



Technicians Service Training

INSIDE THIS ISSUE:

"Scan Tool Specific Diagnostics"

P. 1 - 13

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Editor

"G" Jerry Truglia

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"Scan Tool Specific Diagnostics"

There are many scan tools out there in the market with different options and abilities. Many of these tools share the special features found on other tools.

In order to become familiar with the abilities scan tools have, we provide an overview of some brand-specific scan tool diagnostics. Your scan tool may or may not have the abilities and options that you see here.

The Health Check allows the scan tool to query all onboard computers and report on DTCs. This helps us find out how many problems a vehicle has, and of what nature they are.

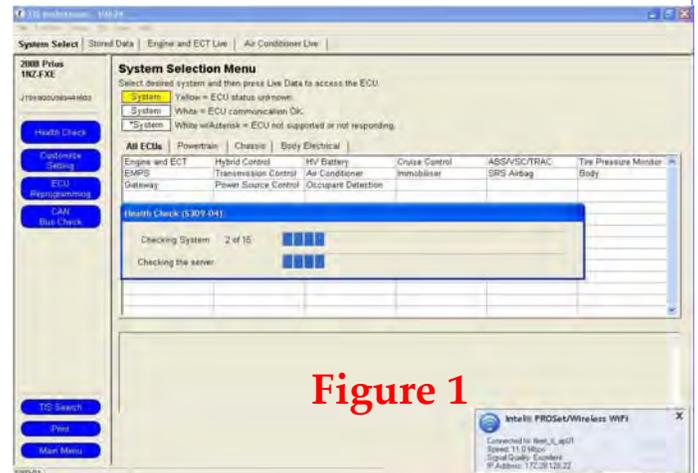


Figure 1

Toyota TIS Monitor Test Results

The TIS allows you to see the success of a repair before the Monitor sets (see page 4). Here the little upside down yellow triangle provides us information on the Monitor. It tells us that the catalyst is currently passing the test and that the tune up helped clear up a P0420 DTC.

(Con't on page 4)

What is TST?

TST is a group of dedicated technicians and instructors committed to the continuing education of our fellow technicians. We provide training seminars to technicians at a reasonable price. TST brings our members nationally known instructors and state of the art training.

Our Goal & Mission Statement

- *Keep our fellow technicians up to date with the latest technology.*
- *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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The following are some of TST’s regular instructors:

Bernie Thompson of ATS

John Thornton of Autotrain Inc.

Wayne Colonna of ATSG

Jorge Menchu the “Labscope Guru,” AES Wave

John Anello of Auto Tech On Wheels

Mark Warren of World Pac / Motor Magazine

Brandon Steckler of CTI & Motor Age Magazine

Peter Meier of Motor Age Magazine

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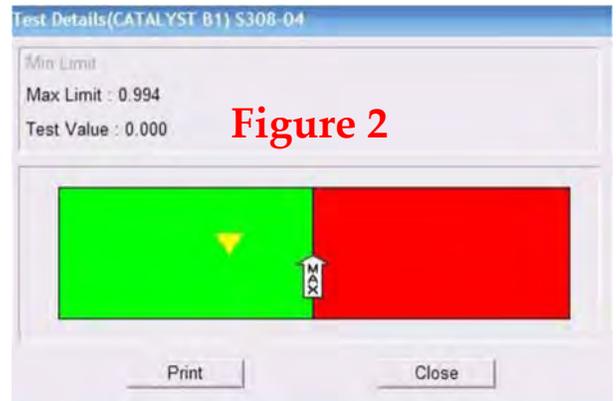
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“Scan Tool Specific Diagnostics” (con’t from p. 1)

