

## **Parking Aid -**

### **General Specification**

### **Item Specification**

#### **Detection (Rear):**

Center sensors 1800 mm (70.9 in)

Side sensors 600 mm (23.6 in)

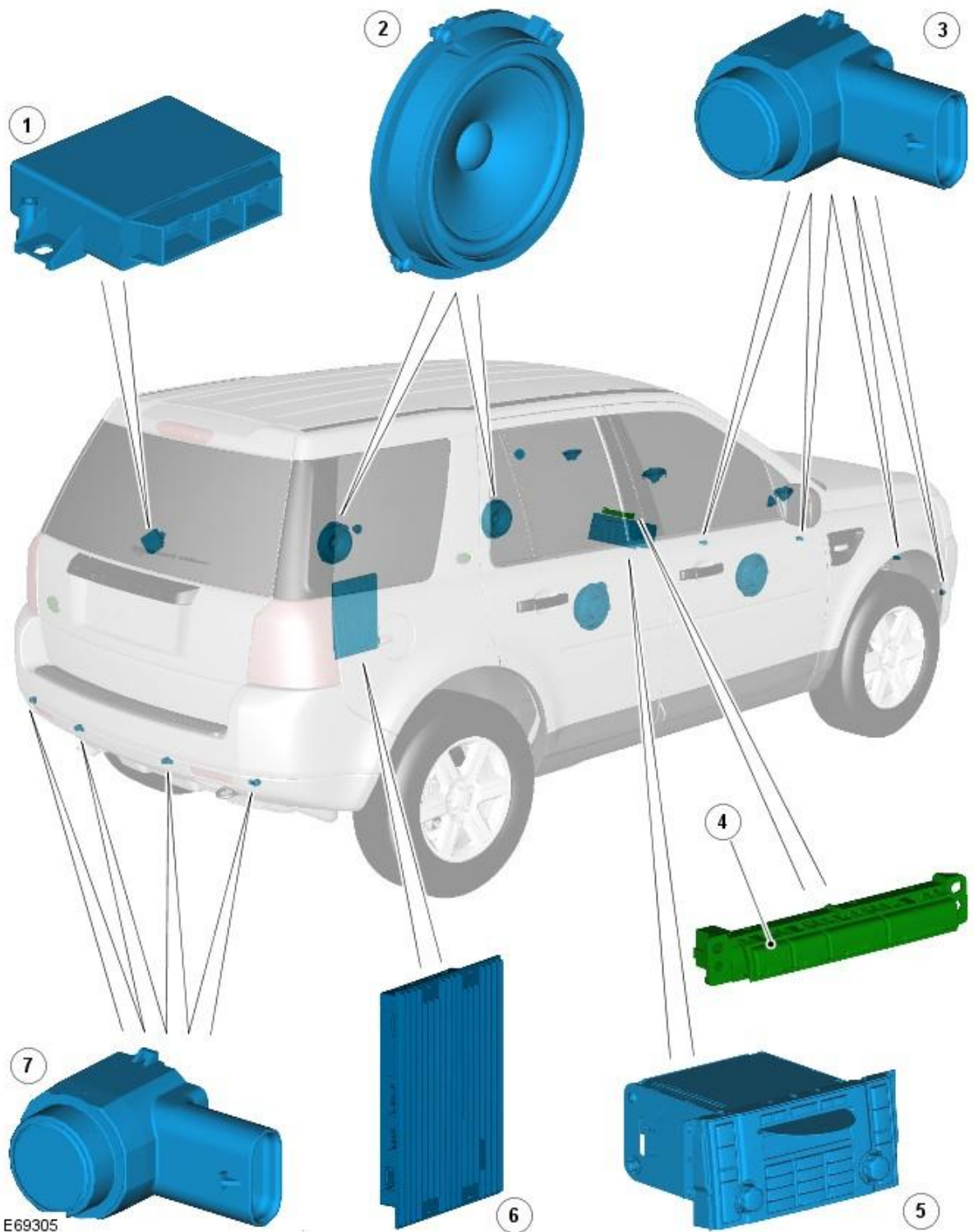
Continuous tone 300 mm (11.8 in)

#### **Detection (Front):**

Center sensors 800 mm (31.5 in)

Side sensors 600 mm (23.6 in)

Continuous tone 300 mm (11.8 in)



E69305

**Item Part Number Description**

- 1 - Parking aid module
- 2 - Front and rear audio speakers
- 3 - Front parking aid sensor (4 off)
- 4 - Parking aid switch
- 5 - Integrated Control Module (ICM)
- 6 - Power amplifier
- 7 - Rear parking aid sensor (4 off)

**OVERVIEW**

Two levels of parking aid system can be fitted; a rear only system or a front and rear system.

