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AEMLog Users Guide

Version 1.01

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Introduction

AEMLog is a data analysis package designed to be used in conjunction with **AEMPro**. **AEMLog** offers many advanced analysis features including overlays, histograms, XY plots, maths channels, lap analysis, track drawing and channel alarms. **AEMLog** runs under the *Windows 95/98/NT/XP* operating systems.

Documentation

This *User Guide* is split into two main sections. The first, *Getting Started*, contains instructions on programming and reading data from the logger and a brief overview of many of the **AEMLog** features. The second section, *Reference*, discusses the features of **AEMLog** in detail and outlines the methodology behind installing and calibrating sensors for use with the logger and the use of **AEM** beacons for lap timing purposes.

Throughout this guide, procedures in **AEMLog** are referred to using the menu commands separated by a | symbol. Thus **File | Open** means select the **Open** command from the **File** menu. If a keyboard shortcut or a button on the **AEMLog** toolbar also performs the same task, this is shown in the left hand margin.

A comprehensive on-line help system is provided with **AEMLog** to give more details on using the package. To view the help, press **F1** or select **Help | Help Topics**.

Help can also be obtained in dialog boxes by clicking on the ? in the top right hand corner of the box and then clicking on the item for which you require help.

Installing AEMLog

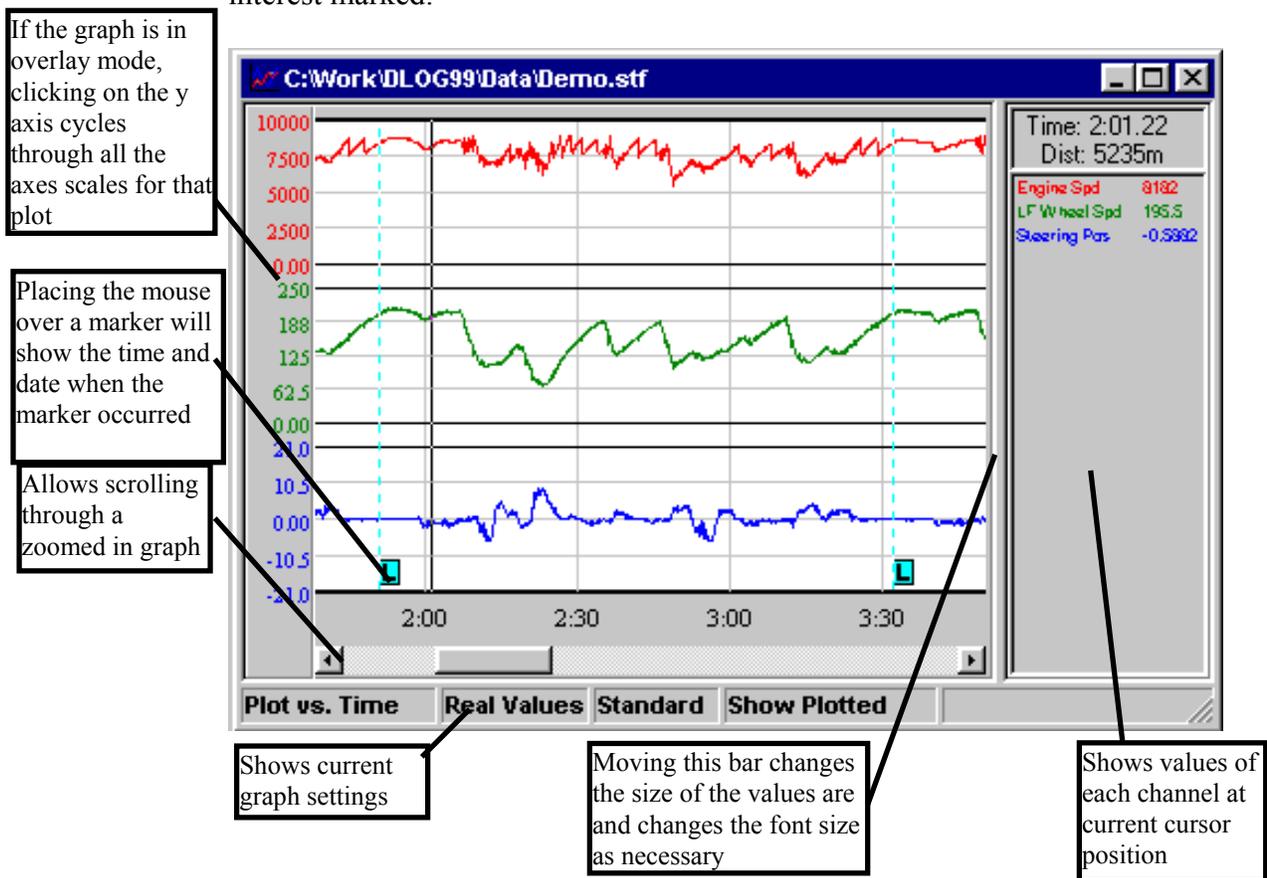
- **AEMLog** is supplied on CD-Rom and automatically installed when AEMPro is installed. To begin, simply click on the AEMLog shortcut that the install placed on your desktop.

