

Why use VBOX for ECE R90 Brake Pad Testing

What is ECE R90 brake testing...?

Introduced in 1999, ECE R90 stipulates that all brake pads and linings manufactured and sold within the EU must comply with R90 standards. The test involves comparing the performance of replacement pads and linings with those originally fitted.

To comply, the brake pads and linings must be put through speed sensitivity and cold performance equivalence tests. Pads that have passed will have an "E" mark alongside a number denoting which authority has approved the pad (e.g. UK - 'E11').

ECE R90 is a Euro Regulation stipulating replacement brake parts must perform within 15% of those originally fitted to the vehicle (as tested to European Quality Standards). Setting minimum levels for both product strength and daily demand routine measurements, ECE R90 also specifies that products are packaged in sealed, tamper-proof boxes before sale.



All brake pads and linings manufactured and sold within the EU must comply with R90 standards

Do I need it...?

Any manufacturer wishing to sell (or export) brake products within the EU must have those products tested and certified to ECE R90 standards by law.

What does VBOX offer...?

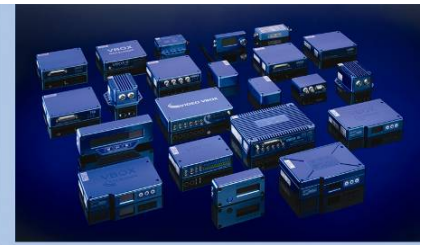
Used in brake testing applications worldwide, VBOX systems provide accurate measurement of vehicle braking capabilities. Able to calculate parameters such as time, position, velocity, heading, height, vertical velocity, lateral acceleration, longitudinal acceleration at 100 samples per second*, VBOX can be used to measure braking distances to within $\pm 1.8\text{cm}$ accuracy**.



Bottom: VBOX 3i data logger
Top left: Multi-Function Display
Top right: 8 channel thermocouple interface

Find out about how VBOX is used to measure braking distance [here](#)

*When using a VBOX 3i (pictured above)
**A Brake trigger is required to gain 1.8cm accuracy

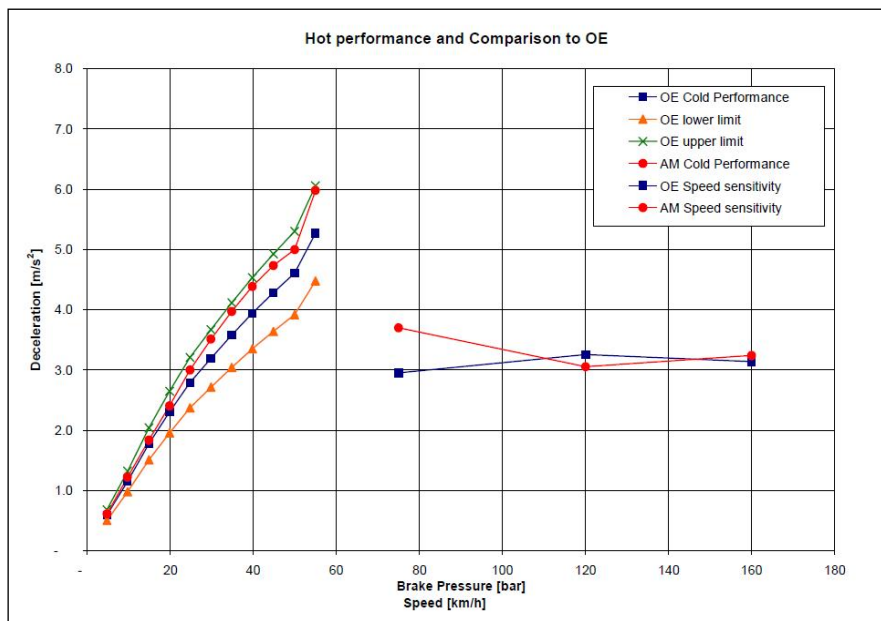


ECE R90 procedures using VBOX equipment

VBOX can be used in all four of the main procedures required to satisfy ECE R90 regulations.

