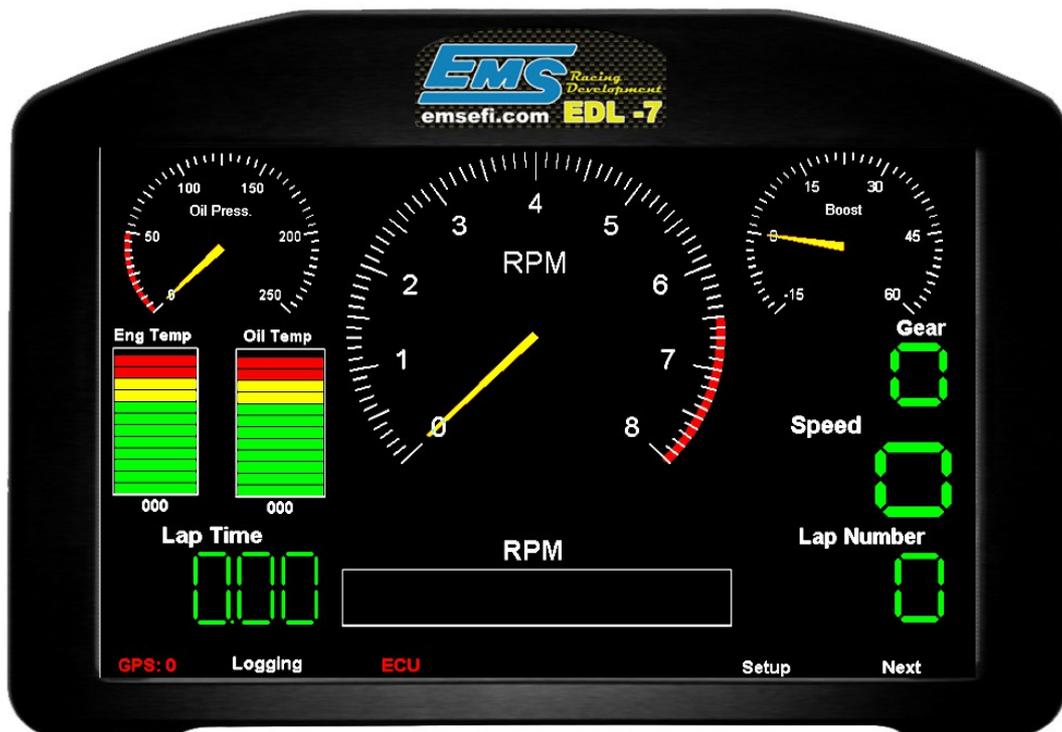# EMS EM-Tech Race Dash Manual
Version 3.1

Thank you for purchasing an EMS Race Dash.

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Before you start

You MUST set the communication baud rate to match the attached ECU.

