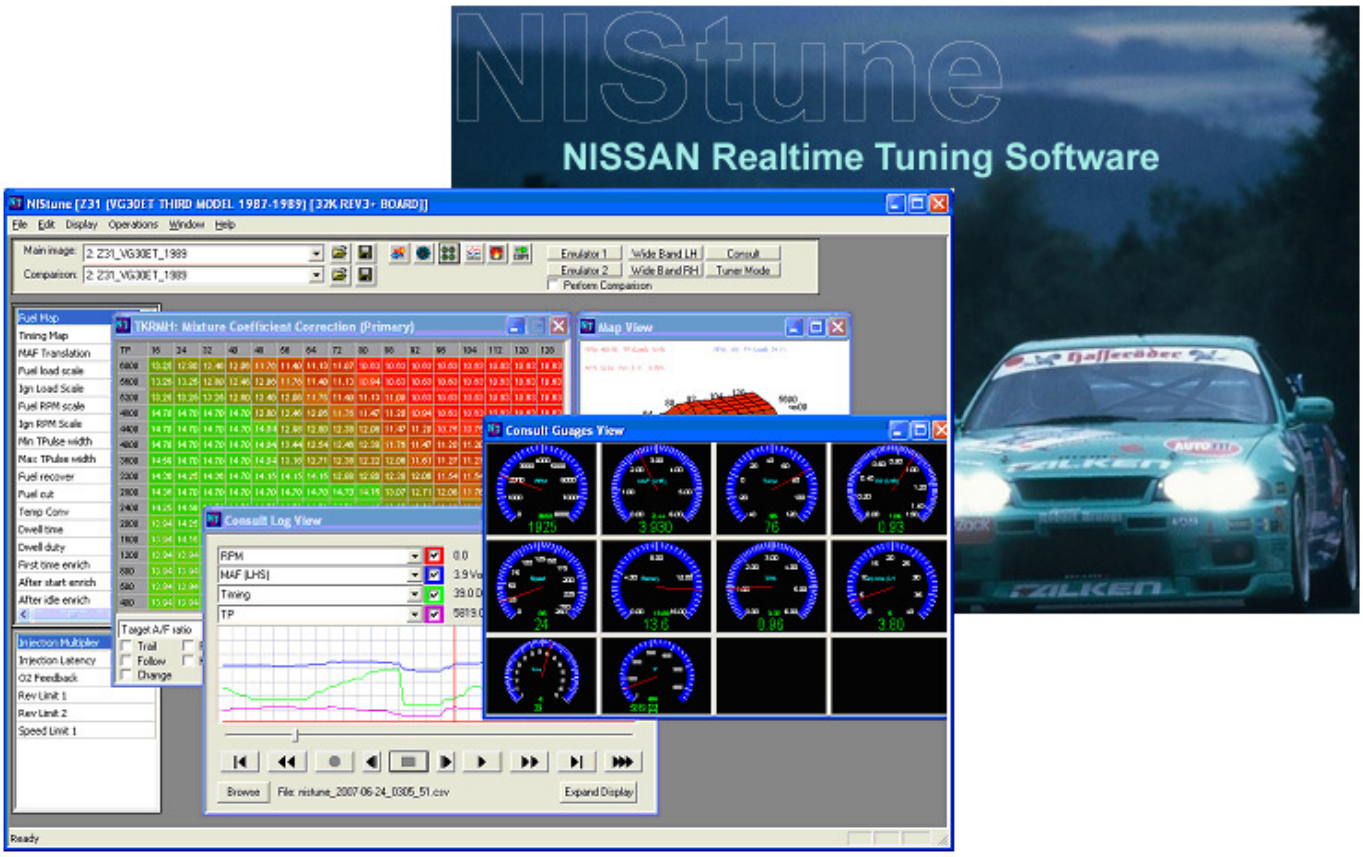
NISTUNE

REALTIME ECU TUNING



Users Manual V1.10

INTRODUCTION

Welcome to Nistune.

The Nistune hardware and software solution provides a means for the car enthusiast to retune their vehicle whilst retaining the factory ECU and its default programming.

This solution provides many advantages over aftermarket ECUs in that the factory default tuning is maintained once the Nistune board is installed. Upon installation of the board the vehicle will be operational as usual.

Nistune provides real-time tuning and maptracing. It provides the ability to make changes on the fly to the factory ECU and when the desired results are achieved, save these permanently in non-volatile memory on the programmable board.

Contained in this manual are the instructions for getting started with the Nistune software.

