D5 System Manual

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Contents

1 Introduction

The **D5** digital dash is a powerful and robust display unit designed for the motorsport and automotive industry; The **D5** can be configured using PC software or by an external keypad controller. This allows custom layouts, easy page navigation and programmable driver aids, warnings and alarms. All functions can be simulated in software or by the payback of data files (.LRD) before programming featuring:

- 5" WVGA colour display
- 8x shift lights
- Programmable warnings and alarms
- Predictive lap timing
- Ambient light sensor
- 10 user inputs
- Easy page navigation
- Multiple display options
- Simulation/Playback of data files
- Twin Gigabit Ethernet
- USB data logging (PRO spec only)

To avoid damage to your new dash, read and follow the instructions in this manual carefully. This manual assumes the reader is familiar with Life Racing products and PC applications.

Due to continuous development, some features may change and the manual will update periodically. Please ensure you have the latest version dated on the cover page of this document.

2 Specification

2.1 Technical data

Processing	Powerful RISC CPU for advanced strategy execution
Display	5" WVGA Ultra Bright for daylight to dark with intelligent auto dimming
Inputs	6 user configurable general purpose analogue sensor inputs
	4 user configurable switch inputs
Interfaces	2 Gigabit full duplex Ethernet for configuration and data download
	2 CAN 2.0B interfaces
	RS232 serial interface
Memory	USB 2.0 for bulk data storage on USB stick
Power Supply	6V to 80V input voltage range with reverse polarity protection
	Regulated 5V sensor supply output with short circuit protection
Physical	55Way D-type connector
	CNC machined, sealed IP67, black anodised aluminium case
	Class leading slim profile for flat panel mounting
	Maximum dimensions including the connectors are 140 x 123 x 31 mm
	Total mass is ~395 grams

2.2 Club/pro spec

The pro spec enables the user to stream data from the ECU to a USB memory stick. This feature is currently only compatible with Life Racing ECU's and PDU's.

3 Installation

3.1 Wiring

3.1.1 Pinout

The D5 features a single 50 pin D-type connection.

Recommended Mating Connector: Harting 09670504701
Connector Crimps: Harting 09670008277
Recommended Connector Hood: TE Connectivity 5745175-5

Pin	Function		Pin	Function		
1	BATTERY SUPPLY		26	USB D+[7][9]		
2	BATTERY SUPPLY		27	USB GND[7][9]		
3	ANALOGUE INPUT 1 (5V/TH)[6]		28	USB VCC[7][9]		
4	ANALOGUE INPUT 4 (5V/TH)[6]		29	N/C		
5	5V OUT		30	N/C		
6	SWITCH INPUT 3[8]		31	N/C		
7	RS232 RX		32	N/C		
8	CAN LO #01[1]	*F88 Pin 81*	33	N/C		
9	CAN HI #02		34	POWER GROUND		
10	RESERVED[2]		35	POWER GROUND		
11	RESERVED[2]		36	ANALOGUE INPUT 3 (5V/TH)[6]		
12	RESERVED[2]		37	ANALOGUE INPUT 6 (5V)		
13	RESERVED[2]		38	SWITCH INPUT 2[8]		
14	ECU RX- [4]	*F88 Pin 86*	39	N/C		
15	ECU RX+ [4]	*F88 Pin 85*	40	DIGITAL GROUND [3]		
16	ECU TX- [4]	*F88 Pin 88*	41	CAN LO #02		
17	ECU TX+ [4]	*F88 Pin 87*	42	USB D-[7][9]		
18	N/C		43	DASH TX+ (BI_DA+)	*orange/white*	*RJ45 Pin 1*
19	SENSOR GROUND		44	DASH TX- (BI_DA-)	*orange*	*RJ45 Pin 2*
20	ANALOGUE INPUT 2 (5V/TH)[6]		45	DASH RX+ (BI_DB+)	*green/white*	*RJ45 Pin 3*
21	ANALOGUE INPUT 5 (5V)		46	DASH RX- (BI_DB-)	*green*	*RJ45 Pin 6*
22	SWITCH INPUT 1[8]		47	DASH (BI_DC+) [5]	*blue*	*RJ45 Pin 4*
23	SWITCH INPUT 4[8]		48	DASH (BI_DC-) [5]	*blue/white*	*RJ45 Pin 5*
24	RS232 TX		49	DASH (BI_DD+) [5]	*brown/white*	*RJ45 Pin 7*
25	CAN HI #01[1]	*F88 Pin 82*	50	DASH (BI_DD-) [5]	*brown*	*RJ45 Pin8*

(1) Used for connection to Life Racing ECU's CAN 1
(2) LR internal use only or custom projects
(3) Use for switch inputs
(4) Recommended connection to Life Racing ECU (required for "PRO Spec" upgrade)
(5) Optional connection required for 1GHz Ethernet
(6) All 'TH' compatible inputs utilise a 3K pull-up to 5V
(7) Required for "PRO Spec" upgrade otherwise DO NOT CONNECT
(8) All switch inputs utilise a 10K pull-up to 3.3V
(9) Standard USB data cables must be used and not exceed 2m in length

3.1.2 Input Switches

To navigate the dash and make the most of its features, input switches are required. The D5 allows different options for you to do this. Each option requires setup of special items under the 'Items' tab of LifeDash to define which dash inputs are used. The 'pull-up' resistor must be enabled for analogue inputs to be used as switches.

Life Racing D5 Keypad

All dimensions in mm
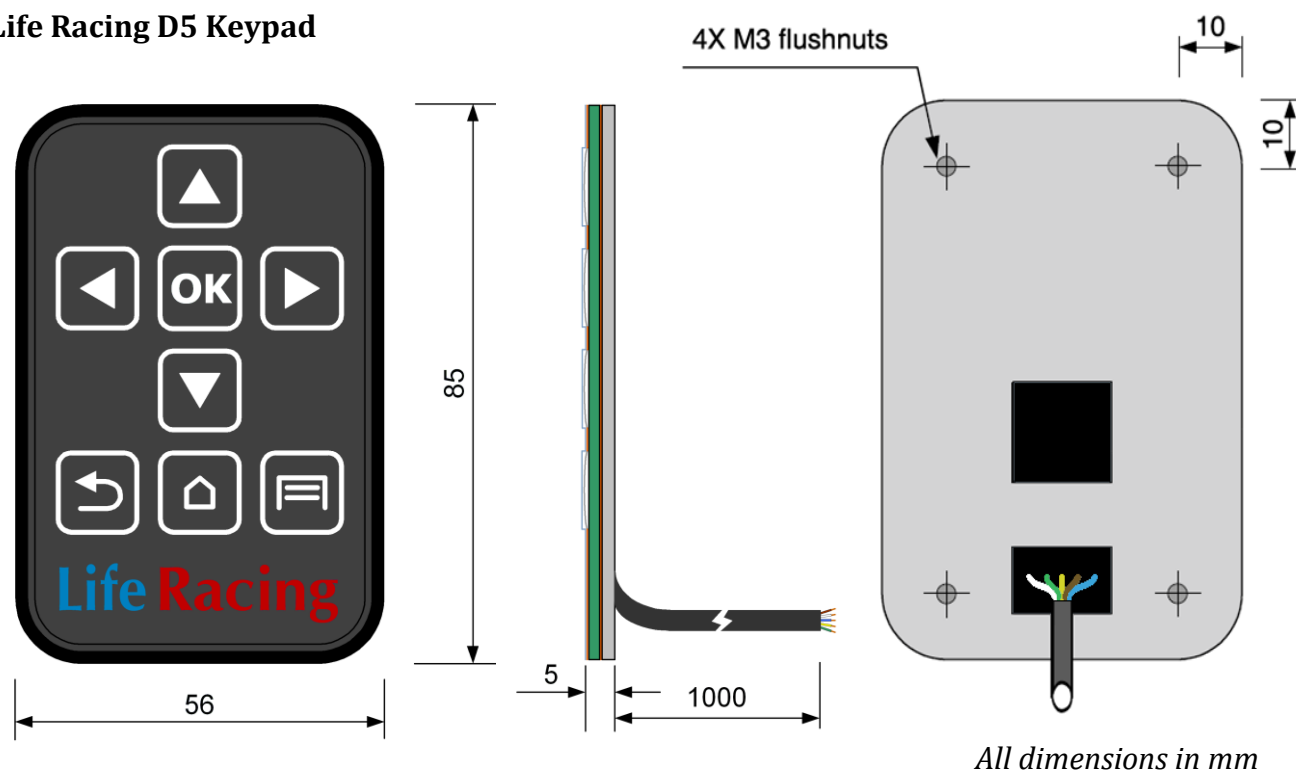
The Life Racing D5 Keypad allows full control of the dash and is required for most 'in dash' editing. The keypad can be mounted using 'dual lock' or similar or by using the four M3 nut inserts in the back panel, taking care to not push the studs through the membrane. However, it does not need to be permanently connected for the dash to operate.

It is recommended to secure the cable once desired angle is determined.

If permanent, it has the option of connecting external switches for more convenient use while driving. The 'Right,' 'Left' and 'OK' functions can be separately mounted externally by connecting the relevant wire to the LR Keypad Input through normally open momentary switches.

The special item "AN-KEYPAD8" must be assigned to the analogue input used.

Recommended connector: Binder 09-9789-71-05

Pin	Wire colour	Connect to:
1	White	Any one of ANALOGUE INPUT 1-4
2	Green	OK external switch
3	Yellow	Right external switch
4	Brown/Black	SENSOR GROUND (pin 19)
5	Blue	Left external switch
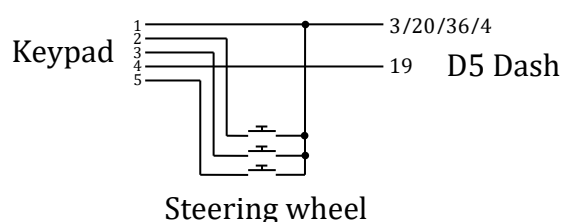
Hardwired switches

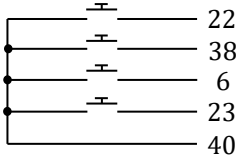External buttons can be hard wired into the dash through the switch inputs and DIGITAL GROUND (pin 40). However, only four switch inputs are available so there will be limited functionality.
The relevant special items "SW-X" must be assigned to their corresponding inputs.

```
                22
                38
                 6
                23
                40
```

4 Way keypad

The D5 also allows the option of your own 4 way setup using a single input pin and ground with the keys 'Left,' 'Right,' 'OK' and 'Down.' This will allow navigation and the ability to change anything on the settings page and is ideal for switches on a steering wheel. For custom display changes the Life Racing D5 Keypad or PC application is needed.

Each button should be a normally open momentary switch connecting SENSOR GROUND (pin 19) to the same ANALOGUE INPUT pin (1-4 only) through different value resistors.
The special item "AN-KEYPAD4" must be assigned to the analogue input used.

Left   12kΩ
Right   4.5kΩ
OK   2kΩ
Down   0.8kΩ

3/20/36/4

19
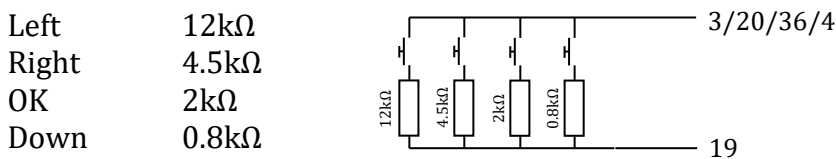
CAN inputs
An individual CAN message can be used for every switch input. Create the items and ensure they are used to define the CAN inputs under special items. Any non-zero value will be considered a key press.
The relevant special items "CAN-X" must be assigned to their corresponding items.

3.1.3 Lap Beacon

The lap beacon is used for lap times and in calculations such as fuel consumption. It can be received either directly into one of the four switch inputs or over CAN. Both methods require Special Item definitions.

Note
If directly connecting, it is recommended that the beacon is duel wired to both the Dash and ECU.

3.1.4 Brightness Adjustment

The D5 is fitted with an ambient light sensor that automatically adjusts the screen brightness. Automatic adjustment can be set up with custom linearisation in the Misc tab of LifeDash. However, this can be overridden through the use of an external potentiometer connected as below or with a CAN message.

+	5V OUT (pin 5)	5
Signal	Any ANALOGUE INPUT pin	3/20/36/4/21/37
-	SENSOR GROUND (pin 19)	19
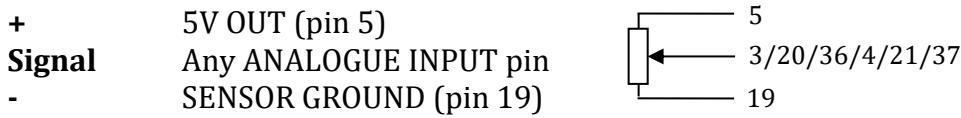
Both methods require Special Item definitions.

3.1.5 CAN

The dash uses a CAN2.0B data bus to stream information from the ECU. The CAN settings must agree between both ECU and D5. Any CAN configuration errors are displayed on the screen during boot up as a warning message. The dash has fixed CAN termination o must be placed at the end of the bus.

3.1.6 Dash Comms

Dash comms is required to connect the Dash to a PC for programming. If a connection is established, the dash will display a white Ethernet symbol (black on white backgrounds). Pins 47-50 will enable up to 1GHz connection speed but are not mandatory.
Symbol only shows on certain pages such as road, race or stage.

3.1.7 ECU Comms
(Optional)

For Data Logging (PRO only), an ECU comms connection is required to stream data from the ECU to the USB. However, it also provides other advantages with or without the PRO spec upgrade; it enables both the ECU and Dash to connect to a single PC Ethernet port making it possible to program both devices through the Dash connection. It also allows the receiving of ECU CAN items over Ethernet to reduce load on the CAN bus.

