Welcome

AUTOMOTIVE TECHNICIAN TRAINING SERVICES

Presents

Monitors and Mode 6

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Your Instructor For This Seminar

"G" Jerry Truglia

- **National Trainer, ASE World Class, Master: Auto, Truck, School Bus, L1, L3, CNG and…**
- **ATTP Master Instructor, New York State, CT and New Jersey**
- **STS (Service Technician Society) 2003 President**
- **TST (Technicians Service Training) Founder and President**
- **Author / Co Author/ Technical adviser on 25 plus books including OBD II and Mode 6, and Understanding and Diagnosing Hybrid Vehicles**
- **Published articles for multiple newsletters, and magazines**
- **Picked as one of the Top Instructors in the country by EPA & SAE**
- **Numerous Radio, TV, Internet, and SAE Video appearances**
- **PTEN, MotorAge and TST Webcast Instructor**
- **Motor Magazine Top 20 award winner**
- **Provider of OBD II Training for 14 states, Ontario Canada and the US EPA**
- **Guest speaker at SAE Congress, IM Solutions and Clean Air Conference**

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Monitors and Mode 6

What will be covered:

- OBD II Monitors
- DTC Repairs And OBD II Monitors
- What Is Mode 6
- Raw Data And Calculated Values
- Using Mode 6 Test Results
- How To Use Mode 6
- Repairing Vehicles Using Mode 6
- On Vehicle Mode 6 Testing

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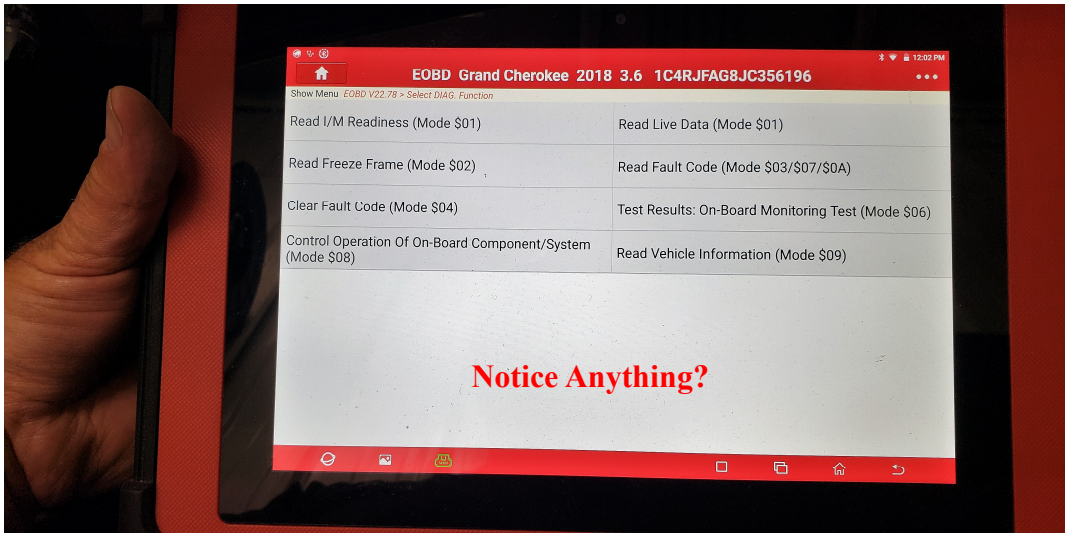
Monitors



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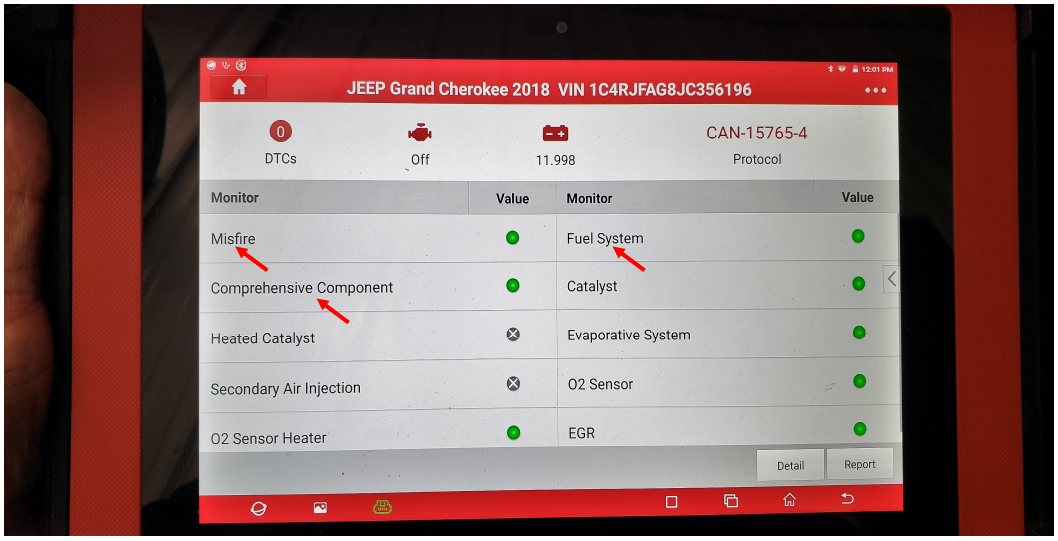
Monitors



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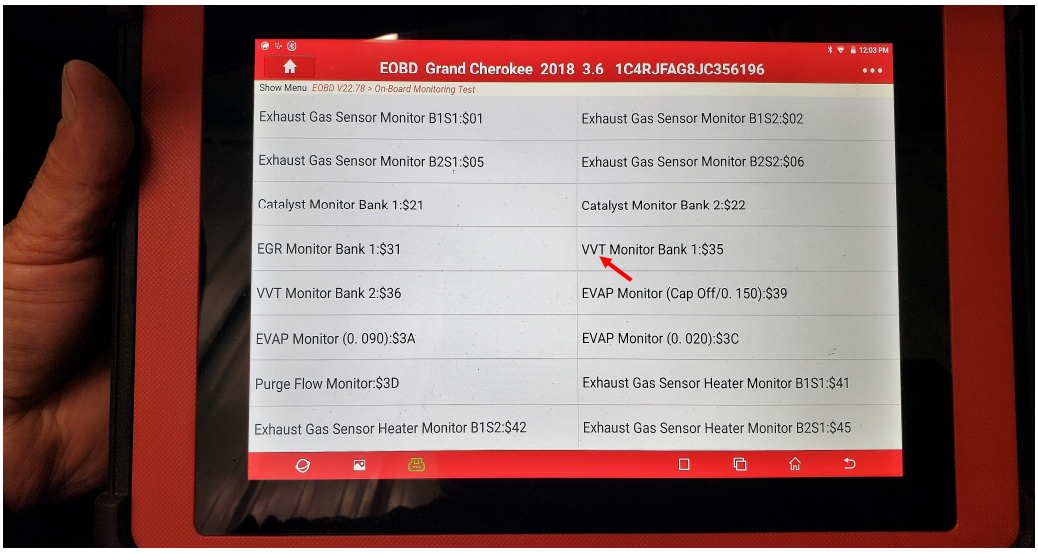
Monitors



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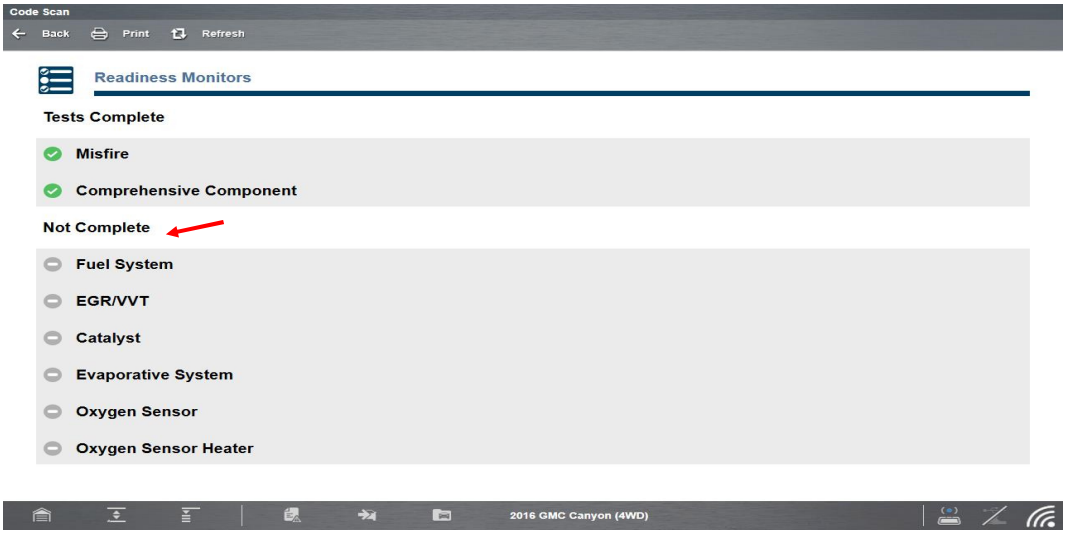
Monitors



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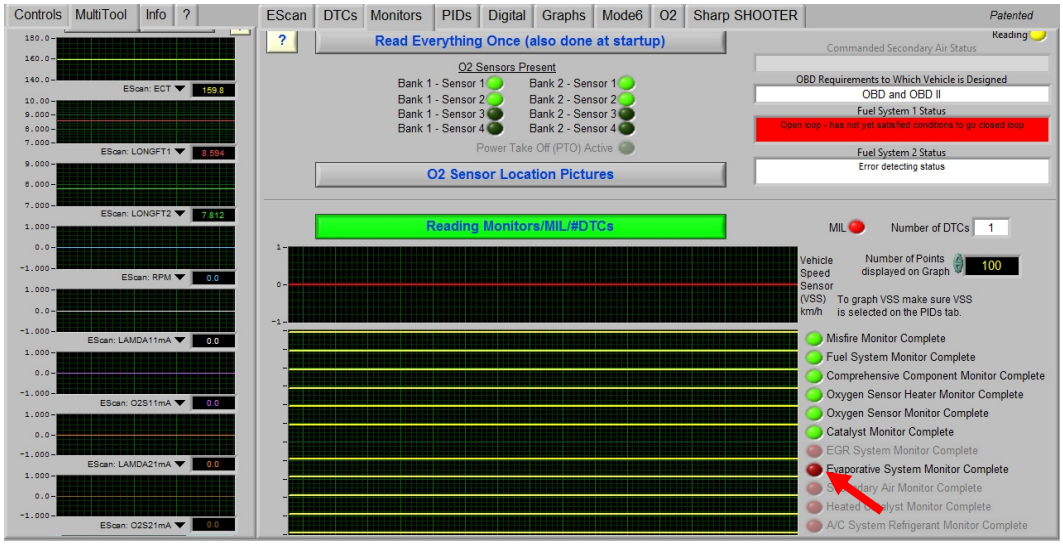
Monitors



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Monitor Information

Monitors on OBD II systems work like this:

- ✓ **Onboard test strategies programmed into the PCM check the vehicle systems**
- ✓ **These test sequences are called "Monitors"**
- ✓ **Monitors run when conditions are right for them to run**
- ✓ **Vehicle operating conditions required to run Monitors are referred to as "Trips"**

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Monitor Information

- **Just like the Hall monitor's job is to monitor the halls, there are different kinds of Monitors in the vehicle that monitor different vehicle systems.**
- **All vehicles have at least 3 Non-Continuous Monitors:**
- **O2 Heater, O2 Sensor & Catalyst.**
- **Other Monitors may include EVAP, EGR, Secondary AIR, AC System &VVT.**
- **These Monitors run only after completing a "Trip," which is a specific set of driving conditions demanded by the manufacturer.**

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Continuous Monitors

Some Monitors run c*ontinuously* as the vehicle is operated. These are known as "Continuous Monitors." They include the Comprehensive Component, Fuel System, and Misfire Monitors. Continuous Monitors should always appear as "Ready" when viewed on a scan tool. (Some scan tools and inspection machines may show them as "Complete," "Done," or "Yes.")

Three Continuous Monitors are supported on all OBD II vehicles: Misfire, Comprehensive Component, and Fuel System.

Continuously Monitored Systems	
OnBoard Module/System	Status
Misfire Monitoring	Complete
Fuel System Monitoring	Complete
Comprehensive Component Monitoring	Complete

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Non-Continuous Monitors

Non-Continuous Monitors run once per Trip. Unlike Continuous Monitors, the status of Non-Continuous Monitors are checked as part of the OBD II emissions test. If there are too many incomplete (Not Ready) Monitors, the vehicle fails an emission test and may illuminate the MIL.

Non-Continuous Monitoring Tests		
Monitor	Availability	Status
Catalyst	Supported	Not Complete
Heated Catalyst	Unsupported	
Evaporative System	Unsupported	
Secondary Air System	Unsupported	
A/C System	Unsupported	
Oxygen Sensor	Supported	Not Complete
Oxygen Sensor Heater	Supported	Not Complete
EGR System	Supported	Not Complete

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Non-Continuous Monitors

Non-Continuous Monitors, Oxygen Sensor Heater, Oxygen Sensor, Catalyst, EVAP, EGR, Secondary Air and now VVT are used in many vehicles.

Air Conditioning and Heated Catalyst are not currently used and are listed as Unsupported. The Air Conditioning Monitor was originally intended for use only in vehicles with R-12 systems.

Non-Continuous Monitoring Tests		
Monitor	Availability	Status
Catalyst	Supported	Not Complete
Heated Catalyst	Unsupported	
Evaporative System	Unsupported	
Secondary Air System	Unsupported	
A/C System	Unsupported	
Oxygen Sensor	Supported	Not Complete
Oxygen Sensor Heater	Supported	Not Complete
EGR System	Supported	Not Complete

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Non-Continuous Monitors

Two other Non-Continuous Monitors, Thermostat Monitor (began 2000 M/Y) and PCV Monitor (began 2002 M/Y) do not have their own Monitor title on most scan tools, however they do have a set of DTCs that are checked in the Comprehensive Component Monitor (CCM).

