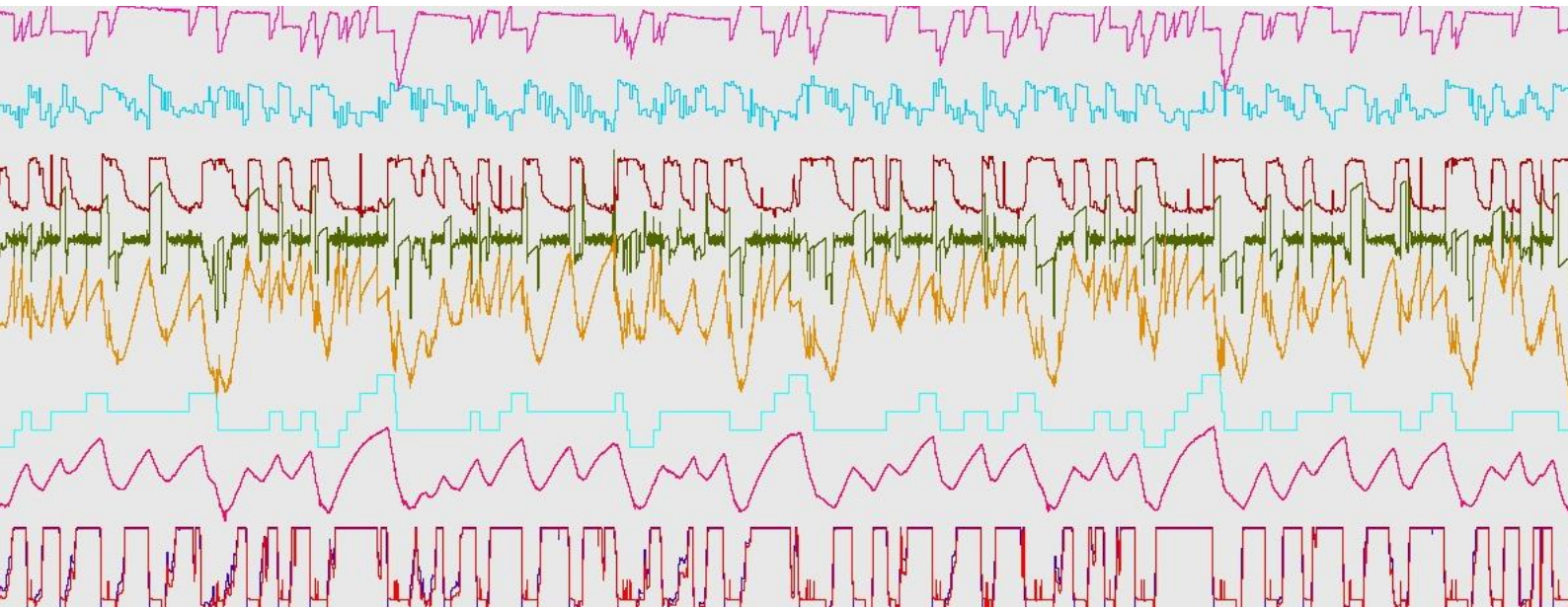
RADICAL MOTORSPORT
DATA ANALYSIS MANUAL



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V1.8

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INTRODUCTION

All modern Radical cars are fitted with Life Racing ECUs, Life Racing PDU's and optional Aim dataloggers. The Life Racing ECU is a professional motorsport logging ECU, used in a range of vehicles all the way up to LeMans competitors. The ECU controls the running of the engine and associated hardware (radiator fans, fuel pump, water pump etc) it is also used to control the gearbox. The additional electronics (lights, aux power, air con, wipers etc) are not managed by the ECU and have their own separate control systems.

Life Racing power distribution unit (PDU) provides a replacement of a conventional relay box. These PDUs provide multi channel solid state logic driven processing and data acquisition.

The Dash logger digitally receives signals from the ECU and it also can also interpret its own separate analogue signals for brake pressure, steering angle and damper potentiometers (when fitted). The advanced motorsport ECU allows maximum performance to be extracted from the engine under manageable restrictions to prevent damage to the hardware of the engine or gearbox. As part of the calibration process Radical programs safety features into the mapping to prevent drivers from damaging the engine and gearbox through aggressive use or exceeding safe running parameters. The ECU records data to allow for fast and accurate fault diagnosis. Frequent and accurate checking of the engine data can prevent potential forthcoming issues and will help drivers win races!

THE BASICS

When checking engine data, you should always use the Life engine data, it logs more information than the Aim data and at a higher frequency so it will help you get to any potential problems faster. When reviewing data, it is always important to validate the specific channel you are looking at. The three golden rules that should be considered are:

- is it ***reading***?
- is it ***changing***?
- is it ***realistic***?

Is it reading – is the channel showing any numbers or is it just showing the default value?

Is it changing – does the value change as it should or is it constant? Is it staying at its default value?

Is it realistic – this is the most important consideration. Is the data showing something that is physically possible or is there just a fault with the sensor? E.g. is the driver really entering the corner at 500mph (or is there an electrical fault with the sensor?), water temperature does not drop from 80 degrees to -30 in one second (is there a fault with the wiring?)

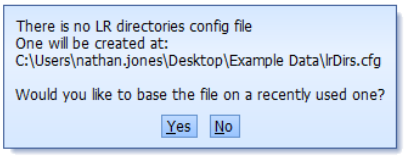
Considering these things is crucial to accurate data analysis.

HOW TO DOWNLOAD LIFE DATA

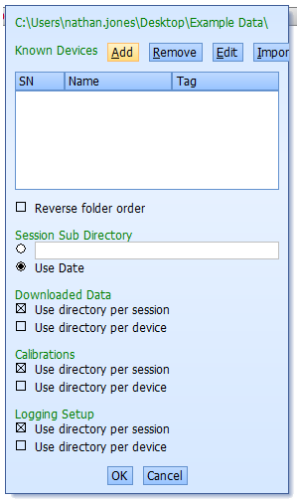
Download the latest Life Racing software from https://radicalmotorsport.com/downloads
Connect the ECU using the download lead (LH0168) connected to the car and laptop
Turn on the car's master switch, the open '***LifeData***'

Choose Where to Save The Data Method 1

Select ***File*** > ***Working directory***
SELECT or ***CREATE*** new folder location eg:
D:\Radical ECU Data\Year\Car model\Engine specification\Chassis number\Date & location
Once in the desired locations choose ***SELECT***
You will then be told a config file is being made in this location. Press '***ESC***' on the keyboard when prompted below.



You will then be asked to give more directory information, this can be ignored. Press '***ESC***'

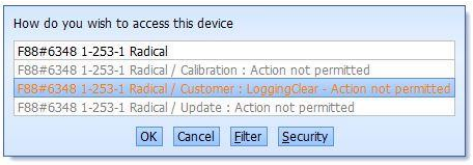


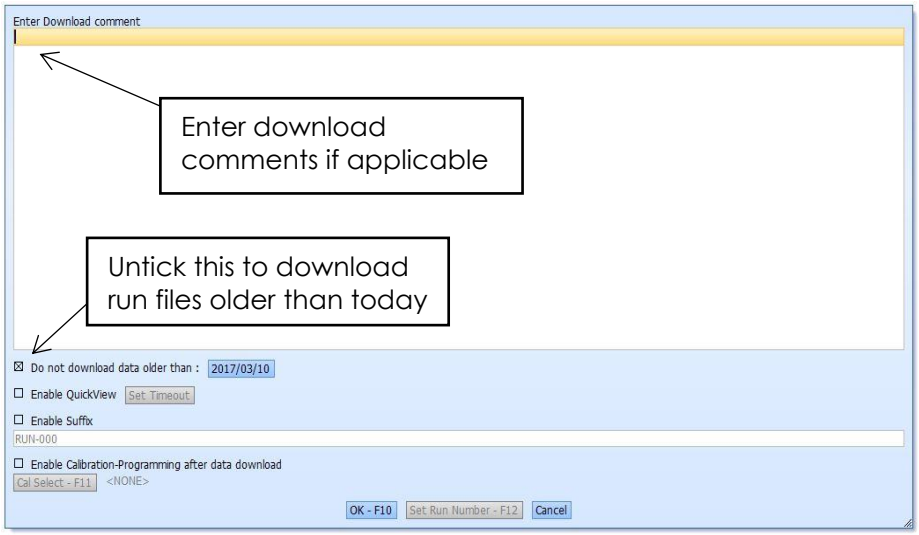
You will then be asked if you would like a shortcut to be placed onto the desktop, always select '***No***'.



Downloading the Data:

Select ***Device*** > ***Read Data***
The software will then connect to the ECU and show you the below options



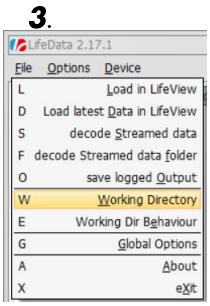


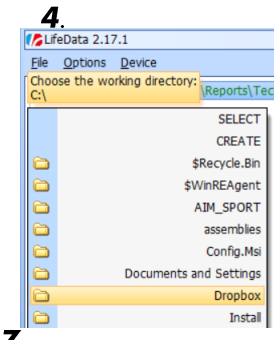
Click ***OK*** and the run files and Logbook will download.

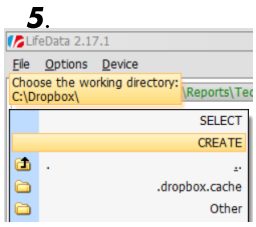
Choose Where to Save The Data Method 2 – Working Directory Setup

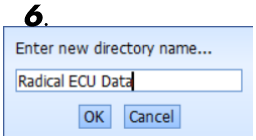
When looking after a fleet of cars use of Working directory as intended will be beneficial.
Working directory can be set by following below steps.

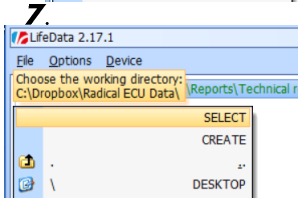
1. Choose a dedicated folder where you want to store your data. This can be a hard drive or if multiple computers are used to download data a cloud solution (i.e. DropBox or OneDrive) is a better option, so all downloaded data is saved to a common place.
2. Open Life data
3. Go to ***File/Working directory*** now choose previously selected folder. (For demonstration we will use Dropbox)
4. Navigate to ***'Dropbox'*** and press Enter
5. Click ***'Create'***
6. Name this folder (In our demonstration it is "Radical ECU Data and press Enter
7. Navigate to ***'Select'*** and press Enter
8. Small dialogue window will pop up. Click on ***'No'***

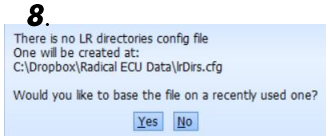




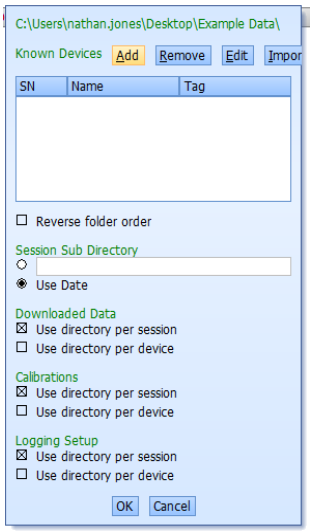


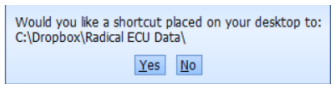




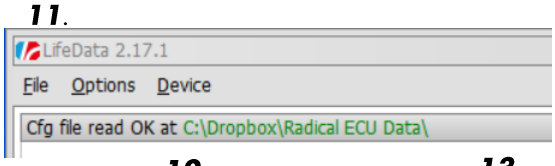


9. You will then be asked to give more directory information, this can be ignored. Press ***'Cancel'***
10. You will then be asked if you would like a shortcut to be placed onto the desktop, always select ***'No'***.



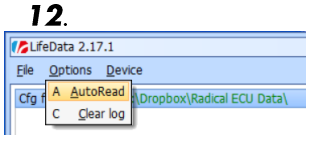


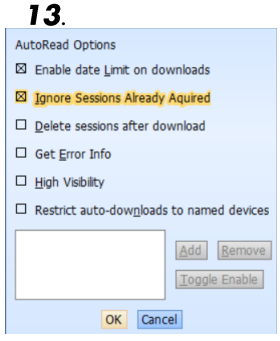
11. The directory was now created and created folder selected for all your data downloads as the final destination.



12. Click ***'Options'*** and choose ***'Auto Read'***
13. From Auto read options select
    a. Enable data Limit on Download (this will avoid data files from dates before the set date. The date can be set in the further steps but the default setting is always the present date.
    b. Ignore Sessions Already Acquired (this will avoid download on data downloaded earlier that day)

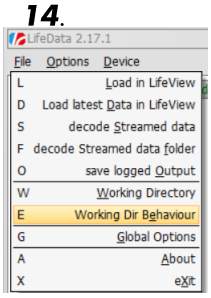
    Confirm by pressing ***'OK'***



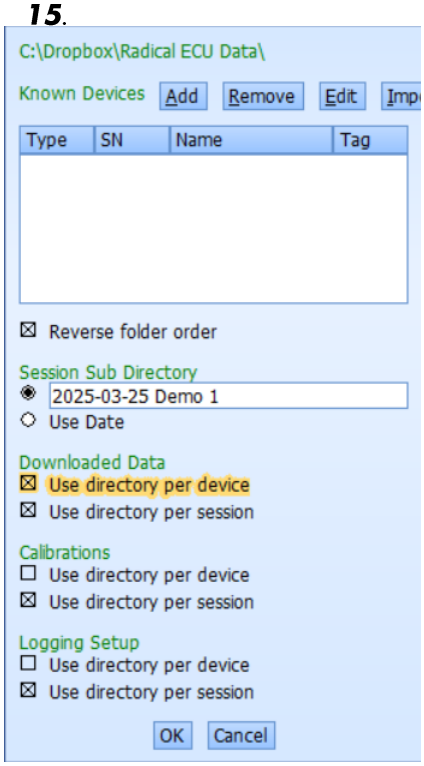


14. Click ***File/Working Dir Behaviour***
15.
    a. Tick 'Reverse folder order'
    b. Name the 'Session Sub Directory' Year/month/day/event
    c. In 'Downloaded data' tick both options
    d. In 'Calibrations' tick directory per session
    e. In 'Logging Setup' tick directory per session
    f. Press OK to confirm

14.



15.

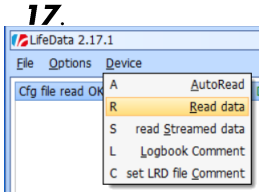


Note:

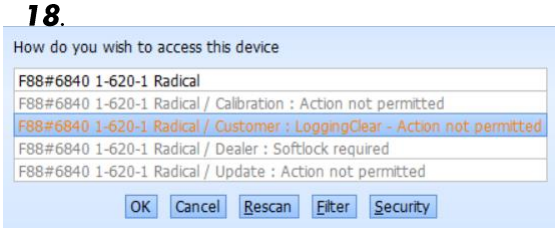
Step ***'15. b.'*** must be repeated at every new event to keep all folders organised and downloaded data easy to find

16. Connect the ECU using the download lead (LH0168) connected to the car and laptop. Turn on the car's master switch.
17. Click ***'Device/Read'***
18. Select Radical/Customer access and confirm by pressing OK

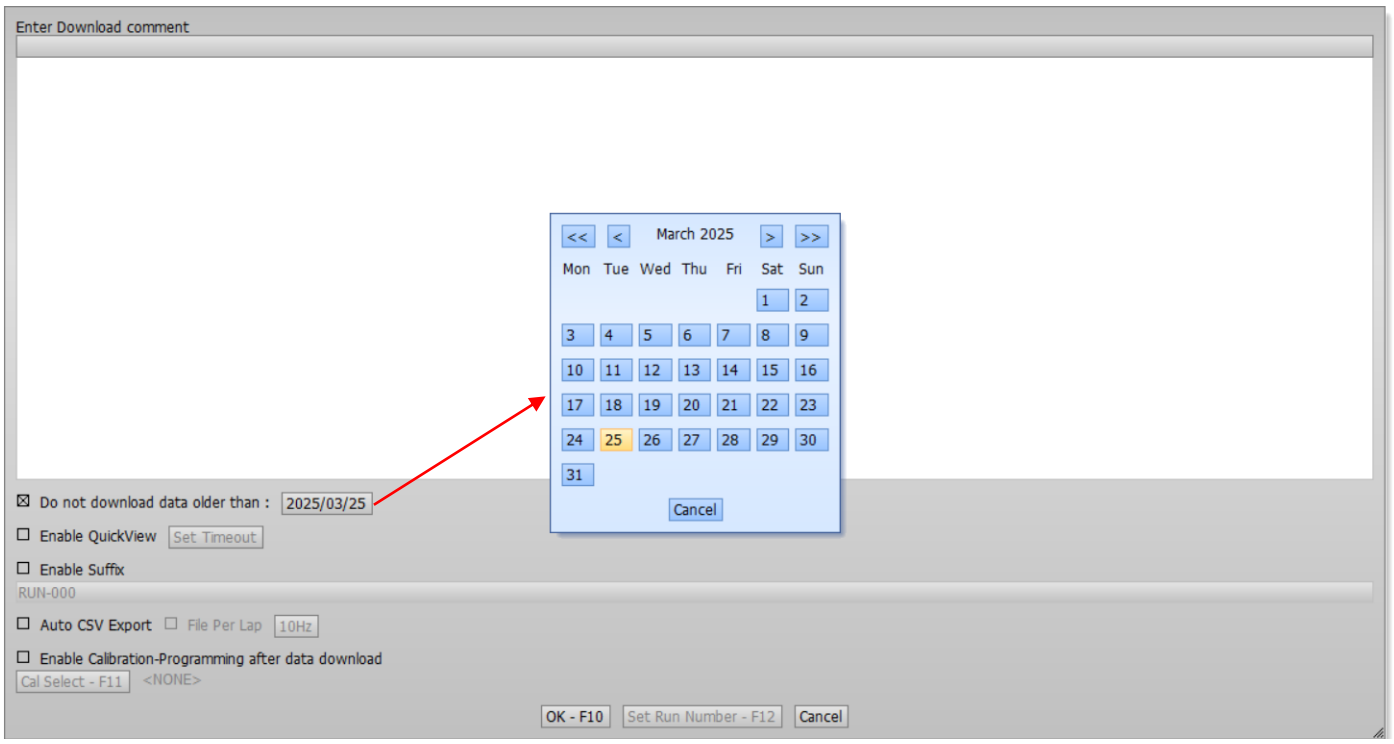
17.



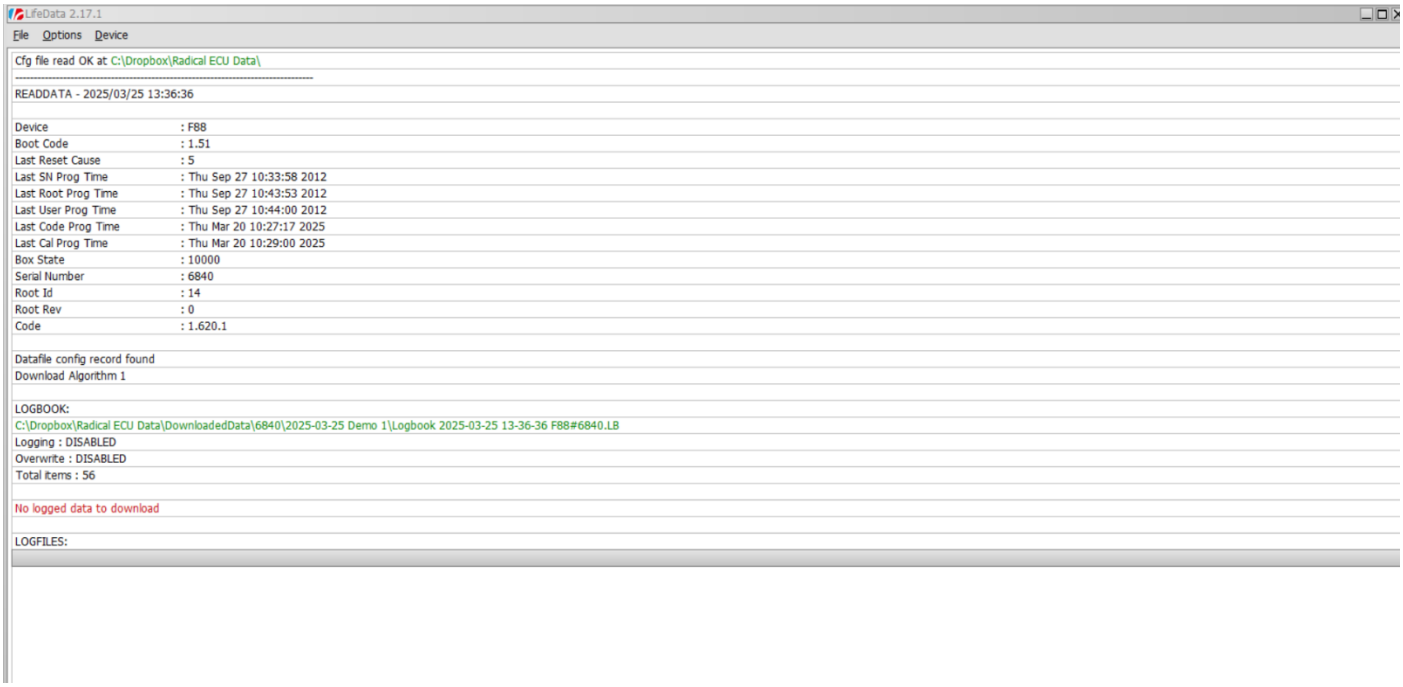
18.



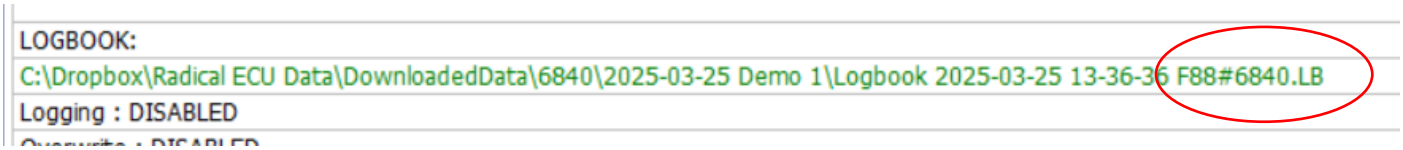
19. As per ***'13. a.'*** the earliest date for you download can be set here.
    Enter a comment if this particular download is somehow specific (known issue, different driver, change of weather….) and confirm by pressing ***'OK'*** or F10 on the keyboard



20. Data and Logbook will now download.

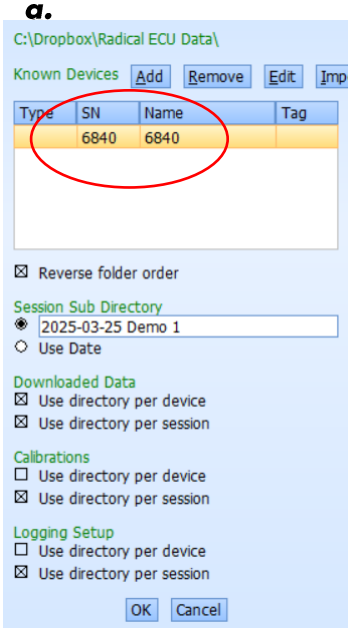


Because there is no run data saved on the demo ECU is too old only Logbook has downloaded noting the ECU serial number

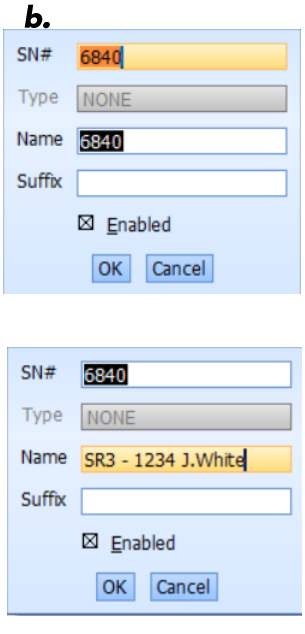


21. Open ***'File/Working Dir Behaviour'*** again.
    You will find the same ECU number in the list.
    a. Click on this new serial number highlighting it (yellow) and click on ***'Edit'***
    b. Small dialogue window will pop with both SN# and Name being the ECU serial number
    c. Change the name to Car model – Chassis number – Drivers name
       Example - (SR3 – 1234 J. White) and press ***'OK'*** to confirm

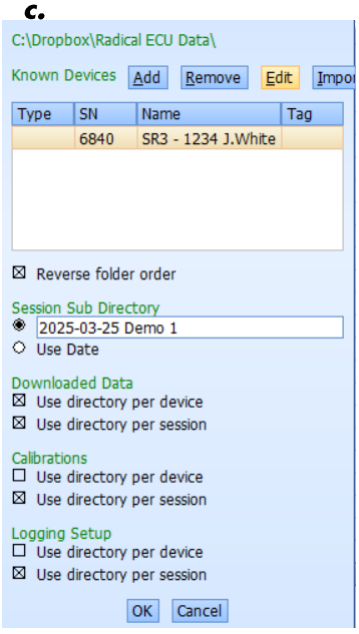
a.



