STACK
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Dash Logger for Porsche GTR3

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CHAPTER 1. INTRODUCING THE STACK SYSTEM
Scope of this manual

The Stack Display System supplied with your car interfaces with the Bosch ECU model MS3.1. Engine data is communicated from the ECU to the Stack system through a CanBus network. Other vehicle parameters are recorded directly by the Stack system.

The supplied system provides both the driver display and data acquisition functions on the car.

This manual explains how to use your Stack System correctly and how to get the most benefit out of the system.

The following items are provided by Stack.

Quantity	Description
1	CanBus interface Module (913034)
1	Display Module (ST868)
1	Recorder Module (ST829)
1	Stack system loom (900093)
1	Infra-red Lap Time Receiver (ST543)
1	Infra-red Lap Time Beacon (ST544)
1	PC Download interface and cable (ST890)
1	PC Software – Level 2

CHAPTER 2. OPERATING THE DISPLAY SYSTEM

The Display Module consists of an analog tachometer and a digital display panel.

When you first switch the ignition on (without the engine running) the digital display will immediately show a "Low Oil P" warning and the alarm light will come on.

The tachometer will reset itself by moving the needle until it touches the stop-pin, and then moving it back to the zero RPM position. Press Switch 3 to clear the warning message from the display. (Switch 2 can also be used for this.)
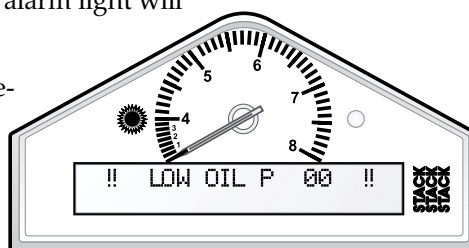
The digital display panel and the analog dial face are always backlit when the system is switched on.

If none of these actions occurs when you switch on, switch off the power to the system and consult the section on troubleshooting in this manual.

Changing the display layers

Each of the display layers can be displayed in turn by pressing Switch 3.

Display Layer 1

Display layer 1 shows:

· Water Temperature (WATER)
· Oil temperature (OIL T)
· Current speed (SPEED).
· Oil Pressure (OIL P)
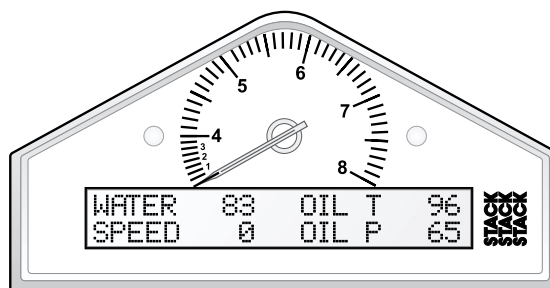
Press Switch 3 to see display layer 2.

Display Layer 2

Display layer 2 shows:

· Battery voltage (BATT)
· Oil Temperature (OIL T)
· Fuel Pressure (FUELP)
· Oil Pressure (OIL P)
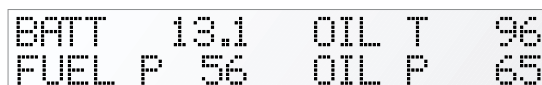
Press Switch 3 to change display to layer 3

6

Display Layer 3

Display layer 3 shows:

Top Row

- Water Temperature

- Gear Temperature

```
WATER    83    GEART    85
AIRT    3.1    OILP     65
```

Bottom Row

- Air Temperature

- Oil Pressure

Press Switch 3 to change the display to layer 4

Display Layer 4

Display layer 4 shows:

- Lap number (LAP No) of last completed lap

```
LAP No   14           1:20.96
SPEED  137    BEST :19.83
```

- Lap time for last completed lap

- Current Speed (SPEED)

- Fastest lap time (BEST) (only the seconds and milliseconds parts of the lap time are shown)

Press Switch 3 to return to layer 1.

Peak Values (Tell Tales)

The system can display the peak values (sometimes called 'tell-tales') that have been recorded during a run for all the monitored parameters.

Peak values are updated only when the engine speed has exceeded its "gate value" for RPM *for at least one second*. This allows the values to stabilise. Blipping the engine may not be enough to update the peak values. The gate value is a predefined RPM value that is used to control when the system updates the peak values. This is to prevent abnormal peak values from being recorded when, for example, the engine is either not running, is idling, or is being warmed up.

The system stores either a maximum or a minimum value as the peak value, depending on the parameter, as follows:

Parameter	Type of Peak Value	Gated to RPM
Engine Speed (RPM)	Maximum	Yes
Oil Temperature	Maximum	Yes
Water Temperature	Maximum	Yes
Oil Pressure	Minimum	Yes
Fuel Pressure	Minimum	Yes
Air Temperature	Maximum	Yes
Gear Temperature	Maximum	Yes
Battery Voltage	Minimum	Yes
Wheel Speed	Maximum	Yes

Displaying the Peak Values

Press and hold **Switch 1** to show the peak values for the parameters currently being displayed. Release the switch to return to the normal display.

Resetting the Peak Values

You can reset all of the peak values, except the fastest lap time, manually. All peak values are reset at the same time. If the engine is running **at** or **above** its gate value when the peak values are reset, they are set to the current value of each performance parameter.

To reset the peak values:

- Press and hold Switch 1 to display the peak values.

- While holding Switch 1, press and hold Switch 3.

- With Switch 3 held down, you will see the display revert to the current values. The new peak values that are stored are those being displayed when you release Switch 3.

Peak Value Memory

The peak values are stored in a memory, which is powered by an internal back-up battery. They remain stored in this memory when the external power source is disconnected from the system. The internal battery needs to be changed every 4-5 years. An alarm is triggered when the power from this battery drops below a safe level and the warning "MEM BATT" is displayed.

Alarms

The Display System has built-in warnings to alert the driver when certain parameters either exceed or fall below their alarm values. For example, a warning is signalled if the fuel pressure falls below its alarm value or if the oil temperature rises above its alarm value. You can adjust the pre-set alarm levels when you configure the Display System. See Chapter 4, *configuring the Display System* in this manual.

Some of the warnings (see the following table) are triggered only while the engine speed exceeds its "Mask value" for RPM *for at least one second*. Blipping the engine may not be enough to trigger a warning. The mask value is a predefined RPM value that is used to control when the system is to trigger a warning. This is to prevent abnormal warnings from being triggered when, for example, the engine is either not running, is idling, or is being warmed up.

The Display System has the following built-in alarms:

Parameter	Alarm is triggered when the:	Gated to RPM
Oil Temperature	current value exceeds the pre-set value	Yes
Water Temperature	current value exceeds the pre-set value	Yes
Oil Pressure	current value drops below the pre-set value	No
Air Temperature	current value exceeds the pre-set value	Yes
Gear Temperature	current value exceeds the pre-set value	Yes
Fuel Pressure	current value drops below the pre-set value	Yes
Battery Voltage	current value drops below the pre-set value	No

Displaying an Alarm

When an alarm condition occurs, the built-in amber warning light turns on, and the digital display gives a warning message to show the type of alarm:
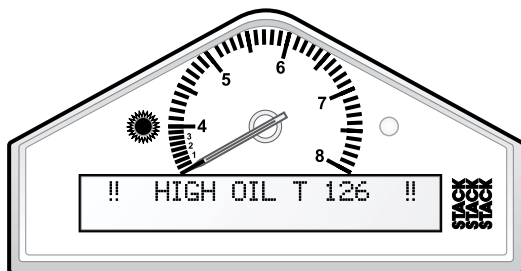
Clearing an Alarm
Press Switch 3. (Switch 2 can also be used.)

Showing the Last Alarm
Press and hold Switch 2

Lap times

The lap time is displayed when triggered by the infra-red lap time sensor on passing the lap time beacon.
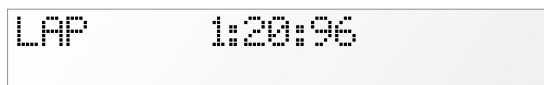
The most recent lap time is held in display layer 4. Press Switch 3 to see this display layer. This display gives you the lap number and time of the last recorded lap.
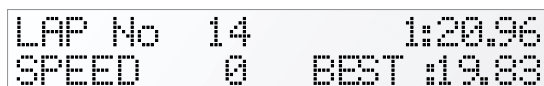
Resetting the Lap Time to Zero

Press and hold Switch 1 and then press Switch 4 to reset the lap count and lap time to zero.

Gear shift light

The gear shift light comes on when the engine RPM exceeds a predefined value. See "Configuring the Display System" for information about setting this value.
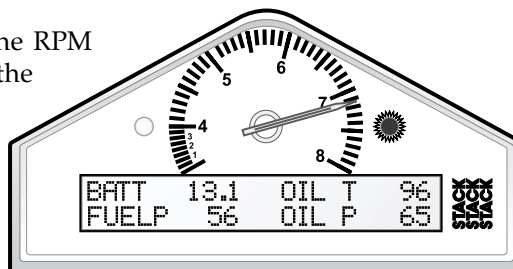
CHAPTER 3. CONFIGURING THE DISPLAY SYSTEM
Configuration mode

You put the Display System into configuration mode by pressing Switches 1 and 2 together. You then work through the configurable parameters in a pre-set sequence. Press Switch 3 to display the next configurable parameter. The configurable parameters are displayed in the following order:

Configurable Parameter	Setting Required
Wheel Circumference	Set a value in the units of measurement indicated
Wheel sensor pulses per revolution (W.S. PULSES/REV)	Set the value to the number of ferrous targets that the wheel sensor is to count for each wheel revolution
Engine Speed	Number of cylinders in engine (for RPM)
Mask RPM	Minimum RPM for the Pressure and Temperature warnings to operate
Start at RPM	RPM at which the logging option is started
SHIFTLIGHT RPM	RPM at which gear shift light is to come on
HIGH WATER	Maximum water temperature alarm
HIGH OIL T	Maximum oil temperature alarm
LOW FUEL P	Minimum fuel pressure alarm
HIGH AIRT	Maximum air temperature alarm
HIGH GEART	Maximum gear temperature alarm
LOW OIL P	Minimum oil pressure alarm
LOW BATT	Minimum battery voltage alarm

Setting or resetting configuration values

Use Switch 1 to decrease the value being configured and Switch 2 to increase it. The rate at which the value increases or decreases itself increases while the switch is being held down. Examples of the displays for each of the configuration items are shown below.

Wheel circumference:

```
Wheel Cir (mm)      1000
```

Wheel speed pulses:

```
W.S. Pulses/Rev       10
```

Engine speed cylinders:

```
Cylinders 4
```

Gate RPM:

```
EDIT TEST
MASK RPM        3000   on
```

Logging RPM:

```
EDIT TEST
START       7000   on
```

Shift RPM:

```
EDIT TEST
SHIFT AT      7000   on
```

High water temperature:

```
EDIT TEST
HIGH WATER    105   on
```

High oil temperature:

```
EDIT TEST
HIGH OIL T      130   on
```

Low fuel pressure:

```
EDIT TEST
LOW FUEL P     10   on
```

Low oil pressure:

```
EDIT TEST
LOW OIL P        35   on
```

High air temperature:

```
EDIT TEST
HIGH AIRT      50   on
```

High Gear temperature:

```
EDIT TEST
LOW HIGH GEART  90   on
```

Low battery voltage:

```
EDIT TEST
LOW BATT       10.0   on
```

Switching Alarms on or off

You can enable (switch on) or disable (switch off) each of the alarm warnings by pressing and holding Switch 1 and then pressing Switch 2.

Note that you might change the pre-set value of the parameter slightly while pressing both switches. This does not matter if you are switching the alarm warning off and, if necessary, you can correct the pre-set value after you switch it on again.

Leaving configuration mode
When you wish to return to the normal display, press Switch 4.

Switches
The four switches are used to control the functions of the Display System.

The normal functions of the four switches are:

Switch	Functions
Switch 1	1. Show Peak Values
Switch 2	1. Clear Alarm 2. Show Last Alarm
Switch 3	1. Change Display Layer 2. Clear Alarm

Warning lights
The Display Module has two built-in warning lights. One of these is the gearshift light and the other is to warn the driver that an alarm has been triggered.

