Tuner-Express

.:Scriptable Tuning Software:.

User's Manual

Version 1.0.8

Table of Contents

Overview

General

Tuner Express is scriptable software intended for the real-time editing of microcontroller code used for late model vehicle engine management. Support for external hardware is in ongoing development.

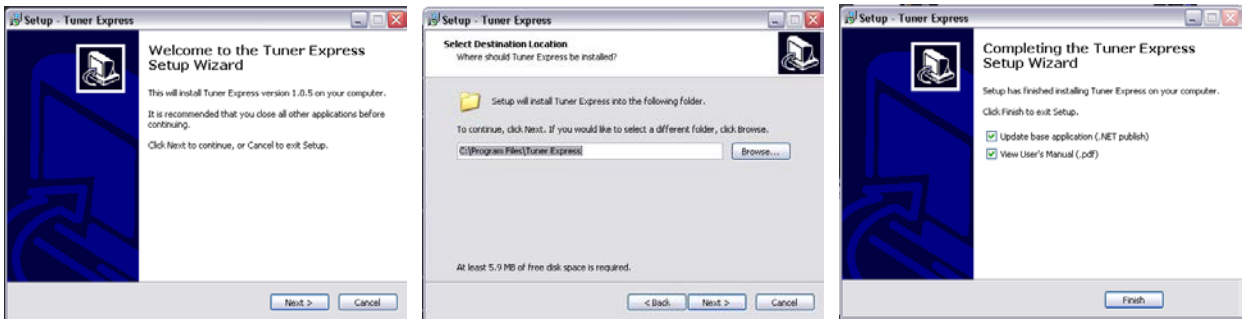
The application displays binary data files in a humanly readable format. A definition file is required to define what is to be displayed within the tables and options windows as well as to define the location of data within the binary file.

Installation

Software distribution files are distributed to the **Program Files** folder by a compressed .exe installer. The application itself uses a traditional Installer Deployment; the application is added to the user's **Program Files** folder, **Start** menu, **Desktop** and to the **Add or Remove Programs** group in the **Control Panel**, additional files are added to the user's **My Documents** folder. Administrative rights may be required for installation. See below for steps on application installation and updating. For more information on the file structure used refer to the **File Structure** section on page 3.

Installation & Updates

1. Double click the downloaded .exe file, this should extract all files and folders to the appropriate locations.



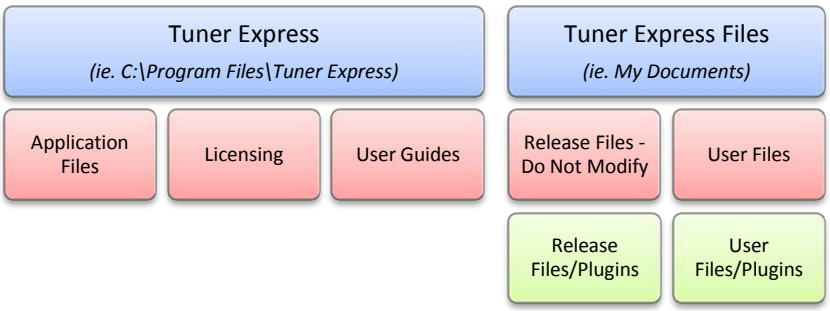
2. When completed, the application itself will be automatically installed or updated to your computer {Update base application (.NET publish)}. Start menu, desktop icon and Add/Remove programs access should be available upon installation. (Note that the base software can be un-installed using Add/Remove Programs only.)
    a. Setup will also install the Microsoft .NET Framework 4 if not found on your computer.

3. After updating the base application, the program should start automatically. If not, you can access from the start menu or the desktop icon.

The Microsoft .NET Framework 4 and Microsoft Visual Basic PowerPacks 10.0 are required and will be downloaded/installed on initial setup of Tuner Express. If the downloads are required but do not function correctly, the software can be downloaded directly from Microsoft.

File Structure

The files inherent to Tuner Express should be extracted and maintained in the following structure. When installed, all updates must come from the same installation folder or else the application will need to be removed and re-installed. Note that all user settings will be lost on removal of the software.



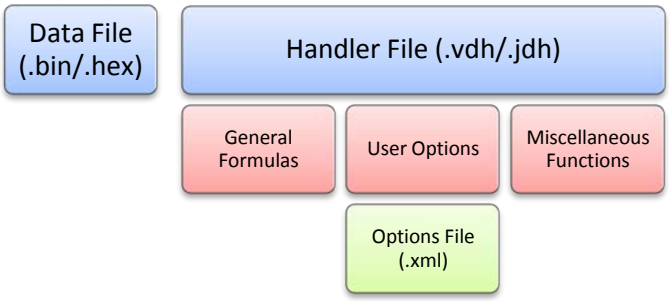
- **Application Files:** This is the location of the files required for the application to run. The uninstaller is located in the root folder or can be accessed from the Add or Remove Programs dialog.

- **Release Files – Do Not Modify:** This is the location for all definition files and plugins released with the software. These definition files and plugins are natively supported by the software. Note that these may be overwritten or added when updating software. **Modifying these files will result in loss of data when updating software.**

- **User Files:** Locate all user created/non-released files in this folder. This includes files, file definitions, log files, logger definition files, plugins, etc. These files will not be modified during software updates and it is the user's responsibility to create, modify or update these files when used.

Scripting

This software uses Microsoft's script control (msscript.ocx) to define tables, options and other data locations inherent to the binary code being viewed. The definition files may be written in either VBS or JS format.



The figure to the right shows the Hierarchy of the types of files used by the scripting engine. Note that the data file requires a corresponding handler file to define tables and option bytes. The handler file may link other files that can be used for multiple purposes.

For additional information on scripting setup and usage, refer to the Scripting Architecture section on page *23*.

File Types

The following is a description of the files used by the software:

- Data File - .bin; This is the main data file used by the ECU.
- Data File Handler - .vdh/.jdh; This is the scriptable file used to define what is actually on the Data File and to display in a humanly readable format. These can be written using VBScript **or** JavaScript formats. The file read by S-Tuner must use the .vdh/.jdh extension, other files linked to the data file handler may use other extensions such as .vbs, .js, .txt, .xml and so on.
- Plugin File - .vpf/.jpf/.html; These files can be used for custom functions relating to the main application. The .vpf extension utilizes the VBScript language while .jpf utilizes JavaScript.
- Log File - .tsv; This is a tab separated value list of all recorded trending data.
- Trending Definition Template- .tdt; This is a template setup to define what channels are to be displayed and available for recording. The channel properties are also defined in this file.
- Overlay Definition Template- .odt; This template is setup to define available charts that will be traced while recording or reviewing trending data.
- Math Channel Definition -.vmc/.jmc; This defines custom recordable Math channels.

Plugins

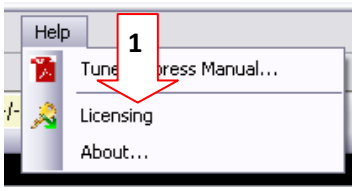
Plugins may be created for additional user functionality. VBS or JS code may be used to converse with the host software or HTML code may be used if displays and additional functionality are required.

For additional information on plugins setup and usage, refer to the Plugins Architecture section on page *23*.

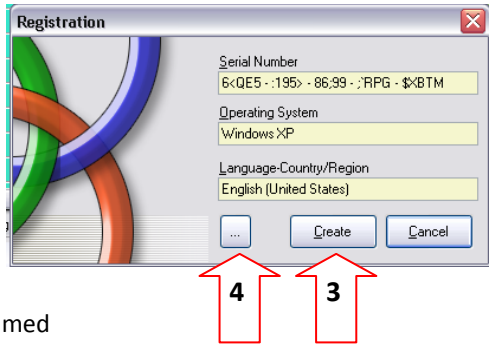
Licensing

Tuner Express is testable without registration, feel free to try things out. Registration is used to enable the saving of files (ie. ROM files, datalogging files, etc.). The following is a current process for registration. Please note that any number of computers may be registered to a single user, just follow the procedure and utilize the same email address.

Start the software and go to the *Help>Licensing* (**1**) menu. This will bring up the Registration form which contains a unique *Serial Number* as well as information on your *Operating System* type and *Language* settings.



- If registering for the first time through the website, enter your information and click *Buy Now* (**2**) to submit a payment through Paypal.
- If registering an additional laptop, click the *Create* button (**3**) and save the serial file. (This file can be saved to any location (*preferably the C:\Program Files\Tuner Express\Licensing folder but can be saved to other locations, Desktop, My Documents, etc.*) and can be named anything you like. **A default name and location will be set in the future as to clear up any confusion.*) Attach the saved ***.ser*** file (*app_ser.ser, myname.ser, xxx@gmail.ser, etc.*) to an email (*preferably your paypal receipt*) from your payment email address to *j.parisella@yahoo.com*.



