

2013 ACCESSORIES & EQUIPMENT

Object Detection - Malibu

SCHEMATIC WIRING DIAGRAMS

OBJECT DETECTION WIRING SCHEMATICS

Rear Park Assist (UD7) Wiring Schematics

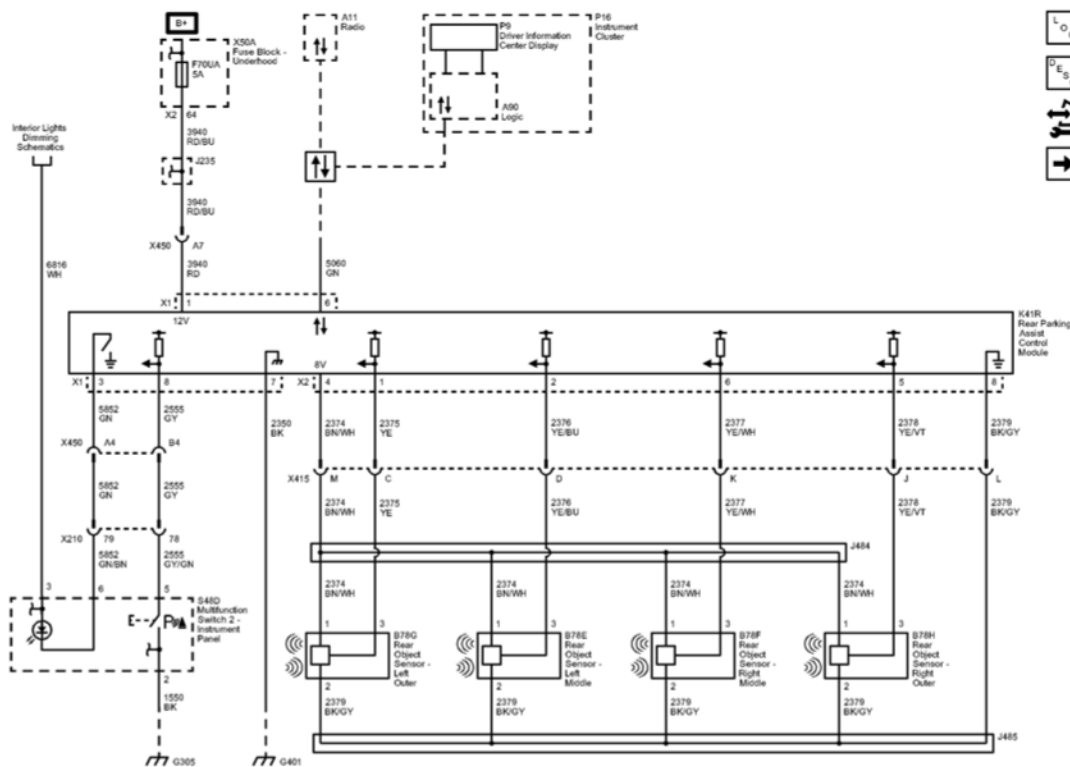


Fig. 1: Rear Park Assist (UD7) Wiring Schematics
Courtesy of GENERAL MOTORS COMPANY

Lane Departure Warning (UFL) Wiring Schematics

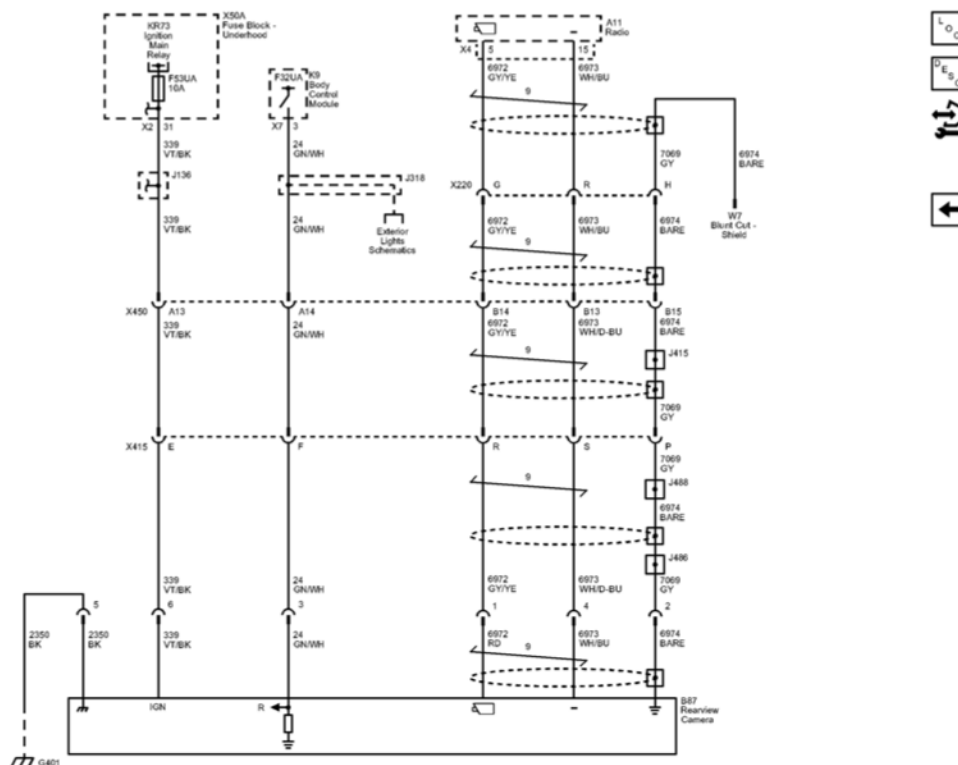


Fig. 3: Rearview Camera (UVC) Wiring Schematics
 Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B0958 01	Parking Assist Rear Sensor Left Corner Circuit Short to Battery
DTC B0958 06	Parking Assist Rear Sensor Left Corner Circuit Low Voltage/Open
DTC B0958 08	Parking Assist Rear Sensor Left Corner Circuit Performance - Signal Invalid
DTC B0958 21	Parking Assist Rear Sensor Left Corner Circuit Incorrect Period
DTC B0958 3A	Parking Assist Rear Sensor Left Corner Circuit Incorrect Component Installed
DTC B0959 01	Parking Assist Rear Sensor Left Middle Circuit Short to Battery
DTC B0959 06	Parking Assist Rear Sensor Left Middle Circuit Low Voltage/Open

<u>DTC B0958, B0959, B0960, or B0961</u>	DTC B0959 08 Parking Assist Rear Sensor Left Middle Circuit Performance - Signal Invalid DTC B0959 21 Parking Assist Rear Sensor Left Middle Circuit Incorrect Period DTC B0959 3A Parking Assist Rear Sensor Left Middle Circuit Incorrect Component Installed DTC B0960 01 Parking Assist Rear Sensor Right Middle Circuit Short to Battery DTC B0960 06 Parking Assist Rear Sensor Right Middle Circuit Low Voltage/Open DTC B0960 08 Parking Assist Rear Sensor Right Middle Circuit Performance - Signal Invalid DTC B0960 21 Parking Assist Rear Sensor Right Middle Circuit Incorrect Period DTC B0960 3A Parking Assist Rear Sensor Right Middle Circuit Incorrect Component Installed DTC B0961 01 Parking Assist Rear Sensor Right Corner Circuit Short to Battery DTC B0961 06 Parking Assist Rear Sensor Right Corner Circuit Low Voltage/Open DTC B0961 08 Parking Assist Rear Sensor Right Corner Circuit Performance - Signal Invalid DTC B0961 21 Parking Assist Rear Sensor Right Corner Circuit Incorrect Period DTC B0961 3A Parking Assist Rear Sensor Right Corner Circuit Incorrect Component Installed
<u>DTC B0967 or B0968</u>	DTC B0967 02 Parking Assist On/Off Switch Circuit Short to Ground DTC B0968 01 Parking Assist On/Off Switch Indicator Circuit Short to Battery DTC B0968 06 Parking Assist On/Off Switch Indicator Circuit Low Voltage/Open
<u>DTC B0987</u>	DTC B0987 01 Vehicle Direction Camera Indicator Circuit Short to Battery. DTC B0987 06 Vehicle Direction Camera Indicator Circuit Low Voltage/Open
<u>DTC B1011</u>	DTC B1011 00 System Disabled Information Stored Malfunction
<u>DTC B1015</u>	DTC B1015 00 Vehicle Identification Number Information Malfunction
<u>DTC B1405</u>	DTC B1405 02 Control Module Voltage Reference Output 2 Circuit Short to Ground DTC B1405 03 Control Module Voltage Reference Output 2 Circuit Low Voltage DTC B1405 07 Control Module Voltage Reference Output 2 Circuit High Voltage
	DTC B356A 02 Vehicle Direction Warning Switch

DTC B356A

Circuit Short to Ground
DTC B356A 05 Vehicle Direction Warning Switch
Circuit Short to Voltage

DTC B0958, B0959, B0960, OR B0961**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 01**

