



Q50 Q60 RED ALPHA INJECTORS

TUNING GUIDE

Introduction

The goal of AMS Performance is to provide the highest quality, best performing products available. By utilizing research and development, and rigorous testing programs AMS Performance will never compromise the quality or performance of our products. In addition, AMS Performance will only provide the finest customer service offering only parts and advice that are in the best interests of the customer. AMS Performance was built on a foundation of integrity. This is who we are; this is what you can count on.

A vehicle modified by the use of performance parts may not meet the legal requirements for use on public roads. Federal and state laws prohibit the removal, modification, or rendering inoperative of any part or element of design affecting emissions or safety on motor vehicles used for transporting persons or property on public streets or highways. Use or installation of performance parts may adversely affect the drivability and reliability of your vehicle, and may also affect or eliminate your insurance coverage, factory warranty, and/or new OEM part warranty. Performance parts are sold as-is without any warranty of any type. There is no warranty stated or implied due to the stresses placed on your vehicle by performance parts and our inability to monitor their use, tuning, or modification.

These instructions are provided as a guide only as there are many variables that cannot be accounted for concerning your particular vehicle, including but not limited to model year differences, model differences, the presence of non-OEM parts, and modifications that may already be or were previously installed. A basic knowledge of automotive parts and systems is helpful but a better understanding of the parts and systems on your particular vehicle may be required.

If you have any questions or issues at any time during the installation of your AMS Performance product(s) please call us for technical assistance. The AMS Performance tech line can be reached during business hours at 847-709-0530 for AMS Performance products only.

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This tuning guide was made using EcuTek software. Other software may not use the same naming conventions for their tables.

ALPHA / Nostrum Injector Calibration Steps

Note: If any of these required MAPs are not available in your ROM, they may need to be requested from ECUtek. Please ensure these MAPs are present before beginning the tuning process.

1. Injector Sizing

- Calibration of the ALPHA/Nostrum KDI injectors requires modification of the calibration data in the injector data table “Injector Magnification.”
 - This calibration table works very similarly to a standard injector scale table for a port injected vehicle. Coarse global fueling adjustments can be made here in respect to injector flow rate changes.
 - This Calibration Table is in the Folder as shown in the screen capture below.
 - Please note, the ALPHA/Nostrum KDI injectors flow approximately ~40% more fuel than the stock injectors and a coarse “Injector Magnification” adjustment could be made to accommodate this, however we
 - recommend the starting point for this calibration table be directly transposed from the data that is provided with your injector purchase.
- 1. Injector calibration from one matched set of 6 injectors may differ slightly than another matched set of 6. Please keep this in mind when calibrating.**

Fuel Pressure (MPa)	Value
0.300	0.4750
0.488	0.3720
0.781	0.2900
1.250	0.2300
2.000	0.1830
2.632	0.1610
2.860	0.1580
3.109	0.1510
3.379	0.1470
3.673	0.1440
3.993	0.1410
4.340	0.1390
4.717	0.1340
5.128	0.1320
5.573	0.1290
6.058	0.1260
6.585	0.1230
7.157	0.1200
7.780	0.1170
8.456	0.1140
9.192	0.1130
9.991	0.1090
10.860	0.1070
11.804	0.1040
12.830	0.1020
13.946	0.1000
15.159	0.0980
16.477	0.0960
17.910	0.0940
19.467	0.0910
21.160	0.0870
23.000	0.0820

2. Injector Drive Current

- Calibration of the ALPHA/Nostrum KDI injectors require modification of the calibration data in the injector data tables responsible for injector drive current.
- The ALPHA/Nostrum KDI Injectors for the VR30DDTT engine require a higher drive current than stock to open fully. The recommended drive currents are listed below:

	<i>High Pressure Fail</i>	<i>High Pressure</i>	<i>Normal</i>	<i>Low Pressure</i>
<i>Peak Current</i>	16.4	15.4	14	12
<i>Hold 1</i>	7	6.6	5.4	5.4
<i>Hold 2</i>	3.6	3.6	3	3

- The ALPHA/Nostrum KDI Injectors for the VR30DDTT engine also require the highest drive current to be utilized at a lower injection pressure.