An email will be sent back (*from j.parisella@yahoo.com*) containing a file named ***app_reg.txt***, this contains licensing strings for each registered computer. Save this file to the installation directory>Licensing (ie *C:\Program Files\Tuner Express\Licensing*, etc.). Note that the … button (**4**) will open the *C:\Program Files\Tuner Express\Licensing* folder by default.

Again, multiple computers may be registered, just email the new serial information for an updated registration file. Your email address will be kept for registration purposes only, this will not be shared. Operating system and language information is used only for debugging.

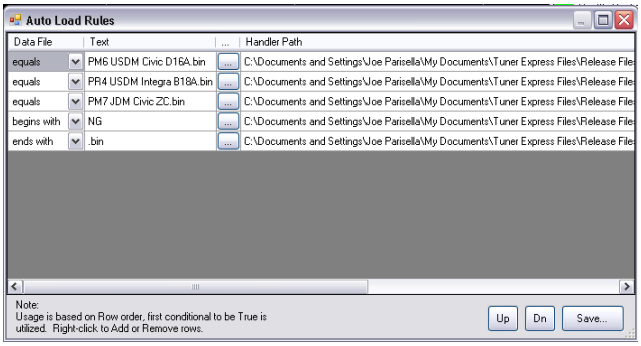
Basic Usage

Files

Data and *handler* files can be accessed using the Files dropdown menu. File properties are also available for viewing. Other files such as datalogging files, templates and plugins are accessed through their respective window. **Most files may opened using the drag and drop feature.**

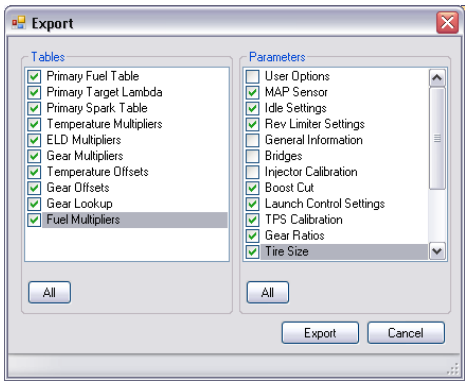
Auto Load…

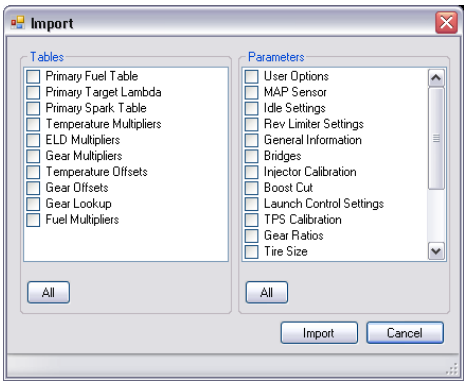
Handler files can be auto loaded based on *Data* file properties. Input the test information and select a *Handler* file to utilize. The *right-click* menu's can be utilized to *Add/Remove* rows. Note that the rows are hierarchical (arranged in order of rank), position them in the desired test order. ⚠



Import/Export

Table and *parameter* data can be imported and exported quickly for future usage. When exporting data, the actual table and parameter values (real values displayed to user) are saved. When importing data these values are run through the data file handler which set the raw values on the data file. It is important to note that when importing data the table/parameter name and size are considered. If a certain table is not found or is of a different physical size (rows and columns) you will receive an alert and the data will not be imported.



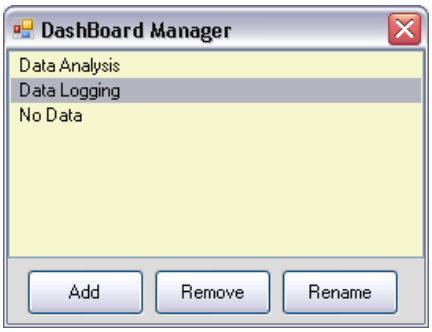


Views

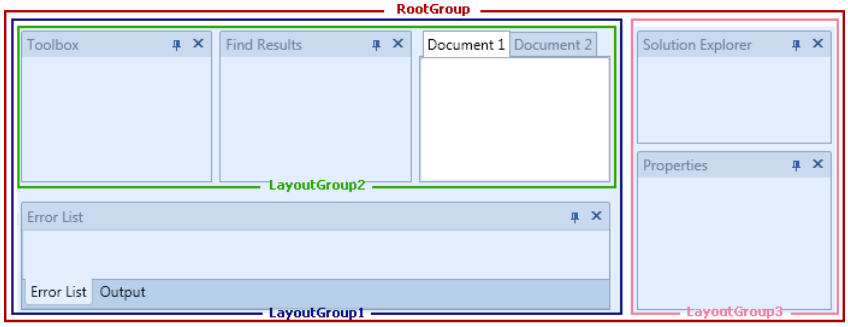
Table, parameter and *data* windows can be quickly accessed from this dropdown menu.

Views>DashBoard Manager

The *DashBoard Manager* is utilized to quickly initialize multiple window views from one customized button. Tables, Parameters and Data window locations and sizes can be saved for quick deployment. To add a DashBoard, the user should set the location and size of each window they would like initialized; then launch the *DashBoard Manager* to save properties to the template.



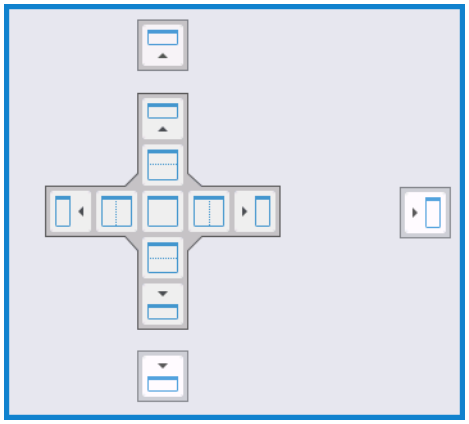
Dockable Panels



Most windows can be positioned using the dockable panels. Multiple layout groups may be added, removed and rearranged based on user preference. All can be saved as a *DashBoard*.

Display windows can be docked so that they have a position and size within the Group frame, or floating as a separate window independent of the Group. Windows can be docked as tabbed windows and they can be pinned to their current position; multiple windows may float together. Windows may also be hidden or minimized.

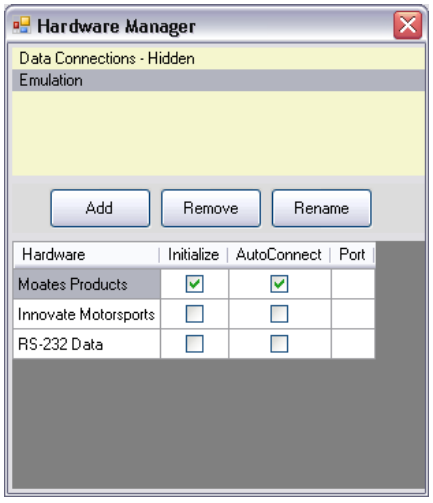
Display windows can be arranged by dragging and by right-clicking the title bar of the window to be arranged. When you click and drag the title bar or tab of a window, a guide diamond appears. During the drag operation, when the mouse cursor is over one of the arrows in the diamond, a shaded area will appear that shows you where the window will be docked if you release the mouse button now. To move a dockable window without snapping it into place, choose the Ctrl key while you drag the window. To return a tool window or document window to its most recent docked location, press **CTRL** while you double-click the title bar or tab of the window.



Tool windows can be fastened to one side of a Group. A guide diamond appears when you drag a tool window to another location to help you to easily re-dock the window.

Hardware

External hardware windows can be accessed from the dropdown menus. Additional support for hardware is currently added to the base application; future support for user coded add-ins is anticipated. Hardware that is currently connected is shown in a **Green** font, if the hardware has been disconnected by the user the title is shown in **Red** font.



Hardware>Hardware Manager

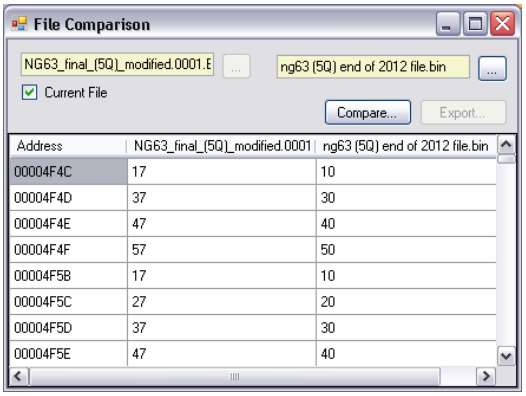
The *Hardware Manager* is utilized to quickly initialize multiple hardware connections from one customized button. Each hardware device can have the display window initialized, have the COM port automatically connected, and have custom COM port settings utilized. The port settings will not be saved on exit of the application; these are used to override the user settings as required for using different machine or port requirements.

