ProECU Nissan GT-R

Phase 6 RaceROM Manual

Contents

1. Introduction

This beta RaceROM is built on the previous generation of Phase 5 releases, this should allow you to understand, configure and calibrate all the RaceROM features.

Summary of updates

Custom sensor input definition

- New/Improved Inputs
  - Fuel pressure
  - Coolant Pressure
  - Flexfuel
- Define min and max voltages to detect failed sensor
- Set default value for failed sensors
- Adjustable sensor filtering

Limp mode with safety trips including custom sensor inputs

- Safety trips for:
  - High Short Term Fuel Trim
  - High AFR
  - High Coolant Pressure
  - High Oil Temperature
  - Low Oil Pressure vs RPM (requires TCM reflash)
  - Low Fuel Pressure
  - Custom Map Channel
- Load and RPM thresholds
- Timeouts for each channel
- Enable each individual trip per Mapswitch mode

Closed loop clutch slip control

- Closed loop control
- Uses retard and/or torque limits
- Enable per Mapswitch mode

Further updates have been made to existing features

12 Injector Support

- Activate second bank over minimum ethanol content
- Fuel pump tool works with 12 injector enabled (when engine is not running)

Boost Control

- Separate high/low altitude wastegate base duty maps
- Overall enable RPM below which wastegate solenoid is disabled
- Separate Integral only activation using throttle/boost/boost error limits

- Revised duty multiplier for Gear/IAT
- Single boost limit hysteresis value to simply setting limits

Launch Control / BOTL

- Launch RPM Overshoot
- Throttle correction for BOTL retard
- Fuel correction while in BOTL
- BOTL Cylinder cut
- 2d minimum ignition to smooth retard application
- Revised BOTL retard base and proportional ignition maps
- Revised BOTL retard activation
- BOTL specific live data parameters

Per Gear Rev Limits

- Adjust limits for all modes in one map
- Single hysteresis value to speed up changes

FlexFuel

- Optionally define a pre-determined ethanol content override per mapswitch mode
- Sensor smoothing
- Separate live data values for actual sensor output (which may vary with inadequate fuel systems) and the ethanol content carried forward into the FlexFuel strategy (which may be fixed due to load thresholds or per Mapswitch mode).

Fuelling

- Correction of fuel injection time for fuel pressure – using relative pressure to make it very simple
- Correction of fuel injection time for fuel temperature
- Fuel Injector ms available as custom map input

Ignition Timing

- Gear and AIT retard maps now activated with a minimum load threshold

Custom maps

- Number of custom maps is maximised per CALID to make the most of the space available typically with the following results:
    - JF Series – 10 Custom Maps
    - JW Series – 8 Custom Maps
    - All 1.5mb ROMs – 16 Custom maps
- Additional inputs
    - TCM Torque Limit
    - VDC Torque Limit
    - Clutch Slip
    - Injector Pulsewidth
    - AFR Average
    - VVT Angle
    - Relative Fuel Pressure (via custom sensor input)

    - Absolute Fuel Pressure (via custom sensor input)
    - Coolant Pressure (via custom sensor input)
- Additional Outputs
    - Custom Limp mode channel

2. FastFlash Programming

Method of operation

FastFlash (FF) will be enabled when a FF enabled RaceROM patch is already installed on an ECM/TCM. This means the first time you program with a FF enabled ROM the programming sequence and programming time will not change.

On subsequent programming operations, FF will be used. The minimum programming time is approximately 20 seconds on a 1mb unit and FF will always reprogram blocks 8 and 15. 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

FastFlash has been tested to ensure that it will not “brick” either the ECM or TCM 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 or TCM programming window for the car. This is a critical step as ProECU will not be able to auto detect a part programmed ECM/TCM
- Select correct ROM
- Program

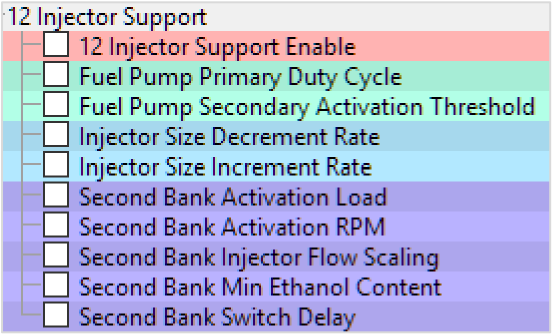
3. Map Descriptions

12 injector Support

Introduction

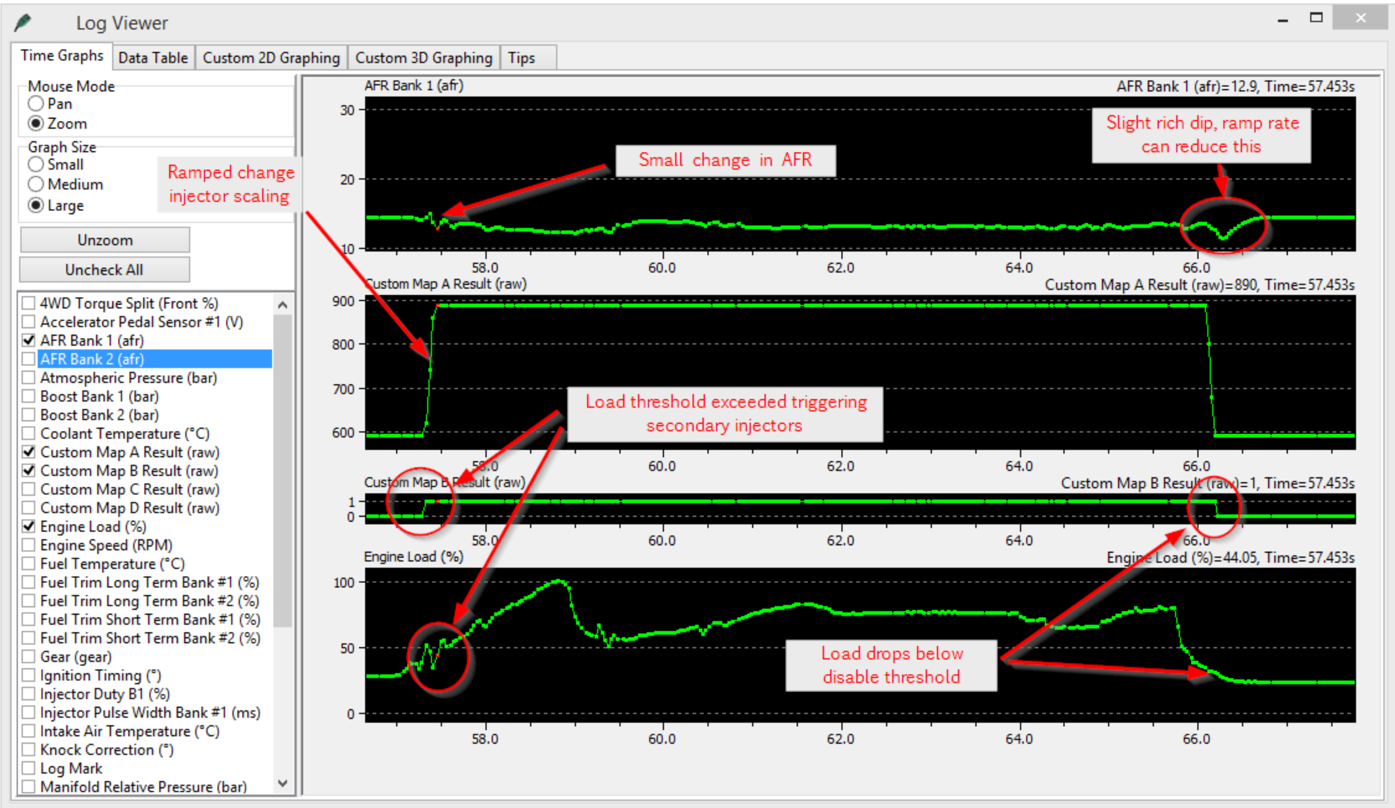
A simple but effective 12 injector strategy has been implemented that allows 12 injectors to be run on the GTR using additional hardware. Due to the limited spare outputs and the difficulty of fundamentally changing the low level scheduling of outputs, 12 injector support is achieved by switching a secondary bank of injectors on at low to moderate load while scaling the injector constant during a “ramp in” period. The secondary air solenoid is the only output currently available to use with this feature. Details on how to implement this are available on request.

Map List

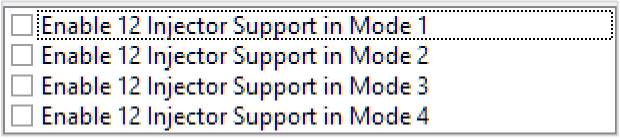


Operation

The below screenshots shows the various stages of activating and deactivating the secondary Injectrors

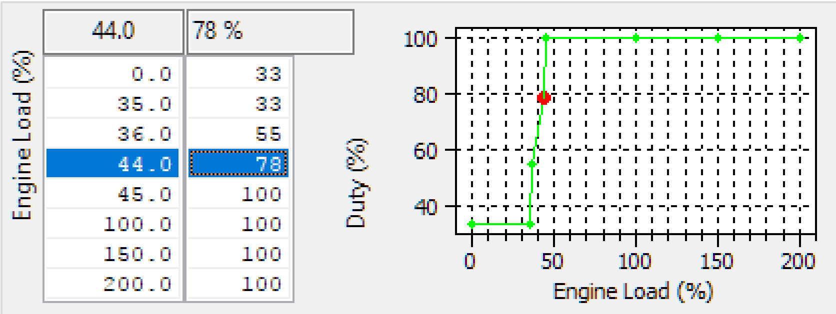


12 Injector Support Enable



12 injector support can be enabled in each map switch mode individually.

Fuel Pump Primary Duty Cycle

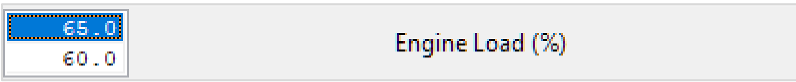


Direct fuel pump control is ONLY ENABLED WHEN 12 INJECTOR CONTROL IS ENABLED! So if you wish to use these maps, enable 12 injector control in all your map switch modes and set the enable RPM to 10000rpm so that it never comes on. Remember when 12 Injector Support is enabled the secondary air solenoid output will be hijacked.

Engine load is used rather than injector duty because when secondary injectors are active, the injector duty will change significantly. These fuel pump maps can be used to avoid such issues.

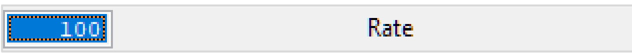
This map uses engine load vs final pump duty cycle and overrides the factory primary pump control strategy.

Fuel Pump Secondary Activation Threshold



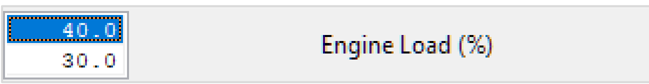
The secondary pump control is still an on/off output but can be directly controlled with engine load.

Injector Size Increment Rate – Injector Size Decrement Rate



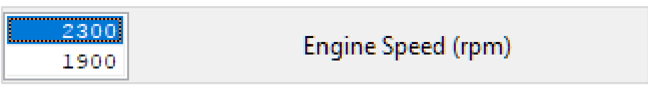
This controls how fast the injector scaling is changed. The units are cc/10ms so large changes in injector scale will need a larger number to make the change in the same time. 40cc/10ms proved a good compromise when testing with 300cc/min secondary injectors taking 75ms to ramp in and out. If using 1050cc/min secondary injectors, a ramp rate of 140cc/10ms will gave the same 75ms ramp time.

Second Bank Activation Load



The secondary injectors can be enabled above a specific load with hysteresis. Recommended activation is 30-50% depending on the injector size, and a 10% difference between activation and deactivation.

Second Bank Activation RPM

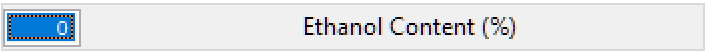


The secondary injectors can be enabled above a specific RPM with hysteresis. Recommended activation is 2000-3500RPM depending on the turbo spool, and a 100-500RPM difference between activation and deactivation.

Second Bank Injector Flow Scaling

The secondary injectors are scaled in a similar way to the primary injectors in cc/min individually for each map switch mode and when enabled the primary and secondary injector scales are summed. When carrying out initial testing, it can be useful to use 3-4 different scales and map switch between them to test which setting gives the most consistent fuelling between 6 and 12 injectors.

Secondary Bank Min Ethanol Content



The ethanol content must exceed this value for the second bank of injectors to be activated. This function is designed to allow cars to run on the primary bank of injectors when running little or no ethanol and fuel requirements are significantly reduced.

Second Bank Switch Delay

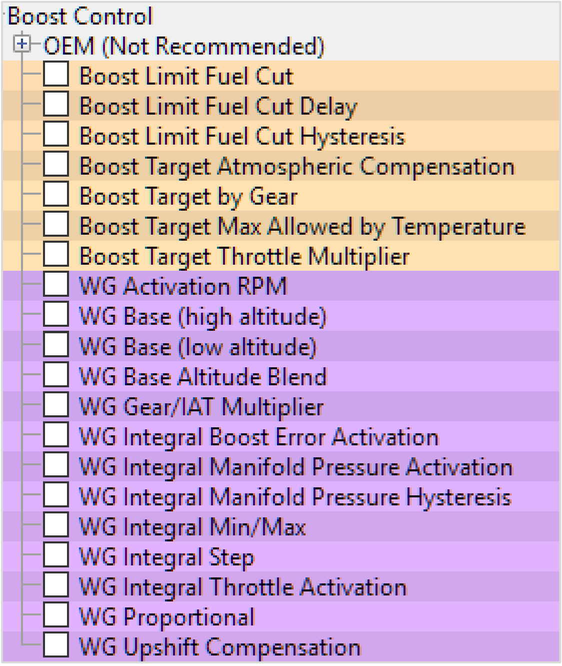
The delay value is used to prevent switching between 6-12 injectors with rapidly fluctuating load that is swinging beyond the thresholds. The thresholds need to be met for a time longer than the delay in order to actual switch between 6 and 12 injectors, when either activating or deactivating.

Boost Control

Introduction

Starting with RaceROM Phase 5, OEM boost control is depreciated and we recommend tuners use our own simplified boost control and now has its own full set of dedicated maps. Upon adding a Phase 5 or later RRFF, this option is enabled by default, and comes pre-populated with a sensible stage 1 boost control setup. All OEM boost control maps, are now found under ***Boost Control->OEM*** category in the map tree.

Map List



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*
- *Manifold Gauge Pressure – "Boost" pressure measure in bar above the current atmospheric pressure*
- *Manifold Absolute Pressure – Absolute pressure in bar, measured by the intake manifold pressure sensor*
- *Wastegate Duty – The duty cycle applied to the wastegate solenoid (Same as Final Duty)*
- *WG Duty Base – Output from **Wastegate Duty Base** maps*
- *WG Duty Adder – Correction resulting from Gear/IAT multiplier step*
- *WG Duty Integral – WG duty added by Integral correction of EcuTek boost control strategy*
- *WG Duty Proportional – WG duty added by Proportional correction of EcuTek boost control strategy*

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 the cruise control switchgear. The maximum boost target is displayed on the boost gauge of the MFD. 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.

Absolute Boost

The single most important concept introduced with Phase 5 GTR is 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.

RaceROM Boost Controller values still correspond to the stock to the gauge, so 1.5bar still equates to 1.5bar of relative boost at sea-level.

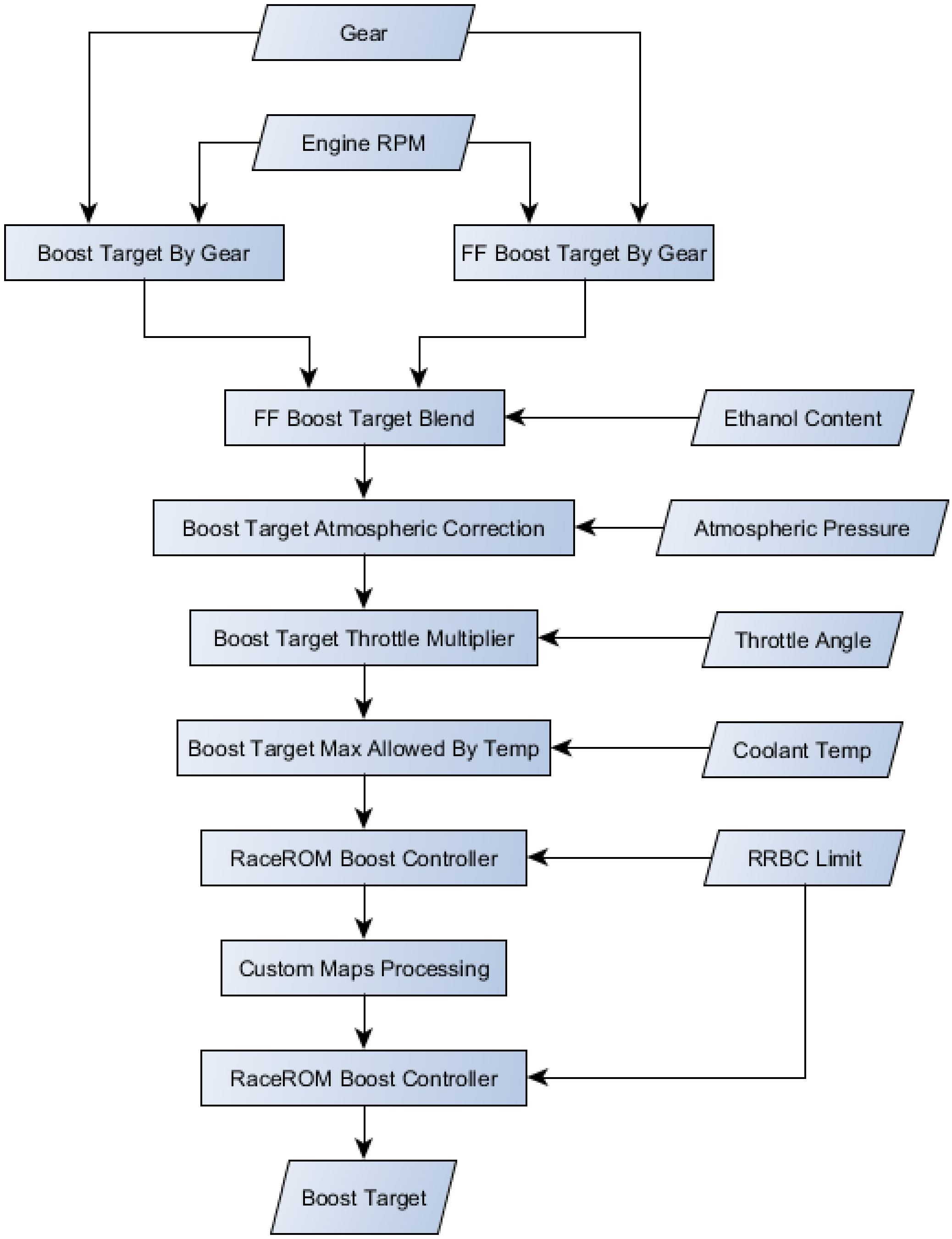
To make tuning as simple as we can we have added an atmospheric compensation that by default gives a consistent “boost” at all altitudes, but the result is that your MAP will drop as a result, and power will be reduced at altitude if using the default **Boost Target Atmospheric Compensation** map.

To ensure that boost tuning is as simple and intuitive as possible, we have corrected the Nissan boost gauge display to show true manifold gauge pressure that will always correlate with the current atmospheric and absolute manifold pressure. Without this correction, your Nissan GTR boost display has been lying to you, displaying instead manifold absolute pressure – 1 resulting in strange behaviour at altitude. It has also been inconsistent with the actual boost level as measured by an independent gauge, such as the boost input on a dyno. This correction can optionally be disabled.

Boost Target Calculation

The boost target is obtained following the below flowchart. You will see that the RRBC limit is imposed both before and after custom maps processing, this ensures that custom maps cannot raise the limit beyond the limit set from the RRBC.

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.



Enable Special Features (Boost Control Related)

- [ ] Enable MAF Swap
- [x] Enable EcuTek Boost Control
- [x] Display corrected boost pressure
- [x] Enable RaceROM Boost Controller
- [ ] RBC - Same value in all modes
- [ ] Use RBC as Custom Map input only (don't control boost)
- [x] Enable Upshift Spike Prevention
- [ ] Display Map Switch mode on Tachometer (requires TCM reflash)
- [ ] Enable Knock Warning
- [x] Enable RaceROM Launch Control
- [ ] Coolant Temp Output is Fahrenheit

Enable EcuTek Boost Control

Overall enable for the RaceROM boost control strategy used instead of the OEM turbine flow based strategy. Enabled by default and highly recommended.

Display corrected boost pressure

By default, the boost gauge shows (absolute pressure – standard atmospheric pressure) which means at altitude with the engine not running it will report a negative number. This options corrects the boost gauge to show a true relative pressure of (manifold absolute pressure – atmospheric pressure)

Enable RaceROM Boost Controller

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

RBC – Same value in all modes

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

Use RBC as Custom Map input only

The RBC can be an excellent tool for interacting with Custom Maps. This option allows a value to be set using the cruise control switches, displayed on the boost gauge, but the value is not used as a limit to boost target. It is however available to use as a custom map, and used for example to adjust traction control implemented using Custom Maps.

Enable Upshift Spike Prevention

Overall enable for the USP strategy.

Boost Limit Fuel Cut

2000 Engine Speed (rpm) 2.40 bar

Mapswitch Mode	800	1200	1600	2000	2400	2800	3200	3600	4000	5000	6000	6400
1	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
2	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
3	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
4	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40

The manifold absolute pressure needs to exceed this limit, measured in Bar (relative) by the manifold pressure sensor, for a time that exceeds **Boost Limit Fuel Cut Delay**, to trigger a fuel cut as an overboost safety measure.

Boost Limit Fuel Cut Delay

0.200 Time (s)

Time period in seconds the ECU will wait before triggering a fuel cut when the manifold relative pressure exceeds the boost limit as set by the **Boost Limit Fuel Cut**.

Boost Limit Fuel Cut Hysteresis

0.600	Boost (bar)

Previous versions of RaceROM used separate cut and resume maps to introduce hysteresis into the fuel cut. However, in version 6 we have introduced a single value to set the hysteresis to simplify setting the boost limit fuel cut and conserve space within the ROM.

With the default limit of 2.4Bar and hysteresis of 0.6Bar, the fuel will be cut when the MAP exceeds 2.4Bar for 0.2 seconds and resume when the MAP drops below 1.8Bar.

Boost Target by Gear

4400 — Engine Speed (rpm) — 2.20 bar

Gear (gear) \ 3	1600	2000	2400	2800	3200	4000	4400	4800	5200	5600	6000	6400	6800
1	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
2	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
3	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05
4	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05
5	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05
6	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05

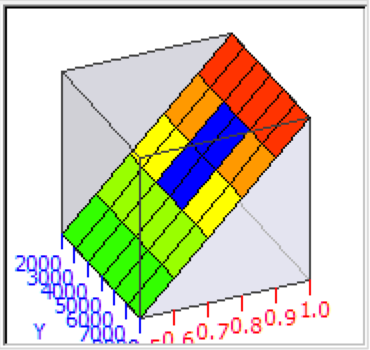
Boost target is no longer defined using a 3D map with RPM and throttle axis', instead the target is defined by gear and RPM, with throttle modulation coming in the form of a simple 2D map. There is also a corresponding boost target for FlexFuel operation named **FF Boost Target By Gear** and can be found in the *RaceROM FlexFuel* category.

