

### Introduction

The deviation of a vehicle from a specified centre line can be measured with a VBOX to an accuracy of between 1 and 2cm (over a 30 second time period).

### Applications

- Measuring side wind susceptibility
- Measuring vehicle deviation (with no steering input)
- Measuring vehicle deviation during brake stops
- Measuring vehicle deviation during lane change tests (Electronic stability control, FMVSS126)

### Theory

The VBOX measures Velocity and Heading to a high accuracy, these measured data channels are then used to determine a lateral deviation from a specified track heading at every sample using simple geometric theories. This calculated deviation (lateral displacement) is an accumulative distance measurement, so the accuracy is at its most accurate when measured over short periods of time. This accuracy will be between 1 and 2cm over a 30 second time period, (given optimum test track and satellite conditions).

### Suitable Equipment

- VBOXIII
- VBOX2SX 20Hz and 10Hz
- VBOX20SL
- VBOX20SL3
- VBOXMini

**NOTE:** The VBOXIII 100Hz is recommended for measurement of centre line deviation in high dynamic manoeuvres such as Lane Change tests.

### Test Setup

Place the magnetic GPS Aerial on the roof of the test vehicle and run the cable into the vehicle through the door seal. Connect the aerial cable to the VBOX ensuring the connection is free from dirt. Connect power to the VBOX using the cigar lighter adaptor or a battery pack. Insert an empty compact flash or SD card into the memory card slot of the VBOX. The hand held brake trigger should be connected to the digital input of the VBOX (DIG IN).

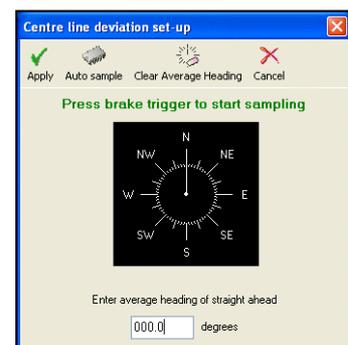
For the test, the VBOX should be left until it indicates that at least 6 satellites are in lock. For optimum conditions the test track for this test should be open and not near to trees or buildings. The placement of the antenna on the vehicle should be on a good ground plane (a typical metal roof will suffice).

### Surveying the Heading of the test track

This can be done in two ways, in post processing or live using VBOXTools software.

#### Surveying Heading Live using VBOXTools:

Connect a hand held Brake trigger to the dig i/p socket of the VBOX, then connect a computer to the VBOX and open the latest VBOXTools software. Select Live/VBOX mode, then open the 'Tools' drop down menu and select 'Centre line deviation', to open the centre line deviation setup screen. Press the brake trigger to start and stop the sampling and averaging of the heading of the centre line of the test track. During this measurement, drive carefully in a perfect straight line down your test track. Then press APPLY to set the new track heading value into the software.



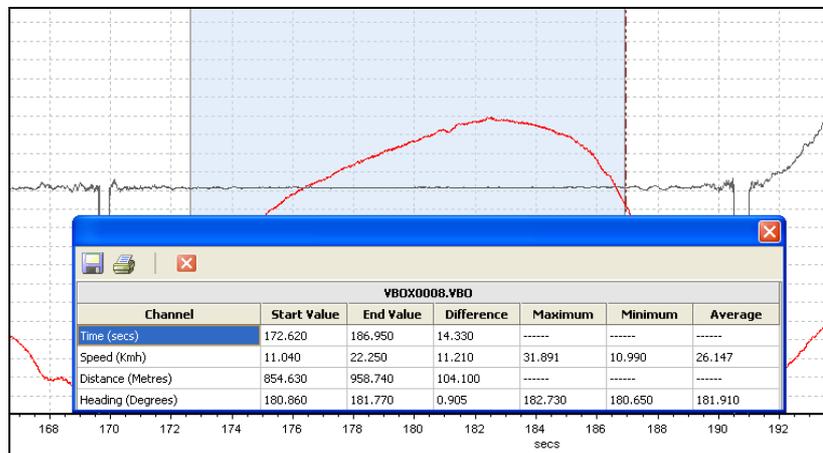
### Surveying the Heading in post processing using VBOXTools:

Insert a CF or SD card into the VBOX, then drive carefully in a perfect straight line down your test track, repeat the drive 2-3 times.

