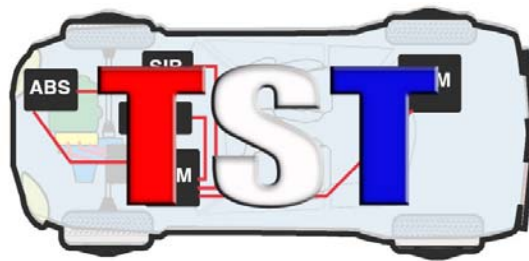


December 2015



Technicians Service Training

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Editor

"G" Jerry Truglia

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"Mastering Your Scan Tool"

In order to master a scan tool you need to understand that there is much more than reading codes. It's the ability of interrupting the PID data that is being displayed on the screen that will lead you to a successful diagnosis and repair of the vehicle. Knowing a good scan tool parameter from a bad one makes all the difference in a proper diagnosis. Remember that DTCs are not set for everything, you can have a thermostat that does not reach the proper temperature in the specific amount of time that is preventing the vehicle from completing Monitors, shifting right or running correctly. Just because the vehicle produces heat does not mean that the thermostat is functioning correctly. Another example could be a BARO sensor that is out of calibration that still in a specific range causing a driveability problem but not enough to set a DTC.



(Con't on page 2)

“Mastering Your Scan Tool” (con’t from p. 1)

My objective in writing this article is to help you utilize your scan tool while getting the most information out of it in the least amount of time. I will also provide some highlights of some common scan tools that are in used in America’s service bays. I am not going to cover OE scan tools in this article since the majority of shops are using aftermarket scan tools such as OTC, Snap On or Launch to name a few. I will cover many different tools in order to provide you with some of their best features. This will help utilize them more effectively to capture the most amount of information in the least amount of time.

Using The Scan Tool For Driveability Problems

Before we go to deep let’s get the caveats out of the way. When it comes to diagnosing engine performance, DTCs or driveability problems use a Generic/Global scan tool to expedite the diagnosis. A Generic/Global OBD II scan tool allows us to view information quickly while allowing access to, Pending DTCs, Monitors, Mode 6 data and Freeze Frame to name a few. You won’t get all that information in the enhanced side of your scan tool, so start with the Generic/Global side first and if you need more data PIDs or bi-directional control switch to the Enhanced side. Also, Generic/Global PIDs are the same on every vehicle, whether it’s a GM or a Porsche, the data PIDs are all the same and easy to understand.

It’s always helpful to know and understand all aspects of your scan tool along with the vehicle systems that you are working on before diving into a problem vehicle. There is nothing worse than going in blind, not understanding or utilizing the functions of the scan tool or knowing how the vehicle system operates. A good understanding of both will allow us to diagnosis and repair the system we are working on. It’s setting up a game plan that is going to save you time in diagnosing the problem. Knowing where to start, such as what scan tool to use on the problem vehicle along with knowing where to find the correct information for the vehicle is the key to success.

(Con’t on page 4)

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Our Goal & Mission Statement

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- **Provide training seminars for a reasonable price.**
- **Deliver information that the technician can use now.**
- **Keep technicians informed of information affecting our industry.**
- **Increase consumer awareness of what a good technician is.**

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Wayne Colonna of ATSG

Jorge Menchu the "Labscope Guru," AES Wave

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Mark Warren of World Pac / Motor Magazine

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Peter Meier of Motor Age Magazine

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“Mastering Your Scan Tool” (con’t from p. 2)

