eSCAN PRO®

Intelligent Power Scan

Patented

User Manual

ATS
AUTOMOTIVE
Test Solutions

Legal Information

Trademarks

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The *Bluetooth* word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by Automotive Test Solutions Incorporated is under license.

Copyright Information

Limited Warranty and Disclaimer

One Year Limited Hardware and Software Warranty
Automotive Test Solutions, Inc. a New Mexico corporation, here after ATS, products are warranted against defects in materials and workmanship for a period of one year from receipt by the end user (proof of purchase and date of delivery required). If ATS receives notice of such defects during the warranty period, ATS will either, at its sole option, repair or replace items which prove to be defective. Should ATS be unable to repair or replace the defective item within a commercially reasonable amount of time, customer's exclusive remedy shall be a refund of the purchase price upon return of the ATS product to ATS.

Exclusions
The above limited warranty shall not apply to defects resulting from:
1. Improper use of the ATS product by the customer; the customer is specifically directed not to open or attempt to disassemble the ATS product to any degree.
2. Modification of the ATS product in any way.
3. Attempt by customer to repair any alleged defect in the ATS product; all repair work should be done by ATS personnel.
4. Accidental, or negligent or malicious or intentional damage, or abuse or misuse of the ATS product.
5. Failure to have ATS products serviced by ATS after discovery of a defect in manufacturer's material or workmanship.
6. Using the ATS product in an improper or dangerous environment, or subjecting the ATS product to improper substances, liquids, heat or cold, chemicals, etc.
7. Any incident or accidental loss which is not the fault of ATS, or over which ATS had no control.
8. Subjecting the ATS product to an improper power source or network, or degree of power.
9. Any injection or insertion of any foreign objects or materials into the test point openings.

Obtaining Warranty Service
To obtain warranty service, the ATS product must be returned to ATS. Any attempt to repair the ATS product or open the ATS product will void the warranty.
The customer shall prepay shipping charges for any ATS product returned to ATS for warranty work. ATS shall pay for return of the ATS product to the customer. However, customer shall pay all shipping charges, duties and taxes both ways for any ATS product shipped from or to any point outside the continental United States. Any ATS product must be properly packaged for shipping by the customer. ATS is not responsible for any damage caused by the shipper or by improper packaging by customer.

IMPORTANT:
Customer should retain the ATS original shipping box and packing for potential return shipping for warranty service. ATS is not responsible for any loss of ATS product while product is in transit to ATS.

Warranty Limitations

ATS makes no other warranty, either expressed or implied, apart from the limited one year warranty recited above. ATS specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Any liabilities of ATS, if any, for damages relating to any allegedly defective ATS product or any part thereof, shall, under any legal theory, be limited to the actual price paid by the customer for the ATS product and shall in no event include incidental or consequential damages of any kind, even If ATS is notified in advance or otherwise, of the possibility of such incidental or consequential damages.

Exclusive Remedies

The remedies provided in this limited warranty document are the customer's sole and exclusive remedies. In no event shall ATS be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Obtaining Service Before or After Warranty

If the customer needs service on the ATS product before or after the warranty period, the customer should first call, E-mail, or write the ATS home office at 515 Wyoming Blvd. SE, suite A, Albuquerque, New Mexico 87123 (Tel:1-800-572-6112) and discuss the needed service with ATS service personnel.

1. When writing or making the call, customers should provide the following information:
2. Approximate date of purchase of the ATS product and place of purchase;
3. Serial number of ATS product if applicable;
4. Description of problem customer is having with the ATS product; and history of any prior repair work;
5. If leaving information, provide customer's name, full address, area code, Email address, and telephone number.

IMPORTANT:

Before operating or maintaining this unit, please read this manual carefully paying extra attention to the safety warnings and precautions.

Contact Information

Websites:

Automotive Test Solutions and Information

- **http://www.automotivetestsolutions.com**

Product Registration

- **http://www.automotivetestsolutions.com/registration.html**

Training and Videos

- **http://www.automotivetestsolutions.com/tva.html**

Software Updates and Notifications

- **http://www.automotivetestsolutions.com/notifications.html**

Phone/E-Mail – Technical Assistance

1-800-572-6112 **/** support@atsnm.com

DISCLAIMER

Automotive Test Solutions, Inc. d/b/a ATS, provides the EScan Pro® and accompanying information as an educational and diagnostic tool. Neither the EScan Pro® nor the accompanying materials are designed to provide specific repair solutions to a specific problem on a specific vehicle. In all cases, the repair person must use their own general technical knowledge, common sense, a concern for safety and other, more specific repair manuals and information on specific vehicles, to achieve specific results on a specific job. The EScan Pro® is designed for general automotive repair education and diagnosis, leaving individual repair problems, challenges, directions and detail to other sources. It is a tool only, not a substitute for individual skills, knowledge and repair processes, standards and disciplines.

Safety Information

Read Instructions
Read all the safety and operating instructions and limited warranty information before you operate the EScan Pro®.

Keep Instructions
Keep the safety and operating instructions for future reference.

Heed Warnings
Adhere to all warnings, either on the EScan Pro® or in the operating manual.

Follow Instructions
Follow all operating and use instructions.

Attachments and/or Modifications
Do not use any attachments, nor make any modifications, that are not specifically authorized and recommended by ATS.

Water, Moisture, Liquids
Do not use this EScan Pro® near water or other liquids, chemicals, etc.

Placement
Place or put the computer that is running the EScan Pro® only on a stable base or foundation for use. Avoid any unstable base such as tables, carts, stands, tripods, brackets etc.

Power Sources
Operate the EScan Pro® only from the type of power source indicated on the marking labels or operating manual. If you are not sure of the type of power supply to your location, consult your local power company or call ATS at the number recited in paragraphs below.

Electrical Wiring Protection
Route the electrical wiring so that it is not likely to obstruct driving a vehicle in any way what so ever, obstruct walkways, be walked on, tripped on, or pinched by items placed upon or against it, paying particular attention to cords at plugs, convenience receptacles and the point where it exits the EScan Pro®.

Modifications/Repair or Opening EScan Pro® Unit
Customer should not attempt to repair the EScan Pro®. Any unauthorized attempt to repair the EScan Pro® will void warranty. For all repair work, EScan Pro® should be returned to Automotive Test Solutions, Inc. at 515 Wyoming Blvd SE Ste A, Albuquerque, New Mexico, 87123 (Tel: 1-800-572-6112). See operating manual.

While Testing/Driving a Vehicle
Make sure the area is well ventilated. Never run a vehicle in an enclosed area. Never monitor the EScan Pro® while driving a vehicle! Have someone else drive the vehicle while you monitor the EScan Pro®.

Contents

Chapter 1   Using This Manual

This manual contains basic operating instructions and is structured in a manner to help you become familiar with your EScan Pro® features and perform basic operations.
The illustrations in this manual are intended as reference only and may not depict actual screen results, information, functions or standard equipment.

1.1 Conventions

1.1.1 Bold Text

Bold emphasis is used in procedures to highlight selectable items such as buttons and menu options.

Example:
- Select **Tools**.

1.1.2 Symbols

The "greater than" arrow (>) indicates an abbreviated set of selection instructions.

Example:
- Select **Controls > Load Setup/Waveform > EGR Controls**.

The above statement abbreviates the following procedure:
1. Select the **Controls** tab.
2. Select the **Load Setup/Waveform** button.
3. Highlight the **EGR Controls** option from the menu.

1.1.3 Terminology

The term "select" describes tapping/touching an icon on the touch screen, or highlighting an icon or menu choice and then selecting the confirmation menu choice such as **Start, Apply, Load,** or other similar choice.

Example:
- Select **Get Cursors**.

The above statement abbreviates the following procedure:
1. Navigate to the **Get Cursors** icon.
2. Select the **Get Cursors** icon with your stylus.

1.1.4 Notes and Important Messages

The following messages are used.

Note

A note provides helpful information such as additional explanations, tips, and comments.

Example:

NOTE:
For additional information refer to….

Important

Important indicates a situation which, if not avoided, may result in damage to the test equipment or vehicle.

Example:

IMPORTANT:
Simultaneously connecting the BNC and transducer on the same channel may damage the transducer

1.1.5 Tool Help

To display help topics for the EScan Pro®, select the help buttons located in the software.

Chapter 2

Introduction

This chapter introduces the basic features of the EScan Pro®, including the control buttons, data ports, and power sources. The EScan Pro®'s SharpSHOOTER™ is a diagnostic tool box, an entire set of built-in assistants that search and interpret data. EScan Pro® is like a diagnostic compass that points you in the right diagnostic direction.

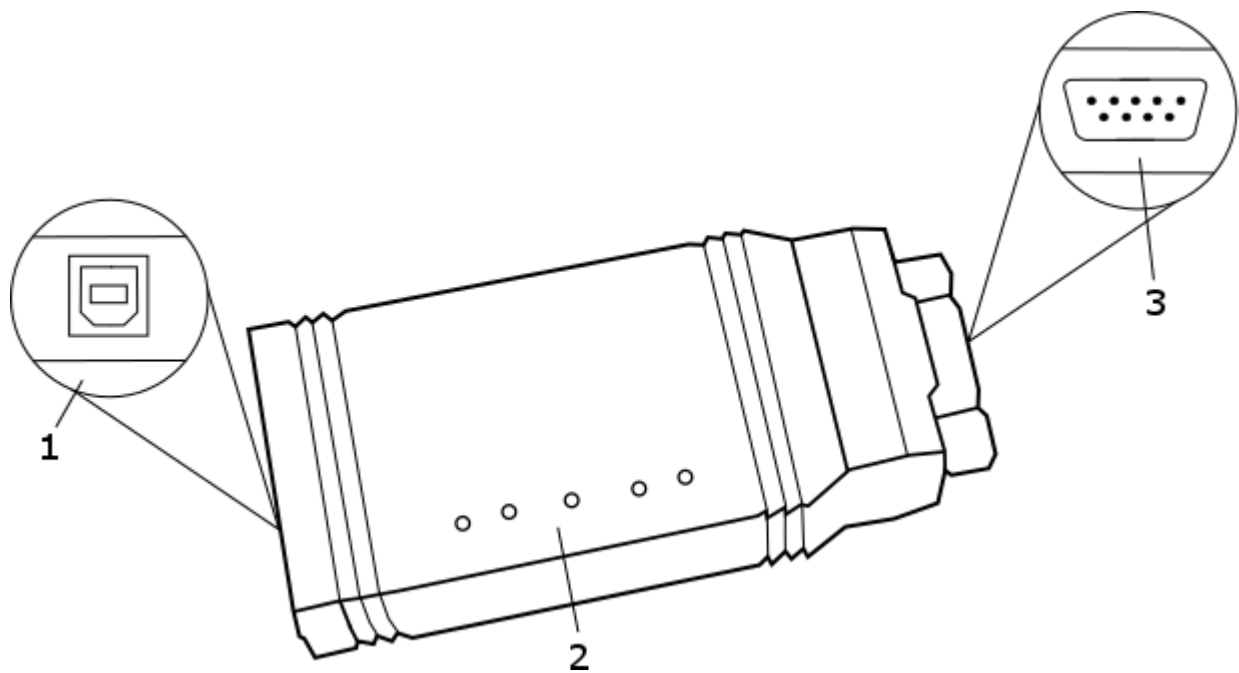## 2.1 Features and Specifications

2.1.1 EScan Pro®

Figure 2-1 *escan*

1—USB Connection
2—LED Indicators
3—DB9 Connector

2.1.2 Technical Specifications and Features

EScan Pro®	
Item	**Description / Specification**
Print Data to PC Software	Yes
Waveform Library	Yes
Built In Help	Yes
Power Requirements	USB
PC Compatible	Yes (Microsoft Windows)
Communications	USB 2.0 or Bluetooth
Width	1 in. (25 mm)
Height	3 in. (76 mm)
Depth	3.5 inches (89 mm)
Weight (including cable)	8.3oz (235g)
Operating Temperature Range (ambient)	At 0 to 90% relative humidity (non-condensing) 32 to 113°F (0 to 45°C)
Storage Temperature (ambient)	At 0 to 70% relative humidity (non-condensing) –4 to 131°F (–20 to 55°C)
Environmental Conditions	This product is to be used in a dry, warm environment

Computer Minimum Requirements	
Item	**Description / Specification**
Screen Resolution	WXGA (1280x768)
Processor Speed	1 GHz
Operating System	Microsoft Windows (Windows RT tablets are not supported)
System Memory (RAM)	256 MB
Hard Drive Capacity	500 MB available
Port Type	USB 2.0

Chapter 3

Software Installation

3.1 Product Registration

In order to receive technical support you **MUST** register your products. Your information will be kept on file and referenced before any support is administered. You may register online by going to: **http://www.atsnm.com/registration.htm**. Your information is kept confidential and will not be shared.

3.2 Installing Software

Insert the EScan Pro® software CD.

Windows 10, 8, 7 or Vista: If the disk does not auto-run, click on **Open folder to view files** in the AutoPlay window and then double click on **setup.exe**. If the AutoPlay window does not come up – select the **Start** button and select **File Explorer**. Navigate to the installation CD (usually drive "D") and double click **setup.exe.** Refer to the picture below.
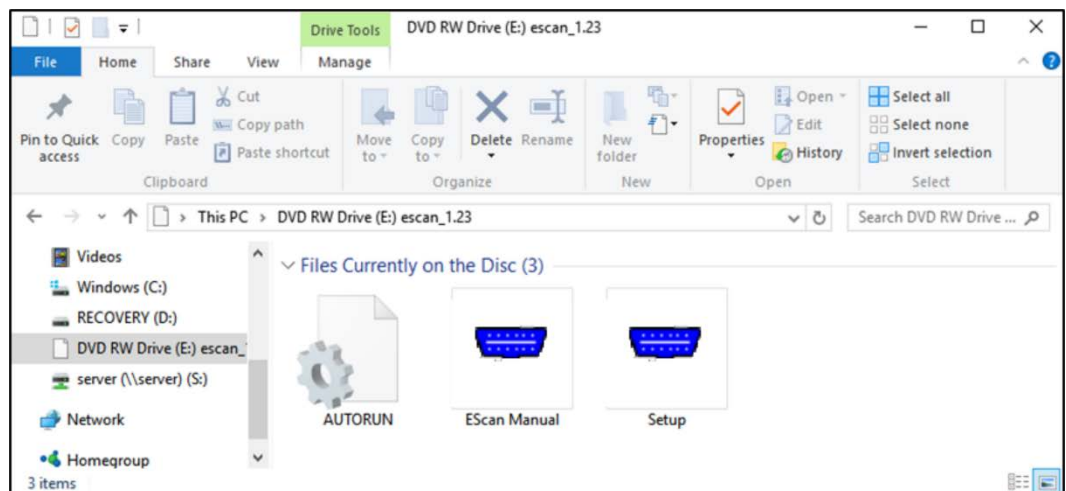

Figure 3-1 *setup*

Be patient, the installer will take a few moments to load from the CD.