If the dash detects a connected ECU with the same ID, it will display a green Ethernet symbol. The symbol only shows on primary display pages such as road, race or stage.
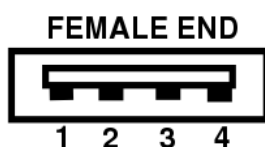

3.1.8 USB
(PRO only)

Data Logging saves data onto a compatible USB memory stick. The dash should be wired to a female USB port as below using standard USB data cable not exceeding 2m in length.

1	+5V	*D5 Pin 28*
2	D-	*D5 Pin 42*
3	D+	*D5 Pin 26*
4	GND	*D5 Pin 27*

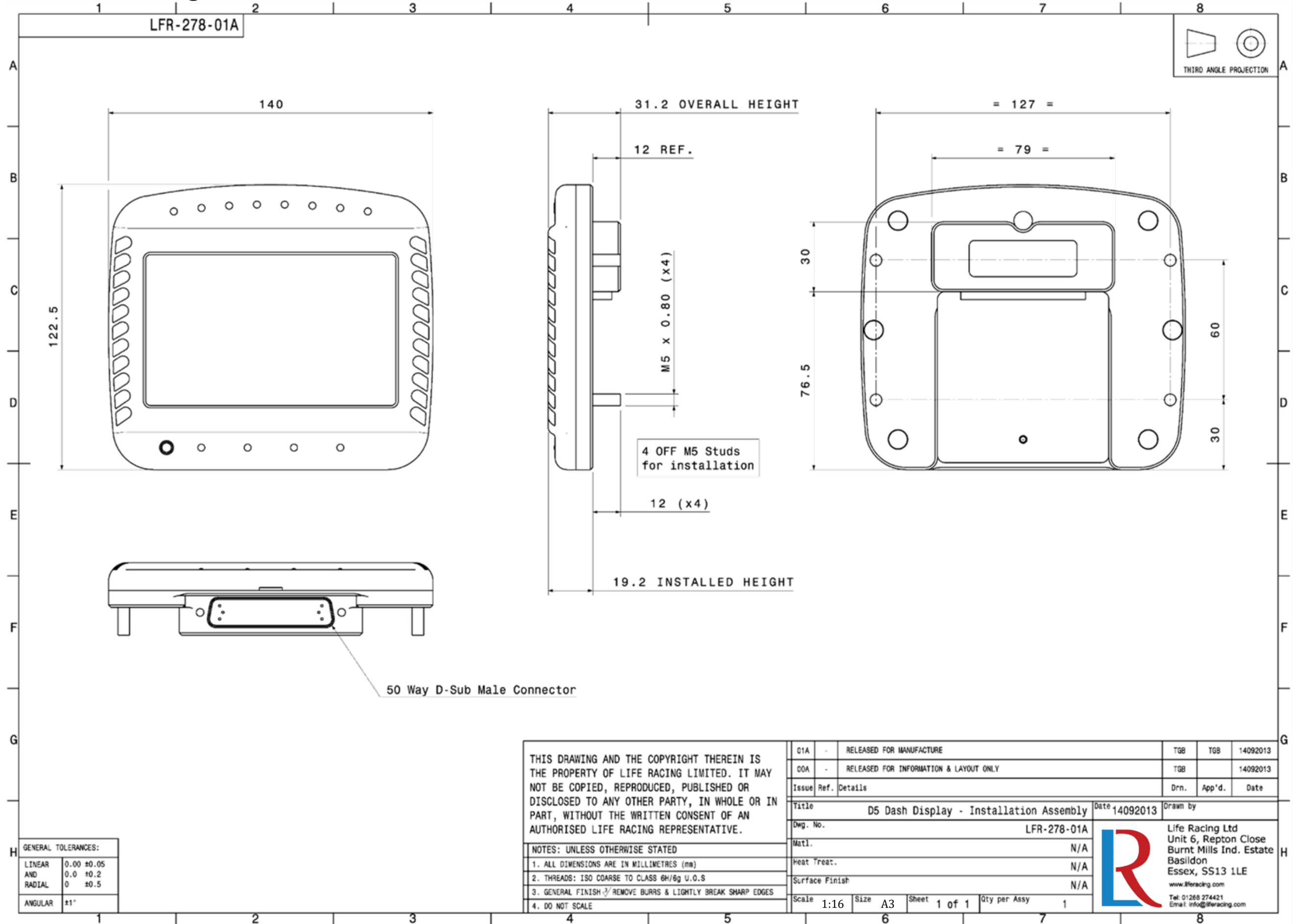LR recommends   SanDisk Cruzer Fit 16G
SanDisk Cruzer Fit 32G

3.2 Software

Initial configuration and advanced customisation requires PC applications from the LifeSuite. To install, contact your Life Racing distributor and you will be sent a link to the latest software package. Download, run and follow the prompts to install.

For further information please visit *www.liferacing.com* and select the Quick Start Guide from Support, User Manuals/Datasheets.

3.3 Mechanical drawing

Mechanical drawing LFR-278-01A — D5 Dash Display - Installation Assembly

- 140
- 122.5
- 31.2 OVERALL HEIGHT
- 12 REF.
- M5 x 0.80 (x4)
- 4 OFF M5 Studs for installation
- 12 (x4)
- 19.2 INSTALLED HEIGHT
- = 127 =
- = 79 =
- 30
- 76.5
- 60
- 30
- 50 Way D-Sub Male Connector

THIRD ANGLE PROJECTION

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01A	-	RELEASED FOR MANUFACTURE		TGB	TGB	14092013
00A	-	RELEASED FOR INFORMATION & LAYOUT ONLY		TGB		14092013
Issue	Ref.	Details		Drn.	App'd.	Date

Title: D5 Dash Display - Installation Assembly — Date 14092013 — Drawn by

Dwg. No. LFR-278-01A

Matl. N/A
Heat Treat. N/A
Surface Finish N/A
Scale 1:16 Size A3 Sheet 1 of 1 Qty per Assy 1

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Unit 6, Repton Close
Burnt Mills Ind. Estate
Basildon
Essex, SS13 1LE
www.liferacing.com
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Email: info@liferacing.com

NOTES: UNLESS OTHERWISE STATED
1. ALL DIMENSIONS ARE IN MILLIMETRES (mm)
2. THREADS: ISO COARSE TO CLASS 6H/6g U.O.S
3. GENERAL FINISH √ REMOVE BURRS & LIGHTLY BREAK SHARP EDGES
4. DO NOT SCALE

GENERAL TOLERANCES:
LINEAR AND RADIAL
LINEAR 0.00 ±0.05
AND 0.0 ±0.2
RADIAL 0 ±0.5
ANGULAR ±1°

4 Configuration
(LifeDash)

Features can be customised through the LifeDash application. Some options are also available to alter on the dash itself through the use of the Life Racing D5 Keypad. As with all LifeSuite applications, LifeDash is designed to be fully useable with one hand using just the keyboard. Shortcut keys are underlined and can allow quick navigation and changes.

4.1 Calibration Tools

4.1.1 Default calibration

When LifeDash is started, the following message will appear.

For Default calibration, press OK as prompted. The default calibration will start in demo mode and gives realistic examples of setup.

4.1.2 Load Calibration
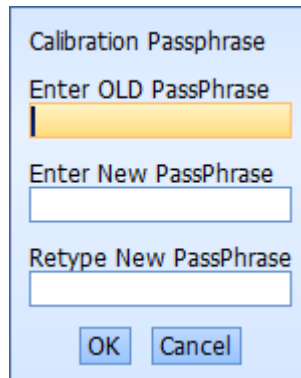
To load a dash calibration from a PC select **_File, Load_** and locate the relevant file.
To read a calibration from the Dash select **_Device, Get._** Make sure any changes are saved beforehand.

4.1.3 Protect Calibration

Calibrations can be password protected by selecting **_Cal, Edit Passphrase._**
This will cause the password to be required before the calibration can be loaded from a PC file or from the Dash itself. For the first password created, leave the Old PassPhrase box blank.

4.1.4 Save Calibration

To save the calibration to a PC file, select **_File, Save_** or **_File, save To_** for a new location*.*
To program the calibration to the Dash select **_Device, Set._**

4.1.5 Compare Calibration

The current calibration can be compared to another file to view the changes between them. Select **_File, Compare_** and locate the comparison file. A report will be created that displays all alarm, item and CAN differences. Visual features cannot be compared.

4.2 CAN

The D5 Dash communicates through CAN with other devices. CAN settings include a quick setup for other Life Racing products and support for fully flexible Custom CAN.
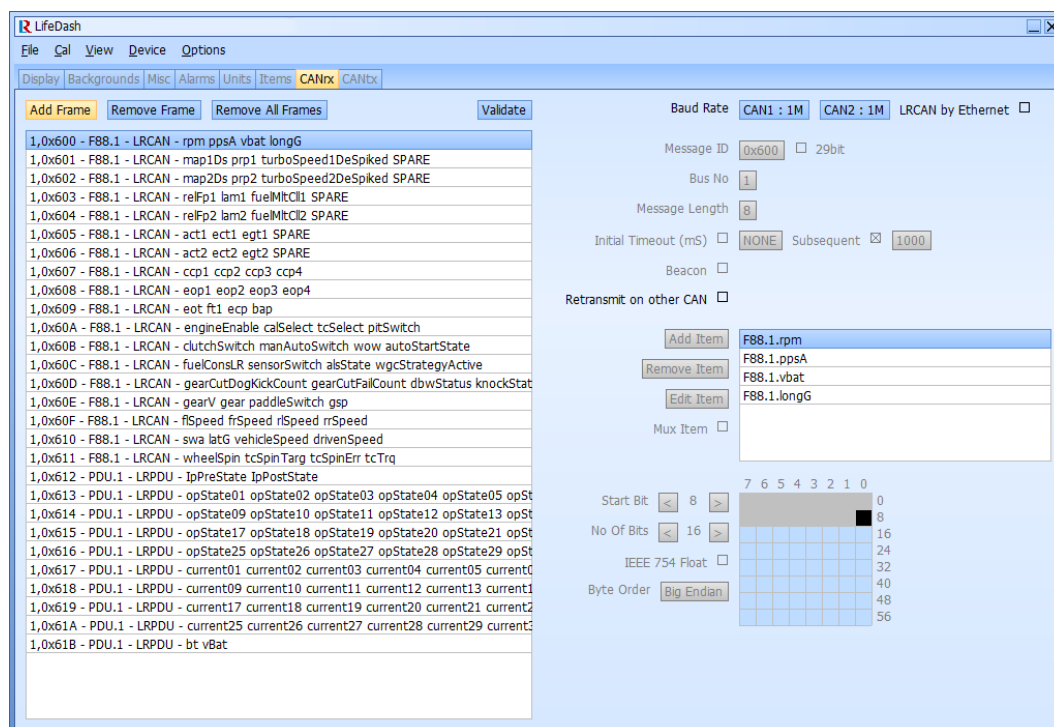
4.2.1 Life Racing CAN Receive

The D5 receives most of its information from CAN, therefore the CAN settings in the dash and ECU must match for communication to work. Select **Add Frame, LRcan from .LRC** to extract the CAN information from an ECU calibration. Loading the calibration from an .LRC will pre-set the features of the dash to match the ECU. This will synchronize the CAN settings and preload the monitoring items available from the CAN content. New items need to be added in the ECU calibration first and loaded into LifeDash. Items selected in CAN will become available under the 'Items' tab and in the display layout. Frame details are displayed but any editing must be done in LifeCal.

To add Life Racing PDU frames, select **Add Frame, LRPDU**, type an address for the starting frame and select which bus the frames will be received on. All available frames will automatically be added but cannot be edited.

For PDU soft inputs select **Add Frame, PDU Soft i/p** while a frame belonging to the correct PDU is highlighted. Type an address and select the soft inputs required.

Switch Panel inputs can be added by selecting **Add Frame, SWP Soft i/p.**

All items will become available under the 'items' tab, allowing renaming and gauge edits. PDU items will automatically be linked to the PDU display page.


4.2.2 LRCAN by Ethernet

By checking the **LRCAN by Ethernet** box, all CAN frames from a Life Racing ECU will be received by Ethernet instead of CAN, reducing the amount of traffic on the CAN bus. This option requires an ECU to Dash Ethernet connection.