We have all wasted time in diagnosis a problem vehicle whether it was using a scan tool that could not provide the information we needed to view or component to activate. Some shops decided to purchase a second scan tool out of frustration of not being able to diagnosis a problem vehicle. Let’s face it you need the right tools in order to perform the correct diagnosis. Since some scan tools work better than others on different vehicle lines, another scan tool maybe the correct option to invest in if you haven’t already done so. A good example is when a Benz rolls into my shop, I know what scan tool I am going to connect to the vehicle. I don’t want to connect a scan tool that is only going to provide a partial list of information limiting my ability to repair the vehicle. The scan tool that I will connect to the Benz is Autologic since it has the proper software displaying engine to body data and everything in between including bi-directional control, module coding and the ability to reprogram modules. I understand that not everyone reading this article has the variety of scan tools that I have, but you may be thinking about which one to purchase to fill the hole. Some of you may not work on every vehicle line that’s on the road, maybe you just work on Domestic, Asian, European, or even one vehicle from that selection such as BMW or Toyota. There are many specialty shops in the country that just focus on one vehicle brand making their selection of a scan tool easier and less expensive in most cases. Most scan tools today provide a full system aka health check scan that queries the entire vehicle’s control modules (ECUs) that display any system faults. Sometimes a fault in one system can affect another system. For example, our shop once had a Dodge Dakota with a complaint of a hard 1st shift. The shifting problem turned out to be caused by a PO136 (O2 Sensor Bank 1 Sensor 2 heater malfunction). After Wayne Colonna (transmission guru extraordinaire and ATSG president besides publisher of Motor Age’s “Powertrain Pro”) turned us on to the correct diagnostic path, we found the connection between the O2 heater to the shifting problem along with help from the OTC all system scan. To be successful using a scan tool you need to connect it to a bunch of vehicles and see what good data looks like so you can identify bad data.

(Con’t on page 5)

“Mastering Your Scan Tool” (con’t from p. 4)

For instance you should check STFT and LTFT (Short and Long Term Fuel Trim), engine temperature, BARO, Calculated load, RPM, MAP or MAF and the O2 / AF sensors on every vehicle you test. You should always start your diagnosis by using the Generic/ Global section on your scan tool even if you have the factory level scan data available. The reason why, is that Generic/ Global OBD II PID (Parameter ID) data is limited to a select number of the most important data PIDS that the PCM can provide for emissions and driveability related failures in OBD II. Remember that Generic/Global PIDS are the same on every vehicle so weather it’s a Ford or a Subaru, the data PIDs are all the same and not confusing to understand. Another important fact is that Generic/Global will not substitute a PID value as Enhanced data will display. Of course as you can expect in the automotive field there is an exception, which concerns the Air Fuel Ratio/Wide Range sensors. Some scan tools will display a Toyota AF sensor voltage at approximately 0.685 volts, when in reality it’s at 3.3 volts in the Enhanced side of the scan tool.

The best way to master scan tool data is to connect a Generic/Global scan tool to known good vehicles and record the data. Remember that there is much less data to deal with and decipher in generic mode. A few PID data examples are MAP (manifold absolute pressure) sensor reading KOEO = 5 volts, KOER on a good idling engine = approximately 1.2 volts, MAF (mass air flow) GPS (grams per second) is 1 gram per liter, 3 liter motor = 3 grams per second, STFT (short term fuel trim), LTFT (long term fuel trim), = under + 6 or – 6 on a good running engine, and Calculated Load at WOT (wide open throttle) = at least 90% to name a few. Start by checking the following PIDs and make it a habit on every vehicle that comes in for you to diagnosis; barometric pressure, calculated load, engine temperature, long-term fuel trim (LTFT), short-term fuel trim (STFT), manifold absolute pressure (MAP) or mass air flow (MAF), O2 / air fuel sensors, and RPM for starters.

(Con’t on page 7)

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FIX



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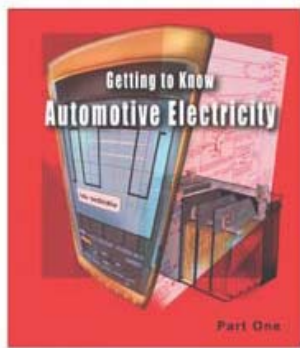
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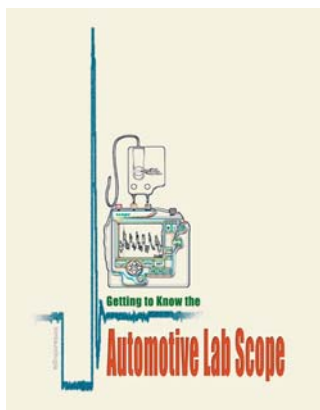
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"Mastering Your Scan Tool" (con't from p. 5)