AEMLog Quick Reference

The following sections give a brief overview of options and menu commands available in **AEMLog**. For more information, see either the on-line help or the *Reference* section later in this *User Guide*.

The Main Graph Screen

The following screenshot shows a typical AEMLog graph screen with areas of interest marked.



Many of the commands in the Graph menu are reproduced in the graph popup menu. To view this menu, right click on the graph itself.

To zoom in on the graph to view the data in more detail:

Keypad +

- Select **Graph | Zoom | In**. The cursor will change into a  showing that you are in x axes zoom mode.
- Click on the area of the graph where you want the zoom to start.

- Click on the area of the graph where you want the zoom to end. The graph will be redrawn with the new zoom range.
- The selected zoom range is bounded by red vertical lines at the start and end. Using the scroll bar at the bottom of the graph, data outside this zoom range can be viewed.
- If there is data outside the scrollable region, a  or  will be shown at the edge of the scrollable area. These will shift the zoom area to the left or right respectively.

Ctrl Keypad
+

The y axis can be zoomed in a similar manner by selecting **Graph | Zoom | Expand** which will change the cursor to  to show that you are in y axis zoom mode.

Menu Commands

The following section gives a brief overview of the menu commands and their use. If a tool bar button or a keyboard shortcut can be used to perform the same function, it is shown in the left hand margin.

File Menu

The File Menu contains all the commands used for file management:

F3



Open

- Use the open command to open a log file.

Reopen

- Allows a file to be selected from the most recently opened log files. The down arrow next to the open button can also be used to reopen files.

Export

- Exports data in an ASCII format suitable for use in other applications such as word processors or spreadsheets.

Abstract

- Copies selected channels into a new data file.

Ctrl F3



Notes

- Displays notes about the current data file and allows new notes to be added.

Exit

- Quits AEMLog.

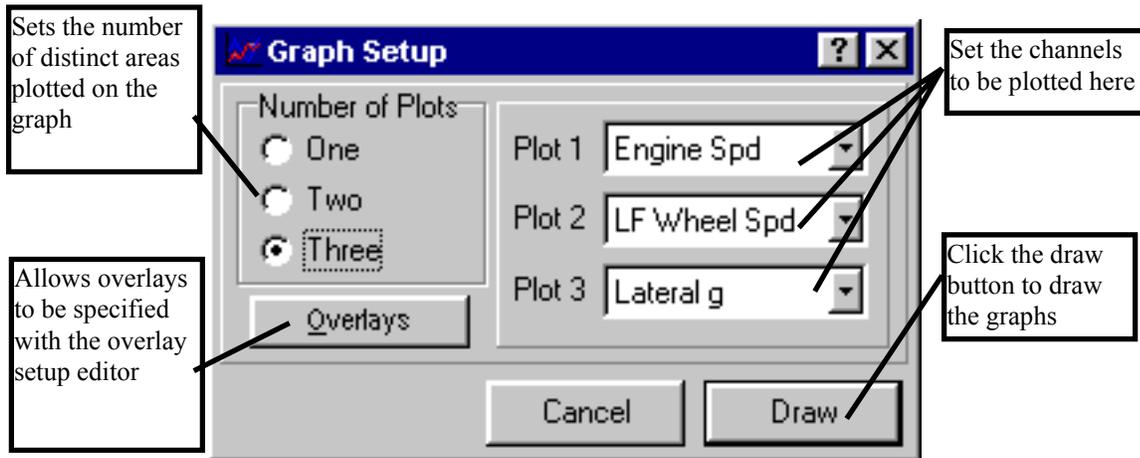
Graph Menu

The Graph Menu contains commands used for displaying and printing graphs.

Ctrl G

Graph

- Invokes the graph options editor where the number of lines, overlays and lap markers can be specified. An example screen is shown below



Overlays

- Allows the graph overlays to be set.

Setup

- **Edit** edits the setup of the currently active graph. (Note that this is different from the currently active setup).

F2

- **Update Log File** saves any changes made to the data file.

Shift Overlays

- Allows the x axis of any overlaid *Files* to be moved relative to the base graph x axis by dragging the plot. When in shift mode, the cursor will change to a . Click on the graph and drag the overlaid plots to a new position.

