SECTION : 413-13 Parking Aid

VEHICLE APPLICATION : 2008.0 Falcon

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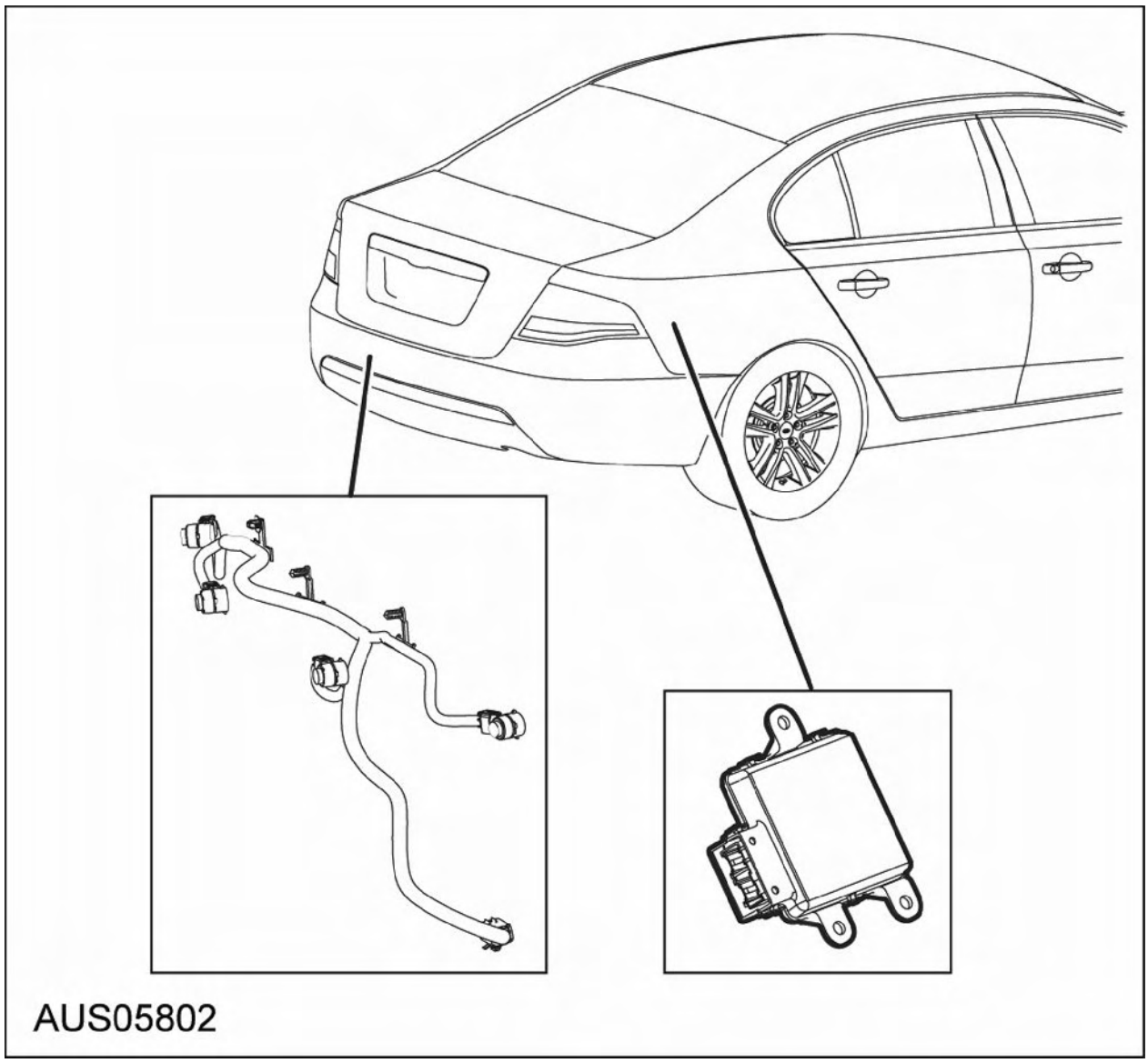
COMPONENT LOCATION

Reverse Sensing System (RSS)



Item	Description
1	Park Aid Module - (PAM)
2	Ultrasonic sensor (x4)
3	Ultrasonic sensor wiring harness

The system consists of four ultrasonic sensors mounted in the rear bumper, a controller and an audio warning output that is emitted from the rear audio speakers. The system measures the distance to the closest obstacle when reversing and emits a corresponding audible warning.

The reverse sensing system is an auxiliary system that is not intended to relieve the driver of their responsibility for exercising due care and attention when reversing.