CHAPTER 4. PREDICTIVE LAP TIMING SYSTEM (OPTION)

The Predictive Lap Timing System is an upgrade option to the dash, which requires the dash to be returned to Stack for re-configuration.

When this option is activated the display will have an additional display layer for the driver to view on the track and will have addition menu items in the set up mode.

Predictive Lap Time Display Layer (Layer 5)

Top Row

- Best lap time
- Running time from start of lap
- Prediction of next lap time
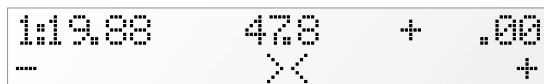
Bottom Row

- A graphical comparison of the relative Press Switch 3 to change the display back to layer 1

Switch Functions
Additional Configuration Parameters

Switches	Functions
Switch1 + Switch 4	1. Clears fastest lap stored by Predictive Lap Timing System 2. Clears fastest lap from Lap Time Memory

Bar Width

Specifies the time range of the bar graph either side of the centre.
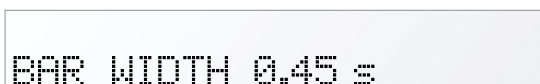
The number shown is the time in seconds – e.g. 0.45 seconds – and can be adjusted to suit driver consistency.

Accel Limit

This value can be adjusted to reduce the effects of wheels spin. The value represents an acceleration rate limit in G (M/S^2).   Under normal circumstances it can be left as the default value (10G) but on wet tracks it may be reduced to improve accuracy.

Decel Limit

This value can be adjusted to reduce the effects of wheels lock up. The value represents an acceleration rate limit in G (M/S2). Under normal circumstances it can be left as the

```
DECEL LIMIT 10G
```

default value (10G) but on wet tracks it may be reduced to improve accuracy.

CHAPTER 5. STACK SENSORS

The Stack system takes most of its information directly from the Bosch ecu, however the following sensors are provided by Stack.

Lap timing sensor

The lap timing sensor is actuated by an infra-red beacon positioned at the side of the circuit.

This sensor must be positioned horizontally and square to the axis of the vehicle. In order to detect the signals from the beacon, it must be sighted outside the vehicle. It should, if possible, be positioned so that other vehicles that are being overtaken (or are overtaking) at the moment your vehicle passes the beacon do not block the signal.
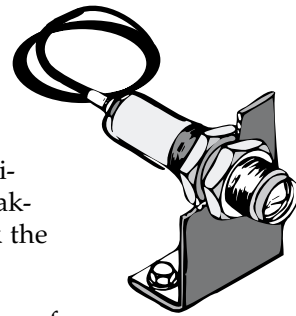
Note that after detecting a signal, the system does not recognise any further signals from beacons for a period of ten seconds.

Trackside Infra-Red Lap Beacon

The ST544 trackside infra-red lap beacon should be located as follows:

- As near to the start-finish line as possible

- At the same height as the on-vehicle detector

- Level, so that it emits a horizontal beam

- It must be between 2 and 30 meters (6 to 95ft) from the vehicle when the vehicle passes it.
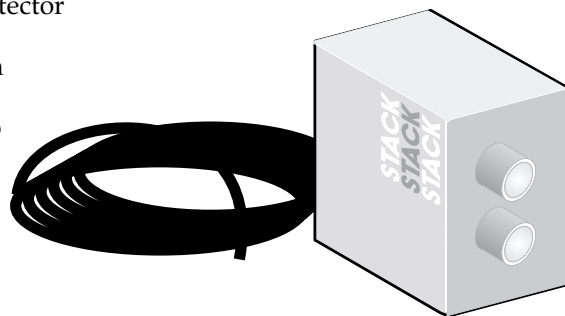
Avoid positioning the beacon so that the sun is directly behind it when it is being used.

Where the unit is to be used for lengthy periods in very hot, sunny conditions, it should be protected by shading it from direct sunlight.

Do not allow water to be sprayed onto the transmitter lenses. During wet conditions, fit a protective shroud over the beacon.

Power supply to Trackside beacon

The beacon operates from a 12v DC supply. A sealed lead-acid battery with a minimum rating of 2.5 Amp/hour is recommended. This provides about 15 hours of operation.

The condition of the battery is indicated by the colour of the LED indicator on the front panel of the unit:

1. Green: The voltage is, at present, adequate for use

2. Red: The voltage is too low (replace the battery).

3. No Colour: Battery exhausted or disconnected.

CHAPTER 6. DATA ACQUISITION EXPANSION OPTIONS

Your system can be upgraded with a range of data acquisition expansion options. These options and installation recommendations are explained below.

"Track Mapping" Upgrade

Upgrade consists of a G sensor. Simply plugging in this sensor allows you to record Lateral-G and enables the standard supplied Software to calculate Track maps and provide Corner Radius analysis.

Installing the G sensor

The lateral Acceleration connects to a ready terminated connector labelled "**A**" on the standard vehicle wiring harness.

The most suitable place to fit the lateral Acceleration sensor is as close as possible to the vehicle's centre of gravity.

The sensor **must** be positioned flat with the label on top and rotated so that the L and R arrow points to the left and right of the car as the driver sits.

"Driver" Upgrade

Upgrade consists of a G sensor and Software. System provides Track Mapping, Corner Radius analysis and Throttle analysis.

"Engineer" Upgrade

Upgrade consists of a G sensor, Steering sensor, Linear potentiometers, potentiometer interfaces, supplementary sensor harness and Software.

This upgrade also requires the Recorder "**R**" module supplied with the car to be returned to Stack for re-configuration.

Provides Track Mapping, Corner Radius Analysis, Steering Analysis, Throttle Analysis and Analysis of … Damper Movement, Damper Velocity, Pitch, Roll and Ride Height.

Installing the Steering Sensor

The supplied sensor kit consists of: Rotary Sensor, Pulley, Rubber Band and Mounting Bracket. This sensor is ready terminated and must be connected to the harness terminated labelled "**STR**".

It is recommended that the steering sensor be installed with the rubber band looped around the steering column to drive the rotary sensor through the pulley.

To minimise "creep", and a resulting calibration drift, the steering sensor must be mounted parallel to the steering column, the band should be looped twice around the steering column contacting on a clean high friction surface (e.g. abrasive tape).
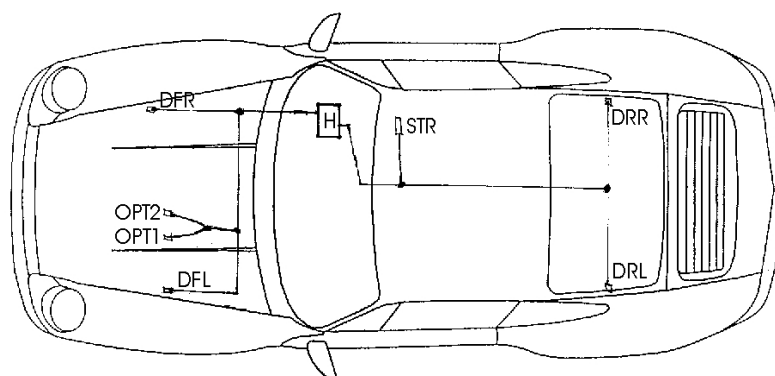
Installing the supplementary wiring harness
The supplementary wiring harness is designed specifically for the GT3R. The harness should be installed in the car as shown below.

Installing Damper Sensors
The supplied sensor kit consists of four (4) 100 mm linear potentiometers and four (4) interface modules.

Each linear potentiometer must be connected to an interface module and the interface module connected to the appropriate harness connection. i.e. **"DFR"** = Damper Front Right, **"DRL"** = Damper Rear Left etc.

The photographs illustrated on the following page show the recommended mounting of the linear potentiometers and interfaces.

Front Dampers – Mounting the Potentiometer (top)
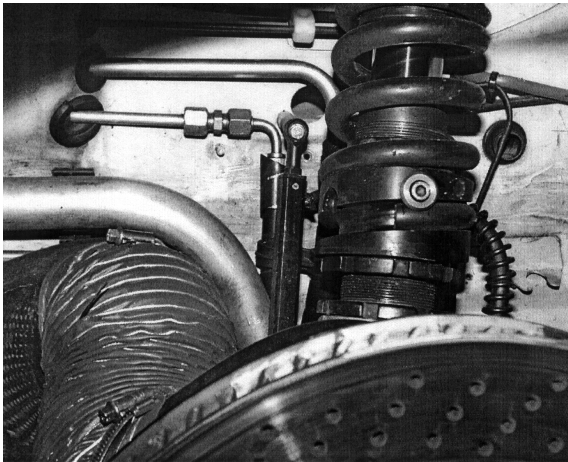
Front Dampers – Mounting the Potentiometer (Bottom)
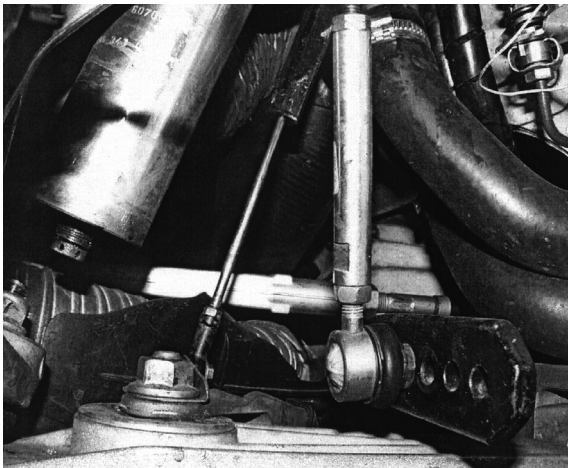
Rear Dampers - Positioning the Potentiometer interfaces
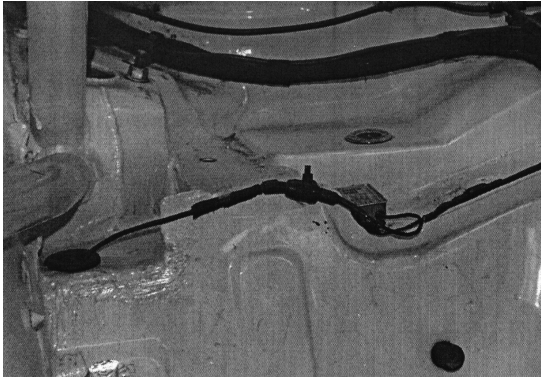
Rear Dampers - Mounting the Linear Potentiometers
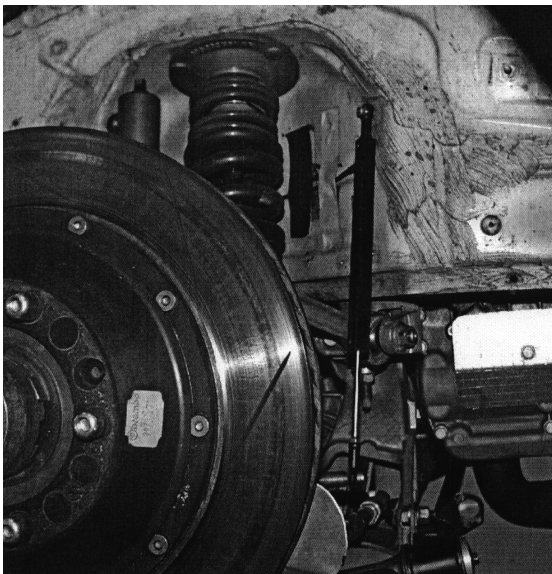
CHAPTER 7. INTRODUCING THE DATA ANALYSIS SOFTWARE

This manual is written to support the Stack Version 6.0 Plus Data Acquisition Software.

The ST800 Data Analysis Software is used to analyse and compare the performance parameters logged by one of the range of STACK on-vehicle data logging systems. The performance parameters that can be charted and analysed depend on the particular STACK Data Logging System in use. Details are given in the User Guide for each system.

Typical performance parameters that are charted are:

- Engine speed (RPM)

- Wheel speed

- Pressures

- Temperatures

- Battery voltage

- Lap time

- Lateral G force

- Suspension movement

- Steering wheel movement

The software allows you to download the data recorded by the on-vehicle logging system. The data is recorded and downloaded as numbered runs in separate sessions, such as practice sessions and the race itself, which can be stored and retrieved for subsequent analysis and comparison.

