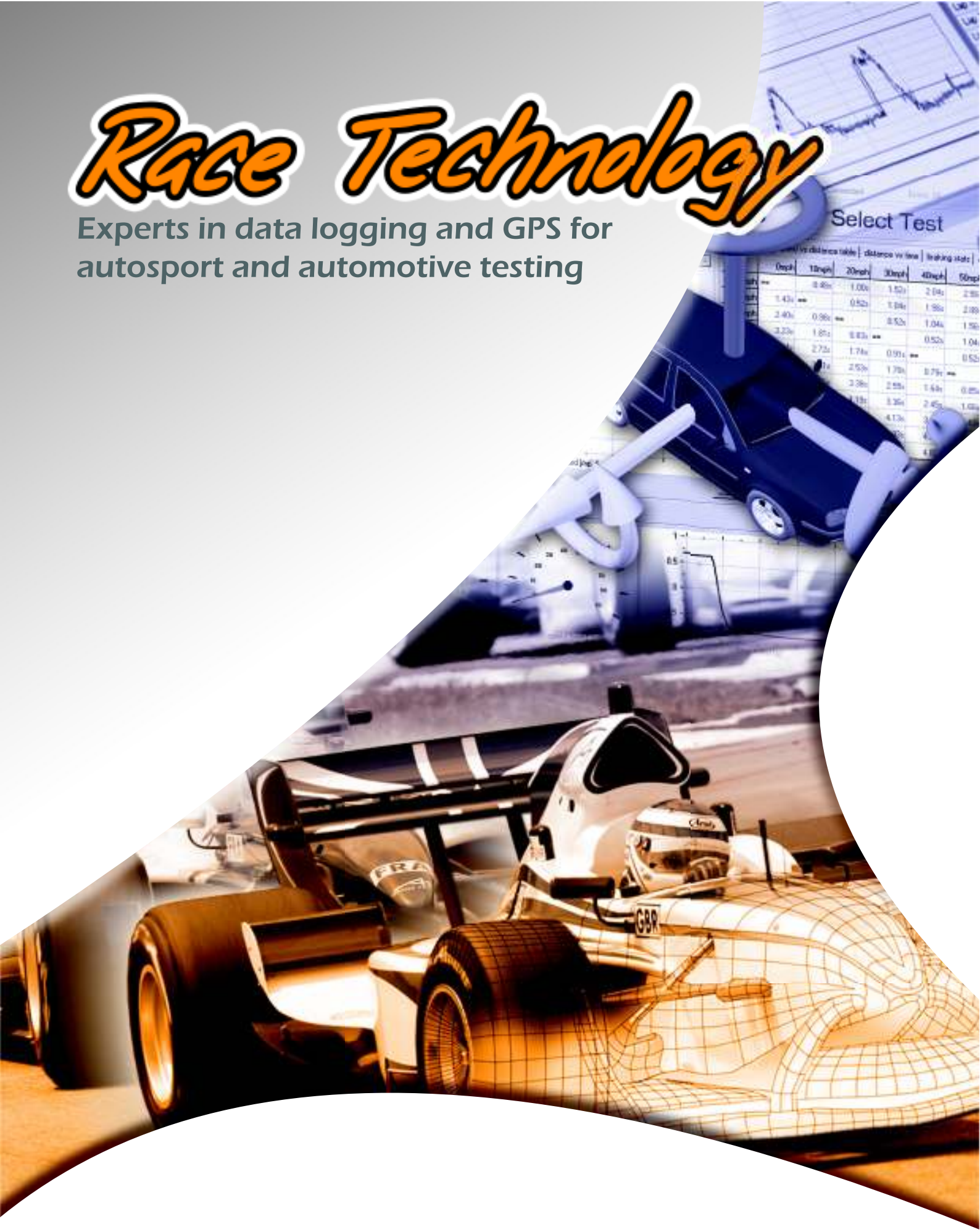
Race Technology

Experts in data logging and GPS for autosport and automotive testing



Version 5
January 2010

Company Profile - Contents

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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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 Loggers

Race Technology has taken the lead in developing a video system designed specifically for use in any moving vehicle. Our video systems can be used on their own as high quality recorders or they can be connected to one of our data loggers for a seamless synchronisation and integration of video and data. The data can be used to control graphic overlays on the video feed or the video can be used in our analysis software greatly improving the usefulness of the data gathered by the on board data logging system. Two and four camera systems are available.

Accessories and Sensors

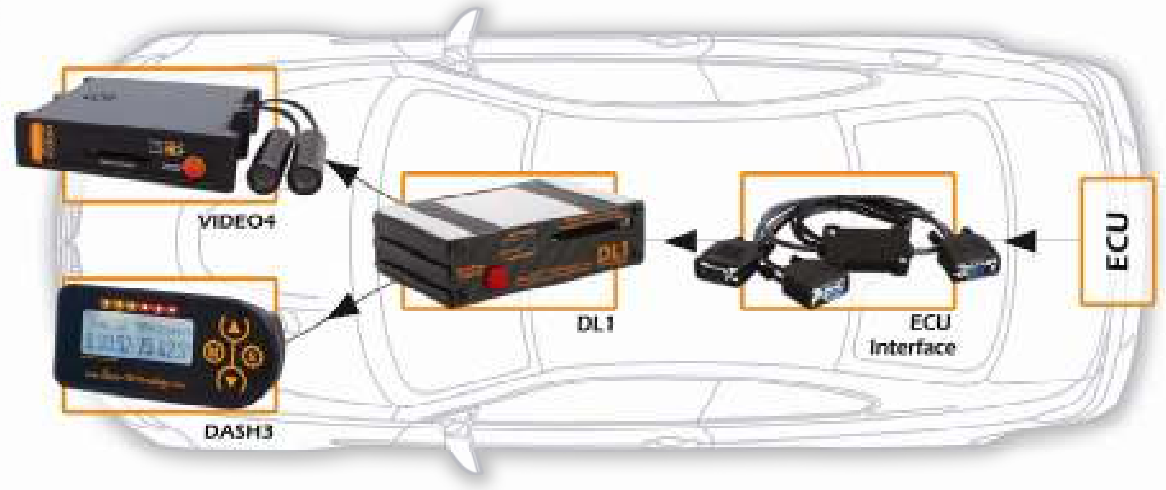
A variety of accessories are available for all of our products to allow our customers to configure and customise their systems the way they want. ECU interfaces and various different sensors are available which means you can create the perfect system for any vehicle.