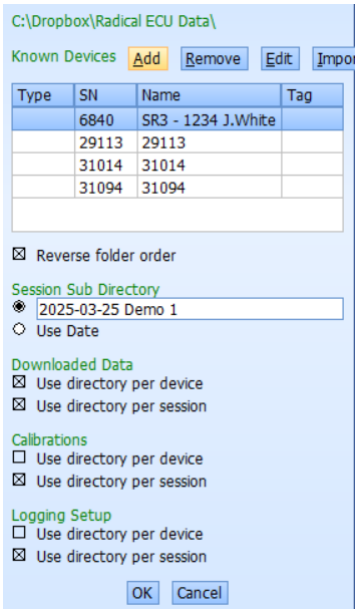
b.

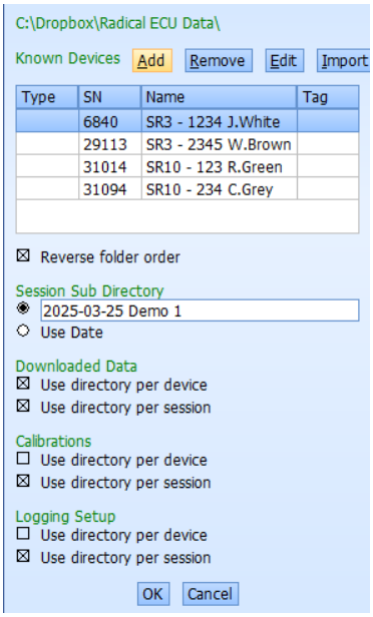


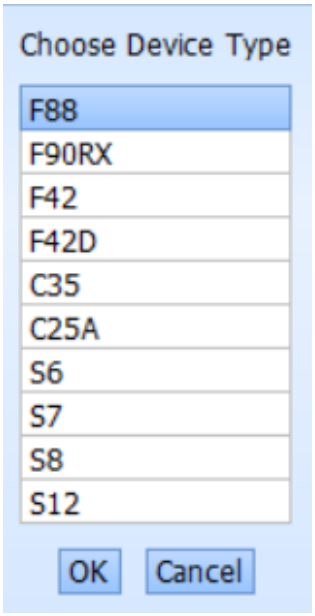
c.



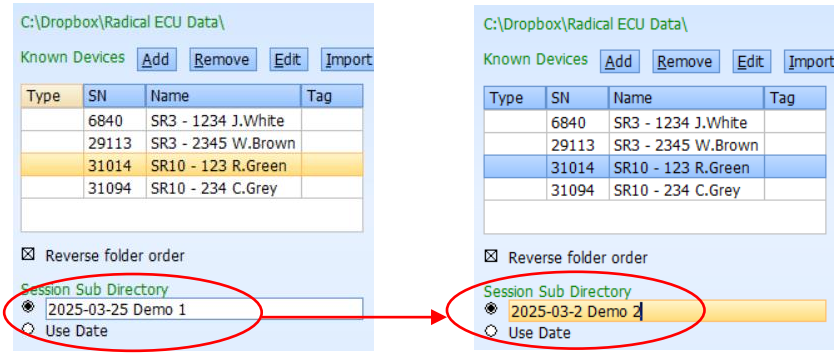
22. The above process can be repeated as many times as necessary; collecting Serial numbers from all ECU's / Cars in your fleet.
    ECU's from serial number 31000 now require you to select a type of ECU which is F88 in all SR models and RXC models with V8 engines
    F90 for RXC models with V6 engines





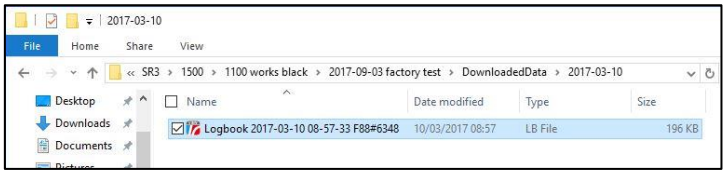


23. If you never change the location of this directory or move to a different directory all of your saved ECU's will be recognised and all you would need to do is to plug in, open up LifeData and press ***'device / read'***
24. At the beginning of the next event open ***'File / Working Dir Behaviour'*** again and change the name of Session Sub Directory and confirm by ***'OK'*** ref. ***'15. b.'***

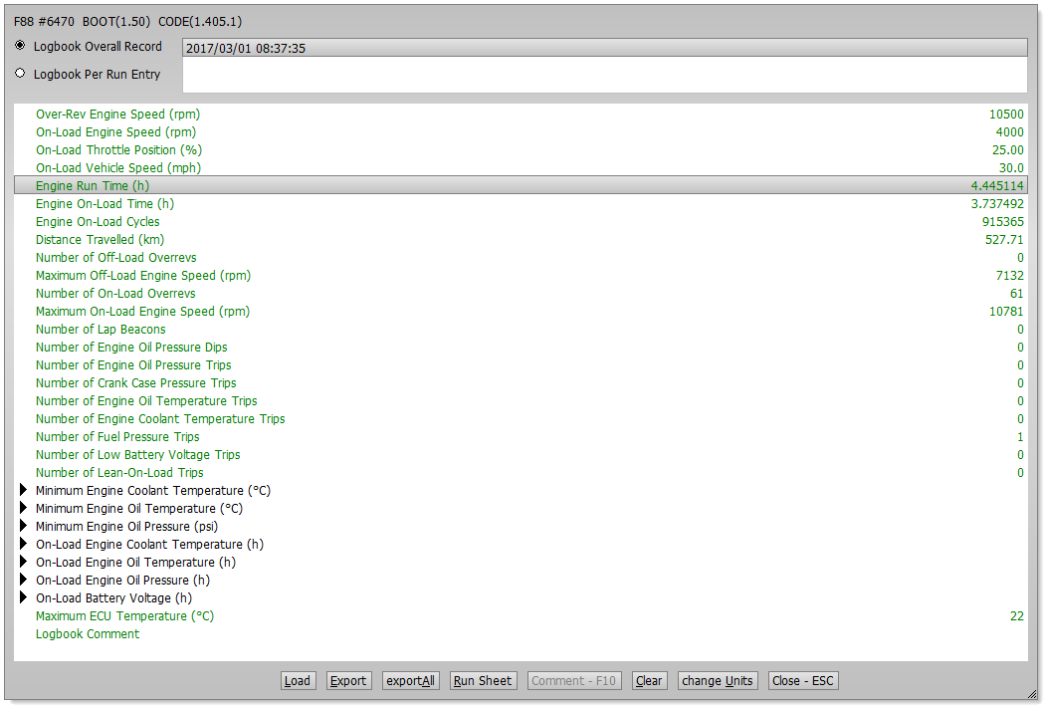


REVIEWING THE LOGBOOK

Using the normal Windows file explorer, navigate to the most recent download folder for the ECU
Double click on the latest logbook (.LB) file



The Logbook will then open in Life View



From here LogBook parameters, engine hours and overall recordings can be found.
For warranty purposes RPE will reference the total ***Engine Run Time*** (selected above)
Units can be changed using the option at the bottom of the screen

LIFE VIEW

Open ***LifeView***
Select ***File*** > ***Load*** and navigate to the location you have downloaded the data to, select the appropriate according to the download date and time.
The data will then open for review in ***LifeView***

To make viewing the data easier, Radical Template Worksheets can be downloaded from the radical website: http://www.radicalsportscars.com/downloads/. You should save these to your desktop

Navigation

Mouse:

Left Click	Place cursor
Right Click	Place marker
Left Drag	Move cursor
Right Drag	Zoom to selection
Scroll	Zoom X-axis
Ctrl Scroll	Zoom Y-axis
Double Click	Add/edit annotation
Drag Y-Axis	Move axis maximum
Ctrl Drag	Y-Axis Move axis minimum
Shift Drag	Y-Axis Move entire axis

Keyboard:

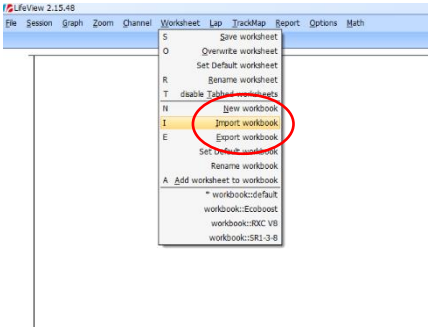
<Left>	Move accelerating cursor to left
<Right>	Move accelerating cursor to right
[	Move cursor left to previous different value
]	Move cursor right to next different value
<	Move cursor to previous alarm position
>	Move cursor to next alarm position
<F6>	Move cursor to minimum visible value
<F7>	Move cursor to maximum visible value
<Ctrl> + <Left>	Move cursor to left by 10% of screen
<Ctrl> + <Right>	Move cursor to right by 10% of screen
<Shift> + <Left>	Accelerating scroll to left
<Shift> + <Right>	Accelerating scroll to right
<Plus>	Zoom in X-axis
<Minus>	Zoom out X-axis
<Ctrl> + <Plus>	Zoom in Y-axis
<Ctrl> + <Minus>	Zoom out Y-axis
<Tab>	Toggle graph focus when multiple graphs are open
<Space>	Place marker
<Backspace>	Remove marker

The Zoom menu can also be utilised with its shortcuts to Zoom To Selection, Zoom Previous or Zoom Right Out. Certain options such as cursor acceleration and right click zooming can be toggled, depending on user preference when navigating.

How to Import a WorkBook

Use the above section to help you extract the data from your car.

Open LifeView and click 'Workbook' in the menu. Then click 'Import workbook'



Then select the 'Factory Approved Workbooks' that should you have downloaded from the website

To set a default worksheet, open the workbook you wish to set as a default by selecting it from the list at the bottom of the 'Worksheet' tab. Then select 'Set Default Workbook'.

Use the tabs in the top left to navigate through the worksheets, which are listed below.

ENGINE DATA ANALYSIS

When reviewing session data, provided there is no specific known issue, it is most efficient to check the data using the below priority order:

1. Engine oil pressure
2. Battery voltage
3. Fuel pressure
4. Running temperatures
5. All other channels

The analysis of these critical channels should be as follows:

Engine oil pressure – low oil pressure causes bad engine oiling which soon becomes an expensive problem! As a rough rule of thumb:

> For a hayabusa engine, when the oil temperature is ***100 degrees C*** and the RPM is at ***10,000 RPM*** the oil pressure should be ***above 65psi***.
>
> For a V6 ecoboost engine the oil pressure on track should remain constant ***above 80psi*** at all times.

Battery voltage – when they battery goes flat the car won't run and won't be able to start. Standard batteries should hold close to 12.8V at rest. When the car is running and charging this should rise to 14V. It is normal for the voltage to drop when load is applied (eg radiator fans on or paddle shift compressor charging) as soon as this electrical draw finishes the measured voltage should bounce back up to 14V. Look for a general trend of the recorded voltage over a session, is the trend horizontal and flat or does it trend down, indicating the battery voltage is depleting and the car may not be charging.

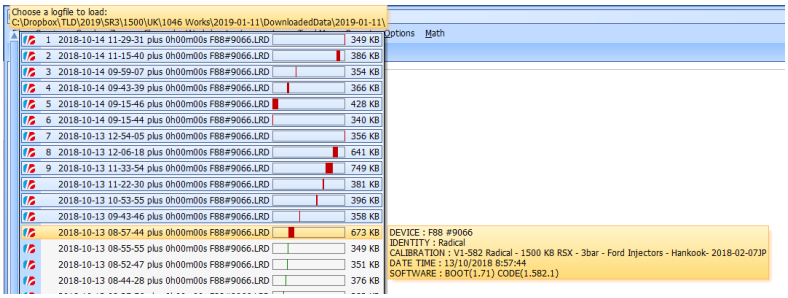
Fuel pressure – low fuel pressure, means less fuel in the cylinder, this leads to lean combustion and in extreme circumstances – detonation. This can quickly damage an engine. The fuel pressure is regulated post fuel rail. For small chassis cars (SR1-3-8) the target fuel pressure is 3 bar. For large RXC chassis variants the target pressure is 4 bar. It is expected for the fuel pressure to reduce by a small amount on load, conversely off load it is possible for the fuel pressure to rise above the regulated pressure if the pump is very strong. The fuel pressure should be checked when the car is on load high in the RPM range. A drop in pressure of 0.2 bar below target is acceptable, below 0.4 bar requires urgent investigation – is the battery providing adequate power to the pump, or has the pump deteriorated?

Running temperatures – tab over to the temperatures worksheet and check that the car is running with the correct target temperatures, water 75-85degrees C, oil 90-110 degrees. Low temperatures cause too higher oil pressure which can damage engine seals. High temperatures cause low oil pressure and can also overheat the engine components potentially damaging them.

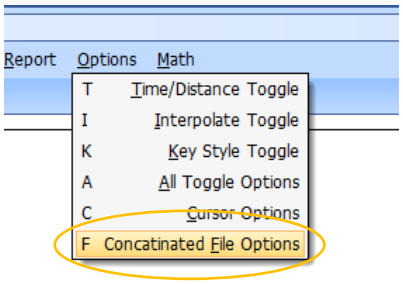
All other channels – now the critical channels have been checked turn your eye to the other channels in the generals tab. An explanation of each channel is given in the next section.

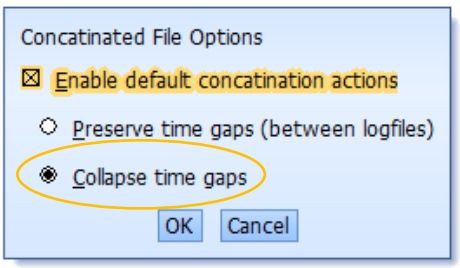
LIFE VIEW SETTINGS

Loading Multiple Run Files: to load more than one run file, press 'File' then 'Load' then hold shift and press the down arrow until you have selected all the files you wish to load, then press 'Enter'.



Collapsing Time Gaps: When loading multiple files are loaded you will be asked if you want to collapse the time gaps. You should always select 'Yes' as choosing no will result in large amounts of blank space between the runs. To automatically collapse the time gaps you can press 'Options' then 'Concatinated File Options' then make sure the 'Collapse Time Gaps' box is checked.





LIFE PROG

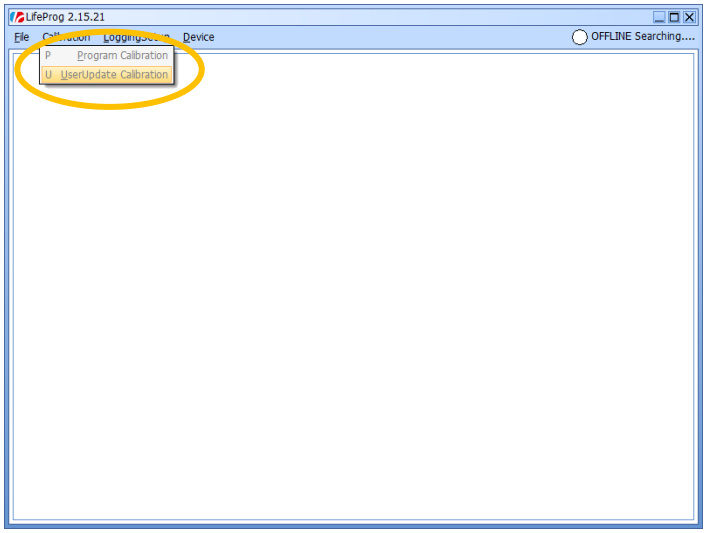
This program will rarely need to be used. Its sole function is to update the map in the ECU remotely, customers do not have access to change maps but with Life Prog a map update file can be sent by the Factory and updated by the customer.

If an engine has been converted for example, and the ECU is unable to be sent to the factory a 'User Update Calibration' can be sent.

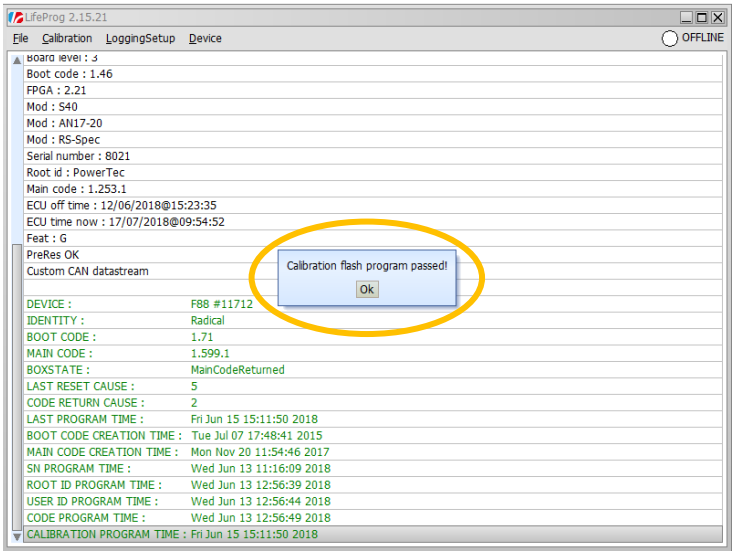
To use this program you need an ***.LRCU*** file.

Open '***LifeProg***' the select '***Calibration***' and '***UserUpdate Calibration***'

You will then need to select the '***.LRCU***' file.



Then press '***Ok***' it will then say '***Calibration Flash Program Passed***' which means the process is complete.



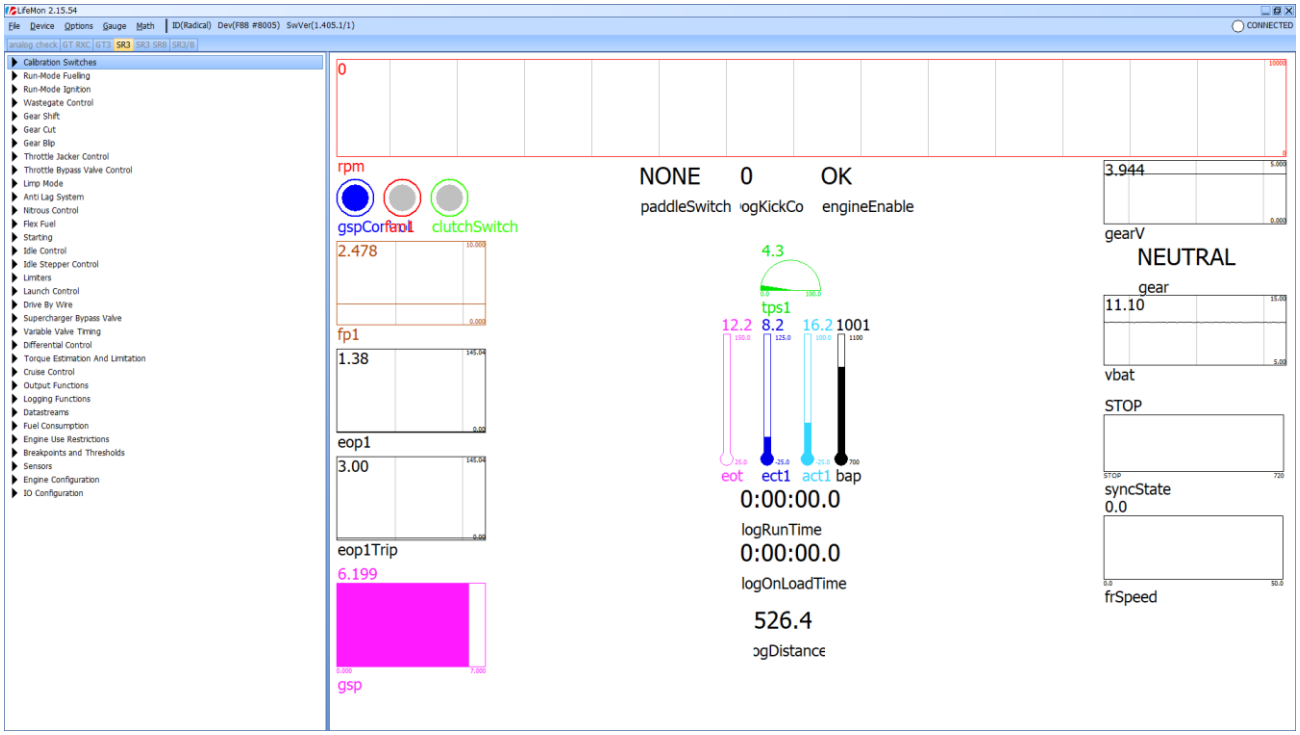
VIEWING THE ECU PARAMETERS LIVE

LifeMon can be used to monitor the channels seen in the data live, this can be useful when running the car up to check for oil pressure and temperatures etc. If you suspect a problem, this is a good place to start, by checking all the readings are correct.

Open 'LifeMon' then press 'Device' then 'Connect.

You will then need to load a gauge layout, to do this select 'Gauge' then 'Import Disk Layout' the Radical layout is available on the website. Select this file and then press 'Gauge' then the name of the layout to load it.

You will now see all the ECU parameters live. Individual parameters can be added or removed by pressing 'Gauge' then 'Add' or 'Remove'. The layout is fully customisable and can be saved to your preference.



GENERAL WORKSHEET

Use this page to have a general check over the parameters. This page is split into 3 graphs. The top graph holds all the general channels and can be used to check battery voltage and fuel pressure. The second graph is specifically for checking oil pressure, remember to check it at the end of the session as this is the most recent data on how the engine is running. The third graph shows instantaneous faults such as overrevs, gear shift disallows or engine trips, use this graph to show major faults such as when the car cuts out on track.

General Checks Graph

clutchSwitch (Clutch Switch) – Neutral Button on the Steering Wheel/ pressure sensor, the channel displays the on/off state of the button.

fp1 (Fuel Rail Pressure) – Shows fuel pressure provided by the in tank pump (Bar)

frSpeed (Front Right Wheel Speed) – Shows the interpreted speed of the front right wheel (mph)

gear (Current Gear) – Converts the gear voltage provided from the gear position sensor into a gear

gsp (Gear System Pressure) – Shows the air pressure for the paddle shift system. (mBar)

rpm (Engine Speed) – Displays current engine speed (rpm)

syncState (SyncState) – Shows the state of synchronisation between the camshaft and crankshaft position sensor, 720 means both are reading together. (°)

tps1 (Throttle Body Position) – Shows the amount the throttle body is opening (%)

vbat (Car Battery Voltage) – Shows current battery voltage (V)

Oil Pressure Check Graph

eop1 (Engine Oil Pressure) – Shows oil pressure, this will vary with temperature. The trace should roughly follow rpm (psi)

eop1Trip (Engine Oil Pressure Trip) – Show the trip line for the oil pressure, uses rpm and safety factor to create a trace, if EOP drops below this line for 2 seconds the engine will turn off. (psi)

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

rpm (Engine Speed) – Displays current engine speed (rpm)

Reference Graph

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why.

gearCutDogKickCount (Incomplete Gearshift's) – Displays interpreted number of failed gear changed suspected to be dog kicks (Count)

gearShiftDecision (Gear Shift Decision) – Displays why a gear change has been dis-allowed by the ECU, the ECU will not allow the car to downshift if the 'rpm is too high' for example.

revLimitActive (Limiter Active) – Displays the points where the rev limiter is in use.

OIL PRESSURE WORKSHEET

This worksheet is a full-scale view of the oil pressure check seen on the 'General' worksheet, this enables you to see the traces in more detail, over a longer period of time.

Oil Pressure Check Graph

eop1 (Engine Oil Pressure) – Shows oil pressure, this will vary with temperature. The trace should roughly follow rpm (psi)

eop1Trip (Engine Oil Pressure Trip) – Show the trip line for the oil pressure, uses rpm and a safety factor to create a trace, if EOP drops below this line for 2 seconds the engine will turn off. (psi)

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

rpm (Engine Speed) – Displays current engine speed (rpm)

TEMPS WORKSHEET

Temperatures Graph

act1 (Air Charge Temperature) – Displays inlet air temperature, (used for fuelling corrections) (°)

bap (Barometric Pressure) – Displays atmosphere pressure, absolute (mBar)

ect1 (Engine Coolant Temperature) – Displays water temperature. (°)

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why. Logging Rate (Event)

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

fan1 (LH Cooling Fan) – Displays the on/off state of the fan, comes on at a certain temperature depending on the model.

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear.

