ASTON MARTIN

DB7

OBD II Diagnostics Manual

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The Development of On Board Diagnostic (OBD) Systems

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 was, in the past, done with mechanical devices; the carburettor for fuelling, and points, coil and distributor for ignition. As these devices were developed they became more complex and sophisticated.

The function of the carburettor was to keep the air-fuel ratio constant, and complex arrangements of passages, jets, chokes etc. were required to modify the fuelling in response to constantly changing conditions.

Mechanical ignition systems had devices such as vacuum and centrifugal advance mechanisms which modified the timing for changing engine loads and speeds. The calibration of these devices was a skilled task, executed by engineers with years of experience. In the search for refinement and accurate control, the increased complexity affected reliability and increased the need for regular servicing.

The first widespread application of electronics for engine control was in the ignition system where part of the control was made "solid state". The mechanical points were replaced by Hall-effect position sensors and the ignition timing was electronically controlled, however the distributor remained. Fully electronic ignition systems followed, with microcomputer and software controls, solid-state amplifiers and now, a small high tension coil for each spark plug.

Electronic fuel injection appeared at this time, although only on "high performance" cars. In this system, fuel at a constant pressure is injected into the inlet tract by opening an injector for a calculated time. Microcomputer controls are required to calculate the length of time the injector is open, for a given engine speed and load, and also to compensate for conditions such as cold start, overrun, hard acceleration etc.

Although often treated as separate systems, many cars today have both fuel and ignition controls integrated into a single computer known as the Engine Management System or EMS. The EMS measures the running state of the engine through a number of sensors such as crank position, coolant temperature, intake air flow etc. and controls the ignition and fuelling according to look-up tables, or "maps", stored within it's programme. The process of "mapping" during vehicle development is the same task that was previously done by experienced engineers calibrating carburettors and ignition timing, except that now it is done with lap top computers and tables of hexadecimal numbers. The use of electronic controls for engines has increased engine reliability and lengthened the intervals between routine services. They have also enabled manufacturers to meet ever tighter regulations on engine exhaust emissions with improved ancillary systems. New problems have been created for those whose job is the solving of vehicle problems because a traditional mechanic's skills must now be augmented by a knowledge of electronic system fault finding.

The latest developments in automotive engine controls are directed towards integrating the Engine Management System with the powertrain and chassis control systems. This involves techniques such as the use of indirect electronic control of the throttle and distributed control via high speed multiplexed data buses.

On Board Diagnostics II System

Overview

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in California beginning in the 1988 model year. The first phase, OBD I, required monitoring of the fuel metering system, exhaust gas recirculation system, and additional emission related components. The Malfunction Indicator Lamp (MIL) (lamp labelled CHECK ENGINE) was required to light and alert the driver if the emission control system malfunctioned or was in need of service. Associated with the MIL was a fault code identifying the specific area of the fault.

The OBD I strategy was further developed and updated to OBD II to include further monitoring of the emission control system.

When a system or component exceeds emission thresholds or when a component operates outside of tolerance, a Diagnostic Trouble Code (DTC) will be stored and the CHECK ENGINE (MIL) lamp will come on (USA and Canada).

The Powertrain Control Module (PCM) contains all the software to supervise and control the engine management system. The PCM also contains 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 (USA and Canada) and memorises freeze frame data for later analysis

The freeze frame data may be accessed using the portable diagnostic equipment 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 to clear all component checks. Until all checks are complete, a P1000 code will be recorded. The P1000 code will clear when all sections of the OBD II drive cycle are completed. The drive cycles are described later in this section.

The following monitors are included in the diagnostic software:

- Exhaust Gas Recirculation (EGR) Monitor
- Heated Oxygen Sensor (HO2S) Monitor
- Catalyst Efficiency Monitor
- Misfire Detection Monitor
- Fuel System Monitor
- Comprehensive Component Monitor
- Secondary Air Injection Monitor

Comprehensive Component Monitor

The comprehensive component monitor is a self test strategy that detects malfunctions of any electronic powertrain component inputting to the PCM which is not exclusively an input to any other OBD II monitor.