1. The recommended value for this pressure threshold is 20MPa.

- These Calibration Tables are in the following folders as shown in the screen capture below.

The screenshot displays a software interface for injector calibration. On the left, a tree view shows the following structure:

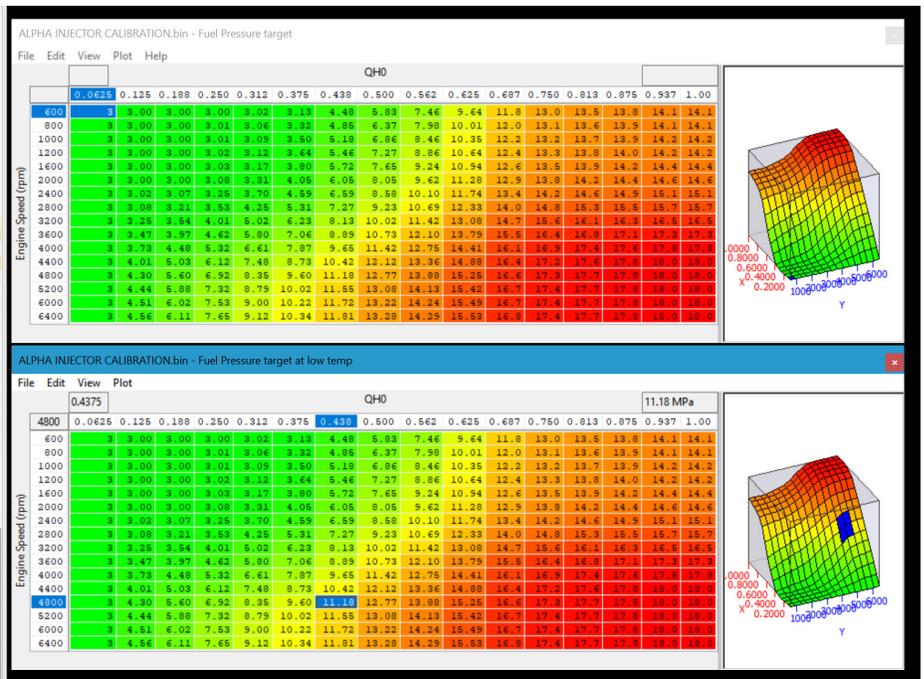
- FlexFuel
 - Fuel Pressure
 - Fuelling
 - Injectors
 - HP
 - Injector Current Switch Pulse Width - HP (Beta: OEM, Beta: OEM)
 - Injector Delay Time Initial - High Pressure (Beta: OEM, Beta: OEM)
 - Injector Hold 1 Current Initial - High Pressure (Beta: OEM, Beta: OEM)
 - Injector Hold 2 Current Initial - High Pressure (Beta: OEM, Beta: OEM)
 - Injector Hold Time Initial - High Pressure (Beta: OEM, Beta: OEM)
 - Injector Hysteresis Initial - High Pressure (Beta: OEM, Beta: OEM)
 - Injector Peak Current Initial - High Pressure (Beta: OEM, Beta: OEM)
 - Injector T2 Delay Time Initial - High Pressure (Beta: OEM, Beta: OEM)
 - HPF
 - Injector Current Switch Pulse Width - HPF (Beta: OEM, Beta: OEM)
 - Injector Delay Time Initial - High Pressure Fail (Beta: OEM, Beta: OEM)
 - Injector Hold 1 Current Initial - High Pressure Fail (Beta: OEM, Beta: OEM)
 - Injector Hold 2 Current Initial - High Pressure Fail (Beta: OEM, Beta: OEM)
 - Injector Hold Time Initial - High Pressure Fail (Beta: OEM, Beta: OEM)
 - Injector Hysteresis Initial - High Pressure Fail (Beta: OEM, Beta: OEM)
 - Injector Peak Current Initial - High Pressure Fail (Beta: OEM, Beta: OEM)
 - Injector T2 Delay Time Initial - High Pressure Fail (Beta: OEM, Beta: OEM)
 - Injection Angle
 - Linearisation
 - LP
 - Injector Current Switch Pulse Width - LP (Beta: OEM, Beta: OEM)
 - Injector Delay Time Initial - Low Pressure (Beta: OEM, Beta: OEM)
 - Injector Hold 1 Current Initial - Low Pressure (Beta: OEM, Beta: OEM)
 - Injector Hold 2 Current Initial - Low Pressure (Beta: OEM, Beta: OEM)
 - Injector Hold Time Initial - Low Pressure (Beta: OEM, Beta: OEM)
 - Injector Hysteresis Initial - Low Pressure (Beta: OEM, Beta: OEM)
 - Injector Peak Current Initial - Low Pressure (Beta: OEM, Beta: OEM)
 - Injector T2 Delay Time Initial - Low Pressure (Beta: OEM, Beta: OEM)
 - Normal
 - Injector Current Switch Pulse Width - Normal (Beta: OEM, Beta: OEM)
 - Injector Delay Time Initial - Normal (Beta: OEM, Beta: OEM)
 - Injector Hold 1 Current Initial - Normal (Beta: OEM, Beta: OEM)
 - Injector Hold 2 Current Initial - Normal (Beta: OEM, Beta: OEM)
 - Injector Hold Time Initial - Normal (Beta: OEM, Beta: OEM)
 - Injector Hysteresis Initial - Normal (Beta: OEM, Beta: OEM)
 - Injector Peak Current Initial - Normal (Beta: OEM, Beta: OEM)
 - Injector T2 Delay Time Initial - Normal (Beta: OEM, Beta: OEM)
 - Pressure
 - Fuel Pressure - Peak Injector Current (Beta: OEM, Beta: OEM)
 - Fuel Pressure - Peak Injector Current Hysteresis (Beta: OEM, Beta: OEM)
 - Variable Injector Current Fuel Pressure Threshold (Beta: OEM, Beta: OEM)
 - Variable Injector Current Fuel Pressure Threshold Hys (Beta: OEM, Beta: OEM)
 - Pump
 - 2 Time Injection split ratio homogenous - 290 (Developme... OEM)
 - 3 Time Injection split ratio for surge control - 289 (Developme... OEM)