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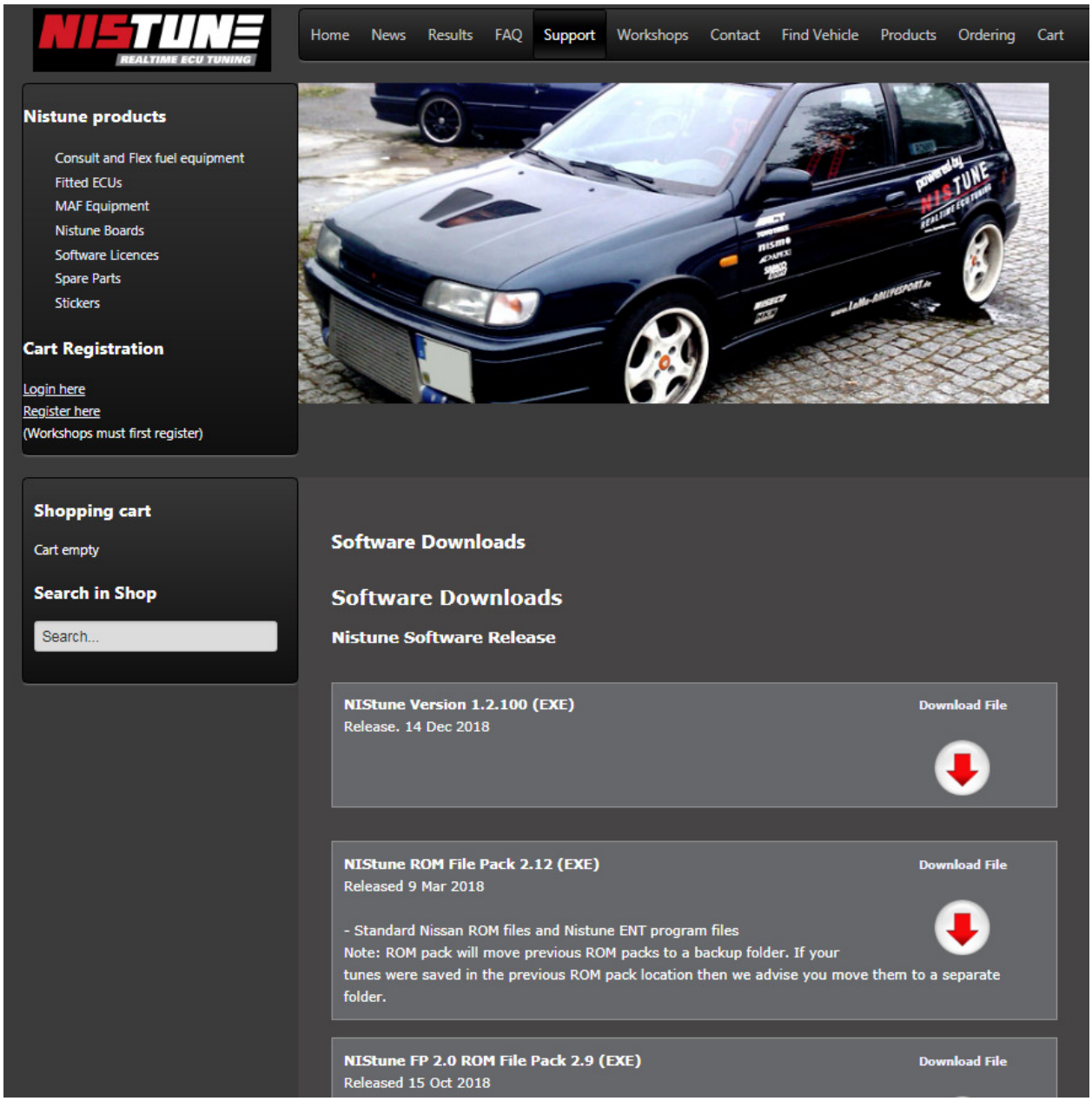
1. Downloading Nistune

1. Download the latest Nistune software and ROM packs from our website, under **Support > Software Downloads**



(a) Download the **Nistune Version xx.xx**
(b) Download the **Nistune ROM file pack xx.xx**
(c) Download the **Nistune FP ROM file pack xx.xx**

2. The latest version will be called **Nistune** in this directory. Click to download. Save this file onto your laptop computer and execute (double click) to install. The software will install and create a desktop icon.