	 DASH3	 DASH3 lite	 DASH2
Display Type	Backlit graphics LCD	Backlit graphics LCD	Backlit custom LCD
Number of Display Screens	5	5	4 + lap, sector and Max/Min
Standalone Operation	No	No	Yes
Built in Inputs	0	0	4 analogue + RPM and wheel speed
Warning Lights	6 Shift lights, custom message alarms	6 Shift lights	6 Shift lights custom alarms and message alarms
Display Control	4 buttons on unit	4 buttons on unit	4 external buttons

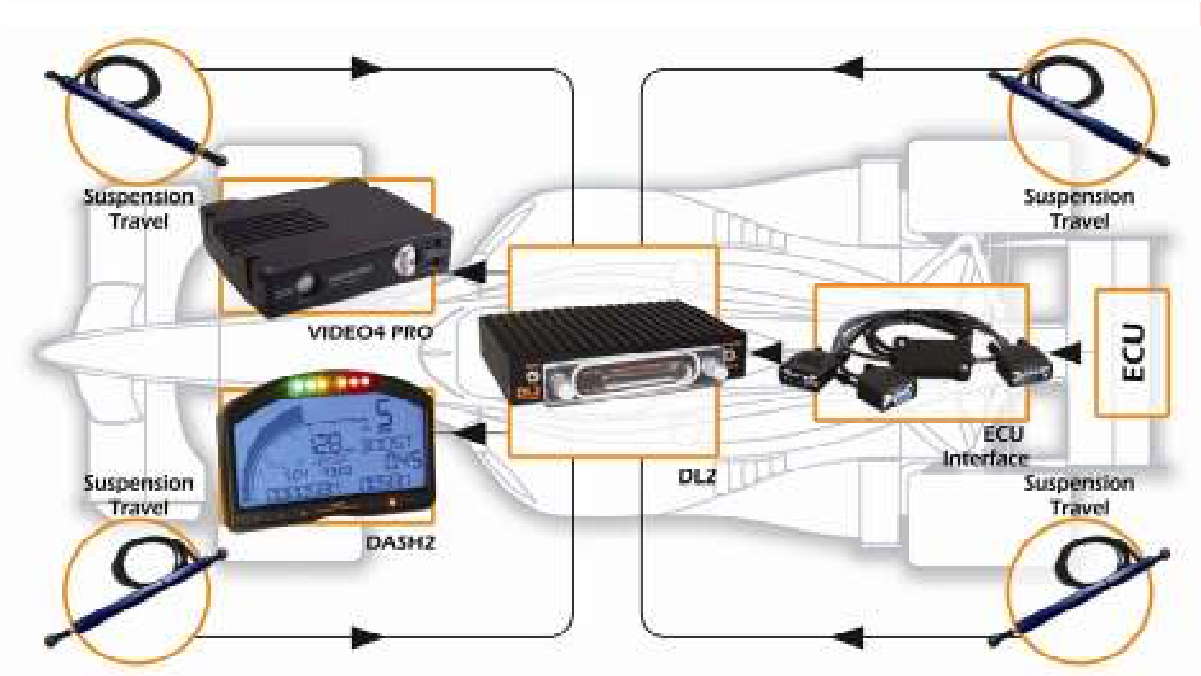
	 AX22	 DL1	 DL2
Description	In car performance meter with data logging	Advanced GPS data logger with analogue inputs	Advanced waterproof GPS data logger with analogue inputs. Fully ruggedised.
Display	2x20 LCD back lit	Optional external	Optional external
Accelerometer	3 axis 2g (6g upgrade available)	3 axis 2g (6g upgrade available)	3 axis 2g (6g upgrade available)
Max Logging Time	Unlimited, about 12MB/hour	Unlimited, about 20MB/hour	Unlimited, about 50MB/hour
GPS Type	5Hz built in	5Hz standard, 20Hz option	5Hz Standard 20Hz option
Inputs	1 RPM	8 Analogue, 4 frequency, 2 RPM	16 Analogue, 4 frequency, 2 RPM