GEARS WORKSHEET

Gearbox Check Graph

clutchSwitch (Clutch Switch) – Neutral Button on the Steering Wheel/ pressure sensor, the channel displays the on/off state of the button

frSpeed (Front Right Wheel Speed) – Shows the speed of the front right wheel (mph)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

gearV (Gear Position Sensor Voltage) – Displays the position of the selector barrel (V)

gsp (Gear System Pressure) – Shows the air pressure for the paddle shift system. (mBar)

gspControl (Gear System Pressure Control) – Shows the on/off cycle of the compressor for the paddleshift system

PaddleSwitch (Paddle Switch) – Displays the input of the paddles from the ECU

rpm (Engine Speed) – Displays current engine speed (rpm)

tps1 (Throttle Body Position) – Shows the amount the throttle body is opening (%)

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

gearCutDogKickCount (Incomplete Gearshift's) – Displays interpreted number of failed gear changed suspected to be dog kicks (Count)

gearShiftDecision (Gear Shift Decision) – Displays why a gear change has been dis-allowed by the ECU, the ECU will not allow the car to downshift if the 'rpm is too high' for example.

lam1 (Lambda) – Displays air/fuel ratio post combustion measured in the exhaust (:)

GENERAL WORKSHEET

General Checks Graph

clutchSwitch (Clutch Switch) – Clutch switch on the pedal, the channel displays the on/off state of the switch

dip1 (direct injection pressure) – Shows fuel pressure provided by high pressure pump (Bar)

flSpeed (Front Left Wheel Speed) – Shows the speed of the front left wheel (mph)

fp1 (Fuel Rail Pressure) / **fpp** (fuel pump pressure) – Shows fuel pressure provided by the pump (Bar)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

gearV (Gear Position Sensor Voltage) – Displays the position of the selector barrel (V)

gsp (Gear System Pressure) – Shows the air pressure for the paddle shift system. (mBar)

ppsFinal (Pedal Position) – Displays the throttle pedal position (%)

rpm (Engine Speed) – Displays current engine speed (rpm)

syncState (SyncState) – Shows the state of synchronisation between the camshaft and crankshaft position sensor, 720 means both are reading together. (°)

tps1 (Throttle Body Position) – Shows the amount the throttle body is opening (%)

vbat (Car Battery Voltage) – Shows current battery voltage, this will drop when the compressor and or fan comes on (V)

Oil Pressure Check Graph

Cyl01Knock (Cylinder 1 Knock) – Displays knock sensor reading for cylinder 1 (%)

Cyl02Knock (Cylinder 2 Knock) – Displays knock sensor reading for cylinder 2 (%)

Cyl03Knock (Cylinder 3 Knock) – Displays knock sensor reading for cylinder 3 (%)

Cyl04Knock (Cylinder 4 Knock) – Displays knock sensor reading for cylinder 4 (%)

Cyl05Knock (Cylinder 5 Knock) – Displays knock sensor reading for cylinder 5 (%)

Cyl06Knock (Cylinder 6 Knock) – Displays knock sensor reading for cylinder 6 (%)

eop1 (Engine Oil Pressure) – Shows oil pressure, this will vary with temperature. The trace should roughly follow rpm (psi)

eop1DipCount (Oil Pressure Dip Count) – Shows the amount of times the oil pressure trace has dropped below the trip line

eop1Trip (Engine Oil Pressure Trip) – Show the trip line for the oil pressure, uses rpm and expected EOP to create a trace, if EOP drops below this line for 2 seconds the engine will turn off. (psi)

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

rpm (Engine Speed) – Displays current engine speed (rpm)

Reference Graph

airConSwitch (Air Conditioning Switch) – Displays the on/off cycle of the air conditioning

calSwitch (Calibration Switch) – Displays the input from the MAP switch on the steering wheel

dbw1Targ (Drive by Wire Target) – Displays the throttle position target (%)

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

gearCutDogKickCount (Incomplete Gearshift's) – Displays how many gear changes have failed (Count)

gearShiftDecision (Gear Shift Decision) – Displays why a gear change has been dis-allowed by the ECU, the ECU will not allow the car to downshift if the 'rpm is too high' for example

limpMode (Limp Mode Active) – Displays when the car is in limp mode, ECT Low for example

pitLimitActive (Pit Limiter Active) – Displays the on/off cycle of the pit limiter button

revCutActive (Ignition Cut Active) – Displays when the ignition is turned off for rev limiter for example

revLimitActive (Limiter Active) – Displays the points where the rev limiter is in use

syncFault (Sync Fault) – Displays the reason why the crank and cam sensors, are not in communication

alsSelect (TPS linearisation) – Displays selected TPS calibration

calSelect (ECU calibration) – Displays selected ECU calibration (Map)

cyl01KnockIgnRtd (Knock induced Ignition retardation cyl 1) – Displays the amount of Ignition retardation in degrees

cyl02KnockIgnRtd (Knock induced Ignition retardation cyl 2) – Displays the amount of Ignition retardation in degrees

cyl03KnockIgnRtd (Knock induced Ignition retardation cyl 3) – Displays the amount of Ignition retardation in degrees

cyl04KnockIgnRtd (Knock induced Ignition retardation cyl 4) – Displays the amount of Ignition retardation in degrees

TEMPS WORKSHEET

Temperatures Graph

ExMWJ_U03 (SR10 Exhaust Manifold Water Jacket) – Displays the dry head temperature (°)

aat (Ambient Air Temperature) – Displays the current ambient air temperature (°)

act1 (Air Charge Temperature) – Displays inlet air temperature, used to calculate fuelling (°)

bap (Barometric Pressure) – Displays atmosphere pressure, absolute (mBar)

ect1 (RXC Head Temperature) – Displays metal temperature of the cylinder head. (°)

egt1 (Exhaust Gas Temperature) – Displays temperature of exhaust gases. (°)

ect_U02 (Water Temperature) – Displays the coolant temperature in the engine.

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

fan1_RadFan (Front Cooling Fans) – Displays the on/off state of the fan, comes on at a certain temperature depending on the model

fan2 (Water Pump) – Displays the on/off state of the water pump

gbt_U15 (Gearbox Temperature) – Displays the temperature of the gearbox oil

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

BOOST WORKSHEET

Boost Level Graph

flSpeed (Front Left Wheel Speed) – Shows the speed of the front left wheel (mph)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

map1 (Manifold Absolute Pressure) – Displays the overall level of boost, including atmospheric pressure (mBar)

rpm (Engine Speed) – Displays current engine speed (rpm)

tps1 (Throttle Body Position) – Shows the amount the throttle body is opening (%)

trqFuelSev (Fuel Cut) – Displays the level of fuel cut (%)

wgMapTarg1 (MAP Target) – Displays the boost target (mBar)

Wastegate Graph

calSwitch (Calibration Switch) – Displays the input from the MAP switch on the steering wheel

wgBaseDuty1 (Wastegate Duty) – Displays the pre-defined duty that is applied by the ECU (%)

wgFinalDuty1 (Final Wastegate Duty) – Displays the actual duty needed to maintain the correct boost target (%)

DRIVER WORKSHEET (RXC)

ABS Graph

flSpeed (Front Left Wheel Speed) – Shows the speed of the front left wheel (mph)

frSpeed (Front Right Wheel Speed) – Shows the speed of the front right wheel (mph)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

rlSpeed (Rear Left Wheel Speed) – Shows the speed of the rear left wheel (mph)

rrSpeed (Rear Right Wheel Speed) – Shows the speed of the rear right wheel (mph)

Traction Control Graph

ppsFinal (Pedal Position) – Displays the throttle pedal position (%)

tcSelect (Traction Dial Position) – Displays the current setting for traction control

trqIgnRtd (Ignition Retard) – Displays the change in ignition angle to maintain traction (°)

EOP WORKSHEET

Oil Pressure Check Graph

eop1 (Engine Oil Pressure) – Shows oil pressure, this will vary with temperature. The trace should roughly follow rpm (psi)

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

rpm (Engine Speed) – Displays current engine speed (rpm)

GEARS WORKSHEET

General Graph

clutchSwitch (Clutch Switch) – Clutch switch on the pedal, the channel displays the on/off state of the switch

flSpeed (Front Left Wheel Speed) – Shows the speed of the front left wheel (mph)

frSpeed (Front Right Wheel Speed) – Shows the speed of the front right wheel (mph)

gbt_U15 (Gearbox Oil Temperature) - Displays the temperature of the gearbox oil (°)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

gearV (Gear Position Sensor Voltage) – Displays the position of the selector barrel (V)

gsp (Gear System Pressure) – Shows the air pressure for the paddle shift system. (mBar)

gspControl (Gear System Pressure Control) – Shows the on/off cycle of the compressor for the paddleshift system

PaddleSwitch (Paddle Switch) – Displays the input of the paddles from the ECU

rlSpeed (Rear Left Wheel Speed) – Shows the speed of the rear left wheel (mph)

rpm (Engine Speed) – Displays current engine speed (rpm)

rrSpeed (Rear Right Wheel Speed) – Shows the speed of the rear right wheel (mph)

tps1 (Throttle Body Position) – Shows the amount the throttle body is opening (%)

trqFuelSev (Fuel Cut) – Displays the level of fuel cut (%)

Reference Graph

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

gearCutDogKickCount (Incomplete Gearshift's) – Displays how many gear changes have failed (Count)

gearCutState (Shift Progress) – Displays the stage of a given shift

gearShiftDecision (Gear Shift Decision) – Displays why a gear change has been dis-allowed by the ECU, the ECU will not allow the car to downshift if the 'rpm is too high' for example

gearShiftState (Shift Review) ECU's interpretation of the state of the gearshift

lam1 (Lambda) – Displays air/fuel ratio post combustion, Bank 1 (:)

lam2 (Lambda) – Displays air/fuel ratio post combustion, Bank 2 (:)

GENERAL WORKSHEET

General Check Graph

clutchSwitch (Clutch Switch) – Clutch switch on the pedal, the channel displays the on/off state of the switch

flSpeed (Front Left Wheel Speed) – Shows the speed of the front left wheel (mph)

fp1 (Fuel Rail Pressure) – Shows fuel pressure provided by the pump (Bar)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

gsp (Gear System Pressure) – Shows the air pressure for the paddle shift system. (mBar)

ppsFinal (Pedal Position) – Displays the throttle pedal position (%)

rpm (Engine Speed) – Displays current engine speed (rpm)

syncState (SyncState) – Shows the state of synchronisation between the camshaft and crankshaft position sensor, 720 means both are reading together. (°)

tps1A (DBW Motor Position) – Shows the amount the DBW Motor is opening (%)

vbat (Car Battery Voltage) – Shows current battery voltage, this will drop when the compressor and or fan comes on (V)

Oil Pressure Check Graph

eop1 (Engine Oil Pressure) – Shows oil pressure - vary with temperature. The trace should roughly follow rpm (psi)

eop1DipCount (Oil Pressure Dip Count) – Shows the amount of times the oil pressure has dropped below the trip line

eop1Trip (Engine Oil Pressure Trip) – Show the trip line for the oil pressure, uses rpm and expected EOP to create a trace, if EOP drops below this line for 2 seconds the engine will turn off. (psi)

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

rpm (Engine Speed) – Displays current engine speed (rpm)

Reference Graph

dbw1Targ (Drive by Wire Target) – Displays the throttle position target (%)

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

gearCutDogKickCount (Incomplete Gearshift's) – Displays how many gear changes have failed (Count)

gearShiftDecision (Gear Shift Decision) – Displays why a gear change has been dis-allowed by the ECU, the ECU will not allow the car to downshift if the 'rpm is too high' for example

limpMode (Limp Mode Active) – Displays when the car is in limp mode, ECT Low for example

pitLimitActive (Pit Limiter Active) – Displays the on/off cycle of the pit limiter button

revCutActive (Ignition Cut Active) – Displays when the ignition is turned off for rev limiter for example

revLimitActive (Limiter Active) – Displays the points where the rev limiter is in use

OIL PRESSURE WORKSHEET

Oil Pressure Check Graph

eop1 (Engine Oil Pressure) – Shows oil pressure, this will vary with temperature. The trace should roughly follow rpm (psi)

eop1Trip (Engine Oil Pressure Trip) – Show the trip line for the oil pressure, uses rpm and expected EOP to create a trace, if EOP drops below this line for 2 seconds the engine will turn off. (psi)

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

revLimitActive (Limiter Active) – Displays the points where the rev limiter is in use

rpm (Engine Speed) – Displays current engine speed (rpm)

TEMPS WORKSHEET

Temperatures Graph

act1 (Air Charge Temperature) – Displays inlet air temperature, used to calculate fuelling (°)

ect1 (Head Temperature) – Displays metal temperature of the cylinder head. (°)

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

eot (Engine Oil Temperature) – Displays engine oil temperature. (°)

fan1 (Front Cooling Fans) – Displays the on/off state of the fan, comes on at a certain temperature depending on the model

flSpeed (Front Left Wheel Speed) – Shows the speed of the front left wheel (mph)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

DBW WORKSHEET

Reference Graph

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

gearShiftDecision (Gear Shift Decision) – Displays why a gear change has been dis-allowed by the ECU, the ECU will not allow the car to downshift if the 'rpm is too high' for example

limpMode (Limp Mode Active) – Displays when the car is in limp mode, ECT Low for example

rpm (Engine Speed) – Displays current engine speed (rpm)

tps1A (DBW Motor Position) – Shows the amount the DBW Motor is opening (%)

tps1B (Throttle Body Position) – Shows the amount the Throttle Body is opening (%)

PPS Graph

ppsA (Pedal Position) – Displays the throttle pedal position (%)

ppsB (Pedal Position) – Displays the throttle pedal position (%)

ppsFinal (Pedal Position) – Displays the throttle pedal position (%)

GEARS WORKSHEET

General Graph

clutchSwitch (Clutch Switch) – Clutch switch on the pedal, the channel displays the on/off state of the switch

flSpeed (Front Left Wheel Speed) – Shows the speed of the front left wheel (mph)

frSpeed (Front Right Wheel Speed) – Shows the speed of the front right wheel (mph)

gear (Current Gear) – Converts the gear voltage provided front the gear position sensor into a gear

gearV (Gear Position Sensor Voltage) – Displays the position of the selector barrel (V)

gsp (Gear System Pressure) – Shows the air pressure for the paddle shift system. (mBar)

gspControl (Gear System Pressure Control) – Shows the on/off cycle of the compressor for the paddleshift system

PaddleSwitch (Paddle Switch) – Displays the input of the paddles from the ECU

rpm (Engine Speed) – Displays current engine speed (rpm)

Reference Graph

engineEnable (Engine Enable) – Displays what trips have occurred, if the car has been turned off by the ECU this channel will tell you why

gearCutDogKickCount (Incomplete Gearshift's) – Displays how many gear changes have failed (Count)

gearShiftDecision (Gear Shift Decision) – Displays why a gear change has been dis-allowed by the ECU, the ECU will not allow the car to downshift if the 'rpm is too high' for example

lam1 (Lambda) – Displays air/fuel ratio post combustion, Bank 1 (:)

lam2 (Lambda) – Displays air/fuel ratio post combustion, Bank 2 (:)

trqFuelSev (Fuel Cut) – Displays the level of fuel cut (%)

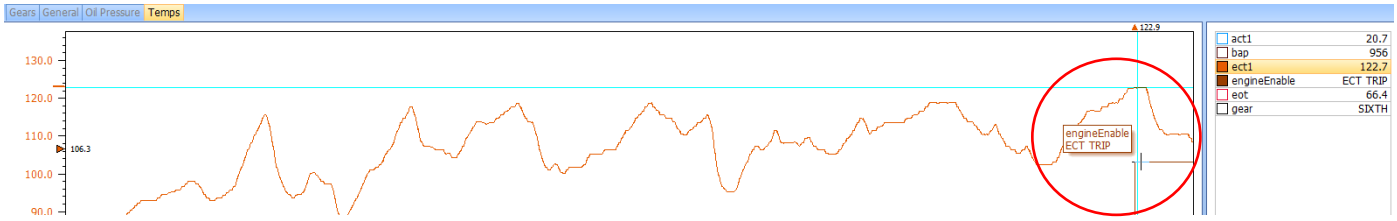
EXPECTED RUNNING PARAMETERS

The below table shows target running parameters as well as hints on what faults to look out for on specific channels.

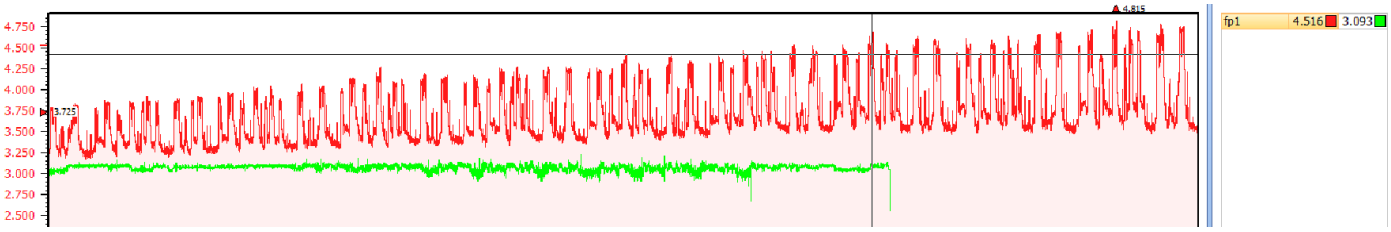
Sensor	***Description***	***Parameters***	***Default***
EOP	Check for surge, low pressure	Busa 65psi+	0
FP1	Check for noise, high return when off throttle (blocked regulator) and fuel surge (low fuel level)	2.8-3.1	0
VBAT	Low voltage (-13v) check for consistent charging sudden drops should only be caused by compressor and Fan1	13v-14.4v	0
engineEnable	Shows reason for engine trips	N/A	OK
ECT	Check for noise, a big variance between high and low may be because of low water level	75-85	150
EOT	Check for noise and low temperature	90-110	150
gearV	Check for straightness of the shifts, should be sharp lines gradual shifts means slow gear change.	N/A	0
TPS	Check for rolling onto full throttle, 4% when off throttle, 25% blips and not noisy when on full throttle	Busa 4-100%	0
SYNCSTATE	Should be 720 all the time if the engine is running, if running in 360 (Cam sensor failure)	720	N/A
revLimitActive	Check for persistent use of the limiter	N/A	0
gearShiftDecision	Shows reason for any disallowed shifts	N/A	OK
RPM	Check for misfire, not dropping out	N/A	0
GSP	Check pressure comes back up, check for leaks when fully charged	6-7bar	0
BAP	Check for noise, value is altitude dependant	950-1050mbar	1013
frSpeed	Check for shorting (erratic trace) check for dropping out or a lower reading than normal	N/A	0
ACT	Check for default reading and unrealistic readings. Ambient +10-20.	10-50	10

EXAMPLES OF PROBLEMS IN THE DATA

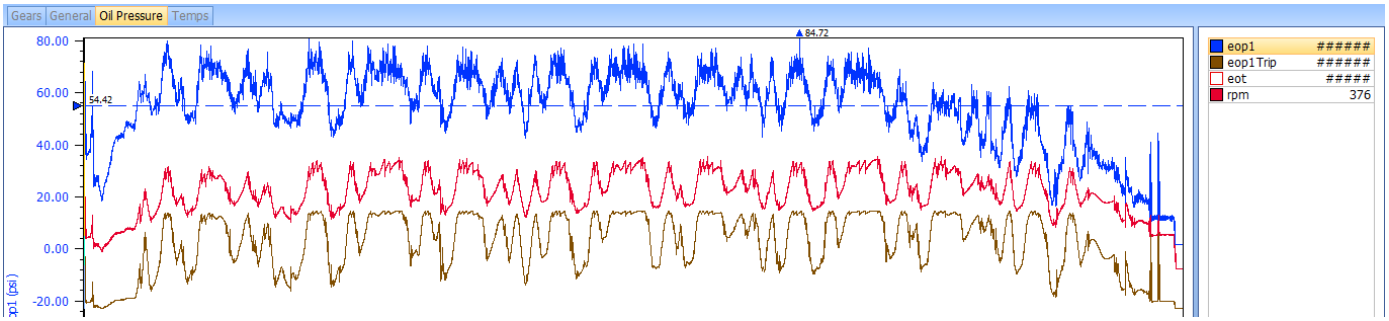
Below is an example of an 'ECT Trip' this is the trip for high coolant temperature. The engine will have switch off and a warning displayed on the dash at this point.



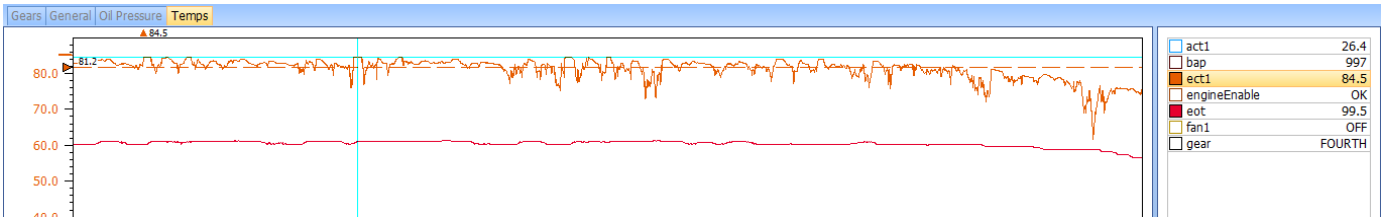
This is an example of high fuel pressure; the fuel pressure exceeds the regulated pressure in this instance, the green trace shows where the fuel pressure should be.



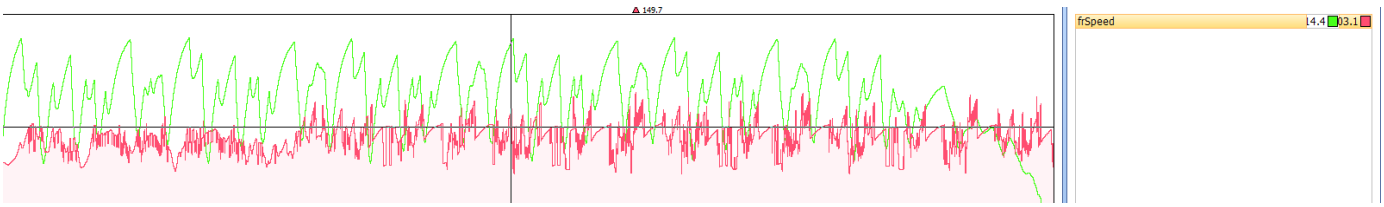
Below is an example of the oil pressure dropping off: The oil pressure should follow the same trend as the RPM. The pressure falls away from the RPM towards the end as shown.



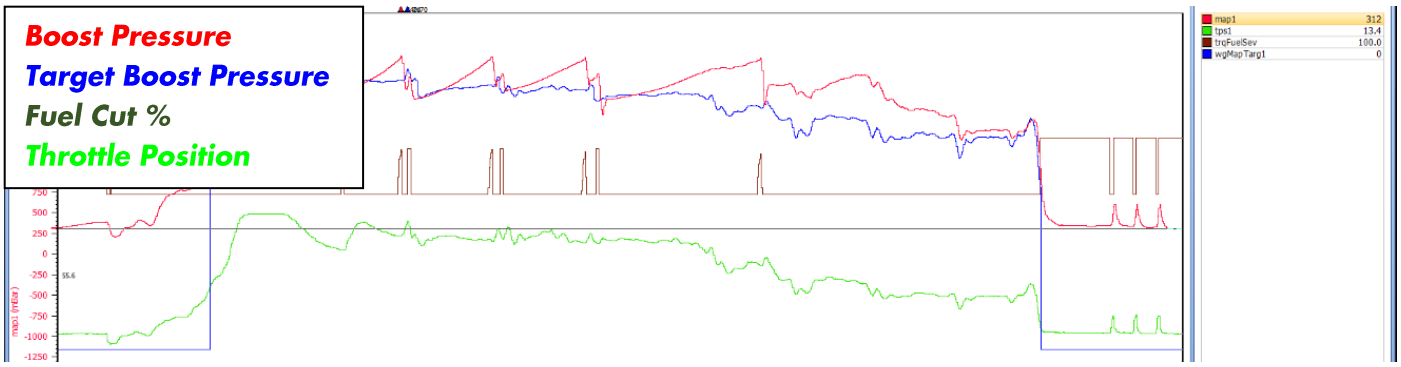
Below is an example of a noisy sensor, the bottom line is what the trace should look like and the top trace contains excessive noise.