3. The ROM pack contains all the factory tune files from various Nissan ECUs required for use with your vehicles. It also contains ENT program files for reflashing Nistune boards using a base image programmer.

4. Software updates will be periodically available on the Nistune website, and you may be prompted for when an installation update is available, which will then automatically update the software.

After installing Nistune, double click the Nistune icon from your Windows menu or desktop to start.

2. Software Registration

2.1 Overview

Nistune boards are sold individually or can be purchased together with a licence bundle from our website. A licence must be purchased to use the software.

Boards can be purchased individually customers who do not intend to tune their own vehicle, but will have a licenced tuner or workshop tune their vehicle for them.

Licences are sold as:

- Individual licence (tune up to three vehicles)
- Workshop tuners licence (unlimited vehicles)

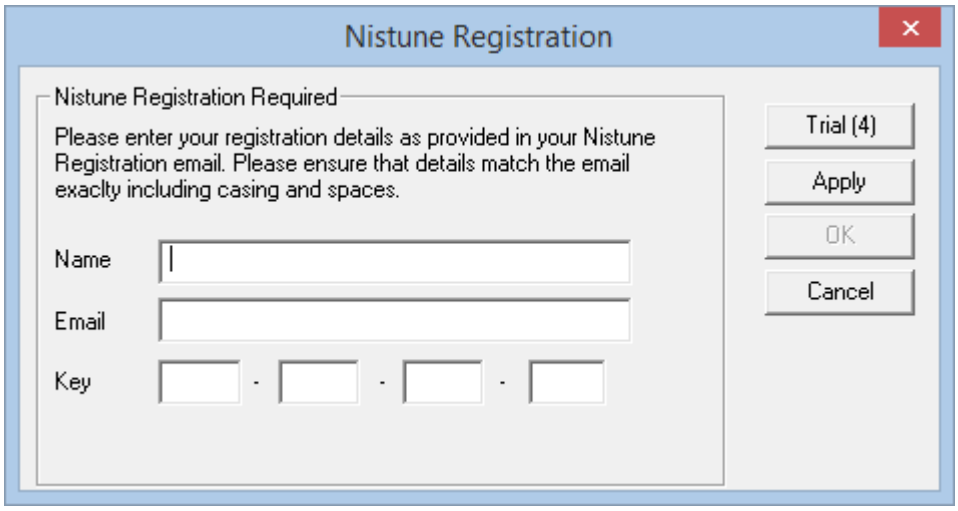
Pricing details for licences are on our website under **Software Licences** from our website

2.2 Registration Details

The first time you run Nistune, you will be required to register your software using the licence key provided.

Enter your Name, Email and key provided in your Nistune Registration email and click ***Apply***. The screen should then say 'Registration Successful' and then you can click the OK button.

Make sure there are no extra spaces before or after the items entered, and that casing matches exactly what you have been emailed.

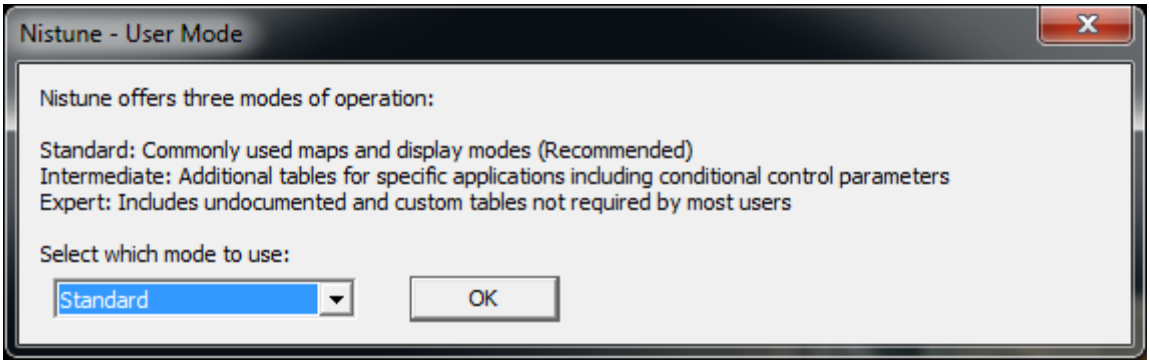


The software also offers trial periods. Each trial period will allow usage of for the software for 10 minutes. The trial version will allow opening, viewing and editing of files as well as connecting to an ECU for logging and display purposes. It will not allow you to upload/download maps from the vehicle.

3. Initial Start Up

Read the agreement on the WARNING page and click ***YES*** if you understand and agree to the conditions.