The inputs monitored include the Vehicle Speed Sensor (VSS), Mass Air Flow Meter (MAF, Engine Coolant Temperature (ECT), and Throttle Potentiometer (TP) sensors. Outputs monitored by the comprehensive component monitor include the Ignition System (ID and PIP), Fuel Pump, Fan Control and Idle Speed Control.

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 a PCM command does not occur.

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

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 a PCM reset.

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. Two additional oxygen sensors are located downstream to determine the efficiency of the catalyst. Although the downstream sensors are the same type used for fuel control, they function differently. 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 14.7:1. The PCM uses the input from the upstream HO2S sensors to fine tune the air fuel mixture.

The 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 corresponding changes in the output voltages.

When a HO2S malfunction is detected for two drive cycles, the DTC is stored in memory and the MIL is turned on (USA and Canada). 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.

Upstream and downstream oxygen sensor signals are compared during a range of speed/load conditions. The catalyst must be able to process the exhaust gasses 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 (USA and Canada). 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.

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 table values will be shifted to remove the bias.

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, Intake Air Temperature, Engine 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 mph. 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 (USA and Canada). 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 warm up cycles provided that the same DTC is not detected. The code may also be cleared by performing a PCM reset.

Exhaust Gas Recirculation (EGR) Monitor

Tests the integrity of the circuitry, components and hoses that make up the EGR system. Detects errors in the circuitry or components and detects EGR flow rate errors.

Operation

The EGR monitor uses inputs from the Differential Pressure Feedback Sensor (DPFE) to monitor the EGR system. The monitor is capable of checking the DPFE sensor, Electronic Vacuum Regulator (EVR) solenoid, electrical circuits, pressure signal hoses, and the EGR valve. The EGR monitor sequence is only enabled when certain preconditions have been satisfied. Any failure in the PCM inputs from the engine coolant temperature (ECT), intake air temperature (IAT), throttle position sensor (TP) or mass air flow sensor (MAF) will prevent the EGR monitor sequence from starting.

EGR system components and EGR flow checks are performed.

When an EGR malfunction is detected for two drive cycles, the DTC is stored in memory and the MIL is turned on (USA and Canada). 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.

Purge System Monitor

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

Operation

During vehicle acceleration, the engine fuelling requirements are stabilised and then the vapour management valve is opened . The fuelling correction required to rectify the fuel inbalance caused by the additional fuel vapour is used as an indicator of 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.

The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalysts from permanent damage and to alert the driver to an emission related failure by illuminating the MIL lamp (USA and Canada).

The misfire detection system monitors the crankshaft position sensor to detect abnormalities in crank rotation speed. Acceleration due to each cylinder firing can be calculated and memorised. Any crankshaft acceleration which is significantly less than the recorded value will be detected as a misfire.

When a misfire is detected, the freeze frame function is activated and current data on the operational state of the vehicle is recorded and held in PCM memory. This data can then be accessed by the PDU or scan tool and analysed to find the cause of the misfire.

When a misfire that would cause catalyst damage is detected, the MIL lamp is turned on (USA and Canada) and a diagnostic trouble code (DTC) is logged. If the misfire is the type that will cause an emission failure, the MIL will remain on continuously and a DTC will be stored after two malfunctions on separate drive cycles. DTCs will be erased and the MIL lamp turned off after 40 warm up cycles provided that the fault does not recur. The code may also be cleared by performing a PCM reset.