Zoom

- Allows zooming in or out on the x and y axes.
- **In** Zooms in the x axis.
- **Out** Zooms out the x axis.
- **Expand** Zooms in the y axis.
- **Contract** Zooms out the y axis.
- **Normal** Resets all zooms.

Plot Types

- **Time or Distance:** Plots the graph against time or distance (if recorded).
- **Real or A-D:** Plot the graph using real (engineering) units or using raw 8 or 16 bit data.
- **Standard Plot or Lap Plot:** Allows the lap plot facility to be switched on.

Ctrl T



Tape Measure

- Displays the Tape Measure window. This allows the difference between two points on a graph to be measured.

Insert Marker

- Inserts a Custom Marker at the current position.

Analysis Menu

The Analysis Menu contains commands for examining the data in more detail than possible via a simple graph.

F5



Lap Times

- Use to display lap markers, split, total lap times and average lap speed.

F6



Statistics

- Displays minimum, maximum and average values of channels.
- Double clicking on a minimum or maximum value will automatically zoom the graph around that point.

Ctrl F7



Histogram

- Shows the frequency of occurrence of values in a channel as a percentage of the current zoom range time or distance.

Ctrl F8



XY Plot

- XY plots allow one channel to be plotted against another thus allowing the relationship between the two channels to be explored.

Templates Menu

Graph templates allow frequently used graph plots, graph types and window positions to be saved. These can then be recalled at any time by running the template from the menu or by assigning a button on the toolbar to the template and clicking on the button

Save

- Saves the current screen layout and graph options as a template.

Run

- Prompts for a template file name and then runs the specified template.

Configure

- Configures toolbar buttons for use with saved templates.

Maths Menu

AEMLog allows mathematical formulae to be applied to recorded data providing for much more complex analysis. Once maths channels have been created, the calculated data can be plotted and analysed like any other channel and can even be used in other maths channels.

Maths functions are stored in a Maths Library. This central repository of maths functions allows libraries to be shared between users.

Note that the maths channels reference recorded channels by the name of the channel. Therefore, for maths channels to work consistently, an effort must be made to ensure that channel naming is consistent over time.

Shift F9

Open Library

- Opens and existing maths library.

F9

Edit Library

- Edits the currently active maths library

Ctrl F9

Recalculate

- Adds maths channels to the currently active data file using the current maths library.
- Added maths channels can be displayed and analysed just like recorded channels.

Merge

- Combines two maths libraries.

Create

- Creates a new maths library.

Calculate On Open

- When checked, maths channels are calculated when a data file is opened.

Calculate On Read

- When checked, maths channels are calculated when a data file is read from a logger.

Config Menu

Logger

- Specifies the type of logger AEMLog is being used with. The logger type affects certain areas of the setup editor. This needs to be set to DLOG99.

Options

- Allows options such as PCMCIA slot mapping and graph colours to be set.

Tool Bars

- Some or all of the tool bars can be turned off if desired.

Close On Read

- When checked, all existing data files will be closed when a new file is read from a card. This can be useful during a logging session that may result in the potentially confusing situation of many windows being open at once. Opening files will not force other windows to close. When not checked, existing files remain open when a new file is read from a card.

Notes On Read

- When checked, the user will be prompted to enter notes about the data file whenever a new file is read from a card.

Window Menu

Tile Vertically

- Arranges windows vertically with all windows visible if possible.

Tile Horizontally

- Arranges windows horizontally with all windows visible if possible

Cascade

- Arranges windows in a cascaded format with each window on top of the previous one.

Minimise All

- Minimises all windows.

Arrange

- Arranges iconized windows.

Close

- Closes the active window.

The numbered list at the foot of the Window menu can be used to make the desired window active.

Cascaded windows appear on the screen diagonally, from upper left to lower right, overlapping so that the title bar of each window remains visible.

Tiled windows are distributed to each corner of the screen, so that each window is visible and none overlap.

Icons (or reduced windows) appear at the bottom of the AEMLog main window. Each icon remains visible. Double-click an icon to make that window active.

Help Menu

F1

Help Topics

- Display the Help Topics dialog box:

About

- Display program version and serial number information.

To find a topic in Help:

- Click the Contents tab to browse through topics by category.
- Click the Index tab to see a list of index entries: either type the word you're looking for or scroll through the list.
- Click the Find tab to search for words or phrases that may be contained in a Help topic.

Context sensitive help can be obtained by pressing the **F1** key.

Help can also be obtained in dialog boxes by clicking on the ? in the top right of the dialog box and then clicking on the item for which you require help.

The Scalars Table

Scalars are used to calibrate raw data in the form $y = mx + c$, where y is the real data, x is the raw data, m is the multiplier and c is the offset. Scalars are combined with Inputs in the Output page to create the recorded outputs.