Then load the file from the data card into VBOXTools and open the Graph Screen to display the logged file.

Then use the Graph screen 'Measure Tool' to highlight and average the part of the logged file where the vehicle is driving in a straight line down the centre of the track. To do this, ensure that Heading is visible in the graph screen then click and release the mouse on the start of the data where the heading is stable so that the cursor appears at that point. Now hold the shift key down, click on the cursor and drag it to the end of the straight, making sure you are still selecting a stable region for the heading.

A blue box should appear whilst you are dragging the cursor with the shift key held down:



A box will pop up showing a number of parameters. If you look down the Average column, and then take the heading value, you will get an average heading for this section of track (181.910 degrees in the example above).

It is best to repeat this test, and check that the average heading is within a few tenths of a degree. If it is not, take an average of a number of runs.

When you have established the heading of the centre line of the test track, enter the heading value manually into the 'Centre line deviation set-up' window and press apply.

### Test Procedure

Results from the centre line deviation can be produced in two ways.

**Live:** Results are calculated and displayed live in VBOXTools software.

**Post processing:** During the test data is recorded onto a data card and then results are calculated from the logged data at a later time using VBOXTools software.

### Live:

Connect a PC running the latest VBOXTools software to the VBOX. Establish the heading of the centre line of the test track, as shown above.

Once the heading of the centre line of the test track has been set-up in the software then open the Report Generator screen and configure the Test setup by configuring the start and stop conditions to suit the Vehicle test

Centre line deviation is available as a column title in the Report Generator screen, so now insert Centre line deviation as a Column title.

Report Generator - centre-line (modified)						
use	Run num	Time(s)	Dist(m)	Centre Line Deviation	Graph run	

Once centre line deviation is set as a column title in Report Generator it will display the deviation at the end of the test that has been setup.

Now press 'F2' to start the Report Generator and perform the Vehicle centre line test, results will automatically be calculated and displayed in the table.

Report Generator - centre-line (modified)						
use	Run num	Time(s)	Dist(m)	Centre Line Deviation	Graph run	Description
	1	0	0.00	0.00		Trigger Start
	1	1.00	12.33	-0.23		Time Line
	1	2.00	21.13	-1.36		Time Line
<input checked="" type="checkbox"/>	1	2.65	23.04	-1.72		Speed End

### Showing Centre Line Deviation in a Live Window:

During the testing the 'centre line deviation' can be viewed more clearly in a live window. There are two ways of showing a live window of centre line deviation.

- From Rep Gen:
  - Right click on the 'centre line deviation' column title and select 'Show as Live Window'. **NOTE, this only updates results at the same time as they are updated in the Rep Gen results table.**
- From Main Toolbar
  - Click New Window from the main tool bar, then right-click on the new window and select 'Centre Line Deviation' from the 'Data' -> 'Calculated' menu option. **NOTE, this live window is constantly updated and is only reset by pressing a connected brake trigger.**

### Post Processing:

Insert a data card into the VBOX and then perform the vehicle centre line test. Load the logged file into the VBOXTools software. Ensure the heading of the straight line of the test track is set in the 'centre line deviation' setup screen, as shown above. Open the Report Generator screen and configure the test setup to suit the vehicle test, inserting 'centre line deviation' as a column title, as shown above.

Then press 'F2' (scan) to display results from the file in the Rep Gen results table.

Report Generator - centre-line (modified)							
use	Run num	Time(s)	Dist(m)	Centre Line Deviation	Graph run	Description	
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	1	1.00	12.33	-0.23		Time Line	
	1	2.00	21.13	-1.36		Time Line	
<input checked="" type="checkbox"/>	1	2.65	23.04	-1.72		Speed End	

### Displaying Centre Line Deviation in the Graph screen:

Centre line deviation is automatically calculated as a data channel whenever a file is loaded (using the centre line heading value already set in the Centre Line Deviation Setup tool) and can be shown in the main Graph Screen.

Below is a screen shot of the graph screen showing the 'centre line deviation' channel in blue. The brake stop was performed on a split u surface and the car deviated to the right, which is clearly shown during the brake stop by the blue trace.