Note: Not all light duty diesel vehicles support Non-Continuous Monitors, but new ones do.

The Non-Continuous Monitors that must be used all the time are: Oxygen Sensor Heater, Oxygen Sensor and Catalyst.

Non-Continuous Monitoring Tests		
Monitor	Availability	Status
Catalyst	Supported	Not Complete
Heated Catalyst	Unsupported	
Evaporative System	Unsupported	
Secondary Air System	Unsupported	
A/C System	Unsupported	
Oxygen Sensor	Supported	Not Complete
Oxygen Sensor Heater	Supported	Not Complete
EGR System	Supported	Not Complete

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Things That Prevent Monitors From Running – Becoming READY

1. Engine Thermostat
2. Engine Coolant/ Antifreeze Mixture
3. Crankshaft Relearn Not Completed
4. DTC's or Pending DTC's Stored
5. Vehicle Fuel Level Above 15% And Below 85 %
   * Check Manufacturer Specs
6. Battery And Charging Voltage
7. Mode 6 data that indicates a system that is borderline failing
8. The PCM needs a soft reset

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Things That Prevent Monitors From Running – Becoming READY

No hocus pocus is necessary. The previous need to be corrected in order to run Monitors.

On extremely tough-to-run Monitors, some vehicles need you to artificially set a DTC to wake up the PCM.

After making a misfire or some other malfunction, a DTC will be set.

Erase it and afterward complete the Drive Cycle to allow Monitors to become Ready.

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Monitors Tips

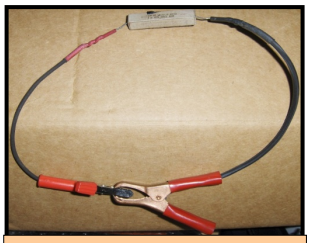
As previous stated on some vehicles you will need to force a DTC, followed by erasing the DTC. Or

If all else fails, you may need to erase the computer learned memory and start over. Disconnect the battery cables and connect a 1 ohm - 10 watt resistor for at least 5 minutes.

This erases learned computer values and place the computer in a "fast-learn" mode that accelerates Monitor completion.

Monitors Not Complete

Ready Scan from OTC/SPX



1 Ohm – 10 watt resistor

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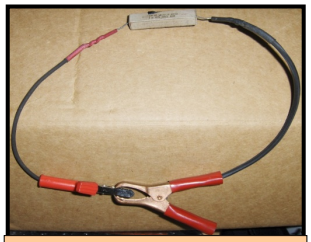
Monitors Tips

Caution: Disconnecting the battery in some vehicles can cause significant problems when some "drive by wire" throttles and radios with security codes refuse to work after the battery is reconnected. This is especially problematic on newer vehicles.

Note: If you replaced an O2, MAF or any other part with a poor quality aftermarket part and now the Monitors are not completing, you may want to replace it with an OE equivalent.

Monitors Not Complete

Ready Scan from OTC/SPX



1 Ohm – 10 watt resistor

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Monitors Tips

The next examples are not typical but demonstrate very odd criteria are sometimes required to run Monitors.

Readiness Monitor Drive Patterns: EVAP Monitors (Continued)

Drive Pattern Preconditions

Courtesy of University Toyota, Toyota Motor Sales USA, Inc.

The monitor will not run unless:

- MIL is OFF.
- Fuel level is between 1/2 to 3/4 full.
- Altitude is 7800 feet (2400 m) or less.*
- ECT (Coolant Temp) is between 40F and 95F (4.4C – 35C).
- IAT (Intake Air) is between 40F and 95F (4.4C – 35C).*
- Cold Soak Procedure has been completed.

* For 2002 MY and later vehicles: The readiness test can be completed in cold ambient conditions (less than 40F / 4.4C) and/or at high altitudes (more than 7800 feet / 2400 m) if the complete drive pattern (including Cold Soak) is repeated a second time after cycling the ignition OFF.

NOTE:

Before starting the engine, the difference between ECT (Coolant Temp) and IAT (Intake Air) must be less than 13F (7C). (Refer to Examples 1 and 2 on previous page.)

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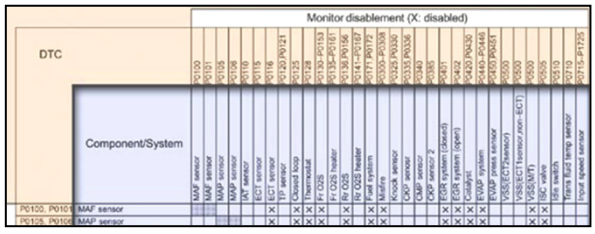
Monitors Tips

Monitor Disablers You Might Not Be Thinking About:

Wrong or defective thermostat. This can prevent the engine from reaching the correct operating temperature in a specific time. ***Air trapped in the cooling system can have the same effect.***

Wrong coolant mix, ***specifically those with way too much antifreeze.***



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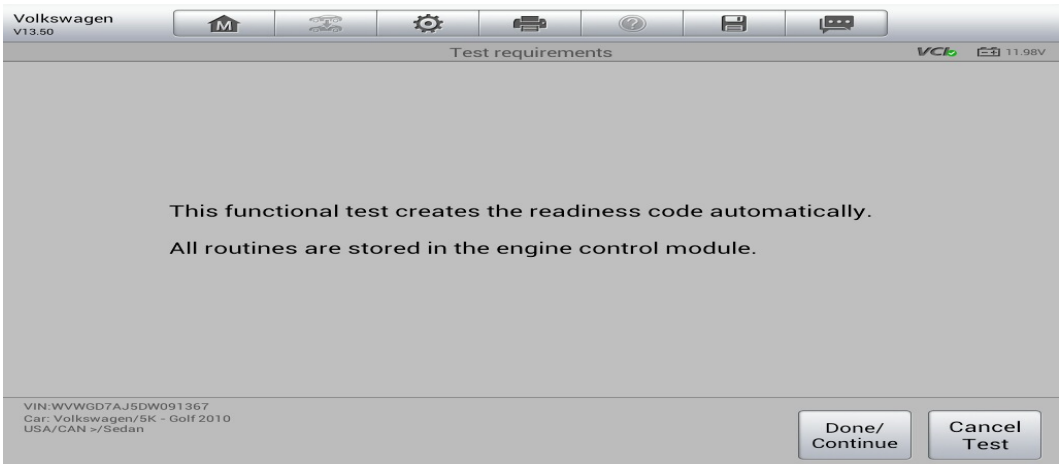
Monitors Tips

Getting Monitors Ready Via Scan Tool



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Generic Drive Cycle

The following is a Generic Drive Cycle that runs the Non-Continuous Monitors to Completion in most vehicles in about 30 minutes.

Step 1. Some vehicles must be sitting for 8 hours before the test, without a start. This is primarily for the EVAP monitor.

Step 2. Warm the engine to normal operating temperature before driving it.

Step 3. Drive the vehicle for 10 minutes at highway speeds.

Step 4. Drive the vehicle for 20 minutes in stop and go traffic with at least four idle periods at least 2-3 minutes. Do not turn the ignition off at anytime during the cycle.

When completed turn the Key off and wait 3 minutes before checking the status.

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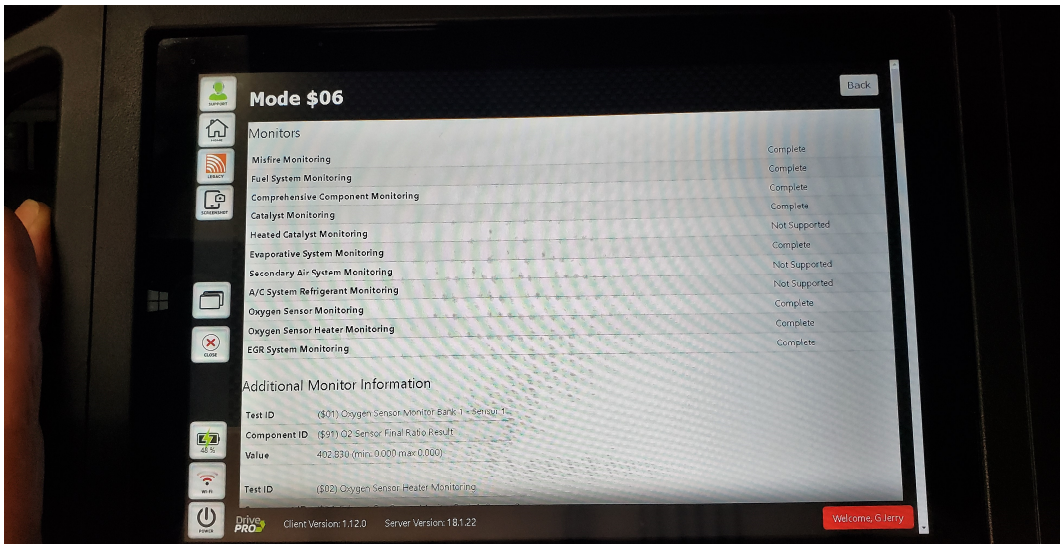
Monitors



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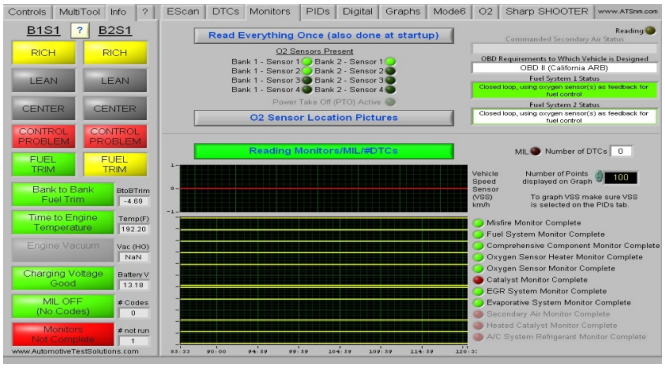
Monitor Information

Monitors on all vehicles are Incomplete (Not Ready) until they run to completion one time. Once they are set to Ready they will NOT change back to Incomplete (Not Ready) until the DTCs are erased, battery power is disconnected, or the PCM is disconnected and/or KAM (Keep Alive Memory) is lost.



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Monitor Information

This is an example of a Ford pickup with an OBD II connector that oddly enough is not OBD II certified due to overall vehicle weight. Just because it has an OBD II 16 cavity connector does not mean it's OBD II compliant. Always check the underhood Emission Label on all vehicles to make sure.

Vehicles 8501 lb/3856 kg and above DO NOT support OBD II, even though the vehicle has an OBD II 16 cavity connector.

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OBD II Modes

Mode	Description
01	Current PID Data
02	Freeze Frame Data
03	DTCs (Diagnostic Trouble Codes)
04	Clear DTCs (Clears Everything EXCEPT KAM)
05	O2 Sensor Data (Only Non CAN systems)
06	Most Other Quiz's / Test Results
07	Pending DTCs
08	Bi-Directional Control For Some EVAP Vent Solenoids
09	Vehicle Information (VIN / Calibration on most vehicles)
0A / 10	Permanent DTCs / Cleared DTCs

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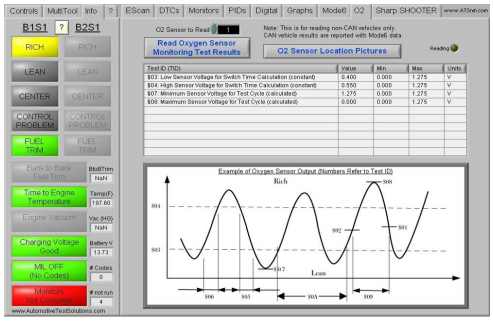
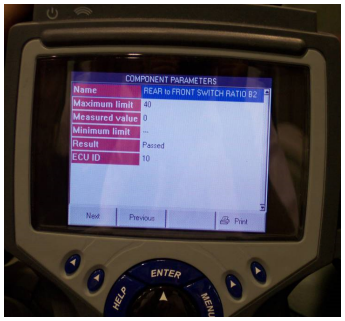
Mode 5 HO2s Sensor And Converter Test





Mode 5 is not available on all vehicles but when it is you should view the data. The results can be helpful in making a decision on a P0420 DTC. When Mode 5 is not available Mode 6 should be used to view O2 sensor test. Note: When Mode 6 does not have O2 sensor test look for info in Mode 5.

