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MAP3000

Software Instructions

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1   Introducing MAP3000

MAP3000 is the next generation of monitoring and calibration tools for OMEX Electronic Control Units (ECUs). It can either be used whilst connected to an ECU for realtime monitoring and calibration changes or offline as a stand-alone calibration file editor.

MAP3000 offers many advanced features including PC based datalogging, virtual dashboards and auto-mapping.

1.1   Notation Used in This Manual

Menu commands are signified in bold type with a pipe symbol **|** between each level of the menu.

For example, **File | Open** indicates that you should click on the **Open** option in the **File** menu.

`UPPER CASE TEXT` is used to indicate text that should be typed in by the user.

1.2   Installing MAP3000

MAP3000 is distributed on either floppy disk or CD ROM.

Installing from floppy disk
- Insert the disk in the disk drive.
- Click on the Windows **Start** menu and select **Run...**.
- In the Open box, type `A:\SETUP.EXE` and click **OK**.
- The installation wizard will start. Follow the instructions on screen to install the software.

Installing from CD ROM
- Insert the disk in the CD drive.
- The installation wizard should start automatically. If it does not:
  - Click on the Windows **Start** menu and select **Run...**
  - In the Open box type `X:\SETUP.EXE` (where X is the drive letter of your CD drive) and click **OK**.
- Once the installation wizard is running, follow the instructions on screen.

1.3   Menu Commands

This section provides an overview of all the available menu commands.

1.3.1   File Menu

The file menu contains functions for managing calibration files:

- **New...** - Creates a new calibration.
- **Open... -** Opens a calibration.
- **Reopen** - Allows the 10 most recently opened calibrations to be quickly opened.
- **Save** - Saves the calibration to the current filename.
- **Save As...** - Saves the calibration to a new file.
- **Close** - Closes the current calibration.
- **Batch Import...** - Imports a group of .gdf files into .cal files.
- **Import...** - Imports a .hex or .do file to a MAP3000 calibration or converts a .gdf file to a .cal file.
- **Export...** - Exports a MAP3000 calibration to a .hex or .do file.
- **Calibration Name** - Sets the calibration name.
- **Compare...** - Compares the currently open calibration to another calibration.
- **Convert...** - Converts a calibration from one ECU type and version to another.

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- **Print...** - Prints the selected calibration items.
- **Exit**

1.3.2 ECU Menu

The ECU menu contains functions for working on-line with the ECU.

- **Connect** - Connects the PC to an ECU.
- **Send new calibration...** - Uploads a calibration to an ECU.
- **Update ECU firmware...** - Uploads new firmware to an ECU.
- **Download log data...** - Downloads logged data from an ECU.
- **Wake up** - Forces an ECU into allow connect mode from data stream mode.
- **Pause** - Pauses the connection to the ECU, releasing the com port for other applications.
- **Verify** - Compares the calibration currently in the PC memory with that in the ECU.
- **Program checksum** - Sets the ECU checksum.
- **Set password** - Sets the password. (Only for ECUs that support security).
- **Clear password** - Clears the password. (Only for ECUs that support security).
- **Background load** - When checked, parameters can be viewed whilst calibration data is downloaded from the ECU.
- **Port** - Selects the COM port used for communications.
- **Baud rate** - Selects the baud rate used for communications.
- **Install ECU** - Installs an ECU definition file.

1.3.3 View Menu

The View menu allows parameters, options, tables and maps that have not been assigned to a custom menu, to be viewed.

1.3.4 Template Menu

The templates menu allows templates and virtual dashboards to be setup and run.

- **Save...** - Saves the current screen layout as a template.
- **Save as Window...** - Saves the current screen layout as a window template. Window templates differ from standard templates in that they overlay the template over existing windows, whereas standard templates replace the existing windows.
- **Run...** - Runs a template.
- **Configure** - Configures the template buttons.
- **Dash** - Configures virtual dashboards.

Templates installed as buttons in the toolbar will also appear as options in the template menu.

1.3.5 Logging Menu

The logging menu contains functions for PC logging.

- **Start** - Starts PC logging.
- **Stop and save** - Stops the logging and saves the logged data to disk.
- **Cancel** - Cancels logging.
- **Insert marker** - Inserts a hand marker in the log data.

1.3.6 Configure Menu

The configure menu contains functions for customising MAP3000.

- **Menu** - Configures the menu layout for an ECU.
- **Logging options...** - Configures the log file naming options.
- **Colours...** - Configures the screen colours.
- **Units** - Configures user definable units.
- **Keymode shortcuts...** - Configures the shortcuts used in key mode.

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1.3.7   Window Menu

The window menu contains standard windows functions for changing the way windows are displayed in MAP3000.

- **Tile** - Tiles the windows so that all are visible on screen.
- **Cascade** - Arranges the windows so that all can be clicked on.
- **Arrange all** - arranges any icons.
- **Minimise** - Minimises the current window.
- **Close** - Closes the current window.
- **Close all** - Closes all windows.

1.3.8   Help Menu

The help menu provide access to help about MAP3000.

- **Contents** - Shows the help file.
- **Context window** - Shows the context window which provides information about the currently active window.
- **About** - Displays information about MAP3000, required files and the operating system. This information is required in all correspondence regarding bugs or feature requests.

1.4   Keyboard Shortcuts

General Shortcuts

- **F1** - Shows the on-line help.
- **Ctrl F1** - Shows the help context window. This gives hints about the currently active window.
- **F2** - Saves the current calibration.
- **F3** - Opens a calibration.
- **F4** - Creates a new calibration.
- **F5** - Activates or deactivates key mode. On-line only.
- **Ctrl F4** - Close the active window.
- **Shift F7** - Connect to an ECU.
- **Shift F8** - Upload a calibration to an ECU.
- **Ctrl F** - View the fuel map (if present in this ECU).
- **Ctrl I** - View the ignition map (if present in this ECU).
- **Ctrl K** - Program Checksum.
- **Ctrl L** - Insert marker when PC logging.
- **Ctrl N** - View the calibration notes.
- **Ctrl O** - View the option list.
- **Ctrl P** - View the parameter list.
- **Ctrl Z** - Undo the last change to the calibration.
- **Ctrl Shift Z** - Redo the last undo.
- **Ctrl TAB** - Cycle forwards through the open windows.
- **Ctrl Shift TAB** - Cycle backwards through the open windows.

Table View Shortcuts

- **space bar** - Follow ECU (when on-line).
- **m** - Show pop-up menu.
- **s** - Switch to graphical view.

3D Graph View Shortcuts

- **z** - Zoom in.
- **x** - Zoom out.
- **1** - Show map in wire frame mode with no state information.
- **2** - Show map in wire frame mode with state information.
- **3** - Show map in solid fill mode with no state information.

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- **4** - Show map in solid fill mode with state information.
- **r** - Reflect map.
- **s** - Switch to table mode.
- **m** - Show pop-up menu.

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2	Working With Calibrations

Calibrations are at the core of MAP3000. All ECUs that MAP3000 can connect to contain calibration data, for example fuel and ignition maps.

Calibrations can be downloaded from the ECU, manipulated either on or off-line and saved to the PC. This allows a library of calibrations to be built up for uploading into the ECU.

2.1   Installing an ECU Definition

ECU definition files (called GIN files) are required by MAP3000 to determine the type of data stored in the calibration. These files will be embedded in MAP3000. If you have a version of .gin file ECU that is not embedded in your MAP3000 please contact Omex.

2.2   File Operations

Calibrations can be created, opened and saved for any ECU type with an installed definition (GIN) file. When starting MAP3000 the last calibration opened or saved is automatically opened for editing.

2.2.1   Creating a New Calibration

It is not possible to start a new calibration from File | New. Please contact Omex for a suitable start-up map. There are many options and tables that need to be set in the background and are not covered by the hardware manual, and many that are not accessible by the user.

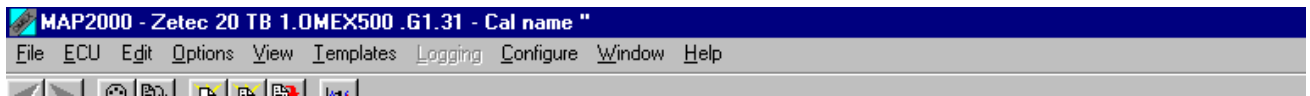## 2.2.2   Opening an Existing Calibration

To open a calibration:
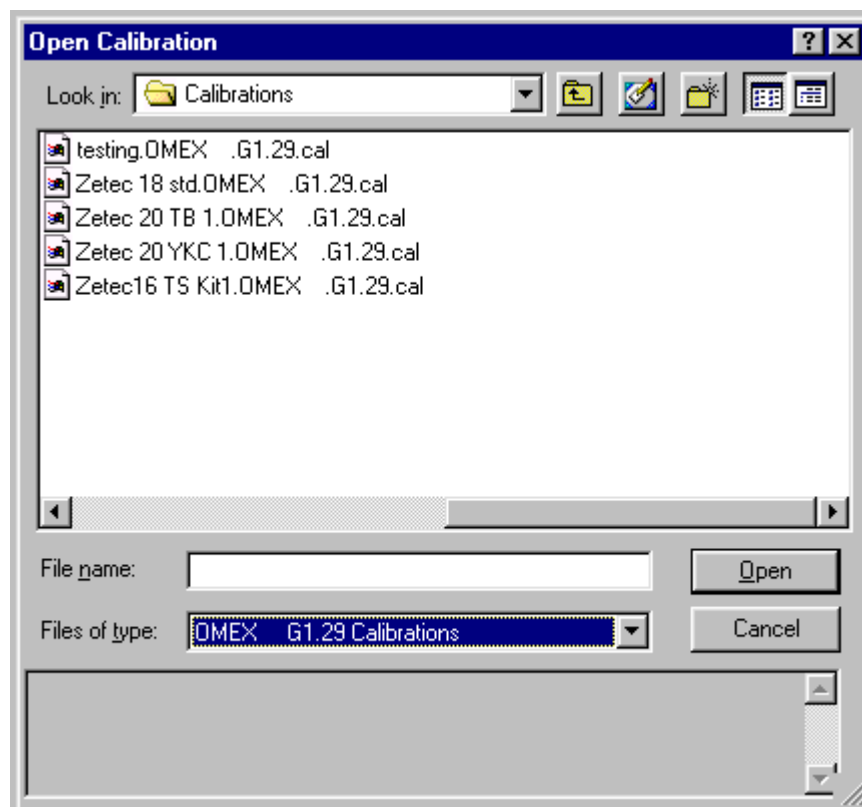
- Select **File | Open...**, press **F3** or click the ⬛ button on the tool bar.
- The Open Calibration Dialog is shown:

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- Select the required ECU type and version from the **Files of Type** combo box. This is automatically set to the last ECU type and version used. The initial folder is also set to that last used.
- Use the standard windows controls to locate the required file and click **Open** to open it.

