Object Detection - SRX

Specifications

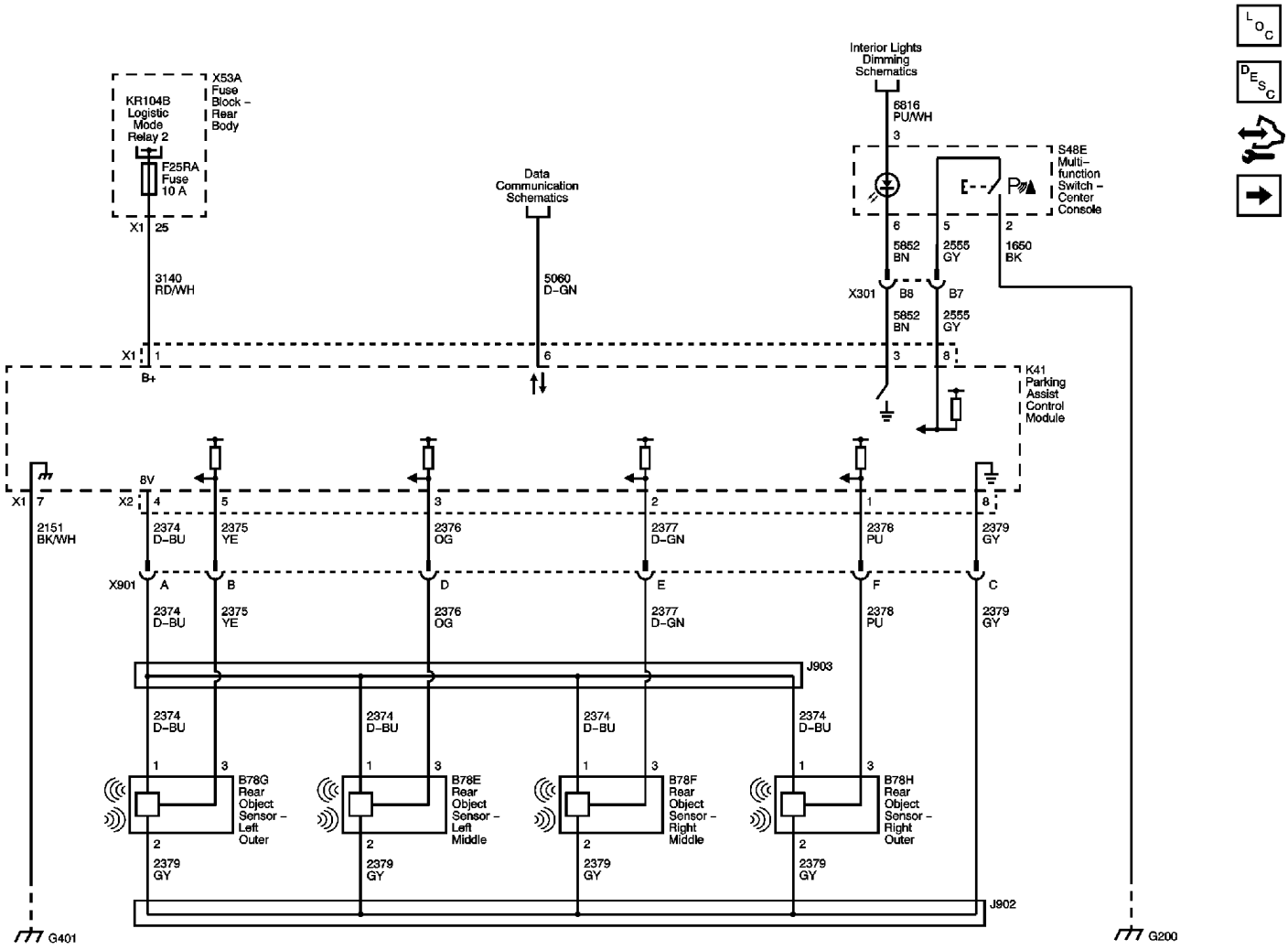
Fastener Tightening Specifications

Application	Specification	
	Metric	English
Front and Rear Object Alarm Module Nuts	6 N.m	53 lb in

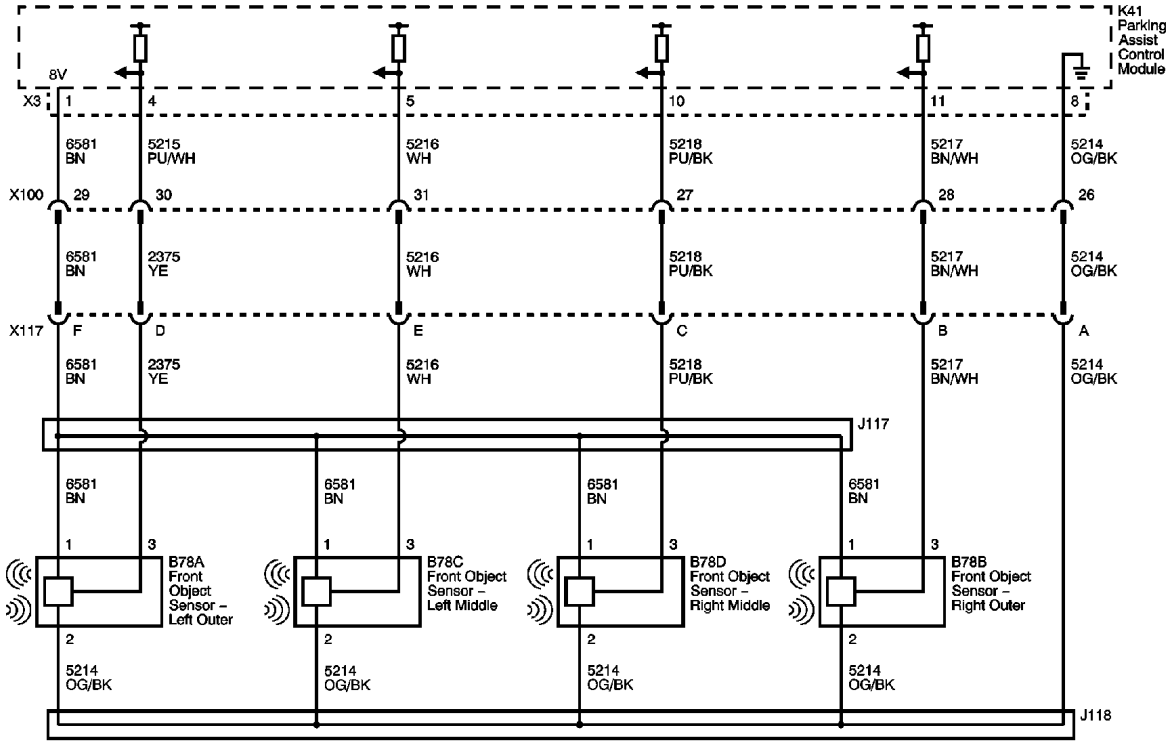
Schematic and Routing Diagrams

Object Detection Schematics

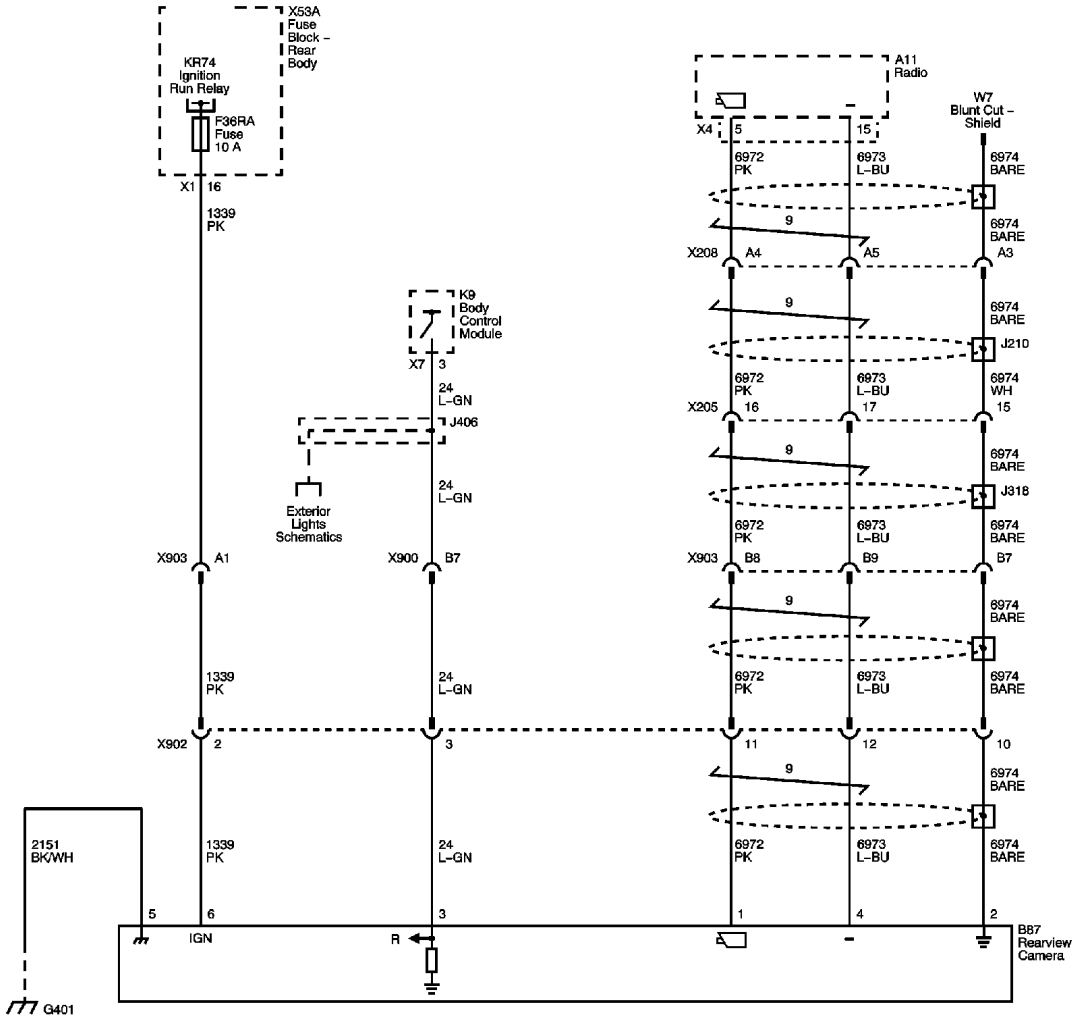
Fig 1: Power, Ground & Rear Sensors Circuit Schematic



Courtesy of GENERAL MOTORS CORP.
Fig 2: Front Sensors Circuit Schematic



Courtesy of GENERAL MOTORS CORP.
Fig 3: Rear Vision camera Circuit Schematic



Courtesy of GENERAL MOTORS CORP.