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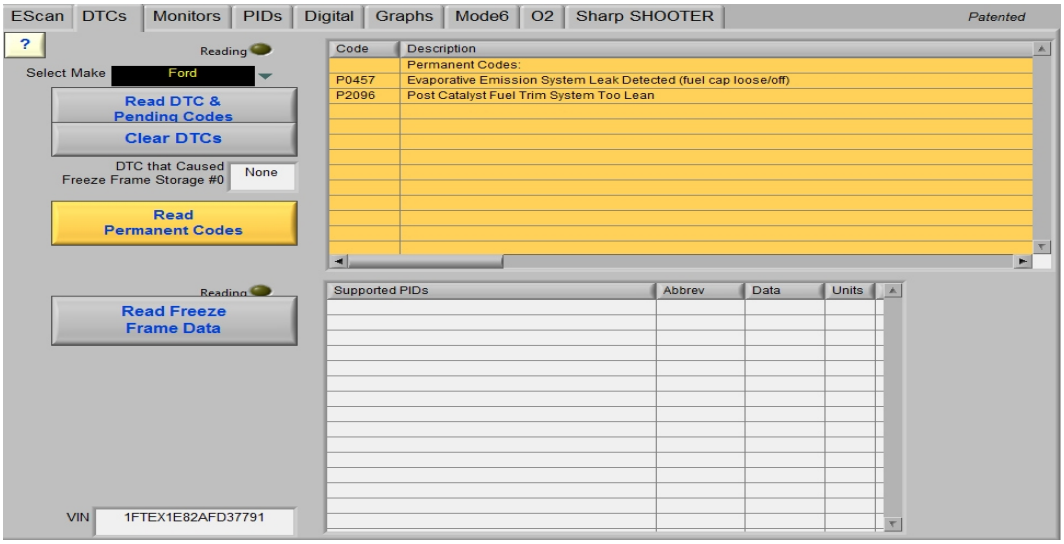
OBD II Mode 10



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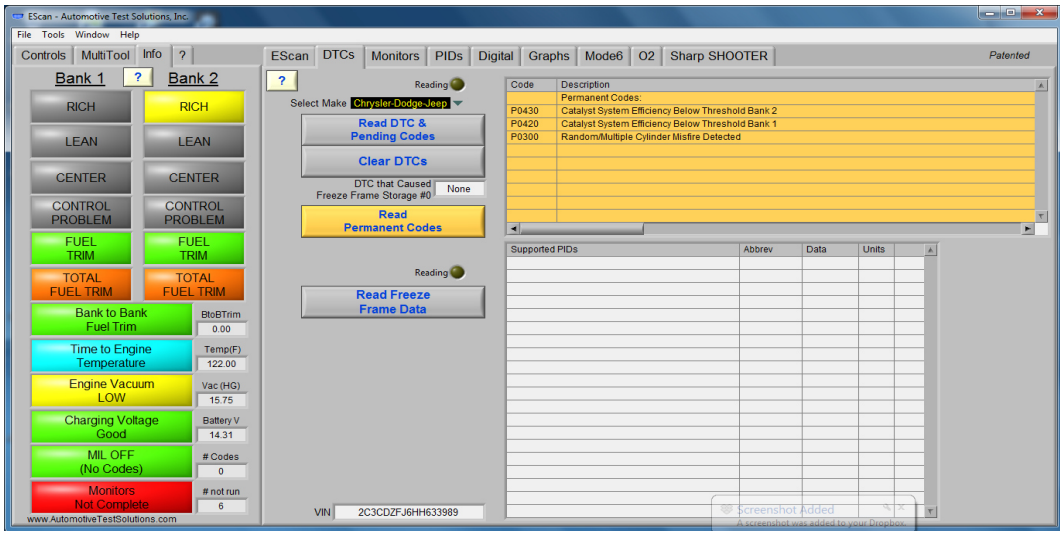
OBD II Mode 10



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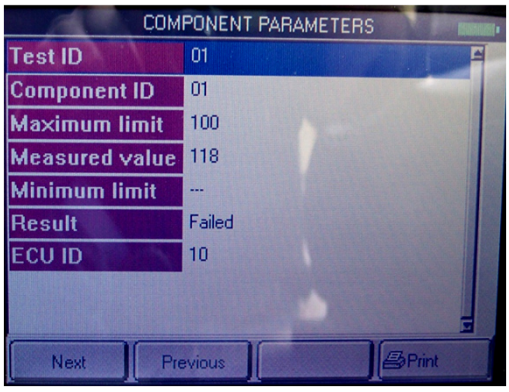
Mode 6

What is Mode 6?

In a nutshell, Mode 6 allows a scan tool to access the results of the onboard test results for non-continuous monitors. Ideally, Mode 6 will provide us with information about the most recent test data for these monitored systems.



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Hexadecimal

Counting to 16
Decimal Numbers - Right
Hexadecimal Number - Left

$1=1
$2=2
$3=3
$4=4
$5=5
$6=6
$7=7
$8=8
$9=9
$A=10
$B=11
$C=12
$D=13
$E=14
$F=15
$10-16

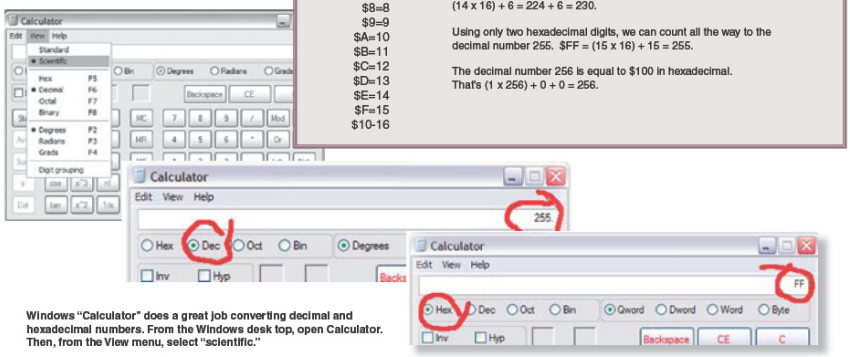
The decimal number 17 is represented by the hexadecimal number 11. That's 16x1 plus 1x1 = 17.

Let's try one more. Convert $E6 to decimal. Since $E=14 and it's in the "16's" column, we need to multiply 14x16 and then add the 6 from the right column to get the decimal equivalent.

(14 x 16) + 6 = 224 + 6 = 230.

Using only two hexadecimal digits, we can count all the way to the decimal number 255. $FF = (15 x 16) + 15 = 255.

The decimal number 256 is equal to $100 in hexadecimal. That's (1 x 256) + 0 + 0 = 256.



Windows "Calculator" does a great job converting decimal and hexadecimal numbers. From the Windows desk top, open Calculator. Then, from the View menu, select "scientific."

Type in the value you want converted and then select the correct scale radio button to display the converted value in Hexadecimal or Decimal.

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Mode 6

Pass/Fail Standards

Here is how Mode 6 is ***supposed*** to work:

- Vehicle manufacturers assign **Test IDs (TIDs)** and **Component IDs (CIDs)** for different systems and components used in their vehicles. Test data for many of these components and systems can be found in Mode 6.

- Mode 6 data are all manufacturer-specific — from the components listed — to the test values for each component. Mode 6 data is vehicle specific.

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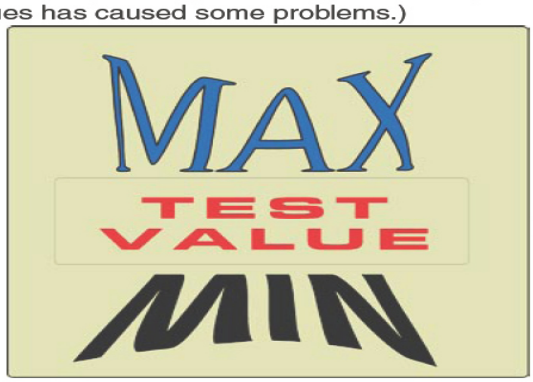
Mode 6

Pass/Fail Standards

- Raw test values are numbers that indicate test limits and actual results. These numbers do not always correspond to common measurement values like miles per hour, inches of vacuum, or rpm. They may be "computer speak" that won't mean a thing to us until they are converted to those common measurement values. Raw test values should be reported only as positive (unsigned) values. (Once again, this has not always been the case, and the use of negative test values has caused some problems.)

- Pass/Fail standards are referred to as test limits. To pass, a component test result must be **below a maximum**, **above a minimum**, or fall **between a minimum and a maximum** level. In cases where a minimum and a maximum test limit are used, two separate tests are run on the same component; one a minimum test, the other a maximum test. Two test results will be given.



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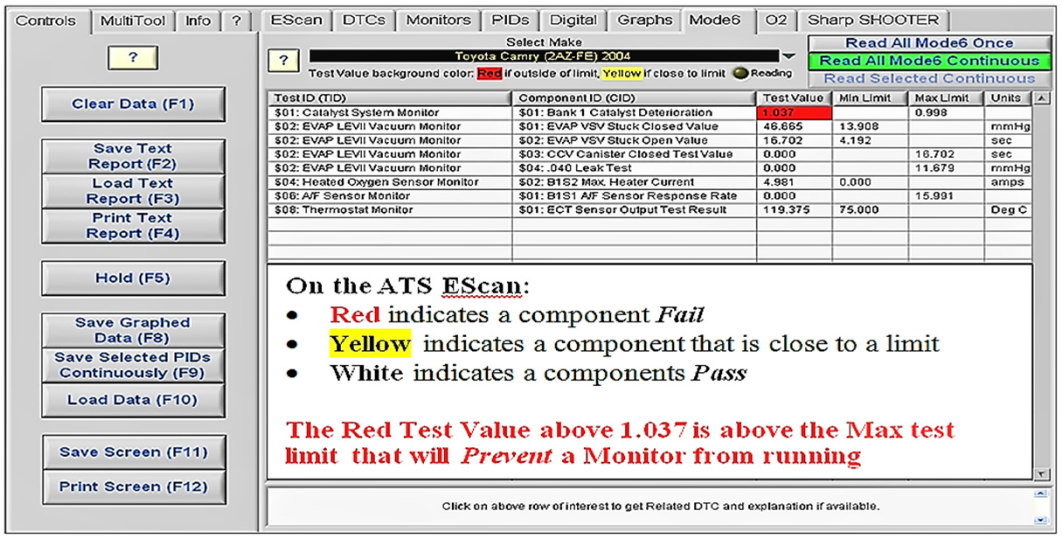
Mode 6



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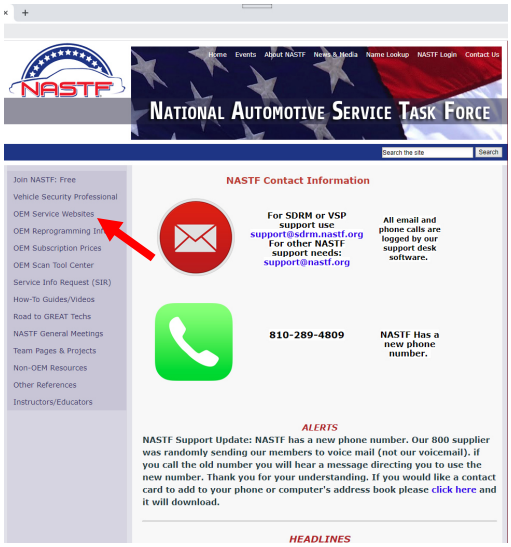
Get Factory Scan Tool Data Including Mode 6



Mode 6 On-Board Monitoring Test Results, and OBD-II Diagnostic Parameters

Identification and scaling of J1979 mode 6 test values and limits data available on GM vehicles, for use with a generic scan tool. This are equipped.

Generic Scan Tool Information - Mode 6 Data

- GM CAN - GM Powertrain
- GM Class 2 - GM Powertrain
- 2015-2016 City Express
- Cadillac Catera
- Cadillac 2003-2008 CTS, SRX, STS w/V6
- Saturn VUE w/V6
- Saturn L-series w/V6
- Solstice, Sky w/2.0L turbo
- Rendezvous w/3.6L V6
- LaCrosse, Allure w/3.6L V6
- Pontiac G8 w/3.6L V6
- 2008 Equinox, Torrent w/3.6L V6
- Aveo, Wave, Optra and Epica

OBD II System Information

- 1996 - 2003 Metro/Tracker with mode 6 data
- 1996 - 2003 Prizm/Vibe

Courtesy of GM

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Get Factory Scan Tool Data Including Mode 6

GM mode $06 data definitions for GM vehicles using GMLAN diagnostic data link

Some items have footnotes, defined on the last pages.

OBD Monitor ID (OBDMID)	Test ID (TID)	Units and Scaling ID (UASID)	Description	Range For Information ONLY. Source information is J1979	Resolution For Information ONLY. Source information is J1979
A8	0C	24 [13]	Misfire counts since the last restart after hybrid/electric autostart	0 to 65535 counts	1 count / bit
A8	0C	24 [16]	Misfire counts for last/current driving cycles (calculated) [16]	0 to 65535 counts	1 count / bit
A8	A5	24	EWMA (Exponentially Weighted Moving Average) misfire counts for the last 10 driving cycles	0 to 65535 counts	1 count / bit
		Misfire Cylinder 8 Data			
A9	0B	24	EWMA (Exponential Weighted Moving Average) misfire counts for the last 10 driving cycles	0 to 65535 counts	1 count / bit
A9	0B	24 [13]	EWMA (Exponential Weighted Moving Average) misfire counts since the last restart after hybrid/electric autostop for the last 10 driving cycles	0 to 65535 counts	1 count / bit
A9	0B	24 [16]	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated), Calculation: 0.1 * (current counts) + 0.9 * (previous average), Initial value for (previous average) = 0 [16]	0 to 65535 counts	1 count / bit
A9	0C	24	Misfire counts for the last / current driving cycles	0 to 65535 counts	1 count / bit
A9	0C	24 [13]	Misfire counts since the last restart after hybrid/electric autostart	0 to 65535 counts	1 count / bit
A9	0C	24 [16]	Misfire counts for last/current driving cycles (calculated) [16]	0 to 65535 counts	1 count / bit
A9	A5	24	EWMA (Exponentially Weighted Moving Average) misfire counts for the last 10 driving cycles	0 to 65535 counts	1 count / bit
AA	0B [16]	24	**EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated)**, Calculation: 0.1 * (current counts) + 0.9 * (previous average), Initial value for (previous average) = 0	0 to 65535 counts	1 count / bit
AA	0C [16]	24	Misfire counts for last/current driving cycles (calculated)	0 to 65535 counts	1 count / bit
AB	0B [16]	24	**EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated)**, Calculation: 0.1 * (current counts) + 0.9 * (previous average), Initial value for (previous average) = 0	0 to 65535 counts	1 count / bit
AB	0C [16]	24	Misfire counts for last/current driving cycles (calculated)	0 to 65535 counts	1 count / bit
AC	0B [16]	24	**EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated)**, Calculation: 0.1 * (current counts) + 0.9 * (previous average), Initial value for (previous average) = 0	0 to 65535 counts	1 count / bit
AC	0C [16]	24	Misfire counts for last/current driving cycles (calculated)	0 to 65535 counts	1 count / bit

Courtesy of GM

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Get Factory Scan Tool Data Including Mode 6

J1979 Misfire Mode $06 Data			
Monitor ID	Test ID	Description	
A1	$80	Total engine misfire and catalyst damage misfire rate (updated every 200 revolutions) (P030x)	percent
A1	$81	Total engine misfire and emission threshold misfire rate (updated every 1,000 revolutions) (P030x)	percent
A1	$82	Highest catalyst-damage misfire and catalyst damage threshold misfire rate (updated when DTC set or clears) (P030x)	percent
A1	$83	Highest emission-threshold misfire and emission threshold misfire rate (updated when DTC set or clears) (P030x)	percent
A1	$84	Inferred catalyst mid-bed temperature (P030x)	°C
A2 – AD	$0B	EWMA misfire counts for last 10 driving cycles (P030x)	events
A2 – AD	$0C	Misfire counts for last/current driving cycle (P030x)	events
A2 – AD	$80	Cylinder X misfire rate and catalyst damage misfire rate (updated every 200 revolutions) (P030x)	percent
A2 – AD	$81	Cylinder X misfire rate and emission threshold misfire rate (updated every 1,000 revolutions) (P030x)	percent

