SPECTRUM
by IMPCO

Series III

Diagnostic Scan Tool (DST)

Instruction Manual

IMPCO®
Technologies, Inc.

June, 2013

CONTENTS

- Installation of the DST package to a personal computer (PC).
- Software login and password functionality.
- DST service pages.
- Updating the ECM calibration using a MOT file.
- DTC pages.

Examples and snapshots used in this manual are based off of the initial DST tool release as of July, 2007. This tool is frequently updated and the illustrations may vary depending on the changes included in any updated DST display Interface. Terms, names and descriptions of parts and servicing procedures will be updated based on trade, brand, or common description to more accurately describe the part or service procedure.

DST INSTALLATION INSTRUCTIONS

Before installing the DST software, please be sure your computer meets the minimum system requirements.

Supported operating systems are:

- Windows Vista
- Windows XP
- Windows 2000
- Windows 7
- Windows 8

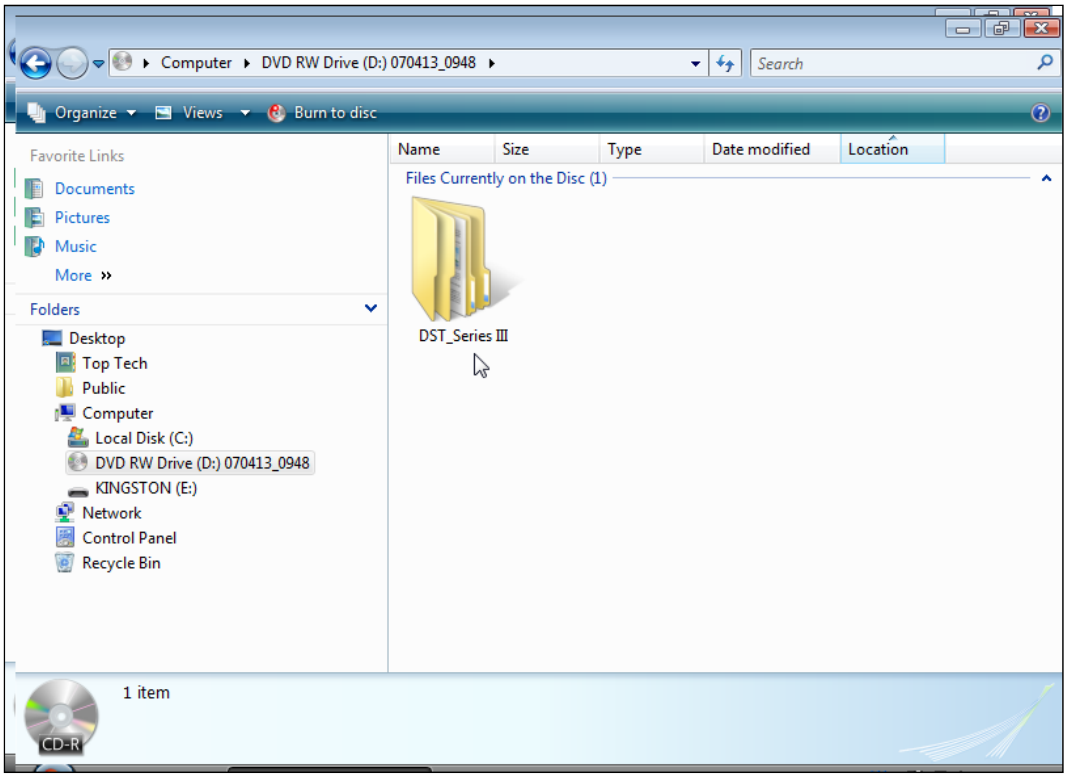
Minimum processor speed:

- Pentium II 450 MHz
- Pentium III 1.0 GHz for Windows Vista

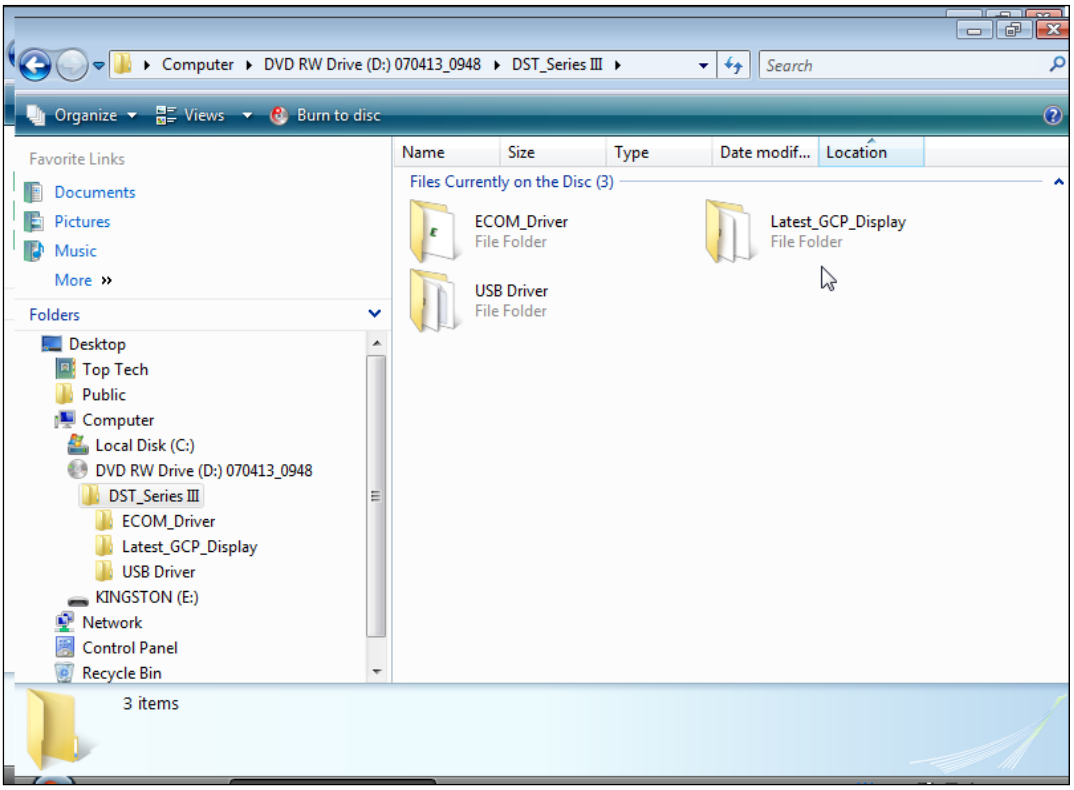
Minimum RAM requirement:

- Windows Vista/7/8 512 MB
- Windows XP 256 MB
- Windows 2000 128 MB

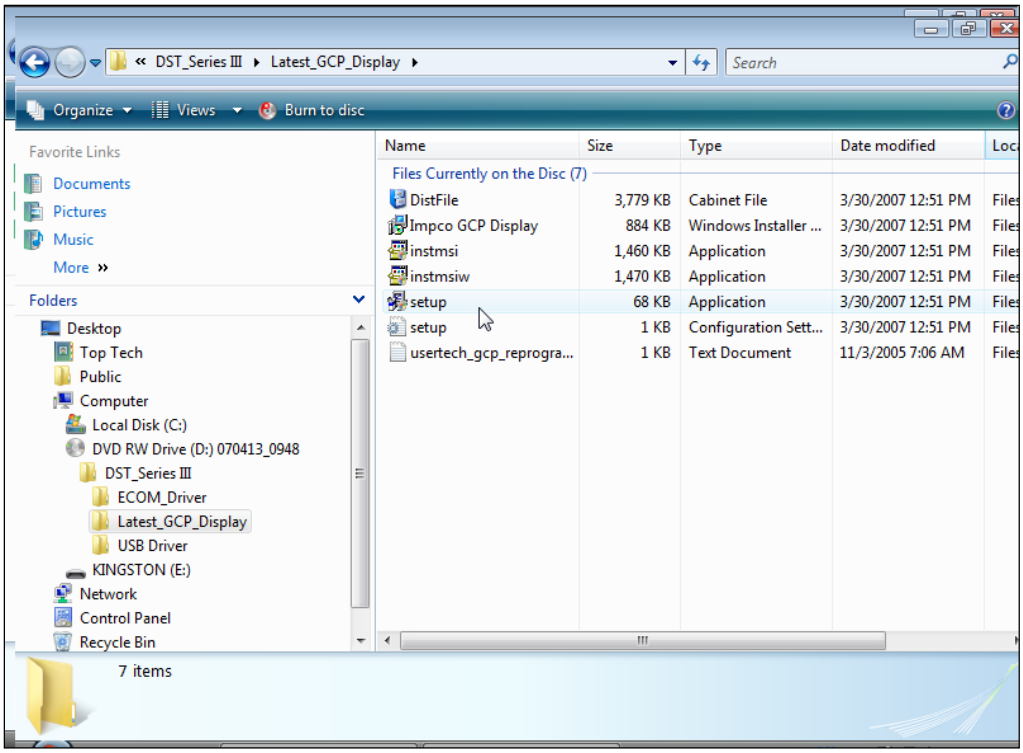
* At least one available USB port.



- Open the DST_Series III folder

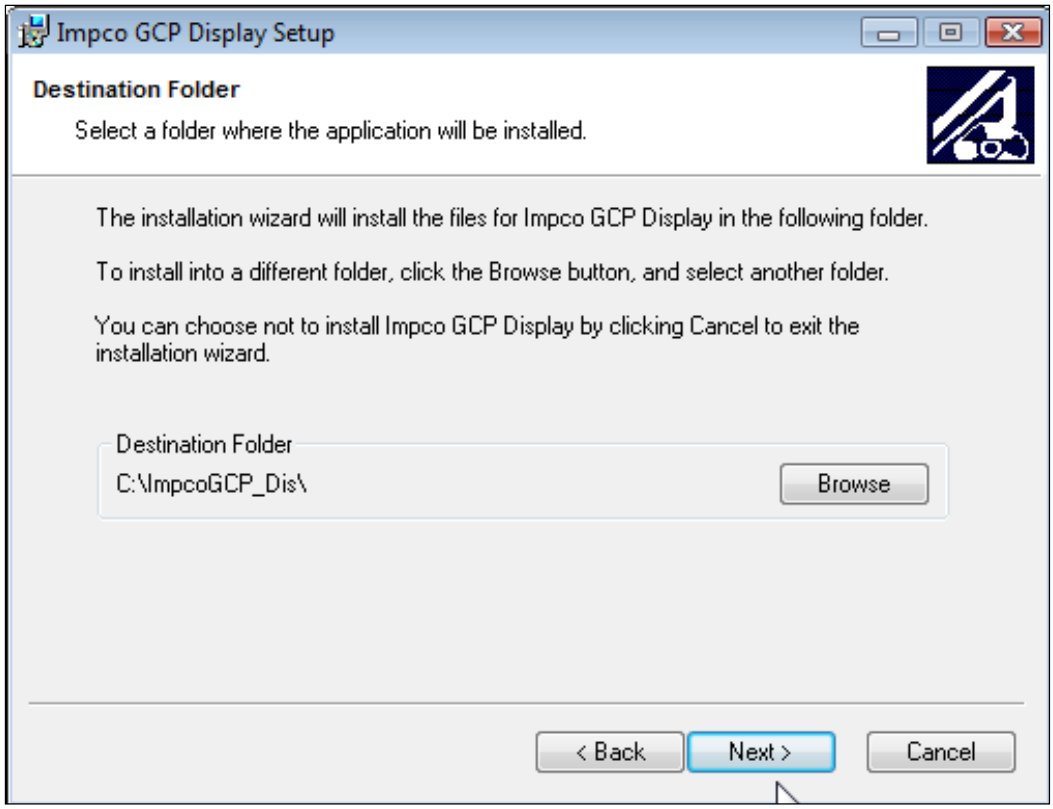


- Open the Latest_GCP_Display folder

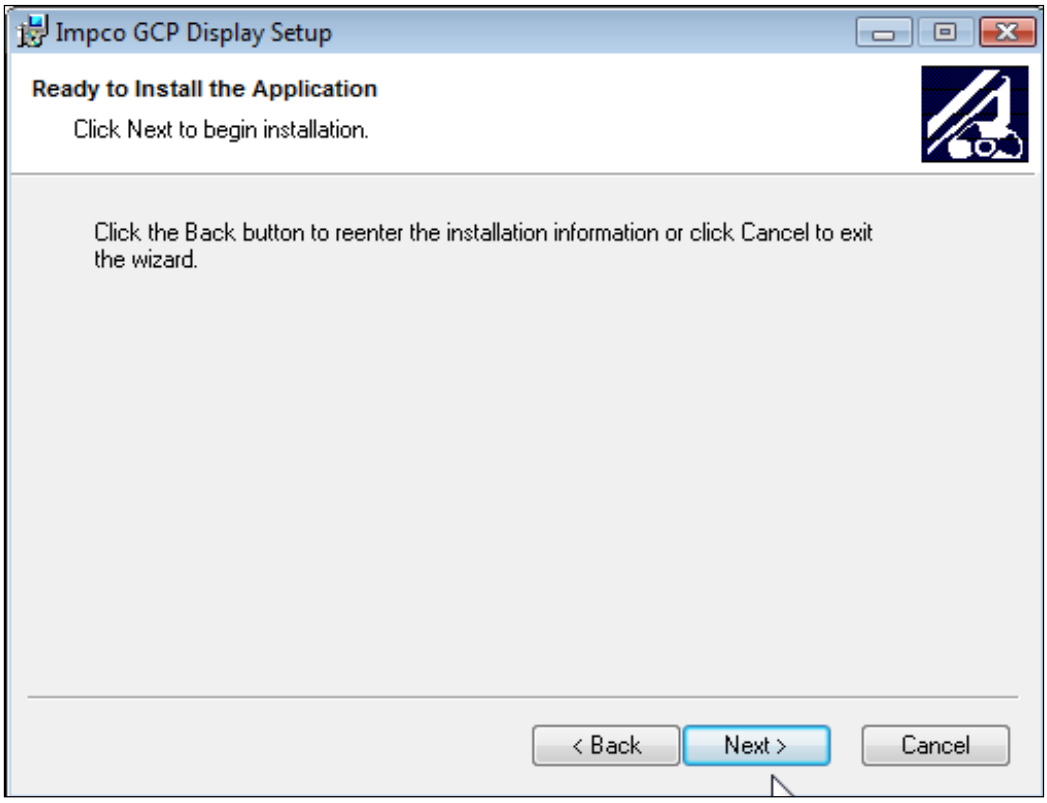


- Double click on “setup.exe” (application file) to start the windows installer. If a previous version of the GCP software is installed, the uninstaller may remove the previous version and exit. You will be required to start the installer again to install the new version.

