ProECU Nissan VR30TT

Tuning Manual

V1.3

Contents

1. Introduction

Nissan and Infinity's latest venture into Sports luxury saloons has resulted in the release of the Nissan VR30DDTT Powered Q50 & Q60 vehicles. These vehicle sport some of the latest features developed and include the twin turbo 3.0L V6. The VR-series 3.0-liter Twin-Turbo V6 engine is available in two configurations:

- a 300 horsepower version with 295 lb-ft of torque
- a high-performance option with 400 horsepower and 350 lb-ft of torque

The VR30 is an award winning engine with seamless power delivery, the latest in Direct Injection technology and a range of special equipment to adequately and easily monitor maintain and increase power and torque delivery. The Items to note on the VR30 are

- Water to Air intercoolers (with Aircon Cooling capacity) 1 pump on 300hp, two pumps on 400hp
- Turbo Speed sensors (on 400hp version)
- Twin turbo with Electronic WG actuators on integrated manifold
- Aluminium block with arc sprayed mirror coating to cylinder bores
- Aluminium cylinder heads with integrated exhaust manifold
- Electronically controlled variable displacement oil pump
- Dual Variable Valve Timing VTC (electronic inlet cam, Hydraulic exhaust cam)
- Direct Injection

Summary of Software

The Software to cover the VR30DDTT engines has been introduced to allow reprogramming of the factory ECU to tune the necessary components of the calibration to allow for modifications and increases in power. This is not a standalone replacement ECU so will not have the associated issues or disadvantages of setting up a purpose-built ECU and control system from scratch.

The software allows easy control of

- Boost Targets and Wastegate control
- Target AFR
- Ignition Timing
- Fuel Delivery including fuel pump calibration (using the same style pump as OEM)
- Airflow Measurement and fuel compensation

It also allows the addition of extra features to improve the speed and quality of the tune, these are features like

- Safe-guards for temperatures and airflow that the factory calibration does not include.
- Valet Modes
- EcuTek ECU Connect Compatibility and adjustment
- Map Switching for fuel and Ignition timing

As the product progresses and development occurs, new features and improved definitions will be added.

2. Block Programming

Method of operation

Block Programming (BP) will be enabled after a RaceROM patch is installed on an ECM. This means the first time you program with a BP/RaceROM equipped ROM the ECU needs to use the slow OEM programming sequence and therefore programming time will not change.

On subsequent programming operations, BP will be used. The minimum programming time is approximately 20 seconds and BP will always reprogram the start and end block. More changes will require more blocks to be reprogrammed taking additional time.

DTC clearing and power-off sequences still need to be followed after programming.

Failed Flash Recovery

Block Programming has been tested to ensure that it will not "brick" the ECM, if there is a programming failure, however the correct sequence must be used to recover from a failed programming attempt.

- Close the ProECU programming window
- Disconnect the battery for at least 15 seconds to stop the programming code continuing to run in RAM.
- Manually select the correct ECM programming window for the car. This is a critical step as ProECU will not be able to auto detect a part programmed ECM
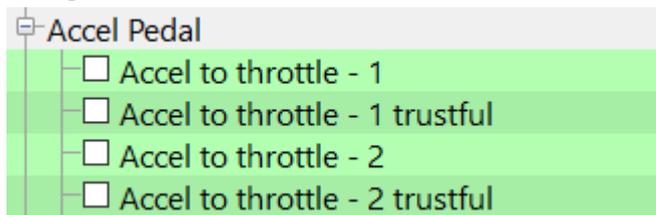- Select correct ROM
- Program

3. Map Descriptions

Accel Pedal

Introduction

Although the VR30 has very complex learning and control strategies (and in some vehicles force feedback pedal control) the accelerator to throttle response is only basically defined, it does however give adequate recalibration of the OEM pedal characteristics.
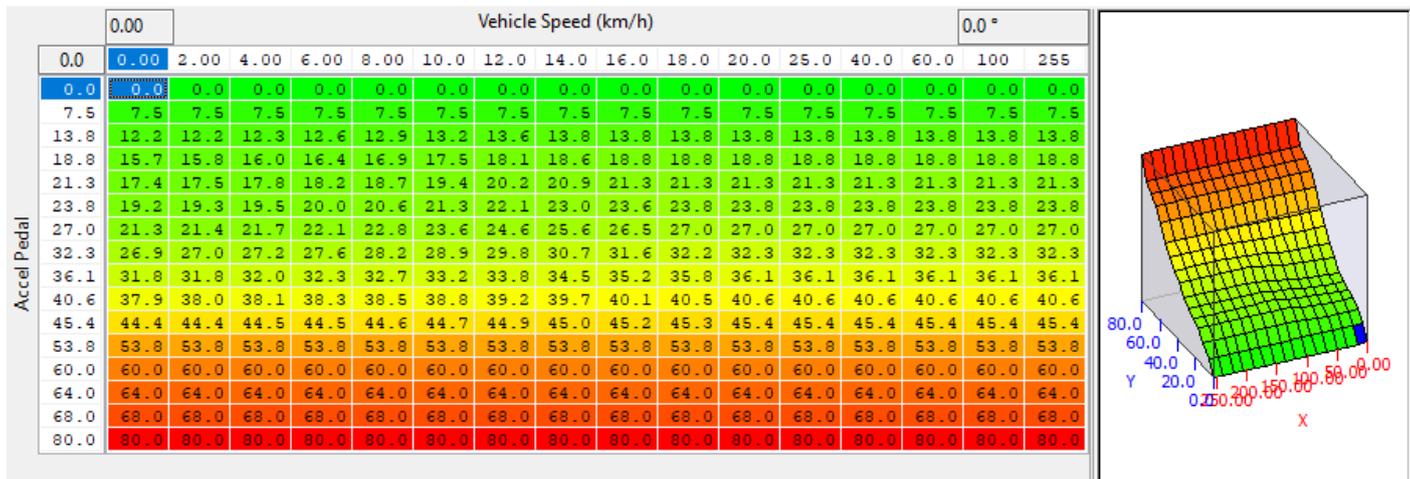
Map List

- Accel Pedal
  - ☐ Accel to throttle - 1
  - ☐ Accel to throttle - 1 trustful
  - ☐ Accel to throttle - 2
  - ☐ Accel to throttle - 2 trustful

Live Data Parameters

- Accelerator Sensor #1 – Default accelerator logging parameter for accelerator pedal voltage.
- Accelerator Sensor #2 – Secondary accelerator pedal sensor logging parameter for pedal voltage.
- QH0 – Percentage of throttle airflow requested (not strictly related to accel pedal)

Accel to Throttle - 1 & 2 with trustful

| 0.00		Vehicle Speed (km/h)													0.0 °	
0.0	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	25.0	40.0	60.0	100	255
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
13.8	12.2	12.2	12.3	12.6	12.9	13.2	13.6	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
18.8	15.7	15.8	16.0	16.4	16.9	17.5	18.1	18.6	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8
21.3	17.4	17.5	17.8	18.2	18.7	19.4	20.2	20.9	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3
23.8	19.2	19.3	19.5	20.0	20.6	21.3	22.1	23.0	23.6	23.8	23.8	23.8	23.8	23.8	23.8	23.8
27.0	21.3	21.4	21.7	22.1	22.8	23.6	24.6	25.6	26.5	27.0	27.0	27.0	27.0	27.0	27.0	27.0
32.3	26.9	27.0	27.2	27.6	28.2	28.9	29.8	30.7	31.6	32.2	32.3	32.3	32.3	32.3	32.3	32.3
36.1	31.8	31.8	32.0	32.3	32.7	33.2	33.8	34.5	35.2	35.8	36.1	36.1	36.1	36.1	36.1	36.1
40.6	37.9	38.0	38.1	38.3	38.5	38.8	39.2	39.7	40.1	40.5	40.6	40.6	40.6	40.6	40.6	40.6
45.4	44.4	44.4	44.5	44.5	44.6	44.7	44.9	45.0	45.2	45.3	45.4	45.4	45.4	45.4	45.4	45.4
53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8
60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0
68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0
80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

These maps can be changed to give a more linear accel pedal response per vehicle speed generally at lower speeds it's a 1:1 ratio but at higher speed it is a little less responsive at low accel pedal positions. There are trustful maps used and the trustful equivalent must match the original otherwise DTC's (P0605) will occur.

Cam Timing

Introduction

The VR30 has variable cam timing on both the inlet and exhaust cams allow for very precise valve opening and closing events and modulation for EGR etc. The Intake cam advance is driven electronically, and the exhaust cam timing is altered hydraulically by engine oil pressure. Cam timing can be adjusted in the calibration to get more power through the midrange and top end.
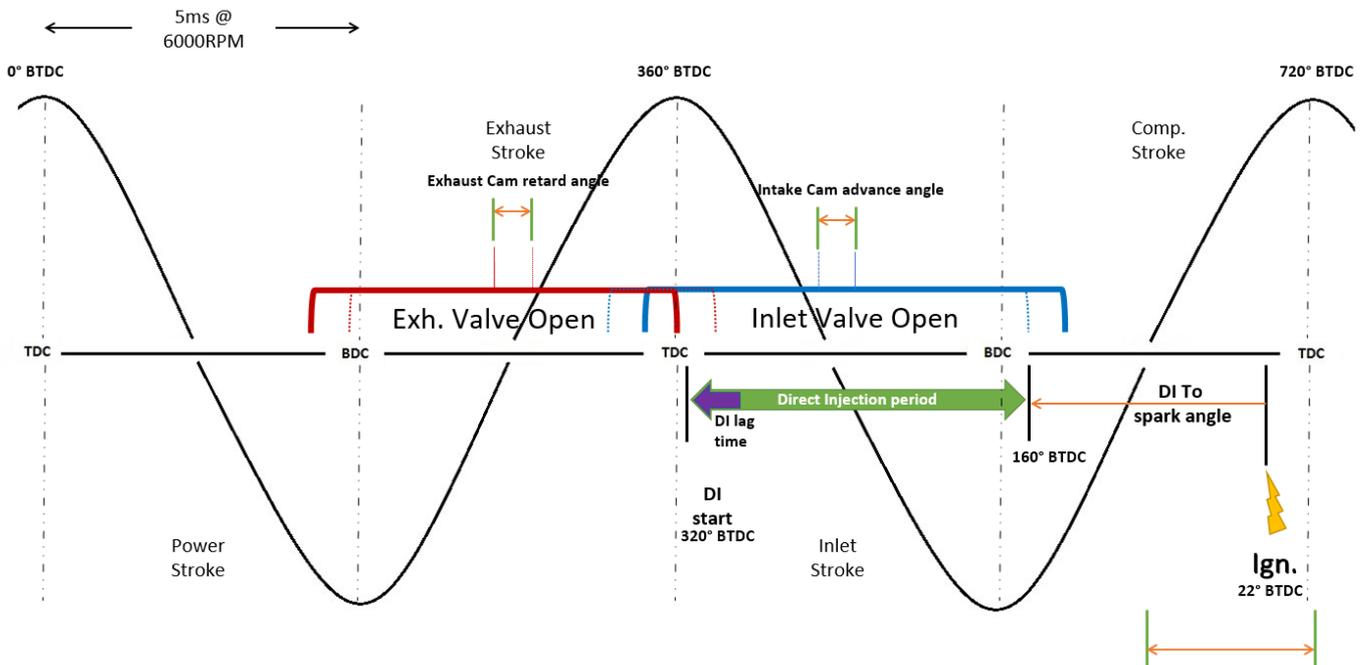
Map List

Cam Timing		
Exhaust		
☐ VVT Exhaust #01	Beginner	OEM
☐ VVT Exhaust #02	Beginner	OEM
Intake		
☐ VVT Intake #01	Beginner	OEM
☐ VVT Intake #02	Beginner	OEM
☐ VVT Intake #03	Beginner	OEM
☐ VVT Intake #04	Beginner	OEM
☐ VVT Intake #05	Beginner	OEM
☐ VVT Intake #06	Beginner	OEM
☐ VVT Intake #07	Beginner	OEM
☐ VVT Intake #08	Beginner	OEM
☐ VVT Intake #09 - used	Beginner	OEM
☐ VVT Intake #10	Beginner	OEM
☐ VVT Intake #11	Beginner	OEM
☐ VVT Intake #12	Beginner	OEM

Live Data Parameters

- *VTC Exhaust Duty B1 (%) – Bank 1 Exhaust VVT Oil control valve duty in %.*
- *VTC Exhaust Duty B2 (%) – Bank 2 Exhaust VVT Oil control valve duty in %.*
- *VVT Exhaust Angle B1 (°CA) – Exhaust cam angle for bank 1 in crank degrees*
- *VVT Exhaust Angle B2 (°CA) – Exhaust cam angle for bank 2 in crank degrees*
- *VVT Intake Angle B1 (°CA) – Bank 1 Intake Cam angle in crank degrees*
- *VVT Intake Angle B2 (°CA) – Bank 2 Intake Cam angle in crank degrees*

Exhaust Cam Timing

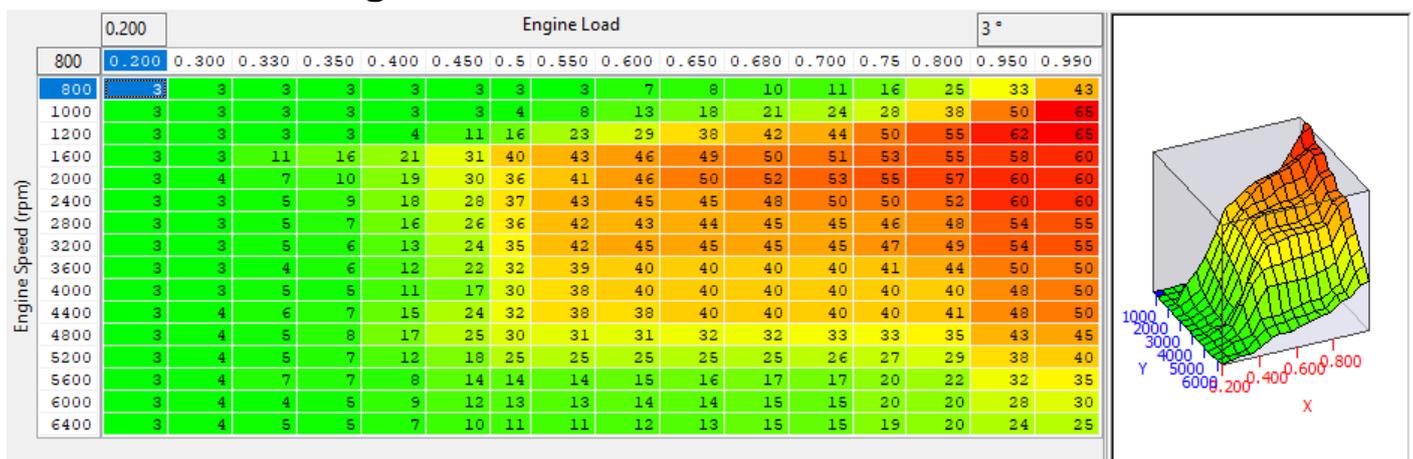| Engine Speed (rpm) \ Engine Load	0.0900	0.100	0.120	0.130	0.150	0.160	0.200	0.220	0.300	0.400	0.5	0.600	0.700	0.800	0.900	0.990
800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	5	16	21	37	45	46	42	37	26	20	10
1200	0	0	0	0	15	23	24	39	47	47	44	35	25	21	16	15
1600	0	15	15	23	38	41	47	47	45	35	25	25	25	25	25	25
2000	0	15	23	32	42	44	47	47	47	38	23	20	17	15	15	15
2400	0	7	27	28	37	47	47	47	47	38	24	20	18	16	15	15
2800	0	0	25	25	32	41	45	45	45	36	23	19	15	15	15	15
3200	0	0	19	21	29	34	40	40	40	34	24	15	15	15	13	13
3600	0	0	17	17	26	30	35	35	35	30	20	17	17	15	10	10
4000	0	0	11	15	21	24	28	30	30	24	19	14	13	13	10	7
4400	0	0	11	13	16	18	22	23	23	18	14	9	8	8	7	5
4800	0	0	9	11	12	14	16	19	19	14	8	8	7	7	5	5
5200	0	0	5	7	9	10	12	15	15	10	6	5	5	5	5	5
5600	0	0	1	4	7	8	10	10	10	8	6	6	5	5	5	5
6000	0	0	0	2	5	6	7	7	7	6	5	5	5	5	5	5
6400	0	0	0	0	3	4	6	6	6	6	5	5	5	5	5	5

There are a series of maps that are used in different conditions, at the time of writing we are unsure of which conditions use which maps as standard there is little difference to the maps so if changes are made on one it may help to change the others.

These maps represent the target exhaust cam retard angle in crank degrees, we believe from the centre point of the cam.

Intake Cam Timing

Engine Speed (rpm) \ Engine Load	0.200	0.300	0.330	0.350	0.400	0.450	0.5	0.550	0.600	0.650	0.680	0.700	0.75	0.800	0.950	0.990
800	3	3	3	3	3	3	3	3	7	8	10	11	16	25	33	43
1000	3	3	3	3	3	3	4	8	13	18	21	24	28	38	50	65
1200	3	3	3	3	4	11	16	23	29	38	42	44	50	55	62	65
1600	3	3	11	16	21	31	40	43	46	49	50	51	53	55	58	60
2000	3	4	7	10	19	30	36	41	46	50	52	53	55	57	60	60
2400	3	3	5	9	18	28	37	43	45	45	48	50	50	52	60	60
2800	3	3	5	7	16	26	36	42	43	44	45	45	46	48	54	55
3200	3	3	5	6	13	24	35	42	45	45	45	45	47	49	54	55
3600	3	3	4	6	12	22	32	39	40	40	40	41	44	50	50	50
4000	3	3	5	5	11	17	30	38	40	40	40	40	40	40	48	50
4400	3	4	6	7	15	24	32	38	38	40	40	40	40	41	48	50
4800	3	4	5	8	17	25	30	31	31	32	32	33	33	35	43	45
5200	3	4	5	7	12	18	25	25	25	25	25	26	27	29	38	40
5600	3	4	7	7	8	14	14	14	15	16	17	17	20	22	32	35
6000	3	4	4	5	9	12	13	13	14	14	15	15	20	20	28	30
6400	3	4	5	5	7	10	11	11	12	13	15	15	19	20	24	25

There are a series of maps 0-12 that are used in different conditions, at the time of writing we believe that map 09 is used primarily but are unsure of which conditions use which maps. As standard there is little difference to the maps so if changes are made on one it may help to change the others.

These maps represent the target intake cam advance angle in crank degrees from cam centre reference point.

Boost Control

Introduction

Starting with RaceROM Version 3, the OEM boost control has been rewritten and replaced with our own simplified boost control strategy using its own set of dedicated RaceROM maps. Upon adding a version 3 or later RRFF, this option is enabled by default, and comes pre-populated with a sensible stage 1 boost control setup.

As the VR30 utilises electronic wastegates it is possible to set WG position at any RPM, the principles (proportional, integral and derivative) are the same as a pneumatic wastegate, however the control is performed in position rather than duty. There are also turbo speed sensors in the 400hp (high boost pressure) model which adds another dimension to the amount of control the ECU can exert.
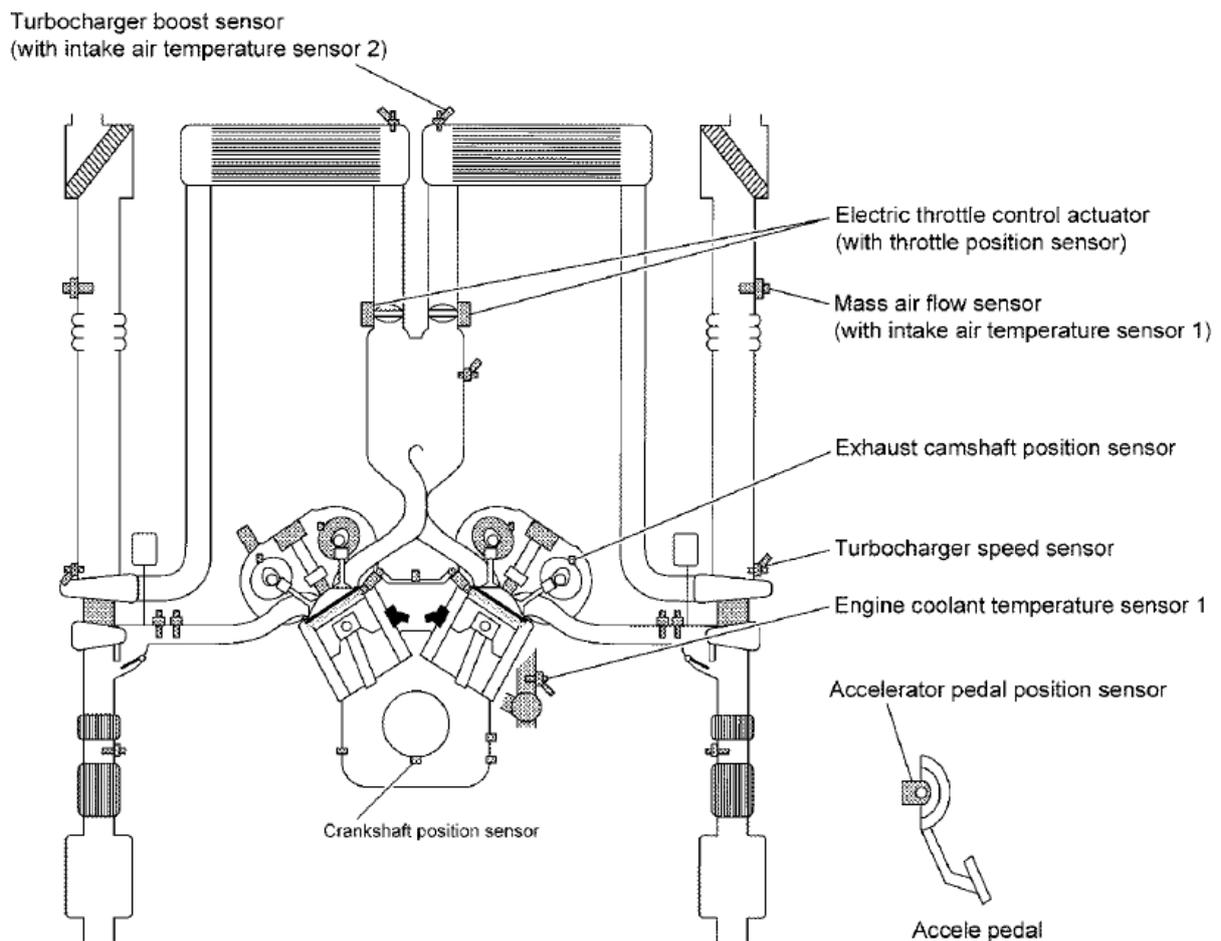
There are no blow off valves (BOV's) as standard on the VR30DDTT motors and as a result they are prone to pre-throttle over boost during gearshifts and also when entering overrun. We have added some functionality to aid in reducing the over boost amount, fortunately the MAP is relatively well controlled using the throttle as well reducing risk to engine internals.

Map List

Boost Control
- ☐ Boost Controller Maximum
- ☐ Boost Controller Minimum
- ☐ Boost Limit
- ☐ Boost Target A
- ☐ Boost Target A (Trustful)
- ☐ Boost Target Max Allowed #1
- ☐ Boost Target Mode 1
- ☐ Boost Target Mode 2
- ☐ Boost Target Mode 3
- ☐ Boost Target Mode 4
- ☐ RaceROM Boost Controller Switches
- ☐ Wastegate Base Target Position
- ☐ Wastegate Base Target Position (EGR off)
- ☐ Wastegate Correction - Integral #1
- ☐ Wastegate Correction - Integral #2
- ☐ Wastegate Correction - Proportional
- ☐ Boost Target - Atmospheric Pressure Compensation #1
- ☐ Boost Target - Atmospheric Pressure Compensation #2
- ☐ Boost Target - Atmospheric Pressure Compensation #3
- ☐ Boost Target Compensation - High Load #1
- ☐ Boost Target Compensation - High Load #2
- ☐ Boost Target Compensation - High Load #3
- ☐ Boost Target Compensation - Low Load #1
- ☐ Boost Target Compensation - Low Load #2
- ☐ Boost Target Compensation - Low Load #3
- ☐ Boost Correction - Air Temp Multiplier
- ☐ Boost Correction - Integral Multiplier
- ☐ Boost Target Scale by QH0
- ☐ Exhaust pressure Map
- ☐ Gearchange - Ignition Minimum Allowed
- ☐ Gearchange - Wastegate Offset
- ☐ Turbo Speed Minimum for Closed Loop
- ☐ Turbo Speed Minimum for Closed Loop (Trustful)
- ☐ Wastegate Correction - Air Temp
- ☐ Wastegate Correction - Atmospheric Pressure
- ☐ Wastegate Correction - Manifold Absolute Pressure
- ☐ Wastegate Correction - Transient #1
- ☐ Wastegate Correction - Turbo Speed Limiter 1
- ☐ Wastegate Correction - Turbo Speed Limiter 2
- ☐ Wastegate Correction - Turbo Speed Limiter 3
- ☐ Wastegate Correction - Turbo Speed Threshold
- ☐ Boost Limit Resume

Live Data Parameters

- *Boost Bank1/Boost Bank2 – Absolute pressure in bar, measured by the two boost sensors*
- *RBC Maximum Desired Boost – Relative boost max target, matches number format on gauge*
- *Boost Target – Absolute pressure target in bar, measured by the intake manifold pressure sensor*
- *Boost Error – Difference between MAP and Boost Target, positive numbers are over boost*
- *Boost Target – RBC Maximum – The current RR boost controller setpoint.*
- *Boost Target Multiplier – The QH0 based multiplier used for boost target correction*
- *Manifold Gauge Pressure – "Boost" pressure measured in bar above the current atmospheric pressure*
- *Manifold Absolute Pressure – Absolute pressure in bar, measured by the intake manifold pressure sensor*
- *Manifold Pressure Sensor – MAP sensor voltage value*
- *Turbo Speed B1 & B2– Current turbo speed in rpm only available on the 400hp models*
- *Wastegate Actuator Position B1 & B2 – The mm distance the wastegate has extended (related to WG angle)*
- *WG Actuator Position Sensor B1 & B2 – the WG position sensors current voltage output*
- *WG Corr Base – Output from Wastegate Posn. Corr. Calculation, not used in RR boost control strategy*
- *WG Corr Integral – WG duty added by Integral correction of EcuTek boost control strategy*
- *WG Corr Proportional – WG duty added by Proportional correction of EcuTek boost control strategy*
- *WG Corr - Prop Int Sum – Correction resulting from proportional and integral added together*

- *WG Corr – Transient – Derivative component of boost error calculation*
- *WG Offset – During Gearshift – Offset applied in mm during upshift.*
- *WG Target – Air Temp Comp – Air temp correction value from target map (in Bar)*
- *WG Target – Atmospheric Pressure Correction amount applied from the Atmo Pressure Comp map*
- *WG target – Basemap Lookup - the value referenced in the WG target map (in mm)*
- *WG Target – Position – Final Position target after all corrections (in mm)*

EcuTek Boost Control vs RaceROM Boost Controller

There may be some confusion between the features for boost control in recent RaceROM versions, despite the similar naming due to historic reasons the two RaceROM features have different functions.

EcuTek Boost Control

EcuTek Boost Control is the control strategy to set the boost target and control the wastegate solenoid such that the boost reaches and remains on target.

RaceROM Boost Controller

(abbreviated to RBC) is a feature used to limit the boost target using ECU Connect and cruise control switchgear (when made available). The maximum boost target is displayed only in ECU connect or a ProECU log file. As can be determined from the boost target flow diagram the boost target can be below the value set by the RBC but it can never exceed it.

The RRBC is a final limit to any boost target, any boost target higher than the RRBC limit will be capped to the RRBC limit.

Absolute Boost

As per the latest updates to GTR the VR30DDTT follows the use of Manifold Absolute Pressure (MAP) for all aspects of tuning the boost control. All boost target, boost limit and boost threshold values are all absolute values in Bar. Tuners will now find that all boost related maps and live data will give consistent readings regardless of altitude, and calculations will hold true in all circumstances.

To make tuning as simple as possible we have added the Boost Target - Atmospheric Pressure Compensation maps by default, this gives a consistent "boost" at all altitudes, but the result is that your MAP will drop as a result, and power will be reduced at altitude if using the default **Boost Target Atmospheric Compensation** map.

Electronic Wastegate Control

The VR30DDTT uses the latest technology for controlling the opening angle of the wastegates, the wastegate actuator is now electronically driven as opposed to pneumatically. The electric wastegate control actuator operates based on a signal from ECM and adjusts the turbocharger boost control valve angle via link rod. The electronic control allows the turbocharger wastegate control valve to be opened even in non-supercharging regions. This reduces pumping losses and contributes to the fuel economy. When boost is requested the wastegate valve angles are controlled by the electronic control with a high degree of accuracy but are currently limited to OEM WG setups.
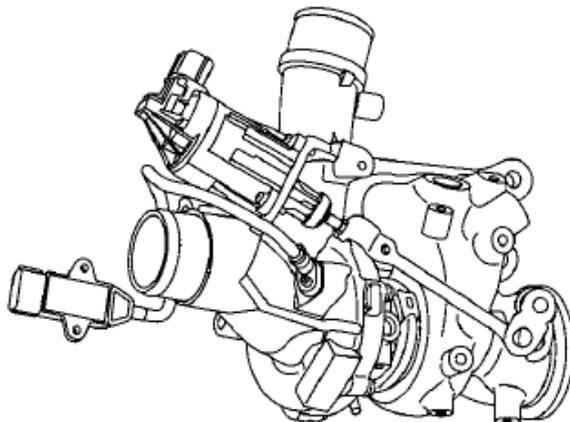
The Key Principle with Electronic wastegates is that they are controlled by a target position as opposed to a duty cycle. This extension is

- 8mm equals fully extended / fully open wastegate (no boost)
- 0mm equals fully protracted / fully closed wastegate (full boost)

There is a further lower level control for the actuator but these are not required currently as aftermarket WG controllers are not widely available.

Enable Special Features (Boost Control Related)

☑ Enable RaceROM Boost Controller
☐ RBC - Same value in all modes
☐ Scale Boost Target by Atmospheric Pressure disable

EcuTek Boost Control – Enabled by default when adding RaceROM Feature File (patch)

The overall enable for the RaceROM boost control strategy is set by default when adding a patch. Once the patch is added the RR maps for boost control are used as opposed to the OEM strategy, this cannot be disabled or unchecked.

Enable RaceROM Boost Controller

Overall enable for the RBC, enabled by default. If turned off the cruise switchgear will do nothing boost control related.

RBC – Same value in all modes

Forces the RBC setpoint to be maintained even when switching MapSwitch Mode. There is a limitation of this in that ALL modes will have a maximum setpoint corresponding to the lowest of the four values in **Boost Controller Maximum**.

Scale Boost Target by Atmospheric Pressure disable

Forces the RRBC to ignore changes in atmospheric pressure when calculating boost error.

Boost Limit (Fuel Cut)

600	3.50 bar
600	3.50
900	3.50
950	1.40
1000	1.41
1200	1.55
1600	2.12
2000	2.17
2400	2.17
2800	2.23
3200	2.24
4000	2.39
4800	2.46
5200	2.39
5600	2.43
6000	2.46
6400	2.46
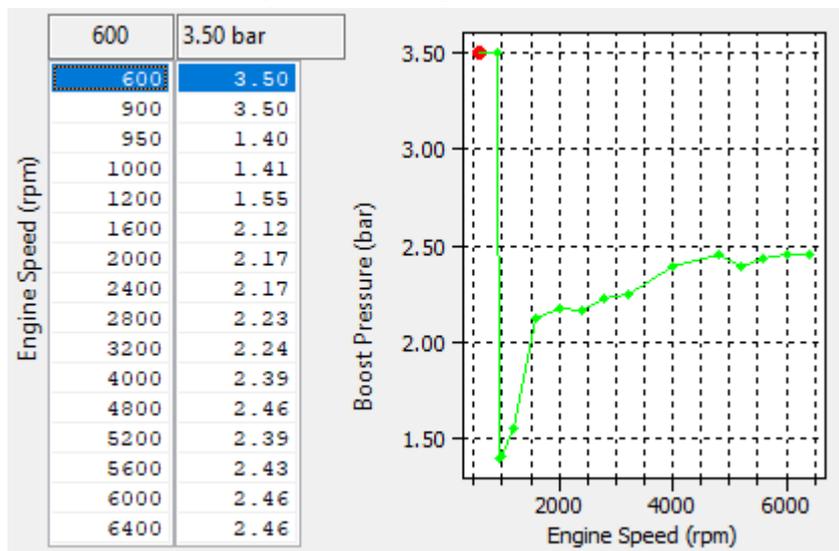
The manifold absolute pressure needs to exceed this limit, measured in Bar (Absolute) by the manifold pressure sensor, for a time that exceeds a currently undiscovered delay timer.

Boost Limit Resume

Engine Speed (rpm)	600	1.08 bar
	600	1.08
	900	1.10
	950	1.11
	1000	1.12
	1200	1.23
	1600	1.41
	2000	1.72
	2400	1.71
	2800	1.71
	3200	1.71
	4000	1.76
	4800	1.91
	5200	1.92
	5600	1.81
	6000	1.59
	6400	1.53
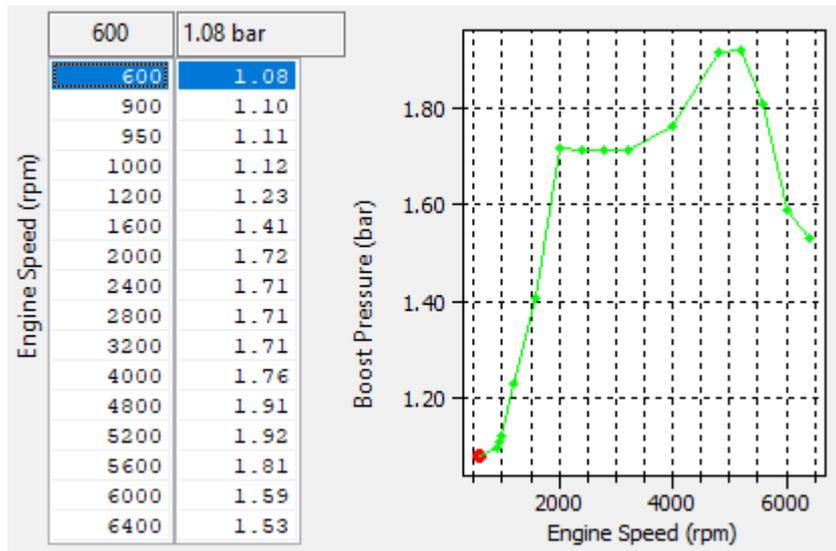
There are separate cut and resume maps to introduce hysteresis into the fuel cut.

With the default limit of 2.44 Bar (at 4400RPM) and a Resume of 1.86Bar, the fuel will be cut when the MAP exceeds 2.44Bar for a set time and resume when the MAP drops below 1.86Bar.

Boost Target

The boost target system in the VR30 product has some aspects that are slightly different to the normal boost target set point methods. The current understanding and setup can be seen in the below flow chart.
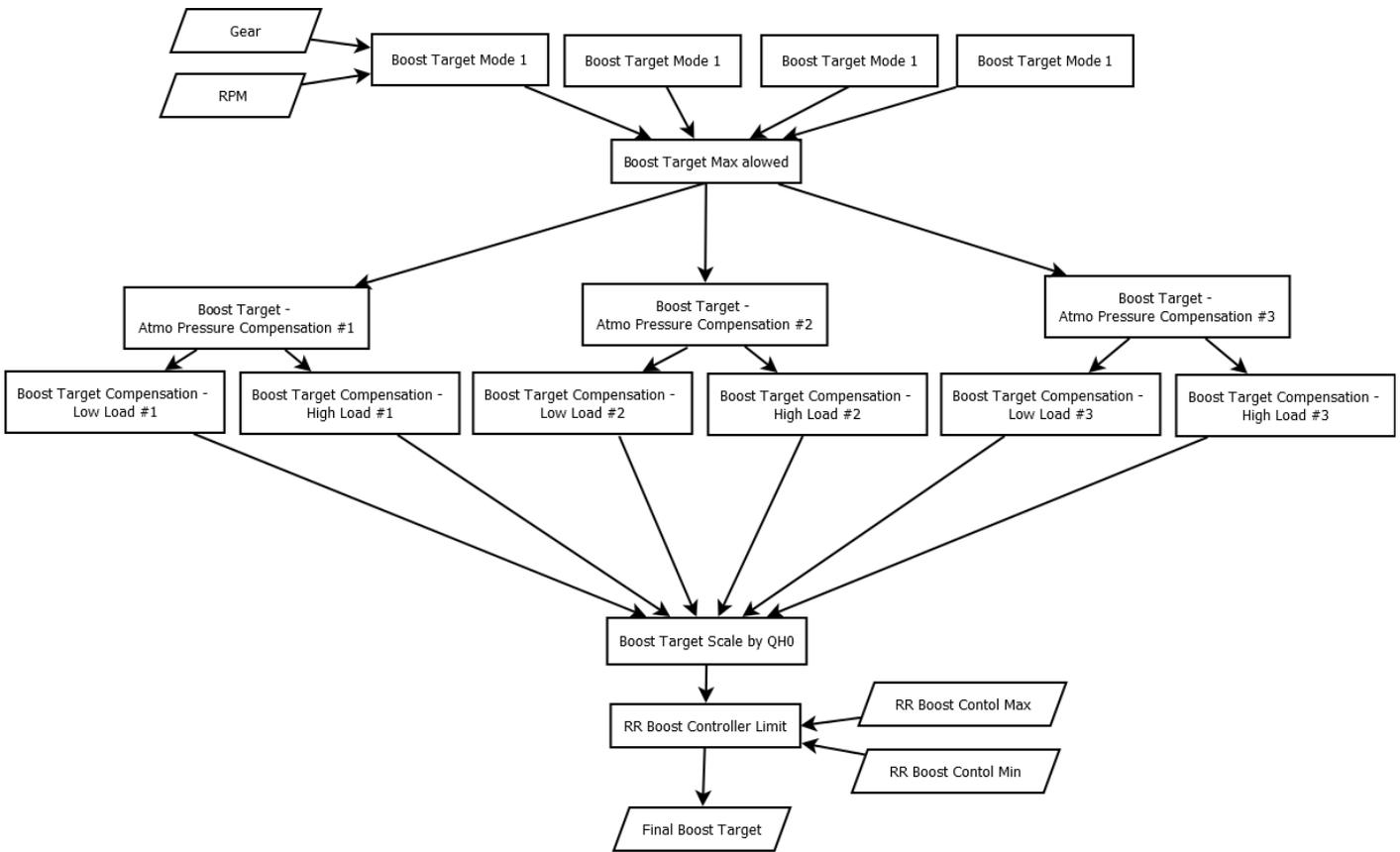
Boost Target Mode 1 - 4

	800.0						Engine Speed (rpm)								0.94 bar	
1	800.0	1000	1200	1600	2000	2400	2800	3200	4000	4400	4800	5200	5600	6000	6400	6800
1	0.945	0.986	1.21	1.71	1.72	1.77	1.82	1.82	1.94	1.98	2.00	1.90	1.78	1.60	1.51	1.40
2	0.945	0.986	1.21	1.71	1.72	1.77	1.82	1.82	1.94	1.98	2.00	1.90	1.78	1.60	1.51	1.40
3	0.945	0.986	1.21	1.71	1.72	1.77	1.82	1.82	1.94	1.98	2.00	1.90	1.78	1.60	1.51	1.40
4	0.945	0.986	1.21	1.71	1.72	1.77	1.82	1.82	1.94	1.98	2.00	1.90	1.78	1.60	1.51	1.40
5	0.945	0.986	1.21	1.71	1.72	1.77	1.82	1.82	1.94	1.98	2.00	1.90	1.78	1.60	1.51	1.40
6	0.945	0.986	1.21	1.71	1.72	1.77	1.82	1.82	1.94	1.98	2.00	1.90	1.78	1.60	1.51	1.40
7	0.945	0.986	1.21	1.71	1.72	1.77	1.82	1.82	1.94	1.98	2.00	1.90	1.78	1.60	1.51	1.40

Boost target is now defined using four 3D maps with RPM and gear axis', there are 4 separate target maps, one for each Map Switch Mode, throttle modulation is in the form of a simple 2D QH0 map.

