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LifeDash
User Manual

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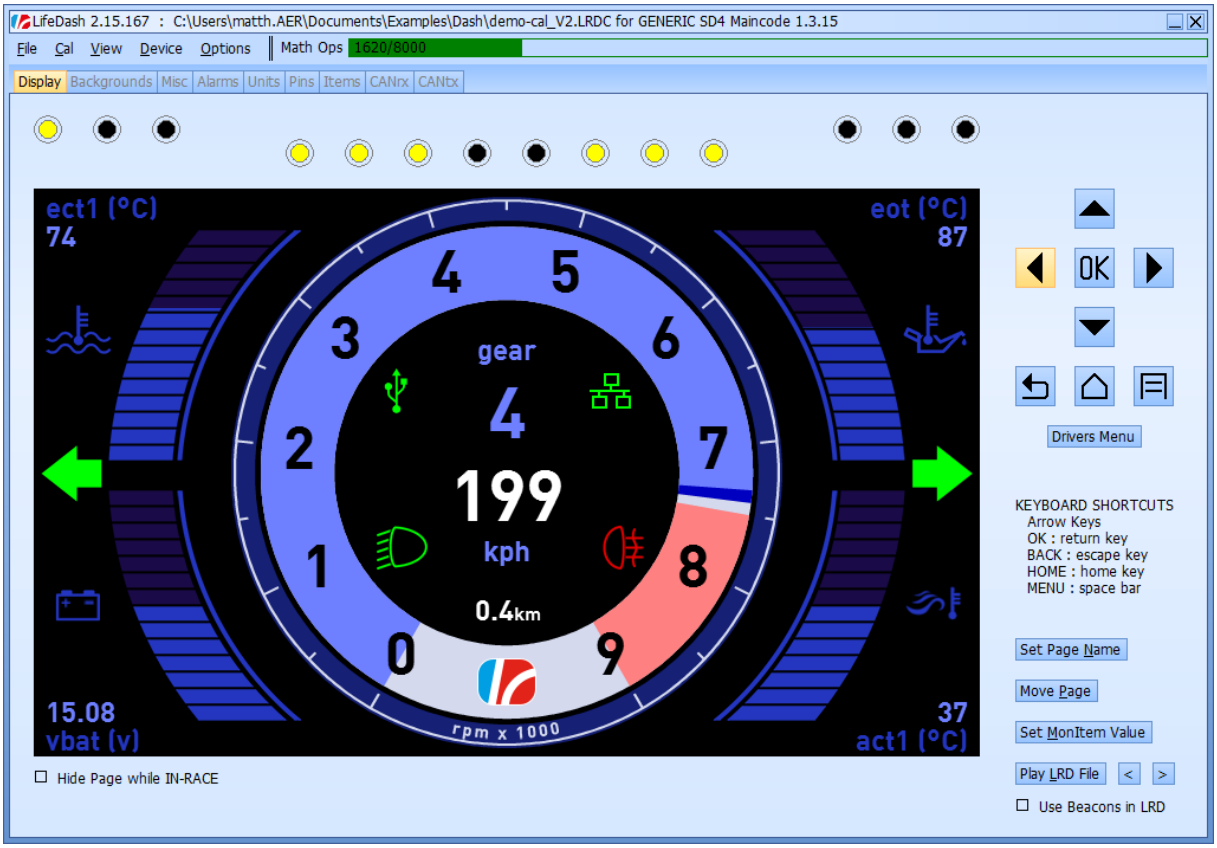
Contents

1 Introduction

LifeDash is used to configure any Life Racing display unit. It includes display customisation and flexible CAN configuration. LifeDash also features a display screen to simulate new designs and allows .LRD playback, allowing simulation of real race events from downloaded ECU data.



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

Menu Shortcuts

Life Racing applications are intended for quick operation without the use of a mouse for improved usability in the pit lane. All menu buttons can therefore be reached using keyboard shortcuts. Each option has an underlined letter, identifying its shortcut key or the shortcut displayed to the left. Dialogue boxes can be navigated with the arrow keys. The <Spacebar> can be used to select while <Enter> and <Esc> are used as OK and CANCEL respectively. In LifeDash, use of the *View* menu enables navigation between tabs with 2 keyboard presses rather than reaching for the mouse.

2 File & Device

2.1 New calibration

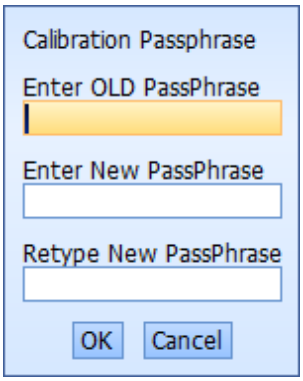
To create a new calibration, select ***File, New*** and select the appropriate device. This will create a calibration with several blank pages and the correct items for that device setup. LED positions will also change to reflect the chosen device.

2.2 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.

2.3 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.

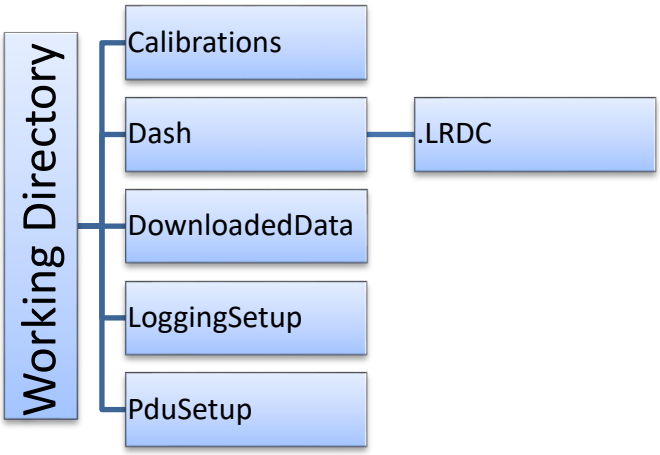


2.4 Save Calibration

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.***

2.5 Working Directory

The working directory is maintained across all Life Racing applications and can be edited in LifeCal, LifeCfg, LifeData, LifeView, Life Dash and PduSetup. To change the current working directory select *Working directory* under *File*. Use *CREATE* to create a new folder in the current location. Use *SELECT* to select the current location as the new working directory. If the location has not been used before, a .CFG file will be created. Selecting *Working Dir Behaviour* allows editing of the .CFG file. All .LRDC files are saved in the Dash folder with no further directories.

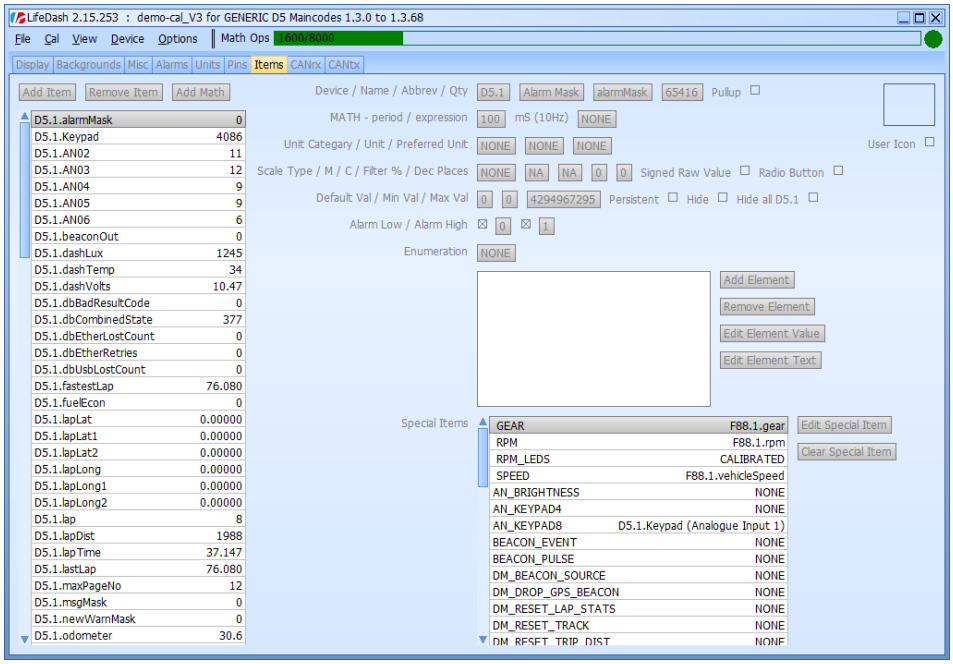


2.6 Compare Calibration

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.

2.7 Connect

Selecting *Device, Connect* will establish a live connection to a connected dash. This will load the calibration and display all values live in LifeDash. This includes all display gauges and tell-tails, alarm values, raw item values and raw CAN receive and transmit vales. A flashing green circle in the top right will indicate an active connection. Disconnecting will close the live link but the file will remain open.



Note

Connecting to a device with *Device, Connect* is used for monitoring only. No changes to the calibration can be made or programmed when in this state.

2.8 Device options

All items are categorised by their source device. These devices can be managed in the *Device* menu and allow the export and import of devices that will include all of the item and CAN receive settings associated with that device. This means if a common device is used across many dashes with different calibrations, once initially created, that device can be imported for quick setup time rather than starting from scratch. Devices can also be renamed and removed with the corresponding menu options. Note that device names cannot include spaces.

3 CAN

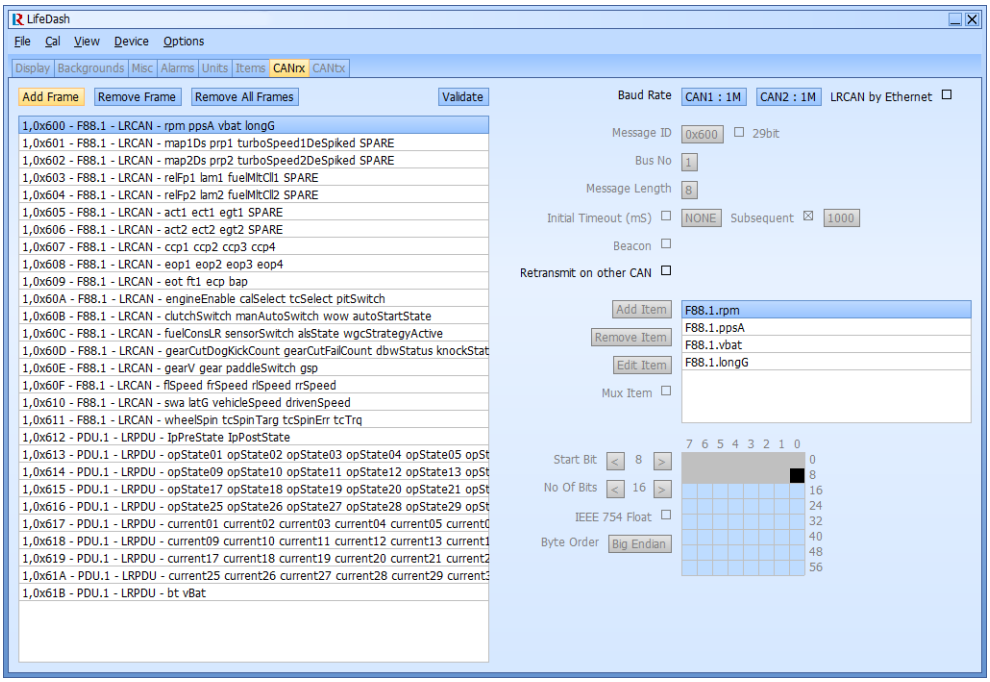
The dash communicates through CAN with other devices. CAN settings include quick setup for other Life Racing products and support for fully flexible Custom CAN.

3.1 Life Racing CAN Receive

Select ***Add Frame, LRcan from .LRC*** to extract the CAN information from a Life Racing 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.

Other LR datastreams can be automatically added in the same way including PDU, GPS and Keypad. The start frame may be required but then all settings are automatically completed and usable items added.

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.

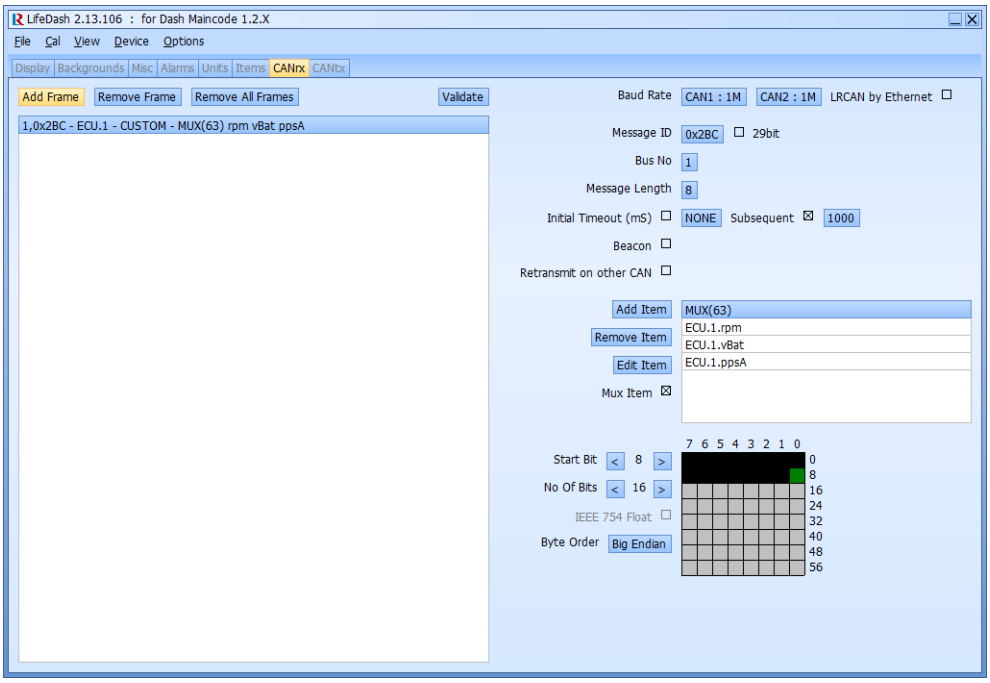


3.2 LRCAN by Ethernet

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.