- 1) Bedding (burnishing) procedure
- 2) Performance Check
- 3) Brake Tests (in Accordance with Reg. 13 Annex. 4)
- 4) Cold Performance Equivalence and Speed Sensitivity tests

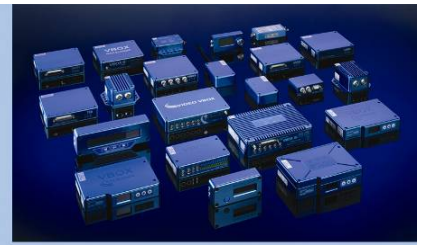
These tests culminate in plotting the vehicle deceleration against brake pedal force/ line pressure measured during the Cold Performance Equivalence and Speed Sensitivity tests, in order to determine if the new test pads are within a $\pm 15\%$ performance window with respect to the original OEM pad. Below is an example plot.



Source:
Link testing Laboratories. Inc. –
'Link Technical Testing
Report FEV205-01'

In each of these four test stages certain parameters are required to be displayed and measured in order to confirm that the new test pads conform and pass each test. The VBOX systems listed in this article allow all of the following required parameters to be easily measured, displayed and logged.

- Speed
- Stopping distance
- MFDD (mean fully developed deceleration)
- Brake pad/lining temperature
- Brake pedal force/ line pressure



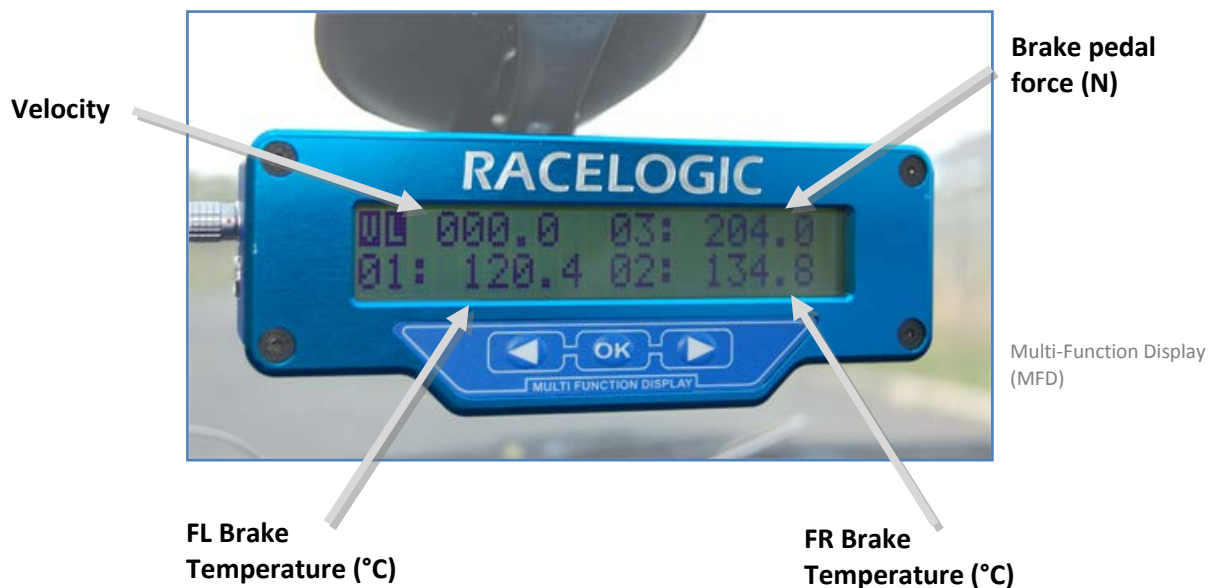
How to view test results

Real-time

Braking parameters can be viewed in real-time via a Multi-Function Display (MFD) or Q2 Tablet PC.

Multi-Function Display (MFD)

A Multi-Function Display can be used to provide the driver with a direct view of real-time braking parameters. These include velocity, brake pedal force/ line pressure and individual brake temperature.



Racelogic Q2 tablet PC

Racelogic's Q2 Tablet PC provides you with the ability to clearly view all parameters captured by the VBOX data logging system in real-time via the provided VBOX Tools software.

By displaying accurate speed, brake temperature and brake pedal force/ line pressure measurements to the driver in real-time, it ensures each test can be conducted in direct accordance with ECE R90 regulations.



