall continuously run the service point calibration until successfully completed. This process shall work across ignition cycles and shall not be required to be re-initialized at start up. If the Lane Departure Warning Switch is pressed during calibration, the indictor will flash momentarily and then stay out - this is normal operation.

During this time the Lane Departure Warning amber indicator will illuminate.

To calibrate the front camera, operate the vehicle in the following conditions until the calibration is complete:

NOTE:

If the front view camera module calibration is not completed during the current ignition cycle, it will restart in next ignition cycle. "Service Front Camera" will be displayed until successful calibration and DTC B1008 4B may be active.

When Lane Departure Warning is on, the indicator is green if Lane Departure Warning is available to warn of a lane departure. If the vehicle crosses a detected lane marking without using the turn signal in that direction, the indicator changes to amber and flashes. To verify if the system is working the indicator on the switch should remain illuminated once pressed, and when up to speeds greater than 35 mph (56 km/h), the lane departure indicator will illuminate on the instrument cluster.

The power mode be in ACCY for the calibration process to become enabled by using the scan tool. GDS2 will display a "loss of com" error message when the procedure is attempted in any power mode other than ACCY.

- Clean windshield.

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- Avoid lane changes.
- Maintain vehicle speeds between 56-90 km/h (35-56 MPH).
- Ensure the road contains visible references (well defined lane markings, curbs, etc.).

Calibration Procedure (Required for North American SPS users)

1. Apply the parking brake.
2. Place the transmission in Park (if applicable)
3. **Place vehicle in ACCY Power Mode**
4. Install scan tool
5. Navigate to the module diagnostics menu
6. Select Frontview Camera Module
7. Select Configuration/ Reset Functions menu Item
8. Select the Frontview Camera Learn procedure and follow the directions displayed on the screen.
9. Drive the vehicle to complete calibration.

Once the procedure is complete, the amber indicator will turn off. Shortly after the green ready to assist light should turn on as long as all conditions are met for normal operation. The system is then ready to assist.

If Slow to Calibrate

The ideal calibration condition is driving on a 2 lane divided highway with markings on both sides of the lane. One or more of the following conditions may increase the length of time required to complete the self-calibration procedure: :

- Camera not properly installed. Verify it is snapped into tabs and is secure. Refer to **Front View Camera Replacement** .
- Heavy traffic
- Stop and go traffic
- Mountain roads
- Curves in roadway
- Poor contrast lane markings
- Botts' Dots type lane markings
- Operating the vehicle speed is greater than 90 km/h (56 MPH)
- Driving through snow or fog, or driving directly into the sun

No Calibration

Conditions that will prevent completion of the self-calibration procedure:

- Camera not properly installed. Verify it is snapped into tabs and is secure. Refer to **Front View Camera Replacement** .
- Dirty windshield glass or obstruction on windshield
- Operating the vehicle with speed less than 56 km/h (35 MPH)
- No visible lane markings
- Severe weather where lane markings cannot be seen

