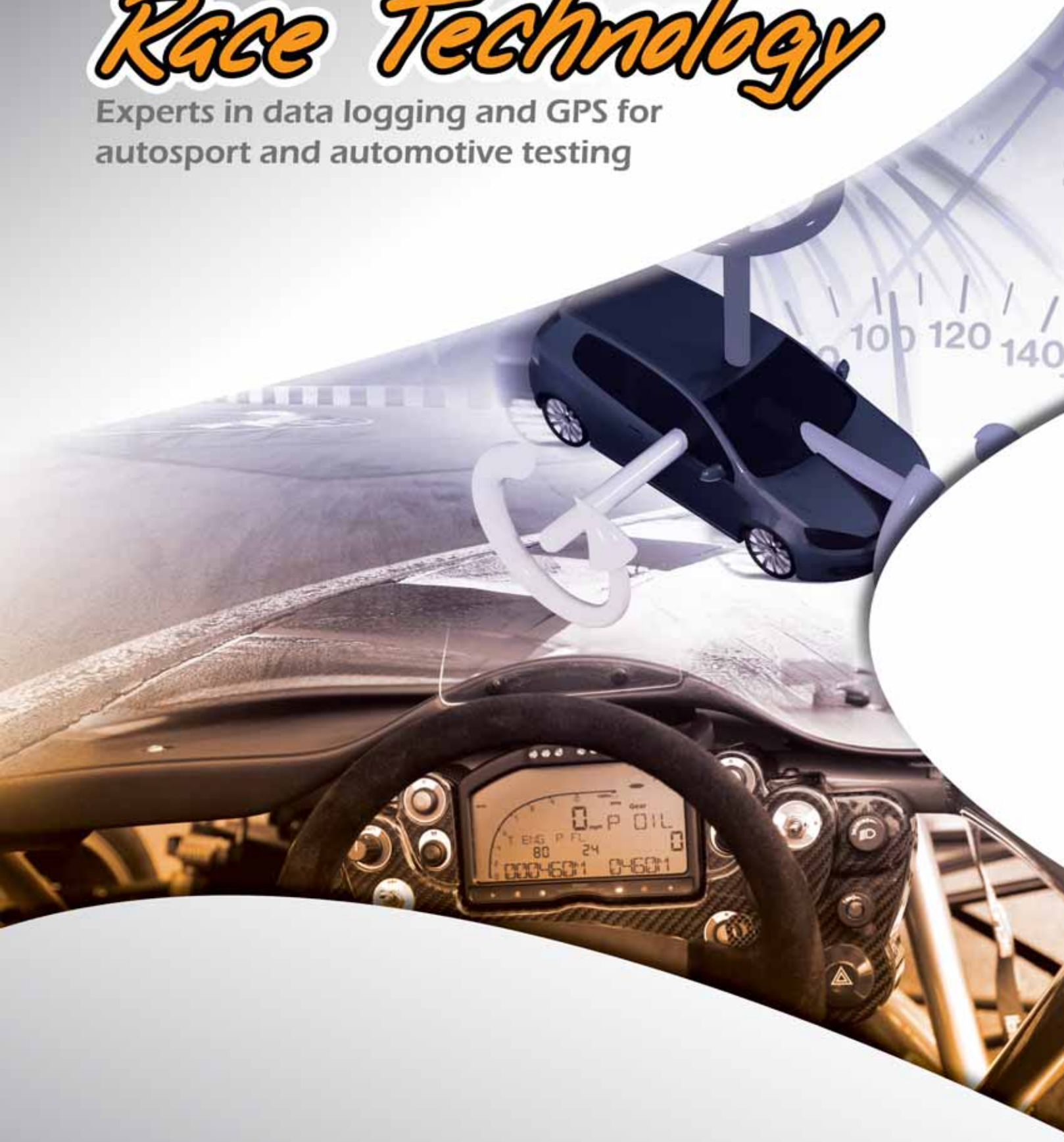
Race Technology

Experts in data logging and GPS for autosport and automotive testing



Version 8
January 2013

Company Profile

Race Technology was founded in 2001, with the introduction of the AC22 Performance Meter. Since then continued innovation and development has led to today's product line-up for the racing and automotive market.

Race Technology Ltd is based in Nottingham, England and is run and staffed by enthusiastic professionals. All product design, assembly and testing is carried out in-house, along with trusted local suppliers, so we can be 100% confident in the quality of our products – we don't buy any products in and certainly don't re-brand products from anyone else. We own all the intellectual property for all of our products, hardware and software; and we continue to believe that this is the only way to achieve the combination of quality and flexibility that we insist on.

Using the very latest technologies available we now lead the way, blending innovative thinking with unsurpassed quality, flexibility and usability, which make our products the first choice for informed racers and engineers alike. Our products are used around the world in many diverse applications, including: individual club racing and professional racing teams. Formula Student/FSAE through to the American Le Mans Series and Grand Am in the USA, and Britcar in the UK. Our products are also widely used in professional automotive testing applications.

As well as racing applications, our street legal DASH2 is now standard equipment in a number of specialist road cars and the DL1 continues to be used by many track day enthusiasts, particularly when coupled with the DASH3 for easy lap timing.

In addition to our range of standard products, Race Technology can also offer a variety of consultancy services and add customisation options to our standard range of products and systems. Our customisation services have recently seen our equipment see service in applications as diverse as canoe logging, powerboat racing and vehicle usage monitoring.

We specialise in offering complete systems, typically including hardware, firmware and PC software to allow control/configuration of the hardware. Our main strengths are our excellent technical team and a pragmatic no-nonsense approach. Combining these two allows us to quickly build technology demonstrators or production ready hardware.

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Contact Details

UK:
After 12, King Street
Eastwood
Nottingham
NG16 3DA
UK
Tel.: +44(0)1773537620
Fax: +44(0)1773537621
Email: sales@race-technology.com

USA:
2317 Westwood Ave.Ste 101
Richmond
VA 23230
USA
Tel.:+1 8043587289
Fax: +1 8043596694
Email: ussales@race-technology.com

www.race-technology.com

Data Loggers

Whether you are an enthusiast on a track day or a professional driver at an international level, data loggers are the tool of choice to improve car and driver.

Race Technology's range of data loggers has been designed to suit everyone from the enthusiast looking to improve himself or his car, to professional racing teams looking for the best that is out there to gain the advantage. Having products that suit different markets allows us to cross reference the needs of our customers to maximise the potential of all of our data loggers.

Dash Displays

Displaying the correct information at the correct point in time can be crucial to winning races. Our range of dash displays allow the user to completely configure and program the way the dash works, whether it is displaying the RPM and speed of the vehicle, lap and sector times or various alarms based on the condition of the vehicle. The dash displays are all designed to work with other Race Technology products so there is a seamless integration when a display is added.

Video Systems

From fully integrated data and video solutions (with perfect, automatically synchronised data) to options to add video from 3rd party video sources.



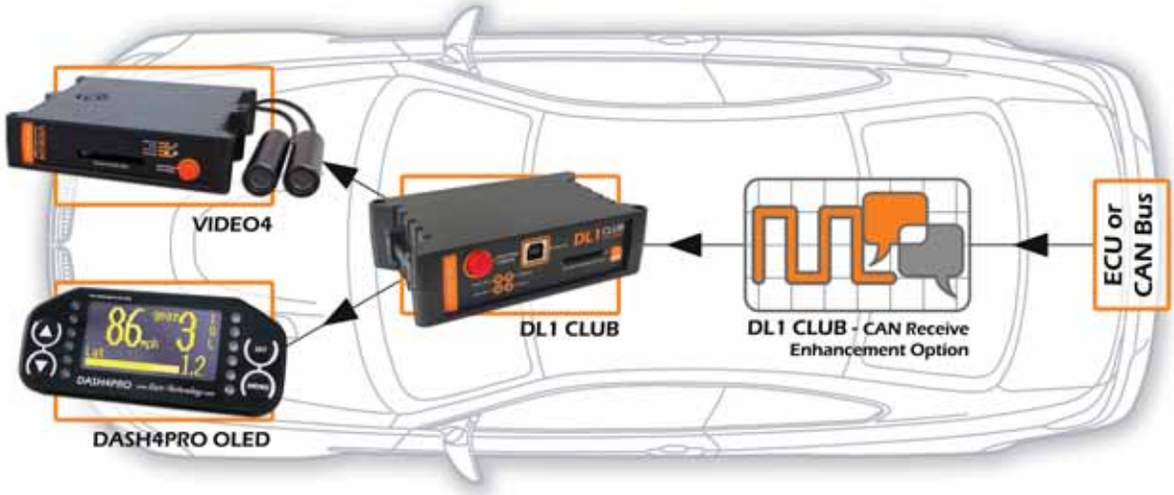

	DL1 SPORT	DL1 CLUB	DL1 PRO	DL1 WP
Body Material	ABS	ABS	Anodised Aluminium	Anodised Aluminium
Sealing	None	None	Splashproof	IP67
5Hz GPS	●	●	●	●
Optional 20Hz GPS		●	●	●
Accelerometer	2g	2g/6g	2g/6g	2g/6g
Data Download Via	Removable Card	Removable Card/USB	Removable Card/USB	USB
RPM Input	High & Low Level	High & Low Level	High & Low Level	High & Low Level
Analogue Inputs	8	8 (12 optional)	8 (12 optional)	8 (12 optional)
Sample Rates	100Hz	100Hz	up to 1000Hz	up to 1000Hz
5v Reference Out	1	2 (protect/monitor)	2 (protect/monitor)	2 (protect/monitor)
Real Time Filtering & scaling		●	●	●
Auto Start/Stop	●	Yes, configurable	Yes, configurable	Yes, configurable
Output Drivers		4 (optional)	4 (optional)	4 (optional)
PWM Output		4 (optional)	4 (optional)	4 (optional)
CAN Input		1 port, up to 105 channels (optional)	1 port, up to 105 channels (optional)	1 port, up to 105 channels (optional)
CAN Output		1 (optional)	1 (optional)	1 (optional)
100Hz Speed Output			Optional	Optional
Configuration Lock		Optional	Optional	Optional
Gyro Drift/Slip angle		Optional	Optional	Optional
Data Port For DASH/ECU Interface	●	●	●	●
2nd Data Port For ECU Interface		Optional	Optional	Optional
Max Logging Time	24 hours+	24 hours+	24 hours+	24 hours+
Memory Card Type	Compact Flash FAT/FAT32	SD or SDHC card (32GB Max) FAT/FAT32	SD or SDHC card (32GB Max) FAT/FAT32	None, internal 8GB
Firmware Updateable	●	●	●	●
Frequency (Wheel Speed) Inputs		4	4	4
Maximum Number of Channels	30+	100++	100++	100++
Connector Type	Plastic, Spring Terminal	Plastic, Spring Terminal	Metal with Pre-soldered Flying Leads	Metal with Pre-soldered Flying Leads
Power Supply	9v - 18v	9v - 26v	9v - 26v	9v - 26v
Power Measurements	●	●	●	●
Lap Timing	●	●	●	●
Live Time Slip		●	●	●





