

2018 ACCESSORIES & EQUIPMENT

Driver Assistance Systems - Traverse

SPECIFICATIONS

FASTENER SPECIFICATIONS

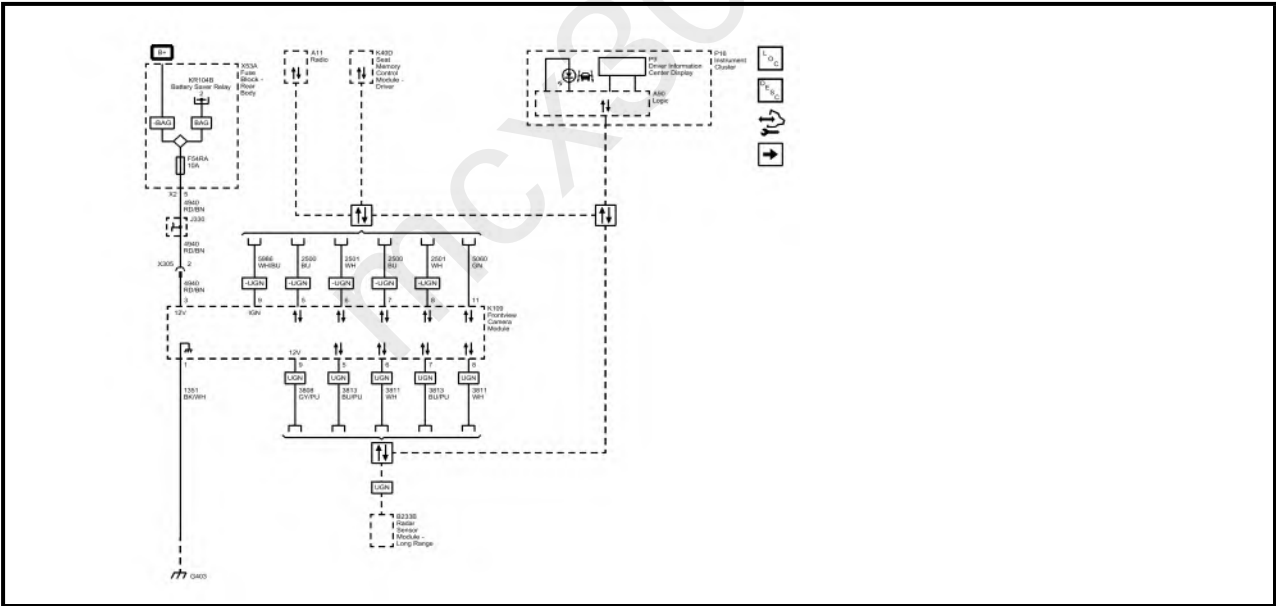
Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Active Safety Control Module Bracket Nut	9 N.m (80 lb in)
Forward Collision Alert Display Bolt	2.5 N.m (22 lb in)
Forward Range Radar Bracket Bolt	2.5 N.m (22 lb in)
Forward Range Radar Sensor Nut	9 N.m (80 lb in)
Side Object Sensing Alert Module Bolt	2.5 N.m (22 lb in)

SCHEMATIC WIRING DIAGRAMS

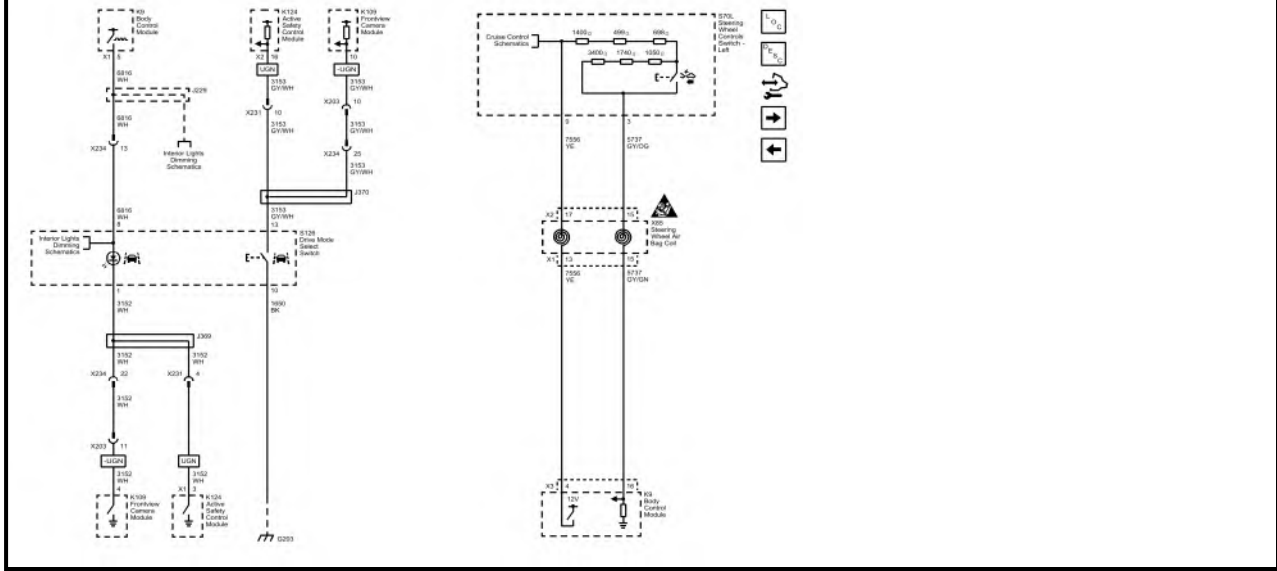
DRIVER ASSISTANCE SYSTEMS WIRING SCHEMATICS

Lane Keep Assist and Forward Collision - Module Power, Ground, and Serial Data (UEU)

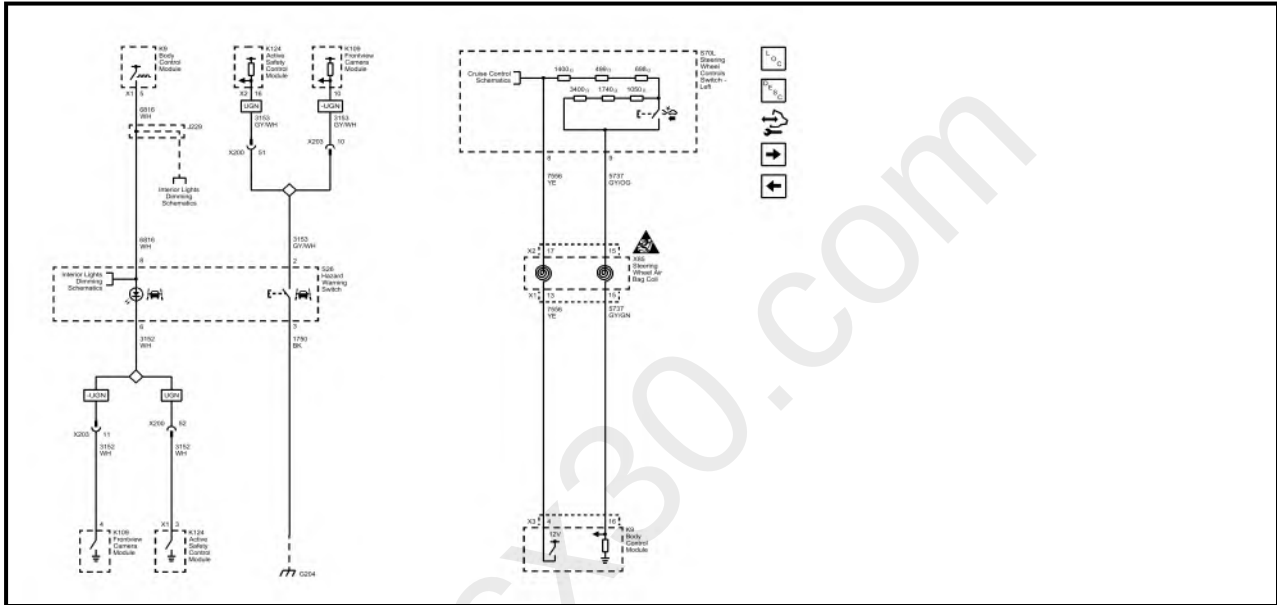


Lane Keep Assist and Forward Collision - Controls (X88 with UEU)

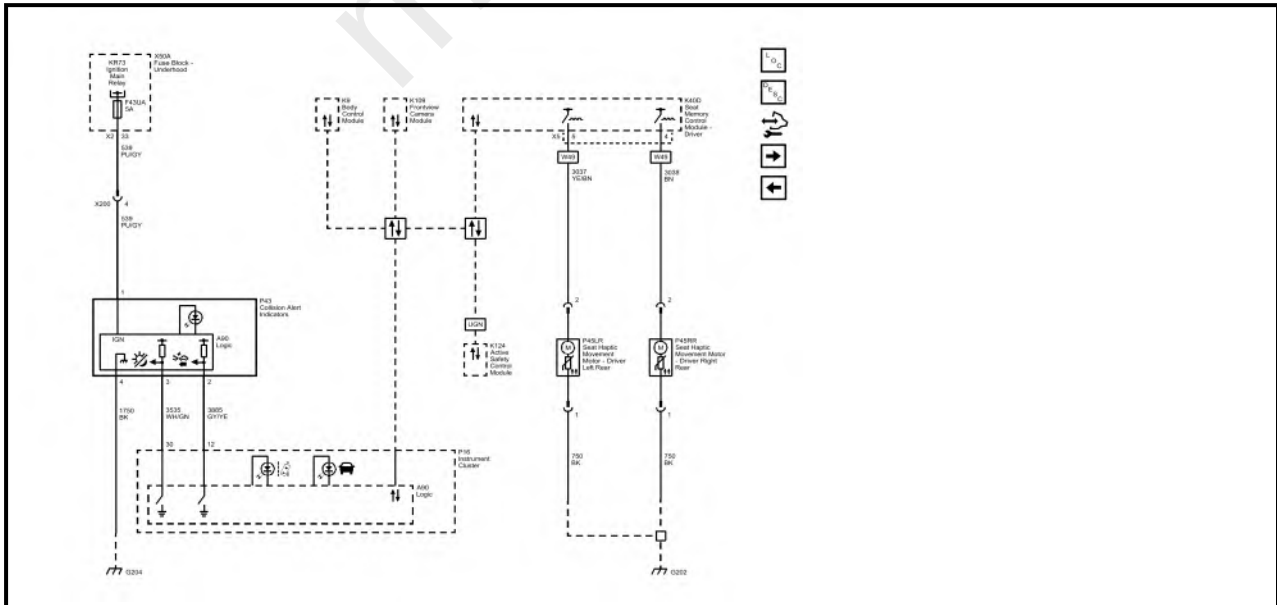




Lane Keep Assist and Forward Collision - Controls (W49 with UEU)



Collision Alert Indicators and Safety Seat (UEU)



Rear Cross Traffic Alert (UFG) and Side Object Detection (UKC)

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC B094B

Left Side Object Detection Control Module

DTC B094C

Right Side Object Detection Control Module

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

Component	Description
B218L Side Object Sensor Module - Left	The assembly has several functions: Side Blind Zone Alert Rear Cross Traffic Audible Alert Rear Cross Traffic Visual Alert
• B218R Side Object Sensor Module - Right	The assembly has several functions: Side Blind Zone Alert Rear Cross Traffic Audible Alert Rear Cross Traffic Visual Alert

Conditions for Running the DTC

Ignition On

Conditions for Setting the DTC

- B094B 00, B094C 00 - System Internal Malfunctions
- B094B 08, B094C 08 - Signal Performance
- B094B 45, B094C 45 - Variant Not Programmed
- B094B 54, B094C 54 - High Temperature
- B094B 58, B094C 58 - Performance

Actions Taken When the DTC Sets

- B218 Side Object Sensor Module = Inoperative
- Driver Information Center Display - Display "Service Side Detection System" Message

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Diagnostic Aids

If DTC B094B 58 is set or DTC B094C 58 is set. - Remove any snow, ice or mud from the vehicle. Also verify the fascia panels in near the radar are damage-free and not obstructed by any add-on accessories such as emblems, etc.

Reference Information

Schematic Reference

[Driver Assistance Systems Wiring Schematics](#)

Connector End View Reference

Description and Operation

Side Blind Zone Alert Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify DTC B094B 45/B094C 45 is not set.
 - **If the DTC is set**
 1. Program the control module: B218 Side Object Sensor Module
 2. Verify the DTC does not set.
 - If the DTC is set

Replace the appropriate component: B218 Side Object Sensor Module
 - Go to next step: If the DTC is not set
3. All OK.
 - **Go to next step: If the DTC is set**
3. Verify DTC B094B 00, B094C 00, B094B 08, B094C 08, B094B 54, B094C 54 is not set.
 - If the DTC is set

Replace the appropriate component: B218 Side Object Sensor Module
 - **Go to next step: If the DTC is not set**
4. Verify DTC B094B 58/B094C 58 is not set.
 - **If the DTC is set**

Verify the following conditions do not exist:
 - Visible Damage
 - Dirty
 - If a condition exists - Repair or replace as necessary
 - If no conditions exist - Replace the appropriate component: B218 Side Object Sensor Module
 - **Go to next step: If the DTC is not set**
5. All OK.

Repair Instructions

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

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

DTC B094D OR B094E

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 B094D

Left Side Object Detection Indicator Circuit

DTC B094E

Right Side Object Detection Indicator Circuit

For symptom byte information, refer to [Symptom Byte List](#).

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Side Object Detection Indicator Control Circuit	B094D 02	B094D 04	B094D 01	-
Right Side Object Detection Indicator Control Circuit	B094E 02	B094E 04	B094E 01	-

Circuit/System Description

The side blind zone alert system sensors are located behind the rear fascia and detect and report objects on either side of the vehicle, within a specified blind zone. The system alerts with a visual indicator placed on each side rear view mirror, to the presence of objects that may not be visible in the inside rearview mirror and outside rearview mirrors. When the system detects a vehicle in the side blind zone while driving forward, independent if passing a vehicle or being passed, an amber warning symbol will light up in the appropriate outside mirror. This indicates that it may be unsafe to change lanes. If the driver then activates the turn signal, the amber warning symbol starts flashing and a chime sounds to give an extra warning not to change lanes. The side object sensor module provides the voltage to the outside rearview mirror to illuminate the side blind zone alert symbol on the mirror.

Side blind zone alert is active from speeds of 10 km/h (6.2 MPH) up to 140 km/h (87 MPH). Driving faster deactivates the system, indicated by low lighting warning symbols in the mirrors. Driving under this speed again will turn off the warning symbols. If then a vehicle is detected in blind zone, the warning symbols will illuminate normally on the appropriate side. When the vehicle is started, both outside mirror displays will briefly come on to indicate that the system is operating.

Conditions for Running the DTC

- Engine running.
- The Side blind zone alert is active from speeds of 10 km/h (6.2 MPH) up to 140 km/h (87 MPH).

Conditions for Setting the DTC

B094D 02

The module has detected a short to ground in the left side object detection indicator circuit.

B094D 01

The module has detected a short to voltage in the left side object detection indicator circuit.

B094E 02

The module has detected a short to ground in the right side object detection indicator circuit.

B094E 01

The module has detected a short to voltage in the right side object detection indicator circuit.

Action Taken When the DTC Sets

The side blind zone alert system is inoperative and Service Side Detection System 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

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Side Blind Zone Alert Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Special Tools

EL-35616-210 Test Light - Probe Kit

Circuit/System Verification

1. Ignition OFF, ignition ON.
2. Verify the side blind zone alert system indicators located in the outside rearview mirrors briefly turn ON and then OFF during the system self test when ignition is turned ON.
 - **If the side blind zone alert system indicators do not briefly turn ON and OFF**

Refer to Circuit/System Testing
 - **Go to next step: If both side blind zone alert indicators briefly turn ON and OFF**
3. All OK.

Circuit/System Testing

NOTE: Make sure to use a high impedance test lamp like special tool **EL-35616-210**.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector for the appropriate A9 Outside Rearview Mirror. It may take up to 2 min for all vehicle systems to power down.
 - X510 - Driver Door Harness to Outside Rearview Mirror
 - X610 - Passenger Door Harness to Outside Rearview Mirror
2. Test for less than 10 Ω between the ground circuit terminal 12 and ground.

- **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
- 3. Ignition ON, connect a test lamp between the control circuit terminal 11 and the ground circuit terminal 12.
- 4. Verify the test lamp turns ON and OFF when commanding the Object Detection Alert Indicators On and Off with a scan tool.
 - **If the test lamp is always OFF**
 1. Ignition OFF, disconnect the harness connector at the appropriate B218 Side Object Sensor 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.
 - Go to next step: If infinite resistance
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the B218 Side Object Sensor Module.
 - **If the test lamp is always ON**
 1. Ignition OFF, disconnect the harness connector at the B218 Side Object Sensor Module, ignition ON.
 2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the B218 Side Object Sensor Module.
 - **Go to next step: If the test lamp turns ON and OFF**
- 5. Test or replace the A9 Outside Rearview Mirror Glass.

Repair Instructions

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

- [Outside Rearview Mirror Glass Replacement](#)
- [Control Module References](#) for control module replacement, programming and setup

DTC B0987

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC B0987

Vehicle Direction Camera Indicator Circuit

Symptom Byte Information: [Symptom Byte List](#)

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
Control - Terminal 4 @ S70L Steering Wheel Controls Switch - Left	B0987 06, 1	B0987 06, B0987 0B	B0987 01, B0987 0B	-
Control - Terminal 5 X1 @ K9 Body Control Module	1	1	1	-
1. Lane Departure Warning Indicator Malfunction				

Circuit/System Description

Component	Description
S70L Steering Wheel Controls Switch - Left	The assembly contains individual switches. Each function has its own switch. The switches are connected to a resistor ladder so that a specific resistance is generated for each switch.
K109 Frontview Camera Module	The video camera and the control module are a single serviceable component. This camera delivers live video of what is in front of the vehicle. The video can be used for several functions, like lane departure warning, lane keep assist, road sign recognition and more. The control module also reads various switches and sensors and makes their values available via serial data.
K9 Body Control Module	Depending on the version, the control module can support different functions: • Exterior Illumination • Interior Illumination • Steering Wheel Controls • Power Mode Control The control module also reads various switches and sensors and makes their values available via serial data.