Parking Assist Rear Sensor Left Corner Circuit Short to Battery

DTC B0958 06

Parking Assist Rear Sensor Left Corner Circuit Low Voltage/Open

DTC B0958 08

Parking Assist Rear Sensor Left Corner Circuit Performance - Signal Invalid

DTC B0958 21

Parking Assist Rear Sensor Left Corner Circuit Incorrect Period

DTC B0958 3A

Parking Assist Rear Sensor Left Corner Circuit Incorrect Component Installed

DTC B0959 01

Parking Assist Rear Sensor Left Middle Circuit Short to Battery

DTC B0959 06

Parking Assist Rear Sensor Left Middle Circuit Low Voltage/Open

DTC B0959 08

Parking Assist Rear Sensor Left Middle Circuit Performance - Signal Invalid

DTC B0959 21

Parking Assist Rear Sensor Left Middle Circuit Incorrect Period

DTC B0959 3A

Parking Assist Rear Sensor Left Middle Circuit Incorrect Component Installed

DTC B0960 01

Parking Assist Rear Sensor Right Middle Circuit Short to Battery

DTC B0960 06

Parking Assist Rear Sensor Right Middle Circuit Low Voltage/Open

DTC B0960 08

Parking Assist Rear Sensor Right Middle Circuit Performance - Signal Invalid

DTC B0960 21

Parking Assist Rear Sensor Right Middle Circuit Incorrect Period

DTC B0960 3A

Parking Assist Rear Sensor Right Middle Circuit Incorrect Component Installed

DTC B0961 01

Parking Assist Rear Sensor Right Corner Circuit Short to Battery

DTC B0961 06

Parking Assist Rear Sensor Right Corner Circuit Low Voltage/Open

DTC B0961 08

Parking Assist Rear Sensor Right Corner Circuit Performance - Signal Invalid

DTC B0961 21

Parking Assist Rear Sensor Right Corner Circuit Incorrect Period

DTC B0961 3A

Parking Assist Rear Sensor Right Corner Circuit Incorrect Component Installed

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
8 V Reference	B1405 02	B0954 06, B0955 06, B0956 06, B0957 06, B0958 06, B0959 06, B0960 06, B0961 06, B1405 03	B0954 06, B0955 06, B0956 06, B0957 06, B0958 06, B0959 06, B0960 06, B0961 06, B1405 07	-
Left Rear Object Sensor Signal	B0958 06	B0958 06	B0958 01	B0958 08, B0958 21
Left Middle Rear Object Sensor Signal	B0959 06	B0959 06	B0959 01	B0959 08, B0959 21
Right Middle Rear Object Sensor Signal	B0960 06	B0960 06	B0960 01	B0960 08, B0960 21
Right Rear Object Sensor Signal	B0961 06	B0961 06	B0961 01	B0961 08, B0961 21
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 sensors that are used to determine the distance between the vehicle and an object of interest. The parking assist control module supplies 8 V to the object sensors via the 8 V reference circuit and provides ground via the low reference circuit. The parking assist control module triggers the sensors in a sequential loop. After each sensor transmits, the 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
- The parking assist is activated. The activation takes place through putting in the reverse gear or through operating the park assist switch.

Conditions for Setting the DTC

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

The parking assist control module has detected the voltage at the sensor circuit is greater than 11.5 V or the object sensor is not grounded.

B0958 06, B0959 06, B0960 06, or B0961 06

The parking assist control module has detected the voltage at the sensor circuit less than 0.5 V.

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

The parking assist control module has received an invalid signal.

B0958 21, B0959 21, B0960 21, or B0961 21

The object sensor 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 parking assist control module determines the wrong sensor type is installed.

Action Taken When the DTC Sets

- The parking assist is disabled.
- The driver information center displays SERVICE PARK ASSIST.

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

Object Detection Description and Operation (Lane Departure Warning, UFL). Object Detection Description and Operation (Rear Vision Camera, UVC). Object Detection Description and Operation (Park Assist, UD7). Object Detection Description and Operation (Forward Collision Alert, UEU)

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.
 - o **If the DTC is set**

Refer to **DTC B1405**

- o **If the DTC is not set**
3. Verify that DTC B0958 01, B0959 01, B0960 01, B0961 01, B0958 21, B0959 21, B0960 21 or B0961 21 is not set.
 - o **If the DTC is set**
 1. Check the B78 Rear Object Sensor for contamination with snow, mud, dirt, slush, or ice.
 - o If contaminated, clean sensor.
 - o If there is no contamination
 2. Refer to Circuit/System Testing below.
 - o **If the DTC is not set**
 4. Verify that DTC B0958 3A, B0959 3A, B0960 3A or B0961 3A is not set.
 - o **If the DTC is set**

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

5. Ignition ON, transmission in REVERSE.
6. Verify the scan tool Parking Assist System Status parameter displays Enabled.
 - o **If the Parking Assist System displays Disabled**

Refer to Circuit/System Testing below.

- o **If the Parking Assist System displays Enabled**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate B87 Rear Object Sensor. It may take up to two minutes for all vehicles systems to power down.
2. Test for less than 10 ohms between the low reference circuit terminal 2 and ground.
 - o **If 10 ohms or greater**
 1. Ignition OFF, disconnect the X2 harness connector at the K41R Rear Parking Assist Control Module.

2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms replace the K41R Rear Parking Assist Control Module.
 - **If less than 10 ohms**
3. Ignition ON.
4. Test for 7.5-9.5 V between the 8 V reference circuit terminal 1 and ground.
 - **If less than 7.5 V**
 1. Ignition OFF, disconnect the harness connector at the K41R Rear Parking Assist Control Module.
 2. Test for infinite resistance between the 8 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the 8 V reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K41R Rear Parking Assist Control Module.
 - **If greater than 9.5 V**
 1. Ignition OFF, disconnect the harness connector at the K41R Rear Parking Assist Control Module, ignition ON.
 2. Test for less than 1 V between the 8 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K41R Rear Parking Assist Control Module.
 - **If between 7.5-9.5 V**
 - 5. Ignition ON.
 - 6. Test for 4.8-5.2 V between the signal circuit terminal 3 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the K41R 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 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K41R Rear Parking Assist Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K41R 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 K41R Rear Parking Assist Control Module.
 - **If between 4.8-5.2 V**

7. Test or replace the appropriate B78 Rear Object Sensor.

Repair Instructions

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

- **Rear Object Alarm Replacement**
- **Control Module References** for rear parking assist control module replacement, programming and setup.

DTC B0967 OR B0968

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 02

Parking Assist On/Off Switch Circuit Short to Ground

DTC B0968 01

Parking Assist On/Off Switch Indicator Circuit Short to Battery

DTC B0968 06

Parking Assist On/Off Switch Indicator Circuit Low Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Parking Assist Switch Indicator Ignition	B0968 06	B0968 06	-	-
Parking Assist Switch Signal	B0967 02	1	-	-
Parking Assist Switch Indicator Control	B0968 06	B0968 06	B0968 01	-
Parking Assist Switch Ground	-	1	-	-
1. Parking Assist Switch Malfunction				

Circuit/System Description

The parking assist can be activated/deactivated by pressing the parking assist switch. By engaging the reverse

gear the parking assist can also be activated. By subsequently pressing the parking assist switch the parking assist can be disabled again.

The indicator in the parking assist switch shows the status of the parking assist. If the lamp is ON, the parking assist is activated.

Conditions for Running the DTC

- Ignition ON
- The parking assist is activated. The activation takes place by putting in the reverse gear or by pressing the parking assist switch.

Conditions for Setting the DTC

B0967 02

The parking assist control module has detected a short to ground.

B0968 01

The parking assist control module has detected a short to battery.

B0968 06

The parking assist control module has detected a short to ground or open.

Action Taken When the DTC Sets

- The parking assist is disabled.
- The driver information center displays SERVICE PARK ASSIST.

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

Object Detection Description and Operation (Lane Departure Warning, UFL). Object Detection Description and Operation (Rear Vision Camera, UVC). Object Detection Description and Operation (Park Assist, UD7). Object Detection Description and Operation (Forward Collision Alert, UEU)

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 B0967 02 is not set.
 - **If the DTC is set**

Refer to Circuit/System Testing below.
 - **If the DTC is not set**
3. Verify that B0968 01 or B0968 06 is not set.
 - **If the DTC is set**

Refer to Circuit/System Testing below.
 - **If the DTC is not set**
4. Verify the scan tool Park Assist Switch parameter changes between Active and Inactive.
 - **If the Parking Assist Switch parameter does not change between Active and Inactive**

Refer to Circuit/System Testing below.
 - **If the Parking Assist Switch parameter changes between Active and Inactive**
5. Verify the Parking Assist Switch Indicator turns ON and OFF when commanding with scan tool.
 - **If the indicator does not illuminate**

Refer to **Parking Assist System Malfunction**
 - **If the indicator change between ON and OFF**
6. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
2. Test for less than 10 ohms between the S48D Multifunction Switch 2 - Instrument Panel terminal 1 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the ground circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify the scan tool Parking Assist Switch parameter is Inactive.
 - **If not Inactive**
 1. Ignition OFF, disconnect the harness connector at the K41R Rear Parking Assist Control Module.
 2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K41R Rear Parking Assist Control Module.
 - **If Inactive**
5. Install a 3 A fused jumper wire between the signal circuit terminal 5 and ground.
6. Verify the scan tool Parking Assist Switch parameter is Active.
 - **If not Active**
 1. Ignition OFF, disconnect the harness connector at the K41R 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.
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K41R Rear Parking Assist Control Module.
 - **If Active**
7. Test or replace the S48D Multifunction Switch 2 - Instrument Panel.

Parking Assist Switch Indicator Malfunction

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
2. Test for less than 10 ohms between the S48D Multifunction Switch 2 - Instrument Panel terminal 1 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.

2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
3. Connect a test lamp between the voltage circuit terminal 3 and ground circuit terminal 1.
4. Verify the test lamp turns ON and OFF when commanding the Parking Assist Switch LED On and Off with a scan tool.
 - **If the test lamp is always OFF**
 1. Ignition OFF, disconnect the harness connector at the K41R Rear Parking Assist Control Module.
 2. Test for infinite resistance between the voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K41R Rear Parking Assist Control Module.
 - **If the test lamp is always ON**
 1. Ignition OFF, disconnect the harness connector at the K41R Rear Parking Assist Control Module, ignition ON.
 2. Test for less than 1 V between the voltage circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K41R Rear Parking Assist Control Module.
 - **If the test lamp turns ON and OFF**
 - 5. All OK.