Secondary Air Injection Monitor

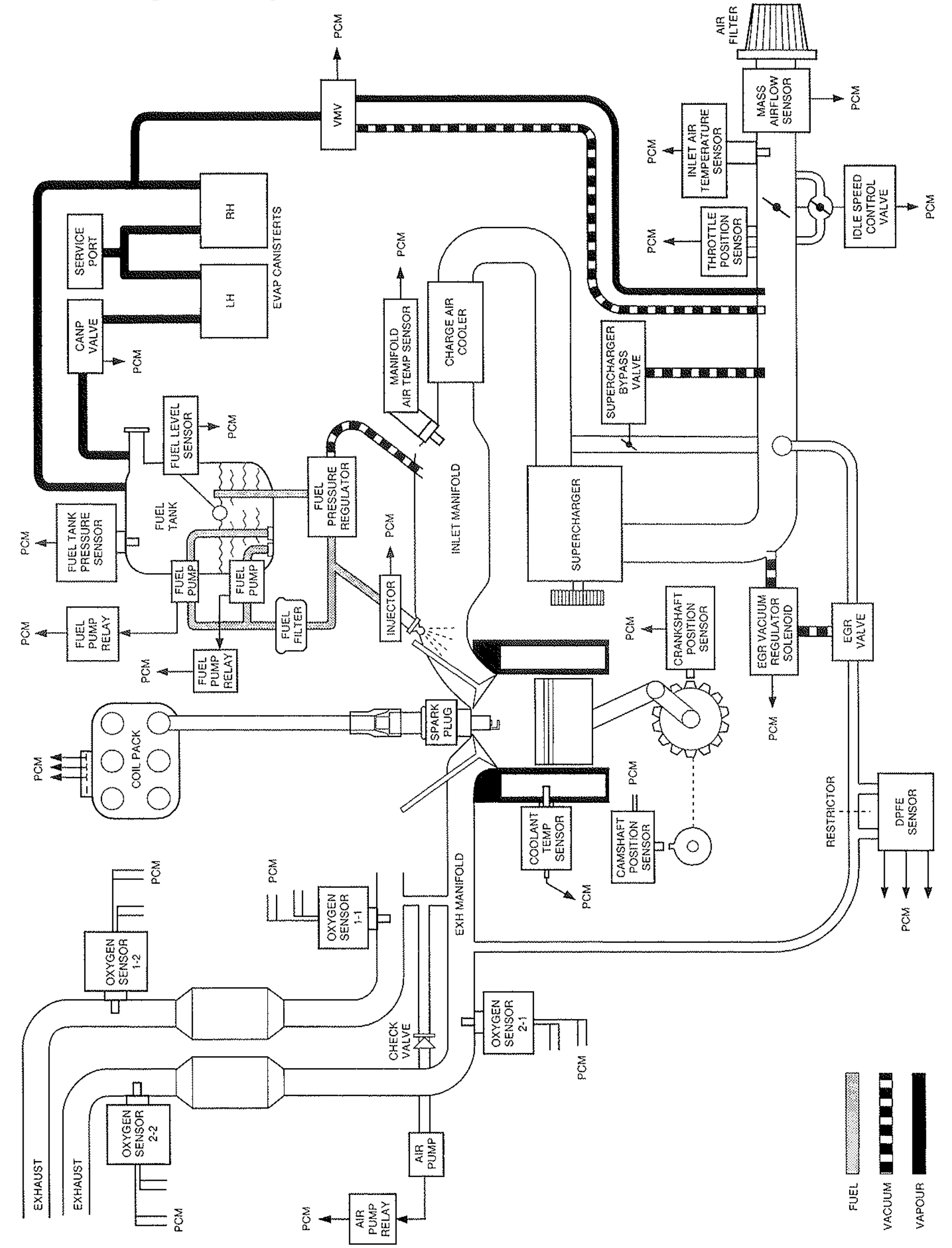
The purpose of the secondary air injection system is to control emissions during the first 20 to 120 seconds after the engine starts. It also provides the additional oxygen required for rapid catalyst warm-up (catalyst light off). Air is forced into the exhaust system to oxidize the additional hydrocarbons and carbon monoxide created by running rich during a cold start. The monitoring of the secondary air injection system will occur only once per drive cycle.