Conditions for Running the DTC

Ignition On

Conditions for Setting the DTC

B0987 01, B0987 0B

Control Circuit = Short to Voltage

B0987 06

Control Circuit = Short to Ground

B0987 06, B0987 0B

Control Circuit = Open

B0987 0B

Control Circuit = High Current

Actions Taken When the DTC Sets

- Lane Departure Warning = Inoperative

- Driver Information Center Display - Service Driver Assist

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify DTC B356A is not set.
 - If the DTC is set
Refer to: **DTC B356A**
 - Go to next step: If the DTC is not set
3. Verify the component turns On and Off: Lane Departure Warning Indicator
 - Lane Departure Warning Switch
 - If the component does not turn On and Off
Refer to Circuit/System Testing.
 - Go to next step: If the component turns On and Off
4. All OK.

Circuit/System Testing

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: S70L Steering Wheel Controls Switch - Left

NOTE: Verify interior lighting dimming is turned all the way up.

3. Test for 4 to 11 V between the test points: Control circuit terminal 11 & Ground

- **If less than 4 V**

1. Ignition/Vehicle - Off
2. Disconnect the electrical connector: X1 K9 Body Control Module
3. Test for infinite resistance between the test points: Control circuit terminal 5 @ K9 Body Control Module & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - Go to next step: If infinite resistance
4. Test for less than 2 ohms between the test points: Control circuit terminal 5 @ K9 Body Control Module & Control circuit terminal 11 @ S70L Steering Wheel Controls Switch - Left
 - 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 greater than 11 V**

1. Ignition/Vehicle - Off
2. Disconnect the electrical connector: X1 K9 Body Control Module
3. Ignition - On/Vehicle - In Service Mode
4. Test for less than 1 V between the test points: Control circuit terminal 5 @ K9 Body Control Module & Ground
 - If greater than 1 V
Repair the short to voltage on the circuit.
 - If 1 V or less
Replace the component: K9 Body Control Module

- **Go to next step: If between 4 - 11 V**

4. Ignition - On/Vehicle - In Service Mode
5. Connect a test lamp between the test points: Control circuit terminal 11 @ S70L Steering Wheel Controls Switch - Left & B+
6. Perform the appropriate scan tool control function: Lane Departure Warning Indicator Command - Cycle On and Off

- **If the test lamp is always Off**

1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
2. Disconnect the electrical connector: X1 K109 Frontview Camera Module
3. Test for less than 2 ohms between the test points: Control circuit terminal 11 @ Component harness & Terminal 4 @ Control module harness
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component: K109 Frontview Camera Module

- **If the test lamp is always On**

1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
2. Disconnect the electrical connector: K109 Frontview Camera Module
3. Test for infinite resistance between the test points: Terminal 4 @ Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component: K109 Frontview Camera Module

- **Go to next step: If the test lamp turns On and Off**

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

Repair Instructions

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

- [Cruise Control Switch Replacement](#) - Procedure for Component Replacement - S70L Steering Wheel Controls Switch - Left
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC B1008

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC B1008

Calibration Data

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

Ignition - On/Vehicle - In Service Mode - B174W Frontview Camera - Windshield - Calibration Data = Invalid

The B174W Frontview Camera Module performs a self-test to verify if a critical malfunction exists within the system. During the power-up mode, the Frontview Camera Module checks for a valid calibration data set.

Conditions for Running the DTC

Ignition - On/Vehicle - In Service Mode

Conditions for Setting the DTC

- B174W Frontview Camera - Windshield - Calibration Data = Invalid
- The frontview camera module has been replaced and programmed, but not calibrated.

Action Taken When the DTC Sets

- Lane Departure Warning = Disabled
- Forward Collision Alert = Disabled
- Driver Information Display - Service Front Camera/Service Lane Departure Warning
- B174W Frontview Camera - Windshield - All functions = Disabled

Conditions for Clearing the DTC

- A current DTC will clear when the diagnostic runs and passes.
- A history DTC will clear after 50 consecutive malfunction-free ignition cycles.

Diagnostic Aids

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

Reference Information

Schematic Reference

[Driver Assistance Systems Wiring Schematics](#)

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

- [Forward Collision Alert Description and Operation](#)
- [Lane Departure Warning Description and Operation](#)

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

NOTE: This DTC can be set as a history DTC without affecting the operation of the component: K109 Frontview Camera Module

1. Ignition - On/Vehicle - In Service Mode

2. Verify DTC B101E 42 is not set.

- If DTC B101E 42 is set

Perform the following procedure/test: [B174W Frontview Camera - Windshield: Programming and Setup](#)

- Go to next step: If the DTC is not set

3. Verify DTC B1008 is not set.

- If DTC B1008 is set

1. Perform the following procedure/test: [Front View Camera Module Learn](#).

2. Verify DTC B1008 is not set.

- If the DTC sets - Replace the component: K109 Frontview Camera Module
- Go to next step: If the DTC is not set

3. All OK.

- Go to next step: If the DTC is not set

4. All OK.

Repair Instructions

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

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC B1011

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC B1011

System Disabled Information Stored

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

Component	Description
P43 Collision Alert Indicators	The assembly contains individual switches. Each function has its own switch. The switches are connected to a resistor ladder so that a specific resistance is generated for each switch.
B174W Frontview Camera - Windshield	This camera delivers live video of what is in front of the vehicle. The video can be used for several functions, like lane departure warning, lane keep assist, road sign recognition and more. The control module also reads various switches and sensors and makes their values available via serial data.
K9 Body Control Module	Depending on the version, the control module can support different functions: • Interior Illumination • Steering Wheel Controls The control module also reads various switches and sensors and makes their values available via serial data.

Conditions for Running the DTC

Ignition - On/Vehicle - In Service Mode

Conditions for Setting the DTC

K109 Frontview Camera Module - System Disabled Information Stored

Action Taken When the DTC Sets

- Lane Departure Warning = Disabled
- Forward Collision Alert = Disabled
- Driver Information Display - Service Front Camera/Service Lane Departure Warning
- B174W Frontview Camera - Windshield - All functions = Disabled

Conditions for Clearing the DTC

- A current DTC will clear when the diagnostic runs and passes.
- A history DTC will clear after 50 consecutive malfunction-free ignition cycles.

Diagnostic Aids

Refer to: Scan Tool Information - Frontview Camera Disable History 1-4

Refer to: [Forward Collision Alert Description and Operation](#)

Reference Information

Schematic Reference

[Driver Assistance Systems Wiring Schematics](#)

Connector End View Reference

Description and Operation

Forward Collision Alert Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

NOTE: This is an informal DTC which does not necessarily indicate a defective control module. DTC B1011 sets when information is stored to the frontview camera module disable history buffers. This contains the reason that one or more of the frontview camera module features is disabled

1. Ignition - On/Vehicle - In Service Mode
2. Verify no other DTCs are set.

- **If any other DTCs are set**

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

- **Go to next step: If no other DTCs are set**

3. Verify the scan tool parameter: Frontview Camera Disable History 1 Malfunction

- **If the parameter displays the following: Malfunction or Undefined**

Refer to: **B174W Frontview Camera: Scan Tool Information (except UGN)**, **B174W Frontview Camera: Scan Tool Information (UGN)**.

- **Go to next step: If the parameter displays the following: Normal**

4. Verify the scan tool parameter: Frontview Camera Disable History 2 Malfunction

- **If the parameter displays the following: Malfunction or Undefined**

Refer to: **B174W Frontview Camera: Scan Tool Information (except UGN)**, **B174W Frontview Camera: Scan Tool Information (UGN)**.

- **Go to next step: If the parameter displays the following: Normal**

5. Verify the scan tool parameter: Frontview Camera Disable History 3 Malfunction

- **If the parameter displays the following: Malfunction or Undefined**

Refer to: **B174W Frontview Camera: Scan Tool Information (except UGN)**, **B174W Frontview Camera: Scan Tool Information (UGN)**.

- **Go to next step: If the parameter displays the following: Normal**

6. Verify the scan tool parameter: Frontview Camera Disable History 4 Malfunction

- **If the parameter displays the following: Malfunction or Undefined**

Refer to: **B174W Frontview Camera: Scan Tool Information (except UGN)**, **B174W Frontview Camera: Scan Tool Information (UGN)**.

- **Go to next step: If the parameter displays the following: Normal**

7. All OK.

Repair Instructions

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

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC B1015

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC B1015

Vehicle Identification Number Information

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

When the ignition is turned On, the control module receives the vehicle identification number (VIN) from the K9 Body Control Module.

The control module will compare the VIN received to the VIN stored in memory.

Conditions for Running the DTC

Ignition On

Conditions for Setting the DTC

The VIN stored in the control module and the VIN received via serial data from another control module are different.

Actions Taken When the DTC Sets

- Forward Collision Alert = Disabled
- Lane Departure Warning = Disabled
- B174W Frontview Camera - Windshield = Inoperative
- K124 Active Safety Control Module - If equipped = Inoperative
- Driver Information Center Display - Service Front Camera/Service Lane Departure Warning

Conditions for Clearing the DTC

A current DTC will clear when the diagnostic runs and passes.

Reference Information

Schematic Reference

[Driver Assistance Systems Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

Forward Collision Alert Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify DTC B1015 is not set.
 - **If the DTC is set**
 1. Program the control module: B174W Frontview Camera - Windshield or K124 Active Safety Control Module
 2. Ignition - On/Vehicle - In Service Mode
 3. Verify DTC B1015 is not set.
 - If the DTC is set

Replace the appropriate component: B174W Frontview Camera - Windshield or K124 Active Safety Control Module
 - Go to next step: If the DTC is not set
4. All OK.
 - **Go to next step: If the DTC is not set**
3. All OK.

Repair Instructions

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

For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC B101D (FRONTVIEW CAMERA MODULE OR FRONTVIEW CAMERA - WINDSHIELD)

Diagnostic Instructions

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

DTC Descriptor

DTC B101D

Electronic Control Unit Hardware

DTC B101D 3C

Electronic Control Unit Hardware Performance Internal Communications Failure

For symptom byte information, refer to [Symptom Byte List](#)

Circuit/System Description

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

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

B101D

The frontview camera module has detected an internal malfunction

B101D 3C

The frontview camera module has detected a software malfunction

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Forward Collision Alert Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Verify that DTC B101D symptom byte 3C is not set as current.
 - **If DTC B101D symptom byte 3C is set as current**
Reprogram the K109 Frontview Camera Module
 - **Go to next step: If DTC B101D symptom byte 3C is not set as current**
2. Verify that DTC B101D is not set as current.
 - **If DTC B101D is set as current**

- Go to next step: If DTC B101D is not set as current

3. All OK.

Repair Instructions

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

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

DTC B172E OR B172F

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC B172E

Driver Seat Cushion Left Rear Haptic Movement

DTC B172F

Driver Seat Cushion Right Rear Haptic Movement

Symptom Byte Information: [Symptom Byte List](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control - Terminal 4 @ K40D Seat Memory Control Module - Driver	B172E 02	B172E 01, B172E 02	B172E 01	-
Control - Terminal 5 X1 @ K40D Seat Memory Control Module - Driver	B172F 02	B172F 01, B172F 02	B172F 01	-
Ground - Terminal 2 @ P45LR Seat Haptic Movement Motor - Driver Left Rear	-	B172E 01, B172E 02	-	-
Ground - Terminal 2 @ P45RR Seat Haptic Movement Motor - Driver Right Rear	-	B172F 01, B172F 02	-	-

Circuit/System Description

For an overview of the component/system, refer to: [Safety Alert Seat Description and Operation](#)

Circuit	Description
Control	The output circuit is switched to 12 V to activate the component.
Ground	Chassis Ground

Component	Description

Component	Description
K40D Seat Memory Control Module - Driver	Depending on the version, the control module can support different functions: • Left Rear Seat Haptic Movement Motor Control • Right Rear Seat Haptic Movement Motor Control • Rear Cross Traffic Haptic Alert The control module also reads various switches and sensors and makes their values available via serial data.
K109 Frontview Camera Module	The video camera and the control module are a single serviceable component. This camera delivers live video of what is in front of the vehicle. The video can be used for several functions, like lane departure warning, lane keep assist, road sign recognition and more. The control module also reads various switches and sensors and makes their values available via serial data.
{If equipped} K124 Active Safety Control Module	Depending on the version, the control module can support different functions: • Brake Assist • Automatic Collision Preparation • Rear Emergency Braking • Distance Sensing Cruise Control Function The control module also reads various switches and sensors and makes their values available via serial data.
P45LR Seat Haptic Movement Motor - Driver Left Rear & P45RR Seat Haptic Movement Motor - Driver Right Rear	An electric DC motor.

Conditions for Running the DTC

Ignition On

Conditions for Setting the DTC

B172E 01

Control module K40D detects: Left Rear Seat Haptic Movement Motor Control = Short to Voltage

B172E 02

Control module K40D detects: Left Rear Seat Haptic Movement Motor Control = Short to Ground

B172F 01

Control module K40D detects: Right Rear Seat Haptic Movement Motor Control = Short to Voltage

B172F 02

Control module K40D detects: Right Rear Seat Haptic Movement Motor Control = Short to Ground

Actions Taken When the DTC Sets

- Seat Cushion Haptic Motors = Inoperative
- Driver Information Center Display - Service Driver Assist

Conditions for Clearing the DTC

The conditions for setting the DTC no longer exist.

Diagnostic Aids

Verify the function: Seat Cushion Haptic Motors Disabled by Driver Personalization

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Safety Alert Seat Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Perform the scan tool function: Driver Seat Cushion Left Rear Haptic Movement & Driver Seat Cushion Right Rear Haptic Movement - On and Off

Verify the component produces a vibration that can be heard and felt.

- **If the component does not activate**
Refer to: Circuit/System Testing
- **Go to next step: If the component activates**

3. All OK.

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: X5 @ K40D Seat Memory Control Module - Driver
3. Ignition - On/Vehicle - In Service Mode
4. Test for less than 1 V between the test points:
 - Control circuit terminal 4 & Ground
 - Control circuit terminal 5 & Ground
 - **If 1 V or greater**

Repair the short to voltage on the circuit.

- **Go to next step: If less than 1 V**

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be

performed.

5. Ignition/Vehicle & All vehicle systems - Off

6. Test for 27 to 51 ohms between the test points:

- Control circuit terminal 4 & Ground
- Control circuit terminal 5 & Ground
- **If less than 27 ohms**

Replace the appropriate component: P45LR Seat Haptic Movement Motor - Driver Left Rear or P45RR Seat Haptic Movement Motor - Driver Right Rear

- **If greater than 51 ohms**

1. Test or inspect for the following: Ground Connection - Clean & Secure

- If not correct

Repair as necessary

- Go to next step: If correct

2. Replace the appropriate component: P45LR Seat Haptic Movement Motor - Driver Left Rear or P45RR Seat Haptic Movement Motor - Driver Right Rear

- **Go to next step: If between 21 and 57 ohms**

7. Momentarily connect a 3 A fused jumper wire between the test points:

- Control circuit terminal 4 & B+
- Control circuit terminal 5 & B+

8. Verify the component turns On and Off when connecting and disconnecting the jumper wire:

P45LR Seat Haptic Movement Motor - Driver Left Rear or P45RR Seat Haptic Movement Motor - Driver Right Rear

- **If the component does not turn On and Off**

Replace the appropriate component: P45LR Seat Haptic Movement Motor - Driver Left Rear or P45RR Seat Haptic Movement Motor - Driver Right Rear

- **Go to next step: If the component turns On and Off**

9. Ignition/Vehicle & All vehicle systems - Off

10. Connect the electrical connector at all components.

11. Ignition - On/Vehicle - In Service Mode

12. Perform the scan tool function: Driver Seat Cushion Left Rear Haptic Movement & Driver Seat Cushion Right Rear Haptic Movement - On and Off

Verify the component produces a vibration that can be heard and felt.

- **If the component does not activate**

Replace the appropriate component: K40D Seat Memory Control Module - Driver

- **Go to next step: If the component activates**

13. All OK.

Repair Instructions

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

- [Front Seat Lane Departure Warning Actuator Replacement](#) - P45LR Seat Haptic Movement Motor - Driver Left Rear or P45RR Seat Haptic Movement Motor - Driver Right Rear
- For control module replacement, programming, and setup refer to: [Control Module References](#)

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
Lane Departure Warning Switch Signal	B356A 02	1	B356A 05	-
Lane Departure Warning Switch Ground	-	1	-	-
1. Lane Departure Warning Malfunction				

Circuit/System Description

The lane departure warning system is controlled by the Active Safety Control Module. Lane departure warning is enabled and disabled through a switch located in the instrument panel. When enabled, the Active Safety Control Module will illuminate the indicator located in the switch.

When the Frontview Camera module is operating and can detect the lane markings, the Frontview Camera module will request via serial data communications that the instrument panel 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 may also sound three times or the haptic seat (if equipped) may pulse when the yellow Instrument Cluster indicator is flashing. The driver can select between audible or haptic alerts in the vehicle personalization menu. See the Owner's Manual for more detailed information on vehicle personalization.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

DTC B356A 02

The Active Safety Control Module has detected a short to ground for more than 10 s.

DTC B356A 05

The Active Safety Control Module has detected a short to voltage or an open/high resistance for more than 10 s.

Action Taken When the DTC Sets

- Lane departure warning is disabled.
- Service Lane Departure is displayed on the driver information center.

Conditions for Clearing the DTC

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

Diagnostic Aids

Manually pressing the lane departure warning switch for an extended length of time will cause this DTC to set.

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Vehicle Direction Warning Switch Status parameter changes between On and Off while cycling the lane departure warning switch.
 - **If the parameter does not change**
Refer to Circuit/System Testing.
 - **Go to next step: If the parameter changes**
3. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the S48A Multifunction Switch - Instrument Panel. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 7 and ground.
 - **If 10 Ω or greater**
 1. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Vehicle Direction Warning Switch Status parameter is Off.
 - **If not Off**
 1. Ignition OFF, disconnect the harness connector at the K124 Active Safety Control Module.
 2. Test for infinite resistance between the S48A Multifunction Switch - Instrument Panel 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 Frontview Camera Module.
- **Go to next step: If Off**

5. Install a 3 A fused jumper wire between the signal circuit terminal 4 and ground circuit terminal 7.

6. Verify within 10 s the scan tool Vehicle Direction Warning Switch Status parameter is On.

- **If not On**

1. Ignition OFF, disconnect harness connector at the K124 Active Safety Control Module. Ignition ON.

2. Test for less than 1 V between the S48A Multifunction Switch - Instrument Panel signal circuit terminal 4 and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- Go to next step: If less than 1 V.

3. Test for less than 2 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K124 Active Safety Control Module.

- **Go to next step: If On**

7. Test or replace the S48A Multifunction Switch - Instrument Panel.

Repair Instructions

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

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

DTC B390A

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 B390A

Short Range Object Sensor Performance

For symptom byte information, refer to [Symptom Byte List](#).