The data from the runs is analysed lap by lap and you can compare the data from different runs or sessions on the same track.

Installing the software

These instructions should be followed when you are installing Version 6.0 Plus Data Analysis Software for the first time. They should also be used if you have to re-install the software at any time.

The Software supplied with your system is designed to work with Windows 98, 95, 3.1 and DOS. These instructions only cover installation and configuration on Windows 98 & 95 machines.

Your system is supplied with two (2) Software disks labelled Porsche GT3R Analysis Software disks 1 and 2.

Place **Disk 1** in the floppy drive and select the Run option from the Windows Start menu.

Type into the dialogue box

`A:\INSTALL`

Press the <enter> key to begin installation.

After a few seconds the following dialogue box will pop up.

```
+[-]-[STACK SYSTEM 800  --  INSTALL V2.4] ---------------------------------+
|                                                                          |
|                                                                          |
|                                                                          |
|          +[-]-------------[Install Details]----------------+             |
|          |                                                 |             |
|          |  Source Drive:        [A:\               ]      |             |
|          |  Destination Drive:   [c:\st800          ]      |             |
|          |  User or Team Name:   [                  ]      |             |
|          |                                                 |             |
|          |  Units                                          |             |
|          |  (•) British   MPH PSI C        Install         |             |
|          |  ( ) American  MPH PSI F                        |             |
|          |  ( ) Metric    KPH BAR C         Exit           |             |
|          +-------------------------------------------------+             |
|                                                                          |
|                                                                          |
|                                                                          |
|                                                               STACK      |
|                                                               STACK      |
|                                                               STACK      |
+--------------------------------------------------------------------------+
```

Select "Install" to continue loading.

As installation proceeds, various messages are displayed which is normal. When the first software disk has been installed, the following message is displayed:

Now remove the disk from the drive, insert **Disk 2** and select "Another" and press <enter>.

```
            ST800 Install
   Installation successful. If you have
   another disk to install put it in the
   drive and select 'Another' or select
   'Exit' to return to DOS

   Another                          Exit
```

Using V6.0 Software with Windows 95 & 98
Installing the Software

From the Windows Desktop screen select: **Start** then select: **Run...**
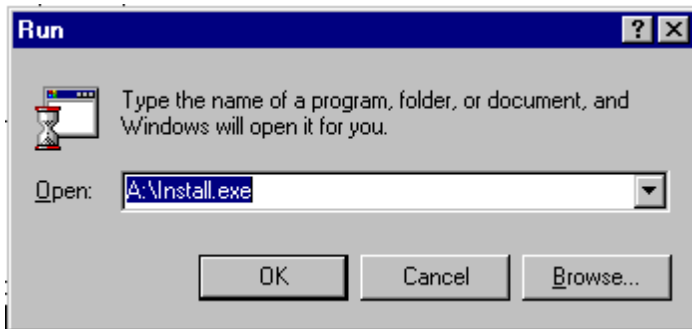
This will pop up the Run dialogue box.

Type 'A:\install.exe' into the Open file command line and click on the OK box to install the program.
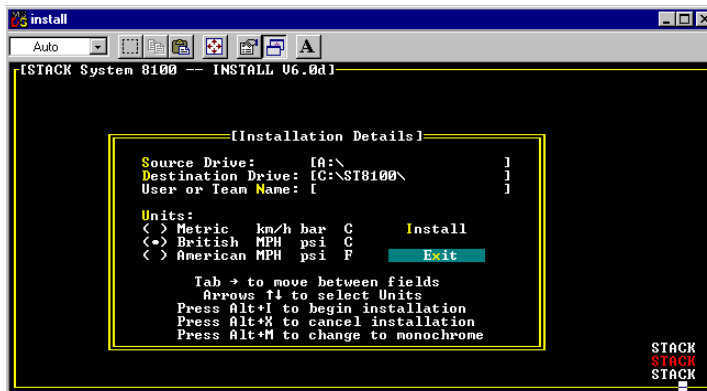
The program will start to install and after a few seconds an installation menu will pop up.

Specify the drive and directory to install Stack software. Note: Systems with option pack disks must use the default drive and directory.

If desired a team name can be included here which will be displayed on screen with the data.
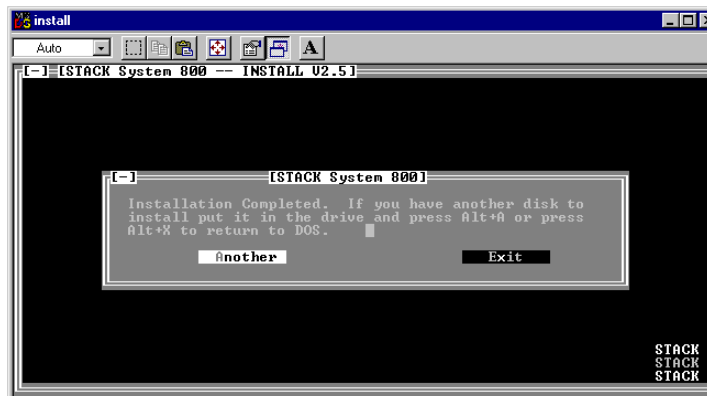
Choose the units the software is to use from this menu.

Select Install (alt-I) to continue loading the program with user preferences.

The program will continue to load and you will be prompted to add the next disk in sequence when each disk has been successfully installed. Select Exit after the last disk has been installed.

Important notes:

1. Only install the low fuel pressure software disk if you are running the low fuel pressure sensor on the vehicle.

2. If you are using an Option Pack, the Option Pack software disk must be loaded independently and after the initial installation. Install the Option Pack disk separately from the Run program.

Setting up a Shortcut

From the Windows Desktop screen move the mouse pointer onto the background and double-click on the right-hand mouse button to pop up the desktop menu.

Select New from the desktop menu which will pop up a follow-on menu. Select Shortcut from this menu.
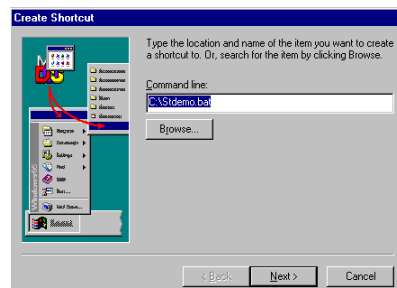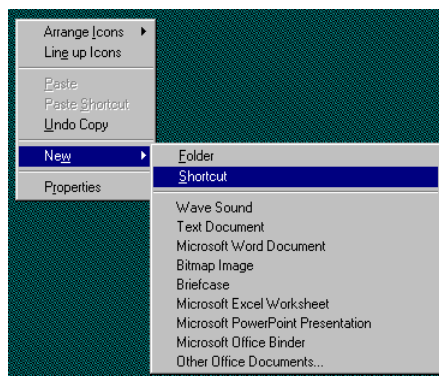
This will pop up a shortcut installation box.

Use browse or type the appropriate batch file name (refer to the floppy disk label) into the Create Shortcut command line and select Next.
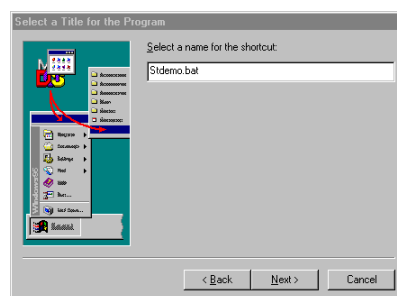
Choose a name to appear with the shortcut icon and select Next.

© Stack Limited

Select the shortcut icon and select Finish to install the shortcut.

Move the mouse pointer to the Stack icon and double click on the right-hand mouse button to pop up the shortcut details.

Select Properties to pop up the shortcut properties folder.

Setting up Shortcut Properties

Ensure the shortcut properties are set to the following:

After setting all the property folders select OK to exit and save the set up. Double click on the Stack icon to run the program.

Select Advanced to pop up the Advanced Program Settings

© Stack Limited
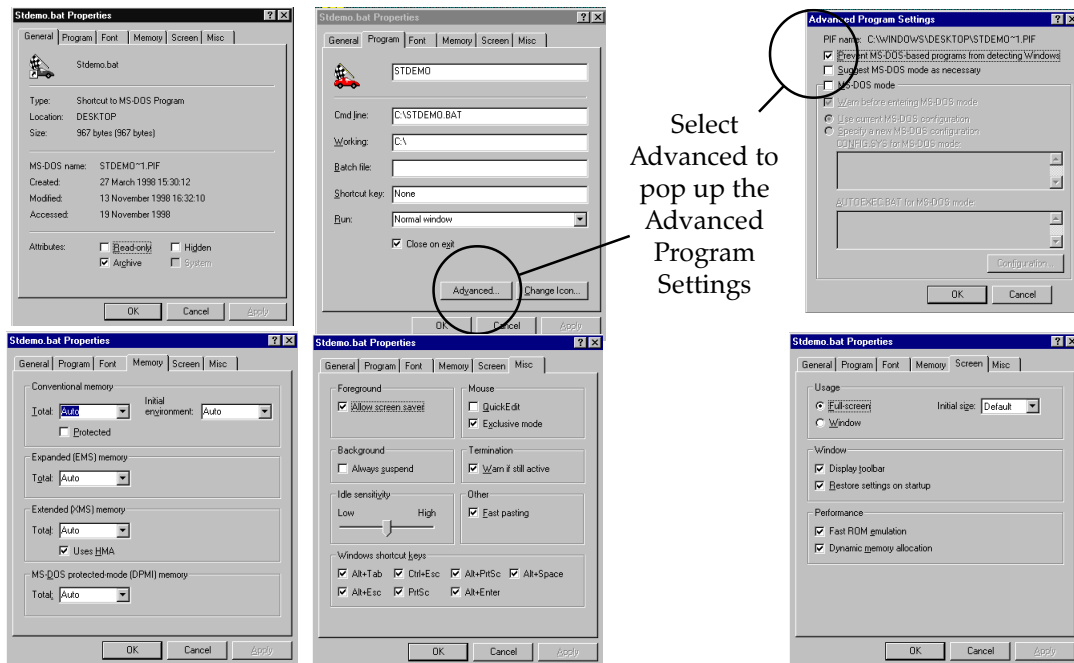
The installation will continue until the above message is repeated again. This time select exit to end the installation routine.

PC Configuration
Operating System
Your PC must have a CONFIG.SYS file that contains the following setting as the minimum value:

> FILES=40

A higher value can be used if required. The CONFIG.SYS file is held in the root directory.

Storage
At least 3.5 MB of disk space is needed to install and start running the ST800 Data Analysis Software. The storage required will thereafter depend on the extent of the track, session, and run data that is created by using the system. Each Download typically using 0.5Mbytes of disk space

Memory (RAM)
Your PC must have at least 590KB of free memory to run the ST800 Data Analysis Software.

It is recommended that if possible that you also configure your system to run EMS memory (see following section).

 EMS Memory

The ST800 Data Analysis Software can process a large number of data channels simultaneously provided that it has enough memory. With a large number of channels, the memory required by the software becomes significant. This requirement doubles when comparing two runs. The software checks whether EMS memory is available and, if there is and it is large enough, allocates its data buffers in it. This effectively allows you to analyse a greater number of channels than would be possible otherwise.

Do I need this feature?
If your system can display all the charts with all the data channels you in a normal MS-DOS or PC DOS environment, you do not need to reconfigure the system memory with EMS. This is normally only possible if you have more than 600K free.

If, however, you see the error message "VNOM Insufficient memory to continue" and the chart closes. Or…   The speed that the Charts redraw is slow.

Then the EMS memory needs to be available.