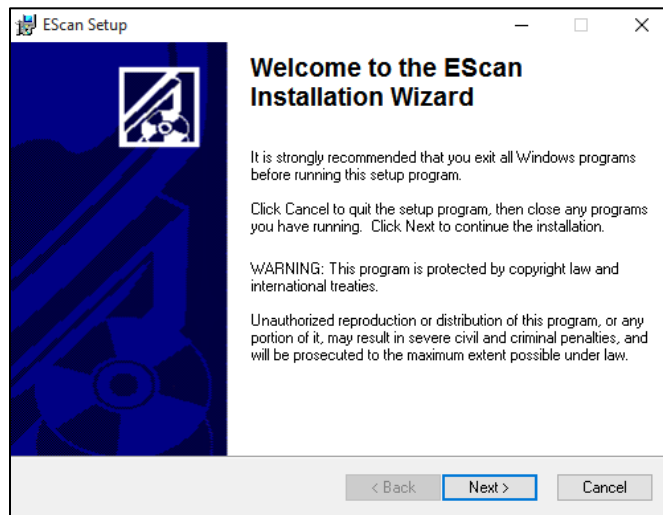At this point you will see the "Installation Wizard" window. Select **Next** and accept all default settings.

Figure 3-2 *install wizard*

ℹ️ **NOTE**: If the following drivers are already installed in your computer, you may not see some of the following items

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Following this the NI-VISA install will start (if NI-VISA is not already installed).
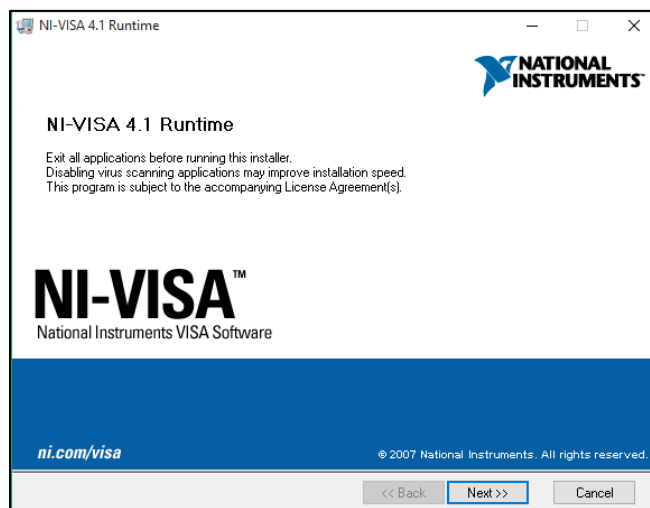

Figure 3-3 *runtime*

Accept all defaults for the NI-VISA install and restart your computer if asked.
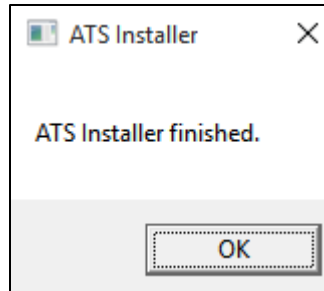When the script completes you will see:

Figure 3-4 *installer*

NOTE: If you restarted the computer after the NI-VISA install you won't see the "ATS Installer Finished" dialog.

A shortcut for the EScan Pro® has been placed on your desktop. Click this shortcut to start the EScan Pro®.

3.3 Flash Videos

If you have problems running the Flash videos within the EScan Pro® program you may need to download the latest version of the Adobe Flash Player. You can get this by going to **http://get.adobe.com/flashplayer** and clicking Download the Adobe® Flash® Player system plug-in link.

3.4 Software Updates

Keep your EScan Pro® up to date!
Go to **http://www.atsnm.com/escan-pro.html** for the latest updates.

3.5 Additional Information

If you have an internet security program like "Norton Internet Security" it may warn you that the EScan Pro® program is trying to access the internet the first time you run it. If this happens tell the security to **unblock** the EScan Pro® program. The EScan Pro® program needs to be unblocked so that it can communicate with other ATS products for the MultiTool function.

Chapter 4

EScan Pro® Setup

4.1 Pairing to Bluetooth

4.1.1 INSTALL USB BLUETOOTH ADAPTER:

Plug in your USB Bluetooth Adapter to an available USB port on your computer.

You should see a "Device setup" pop-up window and other auto-install pop-up windows should appear in the lower right part of your screen.

NOTE: If you have Bluetooth built-in to your computer the distance you can operate the EScan Pro® from the computer is limited to about 10 to 15 feet. If you use the USB Bluetooth Adapter, you can operate the EScan Pro® to about 50 feet (line of sight) from the computer. ATS recommends using the USB Bluetooth Adapter instead of the Bluetooth built-in to your computer.
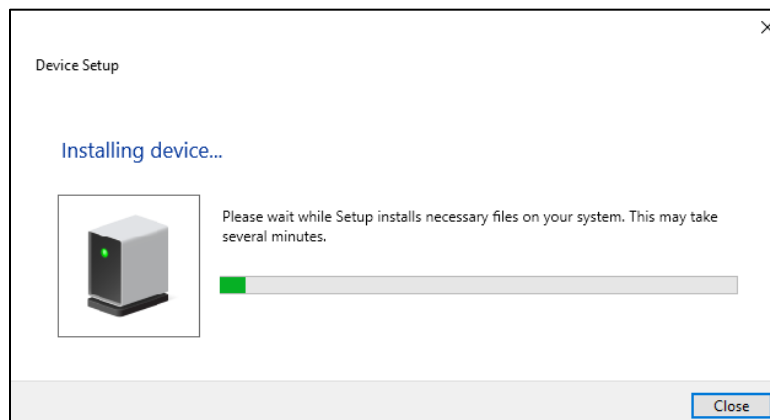

Figure 4-1 *setup*

After windows has completed installation of your USB Bluetooth Adapter you should see a "Your new hardware is installed and ready to use" pop-up window.

4.1.2 INSTALL ESCAN PRO WITH BLUETOOTH:

Plug the EScan Pro® into an automobile's DLC connector (key must be on to provide power).

Confirm that the red power light on the EScan Pro® is lit.

Make sure your computer is powered up with the Bluetooth module enabled (see "INSTALL USB BLUETOOTH ADAPTER" above).

Right-Click on Bluetooth icon 🅑 in the lower right portion of your Windows tool bar and select "Add a Bluetooth Device". On some computers this may be titled "Bluetooth Setup Wizard". You should see the window below:

Figure 4-2 *device wizard*

Confirm that "My device is set up and ready to be found" is check marked, then Click **Next**. After a few seconds, you should see the window below:

Figure 4-3 *add device*
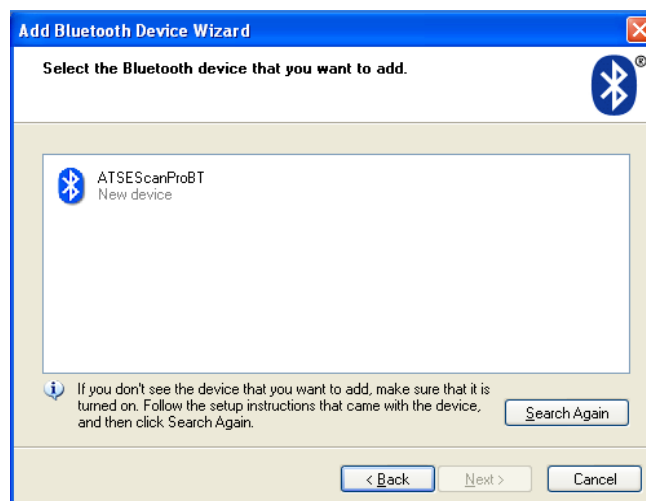
Click on "**ATSEScanProBT**" and select **Next**. You should see the window below:
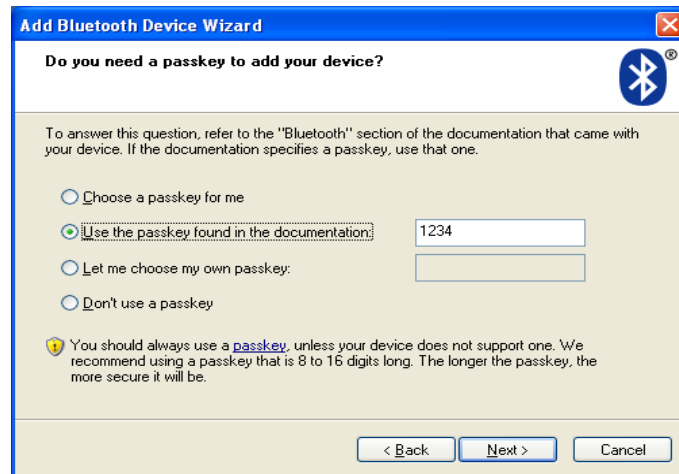

Figure 4-4 *passkey*

Select "Use the passkey found in the documentation"- enter **1234** for the passkey - and click **Next**.

You should briefly see a window that looks like this:
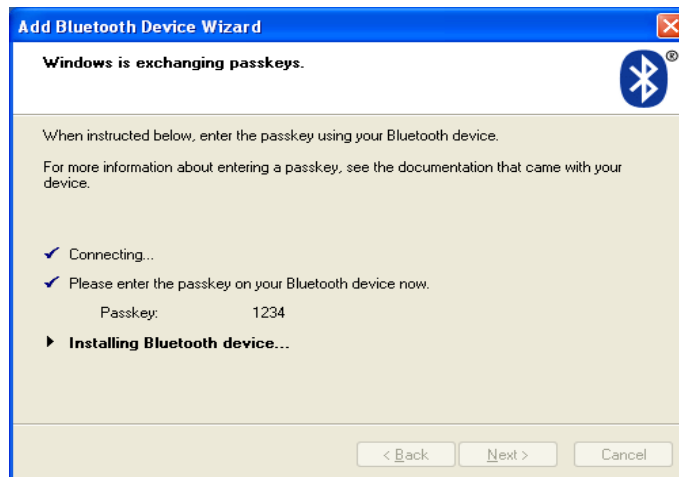
Figure 4-5 *connecting*

Next you should see the window below. Click **Finish**.

Figure 4-5 *finish*

4.2 Connecting USB to Computer

Plug the EScan Pro® into an automobile's DLC connector (key must be on to provide power).

Confirm that the red power light on the EScan Pro® is lit.

Plug the USB cable into the computer. You should see a "Device setup" pop-up window and other auto-install pop-up windows should appear in the lower right part of your screen.
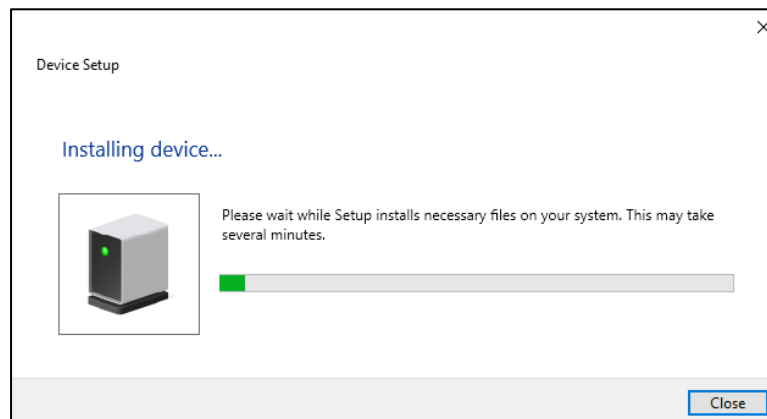
Figure 4-6 *setup*

After windows has completed installation of your USB Adapter you should see a "Your new hardware is installed and ready to use" pop-up window.

4.5 Connecting OBDII to Car

The EScan Pro® connects to an OBD II vehicle through an interface cable that plugs into the vehicle Data Link Connector (DLC)

In most vehicles, the DLC is located beneath the dash, between the right side of the center console and the drive side door. Plug the cable end into the DLC.

NOTE: Double check the plug orientation and push the cable end straight into the DLC to avoid bending the thin electrical pins.

Some OEMs place the DLC in other, more imaginative places. The illustration below shows other places to look for the DLC.