The sensors sequentially transmit short ultrasonic pulses 48kHz then listen for the echo reflected from the detected object. The electronic control unit using triangulation data from the four sensors calculates the distance. Various sound absorbing/reflecting materials or operating conditions can have an effect on the detection range:

- Ultrasonic waves, heavy rain and/or conditions causing disruptive reflections may lead to objects not being detected by the sensors.
- In addition, objects that absorb ultrasonic waves may not always be detected due to their unfavorable surface characteristics.
- Sensors that are covered in dirt, ice or mud may cause the system to detect objects incorrectly.

DESCRIPTION AND OPERATION (Continued)

- If the vehicle sustains damage to the rear bumper/fascia, leaving it misaligned or bent, the sensing zone may be altered causing inaccurate measurement of obstacles or false alarms.

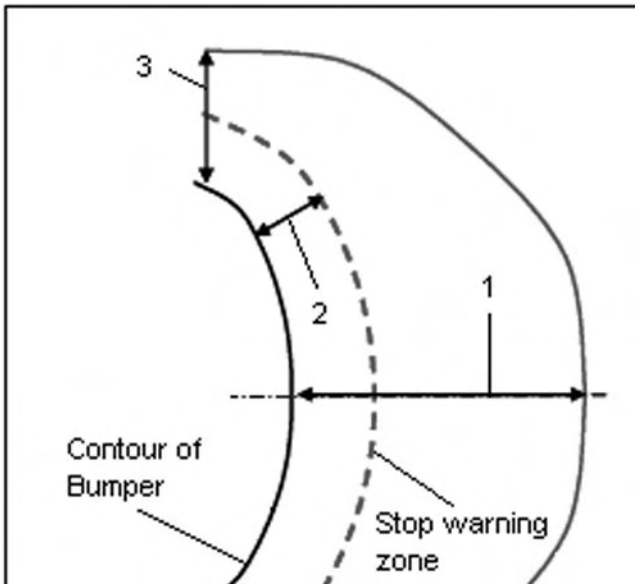
The system is initialised after the ignition is turned on and is powered up always when the ignition is in the on position. The reverse sensing or measurement mode will commence when reverse gear is engaged.

The gear position information, when reverse gear is selected, is transmitted to the Park Assist Module (PAM) via the CAN bus.

When the PAM is initiated an audible tone (roger tone) will then sound for 0.5 seconds.

The reverse sensing system will detect objects within the sensor range (within approximately 180cm). The coverage area is decreased around the outer corners of the bumper.

PAS field of view



Item	Description
1	Defines the start of the warning zone in the central area of detection - 180 cm
2	Defines the start of the stop warning zone - 30 cm side 40 cm rear
3	Defines the start of the lateral distance zone - 50 cm

When an object is detected within the sensor range, an intermittent warning tone is emitted. As the distance between the object and the sensors decreases, the warning tone will sound at shorter intervals. A continuous warning tone sounds if the object is within 30 cm of the rear bumper.

A summary of the warning tones is included in the table below. Reverse sensing system is separated into seven audio and six visual outputs according to the following table. The distances in this table are measured directly from sensor face.

The output frequency and volume is controlled by the Audio system

Range zone table

Range zone	Warning range	Tone on	Visual
Range zone 1	<= 30 cm	Continuous	R
Range zone 2	<= 40 cm	150 ms	Y1
Range zone 3	<= 60 cm	220 ms	Y1
Range zone 4	<= 80 cm	300 ms	Y2
Range zone 5	<= 100 cm	370 ms	G1
Range zone 6	<= 140 cm	450 ms	G2
Range zone 7	<= 180 cm	520 ms	G3
Out of range	> 180 cm	Off	None

Visual information is sent via the CAN network to the visual display device and it indicates the object position graphically, based on four lateral regions each with 6 zones

WARNING: When towing a trailer a switch fitted to the Ford vehicle harness socket is used to disable the system. The trailer installed switch is monitored by the BEM and the status is sent to the PAM via the CAN bus. Ensure that when a trailer is attached to the vehicle that the PID in the PAM indicates this correctly. Some after market trailer plugs may not incorporate the correct hardware.