3.3 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

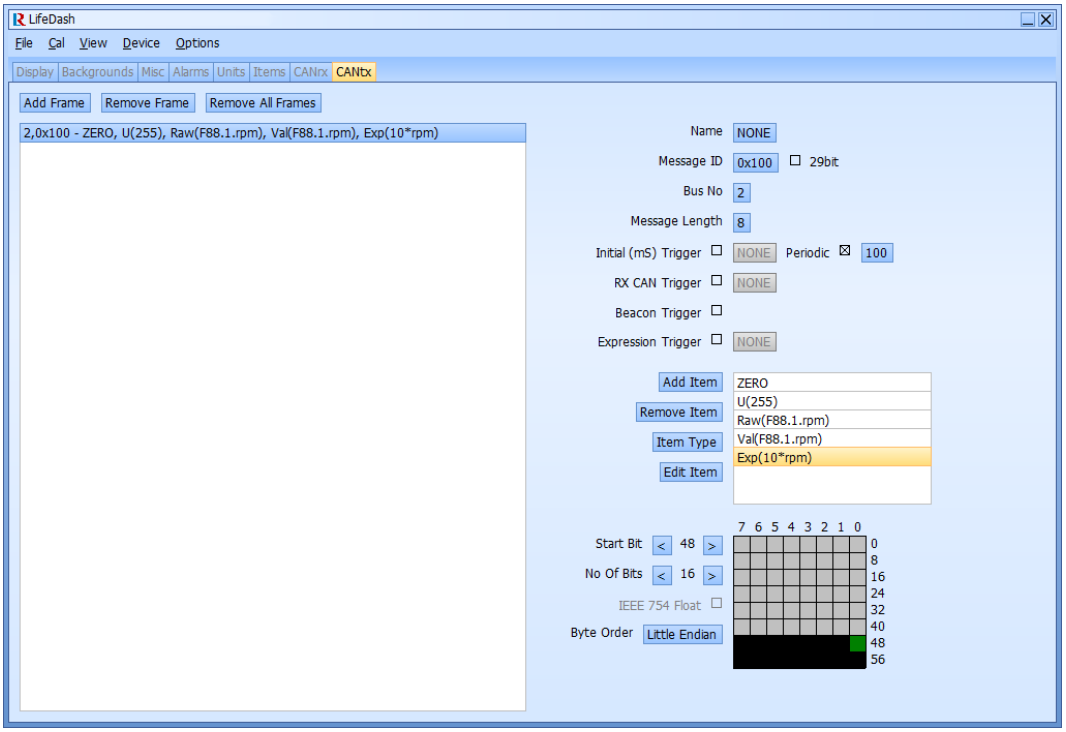
Add Item:	Add an item to the selected frame.
Remove Item:	Delete the selected item.
Edit Item:	Select associated item from the list (items must already exist in the 'Items' tab).
Mux Item:	Ticking this box makes the selected item an ID item. Assigning different ID values to frames allows them to share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

3.4 Custom CAN Transmit

CAN transmit 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
Disable:	With this option checked, the frame will be inactive and not send but can be re-enabled at any time.
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.

3.5 Other CAN 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.

Termination

On specific devices, CAN termination is software selectable. Check this box to enable the resistor.

Validate

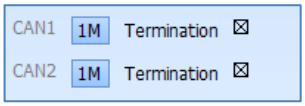
Pressing the ***Validate*** button will perform a check for any validation errors in the active CAN frames such as repeated IDs. A message will only be displayed if a conflict is found.

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.

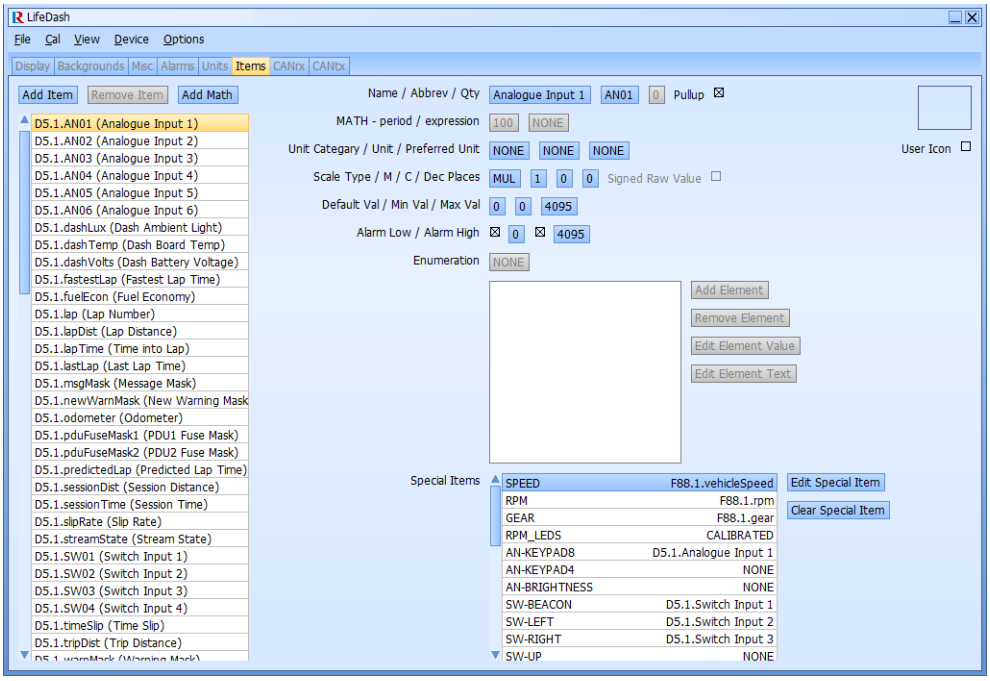
CAN Termination

SD4s, D8s and newer revisions of D5s include software selectable CAN termination. Each bus can be independently terminated by selecting the check box in either the CANtx or CANrx tab.



4 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 dash will 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.

4.1 Items tab

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 3kΩ pull up resistor on analogue inputs (if available).

Math

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

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.

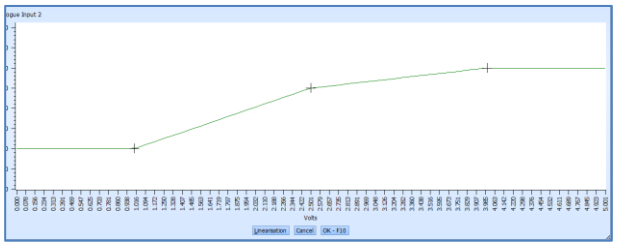
Scaling works in one of the following ways where X is the CAN value.

Mul	XM+C
Div	X/M+C
Inv	M/X+C

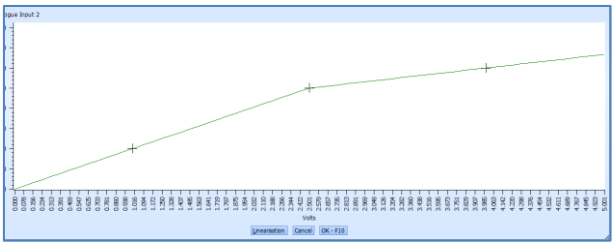
Linearise

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***. Voltage thresholds can be applied that will cause the input to adopt its default value when exceeded. These are displayed as red vertical lines.

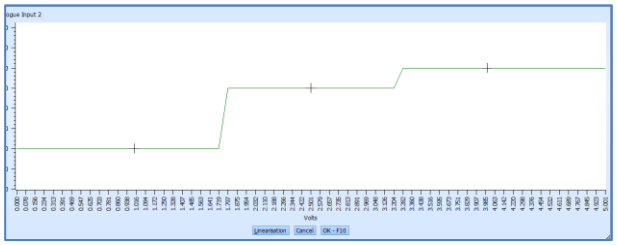
INTERPOLATE



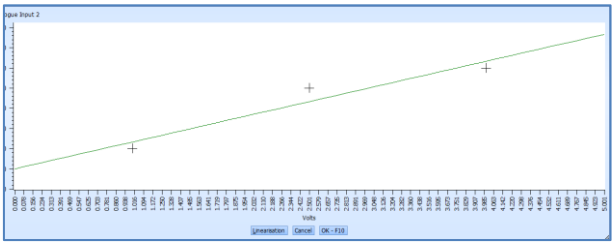
EXTRAPOLATE



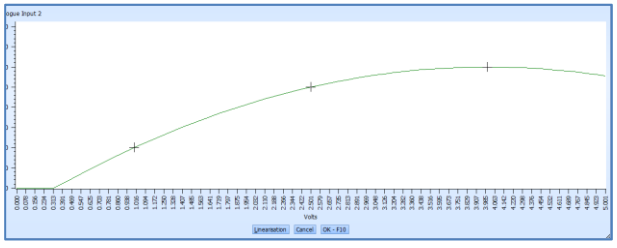
GEAR



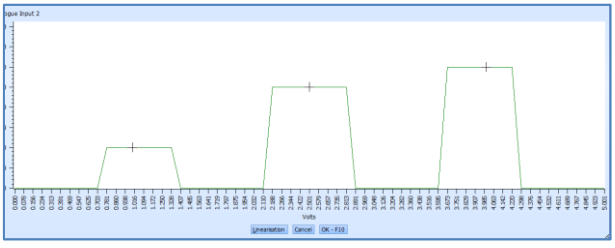
LINEFIT



CURVEFIT



KEYPAD



M: Operation value. Can be negative.
C: Constant. Can be negative.
Filter %: Apply a recursive filter between 0 and 100% to a physical input.
Dec Places: Number of decimal places to display.

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 (e.g. D5.1.X) are unaffected.
Gauge scales are defaulted to these values but can be altered in 'Edit Mode'.

Persistence

Checking the Persistent box will cause the last value of an item to be stored when the dash is switched off. When powered back on, the item will use this as its default value. Only enumerated items can be made persistent. This is most useful when using virtual switches that should be remembered.

Alarm Values

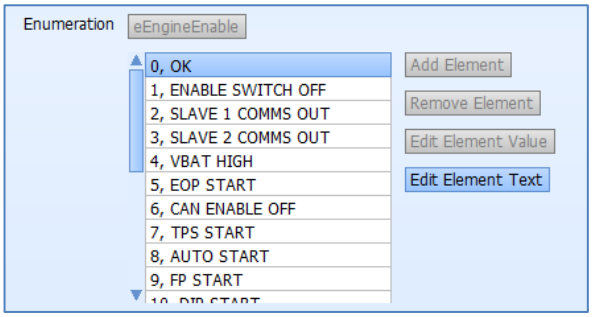
Alarm low: If enabled, when item value is lower than this, gauge changes colour.
Alarm high: If enabled, when item value is higher than this, gauge changes colour.

Note

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

Enumeration

Display text depending on numerical value. Assuming an item will always be an integer, whether it is a raw received number, a maths channel or a linearised input, each number can be given a text value that can be displayed in its place.

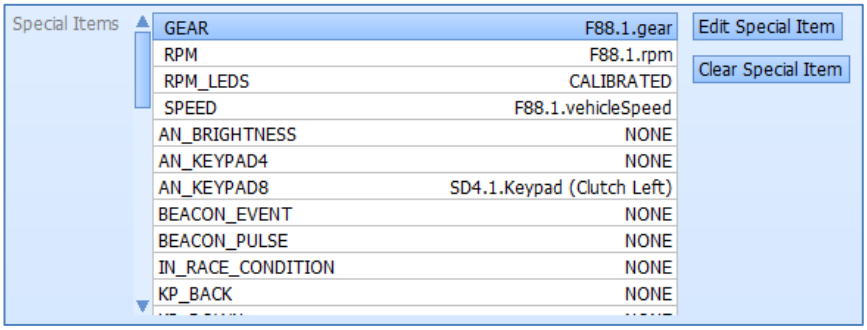


User Icon

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.

4.2 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.



4.2.1 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.

4.2.2 Input Switches

Switch inputs can be physical or received over CAN. For physical inputs, 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.

4.2.3 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, 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.

