4.19 Rough Road signal

4.19.1 Description

The SLABS/ABS control module transmits a PWM signal indicating rough road for misfire detection disablement. The ECM has input diagnostics for this signal.

There are three plausibility checks of the PWM signal during which a fault is detected if: -

1. The PWM signal is greater than a threshold indicating an electrical short to battery positive.
2. The PWM signal is less than a threshold indicating an electrical short to ground.
3. The PWM signal is greater than 44.92% but less than 55.08% indicating an error with the SLABS/ABS control module.

Rough Road Signal								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Rough Road Signal	P1590	plausibility checking of the PWM signal from the anti-lock brake ECM	PWM signal	44.92 % < signal < 55.08 %	ignition engine state	on not starting	2.0 sec/ continuous	no MIL illumination (misfire defaults to enabled)
	P1591		PWM signal	signal < 10.16 %				
	P1592		PWM signal	signal > 89.84%				

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.

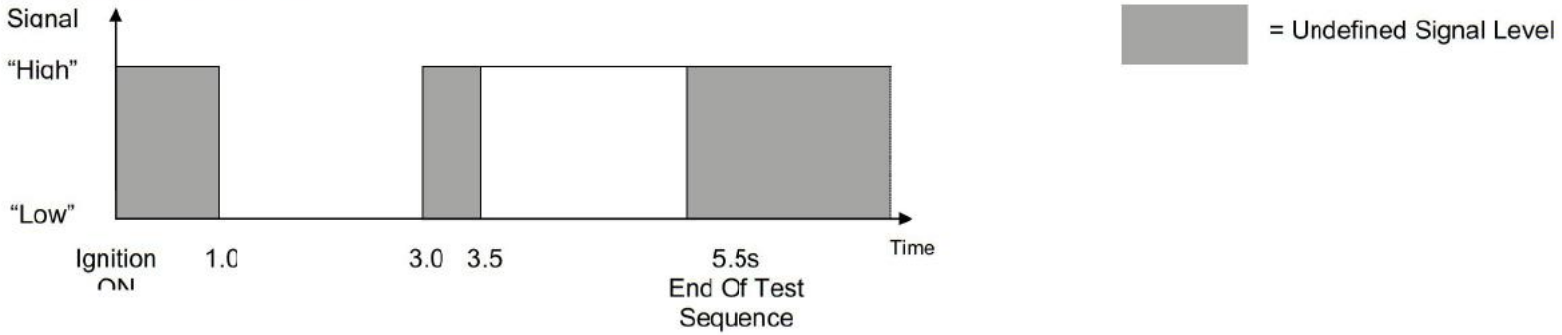
4.20 Transfer Box Malfunction Indicator Lamp Request (Range Rover 38A Only)

4.20.1 Description

This input indicates to the ECM that there is an OBD relevant error within the transfer box control module. The ECM will illuminate the MIL and store the P1701 DTC whenever this signal is true. The ECM carries out an integrity check on this signal following an 'ignition on' condition as shown below and detects a fault if any of the following conditions are satisfied: -

1. The line voltage is high during the low test.
2. The line voltage is low during the high test.
3. The line voltage is in an undefined state, neither high nor low.

Ignition on Integrity Check Waveform



Transfer Box Malfunction Indicator Lamp Request								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Transfer Box Functionality (Range Rover Only)	P1701	MIL request from the transfer box control module			battery voltage	> 8.02V	5.5 sec/ continuous	two driving cycles
	P1702	plausibility checking of the link from the transfer box control module	line voltage	undefined state	ignition reset counter	On = 0	performed once at ignition on	
	P1703		line voltage	high during low test				
	P1708		line voltage	low during high test				

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.

4.21 Air Conditioning System (Discovery Series II Only)

4.21.1 Description

The air conditioning system comprises of the Heating and Ventilation Control (Air Conditioning) Module (HeVAC), the air conditioning compressor and the condenser fans. The ECM controls the compressor clutch via a relay.