Name	Gain	Multiplier	Offset	Min	Max
Raw 8	8x1	1	0	0	255
Raw 16	16 bit	1	0	0	65535
RPM Serial	16 bit	1	0	0	10000
Throttle Ser	16 bit	0.1	0	0	100
Lo Temp Ser	16 bit	0.1	-100	0	150
Hi Temp Ser	16 bit	0.1	-100	0	1000
Lo Press Ser	16 bit	1	0	0	1100
Hi Press Ser	16 bit	0.001	0	0	10
Air/Fuel	16 bit	0.0147	0	0	20
n Sensor	8x16	0.04	-2.64	-2	2

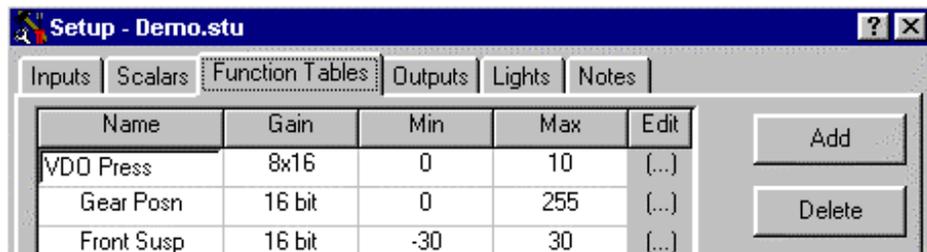
The **Name** column specifies the name of the scalar

$$Real = Raw \times Multiplier + Offset$$

The **Min** and **Max** values define the lower and upper limits of the y axis when the data is plotted. See the **Calibrating Sensors** section for more details on setting up the scalar and function table.

Function Tables

Function tables are used to convert a non-linear sensor output into linear real data and are entered into the Functions page of the setup editor. An example function table page is shown below:



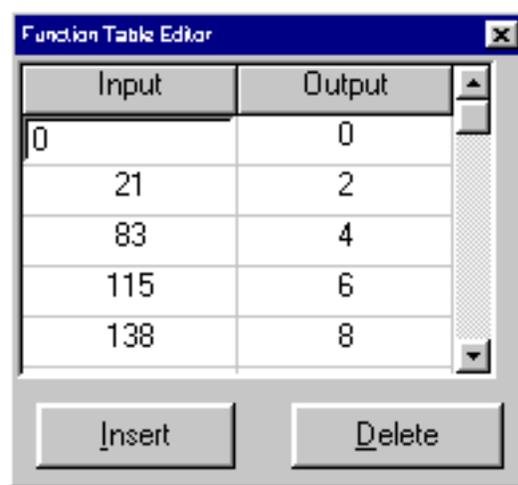
The **Add** and **Delete** buttons can be used to add or delete function table sensors.

The **Name** box is used to specify the name the function table.

The **Gain** column specifies how the raw data is stored as discussed above.

The **Min** and **Max** values define the lower and upper limits of the y axis when the data is plotted.

Clicking on the (...) button displays the function table editor:



Use the **Insert** button to add another entry or the **Delete** button to delete an entry.

The **Input** column contains the raw values.

The **Outputs** column contains the real values.

Once the function table has been entered, click the **x** button to return to the Function Table page of the editor.

Function tables calculate the real value by looking up the raw value in the input list and matching it to an output value which is multiplied by the multiplier. Linear interpolation between nearest sites is carried out if necessary. See the **Calibrating Sensors** section for more details on setting up the scalar and function table.

Analysing Data



Once a data file has been opened, data can be viewed and analysed by several means in AEMLOG, each of which will be considered in detail below.