Example Layouts

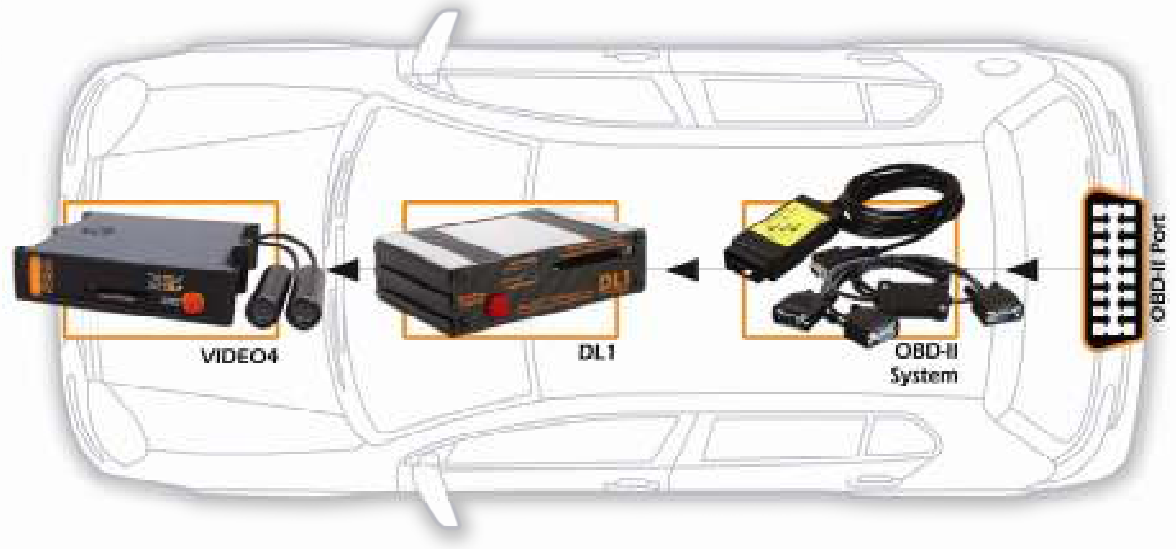
On these two pages you will find examples of systems that are typical for each installation. These are by no means the only configurations possible, each installation can be tailored to the customers requirements. As well as that each system can be built up in stages and new products added at any stage, so you can start of with a simple logging system and build your system up as you go along by adding dash display. ECU adapter, video logger, sensors, etc.



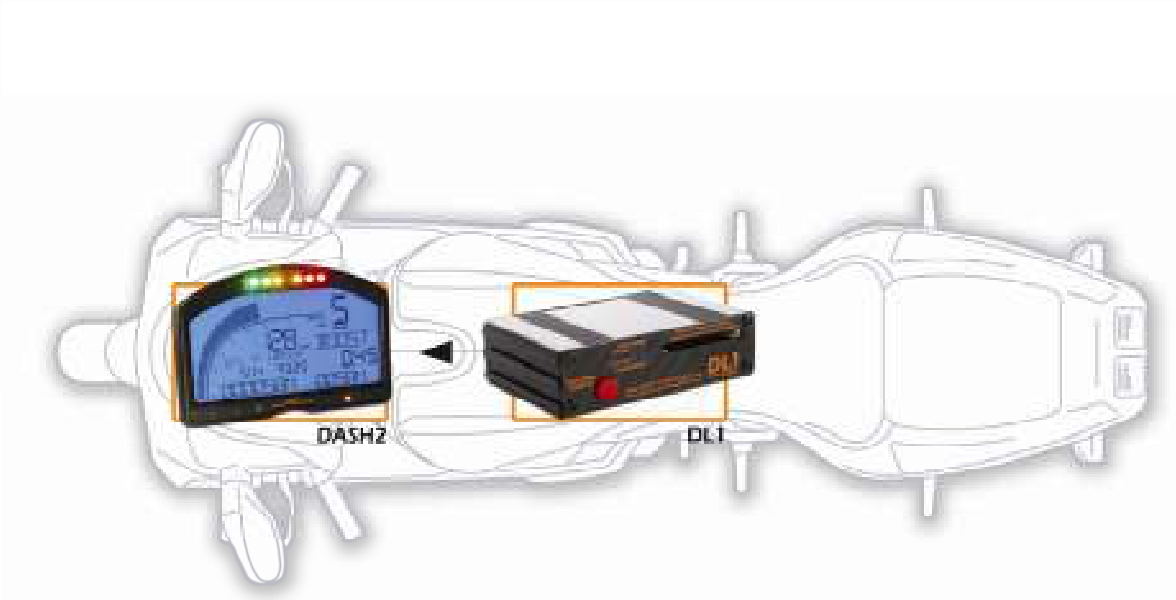
Closed top race/track day car



Single seater race car



Road/track day car



Motorcycle

Why GPS?

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 *Pure*Phase 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 *Pure*Phase 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"

- Powerful post race analysis software
- Fully integrated video support
- Fast, intuitive user interface
- Used by amateur racers to top teams worldwide

Key Features

Naturally, our Data Analysis Software has all the functions of a "standard" data analysis package: lap and sector times, track maps, graphs and comparing the current lap with a theoretical lap etc. But this is just the start; the Race Technology software contains many more features which set it apart from others and give it the competitive edge.

Our software is far more powerful and scalable than most other systems. Over 20 runs can be simultaneously loaded and compared, each with almost unlimited laps and up to 99 sectors per lap (computer memory permitting). In addition up to ten video streams can be loaded per run, and over 100 user defined variables can be added if required. Finally, there is no hard limit on the number of graphs and bar charts that can be generated.

The Analysis software has a built in driving simulation tool. With a few parameters put in by the user or measured from the data the software is able to predict the fastest theoretical lap and sector times based on the vehicle performance. This theoretical data can be used to see where the most likely gains are to be made on a track quickly and easily. The software also features the seamless integration of video with the data and video automatically synchronised. For example, when any graph is clicked on, the associated video frame is shown. When the video is played back the data is shown alongside. Video gives the data "context" making it immediately understandable for both engineers and drivers. The video is automatically loaded with any data and both are recorded on the same memory card. The software also supports 3rd party video, which allows you to take any video footage and manually synchronise it with the data, then it is also possible to reprocess the video to include overlaid data. This combination of features is not available in any other analysis package irrespective of cost. In addition to the Race Technology video support, the Analysis software also supports 3rd party video import with manual synchronisation.