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Get Factory Scan Tool Data Including Mode 6

The following list indicates what monitors and functions have been altered from OBD-II for EMD calibrations:

Monitor / Feature	Calibration
Catalyst Monitor	Functional catalyst monitor required starting in the 2010 MY to meet EMD+.
Misfire Monitor	Calibrated in for service, all DTCs are non-MIL. Catalyst damage misfire criteria calibrated out, emission threshold criteria set to 4%, enabled between 150 °F and 220 °F, 254 sec start-up delay.
Oxygen Sensor Monitor	Front O2 sensor "lack of switching" tests and all circuit and heater tests calibrated in, response/delay test calibrated out. Rear O2 sensor functional tests and all circuit and heater tests calibrated in, response/delay test calibrated out.
EGR/VVT Monitor	Same as OBD-II calibration except that P0402 test uses slightly higher threshold.
Fuel System Monitor	Fuel monitor and FAOSC monitor (rear fuel trim for UEGO systems) same as OBD-II calibration, A/F imbalance monitor calibrated out.
Secondary Air Monitor	Not applicable, AIR not used.
Evap System Monitor	Evap system leak check calibrated out, fuel level input circuit checks retained as non-MIL. Fuel tank pressure sensor and canister vent solenoid may be deleted.
PCV Monitor	Same hardware and function as OBD-II.
Thermostat Monitor	Thermostat monitor calibrated out.
Comprehensive Component Monitor	All circuit checks, rationality and functional tests same as OBD-II.
Communication Protocol and DLC	Same as OBD-II, all generic and enhanced scan tool modes work the same as OBD-II but reflect the EMD calibration that contains fewer supported monitors. "OBD Supported" PID indicates EMD ($11).
MIL Control	Same as OBD-II, it takes 2 driving cycles to illuminate the MIL.

EMD system implementation and operation is a subset of OBD-II and is described in the remainder of this document.

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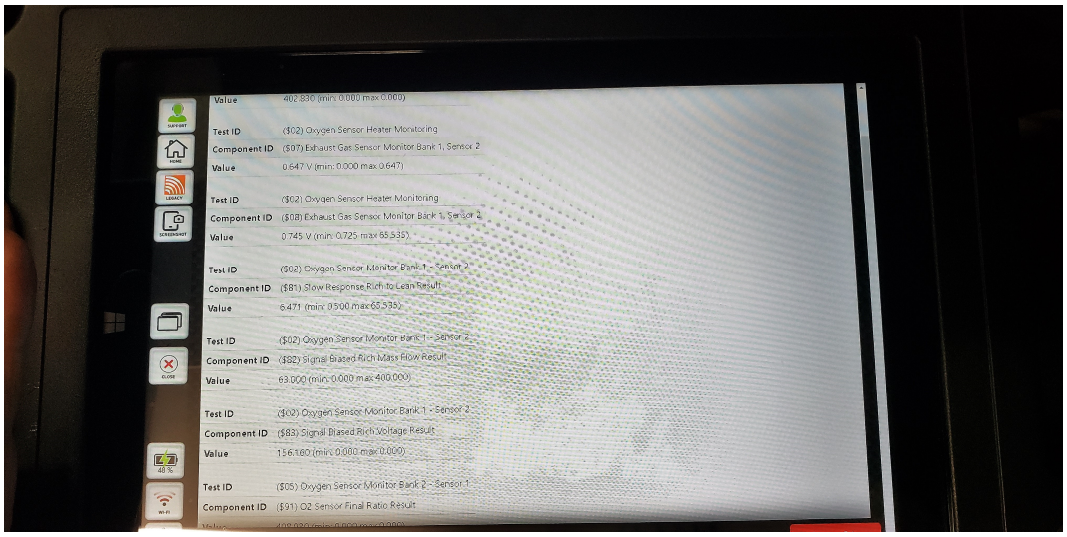
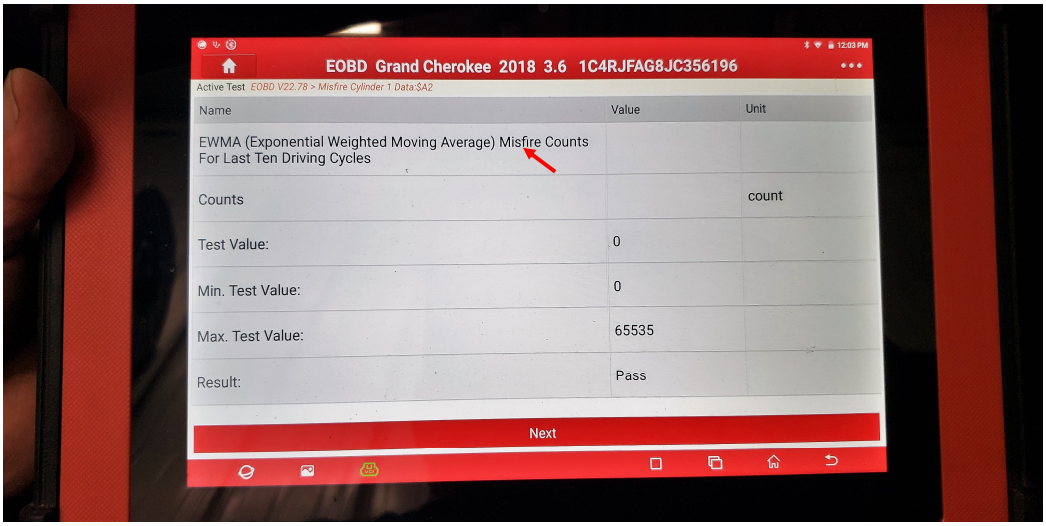
Mode 6



39

Mode 6 Misfire



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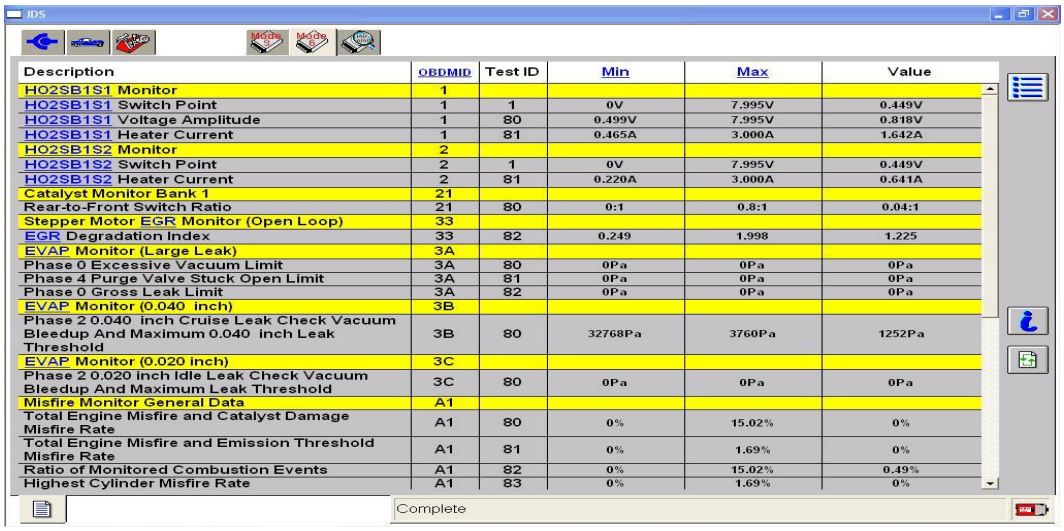
Factory Enhanced Scan Data



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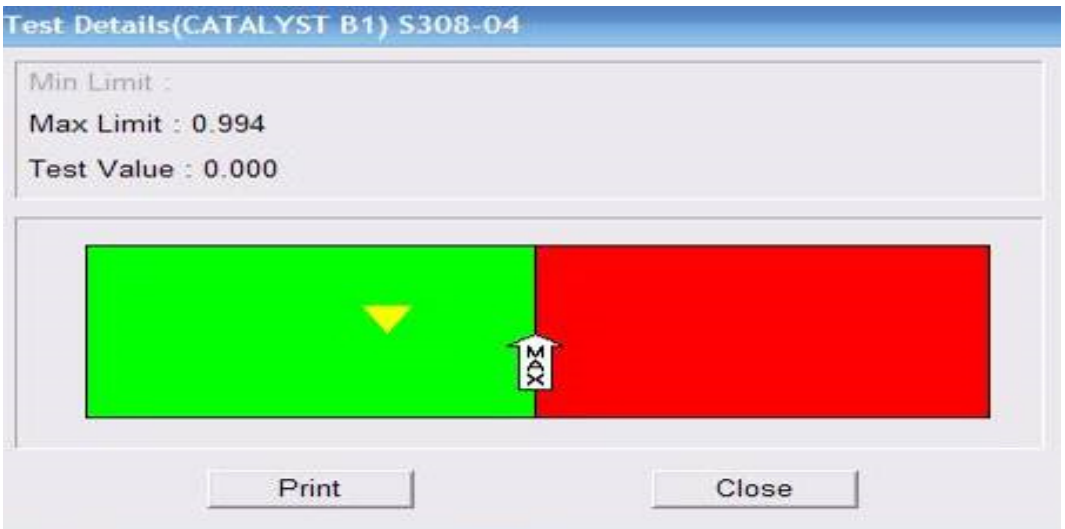
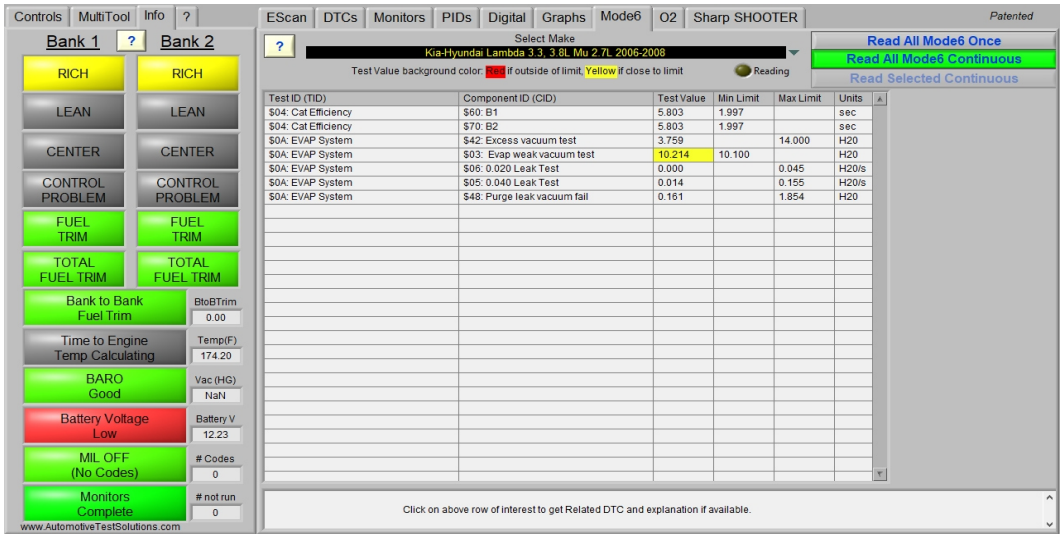
Factory Enhanced Scan Data



42

Mode 6 – Hyundai / Kia



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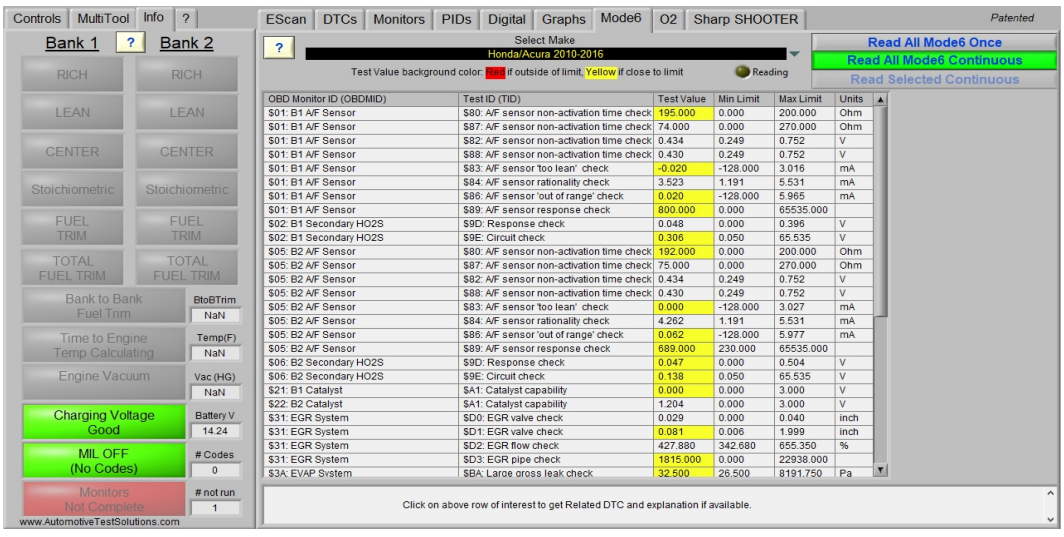
Mode 6 – Acura / Honda



