ENGINE MANAGEMENT

SECTION EMP

EMP.1 - DIAGNOSTIC TROUBLE CODE LIST

When applicable, reference may be made under the 'Notes' heading to a page in the Toyota service manual. This information should be used only for diagnosis and connection detail of the **sensor**. The Elise/Exige uses a Lotus ECU, the connections for which may be found in circuit diagrams in Section MP. Diagnostic Trouble Codes should be read using a Lotus Scan tool T000T1418F.

For 2006 M.Y. Trouble Codes see Section EMP.6

Camshaft Timing Control (VVT) **P0011**
P0012
P0076
P0077

P0011 Camshaft Position – Timing Over-Advanced or System Performance
P0012 Camshaft Position – Timing Over-Retarded
P0076 Intake Valve Control Solenoid Circuit Low
P0077 Intake Valve Control Solenoid Circuit High

Description
The Variable Valve Timing system (VVT) on the intake camshaft can vary the timing by approximately 25°. The camshaft relative position is varied by a system of vanes mounted on the drive end of the camshaft. The VVT oil control valve modulates a spool valve position in accordance with the drive signal duty cycle, this in turns controls the oil pressure applied to the vanes. A 50% duty cycle applied to the valve will hold the valve current timing by preventing oil flow from the VVT controller housing, a duty cycle less than 50% will retard the valve timing, a duty cycle greater then 50% will advance the valve timing.

Component connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Battery Voltage	-	-	
2	VVT Oil Control Valve	49 (J3)	52 Way (Right)	**'06 M.Y. in brackets**

P0011, P0012

Monitor: Continuous

Enable Criteria:
- Engine running > 30 secs
- Coolant temperature > 60°C (140°F)

Disable Criteria:
P0116, P0117, P0118 – Coolant temperature fault codes

Potential failure modes:
- Static valve timing is incorrect
- VVT camshaft actuator failure
- VVT valve stuck open / closed

P0076, P0077

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- VVT valve open circuit
- VVT valve short to ground
- ECU output circuit failure

Notes:
The MIL will be illuminated if the faults are present for 2 consecutive trips

Intake Air Flow **P0101**
P0102
P0103

P0101 Mass or Volume Air Flow Circuit Range/Performance
P0102 Mass or Volume Air Flow Circuit Low Input
P0103 Mass or Volume Air Flow Circuit High Input

Description
The Mass Air Flow (MAF) sensor is incorporated into the airbox, and measures both intake air flow rate and Intake Air Temperature (IAT). The MAF sensor uses a platinum hot wire and a cold wire element. By controlling the current flow through the hot wire to maintain a constant temperature, and therefore known resistance, any change in air flow and therefore temperature, will be detected by a change in resistance. This change of resistance is the output signal from the sensor.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Battery Voltage	-	-	
2	MAF Ground	31 (D2)	52 Way (Right)	
3	MAF Signal	45 (B4)	52 Way (Right)	**'06 M.Y. in brackets**
4	IAT Signal	44 (B3)	52 Way (Right)	
5	IAT Ground	18 (D2)	52 Way (Right)	

Sensor characteristics
0 – 655 g/sec
Typical values: 1.5 – 5.0 g/sec (idle), 5.0 – 15.0 g/sec (2500rpm elevated idle no load)

Monitor: Continuous.

P0101

Enable Criteria:
- Engine running
- Engine speed >2490rpm
- TPS > 80% (P0101 – MAPS* too low)
- TPS < 5% (P0101 – MAPS* too high)

*(MAPS – Mass Air Per Stroke)

Disable Criteria:
P0122, P0123, P0222, P0223 – Throttle/Pedal position fault codes

Potential failure modes:
- MAF sensor battery voltage open circuit (MAF value (g/sec) = 0.0)
- MAF sensor signal open circuit or short to ground (MAF value (g/sec) = 0.0)
- MAF sensor ground open circuit (MAF value (g/sec) > 229.0)

P0102

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- MAF sensor battery voltage open circuit (MAF value (g/sec) = 0.0)
- MAF sensor signal open circuit or short to ground (MAF value (g/sec) = 0.0)
- MAF sensor ground open circuit (MAF value (g/sec) > 229.0)

P0103

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- MAF sensor battery voltage open circuit (MAF value (g/sec) = 0.0)
- MAF sensor signal open circuit or short to ground (MAF value (g/sec) = 0.0)
- MAF sensor ground open circuit (MAF value (g/sec) > 229.0)

Notes:
- The MIL will be illuminated if the faults are present for 2 consecutive trips
- Further information on the sensor may be found in Toyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) Page DI-26 to DI-32

Barometric Pressure **P0106**
P0107
P0108

P0106 Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance
P0107 Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108 Manifold Absolute Pressure/Barometric Pressure Circuit High Input

Description
The barometric pressure sensor is located internally within the ECU, and measures atmospheric pressure. This parameter is required to compensate the mass air flow when the vehicle is operated at higher altitudes.

Monitor: Continuous

P0106

Enable Criteria:
- Engine running
- Engine speed 2190 – 3510rpm
- TPS > 80%

Disable Criteria:
P0101, P0102, P0103 – MAF Sensor fault codes
P0121, P0122, P0123, P0222, P0223, P2135 – Throttle/Pedal position fault codes

Potential failure modes:
Sensor failure

P0107, P0108

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
Sensor failure

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips

Intake Air Temperature **P0111**
P0112
P0113

P0111 Intake Air Temperature Sensor 1 Circuit Range/Performance
P0112 Intake Air Temperature Sensor 1 Circuit Low
P0113 Intake Air Temperature Sensor 1 Circuit High

Description
The combined sensor which measure both Mass Air Flow (MAF) and Intake Air Temperature (IAT) is incorporated into the airbox. The IAT sensor is a thermistor device which changes resistance with temperature. As air intake temperature decreases the thermistor resistance value increases, and conversely as air temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Battery Voltage	-	-	
2	MAF Ground	31 (D2)	52 Way (Right)	
3	MAF Signal	45 (B4)	52 Way (Right)	**'06 M.Y. in brackets**
4	IAT Signal	44 (B3)	52 Way (Right)	
5	IAT Ground	18 (D2)	52 Way (Right)	

Sensor characteristics
IAT -20°C (-4°F) 12.5 – 16.9 kΩ
IAT 20°C (68°F) 2.19 – 2.67 kΩ
IAT 60°C (140°F) 0.50 – 0.68 kΩ

Monitor: Continuous

P0111

Enable Criteria:
- Engine running < 30 secs
- Coolant temperature < 30°C (86°F)

Disable Criteria:
P0116, P0117, P0118 – Coolant temperature fault codes

Potential failure modes:
- P0112 – signal short circuit
- P0113 – signal open circuit
- Sensor failure

P0112

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- Signal short circuit (IAT = –40°C (–104°F) < 0.049 V)
- Sensor failure

P0113

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- Signal open circuit (IAT > 140°C (284°F) > 4.932 V)
- Sensor failure

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-33 to DI-38

Engine Coolant Temperature **P0116**
P0117
P0118

P0116 Engine Coolant Temperature Circuit Range/Performance
P0117 Engine Coolant Temperature Circuit Low
P0118 Engine Coolant Temperature Circuit High

Description
The engine coolant temperature sensor is a thermistor device which changes resistance with temperature. As coolant temperature decreases the thermistor resistance value increases, and conversely as coolant temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Ground	7 (H1)	52 Way (Right)	**'06 M.Y. in brackets**
2	Signal	33 (C3)	52 Way (Right)	

Sensor characteristics
0°C (32°F) = 3.279 V
19.4°C (67°F) = 2.186 V
42.5°C (108.5°F) = 1.249 V
80°C (176°F) = 0.469 V

P0116

Enable Criteria:
Engine running > 800 seconds

Disable Criteria: None

Potential failure modes:
- P0117 – signal short circuit
- P0118 – signal open circuit
- Sensor failure

P0117

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- Signal short circuit (Coolant Temperature = –40°C (–104°F) < 0.029 V)
- Sensor failure

P0118

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- Signal open circuit (Coolant Temperature > 140°C (284°F) > 4.892 V)
- Sensor failure

Notes:

- The MIL will be illuminated if the fault is present for 2 consecutive trips
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) page DI-39 to DI-45

Throttle Position **P0121**
P0122
P0123

P0121 Throttle Position Sensor 'A' Circuit Range/Performance
P0122 Throttle Position Sensor 'A' Circuit Low
P0123 Throttle Position Sensor 'A' Circuit High

Description
The Throttle Position Sensor (TPS) is a potentiometer device, which is connected to a 5V reference source, a ground and an input signal to the ECU.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Ground	34 (D1)	52 Way (Right)	
2	5V Ref.	8 (M4)	52 Way (Right)	**'06 M.Y. in brackets**
3	TPS1 Signal	20 (D3)	52 Way (Right)	
4	TPS2 Signal	(E3)	(Right)	

Sensor characteristics
0% = 0.595 V ± 5%
100% = 4.148 V ± 5%

Monitor: Continuous.

P0121

Enable Criteria:
Rationality check – throttle not too high at low engine load:
- Engine running
- TPS > 80%
- Engine speed >1500rpm
- MAPS* < 40%
- Vehicle Speed > 30 km/h (18.6mph)

OR
Rationality check – throttle not too low at high engine load:
- Engine running
- TPS < 10%
- Engine speed 1500 – 2010rpm
- MAPS* > 65%

*(MAPS – Mass Air Per Stroke)

Disable Criteria:
P0101, P0102, P0103 – MAF Sensor fault codes
P0500 – Vehicle Speed sensor
P0016 – Crankshaft/Camshaft position correlation error

Potential failure modes:
- Sensor short or open circuit
- Sensor failure

P0122

Enable Criteria: None

Disable Criteria:
P0016 – Crankshaft/Camshaft position correlation error

Potential failure modes:
- Signal short circuit (< 0.283 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

P0123

Enable Criteria: None

Disable Criteria:
P0016 – Crankshaft/Camshaft position correlation error

Potential failure modes:
- Signal open circuit (> 4.487 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) page DI-45 to DI-52

Coolant Thermostat **P0128**

P0128 Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)

Description
The thermostat diagnostic is enabled after each cold engine start, and monitors the rate of temperature rise during warm up relative to the measured engine air flow.

Monitor: Continuous

Enable Criteria:
- Engine running
- Coolant Temperature > -10°C (14°F)
- Coolant Temperature < 70°C (158°F)

Disable Criteria:
P116, P117, P118 – Engine Coolant Temperature sensor faults

Potential failure modes:
Thermostat failure

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

O2 Sensor (Pre Catalyst) **P0131**
P0132
P0133
P0134
P0135

P0131 O2 Sensor 1 Circuit Low Voltage
P0132 O2 Sensor 1 Circuit High Voltage
P0133 O2 Sensor 1 Circuit Slow Response
P0134 O2 Sensor 1 Circuit No Activity Detected
P0135 O2 Sensor 1 Heater Circuit

Description
The oxygen sensor monitors the oxygen content in the exhaust gases. The sensor consists of a zirconia electrode between two platinum plates. When zirconia comes into contact with oxygen, it becomes an electrical conductor. The exhaust gases pass through louvers in the sensor. One plate is in contact with the outside air and the other plate is in contact with the exhaust gases. The platinum plate in contact with the air is electrically negative due to the oxygen in the atmosphere and the plate in contact with the exhaust gases is electrically positive. This will cause a difference in electrical potential to develop between the two plates. Thus the voltage across the platinum plates ranges approximately from 100 millivolts to 900 millivolts, depending on the oxygen content of the exhaust gases. Thus when the air/fuel mixture is rich, the oxygen sensor output will be high. If the air/fuel mixture is lean, the oxygen sensor output will be low.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Signal	15 (A3)	52 Way (Left)	
2	Ground	41 (F4)	52 Way (Left)	**'06 M.Y. in brackets**
3	Heater	1 (K3)	52 Way (Left)	
4	Battery Voltage	-	-	

Sensor characteristics
Normal operating range is 0 – 1000mV

Malfunction Criteria

P0131
Set when the sensor operates below 5mV for more than 1.5 seconds consecutively for a specified number of times.

Monitor: Continuous

Disable Criteria: DFCO (Deceleration Fuel Cut Off)

Potential failure modes:
- Low fuel pressure (Lean mixture)
- Malfunctioning sensor
- External water on sensor
- Sensor wire shorted to ground

P0132
Set when the sensor operates above 1200mV for more than 1.5 seconds consecutively for a specified number of times.

Monitor: Continuous

Potential failure modes:
- High fuel pressure (Rich mixture)
- Leaking or shorted injector
- Purge valve fault
- Oxygen sensor contamination
- Engine oil contamination
- Sensor wire

P0133
Set when the sensor fails to switch from a Lean to a Rich condition or switch from a Rich to a Lean condition in a sufficiently timely manner. A selection of switches is used to determine the average times.

Enable Criteria:
- Vehicle speed between 0 – 255 km/h (158.5 mph)
- MAF per stroke between 15 – 70 mg
- Engine speed between 2600 – 3511rpm
- Engine run time > 200 seconds
- Coolant temperature > 60°C (140°F)
- Closed loop fuelling enabled

Disable Criteria:

P0116, P0117, P0118	– Coolant temperature sensor faults
P0131, P0132, P0134, P0135	– Pre catalyst oxygen sensor faults
P0101, P0102, P0103	– MAF sensor faults

Monitor:
Monitored until the required amount of switches in both directions has been achieved (Approx. 150 sec)

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections
- Sensor contaminated, possibly from fuel, improper use of RTV, engine oil or coolant

P0134
Set when the sensor fails to switch above 557mV ('06 M.Y.; 675mV) and below 400mV within a 5.1 second period for 5 consecutive checks ('06 M.Y.; within 60 sec).

Enable Criteria:
- Engine run time > 30 seconds
- Engine is not at idle
- Engine is in closed loop fuel control

Monitor:
Until either passed or failed (5.1 x 5 = 25.5 sec + initial 30 sec = 55 sec maximum).

Potential failure modes:
Sensor connector and wiring should be checked for corrosion and loose connections.

P0135
Set when the sensor output is greater than 1900mA or less than 250mA for 1.5 seconds, for 40 consecutive checks.

Enable Criteria:
Engine run time > 60 seconds

Monitor:
Continuous

Potential failure modes:
Sensor connector and wiring should be checked for corrosion and loose connections.

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-53 to DI-62

O2 Sensor (Post Catalyst) **P0137**
P0138
P0139
P0140
P0141

P0137 O2 Sensor Circuit Low Voltage
P0138 O2 Sensor Circuit High Voltage
P0139 O2 Sensor Circuit Slow Response
P0140 O2 Sensor Circuit No Activity Detected
P0141 O2 Sensor Heater Circuit

Description
The oxygen sensor monitors the oxygen content in the exhaust gases. The sensor consists of a zirconia electrode between two platinum plates. When zirconia comes into contact with oxygen, it becomes an electrical conductor. The exhaust gases passes through louvers in the sensor. One plate is in contact with the outside air and the other plate is in contact with the exhaust gases. The platinum plate in contact with the air is electrically negative due to the oxygen in the atmosphere and the plate in contact with the exhaust gases is electrically positive. This will cause a difference in electrical potential to develop between the two plates. Thus the voltage across the platinum plates ranges approximately from 100 millivolts to 900 millivolts, depending on the oxygen content of the exhaust gases. Thus when the air/fuel mixture is rich, the oxygen sensor output will be high. If the air/fuel mixture is lean, the oxygen sensor output will be low. The post catalyst oxygen sensor performance is a good indicator of catalyst efficiency.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Signal	3 (B3)	52 Way (Left)	
2	Ground	29 (F4)	52 Way (Left)	**'06 M.Y. in brackets**
3	Heater	27 (H3)	52 Way (Left)	
4	Battery Voltage	-	-	

Sensor characteristics
Normal operating range is 0 – 1000mV

Malfunction Criteria

P0137
Set when the sensor operates below 5mV for more than 1.5 seconds consecutively for a specified number of times.

Monitor: Continuous

Disable Criteria: DFCO (Deceleration Fuel Cut Off)

Potential failure modes:
- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set
- Sensor wire shorted to ground
- Catalyst

P0138
Set when the sensor operates above 1200mV for more than 1.5 seconds consecutively for a specified number of times.

Monitor: Continuous

Potential failure modes:
- Check and rectify any front sensor fault code, as they may be causing the fault code to be set
- Catalyst

P0139

Set when the sensor fails to reach 650mV after 1.9 seconds of P.E or when the sensor fails to drop below 150mV after 5 seconds of DFCO ('06 M.Y.; Set when sensor fails to switch between 250mV and 650mV with sufficient rapidity).

Enable Criteria:
- Engine run time > 200 seconds
- Coolant temperature > 60°C (140°F)
- Open loop fuel control
- DFCO (Deceleration Fuel Cut Off) followed by idle operation for 'lean to rich' switch
- DFCO for 'rich to lean' switch

Disable Criteria:

P0116, P0117, P0118	– Coolant Temperature Sensor faults
P0201, P0202, P0203, P0204	– Injector faults
P0300, P0301, P0302, P0303, P0304	– Misfire faults
P1301, P1302	– Misfire faults causing emission or catalyst damage

Monitor: Continuous, until the test is either passed or failed

Potential failure modes:
- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set
- Catalyst

P0140

Set when the sensor fails to switch above 557mV and below 400mV within 60 seconds.

Enable Criteria:
- Engine run time > 30 seconds
- Engine is not at idle
- Engine is in closed loop fuel control

Monitor: Continuous

Potential failure modes:
- Check and rectify any front sensor fault code, as they may be causing the fault code to be set
- Sensor connector and wiring should be checked for corrosion and loose connections
- Catalyst

P0141

Set when the sensor output is greater than 1900mA or less than 250mA for 1.5 seconds, for 40 consecutive checks.