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

0.8 — Atmospheric Pressure (bar) — -0.200 bar

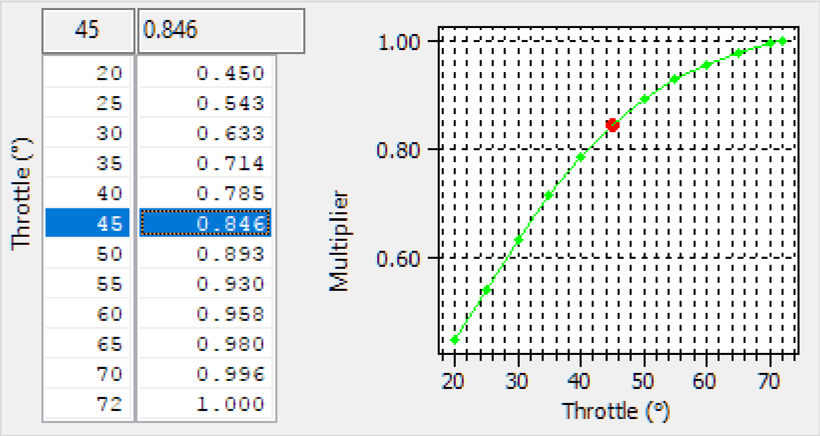
Engine Speed (rpm) \ 5000	0.5	0.600	0.700	0.800	0.8999	1
2000	-0.5	-0.400	-0.300	-0.200	-0.1000	0
3000	-0.5	-0.400	-0.300	-0.200	-0.1000	0
4000	-0.5	-0.400	-0.300	-0.200	-0.1000	0
5000	-0.5	-0.400	-0.300	-0.200	-0.1000	0
6000	-0.5	-0.400	-0.300	-0.200	-0.1000	0
7000	-0.5	-0.400	-0.300	-0.200	-0.1000	0
8000	-0.5	-0.400	-0.300	-0.200	-0.1000	0



The boost target can be offset for changes in atmospheric pressure the default map values reduce the absolute boost target 0.1Bar for each 0.1Bar drop in atmospheric pressure. This is suitable for stock turbos which will often be pushed to their maximum at sea level, and pushing the same absolute pressure at altitude can be detrimental to the turbos while not giving 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.

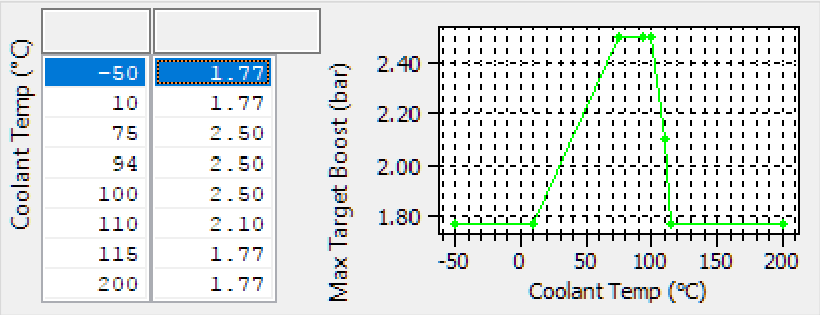
Boost Target Throttle Multiplier



Throttle (°)	Multiplier
20	0.450
25	0.543
30	0.633
35	0.714
40	0.785
45	0.846
50	0.893
55	0.930
60	0.958
65	0.980
70	0.996
72	1.000

The boost target as adjusted by the ***Boost Target Atmospheric Correction*** 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 By Temperature

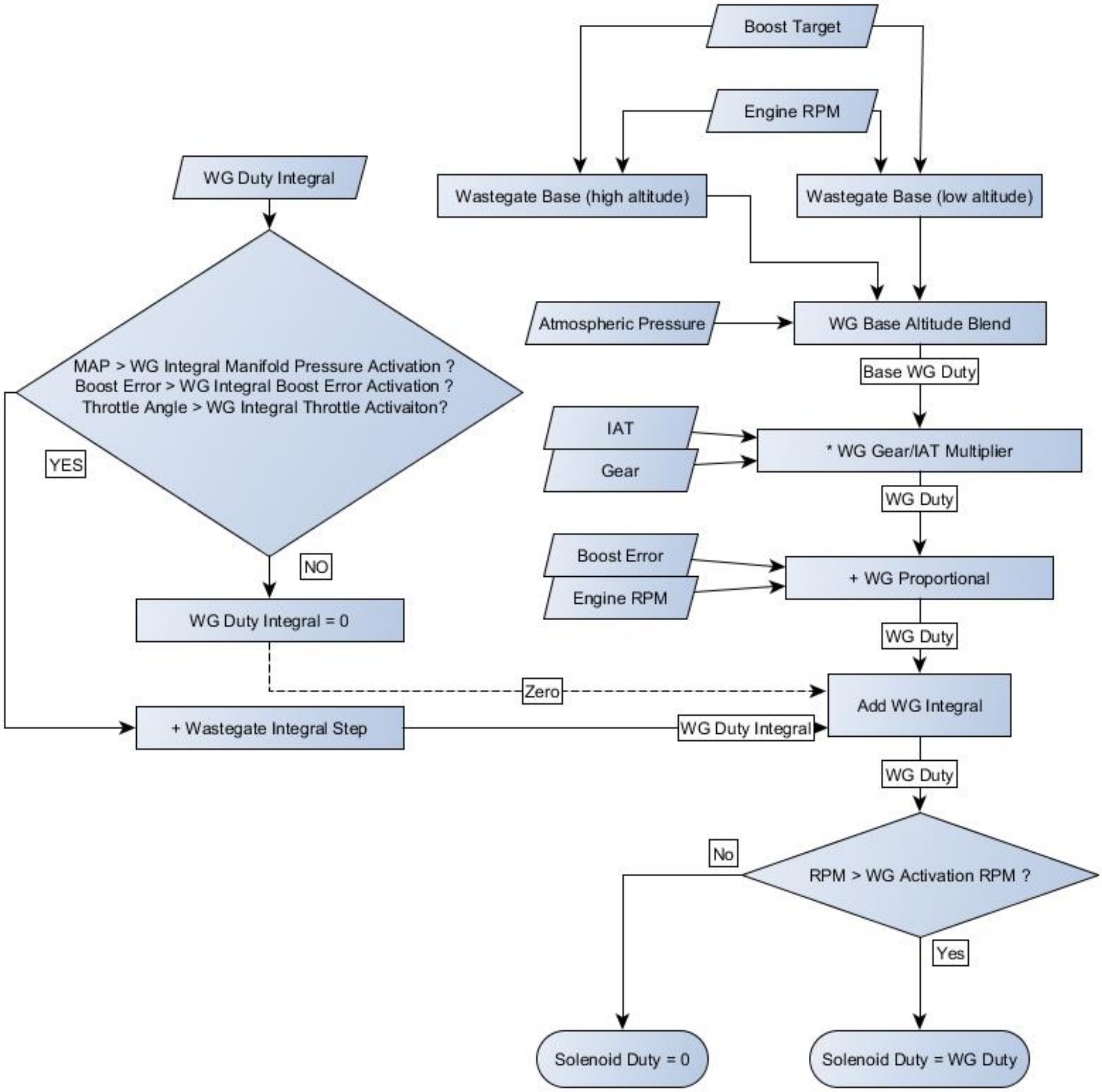


Coolant Temp (°C)	Max Target Boost (bar)
-50	1.77
10	1.77
75	2.50
94	2.50
100	2.50
110	2.10
115	1.77
200	1.77

Maximum target based on engine coolant temperature, used as a maximum limit for boost target at normal engine temps and reduced significantly at excessive temps for engine safety.

Wastegate Duty Calculation

The Wastegate duty calculation follows the process below, the closed loop control consists of a base wastegate duty that blended from a high and low altitude base map def into a base multiplier for IAT/Gear. The base duty is always subject to a proportional correction, and an integral correction term is calculated and added only when MAP, Boost Error and Throttle Angle tests are met. There is an overall enable of boost control based on RPM, and the wastegate duty is always zero if the engine speed is below this RPM threshold.



WG Activation RPM

1800	RPM (rpm)

The wastegate solenoid will not be active until this RPM is reached.

WG Base Duty (low altitude)
WG Base Duty (high altitude)

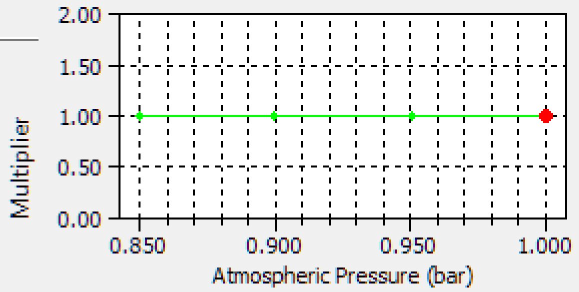
2.3 — Target Boost (bar) — 67.1 %

Engine Speed (rpm) \ Target Boost (bar)	1.5	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.0
1600	0	29	50.0	55.1	64.5	71.9	82.2	89.2	90.6	92.6	94.6	94.6	94.6	94.6	94.9	95
2000	0	29	50.0	55.1	64.5	71.9	82.2	89.2	90.6	92.6	94.6	94.6	94.6	94.6	94.9	95
2400	0	29	47.0	51.6	59.7	67.2	76.6	83.4	87.4	90.2	92.0	94.6	94.6	94.6	94.9	95
2800	0	29	44.0	48.2	55.6	62.7	72.0	78.6	81.2	84.6	88.2	90.6	91.2	92.0	94.3	95
3200	0	29	40.0	44.8	52.0	58.5	65.7	72.4	76.3	79.9	83.6	85.7	88.6	91.9	94.3	95
3600	0	29	37.0	42.4	49.2	55.1	60.5	66.4	71.1	75.8	80.2	83.5	87.7	91.8	94.3	95
4000	0	29	35.0	40.1	47.3	53.1	59.0	63.7	68.2	73.9	78.4	82.3	87.0	91.8	94.3	95
4400	0	29	36.0	42.0	48.1	54.1	59.6	63.6	67.1	72.7	78.2	82.0	86.8	91.8	94.3	95
4800	0	29	38.0	43.2	49.5	55.7	62.0	65.2	68.7	74.4	79.7	82.0	86.8	91.8	94.3	95
5200	0	30	39.0	44.7	51.5	58.2	66.0	69.3	73.1	77.9	82.9	86.3	89.7	93.0	94.3	95
5600	0	31	41.5	46.9	54.2	63.6	73.1	75.7	79.0	82.0	88.2	91.8	93.2	94.5	95.0	95
6000	0	32	43.0	50.3	58.5	70.8	83.3	84.7	86.4	89.1	92.2	94.9	95.0	95.0	95.0	95
6400	0	34	46.0	54.8	64.7	77.5	90.0	91.3	93.2	93.5	94.7	95.0	95.0	95.0	95.0	95
6800	0	35	47.3	57.1	70.8	83.5	92.9	93.6	94.4	94.7	94.9	95.0	95.0	95.0	95.0	95
7200	0	36	48.7	59.4	74.2	86.9	93.5	94.5	95.1	94.4	95.0	95.0	95.0	95.0	95.0	95
7600	0	37	50.0	61.8	75.5	88.3	94.5	94.0	94.5	94.8	95.0	95.0	95.0	95.0	95.0	95

These two maps are used to set a base duty for high and low altitudes, which are combined using the *Wastegate Base Altitude Blend* map. The X axis is target boost in Bar(absolute) and the Y axis is engine speed.

WG Base Altitude Blend

Atmospheric Pressure (bar)	1
0.850	1
0.900	1
0.950	1
1.000	1



This map defines how the high and low altitude base maps are combined to produce the wastegate base duty. A value of 1.0 uses only the value from the low altitude (sealevel) base map, a value of 0.0 uses only the value from the high altitude base map. The final value for *WG Duty Base* is calculated as:

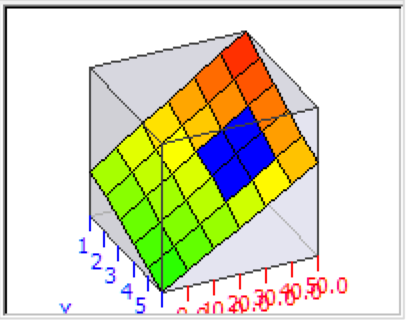
$$\begin{aligned} WG\ Duty\ Base = {} & (WG\ Base\ Duty\ (low\ altitide) \times WG\ Base\ Altitude\ Blend) \\ & + \big(WG\ Base\ Duty\ (high\ altitide) \times (1 - WG\ Base\ Altitude\ Blend)\big) \end{aligned}$$

The example shown below uses the high altitude base map at 0.85 bar atmospheric pressure and the low altitude base map at 1.00 bar atmospheric pressure with linear interpolation in between.

WG Gear/IAT Multiplier

30.0 | Intake Air Temperature (°C) | 1.033

Gear (gear) 4	-10.0	0.000	10.00	20.00	30.00	40.0	50.0
1	0.954	0.989	1.024	1.060	1.096	1.13	1.17
2	0.936	0.971	1.005	1.040	1.074	1.11	1.14
3	0.918	0.952	0.986	1.020	1.054	1.09	1.12
4	0.900	0.933	0.967	1.000	1.033	1.07	1.10
5	0.882	0.915	0.947	0.980	1.013	1.04	1.08
6	0.864	0.896	0.928	0.960	0.992	1.02	1.06



The output of the Wastegate base duty map can be multiplied to increase or decrease it to compensate for changes in intake air temp and/or gear. Typically the base duty is increased with values greater than 1.0 for lower gears (1st/2nd) to improve spoolup with rapidly changing RPM. Conversely the base duty is often decreased with values of less than 1.0 for higher gears (5th/6th) to prevent overboost with increasing load and slower RPM rates.

WG Integral Boost Error Activation

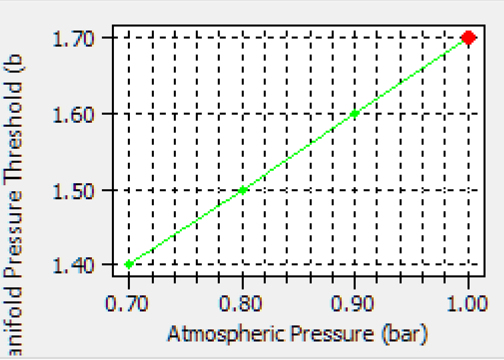
Boost Error (bar)
-0.500
-0.600

A threshold of boost error with hysteresis to enable integral closed loop control of the wastegate duty. Integral feedback is activated when the upper value is exceeded and remains active until the error drops below the lower value. This table can be used to stop integral windup when at full throttle and waiting for the boost to rise.

Integral correction will only begin when the conditions for Boost Error, MAP and Throttle are met, and will be reset to zero if any one of these conditions are not met

WG Integral Manifold Pressure Activation

Atmospheric Pressure (bar) 1.000	1.70 bar
0.700	1.40
0.800	1.50
0.900	1.60
1.000	1.70



A threshold of manifold absolute pressure above which the integral correction is activated.

This table can be used to stop “integral windup” by preventing integral feedback under conditions where the boost control cannot realistically achieve any target boost. The input axis is Atmospheric pressure, and allows the tuner to lower the threshold in line with the drop in atmospheric pressure. Typically this table is set at or slightly below the base pressure for the actuator or wastegate.

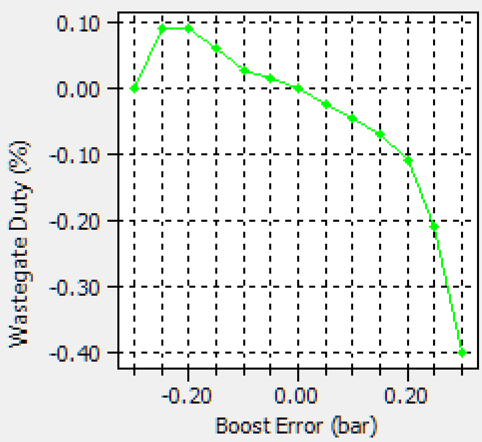
WG Integral Manifold Pressure Hysteresis

Manifold Pressure Hysteresis (bar)
0.200

Manifold Absolute Pressure must fall below *WG Integral Manifold Absolute Pressure Activation* by this value for the integral correction to become inactive.

WG Duty Integral Step

Boost Error (bar)	
-0.3000	0.0000
-0.2500	0.0900
-0.2000	0.0900
-0.1500	0.0600
-0.1000	0.0260
-0.0500	0.0150
0.0000	0.0000
0.0500	-0.0250
0.1000	-0.0460
0.1500	-0.0700
0.2000	-0.1100
0.2500	-0.2100
0.3000	-0.3999



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 can be observed by checking the *WG Duty Integral* live data parameter which is logged by default.

WG Duty Integral Min/Max

	Wastegate Duty (%)
-20	
20	

The integral correction can be limited with these two values. The minimum limit is the top value and the max limit is the lower value. On cars running significantly larger turbos than stock, these values can be scaled down in line with the expected lower wastegate duty. Values of approximately +/- 20% of your max final duty will be a good start.

WG Integral Throttle Activation

Throttle (°)	
35	Integral active above
30	Integral inactive below

A threshold of throttle angle with hysteresis to enable integral closed loop control of the wastegate duty. Proportional and integral feedback is activated when the upper value is exceeded and remains active until the throttle angle drops below the lower value. This table can be used to stop overactive closed loop corrections under light load conditions.

WG Proportional

0.150 Boost Error (bar) -11 %

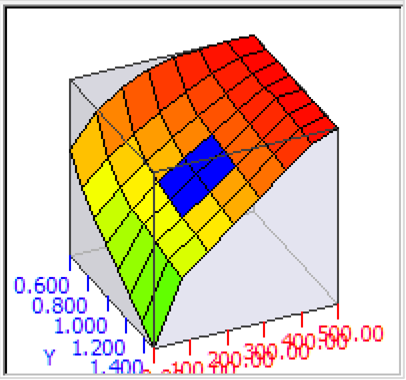
Engine Speed (rpm) \ 3600	-0.400	-0.300	-0.200	-0.150	-0.1000	-0.0500	0	0.0500	0.1000	0.150	0.200	0.300	0.50
1600	48.1	38.41	26.59	14.04	6.02	1	0	-1	-5	-11	-18	-27	-35
2000	39.7	30.41	20.52	11.75	5.52	1	0	-1	-5	-11	-18	-27	-35
2400	28.0	21.41	15.83	9.83	5.00	1	0	-1	-5	-11	-18	-27	-35
2800	22.6	17.41	12.63	8.21	4.39	1	0	-1	-5	-11	-18	-27	-35
3200	17.9	13.90	10.10	6.72	3.76	1	0	-1	-5	-11	-18	-27	-35
3600	14.4	11.40	8.40	5.60	3.20	1	0	-1	-5	-11	-18	-27	-35
4000	12.2	9.70	7.30	5.00	2.90	1	0	-1	-5	-11	-18	-27	-35
4400	11.0	8.80	6.70	4.60	2.80	1	0	-1	-5	-11	-18	-27	-35
4800	10.4	8.30	6.40	4.50	2.70	1	0	-1	-5	-11	-18	-27	-35
5200	10.1	8.20	6.20	4.40	2.70	1	0	-1	-5	-11	-18	-27	-35
5600	10.0	8.10	6.20	4.40	2.60	1	0	-1	-5	-11	-18	-27	-35
6000	10.0	8.10	6.20	4.40	2.60	1	0	-1	-5	-11	-18	-27	-35

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 high wastegate duty on spool.

WG Upshift Compensation

150.00 Time (ms) 74.1 %

Boost (bar) 1.200	0.00	50.0	60.0	150	200	250	300	500
0.600	70.0	83.9	91.2	96.7	99.1	99.8	100.0	100
0.800	59.3	69.7	76.9	83.7	89.5	94.6	98.7	100
1.000	52.0	62.5	70.5	78.1	85.4	92.4	98.3	100
1.100	46.3	58.7	67.6	75.6	83.5	91.2	97.9	100
1.200	40.9	57.8	65.9	74.1	82.3	90.4	98.6	100
1.300	35.6	55.7	64.1	72.6	81.0	89.4	97.8	100
1.400	30.3	53.6	62.3	71.0	79.7	88.4	97.1	100
1.500	25.0	51.6	60.5	69.5	78.5	87.4	96.4	100



A temporary change in the Wastegate duty triggered with an upshift to prevent the 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.

Clutch Slip Protection

Introduction

To meet the increasing demands of higher and higher power levels being achieved on a reprogrammed factory ECU, we have added a strategy to adjust the power output to control and prevent clutch slip. This can be used to both impose a torque limit and/or retard the ignition to temporarily reduce power to halt clutch slip to acceptable levels.

This strategy will cater for instances where the TCM does not send a torque reduction request after a launch.