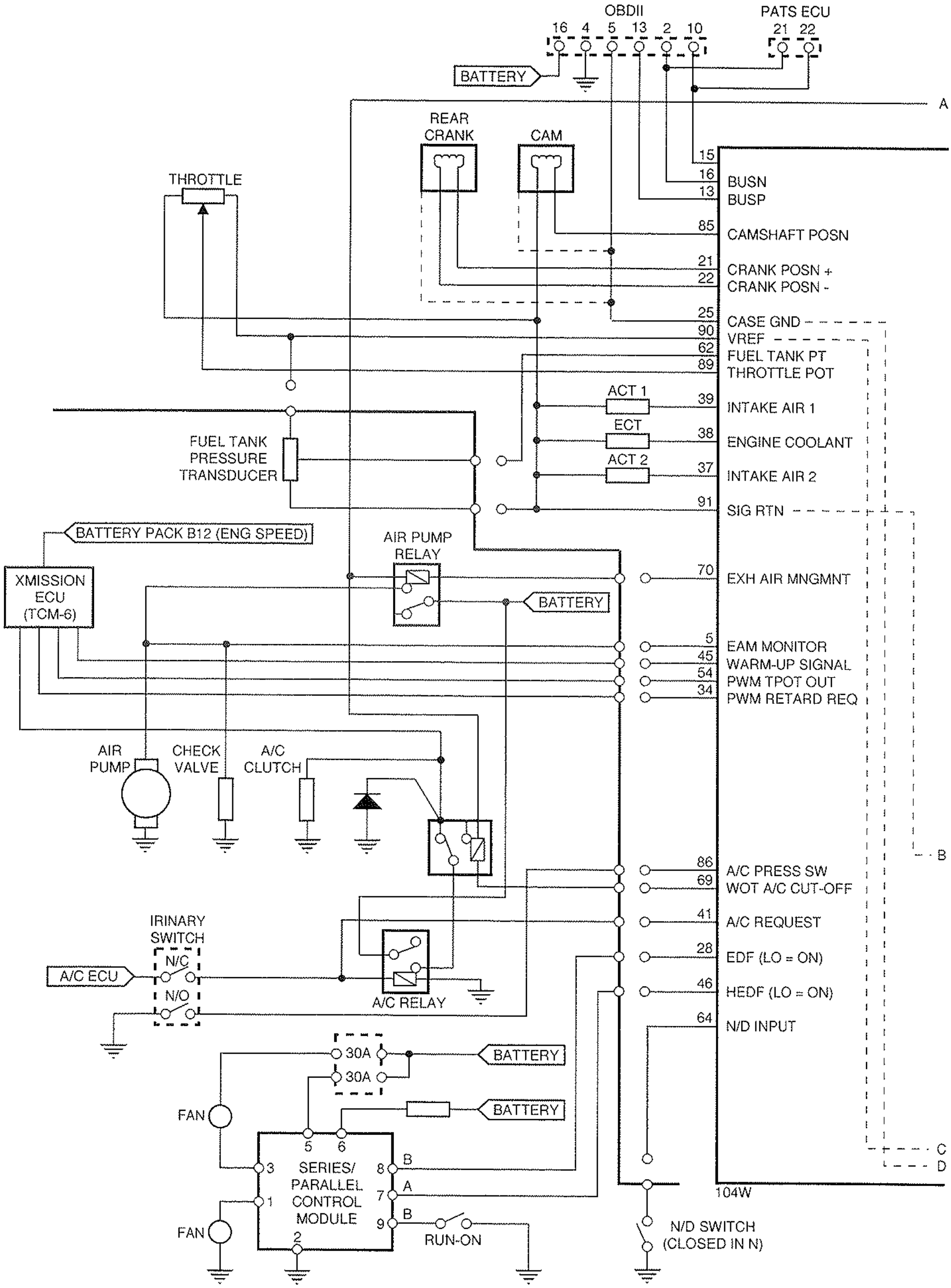
When the engine starts, the PCM signals the air pump relay to energise. The air pump will then provide the additional oxygen required to quickly warm up the catalysts. When the catalyst is up to temperature and the additional air is not required, the PCM signals the relay to switch off the air pump.