Enable Criteria: Engine run time > 60 seconds

Monitor: Continuous

Potential failure modes:
Sensor connector and wiring should be checked for corrosion and loose connections

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found in Toyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-63 to DI-66

Fuel Control System Too Lean Or Rich **P0171**
P0172

P0171 System Too Lean
P0172 System Too Rich

Description
The oxygen sensor sends a signal to the ECU corresponding to the exhaust gas oxygen content enabling the ECU to maintain a 14.7:1 air/fuel ratio under normal driving conditions. The ECU can make fuel corrections of ± 17% to the calculated fuel demand. If the ECU determines a rich condition exists (oxygen sensor above 0.450mV), it will decrease the calculated fuel demand to maintain a 14.7:1 ratio. If the ECU determines a lean condition exists (oxygen sensor below 0.450mV), it will increase the calculated fuel demand to maintain a 14.7:1 ratio.

Enable Criteria
- Fuel Trim condition enabled
- Closed loop fuelling enabled
- Engine speed > 1100 rpm
- MAF > 6 g/sec
- Engine load < 70 %
- Altitude < 8000 ft (2438 m), Baro > 756 mbar
- Inlet air temperature > -10°C (14°F)

Disable Criteria

P0106, P0107, P0108	– Baro sensor faults
P0111, P0112, P0113	– Air Intake Sensor faults
P0131, P0132, P0133, P0134, P0135	– Oxygen sensor faults
P0300, P0301, P0302, P0303, P0304	– Misfire faults
P0441, P0442, P0443, P0447, P0448, P0450, P0451, P0455, P0456	– EVAP faults

Monitor: Continuous

Malfunction Criteria
P0171
This code is set when the calculated fuel demand has been increased to its maximum limit of 17% and the system still cannot maintain an air/fuel ratio of 14.7:1 under normal driving conditions.

Potential failure modes:
- Fuel Pressure too low
- Air leak in system
- Water in fuel
- Exhaust leak / crack before front oxygen sensor
- Injector fault
- Sensor connector and wiring for signs of corrosion or loose connections

P0172
This code is set when the calculated fuel demand has been decreased to its minimum limit of -17% and the system still cannot maintain an air/fuel ratio of 14.7:1 under normal driving conditions.

Potential failure modes:
- Fuel Pressure too high
- Leaking fuel injector
- Restriction in the exhaust system or air intake / filter
- Erratic throttle position sensor

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-67 to DI-72

Fuel Injection System **P0201**
P0202
P0203
P0204

P0201 Injector Circuit/Open – Cylinder 1
P0202 Injector Circuit/Open – Cylinder 2
P0203 Injector Circuit/Open – Cylinder 3
P0204 Injector Circuit/Open – Cylinder 4

Description
The ECU has four injector driver circuits, each of which controls an injector. When the engine is running the ECU continuously monitors the injector circuit feedback signals. The feedback signal should be low when the injector is ON and high voltage when the injector is OFF.

Component connections

Injector	*ECU Pin*	*ECU Connector*
1	25 (J1)	52 Way (Right)
2	51 (K4)	52 Way (Right)
3	14 (K3)	52 Way (Right)
4	40 (K2)	52 Way (Right)

'06 M.Y. in brackets

Malfunction Criteria
The operation of all the injector codes is the same, the last digit relates to the injector involved i.e. a code P0203 indicates there is a problem with injector number 3.

Enable Criteria: Engine running

Monitor: Continuous

Limp home:
- Limit maximum engine speed to 6000rpm
- Return the fuel system to open loop fuel control

Potential failure modes:
Sensor connector or wiring corroded or loose connections

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- If an injector goes short circuit it is likely that the ECU injector driver will be damaged.

Misfire **P0300**
P0301
P0302
P0303
P0304

P0300 Random/Multiple Cylinder Misfire Detected
P0301 Cylinder 1 Misfire Detected
P0302 Cylinder 2 Misfire Detected
P0303 Cylinder 3 Misfire Detected
P0304 Cylinder 4 Misfire Detected

Description
A misfiring cylinder can be detected by analysing crank speed variation. As a result of a combustion event there will be a net acceleration of the crankshaft. Subsequent to a misfire event the engine will decelerate over the period following the missed cylinder event.
Speed changes can be characterised by observing changes in the time period for a fixed angle of rotation after firing events. A significant change in this period, assessed by comparison to previous periods, may be attributed to misfire on a known cylinder.

Component connections **'06 M.Y. in brackets**

Connector	*Description*	*ECU Pin*				*ECU Connector*
1	Supply Voltage	Coil 1	Coil 2	Coil 3	Coil 4	
2	Ignition Coil Feedback	22 (F3)	22 (F3)	22 (F3)	22 (F3)	52 Way (Right)
3	Coil Output (Logic)	52 (G1)	26 (G4)	47 (G3)	48 (G2)	52 Way (Right)
4	Ground					

Malfunction Criteria
The operation of all the misfire codes is the same, the last digit relates to the misfire involved i.e. a code P0303 indicates there is a problem with coil number 3. P0300 indicates the misfire is random and not linked to one particular cylinder.

Enable Criteria:
- Battery voltage between 10 – 16 V
- Coolant temperature between -10 – 120°C (14 – 248°F)
- Engine speed between 660 – 8010rpm
- Engine speed transient > 15rpm
- Altitude < 8000 ft (2438 m) / Baro > 756mbar
- Fuel level > 5 litres (1.3 US gallons)
- Engine load between 15 – 48% depending on engine speed

Disable Criteria: DFCO enabled (Deceleration Fuel Cut Off)

Monitor: Continuous

Limp home:
- Limit maximum engine speed to 6000 rpm
- Return the fuel system to open loop
- ECU may deactivate two cylinders, the misfiring cylinder and it's matched other i.e. 1 & 4 or 2 & 3.

Potential failure modes:
- Injector related codes, as these can cause misfire codes to be set.
- VVT or VVL codes set
- Sensor connector and wiring for signs of corrosion or loose connections
- Spark plug / Cylinder compression
- Cam timing / Damage to rocker arm assembly

Notes:

- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-73 to DI-78

Knock Control System **P0324**
P0327
P0328

P0324 Knock Control System Error
P0327 Knock Sensor 1 Circuit Low
P0328 Knock Sensor 1 Circuit High

Description
The knock sensor contains a piezoelectric element which generates a voltage when it becomes deformed. The piezoelectric element sends the signal to the ECU, when the cylinder block vibrates due to engine knocking. If knock is detected then the ECU will retard the ignition to suppress it. The knock control sensor cannot differentiate between spark knock and other similar sounding noises.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Sensor input	43 (C4)	52 Way (Right)	**'06 M.Y. in brackets**
2	Ground	13 (A4)	52 Way (Right)	

Malfunction Criteria
P0327 – This code is set when the knock sensor signal is < 0.586 V
P0328 – This code is set when the knock sensor signal is > 2.928 V

Potential failure modes:
- Abnormal engine noise, i.e. damaged engine or exhaust system contacting vehicle
- Knock sensor fixing too tight
- Sensor connector / wiring corroded or loose connections

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-79 to DI-81

Engine Speed / Position Sensors **P0335**

P0335 Crankshaft Position Sensor “A” Circuit Range/Performance

Description
Engine speed is calculated by measuring the time between the ‘teeth’ of the crankshaft sensor trigger disc. The disc has 34 ‘teeth’ and 2 missing ‘teeth’, spaced at 10 degree intervals around the disc. The 2 missing ‘teeth’ are positioned at 225 degrees before cylinder No.1 and 4 TDC. The crankshaft sensor signal is also used to determine misfires events.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Sensor input	4 (E1)	52 Way (Right)	**'06 M.Y. in brackets**
2	Ground	30 (E4)	52 Way (Right)	

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- Sensor signal open circuit or short to ground
- Sensor ground open circuit
- Sensor failure

Notes:
- If a sensor or sensor circuit failure occurs, the engine will not fire or start.
- The MIL will be illuminated if the fault is present for 2 consecutive trips
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-82 to DI-83

Engine Speed / Position Sensors **P0340**

P0340 Camshaft Position Sensor “A” Circuit

Description
The camshaft position input to the ECU is used to determine engine phase, enable sequential fuel injection control and to determine camshaft position for the VVT system. The inlet camshaft has three ‘teeth’ spaced 90° apart, which are detected by the electromagnetic sensor. The valve timing setting is measured in the ECU by measuring time from a (fixed position) crankshaft tooth to a (variable position) camshaft tooth. As the engine speed and the position is known from the crankshaft sensor signal, the camshaft position can be calculated.

Sensor connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Signal(VR Input)	16 (C1)	52 Way (Right)	**'06 M.Y. in brackets**
2	Ground	42 (E2)	52 Way (Right)	

Monitor: Continuous

Enable Criteria:
- Engine running
- Engine speed > 600rpm

Disable Criteria: None

Potential failure modes:
- Sensor signal open circuit or short to ground
- Sensor ground open circuit
- Sensor failure

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found in Toyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-84 to DI-85

Ignition System **P0351**
P0352
P0353
P0354

P0351 Ignition Coil “A” Primary/Secondary Circuit
P0352 Ignition Coil “B” Primary/Secondary Circuit
P0353 Ignition Coil “C” Primary/Secondary Circuit
P0354 Ignition Coil “D” Primary/Secondary Circuit

Description
A Direct Ignition System (DIS) is used on the engine. The DIS improves the ignition accuracy, reduces high-voltage loss, and enhances the reliability of the ignition system. The DIS is a 1-cylinder system that ignites one cylinder with one ignition coil. The ECU determines the ignition timing and outputs the ignition signals (IGT) for each cylinder. Based on IGT signals, the power transistors in the igniter cuts off the current to the primary coil, which induces a spark at the spark plug connected to the secondary coil. The igniter will also send an ignition confirmation signal (IGF) as a fail-safe measure to the ECU.

Component connections **'06 M.Y. in brackets**

Connector Pin	*Description*	*ECU Pin*				*ECU Connector*
1	Supply Voltage	Coil 1	Coil 2	Coil 3	Coil 4	
2	Ignition Coil Feedback	22 (F3)	22 (F3)	22 (F3)	22 (F3)	52 Way (Right)
3	Coil Output (Logic)	52 (G1)	26 (G4)	47 (G3)	48 (G2)	52 Way (Right)
4	Ground					

Malfunction Criteria
No IGF signal to ECM while engine is running

Potential failure modes:
- Open or short in IGF1 – IGF4 circuit from ignition coil to ECU
- Coil failure

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-97 to DI-103

Catalyst System Efficiency **P0420**

P0420 Catalyst System Efficiency Below Threshold

Description
The ECU compares the waveform of the oxygen sensors located before and after the catalyst to determine whether or not the catalyst has deteriorated. If the catalyst is functioning normally the front oxygen sensor will be switching between rich and lean whilst the rear oxygen sensor should also be switching between rich and lean but more slowly. When both the oxygen sensor waveforms change at the same rate, it indicates that the catalyst performance has deteriorated. The ECU counts the number of pre and post catalyst oxygen sensor switches and divides one by the other to determine a ratio number. If the ratio number is greater than 0.6 ('06 M.Y.; 0.165) the code is set.

Sensor connections
Pre catalyst oxygen sensor

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Signal	15 (A3)	52 Way (Left)	
2	Ground	41 (F4)	52 Way (Left)	**'06 M.Y. in brackets**
3	Heater Supply	1 (K3)	52 Way (Left)	
4	Battery Voltage	-	-	

Post catalyst oxygen sensor

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Signal	3 (B3)	52 Way (Left)	
2	Ground	29 (F4)	52 Way (Left)	**'06 M.Y. in brackets**
3	Heater Supply	27 (H3)	52 Way (Left)	
4	Battery Voltage	-	-	

Malfunction Criteria
- Closed loop fuel control enabled
- Coolant temperature > 60 °C (140 °F)
- Baro > 756 mbar
- Vehicle speed < 130 km/h (81 mph)
- MAF < 40 g/sec
- Air inlet temp > -10°C (14°F)

Disable Criteria:

P0101, P0102, P0103	– MAF faults
P0107, P0108	– MAP / Baro Faults
P0116, P0117, P0118	– Coolant temperature faults
P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0139, P0140, P0141	– Oxygen sensor faults
P0171, P0172	– Fuelling faults
P0300, P0301, P0302, P0303, P0304	– Misfire faults

Potential failure modes:
- Exhaust system leak
- Oxygen sensor faults
- Oxygen sensor heater failure
- Catalyst failure

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found inToyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) pages DI-86 to DI-88

Evaporative Emission Control – Leak Detection System **P0441**
P0442
P0455
P0456

P0441 Evaporative Emission System Incorrect Purge Flow
P0442 Evaporative Emission System Leak Detected (small leak)
P0455 Evaporative Emission System Leak Detected (large leak)
P0456 Evaporative Emission System Leak Detected (very small leak)

Description
During an Evaporative Emission System Leak Detection check, the vacuum in the system is monitored by ECU using the fuel tank pressure sensor. At the appropriate time, the test starts with the ECU closing the canister closure value and opening the purge solenoid with the appropriate duty cycle. This allows the engine to draw a vacuum on the entire evaporative emission system. After a calibrated vacuum level is achieved the purge solenoid is closed, sealing the system. A leak is detected by monitoring any decrease in vacuum level over a calibrated period of time.

Sensor / component connections
Vapour Pressure sensor

Connector Pins	*Description*	*ECU Pin*	*ECU Connector*	
1	Ground	78 (L4)	28 Way (Left)	
2	Signal	75 (C1)	28 Way (Left)	**'06 M.Y. in brackets**
3	5V V. Ref.	55 (M4)	28 Way (Left)	

Purge Canister Closure Valve

Connector Pins	*Description*	*ECU Pin*	*ECU Connector*	
A	Battery Voltage	-	-	
B	ECU ground	9 (H2)	52 Way (Left)	**'06 M.Y. in brackets**

Purge Solenoid

Connector Pins	*Description*	*ECU Pin*	*ECU Connector*	
A	Battery Voltage	-	-	
B	ECU ground	38 (F4)	52 Way (Right)	**'06 M.Y. in brackets**

Enable Criteria:
- Altitude < 8000 ft (2438 m), Baro > 700 mbar
- Coolant > 45°C (113°F)
- Air temp < 80°C (176°F)
- Fuel level between 8 – 35 litres (2.1 – 9.24 US gallons)
- Vehicle must be stationary
- Closed loop fuelling control enabled
- Closed loop idle speed control enabled
- Ignition on

Disable Criteria:

P0171, P0172	– Fuel trim too rich or lean soft code
P0441, P0444, P0445	– Purge faults
P0446, P0447, P0448	– Canister closure faults
P0451, P0452, P0453	– Tank Pressure sensor faults
P0461, P0462, P0463	– Fuel level sensor faults
P0500	– Vehicle speed faults

Malfunction Criteria

P0441
This code can be caused by the purge value being either stuck closed or open.

Purge valve stuck open
A purge valve that is unable to seal correctly will result in a tank evacuation during the sealing phase of the leak check sequence. In this phase, a pressure rise would normally be expected but when the purge valve is not sealing this causes depression in the tank. When the pressure is below -1.7mbar a purge valve fault is detected.

Purge valve stuck closed
A purge valve that is unable to open will not be able to achieve the required depression during the evacuation phase. A positive pressure rise during the leak check evacuation phase will be detected. Additional purge checks will set a purge valve fault code.

Monitor: Until leak check is completed

P0442
This code is set during the evaporative leak check process if the system calculates the measure of leak is above a specified value (determined by a table related to fuel level) after the 6.3 second timer has expired.

Monitor: Until leak check is completed

Potential failure modes:
- Leak from pipes or connections
- Leaking or damaged seal on filler cap / not fitted correctly
- Canister Closure valve not fully closing

P0455
This code is set if during the evaporative leak check the system fails to reach the evacuation target pressure. The system will perform additional purge checks to determine the nature of the problem. The additional purge checks will also run if the leak check fails to complete because the calculated vapour concentration is above the limit.

Additional Purge Check Enable Criteria:
- Vehicle not stationary
- Load between 30 – 35%
- Purge value >= 75%

Monitor: Until leak check is completed

Potential failure modes
- Fuel filler cap not fitted
- Leak from pipes or connections
- Canister Closure valve stuck open

P0456
This code is set during the evaporative leak check process if the system calculates the measure of leak is above a specified value (determined by a table related to fuel level) after the 19.7 second timer has expired.

Monitor: Until leak check is completed

Potential failure modes:
- Leak from pipes or connections
- Leaking or damaged seal on filler cap / not fitted correctly
- Canister Closure valve not fully closing

Notes:
- The MIL will be illuminated if the fault is present for 2 consecutive trips.
- Further information on the sensor may be found in Toyota 1ZZ-FE, 2ZZ-GE manual RM733E (B120T0327J) page FI-53

Evaporative Emission Control – Purge, Open / Closed Circuit

P0444
P0445
P0446
P0447
P0448
P0451
P0452
P0453

P0444 Evaporative Emission System Purge Control Valve Circuit Open
P0445 Evaporative Emission System Purge Control Valve Circuit Closed
P0446 Evaporative Emission System Vent Control Circuit
P0447 Evaporative Emission System Vent Control Circuit Open
P0448 Evaporative Emission System Vent Control Circuit Closed
P0451 Evaporative Emission System Pressure Sensor/Switch Range/Performance
P0452 Evaporative Emission System Pressure Sensor/Switch Low
P0453 Evaporative Emission System Pressure Sensor/Switch High

Description
When the engine is running the ECU continuously monitors the feedback signals from the evaporative emission components. The feedback signal should be low when the turned ON and high when turned Off. The following codes will be set if the above conditions are not met.

P0444, P0445, P0447, P0448, P0452, P0453

P0446
This code can be caused by the canister closure valve (CCV) being either stuck closed or open.

CCV stuck open:
A CCV is stuck open then there will be minimal tank depression when the leak test is performed. Addition check will be performed when the vehicle is being driven before the code is set.

CCV stuck closed:
Detection of a stuck closed CCV is implemented by detecting an excessively low tank pressure during normal purge. Detection of this fault will disable further purging
Additional checks for stuck CCV closed:
- Vehicle not stationary
- Load between 30 – 35%
- Purge Value >= 75%

Monitor: Until leak check is completed.

P0451
This code is set when the ECU detects abnormalities in the fuel tank vapour pressure sensor signal. The ECU analyses the filtered and unfiltered pressure signal at idle after a de-slosh period to determine if there is any difference, a big difference indicates as fault. The ECU also monitors the signal on gear changes to see if there is any pressure rise as a result of the fuel sloshing around.