Scan Tool Basics

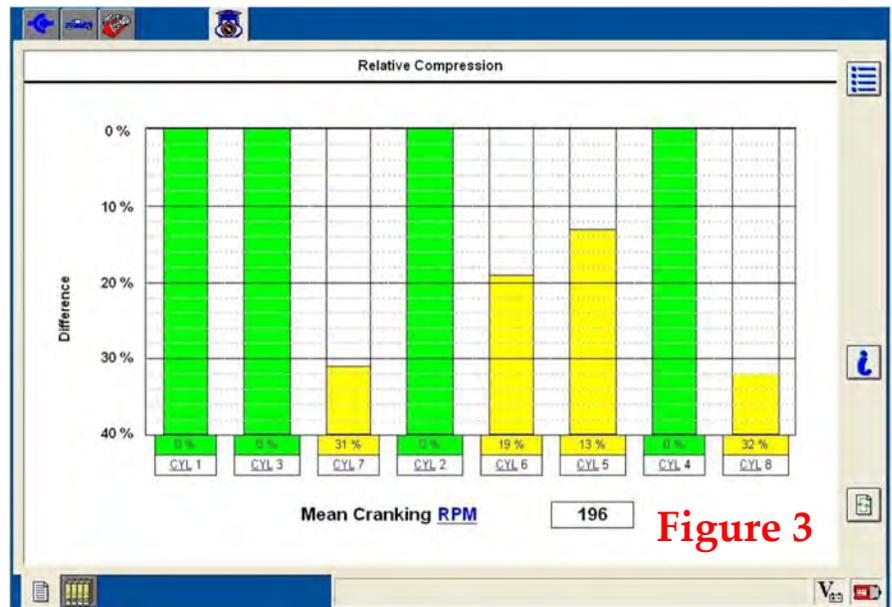
Relative Compression Using the Ford IDS

The Ford IDS scan tool does relative compression by the press of a button. This is a quick test to make sure that the engine itself is not the root cause of a driveability problem. Do it before replacing any sensors or actuators.



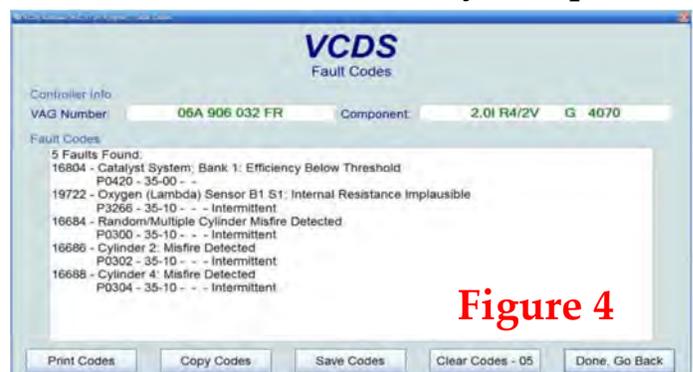
Ross – Tech VCDS Audi VW Scan Tool

This scan tool supplies factory level scan tool information that converts the OE code to understandable DTC information. In fact, almost all of its capabilities are factory level besides reprogramming. There are no other after-market scan tools on the market that offer the same level of ability comparable to a factory tool that the VCDS does.



Using the Launch X-431 to Diagnose EGR DTC

An EGR flow test helps us diagnose if the EGR is operable or not.



(Con’t on page 5)

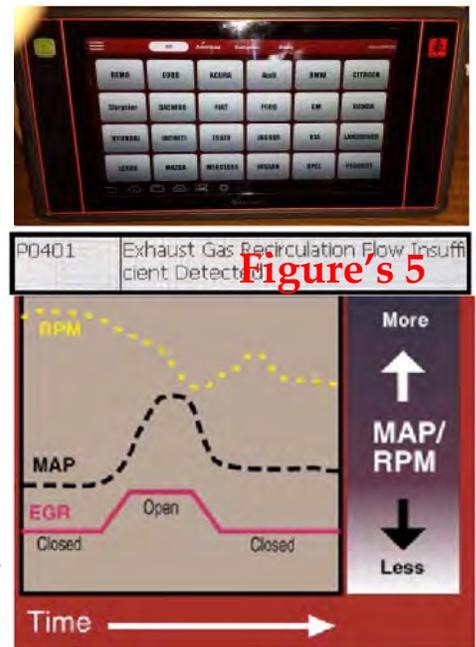
“Scan Tool Specific Diagnostics” (con’t from p. 4)

Use your scan tool’s bidirectional control to open the EGR and check the MAP or MAF sensor for a rise in voltage as RPM drops. If your tool does not have the ability to open and close the EGR valve, use a Power Probe after consulting a wiring diagram.

