ASTON MARTIN

V8 VANTAGE

OBD II Diagnostic Manual

Preliminary Issue

ASTON MARTIN LAGONDA LIMITED

Note: This version of the V8 Vantage OBD II Diagnostic Manual is in the process of validation. The manual will shortly be reissued to include all validation corrections.

Meanwhile, should any errors be identified, please call:
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Issue 1 -January 2006 Part No. 701311

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Introduction

The operation of the internal combustion engine depends on the ability to rapidly and accurately control several variables. The two main variables are; the quantity of fuel passed to the cylinder and the timing of ignition. Basic control of these variables is exercised by the Powertrain Control Module (PCM) which contain all the software to supervise and control the engine management system. The PCM also contain the diagnostic software (the Diagnostic Executive) required to detect any system malfunctions which could increase harmful emissions.

The Diagnostic Executive is the computer programme which monitors aspects of emission related engine performance. This programme controls all the monitor sequences, records DTCs, lights the MIL lamp and memorises freeze frame data for later analysis

The freeze frame data may be accessed using the World Diagnostic System (WDS) or other scan tool. The stored data describes engine conditions at the time the malfunction was detected, such as the state of the engine, state of fuel control, spark, rpm, load and warm up status. Previously stored conditions will be replaced only if a fuel or misfire malfunction is detected.

In order to pass all diagnostic monitors, a new vehicle or one in which the PCM memory has been cleared must be driven sufficiently (a complete drive cycle) to clear all component checks. A P1000 code will be recorded until all sections of the OBD II drive cycle are completed. The presence of a P1000 code is not a cause for concern unless other codes are present. The drive cycles are described later in this section.

The following monitors are included in the diagnostic software:

- Heated Oxygen Sensor (HO2S) Monitor
- Catalyst Efficiency Monitor
- Misfire Detection Monitor
- Fuel System Monitor
- Comprehensive Component Monitor

NB: TRIP - In the following descriptions the term trip is defined as successful completion of all monitors without detecting any fault which would illuminate the MIL lamp.

Comprehensive Component Monitor

The comprehensive component monitor is a self test strategy that detects malfunctions of any electronic powertrain component which may have an effect upon engine emission levels.

The inputs monitored include the PCM Identification, Inlet Air Temperature (IAT), Fuel Tank Pressure (FTPT), Cylinder Identification (CID), Fuel Level Indicator (FLI), Crankshaft Position (CKP), Vehicle Speed Sensor (VSS), Mass Air Flow Meter (MAF), Engine Coolant Temperature (ECT), Throttle Potentiometer (TP) sensors and Throttle Pedal Position (TPP) sensors.

Outputs monitored by the comprehensive component monitor include the Ignition System, Fuel Pump, Fan Control, Vapour Management Valves (VMV), Canister Vent Valve (CANVNT), all fuel injectors, the A/C cut-out relay (WAC) and the Throttle Controller.

An input component malfunction is declared if there is a lack of continuity, the signal is out of range, or if the signal is not in the correct relationship to another associated signal.

An output component malfunction is declared if there is a lack of continuity or if an expected output response to an PCM command does not occur.

In the comprehensive component monitor, when a malfunction has been present for two drive cycles, the relevant DTC is stored in the PCM and the MIL is turned on.

The MIL is turned off after three consecutive trips without the same malfunction being detected provided that no other DTCs are stored which would independently turn on the MIL. The DTC will be erased from memory after 40 warm-up cycles without the malfunction being detected after the MIL is turned off. The code may also be cleared by performing an PCM reset using the Diagnostic System (WDS) or a generic Scan Tool.

During a drive cycle, the individual monitor checks will be completed and entered into the PCM memory. The OBDII Readiness Test screen on the WDS may be used to show which particular monitors have completed since the last PCM reset. All monitors must successfully complete to clear a P1000 code (P1000 = OBD II System Checkout Incomplete).

System and Component Monitors

Heated Oxygen Sensor Monitor

OBD II regulations require monitoring of the upstream heated oxygen sensors to detect when deterioration of the sensor has exceeded emission thresholds. Additional oxygen sensors are located downstream to determine the efficiency of the catalyst. The downstream sensors are of a different type to those used for fuel control. The front and rear sensors are not interchangeable. They are monitored to determine if a voltage is generated. That voltage is then compared to values in memory to determine if the catalyst efficiency is in range.

Operation

The fuel control system attempts to maintain an air/fuel ratio of approximately14.7:1. The PCM uses the input from the upstream HO2S sensors to fine tune the air fuel mixture.

The upstream heated oxygen sensors are mounted in the exhaust flow between the engine and the catalytic convertors. The sensors operate between zero and one volt output depending on the oxygen content of the exhaust gasses. Lean air/fuel mixture will cause a sensor voltage of 0 - 0.4 volts. Rich air/fuel mixture will cause a voltage of 0.6 - 1.0 volts. The ideal air/fuel mixture would cause a sensor voltage of 0.4 - 0.6 volts to be generated. The actual sensor voltage will fluctuate as the system attempts to reach optimum air/fuel mixture under constantly changing conditions.

The following HO2S system checks are performed:

Upstream sensors are checked by changing the air fuel ratio and monitoring the sensor response.

Downstream sensors are monitored by noting the voltage change for changes in downstream oxygen content.

All sensors are monitored for overvoltage conditions

Sensor heaters are checked by turning them on and off and looking for changes in the current they draw.

When a HO2S malfunction is detected for two drive cycles, the DTC is stored in memory and the MIL is turned on. The MIL will be turned off after three consecutive trips without the same malfunction being detected, providing that no other malfunctions are present which would independently turn on the MIL. The DTC will be erased from memory after 40 warm-up cycles provided that the same DTC is not detected. The code may also be cleared by performing a PCM reset.

Catalyst Efficiency Monitor

The catalyst efficiency monitor determines when the catalyst efficiency has fallen below the minimum efficiency requirements.