Diagnostic Information and Procedures

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description

DTC	Description
DTC B0954, B0955, B0956, or B0957	B0954 01: Parking Aid Front Sensor Left Corner Circuit Short to Battery B0954 06: Parking Aid Front Sensor Left Corner Circuit Low Voltage/Open B0954 08: Parking Aid Front Sensor Left Corner Circuit Performance - Signal Invalid B0954 21: Parking Aid Front Sensor Left Corner Circuit Incorrect Period B0954 3A: Parking Aid Front Sensor Left Corner Circuit Incorrect Component Installed B0955 01: Parking Aid Front Sensor Left Middle Circuit Short to Battery B0955 06: Parking Aid Front Sensor Left Middle Circuit Low Voltage/Open B0955 08: Parking Aid Front Sensor Left Middle Circuit Performance - Signal Invalid B0955 21: Parking Aid Front Sensor Left Middle Circuit Incorrect Period B0955 3A: Parking Aid Front Sensor Left Middle Circuit Incorrect Component Installed B0956 01: Parking Aid Front Sensor Right Middle Circuit Short to Battery B0956 06: Parking Aid Front Sensor Right Middle Circuit Low Voltage/Open B0956 08: Parking Aid Front Sensor Right Middle Circuit Performance - Signal Invalid B0956 21: Parking Aid Front Sensor Right Middle Circuit Incorrect Period B0956 3A: Parking Aid Front Sensor Right Middle Circuit Incorrect Component Installed B0957 01: Parking Aid Front Sensor Right Corner Circuit Short to Battery B0957 06: Parking Aid Front Sensor Right Corner Circuit Low Voltage/Open B0957 08: Parking Aid Front Sensor Right Corner Circuit Performance - Signal Invalid B0957 21: Parking Aid Front Sensor Right Corner Circuit Incorrect Period B0957 3A: Parking Aid Front Sensor Right Corner Circuit Incorrect Component Installed

DTC	Description
DTC B0958, B0959, B0960, or B0961	B0958 01: Parking Aid Rear Sensor Left Corner Circuit Short to Battery B0958 06: Parking Aid Rear Sensor Left Corner Circuit Low Voltage/Open B0958 08: Parking Aid Rear Sensor Left Corner Circuit Performance - Signal Invalid B0958 21: Parking Aid Rear Sensor Left Corner Circuit Incorrect Period B0958 3A: Parking Aid Rear Sensor Left Corner Circuit Incorrect Component Installed B0959 01: Parking Aid Rear Sensor Left Middle Circuit Short to Battery B0959 06: Parking Aid Rear Sensor Left Middle Circuit Low Voltage/Open B0959 08: Parking Aid Rear Sensor Left Middle Circuit Performance - Signal Invalid B0959 21: Parking Aid Rear Sensor Left Middle Circuit Incorrect Period B0959 3A: Parking Aid Rear Sensor Left Middle Circuit Incorrect Component Installed B0960 01: Parking Aid Rear Sensor Right Middle Circuit Short to Battery B0960 06: Parking Aid Rear Sensor Right Middle Circuit Low Voltage/Open B0960 08: Parking Aid Rear Sensor Right Middle Circuit Performance - Signal Invalid B0960 21: Parking Aid Rear Sensor Right Middle Circuit Incorrect Period B0960 3A: Parking Aid Rear Sensor Right Middle Circuit Incorrect Component Installed B0961 01: Parking Aid Rear Sensor Right Corner Circuit Short to Battery B0961 06: Parking Aid Rear Sensor Right Corner Circuit Low Voltage/Open B0961 08: Parking Aid Rear Sensor Right Corner Circuit Performance - Signal Invalid B0961 21: Parking Aid Rear Sensor Right Corner Circuit Incorrect Period B0961 3A: Parking Aid Rear Sensor Right Corner Circuit Incorrect Component Installed
DTC B0967 or B0968	B0967 02: Parking Aid On/Off Switch Circuit Short to Ground B0968 01: Parking Aid On/Off Switch Indicator Circuit Short to Battery B0968 06: Parking Aid On/Off Switch Indicator Circuit Low Voltage/Open
DTC B1015	B1015 00: Vehicle Identification Number Information Malfunction
DTC B138A	B138A 03: Control Module Voltage Reference Output Circuit Low Voltage B138A 07: Control Module Voltage Reference Output Circuit High Voltage
DTC B1405	B1405 02: Control Module Voltage Reference Output 2 Circuit Short to Ground B1405 03: Control Module Voltage Reference Output 2 Circuit Low Voltage B1405 07: Control Module Voltage Reference Output 2 Circuit High Voltage

DTC B0954, B0955, B0956, or B0957

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
8V 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 Front Object Sensor Signal	B0954 06	B0954 06	B0954 01	B0954 08, B0954 21
Left Middle Front Object Sensor Signal	B0955 06	B0955 06	B0955 01	B0955 08, B0955 21
Right Middle Front Object Sensor Signal	B0956 06	B0956 06	B0956 01	B0956 08, B0956 21
Right Front Object Sensor Signal	B0957 06	B0957 06	B0957 01	B0957 08, B0957 21
Low Reference	-	B0954 06, B0955 06, B0956 06, B0957 06, 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 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 park 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

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

B0954 06, B0955 06, B0956 06, or B0957 06

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

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

The parking assist control module has received an invalid signal.

B0954 21, B0955 21, B0956 21, or B0957 21

The object sensor determines no change in the position of an object while the vehicle is in motion.

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

The 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

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC B1405 is not present.
    1. If DTC is present, refer to DTC B1405 .
2. Verify that DTC B0954 01, B0955 01, B0956 01 or B0957 01 is not present.
    1. If DTC is present, check the appropriate sensor for contamination with mud, ice or snow. If no contamination is diagnosed, refer to Circuit/System Testing .

3. Verify that DTC B0954 21, B0955 21, B0956 21 or B0957 21 is not present.
    1. If DTC is present, check the respective sensor for contamination by mud, ice or snow. If no contamination is diagnosed, replace the sensor.
4. Verify that DTC B0954 3A, B0955 3A, B0956 3A or B0957 3A is not present.
    1. If DTC is present, replace the respective sensor with a sensor of correct sensor type.
5. Ignition ON, transmission in REVERSE, verify the scan tool Parking Assist System Status parameter displays Enabled.

Circuit/System Testing

1. Ignition OFF for 30 s, disconnect the harness connector at the appropriate front object sensor.
2. Test for less than 5 Ω between the low reference circuit terminal 2 and ground.
    1. If greater than the specified value, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the K41 Parking Assist Control Module.
3. Ignition ON, activate the park assist, test for 7.5-9.0 V between the 8 V reference circuit terminal 1 and ground.
    1. If less than the specified range, test the 8 V reference circuit for an open/high resistance. If the circuit tests normal, replace the K41 Parking Assist Control Module.
4. Ignition OFF, remove the malfunctioning object sensor and swap locations with another properly functioning front object sensor. Connect the harness connector at both sensors.
5. Ignition ON, verify the DTC is set for the new location in which the malfunctioning sensor is installed.
    1. If the DTC does not set for the new location, test the signal circuit terminal 3 for a short to voltage, short to ground, or an open/high resistance. If the circuit tests normal, replace the K41 Parking Assist Control Module.
6. If the DTC sets for the new location in which the malfunctioning sensor is installed, replace the appropriate front object sensor.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance

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 06, B0955 06, B0956 06, B0957 06, 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 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

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC B1405 is not present.
    1. If DTC is present, refer to DTC B1405 .
2. Verify that DTC B0958 01, B0959 01, B0960 01 or B0961 01 is not present.
    1. If DTC is present, check the appropriate sensor for contamination with mud, ice or snow. If no contamination is diagnosed, refer to Circuit/System Testing Circuit/System Verification .
3. Verify that DTC B0958 21, B0959 21, B0960 21 or B0961 21 is not present.

    1. If DTC is present, check the appropriate sensor for contamination with mud, ice or snow. If no contamination is diagnosed, replace the sensor.
4. Verify that DTC B0958 3A, B0959 3A, B0960 3A or B0961 3A is not present.
    1. If DTC is present, replace the appropriate sensor with a sensor of correct sensor type.
5. Ignition ON, transmission in REVERSE, verify the scan tool Parking Assist System Status parameter displays Enabled.

Circuit/System Testing

1. NOTE: Scan tool must be disconnected for steps 1 and 2 to allow module to power down.

   Ignition OFF for 1 minute, disconnect the harness connector at the appropriate B78 rear object sensor.
2. Test for less than 5 Ω between the low reference circuit terminal 2 and ground.
    1. If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the K41 parking assist control module.
3. Ignition ON, transmission in REVERSE, test for 7.5-9.0 V between the 8 V reference circuit terminal 1 and ground.
    1. If less than the specified range, test the 8 V reference circuit for an open/high resistance. If the circuit tests normal, replace the K41 parking assist control module.
    2. If greater than the specified range, test the 8 V reference circuit for a short to voltage. If the circuit tests normal, replace the K41 parking assist control module.
4. Ignition OFF, remove the malfunctioning object sensor and swap locations with another properly functioning rear object sensor. Connect the harness connector at both sensors.
5. Ignition ON, verify the DTC is set for the new location in which the malfunctioning sensor is installed.
    1. If the DTC does not set for the new location, test the signal circuit terminal 3 for a short to voltage, short to ground, or an open/high resistance. If the circuit tests normal, replace the K41 parking assist control module.
6. If the DTC sets for the new location in which the malfunctioning sensor is installed, replace the appropriate rear object sensor.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Rear Object Sensor Replacement
- Control Module References for 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 Descriptors

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

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Verify that DTC B0967 02 is not present.
    1. If DTC is present, refer to Parking Assist Switch Circuit Malfunction .
2. Verify that B0968 01 or B0968 06 is not present.
    1. If DTC is present, refer to Parking Assist Switch Indicator Circuit Malfunction .
3. Activate and deactivate the parking assist switch and verify the scan tool Park Assist Switch parameter changes between Active and Inactive.

Circuit/System Testing

Parking Assist Switch Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48E multi-function switch module - center console.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
    1. If greater than the specified value, test the ground circuit for an open/high resistance.
3. Connect the harness connector at the S48E multi-function switch module - center console.
4. Disconnect the X1 harness connector at the K41 parking assist control module.
5. Ignition ON, test for less than 0.3 V between the signal circuit terminal 8 X1 and ground.
    1. If greater than the specified value, test the signal circuit for a short to voltage.
6. Ignition ON, verify that a test lamp does not illuminate between the B+ circuit terminal 1 X1 and signal circuit terminal 8 X1.
    1. If the test lamp illuminates, test signal circuit for a short to ground. If the circuit tests normal, replace the S48E multi-function switch module - center console.
7. Verify that the test lamp illuminates between the B+ circuit terminal 1 X1 and signal circuit terminal 8 X1 while pressing the parking assist switch.
    1. If the test lamp does not illuminate, test the signal circuit for an open/high resistance. If all circuits test normal, replace the S48E multi-function switch module - center console.

8. If all circuits test normal, replace the K41 parking assist control module.

Parking Assist Switch Indicator Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48E multi-function switch module - center console.
2. Ignition ON, test for B+ between the ignition circuit terminal 3 and ground.
    1. If less than the specified value, test the ignition circuit for a short to ground or an open/high resistance.
3. Command the Park Assist Switch LED output control ON with the scan tool. Test for B+ between the ignition circuit terminal 3 and the signal circuit terminal 6.
    1. If less than the specified value, test the signal circuit for an open/high resistance. If all circuits test normal, replace the K41 parking assist control module.
4. Command the Park Assist Switch LED output control OFF with the scan tool. Test for less than 0.3 V between the ignition circuit terminal 3 and the signal circuit terminal 6.
    1. If greater than the specified value, test the signal circuit for a short to ground. If all circuits test normal, replace the K41 parking assist control module.
5. If all circuits test normal, replace the S48E multi-function switch module - center console.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Accessory Switch Replacement
- Control Module References for parking assist control module replacement, 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

Circuit/System Description

When the ignition is turned ON, the parking assist control module receives the vehicle identification number (VIN) from the body control module. The parking assist 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 VIN stored in the parking assist control module does not match the received VIN.

