EControls, Inc.
Control and Instrumentation Specialists

Global Control Platform (GCP) Engine Display Interface Software (EDIS) Training Manual

04/07-Rev B

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A. Overview

All engine control modules (ECMs) produced by EControls Inc. have the ability to be used as calibration development controllers and include an abundance of interface functionality. This manual is intended to introduce technical professionals and service personnel to EControls' Engine Display Interface Software (EDIS), however, this manual is not intended to define control system variables, outline the ECM's embedded software functionality, or provide calibration direction.

The text outlines:

- Installation of the EDIS package onto a personal computer (PC)
- Software login and password functionality
- EDIS Header and top-level menubar functions
- General functions of each user-interface page
- Fault and Diagnostic Trouble Code (DTC) interaction

Examples and snapshots used in this manual are based off of the Heavy-Duty ECM Display Interface ('HD Display') Software package but extend to all EControls' EDIS packages including 'ECM56 Display,' 'FPP Display,' and 'GCP Display.'

In addition to providing a calibration interface, software capabilities include extracting a calibration from an ECM, loading a calibration to an ECM, reflashing an ECM with a MOT file, graphically plotting variables and metrics, data logging variables and metrics to PC memory, and display/retrieve fault code information. Before elaborating on the software's functionality, it is crucial to understand the ECM's configuration. There are two types of files that can be used to configure an ECM, a *MOT file* and a *CAL file*. The functions of these files are described in Table 1.

Table 1: Calibration Configuration Files

Calibration File (.cal)	Calibration disk file (partial calibration) that contains static variables to define part of an engine's calibration. A CAL file is a calibration overlay but DOES NOT contain the engine's entire calibration. CAL files are used for saving a calibration from an ECM or loading specific variables.
MOT File (.mot)	Binary (S-record) file that contains the full calibration and embedded software algorithms. The MOT file is the one file necessary to completely configure an ECM. MOT files CAN NOT be viewed or executed on a PC.

B. Software Installation

The installation software is contained in six (6) files; these are shown in Figure 1. In order to install the software, all files must be contained in the same directory.

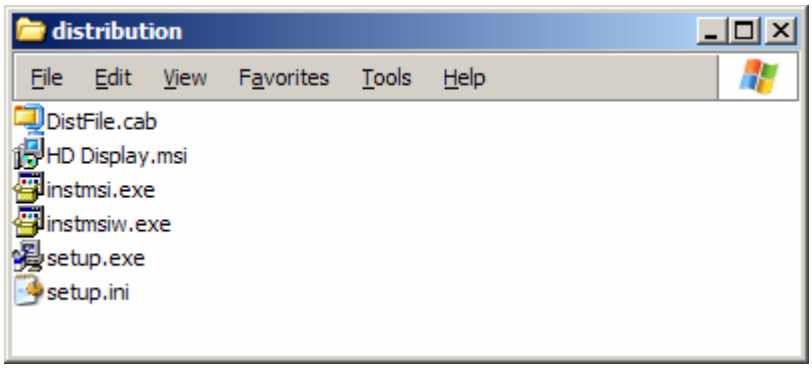
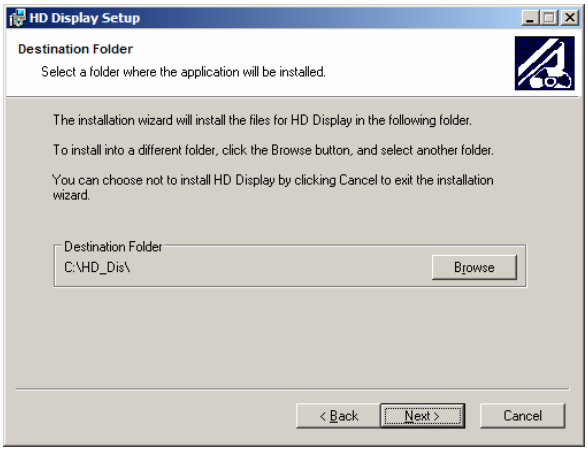
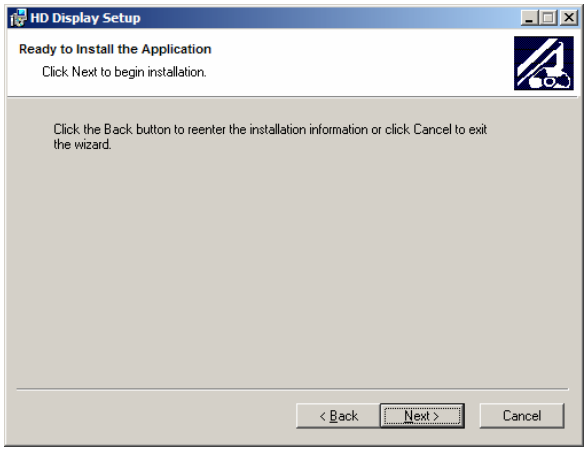


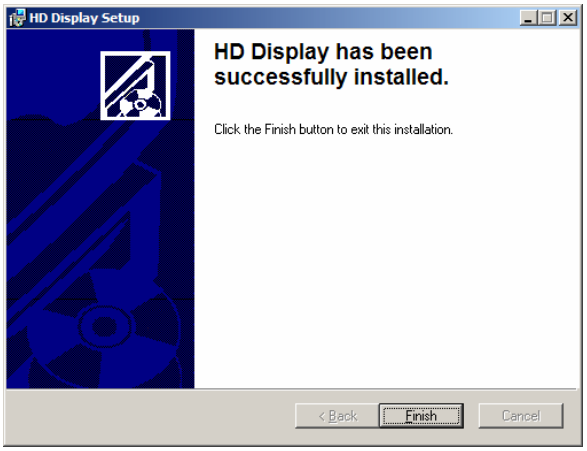
Figure 1: EDIS Installation Files

Installation Instructions

1. Start the Windows Installer by double-clicking one of the following installation files.
   - ***setup.exe***
   - ***HD Display.msi***
2. Follow the instructions for installation. (*NOTE: If a previous version of the software is installed, the uninstaller will remove the previous version and exit. You will be required to start the installer again to install the new version*).







3. Once installed, the software can be accessed from *Start Menu → Programs → HD Display → HD Display*

NOTE: Upon completion of the install, installation files may be deleted from your PC.

C. Software Log-In

Figure 2 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 applicable to all ECMs of a given original equipment manufacture (OEM) or 2) enter a 'Single S/N Password' and corresponding serial number for a single ECM. A Single Serial Number password is only applicable for the specific ECM serial number it applies to and is useful for authorizing service personnel to make changes or view information for a single ECM for which they would otherwise not have access to.

Each password is a 16-character alpha-numeric string specific to each EControls customer and determines which pages and variables are visible through the software as well as which ECM calibration variables can be written. Passwords are assigned to an OEM by EControls Inc. Passwords also determine the functionality granted a user, including loading calibration files and reprogramming the ECM. Passwords can be used to provide full or limited access to as many or as few pages and variables as desired. This allows the software to be all encompassing for the calibration engineer, provide limited access for distributors and service technicians, or provide any access level for a single ECM.

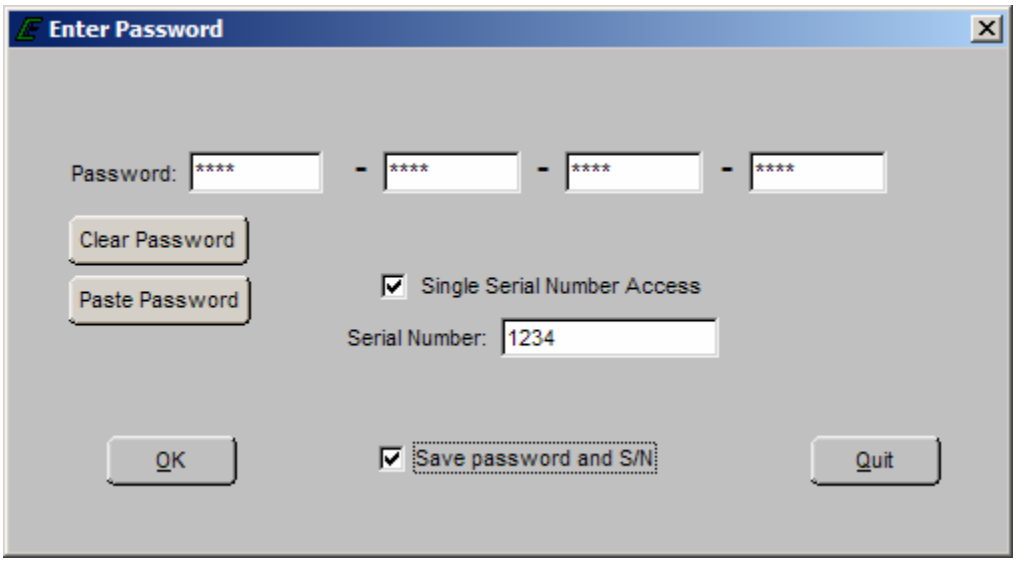


Figure 2: Populated Password Dialog Box for Single Serial Number Access

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. 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 3 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

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 4 will be displayed.

Figure 5 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).

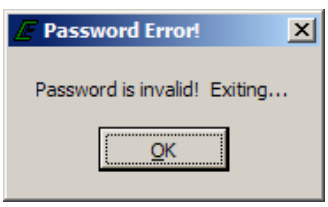


Figure 3: Password Error Prompt

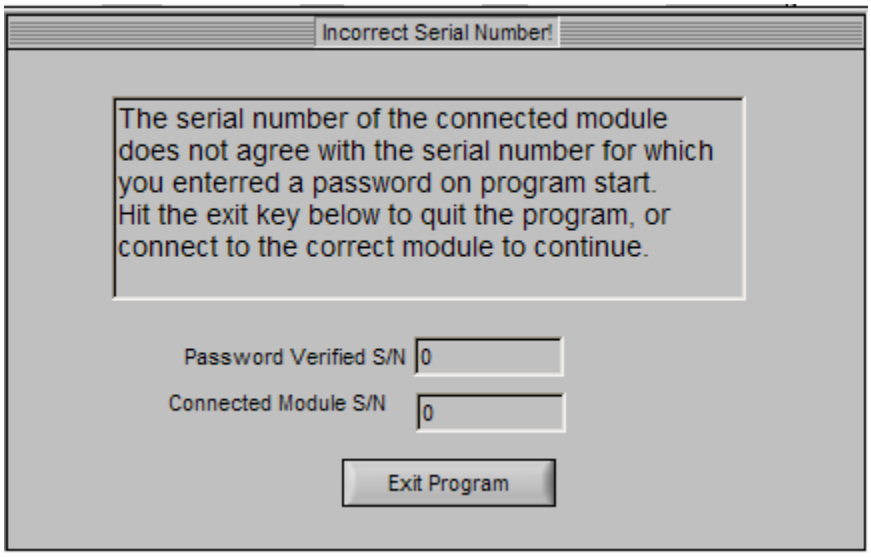


Figure 4: Incorrect Serial Number Message

Figure 5: Not Authorized to Connect Message

D. EDIS Header and Menu Bar Functionality

All high-level functions are accessible from the EDIS Header. The header shown in Figure 6 is displayed above the active page and is accessible from any page. Included in the header is the menu bar, page toggle buttons, communication status window, and active page header. Functions, such as file transfer, plotting, and flash committal are selectable from the menus located in the menu bar. The communication status window, located at the far right of the screen, displays real-time information regarding serial communication. If the PC is connected to a valid target, battery voltage is supplied to the V_bat pins of the ECM, and the proper password has been entered the communication status window will show that the computer is connected and communication is established. Figure 7 is an example of the header once communication has been established. Toggle buttons may be used to advance to the next page or go back to the previous page based on the active page list order. This function may also be accomplished by using the Page Up/Page Down buttons. The F9 key is a shortcut to toggle between the last page visited and the current page.

Figure 6: EDIS Header (Not Connected)

Figure 7: EDIS Header (Connected)

Menu Bar Menus

- **File Menu:** Used primarily to perform disk and file management functions.
- **Page Menu:** Used to select the active page and configure which pages will be visible for use during a software session.
- **Flash Menu:** Commits updated calibration variables from the ECM's random access memory (RAM) to Flash memory or releases/clears updated calibration variables from the ECM's RAM. Flashing an ECM permanently saves a variable or set of variables to the ECM.

- **Comm Port Menu:** Selects the PC's active serial communication port and displays communication statistics.
- **Plot/Log Menu:** Graphically plots or numerically logs static and dynamic variables and metrics that have been tagged for plotting or logging.
- **Help:** Provides general information about EDIS and defines shortcuts for use in the software.

I. *File* Menu Functions

All disk and file management functions are accessible from the File menu. Functions contained in the File menu include:

- ***Save Calibration to Disk:*** Saves calibration variables, accessible from the display software, from the ECM's flash memory to the PC. Table 2 outlines the Save Calibration to Disk functions.
- ***Load Calibration from Disk:*** Loads a partial calibration from a *Trusted Source* (see Trusted Source definition below) calibration file on the PC to the ECM's flash memory. Only variables for which your password has write access will be updated.
- ***Clear Cal Tags:*** Removes all calibration tags from EDIS memory during software use.
- ***Reprogram Target:*** Reprograms the ECM processor with a binary MOT file (S-record) that contains both a full calibration and embedded software control algorithms.
- ***Bulk Reprogram:*** Used to program multiple ECMs for an OEM's end-of-line production process.
- ***Print Panel:*** Sends a snapshot of the active EDIS page to a printer.

Figure 8 is an example of a calibration table that has been tagged for a calibration save. A variable is tagged for a calibration save by combining the shift key with a right-click of the mouse, thereby highlighting the calibration variable or table in blue. This allows for specific calibration variables to be saved to disk without having to know the variable's name. It should be noted that tables are not automatically saved with their corresponding independent axes, therefore, axes should also be tagged.

If the password used at login has a high level of access, the prompt shown in Figure 9 is displayed. This prompt asks if the calibration is a *Trusted Source Calibration*. A *Trusted Source Calibration* allows a high-level user to generate a calibration file that can be loaded and committed into an ECM using any level of password that permits calibration file loads even though the password may not allow write access to all variables contained in the calibration file. A successful calibration save generates the prompt displayed in Figure 10.

Table 2: Save Calibration to Disk Functions

Save All Calibration Variables	Saves all password accessible calibration variables from ECM Flash to the PC that are accessible in the EDIS software package (NOTE: Not all ECM variables are accessible through the interface software, thus this does not constitute saving a 'full' calibration).
*Save Tagged Cal Variables**	Saves any password accessible variable from ECM Flash memory to the PC that is cal. tagged in the display software.
Save Cal Variables for Which You Have Write Access	Saves all calibration variables from ECM Flash memory to PC for which your password allows write access.
Save Cal Variables from List	Saves any password accessible variable from ECM Flash memory to the PC that is selected from the list of accessible variables. Multiple variables may be selected by single left-click of each variable.
Update Existing Cal File	Update an existing calibration file on the PC with the same variables from the connected ECM. Used to update a partial calibration with updated variables from an ECM.
***Calibration Tag (shift & right-click):** Selection of static calibration variables to save to PC disk.	

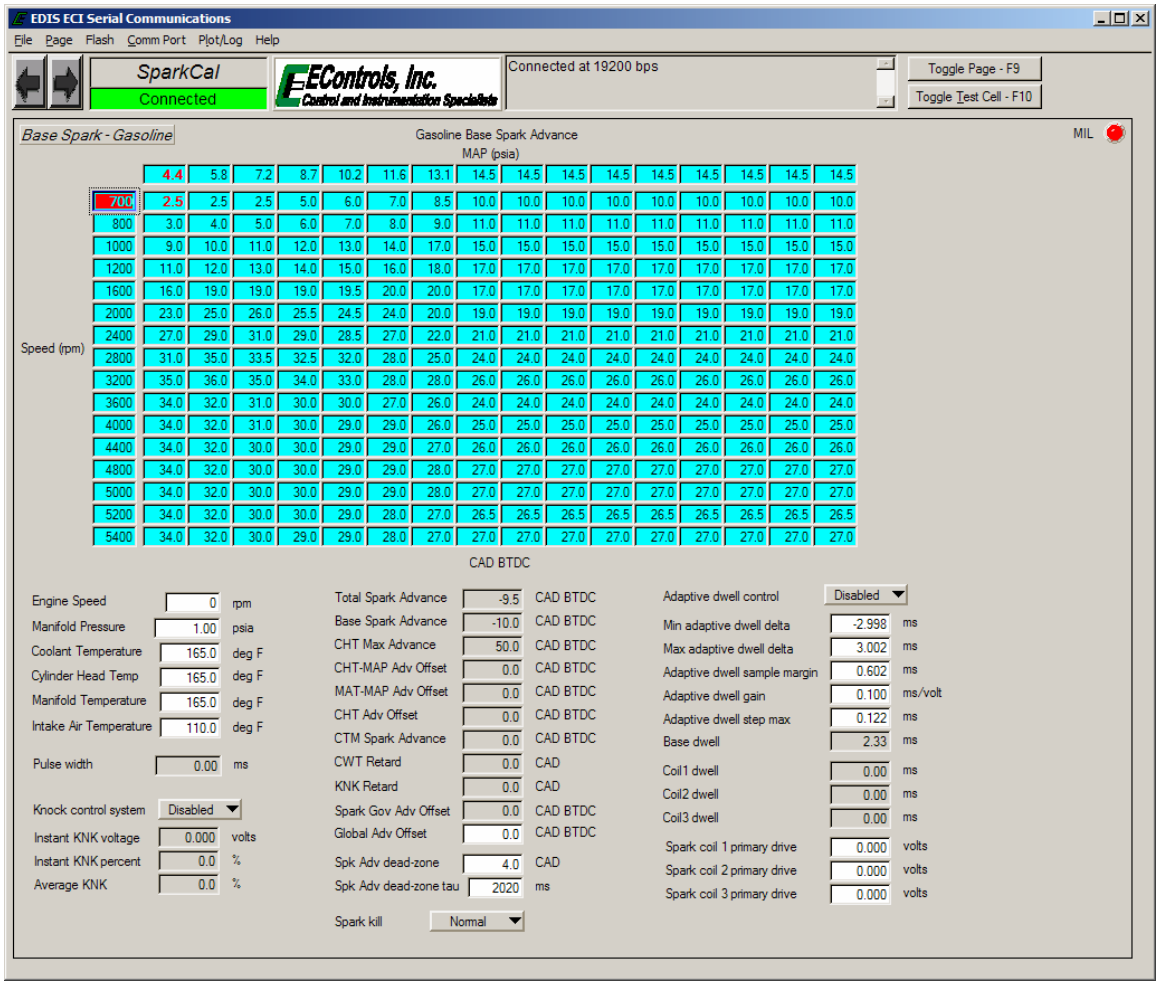


Figure 8: Variables Tagged for Calibration Save

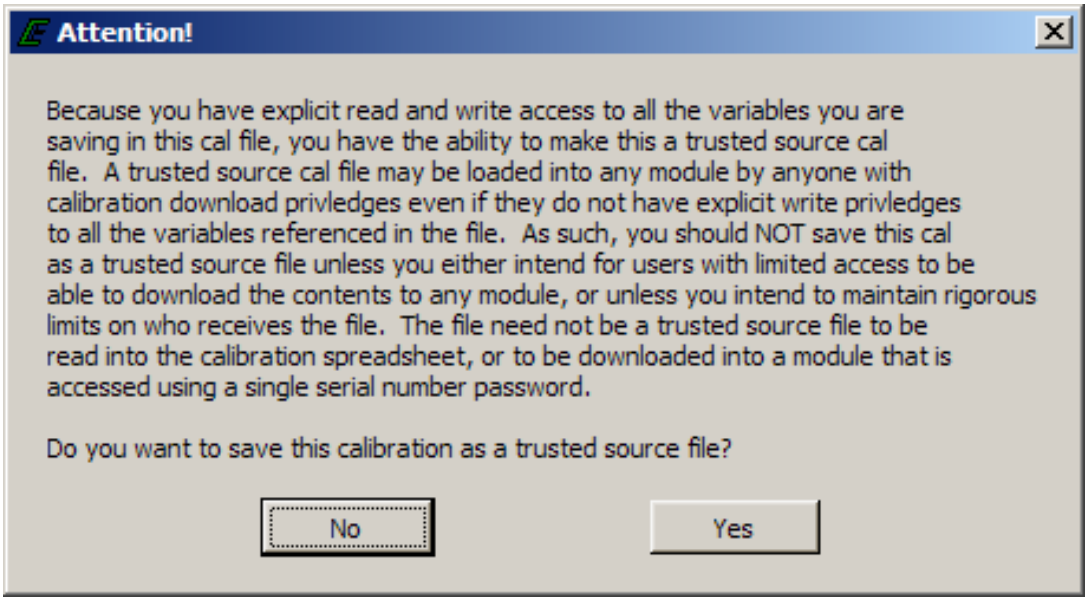


Figure 9: Trusted Source Calibration Save Prompt

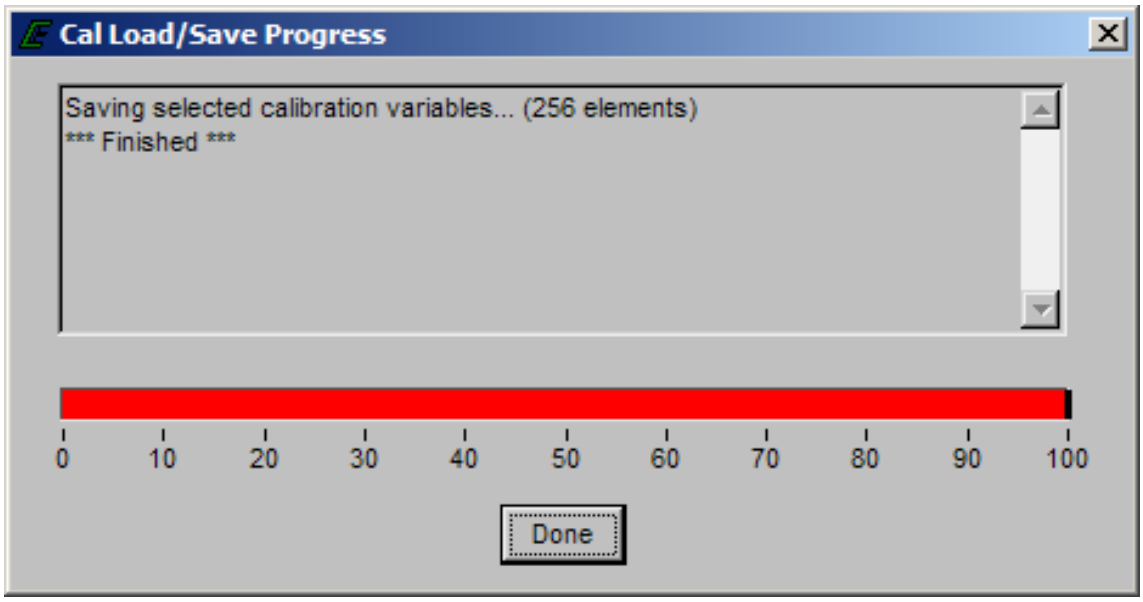


Figure 10: Successful Calibration Save Prompt

Additional functions available from the File menu include:

- ***Load Calibration from Disk:*** Uploads a calibration from a partial calibration file stored on disk to ECM flash memory for the variables your password has write access provided that the password has calibration load privileges. Figure 11 shows the prompt for a successful calibration file load.

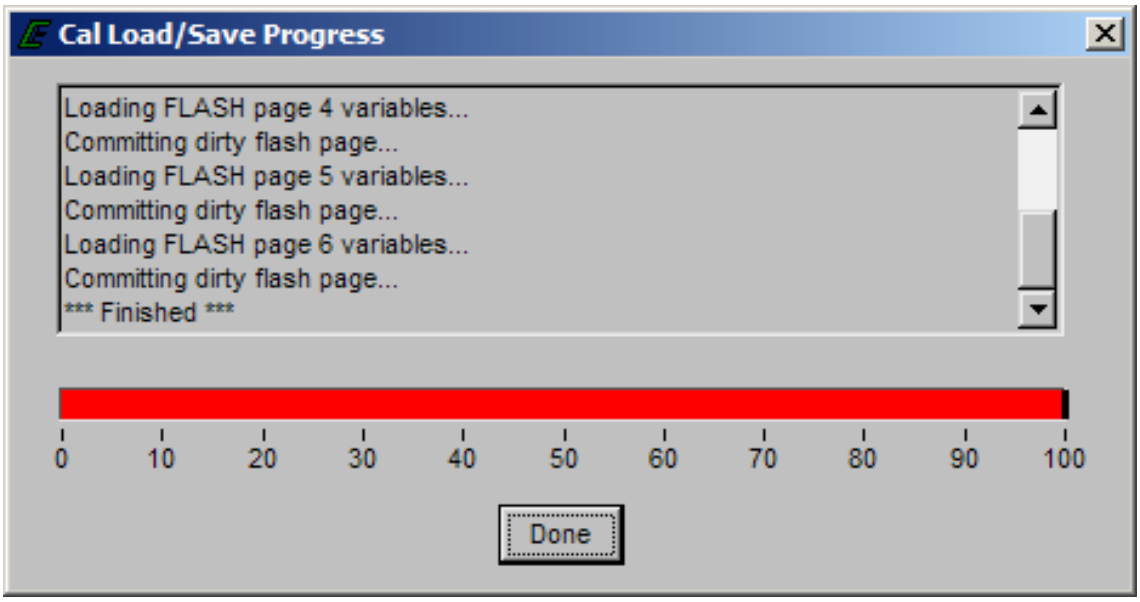


Figure 11: Successful Calibration Load Prompt

- ***Reprogram Target:*** Reprograms the ECM's microprocessor with a binary MOT file (S-record) that contains the full calibration and embedded software control algorithms. This task is performed when software modifications have been released or you desire to load a full calibration.

  When reprogramming an ECM, the prompts shown in Figures 12-14 will be displayed in sequence. Figure 12 is the first prompt, asking if you desire to perform a standard application download. A "standard application" download reprograms the target with the embedded software and the full calibration. Prior to beginning the reprogram sequence, the prompt in Figure 13 will be displayed. Selecting "Yes" will proceed with the reprogramming sequence; selecting "No" will exit the reprogram sequence. During the reprogramming sequence, the serial communication baud rate will change from the preset communication baud rate (default= 19200 bps) to 57600 bps, permitting faster downloads. A status indicator will be displayed during reprogramming to display the

download status. Successful completion of a reprogrammed target will generate the prompt in Figure 14 and the software will automatically revert back to the preset communication baud rate.

Answering "No" to the prompt in Figure 12 indicates a "non-standard application" download that will constitute an application and bootblock download, Figure 15 shows the ensuing dialog box. Bootblock essentially erases everything in the ECM's flash memory and reprograms the ECM. This function is used primarily when updating an ECM's encryption. In order to reprogram in Bootblock, a valid password must be entered in the password field of the Non-standard Target Reprogram prompt. If the password is accepted, the prompts shown in Figure 16 and Figure 17 will be displayed.

NOTE: If serial communication is lost, the reprogramming sequence is cancelled, or ignition and battery power are removed from the ECM during reprogramming, the ECM will inform you that it is in bootstrap mode and is inoperable requiring the ECM to be reprogrammed as shown in Figure 18. This prompt will be presented each time the PC reconnects with the ECM if the ECM is not properly configured.

NOTE: Interruption of bootblock reprogramming may cause the ECM to be unusable. An ECM that becomes unusable as a result of a failed reprogram requires the unit to be returned to EControls Inc.