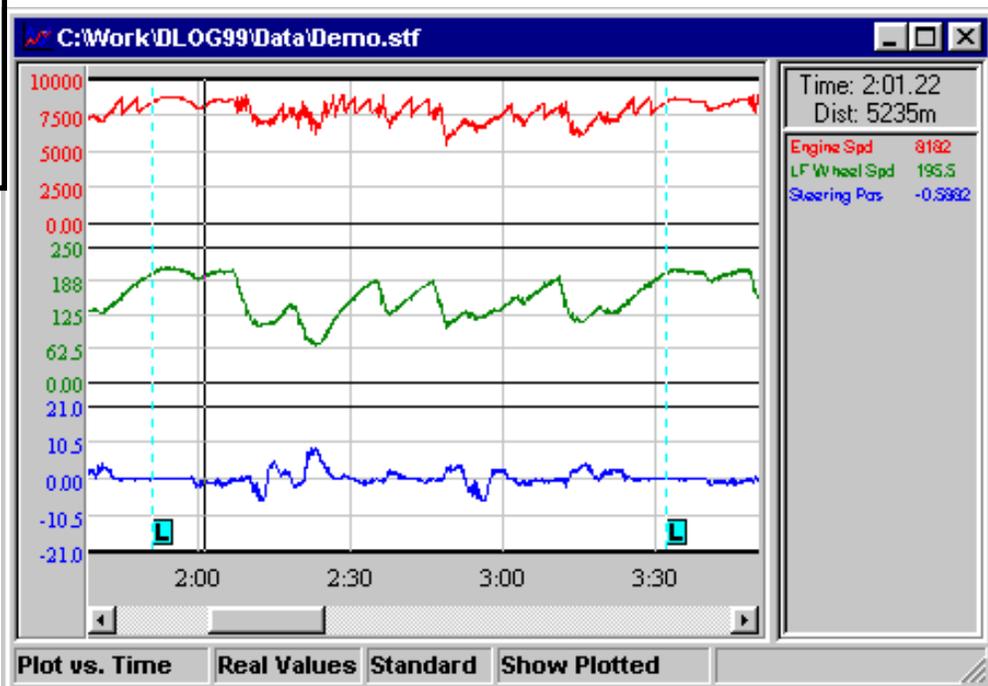
Simple Graphs

The simple graph allows channel data to be plotted against time or distance (if recorded). A typical graph screen is shown below:

If the graph is in overlay mode, clicking on the y axis cycles through all the axes scales for that plot

Placing the mouse over a marker will show the time and date when the marker occurred

Allows scrolling through a zoomed in graph



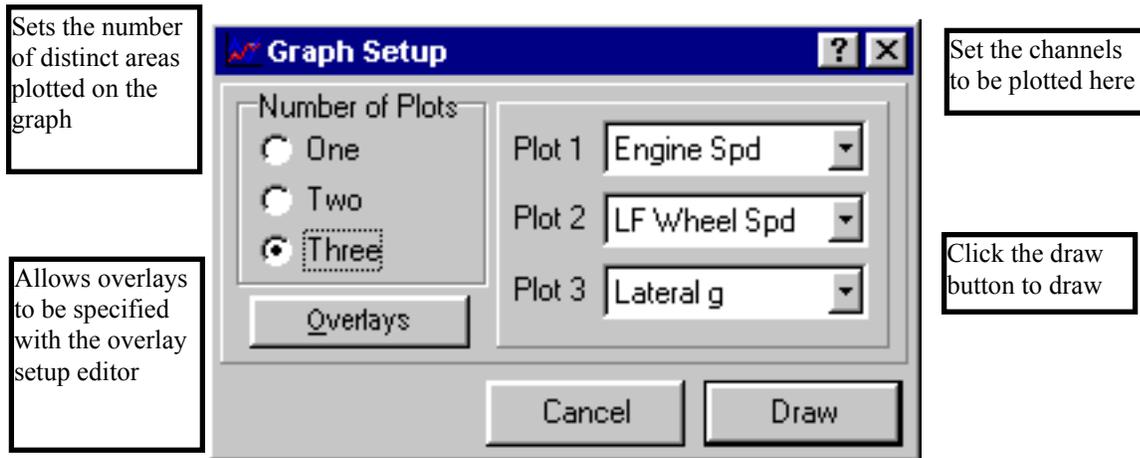
Shows current graph settings

Moving this bar changes the size of the values are and changes the font size as necessary

Shows values of each channel at current cursor position

To alter the graph settings, commands from the graph menu are used. Many of these commands are reproduced in the graph popup menu. To view this menu, right click on the graph itself.

To change the lines plotted, choose **Graph | Graph** and the graph setup editor will be shown:



Overlays can also be added from here by clicking the overlay button. Overlaid channels can be from either the existing file or from additional external files. Up to four external files can be added; when plotted, overlaid channels from external files are preceded with a number corresponding to the file number in the overlay list.

Overlays from external files can be shifted relative to the base graph by selecting **Graph | Shift Overlays**. This allows starting points of data to be easily synchronised.

To zoom in on the graph to view the data in more detail:

Keypad +

- Select **Graph | Zoom | In**. The cursor will change into a  showing that you are in x axes zoom mode.
- Click on the area of the graph where you want the zoom to start.
- Click on the area of the graph where you want the zoom to end. The graph will be redrawn with the new zoom range.
- The selected zoom range is bounded by red vertical lines at the start and end. Using the scroll bar at the bottom of the graph, data outside this zoom range can be viewed.
- If there is data outside the scrollable region, a  or  will be shown at the edge of the scrollable area. These will shift the zoom area to the left or right respectively.

