

ProECU Nissan 370Z



Tuning Guide 2008-onward Model Year

V1.43

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1. Warning

!!! CAUTION !!!

EcuTek ProECU tuning tools should only be used by experienced tuners who understand the product and engine calibration.

If you do not fully understand this product then you WILL damage your engine, the ECU or your vehicle.

Please ensure you fully read all EcuTek manuals BEFORE attempting to use ProECU with your laptop or your vehicle.

Use with extreme caution and understanding at all times, if in doubt then do not proceed.

EcuTek accepts no responsibility for any damage to the engine, ECU or any part of the vehicle that results directly or indirectly from using the product.

** If you are in any doubt that you do NOT have the experienced required to use this product then you should NOT USE IT **

2. Introduction

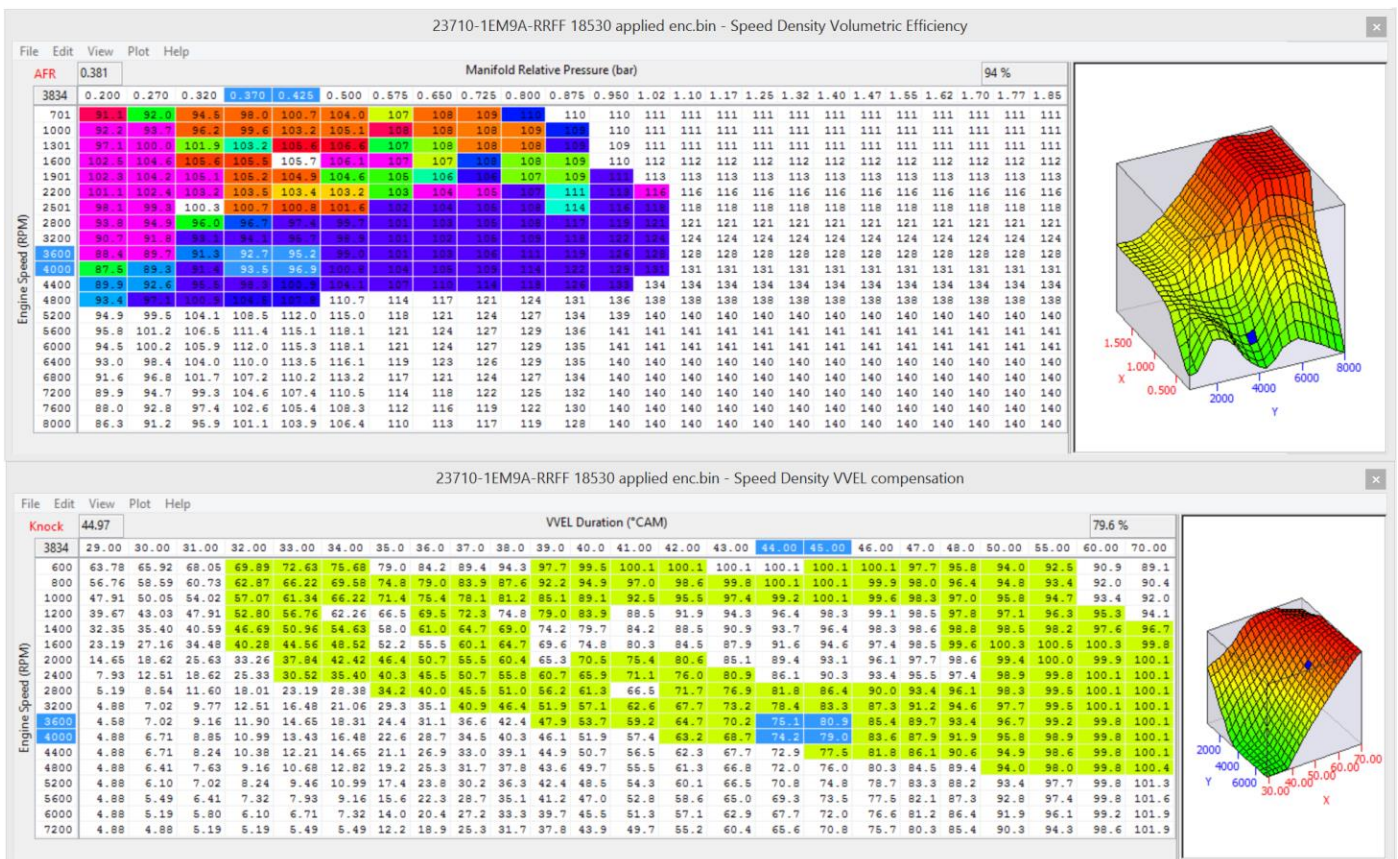
EcuTek ProECU proudly supports the Nissan 3.7ltr V6 engine called VQ37VHR found in the following Nissan and Infiniti vehicles:

- Nissan 370Z
- Nissan G37
- Nissan M37
- Nissan V36
- Infiniti G37
- Infiniti FX37
- Infiniti M37
- Infiniti Q50
- Infiniti Q60
- Infiniti Q70

This naturally aspirated V6 engine has a compression ratio around 11:1 and produces around 326bhp and 269 lbs-ft (365 Nm) Torque depend on the exact model and market. The VQ37 also includes Variable Timing Control (VTC) and Variable Valve Event and Lift (VVEL). The VTC is Intake Cam Shaft Opening Angle and the VVEL controls the Valve Duration amount.

Aftermarket supercharged and turbocharged conversions will offer 450+bhp with around 0.5bar boost.

The screen shot below shows AFR and Knock Correction plotted using the Map Tracing feature.



2.1 RaceROM features currently available for the 370Z

RaceROM Custom Ignition Timing – The 370Z Ignition system is very complicated and difficult to tune due to the adjustments from the VVEL system. RaceROM implements a less complicated ignition strategy which still works with the factory knock control and dynamic advance.

Instead of the standard Ignition MBT Adjustment and Ignition Mode B maps, each of the four Map Switch modes has a single high resolution Ignition Advance map with real Ignition Advance values for easier understanding and more simplistic tuning.

Map Switching - The Map Switching feature allows you to up to define four different calibrations in the ECU ROM. The driver can switch between the calibrations at the press of a button. It is envisaged that this feature will be used to provide a comfortable calibration for everyday road use and a hard-core maximum performance calibration for use at the track. Alternatively you could use this feature to provide four calibrations optimised for different grades of fuel.

Launch Control – The adjustable Launch Control feature allows you to adjust the launch control RPM live. This can be used to provide a higher or lower power/torque output during launch to suit the driver's requirements. Due to vehicle limitations, this feature can only be implemented on vehicles equipped with SyncroRev.

Flat Foot Shifting - The Flat Foot Shifting feature allows the driver to up-shift without lifting his foot from the accelerator pedal. Due to vehicle limitations, this feature is can only be implemented on vehicles equipped with SyncroRev.

Per-gear Rev Limits - The Per Gear Rev Limits feature allows you to define different rev limits for each gear. By setting a higher rev limit in lower gears you may be able to reduce the number of gearshifts required in attaining a given speed. E.g. 0-60mph (0-100km/h) tests.

RaceROM Oil Temp Gauge - This feature allows the tuner to repurpose the oil temp gauge to display a different parameter such as AFR or Fuel Ethanol Content.

Speed Density - Create tuning based on the Manifold Pressure Sensor, this is ideal for forced induction models.

Knock Warning - RaceROM can be configured to flash the check engine light to warn the driver when knock exceeds a predetermined level.

RaceROM Custom Maps - Custom Maps is an advanced feature for expert tuners only. It provides the tuner with the ability to modify the control algorithms within the ECU. The tuner can take advantage of this in order to develop their own features that no other tuner can provide. It can also be used to develop one-off fixes to overcome specific problems encountered while tuning a highly modified vehicle. The Custom Map feature is described in detail in a separate **ProECU RaceROM Custom Maps** manual.

RaceROM Controller – The RaceROM Controller is a driver-adjustable input to the Custom Maps system. The driver can select a value using the cruise control buttons and it is displayed on the Oil Temp gauge. The tuner can create a custom map to adjust any of the engine parameters based on the driver's input. This could be used on a forced induction car, for example, to select a desired level of boost. It can also be used by the tuner to provide a certain amount of live tunability.

Valet Mode - The RaceROM Valet Mode feature allows the customer to select a special mode that will reduce engine power output via a unique key code entry process. This engine torque reduction feature is configured against vehicle speed, torque and distance. This feature can be used during vehicle servicing, valet parking or when the vehicle is driven by family members or loyal trusted friends etc.

RaceROM Security – Providing ROM security for the tuner from read, write, copy by other EcuTek dealers competitors' products, this security feature also prevents the Nissan dealer tool from rewriting the ECU during service (therefore losing any performance tuned ROM that a customer has purchased from an EcuTek tuner.

Custom Parameter Data Logging – A full range of additional custom parameters have been added to aid tuning, this custom parameters are not available from the Nissan factory Consult 3 datalogging tool, these are unique EcuTek logging parameters that are critical for accurate tuning.

Name	Origin	Units	Minimum	Current	Maximum
Logged Parameters					
<input checked="" type="checkbox"/> AFR Average	EcuTek	afr	11.15	13.11	20.00
<input checked="" type="checkbox"/> AFR Bank1	EcuTek	afr	11.15	13.19	20.00
<input checked="" type="checkbox"/> AFR Bank2	EcuTek	afr	11.15	13.03	20.00
<input checked="" type="checkbox"/> Custom Map A Interim	EcuTek	raw	0.00	0.00	0.01
<input checked="" type="checkbox"/> Custom Map A Result	EcuTek	raw	0.00	0.00	0.00
<input checked="" type="checkbox"/> Engine Load	EcuTek	%	12	14	110
<input checked="" type="checkbox"/> Engine Load Absolute MAF	EcuTek	g/rev	0.27	0.32	2.42
<input checked="" type="checkbox"/> Engine Load Absolute SD	EcuTek	g/rev	0.21	0.25	2.34
<input checked="" type="checkbox"/> G force Lateral	EcuTek	G	-0.02	0.00	0.02
<input checked="" type="checkbox"/> G force Longitudinal	EcuTek	G	0.00	0.00	0.02
<input checked="" type="checkbox"/> G force Rotational	EcuTek	G	0.00	0.00	0.28
<input checked="" type="checkbox"/> Heated O2 Sensor #2 B1 Raw	EcuTek	V	0.00	0.92	0.97
<input checked="" type="checkbox"/> Heated O2 Sensor #2 B2 Raw	EcuTek	V	0.00	0.92	123.00
<input checked="" type="checkbox"/> Ignition Correction	EcuTek	°	0	0	0
<input checked="" type="checkbox"/> Ignition Timing Calculated	EcuTek	°	-10	26	54
<input checked="" type="checkbox"/> Injector Duty Bank 1	EcuTek	%	1	3	47
<input checked="" type="checkbox"/> Injector Duty Bank 2	EcuTek	%	1	3	47
<input checked="" type="checkbox"/> Inlet Valve Centre Line	EcuTek	°Crank	78	93	200
<input checked="" type="checkbox"/> Inlet Valve Duration	EcuTek	°Crank	23	133	259
<input checked="" type="checkbox"/> Inlet Valve Open	EcuTek	°Crank	-35	27	223
<input checked="" type="checkbox"/> Inlet Valve Shut	EcuTek	°Crank	0	160	253
<input checked="" type="checkbox"/> Knock Sensor Cylinder 1	EcuTek		-2	1	11
<input checked="" type="checkbox"/> Knock Sensor Cylinder 2	EcuTek		-2	1	8
<input checked="" type="checkbox"/> Knock Sensor Cylinder 3	EcuTek		-2	1	12
<input checked="" type="checkbox"/> Knock Sensor Cylinder 6	EcuTek		-3	1	20
<input checked="" type="checkbox"/> Knock Threshold Cylinder 1	EcuTek		4	9	232
<input checked="" type="checkbox"/> Knock Threshold Cylinder 2	EcuTek		4	10	248
<input checked="" type="checkbox"/> Knock Threshold Cylinder 3	EcuTek		3	12	248
<input checked="" type="checkbox"/> Knock Threshold Cylinder 6	EcuTek		4	10	248
<input checked="" type="checkbox"/> Manifold Absolute Pressure	EcuTek	bar	0.17	0.36	0.96
<input checked="" type="checkbox"/> Manifold Pressure Delta	EcuTek	bar	-0.05	-0.01	0.07
<input checked="" type="checkbox"/> MAP Sensor Voltage	EcuTek	V	0.69	1.54	4.31
<input checked="" type="checkbox"/> Map Trace AFR	EcuTek	afr	11.15	12.65	20.00
<input checked="" type="checkbox"/> Map Trace Knock	EcuTek	°	0	0	0
<input checked="" type="checkbox"/> Mapswitch Mode	EcuTek	mode	1	2	2
<input checked="" type="checkbox"/> Mass Airflow MAF	EcuTek	g/s	3.98	13.12	149.64
<input checked="" type="checkbox"/> Mass Airflow SD	EcuTek	g/s	3.28	9.82	165.69
<input checked="" type="checkbox"/> RaceROM Controller	EcuTek	raw	0	0	0
<input checked="" type="checkbox"/> SD VE map value	EcuTek	%	87.5	104.1	128.9
<input checked="" type="checkbox"/> SD VE vvel compensation	EcuTek	%	37.5	37.5	100.4
<input checked="" type="checkbox"/> SD Volumetric Efficiency MAF	EcuTek	%	47.3	47.3	171.9
<input checked="" type="checkbox"/> SD Volumetric Efficiency SD	EcuTek	%	39.1	39.1	128.7
<input checked="" type="checkbox"/> Steering Wheel Angle	EcuTek	°	-1	-1	1
<input checked="" type="checkbox"/> Throttle Delta	EcuTek	raw	-203	-1	176
<input checked="" type="checkbox"/> Torque Actual	EcuTek	Nm	-89	-2	383
<input checked="" type="checkbox"/> Torque Demand	EcuTek	Nm	-25	-3	349
<input checked="" type="checkbox"/> VVEL Actual Valve Duration	EcuTek	°CAM	28	33	65
<input checked="" type="checkbox"/> VVEL Control Angle Actual #1	OEM	°	2.60	7.41	54.14
<input checked="" type="checkbox"/> VVEL Target Valve Duration	EcuTek	°CAM	28	33	65
<input checked="" type="checkbox"/> Wheel Slip Ratio	EcuTek	%	0.0	0.0	0.0
<input checked="" type="checkbox"/> Wheel Speed FL	EcuTek	km/h	0.0	0.0	0.0
<input checked="" type="checkbox"/> Wheel Speed FR	EcuTek	km/h	0.0	0.0	0.0
<input checked="" type="checkbox"/> Wheel Speed Front	EcuTek	km/h	0.0	0.0	0.0
<input checked="" type="checkbox"/> Wheel Speed Rear	EcuTek	km/h	0.0	0.0	0.0
<input checked="" type="checkbox"/> Wheel Speed RL	EcuTek	km/h	0.0	0.0	0.0
<input checked="" type="checkbox"/> Wheel Speed RR	EcuTek	km/h	0.0	0.0	0.0

Logging Interval: 8 Hz (129 ms)

3. ECU Map Descriptions

Please note that map names are shown in **bold**.
Live Data parameters can be used for Data Logging and are shown in *italic*.

3.1 Fuel Control

Live Data related parameters:

- *AFR Sensor V (Volts)*
- *Air Fuel Ratio (AFR) #1 - #2*
- *Air Fuel Target (AFR)*
- *Injector Pulse Width (ms)*
- *Fuel Trim Short Term (%) #1 - #2*
- *Fuel Trim Long Term (%) #1 - #2*
- *Injector Duty #1 - #2 (RaceROM Only)*
- *AFR Bank #1 & #2 (RaceROM Only)*

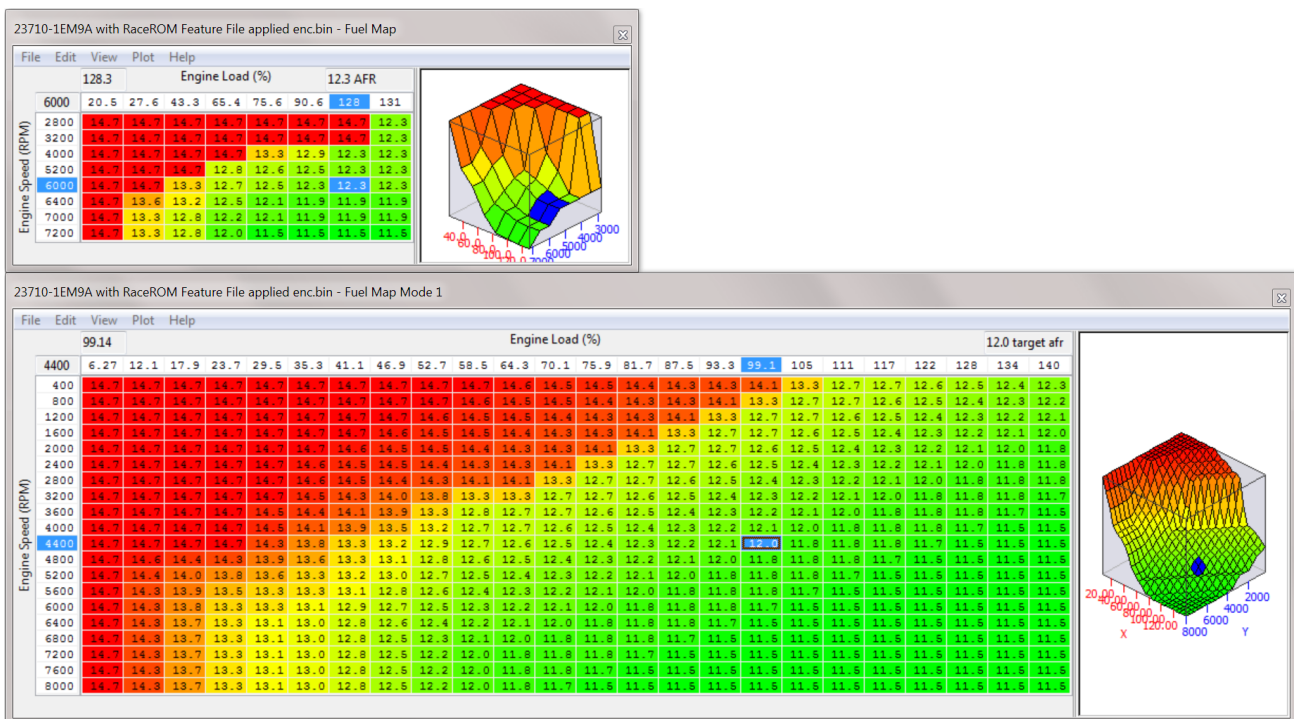
Fuel Map MODE 1 to MODE 4

The fuel map contain target AFR based on Engine Speed (RPM) and Engine Load (%). The vehicle has two factory fitted wideband sensors (one for bank 1 and another for bank 2). The ECU uses *Fuel Trim Short Term* B1 and B2 to ensure the target AFR is achieved during light load closed loop. Further to this the *Fuel Trim Long Term* Bank 1 & 2 will make long term adaption trim for continuous Short Term Fuel Trim corrections.

When Engine Load increases the fuelling will operate in open loop and the FTST feedback will not work and the Target AFR will not necessarily be achieved.

The Nissan factory fuel map is very small with very little resolution (8x8).

EcuTek have replaced this factory Fuel Map with 4 new high resolution fuel maps (24x20) that can be calibrated for each of the Map Switch Modes. Mode 1 is the default fuel map if Map Switching is not enabled. See the comparison below.



Fuel Map Enrichment Warm & Cold

The hot and cold fuel map enrichment maps are used to trim the desired AFR by a percentage to attain the correct AFR for a given RPM and Engine Load. The warm map works above 70 deg C and the cold below this threshold.

Values above 100% will cause the engine to run Richer, (e.g. 110% will be 10% more fuel than desired) and values below 100% will cause the engine to run leaner. This map can be used to fine tune for larger Fuel Injectors without having to alter MAF scaling.

Fuel Trim Per Cylinder

This map can be used to add extra fuel to certain cylinders, see the map help text for further information. We advise that the Injector Open Time is measured with an oscilloscope to ensure the correct Injector delivers the additional fuel, it appears that this map input axis shows cylinder numbers but it could be firing order. We hope to test and verify this in the near future.

Cranking

The various cranking fuel maps can be increased or decreased to improving engine starting when using Ethanol or larger Injectors that may cause issues, the staged pulse width maps are an open time period in Ms and this global fueling period can be adjusted using the compensation maps. It's generally suggested that all common maps are adjusted by the same % amount.

Injection Angle

This is the end of the injection (EOI) crankshaft angle before TDC on the firing stroke, so 180deg would be actual BDC and 270 deg would mean EOI would occur half during the Induction stroke.

Injector Size

The Injector Size (RaceROM) can be set differently for all 4 map switch modes, this enables quicker tuning by setting different injector size bytes and also tuning for Ethanol where 30%+ extra Injection volume is required.

Injector Lag Time Multiplier and Offset

This should be used to recalibrate for larger fuel injectors. This is sometimes called injector dead time or injector latency.

Different design fuel injectors will have a different response time to the original injectors so always check with the Injector manufacture if this information is available before purchasing.

Injector Minimum Open Time

This value may need to be reduced when fitting larger injectors, Injectors twice the size will be open for half the time at Idle.

Over Run Fuel Cut #2

The Engine Speed must be over this RPM for fuel injectors to be cut during a period of deceleration (lift off over run). Only the #2 maps are used during our testing.

Over Run Fuel Cut Restore #2

This is the Engine Speed where the Fuel Injectors will be restored (turned on again). The Injector Open Time (ms) during overrun will never show zero and will be around 0.74ms, this is the Injector lag time period being shown but the injectors are not physically open. These values should always be at least 2300rpm above any target Idle speed (or the engine will stall on overrun). Raising these values to say 5000rpm when the coolant temp is hot will encourage pops and bangs during gear change and decal conditions. Only the #2 maps are used during our testing.

3.2 Ignition Control

Live Data related parameters:

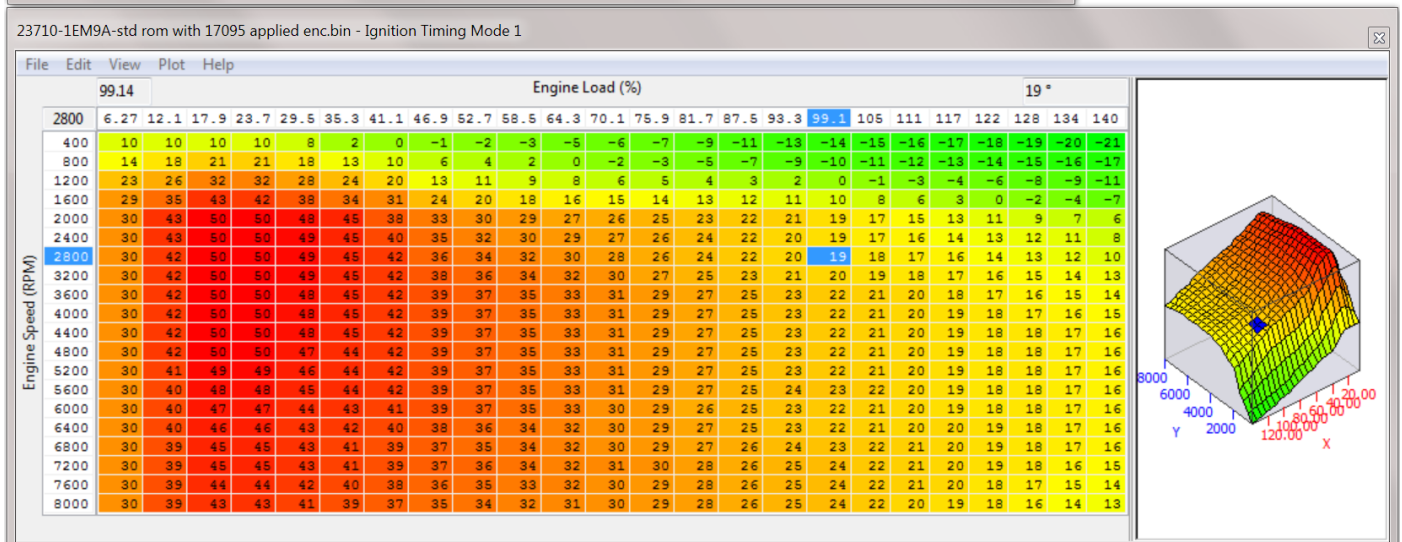
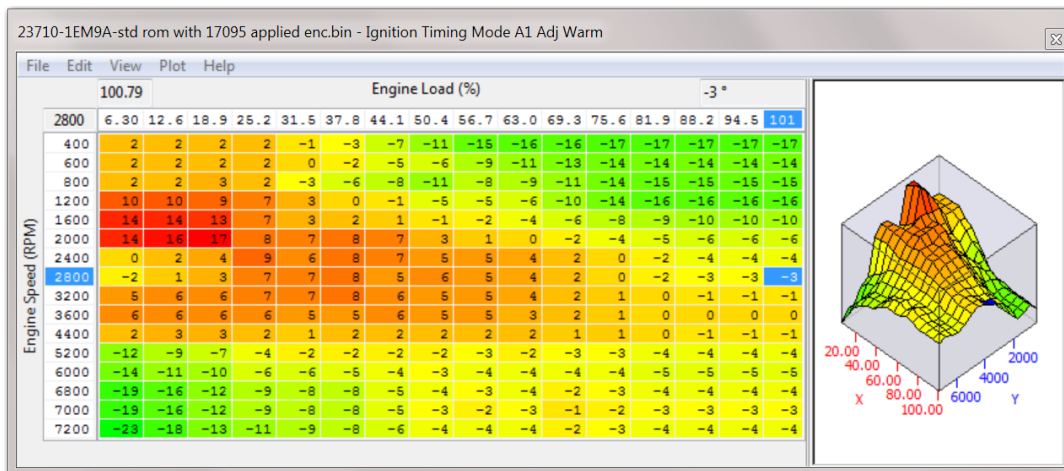
- Ignition Timing (Deg)
- Ignition Timing Calculated (Deg) (RaceROM)
- Ignition Correction (Deg) (RaceROM)

The factory Nissan Ignition maps are low resolution and complex to understand.

EcuTek have rewritten the Ignition control to provide 4 simple high resolution Ignition maps with real Ignition values for each map switch mode.

The RaceROM Ignition maps offer 24x20 resolution vs the factory 16x16. This provides extended RPM and extended engine load rescaling ability that's critical for forced induction vehicles.

See the comparison below showing the factory Ignition map filled with meaningless values vs the RaceROM high resolution Ignition map with Ignition Timing values.



*** NOTE *** As the complex factory Ignition calculations have been over written and simplified by the RaceROM variant it's important to calibrate the RaceROM Ignition maps accurately for your particular vehicle, the region of your vehicle and the fuel quality that is used.

The default the RaceROM ignition map is calibrated from a Euro spec 370z with 97 RON fuel, these timing values may be too advanced for US 91 octane fuel or too little for Japanese 100RON fuel.

When logging you should compare the actual 'Ignition Timing' parameter from the RaceROM Ignition Map against the 'Ignition Timing Calculated' parameter that was generated by the factory Ignition Timing calculation before it was replaced by the RaceROM Ignition value.

Ignition Timing IAT Comp (RaceROM)

This additional EcuTek RaceROM map can be used to advance and retard the Ignition timing based on Intake Air Temperature, it can be used when running a 'blow through' MAF setup when IAT measures Charge Air Temp or when Speed Density is enabled.

Knock Control Enable (RaceROM)

These maps can be used to turn the knock control ON/OFF at different RPM and Load for each of the 4 different Map Switch Modes.

A value of 1 indicates Knock Control is active at that RPM and Engine Load.

A value of 0 indicates Knock Control is NOT active at that RPM and Engine Load.

Knock Sensitivity

This per cylinder threshold map is the point where knock correction will become active for each cylinder. If the values against RPM are breached then the knock correction parameter will start to show knock retard. Built engines often generate excessive engine noise that can be detected as knock, raising these values will help prevent this being detected as knock though care must be taken that the sensitivity will still show true knock! The centre two cylinders are noisier due to cylinders either side (1-3 or 4-6) so the noise thresholds are higher. See the tuning section for more information.

NOTE: Must be used with caution and understanding!

Engine Cold/Warm Thresholds

These parameters specify the Coolant temp thresholds for when the VTC Cam maps **Cold** or **Warm** should be used. The ECU will switch between the maps at 70deg Celsius.

Enable Dynamic Advance

On certain ROMs which use the dynamic advance feature (adding positive Ignition Correction under load) this can be used to disable this feature and stop it from adding additional advance over the RaceROM Ignition Timing map values. See the Tuning section for more information.

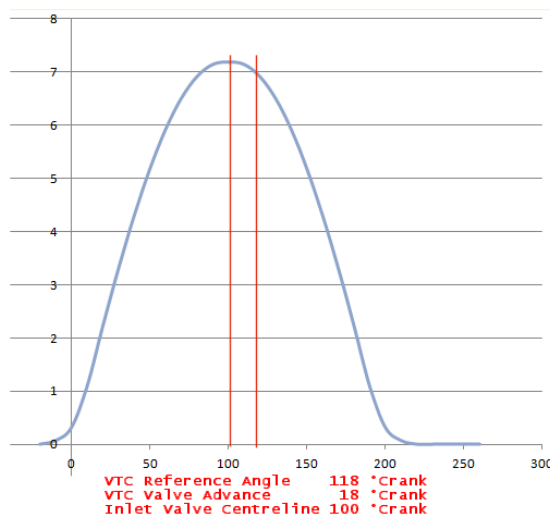
3.3 Cam Timing

The engine is fitted with a complex variable valve timing system that allows the ECU to control both the timing and the duration/lift of the inlet valves. This control is provided by two separate systems that work together.

VTC (Variable Timing Control)

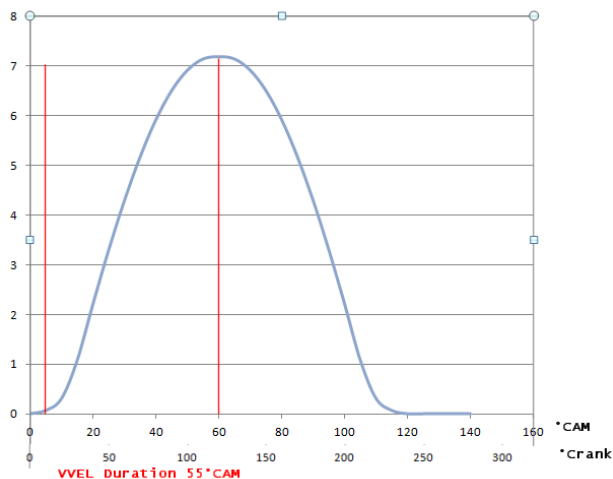
The first system, known as VTC, adjusts the valve timing. It rotates the camshaft relative to the sprocket. The lift and duration of the valve is unaffected. The diagram below shows valve lift against crank angle to illustrate how VTC works. If the VTC system was turned off, the valve would be fully open (centre line) at the VTC reference angle of 118°Crank.

But in this diagram the tuner has requested 18 degrees of VTC Advance. So the centre line has moved 18 degrees to the left and is now at 100°Crank. The inlet valves open 18 degrees earlier and they close 18 degrees earlier.

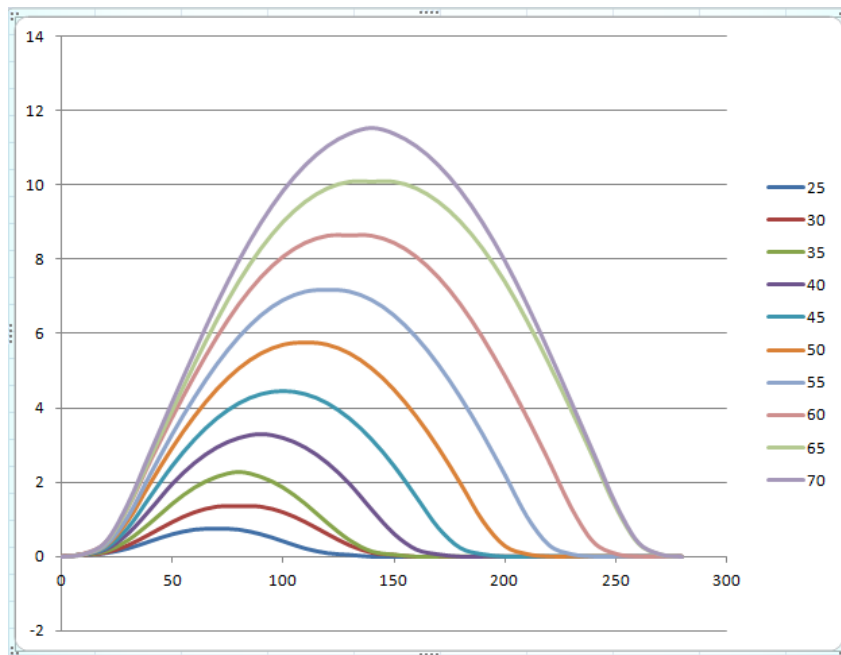


VVEL (Variable Valve Event and Lift)

The second system, known as VVEL, adjusts the valve duration by moving the pivot point of the rocker arm. Valve duration is often measured from valve open to shut in °Crank. But Nissan do not use this convention. Nissan measure the duration from the point at which the valve opens, to the point of maximum lift (centre line). The units are in °Cam. In the diagram below, the VVEL Duration is 55°Cam which would commonly be regarded as 220°Crank. The °Crank measurement is four times the Nissan measurement.