The right side of the screenshot shows a grid of calibration tables. Each table is titled 'ALPHA INJECTOR CALIBRATION.bin - [Parameter] - [Pressure Level]'. The tables contain the following data:

Parameter	High Pressure	High Pressure Fail	Low Pressure	Normal
Peak Current (A)	15.4	16.4	12.0	14.0
Hold Current (A)	6.60	7.00	3.40	5.40
Fuel Pressure (MPa)	20.00			

3. Fuel Pressure Target

- Calibration of the ALPHA/Nostrum KDI injectors require modification of the calibration data responsible for fuel rail pressure targets.
 - Adjustment of the fuel pressure target tables is required as the nominal operating pressure of the ALPHA/Nostrum KDI is lower than that of the factory injectors. This is due to design characteristics that affect all GDI Injectors.
1. **GDI injectors have a max pressure at which the force of the fuel can prevent the injector from opening, and we need to be sure that this pressure is not reached.**
 2. **Pressures above approximately 24 MPa may prevent the injector opening thus it is important to have adequate fuel pressure control to limit pressure oscillations.**
- AMS and Nostrum recommend targeting a maximum fuel pressure of 18 MPa on all three fuel pressure tables as shown in the screen capture below.
 - AMS and Nostrum also recommends that the fuel pressure target near idle and low rpm, low load cruising be lowered to 3MPa and that the fuel pressure target does not rise or fall during idle operation.
1. **This will ensure a more consistent injection quantity at low load and low injector pulse-width to prevent any AFR oscillations.**



4. Narrow Injector Pulse Width

- Calibration of the ALPHA/Nostrum KDI injectors require modification of the Injector calibration data responsible for narrow fuel injection pulse width compensation.
- The “Narrow IDW” tables correct for the non-linear injector flow target characteristics at low injector pulse widths.
- These tables are specific to the OEM injectors and for this reason they should be zeroed out when changing injectors.
- These Calibration Tables are in the folder as shown in the screen capture below.

