

## Specifications

### Torque specifications

Discription	Nm	lb.ft
Instrument cluster	2	1
Instrument cluster upper finisher	2	1
Instrument cluster lower finisher	2	1

## Instrument Cluster

### COMPONENT LOCATION



E83308

Item	Part Number	Description
1		Tachometer
2		Glow plugs active indicator
3		Safety belt indicator (Gulf States only)
4		MIL (malfunction indicator lamp)
5		Left turn signal indicator
6		ECT (engine coolant temperature) gauge
7		High ECT (engine coolant temperature) indicator
8		High beam indicator
9		Hazard flasher indicator
10		Fuel level gauge
11		Right turn signal indicator
12		Traction control indicator
13		Speedometer
14		Differential lock indicator
15		Rear fog lamp indicator
16		Odometer and trip meter display
17		Trip reset button
18		Trailer indicator
19		Low fuel indicator
20		ABS (anti-lock brake system) indicator
21		Brake warning indicator
22		Side lamps on indicator
23		Anti-theft alarm indicator
24		Transfer box low range indicator

25		Ignition/No charge indicator
26		Low oil pressure indicator

## OVERVIEW

The instrument cluster is located in the instrument panel, above the steering column. The instrument cluster comprises analogue gauges and a number of indicator lamps to display system status.

## ANALOGUE GAUGES

The analogue gauges located in the instrument cluster are as follows:

- Speedometer
- Tachometer
- Fuel level gauge
- ECT (engine coolant temperature) gauge.

Each analogue gauge is driven by an electronic stepper motor. The characteristics of this type of motor produce damping of the pointer needle. All gauges return to their respective zero positions when the ignition is switched off.

## INDICATOR LAMPS

Indicator lamps are located in various positions in the instrument cluster and can be split into 2 groups; self controlled and externally controlled.

Self controlled indicators are dependent on software logic within the instrument cluster for activation.

Externally controlled indicators are supplied with current from their respective systems. Engine related externally controlled indicators are illuminated by the instrument cluster on receipt of a high speed CAN (controller area network) bus message from the ECM (engine control module) .

The following table shows the available indicators and indicates if they are subject to an indicator check at ignition on and if they are self or externally controlled.

Indicator Lamp	Illumination Color	Bulb Check	Self Controlled (S)/Externally Controlled (E)
Glow plugs active	Amber	No (may illuminate at ignition on to show glow plugs active)	E
Safety belt	Red	No	E
MIL (malfunction indicator lamp)	Amber	* Yes	E
Left turn signal	Green	No	E
High ECT (engine coolant temperature)	Red	Yes	S
High beam	Blue	No	E
Hazard flasher	Red	No	E
Right turn signal	Green	No	E
Traction control	Amber	Yes	E
Differential lock	Amber	No	E
Rear fog lamp	Amber	No	E
Trailer	Green	No	E
Low fuel	Amber	Yes	S
ABS (anti-lock brake system)	Amber	* Yes	E
Brake warning	Red	Yes	E
Side lamps on	Green	No	E
Anti-theft alarm	Red	No	E
Transfer box low range	Green	No	E