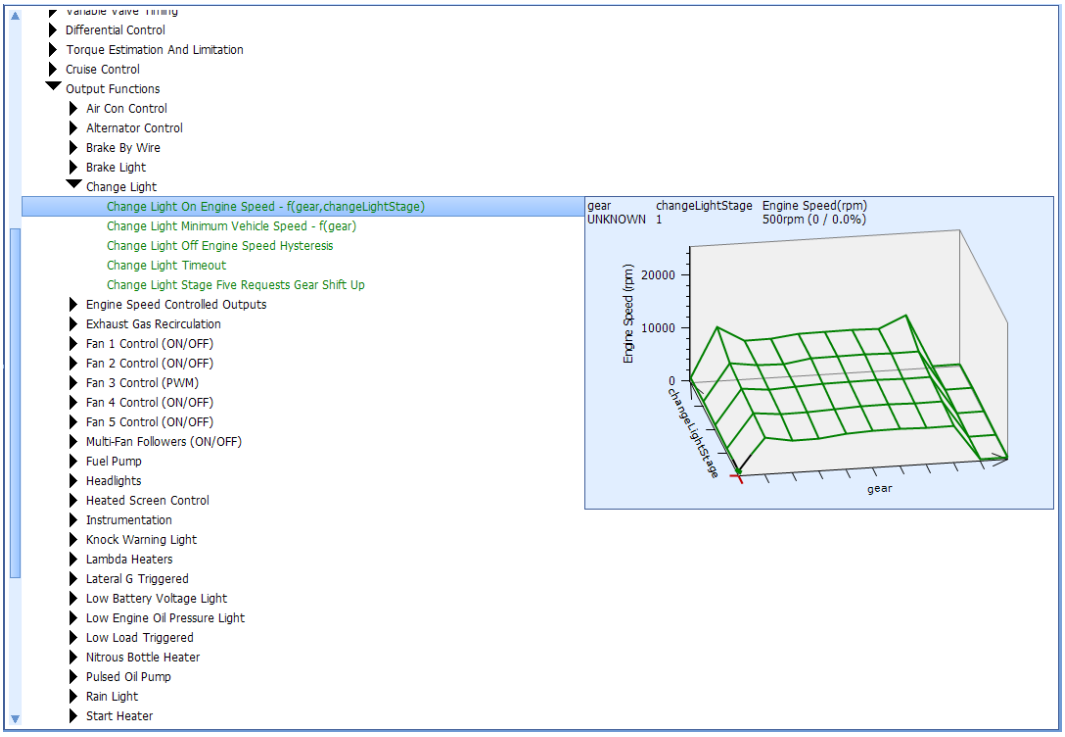
To use CAN or a math item, LUX_BRIGHTNESS must be defined in special items. A CAN message should be 16 bits long and be scaled by multiplying by 2 and adding -1. The values obtained correspond to the lux figures in the 'Misc' tab and use the same linearisation curves. Sending a zero will set the brightness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

4.2.4 Shift lights

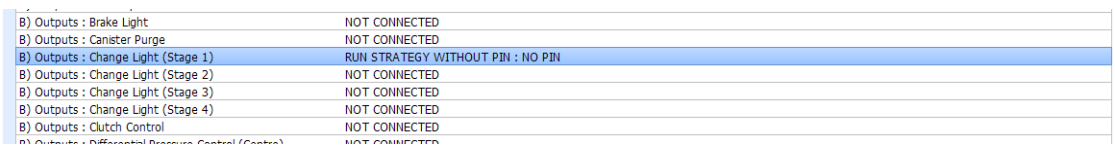
Shift light behaviour can be controlled by either the ECU via CAN or the Dash. Dash control is simpler and can be changed without a PC but ECU control has additional options.

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.



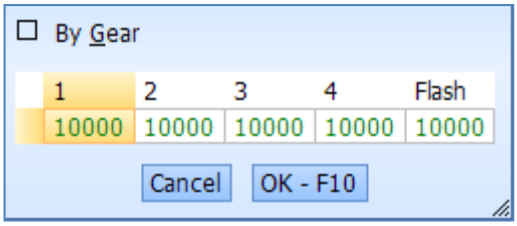
In *On Engine Speed – f(gear, ChangeLightStage)* each gear can have its shift light points independently assigned.
Change light stages 1-4 will progressively light the LED's from the outside in when active.
Stage 5 will cause the shift lights to flash. Stage 5 can alternatively be assigned to request 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. Choose ***No*** 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.

These values can also be changed in the settings page of the dash without the need for a PC or in the "Display" tab.

4.2.5 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 or maths beacon, define the BEACON_EVENT or BEACON_PULSE special item. BEACON_EVENT is active at any non-zero value received whereas BEACON_PULSE is internally validated.
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.

4.2.6 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 TELLTALE_LEFT/RIGHT_IND or a solid item to TELLTALE_FLASH_LEFT/RIGHT_IND.

4.2.7 GPS and Acceleration

GPS and Acceleration terms are used to calculate GPS beacons so must be defined for any of these built in functions to work.

4.2.8 Drivers Menu

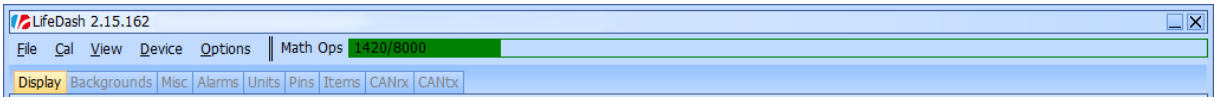
The DM_ special items can be used to operate each function in the drivers menu from a dedicated input or maths function.

4.3 Maths

Math expressions can vary in complexity from simple multiplications to multidimensional lookup tables. Care must be taken to correctly write expressions to avoid errors, particularly as they become more complicated. Expressions can consist of several lines and several functions. A new line will continue from the previous line. To mark the end of a particular function, use a semi-colon (;). The final function does not require this as this will be taken as the final value.
Any text following a double forward slash (//) is considered a comment and is not used in the expression. This is required for each line of comment. e.g.

//maths channel for calculating brake balance
*bpf/(bpf+bpr)*100 //percentage*

Note that the calibration has a limited number of mathematical operations it will allow before being “full”. How much of this allocation is used is always displayed at the top of the LifeDash window. These operations include CAN and alarm functions as well as specific math items.



4.3.1 Operators

Several shorthand standard operators can be used within expressions and include the following:

(	Open Bracket	*	Multiply	&&	Logical AND	=	Assignment
)	Close Bracket	/	Divide	||	Logical OR	*=	Multiplication assignment
{	Open Block	%	Modulus (remainder)	!	Logical NOT	/=	Division assignment
}	Close Block	+	Add	&	Bitwise AND	%=	Modulus assignment
,	Comma	-	Subtract	|	Bitwise OR	+=	Addition assignment
“”	String	<	Less than	^	Bitwise XOR	-=	Subtraction assignment
?	Then	<=	Less than or equal to	~	Bitwise NOT	&=	Bitwise AND assignment
:	Else	>	More than	<<	Bitwise Left Shift	|=	Bitwise OR assignment
pi	π, 3.14159265…	>=	More than or equal to	>>	Bitwise Right Shift	^=	Bitwise XOR assignment
		==	Equal to			<<=	Bitwise Left Shift assignment
		!=	Not equal to			>>=	Bitwise Right Shift assignment

&& can also be written as ‘and’.
|| can also be written as ‘or’.

4.3.2 Functions

Var("name", value)
Declare a new variable and initial constant value.

TextVal(mon-item-enum, show-name)
Intended for alarms, this will allow an alarms to display the text value of an enumerated item rather than set text.
e.g. WARNING(TextVal(engineEnable,0), engineEnable>1, engineEnable<=1)

RawVal(mon-item)
Use the unconverted, raw input value from a monitoring item. This is its value as sent on CAN without being converted into engineering units.

Duration(condition)
The 'Duration' function counts how long a condition is true for in milli-seconds (ms).
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

TextVal(mon-item-enum, show-name)
The 'Text Val' function returns the current value of the monitoring item in full text or partial text. The show-name parameter is expected to be 1 or 0 (true or false). This function can be used to display useful messages setup in the 'Alarms' tab.
e.g. TextVal(calSelect,0) might return "CAL02"
TextVal(calSelect,1) might return "calSelect : CAL02"

Previous(expression)
The 'Previous' function can be used for detecting a change to an item value.
e.g. tcSelect!=Previous(tcSelect)

Validate(condition, milli-seconds)
The 'Validate' function will return a 1 or 0 (true or false) depending on the condition results but will only change when this condition has been met for the time stated. This differs from the 'Duration' function as it validates in both directions, also requiring a false condition for the specified time period.
e.g. Validate(AN01<500,50)

ToggleLatch(condition, off-value, on-value)
The 'ToggleLatch' function will alternate between two values every time a condition is met.

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

IncLatch(condition, default-value, min-value, max-value, wrap-bool)
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.
e.g. IncLatch(Validate(AN01<500,50),5,1,10,0)

DecLatch(condition, default-value, min-value, max-value, wrap-bool)
The 'DecLatch' function will decrease by one each time the condition is met.

BiLatch(dec-condition, inc-condition, default-value, min-value, max-value, wrap-bool)
The BiLatch combines the incrementing and decrementing latch into a single function with independent inc and dec conditions.

Filter(expression, 0.0..1.0)
The 'Filter' function applies a standard recursive filter to the first parameter. The second parameter defines the strength of the filter. A filter constant of near zero will provide little filtering and a value near 1.0 will provide heavy filtering.

RawVal(mon-item)
This will return the raw value from the data stream that the mon item is set from. The raw value being that before any scaling is applied.

BitTest(integer, bit)
This function will convert its first parameter to an integer and then perform a bit test on the specified bit. This is equivalent to (integer&(1<<bit))!=0

Floor(expression)
This will round down the value of the expression to an integer; eg Floor(3.4) will return 3. A bit of care need to be taken when using this function with a negative number as the number when rounded down will be more negative eg Floor(-3.4) will return -4.

Ceil(expression)
This function round up rather than down; eg Ceil(3.4) will return 4. Again care need to be taken when using with a negative number as Ceil(-3.4) will return -3.

Hysteresis(on-condition, off-condition)
This function provides on/off with hysteresis functionality. It uses the same algorithm as used in the ALARM and WARNING functions used on the alarms tab; eg Hysteresis(eop1>3000, eop1<2800) returns true when eop1 initially goes above 3000 but will not go false until eop1 goes below 2800.

min(value1, value2, ...)
Return the lowest value from given list of items or numbers.

max(value1, value2, ...)
Return the highest value from a given list of items or numbers.

Abs(x)
Returns the absolute value (magnitude) of x.

if(Condition, then, [else])
Classic if statement. If condition is true, complete “then” statement. If condition is not true, complete “else” statement. The else statement is not required if no action is to be performed when the condition is false.

UnitScale(mon-item, unit, multiplier)
Intended for easy CANtx scaling, this function will allow the base unit of an item to change without affecting the transmission scaling. The unit parameter follows the same naming as the ‘units’ tab. Enclosing the name in “” allows for spaces.

PWM(frequency, duty)
The D8’s first two outputs may have a configurable PWM output set by this function where the first parameter is the frequency in Hz and the second is the duty between 0 and 100%. Both of these parameters may themselves be more complicated functions.

4.3.3 Beacon Math Functions

Beacon inputs are used to calculate various built in mon items like laptime, predictedLapTime and timeSlip. A new built in monItem beaconOut has been introduced with these new functions. Most of the time this is ZERO, when a beacon event occurs this is pulsed for 50ms to a value of ONE. This item can be used in a CAN message to inform another device of a beacon event. Each of the new math beacon functions take GPS angular parameters. The Latitude and Longitude special items must be set for these functions to work. Also you must use the same units as these special channels are set to e.g. degrees

BeaconPos(beacon-lat, beacon-long, tolerance)
This is the simplest and least accurate. All that is required is the position of the beacon and a tolerance parameter in the same units. As a guide 1 degree is about 111km, so for a tolerance of 10m you will need a tolerance parameter of about 0.00009 degrees.

BeaconLine1(beacon-lat1, beacon-long1, beacon-lat2, beacon-long2)
BeaconLine2(beacon-lat1, beacon-long1, beacon-lat2, beacon-long2)
Both of the BeaconLine functions are considerably more accurate than BeaconPos. These 2 functions calculate the beacon time based on when the GPS coordinates cross a line segments defined by the 4 parameters in each function. The line segment needs to be generous enough to cross a variety of racing lines without going anywhere near other parts of the track. Care has to be taken where the 2 parts of the track are running near to where the beacon is.

What is the difference between BeaconLine1 and BeaconLine2?
BeaconLine1 is a predictive function, it estimates if the vehicle will cross the line segment before the next time it is evaluated. Most of the time it will return ZERO – no

beacon, a non-zero return value indicates an estimated time in the future plus one millisecond when the beacon event is expected to occur.

BeaconLine2 just looks at what has already happened, has the vehicle just crossed the line segment? When a beacon occurs BeaconLine2 will return the number of milli seconds plus one in the past that the beacon was crossed.