Tools

Multiple tools can be accessed from the dropdown menu.

Tools>File Comparison

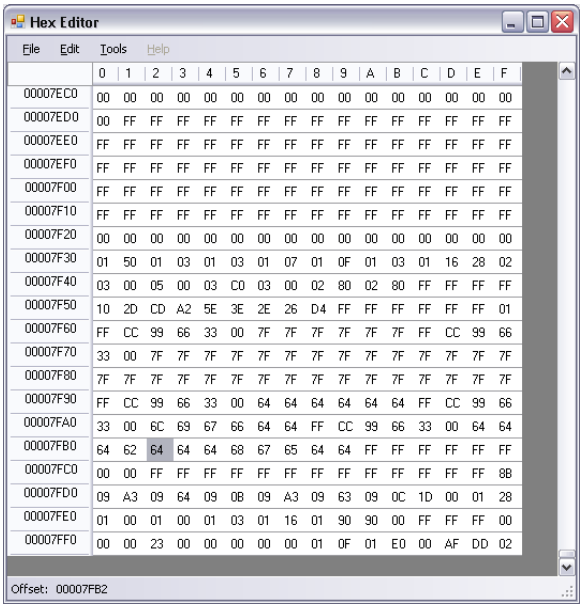
The *file comparison* tool can be used to locate differences between two data files. Each address that has a different value will be show as well as the corresponding numerical values.



Address	NG63_final_(5Q)_modified.0001	ng63 (5Q) end of 2012 file.bin
00004F4C	17	10
00004F4D	37	30
00004F4E	47	40
00004F4F	57	50
00004F5B	17	10
00004F5C	27	20
00004F5D	37	30
00004F5E	47	40

Tools>Hex Editor

The *Hex editor* can be utilized to modify the data file at the base level. This is the data that is converted into a usable human format. When changes are made the *table* and *parameter* windows will be refreshed on exit.



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00007EC0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00007ED0	00	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00007EE0	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00007EF0	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00007F00	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00007F10	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
00007F20	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00007F30	01	50	01	03	01	03	01	07	01	0F	01	03	01	16	28	02
00007F40	03	00	05	00	03	C0	03	00	02	80	02	80	FF	FF	FF	FF
00007F50	10	2D	CD	A2	5E	3E	2E	26	D4	FF	FF	FF	FF	FF	FF	01
00007F60	FF	CC	99	66	33	00	7F	7F	7F	7F	7F	7F	FF	CC	99	66
00007F70	33	00	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F
00007F80	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F	7F
00007F90	FF	CC	99	66	33	00	64	64	64	64	64	64	FF	CC	99	66
00007FA0	33	00	6C	69	67	66	64	64	FF	CC	99	66	33	00	64	64
00007FB0	64	62	64	64	64	68	67	65	64	64	FF	FF	FF	FF	FF	FF
00007FC0	00	00	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	8B
00007FD0	09	A3	09	64	09	0B	09	A3	09	63	09	0C	1D	00	01	28
00007FE0	01	00	01	00	01	03	01	16	01	90	90	00	FF	FF	FF	00
00007FF0	00	00	23	00	00	00	00	00	01	0F	01	E0	00	AF	DD	02

Tools>Loopback Test

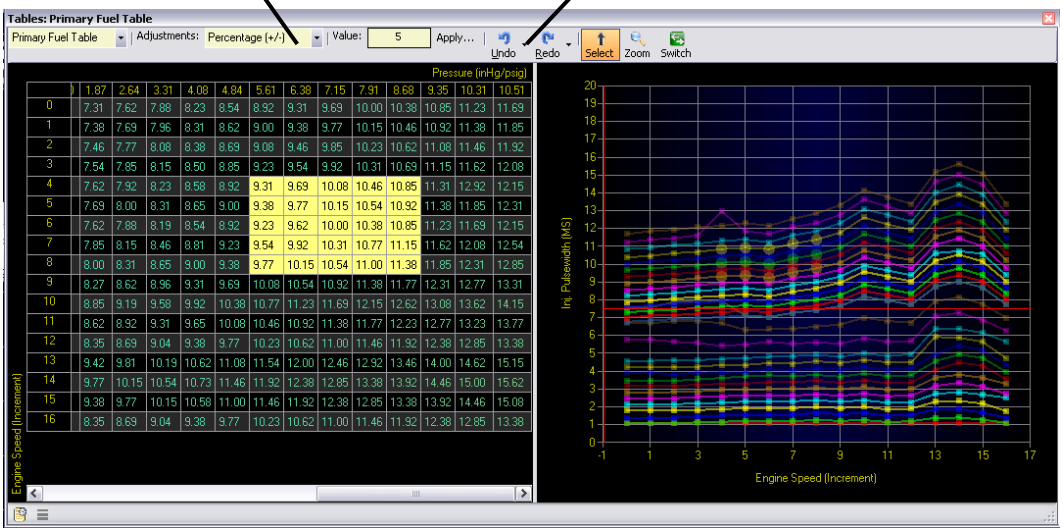
The *Loopback Test* can be utilized to test the Transmit (Tx) and Receive (Rx) of a certain COM port. Upon Transmitting data, the port will be opened, data will be sent, Received data will be displayed (in multiple formats) and the port will be closed.

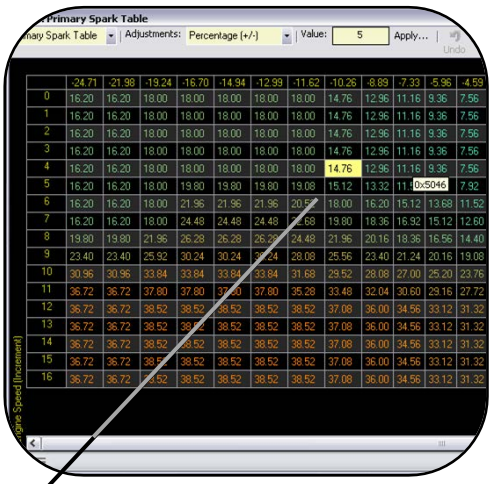
Tables Module

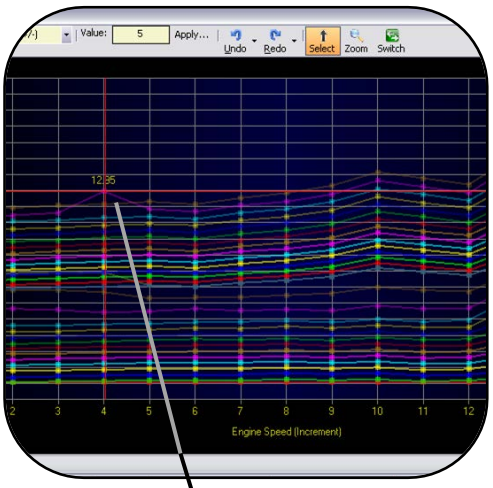
The *Tables Module* gives the ability to display, edit and save numerical data. The following goes into detail of how to use these tables to best suit your needs.

Mathematical tools such as offset, %, replace, X, /, +, - and smoothing allow for quick changes to table values.

Undo and redo functionality is based on Table changes only. Making changes to Parameters will not affect Table data.







Data Grid:
Data can be displayed in tabular form, selected cells show highlighted with custom tool tip (eg. memory location).

Chart:
Convenient graphing views allow for zooming, analysis and modification of tabular data.

Selecting Tables

The currently selected table may be changed by any of the following:

1. Click the desired table within the Navigator display.
2. Click the desired table within the main toolbar dropdown box.
3. Use the **Alt-Up**, **Alt-Dn** or **Alt-F1 through Alt-F12** keys to move throughout the available tables.