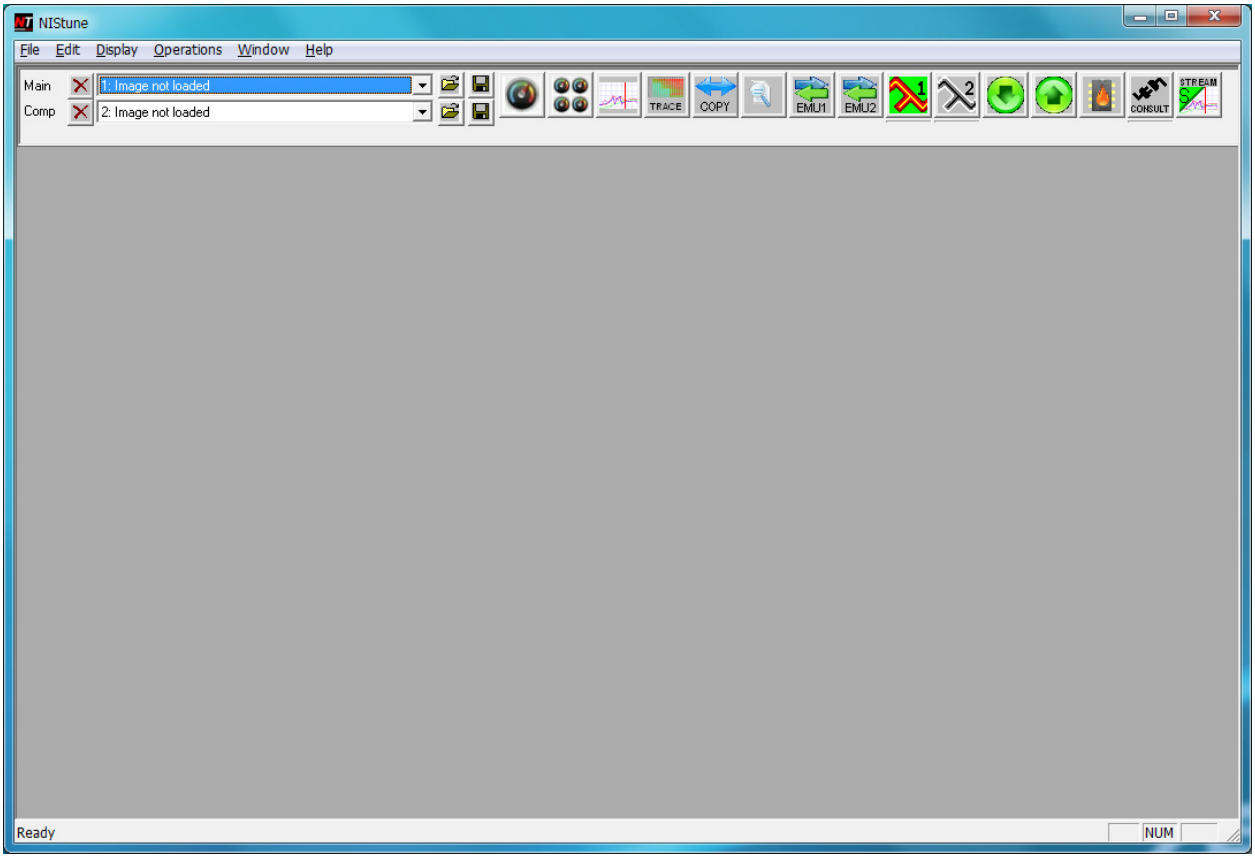
After agreeing to terms and conditions, you will be asked what display mode you wish to use.



Standard Mode will display the minimum tables and parameters needed for tuning.
Intermediate will add some of the more common parameters, including DTC filters
Expert will display all parameters, and additional menu options including ODD/EVEN and hex display support

The following screen is the main screen for Nistune. You need to **Select Vehicle** to open a vehicle definition file and then connect to your ECU and either download or open an image for your ECU type before doing anything else.

Section 4 covers selecting the vehicle, Section 5 covers opening an ECU file, and Section 6 covers downloading the tune from your Nistune board.