An RPM dependant target boost profile is set on a per gear basis. Typically gears 1 and 2 have noticeably lower targets due to traction limitations.

Boost Target Atmospheric Compensation

100	1.00
30	1.12
35	1.12
40	1.12
45	1.12
50	1.12
55	1.12
60	1.12
65	1.12
70	1.12
75	1.12
80	1.12
85	1.12
90	1.12
91	1.11
100	1.00
101	1.00
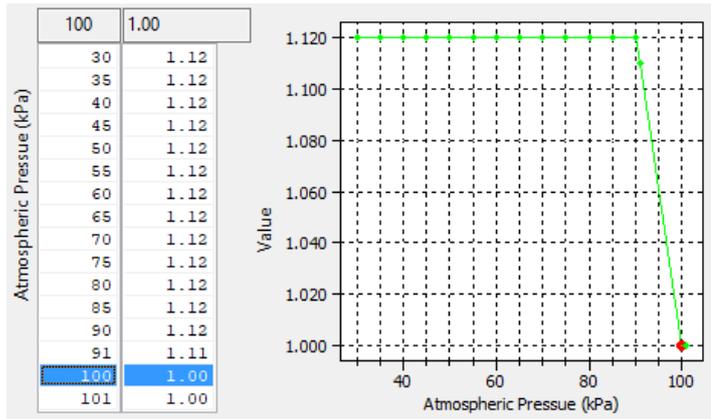
The boost target can be offset for changes in atmospheric pressure, the default map values reduce the absolute boost target 0.1Bar for the first 0.1 Bar drop in atmospheric pressure and stay at that afterwards. This is suitable for stock turbos which will often be further limited by turbo speed, pushing the same absolute pressure at altitude can be damaging to the turbos while still not achieving the desired pressure.

If working with turbos that have plenty of headroom at sea level then flattening this map to 0 will give the same absolute pressure target at altitude and result in similar power levels.

Boost Target Scale By QH0

0.0625	12.5 %
0.0625	12.5
0.1250	12.5
0.1875	18.8
0.2500	25.0
0.3125	31.3
0.3750	37.5
0.4375	43.8
0.5000	50.0
0.5625	56.3
0.6250	62.5
0.6875	68.8
0.7500	75.0
0.8125	81.3
0.8750	87.5
0.9375	100.0
1.0000	100.0
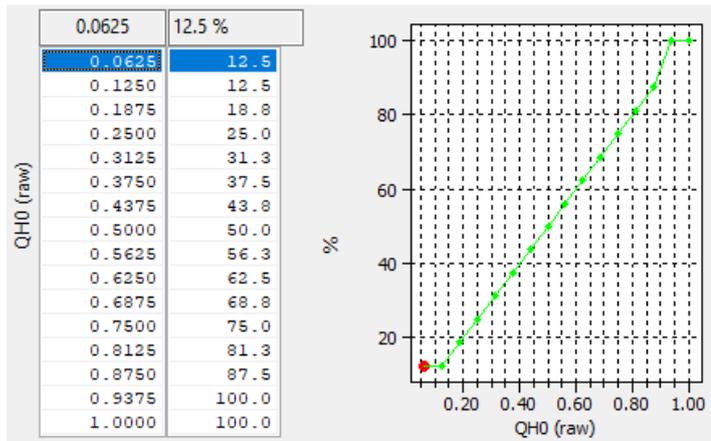
The boost target as set by the **Boost Target** map is multiplied by the output of this map. For example, a target of 2.4bar * 0.45 = 1.08bar absolute.

Boost Target Max Allowed

800	1.13 bar
800	1.13
1000	1.15
1200	1.54
1600	1.85
2000	1.79
2400	2.02
2800	2.09
3200	2.08
4000	2.22
4400	2.26
4800	2.29
5200	2.24
5600	2.27
6000	2.31
6400	2.38
6800	2.00
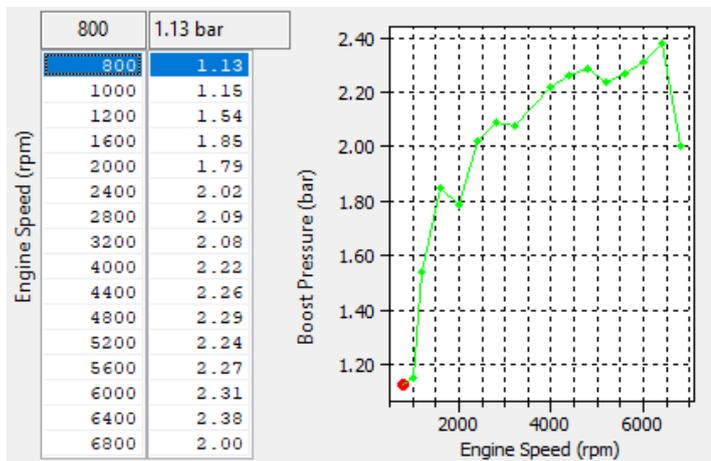
Maximum target based on engine speed, used as a maximum limit for boost target.

Wastegate Duty Calculation

The Wastegate position calculation follows the process below, the closed loop control consists of a base wastegate position. The base duty is always subject to air temperature, Barometric pressure and Manifold pressure corrections. If the turbo speed is high enough (above he threshold for closed loop turbo control) a proportional, integral and a transient correction term are calculated and added. There is an overall turbo speed limiting waste gate correction amount applied when above the maximum allowed turbo speed threshold.
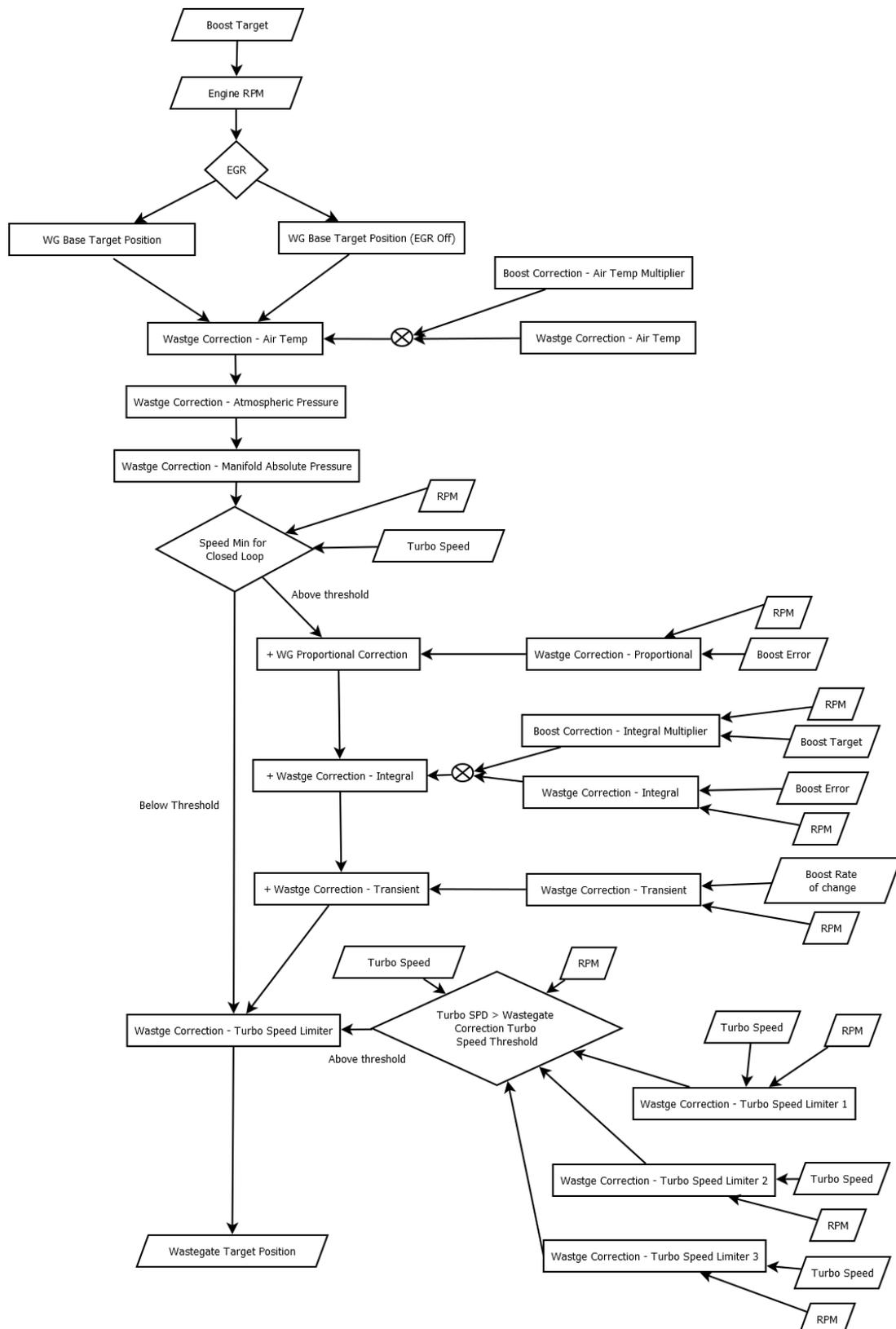
WG Base Target Position (EGR On)
WG Base Target Position (EGR Off)

Engine Speed (rpm)	0.800	0.900	1	1.01	1.100	1.2000	1.300	1.4000	1.5000	1.60000	1.70000	1.80000	1.90000	2.00000	2.1000	2.20000
1000	8	8	8	6.53	0.770	0.0000	-0.630	-1.130	-1.370	-1.5400	-1.6200	-1.7000	-1.7800	-1.8600	-1.950	-2.0300
1200	8	8	8	8.00	1.400	0.0200	-0.250	-0.750	-1.000	-1.1160	-1.2400	-1.3200	-1.4100	-1.4900	-1.570	-1.6500
1600	8	8	8	8.00	6.200	1.9000	0.900	0.430	0.170	-0.0800	-0.3250	-0.5700	-0.6500	-0.7400	-0.820	-0.9000
1700	8	8	8	8.000	8.000	2.3500	1.210	0.660	0.420	0.1500	0.0700	0.0200	-0.0300	-0.0800	-0.130	-0.1800
1800	8	8	8	8.000	8.000	3.1000	1.670	1.120	0.780	0.5600	0.4000	0.3300	0.2600	0.1900	0.120	0.0500
2000	8	8	8	8.00	8.000	4.3000	2.460	1.700	1.240	1.0000	0.8700	0.7600	0.6500	0.5400	0.430	0.3200
2400	8	8	8	8.000	8.000	6.2700	3.750	2.780	2.180	1.7700	1.4400	1.0883	0.7367	0.6433	0.553	0.4600
2800	8	8	8	8.000	8.000	8.000	5.110	3.790	2.990	2.4800	2.0700	1.5450	1.0200	0.8600	0.690	0.5300
3200	8	8	8	8.000	8.000	8.0000	6.930	4.950	3.910	3.1000	2.6000	2.0800	1.5600	1.3900	1.230	1.0600
3600	8	8	8	8.000	8.000	8.000	8.000	6.550	5.000	3.9000	3.2800	2.6800	2.2650	1.8500	1.680	1.5100
4000	8	8	8	8.000	8.000	8.000	8.000	7.430	5.680	4.4800	3.7900	3.1100	2.5000	2.3300	2.170	2.0000
4800	8	8	8	8.000	8.000	8.000	8.000	8.000	6.350	4.9200	4.0000	3.4300	3.0300	2.3200	2.160	2.0000
5200	8	8	8	8.000	8.000	8.000	8.000	8.000	5.770	4.5400	3.7600	3.2300	2.8900	2.2900	2.140	1.9900
5600	8	8	8	8.000	8.000	8.000	8.000	8.000	5.320	4.2100	3.4800	3.0200	2.6100	2.2600	1.870	1.7900
6000	8	8	8	8.000	8.000	8.000	8.000	8.000	5.270	4.1800	3.4400	2.9400	2.5300	2.1400	1.680	1.4700
6400	8	8	8	8.000	8.000	8.0000	8.000	5.790	4.590	3.7600	3.1500	2.6700	2.2700	1.9400	1.460	1.3800

These two maps are used to set a base wastegate position for EGR On and EGR Off, which set a base position in mm extension for the WG for corrections. The X axis is target boost in Bar (absolute) and the Y axis is engine speed. 8mm = fully open, 0mm = fully closed. Negative values cannot be achieved but keep the profile of the map for OEM calculations.

Wastegate Correction – Atmospheric Correction

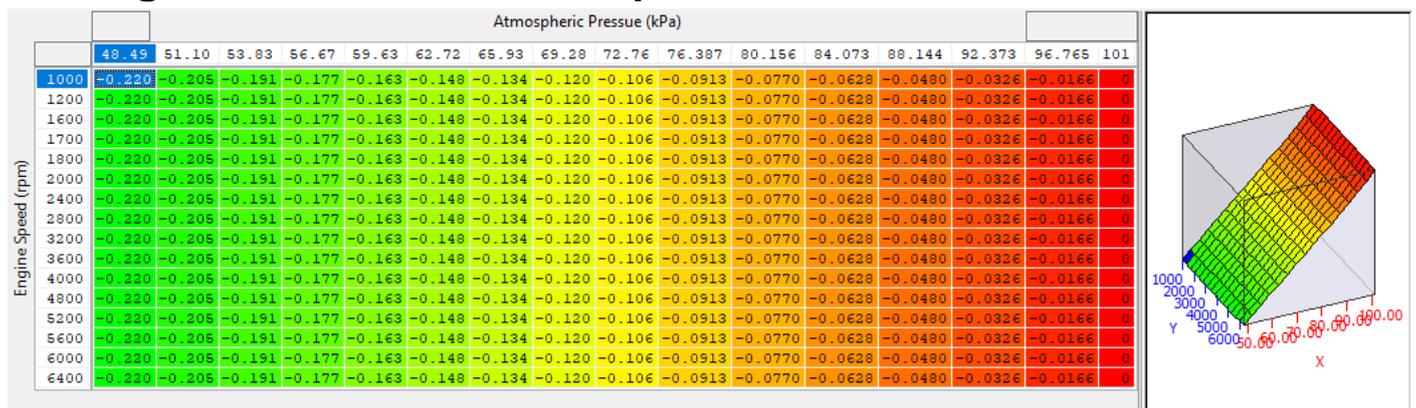| Engine Speed (rpm)	48.49	51.10	53.83	56.67	59.63	62.72	65.93	69.28	72.76	76.387	80.156	84.073	88.144	92.373	96.765	101
1000	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
1200	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
1600	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
1700	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
1800	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
2000	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
2400	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
2800	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
3200	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
3600	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
4000	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
4800	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
5200	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
5600	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
6000	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0
6400	-0.220	-0.205	-0.191	-0.177	-0.163	-0.148	-0.134	-0.120	-0.106	-0.0913	-0.0770	-0.0628	-0.0480	-0.0326	-0.0166	0

This map defines the amount of WG correction applied in millimeters to the base duty maps depending on the measured barometric pressure (in kPa).

Wastegate Correction - Air Temp

Engine Speed (rpm)	-50	-35	-20	-10.0	0.000	10.00	20.00	25	30.00	40.00	50.00	60.00	70.0	80.0	90.0	100
1000	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
1200	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
1600	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
1700	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
1800	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
2000	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
2400	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
2800	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
3200	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
3600	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
4000	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
4800	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
5200	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
5600	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
6000	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8
6400	1.79	1.43	1.07	0.833	0.595	0.357	0.119	0	-0.119	-0.357	-0.595	-0.833	-1.1	-1.3	-1.5	-1.8

This map defines the amount of WG correction applied in millimeters to the base position maps depending on intake air temperature. The map output is then multiplied by the Boost Correction – Air Temp Multiplier.

Boost Correction - Air Temp Multiplier

This map multiplies the amount of WG correction – Air Temp map output. The resulting output is then added to the base position map. It can be used to calibrate the Wastegate - Air Temp correction map for a given RPM and Manifold Absolute Pressure.

Wastegate Correction – Manifold Absolute Pressure
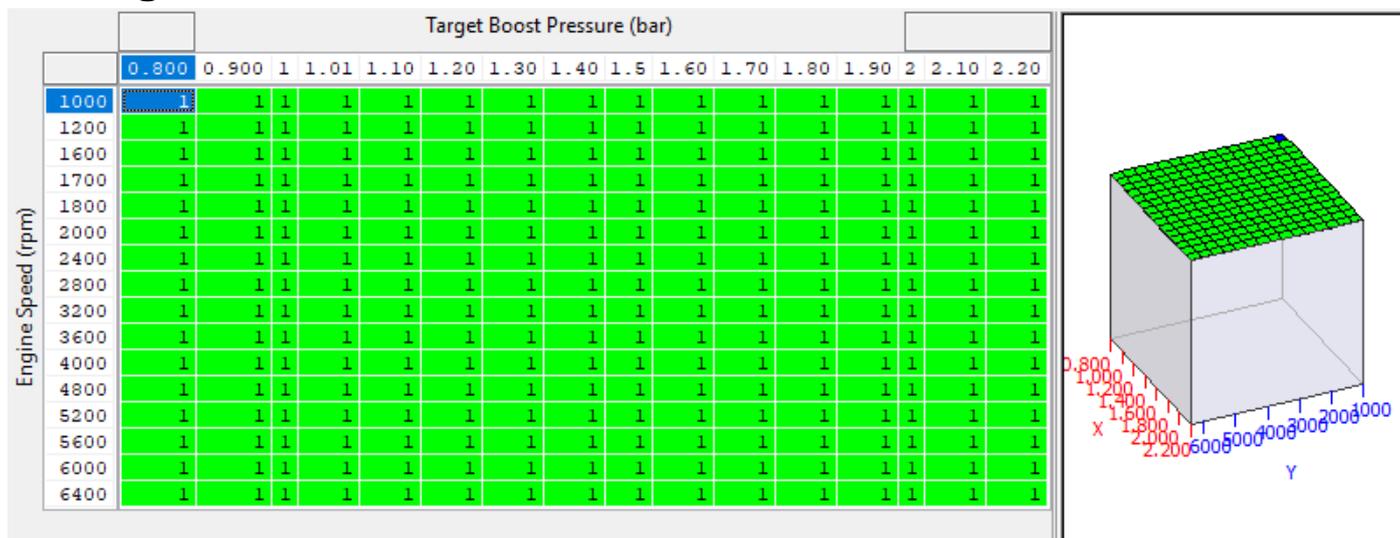
This map multiplies the output of all correction maps before the information is fed into the closed loop corrections.

Turbo Speed Minimum for Closed Loop & Trustful

Engine Speed (rpm)	Value
800	10000
1000	10000
1200	15000
1600	15000
2000	20000
2400	25000
2800	25000
3200	25000
3600	25000
4000	30000
4400	35000
4800	35000
5200	40000
5600	45000
6000	45000
6400	45000

A threshold of turbo speed to enable closed loop control of the wastegate position. Proportional, Integral and Derivative feedback are activated when the turbo speed value is exceeded and remains active until the turbo speed drops by an unknown hysteresis value. This table can be used to stop integral windup when at full throttle and waiting for the boost to rise.

Waste Correction - Proportional

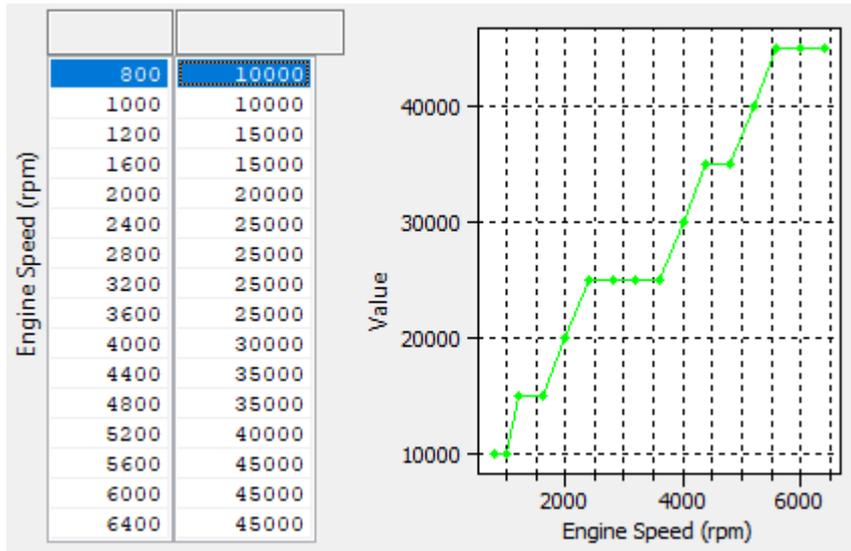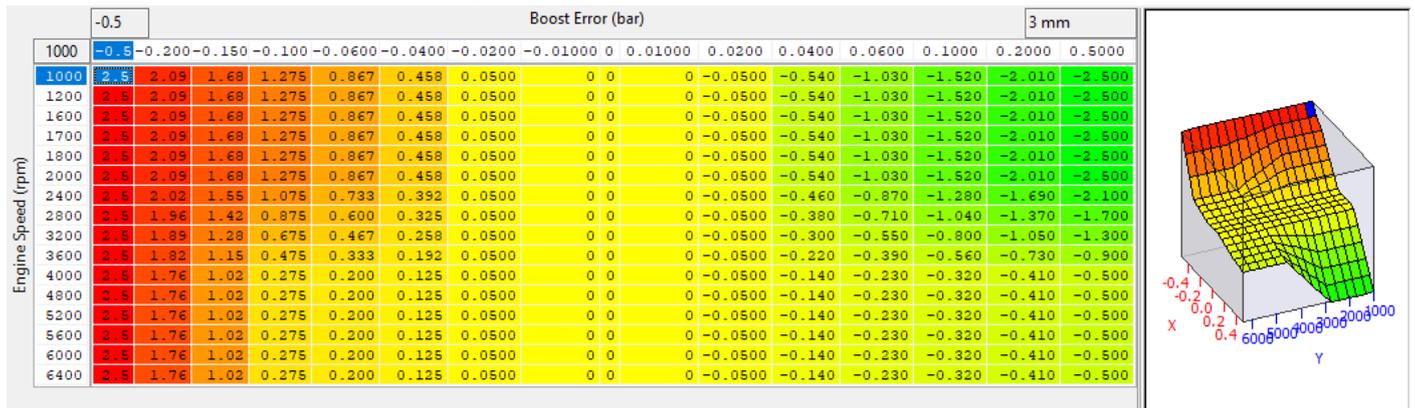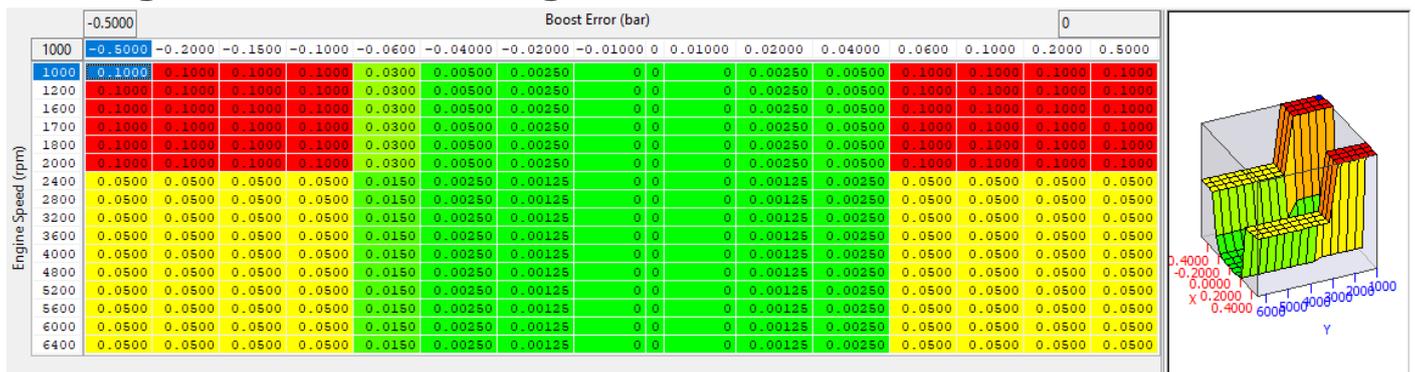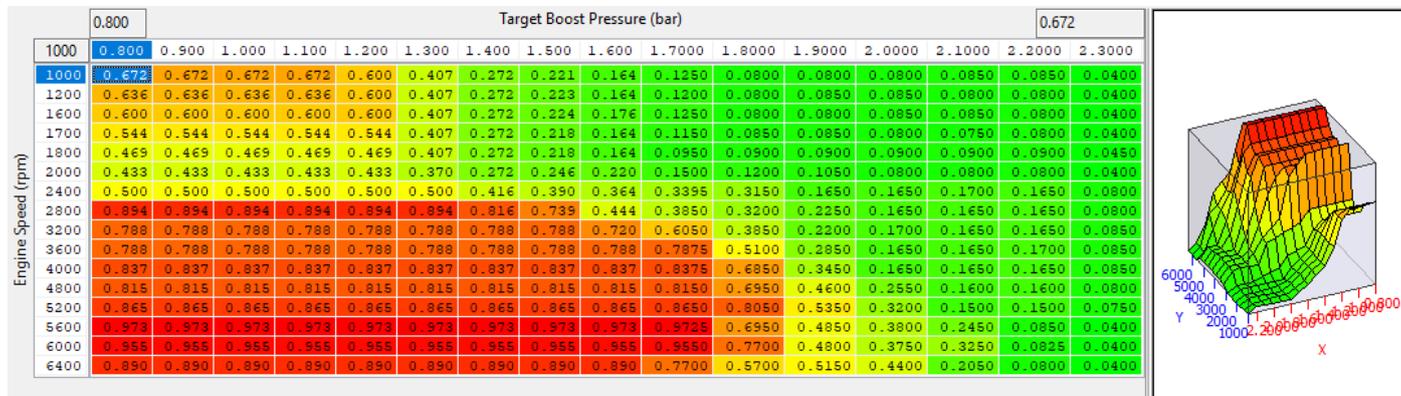| Engine Speed (rpm) \ Boost Error (bar)	-0.5	-0.200	-0.150	-0.100	-0.0600	-0.0400	-0.0200	-0.01000	0	0.01000	0.0200	0.0400	0.0600	0.1000	0.2000	0.5000
1000	2.5	2.09	1.68	1.275	0.867	0.458	0.0500	0	0	0	-0.0500	-0.540	-1.030	-1.520	-2.010	-2.500
1200	2.5	2.09	1.68	1.275	0.867	0.458	0.0500	0	0	0	-0.0500	-0.540	-1.030	-1.520	-2.010	-2.500
1600	2.5	2.09	1.68	1.275	0.867	0.458	0.0500	0	0	0	-0.0500	-0.540	-1.030	-1.520	-2.010	-2.500
1700	2.5	2.09	1.68	1.275	0.867	0.458	0.0500	0	0	0	-0.0500	-0.540	-1.030	-1.520	-2.010	-2.500
1800	2.5	2.09	1.68	1.275	0.867	0.458	0.0500	0	0	0	-0.0500	-0.540	-1.030	-1.520	-2.010	-2.500
2000	2.5	2.09	1.68	1.275	0.867	0.458	0.0500	0	0	0	-0.0500	-0.540	-1.030	-1.520	-2.010	-2.500
2400	2.5	2.02	1.55	1.075	0.733	0.392	0.0500	0	0	0	-0.0500	-0.460	-0.870	-1.280	-1.690	-2.100
2800	2.5	1.96	1.42	0.875	0.600	0.325	0.0500	0	0	0	-0.0500	-0.380	-0.710	-1.040	-1.370	-1.700
3200	2.5	1.89	1.28	0.675	0.467	0.258	0.0500	0	0	0	-0.0500	-0.300	-0.550	-0.800	-1.050	-1.300
3600	2.5	1.82	1.15	0.475	0.333	0.192	0.0500	0	0	0	-0.0500	-0.220	-0.390	-0.560	-0.730	-0.900
4000	2.5	1.76	1.02	0.275	0.200	0.125	0.0500	0	0	0	-0.0500	-0.140	-0.230	-0.320	-0.410	-0.500
4800	2.5	1.76	1.02	0.275	0.200	0.125	0.0500	0	0	0	-0.0500	-0.140	-0.230	-0.320	-0.410	-0.500
5200	2.5	1.76	1.02	0.275	0.200	0.125	0.0500	0	0	0	-0.0500	-0.140	-0.230	-0.320	-0.410	-0.500
5600	2.5	1.76	1.02	0.275	0.200	0.125	0.0500	0	0	0	-0.0500	-0.140	-0.230	-0.320	-0.410	-0.500
6000	2.5	1.76	1.02	0.275	0.200	0.125	0.0500	0	0	0	-0.0500	-0.140	-0.230	-0.320	-0.410	-0.500
6400	2.5	1.76	1.02	0.275	0.200	0.125	0.0500	0	0	0	-0.0500	-0.140	-0.230	-0.320	-0.410	-0.500

Proportional correction is absolute wastegate duty added or subtracted at an instant in time based on the current boost error. The default maps have high positive values when the boost is under target at low RPM while in spool up. Using high proportional values is preferable to high integral values to prevent windup but still results in low wastegate position on spool.

Wastegate Correction Integral #1 & #2

Engine Speed (rpm) \ Boost Error (bar)	-0.5000	-0.2000	-0.1500	-0.1000	-0.0600	-0.04000	-0.02000	-0.01000	0	0.01000	0.02000	0.04000	0.0600	0.1000	0.2000	0.5000
1000	0.1000	0.1000	0.1000	0.1000	0.0300	0.00500	0.00250	0	0	0	0.00250	0.00500	0.1000	0.1000	0.1000	0.1000
1200	0.1000	0.1000	0.1000	0.1000	0.0300	0.00500	0.00250	0	0	0	0.00250	0.00500	0.1000	0.1000	0.1000	0.1000
1600	0.1000	0.1000	0.1000	0.1000	0.0300	0.00500	0.00250	0	0	0	0.00250	0.00500	0.1000	0.1000	0.1000	0.1000
1700	0.1000	0.1000	0.1000	0.1000	0.0300	0.00500	0.00250	0	0	0	0.00250	0.00500	0.1000	0.1000	0.1000	0.1000
1800	0.1000	0.1000	0.1000	0.1000	0.0300	0.00500	0.00250	0	0	0	0.00250	0.00500	0.1000	0.1000	0.1000	0.1000
2000	0.1000	0.1000	0.1000	0.1000	0.0300	0.00500	0.00250	0	0	0	0.00250	0.00500	0.1000	0.1000	0.1000	0.1000
2400	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
2800	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
3200	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
3600	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
4000	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
4800	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
5200	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
5600	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
6000	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500
6400	0.0500	0.0500	0.0500	0.0500	0.0150	0.00250	0.00125	0	0	0	0.00125	0.00250	0.0500	0.0500	0.0500	0.0500

Wastegate Integral correction builds up over time. While active (see above conditions) this map dictates how much the integral value is increased with each cycle of the boost control loop. Each loop takes just 10ms (one 1/100 of a second) and the current integral correction is multiplied by the integral multiplier before being applied, it can be observed by checking the *WG Corr - Integral* live data parameter which is logged by default.

Boost Correction Integral Multiplier

| 0.800						Target Boost Pressure (bar)								0.672	
1000	0.800	0.900	1.000	1.100	1.200	1.300	1.400	1.500	1.600	1.700	1.800	1.900	2.0000	2.1000	2.2000	2.3000
1000	0.672	0.672	0.672	0.672	0.600	0.407	0.272	0.221	0.164	0.1250	0.0800	0.0800	0.0800	0.0850	0.0850	0.0400
1200	0.636	0.636	0.636	0.636	0.600	0.407	0.272	0.223	0.164	0.1200	0.0800	0.0850	0.0850	0.0800	0.0800	0.0400
1600	0.600	0.600	0.600	0.600	0.600	0.407	0.272	0.224	0.176	0.1250	0.0800	0.0800	0.0850	0.0850	0.0800	0.0400
1700	0.544	0.544	0.544	0.544	0.544	0.407	0.272	0.218	0.164	0.1150	0.0850	0.0850	0.0800	0.0750	0.0800	0.0400
1800	0.469	0.469	0.469	0.469	0.469	0.407	0.272	0.218	0.164	0.0950	0.0900	0.0900	0.0900	0.0900	0.0900	0.0450
2000	0.433	0.433	0.433	0.433	0.433	0.370	0.272	0.246	0.220	0.1500	0.1200	0.1050	0.0800	0.0800	0.0800	0.0400
2400	0.500	0.500	0.500	0.500	0.500	0.500	0.416	0.390	0.364	0.3395	0.3150	0.1650	0.1650	0.1700	0.1650	0.0800
2800	0.894	0.894	0.894	0.894	0.894	0.894	0.816	0.739	0.444	0.3850	0.3200	0.2250	0.1650	0.1650	0.1650	0.0800
3200	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.720	0.6050	0.3850	0.2200	0.1700	0.1650	0.1650	0.0850
3600	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.788	0.7875	0.5100	0.2850	0.1650	0.1650	0.1700	0.0850
4000	0.837	0.837	0.837	0.837	0.837	0.837	0.837	0.837	0.837	0.8375	0.6850	0.3450	0.1650	0.1650	0.1650	0.0850
4800	0.815	0.815	0.815	0.815	0.815	0.815	0.815	0.815	0.815	0.8150	0.6950	0.4600	0.2550	0.1600	0.1600	0.0800
5200	0.865	0.865	0.865	0.865	0.865	0.865	0.865	0.865	0.865	0.8650	0.8050	0.5350	0.3200	0.1500	0.1500	0.0750
5600	0.973	0.973	0.973	0.973	0.973	0.973	0.973	0.973	0.973	0.9725	0.6950	0.4850	0.3800	0.2450	0.0850	0.0400
6000	0.955	0.955	0.955	0.955	0.955	0.955	0.955	0.955	0.955	0.9550	0.7700	0.4800	0.3750	0.3250	0.0825	0.0400
6400	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.7700	0.5700	0.5150	0.4400	0.2050	0.0800	0.0400

Multiplies the current integral correction, the result is shown as the logging parameter called *WG Corr – Integral.* The intent of this map is to reduce or increase the effectiveness of the total integral correction based on engine speed and Manifold Absolute Pressure allowing fine control in different running conditions

Waste Correction – Transient (Derivative)

-0.5						Value								0.00000	
1000	-0.200	-0.150	-0.100	-0.0600	-0.0400	-0.0200	-0.01000	0.00000	0.01000	0.02000	0.04000	0.06000	0.10000	0.200	0.5
1000	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
1200	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
1600	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
1700	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
1800	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
2000	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
2400	0	0	0	0	0	0	0	0.02000	0.01900	0.01800	0.01600	0.01400	0.01000	0	0
2800	0	0	0	0	0	0	0	0.02000	0.01900	0.01800	0.01600	0.01400	0.01000	0	0
3200	0	0	0	0	0	0	0	0.02000	0.01900	0.01800	0.01600	0.01400	0.01000	0	0
3600	0	0	0	0	0	0	0	0.02000	0.01900	0.01800	0.01600	0.01400	0.01000	0	0
4000	0	0	0	0	0	0	0	0.02000	0.01900	0.01800	0.01600	0.01400	0.01000	0	0
4800	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
5200	0	0	0	0	0	0	0	0.01000	0.01000	0.00900	0.00800	0.00700	0.00500	0	0
5600	0	0	0	0	0	0	0	0.01000	0.01000	0.00900	0.00800	0.00700	0.00500	0	0
6000	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0
6400	0	0	0	0	0	0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0	0

Transient/Derivative correction is absolute wastegate duty added or subtracted at an instant in time based on the current rate of change in boost. The default maps only have positive values when the boost is increasing at a fast rate (peak spool RPM). Using high derivative values should only really be needed to prevent the inertia of large turbos overshooting the boost target value but still need a closed WG position to spool.
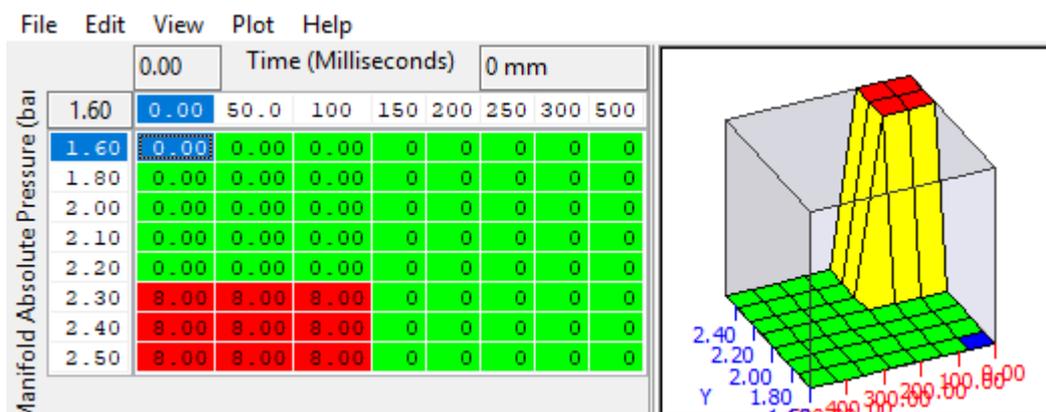
Gearchange Boost Spikes
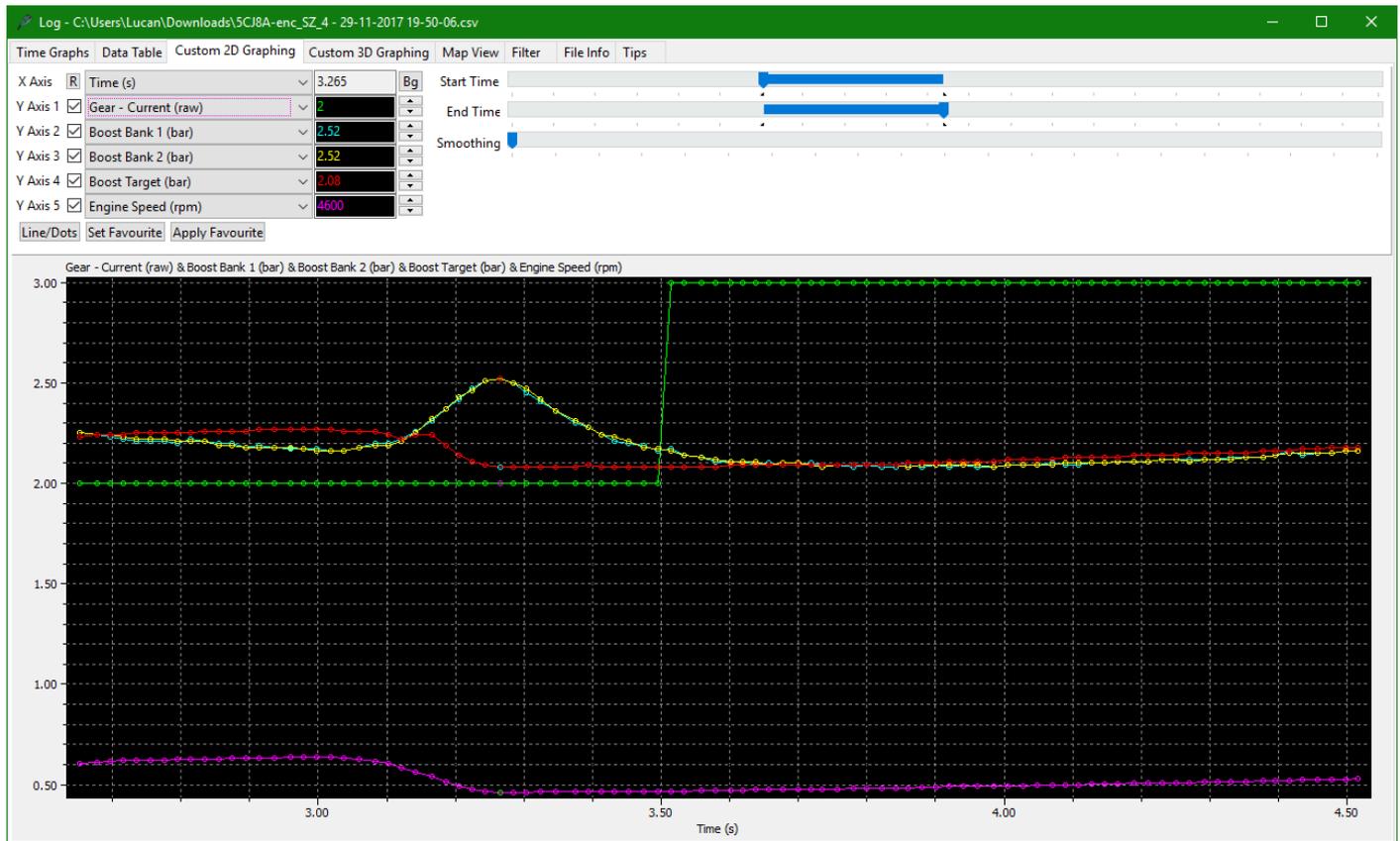
The Turbo chargers on the VR30DDTT engines are designed for optimal drivability but even with turbo speed sensors and electronic wastegates there is still a lag time between the WG opening fully and the boost dropping. This is compounded when the airflow requirements are reduced on gearshift or overrun. There is no mechanical blow off valves (BOV's) on these engines so when the boost is increased and the airflow requirements of the engine reduce (on gearshift) boost spikes can occur.