Map List

- Clutch Slip Protection
  - Clutch Slip Protection Enable
  - CSP Activation Input Shaft RPM
  - CSP Activation Load
  - CSP Activation Load Hysteresis
  - CSP Activation Upshift Delay
  - CSP Activation Vehicle Speed
  - CSP Entry Delay
  - CSP Entry Slip
  - CSP Exit Delay
  - CSP Exit Slip
  - CSP Ignition Retard
  - CSP Slip Target
  - CSP Torque Reduction Gain
  - CSP Torque Reduction Rate
  - CSP Torque to Boost Gain
  - CSP Torque to Retard Gain

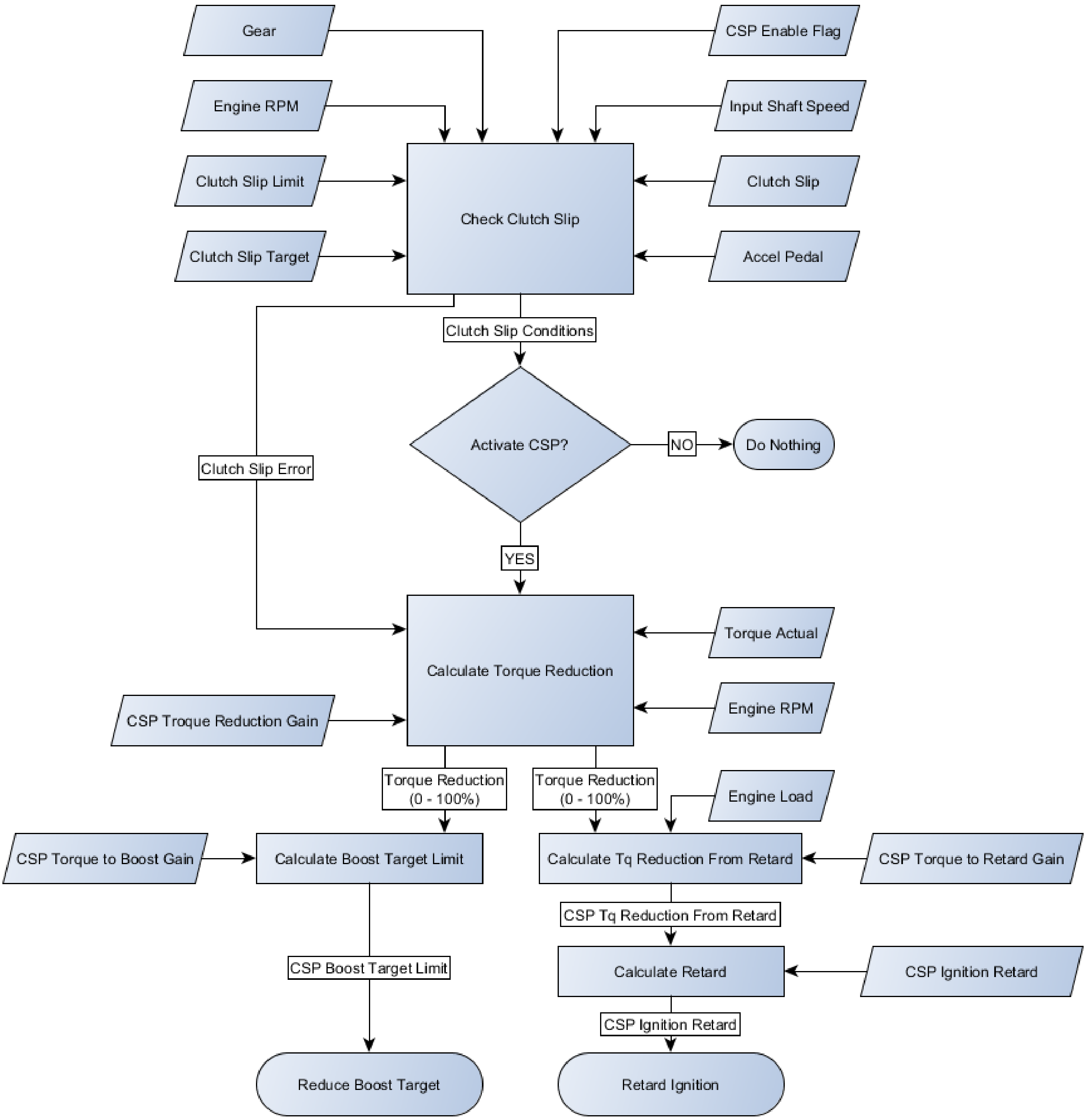
Live Data Parameters

- *Clutch Slip (RPM) – Define as Engine Speed – Input Shaft speed in RPM. This can be negative as the engine speed increases to match shaft speed, typically on a downshift.*
- *Clutch Slip Error (RPM) – Difference between the current clutch slip and the target clutch slip, positive values mean more slip than desired.*
- *Clutch Slip Timer (Seconds) – Elapsed time that clutch slip has been over the limit while all other conditions for entering Clutch Slip Protection have been met. The timer stops once the timer reaches **CSP Entry Delay**.*
- *Clutch Slip Exit Timer (Seconds) – Elapsed time that clutch slip has been below **CSP Exit Slip**, the timer stops once timer reaches **CSP Exit Delay.***
- *Clutch Upshift Timer(Seconds) – Elapsed time since an upshift was detected due to an increase of current gear.*
- *CSP Flags – Combination of flags used for diagnostic purposes by EcuTek*
- *CSP Ignition Retard (degrees) – Amount ignition timing has been retarded due to Clutch Slip Protection.*
- *CSP Boost Limit (Bar) – Boost Target Limit imposed due to Clutch Slip Protection.*
- *CSP Torque Reduction (%) - Current torque will be reduced by this percentage if CSP becomes active. Used as input on Y axis to **Clutch Slip Retard** map.*

Operation

Once slip exceeds **CSP Entry Slip** for a time exceeding **CSP Entry Delay** then CSP becomes active and it reduces the power using ignition retard and reduced boost target. The strategy will try to bring the clutch slip down to **CSP Slip Target** and remains active until *Clutch Slip* drops below **CSP Exit Slip** for a time exceeding **CSP Exit Delay**.

The **CSP Torque Reduction Gain** map is used to change the overall torque reduction response to clutch slip, the **CSP Torque to Boost Gain** and **CSP Torque to Retard Gain** determine how that torque reduction is achieved, this is detailed below.



CSP Enable

File Edit

- ☑ Enable CSP in Mode 1
- ☑ Enable CSP in Mode 2
- ☑ Enable CSP in Mode 3
- ☑ Enable CSP in Mode 4

Clutch Slip Protection measures can be enabled per Mapswitch mode and are enabled in all modes by default.

80.0 Load (%)

CSP Activation Load

Minimum engine load required to enable CSP intervention, raise this if CSP becomes intrusive at low load dealing with normal levels clutch slip encountered on some cars.

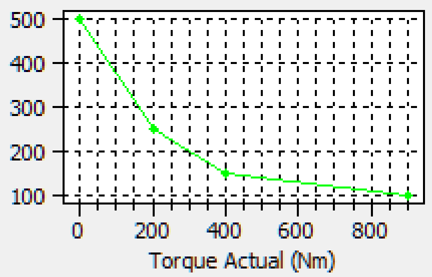
CSP Activation Load Hysteresis

50.0 Load (%)

Once CSP has been activated, the engine load must fall below **(CSP Activation Load – CSP Activation Load Hysteresis)**. The default setting of this value results in CSP remaining active after some excessive clutch slip even if the load falls to a moderately low value. If CSP is generally too intrusive, better results may be obtained by dropping this to 20% load.

CSP Upshift Delay

Torque Actual (Nm)	Time (Milliseconds)
0	500
200	250
400	150
900	100



Clutch slip will be ignored for this amount of time after an increase in current gear. This is used to ignore normal levels of slip during and shortly after a gearshift.

CSP Entry Slip

150 Slip (RPM)

Clutch Slip needs to exceed this value for longer than **CSP Entry Delay** for clutch slip to be considered significant and CSP to be triggered, once triggered it will remain active until the slip drops below **CSP Slip Target**.

CSP Entry Delay

150 Time (Milliseconds)

Clutch Slip needs to exceed **CSP Entry Slip** for this delay time for clutch slip to be considered significant and CSP to be triggered.

CSP Exit Delay

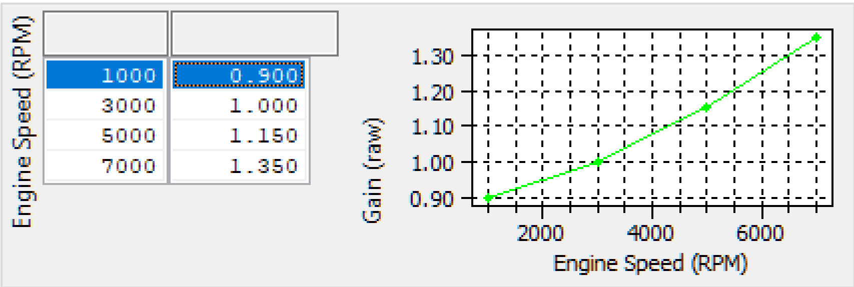
150 Time (Milliseconds)

Clutch Slip needs to fall below **CSP Exit Slip** for this delay time for clutch slip to be ignored and CSP deactivated.

CSP Slip Target

Clutch Slip Error is defined as *Clutch Slip* – ***CSP Slip Target*** and once triggered, Clutch Slip Protection will remain active until *Clutch Slip* has dropped below **CSP Exit Slip**.

CSP Torque Reduction Gain



The level of torque reduction is dictated by the gain values in this map and the amount of unwanted clutch slip *Clutch Slip Error* which is defined as:

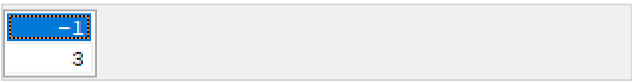
$$Clutch\ Slip\ Error\ (rpm) = Clutch\ Slip(rpm) - Clutch\ Slip\ Target(rpm)$$

The amount of torque reduction that results is calculated as:

$$CSP\ Torque\ Reduction\ (\%) = \frac{Clutch\ Slip\ Error\ (\mathrm{rpm}) \times\ Clutch\ Slip\ Gain}{10}$$

Therefore, a *Clutch Slip Error* of 200rpm, and a *Clutch Slip Gain* of 1.15 will result in a torque reduction of 23%

CSP Torque Reduction Rate

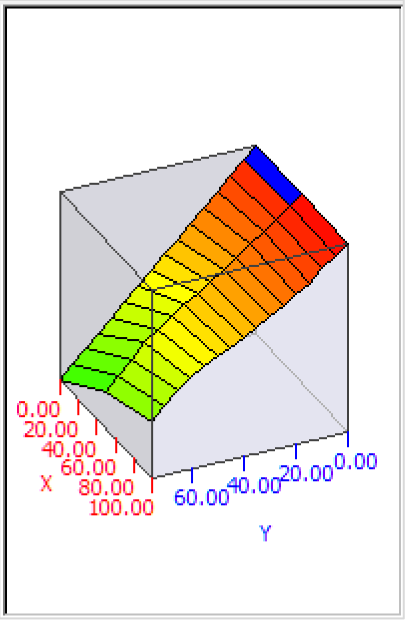


The top value is the limit to the rate at which torque can be reduced and the bottom value is the maximum rate at which torque can be raised. These values are used to prevent rapid oscillation of *CSP Torque Reduction*

CSP Ignition Retard

Torque Reduction (%)

	0.00	50.0	100
0.00	0	0	0
2.34	-4	-3	-3
5.47	-8	-6	-6
7.81	-12	-9	-10
10.94	-16	-12	-12
15.63	-20	-15	-15
21.88	-24	-18	-17
30.47	-28	-21	-20
38.28	-32	-24	-22
45.31	-36	-26	-24
50.00	-40	-29	-26
54.69	-44	-32	-28
60.16	-48	-35	-31
64.84	-52	-40	-34
70.31	-56	-44	-38
75.00	-60	-48	-42



A simple lookup table that returns an ignition offset (negative values retard the ignition) to reduce the torque based on the magnitude of *CSP Torque Reduction* This map should be adjusted to allow the retard to achieve the requested torque reduction. To alter the torque reduction overall changes should be made to **CSP Torque Reduction Gain.**

CSP Torque to Retard Gain

0.800	Gain

The torque reduction achieved using ignition retard is changed by altering this value, it multiplies the initial *CSP Torque Reduction* value before it's fed to the **CSP Ignition Retard** map. Using the default gain of 0.7 combined with a **TQ Limit Gain** value of 0.3 will result in 70% of the torque reduction coming from retard alone, while 30% of the torque reduction will be achieved by imposing a torque limit (which will close the throttle as required).

The **Ignition Retard Gain** and **TQ Limit Gain** values are intended to change the balance of torque reduction between retard and a throttle base torque limit. If you are trying to tune the CSP and wish to change the overall torque reduction, then the **CSP Torque Reduction Gain** map should be adjusted.

CSP Torque to Boost Gain

0.400	Gain

The overall CSP torque reduction is used to reduce the boost to give a slower reacting but longer lasting torque reduction by lowering the boost target. The reduction in target Manifold Absolute Pressure is calculated as CSP Torque Reduction * CSP Torque to Boost Gain.

Custom Maps

Introduction

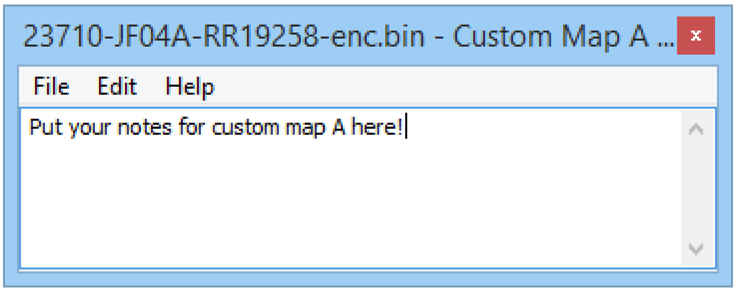
We have improved our unique and innovative Custom Maps feature to enable even more tuning possibilities. With the addition of our dedicated boost control and FlexFuel strategies, all 16 custom maps are now available for the tuners to further exploit the power of RaceROM.

Additional inputs and outputs, combined with expanded possibilities for manipulating the values, allow for complex control strategies to be created from something as simple as a fuel pressure fail safe to a slip target based multi-layered traction control system.

Map List

Custom Map Notes

Notes relating to each custom map can be added here. There is a 100 character limit. The “delete” key cannot be used as it’s still a hot-key for triggering live data, and the “Ctrl-S” hotkey combination doesn’t work for the moment so quit and click *Yes* on the *Save Changes To Custom Map X* dialog box to save your changes.



New Inputs

Boost Sensor B1 (V) / Boost Sensor B2 (V)

When EcuTek boost control is enabled (which uses the OEM charge pipe) boost sensors can be used as voltage inputs for Custom Maps. There have been reports on some ROMs using later Phase 4 patches (v15xxx) where the use of the boost sensors has caused gradual fuelling changes, so please exercise caution if using these.

FlexFuel Ethanol Content

From the FlexFuel strategy this is a dedicated live data parameter that can be used as an input to Custom Maps to extend the base FlexFuel features.

Fuel Injector Duty (%)

Fuel injector duty cycle averaged across both banks.

Heated O2 Sensor B1 (V) / Heated O2 Sensor B2 (V)

The rear lambda sensor inputs can be used as voltage inputs into Custom Maps. Be sure to have the “Disable RearO2 Sensors” check box ticked in the **Enable Special Features** option list.

Ignition Timing (º)

The actual final ignition timing after all compensations or torque corrections. **WARNING** This input should not be combined with an output using ignition timing as it will produce unpredictable results. It can however be used to act upon extremes of ignition timing such as those seen during gear change, launch control and other torque reductions.

Knock Correction (º)

Ignition corrections created by the knock control system. This can be employed to reduce load, boost target or torque limits during excessive knock retard.

Launch RPM Target (RPM)

The current launch control target RPM. This can be used to make further changes to the engine running while in launch control.

Launch RPM Error (RPM)

The Launch RPM error defined as RPM – Launch RPM Target. This can be used to make further corrections to the engine running based on disparity between the actual and target RPM.

Map Sensor Voltage (V)

If the OEM boost control strategy is still used the manifold pressure sensor input can be used for voltage input to Custom Maps.

VDC Torque Limit Request (Nm)

The VDC torque limit sent to the ECU for traction control.

Wheel Slip Ratio (%)

Calculated as *100*(Rear WS – Front WS)/Front WS* and can be used for traction control strategies. This value is similar to the slip or spin values found in aftermarket ECUs.

Wheel Speed Front (km/h) / Wheel Speed Rear (km/h)

Wheel speed for each axle is now chosen from the **Wheel Speed Setup** option list and you can choose from left, right, max, min or average.

New Outputs

Calculation 1 / Calculation 2

These appear simple but greatly enhance the capabilities of Custom Maps as they can be created in one Custom Map and then manipulated by successive Custom Maps as a custom variable. This has been used on 370z to turn wheelspin into to a torque reduction using a few Custom Maps to create a traction control setup that is variable with road speed, RPM, Lateral G and an external input or RaceROM controller.

Target AFR (n:1)

This can be used to manipulate the target AFR for engine safety, fuel trimming, lean spool etc

Charge Air Temp for SD (ºC)

This can be used to manipulate the speed density calculation via the charge temp input.

Fuel Pump Duty (%)

This can be used to manipulate the primary fuel pump controller duty cycle for complex control.

Secondary Air Pump (0=off, 1=on)

Can be used for general purpose on/off control on cars with the secondary air system removed.

Secondary Air Solenoid (0=off, 1=on)

Also used by the 12 injector setup, but can used for general purpose on/off control otherwise.

Secondary Fuel Pump (0=off, 1=on)

Can be used for overall on/off control of the secondary fuel pump.

Cylinder Cut Probability (%)

Uses a pseudo randomised cut of fuel which can be used for torque reduction in traction control, anti-lag system control with a jacked open throttle and many more applications.

Throttle Target (º)

EXTREME CAUTION! Be very careful to use the correct output type as using a “replace value” option can overwrite the intended throttle opening angle.

This can be used primarily to reduce the throttle for the regulation of power, but can also be combined with other Custom Maps and outputs like cylinder cut % to create interesting effects.

Torque Limit (Nm)

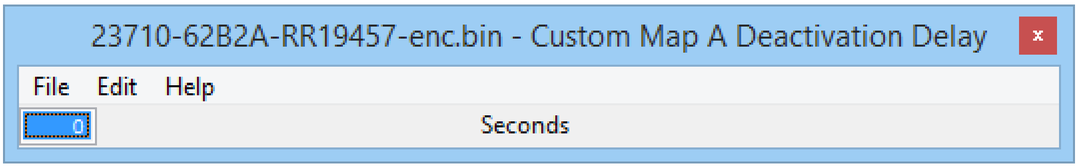
This can be used to reduce the available torque via throttle closure and can be very useful for failsafe Custom Maps, as it provides an easy way to reduce power in a predictable way. Please be aware that if Valet Mode is enabled, *Torque Limit* outputs from Custom Maps will be disabled.

Volumetric Efficiency (%)

Applied over the output of the SD Volumetric Efficiency (VE) map, and can be used for closed loop VE correction, TPS compensation (eg for individual throttle tuning) and for making temporary corrections to the VE using the RaceROM boost controller or external 0-5v input.

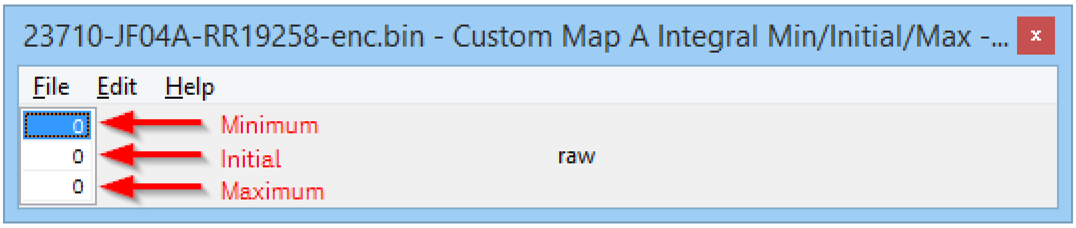
Deactivation Delay

Activation and deactivation now how independent delay times. This means you can trigger a custom map to be active immediately and it will remain on for a time even if the activation conditions are no longer met, for example a 10 second boost target increase.



Integral Min/Initial/Max

On our previous Custom Maps implementation the integral function would always start and default back to zero making multiplication via an integral impossible. An initial value of 1 will fix the issue.



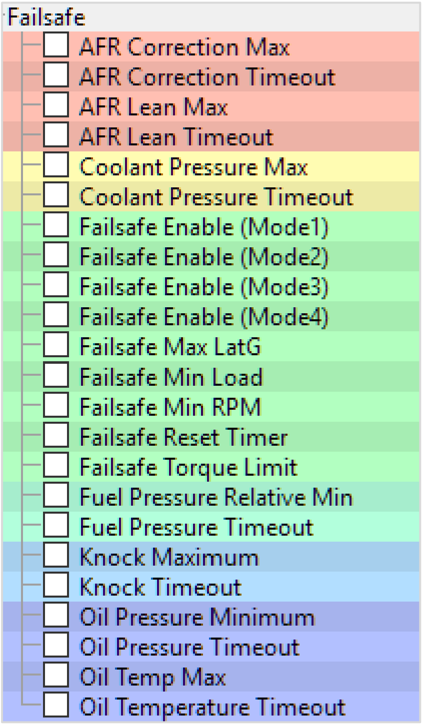
Failsafe

Introduction

Adding an element of safety to tuning, a range of thresholds for important engine variables that if not in a desired range will trigger a torque limit to cut power.

To clear the limp mode torque limit, the ignition will be turned off for a few seconds and then the engine restarted.

Map List



Live Data Parameters

- *Limp Mode Flags – A single integer value that shows the reason limpmode was initially triggered.*

1	*Knock Retard*
2	*Low Oil Pressure*
4	*High Oil Temp*
8	*High Short Term Fuel Trim*
16	*Low Relative Fuel Pressure*
32	*Lean AFR*
64	*High Coolant Pressure*
128	*Custom Maps Limp Mode Flag*

- *Limp Mode Stored Flags – A single integer value that records the last limp mode to be set on the car. There is not currently a way to reset this parameter.*

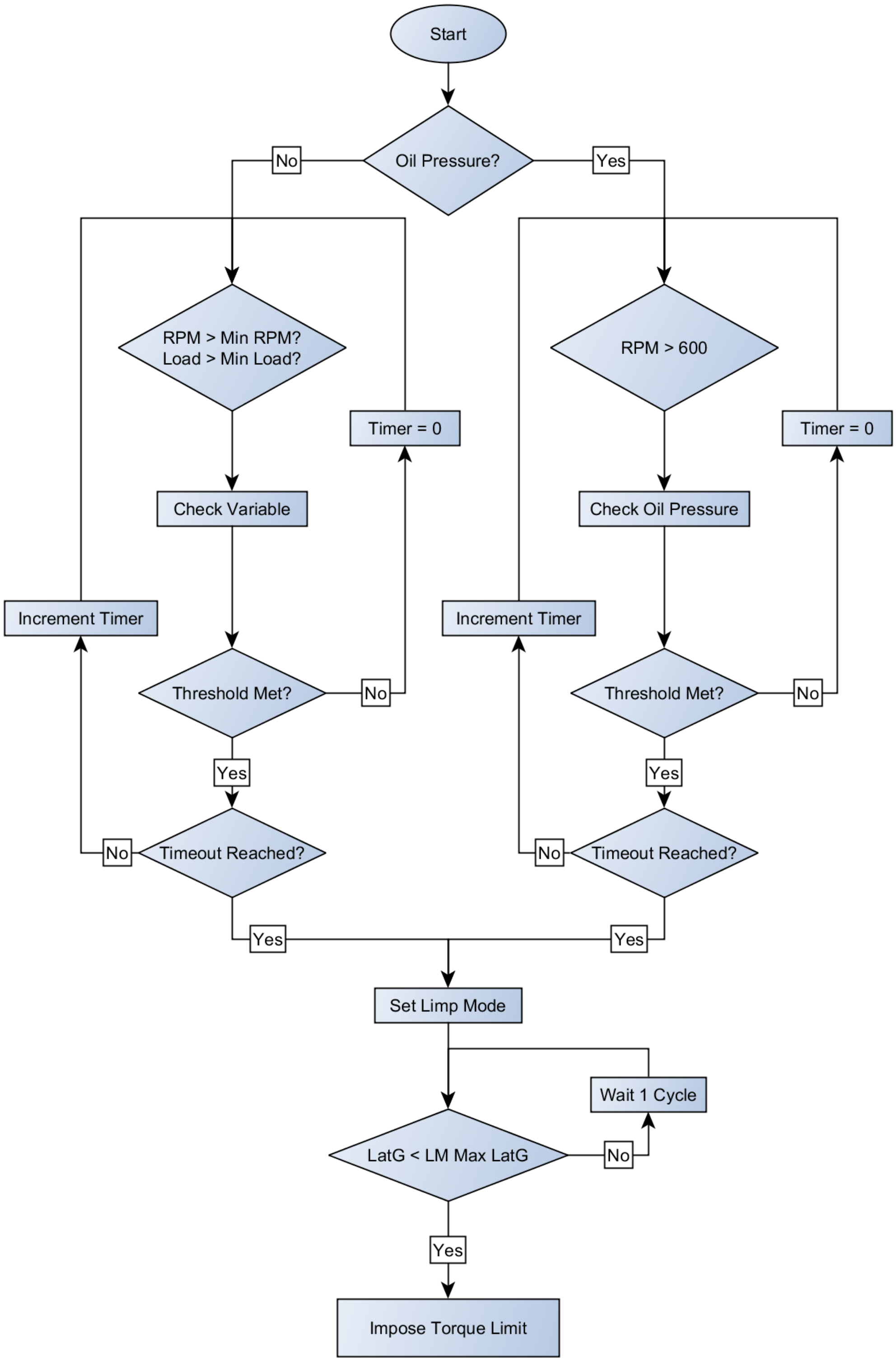
Operation

In each case a safe threshold (high or low) and a timeout is defined. Once the *Engine Load* is greater than **Failsafe Min Load** and the *Engine Speed* is greater than **Failsafe Min RPM** the various thresholds are compared for each of the channels, if the measured value crosses the threshold for time greater than the timeout, then a failsafe condition will be set for that channel.