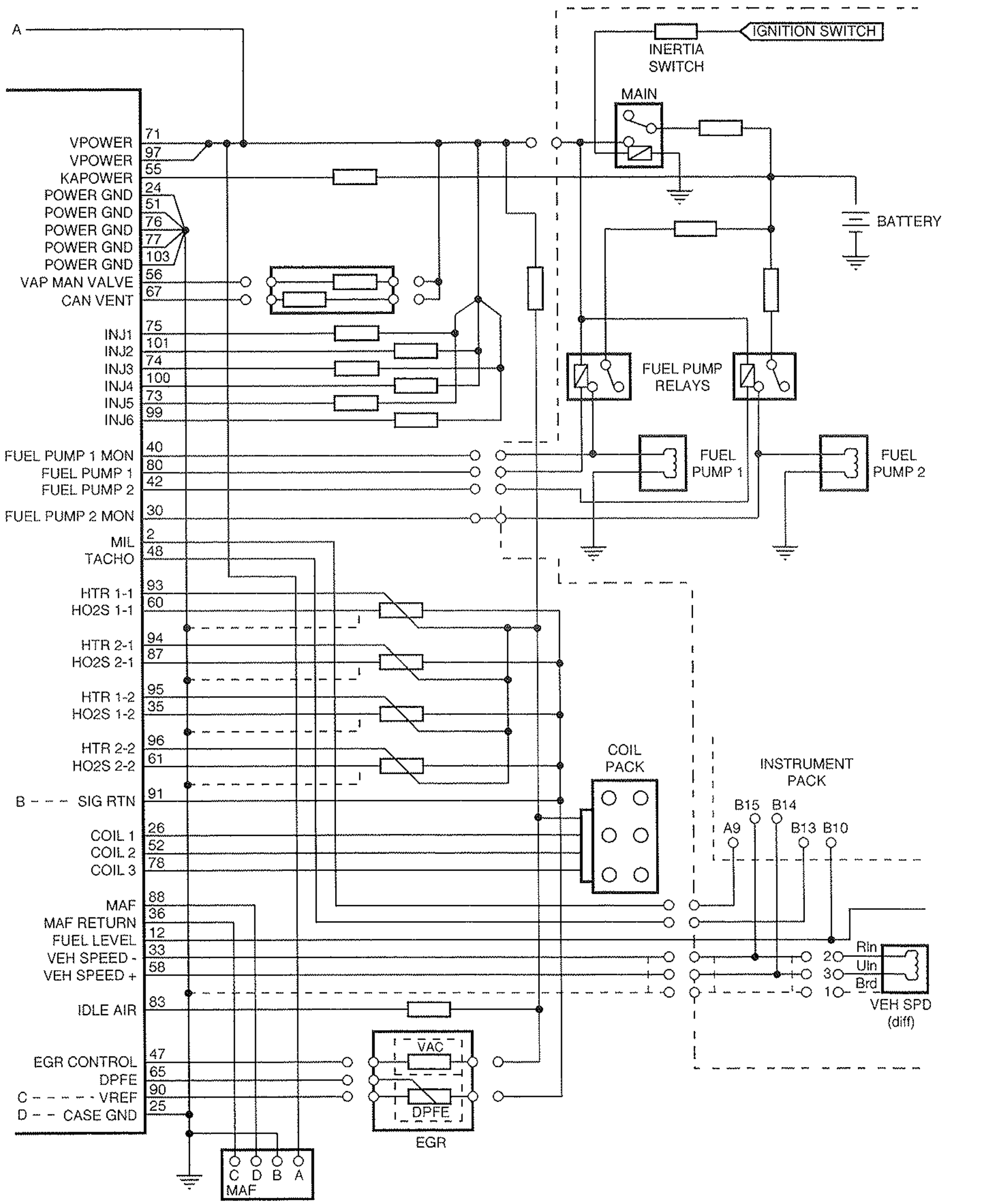
The secondary air injection monitor test switches on the air pump during a warm idle and looks for the upstream oxygen sensors to indicate a lean fuel/air mixture.

In the air system monitor, when a malfunction has been present for two drive cycles, the DTC is stored and the MIL lamp is turned on (USA and Canada). The MIL is turned off after three consecutive drive cycles without the same malfunction being detected provided that no other DTC is stored that 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 lamp is turned off. The code may also be cleared by performing a PCM reset.

The EECV Engine Management System




OBDII
16 4 5 13 2 10
PATS ECU
21 22
BATTERY
A
REAR CRANK
CAM
THROTTLE
15
16 BUSN
13 BUSP
85 CAMSHAFT POSN
21 CRANK POSN +
22 CRANK POSN -
25 CASE GND
90 VREF
62 FUEL TANK PT
89 THROTTLE POT
ACT 1
39 INTAKE AIR 1
ECT
38 ENGINE COOLANT
ACT 2
37 INTAKE AIR 2
91 SIG RTN
FUEL TANK PRESSURE TRANSDUCER
BATTERY PACK B12 (ENG SPEED)
XMISSION ECU (TCM-6)
AIR PUMP RELAY
BATTERY
70 EXH AIR MNGMNT
5 EAM MONITOR
45 WARM-UP SIGNAL
54 PWM TPOT OUT
34 PWM RETARD REQ
AIR PUMP
CHECK VALVE
A/C CLUTCH
B
86 A/C PRESS SW
69 WOT A/C CUT-OFF
41 A/C REQUEST
28 EDF (LO = ON)
46 HEDF (LO = ON)
64 N/D INPUT
IRINARY SWITCH
N/C
N/O
A/C ECU
A/C RELAY
30A
30A
BATTERY
BATTERY
FAN
FAN
5 6
3 SERIES/ PARALLEL CONTROL MODULE
1
2
8 B
7 A
9 B
RUN-ON
C
D
104W
N/D SWITCH (CLOSED IN N)