Using the high quality GPS data from our loggers, the software can calculate very high quality track maps, much better track maps than are available from "conventional systems".

Using the track map as a base, numerous markers or "virtual beacons" can be added, which can then be used as reference points for anything from simple lap or sector timings to far more complex calculations. For example to find the maximum speed, or average throttle opening around a particular corner. The software can even divide the track up into sectors automatically; either a fixed number of sectors, or based on the straights or corners making for very fast efficient trackside analysis. The software also features a satellite picture overlay, an image taken from Google maps is down loaded automatically to show the actual layout of the track

As well as all the standard "built in" variables like speed, acceleration, RPM, user defined variables can be added. These have many applications; simple applications include converting an existing variable to different units, converting a voltage to a physical quantity such as a temperature, calculating the slip ratio between two wheels or shafts or maybe converting a suspension movement to an average ride height.

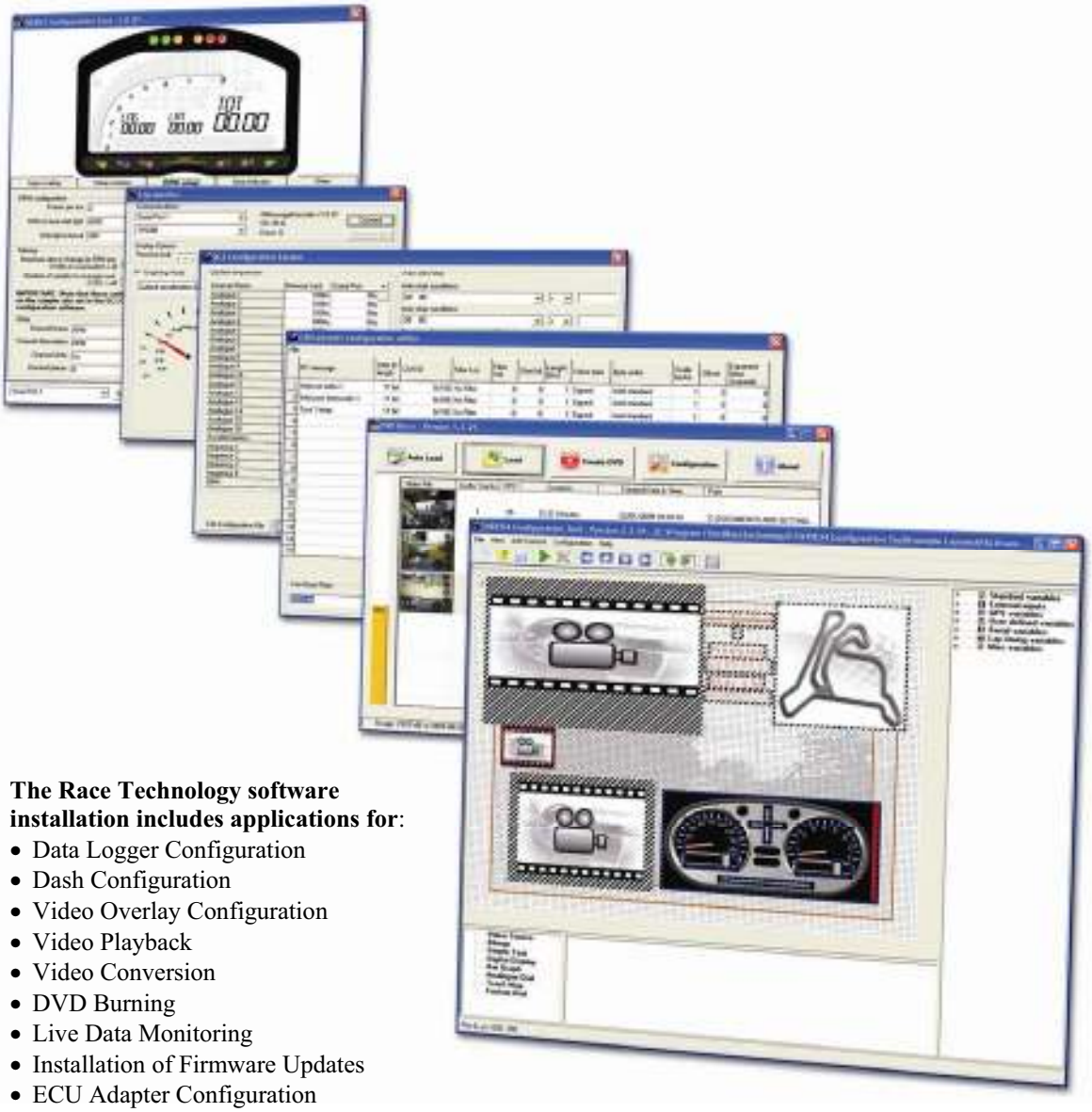
The Analysis software also contains user defined filtering, which allows advanced users to integrate, differentiate and filter data for applications as diverse as removing noise to calculating shock rates.

Track map with satellite overlay

Other Software

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 straight forward 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 – its FREE to download, for life. 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

DL1 Data Logger

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

The DL1 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 may be small in size and price but it is big on features.