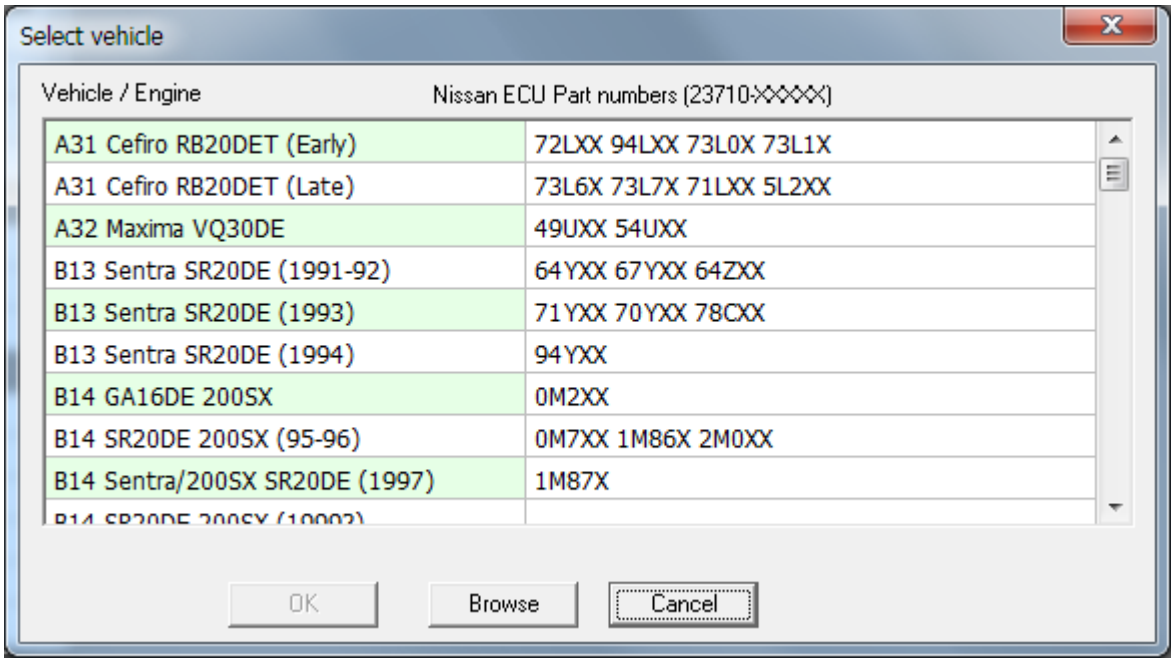
4. Select Vehicle Definition File

Select ***File > Select Vehicle*** and select the vehicle listed for your ECU. This will load an address file which contains all the mapping definitions for your vehicle.

ECU part numbers listed are in the format **23710-XXXX** where the last five digits will match the ECU you are using.

Note: Some model ECUs do not have this part number. We have a look up table on the Nistune website from the Manufacturer part number to Nissan part number.

This is under Support > Technical Bulletins > Nissan ECU Manufacturer Part List



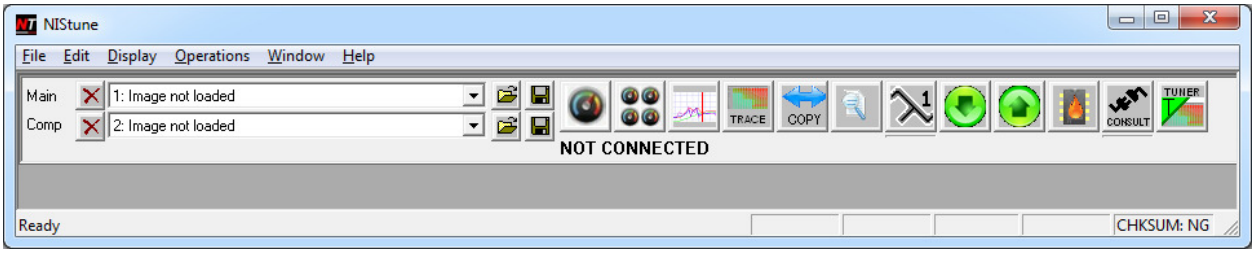
Next, load the connect to the ECU and download the maps, or load a file from disk.

5. Nistune Board tuning

If you have purchased Nistune board (Type 1 – Type 5), then you can download the maps from your ECU and get straight into tuning.

Your Nistune board comes pre-programmed with a factory base tune file, matching the part number for your Nissan ECU (or closest match to your vehicle).

1. Ensure that ECU is connected to vehicle
2. Next switch the IGNITION signal to ON to turn on the ECU, so Nistune can communicate with the board.
3. Connect to consult using the ***CONSULT*** button on the top panel (RHS). Once connected the button will change, and a scrolling indicator will start
4. Use the ***DOWN*** arrow button to retrieve the maps from your vehicle.



