Speed Density EEC Tuning Guide

This guide aims to provide tuning tips and method for tuning Speed Density (SD) or MAP sensor based EECs, i.e. those from the I6 EA - AU Falcon. V8s use MAF tuning, and are covered in another guide available at http://www.tiperformance.com.au/library/.

In order to be able to tune your car, you will need some tools:

- A J3 Chip & Programmer (see http://www.tiperformance.com.au/products/)
- A good understanding of the EEC Tuning Beginners Guide
- A Data Logging device; you will need to log RPM, MAP, and O2 as a minimum. T.I. Performance sell the TechEdge 2J1 / LD02 combo kit at a discounted price. See http://www.tiperformance.com.au/products/ for more information.
- A binary and definition for your ECU from the site
- Tom Cloud's EEC Tech Notes from the Reference section at http://www.tiperformance.com.au/library/
- The Excel log analysis sheet from http://www.tiperformance.com.au/library/diy-guides/

Please take the time to read this guide thoroughly before attempting to tune your vehicle!

Configure your Data Log

You will need to have configured each your logger in order to capture meaningful data to use for tuning. Below is a screenshot of the T.I. Performance Winlog Dash.

From the left, we have:

- **AFR – Air Fuel Ratio.** This tells us how healthy the fuel side of the tune is.
- **Manifold Pressure.** This is used to measure boost (where appropriate) and vacuum. This tells us which inHGa cell to reference.
- **Throttle Position.** This tells us how wide open the throttle is.
- **RPM.** This tells us what RPM cell we are referencing.
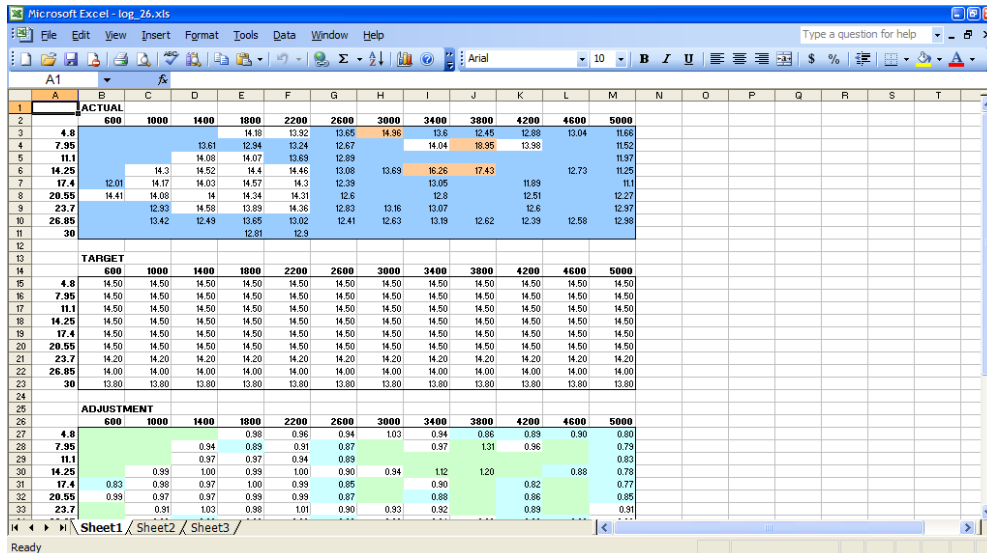- **Speed.** This tells us vehicle speed.

For more information on data logging, see the TechEdge 2J Configuration Guide.

Analysing your log

Using the WinLog tool, you can view your resultant log in a number of ways. Visualising WOT or part throttle runs on the timeline is a good way start off, as you can highlight segments of your log where things aren't as they should be. You will want to log sections of general part throttle driving, cruising at a constant speed, and of course, WOT runs.