Figure 4-6 *DLC*

Chapter 5
Get Connected
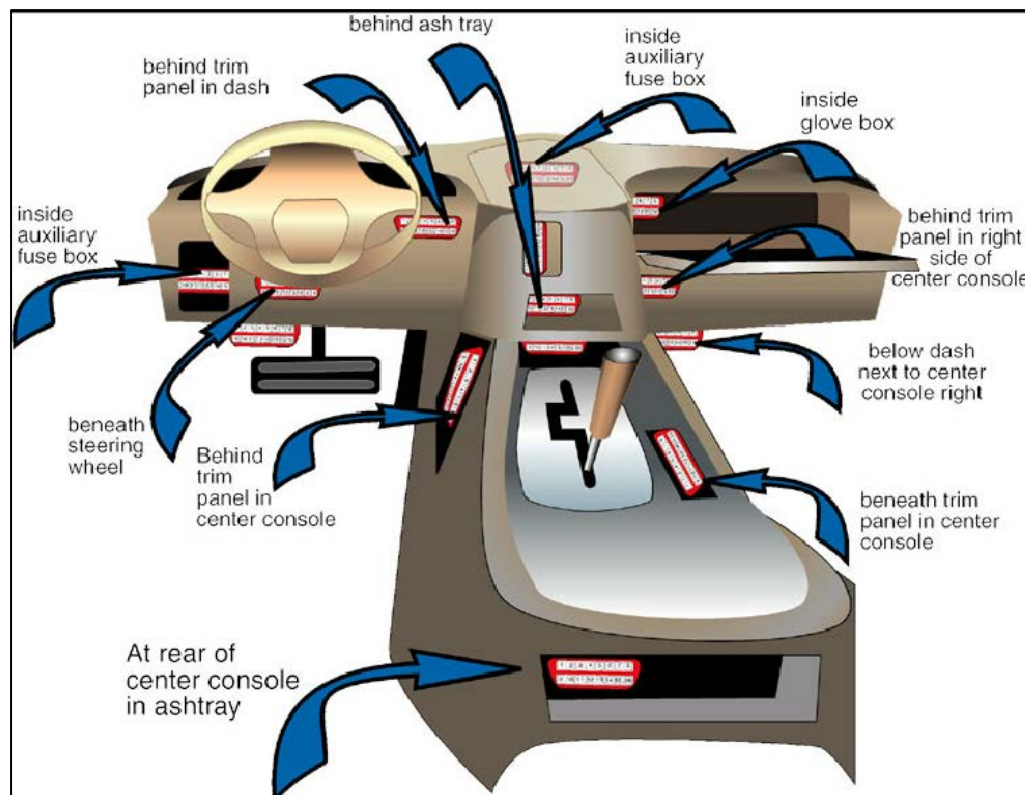
5.1 Startup

5.1.1 Warnings

In order to run the EScan Pro® software, read all of the safety and operating instructions and limited warranty information before you operate any of Automotive Test Solutions, Inc.'s equipment. Select **Enter** when done to accept warning.
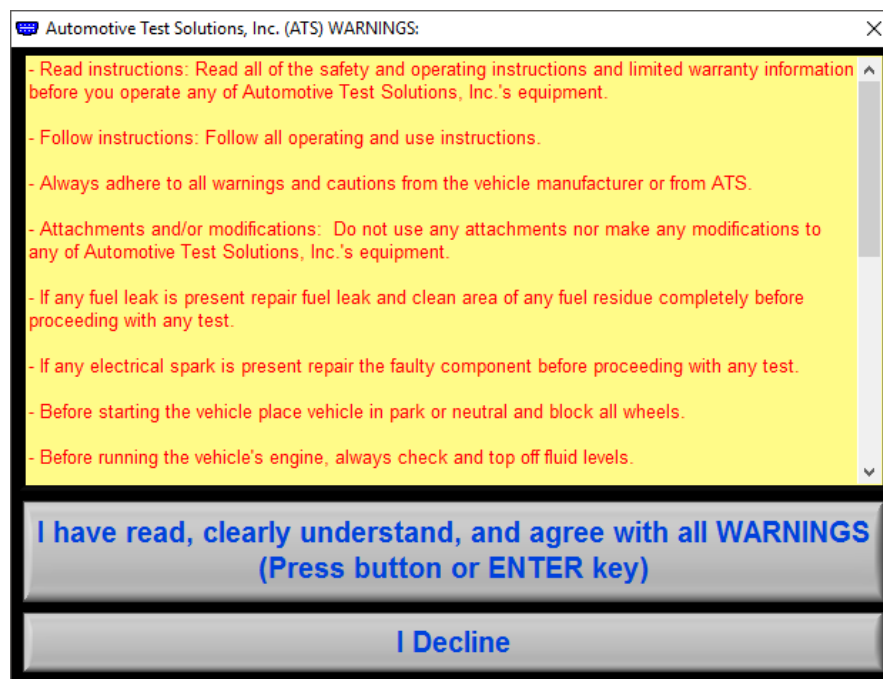
Figure 5-1 *warning*

5.1.2 Cannot Find VCI

The EScan Pro® should find the COM port automatically. If the screen displayed below appears, make sure:
1. The communications cable is connected between the PC and EScan Pro®
2. The EScan Pro® is plugged into the vehicle and the vehicle is running or the key is on
3. The DLC connector has power

Then select **Auto-Search for EScan**
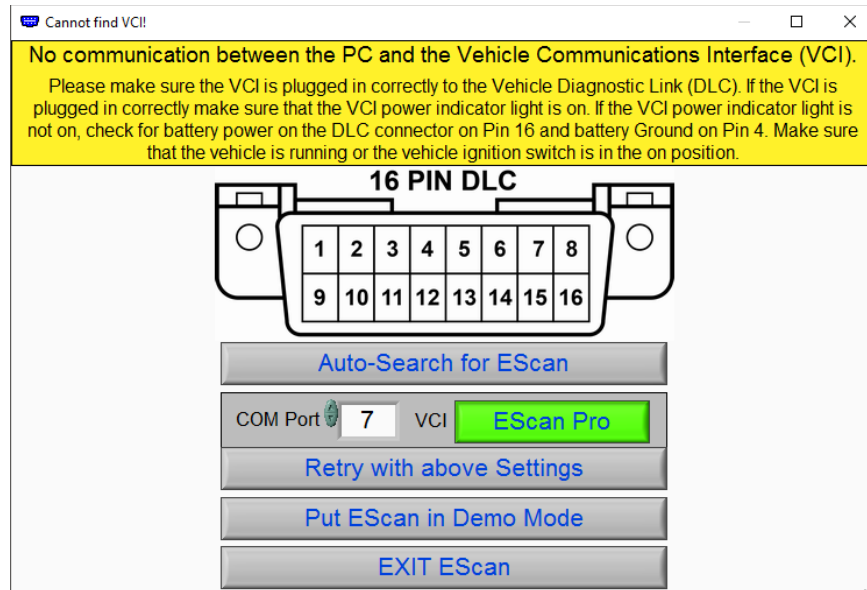
Figure 5-2 *cannot find VCI*

The EScan Pro® software can also be placed in demo mode by selecting **Put EScan in Demo Mode**. The EScan Pro® demonstration mode is provided to help you become familiar with EScan Pro® operations, without connecting to a vehicle. Sample data and test results are provided to help you learn the menus and basic operations.

5.1.3 Toolbar

The following menu options are available in the upper left hand corner of the software

File

- Save Screen
- Print Screen
- Exit

Save Screen

This option will save a screen shot of the software and then allows you to preview the saved screen shot.

Print Screen

This option will print a screen shot of the software.

Exit

This option will exit the program.

Tools

- Escan
- EScope
- EScopeLimited

- Emission
- IEA (EmissFire)

These options will open the corresponding programs.

NOTE: Only tools that are already installed on the computer will show up as an option.

Window

- Size to Full 1280x728
- Size to 1024x574 (Notebooks)
- Size to Upper Half of Screen
- Size to Lower Half of Screen
- Size to size of Left Tab
- Size to size of Right Tab

These options will resize the program screen to fit the computer display.

Help

A variety of utilities and additional resources are available through the Help menu. Basic menu options, which are available for all modules, include:

- Escan Manual
- About Escan

EScan Manual

This option opens this document which provides overall navigation and operation information for the EScan Pro®.

About EScan

This option opens a window showing the version of the software and a copy of the Software License Agreement. Select **OK** to close the window.

Basic Operation

6.1 Left Column Tabs

6.1.1 Controls

Select the first tab **Controls**. The information displayed will show eleven buttons. These buttons can be activated selecting each individual button. All of these buttons have (**Fn**) next to their name and can also be activated by pressing the appropriate Function key on the keyboard.

Figure 6-1 *controls*

Clear Data (F1): Activating this button or pushing the "F1" key will clear all of the saved data being graphed from the memory on the vehicle that is currently being tested. Once the saved data has been cleared, new data will start to be collected until all 2000 data points have been gathered and stored in the memory (this will vary depending on the type of communications bus type used in the vehicle under test, approximately 15min). At this point the oldest data will be dropped from the memory and the newest 2000 data points will be available for review.

Save Text Report (F2): Activating this button or pushing the "F2" key will save the text data from the Monitors, DTCs & Pending Codes, Freeze Frame, PIDs, Mode6, and Mode5 (O2). The data will have a .rpt extension. The format is tab-delimited text which can easily be read by other programs like MS Excel and Notepad.

Load Text Report (F3): Activating this button or pushing the "F3" key will load a text data file and display the Monitors, DTCs & Pending Codes, Freeze Frame, PIDs, Mode6, and Mode5 (O2) information that was previously saved into the file.

Print Text Report (F4): Activating this button or pushing the "F4" key will print the text data from the Monitors, DTCs & Pending Codes, Freeze Frame, PIDs, Mode6, and Mode5 (O2).

Hold (F5): Activating this button or pushing the "F5" key will stop the collection of data. The last screen will be held for review. To change the amount of data displayed the "Hold" button will need to be released and the number of "Points Displayed On Graph" on the upper right side of screen will need to be changed. The data on the chart will either increase (larger number) or decrease (smaller number). Once the data is held the blue pointer on the top of the stacked chart can be used. Move the cursor on top of the blue pointer, push and hold the left mouse button or left touch tab button. Now drag the pointer until it aligns with the portion of the graph that is to be measured.

NOTE: The cursor can now be moved anywhere on the chart to help align the blue pointer to an exact point on the graph. The display boxes on the right hand side of the screen next to the blue pointer will read the data at the point where the blue arrow is currently placed.

Save Graph Data (F8): Activating this button or pushing the "F8" key will save the data that is currently being displayed on the graph. To change the amount of data displayed the "Hold" button will need to be released and the number of "Points Displayed On Graph" on the upper right side of screen will need to be changed. The data on the chart will either increase (larger number) or decrease (smaller number). Once the data being displayed on the graph is correct activate the "Save Graph Data" button. This will bring up a pop-up window. Move the cursor onto "The Automotive Information And Notes" heading and left click the mouse or touch tab. Now enter in the vehicle type and information about the graphs to be saved. Move the cursor to the type of graph to be saved; select **Stacked** or **Dual/Combo** A second pop-up window will now be displayed. Enter in the file name that you wish to save this information under. This file name is what you will look for when you want to load the saved data.

NOTE: This file name and information is what will be displayed once these data are loaded for your review.

Save Selected PIDs Continuously (F9): Activating this button or pushing the "F9" key will save the PIDs that are currently selected on the supported PIDs chart. Once this mode is activated the selected PIDs will be continuously saved, with no time limit, until the "Save Selected PIDs Continuously" button or "F9" key is deactivated. Once this button is activated it will turn green and a pop-up window will appear. Move the cursor onto "The Automotive Information and Notes" heading and left click the mouse or touch tab. Now enter in the vehicle type and information about the graphs to be saved. A second pop-up window will now be displayed. Enter in the file name that you wish to save this information under and left click the mouse or touch tab

NOTE: This file name and information is what will be displayed once these data are loaded for your review.

Mark Continuous Data (Page Up): This button becomes enabled when "Save Selected PIDs Continuously (F9)" is on. Press this button or the Page Up button on your keyboard anytime you want to mark a point in your data record. When you load the data back you can display the "Mark" just like you would display a PID. The mark will show a value of one anywhere the button had been pressed and zero everywhere else.

Load Data (F10): Activating this button or pushing the "F10" key will allow the saved data to be loaded onto the charts. Move the cursor onto "Load Data" button or "F10" key and left click the mouse or touch tab. A pop-up window will appear that contains the saved data. To navigate through the saved data, move the cursor onto one of the blue arrows at the bottom of the charted data. Select to the data that you wish to load. The file name that is selected will now be highlighted in blue. Select OK. A second pop-up window will appear. Move the cursor over the PID or PIDs that you wish to review and left click.   The PID to be selected will now be highlighted blue with a check mark placed in front of it. To deselect a PID, move the cursor over the PID with a check mark in front of it and left click. The PID will now be deselected. Only 8 PIDs can be selected for viewing at one time. Once the PID or PIDs have been selected, move the cursor to the "Continue" button or "F1" key. The data will now be displayed on the graphs. Once the data is displayed the "Hold button will be activated and will turn green. Before any new data can be gathered the "Hold" button will need to be released.

Save Screen (F11): Activating this button or pushing the "F11" key will allow the current screen display to be saved as a JPG file. Move the cursor onto "Save Screen" button or "F11" key and left click the mouse or touch tab. A pop-up window will appear that contains the saved data. Enter in the file name that the screen shot will be saved under. Move the cursor to the "OK" button and left click. The screen shot will now be saved in the Screen JPGs file. To navigate through the saved screen data, move the cursor onto one of the blue arrows at the bottom of the charted data. By left clicking the mouse or touch pad scroll to the data that you wish to load. Move the cursor over the data file to be opened and right click. The file name that is selected will now be highlighted in blue. A pop-up window will now appear. Move the cursor over the item to be selected and left click. The data can be reviewed, printed or sent to another file from this menu.

Print Screen (F12): Activating this button will allow the current screen that is being displayed to be printed. Move the cursor onto "Print Screen" button or "F12" key and left click the mouse or touch tab. A pop-up window will now appear. Select the Shop/Company Name display. Enter the business name. Now move the cursor into Technician/User name display and left click. Enter in the user name. Move the cursor into the Automobile Information and Notes and left click. Enter any pertinent information to be conveyed to the customer. These headings will be printed at the top of the screen print out. Now move the cursor to the correct button below and left click. This information will now be sent to the printer.

NOTE: Printing can pause the computer long enough to lose communications with some ISO-9141-2, and KWP2000 vehicles. If this happens, press the "Restart Communications" button.

6.1.2 MultiTool

The second tab on the left of the screen is the **MultiTool** tab. Select the **MultiTool** tab. Eight histographs will come up on the left side of the screen. Each graph can be customized to what you want to view.
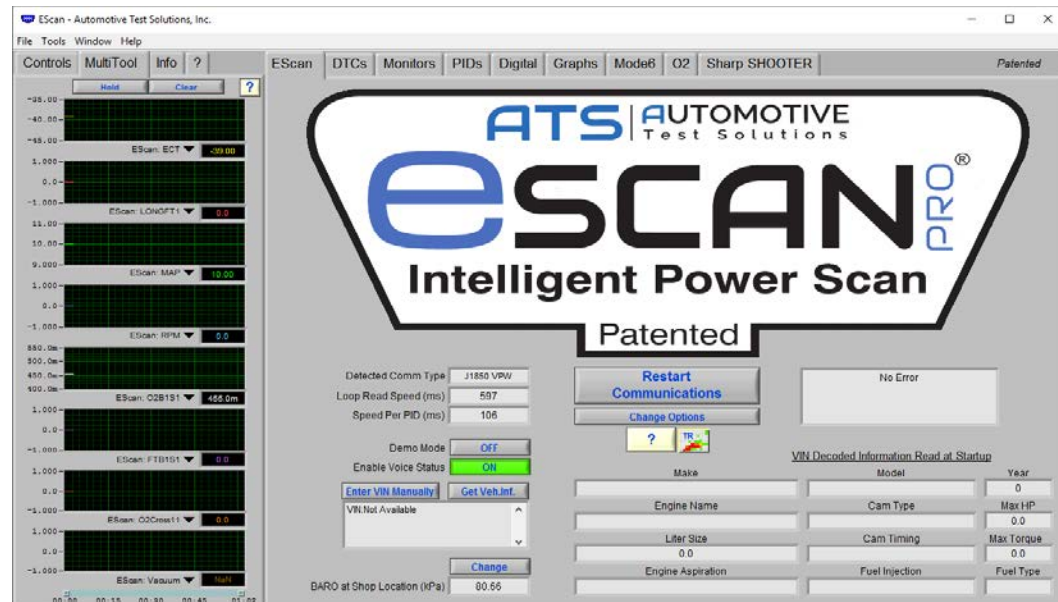

Figure 6-5 *multitool*

Change the graph: Select the black triangle below the graph to be changed. A pop-up window will appear with the choices that are available. Select the data you want to view. The graph will now change and display the data that you have chosen. The data that is displayed will be shown in a heading under each graph. To the right of the heading is a display box that will indicate the current digital readout for that graph.