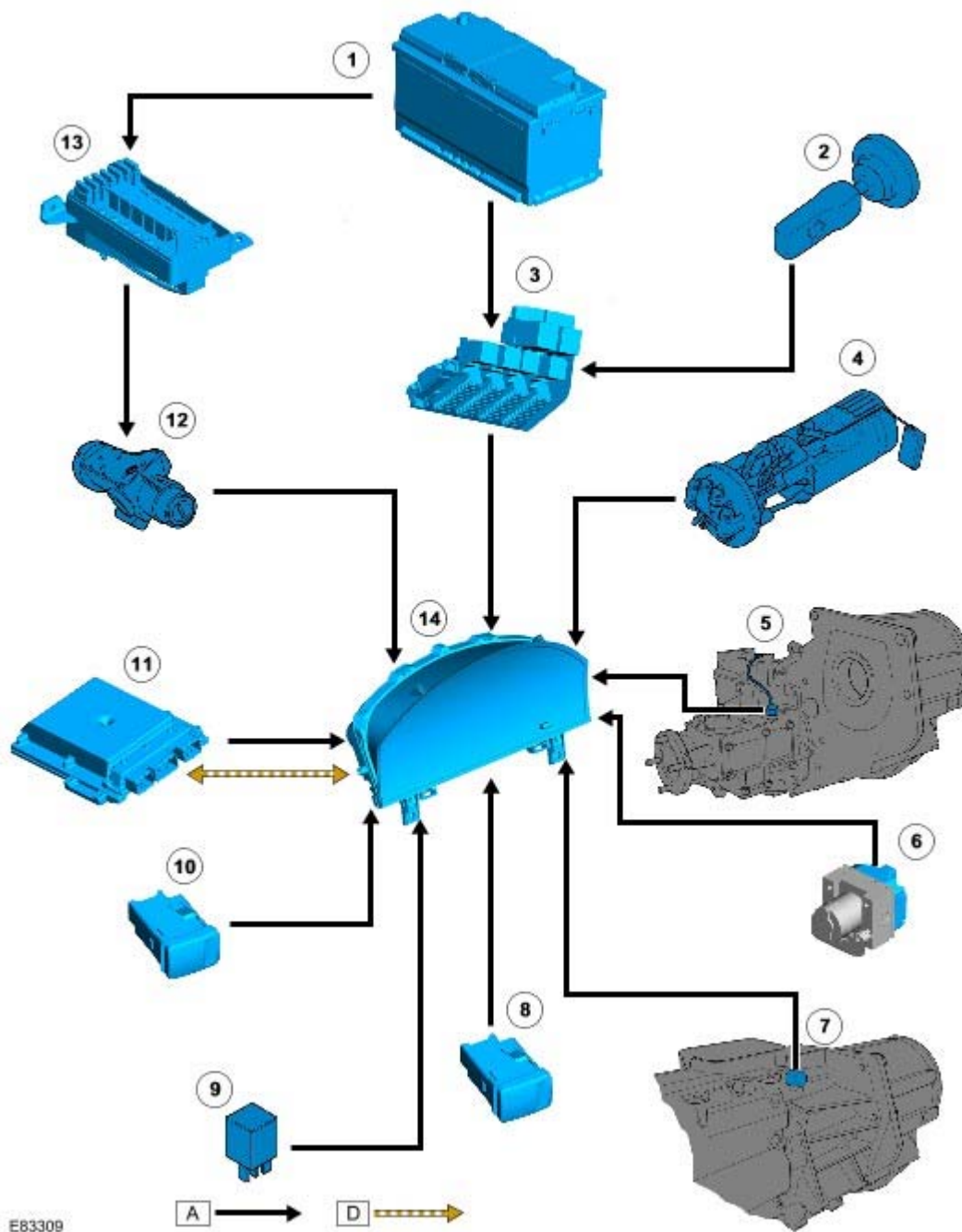
Ignition/No charge	Red	No	E
Low oil pressure	Red	No	E