The parking aid system provides an audible warning to the driver when any obstacles are in the path of the vehicle during forward (if front sensors are fitted) or reverse parking manoeuvres. The system consists of four ultrasonic sensors in each bumper, a parking aid module and a parking aid switch.

At low speeds, the parking aid module uses the ultrasonic sensors to monitor the area around the front and rear bumpers.

If an object is detected within a monitored area, the module then outputs a warning using the audio system speakers. The sensors can detect solid objects such as posts, walls and other vehicles and can also detect less solid objects such as a wire mesh fence. Objects very close to the ground may not be detected, but because of their low height may not cause damage to the vehicle.

The parking aid system comprises the following components:

Parking aid module

Parking aid switch

Eight parking aid sensors.

The parking aid module communicates via the medium speed Controller Area Network (CAN) bus with the audio system via the Integrated Control Module (ICM). The audio system then outputs the applicable warning tones from the front or rear speakers when an object is detected. The medium speed CAN bus is also used to collect vehicle data from other vehicle systems.

### **Parking Aid Module**

The parking aid module is located on the Left Hand (LH) side of the luggage compartment, behind the 'C' pillar trim panel.

The parking aid module has three connectors which provide for power, ground and CAN bus connections, front parking aid sensors and rear parking aid sensors.

The medium speed CAN bus connections provide for the receipt of the following information from other systems:

Anti-lock Brake System (ABS) module - Road speed signal

Transmission Control Module (TCM) - Reverse gear engaged signal

Trailer module - Trailer attached to vehicle

Instrument cluster - Ambient temperature signal.

The module also outputs messages on the medium speed CAN bus which are received by the Integrated Control Module

(ICM). The ICM processes these messages and converts them into Media Orientated System Transport (MOST) signals which are passed to the audio system power amplifier. These signals are then used by the power amplifier to emit the applicable warning tones from the front or rear audio speakers when an object is detected by the front or rear parking aid sensors. A warning tone can also be emitted to alert the driver to a fault in the parking aid system.

The parking aid module performs self check routines and when the system is active checks the sensor wiring for short or open circuits. If a fault is detected a code is stored in a memory in the module and if necessary either the front and/or rear sensors can be disabled. The driver is made aware of any fault condition by the parking aid switch Light Emitting Diode (LED) flashing and a continuous warning tone being emitted for 3 seconds, in place of the normal short tones when the system is functioning normally. Fault codes can be read using the Integrated Diagnostic System (IDS) via the diagnostic socket.

### **Parking Aid Sensors**

Four ultrasonic sensors are located in the front and rear bumpers. Each sensor comprises a sensor and a bumper insert.

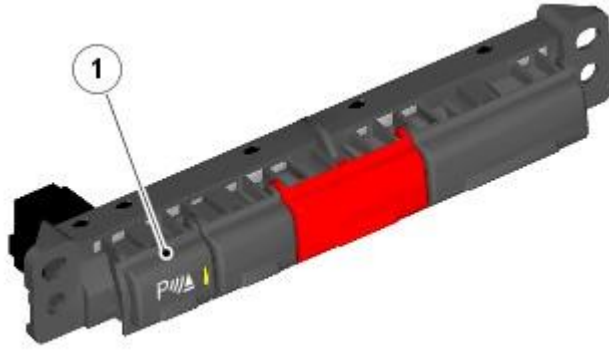
The insert ensures that each sensor is correctly orientated in relation to its location in the bumper.

Each sensor has a three pin connector which mates with a bumper harness, which in turn is connected to the main body harness. Three pins provide for power supply, ground and signal lines to and from the parking aid module.

Each sensor comprises a plastic housing which contains a piezo electric disc. The disc resonates at a frequency of 34.8kHz, producing the ultrasonic output. The disc also receives the reflected echo signal from any objects within range.