The window caption changes to show which file has been opened:

MAP2000 - Zetec 20 TB 1.0MEX500 .G1.31 - Cal name "
File ECU Edit Options View Templates Logging Configure Window Help

2.2.3 Saving Calibrations

There are two methods of saving a calibration to disk, **Save As...** which always prompts for a file name and **Save** which only prompts for a filename if necessary.

To use **Save As...**:

- Select **File | Save As...**
- The save calibration dialog is shown. Select the location and enter a filename for the calibration and click OK to save the calibration. We recommend saving to the /MAP3000 folder.

To quickly save changes to a calibration, use **Save**:

- Select **File | Save**, press **F2** or click the [button] button on the tool bar.
- The calibration is saved to the current filename.
- If this calibration does not have a current filename (for example after creating a new calibration), **Save** behaves like **Save As...**.

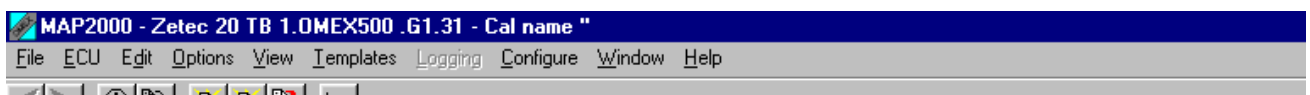## 2.2.4 Setting the Calibration Name

The calibration name is an 8 character name that is stored in the calibration. The calibration name can be used to make it easier to identify a calibration stored in an ECU.

To set the calibration name:

- Select **File | Calibration Name...** to show the calibration name dialog:

Calibration Name

Demo

☑ Save Cal with this name

[Cancel]   [Ok]
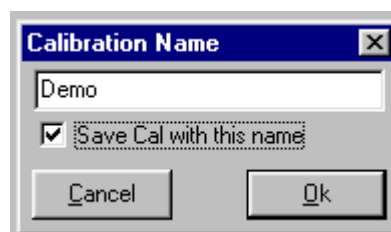
- Enter the desired calibration name in the edit box. This can be up to 8 characters long.
- If the **Save Cal with this name** box is checked, the calibration will be automatically saved with the calibration name as the filename. This also becomes the current file if offline.
- The calibration name is shown in the window caption after the filename:

MAP2000 - Zetec 20 TB 1.0MEX500 .G1.31 - Cal name "
File ECU Edit Options View Templates Logging Configure Window Help

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2.2.5   Comparing Calibrations

Two calibrations can be compared to determine any differences between them. To compare calibrations:

- Open the first calibration using **File | Open...**.
- Select **File | Compare...** and select the second calibration. This can be for any ECU type and version.
- If there are no differences, the following window is shown:
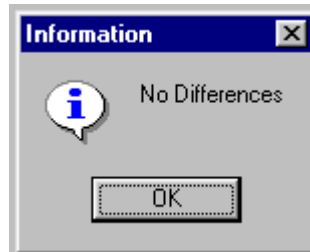
- If there are differences, the difference viewer is shown:

- The left hand column allows areas containing differences to be viewed. The right hand column shows the difference between the two calibrations in the selected area.
- Clicking the **<- Copy** copies the selected values from the compared calibration to the base calibration.
- If the two calibrations are from different ECU versions or types, two additional tabs are added:
- The **Added** tab shows items present in the open calibration opened that are not present in the calibration it was compared with.
- The **Removed** tab shows items not present in the open calibration opened that are present in the calibration it was compared with.

2.2.6   Converting Calibrations

Sometimes it is useful to convert a calibration from one ECU type and version to a new calibration of a different ECU type or version. For example, when an ECU firmware update is released, it is necessary to convert the original calibration to the new version.

The file conversion feature in MAP3000 cannot make all of the changes necessary to convert calibrations to new .gin files. If you need a conversion made please contact Omex.

2.3   Viewing and Editing Calibrations

MAP3000 offers many ways of viewing and editing calibrations. By default, viewable items are added to the **View** menu. However, user defined menus can be created to make navigation through the types more logical. See the section on Customising Menus for more information.

There are four main types of information that can be viewed and edited:

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- Parameters - These are values that are generated in real-time by the ECU such as engine speed or load. As such, values for parameters can only be viewed on-line although the names and units for parameters can be viewed off-line. Parameter values are not stored in the calibration.
- Options - These are single values stored in the calibration and are used to affect the operation of the ECU. An example of an option is Number of Cylinders. Options can be edited on-line and off-line.
- Tables - These are two-dimensional look up tables that produce an output value dependent on an input control value. For example, the battery compensation table produces an output which allows for injector 'dead time' which varies with battery voltage. Tables can be edited on-line and off-line.
- Maps - These are three-dimensional look up tables that produce an output value dependent on two input control values. Maps can be edited on-line and off-line.

2.3.1 State Information

As calibrations are edited, the colour of the data in tables and maps changes to reflect the current state of the data. The state information is held in the calibration stored on the PC, not in the ECU. The states can be reset to **Unchanged** at any time by right-clicking on any table or map and selecting either:

- **Reset selected states** - Resets the states of the currently selected area.
- **Reset all states** - Resets all states in the current table or map.

The various states and their default colours are listed below. See Customising colours for information on how to customise the colour scheme of MAP3000.

- **Unchanged** - The value has not been changed. Default colour **RED**.
- **Changed** - The value has been changed by editing. Default colour **CYAN**.
- **Calibrated** - The value has been changed by auto mapping. Default colour **GREEN**.
- **Calculated** - The value has been changed using the Calculate function. Default colour **BLUE**.
- **Pasted** - The value has been pasted in from another map, table, calibration or spreadsheet. Default colour **MAGENTA**.
- **Optimised** - Fuel maps only - the value has been changed using the optimise function. Default colour **YELLOW**.
- **Undone** - The value has been undone or redone. Default colour **GREY**.

2.3.2 Undoing Changes to a Calibration

As changes are made to a calibration, MAP3000 keeps a record which is maintained until another calibration is opened or MAP3000 is closed.

To undo changes:

- Select **Edit | Undo**, press `Ctrl Z`, or click the button. This will undo the last change made. Repeating the process undoes the previous change and so on. If a change affected several sites, for example a percentage change on an area of the fuel map, then all the site changes will be done in one process.

Undone changes can be redone. To redo the last change undone:

- Select **Edit | Redo**, press `Ctrl Shift Z`, or click the button.

In addition to the button illuminating when the calibration is changed, Calibration changed flashes in the status bar:

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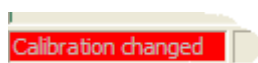
2.3.3 Parameters

Parameters are values that are generated in real-time by the ECU such as engine speed or load. As such, values for parameters can only be viewed on-line although the names and units for parameters can be viewed off-line. Parameter values are not stored in the calibration.

To view parameters, locate the desired parameter group in the custom menu (if defined), select **User Selectable Parameters** from the **View** menu or press *Ctrl P*. The parameter window is shown:
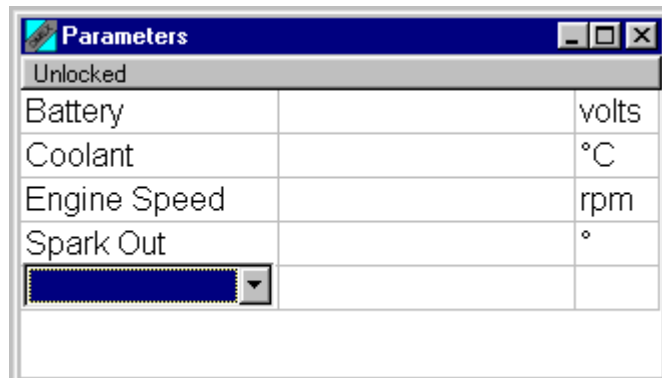
The header of the parameter window shows if it is locked or unlocked. If it is locked, no changes can be made to the parameter window. Double click on the header to set it to unlocked. Once the parameter window is in unlocked mode, parameters can be added to the window by clicking on the last (empty) row and selecting a new parameter. Existing parameters can be changed by clicking on the appropriate parameter name and selecting a new parameter.

The parameter window displays the parameter name in the first column, the value in the second column and the units in the last column. To change the way a parameter is displayed, right click on it to show the pop-up window. The parameter pop-up window has the following functions:

- **Remove** - Removes the currently selected parameter from the parameter window.
- **Insert** - Inserts a new parameter at the current position.
- **Bar** - Changes the selected parameter display to a bar. The upper and lower range of the bar is determined by the **High Limit** and **Low Limit**.
- **Value** - Changes the selected parameter display to show a value only (eg *+dZThrottle* above). If a value falls outside of the range specified by **High limit** and **Low limit**, the value is displayed in red.
- **Mix** - Changes selected parameter display to show a value and a bar (eg *Battery* above). The upper and lower range of the bar is determined by the **High Limit** and **Low Limit**.
- **Scope** - Changes the selected parameter display to scope mode (eg *LOGWTC*) above. In scope mode, the recent history of the parameter is shown as a line. The limits of the line are determined by the **High Limit** and **Low Limit**. If the value is outside of this range, a solid red bar is shown.
- **High limit, Low limit** - Determine the range of bar graphs and scope displays.
- **Update rate** - Changes the speed at which the parameter data is acquired and the speed at which scope views are updated.