Operation

Upstream and downstream oxygen sensor signals are compared during a range of speed/load conditions. The catalyst must be able to process the exhaust gases such that the rear oxygen sensors are prevented from switching in the same way as the front.

When a catalyst efficiency malfunction is detected for two drive cycles, the DTC is stored in memory and the MIL is turned on. The MIL will be turned off after three consecutive trips without the same malfunction being detected, providing that no other malfunctions are present which would independently turn on the MIL. The DTC will be erased from memory after 40 warm-up cycles provided that the same DTC is not detected. The code may also be cleared by performing an PCM reset or a DTC ‘CLEAR’ using WDS.

Fuel System Monitor

The fuel system monitor is a self test strategy within the PCM that monitors the adaptive fuel table. This table is used by the fuel control system to compensate for normal variability of the fuel system components due to age or wear. If the fuel system appears biased lean or rich, the adaptive fuel values will be shifted to remove the bias.

Operation

The adaptive fuel system uses the upstream oxygen sensor outputs as its primary input. The system also is capable of adapting fuelling requirements based on, Air Temperature, Coolant Temperature and Mass Air Flow.

As the fuel control and air metering components age or vary from nominal values, the adaptive fuel strategy learns corrections while in closed loop operation. These corrections are stored in a table called 'Long Term Fuel Trim'. The table resides in KAM (Keep Alive Memory) and is used to correct fuel delivery while in open or closed loop control.

As components continue to change, the table will reach its adaptive limit and can no longer cope with additional changes in fuelling components. Further changes in the fuel system components will cause deviation in the closed loop parameter called 'Short Term Fuel Trim'. As this deviation in short term fuel trim approaches 1.5 times the applicable standard, fuel/ air control suffers and emissions may increase. At this point, a fuel system fault is declared and a DTC is stored.

The fuel system tests are only run when the following preconditions are satisfied, engine rpm within acceptable range, air mass within calibrated limits, engine coolant temperature indicates the engine fully warmed up, steady throttle opening at a road speed of 30 - 45 m.p.h. Idle and deceleration performances are excluded from fuel system testing.

In the fuel system monitor, when a malfunction has been present for two drive cycles, the DTC is stored and the MIL lamp is turned on. At the same time, freeze frame data will be stored as described in the system overview. In order to provide the maximum information for fault analysis, the range of freeze frame data stored when a fuel system monitor fault occurs exceeds that required by the Air Resources Board.

The MIL is turned off after three consecutive drive cycles without the same DTC being detected provided that no other DTCs are recorded which would independently turn on the MIL. The DTC will be erased from memory after 40 trips provided that the same DTC is not detected. The code may also be cleared by performing a PCM reset.

Purge System Monitor

Tests the integrity and operation of the evaporative loss purge system.

Operation

Primary PCM - After an overnight soak, during steady state driving, the canister vent valve is closed and the purge system pulls a light vacuum in the fuel tank. The time taken for the vacuum to decay is measured and compared to calibrated limits. The results indicate whether the fuel vapour system is leak proof.

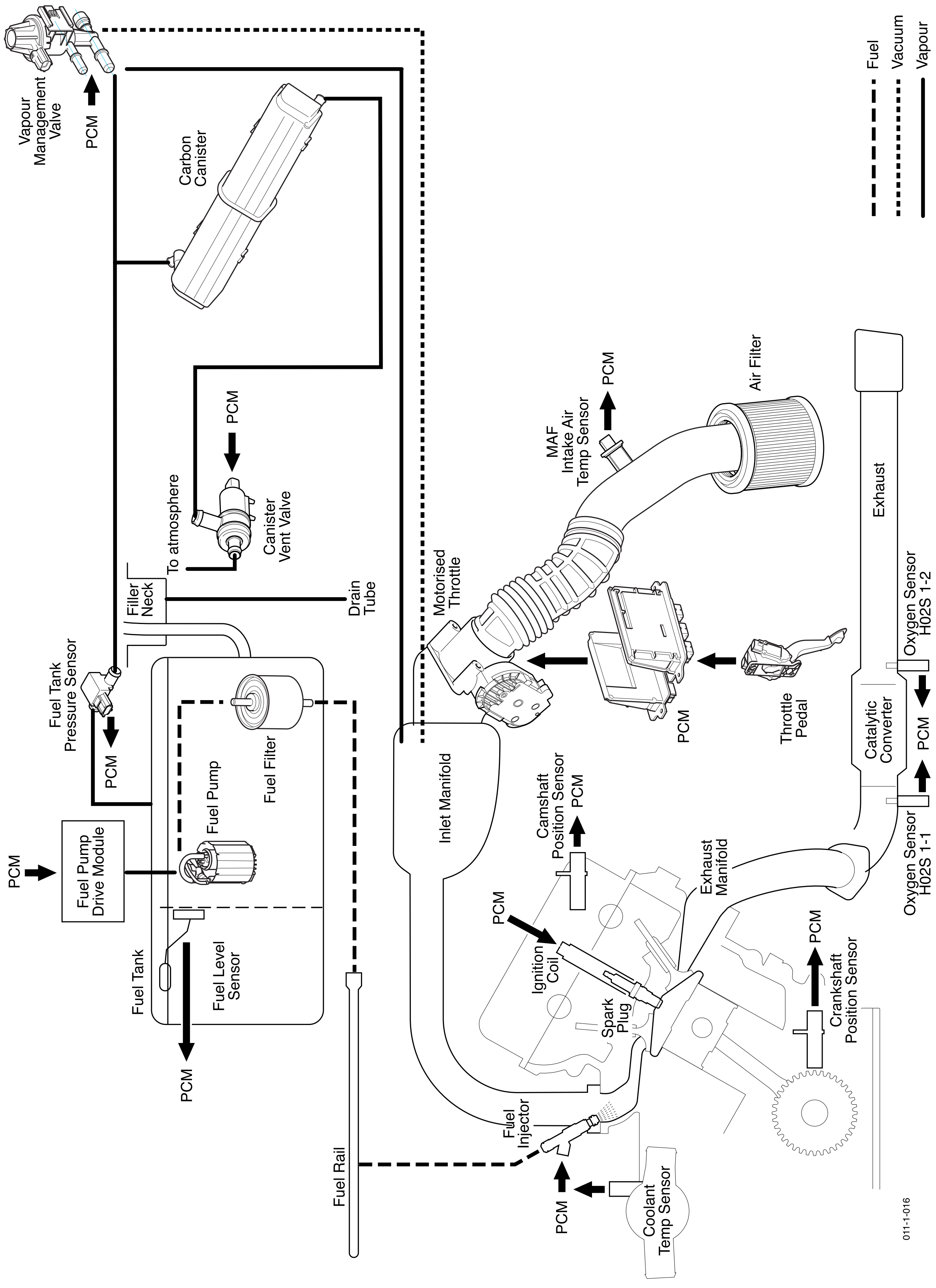
Secondary PCM - During vehicle acceleration, the engine fuelling requirements are stabilised and then the vapour management valve is opened. If the carbon canisters contain fuel vapour, it will be drawn into the inlet manifold. The fuelling correction required to rectify the fuel imbalance caused by the additional fuel vapour is noted. The adjustment required is used as an indicator of correct purge system flow.