The parking aid module controls the operation of each sensor using a digital output on the signal line. The module controls the sensor in one of two modes; combined transmitter and receiver mode or receiver mode only.

### **Parking Aid Switch**



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#### Item Part Number Description

##### 1 - Parking aid switch

The parking aid switch is located in the instrument panel switch pack, above the touch screen. The switch is the LH switch with an integral LED.

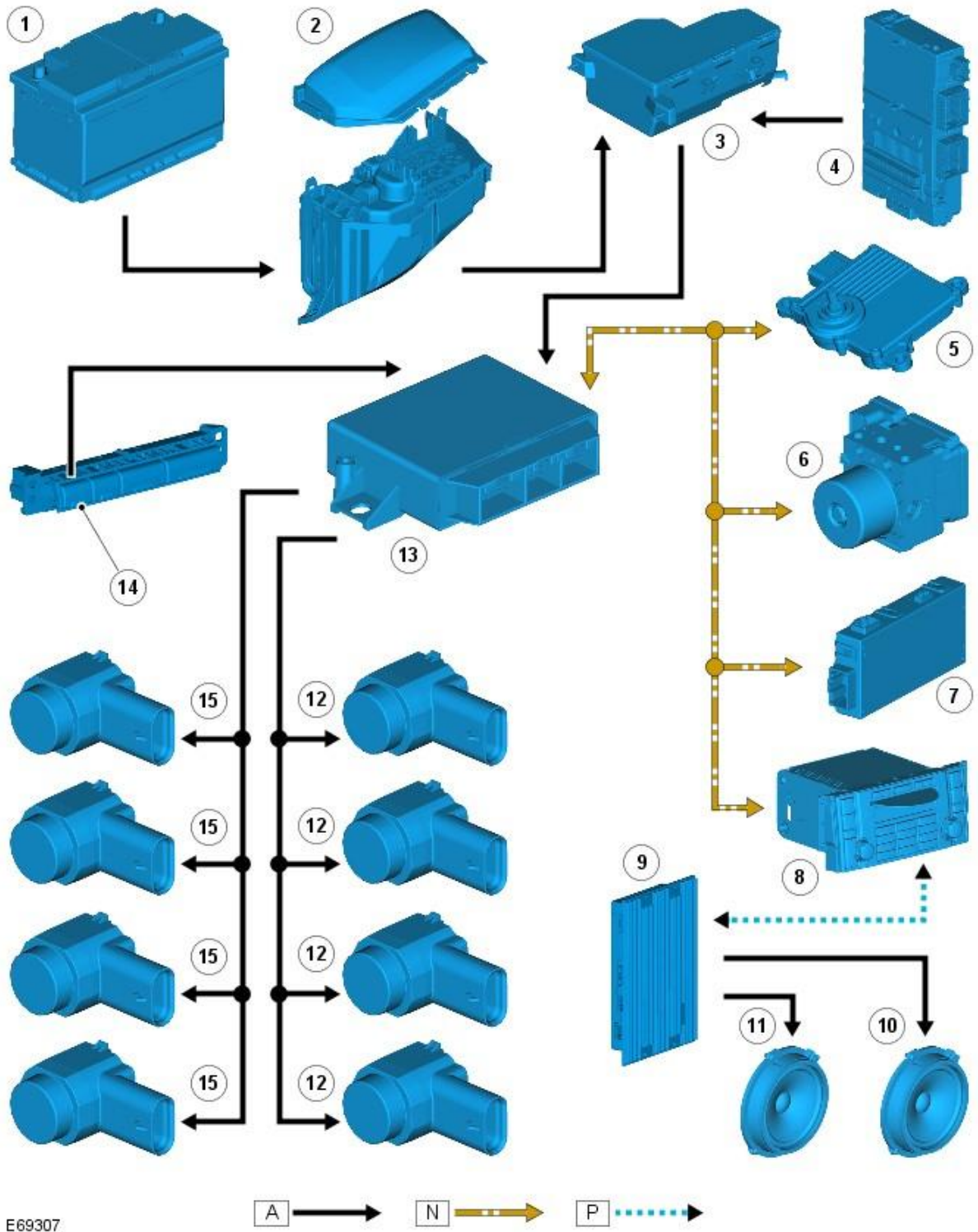
The switch is a non-latching push switch which allows the driver to select the parking aid system on or off. When pressed, the switch momentarily connects a ground to the parking aid module. The LED indicates when the parking aid system is active. The LED is controlled by the parking aid module.