When diagnosing an illuminated malfunction indicator lamp (MIL), do not erase the DTCs unless the original equipment manufacturer (OEM) states in its service information to do or you will clear all Monitor status to Not Ready. When vehicle Monitors are Not Ready it will be difficult to tell if you really solved the problem. When Monitors are Ready the vehicle's PCM (powertrain control module) will be checking for parameters that are out of range and illuminate the check engine light. On many newer vehicles (2010 and up) you most likely don't have to erase the DTC, they will clear on their own if the right conditions are met. The PCM which illuminated the MIL (malfunction indicator lamp) will check for three consecutive passes in the failing system and turn the MIL off. If you erase the DTCs, it's like using bleach on a crime scene erasing all the evidence. It makes no sense to clear anything from the PCM without printing, screen capturing, or writing down all the PID information along with the DTCs, Freeze Frame, Pending DTCs, Mode 6 data, and Monitor status. Using the information on when and what speed, temperature, load, etc., is very important in diagnosing the problem.

Case Study

2002 Chevy Silverado with a 5.3L V8 came in with one DTC, P0300 Random/ Multiple Cylinder Misfire along with three

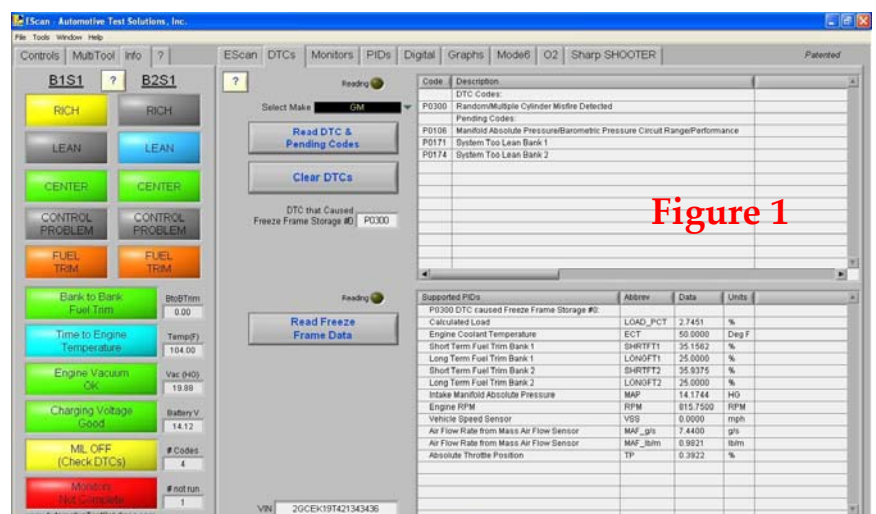
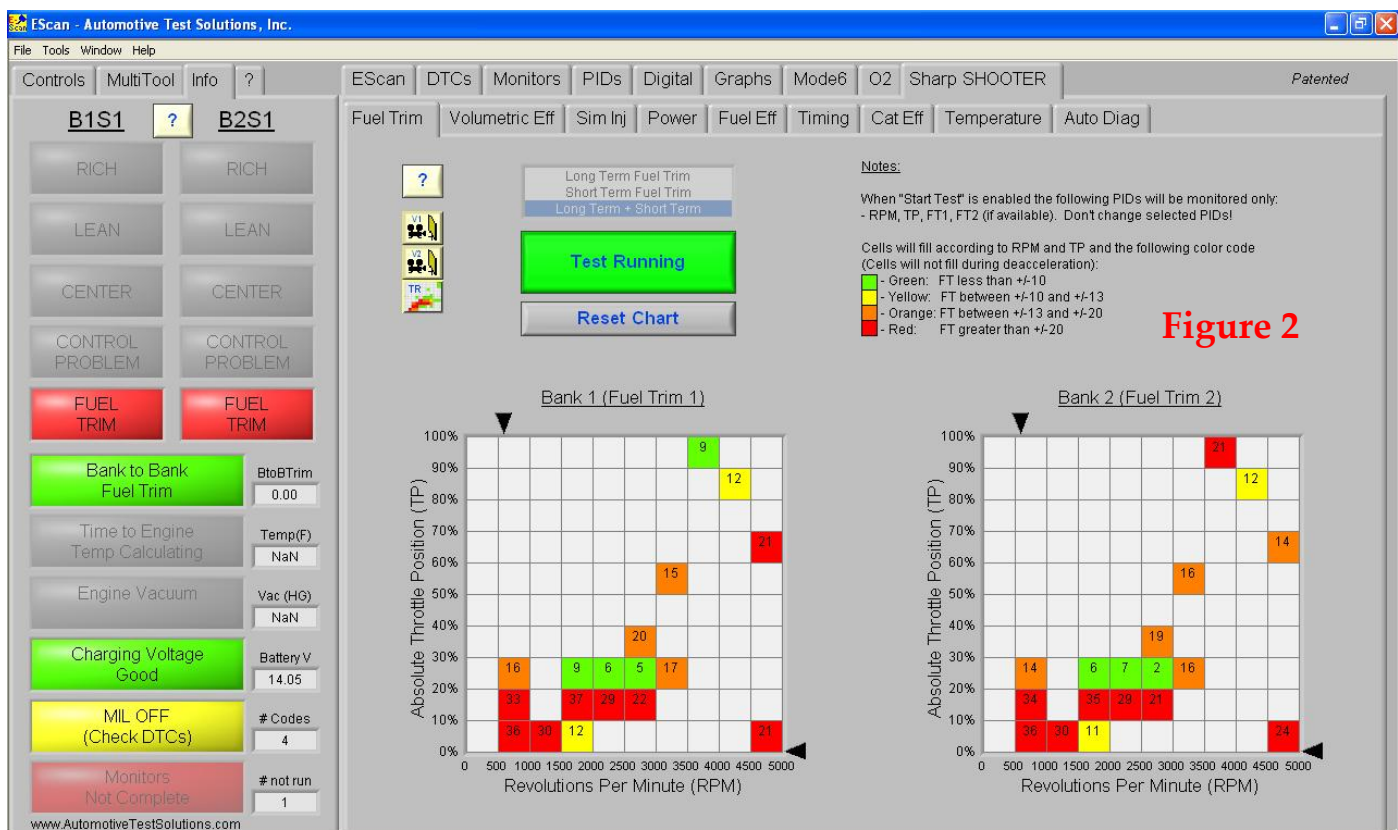


