# *Dorman Training Center Presents:*

## *"OBD II DIAGNOSTIC STRATEGIES"*

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## *Your Instructor For This Seminar*

- National Trainer, ASE World Class, Master Auto, Truck, School Bus, L1, L3, CNG

- 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, Motor Age and TST Webcast Instructor - Dorman Training Director

- 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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## What Will Be Covered

**Instructions For This Seminar**

**This seminar will be approx. 1 + hour long**

- **All slides that are presented are in your handout and are numbered**
- **Have a pen or pencil and paper for notes**
- **Questions can be asked at anytime**

01 **What Is The OBD II Emission Test**

02 **Checking The OBD II Link Connector**

03 **Different Scan Tools**

04 **Monitors**

05 **Case Studies and more……**

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## OBD II Diagnostic Strategies

**OBD II vehicles are being tested everyday in many states with a scan tool instead of an emissions analyzer or just for diagnostic purposes.**

**The following must be checked for a complete diagnosis or OBD II test:**

- **DTCs**
- **MIL commanded state (ON/OFF)**
- **Completion status of Non-Continuous Monitors**

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## About The MIL



**Federal Test Procedure**
**How does OBD II know if the**
**vehicle passes or fails its tests?**
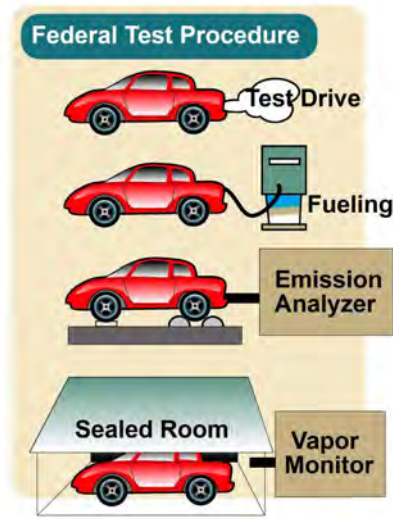


**The Federal Test Procedure is a set of EPA tests used to certify emission levels of new vehicles.**

## OBD II Emission Technology



**The Messenger's**

**The Workers**
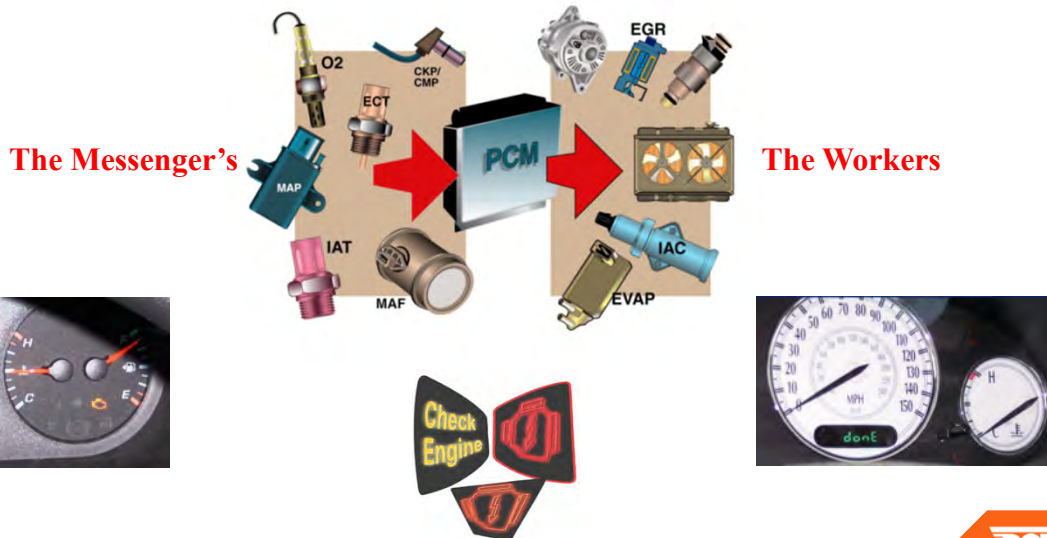
## Things To Know About OBD II

• **PIDs**

• DTCs

• **Freeze Frame**

• Readiness Status

• **Monitors**

• Enabling Criteria

• **Pending DTCs**

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## OBD II Connector
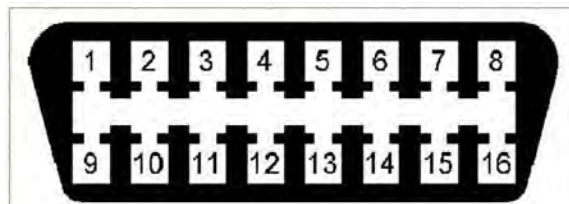


| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | Vendor Option | 9 | Vendor Option |
| 2 | J1850 Bus + | 10 | j1850 BUS |
| 3 | Vendor Option | 11 | Vendor Option |
| 4 | Chassis Ground | 12 | Vendor Option |
| 5 | Signal Ground | 13 | Vendor Option |
| 6 | CAN (J-2234) High | 14 | CAN (J-2234) Low |
| 7 | ISO 9141-2 K-Line | 15 | ISO 9141-2 Low |
| 8 | Vendor Option | 16 | Battery Power |

**What Pins are used to power up your scan tool?**
**Others?**

## Things To Know About OBD II

**DLC (Diagnostic Link Connector)**

• **16 Cavities**

• **PIN 4 Chassis Ground**

• **PIN 5 Sensor Ground**

• **PIN 16 Battery Voltage**
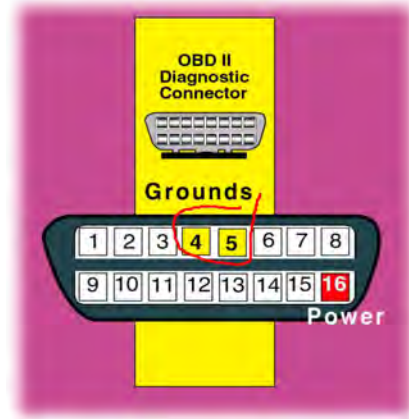


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## Things To Know About OBD II

**Dealership (Factory)**
• **Increased data PIDS**
• **Programming and Re - programming**
• **Diagnosis of complete vehicle systems**

**OEM Enhanced**
• **Full DataStream**
• **Most other computer system datastream**
• **Actuator output test**
• **Diagnosis of complete vehicle systems**

**Generic OBD II**
• **Read Generic/Global DTCs**
• **Read Freeze Frame**
• **Erase DTCs**
• **Monitor Status**
• **Mode 6, 9 and 0A/10**
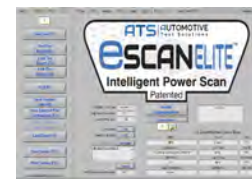
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## Actual vs. Calculated Data Values



**Always use Generic / Global OBD II First**

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## Monitors



**Notice Anything?**
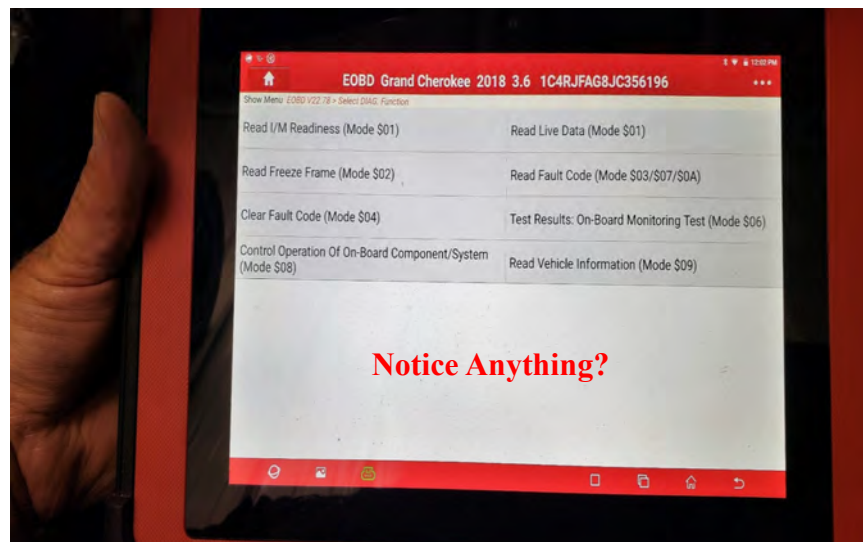
## Monitors



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## Monitors



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# Monitors

# 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"**

## 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.

| Monitor | Availability | Status |
|---|---|---|
| Non-Continuous Monitoring Tests | | |
| 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.

| Monitor | Availability | Status |
|---|---|---|
| Non-Continuous Monitoring Tests | | |
| 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

Monitors
Not Complete

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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.


