
1. INTRODUCTION
   o This manual describes the Denso DVD navigation system installed in LR3, Range Rover, and Range Rover Sport vehicles. Please read this manual thoroughly and make use of it while troubleshooting.
   o This manual focuses on Range Rover models except where noted.
   o Always refer to the latest Electrical Wiring Diagrams on GTR for the latest information.
2. SYSTEM OUTLINE

- This displays the vehicle installation positions for the Navigation ECU and display. The navigation ECU is installed in the left side of the trunk.

(1) On-Board Layout
System Configuration

The navigation ECU and the display are connected via CAN communication. The display is connected to the audio device via MOST communication.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td>Navigation ECU, Display</td>
</tr>
<tr>
<td>Map Disc</td>
<td>DVD-ROM</td>
</tr>
<tr>
<td>Voice Recognition</td>
<td>Voice Recognition Compatible</td>
</tr>
<tr>
<td>Audio-Related (MOST Communication)</td>
<td>AM/FM Radio, CD (MP3 Compatible), CD Changer, DVD Video, TV Compatible, TMC</td>
</tr>
<tr>
<td>Hands-Free (MOST Communication)</td>
<td>Bluetooth Enabled</td>
</tr>
<tr>
<td>RSE (MOST Communication)</td>
<td>TV and DVD Video can be viewed from the back seat.</td>
</tr>
<tr>
<td>Other</td>
<td>Stopwatch/Speed Display Functions (RANGE ROVER Only)</td>
</tr>
</tbody>
</table>
**3. OUTLINE OF COMMUNICATION LINES**

(1) **MOST Communication**

[1] **Outline**

MOST communication is an on-board network system developed and employed by European vehicle manufacturers and suppliers. Each ECU is connected via fiber optic ring topology and communication occurs as audio data transfer and control commands.

### Example MOST Network

**A. MOST Master (Alpine Device)**

In each MOST network, there must be one master to manage the various aspects of the network.

- Manages the network, including light output to the optical fiber.
- Switches the output between the audio sources (CD, radio, navigation voice).
- Functions as the gateway to the vehicle device.

<Reference>

- If the fiber optic cable is disconnected, most of the functions will be unusable. Only the navigation system will operate.
- Functions that are dependant upon information obtained via MOST communication cannot be used.
- The network disconnects if even one device that is part of the network stops operating.
- Every ECU fiber optic connector (input-output cable) can only be inserted one way.
- The main navigation unit communicates with the display only by CAN, not by MOST communication. In this system, the display (HLDF) is connected via MOST and serves as the user interface.
- MOST information can be confirmed from the display diagnostics screen. In some cases the malfunctioning device cannot be identified on the diagnostics screen, however it is possible to check whether MOST communication is functioning properly.
**MOST Features**

1. High-speed network developed for vehicles (can be used for networks other than on-board networks).
2. Maximum transfer speed of up to 24.8 Mbps.
3. Can simultaneously transfer both synchronized and unsynchronized data.
4. Dedicated control message channel.
5. Employs a ring based network topology enabling each port to send and receive data independently (optical fiber).

Some parts also have power supply pin plugs.
[2] MOST Communication Format

The MOST communication frame data is described below.

1) Data Channel (60bytes)
   - Synchronous
     Voice/Picture: CD, DVD, TUNER
   - Asynchronous
     Internet, TCP/IP Communication: Not used in LAND ROVER vehicles.

2) Control Channel (2 bytes)
   - One command consists of a packet of 16 frames (sum 32 bytes).
   - Approximately 700kbps is used for messaging between nodes.
   - Normal messages are request/response messages.
   - The notification system is based on notification protocol.

[3] Data Transfer Format

Data being sent can be thought of as a train, and each device as a station. The train follows the instruction of the master station, receiving and delivering packages. For example, the master stores voice data from a CD in a designated place (train). The master then takes the sound data from the designated place and sends it to the amp, producing music. This train is always moving.

Sound data is taken from the designated place. CD voice is stored in a designated place.

The ‘Source’ gives the data to ‘MOST’, and ‘Sink’ takes the data from ‘MOST’.
Most communication messages follow the request/response model. As in the diagram, a request is sent from the display to device B, and device B responds. This applies to MOST initialization communication, diagnostics communication, and so on.

In contrast, the Notification protocol provides notification when there is a change in status. For example, automatic notification is provided when the telephone status changes from disconnected to connected. This also applies to CD play time and interruptions in traffic information.

Because the MOST communication system is based on the request/response model of messaging, if a request is not made, then the required information is not received.

If there is a change in status, notification is supplied automatically.

CD’s Current Play Time 1:23 → 1:24 ... Automatic Notification
Disconnected Telephone → Connected Telephone ... Automatic Notification

When MOST communication initializes, desired Notification settings are set individually for each device.
[5] **Start-Up**

The MOST master powers ON all devices after receiving door unlock and ACC ON signals. It then turns ON the optical output for optical communication. The master executes the initialization process for each device, and proceeds to normal status.