The advantage of BeaconLine1 is that any beacon event to the outside world is set much more precisely. By the time BeaconLine2 detects a beacon, that event may be up to 100ms in the past if run at 10Hz. With BeaconLine1 a CAN message be sent on a beacon trigger with a great deal more precision than beacon events generated by any of the other beacon math functions.

To transmit the beacon value on CAN, use the built in BeaconOut item which will automatically be associated to any beacon maths item (this allows multiple beacon positions to be stored for multiple circuits).

4.3.4 Beacon Database

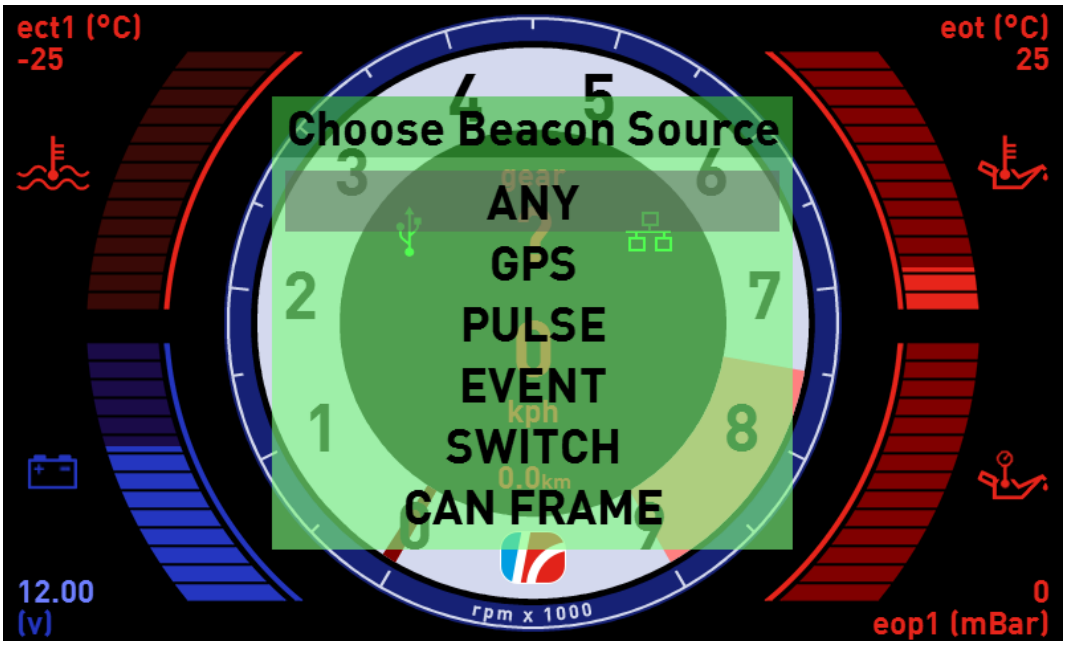
From dash main code 1.3.32, every dash will have a built in database of major circuit beacon locations. This is constantly being updated to include more circuits. This database can be used in conjunction with the beacon maths function to automatically detect the circuit and generate lap times. If more than one circuit or beacon location is available, then the options are given on screen and can be selected. This location will be remembered until another option is available. If this needs to change, the beacon can be reset either in the settings menu or the driver menu.
To use the beacon database, a maths channel must be created using the same beacon maths as a manual position but using the LapLat and LapLong items which refer to the database.

BeaconLine1(lapLat1,lapLong1,lapLat2,lapLong2)

If a circuit does not exist in the database, a manual beacon location can be “dropped” from the drivers menu or from an input assigned to the DM_DROP_GPS_BEACON special item.

4.3.5 Beacon Source

It may be desirable to use a physical beacon in most instances and using GPS only if one is not available. In this instance or in any situation where multiple beacon inputs are available, a specific source may be defined from the drivers menu, including ANY which will trigger the beacon from the first valid signal and mask to avoid multiple triggers according to the mask time in the 'misc' tab.
The source is stored through power cycles and displayed when the dash is first booted.

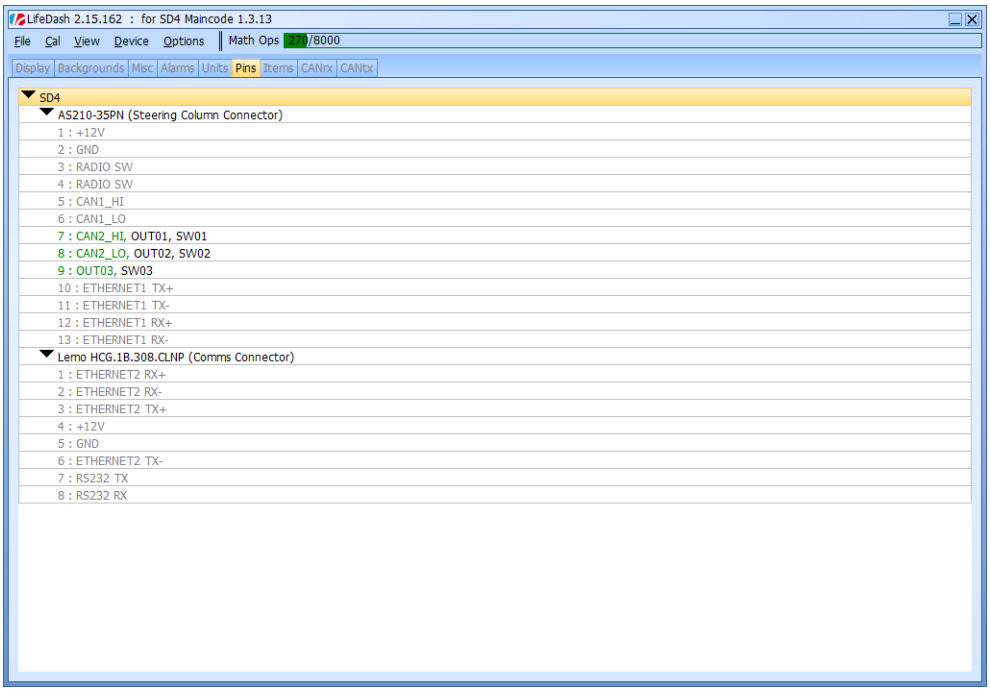


4.4 Virtual Switches

Virtual switches can only be implemented onto the 1x7 or 1x9 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 Display or LR ECU) with enumerated values.

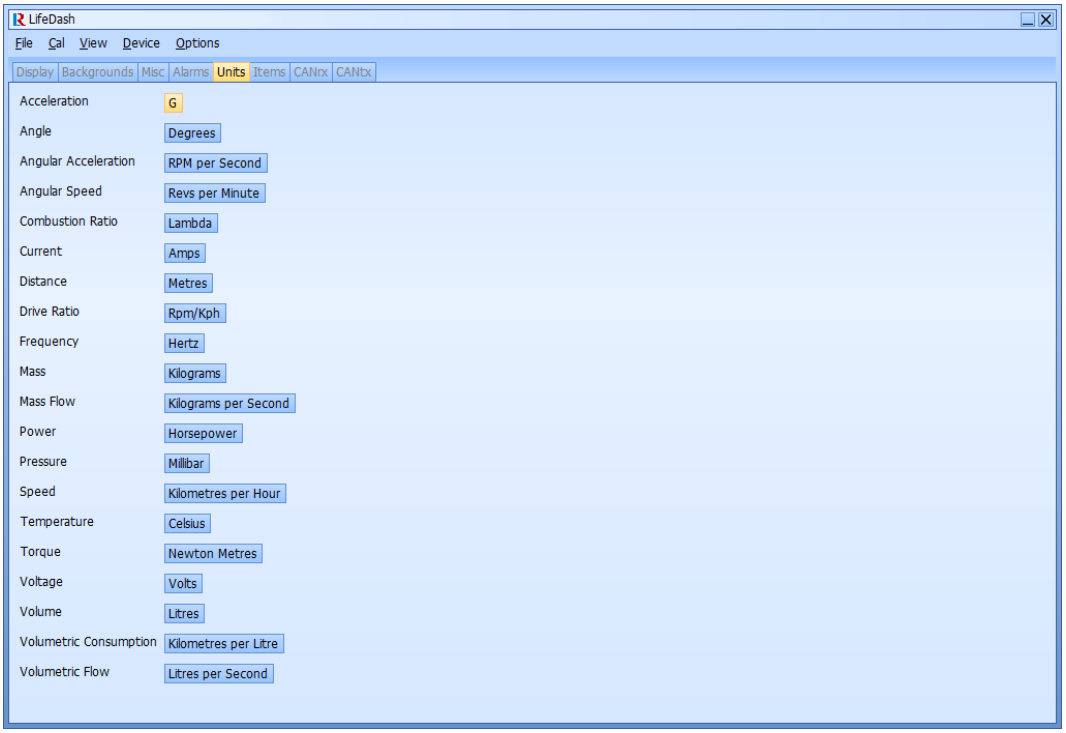
4.5 Pins

The "Pins" tab lists the display connector(s) pinout information. This tab can be used simply as a reference or to change pin shared functions. The active function is displayed in green. To change this, double click or use the <ENTER> key to bring up the available assignments. Fixed pins are greyed out.



4.6 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.
Speed units can be uniquely changed from the drivers menu.



Speed units may be changed from the drivers menu and affect the display value only so any maths functions are unaffected.

5 Display Customisation

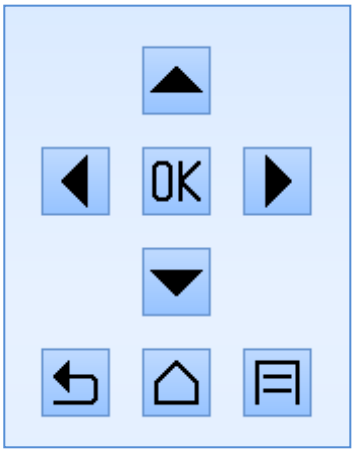
These features can be altered without the use of a PC. However, LifeDash can be used in the same way under the 'Display' tab. Using LifeDash is often the quicker and easier method as this allows mouse use and simulation of scenarios. To keep any changes select ***Save*** from the settings page (not necessary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

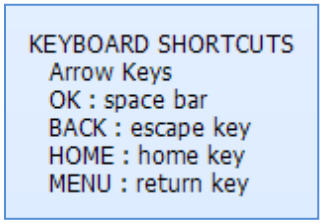
5.1 Display tab

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.

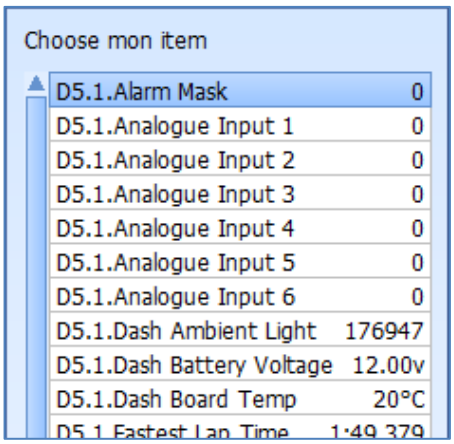
Keyboard shortcuts enable fast navigation without a mouse. The Home and Menu shortcuts can be reversed for your preference by selecting ***Options, Swap MENU/OK keys.***





The drivers menu can be accessed by the driver by holding either the left or right arrow for more than 1 second. LifeDash has a dedicated button to simulate this. The drivers menu gives access to quick options including lap/distance reset, gps beacon options and "Save" to store new lap times.

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.



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.

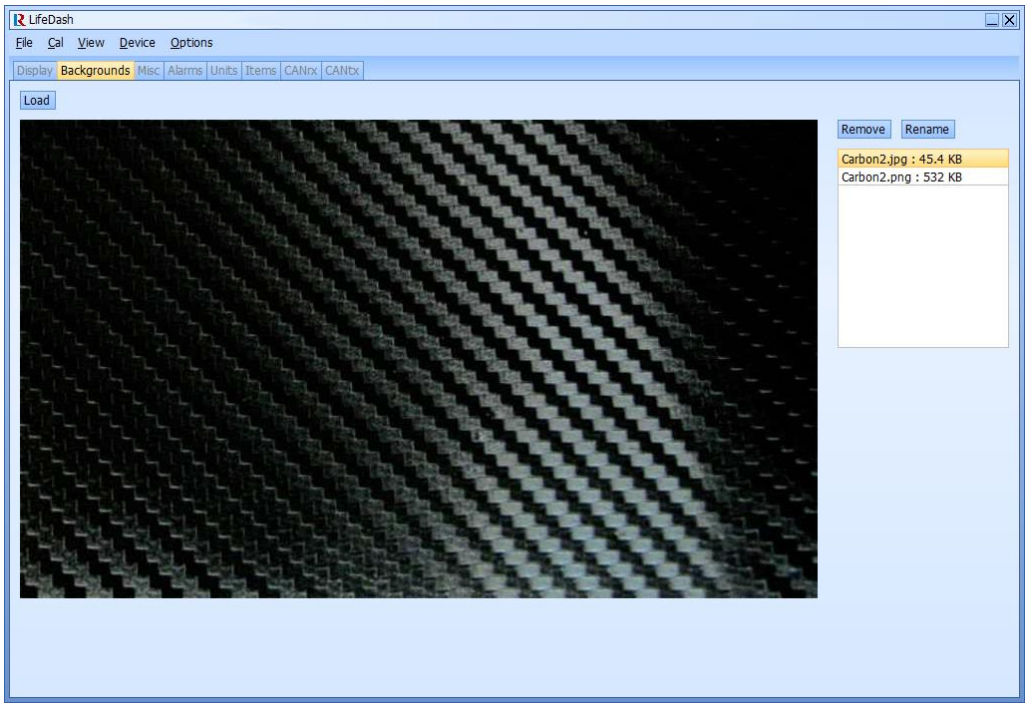
The current page can be moved to a different page number using the ***Move Page*** button and selecting the new location.