Monitors Not Complete

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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

## 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.

**NOTE: The sensor heater may have to be relearned.**


Ready Scan from OTC/SPX


1 Ohm – 10 watt resistor

Monitors
Not Complete

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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.**
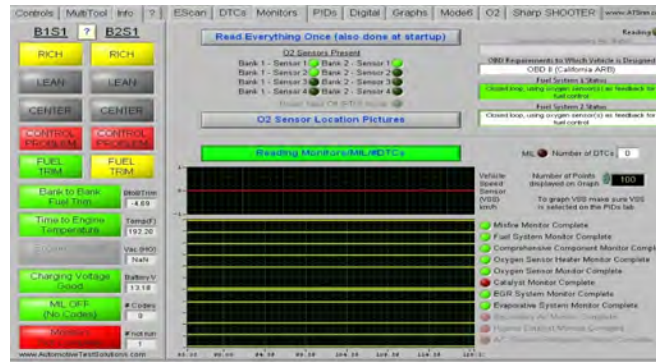
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## Monitors Tips

**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**

The monitor will not run unless:

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

- 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.)

Courtesy of Toyota North America

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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.***



Courtesy of Toyota North America

# TIME OUT - CASE STUDY

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## 2013 Subaru Outback

## 2013 Subaru Outback



**AF Sensor Yellow Front O2**

# TIME OUT - CASE STUDY

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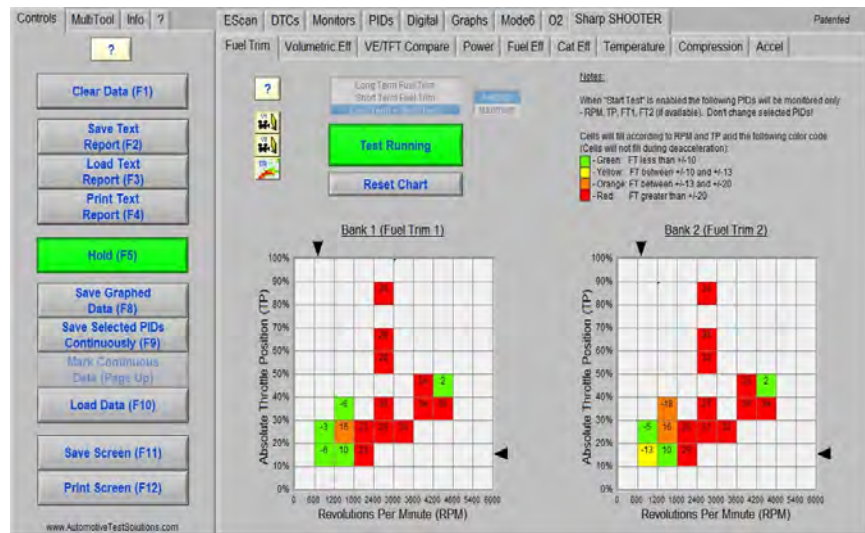## Start Screen - Always Check The VIN



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## Next Check DTCs & Freeze Frame



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# Check The Battery & Engine With Relative Compression

# Check The Fuel Trim

# TIME OUT - CASE STUDY
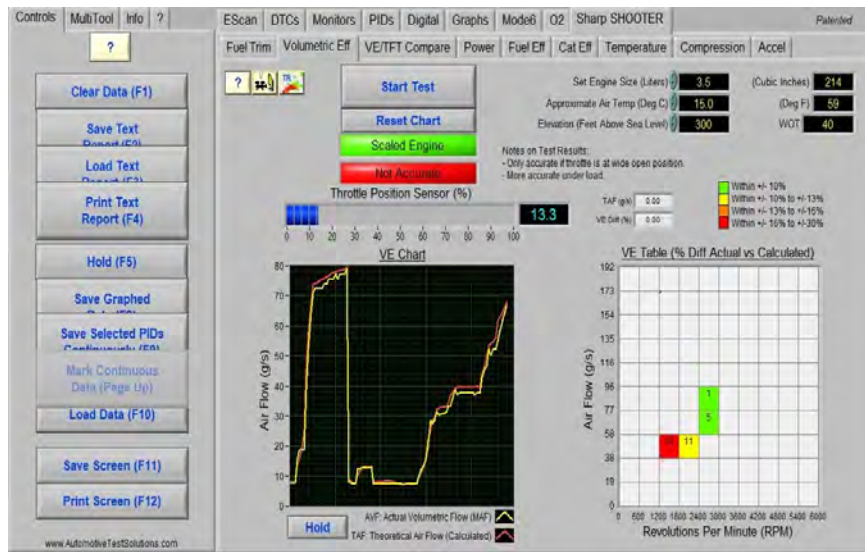
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## 2006 Hummer H3 Rough Idle