For EMS Stinger or Motorsport ECU the rate can be set to either 38400 or 19200 but you must ensure that the ECU baud rate matches. Use the ECU manager software for the relevant ECU to set this. The recommended rate is 19200.
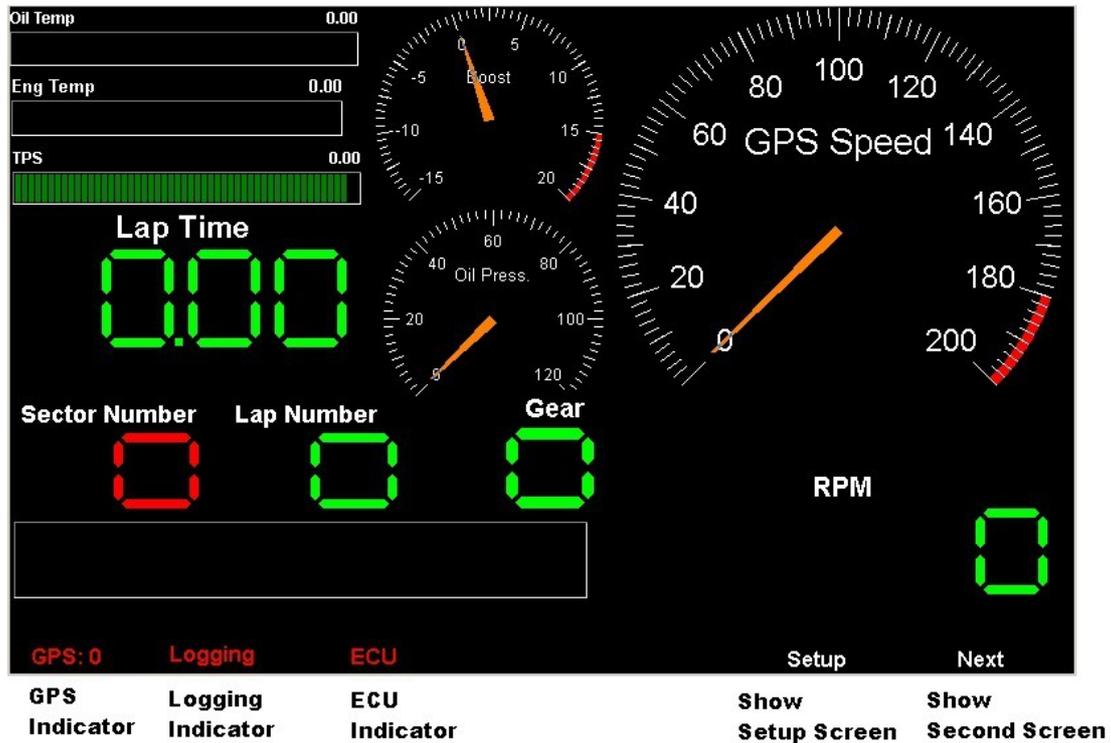
For MoTec M800 the baud rate must set to 19200.

This is set in the logger settings screen.

Note:
As of version 3 of the EDL 7 Racing Dash, gauge properties cannot be changed directly on the race dash. These must be change using the Dash Emulator and saved to the SD card.

Screen Functions

GPS Indicator	**Logging Indicator**	**ECU Indicator**	**Show Setup Screen**	**Show Second Screen**

Please Note:

This is a demonstration screen layout.
Colors and gauges are fully customisable by using the EDL Dash emulator.

GPS Indicator
This indicator will show yellow when a GPS module is connected and bright green when the GPS has locked onto the GPS satellites. The number of satellites is also shown
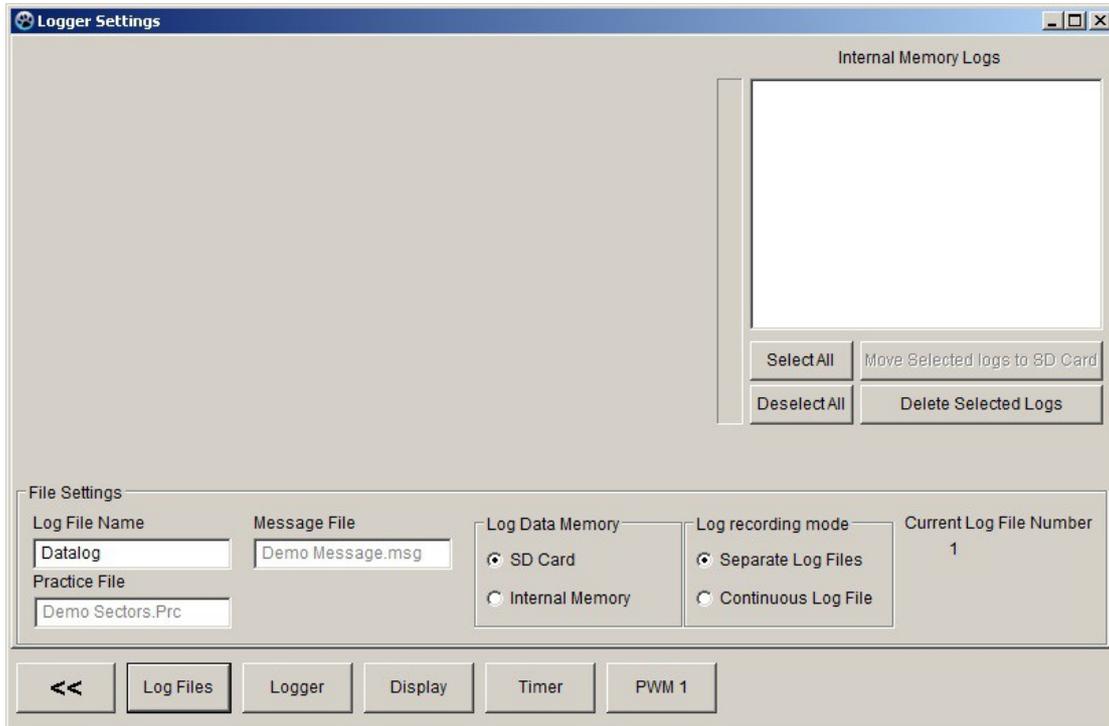
Logging Indicator
This indicator will show bright green when the EDL-7 is saving data to a logging memory.