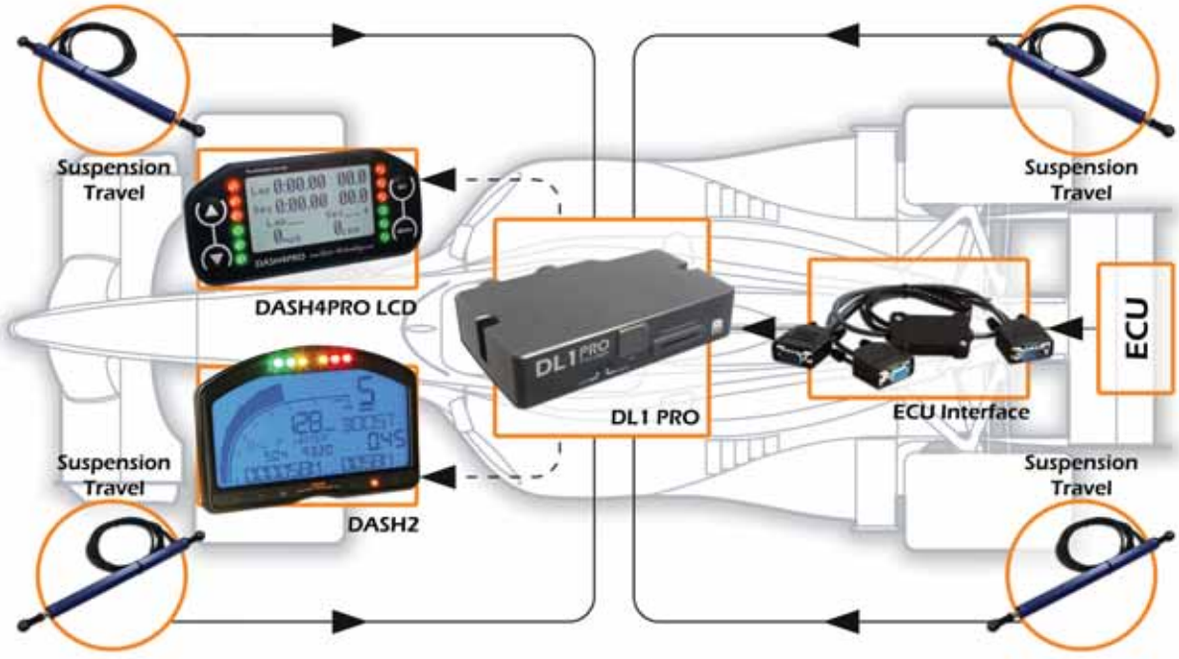
	DASH4PRO	DASH3	DASH3lite	DASH2	DASH2 PRO
Display Type	OLED or LCD graphics	Backlit graphics LCD	Backlit graphics LCD	Backlit Custom LCD	Backlit Custom LCD
N° of Display Screens	4 + lap, sector and Max/Min	4 + lap, sector and Max/Min	4 + lap, sector and Max/Min	5	5
Standalone Operation	No	No	No	Yes	Yes
Built in Inputs				4 analogue + RPM and wheel speed	Up to 8 analogue + RPM and wheel speed
Warning Lights	12 shiftlights, custom message alarms	6 shiftlights, custom message alarms	6 shiftlights	6 shiftlights, custom alarms and message	6 shiftlights, custom alarms and message
Display Control	4 buttons on unit	4 buttons on unit	4 buttons on unit	4 external buttons	4 external buttons
Onboard GPS Logging	No	No	No	No	Yes (optional)

The example systems shown on these two pages are intended to show some typical systems for each type of installation. Whether you are a dedicated racer, serious enthusiast or just do the occasional track day; our modular systems can be tailored to suit your requirements. Because our systems are modular they can be built up in stages, as budgets allow, adapting your system as you discover the benefits that knowledge brings to your driving.



Closed top race/track day car

Using a combined video and data system helps to get a complete view of the action. Analysing the data with perfectly synchronised video can explain any anomalies in the data - traffic situations etc. It can also help with choosing the fastest line, see your track position and see the results alongside. Also in the system is the DASH4PRO display to feedback live lap/sector times and live time slip rate to the driver - Showing red LEDs when slower, and green when faster than previous sectors. Engine parameters (such as RPM, boost pressure, temperatures) are decoded from the vehicle's CAN stream or aftermarket ECU using the CAN receive enhancement option for the DL1 CLUB.

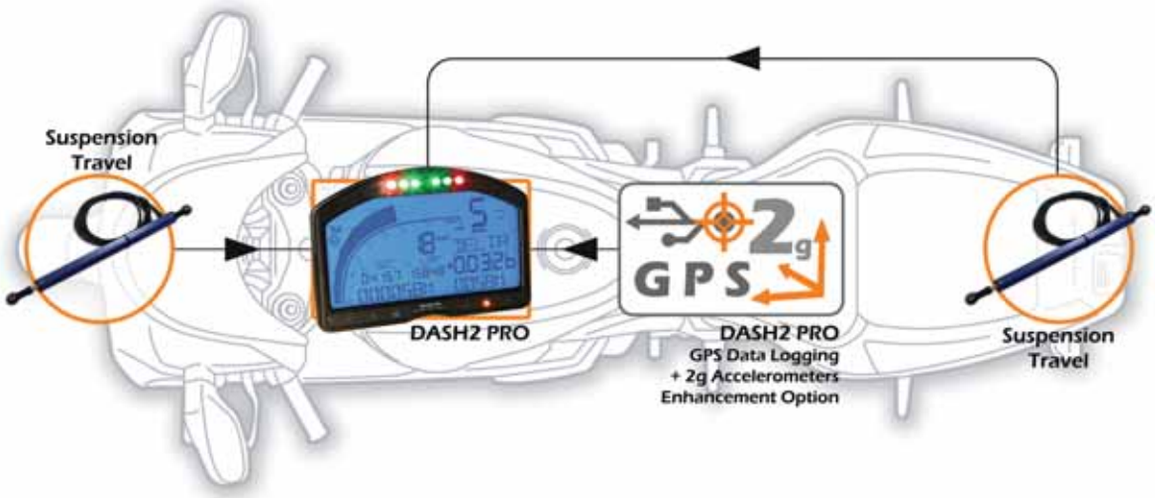


Single seater race car

With 2 display options, either a compact steering wheel mounted DASH4PRO or the larger DASH2 display. All engine parameters are accessed via the ECU interface, logged on the DL1 PRO data logger, and displayed in the DASH4PRO/DASH2. Alarms are set to monitor water and oil temp/pressure without cluttering up the display area. Additional suspension travel sensors are added to the car's setup, enabling the engineers to analyse and optimise the setup for different tracks and conditions and see the effects of the aerodynamic downforce. For high downforce vehicles more grip is available so we recommend the 6g accelerometer enhancement option for the DL1 PRO.

Road/track day car

The non invasive installation of this system allows the user to get the maximum out of their car on the weekend, and remove the whole system for the drive to work on Monday. The DL1 SPORT's GPS receiver measures speed, position and lap/sector times, whilst the built in accelerometers measure braking and cornering grip usage. Engine parameter data is streamed from the vehicle's OBD-II port, decoded and is also logged for additional vehicle performance data (e.g. RPM, pedal position, boost pressure). The DL1 SPORT's optional GoPro control is used to start/stop video recording and provide quickly synchronised data and HD video in the analysis software. The video can be viewed alongside the data, showing racing lines and adding further information to data analysis. HD videos complete with graphic data overlays can be created, using the HD video export tool in the analysis software.



Motorcycle

Using the new DASH2 PRO display it is possible to specify a complete data logging and display system in a single compact package. All necessary engine parameters are either hardwired or can be accessed from the CAN bus using the CAN communication enhancement option. The DASH2 PRO will display any sensor data, RPM, gears, speed etc, along with lap/sector timing. With the GPS data logging (includes 2g accelerometers) enhancement option, all data can be displayed live and logged for post race analysis. Additional performance sensors can be added, for example suspension travel, enabling the suspension to be tuned for different circuits. All recorded data is referenced to the GPS track position enabling logical interpretation and analysis.

Why use GPS?

GPS is used extensively in our products and is one of the key areas where we have a very clear advantage over our competitors. Our products use GPS for three functions: Speed measurement, track mapping and timing.

GPS used for speed measurement

A calibrated standard wheel speed sensor will give a typical accuracy within 2% at best, due to changes in tyre pressure, temperature and wear. The situation is even worse under acceleration or braking. In contrast, GPS speeds are typically accurate to approximately 0.1mph even with the wheels locked. With GPS there is no need to fit a troublesome wheel pickup, and it works equally on cars, bikes and boats.

GPS used for track mapping and timing

Using high accuracy GPS the vehicle position on the track is known precisely the whole time data is being logged, so lap/sector times as well as braking points etc are very accurately represented. The GPS system works anywhere with a good view of the sky and is not just limited to short closed circuits as would be the case with a beacon system – it works just as well on open and closed circuits, on the track or on water, on cars or on bikes, all with excellent accuracy.

What is unique about Race Technology's 20Hz PurePhase GPS receiver?

Where our PurePhase technology really excels is in speed and distance measurement – this is an area where most GPS receivers (even so called "survey grade" receivers) perform badly, as it simply isn't a priority for most applications. Filtering and latency are also very tightly controlled – another area where traditional GPS receivers score very badly. Finally our PurePhase receiver is optimised for levels of dynamics typically encountered in the automotive environment – this is in contrast to survey receivers which are typically stationary and military receivers which are typically designed for very high dynamics.

How often are position/speed updates available from GPS?

Our receivers provide speed/position updates 5 or 20 times a second, depending on the specification of the system. 20Hz is widely accepted as the highest practical sample frequency. At higher frequencies noise becomes an issue for "real world measurements", so the speed/position results have to be filtered or smoothed, completely negating any benefits.

How accurate is GPS?

Positional accuracy is typically 2-3m for our 5Hz receivers, and 1-2m for our 20Hz receiver. However there are many other attributes of a GPS receiver that aren't apparent from this single accuracy figure, for example how quickly it regains lock after a signal dropout, how well it tracks position at high g-forces and how resistant to vibration it is.

What happens if GPS lock is lost during a race?

Because speed and position are calculated from both the GPS data and accelerometers, even if the GPS signal is lost for a number of seconds, it will not be possible to tell from the data in the software. Only if GPS data disappears for an extended time (20+ seconds) will the data start to degrade noticeably.

How can GPS give such good results in automotive testing?

Some potential customers are sceptical of the idea of GPS based automotive test instruments, given the location accuracy and GPS update rate. Yet once they have used the systems, they are amazed at the quality of the results. This stems from several factors:

Hybrid GPS – Inertial systems

Most of our systems are actually hybrid GPS – inertial, meaning that GPS data is combined with accelerometer data (using an advanced technique called adaptive Kalman filtering) which allows each to contribute to a result which is truly better than the sum of the parts. Accelerometer data has quick response and relatively low noise, but is prone to long term drift due to bias. GPS data has a slower update, but has a very small bias, which does not increase with speed.