To aid in combating this spike we have added custom code (*Gearchange – Wastegate Offset*) to drive the waste gate to a set position for a set time during the shift to reduce turbine airflow and hence boost, The *Gearchange - Ignition Minimum Allowed* map can also be used to limit the amount of ignition retard to reduce the amount of exhaust enthalpy limiting the ability of the turbo to make boost pressure.

Gearchange – Wastegate Offset

A temporary change in the Wastegate duty triggered with an upshift to prevent boost spikes on gearshift caused by a sudden change in the air consumption of the engine as the RPM drops. The X axis is time since the start of an upshift, and the Y axis is the relative boost in Bar at the time the shift was triggered.

Gearchange – Ignition Minimum Allowed

	0.00	Time (Milliseconds)						-22 °	
1.60	0.00	50.0	100	150	200	250	300	500	
1.60	-22	-22	-22	-22	-22	-22	-22	-22	
1.80	-22	-22	-22	-22	-22	-22	-22	-22	
2.00	-22	-22	-22	-22	-22	-22	-22	-22	
2.10	-22	-22	-22	-22	-22	-22	-22	-22	
2.20	-22	-22	-22	-22	-22	-22	-22	-22	
2.30	-22	-22	-22	-22	-22	-22	-22	-22	
2.40	-22	-22	-22	-22	-22	-22	-22	-22	
2.50	-22	-22	-22	-22	-22	-22	-22	-22	

Manifold Absolute Pressure (bar)

A temporary lower limit on the final ignition timing value triggered by an upshift to prevent boost spikes on gearshift caused by a sudden change in the air consumption of the engine as the RPM drops. The X axis is time since the start of an upshift, and the Y axis is the relative boost in Bar at the time the shift was triggered.

Keep in mind that this will effect the amount of torque reduction achieved so may mean that gear shift quality is affected.

Wastegate Correction Turbo Speed Threshold

0	350000 rpm
0	350000
4998	350000
5000	222000
5200	222000
5600	222000
6000	222000
6400	222000
6800	222000

Engine Speed (rpm) / *Turbo Speed (rpm)*
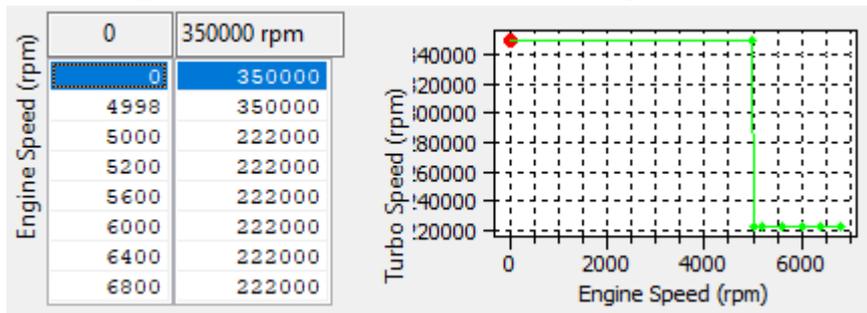
This map is the turbo speed limit, when the measured (or estimated for silver sport cars) turbo speed goes above this threshold the *Wastegate Correction Turbo Speed Limit #1 - #3* maps are applied to maintain the turbo speed for turbo reliability. This map can be increased to allow the turbo to spin faster and increase the airflow/pressure.

Wastegate Correction Turbo Speed limiter #1 - #3

	-500	0.000	500	1000	2000	2500	Turbo Speed (rpm) 3000	3500	4000	4500	5000	5500	6000	6500	7000	0.00 mm 7500
1000	-500	0.000	500	1000	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500
1000	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
1200	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
1600	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
1700	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
1800	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
2000	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
2400	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
2800	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
3200	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
3600	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
4000	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
4800	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
5200	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
5600	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
6000	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00
6400	0	0.533	1.07	1.60	2.13	2.67	3.20	3.73	4.27	4.80	5.33	5.87	6.40	6.93	7.47	8.00

When the **_Wastegate Correction Turbo Speed Threshold_** is exceeded the above offset to absolute WG position is applied reducing the achieved boost. This maintains a specific turbo speed preventing damage to the turbo due to over-speeding. The X axis is turbo speed above the threshold, the Y-Axis is engine speed.

Diagnostic Trouble Codes

Introduction

All OBD vehicles use forms of self diagnosis and driver alerting, in the VR30DDTT equipped vehicles there are two separate DTC lists, one for the ECM limp modes and one for the Check Engine Light (CEL)

Map List

Diagnostic Trouble Codes
- CEL DTCs
- DTCs
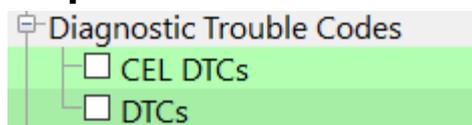
Live Data Parameters

- *Dig: Safe Mode – shows on or off depending on DTC's that cause a limp mode.*

DTC's will need to be scanned using ProECU or ECU Connect to know which DTC's are causing a limp mode. If DTC's occur do not assume that they should just be disabled, it is likely that an actual issue with the car has come up and needs to be fixed as opposed to ignored.

Operation

To Disable a DTC simply uncheck the DTC code, in the VR30DDTT there are separate maps for the CEL DTC and the non CEL DTC's so if you can disable the CEL DTC and still have a limp mode if required.

CEL DTCs & DTCs

File   Edit   Help

```
☐ B1900 -
☐ B1901 -
☐ B1902 -
☐ B1903 -
☐ B1904 -
☐ B1910 -
☐ B1911 -
☐ B1912 -
☐ B1913 -
☐ B1914 -
☑ P0010 - "A" Camshaft Position Actuator Circuit/Open Bank 1
☑ P0010 - "A" Camshaft Position Actuator Circuit/Open Bank 1
☑ P0011 - "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
☑ P0011 - "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
☑ P0014 - "B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
☑ P0020 - "A" Camshaft Position Actuator Circuit/Open Bank 2
☑ P0020 - "A" Camshaft Position Actuator Circuit/Open Bank 2
☑ P0021 - "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 2
☑ P0021 - "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 2
☑ P0024 - "B" Camshaft Position - Timing Over-Advanced or System Performance Bank 2
☑ P0030 - HO2S Heater Control Circuit Bank 1 Sensor 1
☑ P0031 - HO2S Heater Control Circuit Low Bank 1 Sensor 1
☑ P0032 - HO2S Heater Control Circuit High Bank 1 Sensor 1
☑ P0037 - HO2S Heater Control Circuit Low Bank 1 Sensor 2
☑ P0037 - HO2S Heater Control Circuit Low Bank 1 Sensor 2
☑ P0038 - HO2S Heater Control Circuit High Bank 1 Sensor 2
☑ P0046 - Turbocharger/Supercharger Boost Control "A" Circuit Range/Performance
☑ P0046 - Turbocharger/Supercharger Boost Control "A" Circuit Range/Performance
☑ P004B - Turbocharger/Supercharger Boost Control "B" Circuit Range/Performance
☑ P004B - Turbocharger/Supercharger Boost Control "B" Circuit Range/Performance
☑ P0050 - HO2S Heater Control Circuit Bank 2 Sensor 1
☑ P0051 - HO2S Heater Control Circuit Low Bank 2 Sensor 1
☑ P0052 - HO2S Heater Control Circuit High Bank 2 Sensor 1
☑ P0053 - HO2S Heater Resistance Bank 1 Sensor 1
☑ P0057 - HO2S Heater Control Circuit Low Bank 2 Sensor 2
☑ P0057 - HO2S Heater Control Circuit Low Bank 2 Sensor 2
☑ P0058 - HO2S Heater Control Circuit High Bank 2 Sensor 2
☑ P0059 - HO2S Heater Resistance Bank 2 Sensor 1
☑ P0075 - Intake Valve Control Solenoid Circuit Bank 1
☑ P0078 - Exhaust Valve Control Solenoid Circuit Bank 1
```

To turn off a DTC simply uncheck the DTC code you want to disable.
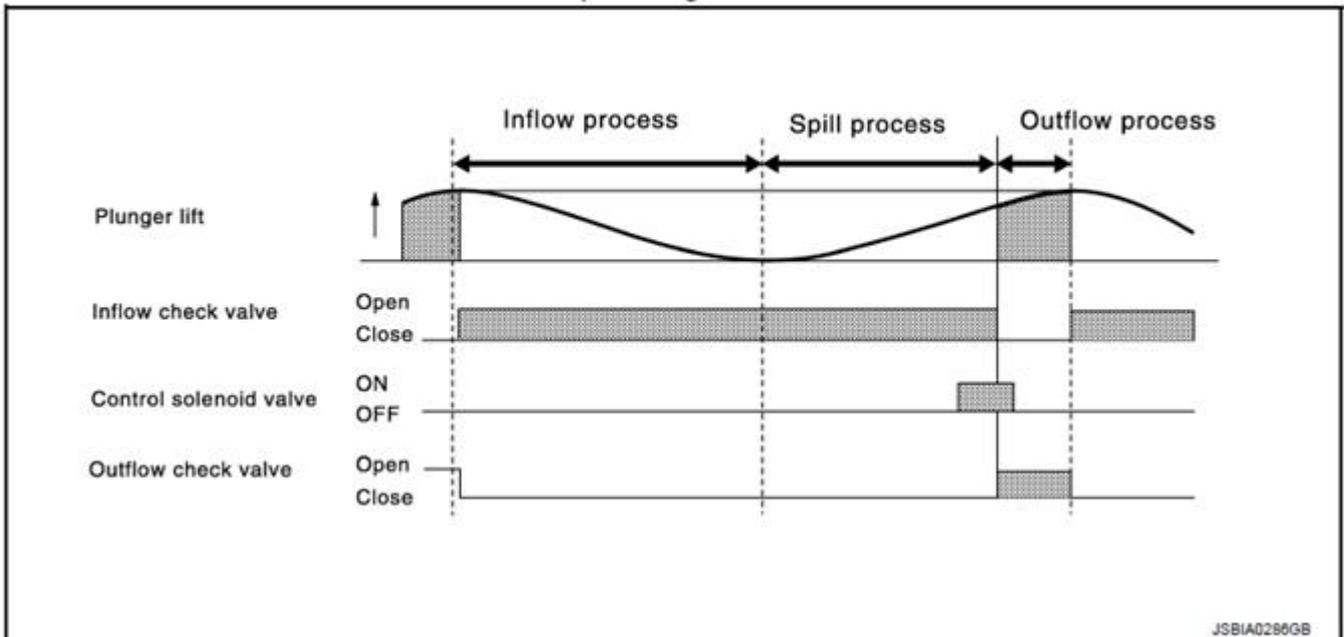
Fuel Pressure

Introduction

The fuel pump in a VR30DDTT is slightly different to other manufacturers but seems to be common across the Nissan DI engines. Nissan specify a trigger point at which to start the outflow process to deliver the correct amount of fuel volume to maintain the correct pressure. The pump works as below but the VR30DDTT has a 3 lobe fuel pump cam, this means that we have 240 degrees of crank rotation per pump cycle and 120 degrees for an output stroke.
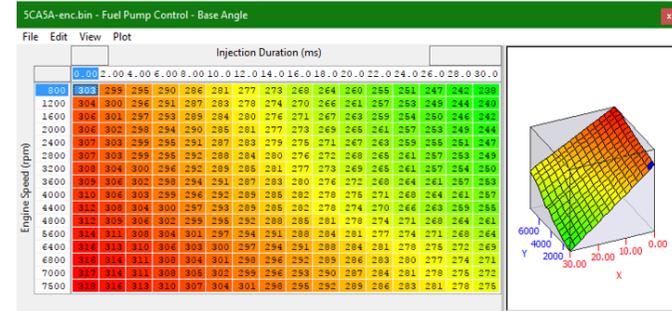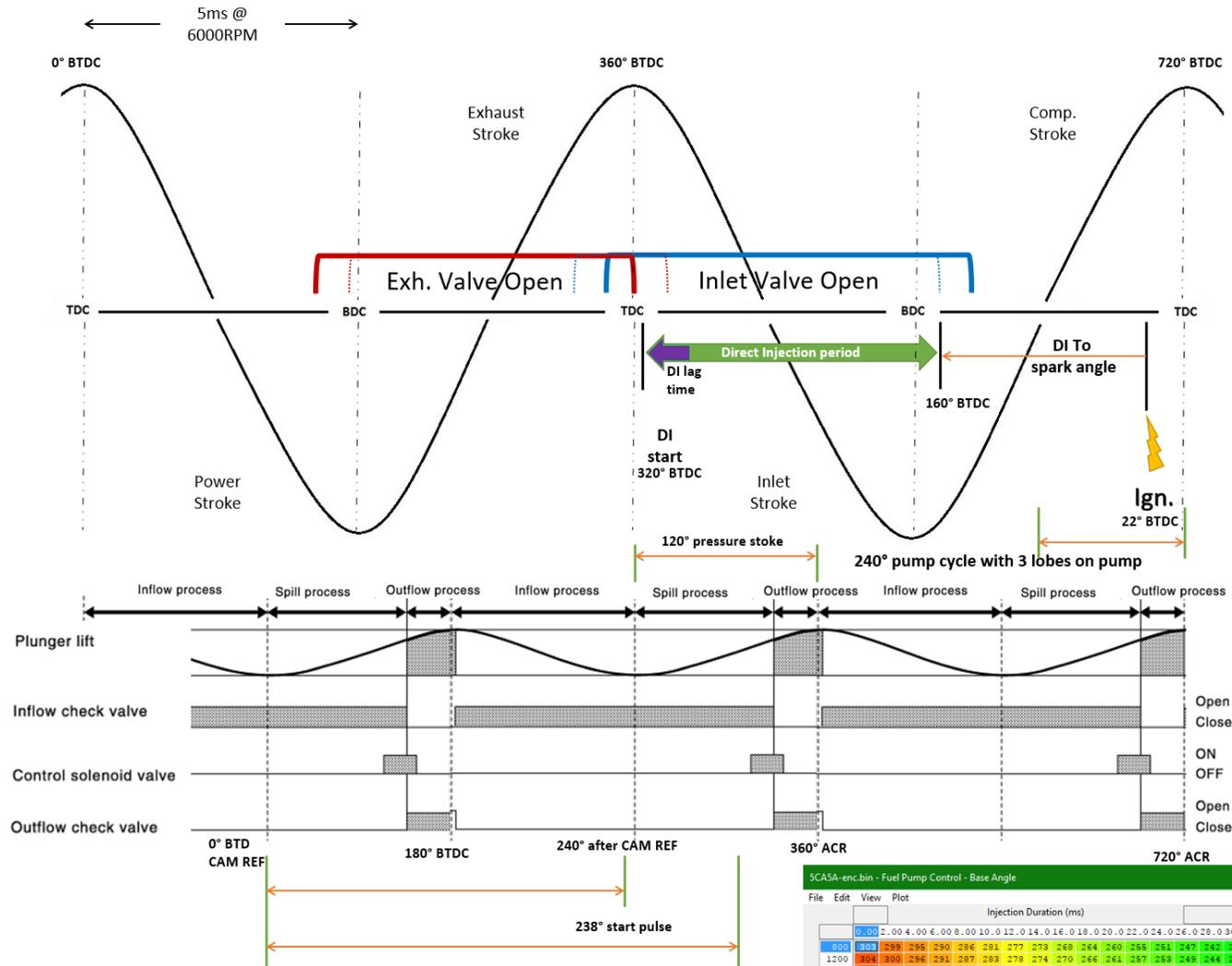
Operating Description

JSBIA0285GB

Operating Chart

JSBIA0286GB
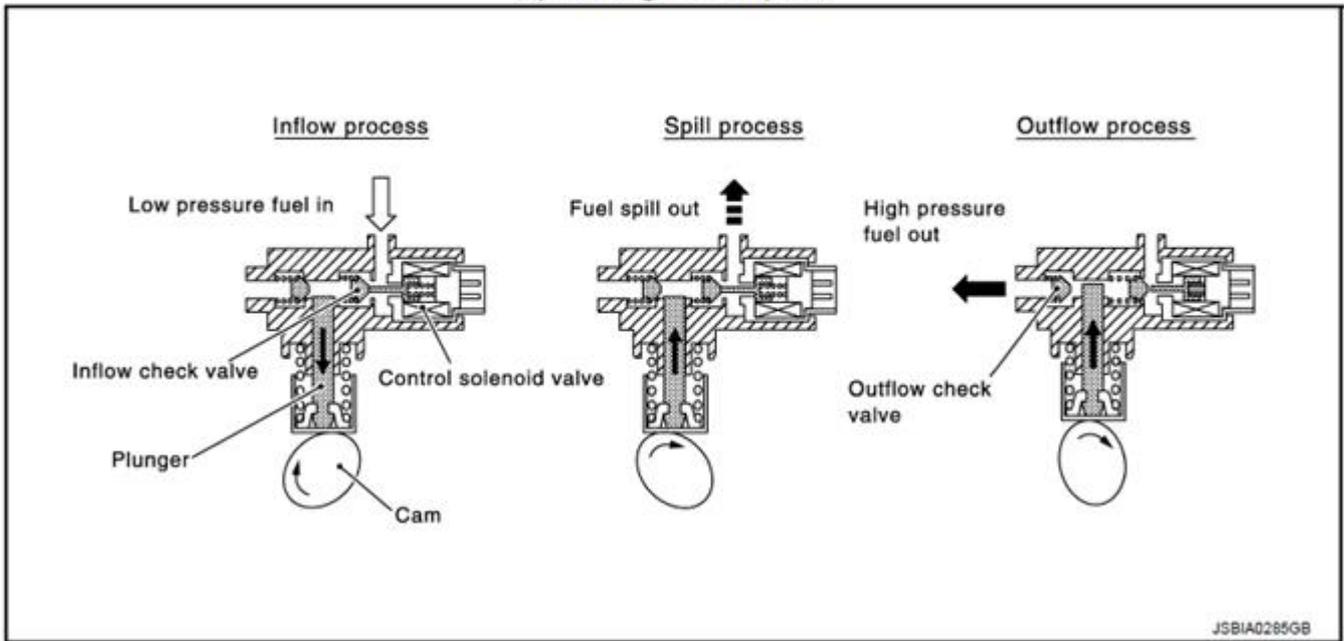
The corrections for closed loop fuel pressure control are all modifiers to the outflow trigger angle. Below is a diagram illustrating how we believe that the pump control strategy and target maps work. The **Fuel pump control - Base angle** map is the ECU's initial point to trigger the outflow process. There are dead times, current targets and limits used as well, but these would only need to be changed if the pump solenoid is different, similar to what you would do if you were to change the injectors in other platforms.

5ms @ 6000RPM

0° BTDC

360° BTDC

720° BTDC

Exhaust Stroke

Comp. Stroke

TDC   BDC   TDC   BDC   TDC

Exh. Valve Open   Inlet Valve Open

Direct Injection period

DI lag time

DI To spark angle

160° BTDC

DI start 320° BTDC

Inlet Stroke

Power Stroke

Ign.

22° BTDC

120° pressure stoke

240° pump cycle with 3 lobes on pump

Inflow process | Spill process | Outflow process | Inflow process | Spill process | Outflow process | Inflow process | Spill process | Outflow process

Plunger lift

Inflow check valve — Open / Close

Control solenoid valve — ON / OFF

Outflow check valve — Open / Close

0° BTD CAM REF

180° BTDC

240° after CAM REF

360° ACR

720° ACR

238° start pulse

5CA5A-enc.bin - Fuel Pump Control - Base Angle

File Edit View Plot

Injection Duration (ms)

Engine Speed (rpm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0
800	303	299	295	290	286	281	277	273	268	264	260	255	251	247	242	238
1200	304	300	296	291	287	283	278	274	270	266	261	257	253	249	244	240
1600	306	301	297	293	289	284	280	276	271	267	263	259	254	250	246	242
2000	306	302	298	294	290	285	281	277	273	269	265	261	257	253	249	244
2400	307	303	299	295	291	287	283	279	275	271	267	263	259	255	251	247
2800	308	303	299	295	292	288	284	280	276	272	268	265	261	257	253	249
3200	308	304	300	296	292	289	285	281	277	273	269	265	261	257	254	250
3600	309	306	302	298	294	291	287	283	280	276	272	268	264	261	257	253
4000	310	306	303	299	296	292	289	285	282	278	275	271	268	264	261	257
4400	312	308	304	300	297	293	289	285	282	278	274	270	266	263	259	255
4800	312	309	306	302	299	295	292	288	285	281	278	274	271	268	264	261
5600	314	311	308	304	301	297	294	291	288	284	281	277	274	271	268	264
6400	316	313	310	306	303	300	297	294	291	288	284	281	278	275	272	269
6800	316	314	311	308	304	301	298	296	293	289	286	283	280	277	274	271
7000	317	314	311	308	305	302	299	296	293	290	287	284	281	278	275	272
7500	319	316	313	310	307	304	301	298	295	292	289	286	283	281	278	275

6000
4000
2000
Y
30.00 20.00 10.00 0.00
X

The base angle maps give the start angle for the outflow process. The start angle (*Fuel Pump Angle Target – Base*) then has closed loop feedback corrections applied to it before the final value (*Fuel Pump Angle Target*) is used to trigger the solenoid. There are two closed loop feedback methods used and the directly work in degrees crank angle. There are

- Proportional feedback (*Fuel Pump Angle Target – Prop*)
- Integral feedback (*Fuel Pump Angle Target – Int*)

It applies the correction coefficients to the calculated fuel pressure error like below.

Feedback Correction Angle = Map Output x (Fuel Pressure - Fuel Pressure Target)

The correction angle values are directly applied to the base output value. If you find your actual fuel pressure does not match the target fuel pressure the first step is to adjust the base map, for example.

- Increase the angle to decrease stroke and delivered pressure
- Decrease the angle to increase stroke and delivered pressure

If you find that the *Fuel Pressure does* not meet the *Fuel Pressure Target* you can modify the proportional and integral factor maps at the required RPM to smooth out the delivered pressure.

The fuel pump solenoid is controlled in a peak and hold method. If you are calibrating a replacement fuel pump solenoid it's likely you will need to adjust **Fuel Pump Regulator Pulse Time** and **Fuel Pump Regulator Response Time.**
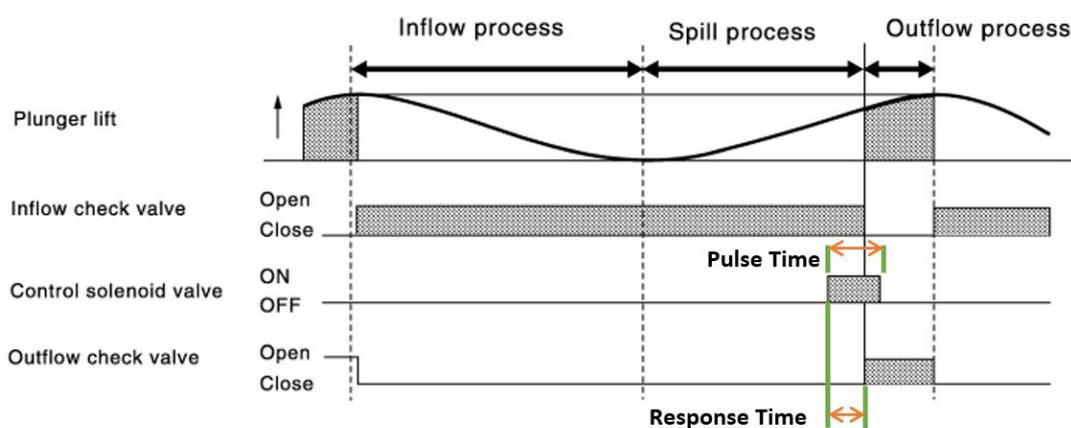
If only the mechanical pump unit has been changed, the **Fuel Pump Control - Base angle** and associated PID maps will require recalibration and the solenoid maps can be left alone. If changing the fuel pump solenoid you may need to alter the actual drive pulse characteristics to suit the physical changes to the solenoid, the drive current and voltage look a little like below, when changing the pulse characteristics use the below diagram as a reference.
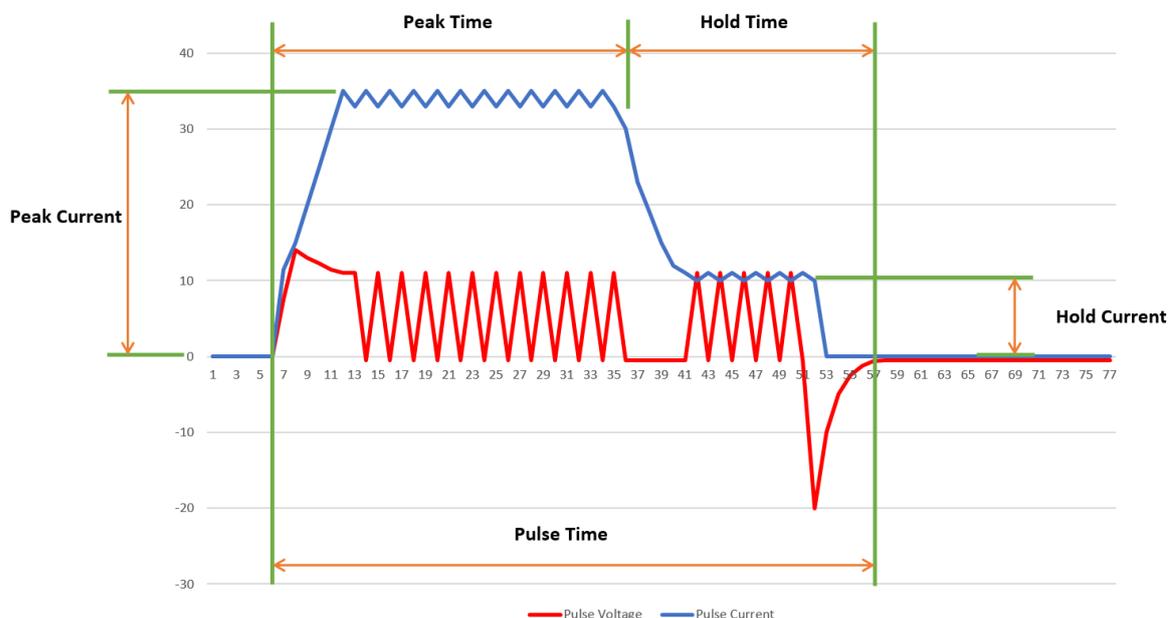
The time period for each total pulse is set by the **fuel Pump Regulator - Pulse Time**. The hold component is set by the **Fuel Pump - Hold Time Initial Value** and the peak section is the difference between the total and hold section of the drive current profile. Peak and hold current can also be switched to different levels depending on engine speed if required.
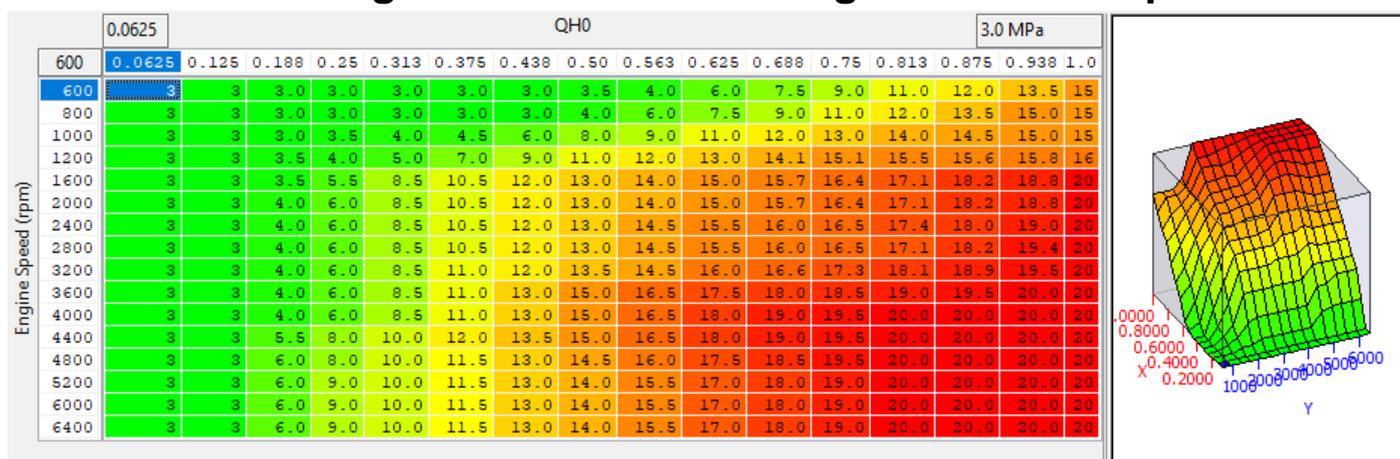
Map List

Fuel Pressure
- ☐ Fuel Pressure target
- ☐ Fuel Pressure target at low temp
- ☐ Fuel Pump - Battery Voltage for Switching Time
- ☐ Fuel Pump - Delay Time switching Peak Current
- ☐ Fuel Pump - Hold Current 1
- ☐ Fuel Pump - Hold Current 2
- ☐ Fuel Pump - Hold Time Initial Value
- ☐ Fuel Pump - Peak Current Initial Value
- ☐ Fuel Pump - RPM for switching hold current
- ☐ Fuel Pump - RPM for switching hold current hys
- ☐ Fuel Pump - RPM for Switching Peak Current
- ☐ Fuel Pump - RPM for Switching Peak Current hys
- ☐ Fuel Pump Control - Base Angle
- ☐ Fuel Pump Control - Feedback Deadband
- ☐ Fuel Pump Control - Integral Factor
- ☐ Fuel Pump Control - Proportional Factor
- ☐ Fuel Pump Regulator Pulse Time
- ☐ Fuel Pump Regulator Response Time
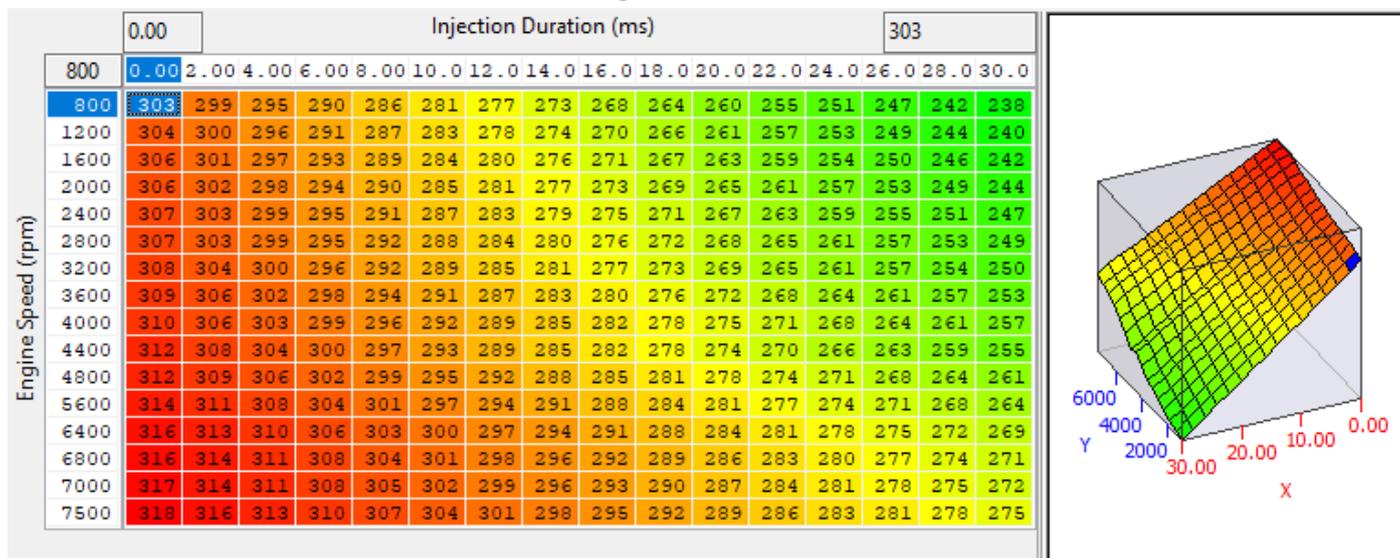
Live Data Parameters

- *Fuel Pressure Target (Mpa) - Fuel Rail Pressure target*
- *Fuel Pressure (Mpa) - Actual Fuel Pressure in High pressure fuel rail*
- *Fuel Pressure Sensor (mV) - Fuel Pressure sensor raw voltage*
- *Fuel Pump Angle Target (°)– Actual target angle for fuel pump solenoid trigger*
- *Fuel Pump Angle Target - Base (°) – Base map angle output value*
- *Fuel Pump Angle Target – Int (°) – Current integral correction angle output value*
- *Fuel Pump Angle Target – Prop (°) – Current Proportional angle correction value*

Fuel Pressure Target / Fuel Pressure Target at Low Temp

0.0625						QH0								3.0 MPa		
600	0.0625	0.125	0.188	0.25	0.313	0.375	0.438	0.50	0.563	0.625	0.688	0.75	0.813	0.875	0.938	1.0
600	3	3	3.0	3.0	3.0	3.0	3.0	3.5	4.0	6.0	7.5	9.0	11.0	12.0	13.5	15
800	3	3	3.0	3.0	3.0	3.0	3.0	4.0	6.0	7.5	9.0	11.0	12.0	13.5	15.0	15
1000	3	3	3.0	3.5	4.0	4.5	6.0	8.0	9.0	11.0	12.0	13.0	14.0	14.5	15.0	15
1200	3	3	3.5	4.0	5.0	7.0	9.0	11.0	12.0	13.0	14.1	15.1	15.5	15.6	15.8	16
1600	3	3	3.5	5.5	8.5	10.5	12.0	13.0	14.0	15.0	15.7	16.4	17.1	18.2	18.8	20
2000	3	3	4.0	6.0	8.5	10.5	12.0	13.0	14.0	15.0	15.7	16.4	17.1	18.2	18.8	20
2400	3	3	4.0	6.0	8.5	10.5	12.0	13.0	14.5	15.5	16.0	16.5	17.4	18.0	19.0	20
2800	3	3	4.0	6.0	8.5	10.5	12.0	13.0	14.5	15.5	16.0	16.5	17.1	18.2	19.4	20
3200	3	3	4.0	6.0	8.5	11.0	12.0	13.5	14.5	16.0	16.6	17.3	18.1	18.9	19.5	20
3600	3	3	4.0	6.0	8.5	11.0	13.0	15.0	16.5	17.5	18.0	18.5	19.0	19.5	20.0	20
4000	3	3	4.0	6.0	8.5	11.0	13.0	15.0	16.5	18.0	19.0	19.5	20.0	20.0	20.0	20
4400	3	3	5.5	8.0	10.0	12.0	13.5	15.0	16.5	18.0	19.0	19.5	20.0	20.0	20.0	20
4800	3	3	6.0	8.0	10.0	11.5	13.0	14.5	16.0	17.5	18.5	19.5	20.0	20.0	20.0	20
5200	3	3	6.0	9.0	10.0	11.5	13.0	14.0	15.5	17.0	18.0	19.0	20.0	20.0	20.0	20
6000	3	3	6.0	9.0	10.0	11.5	13.0	14.0	15.5	17.0	18.0	19.0	20.0	20.0	20.0	20
6400	3	3	6.0	9.0	10.0	11.5	13.0	14.0	15.5	17.0	18.0	19.0	20.0	20.0	20.0	20

There are two fuel pressure target maps, these are active dependant on high and low coolant temperatures. The output is in MPa and profiled for specific RPM and QH0. This value is used for the error calculation and fuel pressure correction function.
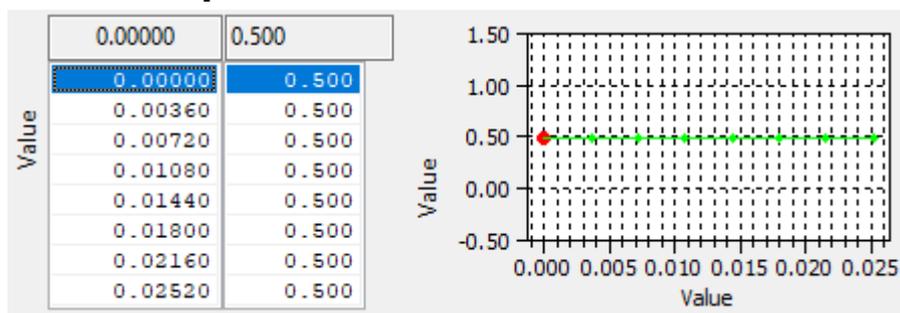
Fuel Pump Control – Base Angle

0.00			Injection Duration (ms)													303
800	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0
800	303	299	295	290	286	281	277	273	268	264	260	255	251	247	242	238
1200	304	300	296	291	287	283	278	274	270	266	261	257	253	249	244	240
1600	306	301	297	293	289	284	280	276	271	267	263	259	254	250	246	242
2000	306	302	298	294	290	285	281	277	273	269	265	261	257	253	249	244
2400	307	303	299	295	291	287	283	279	275	271	267	263	259	255	251	247
2800	307	303	299	295	292	288	284	280	276	272	268	265	261	257	253	249
3200	308	304	300	296	292	289	285	281	277	273	269	265	261	257	254	250
3600	309	306	302	298	294	291	287	283	280	276	272	268	264	261	257	253
4000	310	306	303	299	296	292	289	285	282	278	275	271	268	264	261	257
4400	312	308	304	300	297	293	289	285	282	278	274	270	266	263	259	255
4800	312	309	306	302	299	295	292	288	285	281	278	274	271	268	264	261
5600	314	311	308	304	301	297	294	291	288	284	281	277	274	271	268	264
6400	316	313	310	306	303	300	297	294	291	288	284	281	278	275	272	269
6800	316	314	311	308	304	301	298	296	292	289	286	283	280	277	274	271
7000	317	314	311	308	305	302	299	296	293	290	287	284	281	278	275	272
7500	318	316	313	310	307	304	301	298	295	292	289	286	283	281	278	275

(Engine Speed (rpm) — vertical axis)

This is the crank angle at which the trigger pulse for the fuel pump solenoid is set.
- Increasing the angle reduces outflow and pressure
- Decreasing the angle increases outflow and pressure.