Repair Instructions

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

- **Instrument Panel Multifunction Switch Replacement**
- **Control Module References** for parking assist control module replacement, programming and setup.

DTC B0987

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 01

Vehicle Direction Camera Indicator Circuit Short to Battery.

DTC B0987 06

Vehicle Direction Camera Indicator Circuit Low Voltage/Open

Circuit/System Description

The lane departure warning is enabled and disabled through a switch located in the instrument panel. When the switch is pressed once, the vehicle direction camera control module disable or enable the lane departure warning. When the lane departure warning system is enabled the vehicle direction camera control module will illuminate the indicator in the switch.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

B0987 01

The vehicle direction camera control module detects a short to voltage in the control circuit.

B0987 06

The vehicle direction camera control module detects a short to ground or an open/high resistance in the control circuit.

Action Taken When the DTC Sets

Lane departure warning is disabled.

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

Object Detection Description and Operation (Lane Departure Warning, UFL), Object Detection Description and Operation (Rear Vision Camera, UVC), Object Detection Description and Operation (Park Assist, UD7), Object Detection Description and Operation (Forward Collision Alert, UEU)

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 DTC B356A is not set.
 - **If the DTC is set**

Refer to **DTC B356A**
 - **If the DTC is not set**
3. Verify the scan tool Vehicle Direction Camera Indicator Status parameter changes between ON and OFF when pressing and releasing the lane departure warning switch.
 - **If the parameter does not change between ON and OFF**

Refer to Circuit/System Testing below.
 - **If the parameter changes between ON and OFF**
4. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
2. Test for less than 10 ohms between the ground circuit terminal 1 at the S48D Multifunction Switch 2 - Instrument Panel and ground.
 - **If 10 ohms or greater**
 1. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.

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

○ **If less than 10 ohms**

3. Disconnect the harness connector at the K109 Vehicle Camera Module.

4. Ignition ON, test for less than 1 V between the control circuit terminal 4 at the S48D Multifunction Switch 2 - Instrument Panel and ground.

○ **If 1 V or greater**

Repair the short to voltage on the circuit.

○ **If less than 1 V**

5. Ignition OFF.

6. Test for less than 2 ohms in the control circuit end to end.

○ **If 2 ohms or greater**

Repair the open/high resistance in the circuit.

○ **If less than 2 ohms**

7. Test for infinite resistance between the control circuit terminal 4 and ground.

○ **If less than infinite resistance**

Repair the short to ground on the circuit.

○ **If infinite resistance**

8. Replace the K109 Vehicle Camera Module.

Repair Instructions

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

- **Instrument Panel Multifunction Switch Replacement**
- **Control Module References** for Front View Camera Module replacement, programming and setup.

DTC B1011

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

- 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

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Object Detection Description and Operation (Lane Departure Warning, UFL), Object Detection Description and Operation (Rear Vision Camera, UVC), Object Detection Description and Operation (Park Assist, UD7), Object Detection Description and Operation (Forward Collision Alert, UEU)

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.
 - o If any other DTCs are set

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

- o 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

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 00

Vehicle Identification Number Information Malfunction

Circuit/System Description

When the ignition is turned ON, the rear parking assist control module and the vehicle camera module receives the vehicle identification number (VIN) from the body control module. 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 parking assist system or the lane departure warning system is disabled.
- The driver information center displays SERVICE PARK ASSIST or SERVICE LANE DEPARTURE SYSTEM.

Conditions for Clearing the DTC

The stored VIN matches the VIN stored in the body control module.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Object Detection Description and Operation (Lane Departure Warning, UFL). **Object Detection Description and Operation (Rear Vision Camera, UVC).** **Object Detection Description and Operation (Park Assist, UD7).** **Object Detection Description and Operation (Forward Collision Alert, UEU)**

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B1015 is not.
 - **If DTC B1015 is set**
 1. Program the control module the DTC originally set in.
 2. Verify the DTC does not set.
 - If the DTC is sets, replace the control module the DTC set in.
 - If the DTC does not set
 - **If DTC B1015 is not set**
3. All OK

Repair Instructions

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

Control Module References for the rear parking assist control module or vehicle direction camera control module replacement, programming and setup.

DTC B1405

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 02

Control Module Voltage Reference Output 2 Circuit Short to Ground

DTC B1405 03

Control Module Voltage Reference Output 2 Circuit Low Voltage

DTC B1405 07

Control Module Voltage Reference Output 2 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Object Sensor Supply Voltage	B1405 02	B0958 06, B0959 06, B0960 06, B0961 06, B1405 03	B0958 06, B0959 06, B0960 06, B0961 06, B1405 07	-
Left Rear Corner Object Sensor Signal	B0958 06	B0958 06	B0958 01	B0958 08, B0958 21
Left Rear Middle Object Sensor Signal	B0959 06	B0959 06	B0959 01	B0959 08, B0959 21
Right Rear Middle Object Sensor Signal	B0960 06	B0960 06	B0960 01	B0960 08, B0960 21
Right Rear Corner Object Sensor Signal	B0961 06	B0961 06	B0961 01	B0961 08, B0961 21
Object Sensor Low Reference	-	B0958 06, B0959 06, B0960 06, B0961 06	-	-

Circuit/System Description

The object sensors are 3-wire sensors that are used to determine the distance between the vehicle and an object of interest. The parking assist control module supplies 8 V to the object sensors via the object sensor supply voltage circuit and provides ground via the object sensor low reference circuit. The parking assist control module triggers the sensors in a sequential loop. After each sensor transmits, the parking assist control module uses the sensor echo received through the object sensor signal circuit to calculate the distance and position of an object.

Conditions for Running the DTC

- Ignition ON
- Transmission in REVERSE

Conditions for Setting the DTC

B1405 02

The parking assist control module has detected the object sensor supply voltage circuit is shorted to ground.

B1405 03

The parking assist control module has detected the object sensor supply voltage circuit is less than 7.2 V.

B1405 07

The parking assist control module has detected the object sensor supply voltage circuit is greater than 9.2 V.

Action Taken When the DTC Sets

- The parking assist is disabled.
- The driver information center displays SERVICE PARK ASSIST.

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

Object Detection Description and Operation (Lane Departure Warning, UFL), Object Detection Description and Operation (Rear Vision Camera, UVC), Object Detection Description and Operation (Park Assist, UD7), Object Detection Description and Operation (Forward Collision Alert, UEU)

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 transmission is in REVERSE.
 - **If the transmission not in REVERSE**

Refer to **DTC B2545**

- **If the transmission is in REVERSE**

3. Verify the scan tool Park Assist Sensor Reference Voltage is between 7.2-9.2 V.

- **If not between 7.2-9.2 V**

Refer to Circuit/System Testing below.

- **If is between 7.2-9.2 V**

4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at each of the object sensors, ignition On, transmission in REVERSE
2. Test for 7.2-9.2 V between the object sensor reference circuit terminal 1 at all B78 Rear Object Sensor harness connectors and ground.
 - **If less than 7.2 V**
 1. Ignition OFF, disconnect the harness connector at the K41R Rear Parking Assist Control Module.
 2. Test for infinite resistance between the 8 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the 8 V reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K41R Rear Parking Assist Control Module.
 - **If greater than 9.2 V**
 1. Disconnect the harness connector X 2 at the K41R Rear Parking Assist Control Module, ignition ON.
 2. Test for less than 1 V between the 8 V supply voltage circuit and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K41R Rear Parking Assist Control Module.
 - **If between 7.2-9.2 V**
3. All OK.

Repair Instructions

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

- **Rear Object Alarm Replacement**
- **Control Module References** for parking assist control module replacement, programming and setup

DTC B356A

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 02

Vehicle Direction Warning Switch Circuit Short to Ground

DTC B356A 05

Vehicle Direction Warning Switch Circuit Short to Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Vehicle Direction Warning Switch Signal Circuit	B356A 02	1	B356A 05	-
Vehicle Direction Warning Switch Ground Circuit	-	1	1	-
1. Vehicle direction warning system inoperative				

Circuit/System Description

The lane departure warning is enabled and disabled through a switch located in the instrument panel. When the switch is pressed once, the vehicle direction camera control module disables or enables the lane departure warning. When the lane departure warning system is enabled the vehicle direction camera control module will illuminate the indicator in the switch.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

DTC B356A 02

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

DTC B356A 05

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

Action Taken When the DTC Sets

- Lane departure warning is disabled.

- Lane Departure Unavailable is 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

Object Detection Description and Operation (Lane Departure Warning, UFL), Object Detection Description and Operation (Rear Vision Camera, UVC), Object Detection Description and Operation (Park Assist, UD7), Object Detection Description and Operation (Forward Collision Alert, UEU)

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 Vehicle Direction Warning Switch Status parameter changes between On and Off while cycling the vehicle direction warning switch.
 - **If the parameter does not change**

Refer to Circuit/System Testing below.
 - **If the parameter changes**
3. All OK.

Circuit/System Testing

1. Ignition OFF.
2. Remove the ignition key, open the driver door, disconnect the scan tool, all vehicle systems OFF, this may take up to 2 min.
3. Disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
4. Test for less than 10 ohms between the ground circuit terminal 1 and ground.
 - **If 10 ohms or greater**
 1. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
5. Ignition ON.
6. Verify the scan tool Vehicle Direction Warning Switch Status parameter is Off.
 - **If not Off**
 1. Ignition OFF, disconnect the harness connector at the K109 Vehicle Camera Module.
 2. Test for infinite resistance between the signal circuit terminal 4 at the S48D Multifunction Switch 2 - Instrument Panel and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K109 Vehicle Camera Module.
 - **If Off**
7. Disconnect the harness connector at the K109 Vehicle Camera Module.
8. Install a 3 A fused jumper wire between the signal circuit terminal 4 and ground circuit terminal 1.
9. Verify within 10 s the scan tool Vehicle Direction Warning Switch Status parameter is On.
 - **If not On**
 1. Test for less than 1 V between the signal circuit terminal 4 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V.
 2. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K109 Vehicle Camera Module.
 - **If On**
10. Replace the S48D Multifunction Switch 2 - Instrument Panel.