ECU Indicator
This indicator will show bright green when the EDL-7 is connected to an ECU

Dash Set up

Log File Settings

Log File Name
The EDL-7 race dash saves log sessions into separate files. The "Log File Name" plus a unique number appended to the end of the file name will identify each file.

Practice File
The Practice file is a file that has been created using the EDL-7 analyser software and saved to the SD card. This file contains target lap and sector times used to compare against actual lap and sector times during practice sessions. It also contains the start/stop logging coordinates if you choose to control logging via GPS coordinates.

Message File
The Message file is a file that has been created using the EDL-7 analyser software and saved to the SD card. This file contains messages that are displayed whenever you pass by defined GPS coordinates.

Load Settings From SD Card
You can load the Race Dash settings from the SD Card in to internal memory. This will enable the Race Dash to operate without an SD Card inserted. All logs will be saved in the internal memory; however, an SD card must be inserted so that the internal logs can be moved onto the SD Card for analysis.

Log Data Memory
You can leave the SD Card inserted and choose to save the data log files to internal memory or SD Card. If the logs are saved to internal memory then you must move to SD Card for analysis.

Move Selected logs to SD Card
If you have any log files in internal memory then you must move them to the SD Card for analysis.
Select the logs you want to move then press the "Move Selected Logs to SD Card". The system will move them and then clear them from internal memory.

Delete Selected Logs
Use this button to delete all selected logs from either SD Card or internal memory. You must first select one or more files.

Logger Settings

Start Stop Method
This is used to select how the logger will start and stop logging. It can be set to start logging whenever the selected channels reach a defined value or if the GPS detected that you have crossed a certain location or a manually operated switch connected to a digital input 1 is switched on.

If you select to use start/stop channels then you can select which channels and at which channel values to start and stop.

If you select to use the GPS Track Map then you must define the start/stop GPS coordinates in the EDL-7 Analyser software then save it to the SD card.

Start / Stop Channel
Set the channel you want to use to start and stop the logging. Set the **Start When** parameter to start if the channel value is **greater than or equal to** or **less than** the compare value and then the value you want to use in the Compare Value field.
To stop logging set then **Stop When** parameter to **greater than or equal to** or **less than** the compare value and then enter the value you want to use in the Compare Value field.