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 VIN stored in the parking assist control module matches the VIN stored in the body control module.

Reference Information

Schematic Reference

Object Detection Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, program the K41 Parking Assist Control Module and verify the DTC does not reset.

- If the DTC is reset, replace the K41 Parking Assist Control Module

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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

DTC B138A

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
8V Reference	B0954 06, B0955 06, B0956 06, B0957 06, B0958 06, B0959 06, B0960 06, B0961 06, B138A 03	B0954 06, B0955 06, B0956 06, B0957 06, B0958 06, B0959 06, B0960 06, B0961 06,	B0954 06, B0955 06, B0956 06, B0957 06, B0958 06, B0959 06, B0960 06, B0961 06, B138A 07	-
Front Object Sensor - Left Outer Signal	B0954 06	B0954 06	B0954 01	B0954 08, B0954 21
Front Object Sensor - Left Middle Signal	B0955 06	B0955 06	B0955 01	B0955 08, B0955 21
Front Object Sensor - Right Middle Signal	B0956 06	B0956 06	B0956 01	B0956 08, B0956 21
Front Object Sensor - Right Outer Signal	B0957 06	B0957 06	B0957 01	B0957 08, B0957 21
Rear Object Sensor - Left Outer Signal	B0958 06	B0958 06	B0958 01	B0958 08, B0958 21
Rear Object Sensor - Left Middle Signal	B0959 06	B0959 06	B0959 01	B0959 08, B0959 21
Rear Object Sensor - Right Middle Signal	B0960 06	B0960 06	B0960 01	B0960 08, B0960 21
Rear Object Sensor - Right Outer Signal	B0961 06	B0961 06	B0961 01	B0961 08, B0961 21

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Low Reference	-	B0954 06, B0955 06, B0956 06, B0957 06, 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 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 parking assist switch.

Conditions for Setting the DTC

B138A 03

The parking assist control module has detected the 8 V reference circuit is less than 7.2 V.

B138A 07

The parking assist control module has detected the 8 V reference 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

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

Ignition ON, activate the parking assist, observe the scan tool Park Assist Sensor Reference Voltage parameter. The reading should be between 7.2-9.2 V.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at each of the object sensors.
2. Ignition ON, activate the park assist, test for 7.5-9.0 V between the 8 V reference circuit terminal 1 at the B78G Rear Object Sensor - Left Outer harness connector and ground.
    1. If less than the specified range, test the 8 V reference circuit for a short to ground. If the circuit tests normal, replace the K41 Parking Assist Control Module.
    2. If greater than the specified range, test the 8 V reference circuit for a short to voltage. If the circuit tests normal, replace the K41 Parking Assist Control Module.
3. Install each object alarm sensor harness connector one at a time, checking DTCs after each sensor is connected. Verify DTC B138A is not set as current.
    1. If the DTC is set, replace the object alarm sensor that was connected immediately before the DTC set.
4. If all circuits test normal, replace the K41 Parking Assist Control Module.

Repair Procedures

Perform the Diagnostic Repair Verification .

- Front Object Alarm Sensor Replacement
- Rear Object Sensor Replacement
- Control Module References

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

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 Front Object Sensor Signal	B0954 06	B0954 06	B0954 01	B0954 08, B0954 21
Left Middle Front Object Sensor Signal	B0955 06	B0955 06	B0955 01	B0955 08, B0955 21
Right Middle Front Object Sensor Signal	B0956 06	B0956 06	B0956 01	B0956 08, B0956 21
Right Front Object Sensor Signal	B0957 06	B0957 06	B0957 01	B0957 08, B0957 21
Left Rear Object Sensor Signal	B0958 06	B0958 06	B0958 01	B0958 08, B0959 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, B0958 21
Right Rear Object Sensor Signal	B0961 06	B0961 06	B0961 01	B0961 08, B0961 21
Low Reference	-	B0954 06, B0955 06, B0956 06, B0957 06, 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 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 parking assist switch.

Conditions for Setting the DTC

B1405 02

The parking assist control module has detected the 8 V reference circuit is shorted to ground.

B1405 03

The parking assist control module has detected the 8 V reference circuit is less than 6.3 V.

B1405 07

The parking assist control module has detected the 8 V reference circuit is greater than 10.4 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

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, activate the parking assist, observe the scan tool Park Assist Sensor Reference Voltage parameter. The reading should be between 6.3-10.4 V.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at each of the object sensors.
2. Start at the B78G rear object sensor-left outer, ignition ON, activate the park assist, test for 6.3-10.4 V between the 8 V reference circuit terminal 1 at the object sensor harness connector and ground.
    1. If less than the specified range, test the 8 V reference circuit for a short to ground. If the circuit tests normal, replace the K41 parking assist control module.
    2. If greater than the specified range, test the 8 V reference circuit for a short to voltage. If the circuit tests normal, replace the K41 parking assist control module.
3. Install each object alarm sensor harness connector one at a time, checking DTCs after each sensor is connected. Verify DTC B1405 is not set as current.
    1. If the DTC is set, replace the object alarm sensor that was connected immediately before the DTC set.
4. NOTE: Make sure to check front object sensors.

    If all circuits test normal, replace the K41 parking assist control module.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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

Symptoms - Object Detection

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

1. Perform the Diagnostic System Check - Vehicle before using the Symptom Tables in order to verify that all of the following are true:
    1. There are no DTCs set.
    2. The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5) .

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 rear bumper are clear. Remove any snow, mud or ice that is blocking the sensors.

- Make sure the rear vision camera is clear. Remove any snow, mud or ice that is blocking the rear vision camera.

Intermittent

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

Symptom List

- Parking Assist System Malfunction
- Rear Vision Camera System Malfunction

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 forward or reversing at speeds of less than 8 km/h (5 mph). The distance and location of the object is determined by eight object sensors: four located in the rear bumper and four located in the front bumper. The parking assist system will notify the driver using an audible signal through the radio.

Diagnostic Aids

The scan tool Park Assist Disable History parameters are a list of the seven previous reasons the parking assist system was disabled. These parameters may help in the diagnosis of an intermittent concern or a customer concern which is the result of normal system operation. 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).
- Reverse 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's 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

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, verify the park assist system is enabled through the parking assist switch or audio system personalization menu.

1. If the park assist system is manually disabled, enable the system. Refer to the vehicle owners manual for instructions on enabling the system.
2. Observe the scan tool Park Assist Switch parameter while pressing and releasing the parking assist switch. The parameter should change between Active and Inactive.
    1. If the parameter does not change between the specified values, refer to Parking Assist Switch Circuit Malfunction .
3. Command the Park Assist Switch LED ON and OFF with the scan tool. The parking assist switch indicator should turn ON and OFF when changing between the commanded states.
    1. If the indicator does not turn ON and OFF, refer to Parking Assist Switch Indicator Circuit Malfunction .
4. NOTE: After completing the next step the vehicle might need to be driven in the forward direction at speed greater than 40 km/h (25 mph).

   Transmission in Reverse, verify one audible beep sounds and the scan tool Park Assist System Status parameter is Enable.
    1. If not the specified values, refer to Diagnostic Aids and the scan tool Park Assist Disable History parameters to determine the cause of the inhibit.

Circuit/System Testing

Parking Assist Switch Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48E multi-function switch module - center console.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
    1. If greater than the specified value, test the ground circuit for an open/high resistance.
3. Connect the harness connector at the S48E multi-function switch module - center console.
4. Disconnect the X1 harness connector at the K41 parking assist control module.
5. Ignition ON, test for less than 0.3 V between the signal circuit terminal 8 X1 and ground.
    1. If greater than the specified value, test the signal circuit for a short to voltage.
6. Ignition ON, verify that a test lamp does not illuminate between the B+ circuit terminal 1 X1 and signal circuit terminal 8 X1.
    1. If the test lamp illuminates, test signal circuit for a short to ground. If the circuit tests normal, replace the S48E multi-function switch module - center console.
7. Verify that the test lamp illuminates between the B+ circuit terminal 1 X1 and signal circuit terminal 8 X1 while pressing the parking assist switch.
    1. If the test lamp does not illuminate, test the signal circuit for an open/high resistance. If all circuits test normal, replace the S48E multi-function switch module - center console.
8. If all circuits test normal, replace the K41 parking assist control module.

Parking Assist Switch Indicator Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the S48E multi-function switch module - center console.
2. Ignition ON, test for B+ between the ignition circuit terminal 3 and ground.
    1. If less than the specified value, test the ignition circuit for a short to ground or an open/high resistance.

3. Command the Park Assist Switch LED output control ON with the scan tool. Test for B+ between the ignition circuit terminal 3 and the signal circuit terminal 6.
    1. If less than the specified value, test the signal circuit for an open/high resistance. If all circuits test normal, replace the K41 parking assist control module.
4. Command the Park Assist Switch LED output control OFF with the scan tool. Test for less than 0.3 V between the ignition circuit terminal 3 and the signal circuit terminal 6.
    1. If greater than the specified value, test the signal circuit for a short to ground. If all circuits test normal, replace the K41 parking assist control module.
5. If all circuits test normal, replace the S48E multi-function switch module - center console.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Accessory 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.

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

Description and Operation

Object Detection Description and Operation (UVC) or Object Detection Description and Operation (UD5)

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC B2545 is not present.
    1. If DTC is present, refer to DTC B2545 .
2. Inspect the rearview camera and verify there are no debris on the lens and that the bezel or bezel seal is not damaged.
    1. If debris are found on the lens, clean the lens. If the lens, bezel, or bezel seal are damaged, replace as necessary.
3. Engine running, vehicle in PARK, verify the backup lamps are off.
    1. If the backup lamps are illuminated, refer to Backup Lamps Malfunction .
4. Engine running, transmission in REVERSE, verify the backup lamps are on.
    1. If the backup lamps are not illuminated, refer to Backup Lamps Malfunction .
5. Engine running, transmission in REVERSE, verify a clear rear vision image is displayed on the radio.
    1. If a clear image is not displayed, refer to Circuit/System Testing .

Circuit/System Testing

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

1. Ignition OFF, disconnect the harness connector at the rearview camera.
2. Test for less than 5 Ω between the ground circuit terminal 5 and ground.
    1. If greater than the specified value, test the ground circuit for an open/high resistance.
3. Ignition ON, verify a test lamp illuminates between the ignition circuit terminal 6 and ground.
    1. If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high resistance.
4. Engine running, park brake applied, transmission in REVERSE, test for greater than 11 V between the control circuit terminal 3 and ground.
    1. If less than the specified value, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the K9 Body Control Module.
5. Ignition OFF, disconnect the X4 harness connector at the A11 Radio.
6. Ignition ON, test for less than 0.3 V between the following signal circuit terminals at the rearview camera harness connector and ground:
    1. Signal (+) circuit terminal 1
    2. Signal (-) circuit terminal 4
    1. If greater than the specified value, test the signal circuit for a short to voltage.
7. Test for infinite resistance between the following circuit terminals at the rearview camera harness connector and ground:
    1. Signal (+) circuit terminal 1
    2. Signal (-) circuit terminal 4

1. If not the specified value, test the circuit for a short to ground.
8. Test for less than 5 Ω between the signal (+) circuit terminal 1 at the rearview camera harness connector and the signal (+) circuit terminal 5 X4 at the A11 Radio harness connector.
    1. If greater than the specified value, test the signal circuit for an open/high resistance.
9. Test for less than 5 Ω between the signal (-) circuit terminal 4 at the rearview camera harness connector and the signal (-) circuit terminal 15 X4 at the A11 Radio harness connector.
    1. If greater than the specified value, test the signal circuit for an open/high resistance.
10. If all circuits test normal, replace the rearview camera.
11. Engine running, transmission in REVERSE, verify a clear rear vision image is displayed on the radio.
    1. If a clear rear vision image is not displayed, replace the A11 Radio.