Misfire Detection Monitor

Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering or poor compression. Any combustion occurring at an improper time is also defined as a misfire.

Misfires are detected by the Neural Net Misfire Monitor which checks various engine operating conditions (particularly crankshaft acceleration) and compares them to data held in PCM memory.

Engine Management - Schematic Diagram



Description of Components

Powertrain Control Module (PCM)

The engine management system is controlled by the Powertrain Control Module (PCM), which receive signals from the sensors, compares them to the required standards and then modify the fuel and ignition settings to maintain an optimum, stoichiometric, fuel and air mixture under all conditions. Sensor information is supplied to the Control Module Inputs, and control commands are issued through the Control Module Outputs. The PCM is located under the front righthand wing.

The Mass Air Flow Sensor (MAF)

The Mass Air Flow Sensor (MAF), measures the quantity of air drawn into the engine and reports to the PCM.

The Air Temperature Sensor (IAT)

An Inlet Air Temperature Sensor (IAT), is located inside each mass airflow meter and measures the temperature of the air entering either side of the engine. These sensors are fitted so that the engine management system can compensate for air density changes.

The Engine Coolant Temperature Sensors (ECT)

The Engine Coolant Temperature Sensor (ECT), monitors the coolant temperature and reports to the PCM. The secondary PCM receives the current temperature information from the primary PCM over the CAN bus.

The Fuel Pump

The Fuel Pump, is situated in the fuel tank and supply fuel to the Fuel Rails. The fuel pressure at the fuel rails is regulated by changing the run speed of the fuel pump.

Fuel Injectors

The eight Injector solenoids are operated by the PCM in sequence to inject fuel into the area behind each inlet valve. The volume of fuel injected is governed by the length of time each injector solenoid is actuated and the pressure in the fuel rail.

Ignition Coils

Ignition is by long life Spark Plugs supplied with HT voltage from the Ignition Coils mounted on each plug. The timing of ignition is varied by the PCM according to vehicle speed and engine load.

Catalytic Convertor / Heated Oxygen Sensors (H02S)

The combustion gases, after passing through the exhaust manifolds, enter the Catalytic Convertors, where the quality of the exhaust gas emission is modified. The quality of the exhaust gas emission is constantly checked by the four Upstream Heated Oxygen Sensors (H02S1 on either bank), which are situated at the entrance of the catalysts. The catalyst efficiency is checked using four Downstream Heated Oxygen Sensors (H02S2 on either bank). By comparing the signal outputs of pre and post catalyst heated oxygen sensors the PCM can make corrections to the fuel and ignition settings as necessary. The sensors contain integral heaters which accelerate the warming-up of the sensors to enable a rapid correction of initial settings which may be causing the emission of low quality exhaust gases.

Throttle Position Sensor (TP)

Throttle position is detected by the Throttle Position Sensors (TP) mounted on each throttle body. These sensors report to the PCM.

Throttle Pedal Position Sensor (PPS)

Throttle pedal position is detected by two Throttle Pedal Position Sensors (PPS) mounted in the throttle pedal assembly. These sensors report the PPS signal to the PCM. The pedal position is constantly verified by means of a rationality check between the three potentiometer readings. If any reading goes out of normal range, the in range readings are used and a fault is flagged on the out of range potentiometer.

Throttle Motors

Motor driven throttles are mounted on the left and right inlet manifolds. As the driver moves the throttle pedal, the throttle pedal signals change, the PCM receives the revised position signals and send drive signals to the throttle motors to drive the throttles to the new position.

Crankshaft Position Sensor (CKP)

Engine speed is measured from the pulse timing of the two Crankshaft Position Sensors (CKP). CKP signals are input to the PCM.

Camshaft Position Sensor - Cylinder Identification Sensor (CID)

Engine position is determined by using the two Camshaft Position Sensor (CID) signals. CMP signals are input to the PCM.

Using the CKP and CID signals, the PCM can accurately control the start time for ignition/fuel injection events.

Evaporative Emission Canister

The Fuel Tank, may be filled to 90% of the actual measured capacity; the 10% air volume above the fuel is vented to atmosphere through the Evaporative Emission Canister. The carbon element in this canister absorbs any displaced fuel vapour. As fuel is withdrawn from the tank, air is drawn in through the canisters to avoid creating a vacuum in the fuel tank.

When the fuel laden air in the tank expands at higher temperatures, pressure is relieved by allowing the displaced air to vent through the canister which retains any suspended fuel vapour.

