



## CONGRATULATIONS ON PURCHASING A RACELOGIC PERFORMANCEBOX!

PerformanceBox is based on the Racelogic VBox, which is used by the majority of Car Manufacturers, Tyre Manufacturers and car magazines around the world to assess performance. You can be sure that in PerformanceBox you have a product which will prove to be invaluable in all your motorsport applications.

### Performance

With PerformanceBox it is very easy to measure acceleration times, braking distances, quarter mile times and many more. There are a number of configurable screens that show specific test results such as 0-60, 0-100, 0-100-0, ½ mile and ¼ mile etc.

Because it is very easy to edit the test ranges, PerformanceBox is a very powerful tool for use in many different kinds of vehicle testing. Vehicle modification can be readily assessed and given specific improvement parameters – the perfect tool for any tuning enthusiast.

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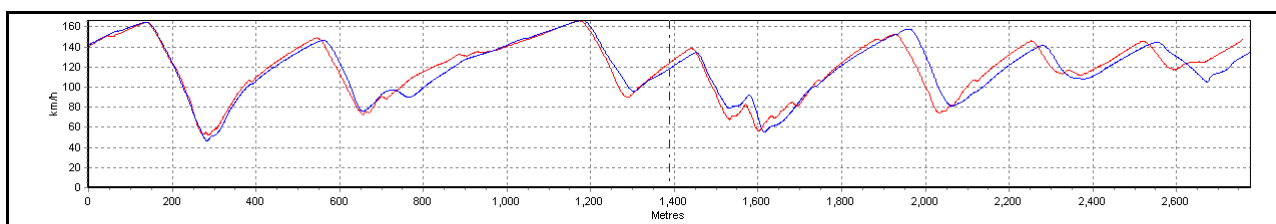


## Lap Timing

Displaying your Lap times as you drive around a circuit is simple with PerformanceBox. You can display your last and best Lap times and Lap count, and also display split times for up to six specified split points around the lap. The split files can be saved and reused should you attend the same circuit again, guaranteeing consistent data. You will be able to catalogue and review your performance over any given period of time.



Through the PerformanceBox website and forum you are able to download circuit overlays from around the world, compare lap times, and share lap overlay data with other users.



## Speed Display

PerformanceBox has a display screen mode that shows a large digital speed value and compass. In open conditions, PerformanceBox has a velocity accuracy of 0.1km/h, which is useful for checking the accuracy of your vehicle's speedometer. In this mode there are also Odometer and Height display screens.

## Power Calculations

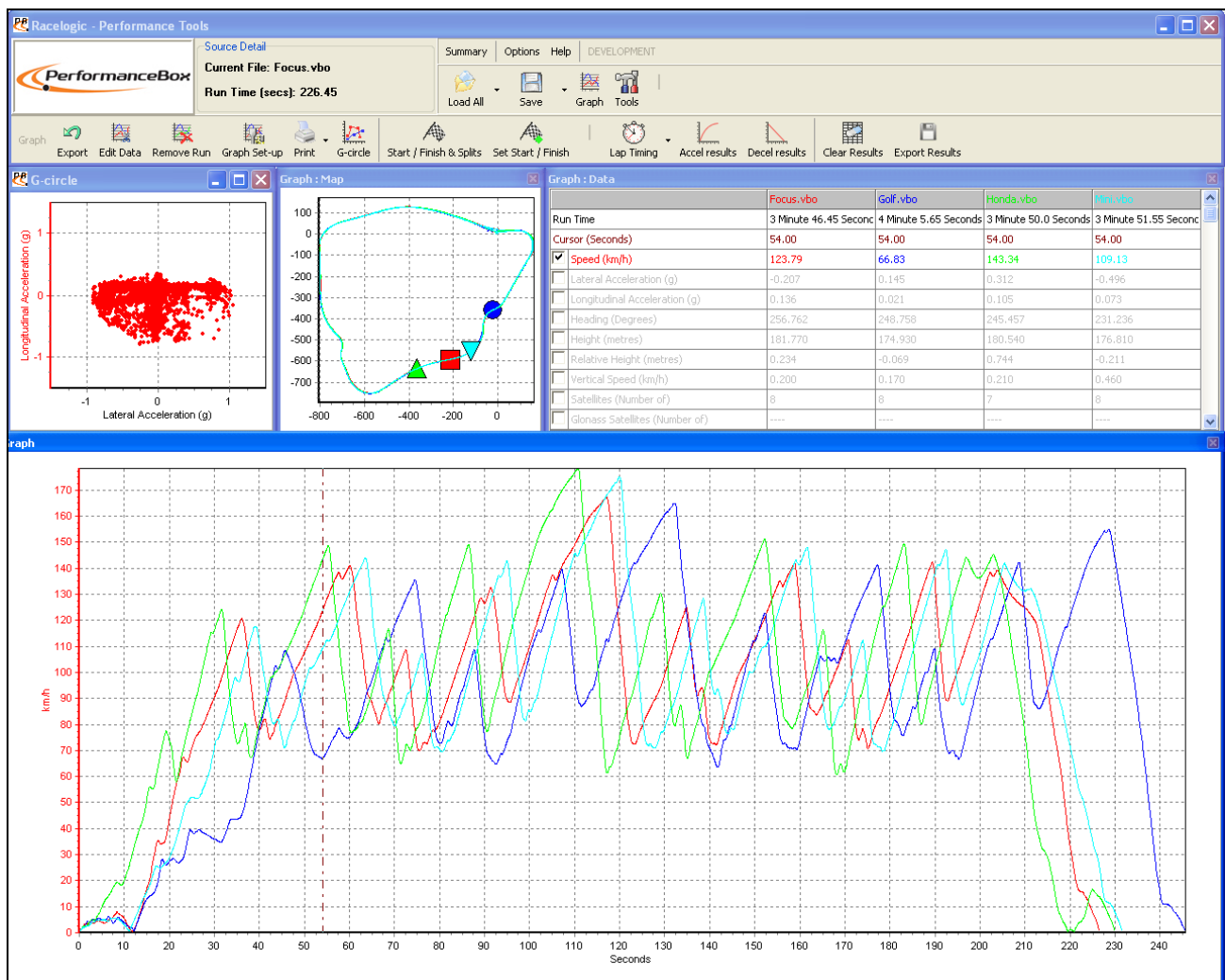
PerformanceBox can help you to measure the power developed by your car's engine, either at the wheels or flywheel. Having set the vehicle weight, results are calculated from the measurements taken by the fast GPS engine to give you useful guidelines to the car's brake horsepower or kilowatt output. Because these calculations are made from the GPS data rather than accelerometers, your results are likely to be more consistent and accurate.

## Data Logger

For drivers keen to improve their lap times and get valuable feedback on technique, PerformanceBox includes a sophisticated, fully functioning data logging package. If used with a 64mb SD card, PerformanceBox can log up to 50 hours of continuous data, which can be analysed in great detail in the available software.

This software allows graphical analysis of acceleration, braking, cornering and lap times, and if the PerformanceBox is used in conjunction with a Micro Input Module, data from the vehicle itself (such as RPM and throttle angle) is recorded alongside the GPS parameters.

You can overlay up to four files, and you get an accurate track map to compare your driving line between different laps. The software also features a graph measure tool, allowing for precise analysis of performance figures. Data-logging capabilities are further enhanced by automatically generated text data on the SD card.



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# Quick Start Guide

## Introduction

PerformanceBox is a self-contained GPS data logger and Performance Meter. A 10Hz fully calibrated GPS engine is used to provide accuracy and precision and the data can be stored on a removable SD flash card. Real time results are displayed on the back-lit LCD display and a USB connection allows data to be downloaded to a laptop for further in-depth analysis.

## Features

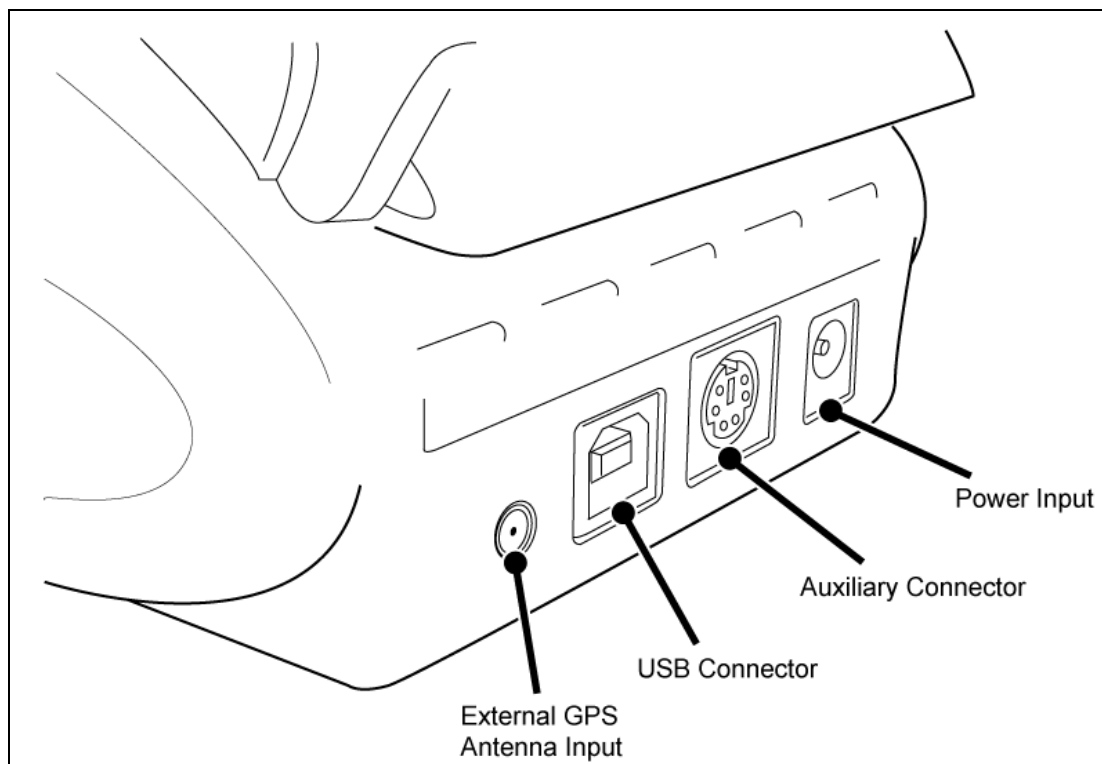
- Non-contact 10Hz speed and distance measurement using GPS
- Internal GPS antenna
- Back-lit LCD screen for viewing live data and results
- Lateral and longitudinal g-force measurement
- SD Card slot for use with SD Cards
- USB interface for reading SD card and upgrading firmware
- Full data-logging analysis software
- Logging of one RPM channel and up to four analogue channels when used in conjunction with optional Micro Input Module.

## Optional Accessories / Replacement Parts

Description:	Racelogic Part Number:
SD Card (4 GB)	RLACS098
External GPS Antenna	RLACS070-R
Mains Power Supply (UK / EU / US / JP / AU)	RLACS074-UK / -EU / -US / -JP / -AU
Windscreen Mount	RLACS071
Windscreen Mount Suction Cup	DBSUCTIONCUP
Cigar Lighter Power Cable	RLCAB041
USB Lead	RLCAB042
2 Ahr Battery Pack with Charger	RLACS072
Micro Input Module	RLPBMICIN01

Please contact your local PerformanceBox distributor for pricing and availability.

## Connections



## Mounting PerformanceBox in your car

1. Connect the cigar lighter adaptor power cable to the power socket on the back of your PerformanceBox.
2. Slide PerformanceBox into the windscreen mounting bracket.
3. Using the suction cups of the windscreen mounting bracket, fix the PerformanceBox assembly to a suitable place low down in the centre of your windscreen.
4. PerformanceBox has an internal GPS antenna, so try to mount PerformanceBox where it will have the largest possible view of the sky.
5. Park your vehicle outside in an open area away from obstacles such as tall buildings and trees.
6. Insert the PerformanceBox power cable into the vehicle cigar lighter socket. If power is not permanently available at this socket, turn on the ignition to ensure power at the socket.
7. The first time PerformanceBox is used it will need to be left for 10-15 minutes to acquire fully the latest satellite constellation information.
8. After this initial period, PerformanceBox will then only take 1-2 minutes to lock onto satellites when you use it next time.
9. Wait for the satellite image to disappear which means lock has been obtained.

## Registering your PerformanceBox and activating all available functions.

To get full PerformanceBox functionality including data logging, lap timing and performance mode, you need to register your PerformanceBox at the PerformanceBox website.

## Registering Your PerformanceBox

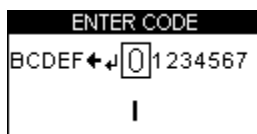
Log onto the PerformanceBox website [www.PerformanceBox.co.uk](http://www.PerformanceBox.co.uk) then go into Product Registration where you will be asked to input information including the serial number of the unit.



The serial number is displayed when you first switch on, or alternatively you can note it from the underside of the PerformanceBox hardware itself (the serial number will begin with 501.) Once you have entered your details you will be emailed an activation code. In the case of web-based email accounts, such as Hotmail, it may be necessary to check the junk email folders. If the activation code email does not arrive in a timely manner please alert our support team by emailing [sales@DriftBox.com](mailto:sales@DriftBox.com) with your serial number.

### Activating the additional functions in your PerformanceBox

1. Switch on PerformanceBox
2. Press **MENU** and select 'SETUP'
3. Select 'UPGRADE'



4. Use ▼▲ to move the alphanumeric list across the screen and then press **OK** to enter each character of your activation code. The centre character on the screen becomes larger and surrounded by a box to indicate that it is ready for selection.
5. Highlight and click on the symbol ◀ if you need to delete a character.



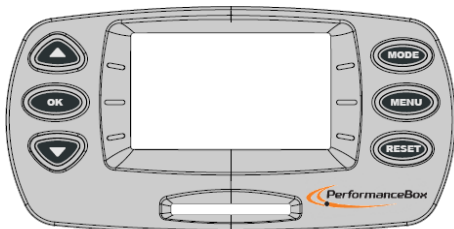
6. Then when you have entered all the characters of the activation code highlight the symbol ◀ and press **OK** to enter the activation code.
7. A confirmation screen will display 'Code OK' and then the screen will go back to SETUP MENU.
8. Now disconnect and then reconnect the power to PerformanceBox.







**The full functionality of your PerformanceBox will now be available.**

# Using PerformanceBox

Your PerformanceBox can be used in a variety of modes, as described in this section.

## PerformanceBox Keypad



	Used to show next screen, or to navigate menu.		Changes Mode.
	Select the menu item that is highlighted on the screen and used to show Score Code.		Accesses the relevant menu, or will exit from current menu.
	Used to show previous screen, or to navigate menu.		Resets totals, averages and peaks if held for 1.5s. Hold for 5s for global Reset.

## Changing Modes

Press the **MODE** button to swap between the 6 display modes



PERFORMANCE



LAP TIMING



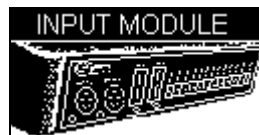
SPEED DISPLAY



PREDICTIVE MODE



POWER MODE



INPUT MODULE

## Changing the Units of Measurement

1. Press the **MENU** button from any of the Display Modes.
2. Highlight UNITS and press **OK**.
3. Highlight SPEED and press **OK**.
4. Highlight KMH or MPH and then press **OK** to tick that selection.
5. Highlight EXIT and press **OK**.

To change the Distance units from metres to feet, follow the same procedure but highlight DISTANCE and press **OK**.

## Satellite Reception

PerformanceBox calculates all of its logged data from the information it receives from GPS satellites and relies on being able to get a good lock to produce this data. So it is imperative that PerformanceBox (or optional external antenna) is placed in the best possible position for a clear view of the sky.

If you are using an external antenna, ensure that it is connected **before** you power up PerformanceBox.

The location that you drive in can also affect data quality, if you drive in a very built up area or an area with overhanging trees then the signal quality can degrade. If the satellite reception does drop out in use, you will see either of the following symbols:

1. LOW SATS



3. LOW  
SATS

## Searching for satellites at power up

Whilst the PerformanceBox is acquiring satellites it will flash the image of a satellite, the location of the flashing image depends on the screen you are in.



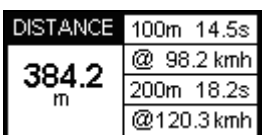
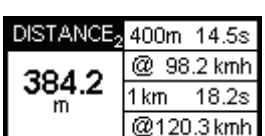



## Performance Mode



The Performance mode is used to measure the acceleration and braking performance of your vehicle. Press the **MODE** button to scroll to the Performance Mode screen. This mode is divided into six screens, each of which displays different performance data. Navigate between these screens by using the ▲ ▼ buttons. Each screen will automatically display the results as they happen, e.g. if you drive from 0 Mph to 60 Mph then the 0-60 section will show the time taken.

Below is a list of the available Performance Mode display screens.

	<p>This Acceleration Screen displays a live velocity in the left half and in the right it shows the times of the following preset test ranges. 0 to 60, 0-100 and 0-100-0. It also shows the maximum speed.</p>
	<p>Acceleration 2 screen shows the 30-50 and 50-70 times. However these two test ranges are user adjustable through the setup menu. Peak lateral g (cornering force) is also shown along with an average velocity value.</p>
	<p>The next screen shows the times required to reach various speeds from rest. The target speeds are every 10 km/h or mph (depending on the units selected), up to a speed of 100 km/h / mph.</p>
	<p>This screen continues the readings of the previous screen, listing the speeds from 110 to 200 km/h / mph.</p>
	<p>This screen shows the best results of the two test ranges from each of the acceleration screens.</p>
	<p>This screen shows the time and distance of two user adjustable deceleration ranges. These test ranges can be configured in the setup menu.</p>
	<p>This screen shows the same information as the previous Deceleration screen, but for a different user-defined speed range.</p>

	<p>This screen shows the time and end velocity of two user-configurable distances, i.e. 0-100m. If the units are changed to feet then the two test ranges default to 60' and 330', but can be changed to the desired distance. Start Speed is also configurable.</p>
	<p>This screen shows the time and end velocity of two user-configurable distances, i.e. 0-400m. If the units are changed to feet then the two test ranges default to 660' and 1320', but can be changed to the desired distance. Start Speed is also configurable.</p>
	<p>This screen shows the current acceleration and peak acceleration achieved by PerformanceBox. A level bar at the bottom of the screen also shows this information in graphical form. The MAX value is cleared by pressing the <b>RESET</b> button.</p>
	<p>This screen shows the current deceleration and peak deceleration achieved by PerformanceBox. A level bar at the bottom of the screen also shows this information in graphical form. The MAX value is cleared by pressing the <b>RESET</b> button.</p>
	<p>This screen shows the current lateral acceleration and peak lateral acceleration achieved by the PerformanceBox. A level bar at the bottom of the screen also shows this information in graphical form. The MAX value is cleared by pressing the <b>RESET</b> button.</p>

## Measuring the 0-60 time of your vehicle

1. Install PerformanceBox into your vehicle as described in the 'Quick Start Guide' section of this manual.
2. Press the **MENU** button to select the Performance Mode.
3. Now use the ▲ ▼ buttons to scroll to the ACCEL screen. This screen shows 0-60 in the top right hand corner:

ACCEL	0-60 ----
000.0 mph	0-100 ----
	0-100-0 ----
	Vmax 000.0

4. The left hand side of the screen shows your live velocity unless you are in an area of poor satellite reception in which case it flashes an image of a satellite.
5. Now perform your 0-60 acceleration run. As your vehicle goes over 60 mph the time will instantly show in the 0-60 section of the window.
6. If you come to a stop you will see that this time remains on view. The Vmax section will also show the highest speed you attained during this particular run.

ACCEL	0-60 6.1s
000.0 mph	0-100 ----
	0-100-0 ----
	Vmax 065.4

7. You can now instantly start another 0-60 acceleration, as you pull away the screen will reset and show your new values as you cross 60 mph.

- After doing a number of runs you can view your best 0-60 time by scrolling to the BEST screen.

BEST	0-60	6.1s
0-100-0	0-100	10.2s
6.1s	30-50	6.1s
BEST	50-70	10.2s

- If you have your SD card inserted then your run data will be stored.  
**Please note**, to record a results file, you must accelerate over at least 30 Km/H.

### Editing a Performance mode Test Range

You can configure the minimum and maximum speeds of two of the acceleration ranges, the 0-100-0 range, the deceleration ranges, and one of the distance ranges, to give an array of useful tests.

