

February 2026



Technicians Service Training

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Editor

"G" Jerry Truglia

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"Modes Of OBD II & More"

The 10 Modes of OBD II are something you have been using for years. When you connect your scan tool collecting information for DTCs, hey that's Mode 3. When you look at scan data PIDS your using Mode 1. So, see you know some of the 10 Modes of OBD II.

MODES	GENERIC TITLE	Figure 1
Mode 1	Powertrain Diagnostic Data	
Mode 2	Powertrain Freeze Frame Data	
Mode 3	Emission Related Powertrain DTCs	
Mode 4	Clear/Reset Emission Related Diagnostic Information	
Mode 5	Oxygen Sensor Monitoring Test Results	
Mode 6	Test Results for Non-Continuously Monitoring Systems	
Mode 7	Test Results for Continuously Monitored Systems	
Mode 8	Request Control of On-Board System Test or Component	
Mode 9	Request Vehicle Information	
Mode 0A/10	Permanent Diagnostic Trouble Codes (DTCs) (Cleared DTCs)	

Mode 5 and Mode 6 Tests

Test ID (TID)	Value	Min	Max	Units
\$03: Low Sensor Voltage for Switch Time Calculation (constant)	0.400	0.000	1.275	V
\$04: High Sensor Voltage for Switch Time Calculation (constant)	0.550	0.000	1.275	V
\$07: Minimum Sensor Voltage for Test Cycle (calculated)	1.275	0.000	1.275	V
\$08: Maximum Sensor Voltage for Test Cycle (calculated)	0.000	0.000	1.275	V
Mode 5				
Figure 2				

(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.*
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- *Deliver information that the technician can use now.*
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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

Ken Zanders of Illinois Air Team

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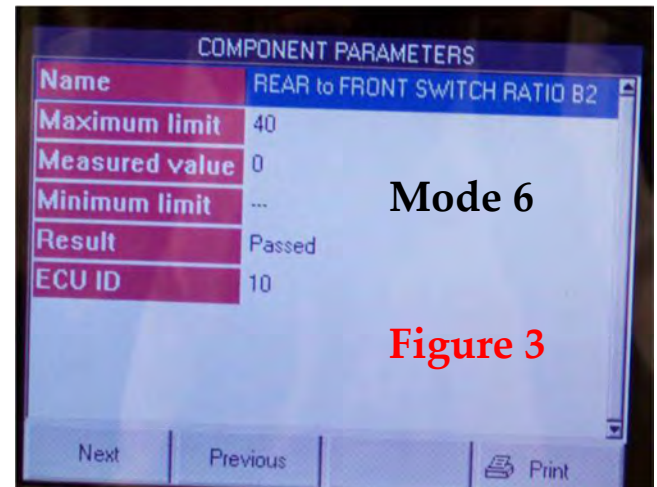


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DTC-2465-Rev1-20240318-01

"Modes Of OBD II & More" (con't from p. 1)