Customising your settings
ST800.INI File

This file is placed in the C:\ST800\ directory of your PC and configures the software for the correct display mode and for other miscellaneous functions. You can edit this file as follows: at the C:\ST800\ prompt, type 'EDIT ST800.INI'

Display Monitors:

The ST800 software can use a variety of displays with different levels of high resolution. The default display type is IBM VGA with 640x480x16 colours. This is set by a line in the <run>.BAT file & the ST800.INI file, as follows:

<run>.BAT requires: **set fg_display=vga12**

ST800.INI requires: **display=vga12**

The complete list of display options follows:

Option	Type
HERC	Hercules 720x348 Monochrome
EGAMONO	IBM EGA 640x350x4 Shades
EGAECD	IBM EGA 640x350x16 colour
VGA12	IBM VGA 640x480x16 colour#
EVGAHIRES	Everex EVGA 800x600x16 colour
ORCHIDPROHIRES	Orchid Prodesigner VGA 800x600x16 Colour
PARADISEHIRES	Paradise VGA 800x600x16 colour
TRIDENTHIRES	Trident VGA 800x600x16 colour
VEGAVGAHIRES	VIDEO7 Vega VGA 800x600x16 colour
VESA0, VESA1, VESA2	640x400, 640X480, 800x600x16 colour
VESA5	Vesa 5 VGA 1024x768x16 colour
VESA6A	Vesa 06A VGA 800x600x16 colour*
VESA7	Vesa 7 1280x1024x16 colour

Default setting

* Recommended choice for most large screen lap tops

Note: There must be no spaces between the = and the screen driver name

Backing up data to other drives

The ST800 software will back up data to the disk drive that you installed the software from. The drive can be changed. This is set by a line in the ST800.INI file, as follows:

[MENU800]

archive_dir=B:

Parallel Port Assignment

If you are planning to use the ST890 Network Interface Adapter on a port that is not LPT1, you must change the following line to define the correct port:

[NET800]

PORT=1   To set the port to LPT2 for example set: PORT=2

ST800.ORG file

The ST800.ORG file is an original copy of the ST800.INI file. Both files can be found in the ST800 directory. If for some reason the ST800.INI file has become damaged or erased, the ST800.ORG file can be copied to the ST800.INI file. To copy the file, at the DOS prompt, enter the following:

CD \ST800 [Enter]

COPY ST800.ORG ST800.INI [Enter]

**CD ** [Enter]

If the computer asks if you wish to overwrite the existing file, enter Y for yes.

CHAPTER 8. THE ANALYSIS SOFTWARE IN DETAIL

This section describes how to use the ST800 Data Analysis Software to analyse your logged data.

- Download data.

- Display an analysis of the downloaded data for a session.

- Compare the data from different laps and different runs.

- Monitor the STACK Data Logging System on the vehicle.

- Organise and manage downloaded data.

- Calibrate sensors.

Main Menu

```
+[STACK ST8203 - Menu800 Plus V6.0]-----------------------------------------------+
¦ File  Edit  Recorder  Display  Utils  Options  System  Help                     ¦
¦                                                                                 ¦
¦                                                                                 ¦
¦                                                                                 ¦
¦                                                                                 ¦
¦                                                                                 ¦
¦                                                                                 ¦
¦                                                                                 ¦
¦                                                                                 ¦
¦                                                                    STACK        ¦
¦                                                                    STACK        ¦
¦                                                                    STACK        ¦
¦ Track:DEMOTRAK    Session:DEMOSESS   Run:  1    Setup:   DASH2                  ¦
+---------------------------------------------------------------------------------+
```

This Main Menu is displayed when you first start the ST800 Data Analysis Software.

You use this window for preparing each session prior to downloading the data and analysing it.

You can also use it to retrieve data downloaded from previous sessions from files stored on the PC's disk storage.

You can select each of the main functions of the Data Logging System:

Using the Mouse

If you have a mouse, move it to the menu and click. You select a choice in a menu by clicking on it. To cancel a menu, click the mouse on the background away from the menu.

Using the Keyboard

To use the keyboard to see the choices in a menu, press the left or right arrow keys to move the highlight across the menu bar to each menu.

When you start the software, the **File** menu is highlighted, meaning that you can select it.

To see the choices in a menu, press the down-arrow key or Enter key.

Use the up-arrow or down-arrow key to move the highlight to the choice you want in the menu.

Press the Enter key to select and activate the highlighted choice.

To cancel a menu, press the Esc key.

File Menu

The File menu contains the following choices:

The use of the options in this menu is described below. The normal sequence of operation is:

1. Select the track. This can be a track that you have used previously or a new track.

2. Select the session. This can be either a new one for which you use data that you are about to download from the vehicle or a previous session that you wish to analyse.

3. Select the setup for the vehicle used in the session. The correct vehicle setup must be defined prior to running the Recorder Download function. The vehicle setup is altered using the Edit->Setup Calibration function (described later in this section).

```
+----------------------+
¦  Select Session...   ¦
¦  Select Track...     ¦
¦  Select Setup...     ¦
¦  Select Run...       ¦
¦----------------------¦
¦  Backup Session...   ¦
¦  Archive Session...  ¦
¦  Restore Session...  ¦
¦  Backup Setups       ¦
¦  Restore Setups      ¦
¦  Move Run...         ¦
¦----------------------¦
¦  Exit...        F10  ¦
+----------------------+
```
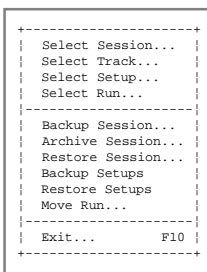
The session name will default to the current date in the form yymmdd (for example, "960611" for June 11th, 1996). This makes subsequent sorting of the sessions into date order straightforward. You may then accept this session name or enter a name of your own.

Note: When analysing data recorded on multiple vehicles or on one vehicle with more than one driver it is recommended that multiple sessions are created with the driver's initial or the vehicle's number identifier at the end of the session name. For example, **990611TW**.

When the new session name is complete, press the Enter key. The session name field is cleared and the track and session names you have selected appear at the bottom of the screen.

(Other) displays a list of other tracks that are available for analysis.

The session names **990527**, **990610** and **990611** in the example above, are the names of previous sessions recorded at the track you have chosen.

Select Run

Use this choice to select the run you wish to analyse. For example:

The run notes for the highlighted run are shown in the lower part of the window.

Select the run by pressing the Enter key or double-clicking the mouse on it. The list of runs is cleared and the run number appears at the base of the screen.

```
+[STACK ST8203 - Menu800 Plus V6.0]---------------------------------------+
| File  Edit  Recorder  Display  Utils  Options  System  Help             |
|    +[Select Run Number:]------------------------------------+           |
|    |Run   Date          Time     Duration  Laps  Fastest  Chan |        |
|    | 1    Fri Jun 21  11:35:11      9:52    11   0:46.500  13  ^|        |
|    | 2    Fri Jun 21  12:55:10      1:38     5   0:50.230  13  I|        |
|    |                                                         #|          |
|    |                                                         I|          |
|    |                                                         I|          |
|    |                                                         I|          |
|    |                                                         v|          |
|    |---------------------------------------------------------|           |
|    |                                                         ^|          |
|    |Use this for notes which relate to this run only.        I|          |
|    |Information which is the same for all runs within one    #|          |
|    |session should be kept in the session notes file.        I|          |
|    |                                                         I|          |
|    |This run is a demonstration run.                         I|          |
|    |                                                         I|          |
|    |                                                         v|          |
|    +---------------------------------------------------------+           |
| Track:DEMOTRAK    Session:DEMOSESS   Run:  1    Setup:   DASH2           |
+-------------------------------------------------------------------------+
```

Backup Session

This option copies all of the data from the selected session onto a diskette in the floppy disk drive* and can be used to transfer data from one PC to another. Your original data will not be removed from your PC. Note the data will be stored in a compressed form as a [Session-name].ZIP file. See Restore Session below if you need to restore the backup data to the original PC or to a different PC.

Archive Session

This option moves all of the data from the selected session onto a diskette in the floppy disk drive*. Your original data will be removed from your PC. Note the data will be stored on the floppy disk in a compressed form as a [Session-name].ZIP file. See Restore Session below if you need to restore the archived data to the PC.

Restore Session

This option copies the backup or archive data from a diskette in the floppy disk drive* back to the session from which it originally came or allows you to create a copy of the data on a different PC. The data will remain on the diskette. All of the data for the runs that were recorded on the diskette will be updated. Any additional runs in the session which are not on the diskette remain unchanged.

Backup Setups

This option copies all the setup data and system configuration data onto a diskette in the floppy disk drive*. Your setup data will not be removed from your PC. See Restore Setups below if you need to restore the setup and system configuration data from a diskette. This allow a second PC to be setup in the same way as the PC used to download.

This drive is set during the installation process and is normally A:

Restore Setups

This option copies all of the setup and system configuration data on a diskette in the floppy disk drive* back into the data analysis software from which it originally came. All of the setup data that is restored from the diskette is updated. Any additional setups in the data analysis software created after the setups were backed up and hence not on the diskette will remain unchanged.

Move Run

This option moves a run of data into a different track and session. Normally this is only used when the data has been accidentally downloaded into the wrong place. When the data is moved into the new session, it is given the next sequential run number. Thus, if you accidentally move data to the wrong place, moving it back again may not result in it having the same run number as originally.

Exit...(F10)

You can select this action when you want to end the data analysis program. Alternatively, you can press F10 to end the program when none of the other menus available on this screen are being displayed. A confirmation box will ask if you do wish to leave the software; select Yes to exit or Cancel to continue running the program.

Edit Menu

When you select the Edit menu, the following list of choices appears:

Chart Ranges

When you select the Chart Ranges choice, a panel is displayed which contains a list of the performance parameters whose chart characteristics can be changed; the contents of that list depend on which level of software you have installed.

```
+------------------------+
¦  Chart Ranges...       ¦
¦  Histogram Ranges...   ¦
¦  Setup Calibration     ¦
¦------------------------¦
¦  Run Details...        ¦
¦  Session Notes...      ¦
¦  Track Details...      ¦
¦------------------------¦
¦  Copy Setup to Run...  ¦
¦  Make New Setup...     ¦
¦  Run Markers...        ¦
¦------------------------¦
¦  Delete Run...         ¦
+------------------------+
```

The Chart Ranges information is stored with the track details. This allows you to have a different set of characteristics for each track that you visit saving you the trouble of reconfiguring the Chart Ranges from those used at the previous track.

The values shown are used to determine the characteristics that you wish to see in the charts.

The Y Min and Y Max values can be reset for each of the items in the list. By narrowing the range to the typical maximum and minimum values you would expect for each sensor, you will obtain a more visible graph plot of that aspect of the

```
+---------------[Histogram Ranges]--------------------+
¦                                                     ¦
¦ +[Graph Item]------------------+  Y Max [60.0    ] ¦
¦ ¦Speed           mph       ^¦                      ¦
¦ ¦Engine Speed    rpm       #¦  Y Min [20.0    ]    ¦
¦ ¦CHT EGT or Water  F       _¦                      ¦
¦ ¦Lateral G         G       _¦  Width [2.0     ]    ¦
¦ ¦Longitudinal G    G       _¦                      ¦
¦ ¦Combined G        G       _¦  Number [20     ]    ¦
¦ ¦Corner Radius    ft       _¦                      ¦
¦ ¦Gear Ratio                _¦  % Max  [15     ]    ¦
¦ ¦Steering         deg      _¦                      ¦
¦ ¦Throttle          %       _¦  Colour [BLUE   ][v] ¦
¦ ¦Brake             %       _¦                      ¦
¦ ¦Battery           V       v¦    OK       Cancel   ¦
¦ +------------------------------+                   ¦
¦                                                     ¦
+-----------------------------------------------------+
```

vehicle's performance.

Y Min can be configured with a value greater than Y Max. This will cause the chart to appear upside down and you can use this to invert the G force or damper movement graphs.

You can change the colour of the chart traces by selecting a colour from the drop-down sub-menu. If the current colour is shown as FIXED, it cannot be changed.

Once you have set all the characteristics to your preferred values, select the OK box to confirm any new values just entered. Selecting Cancel aborts this dialogue box without saving the new values.