Slow drift of GPS position error

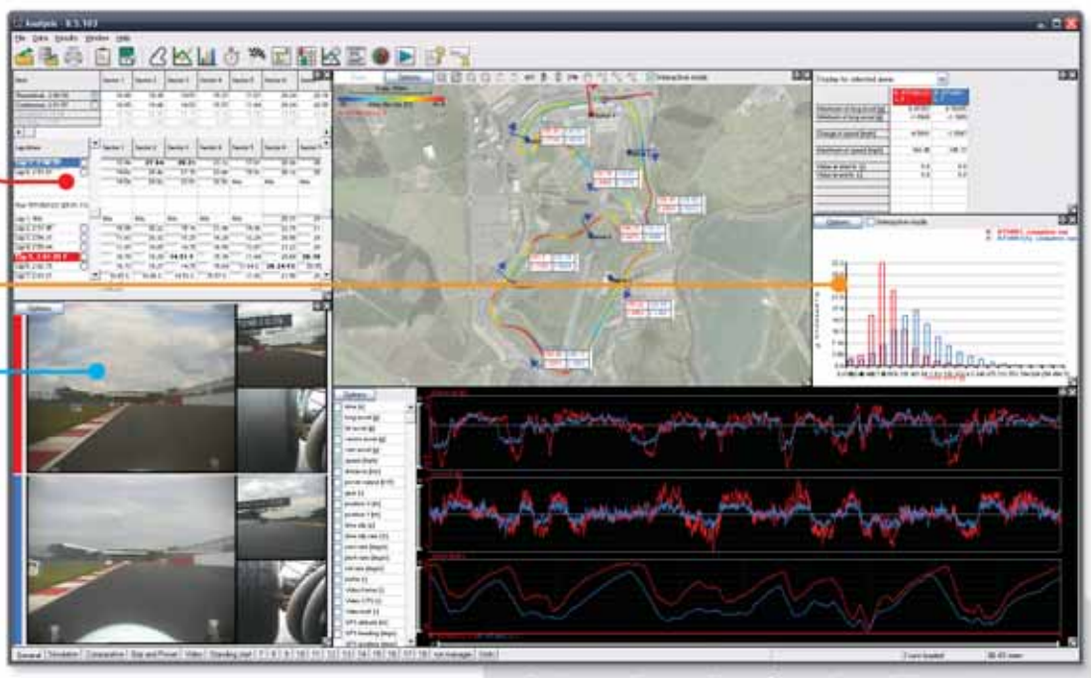
GPS position error is quoted in absolute terms, which is relevant to surveying but not typically relevant to automotive testing. The error in position stems from several factors (satellite orbit errors, satellite clock bias, and atmospheric density variations), which do not tend to change rapidly. Thus, the error (i.e. the exact offset from the true position) now will be very similar to the error a few seconds from now. This allows short term testing – such as virtually any automotive performance testing – to potentially be orders of magnitude more accurate than the GPS "survey accuracy"

Analysis Software

Our data analysis package is now in it's 9th major version. It is used by 1000s of customers all over the world and is very highly regarded. The system uses a modern windows interface, so it's friendly and fast to operate. As well as all the standard features you would expect to find in good data system, it has also got a number of features that make it completely unique – all designed to get you the information you need as quickly as possible.

- Advanced GPS options, including our unique high accuracy 20Hz processing and the option to download GPS corrections from the internet.
- Advanced database functions allow the user to keep organised by driver, location and date – and also share your data and video with other users.
- Fully featured video export system with optional graphics data overlays, with optional automated YouTube upload, and DVD generation.
- Built in support for video-by-data analysis. The video is either from a VIDEO4 system, or a 3rd party recorder.
- Display data in multiple formats, for logical data interpretation and quick comparisons.
- Theoretical lap times as well as simple lap and sector times are available.

- Accurate track maps with satellite imagery for the background to check racing lines.

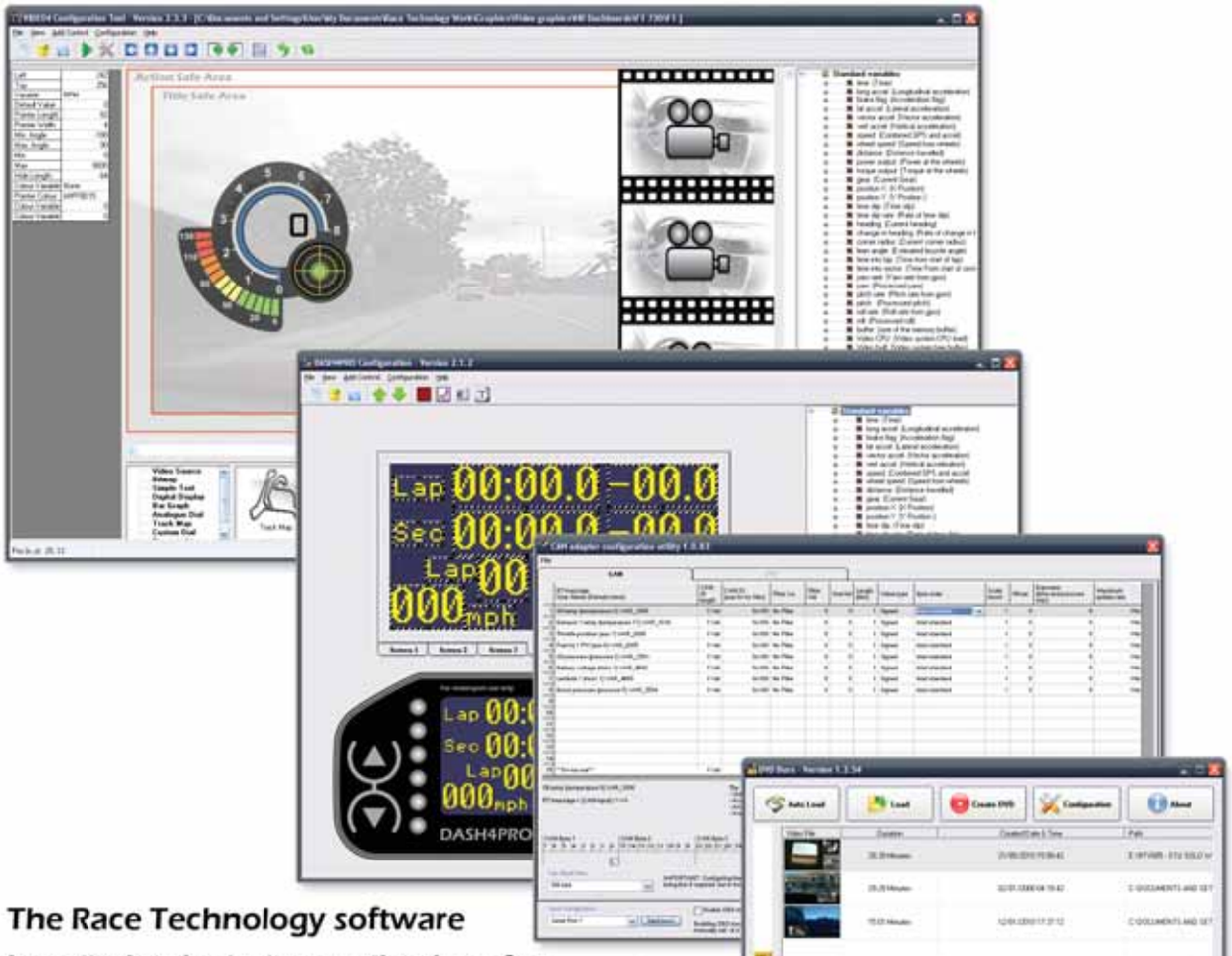


- Advanced user interface that allows the user full customisation with their preferences, a modern tabbed interface and the ability to load and save layouts, all designed to make operation fast and simple, whether working at a desk or at the trackside.

- Unique car simulation tools that allow the driver to see where the car was being driven on the limit and where time was lost. This is the quickest way to improve lap times without exception! Can also be used to estimate the improvement in lap times from car and engine enhancements.

Other Software

Included in the Race Technology software bundle is a variety of supporting applications. In here you will find all the necessary software to set up and configure all of our hardware, from the data loggers to the ECU interfaces. These small but vital applications make it straightforward to configure the hardware specifically to the user's requirements. Other applications include monitoring software for live viewing of data being recorded by the data loggers and a separate application to repair damaged Analysis run files and split up longer run files should that be necessary. And best of all – it's FREE to download. Latest versions of all Race Technology applications are available on our website along with sample data sets, so you can "try before you buy" or update your software at any time to take advantage of the latest features, all without limitations or restrictions.



The Race Technology software installation includes applications for:

- Data Logger Configuration
- Dash Configuration
- Video Overlay Configuration
- Video Playback
- Video Conversion
- DVD Burning
- Live Data Monitoring
- Installation of Firmware Updates
- ECU Adapter Configuration
- Run File to Text Conversion
- Run File Editing
- Performance Monitor for OEM/Professional test applications

- **Integrated high accuracy 5Hz GPS receiver**
- **Digital accelerometers, 2g and 6g range**
- **20Hz GPS option for unrivalled accuracy**
- **Output to drive DASH, VIDEO4 and live monitor**

The DL1 SPORT data logger is a powerful and highly versatile logging instrument, whether you want to do a few track days and analyse your data or if you are a professional racer looking to add logging capabilities to your race car. The DL1 SPORT may be small in size and price but it is big on features.

- Based on the race proven technology of our original DL1
- One box plug and play solution.
- Expandable, 8 analogue inputs for temperatures, steering angle, damper pots, brake pressure, etc.
- Capable of detecting minute changes with 100Hz update rate on all sensor and accelerometer channels.
- Review your braking points and overall grip with the built in 2g 3-axis accelerometer.
- RPM high and low level inputs, for alternative signal source options.
- Get the most out of your engine by logging information from your ECU*.

*ECU adapters available separately.

- 50 hours of logging with a 1 GB compact flash card.
- Easy to use, comprehensive analysis software.
- Lap and sector timing, make sure you find that last 0.01s for pole position .
- Trackmaps with satellite map overlay.
- Live lap and sector timing using DASH2, DASH3, or DASH4PRO.
- Unbeatable value for money.
- Completely modular system, add dash display or video capabilities at any time.
- Optional GoPro control + video licence, for synchronised HD video and DL1 data.

DL1 Sport Enhancement Option:

6g Accelerometers

6g accelerometers are recommended for applications that use large aerodynamic aids.

Applications include: Club racing, motorcycles, track day cars, rally and race cars.

- **Calculate and display timeslip, live!**
- **Control external systems on the vehicle**
- **Extensive automatic logging control**
- **GPS data logger with integrated accelerometers and powerful processing**

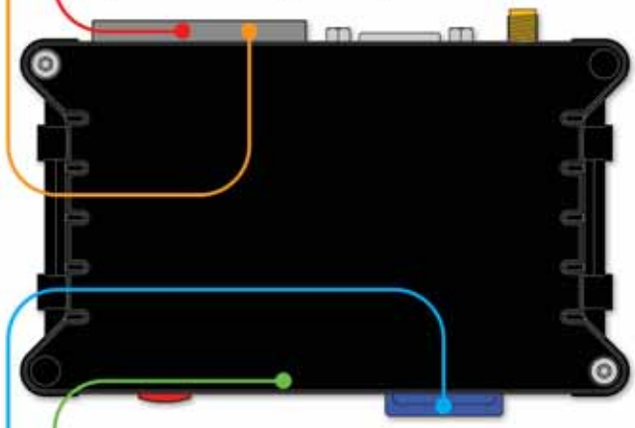
The DL1 CLUB data logger is a highly configurable and powerful logging instrument. Whether you want to do a few track days and analyse your data, or if you are a professional racer looking to add logging and a configurable control system to your race car.