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.

Hide Page While In-Race allows certain pages to not be accessible during racing. This could be to hide a settings page or a warm up page so the driver can navigate quicker or to hide specific pages that are only used in ALARM conditions so should not normally be reached. The In-Race Special item must be defined for this feature.

5.2 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.



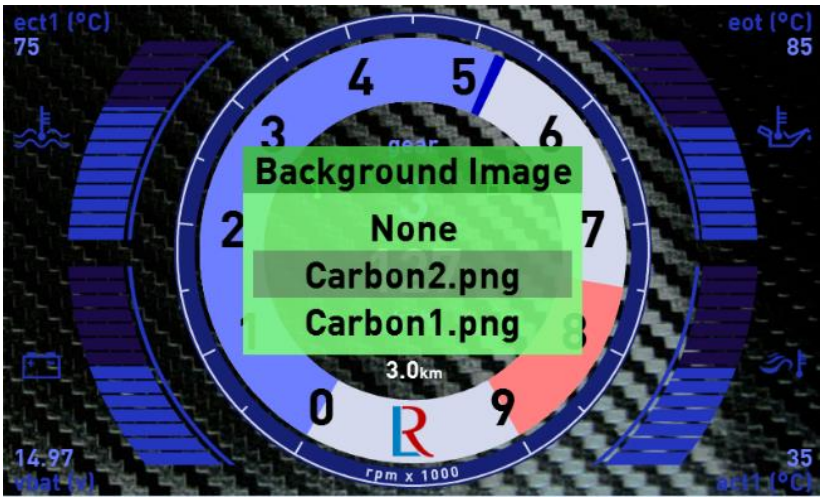
Backgrounds can also be used to display custom layout features, gauge icons or logos.

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.

5.1 Background

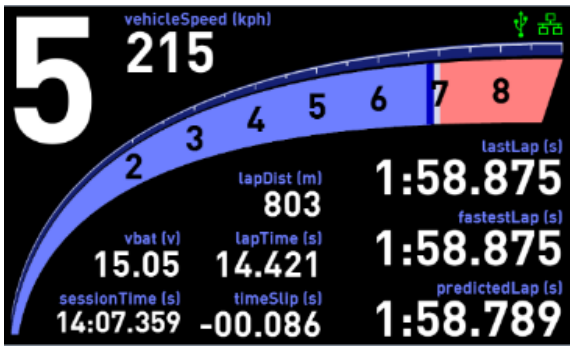
An alternative to a coloured background is to display a custom image. This must first be loaded in the 'Backgrounds' tab of LifeDash before becoming available to use. Selecting *Menu, Background Image* will display the list of uploaded background images. Selecting the desired image will apply it to the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



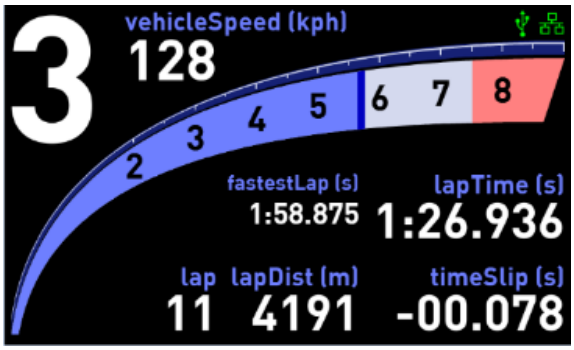
5.2 Templates

Life Racing Displays 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.

Race Arc1



Race Arc2

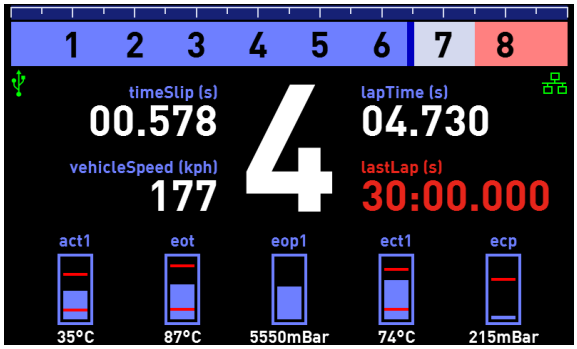


The Race Arc template uses a swept rev counter, a large gear indicator and several text displayers. The layout and number of text displayers differs from Race Arc1 and Race Arc2 depending on preference.

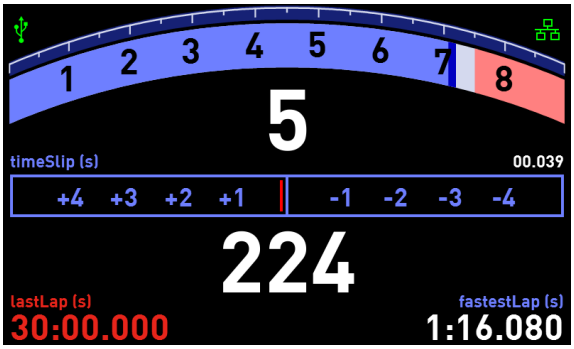
Race1

Race2

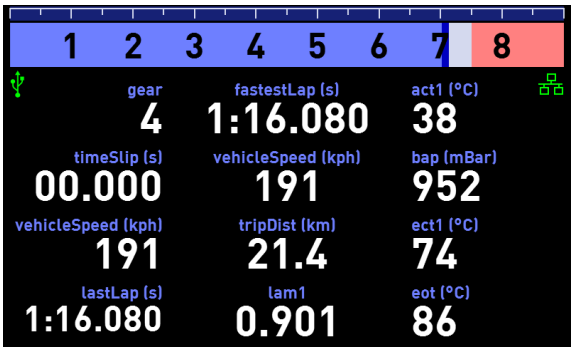
Race3



Race4

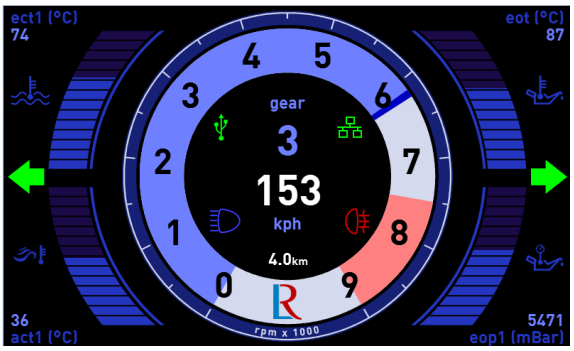


Race 5

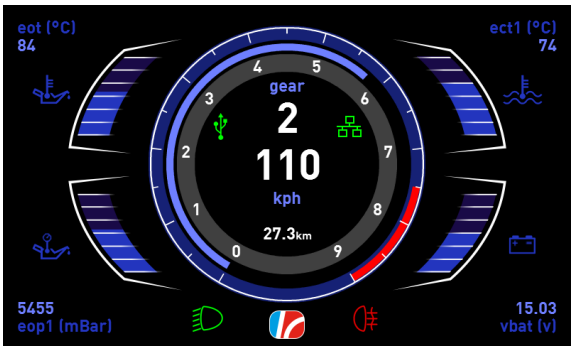


The Race views feature a curved rev counter. Race 1 has a large gear number and six customizable text displays. Race 2 features a time slip indicator and 5 bar gauges. Race3 differs slightly to incorporate a straight rev counter to allow more information underneath as both text and bar gauges. Race 4 features the time slip indicator but without the bar gauges in favour of a large gear and speed indicator. Race5 features the straight rev counter to allow as much information as possible to be displayed below in text format. This gives all the benefits of a text page while keeping the readable rev counter.

Road Arc



Road Arc2



Road Arrow

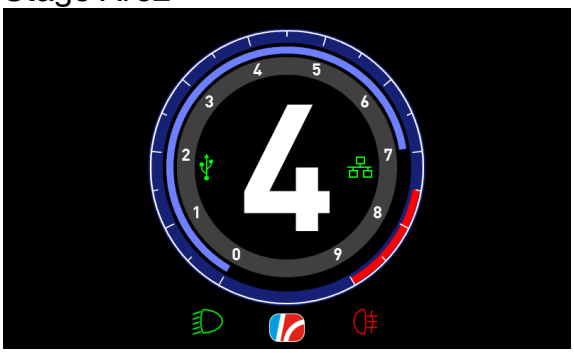
The Road templates display the classic rev counter with gear and speed located in the centre. There are also 4 gauges around the outside that can be set to display any numerical item. Common items also have a corresponding symbol. Road Arc and Road Arc2 use an arc rev counter and sweeping gauges in two different styles. 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.

Stage1

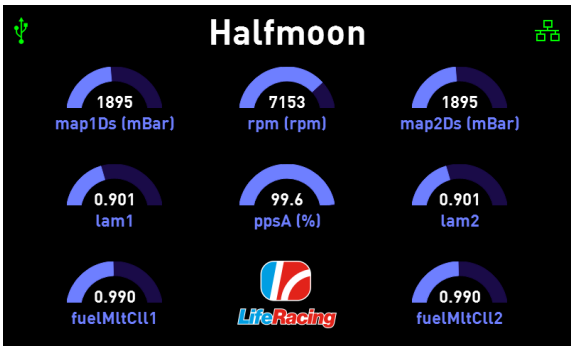
Stage2

Stage3

Stage Arc2

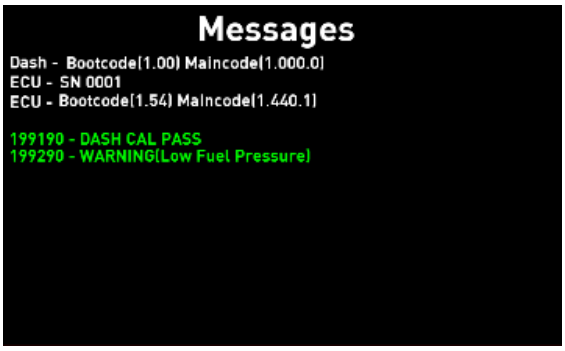


The Stage view is primarily for use in rally stages where a minimal display is often wanted. It displays the classic rev counter with a large gear number in the centre and optional text displays in each corner. Stage 2 has the same layout as stage 1 but with two monitoring items allowed in the centre. Stage 3 features the large gear number of stage 1 but also includes the bar gauges of road arrow. Stage Arc2 incorporates the alternative arc style.

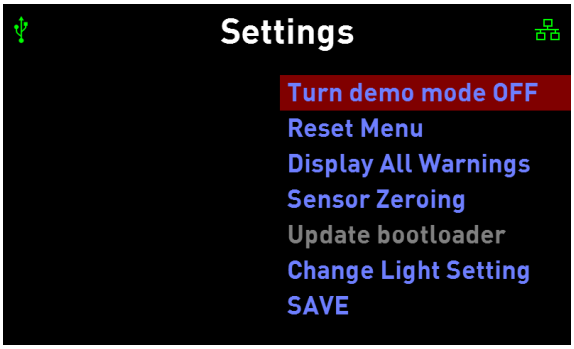


This page can show up to eight half-moon gauges that can display any numerical item.