Modifying Data

1. Table Data:
    a. Any number of table cells may be selected with either the mouse or keyboard. Use the mouse and left mouse button to select an initial cell and drag across the display. When using the keyboard, they shift and arrow keys may be used to expand the selected cell range. Entire row, column or table ranges may be selected by clicking on the table header values.
    b. Values can be directly typed into the selected table cell.
    c. Values may be copied and pasted into the table using the right-click menus or the Ctrl-C and Ctrl-V keys.
    d. Mathematical adjustments may be made thru the main toolbar Adjustment tool.
    e. A quick percentage tool is available thru the right-click menus or the Ctrl-Up and Ctrl-Dn keys.
2. Chart Data:
    a. Multiple chart points may be selected (when not in zoom mode) using the left mouse button, when a single point is selected the actual data value will be displayed. Selecting chart points also highlights the corresponding table cells.
    b. Chart points may be increased or decreased by dragging a single selected point, or utilizing the adjustment algorithm.
    c. Any of the functions used for the tables will also work when in the chart view.

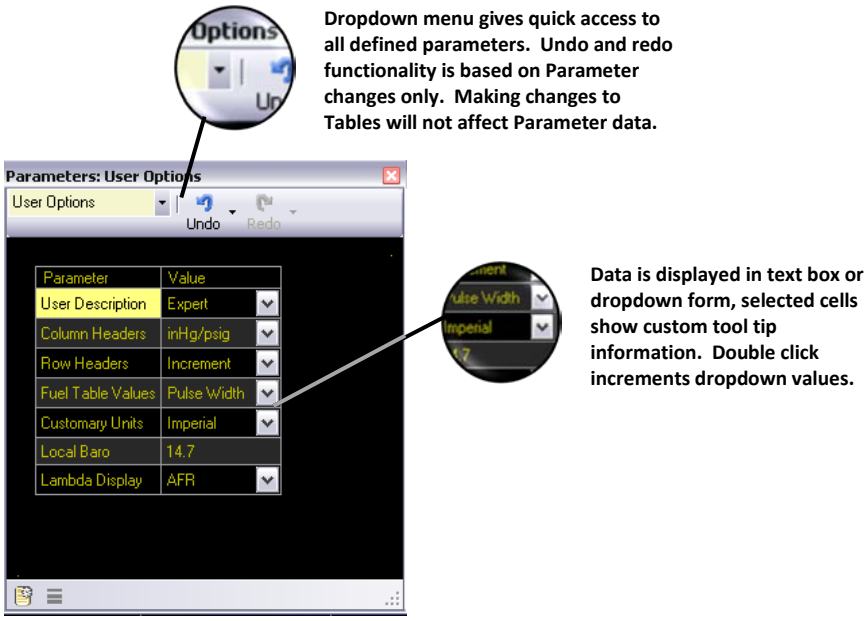
Command Summary

Button	Command	Location
	**Table Settings** Properties of the navigator, chart, table and other controls may be edited within the table properties.	**Status Strip**
	**Navigator Toggle** The navigation panel may be hidden to create more viewable screen space for the actual important data; tables may then be changed by utilizing the toolbar dropdown list.	**Status Strip**
	**Adjustments** Data may be adjusted mathematically by any of the following: • Offset - This adds or subtracts from the selected cell(s) values. • Percentage - This adds or subtracts a percentage from the selected cell(s) values. • Replace - This replaces the selected cell values with the entered value. • Multiply - This performs multiplication to the selected cell(s) values. • Divide - This performs division to the selected cell(s) values. • Smooth by Row - This performs the Hanning smoothing function across each selected row. • Smooth by Column - This performs the Hanning smoothing function across each selected column. • Taper - To be supported in the future.	**Toolbar**
	**Undo** Reverts the last group of commands back to a previous state.	**Toolbar** **Right Click** **Short Cut: Ctrl+Z**
	**Redo** Reverses the undo command and advances to a more current state.	**Toolbar** **Right Click** **Short Cut: Ctrl+Y**

	**Select** Select allows the user to slide data points and change zoomed chart areas. This menu is only enabled when the graph is visible.	**Toolbar**
	**Zoom** Zoom allows the user to zoom in/out on selected chart areas. This menu is only enabled when the graph is visible.	**Toolbar**
	**Switch** Switch axis allows the user to switch the displayed row and column data over the axes. This menu is only enabled when the graph is visible.	**Toolbar**
	Reset Zoom Zoom reset allows the user to quickly zoom to the extents of the chart area.	**Right Click**
	View All (Split Position) Selection shows both the table and graph data. The displays may be split horizontally (graph on bottom) or vertically (graph on right).	**Right Click** **Short Cut: F2**
	View Table This shows only the table data, the graph will not be displayed.	**Right Click** **Short Cut: F3**
	View Graph (Graph Type) This shows only the graphed data, the table will not be displayed. The display may be changed between different types of 2D & 3D graphing types.	**Right Click** **Short Cut: F4**
	**Copy** Copies selected cell(s) data into the clipboard memory.	**Toolbar** **Right Click** **Short Cut: Ctrl+C**
	**Paste** Paste the clipboard memory into the selected cell(s).	**Toolbar** **Right Click** **Short Cut: Ctrl+V**
	Increase (%) This is a quick change feature that adds a percentage from the selected cell(s) values. Percentage is edited within from settings.	**Right Click** **Short Cut: Ctrl+Up**
	Decrease (%) This is a quick change feature that subtracts a percentage from the selected cell(s) values. Percentage is edited within from settings.	**Right Click** **Short Cut: Ctrl+Dn**
	HotKeys This menu shows additional hot keys that may be used for changing selected tables.	**Right Click** **Short Cut: Alt+Up, Alt+Dn, Alt+F1 – F12**

Parameters Module

The purpose of the *Parameters Module* is to be able to edit numerical data, and string options not viewable in chart or table form. The following goes into detail of how to use the parameters module.



Selecting Options

The currently selected option may be changed by any of the following:

1. Click the desired table within the Navigator display.
2. Click the desired table within the main toolbar dropdown box.
3. Use the Alt-Up, Alt-Dn or Alt-F1 through Alt-F12 keys to move throughout the available options.

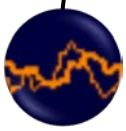
Modifying Data

1. Options:
    a. The option column cells are read-only and may not be changed during run-time.
    b. Double clicking an option column cell will enable the corresponding value cell for editing. If the value is a dropdown menu, the next value will be selected.
2. Values:
    a. String Data:
        i. Single line data may be typed into the cell.
        ii. Double clicking the Options column will set a string data Value cell into edit mode.
    b. Drop-Down List:
        i. Users are limited to the choices in the list; only one option may be selected at a time. Select another cell or press the Enter key in order to successfully change the data.
        ii. Double clicking the Options column will change a drop-down Value cell to the next available option.
    c. Text Box:
        i. Cells that contain large amounts of text can be displayed/edited using a textbox button. Changes will programmatically update all required data values by use of the pre-programmed data handler file.

Data Module

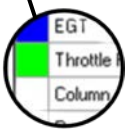
The Data Module gives the ability to display, record and analyze individual Channel information. The display is broken out into the Trend Data, Table Overlay and X-Y Data.

Tools for working with real-time trending data, table overlays and x-y data charts are located in toolbar for quick access.



Comparison data can be quickly copied and pasted onto trending data.

Real time data display shows color legend of plotted trend data. Mousing over pre-recorded data updates display.



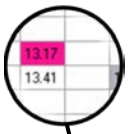
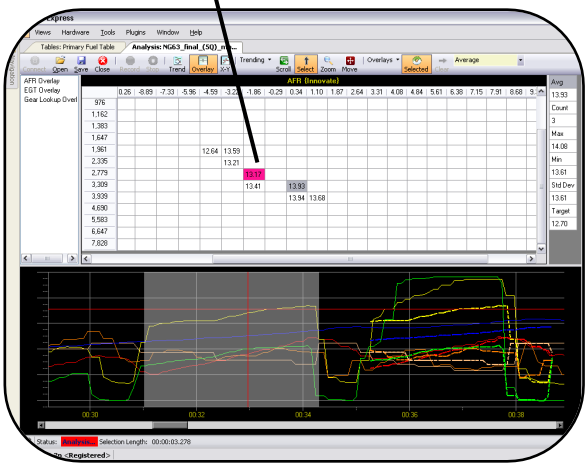
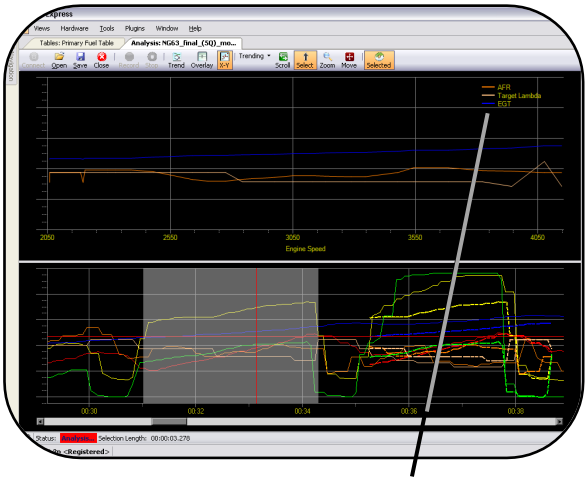


Table Overlay shows Average, Point Count, Minimum, Maximum or Standard Deviation as set by the dropdown menu.





