

Race Technology

DL1 PRO

Instruction manual



Version 1.0

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www.race-technology.com

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1 DL1 PRO Introduction



1.1 What is the DL1 PRO?

The DL1 Pro offers the same features as the DL1 MK3 but is encased in a water resistant enclosure with high specification water resistant connectors and an aluminium enclosure for more demanding environments.

1.2 Who is the DL1 PRO designed for?

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

1.3 What does the DL1 PRO do?

The DL1 PRO 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. The DL1 PRO can also be used to supply data to dashboard displays and to drive auxiliary outputs to control fans, pumps, or lights.

1.4 Why use GPS?

One of the key features of the DL1 PRO 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 data.

1.4.1 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.

1.4.2 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 up to 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%!

1.5 DL1 PRO Features

The DL1 PRO is an all-new, 3rd generation, data logger system from Race Technology. It is a complete redesign of the DL1, retaining all the best features and improving and adding where possible. Some of the most noteworthy features include:

- **Robust enclosure**

The DL1 PRO is housed in an aluminium enclosure with rubber seals around all connectors and the card slot to provide an element of water protection to the electronics. All connections to the unit are through two large multi way connectors and a single GPS connection for easy removal from the vehicle

- **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. Optional storage of raw GPS data for post processing at 20Hz is also possible.

- **Built in accelerometers**

Built in 3-axis accelerometer with 2g full scale (optional 6g full scale).

- **Built in yaw gyro for slip angle measurement (optional)**

- **Logging to SD cards**

Works with SD and SDHC, for up to 32GB storage.

- **Up to 12 analogue inputs**

The DL1 PRO has 12 very high accuracy analogue inputs. All inputs have a maximum of 25V input

- **Up to 4 output drivers**

Low side driver outputs are available for controlling pumps, fans, lights.

- **2 RPM inputs**

The DL1 PRO 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 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.

- **Two RS232 ports**

Either port can be used to receive data for logging, one port is always used for outputting data for storage to a VIDEO4 or to a DASH display.

- **CAN port**

CAN port enable receiving and transmitting of messages at configurable rates up to 1Mbit/s

- **Remote start/stop and add marker inputs**

- **Dual 5v reference outputs**

Two independent 5v outputs can be used to drive up to 500mA each for sensor outputs.

- **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 PRO 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 PRO ensuring its performance is highly robust and stable.

- **USB interface**

USB connection for direct connection to a PC for configuration

- **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 to ensure that connections do not fail at the critical time.

- **Powerful**

The DL1 PRO has the latest 150MHz processor for maximum expandability and functionality