Keypad -

- To zoom out to the previous zoom level, select **Graph | Zoom | Out**.

Ctrl Keypad +

- The y axis can be zoomed in a similar manner by selecting **Graph | Zoom | Expand** which will change the cursor to  to show that you are in y axis zoom mode.

- Ctrl Keypad**
- To contract the y axis to the previous level, select **Graph | Zoom | Contract**.

The right hand side of the graph shows the values at the current position (shown on the graph by a vertical black line). This position marker can be moved by clicking the left mouse button on the graph and dragging the bar whilst still holding the mouse button down. Alternatively, the left and right cursor keys can be used (holding the shift key down whilst pressing the cursor keys will move the bar ten times as fast).

Clicking the right mouse button on the values area of the graph will show a menu allowing line colours, style and y axis limits to be changed. This menu can also be used to add boundary lines for highlighting ranges on the graph.

The y axis labels of the graph show the real or raw ranges of the graph. If a particular plot has overlays, the axis limits will show the current percentage range. By clicking on the y axis, the y axis labels will cycle through all actual channel limits for that plot.

The functions available from the Analysis menu will now be considered.

Statistics

F6



The statistics screen displays the minimum, maximum and average values of all channels in the base graph over the current zoom range and the times at which these occur. Double clicking the mouse on the time at which a minimum or maximum value occurs will zoom the graph in around this point. An example statistics screen is shown below:

Channel	Minimum	Time at Min	Maximum	Time at Max	Average
Engine RPM	1500	21.5	5750	143.5	3236.6
Boost Prs	0.18	59.6	1.26	93.2	0.62453
Water Temp	73	127	94	5.5	80.811
Oil Pressure	2.3332	21.5	4.1624	141.5	3.7393
T P S	8	18.4	84	124.7	27.463
Oil Temp	99	135	104.5	45.5	101.25
A I T s	17	135.2	43	5	25.447
Battery V	13.16	21.5	13.86	121	13.712
Speed Right	0	0	81.4	97.6	50.158
Speed Left	0	3.9	105.6	0.5	49.46
Yaw	-85.964	129	16.926	100.5	-7.9904
Distance	0	0	2568	160.5	1189.5

Histograms

Ctrl F7



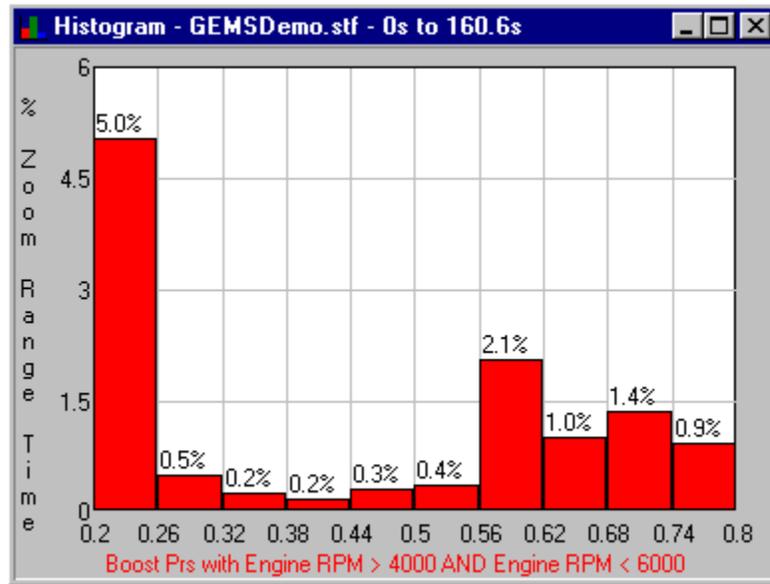
Histogram shows the frequency of occurrence of values in a channel as a percentage of the current zoom range time or distance. Choose **Analysis | Histogram** to show the histogram setup editor:

The screenshot shows the 'Histogram Options' dialog box with the following fields and callouts:

- Channel Options:**
 - Channel:** Boost Prs (Callout: Channel for which the histogram is to be calculated)
 - When:** Engine RPM > 4000 (Callout: Condition which must be met for a value to be added to the histogram)
 - AND:** Engine RPM < 6000 (Callout: Additional conditions)
 - NONE:** Engine RPM > 0 (Callout: Additional conditions)
- Histogram Options:**
 - Number of Bars:** 10 (Callout: Number of bars the histogram is to be split over)
 - Bar Ranges:**
 - Auto (Callout: Set whether the bar ranges are to be calculated automatically or specified manually)
 - Manual
 - Auto Ranges:**
 - Start:** 0.2 (Callout: Sets the start and end bar ranges if in auto range mode)
 - End:** 0.8

Set channel to the channel for which the histogram is to be calculated. Conditions can then be applied to the histogram to limit the amount of data included by checking the When box and entering the condition desired. Up to three conditions can be specified and are combined with the logical operators AND, OR, NOT. Only values that meet the specified criteria will be included in the histogram. The number of bars to plot and the bar ranges can now be specified.