Figure 1

(Con't on page 8)

“Mastering Your Scan Tool” (con’t from p. 7)

Pending DTCs, P0106 Manifold Absolute Pressure, P0171 System Too Lean Bank 1 and P0174 System Too Lean Bank 2. (Figure 1 page 7) Now where do you start to diagnosis and repair this vehicle? Many would say you don’t have to worry about Pending DTCs, so start with the P0300 because it’s a hard DTC. Well that would be absolutely wrong because the Pending DTCs provide great insight on why the P0300 was set. Your game plan should always be to look at all PID data, Monitor status, Freeze Frame, Mode 6, Mode 9 and Pending DTCs. In this case the Pending DTCs are leading us to the source of the problem, the MAP sensor and the two lean DTCs P0171 and P0174. Using that information along with the P0300 Freeze Frame data pin-points the problem. The STFT (short term fuel trim) is requesting 35% while the LTFT (long term fuel trim) is requesting 25% on both banks. (Figure 2) This information along with the Freeze Frame Data informs us that the en-



gine was at 50 degrees F with a MAP reading of 15 inches @ 815 rpms. The MAP reading should be somewhere in the neighborhood of 18 inches of vacuum rather than 14 inches. When the reading of vacuum (Con’t on page 9)

"Mastering Your Scan Tool" (con't from p. 8)

vacuum is this low the MAP sensor voltage will be higher than the normal 1.2 volts or so at idle which the PCM will interpret as a command for more fuel delivery. As you can see from the scan data the PCM is doing its job and commanding a large amount of fuel delivery to compensate for a lean condition. With the Freeze Frame data providing us with the temperature information of 50 F it's a good idea to smoke the engine when it's cold to locate the source of the problem. On this vehicle the intake manifold gaskets needed to be replaced in order to get this engine back in fuel control. After the repair was completed the engine ran well and there were no DTCs or Pending DTCs. (Figure 3) The moral of this case study is not to just jump on the DTC but to take advantage of what OBD II information has to offer and use that information to solve the problem. If this vehicle was a CAN (control area network) vehicle I would have suggested looking at Mode 6 data for test results on cylinder misfires.