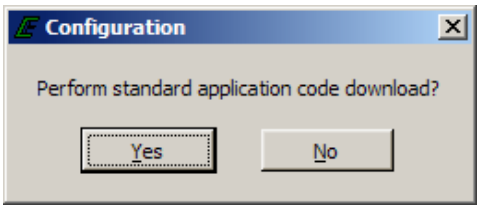


Figure 12: Reprogram Target Download Prompt

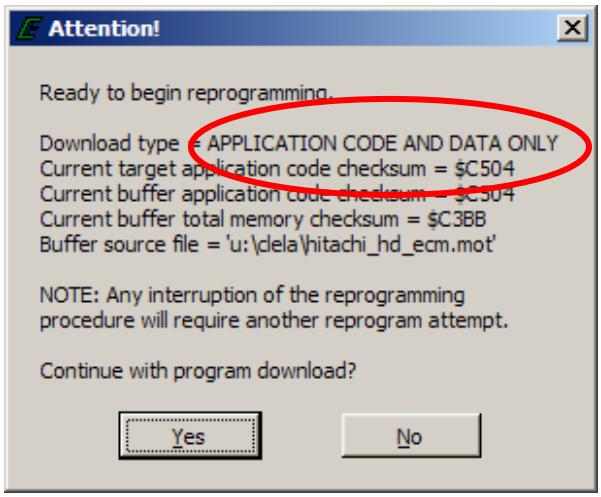


Figure 13: Standard Application Download Prompt

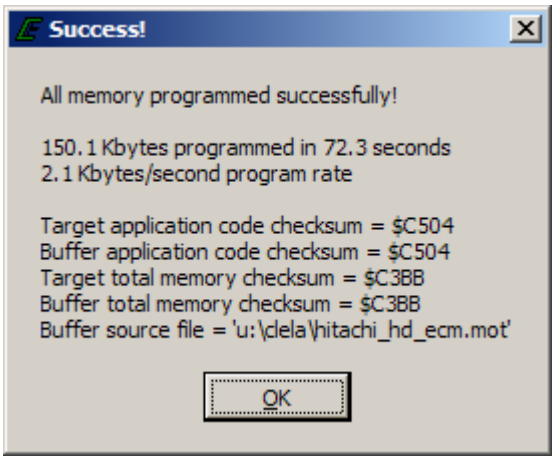


Figure 14: Successful Target Reprogram Prompt

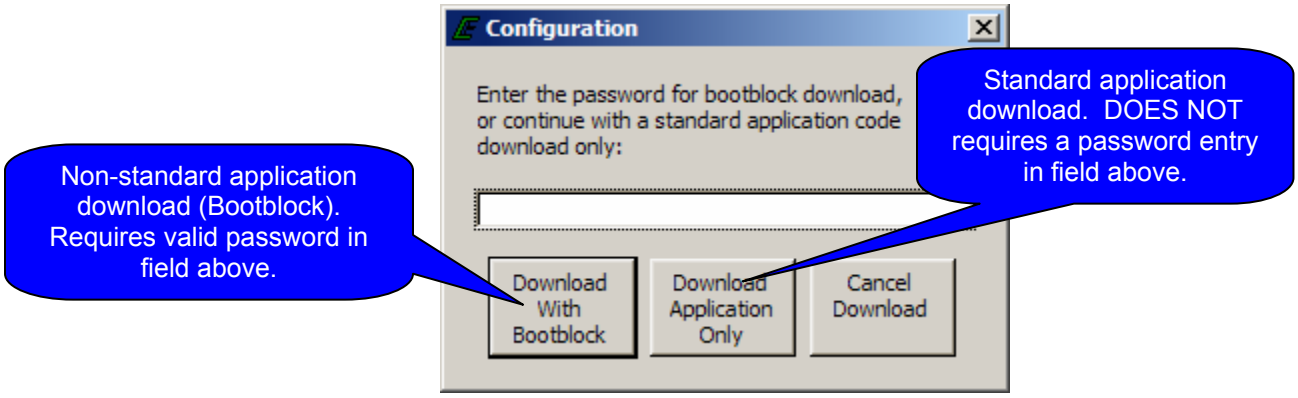


Figure 15: Non-standard Target Reprogram Prompt

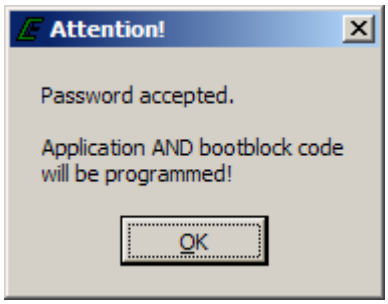


Figure 16: Successful Bootblock Password Entry Prompt

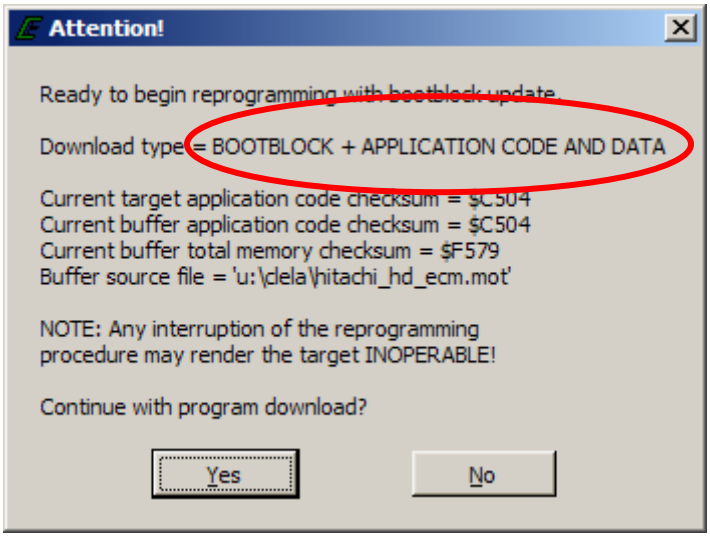


Figure 17: Non-Standard Application Download Prompt

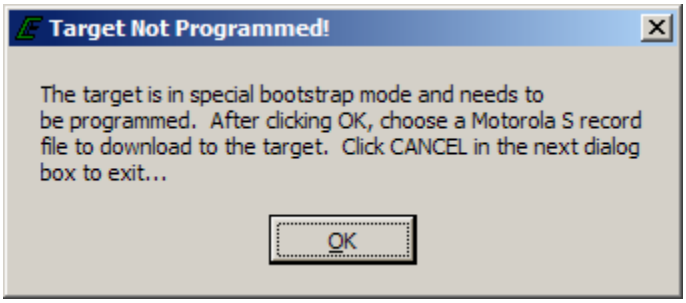


Figure 18: Inoperable Target Prompt

II. *Page* Menu Functions

The Page menu is used to configure which pages will be visible for use during a software session and contains the list of selectable pages. Functions accessible from the Page menu are listed below.

- ***Pages:*** Configures which pages will be selectable from the Page menu. Figure 19 shows an example of the Page Configuration Interface. Selecting a page for use is accomplished by a single left-click next to the page name. Pages available for display are password dependent. Pages may be retained for software re-entry by checking the 'Save pages setup for startup' checkbox.
- ***'Page_Name':*** Selects the active page for display.

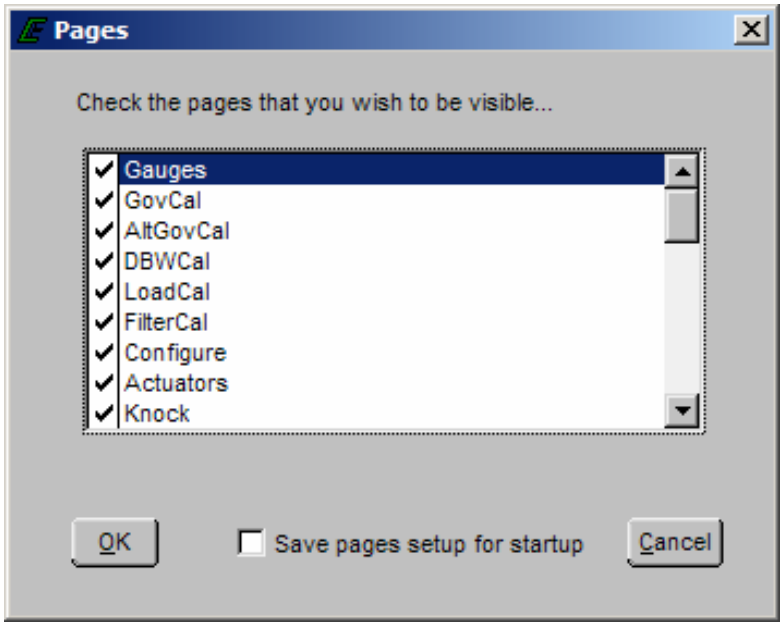


Figure 19: Page Configuration Interface

III. *Flash* Menu Functions

The Flash menu contains the two functions that transfer or release updated variables from ECM RAM to ECM flash. These functions are described below.

- ***Commit Dirty Page:*** Transfers updated calibration variables from ECM RAM to flash memory. Committing variables to flash permanently stores the variables from a flash page allowing variables on different flash pages to be updated. A '*Dirty*' page refers to a flash page that has update calibration variables in RAM that have not been updated in Flash. If a page is 'Dirty' and battery power is removed from the ECM updated variables revert back to values stored in Flash. Once a page has been flashed, the page is no longer 'Dirty.' Upon selecting Commit Dirty Page, the prompt in Figure 20 will be displayed.

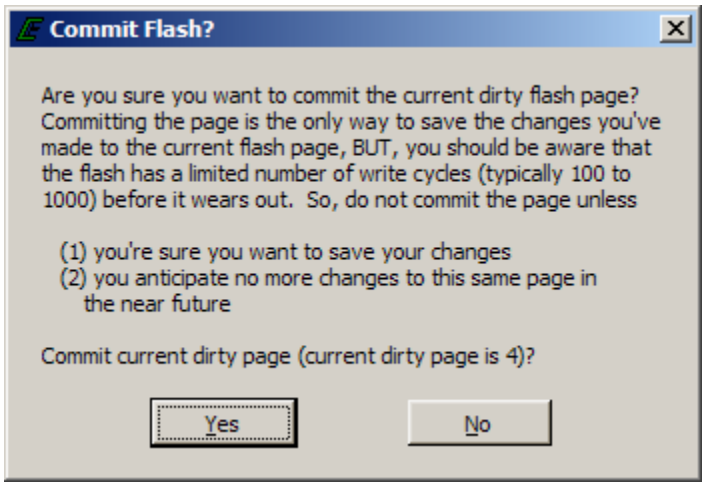


Figure 20: Commit Dirty Page Prompt

NOTE: Caution should be taken to not commit flash pages at high engine speeds as the engine may briefly stall during the flash committal process.

- ***Release Dirty Page:*** Deletes updated calibration variables from ECM RAM and reverts back to the calibration stored in flash memory. Prior to releasing the updated variables from RAM, the prompt in Figure 21 will be displayed.

NOTE: Updated variables that have not been committed to flash memory are retained during ignition key-off cycles, however they are erased if battery power (V_bat) is removed from the ECM.

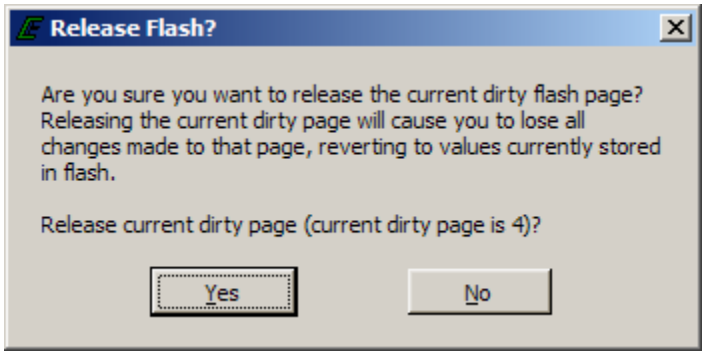


Figure 21: Release Dirty Page Prompt

IV. *Comm Port* Menu Functions

The Comm Port menu allows the user to select the PC's active serial communication port and provides information about communication statistics. Functions available from this menu are detailed below.

- **Automatic (*Default)*:** Permits the software to cycle through available RS-232 serial communication ports until a connection is established with a target.
- ***COM1, COM2, etc.:*** Specifies which communication port to connect through for a given software session. This setting is not retained once the software has been exited, however it may be retained by right-clicking the main software icon, selecting properties, and adding *–com#* to the end of the target field. An example is shown in Figure 22.

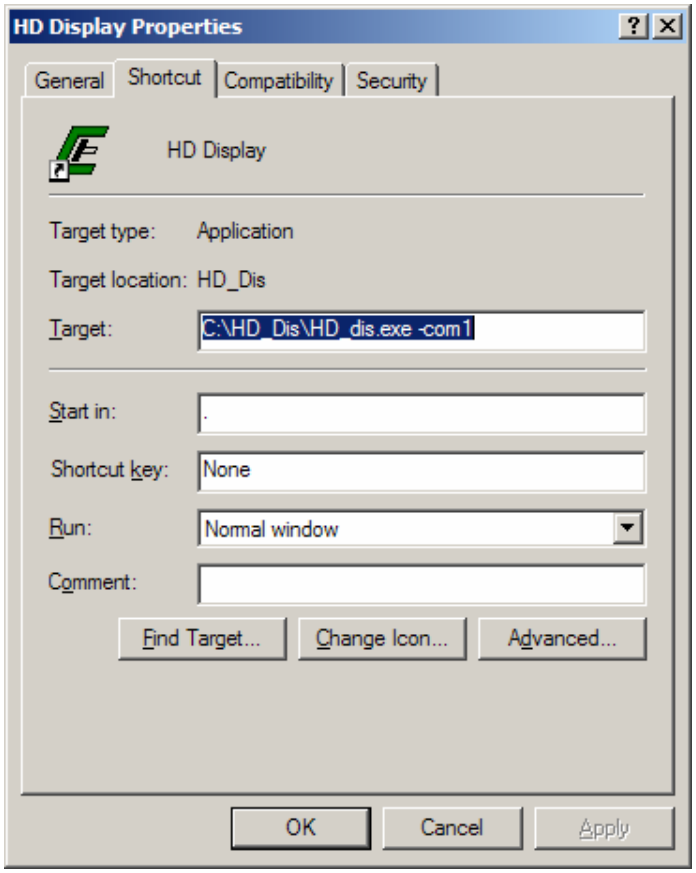


Figure 22: Software Properties

- ***Show Stats (Ctrl+S):*** Displays communication statistics between the PC and ECM once a connection has been established.

Statistics include serial baud rate, transmit and receive loads, and time information. An example of available data is presented in Figure 23.

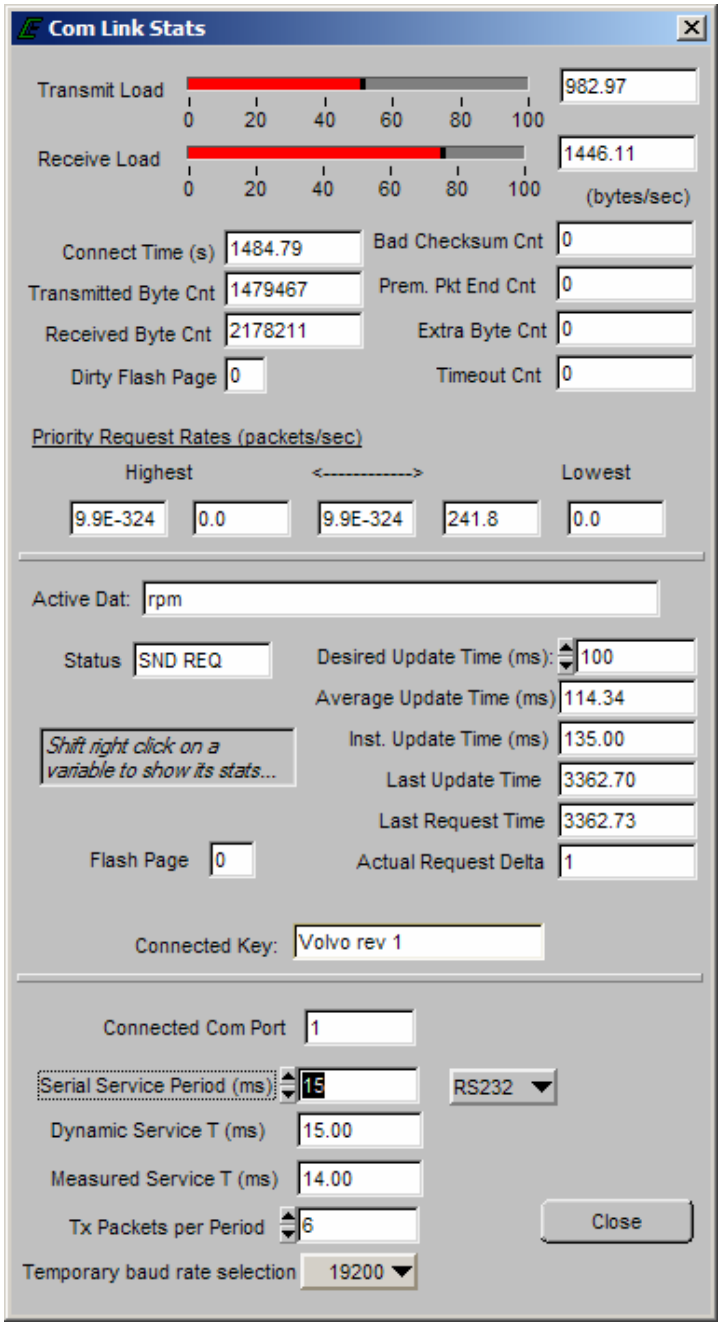


Figure 23: Communication Statistics Interface

V. *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 24 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. The equation below can be used to calculate the minimum sample period for a given selection of variables.

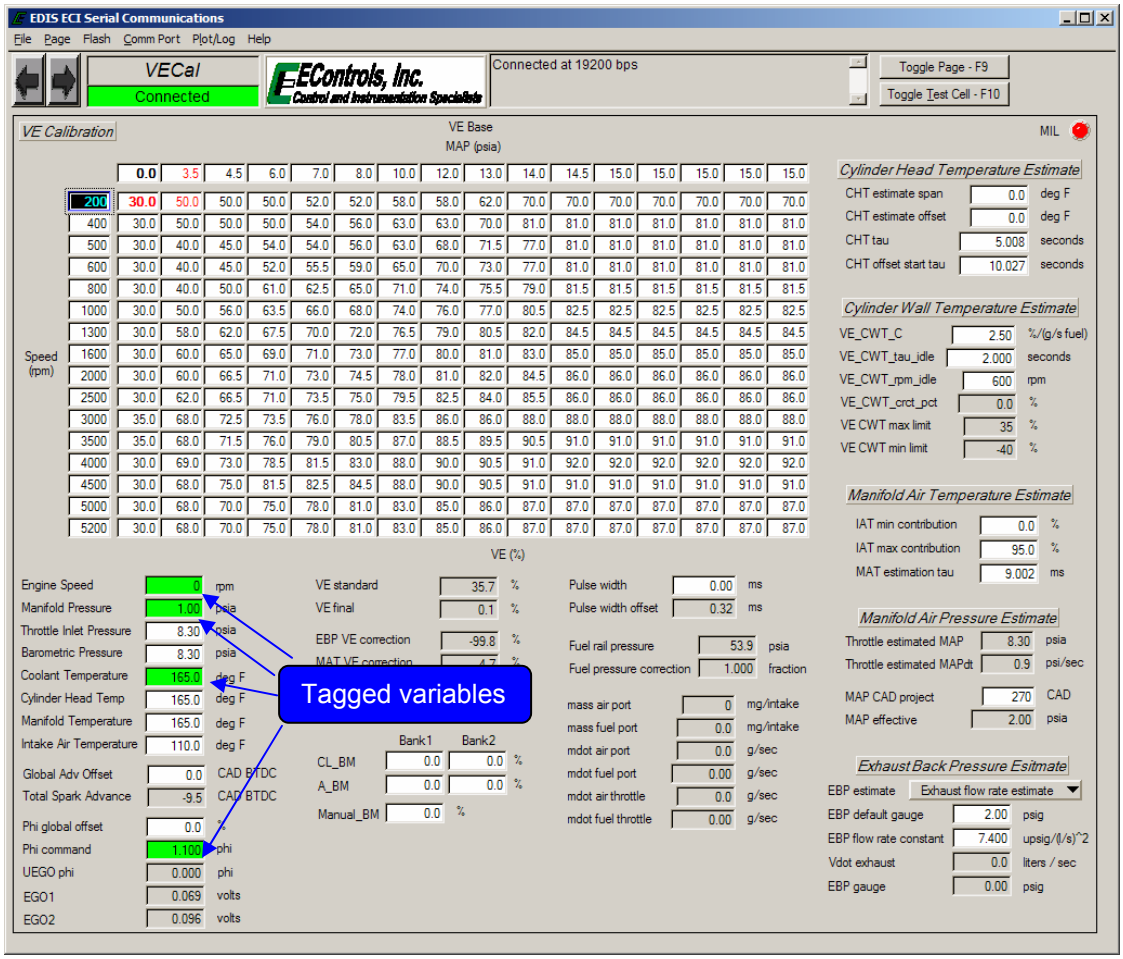


Figure 24: Tagged Variables for Plot/Log

$$P = sample\ period\ (ms) = \left(\frac{N}{6}\right) \times 15\ ms. \quad \text{N} = \#\ \text{of variables rounded up to the nearest multiple of 6}$$

$$\text{Minimum} = 15\ \text{ms}.$$

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 25. Capabilities of the plotter are outlined in Table 3.

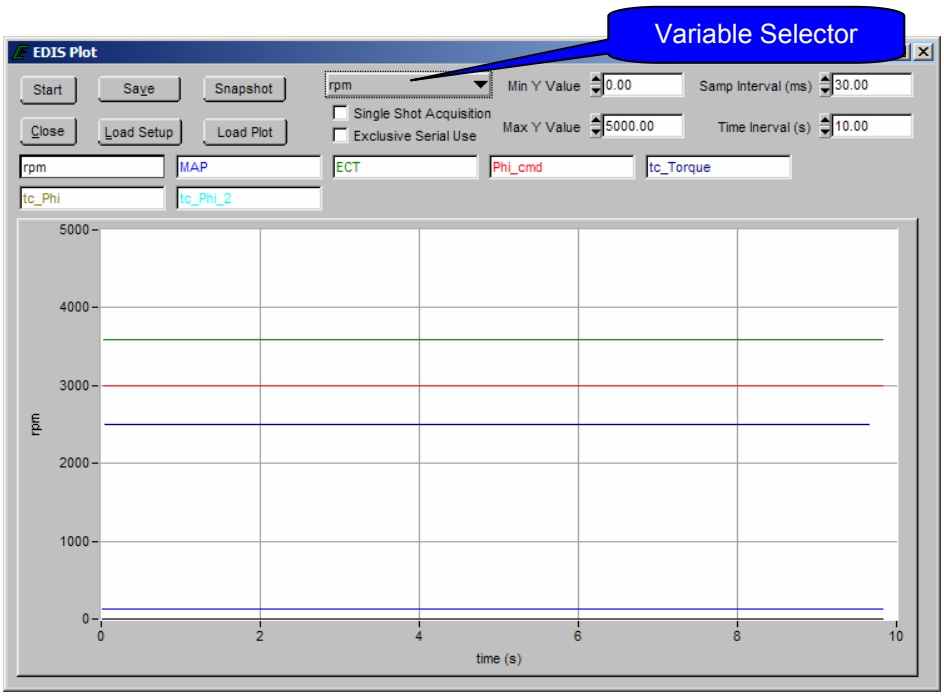


Figure 25: EDIS Plot

Table 3: EDIS Plot Interface Functions

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 EDIS 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 EDIS 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.	

A useful 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 26. Any CSV file in plot format (.plt) may be loaded into the snapshot. Table 4 outlines the available hot key functions of the snapshot screen.

Table 4: 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

Another data capture function incorporated in the software is the EDIS logger. This tool serves as a PC data logger for any variable available in the ECM through the interface software. Figure 27 shows the interface display for configuring EDIS Log. The interface allows the user to create the file's 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 logging. The amount of data stored is only limited by available PC RAM.

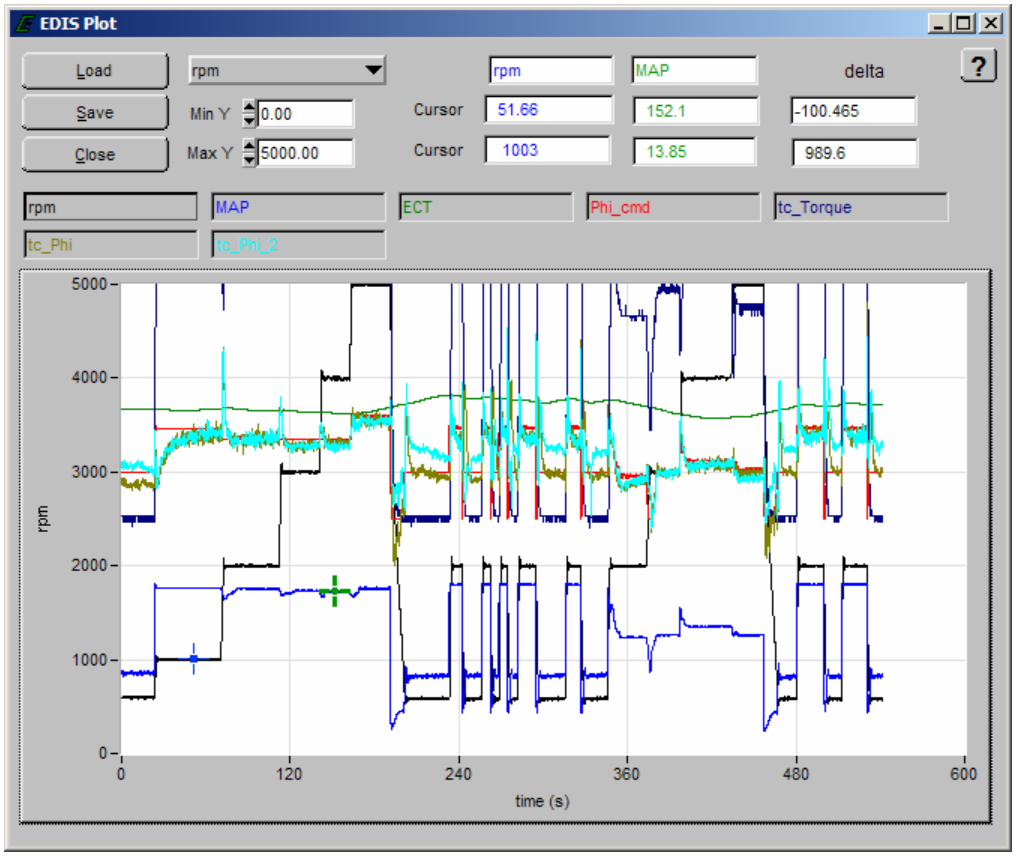


Figure 26: EDIS Plot Snapshot

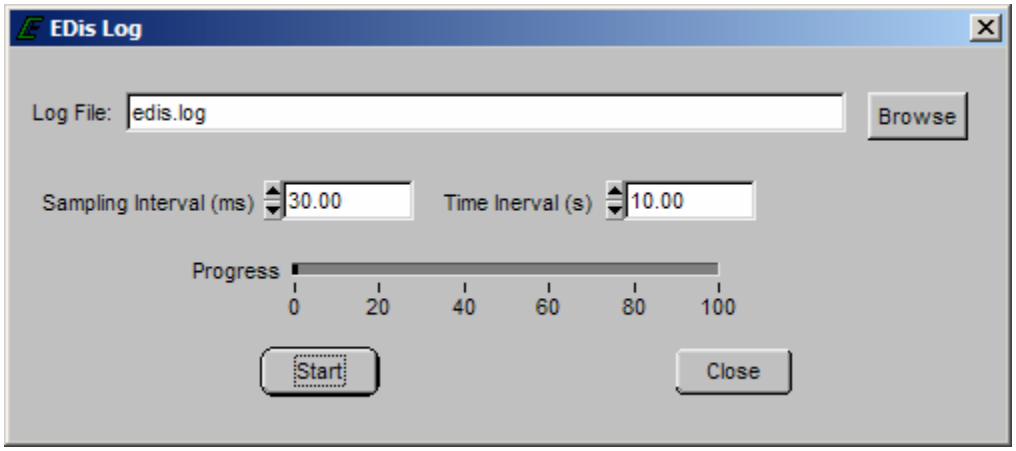
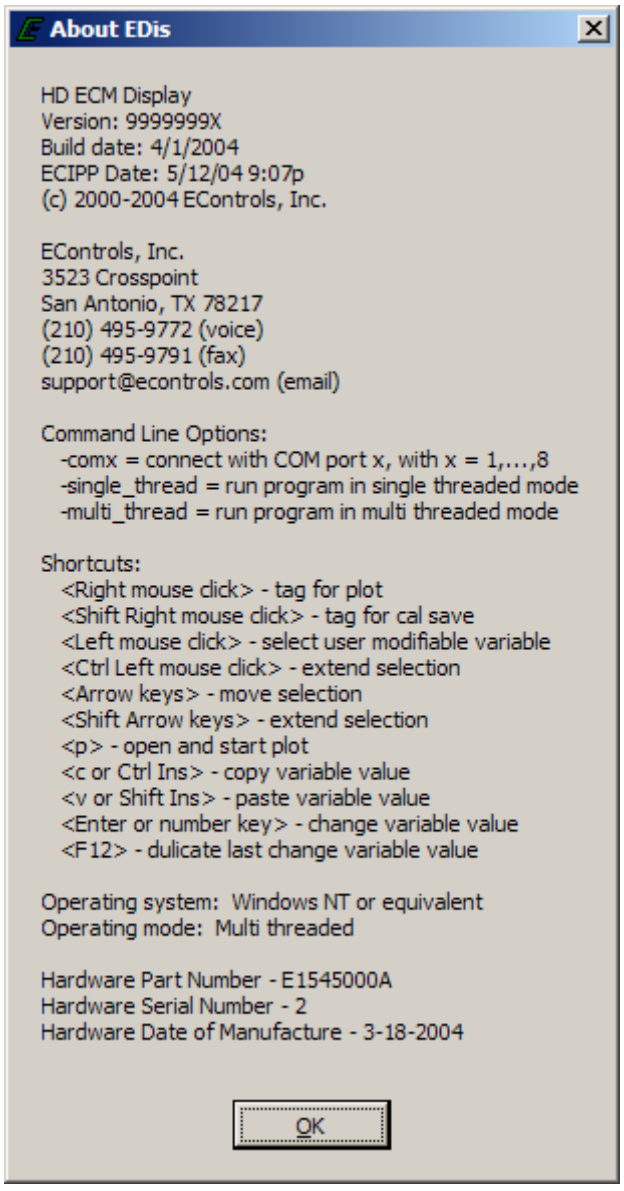