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HUMAN MACHINE INTERFACE CONTROL MODULE BYPASS MODULE REPLACEMENT

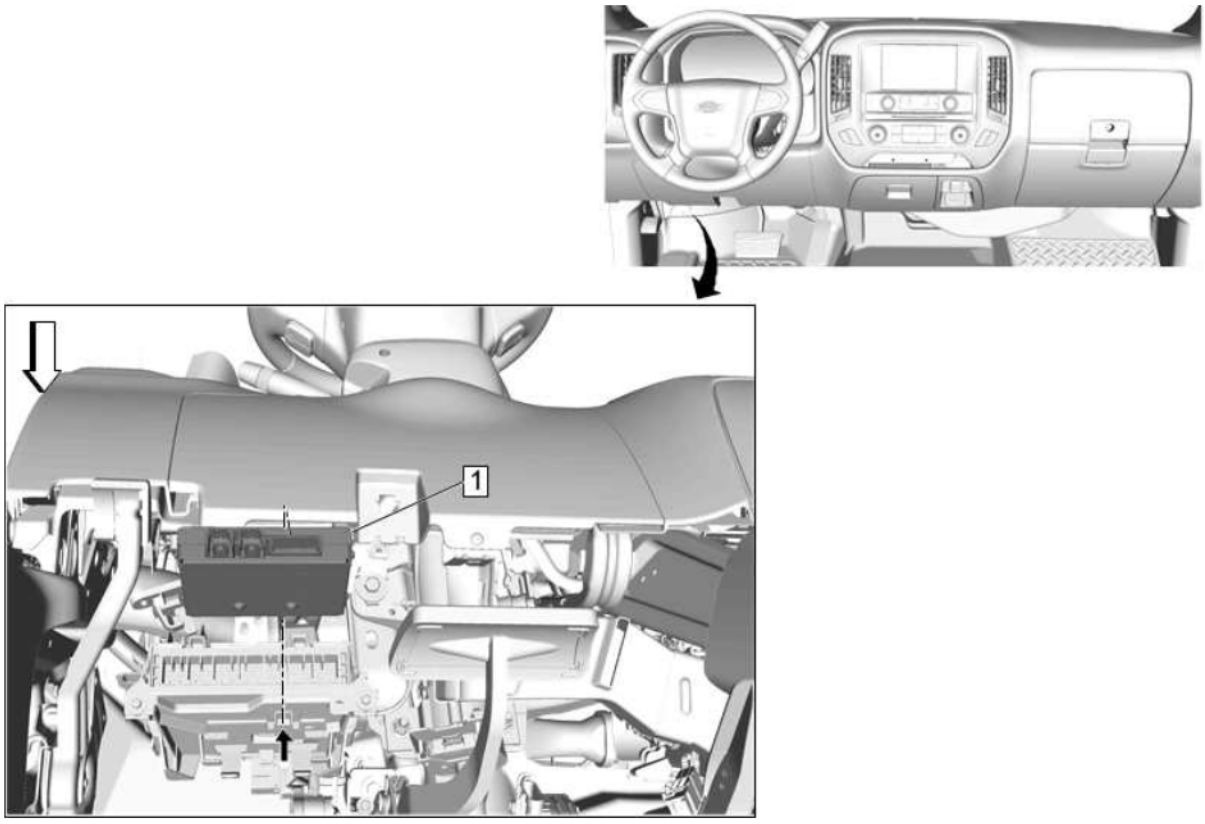


Fig. 29: Human Machine Interface Control Module Bypass Module
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Human Machine Interface Control Module Bypass Module **Procedure** 1. Disconnect the electrical connectors. 2. Release the retaining tab.

HUMAN MACHINE INTERFACE CONTROL MODULE BYPASS MODULE BRACKET REPLACEMENT

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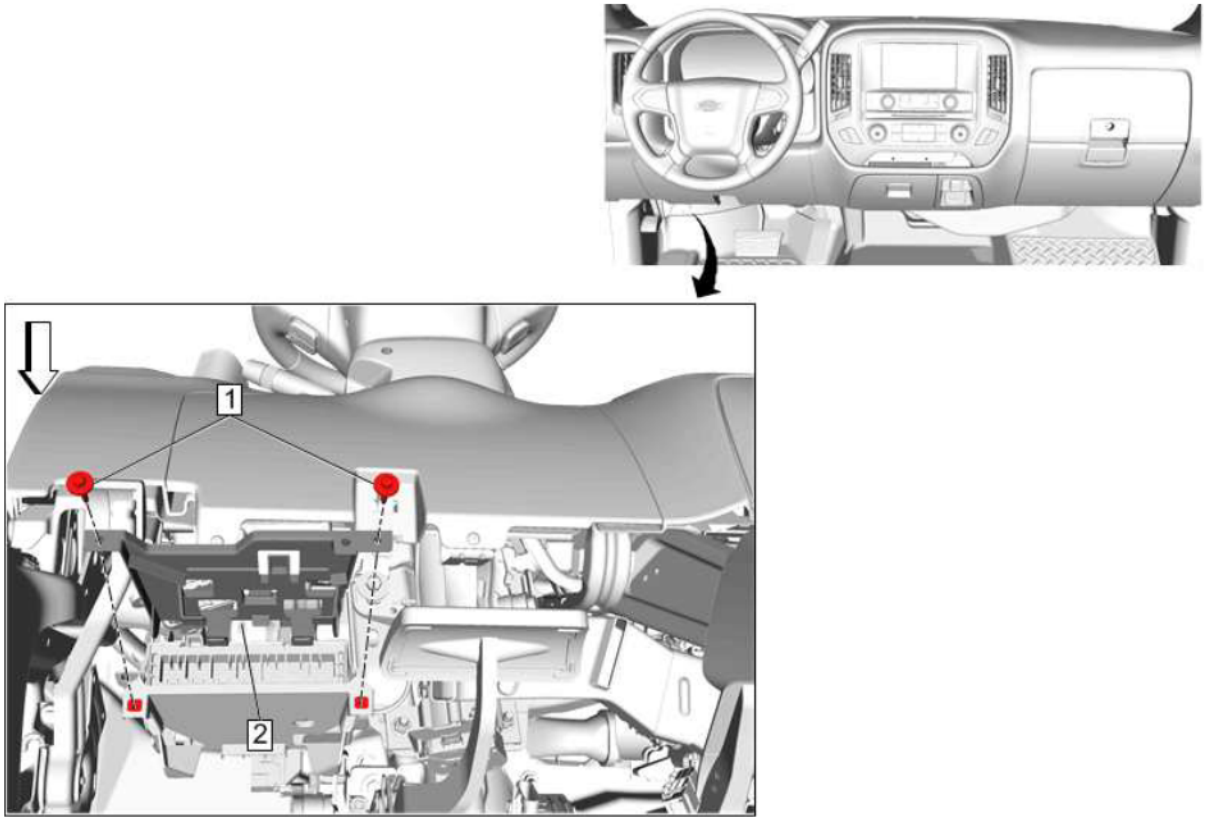