4.2.3 Custom CAN Receive

Custom CAN is also available for communication with non Life Racing products. Receiving items should first be setup in the 'Items' tab to make them available in frame editing. In the 'CANrx' tab, create a blank frame by selecting **Add Frame, Custom** and following dialogue box instructions to include ID and device. All custom CAN options will become available:
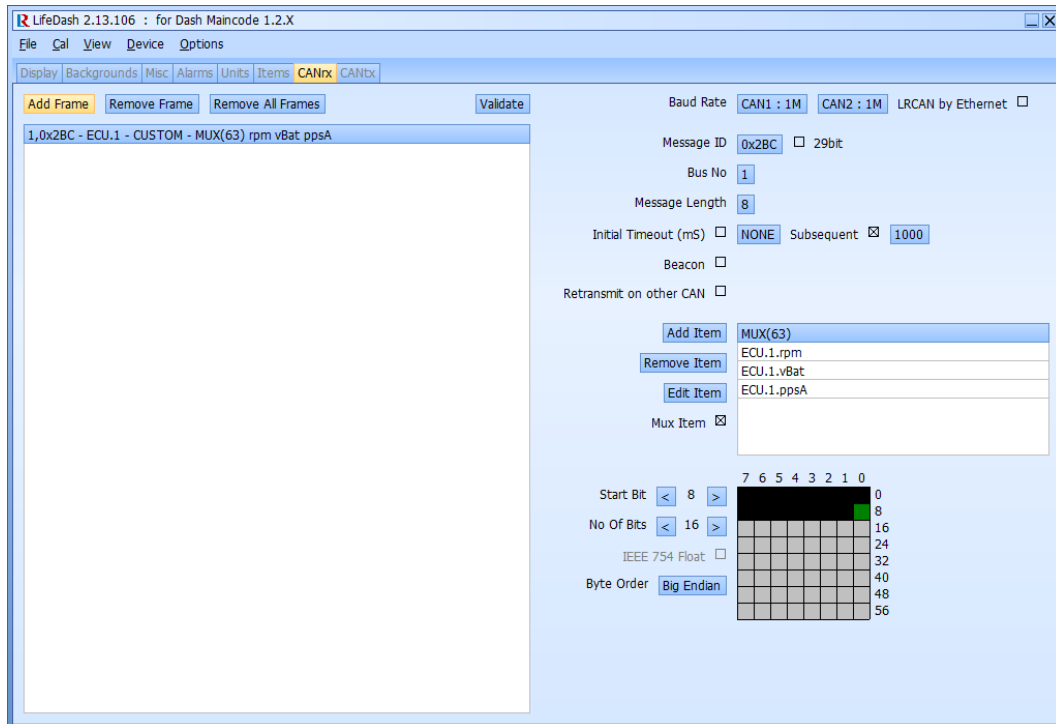
General

Message ID: Frame identifier
29bit: Allows 29bit addresses to be used.
Bus no: Which bus the frame will be received on. CAN 1 or CAN 2.
Length: Frame size in bytes.
Initial Timeout: Time after power up allowed before timeout error.
Subsequent: Time between received frames allowed before timeout error.
Beacon: Ticking this box will result in a beacon event trigger when this frame is received, regardless of content.

Note

It is recommended that the subsequent timeout period is made at least three times the length of the expected reception period.

Frame content

Add Item: Add an item to the selected frame.
Remove Item: Delete the selected item.
Edit Item: Select associated item from the list (items must first be added in the 'Items' tab).
Mux Item: Ticking this box makes the selected item an ID item. Assigning different ID values to frames allows them to share message IDs.

Frame Layout

Frame: Use the *Start Bit* and *No Of Bits* controls or drag across the grid to choose item size and location within the frame.

IEEE 754 Float: Tick this box to allow floating bit points.

Byte Order: Choose between big and little endian byte order for each item.

4.2.4 Other CAN Receive Options

Baud Rate

Change the baud rate of each CAN bus by selecting its corresponding button and choosing a new value. This value must match all devices on the same bus.

Validate

Pressing the *Validate* button will perform a check for any validation errors in the active CAN frames such as repeated IDs. A message will only be displayed if a conflict is found.

Retransmit on other CAN

Any incoming CAN message can be retransmitted on the opposite bus by ticking this box. A transmission frame will be added in the 'CANtx' tab that replicates the received frame.

4.2.5 Custom CAN Transmit

The D5 is capable of transmitting custom CAN frames. This is set up in the 'CANtx' tab. Any frames being retransmitted from the 'CANrx' tab will also appear here but will not be editable.
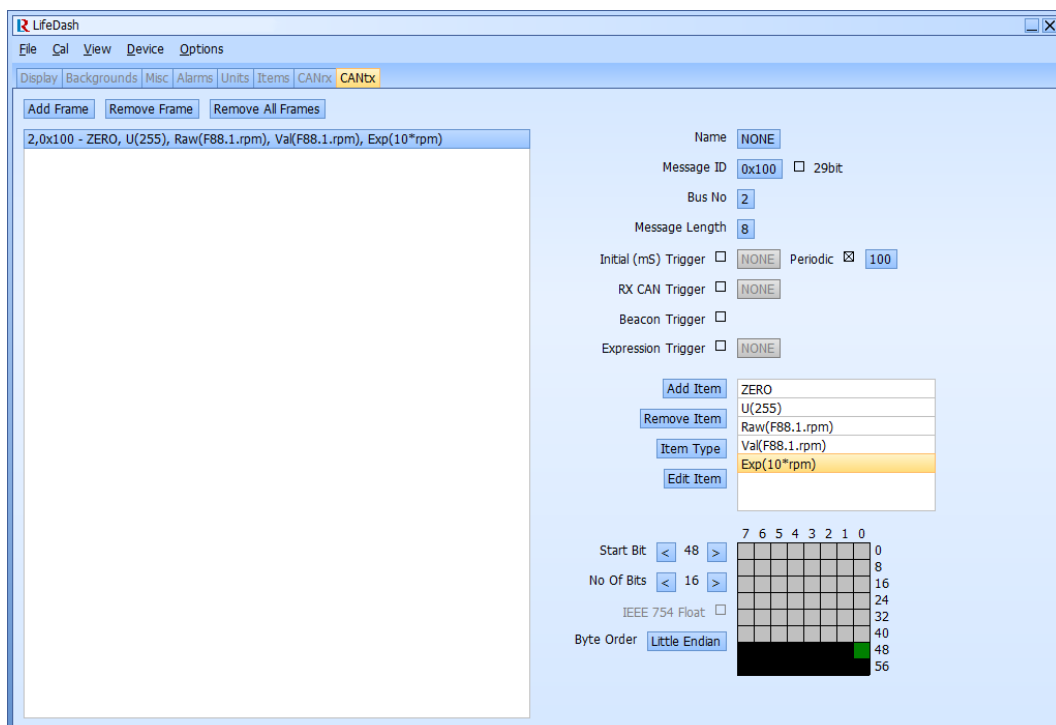
Selecting **Add Frame** creates a blank frame with the following options:

General
Name:	Optional name of frame for easy identification in list
Message Id:	Frame identifier
29bit:	Allows 29bit addresses to be used.
Bus no:	Which bus the frame will be transmitted on. CAN1 or CAN 2
Message Length:	Length of frame in bytes

Triggers
Initial (mS) Trigger:	Time to wait before transmitting first frame
Periodic:	Time period between each transmission
RX CAN Trigger:	Transmit when selected frame is received
Beacon Trigger:	Transmit when beacon is triggered
Expression Trigger:	Transmit when a maths expression is true

Frame content

Add Item: Add an item to the selected frame.

Remove Item: Delete the selected item.

Item Type: Choose between:

ZERO   default blank,

UNSIGNED   numerical value, maximum dependent on No of bits,

MII-RAW   unscaled item values

MII-VAL   scaled item values, rounded to the nearest integer

EXPRESSION mathematical expression

Edit Item: Open the dialogue box for the selected item type. Raw and Val item types will allow selection from the list of items created in the 'Items' tab.

Frame Layout

Frame: Use the *Start Bit* and *No Of Bits* controls or drag across the grid to choose item size and location within the frame.

IEEE 754 Float: Tick this box to allow floating bit points.

Byte Order: Choose between big and little endian byte order for each item.

4.3 Items

'Items' are the different monitoring items that can be displayed on the dash screen. The list of items is determined by the CAN frame configuration and physical inputs.
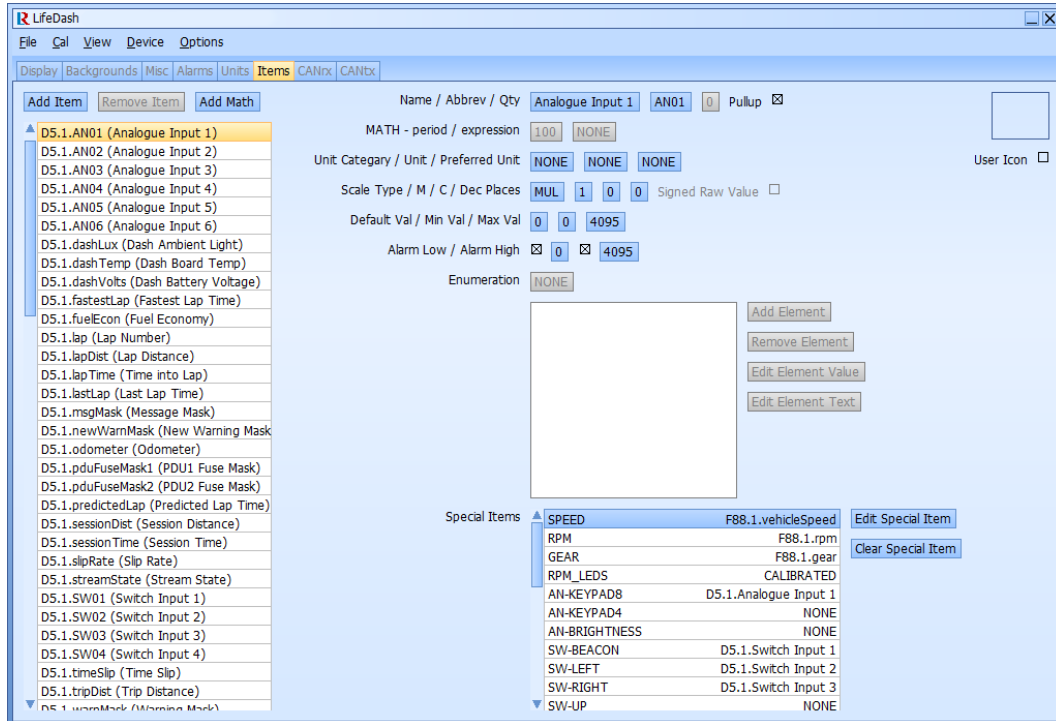
LR items are automatically added when an .LRC file is loaded in the 'CANrx' tab. Other devices must be added manually using the Add Item button and following the dialogue boxes. The D5 also has several of its own monitoring items including lap data and independent inputs. Lap data is calculated live in the dash as long as special items are defined and a lap beacon is connected. It also has its own items for dash voltage, temperature and ambient light sensor. Math can also be added with the Add Math button. This will create a specific item that allows maths expression input.

The following options are displayed for every item:

General

Name:	Full name. Used as most gauge labels.
Abbrev:	Shortened name. Used for alarm and maths expressions.
Qty:	Unique number for selected item.
Pull-up:	Enables or disables the 1kΩ pull up resistor on analogue inputs 1-4 only.

Math

Period:	Amount of time between calculations in milliseconds.
Expression:	Enter mathematical expression for Math Items here.

Note

Math is currently limited to basic operations but future firmware upgrades will improve functionality.

Units

Unit category: Defines what unit options are available and selects the default display units from the 'Units' tab.

Unit: The unit type sent by CAN after scaling. Dependant on unit category.

Preferred unit: Alternative to default display unit **for selected item only.**

Scaling

Mathematical operation to convert the item value into engineering units.

Scale type: Operation type. Can be NONE (equivalent to Mul[1,0]), Mul, Div, Inv or Linearise.

M: Operation value. Can be negative.

C: Constant. Can be negative.

Dec Places: Number of decimal places to display.

Scaling works in one of the following ways where X is the CAN value.

Mul $XM+C$

Div $X/M+C$

Inv $M/X+C$

Linearise   Linearising allows graphical scaling for more complex items. To create a graph add hint points of voltage against value with the relevant button, choose the type of linearisation and select **Apply Hints.**
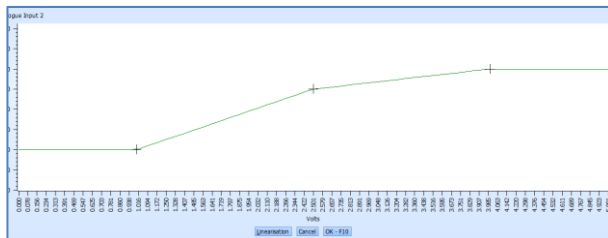
INTERPOLATE   EXTRAPOLATE
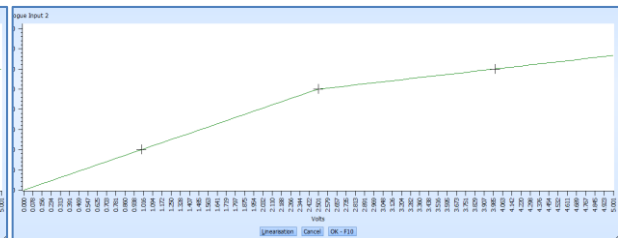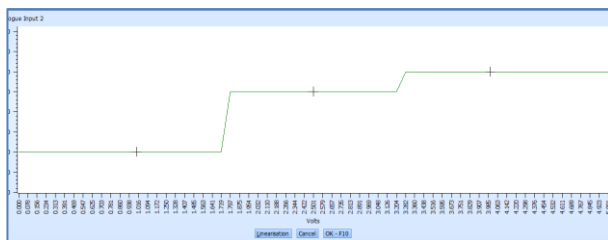
GEAR   LINEFIT
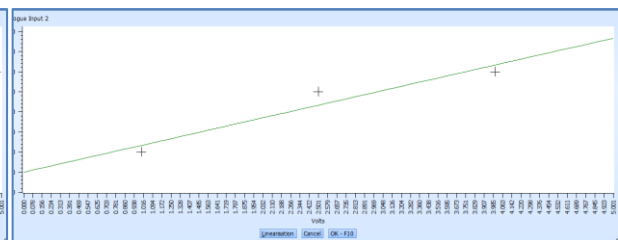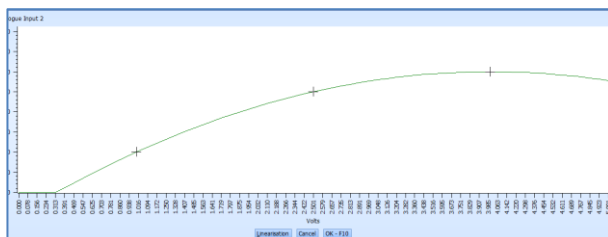
CURVEFIT   KEYPAD
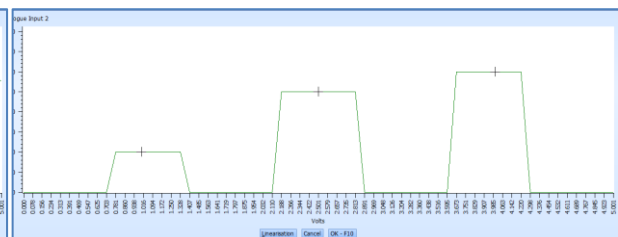
Gauge Values

Default Val: Default value, value shown on gauge if no information is received.
Min Val: Minimum value, lowest allowed value and scale limit.
Max Val: Maximum value, highest allowed value and scale limit.