Figure 27: EDIS Log Interface

VI. *Help* Menu Functions

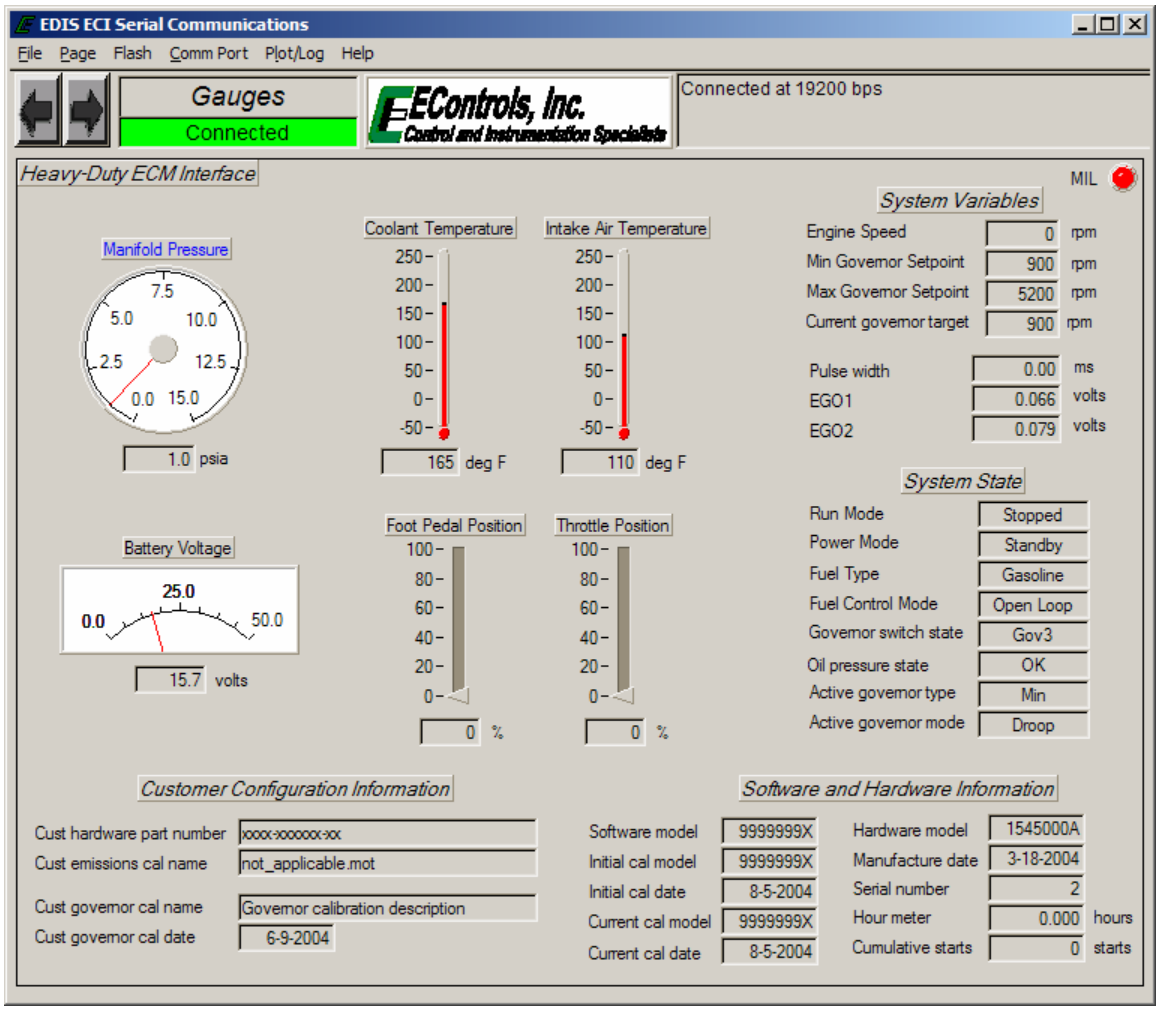
- ***About:*** Documents the EDIS version information, displays information about the connected target, and displays keyboard shortcuts for software navigation.



E. Pages

1. *Gauges* Page

Main Function: Initial screen shown at start-up. Presents visual indication of most viewed information.

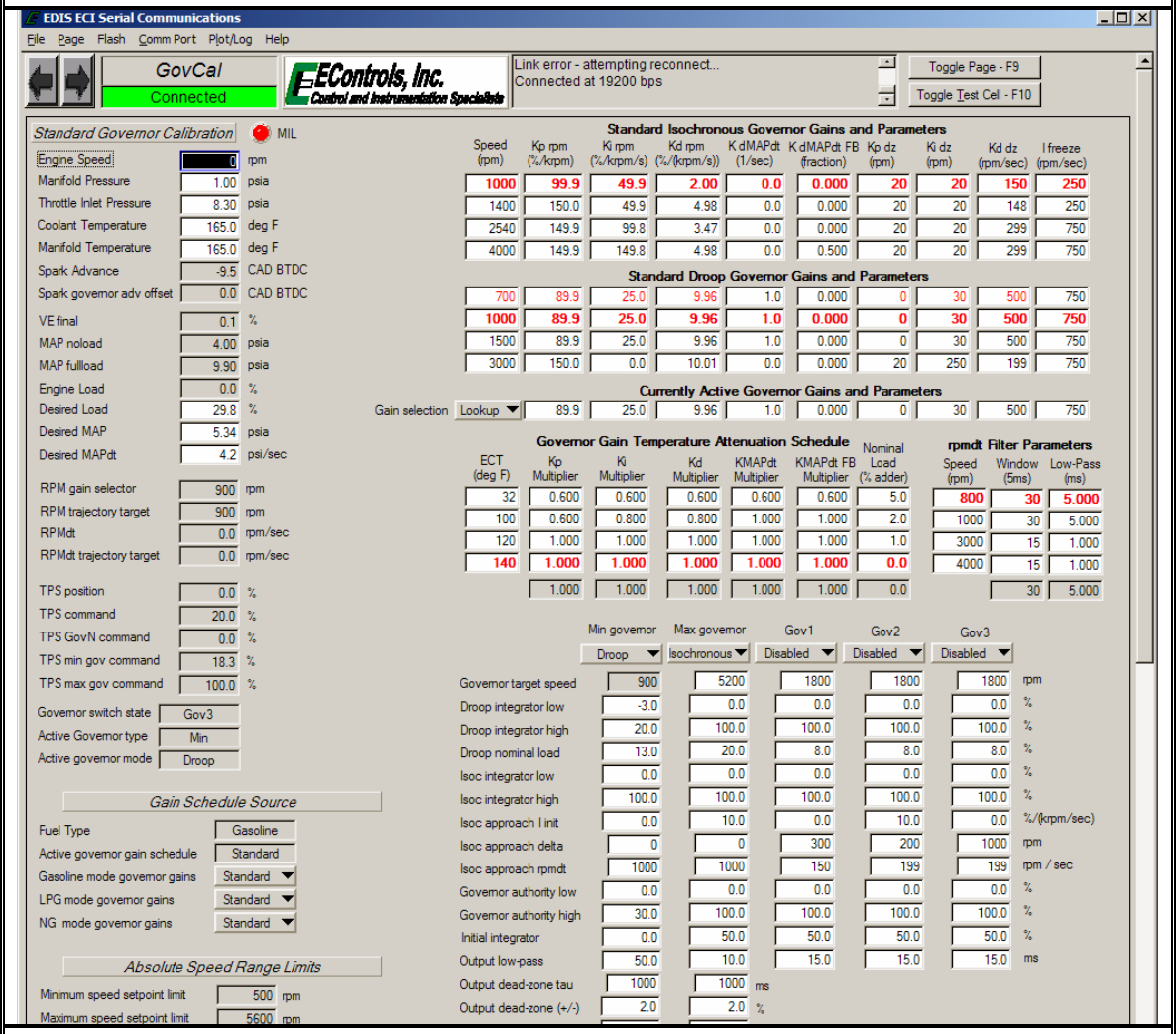


Secondary Functions:

- Displays ECI and customer configuration information including the ECM's part numbers, displays the customer's emissions calibration MOT filename, and displays governor calibration information
- Displays system states based on current operating conditions

2. *GovCal* Page

Main Function: Contains calibration variables that define the engine's electronic governors (for use with electronic throttle only).

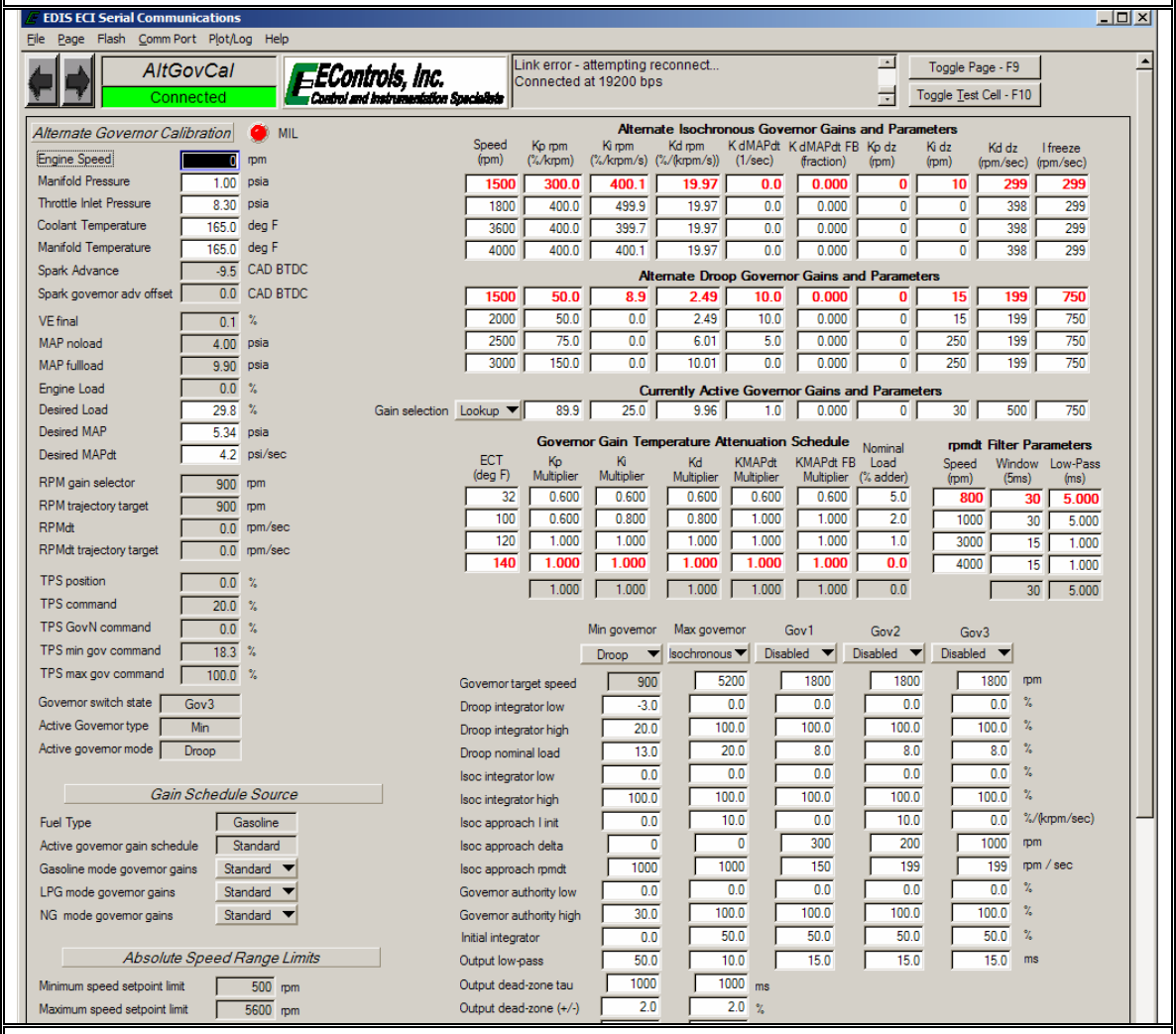


Secondary Functions:

- Contains the gain schedules for the governors
- Contains the idle speed schedule, individual governor setpoints, and governor filters
- Displays feedback referenced during governor tuning

3. *AltGovCal* Page

Main Function: Contains an alternate set of calibration variables that define the engine's electronic governor. Allows a single calibration to have up to ten (10) governors and two (2) sets of governor gains for each governor type based on fuel selection.

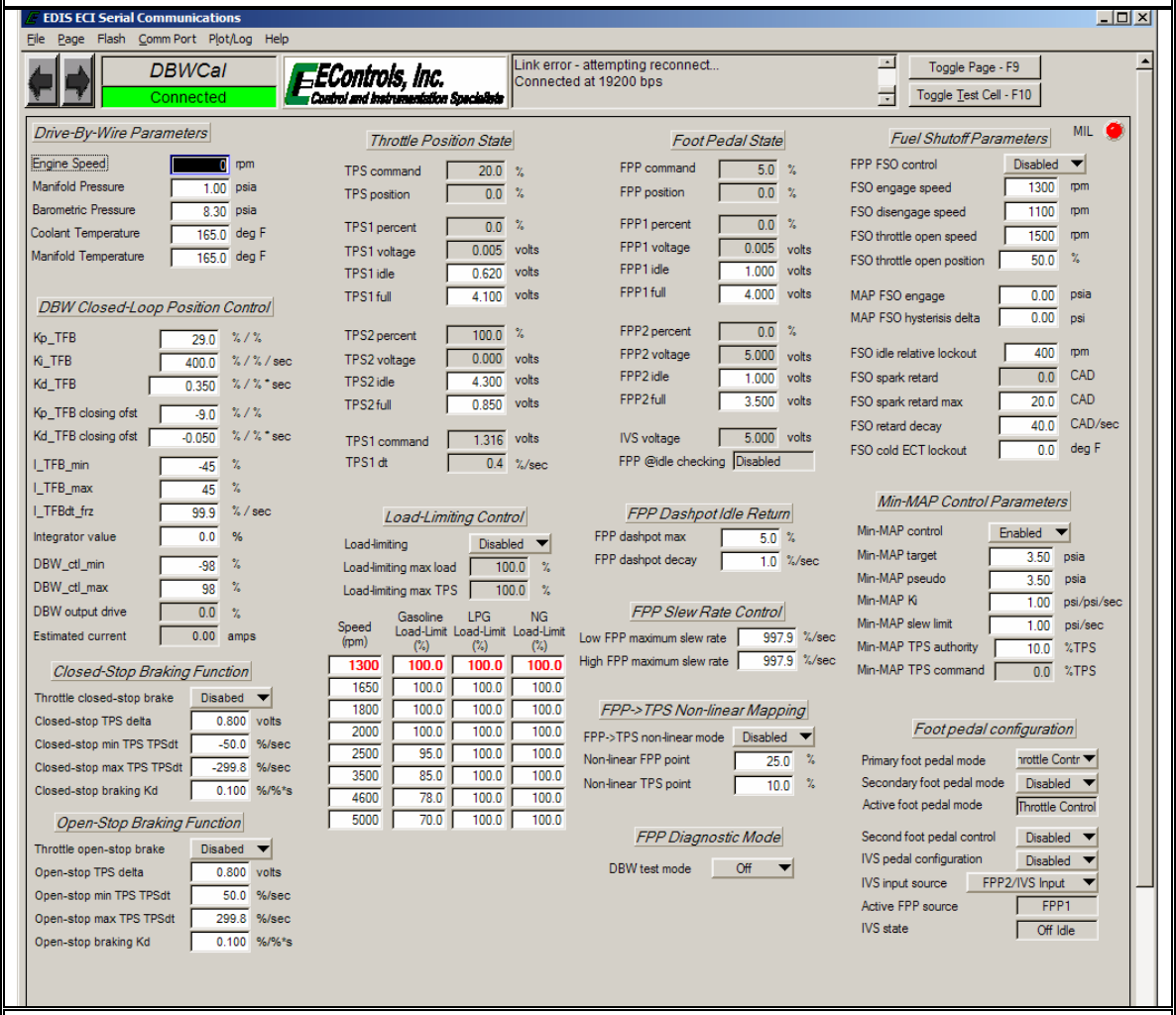


Secondary Functions:

- Contains gain schedules for alternate governor
- Contains the idle speed schedule, individual governor setpoints, and governor filters for alternate governors
- Displays feedback referenced during governor tuning

4. *DBWCal* Page

Main Function: Contains the configuration for an electronic throttle and electronic throttle actuation devices.

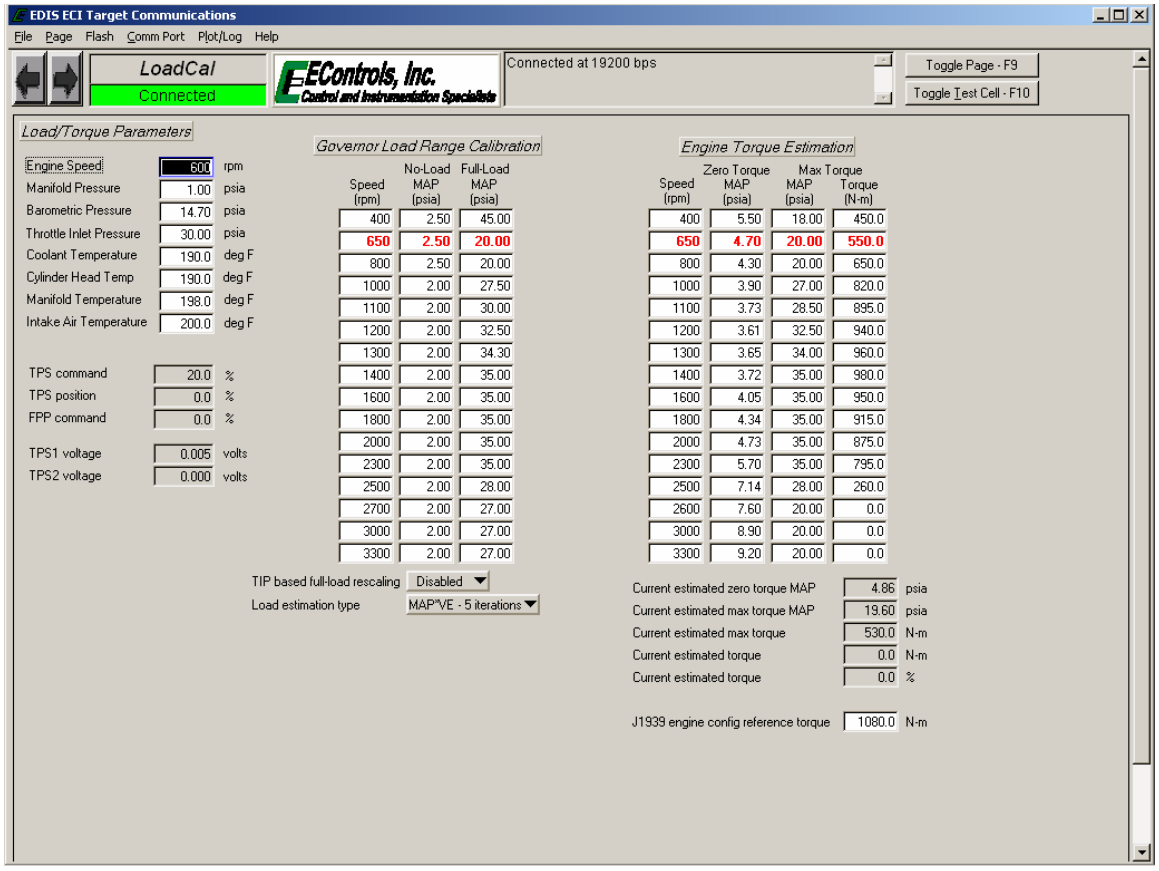


Secondary Functions:

- Contains the Load-Limiting calibration to limit engine power output as a function of speed or coolant temperature
- Contains the Fuel Shutoff calibration to define fuel shutoff operating conditions
- Contains the MIN-MAP calibration to define the minimum MAP target during decelerations (permits electronic throttles to open reducing manifold vacuum and lean misfire)
- Displays calibration and feedback pertaining to electronic throttle and throttle actuation calibrations

5. *LoadCal* Page

Main Function: Defines the engine's no-load and full-load manifold air pressure curves based on engine speed for engine load scaling and torque shaping.

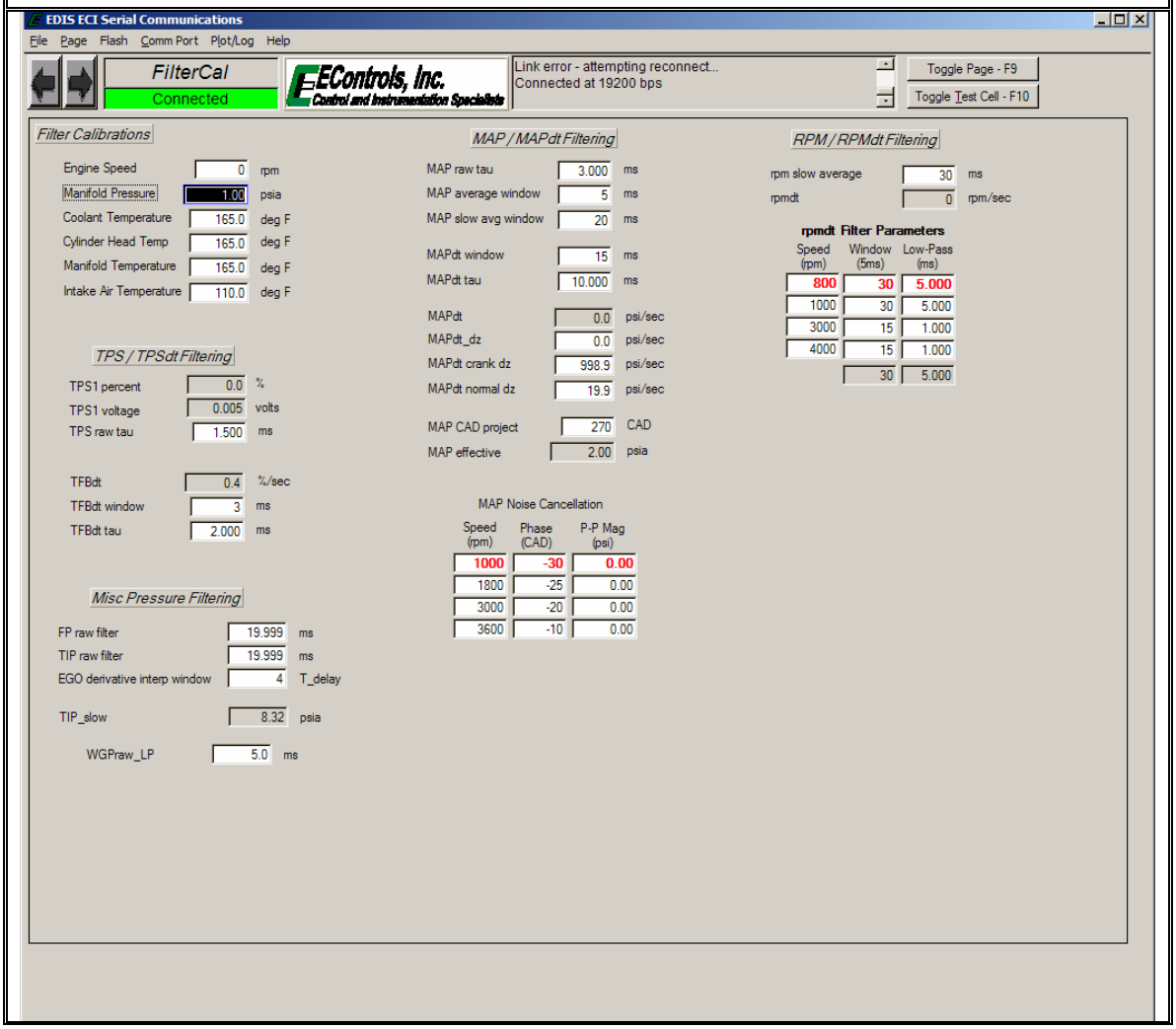


Secondary Functions:

- Defines torque estimation for data broadcast through EDIS and on CAN

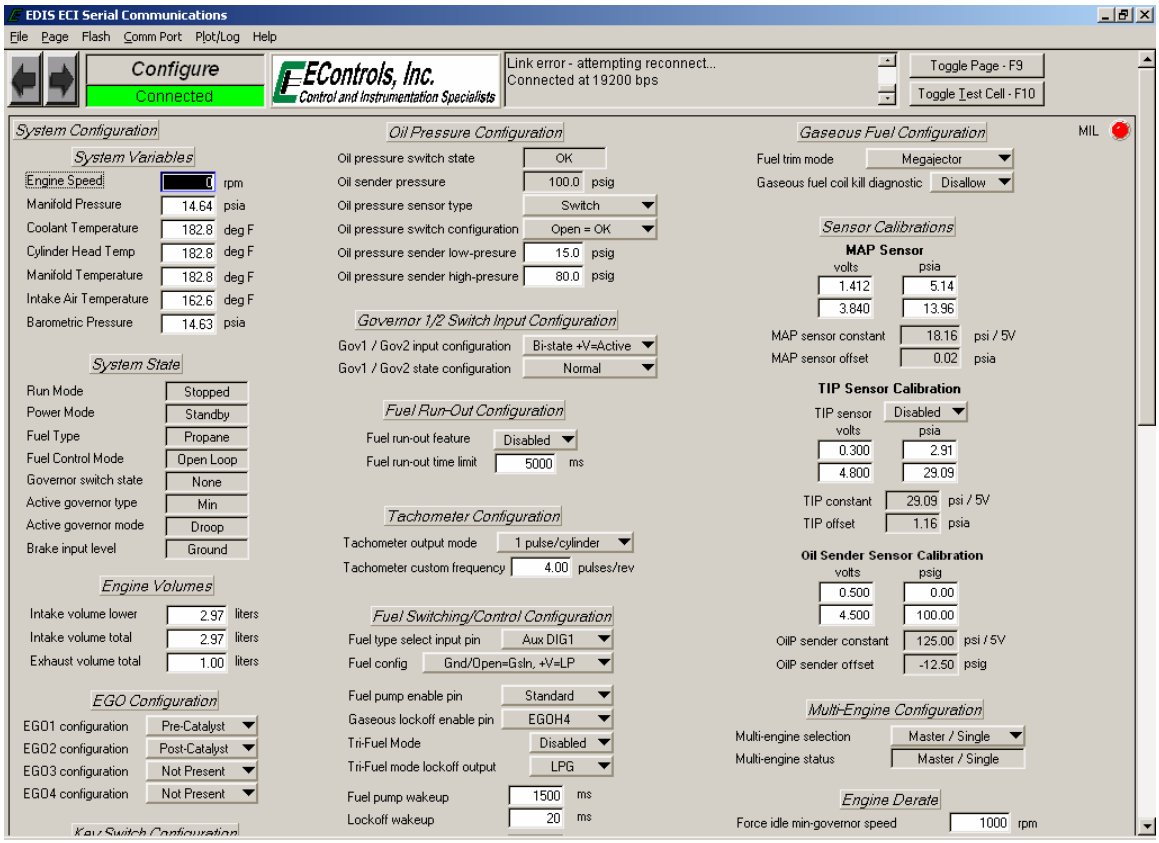
6. *FilterCal* Page

Main Function: Defines software filters for throttle position, fuel pressure, throttle inlet pressure, waste-gate pressure, manifold air pressure, and crankshaft position sensor feedback.