Display Settings
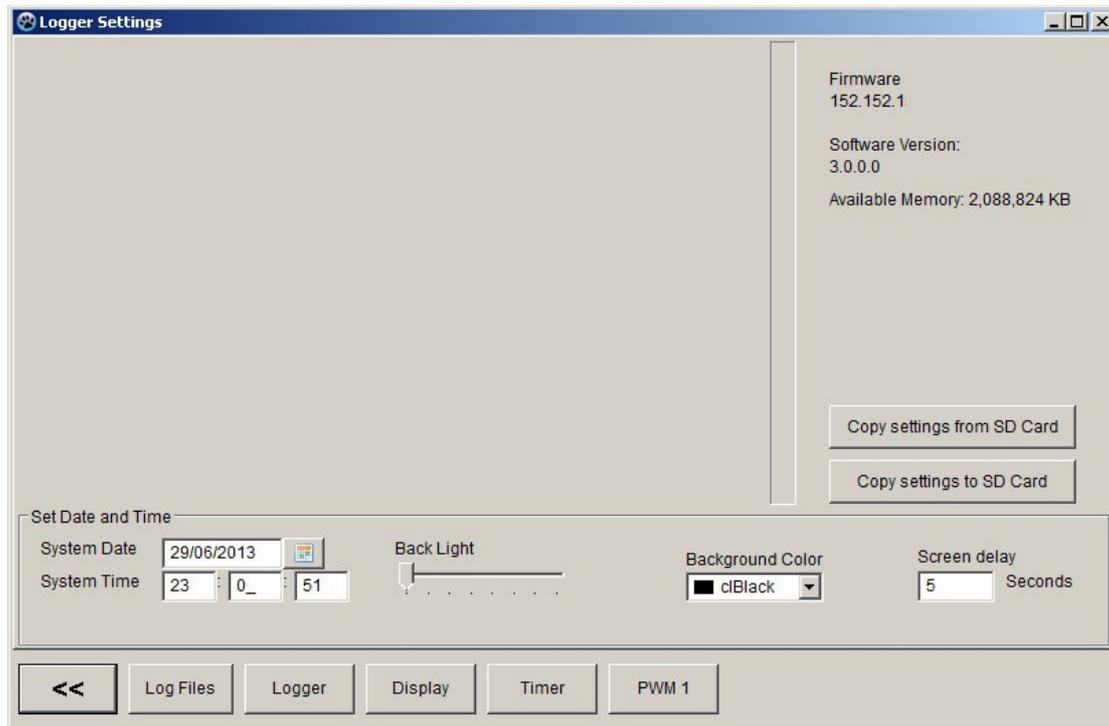
System Date and System Time
This sets the system date and time.

Back light
This slider sets the back light brightness.

Background color
Set the color of the entire screen using this property.

Screen Delay
This field is used when displaying the second screen. If a value greater than zero is entered here then the second screen will remain visible for the number of seconds entered, it then reverts back to the main screen. If this value is set to zero then the auxiliary screen will remain displayed until you press the back (<<) button.

Copy settings from SD Card
This will copy all Dash settings from the SD card to the internal memory of the dash. This allows the dash to be used without an SD card inserted. Data logging will be saved to the internal memory

Copy settings to SD Card
This will copy all Dash settings from the internal memory to the SD Card. This is handy if you have initialised a new card and want to quickly copy the dash settings to the new card.

