FOREWORD

This article will hopefully impart some of the knowledge and facts learnt during the past year by ourselves whilst using the Vehicle Explorer software. In addition it is hoped that it will explain in simplistic terms what the OBD2 standard is about, and the implications of the standard to the after market mechanic or hobbyist. It is in no way a definitive article and we continue to learn something new every week, if not everyday!

To assist in the explanation reference will be made to the Vehicle Explorer program and accompanying screen shots. By systematically going through the program it is hoped that the 'mystery' of OBD2 will be no more.

What are On-Board Diagnostic (OBD) systems?

On-Board Diagnostic (OBD) systems are self-diagnostic systems incorporated into the electronic modules that are commonly found in modern vehicles. Their concept is not actually new, the current OBD2 standard has its origins in 1989. The OBD2 system monitors virtually every component that can affect the emissions of the vehicle and ensures that the vehicle remains as 'clean' as possible over its entire life. The system is futher enhanced by the fact that it provides the means by which these electronic modules can be accessed my persons carrying out diagnostic work when diagnosing and/or fixing problems. The OBD2 system is designed to illuminate a warning lamp (Malfunction Indicator Lamp - **MIL**) on the vehicle instrument panel should a problem arise. Its purpose is to alert the driver to the problem. At the same time the OBD2 system stores relevant important information, in the form of Diagnostic Trouble Codes and Freeze frames, which relate to the detected malfunction.

So how does this relate to the Vehicle Explorer program?

To answer this requires an explanation of the requirements of the OBD2 standard and how this fits into the framework of the Vehicle Explorer Program itself.

Basic overview of the Vehicle Explorer Scan tool

The Vehicle Explorer software is a PC based Scan tool and is one of many possible tools one would first turn to when diagnosing a problem that has illuminated the dash warning light, particularly the MIL, on an OBD2 compliant vehicle. Such scan tools are the easiest, quickest and perhaps only way to directly access Diagnostic Trouble Codes in modern vehicles. It is also the easiest way to erase Diagnostic Trouble Codes that have been stored.

When logged onto the vehicle in question it also allows the user to monitor the system's inputs and outputs. If the software is loaded onto a portable platform, such as a laptop,

this monitored data can be viewed not only in the service bay area of a garage, but also whilst the vehicle is being driven. It is further enhanced by having a built in data logger facility which captures all the data during a test cycle. This data can be played back at a later time in an effort to identify any potential problems or issues arising from the vehicles use and operating conditions. Additionally 'trigger' points can be set within the program that allow it to capture data prior to, on the occurrence of, or after a specific event.

The biggest 'disadvantage' of such OBD2 scan tools, that's if you can call it such, is that it will only display [a] what the electronic control module is 'seeing' & [b] what the electronic module is programmed to do in the way of in-built diagnostic routines etc. What I'm trying to say here is that if the electronic module is programmed such that it does not 'see a problem', then the scan tool will not show there to be one. The program is only as good as the person operating it and it is beneficial to have a working knowledge of the vehicle to which the electronic modules are fitted. It should not be seen as a means to an end in that it will fix the vehicle in question for you. It must be seen as a tool and nothing more. The biggest advantage is that it can direct you in the right direction when carrying out diagnostics.

OBD2 – What is it?

The OBD2 standard has its origins in the United States going back to 1989 when it was decided that vehicles of the future would have a common, or generic, on-board diagnostics system incorporated within the various electronic modules. This came about due to one of the requirements that vehicles should be subject to a regular basic, or enhanced, inspection or maintenance program. Part of such programs was the performance of Onboard Diagnostic (OBD) system checks as part of this required, periodic inspection. This was to ensure that the vehicle in question was running clean and not causing excessive pollution out with the excepted requirements.

It came into 'force' in 1994 but due to a degree of initial resistance from motoring manufacturers, and their right to waiver its initial implementation; it did not become 'THE' standard until 1996. Hence references to OBD2 are generally seen to relate to post 1996 model vehicles.

After 1996 a 'trial' period was begun to validate the accuracy of the OBD2 requirements because at the time of its implementation it was not practical to evaluate the real-world, in-use performance of OBD because the vehicles in question were still too new and the number of those vehicles in need of repair were too few. Its full implementation was delayed until no later than January 1, 2001.

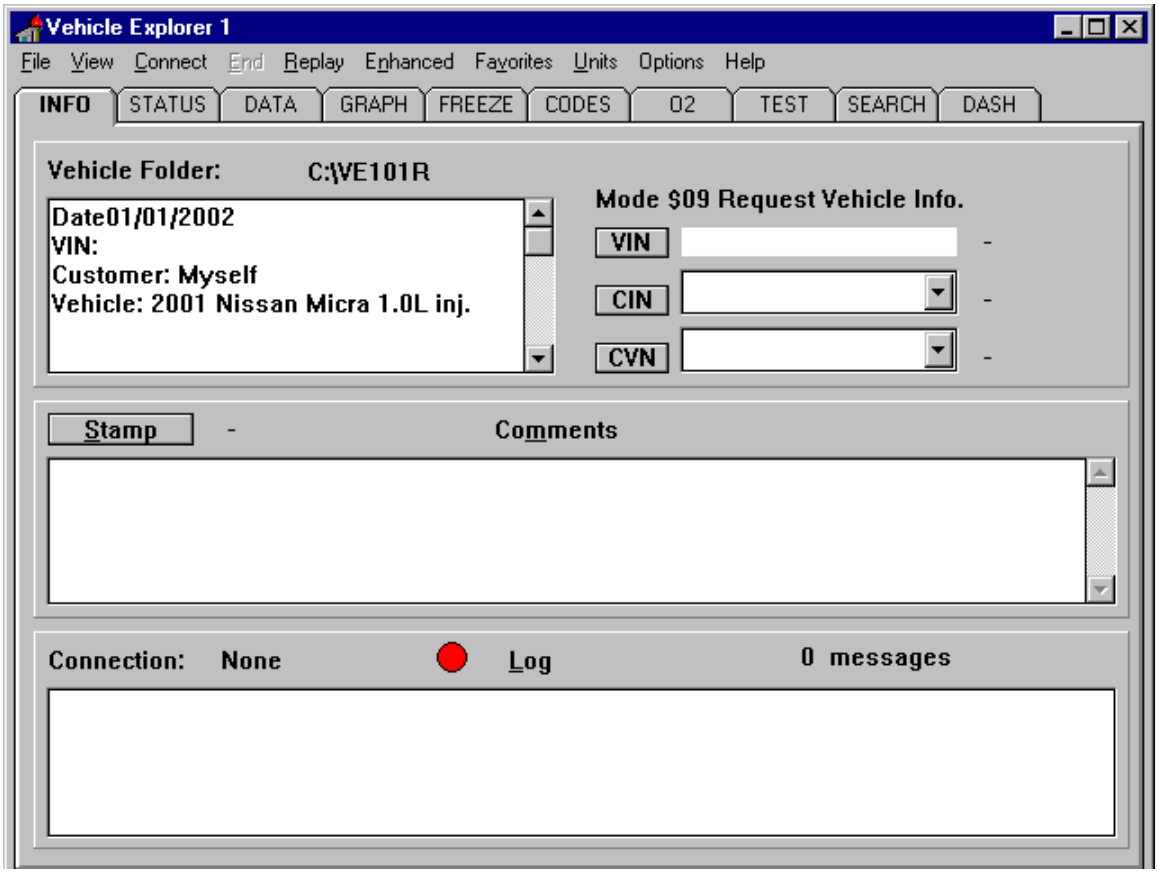
Basically the inspection consists of two types of examination: A visual check of the dashboard display function and status (also known as the MIL and/or bulb check) and an electronic examination, by means of a scan tool, of the OBD computer itself.

Additionally, the requirements were changed such that a vehicle would fail this test where it was found that there was any DTC's present that resulted in the "Check Engine" MIL being commanded on.

Vehicle Explorer program & OBD2

So lets move on to the program itself and see how it relates to the requirements laid down by the OBD2 standard.

If we run the program then this is the first screen to appear

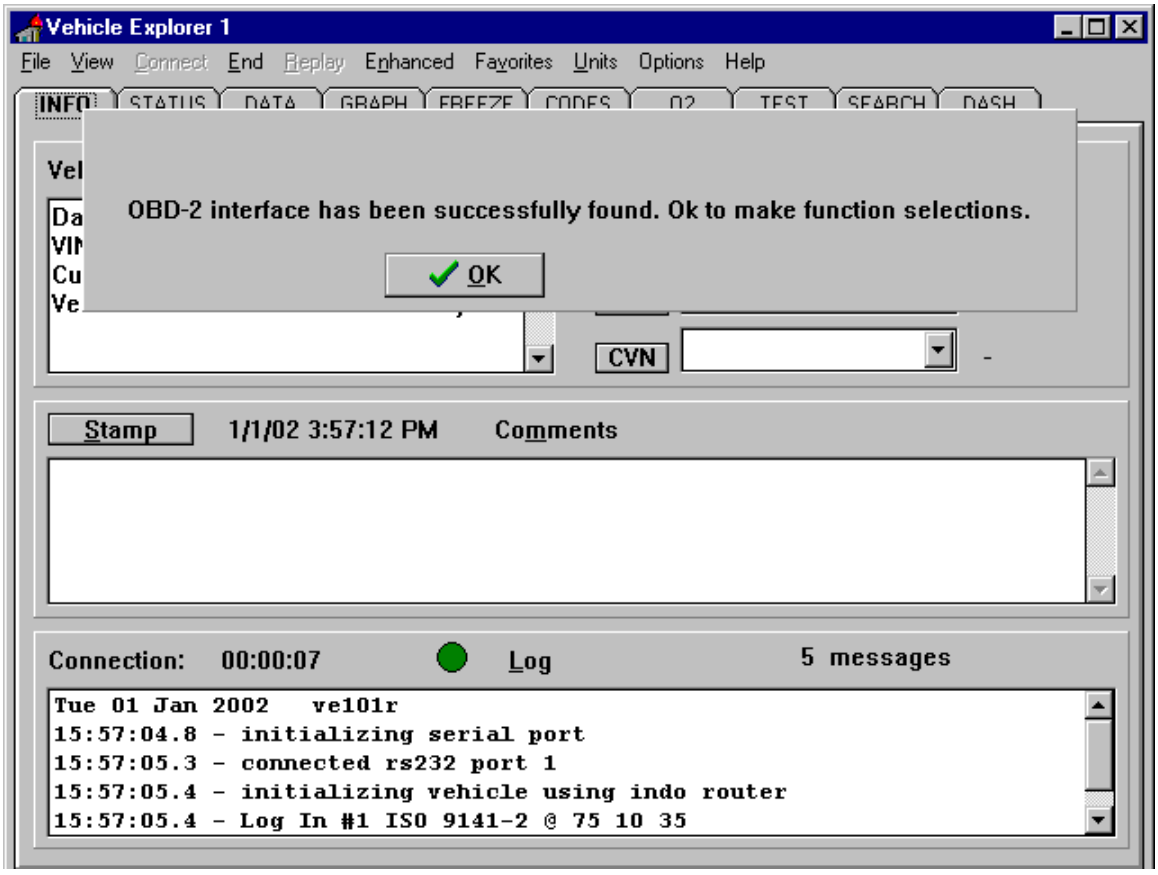


I have completed the Vehicle Folder data so that this can be stored at a later time along with the data files from the diagnostic session.

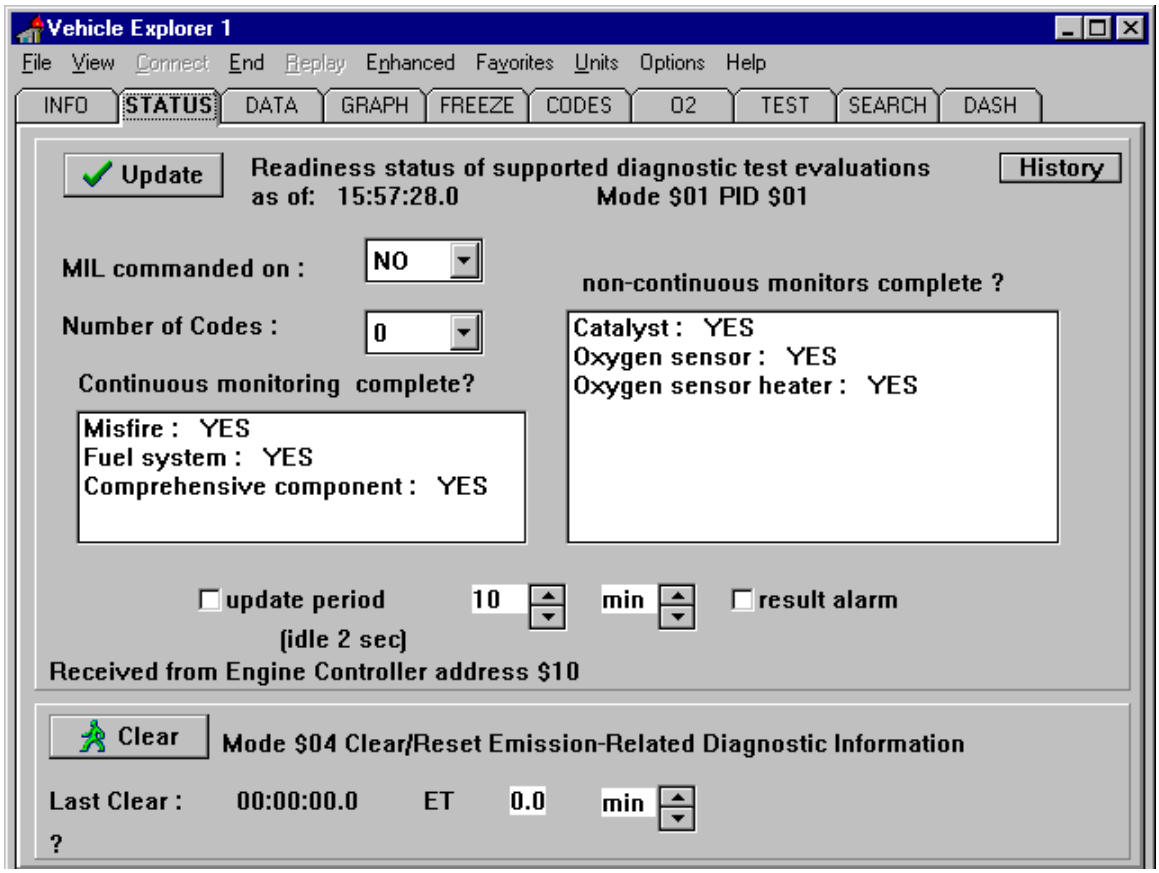
If you look to the right of the vehicle folder window you will see that reference is made to **MODE $09.** This Mode is the **Request Vehicle Information** and provides for Vehicle Identification Number(VIN), Calibration Identification Number(CIN), and Calibration Verification Number(CVN). The calibration numbers and verification are used for anti-tampering of vehicle emission software code. Some cars year 2000+ will support the mode 09 address request, and all cars in 2002. Verification can take several

seconds depending on vehicle server encryption used and if engine is running. For GM vehicles selecting enhanced mode in menu can be used to read and write the VIN to the selected server address number. A listing of server domain names can be found in menu-options-gateways-filters. Changing VIN can be helpful when installing or replacing equipment on the network.

At this time I connect to the vehicle by clicking on the CONNECT tab in the menu options to the top of the screen window. A few seconds later this splash screen appears confirming that the program has successfully found and OBD-2 interface to the vehicle.



To begin investigating the features of the vehicle I click on the OK button, then select the STATUS screen from the VE program. This screen shot is of the STATUS page of the VE program. If you read the first line of bold text to the top of the page you will see the words '**Mode $01'.**

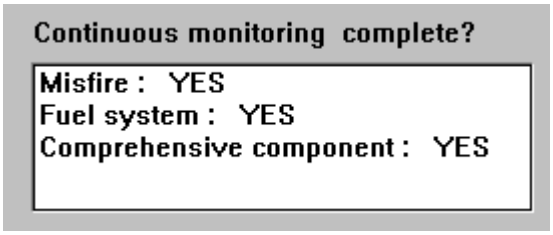


The OBD2 standard lays down in its criteria a number of MODES. As we go through the VE program screen shots each of these modes will be explained.

In this case the **MODE $01** reports if the Malfunction Indicator (check engine) Light (MIL) is turned on, the number of Diagnostic Trouble Codes and the completion of vehicle component testing. The listed parts and systems can be either continuously or non-continuously (only during specific vehicle operation) monitored to finalize a test grade. The monitoring of a test can take from 1 ms to several days depending on the test and you're driving. To pass an inspection the MIL must be off and for most cars all monitoring of tests completed and ready to determine MIL status and trouble codes.

So let's have a look at the screen. We can see in this example that the MIL commanded on is set to the NO state. You can see in the middle of the screen two distinctive windows. One is labeled '***Continuous monitoring complete?***' whilst the other is labeled '***Non-continuous monitoring complete***?' and both are self explanatory in themselves. Within each of the boxes is displayed those area's that form part of the monitored tests. So let's have a look at each one.

Firstly the ‘Continuous Monitored’ box.



With this vehicle there are three areas which are subject to Continuous monitoring. So let’s look at what each relates to.

[1] **MISFIRE** monitoring.

The diagnostic system is required to monitor engine misfire and where a misfire occurs, identify the specific cylinder experiencing the misfire. If more than one cylinder is misfiring, a separate DTC shall indicate that multiple cylinders are misfiring. The reason this was included as a continuous monitor feature is that through exhaustive testing it was found that misfire conditions caused the omission levels to rise drastically. In addition there was also the potential that terminal damage could be caused to the catalyst converter.

Upon detection of a misfire, which falls within the criteria during a single drive cycle, a DTC code is stored in fault memory and the MIL light is commanded to blink once per second during the actual misfire condition. At the same time the diagnostic test routine is required to store the engine speed, load, and warm-up status (i.e., cold or warmed-up) under which the first misfire event which resulted in the storage of a temporary fault code was detected (this is known as a **FREEZE FRAME** and will be explained later on). If during a subsequent drive cycle the misfire condition is still present, the MIL is commanded to remain permanently illuminated.

[2] **FUEL SYSTEM** monitoring

The diagnostic system monitors the fuel delivery system for its ability to provide compliance with emission standards. The criteria used to monitor the system are the long and short term fuel trim adjustments. During running conditions the engine management system continually adjusts the short and long term fuel trim values so as to ensure sufficient fuel is delivered to the engine to allow it to produce the required power whilst at the same time keeping the emission levels low. Under a fault condition the amount of short or long fuel trim period exceeds a predefined value whereupon the diagnostic system determines there is a malfunction. The MIL is commanded to illuminate continuously and a DTC is stored in the fault memory. Upon detection of a fuel system malfunction, the diagnostic system is required to store the engine speed, load and warm-up status (i.e., cold or warmed-up) under which the
malfunction was detected.

[3] **COMPREHENSIVE COMPONENT** monitoring

The diagnostic system monitors all of the components such as coolant temperature sensor, vehicle speed sensor etc for any malfunction of such an electronic module component or system not otherwise continuously monitored in its own right which provides an input to (directly or indirectly), or receives commands from the on-board computer, and which can affect emissions during a drive cycle, or is used as part of the diagnostic strategy for any other monitored system or component.

The components fall into two categories, those that are INPUT, and those which are OUTPUT.