7. *Configure* Page

Main Function: Defines the engine hardware configuration.

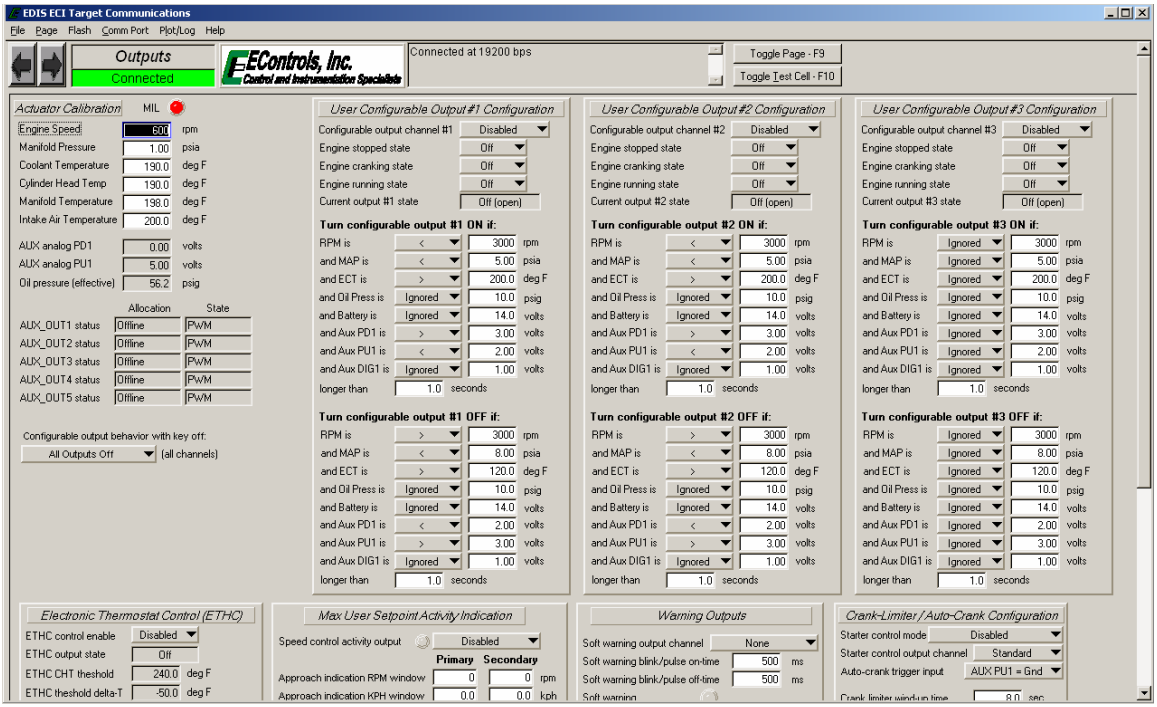


Secondary Functions:

- Defines feedback pressure sensor calibrations
- Defines the engine's fuel, sensor, and manifold configuration
- Defines the engine's derate and multi-engine synchronization configurations
- Displays the system state based on current operating conditions

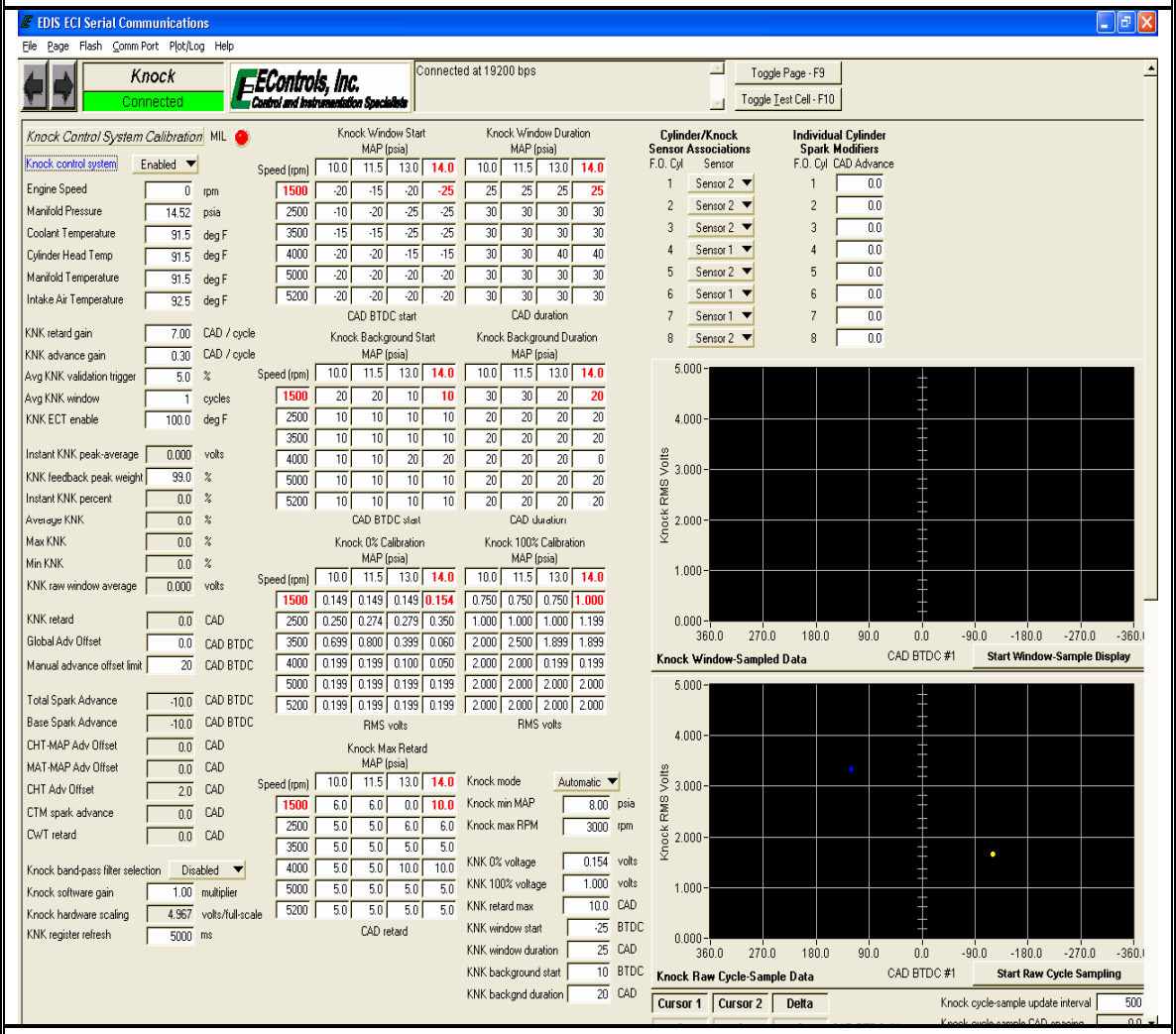
8. *Outputs* Page

Main Function: Configures starter relay control and user configurable low-side outputs used to control LEDs, audible warning devices, and relays.



9. *Knock* Page

Main Function: Configures the engine's knock calibration.

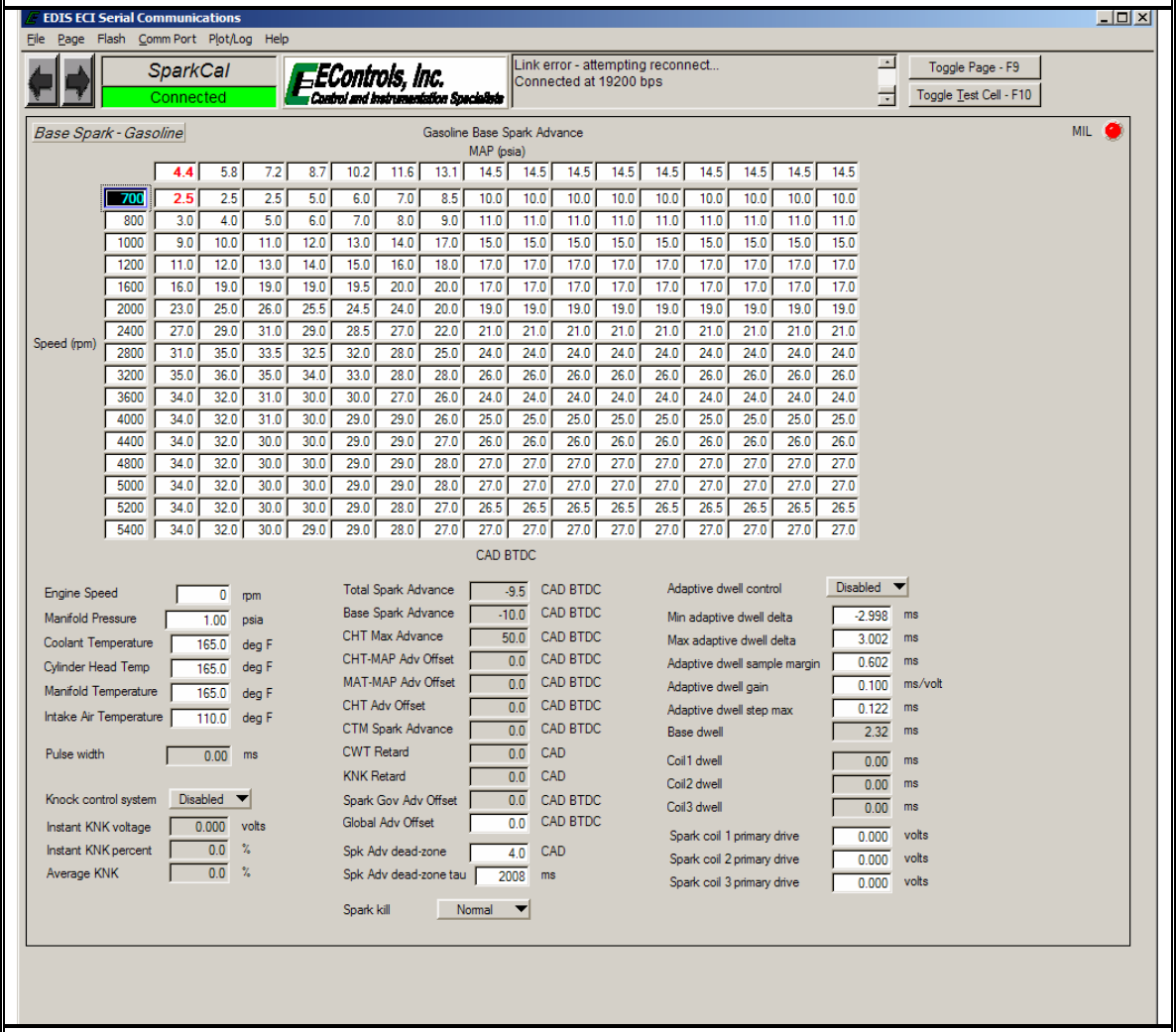


Secondary Functions:

- Contains a table for spark advance of individual cylinders
- Displays plots of real-time knock sensor feedback for knock window definition and knock sensor assignment
- Displays feedback pertinent to knock calibration

10. *SparkCal* Page

Main Function: Contains the base spark advance map for the engine when operating on Gasoline.



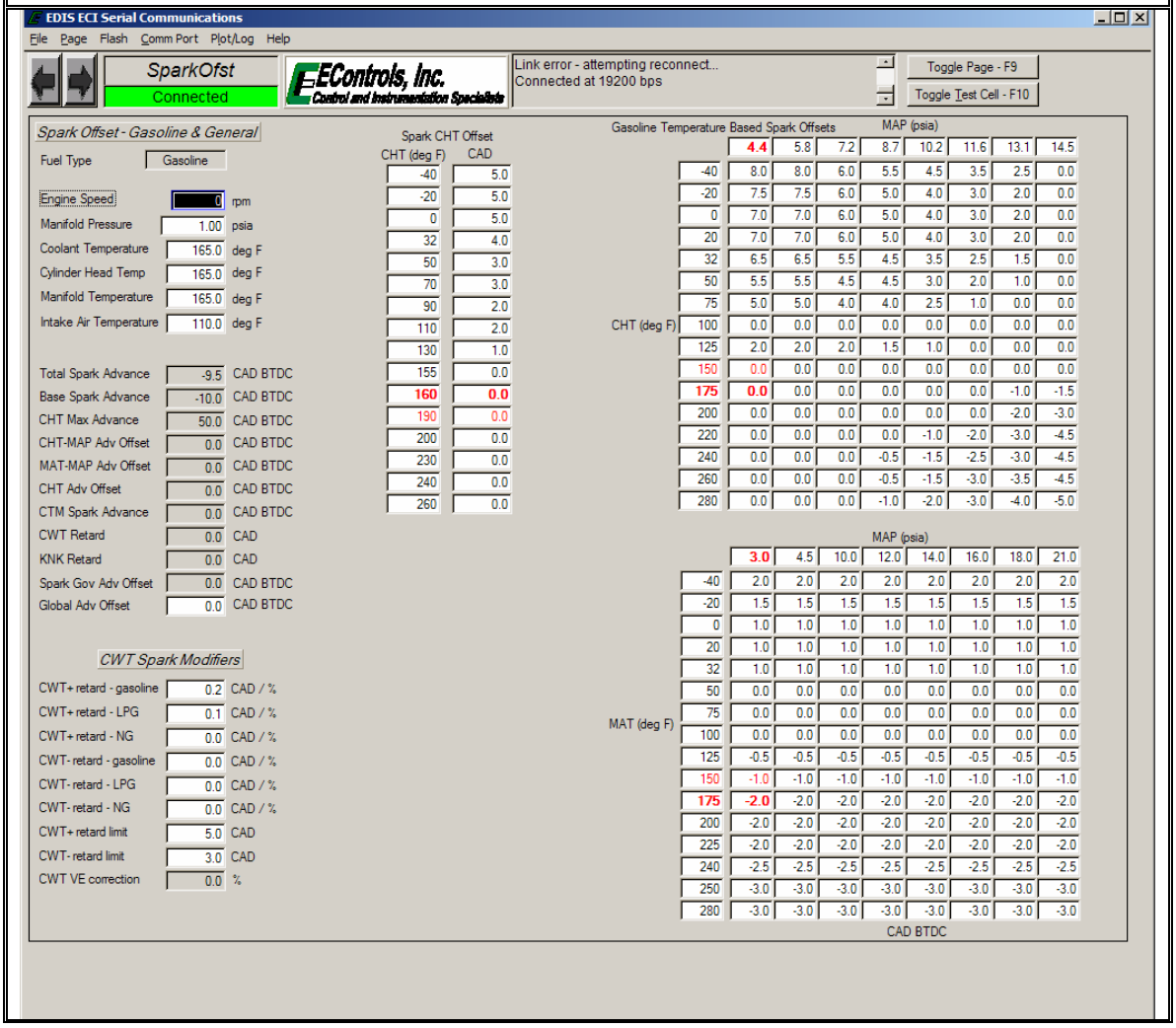
Speed (rpm) \ MAP (psia)	4.4	5.8	7.2	8.7	10.2	11.6	13.1	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
700	2.5	2.5	2.5	5.0	6.0	7.0	8.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
800	3.0	4.0	5.0	6.0	7.0	8.0	9.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
1000	9.0	10.0	11.0	12.0	13.0	14.0	17.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
1200	11.0	12.0	13.0	14.0	15.0	16.0	18.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
1600	16.0	19.0	19.0	19.0	19.5	20.0	20.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
2000	23.0	25.0	26.0	25.5	24.5	24.0	20.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
2400	27.0	29.0	31.0	29.0	28.5	27.0	22.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
2800	31.0	35.0	33.5	32.5	32.0	28.0	25.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
3200	35.0	36.0	35.0	34.0	33.0	28.0	28.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
3600	34.0	32.0	31.0	30.0	30.0	27.0	26.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
4000	34.0	32.0	31.0	30.0	29.0	29.0	26.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
4400	34.0	32.0	30.0	30.0	29.0	29.0	27.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
4800	34.0	32.0	30.0	30.0	29.0	29.0	28.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
5000	34.0	32.0	30.0	30.0	29.0	29.0	28.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
5200	34.0	32.0	30.0	30.0	29.0	28.0	27.0	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
5400	34.0	32.0	30.0	29.0	29.0	28.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0

Secondary Functions:

- Displays feedback and command information pertinent to defining the spark calibration

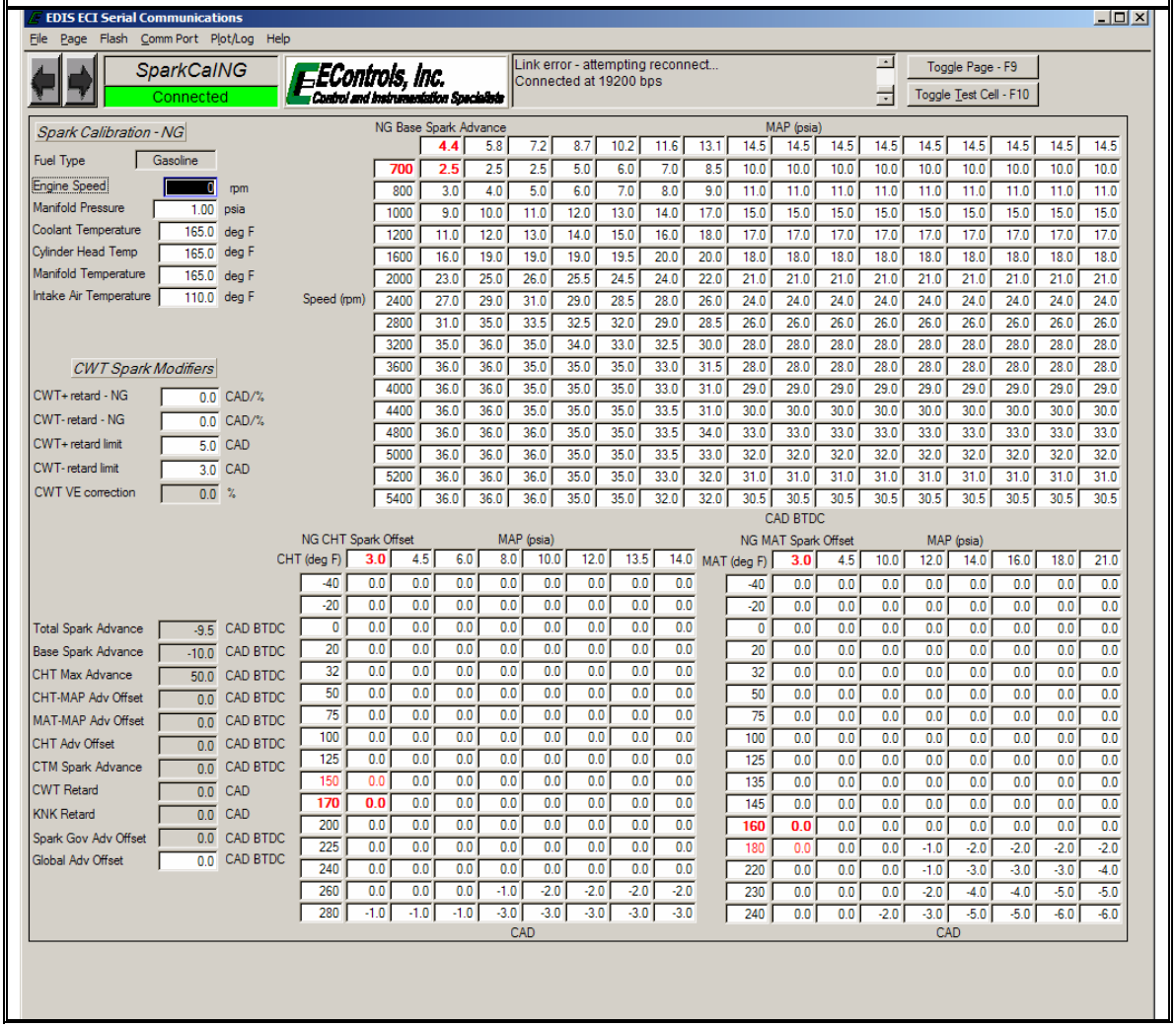
11. *SparkOfst* Page

Main Function: Contains the spark advance offset calibrations based on cylinder head temperature and manifold air temperature for the engine when operating on Gasoline.



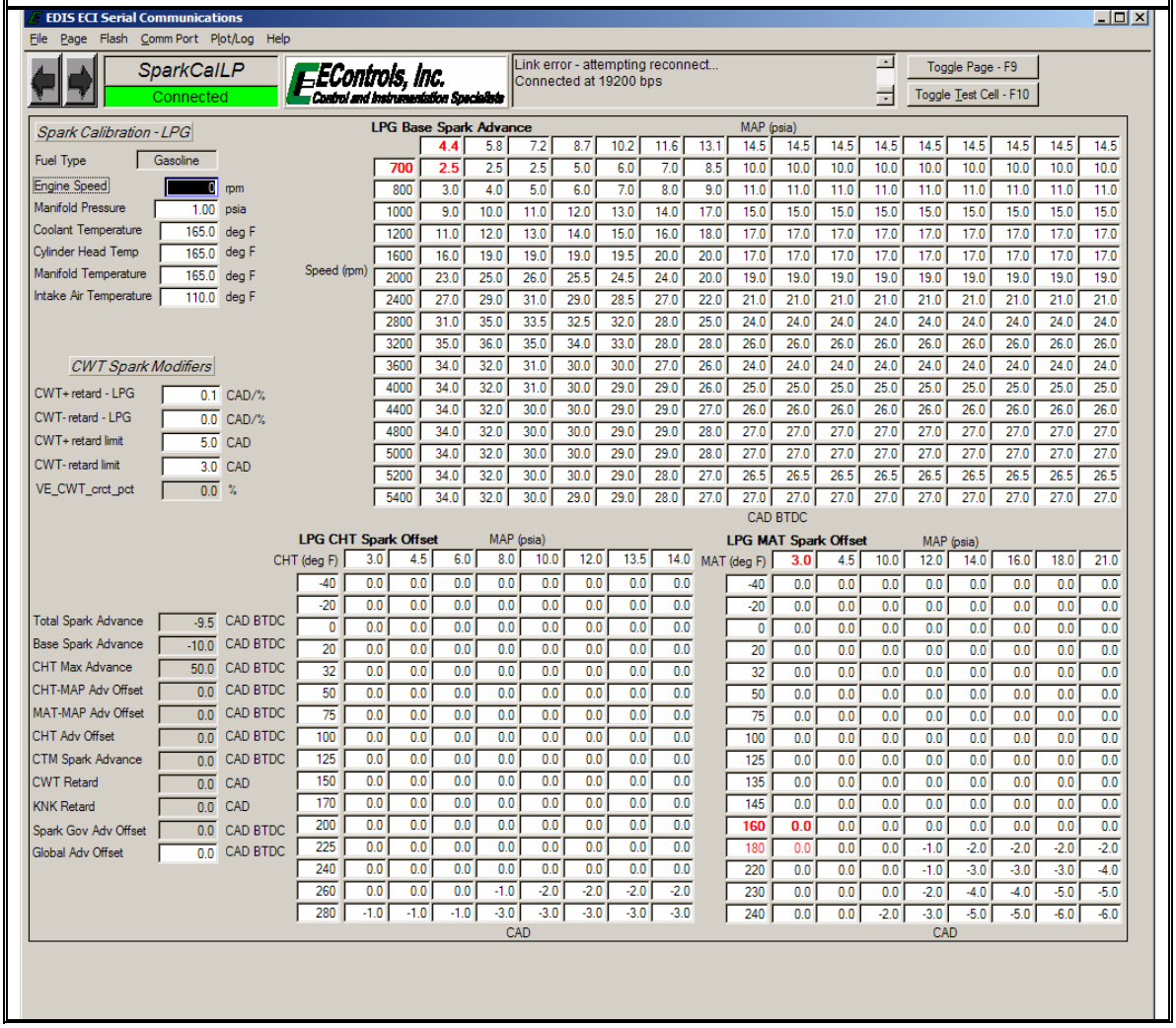
12. *SparkCalNG* Page

Main Function: Contains the base spark advance and spark advance offset calibrations for the engine when operating on Natural Gas.



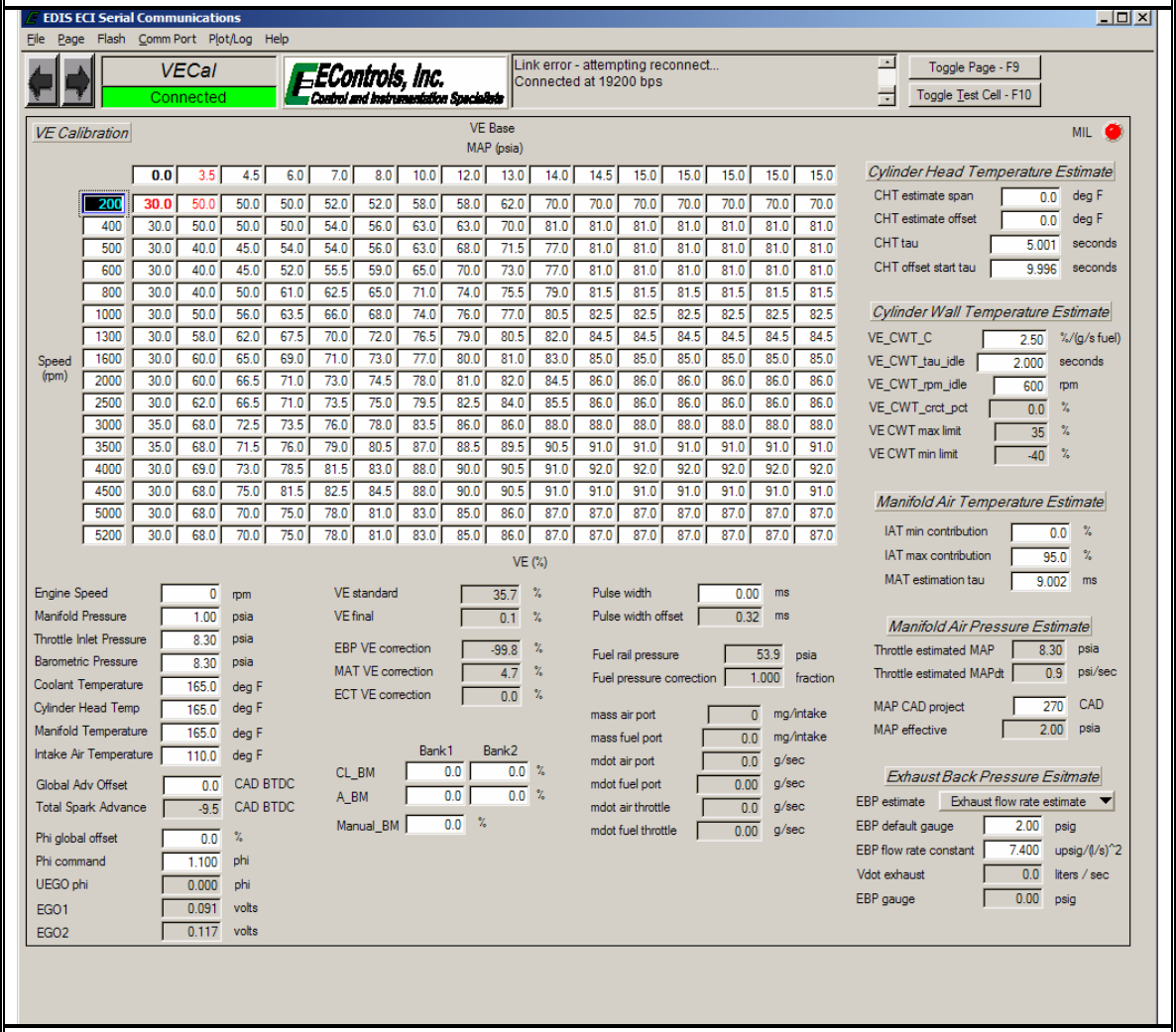
13. *SparkCalLP* Page

Main Function: Contains the base spark advance and spark advance offset calibrations for the engine when operating on Liquefied Propane.