The exception to this is the failsafe for oil pressure, which is always active over 600rpm as a loss of oil pressure will not normally rely on high load or engine speed.

The torque limiting action is performed when *G Force Lateral* falls below the **Failsafe Max LatG** threshold. The lateral G lockout means a tuner has the option of not allowing a sudden loss of power when cornering hard.

The failsafe strategy is outlined in the diagram below.



AFR Correction Max

116 AFR correction (%)

This sets the maximum allowable *Fuel Trim Short Term Bank #1/#2* values, that if reached for **AFR Correction Timeout** while over the **LM Min Load** and **LM Min RPM** will trigger the limp mode limit. Note the default value for this is less than the maximum possible fuel trim of 120% so if enabled, poor tuning or inadequate hardware will be quickly found.

AFR Correction Timeout

1 Time (Seconds)

Fuel Trim Short Term Bank #1/#2 will need to exceed the **AFR Correction Max** thresholds for longer than this delay for the limp mode torque limit to be applied.

AFR Lean Max

13 AFR (afr)

This sets the maximum allowable *AFR Bank1/2* values, that if reached for **AFR Lean Timeout** while over the **LM Min Load** and **LM Min RPM** will trigger the limp mode limit. After ignition-on, *AFR Bank1/2* is monitored and ignored until both sensors are observed outside of the range 14.6 to 14.8 to mitigate AFR limp mode trips on sensor warmup.

AFR Lean Timeout

1 Time (Seconds)

Delay timer in seconds for the **AFR Lean** Max safety trip.

Coolant Pressure Max

3.5 Coolant Pressure (bar)

High coolant pressure can be encountered on high power maximum effort engines as an early sign of head gasket failure due to combustion gases compromising the gasket seal. This limp mode trigger allows an additional sensor configured using coolant pressure options to be used to trigger the torque limit, typically a 0-10bar sensor similar to those used for fuel pressure measurement plumbed into the top radiator hose is suitable. Due to the losses around the coolant system the pressure will vary greatly at different locations, you should first familiarise yourself with normal pressure levels before relying on this.

Coolant Pressure Timeout

0 Time (Seconds)

Delay timer in seconds for the **Coolant Pressure** Max safety trip, this is set to 0 Seconds by default to ensure immediate drop in pressure if dangerously high coolant pressure is encountered.

Fuel Pressure Relative Min

2.5 Fuel Pressure (bar)

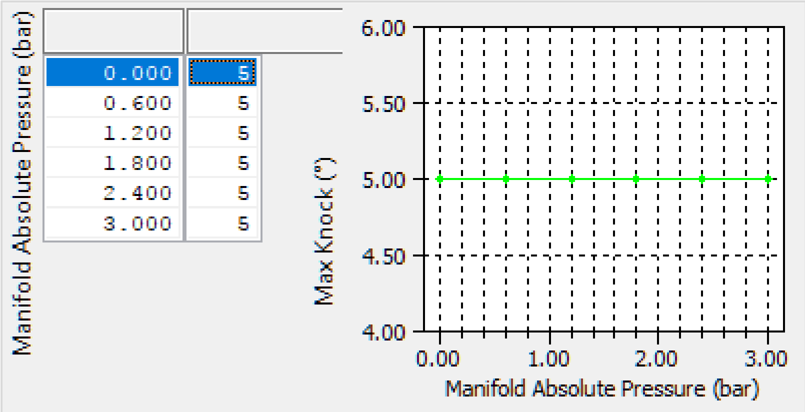
As detailed in the section on fuelling, relative fuel pressure should be consistent with boost, so a single value can be used to determine if the fuel pump is coping with the current demand. Be aware that far too many moderate and high power GT-Rs do not have fuel pumps capable of maintaining the set pressure. If you are adding a fuel pressure sensor for the first time you may find that this threshold causes the limp mode to be set, but ignorance is not bliss!

Fuel Pressure Timeout

1 Time (Seconds)

Delay threshold for the **Fuel Pressure Relative Min** limp mode to be set. On maximum effort cars you may need to lower this threshold to around 0.2 seconds to avoid lean AFRs while experiencing fuel supply issues (although the lean trip and fuel trim trips will offer additional safety).

Knock Maximum



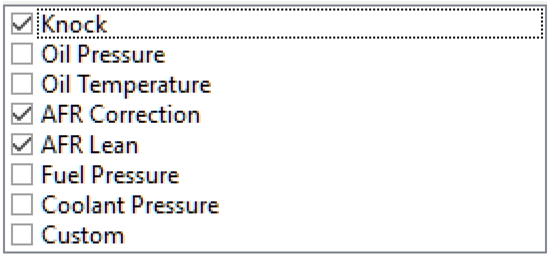
A threshold of the maximum level of knock retard that is permitted before limp mode is triggered. The values in the map equate to retard, so a limit of 5 will be triggered when *Knock Correction* reaches -5 degrees.

Knock Timeout

Delay threshold for **Knock Maximum** limp mode, the knock retard will have to exceed the maximum for at least this time to trigger a failsafe condition.

LM Enable (Mode1 – Mode4)

Each limp mode test can be independently enabled per Mapswitch mode.

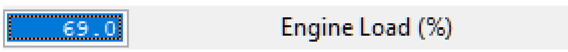


LM Max LatG

The limp mode torque limit will not be imposed until the lateral G has dropped below this absolute threshold. However even while the Lateral G exceeds this limit, the all limp mode tests will continue and if triggered will latch on, only the torque limit itself will be delayed. The default value of 1 will impose the torque limit once the lateral G is within the range of -1 to +1.

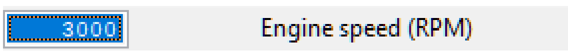
Requires TCM RaceROM to receive Lateral G data.

LM Min Load



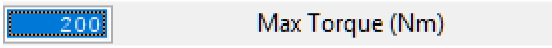
All the tests except oil pressure will only be carried out while engine load is greater than this value.

LM Min RPM



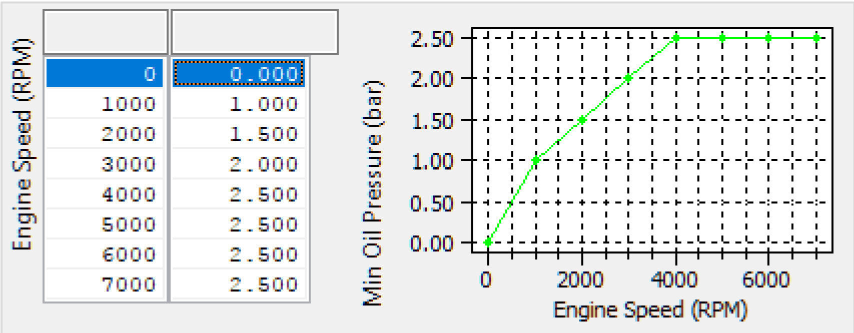
All tests except oil pressure will only be carried out while the engine RPM is greater than this value.

LM Torque Limit



Once a safety trip has been triggered and the ECU puts the car into limp mode a torque limit will be applied using this value.

Oil Pressure Minimum



When using a RaceROM equipped ROM in the TCM the ECU can receive oil pressure information and use this for checking for issues. To trip the oil pressure limp mode, the measured pressure needs to drop below **Oil Pressure Minimum** for at least **Oil Pressure Timeout**.

LM Min Load and **LM Min Load** are ignored when testing oil pressure for limp mode purposes, instead the engine RPM must be above 600RPM to avoid triggering the limp mode when the engine isn't running or on start-up.

Oil Temp Max

A maximum safe oil temperature above which limp mode will be entered. Primarily useful for cars used on circuit or in situations with sustained high power.

Oil Temperature Timeout

Oil Temperature will need to exceed **Oil Temp Max** for this time for limp mode to be triggered. Given the slow rate at which oil temperate changes, this can be extended to ignore brief peaks that might be encountered.

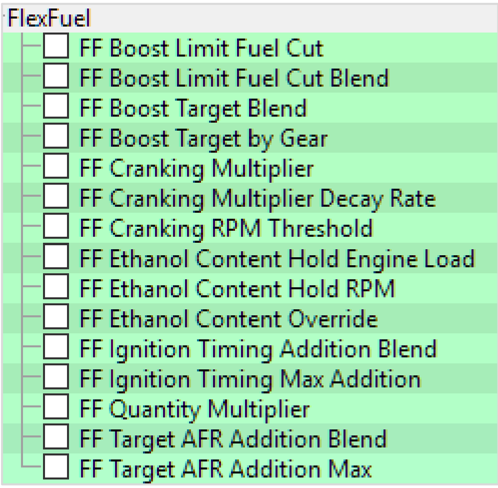
FlexFuel

Introduction

FlexFuel support was added as an integral part of the Phase 5 RaceROM upgrade. It uses a strategy of ignition and AFR target modifier maps for 100% E85 and 2d maps to determine how much of that modification is applied. The difference in base fuel requirement is taken care by the **FlexFuel Quantity Multiplier** map and a 2d blend map. Typically, 40% extra fuel will be required for 100% E85 to maintain the same Lambda (therefore the same reported petrol AFR), and the transition will be quite linear. The change in ignition advance will probably more readily be applied with most, if not all of the additional advance added by 50% E85. For 100% E85 there is a second boost target defined by **FlexFuel Boost Target by Gear** and a corresponding blend map to set how the boost target is determined from the two maps.

Currently the patch is supplied with typical values used in the **FlexFuel Quantity Multiplier** map so that any car with a FlexFuel sensor added should start and run reasonably well when E85 fuel is added. Remaining correction maps for ignition and AFR target are blank, and the **FlexFuel Target Boost** map has default values identical to those found in the **Target Boost** map.

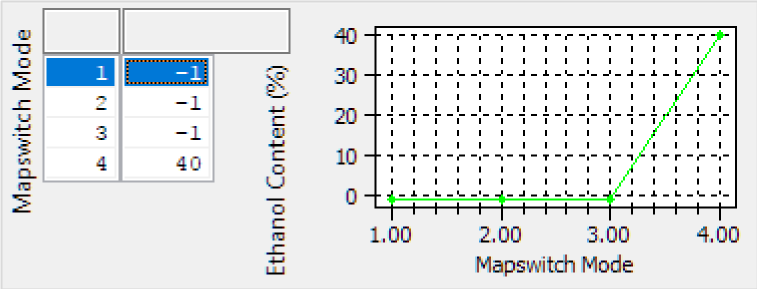
Map List



Live Data Parameters

- *FlexFuel Cranking Multiplier – Injector opening time multiplier only used during cranking*
- *FlexFuel Ethanol Content – Filtered and conditioned Ethanol content % used in all FF calculations*
- *FlexFuel Ethanol Sensor Output – The output directly from the ethanol content sensor*
- *FlexFuel Ignition Advance – Additional ignition advance after all FF compensations*
- *FlexFuel Quantity Multiplier – Current fuel multiplier based on ethanol content and engine temp*
- *FlexFuel AFR Adjustment – Offset to normal target AFR by FlexFuel Strategy*

FF Ethanol Content Override

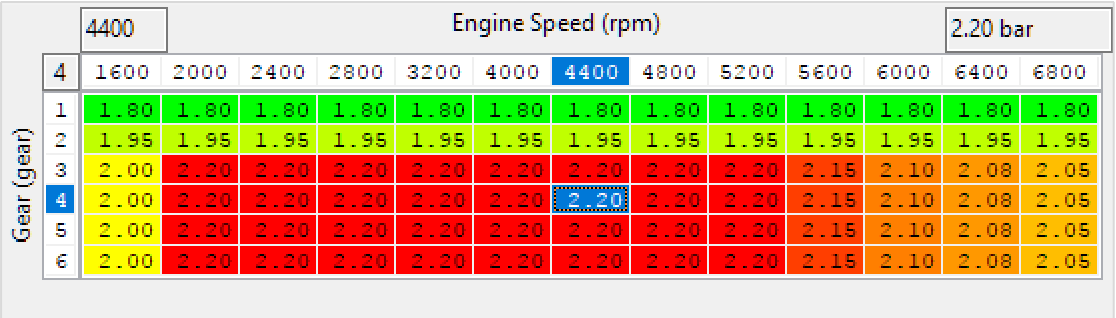


Mapswitch Mode	Ethanol Content (%)
1	-1
2	-1
3	-1
4	40

It is not always practical to add a FlexFuel sensor to every car that uses alcohol in the fuel, and many users may wish to pre-mix a specific amount of ethanol, methanol or E85 with their regular gasoline to improve performance. Pre-mised ratios of alcohol can now be catered for in the RaceROM FlexFuel strategy but entering the ethanol content in this map.

A default value of -1 is employed to use the ethanol content from the sensor. In the screenshot shown above, modes 1-3 use the output from the sensor while mode 4 is configured to assume an alcohol content of 40%.

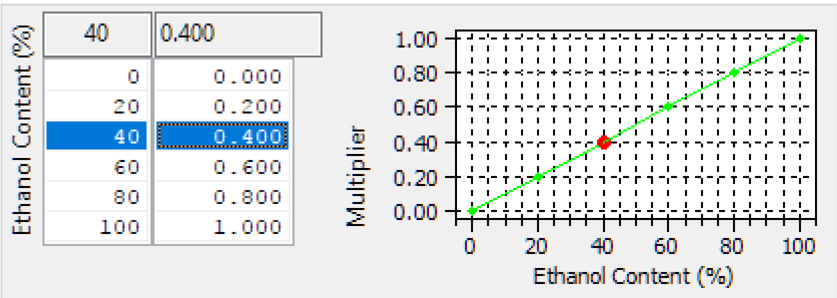
FF Boost Target by Gear



4	1600	2000	2400	2800	3200	4000	4400	4800	5200	5600	6000	6400	6800
1	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
2	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
3	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05
4	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05
5	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05
6	2.00	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15	2.10	2.08	2.05

This is the boost target for maximum Ethanol content and the progression between this and the normal boost target map is set by **FlexFuel Max Boost Target Blend**. It would be sensible to lower the boost target for lower gears due to the likely increased torque available when tuning with high Ethanol contents; enough to overcome the available traction in first and second gear on cars with normal road tyres. When more traction is available it would be normal to increase the available boost where turbo size allows, on cars that would previously have been limited by octane when trying to run such high boost on pump gasoline.

FF Boost Target Blend



Ethanol Content (%)	Multiplier
0	0.000
20	0.200
40	0.400
60	0.600
80	0.800
100	1.000

This map combines **Boost Target by Gear** and **FlexFuel Boost Target by Gear** to derive the final boost target based on *FlexFuel Ethanol content*. The eventual boost target is calculated as:

$$\begin{aligned} Boost\ Target = {} & ((BoostTarget * (1 - FFBoostTargetBlend)) \\ & + (FFBoostTargetByGear * FFBoostTargetBlend) \end{aligned}$$

FF Boost Limit Fuel Cut

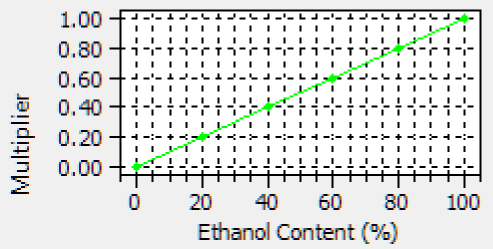
2800 | Engine Speed (rpm) | 2.40 bar

Mapswitch Mode (2)	800	1200	1600	2000	2400	2800	3200	3600	4000	5000	6000	6400
1	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
2	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
3	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
4	2.55	2.55	2.55	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40

Used with the main boost limit to provide a different boost limit when using ethanol. Typically this will be lower than the pump fuel boost limit on stock engines to safeguard against engine damage, but higher than pump fuel limit on built engines.

FF Boost Limit Fuel Cut Blend

Ethanol Content (%)	
0	0.000
20	0.200
40	0.400
60	0.600
80	0.800
100	1.000

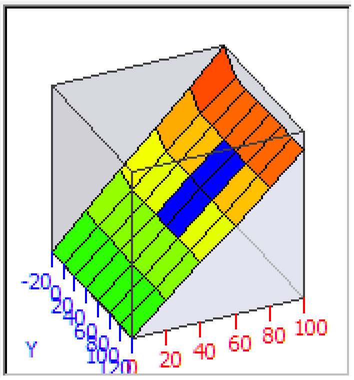


The boost limit for ethanol is blended in the same way as the boost target.

FF Quantity Multiplier

60 | Fuel Ethanol Content (%) | 1.24

Coolant Temp (°C) (60)	0	20.0	40.0	60.0	80.0	100
-20	1	1.09	1.18	1.27	1.36	1.45
0	1	1.08	1.16	1.24	1.32	1.40
20	1	1.08	1.16	1.24	1.32	1.40
40	1	1.08	1.16	1.24	1.32	1.40
60	1	1.08	1.16	1.24	1.32	1.40
80	1	1.08	1.16	1.24	1.32	1.40
100	1	1.08	1.16	1.24	1.32	1.40
120	1	1.08	1.16	1.24	1.32	1.40

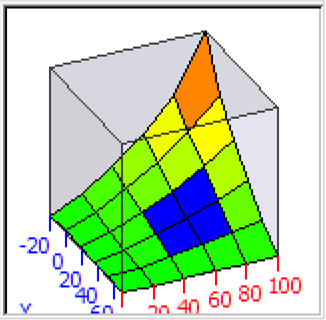


This dictates the additional fuel based on Ethanol content (0-100%) and coolant temperature. It would not be unusual to need to add additional E85 when cold due to some unburnt fuel going through the engine. Pure Ethanol typically requires 40% more fuel to maintain the same lambda (or apparent AFR) as gasoline, there is no significant change to injector flowrates when using E85.

If you want to run a richer or leaner AFR when using E85 do not try and compensate with this map as the ECU will use fuel corrections to hit the same target AFR you are running in a given map switch mode.

FF Cranking Multiplier

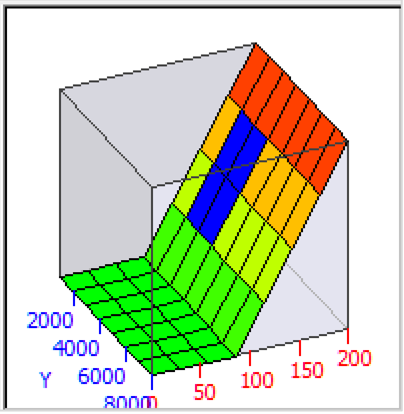
60	Ethanol Content (%)	1.05				
Coolant Temp (°C) 40	0	20.0	40.0	60.0	80.0	100
-20	1	1.03	1.08	1.14	1.22	1.35
0	1	1.03	1.06	1.11	1.17	1.23
20	1	1.02	1.05	1.08	1.12	1.17
40	1	1.01	1.03	1.05	1.08	1.11
60	1	1.01	1.01	1.02	1.04	1.05
70	1	1.00	1.00	1.00	1.00	1.00



The fuel quantity at cranking will be affected by the **FlexFuel Quantity Multiplier** map however it may be required to change the fuelling further at low temperatures when cranking. This map is a 0-2 scalar and will multiply the base fuelling only when cranking.

FF Target AFR Addition Max

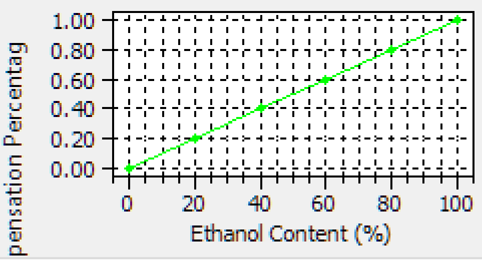
150	Engine Load (%)	0.250 AFR						
Engine Speed (RPM) 3000	0	25	50	100	125.0	150	175.0	200
1000	0	0	0	0	0.125	0.25	0.375	0.5
2000	0	0	0	0	0.125	0.25	0.375	0.5
3000	0	0	0	0	0.125	0.25	0.375	0.5
4000	0	0	0	0	0.125	0.25	0.375	0.5
5000	0	0	0	0	0.125	0.25	0.375	0.5
6000	0	0	0	0	0.125	0.25	0.375	0.5
7000	0	0	0	0	0.125	0.25	0.375	0.5
8000	0	0	0	0	0.125	0.25	0.375	0.5



This map has units of AFR and a positive number will add to the preceding target AFR resulting in a leaner final AFR. Blank by default, the pictured table uses +0.5 at high load to lean out the AFR from (for example) 11:1 at very high load on pump fuel to a cleaner and crisper 11.5:1. However if the base map is already using a good fuel or even a race fuel that would typically be mapped to run more like 12.2:1 then it would be entirely possible to want to lower the target AFR when using high levels of E85.

FF Target AFR Addition Blend

Ethanol Content (%)	
0	0.000
20	0.200
40	0.400
60	0.600
80	0.800
100	1.000



This map dictates how much of the AFR change is used for a given Ethanol content. The resulting *AFR target* is defined as

$$AFR\ Target = AFRTargetGasoline + (FlexFuel\ AFR\ AdditionMax * FFTargetAFRAdditionBlend)$$

FF Ignition Timing Max Addition

Engine Load (%) / Engine Speed (RPM)

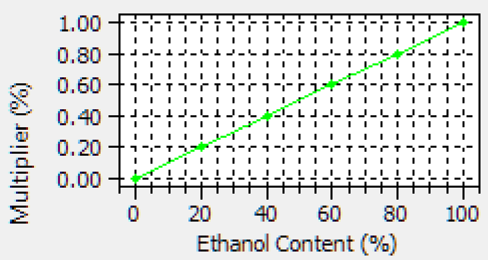
	6.27	12.5	18.8	25.1	31.4	37.6	43.9	50.2	56.5	62.7	69.0	75.3	81.6	87.8	94.1	100	110	120	130	140	150	160	170	180	190	200
800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
2800	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
3200	0	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3	3
3600	0	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3	3
4000	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
4400	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
4800	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
5200	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
5600	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
6000	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
6400	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
6800	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
7200	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
7600	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4
8000	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4

This represents the absolute maximum ignition advance that can be added, typically at 100% E85 but it can be added at lower concentrations using the **FlexFuel Ignition Timing Addition Blend** map. The values in the table below are not tested but purely representative. They would result in significant torque gains and would not necessarily be suitable on a stock engine.