Disable Criteria:
P0500 – Wheel speed sensor fault

Monitor: Until leak check is completed

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

Fuel Level Sensor **P0461**
P0462
P0463

P0461 Fuel Level Sensor “A” Circuit Range/Performance
P0462 Fuel Level Sensor “A” Circuit Low
P0463 Fuel Level Sensor “A” Circuit High

Description
When the engine is running the ECU continuously monitors the fuel level sensor feedback signals. The feedback signal should be low when turned ON and high when turned OFF. The following codes will be set if the above conditions are not meet.

Sensor connections **'06 M.Y. in brackets**

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*
1	Vapour pressure and fuel level ground	78 (L4)	28 Way (Left)
2	Fuel level sensor	76 (E3)	28 Way (Left)
3	Vapour pressure & fuel level V ref.	55 (M4)	28 Way (Left)

Enable Criteria:
- P0462 & P0463 – Condition not met as above
- P0461 – Checks for three conditions, stuck when full, stuck when empty or stuck midway. The ECU determines if the sensor is stuck by calculating the amount of fuel used during the test period with the engine conditions as listed below.
- RPM > 2800rpm
- Load > 40%
- Minimum Fuel level > 2 litres (0.5 US gallons)
- If the ECU calculates that no fuel has been used during these tests it indicates that the sensor is not working correctly. The ECU also monitors the filtered and unfiltered signal at idle after a 10 second de-slosh period and compares the differences. Gear changes cause the fuel to slosh around so the ECU monitors the signal to see if there is any pressure rise.

Disable Criteria:
P0500 – Wheel speed sensor fault

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

Engine Cooling Fan Control **P0480**
P0481

P0480 Fan 1 Control Circuit
P0481 Fan 2 Control Circuit

Component connections

Sensor Connector	*Description*	*ECU Pin*	*ECU Connector*	
2 (ACCM 2*)	Relay #1	67 (J2)	28 Way (Left)	**'06 M.Y. in brackets**
3 (ACCM 2*)	Relay #2	60 (J3)	28 Way (Left)	

*ACCM – A/C Control Module

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- A/C Control Module failure
- ECU output circuit failure

Notes:
No MIL will be illuminated for this failure.

Vehicle Speed Sensor **P0500**

P0500 Vehicle Speed Sensor “A”

Description
The ECU uses the left rear wheel speed sensor to determine vehicle speed. This output to the ECU is via the ABS module.

Sensor connections

ABS Control Unit	*Description*	*ECU Pin*	*ECU Connector*	
3	Wheel Speed 3 from ABS (LR)	77 (B4)	28 Way (Left)	**'06 M.Y. in brackets**

Sensor characteristics
Hall Effect sensor

Malfunction Criteria
- TPS < 0.8
- Engine speed > 1800rpm and < 5010rpm
- Baro > 756 mbar

Monitor: Continuous

Potential failure modes:
- Open or short in vehicle speed sensor circuit
- Build up of debris in the sensing plate on the wheel hub

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

Idle Speed Control **P0506**
P0507
P0508
P0509

P0506 Idle Air Control System RPM Lower Than Expected
P0507 Idle Air Control System RPM Higher Than Expected
P0508 Idle Air Control System Circuit Low (prior '06 M.Y.)
P0509 Idle Air Control System Circuit High (prior '06 M.Y.)

Description
Prior to '06 M.Y. the ECU controls the air entering the engine with an idle air control (IAC) valve. To increase the idle the ECU commands the IAC to open up. This allows more air to bypass the throttle blades. To decrease the idle speed the ECU commands the IAC to close up. This will reduce the amount of air bypassing the throttle body. The ECU performs low and high circuit checks when it is activating the component.
For '06 M.Y. onwards, the electronically controlled throttle needs no IAC, as the ECU commands the throttle valve itself to control idle speed.

Component connections (prior to '06 M.Y.)

Connector	*Description*	*ECU Pin*	*ECU Connector*
1	Idle air control value	35	52 Way
2	Battery Voltage	-	-
3	Ground	-	-

Malfunction Criteria
P0506 – This code is set if the engine fails to achieve the desired idle speed by more than 100 rpm.
P0507 – This code is set if the engine fails to achieve the desired idle speed by more than 200 rpm.
P0508 – This is set when the ECU does not get the expected feedback (prior to '06 M.Y.).
P0509 – This is set when the ECU does not get the expected feedback (prior to '06 M.Y.).

Enable Criteria:
- Engine at idle speed
- Battery Voltage between 10 – 16 V
- Idle speed learn limit ± 15%
- Timer expired 5 seconds

Monitor: Continuous

Potential failure modes:
- Throttle body sticking (not fully closing) (prior to '06 M.Y.)
- Connector / wiring corroded or loose connections (prior to '06 M.Y.)
- Throttle linkage / cable binding (prior to '06 M.Y.)
- Induction system air leak
- Excessive engine load from front end accessory drive system, e.g. water pump seizing

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

Battery Voltage **P0562**
P0563

P0562 System Voltage Low
P0563 System Voltage High

Monitor: Continuous

Enable Criteria:
- Engine running
- P0562 – Voltage Too Low < 10V
- P0563 – Voltage Too High > 16V

Disable Criteria: None

Potential failure modes:
- Alternator fault
- Battery fault

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

ECU Integrity **P0601**
P0606

P0601 Checksum
P0606 Watchdog

Description
These codes are used by the ECU to check the integrity of the software and calibration data. P0601 checks that on power up the checksum for calibration data is the same as checksum saved on power down. P0606 checks the watchdog timer after a defined period to see if it has reset. If the watchdog timer has not reset then the code has entered an unplanned loop or condition stopping it resetting the timer.

Monitor
- P0601 at ECU power up
- P0606 continuously while the engine running

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

Fuel Pump **P0627**

P0627 Fuel Pump Control Circuit /Open

Description
The fuel system is of the non-return type. The pump is incorporated into the fuel tank module which also contains the level sensor, regulator and vapour pressure sensor.

Component connections

Connector	*Description*	*ECU Pin*	*ECU Connector*	
4 (RMC 1 – MFRU*)	Inertia Switch (Pin 1)	-	-	
2 (RMC 2 – MFRU*)	Fuel Pump Relay	68 (J4)	28 Way (Left)	**'06 M.Y. in brackets**

*MFRU – Multi Function Relay Unit

Monitor: Continuous

Enable Criteria: Ignition on

Disable Criteria: None

Potential failure modes:
- Pump open circuit or short to ground
- Multi Function Relay Unit failure
- Pump failure
- ECU output circuit failure

Notes:
No MIL will be illuminated for this failure.

Air Conditioning System **P0646**
P0647

P0646 A/C Clutch Relay Control Circuit Low
P0647 A/C Clutch Relay Control Circuit High

Component connections

Connector	*Description*	*ECU Pin*	*ECU Connector*	
5 (ACCM 2*)	AC Clutch Relay	53 (J1)	28 Way (Left)	**'06 M.Y. in brackets**

*ACCM – A/C Control Module

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- A/C compressor clutch open circuit or short to ground
- A/C Control Module failure
- A/C compressor clutch failure
- ECU output circuit failure

Notes:
No MIL will be illuminated for this failure.

Misfire **P1301**
P1302

P1301 Misfire level causing emissions increase
P1302 Misfire level causing catalyst system damage

Description
When the engine misfire reaches a high enough percentage the engine emission output levels can exceed the allowed limits, this will produce the fault code P1301. If the misfire percentage is high enough and there is a possibility that the catalyst may be damaged then code P1302 will be set.

See misfire faults P0300, P0301, P0302, P0303, P0304

Notes:
- The MIL will flash for a 1302 fault code
- The MIL will be illuminated if the 1301 fault is present for 2 consecutive trips.

Coolant Recirculation Pump **P2602**
P2603

P2602 Coolant Pump Control Circuit Low
P2603 Coolant Pump Control Circuit High

Description
During a hot shutdown of the engine, the recirculation pump can continue to pump coolant around the engine. The recirculation pump will run after the engine has been turned off if the enable criteria are matched.

Component connections

Connector	*Description*	*ECU Pin*	*ECU Connector*	
2 (RMC 1 – MFRU*)	Fuse box	-	-	
5 (RMC 2 – MFRU*)	Recirc Pump Relay	69 (K1)	28 Way (Left)	**'06 M.Y. in brackets**

*MFRU – Multi Function Relay Unit

Monitor: Continuous

Enable Criteria:
P2602 - engine not running
P2603 - engine running

Disable Criteria: None

Potential failure modes:
- Pump open circuit or short to ground
- Multi Function Relay Unit failure
- Pump failure
- ECU output circuit failure

Notes:
No MIL will be illuminated for this failure.

Camshaft Lift Control (VVL) **P2646**
P2647
P2648
P2649

P2646 A Rocker Arm Actuator System Performance or Stuck Off
P2647 A Rocker Arm Actuator System Stuck On
P2648 A Rocker Arm Actuator Control Circuit Low
P2649 A Rocker Arm Actuator Control Circuit High

Description
Intake and exhaust camshaft lift can be changed by means of the Variable Valve Lift (VVL) system, which varies the amount of maximum lift of the intake and exhaust valves. The mechanism uses dual element rocker arms to provide cam changeover, with both the intake and exhaust camshafts having high and low speed cam profiles. The system is ECU controlled, using an oil control solenoid which, when activated, uses hydraulic pressure to push a rocker arm locking pin into engagement to activate the high-speed cam profile. A signal from the VVL oil pressure switch provides feedback to the ECU that VVL activation has taken place. VVL activation* to the high lift camshaft profile occurs at 6200rpm when engine speed is increasing, and returns to the low lift camshaft profile at 6000rpm when the engine speed is decreasing.
*Coolant temperature must be >60°C (140°F).

Component connections

Connector	*Description*	*ECU Pin*	*ECU Connector*	
1	Battery Voltage	-	-	
2	VVL Oil Control Valve	12 (H3)	52 Way (Right)	
				'06 M.Y. in brackets
-	VVL Oil Pressure Switch	21 (B2)	52 Way (Right)	

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
- VVL valve stuck open / closed
- VVL valve open circuit
- VVL valve short to ground
- Rocker arm failure
- Rocker shaft location pin failure
- ECU output circuit failure

Notes:
The MIL will be illuminated if the fault is present for 2 consecutive trips.

EMP.2 - DIAGNOSTIC SCANNER TOOLS

In order to provide for communication with the engine management system electronic control module, a hand held electronic scanner 'Lotus Scan' (part number T000T1418F), may be plugged into a special 16 terminal harness connector socket, known as a Data Link Connector (DLC), located at the front of the passenger footwell. Note that this tool may also be used on previous Elise models (excluding Exige, 340R and 160 models).

Amongst the operations available using the 'Lotus Scan' tool are:

- Reading of Trouble Codes
- Clearing of Trouble Codes
- Reading live data
- Test operation of individual solenoids
- Running engine history report
- Reprogramming ECU

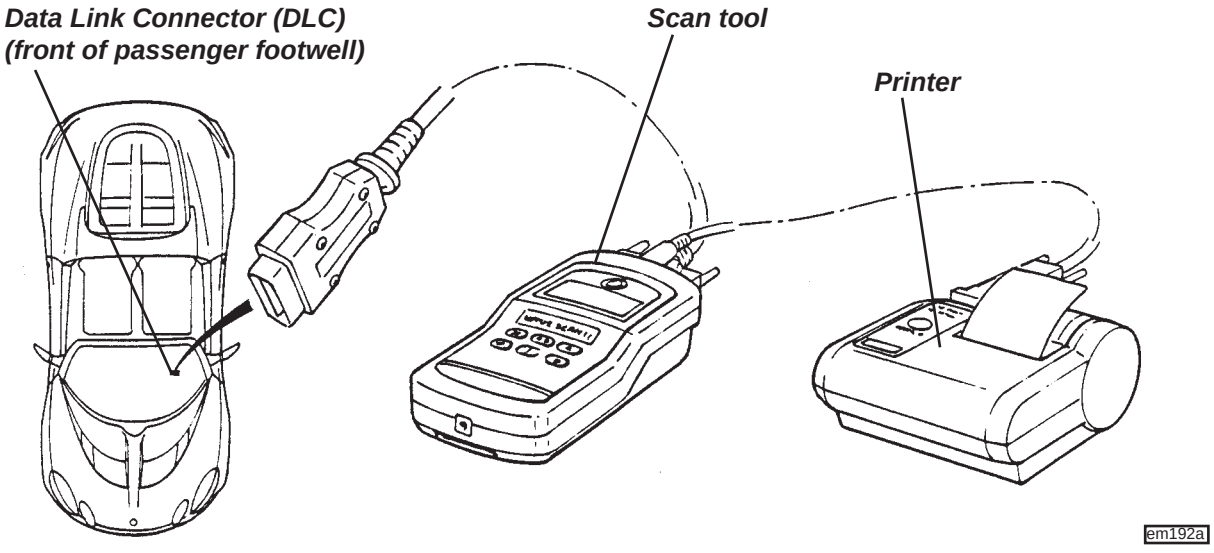
Operating instructions are provided with the tool.

Important Note

The power supply transformer is used for overnight charging of the printer, and also for powering the Scan tool during software downloading from a PC (personal computer). For the software download operation, the Scan tool requires a power supply from the mains via the transformer and an inverter. Two types of inverter have been used; early kits used an adaptor lead to plug into the bottom end of the Scanner tool. Later kits use an adaptor plug fitting into the top end of the scanner.

When charging the printer, it is most important that the inverter is NOT used, or damage to the transformer may be caused. Incorrect connection is possible only with the early type adaptor lead, with which extra care should be exercised.

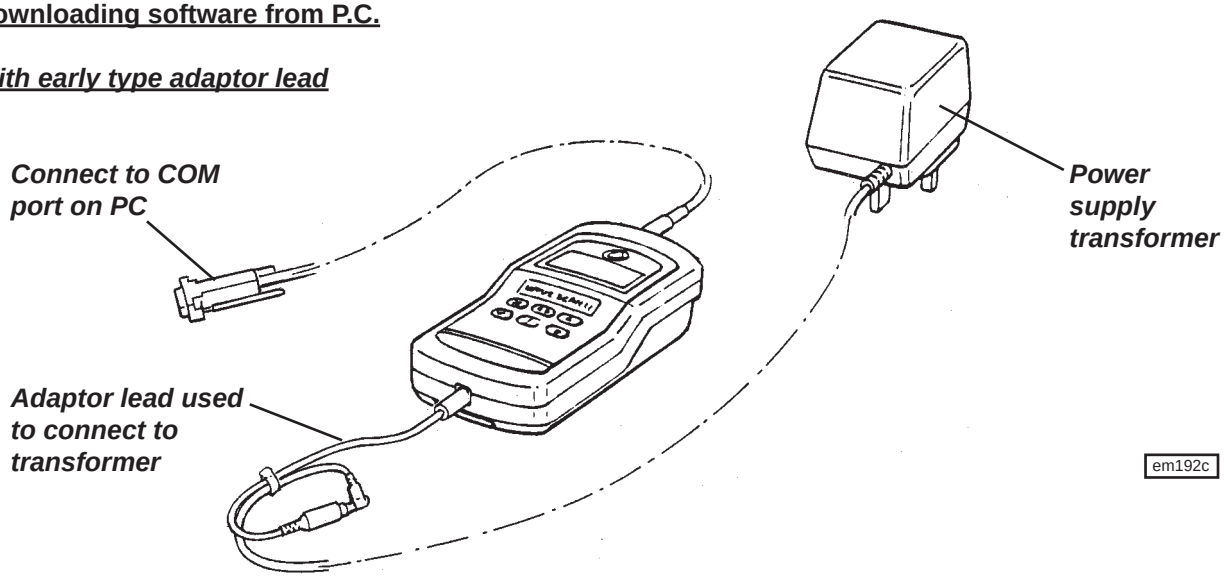
1. Reading data from vehicle



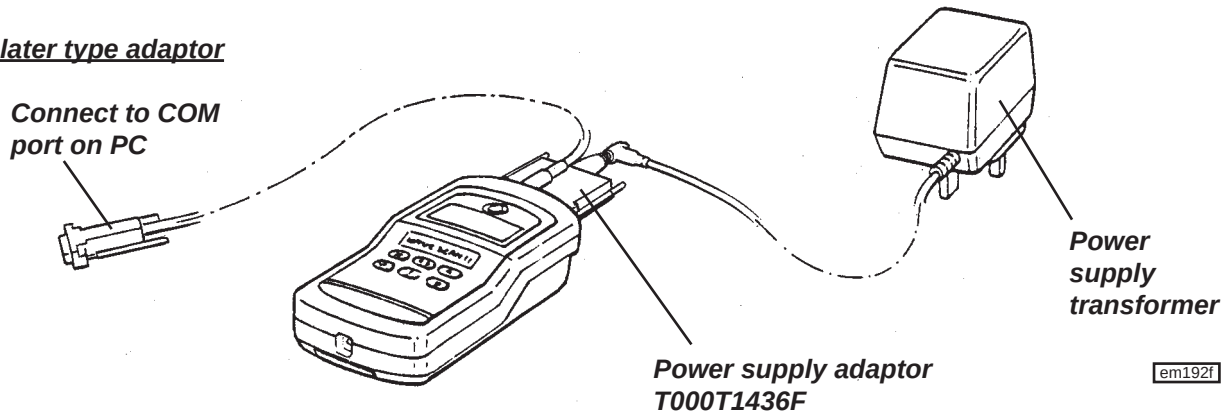
For instructions on how to use Lotus 3 Scan Tool on a Pre-08MY vehicle to identify Current EMS programs stored within the ECU or to download new EMS programs and write the correct VIN to the ECU please see information in section EMP.8.