> **Note** – You cannot change the units of measurement in this dialogue box. The only way to do that is to re-install the software from the master disks.
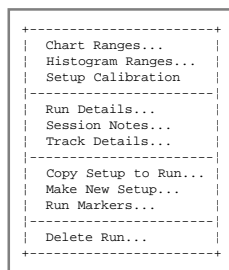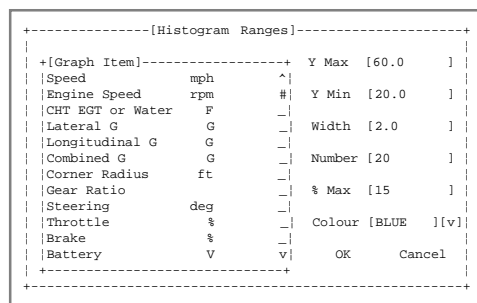
Histogram Ranges

When you select the Histogram Ranges choice, a panel is displayed which contains a list of the performance parameters whose histogram characteristics can be changed; the contents of the list depends on which level of software you have installed.

The Histogram Ranges information is stored with the track details. This allows you to have a different set of characteristics for each track that you visit saving you the trouble of reconfiguring the Histogram Ranges from those used at the previous track.

The values shown are used to determine the characteristics that you wish to see in the histograms.

The Y Min and Y Max values can be reset for each of the items in the list. By narrowing the range to the typical maximum and minimum values you would expect for each sensor, you will obtain a more detailed histogram of that aspect of the vehicle's performance.

Y Min can be configured with a value greater than Y Max. This will cause the histogram to appear upside down and you can use this to invert the G force or damper movement graphs.

The Width value defines the width of the bins used to calculate the histogram bars. In the example above a Width of 2.0 would create bars of 20 to 22, 22 to 24, etc. These values are used to calculate the percentage time that the selected logged parameter spent within each bin.

The Number value defines the number of histogram bars that will be shown on the screen. The minimum value is 1 and the maximum is only limited by the resolution of the PC screen being used. In practice the maximum number of bins which can be seen without overlapping is about 40. The histogram always displays two extra bins at the top and bottom of the screen to show the amount of data that is outside the range of the histogram.

Note – Changing any one of the above four values may affect the values of the other three since the software will attempt to create bins of equal width.

The % Max value allows you to set the width of the X axis against which the histogram bars will be shown. If the bars are longer than this, their values must be read from the tabulated data to the right of the histogram.

You can change the colour of the histogram bars by selecting a colour from the drop-down sub-menu. If the current colour is shown as FIXED, it cannot be changed.

Once you have set all the characteristics to your preferred values, select the OK box to confirm any new values just entered. Selecting Cancel aborts this dialogue box without saving the new values.

Note – You cannot change the units of measurement in this dialogue box. The only way to do that is to re-install the software from the master disks.

Changing Vehicle Setups

If you are using the data logging system on vehicles with different tyre circumferences, it will be necessary to create multiple SETUP files. This is only required where the change in circumference is significant, such as from 14″ to 15″ diameter wheels.

It is not normally necessary to set different tyre circumferences due to normal tyre wear.

Any number of setups can be created using the **Edit -> Make New Setup** choice and copy the default setup file to a file with a recognisable name e.g. **14inch**, **15inch**, etc.

Having created a new setup then use the **Edit -> Setup Calibration** choice to enter the correct tyre circumference for that setup.

Important – When using multiple setups, always make sure the correct setup is selected before downloading a run from the datalogger. Use the **File -> Select Setup** choice to select the correct setup.

Setup Calibration
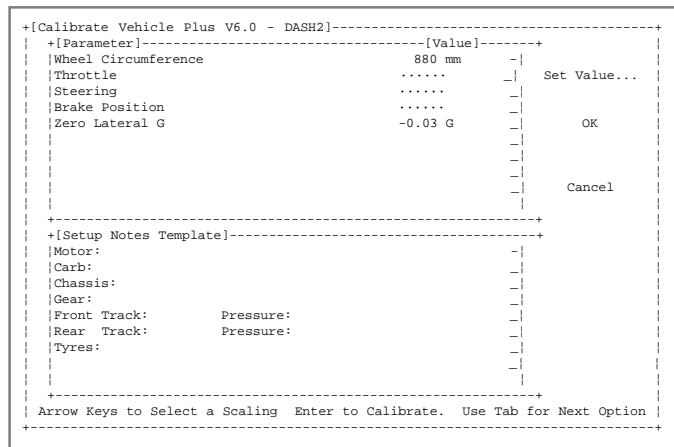
Use this choice to calibrate the software to match the values used by the system installed on your vehicle. The following panel is displayed:

The list may include items not available with your version of the STACK Data Analysis Software installed on your PC.

For the basic system the only Setup Calibration requirement is to set the Wheel Circumference to the correct value for your vehicle.
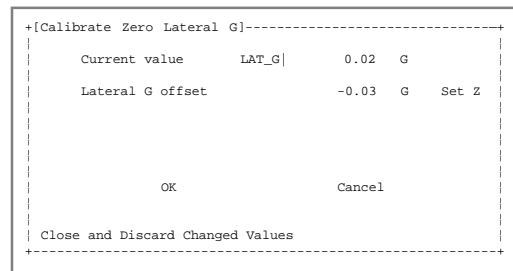
To enter a new calibration value or change an existing one, select the parameter and either press <Enter> or click on the Set Value field. This displays a dialogue box containing a field in which you enter the value (see Sensor Calibration section). Press OK to confirm the new value or Cancel to revert to the original value.

```
+[Calibrate Vehicle Plus V6.0 - DASH2]------------------------------------+
| +[Parameter]---------------------------------[Value]-------+            |
| |Wheel Circumference                         880 mm    -|               |
| |Throttle                                    ......    _|   Set Value... |
| |Steering                                    ......    _|               |
| |Brake Position                              ......    _|               |
| |Zero Lateral G                              -0.03 G   _|       OK       |
| |                                                     -|               |
| |                                                     _|               |
| |                                                     _|    Cancel      |
| |                                                      |               |
| +------------------------------------------------------+               |
| +[Setup Notes Template]--------------------------------+               |
| |Motor:                                               -|               |
| |Carb:                                                _|               |
| |Chassis:                                             _|               |
| |Gear:                                                _|               |
| |Front Track:         Pressure:                       _|               |
| |Rear  Track:         Pressure:                       _|               |
| |Tyres:                                               _|               |
| |                                                     _|               |
| |                                                      |               |
| +------------------------------------------------------+               |
| Arrow Keys to Select a Scaling  Enter to Calibrate.  Use Tab for Next Option |
+------------------------------------------------------------------------+
```

Set up calibration for "Track Mapping" data acquisition upgrade systems

The Lateral G sensor should not need regular re-calibration, however there is often a small offset due to installation or tolerance on the sensor.

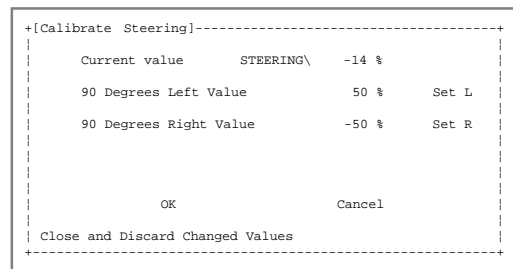Using the set up calibration any zero offset can be calibrated out.

```
+[Calibrate Zero Lateral G]----------------------------+
|                                                      |
|     Current value      LAT_G|      0.02  G           |
|                                                      |
|     Lateral G offset              -0.03  G    Set Z  |
|                                                      |
|                                                      |
|                                                      |
|                                                      |
|          OK                    Cancel                |
|                                                      |
| Close and Discard Changed Values                     |
+------------------------------------------------------+
```

Set up calibration for "Engineer" data acquisition upgrade systems

The throttle values are provided from the ecu and can not be calibrated through the Stack system.

Steering sensor calibration.

With the steering wheel fully to the left, select the Set L field and press <Enter> or click on it. Now turn the steering wheel fully to the right and select the Set F field and press <Enter> or click on it.

When finished, return to the Calibrate screen by selecting OK and pressing <Enter> or clicking on it. Select Cancel to abort.

```
+[Calibrate Steering]----------------------------------+
|                                                      |
|     Current value      STEERING\   -14 %             |
|                                                      |
|     90 Degrees Left Value           50 %      Set L  |
|                                                      |
|     90 Degrees Right Value         -50 %      Set R  |
|                                                      |
|                                                      |
|                                                      |
|          OK                    Cancel                |
| Close and Discard Changed Values                     |
+------------------------------------------------------+
```

Suspension position sensor calibration

The basic purpose of this calibration is to decide which suspension position will be assigned a Zero value. This position could be with the suspension on full droop or more typically it could be when the vehicle is stationary (on the setup plates with the driver).

The Current value indicates the sensor travel. The sensor's lowest position being -50% and its highest position being +50%.

The current values are the values being transmitted from each of the suspension movement sensors.

With the vehicle stationary, to assign the current suspension position a zero value, select the Set Z field and press <Enter> or click on it. In manual mode you can adjust the individual values to compensate for individual differences between the sensors. When finished, return to the Calibrate screen by selecting OK and pressing <Enter> or by clicking on it with the mouse.

Selecting Cancel discards any changes.

Run Details

This choice allows you to go back and modify the setup calibration used for a previous run and also to create and store your own notes and comments about a run.

The Setup Calibration screen is copied into the run details when you download from the recorder.

Select the run and press Enter.

Any existing notes for the run are displayed. You can add further notes and change or delete existing ones. The use of the editor for entering and changing the information in a Notes window is given earlier in this chapter.

```
+[Edit Run Details Plus V6.0 - RUN001]-------------------------------------+
|  +[Parameter]-----------------------------[Value]-------+                |
|  |Wheel Circumference              880 mm    |                          |
|  |Throttle                         ......     |          Set Value...    |
|  |Steering                         ......     |                          |
|  |Brake Position                   ......    _|                          |
|  |Zero Lateral G                   -0.03 G   _|          OK              |
|  |                                            |                          |
|  |                                            |                          |
|  |                                            |          Cancel          |
|  |                                            |                          |
|  +------------------------------------------+                            |
|                                                                          |
|  +[Run Setup Notes]-----------------------------------+                  |
|  |Motor:    Qualifying                                 |                  |
|  |Carb:     Dot                                        |                  |
|  |Chassis: Rocket                                      |                  |
|  |Gear:     90                                         |                  |
|  |Front Track: 20        Pressure: 21                  |                  |
|  |Rear  Track: -25       Pressure: 21                  |                  |
|  |Tyres:    New Slicks                                 |                  |
|  |Bumper: Rubber                                       |                  |
|  |Bolts:  Out                                          |                  |
|  +---------------------------------------------------+                    |
|  Arrow Keys to Select a Scaling  Enter to Calibrate.  Use Tab for Next Option |
+--------------------------------------------------------------------------+
```

Session Notes

Use this option to manually add session notes.

Editor Functions

The Session Notes editor has the following standard function keys:

F2 Save   Saves the text you enter. You can use this function to save your text without closing this window.

F3 Save As Saves the text as a new file. You are prompted for the name of this file. The file can only be created within the data analysis system. Do not attempt to create this file on any other path or disk drive.

F5 Mark   You can mark any text that you want to cut or copy into another part of the Notes text. Position the cursor at the start of the text to be cut or copied. Press F5. Move the cursor to the end of the text to be cut or copied. The marked text is highlighted. You can now use the F6 or F7 keys to cut or copy the marked text. You can also use the Del key to delete the marked text.

Press the F5 key to remove the highlight from marked text that you do not want to cut or copy.

F6 Cut   Use this key to cut marked text. The text is removed and retained in a buffer until you next use the F6 or F7 keys.

F7 Copy   Use this key to copy marked text. The text is copied and retained in a buffer until you next use the F6 or F7 keys.

F8 Paste Use this key to insert text previously cut or copied from a different part of the Notes text. You can paste the same text as many times as you require.

F9 Abort Use this key to end your notes editing session without saving any changes to the text since you started the notes session or since you last used F2 to save the changes.

F10 Exit Use this key to end your notes editing session. Any changes to the text since you started the notes session or since you last used F2 to save the changes are saved automatically.

Esc Abort Same as F9 Abort.