We have chosen to use an addition map as it would require 4 ignition maps, one for each MapSwitch mode to have totally independent maps. An adder map is easier to comprehend for most tuners but should you wish to use total advance maps, it can of course be done using Custom Maps.

FF Ignition Timing Addition Blend

Ethanol Content (%)	
0	0.000
20	0.200
40	0.400
60	0.600
80	0.800
100	1.000



The values are a multiplier of the **FlexFuel Ignition Timing Max Addition** values and dictate how much of that advance is added for a given Ethanol content. The resulting ignition advance is calculated as ((Gasoline Ignition Timing + (Blend Multiplier * FlexFuel Ignition Timing Addition)).

The example shown below adds all the max advance by 70% E85 which is going to be close to ideal for many setups. The default map is linear 0-1.00 and will give conservative results at low to medium Ethanol content.

FF Sensor Scaling (part of sensor scaling in Phase 6)

This map sets the sensor scaling using a 0-5v input defined by **FlexFuel Sensor Source** that many aftermarket FlexFuel gauges or sensor interfaces use. The map is shown with its default values and many setups will not require anything different but you can fine tune to match the RaceROM Ethanol content to that of a gauge.

FF Sensor Source (part of sensor scaling in Phase 6)

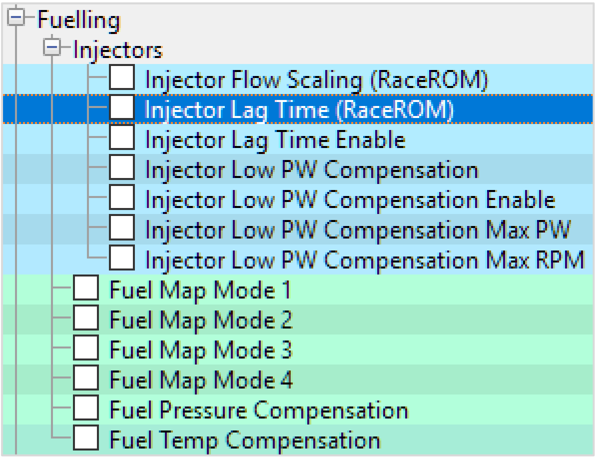
Choose the ECU 0-5v input to use for the FlexFuel sensor. The option of a fuel level sensor is available only because it's possible and may suit circuit cars with replacement fuel tanks.

Fuelling

Introduction

RaceROM adds per mapswitch mode large AFR target maps and advanced injector scaling.

Map List



Live Data Parameters

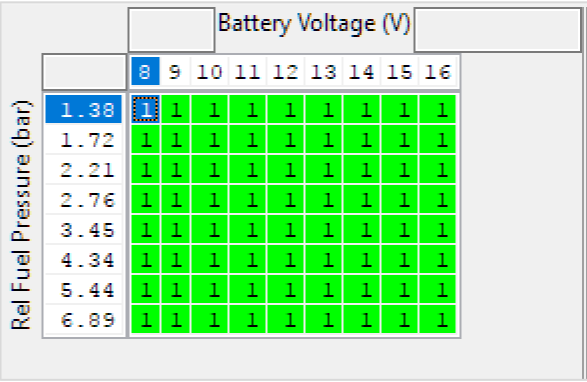
- *AFR B1 – Bank 1 AFR derived directly from raw sensor voltage, typically shows values 0.5 AFR leaner than a wideband at around 12:1 indicated*
- *AFR B2 – As per AFR B1 but for bank 2*
- *AFR Internal B1 – Bank 1 AFR measured by ECU, included atmospheric pressure compensation and sensor learning compensation. This is the AFR compared to the AFR Target Final B1 for closed loop fuel control, and should agree closely with most wideband sensors in the normal measurement range.*
- *AFR Internal B2 – As per AFR Internal B1 but for bank 2.*
- *AFR Target Base – The initial AFR target from the fuel map, after adjustment by High Speed Enrichment, WOT AFR limit, FlexFuel and Custom Maps.*
- *AFR Target Final B1 – The final AFR target derived from AFR Target Base but converted using OEM table "AFR Conversion Bank 1". This is the target compared to AFR Internal B1 for closed loop fuel correction.*
- *AFR Target Final B2 – As per AFR Target Final B1 but for bank 2.*
- *Fuel Pressure (relative) – Filtered pressure differential across the fuel injector used for compensations and safety trips, also available as an input for custom maps. Correct values rely on the use of a fuel pressure sensor that returns gauge pressure (almost all do).*
- *Fuel Pressure Compensation (unitless) – Multiplier of injector pulsewidth due to fuel pressure*
- *Fuel Temperature (°C) – Fuel temperature*
- *Fuel Temperature Compensation (unitless) – Multiplier of injector pulsewidth due to fuel temperature*
- *Fuel Trim Combined (%) – Overall average trim, can be used to indicate required changes in SD VE map or MAF scaling.*
- *Injector Effective PW (ms) – Pulsewidth before any lag time added.*
- *Injector Lag Time (RaceROM) (ms) – Lag time added to effective pulse width if RaceROM lagtime is enabled*
- *Injector Low PW Compensation – Change in fuelling used to compensation for low PW non-linearity*
- *Injector Pulse Width Bank #1 / #2 (ms) – Final pulse width per bank, including all corrections and lag time.*

Injector Flow Scaling (RaceROM)

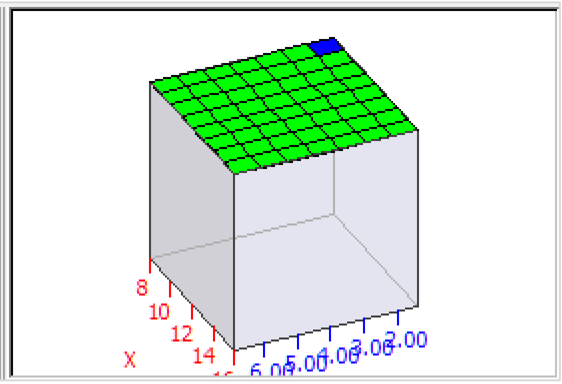
The injector flow rate can be calibrated per map switch mode. By default it assumes the stock injectors flow 570cc/min at the stock fuel pressure. You may been to make fine adjustments to these values different to the stated flow of aftermarket injectors due to assumptions used in the stock ECU code.

It is also possible to use 4 slightly different values in the process of tuning to quickly made adjustments without re-flashing.

Injector Lag Time (RaceROM)



Rel Fuel Pressure (bar)	8	9	10	11	12	13	14	15	16
1.38	1	1	1	1	1	1	1	1	1
1.72	1	1	1	1	1	1	1	1	1
2.21	1	1	1	1	1	1	1	1	1
2.76	1	1	1	1	1	1	1	1	1
3.45	1	1	1	1	1	1	1	1	1
4.34	1	1	1	1	1	1	1	1	1
5.44	1	1	1	1	1	1	1	1	1
6.89	1	1	1	1	1	1	1	1	1



The OEM injector lag time (latency) is defined using a fixed voltage and a slope that gives accurate lag time over a narrow voltage range. It's of limited accuracy, not very intuitive to set up and injector suppliers rarely give useable data for both lag time *and* slope. Instead, RaceROM now provides a 3D map using voltage and fuel pressure to allow complete control of the lag time.

> If use without a fuel pressure sensor fitted to the car, this map can still be populated with values for the whole pressure range. Even without a fuel pressure sensor fitted (custom sensor source set to "no sensor"), this map will use the default value defined in **FP Sensor Default**.

Best results will be obtained by using this in conjunction with a fuel pressure sensor so changes in flow and lag time can be properly corrected.

It is only used when enabled in **Injector Lag Time Enable** for the current Map Switch Mode.

Injector Lag Time Enable

- [ ] Enable RaceROM Injector Lag Time Mode 1
- [ ] Enable RaceROM Injector Lag Time Mode 2
- [ ] Enable RaceROM Injector Lag Time Mode 3
- [ ] Enable RaceROM Injector Lag Time Mode 4

The use of RaceROM 3d lagtime table is entirely optional, and not enabled by default. If you wish to use the table, it can be enabled on a per MapSwitch mode basis.

Injector Low PW Compensation

0.700 Effective Pulse Width (ms) 105 %

Rel Fuel Pressure (bar) / 4.0	0.400	0.450	0.50	0.550	0.600	0.650	0.700	0.75	0.800	0.850	0.900	0.950	1.00	1.10	1.20	1.30
2.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
2.5	100	101	101	101	102	102	101	101	101	101	100	100	100	100	100	100
3.0	100	101	102	103	103	103	103	102	102	101	101	100	100	100	100	100
3.5	100	101	103	104	104	104	104	103	102	101	101	100	100	100	100	100
4.0	100	102	103	104	105	105	105	104	103	102	101	101	100	100	100	100
4.5	100	102	104	105	106	106	105	104	103	102	101	101	100	100	100	100
5.0	100	102	104	105	106	106	106	105	104	102	101	101	100	100	100	100
5.5	100	102	103	105	106	107	106	105	104	103	102	101	100	100	100	100

This table is used to make corrections to the INJECTOR FLOW RATE, so values above 100% will decrease the effective pulse width.

> At the time of writing this is the opposite convention to many injector suppliers, that give data for a percentage of correction to be made to the fuel pulsewidth.

Injector Low PW Compensation Enable

- ☐ Enable Injector Low PW Compensation Mode 1
- ☐ Enable Injector Low PW Compensation Mode 2
- ☐ Enable Injector Low PW Compensation Mode 3
- ☐ Enable Injector Low PW Compensation Mode 4

The use of RaceROM **Injector Low PW Compensation** is entirely optional, and not enabled by default. If you wish to use the table, it can be enabled on a per MapSwitch mode basis.

Injector Low PW Compensation Max PW

0.600 Effective Pulse Width (ms)

When enabled the Injector Low PW Compensation is only active below this effective pulsewidth.

Injector Low PW Compensation Max RPM

4000 Engine Speed (rpm)

When enabled the Injector Low PW Compensation is only active above this engine RPM.

Fuel Map Mode 1 (to 4)

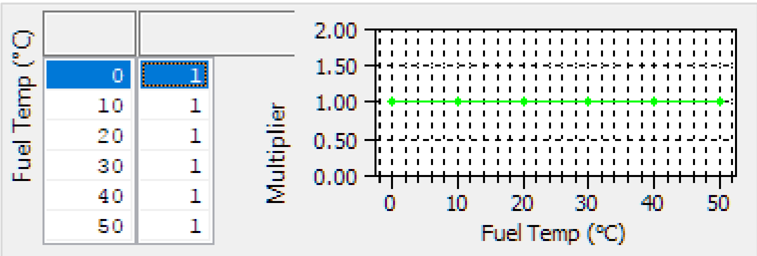
60.2 Engine Load (%) 12.9 afr

Engine Speed (rpm) / 3600	12.9	18.8	24.8	30.7	33.6	36.6	39.5	42.5	48.4	54.3	60.2	66.2	75.7	85.2	94.6	109	123	137	151	166	180	194
800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.0	13.8	13.7	13.4	13.3	13.1	12.7	12.2	11.9	11.5	11.5	11.5	11.5	11.5
1200	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.0	13.8	13.7	13.4	13.3	13.1	12.7	12.2	11.9	11.5	11.5	11.5	11.5	11.5
1600	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.0	13.8	13.7	13.4	13.3	13.1	12.7	12.2	11.9	11.5	11.5	11.5	11.5	11.5
2000	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.0	13.8	13.7	13.4	13.3	13.1	12.7	12.2	11.9	11.5	11.5	11.5	11.5	11.5
2400	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.0	13.8	13.7	13.3	13.1	13.0	12.7	12.2	11.9	11.5	11.5	11.5	11.5	11.5
2800	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.4	14.0	13.7	13.6	13.1	12.9	12.7	12.5	12.2	11.9	11.5	11.5	11.5	11.5	11.5
3200	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.3	13.7	13.3	13.2	12.7	12.5	12.4	12.2	12.1	11.8	11.5	11.5	11.5	11.5	11.5
3600	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.0	13.3	13.1	12.9	12.4	12.4	12.1	12.1	11.9	11.6	11.5	11.5	11.5	11.5	11.5
4000	14.7	14.7	14.7	14.7	14.7	14.7	14.7	13.6	13.3	12.7	12.4	12.1	12.1	11.9	11.8	11.6	11.5	11.5	11.5	11.5	11.5	11.5
4400	14.7	14.7	14.7	14.7	14.7	14.7	13.7	13.2	13.1	12.5	12.1	11.9	11.8	11.7	11.6	11.5	11.5	11.5	11.5	11.5	11.5	11.5
4800	14.7	14.7	14.7	14.7	14.7	13.7	13.3	13.0	12.5	12.2	11.9	11.6	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
5200	14.7	14.7	14.7	14.7	13.7	13.3	13.1	12.7	12.2	11.9	11.6	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
5600	14.7	14.7	14.7	13.7	13.1	12.9	12.5	12.4	12.1	11.7	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
6000	14.7	14.7	13.7	13.3	12.9	12.4	12.1	11.8	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
6400	14.7	14.7	13.2	12.7	12.4	12.1	11.9	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
6800	13.4	13.3	13.1	12.4	12.2	11.9	11.8	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
7200	13.2	13.1	12.5	12.4	12.1	12.1	11.8	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
7600	13.1	12.5	12.5	12.4	12.1	12.1	11.8	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5

For each MapSwitch mode a RaceROM fuel map is used consisting of the base target AFR, and can be monitored by the live data parameter *AFR Target Base*. The target AFR from this map is subject to further changes by the stock Nissan ECU code and may not be the same as the final target used for the closed loop fuel control. For each bank the final target AFR can be monitored using *AFR Target Final B1* and *AFR Target Final B2.*

The default values in this table give mostly stock AFR targets, thus this table if unaltered is conservatively rich if used on a heavily modified GT-R. If no changes to stock maps that adjust AFR targets are made, a target of 11.5 in this table will result in a AFR Target Final value of approximately 10.9:1.

Fuel Temp Compensation

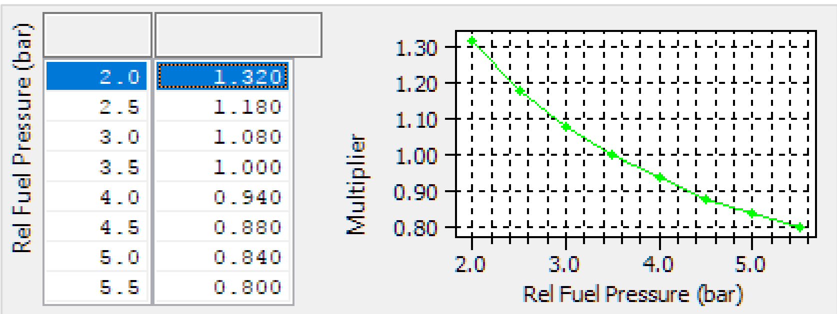


When tuning a car with a fuel temperature sensor, it is now possible to compensate for changes in the fuel temperature. Typically fuel pulsewidth is increased with increasing fuel temperature to compensate for the drop in fuel density, numbers greater than 1.0 will increase injector effective pulsewidth.

The table below outlines the approximate multiplier required to correct for a difference in fuel temperature.

		Choose a column of data that matches your nominal temperature						
		Nominal Fuel Temperature °C						
		20	25	30	35	40	45	50
Measured Fuel Temperature °C	0	**0.98**	**0.98**	**0.97**	**0.97**	**0.96**	**0.96**	**0.95**
	10	**0.99**	**0.99**	**0.98**	**0.98**	**0.97**	**0.97**	**0.96**
	20	**1.00**	**1.00**	**0.99**	**0.99**	**0.98**	**0.98**	**0.97**
	30	**1.01**	**1.01**	**1.00**	**1.00**	**0.99**	**0.99**	**0.98**
	40	**1.02**	**1.02**	**1.01**	**1.01**	**1.00**	**1.00**	**0.99**
	50	**1.03**	**1.03**	**1.02**	**1.02**	**1.01**	**1.01**	**1.00**

Fuel Pressure Compensation

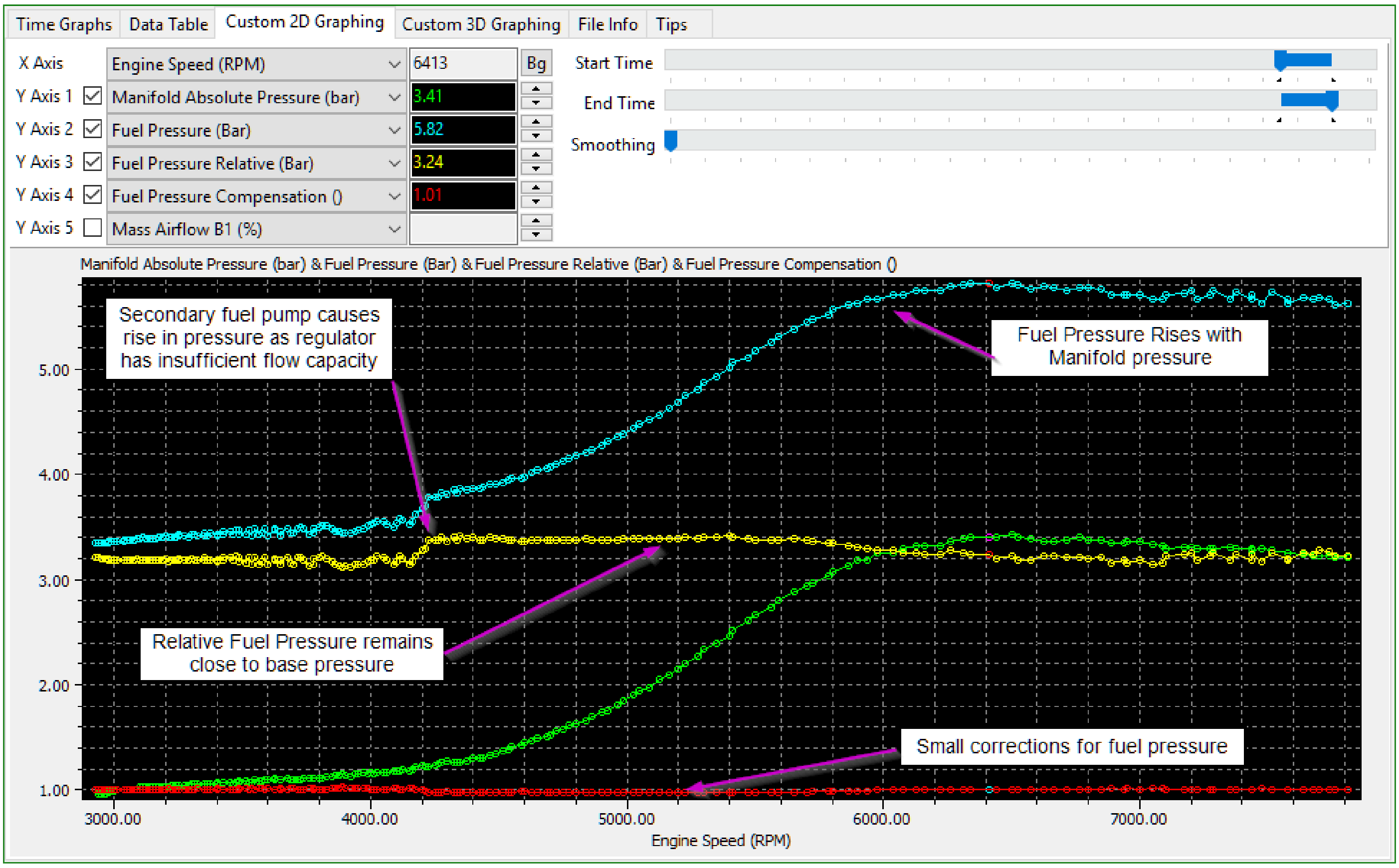


Changes in fuel pressure can be compensated for using this new map, in conjunction with an additional sensor configured using the new sensor options. For the purposes of this correction *Relative Fuel Pressure* is used and represents the pressure difference between the inlet (fuel rail) and nozzle (inlet port) pressures, defined as:

$$Relative\ Fuel\ Pressure = Gauge\ Fuel\ Pressure - Manifold\ Absolute\ Pressure + Atmospheric\ pressure$$

The below example is shown using a nominal fuel pressure of 3.5bar (50.75 psi)

This is demonstrated in the graph below showing that while the pressure in the fuel rises with manifold pressure the relative pressure remains consistent, only varying due to the limits of the regulator when the second pump activates.



At close to sea level with an atmospheric pressure of 1.0 bar this would result in a relative fuel pressure of 3.6 bar if the Gauge Fuel Pressure was 4.9 bar at 2.3 bar MAP (1.3 bar relative boost).

Within the normal range of fuel pressure the injector pulsewidth should be multiplied according the following approximation.

$$\text{FuelPressureCompensation} = \sqrt{\frac{ActualRelativeFuelPressure}{NominalRelativeFuelPressure}}$$

Below are examples of how to populate this table for common base fuel pressures in bar

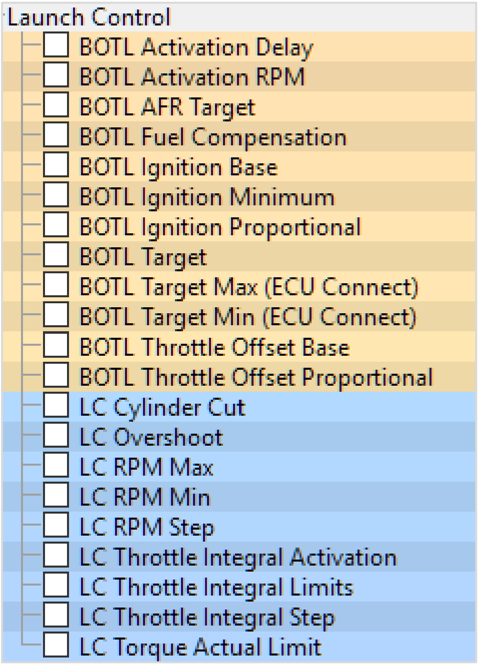
		Nominal Fuel pressure (bar)												
		3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2
Relative Fuel Pressure (bar)	2.0	**1.22**	**1.24**	**1.26**	**1.28**	**1.30**	**1.32**	**1.34**	**1.36**	**1.38**	**1.40**	**1.41**	**1.43**	**1.45**
	2.5	**1.10**	**1.11**	**1.13**	**1.15**	**1.17**	**1.18**	**1.20**	**1.22**	**1.23**	**1.25**	**1.26**	**1.28**	**1.30**
	3.0	**1.00**	**1.02**	**1.03**	**1.05**	**1.06**	**1.08**	**1.10**	**1.11**	**1.13**	**1.14**	**1.15**	**1.17**	**1.18**
	3.5	**0.93**	**0.94**	**0.96**	**0.97**	**0.99**	**1.00**	**1.01**	**1.03**	**1.04**	**1.06**	**1.07**	**1.08**	**1.10**
	4.0	**0.87**	**0.88**	**0.89**	**0.91**	**0.92**	**0.94**	**0.95**	**0.96**	**0.97**	**0.99**	**1.00**	**1.01**	**1.02**
	4.5	**0.82**	**0.83**	**0.84**	**0.86**	**0.87**	**0.88**	**0.89**	**0.91**	**0.92**	**0.93**	**0.94**	**0.95**	**0.97**
	5.0	**0.77**	**0.79**	**0.80**	**0.81**	**0.82**	**0.84**	**0.85**	**0.86**	**0.87**	**0.88**	**0.89**	**0.91**	**0.92**
	5.5	**0.74**	**0.75**	**0.76**	**0.77**	**0.79**	**0.80**	**0.81**	**0.82**	**0.83**	**0.84**	**0.85**	**0.86**	**0.87**

Launch Control (Incorporating BOTL)

Introduction

Launch control has been updated for Phase 6 with additional control of ignition retard for BOTL and a throttle compensation for retard to prevent engine speed from dropping significantly as retard is increased to achieve boost for launch.