Fig. 30: Human Machine Interface Control Module Bypass Module Bracket
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Human Machine Interface Control Module Bypass Module Bracket Bolt **CAUTION:** **Fastener Caution** **Tighten** 2.5 N.m (22 lb in)
2	Human Machine Interface Control Module Bypass Module Bracket **Procedure** Transfer components as necessary.

DESCRIPTION AND OPERATION

PARKING ASSIST DESCRIPTION AND OPERATION (WITH UD7)

The parking assist system is designed to identify and notify the driver of an object in the vehicle path when reversing at speeds of less than 8 km/h (5 MPH). The distance and location of the object is determined by four object sensors located in the rear bumper. The parking assist system will notify the driver using audible beeps through the infotainment system.

The parking assist system is made up of the following components:

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- Parking assist control module
- Object sensors
- Parking assist switch
- Parking assist switch indicator
- Infotainment system

Parking Assist Control Module

The parking assist control module provides a reference voltage and a low reference to the four object alarm sensors. The parking assist control module receives individual signals from each of the four sensors and determines the location and distance of an object based on these inputs. When an object is detected, the parking assist control module will send a message via serial data to the infotainment system requesting an audible alert.

Object Sensors

The object sensors are located in the rear bumper. The sensors are used to determine the distance between an object and the rear of the vehicle. Each sensor emits an ultrasonic frequency which is reflected off an object behind the vehicle. These reflections are received by the sensors. The time difference between the emission of the frequency and when the reflection is received is known as sensor echo time, it is used to determine the distance to the object. The sensors report this information to the parking assist control module.

Parking Assist Switch

The parking assist system can be activated and deactivated by pressing the parking assist switch. The parking assist control module applies voltage and monitors the parking assist switch signal circuit. The parking assist switch is a normally open switch. With the switch open, voltage seen at the parking assist control module is high. When the parking assist switch is pressed, the switch is closed and the signal circuit is pulled to ground. With the switch closed, voltage seen at the parking assist control module is low. The parking assist control module will respond to this by activating or deactivating the parking assist function.

Parking Assist Switch Indicator

When the parking assist system is enabled, the parking assist control module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the parking assist control module.

Infotainment System

The infotainment system controls the audible alert for the park assist alert. If the an object is detected the infotainment system will command beeps as an audible alert to the driver.

Parking Assist Operation

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 parking assist control module. The parking assist control module evaluates the received sensor signals. As soon as an object is within the measuring range, the parking assist control module sends a message via serial data to the infotainment system to provide an alert signal.

The parking assist system can detect objects greater than 7.6 cm (3 in) wide and 25.4 cm (10 in) tall. The system cannot detect objects below the bumper or underneath the vehicle.

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The parking assist system can be activated and deactivated by pressing the parking assist switch. When the transmission is in R, park assist is automatically activated, unless disable by the switch.

The parking assist control module carries out a self test and monitors the sensors for electrical and mechanical faults. Monitored is the power supply of each sensor and the sensor signals. Mud, ice and snow may cause obstruction of the function of the sensors. The parking assist control module also determines if the correct type of sensor is installed. If any of these tests fails, a DTC with corresponding symptom is set and the parking assist system is deactivated.

Parking Assist System Driver Information Center Messages

SERVICE PARK ASSIST

The driver information center displays SERVICE PARK ASSIST when the parking assist control module detects a malfunction in the parking assist system and the system is disabled. The driver information center also displays SERVICE PARK ASSIST when a loss of communication occurs with the parking assist control module.