System Components

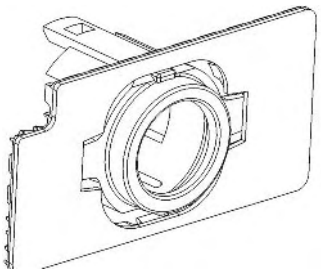
The system comprises of

Qty	Description	Part number
1	Park Aid Module (PAM)	8R29 15K866 AA
1	PAM Insulation adhesive foam	8R29 15B860 AA
4	RSS Ultrasonic sensor	8R29 15K859 AAW
4	RSS Senor housing	8R29 15K861 AAW
4	RSS Decoupling ring	3R23 15A869 AA

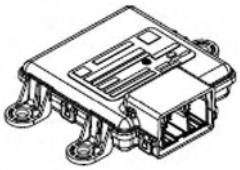
DESCRIPTION AND OPERATION (Continued)

Ultrasonic sensor

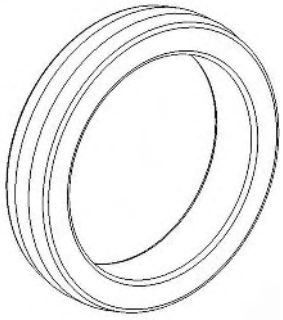
Sensor housing



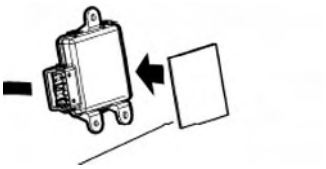
PAM



Decoupling ring



PAM Adhesive Foam



Other Information

Painting specifications for Ultrasonic sensors

The ultrasonic sensors are painted to match the vehicle colour range. Paint is applied to a maximum thickness of 120µm; additional paint must not be applied, as this will effect the operational range of the sensor. Sensors cannot be reworked once painted, if incorrect color or thickness, the sensor cannot be stripped of paint and reused the complete sensor must be replaced

Aftermarket sensors

Aftermarket sensors are unpainted and are packed in a cardboard package that exposes the aluminium membrane for spray painting, once painted remove the cardboard surround. The membrane has a yellow chromate finish so that the finish paint can adhere easily. This coating must be clean and dry before paint application. Alcohol may be applied with a clean lint free cloth, ensure the edge of the membrane is also cleaned. Ultrasonic cleaning must not be used. Scratched or damaged membranes are unserviceable; the complete sensor must be replaced.

Painting sensors

Paint must be applied to a maximum thickness of 120µm with no runs. A waiting time of 24 hours is recommended after painting and drying to ensure a durable finish.

The drying temperature must not exceed 105°C with a maximum drying time of 30 minutes, exceeding this will damage / render inoperable the sensor. Sensors are normally housed in a paint box that exposes only the areas to be painted.

Storage of unpainted sensors

Storage temperature -57 to 100°

Relative humidity 80%

Storage duration 6 Months

Longer storage times before painting will degrade the primed surface.

Operate a first in, first out parts supply.

ESD Protection

All work that is carried where it is possible to touch the connector pins, proper ESD protection procedures must be followed. Eg a grounded wrist strap and an anti static mat.

DIAGNOSIS AND TESTING

Parking Aid

Inspection and Verification

1. Verify the customer's concern by operating the park assist system.
2. Visually inspect the reverse sensing system, referring to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Damage to bumper around sensors • Damage to the interior boot lining • Sensors loose in bumper • Sensors covered in dirt, snow, ice, etc • Damage to connectors on sensors or wiring loom • Trailer connector plug damaged / missing / loose?	• Ignition is operational • Check reverse gear is able to be selected • Audio system (rear speakers) are operational • Sensors are connected to wiring loom • Battery is charged

NOTE: Reverse sensing system will NOT operate if reverse gear can not be selected.

3. If the cause of the customer concern is not visually obvious proceed to:
   - PDS Test Procedures (preferable method) or
   - Symptom chart and Pinpoint tests (if PDS is not available)

PDS Test Procedure

Self Test and Functional Tests

Self test 1: Using the PDS Tester it is possible to conduct an on demand self test.

The pre-conditions for this test are as follows:

- Ignition key turned to the ignition on position,

There must be nothing in the field of view of the sensors.

The Self Test checks application data integrity in PAM and performs attenuation test on all four sensors. The test takes approximately 6.0 seconds to run.

Any errors are logged as On-demand Diagnostic Trouble Codes (DTCs). If any DTCs are logged please go to the **DTC Chart** for more information.

Self test 2: Using the PDS Tester it is possible to conduct an Assembly self test. The pre-conditions for this test are as follows:

- Ignition key turned to the ignition on position

The Self Test checks application data integrity in PAM and does not perform attenuation test on sensors. The test takes approximately 4.0 seconds to run.

Any errors are logged as On-demand Diagnostic Trouble Codes (DTCs). If any DTCs are logged please go to the **DTC Chart** for more information.

Module Configuration

The park assist module has several preset configurations to enable correct operation and calibration. When a new PAM is introduced to the vehicle the configuration information must be downloaded into the new PAM for correct operation.