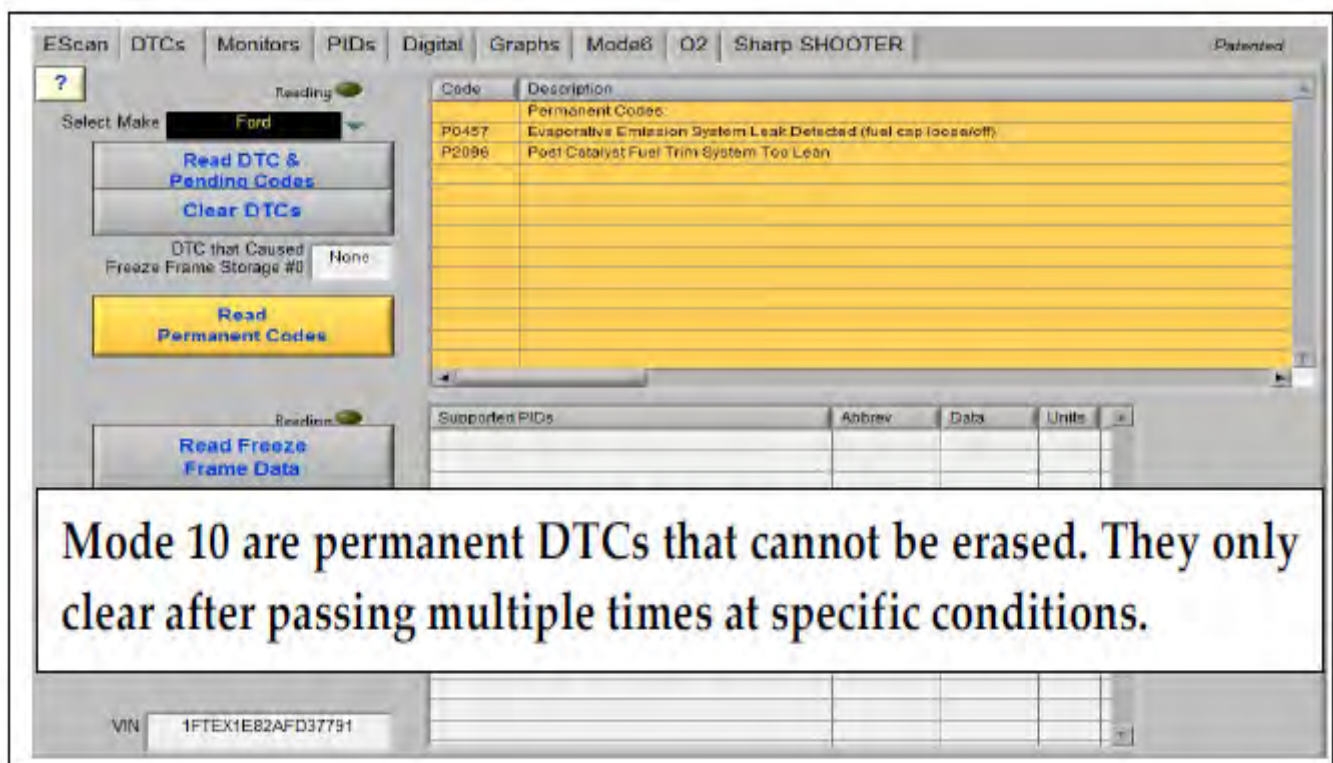
Mode 5 (**Figure 2**) is not available on all vehicles besides some pre-CAN ones, but when it is you should view the data. The scan tool pictures on page 1 (Mode 5 data, and Mode 6 data, right) provide voltage readings and switching results. The results can be helpful in making a decision on a P0420 DTC. If the front O2 voltage is not low or high enough, and is not switching in the correct time, you may not want to condemn that converter. 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.



Mode 6

Figure 3

Mode 10



(Con't on page 5)

"Modes Of OBD II & More" (con't from p. 4)

SCAN TOOLS

Chances are you own some sort of scan tool and are rolling your eyes, because you already use a scan tool every day in your shop. We want to make you a better scan tool user. For example, we are sure you have a cell phone too. But, do you know how to shoot video with your cellular phone? Surf the internet? Play videogames? Chances are you only know how to use twenty percent your cell phone.

The same is true of your scan tool! Do you discern between Generic/Global and enhanced OBD II, use PIDs or Mode 6, exploit bi-directional controls for diagnostic purposes, and more? We hope to make you able to use 100 percent of your scan tool so you can get more tool for your money.



Figure 4



Figure 5



Figure 6



(Con't on page 6)

“Modes Of OBD II & More” (con’t from p. 5)

Connections

We are not going to belabor this topic, because it is elementary. Depending upon whether a vehicle is OBD I or OBD II compliant, it is going to connect to a DLC (Diagnostic Link Connector). Before 1996 or 1998, Canadian the DLCs were often under the hood.