Map List



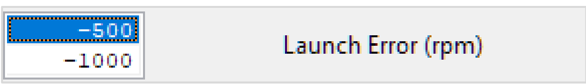
Live Data Parameters

- *Dig: BOTL Active (True / False) – Flag showing if BOTL is active*
- *Dig: Launch Control Active (True / False) – Flag showing if launch mode has been entered.*
- *Launch BOTL Ignition Base (°) – BOTL Base ignition timing*
- *Launch BOTL Igntion Proportional (°) BOTL proportional ignition correction*
- *Launch RPM (RPM) – Current launch control target RPM including any overshoot*
- *Launch RPM Base (RPM) – Current launch control RPM without any overshoot added.*
- *Launch RPM Error – Difference between Actual and Launch RPM, positive is over target.*
- *Launch Timer (s) – Time since launch mode became active*

BOTL Activation Delay

Launch Control must have been active for at least this delay for BOTL to become active, this is usually not important as the timer will have expired by the time the activation RPM has been achieved.

BOTL Activation RPM



The Boost Off The Line Strategy will be enabled when the Launch RPM Error exceeds the upper value and remain active until is drops below the lower value. The lower value to disable BOTL is deliberately low to ensure that BOTL doesn't cycle on/off due to RPM fluctuations caused by the BOTL itself.

Raising the upper value to -100 RPM will disable the BOTL retard from activating until later and may be useful for large turbo cars. Increasing the upper value to more than -50 RPM may have undesirable results as the actual RPM approaches the target launch RPM slowly once close to the target.

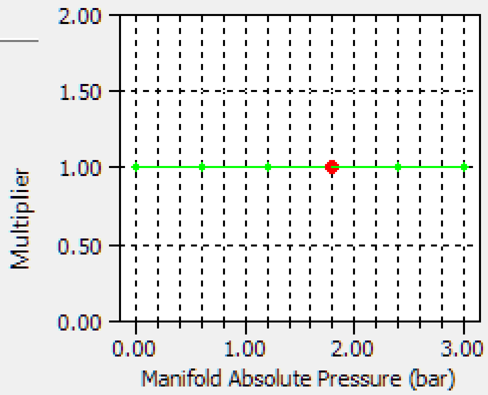
BOTL AFR Target

Target AFR (afr)
12.0
12.0
12.0
12.0

Fixed target AFR while in launch control (LC) mode.

BOTL Fuel Compensation

Manifold Absolute Pressure (bar)	Multiplier
1.800	1
0.000	1
0.600	1
1.200	1
1.800	1
2.400	1
3.000	1

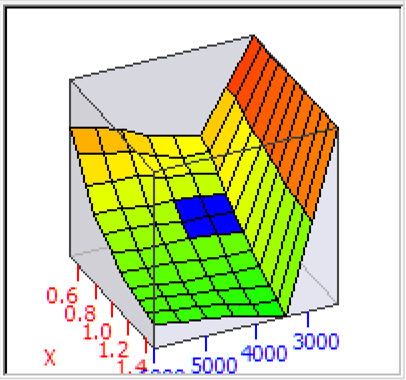


This can be used to multiply the fuel quantity while in launch control to make broad corrections for errors in AFR.

BOTL Ignition Timing Base

0.9 — Manifold Pressure Target (bar) — -12 °

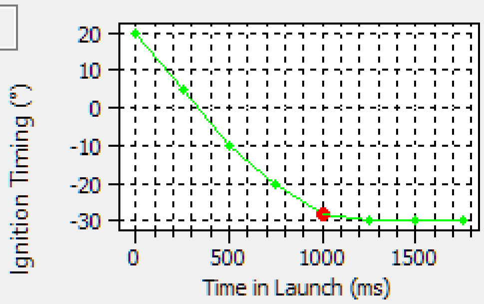
Engine Speed (rpm) \ 3500	0.5	0.600	0.700	0.800	0.900	1.00	1.10	1.20	1.30	1.40	1.50
2400	26	26	26	26	26	26	26	26	26	26	26
2500	12	12	10	8	6	5	4	2	1	0	-1
3000	-1	-3	-7	-10	-13	-16	-19	-21	-24	-26	-28
3500	1	-3	-5	-9	-12	-15	-19	-21	-23	-25	-26
4000	3	0	-4	-8	-12	-14	-18	-20	-22	-23	-24
4500	7	3	-2	-8	-11	-14	-17	-20	-21	-22	-23
5000	9	4	-2	-7	-10	-14	-17	-19	-20	-21	-22
6000	11	6	-1	-7	-10	-13	-16	-18	-19	-20	-21



Sets the base timing while BOTL is active, instead of the main ignition map for each Mapswitch Mode. The ignition timing values are very low to promote making boost, but caution should be employed before lowering them too far as excessively retarded ignition timing will result in sluggish RPM control on launch and potentially boost that is too high and hard to control.

BOTL Ignition Minimum

Time in Launch (ms)	Ignition Timing (°)
0	20
250	5
500	-10
750	-20
1000	-28
1250	-30
1500	-30
1750	-30

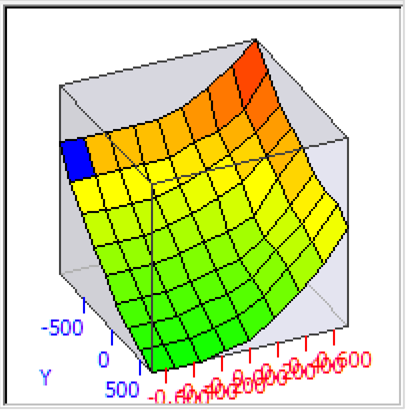


This prevents an instantaneous significant ignition timing change due to BOTL from causing a sudden drop in engine RPM and subsequent cycling of RPM and BOTL switching on/off.

The input axis is time in milliseconds since BOTL became active, the output values are absolute ignition timing.

BOTL Ignition Proportional

Launch Error (rpm) \ Boost Error (bar)	-0.700	-0.50	-0.25	-0.1000	0.00	0.1000	0.25	0.5	0.700
-900	11	11	11	11	11	12	15	18	22
-300	6	6	6	6	6	8	9	12	18
-150	2	2	2	2	3	5	7	10	14
0	-2	-2	-2	-1	0	2	4	8	12
100	-5	-5	-5	-4	-3	-2	0	6	11
200	-8	-8	-8	-7	-6	-5	-2	3	8
300	-10	-10	-10	-9	-8	-6	-2	2	7
450	-12	-12	-12	-11	-10	-7	-3	1	7
700	-14	-14	-14	-13	-12	-9	-5	-1	5



For Phase 6 the Y axis is now Launch RPM Error and allows a change in retard to help stabilise the engine speed and prevent excessive retard while the RPM is still increasing to equal the target.

BOTL Target

Target MAP (bar)
0.5
0.5
0.5
0.5

A target of Manifold Absolute Pressure to achieve using the Boost Off The Line strategy, the default values of 0.5 represent 0.5bar absolute, in other words 0.5 bar of vacuum (at near sea level).

BOTL Target Max (ECU Connect)

Target MAP (bar)
0.5
0.5
0.5
0.5

Using EcuTek's iPhone and Android companion App - ECU Connect, the BOTL target boost can be altered between limits set for each Mapswitch Mode. By default, both the min and max limit are set to the same default values for **LC MAP Target** and will require calibration to allow manipulation from within ECU Connect.

BOTL Target Min (ECU Connect)

Target MAP (bar)

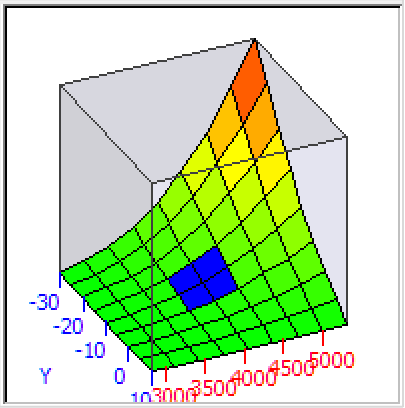
0.5
0.5
0.5
0.5

Corresponding minimum limit for **LC Map Target** when adjusted from ECU Connect.

BOTL Throttle Offset Base

4063 Launch Target (rpm) 1.339 °

BOTL Ignition Base	2813	3125.0	3437.5	3750	4063	4375	4688	5000.0	5313
-30	0	0.5225	1.2119	2.232	3.727	5.797	8.445	11.586	15.00
-25	0	0.4275	0.9922	1.829	3.059	4.762	6.945	9.531	12.34
-20	0	0.3369	0.7832	1.446	2.422	3.773	5.512	7.570	9.81
-15	0	0.2551	0.5938	1.099	1.843	2.877	4.207	5.785	7.50
-10	0	0.1843	0.4299	0.797	1.339	2.094	3.066	4.223	5.48
-5	0	0.1252	0.2925	0.543	0.915	1.434	2.104	2.898	3.77
0	0	0.0767	0.1794	0.334	0.564	0.885	1.300	1.793	2.33
5	0	0.0362	0.0848	0.158	0.267	0.420	0.618	0.853	1.11
10	0	0.0000	0.0000	0.000	0.000	0.000	0.000	0.000	0.00



This adds an offset to the normal throttle angle depending on the current BOTL ignition retard, which is defined as the difference between the normal ignition timing as determined by the RaceROM Ignition Map for the current Mapswitch mode, and the current actual ignition timing as set by the BOTL strategy.

If the values in this map are made too high, the engine RPM will rise out of control, if left unchecked for more than about 1 second the OEM engine speed control strategy which will be trying to regulate the engine speed to match the current launch RPM, will start using fuel cuts to control the speed, and eventually close the throttle altogether.

BOTL Throttle Offset Proportional

0.0000 Boost Error (bar) 2.36 °

Launch Error (rpm)	-0.3000	-0.1500	-0.1000	-0.0500	0.000	0.0500	0.1000	0.1500	0.2000
-1200	11.023	9.336	8.938	8.55	8.36	8.17	7.984	7.789	7.602
-600	5.938	5.367	4.875	4.58	4.40	4.32	4.234	4.137	4.039
-450	4.707	4.180	3.756	3.53	3.39	3.33	3.270	3.199	3.121
-300	3.471	2.984	2.627	2.45	2.36	2.30	2.234	2.152	2.059
-150	2.268	1.692	1.474	1.30	1.30	1.30	1.068	0.943	0.786
0	1.067	0.467	0.254	0.00	0.00	0.00	-0.137	-0.422	-0.667
150	-0.260	-0.901	-1.122	-1.30	-1.30	-1.30	-1.618	-2.061	-2.406
300	-1.700	-2.289	-2.623	-2.83	-2.87	-3.03	-3.238	-3.738	-4.199
450	-3.174	-4.012	-4.172	-4.31	-4.45	-4.69	-5.004	-5.520	-6.141

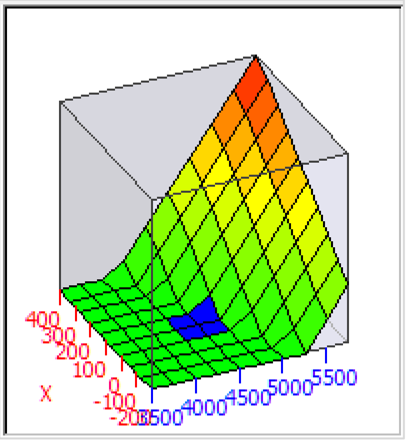
This adds a further correction to the values in **BOTL Throttle Offset Base** used to correct for short term errors in launch RPM and BOTL manifold pressure target. The values in this table vary too much with changes in either input, RPM instability can result.

LC Cylinder Cut

0 | Launch Error | 0.0 %

Launch Target

4500	-200	-100	-50	-25	0.0	25.0	50	100	200	400
3500	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3750	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4000	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4252	0	0.0	0	0.0	0	0.0	0	0.0	0	2.5
4500	0	0.0	0	0.0	0	0.0	0	2.5	5	7.5
4752	0	0.0	0	0.0	0	2.5	5	7.5	10	12.5
5000	0	0.0	0	2.5	5	7.5	10	12.5	15	17.5
5252	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5
5500	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5
5752	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5



If BOTL ignition retard is active, this map also allows for a variable amount of fuel cut using the same cut strategy employed in custom maps, the resulting fuel cut percentage will be reflected in the *Cylinder Cut Probability* live data value. This can be used to help regulate engine speed, lower boost or just make a lot of noise.

The default map is calibrated not to do any cutting when using the stock Launch control RPM.

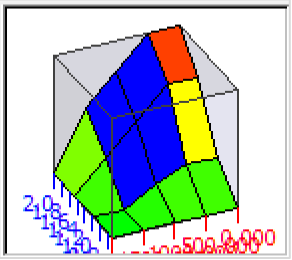
Caution is advised using this map and restraint is recommended, you can damage an engine with prolonged use of BOTL and fuel cut.

LC Overshoot

1000.00 | Time in Launch (ms) | 500 rpm

Target MAP (bar)

1.5	0.000	500.0	1000	1500	2000
0.5	0	0	0	0	0
1.0	250	250	143	0	0
1.5	750	750	500	250	0
2.0	1000	1000	750	500	0



The overshoot RPM is added to the base RPM value to temporarily raise the RPM limit at the beginning of Launch Control to help the boost to be more quickly increased to the target level.

The input X axis is the time in milliseconds since the ECU entered launch control mode, the Y axis is the target *Manifold Absolute Pressure* requested by the BOTL strategy. For very high levels of *MAP* to be achieved it may be necessary to temporarily increase the launch RPM significantly.

The live data value for *Launch RPM* will reflect the offset output by this map, while *Launch Base RPM* will only report the current base RPM as set using ECU Connect or the cruise control switchgear. *Launch RPM Error* will still be calculated using the current value for *Launch RPM* including any offset from this map.

When in launch mode and using the cruise control switch gear to adjust the base RPM, this overshoot will initially be applied, but once the overshoot RPM is 0 then the resulting LC RPM should be close to the base value. To adjust it's recommended to enter launch control and wait for the RPM to stabilise before adjusting.

LC RPM Max

5000 | RPM (rpm)

A maximum limit on the range of adjustment of the launch control RPM, as adjusted using either the cruise control switchgear or ECU Connect.

LC RPM Min

2500 | RPM (rpm)

A minimum limit on the range of adjustment of the launch control RPM, as adjusted using either the cruise control switchgear or ECU Connect.

LC RPM Step

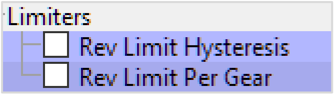
The launch control target RPM is adjusted by this value for each step when live adjusting the RPM using the cruise control switch gear.

Limiters

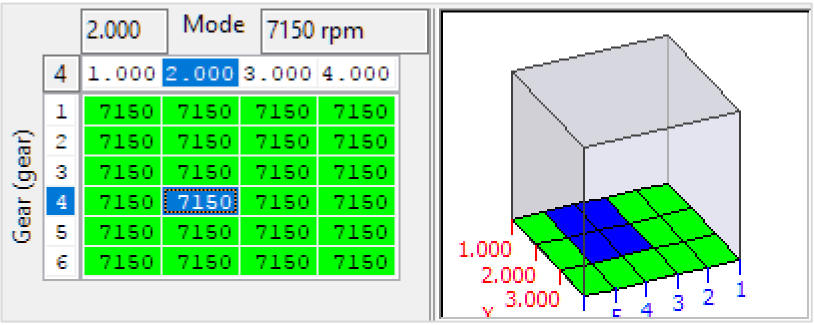
Introduction

Easy to use rev limiter that employs a 100% fuel cut with hysteresis. Calibratable based on Map Switch Mode and Gear.

Map List



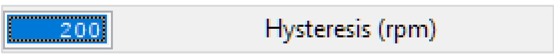
Rev Limit Per Gear



To simplify the setting of the fuel cut based rev limits, they now all appear in one 3d map and use a single 1d value to introduce hysteresis. The fuel cut will be active over the RPM value in this map, and fuel will only be restored when the RPM has dropped below this level by **Rev Limit Hysteresis**.

> Be aware that GEN2 cars typically have a 7300rpm fuel based rev limit so you may wish to raise the defaults in this map to match the stock limit.

Rev Limit Hysteresis



Hysteresis value used when **Rev Limit Per Gear** has been triggered.

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.

Some OEM maps are included here for convenience, but not all are covered in this guide yet.

Live Data Parameters

- *Ignition Timing (°) – Current actual ignition timing in degrees BTDC, negative means ATDC*
- *Ignition Timing Calculated (°) – Ignition timing as calculated by the OEM strategy*
- *Knock Correction (°) – Offset due to knock, negative is retard, positive is dynamic advance on GEN 2*

Map List

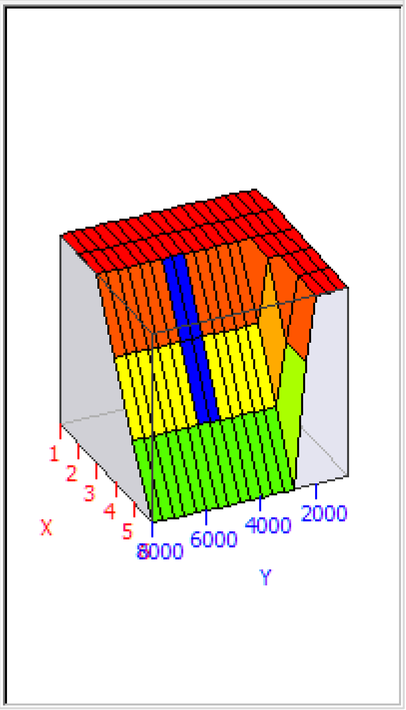
- Ignition Timing
  - Knock Control
    - Knock Control Enable Mode 1
    - Knock Control Enable Mode 2
    - Knock Control Enable Mode 3
    - Knock Control Enable Mode 4
  - Ignition Timing Comp Load Threshold
  - Ignition Timing Gear Comp
  - Ignition Timing IAT Comp
  - Ignition Timing Mode 1
  - Ignition Timing Mode 2
  - Ignition Timing Mode 3
  - Ignition Timing Mode 4

Ignition Timing Gear Comp

4 | 1 °

Engine Speed (rpm)

5200	1	2	3	4.0	5.0	6.0
800	0	0	0	0	0	0
1200	0	0	0	0	0	0
1600	0	0	0	0	0	0
2000	0	0	0	0	0	0
2400	0	0	0	0	-1	-1
2800	0	0	0	-1	-2	-3
3200	0	0	0	-1	-2	-3
3600	0	0	0	-1	-2	-3
4000	0	0	0	-1	-2	-3
4400	0	0	0	-1	-2	-3
4800	0	0	0	-1	-2	-3
5200	0	0	0	-1	-2	-3
5600	0	0	0	-1	-2	-3
6000	0	0	0	-1	-2	-3
6400	0	0	0	-1	-2	-3
6800	0	0	0	-1	-2	-3
7200	0	0	0	-1	-2	-3
7600	0	0	0	-1	-2	-3
8000	0	0	0	-1	-2	-3



Ignition advance can be trimmed on a per gear basis, relative to RPM using this map. It would be normal to reduce advance in higher gears at high RPM or at an RPM sensitive to detonation.

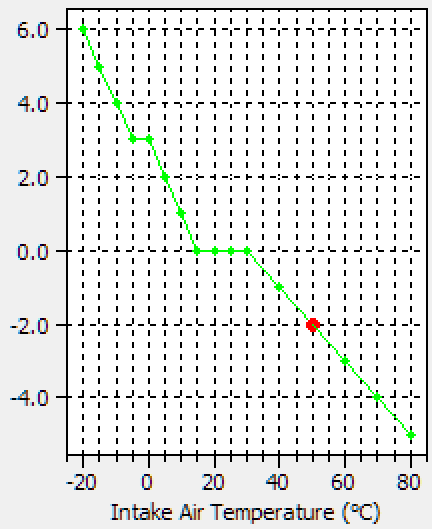
Ignition Timing Comp Load Threshold

56.5	Load (%)

A load threshold under which the offsets in **Ignition Timing Gear Comp** and **Ignition Timing IAT Comp** are ignored.

Ignition Timing IAT Comp

Intake Air Temperature (°C)	
50	-2 °
-20	6
-15	5
-10	4
-5	3
0	3
5	2
10	1
15	0
20	0
25	0
30	0
40	-1
50	-2
60	-3
70	-4
80	-5

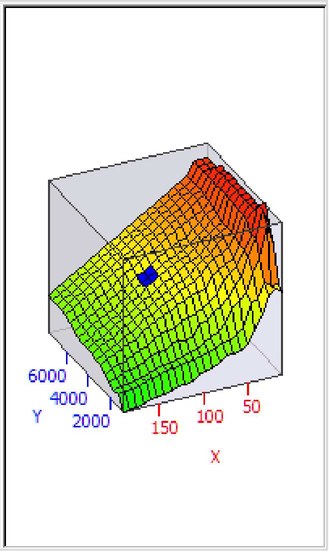


An ignition timing offset based on *Inlet Air Temperature* which can be used to retard the ignition for high air temps. This is particularly useful on cars modified to put the IAT sensor in the low temperature boost pipe (after intercooler) as retard can be applied for charge temperature directly.