Timer Settings
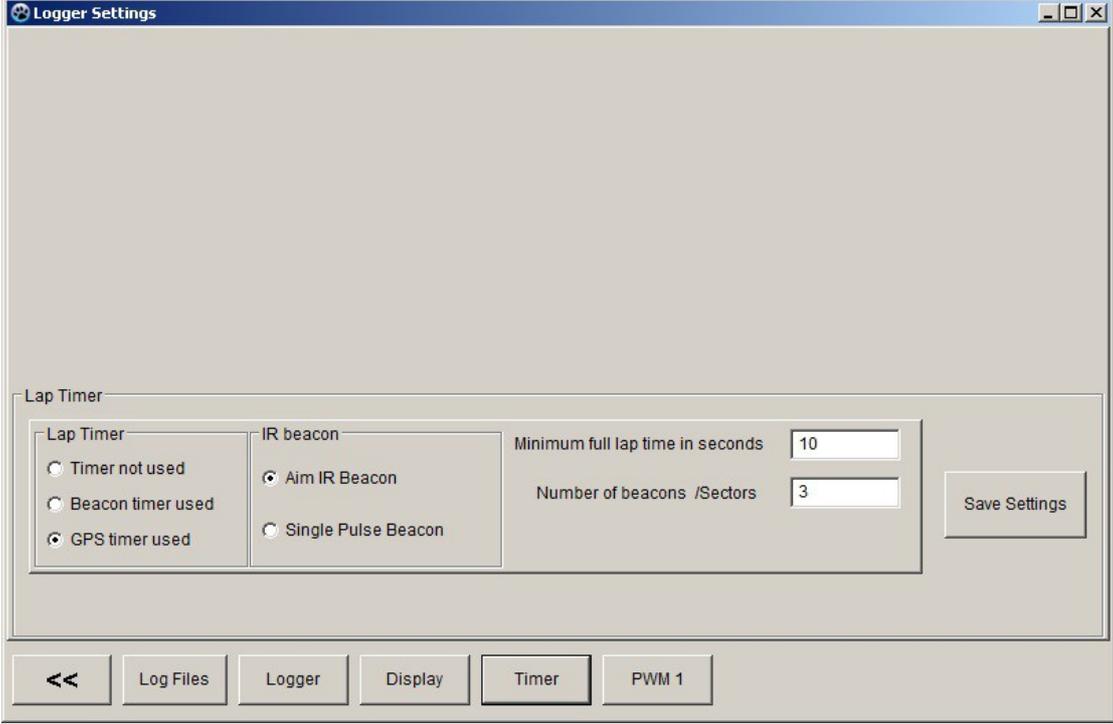
Lap Timer

You can record lap and sector times using either GPS coordinates or infra-red beacons. Select the method by ticking the appropriate selection. If you are using infra-red beacons then you can set the number of beacons being used and you can also set the minimum full lap time. This is useful when there are other beacons on the track with the same code as yours. By setting a minimum lap time the logger will not record a full lap if the last beacon occurs before the minimum lap time.

GPS sectors are defined using the data analyser software. These are saved onto the SD card and use by the race dash when you select to use the GPS lap timer.

PWM Output Controller

The PWM controller can operate in 3 different modes. Closed Loop P.I.D, Open Loop and Boost Control. Adjusting any controller to achieve the desired results is a trial and error process.

Closed Loop Mode
This mode uses the control channel values to look up the nearest control value in the control table. It then uses the target value directly under the nearest control value and compares it to the value of the target channel. If the target channel value does not match the target it then adjusts the PWM output until the target channel value matches the target value. In this mode the Open Lp row is ignored. You must adjust the proportional, integral and derivative gains to achieve the best response.
We do not recommend that you use this mode for boost control if you want different boost levels at different control channel values. This is because the boost control valve characteristics will change with changing boost pressure. This will make the gain values set for one boost level invalid for another boost level. You should use the Boost Control Mode of this purpose.

Boost Control Mode
This mode is semi closed loop. It requires the Open Lp row to be set with PWM duty values that will achieve the desired boost for each boost level you want. It uses the control channel values to look up the nearest control value in the control table then reads the target value directly under the control value and compares it to the value of the target channel. If the boost level is less than the target value the controller will set the PWM duty to the value found in the Open Lp row. If the target channel value is greater than the value found in the control table target it adjusts the PWM output to bring the boost down to

the desired target. You use only the integral gain to adjust the controller response time.

For an explanation of the boost controller refer to the screen image above. This screen demonstrates how to control boost levels based on ethanol content in the fuel.
EG: At an ethanol percentage of 60% the controller will maintain a boost level of 30 PSI by providing a PWM duty of 84. If the boost goes higher than 30 PSI the controller will adjust the PWM duty to bring the boost down. The response time is adjusted using the integral gain. The controller will start to control the PWM duty when the boost level reaches the control target minus the integral dead band percentage.

Open Loop Control Mode
This mode does provide the desire PWM duty without any automatic adjustments. It requires the Open Lp row to be set with PWM duty values that will achieve the desired result for whatever it is you are controlling. It uses the control channel values to look up the nearest control value in the control table then sets the PWM duty to the value directly under the control value.

PWM Status
If set to Active the EDL-7 will start the controller.

Pulse Polarity
Set this according to the device you are controlling. Setting it to reverse will reverse the duty cycle of the output.

Gain Scale
The maximum gain value is 255. If you find that you need to enter values that are high (too close to 255) then you can set to Gain Scale to a value that allows you the enter smaller gain values. This will give you finer gain control.

Integral Dead Band
The integral gain controls the amount of adjustment made to the PWM duty when the desired target is almost reached. It will make small adjustments until the exact target is reached. You can select the plus/minus dead band where the integral gain stops adjusting.

Pulse frequency
This set the PWM frequency and must be set according to the device being controlled.