Input Components may include, but are not limited to,

- the vehicle speed sensor
- crank angle sensor
- knock sensor
- throttle position sensor
- coolant temperature sensor
- cam position sensor
- fuel composition sensor
- transmission electronic components such as sensors, modules, and solenoids which provide signals to the power train control system

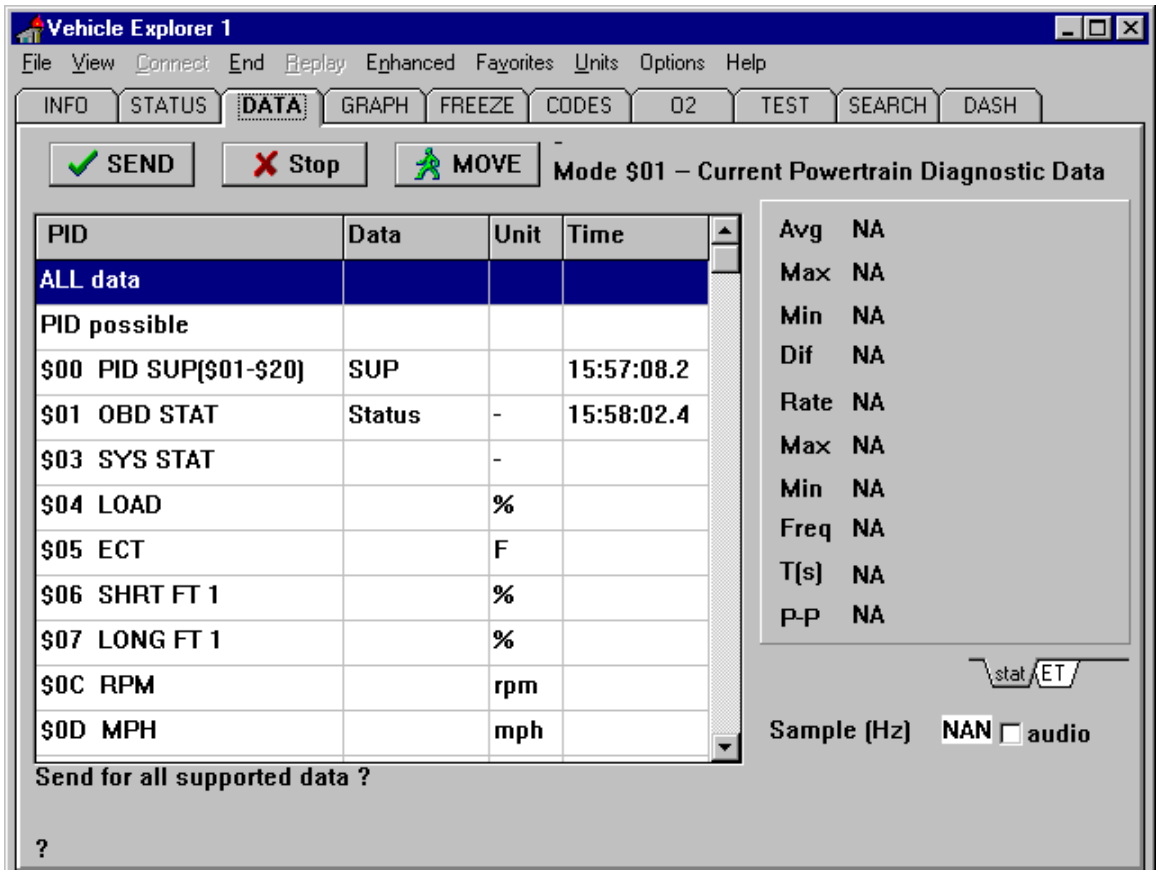
Output Components may include, but are not limited to,

- the automatic idle speed motor
- emission-related electronic only transmission controls
- heated fuel preparation systems
- the wait-to-start lamp on diesel applications
- warm-up catalyst bypass valve.

The diagnostic system monitors the input and output components for proper functional response and it considers them to be malfunctioning when, at a minimum, a lack of circuit continuity or manufacturer-specified out-of-range values occurs.

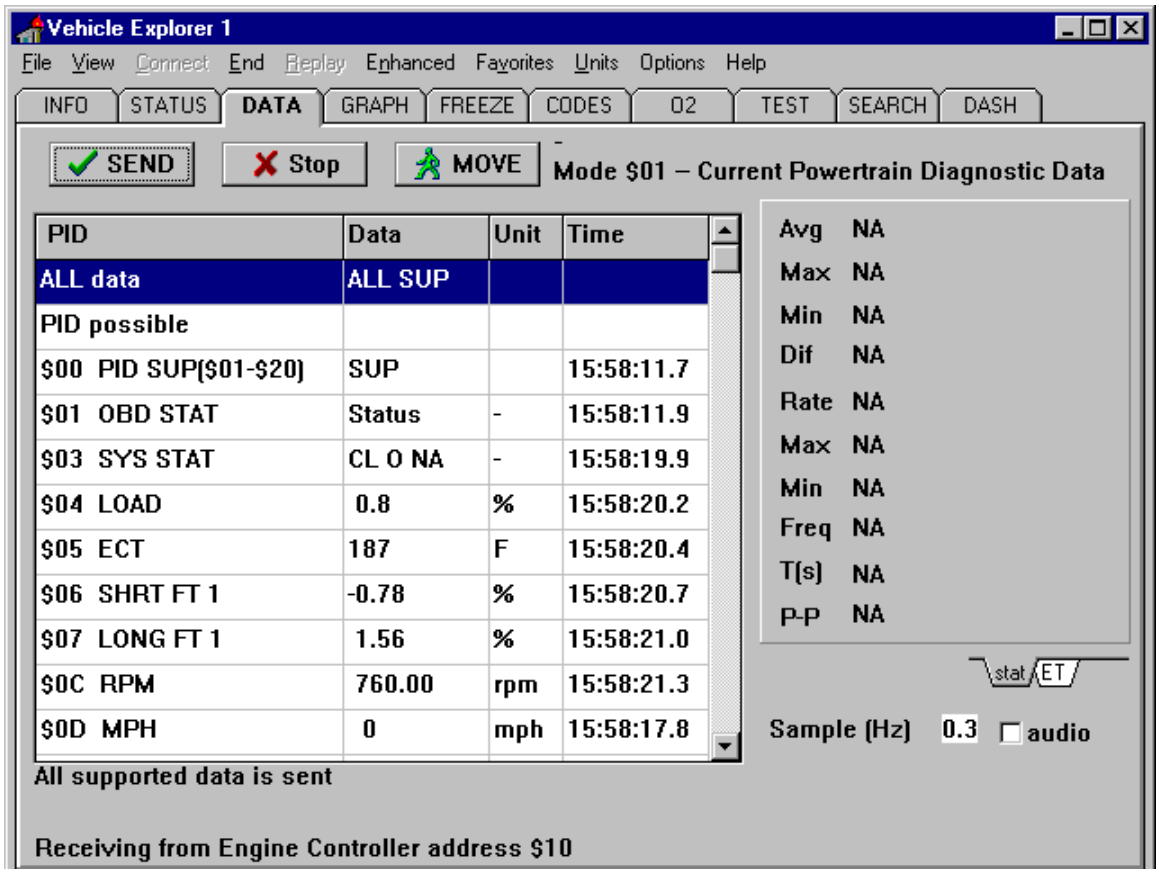
Upon detecting such a malfunction, the diagnostic system stores a fault code and where the malfunctioning component or system could cause vehicle emissions to increase, or the component/system is used as part of the diagnostic strategy for any other monitored system or component, the MIL is continuously illuminated.

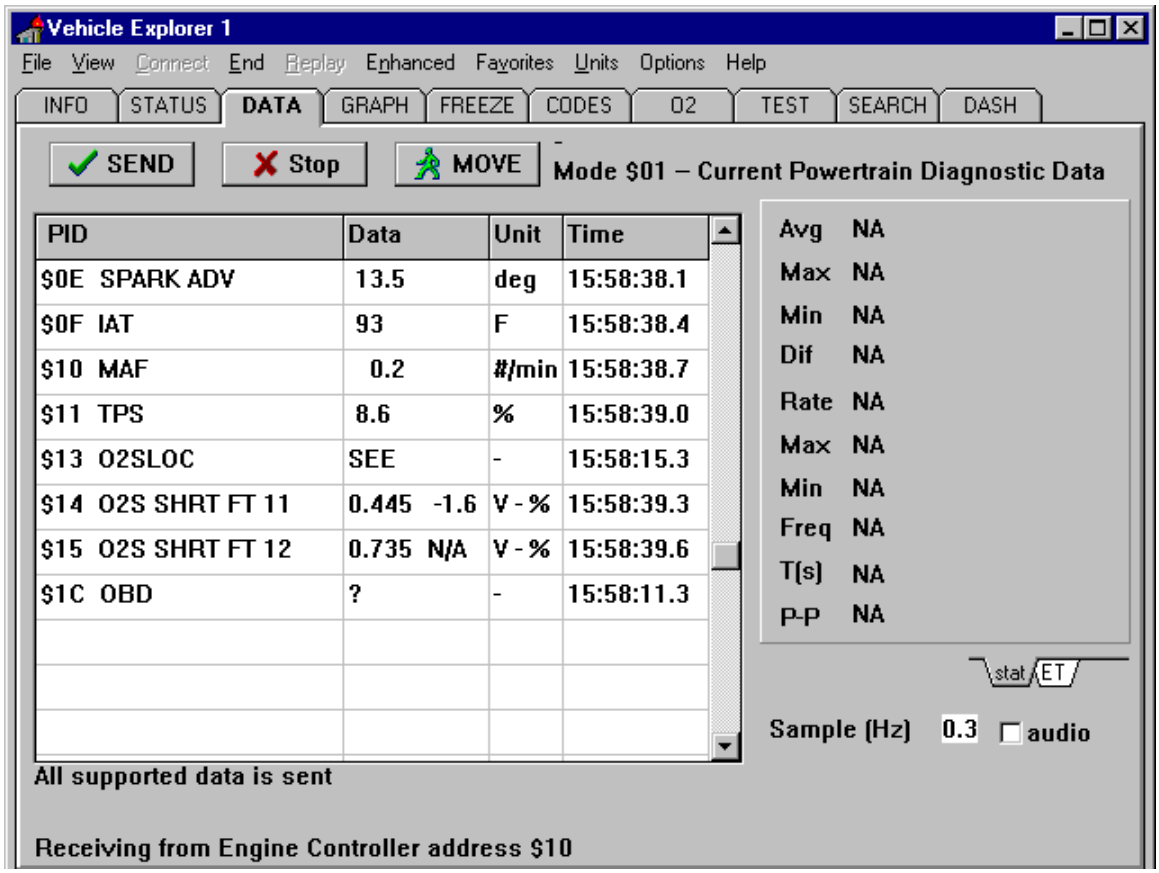
The data for the Comprehensive Component monitoring is presented on the DATA screen of the VE program. Opening up the screen you are presented with this



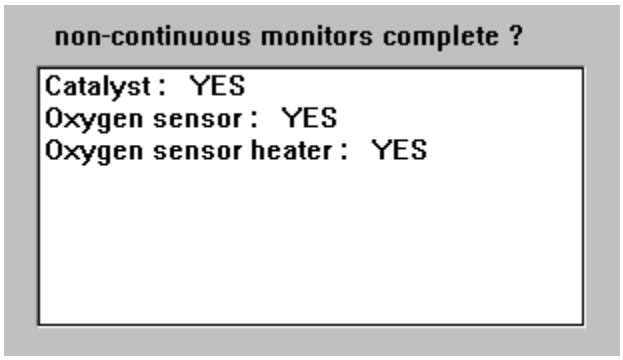
This is Mode 01 for continuous real time data. You can make a request to send all data sequentially or any combination of individual content, by selecting(highlighting) a item and pressing send. A listing of supported vehicle data to view can be found by requesting PID 00. You can also view all 255 mode 01 allocated data names, that could have vehicle support. A full description is shown for the current selected item, below the data grid. All data is time-stamped and stored. The frequency meter indicates the data acquisition speed in Hz (data points per second).

To view the data you click on the SEND button and the ECU is requested to return all monitored data that is supported by the vehicle. In the case of this vehicle the following data is returned


Vehicle Explorer 1
File View Connect End Replay Enhanced Favorites Units Options Help
INFO STATUS DATA GRAPH FREEZE CODES O2 TEST SEARCH DASH
SEND
Stop
MOVE
Mode $01 – Current Powertrain Diagnostic Data
PID Data Unit Time
ALL data ALL SUP
PID possible
$00 PID SUP($01-$20) SUP 15:58:11.7
$01 OBD STAT Status - 15:58:11.9
$03 SYS STAT CL O NA - 15:58:19.9
$04 LOAD 0.8 % 15:58:20.2
$05 ECT 187 F 15:58:20.4
$06 SHRT FT 1 -0.78 % 15:58:20.7
$07 LONG FT 1 1.56 % 15:58:21.0
$0C RPM 760.00 rpm 15:58:21.3
$0D MPH 0 mph 15:58:17.8
Avg NA
Max NA
Min NA
Dif NA
Rate NA
Max NA
Min NA
Freq NA
T(s) NA
P-P NA
stat ET
Sample (Hz) 0.3 audio
All supported data is sent
Receiving from Engine Controller address $10



Let's now look at the 'Non-continuously monitored' box



This vehicle shows there are three tests that can be monitored. You will see that after each test is the word YES. What this is telling me is that the vehicle has successfully completed several drive cycles during which time these tests have been carried out and/or monitored. If they had failed the tests then they would display NO instead of a YES. In this scenario they would have generated a fault code which would be stored in the fault memory. So let's look at each of these tests

[1] **CATALYST** monitoring

The diagnostic system monitors the catalyst system for proper performance. It considers the catalyst system to be malfunctioning when its conversion capability decreases to the point that Hydrocarbon (HC) emissions exceed the applicable emission threshold specified for that vehicle.

If catalyst efficiency remains below a predetermined percentage for three sequential checks, a fault code is generated and stored, whilst the MIL is commanded to continuously illuminate.

[2] **OXYGEN SENSOR** monitoring

The diagnostic system monitors the output voltage, response rate, and any other parameter which can affect emissions, of all primary oxygen sensors for malfunction. It also monitors all secondary oxygen sensors for proper output voltage and/or response rate.

Upon detection of a system malfunction the diagnostic system stores a fault code and the MIL is commanded to continuously illuminate.

[3] **OXYGEN SENSOR HEATER** monitoring

For heated oxygen sensors, the heater circuit is considered malfunctioning when the current or voltage drop in the circuit is no longer within the manufacturers specified limits for normal operation..

Upon detection of a system malfunction the diagnostic system stores a fault code and the MIL is commanded to continuously illuminate.

On some vehicles there are other tests which may be monitored. These could include the following:-

[1] **EVAPORATIVE SYSTEM** monitoring

The diagnostic system verifies the air flow from the complete evaporative system and also monitors the evaporative system for the loss of HC vapour into the atmosphere by performing a pressure or vacuum check of the complete evaporative system. The evaporative system is considered to be malfunctioning when no air flow from the system can be detected, or when a system leak is detected.

Upon detection of a system malfunction the diagnostic system stores a fault code

and the MIL is commanded to continuously illuminate.

[2] **SECONDARY AIR SYSTEM** monitoring

The diagnostic system on any vehicle equipped with any form of secondary air delivery system, monitors the proper functioning of the secondary air delivery system and any air switching valve. In the event of a malfunction the diagnostic system shall store a fault code and the MIL is commanded to continuously illuminate.

[3] **AIR CONDITIONING SYSTEM REFRIGERANT** monitoring

The diagnostic system monitors air conditioning systems for any loss of refrigerants which could harm the stratospheric ozone layer or are reactive in forming atmospheric ozone. Any sensor which is used for such monitoring shall itself be monitored for proper circuit continuity and proper range of operation. A provision for ensuring that a leak has been corrected before extinguishing the MIL shall be provided. In the event of a malfunction the diagnostic system shall store a fault code and the MIL is commanded to continuously illuminate.

A further requirement was that the diagnostic system does not clear the fault code and turn the MIL off unless the leak has been corrected.

[4] **EXHAUST GAS RECIRCULATION (EGR) SYSTEM** monitoring

The the diagnostic system monitors the EGR system on vehicles so-equipped for low and high flow rate malfunctions. The EGR system is considered to be malfunctioning when either any component of the system fails to perform within the manufacturer specifications, or the EGR flow rate exceeds the manufacturer's specified low or high flow limits such that a vehicle would exceed emission standards. In the event of a malfunction the diagnostic system shall store a fault code and the MIL is commanded to continuously illuminate

[5] **POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM** monitoring

The requirement is for the inclusion of this monitoring system on 2002 model year vehicles onwards. On any vehicle to which a PCV system is fitted, the vehicle will be monitored to ensure system integrity. The PCV system will be considered malfunctioning when disconnection occurs between either the crankcase and the PCV valve, or between the PCV valve and the intake manifold. In the event of a malfunction the diagnostic system shall store a fault code and the MIL is commanded to continuously illuminate

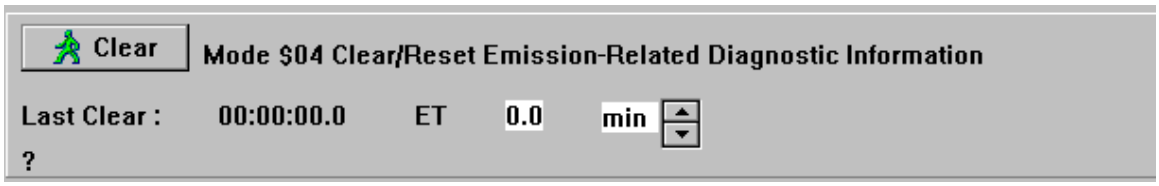
[6] **THERMOSTAT** monitoring

For the beginning of year 2000 model vehicles the diagnostic system are designed to monitor the thermostat on vehicles so-equipped for proper operation. The thermostat is considered to be malfunctioning if, within a manufacturer-specified time interval after starting the engine, the coolant temperature does not reach the highest temperature required by the manufacturer to enable other diagnostics; or the coolant temperature does not reach a warmed-up temperature within 20 degrees Fahrenheit of the manufacturer's thermostat regulating temperature.

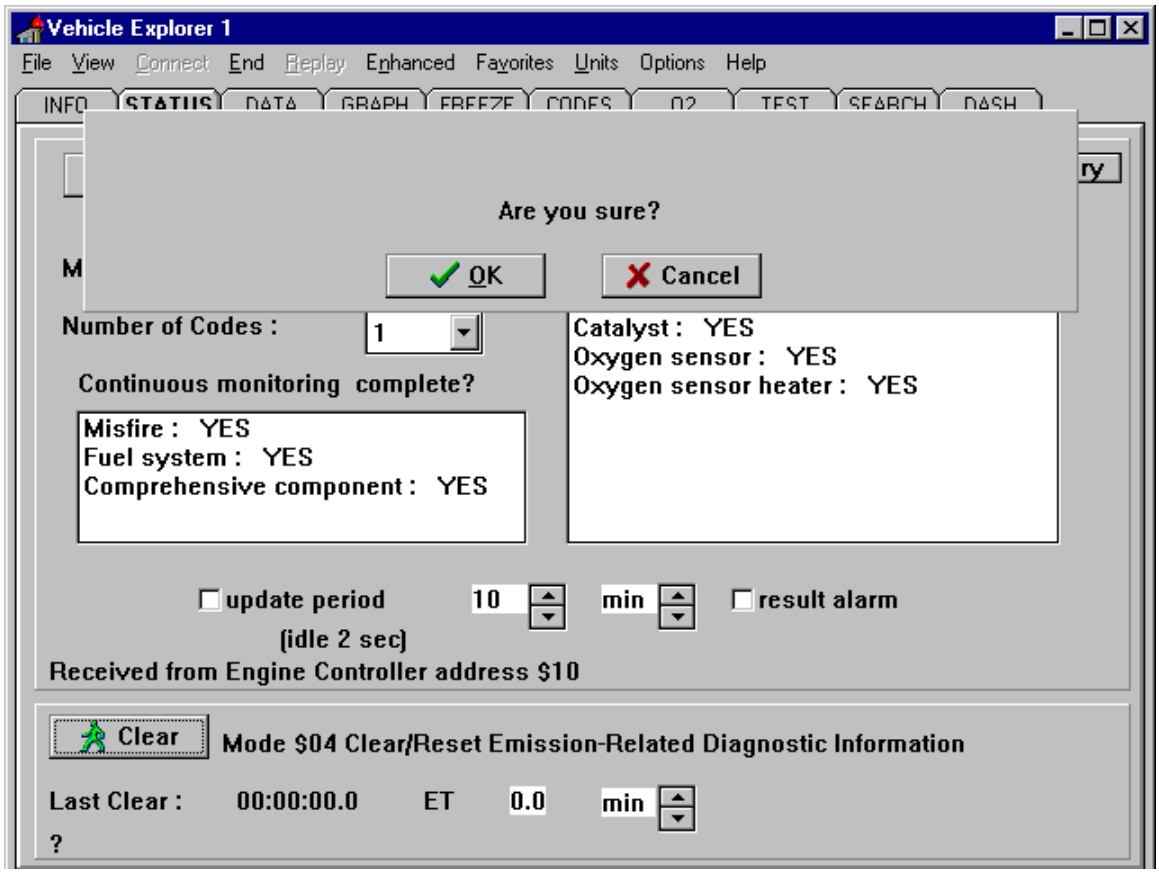
In the event of a malfunction the diagnostic system shall store a fault code and the MIL is commanded to continuously illuminate

If you look below these two windows you will see that the VE program has the facility to set the update period and result alarms as part of these test phases. If the result alarm is on, this page will be automatically opened for your viewing pleasure. You can also select an automatic download request based on an update period. With an ISO-9141-2 connection this program uses Mode 01 PID 01 as a default request to prevent disconnection by the vehicle server if you are idle over 5 seconds. When a message is received you will be notified of the assigned domain name and SAE address. You will also get separate notification and data listings if multiple sites respond to your request.