PARK ASSIST OFF

The PARK ASSIST OFF message is displayed in the driver information center when the parking assist system is disabled due to conditions that disable or inhibit the system. The parking assist control module requests the driver information center display PARK ASSIST OFF when it detects that one of the following conditions:

- The parking assist system is manually disabled using the parking assist switch.
- An object is attached to the rear of the vehicle, such as a trailer, bicycle rack, trailer hitch receiver, or tow bar. Also, an object extending beyond a lowered tailgate will disable the system.
- The object sensors are covered by snow, mud, dirt, slush, or ice.
- The rear bumper is damaged.
- Excessive paint thickness on a replacement parking assist sensor.
- The object sensors are disrupted by vibrations, like those caused by a large nearby vehicle or from heavy equipment such as a jackhammer.

PARKING ASSIST DESCRIPTION AND OPERATION (WITH UD5)

The parking assist system is designed to identify and notify the driver of an object in the vehicle path when moving forward or reversing at speeds of less than 8 km/h (5 MPH). The distance and location of the object is determined by four object sensor located in the rear bumper and four object sensors located in the front bumper. The parking assist system will notify the driver using audible beeps through the infotainment system or haptic pulses through the driver's seat (if equipped).

The parking assist system is made up of the following components:

- Front and rear parking assist control module
- Front object sensors
- Rear object sensors
- Parking assist switch
- Parking assist indicator
- Infotainment system
- Safety alert seat, if equipped.

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Front and rear parking assist control module

The front and rear parking assist control module provides a reference voltage and a low reference to the eight object alarm sensors. The front and rear parking assist control module receives individual signals from each of the eight sensors and determines the location and distance of an object based on these inputs. When an object is detected, the front and rear parking assist control module will send a serial data message to the infotainment system requesting an audible alert.

Object Sensors

The object sensors are located in the front and rear bumpers of the vehicle. The sensors are used to determine the distance between an object and the bumper. Each sensor emits an ultrasonic frequency which is reflected off any object located in front of or behind the vehicle. These reflections are received by the sensors. The time difference between the emission of the frequency and when the reflection is received is known as sensor echo time, it is used to determine the distance to the object. The sensors report this information to the front and rear parking assist control module.

Parking Assist Switch

The parking assist system can be activated and deactivated by pressing the parking assist switch. The front and rear parking assist control module applies voltage and monitors the parking assist switch signal circuit. The parking assist switch is a normally open switch. With the switch open, voltage seen at the front and rear parking assist control module is high. When the parking assist switch is pressed, the switch is closed and the signal circuit is pulled to ground. With the switch closed, voltage seen at the front and rear parking assist control module is low. The front and rear parking assist control module will respond to this by activating or deactivating the parking assist function.

Parking Assist Indicator

When the parking assist system is enabled, the front and rear parking assist control module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the front and rear parking assist control module.

Infotainment system

The infotainment system controls the audible alert for the park assist alert. If the an object is detected the infotainment system will command beeps as an audible alert to the driver.

Safety alert seat (if equipped)

The memory seat module controls the haptic alert provided by the seats. If an object is detected, the memory seat module will command pulses to the driver's seat.

Parking Assist Operation

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 front and rear parking assist control module. The front and rear parking assist control module evaluates the received sensor signals. As soon as an object is within the measuring range, the front and rear parking assist control module sends a message via serial data to the infotainment system to provide an alert signal.

The parking assist system can detect objects greater than 7.6 cm (3 in) wide and 25.4 cm (10 in) tall. The system

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cannot detect objects below the bumper or underneath the vehicle.

The parking assist system can be activated and deactivated by pressing the parking assist switch. When the transmission is in R, park assist is automatically activated, unless disable by the switch.

The front and rear parking assist control module carries out a self test and monitors the sensors for electrical and mechanical faults. Monitored is the power supply of each sensor and the sensor signals. Mud, ice and snow may cause obstruction of the function of the sensors. The front and rear parking assist control module also determines if the correct type of sensor is installed. If any of these tests fails, a DTC with corresponding symptom is set and the parking assist system is deactivated.

When an object is 120 cm (47 in) to 31 cm (12 in) in front of the vehicle, the proximity of the object from the vehicle communicated via the instrument cluster.

When an object is very close (<0.6 m (2 ft) in the vehicle rear, or <0.3 m (1 ft) in the vehicle front), a continuous beep will sound from the front or rear, or both sides of the Safety Alert Seat (if equipped) will pulse.

Parking Assist System Driver Information Center Messages

SERVICE PARK ASSIST

The driver information center displays SERVICE PARK ASSIST when the front and rear parking assist control module detects a malfunction in the parking assist system and the system is disabled. The driver information center also displays SERVICE PARK ASSIST when a loss of communication occurs with the front and rear parking assist control module.