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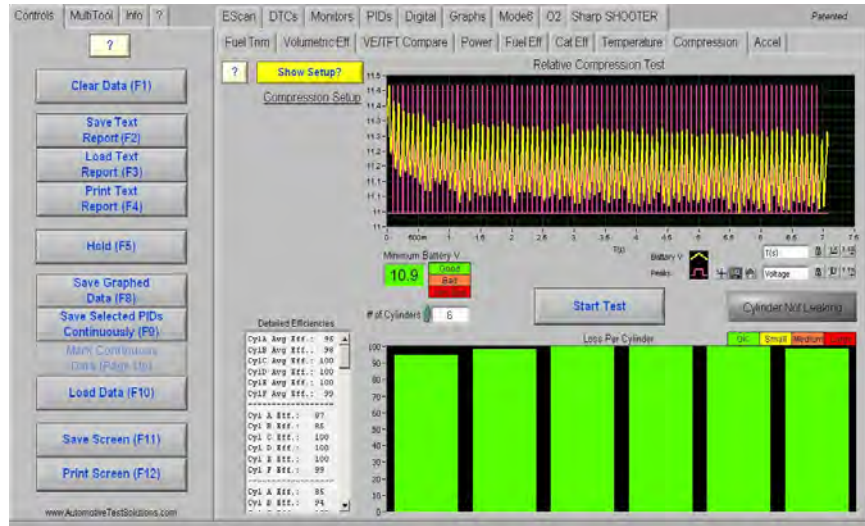
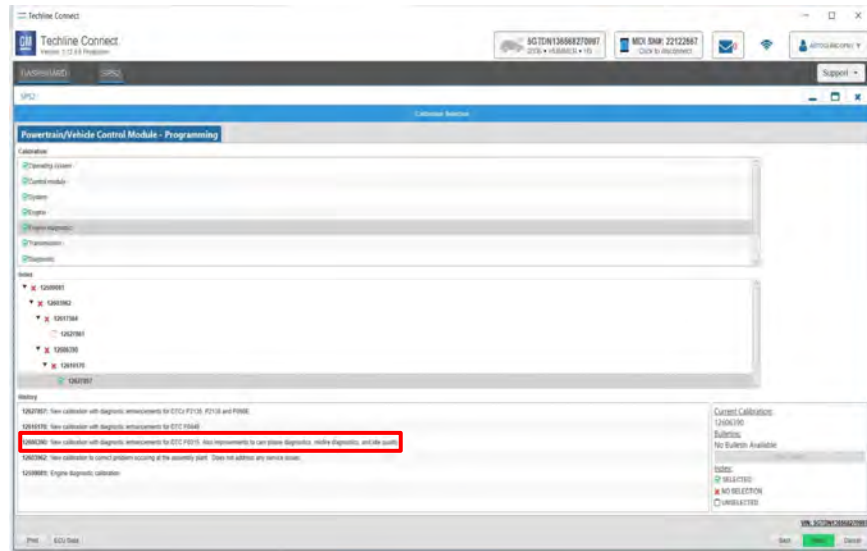## 2006 Hummer H3 Rough Idle
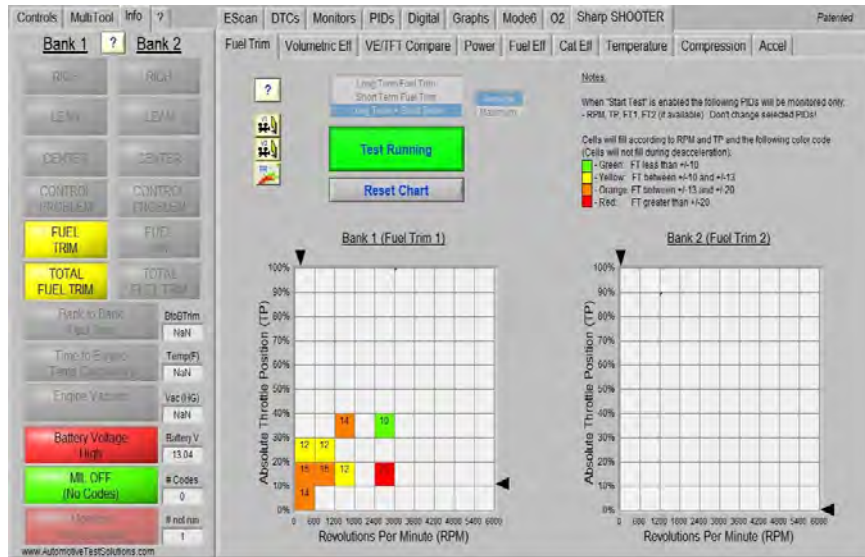