Powerful Onboard Processing

The powerful processor means that you can perform calculations live. The results can be viewed live (on a display or video), not just in post analysis. Here are a few examples:

- Timeslip can be calculated live and displayed directly to the driver, showing exactly how much faster or slower you are continuously – not just at lap and sector markers.
- Sensor data is processed directly by the unit rather than having to be processed in the dashboard, VIDEO4 unit and Analysis software separately.
- User defined channels used to perform maths functions on the live data, e.g. combine four wheel speed sensors to show if the average speed of the front wheels is higher than the rear wheels, showing spin and braking lockup. This can be displayed live to the driver, overlaid onto a video, or logged for analysis.

- Up to 12 analogue and 4 frequency inputs.
- Low side drivers option for advanced control of vehicle options such as pumps and fans. The control can be simple or based on a complicated equation, e.g. turning on a cooling fan when temperature is high and speed is low.



- USB port for configuration and reflashing.
- Huge storage capacity, up to 32GB SD cards.

- Extensive automatic logging control, making sure exactly the required data is logged.
- Unrivalled accuracy with our 20Hz GPS option (5Hz standard).
- Measure your drift angle with the gyro option.
- Review your braking points and overall grip with the built in 2g 3-axis accelerometer, optional 6g 3-axis accelerometer for high down force applications.
- Optional GoPro control + video licence, for synchronised HD video and DL1 data.
- Get the most out of your engine by logging information from your ECU*.

*ECU adapters available separately

Hardware Enhancement Options

To tailor the DL1 CLUB to your application, a range of enhancements are available:

20Hz Advanced GPS Option

Increased speed and position accuracy, with higher GPS resolution. Download corrections from the internet with advanced PPP mode.

6g Accelerometers

6g accelerometers are recommended for applications that use large aerodynamic aids.

Drift Measurement

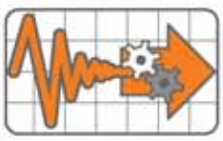
The drift option uses a built in gyro for measuring vehicle drift (yaw).

20Hz GPS Export

If you intend to use the 20Hz GPS data in an external application you will need an export licence to output the full 20Hz resolution.

2nd Serial Port

A second serial port option is ideal for combining multiple input and output modules for complex systems, or driving a low speed telemetry channel on one port and a high speed output for video overlay on the second.



Low Side Drivers and 4 Extra Analogue Channels

This option allows you to switch on/off external systems automatically using the DL1. Control can be simple or based on a complicated equation. This option also enables the 4 additional analogue channels, making a total of 12.

PWM Output Controller and Advanced Frequency Inputs

The PWM output controller allows you to control an external system with a graduated signal. Meaning it can be "on" anywhere between 1 and 100%. This is ideal for water injection systems etc. This option enables the advanced frequency input functions, pulse count, high/low times, duty cycles etc.

CAN Communication

CAN Reception (15 channels per licence): Decode any CAN data from the vehicle's main CAN stream or a CAN based aftermarket ECU. Data can be mapped to any RT channels for logging or sending to serial port. Data rates of up to 1Mbit and 11 or 29 bit addressing.

CAN Transmission: With this option the unit can transmit any of the internal data channels on the CAN bus, at a rate determined by the configuration. Data for transmission could be from internal sensors (GPS, accelerometers, analogue inputs etc.) or from a serial input from an ECU interface or other attached unit. Transmission rates can be individually configured at rates up to 100Hz using 11 or 29 bit addressing.

- **Calculate and display timeslip, live!**
- **Control external systems on the vehicle**
- **Extensive automatic logging control**
- **Exclusive enhancement options - 100Hz live speed output and 1000Hz logging.**

The DL1 PRO and DL1 WP data loggers are the professional choice for high specification installations. Featuring rugged connectors for reliable connections, and water/dust protection features to suit their intended applications.

The **DL1 PRO** features rubber USB bung and SD card surround to protect the unit from splashed water and dust during use.

The **DL1 WP** offers a greater degree of water and dust protection with a fully sealed case and internal 8GB memory. Data is downloaded to the PC for analysis via USB connection.

The DL1 PRO and DL1 WP do not feature start/stop buttons on the unit (a remote button can be installed if required), instead the extensive automatic start/stop functions can be used to collect the required data without having to remember to press the button. Units are supplied complete with connectors featuring pre-soldered fly leads and connectors ready for installation.

Powerful Onboard Processing

The powerful processor means that you can perform calculations live. The results can be viewed live (on a display or video), not just in post analysis. Here are a few examples:

- Timeslip can be calculated live and displayed directly to the driver, showing exactly how much faster or slower you are continuously – not just at lap and sector markers.
- Sensor data is processed directly by the unit rather than having to be processed in the dashboard, VIDEO4 unit and Analysis software separately.
- User defined channels used to perform maths functions on the live data, e.g. combine four wheel speed sensors to show if the average speed of the front wheels is higher than the rear wheels, showing spin and braking lockup. This can be displayed live to the driver, overlaid onto a video, or logged for analysis.

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- Unrivalled accuracy with our 20Hz GPS option (5Hz standard).
- Measure your drift angle with the gyro option.
- Review your braking points and overall grip with the built in 2g 3-axis accelerometer, optional 6g 3-axis accelerometer for high down force applications.
- Optional GoPro control + video licence, for synchronised HD video and DL1 data.
- Get the most out of your engine by logging information from your ECU*.

*ECU adapters available separately

Applications include: Race cars, track cars, motorbikes, rally cars, off road vehicles, powerboats, professional race series scrutineering systems.

DL1 PRO/WP - 100Hz Live Speed Enhancement

The DL1 PRO and WP models are available with an optional live speed output. This option combines the data from the GPS system and built in accelerometers using a Kalman filter, providing a robust, real time output of speed at up to 100Hz.

1000Hz Data Logging Option

Measure rapid changes with the 1000Hz sample rate on sensor channels. Essential for accurate suspension analysis, where the high sample rates allow calculation of shock rates as well as measurement of suspension position.

20Hz Advanced GPS Option

Increased speed and position accuracy, with higher GPS resolution. Download corrections from the internet with advanced PPP mode.

6g Accelerometers

6g accelerometers are recommended for applications that use large aerodynamic aids.

Drift Measurement

The drift option uses a built in gyro for measuring vehicle drift (yaw).

20Hz GPS Export

If you intend to use the 20Hz GPS data in an external application you will need an export licence to output the full 20Hz resolution.

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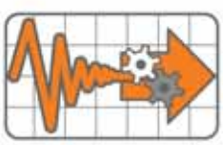

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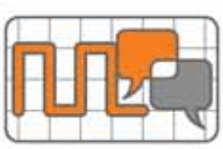


CAN Communication

CAN Reception (15 channels per licence): Decode any CAN data from the vehicle's main CAN stream or a CAN based aftermarket ECU.

CAN Transmission: With this option the unit can transmit any of the internal data channels on the CAN bus, at a rate determined by the configuration.

- **Robust, die cast enclosure, sealed to IP65**
- **Large, clear, non-reflective, backlit display**
- **IVA friendly, road legal dash**
- **Standalone operation or compatible with our data loggers**

The DASH2 is a fully featured dash display unit which can replace all the dials on a normal dash whether it is a road going or race vehicle. Suitable for cars and bikes.

- Custom LCD panel dashboard display with backlight, clearly visible under any light condition.
- Suitable for various installations, water resistant for open top or motorcycle applications.
- Compact and slim, 150 x 102 x 14.5mm
- Suitable for any engine installation with a fully configurable RPM scale.
- Optimise your gear changes with the configurable ultra bright shift lights.
- Road legal, everything required for a vehicle inspection, MOT or IVA testing including tamperproof odometer, backlit display and mandatory warning lights.
- Lap and sector time display using a separate data logger.
- Easy integration with other Race Technology products.
- Stand alone operation, directly connect up to 4 analogue sensors along with RPM and wheel speed channels.
- Display information from your ECU using our CAN or serial interface available separately.
- Monitor your engine and display high/low alarms for any parameter.
- Gear position indicator calculated or via gearbox sensor.
- Can be set up for either MPH/miles or KPH/km.
- Display the information you want to see with 5 user defined screens.
- Control the DASH2 and a data logger with the external button set available separately.
- Easy to use configuration software, available free on our website.

Applications include: Road legal cars and bikes, kit cars, race cars, track day cars and specialist production cars.

- **Powerful & ultra configurable dash display**
- **Advanced options and enhancements**
- **Standalone road legal unit, with optional internal GPS data logging**
- **5 user configurable display screens - see the information you want**

The DASH2 PRO's standard features are the same as the DASH2. The DASH2 PRO offers powerful live data processing and enhancement options, enabling you to specify a complete system in just one compact component.

Add CAN reception to take sensor data directly from your vehicle's CAN bus or ECU, or add an extra 4 analogue inputs for sensors – all without adding another component into the system. Reducing the number of components in the system reduces clutter and improves reliability by reducing the number of connections.

Visually there are differences like the all new LCD, bi-colour shiftlights (which can be configured to work in multiple ways with the Advanced Options Bundle) and higher density connectors.

Advanced Options Bundle

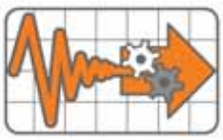
Car computer functions, advanced alarms, advanced shiftlights, advanced RPM scale, advanced unit control inputs, advanced screen display functions, advanced lap timing display.

CAN Communication

CAN Reception (15 channels per licence): Decode any CAN data from the vehicle's main CAN stream or a CAN based aftermarket ECU.
CAN Transmission: With this option the unit can transmit any of the internal data channels on the CAN bus, at a rate determined by the configuration.

GPS Data Logging and 2g Accelerometers

A complete data logger and display in a single compact package. Featuring lap timing using GPS, and accelerometers for measuring grip usage. Data is logged to internal memory and downloaded via USB.



Low Side Drivers and 4 Extra Analogue Channels

This option allows you to switch on/off external systems automatically using the DASH2 PRO. Control can be simple or based on a complicated equation. This option enables the 4 additional analogue channels, making a total of 8.

PWM Output Controller and Advanced Frequency Inputs

The PWM output controller allows you to control an external system with a graduated signal. Meaning it can be "on" anywhere between 1 and 100%. This is ideal for water injection systems etc. This option enables the advanced frequency input functions, pulse count, high/low times, duty cycles etc.

6g Accelerometers

6g accelerometers are recommended for applications that use large aerodynamic aids.

Applications include: Road legal cars and bikes, kit cars, race cars, track day cars and specialist production cars.

- **2 versions available DASH3 and DASH3lite**
- **Configurable backlit display and shift lights**
- **Powerful GPS laptiming features, no lap beacons required**
- **Flexible mounting options, including suction mount**

The DASH3 is an ideal tool for the racer who has limited space or is already running other instrumentation. The DASH3 is available as a lap time display and shift lights only or as a fully programmable display with message alarms and various different ways to display data.