Track Details

Use this choice to define the nominal length of the track and a tolerance for the software to use when it calculates the length of each lap.

```
+-------------[Track Details]----------------+
¦                                            ¦
¦  Track        DEMOTRAK                     ¦
¦  Length      [832.10       ][metres ][v]   ¦
¦  Tolerance   [48.76        ][metres ][v]   ¦
¦                                            ¦
¦  Notes                                     ¦
¦  Use this to store information about     – ¦
¦  the track.                              _ ¦
¦                                          _ ¦
¦  This is a demonstration track.          _ ¦
¦                                            ¦
¦                                            ¦
¦         OK                   Cancel         ¦
¦                                            ¦
+--------------------------------------------+
```

Note – This calculation occurs automatically after data download, therefore it is important to enter the correct track length prior to data download.

If the track length has changed since your last visit to the track, you are advised to redefine the nominal length in this panel.

You should set the nominal track length to the value that you calculate during practice that is based on a lap that has provided clean data.

In particular, you should choose a lap in which the line of the vehicle is "good" and which does not contain excessive wheel lock-up, understeer or oversteer.

The easiest method to determine the Track Length is to set a Length of zero and run the DISTANCE or STANDARD calculation on the downloaded data. An error box will appear which shows the exact distances travelled for each lap in the run. The nominal Track Length is a length that is an average of the displayed lap distances; the Tolerance is the smallest distance that covers most of the laps.

Set the appropriate units of measurement (feet, metres, kilometres or miles) from the drop-down sub-menu and then enter the value.

If the data for the run has already been downloaded from the vehicle, it is essential that you recalculate the normalised* lap lengths for the run. Use the Calculate choice (for Distance) in the Options menu to do this for every run after you have reset the nominal track length.

Refer to the Editor Functions section for details about the function keys available when working with notes. You can also use this panel to record the notes about the currently selected track.

Copy Setup to Run

You can use this choice to copy calibration information stored in the current setup to the run you select.

---

* The system attempts to adjust the data for all laps in a run to the same length so that overlaid comparisons are always perfectly aligned. This process is called normalisation. However, laps whose lengths are outside the tolerance set for the track will not be normalised.

Normally this information is transferred immediately after the data is downloaded. It defines how the ST800 software should scale and present the data in the channels.

You are prompted with the Update Run from Setup dialogue box that asks you to confirm overwriting the calibration values in the current run with those from the current setup. This might be necessary if the sensors have to be re-calibrated, the wrong setup file was used during download or because the data is old and contains no scaling values. Select OK to proceed or Cancel to abort without changing.

Make New Setup

Use the Make New Setup choice to define a new setup for a vehicle.

You are prompted for the name of the new setup. Type in the new name and press the Enter key. The current setup file is copied into the new setup. Its name is shown on the bottom line of the screen.

You can now modify the values in the new setup to the values you require using Edit=>Setup Calibration.

Run Markers

Use this choice to check your lap time data after you have downloaded a run. You are prompted for a run. An example of a set of lap times that are displayed when you select this choice follows:

```
+[MARKERS]-------------+
|LAP   nn   mm:ss.ttt  |
|OUT        0:01.500  ^|
|Lap   1    0:56.570  ||
|Lap   2    0:48.300  ||
|Lap   3    0:47.190  ||
|Lap   4    0:46.710  ||
|Lap   5    0:46.680  ||
|Lap   6    0:47.350  ||
|Lap   7    0:47.170  ||
|Lap   8    0:46.840  ||
|Lap   9    0:47.370  ||
|Lap  10    0:46.610  ||
|Lap  11    0:46.500  ||
|IN         1:03.840  ||
|RUN        9:52.630  ||
|                     v|
+---------------------+
```

Each line shows a time recorded during the run. The first column shows the lap marker type. The lap marker types are:

OUT   First lap recorded in the run.

LAP   Any lap except the IN and OUT laps.

IN   Last lap recorded in the run.

RUN   Total of the IN, OUT and all the Lap times.

The second column shows the lap or segment number. The third column shows the time recorded for the lap in the form minutes:seconds.milliseconds. The final RUN line shows the time for the whole run.

> **Warning** – It is possible to edit the run markers in this window but this should only be done if the lap times are very wrong, e.g., some laps are twice as long as others. Entering incorrect lap times will cause problems when displaying that data. You must also take care to keep the spacing and number formatting exactly the same as the existing entries. See the Editor Functions section for details of how to edit data.

Delete Run

This choice lets you remove a run that is no longer required.

> **Warning** – This function cannot be undone so be sure to make backup copies of any runs you may need again in the future.

Recorder Menu

> Note: Before you use any of the choices in this menu for the first time, be sure to connect the PC to the Data Logging System with the STACK Network cable supplied with this software before you select this choice. This enables automatic configuration of the software for the external interface on your PC to the on-vehicle recorder.

The Recorder menu contains the following choices:

Download, Display Run

Use this to download all runs stored in the recorder. If downloading is successful, the data is erased from the recorder, leaving it ready for the next run, and the chart for the downloaded run is displayed. If downloading is not successful, the data is not erased from the recorder.

```
+----------------------------+
| Download, Display Run  F2  |
| Download, Erase Memory     |
| Download, Save Memory      |
| Erase Memory               |
| Start Logging              |
| Stop Logging               |
| Set Recording Time         |
+----------------------------+
```
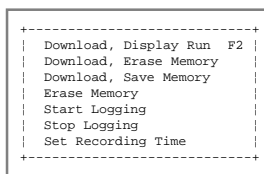
You can select this function before you connect the PC to the recorder. When the connection is detected the data will be downloaded.

You may disconnect the PC from the recorder as soon as downloading is complete.

Once downloaded the software performs a variety of calculations on the data and then the run is displayed. If more than one run is downloaded the latest one is displayed.

Download, Erase Memory

Use this choice to download the data from the vehicle after a run has been completed. The data is removed from the storage on the vehicle's system. The data is not displayed on the PC; it is stored as a run for later analysis.

This choice waits until you connect the PC to the recorder if you select it before connecting. It downloads all runs stored in the recorder and, upon successful completion of downloading, erases the data from the recorder, leaving it ready for another outing. If the downloading operation is not completed successfully, the data is not erased from the recorder.

Disconnect the PC from the recorder as soon as downloading is complete.

Download, Save Memory

Use this choice to download the data from the data logger on your vehicle after a run has been completed. The data is not removed from the data logger on the vehicle. The data is not displayed on the PC; it is stored as a run for later analysis.

This option will wait until the PC is connected to the recorder. It downloads data for all runs present in the recorder but does not erase it from the recorder. Use this choice when you need to download the data in the recorder into more than one PC.

Disconnect the PC from the recorder as soon as downloading is complete.

Erase Memory

Use this choice to remove any unwanted data present in the on-vehicle recording system and reset it, leaving it ready for the next outing.

Start Logging

Use this action to start logging data directly from vehicle.

Stop Logging

Use this action to stop logging data directly from the vehicle.

Display Menu

The Display menu contains three choices each with its own sub-menu of four choices:

Note that you must select the track and session before using the display options. You do this using the File=>Select Track or File=>Select Session facilities.

```
+[STACK ST8204 - Menu800 Plus V6.0]-------------------------------------+
| File  Edit  Recorder  Display  Utils  Options  System  Help           |
|                 +----------------+--------------------+                |
|                 | Chart       -|  Single...          |                |
|                 | Report      -|  Compare...         |                |
|                 | Histogram   -|  Quick Single       |                |
|                 +--------------|  Quick Compare      |                |
|                                +--------------------+                 |
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
|                                                                       |
|  Track:DEMOTRAK   Session:DEMOSESS   Run:  1   Setup:   DASH2          |
+-----------------------------------------------------------------------+
```

Chart

Displays a strip-chart showing the values logged during a run for the track and session that you selected earlier.

Report

Displays a segment-based report for the logged data as Chart.

Histogram

Displays a histogram for the logged data as Chart.

Single Sub-menus

Displays the chart, report or histogram for a single run showing the same channel selection that you chose when you last displayed the chart. You will be prompted to select the run from a list of runs for the selected session.

Compare Sub-menus

Displays a chart, report or histogram comparing the values from two runs. You will be prompted to select the two runs to be compared and the session in which the reference run occurs.

Quick Single Sub-menus

Displays a chart, report or histogram showing the data logged for the currently selected run.

Quick Compare Sub-menus

Displays a chart, report or histogram showing a comparison between the last two selected runs.

Utils Menu
Real Time Display

Use this choice when the system is connected to the vehicle to monitor the sensor values from the logger. The values displayed are determined by the calibration values contained within the setup. Ensure that all of the vehicle sensors have been calibrated prior to using the Real Time Display option in order to the correct values.

Configure Network

Use this choice the first time you connect the PC to the on-vehicle system. Its purpose is to enable the software to configure itself for the computer on which it is running.

Important – You must do this before attempting to download any data from the on-vehicle system.

System Diagnostics

In the event of a system malfunction, this choice allows the user (under guidance from Stacks service personnel) to interact directly with the systems internal control software in order to identify operational problems.

Important – Incorrect use of this feature can cause system corruption and the loss of valuable recorded data.

Options Menu

This menu contains the Calculate and Select Track Map choices. These choices are not used on systems restricted to time-based analysis of performance data.

Calculate

This choice allows you to calculate various parameters for runs in the currently selected session. These include Distance, Calculated channels and Track Maps.

Select Track Map

This choice allows you to select the Track Map to be used on the Chart and Report Displays.

System Menu
Screen Mode

This switches the menu display between white-on-black and black-on-white modes.

Shell to DOS

Select this choice when you wish to suspend the software and run another program.

This function gives you access to the operating system prompt without ending the session. You can use the operating system prompt if you need to run any utility programs or issue any MS-DOS commands to delete; copy or move files and generally maintain your system.

You return to the session by entering the Exit command at the MS-DOS prompt.

Help Menu
Index

The Index choice displays a list of entries which additional detailed on-line help information is provided. Highlight the topic of your choice to see the help information.

About

This choice displays information about the ST800 Data Analysis Software and the operating environment in which you are currently using it.

Press the Enter key to return to the menu screen.

Using Chart

The following example of the data charting window shows values logged for each of the parameters plotted for a lap, graphed against time.

The map of the track shows the location of the vehicle at the cursor position on the chart.

Note: the circuit map is not available in the ST8101 and ST8201 Data Logging Systems.

Each of the logged parameter values are displayed as lines plotted on a graph and as numeric values for the cursor position. You can move the cursor to any position on the track during the run.

You can zoom into any particular section of the display for a run to see it in greater detail. You can overlay data from other runs and compare the differences in the data values or show the differences as a graphed line. Where the data logging system records wheel speed, distance based comparisons can be made.

You can select each of the menus by clicking on it with the mouse or press Alt plus the highlighted key. Click on the chart or Press the Esc key to cancel a menu and return to the chart if you decide not to use any of its choices.

Any changes made to the runs and lap selected or the display colours in the Chart are reflected in the Report and Histogram displays when they are next run.

The headings below show the menu choices and their hot key alternatives.

Files Menu
Select Run   (Ctrl+F3)
Use this choice to display a different run. Select the run from the list of available runs.

Exit   (F10)
Use this to close the chart window and return to the menu system.

Reference Menu
This menu provides a set of choices that allow you to manipulate the reference run. The choices are:

Select Run   (Ctrl+F4)
Use this choice to use a different reference run.

Select Lap   (F4)
The Select Lap menu presents a list of the laps in the reference run being displayed. The reference lap being displayed is shown highlighted. The Fastest Lap is marked with a $>$. You can display any of the laps in the list by selecting it and pressing $<$ Enter$>$ or clicking on it.