2.3.4 Options

Options are single values stored in the calibration and are used to affect the operation of the ECU. An example of an option is Number of Cylinders. Options can be edited on-line and off-line.
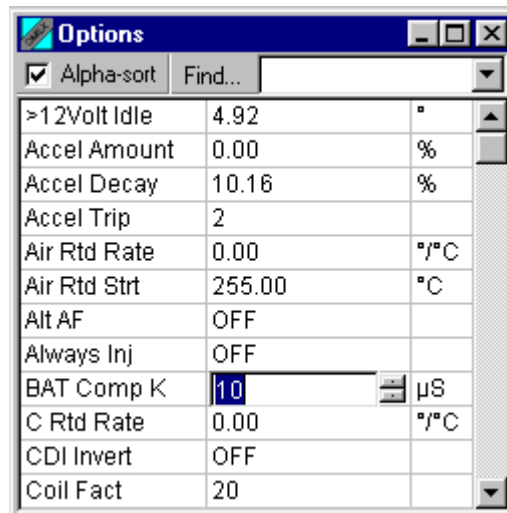
There are three methods of viewing options:

- Locate the desired option group in a custom menu (if defined). This shows the custom option window:

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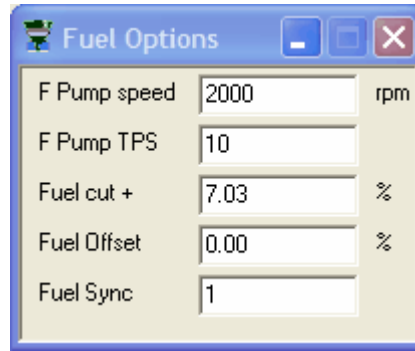
- View a selected list of options using **Options | List selection**. This window is similar in behaviour to the user selectable parameter window.
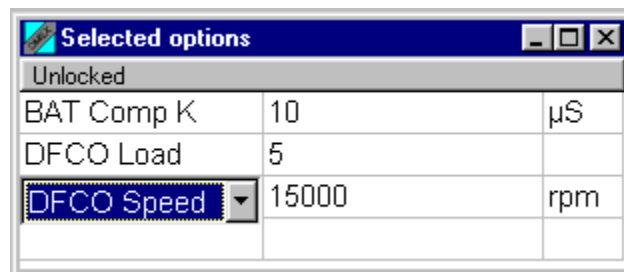
- View the full list of options using **Options | Full list**.

- If **Alpha-sort** is checked, the full list will be sorted alphabetically. If not, the options will occur in the order they were created. The find box can be used to quickly locate an option.

2.3.5 Tables

Two-dimensional look-up tables produce an output value dependent on an input control value. Tables can be edited on-line and off-line.

To view a table, locate the table in the view menu or custom menu if defined. Two sub-menus appear:

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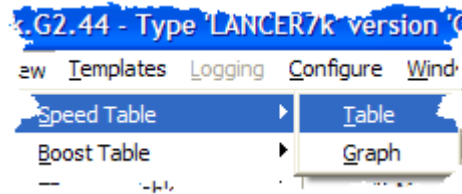
- Selecting Table shows the table in a spreadsheet style format.
- Selecting Graph shows the table as an X-Y style graph.

2.3.5.1 Table View

The table view of a table shows the current values of the data in the table and the control parameter's values for each site. If the table is being viewed on-line, a marker shows the current value of the control parameter. The colour of the data is determined by the State of the data.
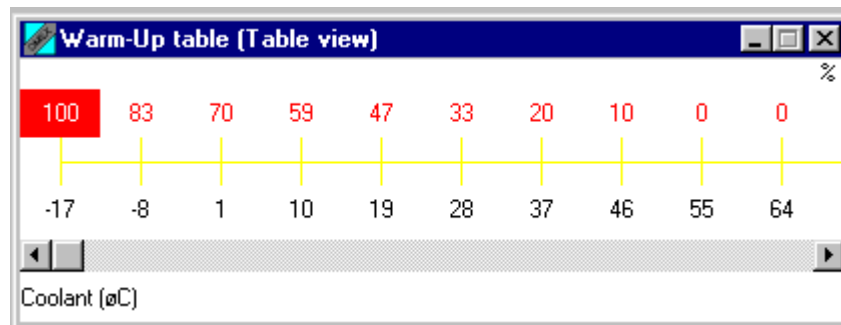
To navigate around the table, use the left and right cursor keys. The current site is highlighted in inverse colour. Pressing **s** switches to a graphical view of the table.

Selecting a range of sites
A range of sites can be selected by:

- Holding the **Shift** key and pressing the left or right cursor keys.
- Pressing and holding the left mouse button on the first site of the range and dragging the mouse to the end site in the range.

Changing values
The values in the cells can be changed as follows:

- Typing the required value and pressing the return key. To enter a negative value, type in the required value and press the - key before pressing return. This only sets the value in the most recently selected cell.
- Press the **+** or **−** key to increase or decrease the values in the current selection by a small amount.
- Press **CTRL +** or **CTRL −** to increase or decrease the values in the current selection by a large amount.
- To copy the currently selected site to the site on its left, press **ALT** and the left cursor key.
- To copy the currently selected site to the site on its right, press **ALT** and the right cursor key.

Pop-up menu
More advanced functions are available in the pop-up menu.

The pop-up menu can be accessed in one of three ways:

- Click the right mouse button on the table.
- Pressing the M key.
- Pressing the windows pop-up menu key

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The following pop-up menu functions are available:

- **Copy** - The current selection is copied to the clipboard.
- **Paste** - Data from the clipboard is pasted into the current selection. If the number of sites contained in the clipboard data is different to the current selection, the copied sites are interpolated. For example, if the clipboard contains two sites with the values 0 and 2, pasting into an area of three sites will paste the values 0, 1 and 2.
- **Calculate** - The two end values of the current selection are used to interpolate the other values. For example, if three sites are selected and the first and last sites are 0 and 2, the middle site will be set to 1 after using **Calculate**.
- **Change** - An edit box prompts for a value. All selected sites will have their values changed by the entered value.
- **Function** - an edit box prompts for a function. All selected sites will have their values set to the result of the function. The function can be any simple mathematical equation with the **x** used to represent the value of the current site, For example, if the function entered is **(x * 2) + 3**, and three sites are selected with values 0, 1 and 2, the resulting values will be 3, 5 and 7.
- **Set value** - An edit box prompts for a value. All selected sites will have their values set to the entered value.
- **Percent change** - An edit box prompts for a value. All selected sites will have their values changed by this percentage where 100% makes no change, 50% halves the values and 200% doubles the values.
- **Reset selected states** - Sets the States of the selected sites to **Unchanged**.
- **Reset all states** - Sets the States of all the sites in the table to **Unchanged.**

Follow ECU function

If the table is being viewed on-line, the **Follow ECU** check box will be visible. If this is checked, as the control parameter changes, the current site will move to the nearest site to the control parameter. The follow ECU mode can also be toggled using the **f** key. Any action will cancel the follow ECU mode.

Programmable control sites

Some tables have programmable control sites. There are two types of programmable control sites:

- **Option start and offset** - These tables use an option to define the start of the control axis and another option to define the offset per site. These option can either be set by finding them in the Option window or by setting the first value in the axis to set the start option and any other site value to set the offset option.
- **Table axis** - These tables use another table as the basis for the control site axis. The values can be edited in the source table or in the axis of the current table. It is important that these values increase from left to right.

2.3.5.2 Graph View

The graphical view of a table shows a graph of values against the control sites. The lines connecting each of their sites are coloured according to their state information.

A site can be selected using the left or right cursor keys. By holding the **SHIFT** key down whilst using the left and right cursor keys, a range of sites can be selected. The selected sites are shown by a thicker line.

Site values can be changed as follows:

- Clicking the left mouse button over a site and dragging it to the new position. This only works for a single site.
- Press the **+** or **−** key to increase or decrease the values in the current selection by a small amount.
- Press **Ctrl +** or **Ctrl −** to increase or decrease the values in the current selection by a large amount.

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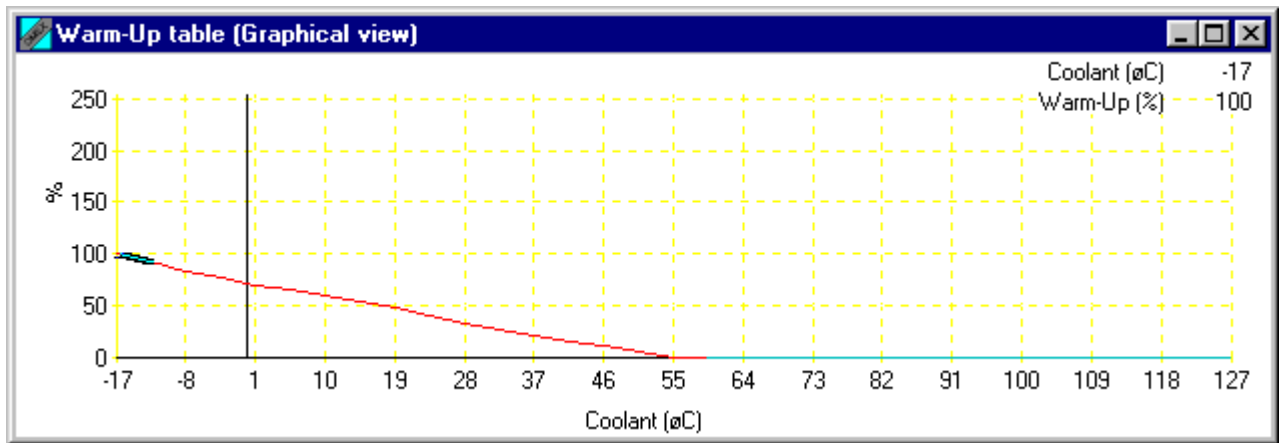
Pressing **s** switches to a table view of the table.

Pop-up menu

More advanced functions are available in the pop-up menu. For more information on Pop-up menus see section **Error! Reference source not found.**

2.3.6 Maps

Maps are three dimensional look up tables that produce an output value dependent on two input control values. Maps can be edited on and off-line.

To view a map, locate the table in the view menu or custom menu if defined. Four sub-menus appear:
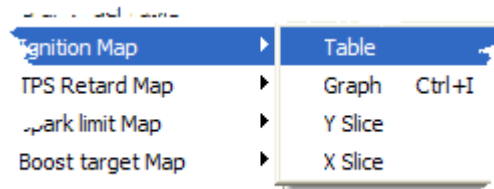
- Selecting Table shows the map in a spreadsheet style format.
- Selecting Graph shows the table as a 3D surface.
- Selecting Y Slice shows a graph of a single x site on the y axis.
- Selecting X Slice shows a graph of a single y site on the x axis.

The two most commonly used maps, the fuel map and ignition map can be accessed quickly using the following shortcut keys:

- Fuel map: **Ctrl F**
- Ignition map: **Ctrl I**

The fuel or ignition maps must be present in the calibration for this to work.

2.3.6.1 Table View

The table view of a map shows the current values of the data in the map and the control parameters values for each axis of the map. If the map is being viewed on-line, a marker shows the current value of each of the control parameters and a cross hairs appears over a target showing how close the control parameters are to a site. The colour of the data is determined by the State of the data.

