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MODULE COMMUNICATIONS NETWORK

COMMUNICATIONS NETWORK (G1226421)

PRINCIPLES OF OPERATION

For a detailed description of the Communications Network, refer to the relevant Description and Operation sections in the workshop manual.

INSPECTION AND VERIFICATION

**CAUTIONS:**

- 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.
- Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

0. Verify the customer concern

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

Visual Inspection**ELECTRICAL**

- Fuses (refer to electrical guide)
- Wiring harness
- Correct engagement of electrical connectors
- Loose or corroded connections
- Routing of fibre optic harnesses
- Correct engagement of optical connectors
- Correct placement of optical connectors (ring order)
- Correct assembly of optical connectors (backout, etc)
- Damage to fibre (chafing, abrasion, kinking, cuts, etc)

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

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

SYMPTOM CHART

SYMPTOM	POSSIBLE CAUSES	ACTION
MOST network fault - Entertainment system on/off switch amber LED flashing	<ul style="list-style-type: none">■ MOST ring broken■ Control module on MOST network power or ground circuit open circuit, high resistance■ Control module on MOST network internal failure	<ul style="list-style-type: none">■ GO to Pinpoint Test B.
MOST network fault - Touch screen display blank	<ul style="list-style-type: none">■ Touch screen display power or ground circuit open circuit, high resistance■ Touch screen display internal failure	<ul style="list-style-type: none">■ GO to Pinpoint Test G.

CONTROLLER AREA NETWORK (CAN)

Control Module Connections to the CAN Harness

Control modules are connected to the CAN harness either in a 'loop' or 'spur' configuration. In the 'loop' type configuration the CAN harness loops into the module (via two connector pins) and then loops out of the module (via another two connector pins). In the 'spur' type configuration, a harness spur is spliced into the main 'backbone' of the CAN harness and the module is connected to the harness spur via two connector pins.

CAN Harness Architecture

For a detailed description of the CAN Networks and architecture, refer to the relevant Description and Operation section in the Workshop Manual.

CAN Network Integrity Tests

If a control module is suspected of non-communication, the Network Integrity test application available on the manufacturer approved diagnostic system can be used to confirm if communication is possible between the control modules on the vehicle and the manufacturer approved diagnostic system (via the J1962 diagnostic connector). The results from the test can be used to determine if either a single module or multiple modules are failing to communicate.

CAN Terminating Modules

If the Network Integrity test indicates that one or more module on one of the CAN networks (HS or MS) are failing to communicate, there are several checks that can be made. The first step is to identify if both of the CAN terminating modules on each individual CAN Bus are communicating. If both CAN terminating modules for each individual CAN Bus are communicating (identified via the Network Integrity test), then it can be confirmed that the main 'backbone' of the CAN harness is complete. The main 'backbone' of the CAN harness consists of all the modules connected to the CAN harness via a 'loop' configuration and also includes the two terminating modules.

Communication with both CAN terminating modules via the Network Integrity test confirms the physical integrity of the main 'backbone' of the CAN harness (and the harness spur to the J1962 diagnostic connector). This means that there is no requirement to check the resistance of the CAN Network. This is because the standard check for 60 ohms

across the CAN High and CAN Low lines will not provide any additional information regarding the physical condition of the CAN harness, beyond what has already been determined from the Network Integrity test.

Non-Communication of a Terminating Module

If a Network Integrity test reveals a terminating module is failing to communicate it can indicate a break in the main 'backbone' of the CAN harness. The first checks should always be to confirm the power and ground supplies to the non-communicating module are correct. Providing these are correct, the resistance between the CAN High and CAN Low lines at the J1962 connector can be checked to determine the integrity of the main 'backbone' of the CAN harness. After disconnecting the battery a reading of 120 ohms would indicate an open circuit in the main 'backbone' of the CAN harness. Alternatively, a reading of 60 ohms would indicate that there is no open circuit fault with the main 'backbone' of the CAN harness.