- Click “Next” to continue

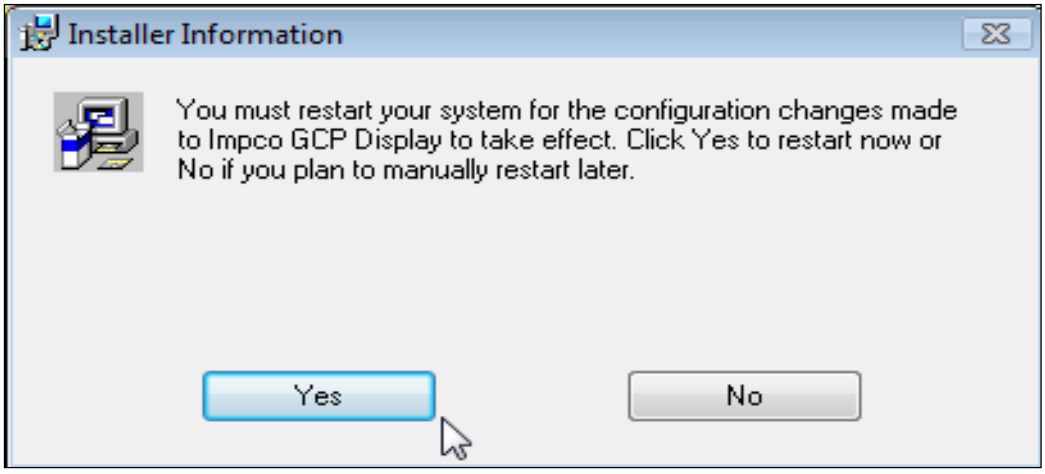


- Click “Next” to continue

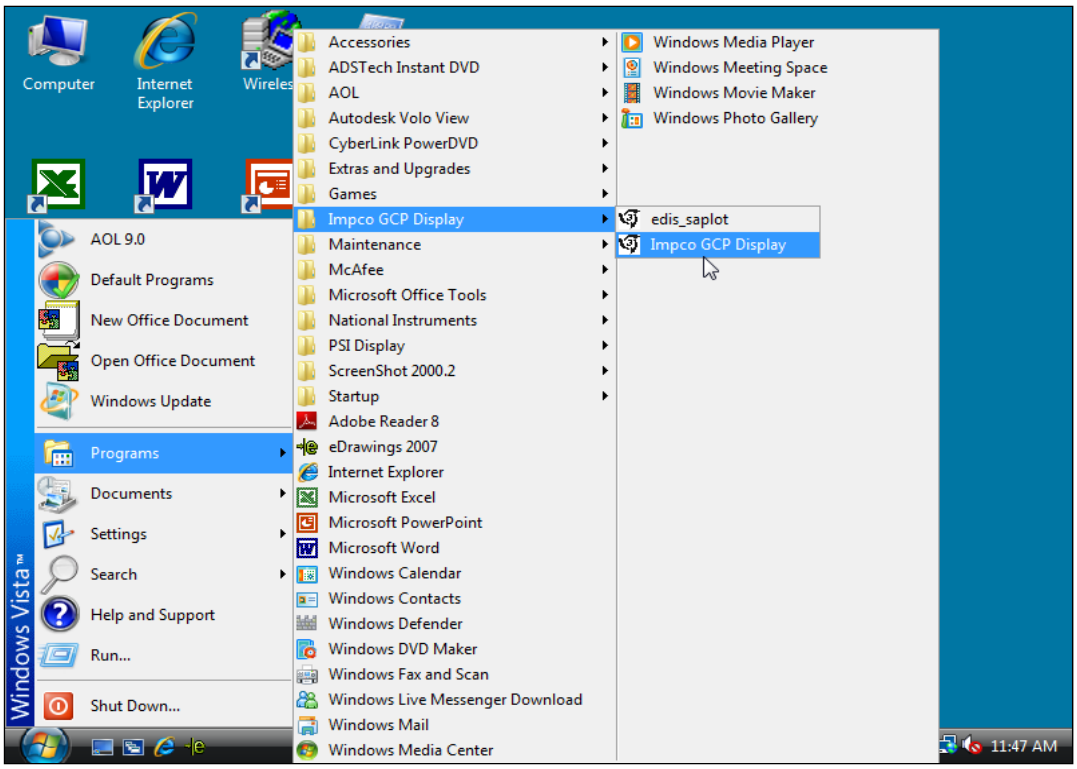


- Click “Next” to continue

- Click the “Finish” box to complete the installation.



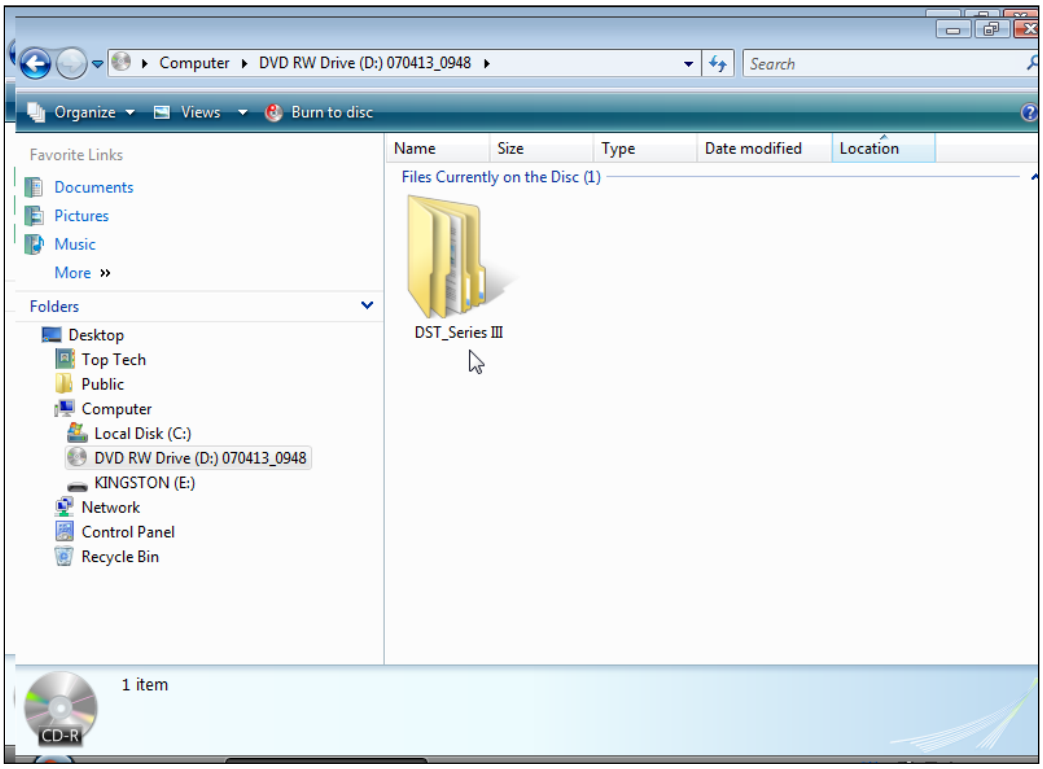
- Click “Yes” to restart your computer



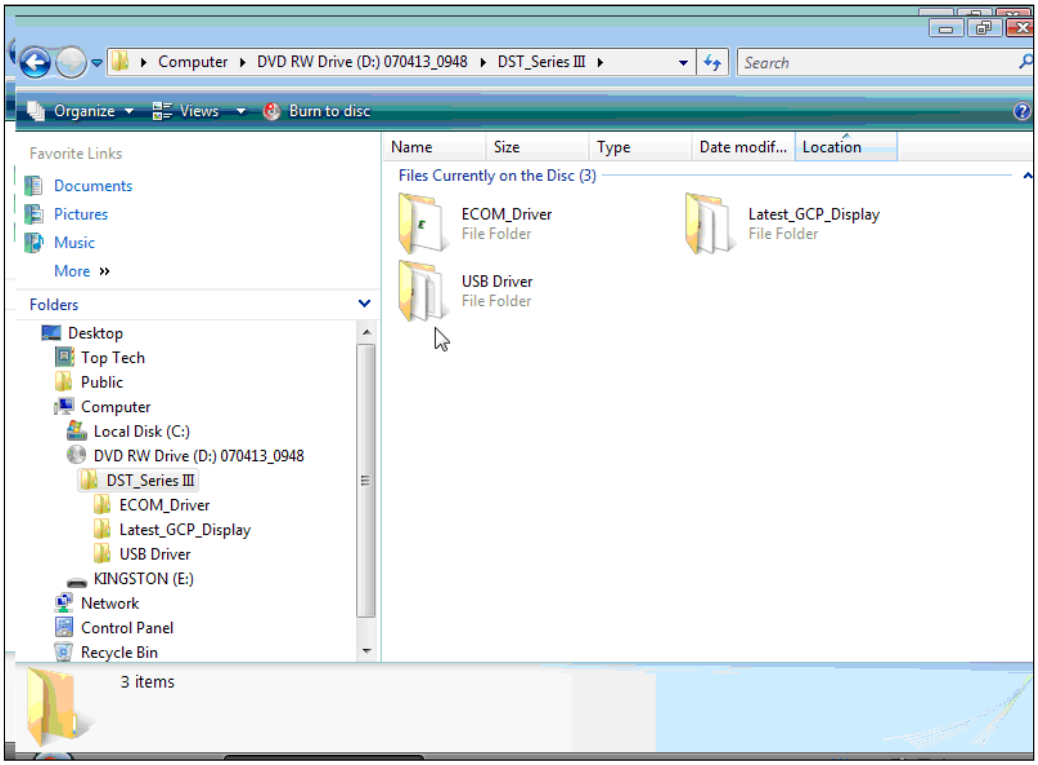
- Once installed, the software can be accessed from Start Menu →Programs → IMPCO GCP Display → IMPCO GCP Display

INSTALLING THE USB ADAPTER DRIVER

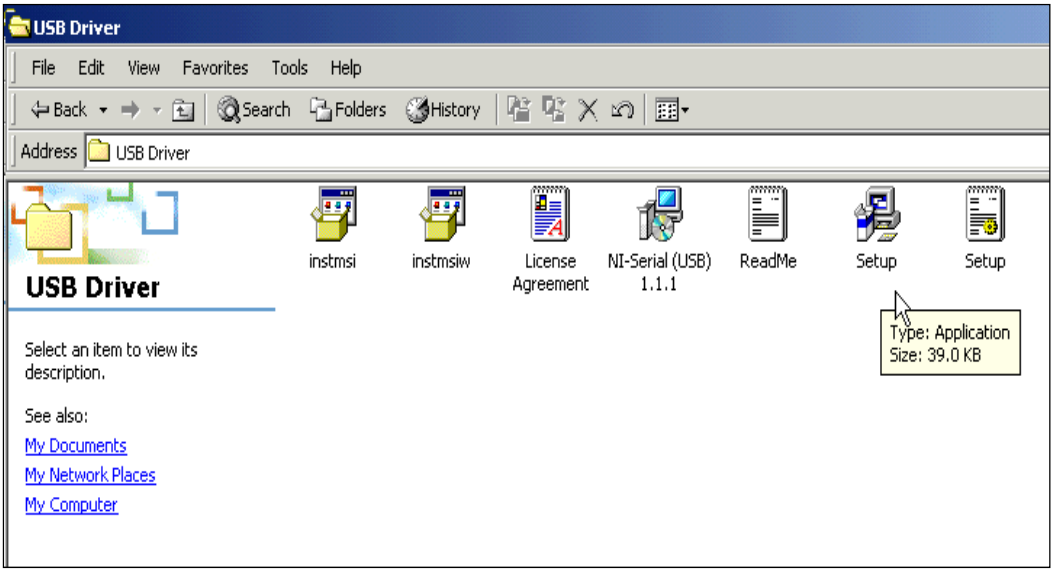
If your computer does not have an RS232 serial port you will need to install the USB adapter driver. You do not need to install this driver if you plan to use the ECOM DLC cable.