The control strategy of the relay features hysteresis to avoid the compressor clutch cycling while the engine is running. When there is a need for the compressor to be activated, the HeVAC module sends a request signal to the ECM, which in turn activates the compressor clutch relay. The condenser fan relay is controlled separately by both the ECM and the HeVAC module, and again, the control strategy features hysteresis to avoid the cooling fans cycling while the engine is running and the engine coolant and/or condenser temperatures fluctuate around a given threshold. When there is a need for condenser cooling for air conditioning performance the HeVAC module sends a request signal to the condenser fan relay. If there is a requirement for condenser cooling due to ECT, the ECM will send the request signal to the condenser fan relay.

When the HeVAC module requests air conditioning, the signal it sends to the ECM is through two binary switches, which sense the minimum and maximum refrigerant pressure and an evaporator thermostat. If the pressure or the temperature is below or above certain levels the binary switches will be open circuit and effectively disable the A/C request line to the ECM, which in turn will disengage the compressor clutch.

The air conditioning system is in standby mode if the HeVAC module is on and economy mode is not selected.

There are four diagnostic checks of the air conditioning system during which a fault is detected if: -

1. The A/C compressor clutch relay short circuit to battery positive, i.e. the driver voltage is greater than half the battery voltage when the driver is on.
2. The A/C compressor clutch relay short circuit to ground, i.e. the driver voltage is less than one third of the battery voltage when the driver is off.
3. The A/C compressor clutch relay is open circuit, i.e. the driver voltage is greater than one third of the battery voltage but less than two thirds of the battery voltage when the driver is off.
4. A/C has been requested when the system is not in standby mode, i.e. a signal rationality check.

Air Conditioning System								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Air Conditioning System	P1538	circuit continuity - short to battery positive	voltage - drive on	voltage > 1/2 * Battery positive	battery voltage	7.5V < Battery positive < 17V	immediately/ continuous	no MIL illumination
	P1537	circuit continuity - short to ground	voltage - drive off	Voltage < 1/3 * Battery positive				
	P1536	circuit continuity - open circuit	voltage - drive off	1/3* Battery positive < voltage < 2/3* Battery positive	engine speed	> 80 rpm		
	P1535	signal rationality check	A/C requested when not in standby mode				0.5 sec	

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.

4.22 Fuel Injectors

4.22.1 Description

The engine is fitted with 8 fuel injectors (one per cylinder), each of which is directly driven by the ECM. The Injectors are fed from a common fuel rail as part of a return less fuel system, with the fuel rail pressure constant at 3.5 bar (52 psi). The Fuel Pressure Regulator is integral to the fuel pump module, within the fuel tank. There is no reference signal line to the intake manifold.

The ECM monitors the output power stages of the injector drivers for electrical faults. A fault is detected if any of the following conditions is satisfied: -

1. Fuel injector driver short circuit to battery positive, i.e. the driver voltage is greater than half the battery voltage when the driver is on.
2. Fuel injector driver short circuit to ground, i.e. the driver voltage is less than one third of the battery voltage when the driver is off.
3. Fuel injector driver open circuit, i.e. the driver voltage is greater than one third of the battery voltage but less than two thirds of the battery voltage when the driver is off.

Fuel Injectors								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Fuel Injector	P0201 to P0208	circuit continuity - open circuit	voltage - drive off	1/3* Battery positive < voltage < 2/3* Battery positive	engine speed battery voltage	> 80 rpm 7.5V < Battery positive < 17V	immediately/ continuous	two driving cycles
	P0261/4/7 P0270/3/6 P0279/82	circuit continuity - short to ground.	voltage - drive off	voltage < 1/3 * Battery positive				
	P0262/5/8 P0271/4/7 P0280/3	circuit continuity - short to battery positive	voltage - drive on	voltage > 1/2 * Battery positive				

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.

4.23 Idle Speed Control Actuator

4.23.1 Description

The load on an idling engine is a combination of both internal and external engine loads such as engine friction, water pump, air conditioning etc., which all change with time and operating conditions. The idle speed control actuator is required to enable closed loop idle speed control to compensate for these changing conditions, by regulating the airflow into the engine.

The device consists of two coils which use opposing PWM signals to control the position of opening / closing of the rotary valve. If one circuit fails the other is switched off by the ECM as soon as it recognises the fault. This prevents the valve going to a maximum or minimum setting. There is a default position, which is determined by a permanent magnet. In the default condition the idle speed is raised and remains fixed at approximately 1200 rpm with no load.