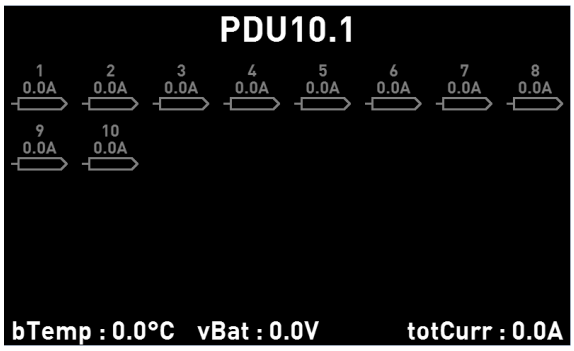
The inputs page displays the status of all the dash inputs. It can be used for input diagnostics and fine tuning linearisation. **This page cannot be edited.**

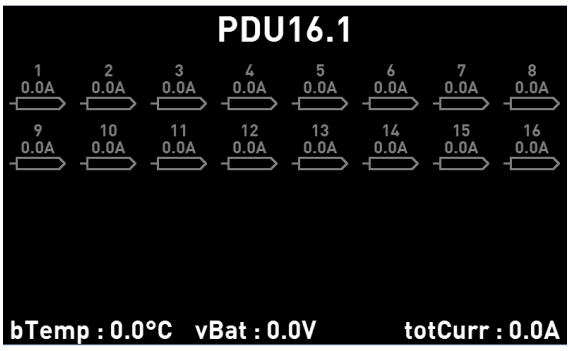


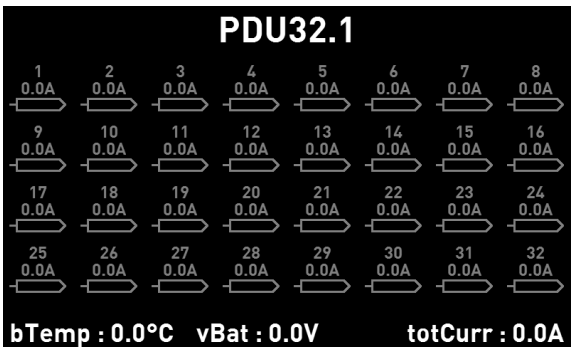
The message screen is used to display Dash and ECU information such as version and software levels, as well as any alarms that have been triggered. **This page cannot be edited.**

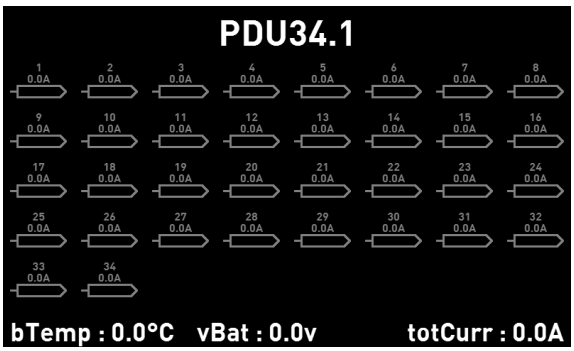


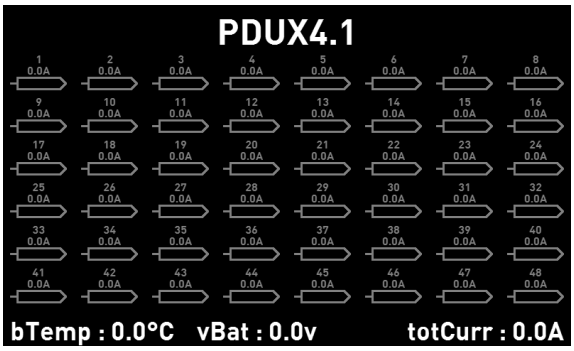
The settings page cannot be altered but gives some global options including input zeroing, lap stats reset and change light settings. The settings page is required to store any changes made on the dash itself.



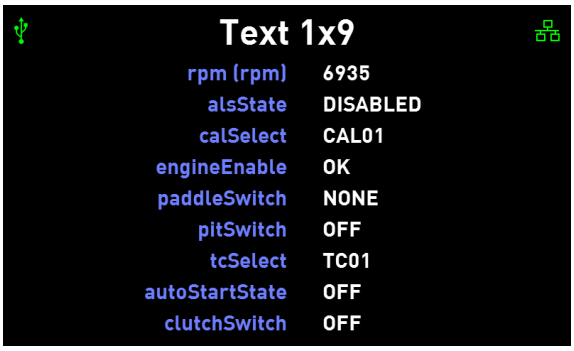


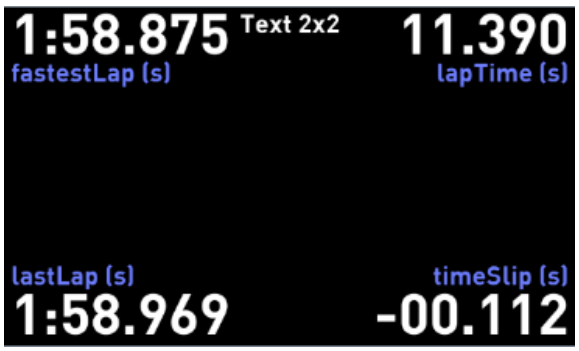


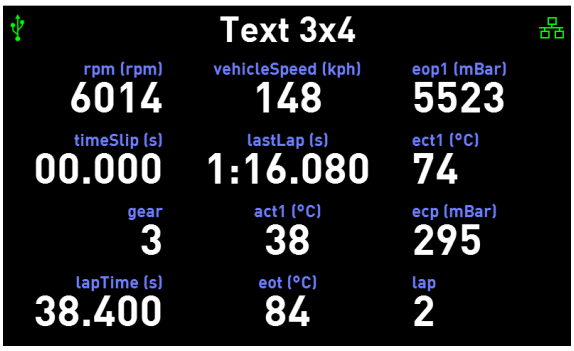




Intended for use with any Life Racing PDU, these pages will give current ratings and status of all PDU outputs and will automatically work when PDU items are added. Output abbreviated names will be displayed in place of the output number where available. Up to 2 of each type of PDU is supported. **These pages cannot be edited.**



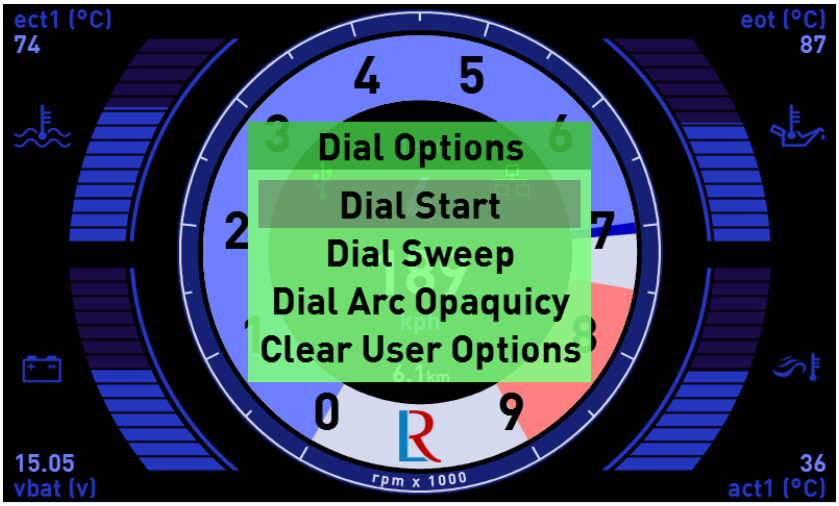




The text views shows up to twelve items as text depending on what grid layout you choose (1x7, 1x9, 2x2, 2x4, 3x3, 3x4). It can be used for any item but is most useful for those with text outputs. This can be useful for showing engine status and diagnostic items or lap times. The 1x7 and 2x2 pages will use full names whereas they others use abbreviations. Only the 1x7 and 1x9 pages can use virtual switches.

5.3 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.

5.4 Display Toggles

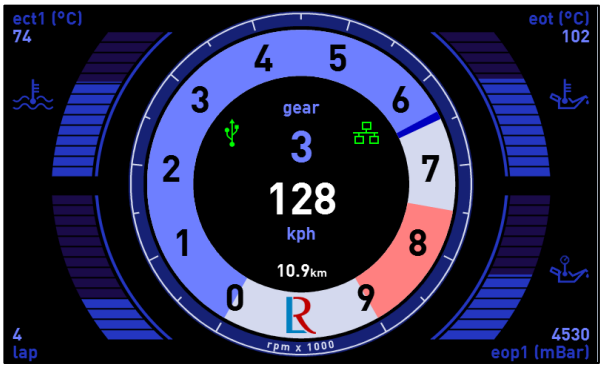
The toggle menu allows certain visual features on the main display templates to be turned on and off. To access these options select *Menu, Template Options, User Display Toggles.*

5.5 Colours

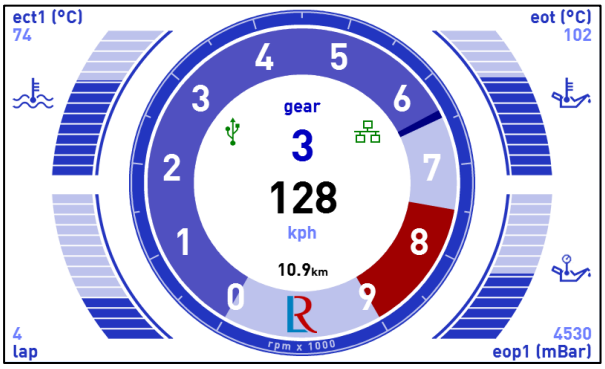
Fully customisable colours can be applied to each screen. An initial template colour scheme can be selected that changes global colours on every page, including the non-editable pages. Finer changes to individual features can be applied using the *Template Colour* tool. Individual gauge colour changes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

5.5.1 Colour scheme

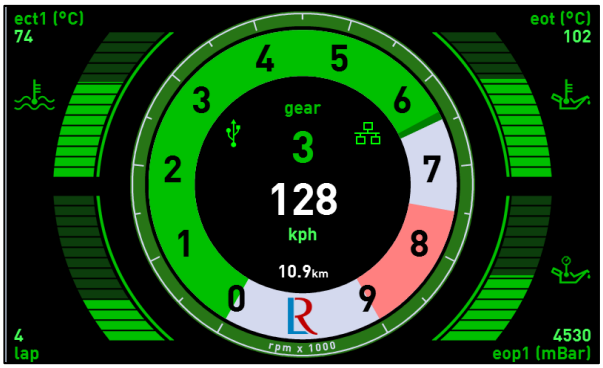
To change colour scheme for all pages, select ***Menu, Change Default Colour Scheme*** and select from the list. To change the colour scheme for a single page, select ***Template Options, Template Colour Scheme.***



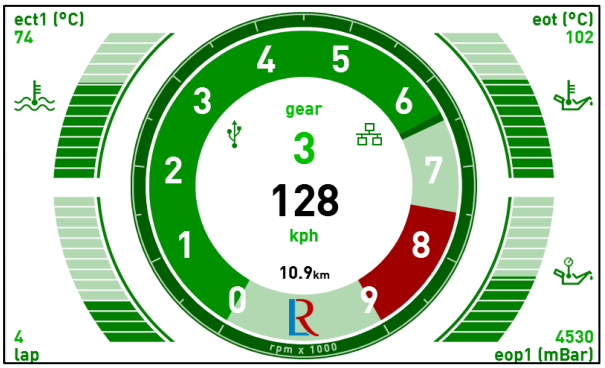
Blue on black



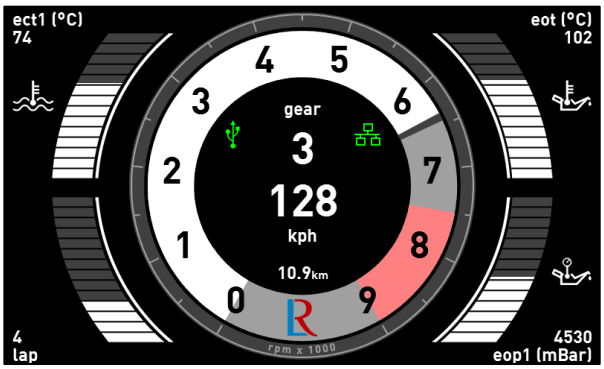
Blue on white



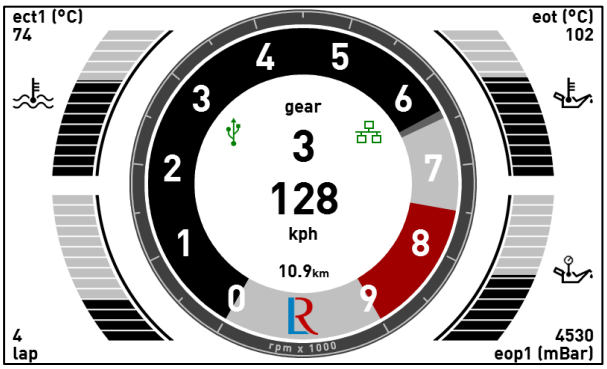
Green on black



Green on white



White on black



Black on white

5.5.2 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

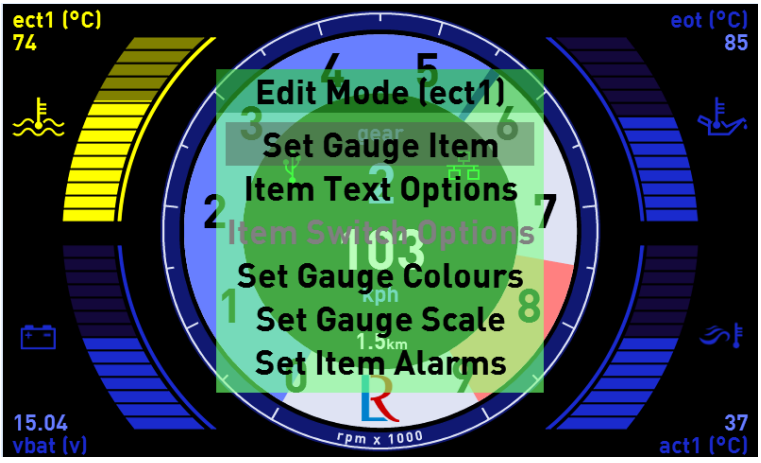
Custom colours will be retained if a new colour scheme is selected but lost if a new page template is selected. Use copy and paste to reload your colours.
Background colour has no effect if custom background is used.

5.6 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.