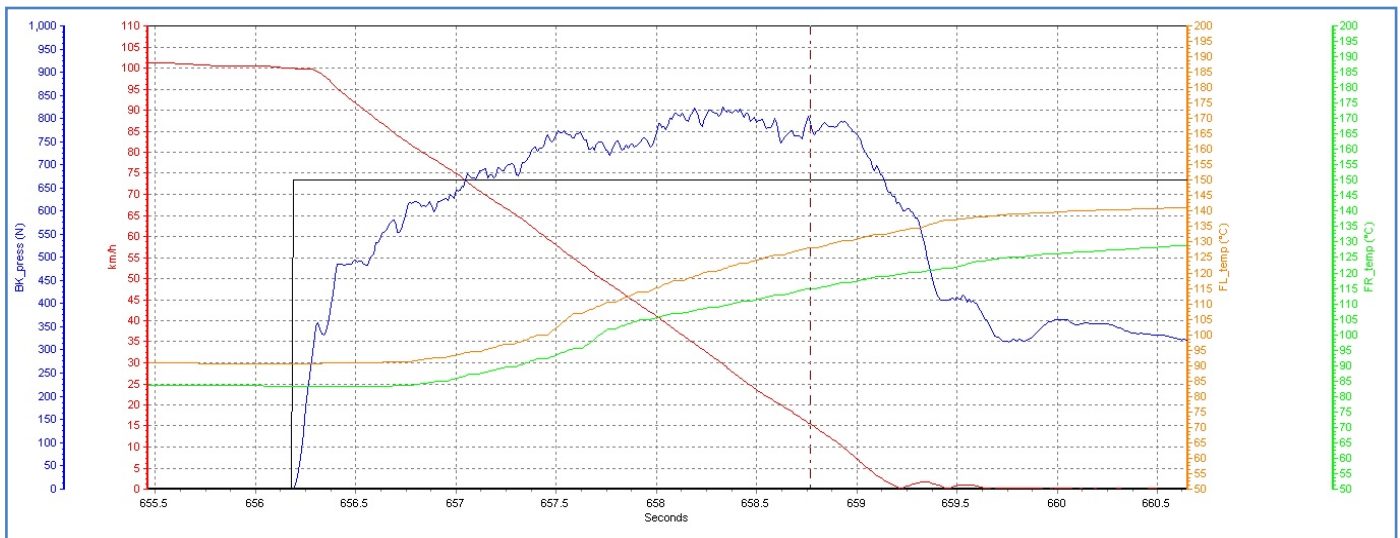
Racelogic Q2 Tablet PC

All parameters can be viewed in real-time via a laptop or alternative tablet PC.



Recorded results

In addition to viewing results in real-time, all data parameters captured using a VBOX are recorded using a media card inserted into the unit prior to test procedures.



Graph indicating the speed (red), brake pedal force/ line pressure (blue), front right brake temperature (green), front left brake temperature (orange) and brake trigger switch (black) readings before, during and after a full 100-0 km/h stop

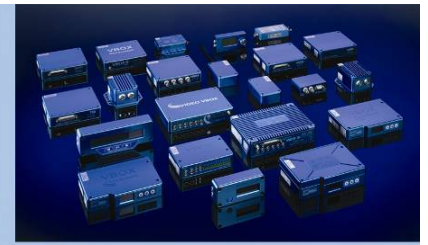
All data can be viewed using the supplied VBOX Tools software in accessible formats (e.g. graphs, charts).

Shown above is a graph generated in VBOX Tools showing the speed, brake pedal force/ line pressure, front right brake temperature, front left brake temperature and brake trigger switch, before, during and after the brakes have been applied in a full ABS 100-0 km/h stop.

User defined parameters can then be processed and displayed via the Report Generator application. Selected field result tables can be saved in numerous file formats or directly imported into Excel to allow further analysis to be completed.