Repair Procedures

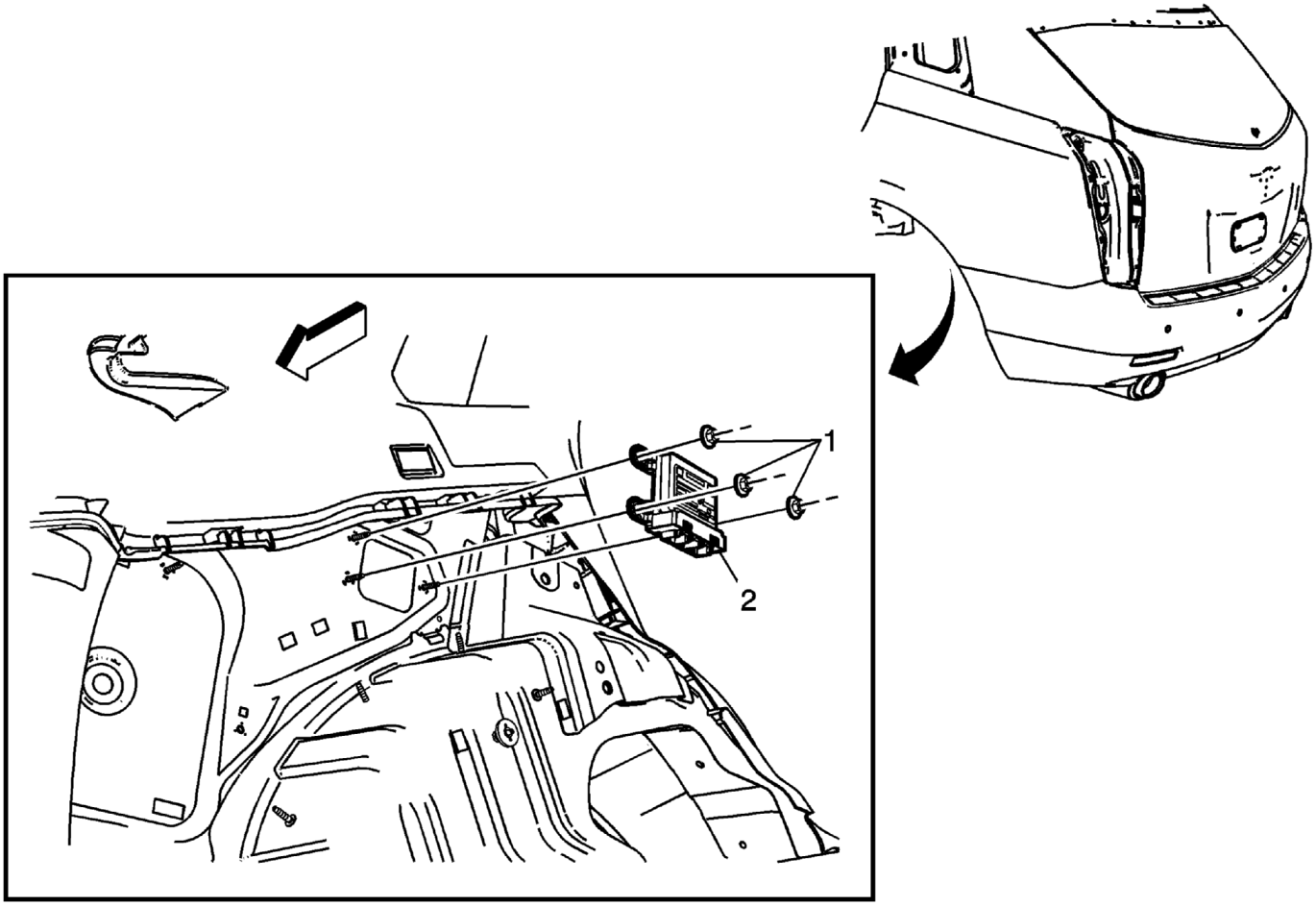
Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Rearview Camera Replacement
- Control Module References for body control module or radio replacement, programming and setup

Repair Instructions

Front and Rear Object Alarm Module Replacement

Fig 4: Identifying Front & Rear Object Alarm Modules



Courtesy of GENERAL MOTORS CORP.

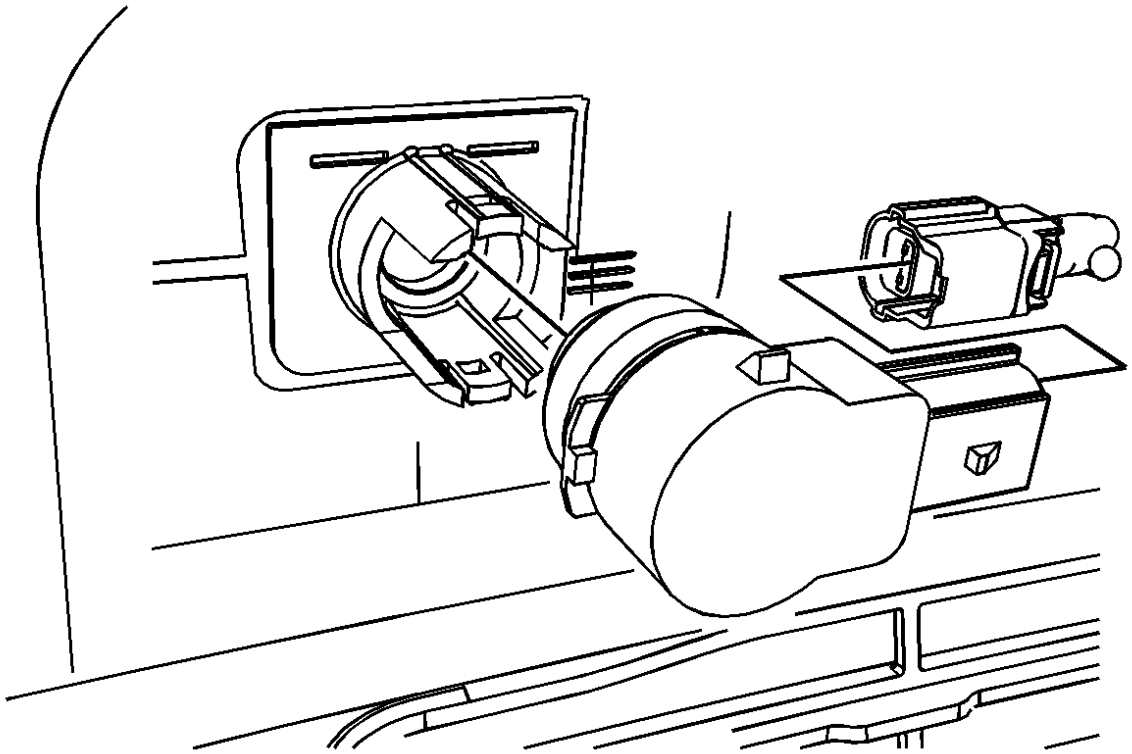
Callout	Component Name

Callout	Component Name
Preliminary Procedure: Remove the left body side trim panel. Refer to Body Side Trim Panel Replacement .	
1	Front And Rear Object Alarm Module Nuts (Qty: 3) CAUTION: Refer to Fastener Caution . **Tighten:** 6 N.m (53 lb in)
2	Front And Rear Object Alarm Module Procedure 1. Disconnect the electrical connectors. 2. For programming and set up, refer to Control Module References

Front Object Alarm Sensor Replacement

Removal Procedure

1. Fig 5: Identifying Rear Object Sensor Housing



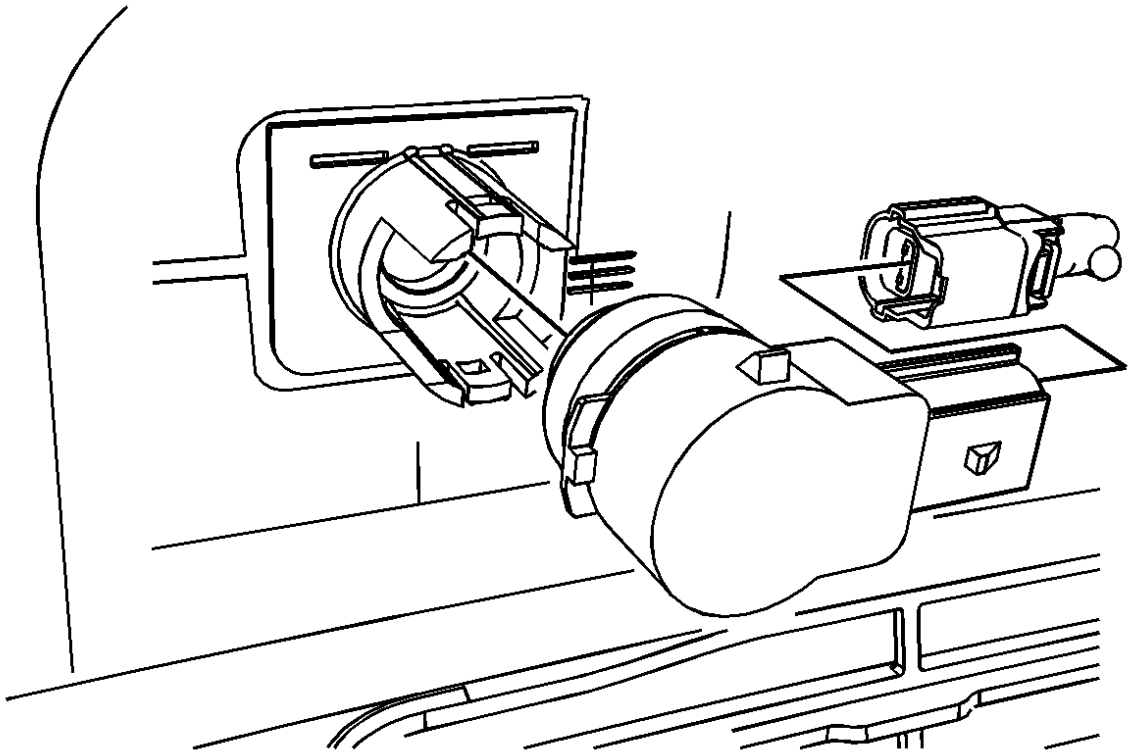
Courtesy of GENERAL MOTORS CORP.

Remove front bumper fascia. Refer to Front Bumper Fascia Replacement .
2. Disconnect electrical from the front object alarm sensor.
3. Lift the locking tabs on the housing and remove the front object alarm sensor.

