

DL1 Data Logger

- Built in 5Hz GPS receiver
- Digital accelerometers
- Compact flash memory
- 8 12bit Analogue inputs
- Dual RPM inputs
- 4 wheel/shaft speed inputs
- Lap beacon input
- Serial input for ECU/OBDii data
- Dashboard output



What is the DL1?

The DL1 is a state of the art, highly robust, compact "black box" data logging system. Put in the simplest terms, it stores a wide range of vehicle data for later analysis on a computer - the system does not include an in-vehicle display, although there is provision to add this in the future.

Who is the DL1 designed for?

The DL1 was initially designed for autosport applications including drag racers, single seater racing cars, rally cars or road car - however it is also ideal for use on power boats, go karts and motorbikes. It is also an high quality platform for use in the auto industry for car testing of all types, from long term monitoring to competitor benchmarking.

What does the DL1 do?

The DL1 can store data from a number of sources including its built in high accuracy GPS and accelerometers, wheel speeds, shaft speeds, engine speeds, temperatures, pressures, lap times, sector times etc. The DL1 comes packaged with the excellent Race Technology data analysis package for Windows. The software allows super accurate track mapping, user defined channels, powerful graphing and allows direct comparison of up to 10 data sets (races) simultaneously with almost unlimited laps.

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Why use GPS?

One of the key features of the DL1 is its built in high accuracy GPS system - this gives the DL1 advantages over other data loggers in 2 key areas – greatly improved track maps and far more accurate speed measurement.

Track Mapping. Conventional data loggers require a "closed circuit" to enable them to calculate the track map; the shape of the track is estimated from a combination of the lateral acceleration and speed. This works adequately in some situations but it becomes increasingly inaccurate for long tracks and impossible for open circuits, motorbikes or boats. In contrast, the GPS will produce high accuracy track maps in almost any situation.

Speed Measurement. While speed is probably the most important parameter that anyone wants to measure using the data logging system, it is also the most inaccurate in a "conventional" system. The normal way to measure speed is to simply attach a pickup to a wheel to detect how fast it is rotating - but the rolling circumference of a tyre changes by 4% just with wear and temperature. Even worse, the error increases significantly under race conditions where the tyre is under load - typically the tyre slips by upto 20% under hard braking going into a corner. Measuring speed using GPS is now common practice in high-end systems - under typical conditions speed error is well under 1%!

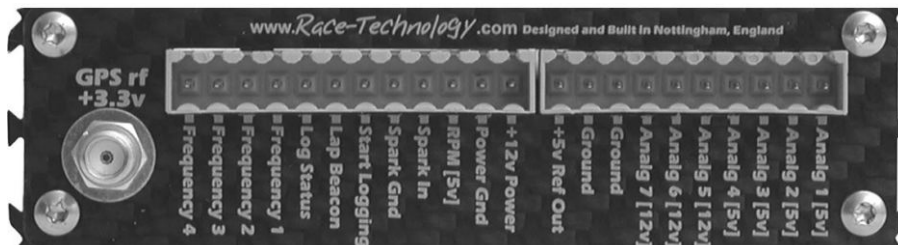
Features of the DL1 data logger

The DL1 is an all-new, 2nd generation, data logger system from Race Technology. Whilst the DL1 builds on the strengths of our highly successful DL90 system, it is a brand new design in almost every respect. Some of the most noteworthy features include:

- Built in GPS. The new GPS unit is based on our own high accuracy GPS3 technology and calculates position and speed 5 times every second. This is easily the fastest, most accurate GPS system available for under \$1500. The measurements from the GPS and accelerometers are combined to calculate very high accuracy positions and speeds at 100 times a second.
- Built in accelerometers. Built in 2-axis accelerometer with 2g full scale (optional 10g full scale).
- Logging to compact flash memory. Compact flash memory is robust, economical and ideal for use in data logging products. The advantages of using compact include incredibly fast download times (using a suitable card reader) and huge storage capacities.
- 8 analogue inputs. The DL1 has 8 very high accuracy analogue inputs. One of these inputs is connected to the DL1 power supply input to measure the battery voltage; the other 7 are available for connection to external sensors. All the inputs are 12-bit accuracy (4096 different levels), 3 of the external inputs have a maximum input of 12v, the remaining 4 have a maximum input of 5v.
- 2 RPM inputs. The DL1 has 2 RPM inputs, only one of which can be used at any one time. One input is designed to be connected to "high level" sources, such as the HT leads or the ignition coil. The other input is designed for low level signals such as a feed from the ECU.
- 4 wheel/shaft speed inputs. The DL1 features 4 totally independent wheel/shaft speed inputs. These can be used to measure the speed of all four wheels, or slip ratios across a torque converter for example.
- Serial data (RS232) input. The serial port can be configured to accept data from an external source – possible examples are data from the engine management unit, OBDii or CAN data (with a suitable adapter)

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- Serial data (RS232) output. As well as logging the data to compact flash it is also available from the serial port. We are already working on a dashboard which will accept and display this data.
- Lap beacon input. For some applications it is desirable to use a lap beacon, so we have included a dedicated input for it. This channel can also be used as a general-purpose digital input if required.
- Small and tough. It's the most compact logger in it's class, at just 110mm x 75mm x 30mm (4.3" x 3" x 1.2") it can be fitted into the smallest single seater, motorbike or go kart. The DL1 is housed in a 2mm thick aluminium enclosure and carbon fibre end panels for very high impact resistance, we even use stainless steel screws!
- Simple operation. A single button to start or stop logging, it's as simple as that! If the button is inaccessible from the drivers seat then a remote button and status indicator can be added if required.
- Power supply requirements. The power supply to the DL1 data logger can be taken directly from the vehicles 12v supply, or it can be powered from it's own battery if required. The power supply is smoothed and regulated within the DL1 ensuring its performance is highly robust and stable.
- Testing. Very high reliability is ensured by calibrating, temperature testing and vibration testing each unit on an individual basis. Autosport applications make tremendous demands on electronic systems and we take great care to make sure our products are up to the task. All the connections to the units are vibration proof, high strength, screw terminals to ensure that connections do not fail at the critical time. Nothing is indestructible - but the DL1 comes close!
- Powerful. The 2 processors in the DL1 are the very latest generation RISC processor that features both higher speed operation and flash upgradability - so as we add new features to the DL1 you can upgrade yours to the latest specification for free.





Frequently Asked Questions

What is the difference between the DL1 and the DL90 data logger?

The DL1 is based around some of the same technologies as the DL90 and they share the same physical dimensions - but that is where the similarities end. All the components inside the DL1 are new and there is no way to physically upgrade a DL90 to a DL1.

What is the maximum g-force/speed that can be measured?

The standard DL1 is configured for a maximum of 2g acceleration, 10g is a factory option. The maximum measurable speed is about 1000mph.

How often do you get GPS speed updates?

The GPS system calculates speed every 200ms (5 Hz), however this data is combined with the data from the accelerometers to calculate speed 100 times every second with very high accuracy.

How often do you get GPS position updates?

The GPS system calculates position every 200ms (5 Hz), however this data is combined with the data from the accelerometers to calculate position 100 times every second with very high accuracy.

How accurately is speed measured?

With average GPS reception, speed accuracy is about 0.1mph (or 0.1% if greater) when you are just driving along at fairly constant speed, and about 0.2mph (or 0.1% if greater) during fast accelerations or braking. The only exception is at very low speeds (under 10mph) where the error increases to about 1mph. Do not be fooled by exaggerated claims from other manufacturers... this is as good as it gets! In contrast, a standard wheel speed pickup is only accurate to about 4% at constant speeds, and under high accelerations or braking, the error increases up to about 20%.

How accurately is position measured?

With good GPS reception, positional accuracy is about 3m (CEP).

What happens to the data if you drive under a bridge/tunnel/trees etc?

Because speed and position are calculated from both the GPS data and accelerometers, even if the GPS data "disappears" for a number of seconds, you won't be able 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 much data can you log to a Compact flash card?