Repair Instructions

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

- **Instrument Panel Multifunction Switch Replacement**
- **Control Module References** for Front View Camera 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 List 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.

NOTE: The rear vision camera does not communicate on the serial data bus.

2. Review the system operation in order to familiarize yourself with the system functions. Refer to **Object Detection Description and Operation (Lane Departure Warning, UFL)**, **Object Detection Description and Operation (Rear Vision Camera, UVC)**, **Object Detection Description and Operation (Park Assist, UD7)**, **Object Detection Description and Operation (Forward Collision Alert, UEU)**.

Visual/Physical Inspection

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

- **Forward Collision Alert System Malfunction**
- **Lane Departure Warning System Malfunction**
- **Parking Assist System Malfunction**
- **Rear Vision Camera System Malfunction**

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	-	-
Forward Collision Alert Switch Signal	P0580, P0592	P0592	P0593	-
Forward Collision Alert Switch Dimming Control	P155A	P0580	-	-
Forward Collision Alert Indicators Control	2	1	1	-
Forward Collision Alert Indicators Ground	-	1	-	-
1. Forward Collision Alert Indicators inoperable 2. Forward Collision Alert Indicators on all the time				

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 meters (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.

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

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Object Detection Description and Operation (Lane Departure Warning, UFL), Object Detection Description and Operation (Rear Vision Camera, UVC), Object Detection Description and Operation (Park Assist, UD7), Object Detection Description and Operation (Forward Collision Alert, UEU)

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

Refer to Circuit/System Testing below - Frontview Camera Module Malfunction
 - **If parameter is not Malfunction**
3. Verify the forward collision alert indicators illuminate momentarily when turning ignition OFF and then ON.
 - **If the indicators do not illuminate**

Refer to Circuit/System Testing below- Forward Collision Alert Indicator Malfunction
 - **If the indicators illuminate**
4. Verify the driver information center forward collision alert distance indicator toggles between far, medium, near and off.

- **If the setting does not change**

Refer to Circuit/System Testing below - Forward Collision Alert Switch Malfunction.

- **If the setting changes**

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

NOTE: Perform the Circuit/System Verification before proceeding with 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 minutes for all vehicle systems to power down.
2. Test for less than 10 ohms between the ground circuit terminal 1 and ground.

- **If 10 ohms or greater**

1. Ignition OFF.
2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.

- **If less than 10 ohms**

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

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

1. 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 minutes for all vehicle systems to power down.
2. Test for less than 10 ohms between the ground circuit terminal 4 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
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 ohms in the ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, 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 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. Connect a test lamp between the control circuit terminal 2 and the ignition circuit terminal 1.
6. Verify the test lamp turns ON and OFF when commanding the Instrument Cluster All Indicators ON and OFF with a scan tool.
 - **If the test lamp is always OFF**
 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 ohms in the control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the P16 Instrument Cluster.
 - **If the test lamp is always ON**

1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the P16 Instrument Cluster.
- **If the test lamp turns ON and OFF**
7. Test or replace the P43 Collision Alert Indicators.

Forward Collision Alert Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the S70L Steering Wheel Controls Switch - Left, ignition ON.
2. Verify a test lamp illuminates between the ignition circuit terminal 1 and ground.
 - **If test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the Ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, 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 Ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the S70L Steering Wheel Controls Switch - Left.
 - **If the test lamp illuminates**
3. Ignition OFF, connect the harness connector at the S70L Steering Wheel Controls Switch - Left, disconnect the X3 harness connector at the K9 Body Control Module, ignition ON.
4. Test for less than 1 V between the signal circuit terminals listed below and ground:
 - Terminal 4
 - Terminal 16
 - **If 1 V or greater**

Repair the short to voltage on the signal circuit.
 - **If less than 1 V**
5. Ignition OFF.
6. Test for infinite resistance between the signal circuit terminals listed below and ground:
 - Terminal 4
 - Terminal 16
 - **If less than infinite resistance**

Repair the short to ground on the signal circuit.

○ **If infinite resistance**

7. Disconnect the harness connector at the S70L Steering Wheel Controls Switch - Left.
8. Test for less than 5 ohms between the circuit terminals listed below:
 - S70L Steering Wheel Controls Switch - Left terminal 1 and K9 Body Control Module terminal 4.
 - S70L Steering Wheel Controls Switch - Left terminal 2 and K9 Body Control Module terminal 16.

○ **If greater than 5 ohms**

Repair the open/high resistance in the circuit.

○ **If less than 5 ohms**

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

Component Testing

Forward Collision Alert Switch

Static Test

1. Ignition OFF, disconnect the harness connector at the S70L Steering Wheel Controls Switch - Left.
2. Test for 6.1k-7.5k ohms between the control terminal 1 and the signal circuit terminal 2.

○ **If not between 6.1k-7.5k ohms**

Replace the S70L Steering Wheel Controls Switch - Left.

○ **If between 6.1k-7.5k ohms**

3. Test for 1.6k-2.1k ohms between the control terminal 1 and the signal circuit terminal 2 while pressing the switch.

○ **If not between 1.6k-2.1k ohms**

Replace the S70L Steering Wheel Controls Switch - Left.

○ **If between 1.6k-2.1k ohms**

4. All OK.

Repair Instructions

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

- **Cruise Control Switch Replacement** - Steering Wheel Controls Switch - Left 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
Parking Assist Switch Indicator Ignition	B0968 06	B0968 06	-	-
Parking Assist Switch Signal	B0967 02	1	-	-
Parking Assist Switch Indicator Control	B0968 06	B0968 06	B0968 01	-
Parking Assist Switch Ground	-	1	-	-
1. Parking Assist Switch Malfunction				

Circuit/System Description

The ultrasonic parking assist system is designed to identify and notify the driver of an object in the vehicle's path when moving reverse 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 fascia. The parking assist system will notify the driver using an audible signal through the radio.

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 or audio system personalization menu.
- Hitch/Object Attached - The 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 bumper itself, the parking assist control module will interpret this as an attached object and disable the system. Carefully inspect the bumper, bumper 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 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 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

Object Detection Description and Operation (Lane Departure Warning, UFL), **Object Detection Description and Operation (Rear Vision Camera, UVC)**, **Object Detection Description and Operation (Park Assist, UD7)**, **Object Detection Description and Operation (Forward Collision Alert, UEU)**

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 park assist system is enabled through the parking assist switch.
 - **If the park assist system is manually disabled, enable the system.**

Refer to the vehicle owners manual for instructions on enabling the system below.

- **If the park assist system is enabled**

3. Verify the scan tool Park Assist Switch parameter changes between Active and Inactive when cycling the park assist switch.

- **If the parameter does not change between Active and Inactive** Refer to Parking Assist Switch Circuit Malfunction below.

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

4. Verify the park assist switch indicator turns ON and OFF when commanding the scan tool Park Assist Switch LED On and Off.

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

Refer to Parking Assist Switch Indicator Circuit Malfunction below.

- **If the indicator does turn ON and OFF**

5. Transmission in REVERSE.
6. Verify the scan tool Park Assist System Status parameter is Enable.

- **If the parameter is not Enabled**

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

- **If the parameter is Enabled**

7. All OK.

Circuit/System Testing

Parking Assist Switch Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
2. Test for less than 10 ohms between the ground circuit terminal 1 and ground.

- **If 10 ohms or greater**

1. Ignition OFF.
2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.

- **If less than 10 ohms**

3. Ignition ON.
4. Verify the scan tool Parking Assist Switch Status parameter is inactive.
 - **If not Inactive**
 1. Ignition OFF, disconnect the harness connector at the K41R Rear Parking Assist Control Module.
 2. Test for infinite resistance between the control circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.

- If infinite resistance, replace the K41R Rear Parking Assist Control Module.
 - **If Inactive**
5. Test for less than 1 V between the control circuit terminal 5 and ground.
- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**
6. All OK.

Parking Assist Switch Indicator Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
2. Test for less than 10 ohms between the low control circuit terminal 6 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the low control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K41R Rear Parking Assist Control Module.
 - **If less than 10 ohms**
3. Ignition ON, test for 4.8-5.2 V between the voltage circuit terminal 3 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch 2 - Instrument Panel.
 2. Test for infinite resistance between the voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the voltage circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, test or replace the K9 Body Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module, ignition ON.
 2. Test for less than 1 V between the voltage circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K9 Body Control Module.
 - **If between 4.8-5.2 V**
4. Test or replace the S48D Multifunction Switch 2 - Instrument Panel.

Repair Instructions

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

- **Instrument Panel Multifunction Switch Replacement**
- **Control Module References** for Parking Assist Control Module replacement, programming and setup.

REAR VISION CAMERA 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
Ignition	1	1	-	-
Ground	-	1	-	-
Backup Signal	1	1	2	-
Shield	3	3	3	-
Camera Module signal +	3	1	1	-
Camera Module signal -	3	1	1	-
1. Rear Vision Camera no image displayed 2. Rear Vision Camera image always displayed 3. Poor Quality Image				

Circuit/System Description

When the transmission is placed into REVERSE, 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.