Note
Physical and CAN inputs will be **clipped** at these min/max values. Built in items (D5.1.X) are unaffected.
Gauge scales are defaulted to these values but can be altered in 'Edit Mode'.

Alarm Values

Alarm low: If enabled, when item value is lower than this, gauge changes colour.
Alarm high: If enabled, when item value is higher than this, gauge changes colour.

Note
The colour that each gauge changes to in alarm conditions can be individually altered in 'Edit Mode.' By default, alarms appear red.

Enumeration
Display text depending on numerical value.
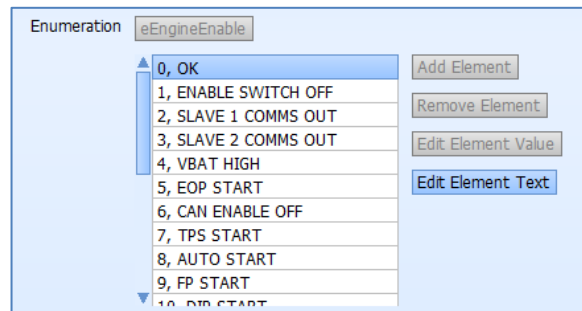
User Icon
An icon can be displayed with the selected item on the dash display. If the box is not checked the default icon will be displayed (may be blank). To apply a different icon, tick the box and select the new icon from the list. More icons will be added with future software updates.

4.4 Maths

Maths expressions are currently limited to basic operators and a few specialised functions.

Operators

(	Open bracket	**<**	Less than	**&&**	Logical AND	**&**	Bitwise AND
)	Close bracket	**<=**	Less than or equal	**||**	Logical OR	**|**	Bitwise OR
*	Multiply	**>**	More than	**!**	Logical NOT	**^**	Bitwise XOR
/	Divide	**>=**	More than or equal	**?**	Then	**~**	Bitwise NOT
%	Modulus	**==**	Equal to	**:**	Else	**<<**	Bitwise Left Shift
+	Add	**!=**	Not Equal	**,**	Comma	**>>**	Bitwise Right Shift
-	Subtract						

&& can also be written as 'and'.
|| can also be written as 'or'.

Functions

The 'Duration' function counts how long a condition is true for in ms. This is typed in the following format:
    Duration(condition)

By pairing with comparative time, a delayed trigger is created:
Duration(condition)OperationTime
e.g.   Duration(egt1>843 and rpmAvg>200)>5000
Where time is in thousandths of a second, e.g. 5000=5 seconds

The 'Text Val' function returns the current value of the monitoring item in full text or partial text. This is used to display useful messages from the 'Alarms' tab and must be typed in the following format:
    TextVal(mon item, show name)
e.g.   TextVal(engineEnable,0) or TextVal(engineEnable,1)
Where 1 is full text and 0 is partial text

The 'Previous' function can be used for detecting a change to an item value. This must be typed in the following format:
    Previous(expression)
e.g.   tcSelect!=Previous(tcSelect)

The 'Validate' function will return a 1 or 0 (true or false) depending on the condition results but will only change when this condition does not change for the length of time stated. This differs from the 'Duration' function as it validates in both directions, also requiring a false condition for the specified time period.
    Validate(condition,time)
e.g.   Validate(AN01<500,50)

The 'ToggleLatch' function will alternate between two values every time a condition is met.
    ToggleLatch(condition, value1, value2)

When combined with the 'Validate function, this will create an effective latching switch.
e.g.   ToggleLatch(Validate(AN01<500,50),0,1)

The 'IncLatch' function will increase its value by one every time the condition is met. This can be used as a counter or, when combined with a second input with a decrementing latch, a calibration position or tuning switch. A wrap option allows a restart at the minimum value when the maximum value is exceeded.
    IncLatch(condition, defaultValue, minValue, maxValue, wrap)
e.g.   IncLatch(Validate(AN01<500,50),5,1,10,0)

The 'DecLatch' function will decrease by one each time the condition is met.
    DecLatch(condition, defaultValue, minValue, maxValue, wrap)

4.5 Special items

The Special Items, found under the 'Items' tab, are a group of specific items that need defining depending on your configuration for certain dash features.

4.5.1 Display Items

RPM and Gear should be defined here to take advantage of the specific display behaviours for these items. The rev counter and gear number are unique gauges in several templates.

4.5.2 Input Switches

Switch inputs can be physical or received over CAN. For physical inputs, connect as described in Wiring, and assign the special item(s) for the chosen method to the chosen input pin(s).
For CAN inputs, assign each CAN special item to its corresponding CAN input item. The dash assumes any non-zero value is a key press.

4.5.3 Brightness Adjustment

LCD and LED brightness is set automatically. However, this can be overridden with either a potentiometer or a CAN message.

To use a potentiometer, connect as described in [Wiring](#) and assign the AN-BRIGHTNESS special item to the analogue input used. The pull up resistor should be disabled under the 'Items' tab if available. Up to 0.3V, the brightness will remain automatic. From 0.3V to 0.6V the brightness will be at minimum. Past 0.6V, manual control is enabled and brightness will increase according to the linearisation graphs.

To use CAN, CAN-LUX-BRIGHTNESS must be defined in special items. A CAN message should be 16 bits long and be scaled by multiplying by 2 and adding -1. The values obtained correspond to the lux figures in the 'Misc' tab and use the same linearisation curves. Sending a zero will set the brightness to automatic.

4.5.4 Shift lights

The D5 has 8 high intensity LED shift lights. These can be controlled by either the ECU via CAN or the Dash.

ECU control

ECU control is altered in LifeCal under *Output Functions, Change Light.* This method allows more complex options such as hysteresis and auto shifting.
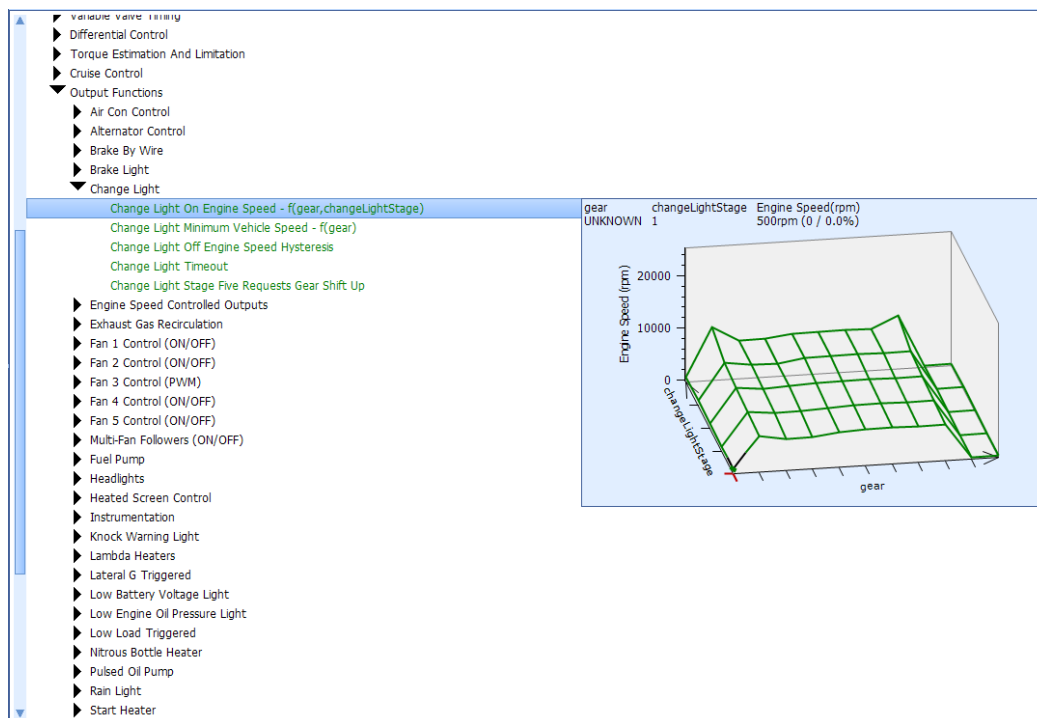
In *On Engine Speed – f(gear, ChangeLightStage)* each gear can have its shift light points independently assigned.
Change light stages 1-4 will progressively light the LED's from the outside in when active.
Stage 5 will cause the shift lights to flash. Stage 5 can alternatively be assigned to request gear shift up by enabling it in *Stage Five Requests Gear Shift Up.* If stage 5 is not required, ensure the RPM value is set beyond what the engine can reach, i.e. 25000RPM.
Minimum speed for each gear can be set in *Minimum Vehicle Speed – f(gear).*

To make sure lights do not flash with RPM oscillation, light timeout and engine speed hysteresis can be altered in *Timeout* and *Off Engine Speed Hysteresis* respectively.

Ensure 'Run strategy without pin' is set in *I/O Configuration, Pin assignment* for any one of the change light outputs and *changeLightStage* is included in the custom CAN datastream.

Define RPM_LEDS in the *Special Items* section of the 'Items' tab in LifeDash as *changeLightStage*.

Dash control

The Dash gives basic control of shift lights with no additional options. This is done in the *Special Items* section of the 'Items' tab by selecting **Edit Special Item** with RPM_LEDS highlighted. Chose <u>**No**</u> to open setup calibration.

RPM special item must be defined.

Double clicking or pressing enter on a highlighted cell will allow the number to be changed. The number represents the RPM value above which each stage will be active. Change light stages 1-4 will progressively light the LED's from the outside in. The Flash stage will cause all shift lights to flash. Custom values for each gear can be changed by ticking the *By Gear* box.

4.5.5 Lap Beacon

For a wired input, define the SW-BEACON special item as the input used. Using this method, the beacon is 'active low'.

To use a CAN beacon, define the CAN-BEACON special item. The CAN beacon is active at any non-zero value received.

Alternatively, an entire frame can be used as a beacon by checking the 'beacon' box for the chosen frame under the 'CANrx' tab. When this frame is received, a beacon event is triggered. No special item needs to be assigned for this method.

4.5.6 Tell-tales

Tell-tales are the extra symbols displayed on the road pages and include light status and indicators. Each symbol can be assigned to an item received over CAN. Any non-zero value will turn on the corresponding symbol.

When defining indicators, consider the incoming CAN message and whether it is already flashing. Assign a flashing item to CAN_TT_LEFT/RIGHT_IND or a solid item to CAN_TT_FLASH_LEFT/RIGHT_IND.

4.6 Virtual Switches

Virtual switches can be implemented onto the 1x7 text page. These switches are enumerated items that can be toggled with a keypad through the dash. This may then be used as a dash control item or sent out on CAN to another device, saving valuable input space. Valid switch items must be new items (not native to the D5 or LR ECU) with enumerated values.

4.7 Units

Default display units can be changed in the 'Units' tab of LifeDash. These are what unit a general item displays if a preferred unit isn't specified in the 'Items' tab.

To change a unit, select it and choose the new unit from the drop down list.
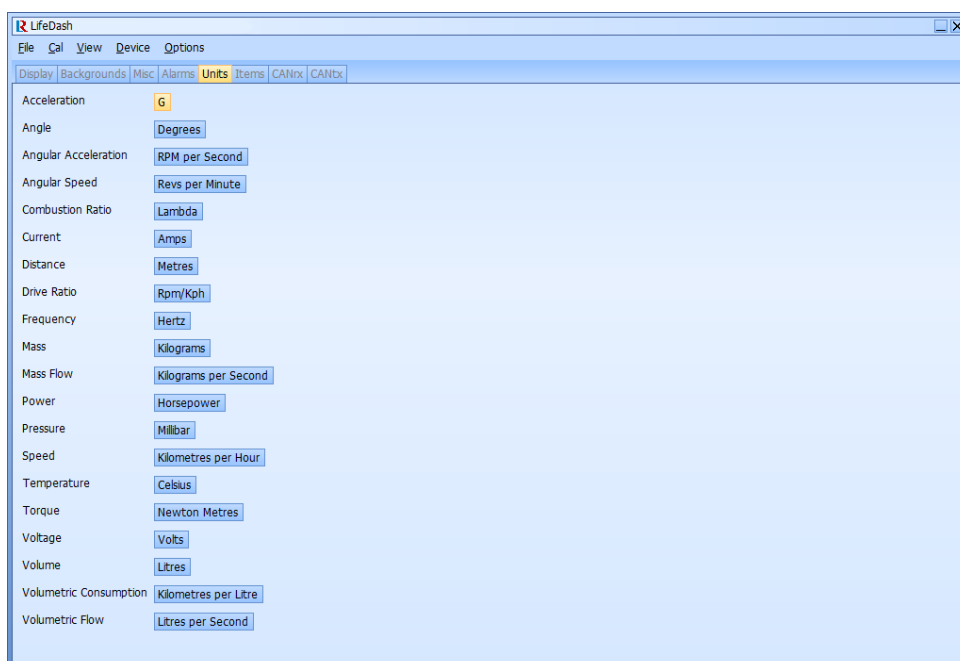
4.8 Alarms

Alarms are set in LifeDash via the 'Alarms' tab. To add an alarm press **Add Alarm**. Alarms are typed in the format:

ALARM TYPE("Display text", On Conditions, Off Conditions)
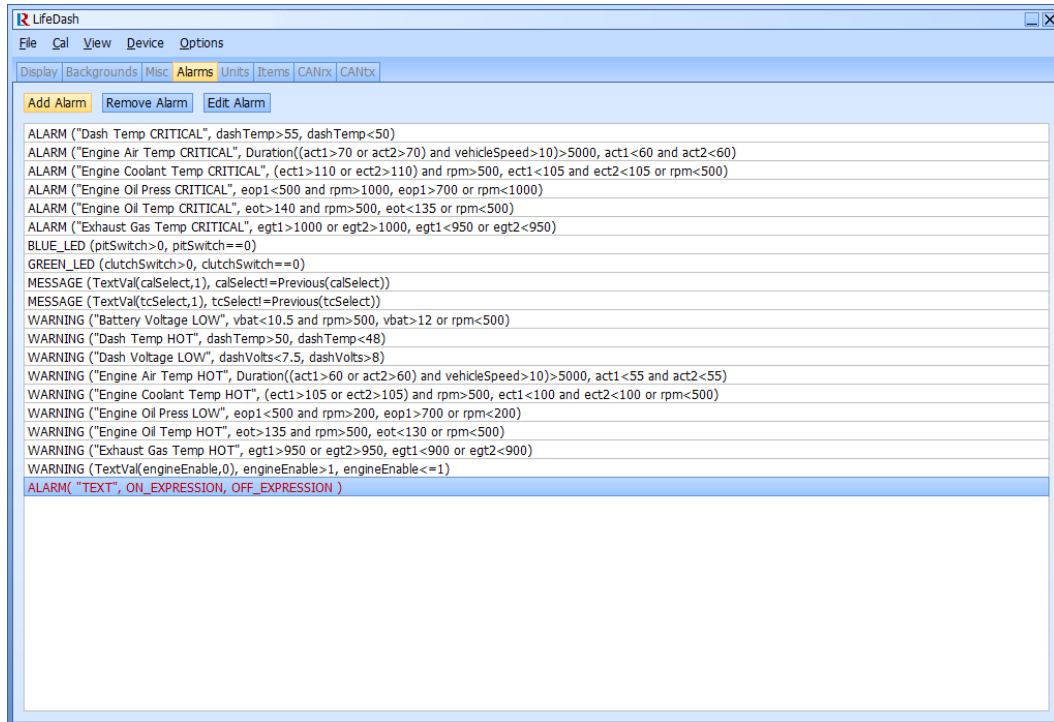
Alarm types can either be;

'MESSAGE' which is dismissible and displayed in green (Off Conditions Omitted).

'WARNING' which is dismissible, displayed in yellow and activates the yellow LED.

'ALARM' which is not dismissible, displayed in red and activates the red LED.

The Display text is the message that will appear when the alarm is triggered.

The On Conditions are the conditions that must be met for the alarm to trigger.

The Off Conditions are the conditions that must be met to switch off an alarm after it has triggered.

Alarms are case sensitive and must use abbreviated names in expressions.

Units used in alarm expressions are the same as displayed units.

To open the Alarm Editor either press **OK** (space) or double click the highlighted alarm. If the alarm is incompatible, the Editor will not allow it to be added. It will instead display an error hint above where the error has occurred.
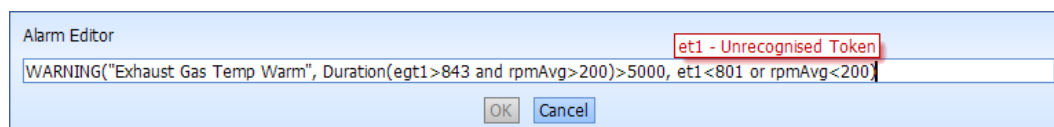
In addition to warnings and messages, an alarm can force a certain page to be displayed with the following command:

'CHANGE_PAGE'(Condition, Page#)

Alarms can use the same basic maths and expressions available to maths items.

To remove an alarm, highlight it and select **Remove Alarm.**

Skip to Operation - Alarms

4.9 Custom LED's

The D5 dash features 4 LED's below the screen that are triggered by custom conditions. Two LED's are used by default for when an alarm or warning has been triggered. Red for alarm and yellow for warning. This function is overridden if custom conditions are used. Custom LED's are set up in the 'Alarms' tab of LifeDash in a similar way to ordinary alarms. Add alarm and open the alarm editor. Custom LED functions are written in the format:

GREEN_LED(On conditions, Off conditions)
BLUE_LED(On conditions, Off conditions)
YELLOW_LED(On conditions, Off conditions)
RED_LED(On conditions, Off conditions)

4.10   Misc

The Misc tab includes options for brightness adjustment, number of pages and fastest lap settings as well as space for calibration comments.
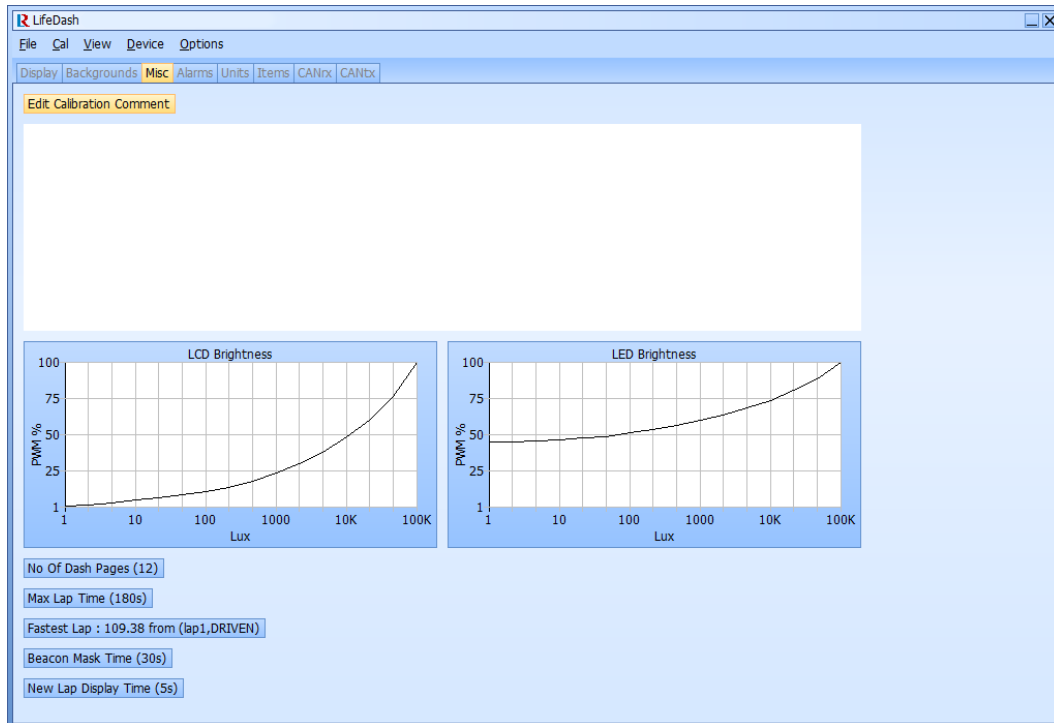
Selecting *Edit Calibration Comment* will open the dialogue box for storing calibration comments. Calibration comment can also be edited from any tab by selecting *Cal, Set Comment*.

Ambient light sensor linearisation can be changed with the use of the two graphs. These determine the brightness levels of the screen and LED's when brightness is set to automatic. PWM% can be changed with the +/- keys or typed when selecting a lux level. Approximate lux level scenarios are displayed below for reference.

Condition	Lux
Direct sunlight	100000
Full daylight	10000
Overcast day	1000
Dark overcast day	100
Twilight	10
Deep Twilight	1

Note
LED's will require a high minimum PWM percentage. It is recommended that this value is not reduced beyond the default (45%).

The total number of dash pages can be changed by selecting the relevant button. The number of pages must be between a minimum of 4 and a maximum of 20. The last three pages are recommended for the inputs, messages and settings pages.
Reducing the number of pages will lose the extra page layouts.

The Max Lap Time defines the amount of memory storage that can be assigned to fastest lap data. This will automatically be set when a fastest lap is loaded.

The fastest lap stored in the dash can be loaded from a saved session with the **Load Lap from .LRD** button. This is cleared when defining a max lap time.
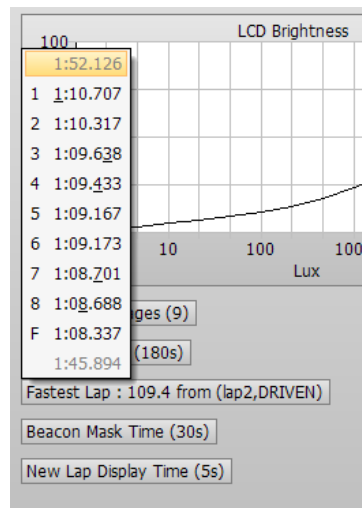
Beacon mask time can be defined to avoid recording a fastest lap at the first beacon trigger.

The amount of time the completed lap time is displayed can be changed using the **New Lap Display Time** button.

4.11   Background

A custom background image can be loaded and applied to dash pages. The Background tab allows management of any backgrounds that are loaded into the dash. Images can be loaded, removed and renamed here with the relevant buttons. Image sizes are displayed next to the file name. Total calibration size cannot exceed **4MB**. Large files will take longer to program into the dash.
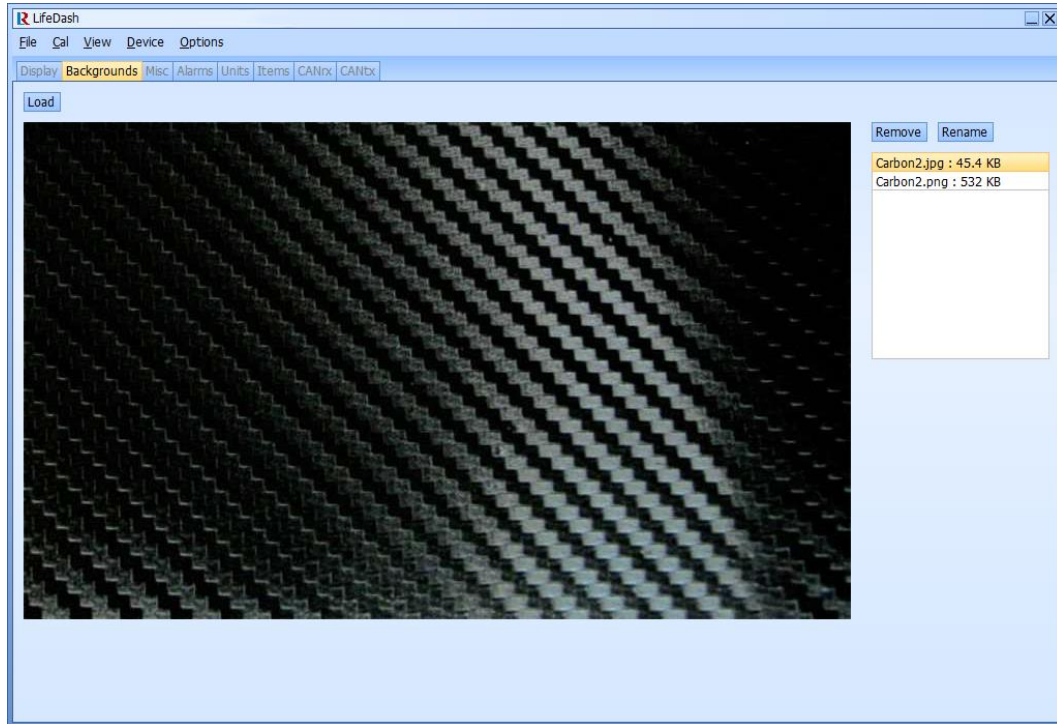
Backgrounds can also be used to display custom layout features, gauge icons or logos.

Note
Images must be **800x480** pixels in size and be in one of the following file formats: **BMP, JPG, PNG.** Generally, JPG images will have the smallest file size (often by a large degree) but may have a lower image sharpness, depending on the type of image.

4.12   Display

The 'Display' tab allows simulation of the dash screen as it operates in the same way as the dash. All In Dash Editing can be performed here. The display can be controlled using a virtual version of the LR keypad, a mouse or keyboard shortcuts.
 Left click for *OK*, right click for *Menu*. Clicking outside of a menu box will have the same effect as the *Back* button. The pointer and scroll wheel can also be used instead of arrows.
Keyboard shortcuts enable fast navigation without a mouse. The Home and Menu shortcuts can be reversed for your preference by selecting *Options, Swap MENU/OK keys.*

KEYBOARD SHORTCUTS
Arrow Keys
OK : space bar
BACK : escape key
HOME : home key
MENU : return key
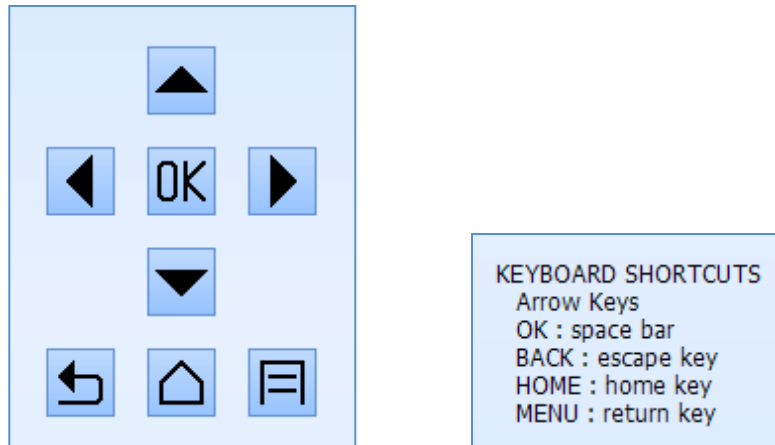
With Demo mode disabled, gauges will display default values set from the 'items' tab. The item values can be temporarily changed to a set figure using the *Set MonItem Values* button. This can be used to test alarm conditions, custom LED's and shift lights.