- Our best selling data logger – over 5000 in use worldwide
- One box plug and play solution
- Expandable, 13 inputs for wheel speeds, steering angle, damper pots, brake pressure, etc.
- Capable of detecting minute changes with 100Hz update rate on all channels
- Unrivalled accuracy with our 20 Hz 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.
- Get the most out of your engine by logging information from your ECU*
- 50 hours of logging with a 1 GB compact flash card
- Scrutineering logger for SportMaxx, the UAE GT Championship and Britcar.
- Easy to use, comprehensive analysis software, free to download from our website
- 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 or DASH3
- Suitable for cars, bikes, boats, trains, you name it!
- Unbeatable value for money
- Completely modular system, add dash display or video capabilities at any time

*ECU adapters available separately

Applications include: Club racing, motor cycles, track day cars and an option on various production sports cars

DL2 Data Logger

- Robust, billet aluminium enclosure, sealed to IP65
- Suitable for high vibration race/testing environments
- 5Hz or 20Hz GPS, 2g or 6g accelerometers
- Highly configurable and upgradeable

The DL2 is the professional's choice, suitable for the harshest of environments. Housed in a waterproof CNC machined enclosure it is bursting with features. The DL2 will handle pretty much anything you throw at it.

- Highly accurate professional data logger
- Waterproof and extremely robust enclosure
- High quality waterproof connectors
- Connect any sensor you like with over 30 channels available, there of 16 analogue channels
- Expandable memory, up to 2.0GB CF cards accepted (around 90 hours of logging depending on configuration and sampling rate)
- Capable of detecting minute changes with 100Hz update rate on all channels
- In house developed GPS receiver, unrivalled accuracy with our 20Hz GPS (5Hz standard)
- Increased GPS accuracy using GNSS augmentation
- Minimise the effect of vibration with fully damped accelerometer and GPS sub-assembly
- Communicate with other 3rd party and Race Technology equipment, dash displays, high accuracy speed sensors, inertial measurement units etc using serial input and output.
- Get the most out of your engine by logging information from your ECU*
- Review your braking points and overall g-forces with the built in 2g 3-axis accelerometer, optional 6g 3-axis accelerometer for high down force applications
- High and low level RPM input suitable for different engine installations

- The official data logger for the Powerboat P1 World Championship
- Easy to use, comprehensive analysis software, free to download from our website
- Lap and sector timing, make sure you find that last 0.01s for pole position
- Trackmaps with satellite overlay
- Live lap and sector timing using DASH2 or DASH3
- Optional built in battery pack available
- Completely modular system, add dash display or video capabilities at any time
- Suitable for cars, bikes, boats, trains... you name it!

*ECU adapters available separately

Applications include: Professional racing, race boats and automotive testing

AX22 Performance meter - DASH1

- Built in 5Hz GPS receiver and digital accelerometer
- Removable compact flash memory
- Simple measurement of acceleration and braking
- Ultra quick installation

The AX22 is part data logger, part performance meter. The result is a system that is suited to applications such as industrial/professional car testing, driving instruction and accident reconstruction - or indeed any application where you need accurate data, but the system needs to be installed/removed on a regular basis.

- Built in display for instant real time results
- Standalone plug and play operation
- Easy to install and remove from any vehicle
- Optional battery pack available
- 5Hz GPS for high accuracy
- Multiple standard tests built in, including 0-60 mph, 0-100-0 mph, 1/4 mile
- MPH or KPH display
- Suitable for any type of speed and acceleration or deceleration test
- Lap and sector timing available live on screen.
- Lap beacon and RPM inputs
- Data can be viewed using the Analysis Software for direct comparison
- Optional analogue outputs

Applications include: accident investigation, magazine performance testing, track day cars, and driver instruction

- Robust, billet aluminium enclosure, sealed to IP65
- Large, ultra clear backlit display
- User configurable display, with 5 screens of data
- Configurable shift and warning lights

The DASH1 is a compact robust display suitable for various installations from industrial test equipment to motorsport applications.

- Compact and light weight
- Connect to any Race Technology data logger and/or ECU adapter
- Water resistant
- Display real time lap and sector times
- Text or bar graph display
- Display any parameter from a data logger, including RPM, wheel speeds, temperatures, pressures etc
- Built in 5 shift lights
- Fully configurable alarms for all channels

Applications include: OEM testing, race and track day/race car display

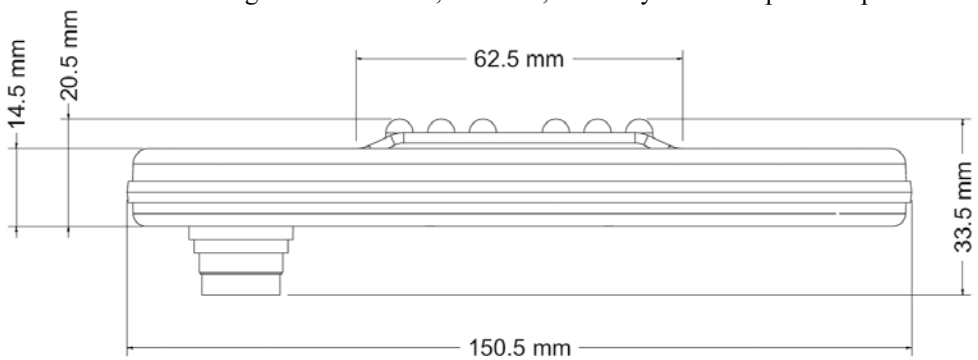
DASH2

- Robust, die cast enclosure, sealed to IP65
- Large, ultra clear non-reflective backlit display
- IVA friendly, road legal dash
- Standalone or with advanced data logging

The DASH2 is a full 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, race cars, track day cars and specialist production cars



DASH3 and DASH3lite Display

- 2 versions available DASH3 and DASH3lite
- Configurable backlit display and shift lights
- Powerful laptiming features, no 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
- 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

Actual Size

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

VIDEO4 Sport

- Perfectly synchronised data and video
- Video and audio recorded to D1 (DVD) standard
- 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.