Circuit/System Description

The radar sensor module - short range performs internal fault detection on itself.

Conditions for Running the DTC

The radar sensor module - short range continually runs the program to detect faults.

Conditions for Setting the DTC

The radar sensor module - short range has detected an internal malfunction.

Action Taken When the DTC Sets

The control module will not function and the Active Safety System will be inoperative.

Conditions for Clearing the DTC

- A current DTC clears when the malfunction is no longer present.

- A history DTC clears when the control module ignition cycle counter reaches the reset threshold of 50, without a repeat of the malfunction.

Diagnostic Aids

- If DTC B390A 58 is set, check for anything that can interfere with the radar signal. Verify area in front of radar is clean of mud, ice, snow, etc. Also verify the fascia panels in front of the radar are damage-free and not obstructed by any add-on accessories such as emblems, stickers, etc.
- If the vehicle fascia is clean, unobstructed, and damage free, and B390A 58 is still set as current, the radar sensor has detected a blockage condition and will not be able to clear it until certain conditions are met. It is necessary to drive the vehicle at a speed greater than 9 km/h (6 mph) and allow the radar sensor to be exposed to other vehicles and traffic in the direction of the radar sensor field of view. Usually, a short drive in normal traffic conditions will allow the radar sensor to clear the blockage condition.
- The radar sensor modules - short range cannot be swapped from side to side once they have been installed. DTC B390A 67 may set if a radar sensor module - short range is reinstalled on the incorrect side of the vehicle.
- If DTC B390A 45 is set, it is most often due to the radar not learning the vehicle position correctly rather than an indication of an actual Software programming issue. To correct, run or re-run the set-up function within the programming tool.

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Active Safety System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B390A 08 or DTC B390A 45 is not set.
 - **If either DTC is set**
 1. Program the appropriate B233 Radar Sensor Module - Short Range.
 2. Verify DTC B390A 08 or DTC B390A 45 is not set after programming.
 - If either DTC sets after programming, replace the appropriate B233 Radar Sensor Module - Short Range.
 - Go to next step: If the DTC does not set
 - 3. All OK.
 - **Go to next step: If both DTCs are not set**
3. Verify DTC B390A 54 is not set.

- **If the DTC is set**

Replace the appropriate B233 Radar Sensor Module - Short Range.

- **Go to next step: If the DTC is not set**

4. Verify DTC B390A 58 is not set.

- **If DTC is set**

1. Verify the area in front of the sensor is clean, unobstructed, and damage-free.
 - If not clean, unobstructed, and damage-free, clean or repair as necessary.
 - Go to next step: If clean, unobstructed, and damage-free
2. Replace the appropriate B233 Radar Sensor Module - Short Range.

- **Go to next step: If DTC is not set**

5. Verify DTC B390A 67 is not set.

- **If the DTC is set in more than one B233 Radar Sensor Module - Short Range**

1. Verify none of the B233 Radar Sensor Module - Short Range have not been swapped side to side.
 - If any B233 Radar Sensor Module - Short Range have been swapped, return them to their original position.
 - Go to next step: If none of the B233 Radar Sensor Module - Short Range have been swapped
2. Replace the appropriate B233 Radar Sensor Module - Short Range.

- **If the DTC is set in only one B233 Radar Sensor Module - Short Range**

Refer to Circuit/System Testing

- **Go to next step: If the DTC is not set**

6. All OK.

Repair Instructions

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

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

DTC B390C

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 B390C

Long Range Radar Sensor Module

Circuit/System Description

After replacement, the radar sensor module - long range must complete an alignment procedure. The alignment procedure can be completed by driving the vehicle for approximately 30 min.

Conditions for Running the DTC

- Module alignment procedure started.
- Vehicle operating on the road.

Conditions for Setting the DTC

The radar sensor module - long range was unable to complete alignment process within approximately 30 min of drive time.

Action Taken When the DTC Sets

- The radar sensor module - long range is disabled.
- Any systems that rely on data from the radar sensor module - long range are disabled.
- A service message may be displayed on the driver information center.

Conditions for Clearing the DTC

The radar sensor module - long range is successfully aligned.

Diagnostic Aids

- The B233B Radar Sensor Module - Long Range must be securely mounted. Verify it is secured properly in its mount.
- The harness, or other obstructions should not pass in front of the B233B Radar Sensor Module - Long Range

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Active Safety System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B390C is not set
 - **If the DTC is set**
 1. Perform the Radar Sensor Module - Long Range Learn procedure.
 2. Verify DTC B390C is not set after the calibration procedure has been completed.
 - If the DTC is set after calibration, replace the B233B Radar Sensor Module - Long Range.
 - Go to next step: If the DTC is not set after calibration
 3. All OK.
 - **Go to next step: If DTC B390C 66 is not set**
3. All OK.

Repair Instructions

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

[Control Module References](#) for radar sensor module - long range replacement, programming, and setup.

DTC B390D

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 B390D

Frontview Camera Module

Circuit/System Description

The frontview camera module has determined that it is not properly mounted.

Conditions for Running the DTC

Vehicle operating on the road.

Conditions for Setting the DTC

The frontview camera module is improperly mounted.

Action Taken When the DTC Sets

- All system that operate with input from the frontview camera module are disabled.
- A service message may be displayed on the driver information center.

Conditions for Clearing the DTC

The frontview camera module is successfully aligned.

Diagnostic Aids

- The frontview camera module must be securely mounted. Verify it is secured properly in it's bracket.
- The frontview camera module must have a clear field of vision to the road ahead. Check for anything that may impair the frontview camera module's ability to clear see the area in front of the vehicle.

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Active Safety System Description and Operation

Electrical Information Reference

- [Circuit Testing](#)

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify there are no DTCs set, except for DTC B390D.
 - **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **Go to next step: If no other DTCs are set**

NOTE: Before performing the calibration, verify that the B174W Frontview Camera - Windshield will not have difficulty seeing lane markings in front of the vehicle. If the view of the B174W Frontview Camera - Windshield is blocked with mud, dirt, snow, ice, or slush, if the windshield is damaged, or if weather limits visibility, such as while driving in fog, rain, or snow conditions, the calibration procedure may not be able to be completed.

3. Calibrate the B174W Frontview Camera - Windshield. Refer to [Front View Camera Module Learn](#).
4. Verify DTC B390D is not set
 - **If DTC B390D is set**

Replace the B174W Frontview Camera - Windshield.

 - **Go to next step: If DTC B390D is not set**
5. All OK.

Repair Instructions

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

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

DTC P15F6

Diagnostic Instructions

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

DTC Descriptors

DTC P15F6

Front Object Detection Control Module Torque Request Signal Message Counter Incorrect

Circuit/System Description

The active safety control module is constantly sending a serial data message to the engine control module requesting engine speed or torque reduction. The engine control module sets DTC P15F6 when it detects a discrepancy in the structure of the message causing the integrity of the message to be

questioned. An intermittent fault in the serial data circuits will cause the engine control module to set DTC P15F6.

Conditions for Running the DTC

Engine running.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- The active safety control module sends a serial data message to display the appropriate indicator message
- The active safety control module features are unavailable.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Active Safety System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

NOTE:

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

1. Verify there are no other K20 Engine Control Module or communication DTCs set.

- **If a DTC is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If a DTC is not set**

2. Complete the diagnosis by looking for an intermittent serial data circuit fault. Refer to [Scan Tool Does Not Communicate with High Speed GMLAN Device](#).

- **If an intermittent serial data circuit fault is found**

Repair as necessary.

- **Go to next step: If an intermittent serial circuit fault is not found**

3. Clear DTCs and operate the vehicle in the conditions that the customer experienced.

4. Verify DTC P15F6 does not set.

- **If the DTC sets**

Replace K124 Active Safety Control Module

- **Go to next step: If the DTC does not set**

5. All OK.

Repair Instructions

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

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

DTC P15F7

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P15F7

Rear Object Detection Control Module Torque Request Signal Message Counter Incorrect

Symptom Byte Information: [Symptom Byte List](#)

Circuit/System Description

Component	Description
K182 Parking Assist Control Module	Depending on the version, the control module can support different functions: • Front Parking Assist • Rear Parking Assist The control module also reads various switches and sensors and makes their values available via serial data.

Conditions for Running the DTC

The vehicle speed is greater than 1 km/h (1 MPH).

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Parking Assist Description and Operation (UD7) Parking Assist 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

NOTE:

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

1. Verify there are no other K20 Engine Control Module or communication DTCs set.

- **If a DTC is set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle

- **Go to next step: If a DTC is not set**

2. Complete the diagnosis by looking for an intermittent serial data circuit fault. Refer to Scan Tool Does Not Communicate with High Speed GMLAN Device .

- **If an intermittent serial data circuit fault is found**

Repair as necessary.

- **Go to next step: If an intermittent serial circuit fault is not found**

3. Clear DTCs and operate the vehicle in the conditions that the customer experienced.

4. Verify DTC P15F7 does not set.

- **If the DTC sets**

Replace the appropriate component: K182 Parking Assist Control Module

- Go to next step: If the DTC does not set

5. All OK.

Repair Instructions

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

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

SYMPTOMS - DRIVER ASSISTANCE SYSTEMS

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

1. Perform the [Diagnostic System Check - Vehicle](#) before using the Symptom Tables in order to verify that all of the following are true: before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions:
 - [Lane Departure Warning Description and Operation](#)
 - [Lane Keep Assist Description and Operation](#)
 - [Cross Traffic Alert Description and Operation](#)
 - [Side Blind Zone Alert Description and Operation](#)
 - [Forward Collision Alert Description and Operation](#)
 - [Safety Alert Seat Description and Operation](#)

Visual/Physical Inspection

- Inspect for aftermarket devices which may affect the operation of the system. Refer to [Checking Aftermarket Accessories](#).
- Inspect the easily accessible or visible system components for obvious damage or conditions which may cause the symptom.
- Make sure the parking assist sensors located on the vehicle front and rear bumper are clear. Remove any snow, mud or ice that is blocking the sensors.

Intermittent

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

Symptom List

- [Seat Haptic Signal Motor Malfunction](#)
- [Forward Collision Alert System Malfunction](#)
- [Rear Cross Traffic Alert System Malfunction](#)
- [Side Blind Zone Alert System Malfunction](#)
- [Lane Departure Warning System Malfunction](#)
- [Lane Keep Assist System Malfunction](#)

ADAPTIVE CRUISE CONTROL 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

Component	Sensor Blocked	Sensor Mis Aligned	Sensor External Interference
B233B Radar Sensor Module - Long Range	1	1, 3	1
K109 Frontview Camera Module	1, 2	-	1, 2
1. Adaptive Cruise: Temporarily Unavailable or ACC TEMP UNAVAILABLE Message Displayed 2. Lane Departure Warning: Unavailable or Lane Keeping Assist: System Unavailable LKA UNAVAILABLE or LDW UNAVAILABLE Message Displayed 3. Service Driver Assist Message Displayed			

Circuit/System Description

Adaptive Cruise Control Description and Operation

Diagnostic Aids

System Disabled possible reasons

- Switchable cruise control (if equipped): Verify the Adaptive Cruise Control is enabled by observing the corresponding indicator and message in the Driver Information Display. Switch between ACC and Regular Cruise Control by pressing and holding the Cancel switch
- B233B Radar Sensor Module - Long Range Mounting/Alignment: For (some) vehicles the "SERVICE DRIVER ASSIST SYSTEM" message can be displayed without a DTC being set, when the long range radar gets misaligned. Inspect the long range radar for proper mounting/alignment. In most cases, a mounting/alignment issue may be caused by a front end impact/collision that may or may not be obvious. Physically check the Long Range Radar Module bracket for damage and make sure it is in alignment. Place the vehicle on a level surface. Use an angle gauge/level to make sure the bracket is mounted 90 degrees (+/- 3 degrees). After the Long Range Radar Module alignment has been checked and/or corrected, perform the [Radar Sensor Module - Long Range Learn](#)
- K109 Frontview Camera Module Mounting: Inspect the front view camera sensor, on the windshield near the inside rearview mirror, to make sure it is attached properly to the windshield. Calibrate the front camera module after repair. Refer to [Front View Camera Module Learn](#)
- Visually inspect the vehicle for any aftermarket add on equipment like bug deflectors, windshield tint/banners, grille emblems, push bars, license plates, etc. These items could block the radar / camera's view. Question the customer to see if this concern started after the installation of the aftermarket equipment. Remove any aftermarket items and retest system for proper operation.
- The radars and front camera are continuously monitoring for a blocked condition and if it determines its ability to "see" clearly is compromised, the radar/camera may become unavailable. When this occurs, the cruise will disengage and/or no cruise engagement with an "Adaptive Cruise: Temporarily Unavailable" message. Since the radars cannot visually "see" they rely on a complex blockage detection algorithm to predict blockage. Also, keep in mind that the front camera cannot see through objects or debris, so the camera can become visibly blocked. It is important to understand that disabling the adaptive cruise control, as a result of sensor blockage, is a normal function of the system and is intended to protect the driver from compromised system performance. Blockage detection is needed because if the radars/camera were/was truly blocked, the adaptive cruise control would not function properly.
- Foul weather: Foul weather such as snow, ice, heavy rain, road spray conditions may limit the sensors ability to "see". Also, a buildup of mud, snow, frost, dirt, bugs, etc on the windshield or front fascia can cause a blockage. This buildup can also occur on the back side of the fascia between the radar and back of fascia. One example, if the windshield has a buildup of frost/snow/ice which covers the front camera, the system may detect a blockage and disable the cruise. After the defroster warms the windshield and melts away the frost/snow/ice the system will become operational. This example may appear to be an intermittent issue.
- If driving in 4WD HI range (if equipped), adaptive cruise control will be disabled, which is normal. (Adaptive cruise control will function in Auto 4WD.)
- Dark Rural Areas: In very dark rural areas, the front view camera may detect blockage.
- Very High Ambient Temperatures: Very high ambient temperatures may affect camera operation.

- Barren Environments: As part of the blockage detection algorithm, the radar may conclude it is blocked if the radar does not "see" anything over a period of time. This can happen when driving in very bare environments, such as deserts and rural areas where there are no large objects to detect like other vehicles, bridges, building, trees, signs, mail boxes, guard rails, etc. Below is an example photo of an area where the radar may determine a blockage because there are no objects in the environment for the radar to "see". In these cases, if the system does not detect an object within approximately 60 seconds or 1.2 miles (2 km) the cruise will be disengaged and a "ADAPTIVE CRUISE TEMPORARILY UNAVAILABLE" message. If there were other vehicles on the road for the radar to detect there would not be any issues.

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Adaptive Cruise Control Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify there are no other DTCs set and that there are no communication DTCs set in the vehicle.
 - **If any DTC's are set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle
 - **Go to next step: If no DTC's are set**
3. Verify the Active Safety Control Module scan tool parameter Adaptive Cruise Control Inhibit History Data 1-6 and Adaptive Cruise Control Disengage History Data 1-6 indicate no current malfunction. Refer to K124 Active Safety Control Module: Scan Tool Information
 - **If not the specified state**

Diagnose the system that sets the malfunction.
 - **Go to next step: If the specified state**
4. Verify the scan tool parameter: B233B Radar Sensor Module - Long Range - Long Range Radar Sensor Module Misaligned - Angled Down = No
 - **If the parameter does not display the following: Long Range Radar Sensor Module Misaligned - Angled Down = No**

Align the B233B Radar Sensor Module - Long Range and perform the Radar Sensor Module - Long Range Learn
 - **Go to next step: If the parameter displays the following: Long Range Radar Sensor Module Misaligned - Angled Down = No**

5. Verify the scan tool parameter: B233B Radar Sensor Module - Long Range - Long Range Radar Sensor Module Misaligned - Angled Left = No
- **If the parameter does not display the following: Long Range Radar Sensor Module Misaligned - Angled Left = No**
- Align the B233B Radar Sensor Module - Long Range and perform the [Radar Sensor Module - Long Range Learn](#)
- **Go to next step: If the parameter displays the following: Long Range Radar Sensor Module Misaligned - Angled Left = No**
6. Verify the scan tool parameter: B233B Radar Sensor Module - Long Range - Long Range Radar Sensor Module Misaligned - Angled Right = No
- **If the parameter does not display the following: Long Range Radar Sensor Module Misaligned - Angled Right = No**
- Align the B233B Radar Sensor Module - Long Range and perform the [Radar Sensor Module - Long Range Learn](#)
- **Go to next step: If the parameter displays the following: Long Range Radar Sensor Module Misaligned - Angled Right = No**
7. Verify the scan tool parameter: B233B Radar Sensor Module - Long Range - Long Range Radar Sensor Module Misaligned - Angled Up = No
- **If the parameter does not display the following: Long Range Radar Sensor Module Misaligned - Angled Up = No**
- Align the B233B Radar Sensor Module - Long Range and perform the [Radar Sensor Module - Long Range Learn](#)
- **Go to next step: If the parameter displays the following: Long Range Radar Sensor Module Misaligned - Angled Up = No**
8. Verify the scan tool parameter: K109 Frontview Camera Calibration Status = Calibrated. Refer to [B174W Frontview Camera: Scan Tool Information \(except UGN\)](#), [B174W Frontview Camera: Scan Tool Information \(UGN\)](#)
- **If not the specified state**
- Perform the following learn procedure: [Front View Camera Module Learn](#)
- **Go to next step: If the specified state**
9. All OK.

Repair Instructions

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

[Control Module References](#)

SEAT HAPTIC SIGNAL MOTOR MALFUNCTION

Diagnostic Instructions

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

Circuit/System Description

The haptic seats, also known as Active Safety Seats, provide a vibration to alert the driver in certain circumstances. There are two motors in the driver's seat cushion. Either the right or left motor can run or both depending on the alert. The K40D Seat Memory Control Module - Driver provides the output voltage for the motors. The K40D Seat Memory Control Module - Driver receives serial data requests from other modules to activate the appropriate seat motors with the number of pulses requested. While

the motors are activated, the K40D Seat Memory Control Module - Driver checks for either shorts to voltage or shorts to ground. Due to the nature of the PWM signal, if a motor circuit is open, it may be reported as either a short to voltage or short to ground.

Diagnostic Aids

The infotainment personalization menu allows the user to set alerts to be either haptic through the seats or audio beeps through the radio. Refer to the Owner's Manual to verify this setting.

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Active Safety System Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the P45LR Seat Haptic Signal Motor - Driver Left Rear turns on and off when commanding the Driver Seat Cushion Left Rear Haptic Movement On and Off with a scan tool.
 - **If the motor does not function**

Refer to Circuit/System Testing.
 - **Go to next step: If the motor functions**
3. Verify the P45RR Seat Haptic Signal Motor - Driver Right Rear turns on and off when commanding the Driver Seat Cushion Right Rear Haptic Movement On and Off with a scan tool.
 - **If the motor does not function**

Refer to Circuit/System Testing.
 - **Go to next step: If the motor functions**
4. All OK.