This configuration procedure can only be installed / loaded via the PDS.

DTC Chart

DTC	Description	Possible Cause
B1298	Power Supply Sensor Circuit Short to battery	The Sensor Supply circuit is shorted to vehicle supply. ie. The voltage at PAM Pin B4 is > 9.2 V. GO to Pinpoint Test A.
B1299	Power Supply Sensor Circuit Short To Ground	The Sensor Supply circuit is shorted to Ground. ie. The voltage at PAM Pin B4 is < 7.2 V. GO to Pinpoint Test C.
B1317	ECU Battery Voltage High	The system supply has exceeded maximum threshold 16V Check charging system
B1318	ECU Battery Voltage Low	The system supply has exceeded minimum threshold 9 V Check charging system

DIAGNOSIS AND TESTING (Continued)

DTC	Description	Possible Cause
B1342	ECU is Faulted	There may be an internal fault in the PAM. Retry self test. If DTC is logged again then, replace PAM.
B2477	Module Configuration Failure	PAM configuration has failed or not been set. Configure module using PDS.
C1699	Left Rear Sensor Circuit Short to Vbat	The Sensor Signal circuit is shorted to supply. ie.The voltage at PAM Pin B5 is > 9.0 V. GO to Pinpoint Test A.
C1700	Left Rear Sensor Circuit Failure	The Sensor Signal circuit failure is possibly due to membrane damage or blockage ie. The signal at PAM pin B5 is incorrect. GO to Pinpoint Test E.
C1701	Left Rear Sensor Circuit Fault	An incorrect signal has been received from the Sensor. There may be an internal fault in the Sensor. Replace Sensor.
C1702	Right Rear Sensor Circuit Short to Vbat	The Sensor Signal circuit is shorted to supply. ie. The voltage at PAM Pin B1 is > 9.0 V. GO to Pinpoint Test A.
C1703	Right Rear Sensor Circuit Failure	The Sensor Signal circuit failure is possibly due to membrane damage or blockage ie. The signal at PAM pin B1 is incorrect. GO to Pinpoint Test E.
C1704	Right Rear Sensor Circuit Fault	An incorrect signal has been received by the Sensor. There may be an internal fault in the sensor. Replace Sensor.
C1705	Left Rear Centre Sensor Circuit Short to Vbat	The Sensor Signal circuit is shorted to supply. ie. The voltage at PAM pin B3 is > 9.0V. GO to Pinpoint Test A.
C1706	Left Rear Centre Circuit Failure	The Sensor Signal circuit failure is possibly due to membrane damage or blockage ie. The signal at PAM pin B3 is incorrect. GO to Pinpoint Test E.
C1707	Left Rear Center Circuit Fault	An incorrect signal has been received by the Sensor. There may be an internal fault in the sensor. Replace Sensor.

DIAGNOSIS AND TESTING (Continued)

DTC	Description	Possible Cause
C1708	Right Rear Center Sensor Circuit Short to Vbat	The Sensor Signal circuit is shorted to supply. ie. The voltage at PAM pin B2 is > 9 V. GO to Pinpoint Test A.
C1709	Right Rear Center Sensor Circuit Failure	The Sensor Signal circuit failure is possibly due to membrane damage or blockage ie. The signal at PAM pin B2 is incorrect. GO to Pinpoint Test E.
C1710	Right Rear Center Sensor Circuit Fault	An incorrect signal has been received by the Sensor. There may be an internal fault in the sensor. Replace Sensor.
C2786	Left Rear Sensor short to ground or Open Circuit.	The Sensor Signal circuit is shorted to ground or open circuit. ie.The voltage at PAM pin B5 is < 0.5 GO to Pinpoint Test D.
C2787	Right Rear Sensor short to ground or Open Circuit	The Sensor Signal circuit is shorted to ground or open circuit. ie.The voltage at PAM pin B1 is < 0.5 GO to Pinpoint Test D.
C2788	Left Rear Center Sensor short to ground or Open Circuit	The Sensor Signal circuit is shorted to ground or open circuit. ie.The voltage at PAM pin B3 is < 0.5 GO to Pinpoint Test D.
C2789	Right Rear Center Sensor short to ground or Open Circuit	The Sensor Signal circuit is shorted to ground or open circuit. ie.The voltage at PAM pin B2 is < 0.5 GO to Pinpoint Test D.
U0073	Control Module Communication Bus A off	Check CAN bus and power supply to system
U0100	Lost Communication With ECM/PCM	Check CAN bus and power supply to ECM/PCM, Check ECM/PCM DTCs
U0140	Lost Communication With Body Control Module (BEM)	Check CAN bus and power supply to BEM, Check BEM DTCs
U0164	Lost Communication With HVAC Control Module (EATC)	Check CAN bus and power supply to HVAC, Check HVAC DTCs
U0194	Lost Communication With Digital Audio Control Module	Check CAN bus and power supply to Audio control module, Check Audio control module DTCs
U0256	Lost Communication With Front Display Interface Module	Check CAN bus and power to Display interface Module Check FDM DTCs
U0401	Invalid Data Received From ECM/PCM A	Transmission Gear Position or Vehicle Speed Signal invalid Check ECM/PCM DTCs
U0466	Invalid Data Received From HVAC Control Module - Rear	Ambient Air Temperature signal invalid Check HVAC DTCs