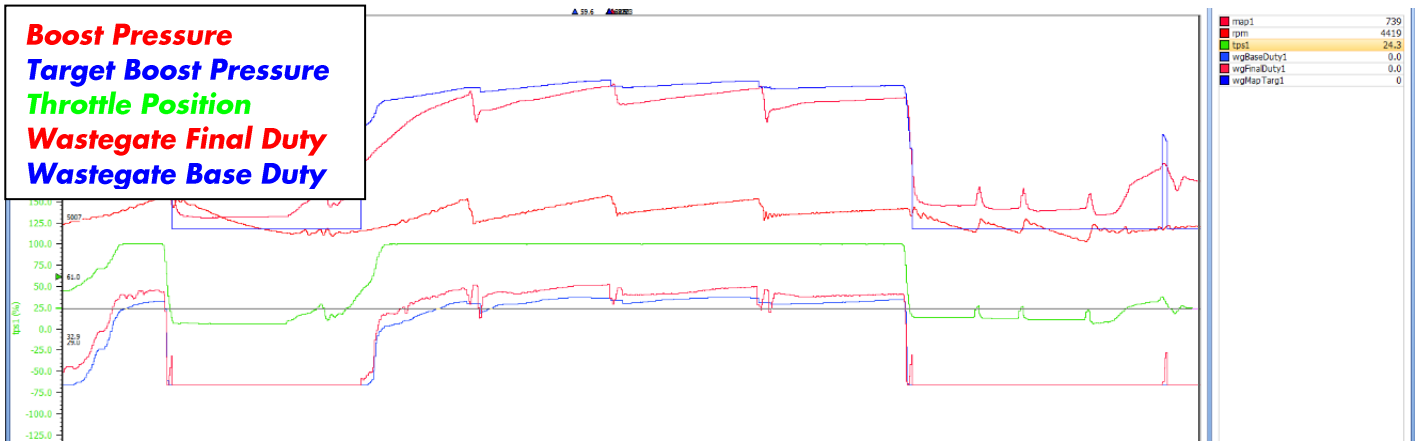
Below is an example of a bad wheel speed reading, it is likely that the hall effect sensor is not registering one of the four pickup points, which is the reason it is reading incorrectly.



Below is an example of overboosting on an RXC GT3, the blue trace is the MAP target, the red trace is the actual boost pressure, MAP. As you can see it is going over the target by a large amount, even when full throttle is not being applied. The most common cause of this, is a wastegate issue. Other causes could be the lines going to the wastegate actuators have melted or rubbed through, so the air coming from the solenoid is unable to get to the actuators. The boost solenoid will fail in the fully open position so in theory the car would under boost if this was to fail. The brown trace below is the fuel cut, the ECU will cut 80% of the fuel temporarily for a gearchange, this is normal, these are the cuts with the square shape. Just before the gearchanges there are some spiky cuts, these are boost limit cuts, where the ECU is cutting the fuel to prevent the boost exceeding the limit. The ECU will be decreasing the wgFinalDuty to try and reduce the boost pressure, this diverts air to the wastegate actuators to force them open.

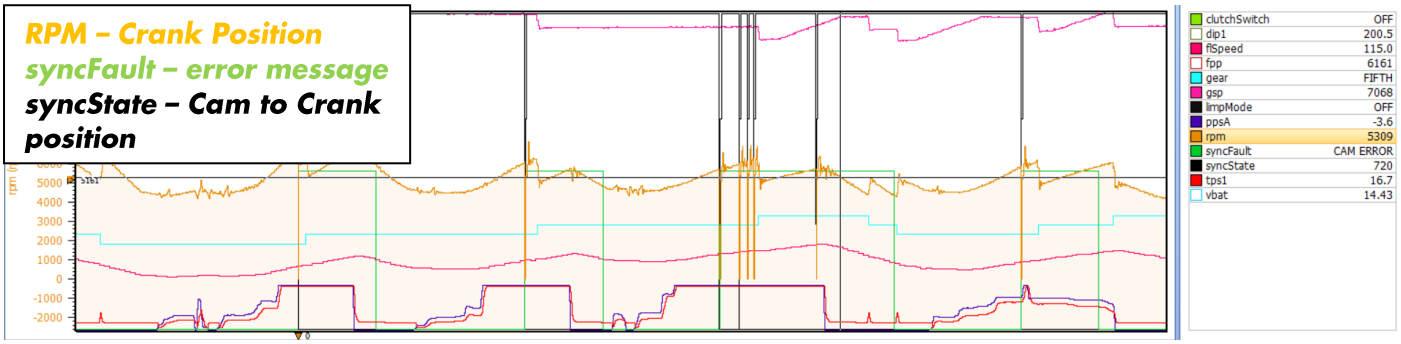


Below is an example of underboosting, again the blue trace is the MAP target, the red trace is the actual boost pressure, MAP. It is lower than the target pressure. The ECU is applying additional duty to try and bring the boost pressure up to the target but it is still not reaching its target. This could be a number of things, check the operation of the boost solenoid. The boost solenoid will fail in the fully open position (diverting all air to the wastegate actuators). A split boost pipe, a leak in the intercooler could cause underboosting. If the turbo's have done 100+ hours and there are no faults elsewhere it is likely the turbo's will need to be replaced.

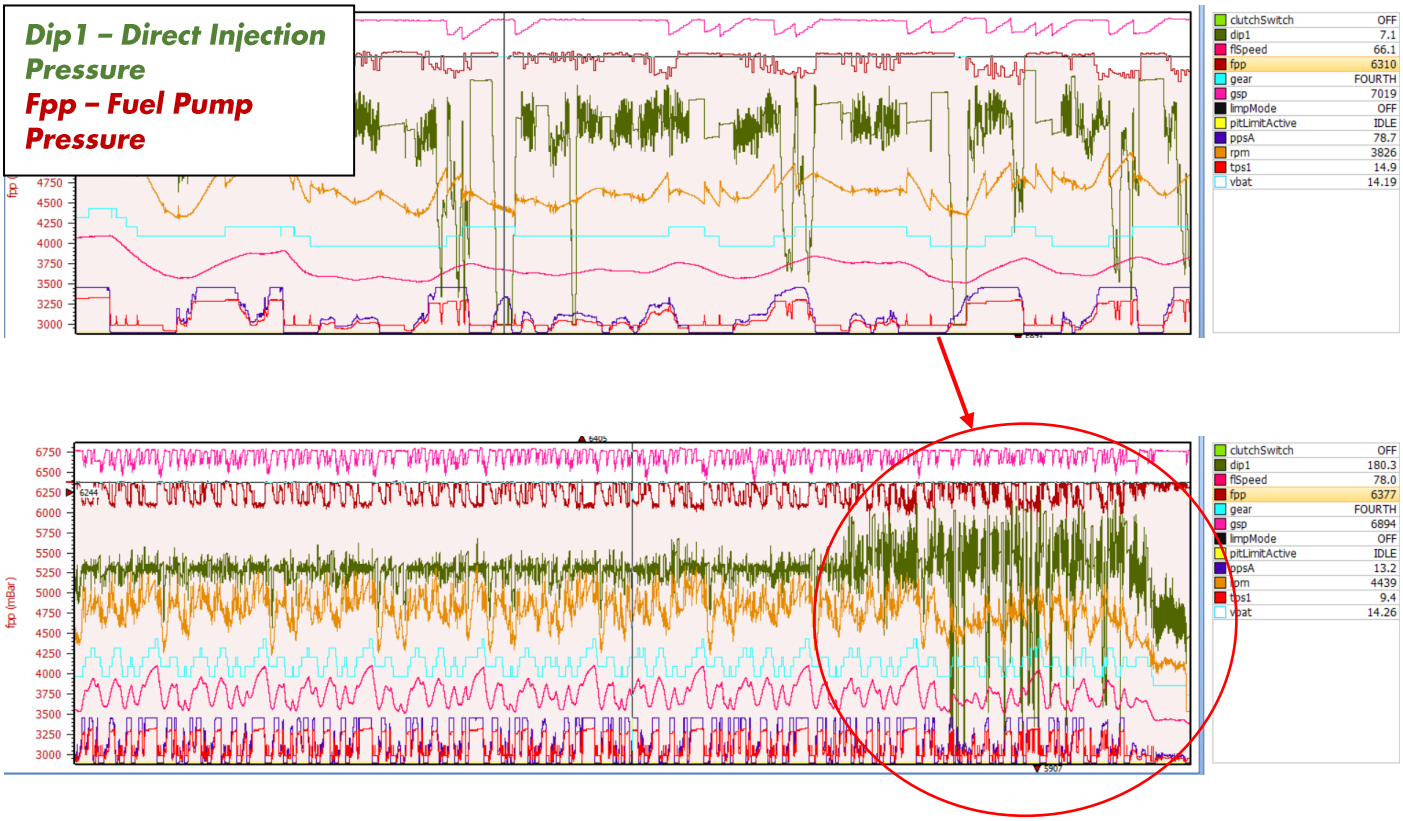


Below is an example of an SR10 data where syncState is dropping to 360 and later into turn. At the same time, we can observe an RPM signal drop out. In majority of these situations, it would point towards an issue with Crank Position Sensor however, the latest ECU calibration is allowing you to review a channel named syncFault. This channel is used to determine a correct functioning of Cam Position Sensors. The below data is revealing an issue on one of the Cam Position Sensors or attached wiring. RPM is an engine speed reading from crank position sensor. syncFault is a calculated channel providing a fault message when inlet and exhaust cam shafts are not in sync. or if one of the sensors is reading incorrectly/not reading at all. syncState is a channel combining a full rotation of crank shaft (360°) and full rotation of cam shafts (360°) If both readings are received by an ECU the syncState will be 720 (360°+360°).

SyncState and SyncFault not accessible under customer access



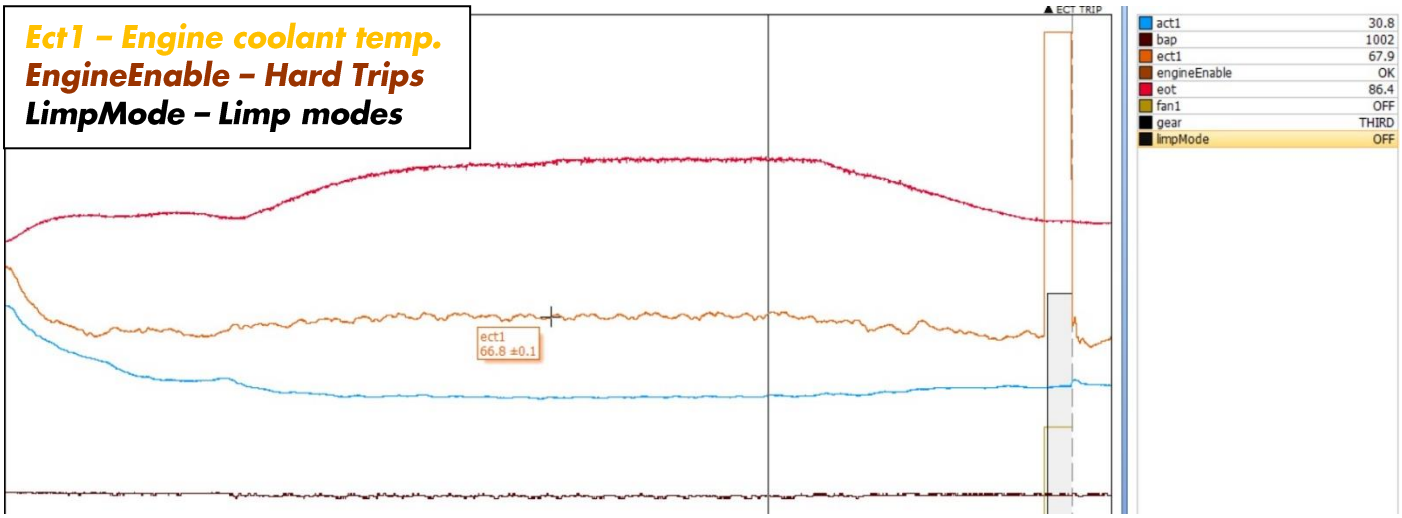
Below is an example of an SR10 data where dip1 – Direct Injection Pressure is dropping out. This issue would represent itself as a power cut. Direct injection pump is being fed 6 bar of fuel pressure from in-tank fuel pump seen on data as FPP. This channel needs to be checked first when dip1 drops out to rule out fuel supply issue. Dip pump is mechanically propelled by exhaust camshaft and operated by a solenoid. The most common issue is a loss of connection between ECU and DIP solenoid caused by vibration or contamination inside the terminal. If this is ruled out the problem could be a faulty DIP sensor (high fuel pressure sensor located underneath the inlet manifold) or attached wiring. The average dip1 pressure on idle should be around 90Bar and reaching up to 200Bar at high RPM.



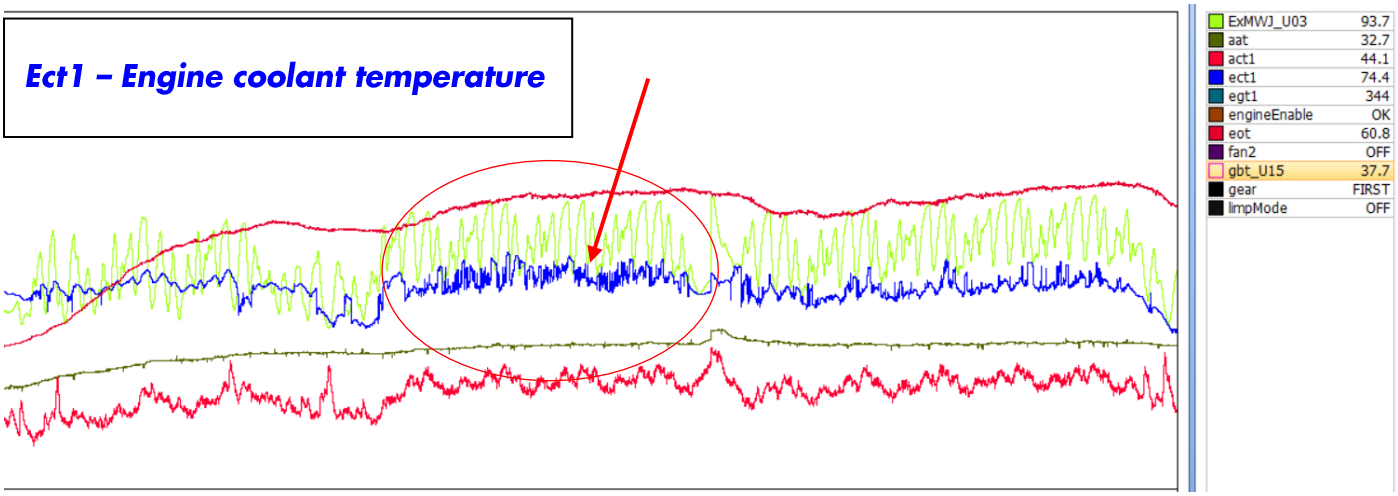
Below is an example of an SR3 XXR data where the car entered the Limp Mode – ECT Trip. Please note that while this Limp Mode is named "ECT Trip" it is not an actual trip until you can observe it in Engine Enable channel.

Limp Mode – ECT Trip is engaged when the engine coolant temperature drops below 57.5°C after initial warmup as a result of overcooling (not enough blanking) or in the case where the coolant was lost and the sensor is no longer submerged in coolant and therefore reading lower temperature.

Engine Enable – ECT Trip is a protection mode where the ECU turns the engine off "Hard Trip" as a result of complete coolant temperature sensor failure or loss of signal between the ECU and the sensor due to wiring issue.

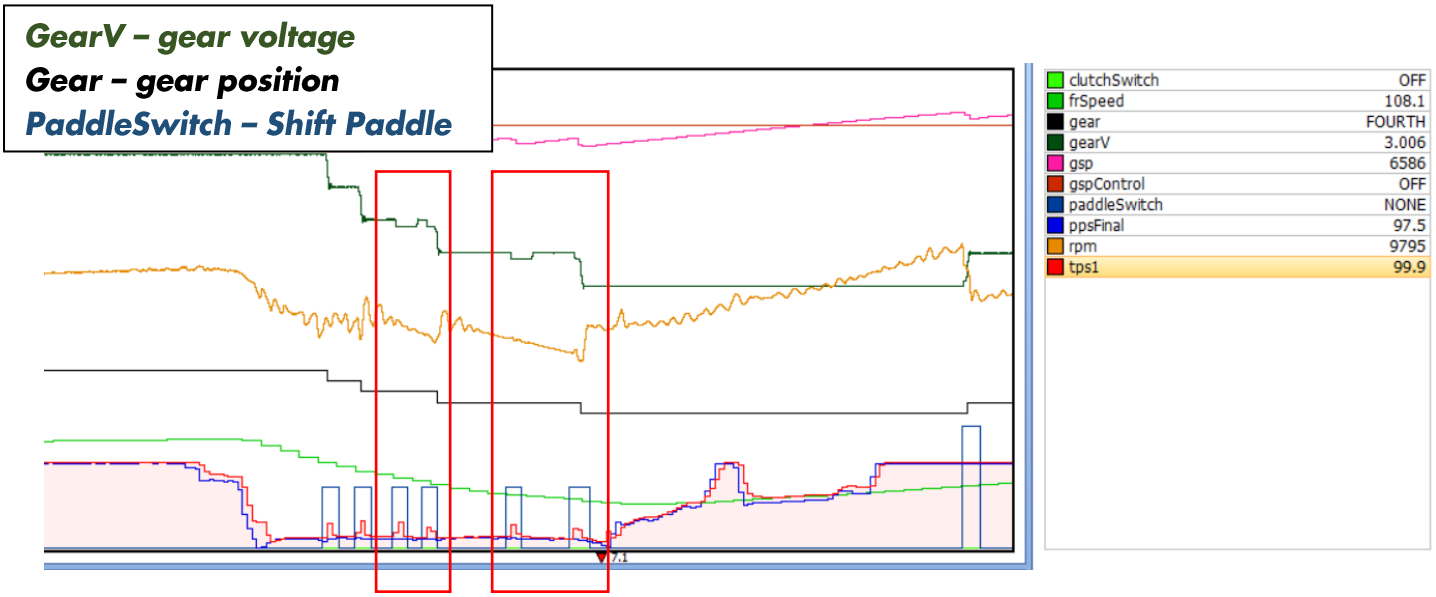


Below is a data example of a failing engine coolant temperature sensor ECT1. When the changes happen faster than they could in a real life we consider this information unrealistic therefore not true. It is impossible for water temperature in closed system to change 10°C or more in a fraction of a second. The issue could be a faulty sensor or connection/wiring.

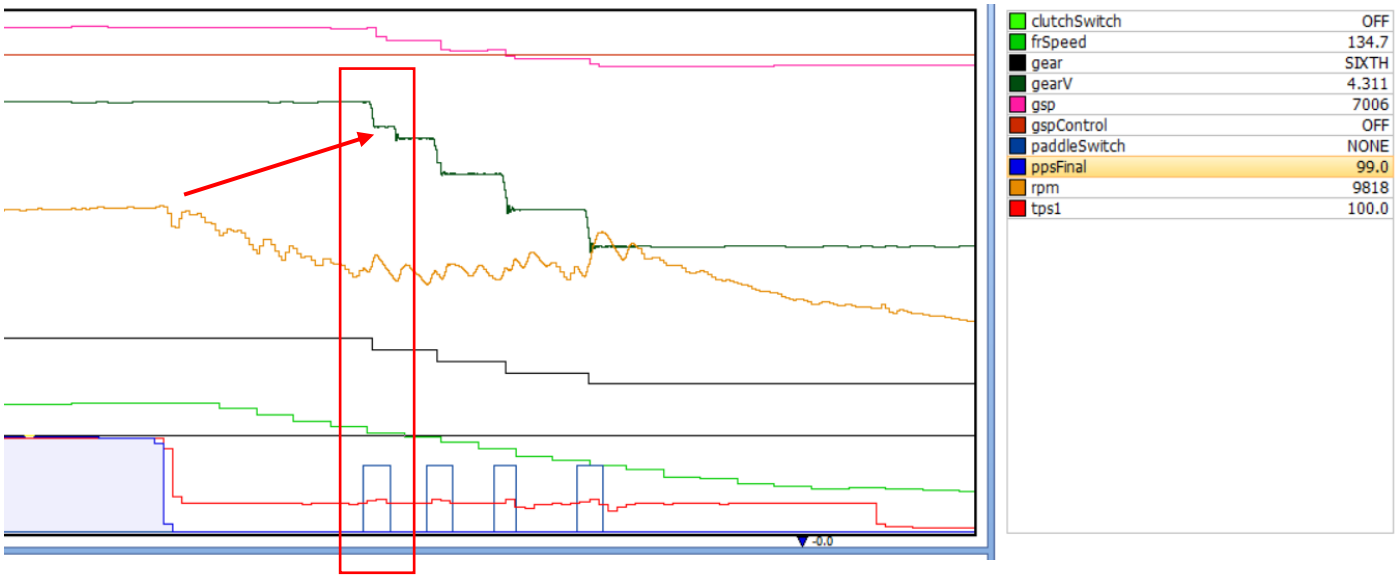


Below are two examples of what could be referred to as shifting issues.

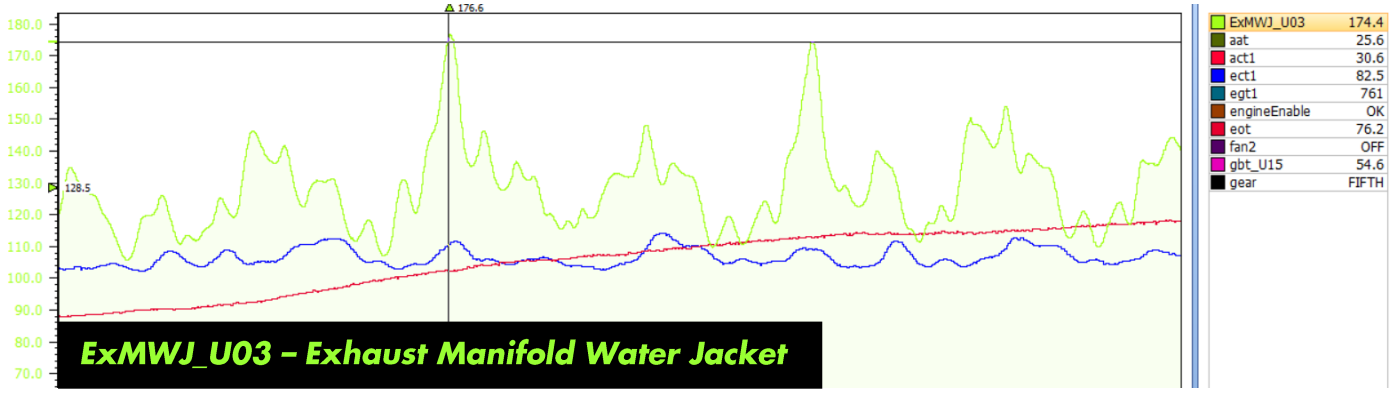
In the first example we can observe a downshift request with only a partial barrel rotation where the downshift request does not result in a gear change followed by another successful gear change request. We are monitoring gearV channel for barrel movements. This is the start of an issue. First check the shifting mechanisms on the outside of an engine before sending an engine off for RPE re-work.



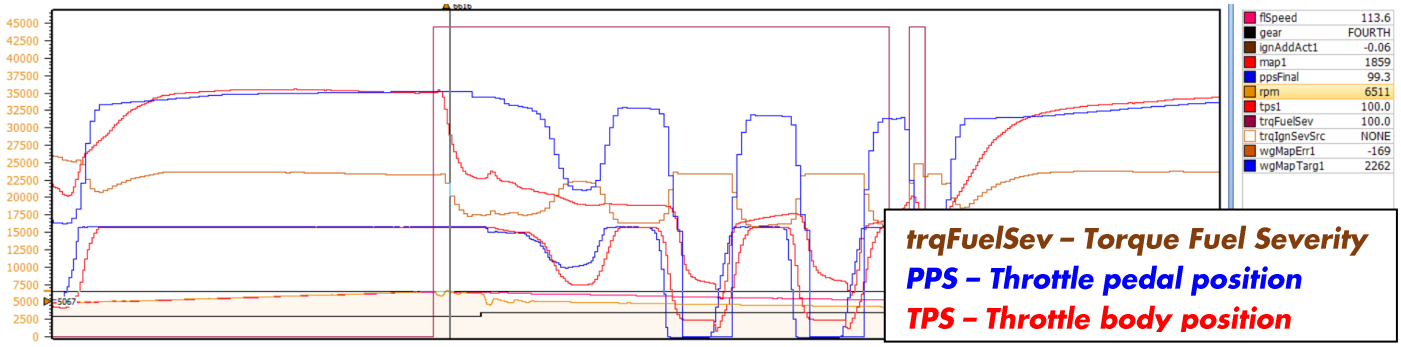
In the second example we can observe a partial barrel movement followed by another movement resulting in a gear change without second gear change request. This behaviour is not an issue as the gearbox is just waiting for torque to be reapplied to drop into gear.



Below is an example of an SR10 exhaust manifold water jacket overheating. All SR10's with calibration V1 - 711 onwards are protected against cylinder head damage during short high temperature exposure. Repeated and long term exposure will result in a terminal damage. The protection is delivered by a fuel cut if the ExMWJ_U03 reaches over 164.9°C. Once hight temperature spike is located a fuel cut can be confirmed via Boost Workbook under channel trqFuelSev.