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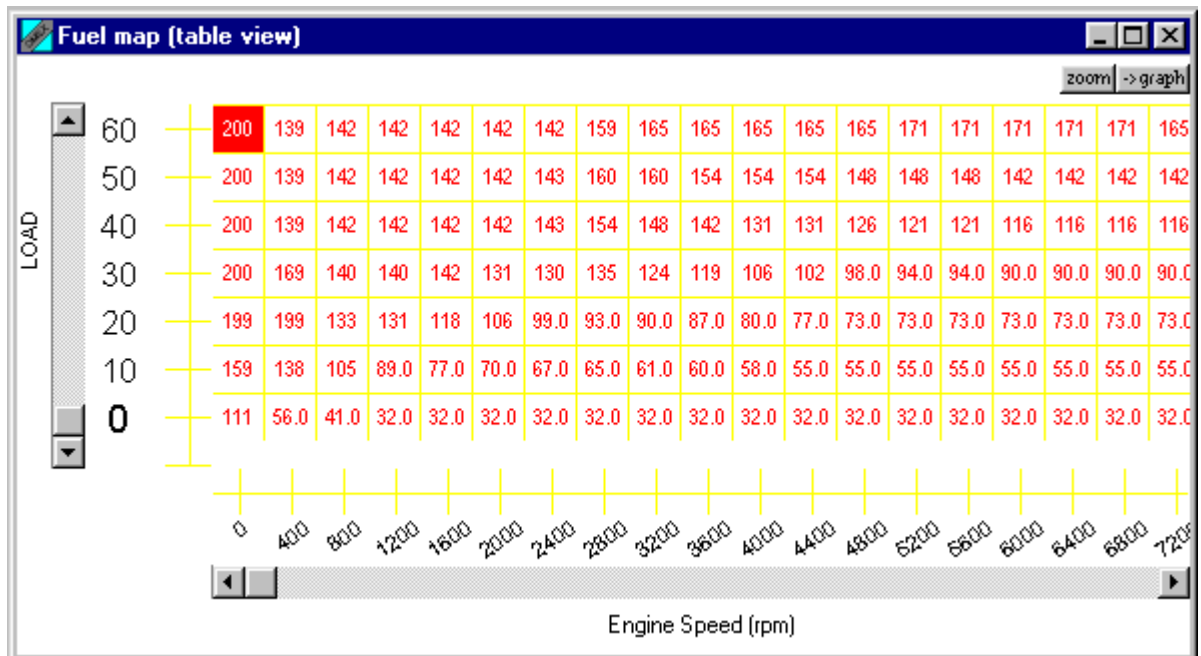
To navigate around the map, use the left, right, up and down cursor keys. The current site is highlighted in inverse colour. Pressing **s** switches to a graphical view of the map.

Selecting a range of sites
A range of sites can be selected by:

- Holding the **Shift** key and pressing the left, right, up and down cursor keys.
- Pressing and holding the left mouse button on the first site of the range and dragging the mouse to the end site in the range.

Changing values using keyboard commands
The values in the cells can be changed as follows:

- Typing the required value and pressing the return key. To enter a negative value, type in the required value and press the - key before pressing return. This only sets the value in the most recently selected cell.
- Press the **+** or **−** key to increase or decrease the values in the current selection by a small amount.
- Press **CTRL +** or **CTRL −** to increase or decrease the values in the current selection by a large amount.
- To copy the currently selected site to the site on its left, press **ALT** and the left cursor key.
- To copy the currently selected site to the site on its right, press **ALT** and the right cursor key.

Changing values using trim controls
Choose **View | Trim Control** The trim control box will be shown:

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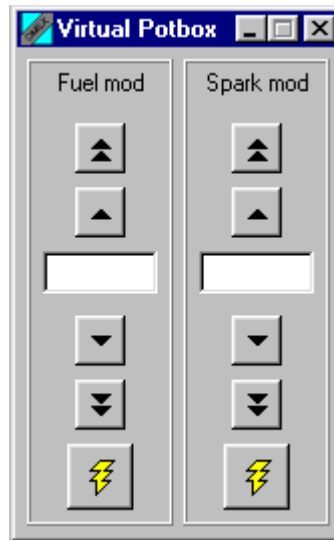
To alter the value of a parameter
- Type in the new value and press the return key
- Or use the graphical buttons

 Clicking on the double arrow buttons will alter the value by a large increment.

 Clicking on the single arrow buttons will alter the value by a small increment.

 Click on the program button to program the current value to the current site.

Changing values using a potbox

OMEX manufactures pot-box tuning aids that allow the user to easily alter maps such as fuel and ignition. Each pot-box contains two pots and two buttons. Each pot can be configured to alter a map modifier and each button then programs that modifier (see map modifiers). The pots work incrementally, rather than absolute, so when a value is assigned to a site, the modifier returns to zero. This is the same as the software Trim Control.

The pot-box is connected in-line between the ECU and PC. Up to 4 pot-boxes can be chained together for complex systems although 1 pot-box is usually adequate. A pot-box is configured as either pot-box 1or 2 depending on the pot-box number switch. If more than 2 pot-boxes are needed at one time then contact Omex.

To set up the potbox actions:

- Connect the potbox in between the ECU and PC
- Connect to the ECU with MAP3000
- Select **ECU | Setup potboxes**…

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The potbox configuration window appears.
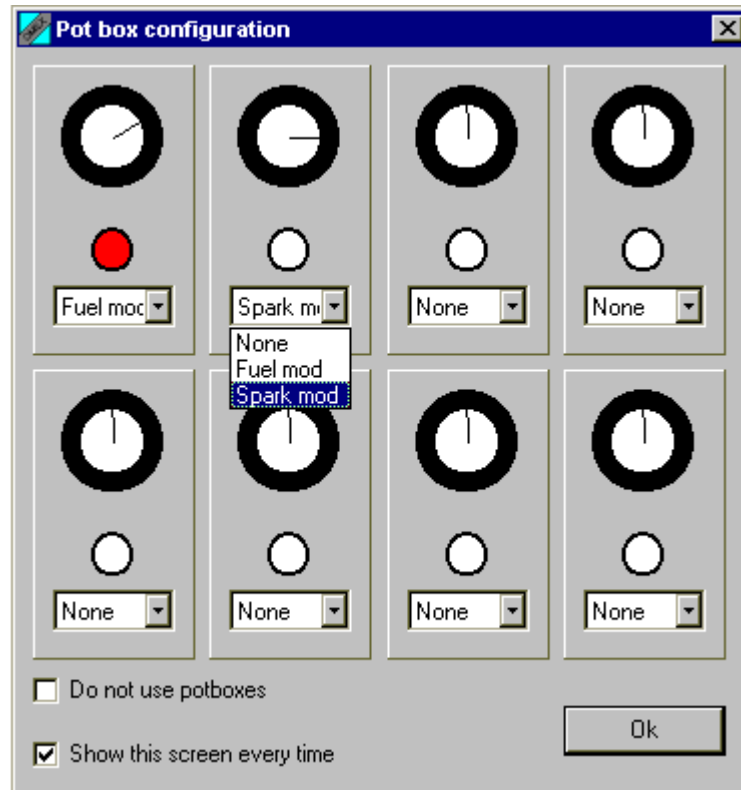
- Rotating pots and pressing buttons on the potbox willmove and highlight the respective pots and buttons in the configuration box.
- The Map Modifier combo box allows you to assign a modifier to each pot.
- Rotating the pot clockwise or anti-clockwise will increase or decrease the modifier respectively while pressing the button will program the modifier into the map. While the potbox configuration window is active no changes are made to the selected modifier.
- Checking the Do not use potboxes check box turns off the potbox.
- Checking the Show this screen every time check box, the potbox configuration window can be made to appear each time an ECU is connected.
- The first time a potbox is used with a particular ECU type the potbox window will automatically appear.

Pop-up menu
More advanced functions are available in the pop-up menu. For more information on Pop-up menus see section **Error! Reference source not found.**

Additional functions are available when the map is a fuel map.

Follow ECU function
If the map is being viewed on-line, the **Follow ECU** check box will be visible. If this is checked, as the control parameter changes, the current site will move to the nearest site to the control parameter. The follow ECU mode can also be toggled using the **f** key. Any action will cancel the follow ECU mode.

Programmable control sites
Some maps have programmable control axes. There are two types of programmable control axes:

- **Option start and offset** - These maps use an option to define the start of the control axis and another option to define the offset per site. These option can either be set by finding them in the Option window or by setting the first value in the axis to set the start option and any other site value to set the offset option.
- **Table axis** - These maps use a table as the basis for the control site axis. The values can be

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edited in the source table or in the axis of the current table. It is important that these values increase from left to right.

2.3.6.2 Graph View

The graphical view of a map shows the map as a 3D surface with the control sites as the X and Y axes and the map values as the Z axis.
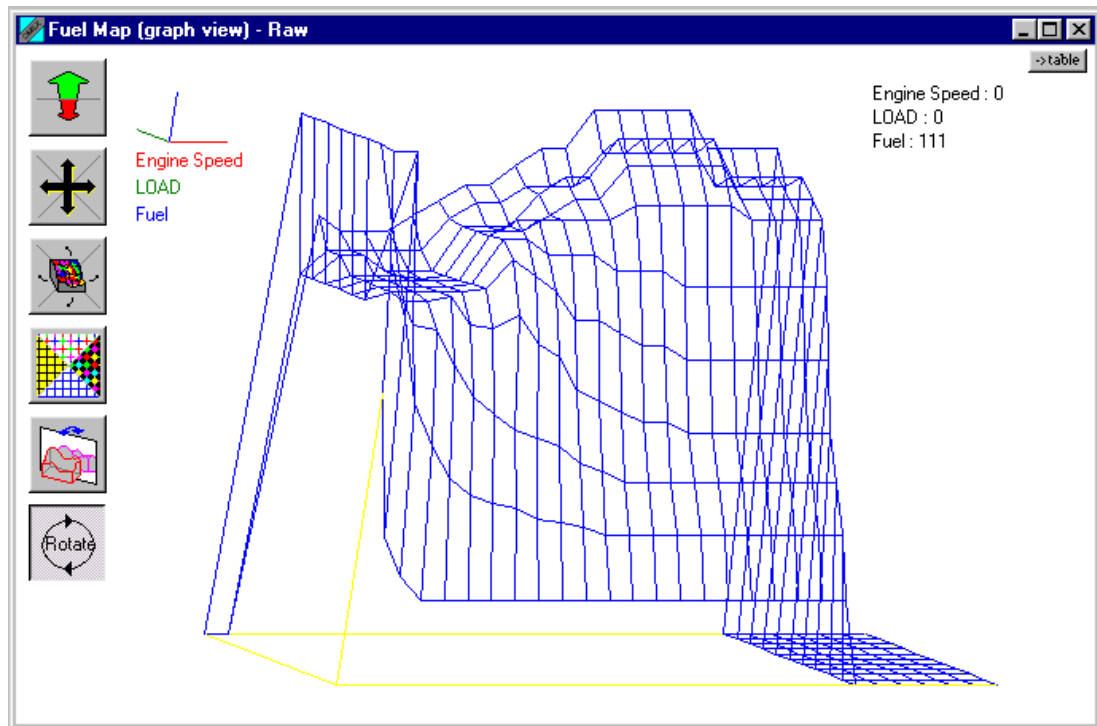
A single site in the map can be selected using the cursor keys or by clicking the left mouse button on the required site. An area of the map can be selected using the *Shift* key and the cursor keys or by clicking on the map with the left mouse button and dragging the mouse over the area to be selected.