\* = Bulb check performed by sub-system module, not instrument cluster

## CONTROL DIAGRAM - SHEET 1 OF 2

**NOTE:**

**A** = Hardwired; **D** = High speed CAN (controller area network) bus



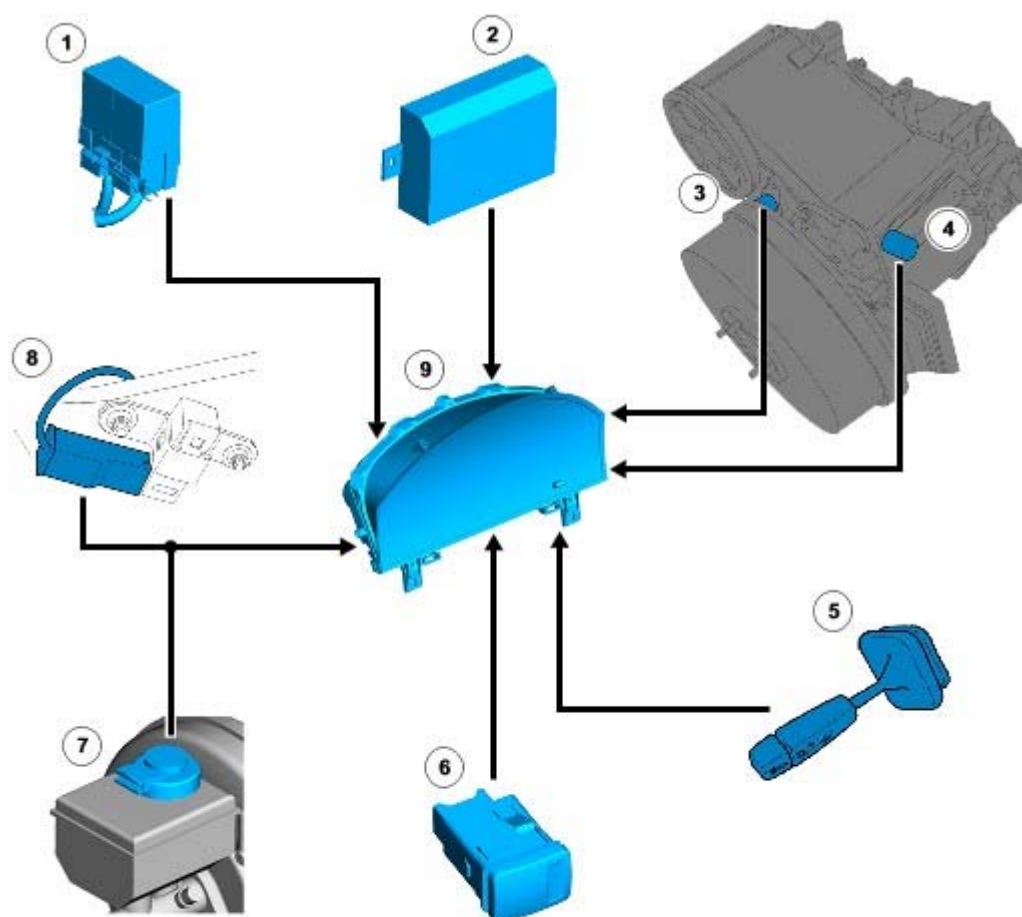
Item	Part Number	Description
1		Battery
2		Lighting switch
3		CJB (central junction box)
4		Fuel tank unit

5		Differential lock switch
6		ABS (anti-lock brake system) module
7		Reverse gear switch
8		Hazard flasher switch
9		Hazard flasher relay
10		Heated rear screen switch
11		ECM (engine control module)
12		Ignition switch
13		BJB (battery junction box)
14		Instrument cluster

## CONTROL DIAGRAM - SHEET 2 OF 2

### NOTE:

A = Hardwired



E89306



Item	Part Number	Description
1		Heated windshield timer unit
2		Anti-theft alarm control module
3		Vehicle speed sensor
4		High/Low range switch
5		Column switch - turn signal indicators

6		Rear fog lamp switch
7		Brake fluid level switch
8		Parking brake switch
9		Instrument cluster

## PRINCIPLES OF OPERATION

### Speedometer

The instrument cluster receives a hardwired vehicle speed signal from the vehicle speed sensor. The vehicle speed sensor is a Hall effect sensor located on the transfer box. The sensor acts on a reluctor ring located on the transfer box rear output shaft. For additional information, refer to [Transfer Case - Vehicles With: 6-Speed Manual Transmission \(MT82\)](#) (308-07 )

### Tachometer

The tachometer is driven by an engine speed signal transmitted on the high speed CAN (controller area network) bus from the ECM (engine control module) . The signal is derived from the CKP (crankshaft position) sensor. The signal is received by the instrument cluster microprocessor and the output from the microprocessor drives the tachometer.

### Fuel Level Gauge

The instrument cluster calculates the amount of fuel in the tank by providing a reference current to the fuel tank level sensor. The fuel tank level sensor uses a float operated MAGnetic Passive Position Sensor (MAPPS) for measuring fuel tank contents.

The instrument cluster measures the returned output from the sensor, which is proportional to the level of the float arm and consequently the amount of fuel in the tank. The instrument cluster monitors the signal from the sensor at approximately 20 second intervals. This prevents the gauge needle pointer from continually moving due to the movement of fuel in the tank when cornering or braking.

### Engine Coolant Temperature Gauge

The ECT (engine coolant temperature) gauge is driven by high speed CAN (controller area network) bus messages from the ECM (engine control module) . For normal operating temperatures the gauge needle pointer is positioned centrally in the gauge display. The needle pointer position translates to the following approximate temperatures.

Engine Coolant Temperature °C (°F)	Needle Pointer Position
Ignition off	Park position
40 (104)	Cold (blue segment)
75 - 115 (167 - 239)	Normal (central)
120 (248)	Start of hot (red segment)
125 (257)	End of hot

### Glow Plugs Active Indicator

The glow plugs active indicator is illuminated by the instrument cluster software on receipt of a high speed CAN (controller area network) bus message from the ECM (engine control module) . The indicator illuminates in an amber color when the ignition is turned to position II. The indicator illumination period varies with ECT (engine coolant temperature) and if ECT (engine coolant temperature) is high, will not illuminate.