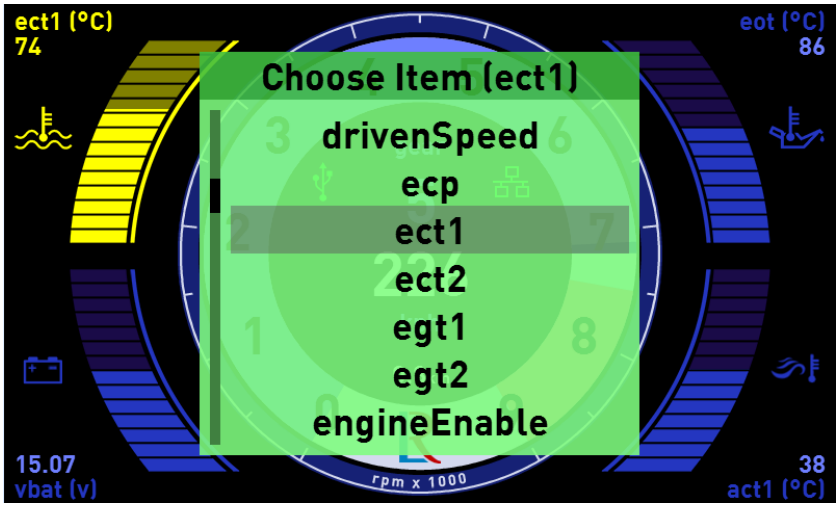
5.7 Edit mode

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.



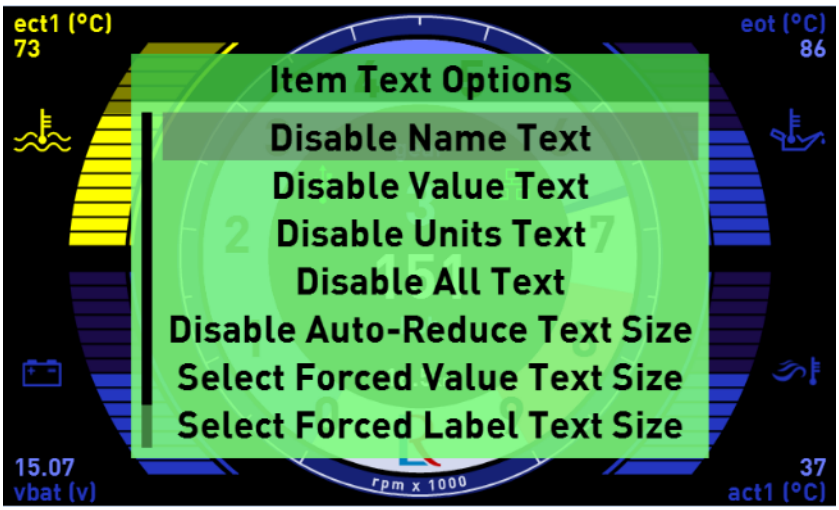
5.7.1 Set Gauge Item

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.

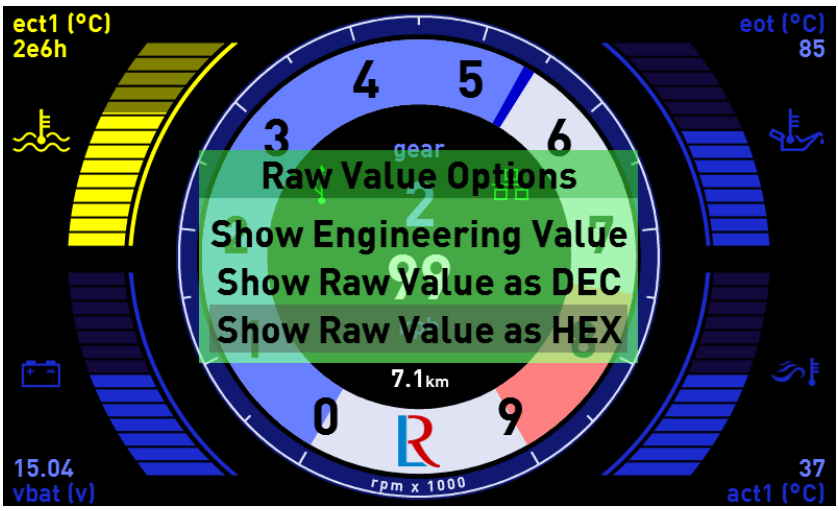


5.7.2 Item Text Options

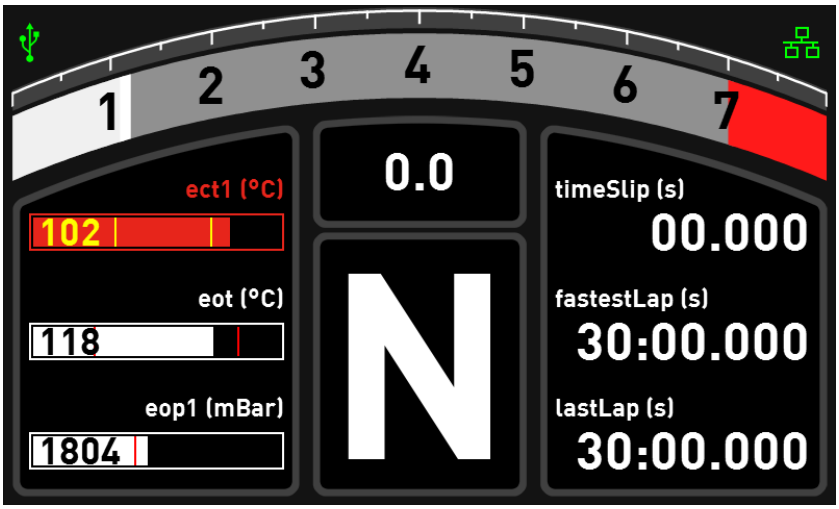
These options allow individual text elements to be modified or removed completely. By default, the abbreviated name is used as the label however, the abbreviation or the full name can be chosen in this menu. On text pages and some text gauges, each element can be resized. The auto-reduce option will 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.



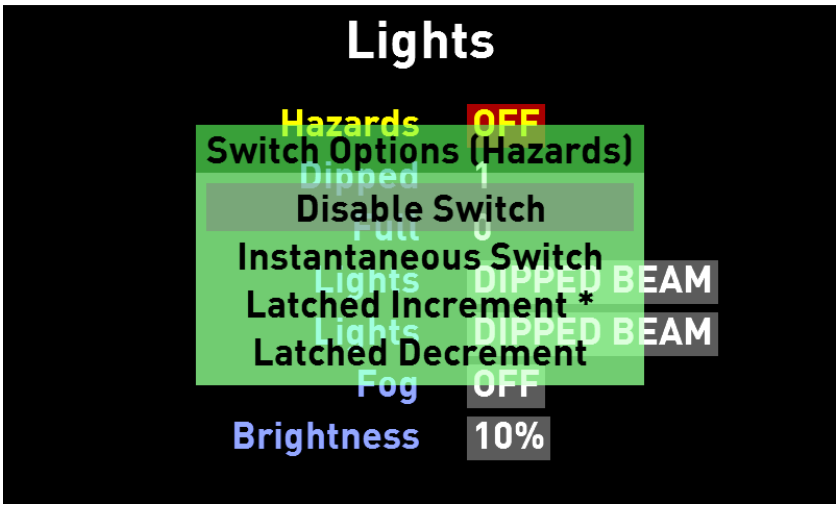
Most text gauges can also be viewed as a horizontal bar by enabling the option in the text menu. Alarm values will be displayed as vertical lines inside the gauge. When an alarm is triggered, the whole gauge will change to the alarm colour but the item value will appear yellow. The numerical value can be disabled so only the bar is visible if preferred.



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 (*).

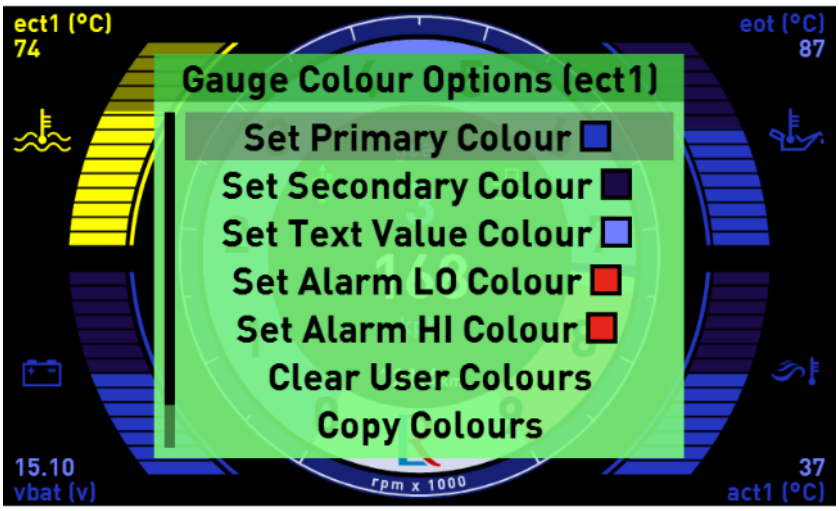
Instantaneous Switch Defaults to first enumeration value. Selecting switches to the second value. Returns to default when switch is released.
Latched Increment Increase enumeration value with each key press.
Latched Decrement Decrease enumeration value with each key press.



A selectable or switchable item will be distinguished by a surrounding box with the active item highlighted. Use the arrow keys to navigate.

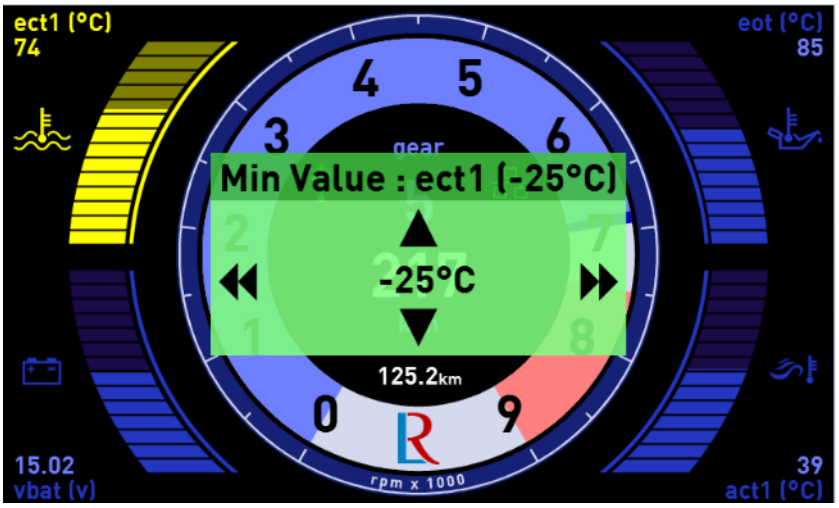
5.7.4 Set Gauge Colours

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.



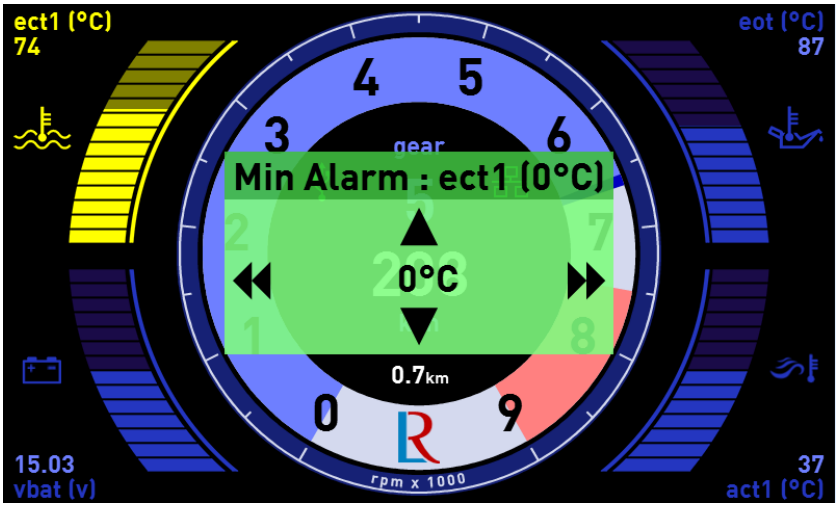
5.7.5 Set Gauge Scale

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.