- Open the DST_Series III folder



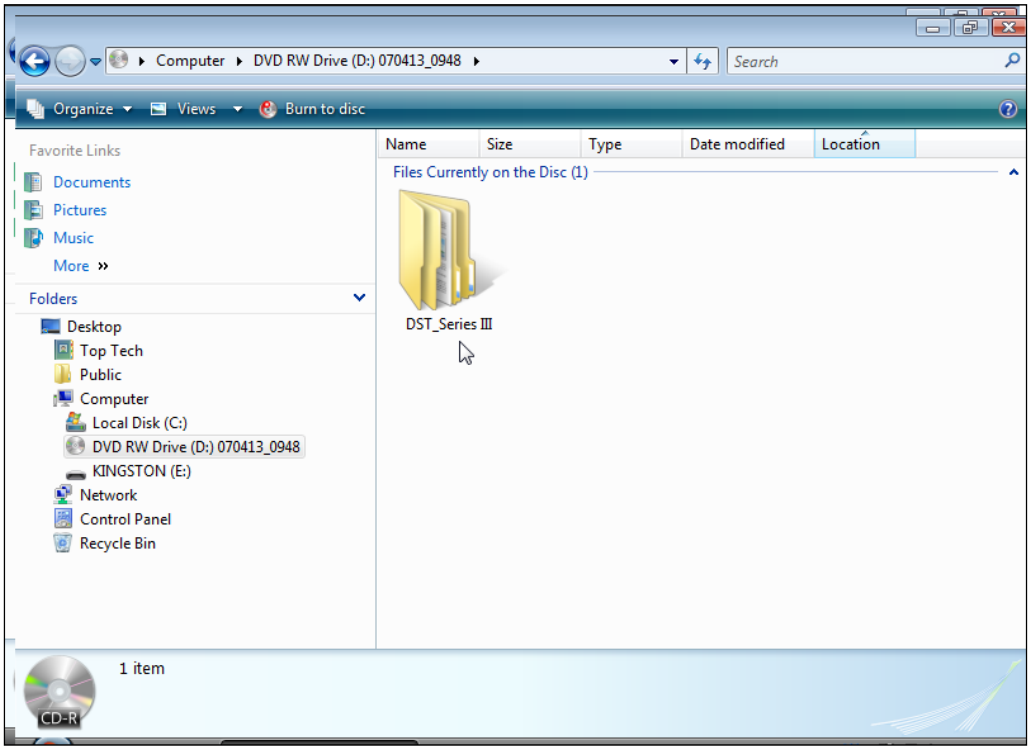
- Open the “USB Driver” folder



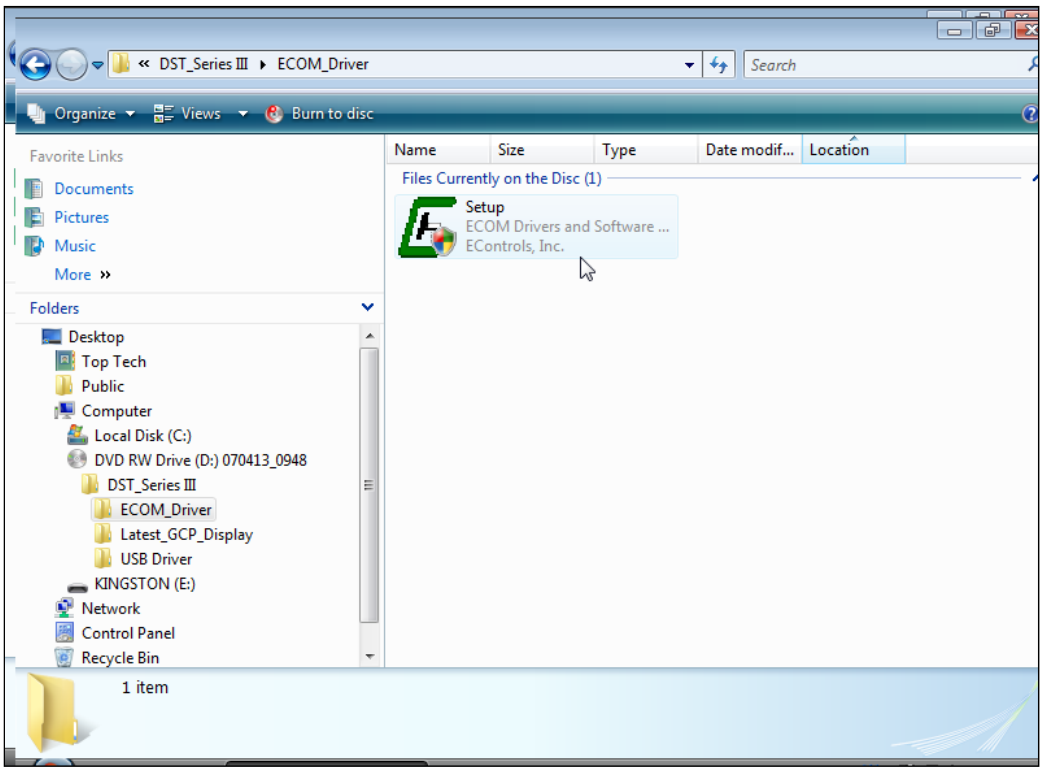
- Double click on “setup.exe” (application file) and follow the on screen prompts.

Installing the ECOM DLC cable driver

The ECOM USB cable is designed to replace both the serial DLC and the USB adapter cables. It also provides communication to the ECM on the CAN line for systems that are CAN enabled. It requires the installation of the ECOM driver and is compatible with the series II and series III DST software programs.

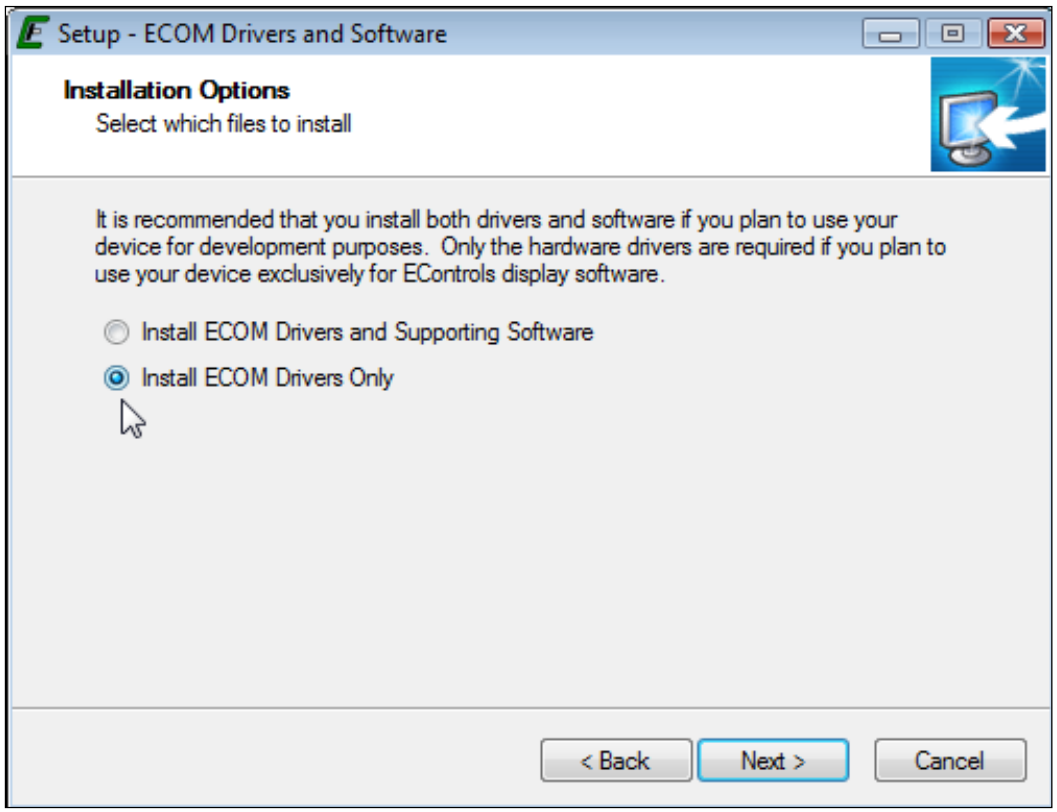


- Open the DST_Series III folder



- Double click on “setup.exe” (application file).

- Click “Next” to continue



- Select install ECOM drivers only. Click “Next” and follow the on screen prompts.

PASSWORD LOGIN

Figure 1 shows the password dialog box, which is displayed when a software session begins. Login can be accomplished in two ways.

1. Enter an “All S/N Password” which is a password applicable to all ECMs of a given original equipment manufacture (OEM).

2. Enter a “Single S/N Password” and corresponding ECM serial number for a single ECM. A Single Serial Number password is unique to a specific ECM serial number and permits authorized service personnel to make changes or view information for a specific ECM.

3. In most instances the top “all” serial number boxes should be used for password entry. In this case, do not check the single serial number box. Each password is a 16-character alpha-numeric string specific to each Spectrum customer and determines which pages and variables are visible through the software. Passwords are assigned by the OEM support group and may change periodically. Check the “save password” box to automatically retain the password for future use.

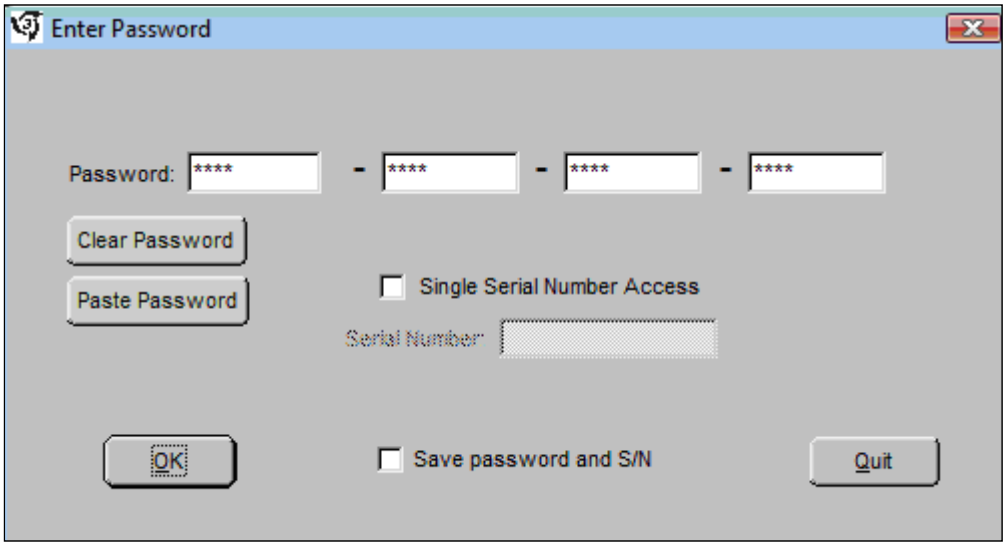


Figure 1: Populated Password Dialog Box

PASSWORD DIALOG BOX FUNCTIONS

- **Clear Password Button** Erases the current password from the password field.
- **Paste Password Button Allows** the user to copy a 16-character string from any word processor and paste the string in the password field.
- **Single Serial Number Access Checkbox** Tells the software that the password is applicable for single serial number access.
- **Serial Number Field** Only applicable when Single Serial Number Access Checkbox is checked. The entry field must be populated for the 6-digit serial number for which the Single Serial Number Access password applies (NOTE: Leading zeros included in the serial number are not required).
- **Save Password and S/N Checkbox** Retains the password, and serial number (if applicable) for the next software session.

Should an invalid password be entered, the error prompt shown in figure (2) will be displayed and the software will not load. This prompt signifies the following:

- The All S/N password is invalid.
- The Single S/N password is incorrect for the Single Serial Number entered.
- An All S/N password is entered for Single Serial Number use.
- The Single Serial Number password is valid; however, the Single Serial Number Access Checkbox is not checked.