If the *Fuel Pressure* is not hitting the *Fuel Pressure Target* at the final *Fuel Pump Angle Target* displayed change this map to give more pump stroke to maintain pressure. Be aware that if the angle is set to high or low it will trigger the pump before on the inlet stroke and cause pressure issues.

Fuel Pump Control – Feedback Deadband

0.00000	0.500
0.00000	0.500
0.00360	0.500
0.00720	0.500
0.01080	0.500
0.01440	0.500
0.01800	0.500
0.02160	0.500
0.02520	0.500

(Value — vertical axis)

This is the pressure range in which the proportional and integral feedback of solenoid trigger angle will not become active, if the error is outside of 0.5 Mpa P&I correction will commence.

Fuel Pump Control – Proportional Factor

400	9.10
400	9.10
1200	7.80
2000	6.30
2800	5.40
3600	4.90
4400	4.30
5200	3.50
6000	3.20

(Engine Speed (rpm) — vertical axis; Value vs Engine Speed (rpm) graph)
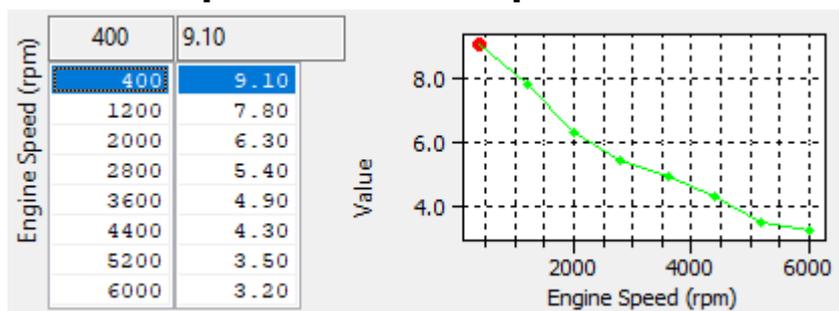
This is a proportional gain to calculate the instantaneous absolute addition to the *Fuel Pump Target* angle, based on RPM, the feedback angle is generated using the fuel pressure error value multiplied by the proportional correction amount.

Fuel Pump Angle Target – Prop = **Fuel Pump Control – Proportional Factor** map output x (*Fuel Pressure - Fuel Pressure Target*)

Increasing the factor give more instantaneous correction for the same amount of fuel pressure error

Fuel Pump Control – Integral Factor

400	0.102	
400	0.102	
1200	0.102	
2000	0.102	
2800	0.102	
3600	0.102	
4400	0.102	
5200	0.102	
6000	0.102	
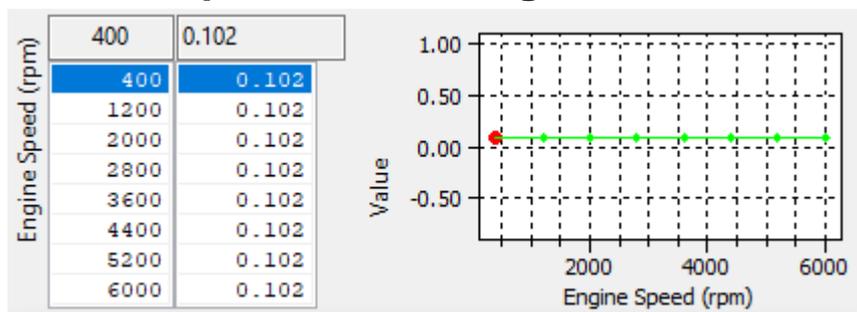
This is an integral gain factor map to calculate the cumulative addition to the *Fuel Pump Angle Target*, based on RPM, the feedback angle is generated using the fuel pressure error value multiplied by the proportional correction amount at the loop speed.

Fuel Pump Angle Target – Int = **Fuel Pump Control – Integral Factor** map output x (*Fuel Pressure - Fuel Pressure Target*)

Increasing the factor give more correction and faster responding cumulative values for the same amount of fuel pressure error.

Fuel Pump Regulator Response Time

4	21.00 ms
4	21.00
5	15.61
6	11.53
7	8.50
8	6.32
9	4.79
10	3.75
11	3.06
12	2.61
13	2.31
14	2.11
15	1.97
16	1.89
17	1.88
18	1.88
19	1.88
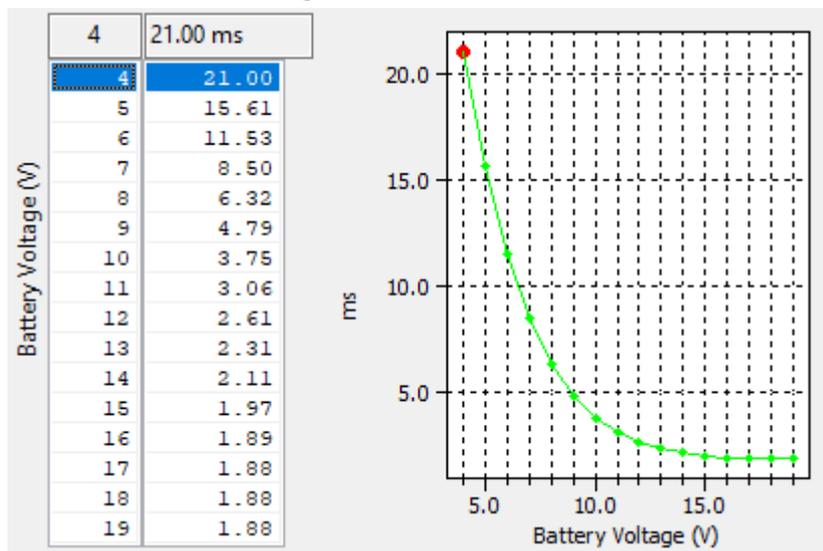
This is the dead / lag time of the pressure control solenoid, when changing pump solenoids this must match the dead time of the new solenoid installed. Like injectors, if tuned incorrectly it will effect the closed loop pressure control systems.

Fuel Pump – Battery Voltage switching Time

15.92
11.92
9.92

Mass Airflow Sensor (V)

At different battery voltages the ECU uses different times for switching between hold time initial values of the fuel pump solenoid. Depending on what the battery voltage is it will use the range specified on the **Fuel Pump – Hold Time Initial Value** map, see that map description for more details.

Fuel Pump – Hold Time Initial Value

2.82	
4.03	
6.40	ms
12.03	

When the battery voltage is above the top threshold of **Fuel Pump – Battery Voltage switching Time** the top row of this map is used, when between the top and middle threshold the second values are used, as per below

Fuel Pump – Peak Current Initial Value

6	Current (A)
6	

The target current (Amps) for the Peak driving phase of the pressure control solenoid. This could be adjusted to better suit increased current demands of an upgraded pump solenoid. The two values are for mode 1 and 2 as per the hold current maps and its believed these are switched by exceeding the thresholds **Fuel Pump - RPM For switching Peak Current & Hys**.

Fuel Pump – Hold Current 1 & Fuel Pump – Hold Current 2

3	Current (A)

The target hold current set to drive the pressure control solenoid. Two maps are used for different modes but believed they are switched using **Fuel Pump – RPM For switching Hold Current**. This could be used to cope with the increased current demands of an upgraded pump solenoid.

Fuel Pump – RPM For switching Hold Current

12750	Engine Speed (rpm)

RPM at which the ECU changes from using **Fuel Pump – Hold Current 1** to **Fuel Pump – Hold Current 2.**

Fuel Pump - RPM For switching Hold Hys

0	Engine Speed (rpm)

Hysteresis value used when evaluating the RPM threshold.

Fuel Pump – RPM For switching Peak Current

0	Engine Speed (rpm)

RPM at which the ECU changes from using **Fuel Pump – Peak Current 1** to **Fuel Pump – Peak Current 2.**

Fuel Pump - RPM For switching Peak Hys

0	Engine Speed (rpm)

Hysteresis value used when evaluating the RPM threshold.

Fuel Pump - Delay Time Switching Peak Current

255	Value

This is the time of the peak current drive for the control solenoid.

Charge Air Failsafe

Introduction

The OEM intercoolers on a VR30DDTT engine are water to air, and prone to airlocks in their coolant system after removal and installation, this creates high charge air temperatures, the OEM code offers no protection, so an engine can be quickly destroyed at higher boost levels. Adding an element of safety to tuning, a charge air to intake air temperature differential threshold has been created to limit the desired torque to reduce power until the dangerous running conditions subside.

To clear the limp mode torque limit, the ignition will need to be turned off for a few seconds and then the engine restarted or the time out option implemented.

Map List

Charge Air Failsafe
- ☐ Charge Air Failsafe - Torque Limit
- ☐ Charge Air Failsafe - Min Engine Load
- ☐ Charge Air Failsafe - Min Engine Speed
- ☐ Charge Air Failsafe - Min Temp Diff
- ☐ Charge Air Failsafe - Timeout
- ☐ Charge Air Failsafe Enable

Live Data Parameters

- *Dig: Charge Air Failsafe Limiter – An on/off parameter to show if the car is in charge air related failsafe modes.*
- *Charge Air Temp – The intake charge air temperature (post intercooler) in °C.*
- *Charge Air Coolant Temperature – The W2A intercooler water temperature in °C.*
- *Intake Air Temp – The intake charge air temperature (pre intercooler) in °C.*

Operation

When enabled, the code then checks if the enable thresholds have been met as per below,
- *Charge Air Temp - Intake Air Temperature* is greater than **Charge Air Failsafe – Min Temp Diff**
- *Engine Load* is greater than **Charge Air Failsafe - Min Engine Load**
- *Engine Speed* is greater than **Charge Air Failsafe - Min Engine Speed**

when all three thresholds have been exceeded the desired torque is limited to **Charge Air failsafe – Torque Limit.**

This will drop the power output, lowering the boost and preventing engine damage.

The torque limit will stay applied until key off, or if enabled, the **Charge Air Failsafe – Timeout** time has been exceeded.

Charge Air Failsafe - Enable

☐ Enable Charge Air Failsafe
☐ Enable Timeout

Check these boxes to enable the charge air failsafe feature.

Charge Air Failsafe - Torque Limit

`300`   max (Nm)

This sets the maximum allowable torque when the failsafe mode is active it allows normal throttle response until the torque limit is achieved.

Charge Air Failsafe – Min Engine Load

`1.20`   min (load)

All Thresholds including the current engine load must be above their respective before the **Charge Air Failsafe – Torque limit** is applied.

Charge Air Failsafe – Min Engine Speed

`3000`   min (rpm)

All Thresholds including the engine speed RPM must be above their respective threshold to apply the **Charge Air Failsafe – Torque limit.**

Charge Air Failsafe – Min Temp Diff

`40`   min (°C)

All Thresholds including the Intake air to charge air temperature difference must be greater than their respective threshold before the **Charge Air Failsafe – Torque limit** is armed.

Charge Air Failsafe - Timeout

`120`   time (s)

If the timeout is enabled, the **Charge Air Failsafe – Torque limit** will be turned off automatically when this time has elapsed from when first triggered. If the timeout is disabled, the ignition will need to be cycled to release the **Charge Air Failsafe – Torque limit**.

Fuelling (Target & Control)

Introduction

The Infinity VR30DDTT has a complex fuelling function, the use of the direct injection enables more accurate adjustment of fuel injection quantity by injecting atomized high-pressure fuel directly into the cylinder. The amount of fuel injected (controlled by injector open time) is determined in the ECM referencing the engine running conditions which are determined by input signals (e.g. engine speed, intake air volume, fuel rail pressure and boost pressure), primarily using the crankshaft position sensor, camshaft position sensor and the mass air flow sensor.

In addition, the amount of fuel injected is adjusted to improve engine performance under various operating conditions as listed below.
Fuel increase
- During warm-up
- When starting the engine
- During acceleration
- Hot-engine operation
- When selector lever position is changed from N to D
- High-load, high-speed operation

Fuel decrease
- During deceleration
- During high engine speed operation

As part of the emissions control and engine safety function implemented in the ECM Stratified-charge Combustion or Homogeneous Combustion have been implemented.

Stratified-charge combustion is a combustion method which enables extremely lean combustion by injecting fuel in the latter half of a compression process, collecting combustible air-fuel around the spark plug, and forming fuel-free airspace around the mixture. The stratified charge can be split in up to 3 separate injection events, even during expansion strokes in some cases possibly to clean the 3 way catalyst NOx trap.
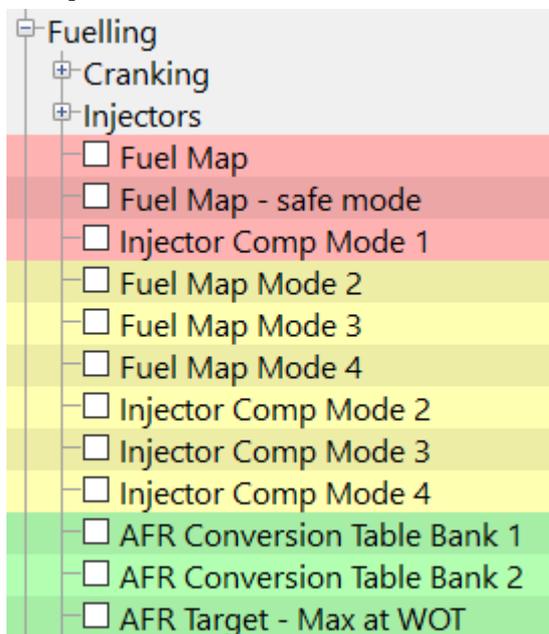
The use of the stratified-charge combustion method enables emissions-reduction when starting the engine with engine coolant temperature between 5°C (41°F) and 40°C (104°F). Right after a start with the engine cold stratified-charge combustion is used to heat up the catalyst as quick as possible.

Homogeneous combustion is a combustion method where fuel is injected during intake process so that combustion occurs in the entire combustion chamber, as is common with conventional methods. Except during start up with the engine cold, homogeneous combustion is used.

The fuel control functions on the VR30 engine we believe are per cylinder sequential (according to ignition order) self-learning and full time closed loop. Open loop fuel delivery is only used in very particular circumstances (like overrun and fail safe). The ECM uses the primary pre-turbo O2 sensors as well as the rear O2 sensors for fuelling adjustment.

There is a self learning function (short term and long term) as per all modern ECU's, long term forming a form of wear and environment change adaptation and the short term handling instantaneous pulse width adaption.

Map List

```
⊟ Fuelling
    ⊞ Cranking
    ⊞ Injectors
      ─ ☐ Fuel Map
      ─ ☐ Fuel Map - safe mode
      ─ ☐ Injector Comp Mode 1
      ─ ☐ Fuel Map Mode 2
      ─ ☐ Fuel Map Mode 3
      ─ ☐ Fuel Map Mode 4
      ─ ☐ Injector Comp Mode 2
      ─ ☐ Injector Comp Mode 3
      ─ ☐ Injector Comp Mode 4
      ─ ☐ AFR Conversion Table Bank 1
      ─ ☐ AFR Conversion Table Bank 2
      ─ ☐ AFR Target - Max at WOT
```
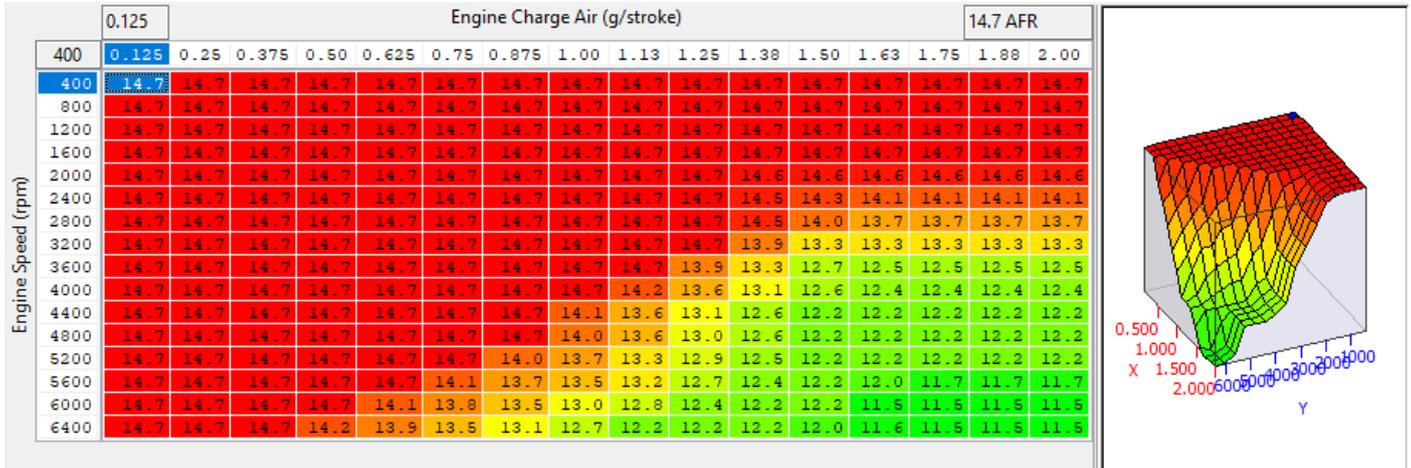
Live Data Parameters

- *AFR Average (AFR) – Bank 1 and 2 sensor values averaged*
- *AFR Average Calibrated (AFR) – Bank 1 and 2 sensor output using EcuTek Polynomial averaged*
- *AFR Bank 1 (AFR) – Bank 1 O2 sensor output as seen by the ECM*
- *AFR Bank 2 (AFR) – Bank 2 O2 sensor output as seen by the ECM*
- *AFR Bank 1 Calibrated (AFR) – Bank 1 O2 sensor output as seen by the EcuTek Polynomial*
- *AFR Bank 2 Calibrated (AFR) – Bank 2 O2 sensor output as seen by the EcuTek Polynomial*
- *AFR Sensor B1 (V) – Bank 1 O2 sensor output raw voltage*
- *AFR Sensor B2 (V) – Bank 2 O2 sensor output raw voltage*
- *AFR Sensor Heater #1 (%) – Percentage duty of Bank 1 O2 sensor heater*
- *AFR Sensor Heater #2 (%) – Percentage duty of Bank 2 O2 sensor heater*
- *AFR Target B1 (AFR) – Bank 1 target AFR*
- *AFR Target B2 (AFR) – Bank 2 target AFR*
- *Fuel Injection Angle (°)– OEM injection angle parameter*
- *Fuel Injector Duration B1(ms) – Injector open time on bank 1*
- *Fuel Injector Duration B2 (ms) – Injector open time on bank 2*
- *Fuel Injector End to Spark (ms) – Time between end of injection and ignition event.*
- *Fuel Trim Long term B1 (%) – Percentage extra injector open time applied by long term fuel correction*
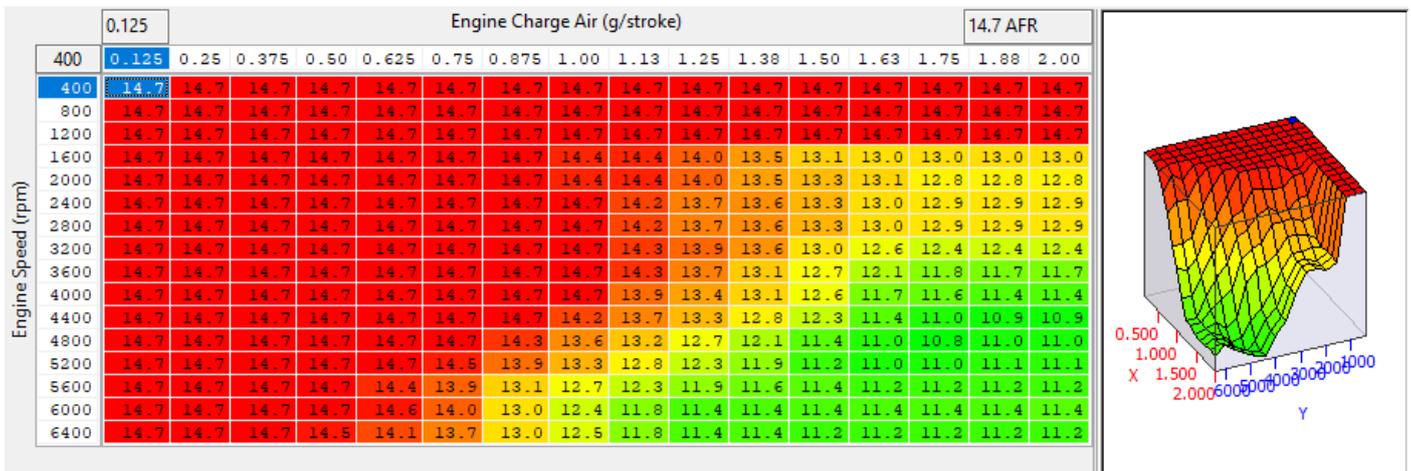
- *Fuel Trim Long term B2 (%) – Percentage extra injector open time applied by long term fuel correction*
- *Fuel Trim Short term B1 (%) – Percentage extra injector open time applied by short term fuel correction*
- *Fuel Trim Short term B2 (%) – Percentage extra injector open time applied by short term fuel correction*
- *Injector Open Time (ms) – The injector open time of the last pulse used in the sequence*
- *Map Trace AFR (AFR) – Value used to map trace on fuel maps and ignition maps when colouring by AFR*

Fuel Map Mode 1 - 4

Engine Charge Air (g/stroke) — 14.7 AFR

| rpm \ g/stroke	0.125	0.25	0.375	0.50	0.625	0.75	0.875	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00
400	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
1200	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
1600	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
2000	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.6	14.6	14.6	14.6	14.6	14.6
2400	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.5	14.3	14.1	14.1	14.1	14.1	14.1
2800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.5	14.0	13.7	13.7	13.7	13.7	13.7
3200	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	13.9	13.3	13.3	13.3	13.3	13.3	13.3
3600	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	13.9	13.3	12.7	12.5	12.5	12.5	12.5	12.5
4000	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.2	13.6	13.1	12.6	12.4	12.4	12.4	12.4	12.4
4400	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.1	13.6	13.1	12.6	12.2	12.2	12.2	12.2	12.2
4800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.0	13.6	13.0	12.6	12.2	12.2	12.2	12.2	12.2
5200	14.7	14.7	14.7	14.7	14.7	14.7	14.0	13.7	13.3	12.9	12.5	12.2	12.2	12.2	12.2	12.2
5600	14.7	14.7	14.7	14.7	14.7	14.1	13.7	13.5	13.2	12.7	12.4	12.2	12.2	11.7	11.7	11.7
6000	14.7	14.7	14.7	14.7	14.1	13.8	13.5	13.0	12.8	12.4	12.2	12.2	11.5	11.5	11.5	11.5
6400	14.7	14.7	14.7	14.2	13.9	13.5	13.1	12.7	12.2	12.2	12.2	12.0	11.6	11.5	11.5	11.5

This is the target AFR the ECU chooses to run when not in lambda control modes, there are individual maps for each mode 1 to 4, these maps are equivalence ratio shown as AFR by the map editor.

Fuel Map - Safe Mode

Engine Charge Air (g/stroke) — 14.7 AFR

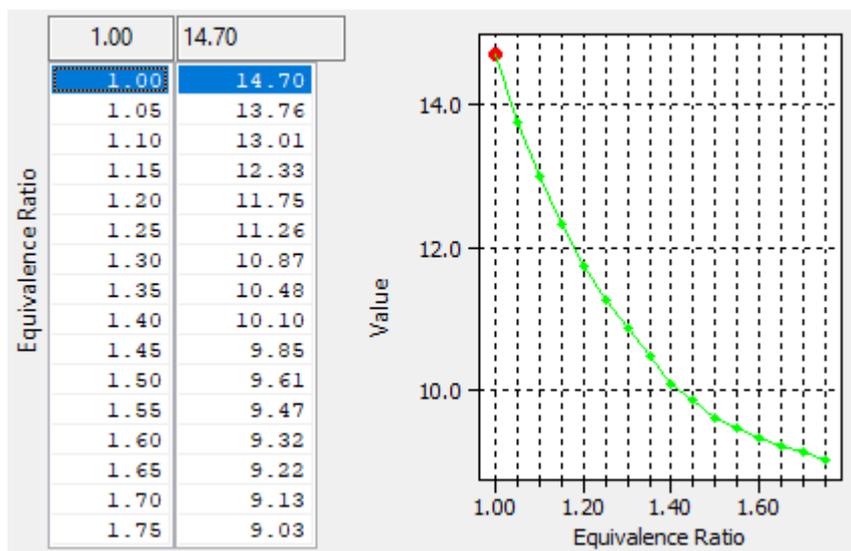| rpm \ g/stroke	0.125	0.25	0.375	0.50	0.625	0.75	0.875	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00
400	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
1200	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
1600	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.4	14.0	13.5	13.1	13.0	13.0	13.0	13.0
2000	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.4	14.0	13.5	13.3	13.1	12.8	12.8	12.8
2400	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.2	13.7	13.6	13.3	13.0	12.9	12.9	12.9
2800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.2	13.7	13.6	13.3	13.0	12.9	12.9	12.9
3200	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.3	13.9	13.6	13.0	12.6	12.4	12.4	12.4
3600	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.3	13.7	13.1	12.7	12.1	11.8	11.7	11.7
4000	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	13.9	13.4	13.1	12.6	11.7	11.6	11.4	11.4
4400	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.2	13.7	13.3	12.8	12.3	11.4	11.0	10.9	10.9
4800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.3	13.6	13.2	12.7	12.1	11.4	11.0	10.8	11.0
5200	14.7	14.7	14.7	14.7	14.7	14.7	14.5	13.9	13.3	12.8	12.3	11.9	11.2	11.0	11.0	11.1
5600	14.7	14.7	14.7	14.7	14.4	13.9	13.1	12.7	12.3	11.9	11.6	11.4	11.2	11.2	11.2	11.2
6000	14.7	14.7	14.7	14.7	14.6	14.0	13.0	12.4	11.8	11.4	11.4	11.4	11.4	11.4	11.4	11.4
6400	14.7	14.7	14.7	14.5	14.1	13.7	13.0	12.5	11.8	11.4	11.4	11.2	11.2	11.2	11.2	11.2

There is a safe mode map as well that we believe is used when the car senses knock events or suspects the octane rating of the fuel has changed (for example after refuelling)

Injector Comp Mode 1 - 4
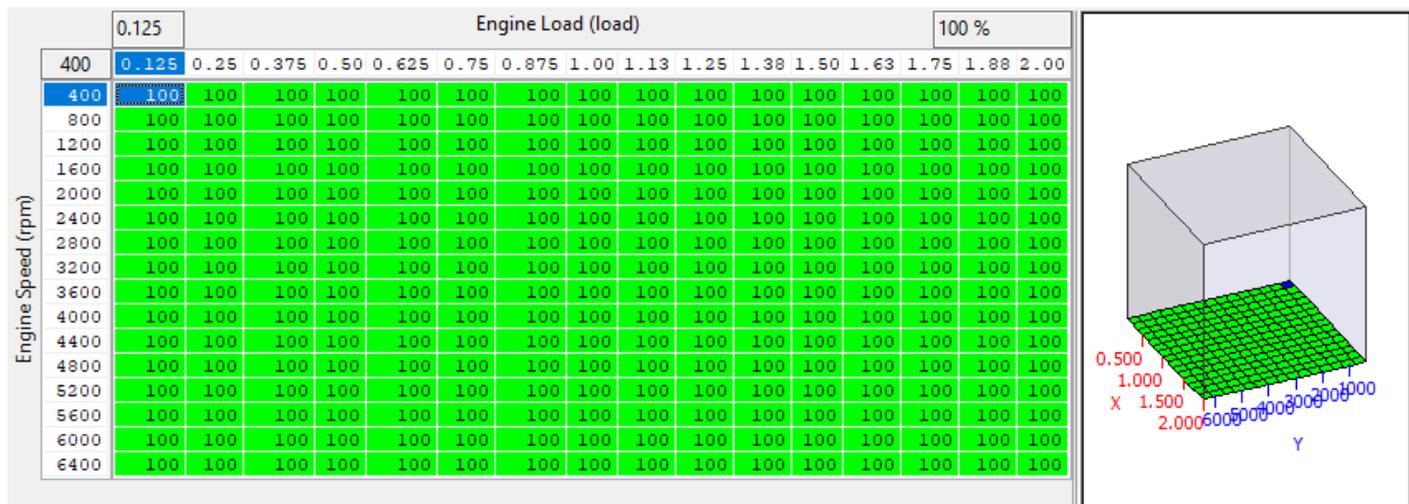
The injector compensation maps work directly on the Injector magnification values so directly effect injector open time during engine operation. They are load and RPM scaled so can be used to adjust the total fuelling under certain running conditions or compensate "per mode" for different fuel densities and mass flow rates e.g. Ethanol fuels.
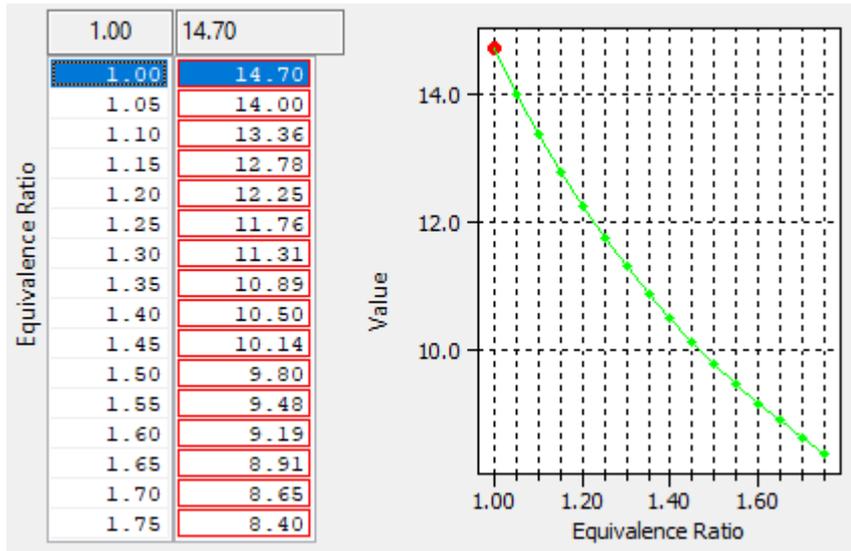
AFR Conversion Bank 1 & 2

	1.00	14.70
	1.00	14.70
	1.05	13.76
	1.10	13.01
	1.15	12.33
	1.20	11.75
	1.25	11.26
	1.30	10.87
	1.35	10.48
	1.40	10.10
	1.45	9.85
	1.50	9.61
	1.55	9.47
	1.60	9.32
	1.65	9.22
	1.70	9.13
	1.75	9.03

There are many different OEM fuelling target selection modes, these are for functions used when trying to achieve high efficiency closed loop stoichiometric fuelling, low temperature cat warm up, limp modes and High Load running conditions. The AFR conversion tables are an offset adjustment to the output of the fuel maps (in equivalence ratio) to convert into AFR. While the exact reason for having a changeable Eq ratio to AFR conversion is unknown we suspect it is to do with "in cylinder mixing" or safety factors.

These two maps, one for each bank, are used internally by the ECU to convert values in the main fuel map to bank specific AFR targets. The units are Equivalence Ratio and can be converted to AFR by dividing 14.7 by the values in the table, for example 1.00 gives an AFR of 14.7:1 and 1.336 gives an AFR of 11:1.

By default they do not give an output identical to the input, and it is different between each bank, and they typically translate values from the fuel maps at high load to slightly richer targets. To nullify this effect, set that the data values to exactly equal the input values, but be aware that the result is that the reported AFR target and AFR logging parameter will not match when long and short term fuel trims are 100 (no trimming).

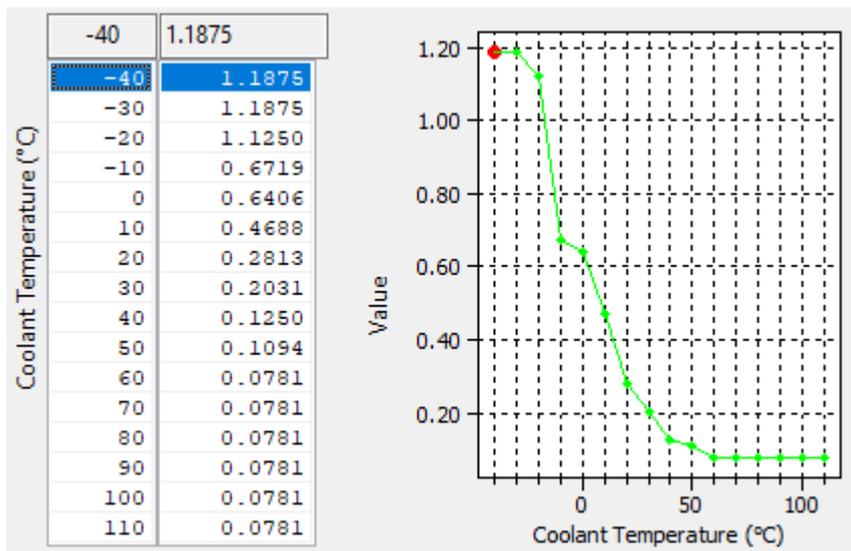This ends up with a setting that looks like below,

1.00	14.70
1.00	14.70
1.05	14.00
1.10	13.36
1.15	12.78
1.20	12.25
1.25	11.76
1.30	11.31
1.35	10.89
1.40	10.50
1.45	10.14
1.50	9.80
1.55	9.48
1.60	9.19
1.65	8.91
1.70	8.65
1.75	8.40

AFR Target – Max at WOT

Engine Speed (rpm)	AFR
800	14.5
2400	14.5
2800	14.5
4000	14.7
4800	14.7
5200	12.6
6000	12.6
6400	12.6
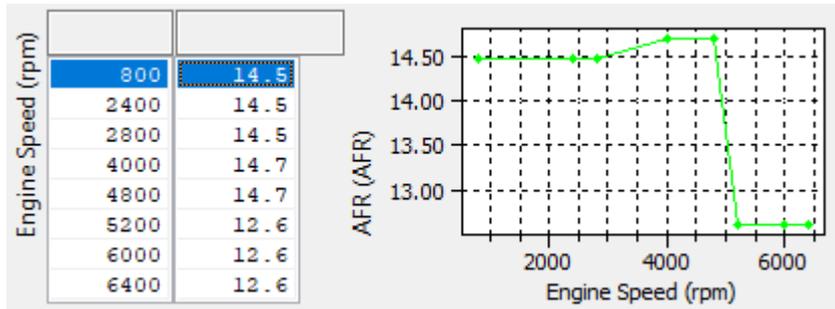
This is the leanest AFR Target permitted for a given RPM when at WOT, it could also be called the leanest AFR for best torque. Of the values returned by this map and the main 3d fuel map(s), the richest value will be used by the ECU. Raising the values in this map prevents rich AFR Targets interfering with the intended target AFR typically used on high power cars with catalysts removed. Setting all the values in this map to 14.7 will completely disable the effect.

Cranking

-40	1.1875
-40	1.1875
-30	1.1875
-20	1.1250
-10	0.6719
0	0.6406
10	0.4688
20	0.2813
30	0.2031
40	0.1250
50	0.1094
60	0.0781
70	0.0781
80	0.0781
90	0.0781
100	0.0781
110	0.0781

There are many cranking maps and this function is currently not well understood, there are set pulse widths for cranking phases with reference to coolant temperature, and after start enrichments periods.

# Injection Angle

Introduction

There are 4 pulse modes and 3 injection windows, these injection modes relate to which windows are used, the 4 modes are

- Homogeneous Middle Pulse Mode
- Homogeneous Pulse Mode
- Stratified Pulse Mode
- Pre-Injection Pulse Mode

The 3 windows that are used are an early, a middle, and a late window, and these have different start and end angles set in the software. The modes and windows are all decided "per injector" sequentially.