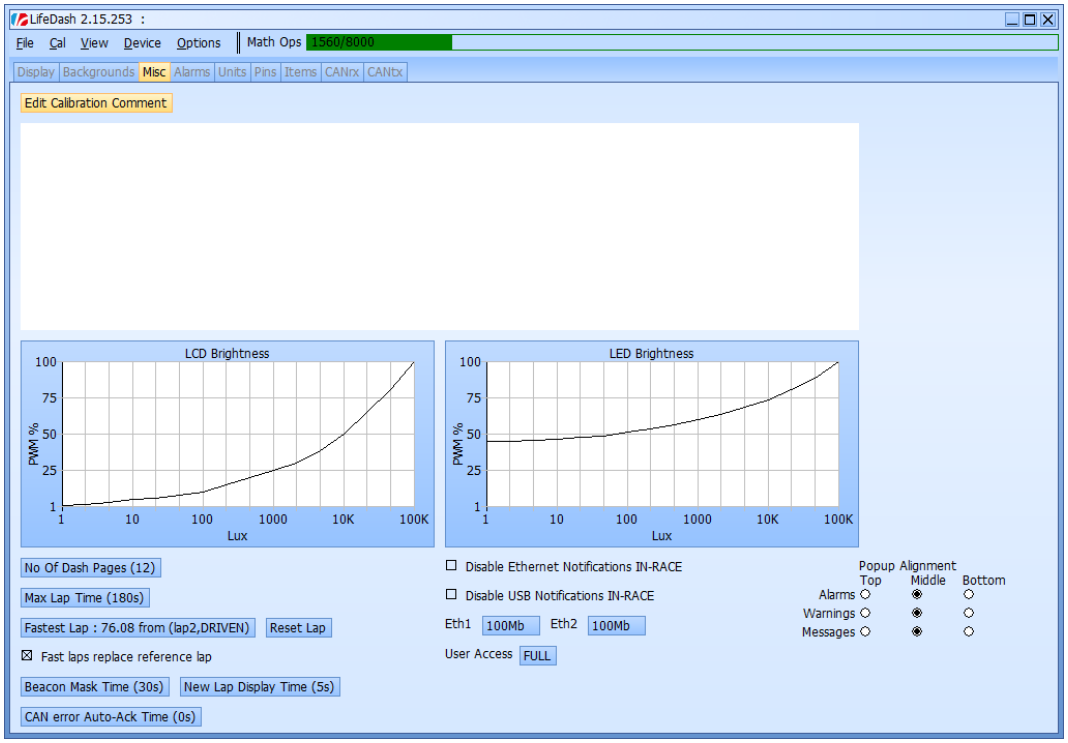
5.7.6 Set Item Alarms

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.



5.1 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***.

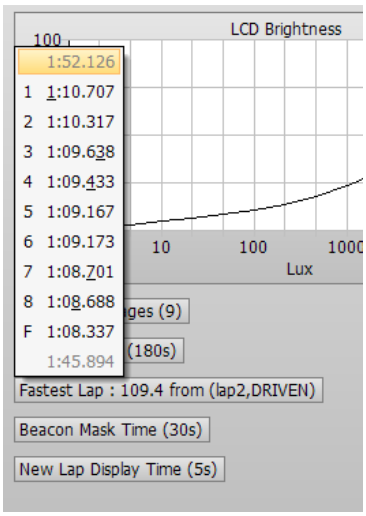
Ambient light sensor linearisation can be changed with the use of the two graphs. These determine the brightness levels of the screen and LED's when brightness is set to automatic. PWM% can be changed with the +/- keys or typed when selecting a lux level. Approximate lux level scenarios are displayed 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. With the checkbox ticked, a faster lap in an active session will overwrite this for that session, but the dash must be saved from the settings page or drivers menu to keep the new fastest lap. The lap can be cleared with the ***Reset Lap*** button or in the reset menu of the dash.



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.

CAN error auto-Ack time can be used to automatically dismiss warning messages about missing CAN frames.

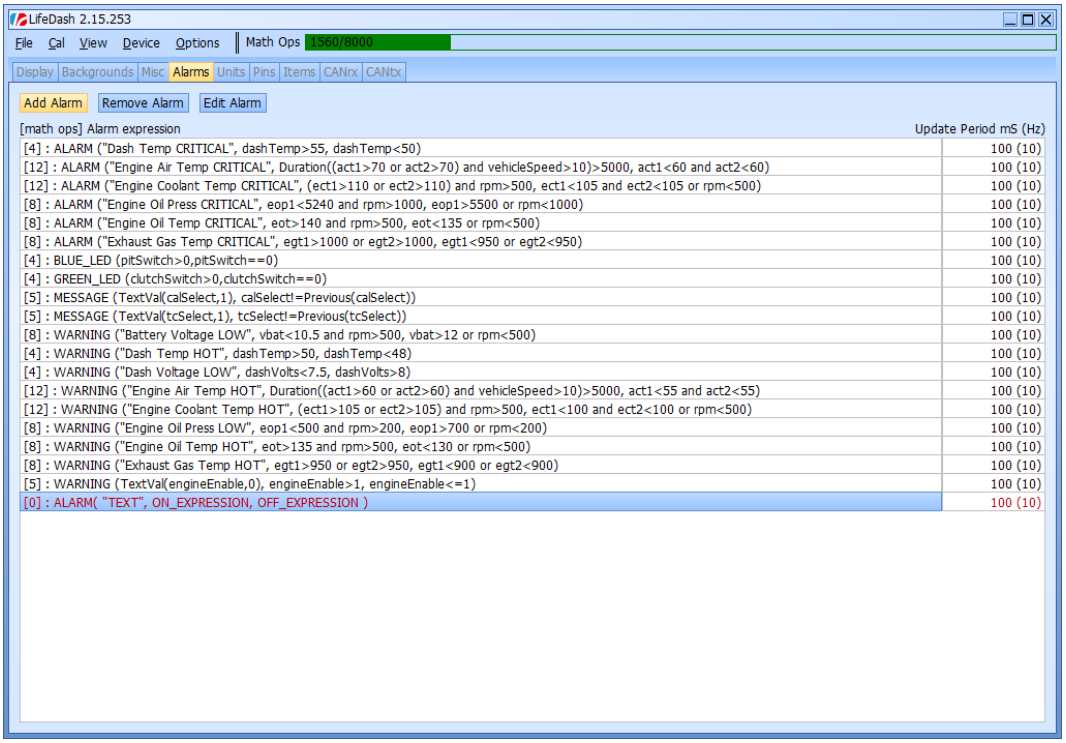
Checking *Disable Ethernet Notifications In-Race* or *Disable USB Notifications In-Race* will disable the notification messages about connected devices during race conditions so distracting messages are ignored if connection is unreliable. The In-Race conditions must be set to the special item for this feature to work.

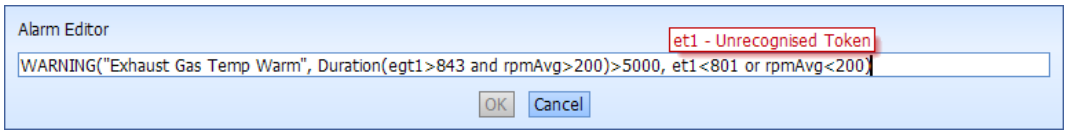
Ethernet speed may be reduced in instances where a strong connection is not possible to help with intermittent connectivity.

Messages, warnings and alarms are all centre orientated by default. These can be independently aligned to the top, middle or bottom of the screen with the relevant button under *Popup Alignment*.

6 Alarm Functions

The Alarms tab is where any on screen messages and other actions are configured such as custom LEDs and page changes.
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.





Alarms can use the same basic maths and expressions available to maths items.
To remove an alarm, highlight it and select ***Remove Alarm.***

Alarms are case sensitive and must use abbreviated names in expressions.
Units used in alarm expressions are the same as displayed units.

Alarms contribute to the total number of Math Ops. The number used per iteration is displayed in square brackets e.g. [4]. Reducing the update period will reduce how often the alarm condition is calculated. This can help reduce the number of math ops used.

6.1 Messages

To add an alarm press *Add Alarm.* Alarms are typed in the format:

ALARM("alarm text", fail-condition, recovery-condition)
WARNING("warning text", fail-condition, recovery-condition [, auto-ack-timeout])
MESSAGE("message text", instantaneous-condition [, auto-ack-timeout])

Alarm types can either be:

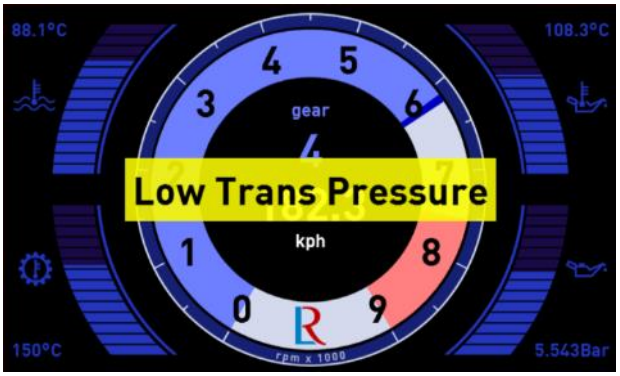
'MESSAGE' which is dismissible and displayed in green (Off Conditions Omitted).

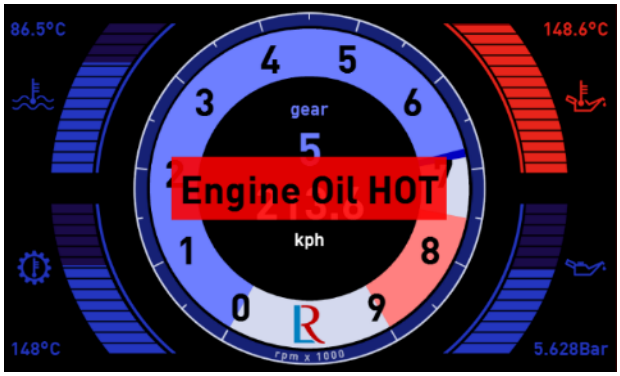
'WARNING' which is dismissible, displayed in yellow and activates the yellow LED.

'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. When using messages, the off condition may be an automatic dismissal after a time period in ms.

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.

From dash v1.3.65 and ECU v1.661.1, these messages will be sent to the ECU and displayed in the ECUs messages during a live connection and added to the ECU logging. Acknowledgements will also be recorded.

6.2 Miscellaneous functions

CHANGE_PAGE(instantaneous-condition, page-number)
This function can automatically change the dash display page without driver intervention. Care has to be take on the condition used to do this. It needs to be defined in such a way as it is instantaneous. This is most easily done using the Previous math function.

CHANGE_PAGE(eop1>3000, 6)
This example will change to page 6 when the eop1 rises above 3000. The trouble here is that while the eop1 is above 3000 the driver will be prevented from moving to another page.

CHANGE_PAGE(eop1>3000 and Previous(eop1<=3000), 6)
This fixes the problem in the previous example by just triggering the page change at the point where the eop1 rises above 3000 for the first time.

USB_LOGGING_ENABLE(on-condition, off-condition)
If USB logging is being used, it is important that the USB stick is not being written to at the point when it is removed. Normally this can be achieved by a long keypress on the OK button. There may be situation where it is desirable to automatically make the USB stick safe to remove.

USB_LOGGING_ENABLE(Duration(vehicleSpeed>0)>2000, vehicleSpeed==0)

In this example USB logging is only enabled if the vehicleSpeed is above zero for 2 seconds. The USB logging is disabled immediately if the vehicle comes to a stop.

6.3 Custom LED's

The dash features 4 LED's below the screen on the D5 and 6 LEDs either side of the screen on the SD4 and D8. These can be triggered by custom conditions. On the D5 2 LEDs are used by default for when an alarm or warning has been triggered. Red for alarm and yellow for warning. On the SD4 only one LED is used by default. This default functionality is overridden if an LED function is used. Where a change light LED is used, the shift light function will always take precedence in instances of conflict. Custom LEDs are set up in the 'Alarms' tab of LifeDash in a similar way to ordinary alarms. Add alarm and open the alarm editor.

D5 only functions
SET_CHANGE_LED(1..8, on-condition, off-condition)
BLUE_LED(on-condition, off-condition)
GREEN_LED(on-condition, off-condition)
YELLOW_LED(on-condition, off-condition)
RED_LED(on-condition, off-condition)

There are similar functions for the SD4 and D8 also. As these dashes support multi-colour RGB LEDs the colour needs to be specified in addition to the on/off conditions.

SET_ALARM_RGBLED(6, eop1>3000, eop1<2800, eop1>3100 ?RED :YELLOW)

In this example the rightmost LED will go YELLOW as soon as the eop1 rises above 3000, if it rises above 3100 it will go RED, the LED will go out (BLACK) as soon as the eop1 drops below 2800.

SD4/D8 only functions
SET_CHANGE_RGBLED(1..8, on-condition, off-condition, colour)
SET_ALARM_RGBLED(1..6, on-condition, off-condition, colour)
Where colour can be:
BLACK, RED, GREEN, YELLOW, BLUE, MAGENTA, CYAN, WHITE

7 Document Revision History

2014-08-20	MH V1.0	Initial public release
2015-07-01	MH V2.0	Custom CAN and new visual options added Section layout changes Minor format changes
2015-10-01	MH V2.1	PRO Spec information updated
2015-12-23	MH V2.2	Compare function & virtual switches added Added Custom page examples
2016-01-08	MH V2.3	LR CAN over Ethernet & raw value text options added
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
2017-03-27	AW V2.6	Overhaul Math, Alarm and LED sections
2017-06-07	MH V3.0	Updated to new format Made generic for all dash variants Minor feature additions
2017-07-28	MH V3.1	New templates added Minor additions and corrections
2019-06-19	MH V3.2	Reformatted for generic LifeDash Connected mode New templates Multi Line maths and new functions Alarm rates GPS Beacon Database Bar display option Other additional features