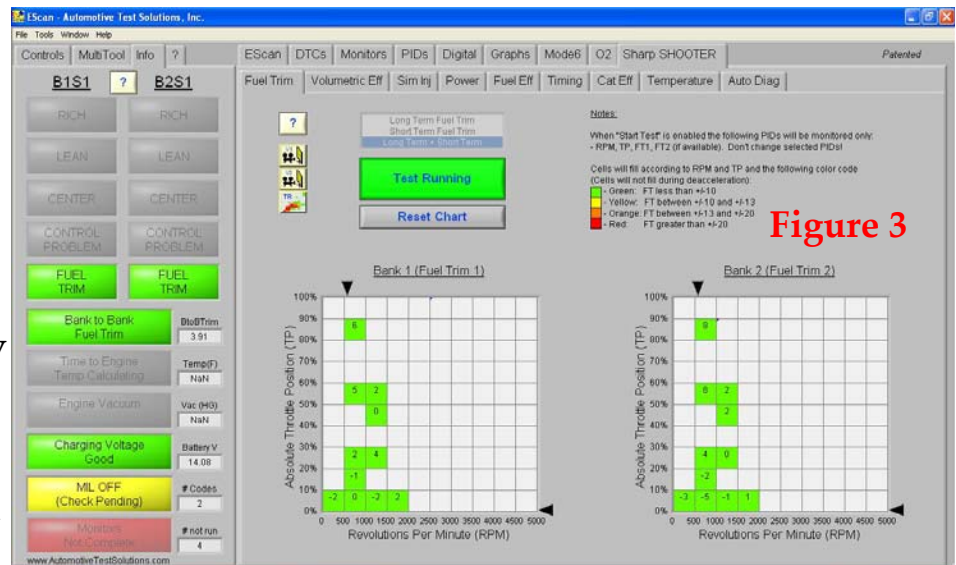


Figure 3

Scan Tools

A great Generic/Global scan tool to use when performing driveability diagnostics is the EScan scan tool from Automotive Test Solutions. The tool makes scanning easy along providing a wealth of information at your fingertips. Take a look to the right (Figure 4) at the screen shoot from the EScan that also provides very import information in the left panel. The top of the left panel has Fuel Trim information, Fuel Control information, Time to Temperature, Engine Vacuum, Charging Voltage, MIL/DTCs and Monitor status.

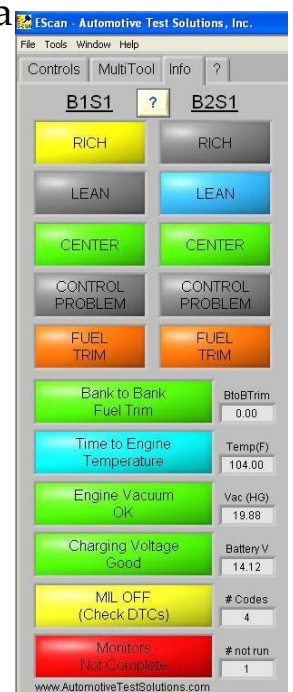


Figure 4

(Con't on page 10)

“Mastering Your Scan Tool” (con’t from p. 9)

The EScan also has eight other tabs on the upper part of the screen that offers more options such as DTCs, Monitors, digital, graphing, Mode 6 decoded data with constant refresh, O2 test and the Sharp Shooter section. In the Sharp Shooter section there are additional tabs that allow the user to take an in-depth look at Fuel Trim, Volumetric Efficiency, Simulated Injector, Power, Fuel Efficiency, Timing, Catalytic Efficiency, Time to Temperature/thermostat time, and *Auto Diagnosis (*this will be completed in the near future providing a comprehensive report on the vehicle being tested). The EScan does not have Enhanced data or bi-directional control, except for Mode 8 that allows the EVAP vent solenoid to be commanded closed. The tool is PC based and is updateable currently for free via the internet. It also has a few built in videos that provide help on fuel trim and volumetric efficiency. This tool fits the bill for diagnosis that I covered in the first part of this article.

The OTC Encore is a mini tablet based scan tool the works on the Android operating system that boots up quickly. The tool allows for Generic/Global OBD II scanning along with a complete system scan, Identifix Quick Fixes, Pathfinder, BOB (break out box) pin locations and other helpful information. The unit also graphs, prints, saves data to a disk along with performing bi-directional control, Mode 6 decoded data as well as other functions. The tool is updated via the internet. OTC also offers the Genisys Touch tablet that has all the same functions along with the ability of utilizing it as a two channel labscope along with its J2534-1 2 compliant interface that can be used for reprograming. This Windows based unit also connects to helpful technical websites such as; Iatn, Identifix, Alldata, TST to name a few and has embedded videos.