Report Generator - Brake Trigger (modified)										
use	Run num	Trigger speed	Time	Dist(m)	MFDD(m/s ²)	Corrtd dist(m)	YV - FL_temp (°C)	YW - FR_temp (°C)	BK pres (N)(Avg-s)	Graph run
<input type="checkbox"/>	1	98.53	0	0.00			80.00	76.60	3.04	
<input checked="" type="checkbox"/>	1	98.53	3.15	41.92	9.24	43.18	125.70	117.70	647.49	
<input type="checkbox"/>	2	99.89	0	0.00			90.70	83.30	-0.20	
<input checked="" type="checkbox"/>	2	99.89	3.00	42.88	9.28	42.98	132.50	118.70	680.21	
<input type="checkbox"/>	3	100.30	0	0.00			91.30	83.20	5.71	
<input checked="" type="checkbox"/>	3	100.30	2.98	42.68	9.38	42.42	135.90	115.00	668.71	

Report Generator allows users to clearly analyse results from selected test fields



Recommended VBOX equipment

Outlined below are two sets of recommended equipment for completion of ECE R90 test regulations. The first set records data at a sample rate of 10/20Hz (adequate for ordinary brake test applications); while the second captures data at 100Hz (ideal when high accuracy test data is required).

10 or 20Hz GPS data logger - Equipment

- **VBOXII SX**

Captures and logs speed, brake trigger events, brake distance, MFDD, brake pedal force/ line pressure and brake temperature at a rate of 10 or 20 samples per second.



- **VBOX Mini Input Module**

Allow users to interface between the VBOX, K-type thermocouples and brake pedal force/ line pressure sensors.



- **Multi-Function Display**

Instantly displays live data (e.g. speed), to permit the driver to adjust performance to ensure test consistency.



100Hz GPS data logging – Equipment

- **VBOX3i**

Captures and logs speed, brake trigger events, brake distance, MFDD, brake pedal force/ line pressure and brake temperatures – with a built in analogue voltage interface for connection to brake pedal force/ line pressure sensors – at a rate of 100 samples per second.



- **8 Channel Thermocouple Interface**

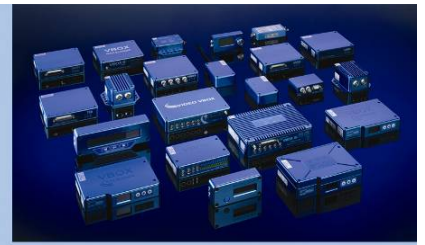
Linked via CAN bus to VBOX to directly measure up to 8 K-type thermocouple channels.



- **Multi-Function Display**

Instantly displays live data (e.g. speed), to permit the driver to adjust performance to ensure test consistency.





Additional equipment

Rubbing Thermocouple

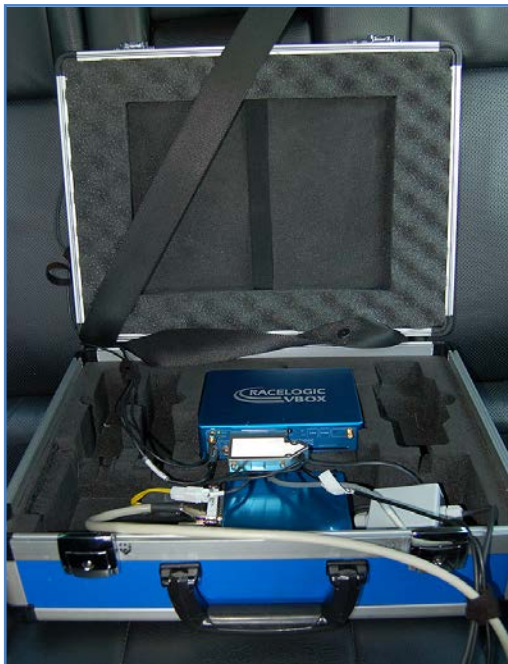
With the fabrication of a simple bracket, rubbing thermocouples can be easily fitted to offer users an effective means to measure brake disc temperature.

On these devices the thermocouple tip is bonded to a spring loaded skid plate, to ensure a good thermal contact and thermocouple longevity.



Pedal Pressure Sensor

A Pedal Pressure Sensor can be easily fitted to the brake pedal and connected to an analogue input module to provide an accurate readout of the pressure applied during a series of brake test scenarios.



For more information on VBOX and to find the right VBOX GPS data logger for you go to www.velocitybox.co.uk or contact us at vbox@racelogic.co.uk.