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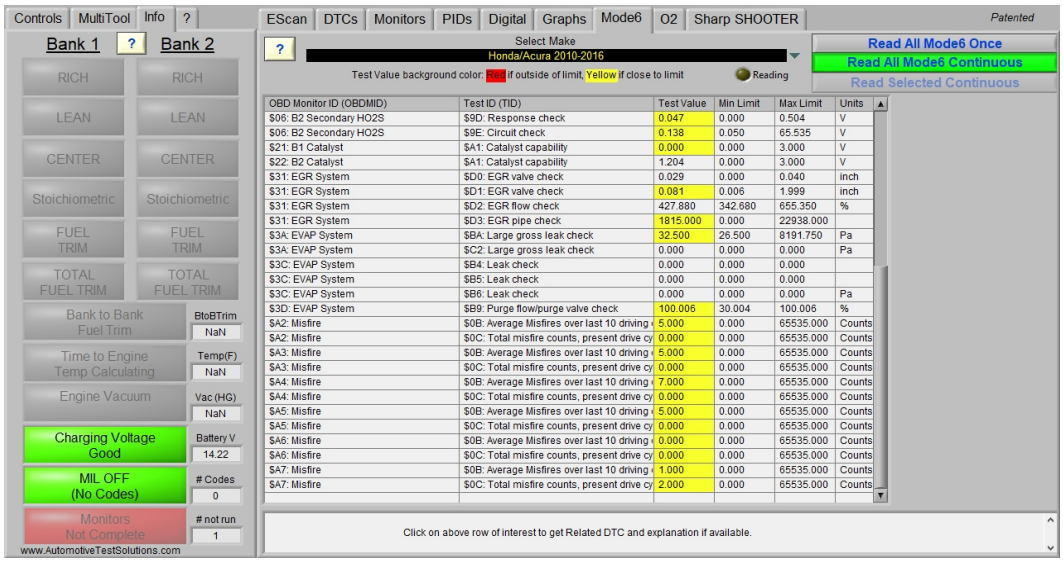
Mode 6 – Acura / Honda



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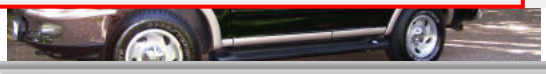
DTCs - Mode 6 Case Study

Code	Description
	DTC Codes:
P0401	Exhaust Gas Recirculation Flow Insufficient Detected
	Pending Codes:
P0300	Random/Multiple Cylinder Misfire Detected
P0308	Cylinder 8 Misfire Detected



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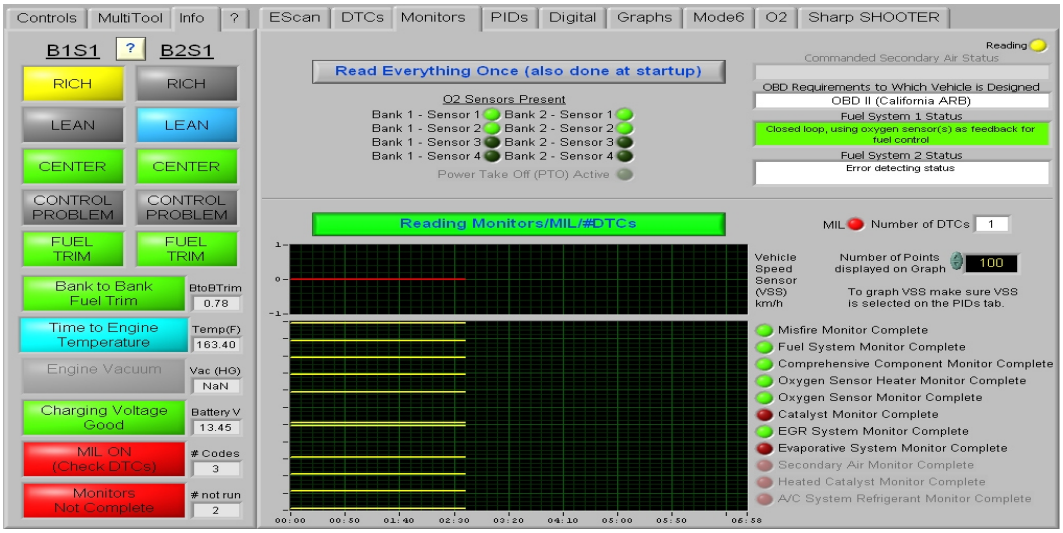
P0308	Cylinder 8 Misfire Detected

46

DTCs - Mode 6 Case Study



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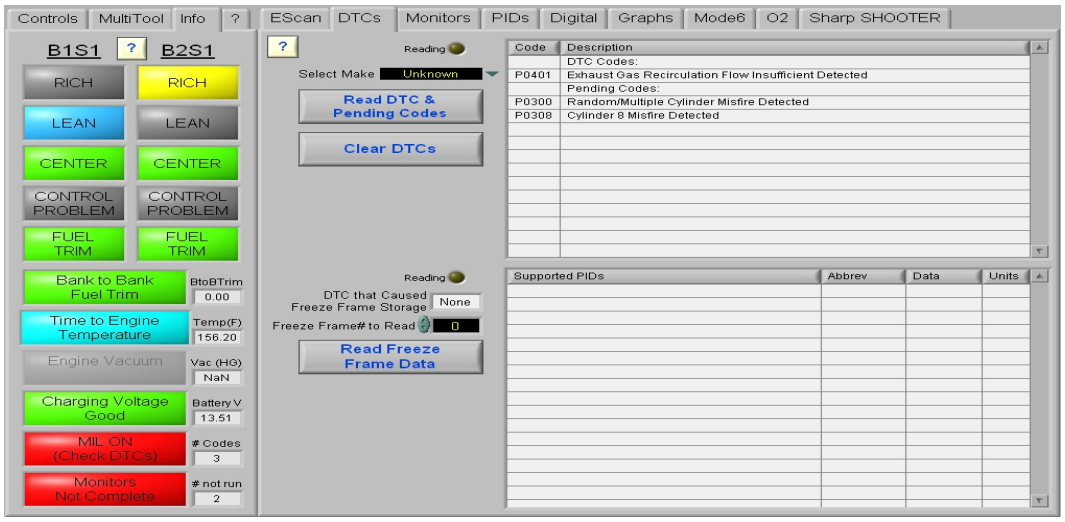
DTCs - Mode 6 Case Study



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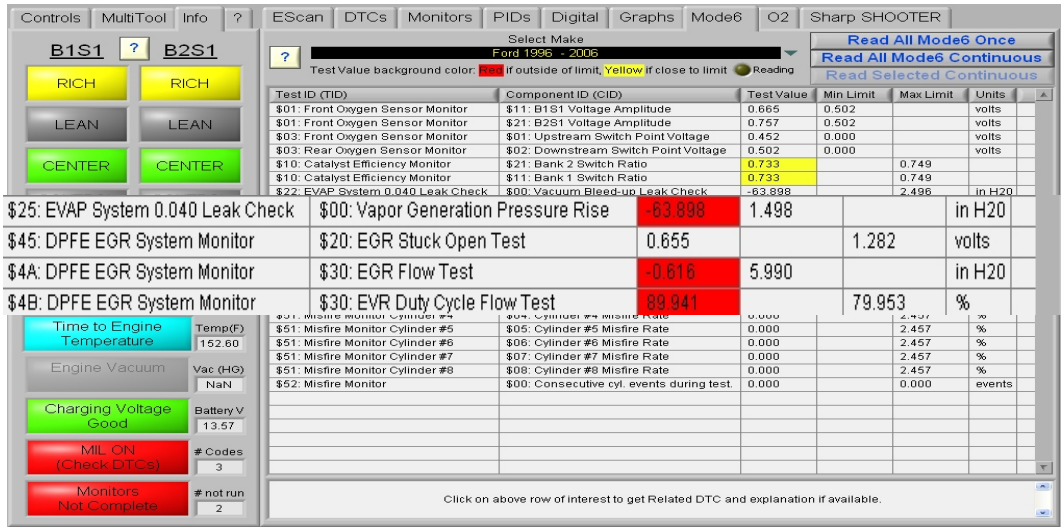
DTCs - Mode 6 Case Study



49

The Fix

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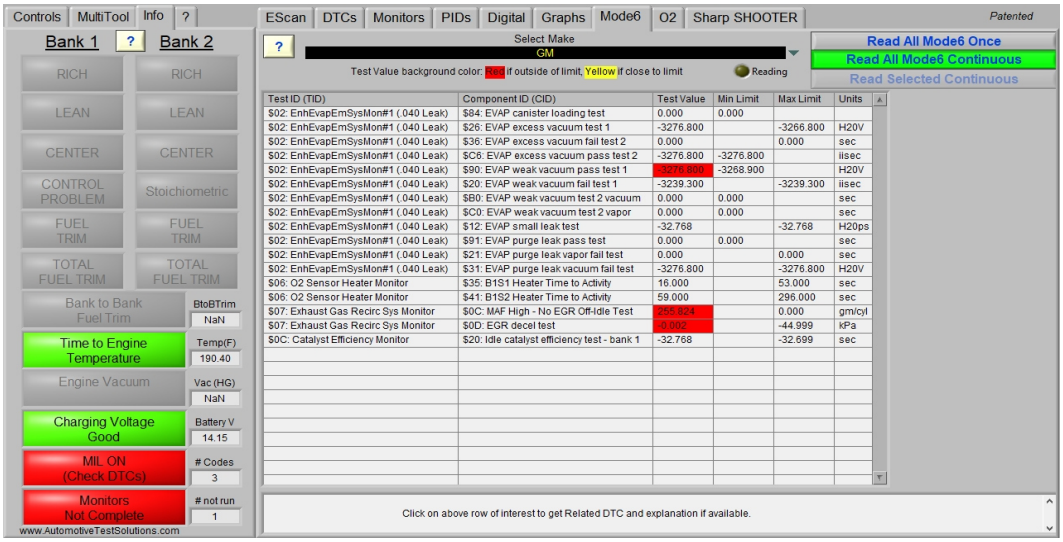
Mode 6 Buick 3.6L



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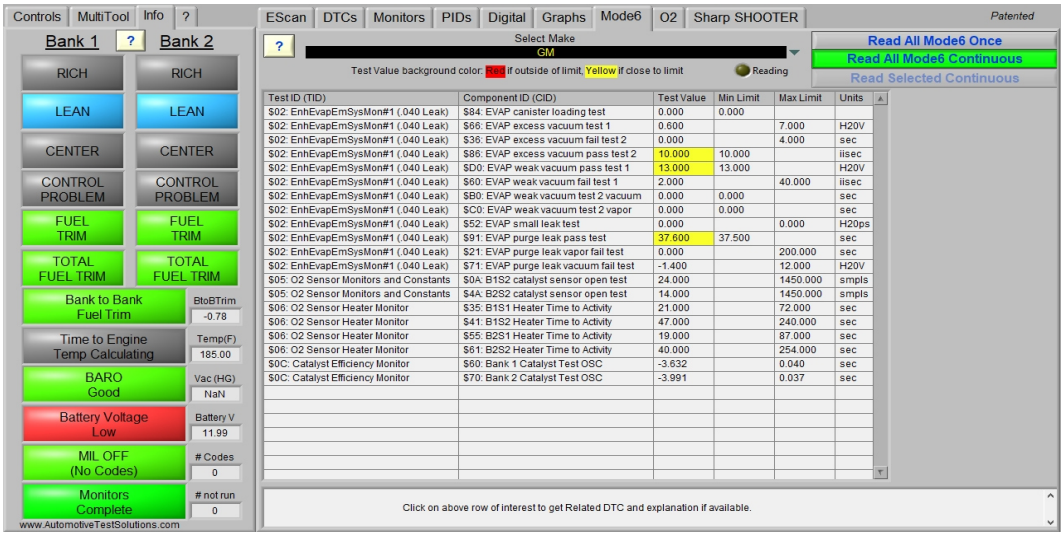
Mode 6 GM



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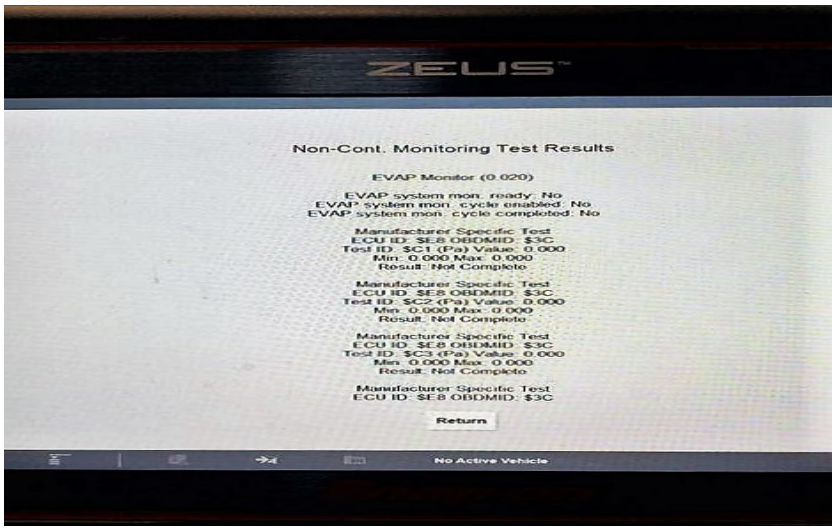
Mode 6



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DTCs - Mode 6 Case Study

Code	Description
	DTC Codes:
P0420	Catalyst System Efficiency Below Threshold Bank 1
	Pending Codes:

54

De-catalyzed Cop Car

It's a cop car. Got cop tires, cop brakes... It also has a DTC -- P0420 -- low catalyst efficiency, Bank One.

Repair records show that this **2006 Impala** 3.8 has been in for repairs before. In fact, due to the presence of oxygen sensor DTCs, upstream and downstream oxygen sensors have already been replaced.

Now that it's come to us with a catalyst DTC, we want to know if the catalyst is **really** bad and, if so, **why** it is bad -- this car has only 40K on the odometer!

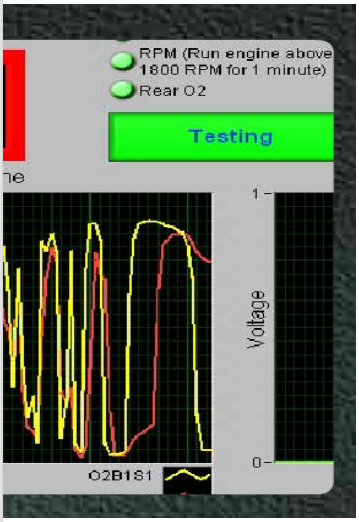
55

De-catalyzed Cop Car

Is the catalyst really bad? We graph data from the upstream and downstream oxygen sensors. Graphed sensor values are shown here, superimposed.