14. *VECal* Page

Main Function: Defines the engine's volumetric efficiency calibration.

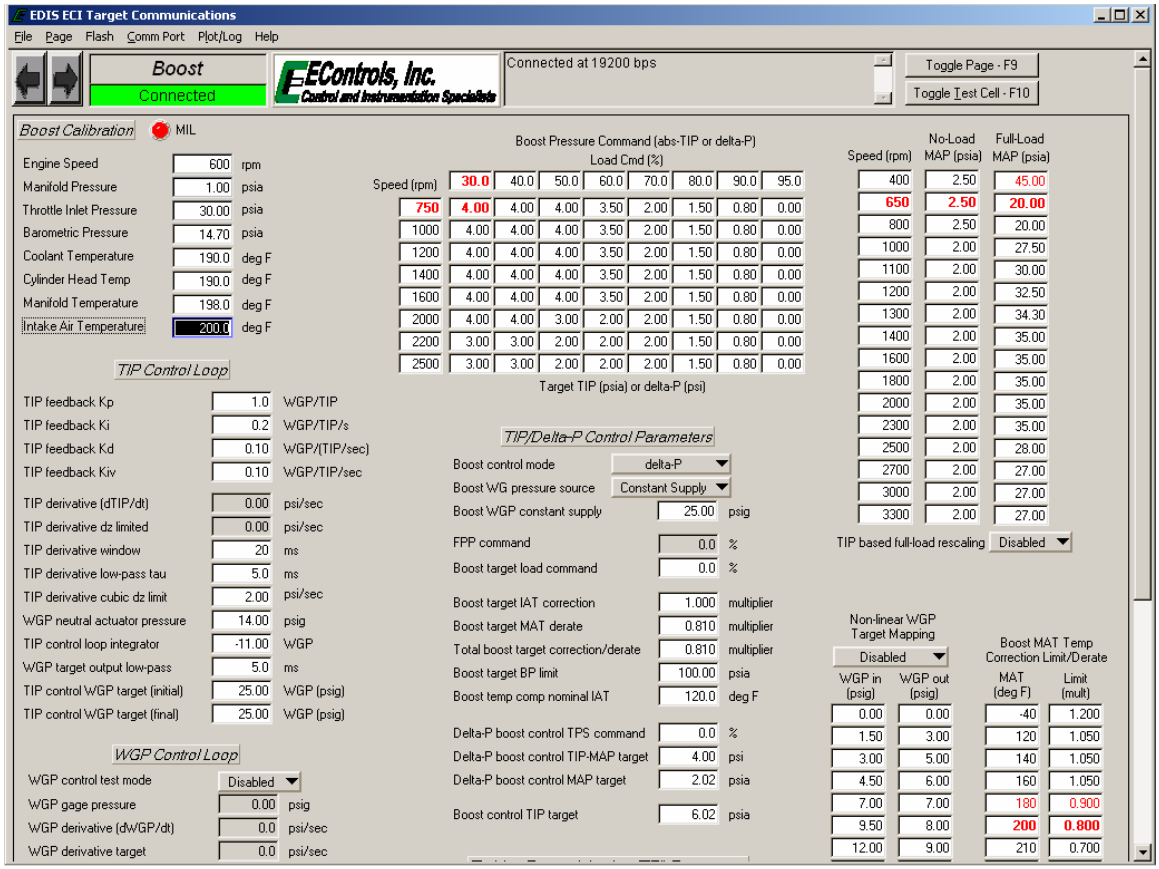


Secondary Functions:

- Defines the model-based calibrations for cylinder head temperature, cylinder wall temperature, manifold air temperature, effective manifold air pressure, and exhaust back-pressure.

15. *Boost* Page

Main Function: Defines a turbocharged or supercharged engine's boost control calibration

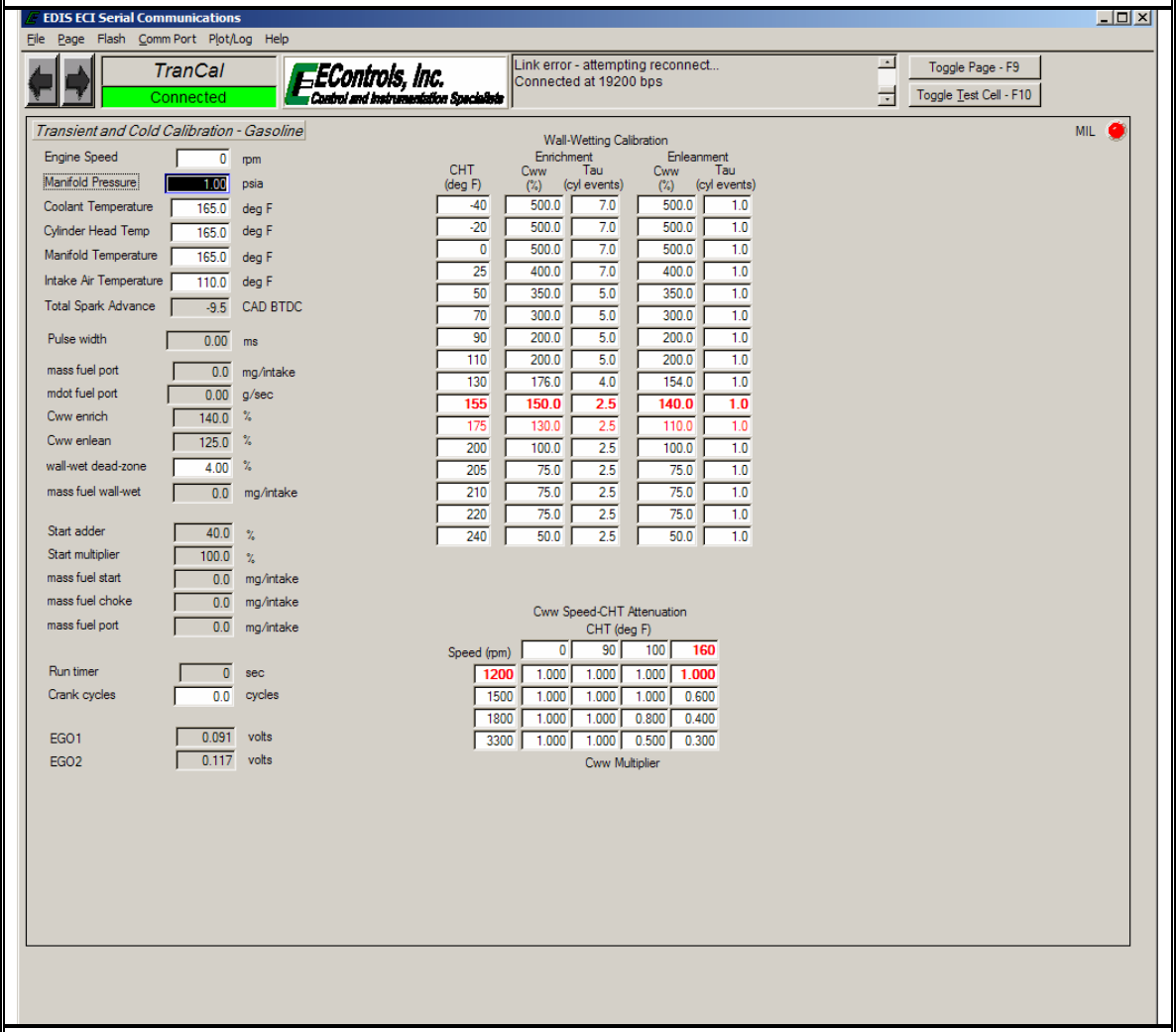


Secondary Functions:

- Defines boost bypass waste-gate control
- Configures TIP sensor control parameters
- Defines Turbine Energy Injection calibration

16. *TranCal* Page

Main Function: Defines the engine's transient fueling calibration for the engine when operating on Gasoline.

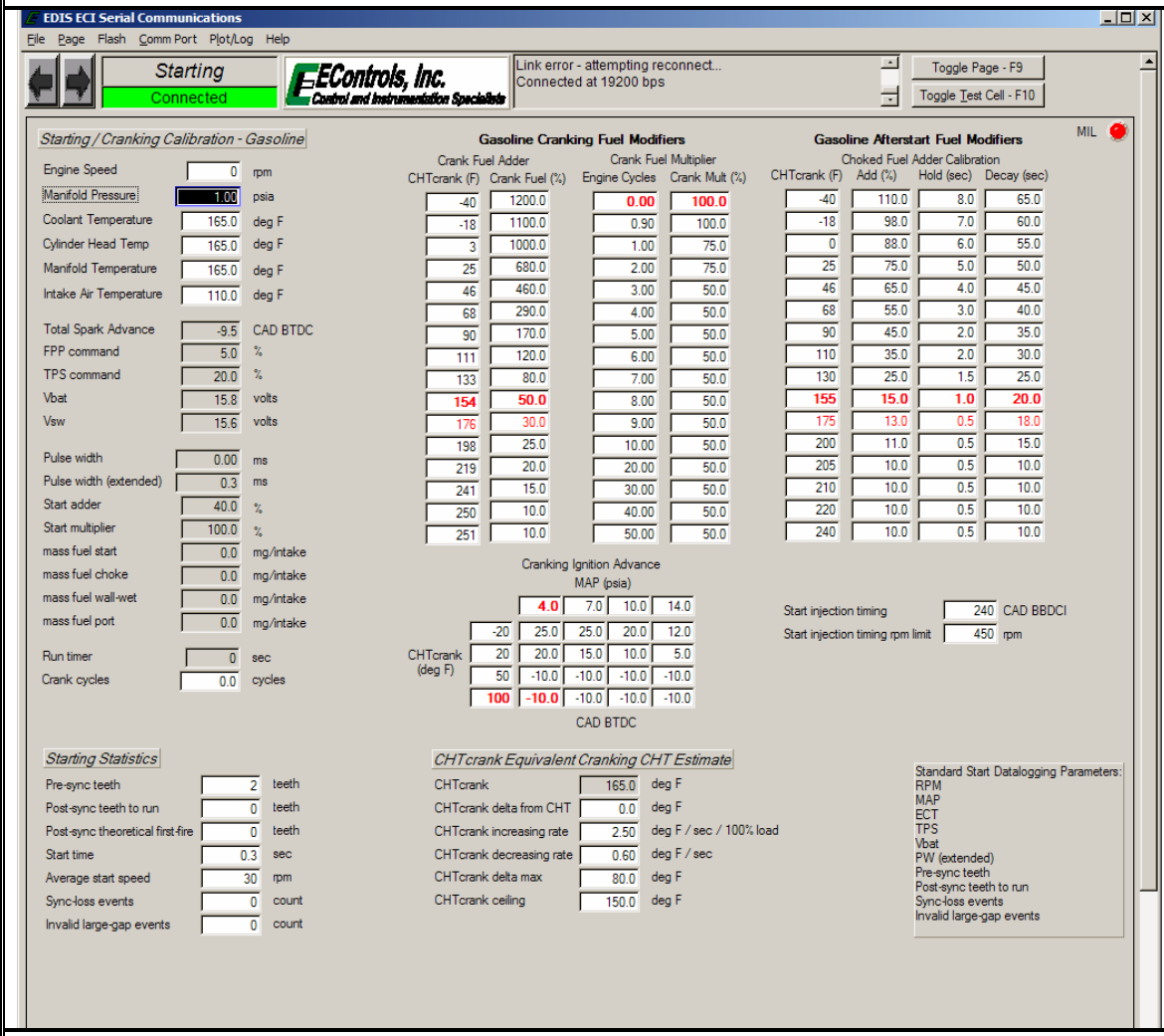


Secondary Functions:

- Contains the cylinder wall-wetting gain schedule based on engine speed and cylinder head temperature.

17. *Starting* Page

Main Function: Contains the fuel and spark advance calibration for starting.

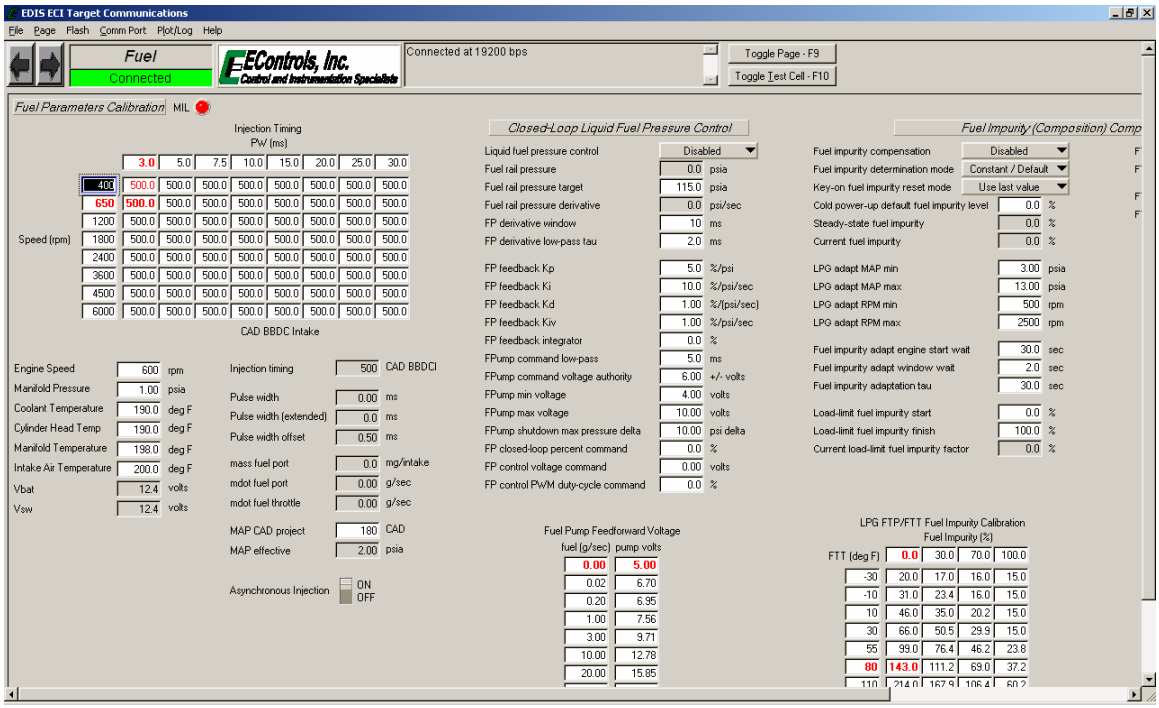


Secondary Functions:

- Contains fuel modifiers for an engine fueled on gasoline
- Displays starting synchronization statistics

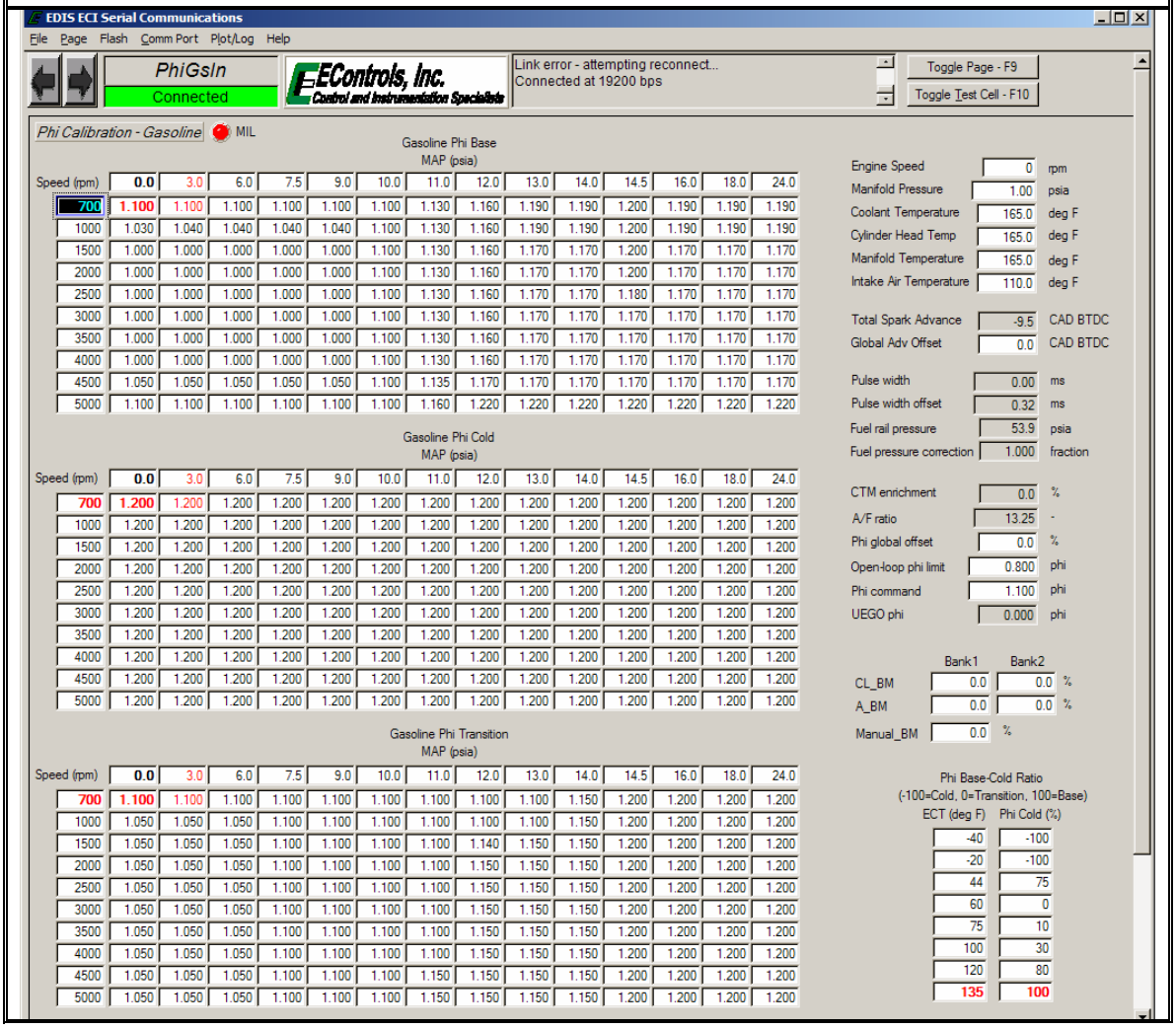
18. *Fuel* Page

Main Function: Contains the injector timing calibration controlling injectors fire during the engine cycle, configures closed-loop fuel pump control, and defines the fuel impurity calibration for inferring gaseous fuel composition.



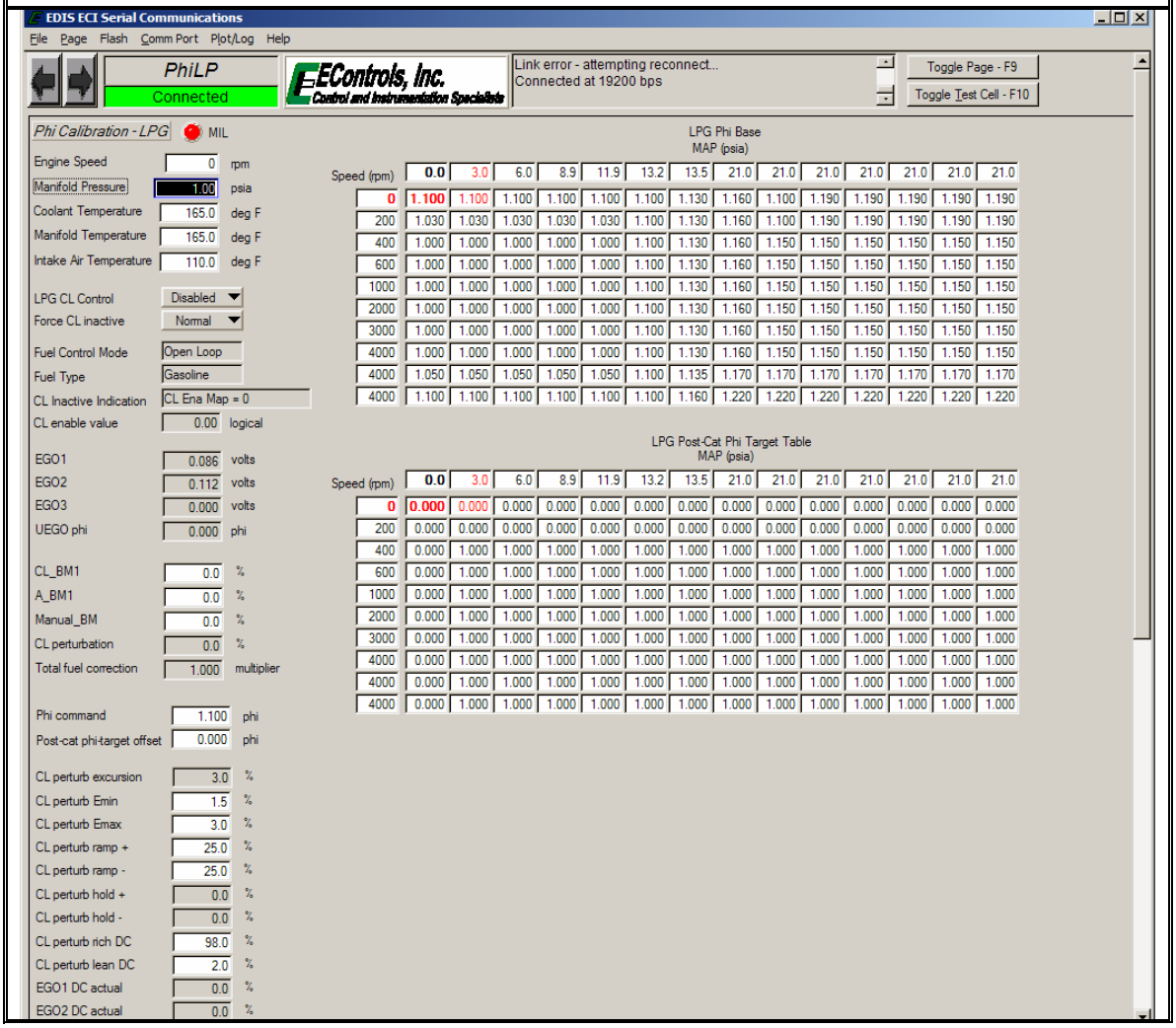
19. *PhiGsIn* Page

Main Function: Defines the gasoline fueling calibration based on engine coolant temperature.



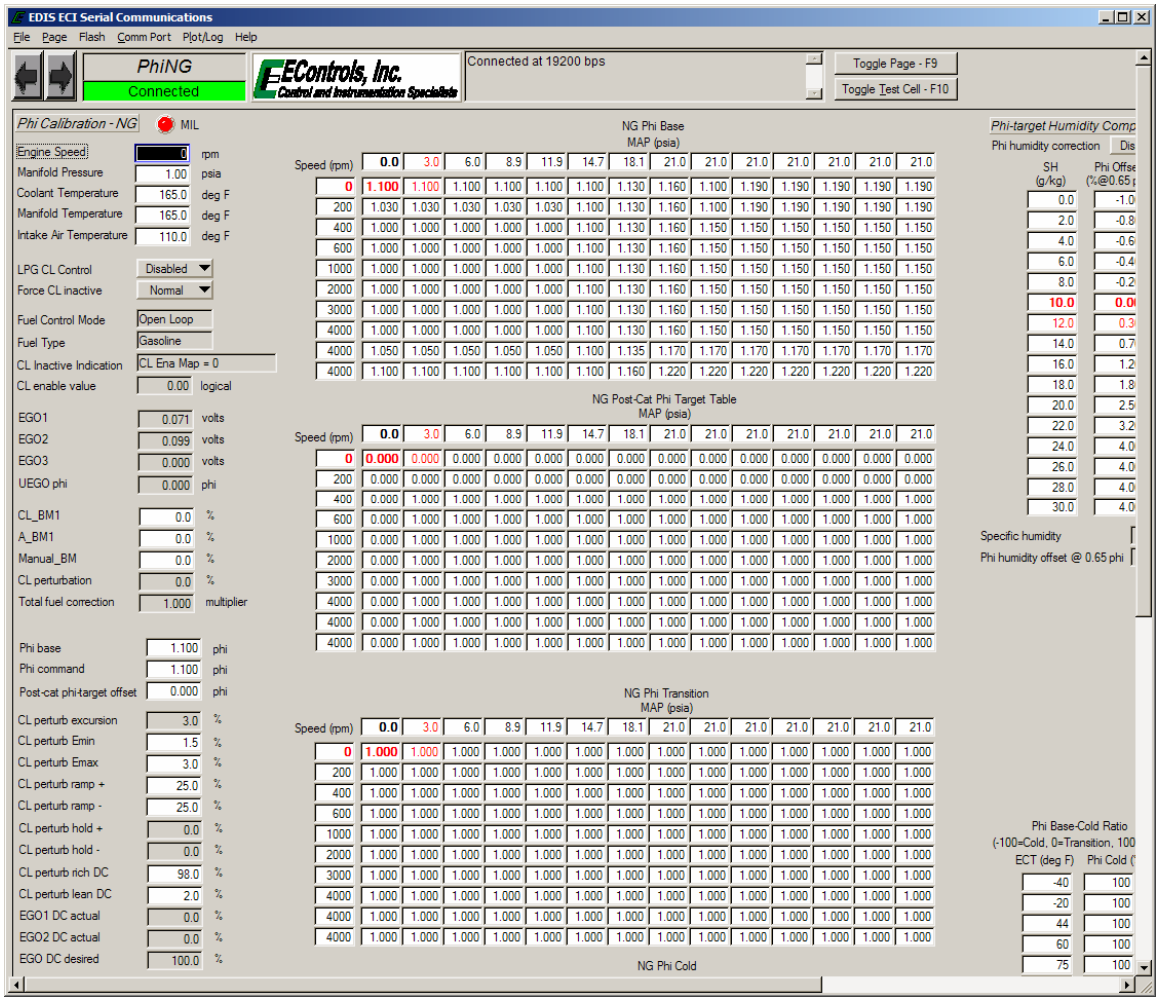
20. *PhiLP* Page

Main Function: Defines fuel and fuel trim calibrations for the engine when operating on Liquefied Propane.



21. *PhiNG* Page

Main Function: Defines fuel and fuel trim calibrations based on engine coolant temperature for the engine when operating on Natural Gas.