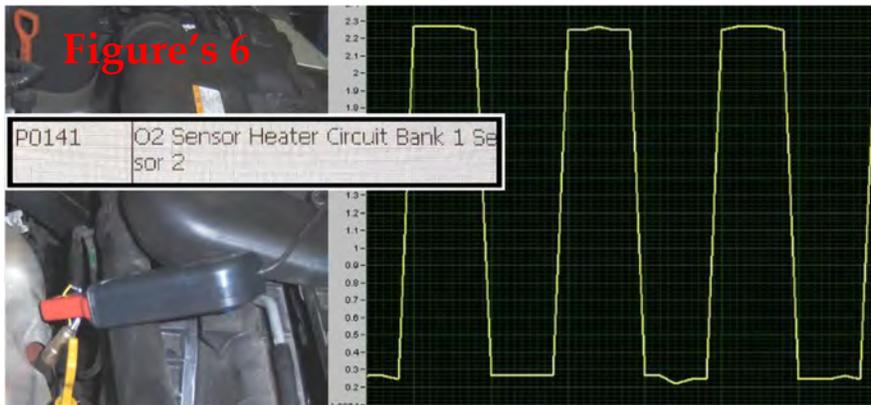
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Using the Launch X-431 to Diagnose HO2S Heater Circuit DTC

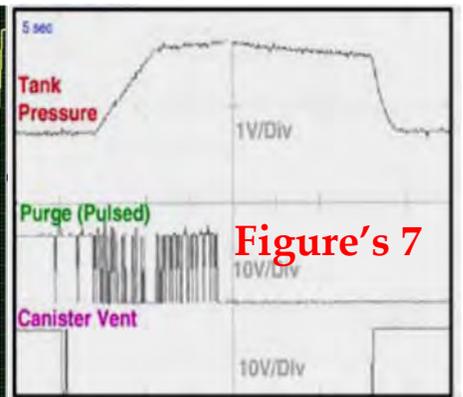
If you have a HO2S heater circuit DTC, diagnose whether it is working or not. A quick easy way to check this is using an amp clamp with a DVOM or scope around the heater circuit wire. The circuit should rise and fall in voltage, as we can see in the adjacent waveform.



Figure's 5

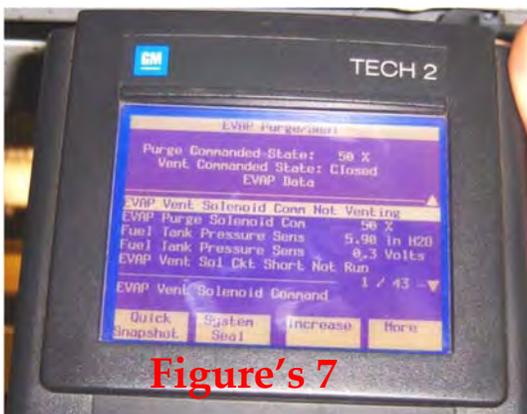


Figure's 6



Figure's 7

EVAP with the GM Tech 2



Figure's 7

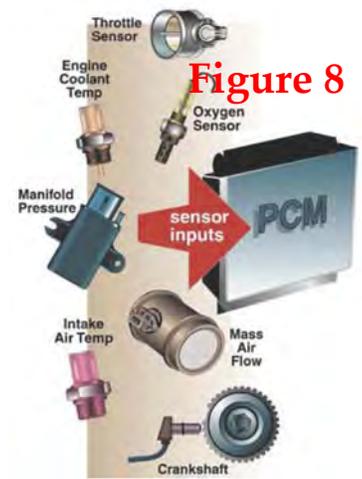
Here using the Tech 2, we are selecting PIDs to view while activating the Purge Solenoid. When the Purge Solenoid is activated there should be a drop in Fuel Tank Pressure in H2O and in voltage pressure. If this does not occur, there is either a clog or the part is not connected properly.