Figure 2: Password Error Prompt

If the Single S/N password entered is correct for the software but does not match the entered S/N of the targeted ECM, the prompt in Figure 3 will be displayed.

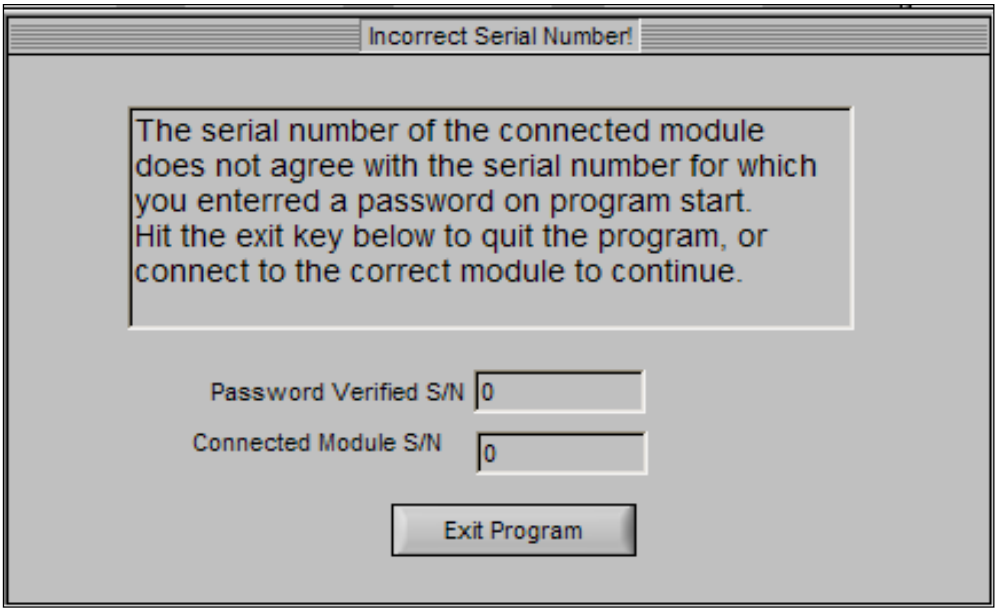


Figure 3: Incorrect Serial Number Message

Figure 4 shows the communication status if a valid software password is entered when attempting to connect to an ECM with a different key. In this instance the software will load but will not connect to the target (ECM).

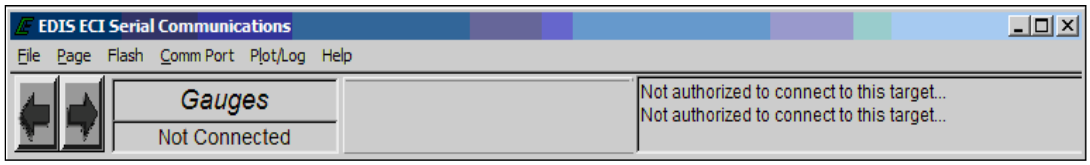
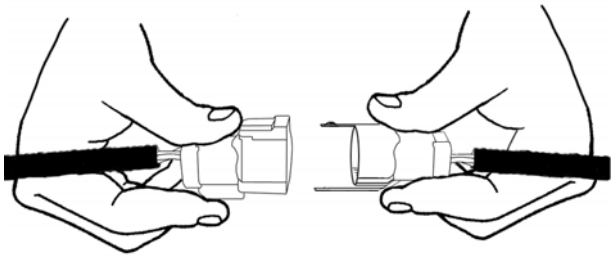


Figure 4: Not Authorized to Connect Message

In the event you receive this error message call your OEM support group for more information.

CONNECTING THE PC TO THE SPECTRUM FUEL SYSTEM



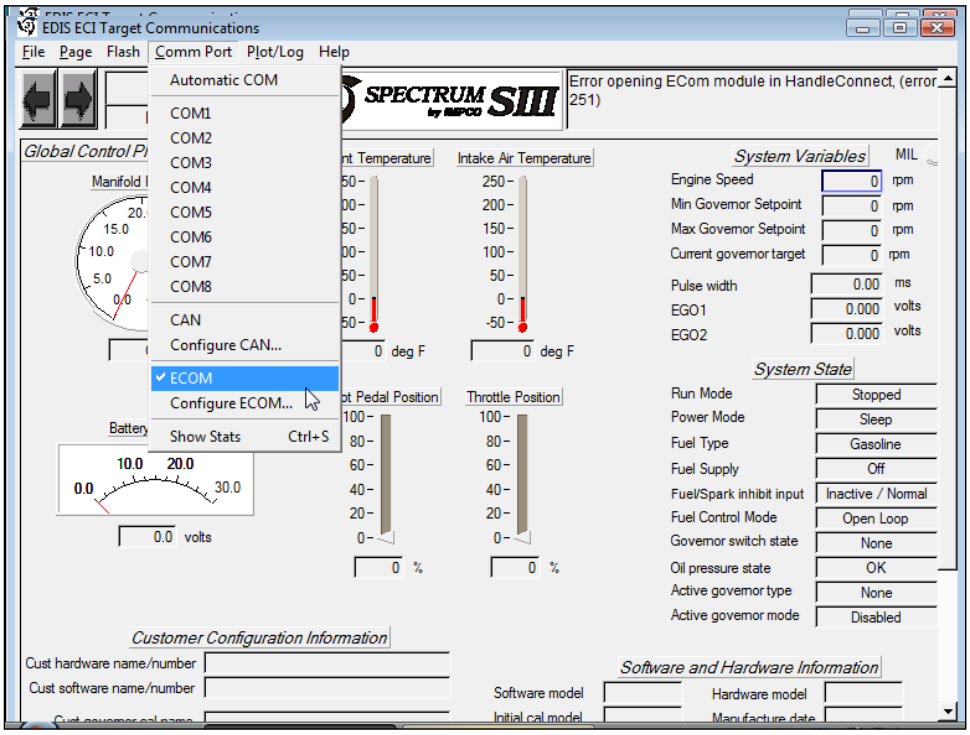
Connecting the DST cable

A laptop computer, with the diagnostic cable and software is the required tool for performing proper diagnostic testing of the Spectrum fuel system. It is also used to monitor sensor and actuator values and to read and clear Diagnostic Trouble codes. The DST software also performs several special tests.

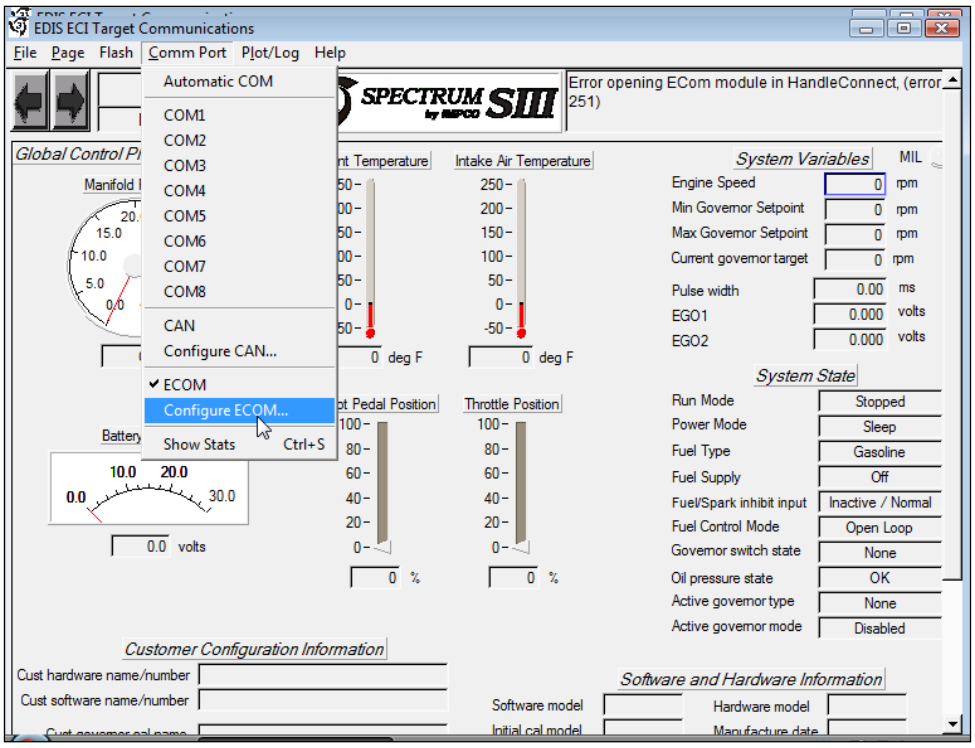
- Connect the system diagnostic cable to the RS232 port on the back of the computer. If you do not have a RS232 port, use the USB to RS232 adapter supplied in the IMPCO ITK test kit. Be sure to install the USB driver to enable the USB adapter for use with your computer.
- Connect the diagnostic cable to the DLC (diagnostic link connector) labeled in the electrical schematic. The DLC is located on the engine harness. The new 8 pin DLC requires the use of the 4 to 8 pin adapter included in the late model ITK test kits.
- Turn the computer ON.
- Start Windows.
- From the start menu select Programs → IMPCO GCP Display → IMPCO GCP Display
- Place the ignition key in the ON position.

Within several seconds the system Gauge screen should now appear and a green banner in the upper left hand will read “Connected.”

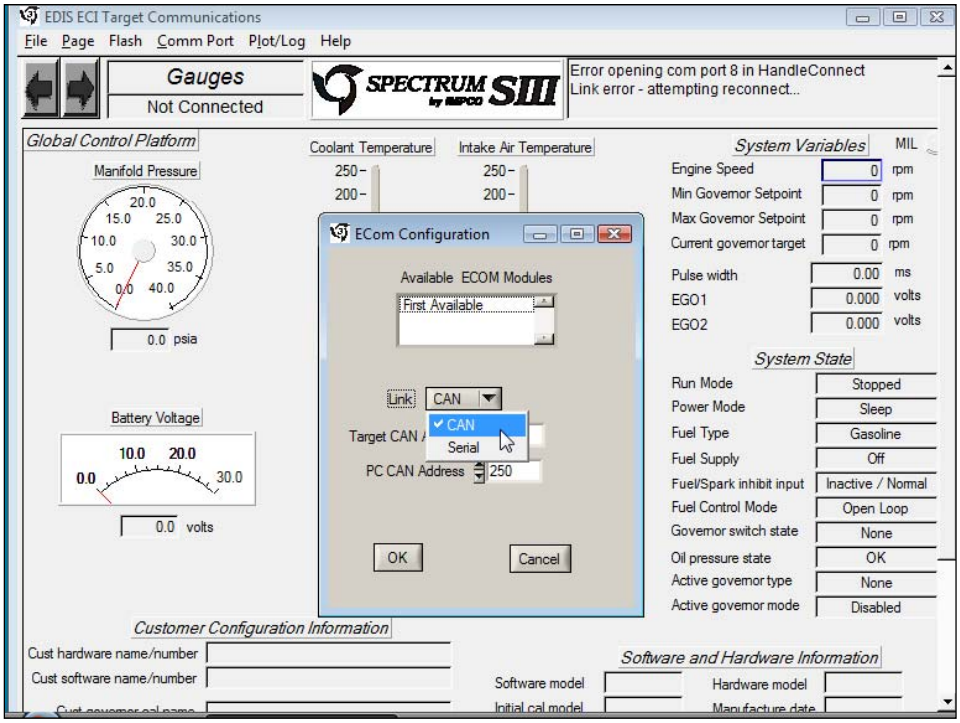
- **Connecting to the PC using the ECOM cable**



- To connect using the ECOM cable you must select ECOM from the COM Port drop down menu.