The indicator is controlled by high speed CAN (controller area network) bus messages from the ECM (engine control module) , which equate to the time the glow plugs are energized to pre-heat the combustion chambers. When the glow plug heating time is complete, the indicator is extinguished indicating to the driver that the engine can now be started.

### Safety Belt Indicator

The safety belt indicator is controlled by a hardwired feed from switches located in the front seat safety belt buckles.

The safety belt indicator is fitted to Gulf specification vehicles only.

## **Malfunction Indicator Lamp**

The MIL (malfunction indicator lamp) is controlled by the instrument cluster software on receipt of a high speed CAN (controller area network) bus message from the ECM (engine control module) . The lamp is illuminated for a bulb check by the ECM (engine control module) when the ignition is moved to position II. The lamp is extinguished when the engine starts.

If the MIL (malfunction indicator lamp) remains illuminated after the engine is started or illuminates while driving, a fault is present and must be investigated at the earliest opportunity. Illumination of the MIL (malfunction indicator lamp) indicates there is an OBD (on-board diagnostic) fault which will cause excessive emissions output.

## **Left and Right Turn Signal Indicators**

The turn signal indicators are controlled by the instrument cluster software on receipt of hardwired signals from the steering column switch. When the turn signal indicator switch is operated, the instrument cluster receives a signal feed from the column switch. The instrument cluster software controls the flash rate of the indicator which flashes in a green color. During normal turn signal indicator operation the indicator flashes slowly, accompanied simultaneously by a sound from the instrument cluster sounder. If a fault exists, the instrument cluster flashes the indicator at double speed.

## **High Engine Coolant Temperature Indicator**

The high ECT (engine coolant temperature) indicator is illuminated on receipt of a high speed CAN (controller area network) bus message from the ECM (engine control module) . The indicator illuminates when the ignition is turned to position II for a 3 second bulb check and is extinguished when the engine is started. If the indicator illuminates while driving, a fault in the engine cooling system has become present and the engine must be stopped at the earliest opportunity.

## **High Beam Indicator**

The high beam indicator is controlled by the instrument cluster software on receipt of a hardwired signal from the CJB (central junction box) . The signal from the CJB (central junction box) originates from the steering column switch when high beam is selected.

## **Hazard Flasher Indicator**

The hazard flasher indicator is controlled by the instrument cluster software on receipt of a hardwired signal from the hazard flasher switch. The hazard flasher indicators can operate with the ignition switched off, flashing both the left and right turn signal indicators simultaneously.

## **Traction Control Indicator**

The traction control indicator is illuminated by the instrument cluster software on receipt of a hardwired signal from the ABS (anti-lock brake system) module. The indicator is illuminated for 3 seconds for a bulb check when the ignition switch is turned to position II. If no fault exists, the indicator is extinguished after the bulb check period.

When traction control is active, the indicator flashes to inform the driver that the system is regulating engine output.

## **Heated Windshield Indicator**

In order for the heated windshield to operate, the engine must be running. The instrument cluster receives an engine running signal from the ECM (engine control module) over the high speed CAN (controller area network) bus. On receipt of this message, the instrument cluster provides a hardwired signal to the heated windshield timer relay. If heated windshield operation is subsequently requested a ground path is created via the heated windshield switch. When the instrument cluster registers the ground, it illuminates the heated windshield indicator.

## **Differential Lock Indicator**

The differential lock indicator is illuminated on receipt of a hardwired signal from the differential lock switch. The indicator will illuminate at all times when the differential lock is selected and the ignition switch is in position II.

## Rear Fog Lamp Indicator

The rear fog lamp indicator is illuminated on receipt of a hardwired signal from the rear fog lamp switch. The indicator will illuminate at all times when the rear fog lamps are selected on and the ignition switch is in position II.

## Trailer Indicator

The trailer indicator is controlled by the instrument cluster software on receipt of a hardwired signal from the hazard flasher relay. When a trailer is connected, the hazard flasher relay energizes and provides a feed to the instrument cluster. The feed across the hazard flasher relay originates from the steering column switch. The instrument cluster software controls the flash rate of the indicator which flashes in a green color. The trailer indicator flashes slowly, accompanied simultaneously by a chime from the instrument cluster sounder, at the same rate as the turn signal indicators.