2. Downloading software from P.C.

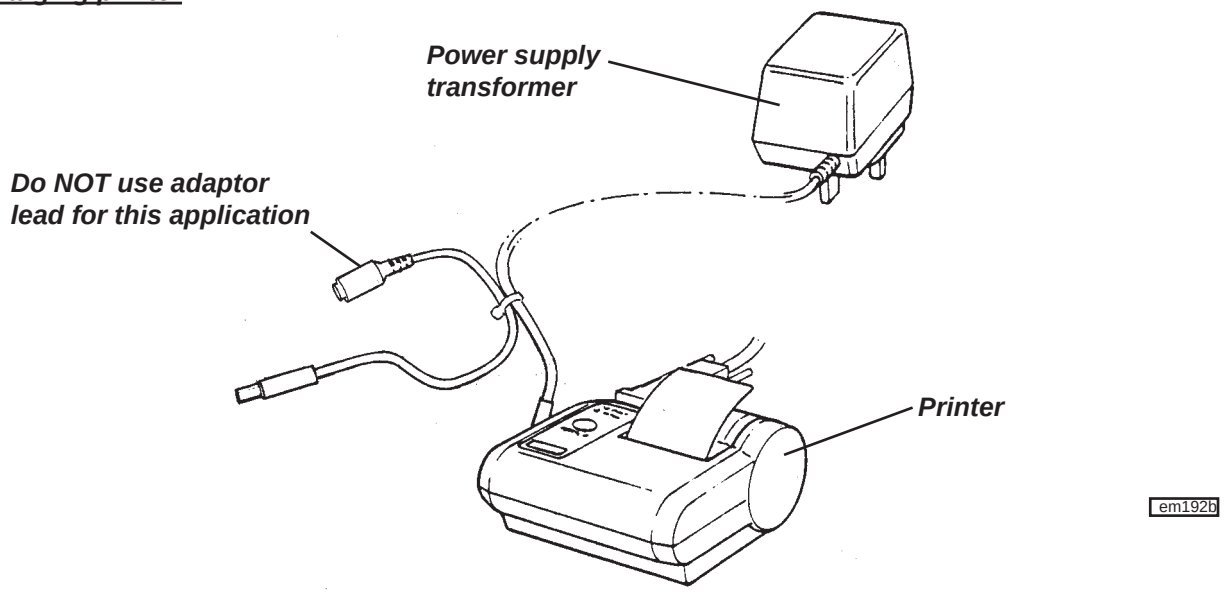
With early type adaptor lead



With later type adaptor



3. Charging printer



Lotus TechCentre - 2008 model year

All USA market cars from '08 model year onwards, are required by legislation to use a CAN compliant on-board diagnostic system. This has been commonised for all Elise/Exige models. The Lotus Scan 3 tool is replaced by a 'stand alone' lap top PC loaded with 'Lotus TechCentre' software to allow the CAN based serial data to be read.

Controller Area Network (CAN) is an electronic standard to allow high speed communication between modules and controllers, via a serial data bus. The bus is a circuit linking the modules to the controller, consisting of a pair of cables, twisted together to reduce electromagnetic interference, and carrying a square wave voltage signal corresponding to '0's and '1's, coded in such a way as to identify and prioritise the individual messages. On the Elise/Exige, CAN based systems for 2008 onwards include; engine management, anti-lock braking and related features, tyre pressure monitoring and onboard diagnostics.

A Vehicle Communication Device (T000T1472F) introduced for the Europa model is used to connect the vehicle to the laptop Lotus TechCentre. All system interrogation and diagnosis are carried out via the Lotus TechCentre.

The minimum specification of the laptop computer for installation of the Lotus TechCentre is as follows:

- Processer 1.70 Ghz;
- 1 GB RAM;
- 40 GB HDD;
- CDRW DVD ROM;
- WIN XP PRO or VISTA;
- USB interface;
- Ethernet or Wireless LAN

Note that this laptop should be dedicated soley to the Lotus TechCentre, with no other software installed. This diagnostic software is designed primarily for use by trained Lotus technicians, and is available as a CD under part number T000T1510F (version 4) or later supercessions. A monthly (Lotus Dealers) or annual (non-Lotus dealers) licence and support fee will also be levied, providing access to Lotus TechCentre Technical Support phoneline on 0870 9493 668, and e-mail on lotus.support.uk@omitec.com

Also required is a unique 18 character licence/registration key without which Techcentre will not function. This key is non transferable to other PC's.

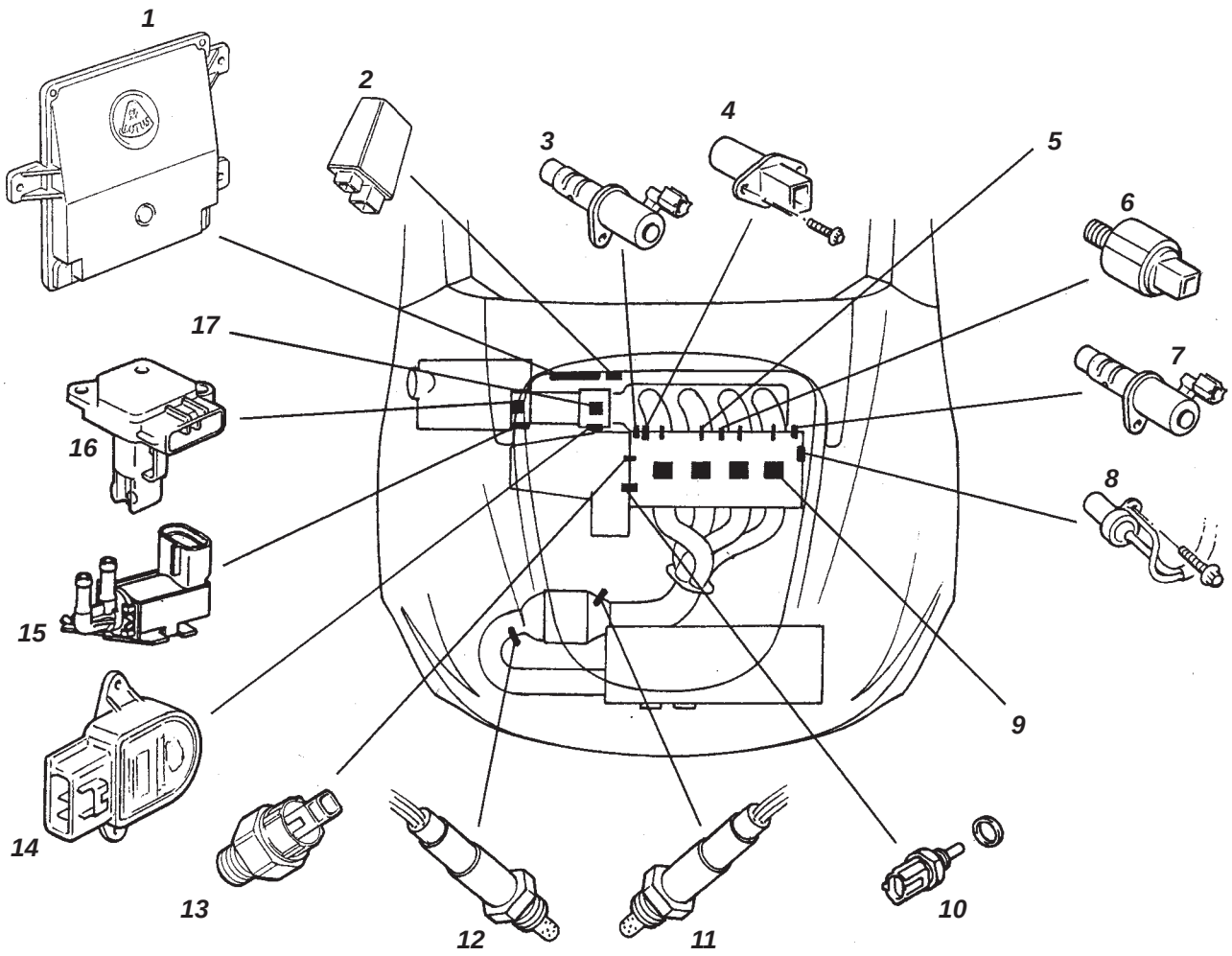
Scope of Lotus TechCentre

Model		Type of Electronic Control Unit					Engine ECU
		Communication compatible					Reprogrammable
		EMS	ABS	SRS	TPMS	IP	08 MY on
Elise	2004 on	**Y**	**Y**	**Y**	**Y**	**N**	**Y**
Exige	2004 on	**Y**	**Y**	**Y**	**Y**	**N**	**Y**
Europa	2006 on	**N**	**Y**	**Y**	**N/A**	**N**	**N**
2-11	2007 on	**Y**	**Y**	**N/A**	**N/A**	**N**	**Y**
Evora	2009 on	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Esprit	V8	**Y**	**Y**	**N**	**N**	**N**	**N**

Note that TechCentre has no connectivity to Rover powertrain Elise/Exige variants, and that only limited diagnostics are available for the V8 Esprit. No communication is available with the Europa powertrain. Diagnostics for these vehicles are accessible using the Lotus Scan 3 tool T000T1467F (U.K./EU).

For instructions on how to use Lotus TechCentre please see the users guide which can be found on the Lotus Dealer Portal http://dealers>Aftersales>TechCentre>TechCentre Information.

EMP.3 - ENGINE MANAGEMENT COMPONENT LOCATION



Key to engine management component location drawing

1. Electronic Control Unit (ECU).
2. Multi-function relay unit.
3. Oil control valve for variable valve lift.
4. Camshaft position sensor.
5. Fuel injector.
6. Knock sensor.
7. Oil control valve for variable valve timing.
8. Crankshaft position sensor.
9. Plug top coil.
10. Coolant temperature sensor.
11. Pre-catalyst oxygen sensor.
12. Post-catalyst oxygen sensor.
13. Oil pressure switch.
14. Throttle position sensor.
15. Vacuum solenoid for intake flap valve.
16. Mass airflow sensor.
17. Idle Air Control (IAC) valve - prior '06 M.Y.

For component replacement procedures, refer to manual B120T0327J.

EMP.4 - MECHANICAL THROTTLE SETTING PROCEDURE (Prior '06 M.Y.)

To avoid throttle cable strain, and ensure correct idle control and pedal operation, the following adjustments must be maintained. If the pedal downstop is incorrectly set, overloading of the throttle body cable quadrant can occur, resulting in quadrant distortion, closed throttle position error and engine stalling:

1. Check the throttle body cable quadrant for distortion and mis-alignment. If necessary, repair or replace the quadrant.

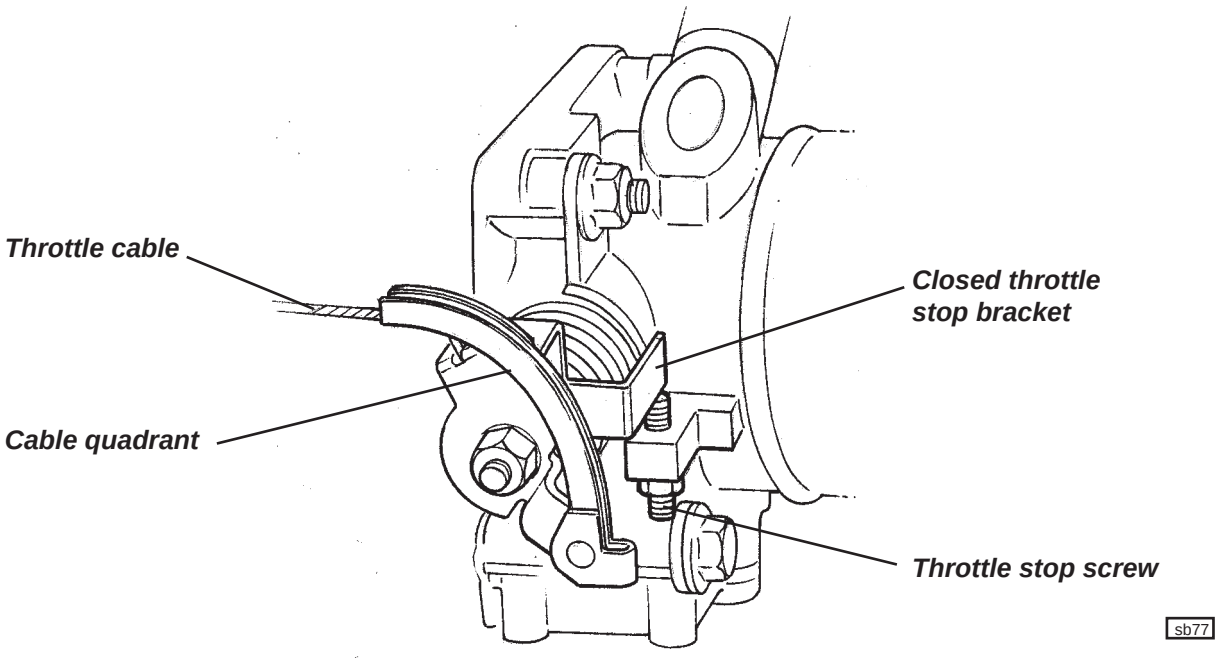
2. Check that there is 2 - 3 mm free play at the throttle pedal, adjusting at the throttle body cable abutment bracket if necessary.

3. If an idle control problem has been reported, reset the closed throttle stop screw on the throttle body: With ignition off, use a hexagonal key in the bottom end of the throttle stop screw to allow the throttle butterfly valve to fully close, and introduce clearance between the screw and quadrant stop bracket. Screw upwards until contact is just made, and then a further ½ turn upwards. Secure with the locknut. Recheck cable adjustment as above.

4. Adjust the throttle pedal downstop such that vigorous full depression of the pedal achieves full opening of the throttle butterfly without allowing the cable or mechanism to be strained.

5. If the throttle stop screw was adjusted, allow the engine to idle for 15 minutes to relearn settings.

6. An alternative pedal position which may be preferred for 'heel and toeing', may be achieved by replacing the rubber upstop buffer with an M5x15 hex. head setscrew, with three flat washers beneath the head for a total thickness of around 7mm. The cable must then be re-adjusted at the engine abutment as above. The foopad downstop bolt should then be replaced by an M8x20 setscrew and reset as above.



EMP.5 - 2006 MODEL YEAR ELECTRONIC THROTTLE CONTROL (ETC)

For '06 model year, the 2ZZ-GE engine is equipped with an electronic 'drive by wire' throttle in order to meet Low Emissions Vehicle 2 emissions standards as dictated by California Air Resources Board. This is achieved by allowing fuel pre-scheduling and consistency of load demand.

The mechanical throttle control cable is replaced by a pedal actuated potentiometer unit which feeds pedal movement and position information to the engine management ECU. The ECU compares this demand information with existing engine throttle position data, and outputs a suitable command signal to the DC stepper motor which operates the throttle valve. For optimum safety, two output curves are produced by the pedal unit and are fed into two processors contained within the ECU. Similarly, two streams of engine throttle valve positional information are fed back into these processors, which are then compared by the ECU software. Any discrepancies are analysed and appropriate safety oriented commands outputed to the throttle valve which may be limited to a maximum 15% opening, or to a 7% mechanically sprung setting for 'limp home', or in extreme cases, the injectors may be shut off.

Note that no IAC valve is required, as the idle air control function is incorporated into the electronic throttle system.

ECU Communication

2006 model year cars with ETC have the VIN included in the ECU memory, without which the MIL will be illuminated, and a fault code stored. The Lotus Scan tool requires an updated operating programme which includes VIN download facility and is available on CD under part number T000T1466/2. This programme must be downloaded on to a PC before being transferred to the Scan tool. The ECU progamme is also specific to ETC, with an i.d. of A120E0030H (non USA) or A121E0010H (USA) .

EMP.6 - DIAGNOSTIC CODE SUPPLEMENT - '06 M.Y.

New fault codes for '06 M.Y. cars with electronic throttle control are as follows:

DTC	Fault Description	Page
P0016	Crankshaft Position – Camshaft Position Correlation Error	49
(P0121/P0122/P0123 Throttle Position Sensor 'A' - see page 12)		
P0222	Throttle Position Sensor 'B' Circuit Low	49
P0223	Throttle Position Sensor 'B' Circuit High	49
P0630	VIN Not Programmed or Incompatible – ECU	50
P0638	Throttle Actuator Control Range/Performance	50
P2100	Throttle Actuator Control Motor Circuit/Open	51
P2102	Throttle Actuator Control Motor Circuit/Low	51
P2103	Throttle Actuator Control Motor Circuit/High	51
P2104	Throttle Actuator Control System – Forced Idle	51
P2105	Throttle Actuator Control System – Forced Engine Shutdown	52
P2106	Throttle Actuator Control System – Forced Limited Power	52
P2107	Throttle Actuator Control Module Processor	52
P2108	Throttle Actuator Control Module Performance	53
P2122	Pedal Position Sensor 'D' Circuit Low	53
P2123	Pedal Position Sensor 'D' Circuit High	53
P2127	Pedal Position Sensor 'E' Circuit Low	54
P2128	Pedal Position Sensor 'E' Circuit High	54
P2135	Throttle Position Sensor 'A'/'B' Voltage Correlation	54
P2138	Pedal Position Sensor 'D'/'E' Voltage Correlation	55
P2173	Throttle Actuator Control System – High Airflow Detected	55

Crankshaft Position–Camshaft Position Correlation Error **P0016**

Description
The crankshaft position sensor is used to identify engine position and speed via a pole wheel mounted on the front end of the crankshaft. The camshaft position sensor is used to determine camshaft position from a three vane reluctor on the rear end of the inlet camshaft. The Variable Valve Timing system (VVT) on the inlet camshaft can vary the timing by up to 25°, with fault codes P0011 and P0012 allocated to errors with the variable timing. Fault code P0016 indicates a mechanical timing error such as incorrectly set, or 'jumped' cam timing.

Enable Criteria:
Engine running (for up to 4 seconds)

Disable Criteria: None

Potential failure modes:
Crankshaft/Camshaft alignment

Throttle Position Sensor 'B' Circuit Low **P0222**

Description
Two potentiometers are built into the throttle valve actuator unit in order to provide a throttle position signal to the ECU. Note that the sensors operate on 5 volts.

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Signal short circuit (< 0.283 V)
Reference voltage open circuit
Reference voltage short to ground
Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Throttle Position Sensor 'B' Circuit High **P0223**

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Signal open circuit (> 4.487 V)
Reference voltage open circuit
Reference voltage short to ground
Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

VIN Not Programmed or Incompatible – ECU/PCM **P0630**

Description
The ECM programming includes the Vehicle Identification Number (VIN). This operation is performed using the Lotus Scan tool.

Enable Criteria:
Engine running (for up to 4 seconds)

Disable Criteria: None

Potential failure modes:
VIN not programmed
Incompatible VIN programmed

Throttle Actuator Control Range/Performance **P0638**

Description
The single throttle butterfly valve, mounted at the inlet to the intake plenum, is operated by a stepper motor under the command of the engine ECU. The valve moves through a range of nearly 90° and should display 100% at full throttle and around 2% at idle.