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.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Object Detection Description and Operation (Lane Departure Warning, UFL), **Object Detection Description and Operation (Rear Vision Camera, UVC)**, **Object Detection Description and Operation (Park Assist, UD7)**, **Object Detection Description and Operation (Forward Collision Alert, UEU)**

Electrical Information Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC B2545 is not set.
 - **If the DTC is set**

Refer to **DTC B2545** .
 - **If the DTC is not set**
3. Verify there is no debris on the rearview camera lens and that the bezel and bezel seal are not damaged.
 - **If debris are found on the lens**

Clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.
 - **If no debris on the lens**
4. Engine running, transmission in REVERSE.
5. Verify the backup lamps are On.
 - **If the backup lamps are not ON**

Refer to **Backup Lamps Malfunction** .
 - **If the backup lamps are ON**
6. Engine running, transmission in REVERSE.
7. Verify a clear rear vision image is displayed on the radio.
 - **If a clear image is not displayed**

Refer to Circuit/System Testing below.

- **If a clear image is displayed**

8. All OK.

Circuit/System Testing

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

1. Ignition OFF, disconnect the harness connector at the B87 Rearview Camera.
2. Test for less than 10 ohms between the ground circuit terminal 5 and ground.
 - **If 10 ohms or greater**
 1. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
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 ohms in the ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, 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 ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K73 Ignition Main Relay.
 - **If the test lamp illuminates**
5. Engine running, park brake applied, transmission in REVERSE.
6. Verify a test lamp illuminates between the control circuit terminal 3 and ground.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, disconnect the X7 harness connector at the K9 Body Control Module.
 2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K9 Body Control Module.

○ **If the test lamp illuminates**

7. Ignition OFF, disconnect the X4 harness connector at the A11 Radio, ignition ON.

8. Test for less than 1 V between the signal circuit terminal listed below and ground:

- B87 Rearview Camera signal (+) circuit terminal 1.
- B87 Rearview Camera signal (-) circuit terminal 4.

○ **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 terminal listed below and ground:

- B87 Rearview Camera signal (+) circuit terminal 1.
- B87 Rearview Camera signal (-) circuit terminal 4.

○ **If less than infinite resistance**

Repair the short to ground on the circuit.

○ **If infinite resistance**

10. Test for less than 2 ohms in the following signal (+) circuits end to end.

- B87 Rearview Camera signal (+) circuit terminal 1 to A11 Radio X4, terminal 5
- B87 Rearview Camera signal (-) circuit terminal 4 to A11 Radio X4, terminal 15

○ **If 2 ohms or greater**

Repair the open/high resistance in the appropriate circuit.

○ **If less than 2 ohms**

11. Test for less than 2 ohms in the signal (-) circuit end to end.

- B87 Rearview Camera signal (+) circuit terminal 1 to A11 Radio X4, terminal 5
- B87 Rearview Camera signal (-) circuit terminal 4 to A11 Radio X4, terminal 15

○ **If 2 ohms or greater**

Test the appropriate signal circuit for an open/high resistance.

○ **If less than 2 ohms**

12. Replace the B87 Rearview Camera.

13. Engine running, transmission in REVERSE.

14. Verify a clear rear vision image is displayed on the driver information display.

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

Refer to **Radio Information Display Malfunction (with Monochrome Display)** , **Radio Information Display Malfunction (with Color Display)** .

- If a clear rear vision image displayed

15. All Ok.

Repair Instructions

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

Rearview Camera Image Display Module Replacement

LANE DEPARTURE WARNING 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
Lane Departure Warning Switch Ignition Circuit	-	2	-	-
Lane Departure Warning Switch Signal Circuit	B356A 02	1	B356A 05	-
Lane Departure Warning Switch Indicator Control Circuit	-	B0987 06	B0987 01	-
Lane Departure Warning Switch Ground Circuit	-	1	1	-
1. Lane Departure Warning Inoperative. 2. Lane Departure Warning Switch Illumination Inoperative.				

Circuit/System Description

The lane departure warning is controlled by the frontview camera module mounted on the windshield. The lane departure warning is enabled and disabled through a switch located at the instrument panel. When enabled, the vehicle direction camera control module will illuminate the indicator located in the switch.

When the system is operating and can detect the lane markings, the vehicle direction camera control module will request via serial data communications that the instrument cluster illuminate the green lane departure ready-to-assist indicator. If the frontview camera module detects that the vehicle has crossed a lane marking without the turn signal being used, the module will request that the instrument cluster flash the yellow lane departure warning indicator. An audible warning will also sound three times when the yellow instrument cluster indicator is flashing.

Diagnostic Aids

Certain factors will affect the operation of the lane departure warning system. When the system is operating properly, the green lane departure 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 indicator will not appear when the system is having difficulty seeing the lines on the road or if the view of the camera on the windshield 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.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Object Detection Description and Operation (Lane Departure Warning, UFL), Object Detection Description and Operation (Rear Vision Camera, UVC), Object Detection Description and Operation (Park Assist, UD7), Object Detection Description and Operation (Forward Collision Alert, UEU)

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 B356A is not set.
 - If the DTC is set

Refer to **DTC B356A**.

- **If the DTC is not set**

3. Verify that DTC B0987 is not set.

- **If the DTC is set**

Refer to **DTC B0987**.

- **If the DTC is not set**

4. Verify the scan tool Frontview Camera System Status parameter is Normal.

- **If the parameter is Undefined or Malfunction**

Refer to Circuit/System Testing below.

- **If the parameter is Normal**

5. Verify the scan tool Lane Departure Warning Switch Status parameter changes between On and Off when pressing the lane departure warning switch.

- **If the parameter does not change between On and Off**

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

- **If the parameter changes between On and Off**

6. All OK.

Circuit/System Testing

Lane Departure Warning Switch Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch - Instrument Panel.

2. Test for less than 10 ohms between the ground circuit terminal 1 and ground.

- **If 10 ohms or greater**

1. Ignition OFF.

2. Test for less than 2 ohms in the ground circuit end to end.

- If 2 ohms or greater, repair the open/high resistance in the ground circuit.

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

- **If less than 10 ohms**

3. Ignition ON.

4. Verify the scan tool Lane Departure Warning Switch parameter is Off.

- **If not Off**

1. Ignition OFF, disconnect the harness connector at the K109 Vehicle Camera Module.

2. Test for infinite resistance between the signal circuit terminal 4 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.

- If infinite resistance, replace the K109 Vehicle Camera Module.
 - **If Off**
- 5. Install a 3 A fused jumper wire between the signal circuit terminal 4 and ground.
- 6. Verify the scan tool Lane Departure Warning Switch parameter is On.
 - **If not On**
 1. Ignition OFF, disconnect the harness connector at the K109 Vehicle 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. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K109 Vehicle Camera Module.
 - **If On**
- 7. Test or replace the S48D Multifunction Switch - Instrument Panel.

Lane Departure Warning Switch Indicator Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48D Multifunction Switch - Instrument Panel.
2. Test for less than 10 ohms between the low control circuit terminal 8 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the low control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K109 Vehicle Camera Module.
 - **If less than 10 ohms**
3. Ignition ON, test for 4.8-5.2 V between the voltage circuit terminal 3 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module.
 2. Test for infinite resistance between the voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the voltage circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K9 Body Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K9 Body Control Module, ignition ON.
 2. Test for less than 1 V between the voltage circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.

- If less than 1 V, replace the K9 Body Control Module.
- **If between 4.8-5.2 V**

4. Test or replace the S48D Multifunction Switch - Instrument Panel.

Repair Instructions

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

Control Module References for Frontview Camera Module replacement, programming and setup

REPAIR INSTRUCTIONS

FORWARD COLLISION ALERT DISPLAY REPLACEMENT

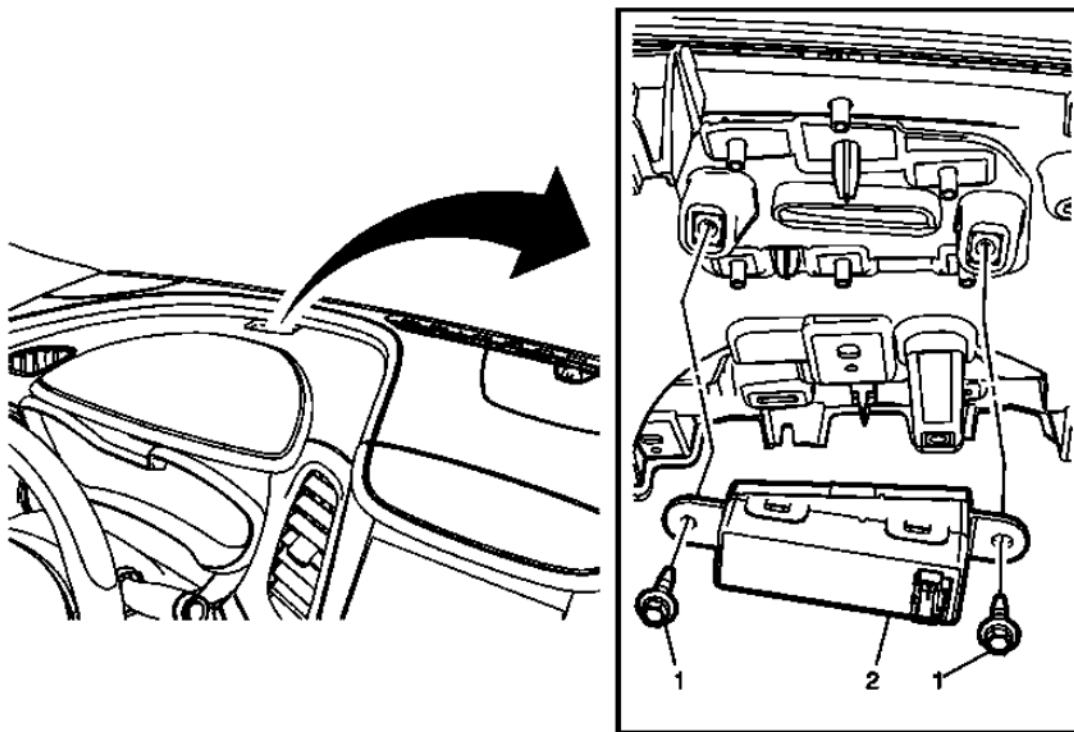


Fig. 4: Forward Collision Alert Display
Courtesy of GENERAL MOTORS COMPANY

Forward Collision Alert Display Replacement

Callout	Component Name
Preliminary Procedure	
Remove the instrument panel assembly. Refer to <u>Instrument Panel Assembly Replacement</u> .	
1	Forward Collision Alert Display (Qty: 2) CAUTION:

	Refer to Fastener Caution .
2	Forward Collision Alert Display Procedure Disconnect the electrical connector.