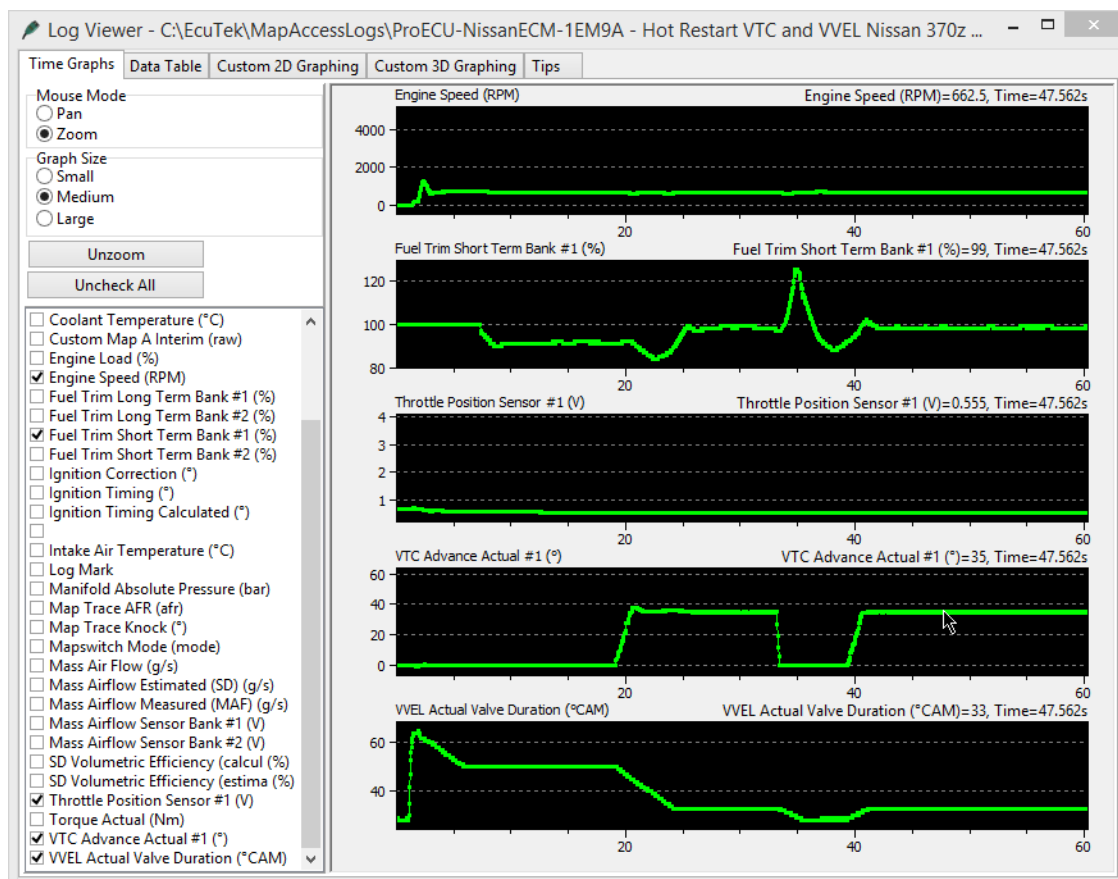


There is a fixed relationship between the valve duration and the lift. More duration means more lift. The diagram below shows valve lift in mm against crank angle for various durations. Requesting a VVEL duration of 25°Cam will result in a valve lift of about 0.75mm. At the other end of the scale, a VVEL duration of 70°Cam will give a valve lift of about 11.50mm.



VTC and VVEL activity

You can see the ECM controlling the VTC and VVEL after this hot restart, the VVEL angle is reduced as the VTC angle is advanced in this example shown below. Notice how the FTST quickly compensates for the change in airflow.



Tuning the Cam Timing

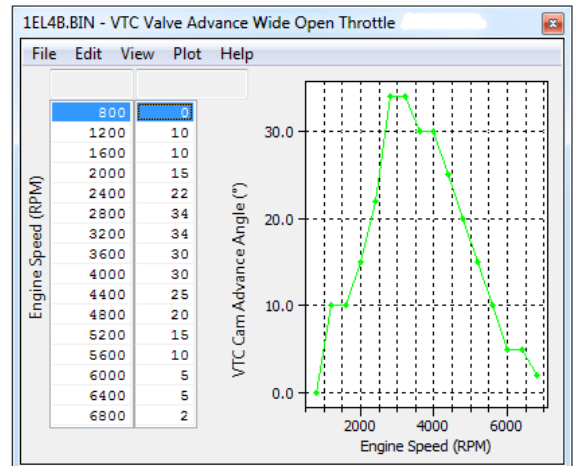
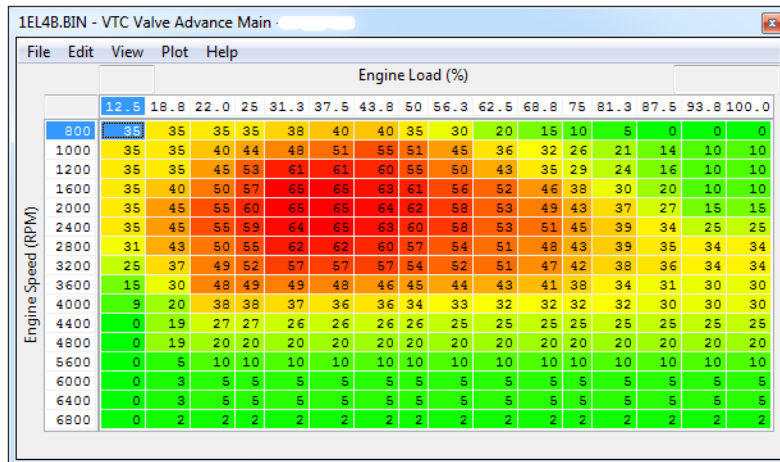
Tuning the VTC and VVEL systems, at a basic level, is fairly straightforward. It is simply necessary to adjust the appropriate target maps and the ECU will follow them while remaining within the safety limits that are present to avoid interference.

The VTC Valve Advance maps contain the target advance in °Crank. There is a 3D map for normal driving. Separate 2D maps are used for Wide Open Throttle and Overrun conditions.

VTC Valve Advance

- VTC Valve Advance Main
- VTC Valve Advance Wide Open Throttle

Intermediate OEM
Intermediate OEM

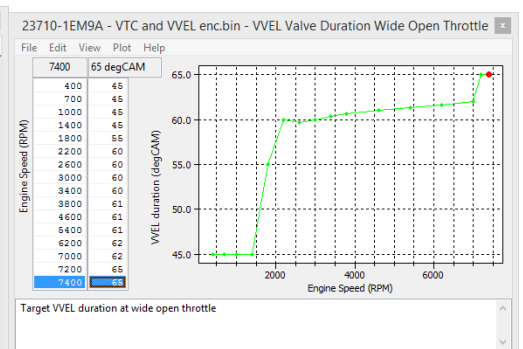
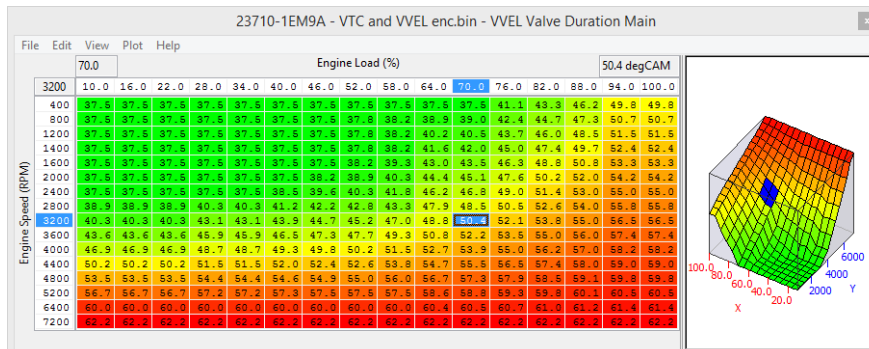


The VVEL Value Duration maps contain the target duration in °Cam from the point at which the valve opens to the point of maximum lift (centre line). As before, there is a 3D map for normal driving and separate 2D maps for Wide Open Throttle and Overrun.

VVEL Valve Duration

- VVEL Valve Duration Main
- VVEL Valve Duration Wide Open Throttle

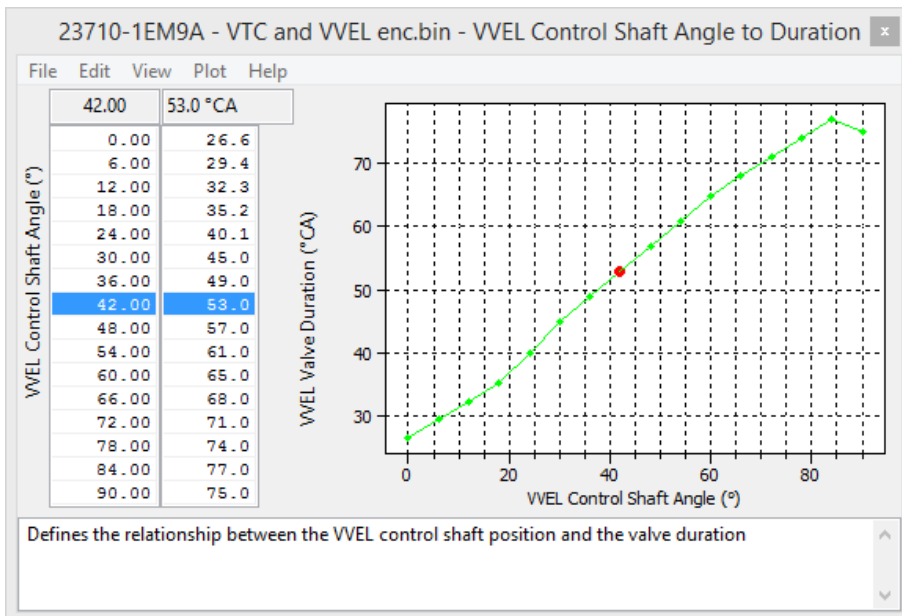
Intermediate OEM
Intermediate OEM



The valve duration is physically controlled by a stepper motor that rotates a shaft under the control of the VVEL control module. Having chosen a target duration, the ECU determines the desired Control Shaft Angle and sends this to the VVEL control module.

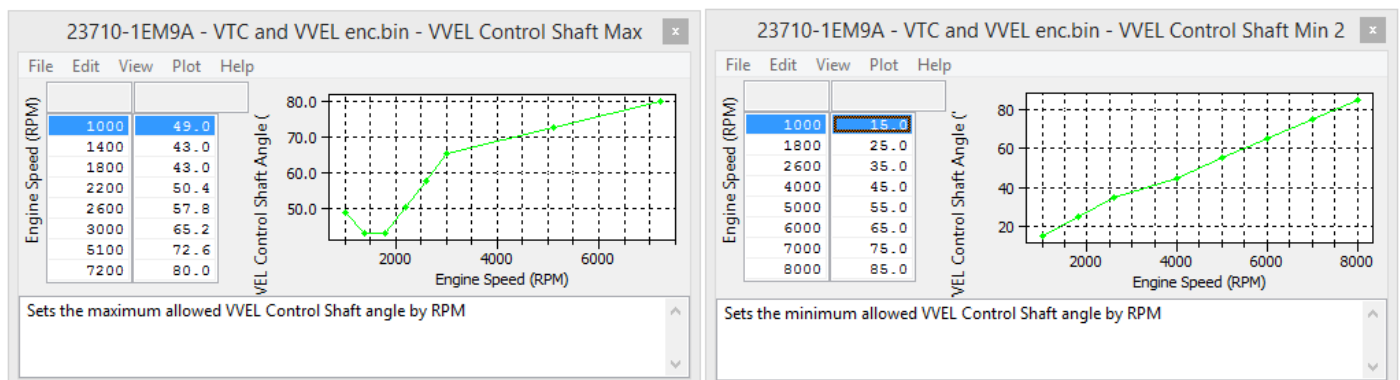
The ECU uses the "VVEL Control Shaft Angle to Duration" map to determine the Control Shaft Angle. This is a bi-directional map. When the ECU needs to determine the desired control shaft angle from the target duration, it reads the map from right to left. When the ECU needs to determine the actual current duration from the measured control shaft angle, it reads the map from left to right.

You should only need to recalibrate this map if you physically adjust the VVEL hardware.



VVEL Min and Max Limits

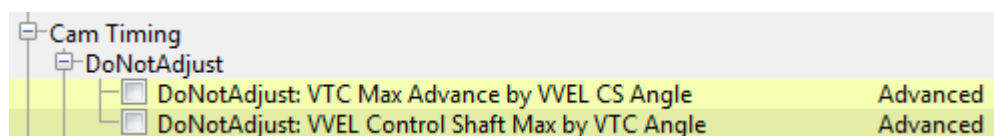
The VVEL system has a number of maps that limit the position of the control shaft, and therefore the valve duration (see above). The two maps shown below limit the VVEL control shaft angle by RPM. At 2400 RPM, the minimum CS Angle is 2.88° and the maximum is 47.8°. This allows a target duration somewhere between approximately 28.5°CAM and 61.9°CAM. The stock calibration runs close to these limits so you will probably need to adjust them in order to tune the VVEL system.



Interference Limits

When adjusting the cam timing, it is important to avoid using long valve duration and large cam advance at the same time. Doing so may result in engine damage due to the inlet valves interfering with the exhaust valves or the piston.

There are two safety limit maps to prevent this from happening. The maps have been included in ProECU for reference purposes only. **We strongly recommend that you do not adjust them.**



When the ECU is selecting the VTC target, it looks at the current VVEL Control Shaft Angle and uses the "VTC Max Advance by VVEL CS Angle" map to determine the maximum allowed VTC target. Conversely, when the ECU is calculating the VVEL Control Shaft Angle, it looks at the current VTC advance and uses the "VVEL Control Shaft Max by VTC Angle" map to determine the maximum allowed control shaft angle.

Starting and Warm Up Cycle

During starting, the ECU will use the "Start-up" Map. Once the engine has started, it will switch to the "First Idle" map for approximately 40 seconds before switching to the "Cold" map. Once the coolant temperature has reached 70°C, the ECU will begin using the "Main", "WOT" and "Overrun" maps as described above.

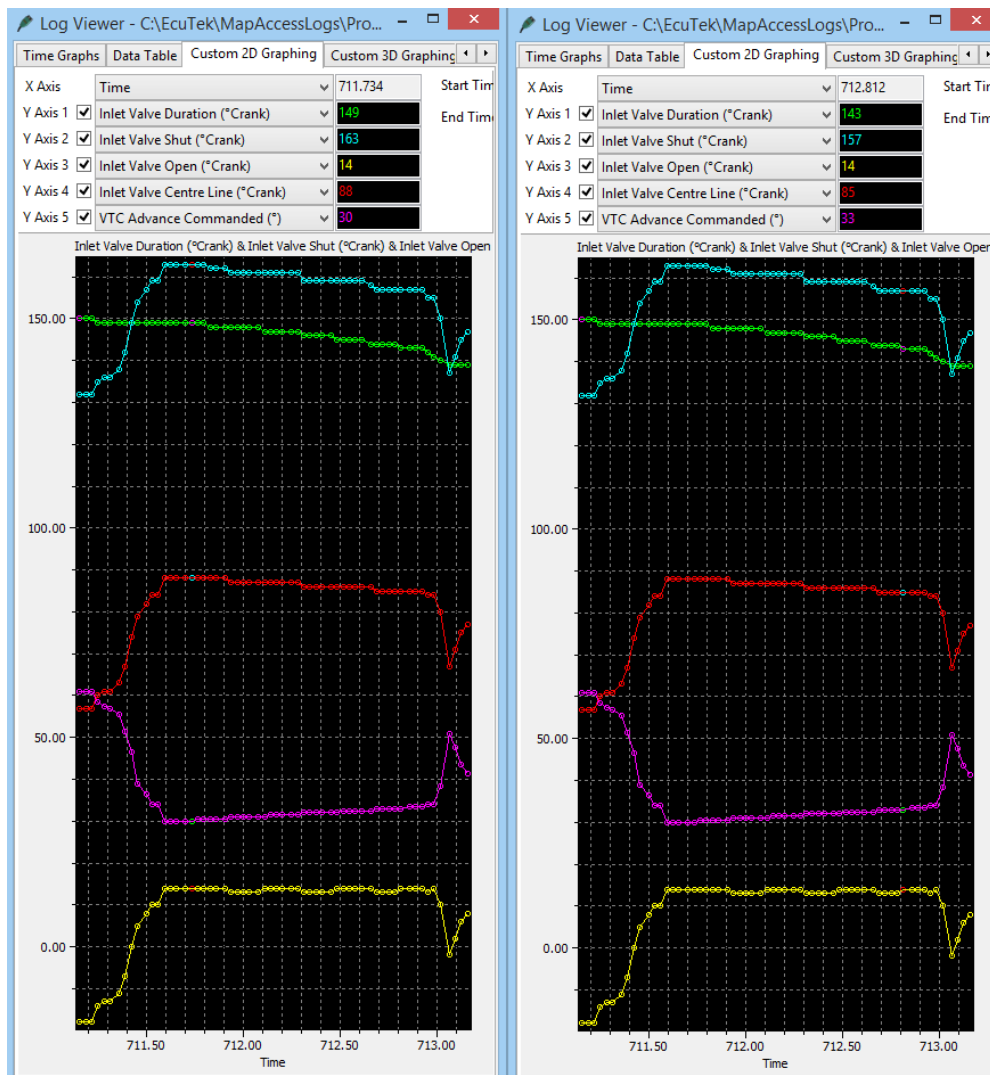
EcuTek Custom Live Data Parameters

As part of our RaceROM features, we have provided some custom logging parameters to help our tuners achieve optimum control of the VTC and VVEL systems.

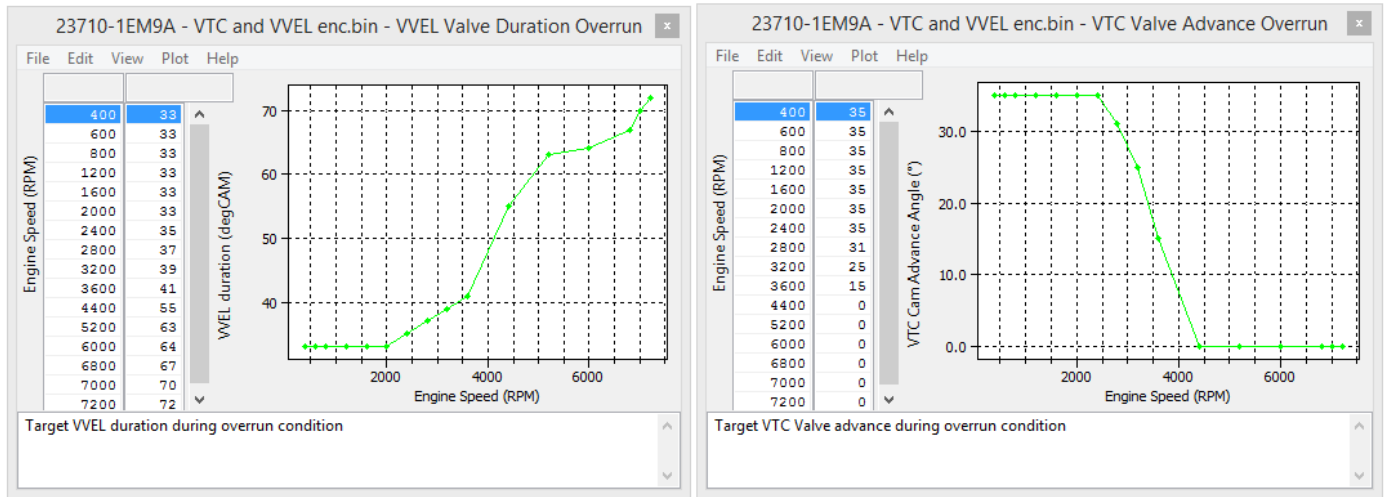
The custom parameters, "Inlet Valve Duration", "Inlet Valve Open", "Inlet Valve Shut" and "Inlet Valve Centre Line", all use the familiar units of °Crank. The picture below shows the parameters changing under deceleration from about 3000rpm.

The left window shows the valve has an advance of 30°. The Centre Line is therefore at $118^\circ - 30^\circ = 88^\circ$. The duration is 149°. Half of the duration is 74.5°. The Open Angle is therefore $88^\circ - 74.5^\circ = 14^\circ$ and the Shut Angle is $88^\circ + 74.5^\circ = 163^\circ$.

The right window shows that the VTC advance has increased to 33°, but the duration has dropped to 143°. The Centre Line and Shut Angle have advanced accordingly, but the Open Angle remains at 14°. The tuner has presumably calibrated the maps to keep the Open Angle constant.



Next are the maps controlling the VTC and VVEL at the time of the log. When looking at the VVEL map, remember that the VVEL Duration in the maps is in °Cam from valve open to full lift, which is one quarter of actual full duration in °Crank. Therefore 37°Cam means 148°Crank and 35°Cam means 140°Crank.



3.4 Accel Pedal and Throttle Angle

There are two stages to the accel and throttle control. Firstly the physical accelerator pedal position is mapped to a logical position. This allows the manufacturer to offer different drive modes with varying throttle response. Secondly the logical accelerator position is mapped to a target throttle angle.

The physical Accel pedal position to logical Accel pedal position relationship is controlled by several sets of 2d maps. For vehicles that support the Infinity "Drive Mode" switch, there are four sets of maps: Normal, Eco, Sport and Snow. These maps are also present on some Nissan vehicles without the Drive Mode switch fitted. In this case we suggest that all values are set the same as per the factory settings.

Each drive mode has a slow map and a fast map. These are for different vehicle speeds. It allows the vehicle to be very responsive when driving at high speed, but less responsive for low speed manoeuvres like parking. The transition between the slow and fast maps is controlled by the "Accel Map Slow/Fast Switch" map.

Each of the Accel pedal maps has a corresponding Trustful check map, these must be set the same or a DTC fail safe condition will occur.

There are two Accel position to Throttle Angle maps. One is for low speed, the other for high speed. The transition between low and high speed is governed by the "Accel to Throttle Lo/Hi Switch" map. Typically the two maps are set the same and the switch map is calibrated so that only one of the Accel to Throttle maps is used.

There is a reverse gear multiplier map which is provided so that the vehicle response in reverse gear can be made to feel the same as in 1st gear.

The Accel to Throttle angle relationship is non-linear and typically 40% Accel pedal will result in only 20% Throttle opening (though throttle airflow characteristics should be considered).

3.5 Traction Control ESP

The factory ESP system will act as a traction control by closing the throttle butterfly should a wheel slip event occur, if you alter the four TCS maps (as per the help text on the individual maps) then the throttle will no longer close if wheel spin occurs, use with caution!!

We recommend that you use the factory supplied ESP to turn off the ESP (traction control).

3.6 Torque Maps

Live Data related parameters:

- *Torque Actual (Nm)*
- *Torque Demand (Nm)*

Torque Demand

This is the torque demanded (Nm) by the driver using the Accel pedal.

This can be used to influence Auto gearbox control, see the tuning section for more info.

Torque Demand – Trustful

This is a check map for **Torque Demand** and must be set the same or a DTC condition will occur.

Torque Demand Multiplier

This is a coarse multiplication for torque demand used to smooth out transition periods. The default maps are calibrated to provide extra torque during pull away to prevent the car bogging down. This can be used to influence Auto gearbox control, see the tuning section for more info.

Torque Actual

This is the calibrated torque output of the engine, measured in Nm. It is important that the figures in this map are correct as it can seriously affect the driveability of the car, especially on the automatic transmission models which use the torque figures to control the TCM.

If the TCM is slipping then increasing these values should make it more firm and lock up quicker. If the gear change is hard then reducing these values will make the changes software and offer more slip between gearshift.

Torque Filtering WOT Hi (including the Trustful)

WOT is Wide Open Throttle, this map will prevent the Throttle from fully opening at low RPM, see the tuning section for advice on how to alter these important maps.

Torque Filtering WOT Lo (including the Trustful)

WOT is Wide Open Throttle, this map will prevent the Throttle from fully opening at low RPM, see the tuning section for advice on how to alter these important maps.

3.7 Idle Control

Idle Target #1 & #2 (Drive and Neutral)

The Idle Target maps are used to control the engine speed for drive and neutral gear shift position. It is advised that you adjust both the maps to the same value to avoid discrepancies in the idle speed.

3.8 Sensor Scaling

MAP Sensor

The MAP is located in the Inlet Manifold, it's a 1 bar sensor and there is a simple 'bar per volt' multiplier, the MAP Sensor Offset will be **added** to the 'bar per volt' pressure reading. Please note that the Offset value cannot be a negative value.

There is a second MAP sensor located in the Brake Boost pipe and this is used to measure Brake Servo pressure during cruise conditions, the ECM will close the throttle and create a depression should the servo pressure become too low.

Coolant and Intake Air Temp Scale

This map can be used to rescale the Coolant and Intake Air Temp sensor voltage to temperature scaling.

3.9 Sensor Scaling and Limiters

Live Data related parameters:

- *Base Fuel Schedule (ms)*
- *Engine Load (%)*
- *Engine Load RR (%)*
- *Engine Load Absolute (MAF) (g/rev)*
- *Engine Load Absolute (SD) (g/rev)*
- *Engine Load Calculated (%)*
- *Mass Airflow Sensor B1/B2 (Volts)*
- *Mass Airflow (g/s)*
- *Mass Airflow Estimated (SD) (g/s)*
- *Mass Airflow Measured (MAF) (g/s)*

MAF Sensor Scaling (% to g/s) for Load

When fitting larger MAF housings (or Induction kits) then this value should be increased proportionally relative to the surface area increase of the larger MAF housing, This is a coarse adjustment for MAF scaling, it converts the MAF sensor % value into grams of air per second. See the tuning section for more information on adjusting this parameter.

MAF Sensor Scaling Bank #1 / #2 (V to %)

These maps should be used to fine tune the MAF sensor scaling after the MAF Sensor Scaling map has been calibrated. When fitting larger Intakes it is critical that the MAF scaling on both banks are corrected. The value in the map is percentage of 100% Mass Air Flow, this is then multiplied by the **MAF Sensor Scaling (% to g/s)** 1D value to give a Mass Air Flow in g/s.

100% Engine Load

The point where 100% Engine Load will be achieved, this is factory set at 39.8 *Base Fuel Schedule* (BFS), increasing this map will advance ignition timing and reduce the Torque Actual output value so Ignition and Torque map rescaling must be made accordingly. EcuTek RaceROM allows the engine load to scale well past 100%. It is not recommended to adjust this map.

BFS Multiplier (K-Factor)

This multiples Mass Airflow into Engine Load. This has been used in other software suites to rescale the MAF Tube size. It is recommended that the map not be altered unless you are constrained by an engine load limit. In all other cases, leave this set to its default value of 26806. Use the 1d map called 'MAF Sensor Scaling (% to g/s) for Load' for larger MAF Tubes and aftermarket Intake rescaling. Limiters

Rev Limit - Fuel Cut

The Engine Speed at which the ECU will cut the Fuel Injectors, this is a hard cut rev limiter, set all values the same. The Input axis to these maps is currently unknown.

Rev Limit – Fuel Cut Restore

The Engine Speed at which the fuel injector will be restored after the Fuel Cut, set all values the same. The Input axis to these maps is currently unknown.

Rev Limit – Fuel Cut Maximum

This is the maximum Rev Limit, the top value is when the Fuel Injectors will be cut, the lower value is when the injectors will be restored. These values should be set the same (or above) the 2d maps called **Rev Limit – Fuel Cut** and **Rev Limit – Fuel Cut Restore**

Speed Limiter - Throttle Cut On/Off

The Vehicle Speed at which the ECU will close the throttle to maintain a target vehicle speed. The Throttle Cut Off value is always set high so we advise to keep it this way.

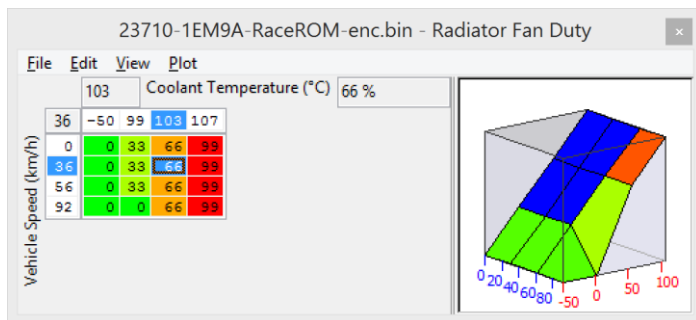
Speed Limiter - Fuel Cut On/Off

The Vehicle Speed at which the ECU will cut and restore the fuel Injectors to maintain a target vehicle speed. It's not advised to use the fuel cut method of speed control.

3.9.1 Radiator Fan Control

Radiator Fan Duty

The fan duty for the current Coolant Temp and Vehicle Speed (A/C Off).



Radiator Fan A/C ON

The map output will be fan duty for the current Coolant Temp and Vehicle Speed (A/C On).

Radiator Fan A/C Related

This additional fan control map is used in alternate circumstances and is related to AC control.

3.9.2 Cruise Control

Cruise Control Set Speed Maximum

Max vehicle speed at which cruise control can be set, this can be quite low in some regions.

Cruise Control Target Max Allowed

Max vehicle speed at which cruise control is allowed to operate, this can be set quite low in some regions.

3.9.3 Gear Ratio

Gear Ratio Manual and Auto Transmission

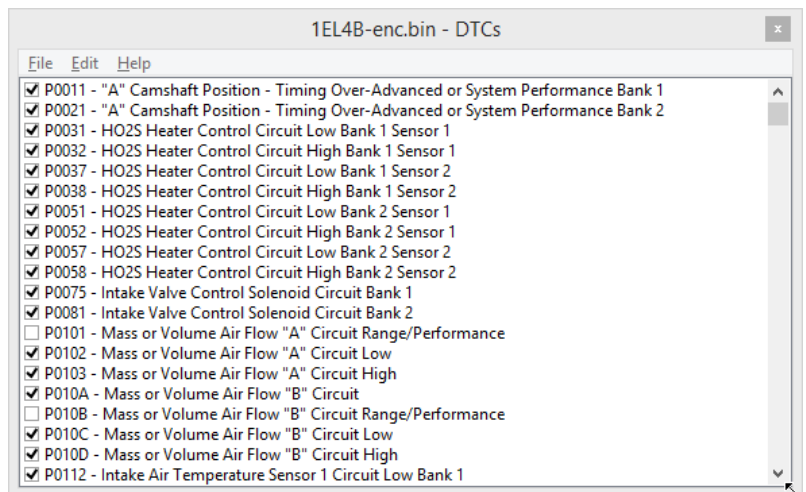
When a taller Final Drive has been fitted the factory Sync Rev feature will not work correctly, simply increase these gear ratio values relative to the Final Drive percentage increment amount.

3.9.4 Diagnostic Trouble Codes

This can be used to turn off any DTCs like catalyst efficiency and fuel tank pressure sensors.

Disabling DTCs should be done with care and understanding.

Example, if you disconnect the coolant sensor the engine will default to a 75 deg C coolant temp and run quite well, if your turn off the Coolant temp DTC then the ECU will use the Coolant temp sensor input and assume -40 deg C.

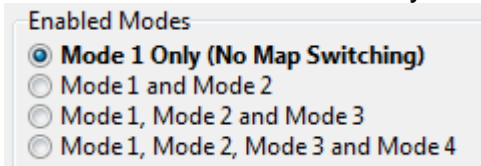


4. RaceROM Configuration

4.1 Map Switching Feature

Four separate maps have been provided for Fuel, Ignition Timing and Knock Control, one for each mode. You can also set different rev limits and injector sizes for each mode. The Launch Control and Flat Foot Shift features can be enabled on a per-mode basis.

Select the number of modes you require using the "Map Switch modes" map.



Enabled Modes

- Mode 1 Only (No Map Switching)
- Mode 1 and Mode 2
- Mode 1, Mode 2 and Mode 3
- Mode 1, Mode 2, Mode 3 and Mode 4

Configure the Fuel, Timing and Knock Control maps as desired for each mode.

<input type="checkbox"/>	Fuel Map Mode 1	Beginner	RaceROM
<input type="checkbox"/>	Fuel Map Mode 2	Beginner	RaceROM
<input type="checkbox"/>	Fuel Map Mode 3	Beginner	RaceROM
<input type="checkbox"/>	Fuel Map Mode 4	Beginner	RaceROM

<input type="checkbox"/>	Ignition Timing Mode 1	Beginner	RaceROM
<input type="checkbox"/>	Ignition Timing Mode 2	Beginner	RaceROM
<input type="checkbox"/>	Ignition Timing Mode 3	Beginner	RaceROM
<input type="checkbox"/>	Ignition Timing Mode 4	Beginner	RaceROM
<input type="checkbox"/>	Knock Control Enable Mode 1	Beginner	RaceROM
<input type="checkbox"/>	Knock Control Enable Mode 2	Beginner	RaceROM
<input type="checkbox"/>	Knock Control Enable Mode 3	Beginner	RaceROM
<input type="checkbox"/>	Knock Control Enable Mode 4	Beginner	RaceROM

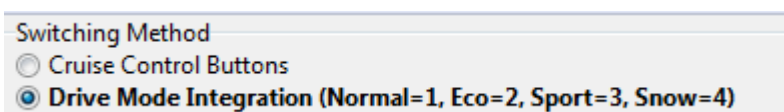
<input type="checkbox"/>	Rev Limit Per Gear mode1	Intermediate	RaceROM
<input type="checkbox"/>	Rev Limit Per Gear mode2	Intermediate	RaceROM
<input type="checkbox"/>	Rev Limit Per Gear mode3	Intermediate	RaceROM
<input type="checkbox"/>	Rev Limit Per Gear mode4	Intermediate	RaceROM

To select a mode:

- Ensure that the cruise control is OFF.
- Hold the CANCEL button for 1 second.
- The Rev Counter will move to indicate the current mode (eg. 2000rpm = mode 2).
- Use the cruise up and down buttons to select the desired mode.
- Press CANCEL to enable the selected mode.

4.1.1 Drive Mode Integration

Some vehicles have a "Drive Mode" switch allowing the driver to select different throttle responses for "Normal, Eco, Sport and Snow". This can be used to control Map Switching by selecting the "Drive Mode Integration" option as shown below.



Switching Method

- Cruise Control Buttons
- Drive Mode Integration (Normal=1, Eco=2, Sport=3, Snow=4)

4.2 Launch Control

Method of Operation

Activate the launch control as follows

- Ensure the 'Launch Control Enable' checkbox is ON for the current Map Switch Mode
- Engine must be running and Vehicle must be stationary
- Press clutch pedal and move the gear stick to 1st position
- Quickly press the accelerator all the way to the floor
- Adjust launch RPM using the cruise control stalk
- Release the clutch to commence launch

When Launch Control is active, the rev limit will be set to the 'Launch Control Rev Limit'. This limit defaults to the 'Launch Control Rev Limit Base' value and can be adjusted up and down using the cruise control stalk. Select "Res/Acc" to increase the launch RPM and "Set/Cst" to decrease it. An alternative method of adjustment is available for vehicles without cruise control. Note: Launch Control is not available on vehicles fitted with Automatic Transmissions.

During the launch, the rev limit increases according to the 'Launch Control Rev Limit Delta, This 2D map, indexed by elapsed time, has multiple columns to allow you to set up a multi-stage system for best results.

There are minimum and maximum coolant temperature limits. Launch control will only operate when the temperature is between these limits.

Adjustments are provided that allow you to enrich the AFR and retard the timing when the vehicle is stationary in order to create pops and bangs. This adjustment is removed as soon as the vehicle starts to move.

The Launch Control feature is deactivated when one of the following conditions occurs:

- The vehicle speed exceeds the last column on the 'Launch Control Rev Limit Delta Map'
- The driver lifts off the accelerator
- The driver performs a flatfoot shift

4.2.1 Integration with Map Switching Feature

The Launch Control Feature can be enabled in any of the four calibration modes by selecting the appropriate checkboxes in the "Enable Special Features" map.