X-Y Data plot shows sorted data along a single x-axis channel and any selected y-axis channels, Right-Click to access

Trend Data

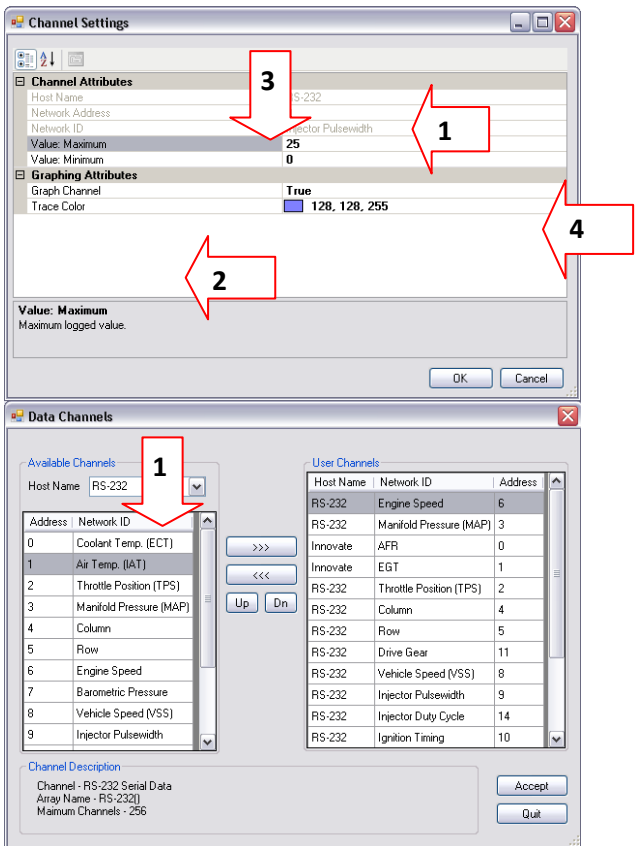
Trending gives the ability to see a graphical representation of real-time or pre-recorded channel data with respect to time. The trending graph is useful for interpreting changes in data as well as locating erratic data that may needed for troubleshooting. The information shown on the trending graph is defined by an external file called Trending Definition Template. The Template may be accessed by selecting the Trending dropdown in the toolbar and selecting Edit Template.

Math Channels

Math Channels can be written to combine data from multiple Hardware devices into a single recordable channel. The Math Channel definition can be loaded thru the Trending Dropdown.

Trending Definition Templates

The trending definition template is utilized for recording and analyzing data. Each piece of hardware with recordable channels may be added to the template, these are listed as Available Channels. User Channels is the ordered list of channels that are defined to be viewed and recorded in the trending display, the channels and order are editable by the User. The definition file links the trending module with the Networked hardware data. The data may be defined as shown in the images below:



1. ***Host Name:***
   a. This dropdown shows the available Hardware that will have data associated with it.
2. ***Available Channels:***
   a. This table populates based on the selected Host Name.
   b. The Address is an array of data ranging from 0 to 255.
   c. The Network ID is the name of the data that will be associated with the Address location.
3. ***Buttons:***
   a. Available channels may be moved to or from the User channels display using the >>> or <<< buttons.
   b. The User channels may be re-ordered using the Up or Dn buttons.
4. ***User Channels:***
   a. This is the list of channels that will be displayed on the Trending window. The Host Name and Address will be accessible through the properties menu.

Creating Trending Definition

Trending definitions shall be created using the following steps:

1. From the Available Channels, select the appropriate Host Name. The host name is a list of available Hardware.
2. Select the Channel that you would like to Record.
3. Press the >>> button to add the target Channel into the User Channels. Press Up or Dn buttons to organize the location of each Channel.
4. The Accept button will load all changes into the Data Module.
5. You can save changes by utilizing the Save Template button within the Trending dropdown of the Data Module.

Channel Setup & Configuration

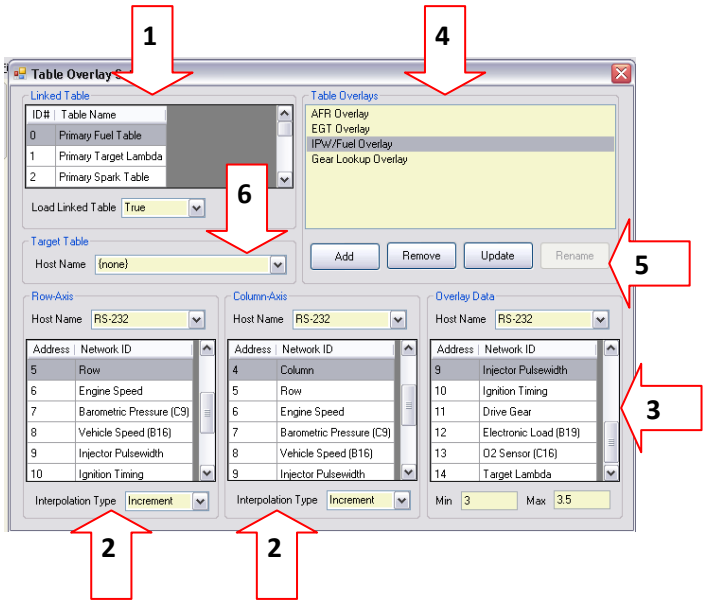
Once a Trending Definition has been setup the display of each individual channel can be configured. The software stores this data in the Trending Definition Template file.

The following is a description of the channel options available:

1. Minimum and Maximum is the actual range of values that will be shown on the Trending graph. When actual sensor values fall above or below this range the graphed value will be cut at the Minimum or Maximum range values. Live data and recorded data will still show the actual sensor value.
2. Graph Channel requires a True or False input, this tells the software if the channel should be graphed on the Trending graph.
3. Trace Color allows the user to select a custom color for each channel that is to be graphed.

Overlay Definition Templates

The Overlay Definition is used to create a Channel based Overlay of any available Table. The User may save and edit any number of Overlays. The following defines what is required to setup an Overlay Definition:



1. ***Linked Table:***
   This allows the User to select the Table which will be overlayed. All overlay properties (size & headers) will be linked to this display table. The user can also select to automatically load the linked table display when changing overlays.
2. ***Row & Column-Axis:***
   Select the Hardware data that will be used to define the Table rows. The interpolation type can be set to interpolate with the Table row headers or as an incremental row/column position indicator.
3. ***Overlay Data:***
   This is the sensor data that will be displayed in the Table Overlay. The Min and Max values are intended to filter the overlay sensor data to remove any unwanted spikes or portions of data, both values must contain a numeric value in order to function correctly.
4. ***Table Overlays:***
   This is a list of named Overlays that is present in the current Template file.
5. ***Buttons:***
   Named Table Overlays can be created, deleted or modified. When finished the changes can be accepted or deleted, the Template file can be saved thru the Data Module.
6. ***Target Table:***
   Select a defined table that contains target sensor data. If set to none the overlay calculated values table will not be available.

Creating Overlay Definition

Overlay definitions shall be created using the following steps (this example creates the Overlay shown in the above image):

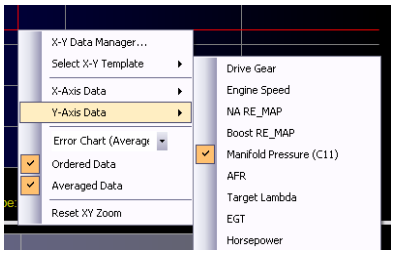
1. From the Linked Tables, select the appropriate Table Name that you would like to Overlay. In this example we are going to Overlay the Primary Fuel Table.
2. Select the Data Channel that will represent the Row-Axis Data. For example we've selected the Row channel and set its interpolation property to Increment. Another example would be to select the Engine Speed (RPM) channel and set its interpolation property to Interpolate.