Our ESCAN scan tool calculates cat efficiency at only 29%! No wonder there's a code.

Even without the automatic calculation, it's clear that the superimposed waveforms are almost identical! This is an indication that the catalyst is **NOT** storing oxygen properly.



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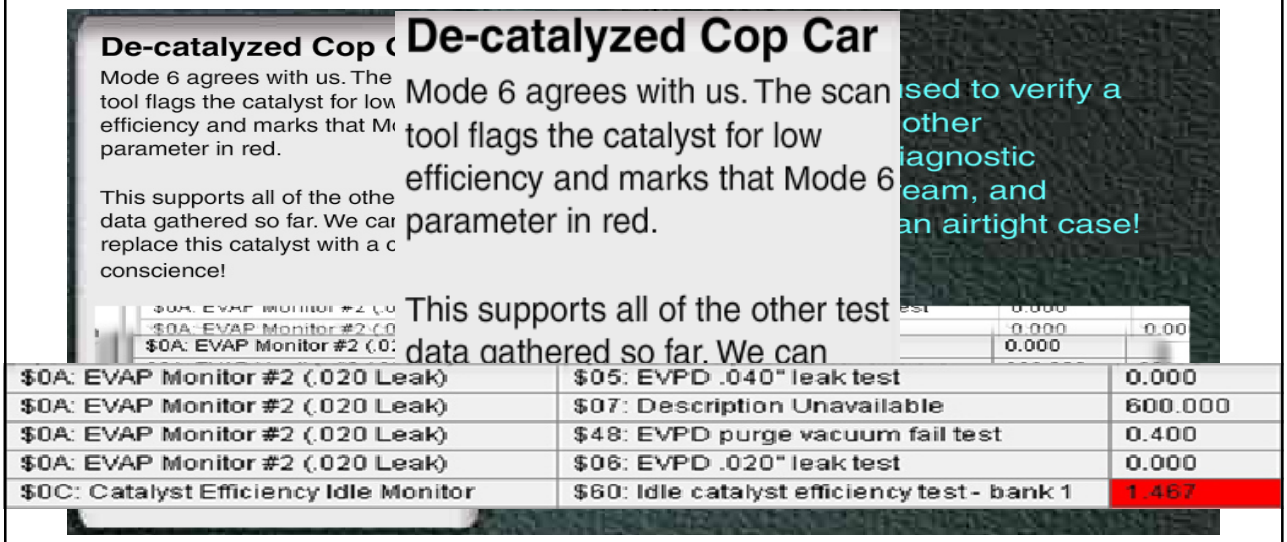
DTCs - Mode 6 Case Study



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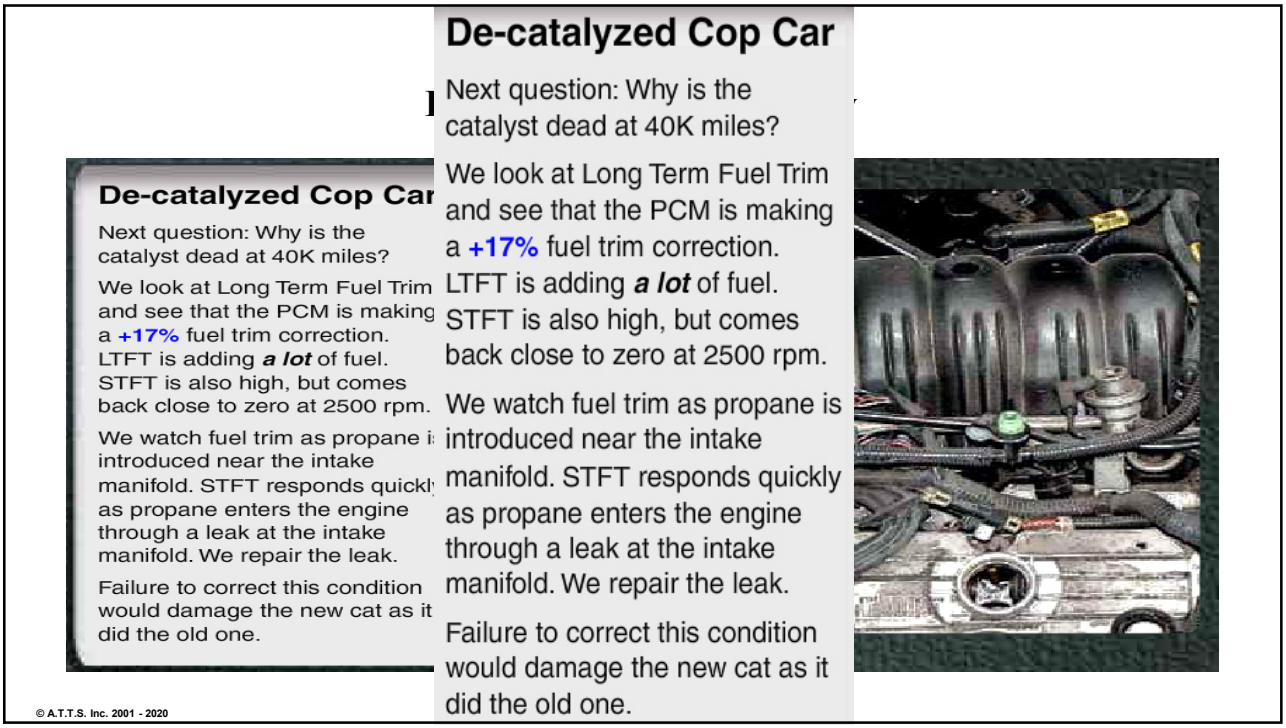

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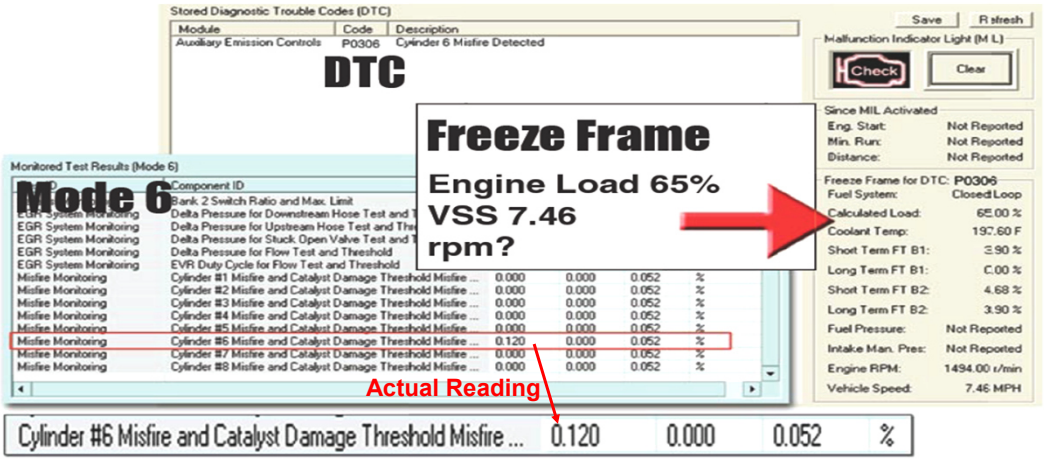
Mode 6