The switch allows the driver to disable the parking aid system when reverse gear is selected or to activate the parking sensors when not in reverse gear.

If a fault exists in the parking aid system, the LED flashes continuously when reverse gear is selected or the driver selects the parking sensors on, using the switch.

#### CONTROL DIAGRAM

- NOTE: **A** = Hardwired; **N** = Medium speed CAN Bus; **P** = Fiber Optic MOST



**Item Part Number Description**

- 1 - Battery
- 2 - Power distribution box
- 3 - Auxiliary junction box
- 4 - Central Junction Box (CJB)
- 5 - Transmission Control Module (TCM)
- 6 - Anti-lock Brake System (ABS) module
- 7 - Trailer module
- 8 - Integrated Control Module (ICM)
- 9 - Power amplifier
- 10 - Front audio speakers
- 11 - Rear audio speakers
- 12 - Rear parking aid sensor
- 13 - Parking aid module

- 14 - Parking aid switch
- 15 - Front parking aid sensor

## **PRINCIPLES OF OPERATION**

When the parking aid module activates the system, the switch LED is illuminated and a single tone is emitted from the front and rear audio speakers to indicate that the system is operating. The parking aid module then processes signals received from the sensors to determine if there is an object within the detection range of the sensors.

In the combined mode, the sensors emit a series of ultrasonic impulses and then switch to receiver mode to receive the echo reflected by an obstacle within the detection range. The received echo signals are amplified and converted from an analogue signal to a digital signal by the sensor. The digital signal is passed to the parking aid module and compared with pre-programmed data stored in an EEPROM within the module. The module receives this data via the signal line from the sensor and calculates the distance from the object using the elapsed time between the transmitted and received impulse.

The duration of the impulse duration is determined by the module, with the sensor controlling the frequency of the impulse output.

In receiver mode, the sensor receives impulses that were emitted by adjacent sensors. The module uses this information to precisely determine the position and distance of the object.

If no objects are detected there are no further warning tones. If an object is detected, repeated audible tones are emitted from either the front or rear audio speakers as appropriate. The time delay between the tones decreases as the distance between the object and the vehicle decreases, until at approximately 250 mm (10 inches), the audible tone becomes continuous.

If, after the initial detection of an object, there is no decrease in distance between the object and the vehicle, the audible warning tones remain constant if the object is detected by a central sensor or stops after 3 seconds if the object is detected by a corner sensor.

The audible tones will stop if the vehicle is moved out of reverse gear. The module continues to monitor the distance and will resume the warning tones if a decrease in distance is detected.