Figure 6

Now they are all in most vehicles, the same shape, usually under the steering column. Some scan tools require you put the right “key” in when working on a certain vehicle. Other more advanced ones do not.



Figure 7



pin

If the scan tool cannot communicate, pins 4 and 5 “grounds” or 16 “power” have problems.

A BOB (Break Out Box) makes it easy to test for OBD II communication and signals coming through the DLC with your meter. All you have to do is plug it into the DLC and put the meter leads into the BOB.

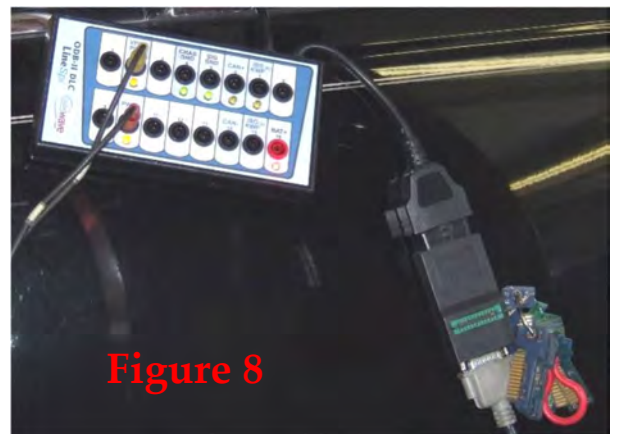


Figure 8

Generic / Global OBD II

All we require to diagnose emissions problems is Generic / Global OBD II.

Granted, OEM software has many useful bi-directional

(Con’t on page 11)

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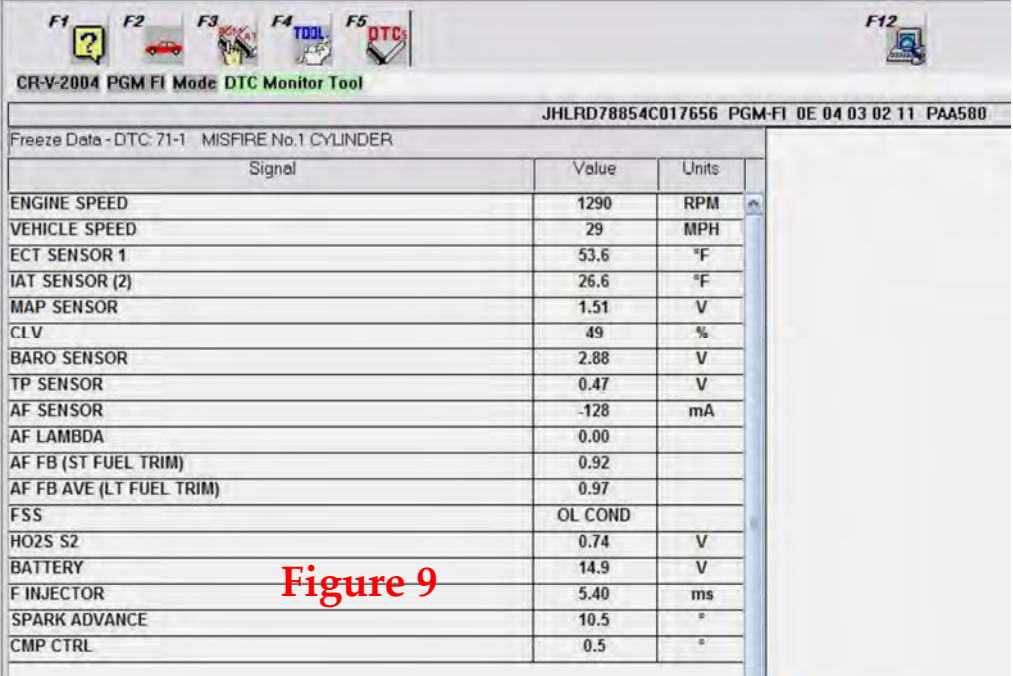
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"Modes Of OBD II & More" (con't from p. 6)

However, the ability to read PIDs, DTCs, Pending DTCs, clear DTCs, Freeze Frame, and Monitor readiness status is nothing to sneeze at. Scan tools these days will give you the code definitions, explaining what caused the DTC.