PARK ASSIST OFF

The PARK ASSIST OFF message is displayed in the driver information center when the parking assist system is disabled due to conditions that disable or inhibit the system. The front and rear parking assist control module requests the driver information center display PARK ASSIST OFF when it detects that one of the following conditions:

- The parking assist system is manually disabled using the parking assist switch.
- An object is attached to the rear of the vehicle, such as a trailer, bicycle rack, trailer hitch receiver, or tow bar. Also, an object extending beyond a lowered tailgate will disable the system.
- The parking assist sensors are covered by snow, mud, dirt, slush, or ice.
- The vehicle bumper is damaged.
- Excessive paint thickness on a replacement parking assist sensor.
- The parking assist sensors are disrupted by vibrations, like those caused by a large nearby vehicle or from heavy equipment such as a jackhammer.

LANE DEPARTURE WARNING DESCRIPTION AND OPERATION

The lane departure warning system is a convenience feature that utilizes the frontview camera module to determine if the vehicle has unintentionally crossed a lane marking and issue a warning. The frontview camera module is located behind the windshield, looking out at the road ahead and detecting any lane markings. When the vehicle unintentionally leaves a detected lane, visual and audible or haptic (if equipped) alerts are given to the driver. The visual alert cannot be changed, but the driver can select between audible or haptic alerts (if equipped)vin the vehicle personalization menus. Refer to the vehicle owner's manual for vehicle personalization options.

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The lane departure warning system utilizes the following components:

- Frontview camera module
- Lane departure warning switch
- Instrument cluster
- Infotainment system
- Safety alert seat, if equipped

Frontview Camera Module

The frontview camera module detects visual queues such as lane markings. When it is determined that the vehicle has unintentionally moved outside of the lane, visual and audible or haptic (if equipped) warning is given to the driver. The frontview camera module receives an input from the lane departure warning switch and controls the lane departure warning switch indicator output. The frontview camera module also communicates via serial data with the instrument cluster, infotainment system, and memory seat module to request visual, audible, and/or haptic alerts.

Lane Departure Warning Switch

The lane departure warning switch provides an input to the frontview camera module to turn the lane departure warning system on and off. The frontview camera module applies voltage and monitors the parking assist switch signal circuit. The lane departure warning switch is a normally open switch. With the switch open, voltage seen at the frontview camera module is high. When the lane departure warning switch is pressed, the switch is closed and the signal circuit is pulled to ground. With the switch closed, voltage seen at the frontview camera module is low. The frontview camera module will respond to this by activating or deactivating the lane departure warning system.

The lane departure warning switch also utilizes the lane departure warning indicator, which is part of the lane departure warning switch and is controlled by the frontview camera module to indicate the operational status of the lane departure warning system. When the lane departure warning is enabled, the frontview camera module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the frontview camera module.

Instrument Cluster

The instrument cluster contains green and amber lane departure warning indicators. These indicators inform the driver of the current status of the lane departure warning system and are controlled via serial data by the frontview camera module. When the vehicle speed is above 56 km/h (35 MPH) and the system has detected the required lane markings and is ready to assist, the green indicator will be illuminated. If the vehicle has unintentionally left the lane, the amber indicator will flash.

Infotainment System

The infotainment system controls the audible alert for the lane departure warning. If the vehicle has unintentionally left the lane, the frontview camera module will request via serial data an audible alert to the driver through the infotainment system

Safety Alert Seat

The memory seat module controls the haptic alert provided by the seats. If the vehicle has unintentionally left the lane, the memory seat module will command pulses to the left or right side of the seat, depending on the lane departure direction.

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Lane Departure Warning Operation

System Operational Modes

- Off State: The system has been turned off by the driver using the lane departure warning switch. The lane departure warning indicator located on the lane departure warning switch will not be illuminated.
- Not Ready To Assist: The system is enabled and the lane departure warning indicator located on the lane departure warning switch is illuminated, but the system is not ready to assist because one of the following conditions is true:
  - Vehicle speed is less than 56 km/h (35 MPH). The system is designed to function at speeds greater than 56 km/h (35 MPH).
  - The system cannot detect lane markings. This may be because there are no lane markings or the lane markings cannot be determined due to snow, rain, or other driving conditions.
  - The windshield area in front of the camera or the camera lens is blocked by fog, dirt, damage to the windshield, or other elements that may prevent the camera from detecting lane markings.
- Ready To Assist: The system is enabled and ready to warn of the unintentional lane crossing. The system is ready to assist when the green lane departure warning indicator is illuminated on the instrument cluster.