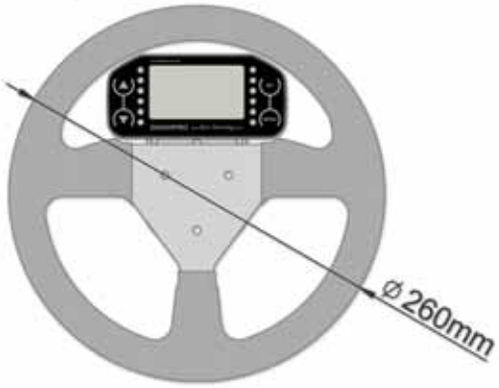
- Easy to use, compact primary or secondary graphical dash display.
- Lap and sector time screens appear momentarily as you pass the GPS lap/sector markers*.
- Available as a lap time display*, DASH3lite or fully configurable display, DASH3.
- Real time display of any parameter from a data logger or ECU**.
- Know when you are going faster with the predictive lap timing feature.
- Display the information the way you want, 7 fully configurable pages for information.
- Optimise your gear changes with the ultra bright configurable shift lights.
- Monitor your engine and drive train with fully configurable alarms.
- Control the data logger with the DASH3, start/stop logging and insert lap and sector markers.
- Temporary suction mount or fixed mounting available.
- Crystal clear backlit display readable from any angle and under any lighting conditions.
- Suitable for cars or bikes.
- Water resistant.
- Max/Min recall on all channels.
- Lap/Sector time memory for session review.

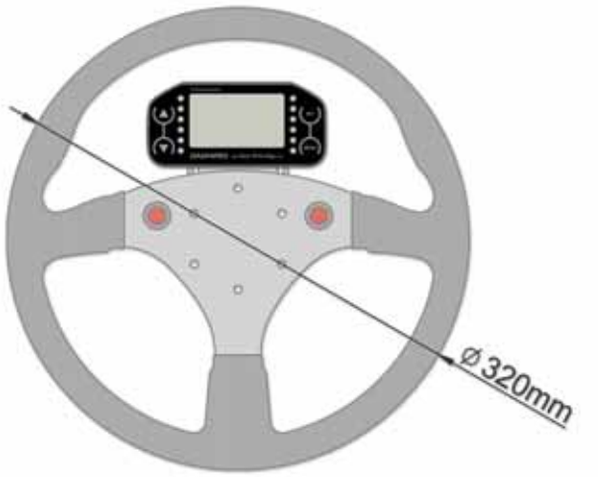
*Data logger required for lap timing
** ECU adapters available separately

Applications include: Road/track day cars, race cars, motorcycles, and OEM testing.

- **High contrast OLED or transflective LCD display**
- **Fully configurable graphic display**
- **Rugged aluminium case**
- **Fully configurable ultra-bright shiftlights**

The DASH4PRO is part of our new professional range of products designed for the professional race market. They feature sealed aluminium cases, high quality connectors and small packaging. It is the ideal partner to match our DL1 PRO and DL1 WP.





The DASH4PRO is designed for steering wheel mounting within all popular sizes of wheel, or alternatively it can be mounted to any flat panel.

The DASH4PRO also features:

- Two display choices:
  - The very latest "OLED" display technology. Recommended for closed cockpit vehicles. This has a high resolution, ultra wide viewing angle and wide operating temperature range.
  - Transflective "LCD" display recommended for open cockpit vehicles. Visible in all lighting conditions, even bright sunlight. Backlit for visibility at night.
- Display any combination of information, split over 5 pages – display ECU variables, speed, analogue inputs etc.
- Very comprehensive lap timing functions including live "time slip" and predictive lap times.*
- Displays text in small, medium and large text and also can be configured to display graphics, graphs and barcharts.
- Variable brightness, bi-colour dual shiftlights.
- Built in performance testing functions to test brake and engine performance.
- Comprehensive alarms which can trigger when any input is out of range.

* Data logger required for lap timing

- **Perfectly synchronised data and video**
- **New widescreen function with 50% higher resolution**
- **Overlay high resolution colour graphics**
- **Record video from up to 4 cameras**

The VIDEO4 is the perfect video recorder to compliment a Race Technology data logging system or as a standalone motorsport video system.

- Error free recording in the harshest of environments with solid state removable memory.
- A single Compact Flash card holds both the video and data* for fast downloads to PC.
- 16:9 Widescreen function (4 channel units), 50% higher resolution for quality playback.
- Catch every angle with up to 4 cameras.
- Create the perfect overlay with our easy to use comprehensive layout software.
  - Picture in picture.
  - Custom high resolution, full colour, fully configurable graphics overlay.
  - Display data from a data logger or ECU**.
- DVD quality video, up to 12 Mbit/s bit rate.
- CD quality stereo sound.
- Visually see how you can go faster on the track with full frame by frame data synchronisation.
- Use the video in the Analysis software for a completely integrated video/data analysis.
- Easy to use, the VIDEO4 combines all the video feeds and graphic overlays into a single video stream AND perfectly synchronises the data automatically as it is recorded.
- Share your moments, create custom DVDs with our single click DVD generation tool.
- View your video/data trackside straight after a run or generate presentation videos.
- Rugged waterproof version available.
- Comprehensive software included for set up, playback and analysis. Updates available from our website for free.

*Data logger available separately, or as an internal enhancement option - see opposite.
** ECU adapters available separately.

Applications include: Track day cars, race cars, motorcycles, driver training, and driver safety training.

Hardware Enhancement Options

To tailor the VIDEO4 unit to your application, a range of enhancements are available:

4 Camera Licence

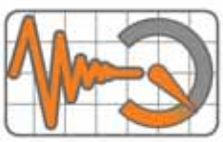
Standard units are 2 channel, see every angle with a 4 camera system. See more with additional PIP cameras: Main track view, rear view, side view, driver, pedals, suspension movement...

Widescreen

Free with a 4 camera licence is the widescreen capability, with 50% higher resolution. See greater quality video on widescreen TVs, and use the extra screen area to layout PIP videos and overlays.

5Hz GPS + 2g Accelerometers

If you don't already own one of our data loggers, it may be preferable to incorporate one into the VIDEO4 unit. Add standard 5Hz GPS data for accurate speed/position data and track maps. 2g accelerometers for analysing your braking and cornering forces.



Analogue and RPM Inputs

Add 4 analogue inputs and the all important RPM input to the unit. This is a perfect accompaniment to the 5Hz GPS + 2g option. This system fulfils most people's needs, negating the need for an additional data logger in the system.

20Hz Advanced GPS Option

An upgrade over the 5Hz GPS + 2g accelerometers option. Increased speed and position accuracy, with higher GPS resolution. Download corrections from the internet with advanced PPP mode.

6g Accelerometers

An upgrade over the 5Hz GPS + 2g accelerometers option. 6g accelerometers are recommended for applications that use large aerodynamic aids.

Battery Backup

Having a built in battery backup allows the system to close the recording successfully, and continue to log data, even with unexpected power outages from the vehicle.

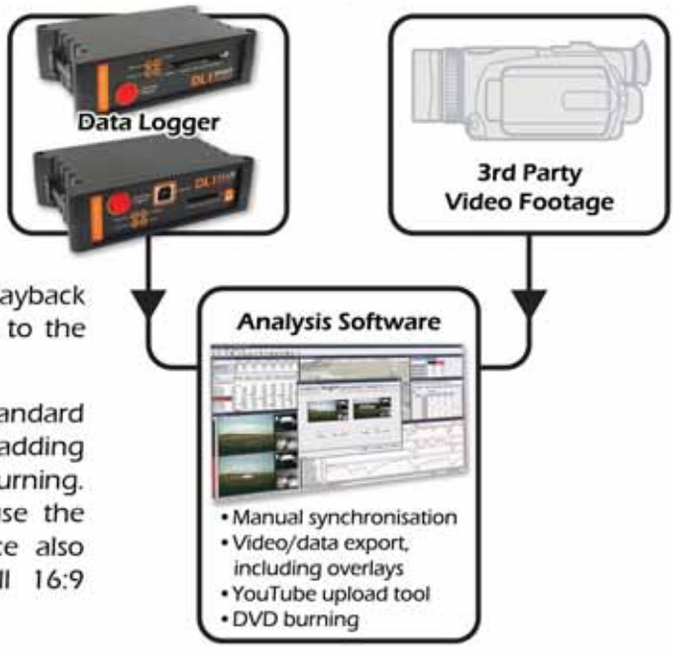
3rd Party Video Support

- **Import 3rd party video into Analysis**
- **Generate videos with data overlays**

Video is becoming an increasing popular option in combination with data systems, Race Technology offers 2 ways for our customers to handle video:

1. Using one of our VIDEO4 products, you can log data and video onto a single memory card pre-synchronised and ready for instant loading and detailed analysis – ideal for track side analysis. Details of VIDEO4 systems are shown over the page.
2. Using a video system from a 3rd party, and importing the video into the analysis software. This is more economical, but it takes longer to load in the data first and then the video. This is ideal for analysis after the race, or for generating videos for upload to YouTube.

The 3rd party video system supports almost any video recording system available. The 3rd party includes a tool to quickly and simply convert any video stream into video that is compatible with the Race Technology system. You can then synchronise the video and data for analysis, and export video with graphics overlay for playback on the PC, generation of DVDs, or upload to the internet.



Video functionality is enabled in the standard software, such as the video export (including adding overlays), YouTube upload, and DVD burning. However a video licence is required to use the video-by-data analysis function. The licence also enables higher resolution export and full 16:9 widescreen compatibility.

VIDEO Synchroniser

- **Synchronise 3rd party video with data**
- **Automatic synchronisation software**

The VIDEO Synchroniser is used to link video from a third party recorder, such as a camcorder, with the data from one of our data loggers. The way the system works is quite simple, the unit provides reference points in the video to sync the data to. The unit is controlled by the data logger and will flash at the correct frequency when logging commences, and this flashing appears subtly in the video. To avoid distracting the driver, the LED is a special type that can be seen by the video system, but it is "out of the range" of the human eye. Also to allow the system to work in bright daylight and in dark conditions it "auto dims" itself so it's never too obtrusive in the video.