Installation Procedure

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

Paint the front object alarm sensor. Refer to Basecoat/Clearcoat Paint Systems .
2. Ensure the paint does not exceed 6 mils. Use a paint thickness gauge suitable for non-ferrous metals. Refer to Paint Gauges .
3. Fig 6: Identifying Rear Object Sensor Housing



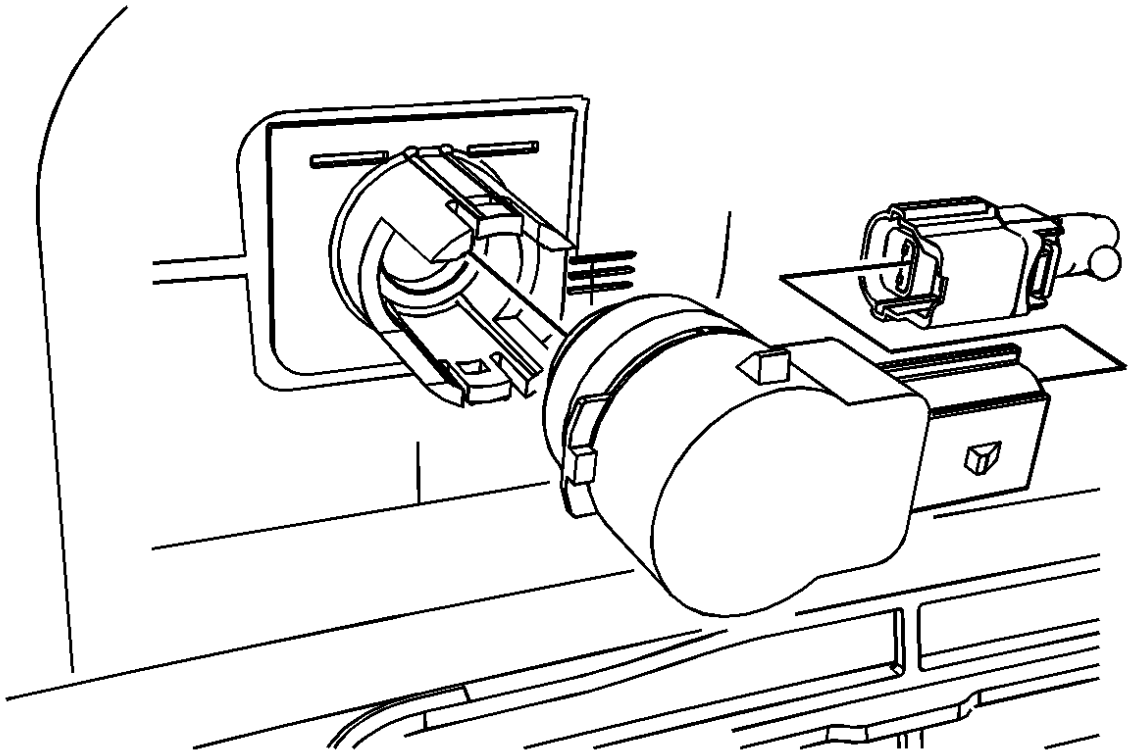
Courtesy of GENERAL MOTORS CORP.

Insert the sensor into the housing.

4. Connect the electrical connector to the front object alarm sensor.
5. Install the front bumper fascia. Refer to Front Bumper Fascia Replacement .

Front Object Alarm Sensor Housing Replacement

1. Remove the front fascia. Refer to Front Bumper Fascia Replacement .
2. Fig 7: Identifying Rear Object Sensor Housing



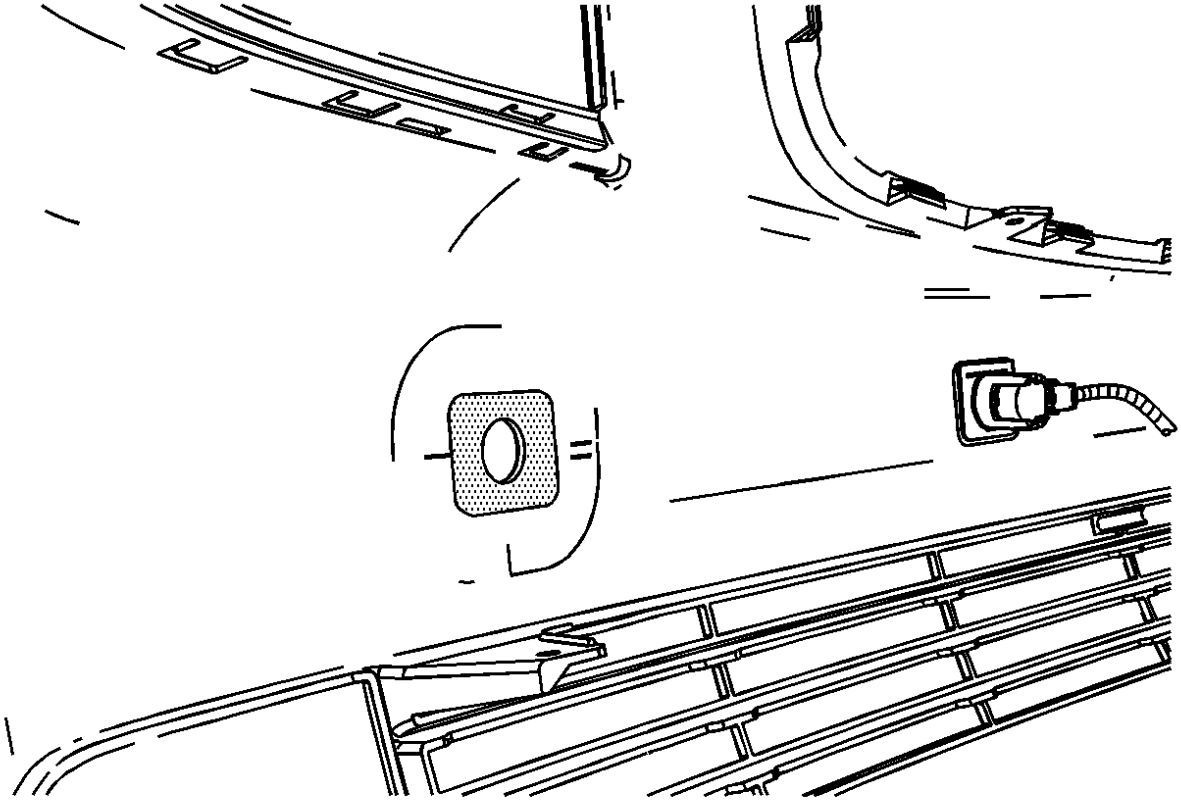
Courtesy of GENERAL MOTORS CORP.

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.

4. Fig 8: Illustrating Sanding/Grinding Sonic Weld Plastic Residue From Fascia

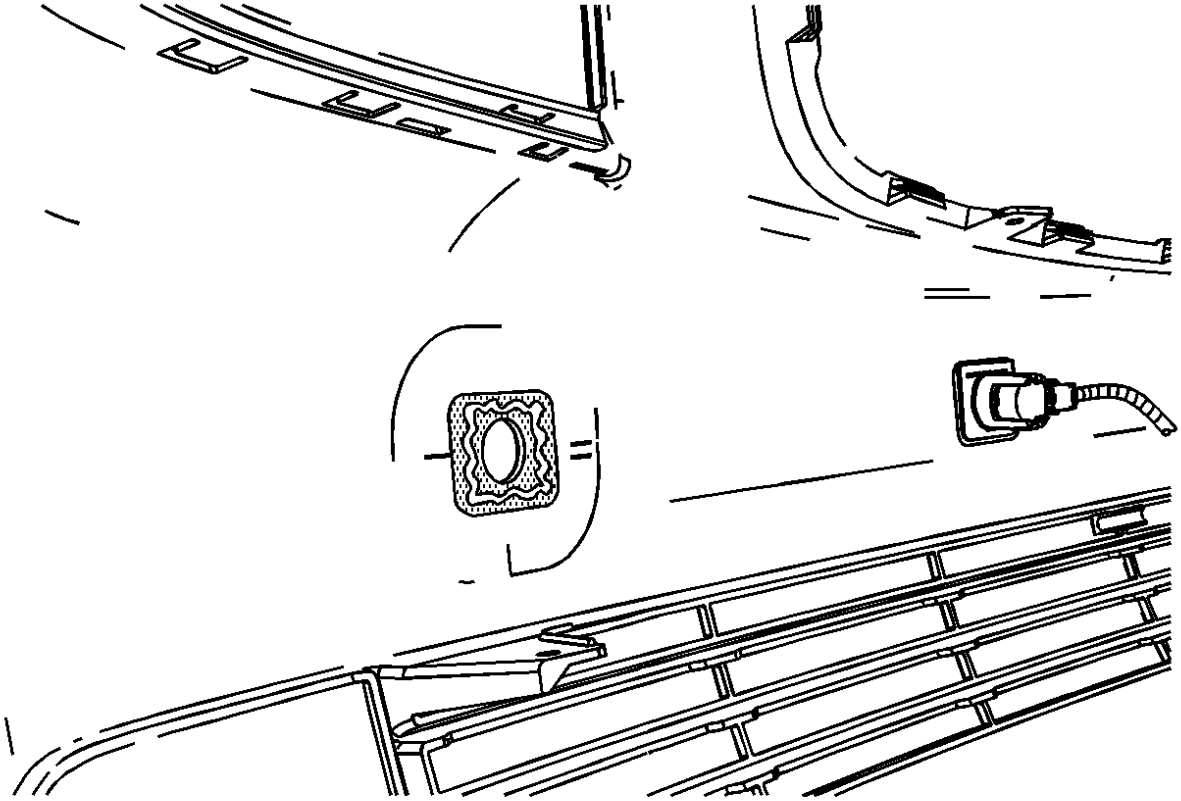


Courtesy of GENERAL MOTORS CORP.

NOTE: Do Not grind off alignment tabs.

Sand/grind sonic weld plastic residue from the fascia.

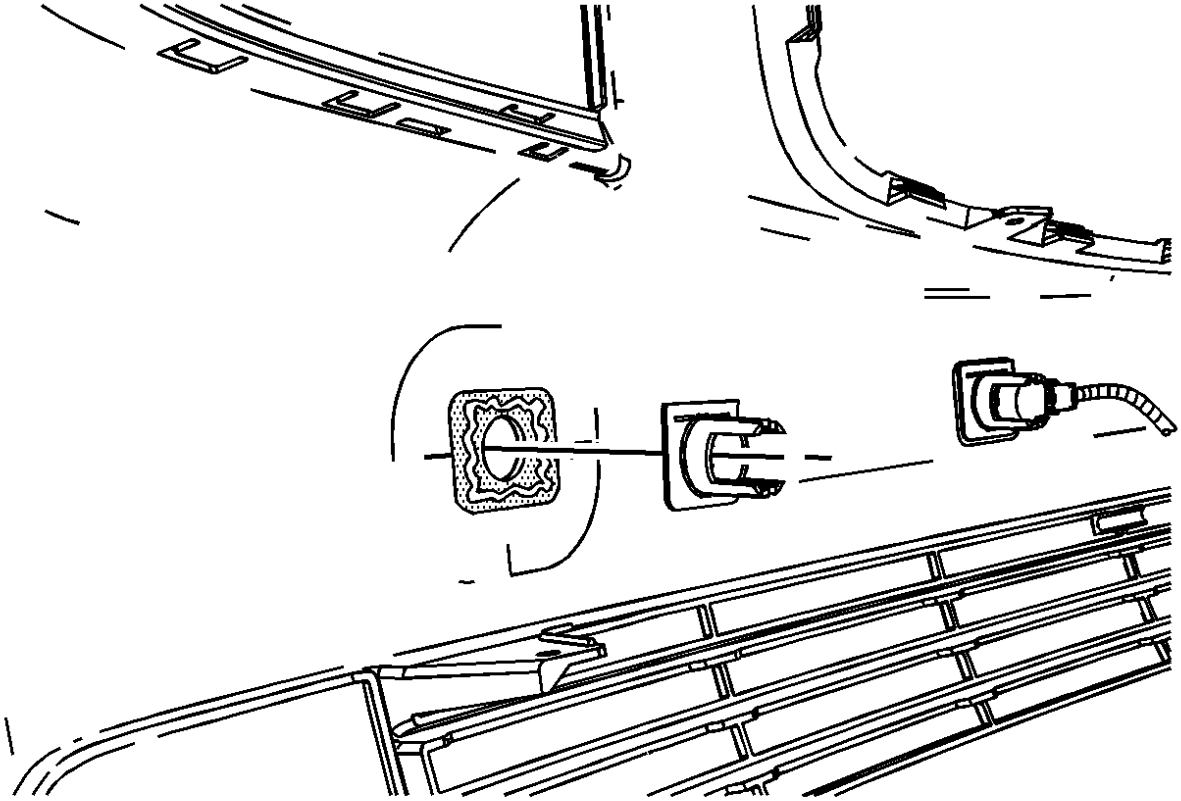
5. Fig 9: Applying Structural Adhesive Epoxy To Fascia



Courtesy of GENERAL MOTORS CORP.