Site values can be changed as follows:

- Press the **+** or **−** key to increase or decrease the values in the current selection by a small amount.
- Press **Ctrl +** or **Ctrl −** to increase or decrease the values in the current selection by a large amount.
- Right clicking on the map and dragging the site(s) to the new value. This changes the selected area by a percentage of the original value - a box appears showing the current percentage change.

The table button at the top right hand corner changes the view to Table view. The buttons to the left of the map are used to change the way the map is displayed:

Clicking on the top half of the zoom button zooms in on the map. Clicking on the bottom half zooms out. **z** can also be used to zoom in and **x** to zoom out.

Click on the arrow in the button to move the map in that direction. The map can also be moved using **Shift** and the cursor keys.

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Click on the relevent section to rotate the map in that direction. The map can also be rotated using **Ctrl** and the cursor keys.

Click on one of the four segments to set the display mode. Clockwise from top:
- Wire frame with state colour information.
- Solid fill with state colour information.
- Wire frame with no state information.
- Solid fill with no state information.

Click to reflect or show the mirror image of the map. The map can also be reflected by pressing **r**.

Clicking the rotate button puts the map in rotate mode. By left clicking on the map and dragging the mouse around, the map can be rotated. Clicking the rotate button again cancels rotate mode.

Pop-up menu

More advanced functions are available in the pop-up menu. For more information on Pop-up menus see section **Error! Reference source not found.**

Additional functions are available when the map is a fuel map.

2.3.6.3 Slice Views

The slice view of a map shows a two dimensional slice of the map taken through one of the axes. The lines connecting each of their sites are coloured according to their state information.
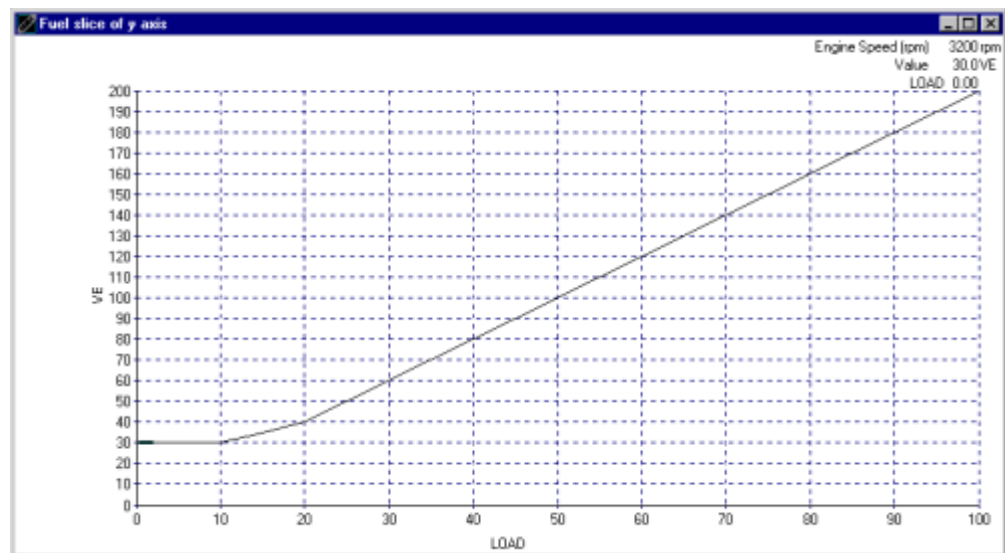
The current axis site is shown in the top right hand corner. This can be changed using the up and down cursor keys. Pressing the *s* key changes the display to the other slice.

A site can be selected using the left or right cursor keys. By holding the **SHIFT** key down whilst using the left and right cursor keys, a range of sites can be selected. The selected sites are shown by a thicker line.

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Site values can be changed as follows:

- Clicking the left mouse button over a site and dragging it to the new position. This only works for a single site.
- Press the **+** or **−** key to increase or decrease the values in the current selection by a small amount.
- Press `Ctrl +` or `Ctrl −` to increase or decrease the values in the current selection by a large amount.

2.3.6.4 Fuel Maps

Fuel maps have six additional commands in the pop-up menu. Three **View** commands change the units the map is displayed in. The other three commands alter the fuel map to achieve better scaling.

View commands
The three view commands select the units the fuel map is displayed in. Only one view command can be checked at any one time.
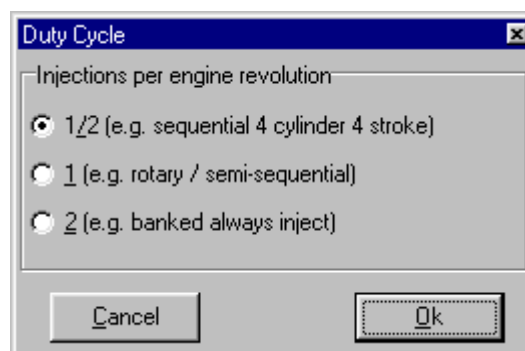

- **View raw** - Shows the raw value of the map as stored in the ECU. It has a range of 0 to 255 for an 8 bit fuel map or 0 to 65535 for a 16 bit fuel map. When selected, the caption of the map window shows **Raw**.
- **View pulse width** - Shows the actual injector pulse width in milliseconds before any modifications. When selected, the caption of the map window shows **Pulse Width**.
- **View duty cycle** - Shows the percentage of time that the injectors are actually open. This value should be less than 90% for correct injector operation. When selected, the caption of the map window shows **Duty Cycle**. In order for MAP3000 to correctly calculate the duty cycle, when **View duty cycle** is selected, it prompts for the number of injections per engine revolution:

Fuel map rescaling
The commands for altering the fuel map are:

- **Rescale fuel map** - This changes the fuel map values and the option **MSPB** (micro seconds per bit) such that the pulse width for every site remains constant but the maximum value in the fuel map is adjusted to 240. This is used to obtain a greater resolution for fuelling when the maximum value is increased and allows the pulse width to be widened when the maximum value is decreased..
- **Optimise fuel map** - This changes the fuel map values, the option **MSPB** and the option **LD0MPC** such that the resolution is increased throughout the fuel map. **LD0MPC** is a fractional scaling factor applied to the 0 load line that progressively increases to 1 on the full load line. For example, when **LD0MPC** is set to 128, the zero load line values are halved (128/256) to obtain the actual fuel map value, the full load line values remain unchanged and those in between are proportionally scaled. Thus, with this value, the resolution of the 0 load line fuelling is doubled. This is particularly useful when calibrating fuelling for low load sites and stable idling.
- **Change injectors/ pressure** - This allows the fuel map to be rescaled to accommodate a change in injector size and/ or fuel line pressure. When selected, the *Injectors Changes* dialog is shown:

MAP3000 1.00 Instructions r1
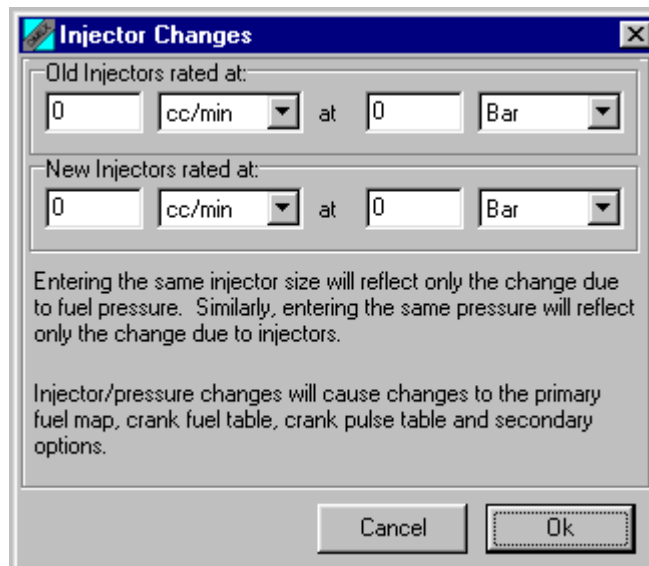
To use this dialog:

- Enter the specification of your fuel system before modification. i.e. the flow rate of the injectors and the fuel pressure. Flow rates can be specified in *cc/min, fl.oz/min* or *lb/hour*. Pressures can be specified in *Bar, PSI, lb/ft2* or *kPa*.
- Enter the specification of your fuel system after modification. Clicking OK will modify the primary fuel map, crank fuel table, crank pulse table and secondary options to reflect the change in fuel system whilst keeping the fuel delivered the same as before.

2.3.7 Calibration Notes

Calibration notes are saved with the calibration file on the PC and provide a place for comments about the calibration or conditions under which the calibration was created. Notes are not stored in the ECU, so if a calibration is uploaded from one PC and down loaded by a second, the second PC will **NOT** be able to see the notes created on the first PC.

To view and edit notes:

- Open a calibration.
- Select **View | Notes** or press **Ctrl N**.
- The notes added to this calibration will appear and can be edited.

2.4 Printing Calibration Data

MAP3000 allows any information displayed on the screen to be sent to the printer. To print calibration data:

- Show the parameters, options, tables and maps you want to print on the screen.
- Select **File | Print**. The Print dialog will be shown:

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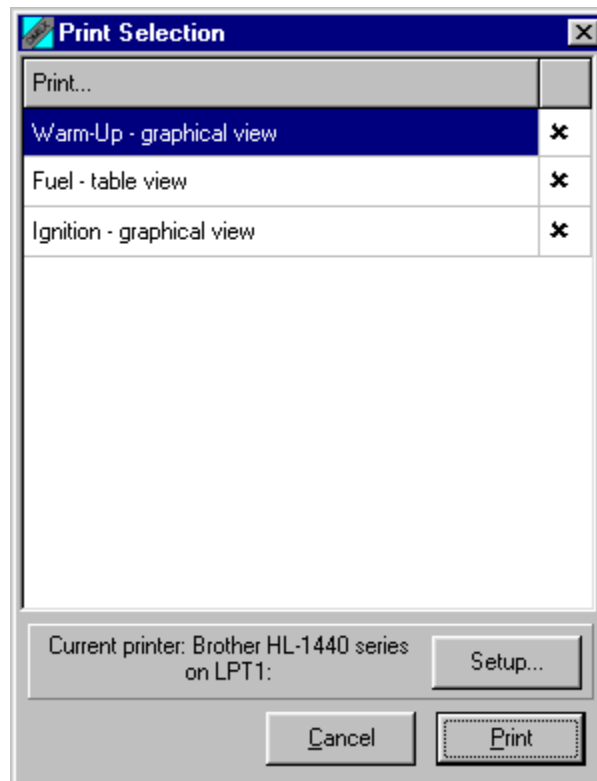
- This shows a list of the currently displayed printable windows. Click on the right hand column to enable/ disable printing of an item.
- The currently selected printer is shown below the window list. To change or setup the printer, click the **Setup** button.
- When all options have been set, click the **Print** button. The selected items are printed.