- Enable Launch Control in Mode 1
- Enable Launch Control in Mode 2
- Enable Launch Control in Mode 3
- Enable Launch Control in Mode 4
- Enable Launch Control only in Sport Mode

4.2.2 Example of use

Please see our website video showing the adjustable Launch Control feature in operation.

4.3 Flat Foot Shifting Feature

4.3.1 Method of Operation

The Flat Foot Shifting Feature (FFS) is activated when all of the following conditions are met:

- 'The Flat Foot Shift Enable' checkbox is ON for the current Map Switch Mode
- The vehicle is travelling faster than the 'Flat Foot Shift Minimum Speed'
- The accelerator amount is greater than the value in the 'Full Accelerator Threshold Map'
- The driver is pressing the Clutch pedal

At the moment when the Flat Foot Shifting feature activates, a temporary rev limit is set that is slightly higher than the current RPM. The ignition timing is retarded by a specified amount that reduces engine torque while preventing the RPM from rising too rapidly. When the driver completes the gear change, the temporary rev limit and timing adjustment are removed.

The Flat Foot Shifting Feature is cancelled when one of the following conditions occurs:

- The driver releases the Clutch pedal
- The driver lifts off the accelerator
- The vehicle speed falls below the value in the 'Flat Foot Shift Minimum Speed Map'

Note: Flat Foot Shifting is not available on vehicles fitted with Automatic Transmissions.

An AFR adjustment is provided that allows you to enrich the mixture during the shift. The richer AFR cannot be measured from the exhaust gas due to the operation of the rev limiter.

A deactivation delay can be configured to prolong the feature after the clutch-switch has disengaged. This may be required for smooth operation if the switch point and the bite point of the clutch are substantially different.

4.3.2 Integration with Map Switching Feature

The Flat Foot Shift Feature can be enabled each of the four modes by selecting the appropriate checkboxes in the "Enable Special Features" map.

4.3.3 Example of use

Please see our website video showing the Flat Foot Shifting feature in operation.

4.4 Per Gear Rev Limits Feature

4.4.1 Method of Operation

A separate per-gear rev limit map is provided for each map switch mode. Enter the fuel cut rpm in the first column and the fuel resume rpm in the second column.

	0.000	1.000
1	7650	7450
2	7650	7450
3	7650	7450
4	7650	7450
5	7650	7450
6	7650	7450
7	7650	7450

4.5 Speed Density

4.5.1 Method of Operation

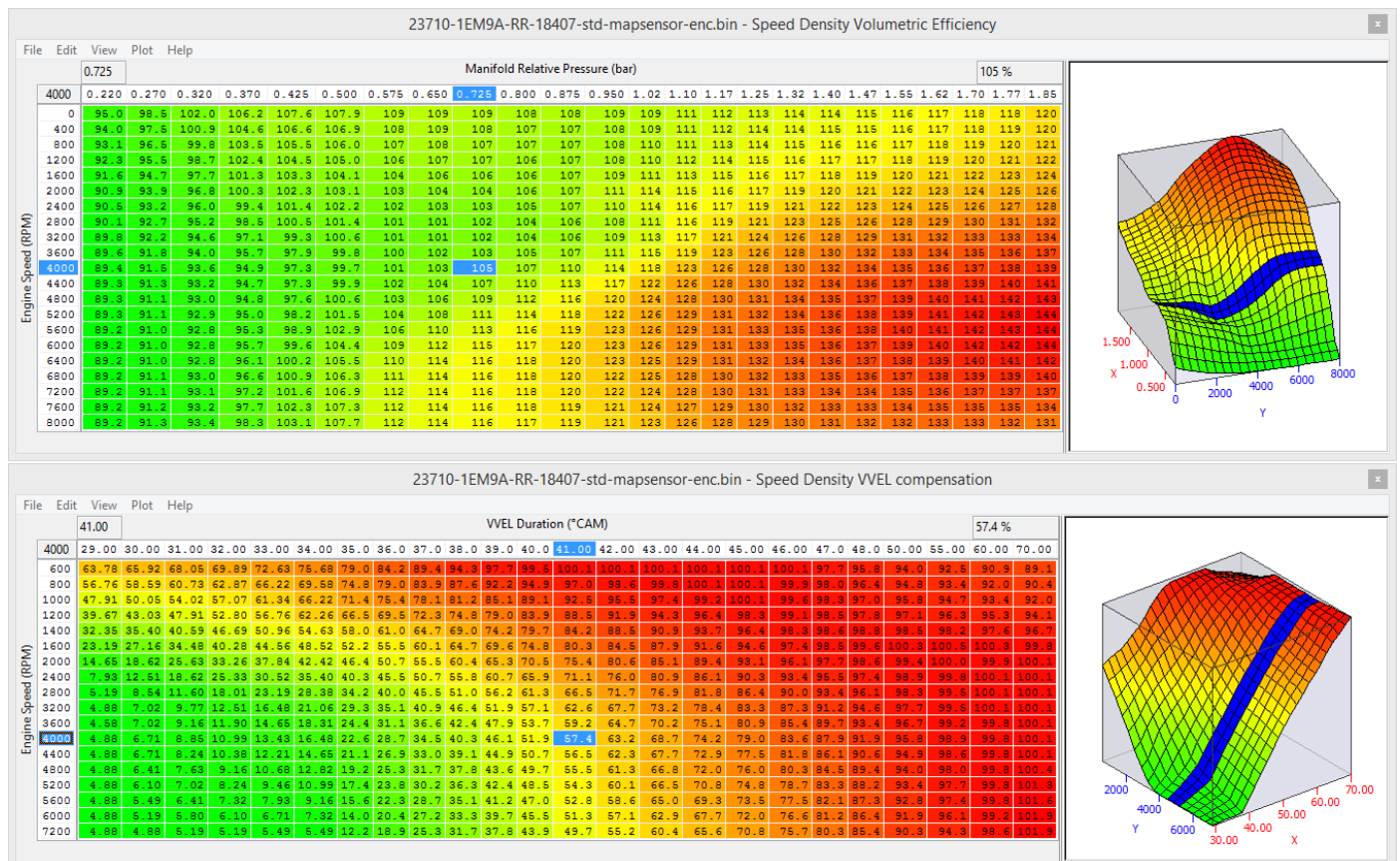
The Speed Density feature changes the way that Mass Airflow is calculated. When SD mode is activated, the ECU will disregard the MAF sensor reading and calculate Mass Airflow based on Engine Speed, Manifold Pressure and Air Temperature instead.

The Speed Density feature is enabled by selecting the **Enable Speed Density** checkbox in the **Speed Density Enable** section. Speed Density can be selected for each of the four map switch modes. When this feature is active, the ECU will ignore the reading from the Mass Airflow sensors and will calculate Mass Airflow as follows:

A value is read from the 3D **Speed Density Volumetric Efficiency** maps, indexed by RPM and Manifold Absolute Pressure. This value is then combined with charge temperature, manifold pressure and engine speed to calculate the Mass Airflow.

In the default configuration, we assume a fixed charge temperature of 20°C then adjust the final result according to Air Intake Temperature using the Speed Density AIT Compensation map. However, RaceROM also supports measuring Charge Air Temperature directly using the AIT sensor or Fuel Temperature Sensor inputs.

The **Speed Density VVEL compensation** map provides SD-VE adjustment for a given VVEL angle ensuring the correct load for any given set of conditions.



1.1.1. Removal of MAF sensor

As the 370z uses VVEL to control cylinder fill at light load in certain conditions, this means that for the same RPM and power output the MAP can be very different which makes SD based calibration impossible **but** the SD VVEL compensation map shown above solves this problem enabling the 370z to run full time SD if required.

1.1.2. Using Speed Density and MAF sensor together

The hybrid Speed Density feature can also be useful in applications where the MAF sensors are present, by configuring the **Speed Density activation** maps. In this scenario, the ECU can be programmed to use the MAF sensors at lower Mass Airflow values and switch to Speed Density for the higher values.

You can specify threshold values of MAF, RPM and MAP that are required for **Speed Density activation**. The ECU will activate the Speed Density feature only when all three of these values are **above** their respective thresholds.

The threshold values are implemented using hysteresis. The 1st value (top value) should be higher than the 2nd value (lower value). The feature will activate when the parameter rises above the 1st value, and will deactivate when it falls below the 2nd value.

You can also use the Speed Density feature in applications where the amount of airflow is lower than the MAF sensor can accurately measure. In this situation, enable the **Speed Density - Activate BELOW thresholds instead of ABOVE** checkbox. The ECU will activate the Speed Density feature when MAF, RPM and MAP are all **below** their respective thresholds.

The default value for the thresholds is zero. If you use the **Speed Density - Activate BELOW thresholds instead of ABOVE** checkbox, then the feature will only be activated when all three parameters are below their respective thresholds. Therefore you need to set a high value into any thresholds that you are not using, otherwise the feature will not activate.

1.1.3. Related Maps

- 1 EcuTek RaceROM Maps\Speed Density**Speed Density Enable**
This map contains the checkbox to enable the Speed Density feature.
- 2 Speed Density**Speed Density Volumetric Efficiency**
This 3D map specifies volumetric efficiency based on RPM and Manifold Absolute Pressure.
- 3 Speed Density**Speed Density VVEL Compensation**
This 3D map corrects the SD calculation for a given VVEL angle.
- 4 Fuelling\Speed Density**Speed Density AIT Compensation**
This 2D map specifies a multiplication factor that is applied to the calculated Mass Airflow.
- 5 Fuelling\Speed Density**Speed Density Activation MAF**
This 1D map specifies that Speed Density mode should only be used above the given Mass Airflow reading. The ECU will switch from MAF sensors to Speed Density when the Mass Airflow rises above the first value. It will switch back to MAF sensors when the (actual) Mass Airflow falls below the second value. This map works in combination with the Activation RPM and MAP maps. Note that each bank is treated independently therefore one bank may switch from MAF to SD mode before the other.
- 6 Fuelling\Speed Density**Speed Density Activation RPM**
This 1D map specifies that Speed Density mode should only be used above the given RPM. The ECU will switch from MAF sensors to Speed Density when the RPM rises above the first value. It will switch back to MAF sensors when the RPM falls below the second value. This map works in combination with the Activation MAF and MAP maps.
- 7 Fuelling\Speed Density**Speed Density Activation MAP**

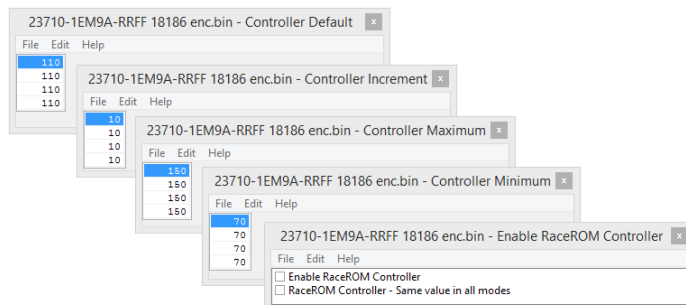
This 1D map specifies that Speed Density mode should only be used above the given Manifold Pressure. The ECU will switch from MAF sensors to Speed Density when the MAP rises above the first value. It will switch back to MAF sensors when the MAP falls below the second value. This map works in combination with the Activation MAF and RPM maps.

4.6 RaceROM Controller (RRC)

4.6.1 Tuner Preparation

The RaceROM Controller is a driver-adjustable input to the Custom Maps system.

- Create a custom map with RaceROM Controller as one of its inputs (see custom maps manual)
- Enable RaceROM Controller
- Flash the file into the car.
- Test your custom map and ensure that it works as envisaged.



4.6.2 Driver Operation

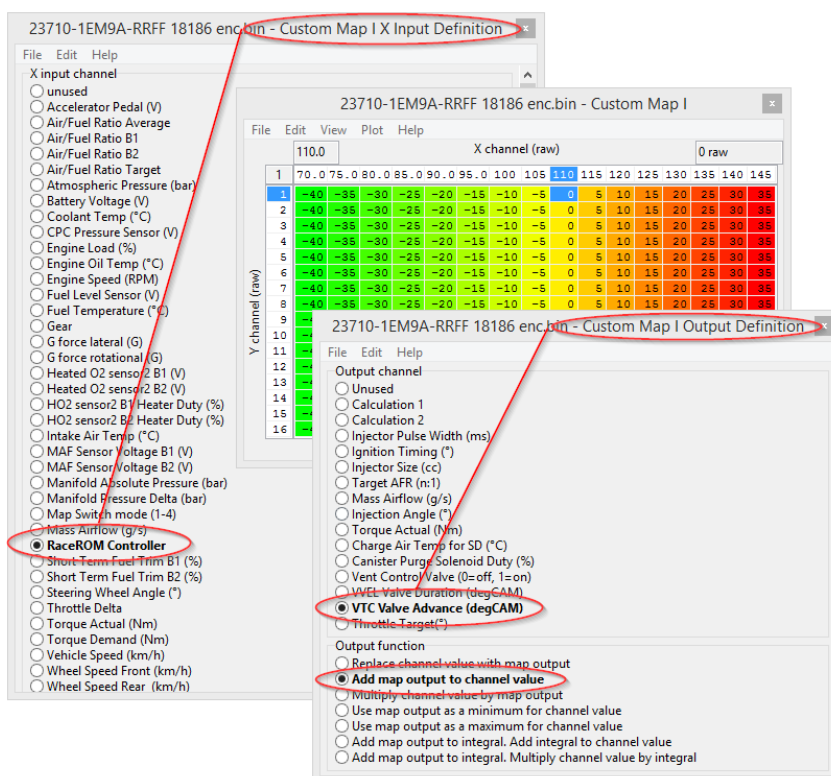
- Ensure that the Cruise control is OFF.
- Press Cruise up or down.
- The current value of the RaceROM controller will be displayed on the Oil Temp Gauge.
- Press up or down to alter the value.
- After a few seconds the gauge will return to normal operation
- The Default values, Min and Max can be configured as desired, see the above screen shot.

4.6.3 Example

The map below will **add** and **subtract** valve angle to the VTC using RRC whilst the engine is running.

The X axis of the map below shows the temperature (°C) displayed on the Oil Temp Gauge (OTG) when RaceROM controller is activated, the initial default value is 110 so the OTG will show 110 though this default can be changed as shown in the map above.

The value in the map is a compensation that can be applied depending on the value that the driver has selected with the RaceROM controller. In this example the output of the map will be **added** to the current VTC angle.



So when the RRC is set to 120 (the OTG shows 120) then the VTC has been increased (advanced) by +10 deg C.

RRC can be configured to adjust VVEL as well as many other output functions as shown in the Custom Map Output Definition map.

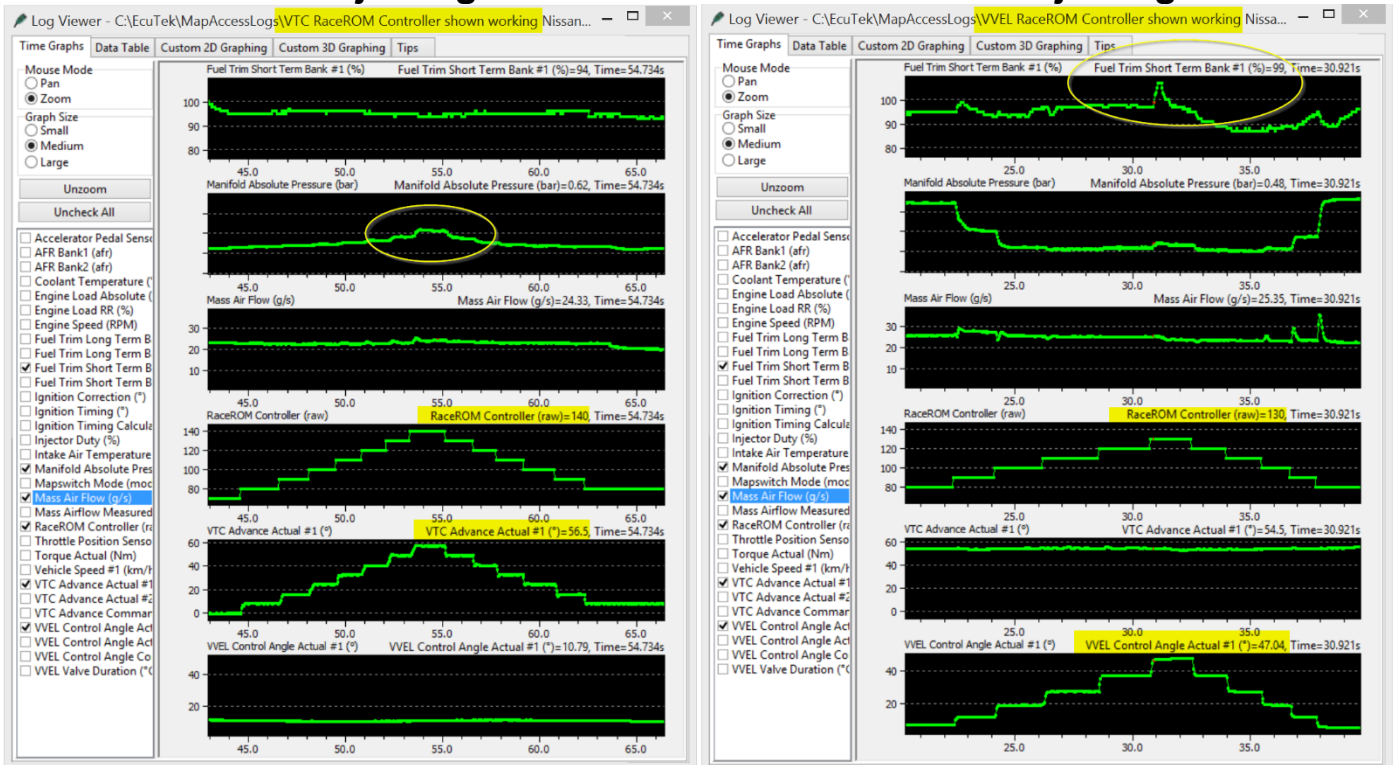
The following log file screen shots shows the VTC and the VVEL being adjusted live using the RRC.

The left hand screen shot shows the VTC being adjusted live, as the RRC is adjusted up to 140 (140 shown on OTG) the VTC has advanced to 56 Degrees.

The right hand screen shot shows the VVEL being adjusted live, as the RRC is adjusted up to 130 (130 shown on OTG) the VVEL has advanced to 47 Degrees.

RRC adjusting the VTC

RRC adjusting the VVEL



See in both examples how the Manifold Pressure, Mass Air Flow and Fuel Trim Short Term are affected by the VTC and VVEL, the RRC can be used adjust the VTC and VVEL live to produce the optimum angle, lift and duration.

In addition the Custom maps Rear O2 import feature allows a 2 x 0-5volt potentiometers to be imported and these in turn can be used to adjust both VTC and VVEL at the same time giving ultimate adjustability and control.

See the custom maps manual for more details and also see the EcuTek YouTube video showing Cosworth using this feature on a Toyota GT86 on EcuTek's dyno, Cosworth adjusted the Inlet and Exhaust cams to produce the optimum angle and they also adjusted the Direct Injection Firing Angle to produce the best power. <https://www.youtube.com/watch?v=bB3PDkSqNo0>

In addition the VTC, or VVEL, Fuel Trims or AFR/Lambda values can be shown on the Oil Temp Gauge, see the Custom Maps manual for Gauge Hi-jack for further suggestions.

4.7 Custom Maps

EcuTek RaceROM Custom Maps is an advanced feature for expert tuners only. It provides the tuner with the ability to modify the control algorithms within the ECU. The tuner can take advantage of this in order to develop their own features that few other tuner can provide. It can also be used to develop one-off fixes to overcome specific problems encountered while tuning a highly modified vehicle.

The following special features are only possible because of Custom Maps

Map Switching	<i>Rev counter indication of the four different map switch modes</i>
Launch Control	<i>Adjustable Launch RPM using the cruise control</i>
Flat Foot Shift	<i>Full throttle gear changes</i>
Speed Density	<i>MAP sensor based tuning</i>
RaceROM Controller	<i>Use the cruise control switch gear for adjust calibration</i>
Knock Warning	<i>Check engine light flashes when knocking is detected</i>
Per Gear Rev Limit	<i>A different rev limit in each gear</i>
Custom Maps	<i>Create a map to do almost anything!</i>
Traction Control	<i>Adjustable traction control using custom maps</i>
Boost Control	<i>Closed loop boost control using custom maps</i>
Flex Fuel	<i>Ethanol flex fuel tuning using custom maps</i>
AFR Control	<i>Closed loop target AFR control using custom maps</i>
Fail Safe	<i>Protect the engine from any dangerous situations</i>
Gauge Hi-Jack	<i>Display lambda or fuel trims on the oil temp gauge</i>

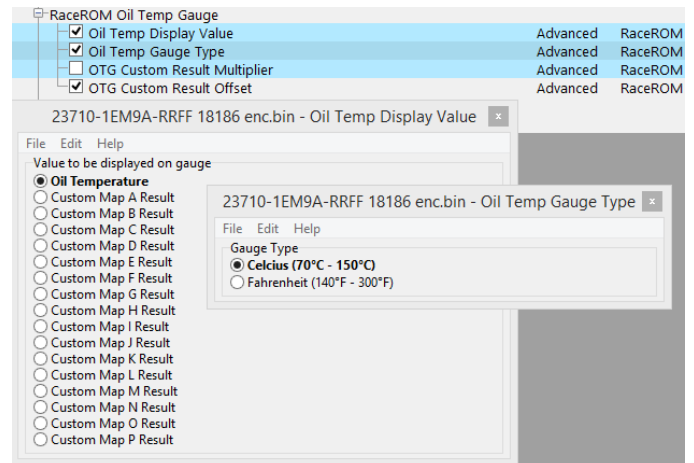
The Custom Maps features shown above are described in detail in a separate Custom Maps manual found in ProECU under HELP tab.

It's also found here: **C:\EcuTek\ProECUHelp\ProECU Tuning RaceROM Custom Maps** manual.

4.8 RaceROM Oil Temp Gauge

4.8.1 Method of Operation

By default, the Oil Temp Gauge displays oil temperature, but it can be configured to display the result of a custom map. A multiplier and offset are provided in case you need to scale the value to fit the range of the display. It is important to select the correct type of gauge, Celcius or Fahrenheit that is fitted to the vehicle.



4.9 RaceROM Valet Mode

4.9.1 Method of Operation

Valet Mode allows the driver to lock the car into a lower performance mode when lending it to a less experienced driver.

4.9.2 Related Maps

Valet Mode Torque Limiter and Valet Mode Speed Limiter

Using these maps you can control how fast the car can accelerate, the maximum speed it can achieve, and the distance it can travel. Distance Travelled axis is measured from when the valet mode is turned on and is subject to a maximum of just over 1150km (740 miles).

Valet Mode Enable

The "Enable Valet Mode" checkbox enables operation of the Valet Mode feature.

4.9.3 Configuration

Valet mode is operated using the cruise control switches in the same way as map switching. Instead of selecting map switch mode 1,2,3 or 4, select mode 7. The map switch mode does not change.

To turn on the Valet mode

- Ensure that the cruise control is OFF.
- Hold the CANCEL button for 1 second.
- The Rev Counter will move to indicate the current mode.
- Use the cruise up until the tachometer shows 7000rpm (mode 7).
- Press CANCEL to enable the valet mode.

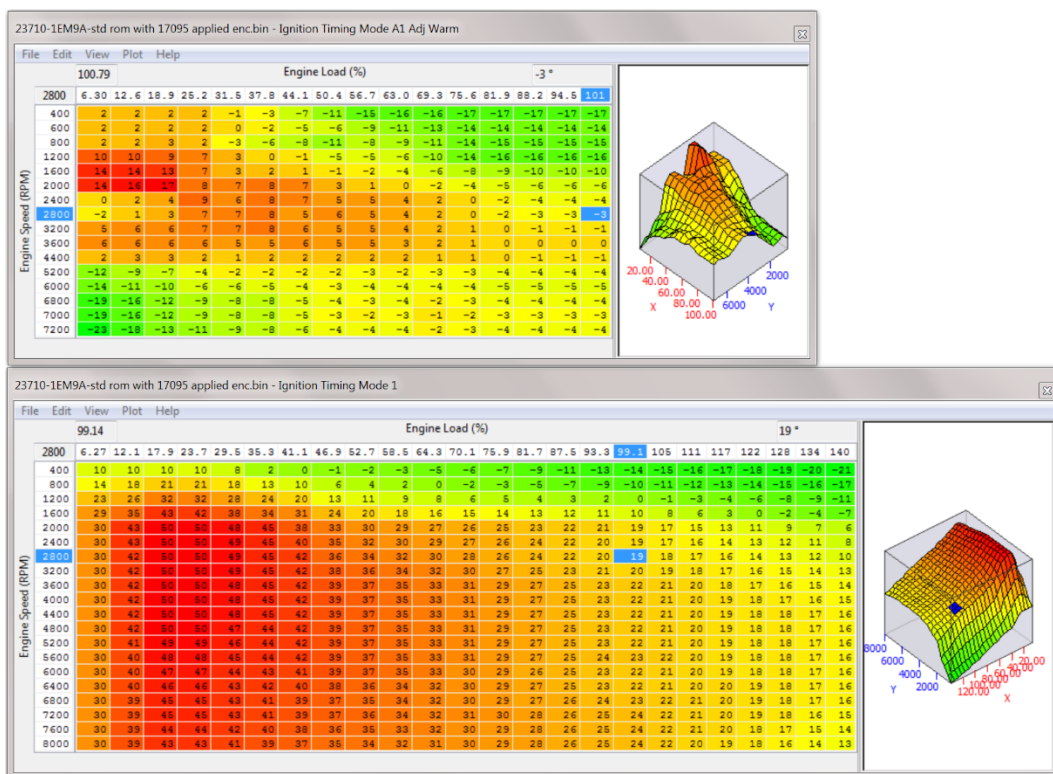
To turn off the Valet mode

- Ensure that the cruise control is OFF.
- Hold the CANCEL button for 1 second.
- The Rev Counter will move to indicate the current mode.
- Use the cruise up until the tachometer shows 7000rpm (mode 7).
- Press CANCEL to disable the valet mode.

5. Tuning Advice

5.1 Ignition Timing

Using the latest RaceROM Feature File (RRFF) the low resolution 16x16 factory Ignition maps are no longer used. They have been replaced with hi-resolution 20x24 Ignition Timing maps (MODE 1 to MODE 4), see ECU Map Descriptions in this manual for further information.



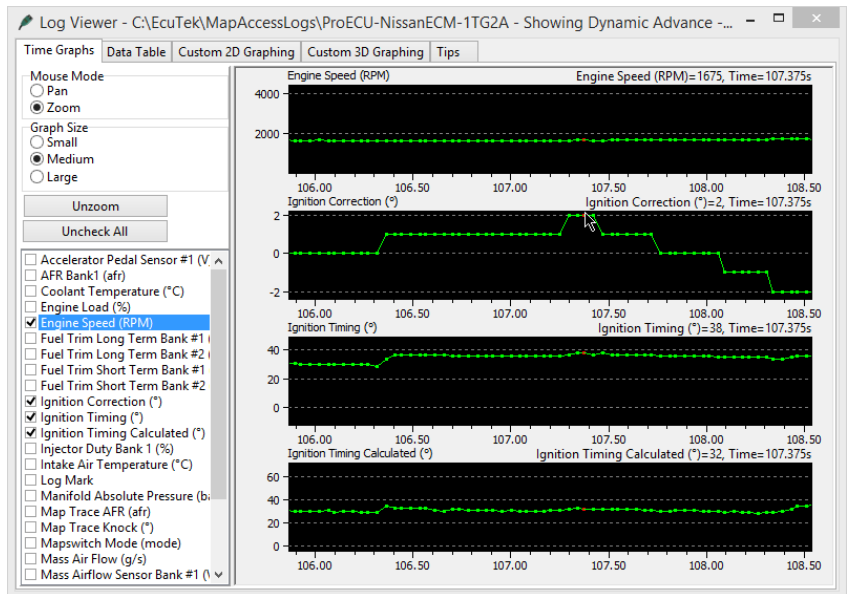
The four different Ignition maps can be calibrated with different values for different fuels like low octane, high octane and race fuel, another map could be for ethanol etc. The 4 maps can also be calibrated to see how much ignition timing the engine will take by quickly switching through the modes whilst testing, you could add +1 degree in Mode 2 and +2 deg in Mode 3 etc. then make a power run in each of the modes and watch the Ignition Correction to see if the ECU shows any negative retard values. If there is no knock retard present then try a slightly more advanced Ignition map, this makes Ignition tuning much faster.

One important consideration is that the base Ignition map shown by RaceROM has been calibrated on a European model 370z running 98 octane RON fuel. This may be too much advance so some regions (like California models running 91 Oct) and it may not be enough advance for Japan model running 100 Octane fuel so expect to have to fine tuning the Ignition map to suit your local condition.

Ignition Correction

The Ignition Correction logging parameter will show knock retard as a negative value (example -3 deg) but will also add Ignition in the event of no knocking (example +2 deg).

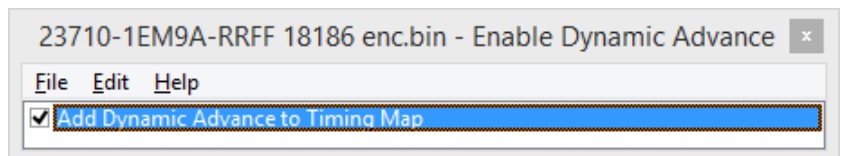
In this example you can see that the Ignition Correction is dynamic and it is advancing the Ignition Timing by +2 deg, it then detects knocking and gently removes the positive advance and levels at -2 deg.



You can see the Ignition Timing (what the ECU actually runs) and the Ignition Timing Calculated (what the ECU would have run before RaceROM overwrote the Ignition control) advancing and retarding as the Ignition Correction is adding and removing the ignition.

The dynamic advance will only become active in the event of no knocking, the complete strategy is unknown at this time but as shown in the above log file the ECU will advance the timing.

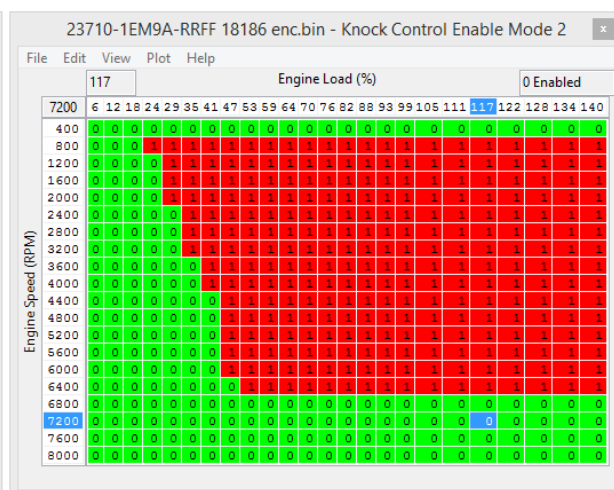
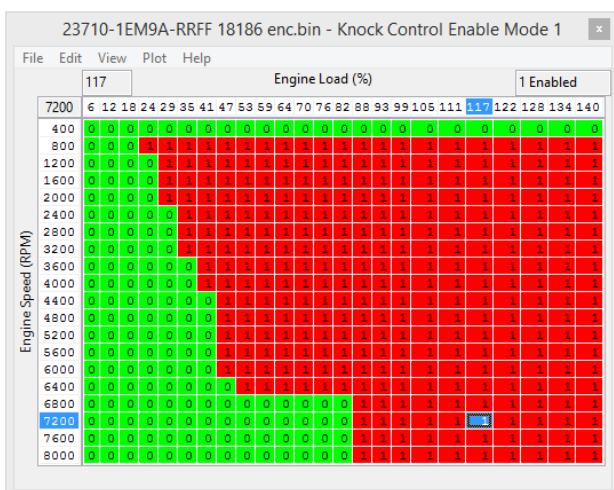
If you do not want the positive dynamic advance to work then simply uncheck the RaceROM map shown below.



The negative dynamic advance will still work (so knock retard will still be active) though detonation should always be listened for even though the ECU will remove Ignition timing if detonation occurs.

Knock Retard

As well as four hi-res Ignition maps we have also written four hi-resolution 'Knock Control Enable' maps which are used to enable and disable the knock control against RPM and Load. We suggest to enable the Knock Detection at high RPM so that the ECU can use active knock correction past 6000rpm as shown on the left in this screen shot below.



With the standard knock switched off past 6000rpm the ECU will hold that knock retard to the rev limiter but if we allow knock detection to take place at high RPM then the ECU will build out any negative knock retard at high RPM (assuming the knocking has stopped). The factory map on the Nissan GTR is also configured to allow knock correction to work up to the rev limiter.

The Knock Sensitivity map can also be altered to raise the knock threshold where the ECU will determine a knock retard value is required. Each row is a cylinder number and the values in the map are the threshold.

Raising these maps by 5% (or maybe 10%) will make the ECU less sensitive to knock retard but you MUST always check for detonation with a 3rd party device.