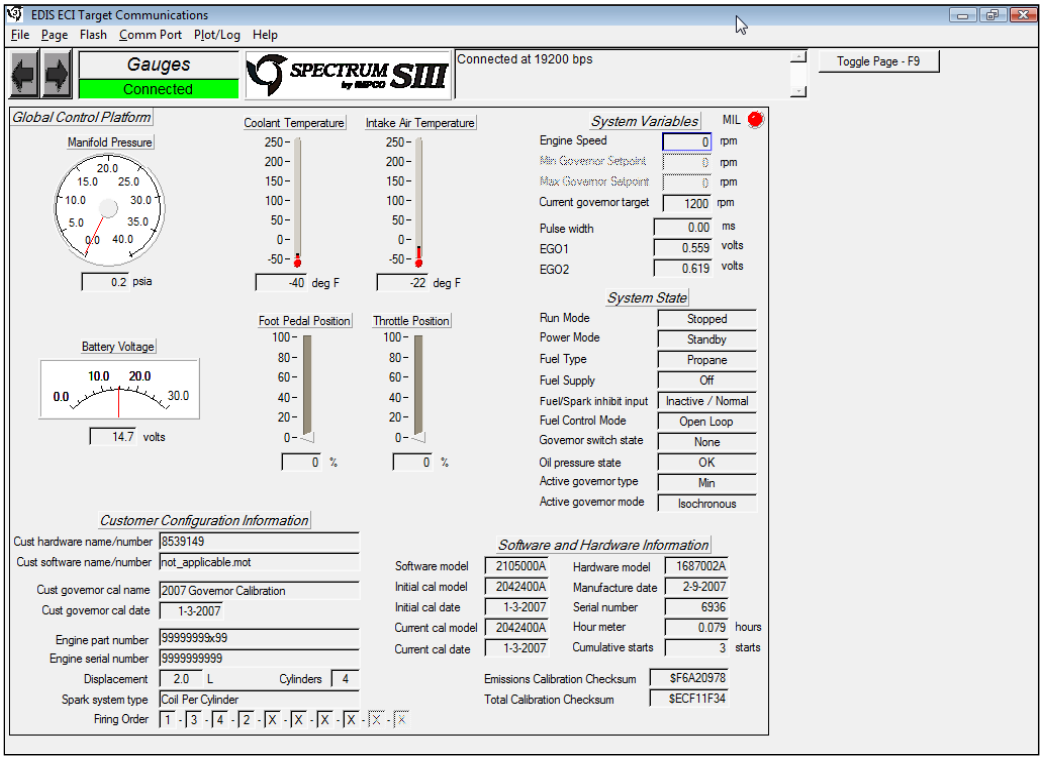


- You will now need to configure the ECOM communication protocol.



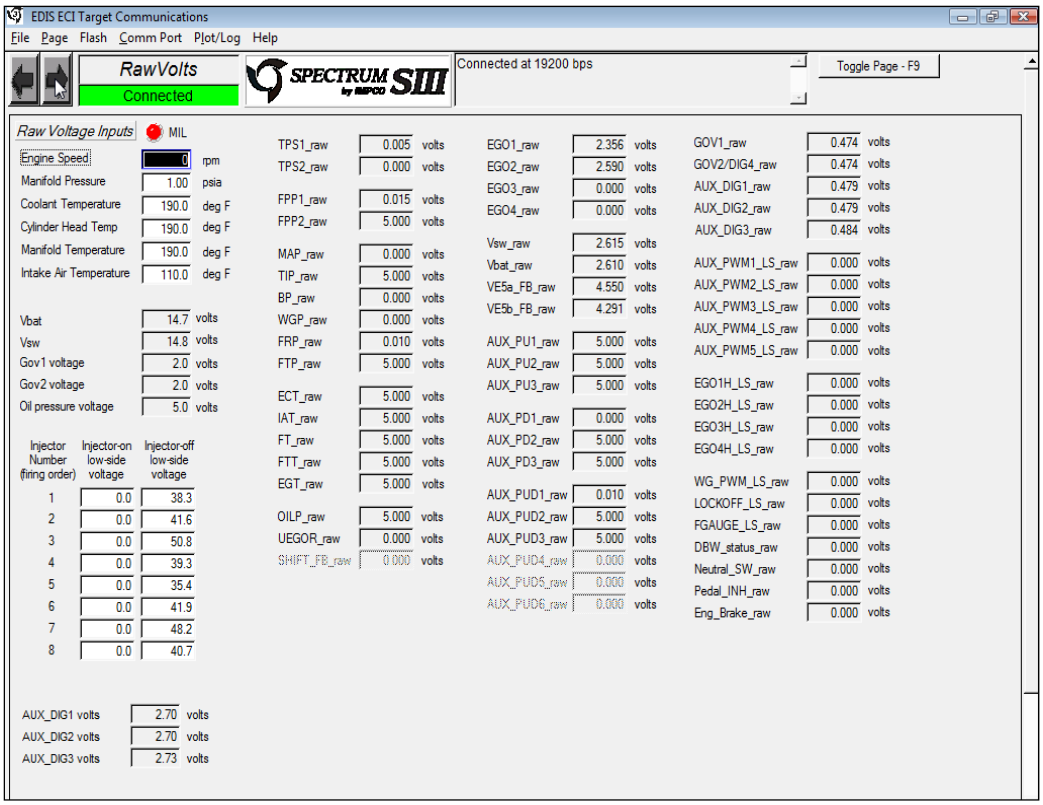
- Select the CAN for systems with CAN enabled or serial for all others. Then select OK. You are now ready to connect using the ECOM USB DLC cable.

DST SERVICE PAGES



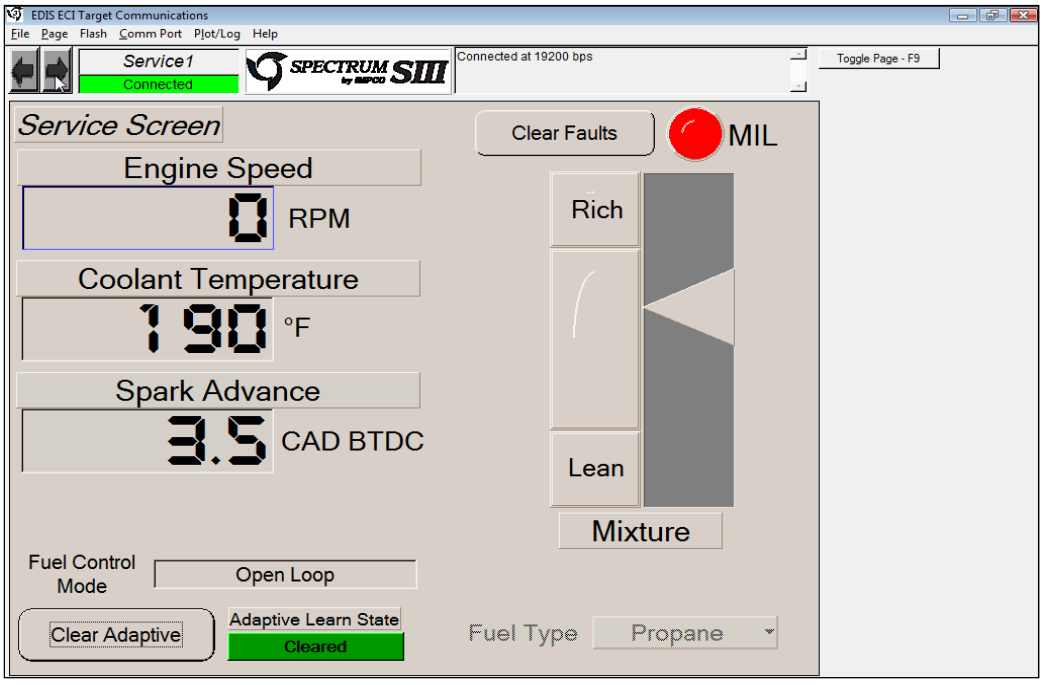
Gauge Page

Provides system data in large easy to read displays. Displays ECM configuration information for the ECM software, hardware, serial numbers and calibration dates.



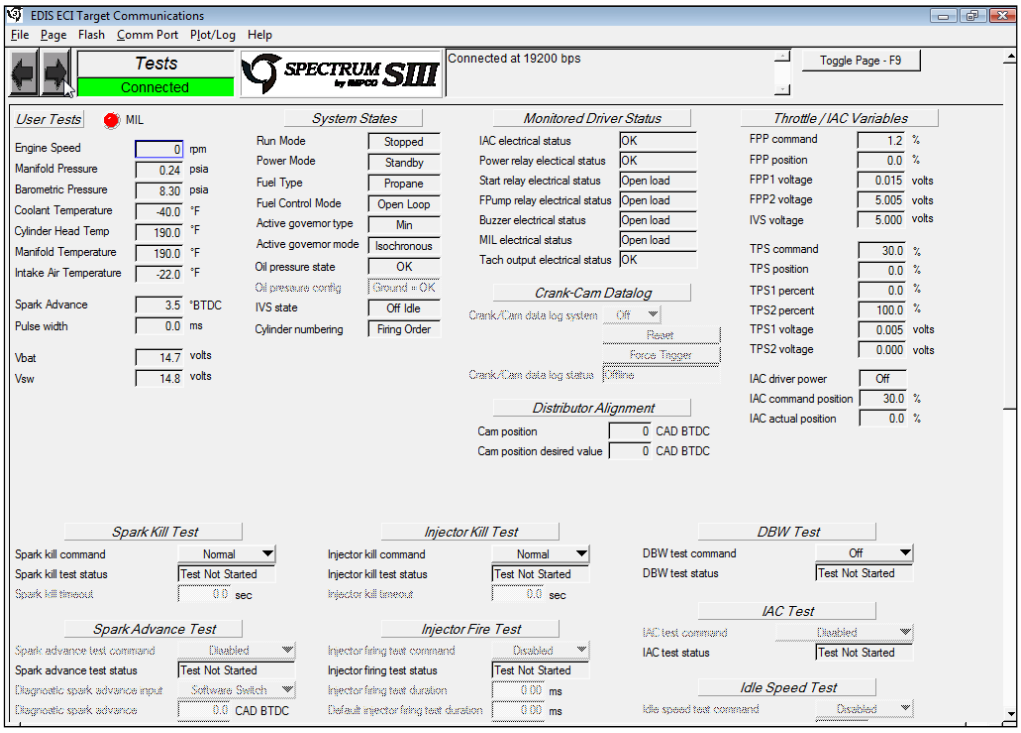
Raw Volts Page

The raw volts page displays the sensor inputs and outputs in a raw voltage format. This page is most commonly used to check values in the diagnostic trouble shooting charts.



Service 1

The Service 1 screen is used to clear the adaptive learn, shows the MIL status and provides a display for rpm, coolant temperature and spark advance. It also provides a large display to monitor the closed loop mixture control.



Tests Page

Provides diagnostic information voltages and sensor outputs and includes diagnostic engine tools such as spark and injector kill controls. Please note that not all features are available for all applications. The disabled item menus are grayed out or rendered inoperative.

SPARK KILL

The spark kill mode allows the technician to disable the ignition on individual cylinders. If the Spark Kill diagnostic mode is selected with the engine running below 1000 rpm, the minimum throttle command will lock into the position it was in when the test mode was entered. If the Spark System Test mode is selected with the engine running above 1000 rpm, the throttle will continue to operate normally. Disabling Ignition Outputs to disable the ignition system for an individual cylinder, use the mouse to highlight the “Spark Kill” button and select the desired coil. The spark output can be re-enabled by using the mouse to highlight the “Spark Kill” button and selecting “Normal.” If the engine is running below 1000 rpm, the spark output will stay disabled for 15 seconds and then re-set. If the engine is running above 1000 rpm, the spark output will stay disabled for 5 seconds and then re-set. This test mode has a timeout of 10 minutes. Record the rpm drop related to each spark output disabled. The spark outputs are arranged in the order which the engine fires, not by cylinder number.

INJECTOR KILL

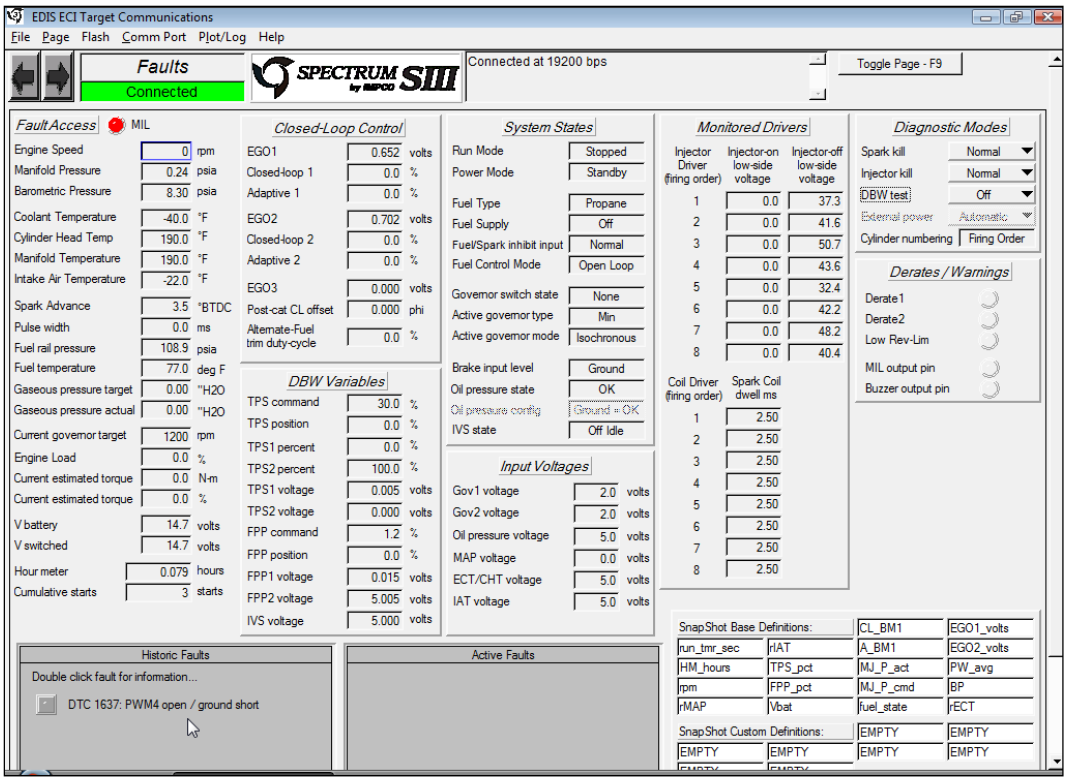
The Injector Kill mode is used to disable individual fuel injectors. If the Injector Kill mode is selected with the engine running below 1000 rpm, the minimum throttle command will lock into the position it was in when the test mode was entered. If the Injector Kill mode is selected with the engine running above 1000 rpm, the throttle will continue to operate normally. To disable an injector, use the mouse to select the desired injector. The word “Normal” will change to the Injector you have selected. The injector driver can be re-enabled by selecting again. If the engine is running below 1000 rpm, the injector driver will stay disabled for 15 seconds and then re-set. If the engine is running above 1000 rpm, the injector driver will stay disabled for 5 seconds and then re-set. Record the change in rpm while each driver is disabled.