Fuel injection timing (*injection Angle 1, 2 & 3* in deg) Indicates the fuel injection timing computed by the ECM according to the input signals. There are 3 windows for injection events and it has been seen that at low RPM and peak torque these different windows are used mostly. This is to improve emissions and mitigate low speed preignition events that can occur. When using Homogenous injection strategies *Injection Angle 2* is used mostly,

NOTE: *Injection Angle* indicates degree of start of injection from TDC of intake stroke (After Top Dead Center). The diagram below shows the relationship between injection angle and combustion cycle.
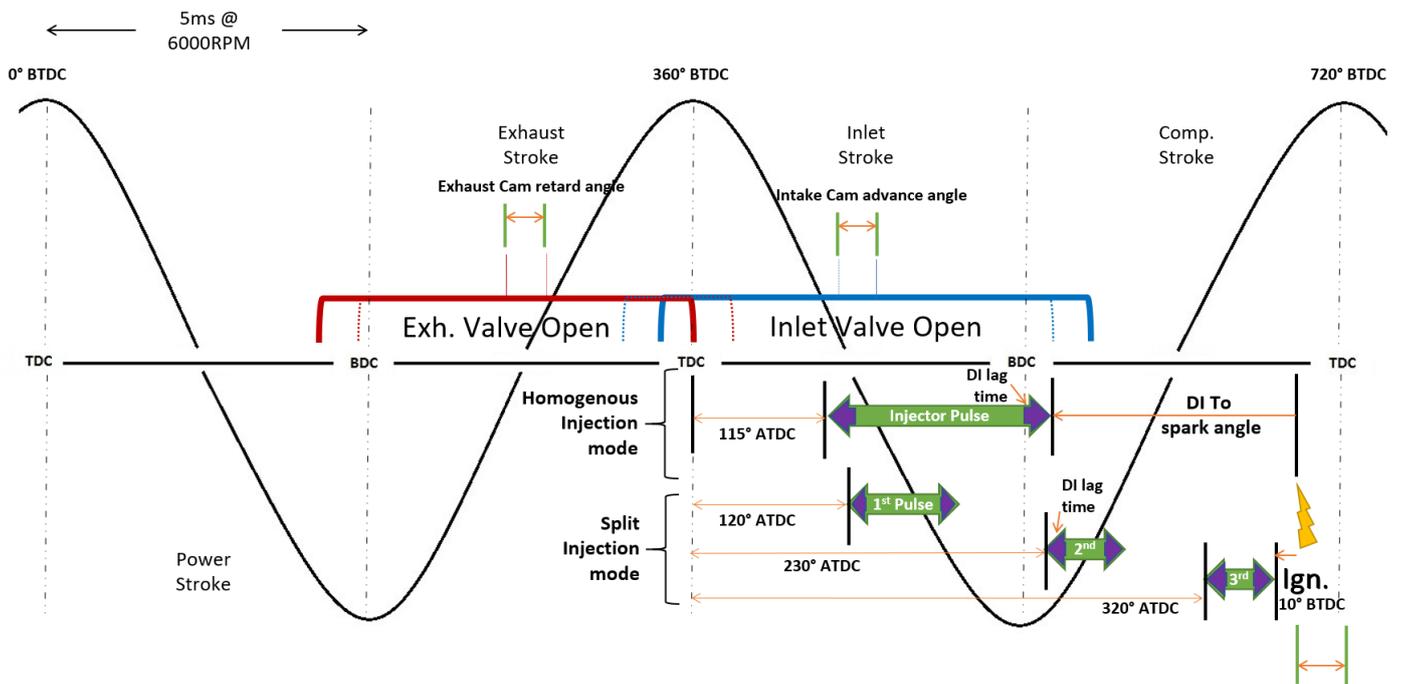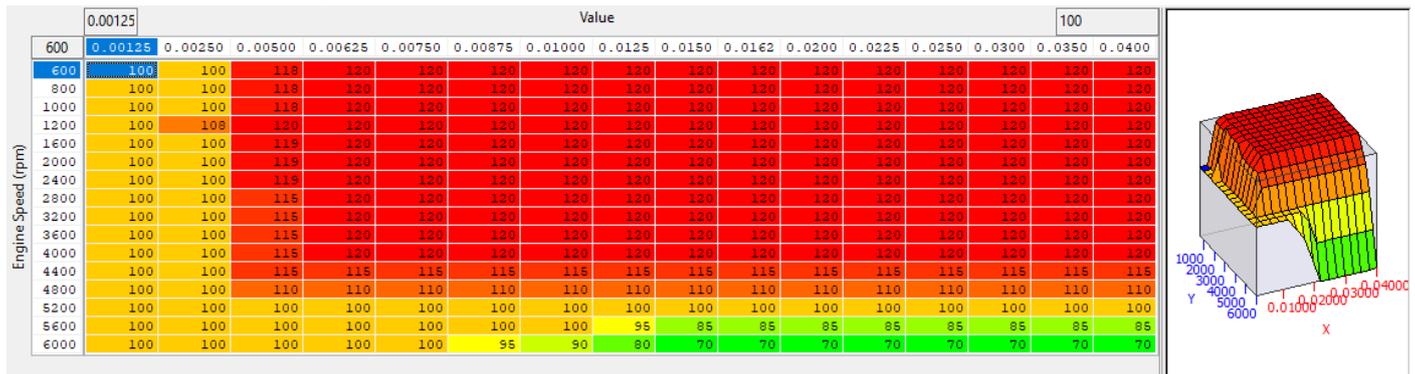
Map List

- ☐ Injection Timing - pre-ignition lower limit - 799
- ☐ Injection timing - Pre-ignition prevention (safe mode) - 832
- ☐ Injection timing - Pre-ignition prevention - 831
- ☐ Injection Timing 1 - 092
- ☐ Injection Timing 1 High Power - 093
- ☐ Injection Timing 1 High Power SCV closed - 094
- ☐ Injection Timing 1 low temp - 098
- ☐ Injection Timing 1 low temp SCV Closed - 099
- ☐ Injection Timing 1 SCV Closed - 095
- ☐ Injection Timing 1 v. low temp - 096
- ☐ Injection Timing 1 v. low temp SCV Closed - 097
- ☐ Injection Timing 1st 2 - 243
- ☐ Injection Timing 1st 2 High power - 244
- ☐ Injection Timing 1st 2 low temp- 245
- ☐ Injection Timing 1st 3 - 252
- ☐ Injection Timing 1st 3 High Power - 253
- ☐ Injection Timing 1st 3 low temp - 254
- ☐ Injection Timing 2nd 2 - 246
- ☐ Injection Timing 2nd 2 High power - 247
- ☐ Injection Timing 2nd 2 low temp - 248
- ☐ Injection Timing 2nd 3 - 249
- ☐ Injection Timing 2nd 3 High Power - 250
- ☐ Injection Timing 2nd 3 Low Temp - 251
- ☐ Injection Timing 3rd 3 - 255
- ☐ Injection Timing 3rd 3 High Power- 256
- ☐ Injection Timing 3rd 3 low temp - 257
- ☐ Injection Timing on stratified startup - 266

These names will be changed and released in the near future.

Live Data Parameters

- *Injection Angle 1 (°) – Start of Injection angle of number 1 injection pulse*
- *Injection Angle 2 (°) – Start of Injection angle of number 2 injection pulse*
- *Injection Angle 3 (°) – Start of Injection angle of number 3 injection pulse*
- *Injection Pulsewidth 1 Cyl 1 (ms) – Injection Pulsewidth of 1st pulse on Cyl #1 injection*
- *Injection Pulsewidth 1 Cyl 2 (ms) – Injection Pulsewidth of 1st pulse on Cyl #2 injection*
- *Injection Pulsewidth 1 Cyl 3 (ms) – Injection Pulsewidth of 1st pulse on Cyl #3 injection*
- *Injection Pulsewidth 1 Cyl 4 (ms) – Injection Pulsewidth of 1st pulse on Cyl #4 injection*
- *Injection Pulsewidth 1 Cyl 5 (ms) – Injection Pulsewidth of 1st pulse on Cyl #5 injection*
- *Injection Pulsewidth 1 Cyl 6 (ms) – Injection Pulsewidth of 1st pulse on Cyl #6 injection*
- *Injection Pulsewidth 2 Cyl 1 (ms) – Injection Pulsewidth of 2st pulse on Cyl #1 injection*
- *Injection Pulsewidth 2 Cyl 2 (ms) – Injection Pulsewidth of 2st pulse on Cyl #2 injection*
- *Injection Pulsewidth 2 Cyl 3 (ms) – Injection Pulsewidth of 2st pulse on Cyl #3 injection*
- *Injection Pulsewidth 2 Cyl 4 (ms) – Injection Pulsewidth of 2st pulse on Cyl #4 injection*
- *Injection Pulsewidth 2 Cyl 5 (ms) – Injection Pulsewidth of 2st pulse on Cyl #5 injection*
- *Injection Pulsewidth 2 Cyl 6 (ms) – Injection Pulsewidth of 2st pulse on Cyl #6 injection*
- *Injection Pulsewidth 3 Cyl 1 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #1 injection*
- *Injection Pulsewidth 3 Cyl 2 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #2 injection*
- *Injection Pulsewidth 3 Cyl 3 (ms)– Injection Pulsewidth of 3rd pulse on Cyl #3 injection*
- *Injection Pulsewidth 3 Cyl 4 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #4 injection*
- *Injection Pulsewidth 3 Cyl 5 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #5 injection*
- *Injection Pulsewidth 3 Cyl 6 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #6 injection*

Injection Timing

Engine Speed (rpm)	0.00125	0.00250	0.00500	0.00625	0.00750	0.00875	0.01000	0.0125	0.0150	0.0162	0.0200	0.0225	0.0250	0.0300	0.0350	0.0400
600	100	100	118	120	120	120	120	120	120	120	120	120	120	120	120	120
800	100	100	118	120	120	120	120	120	120	120	120	120	120	120	120	120
1000	100	100	118	120	120	120	120	120	120	120	120	120	120	120	120	120
1200	100	108	120	120	120	120	120	120	120	120	120	120	120	120	120	120
1600	100	100	119	120	120	120	120	120	120	120	120	120	120	120	120	120
2000	100	100	119	120	120	120	120	120	120	120	120	120	120	120	120	120
2400	100	100	115	120	120	120	120	120	120	120	120	120	120	120	120	120
2800	100	100	115	120	120	120	120	120	120	120	120	120	120	120	120	120
3200	100	100	115	120	120	120	120	120	120	120	120	120	120	120	120	120
3600	100	100	115	120	120	120	120	120	120	120	120	120	120	120	120	120
4000	100	100	115	120	120	120	120	120	120	120	120	120	120	120	120	120
4400	100	100	115	115	115	115	115	115	115	115	115	115	115	115	115	115
4800	100	100	110	110	110	110	110	110	110	110	110	110	110	110	110	110
5200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
5600	100	100	100	100	100	100	100	95	85	85	85	85	85	85	85	85
6000	100	100	100	100	100	95	90	80	70	70	70	70	70	70	70	70

As described in the introduction, the injection timing maps set the angle after TDC of exhaust/intake stroke. The output values are in crank degrees and they are set by engine speed and a calculated load condition using multiple variables to generate the output value.

There are many different modes in which different injection windows are used and different injector "start of pulse" angles are chosen, these are for High power low temperature or SCV position.

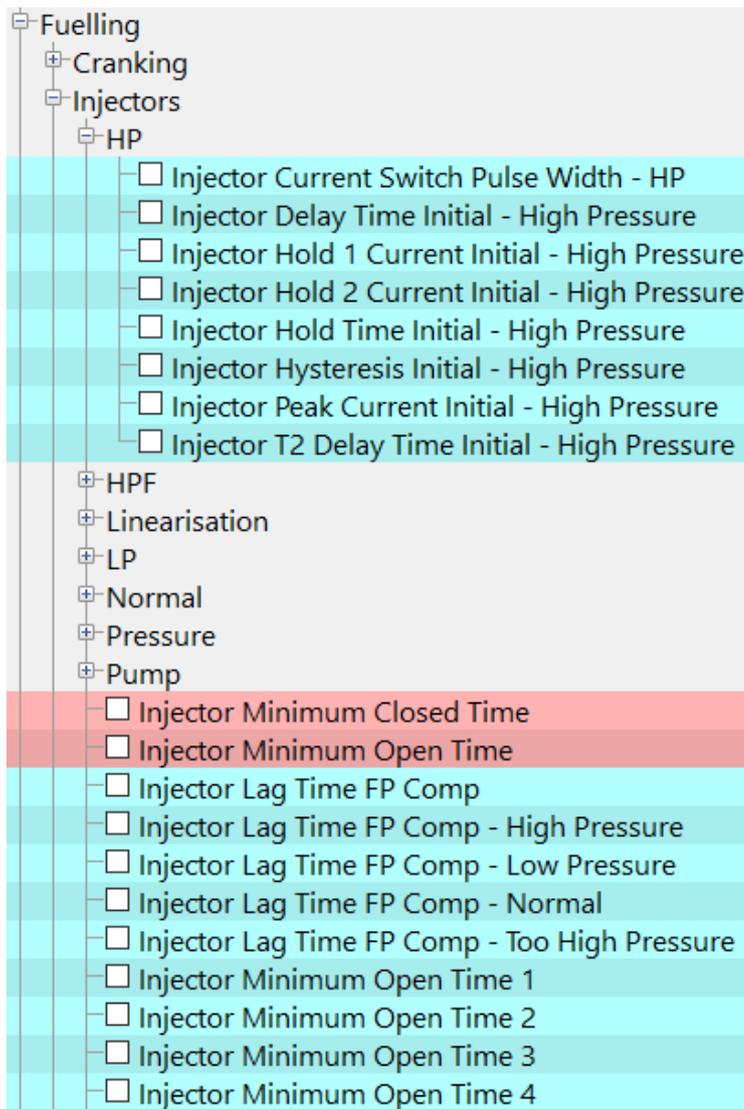# Injection Characteristics

Introduction

Direct injection (DI) characteristics are quite complex but can be broken down into several controlling functions. The injectors are driven at a high voltage for a short time using the high-pressure fuel supply to achieve the required quantity in a short period. The ECM is equipped with an injector driver unit that drives the fuel injector at approximately 65 V (maximum) to increase the speed of injector opening thus increasing the operating window available.

Injector characteristics are split into pressure groups like the following.

- High Pressure failure (pressure to high)
- High pressure
- Normal pressure
- Low Pressure

Each pressure mode has its own set of injector characteristic maps (including peak and hold currents, switching times and delays). The opening time is calculated using these values which are further split into the phase of the injector driving cycle. There are 2 main phases, a peak current phase to drive the injector open and a hold current phase to keep it open. The final pulse width is subject to low pulse width linearization maps and minimum open times.
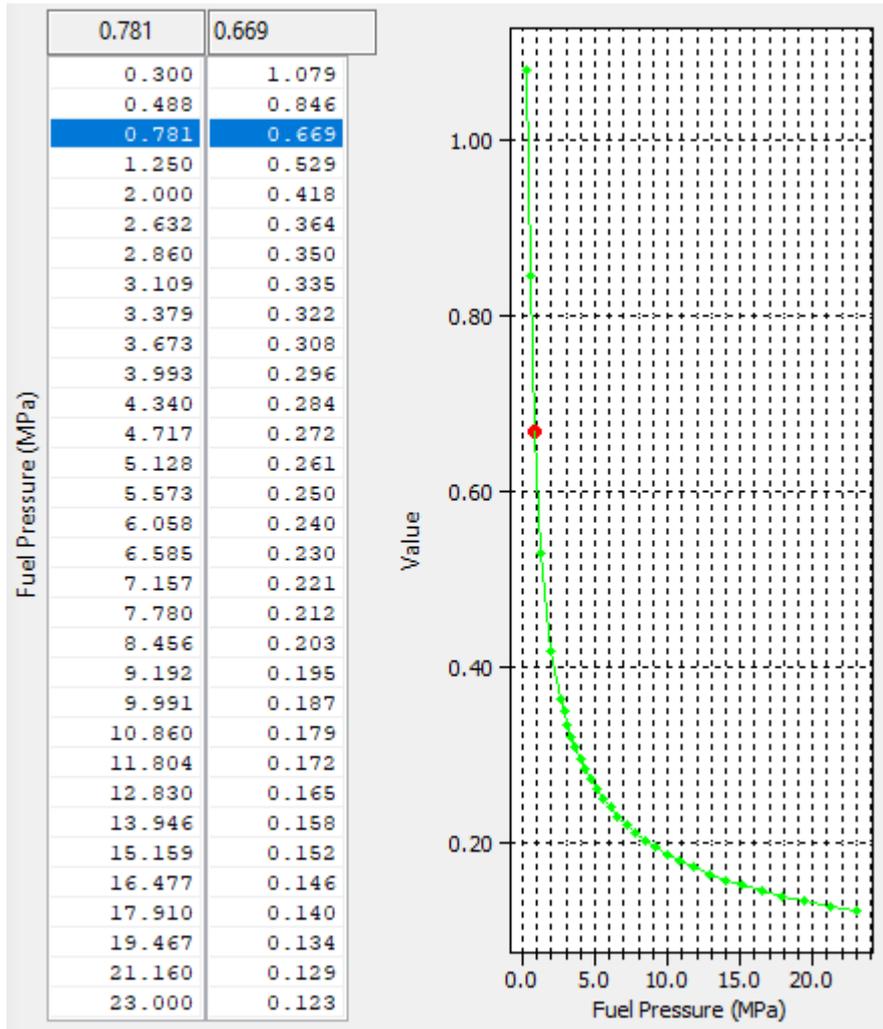
Map List

```
⊟ Fuelling
    ⊞ Cranking
    ⊟ Injectors
        ⊟ HP
            ☐ Injector Current Switch Pulse Width - HP
            ☐ Injector Delay Time Initial - High Pressure
            ☐ Injector Hold 1 Current Initial - High Pressure
            ☐ Injector Hold 2 Current Initial - High Pressure
            ☐ Injector Hold Time Initial - High Pressure
            ☐ Injector Hysteresis Initial - High Pressure
            ☐ Injector Peak Current Initial - High Pressure
            ☐ Injector T2 Delay Time Initial - High Pressure
        ⊞ HPF
        ⊞ Linearisation
        ⊞ LP
        ⊞ Normal
        ⊞ Pressure
        ⊞ Pump
        ☐ Injector Minimum Closed Time
        ☐ Injector Minimum Open Time
        ☐ Injector Lag Time FP Comp
        ☐ Injector Lag Time FP Comp - High Pressure
        ☐ Injector Lag Time FP Comp - Low Pressure
        ☐ Injector Lag Time FP Comp - Normal
        ☐ Injector Lag Time FP Comp - Too High Pressure
        ☐ Injector Minimum Open Time 1
        ☐ Injector Minimum Open Time 2
        ☐ Injector Minimum Open Time 3
        ☐ Injector Minimum Open Time 4
```

Live Data Parameters

- *Injection Pulsewidth 1 Cyl 1 (ms) – Injection Pulsewidth of 1st pulse on Cyl #1 injection*
- *Injection Pulsewidth 1 Cyl 2 (ms) – Injection Pulsewidth of 1st pulse on Cyl #2 injection*
- *Injection Pulsewidth 1 Cyl 3 (ms) – Injection Pulsewidth of 1st pulse on Cyl #3 injection*
- *Injection Pulsewidth 1 Cyl 4 (ms) – Injection Pulsewidth of 1st pulse on Cyl #4 injection*
- *Injection Pulsewidth 1 Cyl 5 (ms) – Injection Pulsewidth of 1st pulse on Cyl #5 injection*
- *Injection Pulsewidth 1 Cyl 6 (ms) – Injection Pulsewidth of 1st pulse on Cyl #6 injection*
- *Injection Pulsewidth 2 Cyl 1 (ms) – Injection Pulsewidth of 2st pulse on Cyl #1 injection*
- *Injection Pulsewidth 2 Cyl 2 (ms) – Injection Pulsewidth of 2st pulse on Cyl #2 injection*
- *Injection Pulsewidth 2 Cyl 3 (ms) – Injection Pulsewidth of 2st pulse on Cyl #3 injection*
- *Injection Pulsewidth 2 Cyl 4 (ms) – Injection Pulsewidth of 2st pulse on Cyl #4 injection*
- *Injection Pulsewidth 2 Cyl 5 (ms) – Injection Pulsewidth of 2st pulse on Cyl #5 injection*
- *Injection Pulsewidth 2 Cyl 6 (ms) – Injection Pulsewidth of 2st pulse on Cyl #6 injection*
- *Injection Pulsewidth 3 Cyl 1 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #1 injection*
- *Injection Pulsewidth 3 Cyl 2 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #2 injection*
- *Injection Pulsewidth 3 Cyl 3 (ms)– Injection Pulsewidth of 3rd pulse on Cyl #3 injection*
- *Injection Pulsewidth 3 Cyl 4 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #4 injection*
- *Injection Pulsewidth 3 Cyl 5 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #5 injection*
- *Injection Pulsewidth 3 Cyl 6 (ms) – Injection Pulsewidth of 3rd pulse on Cyl #6 injection*
- *Injector Open Time (ms) – The injector open time of the last pulse used in the sequence*

Injector Magnification

0.781	0.669
0.300	1.079
0.488	0.846
0.781	0.669
1.250	0.529
2.000	0.418
2.632	0.364
2.860	0.350
3.109	0.335
3.379	0.322
3.673	0.308
3.993	0.296
4.340	0.284
4.717	0.272
5.128	0.261
5.573	0.250
6.058	0.240
6.585	0.230
7.157	0.221
7.780	0.212
8.456	0.203
9.192	0.195
9.991	0.187
10.860	0.179
11.804	0.172
12.830	0.165
13.946	0.158
15.159	0.152
16.477	0.146
17.910	0.140
19.467	0.134
21.160	0.129
23.000	0.123

The injector flow rate differs at different fuel pressures the response time of the injector due to pressure can be modified by adjusting using the injector magnification map. This is also what the injector compensation values work on.

- Increasing the value will increase the calculated fuel amount required
- decreasing the values will decrease the amount of fuel calculated for the current conditions
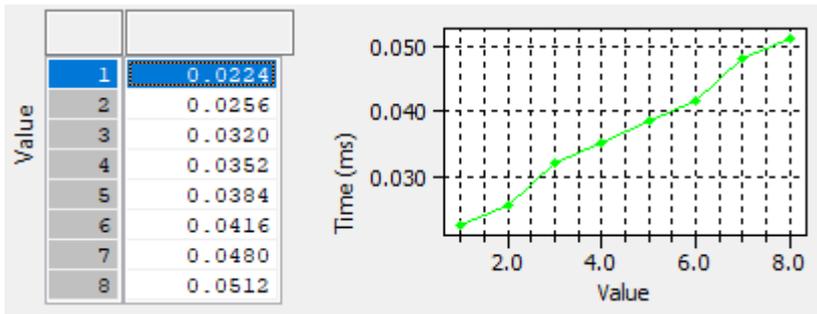
Injector Lag Time

The OEM injector lag time (latency) is not defined like a typical injector, it is set to 0 and then the compensation tables used to determine the correct lag time

Injector Minimum Open Time

The OEM injector lag time (latency) is not defined like a typical injector, it is set to 0 and then the compensation tables are used to determine the correct lag time

Injector Lag Time FP compensation

- Injector Lag Time FP Comp
- Injector Lag Time FP Comp - High Pressure
- Injector Lag Time FP Comp - Low Pressure
- Injector Lag Time FP Comp - Normal
- Injector Lag Time FP Comp - Too High Pressure

	Value			
1	0.0224			
2	0.0256			
3	0.0320			
4	0.0352			
5	0.0384			
6	0.0416			
7	0.0480			
8	0.0512			

The axis of this map is fuel pressure and the output is milliseconds, these are added to the 0ms base time to form a lag time value.

Injector Narrow Pulse-width Linearization Compensation

Linearisation
- ☐ Fuel Pressure High - High Threshold
- ☐ Fuel Pressure High - Idle Threshold
- ☐ Fuel Pressure High - Low Threshold
- ☐ Fuel Pressure High Target - High Threshold
- ☐ Fuel Pressure High Target - Idle Threshold
- ☐ Fuel Pressure Normal - Idle Threshold
- ☐ Fuel Pressure Normal - Low Threshold
- ☐ Fuel Pressure Normal Target - High Threshold
- ☐ Narrow IPW High Target Fuel Pressure - Normal Pressure
- ☐ Narrow IPW High Target Fuel Pressure - Pressure too high
- ☐ Narrow IPW Idle Target Fuel Pressure - High Pressure
- ☐ Narrow IPW Idle Target Fuel Pressure - Normal Pressure
- ☐ Narrow IPW Idle Target Fuel Pressure - Pressure too high
- ☐ Narrow IPW Low Target Fuel Pressure - High Pressure
- ☐ Narrow IPW Low Target Fuel Pressure - Normal Pressure
- ☐ Narrow IPW Low Target Fuel Pressure - Pressure too high

Direct Injectors do have non-linearity characteristics at low pulse widths like Port injectors do. The Low Pulse width linearization maps are split into fuel rail pressure modes and injector drive current phases.

The chart below explains the map functions, they will only need to be adjusted if aftermarket injectors are fitted.
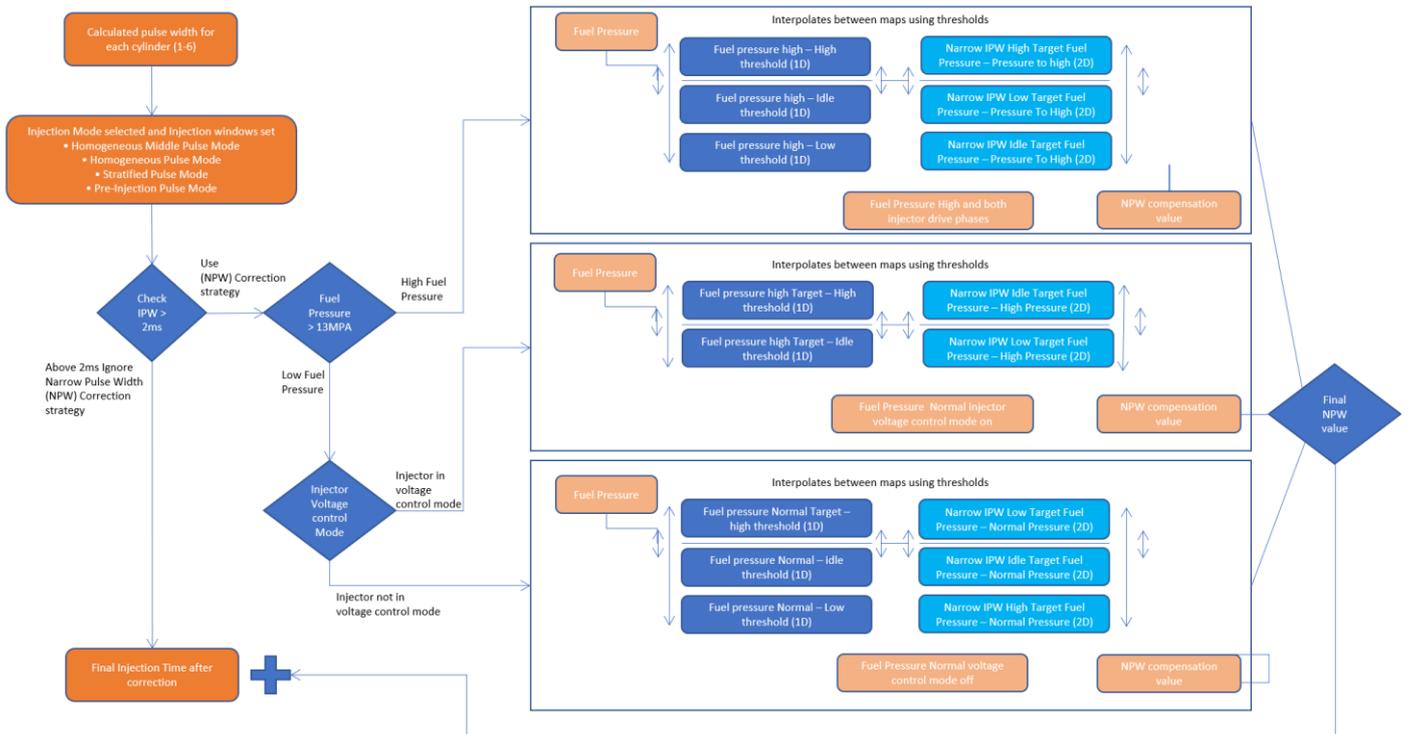
Fuel pressure high Target – Idle threshold (1D)

| 16.5 | Fuel Pressure (MPa) |

These 1D values are used to interpolate. They are compared to the current *Fuel Pressure* value and the difference between the respective threshold values. The difference sets the interpolation factor between the 2D **Narrow IPW Target Fuel Pressure – Pressure** maps as per the diagram above. These values will not need to be changed unless the injectors have been upgraded, the injector supplier should give changes to these values if required.

Narrow IPW Idle Target Fuel Pressure – High Pressure

0.350	-0.07840 ms
0.350	-0.07840
0.400	-0.00960
0.450	0.02240
0.600	-0.02880
0.701	-0.03040
0.800	0.00000
0.901	-0.02400
1.000	0.00000
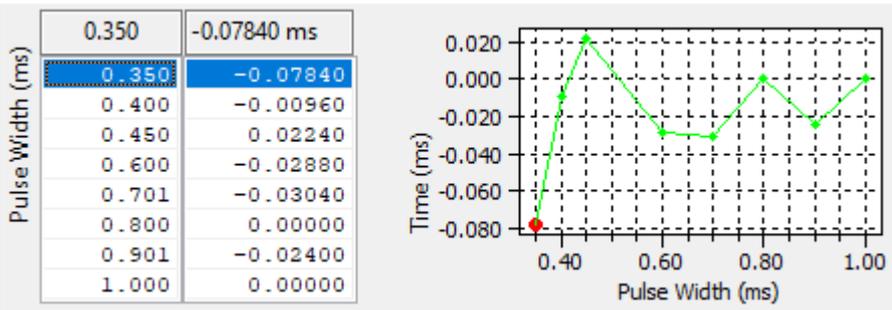
These tables and the similar tables use the interpolation amounts of the 1D pressure thresholds to set the desired addition to pulse width. There are 2 or three maps per mode shown in the diagram above. They have initial injector open time as the input and output a value to add to this current injector time. These values will not need to be changed unless the injectors have been upgraded, the injector supplier should give changes to these values if required.

Injector Current Characterisation

Introduction

The injectors are driven in a peak and hold fashion per fuel pressure mode, there are individual times currents and delays involved for each of these modes, the modes are

- High Pressure Failure
- High Pressure
- Normal Pressure
- Low Pressure

The current drive pattern is the same as most other injector drivers and is roughly represented below.
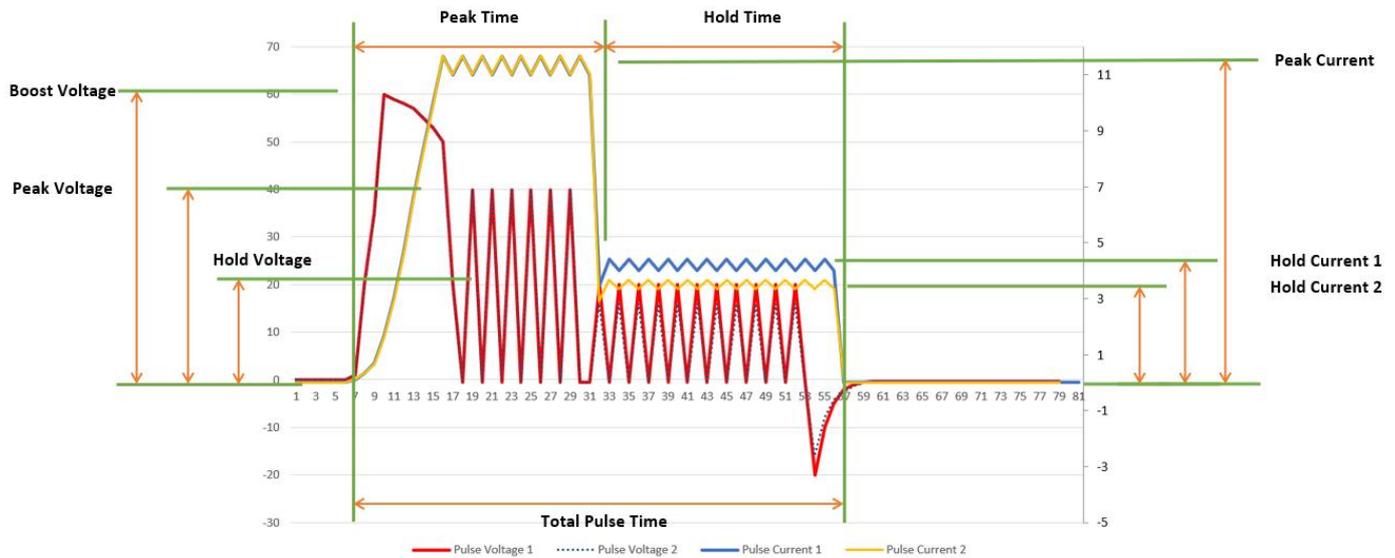
The pressure mode map list consists of the maps below, there is a tree for each pressure mode.

Pressure thresholds

22.0	Fuel Pressure (MPa)

Threshold for Fuel pressure being too high, the pump current is then controlled accordingly.

Injector Current Switch Pulse Width

0.608	Pulse Width (ms)

Initial Peak time switch point when the injector drive switch from peak to hold mode.

Injector Delay Time initial

0	Time (ms)

Initial delay timer for the total pulse to start

Injector Hold 1 Current Initial

5.40   Hold Current (A)

The target hold current for injection mode 1

Injector Hold 2 Current Initial

3   Hold Current (A)

The target hold current for injection mode 2

Injector Hold Time Initial

0   Time (ms)

The initial time of the hold current phase. If the total pulse duration is not long enough hold pulse won't be used

Injector Hysteresis Initial

0.400   Hysteresis Current (A)

Hysteresis value for PWM control when the current drops below this the voltage is increased again.

Injector Peak Current Initial

11   Peak Current (A)

The target peak current during the peak drive phase

Injector T2 Delay Time Initial

0   Delay Time (ms)

Hold delay time for injection mode 2

Ignition Timing

Introduction

The OEM ignition timing strategy is very good when applied to a stock car but difficult and restrictive to tune for high power applications. RaceROM adds easy to use larger maps with high precision load input axis for improved control and range. Supporting maps are also added for further safety.

The VR30DDTT platform uses a Maximum Best Torque (MBT) timing map, a base map (knock limited) and an ignition timing maximum allowed map to determine the base timing, it will choose the lowest value of the Base MBT or max map and then apply the engine conditions corrections and the knock detection correction amounts.

There is a safe mode (low octane) map that is switched to if the car enters a limp mode (DTC's) or high knock levels have been sustained for a set period, it may also switch on a refuelling event, but this is yet to be confirmed. This diagram below illustrates the control function, it doesn't include all of the maps and parameters of the function but the major inputs are included,
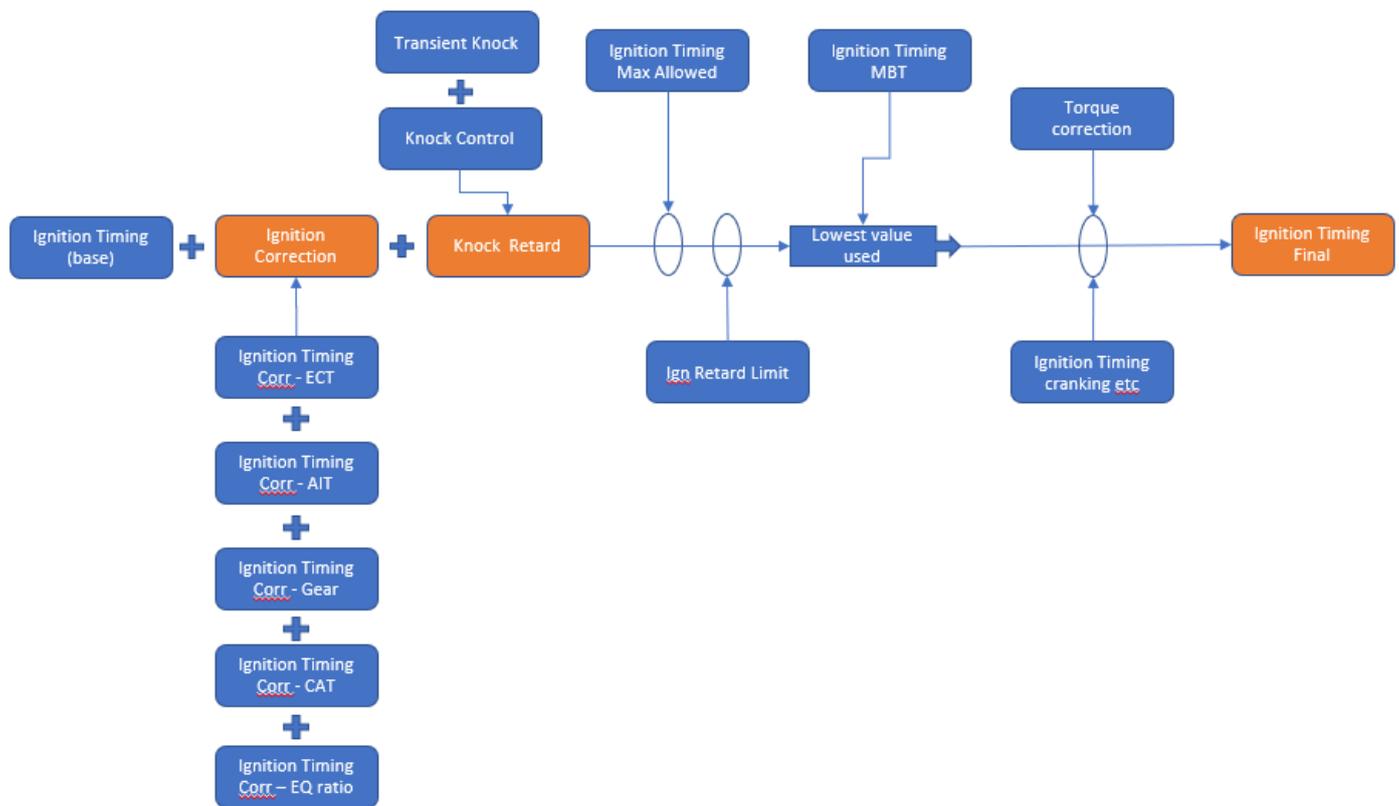
Live Data Parameters

- *Ignition Timing Base (°) – Current base ignition timing in degrees BTDC, negative means ATDC*
- *Ignition Timing Base lookup (°) – Current ignition timing map output in degrees BTDC, negative means ATDC*
- *Ignition Charge air correction (°) – Current ignition timing correction for CAT degrees*
- *Ignition Final (°) – Current actual ignition timing in degrees BTDC, negative means ATDC*
- *Ignition MBT (°) – Calculated MBT ignition timing in degrees BTDC for use in Torque Calcs and max Limits*
- *Ignition Timing (°) – Current actual ignition timing in degrees BTDC, negative means ATDC*
- *Ignition Timing Correction (°) – Ignition timing correction amount*
- *Knock Retard (°) – Offset due to knock, negative is retard, positive is dynamic advance on GEN 2*

Map List

- Ignition Timing
  - Correction
    - ☐ Ignition Timing Correction - Charge Air Multiplier
    - ☐ Ignition Timing - Charge Air Correction
    - ☐ Ignition Timing - Per Gear Correction
    - ☐ Ignition Timing Corr - Coolant Temp Coefficient
    - ☐ Ignition Timing Corr - Coolant Temp Threshold
    - ☐ Ignition Timing Corr - Intake Air Temp Coefficient
    - ☐ Ignition Timing Corr - Intake Air Temp Reference
    - ☐ Ignition Timing Correction - Equivalence Ratio
    - ☐ Ignition Timing Correction - Per Gear Threshold
  - Cranking
  - Idle
  - Knock Control
    - ☐ Knock Control on/off
    - ☐ Knock Retard Limiter
    - ☐ Knock Sensitivity 1
    - ☐ Knock Sensitivity 2
  - ☐ Ignition Timing
  - ☐ Ignition Timing - Safe Mode
  - ☐ Ignition Timing - Max Allowed
  - ☐ Ignition Timing - Max Allowed Mode 2
  - ☐ Ignition Timing - Max Allowed Mode 3
  - ☐ Ignition Timing - Max Allowed Mode 4
  - ☐ Ignition Timing Mode 2
  - ☐ Ignition Timing Mode 3
  - ☐ Ignition Timing Mode 4
  - ☐ Ignition MBT 1 SCV Closed
  - ☐ Ignition MBT 1 SCV Open
  - ☐ Ignition MBT 2 SCV Closed
  - ☐ Ignition MBT 2 SCV Open
  - ☐ Ignition Retard - Torque Reduction
  - ☐ Ignition Timing retard limit
  - ☐ Ignition Timing retard limit
  - ☐ Ignition Timing retard limit
  - ☐ Ignition Timing retard limit

Ignition Timing Mode1 (Mode 2, Mode 3 & Mode 4)

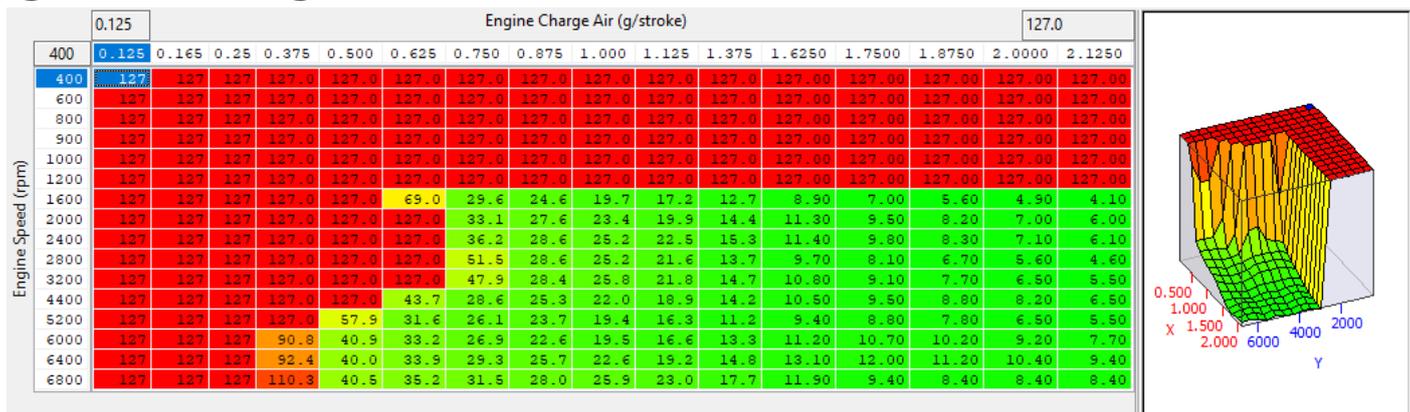| 0.125						Engine Charge Air (g/stroke)									80.0 °
400	**0.125**	0.165	0.25	0.375	0.50	0.625	0.75	0.875	1.000	1.125	1.3750	1.6250	1.7500	1.8750	2.0000	2.1250
400	80	68.8	45.0	25.0	13.0	1.0	−9.0	−12.0	−15.0	−16.0	−18.00	−20.00	−21.00	−22.00	−23.00	−23.00
600	80	70.4	50.0	30.0	22.0	9.0	0.0	−3.0	−5.0	−6.0	−7.00	−8.00	−8.00	−8.00	−8.00	−8.00
800	80	72.0	55.0	40.0	25.0	16.0	9.0	5.0	3.0	2.0	0.00	−1.00	−1.00	−2.00	−2.00	−3.00
900	80	76.0	67.5	47.5	30.0	19.0	13.0	6.5	3.5	2.0	0.00	−1.00	−1.00	−2.00	−2.00	−3.00
1000	80	80.0	80.0	55.0	35.0	22.0	13.0	8.0	4.0	2.0	0.00	−1.00	−1.00	−2.00	−2.00	−3.00
1200	80	80.0	80.0	55.0	40.0	23.5	14.0	10.3	7.0	5.0	4.40	3.00	2.00	1.00	0.00	−1.00
1600	80	80.0	80.0	55.0	47.5	28.0	19.2	15.6	11.0	9.5	6.00	2.00	0.00	0.00	0.00	0.00
2000	80	80.0	80.0	60.0	50.0	37.0	23.5	21.0	17.0	13.5	8.30	5.50	3.70	2.10	1.80	1.60
2400	80	80.0	80.0	60.0	50.0	40.4	28.0	20.8	18.0	15.0	9.10	5.10	4.10	3.40	2.40	1.40
2800	80	80.0	80.0	60.0	45.3	39.0	28.0	19.5	19.0	16.0	9.20	7.00	5.30	4.40	3.40	2.40
3200	80	73.6	60.0	52.0	40.0	32.0	27.5	20.3	19.0	15.3	9.20	6.90	5.60	4.10	2.60	1.60
4400	80	73.6	55.0	38.0	28.0	24.0	20.3	18.3	15.4	12.8	8.10	5.50	4.30	3.60	3.00	1.30
5200	80	73.6	55.0	38.0	29.0	24.0	18.3	17.5	13.5	11.6	7.50	6.20	5.50	4.50	3.20	2.20
6000	80	73.6	55.0	38.0	30.0	24.2	18.3	15.9	12.4	11.3	8.40	7.30	6.60	4.10	3.10	2.60
6400	80	73.6	55.0	38.0	30.6	26.6	22.9	19.8	18.2	15.7	11.00	9.00	7.70	4.90	4.10	3.10
6800	80	73.6	55.0	38.0	30.6	26.6	23.9	22.1	20.2	18.0	14.60	7.70	5.10	4.10	4.10	4.10

Four maps, one for each mapswitch mode providing an easy to understand and tune base ignition value in degrees BTDC. They provide increased precision and headroom for the load axis and increased RPM breakpoints. It's possible to create multiple maps and use map switching to cycle between each map for testing.