Lane Crossing Alerts

- A lane crossing alert consists of the following:
  - The amber lane departure warning indicator located on instrument cluster will flash.
  - Three chimes are activated through the infotainment system or three pulses to the left or right side of the seat, if equipped with safety alert seat
- When any of the following conditions occurs, the system will not give alerts:
  - The appropriate turn signal is activated. An activated turn signal is interpreted as an intentional lane crossing.
  - The operator makes an intentional steering maneuver.
  - The operator makes an intentional accelerating maneuver.
  - The operator makes an intentional braking maneuver.

LANE KEEP ASSIST DESCRIPTION AND OPERATION

NOTE:

- **The Lane Keep Assist system DOES NOT continuously steer the vehicle**
- **The Lane Keep Assist system replaces Lane Departure Warning System**

The system assists driver to keep vehicle in-lane by providing a steering push back to the vehicle when an unintended lane departure is detected. See the user's manual for more detailed information on vehicle personalization.

The lane keep assist system is made up of the following components:

- Front view camera module
- Lane Keep Assist switch / control indicator
- Instrument cluster / Vehicle Direction Display
- Radio

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- Safety Alert Seat (if equipped)
- Yaw rate sensor
- Electric power steering

Front View Camera Module

The camera detects visual queues such as lane markings. When it is determined that the vehicle has unintentionally moved outside of the lane, visual, and audible or haptic warning is given to the driver. The front view camera module receives an input from the lane keep assist switch and controls the lane keep assist switch indicator output. The front view camera module also communicates via serial data with the instrument cluster, radio, and memory seat module to request visual, and audible or haptic alerts.

Lane Keep Assist Switch

The lane keep assist switch provides an input to the front view camera module to turn the lane keep assist system ON and OFF. The front view camera module provides a signal voltage to the normally open momentary switch. When the switch is pressed, the signal circuit is pulled to ground, indicating to the front view camera module that the system has been requested to turn ON or OFF. The lane keep assist switch also contains the lane keep assist switch indicator, which is controlled by the front view camera module to indicate the ON and OFF status of the lane keep assist system. When the system has been enabled by the lane keep assist switch, the front view camera module applies ground to the switch indicator and illuminates the LED. The location of the lane keep assist switch can vary with different vehicles. For the exact location please refer to the user's manual.

Instrument Cluster

The vehicle direction display contains green and amber lane keep assist indicators. These indicate to the driver the current status of the lane keep assist system and are controlled via serial data by the front view camera module. When the vehicle speed is above 56 km/h (35 MPH) and the system has detected the required lane markings and is ready to assist, the green indicator will be illuminated on the vehicle direction display. If the vehicle has unintentionally left the lane, the amber indicator will flash.

Radio

The radio controls the audible alert for the lane keep assist. If the vehicle has unintentionally left the lane, the radio will command three beeps as an audible alert to the driver.

Safety Alert Seat (if equipped)

The memory seat module controls the haptic alert provided by the seats. If the vehicle has unintentionally left the lane, the memory seat module will command three pulses to the left or right side of the seat, depending on the lane departure direction.

Yaw Rate Sensor

The steering intervention is based on the forward looking sensor outputs, such as lateral offset of the vehicle, relative yaw angle and time to line crossing. Over that, other vehicle dynamics signals are needed, e.g. velocity, steering angle, yaw rate for the purpose of a driver suppression.

Electric Power Steering

The electric power steering uses a torque sensor to detect driver inputs and relays that information to the frontview camera module. The electric power steering is used to provide steering push back.

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Lane Keep Assist Operation

There is two stages of warning/intervention for the driver: The first stage is the steering push back, if the lane keep assist system detects that the vehicle will cross the lane marking despite it is intervening, a second stage warning shall be issued. The second stage warning is a chime or a haptic seat vibration, **if equipped** with haptic seats. If a haptic seat vibration is used as stage 2 warning, the vibration shall take place on the side of the seat, where the lane departure happened.

System operation can be described by the following modes:

- Off State: The system has been turned off by the driver using the lane keep assist switch. The lane keep assist indicator will not be illuminated.
- Not Ready To Assist: The system is enabled and the lane keep assist indicator is illuminated, but not ready to assist when any of the following conditions is true:
  - Vehicle speed is less than 37 MPH (60 km/h) . The system is designed to function at speeds greater than 37 MPH (60 km/h).
  - The system cannot detect lane markings. This may be because there are no lane markings, as on a country road or that the lane markings cannot be determined due to snow, rain, or other driving conditions.
  - The windshield area in front of the camera or the camera lens is blocked by fog, dirt, damage to the windshield or other elements that may prevent the camera from detecting lane markings.
- Ready To Assist: The system is enabled and ready to warn of the unintentional lane crossing. The system is ready to assist when the green lane keep assist indicator is illuminated on the vehicle direction display.