During normal engine running, the vapour management valve allows air flow through the carbon canister and into the inlet manifolds, constantly purging any petrol vapour and burning it in the normal combustion process.

The Vapour Management Valve

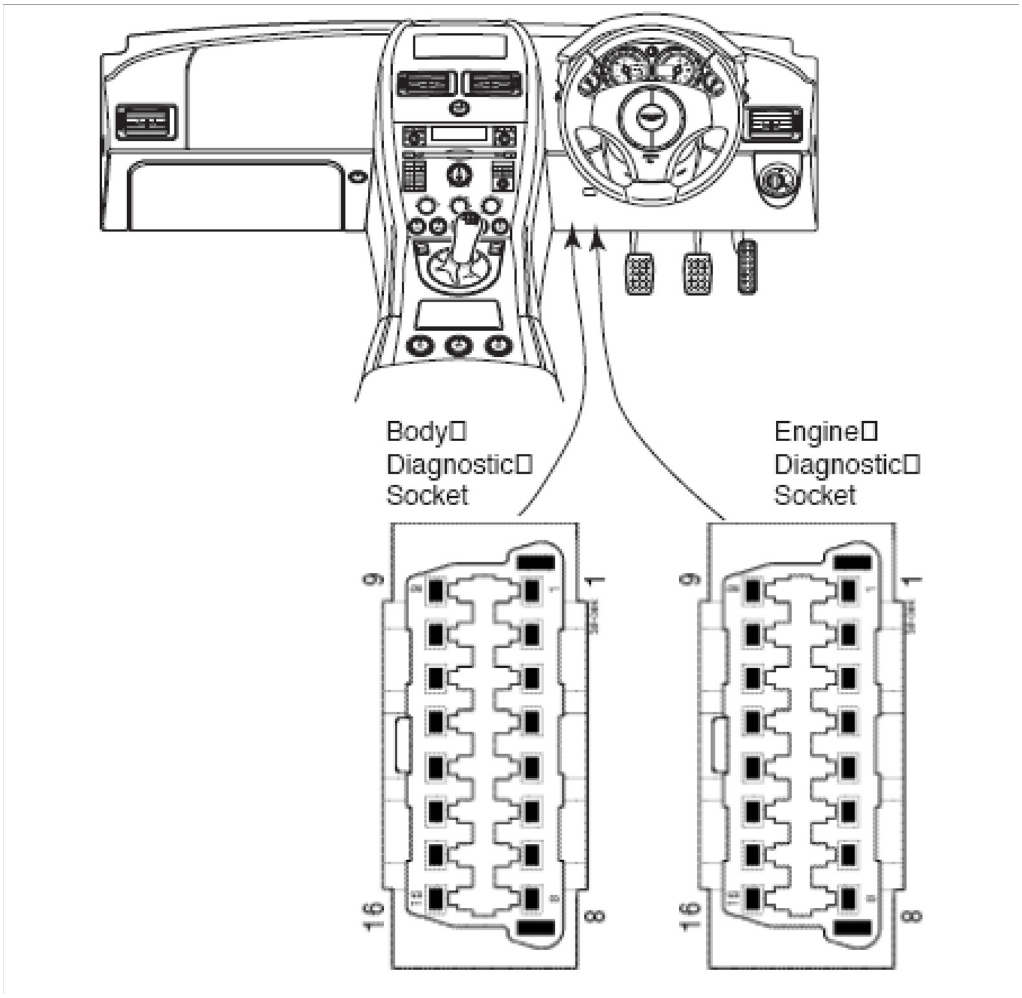
The Vapour Management Valve, is controlled by the PCM and open the canister line to inlet manifold vacuum; when the inlet manifold vacuum is sufficient, the vapour management valve will open. Air can then flow through the carbon canister, carrying fuel vapour to the inlet manifold and into the engine.

Diagnostic Equipment

The Aston Martin Diagnostic System (WDS) is the principal diagnostic tool used by Aston Martin franchised dealers. Non-franchised dealers will require the AML WDS or a compatible scan tool. The WDS installation and use is described in a separate publication. The WDS connects to the diagnostic sockets.

Diagnostic Sockets Location and Use

The two diagnostic sockets are located on the drivers side of the centre console. Note that the sockets change sides between left and right hand drive vehicles. The following systems are accessed from each socket:



Body Socket - Closest to the Centre Stack

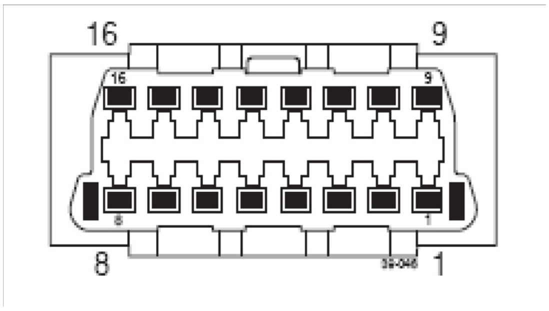
Airbag and Seat Belt Pretensioner System
Security System
Body Module

Engine Socket - Furthest from the Centre Stack

Powertrain Control Module (PCM)
Passive Anti-Theft System
Anti-Lock Braking System

The pin connections to each socket are shown on the following page:

Diagnostic Sockets - Pin Location and Function



Engine Socket (Drivers Side)

Pin	Function	Used by:
1		
2		
3		
4	Power Ground	All
5	Chassis Ground	All
6	CAN Link (+) High Speed	
7		
8		
9	+12V Ignition Supply	Input Power/Signal
10		
11		
12		
13	FEPS	Flash reprogramming
14	CAN Link (-) High Speed	
15		
16	12V Battery	All

Body Socket (Passenger Side)

Pin	Function	Used by:
1		
2		
3	CAN Link (+) Low Speed	
4	Power Ground	All
5	Chassis Ground	
6	CAN Link (+) High Speed	
7	K line ISO 9141	
8		
9	+12V Ignition Supply	
10		
11	CAN Link (-) Low Speed	
12		
13		
14	CAN Link (-) High Speed	
15		
16	12V Battery (unswitched)	All

Drive Cycle Routine

The drive cycle may be run on a rolling road. Running the drive cycle during a road test may take significantly longer.