Combining DTC, Freeze Frame, and Mode 6



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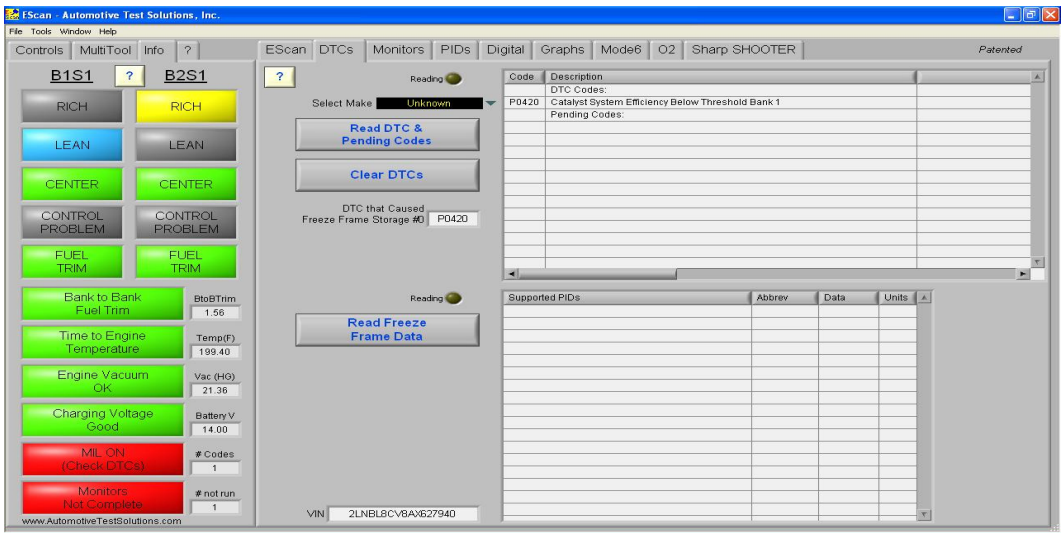
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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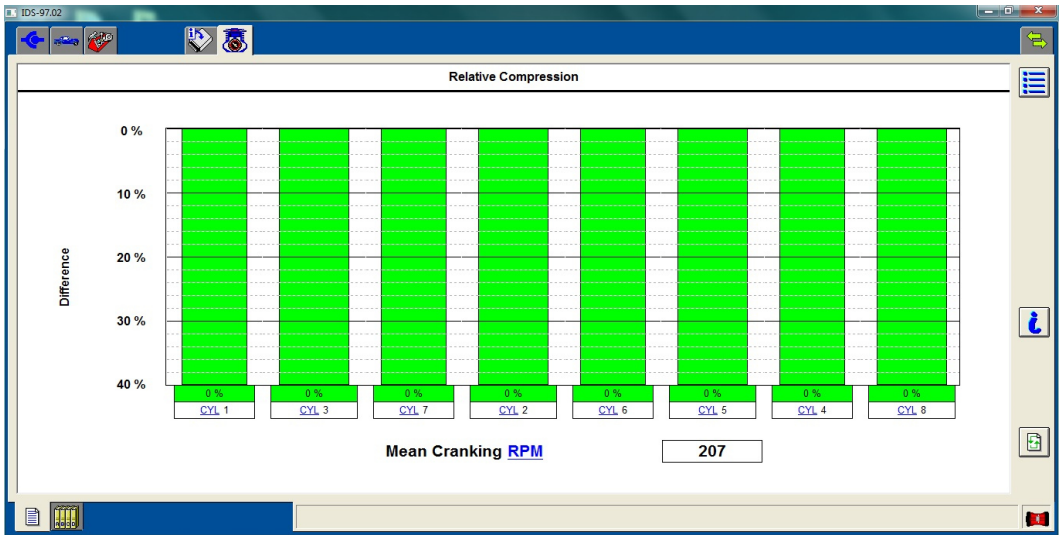
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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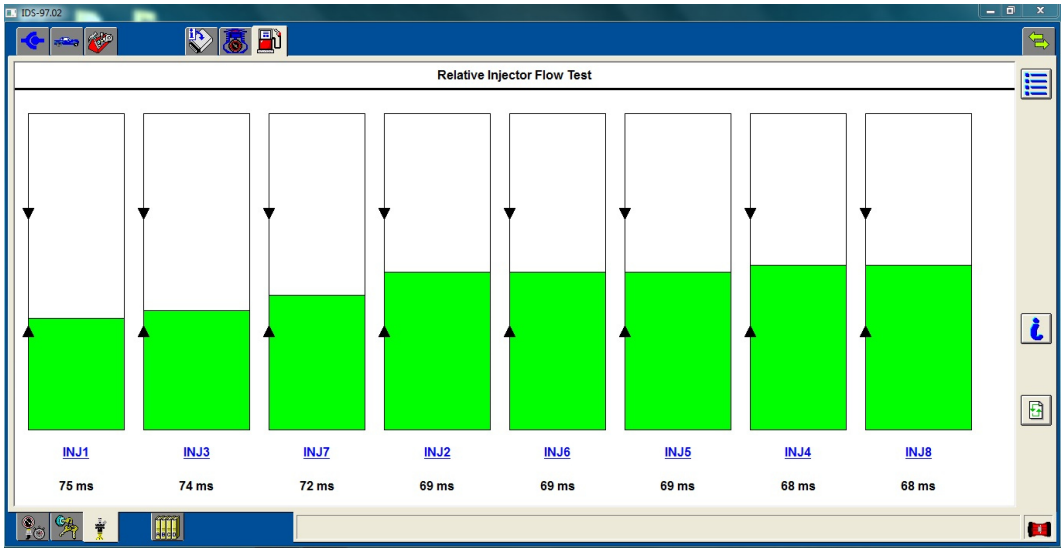
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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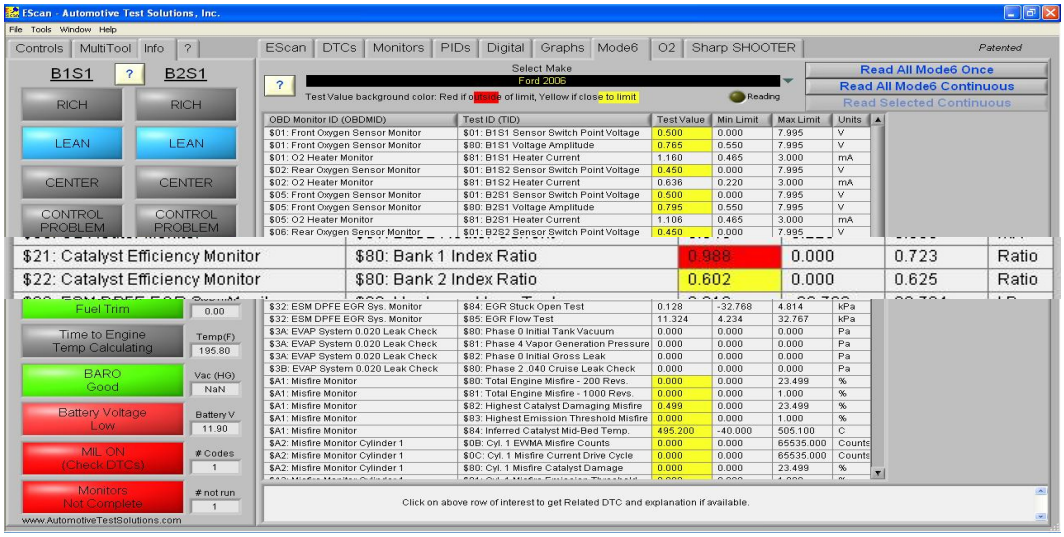
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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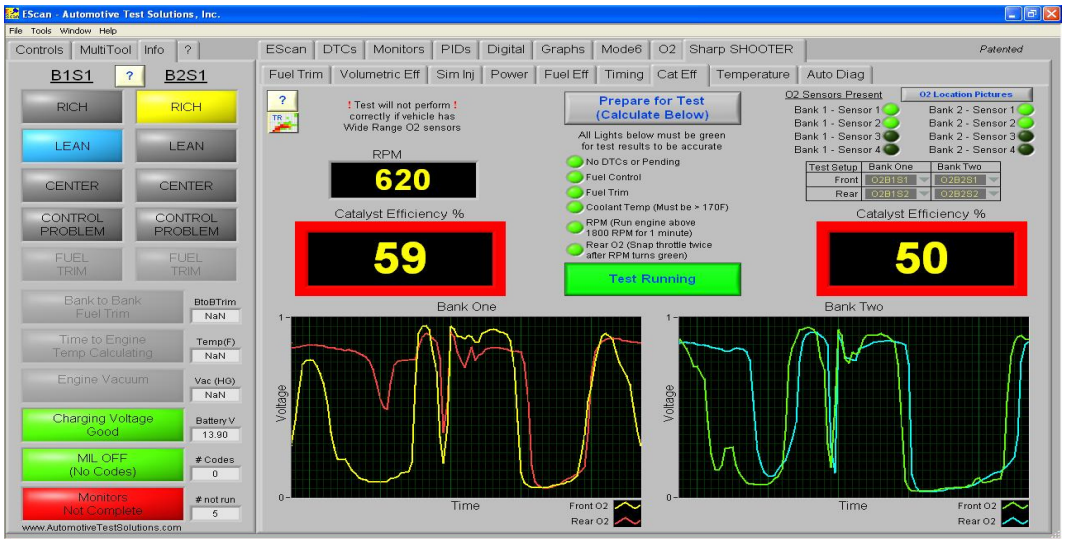
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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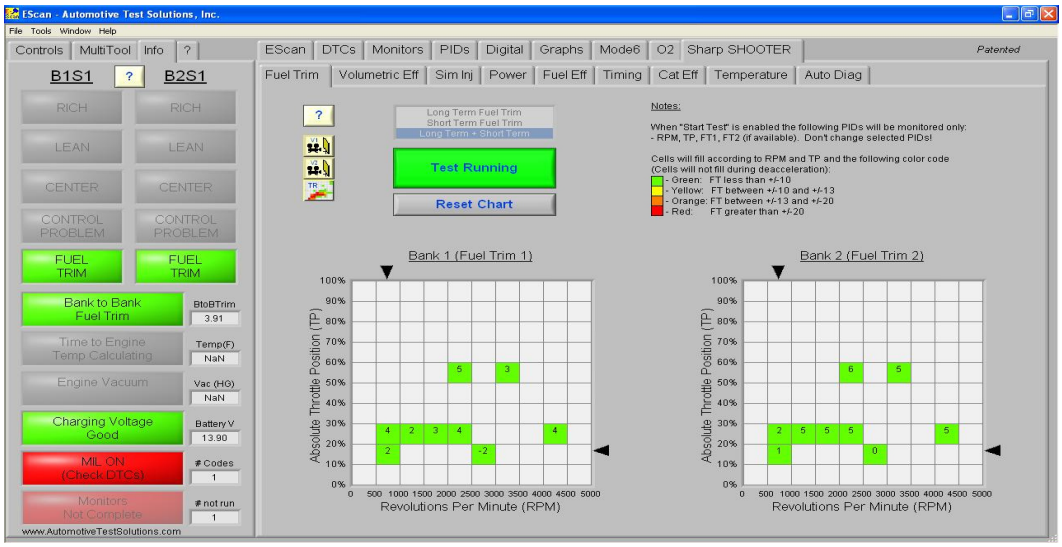
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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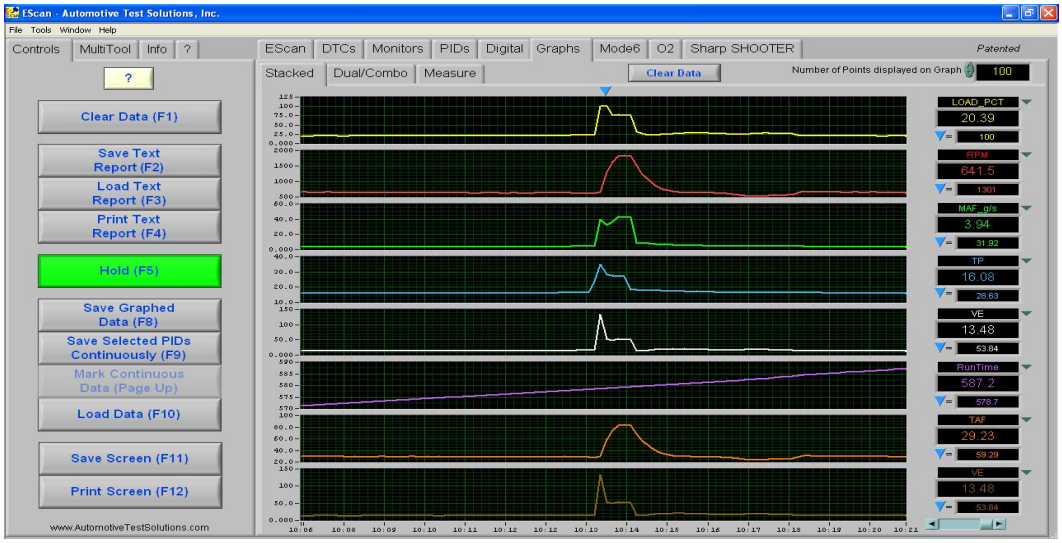
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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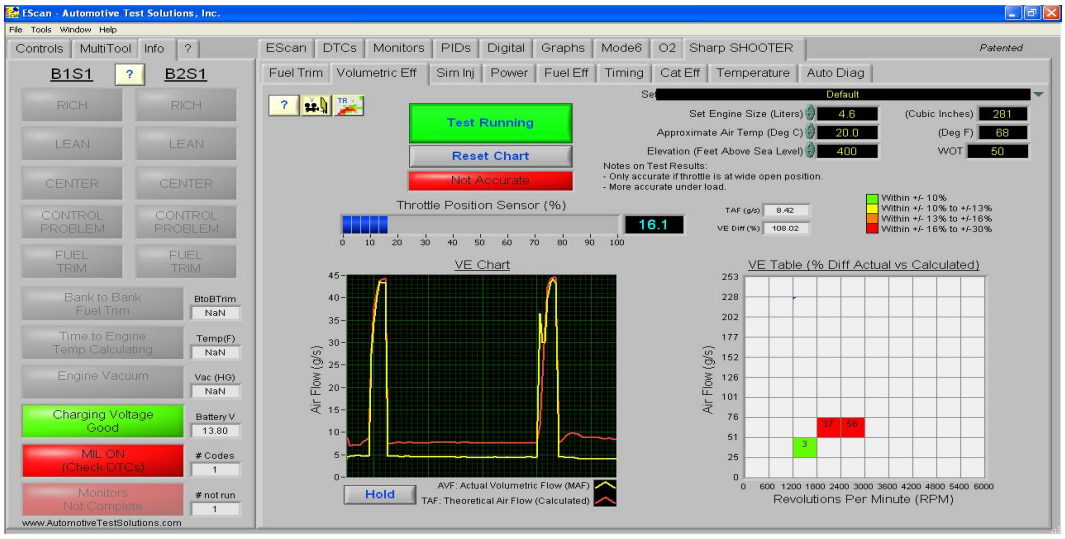
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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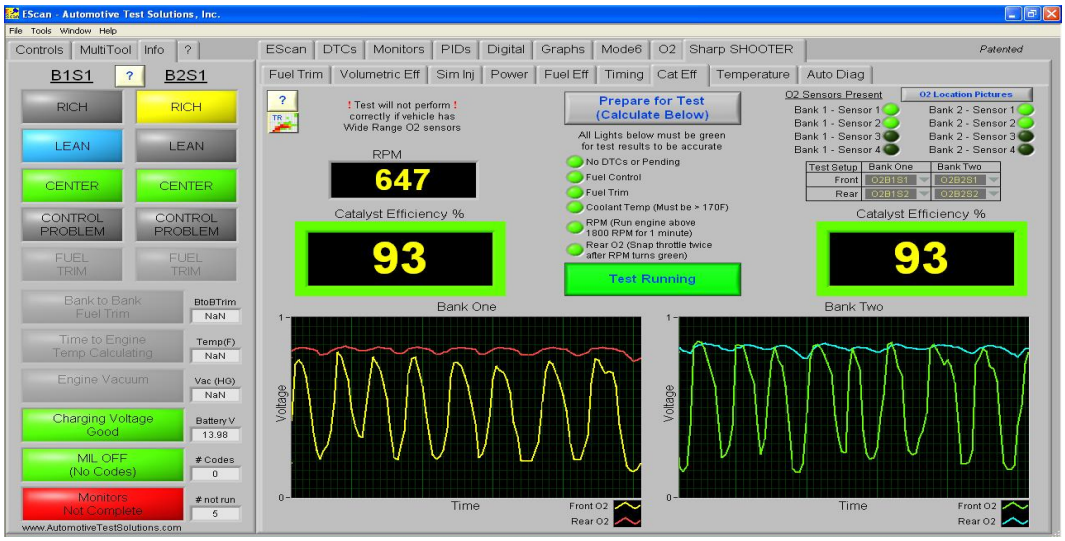
2010 Lincoln Town Car 4.6 Cat Efficiency 200K



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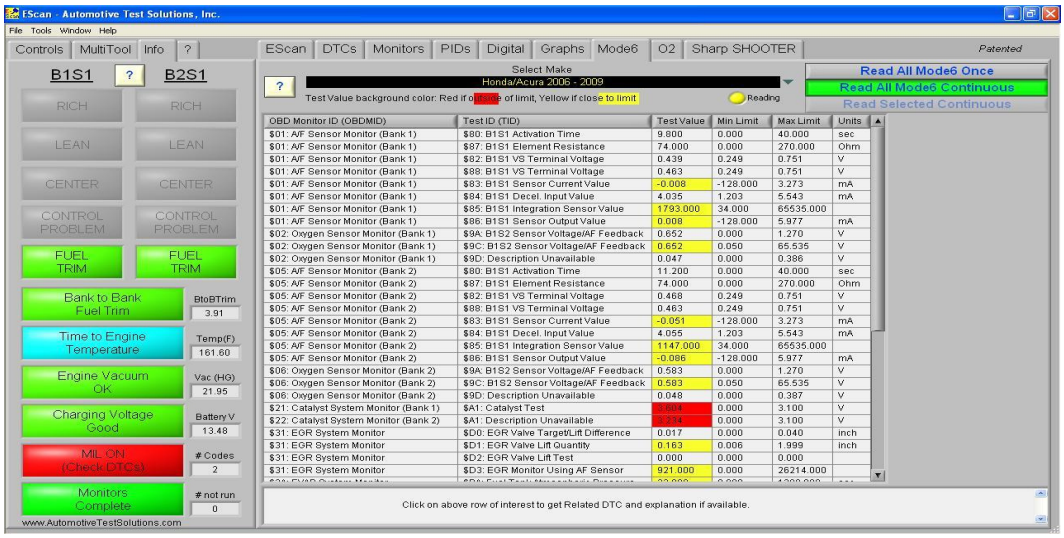
2009 Honda Pilot Mode 6



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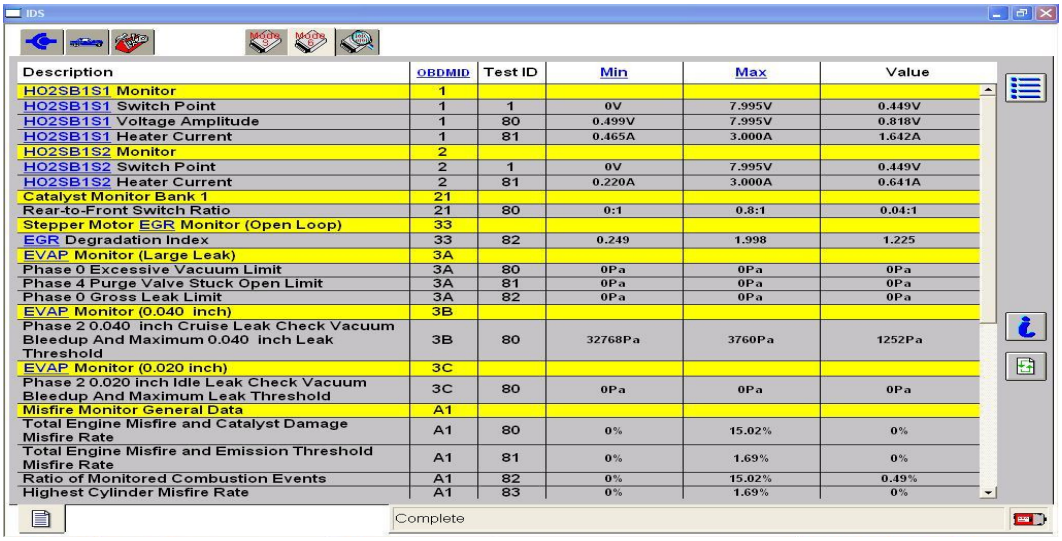
Ford Enhanced Mode 6 Scan Data