The MultiTool can display the data from other ATS diagnostic tools that are running simultaneously. For the MultiTool to show you all the available choices, all of the programs must be loaded and running. For example, if you open the MultiTool choices and the Emission 5GAS Analyzer program is not running there will be no listing for the five gases.

Load ATS tools: Move the cursor to the upper left of the screen in the toolbar, select **Tools**. The programs that are available will be displayed. If no other ATS programs are loaded on the PC, no (Tools) will be shown. Select the program you want to start. The program will now load. The specific program must be running in order for the data to be displayed in the MultiTool.

Hold and Clear: Select **hold** to hold the data on all eight graphs in memory. To play back the data move the cursor to the bottom of the graphs to the history bar. Place the cursor on the arrow at the end of the history bar and left click. The eight graphs will now change the display as they scroll back through the history. To clear the data from the MultiTool, select **Clear**. The data will now be cleared from the graphs.

6.1.3 Info

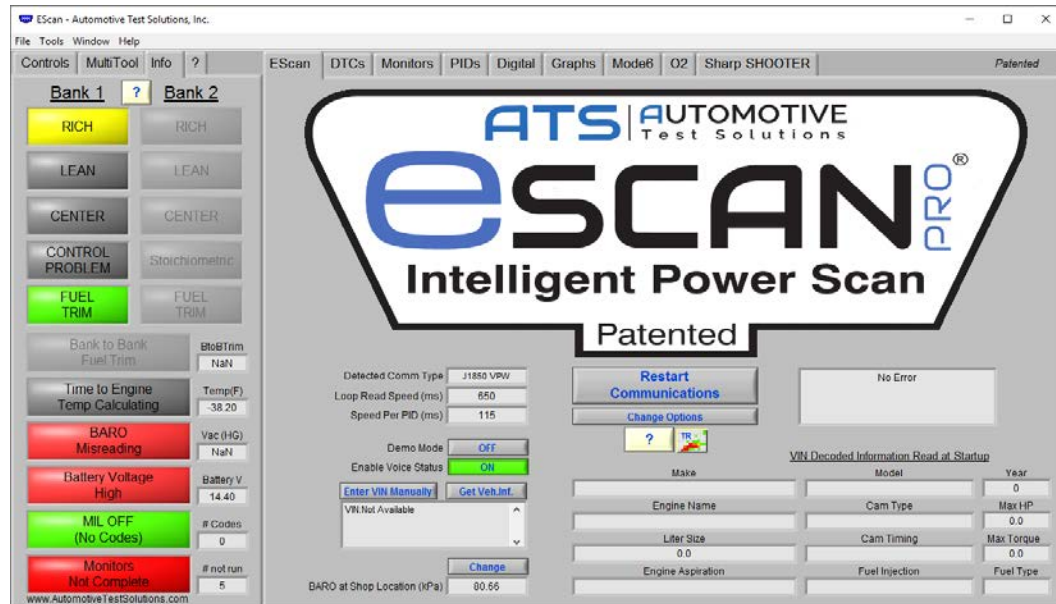The third tab on the left of the screen is the **Info** tab. Select the **MultiTool** tab.

Figure 6-6 *info*

IMPORTANT: Rich, Lean, and Center indicators will not report correctly if vehicle has wide range O2 sensors that are reported as regular O2 sensors (such as Nissan and Infiniti vehicles).

The Rich Indication Alert Light: If the oxygen sensor voltage is greater than 0.45v, the light will be activated yellow. This indicates the air/fuel ratio is less than 14.7 to 1 or rich.

The Lean Indication Alert Light: If the oxygen sensor voltage is less than 0.45v, the light will be activated blue. This indicates the air/fuel ratio is greater than 14.7 to 1 or lean.

The Center Indication Alert Light: If the oxygen sensor's voltage is both greater than 0.55v and less than 0.35v and is cycling at the proper frequency evenly between rich and lean air/fuel mixtures, then the light will be activated green. This is an indication that the fuel control system has good control over fuel delivery and it is maintaining a 14.7 to 1 air/fuel ratio. If the rich and lean lights are active but the center light is not turned on then the fuel control system may not have good delivery.

The Fuel Control Problem Indication Alert Light: If the fuel delivery system has failed to control the proper air/fuel ratio, the light will be activated red. If the fuel delivery system has failed for longer than 15 seconds, then the red fuel control problem light will begin flashing.

The Fuel Trim Indication Alert Light: If the long term fuel trim is less than +/- 10%, the light will be activated green. If the long term fuel trim is between +/-10% and +/-13%, the light will be activated yellow. If the long term fuel trim is between +/-13% and +/-20%, the light will be activated orange and the light will be activated red when the long term fuel trim is greater than +/- 20%.

The Bank To Bank Fuel Trim Indication Alert Light: If the long term fuel trim from bank one and bank two is +/-5%, the light will be activated green. If the long term fuel trim from bank one and bank two is between +/-5% and +/-8%, the light will be activated yellow. The light will be activated orange when the long term fuel trim is between +/-8% and +/-10%. The light will be activated red if it is greater than +/-10%.

Time to Engine Temperature Alert Light. If during engine warm up the temperature is slow to increase, the light will be activated yellow. If during warm up the operating temperature of the engine is not achieved in a predetermined time, the light will turn red, indicating the time to engine temperature has failed.

If the engine overheats, the light will turn red and flash indicating that the engine is overheated. As the coolant is taking on heat the lamp will be blue indicating the temperature increase is good. When the coolant has reached 185º in the correct time the display will alert you and change to green. If the coolant temperature rate of change is not correct the light will turn yellow, orange, or pink. Existing cooling system problems may be indicated by further watching the temperature chart. See SharpSHOOTER℠ temperature tab.

Engine Vacuum Alert Light: This will only be active if the engine is equipped with a MAP sensor. With the key on and the engine off, the light will indicate the barometric pressure. If the barometric pressure sensor misreads, the light is turns red with the message "Baro Misreading". If the barometric pressure is correct, the light will be green with the message "Baro Good". The cranking vacuum is checked when the engine is turned over for 3 seconds. If it is greater than 1" HG, the light turns green with the message "Cranking Vacuum Good". If the reading is less than 1"HG, the light is turned red with the message "Cranking Vacuum Bad". Once the engine is running, a calculation is done that compares the engine vacuum to the barometric pressure. If the engine has good vacuum, the alert light is turned green with the message "Engine Vacuum Good". If the engine vacuum is slightly low, the alert light is turned yellow with the message "Engine Vacuum Low". If the engine vacuum is low, the alert light is turned red with the message "Engine Vacuum Low".

NOTE: When the engine is loaded, put into gear or the A/C is turned on, the vacuum will drop.

Battery Voltage Alert Light: If the battery open circuit voltage is low, the light is turned red with the message "Battery Voltage Low". If the battery open circuit voltage is good, the light is turned green with the message "Battery Voltage Good". If the battery open circuit voltage is high, the light is turned red with the message "Battery Voltage High". During cranking, the cranking voltage is checked. If the cranking voltage is low, the battery voltage alert light is turned red with the message "Cranking Voltage Low". If the cranking voltage is good, the battery voltage alert light is turned green with the message "Cranking Voltage Good". Once the engine is running, the battery voltage alert light monitors the charging system. If the charging system has low voltage, the battery voltage alert light is turned red with the message "Charging System Voltage Low". If the charging system has good voltage, the battery voltage alert light is turned green with the message "Charging System Voltage Good". If the charging system has high voltage, the battery voltage alert light is turned red with the message "Charging System Voltage High".

Malfunction Indicator Light (MIL) Alert Light: If no diagnostic trouble codes are present, the light is turned green with the number '0' displayed. If there are diagnostic trouble codes, the light is turned red with the number of diagnostic trouble codes (DTC) present displayed. For example, if there are 3 DTC's present the light is turned red and the number '3' displayed.
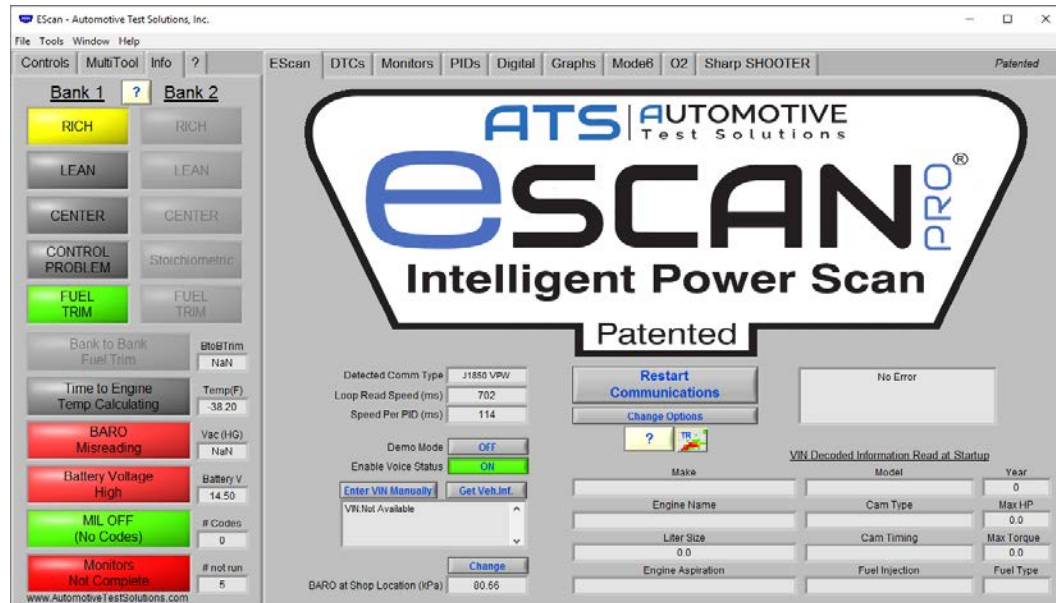
6.2 Main Tabs

6.2.1 EScan

Figure 6-7 *Escan*

Detected Comm Type: This will display the type of protocol that the scan tool is using to communicate with the vehicle:
1. GM J1850VPW
2. Ford J1850PWM
3. CAN ISO15765
4. KPW ISO14230
5. ISO 9141-2

Loop Read Speed (ms): This will indicate the time it takes the cycle to read 1 loop of data. The more PIDs selected the longer the loop read speed. It will be important during some tests to have a minimum number of PIDs selected so that the loop speed will be as fast as possible.

NOTE: KWP2000 communication bus types are very slow and may not provide useful information.

Speed Per PID (ms): This will indicate the time it takes to read 1 PID.

Demo Mode: Turning this on will put the EScan Pro® into Demo Mode. In Demo Mode the EScan Pro® will not try to communicate with vehicles allowing you to browse the tabs and load previously saved data.

VIN: By moving the cursor over the "Update VIN" button, the VIN number of the vehicle that is being scanned will be displayed. Not all vehicles support this function. If no VIN number is available from the on board computer system it must be entered manually. Simply left click on the "Enter VIN Manually" button. Now enter the Vehicle Identification Number of the vehicle under test.

Baro at Shop Location (kPa): To calibrate the scan tool to the correct baro for your shop's location, move the cursor to the change button and left click. A pop-up window will now appear. There are several choices the user can make. The most accurate is to have a known good car connected to the scan tool. Now move the cursor over the 2nd button on the left side "Use this Car's MAP (Must be Key On, Engine Off)" and left click. Move the cursor to the lower right side and select "BARO to be Used (kPa)" and left click. The correct baro will now be loaded for your shop's elevation. If the location the scan tool is used at changes this process must be redone. If a known good car is not available enter in the altitude in feet at the upper right corner.

Restart Communications: If a communications error occurs you can press this button to restart the EScan Pro® communications.

Change Options: Allows you to change EScan Pro® setup options.

TR: Selecting the TR button will bring up troubleshooting examples.

No Error: This display will show the error states that exist between the scan tool and the vehicle being scanned. If errors are set, the "No Communication" screen will flash. What this really means is that the communication between the vehicle and the scan tool has not been established or that communication was established and failed.