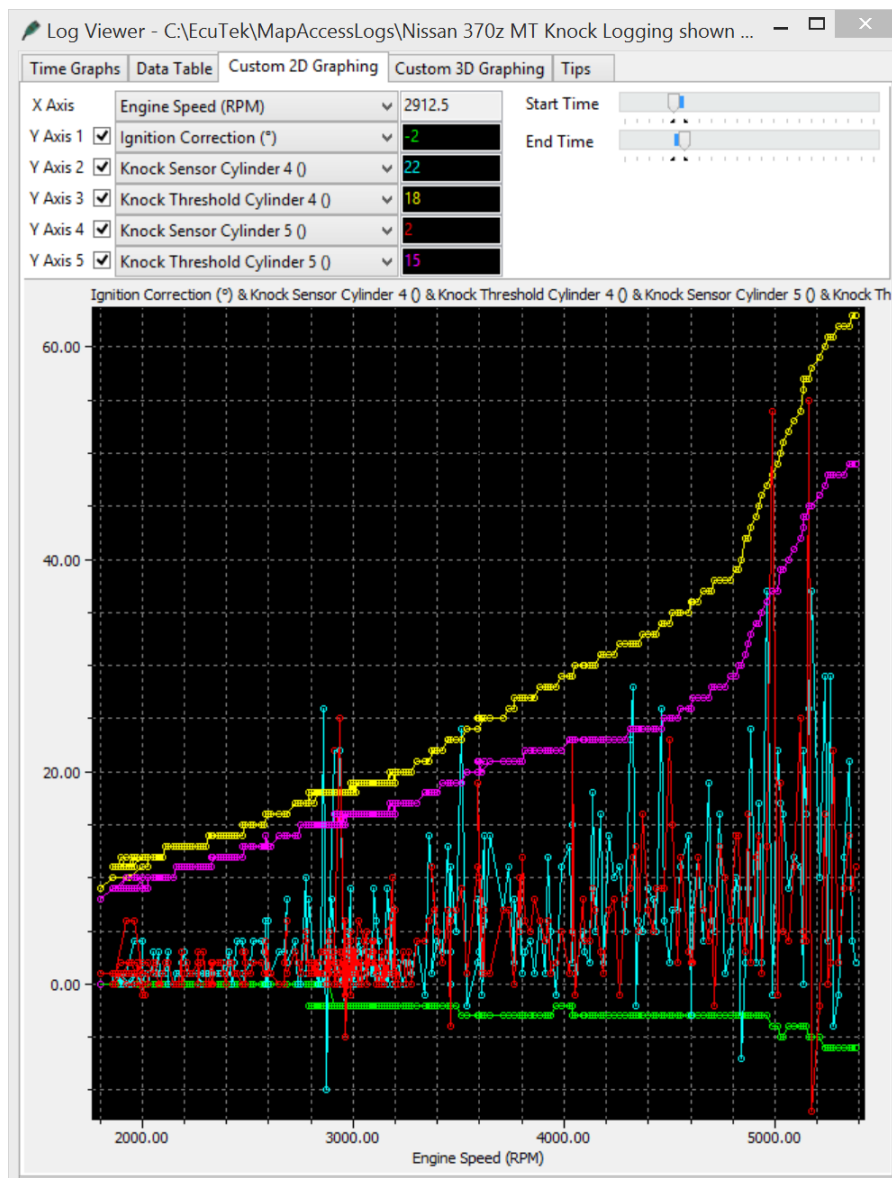
RaceROM offers Per Cylinder Knock and Per Cylinder Knock Threshold logging ability to aid this calibration process and help identify noisy cylinders so the threshold can be raised without raising the other more quiet cylinders.

You can see in this example where cylinders 4 and 5 are making excessive noise and are breaking the threshold, this in turn is shown in the Ignition Correction parameter (green line) is producing more and more knock retard each time the threshold is breached.

Considerations should be made for logging speed that is available from the factory ECU, not every knock event can be shown in the sampling rate that's available.

Note the central two cylinders 3 and 4 have higher thresholds due to these cylinders being more 'noisy' as they are encased by cylinders 1, 2 and 5 and 6 in the V6 engine block design.

The Knock Retard Multipliers can also be increased and decreased to provide a global gain on the output of the knock sensors but as above you MUST ensure you check for detonation with det cans or a similar knock detection device.



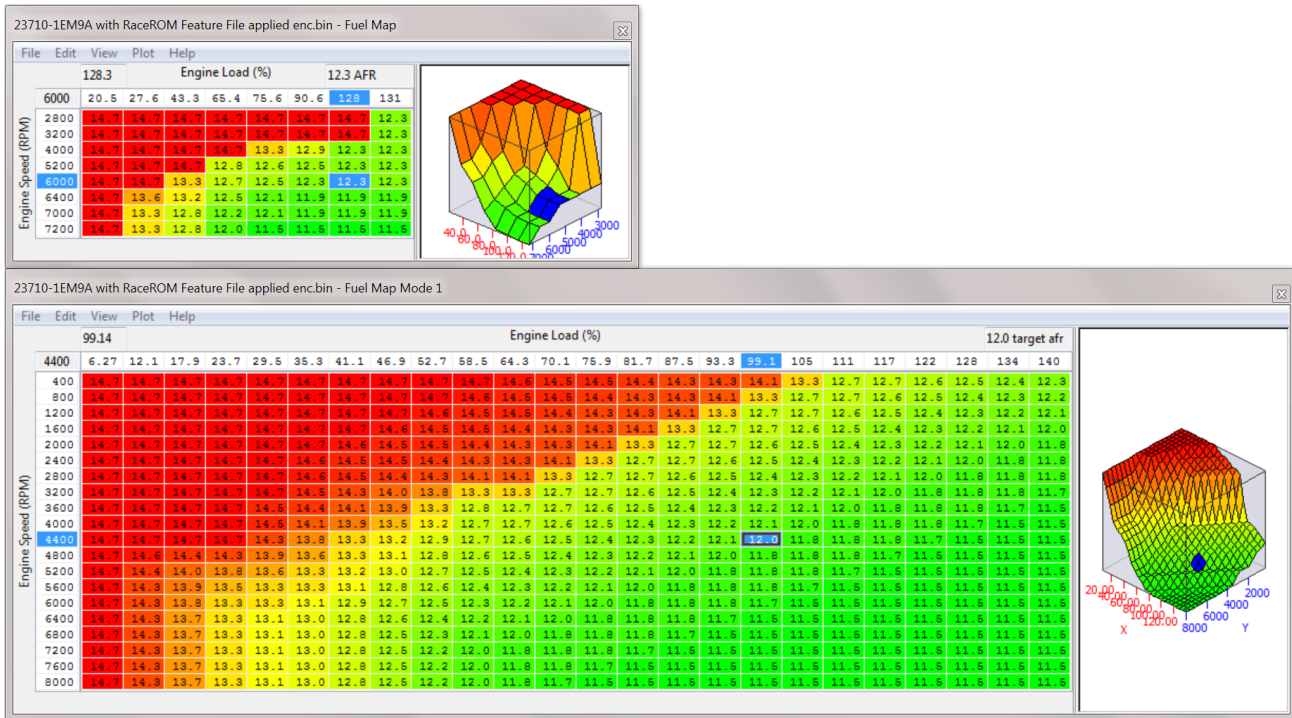
5.2 Fuelling

The Nissan factory fuel map is very small with very little resolution (8x8).

EcuTek have replaced this factory Fuel Map with 4 new high resolution fuel maps (24x20) that can be calibrated for each of the Map Switch Modes.

Mode 1 is the default fuel map if Map Switching is not enabled.

See the factory fuel map vs one of the four RaceROM fuel maps below.



The Fuel Maps are an AFR Target, the ECU will generally strive to achieve a target AFR of 14.7 (or Lambda 1) during Closed Map Loop conditions.

At higher load a more favourable AFR target is needed, at this point the fuelling will go Open Loop where there is no feedback control to the ECU to maintain the fuel target value.

Closed loop will only work at light load and is indicated when Fuel Trim Short Term (FTST) are active.

During mid to full load the FTST will stop working and the ECU will operate in open loop.

Entering a value of less than 14.7 in the fuel map will force the ECU into Open Loop (FTST not working), this trick can be used on forced induction models with big injectors if you are struggling for Idle control and general Idle stability.

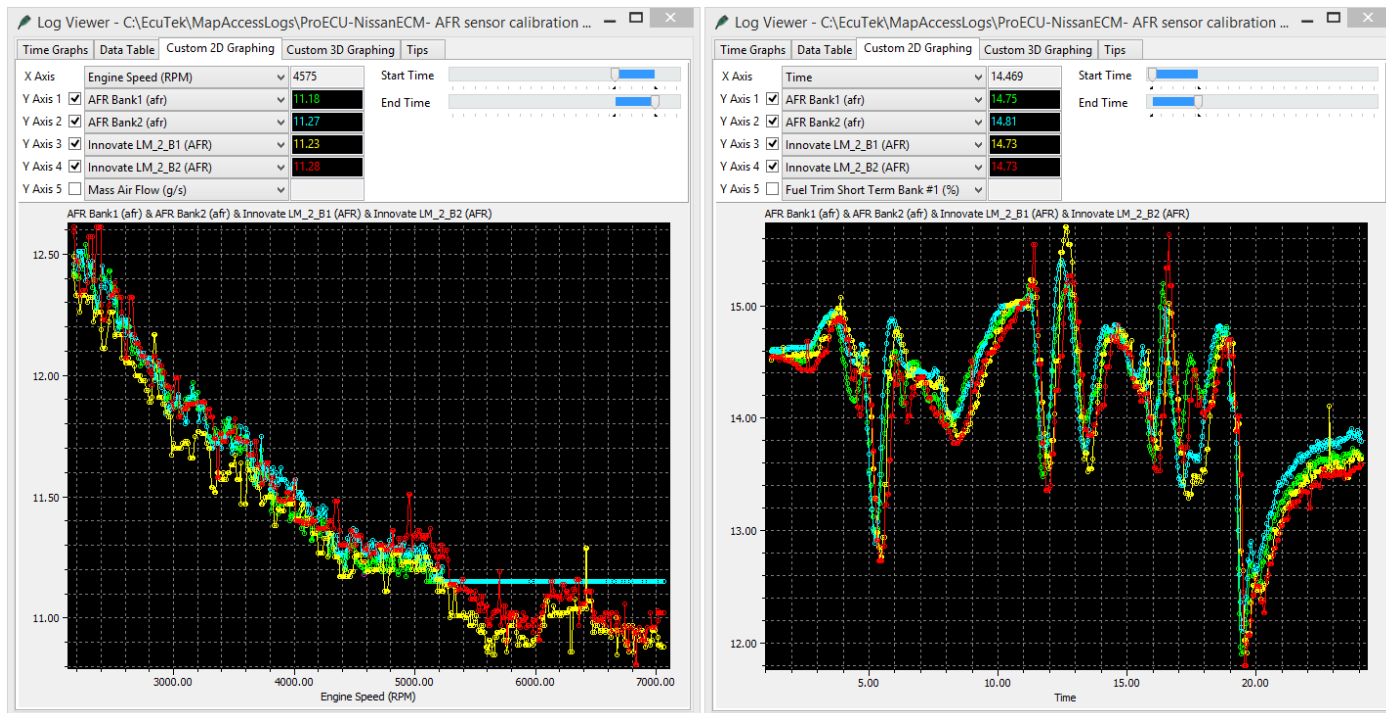
Changing something simple like fuel pressure from say 3.0Bar to 4.0Bar would make the fuel table inaccurate, the FTST will compensate whilst in closed loop and this will transition into a negative Fuel Trim Long Term (FTLT) over a time period.

It's important to understand that FTLT **will** be applied in Open Loop so it's important that your FTST are tight and accurate or long term adaptation will mean that FTLT are applied on full load. This could make the engine run rich or lean over a long term.

Long Term Fuel Trims can be cleared by using the ECU RESET under the Nissan GTR ECM Tool. They are also cleared after ECM programming.

EcuTek have converted the factory Nissan Lambda voltage into a more useful logging parameter called *AFR Bank 1* and *AFR Bank 2*. These AFR logging parameters have been accurately scaled by EcuTek against two Innovate LM2 sensors, see the following screen shot below showing the calibration testing we made.

The factory sensors are quite accurate at richer AFRs but we still suggest that the values shown should only be used for indication and we strongly suggest that all AFR tuning is verified with a **trusted** standalone wideband sensor.



Be sure to check both Bank 1 and Bank 2, as they have different MAF scaling due to different air box designs. Also watch *Fuel Trim Long Term* and *Fuel Trim Short Temp* for bank 1 and 2.

Where different intakes are fitted the MAF scaling should be adjusted so that the FTST are between 90 and 110% at all times during closed loop.

Open Loop tuning should be carried out as per section 4.2 of the BRZ Tuning Guide or the Mazda MX-5 Tuning Guide that's available from EcuTek Update, both these manuals include the basic principles of MAF scaling on ECUs where the fuelling is open loop on full load.

Closed Loop Fuel Control on full load

What quite exciting is that we can use Custom Maps to create a **Full Load Closed Loop Fuel Control**, see the Forced Induction Closed Loop Fuelling section for how to create Custom Maps to do this.

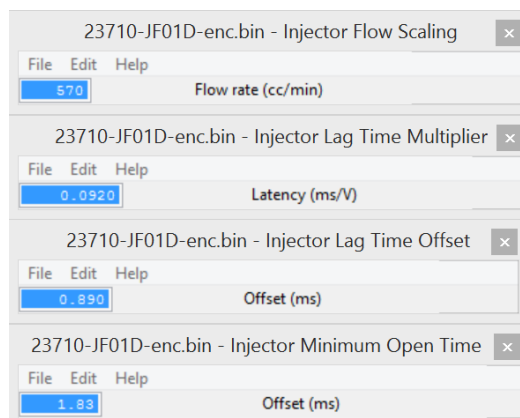
5.2.1 Fuel Injector Scaling

The injector scaling works in a conventional manner, there are Injector Size, Voltage Multiplier and the Offset Time (ms).

The standard injectors are 370cc which are good for around 370bhp.

The factory injectors are open at 84% at 7600rpm (335bhp) at 12.2:1 AFR. This means that factory injectors have a limited capacity for Ethanol tuning.

The factory Nissan GTR injectors (570cc) make a good replacement for the 370z. The Injector Scaling and Offset values would need to be changed, here are the GTR settings.



5.2.2 Cranking Fuel maps

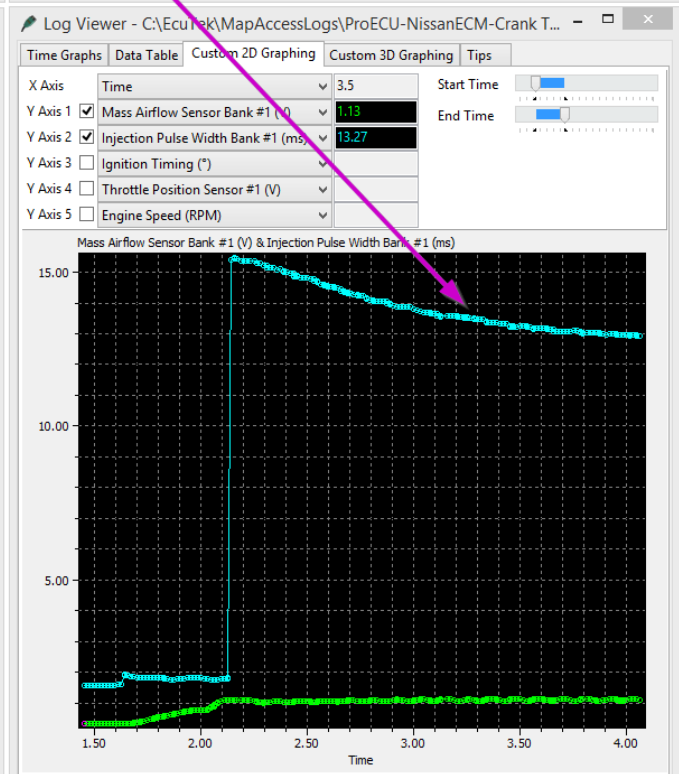
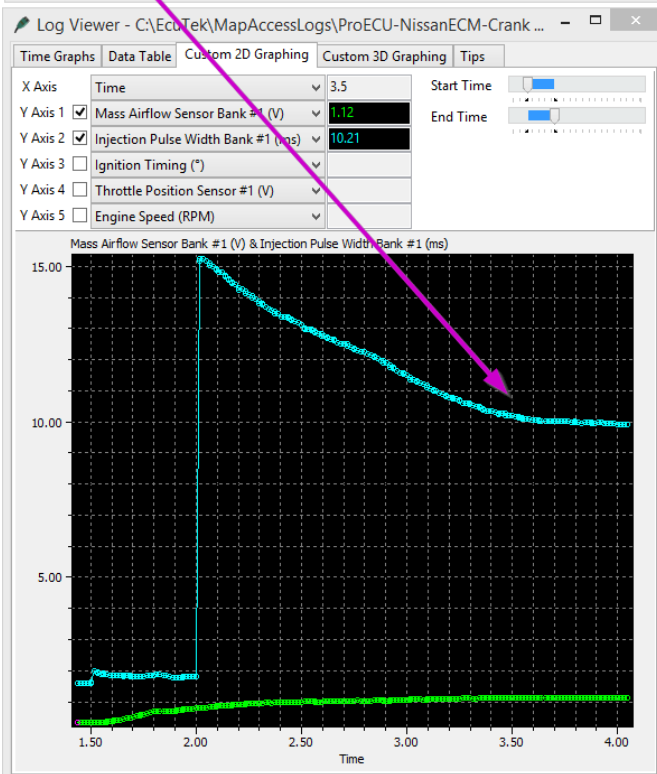
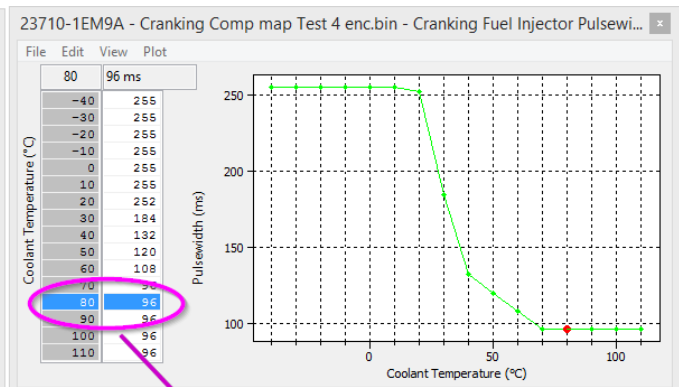
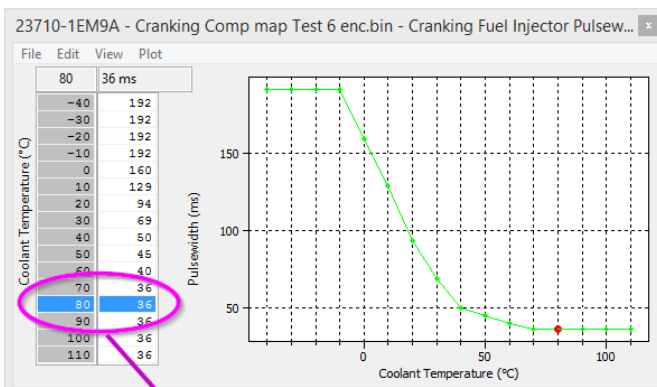
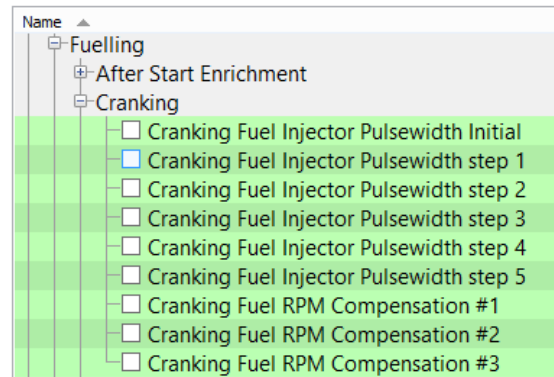
When using larger Injectors or running on Ethanol its necessary to change the cranking fuel volume amount.

There are numerous cranking fuel maps that are shown below, the Initial and step values are an open time period (ms) whereas the compensation maps are a % that affect the overall cranking and starting fuel volume amount.

The full control cannot be defined at this time but the results of changing the various cranking maps can be seen below.

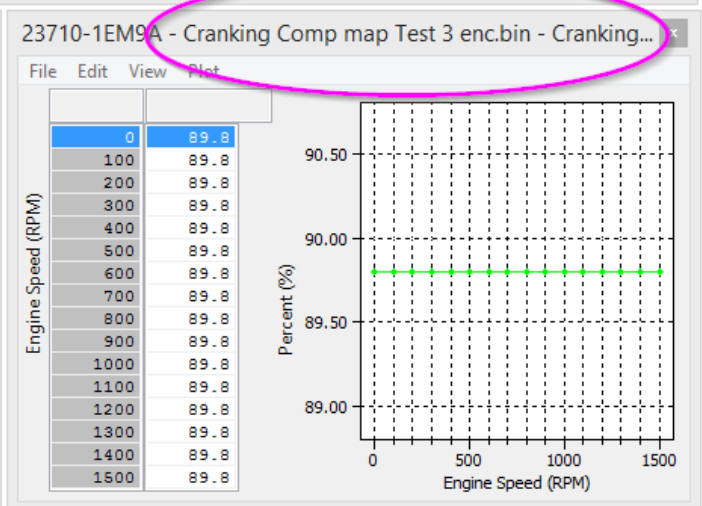
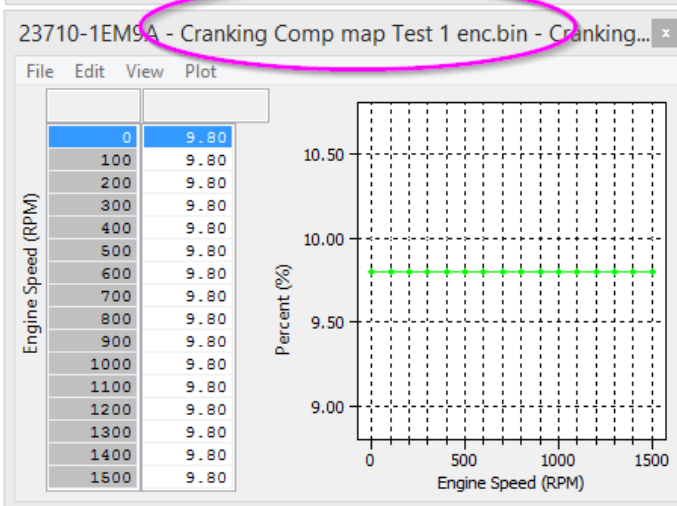
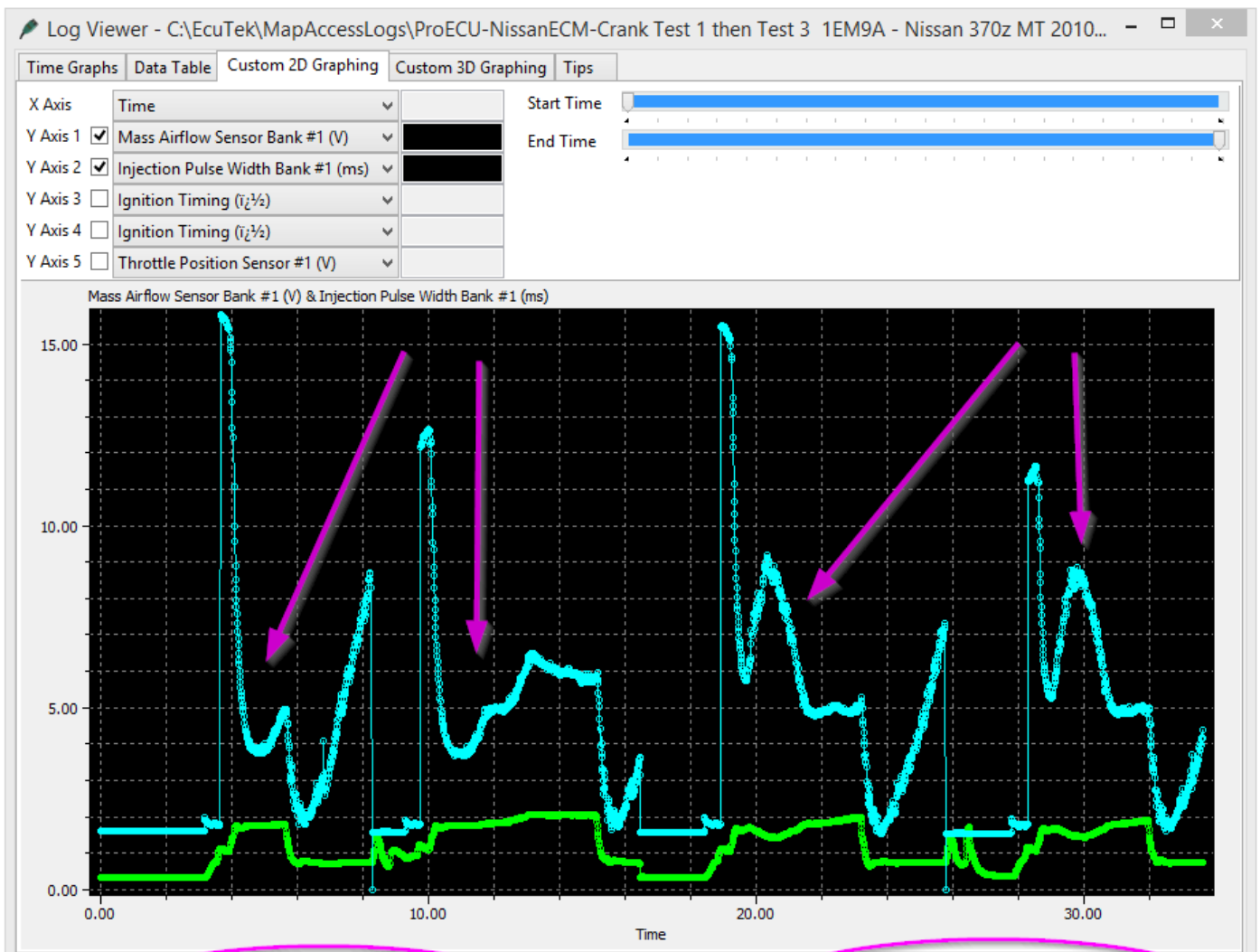
The Cranking Fuel Injector Pulse Width #3 map shown below has been calibrated with 36ms and 96ms for the purpose of example.

See on the left hand log file how the Injector pulse width (ms) reduces and decays much more quickly when compared to the right hand side where the Injector is open for a much longer period with higher values in the map.



The Cranking Fuel Compensation maps can be used as a global 'compensation' for the complete cranking period.

The next test results show the effect of adjusting the Cranking Fuel Injector Compensation #1 - #3



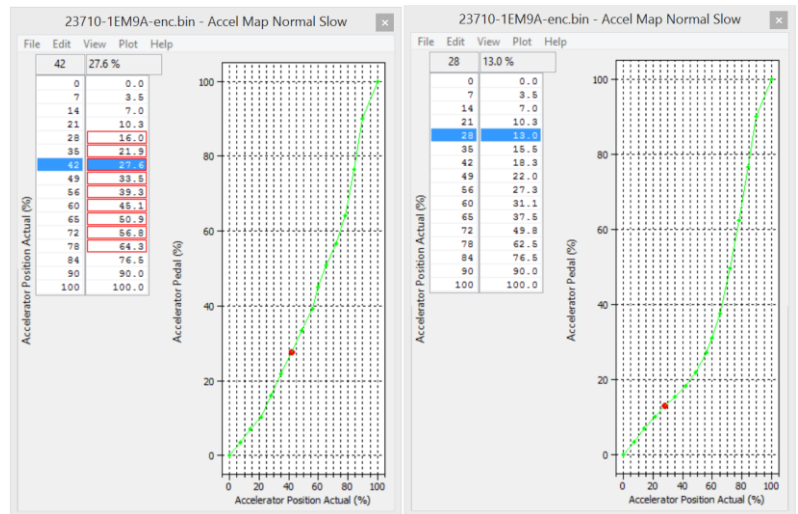
5.3 Throttle and Torque Control

The 370z has a complex relationship between accel pedal and throttle butterfly opening angle that includes cylinder fill and torque calculations, now the fine details of this do not need to be understood but the fact that the throttle butterfly does not fully open below 2400rpm does need to be explained.

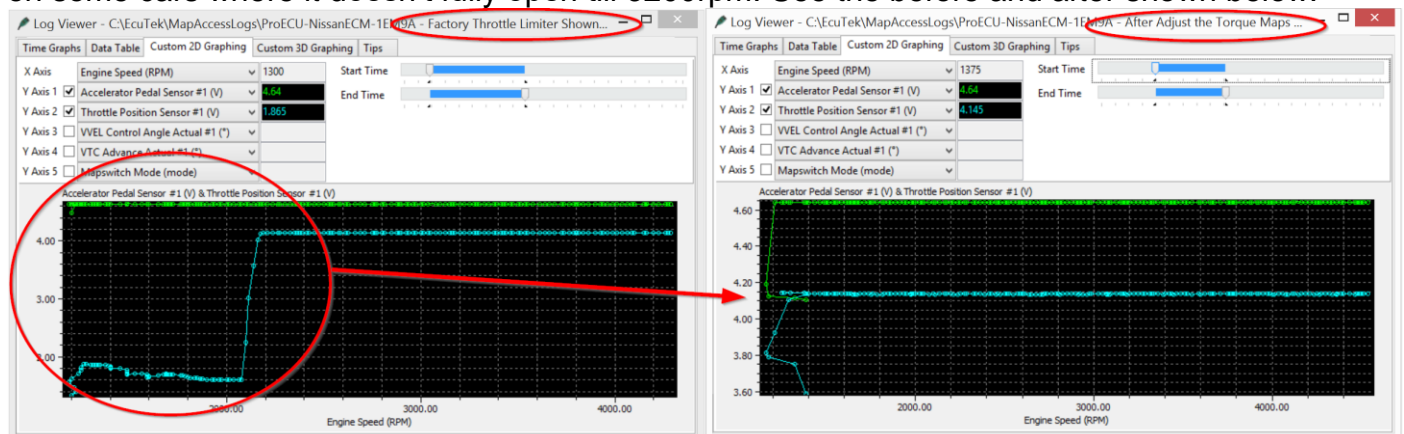
The first adjustment that can be made is the Accel pedal maps as shown below, they are defined earlier in this manual (Section 3.4), these maps can be used to make a worthwhile calibration adjustment that will be felt by the customer.

The factory maps are concave as shown in the factory calibration below, making these maps more linear will mean the engine will deliver more power and torque for a given Accel pedal position.

See the where the modified map has been interpolated between 10% and 76% to produce a much more linear shaped curve, so for a given Accel pedal position the ECU will open the butterfly further. Note that this is only altering the Accel pedal output and doesn't physically create any more power or torque!

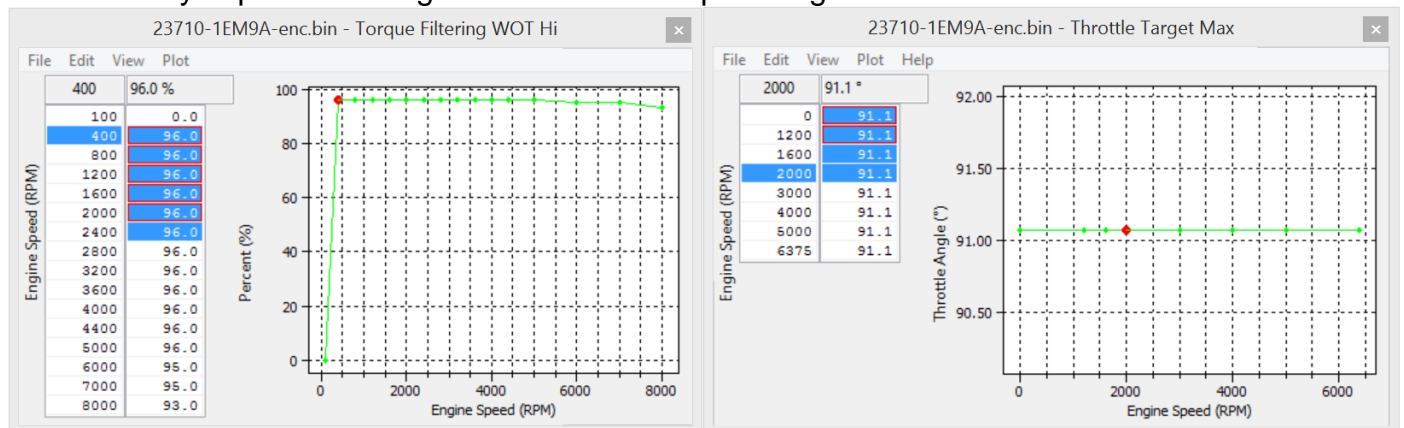


The second issue is the throttle butterfly does not physically open at low rpm, we have seen logs on some cars where it doesn't fully open till 3200rpm! See the before and after shown below.



This is controlled by the Torque Filtering maps, they are a complex control that took a lot of working out and the exact torque control strategy is difficult to explain but the solution is to set the two following maps as shown below, the throttle will now be fully open at low RPM.

This is a very important change for Turbo and Supercharged Forced Induction models.

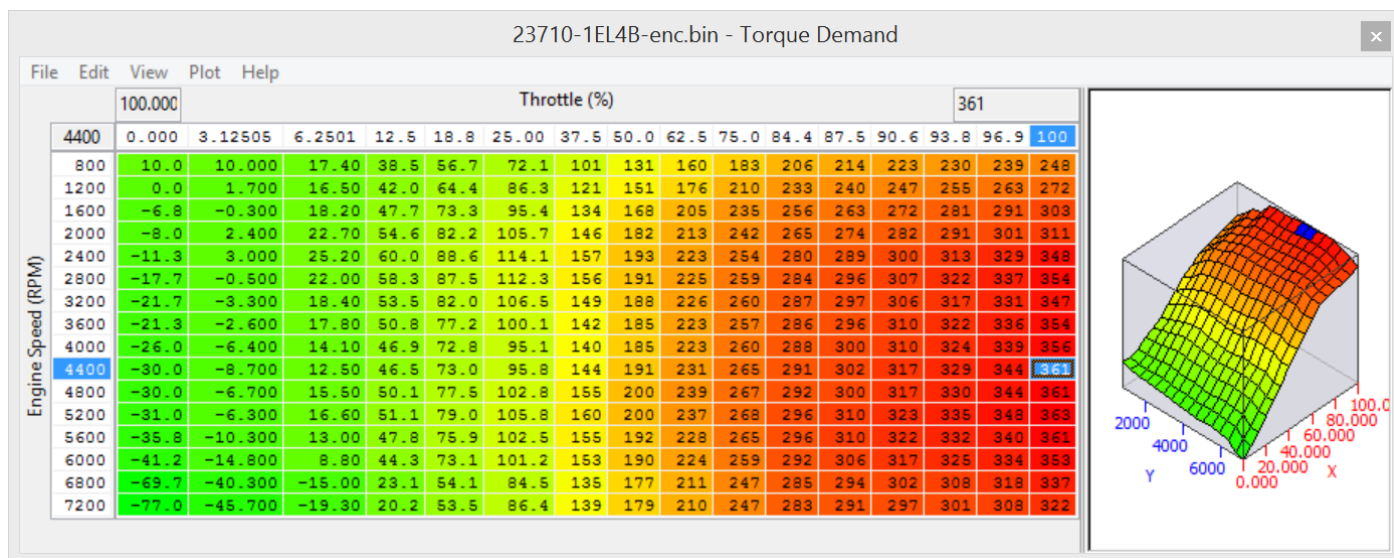


The Torque Actual map values can be raised to influence the Auto gearbox control (AT models). Raising the values on higher load will provide faster harder shifting though high power models may still hit the rev limiter in D mode, though manual shifting can be improved.

The Torque Demand map (and its corresponding Trustful check map that must be filled with the same values) can also be used to influence gearbox control on forced induction models. Increasing the map values (Nm) will tighten gearshifts and enable faster gear shifting in manual mode.

Raising the values on high load may help the gearbox change gear before hitting the rev limiter but ultimately this projection of gear shift in Auto mode is out of the ECMS control.