Monitor: Continuous

Enable Criteria:
Engine running

Disable Criteria:
Electronic throttle fault(s) present

Potential failure modes:
Blocked throttle body
Damage to throttle actuator

Notes: A mechanically sprung 7% throttle opening may be imposed.

Throttle Actuator Control Motor Circuit/Open **P2100**

Description
The throttle actuator stepper motor operates on 12 volts.

Monitor: Continuous

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
#Throttle actuator control motor open circuit

Throttle Actuator Control Motor Circuit/Low **P2102**

Monitor: Continuous

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Throttle actuator control motor short to ground

Throttle Actuator Control Motor Circuit/High **P2103**

Monitor: Continuous

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Throttle actuator control motor short to supply voltage

Throttle Actuator Control System – Forced Idle **P2104**

Description
If a problem is detected which could result in faster engine speed than commanded by the pedal, the actuator is switched out, allowing the throttle valve to default to a 6% mechanically sprung setting. This provides a fast idle speed which may be used to effect a 'limp home' mechanism.

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control System – Forced Engine Shutdown **P2105**

Description
If a problem is detected which could result in engine speed runaway, or if sufficient control of engine speed is lost, the ECU switches off the fuel injectors in order to stop the engine.

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control System – Forced Limited Power **P2106**

Description
If a problem is detected which could result in engine speed control difficulties, the ECU will limit throttle opening to a maximum of 15%.

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control Module Processor **P2107**

Description
The ECU contains two processors dedicated to the throttle pedal and throttle valve potentiometers.

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
ECU internal fault
Incorrect ECU programming

Throttle Actuator Control Module Performance **P2108**

Monitor: Continuous

Enable Criteria: Engine running

Disable Criteria: None

Potential failure modes:
ECU internal failure
Short circuit to throttle actuator

Pedal Position Sensor 'D' Circuit Low **P2122**

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Note that the potentiometers operate on 5 volts.

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Signal short circuit (< 0.283 V)
Reference voltage open circuit
Reference voltage short to ground
Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'D' Circuit High **P2123**

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Signal open circuit (> 4.487 V)
Reference voltage open circuit
Reference voltage short to ground
Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'E' Circuit Low **P2127**

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Note that the potentiometers operate on 5 volts.

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Signal short circuit (< 0.283 V)
Reference voltage open circuit
Reference voltage short to ground
Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'E' Circuit High **P2128**

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
Signal open circuit (> 4.487 V)
Reference voltage open circuit
Reference voltage short to ground
Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Throttle Position Sensor 'A'/'B' Voltage Correlation **P2135**

Description
Two potentiometers are built into the throttle actuator unit in order to provide a throttle position signal to the ECU. Two processors within the ECU compare the two output signals, which should match within a defined tolerance. Note that the potentiometers operate on 5 volts.

Enable Criteria: None

Disable Criteria: Throttle position greater than 60%

Potential failure modes:
TPS1 reading incorrectly
TPS2 reading incorrectly

Notes: A maximum throttle opening of 15% may be imposed.

Pedal Position Sensor/Switch 'D'/'E' Voltage Correlation **P2138**

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Two processors within the ECU compare the two output signals, which should match within a defined tolerance. Note that the potentiometers operate on 5 volts.

Enable Criteria: None

Disable Criteria: None

Potential failure modes:
PPS1 reading incorrectly
PPS2 reading incorrectly

Notes: A maximum throttle opening of 15% may be imposed.

Throttle Actuator Control System – High Airflow Detected **P2173**

Description
The mass air flow is compared with the throttle position to determine whether an incorrect correlation exists.

Enable Criteria: None

Disable Criteria: MAF fault(s) present

Potential failure modes:
Throttle plate damage
Air leak in intake system

Notes: A mechanically sprung 7% throttle opening may be imposed, or the injectors may be shut off to stop the engine.

EMP.7 - DIAGNOSTIC CODE SUPPLEMENT - 2011 M.Y. ELISE 1ZR POWERTRAIN (Euro 5)

Note; Fault code P1047

If the power supply to the VALVEMATIC controller is lost during normal vehicle operation, code P1047 will be stored and a limphome mode initiated. This will result in limited engine torque being available for the remainder of the ignition cycle. Re-instatement of the power supply will not automatically eradicate the code, and neither will clearing of the code via Lotus TechCentre be effective until a learing process has been completed.

After rectification of the power supply fault, proceed as follows:

1. Ignition off and allow ECU to power down (wait for 30 seconds).
2. Start engine and allow to idle for 30 seconds. Idle speed may increase during this recovery process.
3. Ignition off for 30 seconds.
4. Start engine and allow to idle for 30 seconds.
5. Ignition off for 30 seconds.
6. Ignition on and use Lotus TechCentre to reset code P1047 (and any other VALVEMATIC related fault codes).

Process complete.

Camshaft Timing Control (VVT) **P0011**
P0012
P0014
P0015

P0011 Camshaft Position – Inlet Timing Over-Advanced or System Performance
P0012 Camshaft Position – Inlet Timing Over-Retarded
P0014 Camshaft Position – Exhaust Timing Over-Advanced or System Performance
P0015 Camshaft Position – Exhaust Timing Over Retarded

Description

The Variable Valve Timing system (VVT) on the intake camshafts and the exhaust camshafts can vary the timing by approximately 35° on exhaust and 53° on inlet. The camshaft relative position is varied by a system of vanes mounted on the drive end of the camshaft. Each VVT oil control valve modulates a spool valve position in accordance with the drive signal duty cycle, this in turns controls the oil pressure applied to the vanes. A 50% duty cycle applied to the valve will hold the valve current timing by preventing oil flow from the VVT controller housing, a duty cycle less than 50% will retard the valve timing, a duty cycle greater then 50% will advance the valve timing. The ECM regulates this duty cycle based on the feedback signal from the respective camshaft position sensor to optimise the camshaft timing.

Component connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Battery Voltage	-	-
2	VVT Control Valve Inlet	B2	48 Way (Centre)
1	Battery Voltage	-	-
2	VVT Control Valve Exhaust	A2	48 Way (Centre)

P0011, P0012. P0014. P0015.

Monitor:
- Continuous

Enable Criteria:
- Engine running > 30 secs
- Coolant temperature > 60°C (140°F)

Disable Criteria:
- P0116, P0117, P0118 – Coolant temperature fault codes

Malfunction Criteria:
- VVT error > 5 degrees for time > 2.5 secs

Potential failure modes:
- Static valve timing is incorrect
- VVT camshaft actuator failure
- VVT control valve stuck open / closed
- VVT control valve filter

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Crankshaft Position–Camshaft Position Correlation Error **P0016**
P0017

P0016 Crankshaft position – camshaft position correlation – bank 1 sensor A (Inlet)
P0017 Crankshaft position – camshaft position correlation – bank 1 sensor B (Exhaust)

Description

The crankshaft position sensor is used to identify engine position and speed via a pole wheel mounted on the front end of the crankshaft. The camshaft position sensor is used to determine camshaft position from a three vane reluctor on the rear end of the inlet and exhaust camshaft. Fault codes P0016, P0017, indicate a mechanical timing error such as incorrectly set, or 'jumped' cam timing.

Monitor:
- Continuous

Enable Criteria:
- Engine running (from cranking up to 4 seconds)

Disable Criteria:
- None

Malfunction Criteria:
- Camshaft out of phase with crankshaft > 16 degrees

Potential failure modes:
- Static valve timing is incorrect
- VVT camshaft actuator failure
- VVT control valve stuck open / closed
- VVT control valve filter

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Camshaft Timing Control (VVT)

P0076
P0077
P0079
P0080

P0076 Intake Valve Control Solenoid Circuit Low
P0077 Intake Valve Control Solenoid Circuit High
P0079 Exhaust Valve Control Solenoid Circuit Low
P0080 Exhaust Valve Control Solenoid Circuit High

P0076, P0077, P0079, P0080,

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P0076, P0079, - VVT control valve open circuit or short to ground
- P0077, P0080, - VVT control valve circuit short to battery voltage
- ECU output circuit failure
- VVT control valve

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Intake Air Flow **P0101**
P0102
P0103

P0101 Mass or Volume Air Flow Circuit Range/Performance
P0102 Mass or Volume Air Flow Circuit Low Input
P0103 Mass or Volume Air Flow Circuit High Input

Description

The Mass Air Flow (MAF) sensor is incorporated into the airbox, and measures both intake air flow rate and Intake Air Temperature (IAT). The MAF sensor uses a hot wire exposed to the airflow, which is maintained at a constant temperature by a constant current flow. This is achieved within the sensor unit by varying the voltage applied to the hot wire. This voltage is the output signal from the MAF sensor.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	IAT Signal	E3	48 Way (Centre)
2	IAT Ground	J3	48 Way (Centre)
3	Battery Voltage	-	-
4	MAF Ground	J4	48 Way (Centre)
5	MAF Signal	G1	48 Way (Centre)

Sensor characteristics
0 – 330 g/sec
Typical values: 1.5 – 5.5 g/sec (idle), 5.0 – 15.0 g/sec (2500rpm elevated idle no load)

P0101

Monitor:
- Continuous.

Enable Criteria:
- Engine running
- Engine speed >1500rpm
- Engine speed < 3510rpm
- Fuel Learns enabled

Disable Criteria:
- P0122, P0123, P0222, P0223 – Throttle/Pedal position fault codes

Malfunction Criteria:
- Measured MAF is compared to a predicted MAF based on current engine conditions.
- Error > 40% for time > 1.5 secs

Potential failure modes:
- MAF meter
- Air induction system
- Air intake hose connections

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

P0102

Monitor:
- Continuous.

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- Voltage at ECU < 0.52V for time > 1.5 secs

Potential failure modes:
- MAF sensor circuit open
- MAF sensor circuit short to ground

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

P0103

Monitor:
- Continuous.

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- Voltage at ECU > 4.86V for time > 1.5 secs

Potential failure modes:
- MAF sensor circuit short to ECU supply voltage

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Barometric Pressure **P0107**
P0108

P0107 Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108 Manifold Absolute Pressure/Barometric Pressure Circuit High Input

Description
The barometric pressure sensor is located internally within the ECU, and measures atmospheric pressure. This parameter is required to compensate the mass air flow when the vehicle is operated at higher altitudes.

P0107, P0108

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- P0107: Voltage at ECU < 1.08V for time > 1.5 secs
- P0108: Voltage at ECU > 4.98V for time > 1.5 secs

Potential failure modes:
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if the faults are present for 2 consecutive trips

Intake Air Temperature **P0112**
P0113

P0112 Intake Air Temperature Sensor 1 Circuit Low
P0113 Intake Air Temperature Sensor 1 Circuit High

Description

The combined sensor which measures both Mass Air Flow (MAF) and Intake Air Temperature (IAT) is incorporated into the air box. The IAT sensor is a thermistor device which changes resistance with temperature. As air intake temperature decreases the thermistor resistance value increases, and conversely as air temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	IAT Signal	E3	48 Way (Centre)
2	IAT Ground	J3	48 Way (Centre)
3	Battery Voltage	-	-
4	MAF Ground	J4	48 Way (Centre)
5	MAF Signal	G1	48 Way (Centre)

Sensor characteristics

IAT -20°C (-4°F)	13.6 – 18.4 kΩ
IAT 20°C (68°F)	2.21 – 2.69 kΩ
IAT 60°C (140°F)	0.50 – 0.67 kΩ

P0112

Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Inlet air temperature > 119°C (246°F) for time > 1.5 secs

Potential failure modes:
- Signal short circuit
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0113

Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Inlet air temperature < –40°C (–40°F) for time > 1.5 secs

Potential failure modes:
- Signal open circuit
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Engine Coolant Temperature **P0116**
P0117
P0118

P0116 Engine Coolant Temperature Circuit Range/Performance
P0117 Engine Coolant Temperature Circuit Low
P0118 Engine Coolant Temperature Circuit High

Description
The engine coolant temperature sensor is a thermistor device which changes resistance with temperature. As coolant temperature decreases the thermistor resistance value increases, and conversely as coolant temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Ground	C3	48 Way (Centre)
2	Signal	G2	48 Way (Centre)

Sensor characteristics

-20°C (-4°F)	= 13.75 – 16.25 KΩ	(15KΩ)
20°C (68°F)	= 2.31 – 2.58 KΩ	(2.45KΩ)
80°C (176°F)	= 0.310 – 0.326 KΩ	(320Ω)
110°C (230°F)	= 0.1375 – 0.1425 KΩ	(140Ω)

P0116

Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria 1:
- Engine running > 1000 seconds

Malfunction Criteria 1:
- Engine coolant temperature < 40°C (104°F)

Enable Criteria 2:
- Engine running

Malfunction Criteria 2:
- Engine coolant temperature erratic by more than 30°C (54°F)

Potential failure modes:
- Sensor wiring
- Sensor failure
- Thermostat failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0117

Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Coolant temperature > 119°C (246°F) for time > 1.5 secs

Potential failure modes:
- Signal short circuit
- Sensor failure
- Thermostat failure
- Cooling system problem

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0118

Monitor:
- Continuous

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Coolant temperature > -38°C (-36°F) for time > 1.5 secs

Potential failure modes:
- Signal open circuit
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Throttle Position **P0122**
P0123
P0222
P0223

P0122 Throttle Position Sensor 'A' Circuit Low
P0123 Throttle Position Sensor 'A' Circuit High
P0222 Throttle Position Sensor 'B' Circuit Low
P0223 Throttle Position Sensor 'B' Circuit High

Description

The throttle position sensor (TPS) is mounted on the throttle body, and detects the opening angle of the throttle valve. The TPS has 2 sensor circuits, each of which transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECU.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	ETB +ve	M1	48 Way (Centre)
2	ETB +-ve	L2	48 Way (Centre)
3	Ground	C4	48 Way (Centre)
4	TPS 1B Signal	F3	48 Way (Centre)
5	TPS 1A/B V Ref	E4	48 Way (Centre)
6	TPS 1A Signal	F2	48 Way (Centre)

Sensor characteristics
Sensor 1A
0% = 0.69 V ± 5%
100% = 3.87 V ± 5%

Sensor 1B
0% = 2.25 V ± 5%
100% = 4.94 V ± 5%

Idle state is not 0% throttle position and is dependant upon coolant temperature.

P0122

Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage < 0.635V

Potential failure modes:
- Signal short circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P0123

Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage > 4.765V

Potential failure modes:
- Signal open circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P0222

Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage < 2.146V

Potential failure modes:
- Signal short circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P0223

Monitor:
- Continuous.

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- Signal voltage > 4.985V

Potential failure modes:
- Signal open circuit
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

O2 Sensor (Pre Catalyst)

P0131
P0135
P0132
P0133
P0134

P0131 O2 Sensor 1 Circuit Low Voltage
P0132 O2 Sensor 1 Circuit High Voltage
P0133 O2 Sensor 1 Circuit Slow Response
P0134 O2 Sensor 1 Circuit No Activity Detected
P0135 O2 Sensor 1 Heater Circuit

Description

The oxygen sensors separately monitor the oxygen content in the exhaust gases of each bank of the engine. Each sensor is electrically heated to improve response after start.

The sensor consists of a zirconia electrode between two platinum plates. When zirconia comes into contact with oxygen, it becomes an electrical conductor. The exhaust gases pass through louvers in the sensor. One plate is in contact with the outside air and the other plate is in contact with the exhaust gases. The platinum plate in contact with the air is electrically negative due to the oxygen in the atmosphere and the plate in contact with the exhaust gases is electrically positive. This will cause a difference in electrical potential to develop between the two plates. Thus the voltage across the platinum plates ranges approximately from 100 millivolts to 900 millivolts, depending on the oxygen content of the exhaust gases. Thus when the air/fuel mixture is rich, the oxygen sensor output will be high. If the air/fuel mixture is lean, the oxygen sensor output will be low.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Signal	G3	48 Way (Centre)
2 Bank 1	Ground	J2	48 Way (Centre)
3 Bank 1	Heater	H3	48 Way (Centre)
4 Bank 1	Battery Voltage	-	-

Sensor characteristics
Normal operating range is 0 – 1000mV

P0131

Monitor:
- Continuous.

Disable Criteria:
- DFCO (Deceleration Fuel Cut Off)
- AE DE (Acceleration Enrichment Deceleration Enleanment)
- Misfire

Enable Criteria:
- Engine running

Failure Criteria:
- Sensor voltage < 24mV for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- Low fuel pressure (Lean mixture)
- Malfunctioning sensor
- External water on sensor
- Sensor wire shorted to ground

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0132

Monitor:
- Continuous.

Disable Criteria:
- None

Enable Criteria:
- Engine running

Malfunction Criteria:
- Sensor voltage > 1200V for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- High fuel pressure (Rich mixture)
- Leaking or shorted injector
- Purge valve fault
- Oxygen sensor contamination
- Engine oil contamination
- Sensor wire shorted to heater voltage

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0133
Monitor:
- Continuous.

Disable Criteria:
- P0116, P0117, P0118 – Coolant temperature sensor faults
- P0101, P0102, P0103 – MAF sensor faults
- P0335, P0500 – Crank or vehicle speed faults
- P0131, P0132, P0134, P0135 – Pre catalyst oxygen sensor faults checks

Enable Criteria:
- Vehicle speed between 0 – 255 km/h (158.5 mph)
- Percentage load between 22 – 70 %
- Engine speed between 1285 – 3511 rpm
- Engine run time > 200 seconds
- Coolant temperature > 60°C (140°F)
- Closed loop fuelling enabled

Monitor:
- Monitored until the required amount of switches (30) in both directions has been achieved or 130 seconds has elapsed.

Malfunction Criteria:
- Set when the sensor fails to switch from a Lean to a Rich condition or switch from a Rich to a Lean condition in a sufficiently timely manner. A selection of switches is used to determine the average times.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections
- Sensor contaminated, possibly from fuel, improper use of RTV, engine oil or coolant

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0134

Monitor:
- Until either passed or failed.