Circuit/System Testing

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

Repair the short to voltage on the circuit.

- **Go to next step: If less than 1 V**

3. Ignition OFF and all vehicle systems OFF.

4. Install a 3 A fused jumper wire between the appropriate control circuit terminal listed below and B+.

- Terminal 4 - P45RR Seat Haptic Movement Motor - Driver Right Rear
- Terminal 5 - P45LR Seat Haptic Movement Motor - Driver Left Rear

5. Verify the appropriate P45 Seat Haptic Movement Motor - Driver turns on and off.

- **If the P45 Seat Haptic Movement Motor - Driver does not turn on and off**

1. Verify the circuit ground connection is clean and secure.

- If the ground connector is not clean or secure, repair as necessary.
- Go to next step: If the circuit ground connection is clean and secure

2. Replace the appropriate P45 Seat Haptic Movement Motor - Driver.

- **Go to next step: If the P45 Seat Haptic Movement Motor - Driver turn on and off**

6. Ignition OFF, connect the harness connector at the K40D Seat Memory Control Module - Driver, ignition ON.

7. Verify the P45LR Haptic Signal Motor - Driver Left Rear turns on and off when commanding the Driver Seat Cushion Left Rear Haptic Movement On and Off with a scan tool.

- **If the motor does not function**

Replace the K40D Seat Memory Control Module - Driver.

- **Go to next step: If the motor functions**

8. Verify the P45RR Haptic Signal Motor - Driver Right Rear turns on and off when commanding the Driver Seat Cushion Right Rear Haptic Movement On and Off with a scan tool.

- **If the motor does not function**

Replace the K40D Seat Memory Control Module - Driver.

- **Go to next step: If the motor functions**

9. All OK.

Repair Instructions

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

- [Front Seat Lane Departure Warning Actuator Replacement](#) - seat haptic movement motor - driver replacement.
- [Control Module References](#) for control module replacement, programming and setup.

FORWARD COLLISION ALERT SYSTEM MALFUNCTION

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Forward Collision Alert Indicators Ignition	1	1	-	-
Forward Collision Alert Switch Signal	P0580, P0592	P0592	P0593	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Forward Collision Alert Switch Dimming Control	3	3	3	-
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 3. Forward Collision Alert Indicator dimming malfunction				

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 3 km/h (2 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

Camera Mounting: Inspect the front view camera sensor, on the windshield near the inside rearview mirror, to make sure it is attached properly to the windshield. Calibrate the front camera module after repair. Refer to [Front View Camera Module Learn](#)

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

[Driver Assistance Systems Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

[Forward Collision Alert Description and Operation](#)

- [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 that no DTCs are set.
 - **If any DTC is set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If the DTC is not set**
3. Verify the scan tool Frontview Camera Disable History 1 - 4 parameters does not have a current Malfunction. Refer to [B174W Frontview Camera: Scan Tool Information \(except UGN\)](#), [B174W Frontview Camera: Scan Tool Information \(UGN\)](#).
 - **If the parameter is Malfunction**
Diagnose the system that set the malfunction.
 - **Go to next step: If the parameter is Normal**
4. Verify the forward collision alert indicators illuminate momentarily when turning ignition OFF and then ON.
 - **If the indicators do not illuminate**
Refer to [DTC B0987](#).
 - **Go to next step: If the indicators illuminate**
5. 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 [DTC B356A](#).
 - **Go to next step: If the setting changes**
6. Verify the area of the K109 Frontview Camera Module is not contaminated.
 - **If contaminated**
Clean the windshield
 - **Go to next step: If not contaminated**
7. All OK.

Repair Instructions

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

[Control Module References](#) for frontview camera module replacement, programming and setup.

REAR CROSS TRAFFIC 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
Side Object Sensor - Left Ground	-	U0232	-	-
Side Object Sensor - Left B+	-	U0232	-	-
Side Object Sensor - Left Communication (terminal 7)	1	U0232	1	-
Side Object Sensor - Left Communication (terminal 2)	1	U0233	1	Ã,Â
Side Object Sensor - Right Ground (terminal 8)	-	U0233	1	-
Side Object Sensor - Right Ground (terminal 3)	-	U0233	1	Ã,Â
Side Object Sensor - Right B+	1	U0233	-	-
Side Object Sensor - Right Communication	1	U0233	1	-
1. Rear Cross Traffic Alert Malfunction				

Circuit/System Description

The side object sensor modules are located on each side of the vehicle behind the rear fascia and are not directly visible from outside the vehicle. The same sensors are also used for side blind zone alert. The sensors use radar to determine the presence of objects near the back of the vehicle. When an object is detected in the rear cross traffic zone, the module will send out a signal through serial data communication to turn on the visual icons and also audio chime or haptic notification. Each sensor is supplied B+ and ground. The right sensor receives an additional ground. Both sensors communicate independently on the serial data line. The serial data enters the left sensor in a pass-thru configuration, that connects to the right sensor. The scan tool is able to individually communicate with each sensor.

Diagnostic Aids

- The rear cross traffic alert system uses the same sensors as side blind zone alert so a malfunction may affect either or both systems.
- The conditions for disabling the rear cross traffic alert system are captured by DTCs. The drivers information center will display Service Side Detection System if one of the sensors has failed. A B101E 47 Electronic Control Unit Software VIN Not Programmed DTC in history will not affect sensor operation and the module should not be replaced for this DTC.
- The rear cross traffic system can be disabled if any off the following occur:
 - The driver has selected the Off mode through vehicle personalization menus. The selected mode is retained over ignition cycles. A driver information center message stating that the Rear Cross Traffic System Alert Off shall be displayed.
 - There is a loss of serial data communication with a sensor or between modules.
- The side blind zone may be temporarily unavailable due to the following:
 - A blockage condition exists (i.e. mud/snow buildup in front of the sensor). A driver information message "Side Detection System Unavailable" will be displayed. The side blind zone system transitions back to the normal operating state when the blockage is removed. Bumper sticks, fascia damage, labels, and heavy rain storms may also cause this condition. The blockage determination is performed with the vehicle in a drive gear.
 - The rear cross traffic alert system will read the GPS latitude and longitude on the serial data bus and calculate if the vehicle is within a Radio Astronomy zone. These zones are located

in Europe and Japan and require the sensors to be turned off. The "Side Detection System Unavailable" message will be displayed to the driver when this occurs.

- Because the sensors are identical, they may be swapped from one side of the vehicle to the other in an attempt to isolate a concern. Sensors should NOT be swapped from one vehicle to another.
- The rear cross traffic alert system is designed to ignore stationary objects; however, the system may occasionally detect pedestrians, shopping carts, or other objects. This is normal system operation and does not require service.
- The rear cross traffic alert system may indicate an object if a trailer is attached to the vehicle, or a bicycle or object is extending out to either side of the vehicle. This is normal operation and does not require service.

Reference Information

Schematic Reference

Driver Assistance Systems Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Cross Traffic Alert Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify that no DTCs are set.
 - If any DTC is set

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- Go to next step: If no DTC is set
3. Verify the scan tool can communicate with the left side object sensor.
 - **If the scan tool can not communicate with the left side object sensor**

Refer to Circuit/System Testing - Left Side Object Sensor Malfunction.

- **Go to next step: If the scan tool can communicate with the left side object sensor**
4. Verify the scan tool can communicate with the right side object sensor.
 - **If the scan tool can not communicate with the right side object sensor**

Refer to Circuit/System Testing - Right Side Object Sensor Malfunction.

- **Go to next step: If the scan tool can communicate with the right side object sensor**
5. Verify that the rear cross traffic indicators turn ON and then turn OFF when commanding the Rear Cross Traffic Visual Alert Indicators ON and OFF with a scan tool.
 - **If alert indicators do not turn ON and OFF**

1. Verify the system is enabled.
 - If disabled, refer to diagnostic aids for cause of disable.
 - If enabled test or replace the display.
 - **Go to next step: If indicators turn ON and OFF**
6. Verify that the audible alert turns ON and then turn OFF when commanding the Rear Cross Traffic Audible Alert ON and OFF with a scan tool.
 - **If the audible alert does not turn ON and OFF**
 1. Verify the system is enabled.
 - If disabled, refer to diagnostic aids for cause of disable.
 - If enabled refer to audio system malfunction.
 - **Go to next step: If audible alert turns ON and OFF**
7. All OK.

Circuit/System Testing

Left Side Object Sensor Malfunction

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 B218L Side Object Sensor Module - Left.
2. Test for less than 10 Ω between ground circuit terminal 7 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
3. Verify a test lamp illuminates between the B+ circuit terminal 8 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition Off.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the B218L Side Object Sensor Module - Left.
 - **Go to next step: If the test lamp illuminates**
4. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.
5. Test for less than 2 Ω in each of the serial data circuits end to end between the control module harness connector terminal 2 and the DLC terminal 1.
 - **If 2 Ω or greater**

Repair the open/high resistance in the circuit.
 - **Go to next step: If less than 2 Ω**
6. Replace B218L Side Object Sensor Module - Left.

Right Side Object Sensor Malfunction

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 B218R Side Object Sensor Module - Right.

2. Test for less than 10 Ω between the following ground circuit terminals and ground.
 - Terminal 3
 - Terminal 8
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
3. Verify a test lamp illuminates between the B+ circuit terminal 5 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the B218R Side Object Sensor Module - Right.
 - **Go to next step: If the test lamp illuminates**
4. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.
5. Test for less than 2 Ω in each of the serial data circuits end to end between the control module harness connector terminal 7 and the DLC terminal 1.
 - **If 2 Ω or greater**

Repair the open/high resistance in the circuit.
 - **Go to next step: If less than 2 Ω**
6. Replace B218R Side Object Sensor Module - Right.

Repair Instructions

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

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

SIDE BLIND ZONE ALERT SYSTEM MALFUNCTION

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control - Terminal 4 @ B218L Side Object Sensor Module - Left	B094D 02	B094D 04	B094D 01	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control - Terminal 4 @ B218R Side Object Sensor Module - Right	B094E 02	B094E 04	B094E 01	-
Ground - @ A9A Outside Rearview Mirror - Driver	-	B094D 04	-	-
Ground - @ A9B Outside Rearview Mirror - Passenger	-	B094E 04	-	-

Circuit/System Description

Component	Description
B218L Side Object Sensor Module - Left	The assembly has several functions: Side Blind Zone Alert Rear Cross Traffic Audible Alert Rear Cross Traffic Visual Alert
B218R Side Object Sensor Module - Right	The assembly has several functions: Side Blind Zone Alert Rear Cross Traffic Audible Alert Rear Cross Traffic Visual Alert

Diagnostic Aids

- Review the system description and operation in order to familiarize yourself with the system functions. For an overview of the component/system, refer to: [Side Blind Zone Alert Description and Operation](#)
- The side blind zone system can be disabled if any of the following occur:
 - Disabled by Driver Personalization
 - There is a loss of serial data communication with a sensor or between modules.
- The side blind zone may be temporarily unavailable due to the following:
 - A blockage condition exists (i.e. mud/snow buildup in front of the sensor). A driver information message "Side Detection System Unavailable" will be displayed. The side blind zone system transitions back to the normal operating state when the blockage is removed. Bumper sticks, fascia damage, labels, and heavy rain storms may also cause this condition. The blockage determination is performed with the vehicle in a drive gear.
 - The side blind zone alert system will read the GPS latitude and longitude on the serial data bus and calculate if the vehicle is within a Radio Astronomy zone. These zones are located in Europe and Japan and require the sensors to be turned off. The "Side Detection System Unavailable" message will be displayed to the driver when this occurs.
- Because the sensors are identical, they may be swapped from one side of the vehicle to the other in an attempt to isolate a concern. Sensors should NOT be swapped from one vehicle to another.
- The side blind zone system is designed to ignore stationary objects; however, the system may occasionally detect guard rails, signs, trees, shrubs, or other stationary objects as an object in the blind zone. This is normal system operation and does not require service.
- The side blind zone system may indicate an object in the blind zone if a trailer is attached to the vehicle, or a bicycle or object is extending out to either side of the vehicle. This is normal operation and does not require service.
- Lane Change Alert (LCA) can be disabled in vehicle personalized settings, this will also disable the Side Blind Zone Alert (SBZA) system. When disabled, the bulb check of the mirror indicators will also be disabled. A driver information center message will be displayed at start up when the LCA system is disabled. This feature must be enabled prior to trying to diagnose the system.

Reference Information

Schematic Reference

[Driver Assistance Systems Wiring Schematics](#)

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Side Blind Zone Alert Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition/Vehicle - Off
2. Ignition - On/Vehicle - In Service Mode
3. Verify the component turns On and Off:
 - Side Blind Zone Alert Indicator @ A9A Outside Rearview Mirror - Driver
 - Side Blind Zone Alert Indicator @ A9B Outside Rearview Mirror - Passenger
 - **If the component does not turn On and Off**

Refer to: **DTC B094D or B094E**

- **Go to next step: If the component turns On and Off**
4. Verify that no DTCs are set.
 - **If any DTC is set**

Refer to: **Diagnostic Trouble Code (DTC) List - Vehicle** Diagnostic Trouble Code DTC List - Vehicle
 - **Go to next step: If no DTC is set**
 5. Verify the following control modules contain the latest software: B218L Side Object Sensor Module - Left
 - **If not the latest software is contained**

Program the control module: B218L Side Object Sensor Module - Left
 - **Go to next step: If the latest software is contained**
 6. All OK.

Repair Instructions

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

- **Outside Rearview Mirror Glass Replacement**
- For control module replacement, programming, and setup refer to: **Control Module References**

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 Signal	B356A 02	1	B356A 05	-
Lane Departure Warning Switch Ground	-	1	-	-
Lane Departure Warning Switch Indicator Ignition	2	2	-	-
Lane Departure Warning Switch Indicator Control	2	B0987 06, B0987 0B	B0987 01, B0987 0B	-
1. Lane departure warning switch malfunction. 2. Lane departure warning switch indicator malfunction.				

Circuit/System Description

The lane departure warning system is enabled and disabled through the lane departure switch. When enabled, the lane departure warning indicator will illuminate.

For vehicles without UGN, the switch and indicator are connected to the frontview camera module. The frontview camera module supplies a reference voltage to the lane departure switch. When the switch is pressed, the signal circuit is grounded. When enabled, the frontview camera module will illuminate the indicator located in the switch when lane departure warning system is enabled.

With UGN, the indicator and switch are connected to the active safety control module. The active safety control module receives input from several modules including the Parking Assist Control Module to provide additional features. The lane departure warning alerts and DTCs are from the frontview camera module with the exception of the indicator DTCs which are sent by the active safety control module. There are no switch DTCs for vehicles with the active safety control module.

When the system is operating and can detect the lane markings, the frontview camera module will request via serial data communications that the instrument cluster illuminate the green lane departure warning symbol. If the frontview camera module detects that the vehicle unintentionally crosses a lane marking without the turn signal being used, the module will request the instrument cluster to flash the amber lane departure warning indicator. An audible warning will also sound three times when the amber lane departure warning indicator in the instrument cluster is flashing.

Diagnostic Aids

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

Additionally, the Frontview Camera Disable History can give useful hints about what affected the operation of the lane departure warning system. For the Frontview Camera Disable History, refer to [Control Module References](#) for scan tool information.

Reference Information

Schematic Reference

[Driver Assistance Systems Wiring Schematics](#)

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Lane Departure Warning Description and Operation

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC B356A is not set.
 - **If the DTC is set**
Refer to [DTC B356A](#).
 - **Go to next step: If the DTC is not set**
3. Verify that DTC B0987 is not set.
 - **If the DTC is set**
Refer to [DTC B0987](#).
 - **Go to next step: 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 Diagnostic Aids.
 - **Go to next step: If the parameter is Normal**
5. Verify the scan tool Lane Departure Warning Switch Status parameter changes between Active and Inactive when pressing the lane departure warning switch.
 - **If the parameter does not change between Active and Inactive**
Refer to [DTC B356A](#).
 - **Go to next step: If the parameter changes between Active and Inactive**
6. Verify the scan tool Lane Departure Warning Indicator turns ON and OFF when commanding the Lane Departure Warning Indicator On and Off with a scan tool.
 - **If the indicator does not turn on and off**
Refer to [DTC B0987](#).
 - **Go to next step: If the indicator turns on and off**
7. All OK.

Repair Instructions

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

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

LANE KEEP ASSIST SYSTEM MALFUNCTION

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control - Terminal 4 @ S70L Steering Wheel Controls Switch - Left	B0987 06, 1	B0987 06, B0987 0B	B0987 01, B0987 0B	-
Control - Terminal 5 X1 @ K9 Body Control Module	1	1	1	-
1. Lane Departure Warning Indicator Malfunction				

Circuit/System Description

Component	Description
S70L Steering Wheel Controls Switch - Left	The assembly contains individual switches. Each function has its own switch. The switches are connected to a resistor ladder so that a specific resistance is generated for each switch.
B174W Frontview Camera - Windshield	The video camera and the control module are a single serviceable component. This camera delivers live video of what is in front of the vehicle. The video can be used for several functions, like lane departure warning, lane keep assist, road sign recognition and more. The control module also reads various switches and sensors and makes their values available via serial data.
K9 Body Control Module	Depending on the version, the control module can support different functions: • Exterior Illumination • Interior Illumination • Steering Wheel Controls • Power Mode Control The control module also reads various switches and sensors and makes their values available via serial data.

Diagnostic Aids

Refer to: Scan Tool Information - Frontview Camera Disable History 1-4

For more information refer to: [Forward Collision Alert Description and Operation](#)

For more information refer to: [Lane Keep Assist Description and Operation](#)

This procedure is required when the following component has been repaired, replaced, removed, or serviced: B174W Frontview Camera - Windshield - Perform the following action: [Front View Camera Module Learn](#)

Reference Information

Schematic Reference

[Driver Assistance Systems Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

[Lane Departure Warning Description and Operation](#)

[Lane Keep Assist Description and Operation](#)

Electrical Information Reference

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

Scan Tool Reference

[Control Module References](#)

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify that no DTCs are set.
 - If any DTC is set

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - Go to next step: If no DTC is set
3. Verify the component turns On and Off: Lane Departure Warning Indicator
 - Lane Departure Warning Switch
 - If the component does not turn On and Off

Refer to: [DTC B0987](#)
 - Go to next step: If the component turns On and Off
4. All OK.