DBW TEST MODE

The DBW (Drive by Wire) test mode allows the technician to control the throttle directly with the foot pedal or throttle input and is used during the diagnostic routines specified for FPP and TPS for Spectrum systems that use DBW control. FPP position displays the current position of the foot pedal as a percentage. FPP volts display the voltage which the ECM is reading from the FPP sensor. TPS Command displays the commanded throttle position expressed as a percentage, which is being sent to the throttle. TPS Position is the actual percent of throttle opening being sent to the ECM from the throttle. TPS volts display the actual TPS signal voltage the ECM is receiving from the throttle. To select this test mode the engine must be off and the key must be in the ON position.

EXTERNAL POWER TEST

The external power test manually activates relays (relay power, fuel pump, and drive-by wire power) controlled by the ECM while the engine is in the “Stopped” or “Running” states. Reverts to normal operation if “Automatic” state is selected or ignition voltage is cycled from high to low.



Faults Page

Stores DTC codes that may have occurred in the past (Historic Faults) or current set codes (Active Faults). Includes useful system voltages and sensor readings used while working with the fuel and emission trouble shooting charts. Shows power derate mode status. To erase a historic DTC code, double click on the code with the left mouse button. Then choose to "Clear All Faults."

***PLOT/LOG* MENU FUNCTIONS**

The Plot/Log menu allows the user to graphically plot or numerically log variables that have been tagged for plotting/logging. To plot or log variables, a tag must be assigned to each variable of interest. A variable is tagged for plotting/logging through a single right-mouse click in the variable's vicinity. Once a variable has been tagged for plotting/logging, it is highlighted in green.

Figure 5 shows an example of variables that have been tagged. A maximum of twenty (20) variables may be tagged for logging and a maximum of ten (10) variables may be tagged for plotting. The maximum achievable sample frequency/minimum period is dependent on the number of variables tagged.

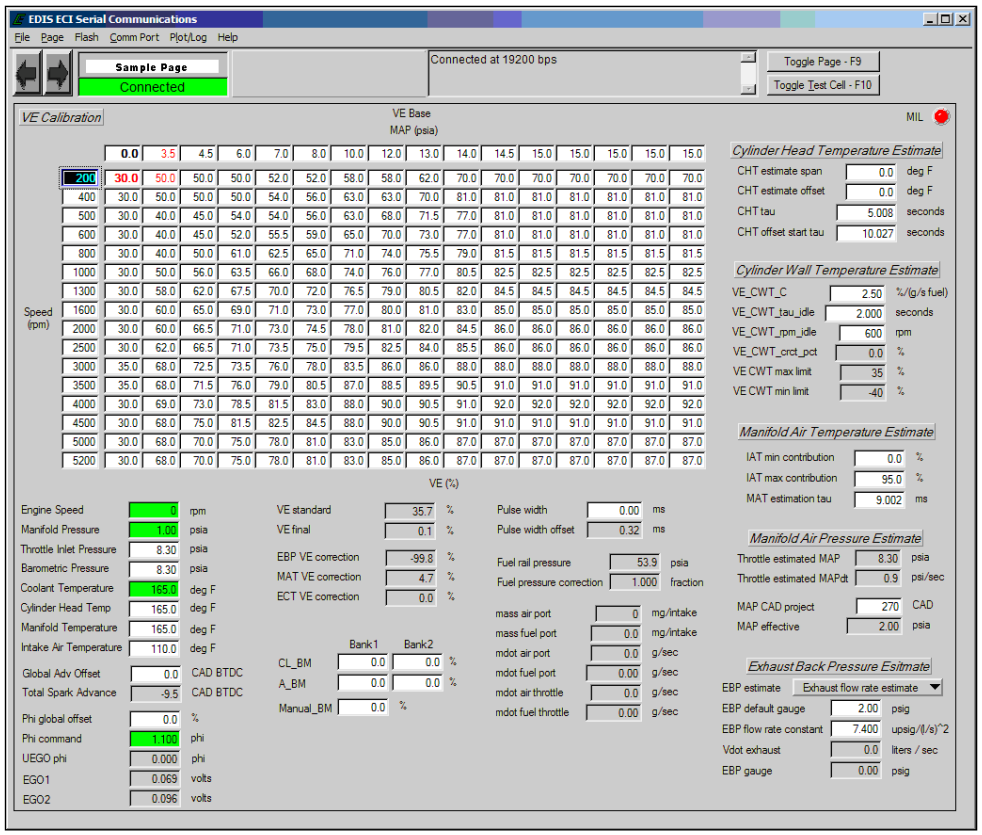


Figure 5: Tagged Variables for Plot/Log

Once the variables have been tagged as highlighted by the green color fill, select the “Plot/Log” function in the top menu bar as shown below in figure 6.

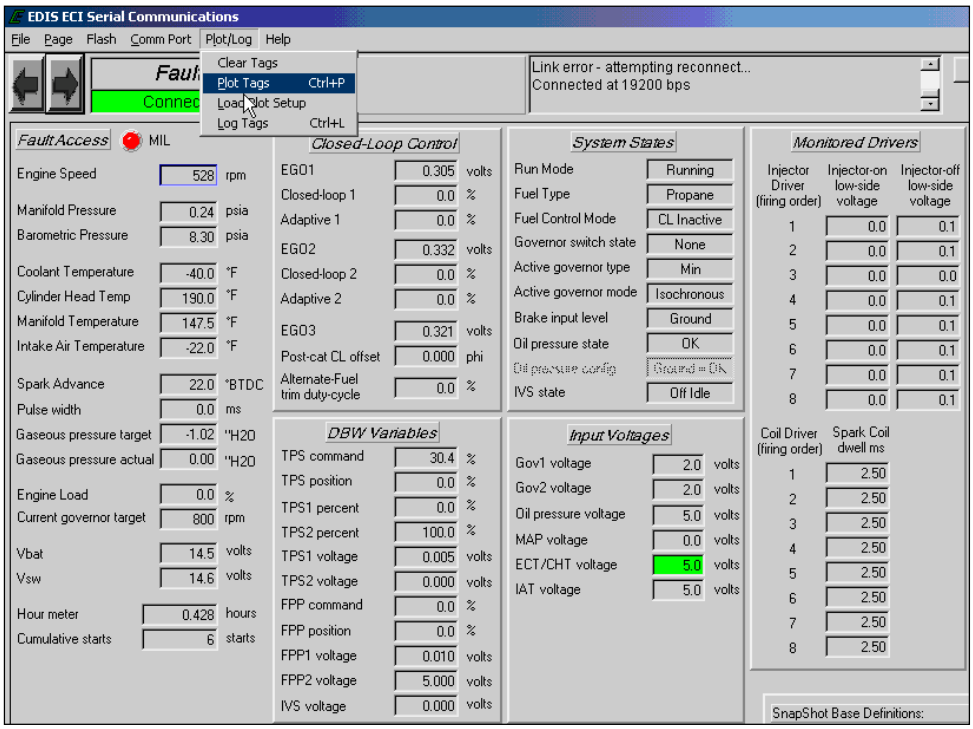


Figure 6

- Select “Plot Tags” to open the snapshot window

Other functions available from the Plot/Log menu include:

- ***Clear Tags***: Releases all plot/log variables.
- ***Plot Tags (Ctrl + P, or P)***: Graphically plot all tagged variables.
- ***Load Plot Setup***: Loads and tags variables for plotting/logging that have been stored in a plot file (.plt).
- ***Log Tags (Ctrl + L)***: Numerically log all variables that have been tagged for plotting/logging.

Once the Plot Tags menu item has been selected, tagged variables are graphically plotted in a strip chart interface. An example of a plot is shown in Figure 7. Capabilities of the plotter are outlined in Table 1.

Start/Stop **Button**	**Start or stop plotting of selected variables**
Save Button	Save plotted data displayed in the plot to a comma-separated value file (CSV) on the PC hard drive. Format must not be altered if the *Load* function is to be used.
Snapshot Button	Convert the plot into a snapshot that may be panned, zoomed, scrolled, **and** saved
Close Button	Close the DST Plot interface
Load Setup Button	Load tags from a previously saved plot (.plt) file to allow for similar plots and logs to be generated
Load Plot Button	Load a previously saved plot from the PC into the DST Plot interface
Variable Selector Menu	Selects the active variable for axis scaling
Single Shot Acquisition Checkbox*	When checked, this does not allow the plot to scroll past the ‘Time Interval’ thereby preserving plotted data for post-processing.
Exclusive Serial Use Checkbox*	When checked, this allows exclusive serial communication for the plot variables. Other variables on the active page are not updated.
Min Y Value Field*	Specify the minimum Y-axis scaling for the active variable
Max Y Value Field*	Specify the maximum Y-axis scaling for the active variable
Sample Interval (ms) Field*	Define the sample period for recording and display *Frequency (Hz.) = 1000/Sample Interval (ms)*
Time Interval (s) Field*	Defines the total sample acquisition time for the plot.
*Accessible only when plotter is not running.	

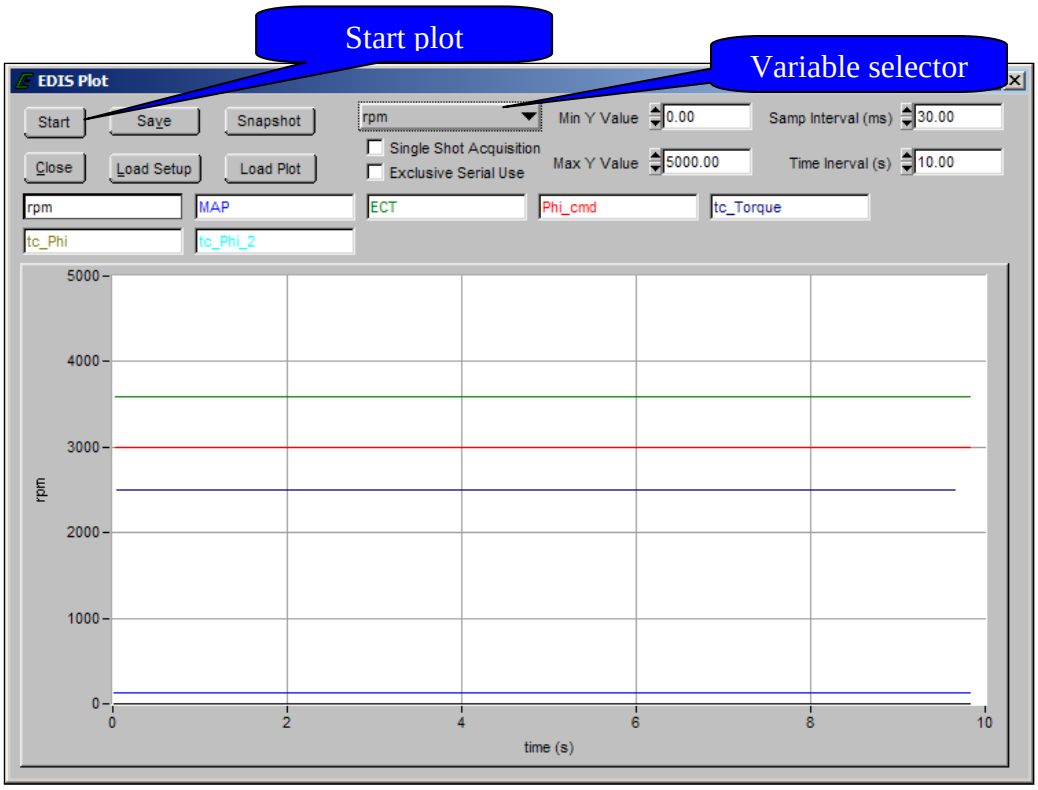


Figure 7: DST Plot

- Click on the “Start” button to start the DST plot function.
- Click on the variable selector button to view selected sensors