5. Make changes to the tables or parameters. All changes made are live
6. Press the **UP** button if you load tunes from a file or perform any changes off line
7. When finished press the **BURN** button to keep the changes in the board for next vehicle start

Known issues: It has been noticed during testing that consult may disconnect during starting the engine. This is due to electrical noise from the vehicle triggered during cranking. See our Diagnostics and Installation guide for more information with resolving noise issues.

6. Loading ROM Files

To either edit a ROM (tune) file that you have used previously, or to use upload to a third party emulator, you will need to load the ROM file first.

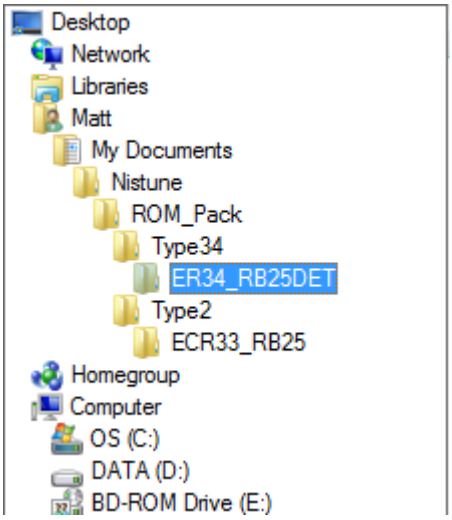
Nistune has two methods of opening ROM files. Either load the file directly from your hard drive/memory device or connect to your ECU and download directly from ECU.

Load ROM Image from file

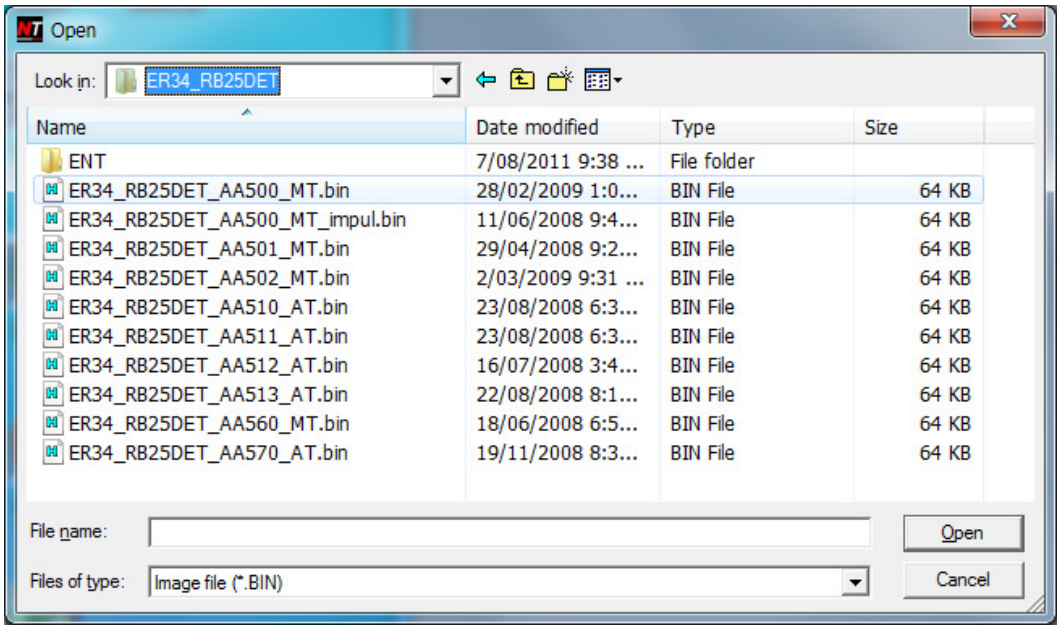
Normal Files

Select ***File, Open Main ECU Image***

Hint: If the Nistune ROM pack is installed you can browse various folders containing our collection of Nistune ROM images



Inside the folders are the BIN files from Nissan factory ROMs which are downloaded out of various ECUs. The five digit part number is 23710-XXXXX