The numbers in these maps may not equal the final timing value as it will be subject to RaceROM corrections, knock control, dynamic advance and other OEM timing corrections.
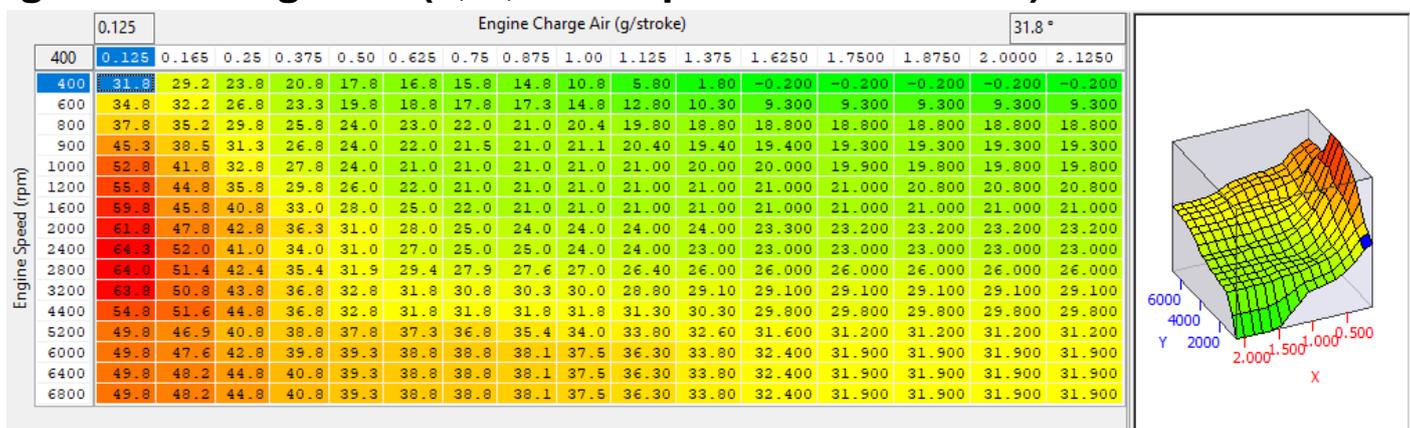
These maps are not employed in overrun and idle conditions where the OEM ignition control is used.

Ignition Timing – Max Allowed

| 0.125						Engine Charge Air (g/stroke)									127.0
400	**0.125**	0.165	0.25	0.375	0.500	0.625	0.750	0.875	1.000	1.125	1.375	1.6250	1.7500	1.8750	2.0000	2.1250
400	127	127	127	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.00	127.00	127.00	127.00	127.00
600	127	127	127	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.00	127.00	127.00	127.00	127.00
800	127	127	127	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.00	127.00	127.00	127.00	127.00
900	127	127	127	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.00	127.00	127.00	127.00	127.00
1000	127	127	127	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.00	127.00	127.00	127.00	127.00
1200	127	127	127	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.00	127.00	127.00	127.00	127.00
1600	127	127	127	127.0	127.0	69.0	29.6	24.6	19.7	17.2	12.7	8.90	7.00	5.60	4.90	4.10
2000	127	127	127	127.0	127.0	127.0	33.1	27.6	23.4	19.9	14.4	11.30	9.50	8.20	7.00	6.00
2400	127	127	127	127.0	127.0	127.0	36.2	28.6	25.2	22.5	15.3	11.40	9.80	8.30	7.10	6.10
2800	127	127	127	127.0	127.0	127.0	51.5	28.6	25.2	21.6	13.7	9.70	8.10	6.70	5.60	4.60
3200	127	127	127	127.0	127.0	127.0	47.9	28.4	25.8	21.8	14.7	10.80	9.10	7.70	6.50	5.50
4400	127	127	127	127.0	127.0	43.7	28.6	25.3	22.0	18.9	14.2	10.50	9.50	8.80	8.20	6.50
5200	127	127	127	127.0	57.9	31.6	26.1	23.7	19.4	16.3	11.2	9.40	8.80	7.80	6.50	5.50
6000	127	127	127	90.8	40.9	33.2	26.9	22.6	19.5	16.6	13.3	11.20	10.70	10.20	9.20	7.70
6400	127	127	127	92.4	40.0	33.9	29.3	25.7	22.6	19.2	14.8	13.10	12.00	11.20	10.40	9.40
6800	127	127	127	110.3	40.5	35.2	31.5	28.0	25.9	23.0	17.7	11.90	9.40	8.40	8.40	8.40

This is the Max allowed ignition timing, it is applied after the base map and corrections but before the torque reduction functions. It will cap the amount of corrections that can be applied ensuring sensible ignition values if sensors misread.

Ignition timing MBT (1, 2, SCV Open & SCV closed)

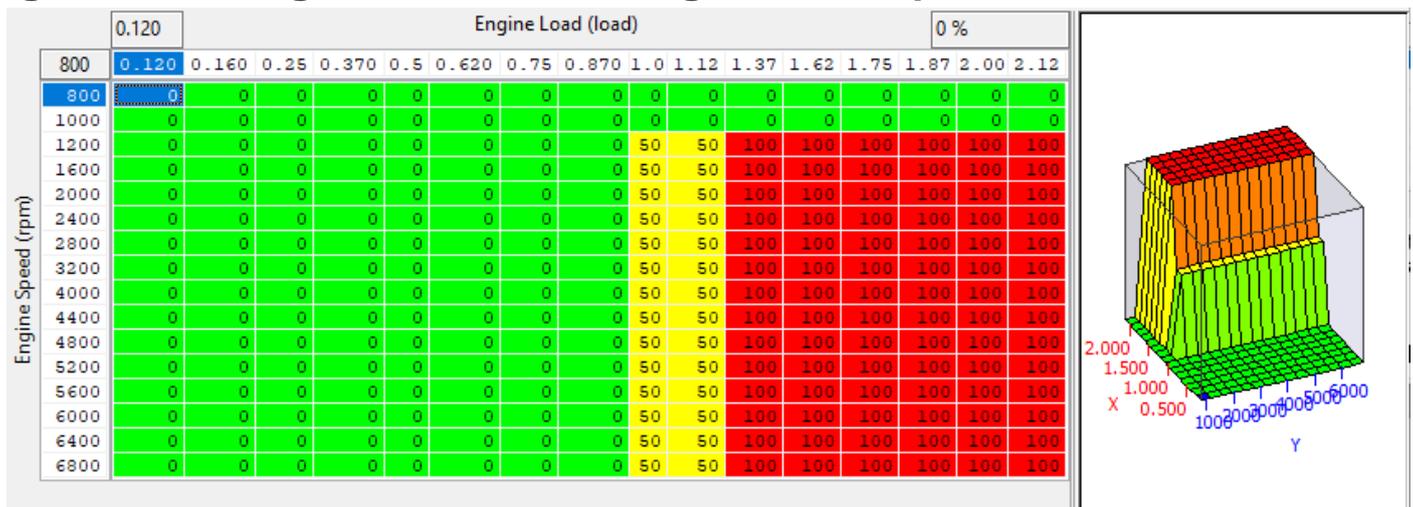| 0.125						Engine Charge Air (g/stroke)									31.8 °
400	**0.125**	0.165	0.25	0.375	0.50	0.625	0.75	0.875	1.00	1.125	1.375	1.6250	1.7500	1.8750	2.0000	2.1250
400	31.8	29.2	23.8	20.8	17.8	16.8	15.8	14.8	10.8	5.80	1.80	−0.200	−0.200	−0.200	−0.200	−0.200
600	34.8	32.2	26.8	23.3	19.8	18.8	17.8	17.3	14.8	12.80	10.30	9.300	9.300	9.300	9.300	9.300
800	37.8	35.2	29.8	25.8	24.0	23.0	22.0	21.0	20.4	19.80	18.80	18.800	18.800	18.800	18.800	18.800
900	45.3	38.5	31.3	26.8	24.0	22.0	21.5	21.0	21.1	20.40	19.40	19.400	19.300	19.300	19.300	19.300
1000	52.8	41.8	32.8	27.8	24.0	21.0	21.0	21.0	21.0	21.00	20.00	20.000	19.900	19.800	19.800	19.800
1200	55.8	44.8	35.8	29.8	26.0	22.0	21.0	21.0	21.0	21.00	21.00	21.000	21.000	20.800	20.800	20.800
1600	59.8	45.8	40.8	33.0	28.0	25.0	22.0	21.0	21.0	21.00	21.00	21.000	21.000	21.000	21.000	21.000
2000	61.8	47.8	42.8	36.3	31.0	28.0	25.0	24.0	24.0	24.00	24.00	23.300	23.200	23.200	23.200	23.200
2400	64.3	52.0	41.0	34.0	31.0	25.0	25.0	24.0	24.0	24.00	23.00	23.000	23.000	23.000	23.000	23.000
2800	64.0	51.4	42.4	35.4	31.9	29.4	27.9	27.6	27.0	26.40	26.00	26.000	26.000	26.000	26.000	26.000
3200	63.8	50.8	43.8	36.8	32.8	31.8	30.8	30.3	30.0	28.80	29.10	29.100	29.100	29.100	29.100	29.100
4400	54.8	51.6	44.8	36.8	32.8	31.8	31.8	31.8	31.8	31.30	30.30	29.800	29.800	29.800	29.800	29.800
5200	49.8	46.9	40.8	38.8	37.8	37.3	36.8	35.4	34.0	33.80	32.60	31.200	31.200	31.200	31.200	31.200
6000	49.8	47.6	42.8	39.8	39.3	38.8	38.8	38.1	37.5	36.30	33.80	32.400	31.900	31.900	31.900	31.900
6400	49.8	48.2	44.8	40.8	39.3	38.8	38.8	38.1	37.5	36.30	33.80	32.400	31.900	31.900	31.900	31.900
6800	49.8	48.2	44.8	40.8	39.3	38.8	38.8	38.1	37.5	36.30	33.80	32.400	31.900	31.900	31.900	31.900

This is the calibrated Maximum Best Torque (MBT) timing for the engine in its OEM form, the timing will be limited to this value if the requested timing is above this. You should not need to go above this timing value.

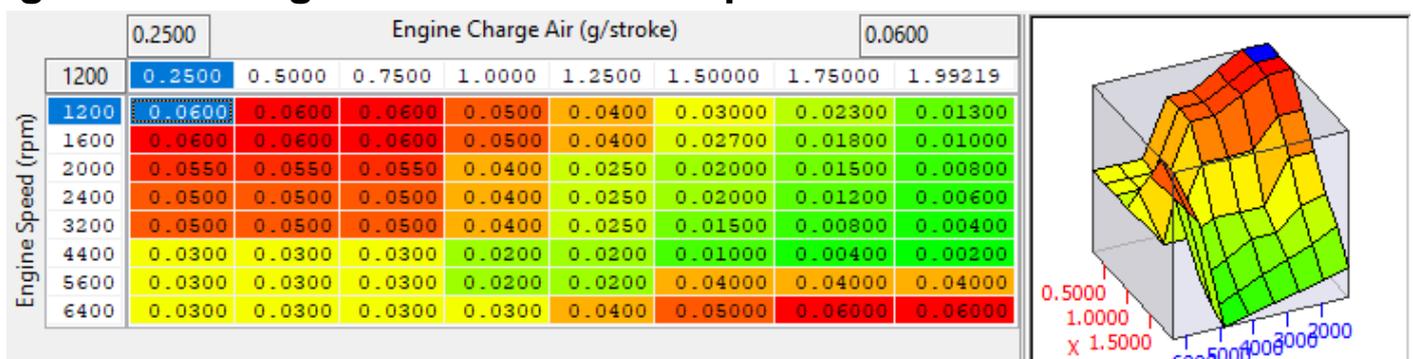# Ignition Timing - Charge Air Correction

-40	0 °
-40	0
-30	0
-20	0
-10	0
0	0
10	0
20	0
30	0
40	0
50	0
60	0
70	-1
80	-2
90	-3
100	-4
110	-5
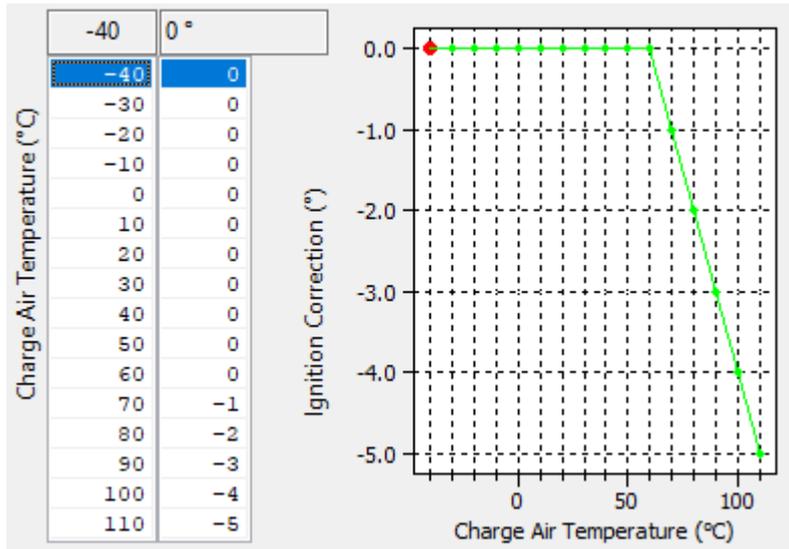
Ignition advance can be trimmed for increased charge air temperature using this map.

Ignition Timing Correction - Charge Air Multiplier

0.120	Engine Load (load)														0 %
800	0.120	0.160	0.25	0.370	0.5	0.620	0.75	0.870	1.0	1.12	1.37	1.62	1.75	1.87	2.00	2.12
800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
1600	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
2000	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
2400	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
2800	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
3200	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
4000	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
4400	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
4800	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
5200	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
5600	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
6000	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
6400	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100
6800	0	0	0	0	0	0	0	0	50	50	100	100	100	100	100	100

Ignition Timing Correction - Charge Air Correction value can be modified relative to RPM and engine load using this map. It would be normal to reduce advance in higher gears at high RPM or at an RPM sensitive to detonation.

Ignition Timing Corr – Coolant Temp Coefficient

0.2500	Engine Charge Air (g/stroke)							0.0600
1200	0.2500	0.5000	0.7500	1.0000	1.2500	1.50000	1.75000	1.99219
1200	0.0600	0.0600	0.0600	0.0500	0.0400	0.03000	0.02300	0.01300
1600	0.0600	0.0600	0.0600	0.0500	0.0400	0.02700	0.01800	0.01000
2000	0.0550	0.0550	0.0550	0.0400	0.0250	0.02000	0.01500	0.00800
2400	0.0500	0.0500	0.0500	0.0400	0.0250	0.02000	0.01200	0.00600
3200	0.0500	0.0500	0.0500	0.0400	0.0250	0.01500	0.00800	0.00400
4400	0.0300	0.0300	0.0300	0.0200	0.0200	0.01000	0.00400	0.00200
5600	0.0300	0.0300	0.0300	0.0200	0.0200	0.04000	0.04000	0.04000
6400	0.0300	0.0300	0.0300	0.0300	0.0400	0.05000	0.06000	0.06000

An ignition timing offset based on the difference between *Coolant Temperature* and **Ignition Timing Corr – Coolant Temp Threshold** this can be used to retard or advance the ignition for different coolant temperatures. The final correction amount due to coolant temperature is calculated using the following formula.
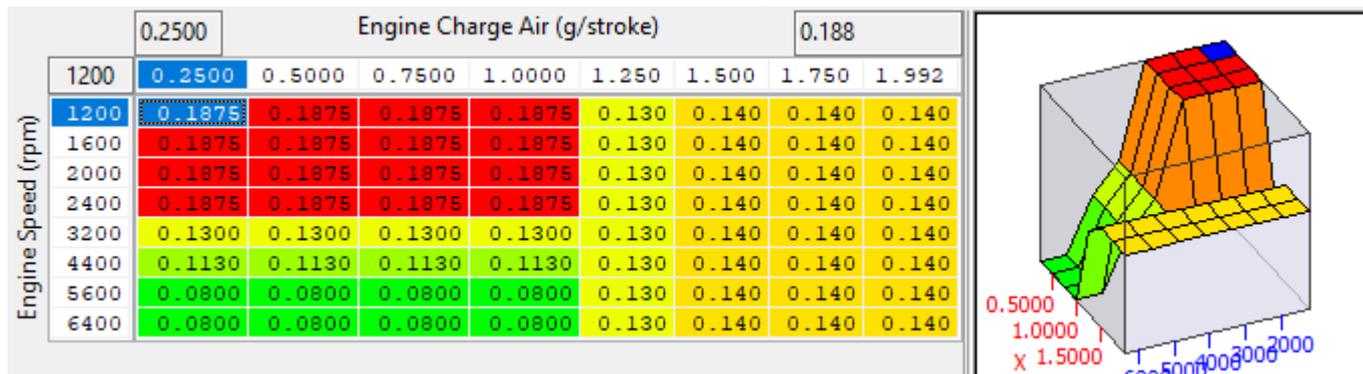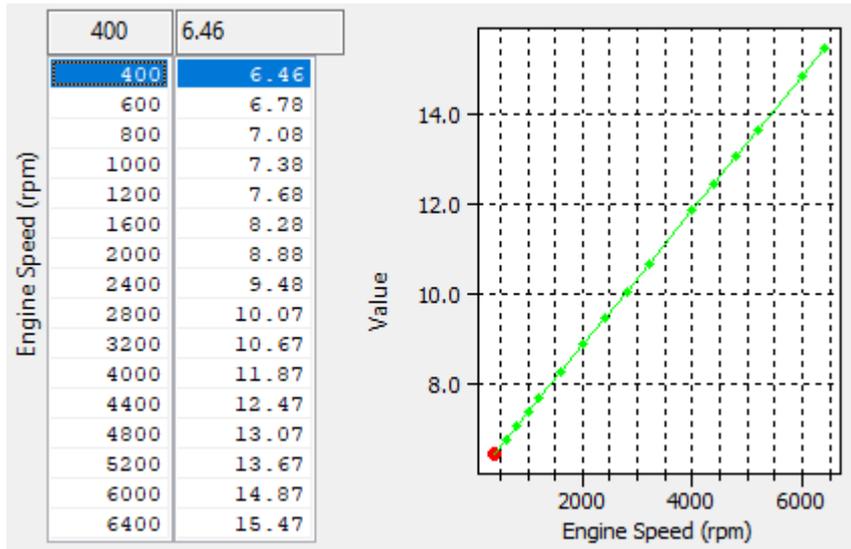
$$Coolant\ Temp\ Correction\ amount = (ECT\ threshold - current\ ECT) \times Coolant\ Temp\ Coefficient$$

Ignition Timing Corr – Coolant Temp Threshold

This is the value used in the formula to calculate the "difference" value that is multiplied by the RPM and the load scale map **Ignition Timing Corr – Coolant Temp Coefficient**,

Ignition Timing Corr – Intake Air Temp Coefficient

0.2500	Engine Charge Air (g/stroke)							0.188
1200	0.2500	0.5000	0.7500	1.0000	1.250	1.500	1.750	1.992
1200	0.1875	0.1875	0.1875	0.1875	0.130	0.140	0.140	0.140
1600	0.1875	0.1875	0.1875	0.1875	0.130	0.140	0.140	0.140
2000	0.1875	0.1875	0.1875	0.1875	0.130	0.140	0.140	0.140
2400	0.1875	0.1875	0.1875	0.1875	0.130	0.140	0.140	0.140
3200	0.1300	0.1300	0.1300	0.1300	0.130	0.140	0.140	0.140
4400	0.1130	0.1130	0.1130	0.1130	0.130	0.140	0.140	0.140
5600	0.0800	0.0800	0.0800	0.0800	0.130	0.140	0.140	0.140
6400	0.0800	0.0800	0.0800	0.0800	0.130	0.140	0.140	0.140

A modifier for ignition timing offset based on the difference between *Intake Air Temperature* and **Ignition Timing Corr – Intake Air Temp Reference** and can be used to retard or advance the ignition for different intake air temperatures. The final correction amount due to IAT is calculated using the following formula.

$$IAT\ Correction\ amount = (IAT\ Reference - current\ IAT) \times IAT\ Temp\ Coefficient$$

Ignition Timing Corr – Intake Air Temp Reference

0.25	gine Charge Air (g/strok							30 °C
1200	0.25	0.5	0.75	1.0	1.25	1.5	1.75	1.99
1200	30	30	30	30	30	30	30	30
1600	30	30	30	30	31	33	35	38
2000	30	30	30	30	31	33	35	38
2400	30	30	30	30	32	35	39	45
3200	30	30	30	32	34	38	42	45
4400	30	30	33	37	41	48	53	53
5600	32	32	35	42	51	58	60	60
6400	34	34	37	44	55	60	60	60
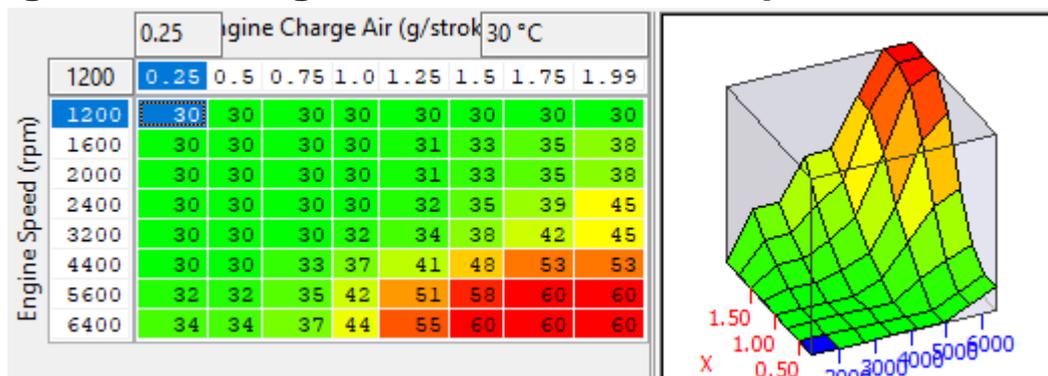
This map sets the reference value used by the multiplier map **Ignition Timing Corr – Intake Air Temp Coefficient** it is essentially an expected charge air temperature map for different engine speeds and load. This OEM strategy combined with RaceROM's charge air temperature correction method should be able to account for all air temperatures.

Ignition Timing Corr – Equivalence Ratio

Engine Speed (rpm)	Value
400	6.46
600	6.78
800	7.08
1000	7.38
1200	7.68
1600	8.28
2000	8.88
2400	9.48
2800	10.07
3200	10.67
4000	11.87
4400	12.47
4800	13.07
5200	13.67
6000	14.87
6400	15.47

This map multiplies the difference between Lambda 1 and the current lambda value and adds this to the correction calculations.
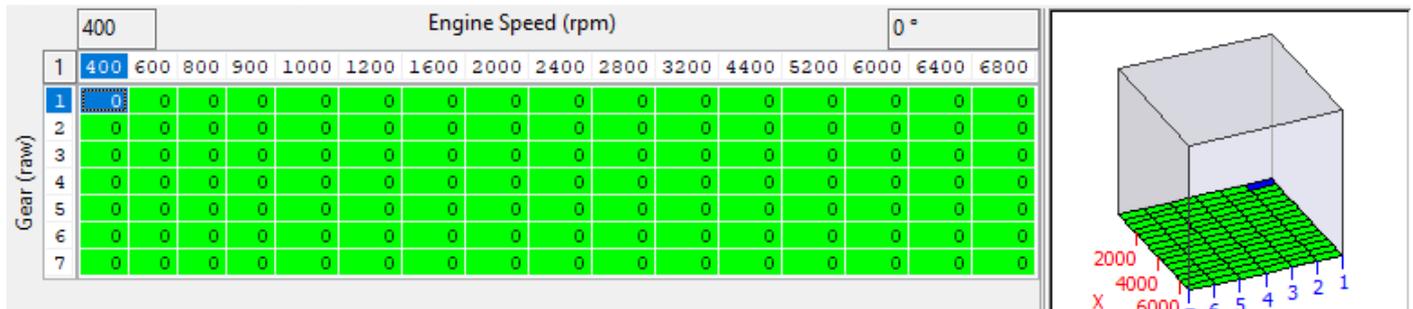
$$Eq\ Ratio\ Correction\ amount = (\lambda_{stoich} - current\ \lambda) \times Equivalence\ Ratio\ Corr\ map\ output$$

Ignition Timing Corr – Per Gear Threshold

1   min (load)

The load value (g/stroke) at which the per gear corrections become active.

Ignition Timing - Per Gear Correction

An amount of ignition retard (or addition) that is applied dependant on current gear and RPM. It is only applied after the load threshold has been exceeded. This can be used to compensate for the increased loading and heat generated in higher gears/high speed.

Knock Control

The knock retard systems in the VR30DDTT follow the Nissan method which involves control maps limiters and thresholds. There is a description on how the knock control strategy works on the EcuTek knowledgebase, for further reading

https://ecutek.zendesk.com/hc/en-gb/articles/115000200589-GT-R-Knock-Sensing

Knock Control on/off

0.125					Engine Load										0
400	0.125	0.165	0.25	0.375	0.5	0.625	0.75	0.875	1	1.13	1.38	1.63	1.75	1.88	2 2.13
400	0	0	0	0	0	0	0	0 0	0	0	0	0	0 0	0
600	0	0	0	0	0	0	0	0 0	0	0	0	0	0 0	0
800	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
900	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
1000	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
1200	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
1600	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
2000	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
2400	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
2800	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
3200	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
4400	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
5200	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
6000	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
6400	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1
6800	0	0	0	0	1	1	1	1 1	1	1	1	1	1 1	1

Easy to use enable (=1) or disable (=0) map based on load and RPM for application of knock retard calculated by the knock control strategy.

Knock Retard Limiter

0.125			Value					-7
400	0.125	0.25	0.375	0.50	0.625	0.75	0.875	1.00
400	-7	-7	-7	-7	-7	-7	-7	-7
1000	-7	-7	-10	-10	-10	-10	-10	-10
1600	-7	-7	-10	-10	-10	-10	-10	-10
2400	-7	-7	-10	-10	-10	-10	-10	-10
3200	-7	-7	-10	-10	-10	-10	-10	-10
4000	-7	-7	-10	-10	-10	-10	-10	-10
4800	-7	-7	-10	-10	-10	-10	-10	-10
6400	-7	-7	-10	-10	-10	-10	-10	-10
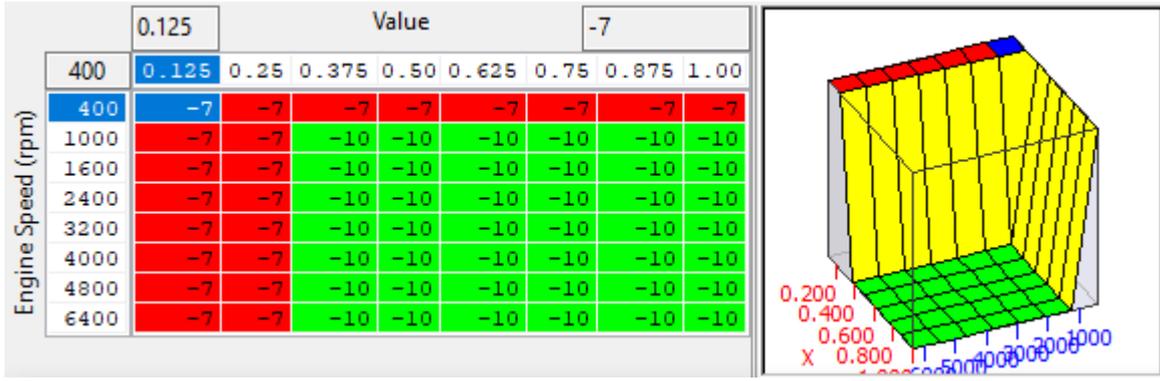
Limit applied to the amount of retard that can be set by the knock control strategy. Based on engine load and RPM the output is in degrees and could be used to limit the amount of knock retard.

Knock Retard Sensitivity 1

400							Engine Speed (rpm)								256.0	
1	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5600	6000	6400	6800
1	256	15	15	17	17.0	26.8	28.1	31.8	36.3	41.9	48.3	55.8	73.4	79.0	94.8	106.9
2	256	18	18	18	18.0	27.0	33.0	36.8	41.5	47.1	53.5	65.0	80.0	90.0	100.0	109.3
3	256	18	18	18	22.0	30.0	33.0	47.0	53.0	59.0	67.0	72.0	80.0	95.0	100.0	110.0
4	256	17	17	17	21.0	29.0	30.0	40.0	50.0	56.0	66.0	73.0	94.0	105.0	110.0	120.0
5	256	15	15	15	18.7	21.0	21.8	26.3	31.1	36.3	41.9	47.8	60.8	67.8	75.3	83.0
6	256	15	15	15	15.0	17.0	21.8	25.2	29.2	33.8	38.9	44.7	55.0	65.5	73.7	82.4
7	256	256	256	256	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0
8	256	256	256	256	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0	256.0

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, 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.

NOTE: the logging rate for per cylinder knock output cannot capture all knock events so use with caution!

Ignition Timing – Torque Reduction

0.00000	0 °
0.00000	0
0.00315	3
0.01000	6
0.03000	9
0.05000	12
0.08000	15
0.11000	18
0.15000	21
0.20000	24
0.31000	28
0.44000	32
0.59000	36
0.72000	40
0.84000	44
0.95000	48
1.00000	50
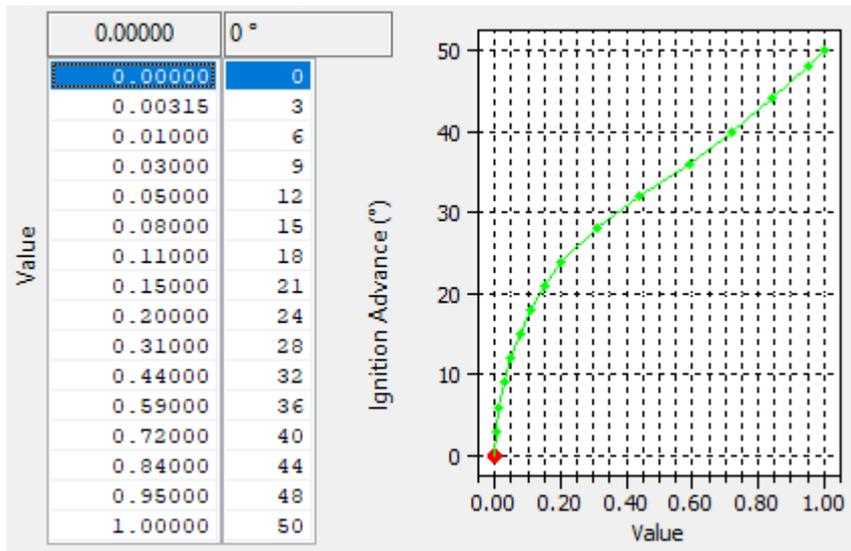
This is the amount of retard (in degrees) applied for a given torque reduction percentage. Requests from other control functions such as Limit Modes or commands from other modules like the TCM, ABS or stability control module.

Ignition Timing Retard Limit

0.125						Engine Charge Air (g/stroke)								25.0	
400	0.125	0.1650	0.2500	0.3750	0.5000	0.62500	0.75000	0.875	1.000	1.125	1.375	1.625	1.750	1.88	2.00	2.13
400	25.00	25.000	-2.00	-16.00	-19.90	-17.400	-17.400	-17.4	-17.4	-17.4	-17.4	-17.4	-17.4	-17	-17	-17
600	27.00	27.000	-2.00	-16.00	-19.90	-17.400	-17.400	-17.4	-17.4	-17.4	-17.4	-17.4	-17.4	-17	-17	-17
800	28.00	28.000	-2.00	-16.00	-19.40	-17.400	-17.400	-17.4	-17.4	-17.4	-17.4	-17.4	-17.4	-17	-17	-17
900	32.00	30.000	-2.00	-16.00	-21.50	-17.200	-16.400	-16.7	-17.4	-17.4	-17.4	-17.4	-17.4	-17	-17	-17
1000	12.00	0.000	-8.20	-17.30	-19.10	-14.600	-14.600	-14.9	-16.4	-17.4	-17.4	-17.4	-17.4	-17	-17	-17
1200	6.10	-2.000	-14.40	-18.60	-16.80	-15.400	-15.100	-14.9	-16.4	-17.4	-17.4	-17.4	-17.4	-17	-17	-17
1600	12.40	1.900	-11.10	-15.20	-12.80	-12.300	-13.500	-14.9	-15.9	-16.4	-17.0	-17.4	-17.4	-17	-17	-17
2000	14.70	0.200	-9.90	-12.90	-12.30	-11.400	-12.600	-12.9	-13.9	-14.8	-16.4	-17.0	-17.4	-17	-17	-17
2400	16.50	3.500	-3.90	-9.00	-14.00	-12.200	-11.800	-10.9	-12.4	-14.2	-16.4	-17.4	-17.4	-17	-17	-17
2800	23.50	4.400	-1.90	-9.80	-9.30	-7.400	-7.000	-7.9	-8.9	-11.0	-16.4	-17.0	-17.4	-17	-17	-17
3200	24.90	9.900	1.60	-3.40	-6.80	-5.400	-5.000	-5.9	-7.4	-9.6	-15.7	-17.0	-17.4	-17	-17	-17
4400	18.50	14.200	7.10	4.10	1.20	-0.400	-0.400	-1.5	-4.3	-7.2	-11.4	-12.0	-12.4	-12	-12	-12
5200	17.50	13.300	7.70	4.30	2.60	1.600	1.000	-1.0	-3.8	-5.4	-5.7	-7.5	-8.6	-10	-10	-10
6000	18.30	15.300	8.90	4.50	3.40	2.600	2.000	0.5	-1.4	-2.8	-5.0	-7.5	-8.6	-10	-10	-10
6400	18.30	15.300	8.90	4.50	3.40	2.600	2.000	0.5	-1.4	-2.8	-5.0	-7.5	-8.6	-10	-10	-10
6800	18.30	15.300	8.90	4.50	3.40	2.600	2.000	0.5	-1.4	-2.8	-5.0	-7.5	-8.6	-10	-10	-10

This is the minimum achievable timing after all the corrections are applied, if you need to apply greater amounts of retard for torque control or shift torque reduction adjust these maps.

Limiters

Introduction

The VR30DDTT has many safety limiters, raising limiters without understanding may cause issues. When attempting to generate more power though certain limiters may need to be increased or decreased.

Map List

```
Limiters
  Brake on Switch
      □ BOS Delay Time
      □ BOS Delta APO Speed Threshold
      □ BOS Delta APO Threshold High Speed
      □ BOS Delta APO Threshold Low Speed
      □ BOS Interval Time
      □ BOS Limiter Time 1
      □ BOS Limiter Time 2
      □ BOS Opening Limiter 1
      □ BOS Opening Limiter 2
      □ BOS Opening Limiter Increment Rate 1
      □ BOS Opening Limiter Increment Rate 2
      □ BOS Opening Limiter Reduction Rate 1
      □ BOS Opening Limiter Reduction Rate 2
  □ Rev Limit
  □ Vehicle Speed Limit
  □ Vehicle Speed Limit Fuel Cut
  □ Vehicle Speed Limit Fuel Cut resume
  □ High Vehicle Speed cut rpm
  □ High Vehicle Speed cut rpm hysteresis
  □ Rev Limit - All Cylinder
  □ Rev Limit - Reverse
  □ Rev Limit - Stationary
  □ Rev Limit - Vehicle Speed
  □ Throttle Angle Max
  □ Throttle Angle Max - Trustful
  □ Vehicle Speed Limit
```

Rev Limit

| 6700 | Engine Speed (rpm) |

This is the normal rev limit of the car, it starts with throttle closing and then a partial fuel cut, raise this if required.

> Be aware that the TCM still has a shift limit so it will always shift at a set RPM.