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

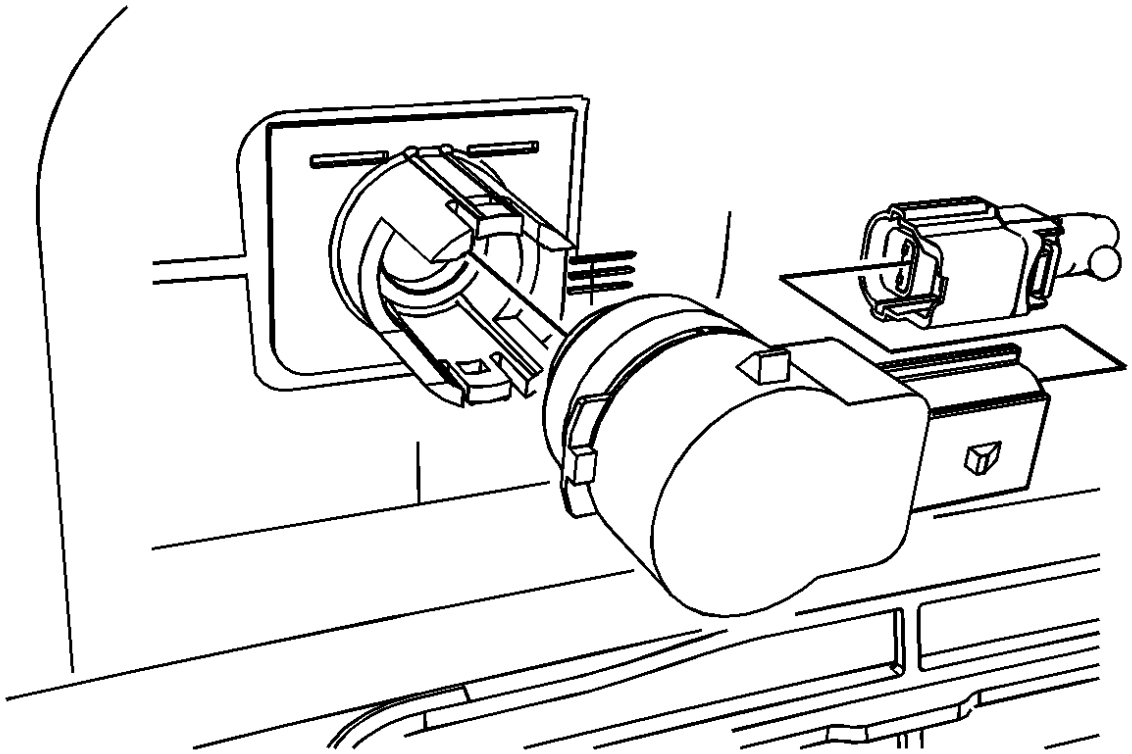
6. Fig 10: Identifying Sensor Housing & Tabs



Courtesy of GENERAL MOTORS CORP.

Using the alignment tabs, install the sensor housing to the fascia.

7. Allow adhesive to cure according to manufacturer's directions.
8. Fig 11: Identifying Rear Object Sensor Housing



Courtesy of GENERAL MOTORS CORP.

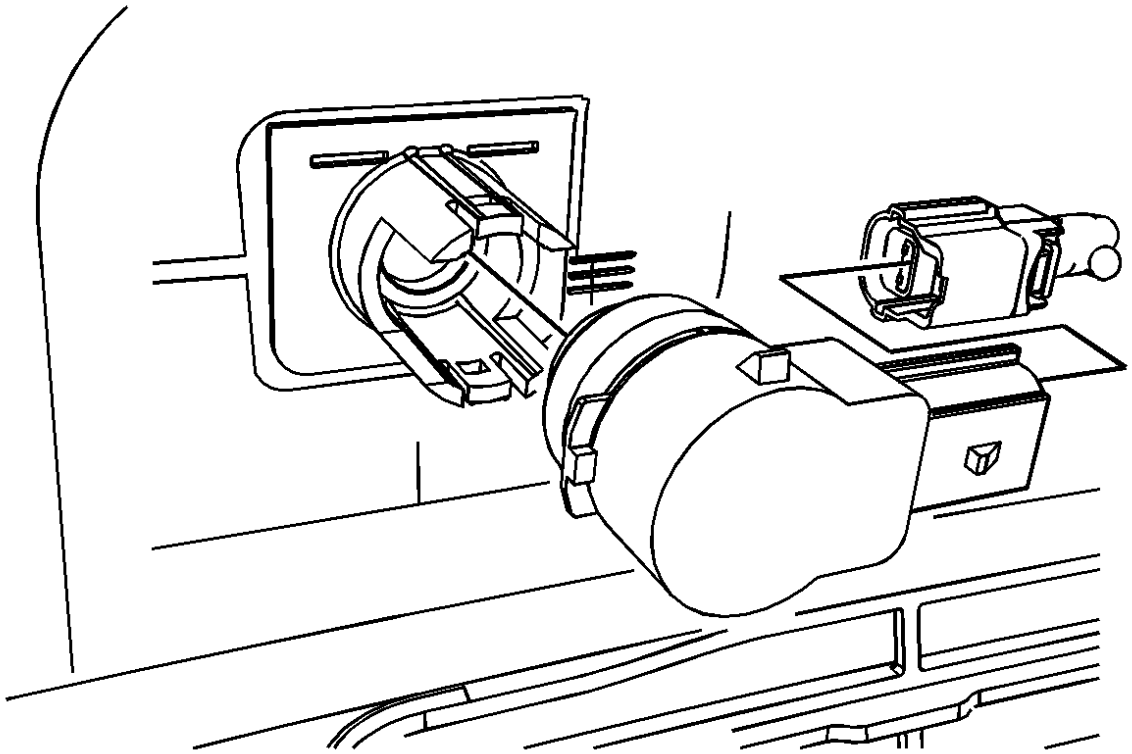
Install the sensor to the sensor housing.

9. Connect the electrical harness.
10. Install the front fascia. Refer to Front Bumper Fascia Replacement .

Rear Object Sensor Replacement

Removal Procedure

1. Fig 12: Identifying Rear Object Sensor Housing



Courtesy of GENERAL MOTORS CORP.

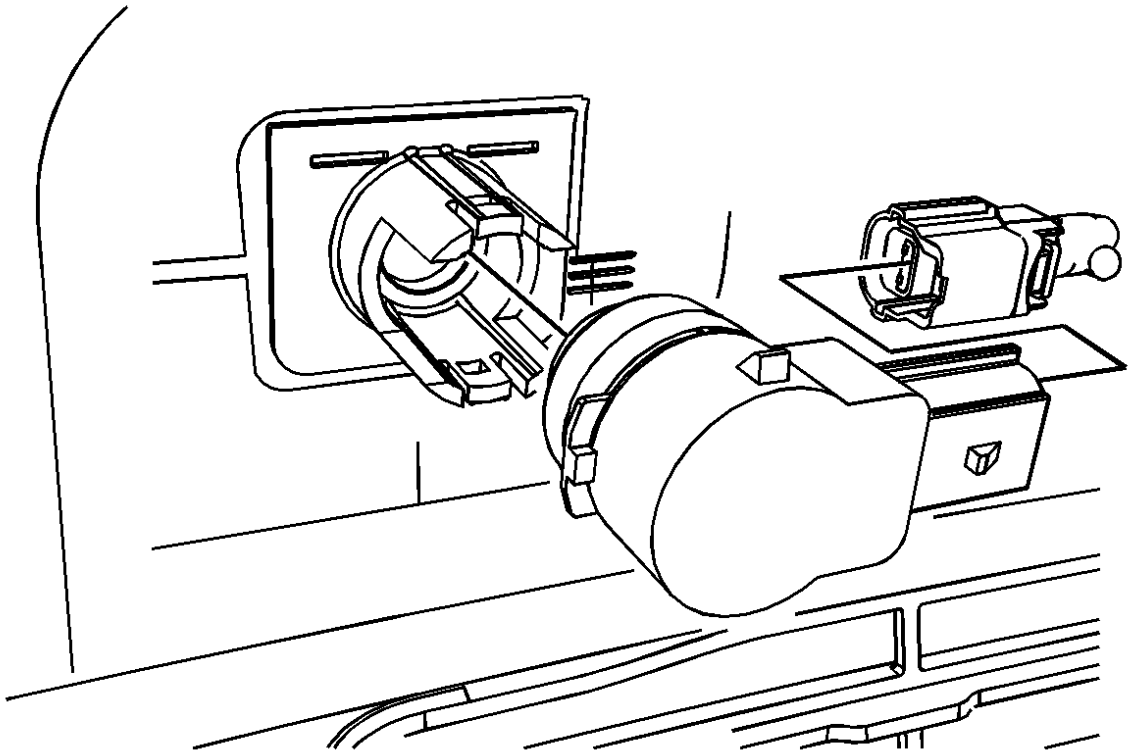
Remove rear bumper fascia. Refer to Rear Bumper Fascia Replacement .
2. Disconnect electrical from the rear object sensor.
3. Lift the locking tabs on the housing and remove the rear object sensor.

Installation Procedure

1.

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

Paint the rear object sensor. Refer to Basecoat/Clearcoat Paint Systems .
2. Ensure the paint does not exceed 6 mils. Use a paint thickness gauge suitable for non-ferrous metals. Refer to Paint Gauges .
3. Fig 13: Identifying Rear Object Sensor Housing



Courtesy of GENERAL MOTORS CORP.