A
VPOWER 71
VPOWER 97
KAPOWER 55
POWER GND 24
POWER GND 51
POWER GND 76
POWER GND 77
POWER GND 103
VAP MAN VALVE 56
CAN VENT 67
INJ1 75
INJ2 101
INJ3 74
INJ4 100
INJ5 73
INJ6 99
FUEL PUMP 1 MON 40
FUEL PUMP 1 80
FUEL PUMP 2 42
FUEL PUMP 2 MON 30
MIL 2
TACHO 48
HTR 1-1 93
HO2S 1-1 60
HTR 2-1 94
HO2S 2-1 87
HTR 1-2 95
HO2S 1-2 35
HTR 2-2 96
HO2S 2-2 61
B SIG RTN 91
COIL 1 26
COIL 2 52
COIL 3 78
MAF 88
MAF RETURN 36
FUEL LEVEL 12
VEH SPEED - 33
VEH SPEED + 58
IDLE AIR 83
EGR CONTROL 47
DPFE 65
C VREF 90
D CASE GND 25
IGNITION SWITCH
INERTIA SWITCH
MAIN
BATTERY
FUEL PUMP RELAYS
FUEL PUMP 1
FUEL PUMP 2
COIL PACK
INSTRUMENT PACK
B15 B14
A9
B13 B10
Rin
Uin
Brd
2 3 1
VEH SPD (diff)
VAC
DPFE
EGR
C D B A
MAF

The Engine Management System - Description of Components

Powertrain Control Module (PCM)

The engine management system is controlled by the Powertrain Control Module (PCM), which receives signals from the sensors, compares them to the required standards and then modifies 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 in the left footwell, behind a carpetted cover.

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 ECM.

The Air Temperature Sensors (IAT)

The Inlet Air Temperature Sensor (IAT), measures the temperature of the air entering the throttle body. The Manifold Air Temperature Sensor measures air temperature after the intercooler so that the engine management system can compensate for air density changes through the supercharger and intercooler.

The Idle Speed Control Valve (ICA)

The Idle Speed Control Valve (ISCO), responding to ECM output signals and in conjunction with ignition timing control, governs engine idle speed.

The Engine Coolant Temperature Sensor (ECT)

The Engine Coolant Temperature Sensor (ECT), monitors the engine operating temperature and reports to the PCM.

The Fuel Pumps

The Fuel Pumps, situated in the fuel tank, supply fuel to the Fuel Rail. The Fuel Pressure Regulator, in the Fuel Rail, controls the fuel pressure at the Fuel Injectors.

Fuel Injectors

The six Injector solenoids are operated by the PCM in sequence to inject fuel into the area behind each inlet valve, when commanded by the PCM. 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 Coil Pack

Ignition is by Spark Plugs supplied with HT voltage from the Ignition Coil Pack, the timing of ignition is varied by the PCM according to speed and load.

Catalytic Convertor
Heated Oxygen Sensors (H02S)

The combustion gases, after passing through the exhaust manifold, enter the Catalytic Convertor, where the quality of the exhaust gas emission is modified. The quality of the exhaust gas emission is constantly checked by the Upstream Heated Oxygen Sensors (H02S 1-1 and 2-1), which are situated at the entrance of the catalysts. The catalyst efficiency is checked by comparing the signal outputs of pre and post catalyst heated oxygen sensors. Using the oxygen sensor signals, 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 Sensor (TP), which reports to the PCM.