The next area we are going to look at is the bottom section of the VE program STATUS screen. You will see that it makes reference to **MODE $04.**

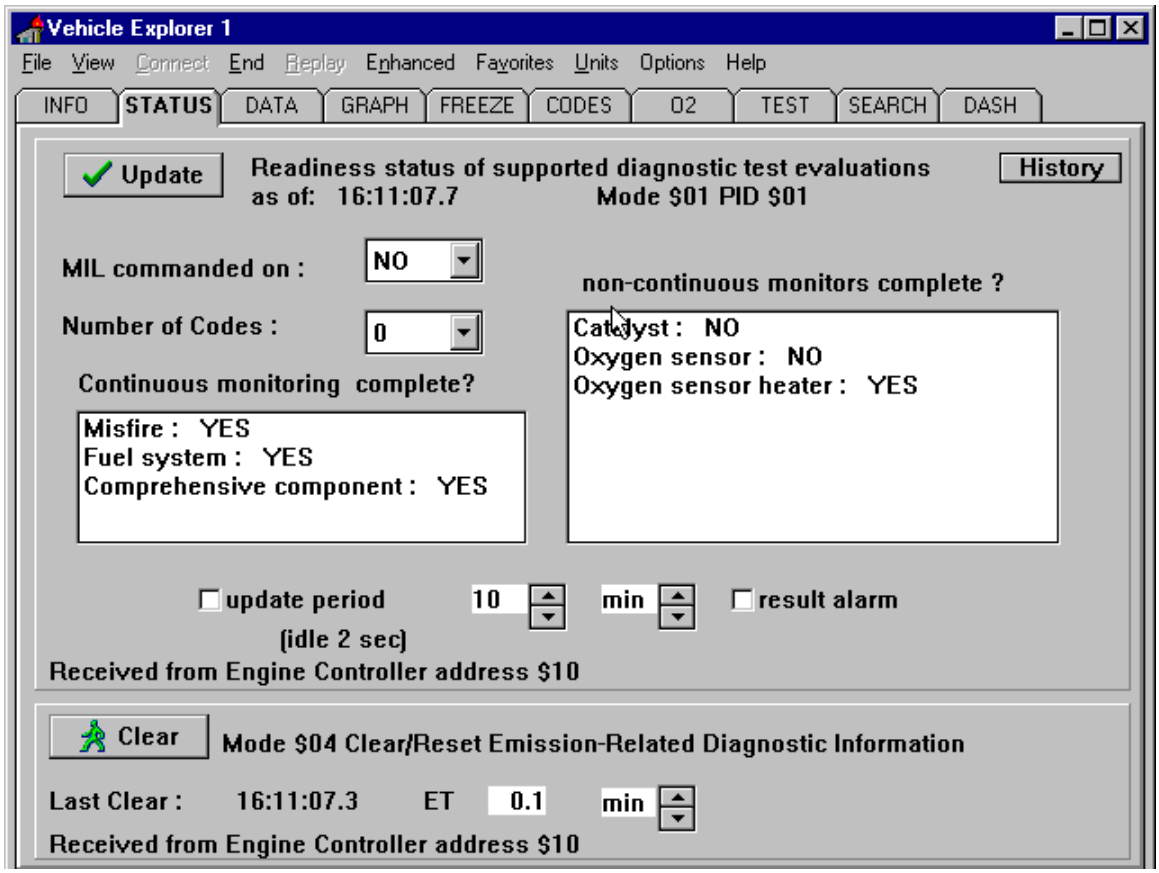


This Mode allows you to connect to your vehicle's main server and erase all diagnostic files. No password is required but you will be prompted to make sure you want to do this once you click on the CLEAR button.



If on, the check engine MIL light will be extinguished, trouble codes will disappear, all testing can be aborted and declared incomplete, with monitoring restarted. Note it can take several days to monitor and complete a final exam depending on the way you drive. This operation is known as an 'all-or nothing' system. The idea was to prevent possible fraudulent misuse prior to a vehicle undergoing either the basic or enhanced inspection.

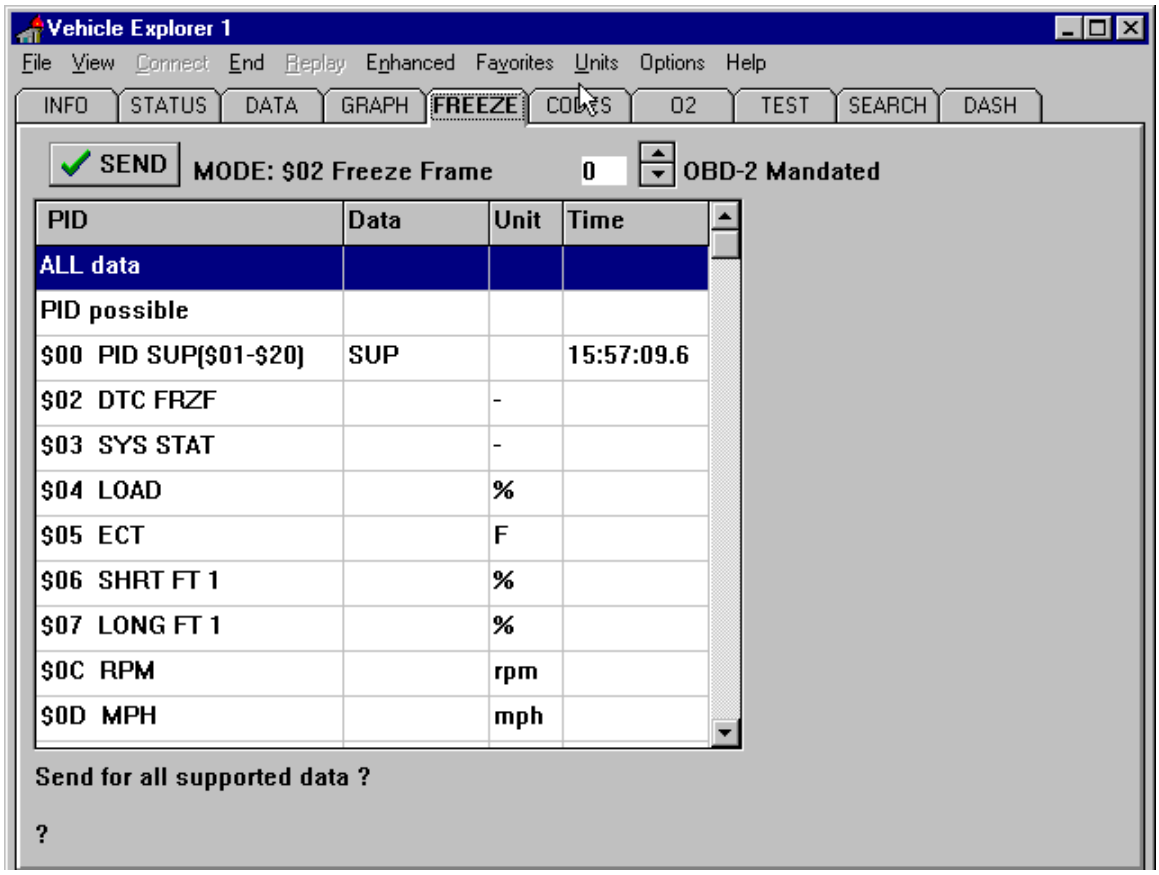
This is the STATUS screen after clicking on the OK button of the confirmation splash screen.



You can see that the Non-continuous monitors have now switched to the NO state for the Catalyst and Oxygen sensor. Because this vehicle's engine was running and it was fully warmed up the Oxygen sensor heater monitor indicates that the test is complete by displaying the Yes status.

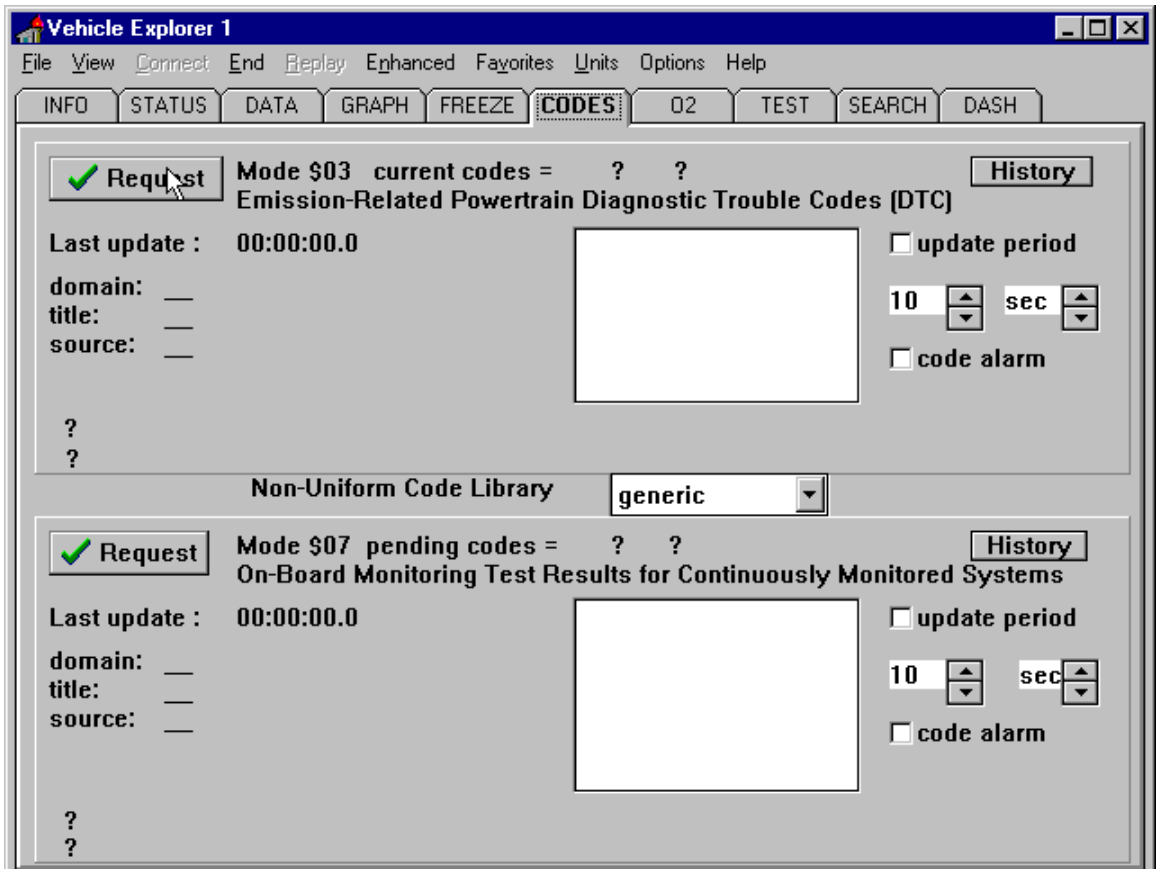
There are at the moment a few DTC's which will cause the MIL to permanently illuminate and remain on and yet the vehicle will not fail the inspection. It was envisaged that if people could selectively delete DTC's then those relating to emission failures could be cleared just as the vehicle was presented at the test station. As a result a polluting vehicle could theoretically pass the test. To prevent this when you clear fault codes on an OBD2 compliant vehicle it clears ALL stored codes. To further ensure compliance with the emission pollution regulations when you clear the stored DTC's the 'Non-continuous monitoring tests' are reset. Therefore any attempt to clear the DTC's will cause the vehicle to return to a 'non-readiness' state for any testing. In this situation it would automatically fail the inspection test.

The FREEZE page of the VE program when opened presents us with the following screen shot



You can see next to the SEND button is written **MODE $02 Freeze Frame**. This Mode is a requirement that the diagnostic system must Store Engine Conditions within the ECU memory upon detection of a malfunction of any component or system. If there are subsequent and/or continuous malfunctions of the component or system, any previously stored freeze frame conditions shall be replaced by the current fuel system or misfire conditions. The FREEZE FRAME shall include, but is not limited to the following parameters (where available/supported by the vehicle); calculated load value, engine RPM, fuel trim value(s), fuel pressure, vehicle speed, coolant temperature, intake manifold pressure, closed- or open-loop operation, and the fault code which caused the data to be stored.

If we move onto the CODES page we get the following screen shot

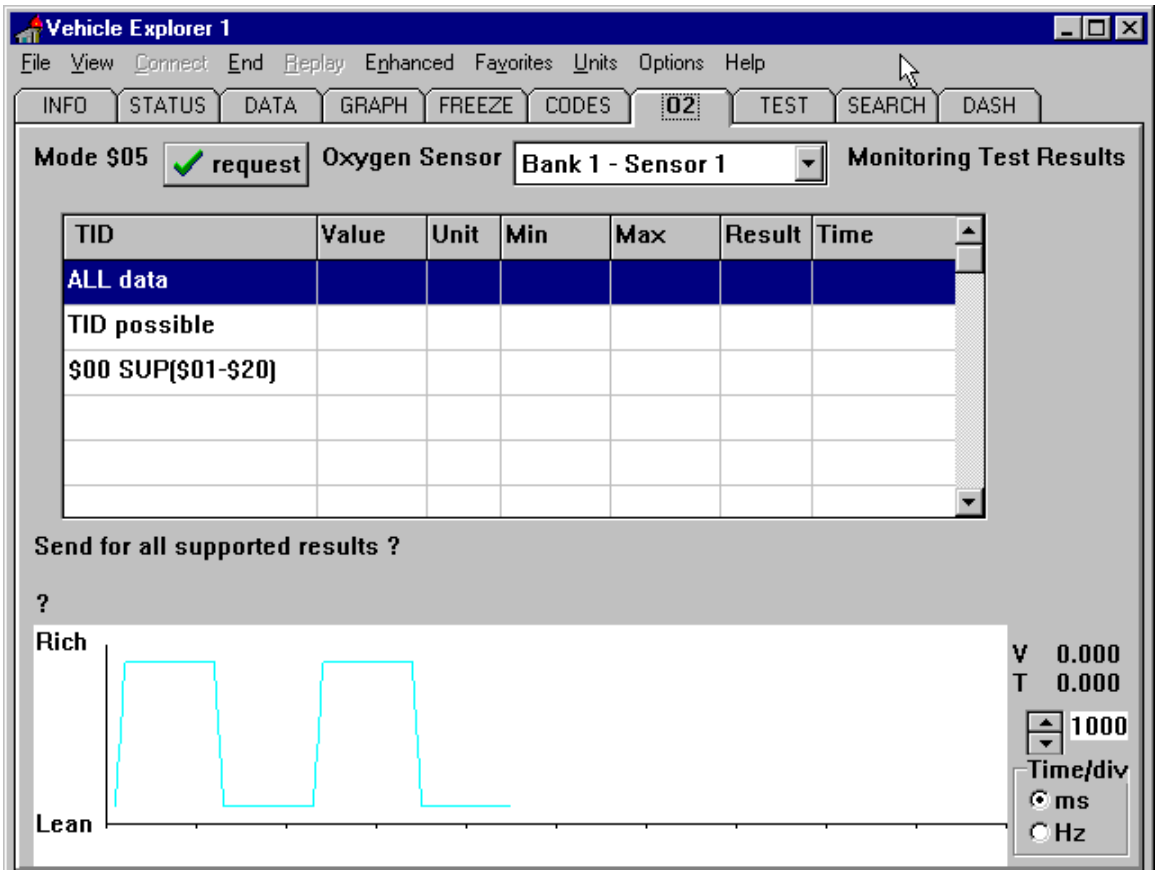


This page is divided into two halves. The upper represents **MODE $03,** whilst the lower portion relates to **MODE $07**

Mode $07 provides a mid term test grade for continuously monitored systems. If a device fails the first test, the code will be listed, and the device will be given another chance to pass by taking the test over. If it again fails the makeup test, it will be reported in the **Mode $03** list of trouble codes and the MIL light will be commanded on.

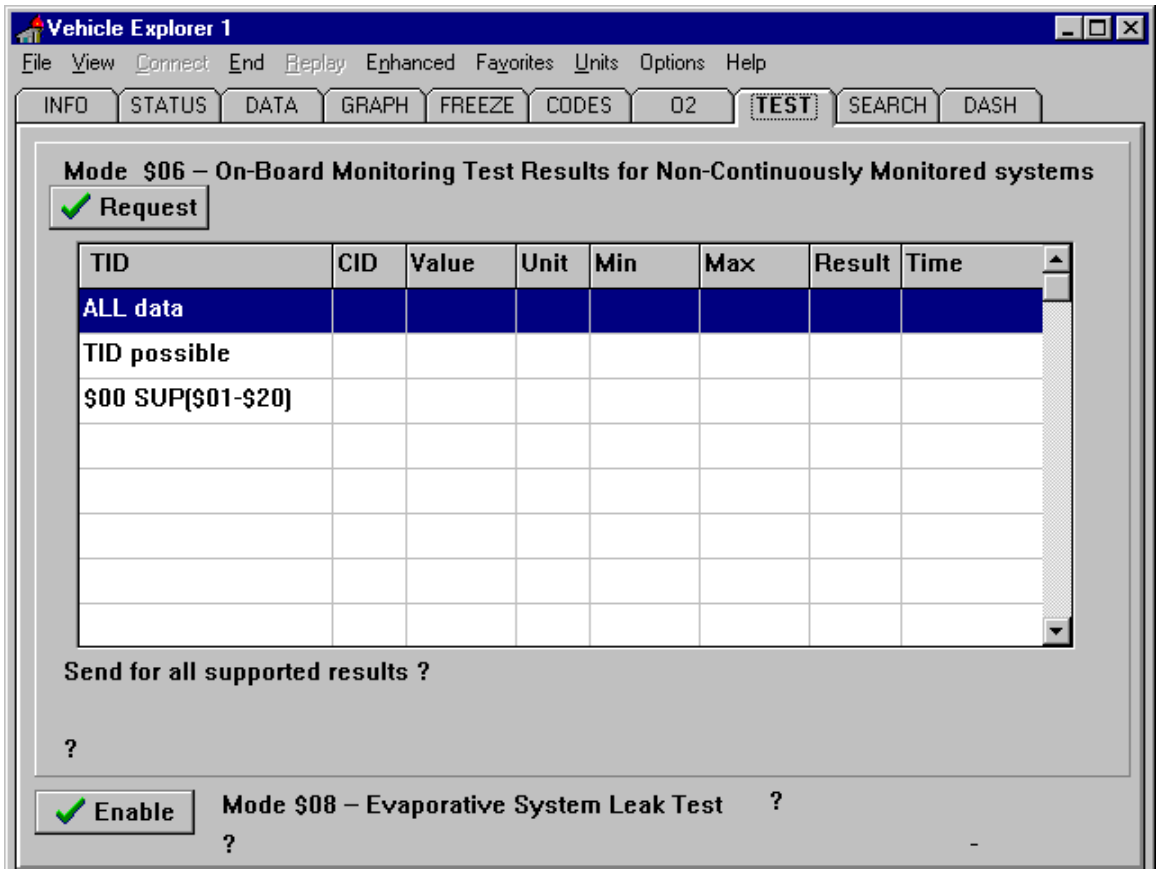
Trouble codes are assigned an alphanumeric identifier, a short acronym and a full descriptive name. The alpha descriptor references the server domain: P=Powertrain, C=Chassis, B=Body, U=Network. The 1st digit identifies the site author, 0=SAE, 1, 2, 3 is by the manufacturer or reserved. The 2nd digit references the code group title, for a powertrain server: 1, 2=Fuel and Air Metering, 3=Ignition System or Misfire, 4=Auxiliary Emission Controls, 5=Vehicle Speed, Idle control, and Auxiliary Inputs, 6=Computer and Auxiliary Outputs, 7, 8=Transmission 9,0=reserved or determined by SAE. The last two digits 00-99 define the actual body of the message. The site author has the option to use a specific source code or a generic source descriptor in the message. This browser will identify a generic message and provide a list of additional code tips. Note: sites authored by manufacturers are strongly encouraged to use the same titles as SAE. If a manufacturer code is not listed in the browser library, it will cross reference the source code to SAE.