If you wish to change the speed range over which performance is measured, press the **MENU** button from any of the performance mode screens and select the range you wish to change from the 'Performance Menu' and press **OK**

PERFORMANCE MENU
UNITS
WRITE RESULTS FILE
ACCEL RANGE 1
ACCEL RANGE 2
0-100-0 RANGE

#### Example: Editing ACCEL RANGE 1

- Highlight 'ACCEL RANGE 1' and press **OK**
- The following screen will appear with the start speed of ACCEL RANGE 1 highlighted:

SET ACCEL RANGE 1	
START	030
END	050

- Whilst the START speed is highlighted use the ▲ ▼ buttons to change the speed.
- Press **OK** and repeat this procedure for the END speed:

SET ACCEL RANGE 1	
START	010
END	070

## 1 Foot Rollout

The PerformanceBox normally takes the start of a performance run at the point at which the vehicle moves, but at drag strips the vehicle starts 1 foot behind the timing start line. You can make the PerformanceBox start **all timing runs** from 1 foot by enabling this feature.

### Enabling 1 Foot Rollout correction

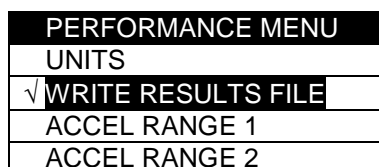
1. Press the **MENU** button to enter the Performance Menu.
2. Highlight the 1 FOOT ROLLOUT option and press **OK**.



## Results and Best Files

If an SD card has been inserted and the 'Write Results File' option has been enabled, the PerformanceBox will create two results files on the card. The first file, 'RESULTXX.TXT' gives the results for every performance test made using the PerformanceBox, each time appending the data onto the end of the file. The second file, 'BESTXX.TXT', displays only the best results achieved for each type of test, overwriting previous results when required. If the unit is power-cycled, two new files will be created with an incremented file name and all data will be written to the new files instead.

Results text files are only created on the SD card if the 'Write Results File' option has been chosen from the Performance Mode Menu:



**Note:** no results will be written to the files if the speed does not exceed 50km/h during the tests.

**Example RESULTXX.TXT file:**

----- Run 0001 -----  
Time 13:09                      Date 31/03/2014

## Accel results

Speed(mph)	Time(s)
0-60	05.3
0-100	11.7

## Accel Distance results

Distance(m)	Time(s)	@Speed(mph)
0-20	02.6	32.0
0-0	00.0	00.5
0-0	00.0	00.5
0-0	00.0	00.5

## Braking results

Speed(mph)	Time(s)	Distance(m)
60-0	98.6	1295.4
100-0	105.7	1532.7

## User range

Speed(mph)	Time(s)
30-100	09.3
30-70	04.1
0-100-0	----

## Misc

Vmax 105.4mph  
Vavg 39.5mph  
AvgLatG -0.00G  
PkLatG 0.50G  
PkAccelG 1.09G  
PkDecelG 0.78G

**Example BESTXX.TXT file:**

----- Best results -----  
Time 13:09                      Date 31/03/2014

Speed(mph)	Time(s)
0-60	05.3
0-100	11.7
30-100	09.3
30-70	04.1
0-100-0	25.3



## Speed Buzzer

The Speed Buzzer can be used in such tests as 0-100-0, as an audible warning when a certain speed has been reached. This means that during such testing the driver will not need to watch the display and can listen for the buzzer instead.

To change the speed at which the buzzer will sound, enter the **MENU** from any mode, scroll to Setup and click **OK**. The speed buzzer is one of the options in the Setup menu. Pressing either the **▲ ▼** alters the speed setting.

SETUP MENU
DIAGNOSTICS
COLDSTART
<b>SPEED BUZZER</b>
UPGRADE

The speed buzzer will only sound once when the set speed is reached. It will not continue to activate every time the vehicle passes through the set speed, on acceleration or deceleration. In order to arm the speed buzzer once more the vehicle must either come to a complete halt for five seconds, or PerformanceBox must be power-cycled.

SPEED BUZZER
✓ <b>ENABLED</b>
SPEED 100
EXIT

## Event Marking

Pressing the OK button when in any of the Performance Mode screens will create an event mark in the logged file (see 'Event Marking' in the software section.)

# Laptiming Mode



PerformanceBox can be used to measure lap times by storing the position of a virtual gate and using this to trigger the start and end of a lap. Further locations can be added to represent split and dedicated finish lines.

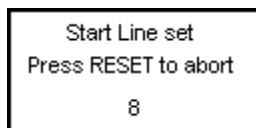
- **Start/Finish Line:** Defines the point at which one lap ends and another starts. It also defines the start of a test that ends in a different location, such as a sprint or slalom stage.
- **Split Line:** Defines a point on the track or stage at which intermediate time and speed measurements are displayed.
- **Finish Line:** Used only in point-to-point tests (such as sprint or slalom tests), to mark a finish point that is in a different location to the start point.

## Measuring Lap times

There are two ways of measuring lap times as you drive round a circuit: by setting the start/finish and split points through the PerformanceBox menu screens, or by using the 'Simple Lap Timing' option. The latter is useful if the user is in a situation where several button presses are difficult to achieve, such as during a qualifying run.

## Simple Lap Timing

This method of lap timing requires just one button push to set up a start/finish line. With the PerformanceBox in Lap Timing mode, press either the up or down arrow key as you drive over the desired start/finish point. The screen will then display the following message:



The screen will then count down to 0 and revert to the normal lap timing screen:



If an arrow button has been pressed in error this count down allows you to abort the setting of the start finish line, whereupon the lap times will be calculated according to any previous start/finish points that may have been set.

As soon as the start / finish line is crossed again, lap timing will begin. The lap time will be displayed at the end of the second lap along with the current best time in the top right and the lap count in the top left of the screen.

### **Lap Count**

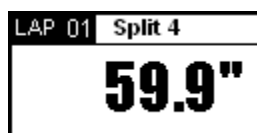
A count of the number of completed Laps is displayed in the top left corner of the Lap timing screen.

To reset the Lap count and the Best Lap time, press the RESET button.

### **Lap Timing Including Split Points**

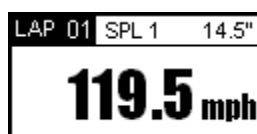
This method allows for the setting of a start/finish line, up to six split points, and a separate finish line if the course being driven is of a sprint or hill-climb type. Due to the fact that it requires several button pushes it is best employed in a non-race session.

- Firstly set the start/finish line and splits or load a previously saved set from the SD card (see Setting Start/finish and Split Lines below).
- If you want to save your lap times to a file, insert an SD card.
- Drive around the circuit, your times will automatically appear on the PerformanceBox display:



### **Big Speed @ Split display**

There is a choice of what is displayed in the main area of the Lap timing screen, either your Lap/Split time, as shown above, or the Vehicle speed as it crosses a split point or start/finish line; with the current lap in the upper left and the split time in the upper right of the window:



If Split points are placed at the exit of corners then this mode displays the corner exit speed, which is a very easy way to help you improve your speed out of a particular corner. To display the exit speed at the last split instead of the time press the **MENU** button and change the 'BIG SPEED @ SPLIT' option.

LAPTIMING MENU	
	UNITS
	SET START & SPLITS
	CLEAR ALL
	LOAD SPLITS
	SAVE SPLITS
	ONE SHOT MODE
	SPLIT TO SPLIT TIME
√	BIG SPEED @SPLIT

### ***Split to Split time***

There are two different ways of measuring split times. The default is from the start of the lap to the split, the other method is from one split to another. To change between these options, tick or untick the option 'SPLIT TO SPLIT TIME' in the LAPTIMING MENU.

LAPTIMING MENU
UNITS
SET START & SPLITS
CLEAR ALL
LOAD SPLITS
SAVE SPLITS
ONE SHOT MODE
✓ SPLIT TO SPLIT TIME
BIG SPEED @SPLIT

### ***Split Widths***

When setting a start / finish or split line, PerformanceBox will set the width of the line at a default value of 25m (12.5m either side of the point at which the OK button was pressed.) However this can be changed by selecting the Split Widths function and altering the value using the ▲▼ buttons. This feature is useful if PerformanceBox is being used on a track where separate sections pass closely by each other, and eliminates the possibility of going through a split line in the wrong direction.

### ***Clearing your Best Lap time***

Press and hold the **RESET** button for 1.5s.

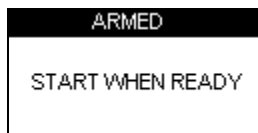
### **One Shot Mode**

By default, PerformanceBox starts the lap time from a start / finish line. If you want to start the lap time from the moment you start moving, then you need to select 'One Shot Mode'. To set this mode:

- Press the **MENU** button to enter the LAP TIMING menu.
- Highlight 'ONE SHOT MODE' and press **OK** to activate.
- Bring the car to a halt at the start point (previously set using either set start/finish method.)
- After two seconds the following screen will appear:



- The screen will count down from 5 to 1 after it reaches 1 the following screen will appear:



- When this screen shows you can then start your lap. Timing of your lap will start as soon as you pull away and will then stop as you cross the start / finish line at the end of your flying lap.

### Start / finish and split lines

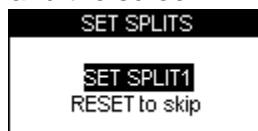
Before PerformanceBox can measure and display times, you will need to either load previously recorded start / finish lines or create new ones in your PerformanceBox. This is done using either Simple Lap Timing, mentioned above, which sets only a start / finish line. In order to set a start / finish AND split points, follow the instructions below.

### Setting start / finish lines

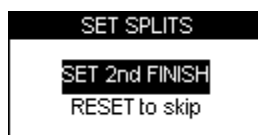
- Press the **MENU** button to display the Lap Timing Menu.
- Highlight 'SET START & SPLITS' and press **OK**



- As you drive across the start / finish line press **OK**
- This will set the start / finish line and the screen will now show the SET SPLIT1 screen.



- To set the first Split, press **OK** when you pass this point or press **RESET** to skip.
- If you wish just to place a separate Finish line, press the '**RESET**' button to skip all the split points and scroll to the SET 2<sup>nd</sup> FINISH screen.



- Press **OK** to set a separate finish line as you drive over it.

**Note: you must be moving to be able to set virtual lines.**

***Saving start / finish and Split Lines***

After creating start / finish, Splits or Finish lines you can save them to a file on the SD card which can be loaded back into PerformanceBox at a later stage, or used in the VBox Tools software. The file created is called DBOX.DSF and is saved into the 'DATA' directory on the SD card. If a DBOX.DSF already exists the file will not be created; this is to prevent existing start and split lines being accidentally overwritten.

To Save the lines you have created:

1. Ensure the SD card is inserted.
2. Press the **MENU** button to enter the Lap timing menu.
3. Highlight the SAVE SPLITS option and press **OK**

***Loading start / finish and split Lines***

You can load start and split line information from a file stored on the SD card into your PerformanceBox. By default the PerformanceBox looks for a file it has saved out; DBOX.DSF in the 'DATA' directory. If no DBOX.DSF file is found the PerformanceBox will look for a 'DSF' directory and display a list of all \*.DSF files in that directory. This facility allows you to keep a library of split lines files on the PerformanceBox from multiple test areas or circuits.

To Load a split line file:

1. Press the **MENU** button to enter the Lap timing menu.
2. Highlight the 'LOAD SPLITS' option and press **OK**

***Clearing start / finish and split Lines***

This option will erase the split line information from the PerformanceBox memory, not from the SD card. Split line information remains in the PerformanceBox memory until they are either cleared or re-entered, even if the unit is power cycled.

1. Press the **MENU** button to enter the Lap timing menu.
2. Highlight the 'CLEAR ALL' option and press **OK**

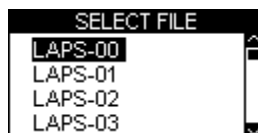
***Recording and Reviewing Lap and Split Times***

To record your run data and lap and split times, simply insert a SD card into PerformanceBox, the run data will be recorded in a '.dbn' file on the SD card and the Lap Time information will be recorded in a text file e.g. 'Laps-01'.txt'

## Using PerformanceBox to review lap times

To review a 'Laps-xx.txt' file with lap and split time data:

- Enter Lap Timing Mode and then press the **OK** button.
- PerformanceBox will then display any Lap Timing files stored on the card:



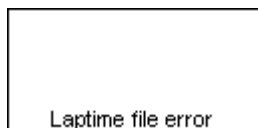
- Press the ▲ ▼ buttons to scroll to the required file, then press the **OK** button to select it. The file will then be displayed in PerformanceBox:

LAP	SPLIT
1 19'59.95"	1 19'59.95"
2 19'59.95"	2 19'59.95"
3*19'59.95"	3 19'59.95"
4 19'59.95"	4 19'59.95"
5 19'59.95"	5 19'59.95"
6 19'59.95"	6 19'59.95"

In each file, the best lap is indicated with an asterisk. To change the lap for which split times are displayed, use the ▲ ▼ buttons to scroll between the laps; the split times will update automatically. Pressing the **OK** button in this screen will return you to the Lap Timing Mode's main screen.

## Laptime File Error

If a file that does not contain any valid lap data, for instance if the car has only moved a few metres, then PerformanceBox will display this screen:



## Using a computer to review lap times

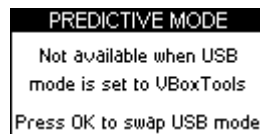
Any of the 'Laps-xx.txt' files can be opened using a text editor program such as notepad. The files have the following example format:

Time : 13:22:33			
Date : 18/7/05			
Lap	Lap Time	Split	Split Time
01		1	0' 10.20"
01		2	0' 11.45"
01		3	0' 22.50"
01		4	0' 8.30"
01		5	0' 19.25"
01		6	0' 8.70"
01	1' 28.35"		
02		1	0' 10.20"
02		2	0' 11.45"

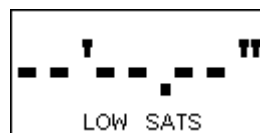
# Predictive Mode



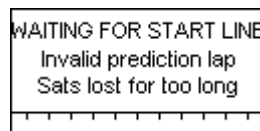
Predictive mode enables you to graphically view your predicted lap time. Predictive lap timing works by saving your position around a circuit, every second. If the current lap is the fastest so far, then this positional data is saved as a reference.



This screen is shown when comms mode is set to VBox Tools. Pressing the **OK** button changes the comms mode to Mass Storage which enables predictive mode.



This message on screen means the Drift Box is receiving positional data from less than three satellites.



If the Performance Box loses satellite lock while predicting, this screen will appear. The user will have wait until the start finish line is crossed before predicting again.

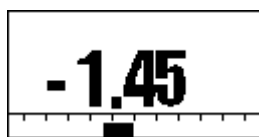


Before Predictive mode can operate, you will need a reference lap. If a reference lap file is found on the SD card as the Drift Box boots up, it will be automatically be loaded. A reference lap file can be loaded from the SD card at any time using the **Load Reference** menu option. The Drift Box will display this screen when no reference lap is available. Once a Reference lap has been set, the Drift Box will start predicting when the start line has been crossed.

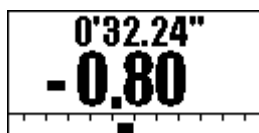


If you do not have a reference lap file, you will have to wait until a full lap of the circuit has been completed. This screen will be displayed while the drift box is creating a reference lap.





Once a valid reference lap has been created or loaded, the Drift Box will begin predicting. The prediction is shown in text and graph format which is a graphical representation of the amount of time gained or lost around the lap.



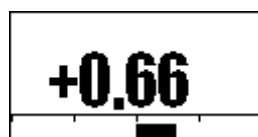
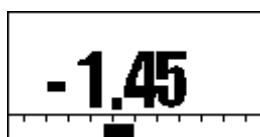
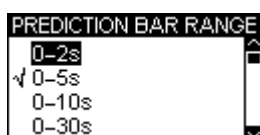
When a lap has been completed this screen is displayed for five seconds before reverting back to the prediction screen.

### Fixed Lap

In predictive mode your reference lap will change if it is faster than the previous. Pressing the OK button will fix your current lap, preventing it from changing. Pressing OK again on the same lap, cancels the fixing. Pressing OK on a later lap will cause that one to be fixed. If you decide to load a lap file from the SD card, it will automatically become the fixed reference lap.

WAITING FOR START LINE  
COMPARISON LAP FIXED  
PRESS OK TO CANCEL

Anything that resets predictive mode will put the unit back in to normal non fixed predictive mode. This includes pressing the reset button, clearing splits or performing a power cycle.



You are able to set the scale of the bar display with each gradation representing a set number of seconds. The options available are 0-2s, 0-5s, 0-10s and 0-30s. This can be changed by selecting **MENU** and then **BAR RANGE**.

To save a reference lap, Press **MENU** and then select **SAVE REFERENCE**.

If you wish to clear your reference lap to enable you to create a new one, holding down the **RESET** button will allow you to do so. Clearing the split points on Laptiming mode will also reset the reference lap. Please note, once you create a new reference lap, the previously saved one will be overwritten.

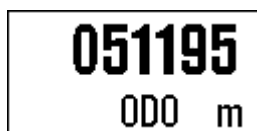
## Speed Display Mode



The Speed Display Mode is divided into three screens. The first contains a compass and current speed in a large font, the second is an Odometer and the third, an Altimeter. Navigate between these screens by using the ▲ ▼ buttons.

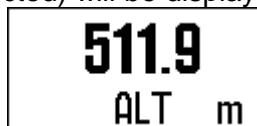
### Odometer

In the Speed Display Mode pressing the ▼ button selects Odometer Mode. The total distance travelled in feet or metres (depending on units selected) will be displayed in the main window. Pressing the **RESET** button resets the Odometer back to zero.



### Altimeter

In the Speed Display Mode pressing the ▲ button selects Altimeter Mode. The current altitude in feet or metres (depending on units selected) will be displayed in the main window.



### Event Marking

Pressing the **OK** button when in any of the Speed Mode screens will create an event mark in the logged file (see 'Event Marking' in the software section).

## Power Mode



Your car's power output can be measured using the Power Mode. There are two parts to this process: the acceleration run, which gives you the power at the wheels minus the losses caused by tyre and air resistance. The second part of the test measures these losses and also estimates gearbox losses. The Power Mode is also an additional tool for car tuning, where access to a chassis dynamometer is not possible.

Note that this is an estimation of power, and as such when carried out correctly will probably be within 5% of the true figure. It is very important that the test is carried out on a completely flat road and the correct procedure is followed very carefully. Power output can only be measured on a car with a standard manual gearbox.

### Power Testing

**Please note that due to the nature of this test and the amount of space required, it is strongly recommended that such measurements are conducted on private roads.**

#### *Setting the Vehicle Weight*

In order for accurate measurements to be made, the vehicle weight must first be entered via the Power Menu:

POWER MENU
UNITS
<b>SET WEIGHT</b>
SETUP
EXIT

The weight you enter must be as accurate as possible - for best results have the car weighed prior to carrying out any tests as even a small inaccuracy will not give correct power figures, a 10% error in weight will give a 10% error in power. Use the ▲▼ buttons to increase or decrease the weight value (Holding down the buttons increments/ decrements faster). Altering the units from the menu will change the weight values from lbs to kg, and the power values from bhp to kw.

ENTER VALUE
<b>2420</b> lbs

Power and losses runs should be carried out on level ground and always in the same direction, and it is recommended that power runs are conducted with the car in second gear.

## Power Runs

Once the vehicle weight has been set, a simple power run can be carried out to give engine output at the wheels. Put the car into second gear at a low RPM, 2000 RPM or less.

POWER	
20 MPH	PRESS OK TO PRIME POWER RUN

Press **OK**, the next screen indicates that PerformanceBox is ready to record the run:

POWER	
20 MPH	POWER RUN BEGINS ON ACCEL

Once the car begins to accelerate, the power is being recorded:

POWER	
25 MPH	RECORDING POWER RUN ENDS ON DECEL

Accelerate to the top of the engine's rev range, disengage the clutch and make a note of the car's speed as this will be required during the losses run, then coast for a few seconds. PerformanceBox will record the amount of power as soon as it recognises deceleration:

POWER	
75 MPH	203 BHP WHEELS

## Calculating Losses

So as to estimate power output figures at the flywheel, you will need to configure the amount of loss generated by tyre and air resistance. To do this requires a 'coast-down' test. It is recommended that this is carried out in third gear.

With the weight correctly entered, switch from the Power Run screen to the Losses Run screen using the **▲▼** buttons. The screen will display a similar initial instruction to the Power Run:

POWER	
20 MPH	PRESS OK TO PRIME LOSSES RUN

Begin to accelerate, and press **OK**. Continue to accelerate to the top of the engine rev range.