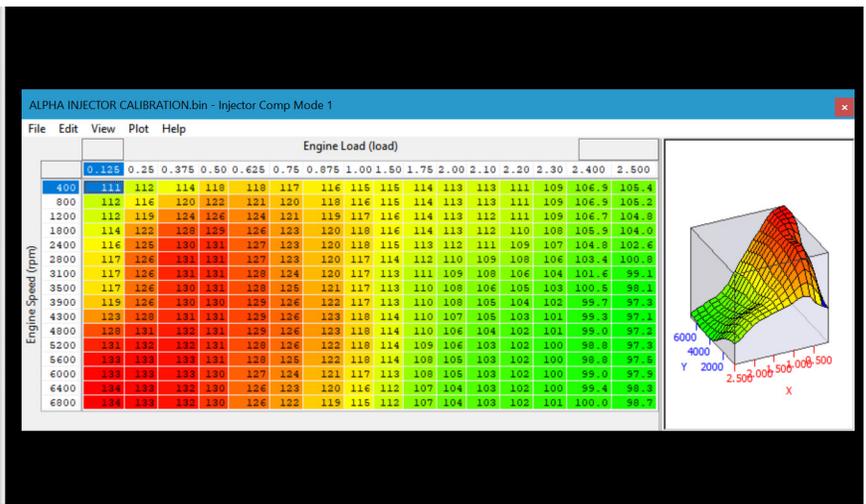
The screenshot displays a software interface with a parameter list on the left and eight calibration graphs on the right. The parameter list includes various fuel pressure and target conditions, such as 'Fuel Pressure High - High Threshold' and 'Narrow IPW High Target Fuel Pressure - Normal Pressure'. The graphs show Pulse Width (ms) on the x-axis (0.40 to 1.00) and Time (ms) on the y-axis (-1.00 to 1.00). Each graph contains a table of data points.

File	Edit	View	Plot
ALPHA INJECTOR CALIBRATION.bin - Narrow IPW High Target Fuel Pressure - ...			
0.350	0.00000 ms		
0.450	0.00000		
0.501	0.00000		
0.600	0.00000		
0.701	0.00000		
0.800	0.00000		
0.901	0.00000		
1.000	0.00000		

5. Base Fueling Compensations

- Calibration of the ALPHA/Nostrum KDI injectors require careful consideration of the calibration tables responsible for fine tuning fueling.
 - These tables are labeled “Injector Comp Mode 1,2,3,4) and as shown in screen capture.
 - It is worth noting that if you have previously applied fueling compensations utilizing these calibration tables due to the modifications on the car or oxygenated fuel, this may be a good place to start for fine tuning your new set of injectors.
1. If you are unsure of your current “Injector Comp” calibration, please “zero” the table out where all cells are equal to 100 as this will apply no fueling corrections and work well as a starting point.

- Fuel Pressure
- Fuelling
 - Cranking
 - Injectors
 - AFR Conversion Table Bank 1 Advanced OEM
 - AFR Conversion Table Bank 2 Advanced OEM
 - AFR for stratified FB equiv ratio conv - 088 Developme... OEM
 - AFR for stratified FB equiv ratio conv - 089 Developme... OEM
 - AFR Target - Max at WOT Advanced OEM
 - Bfs Correction Developme... OEM
 - Cylinder intake basic characteristic Developme... OEM
 - Fuel Enrichment Developme... OEM
 - Fuel Map Beginner OEM
 - Fuel Map - safe mode Beginner OEM
 - Fuel Map Mode 2 Intermediate RaceROM
 - Fuel Map Mode 3 Intermediate RaceROM
 - Fuel Map Mode 4 Intermediate RaceROM
 - Injector Comp Mode 1 Beginner RaceROM
 - Injector Comp Mode 2 Intermediate RaceROM
 - Injector Comp Mode 3 Intermediate RaceROM
 - Injector Comp Mode 4 Intermediate RaceROM
 - Intake theoretical flow Developme... OEM
 - Target AFR idle RO2 off - 021 Developme... OEM
 - Target AFR initial RO2 off - 020 Developme... OEM
 - Target AFR prop factor during CAT diag 1 - 433 Developme... OEM
 - Target AFR prop factor during CAT diag 2 - 434 Developme... OEM
 - Target AFR proportional Factor - 828 Developme... OEM
 - Target AFR proportional Factor - 829 Developme... OEM
 - Target AFR RO2 off - 019 Developme... OEM
- Gear Ratio
- Gear Shift
- Idle Control
- Ignition Timing
- Launch Control
- Limiter