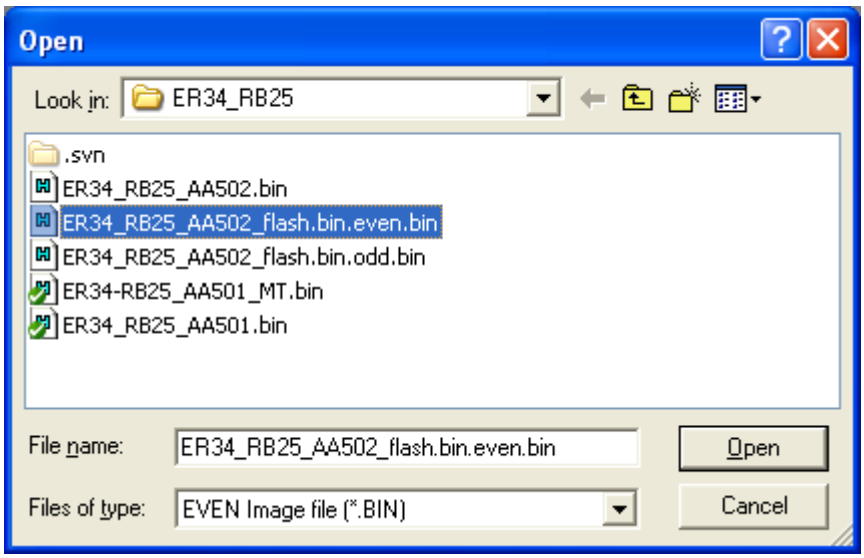


Advanced: Odd/Even Files

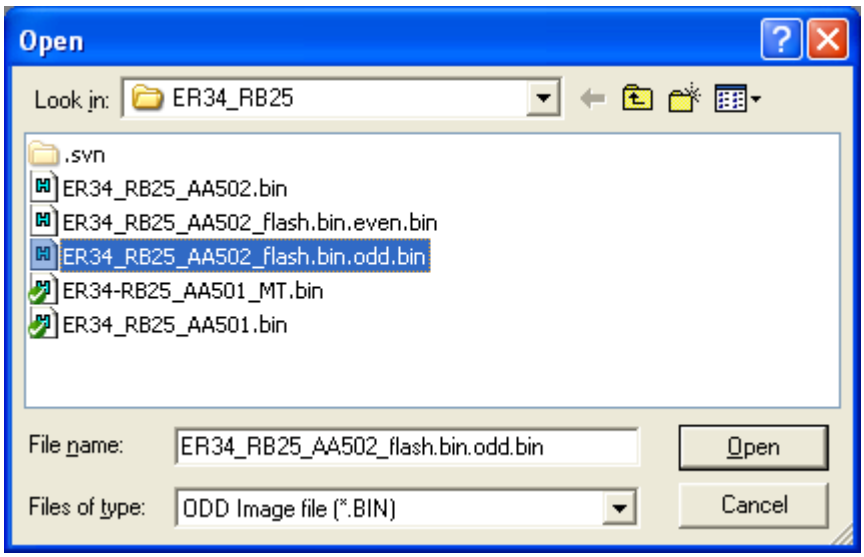
If you have a daughterboard which takes ODD/EVEN chips for 16 bit ECUs then you might have two separate ROM images that need to be loaded.

Note: This option is only available in Expert user mode.

Select ***File, Open Main Odd/Even Files -*** First selecting the ***EVEN*** file:



And then the ***ODD*** file:

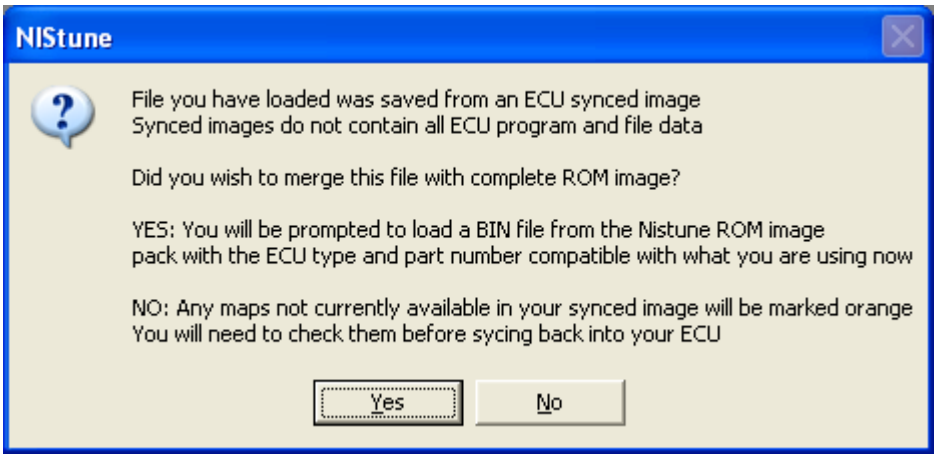


The files will automatically be merged together.