POWER	LOSSES RUN
75 MPH	BEGINS ON DECEL

At the top of the rev range, disengage the clutch and put the gearbox into neutral. Once deceleration has begun the screen will display the recording information:

POWER	RECORDING
95 MPH	LOSSES RUN ENDS ON ACCEL

Let the vehicle coast down to a speed a long way below the speed at which maximum power is likely to occur, then accelerate briefly to finish the run:

POWER	LOSSES RECORDED
25 MPH	OK - SAVE RESET - EXIT

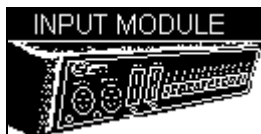
Press **OK** to save the losses; pressing **RESET** will cancel the recorded losses so that you can start the process again. Losses are permanently saved, but you should generally carry this out on the same piece of road in the same direction as your acceleration runs. Note any small gradient can have a large effect on the measurement.

If you have not carried out any power tests at this point then accessing the Power Run screen will simply display the priming instructions. If you have already carried out power runs the results will now be displayed as output from the flywheel rather than the wheels. Any further power runs will display the results at the flywheel, until the **RESET** button is pressed when in the Losses Run screen.

POWER	235 BHP FLYWHEEL
75 MPH	

Pressing the **RESET** button when in the Power Run screen will clear the result in order for a new run to commence.

## Input Module Screen



The Input Module screen provides the ability to configure the input and output channels of a connected Micro Input Module and view the data on each of the input module channels.

**NB:** This mode requires the RS232 chip upgrade in order to function.

### Input module connection

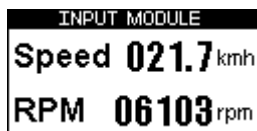
The PBOX connects to a Micro Input Module using an RLCAB045 cable plugged into the Auxiliary connector on the back of the PBOX to the DATA socket on the Micro Input Module. If an input module is connected to a PBOX and it has been initialised then the PerformanceBox will automatically log all of the input module channels to the SD card.

### Initialising the Micro Input module.

In order for the PerformanceBox to log the input module data channels, the Input Module screen must be accessed whilst the input module is connected and the PerformanceBox has satellite lock. After the Input Module screen has been accessed the screen will briefly display the following message.



Then the screen will display the data output diagnostic screen. Once this has happened the PerformanceBox will log the input module data. In firmware revision 1.4.76 and above a new display can be accessed by pressing down in this mode.



This screen displays Speed and a selected input module channel. To select an input module channel press the MENU button then navigate through the list to select display channel. From this screen any one of the MICIN01 channels can be selected.

**NOTE:** After each power up, the Input Module Screen on the PerformanceBox must be accessed in order for the PerformanceBox to recognise the presence of the MICIN01. After this has been done, then any of the PerformanceBox screens can be used, but this must be done or the MICIN01 channels will not be logged.

### Configuring the Inputs and Outputs

See the Micro Input Module user guide for a full explanation of configuring the inputs and outputs of a Micro Input Module.

# Data Logging

Providing that you have registered your PerformanceBox (see Quick Start Guide) then it will be capable of logging data to an SD card.

## Using the SD card

The Performance Box will only work with SD and SDHC hardware.

Files logged by PerformanceBox are named 'PBOX\_001.dbn', where 001 increments when a new file is created. A new file is created every time PerformanceBox is powered up, or when the card is re-inserted. If you wish to log data to the SD card then simply insert the card into the slot in the front of PerformanceBox. PerformanceBox will log vehicle position, speed and acceleration into a binary '.dbn' file which can be opened in PerformanceTools software for analysis. This data is logged when velocity is above 0.5Km/h.

The PerformanceBox has two logging modes, selectable through the **SETUP** menu available from any screen.

- **ONLY WHEN MOVING:** In this mode GPS and PerformanceBox data is only logged to an SD card (.DBN file) whilst the Speed is greater than 0.5km/h.  
**Only ever remove the SD card when you are stationary, otherwise you will risk losing data or corrupting the card (which would require a re-format).**
- **CONTINUOUS:** In this mode all GPS and PerformanceBox data is logged to the SD card (.DBN file) regardless of Speed or satellite reception.  
**Before removing the SD card, the data-logging process must be stopped by pressing the MENU button, which ends the writing of data to the card and closes the current file.**

To read data from the card either insert the card into a SD card reader connected to your computer or connect your computer directly to PerformanceBox via the supplied USB cable to read the data from the card. PerformanceBox must not be writing to the card when you connect to your PC, so you must be stationary. To ensure Windows recognises a PerformanceBox, **power up your PerformanceBox before connecting the USB cable to your PC.**

## File types

Below is a list of the file suffix's and definitions that are used by PerformanceBox and PerformanceTools Software:

Type	Definition
*.dbn	Binary format file containing logged Position, Speed, Acceleration data
*.vbo	ASCII format file containing logged Position, Speed, Acceleration data
*.txt	Performance and Lap times are stored in text format
*.dsf	Split files containing Start/finish and Split line locations
*.cir	Circuit overlay file for track mapping

# Setup Menu

There is a single Setup Menu that is accessible in all of the PerformanceBox's modes.

To access the Setup Menu, press the MENU button in any mode and select the 'SETUP' option and press OK

The Setup Menu contains the following options:

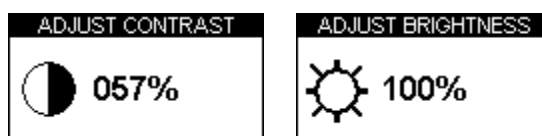
SETUP MENU
LOGGING MODE
<b>CONTRAST</b>
BRIGHTNESS
DIAGNOSTICS
COLDSTART
SPEED BUZZER
UPGRADE
EXIT

## Logging Mode

Allows the logging mode of the PerformanceBox to be configured, see the Data logging section of this manual for more information.

## Contrast & Brightness

Use these to adjust the Brightness & Contrast of the screen, **OK** to return.



## Diagnostic Screens

PerformanceBox has two different diagnostic screens, use ▲ ▼ to swap between the two.

## GPS Diagnostic Screen

GPS	
SAT LEVELS	Sat 08
	Tim 112345.10
	Lat 058.988°N
	Lon 000.981°W
	Ht 135m

This screen allows you to view the following basic GPS information:

- Number of satellites being used by PerformanceBox.
- Signal strength of each satellite.
- Satellite time (UTC)
- Latitude.
- Longitude.
- Height (with respect to sea-level at Greenwich).

**Note:** In this screen data is logged to the SD card at 1Hz not 10Hz



## Cold Start

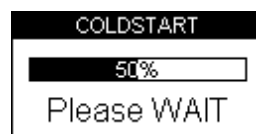
A cold start completely re-initialises the PerformanceBox's GPS engine. GPS coldstarts clear the GPS engine's list of satellite positions and configures the GPS engine for normal PerformanceBox operation. For this reason, coldstarts should be performed at the following times:

- If PerformanceBox has not been used for more than three weeks.
- If PerformanceBox has moved over very large distances (thousands of miles) whilst turned off.
- If PerformanceBox's firmware has just been upgraded.

Because each of these are common during distribution, it is also recommended that the PerformanceBox is coldstarted on its first use. After performing a Cold Start the vehicle to which PerformanceBox is connected should be left in an open area for at least 15 minutes, to re-acquire the satellite almanac. You should only need to do a cold start when you first receive your PerformanceBox, or you are experiencing poor satellite reception in an open area.

### *Performing a Coldstart*

- Press the **MENU** button from any Display mode.
- Highlight the Setup option and press **OK**
- Select COLDSTART
- The following screen appears and a coldstart is performed



When it is finished PerformanceBox will automatically go back to the Setup Menu.

## Speed Buzzer

The speed buzzer is generally for use whilst in Performance Mode, during 0-100-0 style tests. The speed is configurable from this menu option – see the Speed Buzzer section under Performance Mode.

# Troubleshooting

## **My PerformanceBox does not pick up or lock onto satellites.**

Some modern cars are fitted with a special windscreen that cuts down the amount of UV (Ultra Violet) rays that will be transferred through the windscreen which help cut down on glare. These windscreens are called athermic, or UV Coated and will dampen/reduce GPS signals coming through the windscreen, so if you have an athermic windscreen, it means you will not receive the same quality of signal as you would do by taking the PerformanceBox outside of the car.

## **How do I know if I have an Athermic Windscreen?**

You can either contact the manufacturer of your vehicle, or talk to the main authorised dealer who may be able to tell you. If you cannot receive a firm yes or no, then another way to check is to power up the PerformanceBox and hold it outside of the vehicle, receive a satellite fix and use the GPS diagnostic screen to see how many satellites you can see. Once you have noted this down, move the GPS inside the car and see if the GPS signal drops by 2-4 sats. If it does immediately then you probably have an athermic windscreen.

There is list of cars in the table below that we believe have had Athermic windscreens fitted throughout part of their history. Please note that manufacturers don't always use the same windscreens through the life of a car model, so even though a model may be listed below, it does not necessarily mean that the current model that you have may have an Athermic windscreen. If you are unsure, try the above test or talk to your car manufacturer/dealership.

BMW 3 Series	Ford Mondeo	Renault Laguna
BMW 5 Series	Fiat Multipla	Renault Clio
BMW 7 Series	Mercedes W220-S Class	Renault Master
BMW X5	Mercedes Vaneo	Renault Kangoo
Citreon Picasso	Peugeot 206	Renault Scenic
Citreon C5	Peugeot 306	Renault Espace
Citreon Xsara	Peugeot 307	Renault Megane
Citreon Xantia	Peugeot 607	Renault Safrane
Ford Galaxy	Renault Traffic	Vauxhall Zafira

If your car does have this type of windscreen you will need to use an external GPS antenna that magnetically fixes to the roof of your car. An external antenna is available as an optional extra - see the website for details.

## **If you still have reception problems:**

- Obstructions to the open sky will reduce GPS performance. Try to ensure placement of PerformanceBox is away from the windscreen edges so it has the widest view of the skies possible. With an external antenna place it away from roof bars and at least 10 cm way from any other roof mounted items.
- Driving in built up areas and close to tall trees reduces satellite reception.
- PerformanceBox may require a Coldstart, see the PerformanceBox setup section of this manual for more information.

## **No data files are appearing on the SD card**

Make sure the SD card is not full. If your PerformanceBox does not beep twice when you insert the card, then you may have to re-format the card - you should use the utility in PerformanceBox Tools. If purchasing a new SD card, ensure that it is of high quality from a reputable manufacture

# PerformanceTools Software

The PerformanceTools software allows you to view the driving data recorded by PerformanceBox in a '.dbn' file. The software also allows you to display Lap times, Acceleration, Deceleration results, and to carry out detailed analysis of driver and vehicle performance.

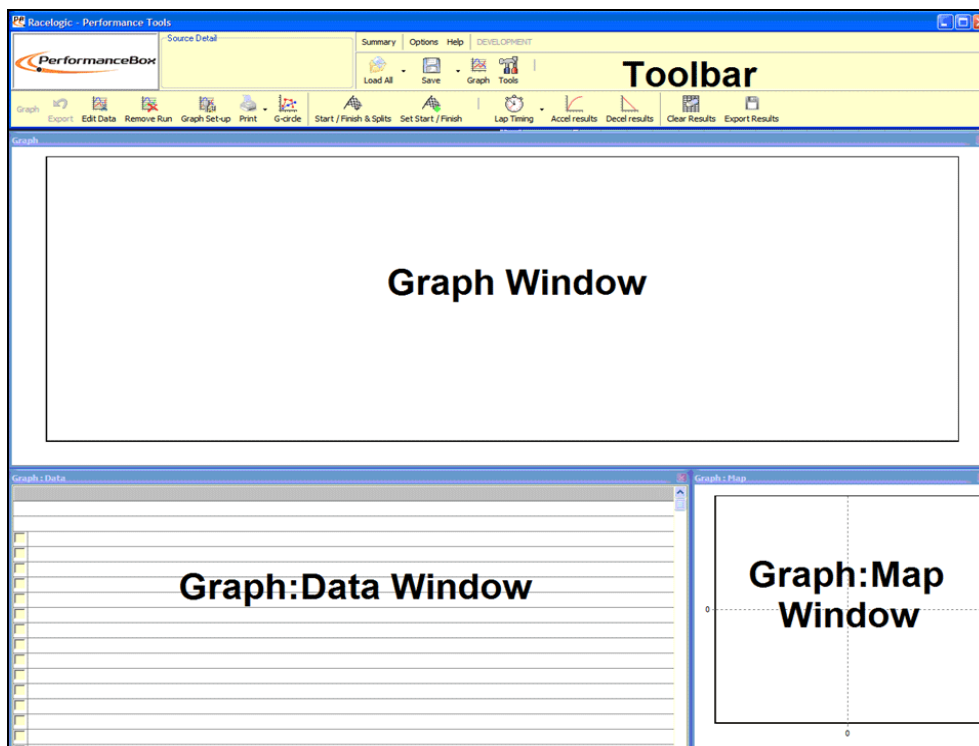
## Installation

Each PerformanceBox is supplied with a CD containing the PerformanceTools software. Insert the CD into your computer, the installation should then auto run. The Installation will place a shortcut onto your desktop for the main analysis software, and also install USB drivers for upgrading your PerformanceBox. The software installation is also available from the downloads section of the PerformanceBox website, along with the current firmware release.

## PerformanceTools Windows

PerformanceTools is made up of several windows, each displaying a variety of data in both a graphical and textual form.

When the software is started for the first time after installation, and before any files have been loaded, the windows visible will be the Toolbar, the Graph screen, the Graph:Data screen, and the Graph:Map screen:



There are additional windows that can be displayed, according to the functions being employed to analyse your data – these will be described in subsequent sections of this manual.

## Graph Window

In the Graph window different channels can be plotted, either against time or against distance, and up to four '.dbn' files can be overlaid on the graph. The Graph window can display large amounts of data at once, with the addition of various axes to aid analysis.

## Graph: Map Window

The Graph:Map window shows the path of the vehicle, calculated from the latitude and longitude data. In addition, a circuit overlay can be applied to the map window, allowing you to see the position of the vehicle in relation to the bounds of a track.

## Graph: Data Window

The Graph: Data window shows a table of the data of the following available channels:

- Speed
- Lateral Acceleration
- Longitudinal Acceleration
- Heading
- Height
- Satellites
- Yaw Rate
- Latitude
- Longitude
- Brake Trigger
- UTC Time
- Distance
- Time
- Radius of Turn

Other channels will appear if a Micro Input Module has been used together with the PerformanceBox, such as RPM or Analogue\_1.

There are a number of other channels which are shown, but these are not relevant to the PerformanceBox and will be blank. For reference, these channels are: Relative Height, Vertical Speed, Glonass Satellites, GPS Satellites, Lat Acc from Yaw Rate, DGPS, Speed Quality, Centre Line Deviation, Solution Type, RMS Error Position, and any channel with an underscore at the start of its name, such as \_latitude.

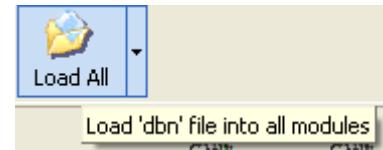
## Window Sizes and Positions

Each of the three display windows can be resized by stretching the window (by holding the mouse pointer over a window corner and then click-dragging when the pointer shape changes to ↗); each window can be repositioned; and all of these windows can be printed. The default position and size of each window can be reset from a function in the Tools menu called 'Arrange Windows' (see page 68.)

## Software Basics

### Opening PerformanceBox Files – Load All

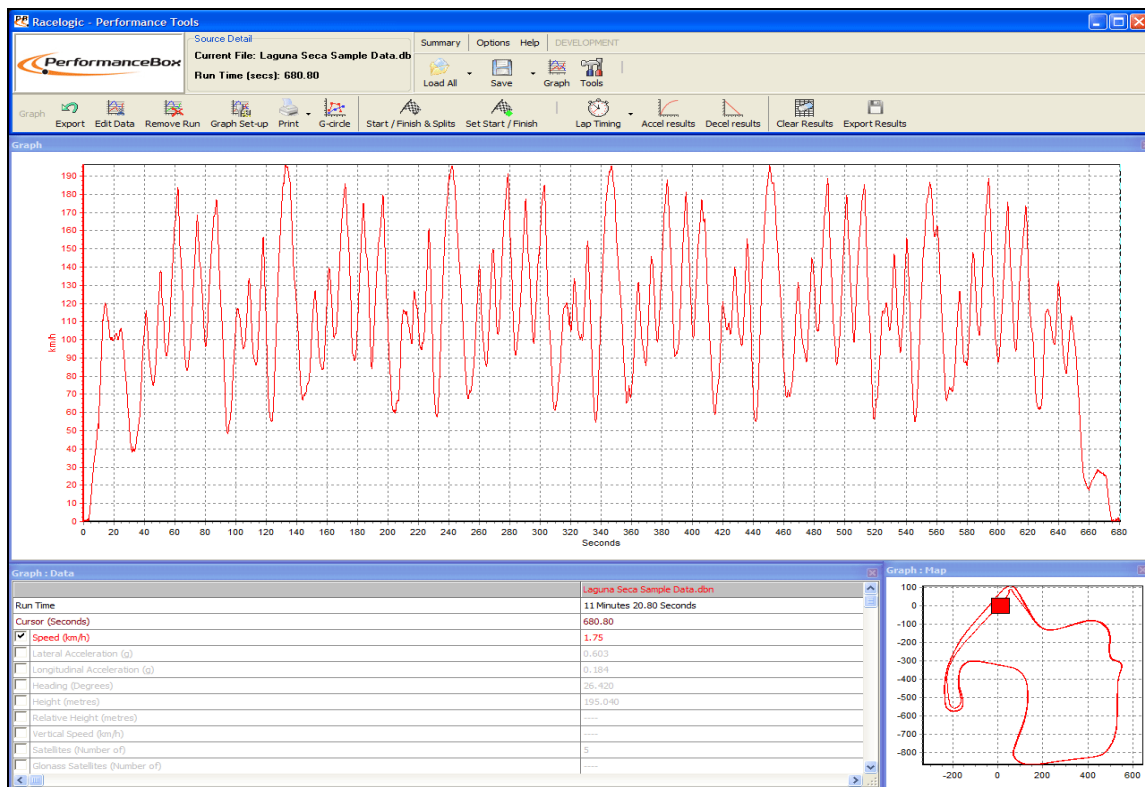
To load a file that has been recorded by your PerformanceBox, click on the Load All button on the Toolbar. An 'Open' window will appear – navigate to the directory on your PC that contains your PerformanceBox files and select the file you wish to view.



By default the 'Files of Type:' will be 'PerformanceBox Binary Files (\*.dbn)', with a further option of 'VBOX Data Files (\*.vbo)'. Unless you are loading files that have been recorded using Racelogic VBOX equipment you will not need to select the .vbo file type.

### Data Display

Once a file has been loaded the three windows will each display some information, as described in PerformanceTools Windows on page 35.



Note how in the example above, the Graph window is showing speed in Km/h (Y axis), and time in seconds (X axis); the Graph:Map shows the path the vehicle took whilst the file was being recorded (in this example the Laguna Seca circuit in the United States); and the Graph:Data window is displaying values from the file according to the position of the cursor in the Graph window.

The Toolbar displays the file name and total run time next to the PerformanceBox logo.

### Graph Set-up

The Graph Set-up button brings up a list of options that apply to all three of the main windows, and can also be brought up by right-clicking on any of the three main windows. Each function is described in further detail in the following sections.

## Moving Around the Graphs

Once a file is displayed the data from the file can be examined more closely using the following basic functions: zoom, pan and cursor movement.

### Cursor

The position of the cursors in the Graph and Graph:Map windows are linked and move together, and the values displayed in the Graph:Data window update as the cursor is moved through the file. The left and right arrow keys control the movement of the cursor. If the shift key is simultaneously pressed then it moves faster across the screen; if the ALT key is simultaneously pressed then it moves through the file one sample at a time (one-tenth of a second.) The cursor can also be placed in the graph window by left-clicking the mouse button at the desired cursor position.

### Zoom

Zooming in on the data in the graph or map window can be done three ways.

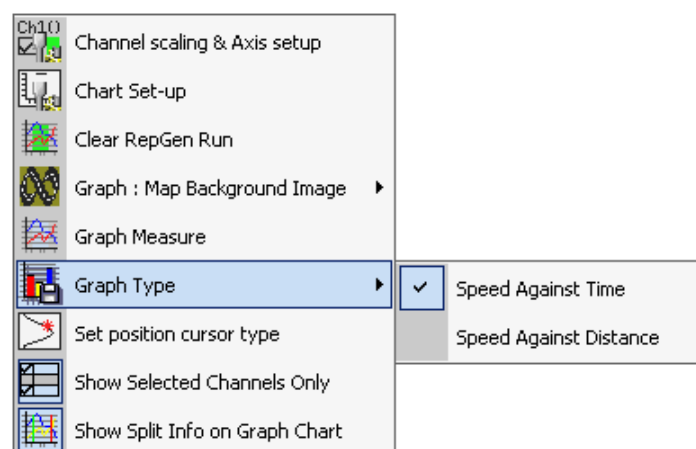
- Use the **left mouse button** to click and drag a window from **left to right** around the area of interest. Click and drag from **right to left** to zoom out.
- Use the **up and down** arrow keys on the keyboard to zoom in around the current cursor position. Pressing the shift key at the same time makes the zoom happen in bigger steps.
- If your mouse has a scroll wheel then this can be used to zoom in around the current cursor position. Pressing the shift key before using the mouse roller ball will make the zoom occur in bigger steps.