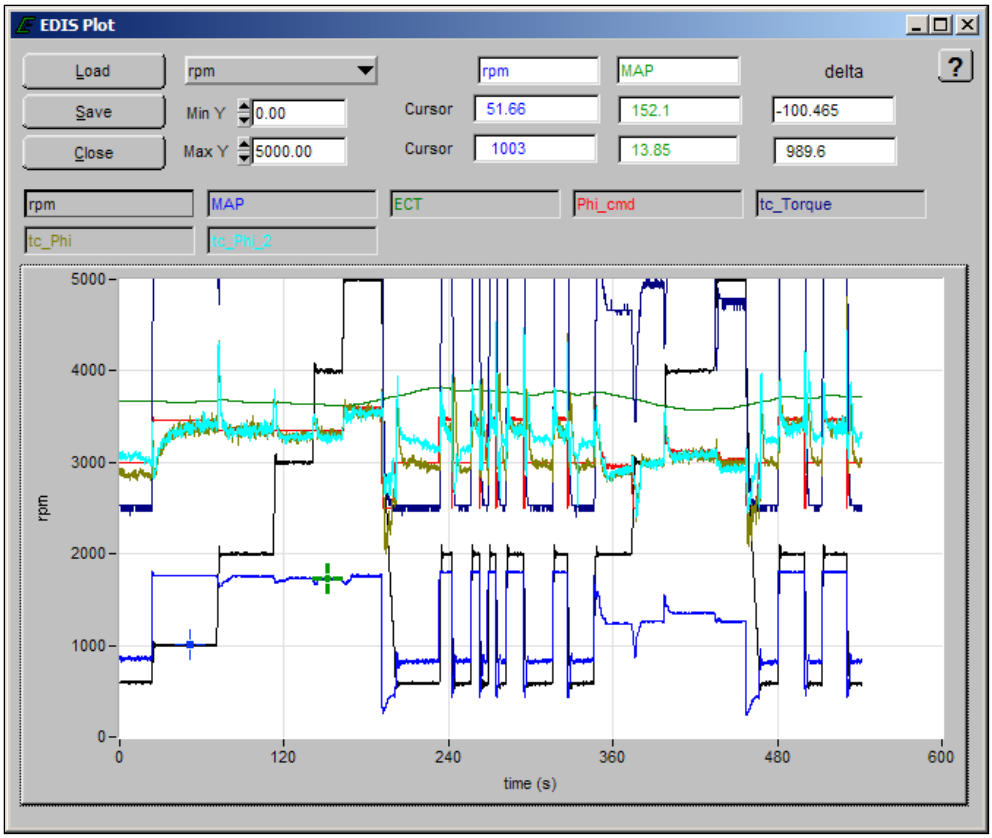
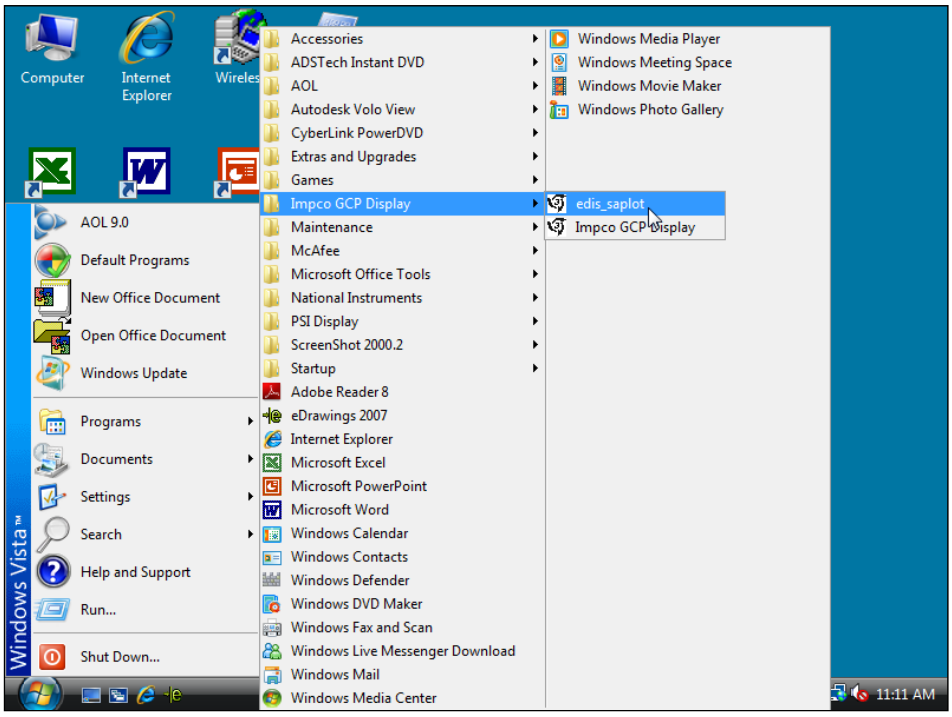


Figure 8: DST Plot Snapshot

- Click on the “Save” button to save the snapshot as a file. To replay the saved file, open the edis_saplot program from the windows start menu.



- Start Menu → Programs → IMPCO GCP Display → edis_saplot

DST PLOT INTERFACE FUNCTIONS

A graphic tool incorporated in the plotter is the snapshot function. This function allows data collected in a plot to be transferred into a second window for quick graphical post-processing. The snapshot allows the user to zoom in/out, pan left/right, and move cursors along the signal traces to measure the variable values in virtual real-time. An example of a snapshot is shown in Figure 8. Any CSV file in plot format (.plt) may be loaded into the snapshot. Table 2 outlines the available hot key functions of the snapshot screen.

SNAPSHOT HOT KEY FUNCTIONS

Command	Function
<Single, left-click on trace>	Snap closest cursor to data
<Ctrl + Up/Down Arrows>	Move/pan plot along y axis
<Ctrl + Left/Right Arrows>	Move/pan plot along t axis
<Ctrl+Shift + Up/Down Arrows>	Zoom plot in and out in y axis
<Ctrl+Shift + Left/Right Arrows>	Zoom plot in and out in t axis
<Ctrl + Home>	Resize plot to default settings
<Ctrl + Page Up>	Zoom out by 10%
<Ctrl + Page Down>	Zoom in by 10%
<Page Up>	Toggle to previous cursor
<Page Down>	Toggle to next cursor
<Left/Right Arrow>	Follow selected data along trace
<Up/Down Arrow>	Follow selected data along trace
<Shift + Left/Right Arrow>	Move 10 points along trace
<Shift + Up/Down Arrow>	Move 10 points along trace
<Home>	Go to first visible point on current plot
<End>	Advance to last visible point on current plot
<Shift + Up/Down Arrow>	Toggle between traces/variables

Table 1

DST LOGGER

Another data capture function incorporated in the software is the DST logger. This tool serves as a PC data logger for any variable available in the ECM through the interface software. Figure 9 shows the interface display for configuring the DST Log. The interface allows the user to create the filename, set the sample rate for acquisition, set the time interval for sampling, and display the progress of acquisition. A maximum of twenty (20) variables may be tagged for the log. The amount of data stored is only limited by available PC RAM. The resulting text file may then be viewed by any standard Windows text editor/reader program. To create a log file select the "Log Tags" in the drop down menu as shown in figure 6.

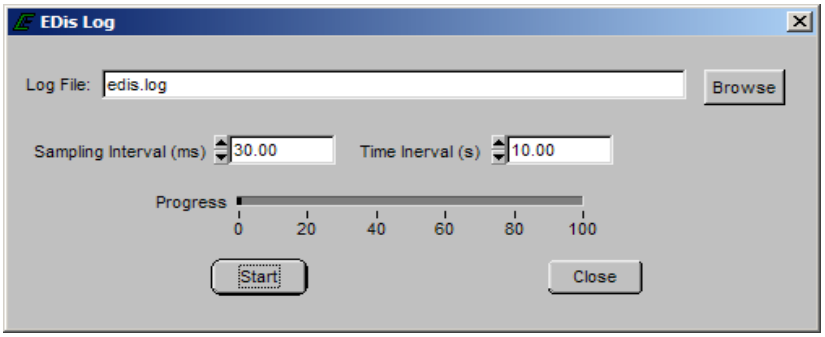
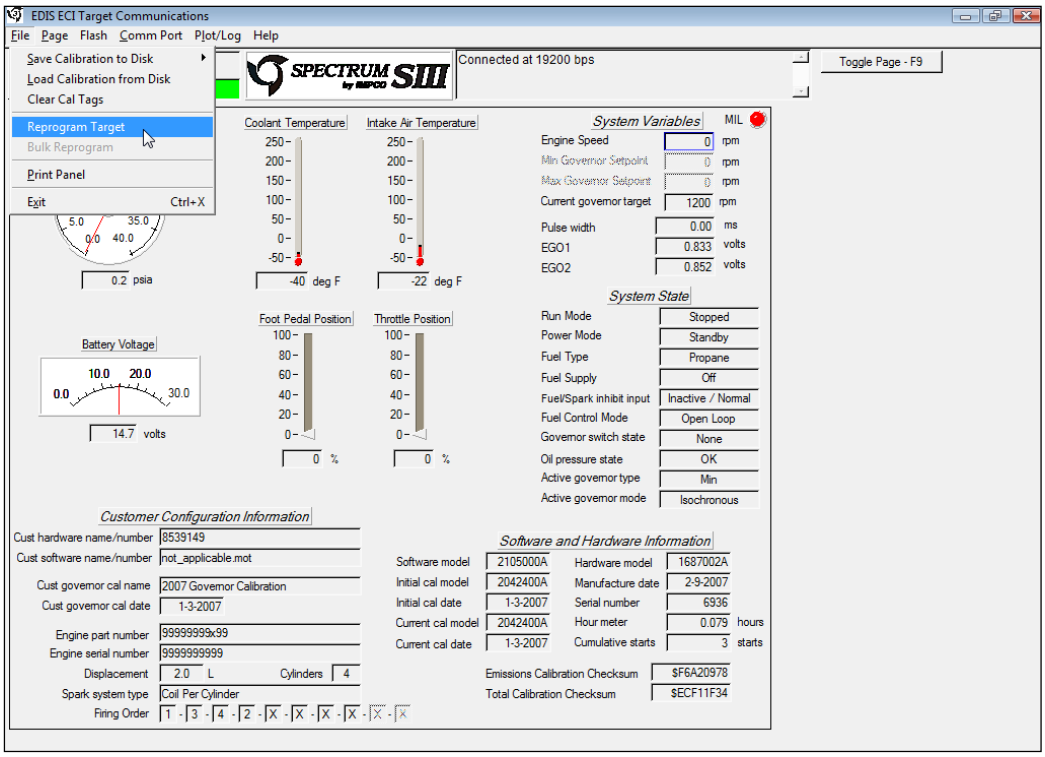


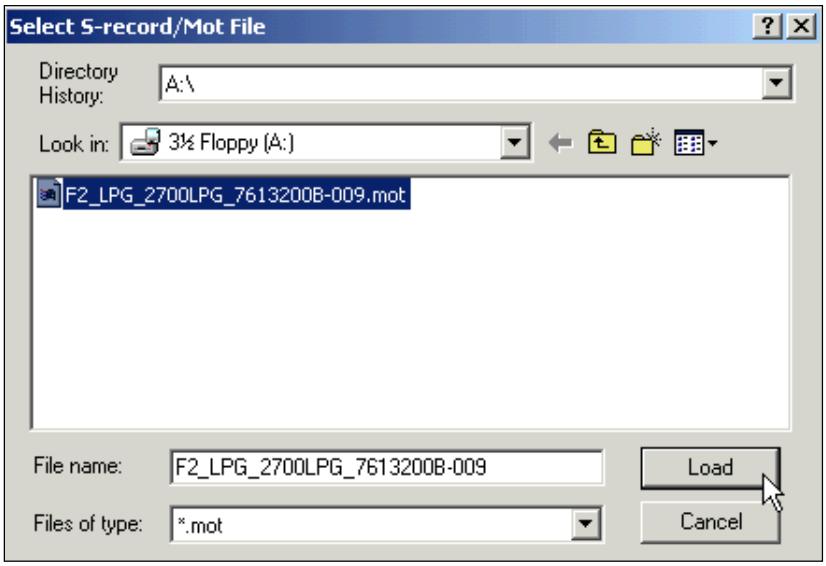
Figure 9: DST Log Interface

REPROGRAMMING THE ECM

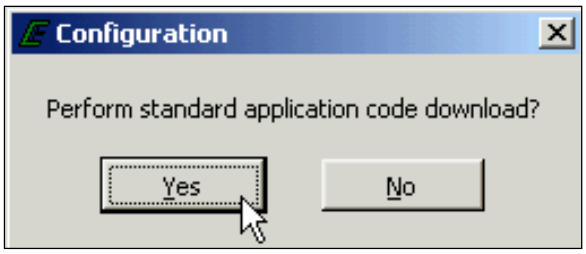
New software upgrades may become available for in field applications. ECM software upgrades are possible using the DST. Updates are released to service in MOT files (A MOT file has an extension .mot and is a binary S-record file that contains the full calibration and embedded software algorithms). The MOT file is the one file necessary to completely configure or update an existing ECM. The MOT may be supplied on a floppy disk, CD ROM or downloaded from the OEM service network. To update the ECM calibration follow the instructions listed on the next three pages.