Repair Instructions

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

For control module replacement, programming, and setup refer to: [Control Module References](#)

REPAIR INSTRUCTIONS

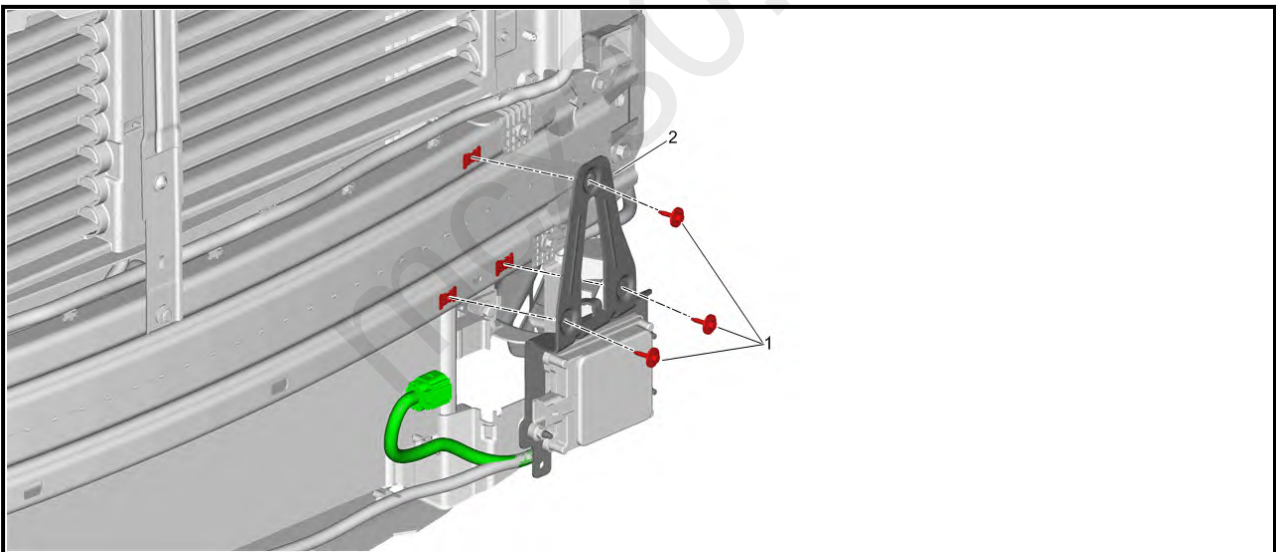
FRONT SEAT LANE DEPARTURE WARNING ACTUATOR REPLACEMENT





Callout	Component Name
Preliminary Procedure Front Seat Cushion Cover and Pad Replacement	
1	Front Seat Lane Departure Warning Actuator Procedure 1. Disconnect the electrical connector. 2. Note the location and routing of the wiring harness to ensure proper reinstallation.

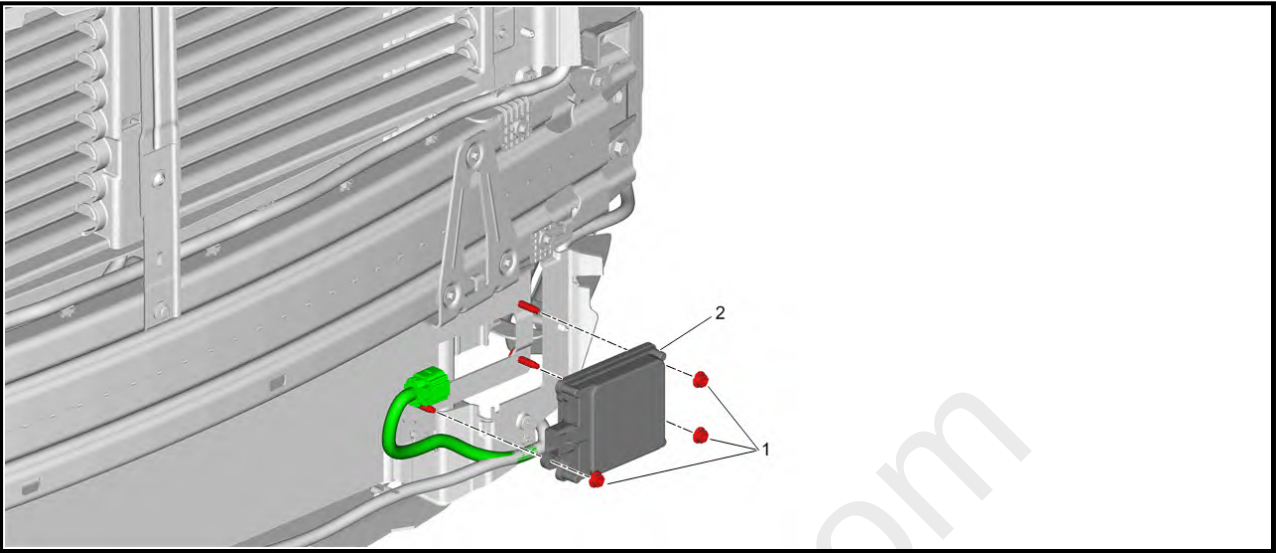
FORWARD RANGE RADAR BRACKET REPLACEMENT



Callout	Component Name
Preliminary Procedure Front Bumper Fascia Replacement	
1	Forward Range Radar Bracket Bolt [3x] CAUTION: Fastener Caution Tighten 2.5 N.m (22 lb in)

Callout	Component Name
2	Forward Range Radar Bracket Procedure 1. Disconnect the electrical connector. 2. Transfer components as necessary.

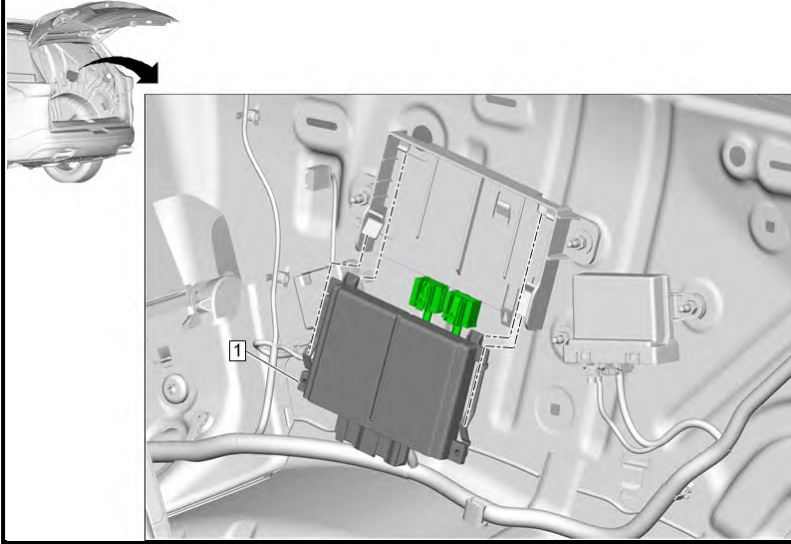
FORWARD RANGE RADAR SENSOR REPLACEMENT



Callout	Component Name
Preliminary Procedure <u>Front Bumper Fascia Replacement</u>	
1	Forward Range Radar Sensor Nut [3x] CAUTION: <u>Fastener Caution</u> Tighten 9 N.m (80 lb in)
2	Forward Range Radar Sensor Procedure 1. Disconnect the electrical connector. 2. Perform the necessary programming and setup procedure: <u>Control Module References</u>

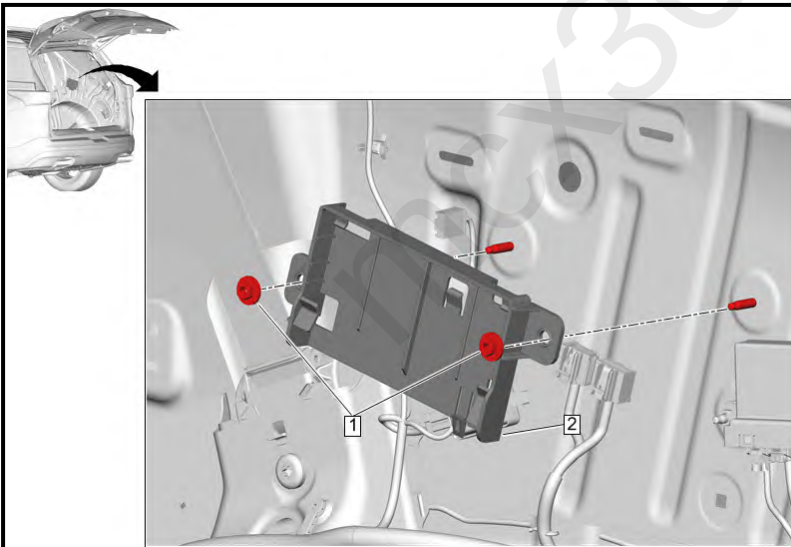
ACTIVE SAFETY CONTROL MODULE REPLACEMENT





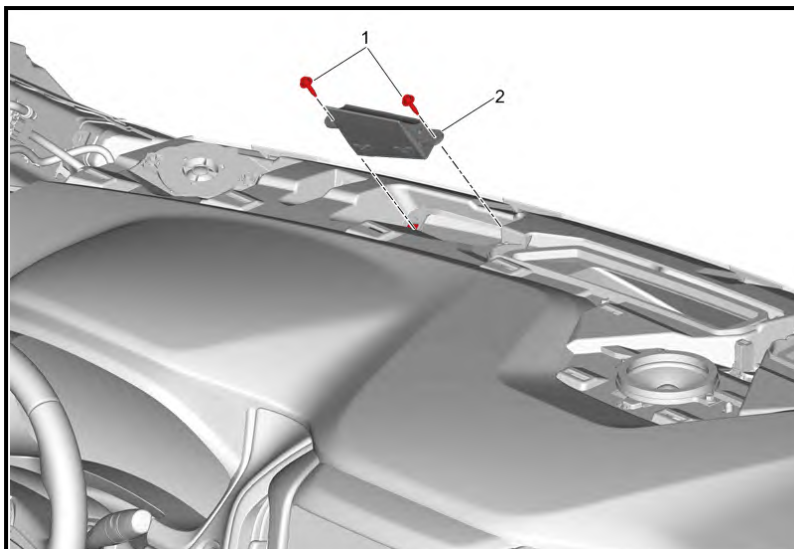
Callout	Component Name
Preliminary Procedure <u>Quarter Lower Rear Trim Panel Replacement (Right Side)</u>	
1	Active Safety Control Module Procedure 1. Disconnect the electrical connectors. 2. Release the retaining tabs. 3. Perform the necessary programming and setup procedure: Control Module References

ACTIVE SAFETY CONTROL MODULE BRACKET REPLACEMENT



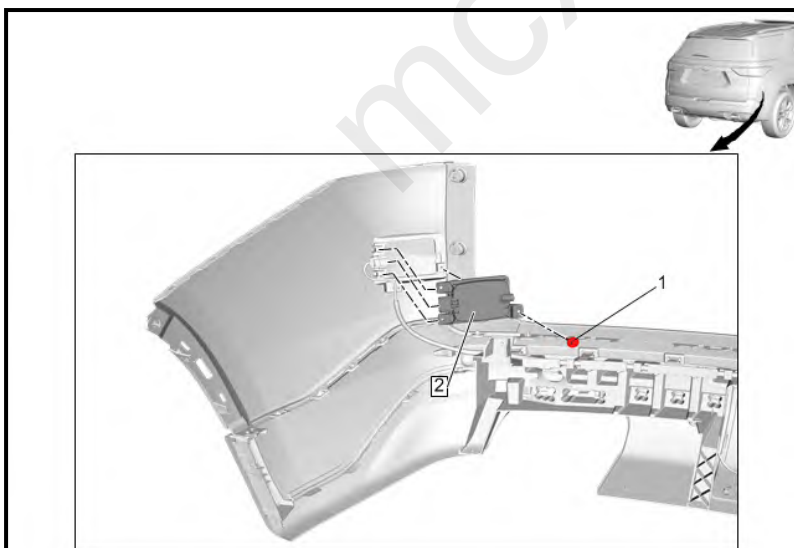
Callout	Component Name
Preliminary Procedure <u>Active Safety Control Module Replacement</u>	
1	Active Safety Control Module Bracket Nut [2x] CAUTION: Fastener Caution Tighten 9 N.m (80 lb in)
2	Active Safety Control Module Bracket

FORWARD COLLISION ALERT DISPLAY REPLACEMENT



Callout	Component Name
Preliminary Procedure <u>Instrument Panel Extension Replacement</u>	
1	Forward Collision Alert Display Bolt [2x] CAUTION: <u>Fastener Caution</u> Tighten 2.5 N.m (22 lb in)
2	Forward Collision Alert Display Procedure Disconnect the electrical connector.

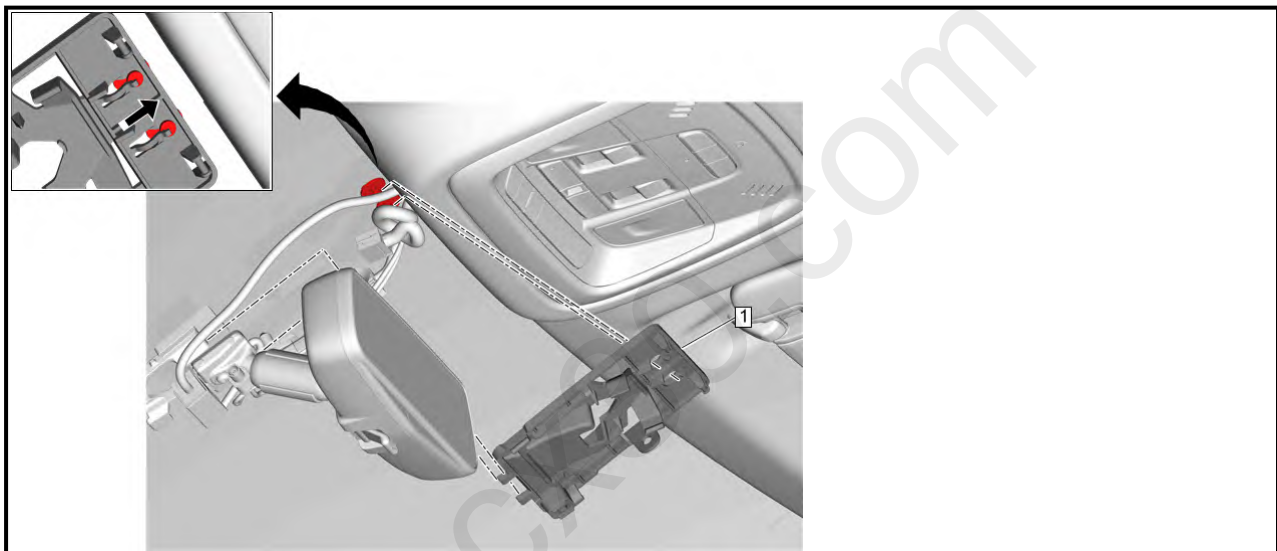
SIDE OBJECT SENSING ALERT MODULE REPLACEMENT



Callout	Component Name
Preliminary Procedure <u>Rear Bumper Fascia Replacement</u>	

Callout	Component Name
1	Side Object Sensing Alert Module Bolt CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)
2	Side Object Sensing Alert Module Procedure 1. Disconnect the electrical connector. 2. Slide the module out of the retaining bracket. 3. Perform the necessary programming and setup procedure: Control Module References

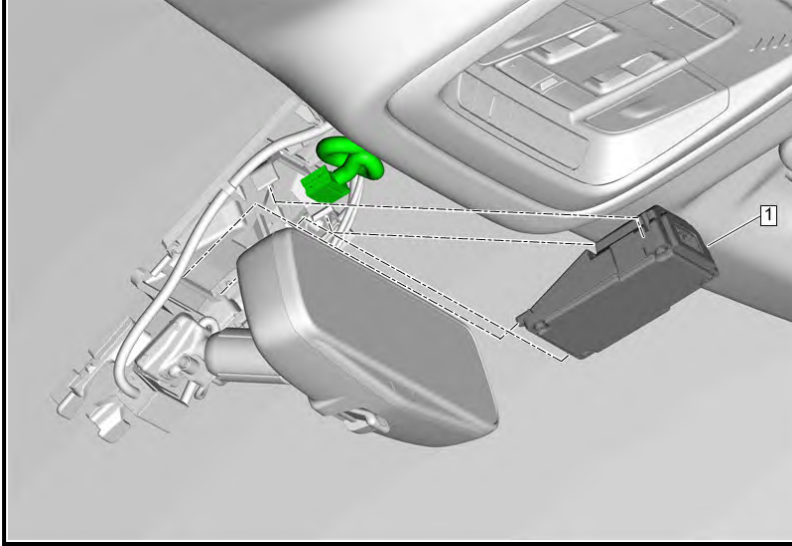
FRONT VIEW DRIVER INFORMATION CAMERA BRACKET REPLACEMENT



Callout	Component Name
Preliminary Procedure Front View Camera Replacement	
1	Front View Driver Information Camera Bracket Procedure 1. Reposition the wiring harness. 2. Release the retaining tabs and slide the bracket upward to disengage pins, gently pull from windshield. 3. Ensure the inside of the windshield is clean before reinstalling the bracket. NOTE: Do Not remove or service the sensor farm pins.

FRONT VIEW CAMERA REPLACEMENT





Callout	Component Name
Preliminary Procedure <u>Windshield Multifunction Sensor Mount Bracket Cover Replacement (With UHX).</u> <u>Windshield Multifunction Sensor Mount Bracket Cover Replacement (Without UHX).</u>	
1	Front View Camera Procedure 1. Release the retaining tabs. 2. Disconnect the electrical connector. 3. Perform the necessary programming and setup procedure: Control Module References

FRONT VIEW CAMERA MODULE LEARN

Calibration (without UGN OR UGN non-Escalade)

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

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

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

- 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.).

Calibration Procedure

1. Apply the parking brake.
2. Place the transmission in Park (if applicable)
3. Install scan tool
4. Navigate to the module diagnostics menu
5. Select Frontview Camera Module

6. Select Configuration/Reset Functions menu Item

7. Select the Frontview Camera Learn procedure and follow the directions displayed on the screen.

8. Drive the vehicle to complete calibration.

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

Calibration (UGN and Escalade)

New modules must be SPS programmed prior to calibration, refer to [Control Module References](#)

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

NOTE: Calibration is not required if the existing module was reprogrammed. This procedure only needs to be conducted if the module was replaced.

Once SPS programming is complete, it is necessary to initiate the calibration using a scantool. During this time the "Service Driver Assist" service message will be displayed.

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.).

Calibration Procedure

NOTE: It is necessary to have the scan tool connected during the entire process. Do not back out of the screen or press any other buttons.