6.2.2 DTCs

To enter into the stacked scope charts, select the **DTCs** tab. Monitors must be complete for related DTCs to be accurate
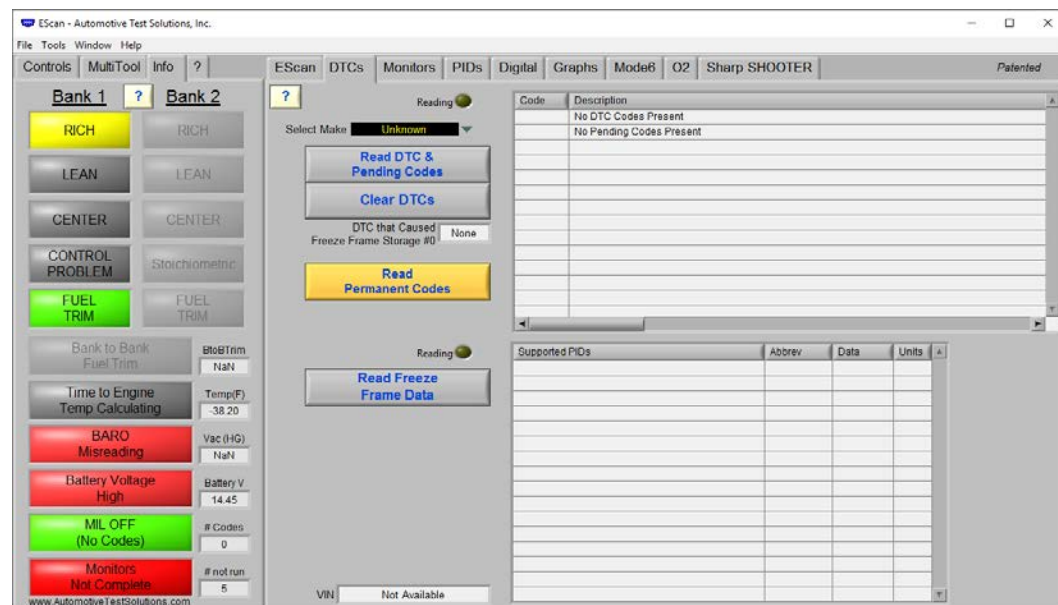

Figure 6-8 *DTCs*

Read DTC & Pending Codes: DTCs and Pending codes are automatically read once at startup. At startup the make has not been selected so make-specific DTCs will not be decoded. Select the make and press "Read DTC & Pending Codes" to properly decode make-specific DTCs.

Clear DTCs: Some ECUs may not respond to this service under all conditions. All ECUs shall respond to this service request with the ignition ON and with the engine not running. This function will clear all emission-related diagnostic information including:
- Number of diagnostic trouble codes
- Diagnostic trouble codes
- Trouble code for freeze frame data
- Freeze frame data
- Oxygen sensor test data
- Status of system monitoring tests
- On-board monitoring test results
- Distance traveled while MIL is activated
- Number of warm-ups since DTC cleared
- Distance since diagnostic trouble codes cleared
- Minutes run by engine while MIL activated
- Time since diagnostic trouble codes cleared
- Other possible manufacturer specific "clearing/resetting" actions

DTC that Caused Freeze Frame Storage: This will update when DTCs & pending codes are read.

Read Freeze Frame Data: Select "Freeze Frame# to Read" and press "Read Freeze Frame Data" to read freeze frame data.

6.2.3 Monitors

To enter into the Measure & Deep Record screen, select the **Monitors** tab.

Figure 6-9 *monitors*

Read Everything Once: This will request and display all monitor data one time after the button is activated.

O2 Sensor Location Pictures: This displays illustrations of where the possible O2 sensors configurations can be located on the vehicle.

Reading Monitors/ML/#DTCs: This is activated when the Monitor data is being continuously acquired. If this is acquiring data (button illuminated green) the overall loop read speed will be slower.

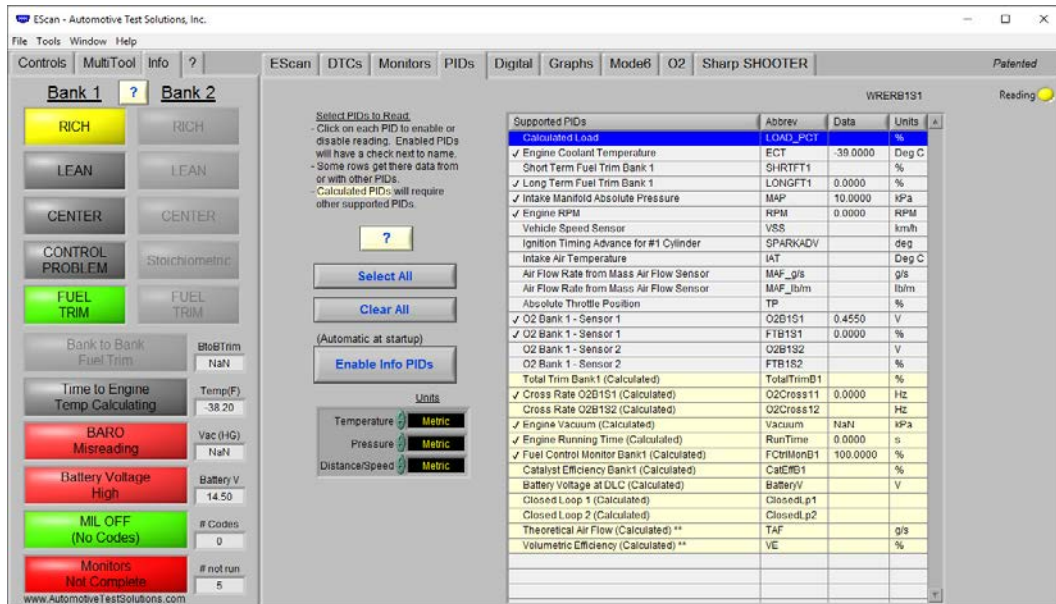## 6.2.4 PIDs

To enter the meter screen, select **PIDs Tab**

Figure 6-10 *pids*

Select All: Enables all supported PIDs. Note that this can significantly slow down the overall loop rate for reading PIDs because the more PIDs that are selected, the longer it will take to read them all.

Clear All: Disables all supported PIDs. Use this button to clear reading all selected PIDs before selecting just the PIDs you are interested in reading. This will optimize the loop time for reading PIDs.

Enable Info PIDs: Enables just the PIDs used for the Info lights on the left side of the screen. This is the default PID selection when the program first starts.

Units: Allows Metric or English unit settings for Temperature, Pressure, and Distance/Speed. The default at startup is Metric. Note that if you change the unit type it will only affect the units for PIDs that are selected and being read.

Calculated PIDs: The calculated PIDs are established from the basic PIDs that are received from the vehicle. By taking the basic PIDs and applying an algorithm more diagnostic data can be conveyed to the technician. The calculated PIDs are as follows.

Total Fuel Trim Bank 1: In this PID the Bank 1 Sensor 1 fuel trims are added together. By adding the long term fuel trim (slow moving) to the short term fuel trim (fast moving) a total

trim can be calculated. This PID will offer a greater understanding of the total fuel correction factor being applied to the fuel control system.

Total Fuel Trim Bank 2: In this PID the Bank 2 Sensor 1 fuel trims are added together. By adding the long term fuel trim (slow moving) to the short term fuel trim (fast moving) a total trim can be calculated. This PID will offer a greater understanding of the total fuel correction factor being applied to the fuel control system.

Cross Rate O2 Bank 1 Sensor 1: In this PID the Bank 1 Sensor 1 is monitored each time the O2 voltage crosses the 0.45v threshold. Each time a cross occurs a count is logged against time. If the cross rate number is greater than 1 the switching rate of the O2 sensor's fuel control is good. If the cross rate number is less than 1 the switching rate of the O2 sensor's fuel control is poor. This PID can be used to check how active the fuel control is.

Cross Rate O2 Bank 2 Sensor 1: In this PID the Bank 2 Sensor 1 is monitored each time the O2 voltage crosses the 0.45v threshold. Each time a cross occurs a count is logged against time. If the cross rate number is greater than 1 the switching rate of the O2 sensor's fuel control is good. If the cross rate number is less than 1 the switching rate of the O2 sensor's fuel control is poor. This PID can be used to check how active the fuel control is.

Cross Rate O2 Bank 1 Sensor 2: In this PID the Bank 1 Sensor 2 is monitored each time the O2 voltage crosses the 0.45v threshold. Each time a cross occurs a count is logged against time. If the cross rate number is close to 1 it is an indication that the catalytic converter is not functional. A cross rate number that is close to zero indicates that the catalyst is operating normally.

Cross Rate O2 Bank 2 Sensor 2: In this PID the Bank 2 Sensor 2 is monitored each time the O2 voltage crosses the 0.45v threshold. Each time a cross occurs a count is logged against time. If the cross rate number is close to 1 it is an indication that the catalytic converter is not functional. A cross rate number that is close to zero indicates that the catalyst is operating normally.

Engine Vacuum: In this PID the barometric pressure is subtracted from the manifold absolute pressure reading. The engine vacuum is a measure of the mechanical condition of the engine. It can also be used to detect a restricted exhaust or restricted intake. The EGR can also be monitored with vacuum. When the EGR is opened the vacuum will also drop indicating the EGR's flow.

Engine Running Time: In this PID the RPM is compared against a clock. Once the PID indicates an RPM is present a clock starts which will accurately assess the time the engine has been running. If the RPM PID is turned off the timer will stop. The time is only counted from the point the RPM PID is activated.

Fuel Control Monitor Bank 1: In this PID the Bank 1 Sensor 1 is monitored. The time the O2 voltage is above or below 0.45v is calculated. If the time above and below 0.45v is equal the fuel control monitor will indicate 50%. If the number is lower than 50% it is an indication that the O2 sensor is on the lean side of fuel control. If the number if higher than 50% this is an indication that the O2 sensor is on the rich side of fuel control.

Fuel Control Monitor Bank 2: In this PID the Bank 2 Sensor 1 is monitored. The time the O2 voltage is above or below 0.45v is calculated. If the time above and below 0.45v is equal the fuel control monitor will indicate 50%. If the number is lower than 50% it is an indication that the O2 sensor is on the lean side of fuel control. If the number if higher than 50% this is an indication that the O2 sensor is on the rich side of fuel control.

Catalyst Efficiency Bank 1: In this PID the catalyst efficiency is calculated by comparing the front O2 sensor to the rear O2 sensor. In order to enable the PID you must go to the SharpSHOOTER tab and open it. Now open the catalyst efficiency tab and push the Prepare For Test button. Once this test has been completed, push the "Start Test" button. It will take 20sec. for the PID to display data. Please read the question mark on the catalyst efficiency screen.

Catalyst Efficiency Bank 2: In this PID the catalyst efficiency is calculated by comparing the front O2 sensor to the rear O2 sensor. In order to enable the PID you must go to the SharpSHOOTER tab and open it. Now open the catalyst efficiency tab and push the "Prepare For Test" button. Once this test has been completed, push the "Start Test" button. It will take 20sec. for the PID to display data. Please read the question mark on the catalyst efficiency screen.

Battery Voltage at DLC: In this PID the battery voltage is read directly from pin 16 of the DLC connector.

Closed Loop 1: In this PID the loop status from the monitors is continuously displayed. The value will be 1.000 if the engine is in closed loop and 0.000 if the engine is out of closed loop.

Closed Loop 2: In this PID the loop status from the monitors is continuously displayed. The value will be 1.000 if the engine is in closed loop and 0.000 the engine is out of closed loop.

**Theoretical Air Flow and Volumetric Efficiency:
Requires setup of engine size, temperature, and elevation. These values will be inaccurate unless at wide open throttle (WOT). Unlike the SharpSHOOTER™ VE calculations, these values are NOT corrected for engine, TP, or RPM efficiency. To maximize update rate and accuracy, press "Clear All" button before enabling TAF and VE calculated PIDs.
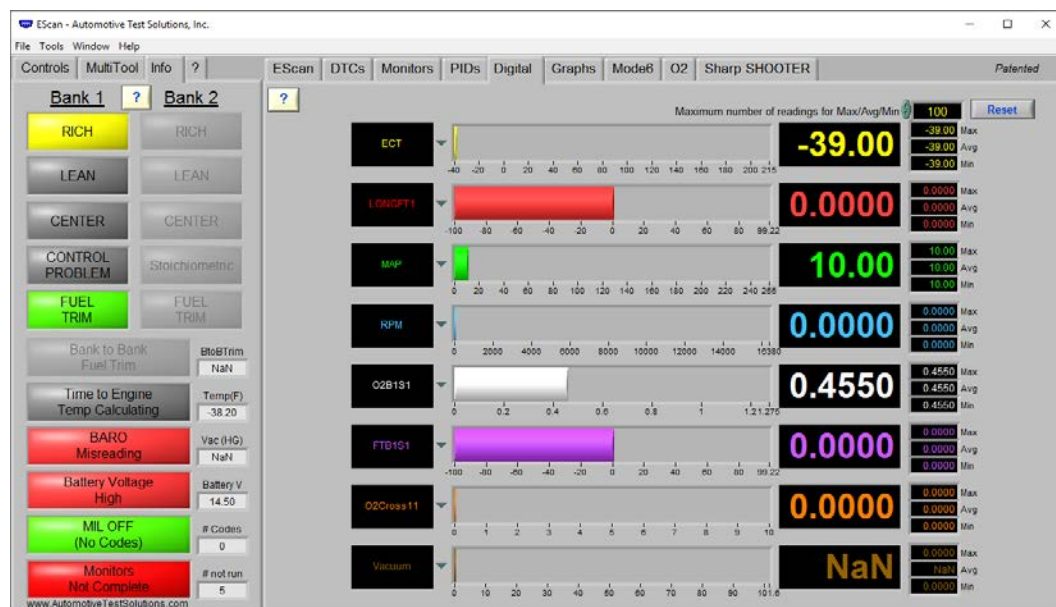
6.2.5 Digital

Figure 6-11 *digital*

Digital scales: The sliding bar graphs are active when the data value changes. The PID for the sliding bar graph is given to the left of the bar graph. The digital value of the PID is given to the right of the sliding bar scale. Further to the right of the digital display there are three display boxes. These will show the maximum, minimum, and average values of the PIDs that are selected. To reset these values there is a reset button located on the top right of the screen. To change the PID for any given sliding bar graph put the cursor over the triangle located between the PID display and the sliding bar graph and left click. All the available PID's are now displayed. Select the PID you would like to change the sliding bar graph to display. If the PID is not available go back to the "PIDs tab" and select the correct PID to be displayed. Now the PID can be selected for any one of the sliding bar graphs.
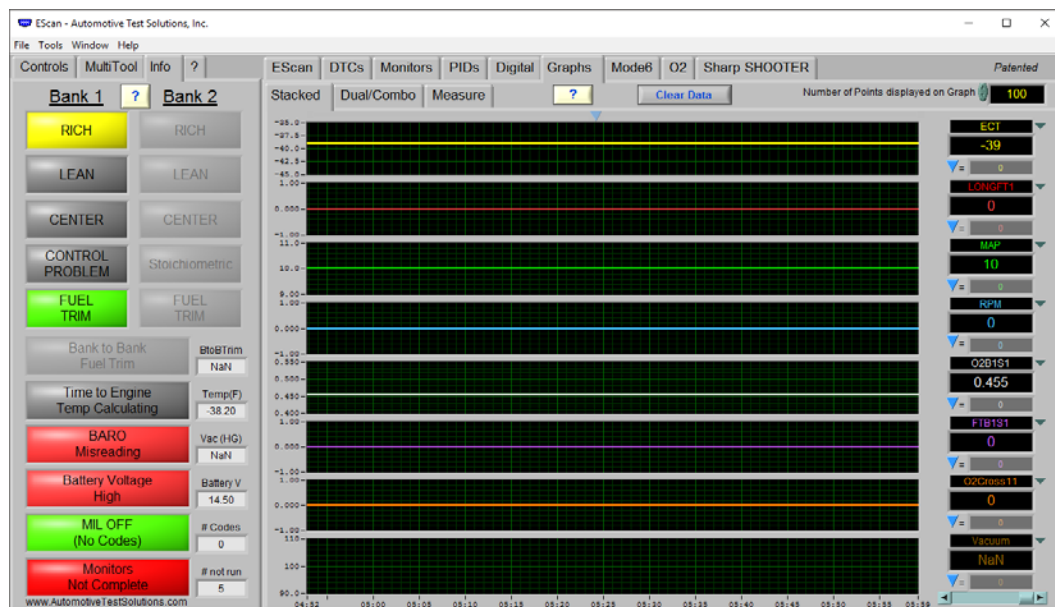
6.2.5 Graphs