Using your log to target your AFR

To help with this, we can use Excel to do a bit of number crunching. Open log analysis v0.1.xls, then update the ACTUAL values in the top of the chart with those from your log. Note: You can use the Matrix view in WinLog in order to display log values in a tabular format. Remember that the EEC measures Vacuum in units relative to vacuum (inHGa). This means that 30inHGa is actually 0inHG (WOT), and 0inHGa is 30inHG (Full Vacuum).

The spreadsheet then calculates the percentage difference from a TARGET AFR value you enter in the second table, and shows this result under ADJUSTMENT. We use these figures to edit the VE in those cells.

Tuning Fuel

Using the resulting Adjustment table from the data log as a guide, you can modify your VE table by this percentage to reign in your tune. Use the spreadsheet to find exceptional cells in the chart. Then, in TunerPro, locate the same cell. You will have to approximate the RPM and MAP values for each cell you want to edit as they may not be a 100% match due to the way the EEC and WinLog scale the tables.

Use the Multiplier function to alter that value, using the figure from the Adjustment table as a guide. Don't be silly; small changes make a lot of difference here, so if Excel suggests *1.5 (50%), try starting with *1.1 (10%).

If you do not wish to use the spreadsheet, you can alter the values manually; **always** be sure to use an AFR monitoring device of some kind (gauge, logger, dyno sheet) to ensure you are not damaging your engine.\

You will want to aim for 14.7-15.0 :1 at cruise, 14.0-14.7 :1 at idle, and 12.5 – 13.0:1 under power. For boosted setups, aim for 11.5-12.0 :1 under power. Every engine is different, which is where a dyno can help show what works for yours.
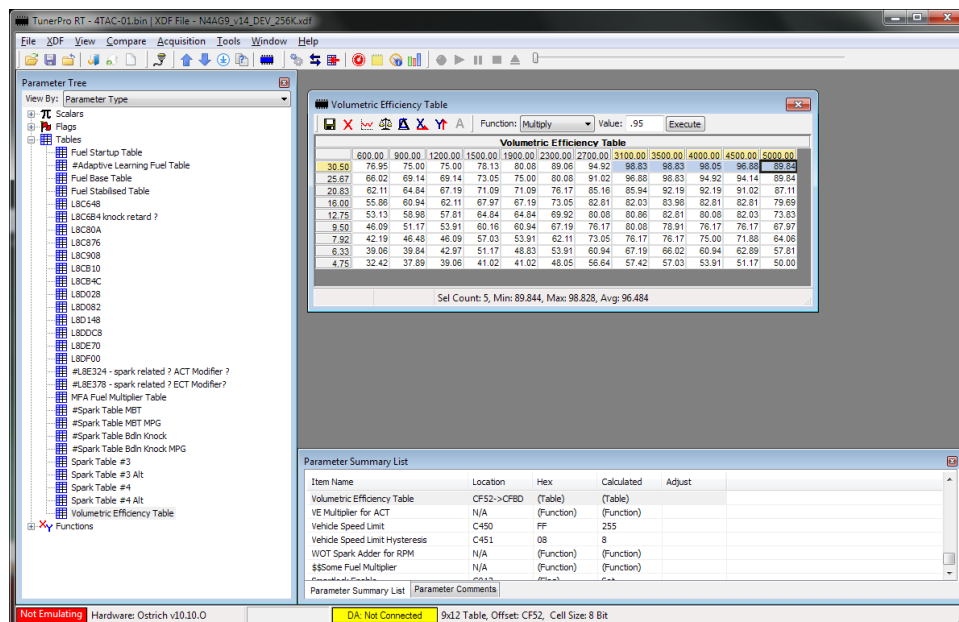
Once you have finished tweaking the table, follow the [EEC Tuning Beginners Guide](#) to send your file to the J3 chip!

Tuning Spark

When tuning spark for the I6, the following tables are used:

Table	Comment
Spark MBT	Spark Maximum Brake Torque. The spark value giving the greatest torque on a stock engine (supposedly). This is lower than the bdln knock table where the engine responded better to less timing.
Spark Bdln Knock	Spark Borderline Knock. The spark value at the threshold of knock on a stock engine (supposedly).
Spark xxx MPG	MPG tables are used in 'cruise' mode; this is activated after a threshold time (~30s) at a constant throttle above a certain road speed (~80km/h).