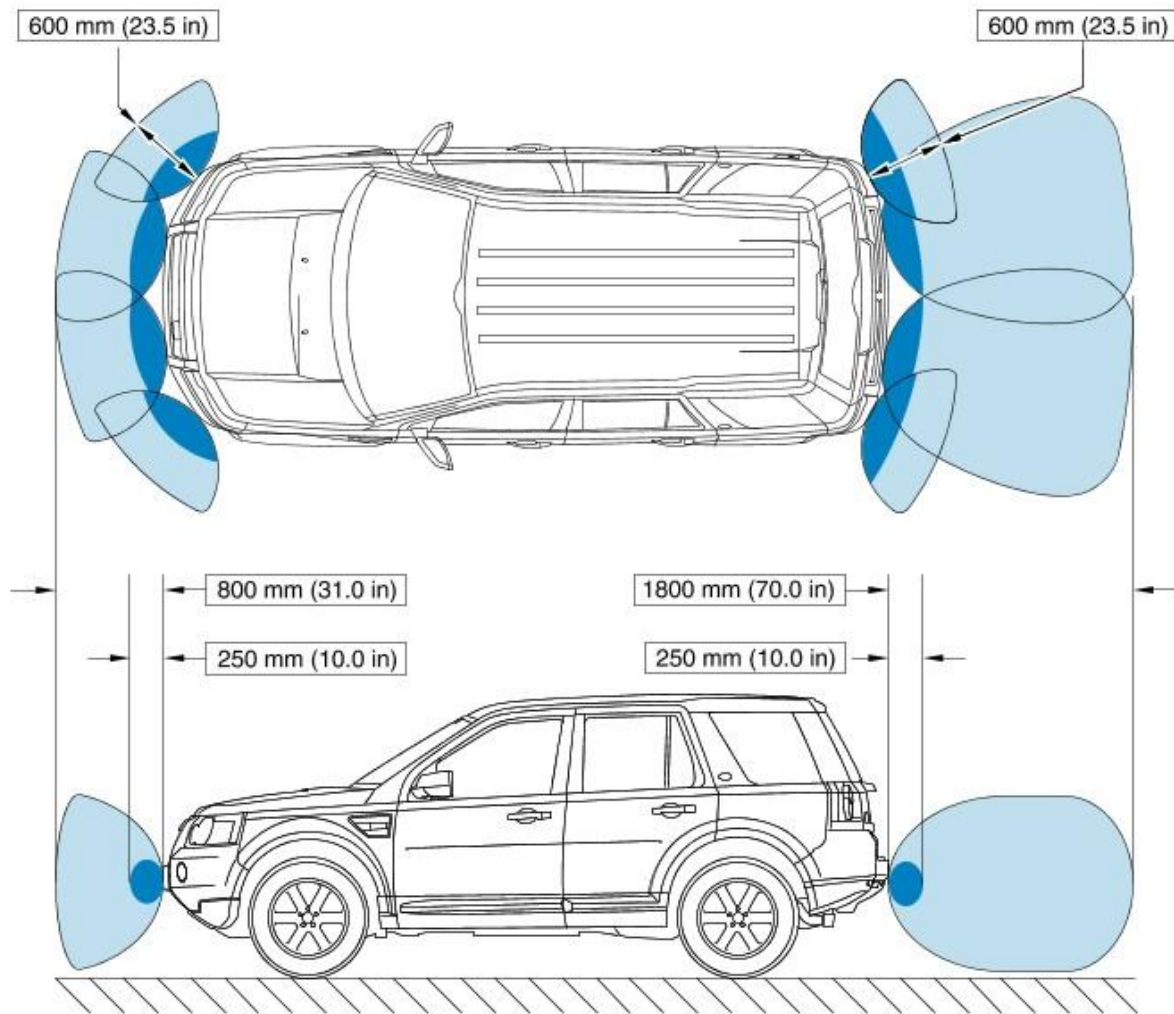
System operation is cancelled when the parking aid switch is pressed or the ignition is switched off. System operation is also cancelled if the vehicle travels more than 50 m (164 ft) or the vehicle forward speed exceeds 30 km/h (19 mph).

The system can detect when a trailer is connected to the vehicle by a message output on the medium speed CAN bus from the trailer module. When the parking aid module detects that a trailer is connected to the vehicle, the rear sensors are disabled to prevent constant warnings due to the close proximity of the trailer.

The parking aid module also incorporates software that compensates for the effects of frost, ice or rain on the sensors. Ice compensation occurs if the ambient temperature, received on a medium speed CAN bus message from the instrument cluster, is less than 6°C (43°F).

## **Distance Calculation**

- NOTE: **A** = Int ermit tent warni ng tone; **B** = Conti nuous warni ng t one



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The maximum detection range for the front sensors is 800 mm (31 inches) for the central sensors and 600 mm (23.5 inches) for the corner sensors.

The maximum detection range for the rear sensors is 1800 mm (70 inches) for the central sensors and 600 mm (23.5 inches).

## Parking Aid - Parking Aid

Diagnosis and Testing

### Principle of Operation

For a detailed description of the parking aid system, refer to the relevant Description and Operation section in the workshop manual .

REFER to: [Parki ng Aid](#) (413-13 Parking Aid, Description and Operation).

### Inspection and Verification

**CAUTION:** Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.

2. Visually inspect for obvious signs of damage and system integrity.

- NOTE: Particular attention should be paid to the following items where DTCs may not be logged:

Check for contamination (e.g. dirt, grime, frosting, ice) around the parking aid sensors, if so refer to the parking aid section in the vehicle handbook.



Check for the correct installation and alignment of the sensors to the bumper.  
Spurious detection of the ground may occur during front system operation on an up-slope, or down slope.