(Con't on page 6)

“Scan Tool Specific Diagnostics” (con't from p. 5)

Sensors In-Depth

Scan tools are useful to us because they provide us with up-to-date information on vehicle conditions thru the PCM (Powertrain Control Module). Sensors do this in two ways: they generate a voltage signal, or they modify a voltage then send to the computer. Voltage levels represent different vehicle operating conditions.



Because sensors can be defective, have electrical circuitry issues, or can be misrepresented by the PCM (either by defect or conditions that necessitate the PCM using “substituted values” - more on this in the scan tool section of this book) we have to sometimes take sensor information with a grain of salt when it does not make sense.



Figure 9

The most important sensors you work with on a daily basis are the engine speed (RPM, CKP & CMP), temperature of engine coolant (ECT) & intake air (IAT), engine load (MAP) or air mass sensor (MAF), throttle position (TP), oxygen (HO2S) and/or air-fuel (AF) sensor, knock sensor (KS), (VSS) vehicle speed sensor.

Engine Speed Sensor, CKP, and CMP



Figure 10

On this VW we can see that the distributor to the right has a cap covering the CMP (cam sensor). It works in concert with the CKP (Crankshaft) and other sensors providing feedback to the ignition module and ECM. The CKP and CMP sensors are important for proper ignition and fuel delivery.

(Con't on page 10)

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“Scan Tool Specific Diagnostics” (con't from p. 6)

Engine Coolant Temperature (ECT) Sensor

Temperature sensors and sensor circuits can fail electrically. When they do, they usually store a trouble code in the computer and turn on the dashboard warning light.

Changes in sensor resistance create different voltage feedbacks which are translated by the PCM into temperature data.

Dual Range Temperature Chart

Temperature ° F	Resistance	Voltage
-40° F	100,700Ω	5.00 V
+33° F	9,600Ω	3.50 V
+57° F	4095Ω	2.70 V
+78° F	2,975Ω	2.00 V
+100° F	1,800Ω	1.50 V
+120° F	1350Ω	3.85 V
+143° F	835Ω	3.20 V
+163° F	432Ω	2.75 V
+186° F	305Ω	2.15 V
+210° F	185Ω	1.70 V
+234° F	60Ω	1.25 V

Figure 10

Intake Air Temperature (IAT) Sensor

IAT information is factored into PCM fuel calculations: air density depends in part on air temperature (air pressure is also important as we'll see shortly). Because air density affects the oxygen in a given volume of air, the powertrain uses the IAT alongside air-flow input to help it adjust fuel delivery to maintain a target air/fuel ratio.

Time Out Real World CTS and IAT Testing



Figure 11

Testing the CTS (Coolant Temperature Sensor) for the 5 volt reference. Open circuit, connector disconnected from the CTS, voltage High, 5 volts or so.

(Con't on page 11)

“Scan Tool Specific Diagnostics” (con’t from p. 10)

Testing the CTS circuit with terminals connected together with a jumper wire and T pins. Short circuit, connector terminals shorted, voltage Low, about 100 mv or so.