## Low Fuel Indicator

The instrument cluster calculates the amount of fuel in the tank by providing a reference current to the fuel tank level sensor. If the cluster determines the level of fuel within the tank is at or below 14 liters (3.69 gallons) it will illuminate the low fuel indicator and emit a single chime. For more information, refer to 'Fuel Level Gauge' above.

## ABS Indicator

The ABS (anti-lock brake system) indicator is controlled by the ABS (anti-lock brake system) module which transmits a hardwired signal to the instrument cluster. The indicator is illuminated in an amber color for a 3 second bulb check by the ABS (anti-lock brake system) module when the ignition is turned to position II. If the indicator remains illuminated or illuminates when driving, an ABS (anti-lock brake system) fault has occurred and the ABS (anti-lock brake system) function will not be available.

The ABS (anti-lock brake system) module will alert the driver that a DTC (diagnostic trouble code) has been stored in its memory during the bulb check process. It will do this by;

- illuminating the indicator for 0.5 seconds
- extinguishing the indicator for 0.5 seconds
- illuminating the indicator for 2 seconds.

If the indicator is illuminated for a sensor fault, the indicator will remain illuminated at the next ignition cycle, even if the fault is rectified. When the vehicle is driven above a speed of 20 km/h (12.5 mph) the indicator will be extinguished. This allows the ABS (anti-lock brake system) module to perform a thorough check of the system and to establish that the output from the replaced sensor is correct.

## Brake Warning Indicator

The brake warning indicator is illuminated for a 3 second bulb check when the ignition is turned to position II. The indicator will also illuminate if the parking brake is on, or the brake fluid falls below a pre-determined level. The instrument cluster is hardwired to the parking brake switch and the brake fluid level switch, which are connected in parallel. If either of the conditions above are met a ground path is created, illuminating the indicator.

## Side Lights On Indicator

The side lights on indicator is controlled by the lighting switch. When the lighting switch is turned to the side or headlamp position, a hardwired feed is provided to the instrument cluster via the CJB (central junction box) . On receipt of the hardwired feed, the instrument cluster illuminates the indicator.

## Anti-theft Alarm Indicator

Illumination of the anti-theft alarm indicator is controlled directly by the anti-theft alarm control module. For additional information, refer to [Anti-Theft - Active](#) (419-01A )

For additional information, refer to [Anti-Theft - Passive](#) (419-01B )

## Transfer Box Low Range Indicator

The transfer box high/low range switch is hardwired to the instrument cluster. When low range is selected, the



transfer box provides a feed to instrument cluster, which subsequently illuminates the green low range indicator. The low range indicator remains permanently illuminated until high range is selected and the feed from the high/low range switch is removed.

## **Ignition/No Charge Warning Indicator**

The ignition/no charge indicator is controlled by the instrument cluster software and illuminated on receipt of a high speed CAN (controller area network) bus message from the ECM (engine control module) . The indicator illuminates in a red color when the ignition is turned to position II and is extinguished when the engine is started.

If the indicator remains illuminated after the engine has started or illuminates when driving, the alternator charge output has failed.

## **Low Oil Pressure Warning Indicator**

The low oil pressure indicator is controlled by the instrument cluster software and illuminated on receipt of a high speed CAN (controller area network) bus message from the ECM (engine control module) . The indicator is illuminated in a red color when the ignition switch is turned to position II. When the engine is started and the oil pressure increases the low oil pressure indicator should extinguish. If the indicator remains illuminated or illuminates when driving the vehicle should be stopped at the earliest opportunity and the engine switched off until the fault is rectified.

## **Instrument Cluster Replacement**

If a new instrument cluster is to be fitted, the Land Rover approved diagnostic system must be connected to the vehicle and the instrument cluster renewal procedure run. This will ensure that vehicle coding data is correctly installed in the new instrument cluster. The Land Rover approved diagnostic system will also record the current service interval data and restore the settings to the new instrument cluster.