### Pan

To pan the view in the graph or map window, put the mouse over the area you wish to pan then click and hold the **right mouse button** and move the mouse in the direction that you wish to pan.

### Graph Screen X Axis

To swap the X axis from Time to Distance either press the right mouse button anywhere on the screen or click the 'Graph Set-up' icon, then select 'Graph Type', then choose one of the two options, 'Speed Against Time' or 'Speed Against Distance'.



Speed against distance is useful for overlaying laps with different lap times around the same circuit (eg. different time, but same distance)

Speed against time is useful for examining performance files (acceleration and deceleration.)

## Graph Screen Y Axis

The default view on the Y axis is for speed, in either MPH or KMH. More axes can be added to either side of the graph screen – see 'Axis Setup'.

## Additional File Functions

By clicking on the small arrow next to the Load All button, a further set of file-loading options is revealed:

### Load Compare File

The Graph screen has the facility to load up to three more files for comparison. Select one of the 'Load Compare File x' items and choose an additional file to examine: the data will be overlaid in the Graph screen, another data set will be displayed in the Graph:Data window, and the comparison file's path will be overlaid in the Graph:Map window.

To remove a compare file, click on the 'Remove Run' icon in the Toolbar and then select the relevant file to remove.

### Append File to Main

PerformanceBox files can be joined together using the 'Append file to Main' option. This is a useful feature if you want to join track sessions together in order to carry out lap time analysis on a whole day's circuit practice, or to view an entire journey which was punctuated by stops.

Appending a file will join the beginning of the additional file to the end of the main file. If you wish to append files to the middle of the main file it will be necessary to manipulate the main file first using the Edit Data functions (see Editing a PerformanceBox File.)

Note that if you have loaded a comparison file, this will be removed by appending an additional file to the Main Run.

### Open in Notepad

A PerformanceBox file can be opened in Notepad by selecting the 'Open In Notepad' option from the 'Load All' drop down list. Note that for large files, it may take some time for Notepad to load all of the lines of data.

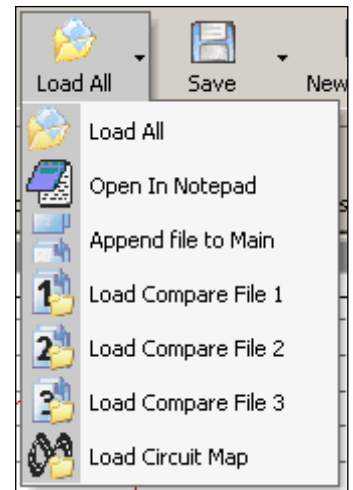
This function can also be used to open the other text files on your SD card such as the lap time results files, Results.txt and Best.txt.

### Load Circuit Map

This feature allows you to load a circuit overlay file in addition to your logged PerformanceBox data, and is covered in the section 'Circuit Overlays' on page 59.

## Editing PerformanceBox Files

Sections of a PerformanceBox file can be removed using basic editing commands accessed through the 'Edit Data' icon in the Graph screen toolbar. Note from the screenshot below that each editing function has a keyboard shortcut.



### Cut All Data before Cursor

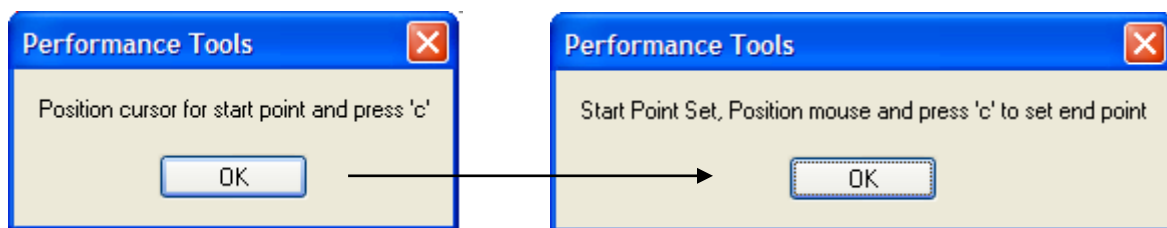
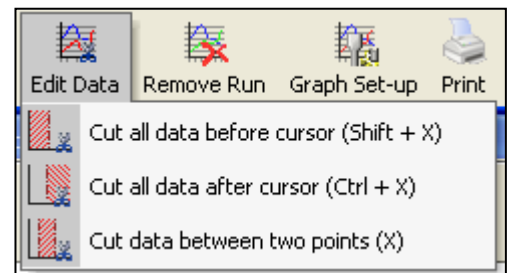
This feature removes the entire file up to the cursor position in the main memory (ie not any compare files currently loaded) only. You can use this to select an area of the graph you are interested in and then save just a portion.

### Cut All Data after Cursor

This feature removes the main memory file from the point of the cursor onwards.

### Cut Data between Two Points

This feature removes a section of the main memory file between two specified cursor points. When choosing this option instructions will appear on the screen:



### Saving PerformanceBox Files

Save a file by clicking on the 'Save' icon in the main toolbar. If you have made changes or edited your PerformanceBox file it is wise to save this file to a new name so that you do not lose the original file.

A .dbn file can be saved in three alternative formats:

- Circuit overlay file (.cir): a file created to display the bounds of a circuit, for drive-line analysis.
- VBOX data file (.vbo): essentially the same as a .dbn, but in ASCII rather than binary format.
- Comma-delimited spreadsheet file (.csv): a raw data spreadsheet file, with all logged information in channel columns.

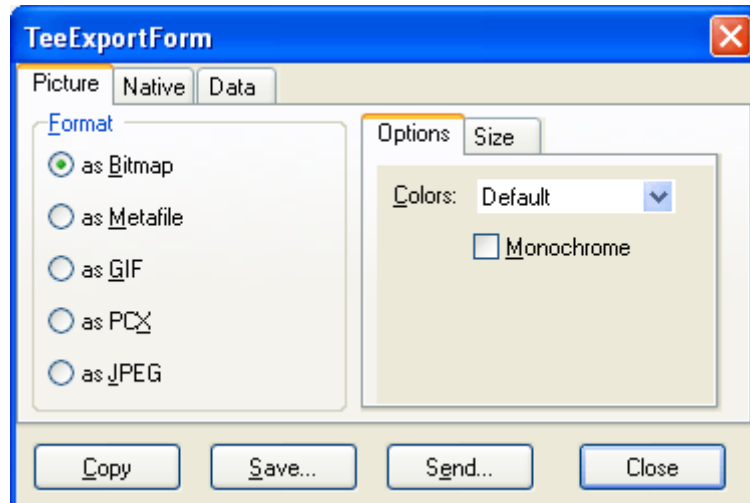
### Printing Graph Data

You may print out the graph data currently being displayed by selecting an option from the 'Print' icon's drop-down list. It is possible to print a single window (Graph, Data or Map) by selecting the relevant options, or all three by selecting the 'Print' option (or by clicking the 'Print' icon itself, rather than its arrow.)



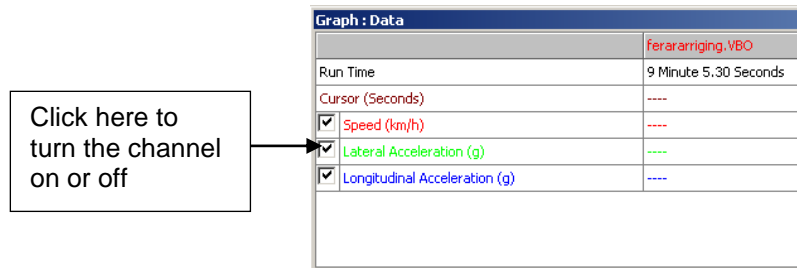
## Exporting Graph Data

It is possible to export the graph or map as a picture file, which can either be saved or copied onto the computer's clipboard for use with other software. Simply click the 'Export' icon and then choose the image to export. A dialogue box will appear that will allow you to choose several factors, including the format in which you wish to export the file:



## Selecting Channels

All channels logged by PerformanceBox appear in the data window; all except speed are initially greyed out, but the data can still be seen. To enable a particular channel and make it visible in the Graph window, click in the tick box to the left of the channel name. For example, to display lateral acceleration:



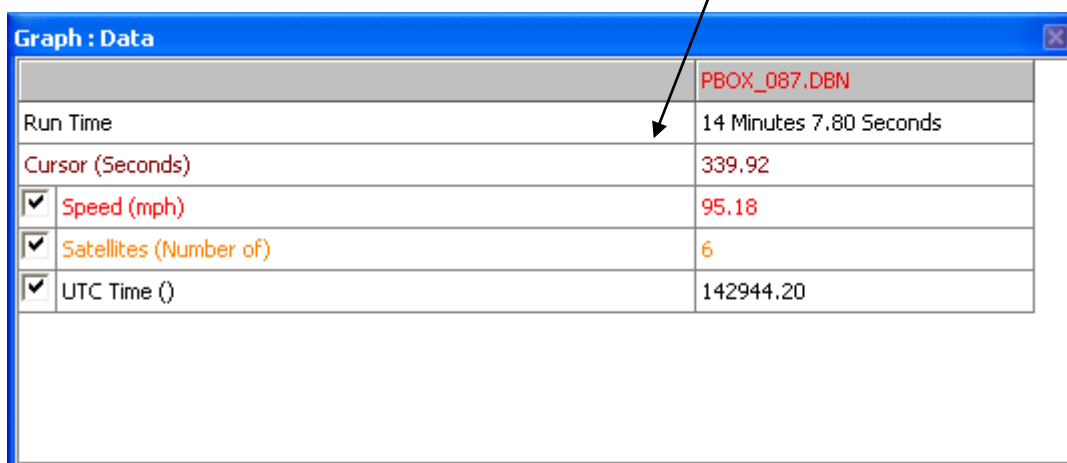
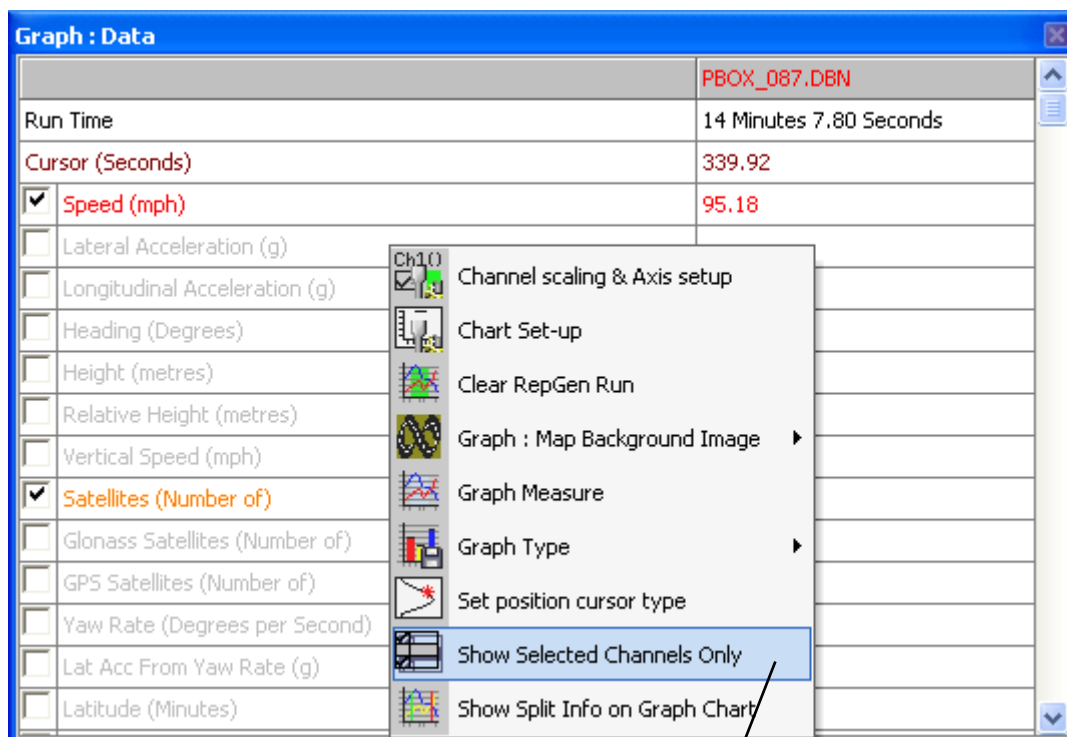
PerformanceTools will automatically scale the channel to its minimum and maximum values and show it in the graph window. The enabled channel will then be highlighted in its display colour.

The data table contains all of the logged channels from the PerformanceBox file plus Lateral and Longitudinal Acceleration and Radius of Turn channels, calculated when the file is first loaded. Scroll up and down the channel list to find the desired channel.

A channel can also be found by typing the first letter of the channel, for example 'S' for Satellites, providing that the data table is the currently active window. If there is more than one channel that starts with the same letter then press the key again until the software stops on your desired channel.

## Show Selected Channels Only

The data table channel list can be reduced to show only the ticked channels, by right-clicking the mouse pointer in any 'graph' window (Graph, Data, or Map) then selecting 'Show Selected Channels Only'. This is very useful when you are moving the cursor through the graph window and wish to see the displayed channel's data at the cursor point:



## Channel and Axis Setup

For each channel there are a number of attributes that can be configured, including those relating to the y-axis. These are configured in the Channel Set-up and Axis Set-up screens, which are accessed by double-clicking on any of the channels in the data table or by right clicking the mouse button and selecting the 'Channel scaling & Axis setup' option, or by clicking the 'Graph Set-up' icon on the Toolbar.

## Channel Setup

Visible	Channel Name	Units	Smoothing	Axis	Run 1
<input checked="" type="checkbox"/>	Speed	km/h	0	km/h	
<input type="checkbox"/>	Lateral Acceleration	g	4	Lateral Acceleration	
<input checked="" type="checkbox"/>	Longitudinal Acceleration	g	4	Longitudinal Acceleration	
<input type="checkbox"/>	Heading	Degrees	0	Heading	
<input type="checkbox"/>	Height	Metres	0	Height	
<input type="checkbox"/>	Relative Height	Metres	0	Relative Height	
<input type="checkbox"/>	Vertical Velocity	km/h	0	Vertical Velocity	
<input type="checkbox"/>	Satellites	Number of	0	Satellites	
<input type="checkbox"/>	Glonass Satellites	Number of	0	Glonass Satellites	
<input type="checkbox"/>	GPS Satellites	Number of	0	GPS Satellites	
<input type="checkbox"/>	Yaw Rate	Degrees per Se	0	Yaw Rate	
<input type="checkbox"/>	Lat Acc From Yaw Rate	g	0	Lat Acc From Yaw Rate	
<input type="checkbox"/>	Latitude	Minutes	0	Latitude	
<input type="checkbox"/>	Longitude	Minutes	0	Longitude	
<input type="checkbox"/>	Brake Trigger	ON/OFF	0	Brake Trigger	
<input type="checkbox"/>	DGPS	ON/OFF	0	DGPS	
<input type="checkbox"/>	UTC Time		0	UTC Time	
<input type="checkbox"/>	Distance	Metres	0	Distance	
<input type="checkbox"/>	Time	Seconds	0	Time	
<input type="checkbox"/>	Radius of Turn	Metres	0	Radius of Turn	
<input type="checkbox"/>	Slip Angle	Degrees	0	Slip Angle	
<input type="checkbox"/>	Velocity Quality	km/h	0	Velocity Quality	

## Column descriptions:

### Visible

The tick boxes in this column switch individual channels on or off in the graph window.

### Channel Name

This column contains the names of the available channels.

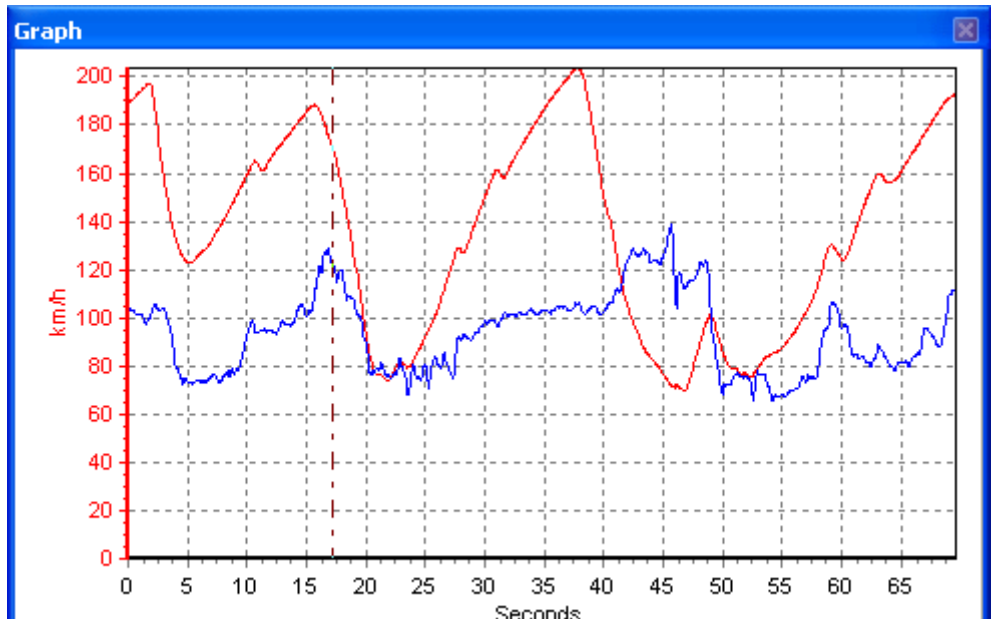
### Units

Shows the units of each of the available channel.

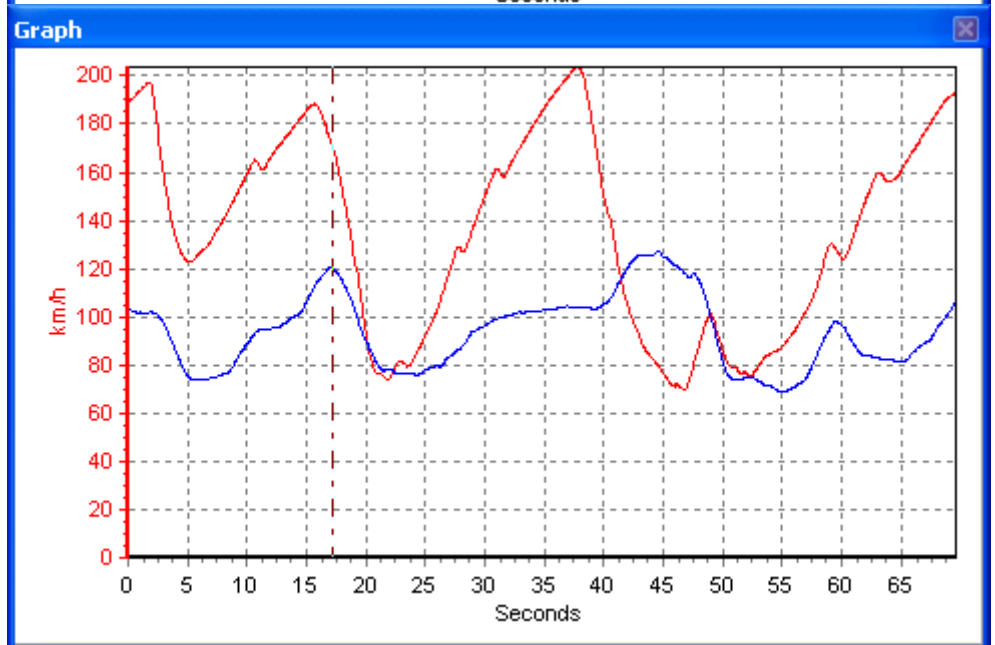
### Smoothing

In this column a smoothing level can be applied to each channel individually. This can be useful for the Longitudinal and Lateral Acceleration channels. The smoothing level number directly relates to the number of samples used in the smoothing routine – the higher the value the smoother the trace will appear on the screen, but it will become less representative of the response of the vehicle as it was actually recorded:

The example on the right shows the Lateral Acceleration channel with a smoothing level of 2.



This example shows the Lateral Acceleration channel with a smoothing level of 25 – note how the individual peaks and troughs are no longer present, so the true dynamic values of the vehicle are now not shown. Smoothing Level should therefore be carefully applied – too little and the data can be too ‘noisy’ for easy analysis; too much and valuable information can be lost.