Lane Crossing Alerts

- When one of the following conditions are met, the system will not give alerts:
  - The correct turn signal is activated. An activated turn signal is interpreted as an intentional lane crossing.
  - The operator makes an intentional steering maneuver.
  - The operator makes an intentional accelerating maneuver.
  - The operator makes an intentional braking maneuver.
- Lane crossing alert consists of the following:
  - The amber lane keep assist indicator will flash.
  - "push-back" steering torque input (or nudge) from Electric Power Steering to help prevent a lane departure
  - Three chimes are activated through the radio.
  - or **if equipped** , three pulses to the left or right side of the seat.

Lane Keep Assist System Driver Information Center Messages

The front view camera module can command the driver information center to display the various messages to alert the driver of a system concern or status information. For detailed information about the possible messages please refer to the user's manual.

FORWARD COLLISION ALERT DESCRIPTION AND OPERATION (WITHOUT UGN)

The forward collision alert system is a convenience feature of the frontview camera module that issues a warning to the driver when a potential collision risk exists. The frontview camera module is located behind the

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windshield, looking out at the road ahead and detecting vehicles directly ahead. When the system detects a vehicle in the path ahead, the green vehicle ahead indicator is illuminated on the instrument cluster. When approaching another vehicle too rapidly, the collision alert symbol will flash in the head-up display (if equipped) or a series of red collision alert indicators will flash. An audible alert sound will simultaneously sound or the safety alert seat will provide haptic feedback. The visual alert cannot be changed, but the driver can select between audible or haptic alerts in the vehicle personalization menus. The forward collision alert system can also be turned on or off through the vehicle personalization menus. See the vehicle owner manual for more detailed information on vehicle personalization.

Forward collision alert does not provide a warning to help avoid a crash, unless it detects a vehicle. Forward collision alert may not detect a vehicle ahead if the frontview camera module is blocked by dirt, snow, or ice, or if the windshield is damaged. It may also not detect a vehicle on winding or hilly roads, or in conditions that can limit visibility such as fog, rain, or snow, or if the headlamps or windshield are not cleaned or in proper condition. Keep the windshield, headlamps, and frontview camera module clean and in good repair.

Forward collision alert may provide unnecessary alerts for turning vehicles, vehicles in other lanes, objects that are not vehicles, or shadows. These alerts are normal operation and the vehicle does not need service.

Front Automatic Braking (if equipped)

When the system detects a vehicle ahead in your path that is traveling in the same direction that you may be about to crash into, it can provide a boost to braking or automatically brake the vehicle. This can help avoid or lessen the severity of crashes when driving in a forward gear. Depending on the situation, the vehicle may automatically brake moderately or hard. This front automatic braking can only occur if a vehicle is detected.

The system works when driving in a forward gear between 5 mph (8 km/h) and 50 mph (80 km/h), or on vehicles with Adaptive Cruise Control above 2 mph (4 km/h). It can detect vehicles up to approximately 197 ft (60 m).

Pedestrian Collision Mitigation Braking (if equipped) is a feature subset of Front Impact Mitigation that aims to reduce the likelihood of collisions or reduce the impact speed with pedestrians in the forward direction by the following:

- Determining the forward path of the vehicle
- Monitoring this path with respect to pedestrians in or near the forward path
- When appropriate, providing pedestrian detection pedestrian and alerts to the driver, and if certain conditions are met, providing autonomous braking to help avoid or reducing the impact speed of a collision with the pedestrian

This system is not intended to replace the driver responsibility paying careful attention to the forward scene for pedestrian, vehicle, and other potential hazards. Its function is limited to supplemental use only to assist rather than replace the driver in responding to pedestrians in the forward scene.

The Pedestrian Collision Mitigation Braking system can detect and alert to up to 10 pedestrians in a forward gear at speeds between 5 mph (8 km/h) and 50 mph (80 km/h). During daytime driving, the system detects pedestrians up to a distance of approximately 40 m (131 ft). Pedestrians must be at least 31.5 inches (80 cm) tall to be detected.

No added components are required for Front Automatic Braking, or Pedestrian Collision Mitigation Braking. Refer to Owner Manual - Driver Assistance Systems for more details.