DIAGNOSIS AND TESTING (Continued)

DTC	Description	Possible Cause
P0604	Internal Control Module RAM Error	Internal fault in the PAM, replace PAM.
P0605	Internal Control Module ROM Error	Internal fault in the PAM, replace PAM.
P062F	Internal Control Module EEPROM error	Internal fault in the PAM, replace PAM.

PID Chart

PID	Description
CCNT	Number of Continuous Trouble Codes Set
NTCSDT	Number of Continuous Trouble Codes Set due to Diagnostic Test
PAM_STAT	ECU Operating States
SYS_OZ	System Output Zone
BODY_TYPE	Body Type
FLT_COND	Fault Condition
TRAILINS	Trailer Installed
TRANSRV	Transmission in Reverse
FNT_SENS	Parking Aid Front Sensor Status
REAR_SENS	Parking Aid Rear Sensor Status
PARK_SYS	Parking Aid System Status
DEACTISY	Deactivate System
MSTATUS	Module Configuration Status
LC_DIST	Echo value for Left Corner Sensor
RC_DIST	Echo value for Right Corner Sensor
LM_DIST	Echo value for Left Middle Sensor
RM_DIST	Echo value for Right Middle Sensor
VER_MID	Module Type ID (Version)
BODY_MID	Module Type ID (Body Config.)
VBAT	Battery Voltage
SENSOR_VOLT	Sensor Supply Voltage
SYS_OZ	Obstacle in rear parking zone
MSN1AU#PAM	Module serial number (part 1)

Symptom Chart PAM

Symptom Chart

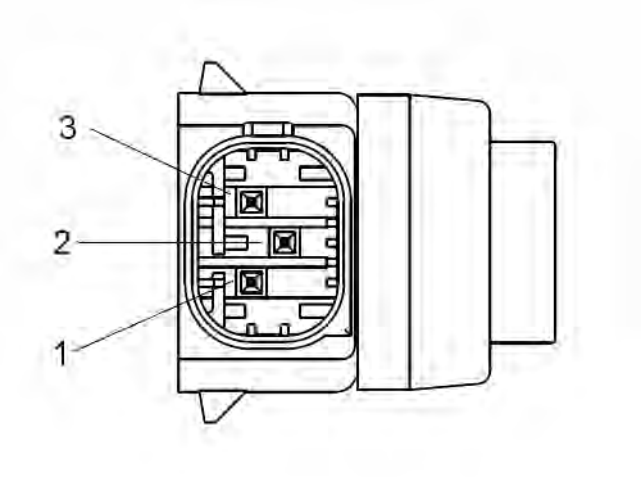
Condition	Source	Action
• No confirmation (roger) tone when reverse gear selected	• Possible power or ground positive supply to the PAM	• Check if vehicle is in reverse. • Check audio system is operatonal • Check power and ground to PAM • Check PIDs ensure correct PAM settings • Ensure CAN network integrity
• Speaker beeping continuously.	• Sensor fault, PAM fault or audio system Fault	• Ensure no obstacles in the PAM field of view • Check PIDs associated with echo values and obstacle in field of view. If no obstacle evident replace PAM • Run on demand self test

DIAGNOSIS AND TESTING (Continued)

Condition	Source	Action
• No speaker output	• Wiring fault • Audio system fault • PAM fault	• Check sensor wiring including supply signal and ground • Check DTCs • Check audio system is operational • Check power and ground to PAM • Check PIDs ensure correct PAM settings • Ensure CAN network integrity
• Continuous beep when trailer connected	• Wiring fault • PAM fault • Non Ford approved trailer plug	• Check trailer plug is actually plugged in • Check PID TRAILINS to ensure recognition • Check PIDs associated with echo values and obstacle in field of view. If no obstacle evident replace PAM