The Snap-On Verus (Figure 5) is a Windows based PC tablet that allows for saving, printing, graphing in Generic/Global as well as enhanced functions on most vehicles. The Mode 6 function of the scan tool with 14.2 and up software decodes many of the Mode 6 data.



Scanner > Engine & Powertrain > Drivability	
RPKM	919
BARO (inHg)	30.1
CO2 (°F)	134
ECT (°F)	132
FUEL STATUS	CL
VACVOLT	NO
VATVO	3.13
LOOP	CLSD
O2T ADJ	CLSD
O2S11(mV)	657
O2S21(mV)	3
LFTRIM (%)	5
DTC Count	1
BARO(kPa)	138
Cyl M Temp (°C)	1.54
DPFE(V)	1.09
VAC(%)	54
VAT (°F)	62
LOAD(%)	26
Multis	NO
O2S11(mV)	499
O2S12(mV)	5
LFTRIM (%)	-3
SPTRIM (%)	1

Figure 5

(Con't on page 11)

“Mastering Your Scan Tool” (con’t from p. 10)

The scan tool performs bi-directional control, codes modules and performs re-learn procedures. The unit also has the ability to function as a four channel lab-scope that allows you to perform sensor/actuator test along with the connections pin locations, on line help and full internet connectivity. The Snap-On Sure Track information is helpful when diagnosing a vehicle problem.

Launch

The Launch X-431 Android based tablet (Figure 6) is a very capable scan tool that uses a Class 1 Bluetooth connector and has the ability to search Google for DTC information. It also has a built in vehicle maintenance and repair database along with the ability to update the scan tool via the internet. The tool can graph 15 data PIDs at once, code modules, perform bi-directional control and perform relearns while performing very fast.

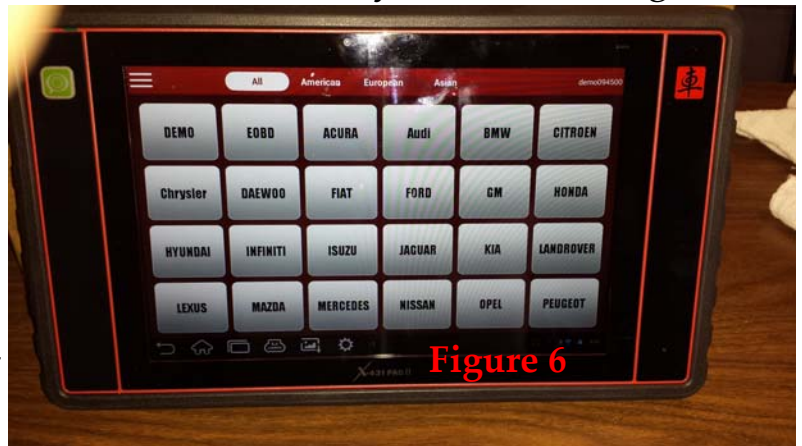


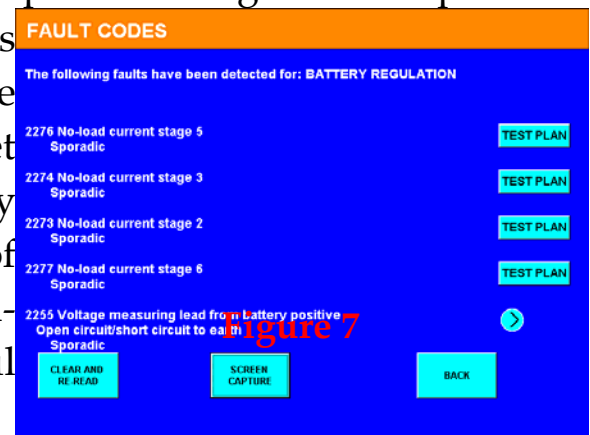
Figure 6

Delphi PC based tablet has very good and powerful coverage on all domestic and Asian vehicles. Beside the normal functions of PID data, graphing, bi-directional control, Mode 6 decoded data, coding, it has the ability to perform reprograming. The tool has deep coverage that performs OE level functions very well. When I used the tool on a new GM vehicle I thought that I was using the factory scan tool. Another good test was when I used it on a 2009 Subaru and found very good data, bi-directional functions and module coverage. The scan tool connected very quickly without a problem while performing a complete module scan and report that is very impressive.