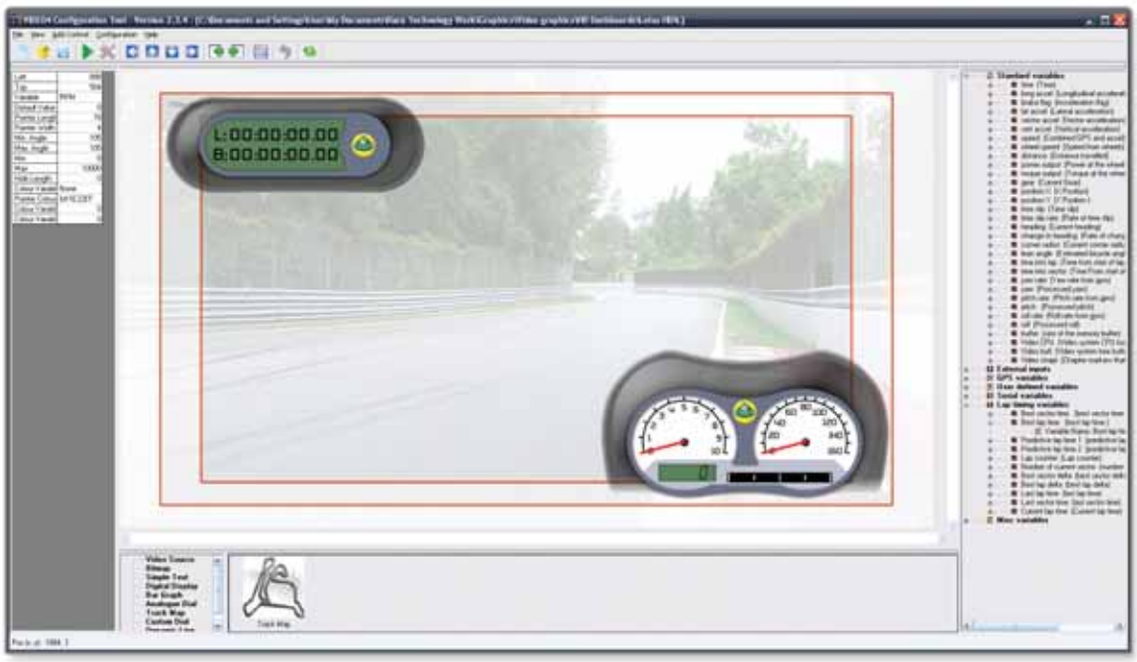
When you load the video into the analysis software, the software scans the video for the flashing LED and locates the exact time when it first starts to flash and when it stops flashing. These times are then used to synchronise the video and data with excellent accuracy, typically just a few frames of video.

- **Create full HD videos with data overlays**
- **Synchronised data and HD video in Analysis**
- **Supplied with Analysis software video licence**
- **Fully customisable HD overlays**

Produce full 1080p HD videos with crisp, full colour, graphic data overlays. Use your GoPro footage alongside your data in the Analysis software for a complete picture of the action.

Synchronise your GoPro HD video camera with your DL1 data logger using the GoPro interface cable. Start and stop recording from the DL1's single button or automatic logging controls. Quick and easy data and video synchronisation using our industry leading Analysis software.

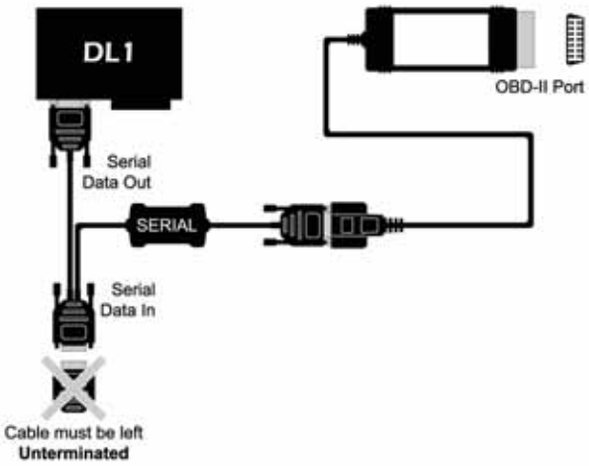
- Complete package with video licence for synchronised data with video analysis, and full HD video export.
- See more with synchronised data and video.
- See traffic problems and line choices to add another dimension to data analysis.
- Create videos with data overlays using the HD video export tool in the Analysis software.
- A range of predefined overlays are supplied for both 1080x1920 and 720x1280 HD formats.

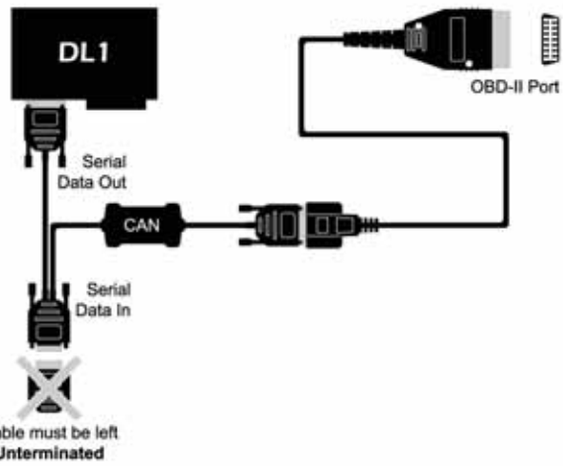


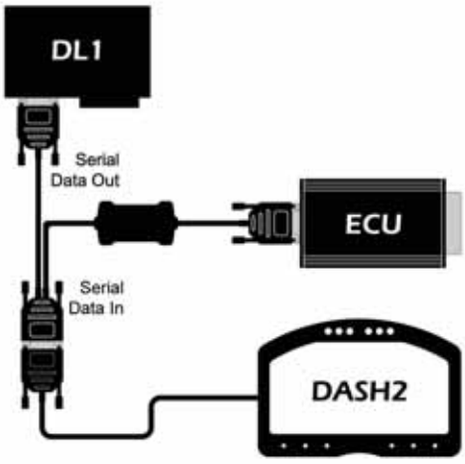
- **Obtain sensor data directly from the ECU or OBD-II port**
- **Compatible with a wide range of ECUs**
- **CAN and serial models available**
- **Display/log data to monitor engine health**

Hardwiring engine sensors is one way to get the data, however is a time consuming job compared to installing an ECU adapter. An ECU adapter can access the crucial sensor information directly from an aftermarket ECU or OBD-II port without getting your hands dirty.

- Display and log information from your ECU
- Save money on sensors
- Simplified wiring
- Use with any combination of Race Technology products and many different ECU manufacturers
- CAN and serial variants available
- Available for road cars with OBDII connectivity
- Compatible with VIDEO4 video and data logging system.
- See our website for the full list of compatible ECUs, more being added frequently.
- Monitor your engine health on track, and display with DASH1, DASH2, DASH3, DASH4PRO.
- Review your engine parameters alongside other data and video, all perfectly synchronised.







Interfaces compatible with most popular ECUs including:
(see website for full list)

- Adaptronic: e420c, e1280s
- AEM ECU
- Autronic: SM2, SM3, SM4, SMC
- DTA: P8 Pro, E48, S40, S60, S80
- EFI Euro 4, 6, 12
- Electromotive: TEC3, TEC GT
- EMS: Stinger, 8860
- Emerald: K3, K6
- Hondata: K series
- Hydra ECU
- KMS MP25, MD35
- MBE: 941, 967, 9A4, 992
- Motec: M4, M48, M84, M400, M600, M800
- Nira i3+
- Omex: 600, 710, 100, 500
- Pectel ECU
- Tatech V05, T32
- VEMS ECU
- ViPEC: V44, V88, Link G4

VRS Conditioner

- **Use your vehicle's existing VRS sensors to get a clean square wave signal**
- **Divide pulse counts to achieve the optimum frequency**

In order to use a standard ABS wheel speed sensor, some standard gearbox speed sensors or any wheel speed sensor with a large number of teeth on the trigger wheel it is necessary to divide the pulse count output from them in order for Race Technology products to be able to display or log the correct speed.

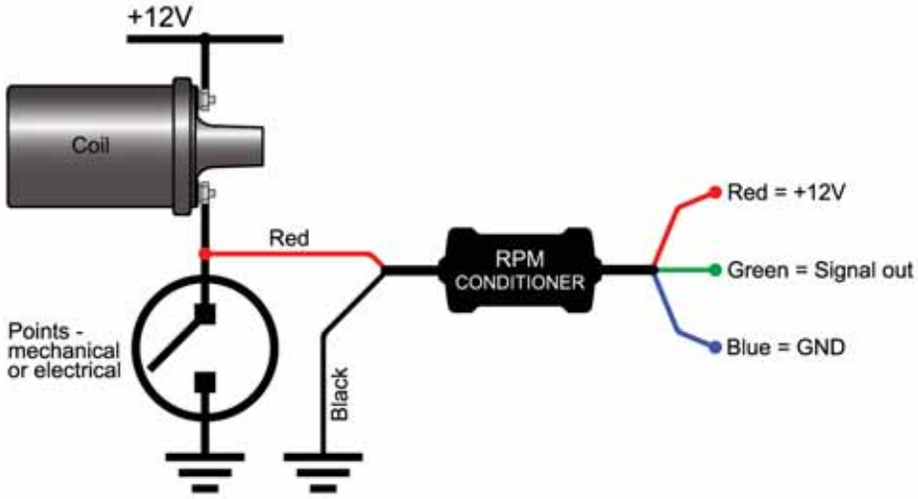
A VRS Signal Conditioner takes the unconditioned output from a Variable Reluctance Sensor (VRS) and outputs this as a clean square wave signal (similar to the output from a Hall Effect type sensor), suitable for connection to a DL1, DL2 or DASH2 and/or divide the pulse frequency by a number between 2 and 255.

RPM Conditioner

- **Outputs a clean logic level RPM signal from noisy problematic ignition systems**

Having trouble getting a good clean RPM signal? Then the RPM conditioner might be for you. It takes a noisy high level signal, typically from an ignition coil, and outputs a nice clean logic level signal that our hardware can use.

The circuit is filtered and optically isolated, making it robust and ideal for problematic ignition systems.



Thermocouple Amplifier

The thermocouple amplifier is our own design, it is a compact inline unit. It takes an input from a standard K-type thermocouple and amplifies it to a voltage suitable for logging. Two versions are available; one optimised for -100°C to 210°C and one for –100°C to 1150°C. In both cases the amplifier is powered from +5v and gives a 0-5v output. Ideal for all temperature measurement applications, including exhaust gas.

Air/Oil/Water Temperature

We stock a range of NTC type temperature sensors with characteristics suitable for air, water or oil. The sensors are accurate, robust, and are supplied pre-characterised and ready for use.

Brake/Oil/Fuel/Air Pressure

We now offer pressure sensors for almost any motor sport application, including: Brake, fuel, oil and air pressures. All of our pressure sensors are pre-amplified and require a single 5v supply and output a simple 0-5v signal.

Suspension Displacement

Linear suspension travel sensors, manufactured to the very highest specification to ensure long life, even in the harshest of environments. The exact same sensors are already in use at every level of motorsport including NASCAR and F1. We stock two sizes: regular with a 15mm square body and miniature 9.5mm diameter circular body. Both are available in a range of lengths from 12.5mm travel to 300mm travel.

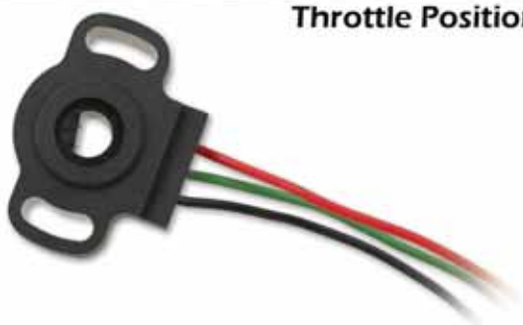
Lambda (Exhaust gas air/fuel ratio)

The lambda (wide range O2) meter features an optional display, and outputs narrow band and wideband lambda data in the form of 0-5v signals for logging. The system uses a true wideband lambda probe manufactured by Bosch. Outputs can also be displayed as Air/Fuel ratio.