Once the setup is complete, click OK and the histogram will be drawn:



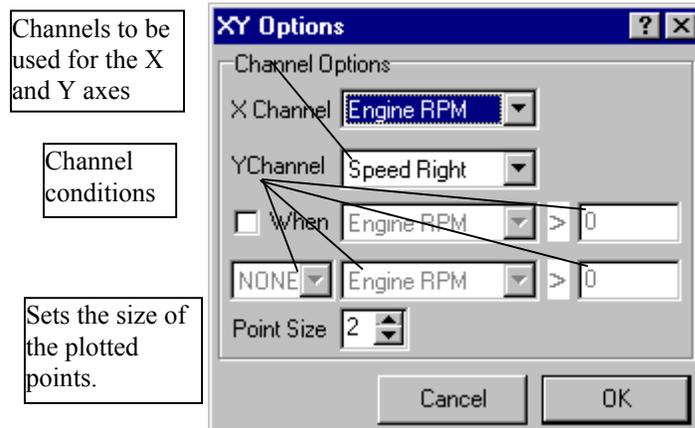
Once a histogram is drawn, the histogram editor can be re-entered by right clicking on the histogram. Once a histogram setup has been created it can be saved to a histogram template by clicking the Save button in the histogram editor. Histogram templates can be assigned to buttons in the histogram editor by selecting **Config | Options** and entering the filename in the histogram buttons page.

XY Plots

Ctrl F8



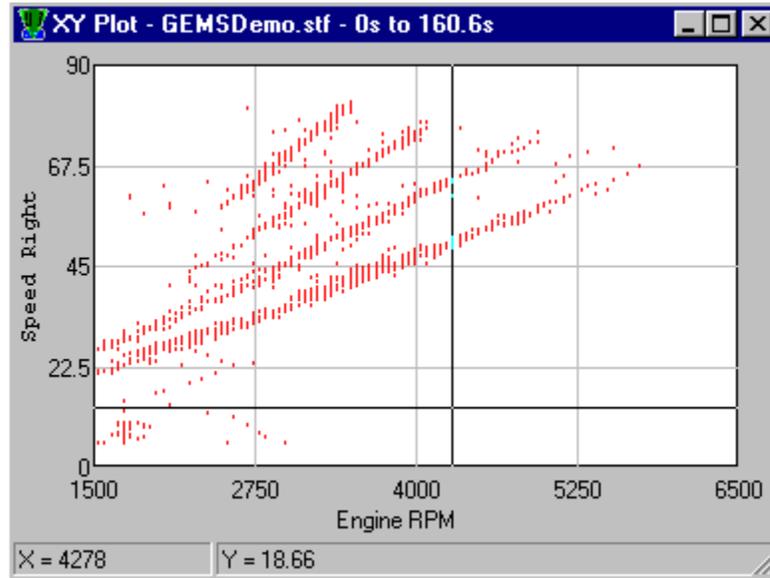
XY plots allow one channel to be plotted against another thus allowing the relationship between the two channels to be explored. To create an XY plot, choose **Analysis | XY Plot**; the XY plot editor will be shown:



Set the X and Y channels for which the XY plot is to be draw. Conditions can then be applied to the plot to limit the amount of data included by checking the **When** box and entering the condition desired. Up to two conditions can be specified and are combined with the logical operators AND, OR, NOT. Only values that meet the specified criteria will be included in the XY plot.

The point size changes the size of the plotted points. On plots using a large amount of data, a small point size should be used. However, when the data set used is small, a larger point size helps to show any trends in the data

Once the setup is complete, click OK and the XY plot will be drawn:



By clicking and holding the left mouse button on the graph, the mouse can move the cross hairs on the plot. The X and Y values at the current cross hair position are shown in the status bar at the foot of the graph.

Once an XY plot is drawn, the XY plot editor can be re-entered by right clicking on the plot. XY plot settings can be saved in an XY plot template by clicking the Save button in the editor. XY templates can be assigned to buttons in the editor by selecting **Config | Options** and entering the filename in the XY plot buttons page.

Maths Channels

AEMLog allows mathematical formulae to be applied to recorded data providing for much more complex analysis. Once maths channels have been created, the calculated data can be plotted and analysed like any other channel and can even be used in other maths channels.

Maths functions are stored in a Maths Library. This central repository of maths functions allows libraries to be shared between users.