REAR OBJECT ALARM REPLACEMENT

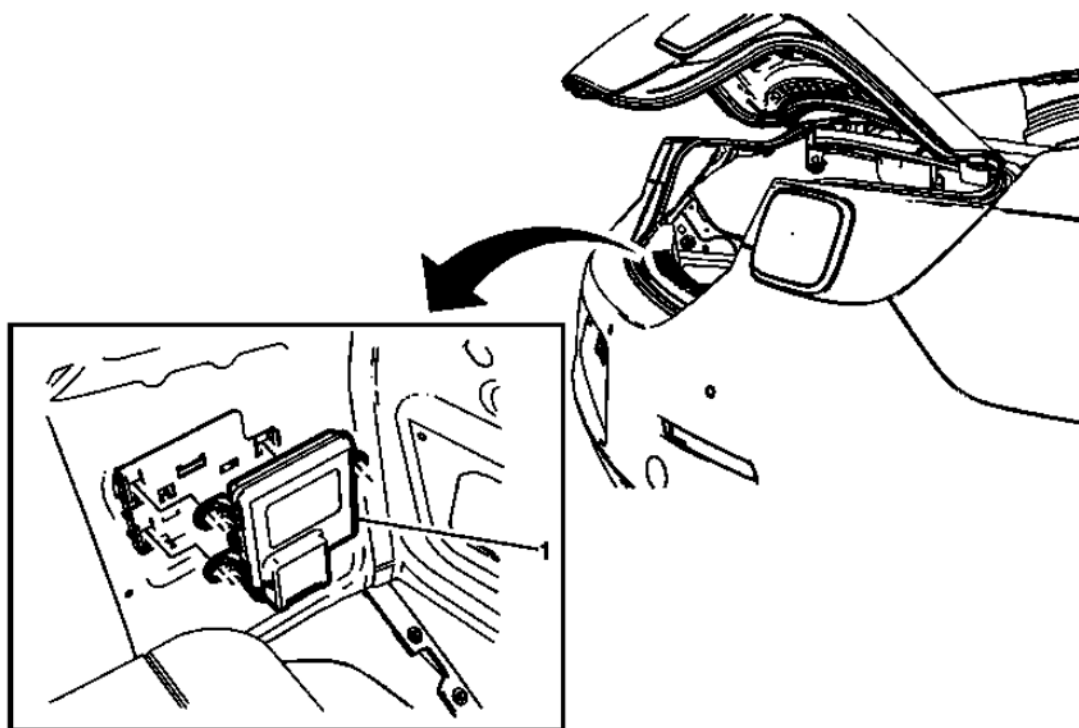


Fig. 5: Rear Object Alarm

Courtesy of GENERAL MOTORS COMPANY

Rear Object Alarm Replacement

Callout	Component Name
Preliminary Procedure Remove the left side rear compartment side trim panel. Refer to Rear Compartment Side Trim Panel Replacement (without HP6) , Rear Compartment Side Trim Panel Replacement (HP6, Left Side) , Rear Compartment Side Trim Panel Replacement (HP6, Right Side) .	
1	Rear Object Alarm Module Assembly Procedure 1. Release the locking retainer from the rear object alarm module bracket. 2. Disconnect the electrical connectors. 3. For programming and set up, refer to Control Module References .

REAR OBJECT SENSOR HOUSING REPLACEMENT

1. Remove the rear fascia. Refer to [Rear Bumper Fascia Replacement](#) .

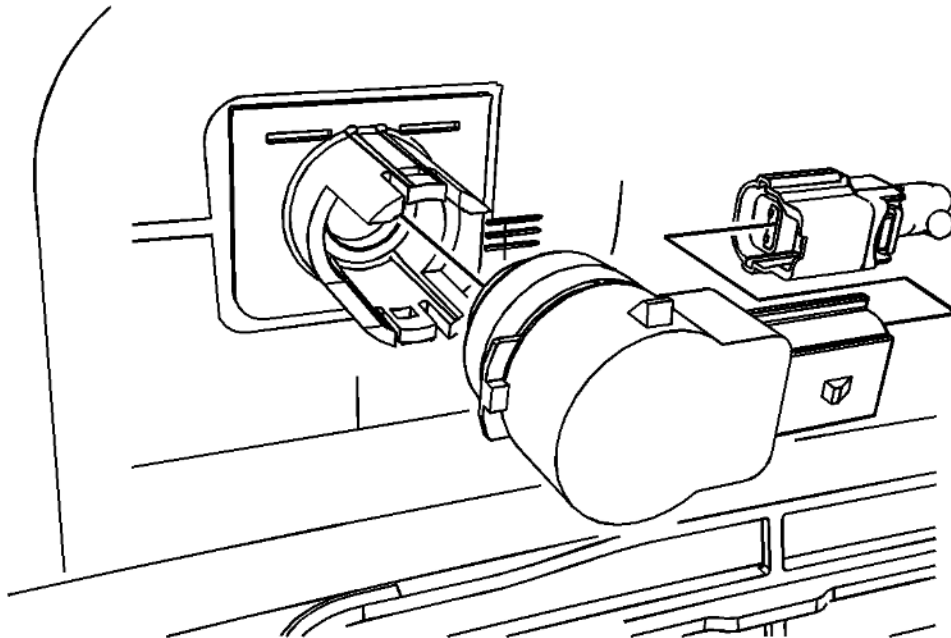


Fig. 6: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the sensor harness.
3. Remove the sensor from the sensor housing.

The sensor housing must be painted if replaced. If reinstalled, painting will not be necessary.

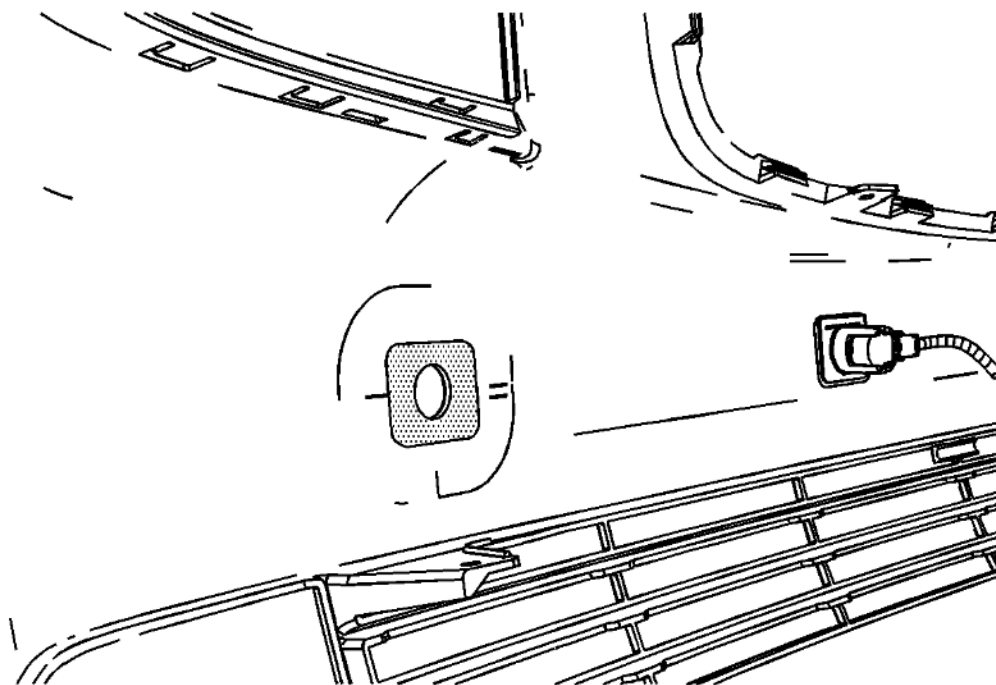


Fig. 7: Sanding/Grinding Sonic Weld Plastic Residue From Fascia
Courtesy of GENERAL MOTORS COMPANY

NOTE: Do Not grind off alignment tabs.

