

INSTRUMENT CLUSTER

DESCRIPTION AND OPERATION

COMPONENT LOCATION



ITEM	DESCRIPTION
1	Tachometer
2	Glow plugs active indicator
3	Safety belt indicator (Gulf States only)
4	malfunction indicator lamp (MIL)
5	Left turn signal indicator
6	engine coolant temperature (ECT) gauge
7	High ECT 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	anti-lock brake system (ABS) 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 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 controller area network (CAN) bus message from the engine control module (ECM).

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.

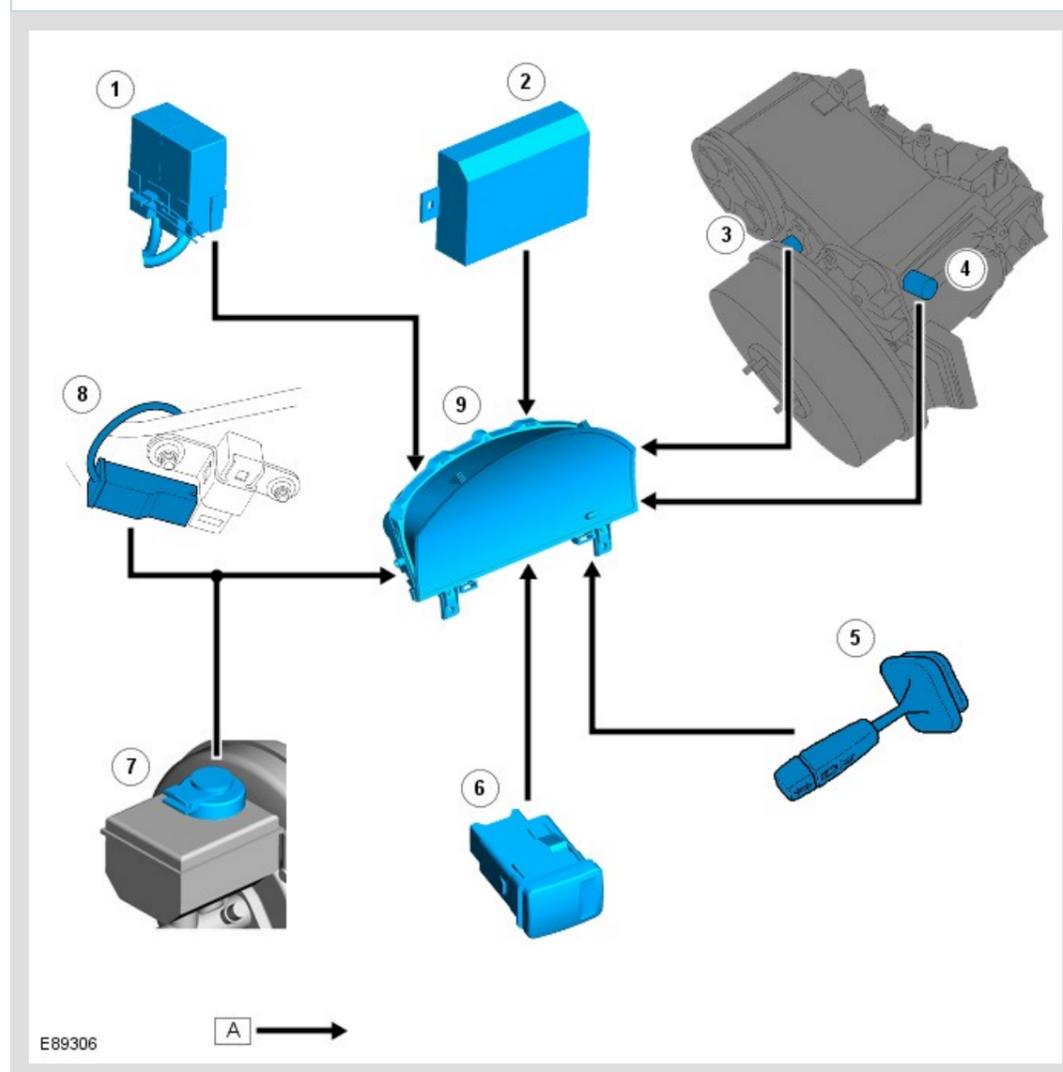
INDICATOR LAMP	ILLUMINATION COLOR	BULB CHECK	SELF CONTROLLED (S)/EXTERNALLY CONTROLLED (E)
Glow plugs active	Amber	No (may illuminate at ignition on to show glow plugs active)	E
Safety belt	Red	No	E
MIL	Amber	* Yes	E
Left turn signal	Green	No	E
High ECT	Red	Yes	S
High beam	Blue	No	E
Hazard flasher	Red	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	Amber	* Yes	E
Brake warning	Red	Yes	E
Side lamps on	Green	No	E
Anti-theft alarm	Red	No	E

7	Reverse gear switch
8	Hazard flasher switch
9	Hazard flasher relay
10	Heated rear screen switch
11	ECM
12	Ignition switch
13	battery junction box (BJB)
14	Instrument cluster

CONTROL DIAGRAM - SHEET 2 OF 2

NOTE:

A = Hardwired



ITEM	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: MT82 6-Speed Manual Transmission (308-07, Description and Operation).

TACHOMETER

The tachometer is driven by an engine speed signal transmitted on the high speed CAN bus from the ECM. The signal is derived from the crankshaft position (CKP) 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 gauge is driven by high speed CAN bus messages from the ECM. 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 bus message from the ECM. The indicator illuminates in an amber color when the ignition is turned to position II. The indicator illumination period varies with ECT and if ECT is high, will not illuminate.

The indicator is controlled by high speed CAN bus messages from the ECM, 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 is controlled by the instrument cluster software on receipt of a high speed CAN bus message from the ECM. The lamp is illuminated for a bulb check by the ECM when the ignition is moved to position II. The lamp is extinguished when the engine starts.

If the MIL 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 indicates there is an on-board diagnostic (OBD) 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 indicator is illuminated on receipt of a high speed CAN bus message from the ECM. 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. The signal from the CJB 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 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 over the high speed CAN 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 indicator is controlled by the ABS 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 module when the ignition is turned to position II. If the indicator remains illuminated or illuminates when driving, an ABS fault has occurred and the ABS function will not be available.

The ABS module will alert the driver that a diagnostic trouble code (DTC) 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 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. 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, Description and Operation),

Anti-Theft - Passive (419-01B, Description and Operation).

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 bus message from the ECM. 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 bus message from the ECM. 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.