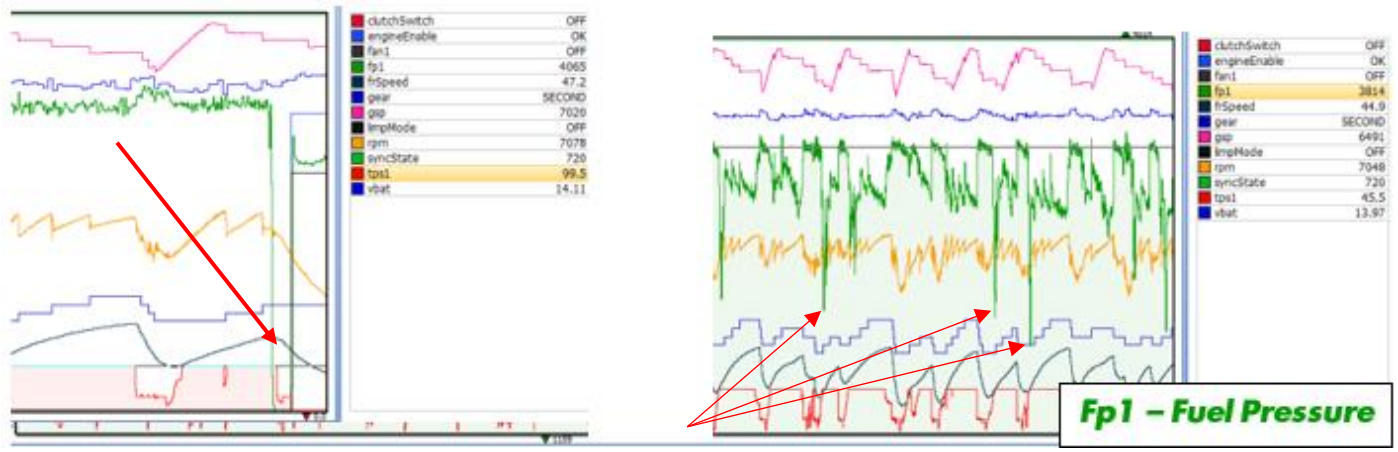


In the Boost Workbook observe the trqFuelSev channel at 100 meaning 100% fuel cut while the PPS and TPS are still at full meaning that the ECU is already trying to protect the engine while the driver is still unaware of an issue. The most common cause of this scenario is a low coolant level and an air lock inside the cylinder head. Stop the car immediately and follow the procedure for bleeding of the cooling system found in the owner's manual.



Below are two examples of a fuel pressure issue.

The example on left side is an instant fuel cut where the pressure drops from 4 Bar to 0 Bar because of a fuel pump failure
The example on right side is called fuel surge which can be a result of an insufficient fuel level, blocked pickup or a loose fuel pump moving around inside the fuel tank.



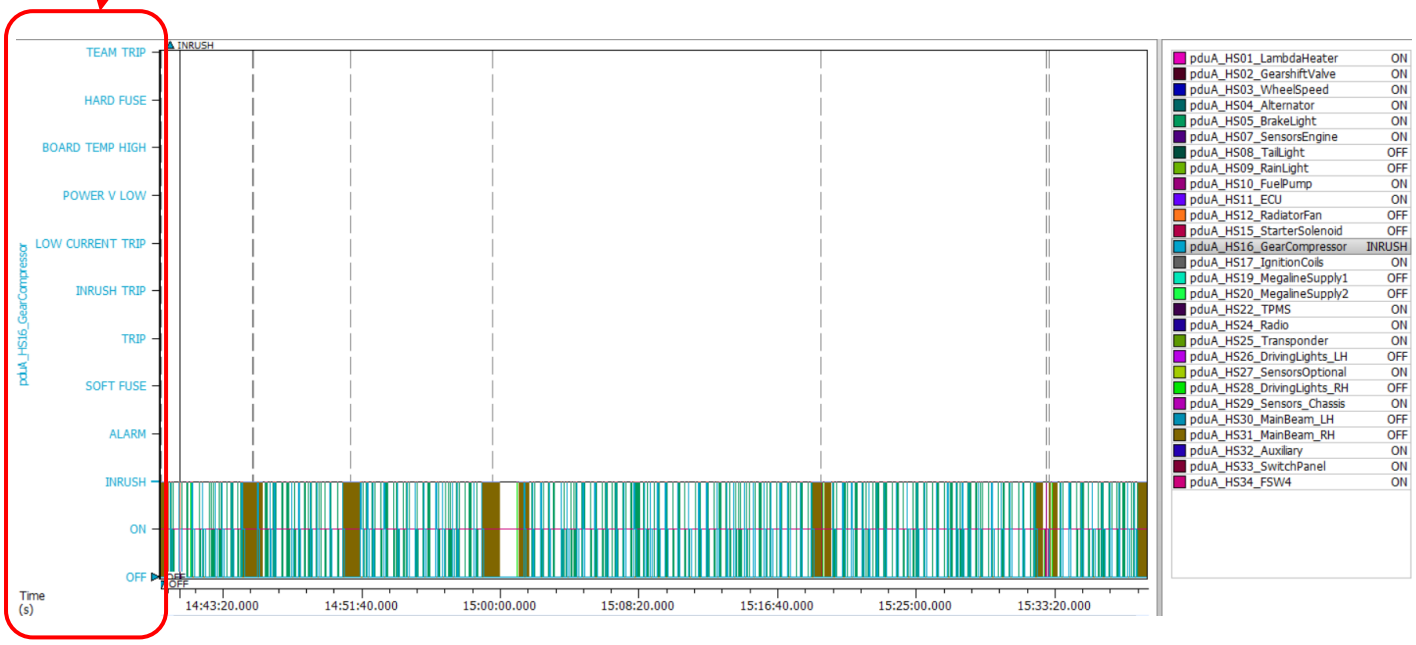
PDU OUTPUT

Amount of current supplied to ¬

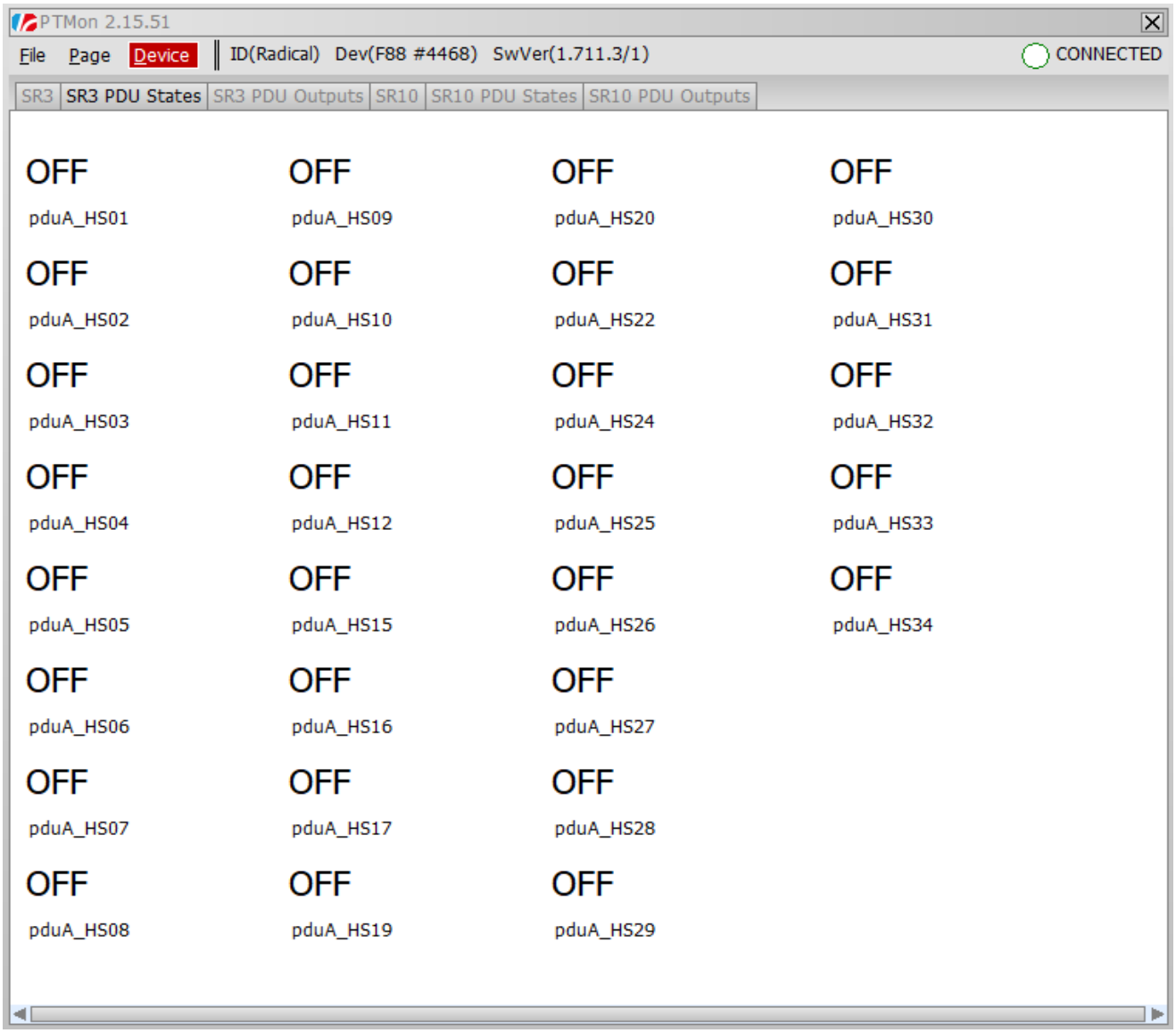
pduA_ATOT	14.2	**The sum of all current supplied by the PDU**
pduA_HS01A_LambdaHeater	0.0	
pduA_HS02A_GearshiftValve	0.0	
pduA_HS03A_WheelSpeed	0.0	
pduA_HS04A_Alternator	0.0	
pduA_HS05A_BrakeLight	0.0	
pduA_HS07A_SensorsEngine	0.0	
pduA_HS08A_TailLight	0.0	
pduA_HS09A_RainLight	0.2	
pduA_HS10A_FuelPump	7.6	
pduA_HS11A_ECU	2.6	
pduA_HS12A_RadiatorFan	0.0	
pduA_HS15A_StarterSolenoid	0.0	
pduA_HS16A_GearCompressor	0.0	
pduA_HS17A_IgnitionCoils	2.6	
pduA_HS19A_MegalineSupply1	0.0	**Not in use**
pduA_HS20A_MegalineSupply2	0.0	**Not in use**
pduA_HS22A_TPMS	0.0	
pduA_HS24A_Radio	0.0	
pduA_HS25A_Transponder	0.0	
pduA_HS26A_DrivingLights_LH	0.0	
pduA_HS27A_SensorsOptional	0.0	
pduA_HS28A_DrivingLights_RH	0.2	
pduA_HS29A_Sensors_Chassis	0.0	
pduA_HS30A_MainBeam_LH	0.0	
pduA_HS31A_MainBeam_RH	0.0	
pduA_HS32A_Auxiliary	0.0	**Optional – Not in use**
pduA_HS33A_SwitchPanel	0.0	
pduA_HS34A_FSW4	0.6	

PDU STATE

Status	Meaning
On	System is turned On and functioning
Inrush	Output is in the specified inrush phase of power delivery
Alarm	Steady state output current has risen above the specified alarm limit for the specified period of time
Soft Fuse	Software controlled output fuse
Trip	Output has tripped due to rising above the specified steady state current limit for the specified period of time
Inrush Trip	Output has tripped during the inrush phase due to rising above the specified inrush current limit for the specified period of time
Low Current Trip	Output has tripped due to be falling below the specified current low limit for the specified period of time
Power V Low	Output has tripped due to be falling below the specified current low limit for the specified period of time
Board Temp High	Output has tripped due to the PDU board exceeding its temperature limit
Hard Fuse	Hardware controlled output fuse
Team Trip	Trip on multiple outputs working together as one

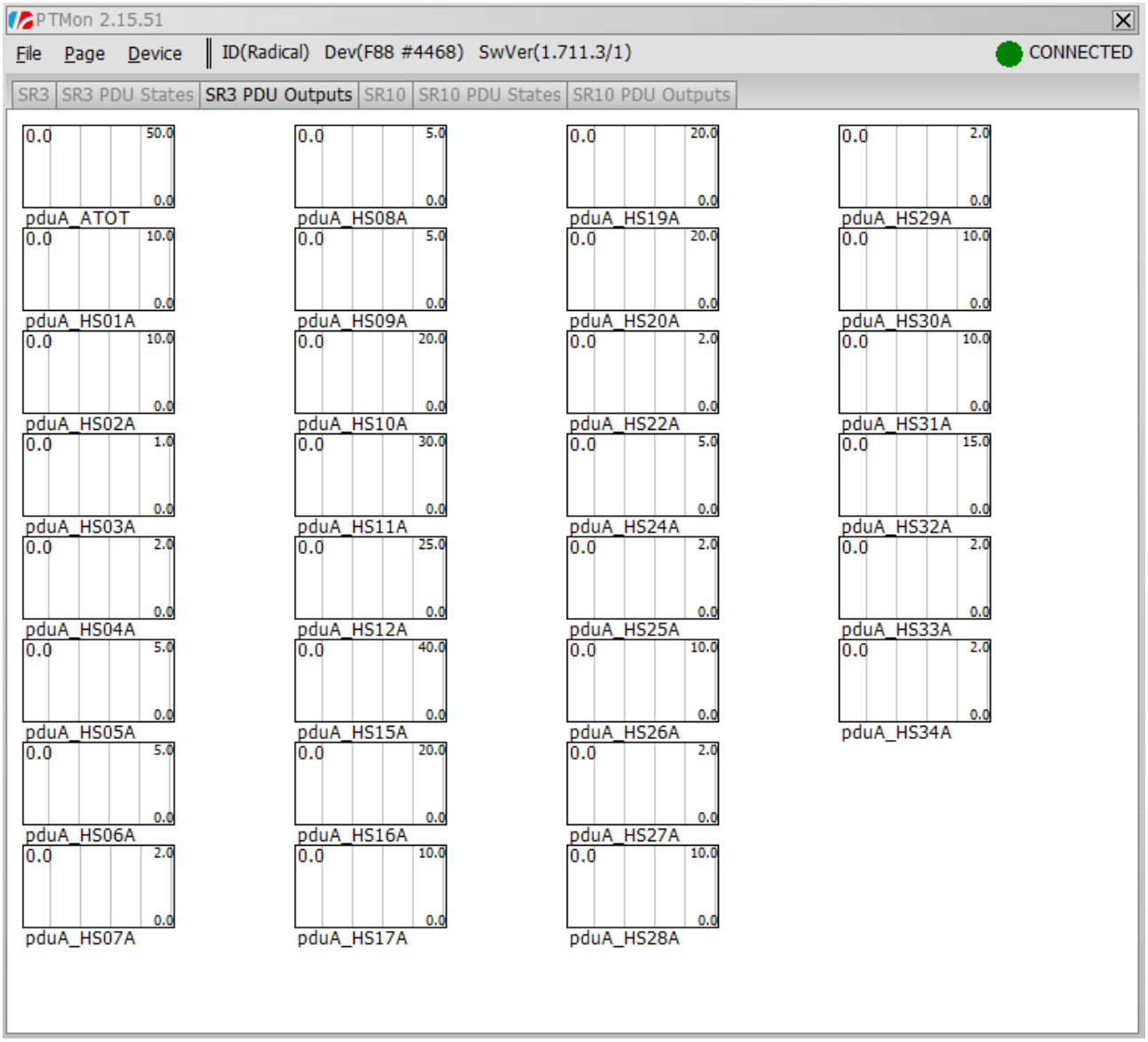


PT-MON – PDU CHANNEL STATUS PAGE



Channel	Allocation	Channel	Allocation
pduA_HS01	Lambda Heater	pduA_HS19	Auxiliary Supply
pduA_HS02	Gearshift Valve	pduA_HS20	Auxiliary Supply
pduA_HS03	Wheel Speed	pduA_HS22	TPMS
pduA_HS04	Alternator	pduA_HS24	Radio
pduA_HS05	Brake Light	pduA_HS25	Transponder
pduA_HS06	24V charging module (optional)	pduA_HS26	Driving Lights LH
pduA_HS07	Sensors Engine	pduA_HS27	Sensors Optional
pduA_HS08	Taillight	pduA_HS28	Driving Lights RH
pduA_HS09	Rain Light	pduA_HS29	Sensors Chassis
pduA_HS10	Fuel Pump	pduA_HS30	Main Beam LH
pduA_HS11	ECU	pduA_HS31	Main Beam RH
pduA_HS12	Radiator Fan	pduA_HS32	Auxiliary Supply
pduA_HS15	Starter Solenoid	pduA_HS33	Switch Panel (Keypad)
pduA_HS16	Gear Compressor	pduA_HS34	Steering Wheel
pduA_HS17	Ignition Coils		

PT-MON – PDU CURRENT OUTPUT PAGE



Channel	Allocation	Channel	Allocation
pduA_ATOT	All Outputs combined	pduA_HS17A	Ignition Coils
pduA_HS01A	Lambda Heater	pduA_HS19A	Auxiliary Supply
pduA_HS02A	Gearshift Valve	pduA_HS20A	Auxiliary Supply
pduA_HS03A	Wheel Speed	pduA_HS22A	TPMS
pduA_HS04A	Alternator	pduA_HS24A	Radio
pduA_HS05A	Brake Light	pduA_HS25A	Transponder
pduA_HS06A	24V charging module (optional)	pduA_HS26A	Driving Lights LH
pduA_HS07A	Sensors Engine	pduA_HS27A	Sensors Optional
pduA_HS08A	Taillight	pduA_HS28A	Driving Lights RH
pduA_HS09A	Rain Light	pduA_HS29A	Sensors Chassis
pduA_HS10A	Fuel Pump	pduA_HS30A	Main Beam LH
pduA_HS11A	ECU	pduA_HS31A	Main Beam RH
pduA_HS12A	Radiator Fan	pduA_HS32A	Auxiliary Supply
pduA_HS15A	Starter Solenoid	pduA_HS33A	Switch Panel (Keypad)
pduA_HS16A	Gear Compressor	pduA_HS34A	Steering Wheel

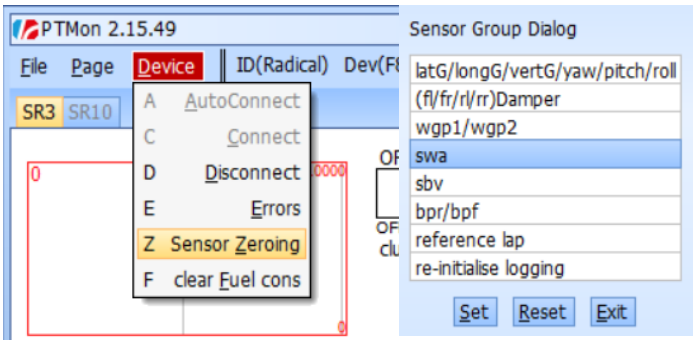
ZEROING TELEMETRY SENSORS VIA PT-mon

Telemetry sensors can be zeroed using PT-mon application.

Follow –
PT-mon – Device – Connect – Device – Sensor Zeroing

Choose required channel and press Set.

To view live values, use Life-mon application.



PDUX SETUP

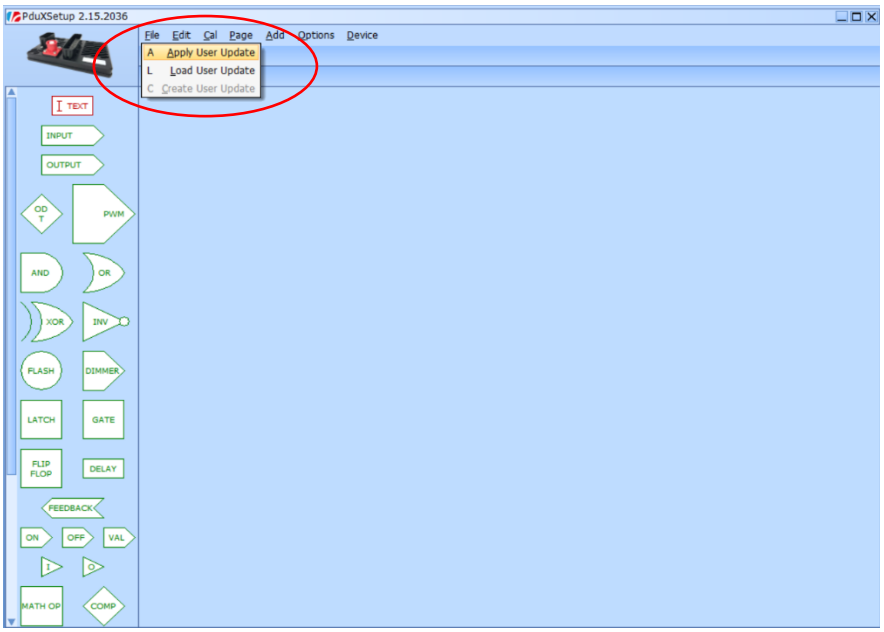
This program will rarely need to be used. Its sole function for end user is to update the PDU calibration remotely, customers do not have access to change calibrations but with PduX Setup a calibration update file can be sent by the Factory and updated by the customer.

If the PDU was replaced for example, and the ECU is unable to be sent to the factory a 'User Update Calibration' can be sent.

To use this program you need an ***.PDUU*** file.

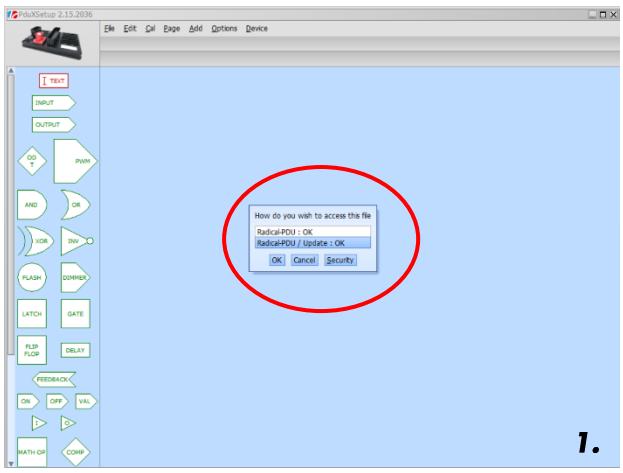
Open '***PduXSetup***' the select '***User Update***' and '***Apply User Update***'

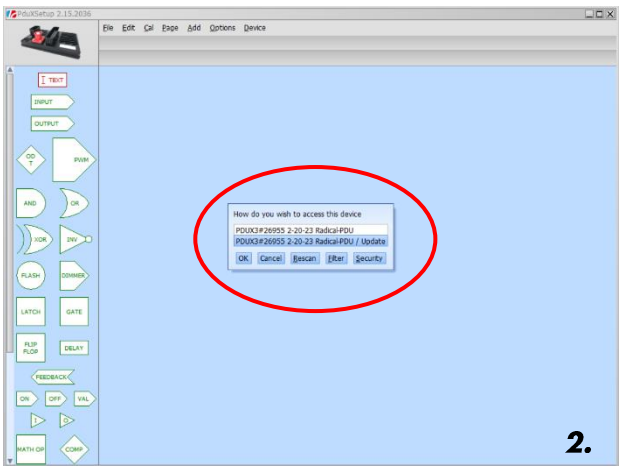
You will then need to select the '***.PDUU***' file.



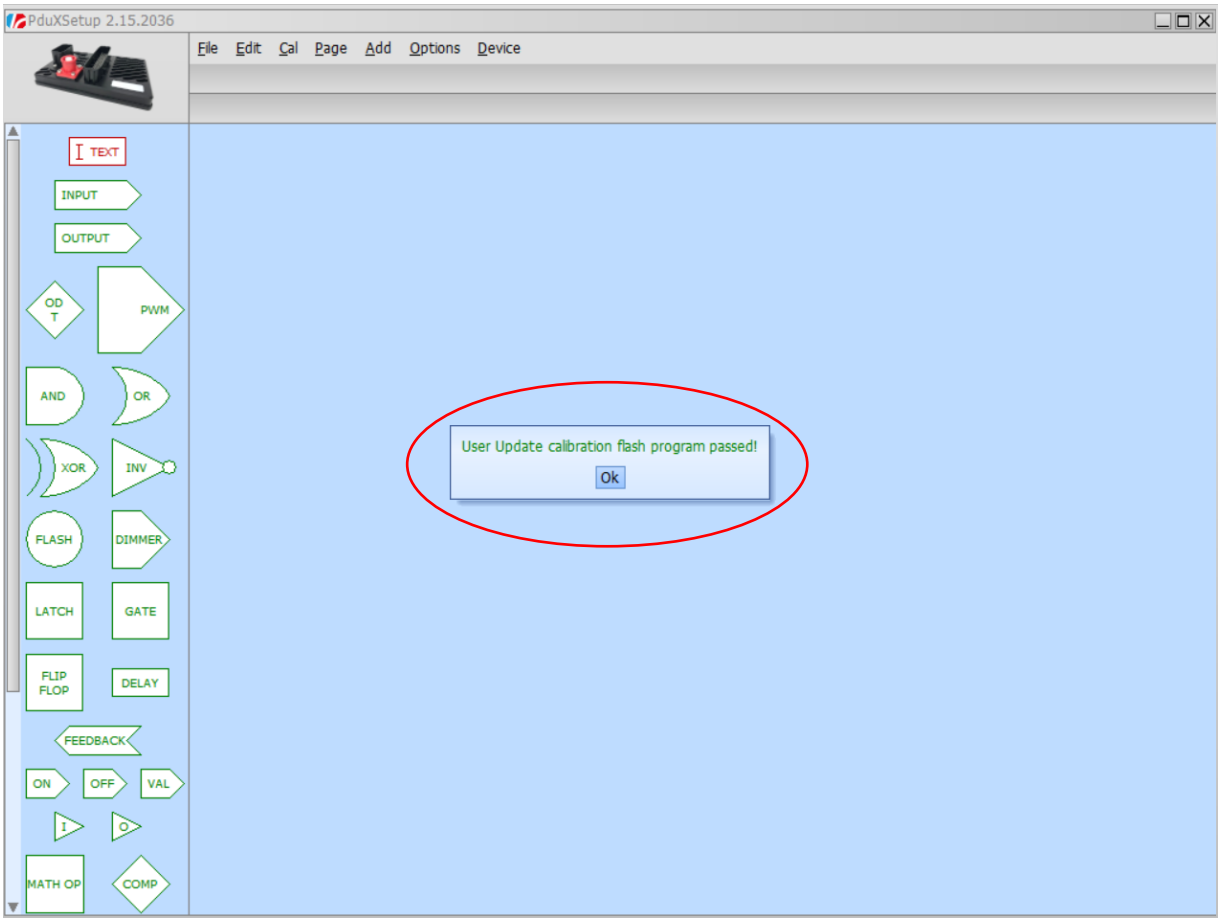
Access file through '***Radical-PDU / Update***' then press '***OK***' (figure1.)