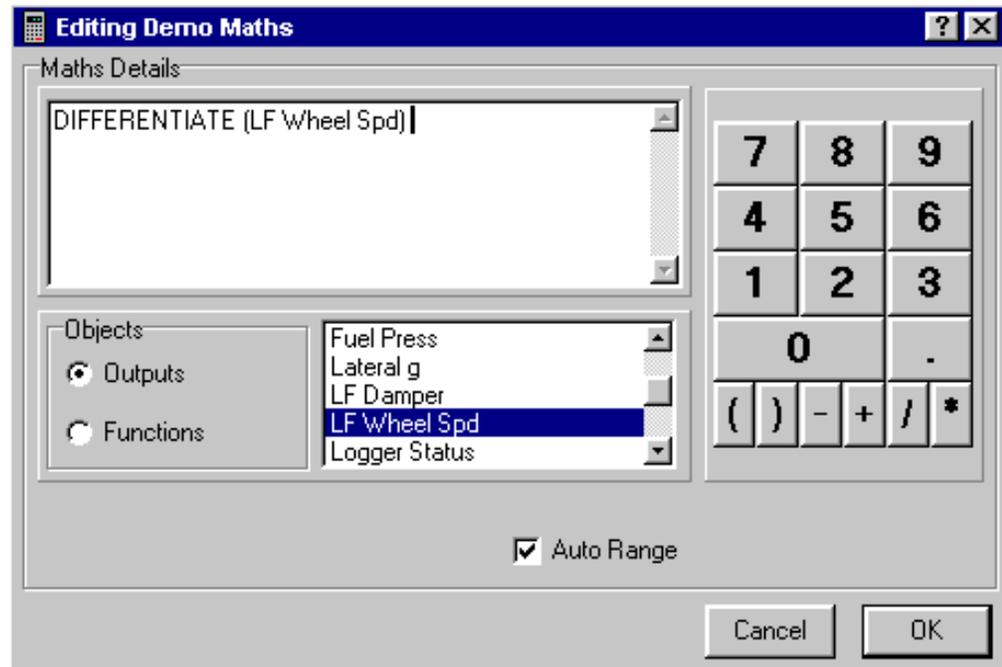
Note that the maths channels reference recorded channels by the name of the channel. Therefore, for maths channels to work consistently, an effort must be made to ensure that channel naming is consistent over time.

Defining Maths Equations

Shift F9 To show the maths library editor, either open a maths library using **Maths | Open Library (Shift F9)** or edit the currently active maths library using **Maths | Edit Library (F9)**. Note that AEMLog always sets the last opened maths library as the currently active maths library. The currently active maths library is shown in the AEMLog status bar.

The main page in the maths library shows the maths equations currently created. The **Name** column shows the name of each equation and the **equation** column shows the actual equation. To create a new maths equation, click the **Add** button and enter a name for the equation. By clicking on the **(...)** button next to the equation, the equation editor is invoked.

The equation editor allows the maths equation to be entered/edited. A typical equation editor window is shown below:



- The equation will appear as it is entered in the top left edit window.
- To add an output to the equation, ensure **Outputs** is selected in the Object box, then click on the desired channel from the list displayed.
- To add numbers, +, -, /, * or brackets, simply type in using the keyboard or use the mouse with the keypad displayed to the right of the Maths Editor. Note: no operators have precedence in the Maths Editor: i.e. $1+2*3$ will evaluate as $3*3$. Use brackets to change the evaluation order: i.e. $1+(2*3)$ will evaluate as 7.
- To add a maths function, ensure **Functions** is selected in the object box, then click on the desired function.
- If **Auto Range** is checked, values for the Minimum and Maximum range will be automatically calculated.
- If **Auto Range** is not checked, values for Minimum and Maximum can be entered. The Min and Max values

Adding Maths Channels

F9 To calculate maths channels for the currently active data file, choose **Maths | ReCalculate** or press **Ctrl F9**. A window will appear showing the progress of the maths calculation. Calculation can be stopped at any point by pressing the Cancel button. Once the maths channels have been added, they can be plotted and analysed like any other channels.

The maths evaluator automatically adds any channels in the currently active maths library that have their required channels recorded. Any maths channels that do not have the required outputs recorded are not added. The record rate for the maths channels is determined automatically from the rates of the recorded data.

Note that the maths library matches channels by name...channel naming must remain consistent over a period of time for the maths library to remain universal.

AEMLog can also be configured to automatically calculate maths channels:

- If **Maths | Calculate On Open** is checked, AEMLog will attempt to calculate the maths channels whenever a file is opened.
- If **Maths | Calculate On Read** is checked, AEMLog will attempt to calculate the maths channels whenever a file is read.