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3   On-line Operations

Connecting the PC to the ECU using a serial link is referred to as going on-line. Once on-line, calibration data is automatically downloaded from the ECU if necessary and parameter data can be viewed. Some MAP3000 functions, such as data logging and auto mapping, can only be used when on-line.

3.1   Connecting to an ECU

When connecting to an ECU, any calibration currently open will be closed with a prompt to save if changes have been made.

To connect to an ECU:

- Connect the serial cable to the PC and the ECU.
- Check the serial port used on the PC is selected in MAP3000 by choosing **ECU | Port...**. This only needs to be done once unless a different serial port is used in the next session.
- Check the baud rate is set correctly using **ECU | Baud Rate...** This only needs to be done once unless an ECU with a different baud rate is used. If you are not sure what baud rate your ECU runs at, selecting **ECU | Baud Rate... | Auto** will automatically detect the baud rate and set it the initial baud rate to the rate of the ECU.
- Select **ECU | Connect...**, press *Shift F8* or click the [ECU] button to connect. The ECU status window will appear together with the connection progress window.
- Power on the ECU. MAP3000 queries the ECU to determine its' name and version number. If a GIN file is not installed for this ECU, the connection process will stop and a warning will appear informing the user that a GIN file must be installed.
- If ECU *is* installed, MAP3000 will check the workmap to see if it is the same as the calibration in the ECU. If **ECU | Check All Files** is checked, MAP3000 will also check all calibrations in the most recently used calibration folder for a match.
- If no match is found, the calibration is downloaded from the ECU and saved as the workmap. A download window shows the progress of the download.

Once the connection process has finished, the last screen layout template used with this ECU is loaded and parameters, options, tables and maps can be viewed on-line.

3.1.1   The Workmap

Workmap is the name given to a calibration when it is first connected from the ECU to the PC. When saved using **file | save**, the calibration will be saved with the calibration name WORKMAP. If saved using **file | save as**, the PC will prompt for a new name, as with most Windows based software.

3.1.2   ECU Status Window

The ECU status window shows status information about the connection to the ECU including port initialisation, baud rate and on-line status. The ECU status window is always present in on-line mode but can be minimised.

3.1.3   Background Loading

By default, when an ECU is connected to and MAP3000 cannot find a matching calibration on disk, the calibration is downloaded from the ECU. A window appears showing the progress of the download and the calibration and parameters cannot be viewed until the download has been completed.

MAP3000 can be set to download the calibration in the background, enabling parameters and dashboards to be viewed before the calibration is available. Maps, tables and options cannot be

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viewed until the background load is completed. The progress of the background load is indicated in the status bar at the bottom of the window.

To enable background loading of the calibration:

- Select **ECU | Background** load to enable or disable background loading. If the menu item is checked background loading is enabled.

3.1.4 ECU Wakeup

Some ECUs continuously send out a data stream which can confuse MAP3000 when it is trying to connect. If this is the case, ECU wakeup can be used which pauses the datastream to allow an ECU connect to be made.

To use ECU wakeup:

- Select **ECU | Wakeup...**. The ECU wakeup window appears:
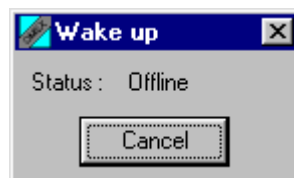
- MAP3000 will attempt to wakeup the ECU.
- When the Status changes from Offline to Online, cancel the wakeup procedure and connect as normal.

3.2 The ECU Checksum

The calibration checksum is used by the ECU to confirm the validity of the calibration. If the checksum does not agree with the calibration, the ECU can report a checksum error to a display or illuminate an error light to indicate a problem.

As the calibration is edited on-line, the checksum will become incorrect. To reset the checksum to the correct value:

- Select **ECU | Program** checksum or press `Ctrl K`.

3.3 Pausing Comms

When MAP3000 is running on-line, the serial COM port it uses is exclusively locked by MAP3000. If this port is required by another application, the connection can be closed by closing MAP3000 or the port can be temporarily released by pausing the comms.

To pause comms:

- Select **ECU | Pause Comms...** The Pause Comms window appears:
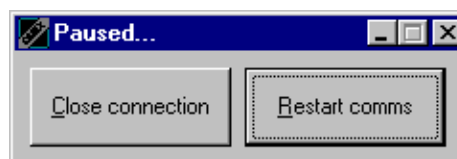
When communication with the ECU is to be restarted, click the **Restart Comms** button. The comms can be closed by clicking the **Close Comms** button.

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3.4   Secure Calibrations

Some ECUs have security features built in that allow calibrations to be password protected. If an ECU supports security, the **Set password...** and **Clear password...** menu items are enabled in the **ECU** menu. Passwords are remembered on the machine they were created with. If another computer is used to connect to a password protected ECU, the password must be entered before the calibration can be downloaded or edited. If the password is not known, the calibration can be erased from the ECU to allow access to the ECU.

To set a password:

- Connect to the ECU.
- Select **ECU | Set password...**
- A dialog box appears prompting for a password. The password is up to 6 characters long and can contain any alphanumeric character.
- Enter the password and click OK.

Once connected to a password protected ECU, the password may be cleared. Clearing the password removes the security such that any PC can connect to this ECU. To clear the password:

- Connect to the ECU.
- Select ECU | Clear password...

3.5   Data Logging

Data logging allows ECU parameters to be recorded and analysed at a later date using **DATA2000**. For more information on analysing data with **DATA2000**, see the **DATA2000** manual or on-line help.

MAP3000 supports two types of data logging:

- ECU based data logging: The ECU itself records data to on-board memory. MAP3000 is used to set up the logging in the ECU and to download the logged data from the ECU.
- PC based logging: MAP3000 logs the currently displayed parameters to disk.

3.5.1   Logging Options

When saving log files created using ECU or PC based logging, it is possible to automate the default filename presented by MAP3000. If an automated file naming option is selected, the automatic filename is inserted into the *Log File Save* dialog. This filename can be selected by pressing the Save button or can be edited as desired.

To change the way log filenames are created:

- Select **Configure | Logging options...** The Logging options dialog is shown:
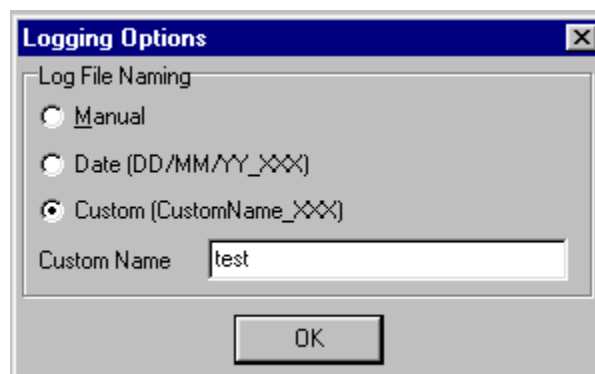
Three options are available:

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- **Manual** - When the log is saved, no filename is automatically created, a file name must be provided.
- **Date DDMMYY_XXX** - A file name is created based on the current date. For example, if the date is the 1st of November 2002, the first filename created that day will be **011102_000.stf**. The **_XXX** section is incremented for each subsequently saved file that day, for example the next file on the above day would be **011102_001.stf**.
- **CustomName_XXX** - A filename is created based of the contents of the **Custom Name** edit box. For example, if the **Custom Name** box is set to **Zetec Test**, the first filename created would be **Zetec Test_000.stf**. Subsequent filenames would be **Zetec Test_001.stf**, **Zetec Test_002.stf** and so on.

3.5.2   ECU Based Logging

Some OMEX ECUs have built in data logging. This allows data to be logged inside the ECU without requiring a lap top to be connected to the ECU. The internal logging setup is stored as part of the calibration.

To set up internal logging:

- Select **View | Internal Logging**.
- Select the parameters to be logged in the Logged Parameters box. The log list is split between fast channels and slow channels. Fast channels are logged 8 times faster than the slow channels.
- Specify the logging options. Options not available on a particular ECU will be greyed out.
    - **Log always** - The ECU will always log data when it is powered up.
    - **Log only if engine running** - The ECU will only log if the engine is running.
    - **Loop logging** - If the logging memory becomes full, logging will wrap around so that the earliest data is overwritten by the new data. If not checked, logging will stop when the logging memory becomes full.
    - **Log Switch** - If checked then logging is started/stopped using an external logging switch connected to the ECU. See the manual for your ECU to determine if this feature is supported by your ECU and for details on which pin is used as a log switch.
- The Rate box shows the current record rate for the slow and fast channels and the total run time available if the ECU is not loop logging. The record rate can be changed using the up and down arrows.
- The Conditions box shows any additional conditions specified by the calibration.
- Click OK to set the internal logging parameters in the calibration.

ECU logs are downloaded as follows:

- Connect the ECU to the PC.
- Make sure the engine is not running. ECUs cannot run an engine and download log data at the same time.
- Select **ECU | Download log data...**
- MAP3000 attempts to connect to the ECU. Once a connection is achieved, the download of the data starts. A window appears showing progress of the download.
- Once the download has completed, a save file dialog appears prompting for a file name. A file name may be automatically provided depending on the logging options specified.
- Click the **Save** button to save the data. A window appears, prompting for any notes about the logged data. These notes are saved with the data and are visible within **DATA2000**.
- Once the notes window has been close, the data file is saved and can be opened in **DATA2000**.

3.5.3   PC Based Logging

When on-line, MAP3000 can log any parameters that it is currently monitoring.

To use PC logging:

- Connect to an ECU.
- View the parameters that are to be logged.
- Select **Logging | Start...** **LOGGING** will appear in the status bar to show that MAP3000 is logging.

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- Markers can be inserted into the data whilst MAP3000 is logging. These markers appear in the graph window of **DATA2000**. To insert a marker, select **Logging | Insert Marker** or press **Ctrl L**.

- To save the logged data, select **Logging | Stop and Save...**. A save file dialog appears prompting for a file name. Depending on the logging options set, a file name may have been automatically created.