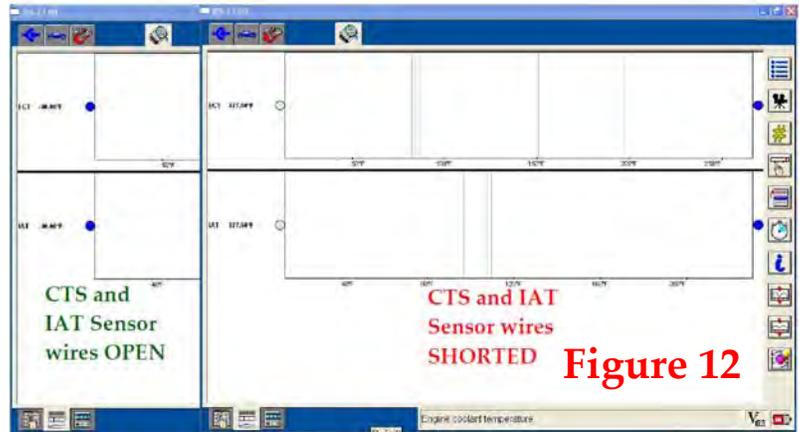


Figure 12

Why would we perform this test? One example would be when the scan tool’s CTS and IAT PIDs are not within 5 to 10 degrees F of each other on a cold engine. To make sure it’s not a PCM problem we suggest that you disconnect the CTS and IAT and check for approximately 5 volts and a -40 or so, on the scan tool data. If those readings are displayed go to the next step of shorting the 5 volt Vref and the ground of the connector together. The scan tool PIDs should now be 300 degrees F or higher and the voltage should be under 100mv. If those readings are displayed then the PCM and the wiring are good and the problem can be dirty sensors, low coolant or bad sensors.



Figure 13

Engine Load and Air Flow Sensors

It is essential for proper engine operation that the PCM knows how much air (which has oxygen for combustion) the engine is dealing with.

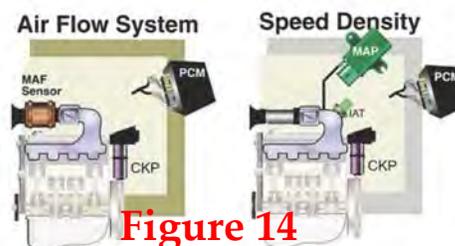


Figure 14

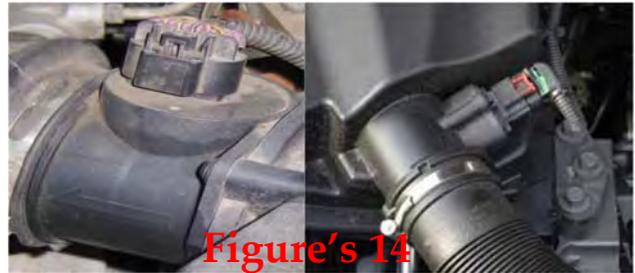
(Con’t on page 12)

“Scan Tool Specific Diagnostics” (con’t from p. 11)

There are two ways to determine available oxygen:

1. MAF systems: Measure the volume or mass of the air as it enters the engine. This process is used in air flow fuel control systems. Newer MAF sensors have 8 wires, since there is a humidity sensor built in.

If you suspect there to be an airflow issue on a MAF system, you are going to want to do a volumetric efficiency test. You can get a volumetric efficiency calculator online, or better yet, look at the Calculated Load PID. If Calculated Load is over 90 percent at Wide Open Throttle, volumetric efficiency is not a problem.



2. MAP systems: Measure the air pressure inside the intake manifold and calculate the amount of oxygen available, based on engine size, speed, efficiency, and the temperature of the air in the manifold. This method is used in speed/density fuel control systems.

MAP Sensor

MAP sensors are used in Speed Density fuel control systems to measure the pressure of the air already inside the intake manifold.



TPS (Throttle Position) Sensor

The TPS is attached to the throttle plate shaft. An electrical contact sweeps across a variable resistor inside the TPS as the throttle opens and closes. The change in resistance modifies a reference voltage from the computer, which indicates TP position.