Access device through '***PDUX3#_S.N._ date Radical-PDU/Update'*** then press '***OK***' (figure2.)





When message '***User Update Calibration Flash Program Passed***' appears press '***OK***' which means the process is complete.



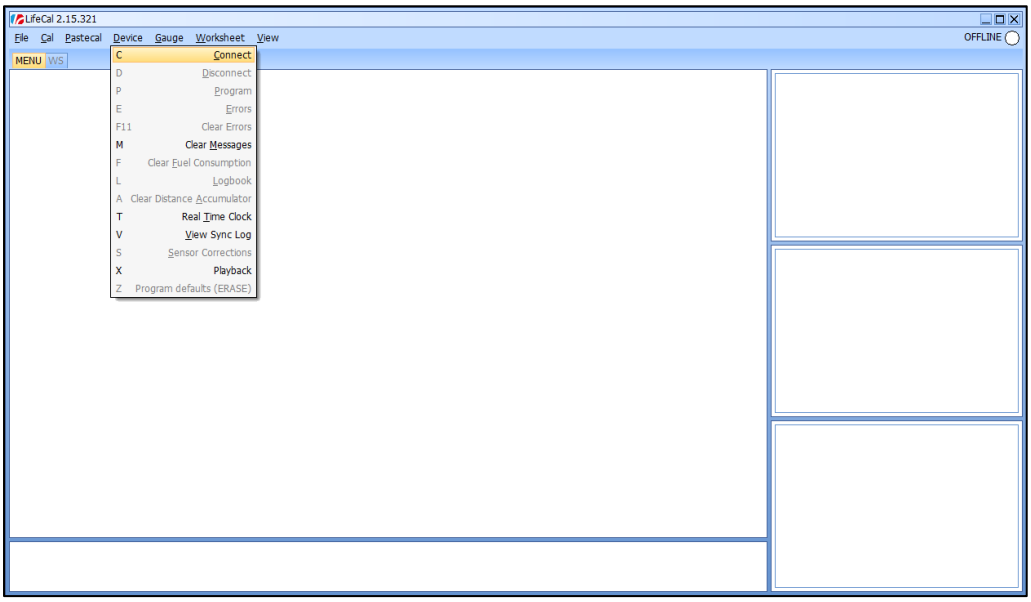
WHEEL SPEED SENSOR CALIBRATION

This process is accessible for all customer access users with the latest Life ECU Software and ECU Map Calibration V1-711 or later. These steps must be taken to update the wheel speed sensor calibration to account for the change in the number of pickup teeth (different style of upright)

1. Open the LifeCal application:

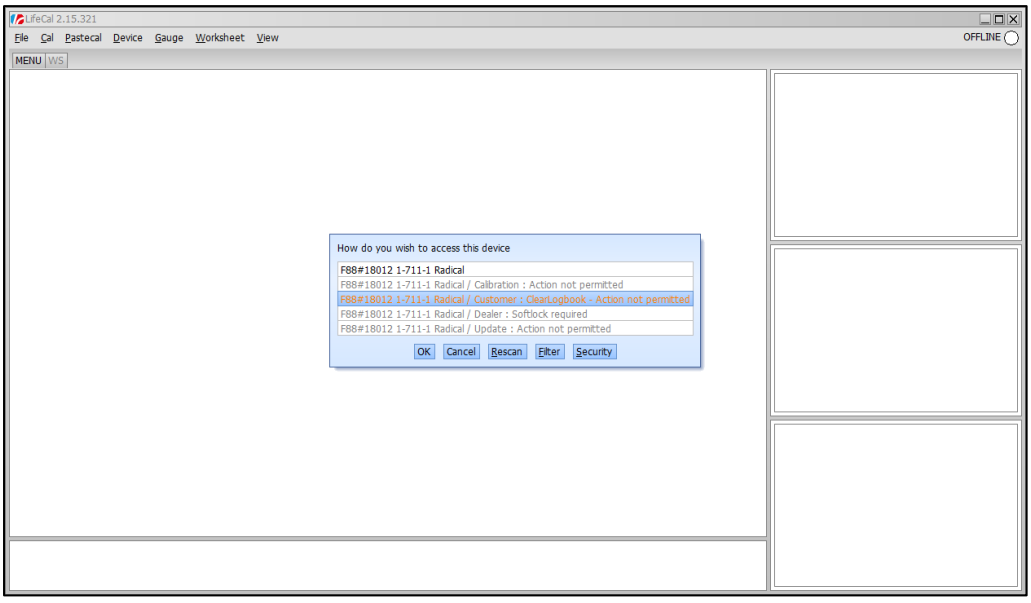


2. With the ECU powered on and your PC connected, select 'Device – Connect':

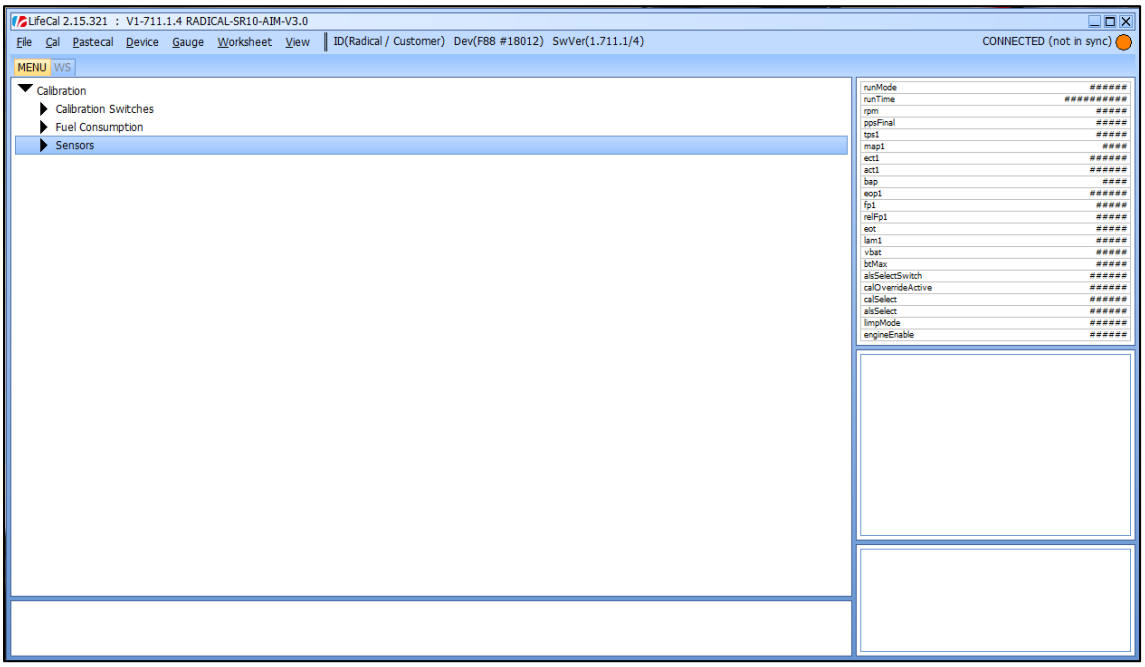


3. The software will then scan for active and connected devices.

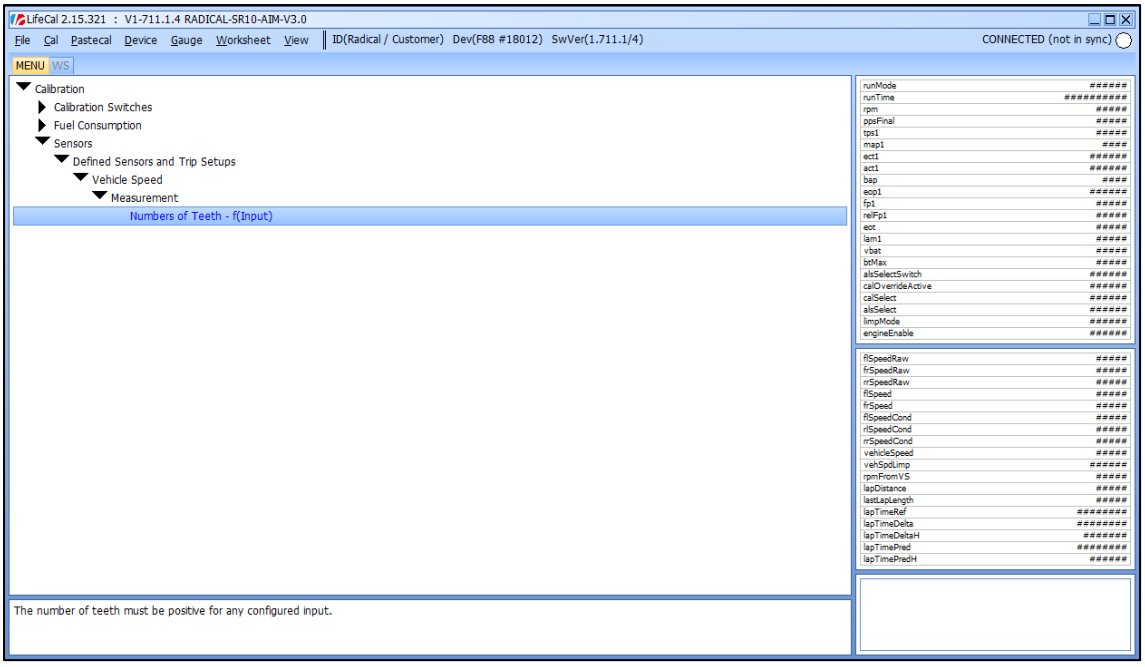
   When prompted select the 'Radical / Customer' access level:



4. The software will then load the calibration parameters that you have access to:

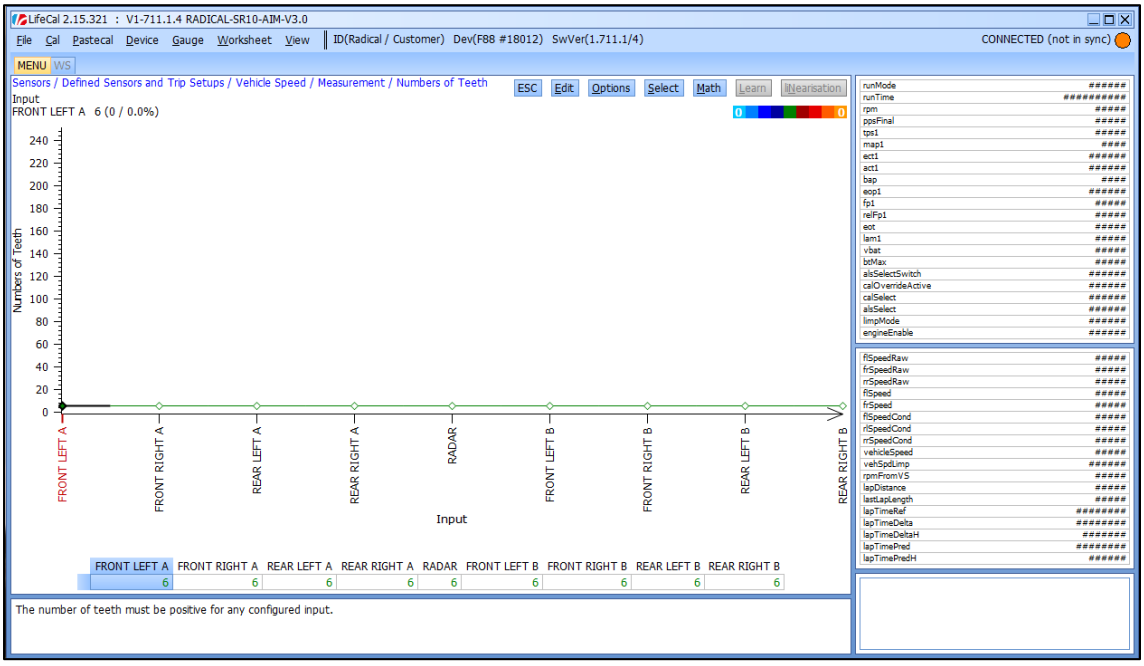


5. Navigate down the tree as follows and select the 'Numbers of Teeth f(Input)' table:

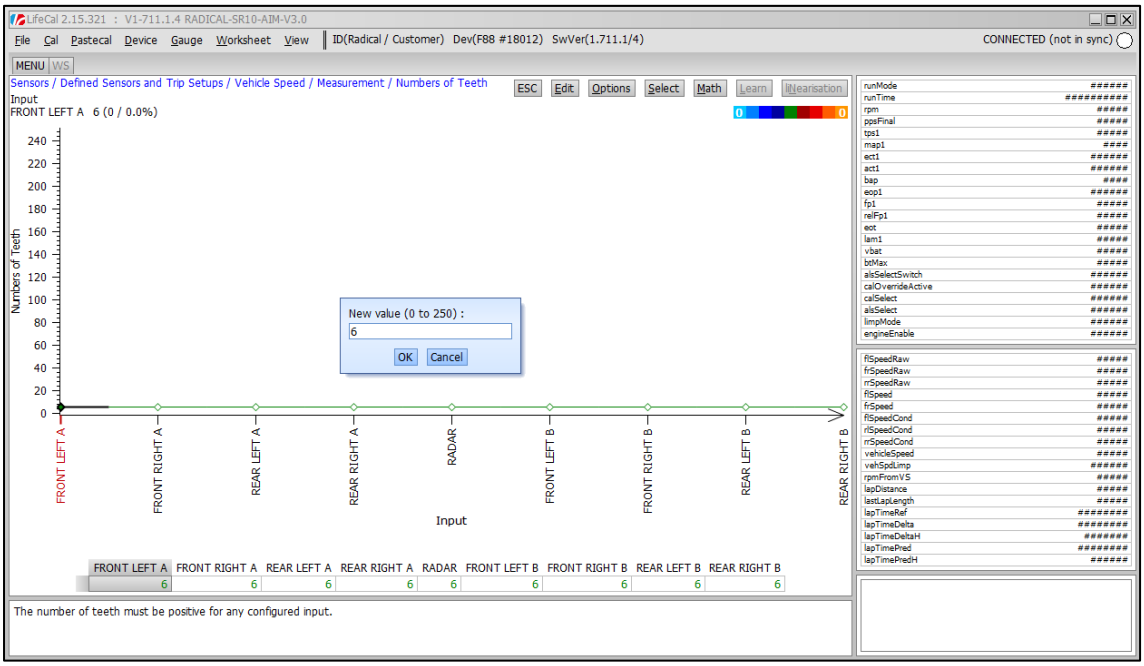


6. The calibration table will open as shown below.

   Using the arrow keys, navigate the table at the bottom of the window and use the enter key to select the 'Front Left A' cell:



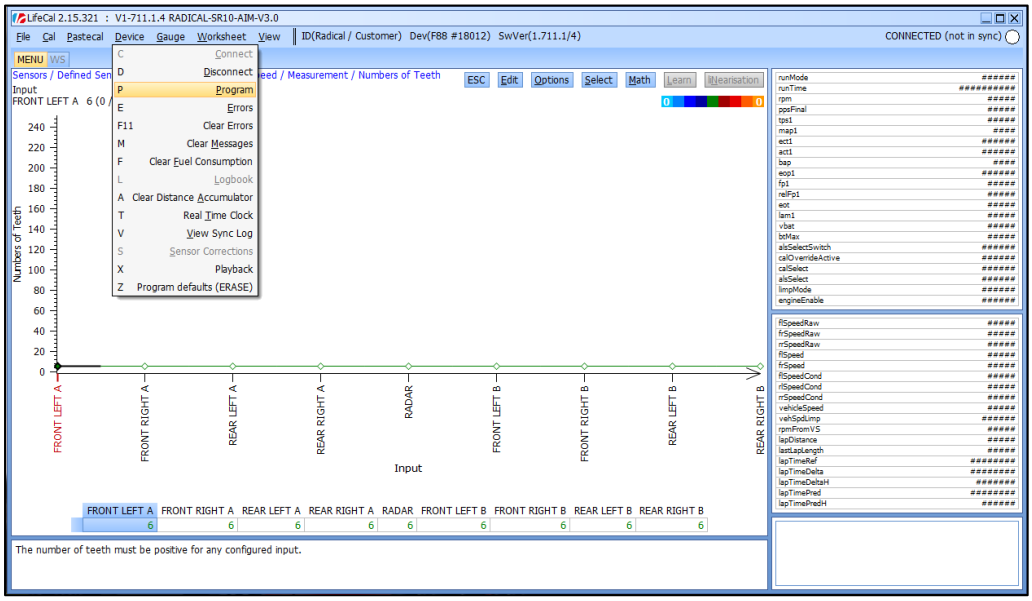
7. You will be prompted to enter a new value for the number of pickup teeth, enter **6** and select ok:



8. Repeat steps 6 & 7 to update the values in the ‘Front Right A’, ‘Rear Left A’ & ‘Rear Right A’ cells in the calibration table.

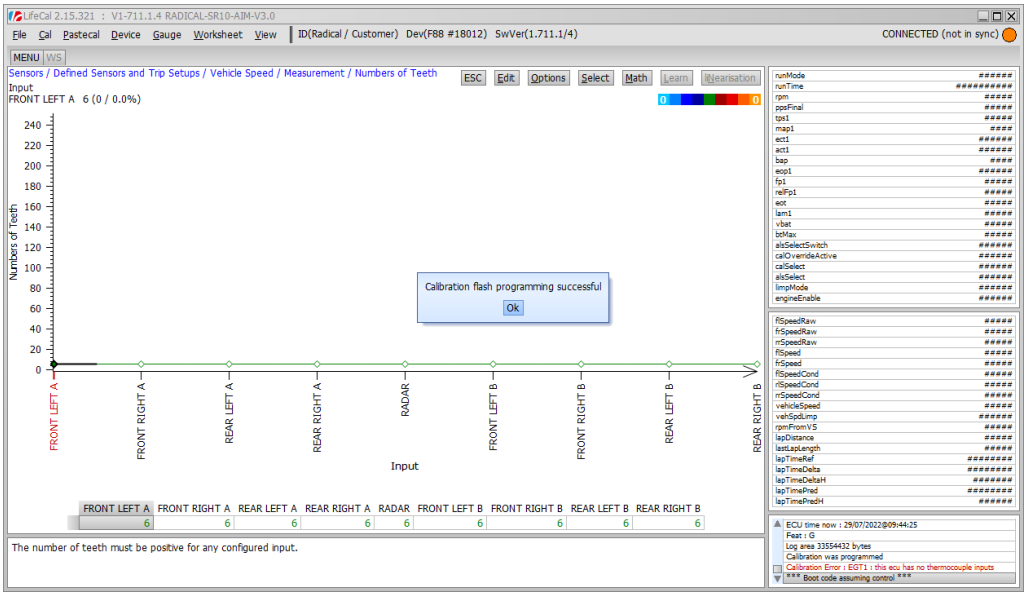
   Ensure the values in all cells designated ‘A’ are updated to ***6***.

9. Once the values in the calibration table are set, select ‘Device – Program’.



10. The software will flash the updated calibration to the ECU. Once finished a dialog box will appear confirming the flash process has completed successfully as shown below.

    Select OK to close this dialog box. This concludes the calibration update process. You can now close the LifeCal application.



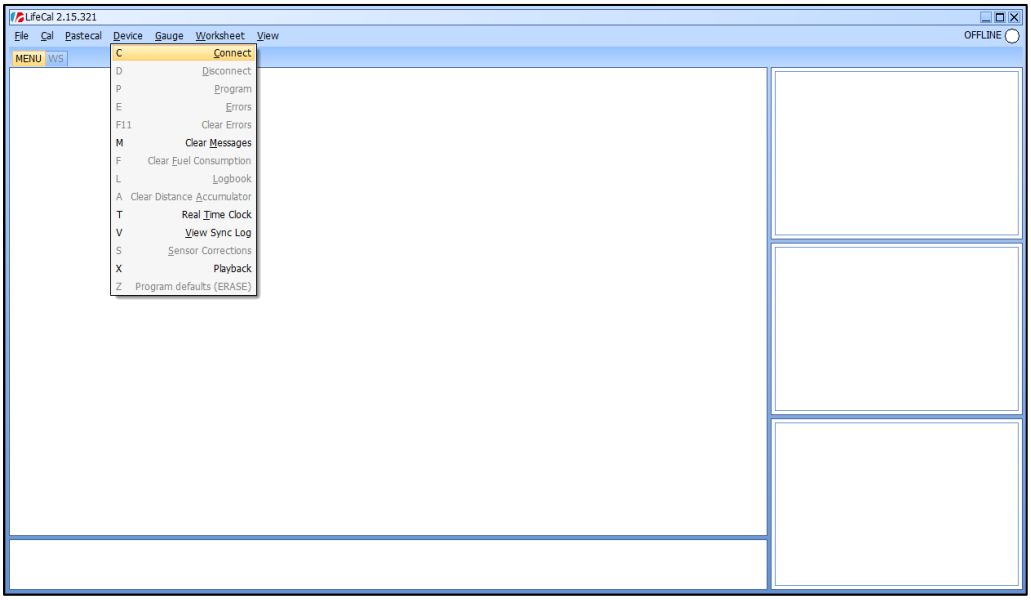
PIT LIMITER SPEED CALIBRATION

This process is accessible for all customer access users with the latest Life ECU Software and ECU Map Calibration V1-711 or later. These steps must be taken to change the pit limiter speed calibration to account for the change in pit lane speed limit requirements