- Click the **Save** button to save the data. A window appears, prompting for any notes about the logged data. These notes are saved with the data and are visible within **DATA2000**.

- To stop the logging without saving, select **Logging | Cancel**.

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4   Uploading a Calibration

Uploading a calibration, programs a calibration file stored on the PC, into the ECU.

To upload a calibration:

- Select **ECU | Upload...**, press **SHIFT F7** or click the [icon] button on the toolbar.
- MAP3000 attempts to connect to the ECU and identify the ECU name and version.
- Once the ECU name and version have been determined, the file open dialog appears:
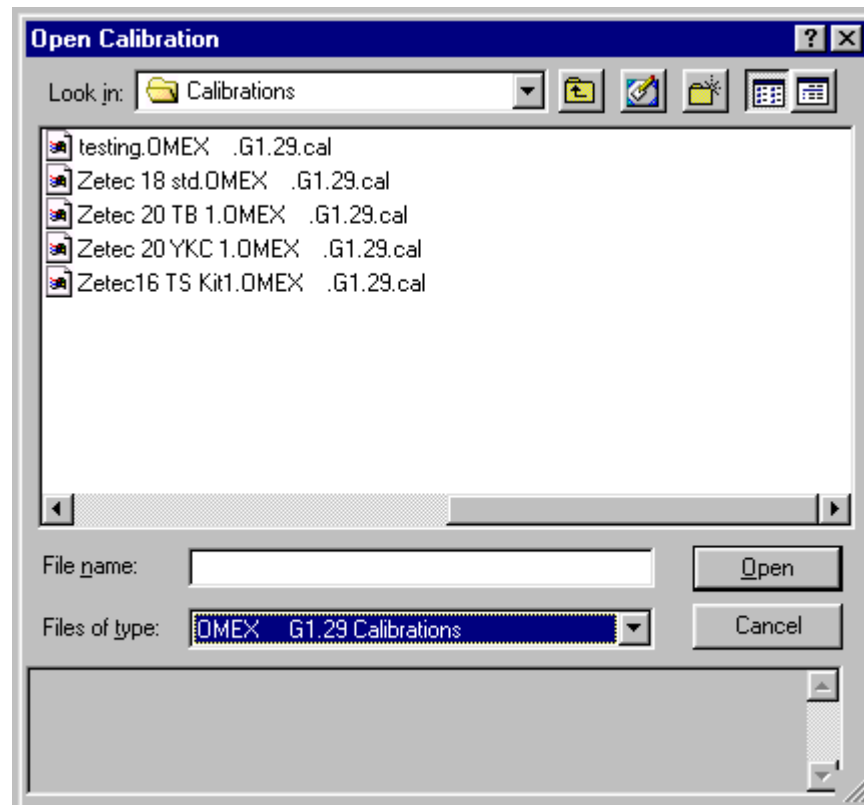
- The **Files of type** combo box will be fixed to the type and version of the ECU connected to. If you wish to upload a calibration from a different ECU version, the calibration must first be converted to this version first.
- Select the desired calibration to upload and click the **Open** button.
- A window will appear showing the progress of the upload.

Once the connection process has finished, the last screen layout template used with this ECU is loaded and parameters, options, tables and maps can be viewed on-line.

Note: It is not possible to upload a calibration when the engine is running.

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5   Customising MAP3000

MAP3000 allows the end user to change the look and feel of the application to suit their preferences.

5.1   Colours

To customise the colours in MAP3000, select **Configure | Colours...**. The Configure colours dialog is shown:
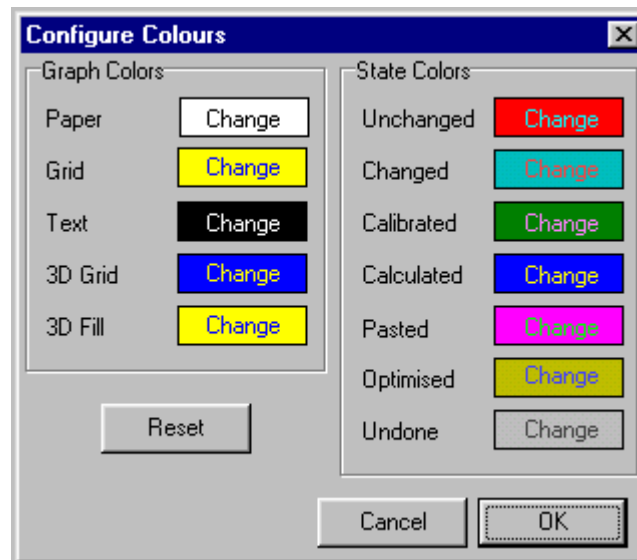
The following colours can be changed:

- **Paper** - The background colour of graphs, tables, option and parameter windows.
- **Grid** - The colour of the grid lines in graphs and tables.
- **Text** - The colour of text in the graph, table, option and parameter windows.
- **3D Grid** - The colour of grid lines in the 3D graphs.
- **3D Fill** - The colour of filled areas in 3D graphs.

The State Colours can also be changed.

To return all colours to their defaults, click the **Reset** button. Clicking the **Cancel** button exits the dialog without making any changes. Clicking the **OK** button implements the changes.

5.2   Key Mode Shortcuts

When on-line, MAP3000 can be put in key mode which allows option, table and map values to be altered by pressing user-defined keys. To define the behaviour of key mode:

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- Select **Configure | Key mode shortcuts**. The Key mode dialog appears:
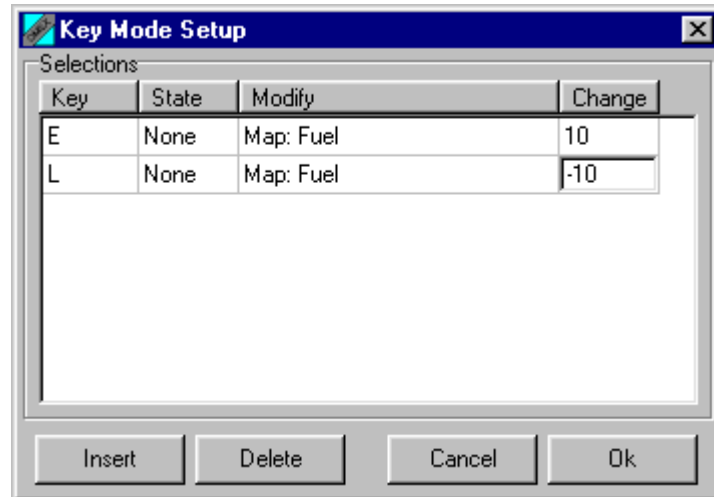
- Click the **Insert** button to insert a new key mode shortcut.
- Select the Key to use in the **Key** column. This can be any alpha numeric key.
- Select any shift state required in the **State** column. This can be **NONE** (only the **Key** is required), **Ctrl** (Ctrl and the key must be pressed), **Shift** (Shift and the key must be pressed) or **Both** (Ctrl Shift and the key must be pressed).
- In the **Modify** column, select the option, table map or modifiable parameter to be modified.
- In the **Change** column, enter the **RAW** value to change the option, table or map by.
- Click **OK** when all required key mode shortcuts have been setup.

To use key mode, MAP3000 must be connected to an ECU. Then use the following steps:

- Select **View | Activate Key Mode** or press **F5**. **KEY MODE** will appear in the status bar.
- Normal short cut keys are disabled and the key mode keys defined above are active. Pressing these keys change the specified option, table or map by the specified amount, irrespective of the windows currently displayed. For tables and maps, the current site (determined by the ECU parameters) is the site that is affected.
- To return to standard mode, select **View | Deactivate Key Mode** or press **F5**.

5.3   Units

In some configurations, certain parameters, options, tables and maps have a choice of units. In addition, user-defined units can be created for these items.

If user-selectable units are available, a **Units** menu item appears in the **Configure** menu. To use user-selectable units:

- Select **Configure | Units | Setup...** The user selectable units dialog appears:

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- The combo box allows you to select the item to change (eg Temperature or Pressure).
- The **Current Configuration** area shows the units used in the current calibration file.
- The library section shows units installed in the library.
- One of the library items will be set as Default. The default item is always used as the units in new calibrations or calibrations imported from older versions. To set the default item, double click in the default column.
- To load a value from the library in to the current calibration:
  - Ensure the desired value is the default. Double click in the default column as necessary.
  - Click on the **Load default** button.
- To copy the values in the **Current Configuration** to the library, click the **Add to library** button.
- There will always be one line present in the library which is the initial units contained in the GIN file. In the above example, these will be Celsius.
- To add user defined units, click the **Add** button and enter the new values in the new row. The multiplier and offset are used to convert the default units into the new units. For example, to add user defined units for Kelvin, the multiplier would be 1 and the offset would be 273 to convert from Celsius to Kelvin. If FP is checked, the resulting units are shown in floating point notation; otherwise integer notation is used.
- Thus the user selectable units dialog would now look like:

User selectable units can be copied between computers. To export user units:

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- Select **Configure | Units | Export...** and enter a filename for an export file.

To import user units:

- Select **Configure | Units | Import...** and select an units export file to import.

5.4   Templates

Templates allow the current screen layout (eg position and size of parameter, option, table and map windows) to be saved and recalled at a later date. This allows screen layouts to be designed for logical groups of items (such as fuel or ignition) , saved and recalled to quickly swap between them. Templates can also be assigned to buttons and menus.

To create a template:

- Show the desired parameter, option, table or map windows and position them on the screen.
- Select **Templates | Save...** A dialog will prompt for a filename for the template. Enter a filename and click **Save**.
- Templates can also be saved using **Templates | Save As Window...**. Templates saved in this manner differ from ordinary templates in that they do not replace existing windows when they are run. They should only be used to give a form of pop-up window support.

To run a template:
- Select **Templates | Run...** An open file dialog appears. Select the template to run and click **Open**. The template runs and the screen is configured as before.
- If the template was saved with **Template | Save...**, all open windows will be closed before the template is run.
- If the template was saved with **Template | Save As Window...**, the templated windows are shown over the top of any existing windows.
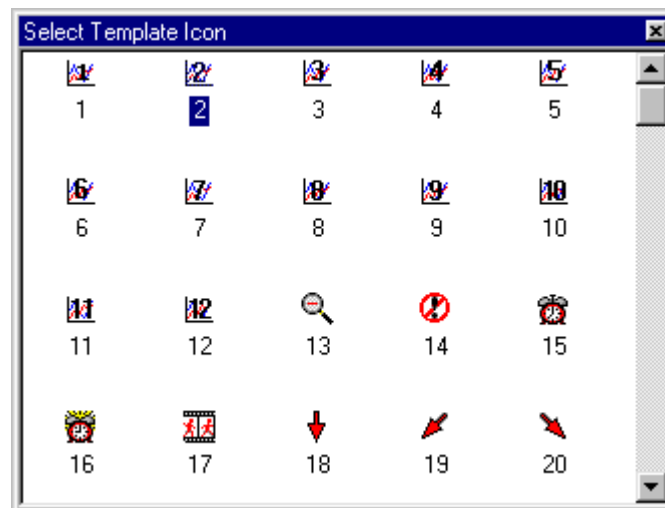
5.4.1   Template Buttons

Templates can be assigned to buttons on the tool bar to allow single-click access to commonly used screen layouts. Template buttons appear to the right of the other buttons on the toolbar.