The maximum speeds during the rolling road cycle may be significantly greater than the legal limit in some areas. The monitor tests will complete at a maximum speed of 55 m.p.h. providing that the PCM has not been disconnected and KAM memory lost. If the KAM memory has been lost, the misfire monitor will require decelerations from at least 55 m.p.h. to complete. If your maximum speed limit is below 55 m.p.h., run the drive cycle on a rolling road.

WARNING: Do not exceed local speed limits.

If run during a road test, the cycle may not complete in the order listed although the Comprehensive Component Monitor is a prerequisite for all other tests, and the HO2S monitor is a prerequisite for the purge tests.

The vehicle must be fully warmed up and have run for a minimum of 200 seconds before this cycle will start.

A P1000 code will only be cleared when all the monitor tests have been satisfactorily completed.

Comprehensive Component Monitor

This test is run continuously but for the purposes of clearing down a P1000 code, this monitor will clear if all sensors and actuators have no out of range values. The engine needs to have warmed up from an ambient start, idled for a short time and then the car must be driven for a short time. If the engine has been warmed up using an extended idle period and the cycle is driven as shown in the diagram, the component monitor tests will complete during stage 1.

Heated Oxygen Sensor (HO2S) Monitor

The HO2S sensors and their heater circuits will be tested and cleared down during stages 1 and 2 of the drive cycle. Periods 1 and 2 from the diagram are each of 60 seconds duration where the engine speed is 1130 and then 1310 rpm (approximately 27 and then 37 m.p.h.). Constant throttle opening must be maintained during these periods.

Catalyst Monitor

Stages 1, 2, 3 and 4 of the cycle provide the optimum conditions to ensure completion of the Catalyst Monitor. The sequence is not important but the vehicle must spend at least 60 seconds at each speed. Stage 1 at 1130 rpm (27-31 m.p.h.), Stage 2 at 1310 rpm (37-42 m.p.h.), Stage 3 at 1700 rpm (48-54 m.p.h.) and Stage 4 at 1860 rpm (53-59 m.p.h.). If constant speed cannot be maintained, then accelerating and decelerating gently between each speed will have the same effect but may take longer to complete the catalyst monitor test.

Misfire Monitor

Powertrain Control Module Memory Intact

The Misfire Monitor is a continuous test and will clear quickly if the PCM keep alive memory power has not been interrupted.

Powertrain Control Module Memory Interrupted (e.g. PCM or battery disconnected)

If the power source to the keep alive memory has been interrupted, the system needs to re-learn ignition and other correction factors before it can complete the misfire monitor tests. These correction factors are learned during long deceleration periods. A closed throttle deceleration from 55+ m.p.h. down to 30 m.p.h. is appropriate. It may require two or three deceleration cycles for the system to acquire the necessary corrections, after which the misfire monitor tests will clear quickly.

Purge Monitor

The Purge Monitor tests the vapour flow from the fuel tank and carbon canisters through into the engine. This monitor has two methods of completion.

The first and most common method occurs during an acceleration cycle from 30 to 50 m.p.h. over a 20 second period. The system looks for a minimum fuelling correction for a minimum purge valve duty cycle. This method will usually be successful since there is nearly always sufficient fuel vapour available to cause a recognisable fuelling correction.

The second method is used in cold ambient conditions when the quantity of fuel vapour available will be at a minimum. The engine is run for a period of several minutes at idle during which the effect of purge vapour flow on engine idle speed control is assessed.

If the purge monitor does not clear during the first method, leave the engine idling for 5-10 minutes. During this time, the purge control monitor will then complete using the second method.

Fuel System Monitor

The capability of the engine management system to control fuelling under closed loop conditions is assessed continuously but will be tested during phases 1 - 4 of the test sequence as the HO2S and catalyst tests are completed.

PCM Reset Procedure

The Powertrain Control Module (PCM) may be reset using either of two following methods.

Note:It is not normally necessary to reset th PCM during fault analysis. Only reset the control module when directed to 'Reset the PCM' in a fault analysis procedures.

Procedure

With the ignition switched off, disconnect the module harness connector at the affected PCM. The following elements will be cleared in the PCM keep alive memory.

- Logged DTC counter will reset.
- All logged DTCs will be cleared.
- Freeze frame data will be cleared.
- Oxygen sensor data will be cleared.
- OBD system monitor status will be reset.
- P1000 status code will be set.

The PCM may be reset by disconnecting the battery but the clock, radio and window controllers will require resetting after reconnecting the battery.

Note: Since the oxygen sensor data has been cleared, the vehicle may exhibit some mild driveability concerns until this data has been relearned during initial driving after the PCM reset.

Note: The P1000 code will remain stored until all diagnostic monitors have cleared after completion of all parts of the drive cycle following the PCM reset.

Caution:

Clearing codes with a generic scan tool resets all modules.

Diagnostic Trouble Code Report Form

The DTC Report Form exists so that dealer technical staff may report occurrences of DTCs back to the manufacturer. When seeking advice, or when requested by Aston Martin Service Operations Department, please complete the Trouble Code Report Form and email the completed form from the 'my documents' folder on WDS.