Moving across to the O2 page we get



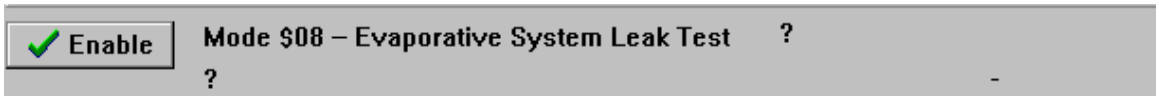
We now see that the program makes reference to **MODE $05**. This Mode provides the vehicle oxygen sensor output characteristics and test results. You can select your available sensors for location and viewing. There is a warning message if any test is not complete. Note, not all vehicles will support O2 sensor test results as it is optional per regulations.

The TEST page for VE program relates to **MODE $06** and provides test information on various components that are not tested continuously, but only during certain operational times and conditions.

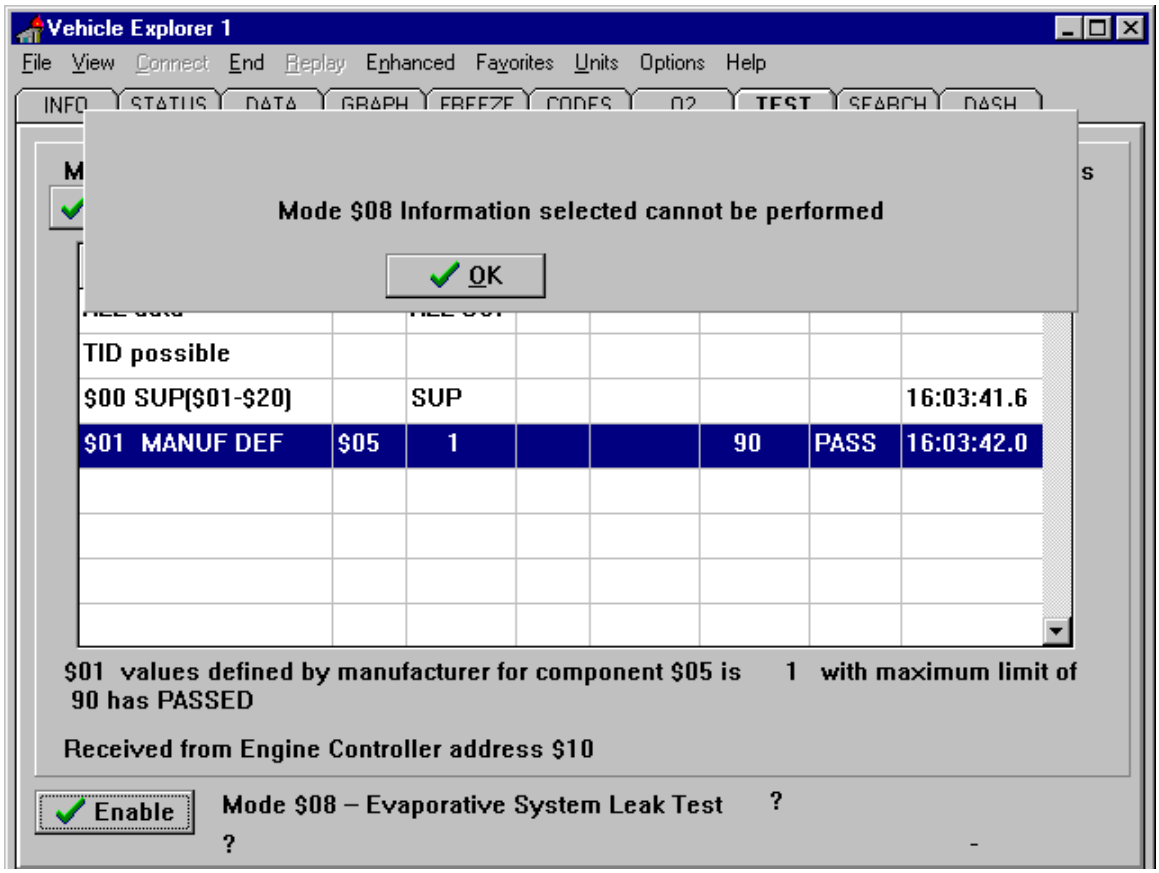


Results will report a minimum and or maximum range of values and a pass or fail grade. One test can be given to a class of components (such as all O2 sensors). Each component will have an ID number. There is a warning message if any test is not complete, and possible incorrect data. Note the supported test type request is optional for this mode. To find out all available tests select the all possible listing. Note this data is manufactured defined and most manufactures to not provide definitions. Possible that data over 32767 is represented in some type of negative notation, and the result would then pass. In menu units you can select various negative number formats.

To the bottom of this screen shot you can see reference is made to **MODE $08.**



This test is not a requirement at present for the EOBD standard. When enabled the diagnostic system performs a system leak test on the Evaporative System to ensure the system is functioning correctly. As we are connected to a UK Spec 2001 Nissan Micra if I click on the ENABLE button for this test I am presented with the following splash screen



As previously stated this function is not a requirement of EOBD standard and hence there is no surprise that it does not work

Up to now we have looked at how the OBD2 required MODES relate to the VE program. We will now move onto showing how the program can be used to retrieve and clear fault codes. In addition we shall look at a few extra features incorporated into the program.

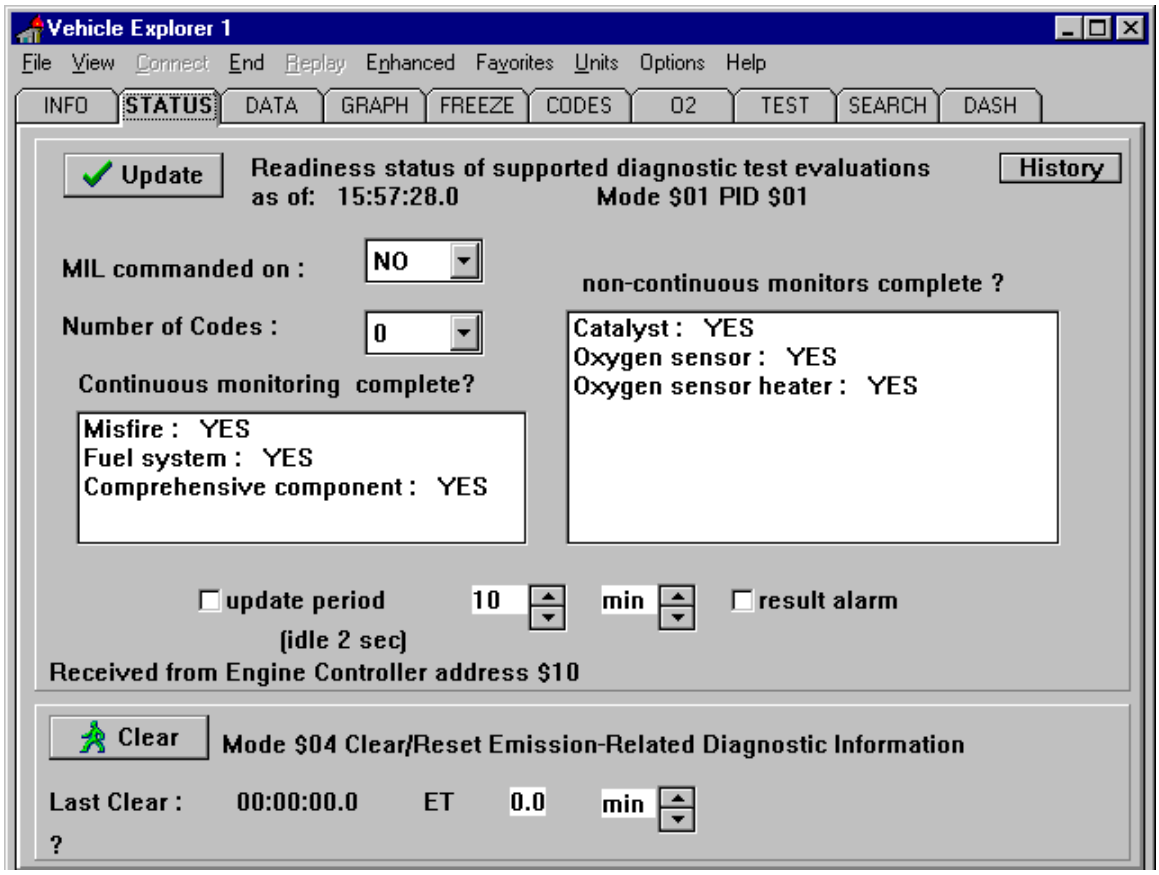
In the following demonstration the following sensors will be disconnected whilst the engine is running to show the ability of the program to quickly identify and store the fault codes

[1] Engine coolant Sensor

[2] Camshaft position sensor

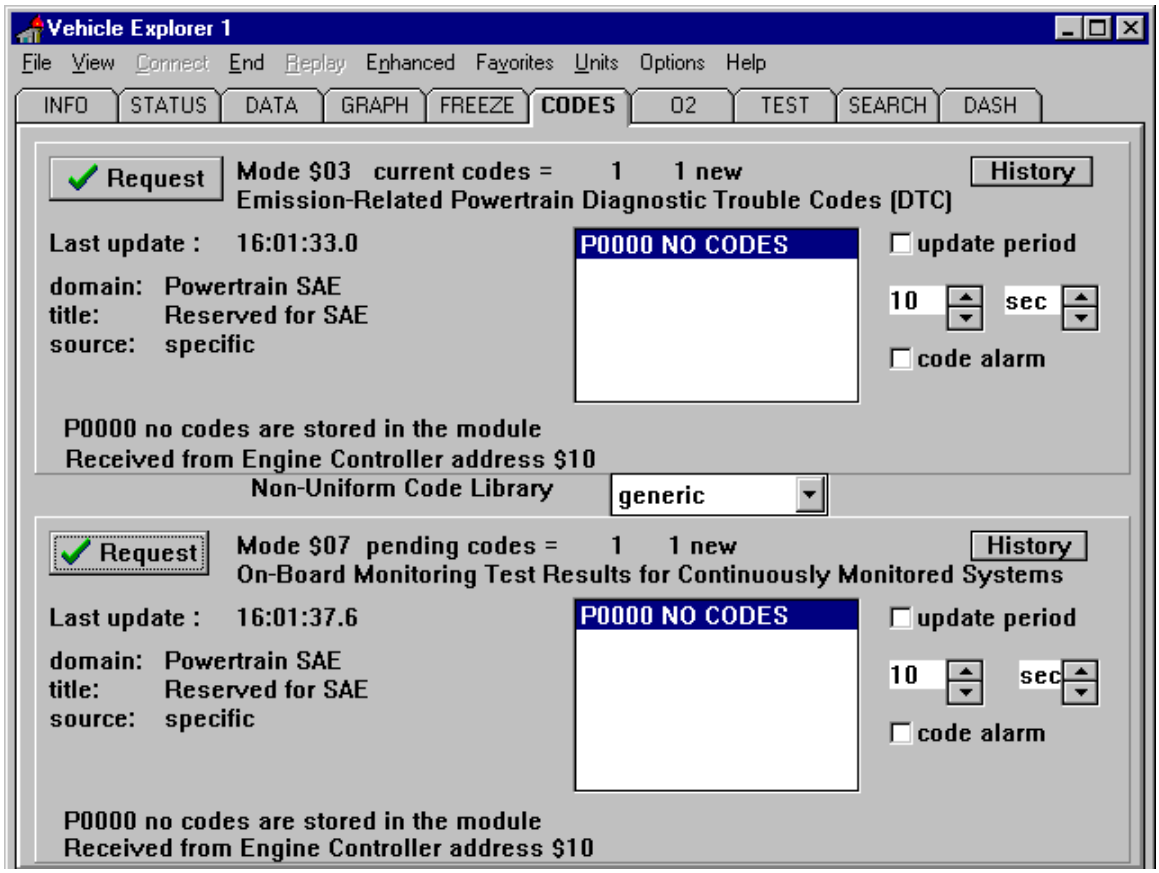
[3] Cylinder No.1 Spark plug

So, firstly, as previously demonstrated I log on to the vehicle via the OBD2 interface and go to the STATUS screen.

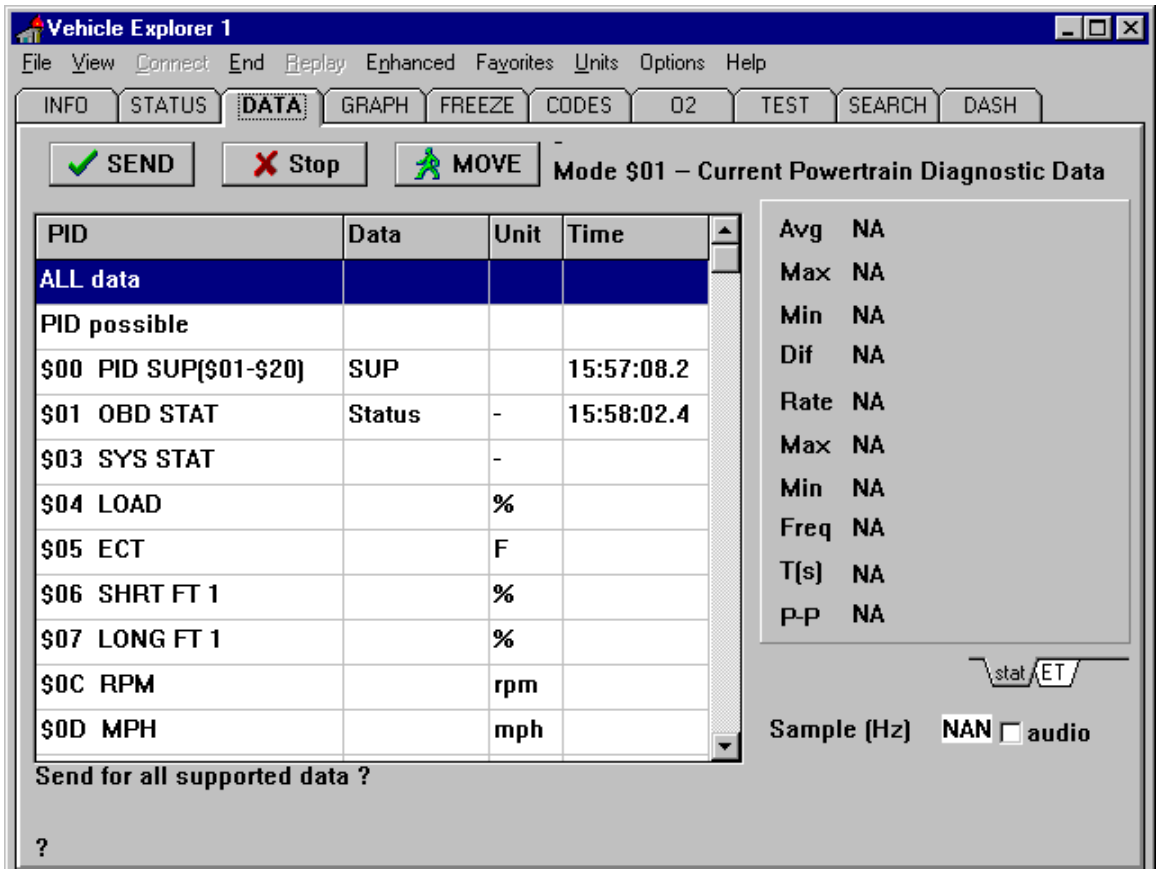


The MIL light is currently switched off, there are no fault codes stored and the Continuous and Non-continuous test are all completed.

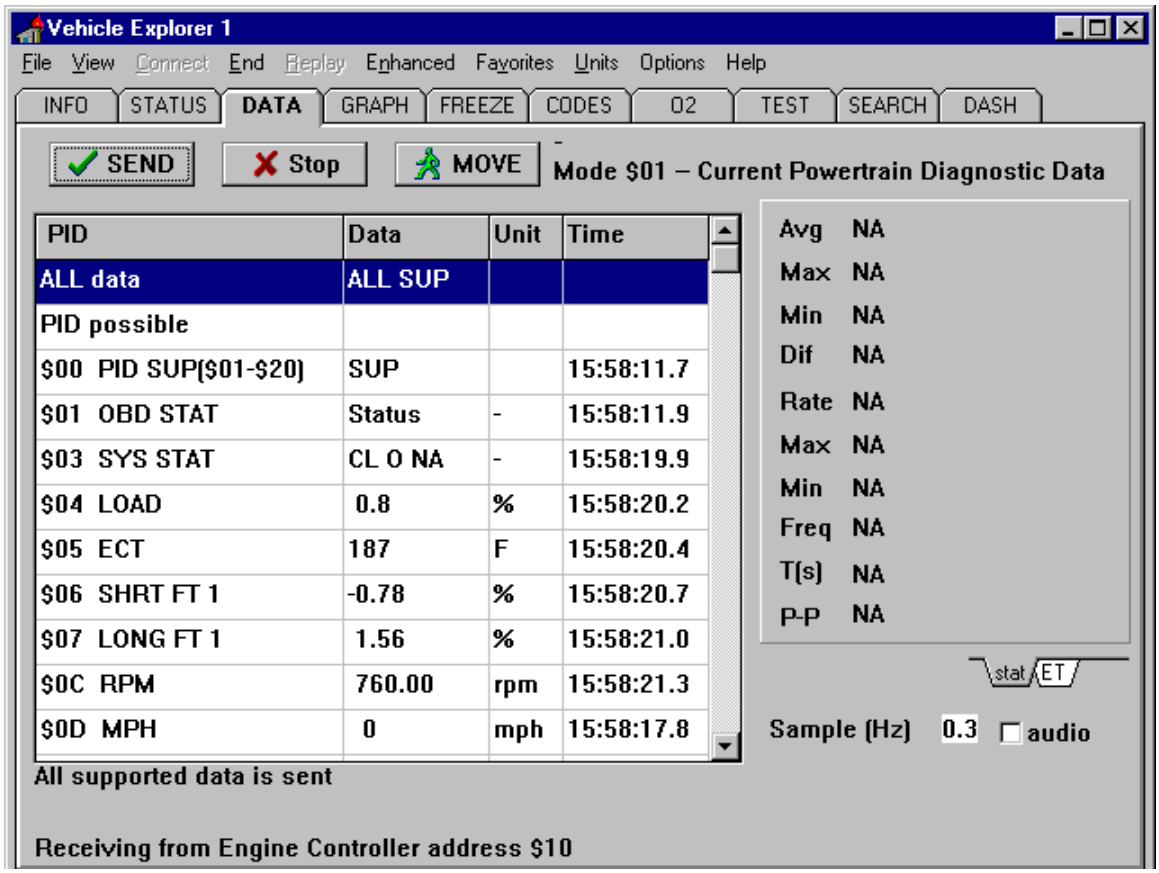
To confirm there are no codes stored I switch to the CODES screen and click on the REQUEST buttons at which time I am presented with the following.