- There are 4 tables (as above) – BDLN Knock, BDLN Knock MPG, MBT, MBT MPG.
- The EEC chooses the least value of the two for that operating mode (Normal or MPG)
- MPG mode is 'cruise' economy mode (unrelated to cruise control or the economy button).

To keep things simple when tuning spark,

- use MBT as your base table for the majority of tuning
- leave the factory MBT MPG as your base table for cruise mode (more on this below)
- fill both BDLN tables with 50s

This will mean the ECU ignores the two BDLN tables, and you end up with one main spark map to tune. If you want to eek further cruise economy from the car, use the MBT MPG mode table to add cruise timing and gain torque. A good start here is to add 10% to the entire table (multiply by 1.1).

Be careful when tuning spark, particularly with boosted engines! Conservative maps in the high RPM will save your head gasket and ultimately your engine from severe damage! Make small changes, 2-4 degrees at a time, carefully listening for detonation. If you hear it, back the timing off 2-4 degrees. Always make sure to tune on the least quality fuel you expect to use in the car, and always allow a margin of a few degrees for hot days. It pays to be conservative here unless you like swapping pistons.

Once you have finished tweaking the table, follow the [EEC Tuning Beginners Guide](#) to send your file to the J3 chip!

Tuning the Auto Transmission

Using the new trans edit features in our defs, we can edit the shift patterns and line pressure of the Auto trans (in EF/EL bins currently; this allows edit for EA-ED using an EL ECU).

- **Transmission LHM Stall Speed** – the engine RPM above which, if there is no signal from the VSS (ie. You are

not moving), there is a fault and the transmission goes into LHM. Edit this to be above your stall convertor flash speed.

- **Shift Schedules** – these tables define at what throttle % and what RPM the transmission will shift. This controls both upshift and downshift patterns. Use these to ensure you stay in your powerband when shifting, or to gain additional economy on the highway by staying in 4th gear at higher throttle positions.
- **Trans TQ lock/unlock curve** – these tables define when the torque convertor will lock/unlock. Use these to gain additional economy on the highway but staying in lockup mode at higher throttle positions.
- **Transmission Line Pressure** – this table alters shift feel by setting the line pressure in the transmission. This is similar to a S5 solenoid mod, or electronic shift kit, but allows you to edit the line pressure by RPM and throttle %. See the below example for a table which works well for a boosted setup; alter as necessary for other combos.
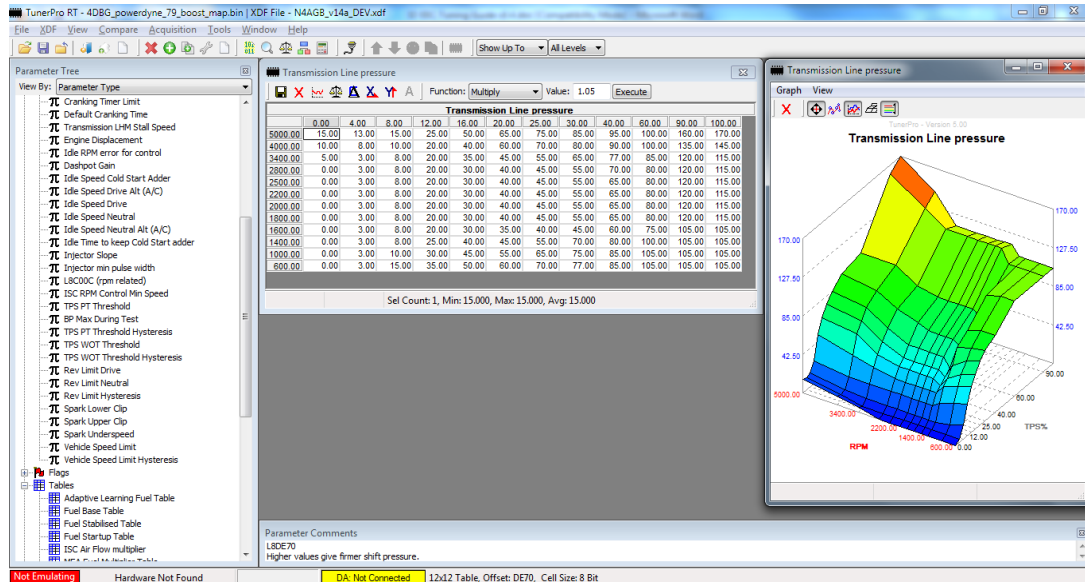