(Con’t on page 12)

“Mastering Your Scan Tool” (con’t from p. 11)

Autologic is for the serious shop that wants complete coverage for European vehicles. This scan tool graphs, saves screens, logs files, graphs, codes and reprograms. This is one of the few scan tools that I use that does not let me down when diagnosing a vehicle. It’s easy to use on every function, while being capable of reprogramming with ease. (Figure 7) The tool also comes with live tech support that is helpful to a tech working on a problem vehicle.



Autoland Scientech IScan II wt is another good scan tool that has excellent coverage for European, Asian and now domestic vehicles. It has most of the features that I described on the other scan tools with a very strong bi-directional and coding function. With a resent download via the internet the tool is able to perform BMW offline programming on many models, with more coming in the future. The tool can also be used as an interface with factory software such as Audi/VW, BMW, Ford, Jaguar, Mazda, Mercedes Benz, Range Rover, Toyota and Volvo. To connect to this software you will need the optional laptop that has the software load on it. In some cases using the laptop software reprogramming is available.

There is a new scan tool worth mention, the Mahle tablet based scan tool. While I was at the APPEX show I seen the Mahle tool in action and was impressed with the speed and functions of the tool. The Mahle scan tool currently covers the following; 2007 -2014 OBD II, Enhanced Ford (complete coverage, GM, Chrysler (partially done), Asian coverage due out by sometime in early 2016 along with European coverage by 2016. The scan tool performs a complete module scan, provides decoded Mode 6 data with constant refresh, graphs, has bi-directional control, full data recording that can fill your hard drive, coding but does not support programing yet. It is update via the internet and connection to AllData, Mitchell, Idenfix etc. The tool also comes with remote customer support.

"A Neglected Volvo"

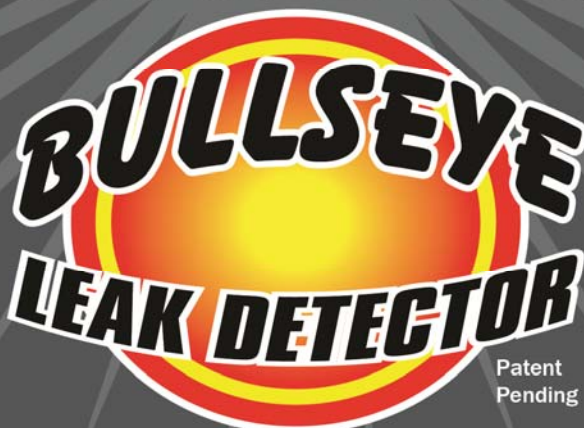
We had a 2006 Volvo XC 90, 2.5 L 5 cylinders with 128,852 that come in with a complaint of low power, stalling and using oil. The Volvo owner brought the vehicle in for a timing belt replacement thinking that this would solve the problem. I explained to him that the timing belt had nothing to do with the stalling or oil consumption problem. After conversing with the owner I uncovered that the vehicle had close to no maintenance other than oil changes about every 6 or 7 K with non-synthetic oil. I suggested beside the work he requested on the vehicle that we perform a thorough vehicle inspection. We strongly recommending the replacement of the PCV system, spark plugs, serpentine belts, thermostat, cooling system flush and an oil change that were all desperately needed. Upon inspection of the vehicle we noticed that the serpentine belts and timing belt were in fact overdue for replacement. We also noticed that the PCV or oil trap system was in real bad shape. The PCV system consists of the flame trap, small and large vacuum hoses along with an oil cap. A tell tail sign of a problem was that there was



a cracked PCV breather hose located on the upper part of the engine next to the fuel injectors. The odd thing about this hose being broken (Figure 1) was that there was not much oil in the surrounding area, leading me to believe that the breather system had to be clogged. A quickly test of the system for proper operation is to remove the dip stick and place a rubber glove or balloon over the dipstick tube. If the balloon or rubber glove starts to blow up, it indicates crankcase pressure is present and not vacuum. If this is the case squeeze the balloon to deflate then check to see if the system has the ability to suck in that will confirm the PCV breather system can create a vacuum. If the balloon or glove continues to blow up the system is clogged. The test needs to be performed first at idle to check the small vacuum PCV hoses for proper operation, followed by testing the system at 2500 rpms checking the large PCV vacuum hoses for restrictions as well. Since this customer had a complain of using 3 or more quarts of oil within 5k, without any visible signs of a leakage it was a