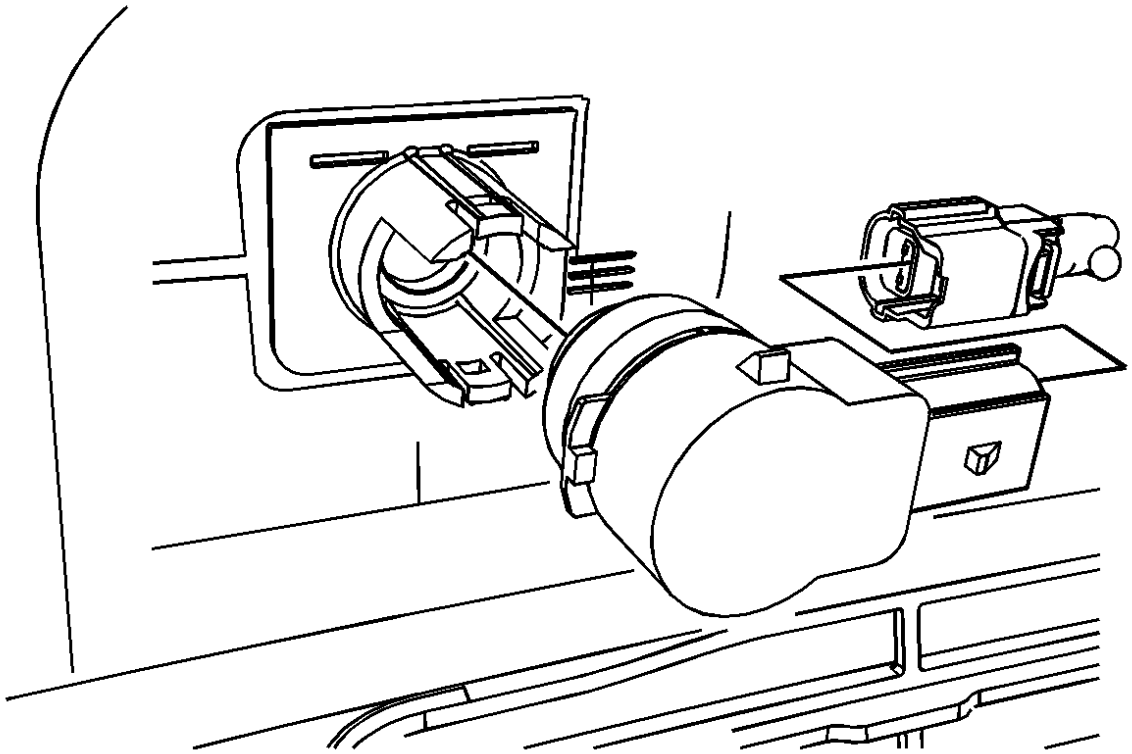
NOTE: Ensure the silicone decoupling ring is installed on the sensor to avoid sensor failure.

Insert the sensor into the housing.

4. Connect the electrical connector to the rear object sensor.
5. Install the rear bumper fascia. Refer to Rear Bumper Fascia Replacement .

Rear Object Sensor Housing Replacement

1. Remove the rear fascia. Refer to Rear Bumper Fascia Replacement .
2. Fig 14: Identifying Rear Object Sensor Housing



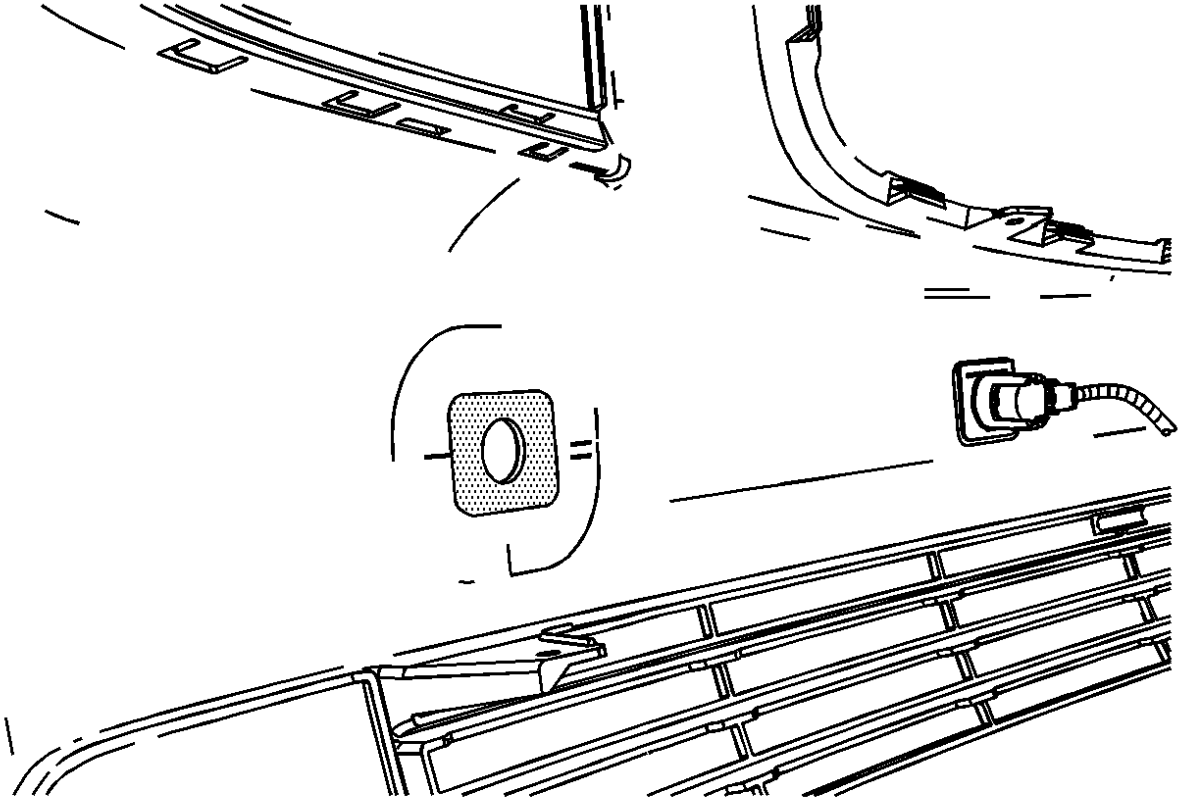
Courtesy of GENERAL MOTORS CORP.

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.

4. Fig 15: Illustrating Sanding/Grinding Sonic Weld Plastic Residue From Fascia

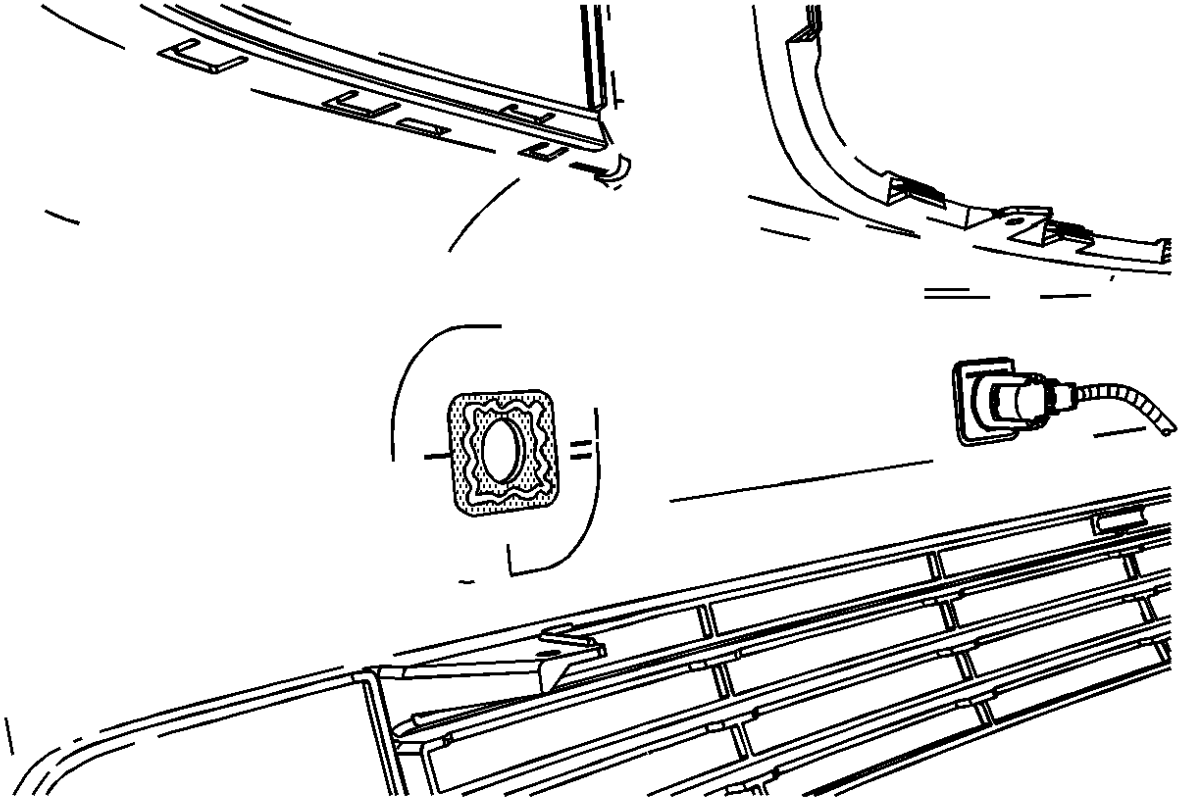


Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do Not grind off alignment tabs.

Sand/grind sonic weld plastic residue from the fascia.

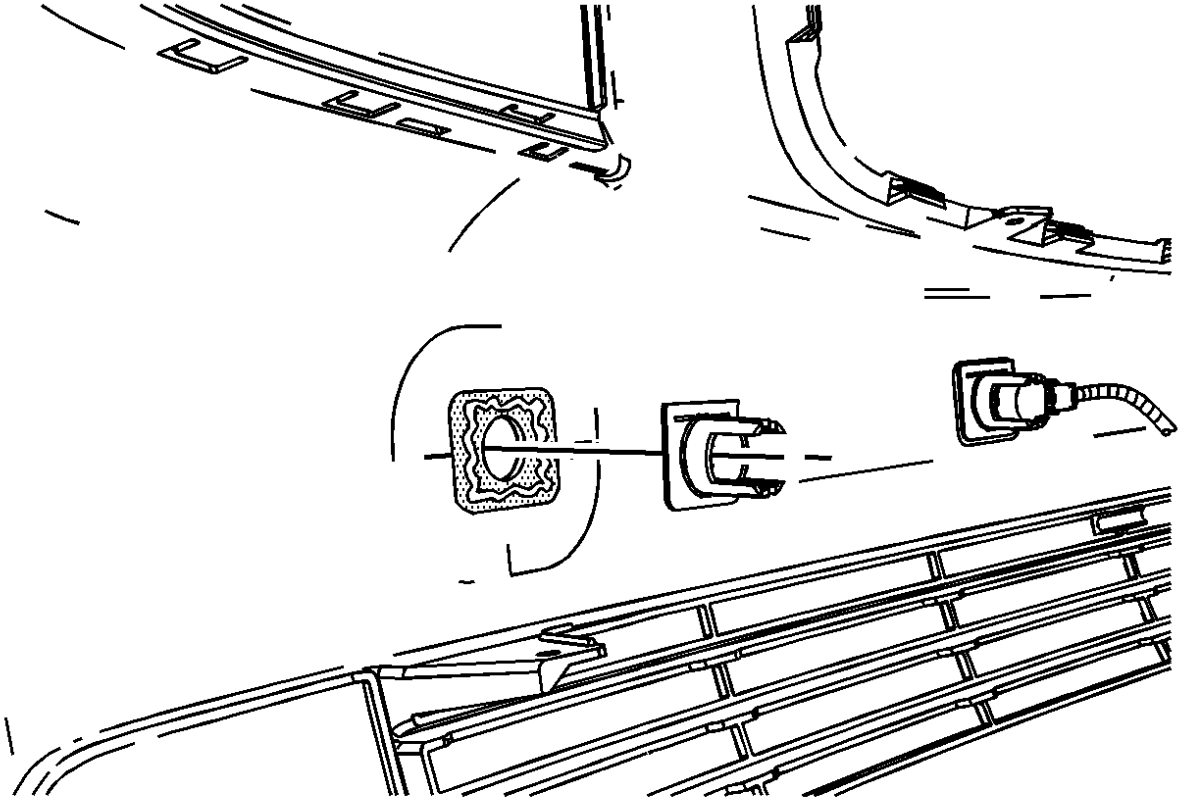
5. Fig 16: Applying Structural Adhesive Epoxy To Fascia



Courtesy of GENERAL MOTORS CORP.