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

94 Engine Load (%) 13 °

Engine Speed (rpm) 4800	13	19	25	31	38	44	50	56	63	69	75	81.6	87.8	94.1	100	110	120	130	140	150	160	170	180	190
800	18	20	18	10	3	-2	-4	-5	-5	-7	-9	-10	-11	-13	-14	-14	-15	-16	-17	-17	-18	-19	-20	-20
1200	20	20	22	15	14	3	1	-1	-1	-3	-4	-5	-6	-6	-7	-8	-8	-9	-10	-11	-12	-13	-13	-14
1600	35	45	31	25	17	14	11	5	2	0	-2	-4	-5	-6	-7	-8	-8	-9	-10	-11	-12	-13	-13	-14
2000	43	50	38	30	22	18	14	10	9	6	4	0	-2	-1	-2	-4	-4	-5	-7	-8	-9	-10	-11	-12
2400	50	50	37	31	24	22	19	14	11	9	7	6	5	3	2	1	0	-2	-4	-5	-7	-8	-9	-11
2800	46	46	42	31	26	24	22	20	15	14	13	12	10	8	7	5	4	2	-1	-2	-4	-5	-7	-9
3200	46	46	42	33	29	27	25	23	19	17	15	14	12	10	8	6	5	2	0	-1	-4	-5	-7	-9
3600	46	46	42	33	31	29	25	23	21	18	16	15	13	11	9	7	6	3	1	0	-3	-4	-6	-8
4000	46	46	43	33	31	29	26	23	21	20	18	16	14	12	10	8	6	4	2	0	-2	-4	-6	-8
4400	46	46	43	33	31	29	27	24	22	20	19	17	15	13	11	8	7	5	2	0	-2	-3	-6	-8
4800	46	46	43	34	32	29	27	24	22	20	19	17	15	13	11	9	7	5	2	1	-1	-3	-5	-7
5200	46	46	43	35	33	30	28	25	23	22	20	18	16	14	12	10	8	6	4	2	0	-2	-4	-6
5600	46	46	43	36	33	31	29	28	26	24	22	20	18	16	14	12	10	7	5	4	1	-1	-3	-5
6000	46	46	43	37	35	33	30	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	-1	-3
6400	46	46	43	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	-1	-3
6800	43	43	43	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	-1	-3
7200	43	43	43	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	-1	-3
7600	43	43	43	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	-1	-3



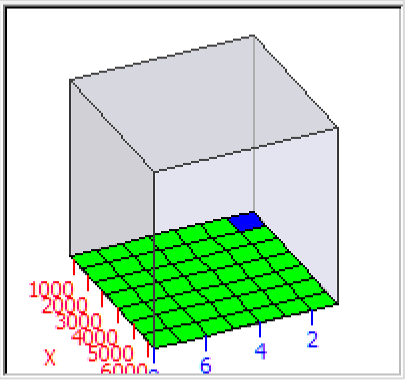
Four maps, one for each mapswitch mode providing an easy to understand and tune base ignition value in degrees BTDC. They provide increased precision and headroom for the load axis and increased RPM breakpoints. It's possible to created multiple maps and use map switching to cycle between each map for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

These maps are not employed in overrun and idle conditions where the OEM ignition control is used.

Ignition Retard Per Cylinder

Cylinder	Engine Speed (rpm) 800	1600	2400	3200	4000	4800	5600	6400
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0



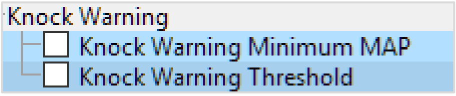
A factory map which can be used to retard the ignition on cylinders especially prone to detonation. Through careful handling and using individual cylinder knock logging, this can gain small but useful amounts of power with no increase in engine risk.

Knock Warning

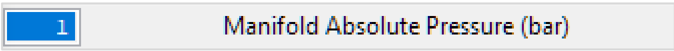
Introduction

A simple driver warning for excessive knock control activity, flashing the CEL when triggered by knock retard.

Map List

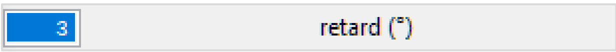


Knock Warning Minimum MAP



The CEL will not be flashed while the *Manifold Absolute Pressure* is below this threshold. The default value of 1bar means the CEL will not flash while in in vacuum even if the knock retard is over the threshold.

Knock Warning Threshold



Knock retard which will trigger the knock warning.

Rolling Launch

Introduction

Rolling Launch throttle compensation has been updated with a different strategy for taking control of the throttle that should prevent spurious Drive-By-Wire related DTCs from being generated. The method of operation is otherwise unchanged and is detailed below (taken from existing manual).

Map List

Rolling Launch
- Rolling Launch Accel Rest Point
- Rolling Launch Accel Threshold
- Rolling Launch Antilag Timeout
- Rolling Launch Enable
- Rolling Launch Ignition Proportional
- Rolling Launch Ignition Timing Base
- Rolling Launch Maximum Boost Target
- Rolling Launch Target AFR
- Rolling Launch Target Manifold Pressure
- Rolling Launch Throttle Compensation

Method of Operation

As the name suggests, Rolling Launch is a type of launch control that can be performed from a rolling start.

To operate Rolling Launch, drive the car at a steady speed in a low gear - 60km/h in 2nd gear is about right. Set the cruise control to maintain the vehicle speed. Now press the accelerator pedal all the way down to the floor. Instead of accelerating, the ECU will initiate an anti-lag effect. This will rapidly generate a large amount of boost, controlled using a proportional closed loop mechanism. But the car will continue to hold steady at the selected vehicle speed. When you are ready to launch, press the CANCEL button on the steering wheel. The cruise control will disengage, the throttles will open fully and the ignition timing will advance. This unleashes a large amount of torque and causes rapid acceleration in an instance.

The rolling launch feature will work in any gear and at any RPM or vehicle speed.

Rolling Launch Accel Rest Point

0.810 volt (V)

While Rolling Launch is enabled in cruise control mode RaceROM will set the Accel pedal input to see this voltage. The default voltage is essentially the normal at rest voltage, and means that cruise control will ignore the accel input and maintain the selected cruise control speed target while rolling launch is enabled.

Rolling Launch Accel Threshold

3.5 volt (V)

While the ECU will still see the **Rolling Launch Accel Rest Point** voltage, if the true accel voltage exceeds this threshold then the antilag function will be activated.

Rolling Launch Antilag Timeout

5 seconds (s)

Once the antilag function has been triggered, it will be deactivated after this time to prevent overheating.

Rolling Launch Enable

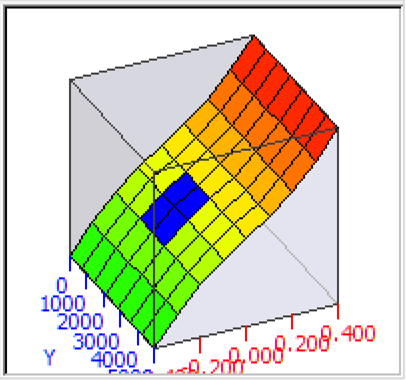
- ☐ Enable Rolling Launch in Mode 1
- ☐ Enable Rolling Launch in Mode 2
- ☐ Enable Rolling Launch in Mode 3
- ☐ Enable Rolling Launch in Mode 4
- ☐ Only with Race Suspension
- ☐ Only when VDC is off

Rolling Launch is enabled on a per Mapswitch mode basis and can be set to only be active when VDC is off and/or Race Suspension mode is enabled.

Rolling Launch Ignition Proportional

-0.100 | Manifold Pressure Error (bar) | -4 °

Engine Speed (rpm) \ 3000	-0.400	-0.300	-0.200	-0.1000	0	0.1000	0.200	0.300	0.400
0	-22	-15	-9	-4	0	4	9	15	22
2400	-22	-15	-9	-4	0	4	9	15	22
2500	-22	-15	-9	-4	0	4	9	15	22
3000	-22	-15	-9	-4	0	4	9	15	22
3500	-22	-15	-9	-4	0	4	9	15	22
4000	-22	-15	-9	-4	0	4	9	15	22
4500	-22	-15	-9	-4	0	4	9	15	22
5000	-22	-15	-9	-4	0	4	9	15	22

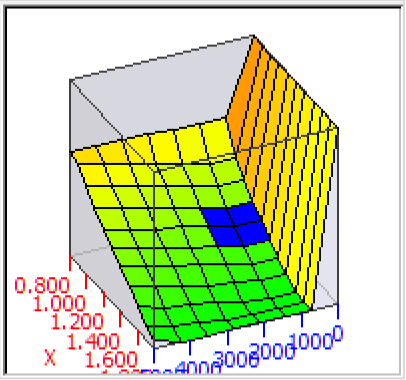


Used in conjunction with **Rolling Launch Ignition Timing Base** to deliver the **Rolling Launch Target Manifold Pressure** typically using increased retard to increase boost. The final ignition value will be capped at -30deg (30deg ATDC).

Rolling Launch Ignition Timing Base

1.200 | Manifold Pressure Target (bar) | -19 °

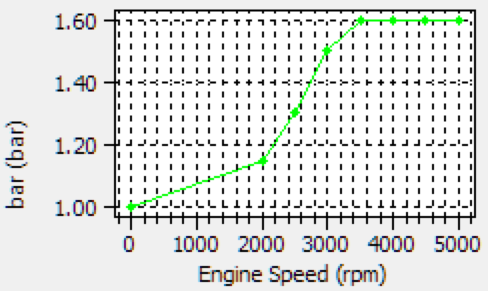
Engine Speed (rpm) \ 2500	0.800	0.900	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80
0	26	26	26	26	26	26	26	26	26	26	26
2400	2	-8	-12	-16	-19	-22	-25	-27	-30	-30	-30
2500	2	-8	-12	-16	-19	-22	-25	-27	-30	-30	-30
3000	2	-6	-10	-14	-17	-20	-23	-26	-29	-30	-30
3500	3	-4	-8	-12	-15	-19	-21	-25	-27	-30	-30
4000	3	-2	-6	-10	-14	-17	-20	-23	-26	-29	-30
4500	3	0	-4	-8	-12	-15	-18	-21	-25	-28	-30
5000	3	2	-2	-6	-10	-13	-16	-19	-23	-26	-28



While the Rolling Launch Antilag system is active, ignition retard is used to build boost. This sets the base value, overriding the values from the main ignition maps. This map should be calibrated such that the values used are close to the final value required to make the target boost at each RPM point. Correction for boost target error comes from the **Rolling Launch Ignition Proportional** map.

Rolling Launch Maximum Boost Target

Engine Speed (rpm)	
0	1.00
2000	1.15
2500	1.30
3000	1.50
3500	1.60
4000	1.60
4500	1.60
5000	1.60



A limit of Manifold Absolute Pressure to the boost target used by the Rolling Launch antilag system. The base target is set by the values in **Rolling Launch Target Manifold Pressure** but can be reduced at specific RPM using this map. The overall target will always be the lower of the two values.

Rolling Launch Target AFR

afr (afr)
12.0
12.0
12.0
12.0

AFR target override to be used while the Rolling Launch retard is active, this should be set reasonably rich to help keep exhaust temperatures from become extreme.

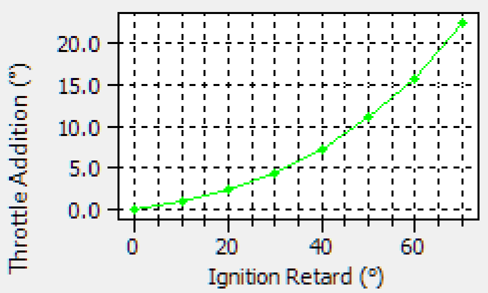
Rolling Launch Target Manifold Pressure

bar (bar)
1.5
1.5
1.5
1.5

The base target Manifold Absolute Pressure while the Rolling Launch anti lag is active. This target is capped by the limits set in **Rolling launch Maximum Boost Target** and the result is used as the target for the ignition retard maps as part of the antilag system.

Rolling Launch Throttle Compensation

Ignition Retard (°)	
0	0.00
10	1.09
20	2.50
30	4.50
40	7.31
50	11.00
60	15.69
70	22.44



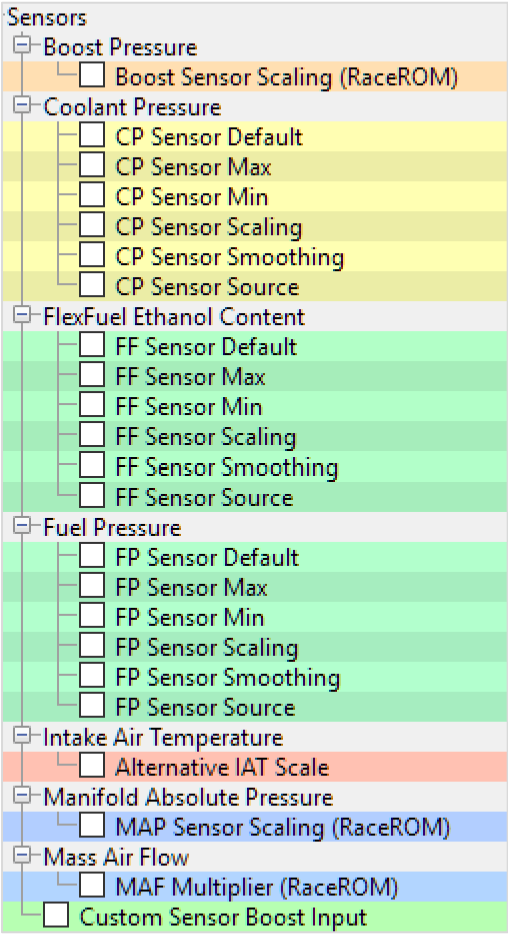
This map adjusts the throttles to compensate for torque variations as the ECU varies the ignition timing to generate boost. The compensation is now an absolute throttle angle adder and the above table has shown to give sensible results but may need fine tuning.

Sensors (*was "Sensor Scaling"*)

Introduction

Custom sensor inputs have been added for fuel pressure and coolant pressure, and extra functionality has been added to the existing FlexFuel sensor input, which now falls under the **Sensors** category with all the OEM and RaceROM sensors.

Map List



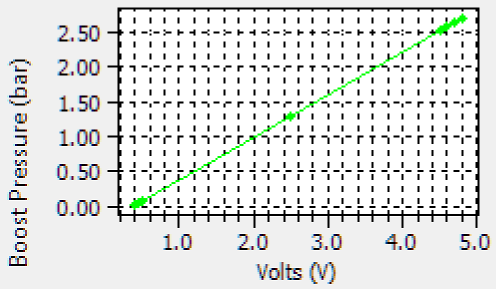
Live Data related parameters

- *Coolant Pressure – Coolant pressure (gauge) in bar*
- *FlexFuel Ethanol Sensor Output – Ethanol content as reported by the sensor output, including filtering*
- *Fuel Pressure – Total Fuel Pressure in bar (gauge) at the point of measurement*
- *Fuel Pressure (relative) – Filtered pressure differential across the fuel injector used for compensations and safety trips, also available as an input for custom maps. Correct values rely on the use of a fuel pressure sensor that returns gauge pressure (almost all do).*

Boost Pressure Sensor Scaling

Volts (V)

0.400	0.01000
0.450	0.04000
0.500	0.07250
2.500	1.29750
4.500	2.52250
4.600	2.58500
4.700	2.64500
4.800	2.70750



The stock scaling for the boost sensors can be replaced. However at the current time it's use is depreciated as there are some OEM strategies that use the raw voltage, resulting in odd behaviour if a pair of 4 bar sensors are used.

Custom Sensor Inputs

Due to the identical nature of each of these sensors, the common maps are only described for the fuel pressure sensor, but the same functionality applies to all the custom sensors.

FP Sensor Default

3.5	Value (bar)

If the sensor voltage is below **FP Sensor Min** or above **FP Sensor Max**, the sensor will be considered to have failed and the default value will be returned. Typically, sensors will give a useful output over a range a little less than their full-scale output so that faults can be diagnosed. For example, many pressure sensors will output between 0.5 and 4.5 volts, and voltages significantly outside this range would indicate an error. Aftermarket FlexFuel sensors that output 0-5v outputs however, normally use a full 0-5v range so the limits for a FlexFuel sensor should be set appropriately for example a minimum of -1v and a maximum of 5.1 volts.

> In the case of the fuel pressure sensor the default value is employed by all maps that use *Rel Fuel Pressure* as an input. Adjust the default value to match your actual fuel pressure as required.

FP Sensor Max

4.75	Value (V)

Maximum nominal voltage expected from the sensor, over which a fault will be assumed and the **FP Sensor Default** value returned. This can be set to a high value such as 6 to never trigger a failure.

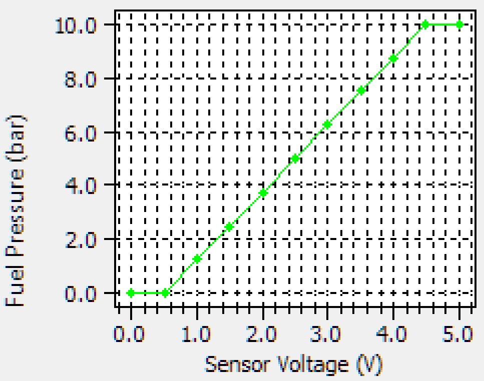
FP Sensor Min

0.25	Value (V)

Minimum nominal voltage expected from the sensor, below which a fault will be assumed and the **FP Sensor Default** value returned. This can be set to a negative value such as -1 to never trigger a failure.

FP Sensor Scaling

Sensor Voltage (V)	
0.0	0.00
0.5	0.00
1.0	1.25
1.5	2.50
2.0	3.75
2.5	5.00
3.0	6.25
3.5	7.50
4.0	8.75
4.5	10.00
5.0	10.00



Sensor output based on input voltage.

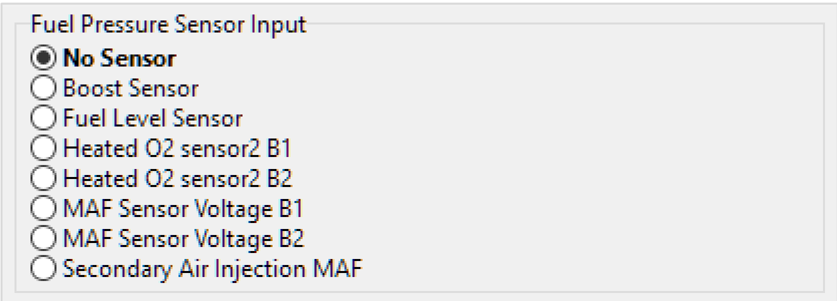
FP Sensor Smoothing

This is an exponential filter, as implemented the filtered value is returned as a weighted average of the new value and the value from the last cycle, thus:

$$NewFilteredValue = (NewRawValue * Smoothing) + ((1 - Smoothing) * LastFilteredValue)$$

Lower filtering values give smoother sensor values, smoothing value of 1 gives no filtering, smoothing value of 0 will result in the sensor output always being 0.

FP Sensor Source



You can select the source for custom sensors, however there are some caveats surrounding some of these choices and they should be considered with care. If you want to re-purpose an input

No Sensor

This will not use the custom input, and the default value will be returned. There is an exception to this when looking at fuel pressure inputs, in that the default value will be presented as the relative fuel pressure instead of the gauge pressure which is used in the sensor scaling.

Boost Sensor

This is one of the preferred options for sensor input and can be the easiest for fuel pressure or FF due to ease of access. It needs to be used with the option specified in **Custom Sensor Boost Input** which selects which bank's boost sensor input your custom sensor is physically connected to.

Fuel Level Sensor

For a very few cars this may be applicable, for example in the case of an aftermarket race fuel tank being fitted and the OEM tank removed.

Heated O2 sensor 2 B1/B2

USE WITH CAUTION. These can be used but can introduce problems. Use of these may introduce problems with the front o2 sensor readings and require regular ECU resetting to clear the *A/F Adjustment Bank #1 / #2* sensor learning that may build up. We hope to be able to limit or eliminate the sensor learning and make rear o2 sensor a more viable option for sensor inputs. You should look to disable DTCs for bank2 sensor 2 if used.

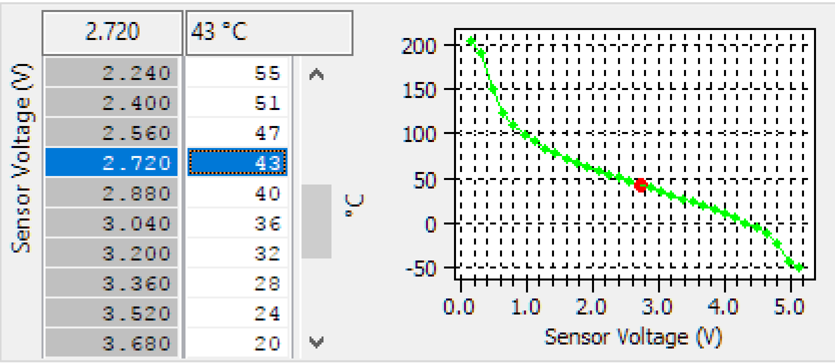
MAF Sensor Voltage B1 / B2

This is another good option for sensor input on cars that have been converted to Speed Density. There are no real restrictions when using MAF inputs but be sure to disable appropriate DTCs and/or adjust min/max voltage levels.

Secondary Air Injection MAF

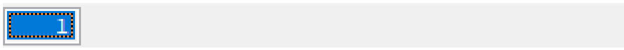
This is one of the easiest and lowest risk options for sensor input and may require some DTCs disabling if your input is likely to reach 0v or 5v.

Alternative IAT Scale



In the stock implementation, the Intake Air Temperature sensor shares it's scaling data with the engine coolant temperature. If replacing the IAT sensor, it's possible to use the RaceROM scaling instead to cater for non-standard scaling without disrupting the ECT sensor scaling. Use of this scaling map is enabled in **Speed Density»SD Enable.**

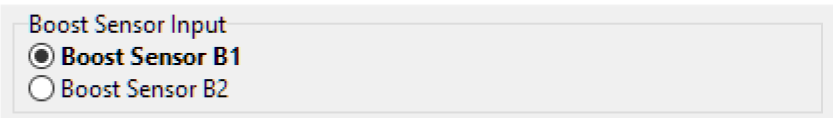
MAF Multiplier (RaceROM)



In previous versions of RaceROM larger MAF housings could be catered for by changing the OEM conversion from MAF load to airflow. However, it was found that at some stages of the airflow calculation, the scaling of large MAF housings caused some internal low precision variables to max out, and irregularities to occur in the load and airflow.

MAF Multiplier (RaceROM) can be used to multiply the measured airflow in line with the relative change in the MAF cross sectional area. All calculations are carried out using high precision numbers and there is no loss of accuracy as a result. Typically, a 76mm MAF housing will work well with this set to 1.33. Do not adjust the stock value in **MAF Sensor Scaling (% to g/s) for Load** when using this, otherwise the load will be adjusted twice.

Custom Sensor Boost Input



If any of the custom sensor inputs are configured to use "Boost Sensor" as their source, the appropriate sensor must be selected here. If any sensor is configured to use "Boost Sensor" the voltage from the non-selected sensor is copied to redundant sensor input.

For example, if "Boost Sensor B1" is selected the follow should happen:

- The custom sensor will use the sensor input from B1 boost sensor.
- The B2 boost sensor input will be copied to the B1 Boost sensor.
- Both B1 and B2 boost values will get their value from the B2 sensor which is still connected.