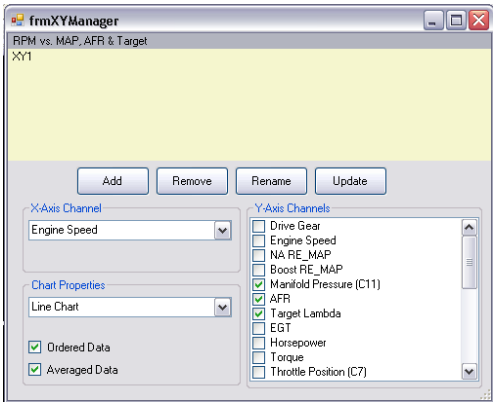
3. Select the Data Channel that will represent the Column-Axis Data, this will be similar to the Row-Axis shown above.
4. Select the Overlay Data Channel, these are the values Overlayed onto the Linked Table. For example the Injector Pulsewidth Channel was selected and the data will be trimmed between 3 and 3.5.
5. Use the Add button to add this to the Template and for utilization in the Data Module.
6. You can save changes by utilizing the Save Template button within the Overlay dropdown of the Data Module.

X-Y Data Templates

The X-Y data chart can be used to plot data on an X-axis other than time. The User may save and edit any number of X-Y templates. The following defines what is required to setup an X-Y data chart. Information to be added for next release.

A single Channel may be selected for X-Axis Data. Y-Axis data may contain multiple Channels (except for Histogram Charts). The Ordered Data checkbox is used to re-order all plotted data based on the X-Axis. The Averaged Data checkbox can be utilized to display a single "average" Y-Axis data point based on multiple X-Axis hits, the data needs to be Ordered to utilize this function.





For example if an RPM channel is utilized for the X-Axis and MAP pressure is used for the Y-Axis. The line chart should show a "curly" line indicating the MAP pressure as the RPM increases and decreases in value (x-axis). Ordered Data will plot a single line with many MAP spikes indicating multiple hits along the x-axis. Averaging Data will take the Ordered MAP Data (along the x-axis) and plot a single MAP value when there are multiple hits at the same RPM.

Refer to the Analyzing X-Y Data section for additional information.

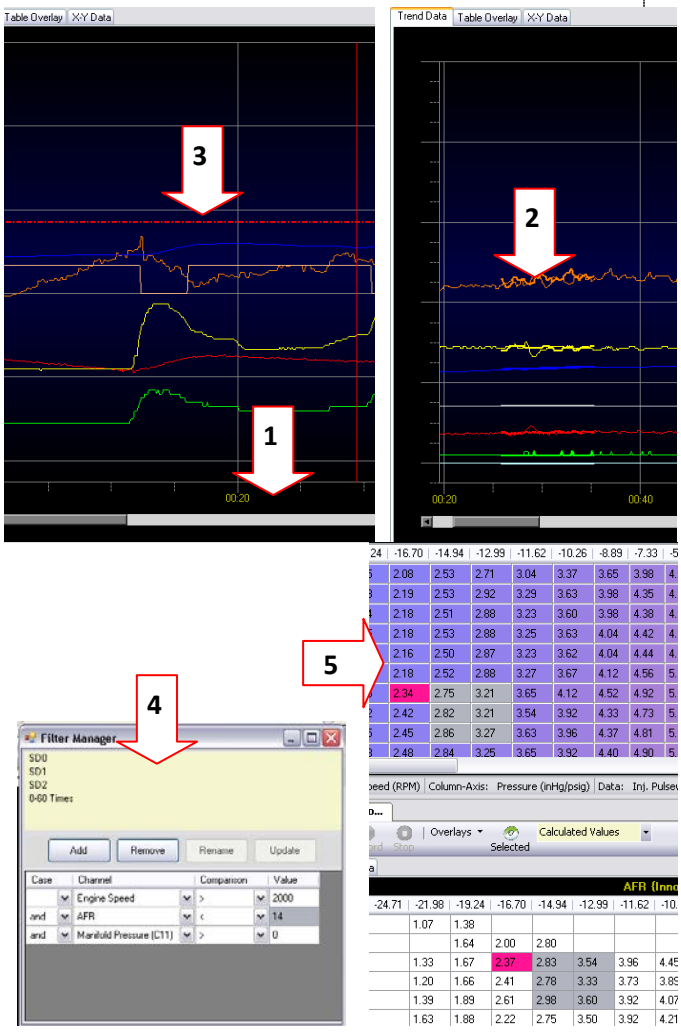
Recording Data

To record data all required Hardware must be connected and logging. When the Data Module is opened a Trending Template must be loaded (may be auto-loaded thru the Module Options) to define what will be displayed. Pressing Connect will start the streaming of network Hardware data, the live data should now be available in the Real-Time Data grid. When the Record button is clicked, the live data is now plotted on the time-based Trending Chart. When finished recording data, the Record or Stop button should be clicked. Data may be saved to a .tsv file by clicking the Save button, auto-save is available thru the Module Options.

Analyzing Trending Data

Data files can be opened and analyzed thru the Data Module. The Trending Definition utilized when analyzing a pre-recorded Log File will match what was used when the file was recorded, as well as any changes that were made by previous usage. Available tools include the following:

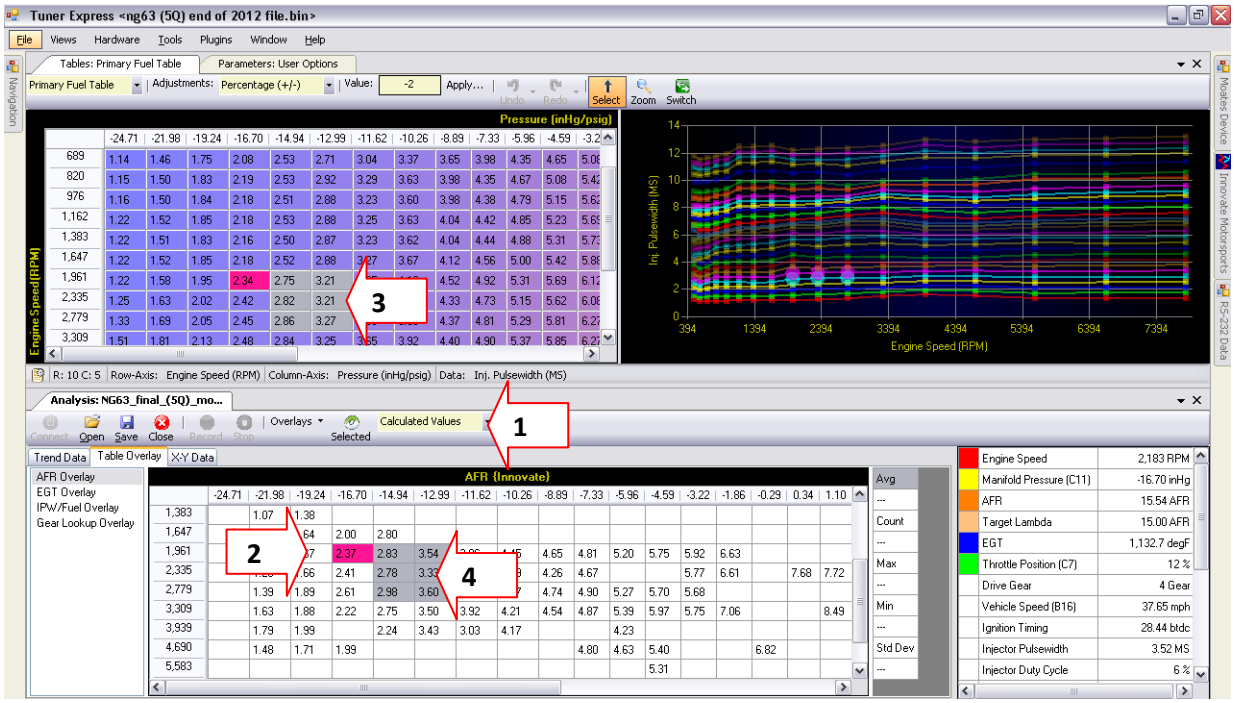
1. Adding/removing Notes.
2. Filtering Data based on logical expressions.
3. Adding horizontal Striplines.
4. Comparison of two portions of the Data File.
5. Table Tracing.
6. Comparing two individual Data Files.



1. ***User Notes:***
   Notes can be added by the user thru the use of the right-click menus. These Notes appear as diamond shaped point on the bottom of the Trending Chart. Double click the diamond to view or edit an existing Note.
2. ***Comparison:***
   With the right-click menus Data can be Selected, copied and pasted as a Comparison. Utilize the Move button to slide the Data across the time based scale.
3. ***Strip Line:***
   With the right-click menus a Strip Line can be added or removed for quick Data comparison.
4. ***Filter Manager:***
   Channel Data can be Filtered based on any number of logical expressions. This will remove portions of the Trending Chart that equate to a value of False.
5. ***Table Trace:***
   As the Trending Chart cursor is moved (or in real-time), the current Table cell is calculated. When the linked Table is active within the Table Module, that current cell shall be highlighted (refer to Options to change highlight properties).