Alternatively, the form may be faxed to:

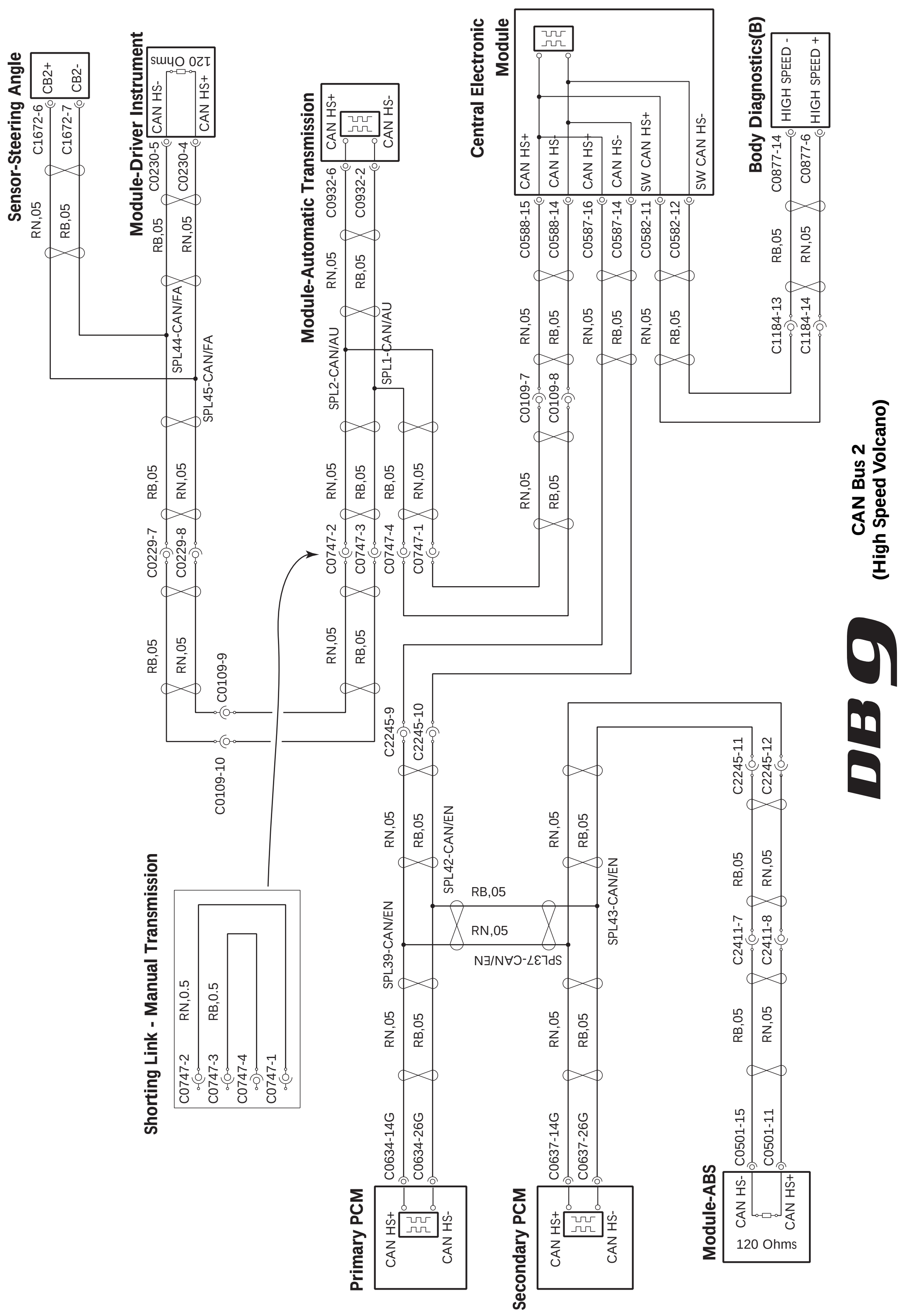
Aston Martin Service Operations Department - Fax No. (0044) (0)1926 644733

High Speed CAN Fault Analysis

1. Connect the WDS to the Body diagnostic connector. Ignition ON.
2. Read the CEM Diagnostic Codes and select those relevant to the high speed CAN bus.

Code	Definition
DE01	Brake Control Module not alive
DE11	Engine Control Module not alive
DE29	Centre Console Module not alive
DE42	Convertible Roof Module_not_alive
DE43	Driver Door Module not alive
DE45	Pass. Door Module not alive
DE49	Steering Angle Sensor not alive
DE51	Driver Information Module not alive
DE52	Convertible Roof Module not alive
DE54	Infotainment Control Module not alive
DE58	Safety Restraint System (Airbag Module) not alive
DE64	Phone Module not alive
DE6E	Transmission Control Module not alive
DF11	HS CAN Bus Open Load or Transmit / Recieve error
DF13	HS CAN + shorted to batt voltage_
DF14	HS CAN - shorted to ground
DF15	HS CAN + shorted to ground
DF16	HS CAN - shorted to battery voltage
DF17	HS CAN - shorted to HS CAN + or Open Load HS CAN - or HS CAN +
E000	HS CAN transmit recieve error(BUS_OFF)
E001	LS CAN transmit recieve error(BUS_OFF)
E010	CEM HS NWM Failed Control Initialisation
E011	CEM LS NWM Failed Control Initialisation
E020	CEM HS NWM Failed Volcano Initialisation

3. Check for relevant modules off-line. (Cross check against the following High Speed CAN Circuit).



4. Check the basic power and ground supplies to the suspect module and service as necessary. If a power fault was detected, clear the CEM DTC's and then go to step 5.

5. Switch the ignition off and then on again to repeat the power up tests. If any HS CAN module is still off line, service the defective link as necessary. If no relevant codes are displayed, go to step 6.

6. Check resistance from HS CAN + to HS CAN -.

   Resistance should be 60¾. (i.e. 2 x 120¾ terminator resistors in parrallel)

   Terminator resistors are in the ABS Module and the DIM Module.

   If 60¾ is measured, the circuits to the terminator resistors are good. Go to step 7.

   If 120¾ is measured, one of the terminator resistors is open circuit. The fault is in either the ABS or the DIM sections of the HS CAN bus. Isolate each section and analyse the fault using continuity checks. Service the open circuit as necessary.