### Visual Inspection

#### Electrical

Fuse(s)

Relay(s)

Wiring Harness

Electrical connector(s)

Front parking aid sensor(s) and holders

Rear parking aid sensor(s) and holders

Audio system.

REFER to: [Information and Entertainment System](#) (415-01 Information and Entertainment System, Diagnosis and Testing).

Parking aid switch and LED

Parking aid module

**3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

**4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

#### DTC Index

- NOTE: If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.
- NOTE: Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).
- NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.
- NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- NOTE: Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.
- NOTE: If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.
- NOTE: When carrying out repair/diagnosis of the system, on removal of the front or rear bumper inspect the sensor connectors to ensure they were correctly latched and check fly leads for signs of chaffing or trapped wires.

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00 REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: Parking Aid Module \(PAM\)](#) (100-00 General Information, Description and Operation).

## Parking Aid - Front Inner Parking Aid Sensor

Removal and Installation

### Removal

**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

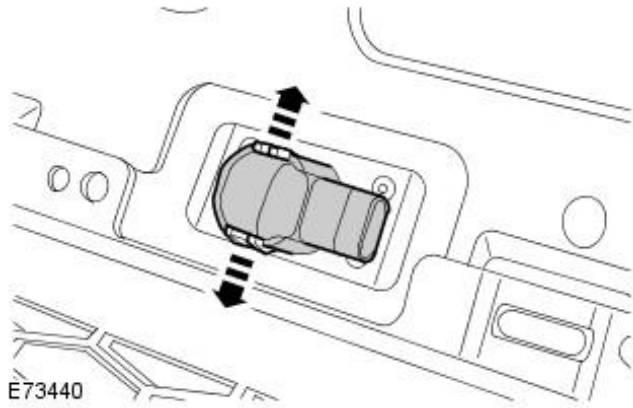
Remove the front wheels and tires.

Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

Remove the front bumper cover.

Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).





4.

## Installation

**1. CAUTION:** If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.  
To install, reverse the removal procedure.

## Parking Aid - Front Outer Parking Aid Sensor

Removal and Installation

### Removal

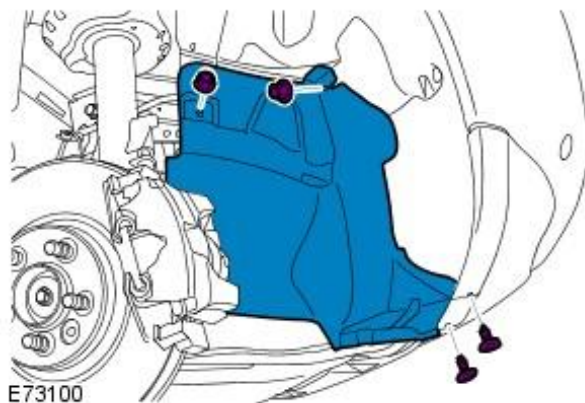
• **NOTE:** Removal of the RH front outer parking aid sensor will require the removal of the front bumper cover.

**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

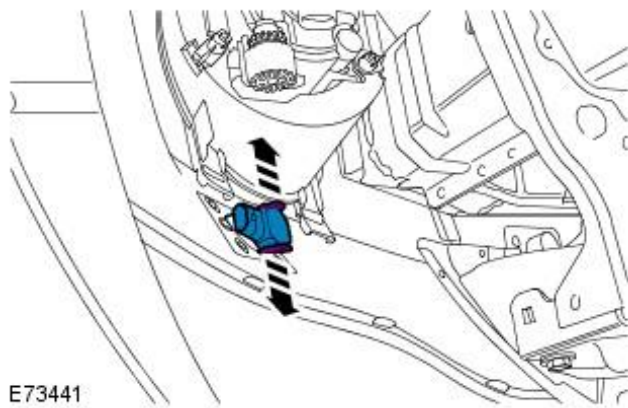
Raise and support the vehicle.

Remove the front wheel and tire.

Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).



3.



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## Installation

**1. CAUTION:** If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

To install , reverse the removal procedure.