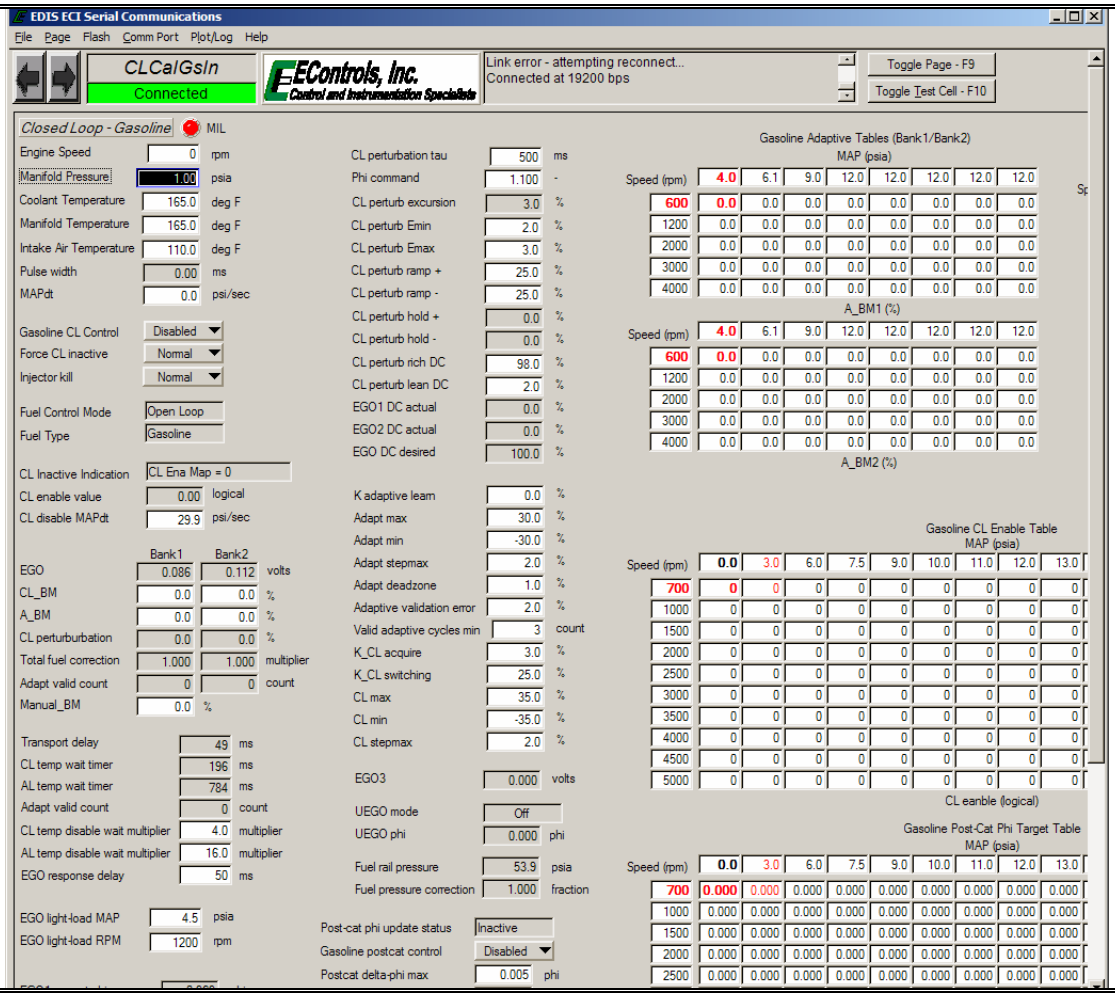


Secondary Functions:

- Defines the fuel correction calibration relative to humidity for NG operation (only applicable for use with Envirotech™ fitted systems)

22. *CLCalGsIn* Page

Main Function: Defines the closed-loop calibration for the engine when operating on Gasoline.

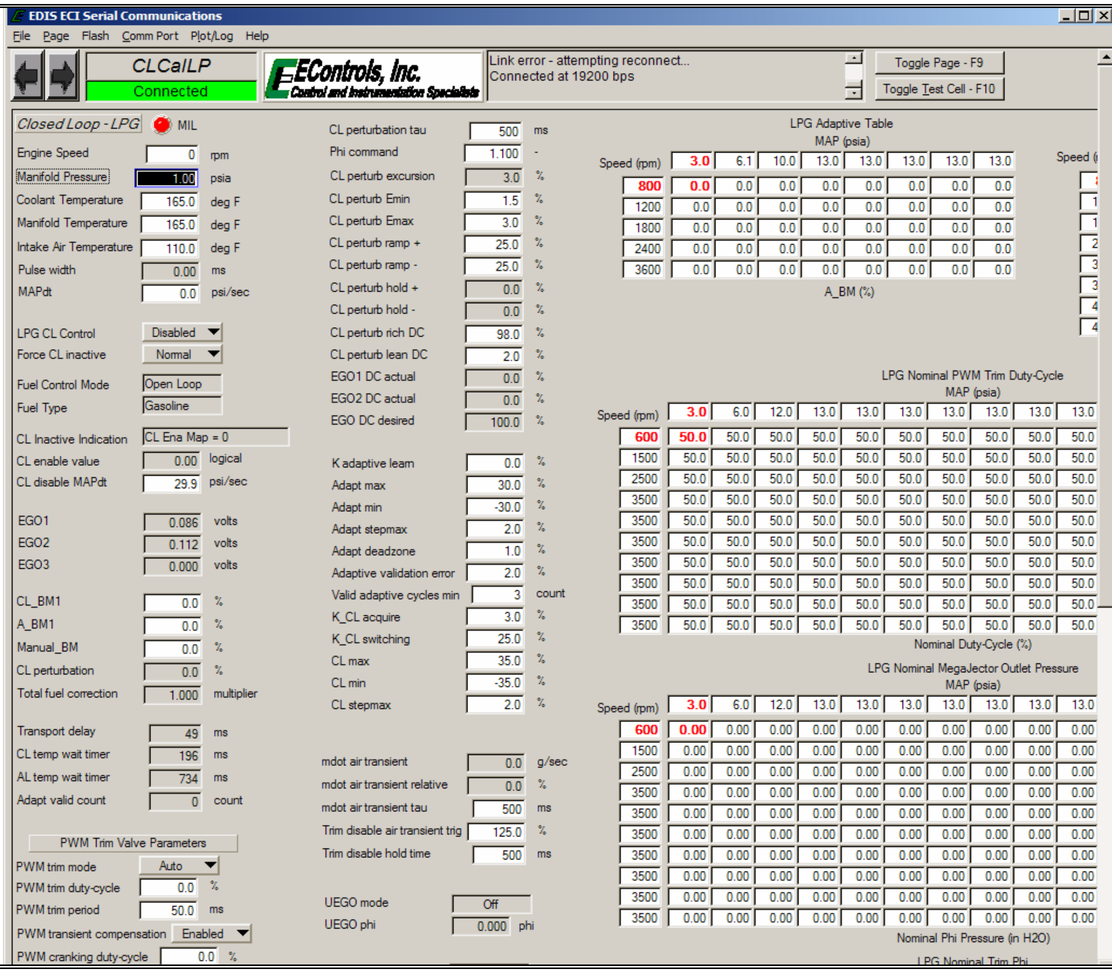


Secondary Functions:

- Displays feedback information for closed-loop (CL) control
- Displays adaptive fuel correction for each pre-catalyst exhaust gas oxygen sensor (EGO)
- Defines the closed-loop switching frequency of pre-catalyst EGO sensors
- Defines the calibration for CL fueling excursions
- Defines CL operating conditions
- Defines fuel trim based on post-catalyst EGO feedback

23. *CLCalLP* Page

Main Function: Defines the closed-loop calibration for the engine when operating on Liquefied Propane.

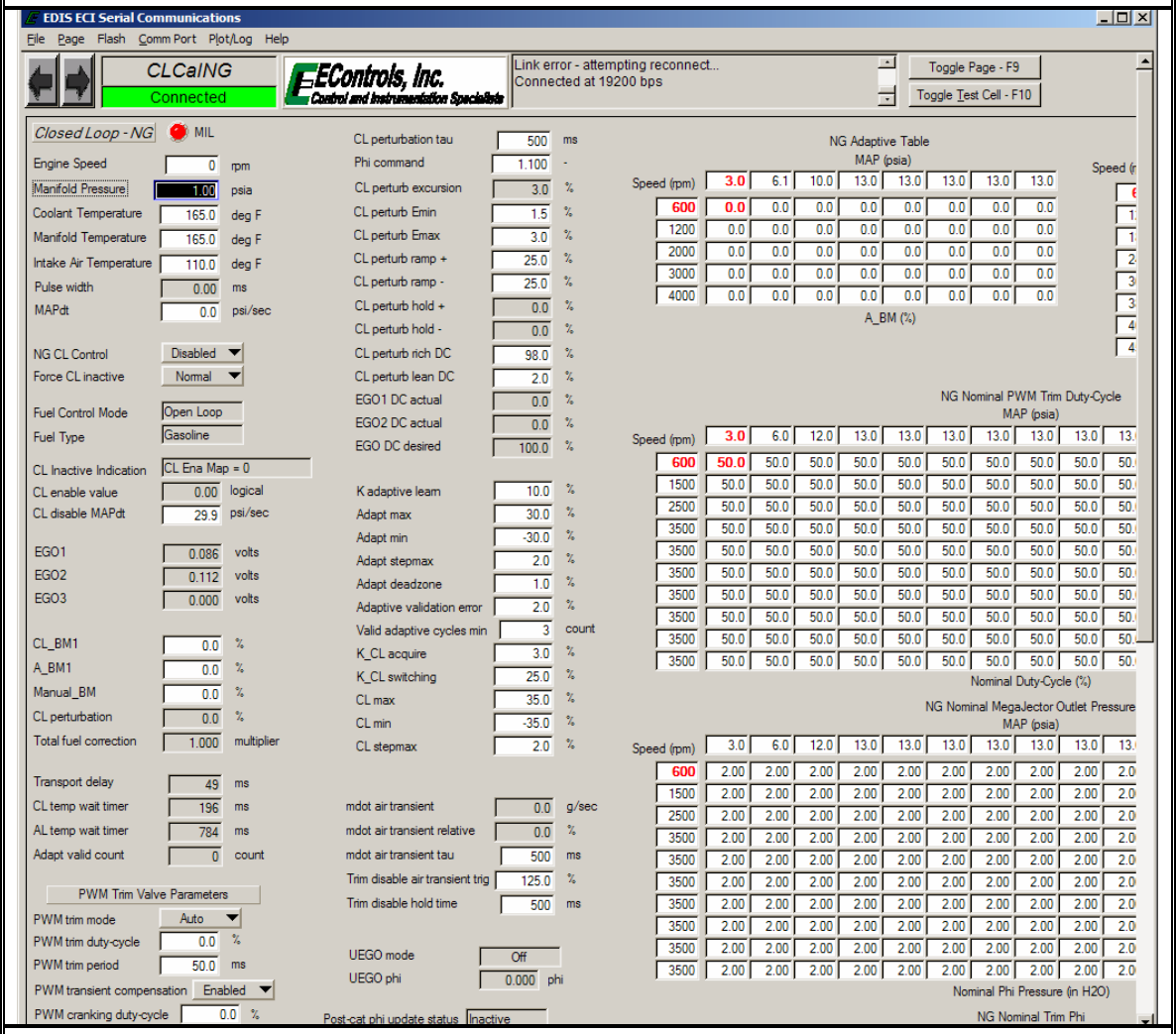


Secondary Functions:

- Displays feedback information for closed-loop (CL) control
- Displays adaptive fueling for Propane operation
- Defines the closed-loop switching frequency of the pre-catalyst EGO sensors for Propane operation
- Defines the calibration for CL Propane fueling excursions
- Defines CL operation conditions for Propane operation
- Defines nominal commands for Propane fuel control
- Defines a carburetor's flow characteristics

24. *CLCalNG* Page

Main Function: Defines the closed-loop calibration for the engine when operating on Natural Gas.

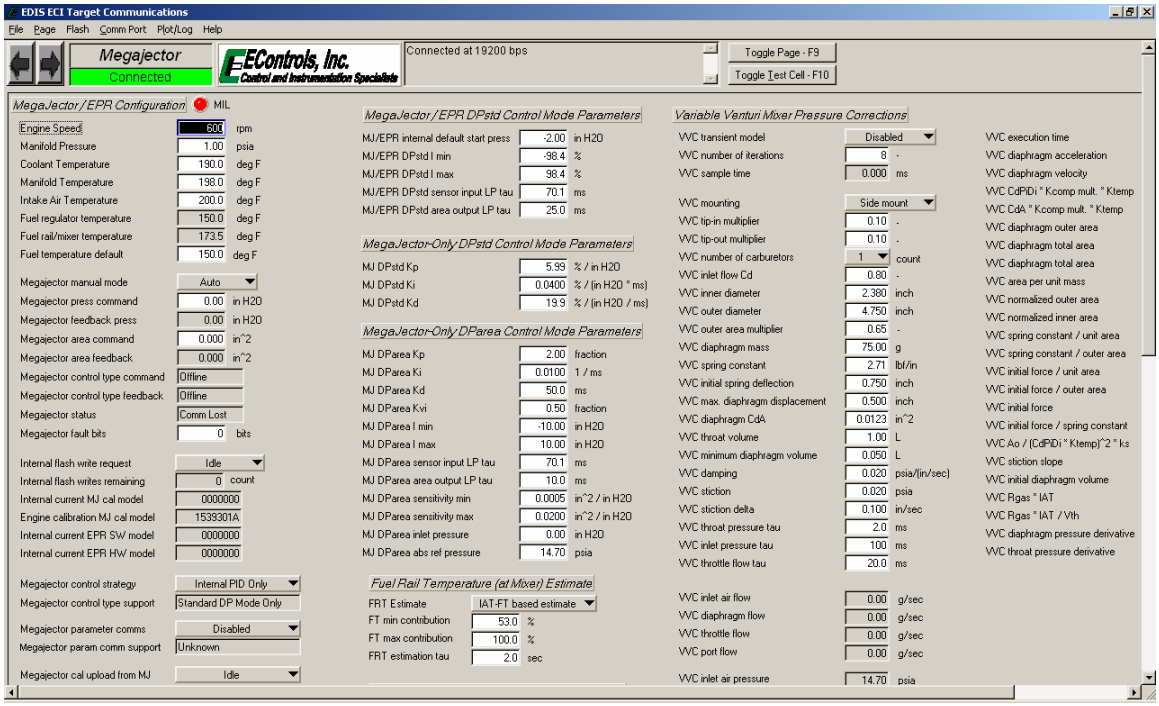


Secondary Functions:

- Displays adaptive fueling for Natural Gas operation
- Defines the closed-loop switching frequency of the pre-catalyst EGO sensors for Natural Gas operation
- Defines the calibration for CL Natural Gas fueling excursions
- Defines CL operating conditions for Natural Gas operation
- Defines nominal commands for Natural Gas fuel control
- Defines a carburetor's flow characteristics.

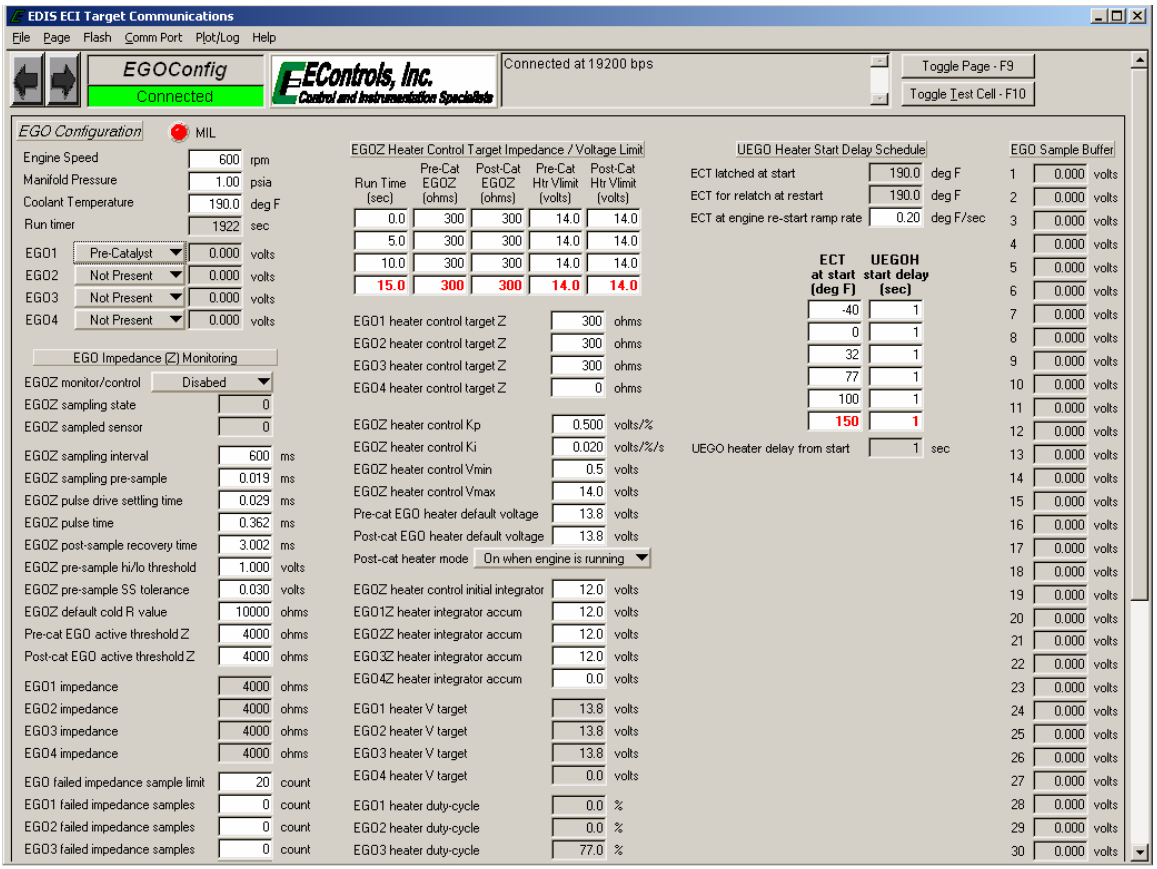
25. *Megajector* Page

Main Function: Configures the Megajector/EPR, gaseous fuel temperature estimate, and carburetor pressure correction model.



26. *EGOConfig* Page

Main Function: Defines the heated exhaust gas oxygen sensor configuration

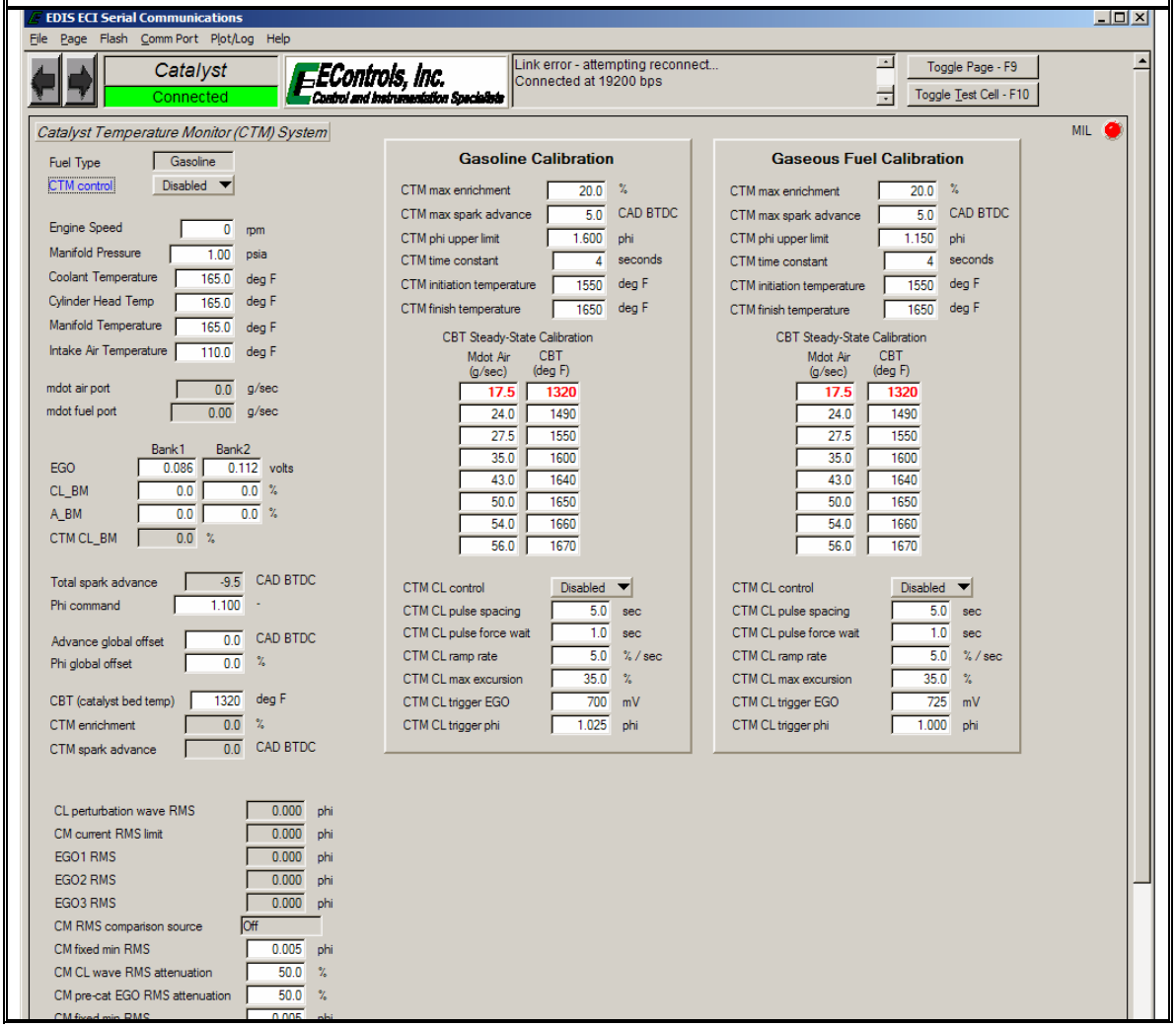


Secondary Functions:

- Defines which HEGO sensor is used for bank-to-bank pre-catalyst and post-catalyst control.
- Defines the HEGO/UEGO sensor heater control calibration
- Displays data pertinent to HEGO/UEGO sensor operation

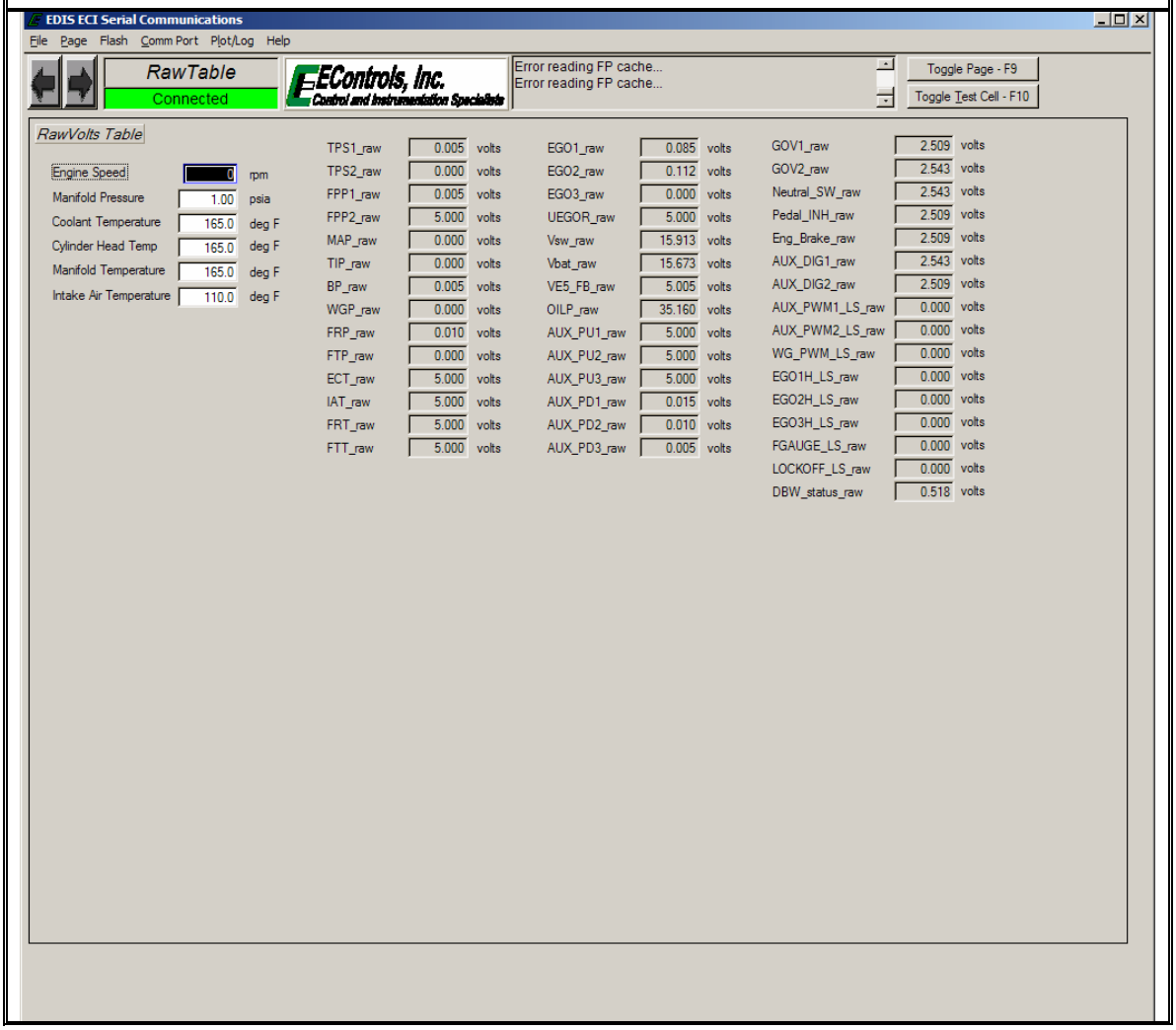
27. *Catalyst* Page

Main Function: Defines the calibration for catalyst protection fuel enrichment based on estimated catalyst temperature relative to air flow.



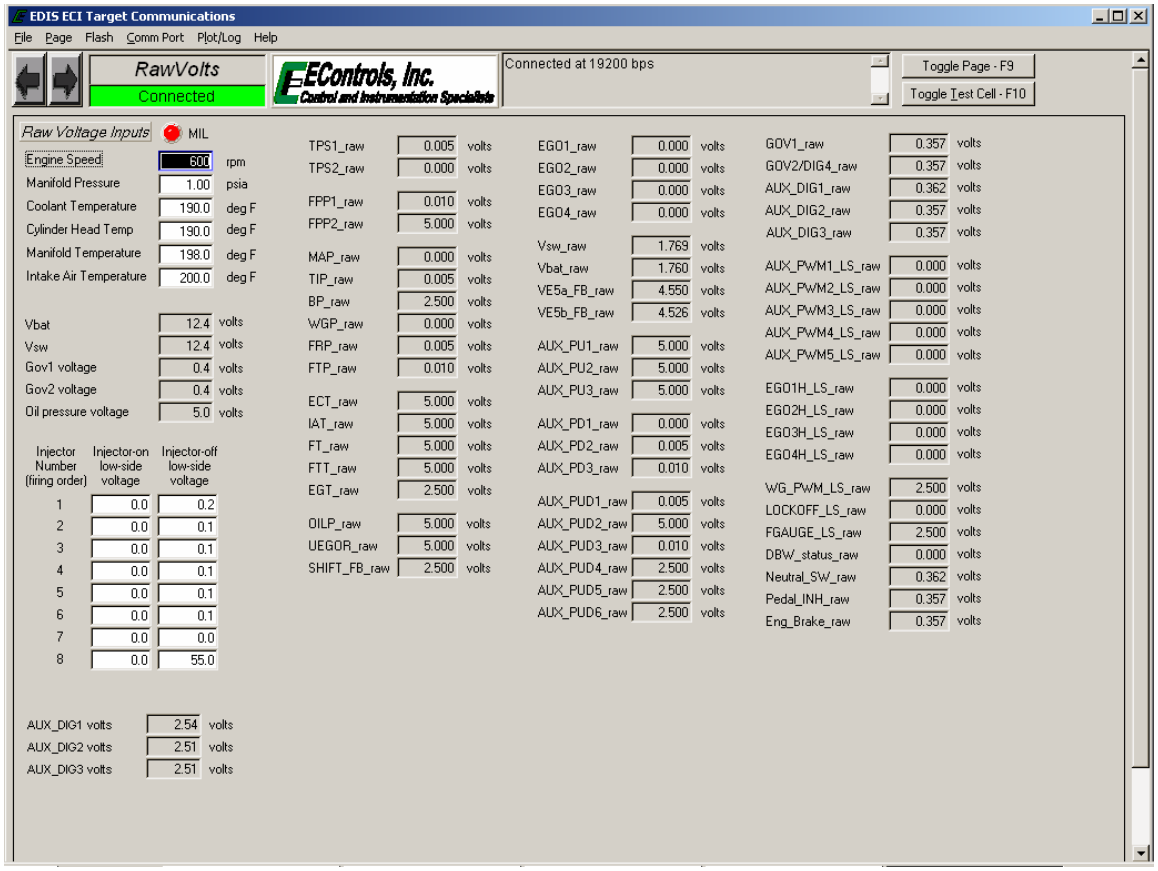
28. *RawTable* Page

Main Function: Displays raw voltage feedback from ECM inputs and outputs.