7. With 60¾ measured between HS CAN + and - at the diagnostic socket, only the PCM and Steering Angle Sensor spurs remain as suspects.

8. For steering angle sensor faults, go to step 9.

   For Transmission Controller faults, go to step 11

   For Powertrain Control Module faults, go to step 12.

Stering Angle Sensor

9. If DE49 (Steering Angle Sensor not alive) is logged, Disconnect the steering angle sensor and check continuity of the HS CAN + line from C1672-6 to C0877-6 and the HS CAN - line from C1672-7 and C0877-14.

10. Set WDS Datalogger to monitor the Steering Angle Sensor. Turn the steering wheel and check for a corresponding change in the sensor reading. If the response does not match steering wheel movement, the sensor is faulty. Replace the steering angle sensor. Reconnect all components and retest the sensor to ensure that the problem is resolved.

Powertrain Control Module

11. If code DE11 (Engine Control Module not alive) is logged in the CEM, Install the breakout box to the PCM connector and check continuity from the HS CAN + and - pins on the body diagnostic connector to the corresponding pins on the PCM. Service any circuit fault as necessary. Clear the DE11 code from the CEM. Reconnect all components and run a KOER test to ensure that the problem is resolved.

    If the code is logged again, check for logged DTCs in the PCM and analyse the problem using the procedures for the PCM fault codes.

Low Speed CAN Procedures

1. Connect the WDS to the OBD II diagnostic connector. Ignition ON.
2. Read the CEM Diagnostic Codes. If CEM diagnostic codes can be read, the OBD II CAN spur and the CEM are good. Go to step 4. We can also assume that there are no shorts to ground, to supply or across the CAN bus in the remainder of the LS CAN Network. This does not eliminate intermittent faults in these areas

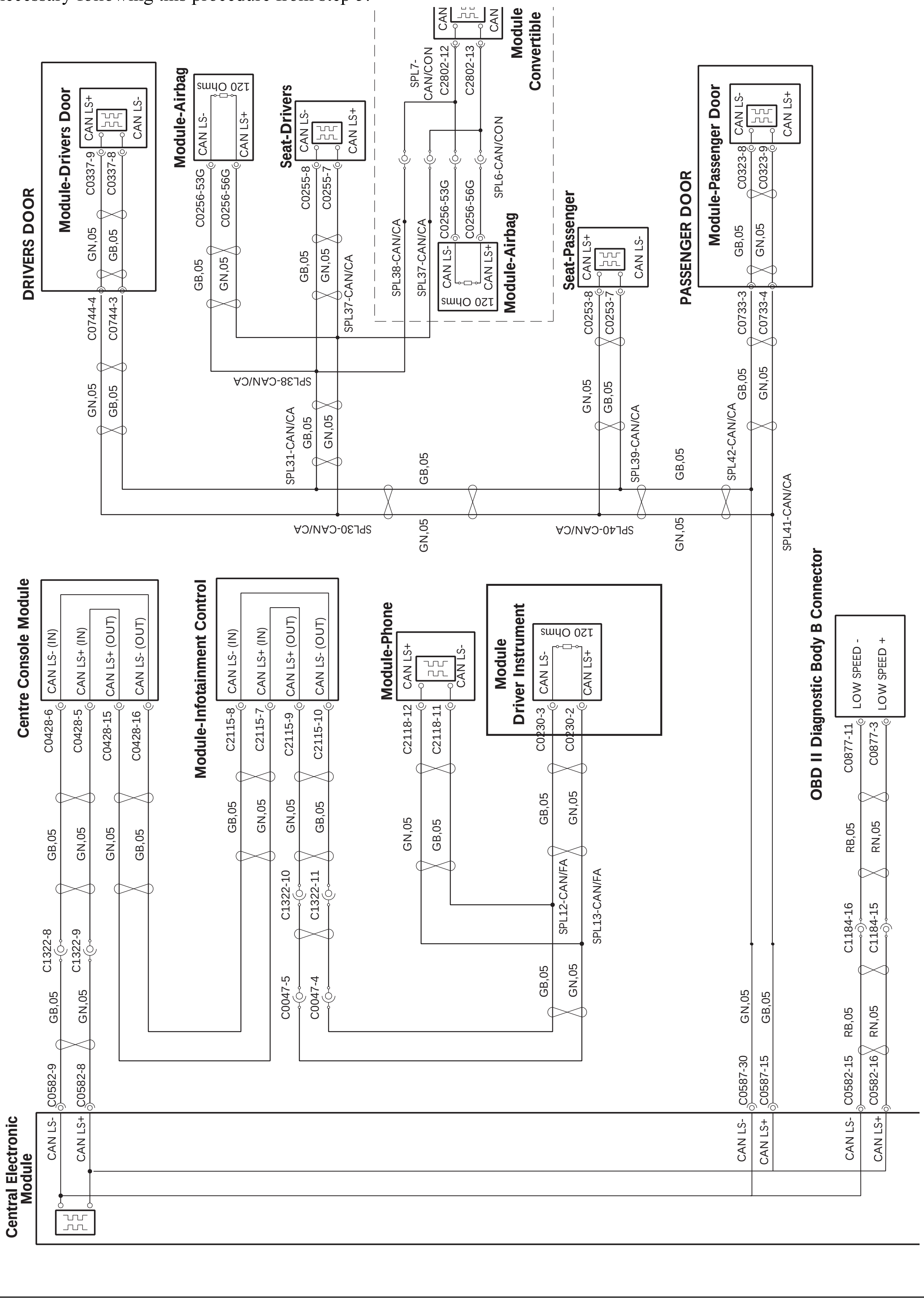
Code	Definition
DE01	Brake Control Module not alive
DE11	Engine Control Module not alive
DE29	Centre Console Module not alive
DE42	Convertible Roof Module_not_alive
DE43	Driver Door Module not alive
DE45	Pass. Door Module not alive
DE49	Steering Angle Sensor not alive
DE51	Driver Information Module not alive
DE52	Convertible Roof Module not alive
DE54	Infotainment Control Module not alive
DE58	Safety Restraint System (Airbag Module) not alive
DE64	Phone Module not alive
DE6E	Transmission Control Module not alive
DF11	HS CAN Bus Open Load or Transmit / Recieve error
DF13	HS CAN + shorted to batt voltage_
DF14	HS CAN - shorted to ground
DF15	HS CAN + shorted to ground
DF16	HS CAN - shorted to battery voltage
DF17	HS CAN - shorted to HS CAN + or Open Load HS CAN - or HS CAN +
E000	HS CAN transmit recieve error(BUS_OFF)
E001	LS CAN transmit recieve error(BUS_OFF)
E010	CEM HS Network Manager Failed Control Initialisation
E011	CEM LS Network Manager Failed Control Initialisation
E020	CEM HS Network Manager Failed Volcano Initialisation