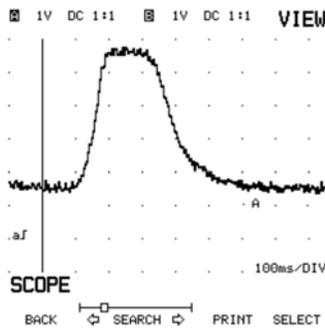
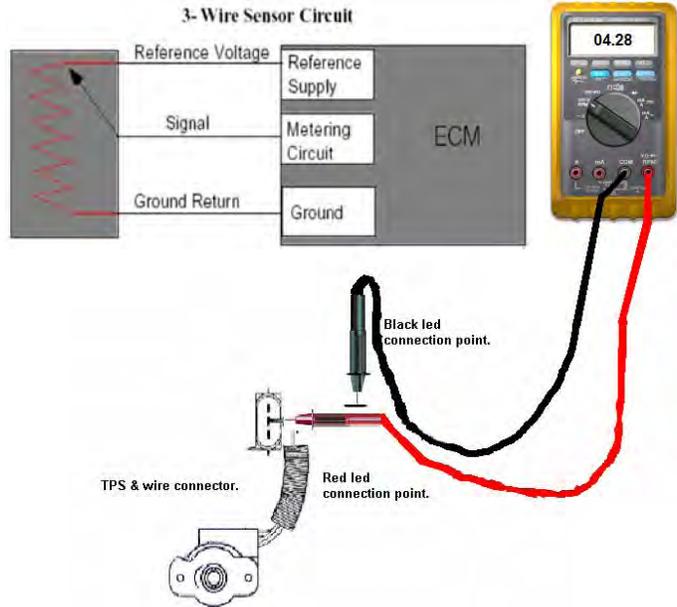


(Con't on page 13)

“Scan Tool Specific Diagnostics” (con’t from p. 12)

Time Out Real World TP Testing

1. Connect meter leads to the correct jacks.
2. Turn the dial to DC Volts.
3. Make sure the meter is reading DC Volts on the display.
4. Connect the red meter lead to the TPS signal wire and the black end to a good ground.
5. Rotate the TPS sensor by depressing the throttle.
6. Check the display for the min and max voltage. Select Min Max to record the voltage and check the readings. Notice the fast update rate on the bottom of the meter display.



Voltage reading (above) and lapscope waveform (left) taken at the signal wire. The 3 wire sensor connector (above right) is a good example of the 5 volt VREF, Signal and Ground.

The Accelerator Pedal Position Sensor (APP) is a drive by wire system that has replaced a mechanical connection from the gas pedal to the throttle plate. The sensor outputs a redundant signal at different voltage levels.



Next month more sensor testing

*Article by “G” Jerry Truglia
TST Founder- President - ASE Master Technician*

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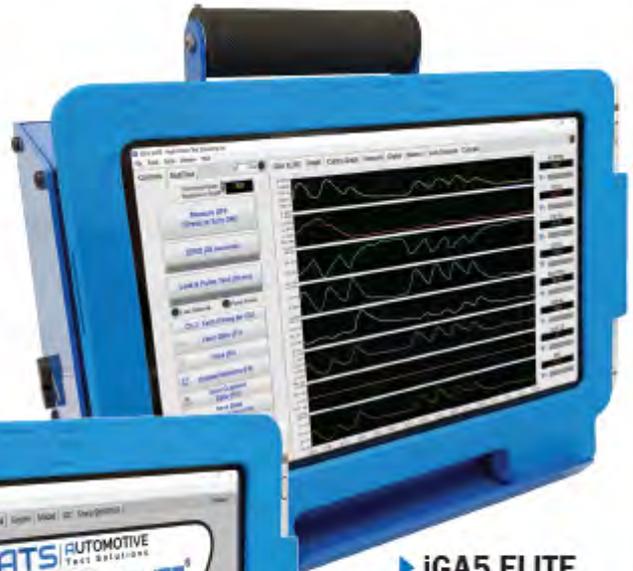
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