Connector Circuit Reference

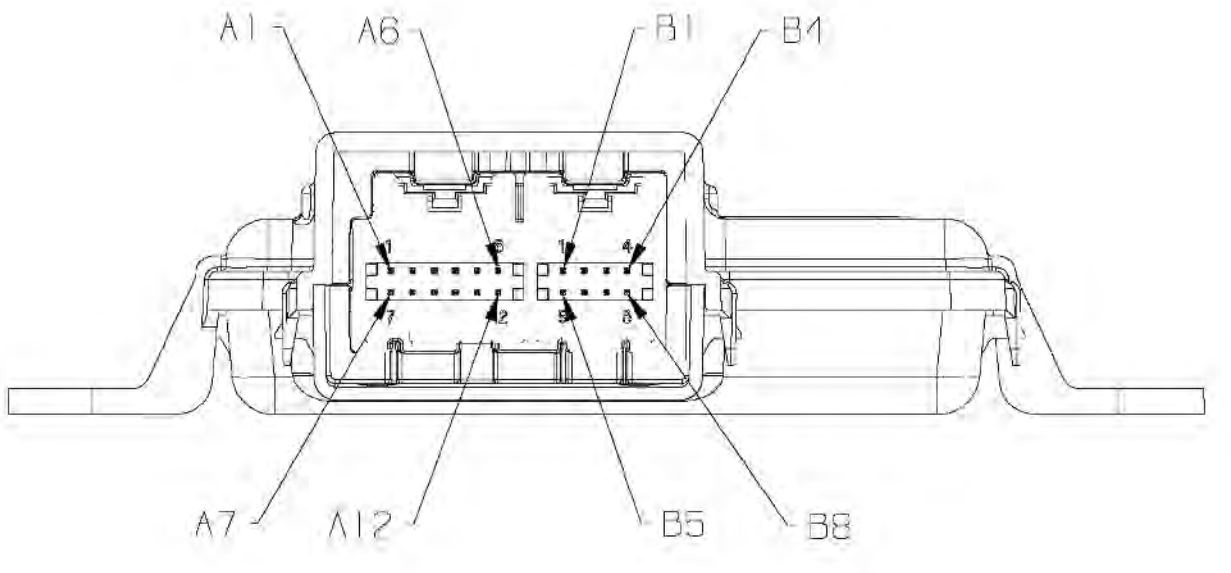
Sensor Connector Diagram



Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
1	Sensor Signal	Sensor Connected and with No object in Sensor's field of view. 8.5 V +/- 0.5 V (approx) - asynchronous data signal
2	Sensor return (ground)	0 Volts
3	Sensor power supply	8 - 8.5 Volts

DIAGNOSIS AND TESTING (Continued)

PAM Connector Diagram



Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
A1	PAM supply	+12 Volts
A6	CAN B + high	
A11	System ground	0 Volts
A12	CAN B - low	
B1	Right Rear Sensor (8)	Asynchronous data transmission
B2	Right Rear Centre Sensor (9)	Asynchronous data transmission
B3	Left Rear Centre Sensor (10)	Asynchronous data transmission
B4	Sensor positive supply	+8.5 Volts +/- 0.5
B5	Left Rear Sensor (11)	Asynchronous data transmission
B6	Sensor Ground	< 0.5 volts

Pinpoint tests

PINPOINT TEST A : SENSOR SHORT CIRCUIT TO VBAT

Test Step		Result / Action to Take
A1	**CHECK SENSOR SIGNAL WIRE**	
	• Remove bumper. Refer to Bumper section for instructions for removal of bumper • Unplug sensor. • Ignition key in on position, measure voltage on sensor signal wire. • **Is Voltage < 1V?**	**Yes** Go to **A2** **No** Go to **B1**
A2	**CHECK SENSOR SIGNAL WIRE WITH SENSOR ATTACHED**	
	• Plug in sensor • Measure voltage on sensor signal wire. • **Is voltage > 5V?**	**Yes** Go to **A3** **No** Go to **C1**

DIAGNOSIS AND TESTING (Continued)

Test Step		Result / Action to Take
A3	**CHECK SENSOR SIGNAL WIRE WITH SENSOR ATTACHED AND OBJECT DETECTED BY SENSOR**	
	• Plug in sensor. Ignition key in on position and reverse selected • Monitor voltage on sensor signal wire with an oscilloscope. • Place your hand in front of the sensor. • **Does the voltage drop when your hand is placed in front of the sensor?**	**Yes** Go to **A4** **No** Internal short circuit in sensor. Replace sensor. Retest system for correct operation.
A4	**CHECK CONTINUITY OF THE SENSOR SIGNAL WIRE BETWEEN THE SENSOR AND THE PAM**	
	• Unplug PAM and sensor. • Measure resistance of sensor signal wire between sensor connector and PAM connector. • **Is resistance = open circuit?**	**Yes** Open circuit in wiring loom. Please refer to schematics section for information on wiring. **No** Perform on demand self test if sensor error still present replace PAM. Retest for correct operation.