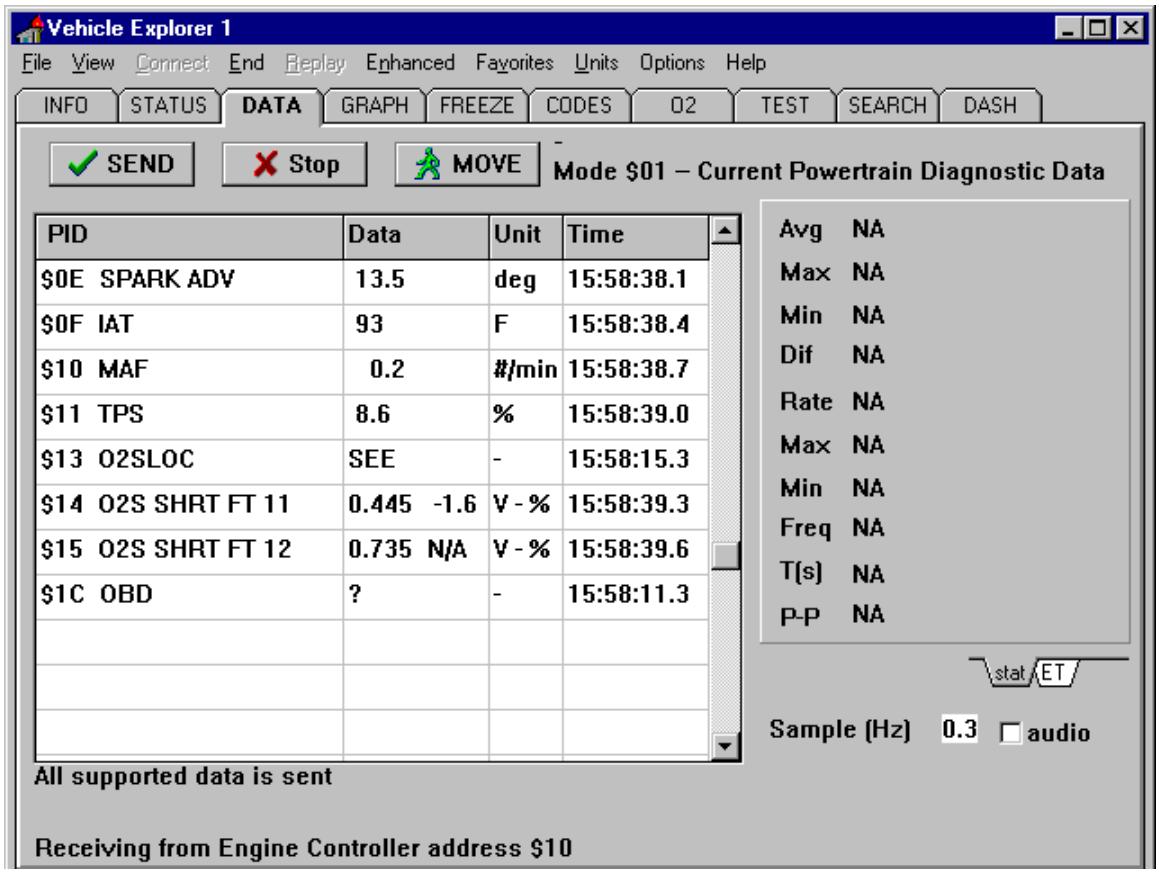
I then switch to the DATA screen



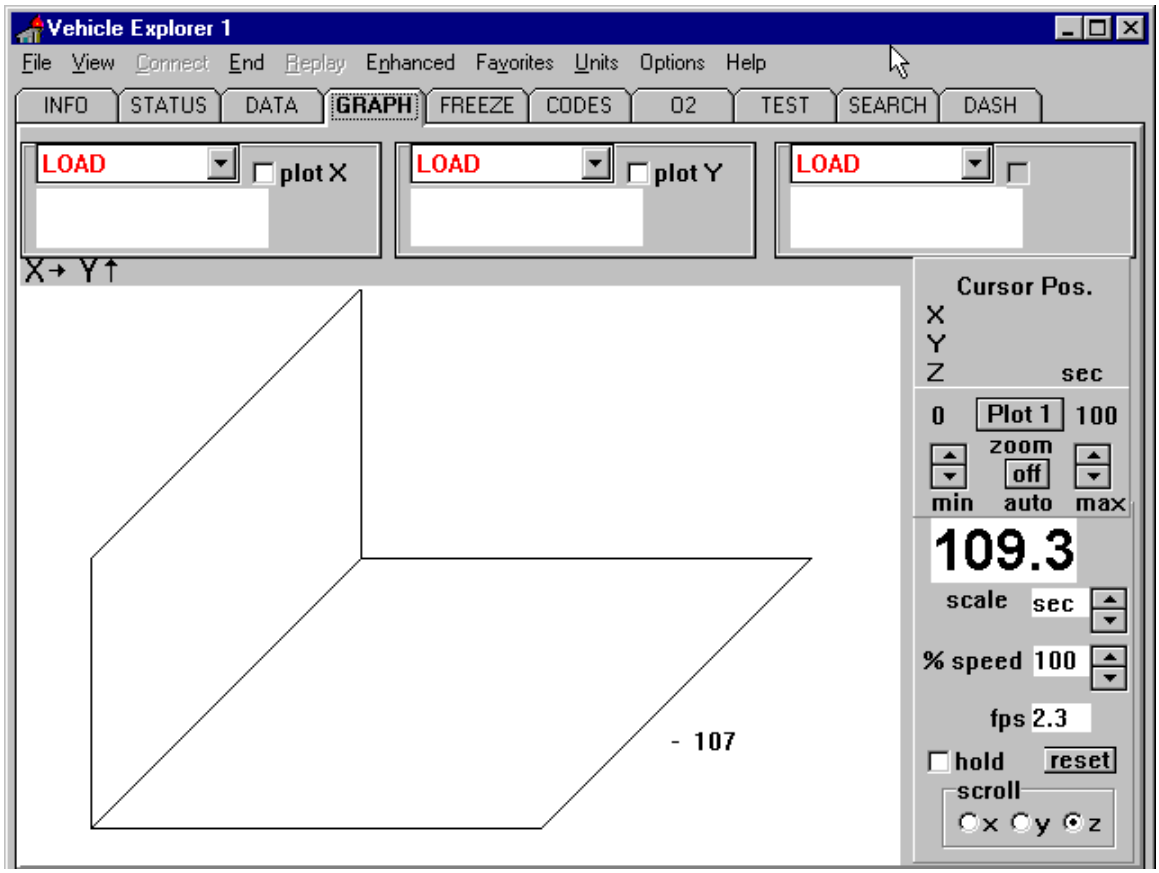
and click on the SEND button. At this time the ECU continuously sends real time data of the Component checking values to the screen


Vehicle Explorer 1
File View Connect End Replay Enhanced Favorites Units Options Help
INFO STATUS DATA GRAPH FREEZE CODES O2 TEST SEARCH DASH
SEND
Stop
MOVE
Mode $01 – Current Powertrain Diagnostic Data
PID Data Unit Time
ALL data ALL SUP
PID possible
$00 PID SUP($01-$20) SUP 15:58:11.7
$01 OBD STAT Status - 15:58:11.9
$03 SYS STAT CL O NA - 15:58:19.9
$04 LOAD 0.8 % 15:58:20.2
$05 ECT 187 F 15:58:20.4
$06 SHRT FT 1 -0.78 % 15:58:20.7
$07 LONG FT 1 1.56 % 15:58:21.0
$0C RPM 760.00 rpm 15:58:21.3
$0D MPH 0 mph 15:58:17.8
Avg NA
Max NA
Min NA
Dif NA
Rate NA
Max NA
Min NA
Freq NA
T(s) NA
P-P NA
stat ET
Sample (Hz) 0.3 audio
All supported data is sent
Receiving from Engine Controller address $10

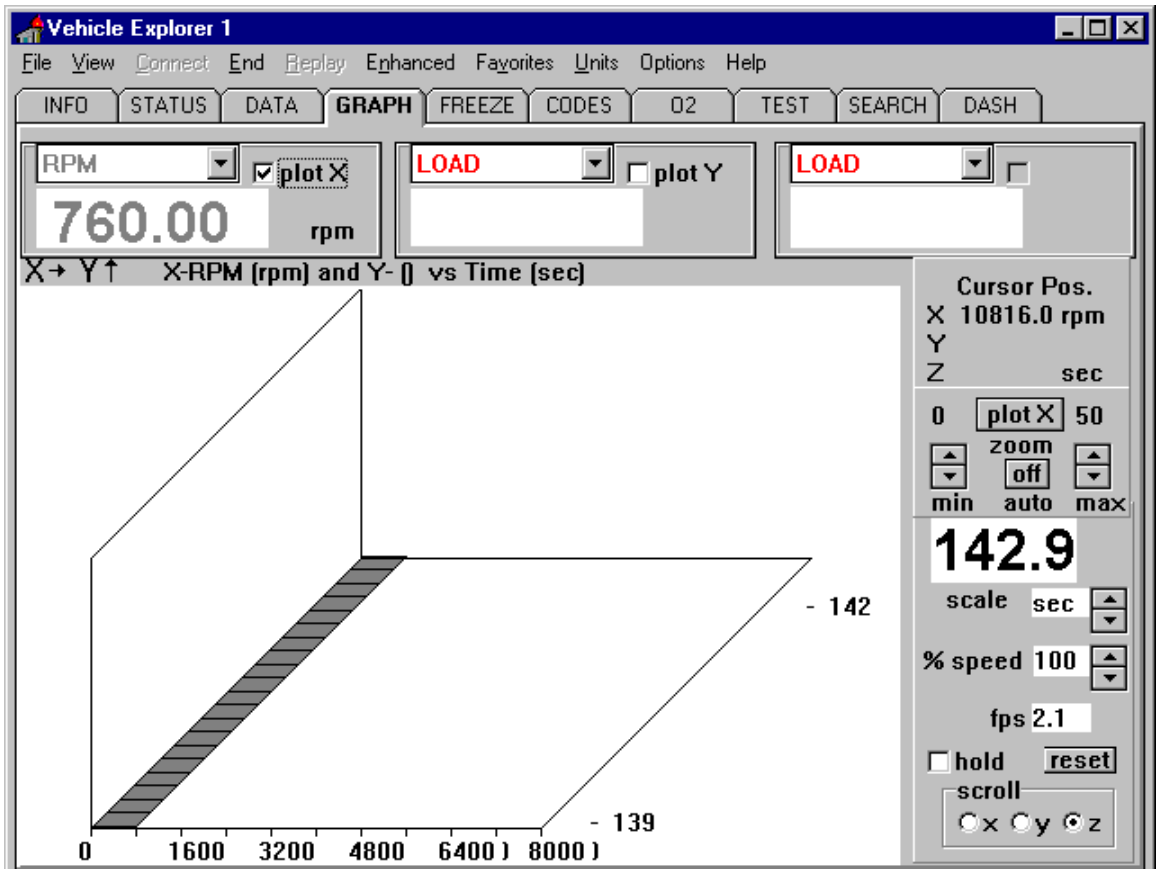
and



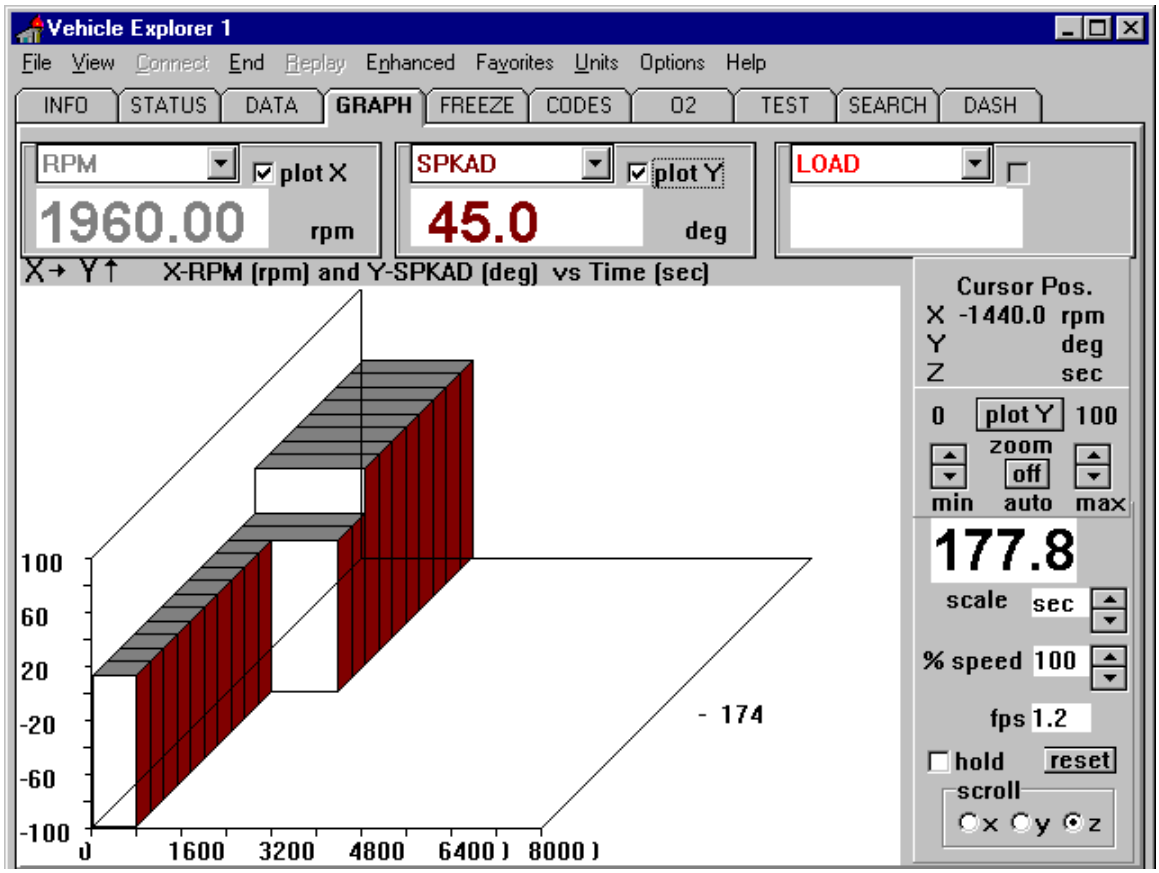
Now that we are receiving data from the vehicle I now have the option to look at it graphically. To do this I switch to the GRAPH screen



With the engine running I decide at this time to compare the vehicles RPM

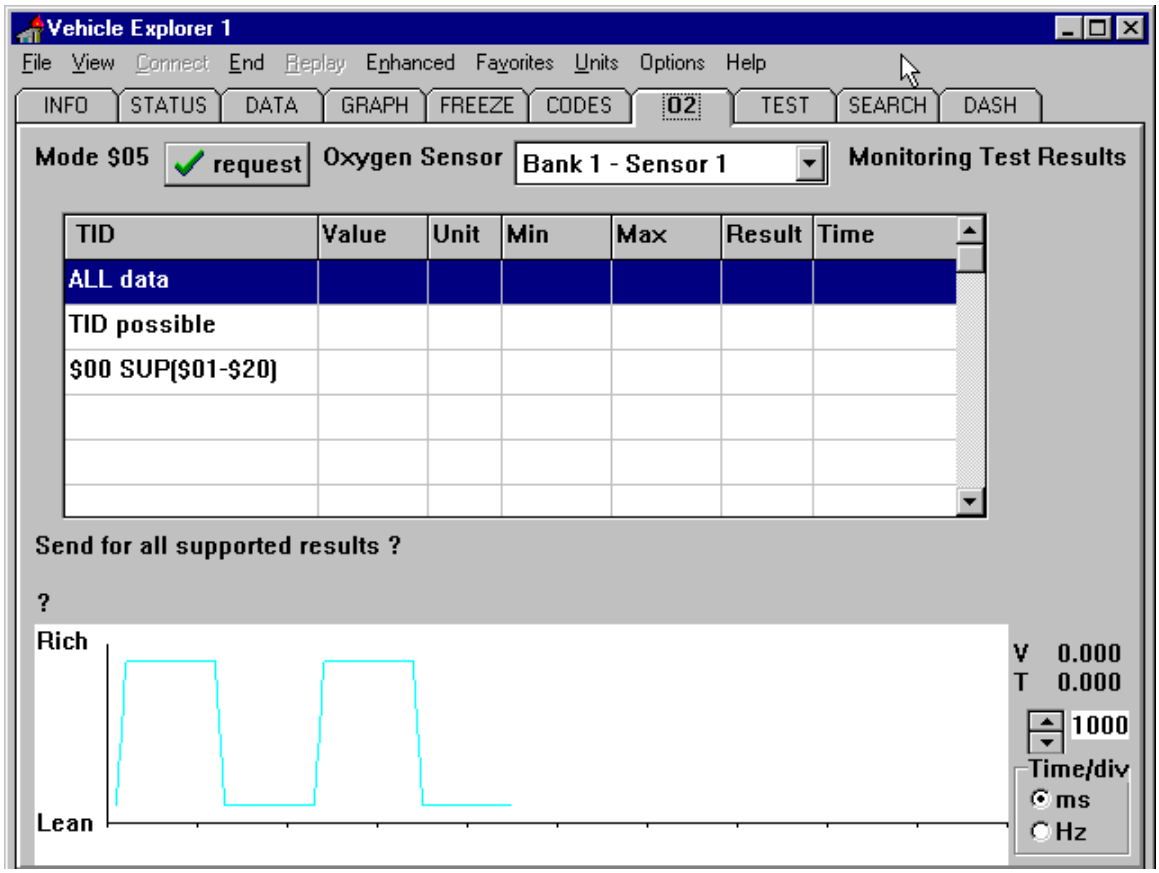


against the spark advance

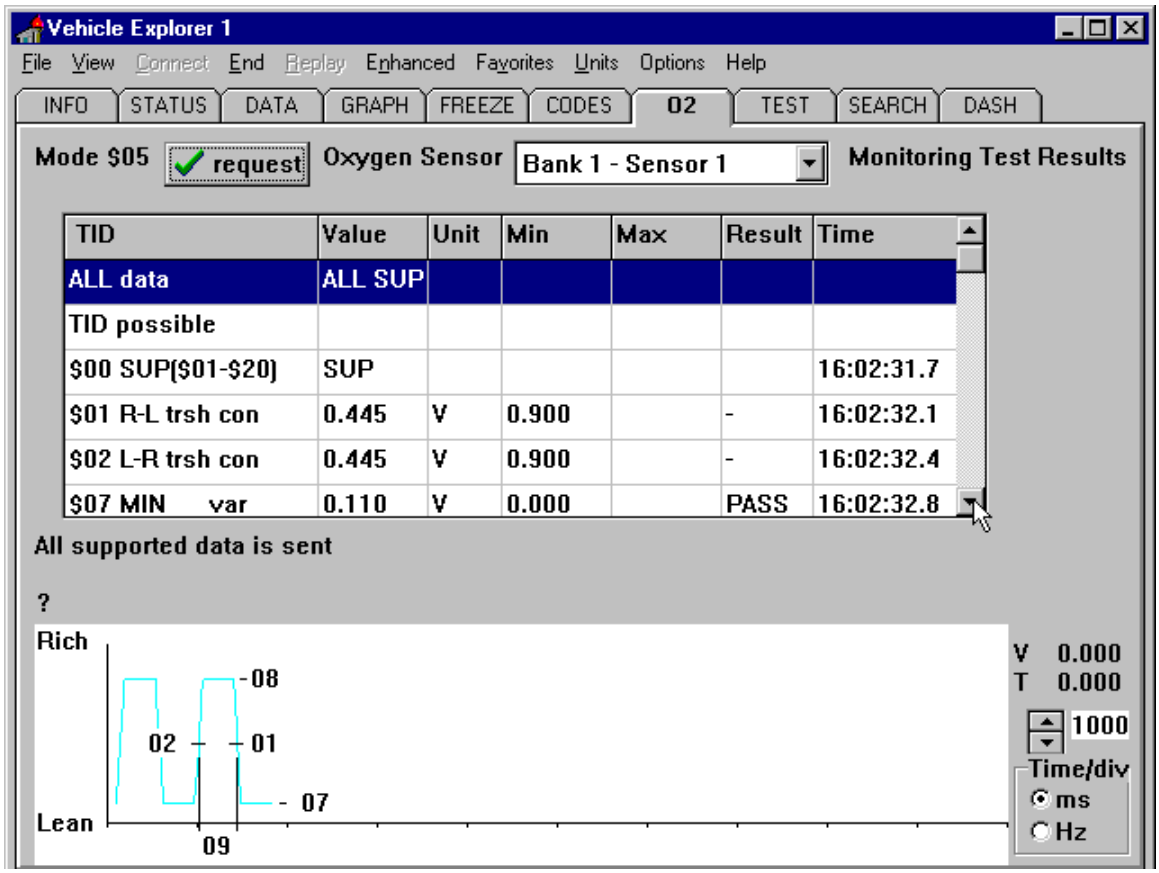


and by reving the engine you can clearly see that the spark advance increases with RPM in this example.