Choose mon item

D5.1.Alarm Mask	0
D5.1.Analogue Input 1	0
D5.1.Analogue Input 2	0
D5.1.Analogue Input 3	0
D5.1.Analogue Input 4	0
D5.1.Analogue Input 5	0
D5.1.Analogue Input 6	0
D5.1.Dash Ambient Light	176947
D5.1.Dash Battery Voltage	12.00v
D5.1.Dash Board Temp	20°C
D5.1.Fastest Lap Time	1:49.379

Pages can also be renamed here using the *Set Page Name* button and typing the new name. Names can be removed by clearing this textbox.

The current page can be moved to a different page number using the *Move Page* button and selecting the new location.

A recorded session can be played out on the display in real time using the *Play LRD File* button. The arrow buttons enable skipping through laps. The **< >** keyboard shortcuts can also be used.

5 Display Customisation

These features can be altered without the use of a PC. However, LifeDash can be used in the same way under the 'Display' tab. Using LifeDash is often the quicker and easier method as this allows mouse use and simulation of scenarios. To keep any changes select **Save** from the settings page (not necessary on LifeDash).

5.1 Templates

The D5 Dash has several templates to choose from. These can then be customised with further options such as colour and scale changes. To select a template, on each page, select **Menu, Template Options, Change Template** and choose an option from the list with the **OK** key. Changing a template will also change the page name to the default for that page. Adding, removing or renaming pages must be done with the PC application.
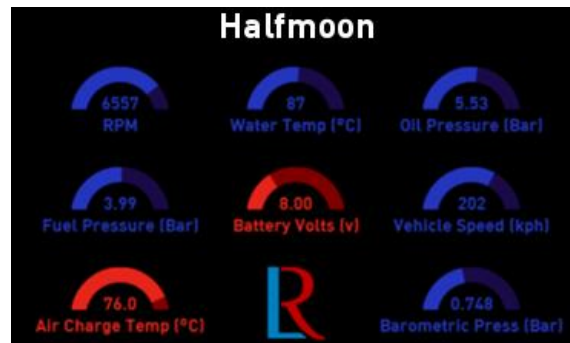
This page can show up to eight half-moon gauges that can display any numerical item.

The inputs page displays the status of all the dash inputs. It can be used for input diagnostics and fine tuning linearisation. **This page cannot be edited.**
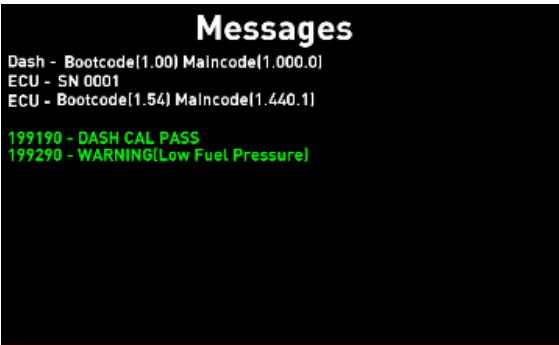
The message screen is used to display Dash and ECU information such as version and software levels, as well as any alarms that have been triggered. **This page cannot be edited.**
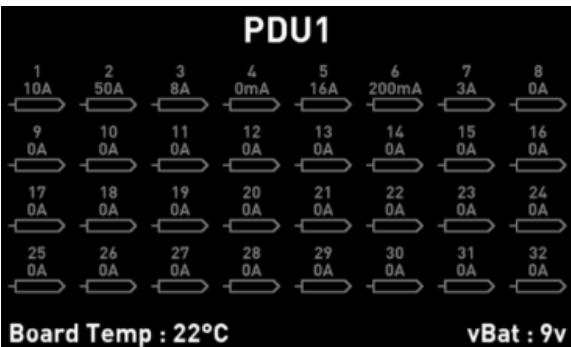
Intended for use with the Life Racing PDU32, these pages will give current ratings and status of all PDU outputs and will automatically work when PDU items are added. **This page cannot be edited.**
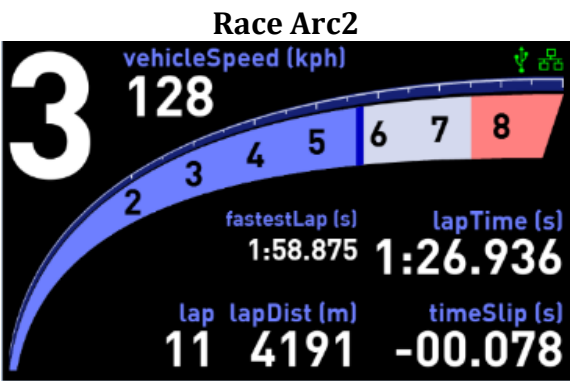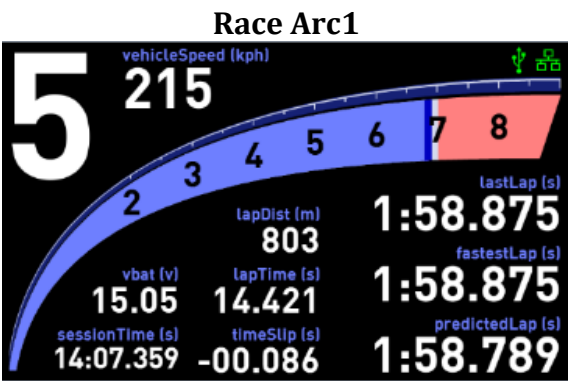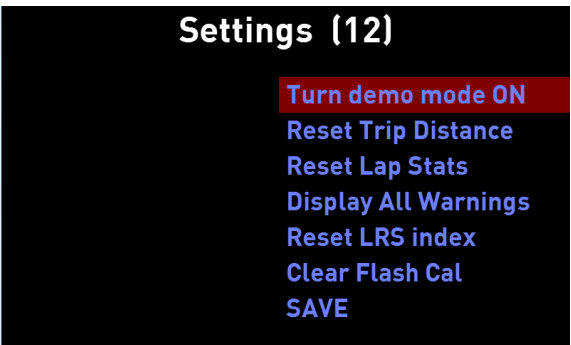
Race Arc1

Race Arc2

The Race Arc template uses a swept rev counter, a large gear indicator and several text displayers. The layout and number of text displayers differs from Race Arc1 and Race Arc2 depending on preference.
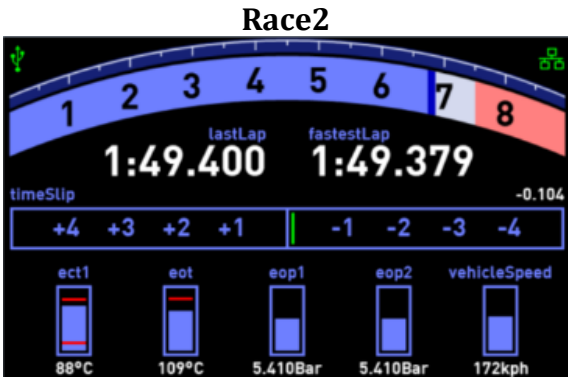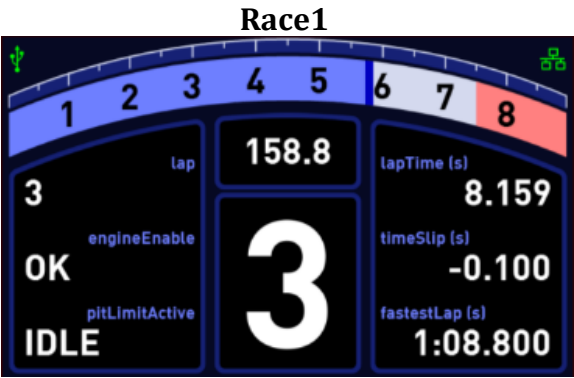
Race1

Race2

The Race views feature a curved rev counter. Race 1 has a large gear number and six customizable text displays. Race 2 features a time slip indicator and 5 bar gauges.

Road Arc

Road Arrow

The Road templates display the classic rev counter with gear and speed located in the centre. There are also 4 gauges around the outside that can be set to display any numerical item. Common items also have a corresponding symbol. Road Arc uses an arc rev counter and sweeping gauges. Road Arrow uses a needle rev counter and bar gauges. The road pages are the only pages that display tell-tales such as indicators and lights.

Settings (12)

Turn demo mode ON
Reset Trip Distance
Reset Lap Stats
Display All Warnings
Reset LRS index
Clear Flash Cal
SAVE

The settings page cannot be altered but gives some global options and is required in order to save changes. To see what options are available skip to Operation - Settings. **This page cannot be edited.**
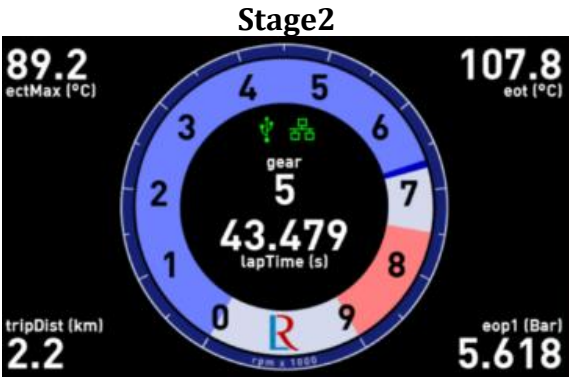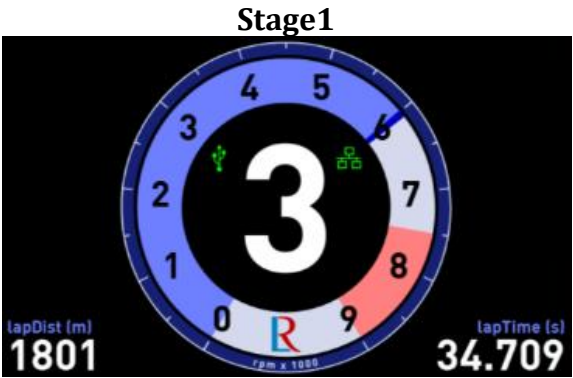
Stage1

Stage2

The Stage view is primarily for use in rally stages where a minimal display is often wanted. It displays the classic rev counter with a large gear number in the centre and optional text displays in each corner. Stage 2 has the same layout as stage 1 but with two monitoring items allowed in the centre.
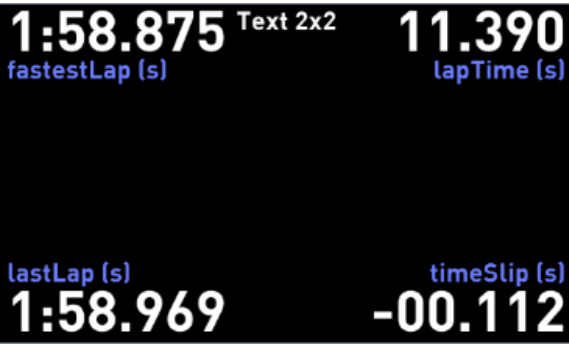

This view shows up to nine items as text depending on what grid layout you choose (1x7, 2x2, 2x4, 3x3). It can be used for any item but is most useful for those with text outputs. This can be useful for showing engine status and diagnostic items or lap times.

5.2 Dial Options

Pages that feature the round rev counter can have the appearance of the dial customised. To access these options select *Menu, Template Options, User Dial Options.*
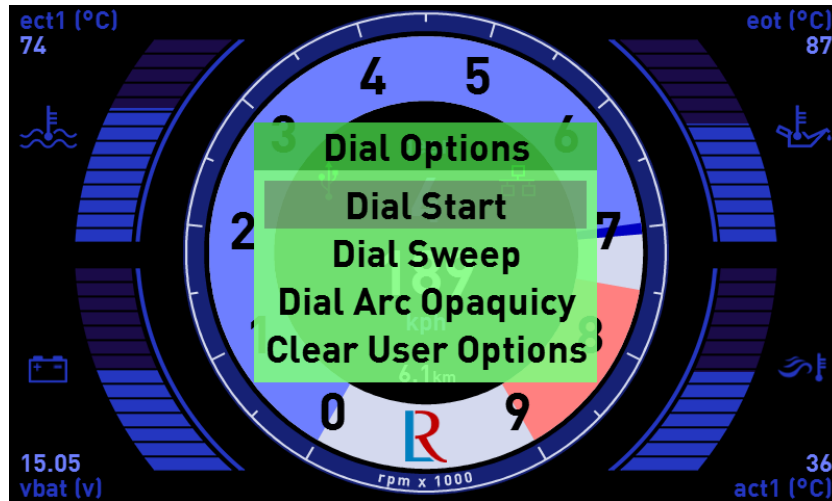
Dial Start selects the starting angle in degrees from the horizontal plane.
Dial Sweep selects the length of the gauge in degrees from the start location.
Dial Arc Opaquicy allows the opacity to be altered from 1 (almost transparent) to 8 (fully opaque).
Clear User Options will reset the dial to defaults.