6.2.5.1 Stacked

Figure 6-12 *stacked*

Stacked Graphs: The stacked graph will display PID data on individual graphs. This PID data will automatically scale to the correct range value for each of the displays. The time that the graphs are displayed can be adjusted at the top right of the screen shown as "Number of Points Displayed on Graph". The lower the Points Displayed number is the faster the graphed data will move. The larger the number indicated the slower the graphed data will move. To clear the data from the graphs there is a button in the top center "Clear Data" that when activated will reset all graphs to zero. The display boxes to the right of the graph will provide the PID information and PID value. The blue triangle at the center top of the screen can be used once the data is held by pushing (F5). By putting the curser on this blue triangle and dragging it to a location along the top of the screen the data that would intersect vertically from the blue triangle will be displayed to the right of the graphs next to the blue triangles.
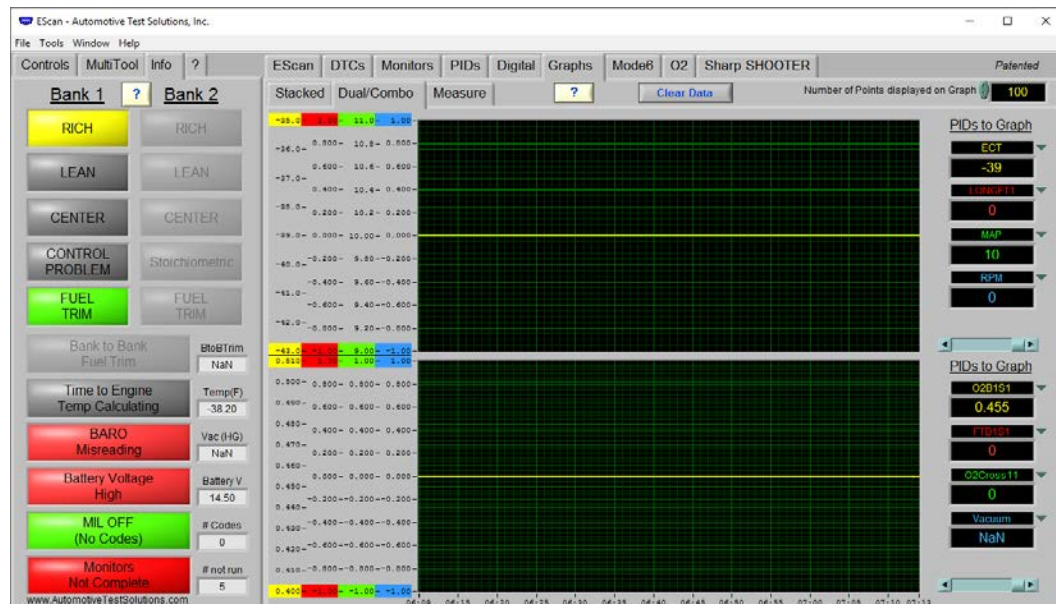
6.2.5.2 Dual/Combo

Figure 6-13 *dual/combo*

The Dual/Combo: The dual graph will display PIDs data that will overlay one another. This is good when comparing data from different PIDs. Since the value of the PIDs can be quite different, all data is automatically scaled to the full value of the graph. The value of each PID is given to the left of the graphs. The top values are the maximum amount for each of the PIDs selected. The bottom value is the minimum amount for each of the PIDs selected. The colors will indicate which value goes with which trace being graphed. For instance the yellow trace will go with the far left values given in yellow, the red trace will go with the second from the left values given in red and so forth. If you would like to change which PID is given with a specific trace, simply click on the gray triangle located to the far right of the PID display boxes. This will open a pop-up window that displays all currently selected PIDS. Now move the cursor over the PID you would like to display and select it. To review the data hit (F5) which will hold the data that has been recorded. Now move the cursor to the history playback located below the PID display boxes and put it on the arrows, this will allow you to move the data forward and backward.
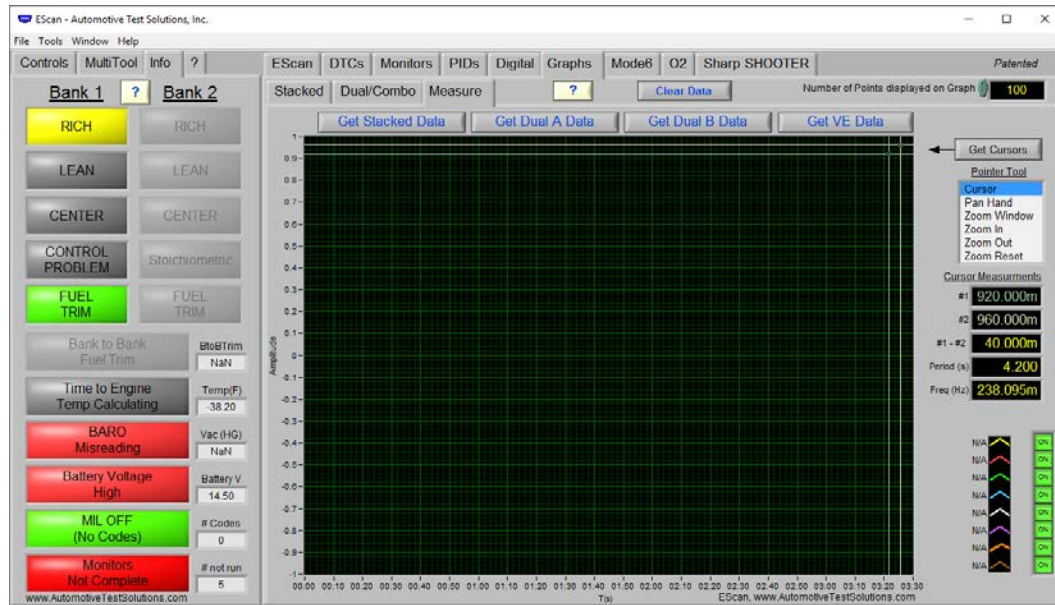
6.2.5.3 Measure

Figure 6-14 *measure*

Measure display: The measure screen allows the data to be moved from the stacked graphs or the dual/combo graphs. This is accomplished by selecting the buttons at the top of the graph. Once the data is moved to this graph you can analyze the data by zooming in or out on the data and using the cursors to make measurements on the data. The cursor button located on the upper right of the screen "Get Cursors" will bring up the measuring cursors on to the screen. Now move the measuring cursors to the locations desired. The measurement data is given at the left center of the screen. The PID data and colored trace for each of the PID's is shown at the bottom left of the screen.

6.2.6 Mode6

Monitors must be complete for related Mode6 information to be accurate.

NOTE: If the DTC's have been recently cleared there will be no Mode 6 data available.
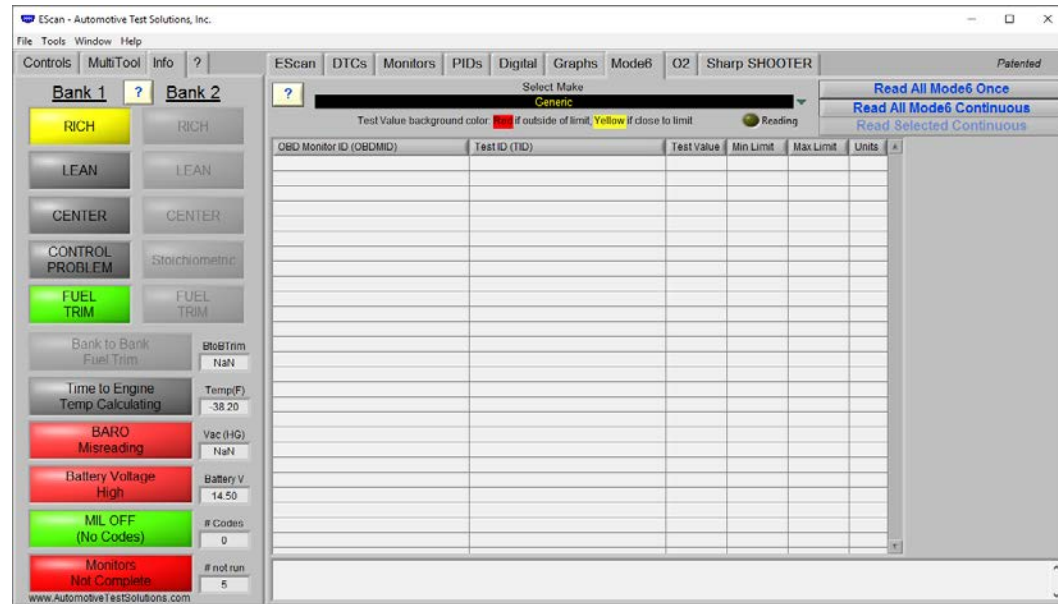

Figure 6-15 *mode6*

Select Make: If possible, select the make of vehicle before reading Mode6 information. If this is unknown leave this value set to Generic. To select a vehicle move the cursor over the gray triangle located to the right of the "Select Make" display at the top of the screen. This will open a window where the specific vehicle under test can be selected from a list.

NOTE: Note that values will not be decoded or scaled if Generic is selected. Also note that the make selection will change for CAN communication compared to non-CAN communication vehicles.

Read All Mode6 Once: Pressing this button will force all Mode6 values to be read once.

Read All Mode6 Continuous: Turning this button on (green) will force all Mode6 values to be read continuously.

NOTE: If other PID's are also chosen this will slow the data read loop speed down.

Read Selected Continuous: Turning this button on (green) will force the selected Mode6 values to be read continuously. "Read All Mode6 Once" must be done and a row in the table must be selected before this can be turned on. All CIDs for a selected TID will be read for non-CAN vehicles and all TIDs for a selected OBDMID will be read for CAN vehicles. Select by clicking on the row of interest.

Reading: This indicator will turn yellow while Mode6 data is being read.

Table: Displays Mode6 data. Test Value background colors in the "Test Value" column will turn red if outside of limit or yellow if close to limit. Normally the background is white.

NOTE: Note that the column headings will change depending on if the vehicle has CAN communications. Non-CAN uses TIDs & CIDs while CAN uses OBDMIDs and TIDs.

Text Under Table: Displays related DTC and explanation if available for selected row in table. Select by clicking on the row of interest.
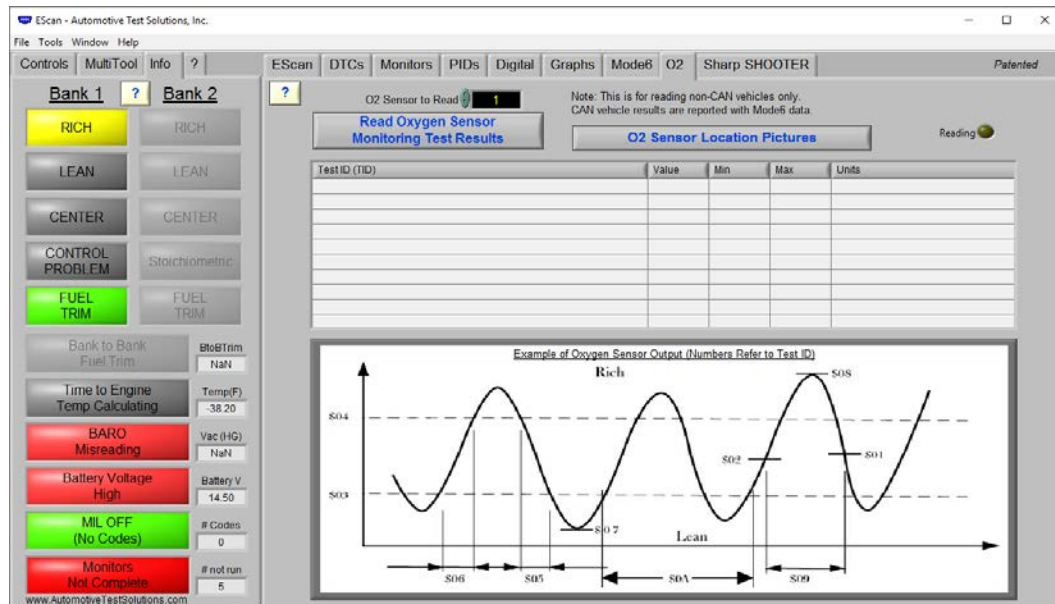
6.2.6 O2

Figure 6-16 *O2*

This test will request data, if available, from the onboard computer. If the O2 data is available the list will be populated with such O2 data. On vehicles newer than 2000 this data is usually displayed in the Mode6 data list.
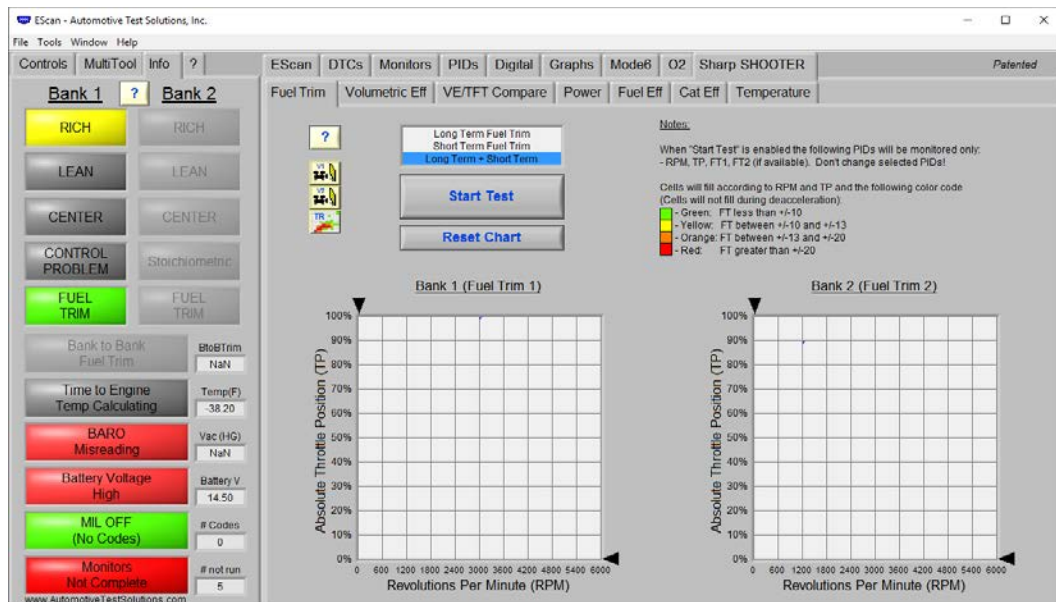
7.1 Sharp SHOOTER™ Tabs

7.1.1 Fuel Trim

Figure 7-1 *fuel trim*

V1 & V2: Pressing the V1 or V2 button will bring up a video.