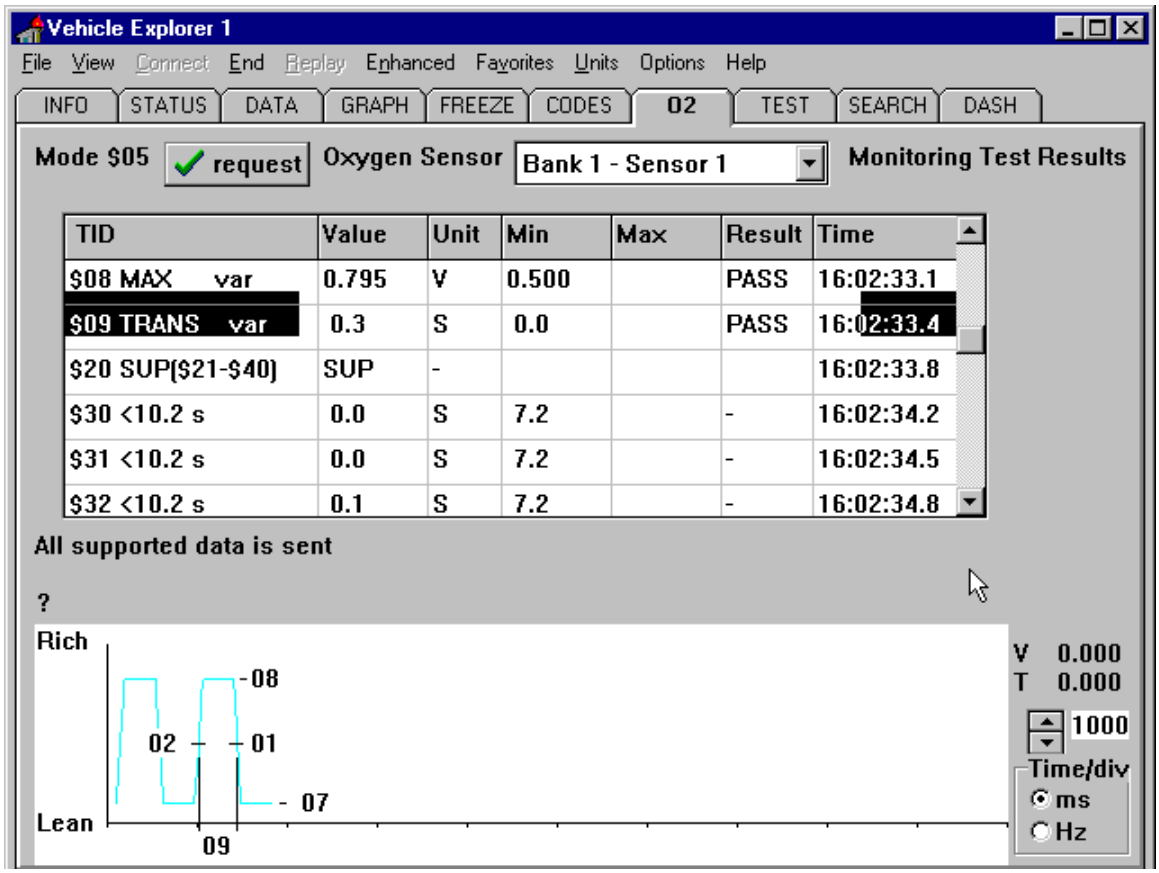
Okay, lets now take a look at the 02 sensor of this vehicle. Switch over to the 02 screen



and click on the REQUEST button. The ECU responds with the following in respect of this vehicle

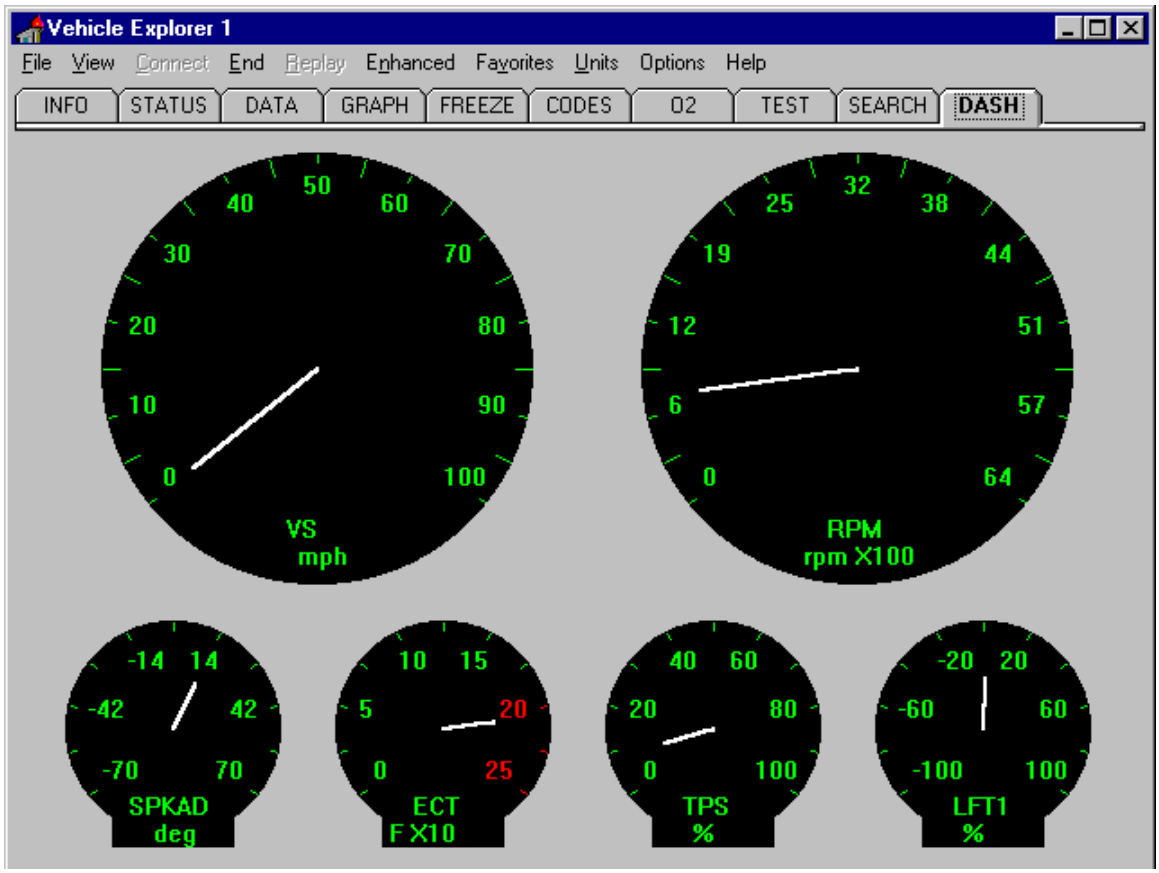


and scrolling down the window we also get



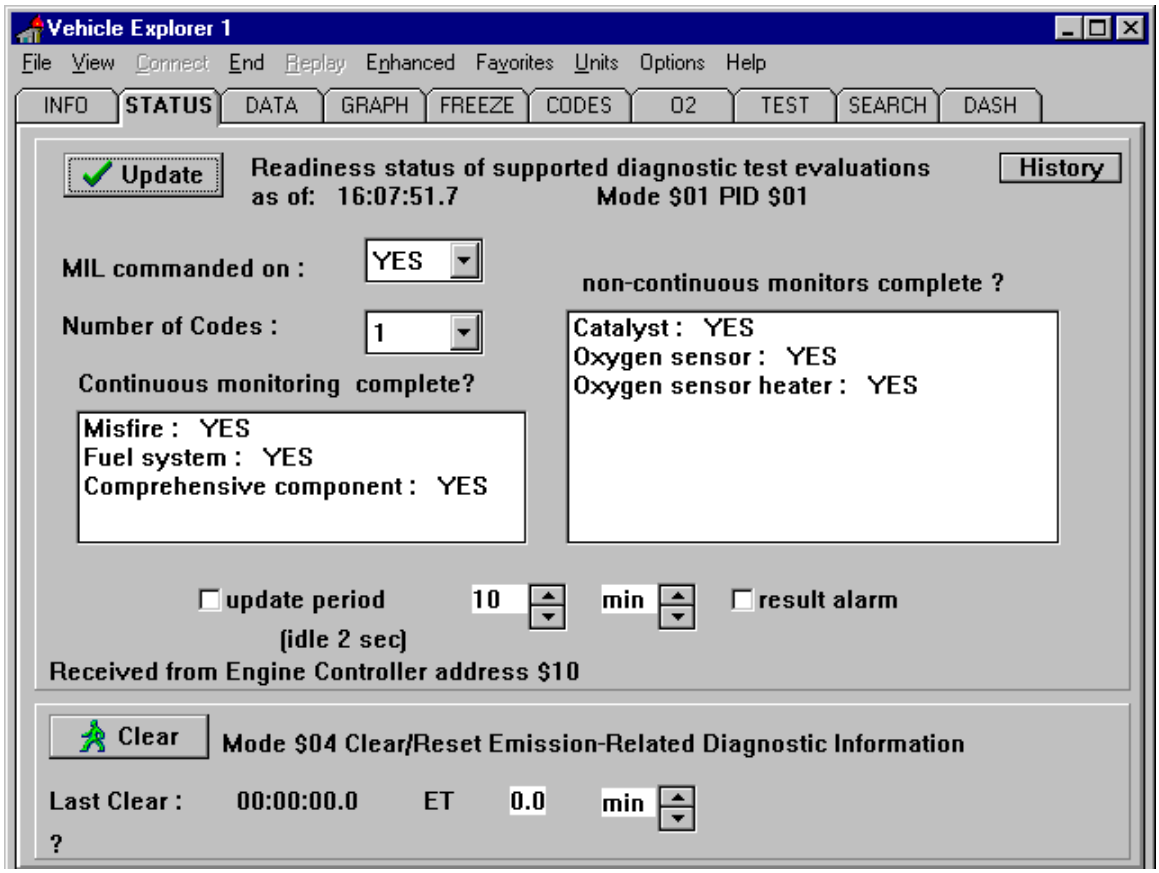
We can see what the values are in respect of 02 parameters and can see that the monitoring tests have PASSed the 02, so basically all is okay here.

If we switch over to the DASH screen we can see the selected data in the following format

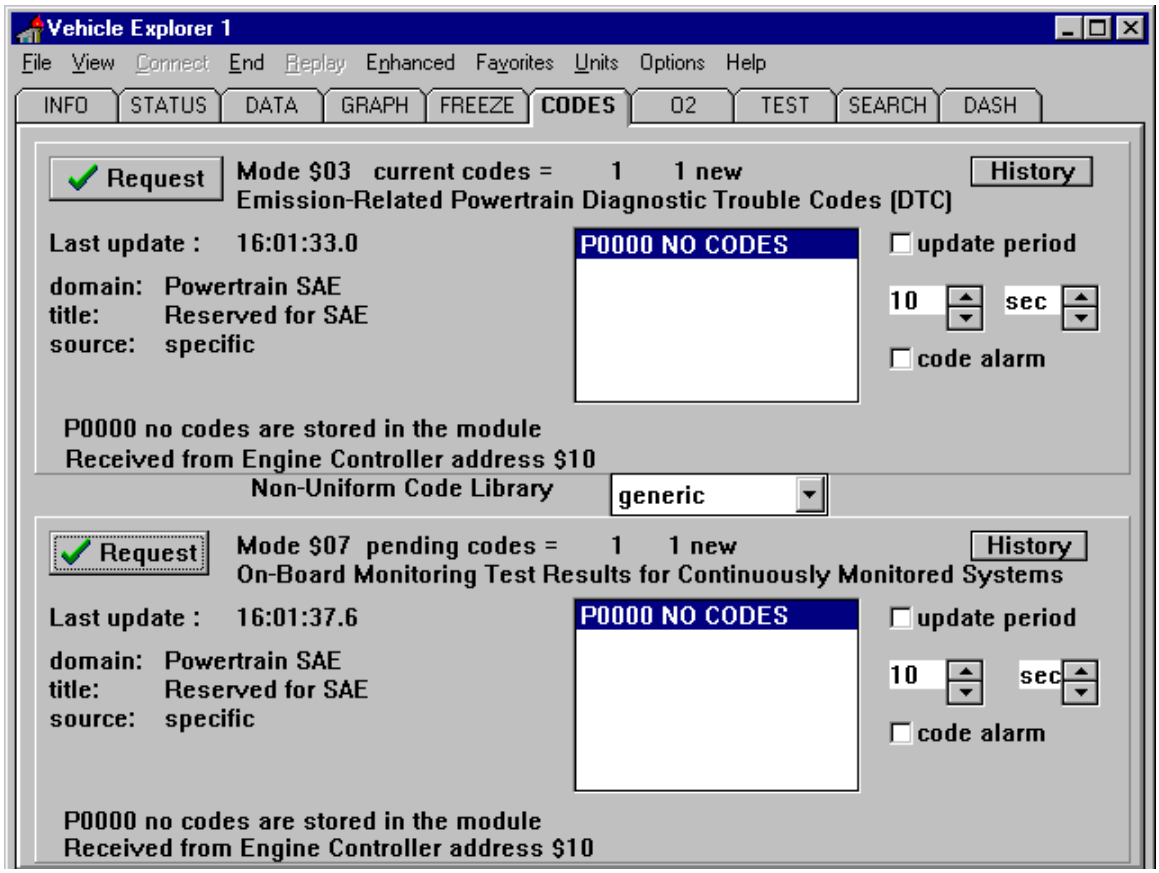


Okay, so we have had a quick look around. Let's go and create some fault codes and see what happens. With the engine still running I lift up the bonnet, locate the connections for the engine coolant sensor, camshaft position sensor and the spark plug for cylinder no.1. I then disconnect them in turn and almost immediately the dash MIL lamp illuminates.

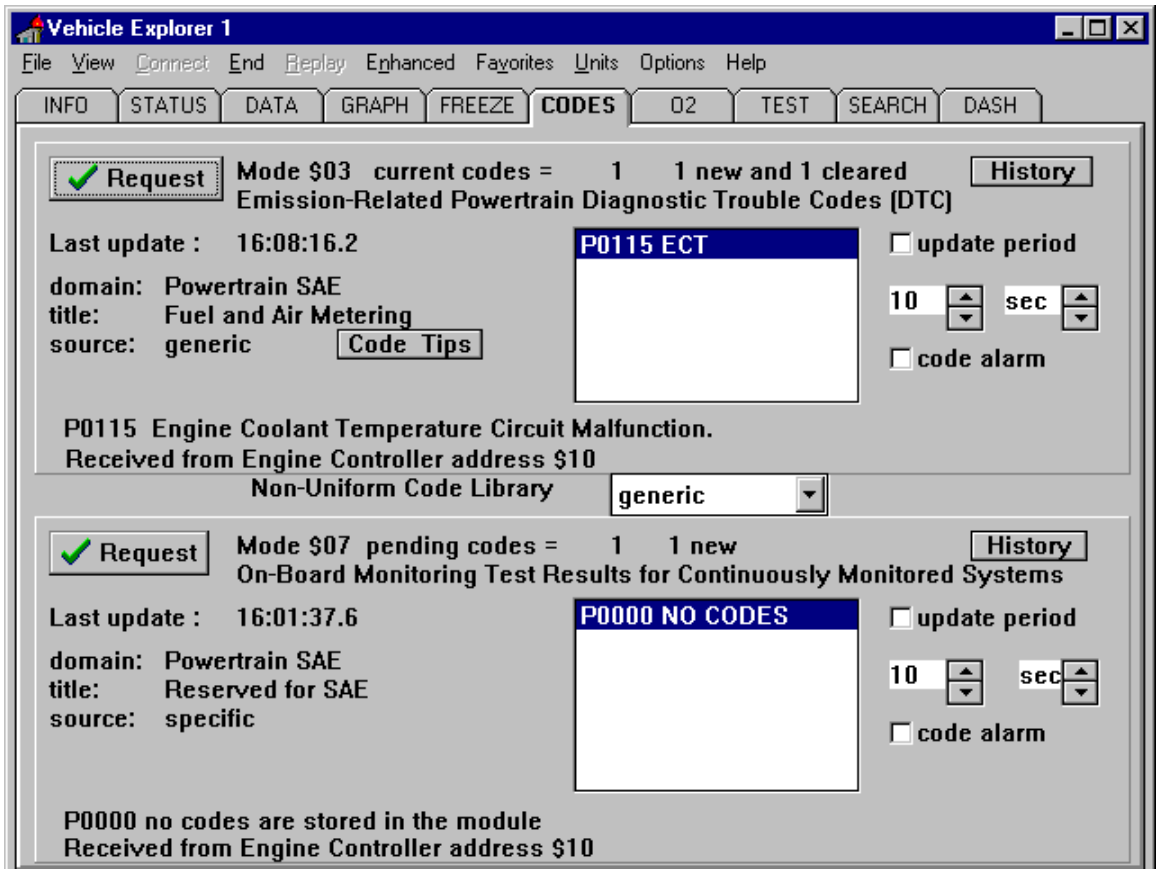
If I switch to the STATUS screen we can see that things have now changed