Enable Criteria:
- Engine run time > 30 seconds
- Engine is not at idle
- Engine is in closed loop fuel control
- O2 sensor ready

Malfunction Criteria:
- Set when the sensor fails to switch above 600mV and below 322mV within a 60 second period.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections.
- Gas leak in exhaust system

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0135

Monitor:
- Continuous

Enable Criteria:
- Engine run time > 20 seconds

Malfunction Criteria:
- Set when the heater output is greater than 1900mA or less than 250mA for 1.5 seconds, for 40 consecutive checks.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections.

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

O2 Sensor (Post Catalyst)

P0137
P0138
P0139
P0140
P0141

P0137 O2 Sensor Circuit Low Voltage
P0138 O2 Sensor Circuit High Voltage
P0139 O2 Sensor Circuit Slow Response
P0140 O2 Sensor Circuit No Activity Detected
P0141 O2 Sensor Heater Circuit

Description

The oxygen sensors separately monitor the oxygen content in the exhaust gases of each bank of the engine. Each sensor is electrically heated to improve response from start.

The sensor consists of a zirconia electrode between two platinum plates. When zirconia comes into contact with oxygen, it becomes an electrical conductor. The exhaust gases passes through louvers in the sensor. One plate is in contact with the outside air and the other plate is in contact with the exhaust gases. The platinum plate in contact with the air is electrically negative due to the oxygen in the atmosphere and the plate in contact with the exhaust gases is electrically positive. This will cause a difference in electrical potential to develop between the two plates. Thus the voltage across the platinum plates ranges approximately from 100 millivolts to 900 millivolts, depending on the oxygen content of the exhaust gases. Thus when the air/fuel mixture is rich, the oxygen sensor output will be high. If the air/fuel mixture is lean, the oxygen sensor output will be low. The post catalyst oxygen sensor performance is a good indicator of catalyst efficiency.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Signal	H1	48 Way (Centre)
2	Ground	K4	48 Way (Centre)
3	Heater	K2	48 Way (Centre)
4	Battery Voltage	-	-

Sensor characteristics
Normal operating range is 0 – 1000mV

Malfunction Criteria

P0137

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- DFCO (Deceleration Fuel Cut Off)
- AE DE (Acceleration Enrichment or Deceleration Enleanment)
- Misfire

Malfunction Criteria:
- Set when the sensor operates below 24mV for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set

- Sensor wire shorted to ground
- Catalyst

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0138
Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- Set when the sensor operates above 1200mV for more than 1.5 seconds consecutively for a specified number of times.

Potential failure modes:
- Check and rectify any front sensor fault code, as they may be causing the fault code to be set
- Catalyst

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0139

“O2 Sensor, slow response” can be defined in two ways; 1) “Slow response” and 2) Delayed response

1) Slow Response
Set when the sensor fails to reach 600mV after 5 seconds of Fuel Enrichment or when the sensor fails to drop below 322mV after 5 seconds of DFCO.

Enable Criteria:
- Engine run time > 200 seconds
- > 10 g/sec MAF (only enable criteria when switching rich, > 600mV, in fuel enrichment state)
- DFCO for 'rich to lean' switch

Disable Criteria:
- P0116, P0117, P0118 – Coolant Temperature Sensor fault
- P0261, P0262, P0264, P0265, P0267, P0268, P0270, P027 – Injector faults
- P0300, P0301, P0302, P0303, P0304 – Misfire faults
- P1301, P1302 – Misfire faults causing emission or catalyst damage

Monitor:
- Continuous, until the test is either passed or failed

Potential failure modes:
- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set
- Catalyst damage/leak/inefficiency

2) Delayed Response
Set when the sensor fails to switch between 300mV and 600mV within a specified time of the pre cat O2 sensor switch.

Enable Criteria:
- Engine run time > 200 seconds
- Rich for >3 seconds prior to switch rich to lean
- Pre Cat O2 sensor must be rich for >0.5 seconds before post cat O2 sensor switch
- DFCO for 'rich to lean' switch

Disable Criteria:
- P0116, P0117, P0118 – Coolant Temperature Sensor faults
- P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271 – Injector faults
- P0300, P0301, P0302, P0303, P0304 – Misfire faults
- P1301, P1302 – Misfire faults causing emission or catalyst damage

Malfunction Criteria:
- 3 consecutive switch times >700 ms.

Monitor:
- Continuous, until the test is either passed or failed

Potential failure modes:
- Check and rectify any pre catalyst sensor fault code, as they may be causing the fault code to be set
- Catalyst damage/leak/inefficiency

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0140

Monitor:
- Continuous

Enable Criteria:
- Engine run time > 30 seconds
- Engine is not at idle
- Engine is in closed loop fuel control
- Oxygen sensors ready

Disable Criteria:
- None

Malfunction Criteria:
- Set when the sensor fails to switch above 600mV and below 322mV within 60 seconds.

Potential failure modes:
- Check and rectify any front sensor fault code, as they may be causing the fault code to be set
- Sensor connector and wiring should be checked for corrosion and loose connections
- Catalyst
- Gas leak in exhaust system

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

P0141

Monitor:
- Continuous

Enable Criteria:
- Engine run time > 20 seconds

Disable Criteria:
- None

Malfunction Criteria:
- Set when the heater output is greater than 1900mA or less than 250mA for 1.5 seconds, for 40 consecutive checks.

Potential failure modes:
- Sensor connector and wiring should be checked for corrosion and loose connections

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Fuel Control System Too Lean Or Rich **P0171**
P0172

P0171 System Too Lean
P0172 System Too Rich

Description

The oxygen sensor sends a signal to the ECU corresponding to the exhaust gas oxygen content enabling the ECU to maintain a 14.7:1 air/fuel ratio under normal driving conditions. The ECU can make fuel corrections of ± 30% to the calculated fuel demand. This value is then learned by the ECU over time. If the ECU determines a rich condition exists (oxygen sensor above 450mV), it will decrease the calculated fuel demand to maintain a 14.7:1 ratio. If the ECU determines a lean condition exists (oxygen sensor below 450mV), it will increase the calculated fuel demand to maintain a 14.7:1 ratio.

Monitor:
- Continuous

Enable Criteria:
- Fuel Trim condition enabled
- Closed loop fuelling enabled
- MAF < 18 g/sec
- Altitude < 8000 ft (2438 m), Baro > 756 mbar

Disable Criteria P0171 & P0172:
- P0106, P0107, P0108 – Baro sensor faults
- P0131, P0135 – Oxygen sensor faults
- P0300, P0301, P0302, P0303 – Misfire faults
- P0111, P0112, P0113 – Intake air temperature faults

Malfunction Criteria P0171:
- These codes will set when the relevant engine bank learned fuel correction has been increased to its maximum limit of 25% and the system still cannot maintain an air/fuel ratio of 14.7:1 under normal driving conditions.
- These codes will also be set if the relevant bank fuel learn injector dead time is greater than 450 micro seconds.

Potential failure modes:
- Fuel Pressure too low (restriction in fuel line)
- Air leak in induction system
- Water in fuel
- Exhaust leak / crack before front oxygen sensor
- Injector fault
- Sensor connector and wiring for signs of corrosion or loose connections
- MAF fault
- Vehicle has previously run out of fuel

Diagnostic Mask:
- The MIL will be illuminated if fault is present for two consecutive trips.

Malfunction Criteria P0172:
- These codes will be set when the relevant bank learned fuel correction has been decreased to its minimum limit of -25% and the system still cannot maintain an air/fuel ratio of 14.7:1 under normal driving conditions.
- These codes will also be set if the relevant bank fuel learn injector dead time is less than -450 micro seconds.

Potential failure modes:
- Fuel pressure too high
- Leaking fuel injector
- Restriction in the exhaust system or air intake / filter
- Erratic throttle position sensor
- MAF fault
- O2 sensor fault
- Ignition fault

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Fuel Injection System

P0261
P0262
P0264
P0265
P0267
P0268
P0270
P0271

P0261 Injector Circuit low voltage – Cylinder 1
P0262 Injector Circuit high voltage – Cylinder 1
P0264 Injector Circuit low voltage – Cylinder 2
P0265 Injector Circuit high voltage – Cylinder 2
P0267 Injector Circuit low voltage – Cylinder 3
P0268 Injector Circuit high voltage – Cylinder 3
P0270 Injector Circuit low voltage – Cylinder 4
P0271 Injector Circuit high voltage – Cylinder 4

Description
The ECU has four injector driver circuits, each of which controls an injector. When the engine is running the ECU continuously monitors the injector circuit feedback signals. The monitored feedback signal should be low voltage when the injector is ON and high voltage when the injector is OFF.

Component connections

Injector	ECU Pin	ECU Connector
1	H4	32 Way (Left)
2	H3	32 Way (Left)
3	H2	32 Way (Left)
4	H1	32 Way (Left)

Malfunction Criteria

Monitor:
- Continuous

Enable Criteria:
- Engine running

Potential failure modes:
- Sensor connector or wiring corroded or loose connections

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Limp home:
- Limit maximum engine speed to 4800rpm
- Return the fuel system of the affected bank to open loop fuel control

Notes:
If an injector goes short circuit it is likely that the ECU injector driver will be damaged.

Misfire **P0300**
P0301
P0302
P0303
P0304

P0300 Random/Multiple Cylinder Misfire Detected
P0301 Cylinder 1 Misfire Detected
P0302 Cylinder 2 Misfire Detected
P0303 Cylinder 3 Misfire Detected
P0304 Cylinder 4 Misfire Detected

Description
A misfiring cylinder can be detected by analysing crank speed variation. As a result of a combustion event there will be a net acceleration of the crankshaft. Subsequent to a misfire event the engine will decelerate over the period following the missed cylinder event.

Speed changes can be characterised by observing changes in the time period for a fixed angle of rotation after firing events. A significant change in this period, assessed by comparison to previous peri ods, may be attributed to misfire on a known cylinder.

Component connections

Connector	Description	ECU Pin				ECU Connector
1	Supply Voltage	Coil 1	Coil 2	Coil 3	Coil 4	
2	Ignition Coil Feedback	D2	D2	D2	D2	32 Way (Left)
3	Coil Output (Logic)	F4	F3	F2	F1	32 Way (Left)
4	Ground					

Malfunction Criteria
The operation of all the misfire codes is the same, the last digit relates to the misfire involved i.e. code P0303 indicates there is a problem with cylinder number 3.
P0300 indicates the misfire is random and not linked to one particular cylinder.

Monitor:
- Continuous

Enable Criteria:
- Battery voltage between 10 – 16 V
- Coolant temperature between -10 – 120°C (14 – 248°F)
- Engine speed between 630 – 8010rpm
- Engine speed transient > 15rpm
- Altitude < 8000 ft (2438 m) / Baro > 756mbar
- Fuel level > 5 litres (1.3 US gallons)
- Engine load greater than 13 – 28% depending on engine speed

Disable Criteria:
- DFCO enabled (Deceleration Fuel Cut Off)
- Rough road
- MAF faults

Malfunction Criteria:
- Individual cylinder misfire in excess of 10% of total engine misfire
- P300 set when more than one cylinder misfiring or when CAM error MIL requested

Limp home (depends on severity and number of cylinders affected):
- Throttle limited and engine continues to run on all cylinders
- Fuel system set to open loop control

Potential failure modes:

- Injectors or related codes
- VVT system (clearance or timing) or related codes
- MAF meter or related codes
- Connectors and wiring for signs of corrosion or loose connections
- Spark plug / coil / cylinder compression
- PCV system / hoses
- Fuel pressure
- Coolant temperature sensor
- Vacuum hoses
- ECU

Diagnostic Mask:

- The MIL will be illuminated if a fault is present for two consecutive trips.

Knock Control System **P0327**
P0328

P0327 Knock Sensor Circuit Low
P0328 Knock Sensor Circuit High

Description
The knock sensor contains a piezoelectric element which generates a voltage when it becomes de formed. The piezoelectric element sends continuously sends a signal to the ECU, when the cylinder block vibrates due to engine knocking this signal increases. The ECU is able to identify each cylinder. If knock is detected then the ECU will retard the ignition of the relevant cylinder to suppress it.
The knock control sensor cannot differentiate between spark knock and other similar sounding noises.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Sensor input	D1	48 Way (Centre)
2	Ground	C1	48 Way (Centre)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Malfunction Criteria:
- P0327 – This code is set when the bank 1 knock sensor signal is < 0.586 V
- P0328 – This code is set when the bank 1 knock sensor signal is > 2.932 V

Potential failure modes:
- Abnormal engine noise, i.e. damaged engine or exhaust system contacting vehicle
- Knock sensor fixing too tight
- Sensor connector / wiring corroded or loose connections
- ECU

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Engine Speed / Position Sensors **P0335**

P0335 Crankshaft Position Sensor “A” Circuit Range/Performance

Description
Engine speed is calculated by measuring the time between the ‘teeth’ of the crankshaft sensor trigger disc. The disc has 34 ‘teeth’ and 2 missing ‘teeth’, spaced at 10 degree intervals around the disc. The centre of the 2 missing ‘teeth’ is positioned at 230 degrees before cylinder No.1 and 4 TDC. The crankshaft sensor signal is also used to determine misfires events.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Sensor input	A4	32 Way (Left)
2	Ground	B2	32 Way (Left)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- 15 crank errors in succession. This can occur due to no crank signal occurring whilst the cams continue to count or if there is a measured consecutive crank error.

Potential failure modes:
- Sensor signal open circuit or short to ground
- Sensor ground open circuit
- Sensor failure
- Crankshaft sensor plate
- ECU

Diagnostic Mask:
- The MIL will be illuminated if this fault is present for two consecutive trips.

Notes:
If a sensor or sensor circuit failure occurs, the engine will not fire or start.

Engine Speed / Position Sensors **P0341**
P0366

P0341 Camshaft Position Sensor “A” Circuit (Bank 1)
P0366 Camshaft Position Sensor “B” Circuit (Bank 1)

Description
The camshaft position input to the ECU is used to determine engine phase, enable sequential fuel injec tion control and to determine camshaft position for VVT control. The inlet camshaft has three ‘teeth’ spaced 90° apart, which are detected by the electromagnetic sensor. The valve timing set ting is measured in the ECU by measuring time from a (fixed position) crankshaft tooth to a (variable position) camshaft tooth. As the engine speed and the position is known from the crankshaft sensor signal, the camshaft position can be calculated.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1 Inlet Bank 1	Signal	A3	32 Way (Left)
2 Inlet Bank 1	Ground	B3	32 Way (Left)
3 Supply voltage	5V	D1	32 Way (Left)
1 Exhaust Bank 1	Signal	D4	32 Way (Left)
2 Exhaust Bank 1	Ground	C3	32 Way (Left)
3 Supply voltage	5V	D1	32 Way (Left)

Monitor:
- Continuous

Enable Criteria:
- Engine running
- Engine speed > 600rpm
- Engine runtime > 4 secs

Disable Criteria:
- None

Malfunction Criteria:
- 15 revolutions of crankshaft without receiving camshaft signal

Potential failure modes:
- Sensor signal open circuit or short to ground
- Sensor ground open circuit
- Sensor failure
- Cam failure
- Camshaft position plate
- ECU

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Notes:
Fault code P0341 will also be generated if the vehicle fails security checks on start up.

Ignition System

P0351
P0352
P0353
P0354

P0351 Ignition Coil “A” Primary/Secondary Circuit
P0352 Ignition Coil “B” Primary/Secondary Circuit
P0353 Ignition Coil “C” Primary/Secondary Circuit
P0354 Ignition Coil “D” Primary/Secondary Circuit

Description

A Direct Ignition System (DIS) is used on the engine. The DIS improves the ignition accuracy, reduces high-voltage loss, and enhances the reliability of the ignition system. The DIS is a 1-cylinder system that ignites one cylinder with one ignition coil. The ECU determines the ignition timing and outputs the ignition signals (IGT) for each cylinder. Based on IGT signals, the power transistors in the igniter cuts off the current to the primary coil, which induces a spark at the spark plug connected to the secondary coil. The igniter will also send an ignition confirmation signal (IGF) as a fail-safe measure to the ECU.

Component connections

Connector Pin	Description	ECU Pin				ECU Connector
1	Supply Voltage	Coil 1	Coil 2	Coil 3	Coil 4	
2	Ignition Coil Feedback	D2	D2	D2	D2	32 Way (Left)
3	Coil Output (Logic)	F4	F3	F2	F1	32 Way (Left)
4	Ground					

Monitor:
- Continuous

Enable Criteria:
- Engine running

Malfunction Criteria:
- No IGF signal to ECM while engine is running

Potential failure modes:
- Open or short in IGF1 – IGF6 circuits from ignition coil to ECU
- Coil failure
- ECU

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Catalyst System Efficiency

P0420 Catalyst System Efficiency Below Threshold

Description

The ECU compares the waveform of the oxygen sensors located before and after the catalyst to determine whether or not the catalyst has deteriorated. If the catalyst is functioning normally the front oxygen sensor will be switching between rich and lean whilst the rear oxygen sensor should also be switching between rich and lean but more slowly. When both the oxygen sensor waveforms change at a similar rate, it indicates that the catalyst performance has deteriorated. The ECU counts the number of pre and post catalyst oxygen sensor switches and divides one by the other to determine a ratio. If this ratio is too high a fault will be indicated.

Sensor connections

Pre catalyst oxygen sensor

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Signal	G3	48 Way (Centre)
2 Bank 1	Ground	J2	48 Way (Centre)
3 Bank 1	Heater Supply	H3	48 Way (Centre)
4 Bank 1	Battery Voltage	-	-

Post catalyst oxygen sensor

Sensor Connector	Description	ECU Pin	ECU Connector
1 Bank 1	Signal	H1	48 Way (Centre)
2 Bank 1	Ground	K4	48 Way (Centre)
3 Bank 1	Heater Supply	K1	48 Way (Centre)
4 Bank 1	Battery Voltage	-	-

Monitor:

- Continuous

Enable Criteria:

- Closed loop fuel control enabled
- Coolant temperature > 60 °C (140 °F)
- Baro > 756 mbar
- Vehicle speed < 130 km/h (81 mph)
- MAF < 48 g/sec & MAF > 2 g/sec
- Air inlet temp > -10°C (14°F)
- Accumulated Mass Air > 2000-4080 grams depending on coolant temperature

Disable Criteria:

- P0101, P0102, P0103 – MAF faults
- P0107, P0108 – MAP / Baro Faults
- P0116, P0117, P0118 – Coolant temperature faults
- P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0139, P0140, P0141 – Oxygen sensor faults
- P0171, P0172, – Fuelling faults
- P0300, P0301, P0302, P0303, P0304 – Misfire faults
- P0500 – Speed sensor fault

Malfunction Criteria:

- Switch ratio between Pre & Post catalytic converter O2 sensors > 0.6

Evaporative Emission Control – Purge, Open / Closed Circuit **P0444**
P0445

P0444 Evaporative Emission System Purge Control Valve Circuit Open
P0445 Evaporative Emission System Purge Control Valve Circuit Closed

Description

When the engine is running the ECU continuously monitors the status of the evaporative emission components for open circuit or short to. The feedback signal should be low when turned ON and high when turned OFF. The following codes will be set if the above conditions are not met.