Tuning for Fuel Economy

When aiming maximum for fuel economy for your car, there are a few tables that can be tweaked via our J3 Chips to help get a few extra kms from a tank. Here we explain some of those tables and how to weak them for the best results.

- **Volumetric Efficiency (VE)** – This table is the major control for fuel. Obviously, you want to dial in your WOT mixtures to be safe and produce as much power as possible, but in the cruise area you want to aim for economy. Small tweaks in the midrange VE areas to ensure you stay around 14.7 – 15.0 :1 AFR at cruise will set a good foundation for economy.
- **MFA Fuel Multiplier** – This table is a multiplier that allows the ECU to target higher than stoich AFRs when under cruise conditions. It will periodically bring the AFR back down to stoich to keep everything cool. The table in the screenshot below is a good start, and your ability to target higher values will depend on your base VE map, as well as compression ratio and spark values.
- **Spark table MBT MPG** – This table is used during cruise mode to achieve better economy. Use this table to target higher advance when cruising. Your base Spark table MBT will also play a big role in part throttle torque and economy when in regular mode.
- **Torque Convertor Lockup** – These tables can be used to lock up the convertor at lower RPMs, helping achieve greater economy.
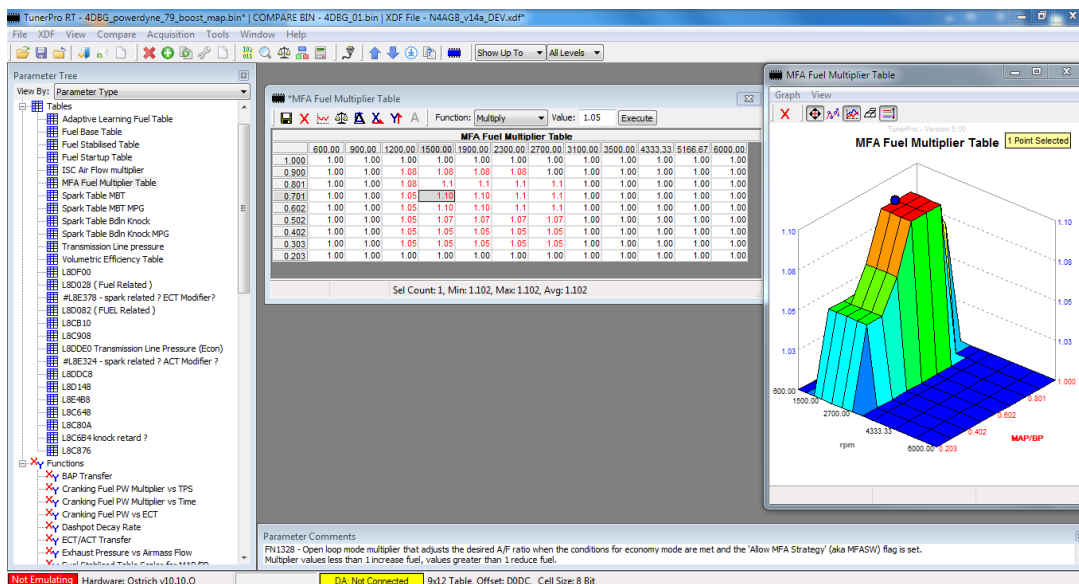
Tuning for common mods

Being an OHC engine, cam changes are very simple in our Falcons. Though good gains can be had, the ECU having an SD strategy which is dependant on Vacuum means a cam change throws out the tune quite a lot. Below are a few tips for helping cars with cam changes idle better.