1. Apply the parking brake.
2. Place the transmission in Park (if applicable)
3. Install scan tool
4. Navigate to the module diagnostics menu
5. Select Frontview Camera Module
6. Select Configuration/Reset Functions menu Item
7. Select the Frontview Camera Learn procedure and follow the directions displayed on the screen.
8. Do not disconnect the scan tool, drive the vehicle to complete calibration.

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

If Slow to Calibrate

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

- 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](#).

RADAR SENSOR MODULE - LONG RANGE LEARN

NOTE: Adaptive Cruise Temporarily Unavailable service message may be displayed if this calibration procedure has to be performed. The radar may have become misaligned.

After replacing and programming the Long Range Radar Sensor Module, it is necessary to perform a calibration procedure to align the radar. This is indicated to the technician by DTC B101E 4B. Calibration is performed while driving the vehicle with the scantool connected. Calibration is initialized using a scantool and the scantool must remain connected until calibration is complete. During this time the "Service Driver Assist" service message will be displayed. Once the procedure is complete, the service message will turn off and normal operation will resume.

Calibration is not required if the existing module was reprogrammed only. Calibration needs to be conducted if the module was replaced or removed and re-secured.

If calibration is not successful, it could be due to improper driving environment, module and bracket assembly bent out of position or incorrect module mounting. A typical driving environment is usually sufficient to calibrate the module within 10 - 30 minutes. Visually inspect for damaged, bent, or broken Long Range Radar bracket. Brackets out of level more than 2 degrees will not calibrate or self-learn. Discuss with the customer about vehicle history and possible past accident. Replace bracket if damaged.

Calibration Procedure

1. Verify no other DTCs except for B101E 4B Electronic Control Unit Software are present.

- **If other DTCs are present**

Refer to service information and repair as necessary.

- **Go to next step: If no other DTCs are present**

2. Prior to driving the vehicle make sure the surface in front of the radar (Cadillac emblem) is clean. Also verify the mounting area is not damaged and allows the module to face the intended direction.
3. Prepare scantool to be mobile for Long Range Radar Calibration driving phase. The scantool needs to stay connected during the driving phase of the calibration.
4. Engine running.
5. Initiate calibration using Long Range Radar Sensor Module Learn in the scantool. The driver information display will display "Service Driver Assist" message during calibration.

NOTE:

Do not back out of screen or press any other buttons until the calibration is complete.

6. Drive the vehicle within the following conditions for 10 - 30 minutes or until calibration is complete. The "Service Driver Assist" message will turn off when calibration is complete.
 - Drive at speeds greater than 56 kph (35 mph)
 - Minimize tight curves
 - Avoid extreme acceleration or deceleration
 - Follow one or multiple vehicles. (typical vehicle traffic is sufficient, but vehicles 30 m - 50 m (100 - 165 ft) away are most effective at decreasing the calibration time)
 - Drive in an environment that has stationary objects on the side of the road (street signs, guard rails, mail boxes, fences, etc)
7. Verify proper calibration by observing that the "Service Driver Assist" message turns off within 10 - 30 minutes of normal driving.
 - **If "Service Driver Assist" message fails to turn off**
 1. Verify correct operating conditions were met
 - If incorrect driving environment, refer to If Slow to Calibrate and repeat calibration procedure following recommended operating conditions.
 - Go to next step: If correct driving environment
 2. Verify DTC B390C 66 Incorrect Mounting is not set
 - If B390C 66 is set

Refer to [DTC B390C](#).
 - Go to next step: If B390C 66 is not set
 - **Go to next step: If "Service Driver Assist" message turns off**
8. Drive at speeds greater than 40 kph (25 mph) and verify engagement of Adaptive Cruise Control (cruise control icon will change from white to green)
 - **If Adaptive Cruise Control will not engage**

Check vehicle for DTCs and correct as required.
 - **Go to next step: If Adaptive Cruise Control engages**
9. All OK.

If Slow to Calibrate

The ideal calibration condition is driving on a freeway or two lane road with medium traffic. One or more of the following conditions may increase the length of time required to complete the self-calibration procedure:

- Visually inspect for damaged, bent, or broken Long Range Radar bracket. Brackets out of level more than 2 degrees will not calibrate or self-learn. Discuss with the customer about vehicle history and possible past accident. Replace bracket if damaged.
- Heavy traffic - following too close behind vehicles for long periods (more than 40 min)
- Stop and go or very slow traffic
- Mountain roads
- Constant sharp curves in roadway
- No traffic - if no traffic is available, may need to add vehicle ahead to support calibration
- Limited or no stationary structures on side of the road - need structures such as street signs, guard rails, mail boxes, parked cars, etc.
- Driving in tunnels

DESCRIPTION AND OPERATION

ACTIVE SAFETY SYSTEM DESCRIPTION AND OPERATION

The active safety system is a comprehensive feature set designed to help a driver avoid collisions or reduce crash damage while driving, backing, and parking. The K124 Active Safety Control Module is the primary controller for the active safety system. The active safety control module communicates on multiple serial data busses to share information with various control modules throughout the vehicle. The active safety control module uses various sensors and control modules to monitor the vehicle surroundings and take deliberate action to avoid collisions or reduce crash damage. The active safety system tightly integrates the forward collision alert, adaptive cruise control, parking assist, and active emergency braking systems into a single cohesive system.

The active safety control module communicates via serial data on the object detection bus with the B174W Frontview Camera - Windshield or K109 Frontview Camera Module, B233B Radar Sensor Module - Long Range, radar sensor module - short range left front, and radar sensor module - short range right front to create a virtual fusion image of the area in front of the vehicle. The active safety control module observes an actual visual image of the area directly ahead of the vehicle, within 60 m (197 ft), with the frontview camera. The radar sensor module - long range is used to measure the distance to objects that are up to 200 m (656 ft) in front the vehicle and the two radar sensor modules - short range are used to measure the distance to objects that are within 30 m (98 ft) of the front of the vehicle. Within 60 m (197 ft) of the vehicle, all of these inputs are combined to create a fusion image of the area in front of the vehicle. At up to 200 m (656 ft), the radar sensor module - long range will detect and begin tracking objects immediately in front of the vehicle. Within 60 m (197 ft), the frontview camera will confirm objects that have been detected by the radar sensor module - long range. The two radar sensor modules - short range improve cut-in detection, which are objects that enter the vehicle path from the side and are not necessarily detected by the frontview camera and radar sensor module - long range, who's focus are those object directly in front of the vehicle.

The fusion image created by the active safety control module is used to detect collision risks and take action based on the immediacy of the risk. The a collision risk exists, the active safety control module will alert the driver using the forward collision alert system. This will provide the driver with a visual and audible or haptic alert that a collision risk has been detected. If the driver does not take action to reduce the risk of collision, such as changing lanes or applying the brakes, the intelligent brake assist system will pre-fill the brake hydraulic system to reduce system response time and increase pressure when quickly applying the brakes. If a collision risk is imminent, the active safety control module will enter automatic collision preparation, which will automatically apply the brakes in an effort to mitigate the collision or reduce collision damage.

The active safety control module communicates with the steering wheel angle sensor and the multi-axis acceleration sensor via serial data on the chassis expansion bus. These sensors are used to determine the intended vehicle path. Using the steering data and vehicle acceleration data, the active safety control module will determine where the vehicle will be traveling and focus attention on objects in this path. An example would be a driver quickly changing lanes to avoid a collision. This would mitigate the collision risk in the previous lane and the active safety control module would quickly transition to tracking objects for any collision risk in the new lane based on intended vehicle path. The active safety control module also communicates with the electronic brake control module to instigate the braking functions of intelligent brake assist and automatic collision preparation.

At the rear of the vehicle, the active safety control module uses the radar sensor module - short range left rear, radar sensor module - short range right rear, and the parking assist control module as part of the backing warning system and the rear automatic braking system. Typical rear parking assist utilizes the parking assist control module and the four ultrasonic rear parking assist sensors to detect object when reversing at speed of up to 8 km/h (5 mph). The backing warning systems utilizes both the four ultrasonic rear parking assist sensors, as well as the radar sensor module - short range left rear and radar sensor module - short range right to detect object at speeds above 8 km/h (5 mph). The rear automatic braking system is intended to help avoid or reduce the harm caused by backing crashes or prevent the vehicle from being from being reversed into an object if the vehicle is already stopped.

The Active Safety System analyzes data from the various control modules and sensors listed below:

- K124 Active Safety Control Module
- B174W Frontview Camera - Windshield or K109 Frontview Camera Module
- B233B Radar Sensor Module - Long Range
- B233LF Radar Sensor Module - Short Range Left Front - If equipped

- B233RF Radar Sensor Module - Short Range Right Front - If equipped
- B233LR Radar Sensor Module - Short Range Left Rear - If equipped
- B233RR Radar Sensor Module - Short Range Right Rear - If equipped
- B233CR Radar Sensor Module - Short Range Rear Middle - If equipped
- K182 Parking Assist Control Module
- K17 Electronic Brake Control Module

Component Description

Active Safety Control Module

The active safety control module analyzes data from various modules, sensors, and switches to provide enhanced safety features. In addition to providing alerts, the active safety control module will provide driver assistance through integrated brake assist, automatic collision preparation, rear emergency braking, and adaptive cruise control. Inputs and outputs can either be connected directly to the active safety control module or communicate through serial data. The active safety control module communicates on a dedicated object detection bus, as well as the chassis expansion bus and low speed GMLAN.

Forward collision alert, lane departure warning, and park assist alerts can be user selected to either a haptic signal utilizing the driver's haptic signal motor seat or using beeps through the audio system. This setting can be found in the vehicle personalization menus. See the owner's manual for more detailed information on vehicle personalization.

If there is a DTC set in any of the modules that the active safety control module uses as inputs, it will send a "Service Driver Assist" to the instrument cluster to alert the driver of a problem with the system. No other specific details are given unless the driver attempts to activate a specific system. For example if the driver attempts to turn on lane departure warning, the instrument cluster will display "Lane Departure Unavailable" and the indicator will flash and then go out. A scan tool must be used to read the DTCs that are causing the malfunction to help find the problem. Some of the inputs to the active safety control module can affect forward facing features, rear facing features, or all features. Systems to check to determine which area to focus are rear park assist for rear features, and lane departure warning and adaptive cruise control for front features. If none of the active safety system features are operative, there may be an issue with another module on the vehicle not providing the proper data to the active safety control module. If all active safety control module features are inoperative, check the Adaptive Cruise Control Inhibit History and Disengage History scan tool data for the reason for the malfunction. Definitions of parameters and suggestions on what to look for can be found in [K124 Active Safety Control Module: Scan Tool Information](#). Any item with a "Yes" was the reason why the adaptive cruise control system was inoperative at that time. In some cases verifying the module is the correct part number, has the latest version of software is necessary, and is calibrated properly.

- Active safety control module inputs:
 - Frontview Camera
 - Radar sensor module - long range
 - Radar sensor module - short range left front
 - Radar sensor module - short range right front
 - Radar sensor module - short range left rear
 - Radar sensor module - short range right rear
 - Parking assist control module
 - Multi-axis acceleration sensor
 - Steering wheel angle sensor
 - Wheel speed sensors
 - Forward collision alert switch
 - Lane departure warning switch
 - Parking assist switch
- Active safety control module outputs:
 - Body control module

- Electronic brake control module
- Engine control module
- Instrument cluster
- Head-up display
- Memory seat module (safety alert seats)
- Lane departure warning switch indicator
- Parking assist switch indicator
- Infotainment system

Frontview Camera

The frontview camera is located behind the windshield, looking out at the road ahead and detects lane markings and objects directly ahead, within a distance of approximately 60 meters (197 ft). The frontview camera is used for lane departure warning and forward collision alert systems. The frontview camera communicates with the active safety control module via serial data on the object detection bus.

Using information from the frontview camera, the active safety control module will provide forward collision alert and lane departure warning to the driver when appropriate. The alerts and warnings can be user-selected to be audible through the audio system or haptic using the active safety seat.

Radar Sensor Module - Long Range

The radar sensor module - long range is located behind the front grille emblem and is used in the 30 - 200 m (98 - 656 ft) range. The radar sensor module - long range communicates with the active safety control module via serial data on the object detection bus. In addition to the wiring harness ground, the module is grounded through the mounting bracket.

Radar Sensor Module - Short Range Front

There are two radar sensor module - short range front located behind the front fascia that detect objects up to approximately 30 meters (98 ft). The radar sensor modules - short range front communicate with the active safety control module via serial data on the object detection bus.

Radar Sensor Module - Short Range Rear

There are two radar sensor modules - short range rear located behind the rear fascia that detect objects up to approximately 30 meters (98 ft). The radar sensor modules - short range rear communicate with the active safety control module via serial data on the object detection bus.

Parking Assist Control Module

The parking assist control module uses ultrasonic object sensors located in the fascias to provide distance measurements to nearby objects. The park assist module sends rear object data to the active safety control module via serial data.

Electronic Brake Control Module

The electronic brake control module performs the braking activities of the active safety system. When requested by the active safety control module, the electronic brake control module will prepare or apply the brakes as necessary in response to an imminent collision.

Active Safety System Operation

Forward Collision Alert

The forward collision alert system is a convenience feature of the active safety control module, frontview camera, radar sensor module - long range, radar sensor module - short range left front, and radar sensor module - short range right front that issues a warning to the driver when a potential collision risk exists. When the system detects a vehicle in the path ahead, the green vehicle ahead indicator is illuminated on the instrument cluster. If the vehicle ahead is being followed too closely, the vehicle ahead indicator will be amber. When approaching another vehicle too rapidly, the collision alert symbol will flash in the head-up display. An audible alert sound will simultaneously sound or the safety

alert seat will provide haptic feedback. The visual alert cannot be changed, but the driver can select between audible or haptic alerts in the vehicle personalization menus. Refer to the vehicle owner's manual for more detailed information on vehicle personalization.

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

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

Intelligent Brake Assist

Intelligent brake assist is designed to pre-fill the brake hydraulic system to reduce system response time and increase pressure when quickly applying the brakes. Using the active safety control module, frontview camera, radar sensor module - long range, radar sensor module - short range left front, and radar sensor module - short range right front, the system monitors the approach speed and distance to a vehicle ahead. If the Intelligent brake assist system determines a collision risk exists, it will begin preparations to the brake hydraulic system. When active, minor brake pedal pulsations or pedal movement may occur and this should be considered normal. Intelligent brake assist will resort to normal braking operation after an intelligent brake assist even has occurred when the brake pedal is released.

Automatic Collision Preparation

Automatic collision preparation system uses the active safety control module, frontview camera, radar sensor module - long range, radar sensor module - short range left front, and radar sensor module - short range right front to determine if an imminent collision risk exists. If the brakes have not been applied, the system will automatically apply the brakes in an effort to mitigate the collision or reduce collision damage. The system has a detection range of approximately 60 m (197 ft) and will only function when a vehicle is detected, as indicated by the green vehicle ahead indicator is illuminated on the instrument cluster.

Automatic collision preparation is not a substitute for normal vehicle braking and should not be relied on to brake the vehicle. Automatic collision preparation may not detect a vehicle ahead if the frontview camera is blocked by dirt, snow, or ice, or if the windshield is damaged. It may also not detect a vehicle on winding or hilly roads, or in conditions that can limit visibility such as fog, rain, or snow, or if the headlamps or windshield are not cleaned or in proper condition. Keep the windshield, headlamps, and frontview camera area clean and in good repair.

Backing Warning System

The backing warning system utilized the active safety control module, radar sensor module - short range left rear, radar sensor module - short range right rear, and the parking assist control module to warn of rear objects when backing up at speeds greater than 8 km/h (5 mph). Utilizing the ultrasonic rear object sensors, the parking assist control module can only detect object at seeps up to 8 km/h (5 mph). By utilizing the active safety control module and radar sensor modules - short range along with the parking assist control module and the rear object sensors, object can be detected at speeds greater than 8 km/h (5 mph).

While reversing at speeds greater than 8 km/h (5 mph), the backing warning system will alert the driver with an audible alert or through haptic feedback from the safety alert seat when an object is first detected. If the system detects a potential collision risk, a series of audible beeps or haptic feedback pulses will be provided, as well as a quick pulse of the brakes.

Rear Automatic Braking

The rear automatic braking system is designed to help avoid or reduce the harm caused by backing crashes. If the system detects the vehicle is backing too fast to avoid a collision, it may automatically brake hard to a stop.

Utilizing the active safety control module, radar sensor module - short range left rear, radar sensor module - short range right rear, and the parking assist control module, rear automatic braking attempts to avoid imminent collision by automatically braking the vehicle when traveling in reverse. In conjunction with the backing warning system, if the driver does not respond to the audible and haptic alerts while reversing, the system will automatically brake the vehicle to a stop.

Rear automatic braking also prevents the vehicle from backing into an object if the vehicle is stopped and shifted to R. If the system detects an object immediately behind the vehicle while attempting to reverse from a stop, the brakes will be applied.

Pressing the brake pedal after the vehicle comes to a stop will release the rear automatic braking. It may be necessary to release the electronic parking brake. When it is safe to do so, pressing the accelerator pedal firmly at any time will override the rear automatic braking. If rear automatic braking is active and there is no object behind the vehicle, make sure there is no snow, ice, or debris on the rear object sensors.

Lane Departure Warning/Lane Keep Assist

The lane departure warning system is a convenience feature that utilizes the frontview camera and active safety control module to determine if the vehicle has unintentionally crossed a lane marking and issue a warning. The frontview 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, visual and audible or haptic alerts are given to the driver. The visual alert cannot be changed, but the driver can select between audible or haptic alerts in the vehicle personalization menus.

Refer to [Lane Departure Warning Description and Operation](#) for more information about the Lane Departure Warning function.

ADAPTIVE CRUISE CONTROL DESCRIPTION AND OPERATION

The adaptive cruise control system is an enhanced cruise control system with the ability to sense and react to forward traffic. Compared to the common cruise control system found on many vehicles, the main functional enhancement of the adaptive cruise control system is the ability to detect the presence of a vehicle in the path of the adaptive cruise control vehicle. Adaptive cruise control retains the existing cruise control feature that controls the vehicle speed to the driver selected speed. However, adaptive cruise control allows a driver to set and maintain a following distance to the preceding nearest vehicle in the path ahead. The active safety control module controller calculates a follow speed limit to ensure an acceptable distance is maintained to the preceding vehicle in front, should one be present. The adaptive cruise control system automatically adjusts the speed when the vehicle comes up behind a slower travelling vehicle in front. The system applies limited automatic braking and throttle control without driver input when necessary to maintain the set following distance. The preceding vehicle's speed and acceleration along with the active cruise control vehicle speed and acceleration and the distance between the two vehicles are factors used by the active safety control module controller to determine the follow speed limit. The vehicle speeds up to the original driver selected set speed when the pathway becomes clear without driver input.