P0444, P0445

Sensor / component connections
Purge Solenoid

Connector Pins	Description	ECU Pin	ECU Connector
1	Battery Voltage	-	-
2	Solenoid Output	B3	48 Way (Centre)

Potential failure modes:
- P0444 – purge valve/wiring open circuit
- P0445 – purge valve short circuit

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Fuel Level Sensor **P0462**
P0463

P0462 Fuel Level Sensor “A” Circuit Low
P0463 Fuel Level Sensor “A” Circuit High

Description
When the engine is running the ECU continuously monitors the fuel level sensor feedback signals. The feedback signal should be low when turned ON and high when turned OFF. The following codes will be set if the above conditions are not meet.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1			
2	Fuel level sensor	A2	48 Way (Right)
3	Fuel level sensor ground.	K3	48 Way (Right)

P0462, P0463

Monitor:
- Continuous

Enable Criteria:
- Engine Running

Disable Criteria:
- None

Malfunction Criteria:
- P0462 – Voltage < 0.020V
- P0463 – Voltage > 0.684V for 1.5 secs

Potential failure modes:
- Sensor open or short circuit
- Fuel level sensor

Diagnostic Mask:
- The MIL will be illuminated if these faults are present for 2 consecutive trips.

Engine Cooling Fan Control **P0480**
P0481

P0480 Fan 1 Control Circuit
P0481 Fan 2 Control Circuit

Component connections

Sensor Connector	Description	ECU Pin	ECU Connector
	Fan Relay Slow	F1	48 Way (Right)
	Fan Relay Fast	E2	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Wiring harness problem
- Relay
- ECU

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminated for 30 seconds after engine start if the fault is present.

Vehicle Speed Sensor **P0500**

P0500 Vehicle Speed Sensor “A”

Description
This input to the ECU is from the ABS module via CAN.

Monitor:
- Continuous

Enable Criteria:
- Following conditions must occur for 5 seconds
- Engine speed > 1800rpm and < 5010rpm
- Baro > 756 mbar
- Engine in a mode that indicates that the vehicle must be moving.

Malfunction Criteria:
- KMH < 5 kmh

Potential failure modes:
- ABS module failure
- CAN bus communication error to ABS controller

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.
  Idle Speed Control

Idle Speed Control **P0506**
P0507

P0506 Idle Air Control System RPM Lower Than Expected
P0507 Idle Air Control System RPM Higher Than Expected

Description
The ECM controls the engine idle speed using a combination of spark advance and throttle blade adjustment. If this control cannot attain the desired idle speed a fault is diagnosed.

Monitor:
- Continuous

Enable Criteria:
- Engine at idle speed
- Battery voltage between 10 V and 16 V

Malfunction Criteria 1:
- Idle air learn value on upper limit of +1.8g/s
- Idle speed more than 200 rpm above desired idle speed for more than 5 seconds.

Malfunction Criteria 2:
- Idle air learn value on lower limit of -1.8g/s
- Idle speed more than 100 rpm below desired idle speed for more than 5 seconds.

Potential failure modes:
- Induction system air leak
- Excessive engine load from front end accessory drive system, water pump, power steering, alternator
- Electronic Throttle Control

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for 2 consecutive trips.

Notes:
There will be a different learn value for AC on and AC off. Either could trigger fault

A/C Evaporator temperature sensor **P0537**
P0538

P0537 A/C Evaporator temperature sensor circuit low
P0538 A/C Evaporator temperature sensor circuit high

Description
The A/C system incorporates an evaporator temperature sensor for system control. This is a thermistor device that changes resistance with temperature. As the evaporator temperature decreases the thermistor resistance value increases, and conversely as the evaporator temperature increases so the thermistor resistance value decreases.

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
1	Sensor signal	A3	48 Way (Right)
1	Sensor ground	K3	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Vehicle Running

Disable Criteria:
- None

Malfunction Criteria:
- P0537 – Signal voltage < 0.049V for 1.5 seconds
- P0538 – Signal voltage > 4.399V for 1.5 seconds

Potential failure modes:
- Thermistor wiring open circuit or shorted
- Thermistor fault

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

Battery Voltage **P0562**
P0563

P0562 System Voltage Low
P0563 System Voltage High

Description
With a battery and alternator functioning as normal the system voltage for a running engine should be around 14V. The ECM monitors this and will diagnose if the voltage is too high or too low.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Malfunction Criteria:
- P0562 – Voltage Too Low < 10V for 10 seconds
- P0563 – Voltage Too High > 16V for 25.5 seconds

Potential failure modes:
- Alternator fault
- Battery fault

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Cruise Control **P0565**
P0567
P0568
P0571

P0565 Cruise control on/off signal
P0567 Cruise control resume/decal signal
P0568 Cruise control set/accel signal
P0571 Brake switch “A” circuit

Description
Cruise control requests are made using a multi-function switch input directly wired into engine control unit. From this input the ECM determines the driver request.
In addition cruise control is cancelled by the application of either the brake pedal or the clutch pedal (see also P0806, P0807 and P0808)

Sensor connections

Sensor Connector	Description	ECU Pin	ECU Connector
A	Cruise control switch input Off	A1	48 Way (Right)
B	Cruise control ground	K3	48 Way (Right)
C	Cruise control switch input Resume/Decease	C3	48 Way (Right)
D	Cruise control switch input Set/Increase	E3 -	48 Way (Right)
1	Brake Switch Ground		
2	Brake Switch Input	C4	48 Way (Right)

P0565, P0567, P0568
Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- P0565 - Input other than OFF received for more than 100 seconds
- P0567 - Input other than OFF received for more than 100 seconds
- P0578 – Input other than OFF received for more than 100 seconds

Potential failure modes:
- Cruise switch wiring open circuit or shorted
- Cruise switch fault
- ECU input circuit fault

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

P0571
Monitor:
- Continuous

Enable Criteria 1:
- KMH > 10 kmh
- PPS > 0.488%

Enable Criteria 2:
- ABS communications working

Disable Criteria:
- None

Malfunction Criteria 1:
- Brake switch on for greater than 25.5 seconds

Malfunction Criteria 2:
- ABS indicating brakes are on but brake switch off for greater than 0.5 seconds

Potential failure modes:
- Brake switch wiring open circuit or shorted
- Brake switch fault

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

ECU Integrity **P0601**
P0606

P0601 Internal Control Module Memory Checksum Error
P0606 ECM/PCM Processor

Description
These codes are used by the ECU to check the integrity of the software and calibration data.
P0601 checks that on power up the checksum for calibration data is the same as checksum saved on the previous power down.
P0606 checks the watchdog timer after a defined period to see if it has reset. If the watchdog timer has not reset then the code has entered an unplanned loop or condition stopping it resetting the timer.

Monitor
- P0601 at ECU power up
- P0606 continuously while the engine running

Diagnostic Mask:
- The MIL will be illuminated if a fault is present.

Variant Code Options Error **P0610**

P0610 - Control Module Vehicle Variant Code Options Error

Description
The variant code is used by the ECU to determine the vehicle variant. P0610 checks that on power up the variant code is set.
If a new ECM has been fitted the operation is performed using the Lotus TechCentre tool.

Monitor
- P0610 at ECU power up

Enable Criteria:
- Ignition on
- Time > 1 sec

Disable Criteria:
- None

Potential failure modes
- Variant code not programmed

Diagnostic Mask:
- The MIL will be illuminated if a fault is present.

Crank Relay **P0617**

P0617 Starter relay circuit high

Description
When the ignition key is in the crank position battery voltage is applied to the start request input of the ECM. The ECM will then energise the crank relay, via the immobiliser, to allow the starter motor to be engaged.
ECM diagnosis is only carried out on the crank relay.

Component connections

Relay Connector	Description	ECU Pin	ECU Connector
2	Main relay via fuse F13	-	-
4	Crank relay control	G1	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P0617 – Crank relay wiring shorted to 12V
- Crank relay failure
- Immobiliser failure
- ECU output circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

Fuel Pump Relay **P0628**
P0629

P0628 Fuel Pump “A” Control Circuit Low Voltage
P0629 Fuel Pump “A” Control Circuit High Voltage

Description
The fuel system is of the non-return type. The fuel pump is incorporated into the fuel tank module, which also contains the level sensor, fuel pressure regulator and vapour pressure sensor. The ECM controls the fuel pump operation via a relay, because of this the only fault diagnosis is of the fuel pump relay.

Component connections

Relay connector	Description	ECU Pin	ECU Connector
1	Rear ignition relay (fuse R1)	-	-
2	Fuel pump relay control	H2	48 Way (Right)

Monitor:
- Continuous

Enable Criteria:
- Ignition on

Disable Criteria:
- None

Potential failure modes:
- P0628 fuel pump relay wiring open circuit or shorted to ground
- P0628 fuse R1
- P0629 fuel pump relay wiring shorted to 12V
- Fuel pump relay failure
- ECU output circuit failure

Diagnostic Mask:
- The MIL will be illuminated immediately if a fault is present.

VIN Not Programmed or Incompatible – ECU/PCM P0630

P0630 Vin not programmed or incompatible

Description
The ECM programming process includes the Vehicle Identification Number (VIN). If a new ECM has been fitted this operation is performed using the Lotus TechCentre tool.

Monitor:
- During start up

Enable Criteria:
- Engine running (for up to 4 seconds)

Disable Criteria:
- None

Potential failure modes:
- VIN not programmed

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Throttle Actuator Control Range/Performance P0638

P0638 Throttle actuator control range/performance

Description
The single throttle butterfly valve mounted at the inlet to the intake plenum is operated by a stepper motor under the command of the engine ECU. The valve moves through a range of nearly 90° and should display 100% at full throttle and around 2% at idle.

Monitor:
- Continuous

Enable Criteria 1:
- Engine running

Disable Criteria 1:
- Electronic throttle fault P2135, P0122, P0123, P0222 or P0223 present
- Throttle demand transient condition

Malfunction Criteria 1:
- TPS error > 3% for 7.5 secs

Enable Criteria 2:
- Ignition on

Disable Criteria 2:
- Electronic throttle fault P2135, P0122, P0123, P0222 or P0223 present

Malfunction Criteria 2:
- Throttle not able to find closed position during boot

Potential failure modes:
- Blocked throttle body
- Damage to throttle actuator

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Notes: A mechanically sprung 7% throttle opening may be imposed.

Variable intake manifold circuit **P0661**
P0662

P0661 Variable intake manifold circuit voltage low
P0662 Variable intake manifold circuit voltage high

Description
This circuit activates a vacuum control solenoid which controls the variable intake manifold (VIM) and Air Intake Control Valve in response to changes in the engine speed and load in order to increase the intake efficiency.
When the engine speed is less than 4800 rpm and the engine load is greater than 50%, the ECM turns on the solenoid valve to close the VIM and AICV. Under all other conditions, the VIM and AICV are usually off and the VIM and AICV are open.

Component connections

Connector	Description	ECU Pin	ECU Connector
1	Ignition supply (fuse R6)	-	-
2	Solenoid control valve control	L4	48 Way (Central)

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P0661 – VIM wiring open circuit or shorted to ground
- P0661 – Fuse R6
- P0662 – VIM circuit, ECM side, shorted to battery voltage
- VIM control valve failure
- ECU output circuit failure

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

ECU Power Relay **P0685**

P0685 ECU Power Relay Open Circuit

Description
The ECU power is controlled by the main power relay. The voltage at ECM pins RM2/RM3/RM4 is compared to ignition switch input RB1 to determine if the power relay is open circuit.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Fuse R7
- Relay open circuit

Diagnostic Mask:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Brake Switch "B" Circuit **P0703**

P0703 – Brake switch

1	Brake Switch Ground		
2	Brake Switch Input	D1	48 Way (Right)

Clutch position sensor circuit **P0806**
P0807
P0808

P0806 Clutch position sensor circuit range/performance
P0807 Clutch position sensor circuit low
P0808 Clutch position sensor circuit high

Description
The clutch position sensor is used to identify the position of the clutch (engaged, disengaged or slipping). This information is used to control features such as fuel cut during gear changes, cruise control deactivation and ensuring any torque increase requests from the ESP system only occur with the clutch engaged.
The ECM continuously monitors the clutch position sensor input for malfunctions.

Component connections

Connector	Description	ECU Pin	ECU Connector
A	Ground	K3	48 Way (Right)
B	Clutch position sensor signal	B1	48 Way (Right)
C	Reference voltage	F4	48 Way (Right)

P0806

Monitor:
- Continuous

Enable Criteria:
- Maximum and minimum clutch position measured over 15 gear changes

Disable Criteria:
- None

Malfunction Criteria:
- Voltage difference between maximum and minimum of less than 1.47 V

Potential failure modes:
- Clutch sensor failure
- Clutch pedal failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

P0807, P0808

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Malfunction Criteria:
- P0807 – Sensor voltage < 0.21V

- P0808 – Sensor voltage > 4.93V

Potential failure modes:
- P0807 – Clutch sensor wiring open circuit or shorted to ground
- P0808 – Clutch sensor ECU input circuit shorted to 5V or 12V
- Clutch sensor failure
- Clutch pedal failure
- ECU input circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

Valvematic variable valve lift controller

P1045 Valvematic SDOWN Circuit Malfunction
P1046 Valvematic ECU Detected Difference Between Target and Actual Valvematic Angle
P1047 Valvematic Driver Learned Value Error / Power Source Circuit Malfunction
P1049 Valvematic Driver Internal Circuit Malfunction
P1055 ECU Detected Difference Between Target and Actual Valvematic Angle
P1645 “A” rocker arm actuator position sensor circuit
P2646 “A” Rocker Arm Actuator System Performance or Stuck Off
P2647 “A” Rocker Arm Actuator System Stuck On
P2648 “A” Rocker Arm Actuator Control Circuit Low
P2649 “A” Rocker Arm Actuator Control Circuit High
U0115 Lost communication with ECM/PCM “B” (Valvematic controller)

Description
In addition to the continuously variable valve timing (VVT), the VALVEMATIC system continuously changes the amount of intake valve lift and duration. The VALVEMATIC and electronic throttle control (ETC) systems operate cooperatively to control intake air volume by controlling the amount of intake valve lift and throttle valve opening.

Component connections

Valvematic control unit is connected to the engine management system over CAN bus

P1045
Monitor:
- Continuous

Enable Criteria:
- Ignition on
- Time > 100ms

Disable Criteria:
- None

Malfunction Criteria:
- Driver current short circuit to battery, Drive current >4.5A
- short circuit to ground, Drive current <100uA
- open loop, voltage over 3V

Potential failure modes:
- Open or short in continuously variable valve lift controller assembly circuit
- ECM

Diagnostic Mask:
- The MIL light will be on when fault is present.

P1046
Monitor:
- Continuous

Enable Criteria:
- Engine running
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
Valvematic ECU detected difference between target & actual valvematic angle.
- Crank angle duration differs by requested duration by 22 deg crank angle or more.

On board hardware detection

Potential failure modes:
- Continuously variable valve lift controller assembly
- Camshaft housing

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P1047
Monitor:
- Continuous

Enable Criteria:
- Engine running
- Valvematic operational
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
- Valvematic driver learned value error / power source circuit malfunction. Valvematic signals RAM error or Low Position Learn request. On board hardware detection

Potential failure modes:
- Continuously variable valve lift controller assembly power source circuit
- Continuously variable valve lift controller assembly

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P1049
Monitor:
- Continuous

Enable Criteria:
- Engine running
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
- Valvematic driver internal circuit malfunction:
- Valvematic EDU fails,
- Valvematic loses memory whilst in operational state

Potential failure modes:
- Continuously variable valve lift controller assembly

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P1055
Monitor:
- Continuous

Enable Criteria:
- Engine running
- Valvematic not in operational state
- Time > 500msec

Disable Criteria:
- P1045, P1046, P1049, P1055, P1645, P2646, P2647, P2648 and P2649

Malfunction Criteria:
- ECU detected difference between target & actual valvematic angle.
- Crank angle duration differs by requested duration by 22 deg crank angle or more

Potential failure modes:
- Continuously variable valve lift controller assembly
- Camshaft housing

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P1645
Monitor:
- Continuous

Enable Criteria:
- Ignition on
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
- Valvematic Angle sensor open or short circuit.

Potential failure modes:
- Continuously variable valve lift controller assembly

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P2646
Monitor:
- Continuous

Enable Criteria:
- Ignition on
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
"A" rocker arm actuator system performance or stuck off.
- Actuator duty cycle is 80% or more
- Actuator current is 10A or more.
- Stroke variation is 0.01mm or less over 0.016 seconds.

Potential failure modes:
- Continuously variable valve lift controller assembly
- Camshaft housing

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P2647
Monitor:
- Continuous

Enable Criteria:
- Ignition on
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
"A" rocker arm actuator system performance or stuck on.
- Actuator duty cycle is 80% or more.
- Actuator current is 10A or less.
- Stroke variation is 0.01mm or less over 0.016 seconds.

Potential failure modes
- Continuously variable valve lift controller assembly
- Camshaft housing

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

P2648
Monitor:
- Continuous

Enable Criteria:
- Ignition on
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
- "A" rocker arm actuator control circuit low.
- Current does not flow to actuator when commanded to operate

Potential failure modes
- Continuously variable valve lift controller assembly

Diagnostic Mask:

- The MIL will be illuminated if fault is present.