It is worth noting that even if one of the terminating modules is disconnected from the CAN harness, communications between the modules still connected may still be possible. Therefore communication between the manufacturer approved diagnostic system and the connected modules may also be possible.

Locating CAN Harness Open Circuits

In the case where multiple modules, including a terminating module, are failing to communicate, having first confirmed the power and ground supplies are correct, the approximate location of the open circuit can be identified from analysis of the Network Integrity test results and reference to the relevant CAN network circuit diagrams. For example, if an open circuit existed in a certain position on the CAN harness, any module positioned on the Network between the J1962 connector and the open circuit should return a response during the Network Integrity test. No responses would be returned from any modules past the open circuit fault in the Network.

CAN Harness 'Spur' Type Configuration Circuits

If, after the initial checks (Network Integrity test using the manufacturer approved diagnostic system, and power and ground supplies to the module have been checked and confirmed as correct), a module that is connected to the CAN harness via a 'spur' type configuration is suspected of not communicating, then the physical integrity of the CAN harness 'spur' can be checked.

This is most easily undertaken by individually checking the continuity of the CAN High and CAN Low lines between the non-communicating module connector (with the module disconnected) and the J1962 diagnostic connector.

'Lost Communications' DTCs

As well as the methods described so far in this document, which can be used to determine the location of an open circuit in the CAN harness, 'Lost Communications' DTCs can also be used for this purpose. Lost communication DTCs mean that a module is not receiving CAN information from another module.

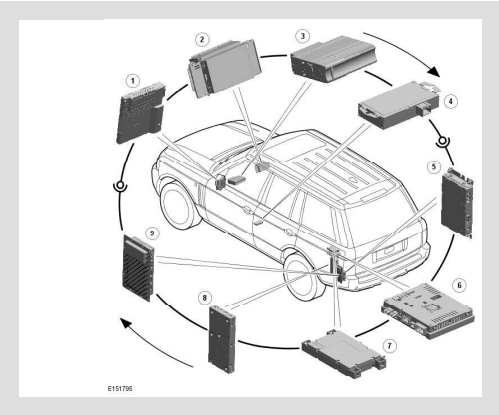
For example, if a global DTC read were to be carried out, only DTCs stored in the modules that the manufacturer approved diagnostic system could communicate with would be displayed. If there was an open circuit fault in a certain position on the CAN harness, the modules that could display DTCs would all be prior to the open circuit on the Network, and these modules should display 'Lost Communications' DTCs with all the modules located on the Network past the open circuit fault.


'Bus off' DTCs

The references to bus and its condition refer to the network concerned and the modules on that network.

If a module logs a 'Bus Off' DTC, it means that the module has detected CAN transmission errors and has disabled it's own CAN transmissions and disconnected itself from the network in an attempt to allow the rest of the network to function. At this point the 'Bus Off' DTC is set. A common cause of 'Bus Off' DTCs can be a short circuit in the CAN network.

MEDIA ORIENTED SYSTEMS TRANSPORT (MOST)



 **NOTE:**

Items 1, 2 and 9 will always be present. The remaining items are optional and/or market specific.

ITEM	DESCRIPTION
1	Audio head unit
2	Touch screen display
3	CD autochanger
4	Portable audio interface module
5	DAB tuner module
6	Television receiver
7	Telephone module
8	Rear seat entertainment module
9	Power amplifier

Overview

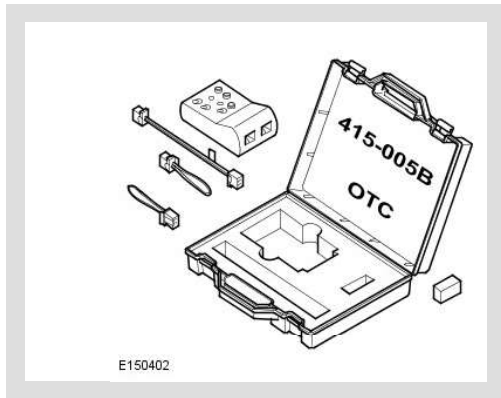
The basic guidelines are covered in the description and operation section, such as not attempting to repair fibre optic cables, but additional precautions include:

- Do not touch the exposed ends of the optical fibres (grease from skin can contaminate the fibre)
- Whenever the fibre optic cable is disconnected, cover the connectors to prevent dust contamination

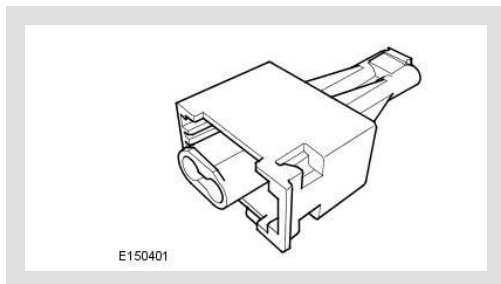
- Do not expose the fibre optic cable to heat
- Do not bend the fibre optic cable through less than a 25 mm (one inch) radius
- Do not use laser pens to test the fibre optic cable's ability to pass light

MOST Diagnostic Tools

There are two dedicated tools for testing the MOST system:





MOST tester. The MOST tester is connected to the MOST network in place of a control module. It will confirm receipt of any existing MOST signal and transmit it to the next control module on the network. Perform the following tests to validate the operation of the MOST tester. GO to Pinpoint Test [A](#).





MOST prism: The MOST prism is connected in the same way as the MOST tester but will simply reflect any existing signal onward to the next control module. Using the MOST prism before or after a long run of harness may cause a ring break as a good signal may be too weak after travelling the extended distance. Also, the MOST prism will pass light in either direction so will not detect reversed MOST terminals elsewhere in the network. For these reasons, the MOST tester is the preferred tool and should be used unless limited access does not permit it

MOST Ring Break Indication

A ring break in the MOST network is indicated by a loss of functionality and the entertainment system on/off switch amber LED flashing. The touch screen will default to the logo screen if the fault is present at the start of the ignition cycle and will freeze on the current screen if the fault occurs during an ignition cycle. Possible causes of ring breaks are listed in the symptom chart.

PINPOINT TEST A : MOST TESTER TESTS	
A1: MOST TESTER BATTERY TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Set the MOST tester power switch to 'on'
	Is the power LED illuminated? Yes Test passed. GO toA2. No Test failed. Install a new battery into the MOST tester. GO toA1.
A2: 2+0 INPUT/OUTPUT TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<div>  NOTES: <ul style="list-style-type: none"> '2+0' indicates that the loop harness connector consists of 2 fibre optic terminals and 0 electrical terminals. The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault. </div>	
	1 Set the MOST tester power switch to 'on'
	2 Set the connector selector switch to '2+0'
	3 Set the indication switch to 'beep' or 'LED'
	4 Remove the covers from the MOST tester 2+0 connector and the 2+0 loop harness connector
	5 Connect the 2+0 loop harness to the MOST tester 2+0 connector
	6 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes Test passed. GO toA3. No Test failed. MOST tester or 2+0 harness fault
A3: 2+4 INPUT/OUTPUT TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<div>  NOTES: <ul style="list-style-type: none"> '2+4' indicates that the loop harness connector consists of 2 fibre optic terminals and 4 electrical terminals. The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault. </div>	
	1 Set the MOST tester power switch to 'on'
	2 Set the connector selector switch to '2+4'
	3 Set the indication switch to 'beep' or 'LED'
	4 Remove the covers from the MOST tester 2+4 connector and the 2+4 loop harness connector
	5 Connect the 2+4 loop harness to the MOST tester 2+4 connector