PINPOINT TEST B : SENSOR SHORT CIRCUIT TO VBAT

Test Step		Result / Action to Take
B1	**CHECK RESISTANCE BETWEEN SENSOR SIGNAL WIRE AND SENSOR SUPPLY WIRE**	
	• Unplug PAM and sensor. Refer to removal and installation section of entry for instructions for accessing module. • Measure resistance between sensor signal wire and sensor supply wire • **Is resistance = open circuit?**	**Yes** Internal short circuit in PAM. Replace PAM. Retest for correct operation. **No** Short circuit in wiring loom. Check wiring loom for short circuit. Please refer to schematics section for information on wiring.

PINPOINT TEST C : SENSOR POWER SUPPLY SHORT CIRCUIT TO GROUND

Test Step		Result / Action to Take
C1	**CHECK SENSOR SUPPLY WIRE**	
	• Remove bumper. Refer to Bumper section for instructions for removal of bumper • Unplug all 4 sensors. • Ignition key in on position, measure voltage on sensor supply wire. • **Is Voltage > 7V?**	**Yes** Go to **C2** **No** Go to **C3**
C2	**CHECK SENSOR SUPPLY WIRE WITH SENSOR ATTACHED**	
	• Plug in each sensor (one at a time) • Measure voltage on sensor supply wire. • **Is voltage < 7V ?**	**Yes** Internal short circuit in sensor. Replace sensor. Retest system for correct operation. **No** Retest for correct operation. If the same Fault is constantly present, Replace PAM.

DIAGNOSIS AND TESTING (Continued)

Test Step		Result / Action to Take
C3	**CHECK RESISTANCE BETWEEN SENSOR SUPPLY, SENSOR EARTH WIRE AND VEHICLE GROUND**	
	• Unplug PAM and sensor. • Measure resistance between sensor supply wire, and sensor ground wire and vehicle ground. • **Is resistance = short circuit?**	**Yes** Short circuit in wiring loom. Check wiring loom for short circuit. Please refer to schematics section for information on wiring. **No** Go to **C4**.
C4	**CHECK CONTINUITY OF THE SENSOR SUPPLY WIRE BETWEEN THE SENSOR AND THE PAM**	
	• Unplug PAM and sensor. • Measure resistance of sensor supply wire between sensor connector and PAM connector. • **Is resistance = open circuit?**	**Yes** Open circuit in wiring loom. Please refer to schematics section for information on wiring. **No** Replace PAM. Retest for correct operation.

PINPOINT TEST D : SENSOR SIGNAL WIRE SIGNAL SHORT CIRCUIT TO GROUND

Test Step		Result / Action to Take
D1	**CHECK RESISTANCE BETWEEN SENSOR SIGNAL WIRE AND SENSOR RETURN WIRE (IE.GROUND)**	
	• Unplug connector from PAM. Refer to removal and installation section of entry for instructions for accessing module. • Remove bumper from vehicle. Refer to Bumper section for instructions for removal of bumper • Unplug sensor from wiring loom. • Measure resistance between sensor signal wire and sensor return (ground) wire or vehicle ground. • **Is measured resistance short circuit?**	**Yes** Short circuit in wiring loom. Locate fault and repair harness. Please refer to schematics section for information on wiring. **No** Go to **D2**
D2	**CHECK CONTINUITY OF SENSOR SIGNAL WIRE**	
	• Check continuity of sensor signal wire between the PAM and sensor connectors. • **Is there an open circuit in the harness?**	**Yes** Fault in wiring loom. Locate fault and repair harness. Please refer to schematics section for information on wiring. **No** Go to **C1**