Freeze Frame

Freeze Frame simply is information the vehicle saves when it stores a DTC. Knowing an array of sensor values helps you figure out what really caused the DTC.



Signal	Value	Units
ENGINE SPEED	1290	RPM
VEHICLE SPEED	29	MPH
ECT SENSOR 1	53.6	°F
IAT SENSOR (2)	26.6	°F
MAP SENSOR	1.51	V
CLV	49	%
BARO SENSOR	2.88	V
TP SENSOR	0.47	V
AF SENSOR	-128	mA
AF LAMBDA	0.00	
AF FB (ST FUEL TRIM)	0.92	
AF FB AVE (LT FUEL TRIM)	0.97	
FSS	OL COND	
HO2S S2	0.74	V
BATTERY	14.9	V
F INJECTOR	5.40	ms
SPARK ADVANCE	10.5	°
CMP CTRL	0.5	°

Figure 9

Erasing DTCs

After completing a repair or trying to discern if a DTC is for real or not (i.e. an EVAP DTC when the motorist probably left the gas cap loose), you will need to erase the DTCs. When you erase DTCs, not only DTCs but all Freeze Frame information and monitor status will be reset.

Actual versus Calculated "Substituted" Values

Sometimes the "direct measurements" scan tools reflect are in fact "substituted" or "calculated" values when we use Enhanced OBD II. Why? Because if a sensor breaks, the PCM needs to substitute a workable value to prevent breakdown.

(Con't on page 12)

"Modes Of OBD II & More" (con't from p. 11)

For example, when we see a crazy value, like -40 degrees F in the above, we can rest assured that the normal looking value in enhanced is false. The PCM substitutes a workable value so the vehicle can keep running. However, the suspect sensor will need to be diagnosed and repaired to correct the problem. To the left are typical substituted values.

Below Right is an example:
This scan tool display indicates an open MAP sensor circuit with a fixed voltage of 4.8 volts, even though the MAP calculated pressure reading is fluctuating.

PIDs (Parameter Identifications)

Looking at PIDs helps us look at the values of an array of sensors and actuators without directly measuring them without a meter or scope.

We want to look at PIDs to diagnose emissions problems that might be related to a specific component. For example, to diagnose a catalytic converter, we might want to see whether the post-cat sensor is switching or not. If the voltage keeps going up and down instead of staying steady, then we know that the cat might be bad. ***(Con't on page 13)***

DTC	PCM Response
P0100 (MAF)	Ignition fixed @10°BTDC Injection duration fixed: Idle switch ON.....3.5ms Idle Switch OFF ..6.3ms
P0110 (IAT)	IAT fixed @20°C (68°F)
P0115 (ECT)	ECT fixed @80°C (176°F)
P0120 (TP)	Throttle angle (VTA) fixed @ 0°
P0135 (O2 Heater) P0141 (O2 Heater) P0155 (O2 Heater)	Heater turned off in heater circuit that stored DTC
P0325 (Knock Sensor) P0330 (Knock Sensor 2)	Max timing retard
P1300 (Igniter - no IGF)	Fuel Cut (no injection)
P1605 (Knock Control)	Max timing retard