There is no need to change this maps on manual gearbox models (MT) and changing them may have adverse effects on throttle control and VVEL operation.

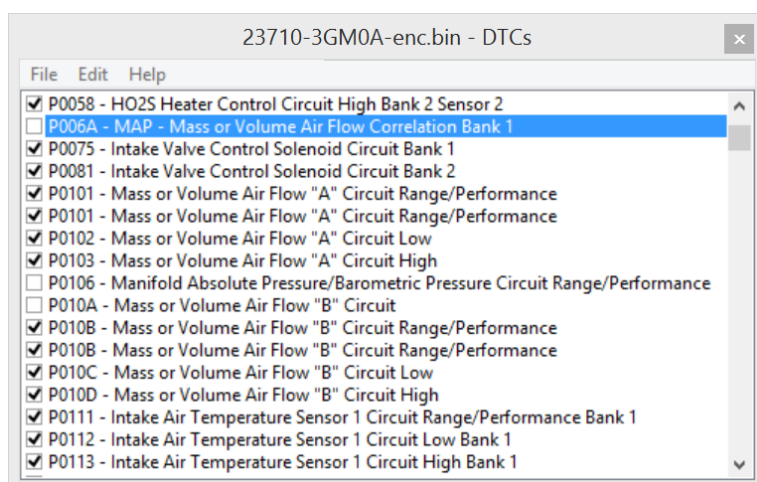


5.4 DTCs and MAF limits

Some forced induction setups may cause DTC and DTC conditions that do not illuminate the DTC.

With larger MAF tubes and if you exceed 4.85 MAF volts you may need to disable various MAF related codes, P0100 through to P010D.

If the catalysts have been removed then the usual P0420 and P0430 will need to be disabled but this is strictly 'for off road use only' in some states where it's an offence to remove vehicle emission hardware.



In addition MAF minimum and maximum voltage Limits can be adjusted where available.

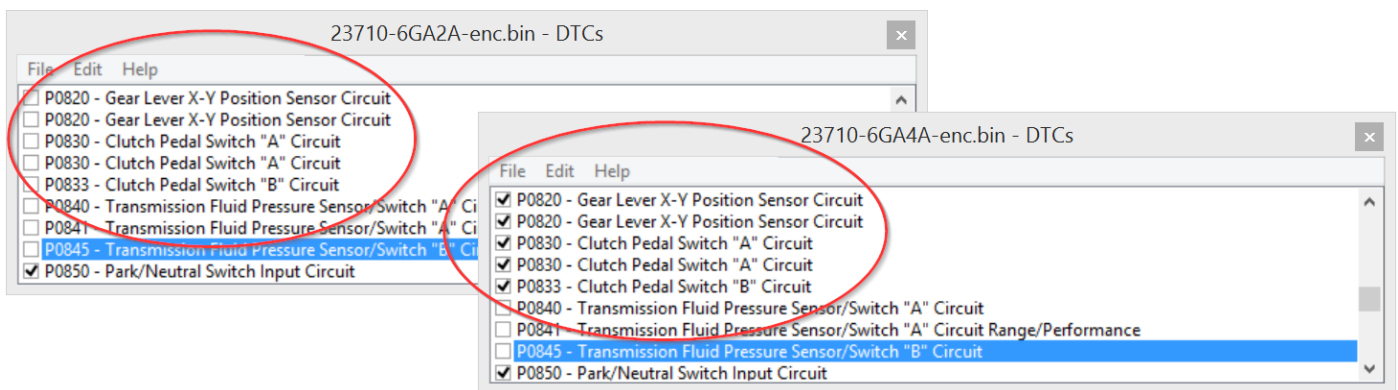
5.5 Syncro Rev Models

Some MT models have the factory auto blip functionality called Syncro Rev, the feature is enabled using the S Sport button near the gear stick. Once in S mode the ECM will blip the throttle during downshifts.

Working out which models do or don't have this feature fitted is difficult and depends on regions and exact specification though the overall production seems to be as follows

Vehicle Model	Syncro Rev Fitted
370z Base	No
370z Sport	Yes
370z NISMO	Yes

Working out and which exact ROMs are compatible is difficult but you may find that if you use a 'compatible ROM' that you will get Syncro Rev related DTCs that can be disabled. See below for a Base and NISMO comparison.



The 6GA4A can be used in the 6GA2A but the P0820 to P0833 will need to be disabled.

We do not know if the Base model (non Syncro Rev model) can be to work with Syncro Rev or not so if you get it working please let us know how!

5.6 Forced Induction Tuning – Speed Density

One of the biggest issues with tuning a Forced Induction setup is the MAF scaling, where the MAFs are located and are they joined together in a common pipe or not!

Speed Density can be used with forced induction models to help solve these problems, its useful when a supercharger (SC) or turbocharger has been fitted and the Intakes/MAF sensors are housed too close to the compressor wheel. This causes pulsing or general poor airflow between the two MAF sensors and means accurate calibration is impossible. Other considerations are fitting a blow off valve and measuring charge air temperature.

There are several useful logging parameters that should be considered and understood to help with MAF and SD tuning.

MAF sensor related logging parameters

- **Mass Airflow Measured** is the output of the MAF sensor, if the MAF sensor is unplugged this would show zero
- **SD Volumetric Efficiency (Calculated)** is a MAF sensor based VE calculation, if the MAF sensor is unplugged this would show zero

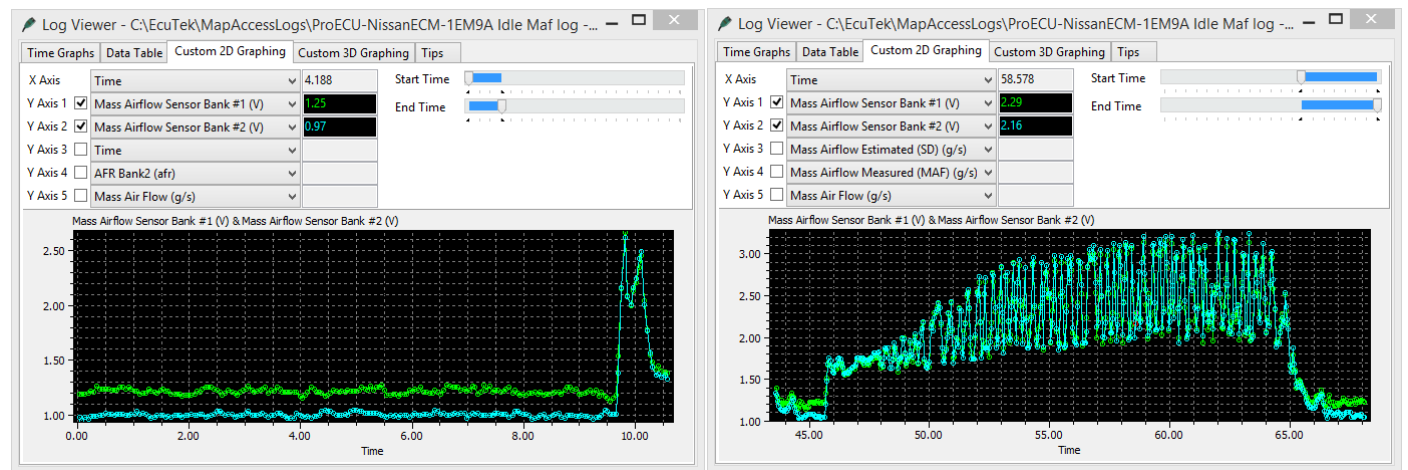
Speed Density related logging parameters

- **Mass Airflow Estimated** is the output of the SD-VE map, this will read all the time regardless if the ECU is currently running on SD or not.
- **SD Volumetric Efficiency (Estimated)** is the output of the SD-VE map (multiplied by the VVEL comp map), this will read all the time regardless if the ECU is running on SD or not.

Time Graphs	Data Table	Custom 2D Graphing	Custom 3D Graphing
X Axis	Time	111.953	
Y Axis 1	<input checked="" type="checkbox"/> Mass Airflow Estimated (SD) (g/s)	386.26	
Y Axis 2	<input checked="" type="checkbox"/> Mass Airflow Measured (MAF) (g/s)	390.89	
Y Axis 3	<input checked="" type="checkbox"/> SD Volumetric Efficiency (calcul (%))	119.1	
Y Axis 4	<input checked="" type="checkbox"/> SD Volumetric Efficiency (estima (%))	117.7	
Y Axis 5	<input checked="" type="checkbox"/> Engine Load (%)	150	

5.6.1 MAF tuning issues - Idle

See below on a SC version where the MAF reading between banks is very different, Bank 1 is 1.25v whilst Bank 2 is 0.97v. As the engine speed is lifted the MAF volts reading is very erratic.

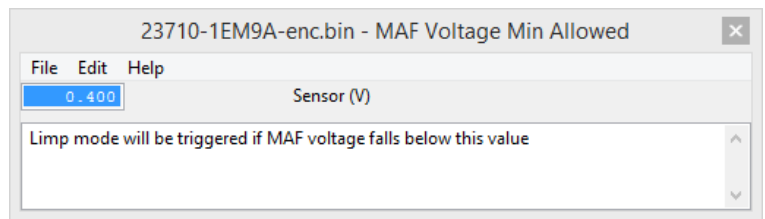


The standard intake system has two separate banks (1 and 2) with two separate throttle butterflies for each bank. The ECM will use the individual throttles to try and balance the mass airflow between each bank.

Now the supercharger or turbo will have a common inlet feed into the compressor (or SC inlet) so the two banks are no longer separate, when the ECM moves bank 1 throttle butterfly the mass airflow will change for bank 1 and bank 2.

This will cause problems for idle stability and if the MAF volts drop below the 'MAF Voltage Min Allowed' then the ECM will enter a 'safe' or 'limp' mode but no DTC will be shown.

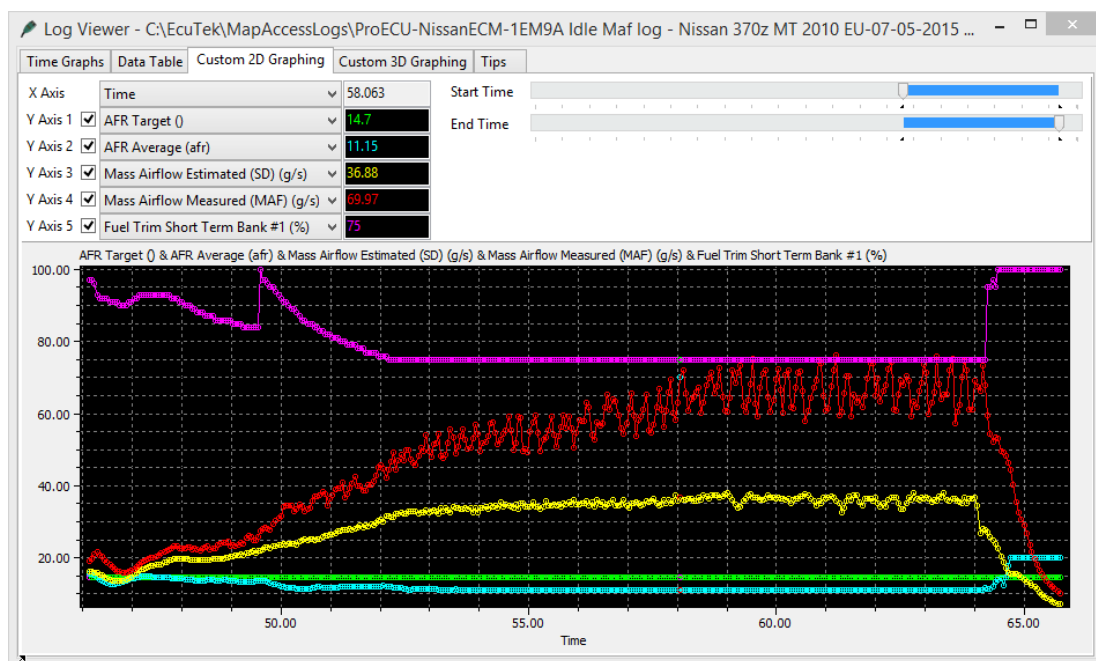
So it's important that the MAF Voltage Min Allowed is reduced, we suggest 0.1v



By running Speed Density we do not have these 'per bank' MAF sensor issues as the mass airflow is generated from our SD-VE map, so the mass airflow will be the same for both banks, so running SD vastly improves idle stability.

5.6.2 MAF Tuning issue – Fast Idle

This next log file screen shot shows a fast idle condition where the ECM is running on MAF and the MAF reverberations are clearly visible.



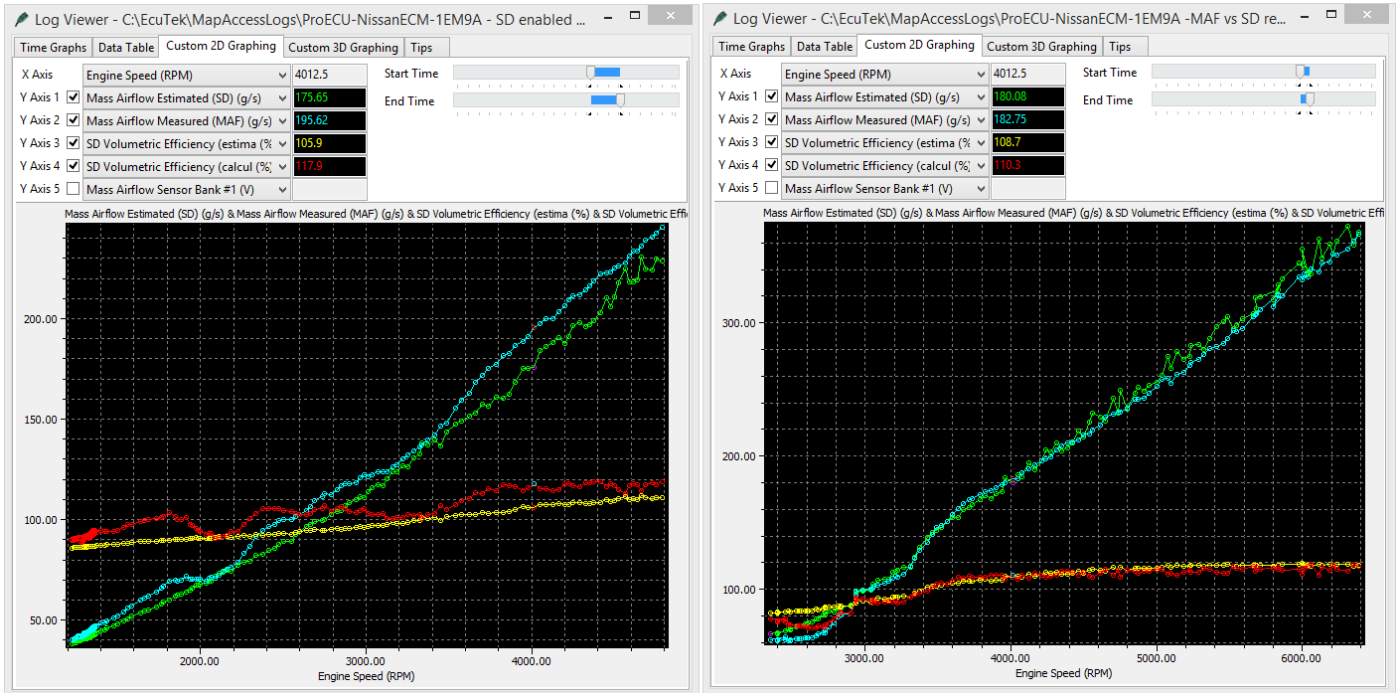
- The SD mass airflow is the **Yellow** line and it has been accurately calibrated and is very smooth.
- The MAF reading is the **Red** line, it's very erratic and is over reading when compared to the true mass airflow shown by the SD **Yellow** line.
- The Fuel Trim Short Term (FTST) has reduced from 100% down to 75% (its minimum amount) but the AFR is still far too rich (11.15 AFR vs the Target AFR of 14.7).

By simply enabling SD the mass airflow reading will be correct and the FTST will be corrected, this issue is caused by a combination of short MAF tube that's too close to the compressor wheel and a recirc valve that vents into the Inlet and far too close to the MAF sensors. As the engine speed and airflow rises this is less of a problem but at lower rpm it certainly is an issue that needs fixing and SD is the easiest solution.

5.6.1 Intake rescaling using SD

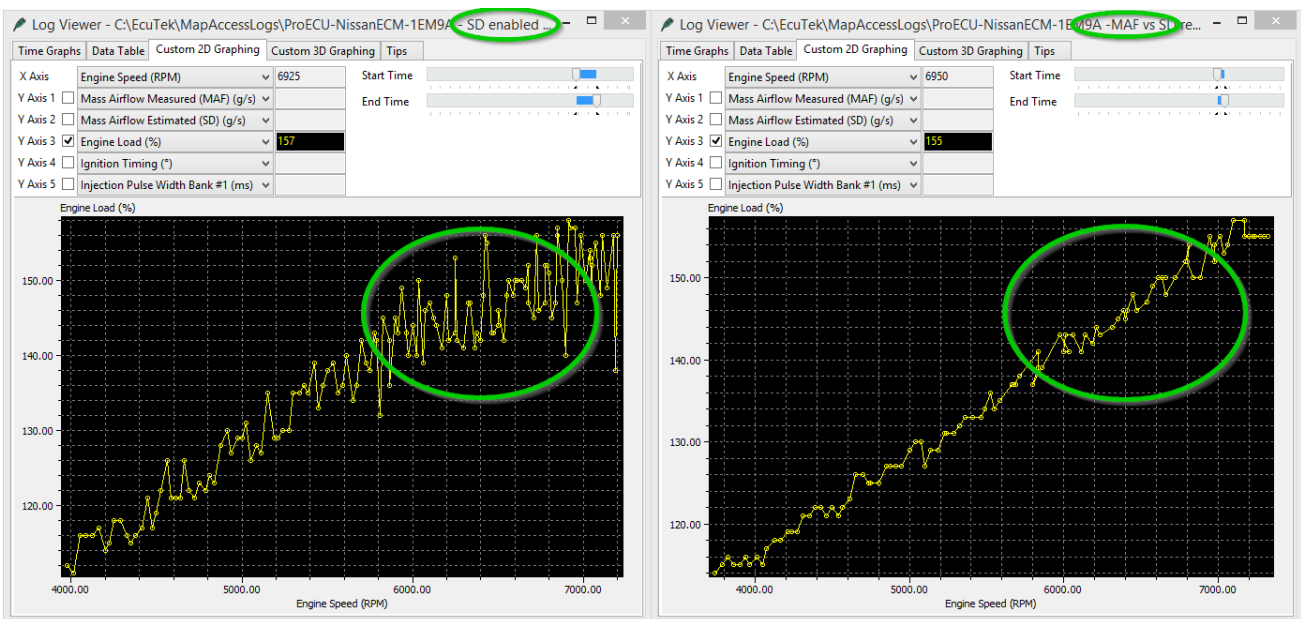
You can use SD to help rescale for new Intakes, simply enable SD and then log the output of the MAF sensor, then adjust the MAF scaling to match the SD.

See below on the left where the MAF scaling is over reading and on the right after the MAF scaling has been corrected by simply analysing the log file and cross referencing MAF Volts it was quick and easy to correct the MAF sensor scaling.



5.6.2 MAP sensor reading at High RPM

At higher RPM the SD based MAP sensor may pulsate depending on it location. In the Stillen SC we tested the MAP sensor location is in the plenum chamber and it suffers from pulsations at high RPM, this in turn reflects into a pulsating Engine Load, along with erratic Ignition timing and Injector open time, this can be clearly seen on the next log file.



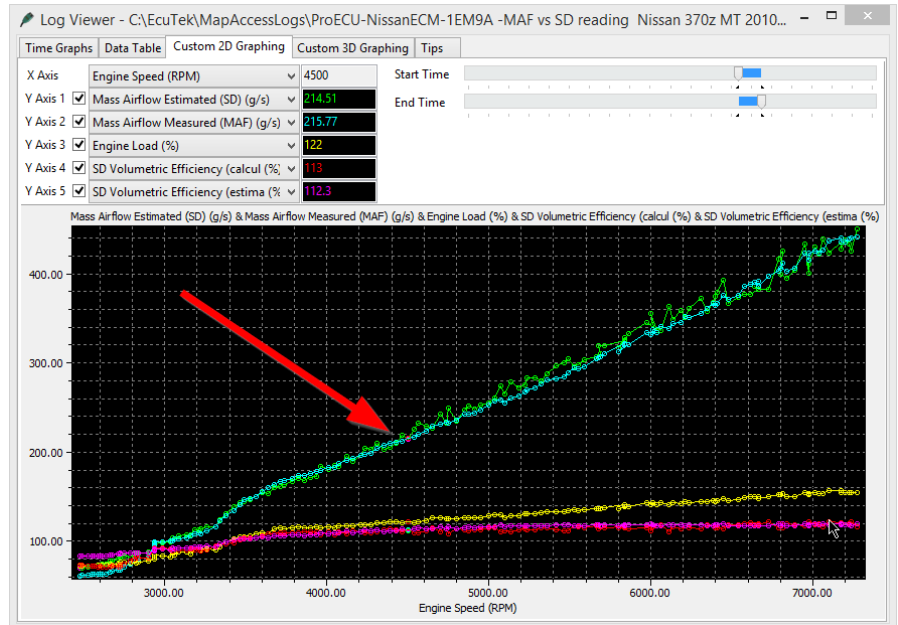
There are several things that can solve this issue

- Remote mount the MAP sensor and include a pressure reservoir in-line so the pulsations are dampened, we would advise to use a GM Map sensor that uses a zero offset.
- Place a very small restrictor in the map sensor orifice to dampen the pressure waves (though this is not possible with the Juke sensor due to the integrated Charge Air sensor)
- Switch to MAF instead of SD at higher RPM utilising EcuTek Hybrid SD function, this is what we would advise.

The example shows a hybrid switch from SD to MAF around 4500rpm when the MAP sensor output became erratic. See how close the SD and MAF scaling is when the switch took place.

Switching to MAF made around 40bhp more simply by having a smooth and consistent engine load.

So this is very important if you are tuning on SD, make sure the MAP sensor output is smooth at high RPM.



5.6.1 Blow Off Valve (BOV)

Other SD advantages are when a recirculation valve (dump or blow off valve BOV) has been fitted and the air is recirculated back into the Intake, this can seriously upset the MAF sensor reading (see the previous 2 screen shots for this problem).

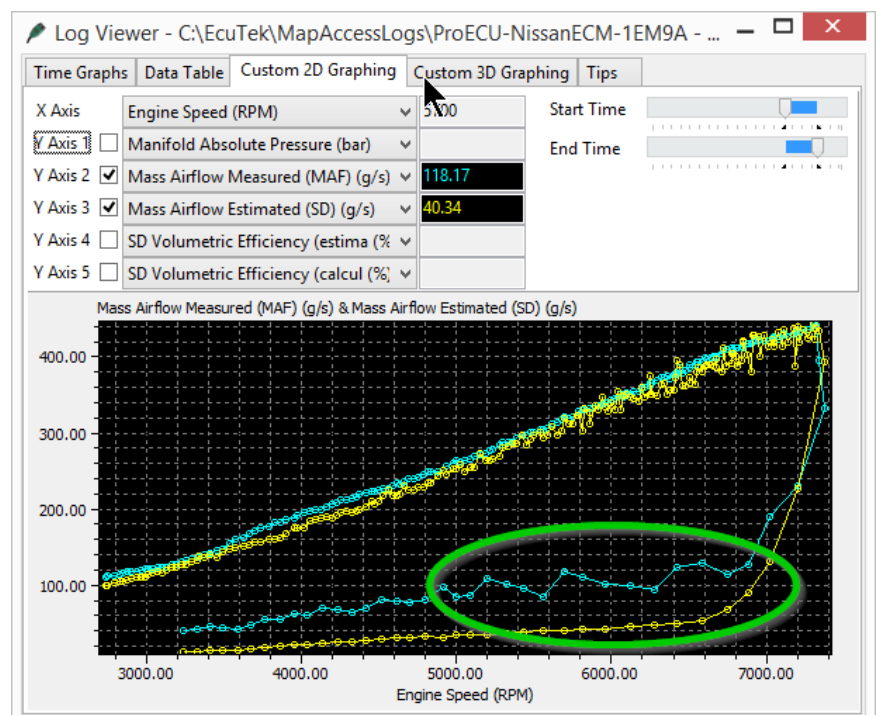
Furthermore venting BOV to atmosphere will 'dump' the metered air to atmosphere and this will cause a rich hesitation during gear change or deceleration.

In this example we are running on SD with a recirculation valve venting back into the intake, see how the MAF reading goes crazy on lift off, the Green circle.

The Cyan line shows the reading from the MAF Sensor and it reads excessively high.

The Yellow line shows the reading from the MAP sensor and shows the true current mass airflow.

This is not so much a problem on blow thru MAF setups assuming the MAF sensors are in a clean straight section of intercooler piping, though oil contamination is a long term concern.



5.6.2 Fitting a MAP sensor with Charge Air Temp

The standard MAP sensor will flat line at 1.07bar so you will need to replace the MAP sensor when running SD with a FI model.

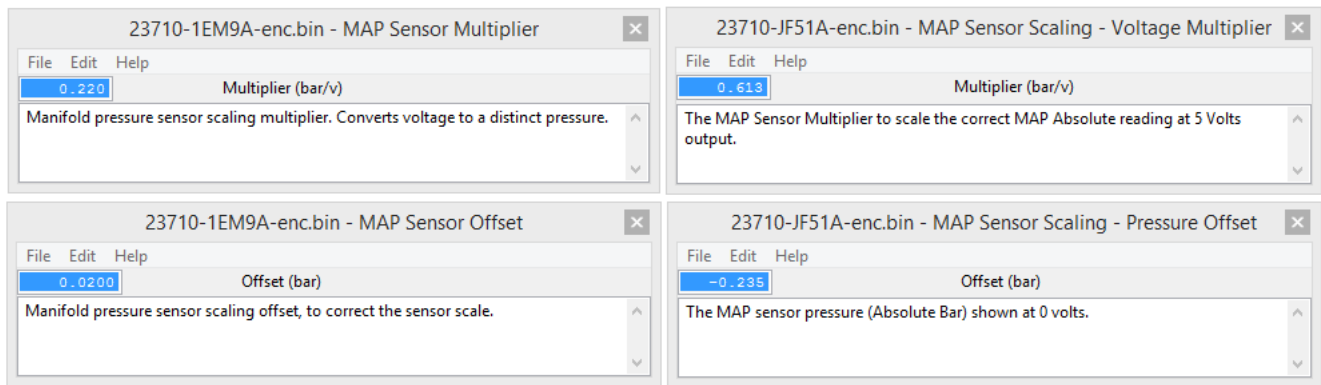
For our testing we used the popular GTR SD 'Plug n Play' conversion from Got Boosted, this uses a Nissan Juke 2.72 bar MAP sensor that has a built in Charge Air sensor. The simple 'PnP' wiring harness replaces the factory MAF sensor 'Intake Air Temp' signal with the charge air temp signal. So the ECM is now looking at Charge Air and NOT Intake Air, the hardness is long enough so this makes for a simple conversion.

One slight problem is the Juke MAP sensor scaling requires a negative offset value and Nissan's sensor scaling code will only allow positive values, this is a pain and is not easily fixed.

The Offset value should be -0.23bar but as a negative value is not possible this means the MAP sensor scaling with a 0 Offset will read 0.23bar too high.

So at sea level the Manifold Absolute Pressure will not be 1bar but 1.23bar.

This isn't a major problem as we can simply offset the X axis of the SD map by 0.23 bar but the logging parameter will obviously be wrong, see below the difference between the 370z and the Juke/GTR MAP sensor scaling.



Nissan 370z – 1bar sensor

Nissan Juke or GTR – 2.8bar sensor

Standard 370z Map Sensor Scaling is as following:

Multiplier (bar/volt) 0.22

Offset (bar) 0.02

So: $0.22\text{bar} \times 5\text{ volt} = 1.1\text{bar}$ PLUS the 0.02bar Offset is 1.12 bar sensor

Standard Juke or GTR Map Sensor Scaling:

Multiplier (bar/volt) 0.613

Offset (bar) -0.235

So: $0.613 \times 5\text{ volt} = 3.065\text{bar}$ PLUS the -0.235bar Offset is 2.83 bar sensor

As the 370z Offset value cannot be a negative value the Offset value will be zero, this means the MAP sensor reading will be 0.23 bar too high when a Juke or GTR MAP sensor is fitted.

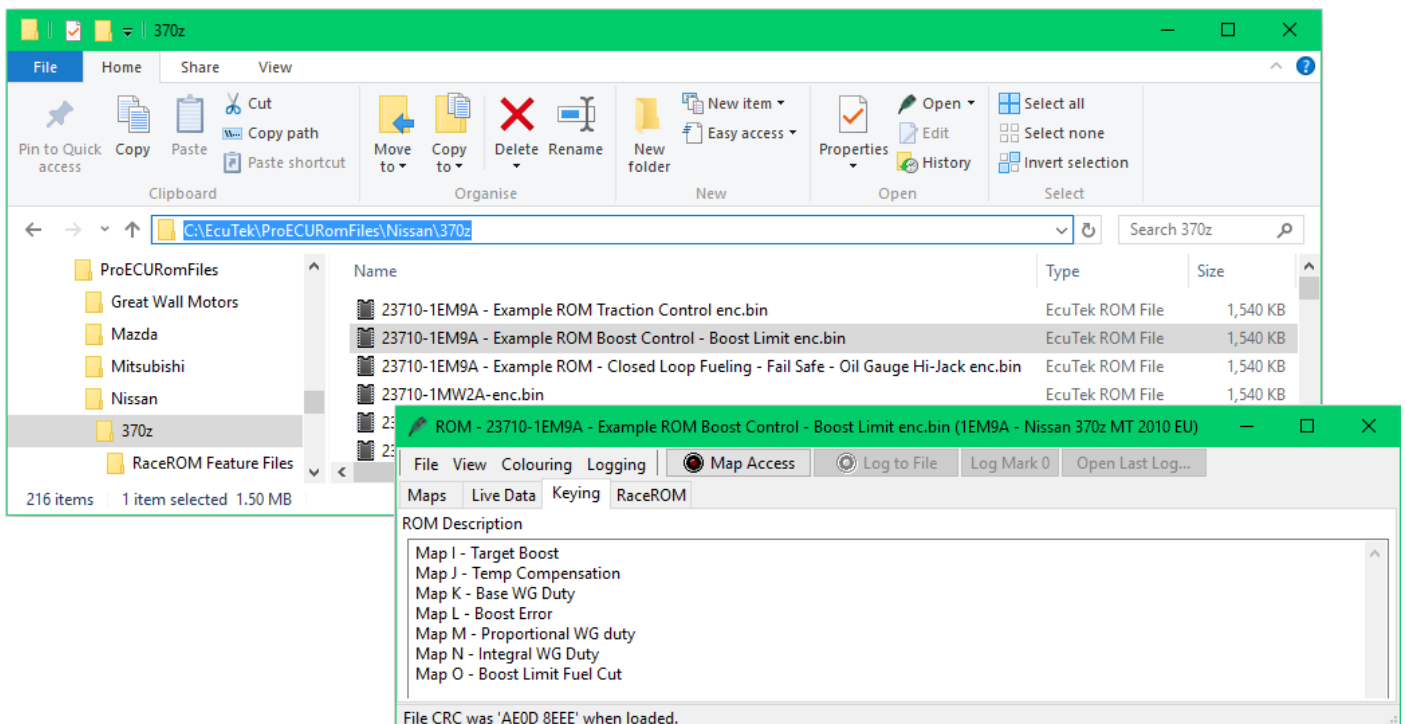
Don't forget there is a second MAP sensor located in the Brake Boost pipe and this is used to measure Brake Servo pressure during cruise conditions, the ECM will close the throttle and create a depression should the servo pressure become too low.

5.7 Custom Maps Example ROMs

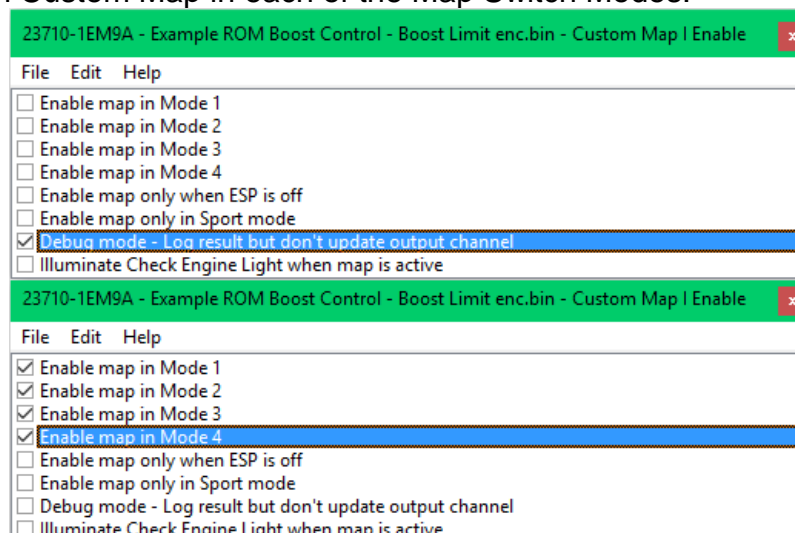
We have created various example ROMs that can be found in your Nissan 370z folder as shown below. The examples have the following special features pre-configured:

- Closed Loop Fuelling
- Closed Loop Boost Control
- Boost Limit
- Traction Control
- Fail Safe
- Oil Temp Gauge Hi-Jack

Each Example ROM has certain Custom Maps pre-defined and the description of the Custom Maps populated are shown in the ROM DESCRIPTION section under the KEYING tab. Each of the Custom Map Example ROM features have been defined over the next few pages.



NOTE: None of the Custom Maps have been enabled, to enable simply deselect the Debug check box and enable each Custom Map in each of the Map Switch Modes.



5.8 Closed Loop Fuelling

The 370z uses closed loop fuel control under light load conditions, the FTST (Fuel Trim Short Term) will be active in this range and will adjust the injector open time by up to 25% (shown as 75% to 125%). Once on mid to full load the fuel control will be open loop (no feedback control) and the FTST will become inactive and will show 100% indicating open loop.

Using Custom Maps we can create a closed loop fuel control with proportional and integral corrections, there is an example ROM available on EcuTek Update, see **Section 5.7** for more details.