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

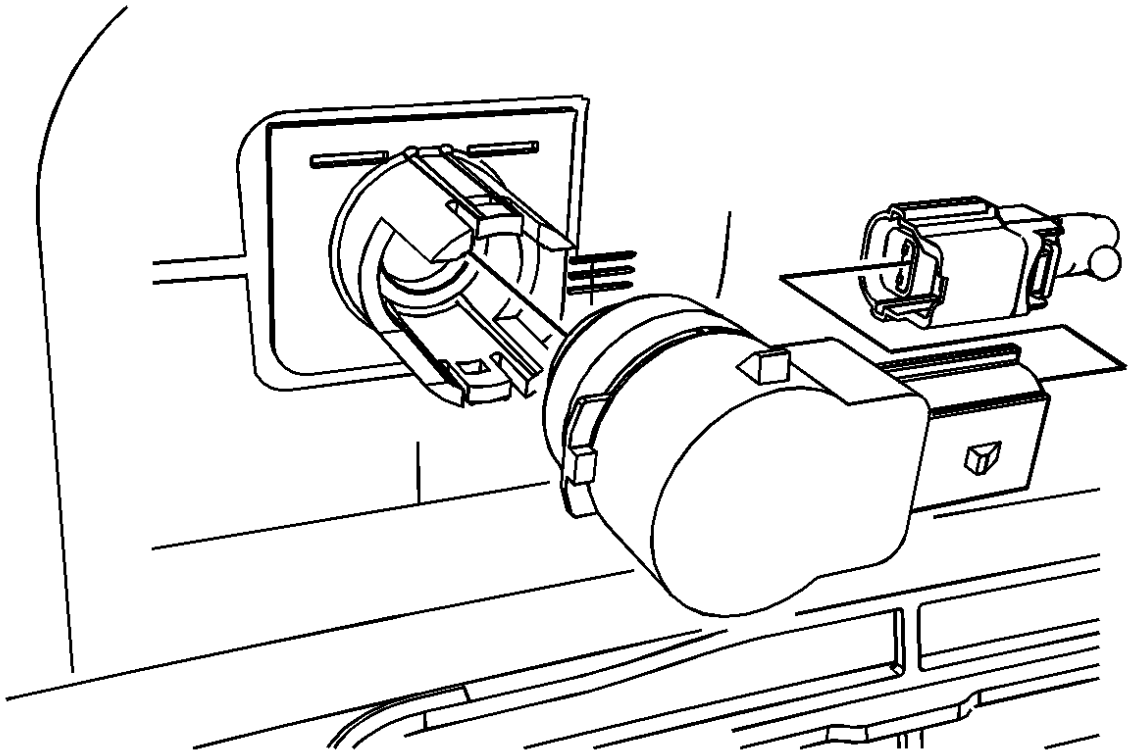
6. Fig 17: Identifying Sensor Housing & Tabs



Courtesy of GENERAL MOTORS CORP.

Using the alignment tabs, install the sensor housing to the fascia.

7. Allow adhesive to cure according to manufacturer's directions.
8. Fig 18: Identifying Rear Object Sensor Housing



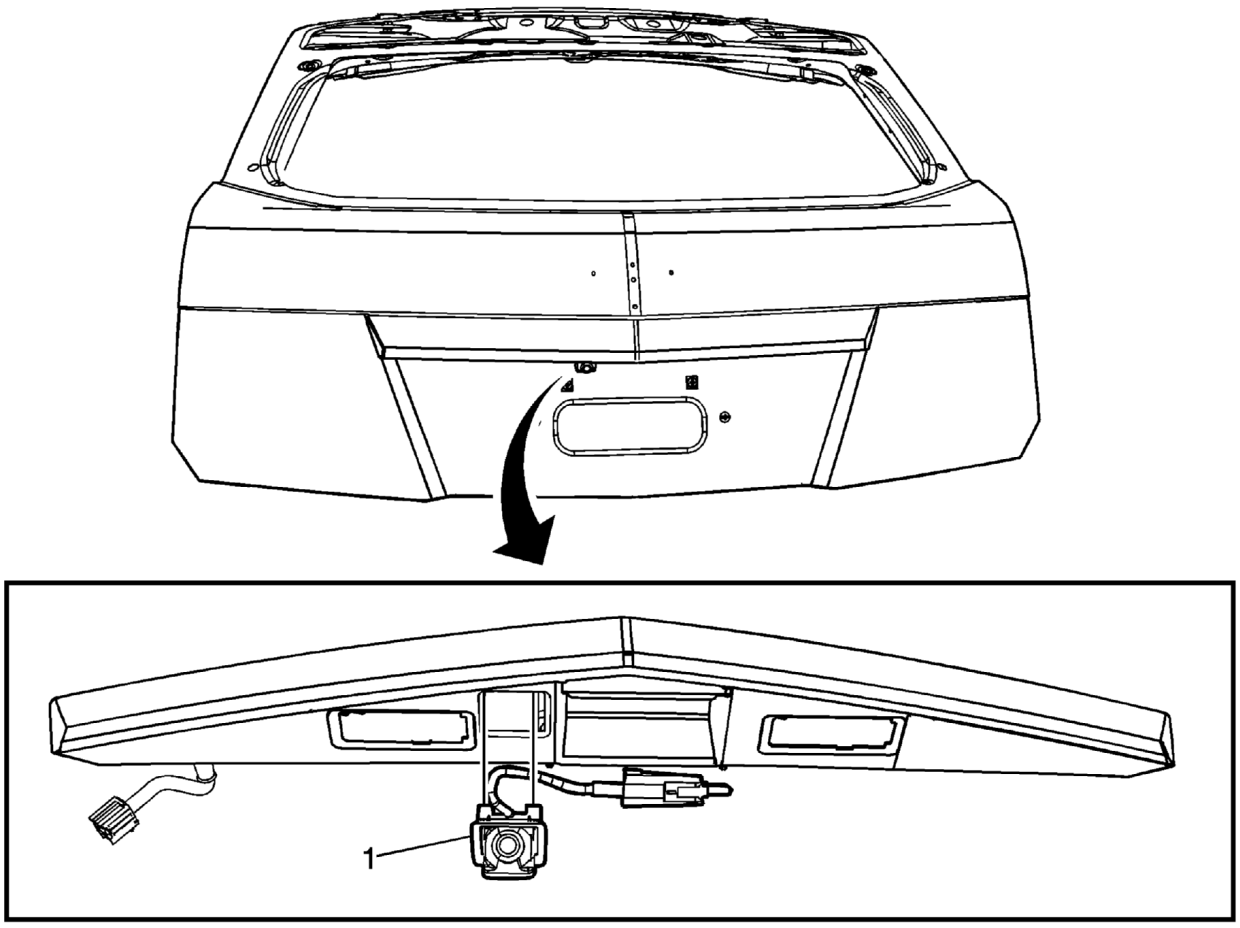
Courtesy of GENERAL MOTORS CORP.

Install the sensor to the sensor housing.

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

Rearview Camera Replacement

Fig 19: Identifying Rearview Camera



Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the liftgate center applique. Refer to Liftgate Center Applique Replacement .	
1	Rearview Camera Procedure 1. Disconnect the electrical connector. 2. Depress the clip fingers and push outward to remove the rearview camera from the applique.

Description and Operation

Object Detection Description and Operation (UVC)

Rear Vision Camera System Operation

The components used in the rear vision camera system are the camera, located at the rear of the vehicle, and the navigation radio.

When the vehicle is placed in REVERSE, the body control module sends a 12 V signal to the rearview camera. This signal indicates that rear vision camera operation is required. Upon receipt of this signal, the camera will begin the power up cycle. A serial data message is also received by the navigation radio indicating the vehicle is

in REVERSE. Upon receipt of this message, the navigation radio will also begin a power up cycle for the display. The rear vision camera transmits the video signal to the navigation radio through discrete + and - signal circuits. A metallic foil encases the video signal circuits and is tied to a shield ground circuit. This shield is designed to reduce electronic interference which may degrade the video signal and cause a distorted or otherwise degraded image.

If desired, the rear vision camera may be manually disabled through the navigation system menu. Refer to the navigation system owners manual for instructions on manually disabling and enabling the rear vision camera system. 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 or low 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 (UD5)

The ultrasonic parking assist system is designed to identify and notify the driver of an object in the vehicle path when moving forward or reversing at speeds of less than 8 km/h (5 MPH). The distance and location of the object is determined by 8 object sensors: 4 located in the rear bumper and 4 located in the front bumper. The parking assist system will notify the driver using an audible beep signal through the radio.

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

- Parking assist control module
- Front object alarm sensors
- Rear object alarm sensors
- Parking assist switch
- Parking assist switch indicator

Parking Assist Control Module

The parking assist control module provides an 8 V reference and a low reference to the 8 object alarm sensors. The parking assist control module receives individual signals from each of the 8 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 CAN-Bus to the radio requesting an audible alert.

Object Alarm Sensors

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

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 CAN-Bus to the radio in order to give out the acoustic distance 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. If an object is detected, one of the following will occur:

- The measuring range of the front object alarm sensors is between 30-120 cm (11.8-47.2 in). From a distance of 120 cm (47.2 in), the acoustic signal is active. The frequency of the beep sound increases with decreasing distance. From a distance less than 30 cm (11.8 in), the sound becomes continuous.
- The measuring range of the rear object alarm sensors is between 30-250 cm (11.8-98.4 in). From a distance of 250 cm (98.4 in), the acoustic signal is active. The frequency of the beep sound increases with decreasing distance. From a distance less than 30 cm (11.8 in), the sound becomes continuous.

The parking assist can be activated and deactivated by pressing the parking assist switch. When REVERSE gear is selected, park assist automatically is engaged for both front and rear sensors. When the vehicle is put into DRIVE from REVERSE the front assist sensors will be active up to speeds of 8 km/h (5 MPH) to assist with parking maneuvers. Once the vehicle is above 8 km/h (5 MPH) the front sensors are disabled and will not be re-enabled until either REVERSE gear is selected or the parking assist switch is pressed to activate the system. Once the parking assist switch is pressed during a key cycle the front sensors become active at speeds under 8 km/h (5 MPH). If the park assist switch is pressed again in the same key cycle the message "Park Assist Off" will be displayed in the driver information center if the vehicle speed is under 8 km/h (5 MPH) and front sensors detect an object within 120 cm (47.2 in). The LED indicator on the parking assist switch provides the ON/OFF state of the system. If the indicator is ON, the system is active and ready to assist.

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. Besides that the parking assist control module 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.