1. Open the LifeCal application:

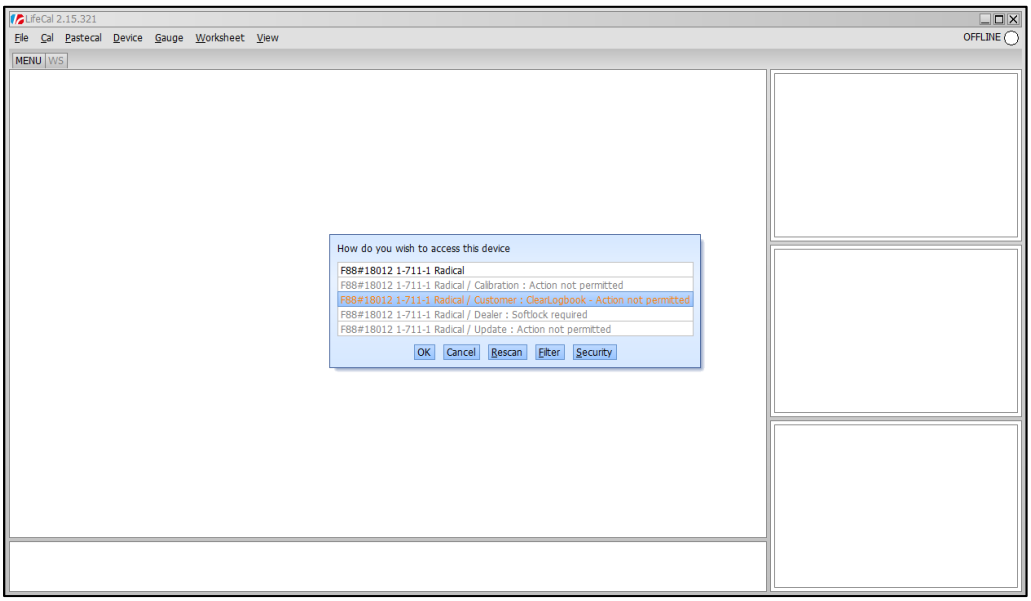


2. With the ECU powered on and your PC connected, select 'Device – Connect':

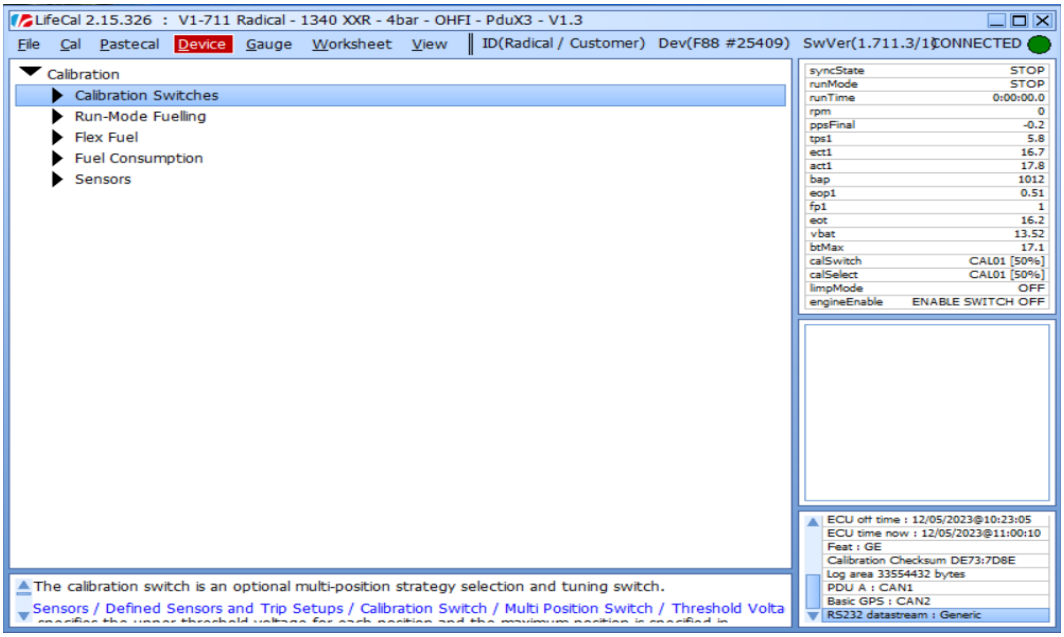


3. The software will then scan for active and connected devices.

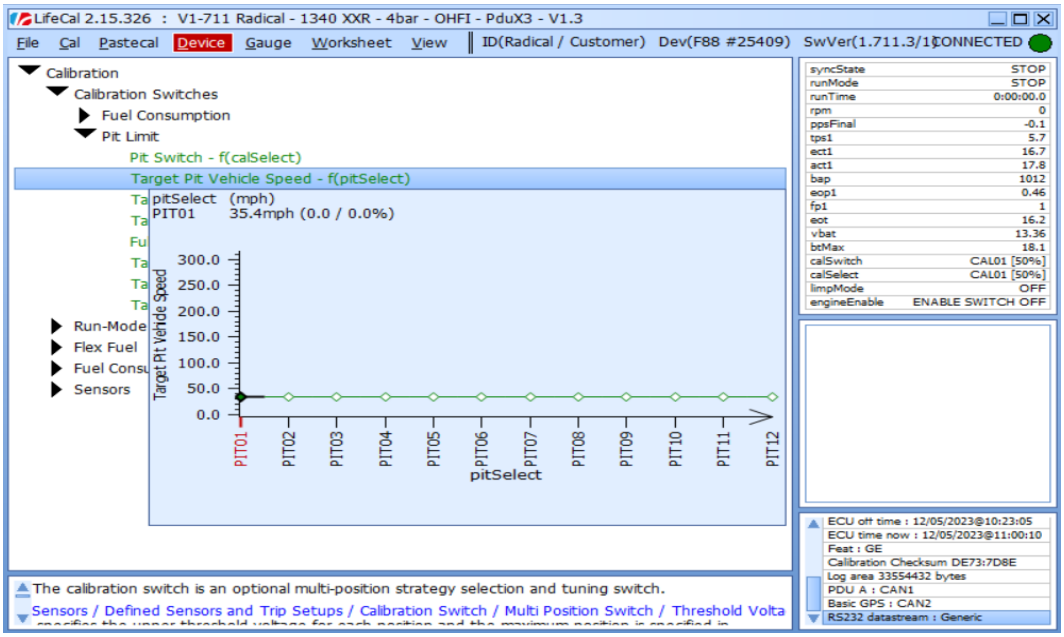
   When prompted select the 'Radical / Customer' access level:



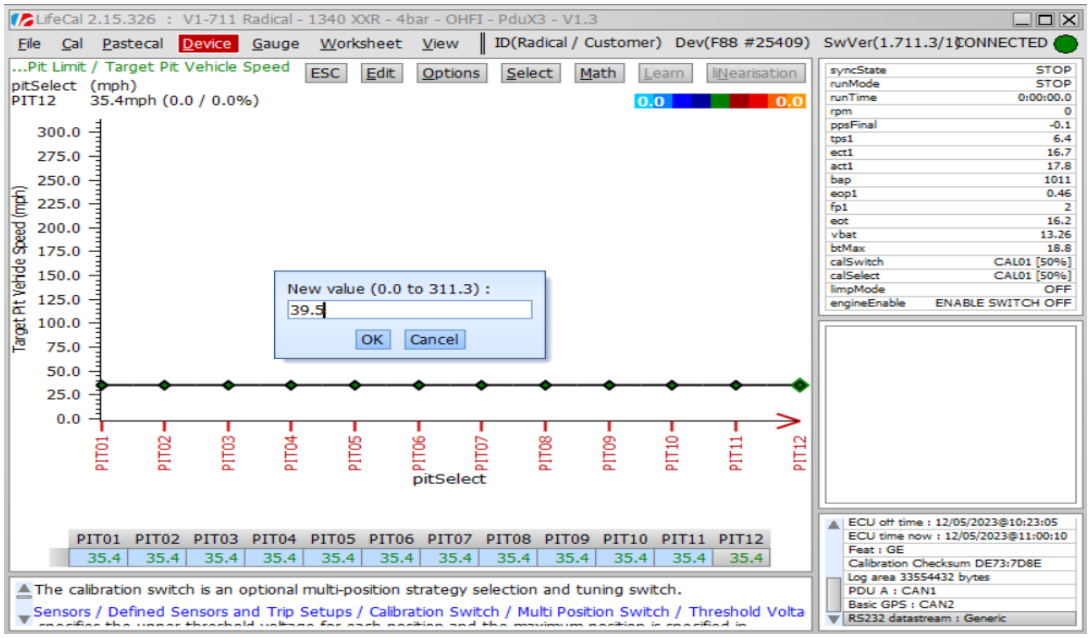
4. The software will then load the calibration parameters that you have access to:



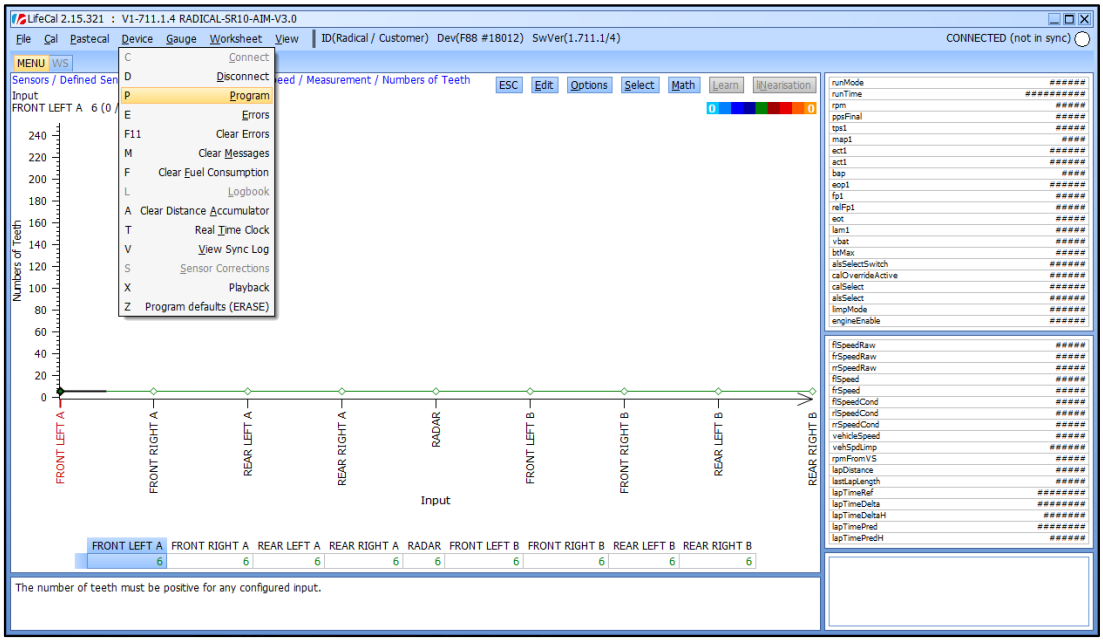
5. Navigate down the tree as follows and select the "Target Pit Vehicle Speed – f(pitSelect)



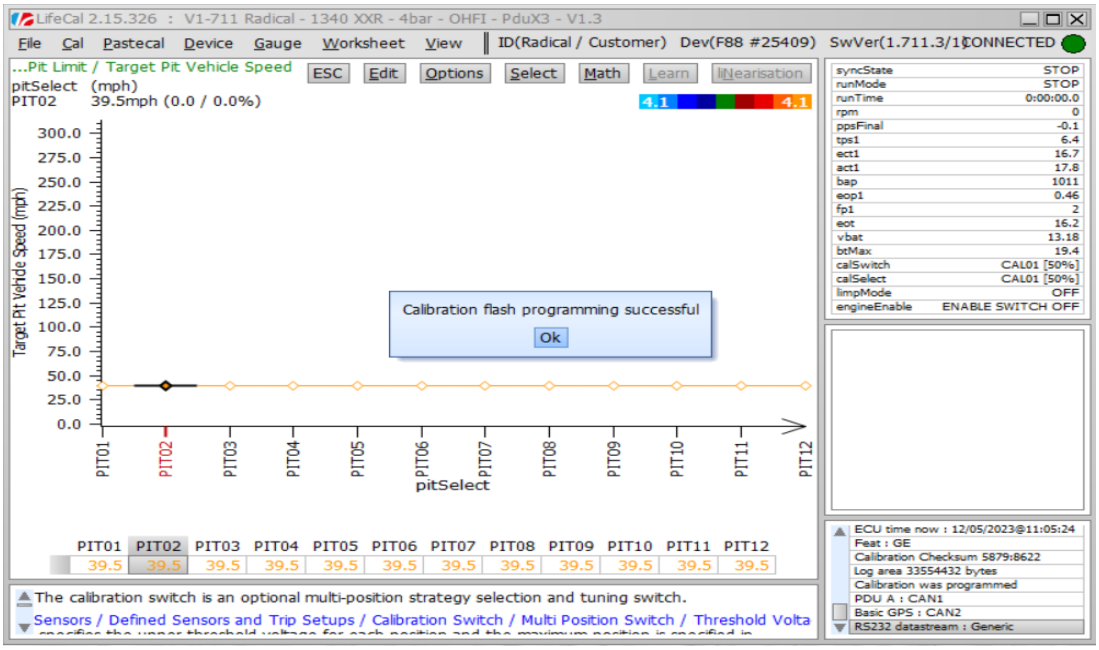
6. The calibration table will open as shown below.
   Using the arrow keys, navigate the table at the bottom in combination with Shift. This will highlight whole table.
   Confirm selection by pressing Enter.



7. Once the values in the calibration table are set, select 'Device – Program'.



8. The software will flash the updated calibration to the ECU. Once finished a dialog box will appear confirming the flash process has completed successfully as shown below.
   Select OK to close this dialog box. This concludes the calibration update process. You can now close the LifeCal application.



Note: Always set The Pit Limit Speed fraction lower (-0.5MPH or -1KPH) than maximum pit lane speed to allow some room for error.

AIM DATA

Since 2009 Radical has solely used Aim dash, datalogging and camera products.

GETTING STARTED

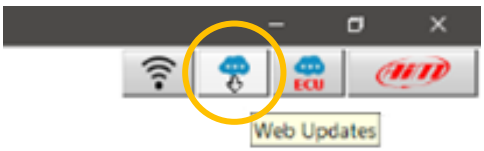
1. Check the camera turns on with the master. Ensure there is an SD card fitted the SD card.

2. Connect to the dash and camera using the AIM download lead (AD0109) and mini USB cable for the Smartycam.

3. Check the software is up to date using the guide below, before installing any configurations onto a device.

UPDATING THE SOFTWARE

Click the icon of the cloud with the arrow underneath "Web Updates" ensuring you are connected to the internet. It will then show all the devices/software that have updates with the red 'NEW' icon. If there aren't any updates, the arrow underneath the cloud will not be visible. Ensure all the devices that need updating are ticked then click the download icon in the top left, shown below.

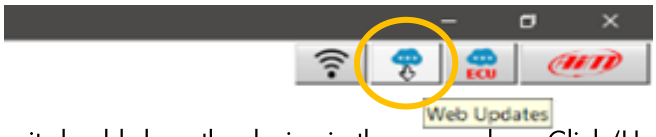




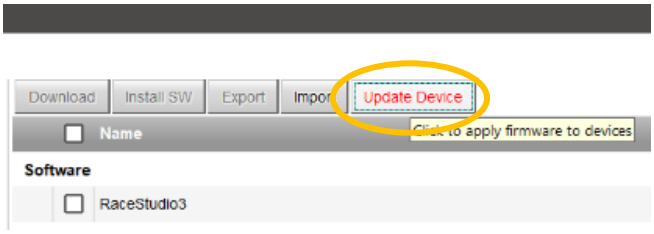
RaceStudio3 will then download all the updates and install them, you may then be asked to install the latest RaceStudio3, if so just follow the instructions on the installer.

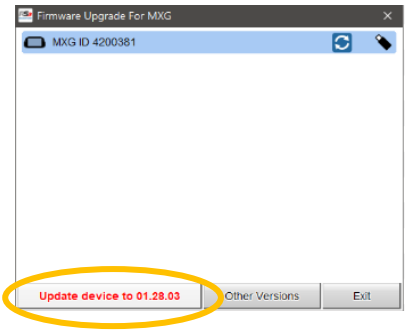
UPDATING THE DEVICE FIRMWARE

1. To update the device, click "Web Updates" ensuring your device is connected. Then click update device.



2. Click 'Update Device' then it should show the device in the pop-up box. Click 'Update Device to *XX.XX.XX*' it will then begin to update the device. The process will then need to be repeated on the Smartycam.

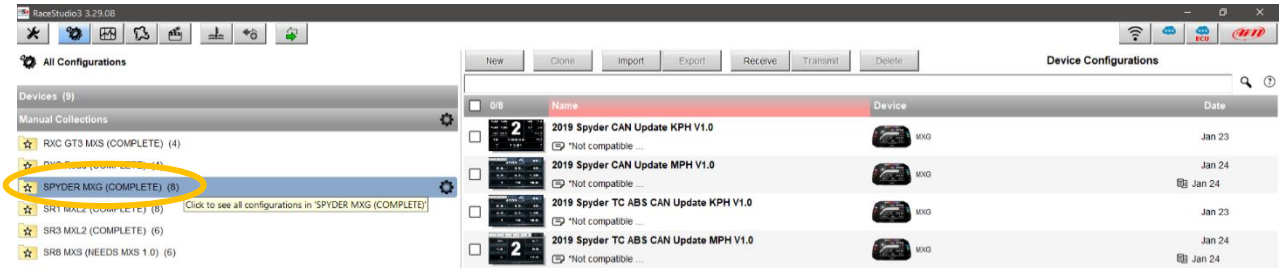




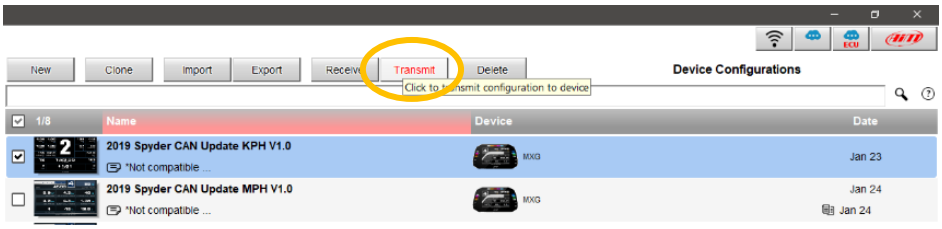
TRANSMITTING A CONFIGURATION TO THE DASH

1. Click the configuration's tab, then locate the correct configuration for the car., then press 'Transmit'.

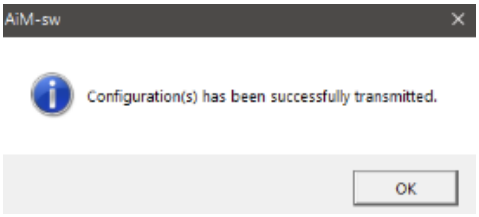




2. Tick the configuration that you want to transmit, then click "Transmit" at the top of the screen.

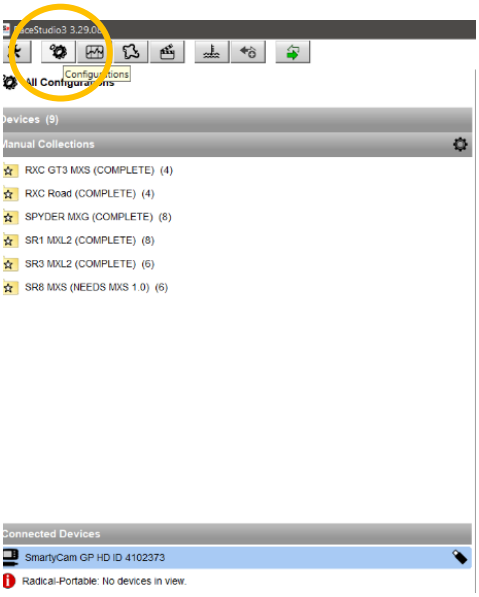


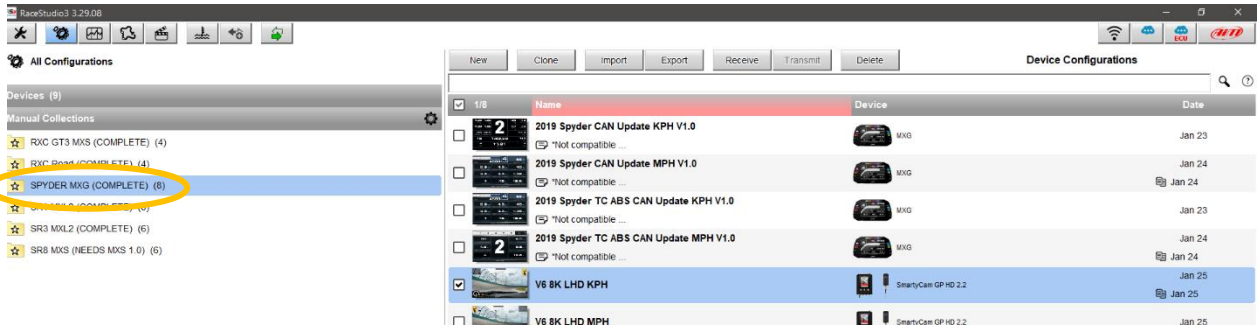
3. This message should then pop up after successfully transmitting the config.



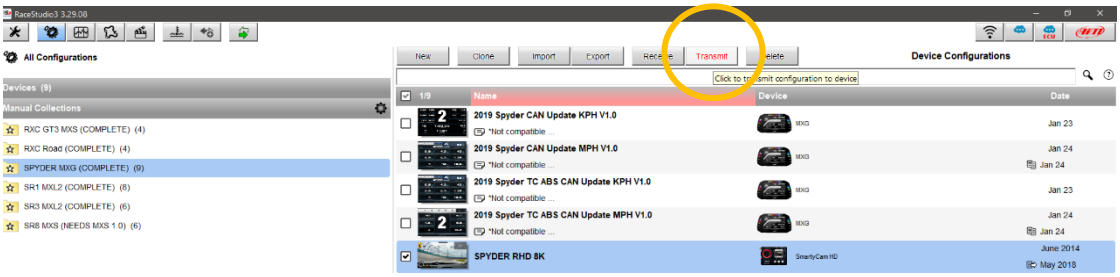
TRANSMITTING A CONFIGURATION TO THE SMARTYCAM

1. Click the configuration's tab, then locate the correct configuration for the car, then press 'Transmit'

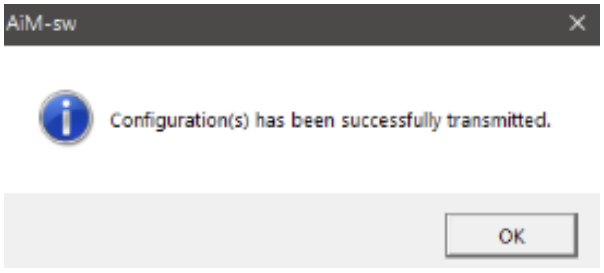




2. Tick the configuration that you want to transmit, then click "Transmit" at the top of the screen.



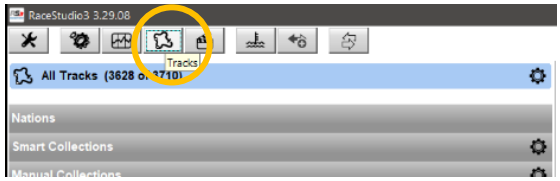
3. This message should then pop up after successfully transmitting the config.



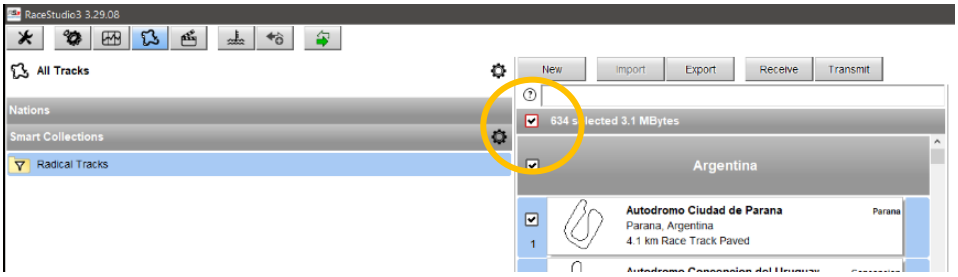
LOADING TRACK MAPS ONTO A DEVICE

It is important to load the trackmaps after transmitting a configuration, this is the most common cause for a car not receiving lap times at an event.

1. Click on the "Tracks" icon in the top left corner.



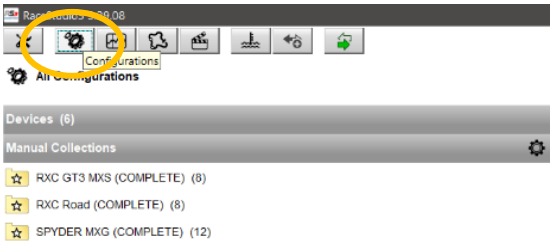
2. Tick all the track maps you wish to load, then click 'Transmit' then select the ***Smartycam***. You will then need to press transmit and select the ***Dash*** after it is finished.



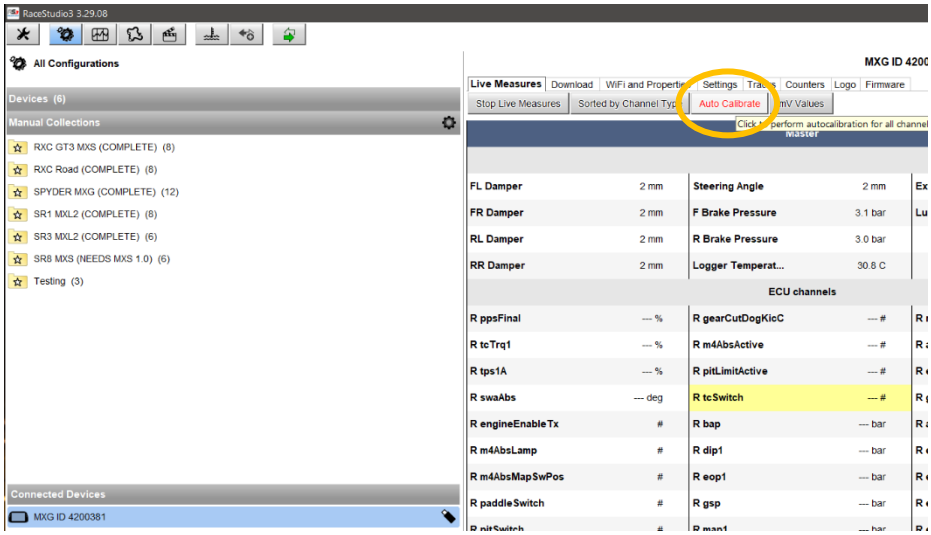
3. Ensure the green bar finishes before continuing. Click on the Smartycam and the dash in the bottom left to confirm the tracks were successfully transmitted.