2 Technical Specification

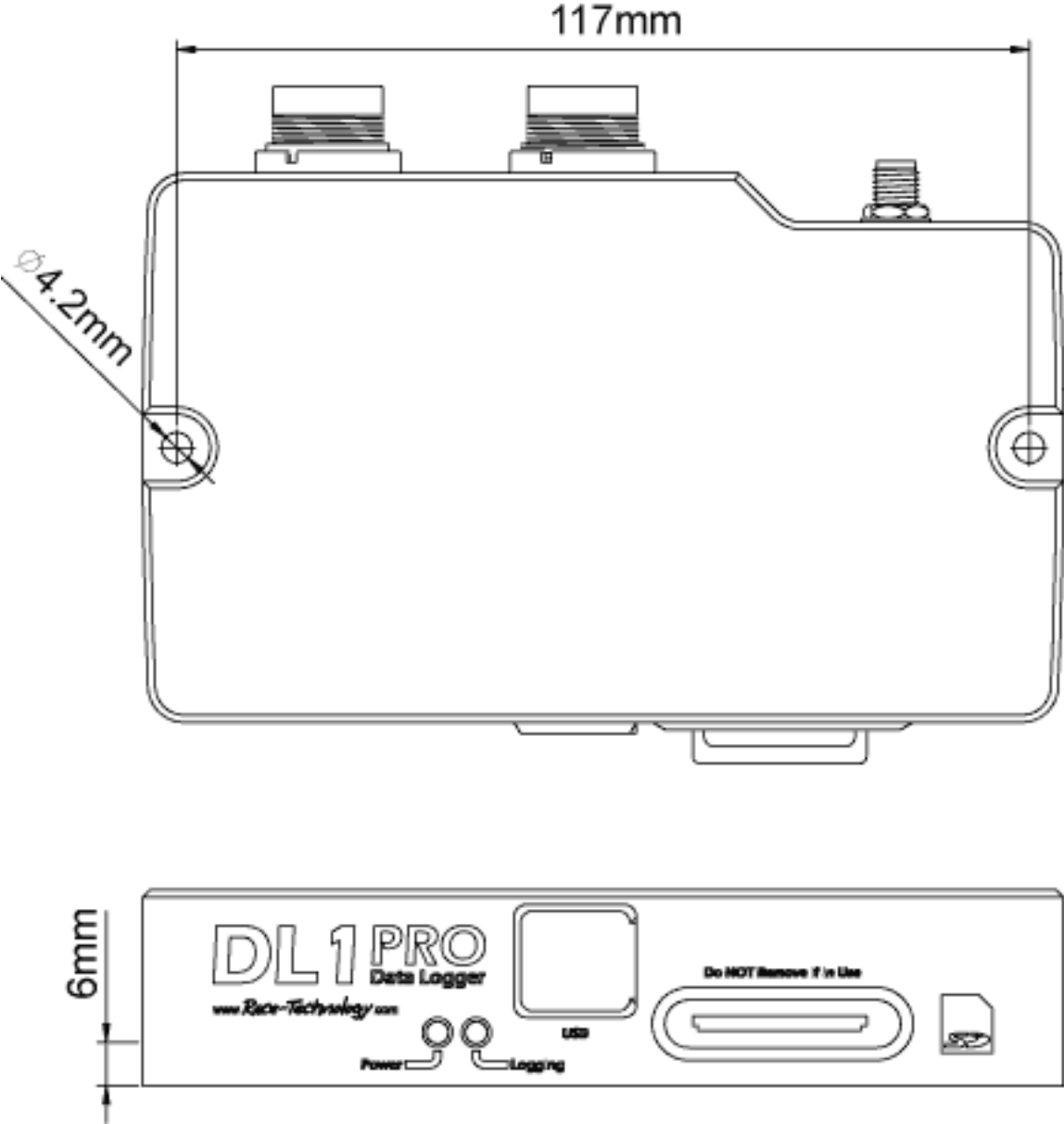
Memory	SD memory card, can be SD or SDHC. Up to 32GB
GPS	Outputs position, speed, position accuracy and speed accuracy at 5Hz with no interpolation. GPS tracking loops optimised for applications up to about 4g. tracking of all satellites in view. 20Hz raw data storage for post-processed operation
GPS Antenna	Magnetic base, 3.3v active antenna with SMA connector.
Analogue Inputs	12 external inputs, all 12 bit resolution and 0-25v. All inputs are protected and filtered.
Frequency Inputs	4 external frequency inputs with a maximum input frequency >2kHz. Triggering voltage requires a low input of <1v and a high input of >4v and 15v maximum.
Lap Marker Input	Triggering voltage requires a low input of <1v and a high input of >4v and 25v maximum.
Start Sample Input	Triggering voltage requires a low input of <1v and a high input of >4v and 25v maximum
Low level outputs	4 low side drivers, each capable of driving 500mA.
Power Supply Requirements	12v nominal input, minimum of 10v, maximum of 25v. Current consumption of about 180mA including GPS, dependant on SD card requirements. +5v Reference Out Maximum current draw 500mA x 2.
Ignition In Signal (High Level)	Designed to connect directly to negative terminal of ignition coil. Can also fire from fuel injectors and from CD ignition systems.
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	Custom aluminium housing with integral mounting holes.
Connector Type	19 way and 24 way Binder connector
Main Processor	150MHz TI Digital Signal Processor
Serial Port 1	User configurable for messages. Transmission and reception of RT format messages at 115200 baud
Serial Port 2	Used for reception of RT messages at a fixed baud rate of 115200
CAN Port	Message reception and transmission up to 1MBit/s
Computer communication	USB port for reflashing and reading/writing configuration

Accelerometers	3 axis, precision digital output. Guaranteed 2g minimum full scale on both axes. Resolution of 0.005g. Optional 6g sensor available as a factory option.
Gyroscope	Single axis yaw rate gyro with a maximum rate of 300 degrees / sec.
Vibration	Factory tested at 25g, 50Hz sinusoid for 5 minutes (without compact flash card inserted).
Temperature	Factory tested from -20oC to 70oC