## Axis

Displays the axis with which the channel is associated. To change the associated axis, click the mouse in the right hand end of the axis box once the channel has been made visible. A common application for this is to display both the Longitudinal and Lateral Acceleration channels, but to have them referring to one axis only:

Visible	Channel Name	Units	Smoothing	Axis	Run 1
<input checked="" type="checkbox"/>	Speed	mph	0	mph	
<input checked="" type="checkbox"/>	Lateral Acceleration	g	0	Lateral Acceleration (g)	
<input checked="" type="checkbox"/>	Longitudinal Acceleration	g	0	Lateral Acceleration (g)	

## Run 1

This column shows the selected colour for each active channel. To change the colour click on the colour box of the channel and select a new colour from the colour selection box that appears. The colour chosen will also be applied to the axis, should this be selected; for example, if the Lateral Acceleration channel is used in green, so too will the Lateral Acceleration axis, if it is used.

If compare files are also loaded then Run2, Run3 etc columns will be present in which the colours of these compare file channels can be set:

Visible	Channel Name	Units	Smoothing	Axis	Run 1	Run 2
<input checked="" type="checkbox"/>	Speed	mph	0	mph		
<input checked="" type="checkbox"/>	Lateral Acceleration	g	0			

## Axis Setup

The Axis Setup window contains all the controls needed for assigning and configuring the y-axis of the Graph screen:

The screenshot shows the 'Axis Set-Up' window with a toolbar at the top containing icons for 'Channel Set-up', 'Axis Set-up', 'Apply', and 'Cancel'. Below the toolbar is a table with the following columns: Visible, Axis Title, Min, Max, AutoScale, Symmetrical, and Position. The table lists various channels and their configurations.

Visible	Axis Title	Min	Max	AutoScale	Symmetrical	Position
<input checked="" type="checkbox"/>	km/h	0.0	43.5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Lateral Acceleration	-2.0	2.0	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Longitudinal Acceleration	-2.0	2.0	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Heading	0.0	360.0	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Height	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Relative Height	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Vertical Velocity	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Satellites	0.0	15.0	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Glonass Satellites	0.0	15.0	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	GPS Satellites	0.0	15.0	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Yaw Rate	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Lat Acc From Yaw Rate	-2.0	2.0	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Latitude	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Longitude	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Brake Trigger	-0.5	1.5	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	DGPS	-0.5	1.5	<input type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	UTC Time	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Distance	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Time	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Radius of Turn	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Slip Angle	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left
<input type="checkbox"/>	Velocity Quality	0.0	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left

**Column descriptions:****Visible**

Each tick box in this column switches an individual axis on or off in the graph window.

**Axis Title**

Shows the title of each available axis. The axis title is edited by clicking on the box and entering a new name.

**Min / Max**

The Min and Max boxes allow the scale ranges for each axis to be set.

**Autoscale**

The autoscale option causes the axis scales to automatically fit the minimum and maximum values of the loaded channel.

**Symmetrical**

This option will cause the positive and negative maximum values on the axis to be the same magnitude. The magnitude of these will be determined by the largest positive or negative value of the channel.

**Position**

This option controls whether the channel axis appears at the left or right of the Graph window.

## Analysing Your Data In PerformanceTools

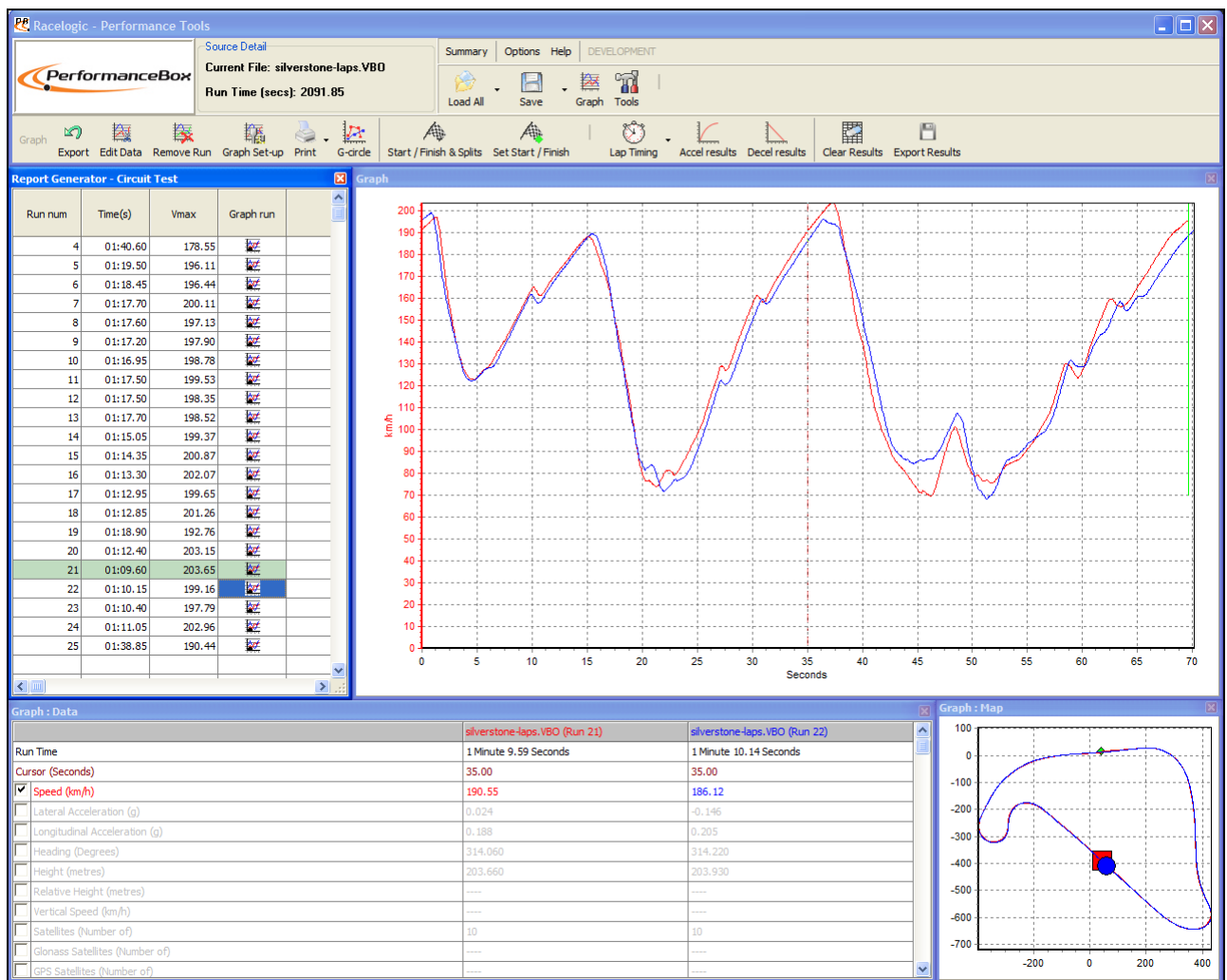
PerformanceBox Tools has three main features which will allow you gather results from data you have logged. Many of these results are available to view on the PerformanceBox itself, but the software allows for more detailed analysis.

This section is divided into two subject areas: Lap Time Results, and Performance (ie Accel/Decel) Results. It also describes additional features which enhance the analysis but which have uses within each main function, such as the G-Circle.

### Lap Timing

Pressing the Lap timing button in the Toolbar causes the software to scan the loaded file and apply loaded split file information to produce a table of Lap times, with a V Max for each lap and with the fastest lap highlighted.

This facility also allows individual laps from the loaded file to be loaded and compared in the main Graph window. In addition a circuit overlay can be loaded into the Graph:Map window to aid with drive-line analysis.





## Start / Finish Lines and Splits

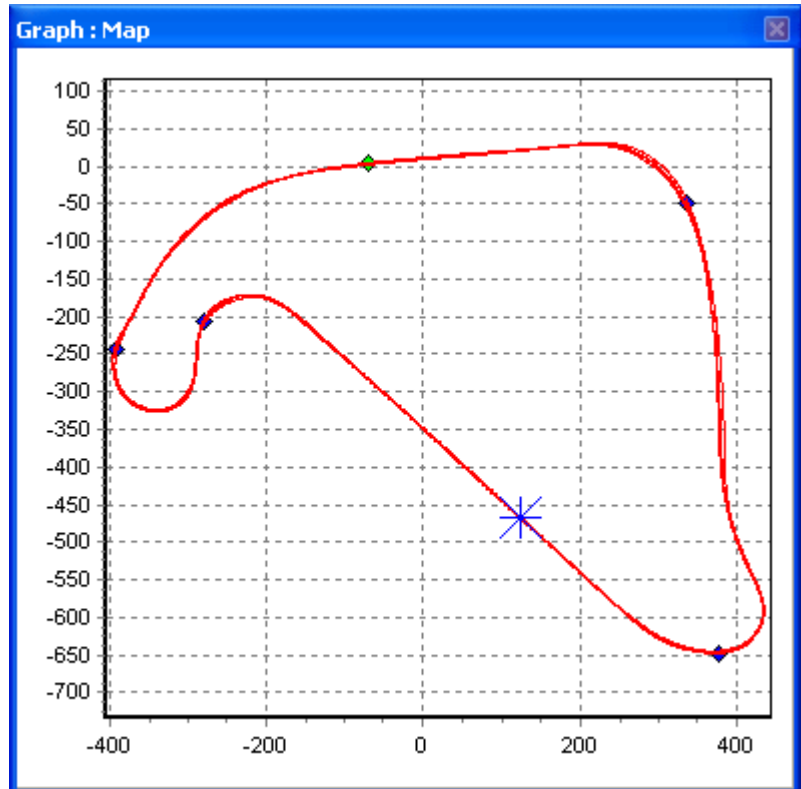
Before you can carry out any lap time analysis you must set a start / finish line in the file you have loaded. The information pertaining to these points can be saved to start / finish files for later use with new data from the same circuit, or for sharing with other PerformanceBox users.

### Defining start / finish lines and splits in the PerformanceBox software

To define a start / finish line, move the cursor in the Graph window to the desired point, then press the **SPACEBAR** to mark a start / finish point, or press the Set Start / Finish button in the Toolbar.

When the cursor is moved in the Graph window the cursor in the Map window follows this movement so you can see where the cursor point relates to on the track. After setting a start / finish line a green dot will then appear in the Map window at the corresponding cursor position.

In addition to the start / finish, up to 20 split points can also be set in the software. However if you save the start / finish and splits to a file for use in a PerformanceBox only the first six will be saved and used by the PerformanceBox. To ensure that only the maximum amount of splits that can be accepted by the PerformanceBox are created, an option to set this maximum is in the 'Start, Finish & Splits' menu.

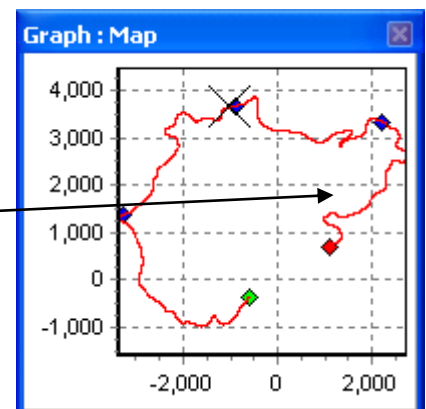


To define the split points, press the **'S'** key at the desired cursor location or select the 'Set Split' option from the 'Start / Finish & Splits' drop down menu.

A separate finish line can be placed when the start line is not also the finish line. This is used in situations such as hill climbs, or for data analysis along a stretch of track that does not end where it starts - such as "Bridge to Gantry" at the Nordschleife in Germany.

Create a finish line by holding the **SHIFT** + **SPACEBAR** at the desired cursor location or by selecting the 'Set finish' button from the 'start / finish & splits' menu.

**Note:** It is important to try to place the start / finish line at a fast part of the circuit to reduce the effects of positional error and to get the best lap timing accuracy.



## Loading and Saving start / finish line and split data

Click on the 'Save' option from the start/finish drop down menu to save to the start / finish and split line information created in the Graph screen to a '.dsf' file. If you want to save more than six splits for software use only then choose the file type '.spl' instead which is only compatible with the software and not PerformanceBox itself.

Click on the 'Load' button in the Start/finish drop down menu to load in a '.dsf' or '.spl' file. The .dsf file must be copied into the DATA directory of the PerformanceBox SD card.

If you have multiple .dsf files from various tracks, it is advisable to keep them stored on the PC in directories named after the track – then the DBOX.dsf file can be loaded into PerformanceBox prior to going to the circuit.

## Clearing start / finish line and split data

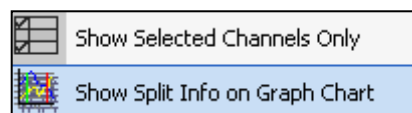
If the current start / finish and split file information needs to be cleared from the PerformanceTools background memory and display screens, select 'Clear All' from the 'Start / Finish & Splits' menu in the Graph screen toolbar, or from the main 'Tools' menu.

## Moving Splits

Splits can be moved by pressing 'M' in the Graph window and entering the number of the split to be moved, or by selecting 'Move split' from the menu.

## Show Split Info on Graph Chart

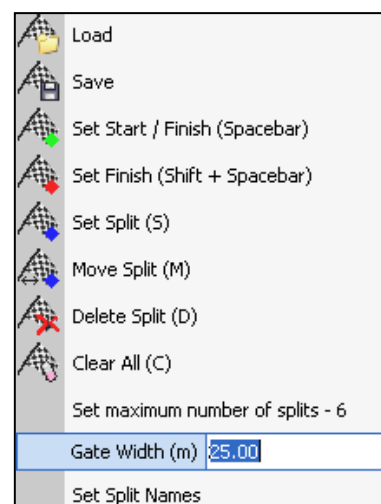
The start / finish and split lines can be hidden from view by selecting the Show Split Info on Graph Chart option. This is available either by right-clicking on any of the three main windows to bring up the context menu, or from the Graph Setup button on the Toolbar. If you choose to hide the start / finish and split lines they will still remain active – the software will still generate lap time data even if the lines are not visible.



## Gate Width

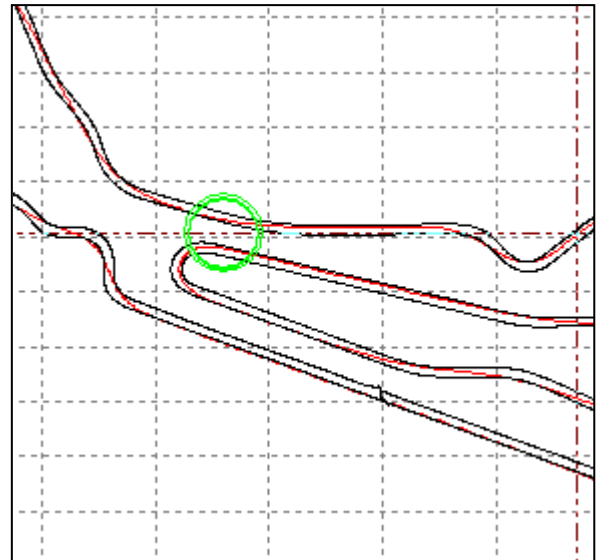
The width of the split gate can be set from the 'Start, Finish & Splits' menu.

If you intend to create a .dsf file in PerformanceBox Tools for use at a circuit, where split points are placed on areas of track which pass very close to each other, it may be necessary to reduce the gate width accordingly: this will ensure that you do not inadvertently drive back through a split point even though you are on a different section of the track. See the example on the next page.



The circled area circled in green shows two sections of track passing by each other by only approximately 20m. If a split point is set on this section, and the virtual gate has been set too wide, the split point could be registered by the PerformanceBox as it passes by in the opposite direction.

Track proximity can be checked in Google Earth™ using the measurement tool if you are in doubt as to how wide the split points should be created.



### Split Names

Split points can be named from the option in the 'Start, Finish & Splits' menu. When the Lap Timing – Split Line option is chosen to display lap times (assuming that split points have been created) an extra column will display the split names.

### Displaying Lap Times

Load the PerformanceBox .dbn file into the software, then define a start / finish line (along with split points and a separate finish line if required) in the manner described above, or by loading a .dsf or .spl file.



**Report Generator - Circuit Test**

Run num	Time(s)	Vmax	Graph run
1	01:27.80	120.69	
2	01:27.90	120.48	
3	01:27.60	116.84	
4	01:28.30	115.97	
5	01:30.70	125.07	
6	01:27.30	115.92	
7	01:26.40	117.13	
8	01:26.10	121.51	
9	01:26.30	120.73	
10	01:34.80	117.82	

Press the Lap Timing button on the Toolbar. The software scans the currently loaded file, extracts lap times and Vmax for each logged lap, and displays the data in a results window.

Note: The fastest lap in the results table will be highlighted for quick and easy recognition (see example left.)

### Including Split times

If you have set up split points in addition to the start / finish and wish to see the split times displayed, click on the right hand arrow on the Lap timing button, then from the drop down menu select 'Lap Timing – Split Line'. The results table will show the split times as well as the Lap times in the file.

Naming the split files (see 'Split Names' above) from the option in the 'Start, Finish & Splits' menu will result in the split names being displayed when the 'Lap Timing – Split Line' option is chosen – see the example on the next page, which shows the split points that have been set on corners at Silverstone Circuit and named accordingly.

## Exporting Lap Time Results

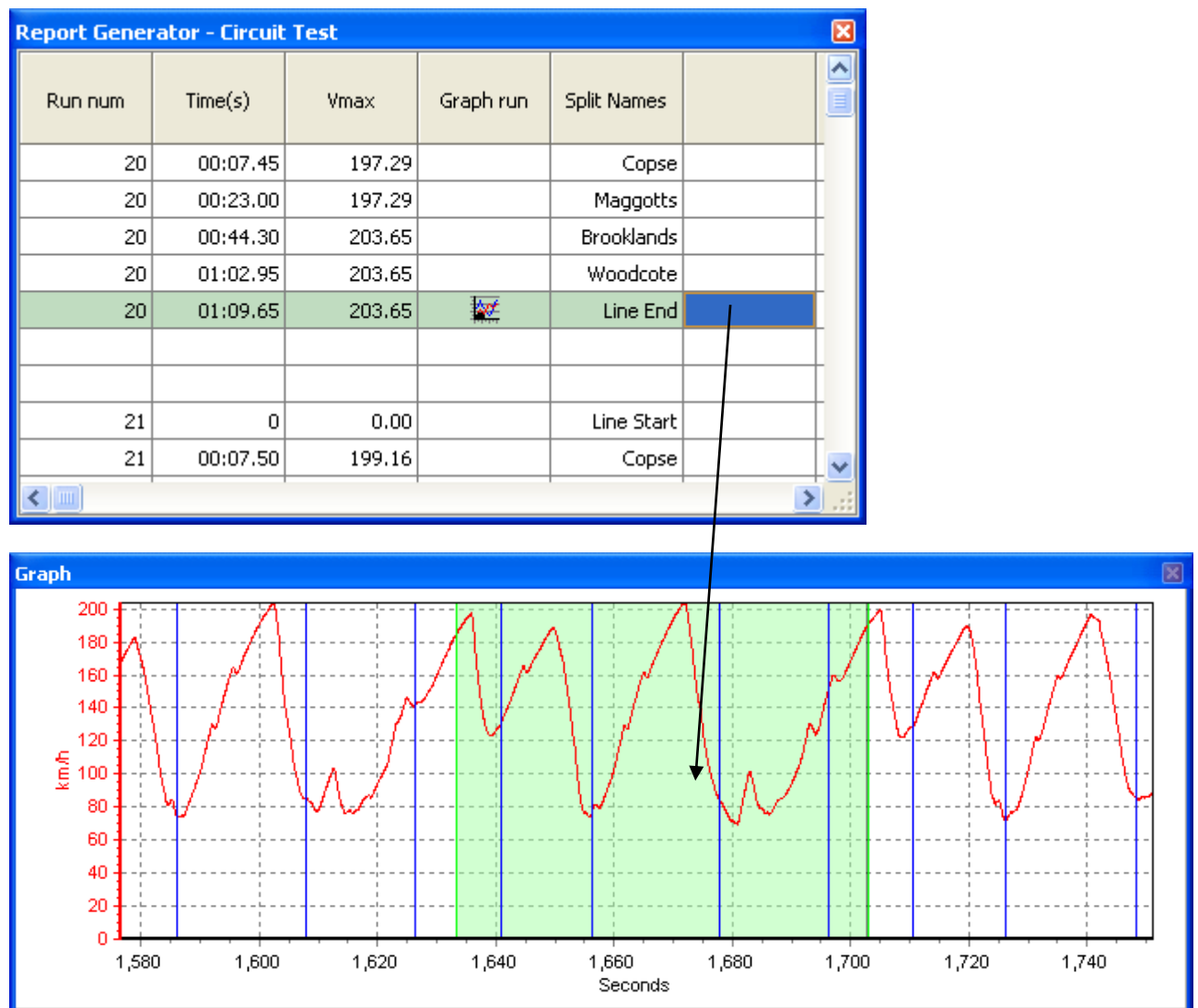
The generated results can be exported into other software as a variety of document types by clicking the Export Results button on the Toolbar and selecting the required file type.