There are eight idle speed control actuator diagnostic checks: -

1. Opening winding driver short circuit to battery positive, i.e. the driver voltage is greater than half the battery voltage when the driver is on.
2. Opening winding driver short circuit to ground, i.e. the driver voltage is less than one third of the battery voltage when the driver is off.
3. Opening winding driver open circuit, i.e. the driver voltage is greater than one third of the battery voltage but less than two thirds of the battery voltage when the driver is off.
4. Closing winding driver short circuit to battery positive, i.e. the driver voltage is greater than half the battery voltage when the driver is on.
5. Closing winding driver short circuit to ground, i.e. the driver voltage is less than one third of the battery voltage when the driver is off.
6. Closing winding driver open circuit, i.e. the driver voltage is greater than one third of the battery voltage but less than two thirds of the battery voltage when the driver is off.
7. Blocked Idle Air Control (IAC) valve – rpm error low, i.e. the engine speed is 100 rpm less than the target speed.
8. Blocked IAC valve – rpm error high, i.e. the engine speed is 180 rpm greater than the target speed.

Idle Air Control Valve								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Idle Air Control Valve opening	P1510	circuit continuity - Open circuit	voltage - drive off	1/3 * Battery positive < voltage <2/3 * Battery positive	engine speed battery voltage	> 80 rpm 7.5V < Battery positive < 17V	immediately/ continuous	two driving Cycles
	P1513	circuit continuity - short to ground	voltage - drive off	voltage < 1/3 * Battery positive				
	P1514	circuit continuity - Short to battery positive	voltage - drive on	voltage > 1/2 * Battery positive				
closing	P1551	circuit continuity - open circuit	voltage - drive off	1/3 * Battery positive < voltage <2/3 * Battery positive				
	P1552	circuit continuity - short to ground	voltage - drive off	voltage < 1/3 * Battery positive				
	P1553	circuit continuity - short to battery positive	voltage - drive on	voltage > 1/2 * Battery positive				
	P0505	functional check	actual - desired RPM	> +180 rpm < -100 rpm	vehicle speed ECT IAT altitude adaptation transfer gears engine load	= 0 mph > 80.25° C > -9.75° C > 0.712 high range < 2.5 m sec	2.0 to 3.0 sec/once per driving cycle	

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.

4.24 Fuel Pump Relay

4.24.1 Description

The Land Rover V8 engine has a return-less fuel system. The fuel pressure regulator and filter are fitted to the 'in tank fuel pump module'. The system pressure is maintained at a constant 3.5 bar (52 Psi), with no reference to intake manifold pressure. The ECM compensates for the non-constant pressure drop across the injector nozzles.

The fuel is supplied to the injectors from a fuel pump fitted within the fuel tank. The electrical supply to this fuel pump is controlled by the ECM via a relay and an Inertia fuel shutoff switch, which will turn off the fuel supply upon vehicle impact. The fuel system is pressurised to 3.5 bar as soon as the ECM is powered up, the pump is then switched off until engine start has been achieved. If the pump runs but the fuel pressure is out of limits, adaptive fuel faults are stored.

The ECM monitors the output power stage of the fuel pump relay drive for electrical faults. A fault is detected if any of the following conditions is satisfied: -

1. Fuel pump relay driver short circuit to battery positive, i.e. the driver voltage is greater than half the battery voltage when the driver is on.
2. Fuel pump relay driver short circuit to ground, i.e. the driver voltage is less than one third of the battery voltage when the driver is off.
3. Fuel pump relay driver open circuit, i.e. the driver voltage is greater than one third of the battery voltage but less than two thirds of the battery voltage when the driver is off.

Fuel Pump Relay								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Fuel Pump Relay	P1232	circuit continuity - short to battery positive	Voltage - drive on	voltage > 1/2 * Battery positive	battery voltage engine speed	7.5V < Battery positive < 17V > 80 rpm	immediately/ continuous	no MIL illumination
	P1231	circuit continuity – short to ground	Voltage - drive off	voltage < 1/3 * Battery positive	time after fuel pump off	> 0.5 sec		
	P1230	circuit continuity – open circuit	Voltage - drive off	1/3 * Battery positive < voltage < 2/3 * Battery positive				

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.