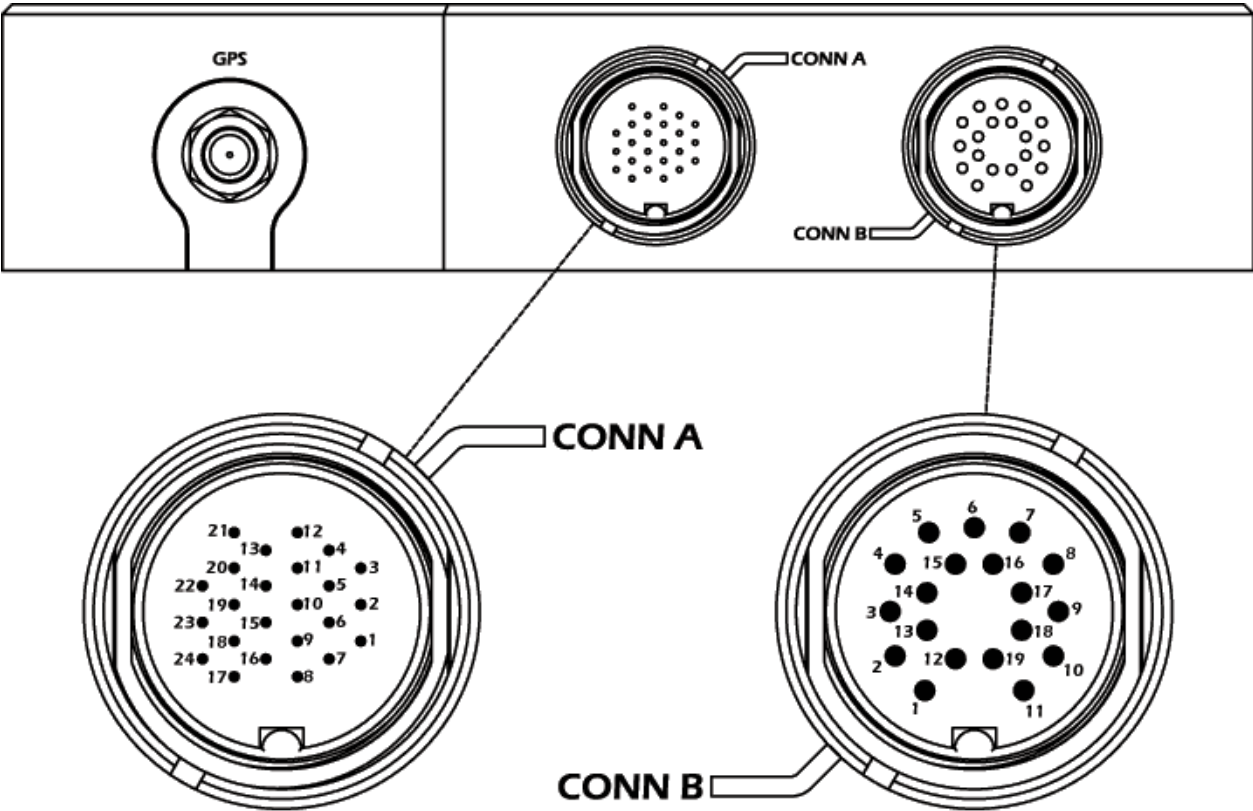
"WARNING": To avoid any possible damage to the car paintwork, please take care when mounting magnetic GPS antennas. In particular make sure that there are no dust or grit under the antenna. In some cases it maybe required to add additional protection to the paintwork prior to mounting the antenna to avoid damage.