Figure 10

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

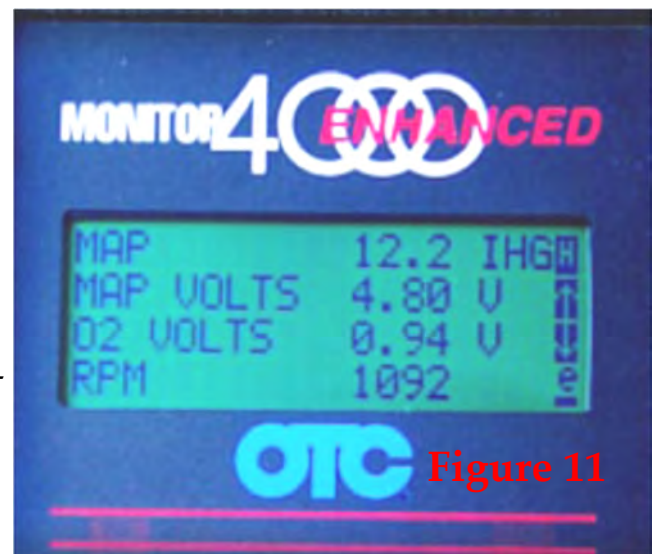
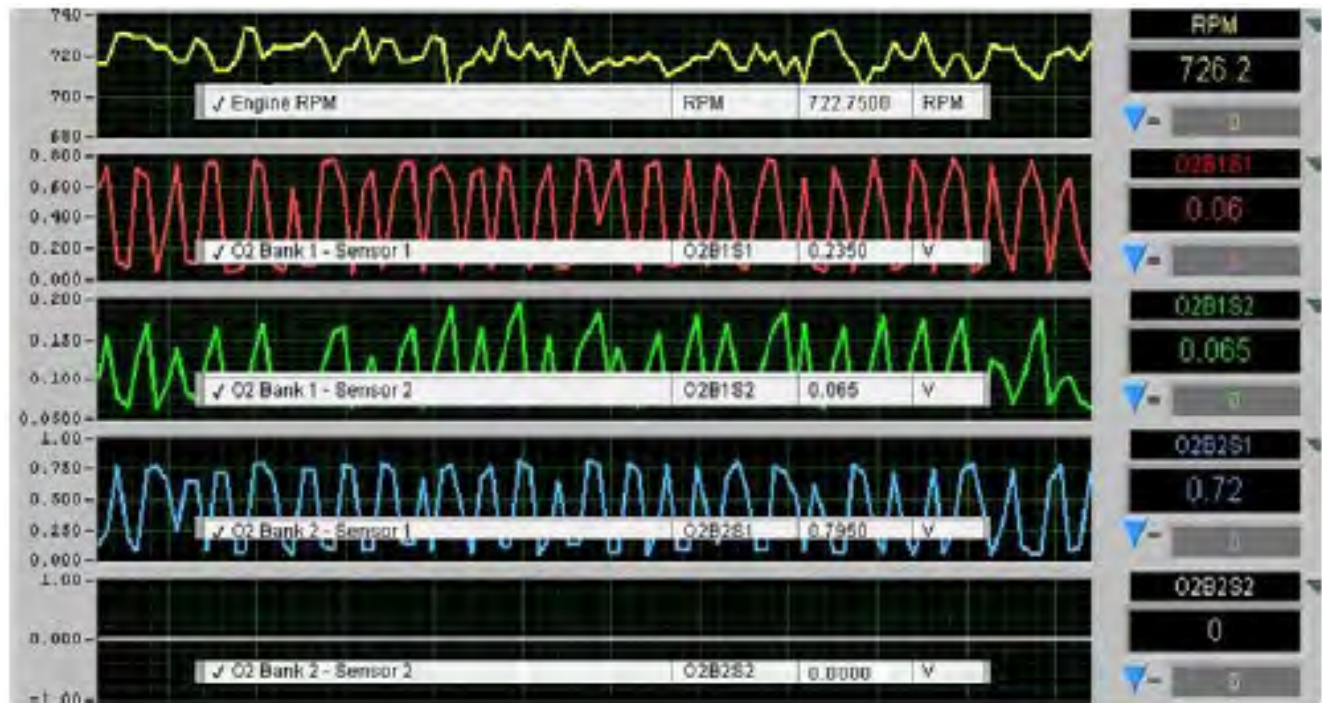


Figure 11

"Modes Of OBD II & More" (con't from p. 12)

Graphing PIDs



Graphing is simply a graphical representation of the PIDs. It helps problems stand out. Here, we can see that the post-cat oxygen sensor (O2) Bank 1 Sensor 2 (green/third from the top) is switching and that we have a catalytic converter problem.