Sample Hertz
The minimum value is 1 and the largest value is 25.
This sets the number of times per second that the controller samples target channel and makes adjustments to the PWM duty. If controlling slow changing target values such as temperature then set this to a very low number. If adjusting fast changing target values like turbo boost then set this to a large number.

Save Calibration
Very important!
One you made any adjustments to the controller parameters you must press the Save Calibration button for the changes to take effect.

EDL-7 loom colour code

Pin Number	Printed wire text	Wire Colour	Wire Function
1	PWM output 1	Yellow	PWM Controller 1
2	Spare	Green	PWM Controller 2
3	+ 5V Output	Orange	5 Volt reference
4	Digital Input 1	Green	Switch Screen
5	CAN Low	Grey	Used for CAN coms
6	CAN Resistor	Grey	Used for CAN coms
7	CAN Resistor	Grey	Used for CAN coms
8	Ground	Black	Ground
9	Digital Input 2	Green	Start/Stop Logging
10	CAN High	Grey	Used for CAN coms
11	Voltage output 1	Yellow	Future use
12	Pulse input 3	Green	Future use (Hall Only)
13	Voltage output 2	Yellow	Future use
15	+ 12V	Red	Power supply
19	Digital Input 3	Green	Switch input
22	Analogue Input 4	Blue	Sensor input
23	Analogue Input 3	Blue	Sensor input
24	Analogue Input 2	Blue	Sensor input
25	Analogue Input 1	Blue	Sensor input
26	Pulse Input 4	Green	Future use (Hall Only)
27	Pulse Input 1	Green	Speed input (Hall Only)
28	Pulse Input 2	Green	Speed input (Hall Only)

GPS Input

RS232 Coms to ECU

Ir Beacon input
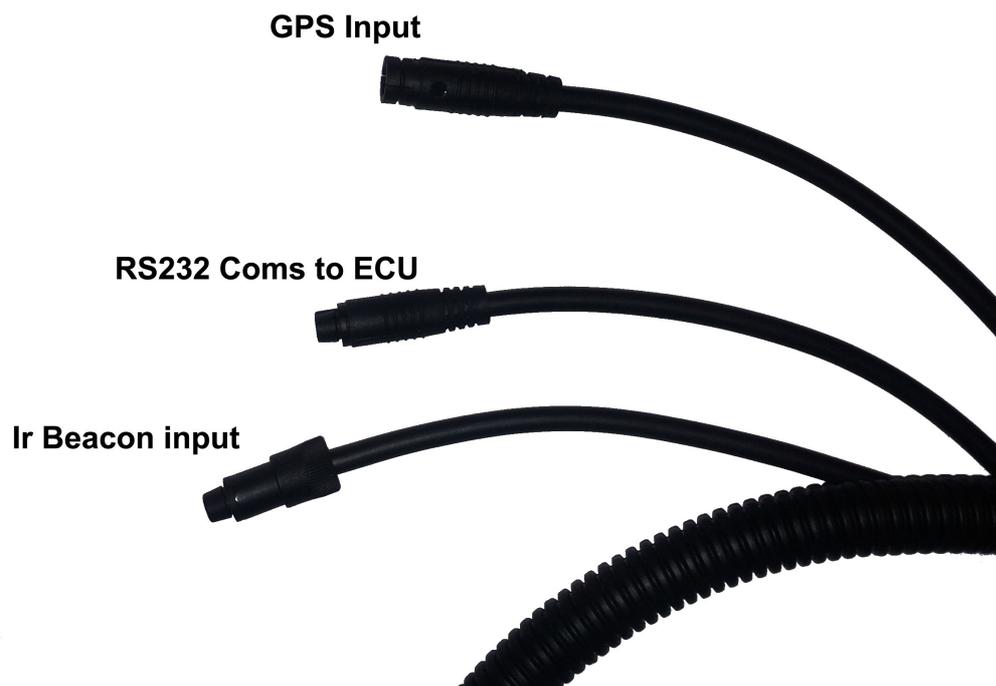
All PWM outputs will ground the device being controlled.
All digital inputs activate when grounded.
All pulse inputs read a square wave signal.
All analogue inputs read 0 – 5 volts.

Note: The wire marked "spare" is PWM output 2