3 Installing the unit

3.1 Mounting

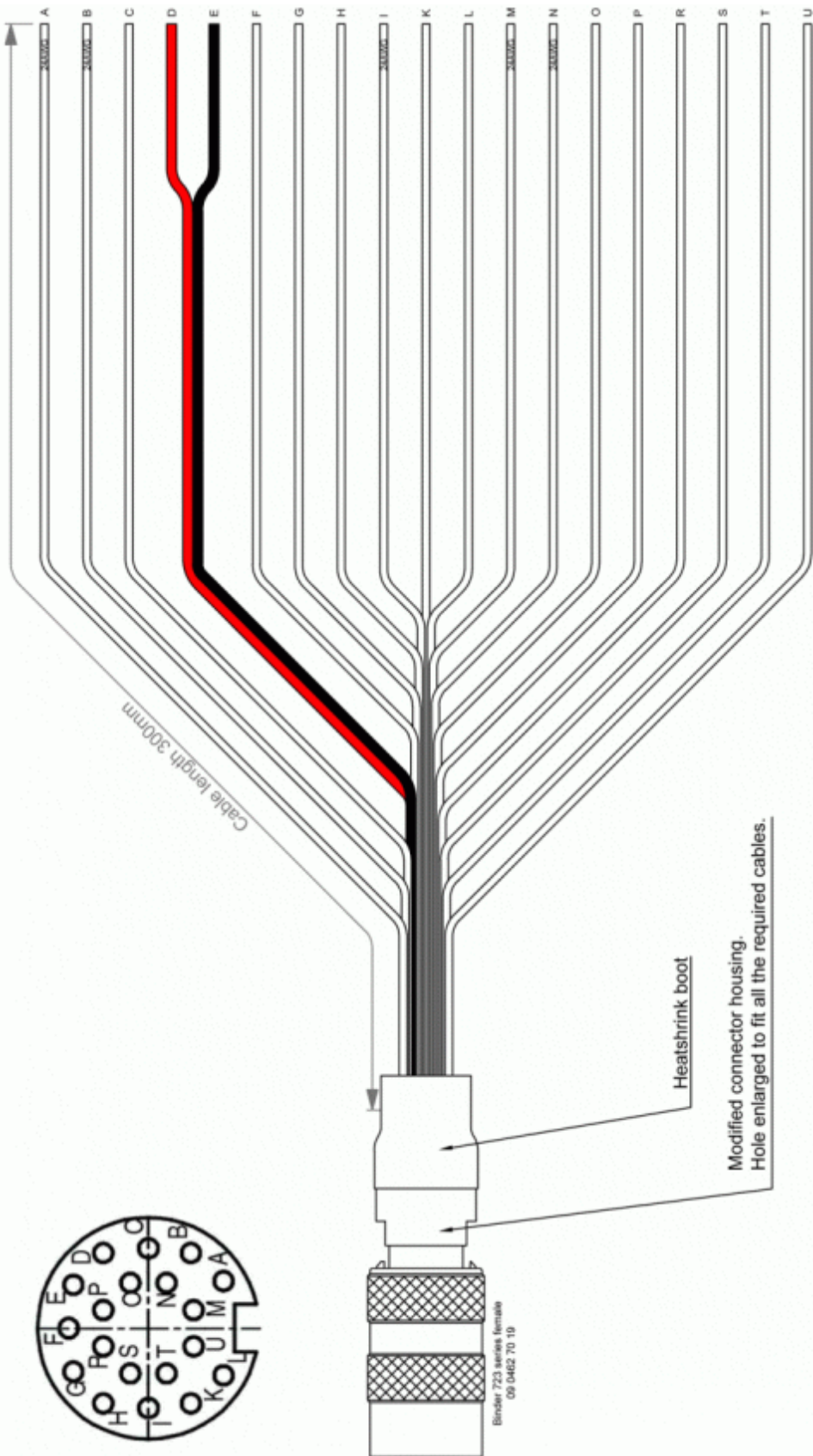


4 Connections



24 way	Name	Description	Connector or wire colour
1	ADC7	0-25v 12 bit analogue input	white
2	ADC5	0-25v 12 bit analogue input	black
3	ADC10 Out2	0-25v input, low side output 0.5A	red-black
4	ADC 9 Out1	0-25v input, low side output 0.5A	gray
5	ADC6	0-25v 12 bit analogue input	blue
6	ADC8	0-25v 12 bit analogue input	green
7	12v	3 core screened 1 + 3 core screened 2	2 x 9 way d-type plug pin 7
8	5v ref 2	0.5A reference output	brown
9	ADC12 Out4	0-25v input, low side output 0.5A	red
10	ADC11 Out3	0-25v input, low side output 0.5A	orange
11	GND	NOT FITTED	
12	USB5V	NOT FITTED	
13	USB D-	NOT FITTED	
14	CAN1 L	CAN low	9 way d-type plug pin 2
15	GND	Serial 1 GND	9 way d-type plug pin 5
16	GND	Serial 2 GND	9 way d-type plug pin 5
17	RS232 2 in	RS232 2 RX	9 way d-type plug pin 2
18	RS232 1 out	RS232 1 TX	9 way d-type plug pin 3
19	CAN2 L	NOT FITTED	9 way d-type plug pin 2
20	CAN1 H	CAN high	
21	USB D+	NOT FITTED	
22	CAN 2 H	NOT FITTED	
23	RS232 1 in	RS232 1 Rx	9 way d-type plug pin 2
24	RS232 2 out	RS232 2 Tx	9 way d-type plug pin 3

4.2 DL1 PRO 19 Way Cable



19 way	Name	Description	Connector or wire colour
A	ADC1	0-25v 12 bit analogue input	black
B	ADC2	0-25v 12 bit analogue input	brown-black
C	GND	Sensor ground	red-black
D	12v	System power 9-24v	figure-8 cable black-white
E	GND	Power ground	figure-8 cable black
F	High level RPM	1kHz HT input	orange-black
G	RPM_GND	See Connecting RPM	yellow-black
H	GPS LED	Active low GPS LED driver (20mA)	green-black
I	5v ref 1	0.5A Reference output	blue-black
K	Frequency in 3	5-12v input >2khz max (100k pulldown)	grey-black
L	Frequency in 4	5-12v input >2khz max (100k pulldown)	white-black
M	ADC4	0-25v 12 bit analogue input	brown
N	ADC3	0-25v 12 bit analogue input	red
O	Power LED	Active low Power LED driver (20mA)	orange
P	Low level RPM	5-15v Trigger - ECU or Tacho use	yellow
R	Logging LED	Active low Logging LED driver (20mA)	Green
S	Status LED	Active low Status LED driver (20mA)	blue
T	Frequency in 1	5-12v input >2khz max (100k pulldown)	gray
U	Frequency in 2	5-12v input >2khz max (100k pulldown)	white