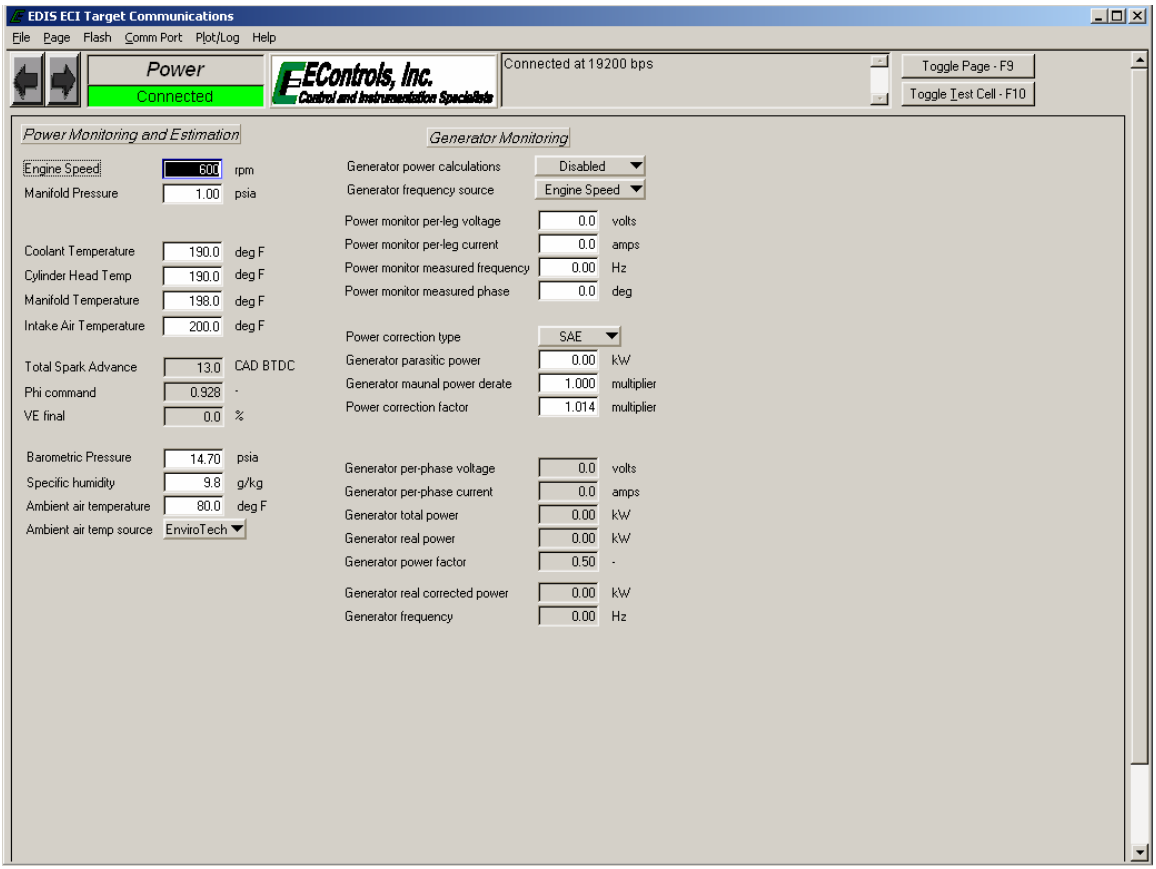
29. *RawVolts* Page

Main Function: Displays most commonly referenced raw voltage feedback from ECM inputs.



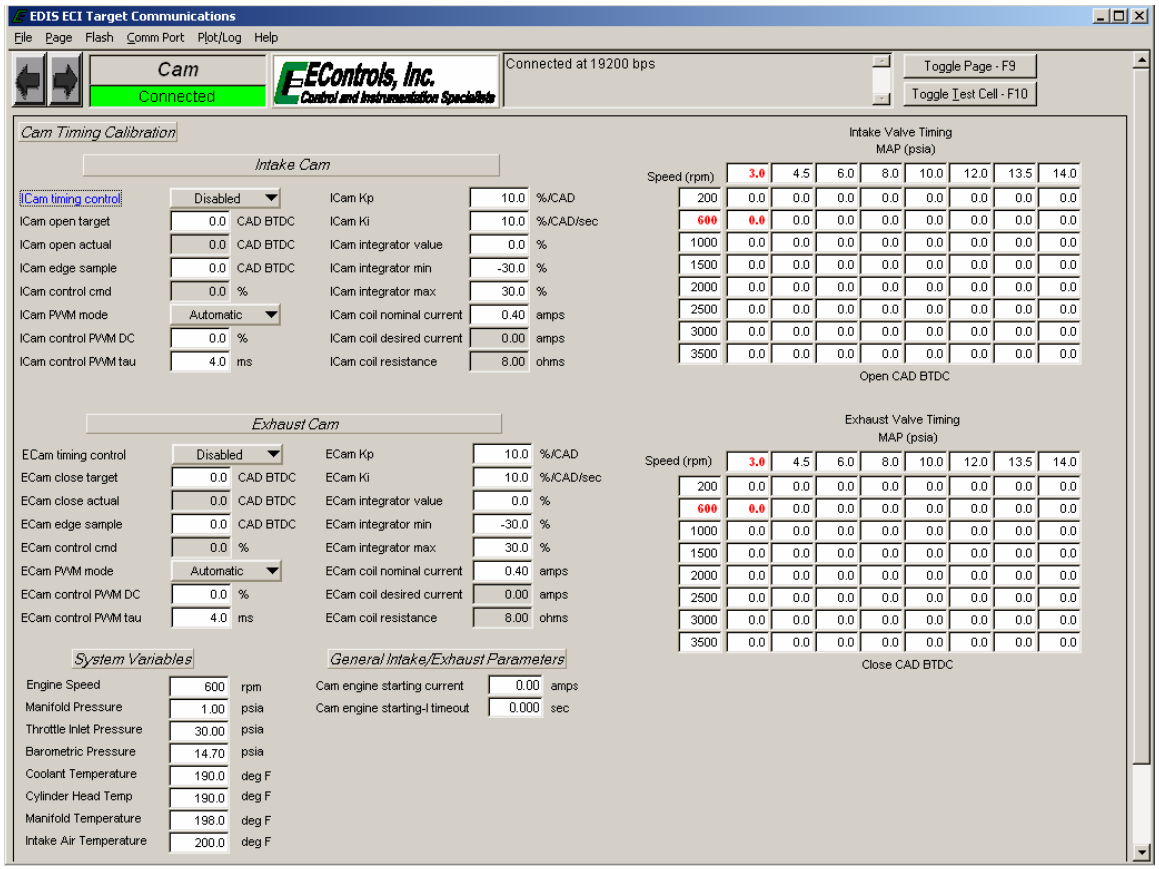
30. *Power* Page

Main Function: Displays generator power monitoring data and ambient conditions.



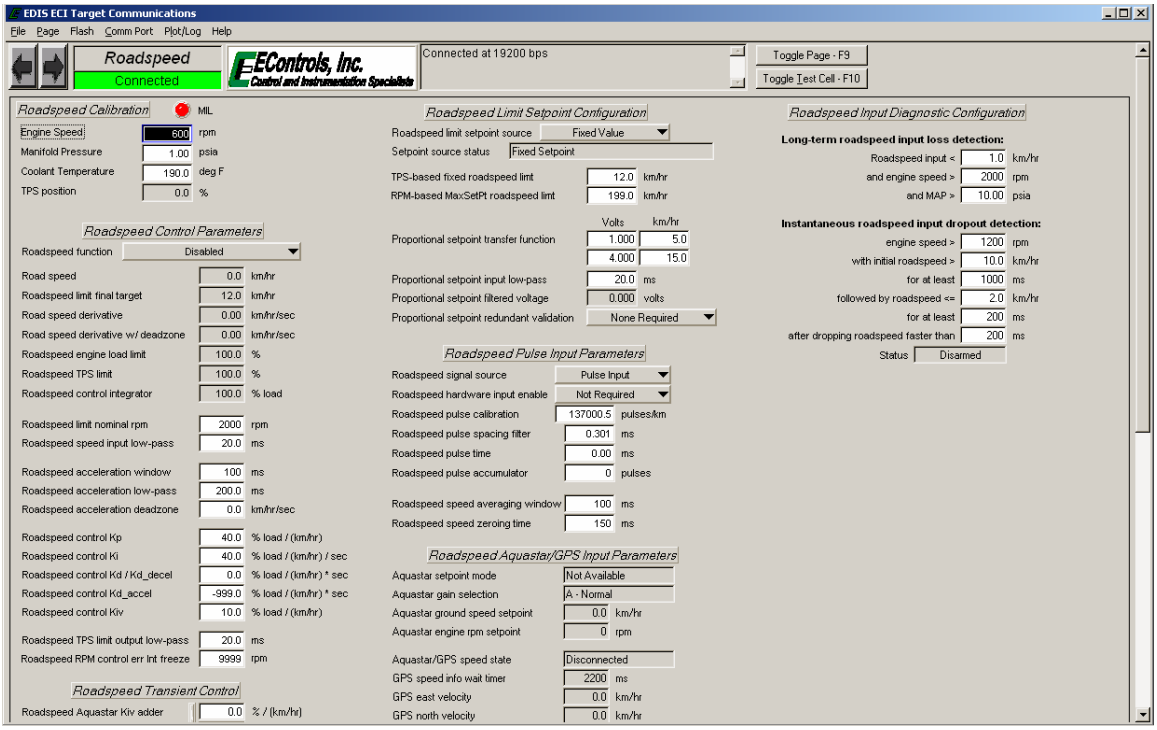
31. *Cam* Page

Main Function: Defines cam position calibration for variable cam engines.



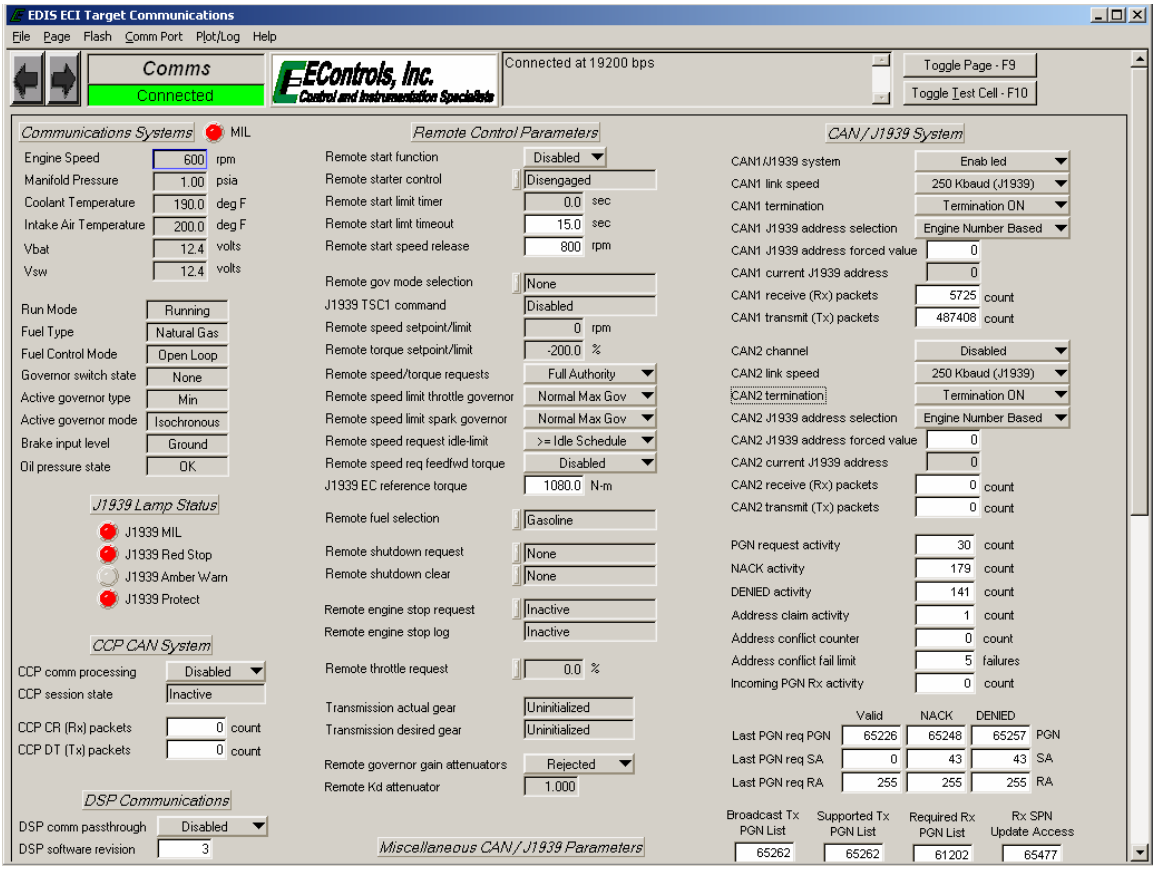
32. *Roadspeed* Page

Main Function: Configures roadspeed/vehicle speed sensor calibration, displays vehicle speed feedback, configures roadspeed speed control limiting system, and configures roadspeed diagnostic calibration.



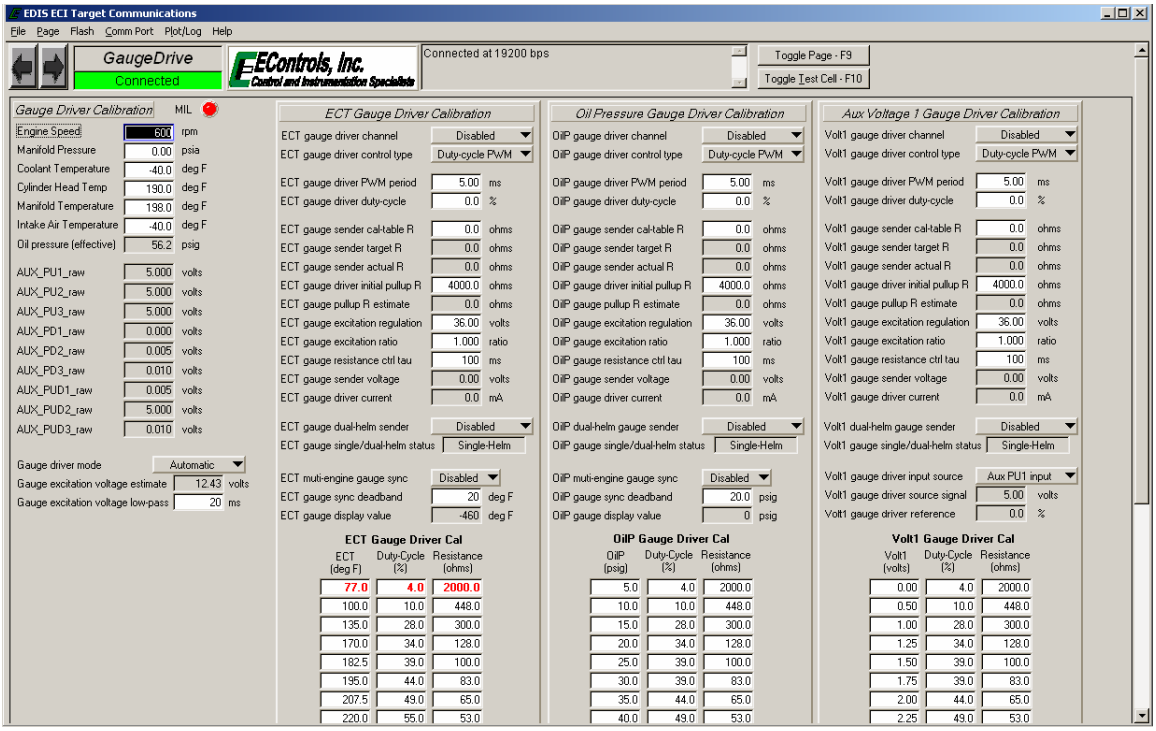
33. *Comms* Page

Main Function: Defines parameters broadcast via CAN communication, permits serial communication with digital signal processors, and permits remote starting.



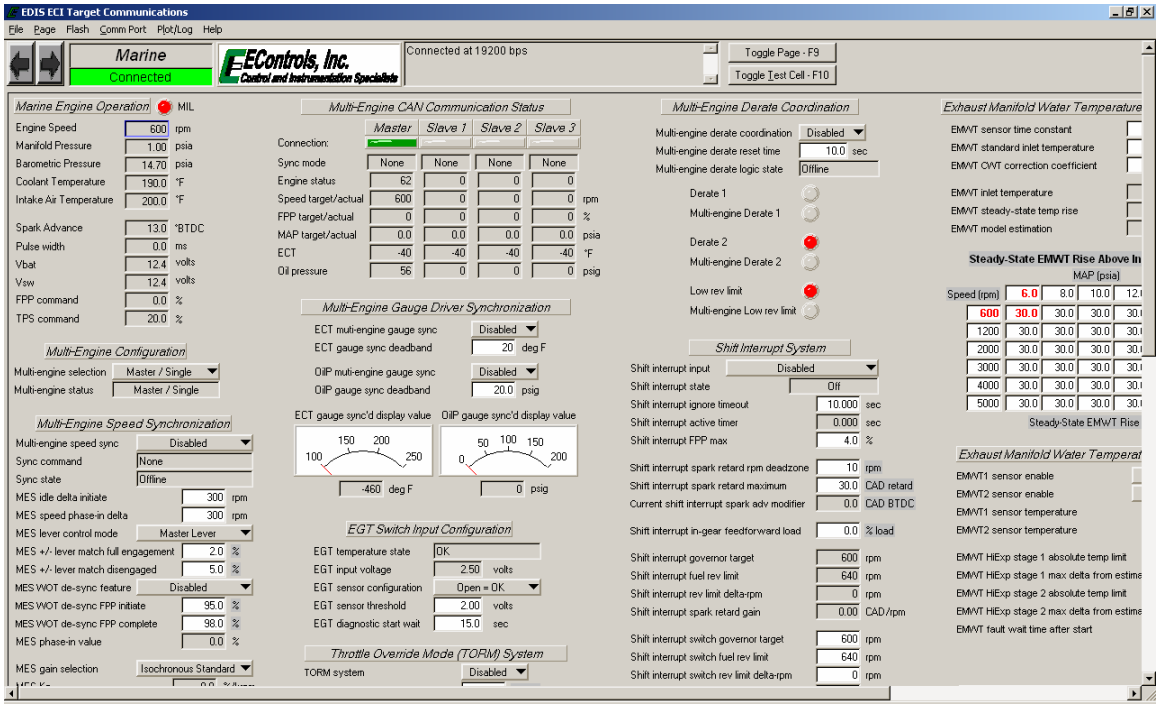
34. *GaugeDrive* Page

Main Function: Configures analog gauge driver circuits



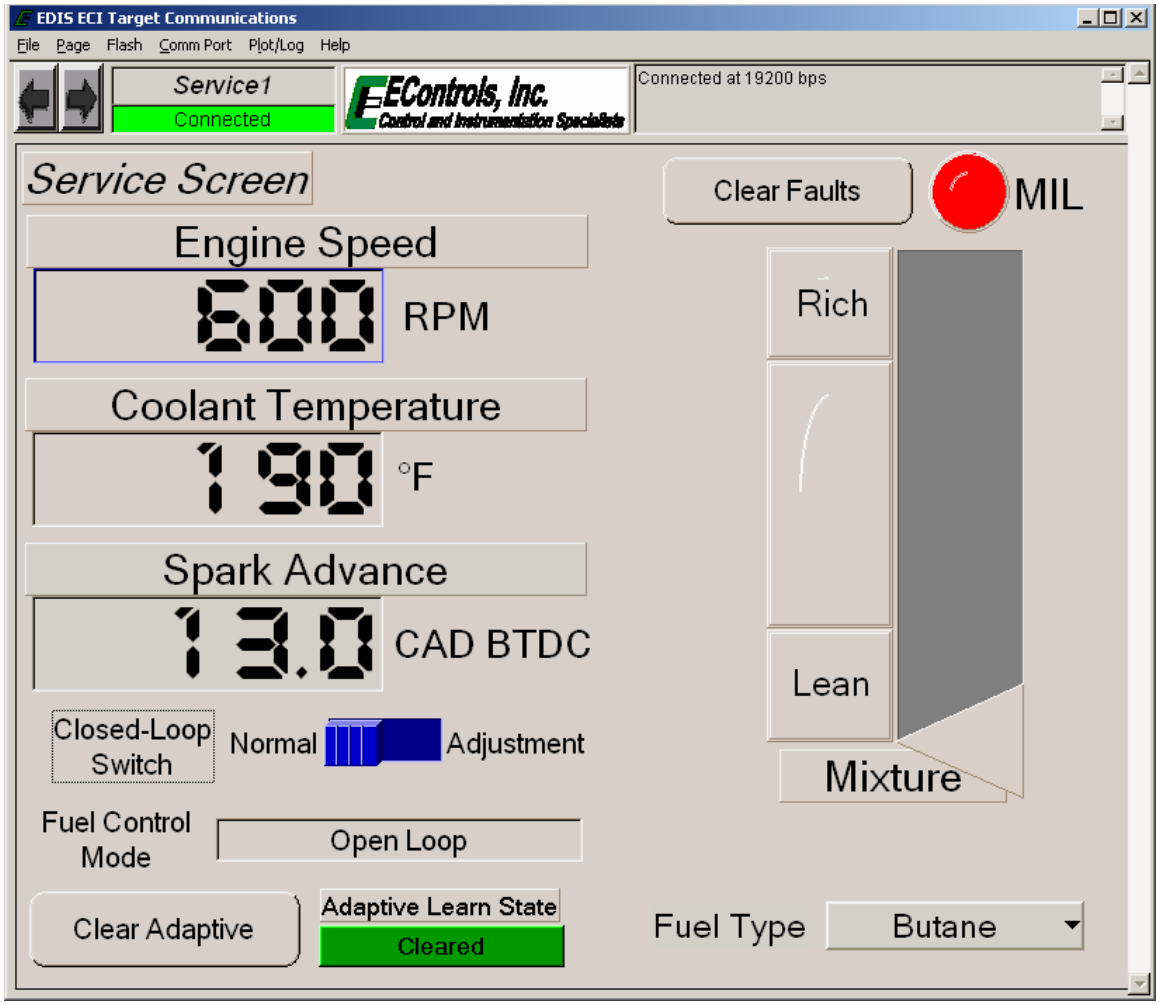
35. *Marine* Page

Main Function: Defines multi-engine synchronization configuration, multi-engine derate, exhaust manifold/riser water temperature estimate and diagnostic, and shift interrupt systems.



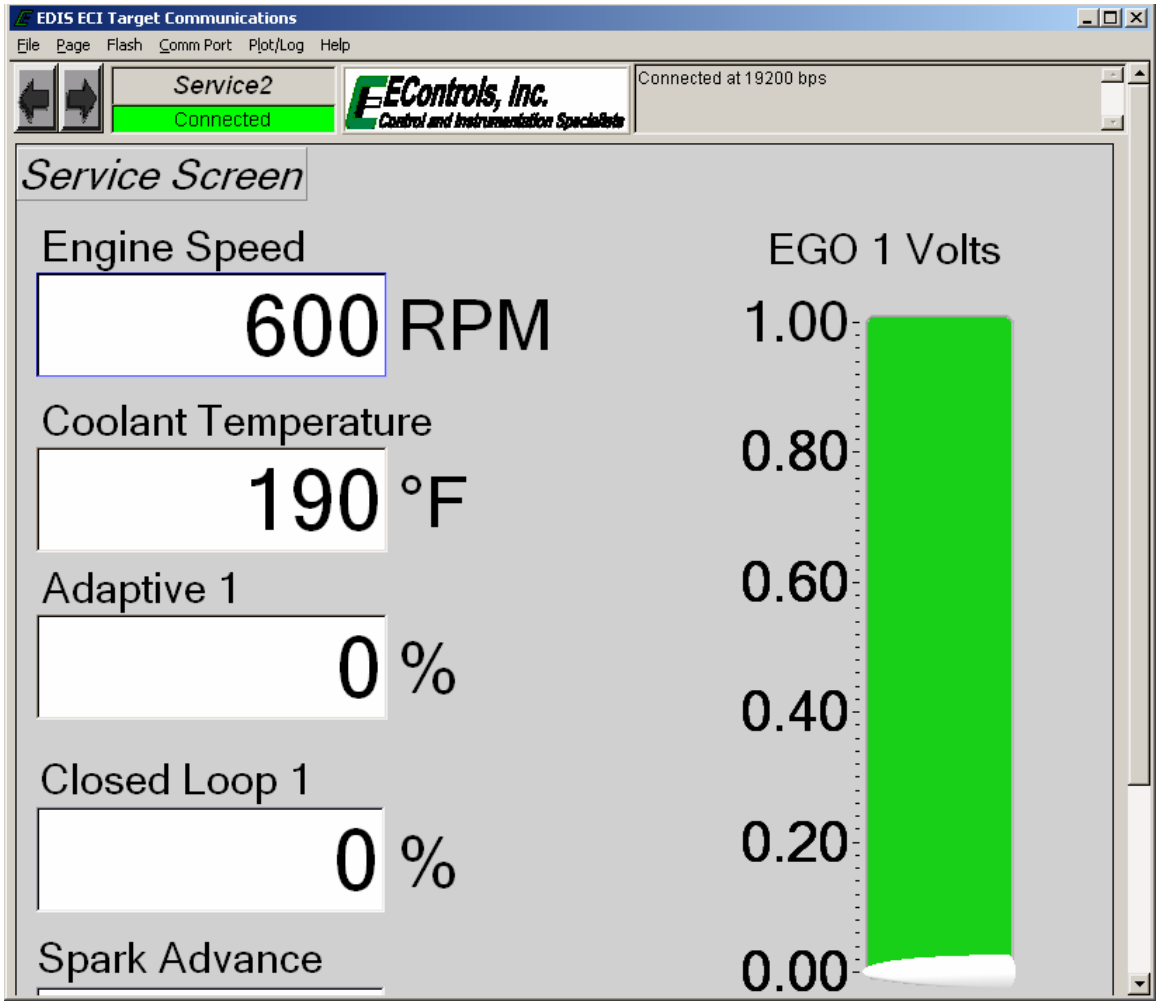
36. Service1 Page

Main Function: Displays primary service variables in an easy-to-read display and clears adaptive learn table(s).