# Instrument Cluster

## Overview

The instrument cluster is a totally electronic device which receives analogue or digital signals via hardwired or bus system for instrumentation operation. The signals which are processed by the engine control module (ECM) are transmitted via controller area network (CAN) to the instrument cluster and displayed as analogue gauge indications or warning lamp illuminations. The instrument cluster is connected to the vehicle electrical system by one connector which provides all input and output connections. No components of the instrument cluster are serviceable. The instrument cluster has two main functions to provide information to the driver of the vehicle status and to process and relay digital signals. The instrument cluster identifies the signals and displays the appropriate message in the message center. For information on the operation of the systems:

[Instrument Cluster Communications Network](#)

## Car Configuration File (CCF)



**CAUTION:** If a new instrument cluster is to be installed, the instrument cluster renewal procedure must be carried out using the approved diagnostic system. This will make sure that the car configuration file (CCF) data is correctly transferred from the ECM to the replacement instrument cluster. The CCF will also need to be updated using the approved diagnostic system if the vehicle is modified in service from its original factory specification. This can include the fitting of non-standard wheels and/or tires and optional dealer fit accessory components with an electrical interface, such as parking aid.

The CCF contains all relevant data about the specification and market condition of the applicable vehicle, immobilization codes and driver personal settings. This information is retained in the ECM and the instrument cluster enabling each system module to detect which systems and components are fitted to the vehicle. The information is continuously transferred between these two system modules to make sure that the data is constantly backed-up between the modules.

## Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Confirm which, if any, warning lights were displayed on the instrument cluster.
- 3 . Visually inspect for obvious electrical faults.

Electrical
<ul style="list-style-type: none"> <li>• Battery and passenger junction box fuses</li> <li>• Read diagnostic trouble codes (DTCs) Using the approved diagnostic system or a scan tool</li> <li>• Damaged, loose or corroded connectors</li> <li>• Instrument cluster for any external damage</li> <li>• Electrical circuits</li> </ul>

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

5 . Use the approved diagnostic system or a scan tool to retrieve any DTCs before moving onto the DTC index.



Make sure that all DTCs are cleared following rectification.

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## DTC Index

### NOTE:

If a control module or component 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 program is in operation, before the replacement of a component.

### NOTE:

Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra 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.

DTC	Description	Possible cause(s)	Action
U000188	High speed controller area network (CAN) bus off fault	<ul style="list-style-type: none"> <li>CAN circuit: short circuit to each other</li> <li>CAN circuit: short circuit to power</li> <li>CAN circuit: short circuit to ground</li> <li>Engine control module (ECM) fault</li> <li>Instrument cluster fault</li> </ul>	Carry out a complete vehicle read for DTCs indicating a CAN circuit or module fault. Rectify as necessary. Clear the DTCs and test for normal operation. Refer to the warranty policy and procedures manual if a module is suspect.
B1A7501	Fuel sender 1- general electrical error	<ul style="list-style-type: none"> <li>Fuel level sender circuit: short circuit to ground</li> <li>Fuel level sender circuit: short circuit to power</li> <li>Fuel level sender circuit: open circuit</li> <li>Fuel sender fault</li> <li>Instrument cluster fault</li> </ul>	Check the fuel level sender and circuits. Refer to the electrical guides. Install a new fuel level sensor if necessary, <a href="#">Fuel Level Sender</a> . Clear the DTCs and test for normal operation. Refer to the warranty policy and procedures manual if the instrument cluster is suspect.
B1A8164	Internal trip switch plausibility fault	<ul style="list-style-type: none"> <li>Instrument cluster fault</li> </ul>	Check the instrument cluster circuits. Refer to the electrical guides. Clear the DTC. Cycle the ignition and retest. If the DTC resets, suspect the instrument cluster. Refer to the warranty policy and procedures manual if the instrument cluster is suspect.
P160231	Immobilizer/engine control module (ECM) communication error – no signal	<ul style="list-style-type: none"> <li>Alarm (immobiliser) - instrument cluster circuit: short circuit to ground</li> <li>Alarm (immobiliser) - instrument cluster circuit: short circuit to power</li> <li>Alarm (immobiliser) - instrument cluster circuit: open circuit</li> <li>ECM fault</li> <li>Instrument cluster fault</li> </ul>	Check for related DTCs. Rectify as necessary. Clear the DTCs and test for normal operation. Check the alarm (immobilizer) circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs and test for normal operation. Refer to the warranty policy and procedures manual if a module is suspect.
			Carry out a complete vehicle DTC read. Check