CALIBRATING THE SENSORS

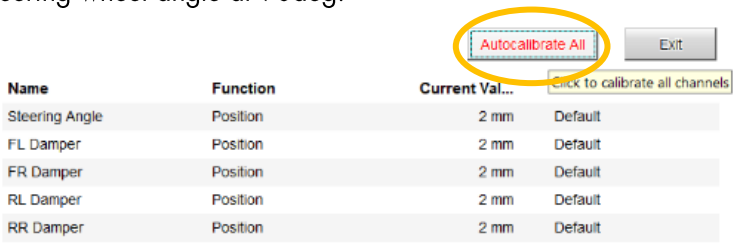
1. Click on the "Configurations" tab



2. Click on the device shown in the bottom left corner, then click "Auto Calibrate"



3. Ensure the steering wheel is straight then click "Autocalibrate All". After this process check that the steering angle is equal to the actual steering wheel angle at 90deg.

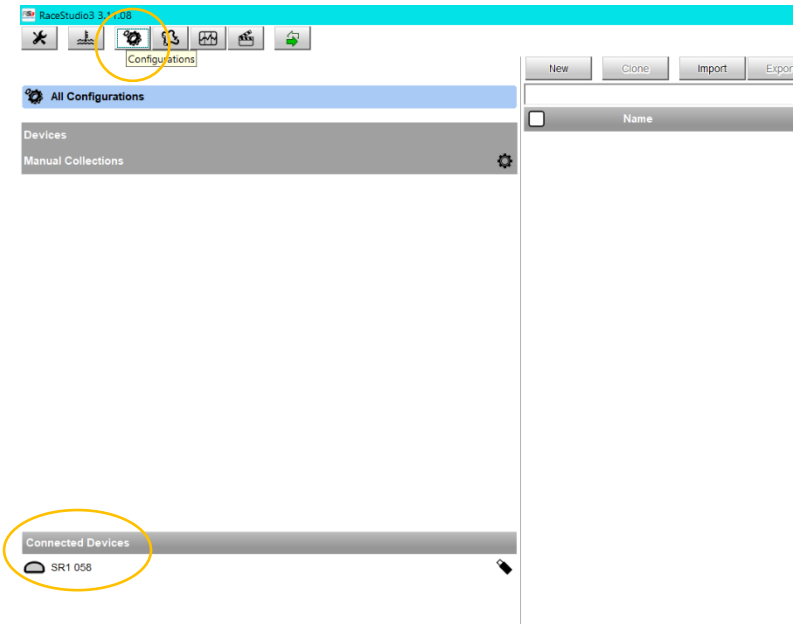


4. Click 'WIFI and Properties' and set the time on both the Smartycam and the Dash.

HOW TO DOWNLOAD AIM DATA

Plug the car in using the AIM download lead (AD0109) and turn on the cars master switch. Then open 'RaceStudio3'.

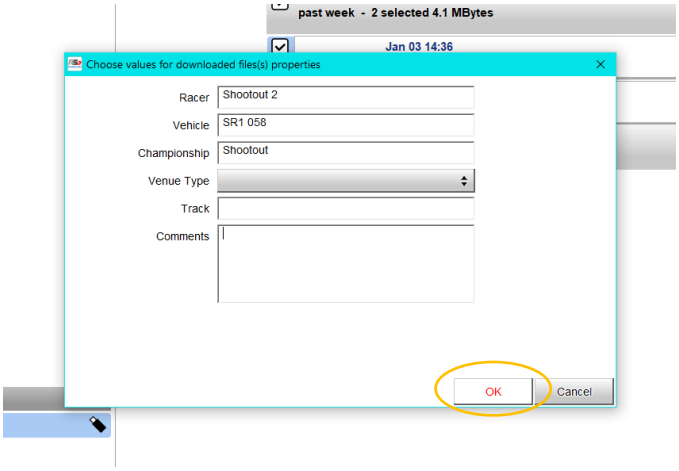
Press the 'Configurations' tab shown by the gears icon. Then the dash name should be shown in the bottom left, select the dash.



Select the 'download' tab to view the data to be downloaded. Once the data you wish to download has been selected, press the download button circled in the picture below.



You will be prompted to provide information about the session, be sure to include the chassis number and driver name. Include any comments in the description, then press ok.



Select the analysis tab in the top left corner, this will open 'RaceStudio2 Analysis' you can then select the sessions you wish to load, open a run file to veiw the data.



Test name	Test date	N...	B...	R...	Best lap...	Driver	Test type	Vehicle	Cham...	Track	C...	File path
Shootout 2_SR1 058_4302212_a_0835	Wed, Jan 03, 2018 13:50:55	1	1	1	08.32.180	Shootout 2	Generic testing	SR1 058	Shootout	None		C:\AIM_SPORT\RaceStudio3\user\data\2018-01-03\
Shootout 2_SR1 058_4302212_a_0836	Wed, Jan 03, 2018 14:36:15	1	1	1	06.34.186	Shootout 2	Generic testing	SR1 058	Shootout	None		C:\AIM_SPORT\RaceStudio3\user\data\2018-01-03\

HOW TO DOWNLOAD CAMERA VIDEO

To watch back video recorded on the Smartycam camera is it easiest to simply remove the SD card from the camera and play the videos from there.

AIM POWER DISTRIBUTION MODULE PDM32

The AiM PDM32 is a 32 channel advanced power distribution module designed to power a multitude of vehicle circuits, removing the need for traditional fuse boxes and relays. One of the key features is a Data logging facility widely used for component failure predictions.



Loading a configuration, updating firmware, loading track maps and downloading data is done in exactly same fashion as in all previous Aim devices.

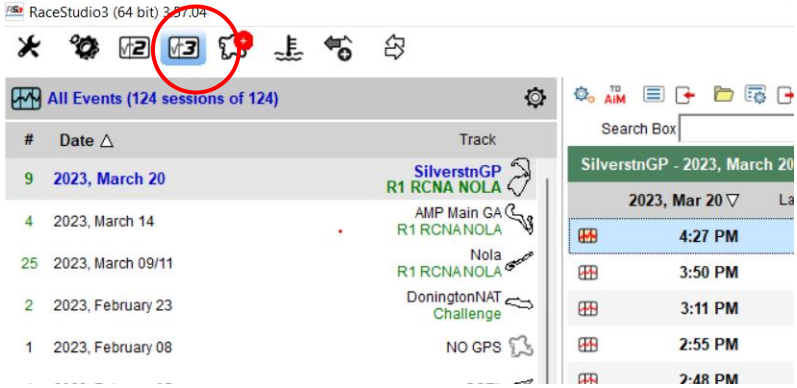
Race Studio 3 PDM

As previously mentioned, the key feature of using PDM is Data logging. Logged data are not only limited to driving telemetry but also constant feedback from all devices supplied by PDM. This feature makes PDM a great tool in troubleshooting process.

Example:

Car comes in and driver will report intermittent inability to change gear up or down. Checking ECU data on Life View will reveal lack of GSP (gear shift pressure) whilst GSP control is on. We've already narrowed our options down to air supply issue. Since the issue is intermittent, we can also rule out a break in the air supply pipe. This points us directly to compressor itself but not necessarily telling us what exactly an issue is. Since the PDM is managing compressor power out and acts as a relay and fuse at the same time there's few conditions in which the power supply will be stopped as a measure of protection. E.G. Short to ground, overcurrent but it could also be an open circuit.

At this point we will download the PDM data through Race Studio 3 and open up the latest run in Race Studio 3 Analysis

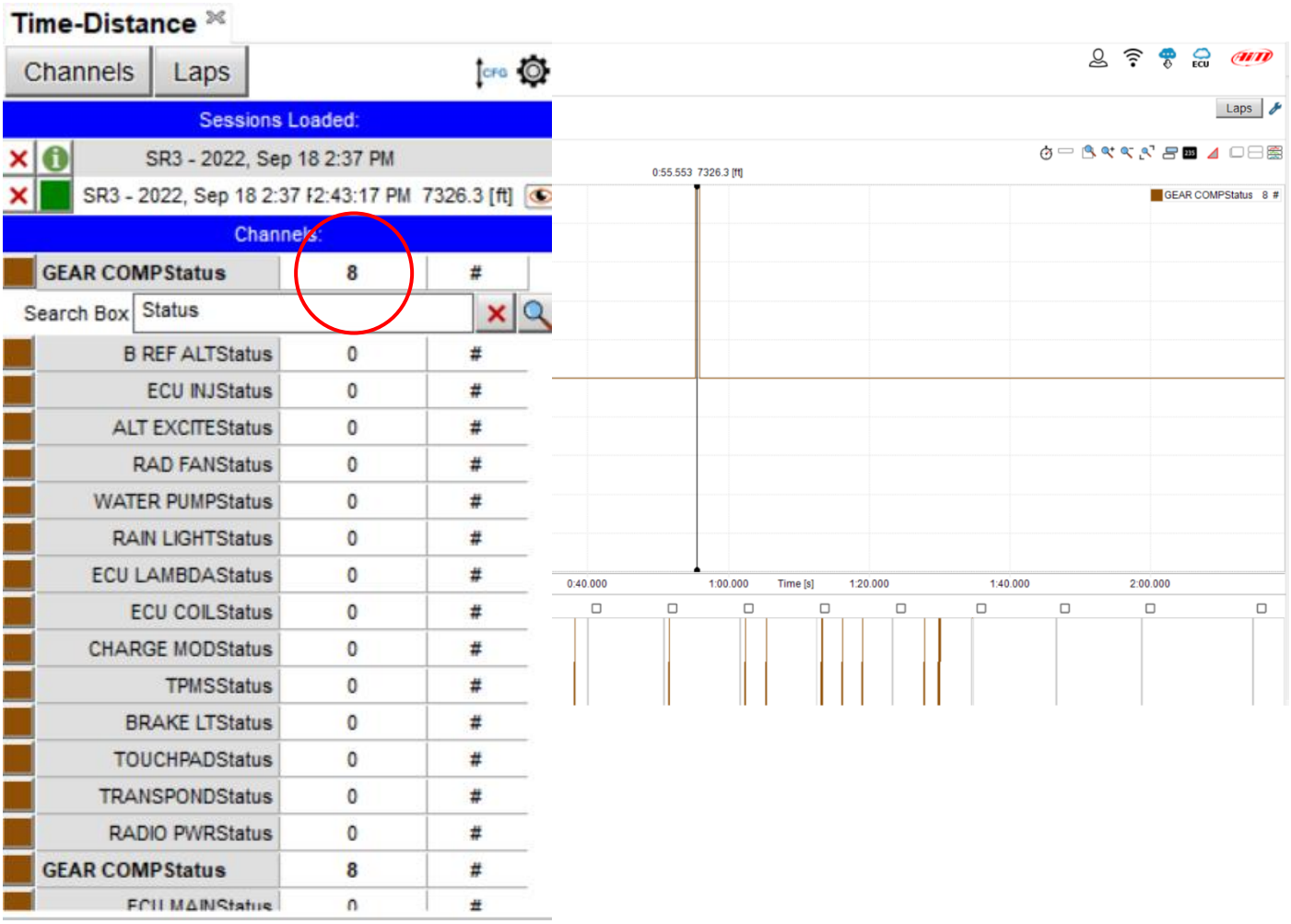


Select latest downloaded data. This will display all downloaded data but highlight the fastest lap only.

Open channels and type Status into search bar. This will highlight all Status channels. Find and select Gear Comp Status channel



Move cursor over to the part of data where the difference appeared and note the number found in selected channel tab



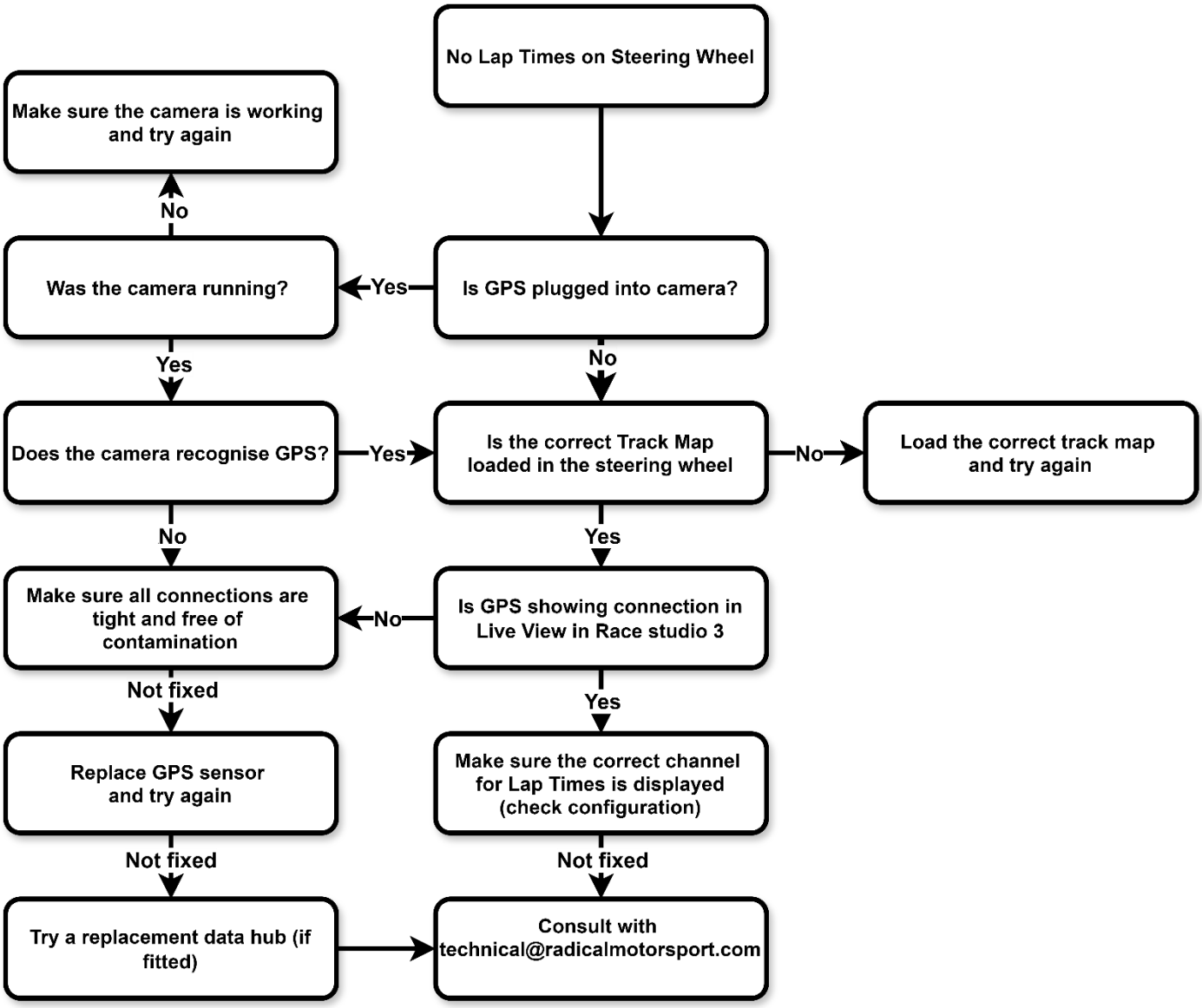
Each number is representing different condition explained in table below.

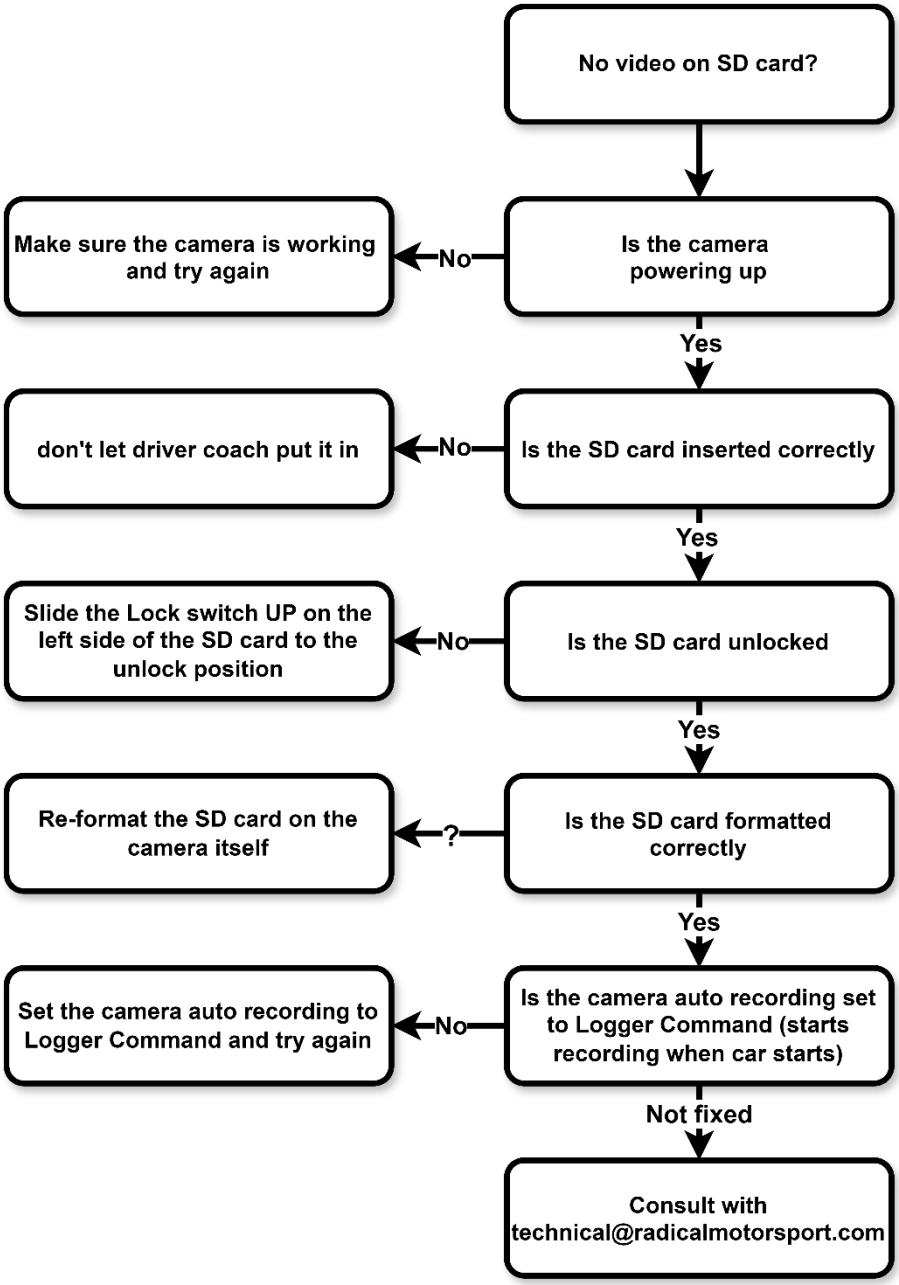
Status Legend							
Value	0	1	2	4	8	16	32
Label	ok	sc	open	htemp	ovcur	unvol	ovvol
Description	OK	Short Circuit	Open Circuit	High Temperature	Over Current	Under Voltage	Over Voltage

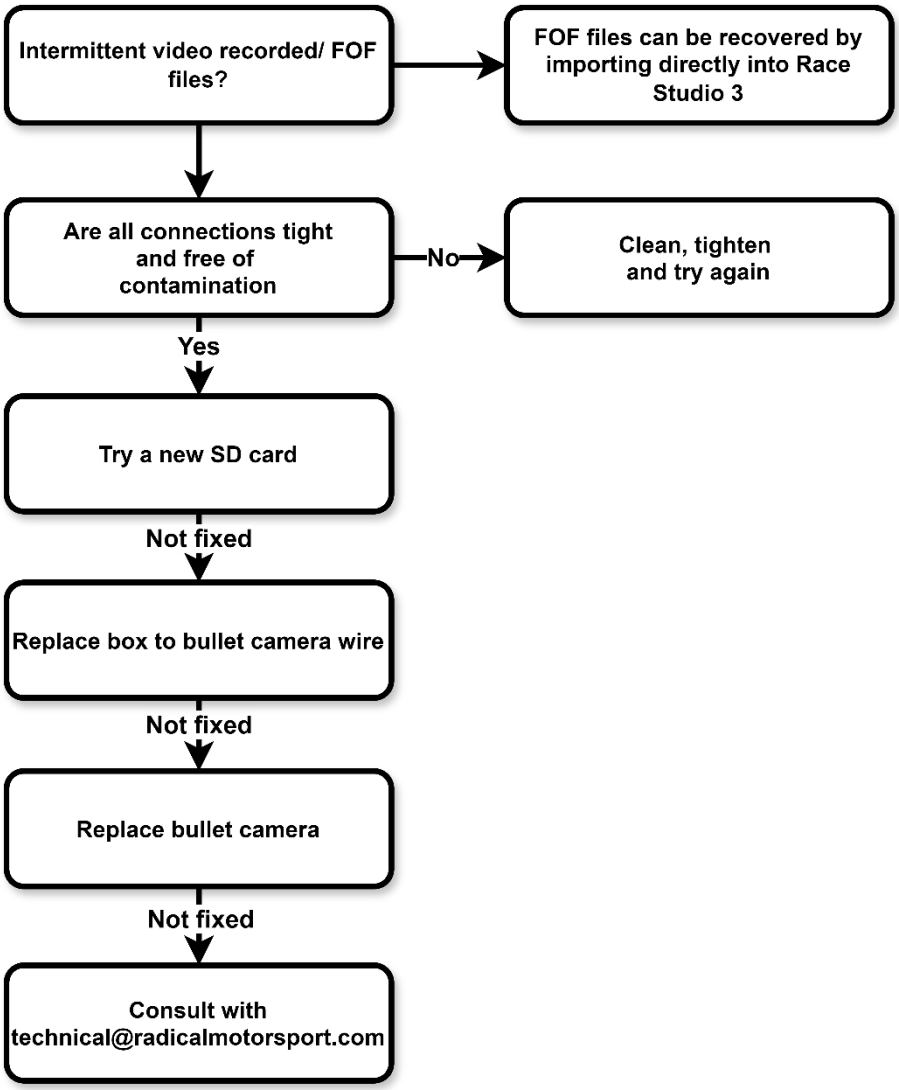
In our case number 8 is representing over current means that the maximum safe current draw limit for this device was reached and PDM stopped the power supply when it happened. High current draw indicates that device if having to work harder to provide its service. In our case, the compressor bearings were seizing up. Replacement compressor resolved this issue.

To see an actual current draws, type '***Current***' into channels search bar and all current channels will be highlighted.

For more in depth Data training, please contact technical@radicalmotorsport.com and arrange a training session with our product training representative.


No Lap Times on Steering Wheel
Is GPS plugged into camera?
Yes
Was the camera running?
No
Make sure the camera is working and try again
No
Is the correct Track Map loaded in the steering wheel
Yes
Load the correct track map and try again
Yes
Does the camera recognise GPS?
Yes
No
Is GPS showing connection in Live View in Race studio 3
No
Make sure all connections are tight and free of contamination
Yes
Make sure the correct channel for Lap Times is displayed (check configuration)
Not fixed
Replace GPS sensor and try again
Not fixed
Consult with technical@radicalmotorsport.com
Not fixed
Try a replacement data hub (if fitted)


No video on SD card?
Is the camera powering up
No
Make sure the camera is working and try again
Yes
Is the SD card inserted correctly
No
don't let driver coach put it in
Yes
Is the SD card unlocked
No
Slide the Lock switch UP on the left side of the SD card to the unlock position
Yes
Is the SD card formatted correctly
?
Re-format the SD card on the camera itself
Yes
Is the camera auto recording set to Logger Command (starts recording when car starts)
No
Set the camera auto recording to Logger Command and try again
Not fixed
Consult with technical@radicalmotorsport.com


Intermittent video recorded/ FOF files?
FOF files can be recovered by importing directly into Race Studio 3
Are all connections tight and free of contamination
No
Clean, tighten and try again
Yes
Try a new SD card
Not fixed
Replace box to bullet camera wire
Not fixed
Replace bullet camera
Not fixed
Consult with technical@radicalmotorsport.com

VERSION HISTORY

2018-04-11 v1.0 initial public release

2018-07-17 v1.1 Life Prog Instructions

2018-07-17 v1.2 Updated LifeData procedure

2019-04-16 V1.3

2020-04-30 V1.4 Boost examples added

2023-04-17 V1.5 Zeroing telemetry sensors via PT-mon, PDU worksheets, PDUU explained, PDM explained, Pit limiter and Wheel speed Calibration added

2023-08-07 V1.6 SR10 missing channels added

2024-04-22 V1.7 Troubleshooting flow charts added

2025-03-25 V1.8 More data examples added, Working Directory setup



technical@radicalmotorsport.com