Analyzing Overlay Data

The Overlay chart shows channel information in relation to two other channels. Setup is discussed in the Overlay Definition Template paragraph above. The Overlay Channel data is sorted into a matrix based on the X and Y Axis Channels. The Average, Point Count, Minimum, Maximum and Standard Deviation values are automatically calculated for each point. When a target table is specified within the Overlay Template, a Calculated Value option is also available.



1. ***Toolbar:***
   The Overlay table can be adjusted to utilize an entire log file or only the Trend Data selection.
2. ***Trace:***
   The cell being utilized in real-time or the last position of the Trend Data will be highlighted when the linked Table is open.
3. ***Selections:***
   The Overlay cell selections are also shown on the linked Table.
4. ***Right-Click:***
   When Calculated Values are shown the right-click menu allows the selected Table values to be adjusted. The calculated values are based on the average values and target values setup within the Overlay Template. Go to Options to change the minimum point count and maximum cell change percentages.

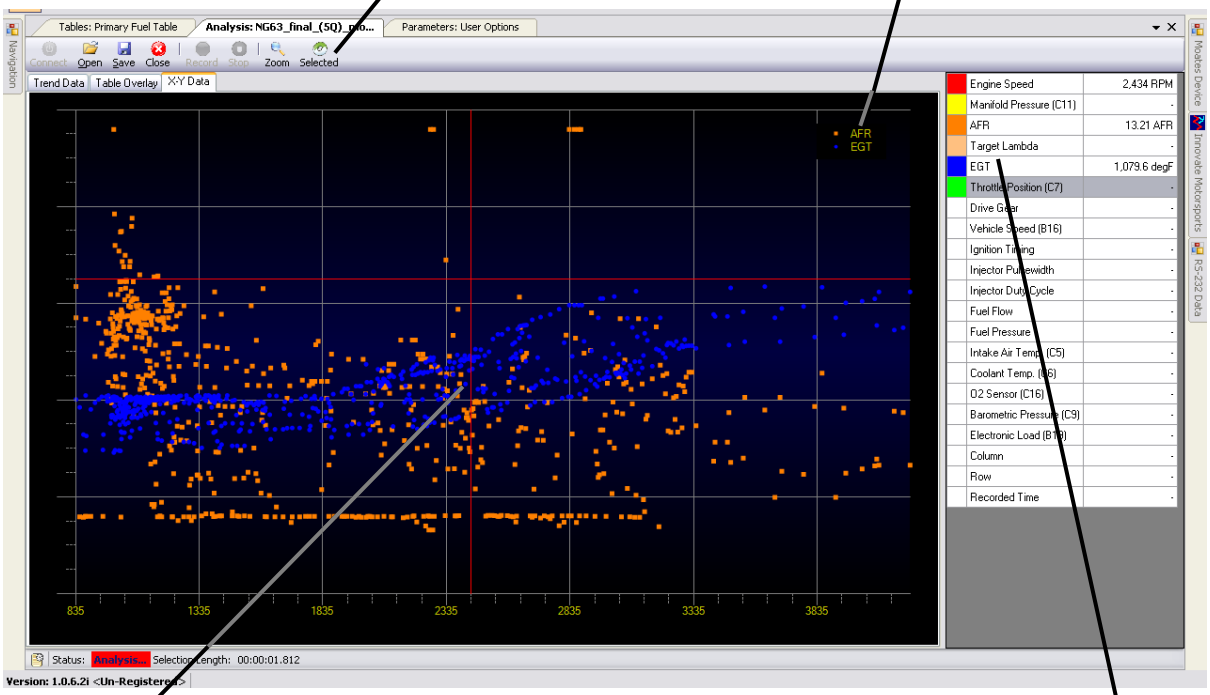
Analyzing XY Data

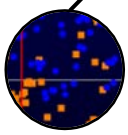
The XY plot shows various channel data (y-axis) in relation to another specific channel (x-axis); histogram view utilizes frequency for the y-axis data.

Setup is based on the right-click menus.

The XY Graph can be adjusted to utilize an entire log file or only the Trend Data selection. An X-axis zoom is also available.

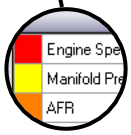
The legend displays the colors used by each channel. Colors are editable thru the channel properties (double-click grid view, or edit thru trending menus).

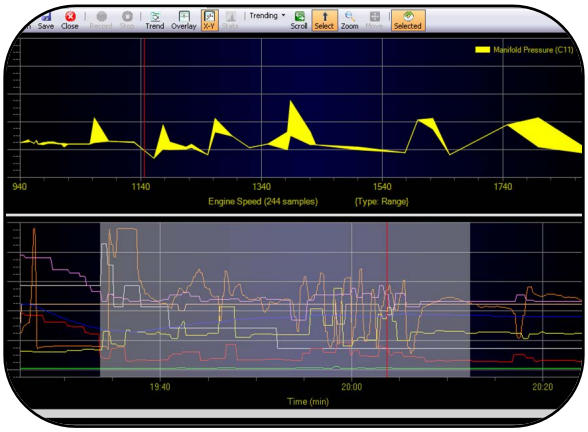




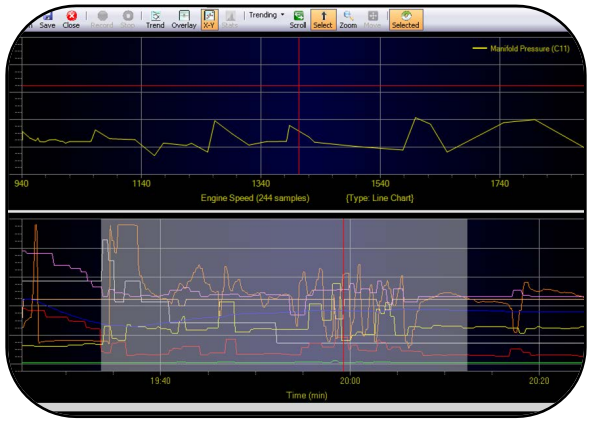
XY data may be added thru the right-click menus. A single X channel and multiple Y channels are available. Data may be plotted in multiple ways.

This real time data grid shows the X-value and average Y-values of graphed channels at their respective cursor location.