![diagram]

- Door Unlock
- ACC ON

**Light Output ON**

**Initialization Process**

**Normal Status**

- Logo Screen (Land Rover)
  - Power Light Blinks
  - The MOST master (IHU) notifies the display with a cancel logo screen request.

- Navigation/Audio Screen
  - Power Light ON
  - The MOST master controls the display (HLDF) power light directly through a wire.

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[6] **Shutdown**

The MOST master executes the shutdown process for each device after receiving the ACC OFF signal. It then turns OFF the optical output to end optical communication.

![diagram]

**Normal Status**

- ACC OFF

**Shutdown Process**

- Light Output OFF

- Power OFF

**Screen OFF**

- Power Light Blinks
  - 1 Minute Duration

- Power Light Turns OFF

- The MOST master controls the display (HLDF) power light directly through a wire.
MOST Troubleshooting

1. MOST TEST (Diagnostics)
   The following information is displayed in the upper right window of the display diagnostics screen.
   - Mpr: Number of MOST devices currently present on the network.
     If this value is 0 or 1, the network is not communicating properly.

   <Reference>
   - The light is being output from the MOST master, so disconnect the connector from the master and check whether light
     is being output. Trace the cable that is outputting light and check the next device to see if it is outputting light.
   - If the Mpr counter is correctly displaying the number of devices on the network, the network is communicating properly.
     MOST communication is also displayed on the log screen.

   ![Display Diagnostics Menu Screen](image)

   ![MOST Test Form](image)

   <Reference>
   - If the CD and radio are completely inoperative, the diagnostics screen will provide an idea of the problem. However, if
     only certain functions are not operating (the CD plays but the track does not change; navigation is operational, but there
     is no voice), the MOST communication log must be checked using specialized tools. The log can also be viewed from
     the display's diagnostics screen, but data cannot be saved.

2. MOST Network Analyzer
   The Optolyzer network analyzer is required to examine MOST communication. The network can be monitored by
   connecting the Optolyzer to the network in bypass mode.
(2) Bluetooth
Bluetooth allows wireless communication between cellular phones and the in-vehicle system. Conventional wire-based connection is unnecessary. Mutual communication is possible even when the cellular phone is positioned in a shirt pocket.

[1] Outline
Incorporating a Bluetooth compatible transceiver in the telephone module has enabled wireless communication between the telephone module and the cellular phone. Hands-free operation is possible without connecting to cables or cradles.

[2] What is Bluetooth?
Bluetooth is a global short-distance wireless standard, resulting from standardization activities by major telephone communication, computer, and network industry manufacturers such as Ericsson, Intel, Toshiba, Nokia, and IBM. Bluetooth uses a 2.4 GHz wireless frequency band. It has a maximum wireless range of up to 10m, and can transmit both voice and data at a speed of up to 1Mbps. Since radio waves are used, communication is possible as long there is no interference from metal objects. It is capable of a 1:7 network, otherwise known as a piconet.

[3] The Origin of the Name
The name “Bluetooth” is derived from Harald Bluetooth, king of Denmark, who unified Denmark and Norway at the beginning of the 10th century.

[4] Bluetooth Features
- With Bluetooth, various devices that were connected by conventional cables can now communicate freely without them. This enables wireless, hands-free operation, transfer of data from a cellular phone to a phonebook, and data communication.
- Until now, wireless communication was performed using infrared communication. With infrared communication however, “obstructions” in the communication interval prevent communication taking place. However, because Bluetooth uses weak radio waves, communication is possible even if there are obstructions.
- Bluetooth technology is becoming a global standard and has obtained many patents, but because licensing is free, it is estimated that the number of manufacturers adopting Bluetooth will continue to increase.
- Bluetooth reception can fluctuate depending on various conditions such as obstructions and signal status between the communicating devices, signal interference, reception sensitivity of the communicating devices, and antenna performance.
Bluetooth Settings

Before a cellular phone can be connected to the navigation system using Bluetooth, it is necessary to register and setup the Bluetooth compatible cellular phone and navigation system.

<Reference>
● Please refer to the cellular phone owner's manual for details on setting up a Bluetooth compatible cellular phone.
(3)  **RDS-TMC (Radio Data System - Traffic Message Channel) - Eu Only**

TMC-RDS is an FM radio channel dedicated to traffic messages.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Area</td>
<td>Europe</td>
</tr>
<tr>
<td>Frequency Band</td>
<td>87.50 to 108.0MHz</td>
</tr>
<tr>
<td>Provider Fee Required</td>
<td>Required (Contract Required with Provider)</td>
</tr>
<tr>
<td>Circuit</td>
<td>Navigation Internal Circuit Board</td>
</tr>
<tr>
<td>Antenna</td>
<td>Non-Diversity</td>
</tr>
</tbody>
</table>

**[1] Main Functions**

(1)  **Select Station**

This function displays a list of the stations broadcasting RDS-TMC information.
(RDS-only stations are not displayed.)