## Clearing Lap Time Results


To clear all the results in the results window, click the 'Clear Results' button on the Toolbar.

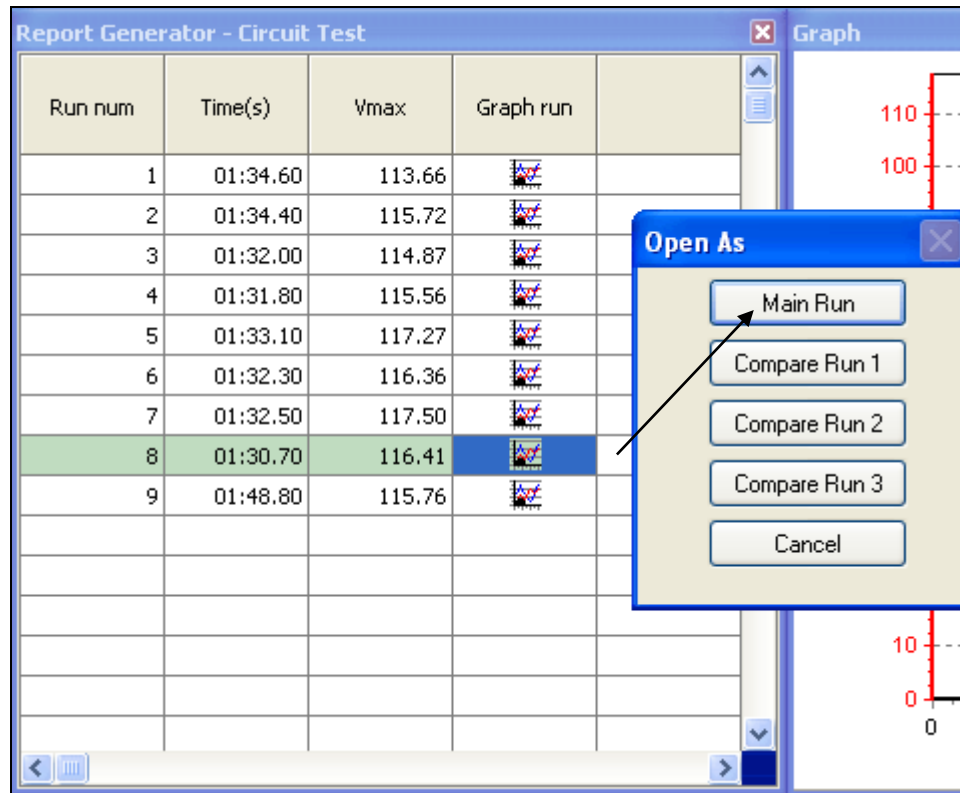
## Lap Highlight

With lap data being displayed in the 'Report Generator – Circuit Test' window, individual laps are highlighted in the main Graph screen by clicking on any of the values at the bottom of individual lap/split data tables:

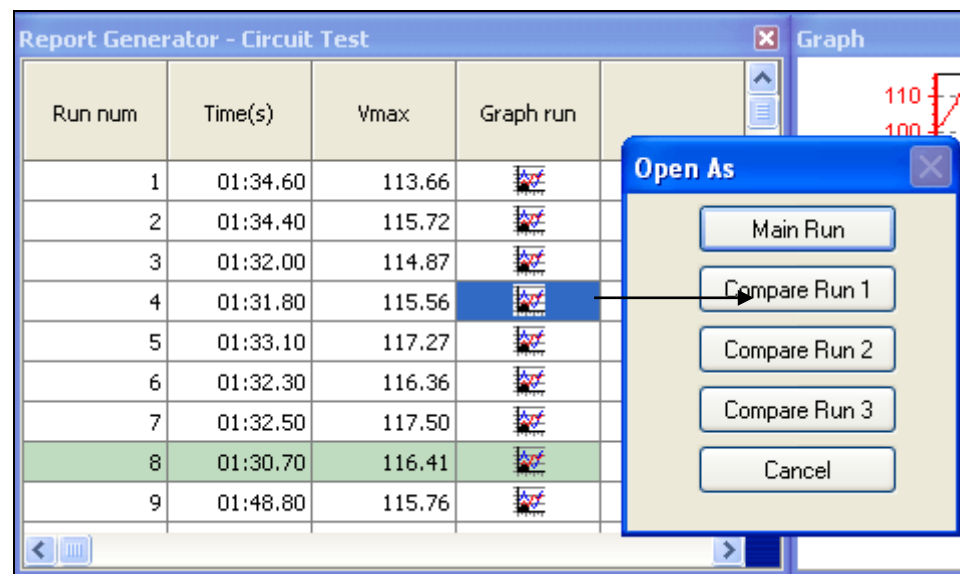


### Loading and comparing individual laps from the same file

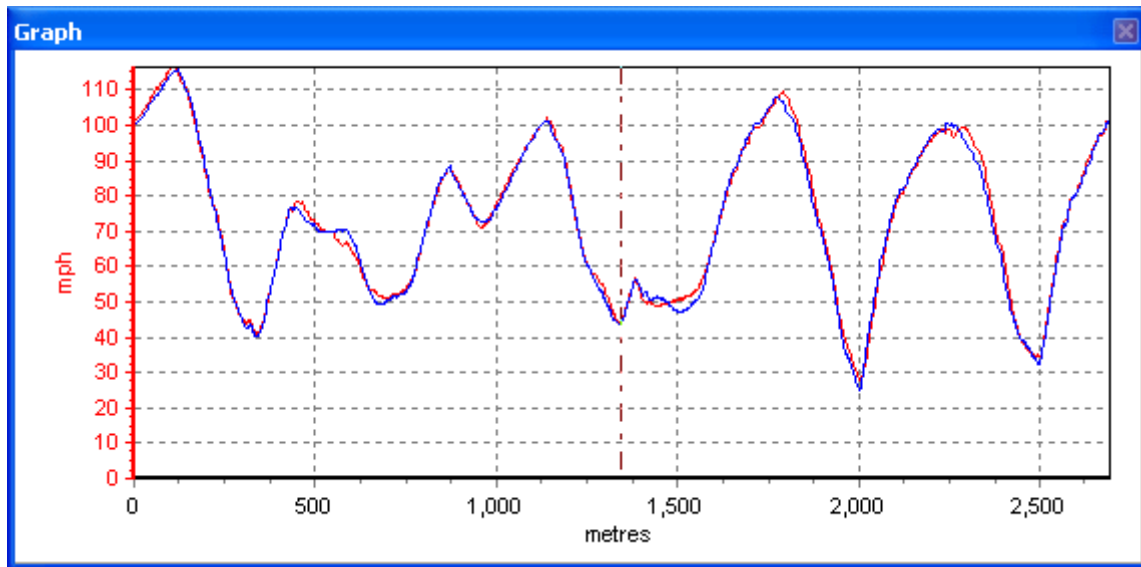
Individual laps from the loaded file can be compared to each other in the main Graph and Graph:Map windows. Each lap shown in the Lap timing table has a Graph Icon  associated with it in the right hand column. Clicking one of these buttons allows that lap to be individually graphed:



You will now have one individual lap displayed in the Graph window, and one corresponding column in the Graph:Data window. From the results window, select a compare lap by clicking a different Graph Icon, in this example the next fastest lap:



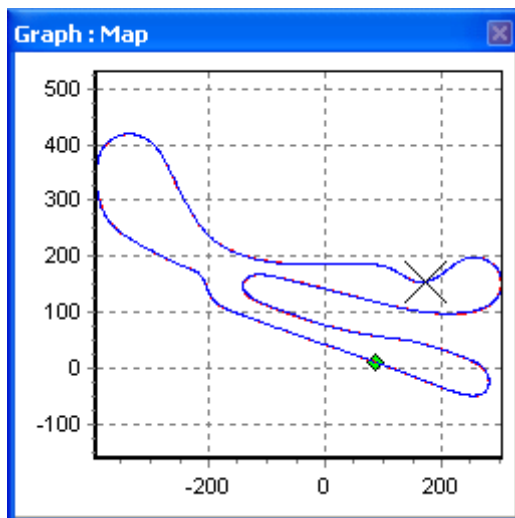
Result in the Graph window:



The main run is in red, the compare run in blue. In this instance the two laps have been performed very consistently: the peaks and troughs, which indicate the braking and acceleration points, sit on top of each other almost every time.

Note that the Graph window's X axis is set to distance – this makes direct comparison of braking and acceleration points possible as the distance covered on each lap will be virtually identical. If comparison laps are loaded when the Graph window's X axis is set to time, the data is very much more difficult to analyse.

Result in the Graph:Map window:



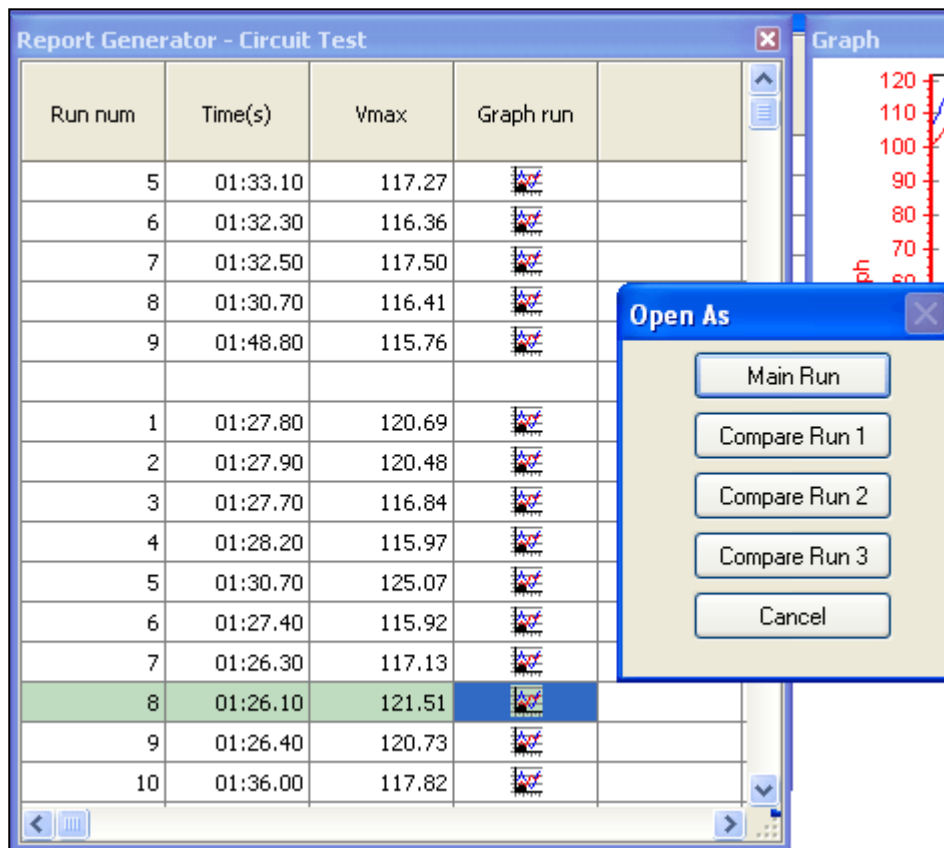
Note how in this instance, the driver's lines have barely deviated between the two laps – the main run in red is only just visible below the compare run in blue.

Three compare laps can be loaded in total, allowing for comparison of four laps at once (the main run plus compare runs 1, 2, and 3.) Each compare lap will have corresponding data displayed in an individual column in the Graph:Data window. To change the colours of each run, open the Channel Setup window and pick the colours required from the Run x columns.

## Loading and comparing individual laps from different files

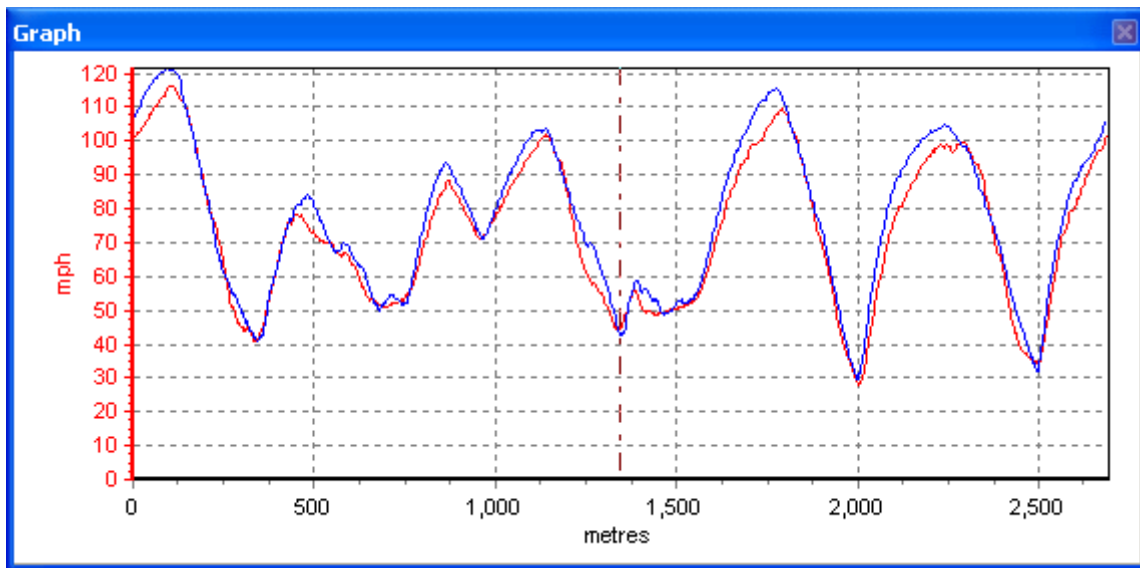
Lap data created by individual users, and therefore not logged in one .dbn file, can also be loaded and compared:

- Load the first file containing the lap data, set the start / finish line, and click the lap timing button. The laps will appear in the results window.
- Load the next file to be analysed – ensure that the results from the first file have not been cleared, and do not load the second file as a compare file.
- Click the laptiming button again and the second set of lap times will appear in the results window.
- The individual laps can now be chosen as Main and Compare files in the same manner as before:



In this example, the main run chosen is lap 8 from the first set of times (the same fastest lap from the previous example.) The Compare Run 1 is lap 8 from another file, which is again the fastest lap. See below to view the differences in performance as shown in the Graph window.

Result in the Graph window:



The main run (1:30.70 – the fastest lap from the previous example) is in red, the compare run (1:26.10) in blue. Note in this instance how there are differences in the peaks and troughs of the speed plots, indicating that the faster driver carried more speed before braking, and accelerated harder.



## Replaying Laps (DriftBox Tools Only)

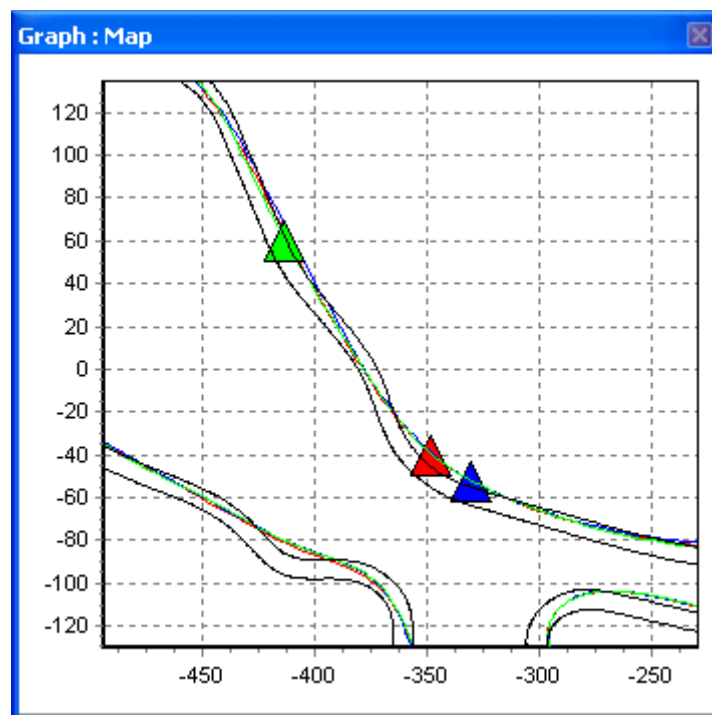
If you have recorded laps loaded into the software you can replay them, by clicking on the Replay button. By default the cursor will move through the Graph window and round the path in the Graph:Map window at the same speed at which the file was recorded. However by clicking on the arrow to the right of the button a faster replay speed can be chosen.



When the Replay button is pressed the Drift Meter and Sector windows will also appear, but these can be closed if not required.

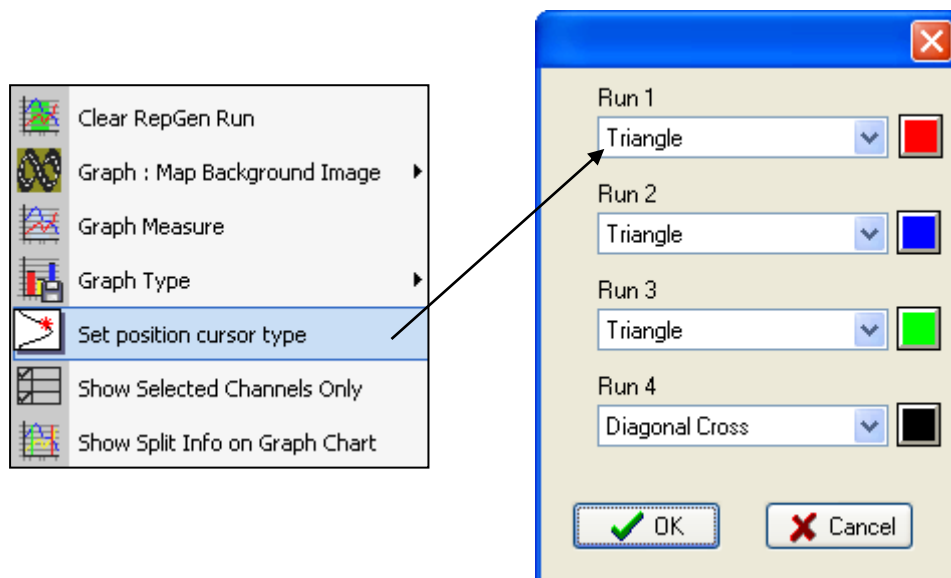
Whilst the file is being replayed the cursor in the Graph:Map will move around the path taken. If more than one lap is currently being viewed there will be a cursor for each run, and these will move around the circuit in a manner according to how the graph window x axis has been set: if the Graph window is displaying speed over distance, the cursors will move around the circuit together, as the distance covered during each lap will be virtually identical. However, if the Graph window is set to speed over time then the cursors will travel according to the actual lap times.

Note in this example (below) how the green triangle is behind the red and blue triangles – this is a snapshot of three individual laps being replayed when the Graph screen has been set to speed over time. This feature allows for 'live' analysis of where a driver is gaining or losing time, and on which part of the circuit.



### Set Position Cursor Type

The cursors themselves are configurable: right click on any of the main windows (Graph, Data or Map) to bring up the context menu (or click on the Graph Setup button on the Toolbar.) Select 'Set Position Cursor Type' and choose the style and colour required for each cursor. Each run can now display a different shape and colour of position cursor.



## Circuit Overlays

A circuit overlay is a file created to map the outer and inner bounds of a circuit, and is a useful aid in drive-line analysis - comparison of lines taken by different drivers can help to improve lap times.

**NOTE:** A circuit overlay is only a feature that can be used in software post-processing – it is not vital that it is created or obtained prior to visiting a circuit unless specific drive line analysis, that requires the track boundaries, is going to be carried out between lap sessions.

### Creating a Circuit Overlay

There are two ways that an overlay file can be created: either by driving around the circuit, or by creating a .kml file in Google Earth and importing it into PerformanceBox Tools.