Refresh Rate

As a quick note, the more PIDs we view or graph, or when we read Mode 6 continuously the scan tool will slow down.

Recording a Movie

Recording data is a powerful and useful tool. This is used if there is an intermittent problem that only pops up after a long while.

(Con't on page 15)

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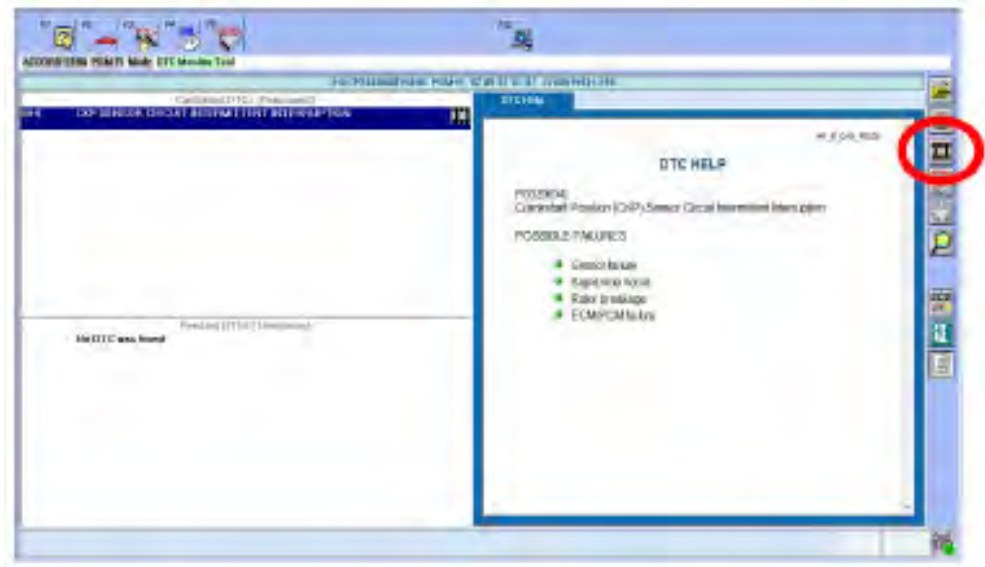
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"Modes Of OBD II & More" (con't from p. 13)

Think of a scan tool movie as a multiple frame film strip that can be replayed. Simply press record so you can record data over a prolonged period of time, so subsequently you can view each frame to see if any values have changed.



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.


Next month Toyota TIS Health Check

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

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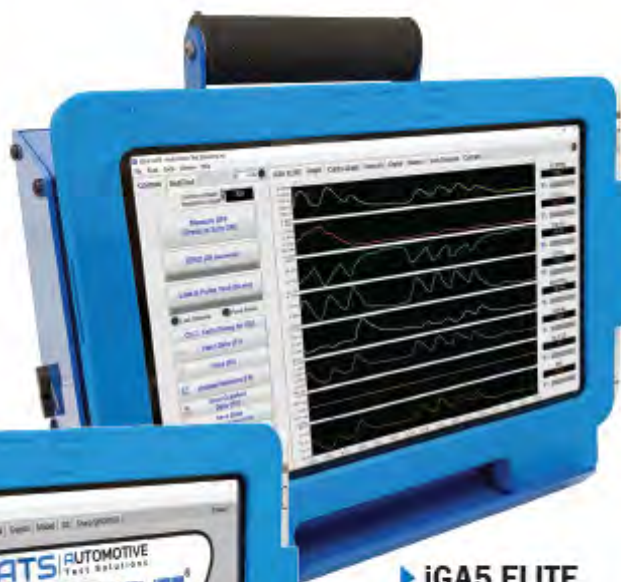
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