The list of stations shows RDS stations broadcasting TMC information.
Pressing "Select Station" will display the station selection screen.

(2)  **Traffic On Route**

This function displays a list of events occurring along the guidance route.
If an event is occurring along the route the vehicle is traveling, this function lists the event during guidance.
Only events occurring within the next 10 kilometers of the current position are listed.

(3)  **All Traffic Events**

This function displays all events occurring in areas surrounding the current map display position.
### RANGE ROVER BASIC OPERATION

#### 1. DISPLAY PANEL

<table>
<thead>
<tr>
<th>Button/Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 System Settings Button</td>
<td>System Settings</td>
</tr>
<tr>
<td>2 On-Road Information Button</td>
<td>Displays the On-Road Information Screen</td>
</tr>
<tr>
<td>3 4x4 Information Button</td>
<td>Displays the 4x4 Information Screen</td>
</tr>
<tr>
<td>4 Audio Power Button/Volume Dial</td>
<td>Push: Audio System ON/OFF&lt;br&gt;Turn: Adjusts Volume</td>
</tr>
<tr>
<td>5 Navigation Button</td>
<td>Displays the Navigation Screen&lt;br&gt;Replays the Voice Guidance (During Route Guidance)</td>
</tr>
<tr>
<td>6 Telephone Button</td>
<td>Displays the Hands-Free Operation Screen</td>
</tr>
<tr>
<td>7 Audio Operation Button</td>
<td>Displays All Audio Operation Screens</td>
</tr>
<tr>
<td>8 Mode Button/Select Dial</td>
<td>Push: Displays the Audio Selection Pop-Up&lt;br&gt;Turn: CD → Disk Select, Radio/TV → Preset Select</td>
</tr>
<tr>
<td>9 Tone Settings Button</td>
<td>Tone Quality Settings</td>
</tr>
<tr>
<td>10 Information Button</td>
<td>Receives Traffic Information</td>
</tr>
<tr>
<td>12 Light Sensor</td>
<td></td>
</tr>
</tbody>
</table>
2. OPERATION METHODS AND SCREEN TRANSITIONS

From the Menu Screen, the Navigation Functions Menu Screen (Navigation Menu Screen) and other menu screens are available.

(1) Switching to the Navigation Menu Screen

*1: When ☐ is pushed on any screen excepting the navigation screen, the last displayed navigation screen will be shown. Pushing ☐ again will display the current location screen.

*2: RDS-TMC is for the EU only.
### Destination Entry

<table>
<thead>
<tr>
<th>Address</th>
<th>Point Of Interest</th>
<th>Select from Map</th>
<th>Postcode*1</th>
<th>Memory Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous Destination</td>
<td>Intersection</td>
<td>Motorway Entry/Exit</td>
<td>Coordinates</td>
<td>Search Area</td>
</tr>
<tr>
<td>Off Road Point</td>
<td>Phone Number*2</td>
<td>Emergency*2</td>
<td>[*1: EU Only]</td>
<td>[*2: US Only]</td>
</tr>
</tbody>
</table>

### Stored Locations

<table>
<thead>
<tr>
<th>Memory Points</th>
<th>Avoid Area</th>
<th>Destination &amp; Way Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>Previous Destinations</td>
<td>Preset Destinations</td>
</tr>
</tbody>
</table>

### Navigation Set Up

<table>
<thead>
<tr>
<th>2D/3D View</th>
<th>Quick POI Selection</th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Settings</td>
<td>Restore System Defaults</td>
<td>Trace Points</td>
</tr>
</tbody>
</table>

### Route Options

<table>
<thead>
<tr>
<th>Search Condition</th>
<th>Detour</th>
<th>Route Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination &amp; Way Point</td>
<td>Display Route</td>
<td>Route Preview</td>
</tr>
</tbody>
</table>
(2) Switching to Other Menu Screens

- System Menu
- Trip Computer Menu
- 4x4 Info
- Tone Settings Menu
- Hands-Free Menu
- Audio Menu
1. DISPLAY PANEL

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | Navigation Button | Displays the Navigation Screen  
  |               |   Repays the Voice Guidance (During Route Guidance) |
| 2 | Menu Button       | Displays the Home Menu Screen     |
2. OPERATION METHODS AND SCREEN TRANSITIONS

From the menu screen, the navigation functions menu screen (navigation menu screen) and other menu screens are available.

(1) Switching to the Navigation Menu Screen

*1: When is pushed on any screen excepting the navigation screen, the last displayed navigation screen will be shown. Pushing again will display the current location screen.

*2: RDS-TMC is for the EU only.
(2) Switching to Other Menu Screens

- Settings
- Navigation
- 4x4 Info
- Compass
- TV-DVD
- RSE (Rear Entertainment)