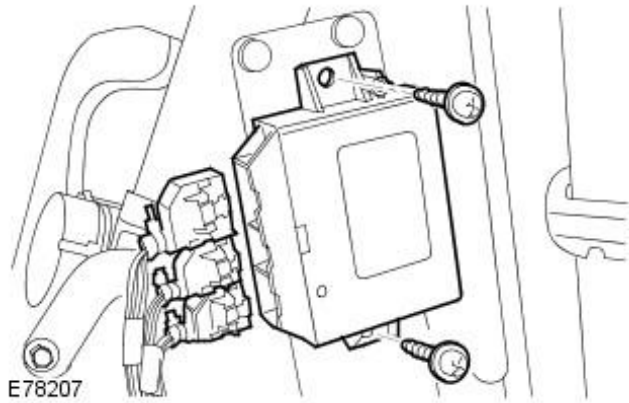
## Parking Aid - Parking Aid Module

Removal and Installation

### Removal

Remove the LH rear quarter trim panel . Refer to: [Rear Quarter Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Remove the parking aid module.2.



### Installation

To install, reverse the removal procedure.1.

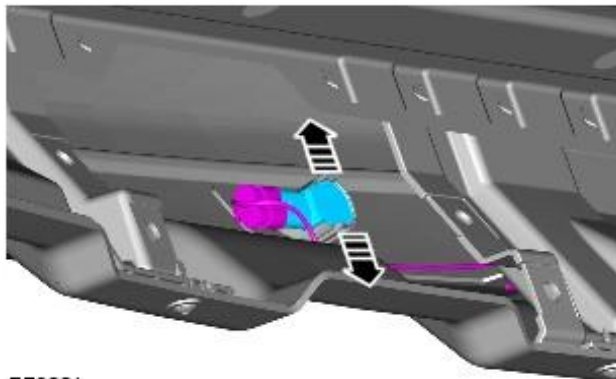
If a new component is to be installed, configure using IDS.

## Parking Aid - Rear Inner Parking Aid Sensor

Removal and Installation

### Removal

1. **WARNING:** Make sure to support the vehicle with axle stands.  
Raise and support the vehicle.



### Installation

1. **CAUTION:** If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

To install , reverse the removal procedure.

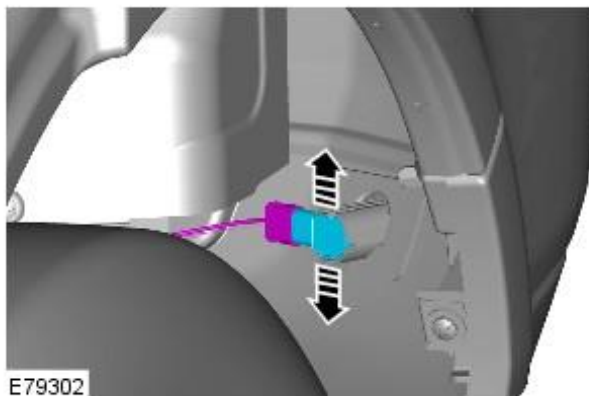
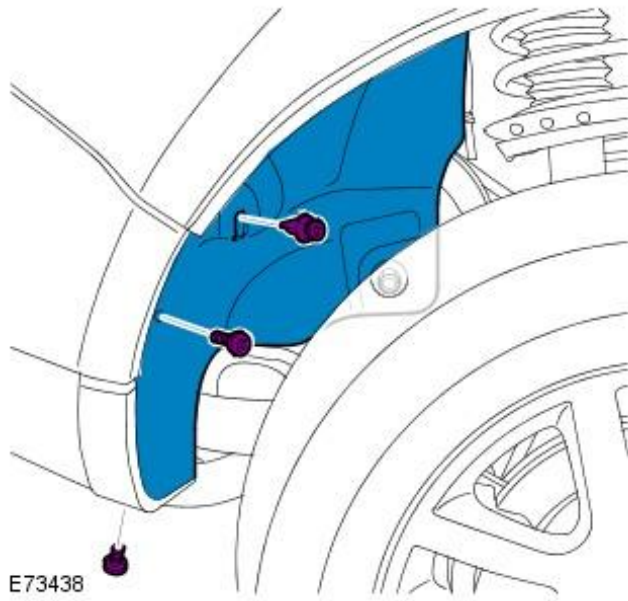
## Parking Aid - Rear Outer Parking Aid Sensor

Removal and Installation

### Removal

1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.  
Release the fender splash shield.



## Installation

**1. CAUTION:** If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.  
To install, reverse the removal procedure.