The forward collision alert system is made up of the following components:

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- Frontview camera module
- Forward collision alert switch
- Instrument cluster
- Collision alert indicators (without UV6)
- Head-up display (with UV6)
- Infotainment system
- Safety alert seat, if equipped

Frontview Camera Module

The frontview camera module detects vehicles in front of the vehicle. The frontview camera module communicates with the instrument cluster via serial data to illuminate the appropriate amber or green vehicle ahead indicator, collision alert symbol will flash in the head-up display, or collision alert indicators. The frontview camera module also communicates via serial data with the infotainment system and memory seat module to request audible or haptic alerts.

Forward Collision Alert Switch

The forward collision alert switch provides an input to the frontview camera module to select the alert timing sensitivity when approaching another vehicle too rapidly. The forward collision alert switch is part of the steering wheel controls switch - left and provides inputs to the body control module (BCM), which then communicates with the frontview camera module via serial data.

The BCM applies a reference voltage and monitors a low signal voltage from the normally open switch. When the switch is pressed, the signal circuit is pulled low through a specific series of resistors, indicating that the system has been requested to change the alert timing sensitivity. The first button press will show the current alert timing setting on the driver information center. With every subsequent button press, the alert timing sensitivity is changed.

Instrument Cluster

The instrument cluster communicates via serial data with the frontview camera module and will illuminate the amber or green vehicle ahead indicator as requested by the frontview camera module. The instrument cluster also controls the head-up display or the collision alert indicators.

Collision Alert Indicators (without UV6)

The collision alert indicators are a series of red LEDs that will flash when approaching another vehicle too rapidly. The collision alert indicators are located in the upper instrument panel area and reflect off the windshield when illuminated.

The collision alert indicators receive power and ground and are discretely controlled by the instrument cluster through a pair of low control circuits. When requested by the frontview camera module, the instrument panel will pulse the low control circuits, flashing the LEDs as a visual alert that another vehicle is being approached too rapidly.

Head-up Display (with UV6)

The instrument cluster controls the head-up display via serial data. The instrument cluster will command the head-up display to flash the collision alert indicator as a visual alert when approaching another vehicle too rapidly as requested by the frontview camera module.

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Infotainment System

The infotainment system controls the audible alerts for the forward collision alert system. If the host vehicle is approaching another vehicle too rapidly, the frontview camera module will command the infotainment system issue an audible alert to the driver.

Safety Alert Seat (if equipped)

The memory seat module controls the haptic alert provided by the seats. If the vehicle is approaching another vehicle too quickly, the frontview camera module will command the memory seat module to pulse both sides of the seat.

REAR VISION CAMERA DESCRIPTION AND OPERATION

The rear vision camera system consists of the rearview camera and the infotainment system.

When the transmission is placed into R, 12 V is applied to the reverse lamp control circuit by the body control module (BCM). The rearview camera monitors this circuit and when 12 V is seen, indicating that the transmission is in R, the rearview camera will activate. The rearview camera receives ignition voltage and a constant ground to power the camera. Video signal + and video signal - circuits carry the video image from the rearview camera to the infotainment system. Additionally, the video signal circuits are shielded to prevent any interference which may lead to a loss of video signal resolution and cause a degraded video image. The shield is grounded by the rearview camera.

The following conditions may cause a degraded rear vision camera image:

- Ice, snow, or mud has built up on the rear vision camera
- Dark conditions
- Extreme light conditions, such as glare from the sun or the headlights of another vehicle
- Damage to the rear of the vehicle
- Extreme high temperatures or extreme temperature changes

SAFETY ALERT SEAT DESCRIPTION AND OPERATION

The active safety seat provides a vibration in the driver's seat bottom cushion to alert the driver of a number of concerns. There are two motors providing the vibration and are located on the left and right sides of the seat cushion. Depending on the alert, either the left, right, or both motors will activate.

The active safety seat is made up of the following components:

- Seat Memory Control Module
- Haptic Seat Motor - Driver Left
- Haptic Seat Motor - Driver Right

Seat Memory Control Module

The seat memory control module receives serial data messages from other modules and provides a voltage output to activate haptic signal motors. The seat memory control module will pulse the left, right, or both motors with the number of pulses requested over serial data. The module monitors the circuits for open, short to ground, and short to voltage conditions and will set DTCs if a problem is detected.

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Haptic Seat Motor

The motors are located in the driver's seat bottom cushion and are positioned on the left and right sides. The motors are connected to ground and receive voltage from the seat memory control module.

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