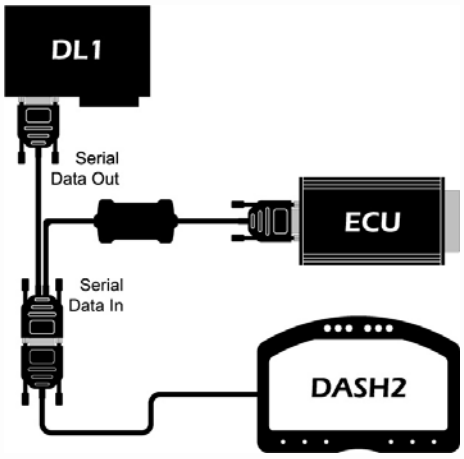
- Error free recording in the harshest of environments with solid state removable memory
- A single Compact Flash card holds both the video and data* for fast downloads to PC
- Completely modular system, add a data logger at any time.
- Catch every angle with up to 4 cameras
- Create the perfect overlay 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
- Waterproof ruggedized version available
- Comprehensive software included for set up, playback and analysis. Updates available from our website for free.

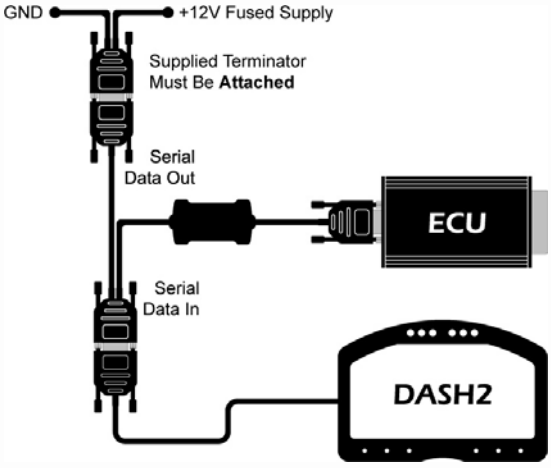
*Data logger available separately
** ECU adapters available separately

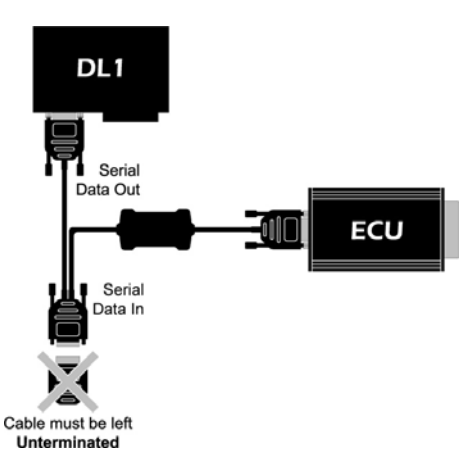
Applications include: track day cars, race cars, motorcycles, driver training, and driver safety training

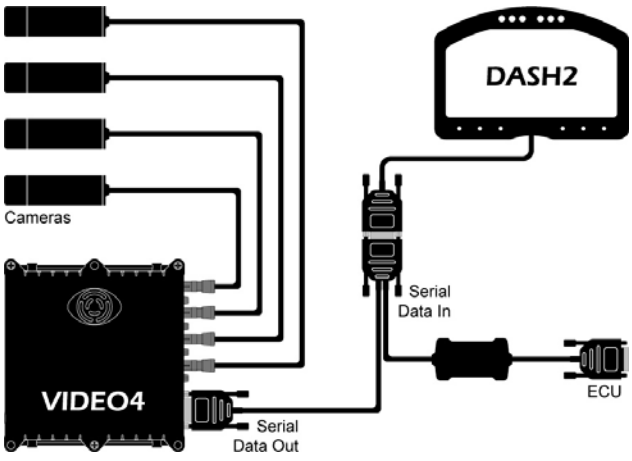
ECU + OBDII adapters

- 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
- Also compatible with VIDEO4 video recording system
- See our website for the full list of compatible ECUs, more being added frequently
- Monitor your engine health on track and display with the DASH1, DASH2 or the DASH3
- Review your engine parameters alongside other data and video all perfectly synchronised









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 O_2) 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 help tune the drivers application of the throttle.

VRS Signal Conditioner/Pulse Divider

Used to modify the signal from a sensor which otherwise might be out of range for Race Technology products. Useful when OEM ABS sensors are being used as wheel speed sensors.

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.

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 *Pure***Phase** GPS and accelerometers to calculate speeds to within 0.05 kph (<0.1mph), at 200Hz with very low latency (less than 5ms). It has three 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 *Pure***Phase** 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 with IMU option