The adaptive cruise control functionality depends on various modules on the vehicle to function and each module performs a function that is critical to the proper operation of the adaptive cruise control system. Adaptive cruise control will not operate if any components fail. Communication between modules is via serial data. The following is a functional description of the active safety control module and the other associated components:

- Active Safety Control Module
- Body Control Module
- Digital Map Module
- Engine Control Module
- Electronic Brake Control Module
- Transmission Control Module
- Instrument Cluster
- Cruise Control Switch
- Gap Switch

Active Safety Control Module

The active safety control module analyzes data from various modules, sensors, and switches to provide enhanced safety features. In addition to enhanced safety features, the active safety control module provides the adaptive cruise control system functionality. The active safety control module analyzes data from the long range radar sensor module, front short range radar sensor modules, and frontview camera module to identify and classify objects in the road environment. The system scans the road environment to detect targets within its specified field of view. The active safety control module then sends throttle and/or brake commands to the engine control module (ECM) and electronic brake control module (EBCM) via serial data in order to control the vehicle acceleration/deceleration based on the data from the modules. The ECM and EBCM provide throttle control and automatic braking needed for proper cruise speed adjustment. The following is a list of the active safety control module functions pertaining to the adaptive cruise control functionality:

- The active safety control module processes the road environment to get data concerning any vehicle ahead of the adaptive cruise control vehicle. Detection, parameter estimation, tracking, object classification and diagnostics are the primary functions. When an object is detected, the controller calculates the object range, range rate, acceleration and azimuth angle parameters.
- The active safety control module performs adaptive cruise control state processing automatically - distance control or speed control. The adaptive cruise control operates in 2 possible states - cruise or follow. The normal operating state is cruise, whereby the vehicle speed is controlled to match the driver selected set speed. When a preceding forward target is identified, the adaptive cruise control system will automatically transition into the follow speed state to provide proper lane spacing behind the target vehicle in front. The preceding vehicle's speed and acceleration, with the adaptive cruise control vehicle speed, acceleration and distance between the two vehicles will be used to determine the adaptive cruise control follow speed limit. The adaptive cruise control follow speed limit will ensure that an acceptable distance is maintained to the preceding vehicle.
- The active safety control module determines the follow speed limit for throttle control by the ECM.
- The active safety control module arbitrates the adaptive cruise control system brake and throttle control between the EBCM and the ECM.
- The active safety control module requests brake light activation during automatic braking.
- The active safety control module provides operational feedback to the vehicle driver. The active safety control module sends signals for telltales and messages to be displayed on the instrument cluster or driver information center.

Body Control Module

The following are the adaptive cruise control System functions provided by the body control module (BCM):

- The BCM provides a translating gateway for the high speed GMLAN serial data circuit.
- The BCM reads all cruise control switches and the gap switch. The active safety control module monitors a variety of user operated switches from the BCM switch status information sent via the GMLAN serial data circuit.
- The BCM illuminates the brake light based on a GMLAN message from the active safety control module during automatic braking.
- The BCM measures the brake pedal position and sends brake pedal travel status via GMLAN serial data circuit to the ECM. The ECM disengages the adaptive cruise control system when the brake is applied by the driver pressing the brake pedal.
- The BCM serves as a gateway to the instrument cluster and driver information center. The BCM will generate visual warnings based on high speed GMLAN serial data messages from the active safety control module.

Digital Map Module

The following are the adaptive cruise control System functions provided by the Digital Map Module:

- The Digital Map Module (DMM) is capable of determining vehicle position and localization and then communicating navigational and predictive data

- The Digital Map Module provides information to the Cruise system that the vehicle is on an acceptable freeway or highway for engaging the feature
- The Digital Map Module provides road information to the Cruise system about road characteristics, like exits and merge areas that will alert the system to changing road conditions

Engine Control Module

The following are the adaptive cruise control system functions performed by the engine control module (ECM):

- The ECM provides the electronic throttle control to the adaptive cruise control System. The ECM is also responsible for determining when a driver is overriding the adaptive cruise control throttle position by pressing the accelerator pedal.
- The ECM processes the cruise control switch requests received via the GMLAN serial data circuit from the BCM. Engaging and disengaging the adaptive cruise control system are functions performed by the ECM.
- The ECM determines the driver selected vehicle speed. Unless the adaptive cruise control module requests a lower vehicle speed, the ECM will control the vehicle speed to the driver selected set speed.
- The ECM allows automatic braking without disengaging the adaptive cruise control.

Electronic Brake Control Module

The following are the adaptive cruise control System functions performed by the electronic brake control module (EBCM):

- The EBCM controls the operation of the Antilock Brake System.
- The EBCM provides automatic braking for the adaptive cruise control system. The active safety control module will request vehicle deceleration via high speed GMLAN serial data circuit.
- The EBCM determines when the driver - applied brake pressure is active. The EBCM will communicate this status via the GMLAN serial data circuit to the BCM.
- The EBCM releases vehicle automatic braking when there is a throttle override by the driver pressing the accelerator.
- The EBCM predicts brake temperatures. Due to automatic braking, the brake system may overheat. When the brakes are overheated, the EBCM requests the adaptive cruise control System to be temporarily shut down by the ECM until the brakes cool to a normal operating temperature.

Transmission Control Module

The transmission control module (TCM) provides a down shift to protect the brakes. When the TCM detects some driver braking activity or adaptive cruise control automatic braking activity, the TCM down shifts the vehicle transmission to increase engine braking. This helps reduce braking activity, extend brake pad life and reduce brake system overheating.

Instrument Cluster

The driver information center is a part of the instrument cluster and displays the adaptive cruise control system warning messages. The active safety control module requests messages to be displayed on the driver information center by sending a GMLAN request to the BCM. The BCM sends a GMLAN serial data request to the instrument cluster demanding the display of the warning message. When the message is acknowledged by the driver and the cause of the message resolved, the driver information center turns the message off. The adaptive cruise control system will not operate if the driver information center fails.

Cruise Control Switch

The cruise control switch, functionally is a common feature that is shared between the adaptive cruise control system and the regular cruise control system. The adaptive cruise control system will not operate if any cruise switch fails. The cruise control switch comprises the following cruise control function switches:

- On/Off switch
- Set/decrease switch
- Resume/increase switch

The cruise control function switches are arranged in a resistive ladder design whereby each switch function is set up with different resistance values. The BCM through the cruise control switch signal circuit detects a predetermined voltage value when any cruise control switch function is activated. The associated cruise control function signal detected by the BCM is then sent to the engine control module (ECM) as a GMLAN serial data circuit message. The ECM on receiving the message provides the cruise control function requested by the BCM. The ECM is responsible for recognizing and responding to cruise control switch requests sent by the BCM. The cruise control function switches are used by the ECM to communicate to the active safety control module the driver selected vehicle speed. The driver selected vehicle speed is communicated through GMLAN serial data circuit to the active safety control module and the BCM. The adaptive cruise control system engages and adjusts vehicle speeds based on the activation of the following cruise control function switches:

Cruise Control On/Off Switch

The BCM monitors the switch signal circuit in order to determine when the On/Off switch is disabled or activated. The BCM detects a predetermined voltage value on the switch signal circuit. The On/Off switch state is then relayed to the ECM via the GMLAN serial data circuit. The ECM sends the On/Off switch input status to the active safety control module. When the On/Off switch is turned ON, the adaptive cruise control system enters either a standby enabled or a standby disabled mode. The standby enabled mode indicates that every condition required for the adaptive cruise control system to function has been met, but the adaptive cruise control is not engaged. When the adaptive cruise control is in the standby disabled mode, the conditions necessary for the adaptive cruise control system to function has not been met. When the On/Off switch is turned OFF, the adaptive cruise control will enter the disabled mode. The adaptive cruise control will not activate in the disabled mode.

Cruise Control Set/Decrease Switch

The adaptive cruise control system is engaged when the adaptive cruise control On/Off switch is turned ON and the set/decrease switch is momentarily pressed and released. When the set/decrease switch is pressed, the selected vehicle speed is set to the current vehicle speed by the ECM. The vehicle speed must be at or greater than 40 km/h (25 MPH). The selected vehicle speed is displayed by the driver information center. While in the engaged state, the selected vehicle speed and the following distance can be adjusted. Pressing and holding the set/decrease switch, when the adaptive cruise control system is engaged, will decrease the selected vehicle speed without deactivating the adaptive cruise control. Momentarily pressing and releasing the set/decrease switch, when the adaptive cruise control is engaged, decreased the selected vehicle speed by 1.6 km/h (1 MPH) for each time that the set/decrease switch is pressed.

Cruise Control Resume/Increase Switch

The resume/increase switch is used in order to increase the selected vehicle speed when adaptive cruise control is active. The amount selected vehicle speed can be increased from the resume/increase switch depends on how long the switch is pressed. The presence of a slower moving vehicle in the path of the adaptive cruise control vehicle will limit the extent to which the selected vehicle speed can be achieved. If there is no preceding vehicle in front, limiting the adaptive cruise control vehicle acceleration, then the vehicle speed that is attained is the new selected vehicle speed. The current selected vehicle speed is displayed by the driver information center. Acceleration is terminated when the resume/increase switch is released. Momentarily pressing and releasing the resume/increase switch will allow the selected vehicle to accelerate in at 1.6 km/h (1 MPH) increments for each time that the resume/increase switch is momentarily pressed.

Gap Switch

The gap switch allows the driver to determine how closely the adaptive cruise control vehicle follows a target vehicle while adaptive cruise control is engaged. When the adaptive cruise control vehicle speed is being limited due to a slower travelling vehicle, the adaptive cruise control vehicle speed is automatically controlled to the follow speed limit. The gap switch has 3 following distance selections that range from 1 - 2 s. The gap switch following distance between the adaptive cruise control vehicle

and the target vehicle is expressed in time as opposed to actual distance. The distance maintained for a selected gap will vary based on vehicle speed. The faster the vehicle speed, the further back you will follow. The gap setting can only be adjusted when the adaptive cruise control system is engaged. The gap switch is hard-wired to the BCM. Based on voltage variations, the BCM is able to read the gap switch selection and communicates the switch status on the GMLAN serial data circuit to the active safety control module. The gap switch is a momentary switch.

The initial push of the gap switch recalls the current setting and activates the display. Subsequent pushes of the gap switch will change the gap setting.

Driver Information Messages

Adaptive Cruise Control Temporarily Unavailable

The active safety control module will send this message if the adaptive cruise control has been disengage or disabled. There are many reasons that can cause this, some will also set DTCs. Check vehicle for DTCs and also check the adaptive cruise control enable and disengage scan tool data. Definitions of parameters can be found in active safety control module scan tool information.

Service Driver Assist System

This message can be set by either the active safety control module if there is a problem with the driver assist system or by the memory seat module if there is a problem with the haptic seat circuits. Check vehicle for DTCs.

Service Adaptive Cruise Control and Service Front Camera

The message is set if the active safety control module is not communicating to the instrument cluster. Check vehicle for DTCs.

Set Speed

The adaptive cruise control vehicle set speed is displayed at all times in the driver information center when adaptive cruise control is engaged. The active safety control module set speed display request is sent to the instrument cluster via the GMLAN serial data circuit.

Follow Distance

The driver information center displays the driver selected following distance when adaptive cruise control is engaged and the gap switch is active. The current follow distance setting is displayed in the driver information center for a few seconds after the gap switch is pressed to increase or decrease the following distance. The active safety control module follow distance display request is sent to the instrument cluster via the GMLAN serial data circuit.

Vehicle Ahead Indicator

The vehicle ahead indicator is displayed in the instrument cluster when the radar identifies an in-path vehicle. The vehicle ahead indicator is a warning to the driver that a vehicle is ahead. The indicator also serves as a feedback to the driver that the radar is functioning properly. The active safety control module commands the display of the vehicle ahead indicator via a GMLAN serial data message to the instrument cluster. The vehicle ahead indicator only displays with the adaptive cruise control active and may sometimes display for stationary road objects.

Digital Map Database

The Map Database Update Function shall take the received update data via 4G LTE Wireless connection and uplink connectivity, verify the data received, then substitute or incrementally update the Map Database in the next COMM_ENABLE cycle and inform the horizon provider of the successful update in order to trigger a restart.

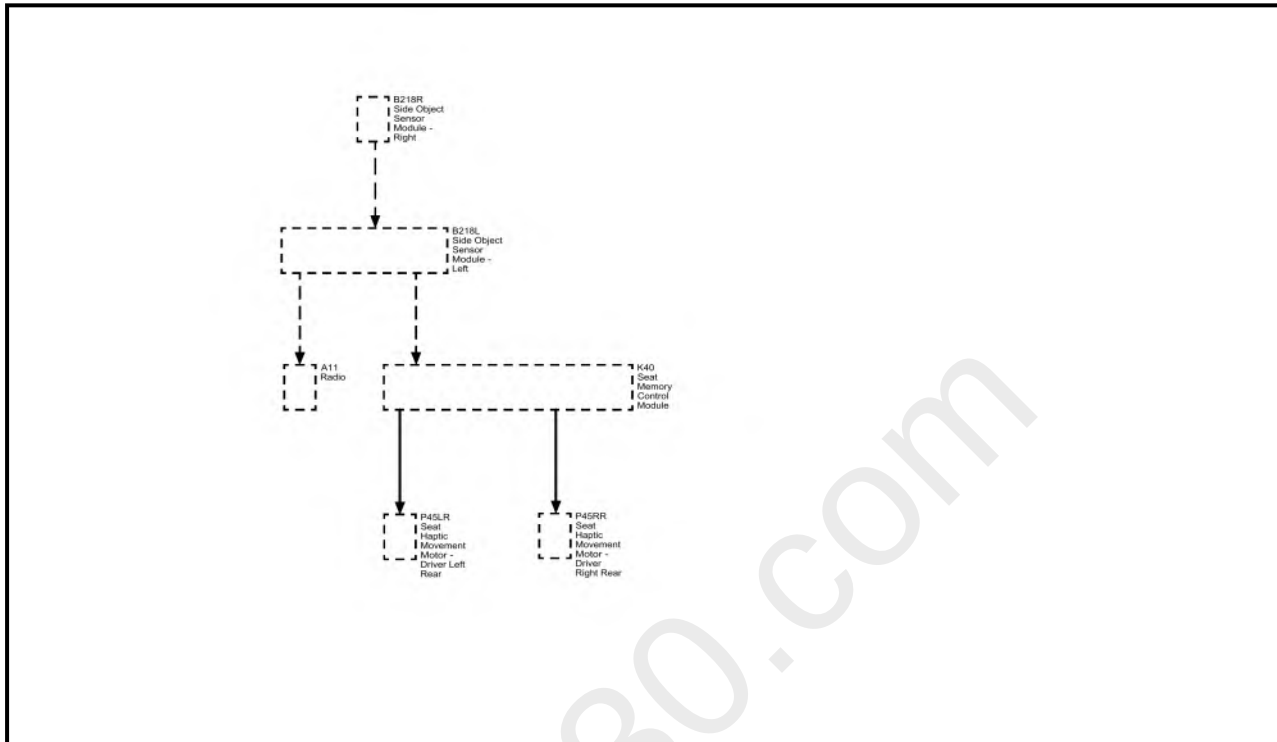
The map database update function will diagnose its capability to update and report its status to the Diagnostic Function.

The Digital Map Module shall be able to initiate a map database update by establishing a connection to the backend server and request information about the latest available map update

The Digital Map Module shall diagnose the Map Database with software logical detection within itself and look for:

- Defects
- Age
- Correct Version

CROSS TRAFFIC ALERT DESCRIPTION AND OPERATION



Callout	Component Name
B218R	B218R Side Object Sensor Module - Right
B218L	B218L Side Object Sensor Module - Left
A11	A11 Radio
K40	K40 Seat Memory Control Module
P45LR	Seat Haptic Movement Motor - Driver Left Rear
P45RR	Seat Haptic Movement Motor - Driver Right Rear

The rear cross traffic alert system is designed to provide enhanced customer visibility while backing up by providing warnings to the driver on impending rear cross traffic. The rear cross traffic alert system is designed to detect and track objects of interest within a specified coverage zone behind the vehicle. The system is designed to alert the driver, with a visual display and either an audible sound or a haptic warning, to the presence of objects of interest that may cause a collision with the host vehicle. Although the system is intended to assist drivers in backing up, it does not replace driver's vision. The driver is responsible to check carefully for objects outside of the coverage zone (e.g., a fast approaching vehicle) for a safe backing maneuver. In the event that the system senses a malfunction through its diagnostic functions, the system will be disabled and the driver will be visually notified.

Rear Cross Traffic Alert System Components

The side blind zone alert system is made up of the following components:

- Left side object sensor module (also used for side blind zone alert)
- Right side object sensor module (also used for side blind zone alert)
- Visual Display Icons located on the rear vision display screen
- Audio System chime or Haptic Seat notification

Side Object Sensor Modules

The side object sensor modules are located on each side of the vehicle behind the rear fascia and are not directly visible from outside the vehicle. The sensors use radar to determine the presence of objects nearby. When an object is detected in the rear cross traffic zone, the module will send out a signal through serial data communication to turn on the visual icons and also audio chime or haptic notification. Each sensor is supplied B+ and ground. The right sensor receives an additional ground. Both sensors communicate independently on the serial data line. The serial data enters the left sensor in a pass-thru configuration, that connects to the right sensor. The scan tool is able to individually communicate with each sensor.

Display Icons

The rear cross traffic alert system visual alert display consists of two visual icons, one on each side of the display screen of the rear vision camera, that are used to alert the driver on rear cross traffic from each side of the host vehicle respectively.

Audio or Haptic Notification

The alert output type can be driver selected to either audio or haptic. The chime location will be left rear for left rear cross traffic alert and right rear for right rear cross traffic alert. The haptic seat system response will be to generate 3 repetitions of haptic vibration in the left rear area of the seat for left cross traffic alert and right rear area of the seat for right cross traffic alert. If there is a problem with the haptic seats, the audio chime will be substituted.

Rear Cross Traffic Alert Operation

The rear cross traffic alert system is designed to detect objects of interest as small as a 125cc motorcycle with rider. The detection zone extends approximately 30 m (99 ft) from the rear corner of the car and covers an area from behind the vehicle to 125 degrees towards the front at a height of 0.45 m (1.5 ft) to 2 m (6.5 ft) above ground. The system operates when vehicle speed is 10 kph (6 mph) or less and is designed to detect objects moving at speeds up to 36 kph (22 mph).