- The biggest changes will need to be around idle. Tweak the VE table in your idle cell range (use WinLog to find out what this is, my Wade 1521a equipped EF idles around 18inHga) to perfect your idle AFRs. **This will help stop hunting.**
- Also look at the Fuel Startup Table (a multiplier which richens the when the car is cold). Reduce the values if you find cold starts rich but warm idle fine. **This will help stop hunting.**
- Idle Speed - I find 750 works well; anything higher can mess with the Dashpot and harm drivability. **This will help stop hunting.**
- Most Falcons run extremely rich at WOT through the 2700-4500rpm range. Carefully scale back the fuel in this area using the VE table. Depending on the intake and head setup, you may find it runs rich/lean at higher rpm – alter the VE tale to suit. **This will give more power.**
- Spark tables make a huge difference to torque production, which affects both economy and power. Following the spark section above to remove the 'bdln knock' tables and sticking to MBT will alone bring a great power gain, but from there you can alter the MBT table to increase advance to suit your camshaft. **This will give more power and economy.**
- Rev and Speed Limiters can be raised under the scaler section – AT YOUR OWN RISK!

Tuning for boost

Boosted Falcons are more and more common these days -- there's a whole website dedicated to them at boostedfalcon.net! The following tips aim to help tuning turbo or supercharged 6 cylinder falcons.

Boost fuel with an FMU
If using an FMU for increased fuel on boost, keep the injector size and Fuel Stabilised Table stock. Use the VE table to dial the fuel delivery into your target zone (11.5-12:1 is a safe target). Ensure you have a quality fuel pump that can keep up under high pressures – we recommend the Walbro GSS342 and similar. If in doubt, install a fuel pressure gauge and measure pressure with boost applied to the FMU.

A safe maximum here is around 10psi, with the limit being the ability of the fuel pump to supply fuel under 12x that pressure (in the case of a 12:1 FMU).

Boost fuel with larger injectors
If using larger injectors, contact us regarding a boost mapped base tune. With a boost mapped tune, you should aim to set the injector size to approx ½ of the size of injector you are using (normally 36-60lb for 190-300rwkw – we recommend 42lb for most setups).

Scale the VE table back to approximately the ratio of your injectors to the size of the standard injector. Use the Fuel Stabilised Table to add fuel under boost by targeting an unrealistically low AFR in the 100% load row above approx. 3500rpm (or where you struggle to get fuel).

Adjust the Cranking Pulse Width vs ECT to drop crank fuelling according to the ratio of injector increase.

Boost timing

Remove timing at approx. 1 degree per psi. For example, aim to be at approx. 20 degrees at WOT for around 10psi, depending on your intercooler efficiency and turbo size. Be very conservative with boost timing, especially on AU engines, which have lighter (weaker) conrods than the EA-EL engine.

Other tips

- If you wish to run over 10psi, use one of our Fuel Cut Defeaters to ensure the ECU does not see more than 10psi boost. This kind of setup is safe with no other fuel adders to approx. 14psi; beyond this, look at running a low rate rising reg or an automated tune switch to add fuel as boost rises.
- If you are boosting an AU, you will need an FCD or XR6T MAP sensor to get past approx. 3psi boost.

Good Luck

Remember, tuning is no precise science and it will take a lot of time to perfect your tune. Small, documented changes are the way to go to help you incrementally build a perfect tune. Without documentation you will find it very hard to keep track of what you have done and what impact it has.

If you find this guide useful or have any suggestions please contact us.

Happy Tuning!

Jason Bolger