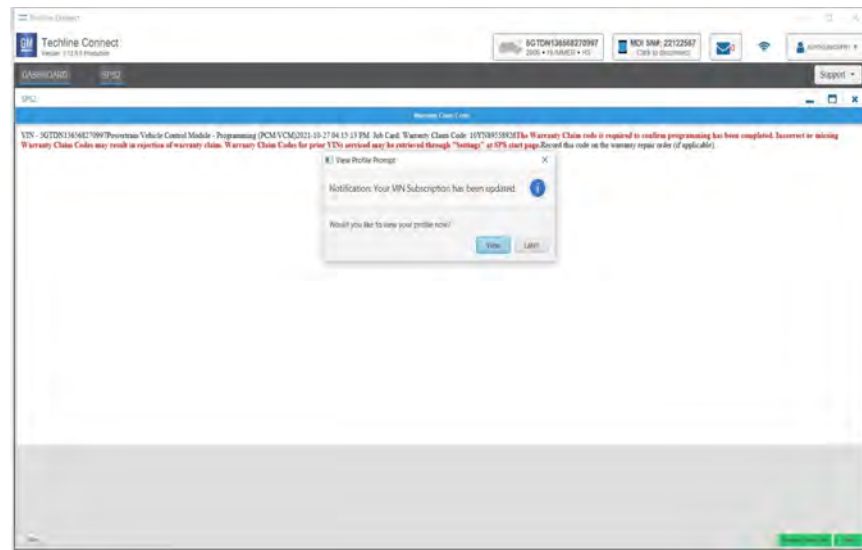39

## 2006 Hummer H3 Rough Idle
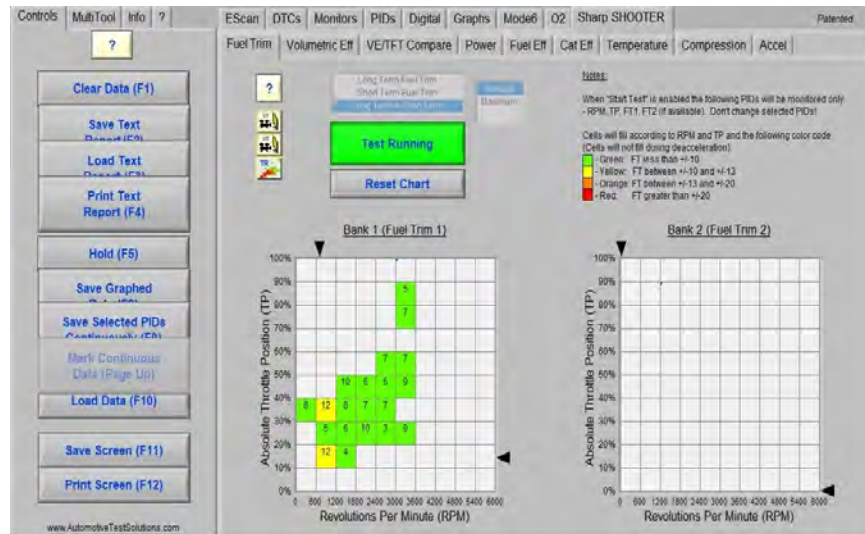


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## 2006 Hummer H3 Rough Idle



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## 2006 Hummer H3 Rough Idle



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## 2006 Hummer H3 Rough Idle

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**Tuesday November 26th, 2024**

**Heavy Duty Lunch & Learn 12:00pm to 1:00pm ET**

***"Heavy Duty Vehicle Multiplexing" Part 2***

**What will be covered:**
- **Continuation of "Multiplexing"**
- **Controller Area Networking (CAN)**
- **Understanding Scan-tool interfaces and relationship to a network.**
- **Terminating resistors**

**Instructor: Swede Oun**

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*Questions?*

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*Thank You!*

Please scan the QR code to fill out a quick survey about this presentation

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