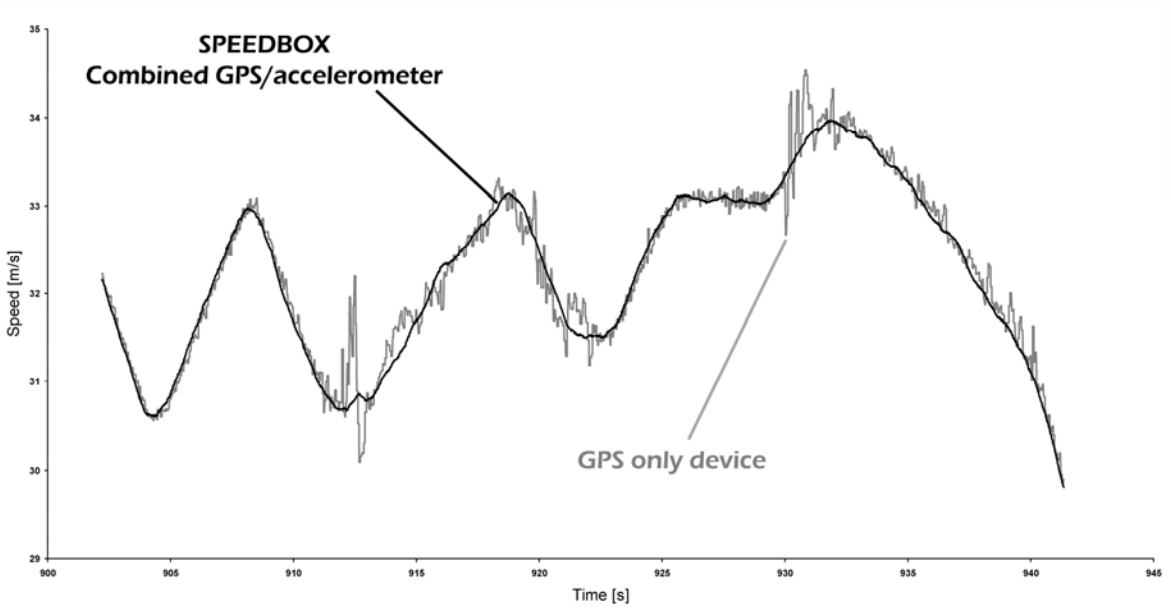
With the addition or angular velocity measurement and upgraded accelerometers offering 10g 3 axis accelerations, the SPEEDBOX with IMU is a full 6 degree of freedom measurement unit combined with high accuracy speed measurement. The additional channels of pitch rate, roll rate and yaw rate are measurable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

BRAKEBOX

The BRAKEBOX is a specialist logging and display system which uses high accuracy *Pure***Phase** GPS to very accurately calculate and display brake testing results. Designed for automotive testing applications, the BRAKEBOX has a clear and simple user interface for performing tests, the results of which can be printed out on the optional printer, or downloaded to a PC for archiving.

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 300º/s rotational rate.



The Benefit of Race Technology hybrid GPS-inertial technology compared with GPS-only systems

VIDEO4 Professional

- Perfectly synchronised data and video
- CNC'd aluminium enclosure passively cools the unit
- Waterproof - sealed to IP67
- Record video from up to 4 cameras

The VIDEO4 Professional is a ruggedised and fully sealed version of the VIDEO4 Sport. It boasts all the features of the 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
- 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
- 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

SPEEDBOX

- Very high accuracy non-contact speed sensor
- 200Hz speed measurement with no interpolation
- Combined GPS and accelerometer data to give high accuracy, low noise measurements, highly resistant to GPS "dropouts"

The SPEEDBOX is a very high accuracy non-contact speed sensor that 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.

- Highly accurate (0.05km/h) and extremely fast (output latency 2ms)
- 20Hz *Pure***Phase** GPS developed by Race Technology
- Speed is measured at 200Hz
- 3 axis accelerometer.
- Accelerometers combined with GPS create maximum accuracy even during short GPS signal drop outs
- Self-optimising Kalman filter used to combine 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
- Uses Race Technology PurePhase GPS – Specifically developed for automotive testing.
- 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

Options:

- Pitch, roll and yaw measurement using a GPS based RTK solution
- Inertial measurement unit for pitch, roll and yaw rates
- NEW! By combining the RTK and IMU pitch, roll and yaw measurements the ultimate accuracy in speed and attitude measurement can be achieved.

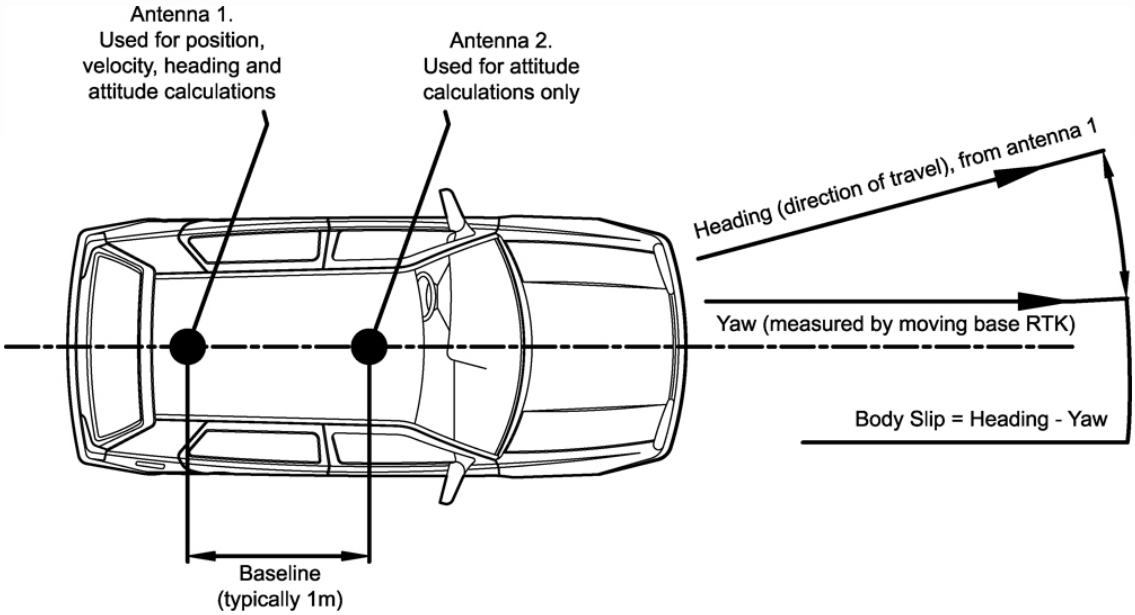
Applications include: OEM vehicle testing, any application that requires maximum accuracy for speed measurement

SPEEDBOX with RTK option

SPEEDBOX with IMU option

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 1m 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.
The SPEEDBOX-RTK may optionally be supplied with a magnetic-mounting dual antenna strip, containing 2 low-noise antennas mounted 800mm apart on a flexible magnetic mounting strip. The direction of travel is clearly marked on the magnetic strip, and must be followed.