The Supercharger Bypass Valve

This vacuum operated valve allows inlet air to bypass the supercharger when the engine is idling or when the throttle opening is small. It also opens the bypass line when the throttle is closed at high engine speed to avoid excessive pressure differences across the supercharger.

The Exhaust Gas Recirculation Valve (EGR)
The vacuum operated Exhaust Gas Recirculation Valve (EGR), when activated by the PCM and EGR Vacuum Regulator, allows exhaust gas to enter the intake air stream to dilute the oxygen content of the combustible fuel / air mixture, so lowering combustion temperatures and consequently NOx emissions.

Differential Pressure Feedback Sensor (DPFE)
The Differential Pressure Feedback Sensor (DPFE) is placed across a restrictor in the EGR line. By measuring the pressure difference across the restrictor, variations in exhaust gas pressure can be detected by the PCM. The setting of the EGR Valve can then be 'fine tuned' to give a more accurate mix of exhaust gas in the inlet manifold.

Crankshaft Position Sensor (CKP)
Camshaft Position Sensor (CMP)

Engine speed is measured from the pulse timing of the Crankshaft Position Sensor (CKP). The CKP signal is also used by the PCM to note the acceleration in crankshaft speed as each cylinder fires. Any particularly low acceleration is logged as a misfire.

Engine position is determined by using the Camshaft Position Sensor (CMP) signal.

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

The Secondary Air Injection Pump (AIR)
Mechanical Check Valve

At cold engine start, the Secondary Air Injection Pump (AIR), on command from the PCM, via a relay, provides additional air to reduce the level of Carbon Monoxide (CO) and Hydrocarbons (HC), in the exhaust gases. The additional air accelerates the rise in catalyst temperature to rapidly reach operating temperature level. When the relay energises the pump in the AIR system, it also energises the solenoid controlling the Integral Stop Valve, opening the air line, through the Mechanical Check Valve, to the exhaust manifold.

The Fuel Tank
Evaporative Emission Canisters

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 Canisters. The carbon elements in the cannisters absorb 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 in higher temperatures, pressure is relieved by allowing the displaced air to vent through the canisters which retain the suspended fuel vapour.

The Purge Valve
The Purge Valve opens when the ignition is turned on to enable air flow in the purge lines.

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

Diagnostic Equipment

The Aston Martin Portable Diagnostic Unit (PDU) is the principal diagnostic tool used by Aston Martin franchised dealers. Non-franchised dealers will require the AML PDU or a compatible scan tool. The Portable Diagnostic Unit installation and use is described in section 9 of the Workshop Manual.

The diagnostic tool connects to diagnostic sockets mounted under the passenger side knee bolster.

The Vehicle Identification Number and the Emissions Label may be found on a plate on the right front inner wing (see diagram below).

Accessing the PCM using a Generic Scan Tool

Input Tests and Logged Data

Connect the scan tool and establish communications with the PCM following the manufacturers instructions. Continue to follow the manufacturers instructions to access input signal values and any data logged in the PCM memory. The Parameter Identification (PID) list on the following pages gives the PID address for each signal.

A string of characters must be entered into the generic scan tool to perform output tests. The generic keystroke entry for this specific function is provided below. Also refer to the scan tool manufacturers instructions for additional information.

Generic Keystrokes for Output Test Mode

Output test mode has four separate forms to enter:

- All outputs on (except cooling fans)
- All outputs off
- Low speed cooling fans on/off
- High speed cooling fans on/off

Refer to the scan tool manufacturers manual for specific information on which cables to use or how to manually enter character strings for the following examples.

- Perform the necessary safety precautions and visual inspection.
- Turn the ignition key to the On position.
- Verify that the tool is connected and communicating properly by entering the OBD II system readiness test.
- Enter the strings separately and in the order shown.