Steering Angle

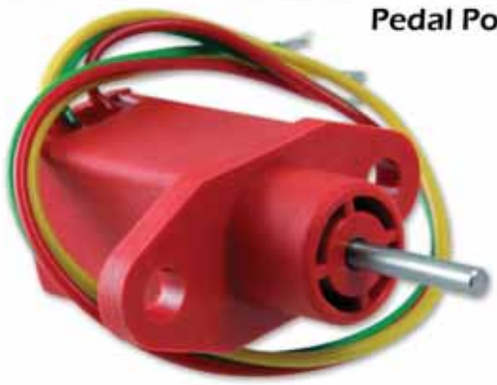
String potentiometer used to measure the angle of the steering wheel. This gives the driver a clear record of the steering wheel movement and can be used to calculate understeer/oversteer characteristics of a chassis.

Throttle Position



Rotary potentiometer for use on the throttle body of an engine. This gives a clear record of how the throttle was applied and can be used to tune the drivers application of the throttle.

Pedal Position



A low cost alternative way of measuring brake usage. Although it does not give a direct measure of the brake pressure it shows clearly how and when the brake pedal is applied. This can also be used to measure clutch pedal movement.

Wheel Speed

This "Hall Effect" type wheel speed sensor is highly robust and designed specifically for high reliability automotive applications. It does not require a magnet to trigger it, just a moving metal "target", for example a bolt on the back of the brake disk. Much better signal to noise ratio than variable reluctance type sensors.

Sensor Cables

Race Technology also supplies all sensors with optional cable lengths. We use a very high quality high temperature, electrically screened cable, with black outer sheath and three conductors. Please contact us with your requirements. This high quality cable is also available separately by the meter.

Race Technology Professional Product Range

The Professional range of products from Race Technology consists of high precision instruments used for automotive testing purposes and those that require maximum reliability and accuracy under the most extreme conditions. Many of our Sport products are also used by motorsport and automotive professionals or can be combined with our professional range for systems that are cost effective yet highly accurate and packed with powerful features.

Race Technology leads the way with hybrid GPS + Inertial systems – which other manufacturers are now copying. Race Technology innovates – others follow. This principle is used in the SPEEDBOX. Combining GPS and inertial data gives accurate, robust, low noise speed measurement as illustrated in the figure below.

SPEEDBOX

The SPEEDBOX is a 200Hz non-contact speed sensor intended to replace a wheel speed sensor where higher accuracy and greater convenience are required. The SPEEDBOX uses ***PurePhase*** GPS and accelerometers to calculate speeds to within 0.05 kph (<0.1mph), at 200Hz with very low latency (less than 5ms). It has four analogue outputs as well as CAN, RS232 and a pulse output for connection to almost any data logging system.

SPEEDBOX with RTK option

For accurate determination of vehicle yaw and slip angles, the SPEEDBOX with RTK is the ideal solution.

By utilising dual ***PurePhase*** GPS receivers the SPEEDBOX with RTK is able to accurately calculate yaw angle with an update rate of 20Hz, as well as offering the features of the standard SPEEDBOX.

SPEEDBOX with IMU option

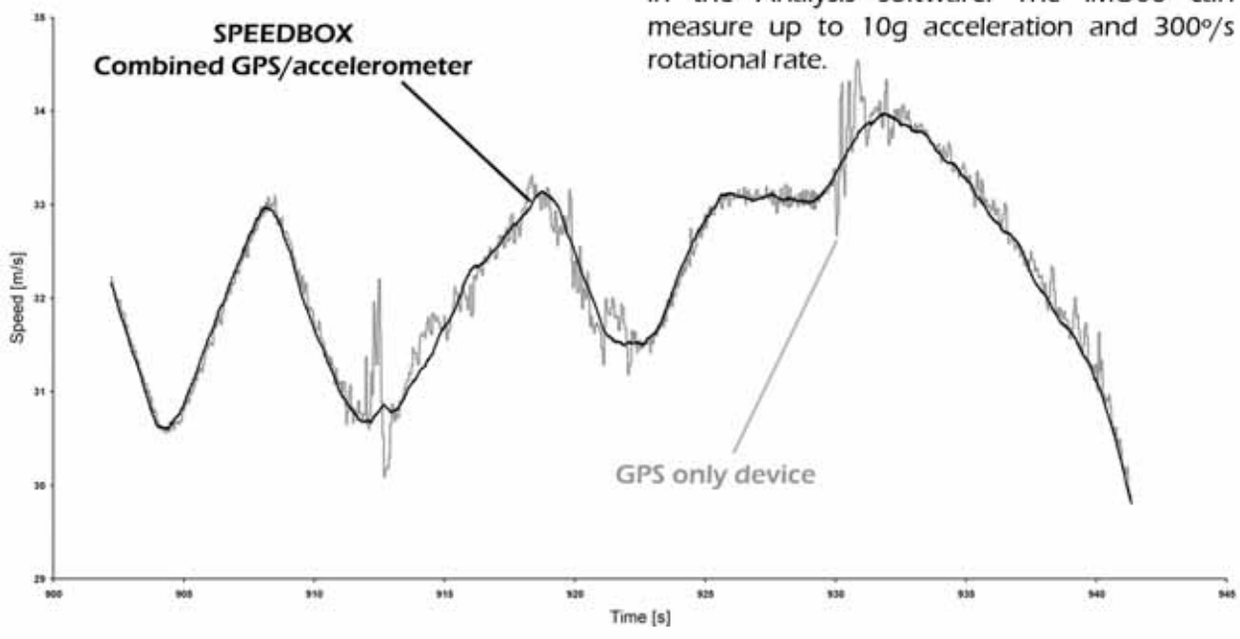
With the addition of angular velocity measurement and upgraded accelerometers offering 10g 3 axis accelerations, the SPEEDBOX with IMU is a full 6 degree of freedom measurement unit combined with high accuracy speed measurement. The additional channels of pitch rate, roll rate and yaw rate are measurable up to 300 degrees/s, as well as offering the features of the standard SPEEDBOX.

SPEEDBOX with INS option

The SPEEDBOX INS range are our flagship industrial test products. Combining high accuracy 3 axis accelerometers, 3 axis gyro, together with a dual or single antenna GPS system into a single unit. This sensor assembly is quickly and easily mounted on the roof of the test vehicle and can be outputting data within a few minutes - no "initialisation" phase is required. The unit measures vehicle roll, pitch, yaw, acceleration, velocity, distance, gradient and heading as well as position, all output at 200Hz.

IMU06

The IMU06 is a compact inertial sensor giving a full six degree of freedom output at 100Hz, The serial output data can be logged on a DL1 or DL2 and viewed as an extra six channels of data in the Analysis software. The IMU06 can measure up to 10g acceleration and 300°/s rotational rate.



- **Perfectly synchronised data and video**
- **Waterproof - sealed to IP67**
- **Record video from up to 4 cameras**
- **Video and audio recorded to D1 (DVD) standard**

The VIDEO4 Professional is a rugged and fully sealed version of the VIDEO4 Sport. It boasts all the features of a 4 channel VIDEO4 Sport plus a fully sealed CNC machined enclosure, waterproof Deutsch Autosport connectors passive cooling and extremely robust power supply. It is designed for use in the harshest of environments.

- CNC machined enclosure.
- Waterproof (IP67).
- Deutsch Autosport connectors.
- Highly flexible power supply, anything from 6 –35v is accepted, outputs 12v for the cameras.
- Error free recording in the harshest of environments with solid state removable memory.
- A single Compact Flash card holds both the video and data* for fast downloads to PC.
- 16:9 Widescreen function, 50% higher resolution for high quality playback.
- Create the perfect overlay with our easy to use comprehensive layout software:
  - Picture in picture.
  - Custom high resolution, full colour, fully configurable graphics overlay.
  - Display data from a data logger or ECU**.
- DVD quality video, up to 12 Mbit/s bit rate.
- CD quality stereo sound.
- Use the video in the Analysis software for a completely integrated video/data analysis.
- Easy to use, the VIDEO4 combines all the video feeds and graphic overlays into a single video stream AND perfectly synchronises the data automatically.
- Share your moments, create custom DVDs with our single click DVD generation tool.
- View your video/data track side straight after a run or generate presentation videos.
- Comprehensive software for set up, playback and analysis, available from our website for free.

*Data logger available separately.
** ECU adapters available separately.

Applications include: Desert rallying, driver training, boat racing, single seaters or any application requiring waterproof video recording equipment.

- **Typical speed accuracy of 0.02m/s**
- **Braking distance accuracy to a few cm**
- **200Hz speed output without interpolation**
- **Drop in upgrade to 5th wheel and GPS only systems**

PurePhase

The SPEEDBOX is a very high accuracy non-contact speed sensor which has been designed for professional automotive testing as well as other industrial and high-end motorsport applications. It outputs a low latency, non-interpolated speed measurement comprised of GPS and inertial data combined using an adaptive filter for exceptional performance even in environments where accuracy of GPS-only sensors is severely degraded.

The SPEEDBOX is used by many vehicle OEMs, test tracks and professional engineers worldwide.

- Highly accurate (0.05km/h) and extremely fast (output latency 2ms).
- 20Hz ***PurePhase*** GPS developed by Race Technology specifically for automotive testing.
- 3 axis accelerometer.
- Accelerometers combined with GPS create maximum accuracy even during short GPS signal drop-outs.
- Self-optimising Kalman filter used to maintain GPS and accelerometer data.
- Unrivalled cost/performance ratio.
- Outperforms even top of the range survey grade receivers in speed measurement.
- 4 configurable analogue ports, can be set up as either inputs or outputs for combined speed, GPS or acceleration data.
- Digital pulse output for speed and distance measurement.
- Trigger input for data synchronisation with external events.
- 2 serial and 1 USB port for data output, in uBlox, Race Technology format, ASCII messages in NMEA format.
- Fully configurable CAN output.
- Live Performance Monitor software available to control various tests.
- 7 – 30v power supply range.
- Dimensions 199 x 135 x 43 mm.

The SPEEDBOX is available with a number of options, namely RTK, IMU, and the new INS systems, see details below:

	SPEEDBOX	Options				
		+IMU	+RTK	+IMU/RTK	+INS Standard	+INS Tactical
Accelerations	200Hz, 0.1m/s²	200Hz, 0.05m/s²	200Hz, 0.1m/s²	200Hz, 0.05m/s²	200Hz, 0.05m/s²	200Hz, 0.025m/s²
Speed	200Hz, 0.02m/s	200Hz, 0.015m/s	200Hz, 0.02m/s	200Hz, 0.015m/s	200Hz, 0.015m/s	200Hz, 0.015m/s
Distance	200Hz, 2cm in 50m	200Hz, 2cm in 50m	200Hz, 2cm in 50m	200Hz, 2cm in 50m	200Hz, 2cm in 50m	200Hz, 2cm in 50m
Position	20Hz, 3m	20Hz, 3m	20Hz, 3m	20Hz, 3m	200Hz, 2m	200Hz, 2m
Roll rate /Pitch rate / Yaw rate		200Hz, 0.1deg/s		200Hz, 0.1deg/s	200Hz, 0.05deg/s	200Hz, 0.01deg/s
Yaw			20Hz, 0.2deg	20Hz, 0.2deg	200Hz, 0.15deg	200Hz, 0.05deg
Roll / Pitch			20Hz (note1), 0.6deg	20Hz (note1), 0.6deg	200Hz, 0.1deg	200Hz, 0.025deg
Price Comparison	$$$	$$$$	$$$$	$$$$$	$$$$$$	$$$$$$$

The figures given are for 50% CEP accuracy and with a good GPS signal.