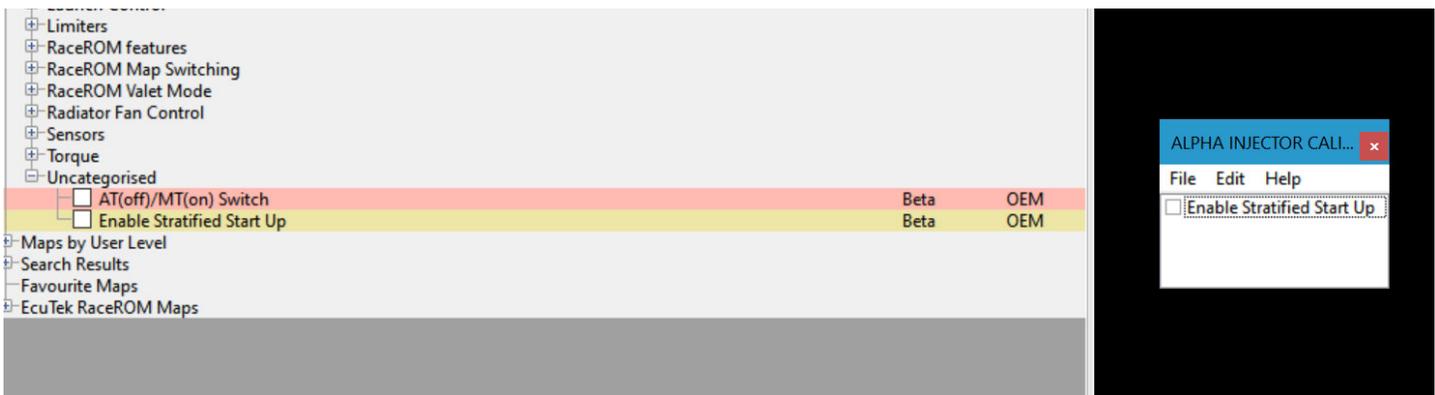


SC#5

6. Stratified Startup

- Calibration of the ALPHA/Nostrum KDI injectors require the toggle “Enabled Stratified Startup) to be disabled. (not checked)
- Leaving this table “checked”, will cause poor cold and warm startup conditions.

This is due to the very narrow pulse width of the factory startup, split injection, and injection angle of the startup. Under these conditions, the Alpha injectors would be commanded to inject such a small amount of fuel per injection stage that there can be a discrepancy between the amount of fuel being commanded for injection, and the amount of fuel actually injected.



<input type="checkbox"/> AT(off)/MT(on) Switch	Beta	OEM
<input type="checkbox"/> Enable Stratified Start Up	Beta	OEM

7. Fine Tuning

- After you have completed all the previous steps it's time to start the engine and start tuning.
- Dialing in your new injectors to maintain a target AFR with minimal fuel trim corrections will be an iterative process of driving at various engine speeds and engine loads and reviewing your datalogs.
- The first task you should work on is fine-tuning the injector magnification table.
 1. **You will want to calibrate this table so that the average of the fuel trims at each fuel pressure is within +/- 10%.**
 2. **This injector magnification curve should remain quite smooth**
- If your collected data suggests otherwise you can make up for it in the next step using the injector compensation table.
- Secondary fuel adjustments after adjusting the "Injector Magnification" table will be taken care of in the previously mentioned "Injector Comp" tables.
 1. **Adjustments to this table should have smooth transitions for good drivability.**
 2. **Please reference SC#5 for the location of this table, and for the smoothness of the data.**

Any questions or concerns that are not outlined in this tuning guide shall be forwarded to your AMS sales representative. Thank you and enjoy!