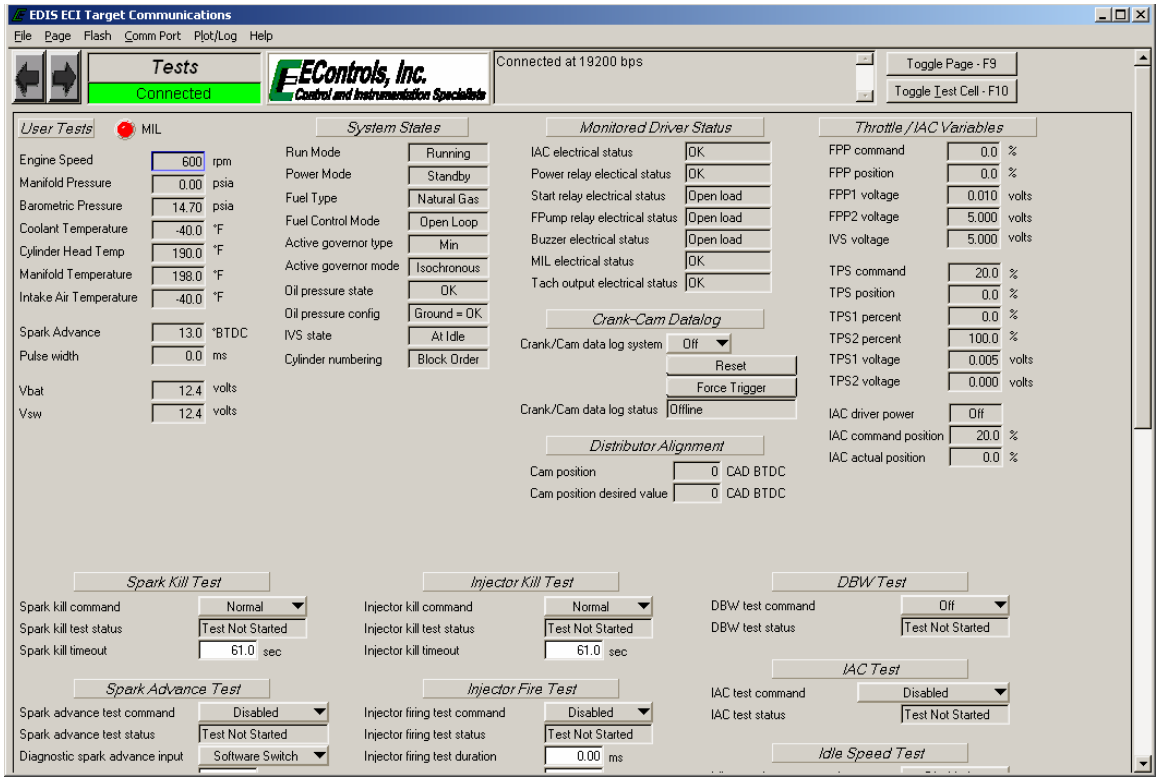
37. *Service2* Page

Main Function: Displays primary service variables in an easy-to-read display and clears adaptive learn table(s).



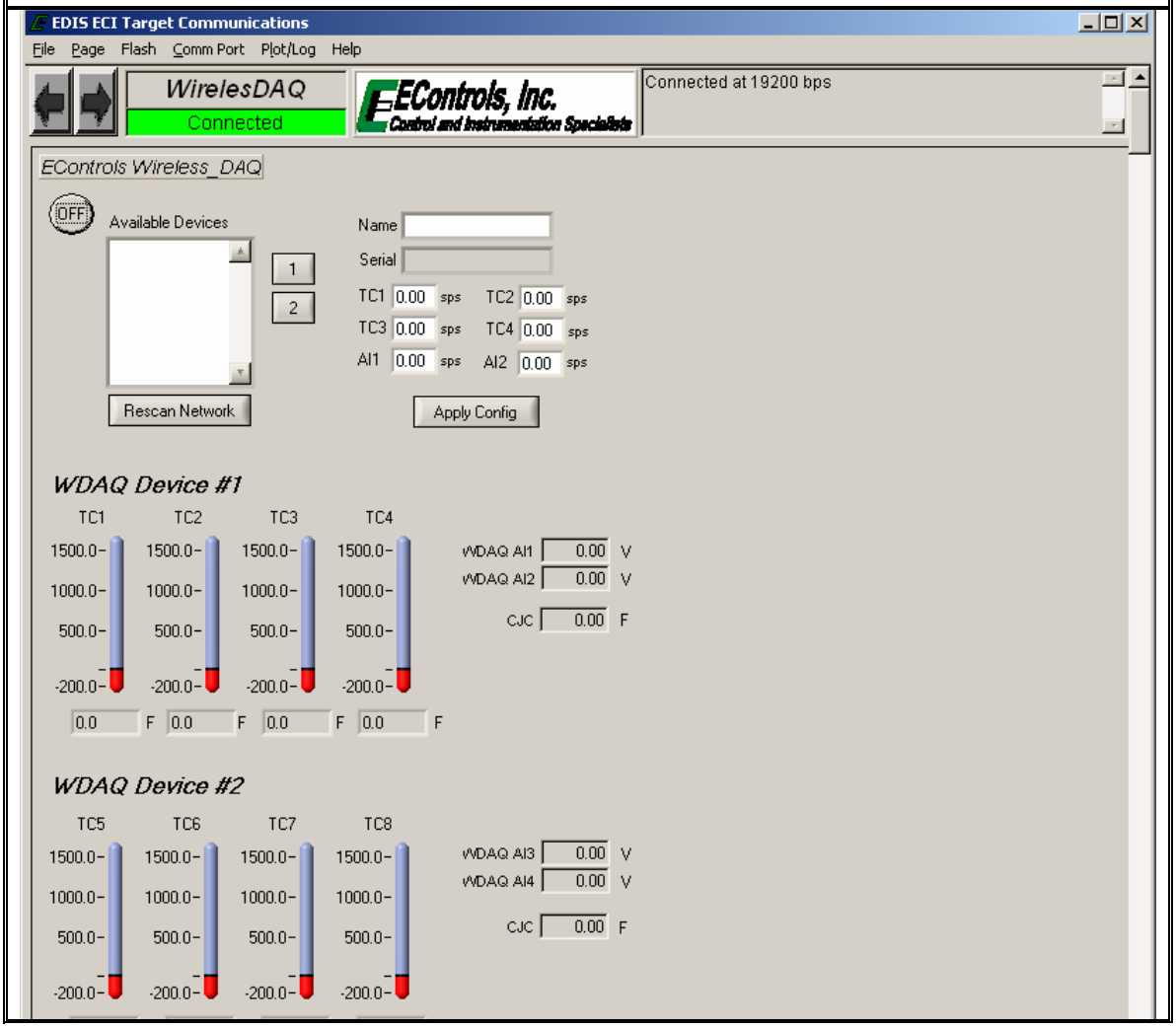
38. *Tests* Page

Main Function: Displays many of the primary engine parameters and contains all diagnostic engine tests.



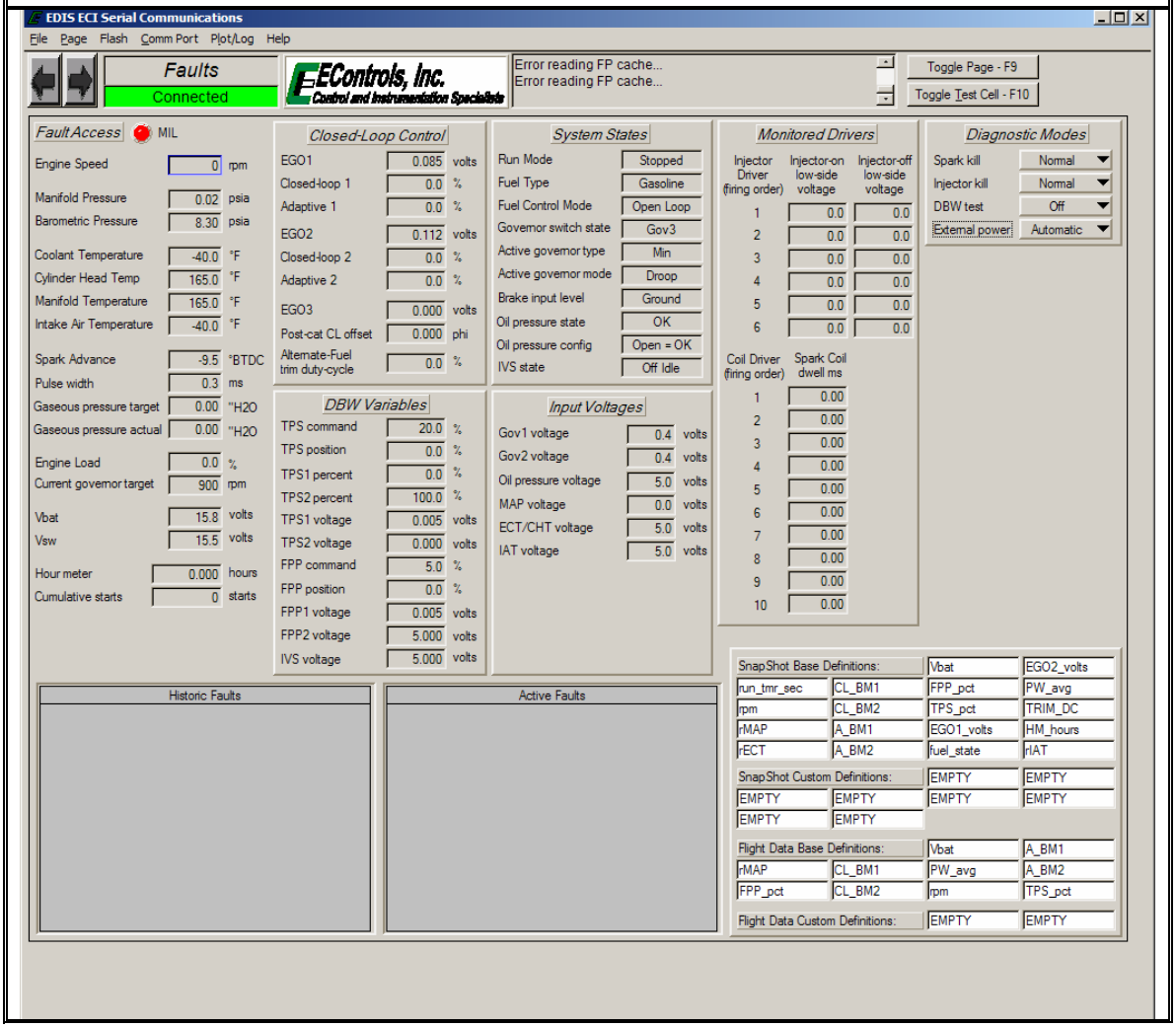
39. *WirelesDAQ* Page

Main Function: Interfaces with EControls Inc. wireless data acquisition devices for real-time display through EDIS.



40. *Faults* Page

Main Function: Displays information generally used during fault detection and provides fault code interaction.



F. Fault/Diagnostic Trouble Code Interaction

All fault and diagnostic information is managed through the Faults page. Interaction includes viewing fault messages, downloading fault data (fault snapshot and flight data recorder), erasing faults from memory, and defining variables for fault data logging.

Faults are separated into two categories, Active and Historic. Active faults are active in real-time and historic faults have been generated at some instance in time that may or may not be active in real-time. Once a fault has become active, it is immediately logged as historic and a snapshot and flight data log is saved. Figure 28 shows an example of the fault page when an active fault has been generated. Notice that the fault is present in both the active and historic lists and the malfunction indicator lamp (MIL) has been illuminated. Figure 29 shows an example of the fault page with a historic fault stored in memory.

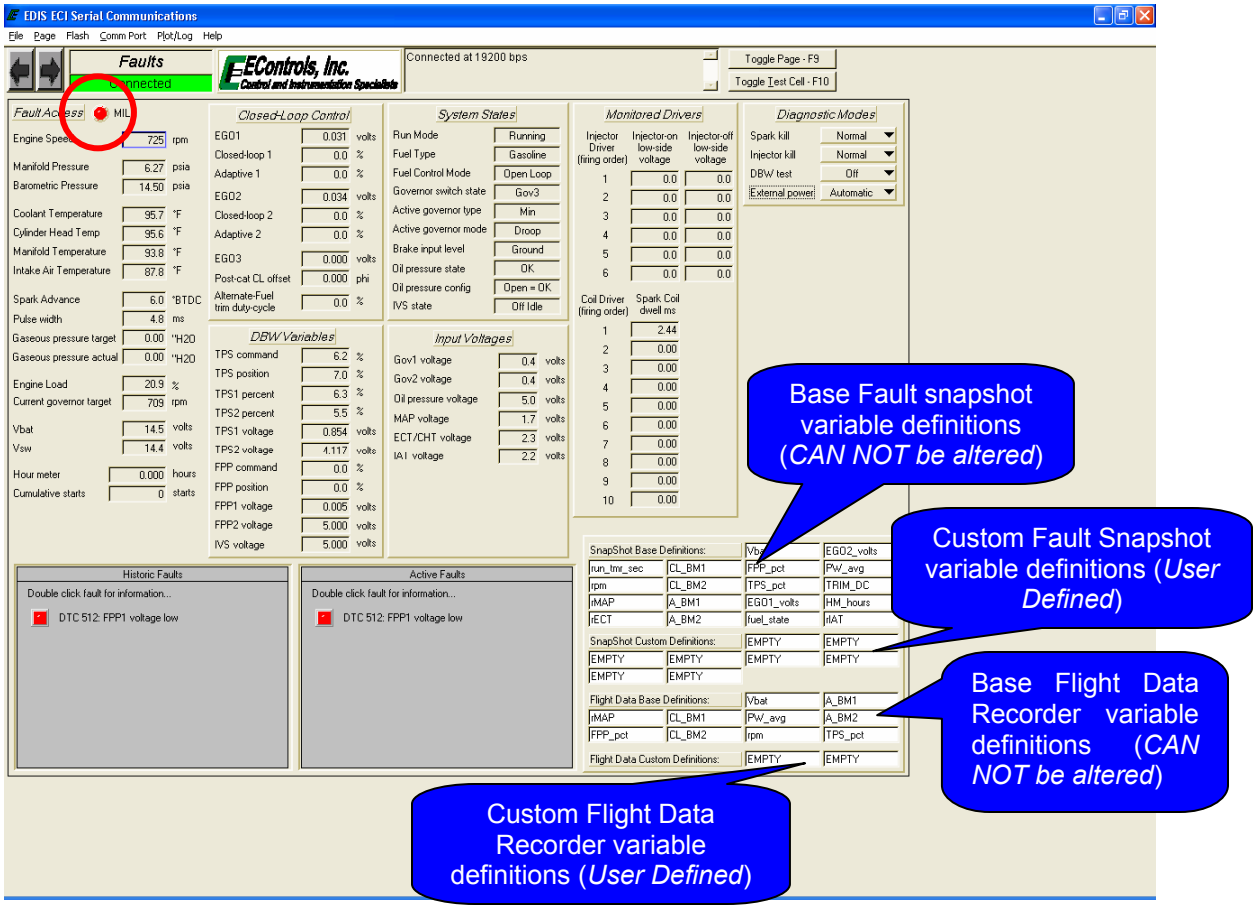


Figure 28: Faults Page with Active Fault Message

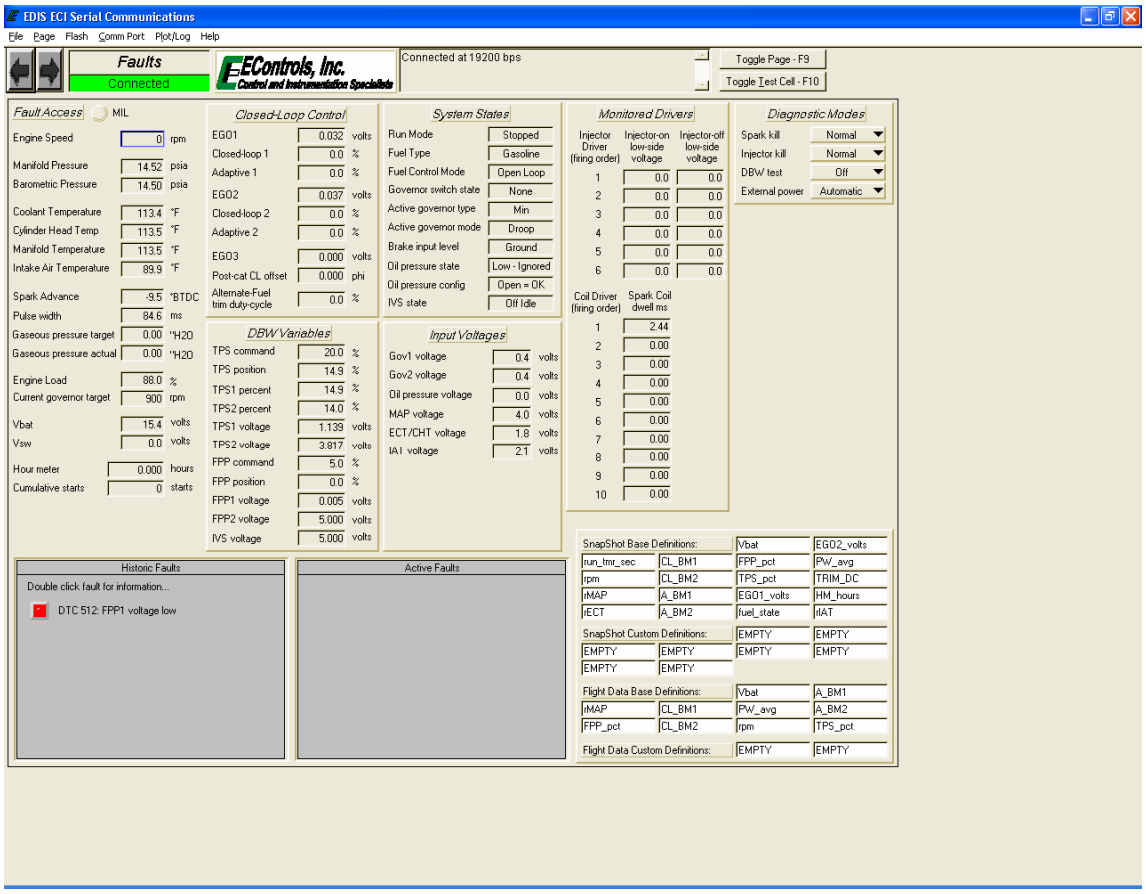


Figure 29: Faults Page with Historic Fault Message

Once an active fault has occurred two sets of data are recorded, fault snapshot and flight data recorder. The fault snapshot (FSS) is a sample of data taken at the instance the fault triggered. Variables included in the FSS are defined in the Snapshot Base and Snapshot Custom Definition fields found on the Faults Page. A FSS is saved with each of the first eight (8) faults for the first time the fault becomes active. Conversely, the flight data recorder (FDR) is a ten-second stream of data that includes eight-seconds prior and two-seconds after triggering the fault. An FDR is saved for each of the first two (2) faults for the first time the fault becomes active. Variables included in the FDR are defined in the Flight Data Base and Flight Data Custom Definition fields found on the Faults Page.

The memory location of the FDR is RAM, therefore this data is only available if the ECM has not lost battery power. In addition, if there is a “Dirty Flash Page” in the ECM, the FDR data will not be available. The memory location of the FSS data is EEPROM and is retained when the ECM loses battery power.

Both sets of data are accessed from the Historic Fault Information interface and can be saved to the PC upon retrieval. Base variables for FSS and FDR are generally defined by the OEM to include variables most often referenced during fault diagnosis. The base definitions are not fault dependent. Additional variables may be selected for capture during a fault occurrence through a single, left-click of the custom table and selecting the desired variables from a list. An example of custom fault variable definitions is shown in Figure 30.

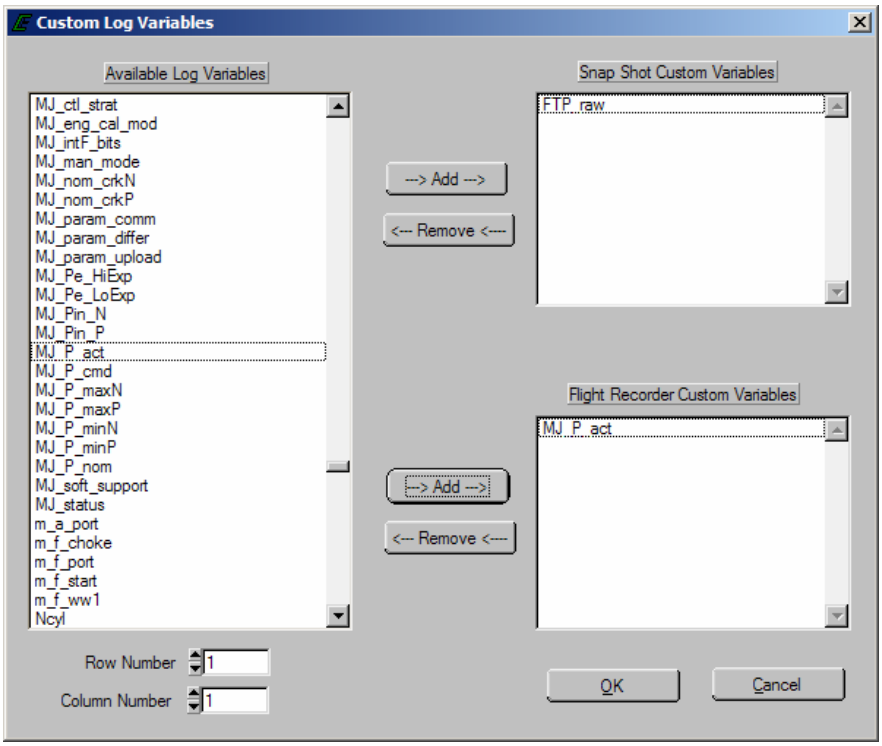


Figure 30: Custom Fault Variable Interface

Accessing fault information is accomplished through a double left-click of the fault LED in the historic fault list. This produces the Historic Fault Information interface shown in Figure 31. From this interface the user can interpret a diagnostic trouble code (DTC) message, identify whether or not the fault occurred during the current key cycle, identify if the fault caused the engine to shutdown, determine how many key cycles have occurred since the fault was last active, clear selected or all historic faults, and view snapshot and flight data. Table 5 outlines the options displayed in the Historic Fault Information screen. Historic faults are not overwritten if the same fault becomes active, storing data from the original active fault.

Figure 32 is an example of a fault snapshot after View Fault Snapshot is selected. Data is presented in two columns, base and custom variables. Once retrieved, the FSS data may be saved to the PC in text format with an *.fss*

extension. A FSS saved to a PC may be reviewed in any ASCII based software program.

Figure 33 shows the Flight Data Recorder interface after View Flight Data Recorder is selected. The FDR captures a ten second (eight seconds prior and two seconds after generating the fault) strip of data for base and custom variables. FDR data is presented in an interface similar to the Plot interface for a quick graphical presentation. From this interface, the FDR data may be saved to the PC in text, tab-delimited format with an *.fdr* file extension. Once saved to PC, FDR data may be reviewed using any graphical post-processing software capable of handling tab-delimited formatting.

Fault information may be manually erased using the "Clear" button functions. Once a "Clear" function has been selected, the dialog prompt shown in Figure 34 will be displayed. Choosing YES deletes all fault information from the ECM.

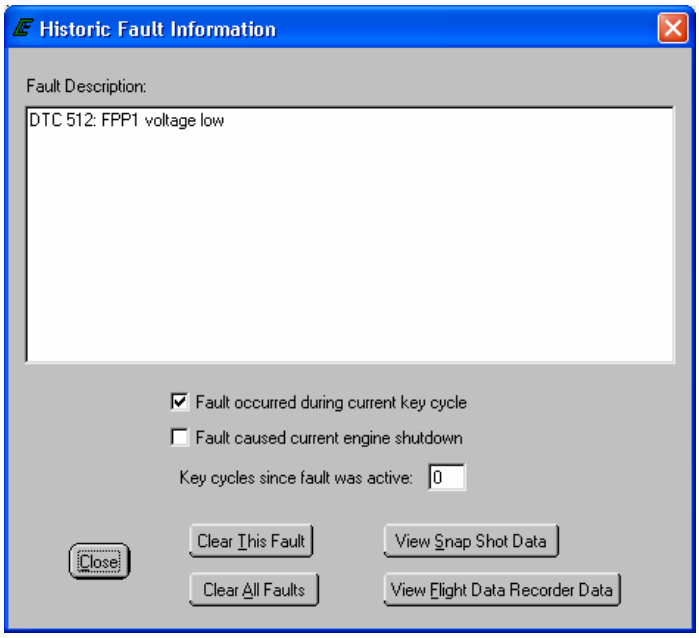


Figure 31: Historic Fault Information Interface

Table 5: Historic Fault Information Interface Functions

Fault Description Message Box	Customized text that references the DTC flash code and describes the fault.
Fault During Key Cycle Checkbox	Informs that the fault occurred during the current key-on event.
Fault Caused Engine Shutdown Checkbox	Informs that the fault caused the engine to shutdown.
Key Cycles Since	Displays the amount of key-on events since the fault was

Fault Active Indicator	last active.
Clear This Fault Button*	Erases the selected historic fault from the ECM.
Clear All Faults Button*	Erases all historic faults from the ECM.
View Snap Shot Data Button	Retrieves a data "snap shot" from the ECM for variables defined in the base and custom snapshot variable definition lists. An example of a fault snap shot is shown in Figure 32.
View Flight Data Recorder Data Button	Retrieves a 10-second data strip chart (8 seconds prior, 2 seconds after fault trigger) from the ECM for variables defined in the base and custom flight data recorder definition lists. An example of a fault snap shot is shown in Figure 33.
Close Button	Exits the Historic Fault Information interface. DOES NOT cancel or clear any faults.
* Snapshot and flight data recorder data for historic faults is erased after the prompt shown in Figure 34 is satisfied	

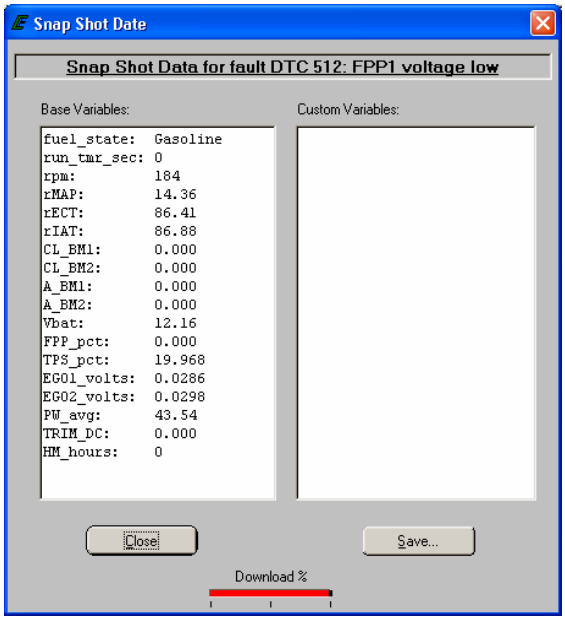


Figure 32: Snapshot Data Interface

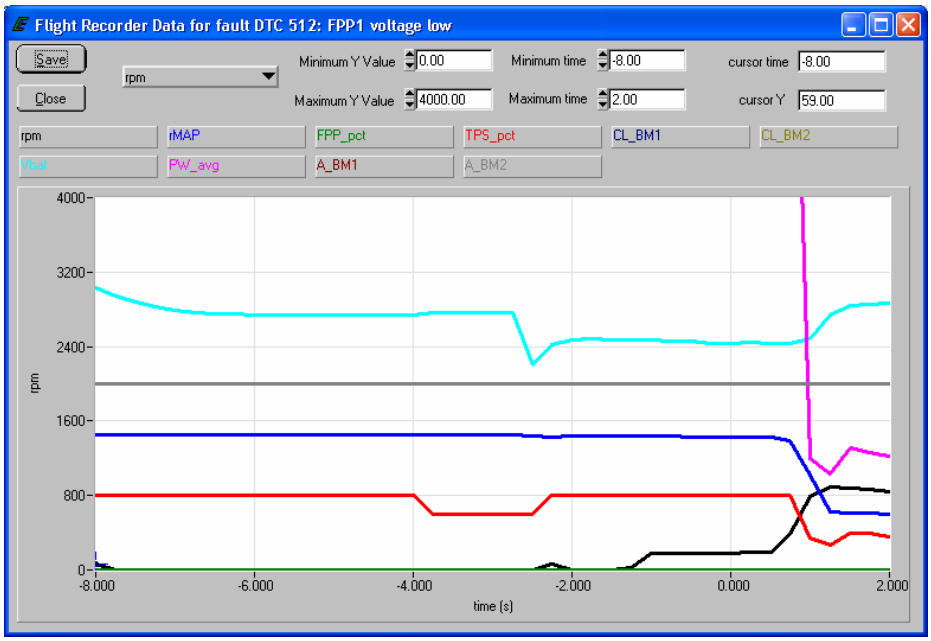


Figure 33: Flight Data Recorder Interface

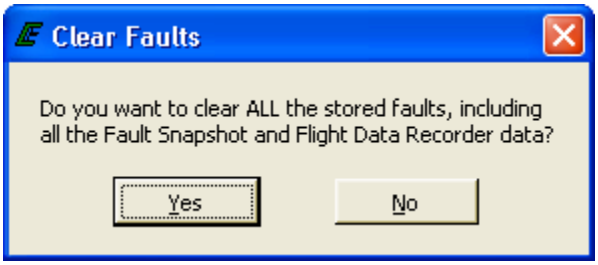


Figure 34: Clear Faults Prompt