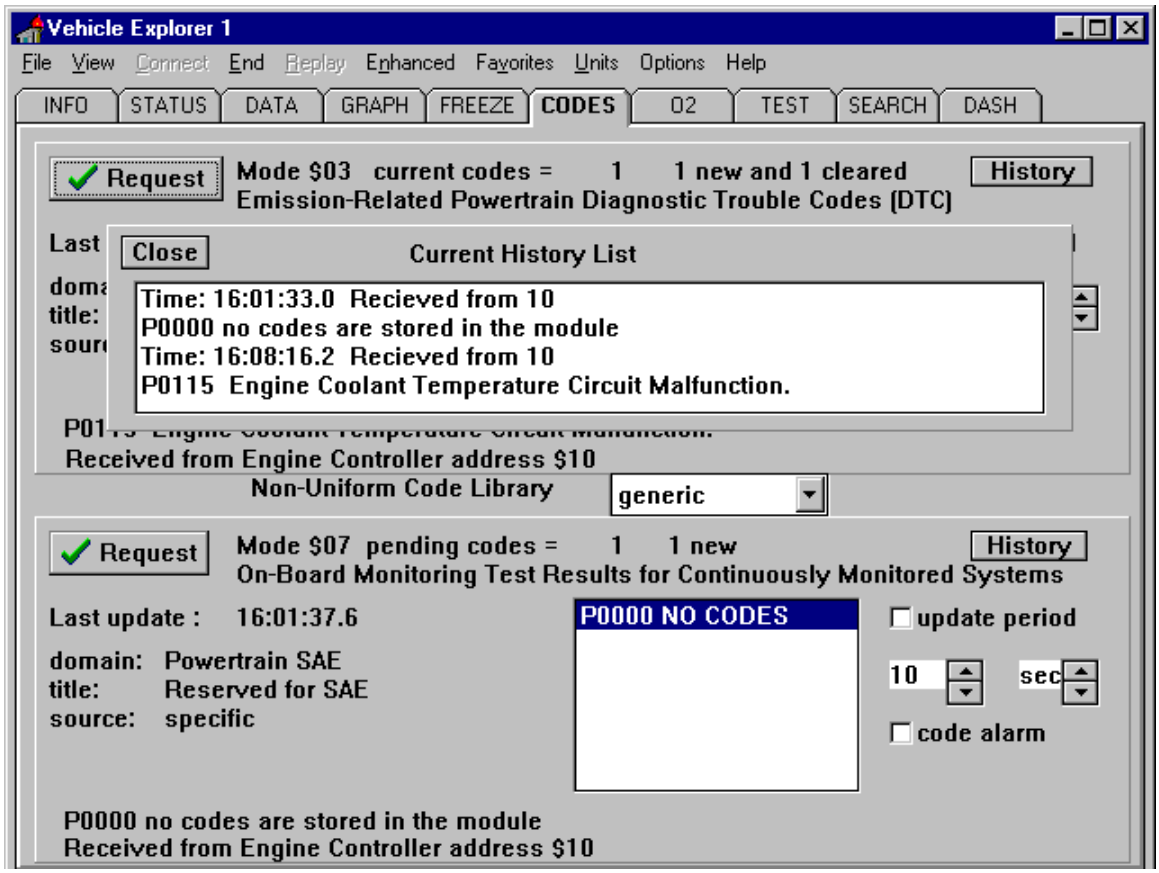
The MIL commanded on has changed to the YES state, which is confirmed by the fact that the dash MIL light is on. I am also informed that there is now 1 code stored in the fault memory. But hey, wait a minute, did we not disconnect 3 connections? Yes we did but to understand what is going on we need to switch to the CODES screen



And then click on the REQUEST buttons for the MODE $03 faults

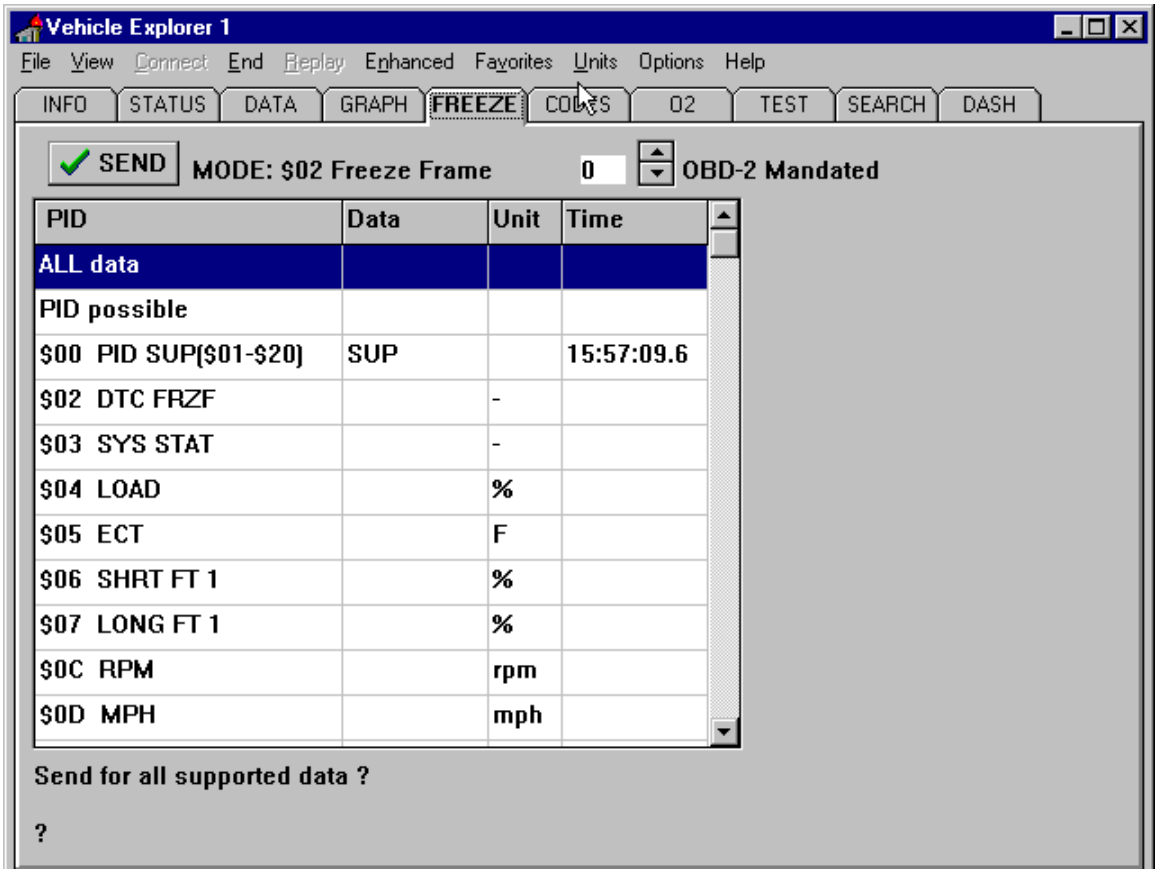


We have one fault present. The program identifies it as the engine coolant temperature sensor. From our earlier explanation of MODE $03 you can see that this fault code relates to an immediate failure and therefore switches the MIL light on. If you look carefully to the right of the fault code window you will see a HISTORY button for MODE $03 faults. If you click on this you will see the following

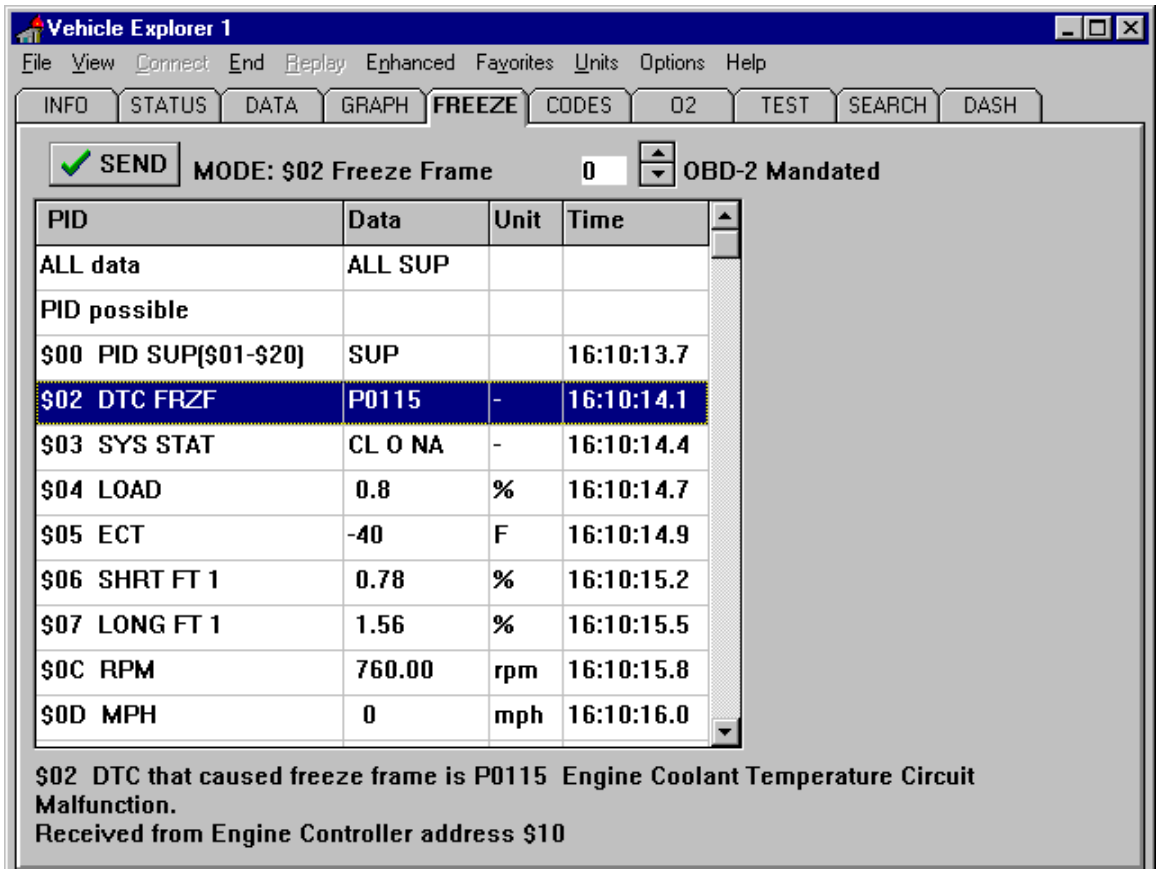


This feature time stamps and stores a log of fault codes and from where they originated.

It is now time to quickly look at the OBD2 Freeze Frame feature. If we quickly switch to the FREEZE screen

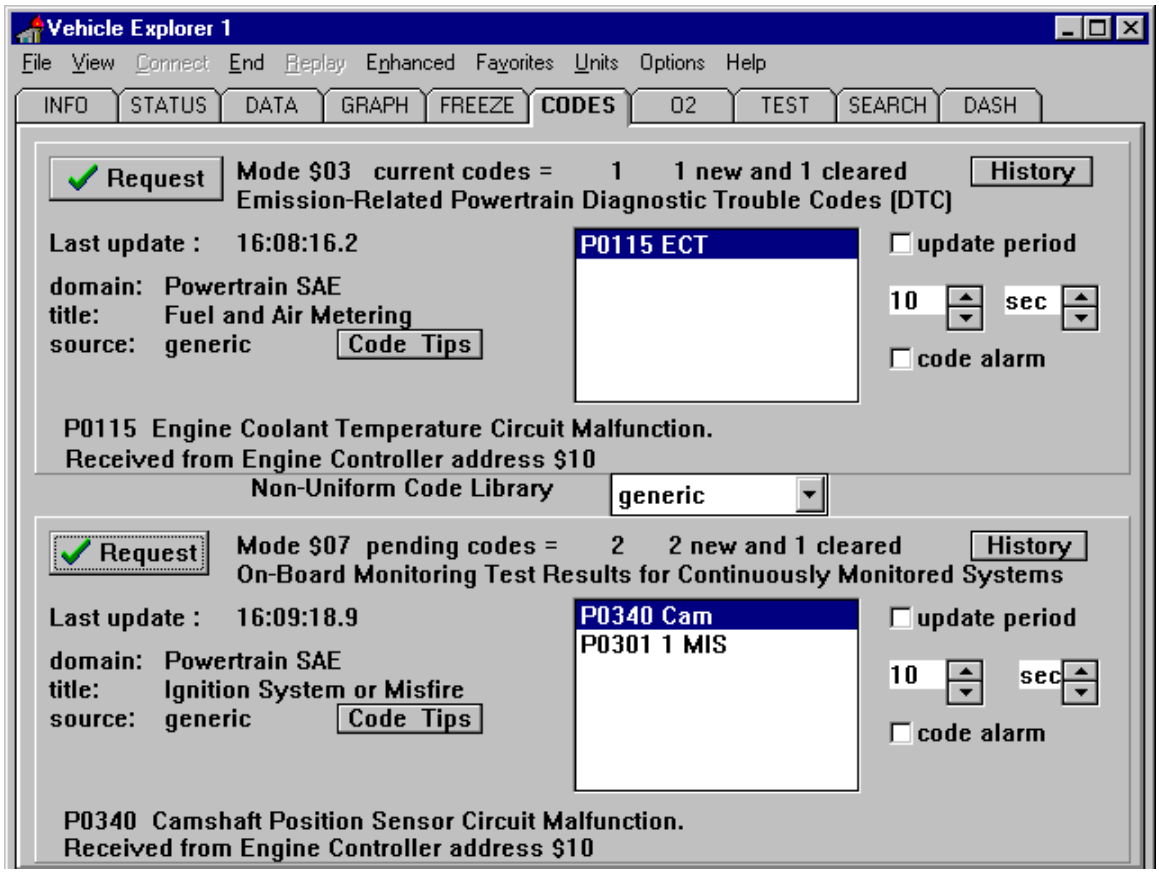


and then click on the SEND button, we are presented with the following data from the ECU.



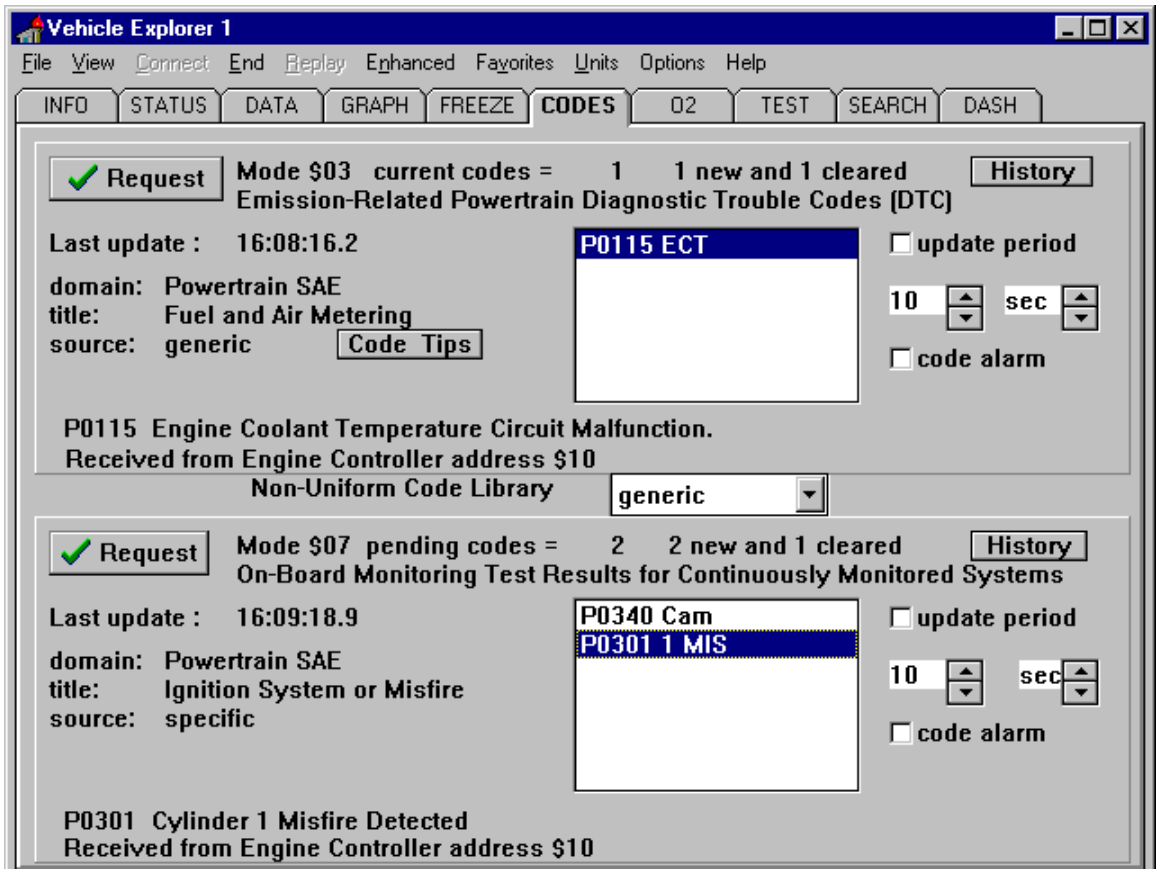
When I highlight the DTC FRZF line, the DTC that caused the freeze frame is explained in the text below the window, in this case the Engine Coolant Temperature Sensor. The rest of the data displayed is the instantaneous values of measured parameters at the time the malfunction occurred. If you look down to the ECT temperature value, it is indicated as being at -40 F. At the time of the test the engine was fully warmed up so obviously this is an obvious incorrect value and draws attention to the engine coolant temperature sensor as being defective, or some related malfunction, which in this case was the wiring effectively going open circuit to this sensor.

If I now switch back to the CODES screen and click on the REQUEST button for the MODE $07 faults we get the following

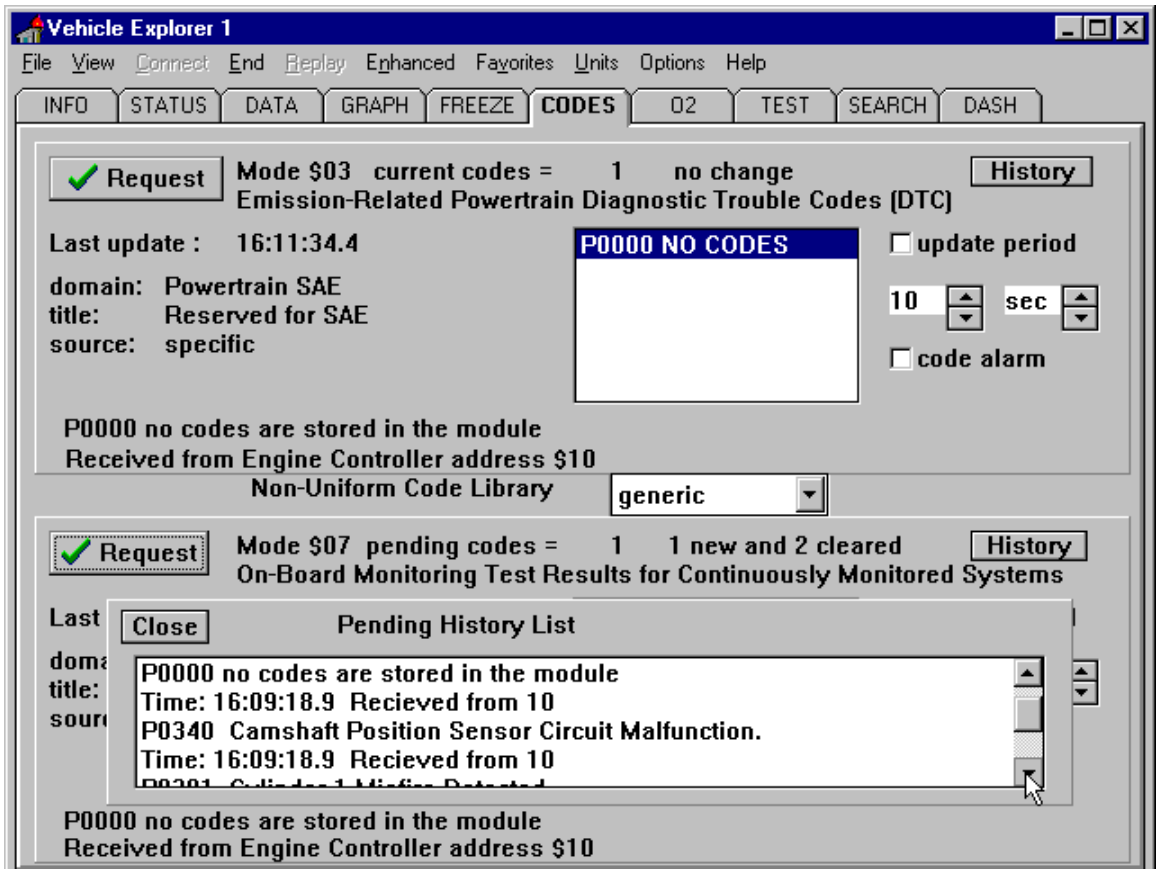


This represents the other two faults I created with the vehicle. The first code is highlighted and you can see its meaning in the bottom left of the screen shot and we are not surprised to see it is the camshaft position sensor circuit.