(Con't on page 15)

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"A Neglected Volvo" (con't from p. 13)

good indication that the flame trap and hoses were clogged. To perform this PCV flame trap replacement the intake manifold would have to be removed to uncover all the hoses and components. One of the PCV hoses is connected to the fuel line that goes from the front of the engine to the rear. Since this vehicle had over 128K it was in desperate need of every PCV line replacement. Obviously since the engine had so many miles on it everything we touched broke having us to replace more than the normal PCV breather replacement parts.

Once the manifold was removed we were able to see just how clogged this engine's PCV system really was. Take a look at one of the main breather ports (Figure 2) for the system that is located on the lower front engine block. As you can see it was totally clogged and needed to be drilled scrapped and picked clean. My tech Franklin had to spend a good two or more hours just cleaning all the passages as well as cleaning carbon deposits from the valves and intake manifold. If the vehicle would have had proper maintenance, the replacement of the flame trap (Figure 3) would have been much easier. If we would have just done what the customer originally requested he would have still had the same problem of oil consumption and stalling. It's always a good idea to make a thorough inspection and make sure to address the vehicle owners concerns so they leave the shop satisfied with a vehicle that is running well. Now that the engine was running good and the PCV system was able to suck rather than blow the vehicle was ready to ship.

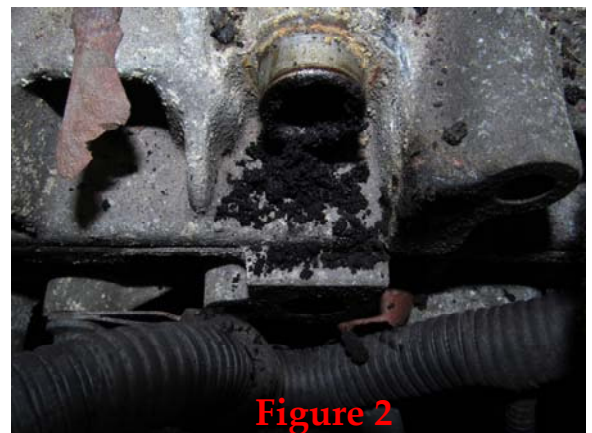


Figure 2



Figure 3

***All Articles in this newsletter by
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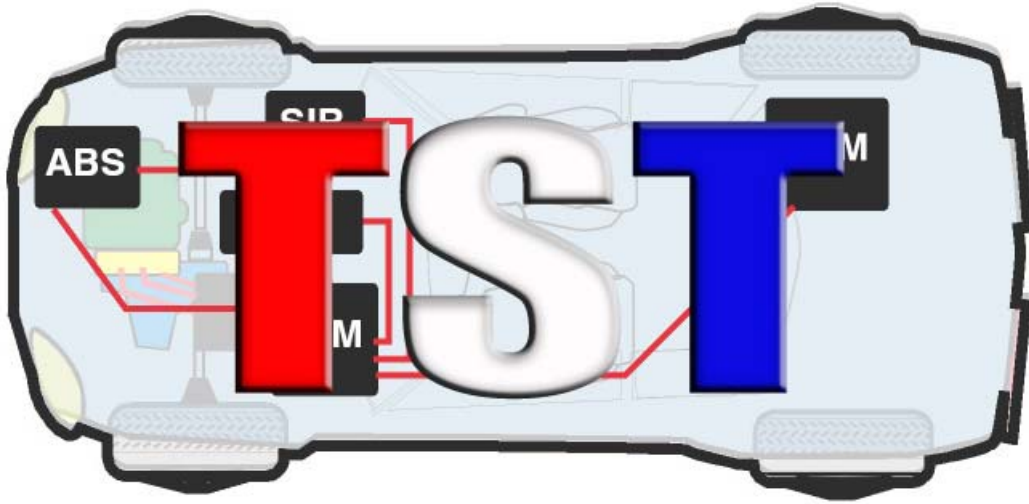
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