Lap menu presents a list of the laps in the reference run being displayed. The reference lap being displayed is shown highlighted. The Fastest Lap is marked with a $>$. You can display any of the laps in the list by selecting it and pressing $<$ Enter$>$ or clicking on it.

```
STACK Chart800 Plus V6.0b DEMOTRAK                    All Channels
    Files   Reference   Move   Chart   Reports   Notes   Help F1  ◀◀  ▶▶
```

* DEMOSESS *	WSPD 46.8	Long 0.05	Water 78
RUN 2 4:59	ESPD10082	ComG 1.29	Gear 214
L 5 0:46.460	Steer 8	Batt 10.3	Rad 39
Throt 84	CHT 196	Dist 4207	
Pos 0:23.230	LatG-0.86	EGT 398	

Set Reference Offset   (Ctrl+O)

This function is used to align the runs when you are comparing data which has the laptimer beacon in a different location or when you are operating in time-based mode and need to align a section.

To realign the runs start by positioning the cursor on the reference trace (dark colour) and select a region from there to the equivalent position on the current trace (light colour). Then select the menu option or press Ctrl-O and the runs will be realigned. If the alignment becomes worse, select the traces in the reverse order.

Move Menu

The Move menu provides a set of choices that allow you to change your view of the run being displayed. The choices are:

Select Lap   (F3)

The Lap menu presents a list of the laps in the run being displayed. The current lap being displayed is shown highlighted. The Fastest Lap is marked with a >. You can display any of the laps in the list by selecting it and pressing <Enter> or clicking on it.

Fastest Lap

Displays the fastest lap in the run.

Previous/Next Lap (Ctrl+J, Ctrl+K)

Displays the lap before or the lap after the current lap.

Zoom In/Zoom Out ($\uparrow$, $\downarrow$)

Use these to see the chart in more or less detail.

Zoom sequence Run=> Lap=> Selected section.

Zoom Run

Zooms to show the full run across the screen.

Scroll Left/Scroll Right   (Home, End)

Use these to pan the view half a screen width towards the start of the run (left) or the end of the run (right).

> **Warning** – This command scrolls both the reference run and the Current run. Doing so can result in the displayed reference data not being that selected for the reference lap. Always use Previous Lap or Next Lap if you wish to keep the same reference lap.

Jump Left/Jump Right   (Ctrl+Home, Ctrl+End)

Use these to pan the view a whole screen to the left or right (as for scroll).

To Run Start / To Run Finish

Use these to move to the start or end of the run. Run Start moves the view to the start of the Out lap. Run Finish moves the view to the end of the In lap.

Chart Menu

The Chart menu contains the following choices:

Select   (F2)

This lists the choices of chart available with the version of the ST800 Data Analysis software you are using.

Layer   (Ctrl+T)

This allows you to switch the view between the current run and the reference run.

Line type   (Ctrl+L)

This allows you to select the type of line for charting the recorded values: these can be Summary, Real or Point.

Grid type   (Ctrl+G)

This allows you to define the type of grid for the chart. These can be Lines, Dots or None.

Colours   (Ctrl+M)

This choice changes the colour schemes used for the chart.

Refresh Chart   (Ctrl+W)

Causes a complete redisplay of the chart screen.

Reports   (F5)

Displays a statistical report calculated for the currently displayed zoom or the selected region.

Notes

Displays the run notes for the current run and the reference run in a scrollable window.

Help   (F1)

Displays the help text in a scrollable window.

<<

Scrolls the current run backwards one lap. The reference is not affected. The same function is available with the (,) key or from the Move=>Previous Lap menu choice.

>>
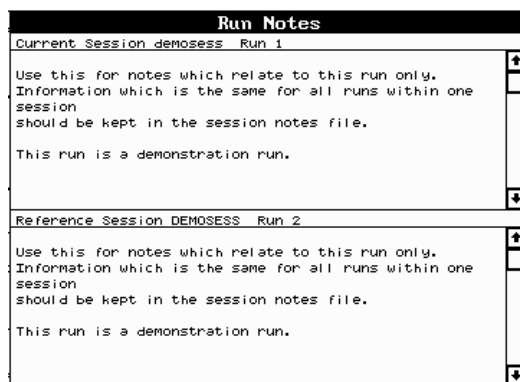
Scrolls the current run forward one lap. The reference is not affected. The same function is available with the (.) key or from the Move=>Next Lap menu choice.

Using Report

The Report display is not available in the ST8101 and ST8201 Data Logging Systems.

The map-based report generator has an interactive map display showing segments, a set of value boxes showing the value on each channel at the cursor position and a report window.

The report window can show a Statistics report, a Segment Compare report or a Segmented Run report.

Segments can be added or deleted at any time. They are stored along with the track in the track directory.

The cursor position is shown on the map with a diagonal cross. The cursor can be moved by clicking on a new position with the mouse or with the left-arrow and right-arrow keys.

The corner segments are numbered sequentially starting at the laptime beacon. Corners are shown in black and straights are white. The beacon position is a blue triangle pointing in the direction of travel.

Any changes made to the runs and lap selected or the display colours in the Report are reflected in the Chart and Histogram displays when they are next run.

Note – It is not valid to compare data recorded with different beacon locations using the report program since it has no lap realignment facility.

Statistics Report

The Statistics Report shows the statistics calculated for the whole of the current lap. It is not possible to display statistics for the reference lap.

An example report is shown below:

Segment Compare Report

The Segment Compare Report shows the speeds and times for each segment for the current lap compared against the reference lap. This report cannot be displayed when a single run is being shown.

An example report is shown below:

Segmented Run Report

The Segmented Run Report shows the times for each segment for every lap in the current run. It is not possible to display this report for the reference run.

The fastest segments in the run a surrounded with brackets and these are repeated in the Theoretical Fastest Lap row below. Furthermore, the Fastest Rolling Lap is also shown

An example report is shown below:

Files Menu
Select Run   (Ctrl+F3)
Use this choice to display a different run. Select the run from the list of available runs.

Exit   (F10)
Use this to close the report window and return to the menu system.

Reference Menu
Select Run   (Ctrl+F4)
Use this choice to select a different reference run.

Select Lap   (F4)
The Select Lap menu presents a list of the laps in the reference run being displayed. The reference lap being displayed is shown highlighted. The Fastest Lap is marked with a >. You can display any of the laps in the list by selecting it and pressing < Enter> or clicking on it.

Lap menu presents a list of the laps in the reference run being displayed. The reference lap being displayed is shown highlighted. The Fastest Lap is marked with a >. You can display any of the laps in the list by selecting it and pressing < Enter> or clicking on it.

Move Menu
The Move menu provides a set of choices that allow you to change your view of the run being displayed. The choices are:

Select Lap   (F3)
The Lap menu presents a list of the laps in the run being displayed. The current lap being displayed is shown highlighted. The Fastest Lap is marked with a >. You can display any of the laps in the list by selecting it and pressing < Enter> or clicking on it.

Fastest Lap
Zooms to the fastest lap in the run.

Previous/Next Lap (Ctrl+J, Ctrl+K)
Moves to the previous or next laps.

Edit Menu

The Edit menu contains the following choices:

Insert Segment   (Insert, Ins)

This adds a segment to the map. Highlight an area using the mouse or the shift-cursor keys and then press the Insert key or select Insert Segment from the menu.

Delete Segment   (Delete, Del)

Deletes a segment from the map. Move the cursor into a corner segment using the mouse or the cursor keys and then select Delete Segment from the menu.

Colours   (Ctrl+M)

This choice changes the colours used for the report.

Reports Menu

This menu contains the following choice:

Statistics   (F5)

The values displayed are calculated for the currently displayed lap and not for the selected region.

Segment Compare

Displays segment time and speed comparison chart for the selected and reference laps.

Segmented Run

Displays a table of the segment times for each lap over the entire run with the fastest segment times enclosed in brackets. At the base of the table are two lines showing the segment times for the fastest rolling lap and the fastest theoretical lap which is made up of all the fastest segment times.

Notes

Displays the run notes for the current run and the reference run in a scrollable window.

Help (F1)

Displays the help text in a scrollable window.

<<

Scrolls back one lap. The same function is available with the (,) key or from Move=> Previous Lap menu choice.

>>

Scrolls forward one lap. The same function is available with the (.) key or from the Move=>Next Lap menu choice.

Using Histogram

The following example of the histogram window shows values logged for the wheel speed parameter plotted against time for one lap in the current run compared with a lap from the reference run.
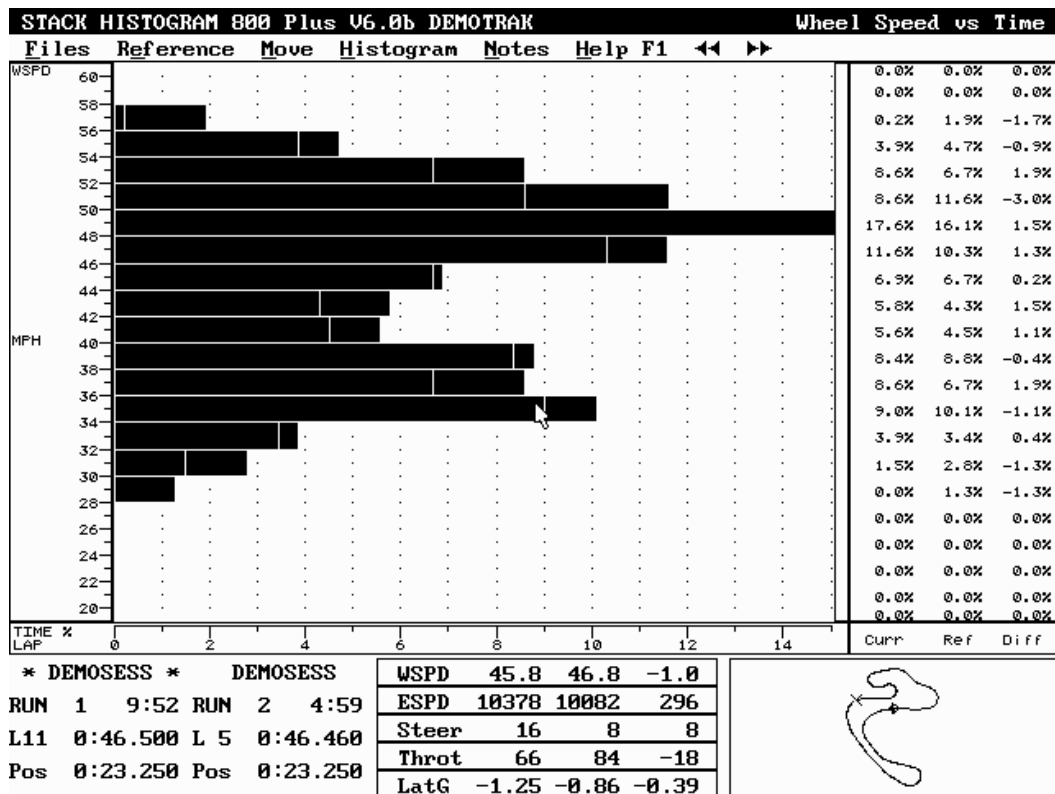
The map of the track shows the current location of the vehicle.

The width of each bar represents the percentage of the time for the selected lap for which the parameter was within the bins defined for that parameter. The box to the right show those times as columns of data. Numeric values are shown below the histogram for the current cursor position on the map. You can move the cursor to any position in the current lap.

You can zoom into any particular section of a lap to see it in greater detail. You can overlay data from other runs and compare the differences in the data values.

You can select each of the menus by clicking on it with the mouse or press Alt plus the high-lighted key. Click on the histogram or press the Esc key to cancel a menu if you decide not to use any of its choices.

Any changes made to the runs and lap selected or the display colours in the Histogram are reflected in the Chart and Report displays when they are next run.

The headings below show the menu choices and their hot key alternatives.

Files Menu
Select Run   (Ctrl+F3)
Use this choice to display a different run. Select the run from the list of available runs.

Exit   (F10)
Use this to close the histogram window and return to the menu system.

Reference Menu
This menu provides a set of choices that allow you to manipulate the reference run. The choices are:

Select Run   (Ctrl+F4)
Use this choice to use a different reference run.

Select Lap   (F4)
The Select Lap menu presents a list of the laps in the reference run being displayed. The reference lap being displayed is shown highlighted. The Fastest Lap is marked with a >. You can display any of the laps in the list by selecting it and pressing <Enter> or clicking on it.