U010087	Lost controller area network (CAN) communication – engine control module (ECM)	<ul style="list-style-type: none"> <li>• CAN circuit: open circuit</li> <li>• ECM fault</li> <li>• Instrument cluster fault</li> </ul>	for other CAN DTCs or apparently unrelated customer complaints. Check the CAN and module power and ground circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs and test for normal operation. Refer to the warranty policy and procedures manual if a module is suspect.
U040168	Invalid data received from engine control module (ECM)	<ul style="list-style-type: none"> <li>• Incorrect signals received from ECM</li> </ul>	Check for related DTCs. Rectify as necessary. Clear the DTCs and test for normal operation. Check the sensor signal circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs and test for normal operation.
U210100	Control module configuration incompatible	<ul style="list-style-type: none"> <li>• Central car configuration parameter missing or corrupted</li> </ul>	Check correct central car configuration software is installed. Reprogramme the instrument cluster as necessary.
U300017	Control module over voltage	<ul style="list-style-type: none"> <li>• Vehicle started using a booster pack</li> <li>• Supply voltage has exceeded 17.4v for 12 seconds</li> <li>• Charging system over charging</li> </ul>	Check the instrument cluster supply circuits. Check the charging system and charging voltage. Refer to the electrical guides. Rectify as necessary. Clear the DTC. Cycle the ignition and retest. Refer to the warranty policy and procedures manual if the instrument cluster is suspect.
U300046	Control module electrically eraseable programmable read only memory (EEPROM) error	<ul style="list-style-type: none"> <li>• Power supply lost from the instrument cluster with the ignition on</li> <li>• Instrument cluster fault</li> </ul>	Check the instrument cluster circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTC. Cycle the ignition and retest. Configure the module using the approved diagnostic system. If the DTC resets suspect the instrument cluster. Refer to the warranty policy and procedures manual if the instrument cluster is suspect.

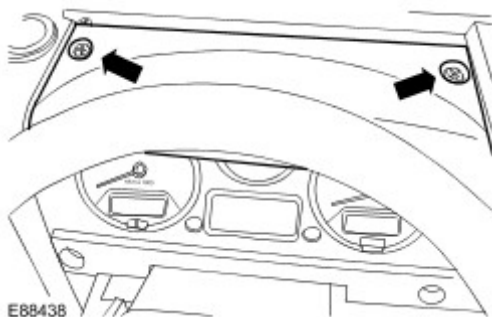
## Instrument Cluster (80.20.01.99)

### Removal

- 1 . Disconnect the battery ground cable.  
For additional information, refer to [Battery Disconnect and Connect](#)

- 2 . Remove the instrument cluster upper finisher.

➤ Remove the 2 screws.



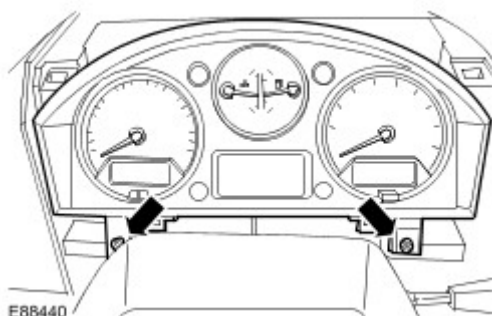
- 3 . Remove the instrument cluster lower finisher.

➤ Remove the 2 screws.



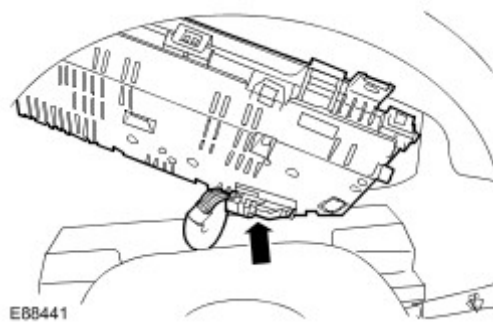
- 4 . Release the instrument cluster.

➤ Remove the 2 screws.



- 5 . Remove the instrument cluster.

➤ Disconnect the electrical connector.



## Installation

- 1 . Install the instrument cluster.
  - ▶ Connect the electrical connector.
- 2 . Secure the instrument cluster.
  - ▶ Install the 2 screws.
- 3 . Install the instrument cluster lower finisher.
  - ▶ Install the 2 screws.
- 4 . Install the instrument cluster upper finisher.
  - ▶ Install the 2 screws.
- 5 . Connect the battery ground cable.  
For additional information, refer to [Battery Connect](#).
- 6 . Using the approved Land Rover diagnostic equipment, configure the instrument cluster.