### Creating an Overlay File by Driving the Circuit

**Note: It is best to use an external antenna to get maximum positional accuracy**

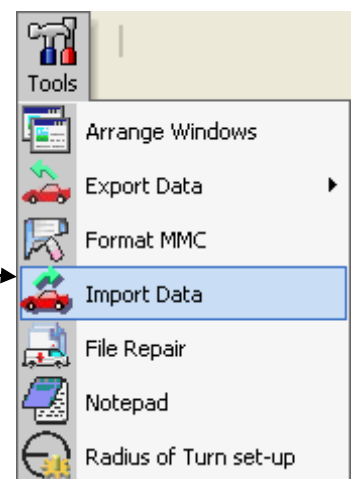
- Power up PerformanceBox and let it acquire satellites for at least 5 minutes.
- Drive to the left hand side of the start of the circuit.
- Place the antenna on the left hand side of the roof.
- Insert the SD card, ready for logging.
- Drive round the left hand side of the circuit.
- Stop back at the place you started.
- Move the antenna from the left hand side of the roof to the right hand side slowly, being careful not to cover the aerial – let it see the sky at all times.
- Drive at right angles across the track to the opposite side.
- Drive round the right hand side of the circuit.
- Load the logged file from the SD card using 'File' -> 'Load All'
- Save using 'Save', select 'Save as type' and pick 'Circuit file' (.cir').

### Creating an Overlay File in Google Earth™

Please refer to the Google Earth help files for instructions on creating paths in the software. Once you have plotted a path along the inside and outside of your chosen track, it must be saved as a .kml file. This can then be imported into PerformanceBox Tools by clicking on

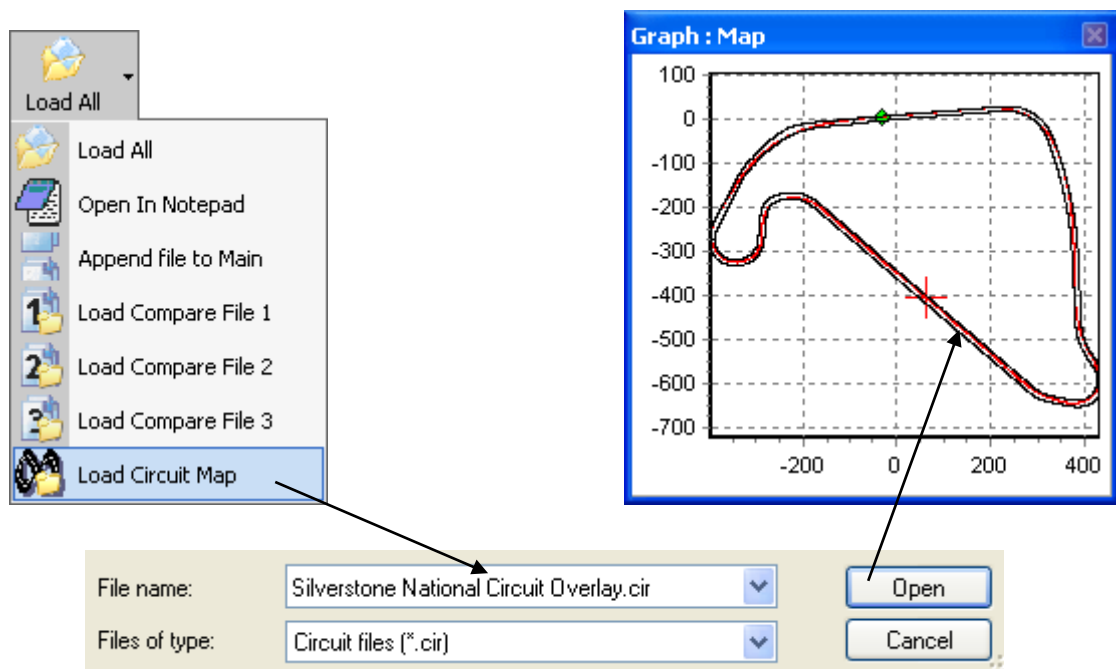
**TOOLS>Import Data**

Once the .kml file has been imported, it can be re-saved as a .cir file for later use with lap data from the circuit. See page 69 for more information about importing .kml files.

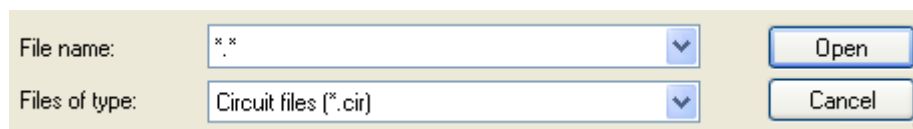


### Loading a Circuit Overlay File

The .cir file can now be loaded into the Graph screen and viewed in the Map window. To do this, first load a file logged from the circuit in question, and then click on the drop-down arrow next to the Load All button. Select Load Circuit Map, and choose the .cir file you have created:



If you want to load a .cir file into PerformanceBox Tools on its own, click Load All and then type \*.\* in the File name field:



You can then select the .cir file and it will load like a normal .dbn file.

A library of circuit overlay files is available from the PerformanceBox website. If you would like to share circuit files you have created please contact us and they will be added to those already available.

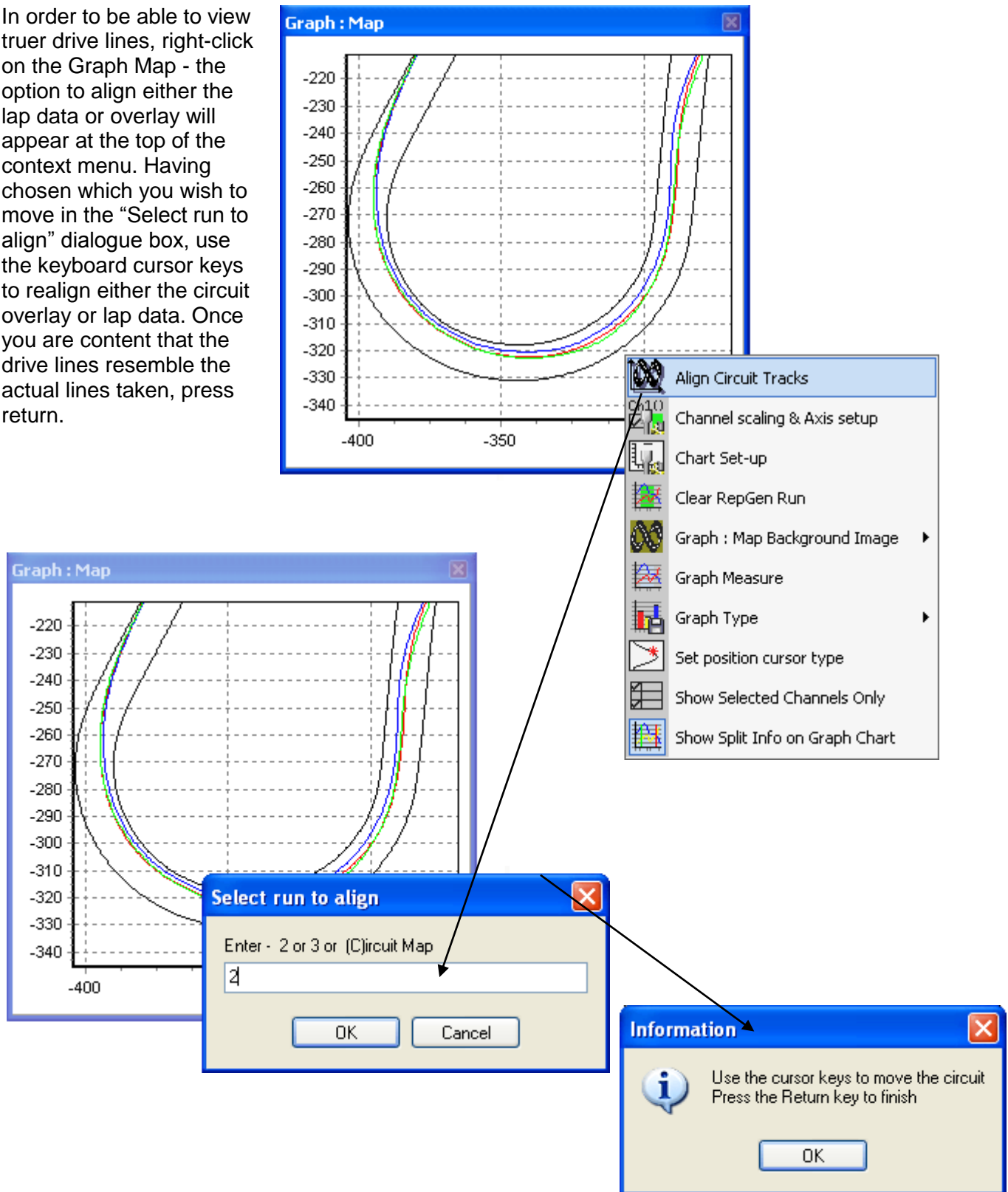
### Aligning Circuit Overlays and Laps

The standard positional accuracy of PerformanceBox is 5m 95% CEP for Longitude and Latitude. CEP = circle error probable.

95% CEP means 95% of the time the position readings will be within a 5m diameter circle of the true position. This error is due to the changing state of the ionosphere, constantly changing the time taken for the satellite signals to reach the earth. This means that overlaid laps may appear to miss the edges of the track, especially if the laps or overlay were logged several hours apart.

The Align Circuit Tracks feature allows post-processing analysis to counter some of this positional error, by rearranging the driving lines or circuit overlay in the Graph:Map window. This can be especially useful if the circuit overlay file has been created in Google Earth, which is not always 100% positionally accurate (a good example of this, at the time of going to press, is the Paul Ricard circuit in the south of France – the Google Earth image is approximately 200m adrift of its true position.) It can also help to combat the effects of positional shift that have occurred between sessions at a circuit, such as morning/afternoon or one day to another.

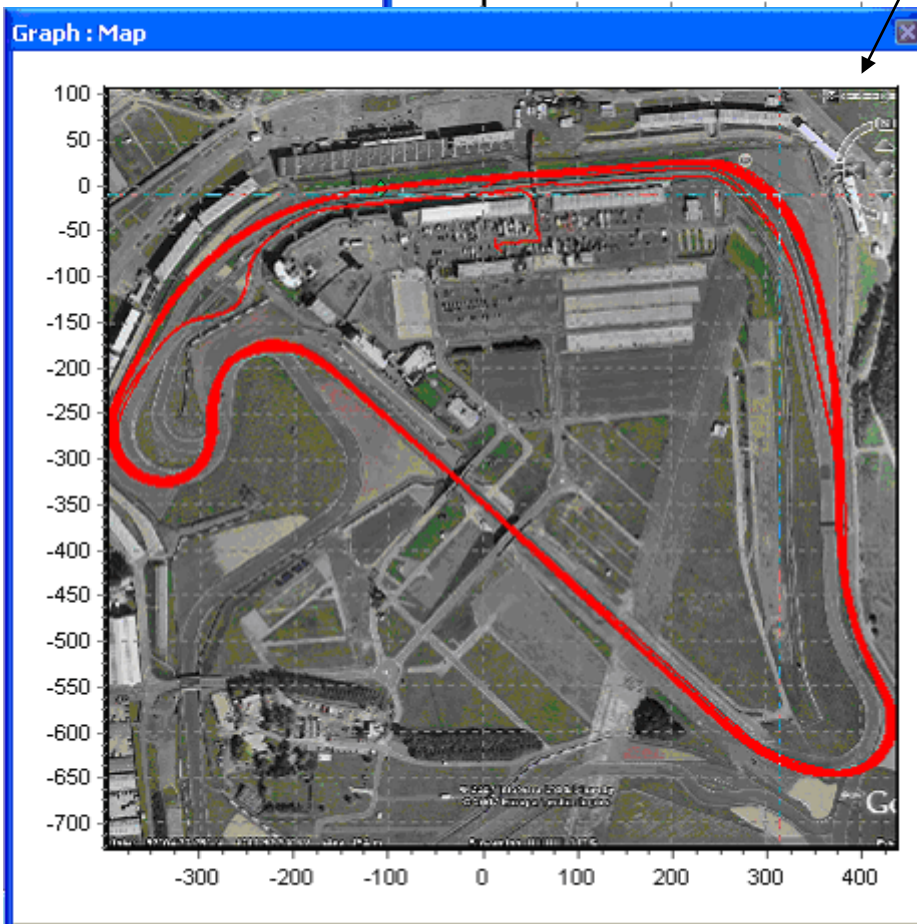
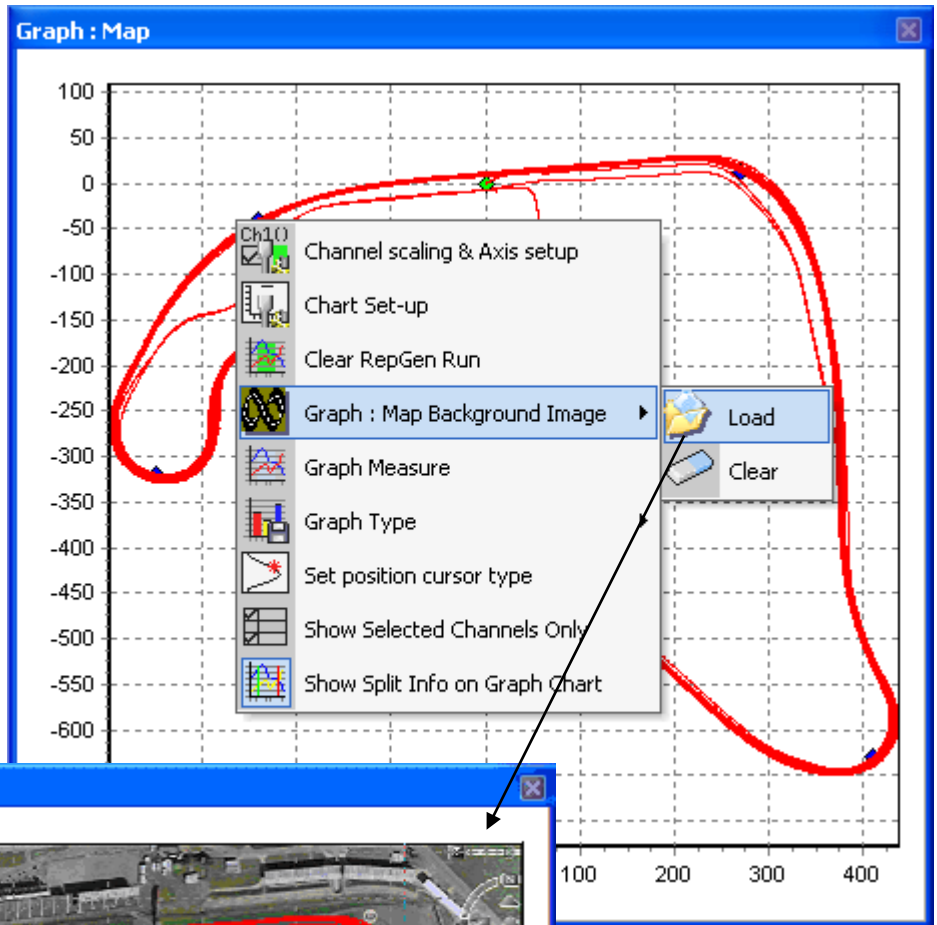
In order to be able to view truer drive lines, right-click on the Graph Map - the option to align either the lap data or overlay will appear at the top of the context menu. Having chosen which you wish to move in the "Select run to align" dialogue box, use the keyboard cursor keys to realign either the circuit overlay or lap data. Once you are content that the drive lines resemble the actual lines taken, press return.



## Importing a background image in to the Graph Map

You can import any image of your choosing into the Graph Map by right-clicking on either the Graph:Data, Graph:Map, or Graph windows and selecting the Graph: Map Background Image>Load option:

The image will need to be resized and scaled to fit correctly in the Graph:Map window.



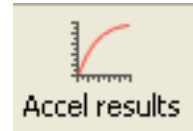
## Performance Results

Acceleration and deceleration results can be easily extracted from your logged data by using the various performance results tools. These are available by clicking on the 'Accel results' and 'Decel results' buttons on the Toolbar.

You can extract speed or distance data for acceleration and deceleration runs. Most of the tests use standard parameters (such as 0-60 or 0-100) but custom results can also be produced.

### Producing Acceleration Results

Acceleration data can be produced and shown in a results table from the currently loaded data file by selecting one of the acceleration test options within the 'Accel results' drop down menu. Click on the 'Accel results' button to open a list of the following options:



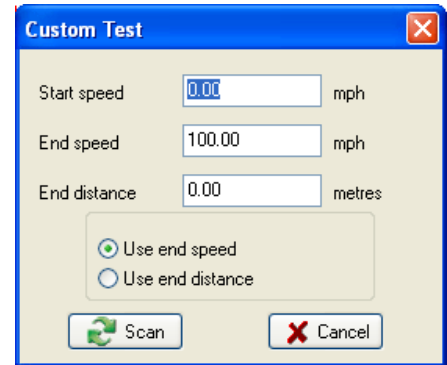
- **0-VMax:** This will tabulate speed, time and distance data, starting each time the velocity data has a value of zero up to the maximum speed reached during that acceleration period.
- **0-100 kmh (0-60 mph):** This will tabulate speed, time and distance data, starting each time the velocity data goes from zero up to a speed of 100 km/h reached during that acceleration period.
- **0-160 kmh (0-100 mph):** This will tabulate speed, time and distance data each time the velocity data goes from zero up to a speed of 160 km/h reached during that acceleration period.
- **0-160-0 kmh (0-100-0 mph):** This will tabulate speed, time and distance data, starting each time the velocity data goes from zero up to a speed of 160 km/h then returning to 0 km/h reached during that acceleration - deceleration period.
- **100-200 kmh (60-130 mph):** This will tabulate speed, time and distance data, starting each time the velocity data goes from 100 kmh up to a speed of 200 km/h reached during that acceleration period.
- **440 m:** This will tabulate speed, time and distance data, starting from zero to a total distance of 440 m.
- **18.7 m:** This will tabulate speed, time and distance data, starting from zero to a total distance of 18.7 m.
- **100 m:** This will tabulate speed, time and distance data, starting from zero to a total distance of 100 m.
- **Custom:** This will tabulate speed, time and distance data, starting over a custom defined speed range e.g. 0-100-0 kmh.

For each of the test ranges the results table will show Speed, Time, and Distance in 10Kph or 10Mph steps.



## Creating a Custom Acceleration test

1. Click on the Custom option in the Accel test drop down list. This will then open the following window:
2. Enter the speed of the start condition.
3. Set the end condition option, speed or distance.
4. Enter a value for the chosen End condition.
5. Press Scan to scan the loaded file and produce a table of results for all tests fitting the custom test setup.



The 'Custom Test' dialog box for acceleration tests. It has a blue title bar with a close button. The main area is light beige. It contains three input fields: 'Start speed' with a value of 0.00 and unit 'mph', 'End speed' with a value of 100.00 and unit 'mph', and 'End distance' with a value of 0.00 and unit 'metres'. Below these fields are two radio buttons: 'Use end speed' (which is selected) and 'Use end distance'. At the bottom are two buttons: 'Scan' with a green circular arrow icon and 'Cancel' with a red 'X' icon.

## Producing Deceleration Results

Deceleration data can be produced and shown in a results table from the currently loaded data file by selecting one of the deceleration test options within the 'Decel results' drop down menu. Click on the 'Decel results' button to open a list of the following options:



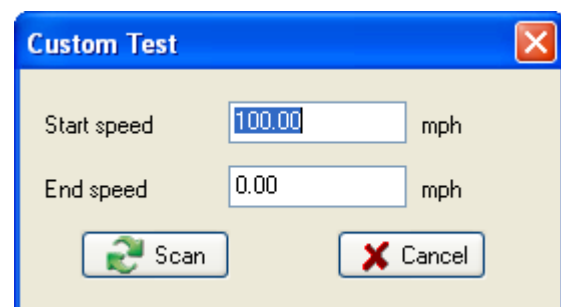
- **70-0 kmh:** This will output the time and distance taken to decelerate from an initial speed of 70 kmh to 0 kmh.
- **50-0 kmh:** This will output the time and distance taken to decelerate from an initial speed of 50 kmh to 0 kmh.
- **Custom:** This will output the time and distance taken to decelerate from one user definable initial speed to another, e.g. 100 kmh – 0 kmh.

In all of the Decel tests if more than one run is performed an average distance is also calculated and shown.

Any of the Runs on the table can be omitted from the average by deselecting the tick in the use box.

## Creating a Custom Deceleration test

1. Click on the Custom option in the Decel test drop down list. This will then open the following window:
2. Enter the speed of the start condition
3. Set the speed of the end condition.
4. Press Scan to scan the loaded file and produce a table of results for all tests fitting the custom test setup.



The 'Custom Test' dialog box for deceleration tests. It has a blue title bar with a close button. The main area is light beige. It contains two input fields: 'Start speed' with a value of 100.00 and unit 'mph', and 'End speed' with a value of 0.00 and unit 'mph'. At the bottom are two buttons: 'Scan' with a green circular arrow icon and 'Cancel' with a red 'X' icon.



## Additional Data Analysis Features

The software has additional features to aid in data analysis, explained in this section. Many of these features can be used as a part of the analysis whilst producing Performance results.