5.3 Display Toggles

The toggle menu allows certain visual features on the main display templates to be turned on and off. To access these options select *Menu, Template Options, User Display Toggles.*
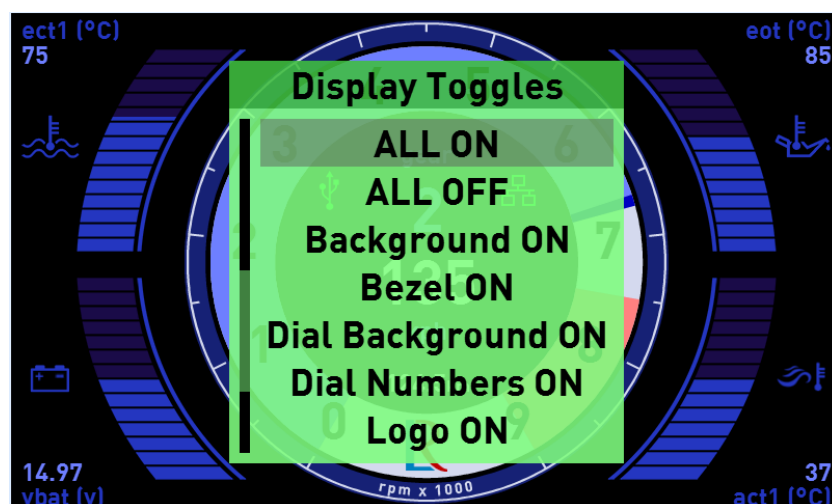
5.4 Colours

Fully customisable colours can be applied to each screen. An initial template colour scheme can be selected that changes global colours on every page, including the non-editable pages. Finer changes to individual features can be applied using the *Template Colour* tool. Individual gauge colour changes are done in [Edit Mode](#).

5.4.1 Colour scheme

To change colour scheme for all pages, select **Menu, Change Default Colour Scheme** and select from the list. To change the colour scheme for a single page, select **Template Options, Template Colour Scheme.**

Blue on black
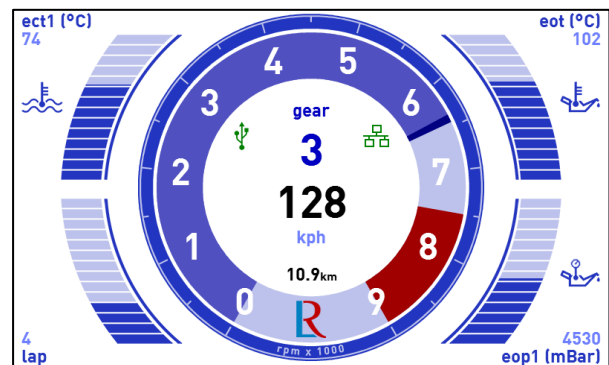
Blue on white


Green on black
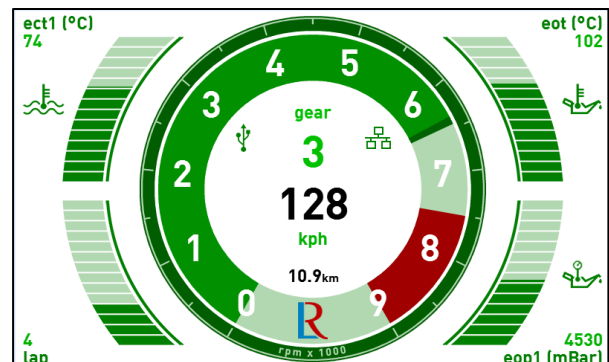
Green on white
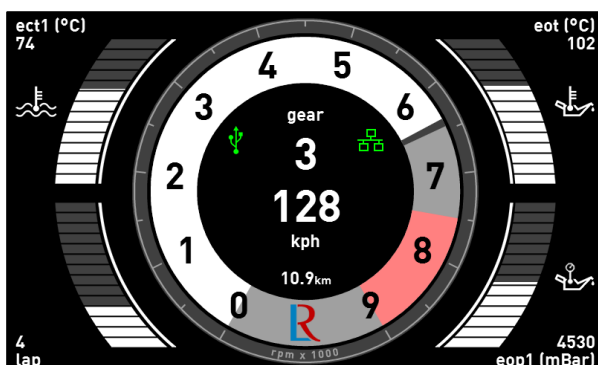
White on black
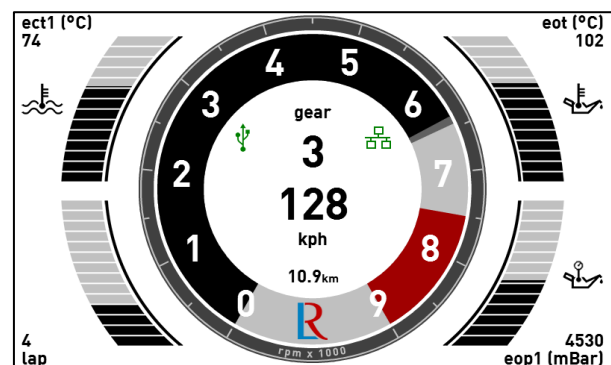
Black on white

5.4.2 Template Colours

Template feature colours can be altered by selecting **Menu, Template Options, User Template Colours.** More than 500 colours are available to choose from. These custom colours can be transferred to other pages and templates using the copy and paste options in the same menu. Selecting **Clear User Colours** will revert colours to the default of the active colour scheme.
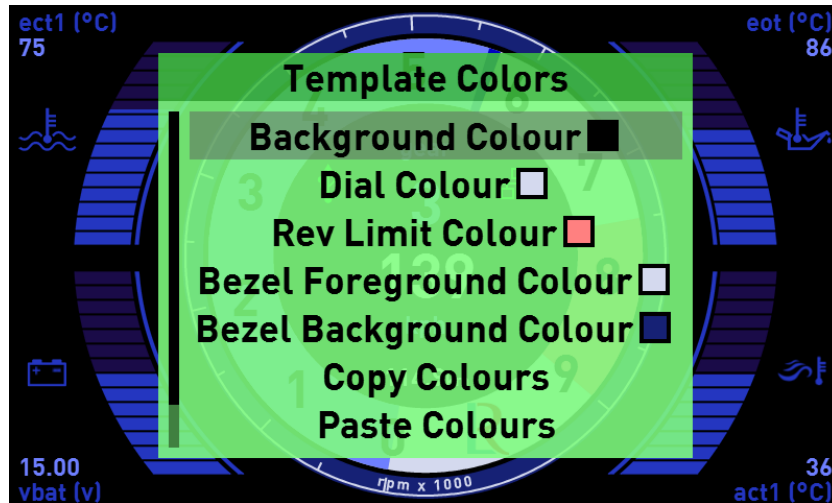

Note
Custom colours will be retained if a new colour scheme is selected but lost if a new page template is selected. Use copy and paste to reload your colours.
Background colour has no effect if custom background is used.

5.5 Background

An alternative to a coloured background is to display a custom image. This must first be loaded in the 'Backgrounds' tab of LifeDash before becoming available to use. Selecting **Menu, Background Image** will display the list of uploaded background images. Selecting the desired image will apply it to the current page only, giving the option of multiple backgrounds for different pages.
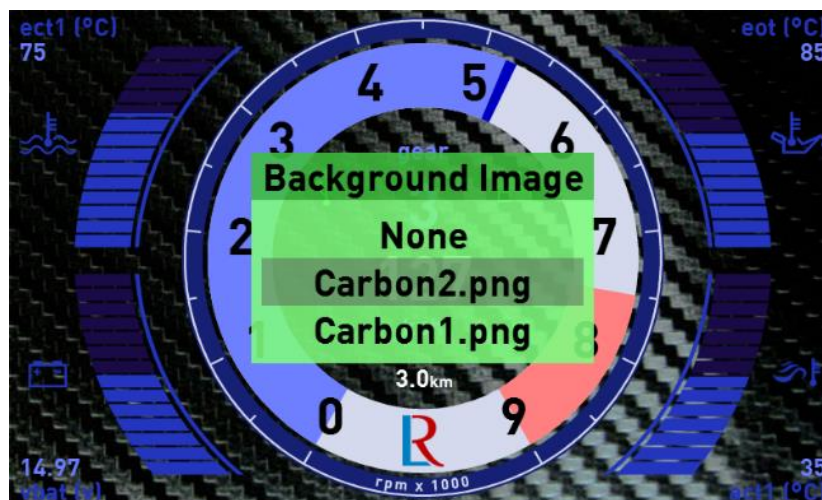
Back to Configuration - Backgrounds

5.6 Copy & Paste

Entire page formats can be copied over to another page using these tools found in the main menu. Select *Copy Page* when the desired page is open and *Paste Page* in the new location.

5.7 Edit mode

This mode allows individual display items to be customised including extreme and alarm values without the need for a PC. To enter edit mode select *Menu, Toggle Edit Mode.* A gauge should now appear yellow. Gauges can be cycled with the use of the *Up* and *Down* keys or the mouse. Press *OK* to select the highlighted gauge and open the Edit Mode Menu.


5.7.1 Set Gauge Item

To change what items are displayed, select the desired gauge and select *Set Gauge Item* from the menu. Select the device, then the item from the list. This list will be the same as the list set in the 'Items' tab.

Selecting *Clear* will remove the graphic or text completely on most gauges however they will remain visible while in edit mode.
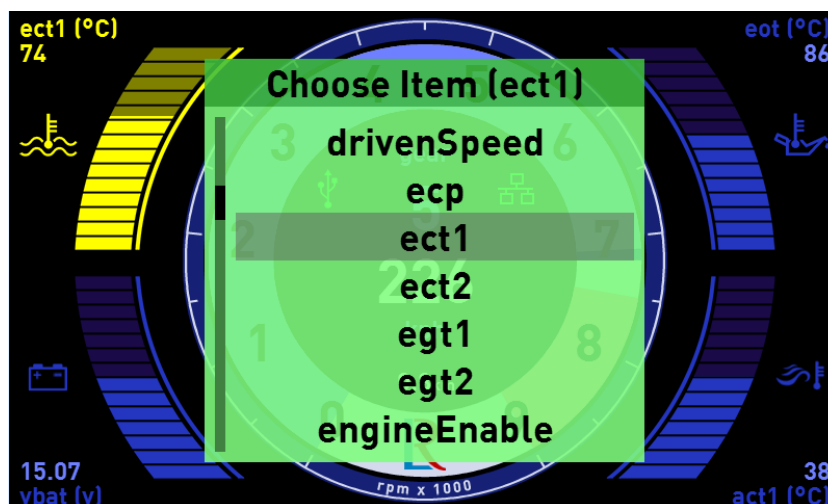
5.7.2 Item Text Options

These options allow individual text elements to be modified or removed completely. On text pages only, each element can be resized. The auto-reduce option will shrink text if it begins to overlap another item or the screen boundaries. This is active by default but is disabled when a forced value is used.
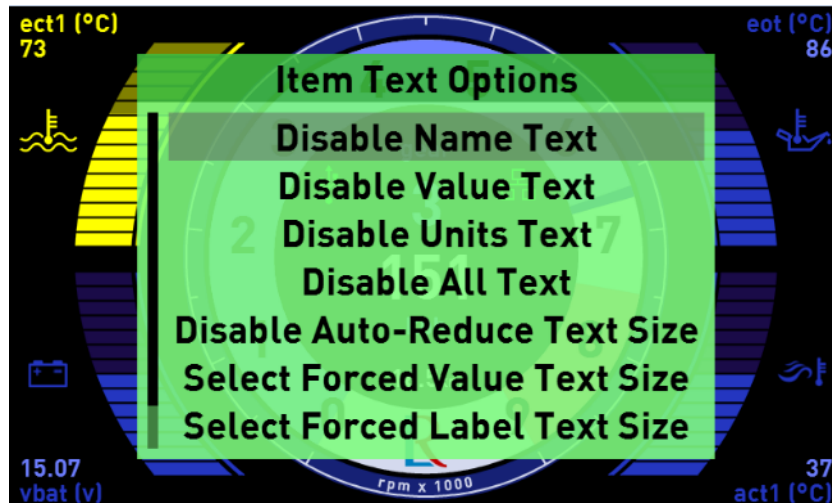

Also available is the option to display raw values rather than the converted engineering value. This can be used to diagnose faults and assist in correct CAN and item setup.
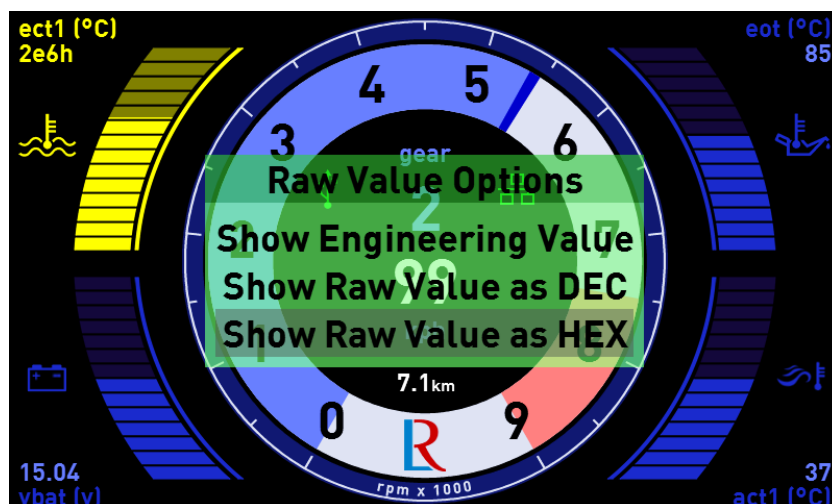
5.7.3 Item Switch Options

On the **1x7 text page only,** virtual switches can be created. This allows switch input via the dash screen and saves using physical pins. Valid items must first be created in the 'items' tab. These can then be set as one of the following switch types. The active type is marked with an asterisk (*).

Instantaneous Switch   Defaults to first enumeration value. Selecting switches to the second value. Returns to default when switch is released.

Latched Increment   Increase enumeration value with each key press.