Rev Limit – All Cylinder

| 6950 | Engine Speed (rpm) |
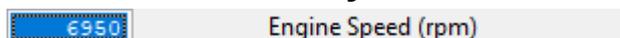
This is the full fuel cut "all cylinder" RPM limit, This value should always be greater than the **Rev Limit** value.

Rev Limit – Reverse

| 6950 | Engine Speed (rpm) |

Rev limit when in reverse gear.

Rev Limit – Stationary

| 4760 | Engine Speed (rpm) |

Rev limit when stationary

Rev Limit – Vehicle Speed

Vehicle Speed (km/h)	Engine Speed (rpm)
0	6375 rpm
0	6375
16	6375
32	6375
48	6375
64	6375
80	6375
96	6375
112	6375
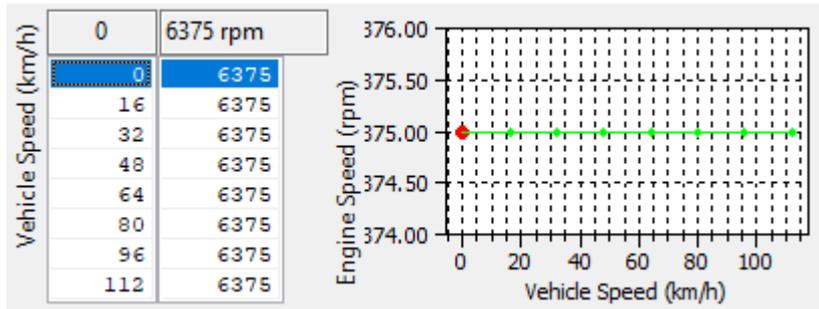
Secondary rev limit at individual vehicle speeds, the TCM will still limit RPM by shifting.

Vehicle Speed Limit

| 240 | Vehicle Speed (km/h) |

Primary speed limiter in Km/h

Vehicle Speed Limit

| 150 | Vehicle Speed (km/h) |

Secondary speed limit, raise if you find it limiting the vehicle speed.

Vehicle Speed Limit Fuel Cut & Resume

| 244 | Vehicle Speed (km/h) |
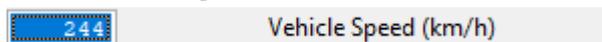
Fuel Cut will occur above this vehicle speed

| 240 | Vehicle Speed (km/h) |

Fuel Cut will end when the vehicle speed returns below this value.

Throttle Angle Max & Trustful

Engine Speed (rpm)	Throttle
800	91.2
800	91.2
1600	91.2
2400	91.2
3200	91.2
4000	91.2
4800	91.2
5600	91.2
6375	91.2
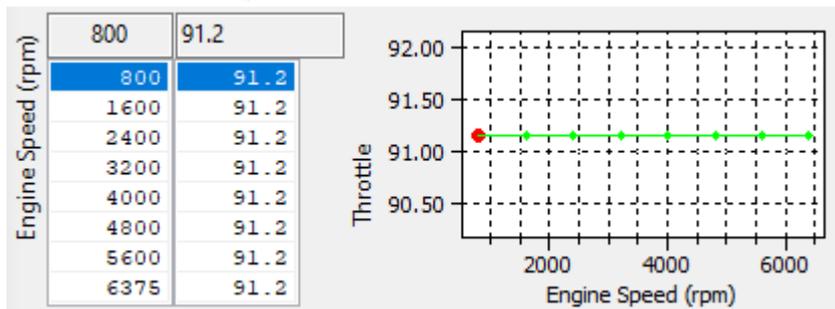
Maximum allowed throttle angle at independent engine speeds, the trustful map must match this exactly.

Brake On Switch (BOS) limiters

As with most modern ECU's there is a fail safe to cut the accelerator pedal input when the brake pedal is applied at the same time as the accelerator, this is a safety feature to slow the car if the driver or driving signals are not being received correctly to prevent the car from accelerating without driver input. This feature can be adjusted or disabled to allow the brake to be applied while applying the accelerator pedal for use while brake boosting etc.

The diagram below shows which maps are responsible for which part of the BOS limit process
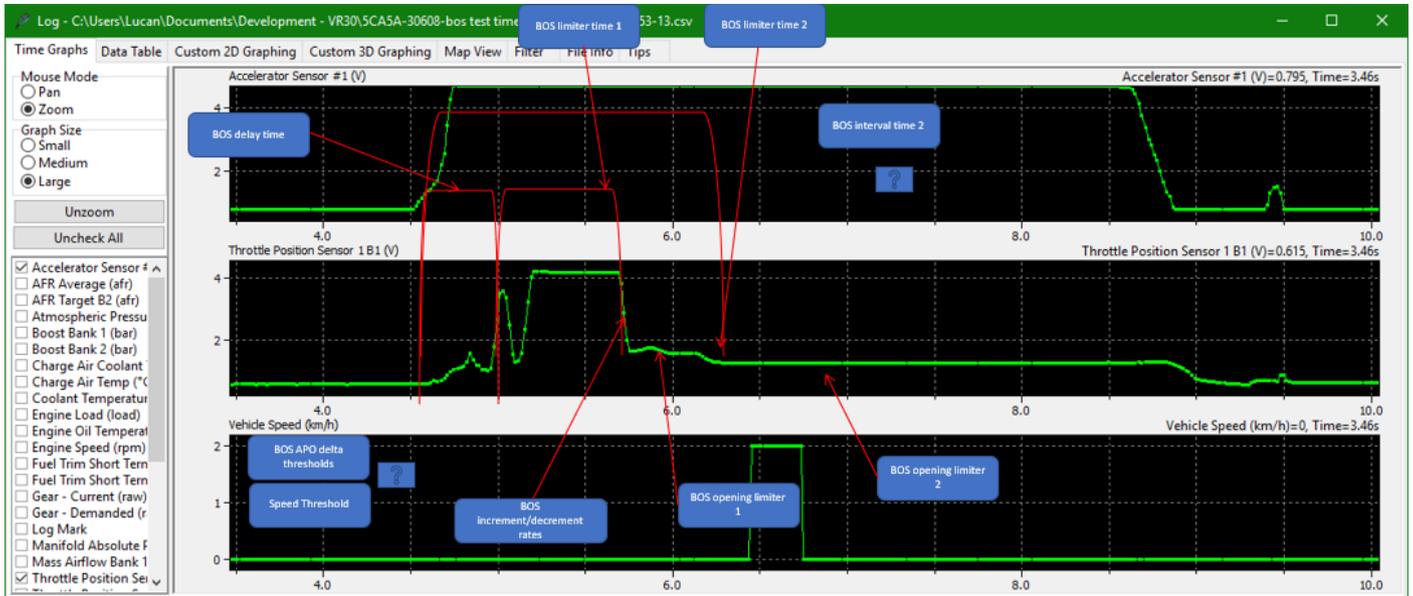
BOS Delay Time

The delay time before the BOS limiter adjusts accel pedal output amount.

BOS Delta APO Speed Threshold

The vehicle speed to differentiate between **BOS Delta APO Speed Threshold High Speed & Low Speed**

BOS Delta APO Speed Threshold High Speed

The function of these are not completely understood but they appear to be the activation thresholds based on accel pedal position. Changing these had little effect on our test vehicle.

BOS Delta APO Speed Threshold Low Speed

The function of these is not completely understood but they appear to be the activation thresholds based on accel pedal position. Changing these had little effect on our test vehicle.

BOS Interval Time

The function of this value is currently unknown but may be related to the maximum time allowed before any BOS limits are applied or possibly the time before reactivation.

BOS Limiter Time 1

The time to wait before the **BOS Opening Limit 1** accel pedal adjustment is applied.

BOS Limiter Time 2

5	Time (s)

The time to wait before the **BOS Opening Limit 2** accel pedal adjustment is applied.

BOS Opening Limiter 1

25	Accel Pedal (%)

Limit applied to the Accel pedal input for torque calculations while before the **BOS Limiter Time 1** is, this will need to be raised to allow more accel pedal to be applied with the brake switch on.

BOS Opening Limiter 2

5.00	Accel Pedal (%)

Limit applied to the Accel pedal input for torque calculations while before the **BOS Limiter Time 2** is, this will need to be raised to allow more accel pedal to be applied with the brake switch on.

BOS Opening Limiter Increment Rate 1

0.375	Accel Pedal (%)

Rate at which the accel pedal is raised from the **BOS Opening Limiter 1** set point when the brake pedal is released. This is likely to be used for the BOS limits applied above **BOS Delta APO Speed threshold.**

BOS Opening Limiter Increment Rate 2

100	Accel Pedal (%)

Rate at which the accel pedal is raised from the **BOS Opening Limiter 2** set point when the brake pedal is released. This is likely to be used for the BOS limits applied below **BOS Delta APO Speed threshold.**

BOS Opening Limiter Reduction Rate 1

100	Accel Pedal (%)

Rate at which the accel pedal is lowered to the **BOS Opening Limiter 1** set point when the brake pedal is applied. This is likely to be used for the BOS limits applied above **BOS Delta APO Speed threshold.**

BOS Opening Limiter Reduction Rate 2

0.25	Accel Pedal (%)

Rate at which the accel pedal is lowered to the **BOS Opening Limiter 1** set point when the brake pedal is applied. This is likely for the BOS limits applied below **BOS Delta APO Speed threshold.**

Sensor Scaling

Introduction

Sensor scaling is the category that contains all the sensor-based scaling factors relevant to tuning the VR30DDTT engine. If there are sensors that you wish to replace with aftermarket types use the sensor scaling maps and enter the values of the new sensors.

Map List

```
⊟ Sensors
  ⊟ Front O2
    ─☐ O2 Sensor to AFR
    ─☐ AF Sensor Correction - Exhaust Pressure Estim…
    ─☐ AF Sensor Correction for Exhaust Pressure
  ⊟ Fuel Pressure
    ─☐ Fuel Pressure Scaling - Pressure Offset
    ─☐ Fuel Pressure Scaling - Voltage Multiplier
  ⊟ Knock
    ─☐ Frequency Mask - Cylinder Charge Hysteresis
    ─☐ Frequency Mask - Cylinder Charge Lower Limit
    ─☐ Frequency Mask - Cylinder Charge Upper Limit
    ─☐ Frequency Mask - Engine Speed Hysteresis
    ─☐ Frequency Mask - Engine Speed Lower Limit
    ─☐ Frequency Mask - Engine Speed Upper Limit
    ─☐ Frequency Mask Enable Switches
  ⊟ Manifold Pressure
    ─☐ MAP Sensor Scaling - Pressure Offset
    ─☐ MAP Sensor Scaling - Voltage Multiplier
  ⊟ Mass Airflow
    ─☐ MAF Sensor Q-Hz conversion Bank 1
    ─☐ MAF Sensor Q-Hz conversion Bank 2
    ─☐ BFS Multiplier (K-Factor)
    ─☐ MAF Sensor Scale (% to g/s) for Load
  ⊟ Temperature
    ─☐ Exhaust Temperature scaling
```

Live Data Parameters

- *AF Sensor B1 (V) – Voltage output of the AFR sensor bank 1*
- *AF Sensor B21 (V) – Voltage output of the AFR sensor bank 2*
- *AFR Bank 1 (AFR) – Bank 1 Sensor output in AFR counts as seen by the ECU after corrections*
- *AFR Bank 2 (AFR) – Bank 2 Sensor output in AFR counts as seen by the ECU after corrections*
- *AFR Calibrated – AFR value according to polynomial calculation based on wideband measured AFR*
- *Fuel Pressure (MPA) – Absolute measured fuel pressure output of High pressure fuel rail in Mpa*
- *Fuel Pressure Sensor (mV) – Voltage output of High pressure fuel rail sensor in millivolts*
- *Knock Index - Cylinder 1 to 6 – Knock count value as seen by the ECU for each individual cylinder*
- *Knock Threshold – Cylinder 1 to 6 – The set knock threshold output of the knock threshold map.*
- *Boost Sensor 1 & 2 (bar) – Boost sensor output value in Bar*
- *Manifold Pressure Sensor (V) – Voltage output of the Manifold pressure sensor*
- *Manifold Absolute Pressure (bar) – Absolute pressure measure in the manifold.*

- *Mass Airflow (g/s) – Converted Mass airflow after MAF sensor output processing*
- *Mass airflow Bank 1 (% load) – Bank 1 specific load converted output of MAF sensor (not corrected)*
- *Mass airflow Bank 2 (% load) – Bank 2 specific load converted output of MAF sensor (not corrected)*
- *Mass Airflow Sensor Freq B1 – Bank 1 MAF sensor output frequency*
- *Mass Airflow Sensor Freq B1 – Bank 2 MAF sensor output frequency*
- *Exhaust Temp 1 B1 (V) – Voltage output of EGT sensor for bank 1*
- *Exhaust Temp 1 B2 (V) – Voltage output of EGT sensor for bank 2*
- *Exhaust Temp B1 (℃) – Converted Exhaust gas temperature for Bank 2*
- *Exhaust Temp B2 (℃) – Converted exhaust gas temperature for bank 2*

O2 Sensor to AFR
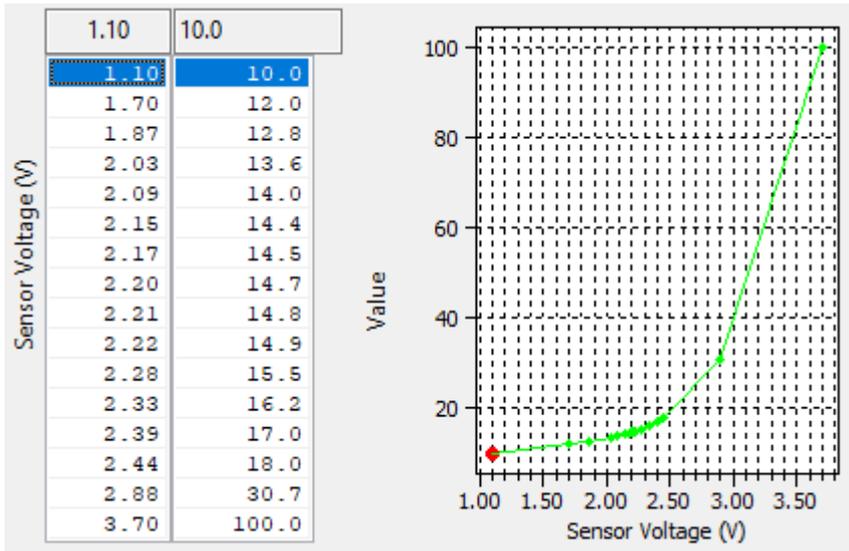
This is the map that converts O2 sensor voltage into AFR, there are corrections on this value after the sensor scaling is applied.

AF Sensor Correction – Exhaust Pressure Estimate
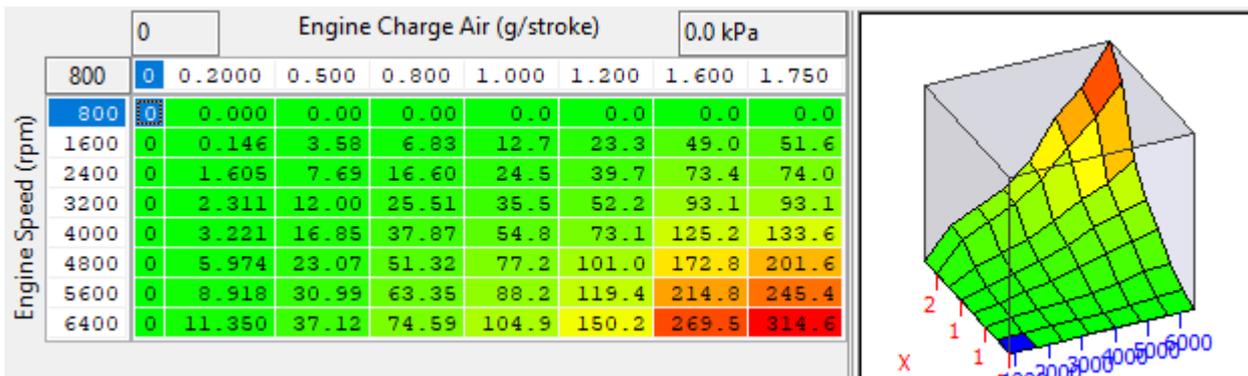
This map is the exhaust back pressure estimate used in the sensor correction function. If you have repositioned the O2 sensor to post turbo or the sensor readings become inaccurate at high loads and speeds this table may need to be adjusted. If you can measure exhaust pressure and put the measured values into this map it will hopefully give accurate pressure corrections.

AF Sensor Correction for Exhaust Back Pressure

Atmospheric Pressure (kPa)	Value
21.3	0.399
31.3	0.539
41.3	0.654
51.3	0.746
61.3	0.820
71.3	0.879
81.3	0.926
101.3	1.000
131.3	1.086
161.3	1.154
201.3	1.223
241.3	1.271
281.3	1.306
321.3	1.331
361.3	1.354
401.3	1.379
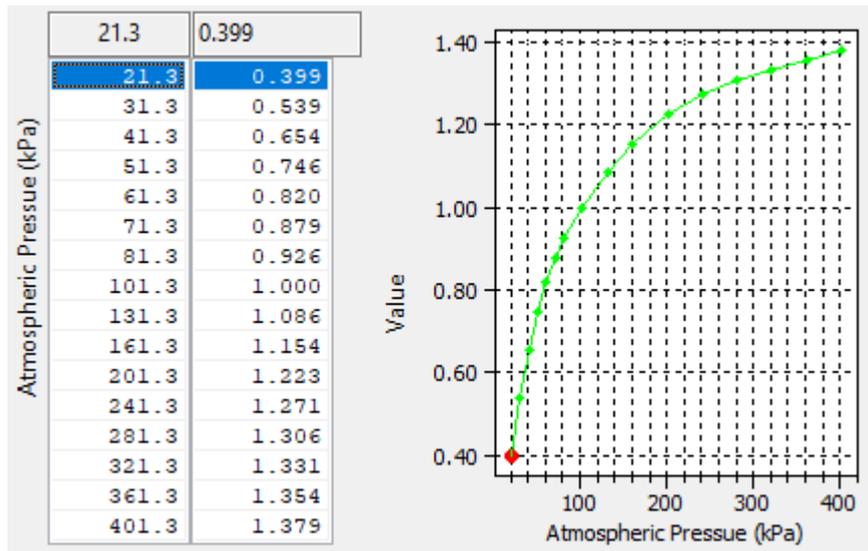
This is the amount of AFR correction applied for the estimated back pressure (the left axis is believed to be estimated exhaust pressure not Atmo) This is used to compensate for inaccuracies created by measuring the exhaust gas above ambient pressure. It should not need to be adjusted unless the sensor has been changed or you need to make corrections because the sensor has been moved.

Fuel Pressure Scaling – Pressure Offset

    -4.4   Offset (MPa)

The offset for pressure sensor scaling in MPa, scale this in the same method as MAP sensor scaling.

Fuel Pressure Scaling – Voltage Multiplier

    8.75   Multiplier (MPa/V)

The multiplier value in MPa / volt used to convert sensor voltage to pressure, scale this similarly to a MAP sensor.

Knock Frequency Masking
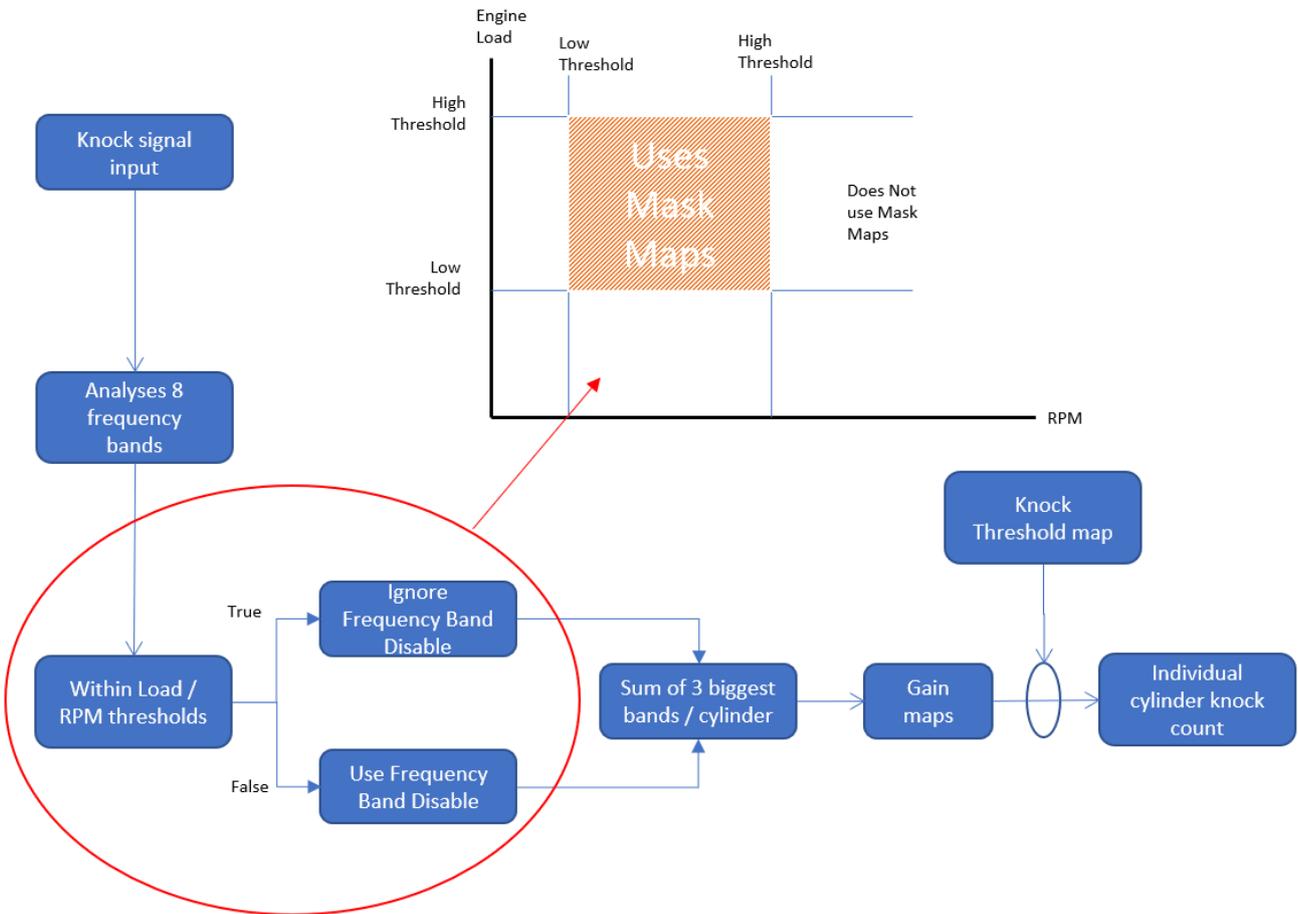
The Nissan/Infinity strategy for knock sensor signal analysis takes windowed knock signals and sums up the amplitudes based on separate frequency bands. If you have a forged engine that makes more noise due to differences in clearances etc you may want to use these masks to try to reduce the background noise to eliminate "false knock" .

Frequency Mask – Enable (disable) Switches

We believe that the frequencies that are disabled go from top to bottom, lowest at the top highest at the bottom however this currently has not been confirmed.

1 - 6.1kHz
2 - 7.3kHz
3 - 8.5kHz
4 - 9.8kHz
5 - 11.0kHz
6 - 12.2kHz
7 - 13.4kHz
8 - 14.6kHz

Frequency Mask – Cylinder Charge Lower Limit

1	0.720 g/stroke
1	0.720
2	0.720
3	1.250
4	1.250
5	1.250
6	1.250
7	1.250
8	1.250
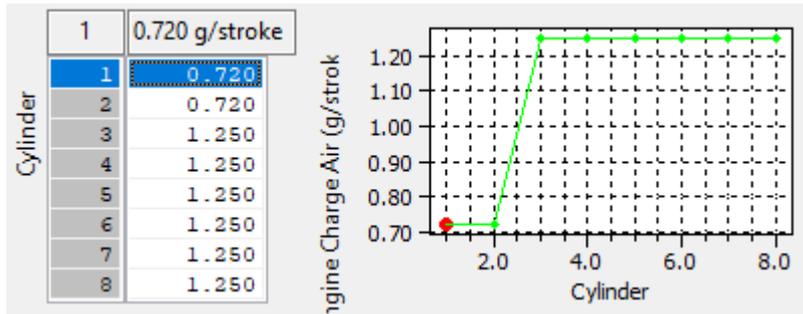
The load threshold that the engine load needs to be above for the masking maps to be used.

Frequency Mask – Cylinder Charge Upper Limit

1	3 g/stroke
1	3
2	3
3	3
4	3
5	3
6	3
7	3
8	3
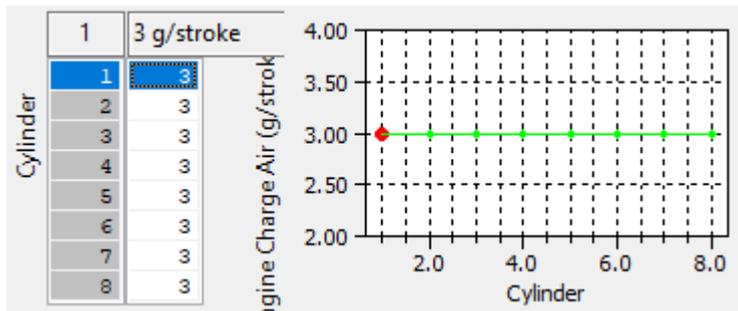
The load threshold that the engine load needs to be below for the masking maps to be used.

Frequency Mask - Cylinder Charge Hysteresis

0.100	Engine Charge Air (g/stroke)
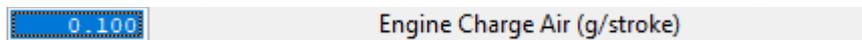
Hysteresis value for the engine load thresholds

Frequency Mask – Engine Speed Lower Limit

1	0 rpm
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
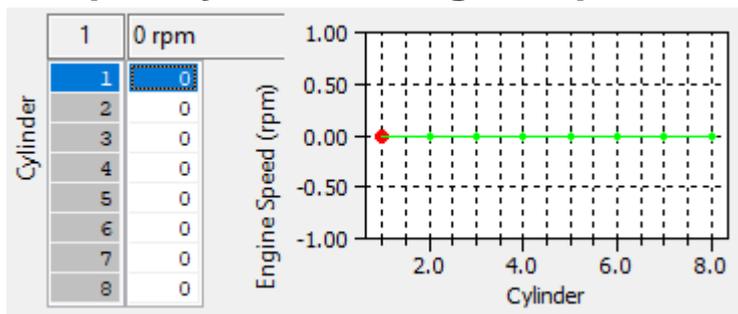
Engine speed threshold for enabling the knock masking maps.

Frequency Mask – Engine Speed Upper Limit

1	2850 rpm
1	2850
2	2850
3	2050
4	2050
5	2050
6	2050
7	2050
8	2050
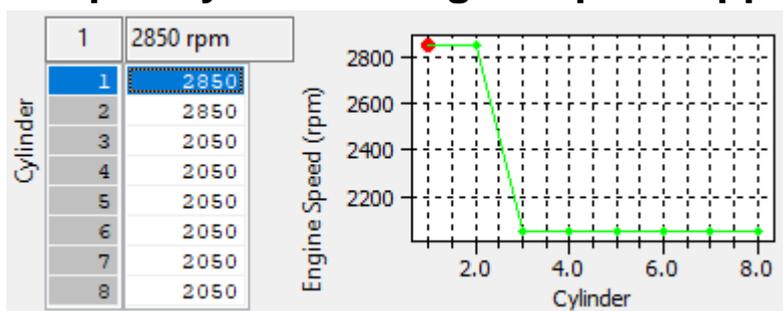
Engine speed threshold for disabling the knock masking maps.

Frequency Mask – Engine Speed hysteresis

| 50 | Engine Speed (rpm) |

Hysteresis value for engine speed thresholds.

Knock Sensor Gain

This is not currently defined however it does directly affect the knock sum per cylinder for the highest count frequency bands.

MAP Sensor Scaling – Pressure Offset

| -0.235 | Offset (bar) |

This is the sensor located in the Inlet manifold, which is used for airflow estimation and pressure control. The standard sensor is a 3.0bar Absolute sensor. There is shared scaling for the MAP and pre-throttle boost sensors so all three sensors must be changed to keep the measurements correct. This is the pressure offset value to adjust the conversion output of the sensor to hit the calibrated 0 (Zero) point.

MAP Sensor Scaling – Voltage Multiplier

File   Edit   Help

| 0.613 | Multiplier (bar/V) |

This is the sensor located in the Inlet manifold, which is used for airflow estimation and pressure control. The standard sensor is a 3.0 bar Absolute sensor. There is shared scaling for the MAP and pre-throttle boost sensors so all three sensors must be changed to keep the measurements correct. This is the voltage multiplier value to set the slope of the boost sensor output.

MAF sensor Q-Hz Conversion Bank 1 & 2

0	6.02 %
0	6.02
501	6.02
502	99.63
1000	99.63
1064	76.06
1099	66.68
1136	58.69
1177	51.56
1220	45.09
1266	39.27
1299	35.74
1333	32.49
1370	29.52
1409	26.81
1449	24.34
1493	22.08
1539	20.02
1587	18.14
1639	16.45
1695	14.93
1754	13.58
1818	12.40
1887	11.34
1961	10.38
2041	9.53
2128	8.79
2174	8.46
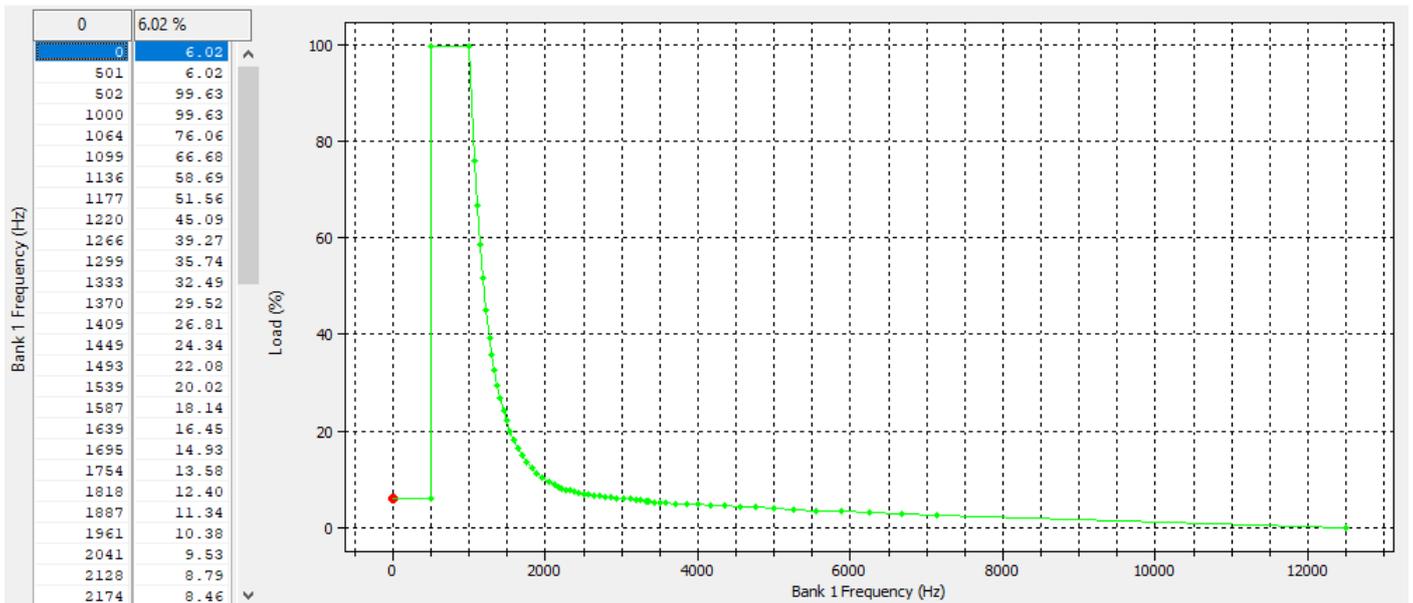
Mass air flow sensor frequency to air flow conversion table. The mass air flow sensor is placed in the intake air stream measuring a part of the entire intake flow and outputting a frequency back to the ECU. It measures the frequency from both MAFs and uses the load output of each one to calculate a respective airflow. To tune the fuel trims you should adjust the load output of these maps for given frequencies.

BFS Multiplier (K-Factor)

0.0268	s/g

This is a conversion factor that is used to generate engine load and fuel volumes, it should not need to be adjusted.
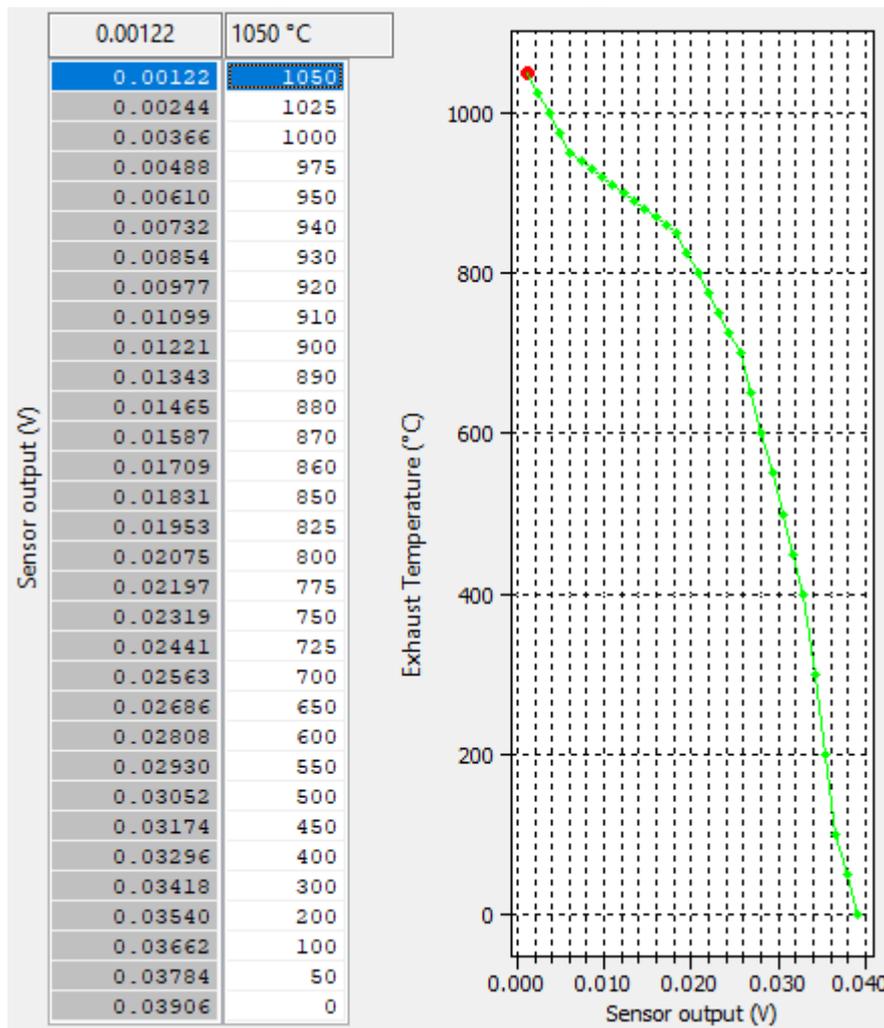
MAF Sensor Scale (% to g/sec) for Load

138	100% MAF

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

Exhaust Temperature Scaling

0.00122	1050 °C
0.00122	1050
0.00244	1025
0.00366	1000
0.00488	975
0.00610	950
0.00732	940
0.00854	930
0.00977	920
0.01099	910
0.01221	900
0.01343	890
0.01465	880
0.01587	870
0.01709	860
0.01831	850
0.01953	825
0.02075	800
0.02197	775
0.02319	750
0.02441	725
0.02563	700
0.02686	650
0.02808	600
0.02930	550
0.03052	500
0.03174	450
0.03296	400
0.03418	300
0.03540	200
0.03662	100
0.03784	50
0.03906	0

Sensor voltage output conversion to temperature, this will need to be changed if the sensors are changed or removed. There is common scaling for both banks.