Move Menu
The Move menu provides a set of choices that allow you to change your view of the run being displayed. The choices are:

Select Lap   (F3)
The Lap menu presents a list of the laps in the run being displayed. The current lap being displayed is shown highlighted. The Fastest Lap is marked with a >. You can display any of the laps in the list by selecting it and pressing <Enter> or clicking on it.

Fastest Lap
Displays the fastest lap in the run.

Previous/Next Lap (Ctrl+J, Ctrl+K)
Displays the lap before or the lap after the current lap.

Zoom In/Zoom Out (↑, ↓)

Use these to zoom in to a area of the lap selected on the map or to zoom out to show the whole run.

Zoom sequence Run=> Lap=> Selected section.

Zoom Run

Zooms to show a histogram of all the data the full run.

Histogram Menu

The Histogram menu contains the following choices:

Select   (F2)

This lists the choices of histogram available with the version of the ST800 Data Analysis software you are using.

Bar type   (Ctrl+L)

This allows you to select the type of bars to be used to display the histogram. These can be Open, Closed or Filled.

Grid type   (Ctrl+G)

This allows you to define the type of grid for the histogram. These can be Lines, Dots or None.

Colours   (Ctrl+M)

This choice changes the colour schemes used for the histogram.

Refresh Histogram (Ctrl+W)

Causes a complete redisplay of the histogram screen.

Notes

Displays the run notes for the current run and the reference run in a scrollable window.

Help (F1)

Displays the help text in a scrollable window.

<<

Scrolls the current run backwards one lap. The reference is not affected. The same function is available with the (,) key or from the Move=>Previous Lap menu choice.

>>

Scrolls the current run forward one lap. The reference is not affected. The same function is available with the (.) key or from the Move=>Next Lap menu choice.

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Printing data

To print Charts, Reports & Histograms it is recommended that you purchase "Printscreen 95 v4.0" from Super Simple Software, Los Angeles, CA, USA.

E mail: glencj@sssware.com

http://printscreen95.com

Tel: ++(1) 310 839 9543

Fax: ++(1) 310 839 9280

CHAPTER 9. TROUBLESHOOTING
Display System problems

No.	Symptom	Possible Cause	Remedy	Notes
1	Display is dead (no backlight, nothing on display, no green dial lights)	Ignition is off	Turn ignition on	
		Battery is dead	Recharge or replace battery	
		Power connection to B+ or B- is faulty	Check if battery is connected correctly. Check power lead continuity	
2	Display is dead (no backlight, nothing on display, green dial lights on but dim) *or* !! LOW BATT !! warning on display	Battery is almost dead	Recharge or replace battery	
		Power connection is faulty	Check power lead continuity	
3	Display flashes andd dial pointer resets or vibrates	Battery is almost dead	Recharge or replace battery	
		Power connection is faulty	Check power lead continuity	
4	Display values do not update	Dash is not receiving data from ECU	Check connections and wiring to EC	If you have just changed or re-programmed the ECU check correct ECU protocol is being transmitted

No.	Symptom	Possible Cause	Remedy	Notes
5	The ‼ LOW OIL P ‼ message does NOT appear on power up.	Pressure sensor has failed	Replace sensor	
		Oil pressure alarm disabled	Check that the oil pressure alarm is set on	
		ECU not powered	Check power to ECU	
6	Displayed values are incorrect	Incorrect values being transmitted by the ECU	Check ECU protocol being transmitted	
7	Peak values not updated	Gate value set too high	Change Gate RPM in the display configuration menu	Peak values only updated while the engine RPM is greater than the Gate value
		Internal memory battery dead	Return unit to Stack for new battery service	Display shows ‼ MEM BATT ‼ warning on power up
8	Switch 1: Show peak values does not work	Switch 1 faulty	Replace switch	Disconnect switch and short its leads. If display changes, replace Switch 1. Otherwise check wiring.

No.	Symptom	Possible Cause	Remedy	Notes
9	Switch 1: Show peak values does not work	Faulty switch wiring	Check switch wiring for correct continuity	Pin K to red S1 wire less than 1.0 Ohm and Pin K to Pin H (earth) greater than 1M Ohms)
10	Switch 2: Show last alarm function does not work	Switch 2 faulty	Replace switch	Disconnect switch and short its leads. If display changes, replace Switch 2. Otherwise check wiring.
		Faulty switch wiring	Check switch wiring for correct continuity.	Pin L to red S2 wire less than 1.0 Ohm and Pin L to Pin H (earth) greater than 1M Ohms)
11	Switch 3: Change display layer function does not work	Switch 3 faulty	Replace switch	Disconnect switch and short its leads. If display changes, replace Switch 3. Otherwise check wiring.
		Faulty switch wiring	Check switch wiring for correct continuity.	Pin U to orange S3 wire less than 1.0 Ohm and Pin U to Pin H (earth) greater than 1M Ohms)

No.	Symptom	Possible Cause	Remedy	Notes
12	Switch 4: does not set or display pop-up lap times when no automatic receiver in use	Switch 4 faulty	Replace switch	Disconnect the switch and short the leads together. If the display changes replace Switch 4. Otherwise check wiring.
		Faulty switch wiring	Check switch wiring for correct continuity.	Pin U to yellow S4 wire less than 1.0 Ohm and Pin U to Pin H (earth) greater than 1M Ohms)
13	Lap time is not displayed automatically	Trackside Beacon has not been put out/ powered up	Check Trackside beacon is out and has power	Green LED on Beacon is illuminated when there is power to the beacon
		Trackside Beacon is not aligned correctly	Align Beacon	Receiver and Beacon must be parallel and same height
		On car Receiver is not aligned correctly	Align Receiver	
		Lap marker receiver lead faulty	Check lap marker wiring	Dis-connect receiver and press lap switch 4.
		Lap marker receiver faulty	Replace lap marker receiver	If display changes, replace Receiver after checking its wiring.

No.	Symptom	Possible Cause	Remedy	Notes
14	Displayed speed value too high or too low by a constant %-age amount.	System configured with wrong number of targets per wheel revolution	Reconfigure the system with correct values	
		System configured with wrong circumference.		Typical wheel circumference for a vehicle is 1800mm / 70"
15	No speed reading. Speed reading erratic, value jumps high or low	Faulty sensor and/or wiring	Check sensor	
16	No alarms for water, oil, or fuel (temperatures and pressures) being displayed	All the alarms have been switched off	Switch on the required alarms	Alarms only operate when the engine is running at the RPM gate value or above it.
		The engine RPM gate value is set too high	Reset the RPM gate to a lower value.	
17	Display and alarm light flash when the engine is running	Intermittent alarm caused by a parameter with its alarm level set too close to the normal operating value	Either change the value for the alarm or turn the alarm off	Press Switch 2 to see which sensor is causing the alarm.
18	No alarms for water, oil, or fuel (temperatures and pressures) being displayed	All the alarms have been switched off	Switch on the required alarms	Alarms only operate when the engine is running at the RPM gate value or above it.
		The engine RPM gate value is set too high	Reset the RPM gate to a lower value.	

Data Analysis Software Problems

GENERAL DATA ANALYSIS SOFTWARE PROBLEMS			
Fault Description	**Possible Cause**	**Remedy**	**Notes**
'Insufficient Memory' error	Insufficient conventional RAM Memory	Ensure all other program drivers are loaded into high memory	
		Run program in MS_DOS mode	Ensure sufficient RAM Memory is available
		Create separate DOS partition	Ensure sufficient RAM Memory is available
Histogram program or Map program "Crash"	Insufficient conventional RAM Memory	See above	
'Invalid Directory Bad Command or File name, error	Software installed to a different directory	Edit <run>.BAT file and enter the correct directory path	
'Demonstration Version' errors or... Inconsistent menu options and or operation	ST800.INI file corrupted or erased	Replace by Copying ST800.ORG file to ST800.INI	

BACKUP, ARCHIVE AND RESTORE PROBLEMS			
Fault Description	**Possible Cause**	**Remedy**	**Notes**
'Nothing to Do' error when backing up, archiving or restoring data	Selected data does not exist and hence cannot be backed up, archived or restored	Use DOS UNDELETE to recover data. See DOS user guide for details	You must exit the program and return to the DOS prompt C:> to do this
	Duplicate action, data has already been backed up, archived or restored	No action required	
'Could not create destination directory' error when backing up, archiving or restoring data	Floppy disk Write protected	Remove disk and check that the hole is blanked off	
	Disk contains a file of the same name as the track	Use DOS to Rename the file See DOS user guide for details	You must exit the program and return to the DOS prompt C:> to do this
'Target disk not accessible' error when backing up, archiving or restoring data	Disk not placed in appropriate drive	Insert disk into the drive.	Check that the correct drive is specified by archive_dir= in ST800.INI file
Menu options scroll over the top of screen	Unexpected DOS/Disk error has occurred	Press the 'F' key to recover	Press the 'A' key to return to DOS
'Error creating compressed file' when backing up, or archiving data	Floppy disk is full	Insert blank disk into the drive	Do not forget to label the disk with the track and session
	Too many runs in one session to fit onto one disk	Use HD 1.44Mbyte disk in place of a DD 720kbyte disk	

DATA RECORDING AND DOWNLOADING PROBLEMS			
Symptom	**Possible Cause**	**Remedy**	**Notes**
Download fails with 'Download incomplete' Error	Logging system not powered	Check for power to the logging system and retry	
	Logging system is in setup mode	Power the logging system off then on and retry	
	Wrong parallel port connection	Check the Port= parameter in the ST800.INI file	See section 10 "Optimising and Customising Your Software"
		Check the lead is plugged into the correct port	

PC DISPLAY PROBLEMS			
Symptom	Possible Cause	Remedy	Notes
No data visible in chart. Numbers on Left Axis incorrect	Incorrect chart range	Use Edit ⇒Chart Range to enter the correct Min and Max values of the chart	
Chart displays 'Warning Data channel not recorded' error	Data has been Archived onto floppy and not restored	Use File ⇒Restore Data to recover data	
	Download of Data did not complete successfully	Use Recorder ⇒ Download, to Download data	
Invisible peak or trough in data graphs. Values at bottom of chart are correct	Incorrect chart range is truncating data outside the Min Max range	Use Edit ⇒Chart Range to enter the correct Min and Max values of the chart	
Laps within two runs do not align, or overlay correctly (All laps affected)	Lap Beacon was moved or placed differently for each run	Use Alt+A to realign data	Always site the Lap beacon in the same place
	The value for the track length has been changed	Use Edit ⇒ Track Details to reset the Track length and tolerance	Use Options⇒ Calculate to correct the affected runs

PC DISPLAY PROBLEMS			
Symptom	Possible Cause	Remedy	Notes
One or more Laps within two runs do not align, overlay correctly (Not all laps affected)	Lap Beacon was missed on one or more laps for one or both of the runs	If the lap times are known use Edit ⟹ Run markers to insert the missing lap times	Check alignment of both the transmitter and the receiver
	Track tolerance set too tight	Use Edit ⟹ Track Details to increase the Track tolerance	
Chart displays blank graphs, may have correct speeds at bottom of chart	Insufficient number of Files specified in CONFIG.SYS	Check the Files= 40 parameter in the CONFIG.SYS file	To do this, Exit the program and return to the DOS prompt C:\>. Reboot the PC after changes

APPENDIX A. SUMMARY OF SWITCH FUNCTIONS
Normal Operation

Functions	Switch or Switches
Show Peak Values	Switch 1
Change Display Layer	Switch 3
Clear Alarm	Switch 2 or Switch 3
Show Last Alarm	Switch 2
Manual Lap Marker	Switch 4
Latch Speed Display	Switch 1
Reset Peak Values	Switches 1 & 3 together
Reset lap count and lap time to zero	Switches 1 & 4 together
Put system into configuration mode	Switches 1 & 2 together

System Configuration Mode

Functions	Switch or Switches
Decrease the alarm value of the parameter being displayed	Switch 1
Increase the alarm value of the parameter being displayed	Switch 2
Enable or disable an alarm for the parameter being displayed	Switches 1 & 2 together
Display the next configurable parameter	Switch 3
Quit configuration mode and return to normal mode	Switch 4

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