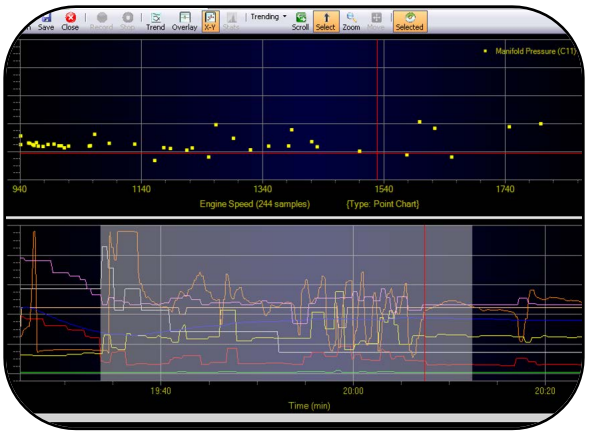




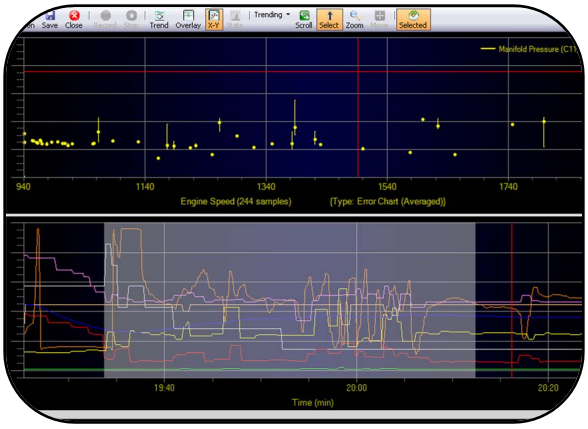
Range Chart



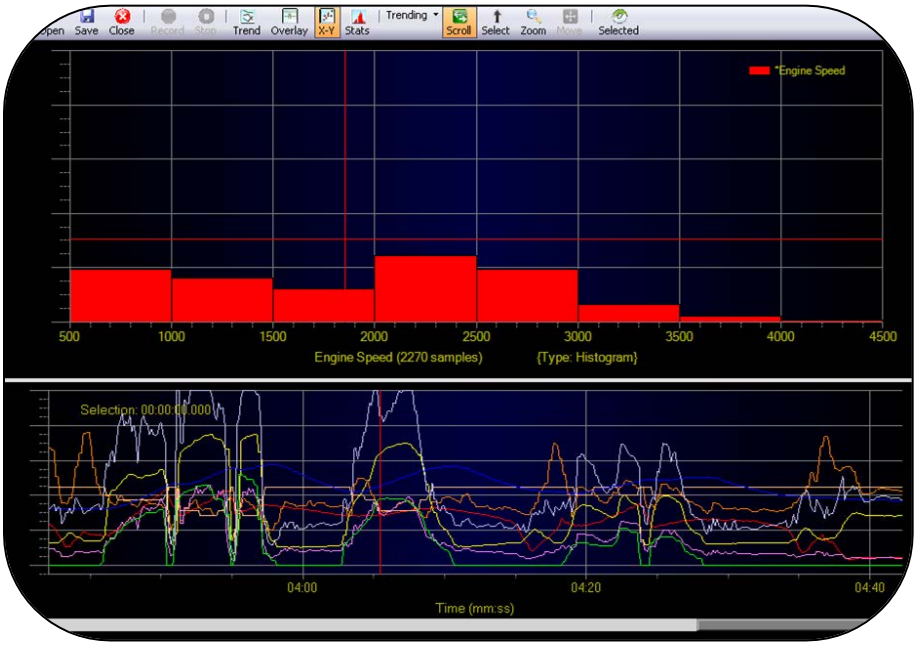
Line Chart



Point Chart



Error Chart



Histogram

Analyzing Statistical Data

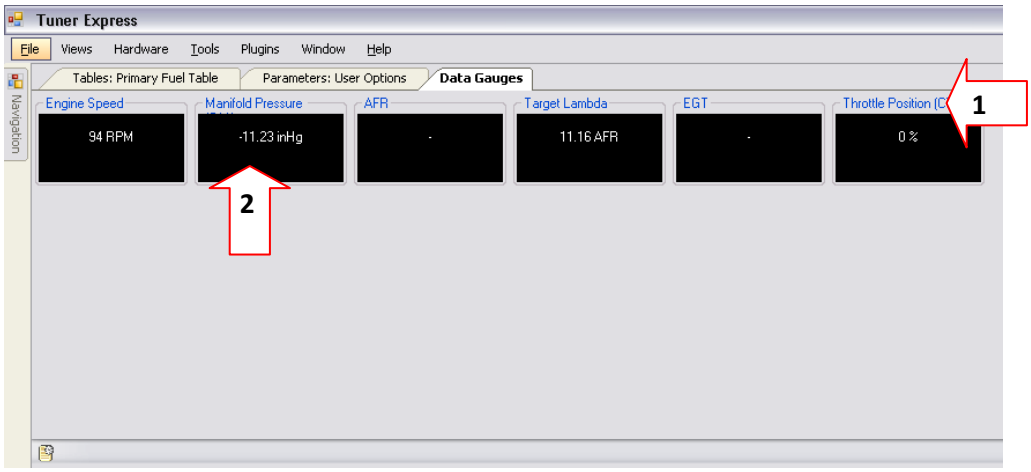
The statistical tab shows channel minimum, maximum and average values for each sensor. Data is calculated for the selected time period.

Data Module Command Summary

Button	Command	Location
	**Data Settings** Properties of the chart, table and other controls may be edited within the table properties.	**Status Strip**
	**Connect or Scan** This is used to start or stop the streaming of network data.	**Status Strip** **Shortcut: F11**
	**Open File** Opens a saved trending file in .tsv format.	**Toolbar**
	**Save** Saves the current recorded session or a modified trending file in .tsv format. This will always perform a save-as, the existing file may be overwritten if so desired.	**Toolbar**
	**Close File** Closes an open trending file or recorded session.	**Toolbar**
	**Record** Starts recording the current live data session.	**Toolbar**
	**Stop** Stops recording the current live data session and saves the trending file if AutoSave is enabled.	**Toolbar**
	**Load Trending Template** Opens a saved template file and displays loaded channels within the trending view.	**Trending Toolbar**
	**Edit Trending Template** Opens a window which allows for customization of the data displayed. This also allows for the creation of an initial trending template file.	**Trending Toolbar**
	**Save Trending Template** Saves a modified template file. This will always perform a save-as, the existing file may be overwritten if so desired.	**Trending Toolbar**
	Edit Channel Properties Opens the channel settings dialog which allows formatting of such properties and trending color, minimum and maximum values, etc.	**Trending Toolbar**
	**Select** Select allows the user to select time based periods of the recorded chart data.	**Toolbar**
	**Zoom** Zoom allows the user to zoom in/out on selected chart areas.	**Toolbar**
	**Load Table Overlay Template** Opens a saved template file and displays loaded overlays within the tree view.	**Table Overlay Toolbar**
	**Edit Table Overlay Template** Opens a window which allows for customization of the table overlays within the template file.	**Table Overlay Toolbar**
	**Save Table Overlay Template** Saves a modified template file. This will always perform a save-as, the existing file may be overwritten if so desired.	**Table Overlay Toolbar**
	**Selected** Creates the Table Overlay and XY Graph data based on the entire recorded session or only the selected portion of data.	**Toolbar**

Data Gauges

The Data Gauges allow a quick view of Channel Trending Data. These gauges are linked to the Data Module's Trending Definition.



Overview

1. **Channel Name**
    a. This is the name of the linked Channel.
2. **Channel Value**
    a. This is the real time value of the linked Channel.
    b. If included in the definition file, the Raw (un-calculated) values received will be displayed above the Channel value.

Gauge Usage

When setting up the Trending Definition, any Channels that are set to plot on the Trending Graph will be shown as a Gauge. Individual Gauges may be enabled or disabled using the right-click menu. Gauge fonts and colors are editable through the Options menu. Currently up to 24 channels may be added to the Gauge window.

Scripting Architecture

General Usage

To be completed…

Requirements

To be completed…

Definition Files

To be completed…

Plugins Architecture

General Usage

Plugins can be written to enable the customization of the host application. The plugin can communicate with the host software to retrieve data, run calculations and send data to the application, refer to the image “borrowed” from Wikipedia.

Requirements

To be completed…

External Hardware

Scriptable Serial Port (RS-232)

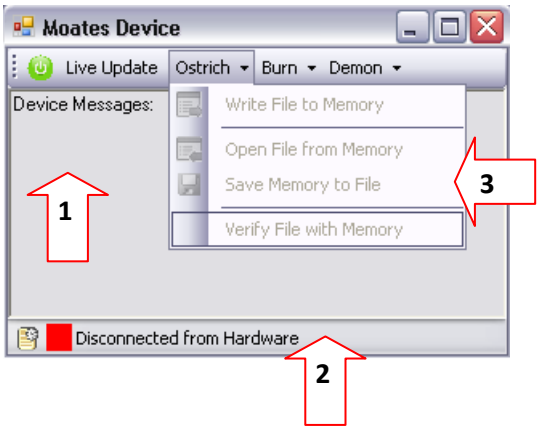
To be completed…

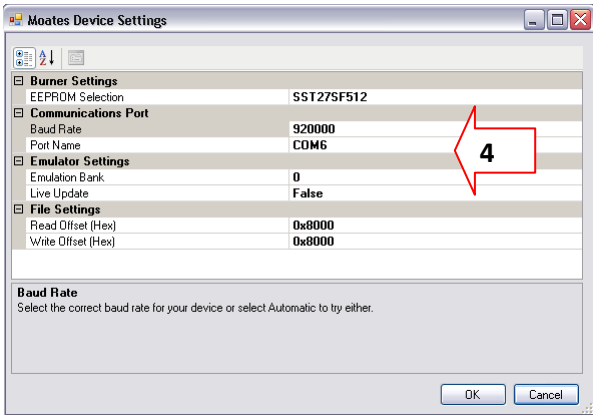
Moates Products

General Usage

The purpose of this dialog is to be able to communicate in real-time with various products from Moates.net. The following goes into detail of how to use this tool to best suit your needs.

The user interface and settings are defined as shown in the images below:





1. ***Device Messages***
   a. This textbox displays pertinent information to the user. Information contains verification of data sent as well as any error messages received from the connected hardware.
2. ***Status Bar***
   a. This displays the status of the current hardware device. Progress of larger tasks is also displayed to the user.
3. ***Device Dropdown***
   a. The dropdown buttons will enable/disable based on the connected device.
   b. A tooltip description of each process is given.
4. ***Device Settings***
   a. COM port, Burner and Emulation settings are available in this dialog.

Innovate Motorsports Products

To be completed…