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 at the same offering the ultimate in features, accuracy and measurement robustness.
New for 2010 is the ability to sense direction of travel (forward and backwards). The IMU option now also offers even greater speed accuracy when GPS signal is lost and the road gradient changes – For example in a tunnel with non-zero gradient.



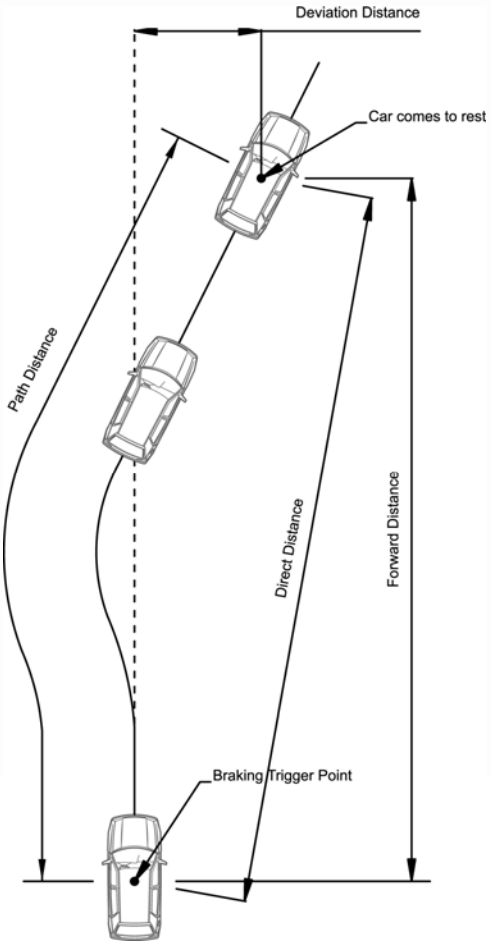
RTK Option uses dual channel GPS for vehicle attitude measurements

BRAKEBOX

- Braking distance measurements with a typical accuracy of 2cm
- View results on the screen, save and recall runs, print to optional serial printer
- Trigger runs based on speed or external input
- Download data to PC for further detailed analysis

The BRAKEBOX is a self contained and exceptionally accurate system for measuring braking distances of cars, bikes and trains, etc using the very latest GPS technology with a typical accuracy of 2-3 cm in a brake test from 100mph . The BRAKEBOX needs no sensor connections to the vehicle and so can be fitted and working in seconds. The system requires no calibration, and is engineered to very high standards, ensuring long reliable service in demanding industrial environments.

- Robust aluminium enclosure for sensor unit and display/control unit
- 20Hz *Pure***Phase** GPS
- 0.05 kph speed accuracy
- Fully self contained system
- Simple four button, menu driven operation
- Intuitive menu driven user interface, minimal training needed to operate the system
- Supplied with comprehensive data analysis software and operating instructions
- Automatically cancels out all speed latency effects to within 6us
- Measures deviation distance, direct distance, path distance and forward distance
- Trigger run measurements based on speed or external input
- Suitable for coast down tests
- Suitable for bikes, cars, trains boats, etc
- Internal memory – results can be reviewed on display, output to optional printer, or downloaded to PC for detailed analysis
- User upgradable firmware



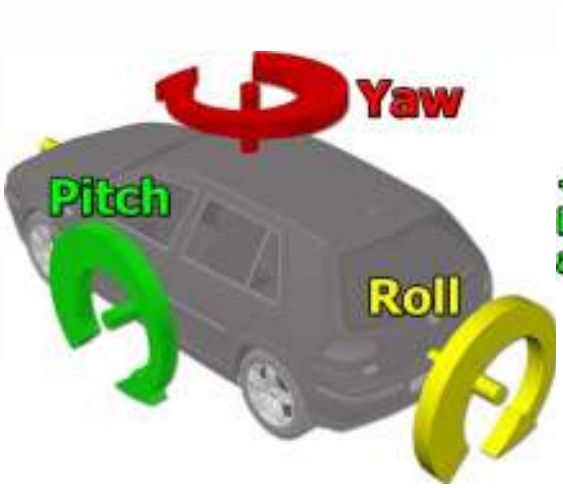
Applications include: OEM brake testing, accident investigation, heavy goods vehicle brake testing, tyre testing, road surface testing

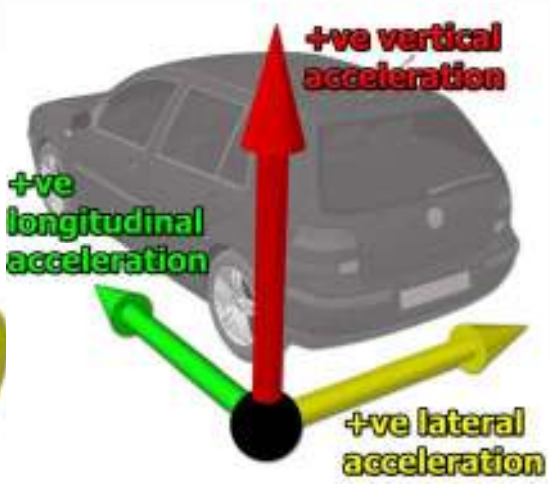
IMU06

- 3 axis acceleration, 3 axis gyro
- Maximum 10g accelerations/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 of 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 (mm): 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

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