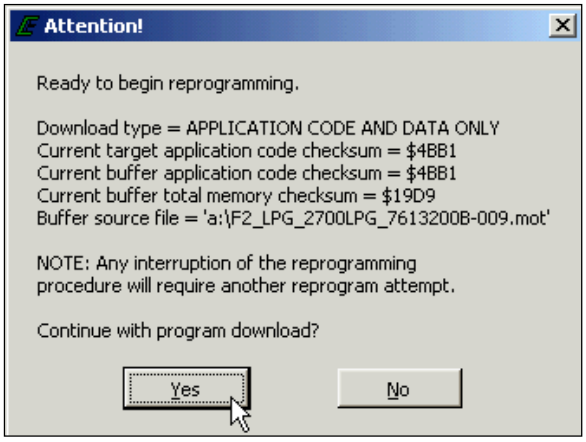
- Turn the ignition key to the ON position.
- Verify the DST is “connected” to the ECM.
- From the “File” menu select “Reprogram target.”



- Navigate to the media where you have stored the MOT file. In the example above the MOT file was stored on the on the floppy (A) drive.
- Highlight the correct .mot file using the left mouse button.
- Click on “Load.”



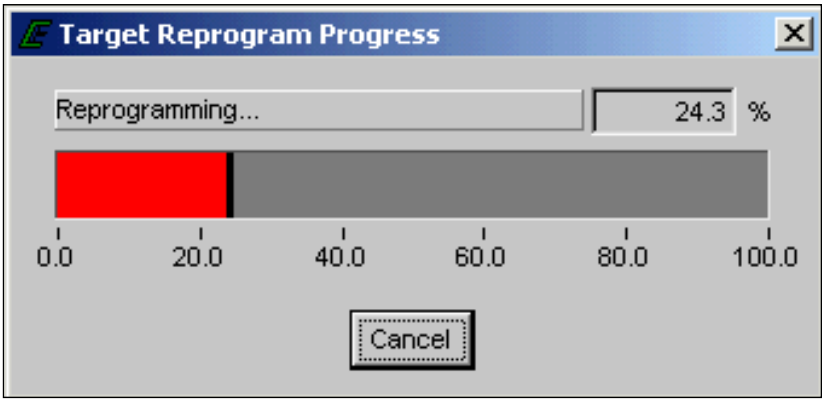
- Click “Yes” to continue.



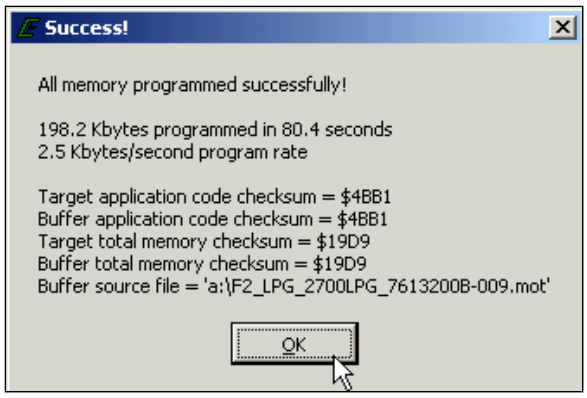
- Click the “Yes” box to continue with the update. Refrain from using other functions on the computer while the download takes place.

CAUTION

Do not disconnect the DLC, remove power or use the PC for any other function during this process. Any interruption during this reprogram process may render the ECM non-programmable in the field.



The status bar shows the update process.



Message is displayed confirming the update was successful.

MALFUNCTION INDICATOR LAMP (MIL)

The Spectrum Fuel system has built-in diagnostics for system trouble shooting. The system has a dash mounted malfunction indicator lamp (MIL) that provides indications of an emissions related problem. Most engine control system related problems that affect emissions or driveability of the vehicle will set a (DTC) diagnostic trouble code and illuminate the MIL.

The MIL serves as notification to the operator of a problem related to the emission control system so the driver can arrange for service as soon as possible. It will also display DTCs that have been stored due to a system malfunction.

The MIL should illuminate when the key is in the ON position and the engine is not running. This feature verifies that the lamp is in proper working order. If the MIL does not illuminate with the vehicle key ON/engine OFF, repair it as soon as possible. Once the engine is in start or run mode, the MIL should turn off. If the lamp remains on while the engine is in the start or run mode a diagnostic trouble code may be set.

The MIL will be turned OFF after three (3) consecutive run cycles or by clearing the active code with the Diagnostic Scan Tool (DST).

SPECTRUM DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Trouble Codes are set when the Spectrum ECM (Electronic Control Module) runs a diagnostic self test and the test fails. When a DTC is set, the ECM will illuminate the MIL on the instrument panel and also save the DTC in memory. The ECM will continue to run the self test. If the system continues to fail the test, the lamp will stay illuminated and the DTC is stored as an active DTC. If the self test runs and passes, the DTC will be stored as historic DTC. All DTCs are stored as historic faults until they are cleared. Most DTCs will automatically clear from memory if the DTC does not reset within 50 to 100 consecutive engine run cycles.

While a Diagnostic Trouble Code is current for a sensor, the ECM may assign a default “limp home” value and use that value in its control algorithms. All of the system diagnostic self-tests run continuously during normal vehicle operation.

The Diagnostic Trouble Codes can be read by using either the MIL lamp or a laptop computer. Diagnostic Trouble Codes can be cleared from memory with a laptop computer, or by turning the ignition key to the OFF position and removing the ECM power fuse or battery cable for at least 15 seconds.

If more than one DTC is detected, start the diagnostic repair with the lowest DTC number set. Diagnose each problem to correction unless directed to do otherwise by the diagnostic chart. The DTCs are numbered in order of importance. Both DTC 112 and DTC122 pertain to the oxygen sensor, so it is possible that a repair that corrects DTC 112 may also correct the problem causing the DTC 122.

Diagnostic test charts contained in this manual refer to the DST to be connected and in the “System Data Mode.” This simply means that the DST is connected and communicating with the PC. In some instances the chart will call out a special test mode. An example of this would be instructions for the DST to be connected and in the DBW (drive by wire) mode. Always be sure to follow the special instructions to avoid a false diagnosis of fuel system components.

DLC COMMUNICATION ERROR

The ECM 5 volt reference circuit powers the Spectrum diagnostic link cable. In the event that the 5 volt reference signal is open or shorted to ground, you will not be able to connect to the system. If you are unable to connect, follow the quick checks listed below:

Be sure you are using the correct password and latest software for the system you are connecting to.

Check the ECM system power and ground circuits. Refer to DTC 562 for the power schematic. Also check for +12 volts switched power at ECM pin 45 with the ignition key ON.

Check for power at the DLC connector for + 5 volts between pin 1 (BLK /LT GRN) and pin 2 (LT GRN RED) with the ignition key in the ON position.

You may still be able to retrieve a code using the blink code function if none of the above recommendations prove useful. In the event of a 5 volt reference signal malfunction, DTC 642 or DTC 643 should set. If you find one of these codes using the blink code function, follow the DTC diagnostic chart recommendations for that specific DTC.

BLINK CODE FUNCTION

Although the DST is considered a required tool to access the DTC codes, codes may be retrieved without a laptop computer using the blink code function. To enable this function follow the steps below:

- Jump pins 1 and 4 at the DLC connector.
- Turn the ignition key to the on position
- The system will now enter the self diagnostic blink code mode. Be ready with pen and paper to write down any codes that may be stored.
- The ECM will flash the MIL indicator with a pause between represented numbers that represent DTC codes. The sequence starts with code 1654. Code 1654 confirms the system has entered the blink code mode. The ECM will flash code 1654 (3) times before displaying the actual DTC code that may be set.

  Example:

  <u>One short blink</u> (pause) <u>six short blinks</u> (pause) <u>five short blinks</u> (pause) <u>four short blinks.</u>

- If no DTC codes are found, the ECM will continue to flash 1654 only. This means no stored DTC codes were found.
- If one of the numbers in the DTC code is zero (0), no flash will occur to represent the zero value—it will be represented as a short pause.

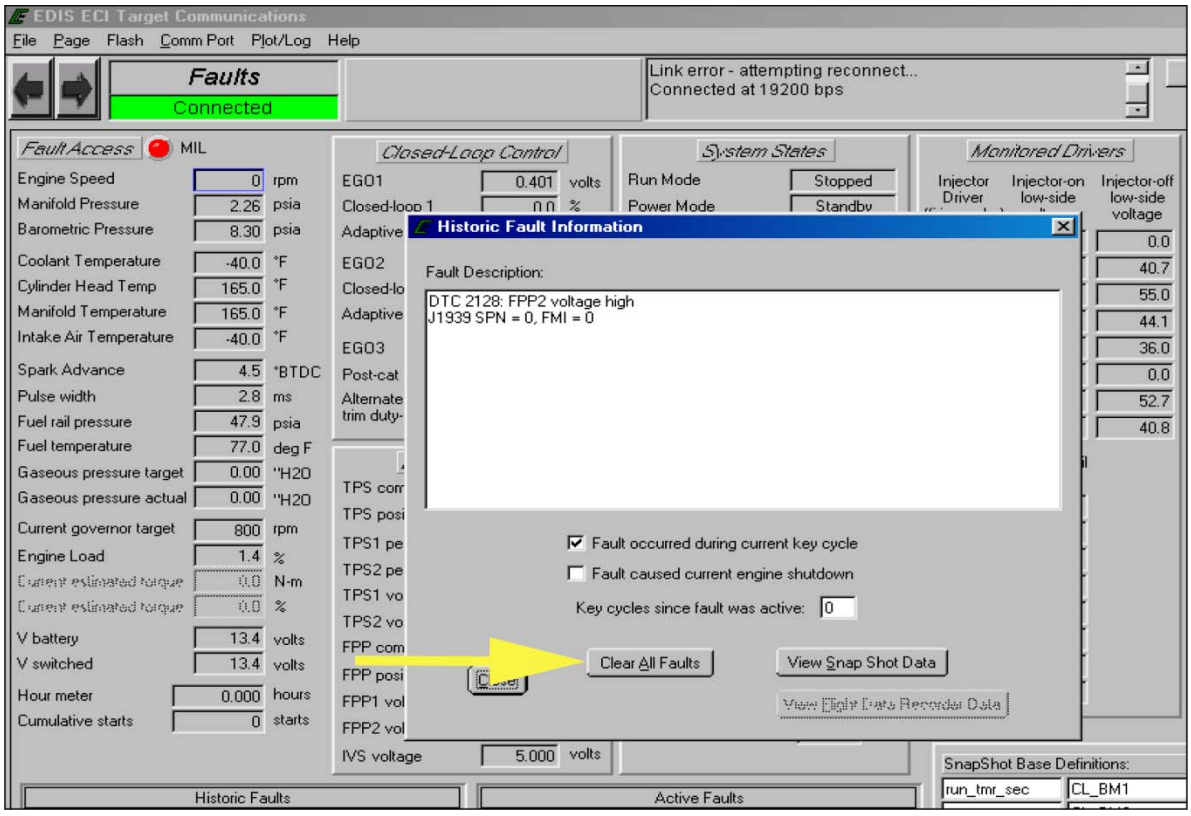


Diagram 1

When using the DST program to clear a DTC, always select the “Clear All Faults” function to immediately turn the MIL OFF after a successful repair (as shown in diagram 1 above).

INTERMITTENT PROBLEMS

Intermittent fuel system problems can prove to be the most challenging to repair. It is most important to remember when looking to find the cause of these problems, to operate the system in the condition when and where the problem occurs. An example of this would be, if the DST showed a lean fuel mixture at full load, one of the first things to look at would be the fuel pressure. The fuel pressure would need to be monitored while the machine is operating at full load, not at idle because the leaning effect does not occur at idle. Electrical problems should be treated the same way. One excellent tool for finding intermittent electrical problems is the DST plot/log function. Set up the plot for the code that sets. An example of this would be if an intermittent IAT code set, tag the IAT voltage and watch the plot. While watching the plot, agitate the electrical wire connection at the sensor and ECM connector. The resolution of the plot screen is such that you will be able to see any unstable voltages that you would otherwise not see with a standard DVOM.

Caution should be used when pressure washing the under hood of any electrical system. Avoid direct pressure spray on the system electrical connectors. They are splash proof, but if water is sprayed directly at the connector moisture can become trapped behind the connector seal and cause serious system problems.

Extra care must be taken when probing electrical pins and terminals. Do not bend or spread these terminals as this can also be a source of intermittent problems cause by improper handling of these connectors.