TR: Pressing the TR button will bring up troubleshooting examples.

The fuel trim is the technician's window into the PCM's program. If all the calculations (input) are correct, the fuel delivery will not need to be changed, so the fuel trim will remain at or close to '0'. If the computer's calculations (inputs) are off, the feedback system (oxygen sensor) will add or subtract fuel so that the air/fuel ratio will remain at 14.7 parts air to 1 part fuel. This shift that is created by the feedback system is given to the technician as fuel trim. If the long term trim exceeds +/-13%, it is recommended that the vehicle's fuel control system be repaired. The charts reflect this by adding color to the fuel trim reading. If the chart is orange or red, there is a problem within the fuel control system that will need to be repaired. When the engine is programmed, a linear equation from idle to wide open throttle is written. However, an engine does not have a linear air flow curve so a volumetric efficiency table is used to change the fuel delivery along this linear calculation. The VE table is broken up into cells which represent loads against RPMs. As the RPM and load shifts, the program moves into different volumetric efficiency cells. In one cell, the fuel trim could be failing while in others the fuel trim is correct. This calculated load chart is a representation of the VE that was programmed in the processor. If the vehicle is taken on

a test drive and the cells are filled between idle and WOT, the technician will have a window into the VE chart of the on board computers program.

Long Term Fuel Trim
Short Term Fuel Trim
Long Term + Short Term

The default setting will be Long Term + Short Term = Total Fuel Trim Calculations. If Long Term or Short Term Fuel Trim is desired put the cursor over the correct Fuel Trim and select.

Start Test: Pushing this button will start the test

Reset Chart: Pushing this button will reset the data displayed on the Fuel Trim tables.

7.1.2 Volumetric Efficiency

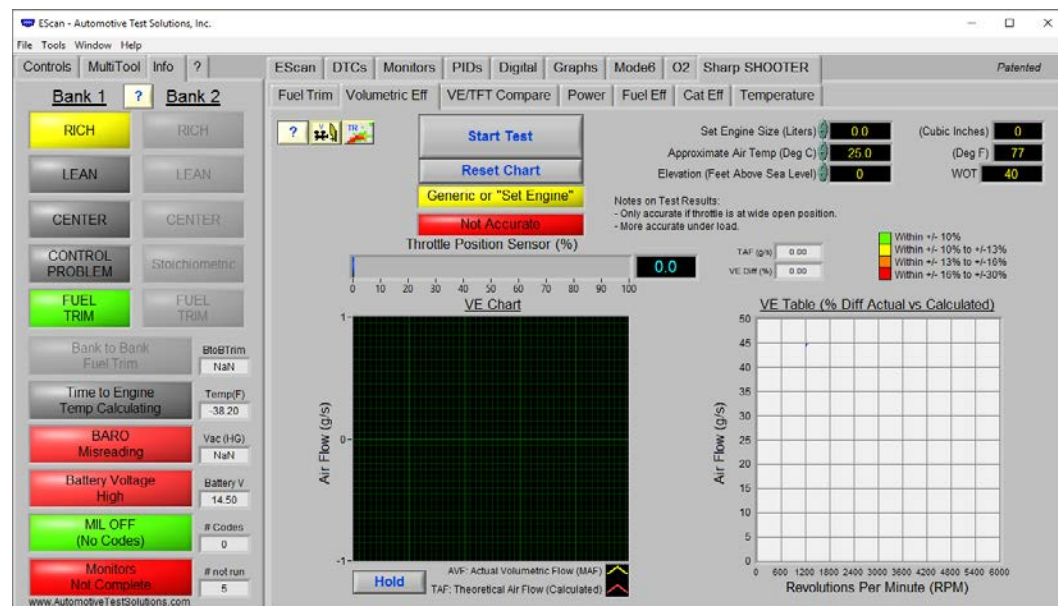This test will only work if the vehicle is equipped with a MAF.

Figure 7-2 *volumetric eff*

V: Pressing the V button will bring up a video.

TR: Pressing the TR button will bring up troubleshooting examples.

An engine is an air pump that pumps air from the intake to the exhaust. If the liter capacity of the engine is known, the RPM are known and the barometric pressure is set correctly then the VE, or how much air the engine is capable of pumping, can be calculated. The volumetric efficiency tables are used to determine the mass volume of air entering the engine. Since an engine is a mechanical device, if a problem exists the engine will be unable to pump the same amount of air, thus, the VE readings will be lower than calculated. In this condition, the fuel trim tables will be green. This is due to the mass air flow sensor reading the air flowing into the engine correctly. This will also apply to a restricted exhaust or a mechanical problem with the engine. In these conditions, the mass air sensor will correctly read the

volume of air passing through it which will turn the fuel trim tables to green. If the mass air flow sensor is reading out of calibration, the VE reading on the table will be incorrect and the fuel trim table will have large changes in order to compensate for the mass air flow sensors readings. These tests are most accurate at WOT. The indication light reading 'Not Accurate' will be activated below throttle openings of 50%. Once the throttle is opened greater than 50% the light will read 'Accurate'. For best test results, put the vehicle in first gear and slowly open the throttle to 20%. Once the vehicle is rolling push the throttle to WOT. When the engine is close to its rev limit, back out of the throttle very quickly. The graph will now be loaded for your review.

NOTE: This test will not be accurate when power braking. The vehicle must be driven.

Note that the equation for VE = (AVF/TAF) * 100% where:
    VE = volumetric efficiency.
    AVF = Actual Volumetric Flow rate, normally measured with a MAF sensor.
    TAF = Theoretical Air Flow rate, calculated.

To make it easier to see problems we actually show the percentage difference between AVF and TAF instead of the AVF percentage of TAF like in the equation above. This means that the percentages should be closer to zero instead of 100.

The equation we use after calculating TAF is:
    VE% Difference = ((TAF-AVF)/AVF) * 100%.

NOTE: the TAF used in this equation is corrected to be as close as possible to the normal airflow of the engine. This is done by modeling known good engines.

The calculated TAF and calculated VE PIDs are not used on the Volumetric Efficiency Test. These PID's are not corrected for engines. The calculated VE PID uses the normal VE formula: VE = (AVF/TAF) * 100%. These calculated PIDs can be selected on the PIDs page and can be viewed on the regular Digital and Graphs tabs.

TAF: Displays the Theoretical Air Flow rate

VE Diff: Displays the difference between the Theoretical Air Flow rate and the Actual Volumetric Flow rate.

Set Engine Size: This is set to the engine's liter size under test. If the Vehicle Identification Number (VIN) of the vehicle can be automatically read when the EScan Pro® is first started, the VIN will load the engine liter size and the specific engine model to be tested. If the VIN is not available it **must be** manually entered. This is accomplished by selecting the EScan tab at the far upper left. Now locate the "Enter VIN Manually" button located at the lower left side of the screen. Push this button and a pop-up window will appear. Enter the correct VIN for the vehicle under test. The correct data will now be loaded into the Sharp SHOOTERTM tests.

Approximate Air Temp: The ambient air temperature of the test site must be entered within 5 °F of the actual temperature.

Elevation: The elevation (altitude) of the test site must be entered within 100 feet of the actual elevation.

Start Test: Pushing this button will start the VE test.

Reset Chart: Pushing this button will reset the graph and table to zero.

Not Actuate Lamp: This lamp is on if the throttle position is less than 50%. The VE table will not load data in this condition. If the throttle is greater than 50% the lamp will now display actuate. In this condition the VE table will now load the % difference between the AVF and the TAF data.

Hold: Pushing this button will hold the data that has been acquired on the graph and the VE table

7.1.3 VE/TFT Compare

NOTE: The VE test and the TFT test must be run before this test can be completed.

Figure 7-3 *ve/tft compare*

This test will compare the Total Fuel Trim (TFT = Long + Short) with the Volumetric Efficiency of the engine. The Fuel Trim multiplies the quantity of incoming air into the engine in order to decrease or increase the fuel delivered to the cylinder. By comparing the base air entering the engine with the amount of Fuel Trim you can determine what is wrong with the system.

For example if the Mass Air Flow (MAF) sensor is read in Grams Per Second (GPS) and is under reading the air weight entering the engine, the Fuel Trim will multiply the air weight in order to correct the under read weight to the actual weight entering the engine. This means that the amount of air weight that was under read when put into a percentage format will match the amount of Fuel Trim in a percentage format. When loaded on the graph the air weight % will match the TFT % thus indicating the air reading is incorrect.

In another example, if the air weight is correctly read by the MAF sensor and the TFT has high (>13%) readings, when loaded on the graph these will not match indicating the problem

is on the fuel delivery side. If the air weight is read correctly then the feedback system will not need to correct the air weight. So, if the air weight is correct and there is a TFT multiplier applied it is correcting for a fuel delivery problem. In this case go back and look at the TFT table to see how the TFT multipliers are applied under load. This will indicate where the fuel delivery problem is located.

In yet another example, if the air weight is under read and there is no corresponding TFT percentage, this would indicate that the problem is one of a mechanical nature. If the air entering the engine is truly low and the MAF sensor read the air weight correctly there will be no fuel trim multiplier applied. If the exhaust is restricted at a common location to all banks the engine cannot pump the correct amount of air under heavy load, thus, the VE will be low when compared to the calculated air equation provided by the EScan Pro®. In this condition the fuel trim multiplier % will be low. This would indicate problems such as exhaust restriction, catalysis Restriction, camshaft to crankshaft timing issues, induction system restriction, etc.

NOTE: Normally, if the induction system is restricted it will create turbulence that will alter the VE and TFT as well.

Load FT/VE: Pushing this button will load the TFT tables and the VE table data to the FT/VE tables and graph where they will be compared.

Chart Values Avg/Max: Pushing this button will change the way the data on the graph is displayed. In the default modes the data is averaged, if the button is pushed this will change to use the maximum value instead.

FT Absolute Value: Pushing this button will change the way the data on the graph is displayed. In the default modes the data is given with the TFT positive and negative, if the button is pushed this will change to use the absolute (all positive) value instead. This makes comparing the bank to bank Fuel Trims very easy.
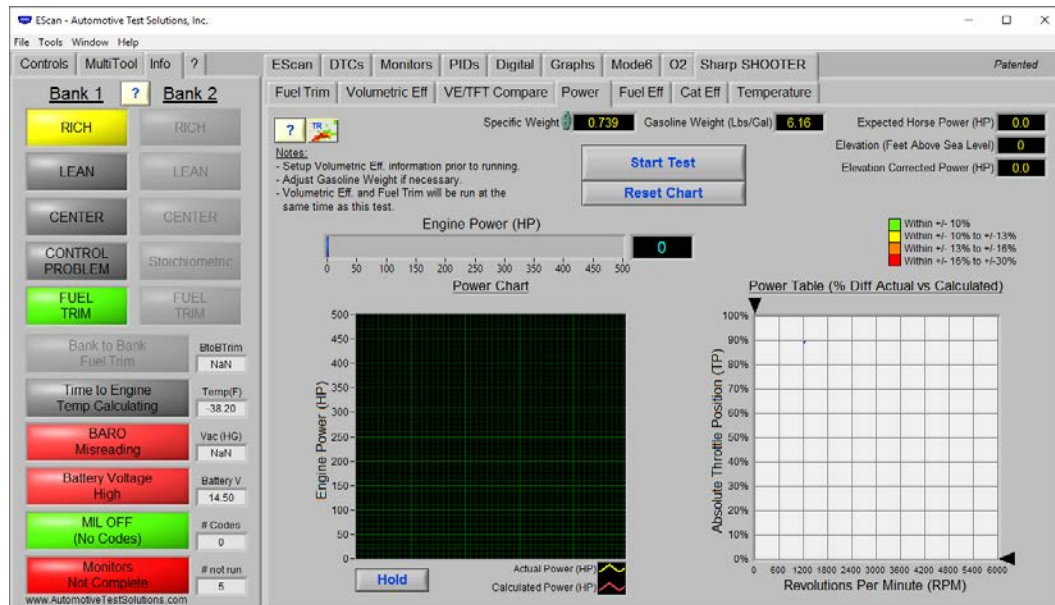
7.1.4 Power

Figure 7-4 *power*

The power test will provide the Horse Power (HP) produced for the engine being tested. This test will use the air weight that is pumped by the engine to calculate the HP. If the air weight is known the Fuel Weight can be determined for the load applied on the engine. Under light load, less than 70% throttle opening, the Air Fuel Ratio (AFR) will be stoichiometric or approximately 14.5/1 to 14.7 /1 depending on the pump gasolines weight rated in specific gravity. Under heavy engine load, throttle opening greater than 70%, the AFR will move to approximately 12.8/1. The HP will be calculated from these AFR and is approximately the HP at the flywheel.

NOTE: These HP ratings are only accurate when the ignition timing is accurately generated with a high energy spark event.