A3: 2+4 INPUT/OUTPUT TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	6 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes Test passed. GO to A4. No Test failed. MOST tester or 2+4 harness fault
A4: ADAPTER HARNESS AND PRISM TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<div>  NOTE: The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault. </div>	
	1 Set the MOST tester power switch to 'on'
	2 Set the connector selector switch to '2+0'
	3 Set the indication switch to 'beep' or 'LED'
	4 Remove the covers from the MOST tester 2+0 connector, the prism, and the adapter harness connectors
	5 Connect the adapter harness to the MOST tester 2+0 connector
	6 Connect the prism to the adapter harness
	7 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes Test passed No Test failed. MOST tester, adapter harness or prism fault


PINPOINT TEST B : MOST NETWORK INITIAL TESTS	
B1: MOST NETWORK INITIAL TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<div>  NOTE: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use </div>	
	1 Switch on the audio/video system
	2 Disconnect the MOST harness connector from the power amplifier
	3 Set the MOST tester power switch to 'on'
	4 Connect the MOST harness connector to the MOST tester

PINPOINT TEST B : MOST NETWORK INITIAL TESTS	
B1: MOST NETWORK INITIAL TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	5 Check the entertainment system on/off switch amber LED for indication of a MOST network fault
	Has the MOST network been restored? Yes The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E. No The disconnected control module is not causing MOST network fault. GO to B2.
B2: MOST NETWORK INITIAL TEST 2	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes MOST signal received. The MOST network fault is located downstream of the MOST tester. GO to Pinpoint Test C. No MOST signal not received. The MOST network fault is located upstream of the MOST tester. Disconnect the MOST harness connector from the MOST tester and reconnect it to the control module. GO to Pinpoint Test D.

PINPOINT TEST C : MOST NETWORK DOWNSTREAM TESTS	
C1: MOST NETWORK DOWNSTREAM TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Disconnect the MOST harness connector from the audio head unit
	2 Direct the MOST harness connector at a suitable surface and check for the presence of red light
	Is red light present? Yes GO to Pinpoint Test H. No The fault is in the MOST harness between the MOST tester and the audio head unit. Install a new MOST harness as necessary

PINPOINT TEST D : MOST NETWORK UPSTREAM TESTS	
D1: MOST NETWORK UPSTREAM TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Refer to the electrical circuit diagrams and identify the preceding control module on the MOST network
	Is this control module the touch screen display? Yes GO to Pinpoint Test F. No GO to D2.

D2: MOST NETWORK UPSTREAM TEST 2	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Disconnect the MOST harness connector from the control module
	2 Direct the MOST harness connector at a suitable surface and check for the presence of red light
	<p>Is red light present?</p> <p>Yes</p> <p>The MOST network fault is in the control module or the MOST harness to the succeeding control module. GO to D3.</p> <p>No</p> <p>The MOST network fault is located upstream of the disconnected control module. Reconnect the MOST harness connector to the control module. GO to D1.</p>
D3: MOST NETWORK UPSTREAM TEST 3	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<div>  NOTE: </div> <div> <p>When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use</p> </div>	
	1 Connect the MOST harness connector to the MOST tester
	2 Check the entertainment system on/off switch amber LED for indication of a MOST network fault
	<p>Has the MOST network been restored?</p> <p>Yes</p> <p>The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E.</p> <p>No</p> <p>The fault is in the MOST harness between the MOST tester and the succeeding control module. Install a new MOST harness as necessary</p>

PINPOINT TEST E : CONTROL MODULE TESTS	
E1: CONTROL MODULE TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<div>  NOTE: </div> <div> <p>When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use</p> </div>	
	1 Connect the MOST tester to the relevant control module using the adapter harness
	<p>Did the MOST tester emit a tone or illuminate the LED?</p> <p>Yes</p> <p>MOST signal received. Tests inconclusive. Reconnect the MOST harness connector to the control module and confirm that the MOST network fault is still present. Repeat the tests from the beginning. GO to Pinpoint Test B.</p> <p>No</p> <p>GO to E2.</p>