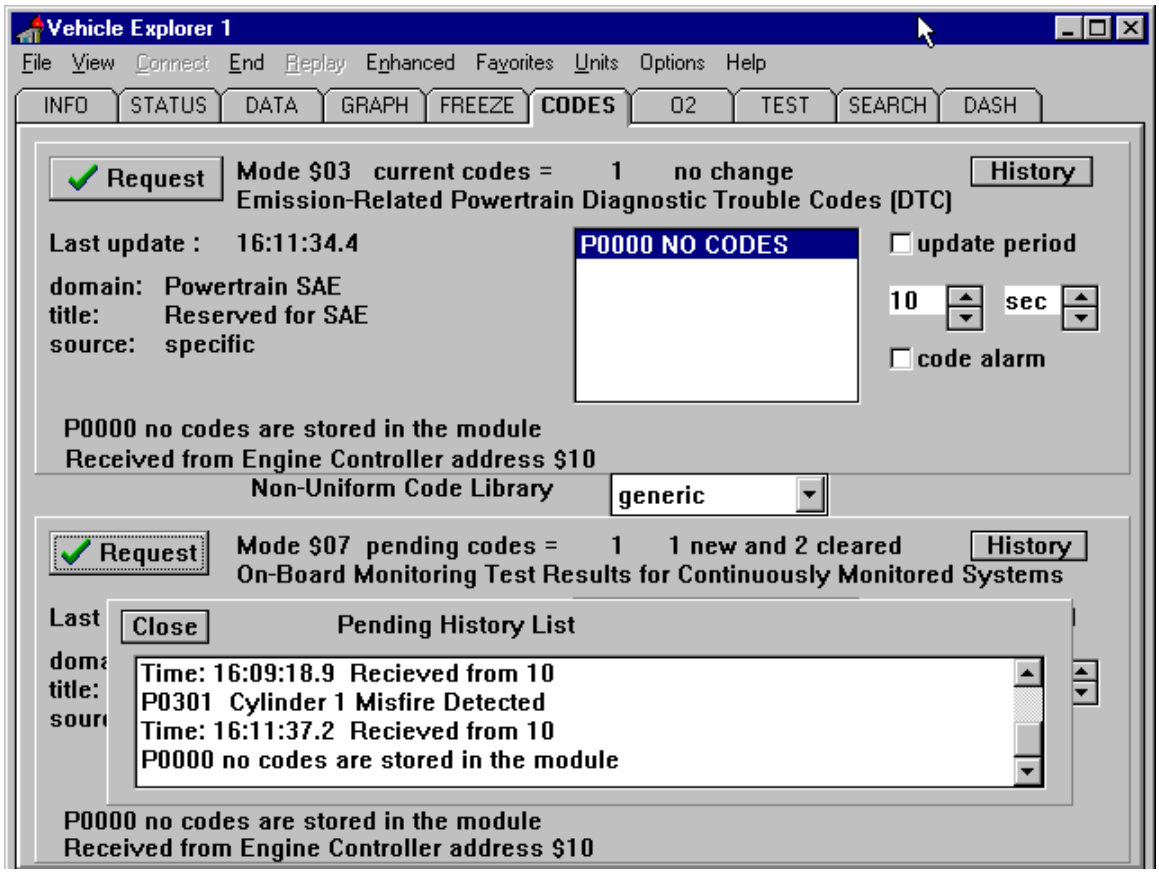
If I now highlight the fault code below it then the description in the bottom left of the screen changes to this



and informs us that there is a cylinder 1 Misfire detection. Like the previous mode if we click on the HISTORY tab to the right of the window we get the following



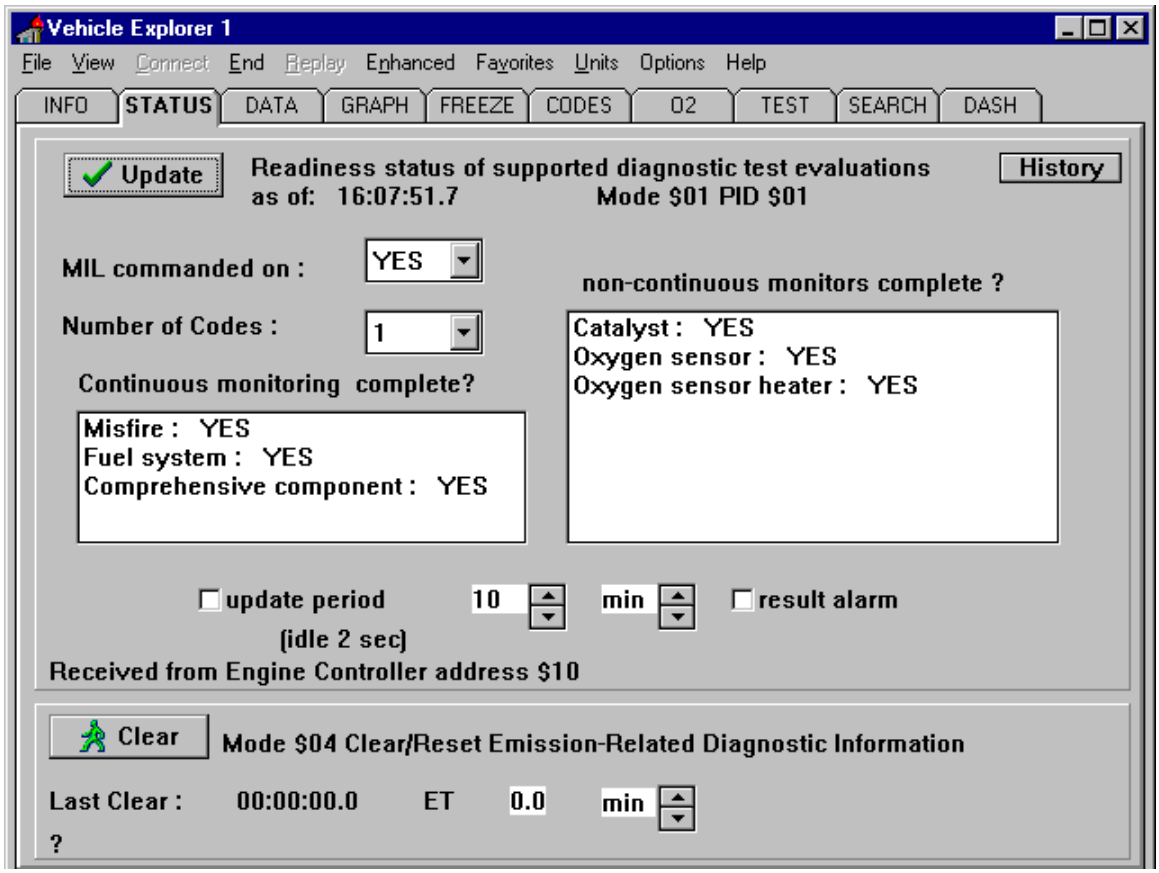
and scrolling down this window we get



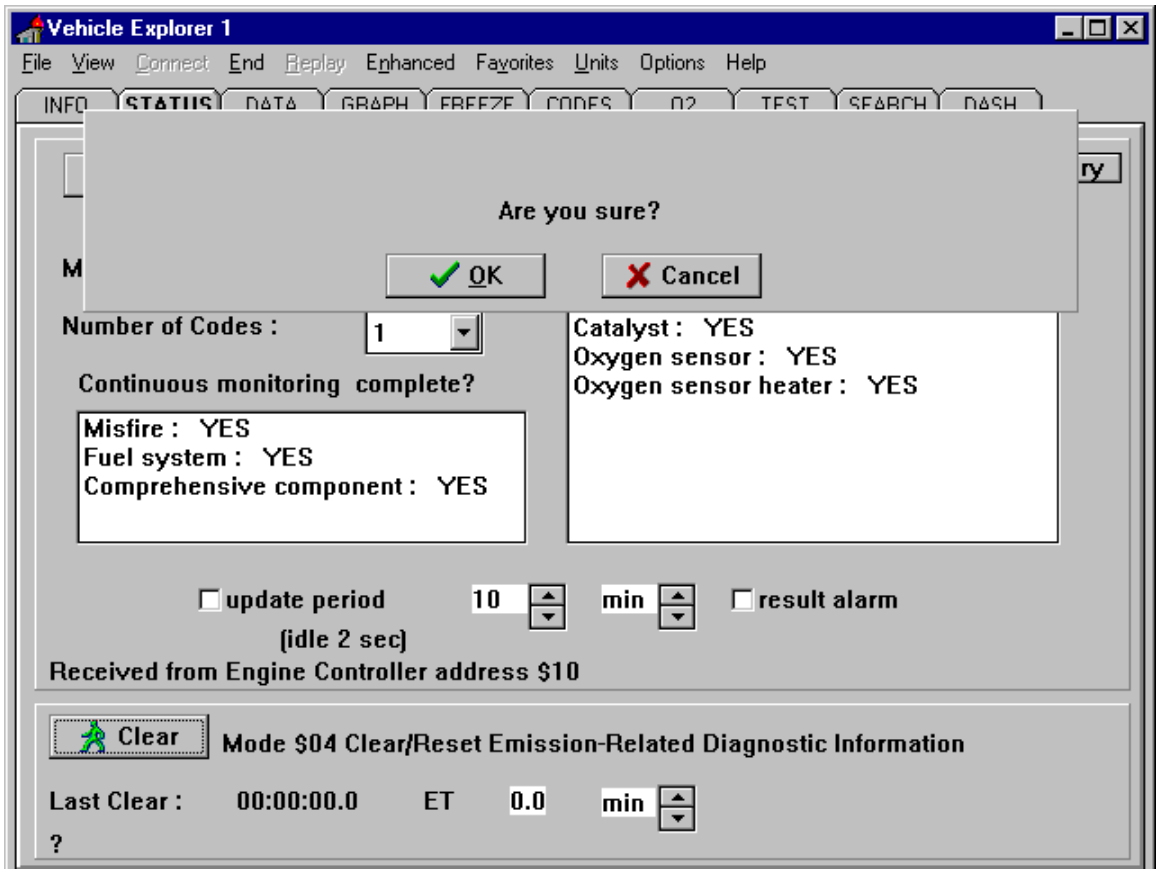
What you are seeing here is a feature specific to OBD2. The engine coolant temperature sensor is a main component in deciding the fuel injection period and hence a wrong value can increase the emissions generated by the vehicle. As this standard is concerned with keeping emissions to the absolute minimum this is termed a category ‘A’ fault code. In other words when such a malfunction is detected the diagnostic system stores a fault code and immediately illuminates the MIL .

The malfunctions generated by the camshaft position sensor and cylinder misfire are classed as category ‘B’ fault codes. Although the diagnostic system detects them and stores fault codes, it does not illuminate the MIL. The fault is seen as a pending fault. What this means is that the fault would have to re-occur continuously throughout a predetermined number of drive cycles before it was upgraded to a class ‘A’ fault at which time the MIL would be illuminated. The system is basically designed to allow for certain intermittent faults to occur and provided they do not occur in ‘x’ number of drive cycles, the fault is ignored and the code cleared.

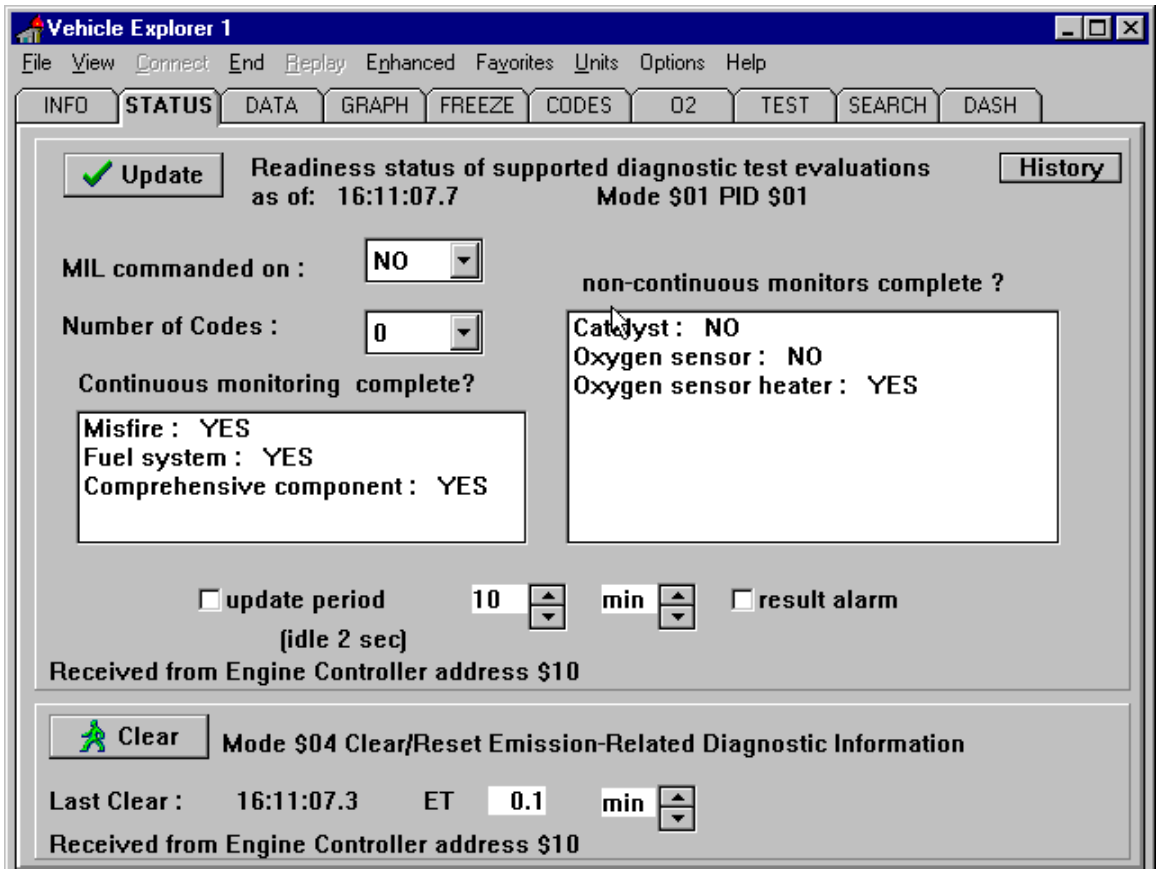
Okay, now I reconnect all the connectors I had earlier removed and I return to the STATUS screen.



I wish to clear the fault codes I had created and at the same time switch the MIL light off. So I click on the CLEAR button to the bottom left of the screen and if you remember I am presented with this conformation splash screen

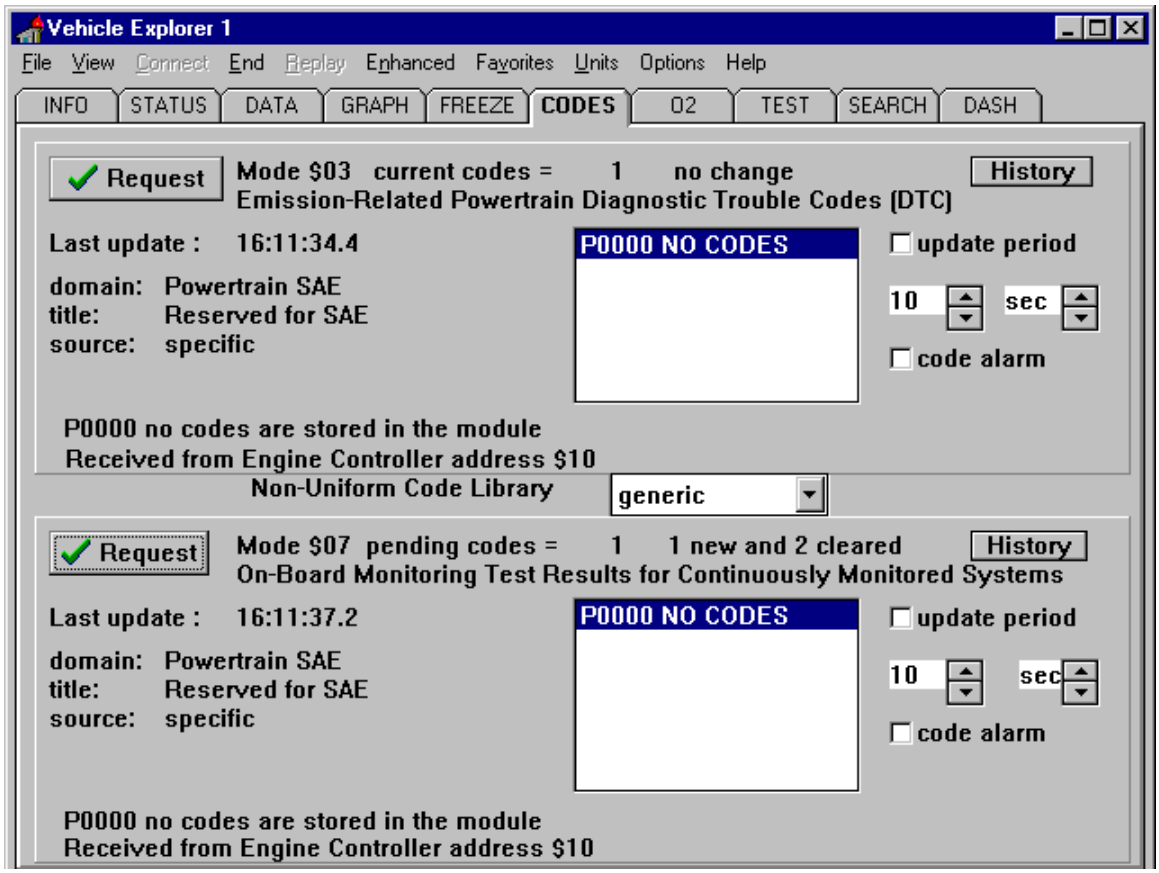


On clicking the OK button the STATUS screen changes to this



The MIL lamp is now switched off, there are no fault codes stored in the fault memory and the non-continuous monitor tests have been reset.

To confirm that the fault codes are clear I return to the CODES screen and click on the REQUEST buttons for both the category ‘A’ & ‘B’ fault codes



You can clearly see that the fault codes have now been cleared and everything is running as it should.

Hopefully by now you will have seen how the VE program relates to the OBD2 standard, and that you perhaps now have a clearer understanding of how the standard works. The only real way to learn how to use this program is to practice it on an OBD2 compliant vehicle. By trial and error you will become comfortable and confident in its use.