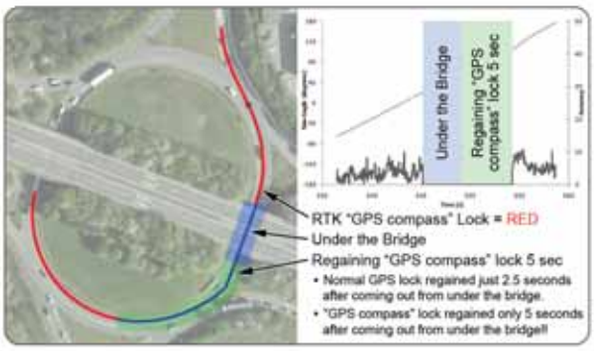
Note 1: for the RTK option only either Pitch or Roll is available at one time, not both. For the INS option, all outputs are available simultaneously.

Note that 20Hz measurements need a GPS fix to be valid, all 200Hz measurements are from the inertial sensors and robust to GPS outages making them far more suited to highway testing.

What is the SPEEDBOX with RTK option?

The additional RTK option can either be specified at the time of ordering, or a standard SPEEDBOX can be factory-upgraded.

The SPEEDBOX with RTK uses innovative cutting-edge "Moving Base Real Time Kinematics" GPS technology to accurately measure vehicle yaw and pitch 20 times per second. These parameters are calculated using very high accuracy position measurements from two separate GPS antennas. The relative positions of the two GPS antennas can be determined within a few millimetres, so for a typical baseline distance of 80cm between the two antennas the vehicle pitch and yaw can be calculated to an accuracy of a few tenths of a degree. Vehicle yaw and pitch are measured directly and do not require the vehicle to be moving.



Our unique GPS compass system typically regains lock in just 5 seconds in real world conditions. This is by far the best of any competitor system, with most taking over 30 seconds in the same conditions, with some taking several minutes. By this measure, whilst other similar systems are only suitable for use at test tracks where there are no GPS obstructions, our system can be used on the race track or on public roads. This technology has been developed by Race Technology and is unique to Race Technology.

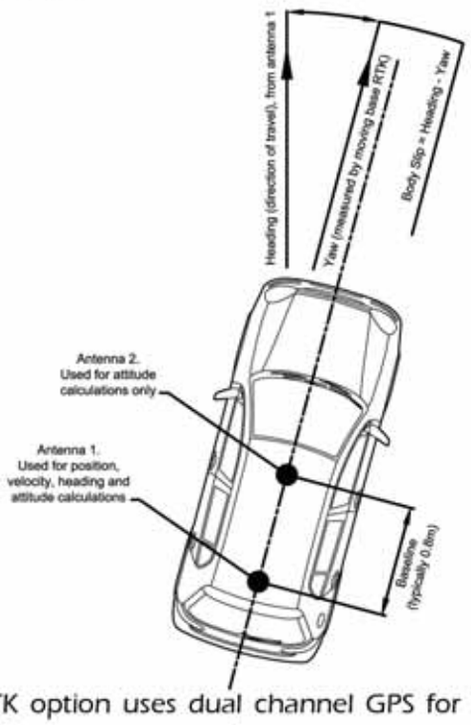
What is the SPEEDBOX with IMU option?

The additional IMU option can either be specified at the time of ordering, or a standard SPEEDBOX can be factory-upgraded.

The SPEEDBOX with IMU uses an internal, high accuracy inertial measurement unit to give additional angular velocity measurements. The IMU option also upgrades the 3 axis accelerometers to measure accelerations up to 10g with very high accuracy. The angular velocity measurement offers pitch rate, yaw rate and roll rate. The rates are measurable up to a maximum 300 degrees/s

The SPEEDBOX can be specified with both the RTK and IMU options on the same unit.

The SPEEDBOX has the ability to sense direction of travel (forward and backwards). The IMU option offers improved speed accuracy when GPS signal is lost and the road gradient changes – For example in a tunnel with non-zero gradient.



RTK option uses dual channel GPS for vehicle attitude measurements

SPEEDBOX-INS

Roll, pitch, yaw, heading, gradient, velocity, accelerations, and distance all at 200Hz

- Best performance available
- 200Hz output on serial, CAN and analogue
- Highly accurate combined GPS and inertial data ensures no outages even in challenging GPS conditions

The SPEEDBOX-INS range is our purpose designed automotive testing solution offering enhanced accuracy and flexibility over the standard SPEEDBOX product. The system comprises of a SPEEDBOX unit coupled with a roof mounted sensor and antenna assembly.

Three models are available to suit the application and accuracy required:

- **SPEEDBOX-INS Standard Dual Antenna**
  Quick to install and highly accurate, fitted and outputting data in minutes
- **SPEEDBOX-INS Tactical Dual Antenna**
  Improved accuracy over the standard dual antenna
- **SPEEDBOX-INS Tactical Single Antenna**
  For aerodynamic & space critical applications

	SPEEDBOX-INS		
	Standard Dual Antenna	Tactical Dual Antenna	Tactical Single Antenna
Accelerations	200Hz, 0.05m/s²	200Hz, 0.025m/s²	200Hz, 0.025m/s²
Speed	200Hz, 0.015m/s	200Hz, 0.015m/s	200Hz, 0.015m/s
Distance	200Hz, 2cm in 50m	200Hz, 2cm in 50m	200Hz, 2cm in 50m
Position	200Hz, 2m	200Hz, 2m	200Hz, 2m
Roll / Pitch / Yaw rate	200Hz, 0.05deg/s	200Hz, 0.01deg/s	200Hz, 0.01deg/s
Yaw	200Hz, 0.15deg	200Hz, 0.05deg	200Hz, 0.05deg
Roll / Pitch	200Hz, 0.1deg	200Hz, 0.025deg	200Hz, 0.025deg

The INS sensor is connected to the main SPEEDBOX unit, where the raw inertial and GPS outputs are combined (using complex algorithms and Kalman filtering) in real time to accurately measure vehicle roll, pitch, yaw, acceleration, velocity, distance, gradient and heading as well as position.

All measurements have a very low latency of just a few milliseconds, and are output at a rate of 200Hz with no interpolation.

The 200Hz update rate is very important when accurately measuring vehicle responses during testing, assuring the data is accurate during dynamic manoeuvres. The SPEEDBOX range is optimised for automotive testing, ensuring that the update rates are as high as possible, without introducing noise into the system's measurements.

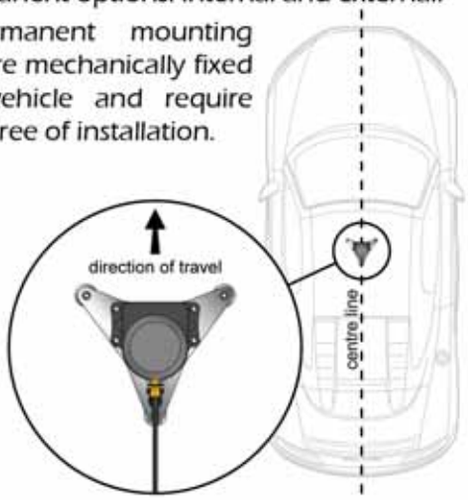
The **Dual Antenna SPEEDBOX-INS** is favoured for industrial testing where the secure temporary installation, and quick set up make efficient use of time, with exceptionally accurate results. The unit can be fitted and ready in minutes; outputting data as soon as it has a GPS lock, with no set "learning manoeuvres" required. Temporary mounting is achieved using the secure suction mounts, or alternative mounting points are available for a more permanent installation.

The example below shows the SPEEDBOX INS system compared against a GPS only system in difficult GPS conditions. With trees lining the road and the vehicle driving under the road bridge. The SPEEDBOX INS system retains excellent data throughout

The **Single Antenna SPEEDBOX-INS** system's compact size makes it ideal for aerodynamic and space critical applications, and is ideal for use on professional racing vehicles and motorcycles. The high dynamic attitude data being used to improve driver performance and to tune and develop racing chassis and suspension. The single antenna system requires a short initialisation phase before it outputs converged data - typically this would be a single warm up lap.

Three mounting options are available for the single antenna assembly, a temporary external mounting, using a magnetic mount plate, and two permanent options: internal and external.

The permanent mounting options are mechanically fixed to the vehicle and require some degree of installation.



- **3 axis acceleration, 3 axis gyro**
- **Maximum 10g accelerations and 300 degrees/s velocities**
- **Direct connection to Race Technology data loggers and displays**
- **Pulse output for accurate data alignment**

The IMU06 is a compact 6 degree of freedom inertial measurement unit. It can be used with other Race Technology products or any other data logging device. NOTE: The IMU06 outputs roll, pitch, and yaw rates, not actual roll, pitch and yaw angles. These can be estimated from the rates but will not be exact. The IMU06 is designed for vehicle dynamics testing applications, particularly for suspension or braking testing. It can also find application in a number of other position sensing applications such as stability control. Available in standard or waterproof (IP67) packages.

- 3 axis accelerometer up to 10g.
- Angular velocity up to 300°/s, user configurable.
- Data rates up to 100Hz, user configurable.
- Waterproof (IP67) version available.
- CAN and RS232 outputs.
- User configurable CAN outputs.
- RS232 data output using Race Technology serial format.
- Dimensions
  Standard : 60.4 (W) x 70 (L) x 35 (H) mm.
  Waterproof: 70.4 (W) x 75 (L) x 35 (H) mm.
- Timing pulse output for data alignment.

Applications include: Vehicle handling tests, chassis development, suspension development, tyre testing, accident investigation, roller coaster testing.

"Your data logging system has provided us the information required to develop our drivers **into regular podium visitors and ultimately the outright champion.**"

Richard Ollerenshaw, Team Principal - Hillspeed Racing.

"Thanks again for your help and support this season...
...I'll continue to use your excellent products and service as much as I can."

Peter Studer, vehicle dynamics engineer and club racer.

"Whoever came up with the interactive mode was a genius!
Its so useful when you're looking at sector time/gps/quick graph at once."

Andy Burbidge (about the Analysis software), Vehicle development engineer and motorcycle racer.

"My experience with the DASH2 and DL1 has been a pleasure for the past two seasons, installation, setup and use has all been very easy.
The data logger in particular has certainly helped a great deal enabling me learn the tracks quickly with minimal testing."

Jason Cooper, UK Ford Fiesta ST championship winner.

"We integrated the DL1 and DASH2 into the Life engine management system via the RT CAN interface. This allowed us to monitor and log all of the channels from the ECU without the addition of extra sensors or wiring.
This configuration proved utterly reliable throughout a long hard season's racing and the results speak for themselves."

Simon Tilling, Castle Combe GT championship winner.

Race Technology
www.race-technology.com

Race Technology Ltd
+44 (0)1773 537620
After 12
King Street
Eastwood
Nottingham
NG16 3DA
UK

Race Technology USA
+1 804 358 7289
2317 Westwood Ave
Ste 101
Richmond
VA 23230
USA