P2649
Monitor:
- Continuous

Enable Criteria:
- Ignition on
- Time > 200msec

Disable Criteria:
- U0115

Malfunction Criteria:
“A” rocker arm actuator control circuit high.
- Current flowing to actuator is more than requested

Potential failure modes
- Continuously variable valve lift controller assembly

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

MAP **P1107**
P1108

P1107 Manifold Absolute Pressure Circuit Low Input
P1108 Manifold Absolute Pressure Circuit High Input

Connector	Description	ECU Pin	ECU Connector
1	Ground	J4	48 Way (Centre)
2	Clutch position sensorsignal	D4	48 Way (Centre)
3	Reference voltage	J1	48 Way (Centre)

Description

Monitor:
- Continuous

Enable Criteria:
- Engine running

Malfunction Criteria:
- Low/high voltage, out of range < (1.075 V / 54.0kPa) or > (4.976 V / 106.9kPa)

Diagnostic Masks:
- The MIL will be illuminated if a fault is present for two consecutive trips.

Misfire **P1301**
P1302

P1301 Misfire level causing emissions increase
P1302 Misfire level causing catalyst system damage

Description
When the engine misfire reaches a high enough percentage the engine emission output levels can exceed the allowed limits, this will produce the fault code P1301.
If the misfire percentage is high enough and there is a possibility that the catalyst may be damaged then code P1302 will be set. To prevent catalyst damage the ECM will take action to shut down the misfiring cylinder and the corresponding paired cylinder.

See misfire faults P0300, P0301, P0302, P0303, P0304.

Monitor:
- Continuous

Enable Criteria:
- Battery voltage between 10 – 16 V
- Coolant temperature between -10 – 120°C (14 – 248°F)
- Engine speed between 480 – 8010rpm
- Engine speed transient > 15rpm
- Altitude < 8000 ft (2438 m) / Baro > 756mbar
- Fuel level > 5 litres (1.3 US gallons)
- Engine load greater than 14 – 25% depending on engine speed

Disable Criteria:
- DFCO enabled (Deceleration Fuel Cut Off)
- Rough road
- MAF faults

Malfunction Criteria:
- P1301 Emissions Failure – Misfire percentage > 5.6% measured over 1000 engine revolutions.
- P1302 Catalyst Damage Failure – Misfire percentage > 9% - 25% depending on engine speed and load, measured over 200 engine revolutions.

Potential failure modes:
- Injector related codes, as these can cause misfire codes to be set.
- VVT codes set
- Sensor connector and wiring for signs of corrosion or loose connections
- Spark plug / cylinder compression
- Cam timing / damage to rocker arm assembly
- Fuel pressure

Diagnostic Masks:
- For a P1301 fault code the MIL will be illuminated immediately.
- For a P1302 fault code the MIL will be illuminated immediately and the ECM will take action to prevent catalyst damage.

Notes:
- Misfire learns are calculated during DFCO (Deceleration Fuel Cut Off)

Throttle Actuator Control Motor Circuit/Open **P2100**

P2100 Throttle actuator control motor circuit open

Description
The throttle actuator stepper motor operates on 12 volts.

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Throttle actuator control motor open circuit

Throttle Actuator Control Motor Circuit/Low **P2102**

P2102 Throttle actuator control motor circuit low

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Throttle actuator control motor short to ground

Throttle Actuator Control Motor Circuit/High **P2103**

P2103 Throttle actuator control motor circuit high

Monitor:
- Continuous

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Throttle actuator control motor short to supply voltage

Throttle Actuator Control System – Forced Idle P2104

P2104 Throttle actuator control system – forced idle

Description
If a problem is detected which could result in faster engine speed than commanded by the pedal, the actuator is switched out, allowing the throttle valve to default to a 6% mechanically sprung setting. This provides a fast idle speed which may be used to effect a 'limp home' mechanism.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control System – Forced Engine Shutdown
P2105 Throttle actuator control system – forced engine shutdown

Description
If a problem is detected which could result in engine speed runaway, or if sufficient control of engine speed is lost, the ECU switches off the fuel injectors in order to stop the engine.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control System – Forced Limited Power P2106

P2106 Throttle actuator control system – forced limited power

Description
If a problem is detected which could result in engine speed control difficulties, the ECU will limit throttle opening to a maximum of 15%.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- Electronic throttle fault

Note: This code indicates action taken by the ECU, and will always be accompanied by another code which has caused this action.

Throttle Actuator Control Module Processor P2107

P2107 Throttle actuator control module processor

Description
The ECU contains two processors dedicated to the throttle pedal and throttle valve potentiometers.

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- ECU internal fault
- Incorrect ECU programming

Throttle Actuator Control Module Performance **P2108**

P2108 Throttle actuator control module performance

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- ECU internal failure
- Short circuit to throttle actuator

Throttle Actuator Control Throttle Body Range/Performance P2119

P2119 Throttle Actuator Control Throttle Body Range/Performance

Monitor:
- Continuous

Enable Criteria:
- Ignition on

Disable Criteria:
- None

Malfunction Criteria
- Throttle position does not close during start up.
- Throttle position stationary to within 0.01V over 10ms interval

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Pedal Position

P2122
P2123
P2127
P2128
P2135
P2138

P2122 Pedal position sensor ‘D’ circuit low
P2123 Pedal position sensor ‘D’ circuit high
P2127 Pedal position sensor ‘E’ circuit low
P2128 Pedal position sensor ‘E’ circuit high
P2135 Throttle position sensor/switch ‘A/B’ voltage correlation
P2138 Pedal position sensor/switch ‘D/E’ voltage correlation

Connector	Description	ECU Pin	ECU Connector
1	Reference voltage E circuit	F3	48 Way (Right)
2	Reference voltage D circuit	F3	48 Way (Right)
3	Pedal D position sensor signal	B4	48 Way (Right)
4	Ground D circuit	K4	48 Way (Right)
5	Ground E circuit	K4	48 Way (Right)
6	Pedal E position sensor signal	A4	48 Way (Right)

Pedal Position Sensor 'D' Circuit Low
P2122 Pedal position sensor ‘D’ circuit low

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal short circuit (< 0.283 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'D' Circuit High
P2123 Pedal position sensor ‘D’ circuit high

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal open circuit (> 4.487 V)
- Reference voltage open circuit

- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'E' Circuit Low
P2127 Pedal position sensor ‘E’ circuit low

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal short circuit (< 0.283 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Pedal Position Sensor 'E' Circuit High
P2128 Pedal position sensor ‘E’ circuit high

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- Signal open circuit (> 4.487 V)
- Reference voltage open circuit
- Reference voltage short to ground
- Sensor failure

Notes: A maximum throttle opening of 15% may be imposed due to this single code. In the case of multiple codes, a mechanically sprung 7% opening may be applied.

Throttle Position Sensor 'A'/'B' Voltage Correlation P2135

P2135 Throttle position sensor ‘A/B’ voltage correlation

(See P0122 for sensor pin inputs)

Description
Two potentiometers are built into the throttle actuator unit in order to provide a throttle position signal to the ECU. Two processors within the ECU compare the two output signals, which should match within a defined tolerance. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- Throttle position greater than 60%

Potential failure modes:
- TPS1 (A) reading incorrectly
- TPS2 (B) reading incorrectly

Notes: A maximum throttle opening of 15% may be imposed.

Pedal Position Sensor/Switch 'D'/'E' Voltage Correlation P2138

P2138 Pedal position sensor/switch ‘D/E’ voltage correlation

Description
Two potentiometers are built into the throttle pedal unit in order to provide a throttle demand signal to the ECU. Two processors within the ECU compare the two output signals, which should match within a defined tolerance. Note that the potentiometers operate on 5 volts.

Enable Criteria:
- None

Disable Criteria:
- None

Potential failure modes:
- PPS1 (D) reading incorrectly
- PPS2 (E) reading incorrectly

Notes: A maximum throttle opening of 15% may be imposed.

Throttle Actuator Control System – High Airflow Detected P2173

P2173 Throttle actuator control system – high airflow detected

Description
The mass air flow is compared with the throttle position to determine whether an incorrect correlation exists.

Enable Criteria:
- None

Disable Criteria:
- MAF fault(s) present

Potential failure modes:
- Throttle plate damage
- Air leak in intake system

Notes: A mechanically sprung 7% throttle opening may be imposed, or the injectors may be shut off to stop the engine.

A/C Refrigerant Distribution Valve **P2612**
P2613

P2612 A/C Refrigerant Distribution Valve Control Circuit Low
P2613 A/C Refrigerant Distribution Valve Control Circuit High

Description:
The A/C refrigerant flow is regulated by the ECM using the distribution valve to control the evaporator to the required temperature and prevent freezing.

Component connections:

Connector	Description	ECM Pin	ECM Connector
1	Control valve driver	K3	48 Way (Centre)
2	Ignition via rear ign relay	-	-

Monitor:
- Continuous

Enable Criteria:
- Engine running

Disable Criteria:
- None

Potential failure modes:
- P2612 – valve wiring open circuit or shorted to ground
- P2612 – loss of power from rear ignition relay
- P2613 – valve circuit, ECM side, shorted to battery voltage
- Valve failure
- ECM output circuit failure

Diagnostic Mask:
- The service light will be illuminated for 30 seconds after engine start if the fault has been present for the previous two trips.

Lost Communications with TCM U0101

U0101 Lost Communications with TCM

Description:
The ECM communicates with the Transmission Control Module (TCM) via the CAN bus.
If these CAN bus communications have been interrupted the ECM will register a diagnostic code.

Potential failure modes:
- CAN wiring
- TCM control module failure
- CAN bus corruption by another module on bus

Diagnostic Mask:
- The service light will be illuminated for 30 seconds after engine start if the fault was present on the previous trip.

Lost communication with ECM/PCM "B" (Valvematic controller) U0115

U0115 Lost communication with ECM/PCM "B" (Valvematic controller)

Monitor:
- Continuous

Enable Criteria:
- Valvematic enabled by SDOWN line
- ECU transmitting CAN messages to valvematic
- Time > 100msec

Disable Criteria:
- U0115

Malfunction Criteria:
- Lost communication with ECM/PCM "B". CAN communications failed in Valvematic to ECU direction. CAN messages; PID2S01, PID2S02 or PID2S03 failed continuously for 100ms.

Potential failure modes
- CAN wiring
- Valvematic control module failure
- CAN bus corruption by another module on bus

Diagnostic Mask:
- The MIL will be illuminated if fault is present.

Lost Communications with VDCM **U0122**

U0122 Lost Communications with VDCM

Description:
The ECM communicates with the Vehicle Dynamic Control Module (VDCM) via the CAN bus.
If these CAN bus communications have been interrupted the ECM will register a diagnostic code.

Potential failure modes:
• CAN wiring
• VDCM control module failure
• CAN bus corruption by another module on bus

Diagnostic Mask:
• The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

Software Incompatible with VDCM **U0316**

U0316 Software Incompatible with VDCM

Description:
The ECM checks that the Vehicle Dynamic Control Module (VDCM) matches the vehicle variant code. If not the above code will be set and the ECM will not respond to torque requests from the VDCM.

Potential failure modes:
• The ECM has been programmed with an incorrect variant code which does not match vehicle VDCM level.
• VDCM error.

Diagnostic Mask:
• The service light will be illuminated for 30 seconds at the point the fault occurs, and then illuminate for 30 seconds after engine start if the fault is present.

EMP.8 - BASIC FUNCTIONS OF LOTUS SCAN 3 TOOL

Identifyiing the ECU's current EMS program

It is highly recommended that before carrying out any program downloads, live vehicle data readings or sensor/ actuator testing that you identify the current EMS program stored within the ECU to confirm if the ECU is using an old level EMS program or if the EMS program stored either a standard production, authorised Lotus Motorsport or non authorised program.

Preparation for identifying ECM program ID

- Ensure the vehicles battery is fully charged.
- Visually inspect the vehicles ECM and see if any non-production labels or stickers have been applied (this may indicate that the vehicle may be running on either an unauthorised ECM or EMS program).
- Connect the Scan Tools harness into the vehicles Data Link Connector (DLC) located at the front of the passenger footwell and turn on the vehicles ignition and then follow the on screen instructions.

MAIN MENU
1►Lotus Vehicles
2. Other Vehicles
3. Scan 3 Functions ?

Step 1. From the main menu select:
1. Lotus Vehicles

MAIN OPERATIONS
1►Elise
2. Exige
3. 340R ?

Step 2. From main operations select:
1. for Elise
2. for Exige

MAIN OPERATIONS
3►Elise 04MY on
1. Elise 96-00 MY
2. Elise 01-03 MY ?

Step 3. From main operations
Select 3. Elise 04MY on
Select 2. Exige 04MY on

MAIN OPERATIONS
3►Elise 2ZZ-GE
1. Elise K Series
2. Elise 1ZZ-FE ?

Step 4. From main operations select:
3. Elise 2ZZ-GE (Elise only).

MAIN MENU
4. Reprogram ECU
1► Engine Data
2. ABS ?

Step 5. From main operations select:
1. Engine Data.
Then follow on screen instructions

MAIN OPERATIONS
7►View Program ID's
8. View Hardware ID
9. 02 Sensor Tests ?

Step 6. From main operations Select:
7. View Program ID's

IMPORTANT!

Program ID's
E121E10H
Program ID's 2
Lotus 2ZZ-GE FED ✓

Compare the Program ID1 with those shown on Omitec Library located on the Dealer Portal.
Only download a new program to the ECM if the main number displayed on the Scan Tool is a recognised Lotus program.
Caution: Overwriting a non - Lotus program may cause running issues and the ECM's non original program cannot be restored

Downloading an EMS program

MAIN MENU
1►Lotus Vehicles
2. Other Vehicles
3. Scan 3 Functions ?

Step 1. From the main menu select:
1. Lotus Vehicles

MAIN OPERATIONS
1►Elise
2. Exige
3. 340R ?

Step 2. From main operations select:
1. for Elise
2. for Exige

MAIN OPERATIONS
3►Elise 04MY on
1. Elise 96-00 MY
2. Elise 01-03 MY ?

Step 3. From main operations
Select 3. Elise 04MY on
Select 2. Exige 04MY on

MAIN OPERATIONS
3►Elise 2ZZ-GE
1. Elise K Series
2. Elise 1ZZ-FE ?

Step 4. From main operations select:
3. Elise 2ZZ-GE (Elise only).

MAIN MENU
4►Reprogram ECU
1. Engine Data
2. ABS ?

Step 5. From main operations Select:
4. Reprogram ECU.

Downloading
Program
Please Wait
■■■

Step 6. Follow the on screen instructions, Confirm the program by pressing ✓ button. Follow on screen instructions and wait for download

ECU Reprogramming
Completed
✓

Step 7. Select ✓

Misfire Learns Not
Required
✓

Step 8. Select ✓

MAIN MENU
1►Engine Data
2. Reprogram ECU
3. Elise SRS ?

Step 9. From main operations select:
1. Engine Data.

MAIN OPERATIONS
7►View Program ID's
8. View Hardware ID
9. 02 Sensor Tests ?

Step 10. From main operations Select:
7. View Program ID's

Program ID's 1
F121E10H
Program ID's 2
Lotus 2ZZ-GE FED ✓

Step 11. Confirm program installed then use '✓'.

Step 12. To write the vehicle VIN (if required) refer to step 6 on 'VIN writing to ECU' instructions.

If VIN writing is not required then use the 'X' button to exit out of all menus (except '✓' to confirm you want to exit) and then disconnect the Scan 3 Tool from the vehicle.

VIN writing to the ECU (except '06MY)

MAIN MENU
1►Lotus Vehicles
2. Other Vehicles
3. Scan 3 Functions ?

Step 1. From the main menu select:
1. Lotus Vehicles

MAIN OPERATIONS
1►Elise
2. Exige
3. 340R ?

Step 2. From main operations select:
1. for Elise
2. for Exige

MAIN OPERATIONS
3►Elise 04MY on
1. Elise 96-00 MY
2. Elise 01-03 MY ?

Step 3. From main operations
Select 3. Elise 04MY on
Select 2. Exige 04MY on

MAIN OPERATIONS
3►Elise 2ZZ-GE
1. Elise K Series
2. Elise 1ZZ-FE ?

Step 4. From main operations select:
3. Elise 2ZZ-GE (Elise only).

MAIN MENU
1►Engine Data
2. Reprogram ECU
3. Elise SRS ?

Step 5. From main operations select:
1. Engine Data.
The follow on screen instructions.

MAIN OPERATIONS
12 ► Vehicle Info
13. Restart Comms
14. ODB Status ?

Step 6. From main operations select:
12. Vehicle Info

VEHICLE INFO
5 ► Reprogram VIN
1. Vehicle ID
2. Calibration ID ?

Step 7. From vehicle info select:
5. Reprogram VIN
Note: If writing an '06MY VIN then go straight to next page at this step.

SCCPC111 7HL3000

↑Up ↓Down ⇄ Next
✓Reprogram X Exit

Step 8. Using the <> and Λ buttons change the VIN to match the vehicle then press '✓'.

The ECU has been successfully reprogrammed with a new Identification

Step 9. Follow the on screen instructions then press 'X' to exit out of all the menus (except '✓' to confirm you want to exit) and disconnect Scan Tool from the vehicle.

VIN writing to the ECU ('06MY specific)

Before following instructions on this page carry out steps 1 - 7 as shown in previous 'VIN writing to the ECU except '06MY' instructions.

SCCPC111 7HL36999

↑Up ↓Down ⇄ Next
✓Reprogram X Exit

Step 1. Change the VIN's serial number (last for digits) to 6999 and select ✓

FAILED to reprogram the Vehicle Identification ! ✓

Step 2. You will see the following error message. This indicates that the VIN has not been changed but the model year has.

VEHICLE INFO
5 ► Reprogram VIN
1. Vehicle ID
2. Calibration ID ?

Step 7. From main operations select:
5. Reprogram VIN

SCCPC111 6HL30000

↑Up ↓Down ⇄ Next
✓Reprogram X Exit

Step 3. Using the <>/\ buttons change the VIN to match the vehicle and then press ' ✓'

The ECU has been successfully reprogrammed with a new Identification ✓

Step 4. Follow the on screen instructions then press 'X' to exit out of all the menus (except '✓' to confirm you want to exit) and disconnect the Scan Tool from the vehicle.