4. Sand/grind sonic weld plastic residue from the fascia.

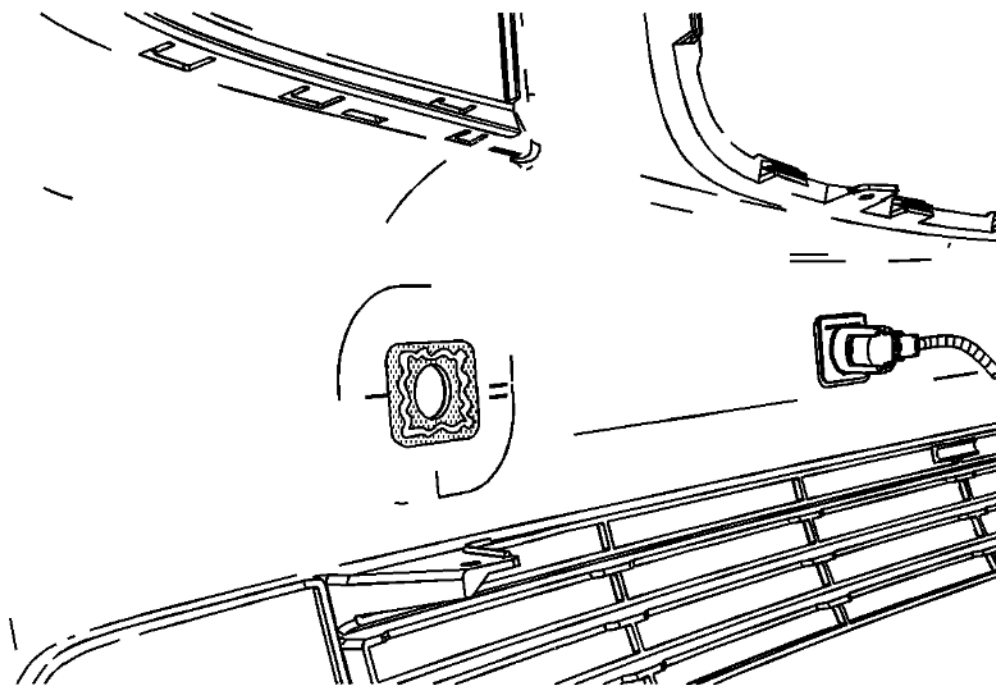


Fig. 8: Applying Structural Adhesive Epoxy To Fascia
Courtesy of GENERAL MOTORS COMPANY

5. Apply structural adhesive epoxy, Lord Fusor™ 127EZ or equivalent, to fascia at mating surface.

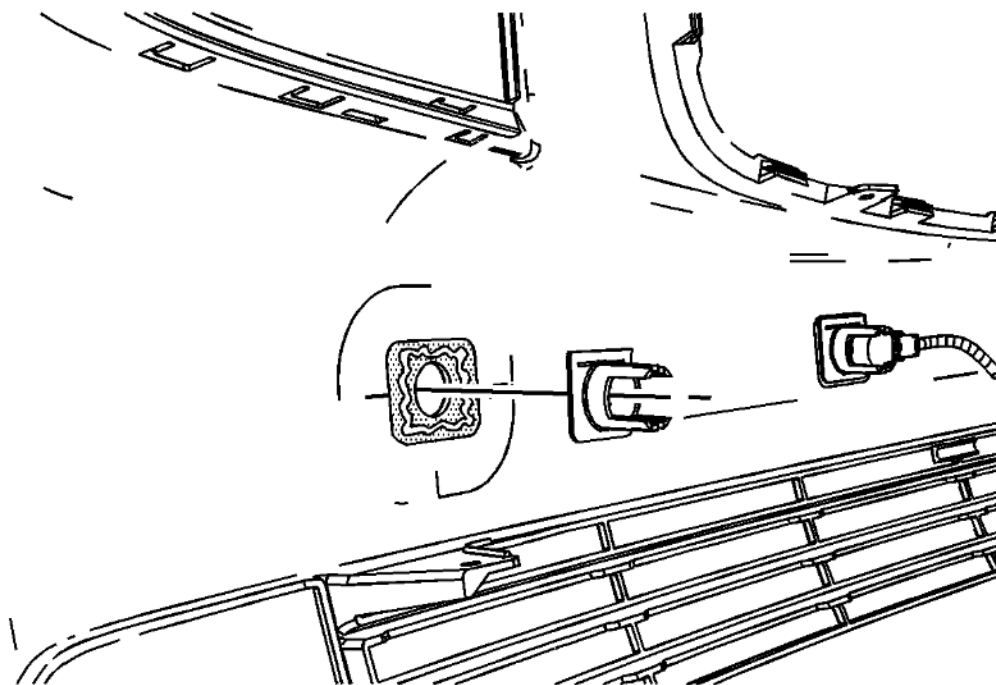


Fig. 9: Identifying Sensor Housing & Tabs
Courtesy of GENERAL MOTORS COMPANY

6. Using the alignment tabs, install the sensor housing to the fascia.
7. Allow adhesive to cure according to manufacturer's directions.

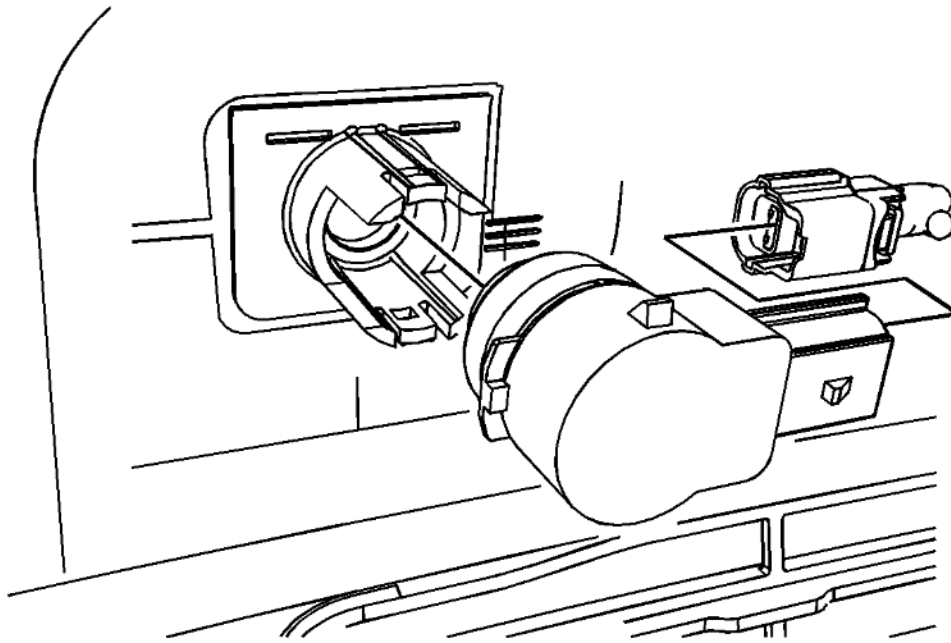


Fig. 10: Identifying Rear Object Sensor Housing
Courtesy of GENERAL MOTORS COMPANY

8. Install the sensor to the sensor housing.
9. Connect the electrical harness.
10. Install the rear fascia. Refer to **Rear Bumper Fascia Replacement** .

FRONT VIEW CAMERA REPLACEMENT

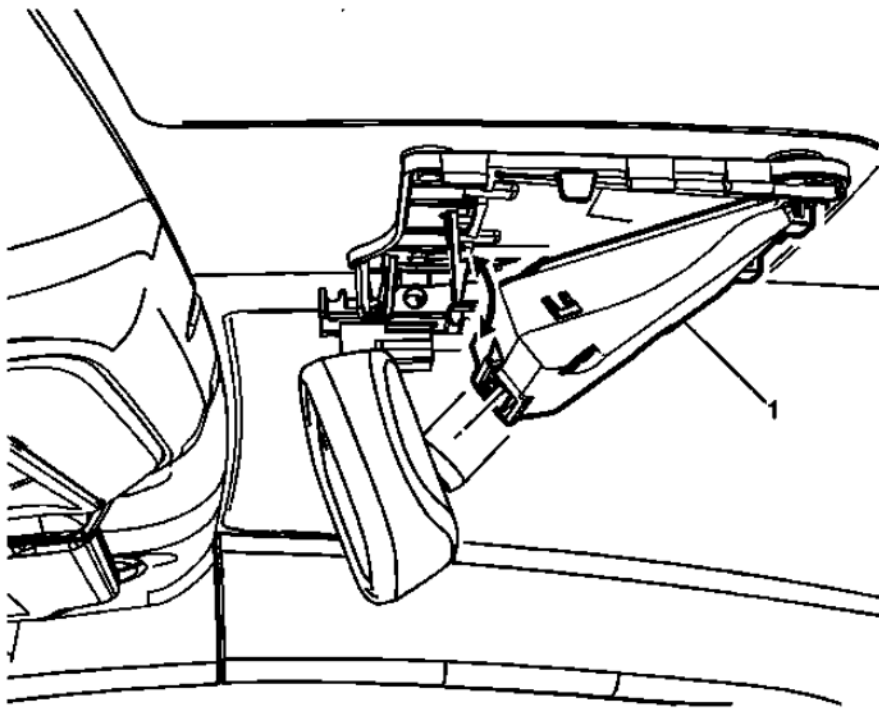


Fig. 11: Front View Camera
 Courtesy of GENERAL MOTORS COMPANY

Front View Camera Replacement

Callout	Component Name
Preliminary Procedure Remove the inside rearview mirror wiring harness cover. Refer to <u>Inside Rearview Mirror Wiring Harness Cover Replacement</u> .	
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. Program and calibrate the front view camera. For programming and set up, refer to <u>Front View Camera Module Calibration</u>.