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST E : SENSOR CHECK

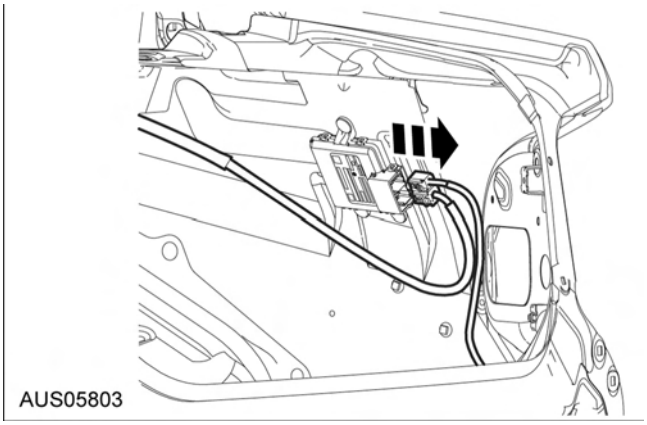
Test Step		Result / Action to Take
E1	**CHECK SENSOR SIGNAL WIRE WITH SENSOR ATTACHED AND OBJECT DETECTED BY SENSOR**	
	• Ensure all sensors are clean and free from dirt mud, ice and obstructions. • Ensure all decoupling rings are installed and not damaged. • Ensure detecting zone is clear and free from obstacles - towbar hitch/bicycle rack etc. • Perform on demand self test. • **System self test ok?**	**Yes** End of test sequence - retest for correct operation **No** Replace faulty sensor • Perform on demand self test - and retest for correct operation

REMOVAL AND INSTALLATION

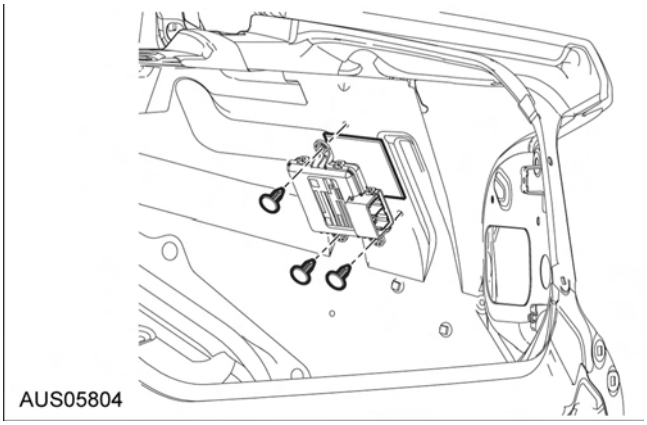
Reverse Sensing System PAM

Removal

1. Remove fir trees on rear boot trim.
2. Pull back rear boot trim and shift it of the way. For additional information refer to section 501-05.
3. Remove the electrical connector from module.



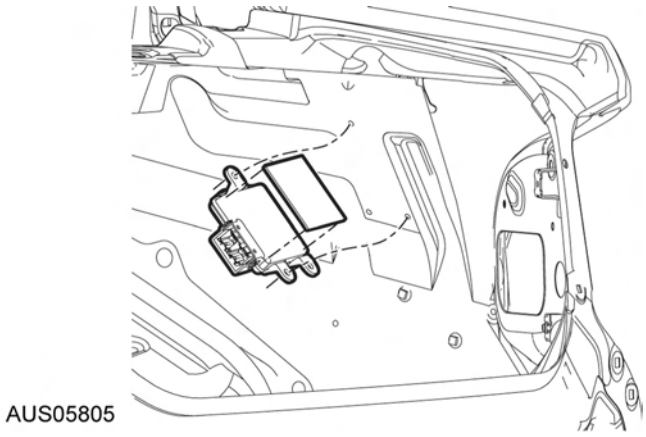
4. Remove fir trees.



5. Remove the module.
   NOTE: The module is retained by an adhesive foam.

Installation

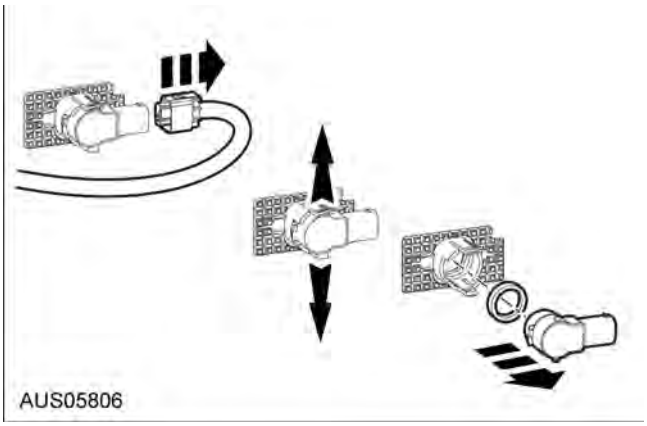
1. To install, reverse the removal process.
   NOTE: Apply adhesive foam on to module prior to assembling the module to vehicle.



Sensors

Removal

1. Remove the rear bumper. For addition information, refer to section 501-19.



2. Disconnect the wiring harness.
3. Gently pry the catches on the holder to unlatch the sensor.
4. Remove the decoupling ring.
5. Remove the sensor.
6. Remove the sensor bezel (If required).

Installation

1. To install, reverse the removal process.