E2: CONTROL MODULE TEST 2	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Refer to the electrical circuit diagrams and test the relevant control module power and ground circuits for open circuit, high resistance
	Are the power and ground circuits within specification? Yes GO to E3. No Repair the power and/or ground circuit
E3: CONTROL MODULE TEST 3	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Reconnect the MOST harness connector to the control module
	2 Check the entertainment system on/off switch amber LED for indication of a MOST network fault
	Has the MOST network been restored? Yes Tests inconclusive. Repeat the tests from the beginning. GO to Pinpoint Test B. No Install a new control module

PINPOINT TEST F : MOST NETWORK FINAL UPSTREAM TESTS	
F1: MOST NETWORK FINAL UPSTREAM TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Disconnect the MOST harness connector from the touch screen display
	2 Direct the touch screen display at a suitable surface and check for the presence of red light
	Is red light present? Yes The fault is in the MOST harness between the touch screen display and the succeeding control module. Install a new MOST harness as necessary No GO to F2.
F2: MOST NETWORK FINAL UPSTREAM TEST 2	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Direct the MOST harness connector at a suitable surface and check for the presence of red light
	Is red light present? Yes GO to F3. No GO to F4.
F3: MOST NETWORK FINAL UPSTREAM TEST 3	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Reconnect the MOST harness connector to the touch screen display

F3: MOST NETWORK FINAL UPSTREAM TEST 3	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Set the ignition switch to 'off'
	3 Set the ignition switch to 'on'
	<p>Has the touch screen display operation been restored?</p> <p>Yes</p> <p>Tests inconclusive. Repeat the tests from the beginning. GO to Pinpoint Test B.</p> <p>No</p> <p>Install a new touch screen display</p>
F4: MOST NETWORK FINAL UPSTREAM TEST 4	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Disconnect the MOST harness connector from the audio head unit
	2 Direct the audio head unit at a suitable surface and check for the presence of red light
	<p>Is red light present?</p> <p>Yes</p> <p>The fault is in the MOST harness between the audio head unit and the touch screen display. Install a new MOST harness as necessary</p> <p>No</p> <p>GO to Pinpoint Test H.</p>

PINPOINT TEST G : BLANK SCREEN TESTS	
G1: BLANK SCREEN TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Refer to the electrical circuit diagrams and test the touch screen display power and ground circuits for open circuit, high resistance
	<p>Are the power and ground circuits within specification?</p> <p>Yes</p> <p>GO to G2.</p> <p>No</p> <p>Repair the power and/or ground circuit</p>
G2: BLANK SCREEN TEST 2	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Set the ignition switch to 'off'
	2 Set the ignition switch to 'on'
	<p>Has the touch screen display operation been restored?</p> <p>Yes</p> <p>Tests inconclusive. Repeat the tests from the beginning. GO to Pinpoint Test B.</p> <p>No</p> <p>Install a new touch screen display</p>

PINPOINT TEST H : AUDIO HEAD UNIT TESTS	
H1: AUDIO HEAD UNIT TEST 1	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Using the manufacturer approved diagnostic system, check the audio head unit for related DTCs
	Is communication possible between the manufacturer approved diagnostic system and the audio head unit? Yes Refer to the relevant DTC index No GO toH2.
H2: AUDIO HEAD UNIT TEST 2	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Refer to the electrical circuit diagrams and test the audio head unit power and ground circuits for open circuit, high resistance
	Are the power and ground circuits within specification? Yes GO toH3. No Repair the power and/or ground circuit
H3: AUDIO HEAD UNIT TEST 3	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and test the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
	Is the medium speed CAN bus within specification? Yes Install a new audio head unit No Repair the medium speed CAN bus circuit

DTC INDEX

For a list of 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: Module Name: Audio Front Control Module (100-00, Description and Operation).