To configure template buttons:

- Select **Templates | Configure...** The *Configure Template Buttons* dialog will appear:

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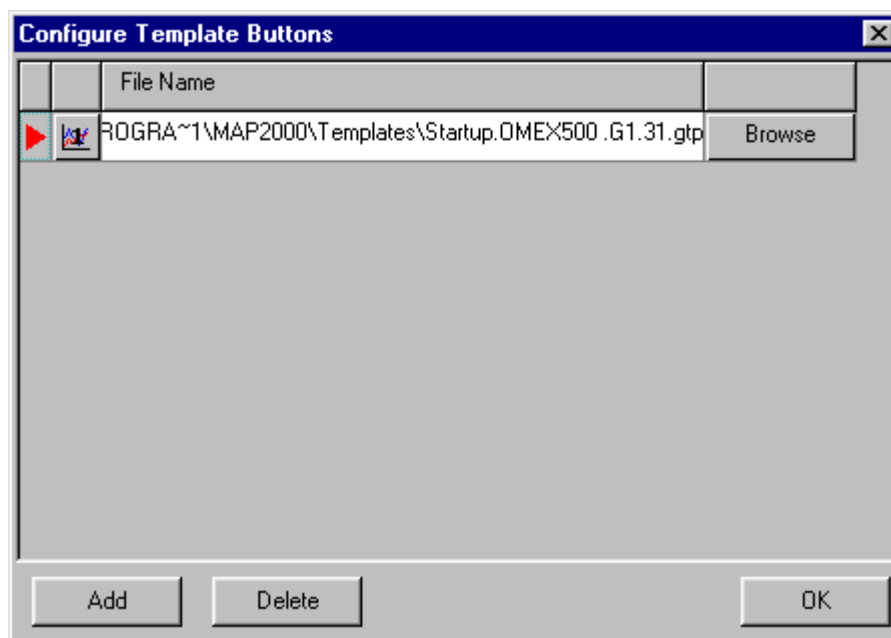
- Click the **Add** button to add a template button. A new line appears in the grid.
- Click the **Browse** button to set/change the template used. A file open dialog appears. Select the required template and click **Open**.
- To change the icon used by the template button, click on the icon to the left of the template filename. The icon select dialog will appear:

- Click on the new icon to select it.

Once all the template buttons have been added, click the **OK** button. The template buttons are drawn on the toolbar. Clicking on the button runs the template.

The *Configure Template Buttons* dialog appears automatically when a template is saved if *Add Template Button* is checked in the save template dialog.

5.5   Virtual Dashboards

Virtual dashboards mimic a colour display dashboard and can be configured to display any parameter using a variety of gauge types. Dashboards can be created, edited and displayed off-line but only display data on-line.

To create a virtual dashboard:

- Select **Templates | Dash | Configure...** The dash editor window is shown:
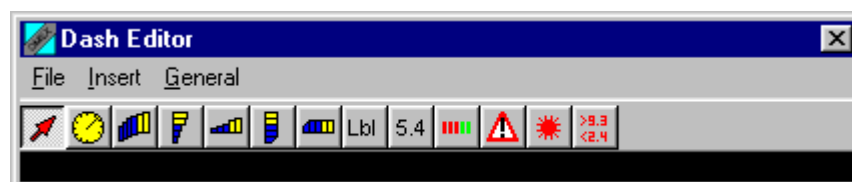
- The dash editor window can be resized. The size of the window when the dash is saved is used as the default size when the dash is run.
- To set the default colours of the dashboard:
  - Select **General | Background colour...** to set the background colour.
  - Select **General | Warning colour...** to set the warning colour. The warning colour is used by all gauges to indicate an error or out of range condition.
- To add a gauge to the dash, click on the required gauge in the toolbar or select it from the **Insert** menu and then click on the required location in the dash. The new gauge is added.
- To edit the properties of a gauge, right click on the gauge to show the gauge property editor.
- To move a gauge, click and hold the left mouse button on the gauge and move it to the new location.

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- To resize a gauge, click on the gauge to select it and move the mouse to the edge of the boundary box until the resize cursor appears. Click and hold the left mouse button and move it to resize the gauge.
- To delete a gauge, click on it to select it and press the *Delete* key.

Once a dash has been created, it can be saved using **File | Save...**. Dashboards can be edited at a later date by opening the dash editor using **Templates | Dash | Configure...** and selecting **File | Open...**.

To show a dash:

- Select **Templates | Dash | Run...** An open file dialog appears prompting for a dash file name.
- Select the required dash file and click open. The dash is drawn on screen in the designed size. If MAP3000 is on-line, values are drawn in the dash.
- The dash window can be resized if required - the contents of the dash window also resize to match the new window size.

If a template is saved that includes a dash, the dash is also displayed the next time the template is run.

5.5.1   Gauge Types

To add a gauge, click on the appropriate button in the tool bar or select from the **Insert** menu. To set the properties of a gauge that has been added, right click on it. To cancel an add operation, click on the cursor button .

The following gauges are available.

- **Insert | Circular Tacho** - Adds a round tacho.
- **Insert | Bar Tacho** - Adds a bar tacho.
- **Insert | Triangular Bar (Horizontal)** - Adds a triangular horizontal bar.
- **Insert | Triangular Bar (Vertical)** - Adds a triangular vertical bar.
- **Insert | Square Bar (Horizontal)** - Adds a square horizontal bar.
- **Insert | Square Bar (Vertical)** - Adds a square vertical bar.
- **Insert | Label** - Adds a text label. These do not show values.
- **Insert | Value** - Adds a value gauge. These show the value of a parameter as a text number.
- **Insert | Limit Mark** - Adds a limit mark. These consist of a number of boxes that illuminate in sequence according to a parameter value.
- **Insert | Message** - Adds a warning message. If any of the gauges generate a warning (if their parameter value falls outside the specified range) a warning message (eg Water Temp > 110) appears in this gauge.
- **Insert | Warning** - Adds a warning bar. If any of the gauges generate a warning (if their parameter value falls outside the specified range), the bar changes colour to the warning colour.
- **Insert | Out of Range** - This gauge is only visible in the editor. The gauge monitors a parameter value and generates a warning if the parameter value falls outside the specified range. This warning is triggers **Message** and **Warning** gauges.

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5.5.2 Gauge Property Editor

To set the properties of a gauge, right click on it to show the gauge property editor:
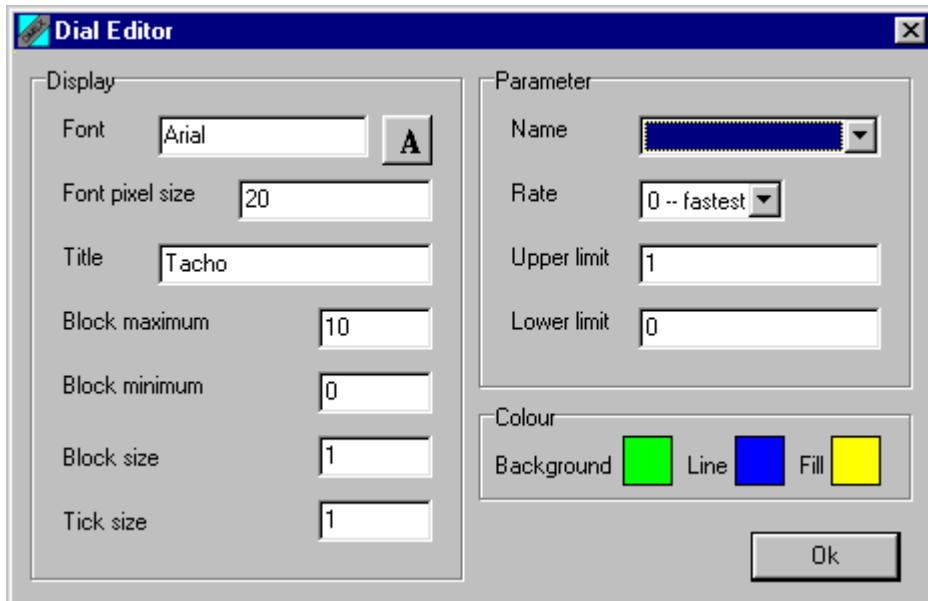
The following properties can be set:

- **Font** - Sets the font used in gauge titles and labels.
- **Font Size** - Sets the size of the font used in gauge titles and labels.
- **Title -** Sets the title of tacho and bar gauges. Sets the text of a label gauge. Sets the text displayed in a warning gauge.
- **Block Maximum** - Sets the maximum value of a tacho or bar graph.
- **Block Minimum** - Sets the minimum value of a tacho or bar graph.
- **Block Size** - The size of a block in tacho or bar gauges. This also defines the number of blocks - i.e.
- *Number of blocks = (Block Max - Block Min) / Block Size*
- **Tick Size** - Defines the position of the tick labels in tacho gauges. Tick Size must be an integer multiple of Block Size. If Tick Size is 5 times the size of Block Size, the ticks occur every 5 blocks.
- **Block Start** - Limit gauges only. Defines the value at which the first limit box is filled in.
- **Block Offset** - Limit gauges only. Added to the value of Block Start to determine the value at which subsequent limit boxes are filled in.
- **Limit Boxes** - Limit gauges only. Defines the number of limit boxes in the limit gauge.
- **Parameter Name** - The name of parameter used by this gauge.
- **Parameter Rate** - The speed at which the parameter reads data from the ECU. Faster rates produce quicker updates of the data on the screen. However, having many parameters set to fast will result in a slower update rate.
- **Upper Limit** - If the parameter value exceeds this value, a warning will appear on the warning gauge if present and the warning bar will illuminate if this gauge is a bar gauge.
- **Lower limit** - If the parameter value falls below this value, a warning will appear on the warning gauge if present and the warning bar will illuminate if this gauge is a bar gauge.
- **Colour** - Click on the boxes to set the Background, Line or Fill colour.