3. If you cannot read the CEM codes, then one of the following failures exists:
   - CEM not functional. CEM failure or power failure.
   - LS CAN OBD II spur faulty
   - Short to ground, to supply or across the LS CAN Network

If any of the above faults are identified, service the circuits or components as necessary. Clear the CEM DTCs and turn the ignition off and on again. Check that no DTCs are logged inthe CEM at power on.

4. From the logged DTCs, check for relevant modules off-line. (Cross check against the following Low Speed CAN Circuit). If any module is Off-Line, check the power and ground supplies to that module and service as necessary.

   If no fault is found in the power and ground supplies, note the CEM fault code(s) and service the defective CAN link as necessary following this procedure from step 5.



5. If any of codes DE29, DE51, DE54, or DE58 is present, there is a continuity fault in the CAN Bus between the terminator resistors. Go to step 6.

   If none of the above codes is logged but any of codes DE42, DE 43, DE45, DE52 or DE64 is present, the continuity check in step 6 should pass. The fault lies in a LS CAN bus spur and not in the main CAN bus between the terminator resistors. Go to step 7.

6. Switch off the ignition. Disconnect the battery. (Check with Elec Eng.)

   Check resistance from LS CAN + to LS CAN - at the OBD II diagnostic socket.

   Resistance should be 60¾. (i.e. 2 x 120¾ terminator resistors in parallel)

   Terminator resistors are in the Airbag Module and the DIM Module.

   If 60¾ is measured, the circuits to the terminator resistors are good. Suspect a module failure

   If 120¾ is measured, one of the circuits to the terminator resistors is open circuit. The fault is in either the DIM or the Airbag sections of the LS CAN bus. Isolate each section and analyse the fault using continuity checks. Service the open circuit as necessary.

7. For each Logged DTC, access the module connector and complete continuity checks for the CAN + and CAN - links to the OBD II diagnostic socket pins C0877-11 CAN - and C0877-3 CAN +.

   Service any open or short circuits as necessary. Clear the CEM DTCs. Turn the ignition off and then on again. Check that no CEM DTCs are logged at power on.

   If no circuit faults are identified, the fault must lie in the relevant module. Replace the module. Clear the CEM DTCs. Turn the ignition off and then on again. Check that no CEM DTCs are logged at power on.

Special Tests

Soak and Road Test

The vacuum tests are only run during a drive cycle after the ignition has been switched off for more than 5 hours. If less than 5 hours have elapsed, the vacuum tests are not included in the drive cycle.

Leave the vehicle parked overnight (or more than 5 hours and then run a road test which must include steady running at over 40 m.p.h. for more than 5 minutes.

Quick Check - Battery and Battery Charging

Battery - Measure battery voltage from the jump start terminal to chassis ground. If less than 12.5 volts, suspect a defective battery. Service/replace the battery as necessary and retest for a P0562 condition. If above 12.5 volts, the battery is serviceable, go to the charging check.

Charging - Run the engine at 2000 rpm whilst the headlamps are switched on. Charge voltage measured from the jump start terminal to chassis ground should be about 13.8 volts. If significantly below 13.8 volts, service the charging system and retest for a P0562 condition. If at 13.8 volts, the charging system is serviceable.

Quick Check - Engine Fuelling

This procedure is intended as a quick check for correct engine running after major work on the fuel system. It uses the WDS datalogger to monitor the engine management oxygen sensor output signals.

A regular fluctuating signal from all EGO sensors indicates normal fuelling and ignition performance on both sides of the engine. If this is accompanied by a clear DTC log, then there are no current engine management problems.

1. Connect the WDS and note all logged DTCs.
2. Set the datalogger to monitor VEGO11 and VEGO21 for the PCM.

   VEGO = Voltage - Exhaust Gas Oxygen sensors

   Also monitor ýFPRESS (fuel rail pressure) for both fuel rails
3. Start the engine and run at idle until the temperature gauge rises above minimum.
4. Start the datalogger to monitor the upstream engine management VEGO signals. Observe the signal trace and compare with the illustration below

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5. Note also the fuel rail pressure for both fuel rails.
6. Raise the engine speed to a steady level of approximately 2000 rpm. Again monitor the upstream VEGO signals and ýFPRESS readings.
7. If there are no engine management DTCs logged and if the signal patterns observed in steps 4 and 6 meet the following guidelines, then engine running is acceptable.

   Look for:

   - a regular rise and fall in the EGO signal voltage
   - Increased frequency of EGO signals with increasing rpm.
   - similar signal patterns from all four EGO sensors
   - no major irregularities over time
   - ýFPRESS above 40 psi for both engine banks
8. If the VEGO signal patterns are irregular or not closely matched, check for newly logged DTCs and investigate them using the procedures in this manual. Stop the datalogger and switch off the engine.