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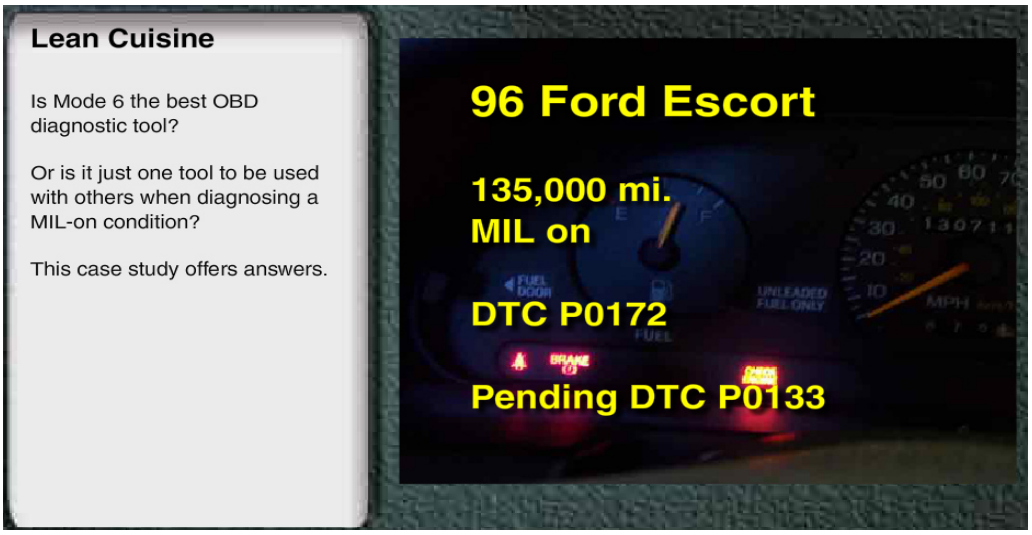
Mode 6 Case Study



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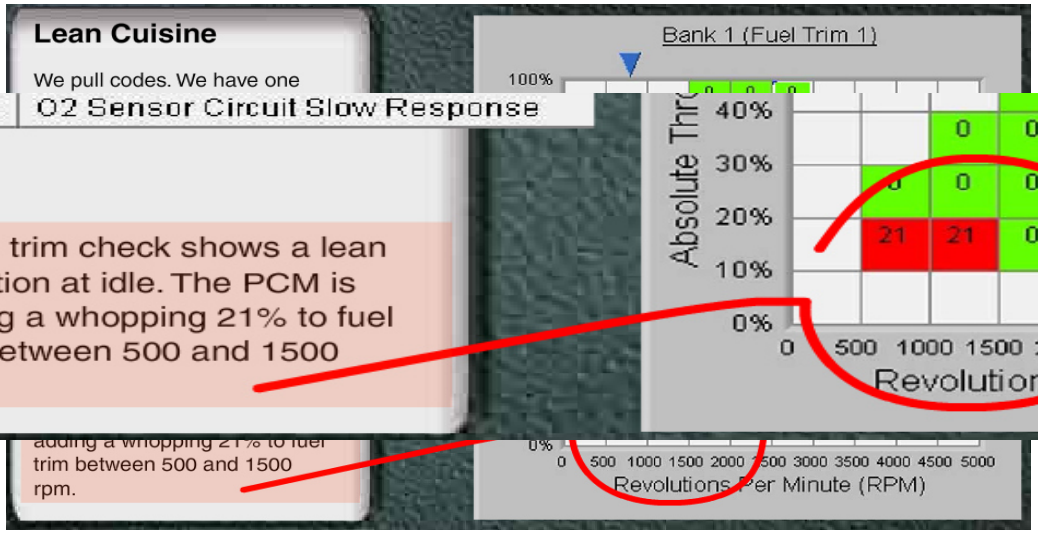
Mode 6 Case Study



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Mode 6 Case Study

Lean Cuisine

An underhood inspection and a little shot of propane soon lead us to a cracked PCV hose.

We replace the hose and re-check fuel trim.

73

Mode 6 Case Study

Lean Cuisine

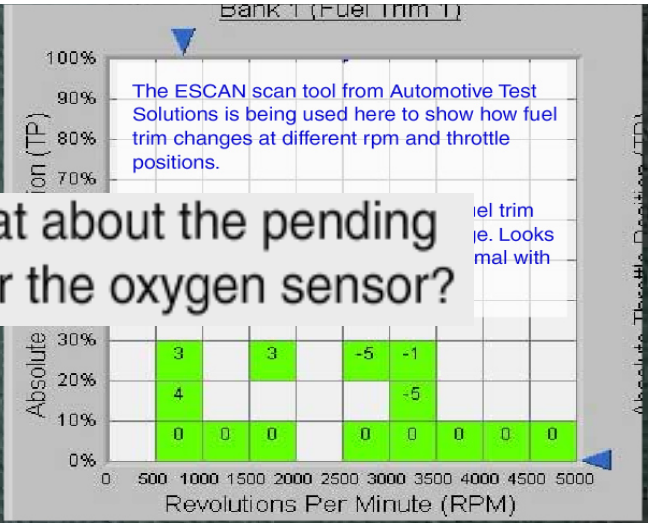
That's more like it.

Our fuel trim numbers are back to acceptable levels.

That should take c
fuel trim lean code

But what about the
code for the oxyge

But what about the pending code for the oxygen sensor?



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Mode 6 Case Study

75

Mode 6 Case Study

Lean Cuisine

Our Ford displays oxygen sensor test data in Mode 6, not Mode 5. Let's see if we can find a clue about our pending DTC.

The scan tool has flagged some of the HO2S parameters in red!

Mode 6 test data suggest a problem in the oxygen sensor circuit. Remember, Mode 6 is not live data, only the most recent test results. Since sensor data look normal in datastream at the moment, Mode 6 is suggesting an intermittent problem.

Component ID (CID)	Test Value	Min Limit
$11: B1S1 Voltage Amplitude	0.000	0.471
$21: B2S1 Voltage Amplitude	64.224	0.471
$11: B1S1 Static Shift Min/Max	0.000	32.193
$11: B1S1 Static Shift Min/Max	0.000	
$21: B2S1 Static Shift Min/Max	64.224	32.193
$21: B2S1 Static Shift Min/Max	64.224	

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Mode 6 Case Study

Lean Cuisine

We return to the engine compartment and begin to wiggle wires in the oxygen sensor circuit as we watch datastream. To speed the data update rate, we select only the oxygen sensor PID.

As we wiggle the wire at the oxygen sensor, we can make the HO2S sensor PID toggle between normal voltage and zero volts.

The sensor seems to be failing intermittently.

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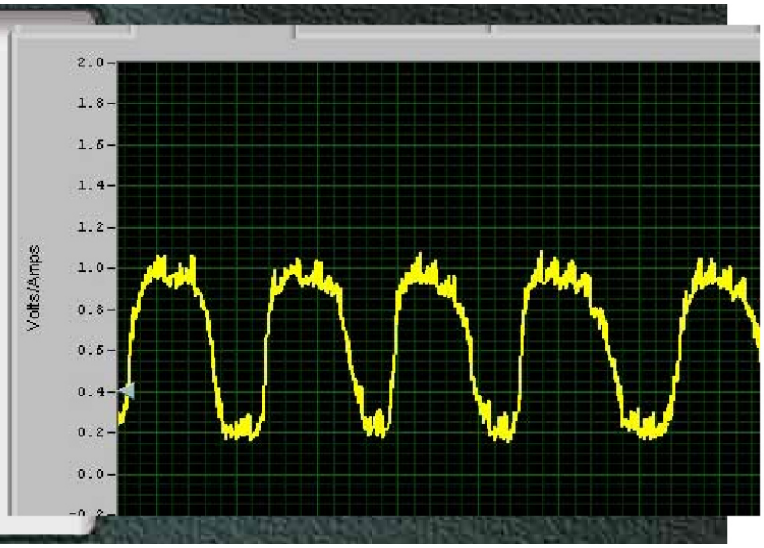
Mode 6 Case Study

Lean Cuisine

With a new oxygen sensor installed, we are unable to duplicate the intermittent dropout with a wiggle test.

The new oxygen sensor total range and frequency look good when viewed on a scope.



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Mode 6 Case Study

Lean Cuisine

We decide to test drive the Escort. DTCs are not erased yet.

It runs well.

Datastream values look normal.

Supported PIDs	Abbrev	Data	Units
Calculated Load	LOAD_PCT		%
✓ Engine Coolant Temperature	ECT	221.0000	Deg F
Short Term Fuel Trim Bank 1	SHRTFT1	2.3437	%
✓ Long Term Fuel Trim Bank 1	LONGFT1	2.8125	%
✓ Engine RPM	RPM	790.5000	RPM
Vehicle Speed Sensor	VSS		km/h
Ignition Timing Advance for #1 Cylinder	SPARKADV		deg
Intake Air Temperature	IAT		Deg C
Air Flow Rate from Mass Air Flow Sensor	MAF_g/s		g/s
Air Flow Rate from Mass Air Flow Sensor	MAF_lb/m		lb/m
Absolute Throttle Position	TP	19.2157	%
✓ O2 Bank 1 - Sensor 1	O2B1S1	0.7800	V
✓ O2 Bank 1 - Sensor 1	FTB1S1	-1.5625	%
O2 Bank 1 - Sensor 2	O2B1S2		V
O2 Bank 1 - Sensor 2	FTB1S2		%

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Mode 6 Case Study

Lean Cuisine

After a test drive, we decide to recheck DTCs.

Hello. Seems we have a new pending DTC for a cylinder misfire on cylinder number one.

Good thing we checked.

Code	Description
	DTC Codes:
P0171	System Too Lean
	Pending Codes:
P0130	O2 Sensor Circuit Slow Response
P0301	Cylinder 1 Misfire Detected

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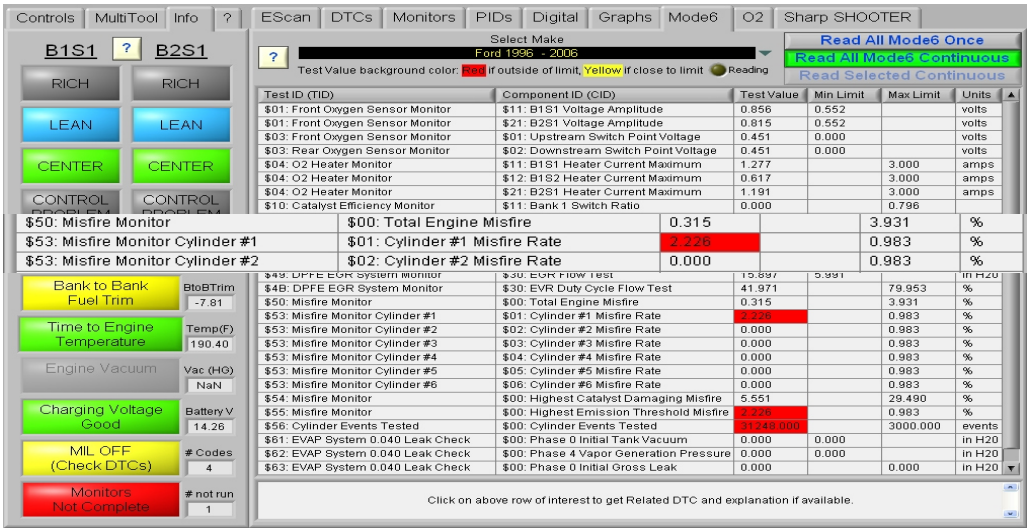
Mode 6 Case Study



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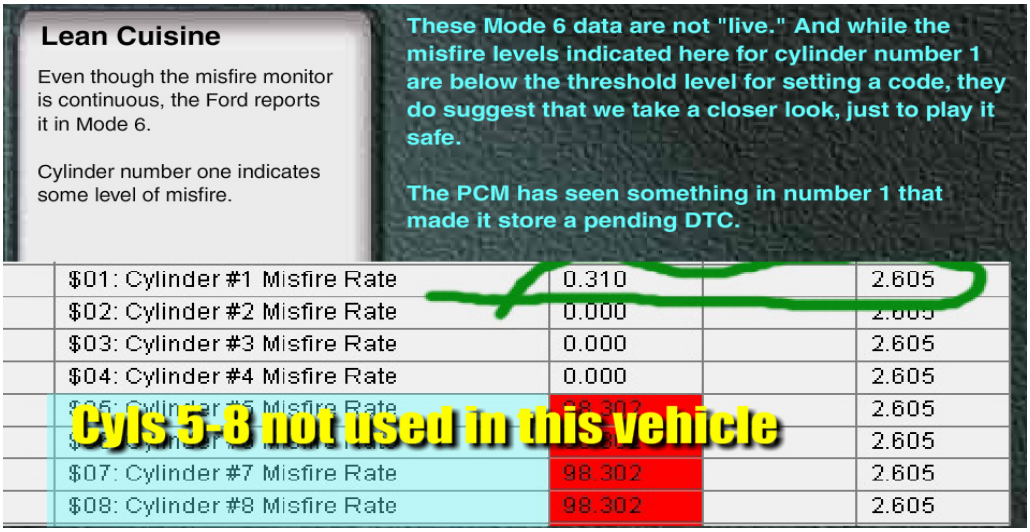
Mode 6 Case Study



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Mode 6 Case Study

Lean Cuisine

Misting the wires with a mixture of water and baking soda shows a leaking plug wire boot at number one cylinder.

At 130K, a new set of wires seems to be in order!

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Mode 6 Case Study

Lean Cuisine

Mode 6 is not some magic weapon that will shoot down all your diagnostic problems.

The Escort was repaired using a number of tools, some high tech like Mode 6, others low tech like propane and water.

A lesson to be learned here is that Mode 6 provides clues that must be proven or disproven with good automotive test procedures.

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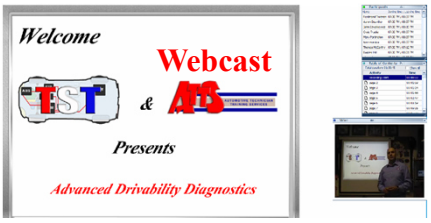

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Thank You !

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