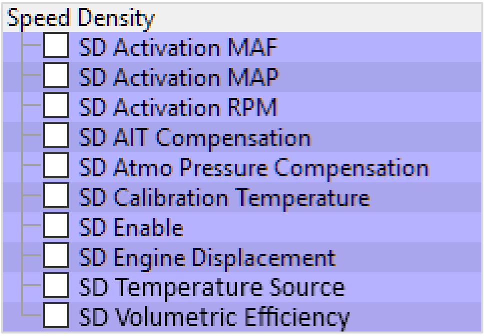
Speed Density

Introduction

So called because it's a method of estimating the mass flow using engine speed and air density (derived from measured air conditions and empirical volumetric efficiency data). For the purposes of tuning the GT-R, Speed Density can be employed in conditions where the MAF sensor has insufficient measurement range, the MAF voltage inputs are required for re-purposing, or the turbo installation dictates that a MAF sensor would be impractical or inaccurate.

RaceROM Speed Density can be enabled on a per Mapswitch Mode basis, and used in a hybrid fashion in conjunction with the MAF sensors to give the benefits of both strategies. If SD is enabled in the current Mapswitch mode, MAF is still used until all the activation conditions (MAF, MAP and RPM) are met.

Map List

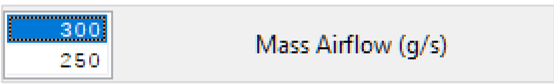


Live Data related parameters

- *Dig: Speed Density – Digital flag, set to 1 when Speed Density is Active*
- *Engine Load Absolute – Engine load calculated by the speed density strategy*
- *Mass Airflow Estimated (SD) – The mass airflow in g/s as calculated by speed density strategy*
- *SD Volumetric Efficiency – The VE used by the speed density strategy*

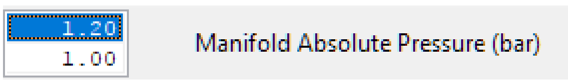
SD live data for MAF and load is only calculated while SD is active, and will otherwise match MAF based values.

SD Activation MAF



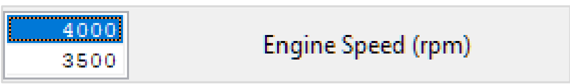
Hysteresis is achieved using two separate values for activation and deactivation. The upper value (0 by default) is the MAF in g/s over which SD will become active, the lower value (0 by default) is the MAF in g/s below which SD will become inactive.

SD Activation MAP



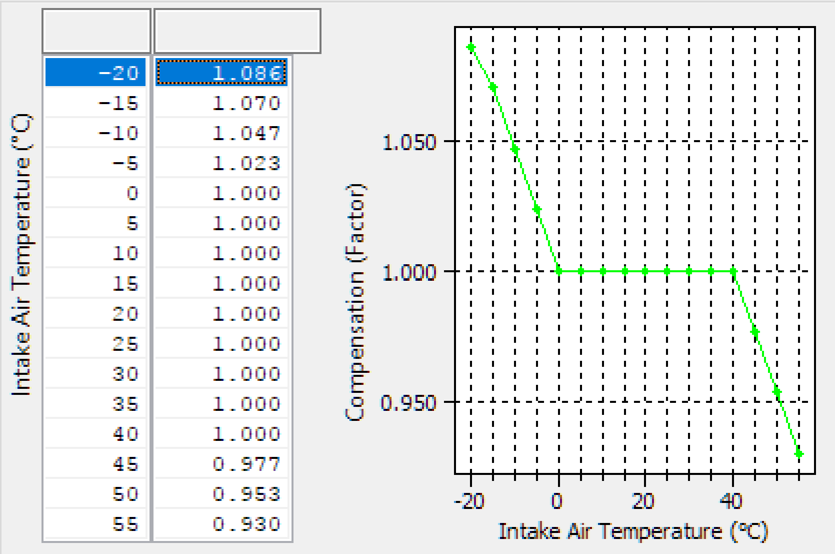
Hysteresis is achieved using two separate values for activation and deactivation. The upper value (0 by default) is the MAP in bar over which SD will become active, the lower value (0 by default) is the MAP in bar below which SD will become inactive.

SD Activation RPM



Hysteresis is achieved using two separate values for activation and deactivation. The upper value (0 by default) is the engine speed in RPM over which SD will become active, the lower value (0 by default) is the engine speed in RPM below which SD will become inactive.

SD AIT Compensation

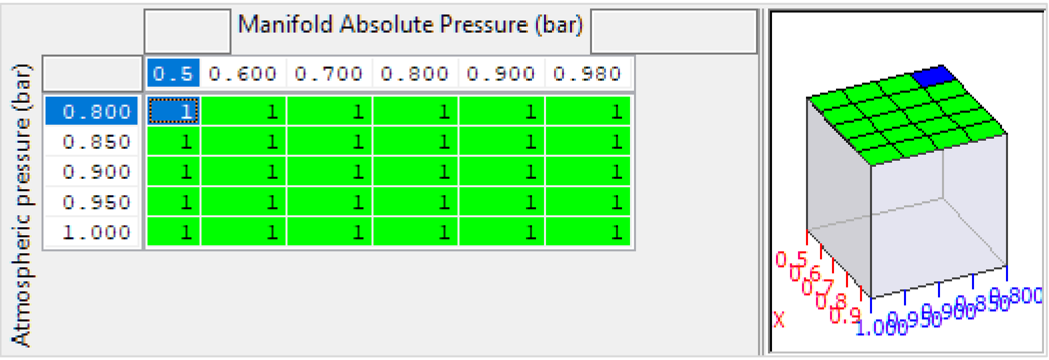


Intake Air Temperature (°C)	
-20	1.086
-15	1.070
-10	1.047
-5	1.023
0	1.000
5	1.000
10	1.000
15	1.000
20	1.000
25	1.000
30	1.000
35	1.000
40	1.000
45	0.977
50	0.953
55	0.930

If the **SD Temperature Source** is set to *Use fixed calibration temperature* this map can be used to make adjustments to the calculated mass airflow based in *Intake Air Temperature*. It can be used in situations where SD is required on an otherwise standard car to deal with MAF limits, and a dedicated charge air temperature measurement solution is not in place.

This map is ignored if either of the direct temperature measurement sources are used.

SD Atmo Pressure Compensation



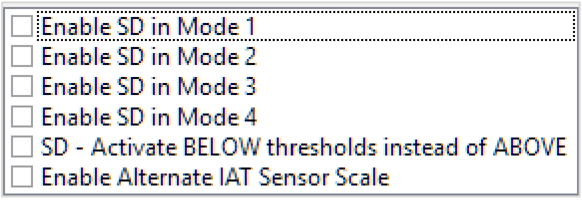
Atmospheric pressure (bar) \ Manifold Absolute Pressure (bar)	0.5	0.600	0.700	0.800	0.900	0.980
0.800	1	1	1	1	1	1
0.850	1	1	1	1	1	1
0.900	1	1	1	1	1	1
0.950	1	1	1	1	1	1
1.000	1	1	1	1	1	1

This can be used to compensate for the changes in VE typically experienced at high altitude and low atmospheric pressure. The values will multiply the VE from the SD VE map.

SD Calibration Temperature

This is the charge air temperature assumed by the Speed Density strategy if **SD Temperature Source** is set to *Use fixed calibration temperature.*

SD Enable

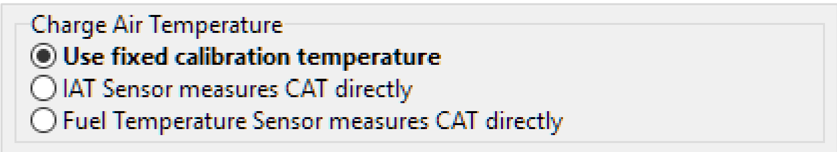


An overall enable of the Speed Density strategy on a per mapswitch mode basis. It also includes options to use the activations thresholds as maximums in cases were SD is employed in low load conditions, and to activate the alternative IAT sensor scaling in **Sensors » Intake Air Temperature » Alternative IAT Scale.**

SD Engine Displacement

The engine displacement is a key part of calculating the rate of air consumption, increasing or decreasing this value will proportionally increase or decrease the resulting mass airflow. Ensure this is changed to match the capacity of non-standard engine builds.

SD Temperature Source



This is used to select Speed Density strategy handles Charge Air Temperature for air density compensations. If *Use fixed calibration temperature* is selected, temperature is assumed to be constant at the level set in **SD Calibration Temperature** and the mass airflow is corrected as per the multiplier in **SD AIT Compensation**.

If *IAT Sensor measured CAT directly* is selected, the temperature input from Input Air Temperature sensor (normally located in the MAF sensor) is used as part of the ideal gas law calculation to estimate air density and **SD IAT Compensation** is ignored.

Fuel Temperature Sensor measured CAT directly can be selected if a dedicated Charge Air Temperature sensor is wired into the fuel temperature input (a useful option for cars that don't have a fuel temperature sensor as standard). The output from the sensor is then used in the ideal gas law calculation to estimate air density and **SD IAT Compensation** is ignored.

SD Volumetric Efficiency

0.96

Manifold Absolute Pressure (

Engine Speed (rpm)

3200	0.00	0.120	0.240	0.360	0.480	0.600	0.720	0.840	0.960	1.08	1.20	1.32	1.44	1.56
0	60.9	61.9	63.0	63.0	68.1	72.5	75.9	79.3	83.4	88.7	92.2	94.8	95.7	96.3
400	61.1	62.2	63.4	63.4	68.9	73.4	76.7	79.8	84.1	89.2	92.6	95.1	96.0	96.3
800	61.3	62.4	63.8	63.8	69.8	73.9	77.2	80.2	84.9	90.1	93.2	95.4	96.3	96.6
1200	61.6	62.6	64.1	64.6	70.5	74.5	77.6	80.9	86.9	91.6	93.8	95.7	96.3	96.6
1600	61.8	62.8	64.6	65.4	71.3	75.3	78.6	81.9	88.6	92.4	94.8	96.1	96.7	96.9
2000	61.6	63.2	65.3	68.4	72.4	76.3	79.3	82.9	89.4	93.2	95.5	97.3	97.9	97.8
2400	60.9	63.3	65.7	69.4	73.6	77.1	80.0	83.6	89.9	93.6	95.9	98.4	99.0	99.0
2800	60.9	63.3	65.7	70.1	74.4	78.0	80.8	84.6	89.9	93.6	96.0	98.4	99.0	99.0
3200	60.9	63.3	65.5	70.7	75.2	78.9	81.6	85.3	90.1	93.4	95.9	96.6	96.9	97.2
3600	60.9	63.3	65.8	71.4	76.1	79.6	82.3	85.8	90.1	93.2	94.9	95.5	96.1	96.5
4000	60.9	63.2	65.9	72.5	77.3	80.4	82.8	86.8	90.0	93.1	94.5	95.6	96.4	96.8
4400	60.9	63.5	66.1	73.2	78.3	81.8	84.1	87.8	90.4	93.1	94.8	96.0	97.1	97.6
4800	60.9	63.6	66.3	73.8	79.6	83.9	86.6	89.2	91.4	93.6	95.1	96.3	97.6	98.5
5200	60.9	63.7	66.6	74.4	80.7	85.8	88.8	91.1	93.5	94.8	95.9	97.0	97.8	98.8
5600	60.9	63.8	66.8	74.9	81.4	86.9	90.1	92.6	94.8	95.9	96.8	97.6	98.1	98.9
6000	60.9	64.0	67.1	74.9	81.6	87.1	91.0	93.8	95.6	96.7	97.4	97.8	98.2	98.8

Only a snippet of this 26x21 cell map shown above. It is used to correct the volumetric air flow of the engine based on manifold absolute pressure and engine speed. The default map is good enough run a mostly stock car in full time SD and should be a good based for custom tuning.

It would not be expected for the values in this table to exceed 105%, if you find yourself using values much higher than this, it’s the sure sign of other problems such as poorly calibrated injectors or insufficient fuel flow. A badly calibrated VE map will lead to incorrect load estimation leading to erroneous torque values being sent to the TCM and poor shifting can result.

Torque

Introduction

The GT-R uses torque extensively for interacting with the TCM and VDC systems, but the 16x16 OEM map used as the basis to calculate torque only accommodates with load values up to 100% which can be exceeded by a stock car running increased boost. To overcome this issue RaceROM adds a new 26x19 map that uses a high precision load input that allows any load value to be used. This gives more accurate torque values at low loads while catering for torque values that can increase with engine loads seen on 1500hp cars.

It is important to understand that torque is derived from load, which is an expression of estimated airflow, so proper operation of the torque model relies on accurate tuning of the MAF or SD and injectors. Errors in the resulting torque of just 10% can give poor shifting feel, so efforts need to be made to ensure that errors in injector scaling are not covered up by poorly calibrated MAF or SD VE maps, or vice-versa.

Map List

Torque
- Torque Actual (RaceROM)

Live Data Parameters

- *Torque Actual – Final Torque actual value after compensations, usually different to values in map*

Torque Actual (RaceROM)

25.000 Engine Load (%) 167 Nm

Engine Speed (rpm)

3600	0.000	5.00	10.00	15.00	20.00	25.00	35.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	90.0	100	110	120	130	140	150	160	170	180	190
400	-50	7	60.0	90.00	125.0	166.0	221	298	336	375	413	451	492	530	572	621	669	718	767	816	864	893	921	949	949	949
800	-52	3	56.5	93.81	135.9	177.1	249	295	335	374	413	453	492	531	571	620	669	718	767	815	864	893	921	949	949	949
1200	-53	0	45.0	86.19	134.3	177.3	272	331	370	413	453	493	533	573	613	656	699	742	785	828	871	897	923	949	949	949
1600	-56	-3	41.1	87.13	136.0	178.0	271	349	396	431	475	508	549	585	628	669	710	750	791	832	872	898	924	949	949	949
2000	-58	-4	41.0	87.00	137.0	178.0	272	354	401	431	466	498	545	584	624	665	707	748	789	831	872	898	924	949	949	949
2400	-60	-7	41.1	89.13	138.0	179.0	275	350	396	422	464	492	540	580	621	663	705	747	788	830	872	898	923	949	949	949
2800	-64	-10	40.1	86.13	126.0	173.0	275	345	398	418	462	491	542	581	622	664	705	747	789	830	872	898	923	949	949	949
3600	-73	-11	33.0	79.13	122.0	167.0	259	339	394	415	457	485	539	581	618	660	703	745	787	829	872	897	923	949	949	949
4000	-77	-18	30.0	79.00	122.0	166.0	256	336	399	420	459	485	547	586	624	665	706	748	789	831	872	898	924	949	949	949
4400	-85	-23	25.0	75.00	120.0	162.0	249	333	397	417	460	489	546	583	625	667	708	749	790	831	872	898	924	949	949	949
4800	-94	-28	23.0	70.00	115.0	160.0	244	328	393	412	455	486	540	580	617	660	702	744	787	829	871	897	923	949	949	949
5200	-100	-35	19.0	64.00	105.0	155.0	236	327	390	411	453	479	539	572	609	652	696	740	783	827	871	897	923	949	949	949
5600	-113	-48	17.0	60.00	100.0	150.0	224	327	385	408	450	472	524	554	591	637	683	730	776	823	869	896	923	949	949	949
6000	-125	-60	5.0	50.00	85.0	140.0	215	320	382	406	451	467	508	543	573	622	671	720	769	818	866	894	922	949	949	949
6400	-136	-87	-33.0	15.00	60.0	107.0	196	299	368	399	438	460	497	533	561	611	662	712	762	812	862	891	920	949	949	949
6800	-147	-96	-44.2	5.60	49.2	92.8	181	269	315	360	404	426	467	502	537	589	641	693	745	797	848	882	916	949	949	949
7200	-145	-95	-43.8	5.50	48.7	91.9	179	266	312	356	400	422	463	497	532	583	634	686	737	788	839	873	906	940	940	940
7600	-144	-94	-43.3	5.50	48.2	91.0	178	264	309	353	396	418	458	492	526	577	628	678	729	780	830	864	897	930	930	930
8000	-142	-93	-42.9	5.40	47.7	90.0	176	261	306	349	392	414	453	487	521	571	621	671	721	771	822	855	888	921	921	921

The default values are calibrated to give results that offer as close to stock behaviour as possible within the range of the stock map. The areas most likely to benefit from fine tuning are in the part throttle zones, and even on cars which have well calibrated fuelling and airflow, tuning this can be of benefit to iron out some odd TCM behaviours.

This map should not however be used as a band-aid to fix a general trend of slipping clutches. Specific tuning of the TCM should be used on cars that have issues holding the peak torque the engine can deliver.

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

Valet Mode
- ☐ Valet Mode Enable
- ☐ Valet Mode Speed Limiter
- ☐ Valet Mode Torque Limiter

Method of Operation

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!

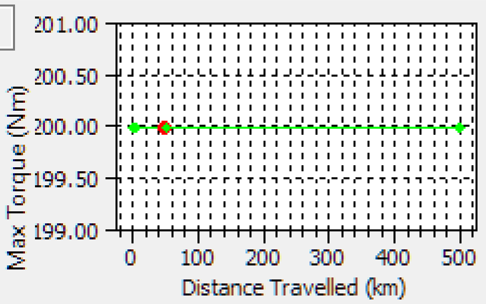
Valet Mode Enable

☐ Enable Valet Mode

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

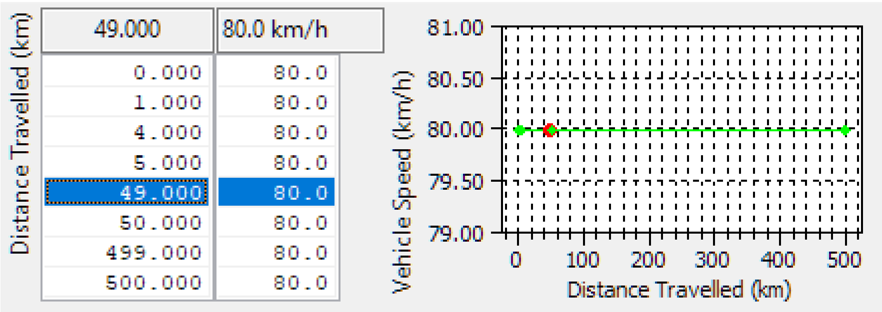
Valet Mode Torque Limiter

Distance Travelled (km)	49.000	200 Nm
	0.000	200
	1.000	200
	4.000	200
	5.000	200
	49.000	200
	50.000	200
	499.000	200
	500.000	200



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. Custom Map Examples

Gear change fuel cut

The following example enables a partial fuel cut on gearshift. The result is increased noise on the shift, but can also be used in very high powered cars to get a faster speed match and ultimately a faster shift. You can download the example rom used here by using EcuTek Update:

`23710-62B2A-RR19472-Example ROM Gearchange fuelcut enc.bin`

A Custom Map N is used to create a partial fuel cut when the ignition timing is below -6º, and the throttle angle is above 68º, this situation is only encountered during a gearshift. Manifold absolute pressure is used to vary the cut level, so at low boost even if at full throttle there will be no cut.

Custom Map N

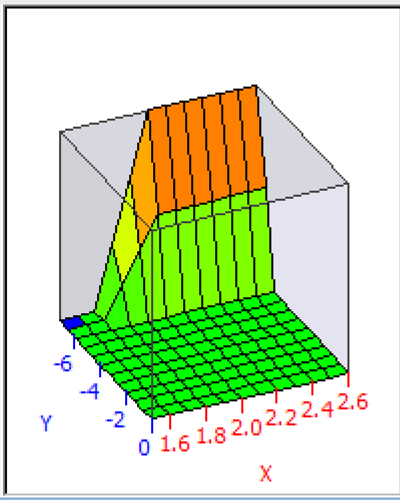
23710-62B2A-RR19472-Example ROM Gearchange fuelcut enc.bin - Custom Map N

File Edit View Plot Help

X channel (raw)

Y channel (raw)

Y \ X	1.5	1.60	1.70	1.800	1.90	2.0	2.10	2.20	2.30	2.40	2.5	2.60
-7	0	0	0	16.67	33.3	50	50	50	50	50	50	50
-6	0	0	0	8.33	16.7	25	25	25	25	25	25	25
-5	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0
0	0	0	0	0.00	0.0	0	0	0	0	0	0	0



Custom Map N Activation Definition

Activation Channel: *Throttle Angle*

Activation mode: *Map is only active when channel value is above threshold (with hysteresis)*

Activation options: *Map activates and deactivates as normal*

Custom Map N Activation Delay: *0 (zero)*

Custom Map N Activation Threshold: *Activates above 68, deactivates below 66*

Custom Map N Enable: Enabled in mode 4 and all suspension modes in example

Custom Map N Output Definition: *Cylinder Cut Probability (%)*

Custom Map N X Input Definition: *Manifold Absolute Pressure (bar)*

Custom Map N Y Input Definition: *Ignition Timing (º)*

Throttle angle typically ranges from 0 to 74 in live data and custom maps.

Slip Target based Traction control

This is an advanced application of Custom maps, and for it to successfully work all 5 Custom Maps will need to be transferred your tuned ROM file in order for it to work. Also note that because a user variable in the form of *Calculation 1* is used the order of the custom maps is critical. You can download the example rom from EcuTek Update:

`23710-62B2A-RR19472 Example ROM Gearchange fuelcut traction control enc.bin`

Custom Map E

takes wheel slip and puts it back into the *Calculation 1* value, in this example the *RaceROM Boost Controller* is not used for boost target selection, but instead reduces the reported *Wheel Slip (%)* by a small amount (typically 1-3%), which has the same effect as increasing the slip target by the same amount.

Custom Map F

This is a slip target table, similar to aftermarket TC strategies, except they are negative numbers, the output is added to C*alculation 1* and the net result of that is we can subtract one number from another. This is one of the key tables used for TC tuning and you should compare your logged data for normal wheel slip to the values in this table, at low speeds Wheel Slip can be in 10-30 range even with no apparent slip, and in launch conditions at low speed values of 300 would not be unusual.

At this point *Calculation 1* = Wheel slip – Slip target = slip error

Custom Map G

This is a TC "gain" table that varies with front wheel speed and RaceROM Boost Controller, it multiplies the stored *Calculation 1* value by the numbers in the table. The output of this map dictates how severe the torque reduction should be to correct the current wheel slip greater than the targeted values (slip error) at different wheel speeds. In this example much reduced effects are used at low front wheel speed to be careful not to interrupt a launch process where a certain amount of wheelspin is required. Adding a potentiometer or multi-positon trim switch via a free voltage input to the Y axis of this map can be a useful way of adding driver trim to the Traction control while freeing up the RaceROM Boost Controller.

At this point *Calculation 1* = gain * slip error = % torque reduction

Custom Map H

This is a cylinder cut map used to momentarily reduce power based on % torque reduction (*Custom Map G Result)* and is activated by *Front wheel speed* going above 2km. The highest values in this table on the example rom are typically 35% and it should be considered in conjunction with **Custom Map I** which retards the ignition to reduce power. The effects are reduced in the example rom at low engine RPM to prevent bogging.

Custom Map I

This is an ignition retard table based on RPM and % torque reduction (*Custom Map G Result)*, it has reduced effects at low engine rpm in the example RPM to prevent bogging.

Custom maps H / I should are activated by the accel pedal going above about 18% volts, so they are off on overrun and idle. As seen and used by Custom Maps, the accel Pedal ranges from 15.4% to 93.4% on our car.

Custom maps H and I are enabled in map switch modes 2 and 3 only with VDC off.

5. 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