Output Test Mode:

All Outputs On:

- 02, 20, 20, C4 10 25,,9E 00 A1 91 00 03, 16
- 03, 22, 20, C4 10 31 84,,9E 00 A1 91 00 04, AA
- 04, 2A, 20, C4 10 B1 00 25 02,,9E 00 41 4C 4C 20 4F 4E, 36

All Outputs Off

- 05, 28, 20, C4 10 32 84,,9E 00 41 4C 4C 20 4F 46 46, 51

Low Speed Fans On

- 02, 20, 20, C4 10 25,,9E 00 A1 91 00 03, 16
- 03, 22, 20, C4 10 31 84,,9E 00 A1 91 00 04, AA
- 04, 2A, 20, C4 10 B1 00 25 03,,9E 00 4C 46 43 20 4F 4E, 33

Low Speed Fans Off

- 05, 28, 20, C4 10 32 84,,9E 00 41 4C 4C 20 4F 46 46, 51

High Speed Fans On

- 02, 20, 20, C4 10 25,,9E 00 A1 91 00 03, 16
- 03, 22, 20, C4 10 31 84,,9E 00 A1 91 00 04, AA
- 04, 2A, 20, C4 10 B1 00 25 04,,9E 00 48 46 43 20 4F 4E, 2F

High Speed Fans Off

- 05, 28, 20, C4 10 32 84, 9E 00 41 4C 4C 20 4F 46 46, 51

Normally On Outputs Off

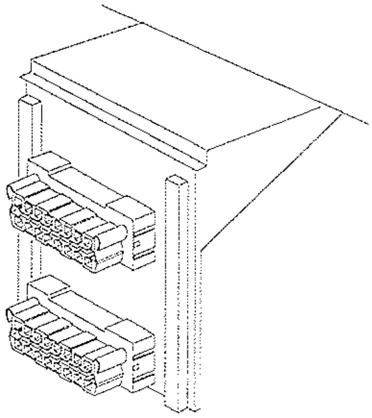
- 02, 20, 20, C4 10 25,,9E 00 A1 91 00 03, 16
- 03, 22, 20, C4 10 31 84,,9E 00 A1 91 00 04, AA
- 04, 2A, 20, C4 10 B1 00 25 01,,9E 00 4F 2F 50 20 4F 46 46 , 6C

Return to Normal State

- 05, 28, 20, C4 10 32 84,,9E 00 41 4C 4C 20 4F 46 46, 51

Diagnostic Socket Location and Use

The two diagnostic sockets are located behind the passenger side underscuttle trim panel. The sockets are mounted on a bracket and labelled Upper and Lower. The following systems are accessed from each socket:



Upper Socket

Transmission Control Module (TCM)
Security System
Air Bag System
Anti-Lock Braking System

Lower Socket

Powertrain Control Module (PCM)
Passive Anti-Theft System
Seat Belt Pretensioner System

The connections to each socket are shown on the lists below:

Upper (Transmission) Socket - ISO 9141

Pin	Function	Use on DB7
1	Ignition Relay Activation	
2	J1850 Bus+ (Ford SCP)	
3	Airbag Serial Data Burst	Air Bag Data Pin 4
4	Chassis Ground	
5	Signal Ground	Air Bag Ground
6	Class 'C' Link (Bus+)	
7	K Line : ISO9141	TCM Pin 45, ABS Pin 28, Security ECU
8	S/W Link Controlled Trigger In	
9	Battery Power (Switched)	
10	J1850 Bus- (Ford SCP)	
11	Not Assigned	
12	2nd. Flash EPROM Prog. Signal	
13	1st. Flash EPROM Prog. Signal	
14	Class 'C' Link (Bus-)	
15	L Line : ISO9141	TCM Pin 16
16	Battery Power (Unswitched)	Battery Voltage

Lower (Engine) Socket - Ford SCP

Pin	Function	Use on DB7
1	Ignition Relay Activation	
2	J1850 Bus+ (Ford SCP)	PCM Pin 16 and PATS Controller Pin 21
3	Seat Belt Pretensioner (Autoliv)	Seat Belt Pretensioner
4	Chassis Ground	
5	Signal Ground	PCM Pins 24, 51, 76, 77 and 103
6	Class 'C' Link (Bus+)	
7	K Line : ISO9141	
8	S/W Link Controlled Trigger In	
9	Battery Power (Switched)	
10	J1850 Bus- (Ford SCP)	PCM Pin 15 and PATS Controller Pin 22
11	Not Assigned	
12	2nd. Flash EPROM Prog. Signal	
13	1st. Flash EPROM Prog. Signal	
14	Class 'C' Link (Bus-)	
15	L Line : ISO9141	
16	Battery Power (Unswitched)	Battery Voltage