Latched Decrement   Decrease enumeration value with each key press.
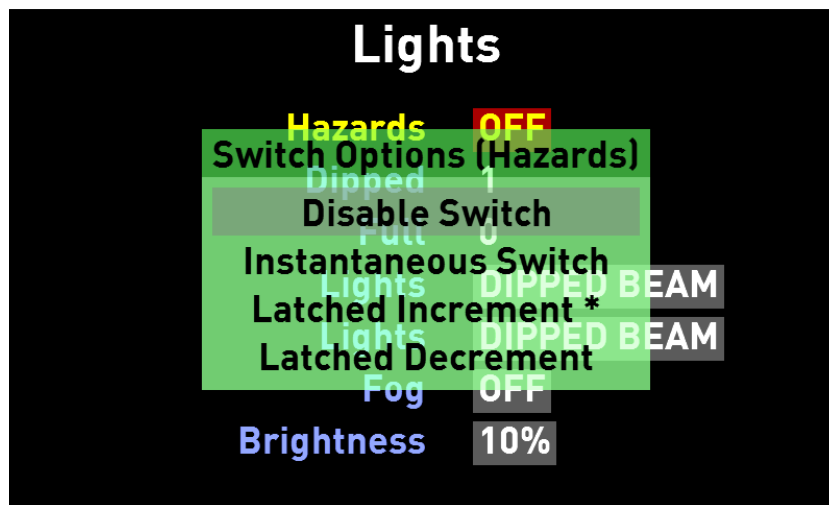
A selectable or switchable item will be distinguished by a surrounding box with the active item highlighted. Use the arrow keys to navigate.

5.7.4 Set Gauge Colours

Individual gauge colours can be changed using this tool. Clearing user colours will reset them to default according to the colour scheme. Custom colours can be copied to other gauges using the copy and paste options accordingly.
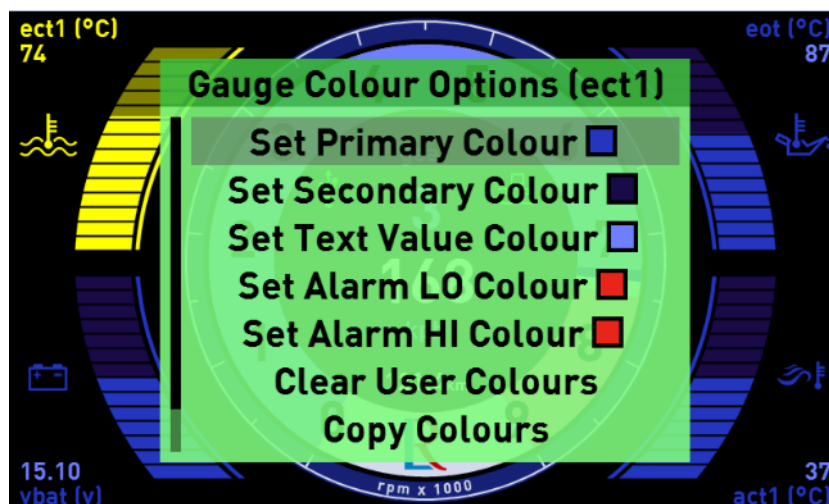
5.7.5 Set Gauge Scale

This allows the gauge minimum and maximum values to be set independent of the values set in the 'Items' tab, allowing different scaling across pages. Selecting *Clear User Scale* will reset these values to those set in the 'Items' tab. *Up* and *Down* make small changes whilst *Left* and *Right* make larger changes. Select *OK* when done. Values cannot exceed those given in the 'Items' tab.
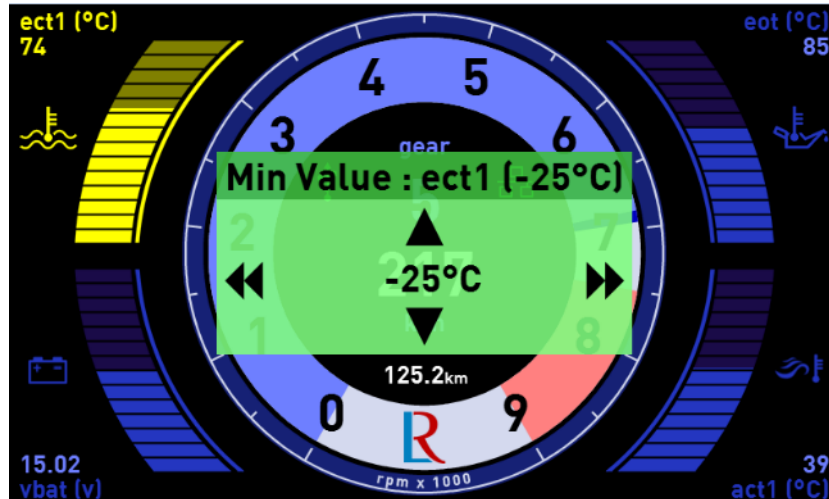
5.7.6 Set Item Alarms

This allows the alteration of item alarm values without the use of a PC. These changes are global for the selected item and cannot be different across pages. This is done in the same way as the gauge scale; *Up* and *Down* make small changes whilst *Left* and *Right* make larger changes. Select *OK* when done.
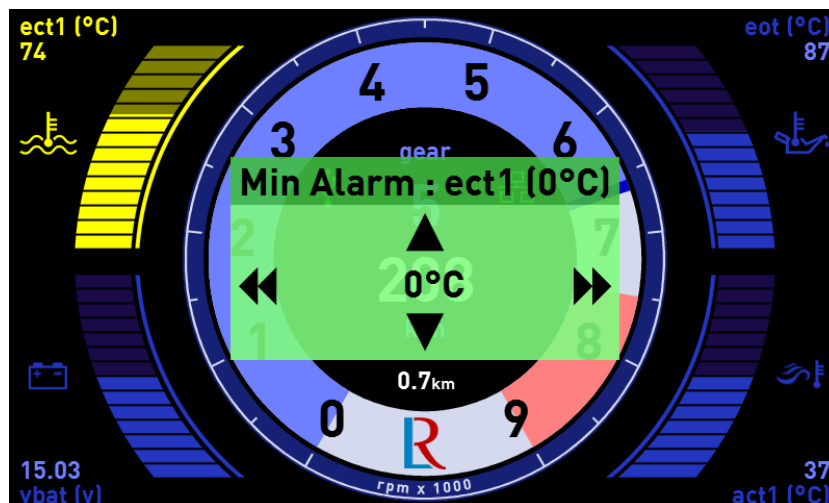
6 Operation

6.1 Navigation

Navigation requires [Input Switches](#). Functionality depends on what switches are installed.

Arrows   Navigate pages and lists
OK   Select. Dismiss warning/toggle virtual switch/select option
Menu   Open menu
Back   Close menu/list
Home   Return to display page 1 or top of list

The 'Drivers Menu' can be opened by holding the left or right switches. This gives quick access to settings without the need to change or obscure the page. Settings available include Reset Trip Distance, Reset Lap Stats and Save.
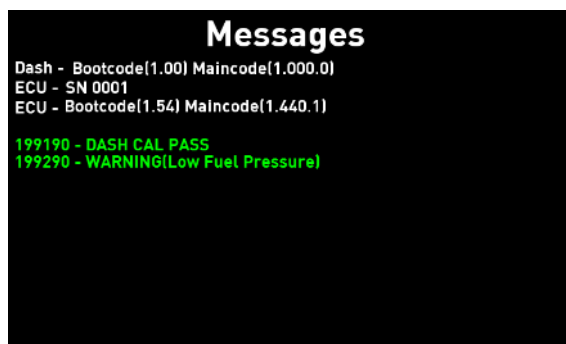

6.2 Alarms

Warnings are displayed on the screen in yellow and can be dismissed using the **OK** button. When a warning is active a yellow LED on the bottom of dash will light up. The LED will remain lit until off conditions are met. Alarms are displayed in red and cannot be dismissed. When an alarm is active a red LED will light up.
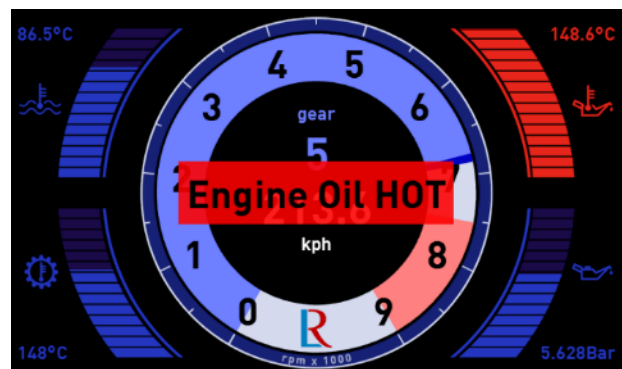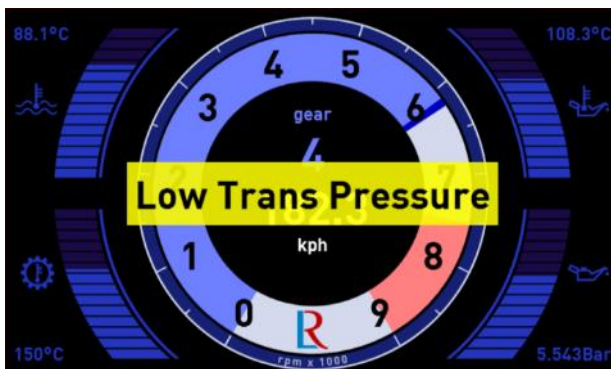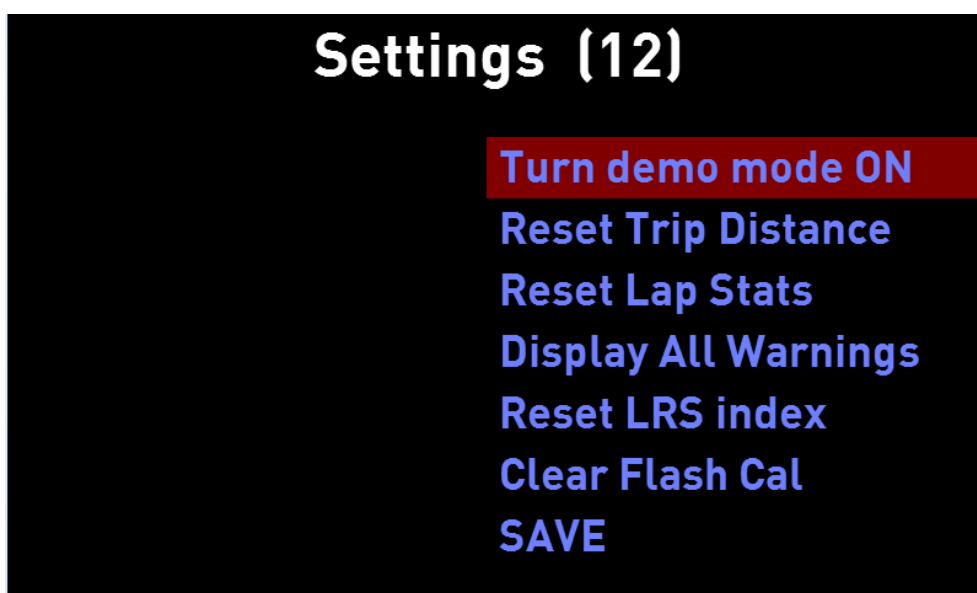
Triggered alarms and warnings are logged on the messages page. The number displayed is the number of milliseconds since power up at the point where the alarm was triggered.

6.3 Settings

The Settings page contains global options.

Toggle demo mode by selecting *Turn Demo Mode On/Off.*
Reset the trip Distance by selecting *Reset Trip Distance*.
Reset fastest lap by selecting *Reset Lap Stats*.
Unhide dismissed warnings by selecting *Display All Warnings.*
Reset the logging file index counter back to 0001 by selecting *Reset LRS index* (PRO Spec only).
Selecting *Clear Flash Cal* will delete everything in the dash's memory and reset it.
Any changes made can be saved through the settings page by selecting *SAVE* with the *OK* key.

Note
Selecting Clear Flash Cal or SAVE does not have any function in LifeDash.

7 PRO Spec

7.1 Data logging

With the PRO spec, data logging becomes available. This allows logging data from the ECU to be streamed and stored on a USB memory stick (ECU to dash Ethernet required), increasing logging capacity. Logging settings follow those set in LifeCfg.

When a compatible USB device is connected, a white USB icon should appear (black on white background). When streaming, this icon will turn green.
Symbol only shows on primary display pages such as road, race or stage.

Note
If the USB is green, the streaming needs to be stopped before unplugging the USB stick. To do this press and hold the *OK* or *DOWN* button for about a second. The USB icon will change to white indicating it's safe to remove. Failing to do this can corrupt logging files.

Data logging files are stored in .LRS format and are named with eight digits. The first four numbers match the connected ECU serial number. The remaining four numbers are an index number given by the dash. This number will update for every file saved, even on different memory sticks. The index can be reset in the settings page.

To download logged data from USB, insert the memory stick into a PC. Logged data files will need to be decoded using LifeData before viewing in LifeView. Select *decode Streamed data* to decode a single file or *decode Streamed data folder* to decode an array of files. Decoded files are automatically stored in the working directory as .LRD which can then be loaded in LifeView for analysis.

8 Document Revision History

2014-08-20 – MH V1.0 – Initial public release
2015-07-01 – MH V2.0 – New features added including custom CAN and new visual options
Section layout changes
Minor format changes
2015-10-01 – MH V2.1 – PRO Spec information updated
2015-12-23 – MH V2.2 – New features added: compare function & virtual switches
Added Custom page examples
2016-01-08 – MH V2.3 – New features added: LR CAN over Ethernet & raw value text option
2016-04-11 – MH V2.4 – Custom yellow and red LEDs
Switch input special items clarified
Input clipping on min/max item values
Background import updated
Change Page alarm
Item maths
2016-06-20 – MH V2.5 – Latching maths options added