When the vehicle is backing up, the side object sensors receive energy that is reflected from external objects and determine if the objects are objects of interest or not. The system may at times detect pedestrians, shopping carts, or similar moving objects. This is normal and should not be considered as a false alert or problem with the system. The rear cross traffic alert system will estimate vehicle travel trajectory and use the information in conjunction with object travel trajectory information to determine if there is a potential collision between the vehicle and the object of interest. The rear cross traffic alert function will only alert on objects of interest that pose a potential collision with the host vehicle. The system is not designed to provide an alert to objects that have no potential collision with vehicle. In addition, the system will not alert to stationary objects such as signs, parked cars, etc.

Rear Cross Traffic Alert Driver Information Center Messages

REAR CROSS TRAFFIC ALERT OFF

This message indicates that the system has been disabled through the driver information center. Refer to the vehicle owner's manual for instructions on how to set personalization options on the driver information center.

SERVICE SIDE DETECTION SYSTEM

This message indicates that the system requires service. Since the sensors are also used for side blind zone alert, this feature will also be inoperative.

SIDE DETECTION SYSTEM UNAVAILABLE

This message indicates that the system has been temporarily disabled because the sensor is blocked or can otherwise not accurately detect vehicles or objects. Such instances may be mud, dirt, snow, ice, or slush build-up on the rear fascia, heavy rainfall, excessive road spray, fascia damage or stickers.

The rear cross traffic alert system will read the GPS latitude and longitude on the serial data bus and calculate if the vehicle is within a Radio Astronomy zone. These zones are located in Europe and Japan

and require the sensors to be turned off. The "Side Detection System Unavailable" message will be displayed to the driver when this occurs.

FORWARD COLLISION ALERT DESCRIPTION AND OPERATION

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

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

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

Forward Collision System Reduced Message

This message displays when Forward Automatic Braking or Front Automatic Braking has been set to the "Alert" setting. This setting disables most automatic braking functions. This is normal operation when the **Forward Collision System** setting is set to **OFF** or **ALERT**. This message is not present when the **Forward Collision System** is set to **Alert and Brake**.

Front Automatic Braking (UHY) (if equipped)

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

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

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

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

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

The Pedestrian Collision Mitigation Braking system can detect and alert to up to 10 pedestrians in a forward gear at speeds between 5 mph (8 km/h) and 50 mph (80 km/h). During daytime driving, the

system detects pedestrians up to a distance of approximately 40 m (131 ft). Pedestrians must be at least 31.5 inches (80 cm) tall to be detected.

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

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

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

Frontview Camera Module

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

Forward Collision Alert Switch

The forward collision alert switch provides an input to the frontview camera module to select the alert timing sensitivity when approaching another vehicle too rapidly. The forward collision alert switch is part of the steering wheel controls switch - left and provides inputs to the body control module (BCM), which then communicates with the frontview camera module via serial data.

The BCM applies a reference voltage and monitors a low signal voltage from the normally open switch. When the switch is pressed, the signal circuit is pulled low through a specific series of resistors, indicating that the system has been requested to change the alert timing sensitivity. The first button press will show the current alert timing setting on the driver information center. With every subsequent button press, the alert timing sensitivity is changed.

Instrument Cluster

The instrument cluster communicates via serial data with the frontview camera module and will illuminate the amber or green vehicle ahead indicator as requested by the frontview camera module. The instrument cluster also controls the head-up display or the collision alert indicators.

Collision Alert Indicators (without UV6) (if equipped)

The collision alert indicators are a series of red LEDs that will flash when approaching another vehicle too rapidly. The collision alert indicators are located in the upper instrument panel area and reflect off the windshield when illuminated.

The collision alert indicators receive power and ground and are discretely controlled by the instrument cluster through a pair of low control circuits. When requested by the frontview camera module, the instrument panel will pulse the low control circuits, flashing the LEDs as a visual alert that another vehicle is being approached too rapidly.

Head-up Display (with UV6) (if equipped)

The instrument cluster controls the head-up display via serial data. The instrument cluster will command the head-up display to flash the collision alert indicator as a visual alert when approaching another vehicle too rapidly as requested by the frontview camera module.

Infotainment System

The infotainment system controls the audible alerts for the forward collision alert system. If the host vehicle is approaching another vehicle too rapidly, the frontview camera module will command the infotainment system issue an audible alert to the driver.

Safety Alert Seat (if equipped)

The memory seat module controls the haptic alert provided by the seats. If the vehicle is approaching another vehicle too quickly, the frontview camera module will command the memory seat module to pulse both sides of the seat.

LANE DEPARTURE WARNING DESCRIPTION AND OPERATION

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

The lane departure warning system utilizes the following components:

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

Frontview Camera Module

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

Lane Departure Warning Switch

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

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

Instrument Cluster

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

Infotainment System

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

Safety Alert Seat

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

Lane Departure Warning Operation

System Operational Modes

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

Lane Crossing Alerts

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

LANE KEEP ASSIST DESCRIPTION AND OPERATION

NOTE:

- **The Lane Keep Assist system DOES NOT continuously steer the vehicle**
- **The Lane Keep Assist system replaces Lane Departure Warning System**
- **Lane Departure Warning will have more alerts than Lane Keep Assist (visual, audible, and haptic warning)**

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

personalization.

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

- Front view camera module
- Lane Keep Assist switch/control indicator
- Instrument cluster/Vehicle Direction Display
- Radio
- Safety Alert Seat (if equipped)
- Yaw rate sensor
- Electric power steering

Front View Camera Module

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

Lane Keep Assist Switch

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

Instrument Cluster

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

Radio

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

Safety Alert Seat (if equipped)

The memory seat module controls the haptic alert provided by the seats. If the vehicle has unintentionally left the lane, and the Electric Power Steering determines the corrective action requires an above threshold amount of effort, the memory seat module will command three pulses to the left or right side of the seat, depending on the lane departure direction.

Yaw Rate Sensor

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

Electric Power Steering

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

Lane Keep Assist Operation

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

System operation can be described by the following modes:

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

Lane Crossing Alerts

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

Lane Keep Assist System Driver Information Center Messages

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

SAFETY ALERT SEAT DESCRIPTION AND OPERATION

The safety alert seat provides a vibration in the driver's seat bottom cushion to alert the driver of a number of concerns. Two seat haptic movement motors are utilized to create the vibration and are located on the left and right sides of the seat cushion. Utilizing two motors allows the vibration to be localized to the left or right side of the seat, depending on the side of the vehicle generating the alert, or to vibrate both simultaneously.

The active safety seat utilizes the following components:

- Seat Memory Control Module
- Seat Haptic Movement Motor - Driver Left
- Seat Haptic Movement Motor - Driver Left

Seat Memory Control Module

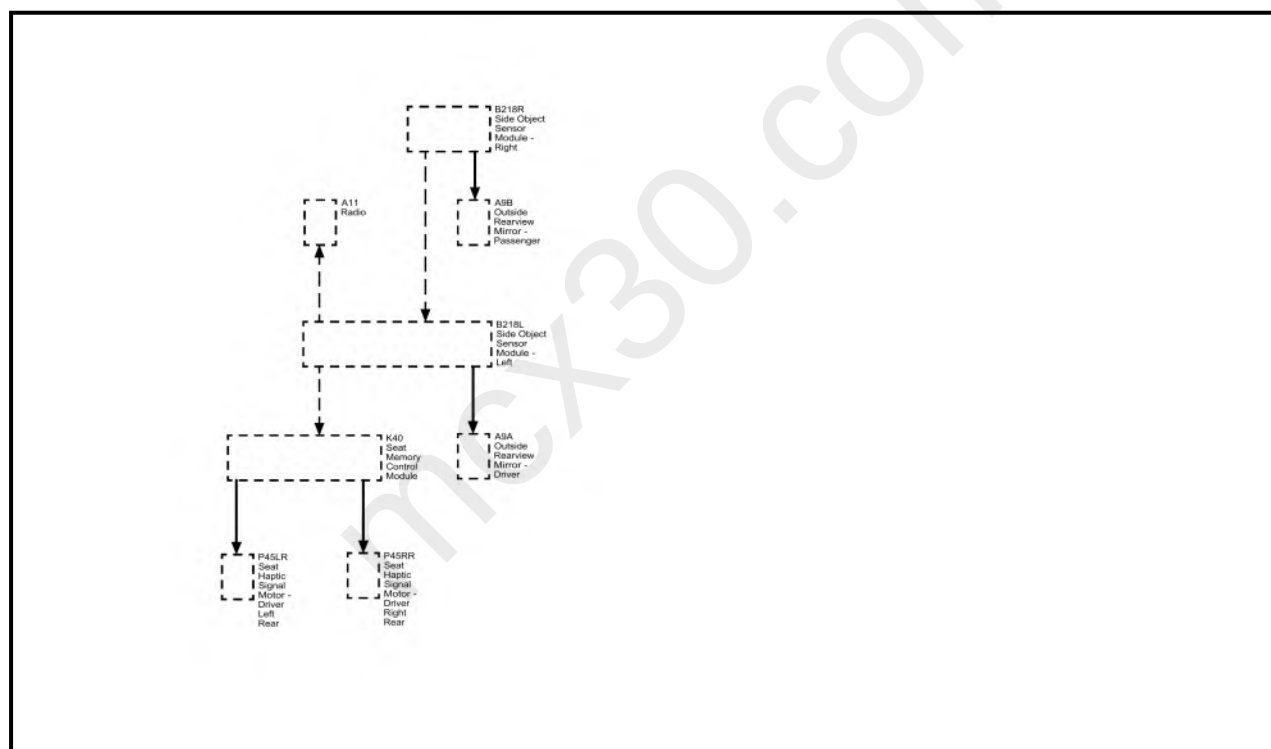
The seat memory control module receives serial data messages from other modules and provides voltage to control the seat haptic movement motors. The seat memory control module will pulse the left, right, or both motors with the number of pulses requested over serial data. The seat memory control module monitors the control circuits for open, short to ground, and short to voltage conditions and will set DTCs if a circuit fault is detected.

Seat Haptic Movement Motor

The seat haptic movement motor is DC motor located in the driver's seat bottom cushion. Two seat haptic movement motors are used in the seat bottom cushion, positioned on the left and right side. An offset weight is attached to the motor. When activated, the spinning offset weight creates a vibration felt by the driver through the seat cushion.

Each seat haptic movement motor receives a constant chassis ground. The motor is controlled by the seat memory control module providing voltage through a dedicated control circuit. When an alert is required, the seat memory control module will apply voltage, activating the seat haptic movement motor.

SIDE BLIND ZONE ALERT DESCRIPTION AND OPERATION



Callout	Component Name
B218R	B218R Side Object Sensor Module - Right
A9B	A9B Outside Rearview Mirror - Passenger
A11	A11 Radio
B218L	B218L Side Object Sensor Module - Left
A9A	A9A Outside Rearview Mirror - Driver
K40	K40 Seat Memory Control Module
P45LR	Seat Haptic Movement Motor - Driver Left Rear
P45RR	Seat Haptic Movement Motor - Driver Right Rear

NOTE: Not all items in block diagram may apply to specific vehicle. Refer to wiring schematics for specific vehicle wiring diagrams.

Description and Operation

The side blind zone alert system shall detect and report "objects of interest" on either side of the vehicle, within a specified "blind spot" zone. The system is designed to alert the driver, with a visual display placed on the side view mirror, to the presence of objects of interest that may not be visible in the inside rearview mirror and outside rear view mirrors. Although this system is intended to help drivers avoid lane change crashes, it does not replace driver vision and therefore should be considered a lane change aid. Even with the side blind zone alert system, the driver must check carefully for objects outside of the reporting zone (e.g., a fast approaching vehicle) before changing lanes. In the event that the system senses a malfunction through its diagnostic routines, the system will be disabled and the driver will be visually notified.

When the system detects a vehicle in the side blind zone while driving forward, an amber warning symbol will light up in the appropriate outside mirror. This indicates that it may be unsafe to change lanes. If the driver then activates the turn signal, the amber warning symbol starts flashing as an extra warning not to change lanes.

Side blind zone alert is active when the vehicle is out of park or the parking brake is off on manual transmission vehicles and at speeds up to approximately 140 km/h (87 MPH). If a vehicle is detected in the blind zone, the warning symbols will turn illuminate on the appropriate side. When the vehicle is started, both outside mirror displays will briefly come on to indicate that the system is operating. The warning symbols will vary brightness based on the ambient light conditions.

Side Blind Zone Alert System Components

The side blind zone alert system is made up of the following components:

- Left side object sensor module (also used for rear cross traffic alert)
- Right side object sensor module (also used for rear cross traffic alert)
- Driver outside rearview mirror
- Passenger outside rearview mirror

Side Object Sensor Modules

The side object sensor modules are located on each side of the vehicle behind the rear fascia and are not directly visible from outside the vehicle. The sensors use radar to determine the presence of objects nearby. When an object is detected in the side blind zone, the side object sensor module supplies voltage to illuminate the visual indicator on the appropriate side rear view mirror. Each sensor is supplied B+ and ground. The right sensor receives an additional ground. Both sensors communicate independently on the serial data line. The serial data enters the left sensor in a pass-thru configuration, that connects to the right sensor. The scan tool is able to individually communicate with each sensor.

Outside Rearview Mirrors

The outside rearview mirrors contain an icon that is backlit with high intensity, amber-colored LED's located on the mirror surface. The display brightness adapts to day/night conditions. The side blind zone alert indicator icon in the left or right outside rearview mirror is illuminated if the left or right side object sensor module detects a vehicle in the side blind zone to inform the driver that there is a vehicle driving in the blind spot zone.

Side Blind Zone Alert Operation

When the vehicle is started, both outside mirror displays will briefly come on to indicate that the system is operating. The system is designed to detect objects of interest as small as a 125cc motorcycle with rider. The detection zone starts at the outside rearview mirror and extends out to 3.5 m (11 ft) at the back corner of the vehicle and 3 m (10 ft) behind the vehicle at a height of 0.5 m (1.5 ft) to 2.0 m (6 ft) above the ground. The system may light up an indicator due to guardrails, signs, trees, shrubs, and other non-moving objects. This is normal system operation; the vehicle does not need service.

When the system detects a vehicle in the side blind zone while driving forward, independent if passing a vehicle or being passed, an amber warning symbol will light up in the appropriate outside mirror. This indicates that it may be unsafe to change lanes. If the driver then activates the turn signal, the amber warning symbol starts flashing as an extra warning not to change lanes.

Foul weather may affect the operation of the side blind zone system. Occasional missed alerts can occur under normal circumstances and will increase in wet conditions. The number of missed alerts will increase with increased rainfall or road spray. Heavy rainfall, as well as mud, dirt, snow, ice, or slush build-up on the rear fascia, can completely disable the system.

If the vehicle is towing a trailer or has an object such as a bicycle rack attached to the rear of the vehicle, the side blind zone system may not function properly and the indicators may illuminate intermittently or remain illuminated all the time.

Side Blind Zone Alert Driver Information Center Messages

SIDE BLIND ZONE ALERT OFF

This message indicates that the system has been disabled through the driver information center. Refer to the vehicle owner's manual for instructions on how to set personalization options on the driver information center.

SERVICE SIDE DETECTION SYSTEM

This message indicates that the system requires service. When the message is displayed, the indicators will remain illuminated at all times, notifying the driver that the side blind zone system should not be relied upon when changing lanes. Since the sensors are also used for rear cross traffic alert, this feature will also be inoperative.

SIDE DETECTION SYSTEM UNAVAILABLE

This message indicates that the system has been temporarily disabled because the sensor is blocked or can otherwise not accurately detect vehicles or objects. Such instances may be mud, dirt, snow, ice, or slush build-up on the rear fascia, heavy rainfall, excessive road spray, fascia damage or stickers.

The rear cross traffic alert system will read the GPS latitude and longitude on the serial data bus and calculate if the vehicle is within a Radio Astronomy zone. These zones are located in Europe and Japan and require the sensors to be turned off. The "Side Detection System Unavailable" message will be displayed to the driver when this occurs.

Lane Change Alert Operation (if equipped)

Lane Change Alert (LCA) can be disabled in vehicle personalized settings, this will also disable the Side Blind Zone Alert (SBZA) system. When disabled, the bulb check of the mirror indicators will also be disabled. A driver information center message will be displayed at start up when the LCA system is disabled. This feature must be enabled prior to trying to diagnose the system.

The lane change alert system shall detect and report objects in the driver's blind zone, or approaching on either side of the vehicle, within a specified lane change zone. The system is designed to alert the driver, with a visual display placed on the side view mirror, to the presence of objects of interest that may not be visible in the inside rearview mirror and outside rear view mirrors. Although this system is intended to help drivers avoid lane change crashes, it does not replace driver vision and therefore should be considered a lane change aid. Even with the lane change alert system, the driver must check carefully for objects outside of the reporting zone before changing lanes. In the event that the system senses a malfunction through its diagnostic routines, the system will be disabled and the driver will be visually notified.

When the vehicle is started, both outside mirror displays will briefly come on to indicate that the system is operating. The warning symbols will vary brightness based on the ambient light conditions. Lane change alert is active when the vehicle is out of park or the parking brake is off on manual transmission vehicles. When the system detects a vehicle in the side blind zone or approaching in the lane change alert zone while driving forward, an amber warning symbol will light up in the appropriate outside mirror. This indicates that it may be unsafe to change lanes. If the driver then activates the turn signal, the amber warning symbol starts flashing as an extra warning not to change lanes.

The system is designed to detect objects of interest as small as a 125cc motorcycle with rider. The detection zone starts at the outside rearview mirror and extends out to 3.5 m (11 ft) at the back corner of the vehicle and 70 m (230 ft) behind the vehicle at a height between 0.5 m (1.5 ft) and 2.0 m (6 ft) above

the ground. The system may light up an indicator due to guardrails, signs, trees, shrubs, and other non-moving objects. This is normal system operation; the vehicle does not need service.

If the vehicle is towing a trailer or has an object such as a bicycle rack attached to the rear of the vehicle, the lane change alert system may not function properly and the indicators may illuminate intermittently or remain illuminated all the time. The driver information center may display "SIDE DETECTION SYSTEM UNAVAILABLE".

Foul weather may affect the operation of the lane change alert system. Occasional missed alerts can occur under normal circumstances and will increase in wet conditions. The number of missed alerts will increase with increased rainfall or road spray. Heavy rainfall, as well as mud, dirt, snow, ice, or slush build-up on the rear fascia, can completely disable the system. The warning symbols will vary brightness based on the ambient light conditions.

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