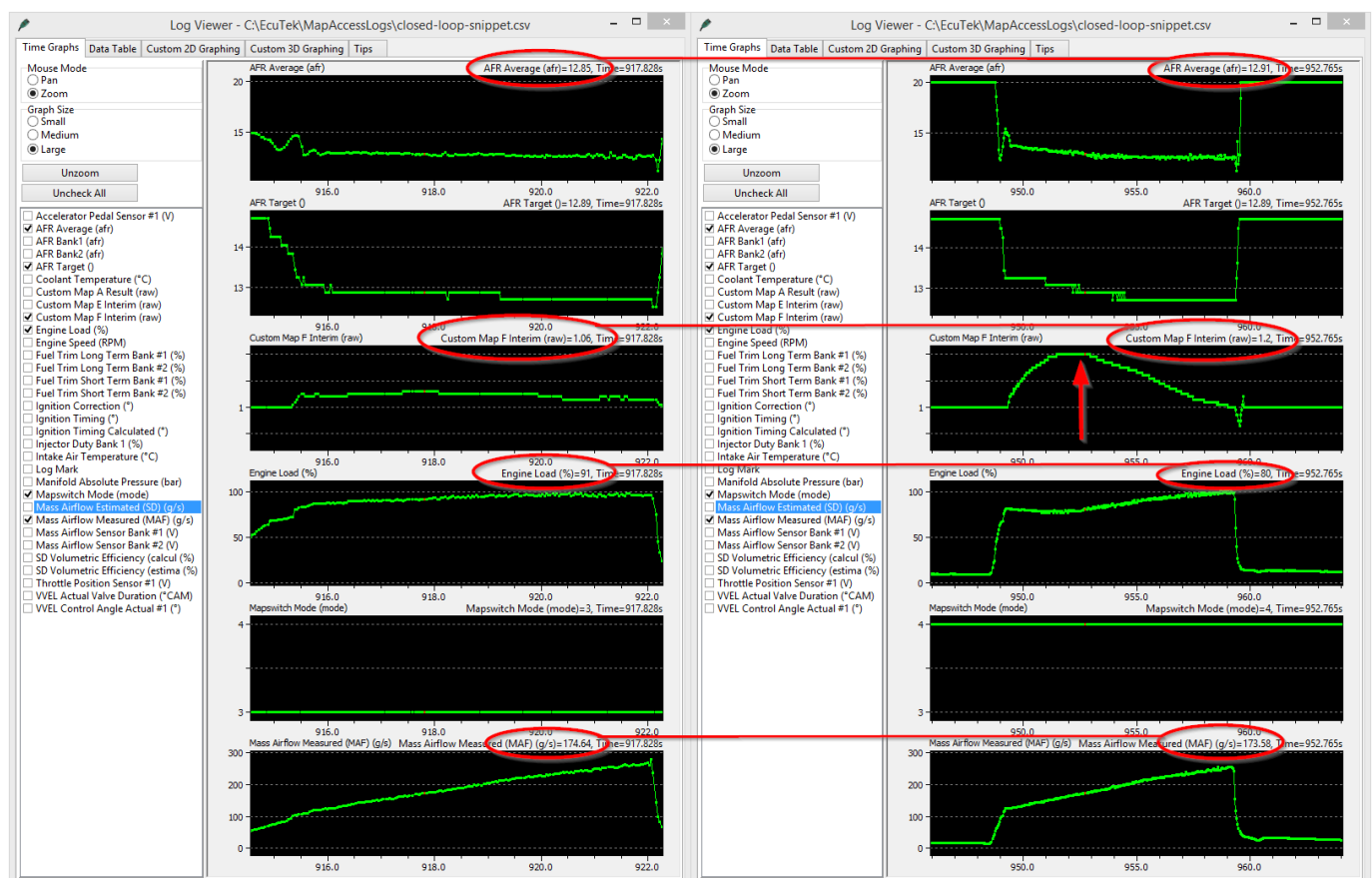
This feature combined with a Custom Map providing a AFR Fail Safe protection (should the engine run lean at high rpm for example) means we can truly offer accurate, secure and protected calibration that was previously unthinkable from the factory ECU!

The following Closed Loop example will show how the difference between an AFR Target and the Actual AFR (AFR Average) are compared and an output multiplier is used to adjust the Injector Open Time Ms.

The following screenshot example shows how the closed loop control will dial in the AFR when the MAF scaling is wrong (like a new intake has been fitted), this particular example had been configured to reduce Engine Load by 10% in Map Switch Mode 4.

You will see the Mass Airflow is constant between both log files but the Custom Map F Integral value has increased to keep the AFR constant between both pulls despite the difference in Engine Load.

This shows the Closed Loop Fuelling fully working and adding 20% (Map F Interim 1.2) to the Injector Ms to hit the AFR Target.



The two custom maps needed for closed loop fuel control are configured as follows:

- Map E is a **proportional correction** (one time only addition) that will multiply the current Injector Ms for a given AFR error
- Map F is an **integral correction** (a continuously added accumulative value) for the current given AFR error

With each map having addition control like activation thresholds and time delays this truly is a comprehensive and powerful feature for the factory fuel control.

Custom Map E – Proportional Correction

- X axis is AFR Target – Output of the fuel map
- Y axis is AFR Average - Average of B1 and B2 factory AF sensors
- Map Output - The current Injector Ms will be multiplied by this value
- Activation Mode – The map is enabled when the Engine Load is over 65%

So when the Engine Load exceeds 65% Custom Map E will become active, when engine load drops below 62% the map will be deactivated.

23710-1EM9A-21120 - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map E Activation Definition

File Edit Help

Activation channel

- unused
- Accelerator Pedal (V)
- Air/Fuel Ratio Average
- Air/Fuel Ratio B1
- Air/Fuel Ratio B2
- Air/Fuel Ratio Target
- Atmospheric Pressure (bar)
- Battery Voltage (V)
- Coolant Temp (°C)
- CPC Pressure Sensor (V)
- Engine Load (%)
- Engine Oil Temp (°C)
- Engine Speed (RPM)
- Fuel Level Sensor (V)
- Fuel Temperature (°C)
- Gear
- G force lateral (G)
- G force rotational (G)
- HO2 sensor2 B1 Heater Duty (%)
- HO2 sensor2 B2 Heater Duty (%)
- Intake Air Temp (°C)
- MAF Sensor Voltage B1 (V)
- MAF Sensor Voltage B2 (V)
- Manifold Absolute Pressure (bar)
- Manifold Pressure (bar)
- Map Switch mode
- Mass Airflow (g)
- RaceROM Control
- Short Term Fuel Trim
- Short Term Fuel Trim
- Steering Wheel Angle (°)
- Throttle Delta
- Torque Actual (Nm)
- Torque Demand (Nm)
- Vehicle Speed (km/h)
- VTC Valve Advance Actual (°)
- VVEL Valve Duration Actual (ms)
- Wheel Slip Ratio (%)
- Wheel Speed Front (km/h)
- Wheel Speed Rear (km/h)
- Custom Map A result
- Custom Map B result
- Custom Map C result
- Custom Map D result
- Custom Map E result
- Custom Map F result
- Custom Map G result
- Custom Map H result
- Custom Map I result
- Custom Map J result
- Custom Map K result
- Custom Map L result
- Custom Map M result
- Custom Map N result
- Custom Map O result
- Custom Map P result

23710-1EM9A-21120 - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map E

File Edit View Plot Help

X channel (raw)

Y channel (raw)	9.50	10.00	10.50	11.00	11.50	12.00	12.50	13.00	13.50	14	14.5	15	15.5	16	16.5	17
9.5	1.000	0.965	0.931	0.896	0.861	0.826	0.792	0.757	0.750	1	1	1	1	1	1	1
10.0	1.03	1.000	0.967	0.934	0.901	0.868	0.835	0.802	0.769	1	1	1	1	1	1	1
10.5	1.06	1.031	1.000	0.969	0.937	0.906	0.875	0.843	0.812	1	1	1	1	1	1	1
11.0	1.09	1.060	1.030	1.000	0.970	0.940	0.910	0.880	0.850	1	1	1	1	1	1	1
11.5	1.12	1.086	1.058	1.028	1.000	0.971	0.942	0.914	0.885	1	1	1	1	1	1	1
12.0	1.14	1.110	1.082	1.055	1.027	1.000	0.973	0.945	0.917	1	1	1	1	1	1	1
12.5	1.16	1.132	1.105	1.079	1.053	1.026	1.000	0.974	0.947	1	1	1	1	1	1	1
13.0	1.18	1.152	1.127	1.102	1.076	1.051	1.025	1.000	0.975	1	1	1	1	1	1	1
13.5	1.20	1.171	1.146	1.122	1.098	1.073	1.049	1.024	1.000	1	1	1	1	1	1	1
14.0	1.21	1.189	1.165	1.142	1.118	1.095	1.070	1.047	1.023	1	1	1	1	1	1	1
14.5	1.23	1.205	1.182	1.159	1.137	1.114	1.091	1.068	1.046	1	1	1	1	1	1	1
15.0	1.24	1.220	1.198	1.176	1.154	1.132	1.110	1.088	1.066	1	1	1	1	1	1	1
15.5	1.25	1.234	1.213	1.191	1.170	1.149	1.128	1.106	1.085	1	1	1	1	1	1	1
16.0	1.25	1.247	1.227	1.206	1.186	1.165	1.145	1.124	1.104	1	1	1	1	1	1	1
16.5	1.25	1.250	1.240	1.220	1.200	1.180	1.160	1.140	1.120	1	1	1	1	1	1	1
17.0	1.25	1.250	1.250	1.233	1.214	1.194	1.175	1.155	1.136	1	1	1	1	1	1	1

1.051 raw

23710-1EM9A-21120 - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map E X Input Definition

File Edit Help

Output channel

- Unused
- Calculation 1
- Calculation 2
- Injector Pulse Width
- Ignition Timing (°)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (°)
- Torque Actual (Nm)
- Charge Air Temp for S
- Canister Purge Solenoid
- Vent Control Valve (0=)
- VTC Valve Advance Target (°)
- VVEL Valve Duration Target (ms)
- Throttle Target (°)
- Speed Density Volume

23710-1EM9A-21120 - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map E Y Input Definition

File Edit Help

Output channel

- Air/Fuel Ratio B2
- Air/Fuel Ratio Target
- Atmospheric Pressure (bar)
- Battery Voltage (V)

23710-1EM9A-21120 - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map E Activation Threshold

File Edit Help

Activation mode

- Map is always active
- Map is only active when channel value is above threshold (with hysteresis)
- Map is only active when channel value is below threshold (with hysteresis)
- Map is only active when channel value is between the threshold values

Activation options

- Map activates and deactivates as normal
- Map is initially inactive. Once activated, remains activate until key off
- Map is initially active. Once deactivated, remains inactive until key off

23710-1EM9A-21120 - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map E Activation Delay

File Edit Help

Activation delay

0.300 Seconds

Custom Map F – Integral Correction

- X axis is AFR Target - comes from fuel map
- Y axis is AFR Average - average of B1 and B2 factory AF sensors
- Map Output will multiply the current Injector Ms
- Activation Mode - The map is enabled when the Engine Load is over 65%
- Integral Limits are 0.8 and 1.2 with an Initial value of 1

So when the Engine Load exceeds 65% Custom Map F will become active, when engine load drops below 62% the map will be deactivated

In this example the AFR Target is 11.5 but the AFR Average from the factory sensors is 14.0:1 so the map output will be 0.00333, this will be added as an integral so the value will quickly increase to a larger number which will be ADDED to the Injector Ms and alter the current AFR
 Whenever the map becomes active (Engine Load over 65%) the Integral will start from 1, the Minimum value will be 0.8 and the maximum will be 1.2. This prevents the Integral from ramping up during transient condition and the delay period allows a settle time

The screenshot displays the configuration for Custom Map F in a software application. The main window shows a grid with X-axis values (14.0 to 17.0) and Y-axis values (9.5 to 17.0). The current X channel value is 11.5000 and the raw output is 0.003334. A 3D surface plot on the right shows the map's output across the AFR range.

Configuration windows are overlaid on the main window:

- Custom Map F Activation Definition:** Shows the activation channel as Engine Load (%).
- Custom Map F Output Definition:** Shows the output channel as Air/Fuel Ratio Target.
- Custom Map F X Input Definition:** Shows the X input as Air/Fuel Ratio Average.
- Custom Map F Y Input Definition:** Shows the Y input as Air/Fuel Ratio Average.
- Custom Map F Integral Min/Initial/Max:** Shows initial value 0.800, minimum 1.000, and maximum 1.200.
- Custom Map F Activation Threshold:** Shows a threshold of 65% with a delay of 0.300 seconds.
- Output function:** Shows the option "Add map output to integral. Multiply channel value by integral" selected.
- Activation mode:** Shows "Map is only active when channel value is above threshold (with hysteresis)" selected.
- Activation options:** Shows "Map activates and deactivates as normal" selected.

Map E and F show the closed loop fuelling control acting on the factory AF sensors but it's possible to improve this closed loop control by importing true wideband through the rear O2 sensors, see the next section for how to do this.

Importing Wideband sensors**

Using Map E again (just for the purpose of example) we are showing how to import a pair of Innovate LM2 sensors through the rear O2 sensors using the stock Innovate scaling of 0v=7.35:1 and 5v = 22.39:1

This map is active all the time and the average wideband AFR value will be stored as a calculation 1 for future use. The output of this map would be used as the Y axis in Custom Map E and F for a wideband closed loop fuelling control.

- X axis is Wideband sensor B1 – imported thru the Rear O2 sensor B1
- Y axis is Wideband sensor B2 – imported thru the Rear O2 sensor B2
- Map Output is the average wideband sensor AFR from B1 and B2

The image shows a screenshot of a software interface for configuring a custom map. The main window displays a 2D grid representing the map's data points. The X-axis is labeled 'X channel (raw)' and ranges from 0.000 to 5.000. The Y-axis is labeled 'Y channel (raw)' and ranges from 0.000 to 5.000. A 3D surface plot is visible on the right side of the grid. Below the grid, there are three configuration windows:

- Output Definition:** Shows the output channel configuration. The 'Calculation 1' option is selected.
- Input Definition X:** Shows the input configuration for the X-axis. The 'Heated O2 sensor2 B1 (V)' option is selected.
- Input Definition Y:** Shows the input configuration for the Y-axis. The 'Heated O2 sensor2 B2 (V)' option is selected.

The 'Output function' section is also visible, with 'Replace channel value with map output' selected.

Due to condition like wideband sensor failure or sensor warm up timing we advise that is an extreme reading of say 0 volt or 5 volt was received then the proportion and integral compensations should do 'nothing' and the result should be multiplied by 1.

An additional safe guard is to configure an AFR Fail Safe map as shown in the Custom Maps manual. This will always protect the engine if the AFR runs very rich or very lean on full load for any reasons.

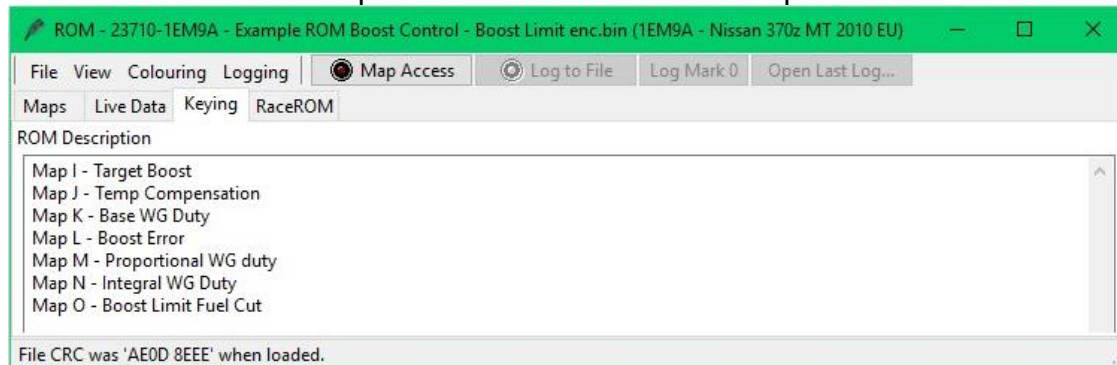
**Though we have imported wideband sensors voltages through the rear O2 sensors (as shown in section 5.2) at the time of writing some tuners have reported some issues so we have temporarily removed the import option from Custom Maps. We hope to investigate and solve these issues and reintroduce the feature again in the near future, if you have a specific requirement at this time then please email support@ecutek.com to see if there have been any further developments.

5.9 Closed Loop Boost Control

Using Custom Maps it's possible to configure a clever closed (or open loop) boost control by replacing the Carbon Purge Control (CPC) solenoid valve with a Wastegate Duty solenoid. This can also be used on vehicles which have a superchargers fitted where the solenoid is used to vent/recirc Supercharger pressure at light load and high rpm.

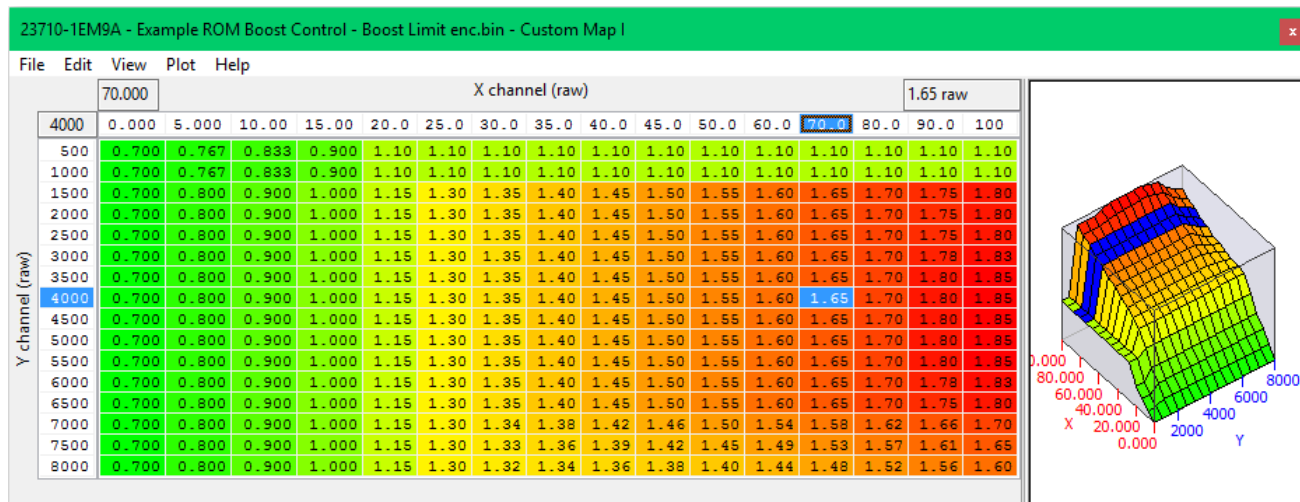
You can find a Closed Loop Boost Control Example ROM in your 370z folder, see Section 5.7 for its location. If you prefer a simpler open loop boost control then simply calibrate Map I as a WG Duty and set Map I Output CPC Valve Duty.

Here are the Custom Maps used to create a closed loop boost control:



Custom Map I – Creates a Target Boost Pressure

- X axis is Accel Pedal
- Y axis is Engine Speed
- Map Output will be a Target Boost Pressure in Bar Absolute as Calculation 1



Custom Map J – Target Boost Temperature Compensation

- X axis is Coolant Temp
- Y axis is Air Temp
- Target Boost Pressure stored in Calculation 1 will be multiplied by the result of Map J

So if the Coolant Temp is below 40 degC and the Air Temp is below -15 Deg C then the boost target will be multiplied by 0.5 making it half of what it will be when the engine is within normal operating range

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map J Output Definition

File Edit Help

Output channel

- Unused
- Calculation 1**
- Calculation 2
- Injector Pulse Width (ms)
- Ignition Timing (°)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (°)
- Torque Actual (Nm)
- Charge Air Temp for SD (°C)
- Canister Purge Solenoid Duty (%)
- Vent Control Valve (0=off, 1=on)
- VTC Valve Advance Target (°CAM)
- VVEL Valve Duration Target (°CAM)
- Throttle Target(°)
- Speed Density Volumetric Efficiency(%)

Output function

- Replace channel value with map output
- Add map output to channel value
- Multiply channel value by map output**
- Use map output as a minimum for channel value
- Use map output as a maximum for channel value
- Add map output to integral. Add integral to channel value
- Add map output to integral. Multiply channel value by integral

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map J

File Edit View Plot Help

80 X channel (raw) 1.0 raw

Y channel (raw)	20.00	-20	-10	0.00	10	20	30	40	50	60	70	80	90	100	110	120	130
-20.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
-15.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
-10.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
-5.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.5	0.5
0.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.9	0.9	0.9	0.9	0.9	0.8	0.7	0.5
5.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
10.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
15.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
20.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
25.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
30.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
35.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
40.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.5
45.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.9	0.9	0.9	0.9	0.9	0.7	0.5	0.5
50.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.8	0.8	0.8	0.8	0.8	0.6	0.5	0.5
55.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.5	0.5

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map J X Input Definition

File Edit Help

- Battery Voltage (V)
- Coolant Temp (°C)**
- CPC Pressure Sensor (V)
- Engine Load (%)
- Engine Oil Temp (°C)

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map J Y Input Definition

File Edit Help

- Intake Air Temp (°C)**
- MAF Sensor Voltage B1 (V)
- MAF Sensor Voltage B2 (V)
- Manifold Absolute Pressure (bar)
- Manifold Pressure Delta (bar)

Custom Map K – Base WG Duty

- X axis is the compensated Target Boost (Output of Map J)
- Y axis is Engine Speed
- Map Output will be Boost Error in Bar

By fitting a Wastegate Duty Solenoid Valve in place of the factory Canister Purge Solenoid Valve we now have boost control.

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map K Output Definition

File Edit Help

- Unused
- Calculation 1
- Calculation 2
- Injector Pulse Width (ms)
- Ignition Timing (°)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (°)
- Torque Actual (Nm)
- Charge Air Temp for SD (°C)
- Canister Purge Solenoid Duty (%)**
- Vent Control Valve (0=off, 1=on)
- VTC Valve Advance Target (°CAM)
- VVEL Valve Duration Target (°CAM)
- Throttle Target(°)
- Speed Density Volumetric Efficiency(%)

Output function

- Replace channel value with map output**
- Add map output to channel value
- Multiply channel value by map output
- Use map output as a minimum for channel
- Use map output as a maximum for channel value
- Add map output to integral. Add integral to channel value
- Add map output to integral. Multiply channel value by integral

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map K

File Edit View Plot Help

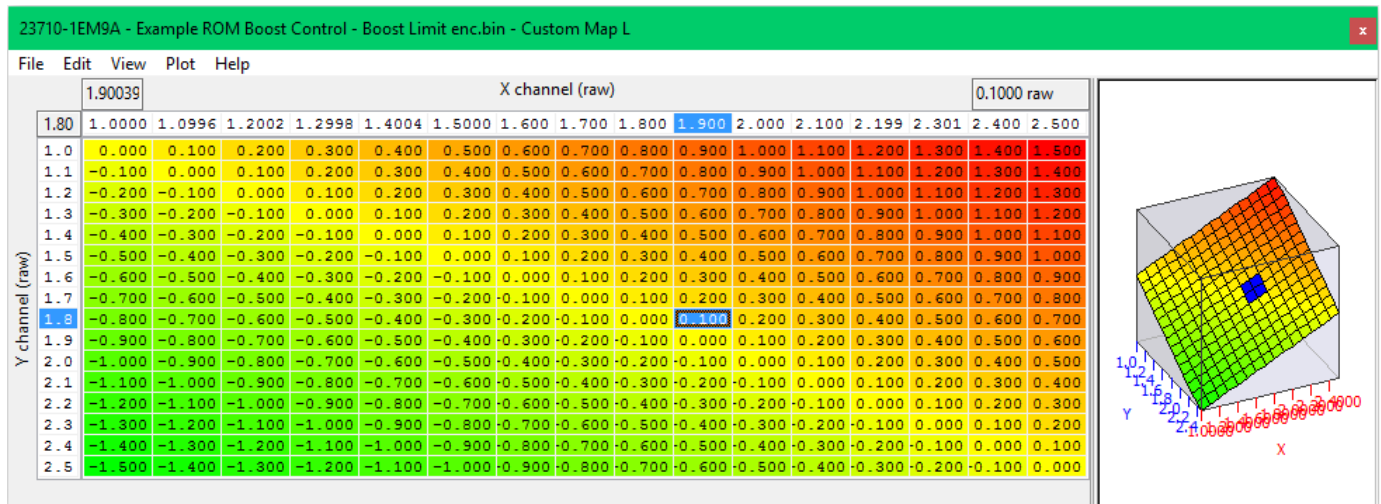
2 X channel (raw) 75 raw

Y channel (raw)	5500	1	1.10	1.20	1.30	1.40	1.5	1.60	1.70	1.75	1.80	1.85	1.90	1.95	2.0	2.05	2.10
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1495	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
2000	0	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
2500	0	50	55	60	65	70	75	80	85	90	90	90	90	90	90	90	90
3000	0	10	15	20	25	30	35	40	45	50	50	50	50	50	50	50	50
3500	0	15	20	25	30	35	40	45	50	55	55	55	55	55	55	55	55
4000	0	20	25	30	35	40	45	50	55	60	60	60	60	60	60	60	60
4500	0	25	30	35	40	45	50	55	60	65	65	65	65	65	65	65	65
5000	0	30	35	40	45	50	55	60	65	70	70	70	70	70	70	70	70
5500	0	35	40	45	50	55	60	65	70	75	75	75	75	75	75	75	75
6000	0	35	40	45	50	55	60	65	70	75	80	80	80	80	80	80	80
6500	0	40	45	50	55	60	65	70	75	80	85	85	85	85	85	85	85
7000	0	45	50	55	60	65	70	75	80	85	90	90	90	90	90	90	90
7500	0	45	50	55	60	65	70	75	80	85	90	90	90	90	90	90	90
8000	0	45	50	55	60	65	70	75	80	85	90	90	90	90	90	90	90

Custom Map L – Boost Error

- X axis is Manifold Absolute Pressure in Bar
- Y axis is the compensated Target Boost (Output of Map J)
- Target Boost Pressure stored in Calculation 1 will be multiplied by the result of Map J

By comparing the current boost pressure with the target boost pressure we now have a boost error that can be stored (Map Output) as Calculation 2. In the example below we can see the current boost is 1.9bar and target boost is 1.8bar, so we have an overboost of +0.1bar



23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map L Output Definition

File Edit Help

Output channel

- Unused
- Calculation 1
- Calculation 2
- Injector Pulse Width (ms)
- Ignition Timing (°)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (°)
- Torque Actual (Nm)
- Charge Air Temp for SD (°C)
- Canister Purge Solenoid Duty (%)
- Vent Control Valve (0=off, 1=on)
- VTC Valve Advance Target (°CAM)
- VVEL Valve Duration Target (°CAM)
- Throttle Target(°)
- Speed Density Volumetric Efficiency(%)

Output function

- Replace channel value with map output
- Add map output to channel value
- Multiply channel value by map output
- Use map output as a minimum for channel value
- Use map output as a maximum for channel value
- Add map output to integral. Add integral to channel value
- Add map output to integral. Multiply channel value by integral

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map L Y Input Definition

File Edit Help

- Custom Map G result
- Custom Map H result
- Custom Map I result
- Custom Map J result
- Custom Map K result
- Custom Map L result

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map L X Input Definition

File Edit Help

- MAF Sensor Voltage B1 (V)
- MAF Sensor Voltage B2 (V)
- Manifold Absolute Pressure (bar)
- Manifold Pressure Delta (bar)
- Map Switch mode (1-4)
- Mass Airflow (g/s)

Custom Map M – Proportional Compensation

- X axis is Boost Error (Custom Map L result)
- Y axis is Engine Speed
- Map Output is WG Duty compensation that will be added for a boost error

The proportional map M will add a specific value to the WG Duty for a given boost error. In this instance you can see that at 4000rpm the boost error is 0.1bar (so overboosting) and the WG Duty will be reduced by -8.3% therefor reducing the manifold absolute pressure

File Edit Help

Output channel

- Unused
- Calculation 1
- Calculation 2
- Injector Pulse Width (ms)
- Ignition Timing (°)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (°)
- Torque Actual (Nm)
- Charge Air Temp for SD (°C)
- Canister Purge Solenoid Duty (%)**
- Vent Control Valve (0=off, 1=on)
- VTC Valve Advance Target (°CAM)
- VVEL Valve Duration Target (°CAM)
- Throttle Target(°)
- Speed Density Volumetric Efficiency(%)

Output function

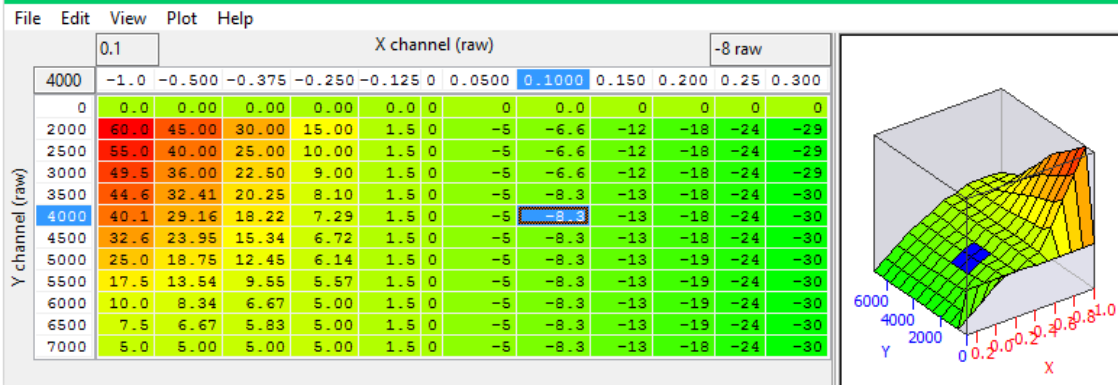
- Replace channel value with map output
- Add map output to channel value**
- Multiply channel value by map output
- Use map output as a minimum for channel value
- Use map output as a maximum for channel value
- Add map output to integral. Add integral to channel value
- Add map output to integral. Multiply channel value by integral

File Edit Help

- Custom Map J result
- Custom Map K result
- Custom Map L result**
- Custom Map M result
- Custom Map N result

File Edit Help

- Engine Oil Temp (°C)
- Engine Speed (RPM)**
- Fuel Level Sensor (V)
- Fuel Temperature (°C)
- Gear



Custom Map N – Integral Compensation

- X axis is Boost Error (Custom Map L result)
- Y axis is Engine Speed
- Map Output is WG Duty compensation that will be added as an Integral for a boost error

The integral map N will add a specific value to the WG Duty for a given boost error but will continue to add that value each time the calculation is made. So the wastegate duty will increase or decrease over a time period.

In this instance you can see that at 4000rpm the boost error is 0.1bar (so overboosting) and the WG Duty will be reduced by -0.46% which is a small amount but this value will continued to be subtracted many times a second.

Custom Map N has a Map Activation threshold and the Integral is only allowed to work when the manifold absolute pressure is within 0.2 bar of the target. This helps prevents the integral value from ramping up at part load conditions.

The Integral is also capped with the minimum allowed reduction of -50% and the maximum of +10% to be added, each time Custom Map N is activated the Integral will start from zero.

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map N Output Definition

File Edit Help

Output channel

- Unused
- Calculation 1
- Calculation 2
- Injector Pulse Width (ms)
- Ignition Timing (*)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (*)
- Torque Actual (Nm)
- Charge Air Temp for SD (°C)
- Canister Purge Solenoid Duty (%)
- Vent Control Valve (0=off, 1=on)
- VTC Valve Advance Target (°CAM)
- VWEL Valve Duration Target (°CAM)
- Throttle Target(*)
- Speed Density Volumetric Efficiency(%)

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map N

File Edit View Plot Help

0.100 X channel (raw) -0.0460 raw

4000	-1.000	-0.3999	-0.3000	-0.2000	-0.1000	0	0.0500	0.1000	0.1500	0.200	0.300	0.5
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0
2000	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
2500	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
3000	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
3500	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
4000	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
4500	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
5000	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
5500	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
6000	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
6500	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1
7000	0.0600	0.0600	0.0600	0.0600	0.0536	0	-0.0250	-0.0460	-0.0587	-0.127	-0.327	-1

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map N X Input Definition

File Edit Help

- Custom Map K result
- Custom Map L result
- Custom Map M result
- Custom Map N result

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map N Y Input Definition

File Edit Help

- Engine Load (%)
- Engine Oil Temp (°C)
- Engine Speed (RPM)
- Fuel Level Sensor (V)

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map N Activation Definition

File Edit Help

- Custom Map L result
- Custom Map M result
- Custom Map N result
- Custom Map O result
- Custom Map P result

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map N Activation Threshold

File Edit Help

0.200 raw

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map N Integral Min/Initial/Max

File Edit Help

0 raw

1.0 raw

Custom Map O – Boost Limit

- X axis is Manifold Absolute Pressure
- Y axis is Engine Speed
- Map Output will multiply the current Injector Ms

If the manifold absolute pressure (Boost) is over 2.0bar for more than 1 second then the Fuel Injector Duty will be multiplier by zero, causing a fuel cut.

A deactivation delay of 1 second will ensure that the fuel cut is long enough to reduce the boost pressure and therefor cylinder pressure before injector restore.

IMPORTANT: the X axis step value from 2.0bar to 2.02bar which will provide an instant fuel cut rather than a high risk interpolated fuel cut which would cause the engine to run lean

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map O

File Edit View Plot Help

2.0 X channel (raw) 1 raw

5000	0.5	0.600	0.700	0.800	0.900	1	1.10	1.20	1.30	1.40	1.5	1.60	1.70	1.80	1.90	2.02	2.10	2.20	2.30	2.40	2.5	2.60	2.70	
1990	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map O Output Definition

File Edit Help

Output channel

- Unused
- Calculation 1
- Calculation 2
- Injector Pulse Width (ms)
- Ignition Timing (*)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (*)
- Torque Actual (Nm)
- Charge Air Temp for SD (°C)
- Canister Purge Solenoid Duty (%)
- Vent Control Valve (0=off, 1=on)
- VTC Valve Advance Target (°CAM)
- VWEL Valve Duration Target (°CAM)
- Throttle Target(*)
- Speed Density Volumetric Efficiency(%)

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map O X Input Definition

File Edit Help

- MAF Sensor Voltage B2 (V)
- Manifold Absolute Pressure (bar)
- Manifold Pressure Delta (bar)
- Map Switch mode (1-4)

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map O Y Input Definition

File Edit Help

- CPC Pressure Sensor (V)
- Engine Load (%)
- Engine Oil Temp (°C)
- Engine Speed (RPM)

23710-1EM9A - Example ROM Boost Control - Boost Limit enc.bin - Custom Map O Output Function

Output function

- Replace channel value with map output
- Add map output to channel value
- Multiply channel value by map output
- Use map output as a minimum for channel value
- Use map output as a maximum for channel value
- Add map output to integral. Add integral to channel value
- Add map output to integral. Multiply channel value by integral

5.10 Traction Control

Using Custom Maps it's possible to create Traction Control maps that will reduce engine torque for a given wheel slip ratio%

You can find a Traction Control Example ROM in your 370z folder, see Section 5.7 for its location.