Torque

Introduction

The VR30DDTT uses torque targets to control requested throttle airflows and power demand, torque reduction requests are also released through these strategies. Similar to other Nissan platforms there are powertrain torque demand maps, torque output maps, limits and torque corrections.
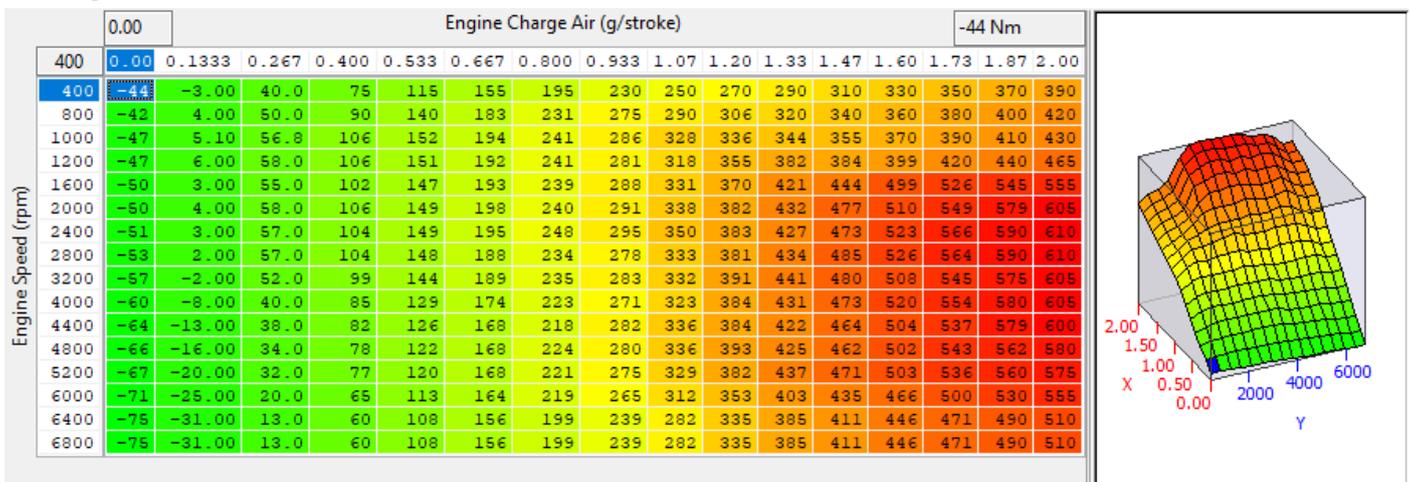
Map List

Torque
- Torque Actual
- Torque Desired - 1
- Torque Desired - 1 trustful
- Torque Desired - 2
- Torque Desired - 2 trustful
- Torque - PTD Correction
- Torque Limit correction
- Torque Limit failsafe
- Torque Limit for Drive Mode
- Torque Limit knock prevention
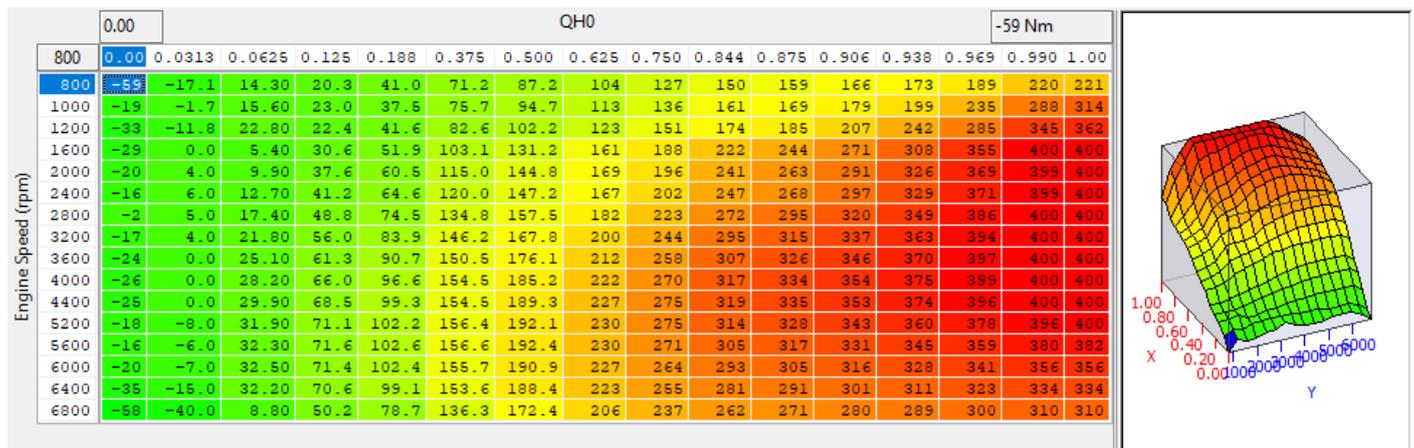- Torque Overboost Limit

Live Data Parameters

- *Torque Actual (Nm) – Estimates Actual Engine Torque Produced.*
- *Torque Demand 1 (Nm) – Demanded torque for powertrain*
- *Torque Demand 3 (Nm) – Demanded torque for other units*
- *Torque Limit (Nm) – Current safety limit for torque*
- *Torque Red Req – Time Since Gear (s) – Gear sift timer from torque reduction request release*
- *Torque Red Req 1 (Nm) – Torque reduction request from transmission*
- *Torque Red Req 2 (Nm) – Torque reduction request from other modules*

Torque Actual

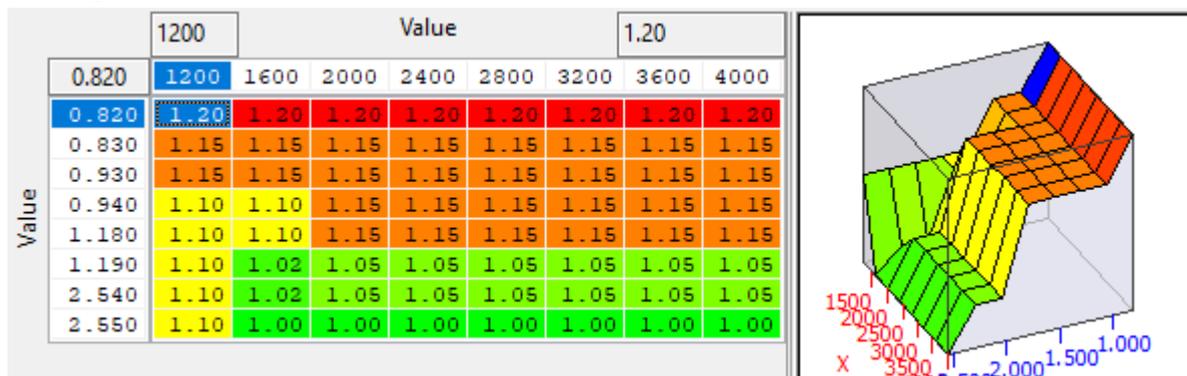| 0.00	Engine Charge Air (g/stroke)															-44 Nm
400	0.00	0.1333	0.267	0.400	0.533	0.667	0.800	0.933	1.07	1.20	1.33	1.47	1.60	1.73	1.87	2.00
400	-44	-3.00	40.0	75	115	155	195	230	250	270	290	310	330	350	370	390
800	-42	4.00	50.0	90	140	183	231	275	290	306	320	340	360	380	400	420
1000	-47	5.10	56.8	106	152	194	241	286	328	336	344	355	370	390	410	430
1200	-47	6.00	58.0	106	151	192	241	281	318	355	382	384	399	420	440	465
1600	-50	3.00	55.0	102	147	193	239	288	331	370	421	444	499	526	545	555
2000	-50	4.00	58.0	106	149	198	240	291	338	382	432	477	510	549	579	605
2400	-51	3.00	57.0	104	149	195	248	295	350	383	427	473	523	566	590	610
2800	-53	2.00	57.0	104	148	188	234	278	333	381	434	485	526	564	590	610
3200	-57	-2.00	52.0	99	144	189	235	283	332	391	441	480	508	545	575	605
4000	-60	-8.00	40.0	85	129	174	223	271	323	384	431	473	520	554	580	605
4400	-64	-13.00	38.0	82	126	168	218	282	336	384	422	464	504	537	579	600
4800	-66	-16.00	34.0	78	122	168	224	280	336	393	425	462	502	543	562	580
5200	-67	-20.00	32.0	77	120	168	221	275	329	382	437	471	503	536	560	575
6000	-71	-25.00	20.0	65	113	164	219	265	312	353	403	435	466	500	530	555
6400	-75	-31.00	13.0	60	108	156	199	239	282	335	385	411	446	471	490	510
6800	-75	-31.00	13.0	60	108	156	199	239	282	335	385	411	446	471	490	510

Estimates Actual Engine Torque and is used by the TCM and other modules to decide on the amount and level of torque reduction.

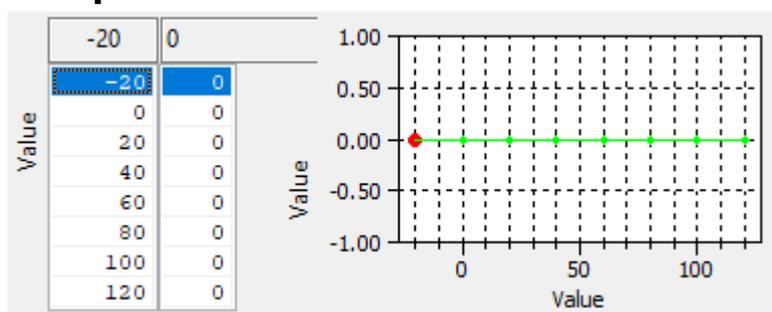# Torque Desired – 1 & 2 (& trustful)

0.00							QH0								-59 Nm
800	0.00	0.0313	0.0625	0.125	0.188	0.375	0.500	0.625	0.750	0.844	0.875	0.906	0.938	0.969	0.990	1.00
800	-59	-17.1	14.30	20.3	41.0	71.2	87.2	104	127	150	159	166	173	189	220	221
1000	-19	-1.7	15.60	23.0	37.5	75.7	94.7	113	136	161	169	179	199	235	288	314
1200	-33	-11.8	22.80	22.4	41.6	82.6	102.2	123	151	174	185	207	242	285	345	362
1600	-29	0.0	5.40	30.6	51.9	103.1	131.2	161	188	222	244	271	308	355	400	400
2000	-20	4.0	9.90	37.6	60.5	115.0	144.8	169	196	241	263	291	326	369	399	400
2400	-16	6.0	12.70	41.2	64.6	120.0	147.2	167	202	247	268	297	329	371	399	400
2800	-2	5.0	17.40	48.8	74.5	134.8	157.5	182	223	272	295	320	349	386	400	400
3200	-17	4.0	21.80	56.0	83.9	146.2	167.8	200	244	295	315	337	363	394	400	400
3600	-24	0.0	25.10	61.3	90.7	150.5	176.1	212	258	307	326	346	370	397	400	400
4000	-26	0.0	28.20	66.0	96.6	154.5	185.2	222	270	317	334	354	375	399	400	400
4400	-25	0.0	29.90	68.5	99.3	154.5	189.3	227	275	319	335	353	374	396	400	400
5200	-18	-8.0	31.90	71.1	102.2	156.4	192.1	230	275	314	328	343	360	378	396	400
5600	-16	-6.0	32.30	71.6	102.6	156.6	192.4	230	271	305	317	331	345	359	380	382
6000	-20	-7.0	32.50	71.4	102.4	155.7	190.9	227	264	293	305	316	328	341	356	356
6400	-35	-15.0	32.20	70.6	99.1	153.6	188.4	223	255	281	291	301	311	323	334	334
6800	-58	-40.0	8.80	50.2	78.7	136.3	172.4	206	237	262	271	280	289	300	310	310

(Engine Speed (rpm))

The demanded torque from the power train, there are two modes and the #1 maps appear to be used most of the time, the trustful equivalent must match exactly or P0605 DTC's will occur. The silver sport cars have a lower torque target from the factory and these may need to be raised to get the boost to increase.

Torque – PTD correction

1200			Value					1.20
0.820	1200	1600	2000	2400	2800	3200	3600	4000
0.820	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
0.830	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
0.930	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
0.940	1.10	1.10	1.15	1.15	1.15	1.15	1.15	1.15
1.180	1.10	1.10	1.15	1.15	1.15	1.15	1.15	1.15
1.190	1.10	1.02	1.05	1.05	1.05	1.05	1.05	1.05
2.540	1.10	1.02	1.05	1.05	1.05	1.05	1.05	1.05
2.550	1.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00

(Value)

The Powertrain Torque Desired correction based on current gear ratio, the adjust the torque demanded in different gears.

Torque limit correction

-20	0
-20	0
0	0
20	0
40	0
60	0
80	0
100	0
120	0

(Value)

This is an adjustment to the torque limit based on temperature

Torque Limit Failsafe

Engine Speed (rpm)	Value
800	200
800	200
1200	250
1600	260
2000	260
2800	260
4000	600
5200	3277
6400	3277
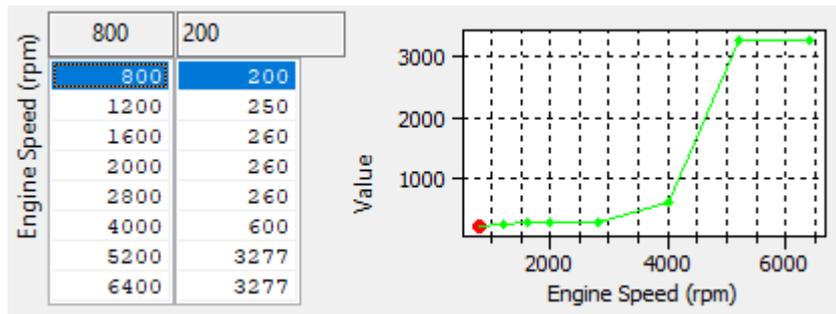
This is the maximum allowed torque in failsafe mode.

Torque limit Drive Mode

Value	Value
800	3277
800	3277
1000	3277
1200	3277
1600	3277
2000	3277
2400	3277
2800	3277
3200	3277
3600	3277
4000	3277
4400	3277
5200	3277
5600	3277
6000	3277
6400	3277
6800	3277
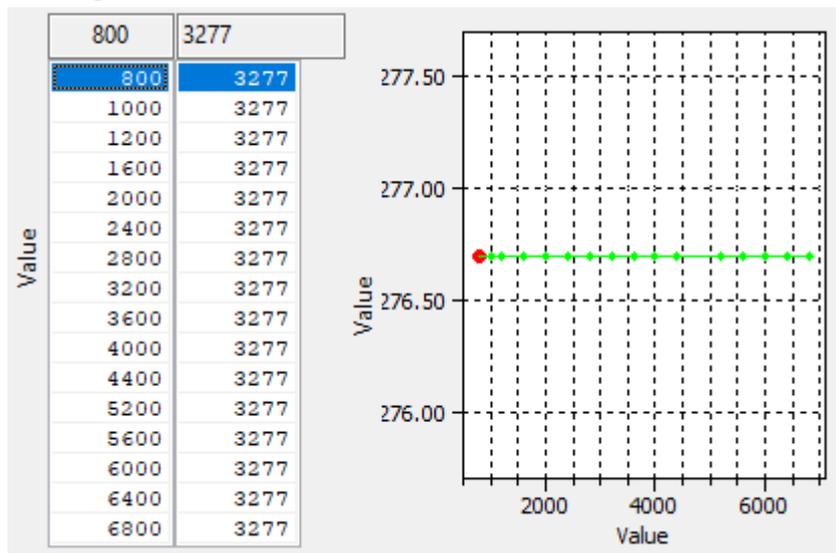
This is the maximum allowed torque when in drive, it is currently set to maximum.

Torque Limit Knock Prevention

Engine Speed (rpm)	-20	0.00	20.0	40.0	60.0	70.0	80.0	100
800	200	200	200	200	200	270	270	270
1200	250	250	250	250	250	381	381	381
1600	300	300	300	300	300	501	501	501
2000	360	360	360	360	360	508	508	508
2800	365	365	365	365	365	512	512	512
4000	511	511	511	511	511	511	511	511
5200	488	488	488	488	488	488	488	488
6400	462	462	462	462	462	462	462	462
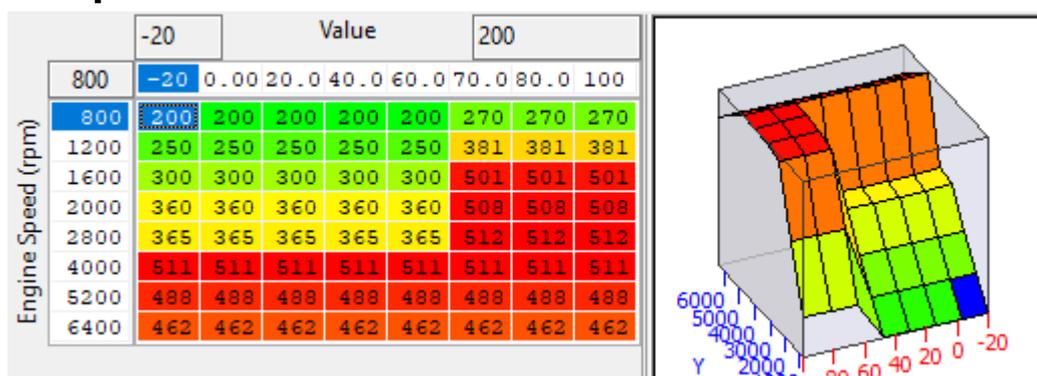
This is the maximum allowed torque for coolant temperature to prevent knock.

Torque Overboost Limit
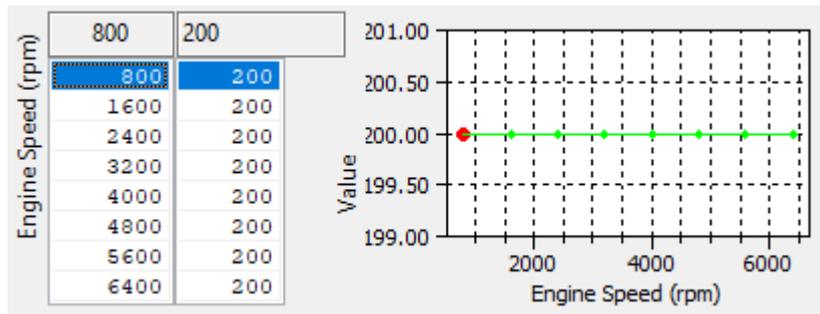
This is the maximum allowed torque when over boost is detected.

Idle Control

Introduction

Idle control is done using the electronic throttle, the function uses a similar method to other Nissan products.

Map List

Live Data related parameters

- *Engine Speed (RPM) – Current engine speed*
- *Coolant Temperature (°C) – Current engine coolant temperature*
- *Mass Airflow Sensor Freq B1 – Bank 1 MAF sensor output frequency*
- *Mass Airflow Sensor Freq B1 – Bank 2 MAF sensor output frequency*
- *Intake Air Temperature (°C) – Current intake air temperature*
- *Atmospheric Pressure (Bar) – Current Barometric Pressure*

Idle Target

-40	1800 rpm
-40	1800
-30	1800
-20	1800
-10	1800
0	1800
10	1700
20	1600
30	1500
40	1400
50	1300
60	1300
70	1250
80	1000
90	1000
100	1000
110	1300
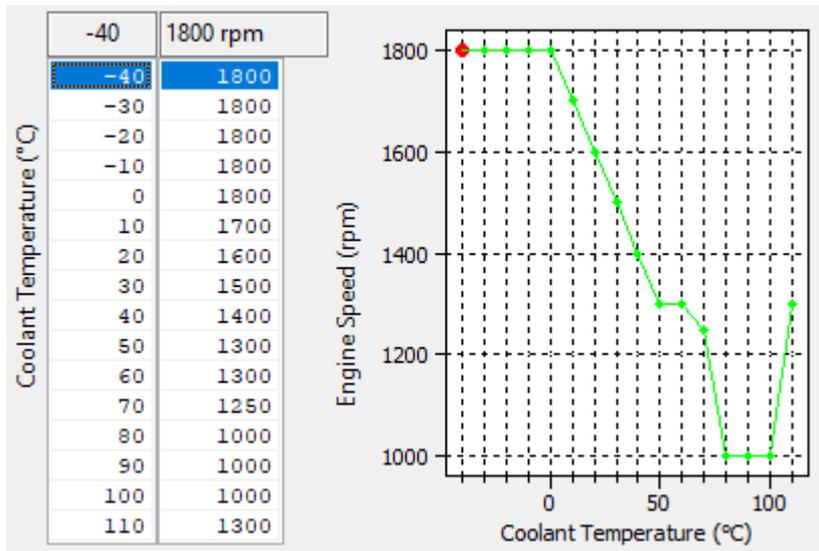
There are many idle target maps identified, we currently do not know in which situation all of them are used however the all have coolant temperature as the axis and it's likely that there is one map used primarily and the other used in modes such as immediate after start, limp modes and target limits.

Idle IPW Upper / Lower Limit

2.48	IPW (ms)
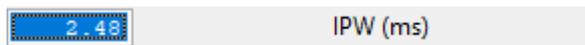
Upper and Lower limit of injector pulse width to allow idle flag to be set.

Idle MAF Frequency Upper / Lower limit

2738	Bank 1 Frequency (Hz)

These maps set the idle MAF frequency bounds for the idle flag, there are also thresholds based on RPM and time

ISC Airflow Comp – Atmospheric Pressure

54.1	1.48
54.1	1.48
68.6	1.48
72.3	1.40
79.5	1.27
90.4	1.12
97.6	1.03
101.3	1.00
108.5	1.00
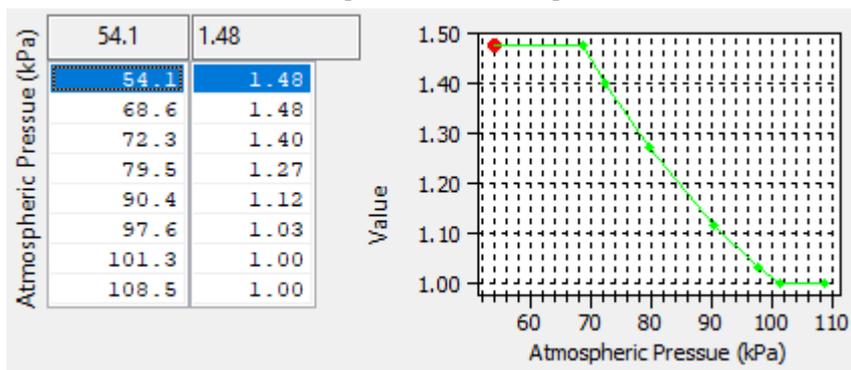
This is a compensation to Idle Speed Control (ISC) airflow target based on the atmospheric pressure. It should not need to be adjusted unless idle airflow requirements have changed significantly with different throttles or intake systems.
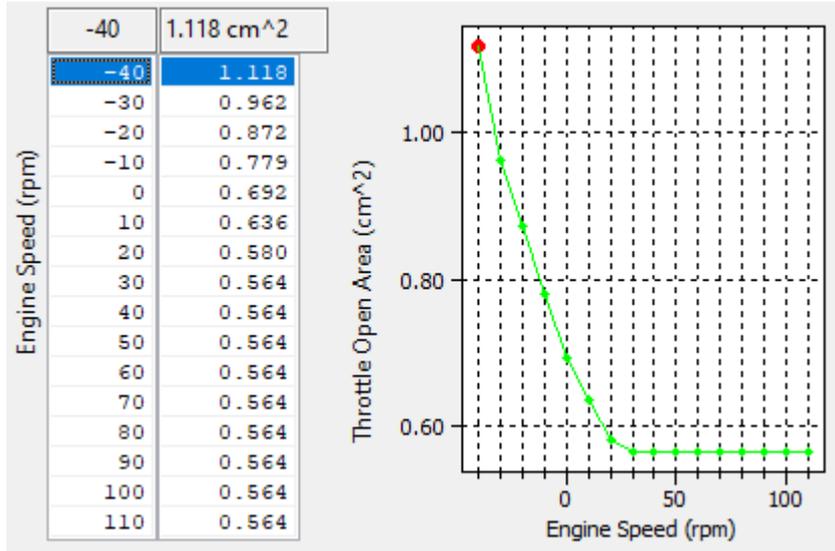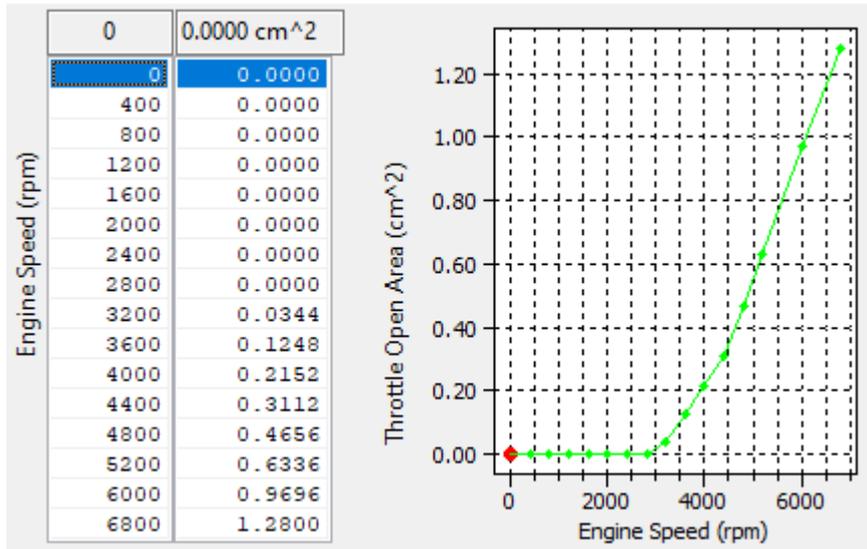
ISC Airflow Comp - Coolant Temp

-40	1
-40	1
-30	1
-20	1
-10	1
0	1
10	1
20	1
30	1
40	1
50	1
60	1
70	1
80	1
90	1
100	1
110	1
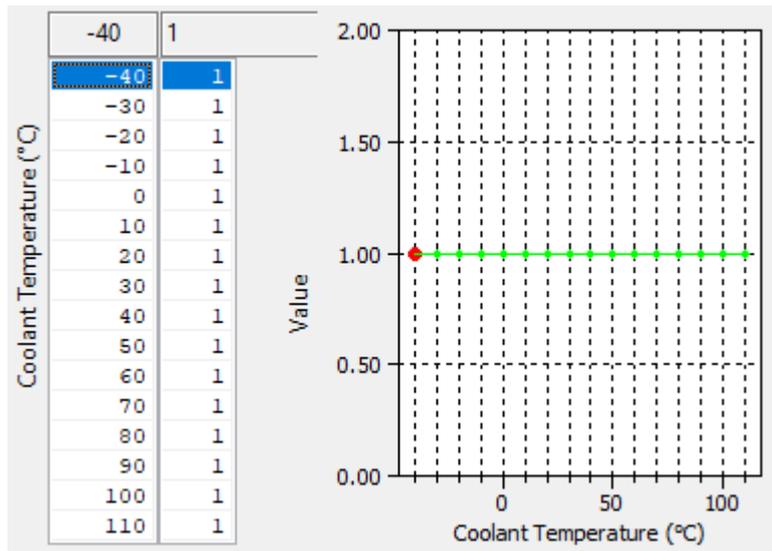
This is a compensation to idle airflow target based on the engine coolant temperature. It should not need to be adjusted unless idle airflow requirements have changed significantly with different throttles or intake systems.

ISC Airflow Comp - IAT

-40	1.00
-40	1.00
-20	1.00
0	1.00
20	1.00
40	1.01
60	1.07
80	1.13
100	1.20
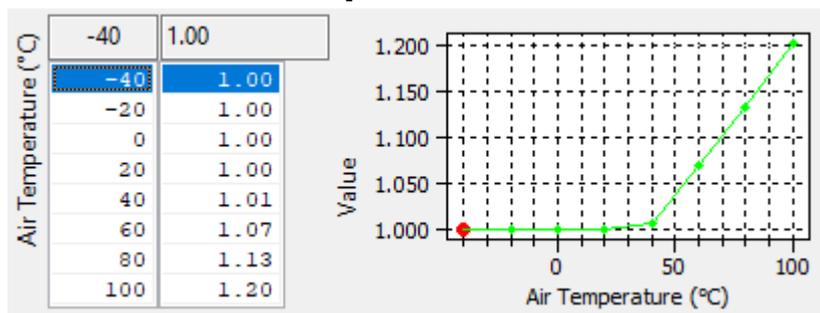
This is a compensation to idle airflow target based on the Intake Air Temperature. It should not need to be adjusted unless idle airflow requirements have changed significantly with different throttles or intake systems.

ISC Open Area Max

The Idle Speed Control (ISC) function constantly calculates an open area and hence throttle angle based on the idle airflow requirements, this value has a setting for maximum open area allowed for idle control to stop the calculations running away, this value has various offsets calculated and applied, these can be limited by the following maps

ISC Open Area Max & Trustful

-40	1.118 cm^2
-40	1.118
-30	0.962
-20	0.872
-10	0.779
0	0.692
10	0.636
20	0.580
30	0.564
40	0.564
50	0.564
60	0.564
70	0.564
80	0.564
90	0.564
100	0.564
110	0.564

This is the base value for Maximum idle open area referencing coolant temperature the other offsets are added to the output of this map. The final value is used to cap the allow idle open area.

2D RPM based Offset limiter & Trustful

0	0.0000 cm^2
0	0.0000
400	0.0000
800	0.0000
1200	0.0000
1600	0.0000
2000	0.0000
2400	0.0000
2800	0.0000
3200	0.0344
3600	0.1248
4000	0.2152
4400	0.3112
4800	0.4656
5200	0.6336
6000	0.9696
6800	1.2800

This will limit the open area adjustment based on engine speed, it will cap the adjustment to maximum allowed open area. The trustful map of the same name must match this map exactly otherwise DTC's will occur. The intent of this map is to allow the base idle throttle open area to be increased with RPM.

3D Torque based offset limiter & trustful

0	0.000000	10.00000	20.00000	30.00000	40.00000	50.00000	60.00000	70.00000	80.00000	90.00000	100.0000	110.000	120.000	130.000	140.000	150.00
0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00111	0.00198	0.00343	0.00741	0.0127
400	0.000688	0.000688	0.000688	0.000688	0.000688	0.000688	0.000688	0.000688	0.000688	0.000688	0.000688	0.00180	0.00268	0.00412	0.00810	0.0134
800	0.001384	0.001384	0.001384	0.001384	0.001384	0.001384	0.001384	0.001384	0.001384	0.001384	0.001384	0.00249	0.00337	0.00482	0.00879	0.0141
1200	0.002072	0.002072	0.002072	0.002072	0.002072	0.002072	0.002072	0.002072	0.002072	0.002072	0.002072	0.00318	0.00406	0.00550	0.00948	0.0148
1600	0.002760	0.002760	0.002760	0.002760	0.002760	0.002760	0.002760	0.002760	0.002760	0.002760	0.002760	0.00387	0.00475	0.00619	0.01017	0.0154
2000	0.003456	0.003456	0.003456	0.003456	0.003456	0.003456	0.003456	0.003456	0.003456	0.003456	0.003456	0.00456	0.00544	0.00689	0.01086	0.0161
2400	0.004144	0.004144	0.004144	0.004144	0.004144	0.004144	0.004144	0.004144	0.004144	0.004144	0.004144	0.00526	0.00613	0.00758	0.01155	0.0168
2800	0.004832	0.004832	0.004832	0.004832	0.004832	0.004832	0.004832	0.004832	0.004832	0.004832	0.004832	0.00594	0.00682	0.00826	0.01224	0.0175
3200	0.005528	0.005528	0.005528	0.005528	0.005528	0.005528	0.005528	0.005528	0.005528	0.005528	0.005528	0.00664	0.00751	0.00896	0.01294	0.0182
3600	0.006224	0.006224	0.006224	0.006224	0.006224	0.006224	0.006224	0.006224	0.006224	0.006224	0.006224	0.00734	0.00822	0.00966	0.01363	0.0189
4000	0.006920	0.006920	0.006920	0.006920	0.006920	0.006920	0.006920	0.006920	0.006920	0.006920	0.006920	0.00802	0.00890	0.01035	0.01433	0.0196
4400	0.007608	0.007608	0.007608	0.007608	0.007608	0.007608	0.007608	0.007608	0.007608	0.007608	0.007608	0.00872	0.00959	0.01104	0.01502	0.0203
4800	0.008296	0.008296	0.008296	0.008296	0.008296	0.008296	0.008296	0.008296	0.008296	0.008296	0.008296	0.00941	0.01029	0.01173	0.01570	0.0210
5200	0.008992	0.008992	0.008992	0.008992	0.008992	0.008992	0.008992	0.008992	0.008992	0.008992	0.008992	0.01010	0.01098	0.01242	0.01640	0.0217
6000	0.009680	0.009680	0.009680	0.009680	0.009680	0.009680	0.009680	0.009680	0.009680	0.009680	0.009680	0.01079	0.01166	0.01311	0.01709	0.0224
6800	0.010368	0.010368	0.010368	0.010368	0.010368	0.010368	0.010368	0.010368	0.010368	0.010368	0.010368	0.01148	0.01236	0.01380	0.01778	0.0231

This will limit the open area adjustment based on available torque and engine speed, it will cap the adjustment to allowed open area. The trustful map of the same name must match this map exactly otherwise DTC's will occur. It is believed currently that these maps are used only in hybrid vehicles not the current VR30DDTT line up.

Idle Throttle Upper / Lower Limit (misfire diagnosis at idle)

Upper Limit

| 0.0319 | Time (s) |

BETA MAP USE WITH CAUTION. This is the maximum theoretical injector open time for the misfire diagnosis system to be active when the idle flag is set.

Lower Limit

| 1000 | Engine Speed (rpm) |

BETA MAP USE WITH CAUTION. The Maximum allowed engine speed for misfire diagnosis when idle flag is active.

Radiator Fan Control

Introduction

Radiator fan speed for coolant temperature control is performed by the ECM. The fan speed and activation points can be adjusted in the calibration to cope with increased cooling demand and changed radiator airflow characteristics.

Map List
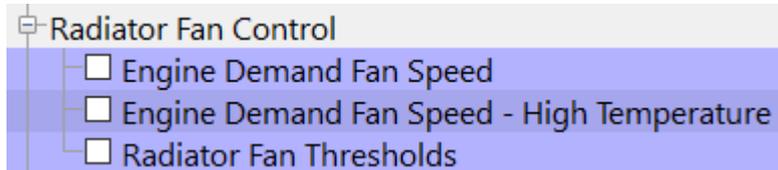
Live Data related parameters

- *Radiator Coolant Temp (°C) – Current radiator temperature.*
- *Fan Duty (%) – Current requested duty for the radiator fan*

Radiator Fan Threshold
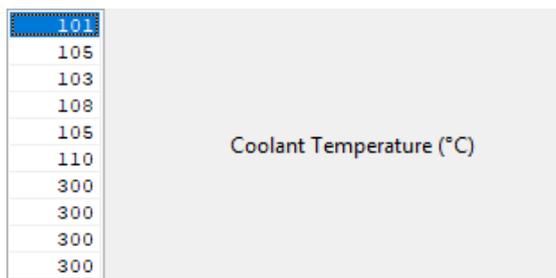
These values for the coolant temp axis of the Radiator Fan Speed control maps. The values are interleaved, so the first 2 values are the first thresholds for each map.

Engine Demand Fan Speed
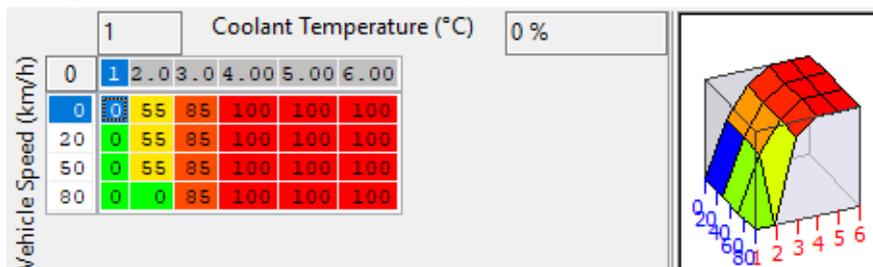
The engine demand for radiator fan speed. X axis is coolant temp with values of 0, 101, 103, 105, 300, 300.

Engine Demand Fan Speed – High Temperature
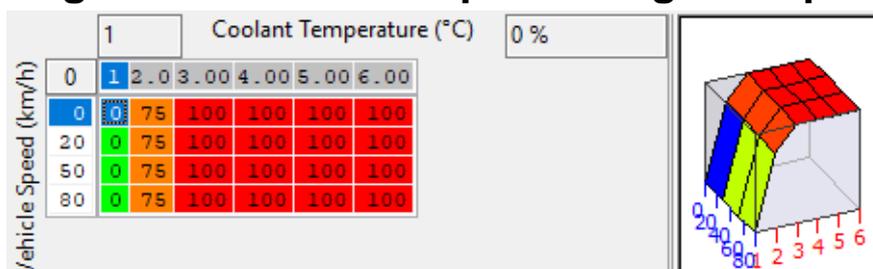
The engine demand for radiator fan speed. X axis is coolant temp with values of 0, 105, 108, 110, 300, 300.

Valet Mode

Introduction

Valet Mode allows the driver to lock the car into a lower performance mode when lending it to a less experienced driver, or as a theft deterrent that kicks in when the car is at a safe distance. Valet mode has been simplified in line with the strategy used on the 370z, as the previous version was frequently commented on as being too complicated to activate and deactivate.

Map List
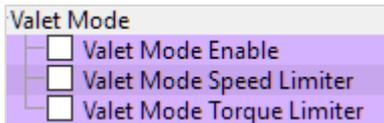
Method of Operation

Valet mode is currently only operated by using Ecu Connect, the ability to switch with the Cruise control buttons will hopefully be implemented in the next releases of RaceROM feature files.
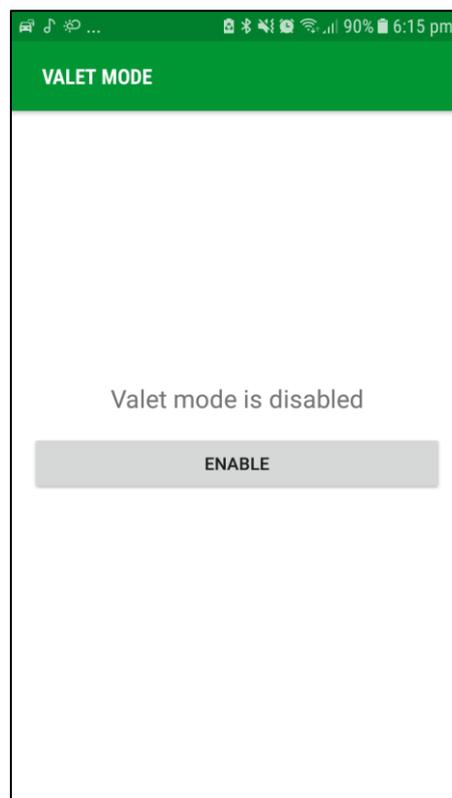
To turn on Valet mode
- Enter the valet mode option and press enable

To turn off the Valet mode
- Enter the valet mode option and press Disable

Method of Operation (Cruise Control Buttons Not currently active)

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 8. 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 8000rpm (mode 8).
- Press CANCEL or wait 1 second to enable the valet mode, the rev counter will show current RPM

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 8000rpm (mode 8).
- Press CANCEL or wait 1 second to enable the valet mode, the rev counter will show current RPM

Cautionary Note for Tuners

Please take note that Valet Mode activation is now a toggle and it's relatively easy to activate. Car owners can in some cases activate it accidentally and it's not been unknown for car owners to end up at a main dealer to have their "problem" fixed!

# Valet Mode Enable

☐ Enable Valet Mode

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

Valet Mode Torque Limiter
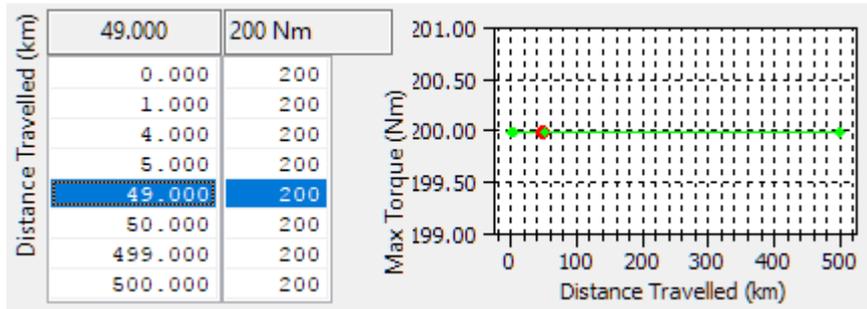
When Valet Mode is active the torque output can be limited to prevent a car being driven hard or recklessly. For use as an anti-theft measure it would be reasonable to reduce these values from the default 200Nm after a short distance.

Valet Mode Speed Limiter
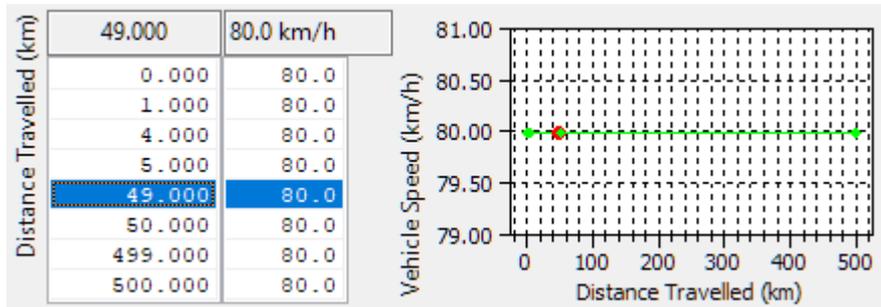
When Valet Mode is active the maximum speed can be limited to prevent the car from being driven at anything beyond a sedate pace. For use as an anti-theft measure it would be normal to significantly reduce these default values to as low as zero after a shorter distance.

4. Glossary

AFM
Air Flow Meter

AFR
Air Fuel Ratio

Calculated Air Flow
The air flow sensor voltage is not linearly related to the amount of air flow. The ECU uses a scaling map to translate the air flow sensor voltage into an air flow rate value i.e. calculated air flow.

ECM
Engine Control Module

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

FTST
Fuel Trim Short Term

FTLT
Fuel Trim Long Term

FMIC
Front Mounted Intercooler

MAF
Mass Air Flow (sensor)

MAP
Manifold Absolute Pressure (sensor)

MRP
Manifold Relative Pressure or boost pressure

MBT
Maximum Best Torque or Minimum Best Timing

O2 Sensor
Lambda Sensor (oxygen sensor)

RRLC
RaceROM Launch Control

RRBC
RaceROM Boost Control

RRFF
RaceROM Feature File (patch)

SD – Speed Density

The Mass Airflow in grams is calculated from MAP sensor not MAF sensors.

TCM

Transmission Control Unit or Gearbox ECU