Specific Weight: The gasoline is measured with a hydrometer that will read .7 to .9 (specific Gravity). This measures the energy contained within the fuel stock. The Default setting is .739 which is an average gasoline stock. In order to change this weight measure the temperature and specific gravity of the fuel in the test vehicle. Now enter the corrected reading for the Specific Weight.

Expected Horsepower: When the EScan Pro® program is first connected to the vehicle it pulls the VIN from the vehicle. This VIN is used to identify which engine is in the vehicle. Once the engine is known the horsepower the engine is expected to produce will be loaded.

Elevation (feet above sea level): The actual elevation (altitude) of the test site must be entered to within 100 feet. This is set in the VE test.

Elevation Corrected Power (HP): This is the horsepower that the engine is expected produce at the elevation of the test site.

Start Test: Selecting this button will start the Power test.

Reset Chart: Selecting this button will reset the graph and table to zero.
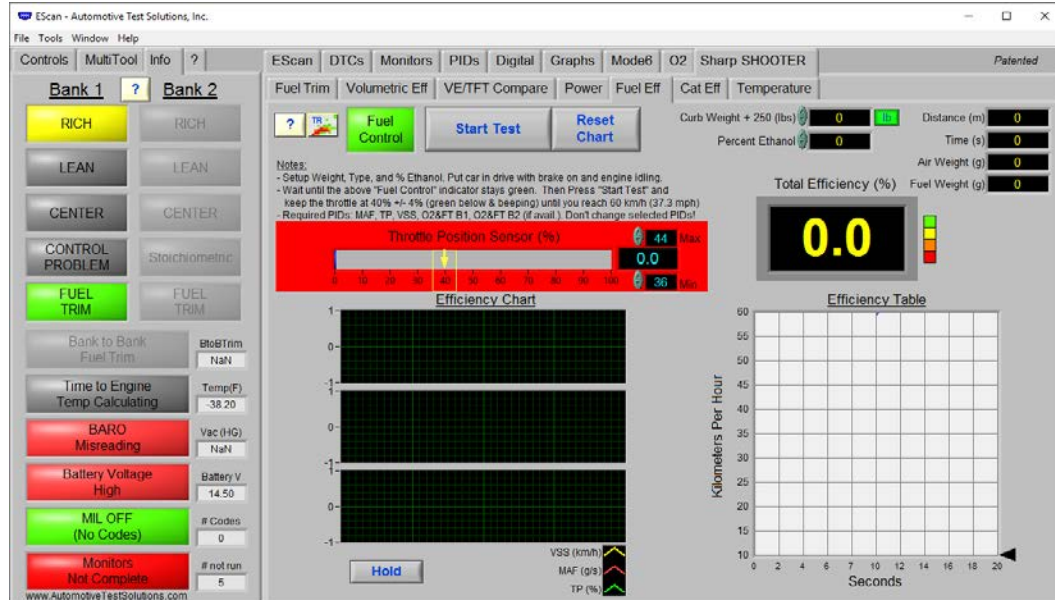
7.1.5 Fuel Efficiency

Figure 7-5 *fuel eff*

The Fuel Efficiency test will provide you with data on how well the thermal energy from the fuel is used to move the vehicles weight.

IMPORTANT: THIS TEST MUST BE RUN ON LEVEL GROUND WHERE THE VEHICLE CAN SAFELY BE ACCELERATED TO 40 MPH WITHOUT HAVING TO MOVE THE THROTTLE PEDAL FROM THE 40% NEEDED TO RUN THE TEST.

The engine should be at operating temperature and all accessories such as air conditioning and HVAC fans should be turned off. The Fuel Efficiency test is run from a stop. Once the start button is pushed the vehicle Throttle Position Sensor (TPS) will be pushed until the reading is at or very close to 40%. When the driver has moved the TPS to the correct level the audio system in the PC will ding. This allows the driver to hear when the TPS is in the correct position for the test to be run.

IMPORTANT: NEVER WATCH THE SCREEN WHILE DRIVING THE VEHICLE!

The vehicle's internal combustion engine will use the energy from the fuel to move the vehicle weight. This energy will then be rated on how efficiently the thermal energy from the fuel stock was used. Any problem will show up as a low efficiency. These low efficiency ratings can be problems, such as; Engine performance problems, Transmission problems, Brake dragging problems, Large tires, Mud tires, Low tire pressures, or anything that would make it hard to roll the vehicle forward.

Curb Weight +250 (lbs): When the EScan Pro® program is first connected to the vehicle it pulls the VIN from the vehicle. This VIN is used to identify the curb weight of the vehicle. Once the VIN is decoded the curb weight will be entered in the Curb Weight display.

Percent Ethanol: This is the percentage of Ethanol contained within the fuel stock. The default value is set at .739 specific gravity which is an average weight for gasoline.

Start Test: Pushing this button will start the Fuel Efficiency test.

Reset Chart: Pushing this button will reset the graph and table to zero.

Total Efficiency %: This is the percent of the total fuel stock's thermal energy used to move the vehicles weight.

Distance (m): This is the distance covered to go from 0 MPH to 40 MPH.

Time (s): This is the time to go from 0 MPH to 40 MPH.

Air Weight (g): This is the amount of air pumped by the engine to go from 0 MPH to 40 MPH.

Fuel Weight (g): This is the amount of fuel delivered to the engine to go from 0 MPH to 40 MPH.

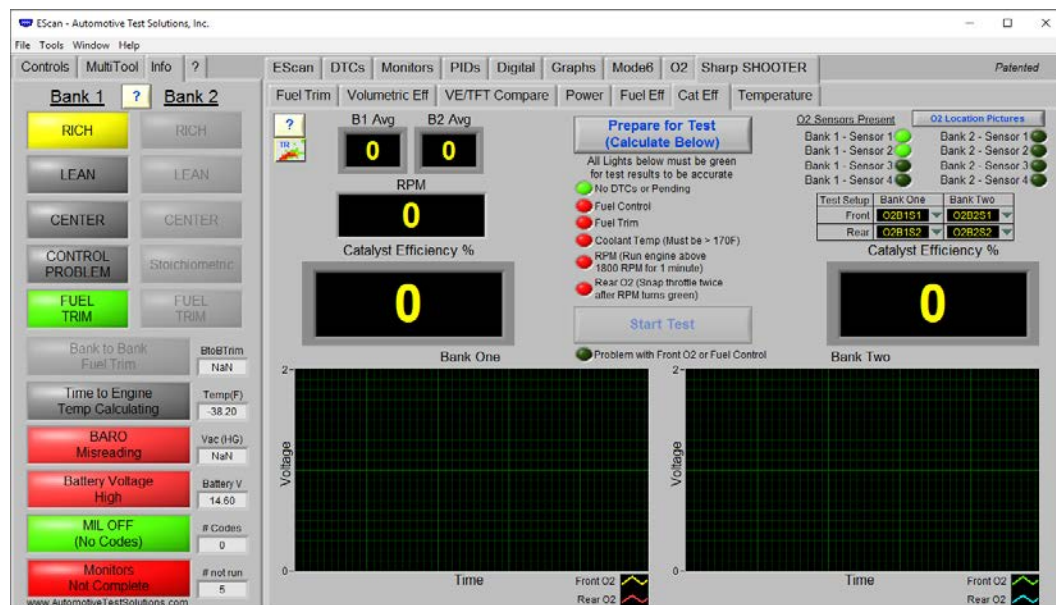# 7.1.6 Catalyst Efficiency

Figure 7-6 *cat eff*

The catalyst efficiency test is used by the technician to confirm the present operation of the catalytic converter.

Prior to preparing or starting a catalyst efficiency test, you can select which Front and Rear O2 sensors are used for Bank One and Bank Two. By default, these will be O2B1S1/O2B1S2 for Bank One and O2B2S1/O2B2S2 for Bank Two but on a few vehicles this may be incorrect. To change these settings, simply adjust the pull-down menus in the "Test Setup" table.

It is important for the operating conditions to be correct before a judgment is passed on the condition of the catalytic converter. To test the operating conditions of the fuel control system, push the "Prepare Test (calculate below)" button.

This button will turn green notifying you that the testing sequence has begun. All of the indication lights must turn from red to green for the results of this test to be accurate. However, the test can be run at any time by pushing the 'Start Test' button.

The DTC Indication Light: The vehicle's on-board computer must not have any DTC's or pending codes available in order for this light to turn green.

The Fuel System Indication Light: The vehicle on-board computer must be in control of the fuel system in order for this light to turn green.

The Fuel Trim Indication Light: The vehicle on-board computer must have the long term fuel trim functioning between +/-10% in order for the light to turn green.

The Coolant Temperature Indication Light: The engine coolant temperature must be higher than 170°F in order for the light to turn green.

The RPM Indication Light: The engine RPM must be held greater than 1800 for at least 1 minute in order for the light to turn green.

The Rear O2 Indication Light: The rear O2 sensor must be active and move > .8V to < .2V with the fuel system conditions in order for the light to turn green. During the rear O2 test the technician will be asked to snap the throttle several times. This will allow the catalytic converter to become saturated and the rear O2 will follow the front O2 with a slight delay.

Once all indication lights turn green, the catalyst efficiency test can be started by pressing the "Start Test" button. It will take 20 seconds for the catalyst efficiency percent to be displayed in the window. Once the display has a digital reading the display border will turn color to indicate the condition of the catalytic converter. Green indicates a good converter. Yellow indicates the converter is marginal. Orange indicates the converter is failing. Red indicates the converter is compromised. To get the best results from this test, place the vehicle in park or neutral, set the parking brake or block the wheels, raise the RPM above 2200 and hold the throttle very steady. It is best to drive the vehicle under a light load at about 35 to 40 MPH with the throttle held steady.

NOTE: If you are driving the vehicle in stop and go traffic the catalyst efficiency will drop to the 60% range with a good converter.

NOTE: Before the catalytic converter is replaced always check for a catalyst efficiency code. If no code is present and the monitors have run, check the mode 6 data on the catalyst efficiency. If it shows good then replacement of the catalytic converter will not fix the vehicle unless the catalytic converter is restricted. If there is a code set and the catalyst efficiency shows good, check for a TSB on reprogramming the PCM or an exhaust leak near one of the O2 sensors.
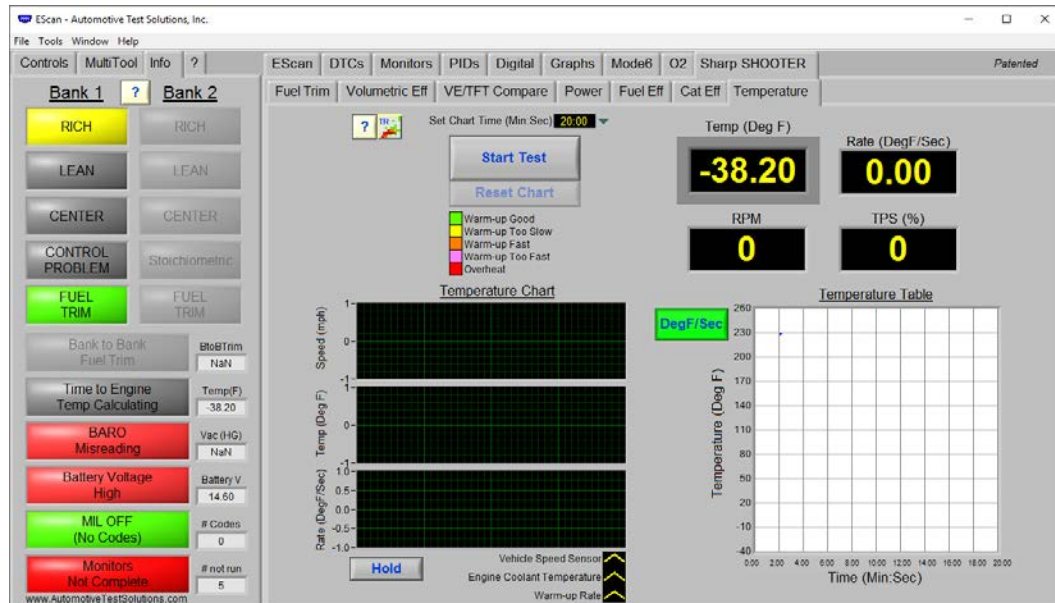
7.1.7 Temperature

Figure 7-7 *temperature*

The engine coolant graph and chart will show the warm up cycle of the engine. The chart will also show the throttle position opening and the RPM, which will show the load of the engine. The load on the engine will change how rapidly the coolant takes on heat. The temperature of the coolant is plotted against the time it takes to increase the temperature of the engine.

The rate at which the coolant temperature changes is how you diagnose the cooling system. A good engine will have a rate of .2°F to .4°F increase per second. For example if the coolant warm up rate is close to 0°F the water is not moving through the engine. If the water is not moving it cannot pick up heat from the engines metal components. This may be caused by a missing water pump drive belt, bad or broken water pump, etc. If the coolant is warming but warming to slow the thermostat could be leaking. In this event the cool water from the radiator is able to move into the engine thus creating a slow warm up rate. If the coolant warm up rate is high close to .5°F to .7°F then there is not enough coolant in the system. If the Warm up rate is correct but the temperature continues until overheating check to see if the thermostat opened. This will be shown by a temperature drop at about 175°F. If no drop is apparent the thermostat is sticking closed. If the water temperature dropped on the graph at about 175°F, this indicates the thermostat opened. If the thermostat opened check for a flow restriction in the radiator or check the head gasket seal with the ATS Bullseye Leak Detector.

NOTE: If the coolant temperature is below 30°F on start the coolant rate will be higher due to the large difference in temperatures. Also the coolant rate will be higher on new vehicle engines that have less coolant in them so they can obtain coolant temperature more quickly.

- If the table is filled in green then the warm up cycle is working correctly.
- If the engine is slow to warm up then the cell in which the temperature fails will turn yellow.
- If the engine is fast to warm up then the cell in which the temperature fails will turn orange.
- If the engine is too fast to warm up then the cell in which the temperature fails will turn pink.
- If the engine is overheated the cell which fails will be red.

Set Chart Time (min sec.): This will change how long it takes the chart to fill.

Temp. (Deg°F): This is the temperature of the engine.

Rate (Deg. °F/sec): This is the coolant temperature rate of change.

RPM: This is the engine's current Revolutions Per Second (RPM)

TPS%: This is the current throttle position

Deg°F/sec: This button will change the table data between temperature and rate of change