REARVIEW CAMERA IMAGE DISPLAY MODULE REPLACEMENT

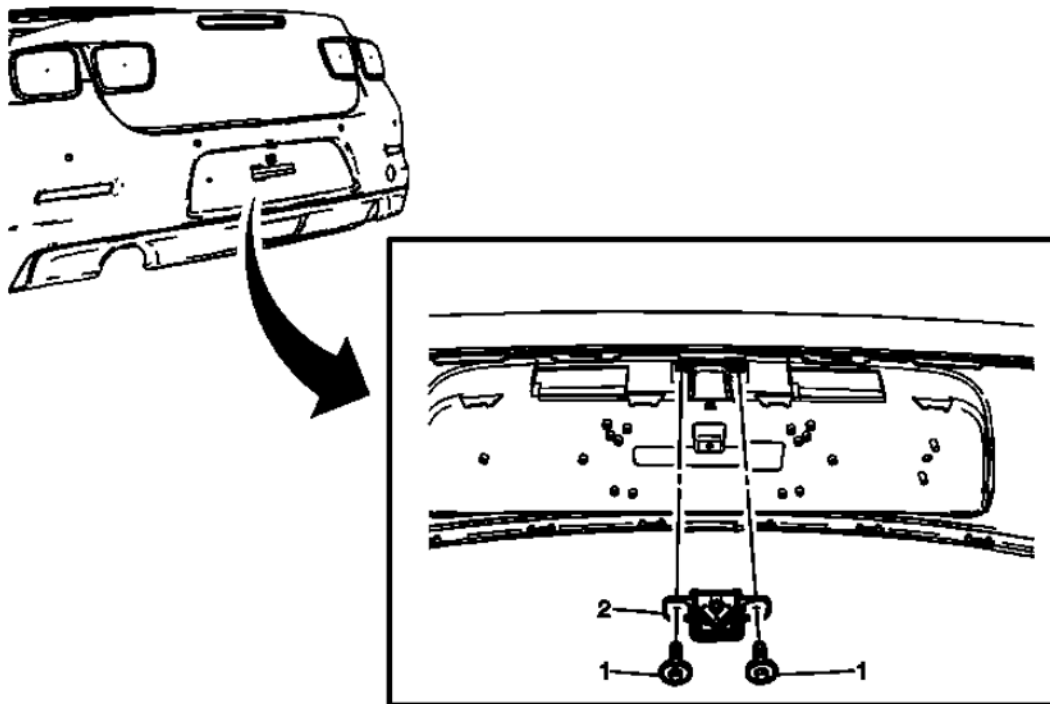


Fig. 12: Rearview Camera Image Display Module
 Courtesy of GENERAL MOTORS COMPANY

Rearview Camera Image Display Module Replacement

Callout	Component Name
Preliminary Procedure Remove the rear bumper upper fascia. Refer to Rear Bumper Upper Fascia Replacement .	
1	Rearview Camera Fastener (Qty: 2) CAUTION: Refer to Fastener Caution .
2	Rearview Camera Image Display Module Procedure Disconnect electrical connector.

FRONT VIEW CAMERA MODULE CALIBRATION

The calibration procedure will start automatically after SPS programming is complete. During this time the Lane Departure Warning amber indicator will illuminate.

Calibration

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 shall not be required when only replacing the windshield and the front view 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 correct, 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 indicator will flash momentarily and then stay out - this is normal operation.

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

- Clean windshield.
- 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.).

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

One or more of the following conditions may increase the length of time required to complete the self-calibration procedure:

- 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
- Camera not properly installed. Verify it is snapped into tabs and is secure. Refer to **Front View Camera Replacement**.

No Calibration

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

- 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
- Camera not properly installed. Verify it is snapped into tabs and is secure. Refer to **Front View Camera Replacement**.

DESCRIPTION AND OPERATION

OBJECT DETECTION DESCRIPTION AND OPERATION (LANE DEPARTURE WARNING, UFL)

The lane departure warning system is a convenience feature of the front view camera that issues a warning when the system detects that the vehicle has unintentionally crossed a lane marking. The front view camera is located behind the windshield, looking out at the road ahead and detecting any lane markings. When the vehicle unintentionally leaves a detected lane, a visual and audible alert is given to the driver.

The lane departure warning system is made up of the following components:

- Front view camera module
- Lane departure warning switch
- Instrument cluster / Vehicle Direction Display
- Radio

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, a visual and audible warning is given to the driver. The front view camera module receives an input from the lane departure warning switch and controls the lane departure warning switch indicator output. The front view camera module also communicates via serial data with the instrument cluster and radio to request visual and audible alerts.

Lane Departure Warning Switch

The lane departure warning switch provides an input to the front view camera module to turn the lane departure warning 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 departure warning switch also contains the lane departure warning switch indicator, which is controlled by the front view camera module to indicate the ON and OFF status of the lane departure warning system. When the system has been enabled by the lane departure warning switch, the front view camera module applies ground to the switch indicator and illuminates the LED. The location of the lane departure warning 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 departure warning indicators. These indicate to the driver the current status of the lane departure warning 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 departure warning. If the vehicle has unintentionally left the lane, the radio will command three beeps as an audible alert to the driver.

Lane Departure Warning Operation

System operation can be describe by the following modes:

- Off State: The system has been turned off by the driver, using the lane departure warning switch. The lane departure warning indicator will not be illuminated.
- Not Ready To Assist: The system is enabled and the lane departure warning indicator is illuminated, but not ready to assist when any 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, 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 departure warning 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:
 - Three chimes are activated through the radio.
 - The amber lane departure warning indicator will flash.

Lane Departure Warning 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.

OBJECT DETECTION DESCRIPTION AND OPERATION (REAR VISION CAMERA, UVC)

Rear Vision Camera System Operation

The rear vision camera system consists of a video camera located at the rear of the vehicle and the navigation radio.

When the transmission is placed into REVERSE, a 12 volt signal is sent to the rear vision camera by the body

control module (BCM). This signal indicates to the camera that the vehicle is in reverse and image display is requested. The rear vision camera receives ignition voltage and a constant ground to power the camera. Video signal + and video signal - circuits carry the video image from the rear vision camera to the navigation radio. Additionally, the video signal circuits are shielded to prevent any interference which may lead to a loss of video signal resolution and a degraded video image. The shield is provided a ground path by the rear vision 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

If a malfunction is detected in the system, Service Rear Vision Camera may be displayed on the navigation radio as an indicator to the customer that a problem exists that requires service.

OBJECT DETECTION DESCRIPTION AND OPERATION (PARK ASSIST, 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 4 object sensors located in the rear bumper. The parking assist system will notify the driver using audible beeps through the radio or haptic pulses through the driver's seat. The driver can select between audible or haptic alerts in the vehicle personalization menus. See the user's manual for more detailed information on vehicle personalization.

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

- Parking assist control module
- Rear object sensors
- Parking assist switch
- Parking assist indicator
- Radio
- Safety Alert Seat, if equipped.

Parking Assist Control Module

The parking assist control module provides a reference voltage and a low reference to the 4 object alarm sensors. The parking assist control module receives individual signals from each of the 4 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 data message via serial data to the radio requesting an audible alert.

Object Sensors

The object sensors are located in the 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 parking assist control module.

Parking Assist Switch

The parking assist can be activated and deactivated by pressing the parking assist switch. By engaging the reverse gear the parking assist can also be activated. By subsequently pressing the parking assist switch the parking assist can be disabled again.

Parking Assist Indicator

The indicator in the parking assist switch shows the status of the parking assist. If the lamp is ON, the parking assist is activated.

Radio

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

Safety Alert Seat

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 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 radio or seat module 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, underneath the vehicle.

The parking assist can be activated and deactivated by pressing the parking assist switch. When REVERSE gear is selected, park assist is automatically activated. By subsequently pressing the parking assist switch the parking assist can be disabled again.

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, which need to alter when the vehicle moves. If this is not the case, the sensor is acoustically blocked or faulty. Mud, ice and snow may cause obstruction of the function of the sensors. The parking assist control module also checks whether the correct type of sensor is installed. If any of these tests fails, a DTC with corresponding symptom is set, the parking assist is deactivated and the parking assist indicator in the instrument panel cluster is activated.

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 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.

OBJECT DETECTION DESCRIPTION AND OPERATION (FOWARD COLLISION ALERT, UEU)

The forward collision alert system is a convenience feature of the front view camera that issues a warning to the driver when a potential collision risk exists. The front view camera is located behind the windshield, looking out at the road ahead and detecting vehicles directly ahead, within a distance of approximately 60 meters (197 ft). The forward collision alert system is always active and operates at speeds above 40 kph (25 mph). When the system detects a vehicle in the path ahead, the green vehicle ahead indicator in the vehicle direction display is illuminated. When approaching another vehicle too rapidly, the collision alert symbol will flash in the vehicle direction display. Simultaneously an audible alert sounds. Forward collision alert does not warn the driver of any objects that are not detected as a vehicle, like e.g. pedestrians, animals, signs, guard rails, bridges, construction barrels or other stationary or slow moving objects. The forward collision alert timing sensitivity to control the distance to the vehicle ahead can be set using the forward collision alert switch in the left steering wheel controls.

In some cases the camera may detect a vehicle that is not in the path ahead, or the system may occasionally provide unrealistic alerts. This could respond to a turning vehicle ahead, guard rails, traffic signs, or other stationary objects. This is normal operation, the vehicle does not need service. Forward collision alert may sometimes set unnecessary alerts to 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.

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

- Front view camera module
- Forward collision alert switch
- Instrument cluster / Vehicle direction display
- Radio

Front View Camera Module

The camera detects vehicles in front of the host vehicle. The front view camera module requests the green vehicle ahead alert indicator in the vehicle direction display ON via serial data when the front view camera system has detected a vehicle in the driving path ahead. The front view camera module also communicates via serial data with the driver information center and the radio to request visual and audible alerts.

- Lane departure warning system unavailable
- Forward collision alert OFF
- Service front camera

Forward Collision Alert Switch

The forward collision alert switch provides an input to the front view camera module to select the alert timing sensitivity when approaching another vehicle too rapidly. The front view camera module provides a signal voltage to the normally open 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 change the alert timing sensitivity. The first button press shows the current alert timing setting on the driver information center. With every button press, the alert timing sensitivity is changed. The current alert timing setting will be maintained until it is changed. The preset alert timing setting is displayed in the top line of the driver information center. The position of the forward collision alert switch can vary with different vehicles. For the exact position please refer to the user's manual.

Instrument Cluster

The Vehicle direction display contains the green vehicle ahead indicator, which indicates to the driver that the Front View Camera system has detected a vehicle in the driving path ahead and is controlled via serial data. When approaching another vehicle too rapidly, the collision alert symbol will flash in the Vehicle direction display. The red Front collision alert display will stay continuously illuminated if the vehicle ahead remains much too close.

Radio

The radio controls the audible alert for the forward collision alert system. If the host vehicle is approaching another vehicle too rapidly, the radio will command an audible alert to the driver.

Forward Collision Alert 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.