To create Traction Control we only need two Custom Maps, in the Example ROM we used maps D and E

Custom Map D – Ignition Timing Retard

- X axis is Wheel Slip Ratio%
- Y axis is Engine Speed
- The Map Output will be added to the current ignition timing for a given Engine Speed and Wheel Slip Ratio

As the differential speed between front and rear wheel speed increase then more ignition retard is applied and the engine torque will be reduced, as the RPM increases the retard amount is increased further reducing engine torque avoiding the fuel cut rev limiter

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map D Output Definition

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map D

Y channel (raw)	4000	X channel (raw)																-22 raw
	0	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000		
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	0	0	0	-4	-6	-8	-10	-12	-14	-16	-18	-20	-22	-24	-26	-28	0	
10	0	0	0	-7	-9	-11	-13	-15	-17	-19	-21	-23	-25	-27	-29	-31	0	
13	0	0	0	-10	-12	-14	-16	-18	-20	-22	-24	-26	-28	-30	-32	-34	0	
17	0	0	0	-12	-14	-16	-18	-20	-22	-24	-26	-28	-30	-32	-34	-36	0	
20	0	0	0	-14	-16	-18	-20	-22	-24	-26	-28	-30	-32	-34	-36	-38	0	
23	0	0	0	-16	-18	-20	-22	-24	-26	-28	-30	-32	-34	-36	-38	-40	0	
25	0	0	0	-18	-20	-22	-24	-26	-28	-30	-32	-34	-36	-38	-40	-42	0	
28	0	0	0	-20	-22	-24	-26	-28	-30	-32	-34	-36	-38	-40	-42	-44	0	
30	0	0	0	-22	-24	-26	-28	-30	-32	-34	-36	-38	-40	-42	-44	-46	0	
33	0	0	0	-24	-26	-28	-30	-32	-34	-36	-38	-40	-42	-44	-46	-48	0	
35	0	0	0	-26	-28	-30	-32	-34	-36	-38	-40	-42	-44	-46	-48	-50	0	
38	0	0	0	-28	-30	-32	-34	-36	-38	-40	-42	-44	-46	-48	-50	-52	0	
40	0	0	0	-30	-32	-34	-36	-38	-40	-42	-44	-46	-48	-50	-52	-54	0	
40	0	0	0	-32	-34	-36	-38	-40	-42	-44	-46	-48	-50	-52	-54	-56	0	

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map D X Input Definition

- VTC Valve Advance Actual (°CAM)
- VVEL Valve Duration Actual (°CAM)
- Wheel Slip Ratio (%)
- Wheel Speed Front (km/h)

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map D Y Input Definition

- Engine Load (%)
- Engine Oil Temp (°C)
- Engine Speed (RPM)
- Fuel Level Sensor (V)

Custom Map E – Throttle Multiplier

- X axis is Wheel Slip Ratio%
- Y axis is Engine Speed
- The Map Output will multiply the current Throttle Target for a given Engine Speed and Wheel Slip Ratio

As the differential speed between front and rear wheel speed increases the throttle target will be reduced by the map output multiplier. Due to two large diameter throttle butterflies being fitted we need to significantly reduce the throttle opening amount at low RPM (low airspeed) for the closing throttle to actually achieve any worthwhile reduction in airflow and therefore engine torque

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map E Output Definition

File Edit Help

Output channel

- Unused
- Calculation 1
- Calculation 2
- Injector Pulse Width (ms)
- Ignition Timing (°)
- Injector Size (cc)
- Target AFR (n:1)
- Mass Airflow (g/s)
- Injection Angle (°)
- Torque Actual (Nm)
- Charge Air Temp for SD (°C)
- Canister Purge Solenoid Duty (%)
- Vent Control Valve (0=off, 1=on)
- VTC Valve Advance Target (°CAM)
- VVEL Valve Duration Target (°CAM)
- Throttle Target(°)
- Speed Density Volumetric Efficiency(%)

Output function

- Replace channel value with map output
- Add map output to channel value
- Multiply channel value by map output
- Use map output as a minimum for channel value
- Use map output as a maximum for channel value
- Add map output to integral. Add integral to channel value
- Add map output to integral. Multiply channel value by integral

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map E

File Edit View Plot Help

4000 X channel (raw) 0.44 raw

Y channel (raw)	0	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
30	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map E X Input Definition

File Edit Help

- Engine Oil Temp (°C)
- Engine Speed (RPM)
- Fuel Level Sensor (V)
- Fuel Temperature (°C)

23710-1EM9A-Traction Control Example ROM enc.bin - Custom Map E Y Input Definition

File Edit Help

- VVEL Valve Duration Actual (°CAM)
- Wheel Slip Ratio (%)
- Wheel Speed Front (km/h)
- Wheel Speed Rear (km/h)

The Traction Control can be further enhanced with the addition weighting factors like vehicle speed, steering angle, G force lateral and rotational and we can even set up a dash mounted potentiometer and import the 0v - 5v signal to be used as an overall gain from the aggression of the feature

5.11 Gauge Hi-Jack

Using Custom Maps we can repurpose the oil temp gauge (OTG) to show any value we like. This works particularly well on OTG that display Celcius as the gauge shows 70deg C to 150deg C In the Custom Map Examples we have configured the gauges to display Fuel Trims Short Term (FTST) and Air Fuel Ration (AFR)

Custom Map H – Fuel Trim Short Term Hijack

- X axis is FTST Bank 1
- Y axis is FTST Bank 2
- Map Output will the highest FTST value

23710-1EM9A - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map H

File Edit View Plot Help

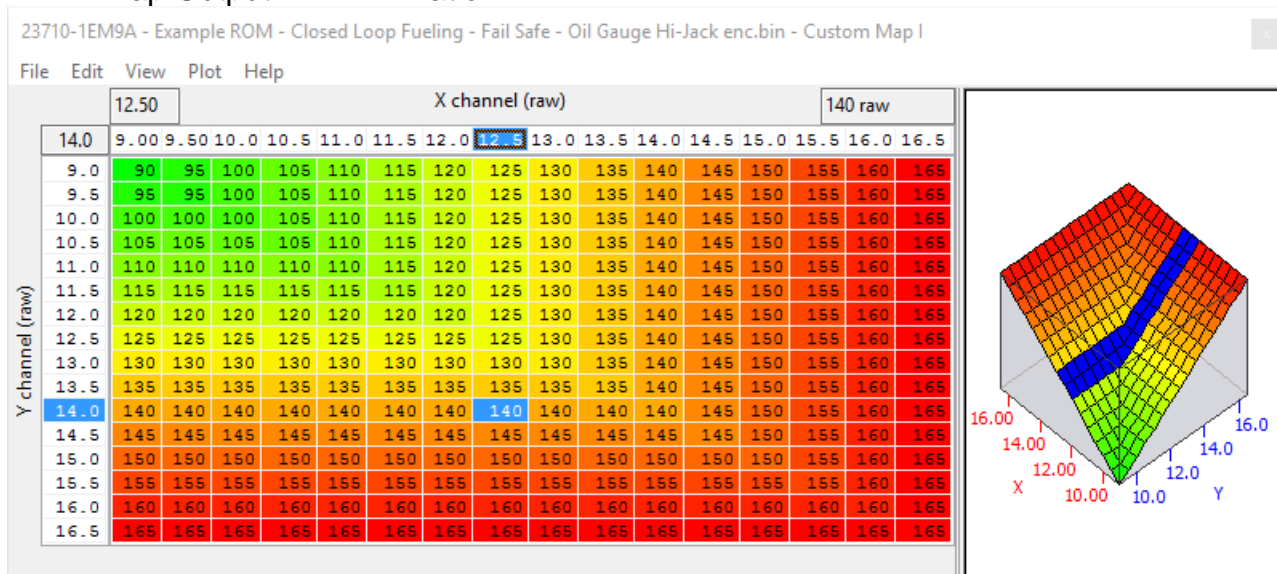
110.0 X channel (raw) 120 raw

Y channel (raw)	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100	105	110	115	120	125	130	135	140
65	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140
70	70	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140
75	75	75	75	80	85	90	95	100	105	110	115	120	125	130	135	140
80	80	80	80	80	85	90	95	100	105	110	115	120	125	130	135	140
85	85	85	85	85	85	90	95	100	105	110	115	120	125	130	135	140
90	90	90	90	90	90	90	95	100	105	110	115	120	125	130	135	140
95	95	95	95	95	95	95	95	100	105	110	115	120	125	130	135	140
100	100	100	100	100	100	100	100	100	105	110	115	120	125	130	135	140
105	105	105	105	105	105	105	105	105	105	110	115	120	125	130	135	140
110	110	110	110	110	110	110	110	110	110	110	115	120	125	130	135	140
115	115	115	115	115	115	115	115	115	115	115	115	120	125	130	135	140
120	120	120	120	120	120	120	120	120	120	120	120	120	125	130	135	140
125	125	125	125	125	125	125	125	125	125	125	125	125	125	130	135	140
130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	135	140
135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	140
140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140

The Fuel Trim value is now stored as Calculation 1 ready to be displayed on the Oil Temp Gauge which is decided by Custom Map J

Custom Map I – AFR Hijack

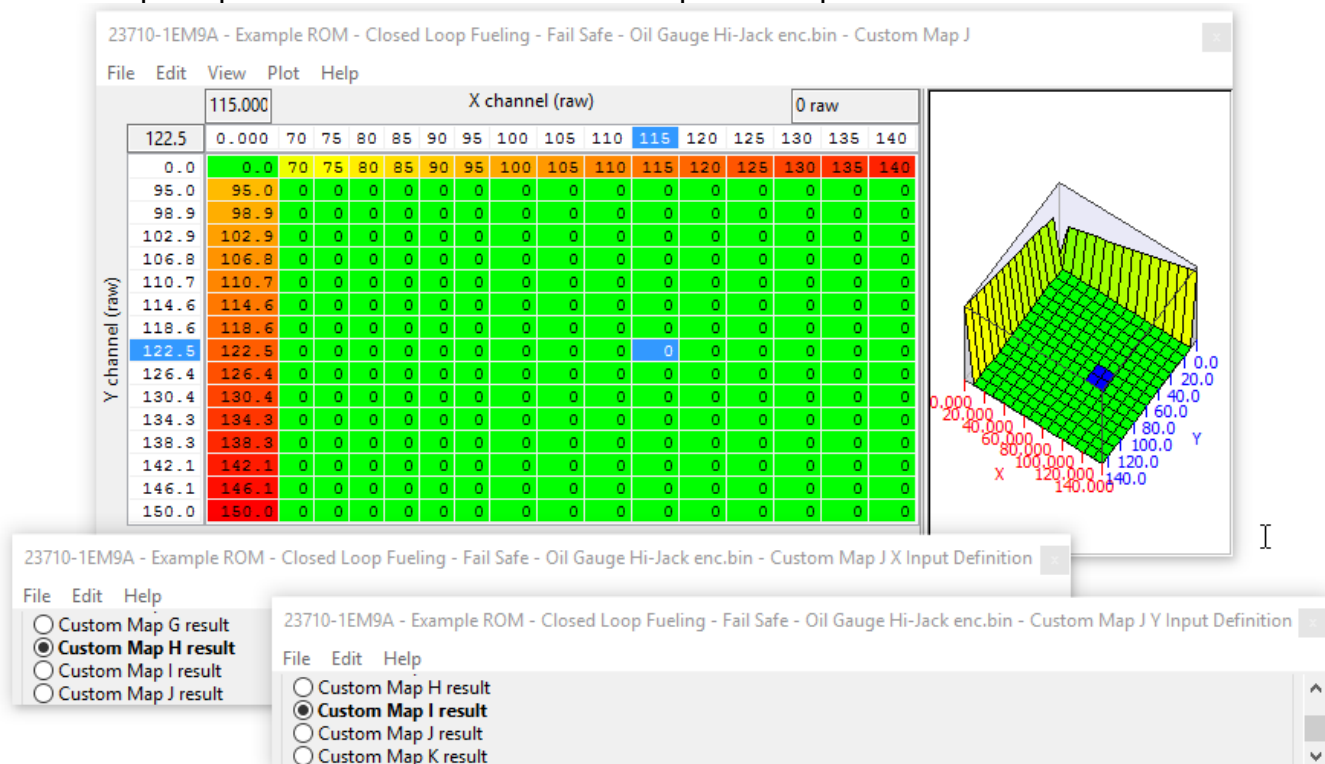
- X axis is Air Fuel Ratio Bank 1
- Y axis is Air Fuel Ratio Bank 2
- Map Output will AFR Ratio



The X and Y axis are AFR from Bank 1 and Bank 2, the map look up value is AFR multiplied by 10, so an AFR of 12:1 is 120 rather than 12, AFR of 14.5 would be 145 so they can be displayed on the OTG correctly. The output is now stored as Calculation 2 ready to be displayed on the OTG which is decided by Custom Map J

Custom Map J – OTG Display

- X axis is Air Fuel Ratio Bank 1
- Y axis is Air Fuel Ratio Bank 2
- Map Output will be either the result of Map H or Map I



Depending which of Map H or Map I is enabled in which map switch mode will dictate which result is shown on the OTG by Map J

5.12 Fail Safe

Using Custom Maps it's possible to create fail safe protection maps if certain events occur. You can find Fail Safe Example ROM in your 370z folder, see Section 5.7 for its location.

Custom Map G – AFR Fail Safe

- X axis is AFR Bank 1
- Y axis is AFR Bank 2
- Map Output will multiply the Throttle Target for a given AFR

In the Custom Map example if the AFR is leaner than 13:1 on either bank then the throttle target will be multiplied by a value less than 1 which in turn will reduce the throttle opening. The Map Activation map has been calibrated so that Engine Load has to be over 120% for more than 1 second before the fail safe map is allowed to work. This will prevent false alarms like during transient conditions or when slow sensor reading or excessive oxygen in the exhaust would trigger a throttle reduce.

The screenshot displays several windows from a software application used for configuring engine maps. The main window is titled "23710-1EM9A - Example ROM - Closed Loop Fueling - Fail Safe - Oil Gauge Hi-Jack enc.bin - Custom Map G Output Definition". It shows a list of output channels with "Throttle Target(%)", "raw", and "110" selected. The "Output function" section has "Multiply channel value by map output" selected.

Other windows include:

- Custom Map G Activation Definition:** Shows "Activation mode" with "Map is only active when channel value is above threshold (with hysteresis)" selected, and "Activation options" with "Map activates and deactivates as normal" selected.
- Custom Map G Activation Threshold:** Shows a value of "110" for the "raw" channel.
- Custom Map G Activation Delay:** Shows a value of "1" for the "Seconds" delay.
- Custom Map G:** A 3D surface plot showing the map output. The X-axis is labeled "X channel (raw)" and the Y-axis is labeled "Y channel (raw)". The plot shows a step function where the output is 1.000 for AFR values above 13.00 and 0.500 for AFR values below 13.00.
- Custom Map G X Input Definition:** Shows "Air/Fuel Ratio Average" selected.
- Custom Map G Y Input Definition:** Shows "Air/Fuel Ratio B2" selected.

5.12.1 High Temperature Protection

The check engine light (DTC) may illuminate on a track day session. This can be caused by the oil or coolant temp getting too hot and the ECU entering a failsafe condition, the Oil Temp trigger is known to activate around 125deg C.

You can simply disable the following oil temp DTC code to avoid this track day problem.

P0198 – Engine Oil Temperature Sensor Circuit High

Or the Coolant Temp DTC is

P0118 – Engine Coolant Temperature High

It's also possible to rescale the 2d Sensor scaling to avoid the ECM seeing the true Coolant or Oil temp, see below an example where the 2d scaling can be manipulated to prevent the issue.

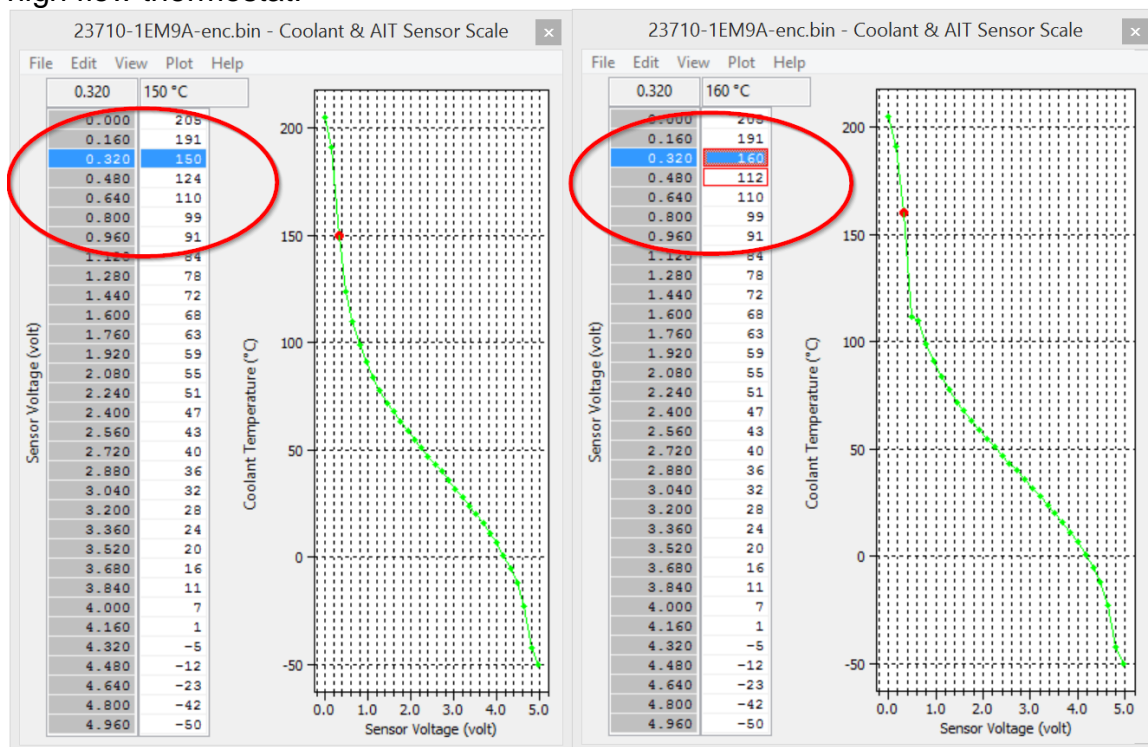
If the temperature really does climb high (over 125 deg C) the ECU will see the true temp and the safe will still kick in.

In this suggested example below the ECU will think the coolant temp is 112deg C all the way to a true 124deg C (0.48 volts).

The 0.32 volts is a true 150 deg C but in the example we increased to 160 deg C.

This is so that at 0.4 volts where the temp should be a true 137 deg C then example will show a temp of 136 deg C, if you prefer greater increment then raise 160 to 170 or 180 deg C so that once past the chosen threshold that the true temperature is seen.

The correct answer here should be to fit an Oil Cooler and a better radiator and/or a lower temp high flow thermostat!



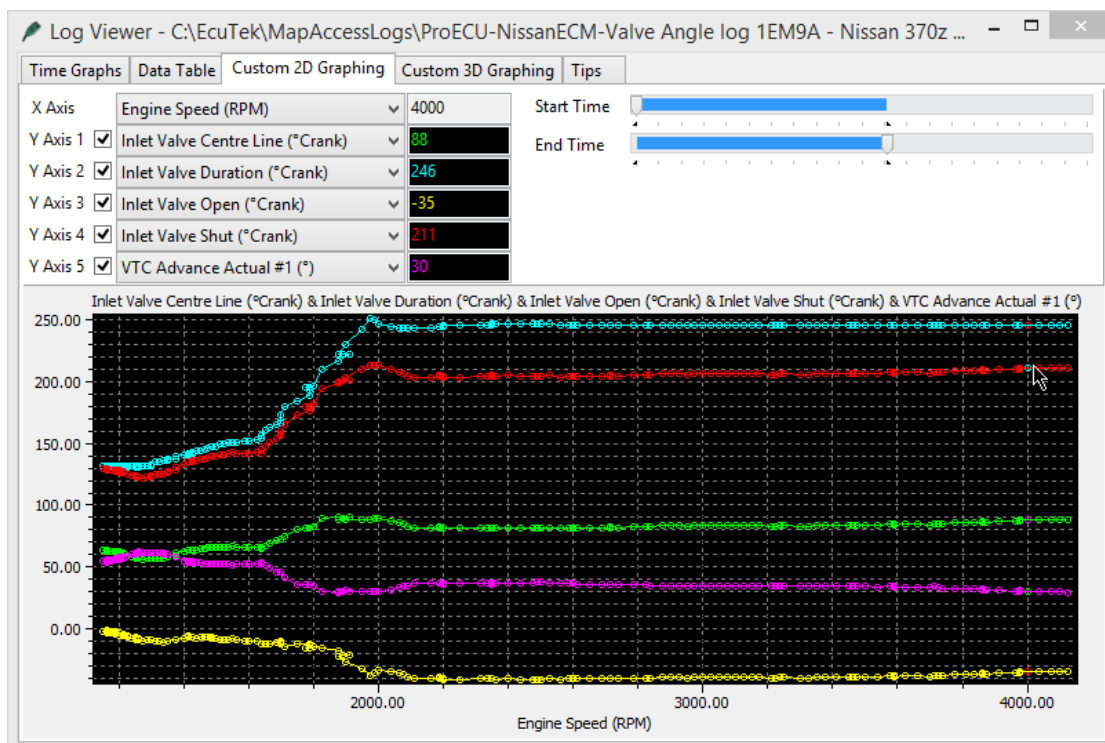
6. Questions and Answers

6.1.1 What RaceROM features are available for 370z?

- | | |
|----------------------------|---------------------------------------------------------------|
| RaceROM Map Switching | – Four different map switch modes |
| RaceROM Launch Control | – Adjustable Launch RPM using the cruise control |
| RaceROM Flat Foot Shift | – Full throttle gear changes |
| RaceROM Knock Warning | – Check engine light flashes when knocking is detected |
| RaceROM Speed Density | – MAP sensor based tuning |
| RaceROM Valet Mode | – Reduced power output for when the vehicle is used by others |
| RaceROM Per Gear Rev Limit | – A different rev limit in each gear |
| RaceROM Custom Maps | – Create a map to do almost anything as below! |
| RaceROM Traction Control | – Adjustable traction control using the cruise control |
| RaceROM Boost Control | – Closed loop boost control with proportional and integral |
| RaceROM Flex Fuel | – Ethanol flex fuel tuning |
| RaceROM AFR Control | – Closed loop target AFR control on full load |
| RaceROM Fail Safe | – Protect the engine from any dangerous situations |
| RaceROM Gauge Hi-Jack | – Display lambda or fuel trims on the oil temp gauge |

6.1.2 Can I change the VTC and VVEL?

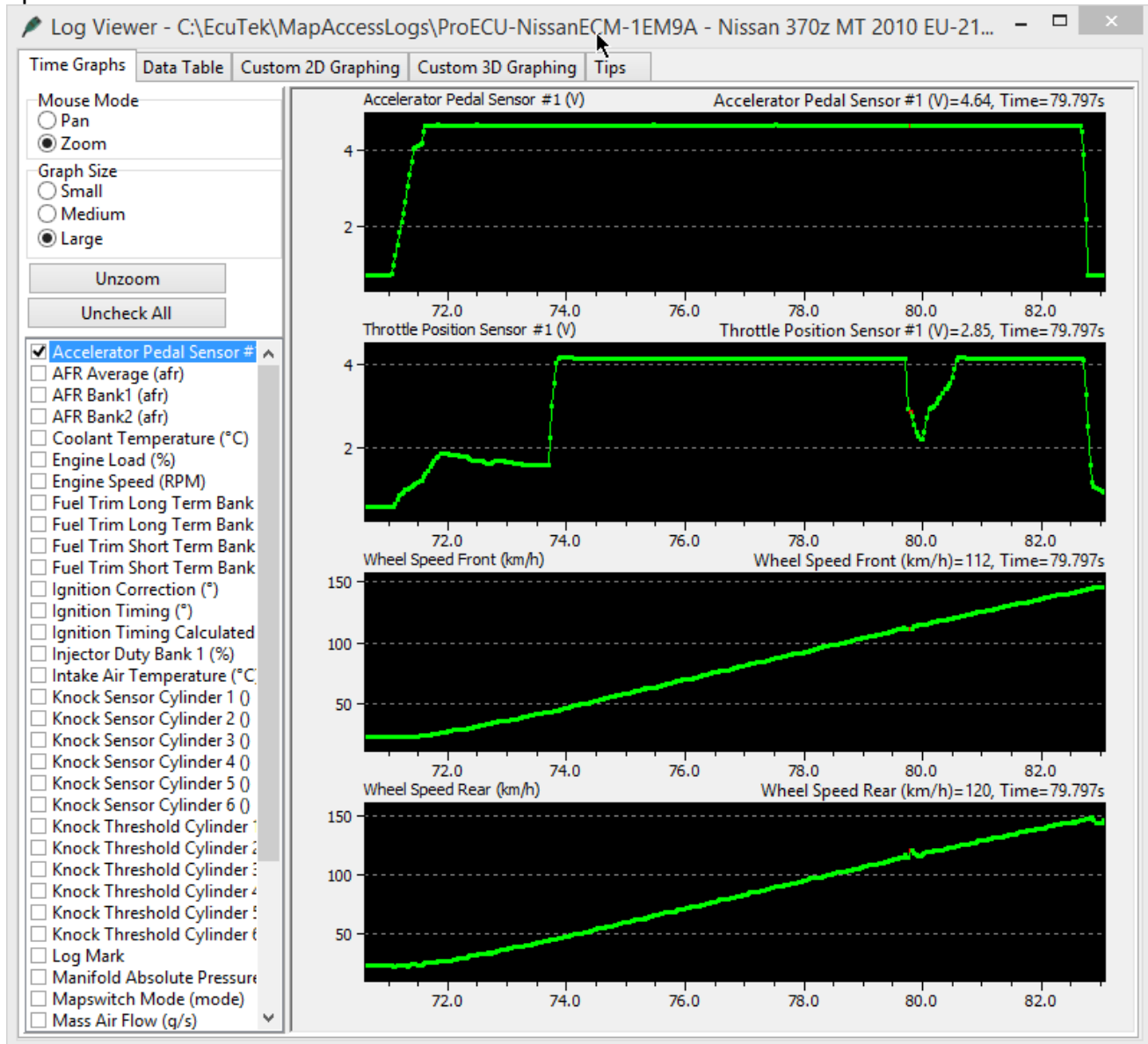
Yes the Variable Timing Control and Variable Valve Lift has been fully defined and it can be adjusted live using the RaceROM Controller. With the custom RaceROM data logging we can also see the full valve control including when the Inlet valve opens, closes, the centre line angle and the duration providing the most comprehensive understanding and control for calibration. See the RRC section in this manual for further details.



6.1.3 Can I stop the factory Traction Control from closing the throttle?

Yes but care must be taken, see below where the vehicle hit a bump in the road on full throttle and the ESP closed the throttle. If the TCS is disabled then the throttle will not close when there is a wheel speed differential.

The log below shows where the throttle butterfly closes as the vehicle hits a bump in the road, it also shows how the Accel pedal is fully depressed at low RPM but the throttle butterfly is only 40% open.



6.1.4 Can I adjust my boost pressure from the steering wheel?

Yes using Custom Maps to configure a closed loop boost control the tuner can calibrate the RaceROM Controller (via the Cruise Control switch gear) to adjust the boost pressure and even display it on the Oil Temp Gauge. You can also fit a dash mount knob (0-5v potentiometer) to adjust the amount of boost or adjust the aggression of the traction control.

See the custom maps manual for further information.

6.1.5 Idle Learning

The 370z will occasionally need an Idle Learning sequence to be initiated, this will balance the airflow between bank #1 and bank #2 using the throttles and will produce a more stable Idle. See the Special Tools section for the exact details of the sequence.

6.1.6 The check engine light comes on during track days

If the Oil Temp exceeds a certain temperature threshold then the check engine light will illuminate and the car enters a failsafe mode. This can be avoided by disabling the DTCs and also rescaling the 2d sensor scaling, see the tuning guide section for more info.

6.1.7 Gear Position N is constantly flashing on the dash

This indicates that the ECM has lost the base neutral position for the gear level and the Neutral Learning process must be carried out. See the ECM Special Tools section later in this manual for how to initiate this learning sequence.

6.1.8 How much power can I make from tuning

The 370z is a highly tuned engine in standard form, there are certainly variances in fuel quality around the world and some regions can gain more power than others. The standard Ignition control is serious capped for how much advance it is allowed to add, raising this limit will allow the ECU to advance the timing further and make more power but EcuTek have rewritten the Ignition Timing and the new RaceROM Ignition maps are no longer limited.

In our testing on our development vehicle from just ECM tuning you can expect around plus 10bhp at high rpm, see the tuning examples at the end of this manual for tuning results.

6.1.9 Calculating Power Output

The maximum Mass Air Flow reading in grams can be used to calculate the theoretical engine power output (assuming a standard air Intake Tubes is still fitted). By multiply the Mass Airflow by 1.25 we can get a rough engine power output. So a peak Mass Air Flow reading of 200 grams at 7000rpm would be calculated as 250BHP.

Standard 370z develops around 260 grams Mass Air Flow at peak power, so $260 \times 1.25 = 325\text{bhp}$. This works on most engines but does depend on the engines design and efficiency, it can also works on naturally aspirated engines.

6.1.10 ECU Programming Time - FastFlash

The first time the ECM if flashed then it will take around 5 to 7 minutes, the programming speed depends on your laptop specification. The first flash will install RaceROM and needs to program the complete ECM.

Once installed then EcuTek special high speed RaceROM programming sequence (called FastFlash) is used and we can flash the ECU as fast as 30 seconds depending on which (and how many) maps have been changed.

Make sure you have plenty of battery power before commencing ECU programming.

7. Special Tools

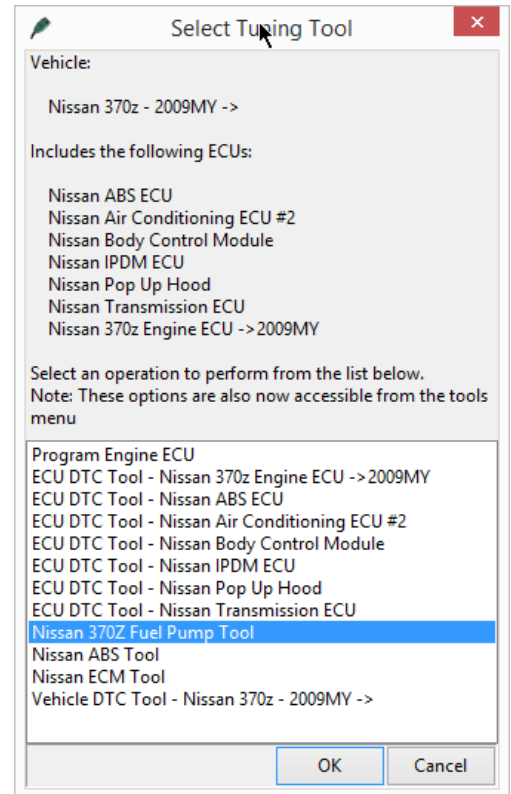
EcuTek have developed several special tools for the Nissan 370Z, these are supported by ProECU under the Special Tools functions as shown here on the right.

Nissan 370z offers access to various Special Tools like ECM, ABS and Fuel Pump Special Tools.

The ProECU special tools are also available for the Nissan GTR and include features like Idle Learning, Gearbox Learning, Clutch Adjustments, Cylinder Power Balance, ABS calibration, Fuel Pump Control and even Steering Wheel Alignment.

These special tools are also available in ProECU Retail edition for end users.

These are various other learning sequences that can be carried out during diagnostics or service as shown below.

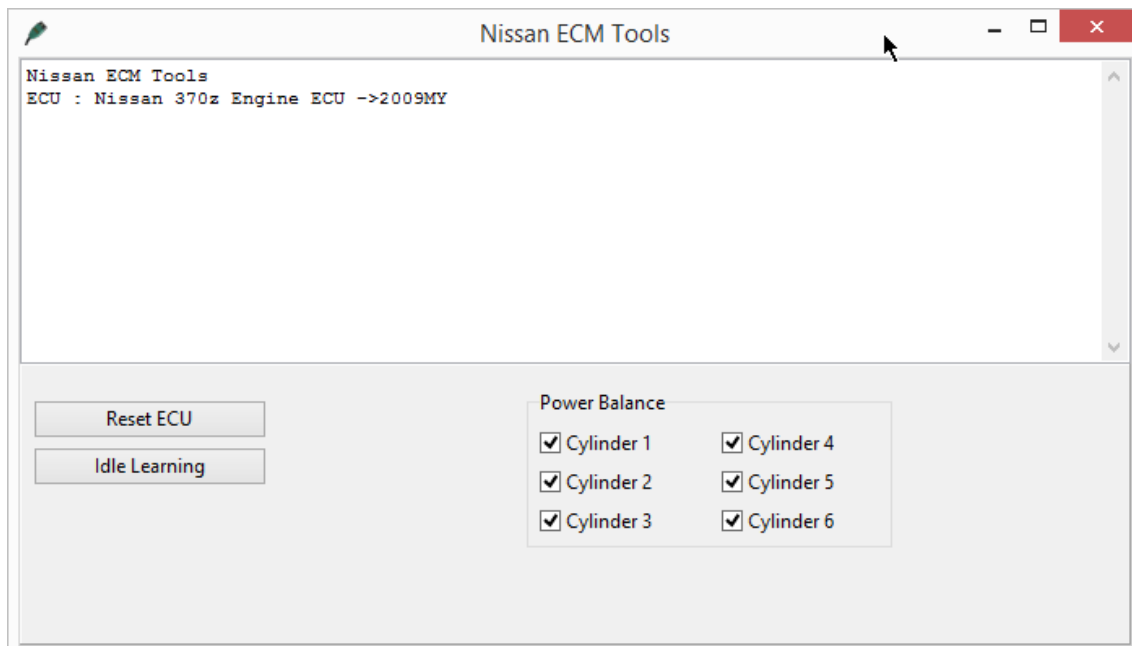


7.1 ECM Tool

Reset ECU – This will clear all learnt values for Idle Control and AFR Learning including Fuel Trims.