The DL1 logs about 18MB of data per hour, so for a 64MB card you could get up to about 3.5 hours of data, for a 2GB card you could get about 5 days!

Will it work with any Compact Flash card?

Whilst we cannot guarantee that the DL1 works with all compact flash cards, we have successfully tested many makes and sizes of compact flash card, we haven't yet found one it won't work with. A list of flash cards that have been tested is available on the website.

Is it easy to use?

The DL1 has one button to start and stop logging, how much simpler could we have made it? We have kept the software as simple as possible whilst making it as flexible as we can to ensure that you can do what you need to with it. As with all computer programs, the first time you use it there is a lot to take in - after you've become familiar with it, you will be able to analyse data quickly and efficiently.

What specification of computer is required?

As with most programs, the analysis software will run on just about any PC with windows 95 or later – however, the faster the PC, the faster the program will run. The main restriction is the memory required for long runs; typically we recommend that your PC has an absolute minimum of about 30MB of memory installed for each hour of data loaded. The PC also requires some means of downloading the data from the compact flash cards, there are many options available – normally a USB reader is most convenient.

Is the DL1 reliable and well made?

The DL1 is absolutely class leading in terms of component quality, build quality and reliability – this is a very high quality professional instrument, entirely designed in-house and manufactured in England. The unit carries the normal 12 month guarantee against manufacturing defects and lifetime email support.



Technical Specification

Memory	Compact flash type I. Data in FAT16 PC format. Minimum card size 32MB, maximum card size 2GB (limited by FAT16).
GPS	Outputs position, speed, position accuracy and speed accuracy every 200ms with no interpolation. GPS tracking loops optimised for applications up to about 4g. tracking of all satellites in view.
GPS Antenna	Magnetic base, 3.3v active antenna with SMA connector
Analogue Inputs	7 external inputs, all 12 bit resolution. 3 inputs are 12v full scale, 4 inputs are 5v full scale. All inputs are protected to twice maximum input voltage. 1 internal analogue input connected to the power supply voltage to measure battery voltage.
Frequency Inputs	4 external frequency inputs with a maximum input frequency >2kHz. Hardware dividers of 4 or 16 to average readings if required. Triggering voltage requires a low input of <1v and a high input of >4v and 15v maximum.
Lap Beacon Input	Triggering voltage requires a low input of <1v and a high input of >4v and 15v maximum.
Start Sample Input/Output	Input requires grounding to start sampling and again to stop sampling. Open collector output with a maximum current of 50mA
Power Supply Requirements	12v nominal input, minimum of 10v, maximum of 15v. Current consumption of about 180mA including GPS, dependant on compact flash card size
+5v Reference Out	Maximum current draw 100mA, tolerance 1%.
Ignition In Signal (High Level)	Triggered by fast voltage transients. Can be connected directly to the low tension side of the ignition coil, or capacitively coupled to the high-tension side.
Ignition In Signal (Low Level)	Triggering voltage requires a low input of <1v and a high input of >4v and 15v maximum. Suitable for connection directly to most ECU tach outputs. Maximum input frequency >300Hz.
Case Construction	Extruded aluminium anodised black, nominal case thickness 2mm. End panels CNC cut carbon fibre.
Connector Type	3.5mm pitch screw connectors
Main Processor	24MHz RISC with embedded flash program memory
GPS Serial Port	User configurable for baud rate and messages. Factory set at 4800 baud and outputting NMEA messages of \$GPRMC and \$GPGGA
DL1 Serial Port	2 separate ports. Port 1 fixed at a baud rate of 115200 baud. Whilst logging outputs all data from all channels at 100Hz. Also used for re flashing, diagnostics and configuration. Port 2 used for inputting RS232 data for storage during a run, from an ECU, OBDII adapter or any other compatible device.
Accelerometers	2 axis, precision digital output. Guaranteed 2g minimum full scale on both axes. Resolution of 0.005g. Optional 10g sensor available as a factory option.
Vibration	Factory tested at 25g, 50Hz sinusoid for 5 minutes (without compact flash card inserted).
Temperature	Factory tested from -20oC to 70oC