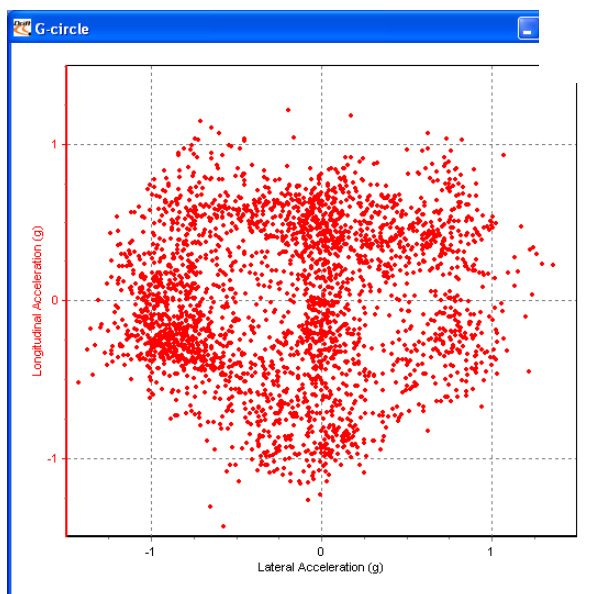
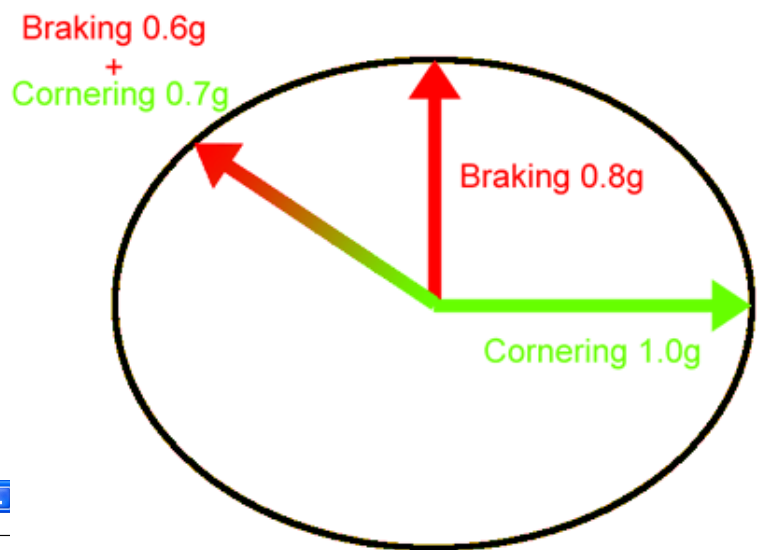
### The G-Circle

Pressing the G-Circle button produces a plot of the Longitudinal vs Latitudinal Acceleration data.

A G-circle (or G-G Plot as it is sometimes known) gives a complete overview of how the tyres are being used. There is a limit to how much G a tyre can generate whilst cornering, and a set amount it can generate whilst braking/accelerating. There is often a small difference between these two values, so you may be able to pull more G in braking than in cornering or vice versa.

However, if you try and combine cornering whilst braking, then these limits are reduced. The idea behind a G-circle is that it tells you how these can be combined. To the right is a theoretical perfect G-circle for a sample tyre.

You can see that the maximum cornering force is 1g, and max braking is 0.8g. However, if you are already braking at 0.6g, then your max cornering force is only 0.7g.



Plotting out your own G-circle lets you know if you are exploiting your tyres' true potential.

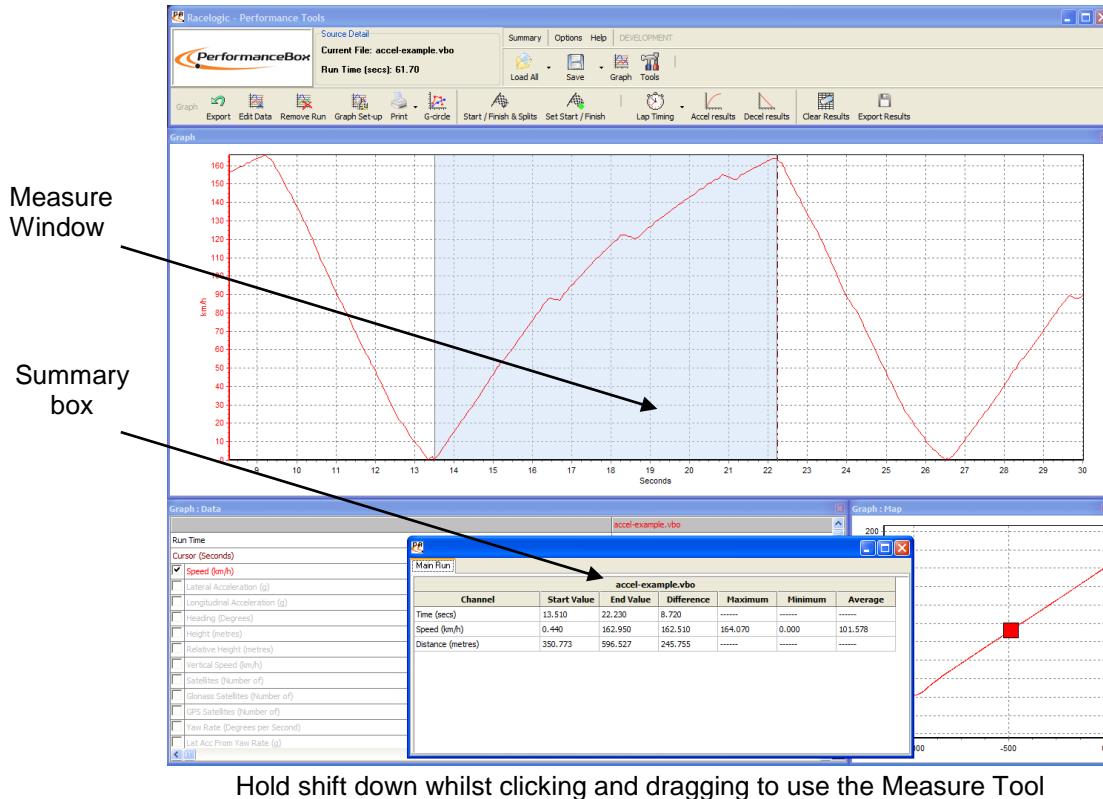
Ideally you should get a symmetrical plot, but bear in mind that you can almost always generate more G under braking than acceleration, so the accelerating area will be shallower than the braking part of the circle.

The example on the left shows a very good spread of data indicating that the rider (motorcycle) was able to accelerate and decelerate whilst cornering to a very good level, creating a symmetrical plot.

The G-Circle can be examined more closely by zooming in as you do with the Graph:Map, and by right-click-dragging the current field of view can be moved.

## Graph Measure Tool

This tool can be used to highlight a section of data in the Graph window and produce a table that summarises the data captured in the window:



The area of data that is displayed in the table is highlighted in blue in the Graph window. This is often useful for quickly establishing average values between two points in a file. In the screen shot example above the first gear section of the acceleration curve has been highlighted and it can be seen from the table that an average Longitudinal Acceleration during first gear is easily seen.

## Creating a Measure Tool Window

To highlight a section in the graph window, move the cursor to the start of the section you wish to highlight. Then place the mouse pointer over the cursor position and press and hold the 'Shift' key, then click and hold the left mouse button. Keep the left mouse button pressed and move the mouse cursor right to drag out a blue highlighted area. At the end of the area you wish to highlight, release the left mouse button. On release of the left mouse button a table of results for all channels in the highlighted area appears as in the screenshot above.

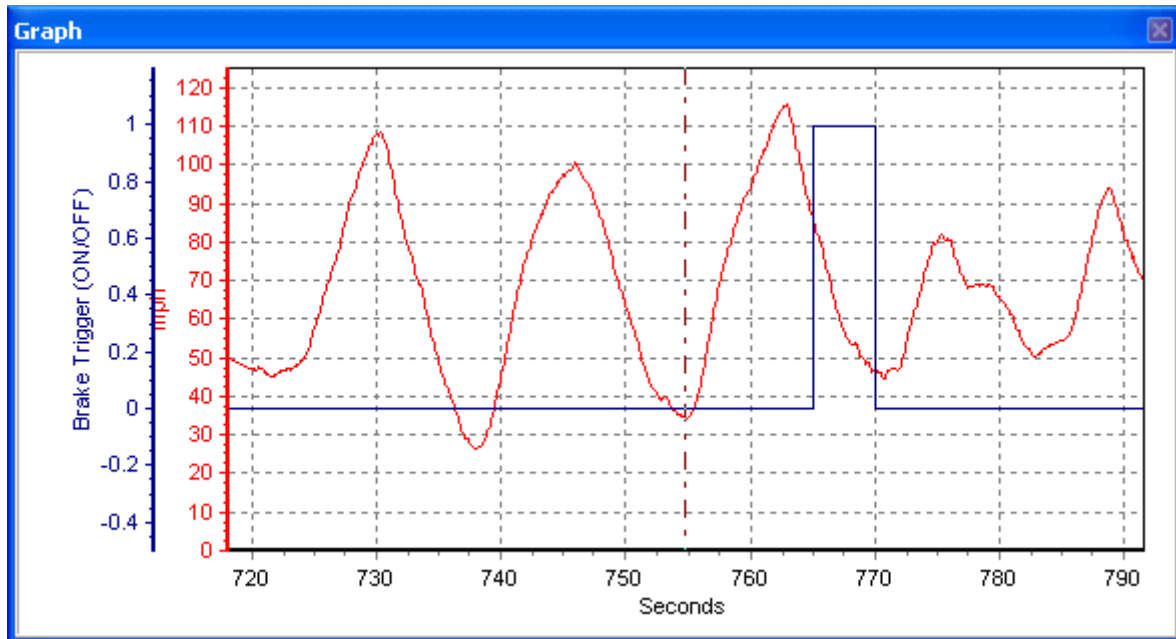
## Saving and Printing the Measure Tool Data Table

Click the 'Save to file' icon in the Measure Tool toolbar to save the data in the table in one of two formats, .csv or '.txt'. Click the 'Print' icon in the Measure Tool toolbar to print the table.

## Event Marking

Event Marking allows for the Brake Trigger channel to display a change in state – an ‘event’ in a logged file which can be useful for measuring distances etc.

The Brake Trigger channel defaults to a value of 0, until the an event is marked at which point the value will become 1. The Brake Trigger channel should be set up in the software so that this can be easily observed, by assigning its axis in a manner such as this:



Note how in the example above, the axis has been set from  $-0.5$  to  $1.2$  – this allows for the change in values from 0 to 1 to be very obvious on the graph. If you do not want the constant value of 0 to be displayed, set the lower axis level to 0 – the event mark will then be displayed as a ‘spike’ in the graph.

The example above demonstrates an event created by the user holding the OK button on the PerformanceBox for five seconds: the event will continue to be recorded for as long as the button is pressed.

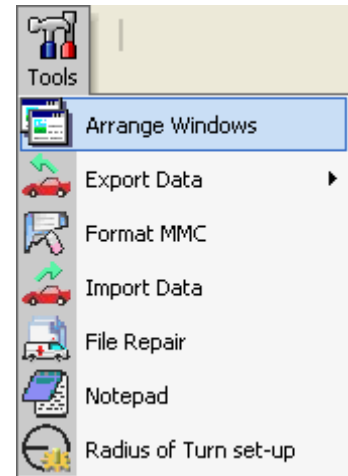
## Tools

Clicking on the 'Tools' icon on the Toolbar will reveal a drop-down list containing a number of useful features, such as File Repair and the Exporting Data to Mapping Software facility.

### Arrange Windows

The use of different screen resolutions or multiple screens can cause PerformanceBox Tools windows to be placed out side of the default screen size, which is then not viewable when the default screen is used.

This facility allows any PerformanceBox Tools windows that have been lost off the visible screen to be located back into the visible screen area.



### Export Data

This option allows the location data stored on a '.dbn' file to be converted into a '.txt' file that may be used with Google Earth, Microsoft AutoRoute and Microsoft Streets & Trips, to show the vehicle's path in the mapping software. This option is also used to create a file that can be used in Track Vision software.

### Exporting Data to Google Earth™

Data can be exported to Google Earth by selecting the Tools menu and choosing the Google Earth option. The resultant file .kml is recognised by the Google Earth software and allows data to be viewed on the satellite images.

Upon exporting the file, you will be prompted for an X and Y offset: this allows for data to be correctly aligned on the satellite images – much of Google Earth is not exactly accurate so some exported files, such as circuit overlays, may 'miss' the edges of the track. The offset allows for this error to be corrected.

NOTE: if your data file has more than 65,000 sample points the PerformanceBox software will automatically sub-sample the file to ensure the entire length of the file is represented in the exported file. Google Earth cannot display files of greater than 65,000 samples.

### Exporting to Mapping Software (AutoRoute or Streets & Trips)

Load the '.dbn' file into PerformanceBox Tools using the 'Load All' button from the main toolbar, then click on the 'Export Data To Mapping Software' option in the 'Tools' menu.

A small selection box will appear, in which the export rate can be chosen.

## Importing the Mapping file into AutoRoute or Streets & Trips

Open AutoRoute or Street & Trips. Click on 'Data' and then select 'Import Data Wizard'. When prompted, browse for the '.txt' file you have just created with PerformanceBox Tools and open it, then select 'Comma' as the delimiter and click 'Next'. In column F2 select Latitude as the column name from the drop down menu. In column F3 select Longitude as the column name from the drop down menu and then click 'Finish'. The program then generates a map of your data location and places markers on the map at every data point that was specified when the output file was, for example once every second.

## Exporting To Track Vision

This option creates a csv file with the data in a format that Track Vision software can use.

## Formatting MMC/SD Cards

Any new MMC/SD cards are formatted in the correct format suitable for PerformanceBox and there is no need to format the card. You can delete any files created on the card by PerformanceBox through your computer when connected to PerformanceBox or when the card is inserted in a card reader connected to your computer.

However if your card has a problem and the card needs to be formatted it is best to do this through the PerformanceBox Tools software SD card formatting facility.

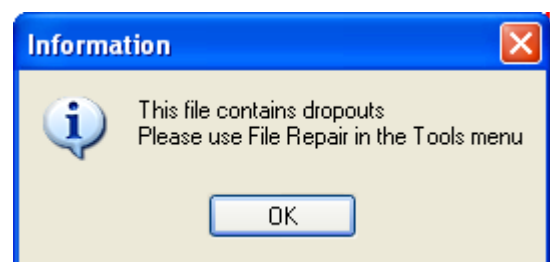
Note: that the card will need to be inserted into a suitable card reader in order to format it; it cannot be formatted through the PerformanceBox and USB cable.

## Import Data

Data created in Google Earth™ as a .kml file can be imported into PerformanceTools. This is particularly useful for creating circuit overlays without having to physically drive the track (see 'Creating a Circuit Overlay' on page 67.) Only .kml files can be imported, so when saving paths created in Google Earth it is necessary to ensure the correct file type is chosen (the other option is .kmz, and is not a valid import file type for PerformanceBox Tools.)

## File Repair

If the file being loaded into the software contains dropped sample data (caused by travelling under a bridge, for example) then Performance Tools will prompt you to repair the file. This can be done by clicking on the Tools menu and choosing File Repair. Areas of dropped samples will be then repaired.



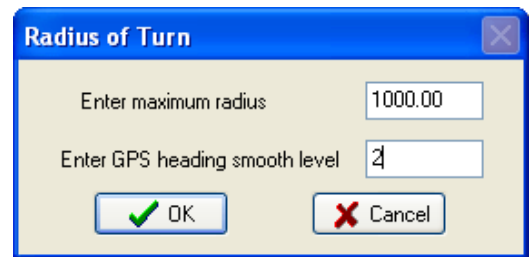
Once the repair has been carried out is advisable to save the file and reload it. This will ensure that all channels are correctly aligned in the Graph screen. Areas that have been repaired will be represented in the Number of Satellites channel as 0.

A repaired file may still display the Dropouts message upon being reloaded. This is generally due to the dropouts occurring at a time when the number of available satellites is so low that an effective repair cannot be carried out (such as travelling through a tunnel.)

## Radius of Turn set-up

Click this option to open the Radius of Turn setup window, in which the smoothing level and maximum radius value can be set.

When smoothing is applied to data, the value of an individual sample point is affected by samples around it. As the effective Radius of a straight line is infinite, the very high samples of data before and after a corner can adversely affect the values of Radius in a corner. To reduce this effect it is advised to set a maximum radius value to a fraction higher than the maximum radius of the corners you are examining.

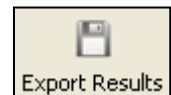


## Other Features

Some useful features that apply to the whole of the PerformanceTools software have been included above the main toolbar. These are described in the following section.

## Export Results

All Performance or Lap Time results can be exported by clicking on the Export Results button on the Toolbar. Results can be exported in a variety of formats such as Excel or Word document files.



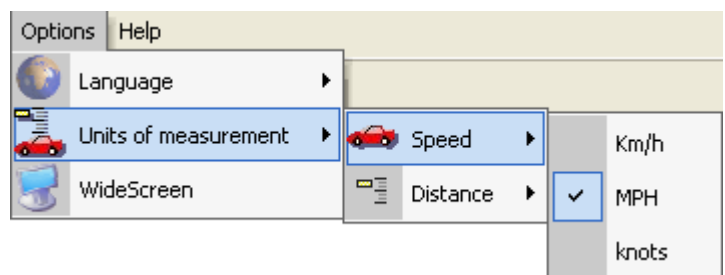
## Summary

You can view basic but important information about the main '.dbn' file loaded into the PerformanceTools software by selecting Summary from the menu. The information displayed includes information such as the time at which the file was logged and its duration, as well as any errors, such as loss of satellites during the file.

This summary may be printed or e-mailed using the icons at the top of the window.

## Units of Measurement

The 'Units of Measurement' menu allows you to set the velocity units to km/h or mph and the distance units to metres or feet. Once the units of measurement have been changed the file must be reloaded for the changes to take effect.



## Help

This menu allows you to view basic information about the PerformanceTools software. It also provides a quick link to the user manual.

# Firmware Upgrades

Firmware refers to the operating software inside PerformanceBox. The firmware is responsible for all of the functions within PerformanceBox and from time to time, firmware updates will be released by Racelogic to improve or enhance the way that PerformanceBox works. The latest firmware will always be available on the PerformanceBox website, in the downloads section:

<http://www.vboxmotorsport.co.uk/firmware>

It is recommended to check the web site periodically for updates. PerformanceBox upgrade files have a '.ruf' file extension. To upgrade the PerformanceBox firmware, please follow these instructions:

- Download the latest firmware file from the website and copy this file onto your PC.
- Ensure that you have the latest version of PerformanceTools software installed on your PC.
- With the PerformanceBox switched off, connect your it to the PC with the USB cable.
- Power on the PerformanceBox whilst holding down the MODE button – instead of the usual splash screen you will see the Upgrader screen:



- Double-click on the '.ruf' upgrade file. The progress bar will indicate the status of the upgrade.
- Once the upgrade is complete the PerformanceBox will restart and you can remove the USB cable.

During the upgrade process an upgrade log file will be created. This log file can be emailed to the support address on the next page should any problems arise.

If you have any questions regarding the upgrade procedure of PerformanceBox, please do not hesitate to contact your local Distributor.

# Specification

GPS			
<b>Velocity</b>		<b>Distance</b>	
Accuracy	0.2 Km/h	Accuracy	0.05% (<50 cm per Km)
Units	Km/h or Mph	Units	Metres / Feet
Update rate	10 Hz	Update rate	10 Hz
Maximum velocity	1000 Mph	Resolution	1 cm
Minimum velocity	0.1 Km/h	Height accuracy	10 metres    95% CEP**
Resolution	0.01 Km/h		
<b>Absolute Positioning</b>		<b>Time</b>	
Accuracy	5m 95% CEP**	Resolution	0.1 s
Update rate	10 Hz	Accuracy	0.1 s
Resolution	1 cm		
<b>Heading</b>		<b>Power</b>	
Resolution	0.01°	Input voltage range	6 – 28 V DC
Accuracy	0.2°	Current	Typically 100 mA
<b>Acceleration</b>		<b>Environmental and Physical</b>	
Accuracy	1%	Weight	225 grams
Maximum	4 G	Size	113 mm x 63 mm x 93 mm
Resolution	0.01 G	Operating temperature	-20°C to +50°C
Update rate	10 Hz	Storage temperature	-30°C to +80°C
<b>Memory</b>		<b>Definitions</b>	
Type	SD Card	** CEP = Circle of Error Probable	
Recording time	Dependent on card capacity*	95% CEP (Circle Error Probable) means that 95% of the time the position readings will fall within a circle of the stated diameter	
* Approximately 1.1Mb per hour used			

## Contact Information

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