Idle Learning – This will commence an auto learn airflow/throttle balance sequence, ensure that the Engine and TCM are over 65 deg C, the vehicle is in Park with handbrake ON and no DTCs are current or historic then start the auto learn sequence. See the detailed Idle Learning Air Volume sequence on the following pages.

Power Balance – Will cut individual fuel injectors to help isolate problem cylinders.



7.2 ABS Tool

Steering Wheel Alignment – This will reset the base learned position for the steering wheel, ensure the steering wheel is straight before commencing this learning procedure.

7.3 Fuel Pump Tool

Main Fuel Pump ON/OFF – This will allow you to turn ON and OFF the fuel pump to establish if the pump is working or not.

7.4 Throttle Valve Closed Position Learning

This function will initial the ECM to learn the throttle motor butterfly closed position

- 1) Make sure Accel pedal is fully released
- 2) Turn Ignition ON
- 3) Turn the Ignition OFF and wait 10 seconds
- 4) Listen to the throttle motor during this time period and ensure it drives back to its base position.

7.5 Idle Learning Air Volume

This function will balance the 2 x throttle motor butterflies for idle stability.

This should be performed in the following situations.

- If the Idle is unstable
- If the throttle voltage or Mass Air Flow between banks is seriously different
- If the AFR is different between the banks
- If the Intakes have been replaced and the MAFs rescaled
- After the tuning process if finished and the vehicle will be returned to the customer

Please ensure the following before commencing the test:

- Engine fully warmed up (Coolant Temp is between 70C - 105C (158 - 221CF))
- Battery voltage is over 12.9 V
- Gearbox is in Neutral or PARK
- TCM Oil Temp is over 60Deg C
- All electrical load is OFF like A/C, heated rear window and headlights, if the vehicle is fitted with daytime running lights then start the vehicle with the TCM in PARK and Handbrake ON.
- Steering Wheel straight position
- Vehicle on level ground
- Ensure the Throttle Valve Closed position Learning has been carried out.

Now using the ProECU ECM Special Tool, start the engine and allow it to Idle and select the Idle Learning feature and follow the on screen instructions.

7.6 Neutral Position Sensor Learning

If the Gear Position indicator is flashing N on a manual transmission vehicle then the ECM has lost the base learning voltage for the neutral position switch and the following sequence will need to be carried out to reset the learnt base position using the following sequence.

NOTE: If you cannot make the sequence work then we suggest you use a stop watch to ensure the time periods are accurate, this Nissan learning sequence is difficult to follow but it does work. It's important that from turning the ignition ON to the end of the 5 clutch depresses and the release of the SPORT button that the time needs to be less than 26 seconds for this to be successful.

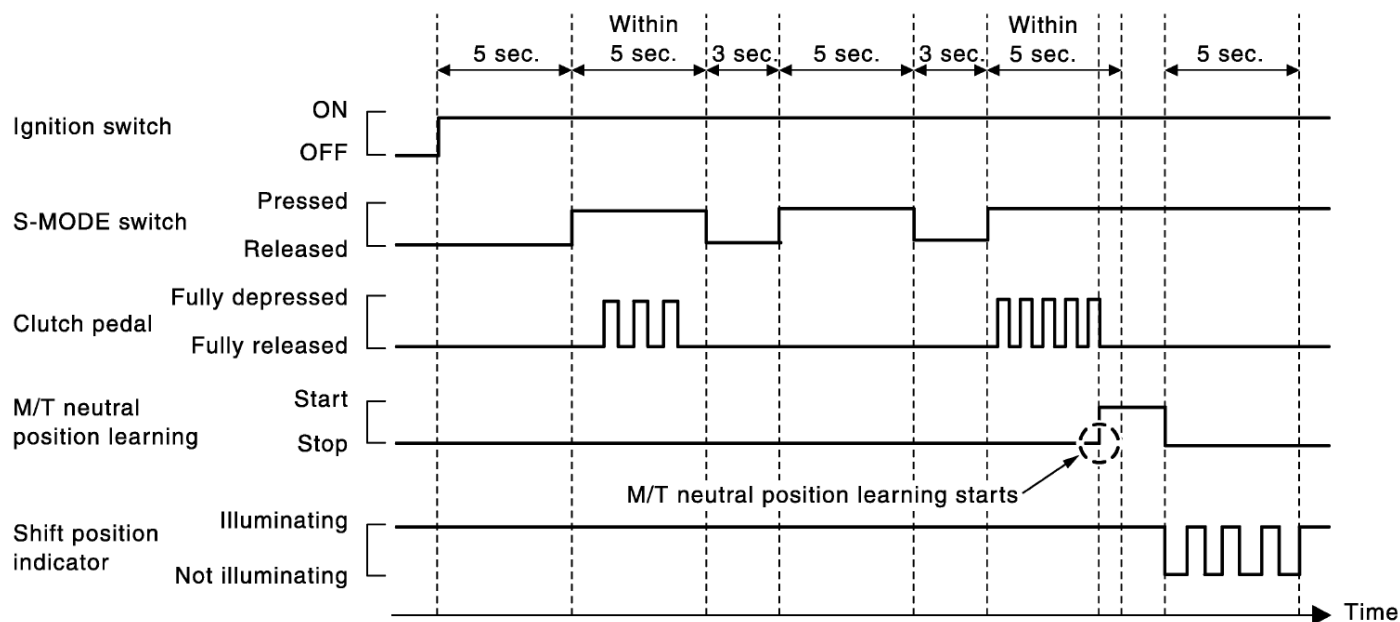
How to carry out the Neutral Position Learning Sequence:

- 1) Turn ignition switch ON and wait 5 seconds.
- 2) Within 5 seconds repeat the following operation 3 times.
Fully depress and fully release clutch pedal while pressing and holding S-MODE switch.
- 3) Wait 3 seconds while S-MODE switch is released.
- 4) Wait 5 seconds while pressing S-MODE switch.
- 5) Wait 3 seconds while S-MODE switch is released.
- 6) Within 5 seconds repeat the following operation 5 times.
Fully depress and fully release clutch pedal while pressing and holding S-MODE switch.

The ECM now starts the Neutral Position Learning sequence.

The shift position indicator on the dash blinks for 5 seconds when the leaning is complete.

If gear position indicator does not blink or blinks continuously then return to start and repeat the sequence. The timing between each step is crucial for the sequence to work and it may take several attempts to make it work!



8. ECU Programming

EcuTek have written a clever custom high speed programming sequence for the Nissan 370z. This has significantly reduced the ECM programming time. The first time the ECM is flashed then it will take around 5 to 7 minutes, though the actual programming time depends on your laptop specification.

The first flash will install the custom RaceROM code and this means the complete ECM must be programmed, this is a long flash. Once RaceROM is installed then EcuTek's special high speed RaceROM programming sequence can now be used, ProECU can flash the ECU as fast as 30 seconds depending on which (and how many) maps have been changed.

The ECU programming progress is indicated on the Rev Counter, sweeping all the way to 7500rpm where the programming sequence is complete. The ECU will be restarted followed by the DTC Clearing process.

In the event of a failed programming sequence then ProECU can recover the ECU (though the correct Programming Window must be chosen first), this ECU recovery will first make a long flash and then on will make the fast RaceROM flash like before the programming failure incident.

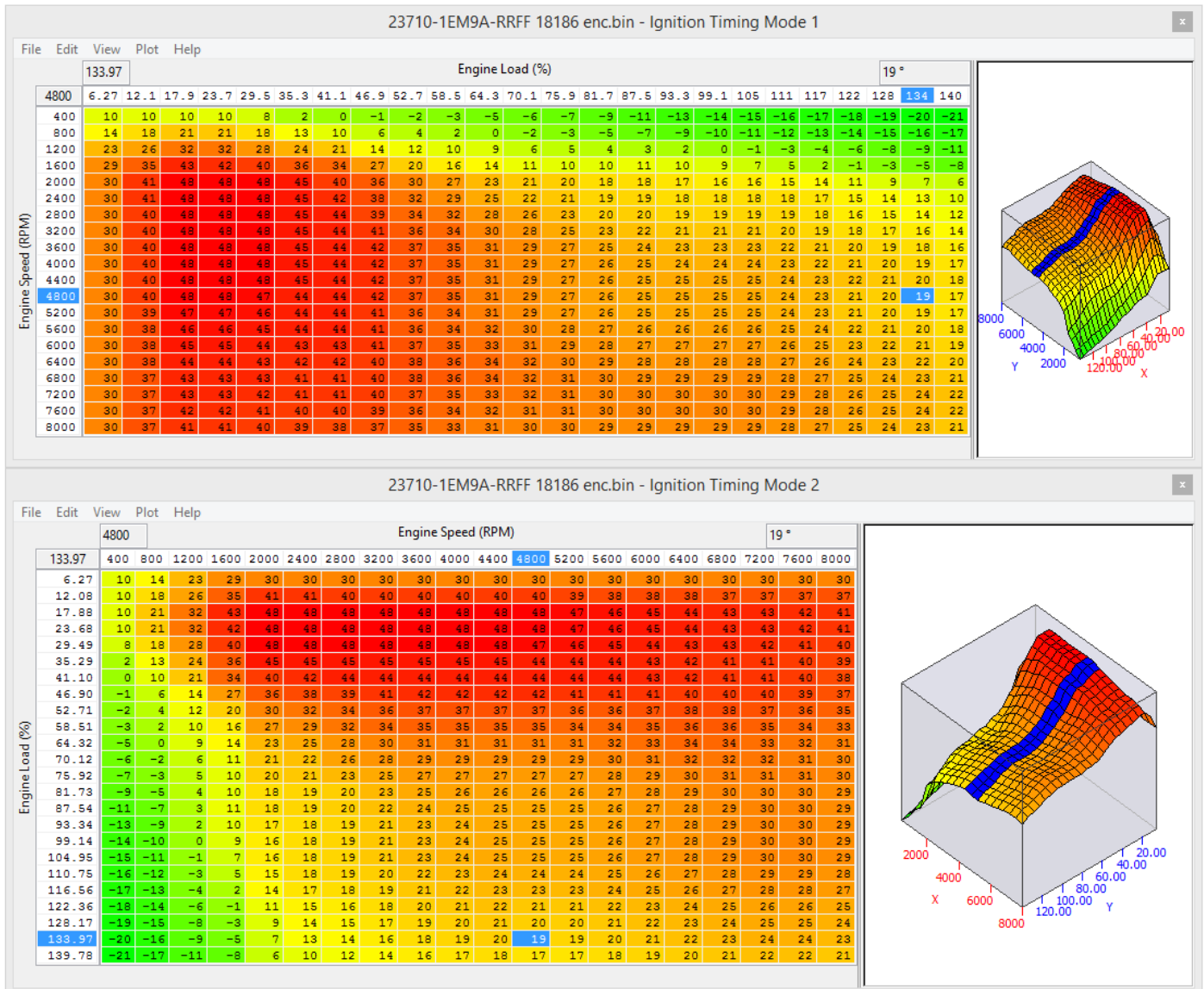
Please note the following:

- Make sure you have plenty of battery power before commencing ECU programming. ECU programming may take 5-7 minutes when first installing the RaceROM Feature File.
- Choose QUERY ECU to see what your current ROM ID is.
- Choose READ ROM to read the ECU contents if required, READ ROM files can be opened in ProECU. This feature can help you look at other company's calibration files if required. If the ECU has previously been programmed with EcuTek software then you will NOT be able to choose READ ROM (to protect the other EcuTek Tuners hard work).
- If you cannot choose READ ROM then you can choose DUMP DETAIL FOR ECUTEK, this will make a backup image of the ECM contents, this ROM can only be opened by EcuTek and it should only be sent to EcuTek if you need to reflash this ROM back into the ECM for some legitimate reason.
- When programming make sure all ancillaries are turned off, these include:
Interior Fan Blower turned OFF (PUSH the Heater Blower knob to turn OFF)
Headlights OFF (exception of Daylight Running Lights)
Gear Lever selector in PARK position
If the above conditions are not met then program may fail to start or possibly fail during programming.
- The ECU reprogramming progress can be seen on the Tacho (Rev Counter) starting from 0rpm to 7500rpm.
- If the ECU cannot be programmed it may be possible it has another product already installed (married), uninstall the product before programming the ECU with EcuTek. If you cannot uninstall (un-marry) the device then contact EcuTek support for forced over programming guidance.
- To put a standard ROM back into the ECM simply choose the stock ROM from the Nissan 370Z folder, C:\EcuTek\ ProECURomFiles\Nissan\370Z. If you wish to completely remove all licence information (which cannot be credited back to your licence key) then contact EcuTek for guidance.

- The ECU can be recovered if part programmed though you will need to Manually select the correct ECU type as the ECU is part programmed its not possible to 'Auto Detect', you must ensure you choose the correct ECU type. This is 1MB for 2008-2009 models or 1.5MB. A flash licence might be lost if the ECU is recovered from a part programmed situation, in this instance send your Flash Log file found here: "C:\EcuTek\ProECU-NissanECU.log" to your tuner or direct to EcuTek (if you are a tuner) for further analysis.

9. Map Editor Features

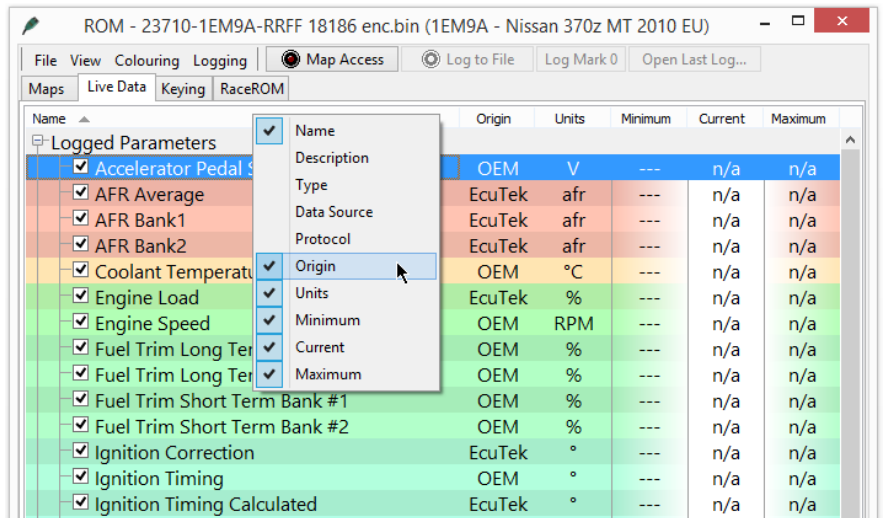
- It is possible to open a map with flipped X and Y axis by simply right-click on the map name and left click on the **Open Map with Flipped Axis**.



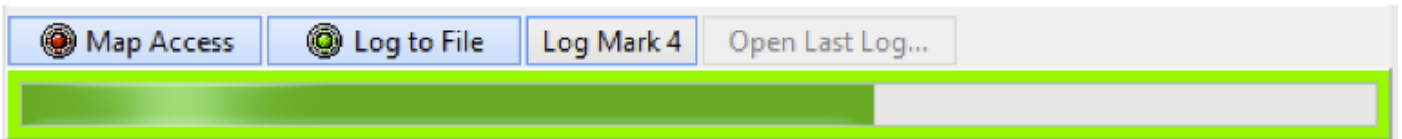
- If a map is too big for the screen then use the CTRL-ALT-F (Fewer Significant points) to reduce the size of the values in the map and make the map smaller.
- You can increase or decrease the text size of the Maps list and Live Data parameters by holding down the **Ctrl** key and using the **mouse wheel** to scroll up or down. It is also possible to go to the View menu and select Increase Font Size (or use Cntr+Alt+I or Cntr+Alt+D).
- You can save your current map editor layout by choosing **View** menu selecting **Save Rom Editor Layout As Default** (or use Cntr+Alt+E)
- You can **drag-and-drop** ROM Files and Log files onto the ProECU header bar to open the log file or ROM. This saves time navigating the File menu, Open Rom File or or Open Log File! You can also drag-and-drop a RaceROM Feature File onto the open ROM file.

- Check and contribute to the EcuTek ProECU Forum. We can all share information that will increase our understanding of the factory ECU, this feedback will allow EcuTek to further develop and improve this new generation ProECU Nissan GTR product. You can navigate to the EcuTek Forum from the **Help** menu.

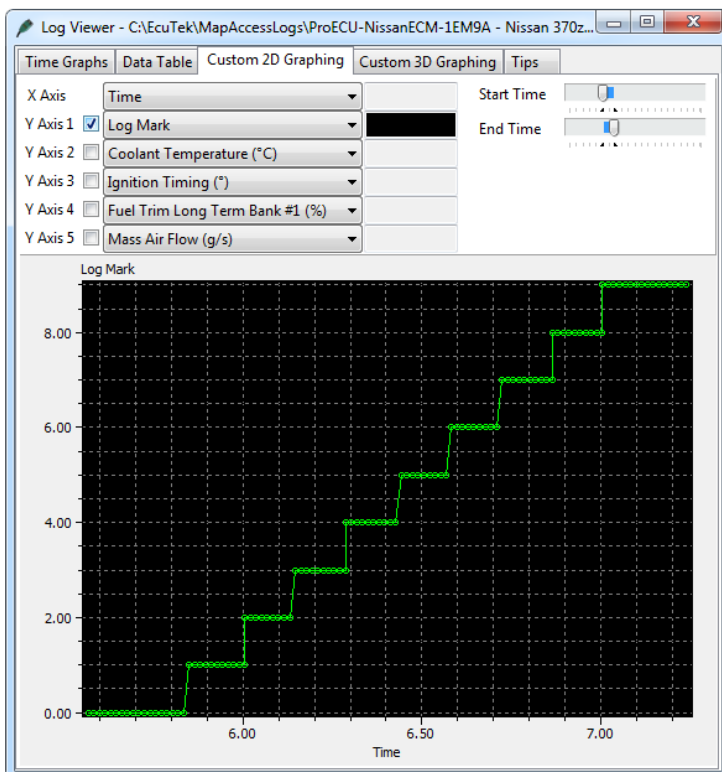
- You can add extra columns to the **Maps** window and **Live Data** window by doing a right-click on the name bar and then left-click on other columns (such as: Min, Max, Units and Origin)



While logging, you can create markers in the log file by clicking the "Log Mark" button. This can be used to mark particular sections of the log that you want to refer to later. Once Map Access is enabled then the Log Mark can be used to add a marker into the log file.

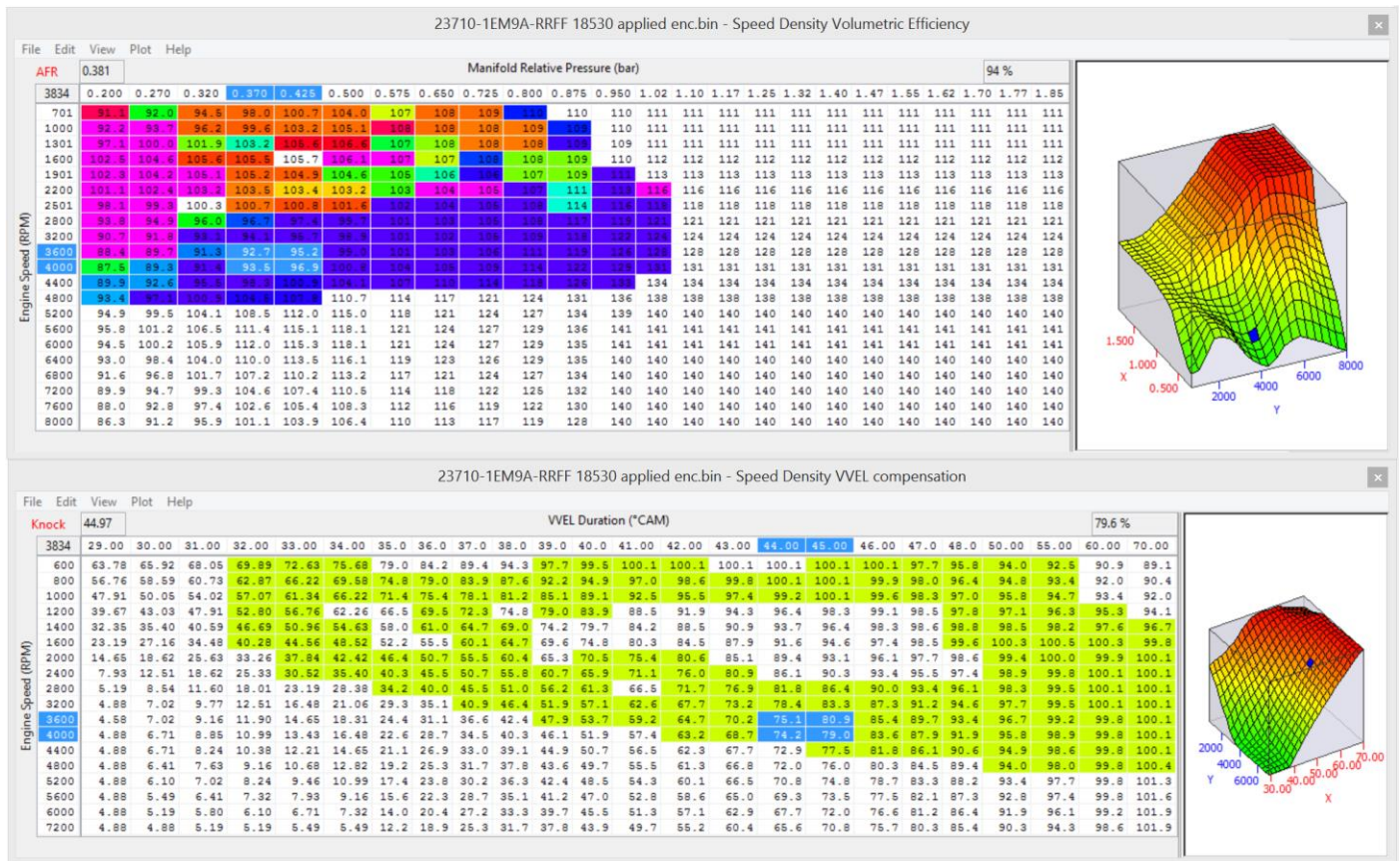


The log file contains a "Log Mark" parameter that increases by 1 every time you click the button or press the BackSpace key. The current value is displayed on the button as shown above.



There is also a Map Tracing option where the current position is shown and plotted on the Ignition, Fuel and several other maps. In addition the Map Trace can plot colour relative to the current AFR or Knock Correction amount. Clicking on a cell will show the Min and Max reading for that particular cell.

This example below shows the AFR has been plotted on the SD-VE map and the Knock Correction has been plotted on the VVEL compensation map.



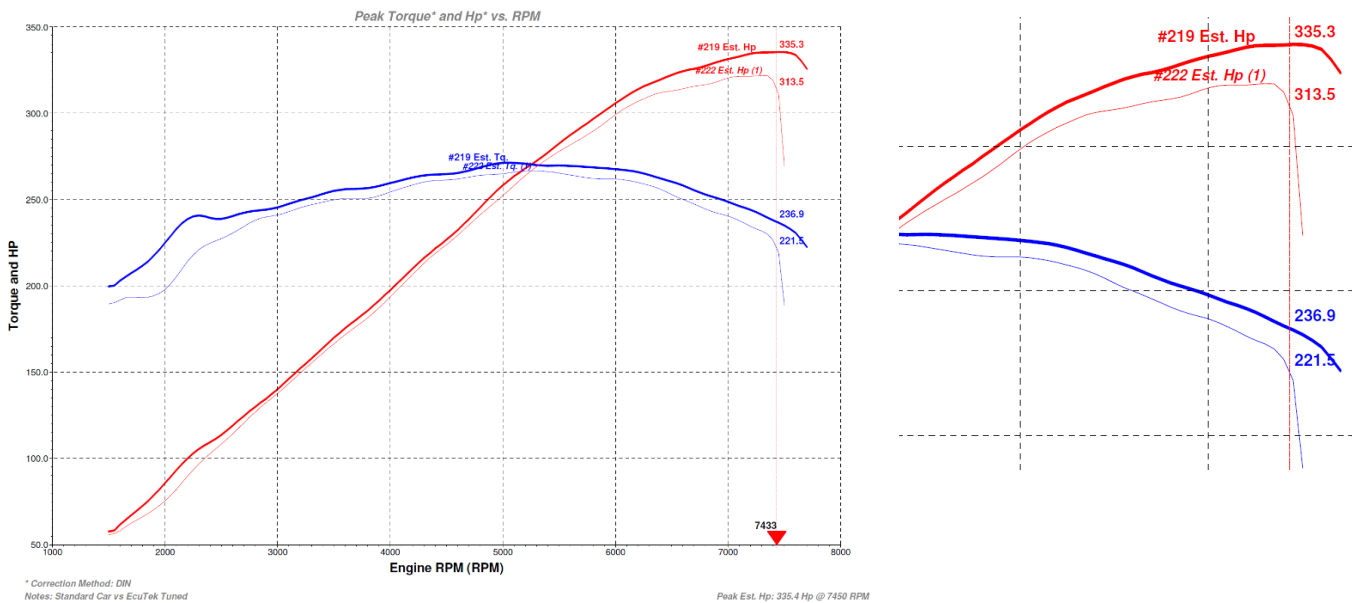
10. Tuning Results

Here are some example power gains that can be achieved.

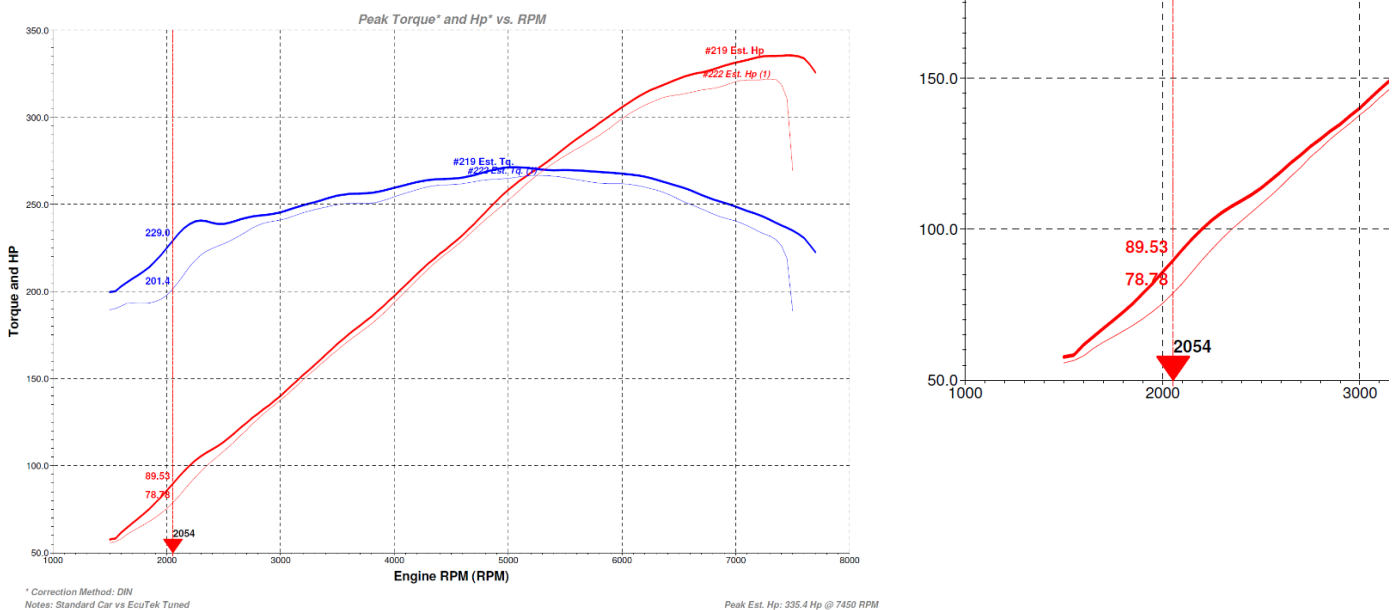
10.1.1 Naturally Aspirated Tuning

This 1st example is naturally aspirated tuning on a 100% stock car with 'before and after' EcuTek tuning. The power increased from 321bhp to 335bhp at higher RPM, most of the power gain comes from 4500rpm onwards. The biggest improvement is actually made from VTC and VVEL calibration at lower RPM and +10bhp and +30 lbs.ft torque can be achieved around 2000rpm. Several EcuTek tuner report +25bhp to +30bhp with a quality sports exhaust system fitted

DYNomite test "Nissan 370z RaceROM Tuning" by EcuTek



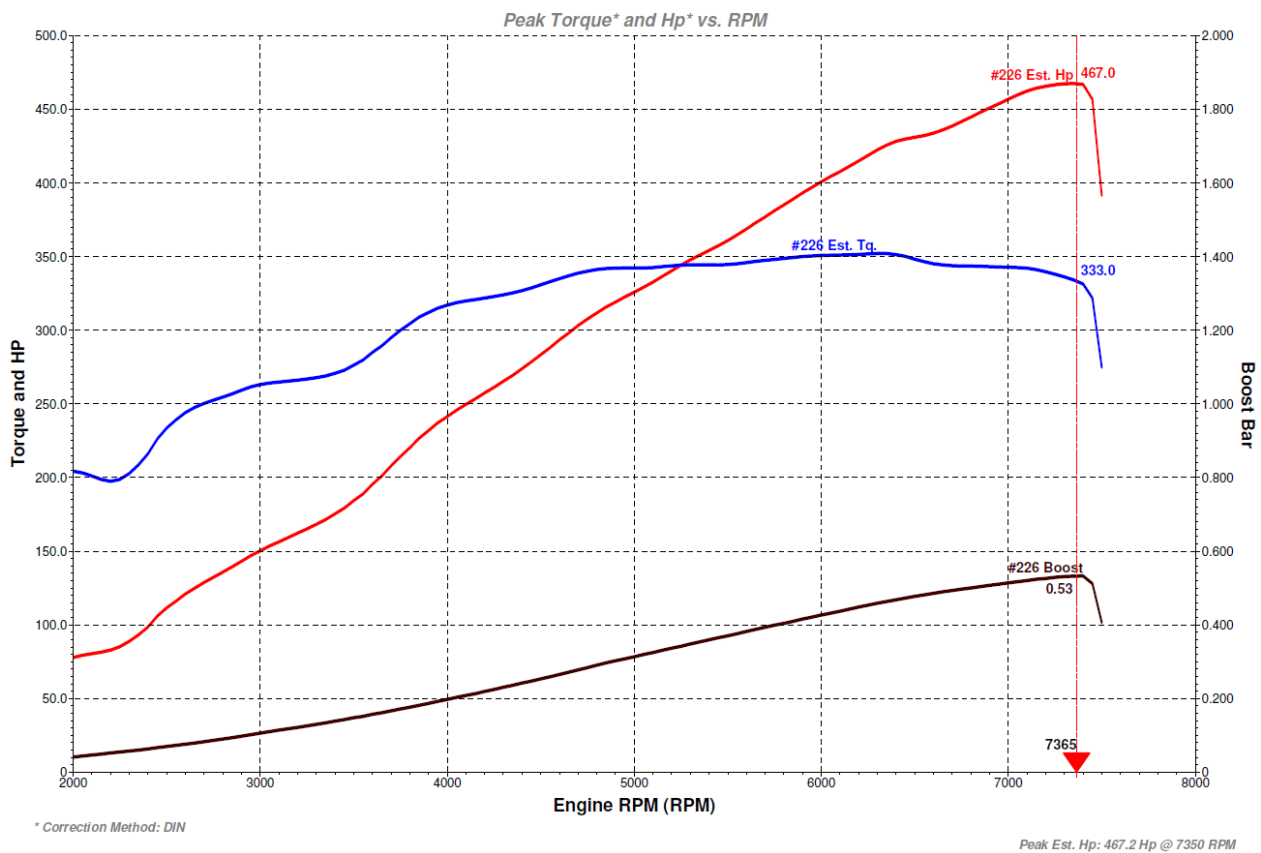
DYNomite test "Nissan 370z RaceROM Tuning" by EcuTek



10.1.2 Forced Induction Tuning

This 2nd example is the popular Stillen Forced Induction kit that uses the centrifugal Vortech Supercharger, this high quality kit produces around 470bhp and 360lbs.ft torque.

DYNomite test "Nissan 370z Stillen Supercharger running RaceROM " by EcuTek



10.1.3 D1 Drift Car Tuning

AP Boss in Japan have also custom tuned this famous turbo powered D1 Drift car to over 800bhp! This good looking race car has the added protection of EcuTek unique fail safe features that will protect the engine should it over boost or run lean whilst out on the track!



11. Technical Support

11.1 What we Support

11.1.1 Bug Fixes

EcuTek provide technical support on ProECU Nissan 370Z. This means that we will endeavour to fix any bugs that you find in the software. If a feature doesn't work as described, then please contact us so that we can make any changes required.

11.1.2 ECU Additions

We will also add support for newly released or reported ECU versions, as and when they are made available – the turnaround time adding new ECU support is around 7 days.

Updates must be tested prior to release, so do not call us on the day when you have a car with a brand new ECU in for tuning. Be organised – when scheduling a car for tuning, you will always take details of its specification, so find out in advance what type of ECU it contains. There will then be no mad rush when the car arrives on your premises.

11.2 What is NOT Supported

11.2.1 Basic Tuning Tuition

EcuTek ECU Software is provided on the understanding that you are an experienced tuner. As such, you should already be familiar with the principles of engine tuning. This means that we do not provide support on tuning questions, such as 'what boost pressure should I run with an xxx turbo?' or 'what AFR should I run at xxx RPM and yyy boost pressure?' – That is for you to decide. We are here to make your job possible, not do your job for you! If we 'costed in' this kind of support, the experienced tuner would end up subsidising the others.

11.3 Contacting EcuTek for Technical Support

Technical support must initially be via email, not via telephone. This is for the following reasons:

Emails may be routed to the individual best placed to reply to them.

Depending on customer location, time zones are likely to be different, making phone calls difficult and expensive.

Writing down the question or problem often helps provide the answer or solution to it. It is also easier to understand, reproduce and fix a well-documented issue, than notes made from a phone call.

Send your emails to support@ecutek.com

12. Glossary

AFM

Air Flow Meter

AFR

Air Fuel Ratio

MAF

Mass Air Flow (sensor)

MAP

Manifold Absolute Pressure (sensor)

MRP

Manifold Relative Pressure

O2 Sensor

Lambda Sensor (oxygen sensor)

FTST

Fuel Trim Short Term

FTLT

Fuel Trim Long Term

Engine Load

The ECU calculates engine load based on calculated air flow entering the engine divided by engine RPM. It is effectively how much air enters the engine on each revolution

SD – Speed Density

The Mass Air Flow in grams is calculated from MAP sensor not the MAF sensors

MBT

Maximum Best Torque or Minimum Best Timing

VTC

Variable Timing Control

VVEL

Variable Valve Event & Lift, a Nissan patented system for controlling valve lift.