Important Notes on Loading Synced Files

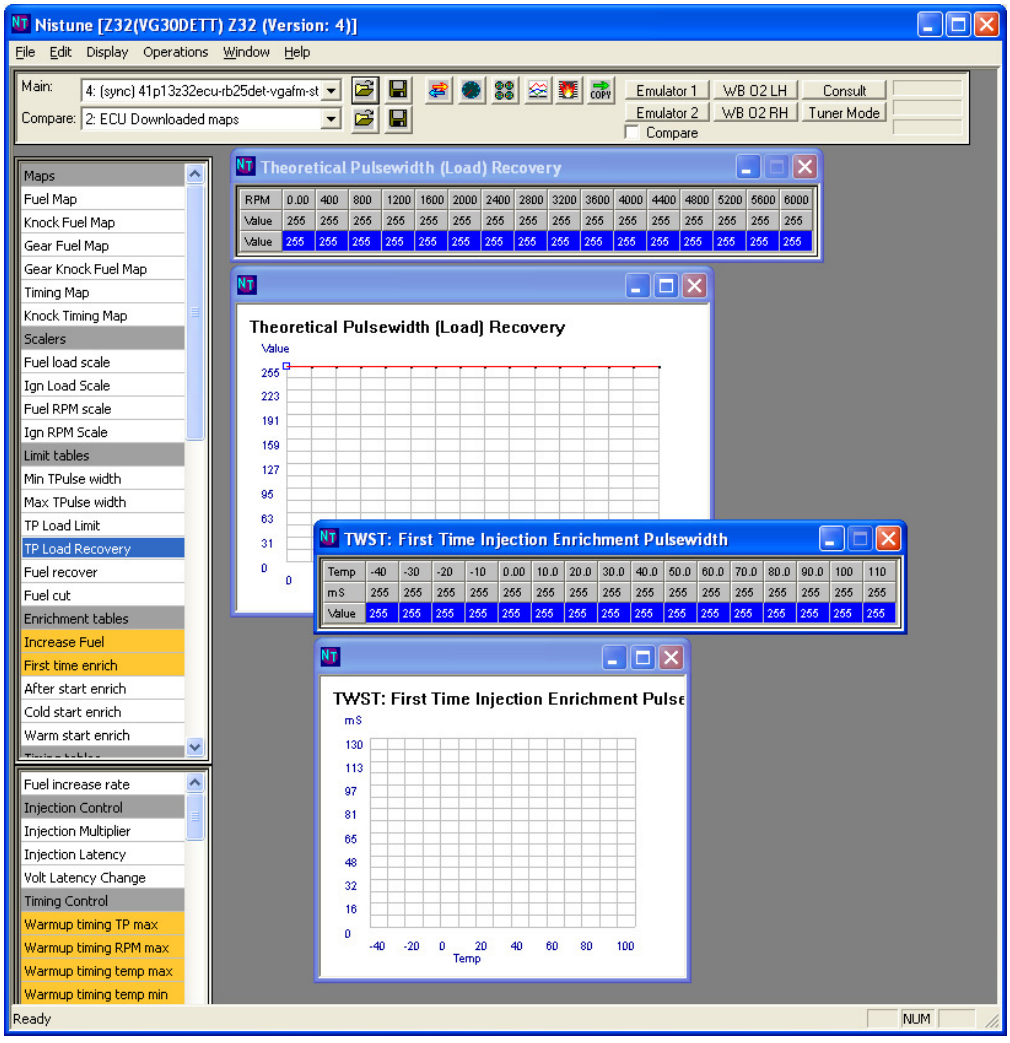
All tables and parameters downloaded from an ECU must be downloaded into a base ECU file. Otherwise if the file is saved, it will be incomplete (or synced)

Synced files are files which are blank files that only has *some* of the available tables and maps from the ECU stored in it. Nistune identifies a synced file as being incomplete and the user will be prompted when this happens:



The user will be notified when first opening the file that the file is a synced image. They will be given a choice to either continue with the synced file, or to merge with an existing ROM image. We recommend that the user merge with an existing ROM image so that they do not run into the danger of uploading empty maps to the ECU and stopping the vehicle from running or otherwise causing potential damage.

If the user clicks 'No' then the filename will be appended with (sync) at the start. Any maps which have been identified as possibly being blank will be highlighted in ORANGE.

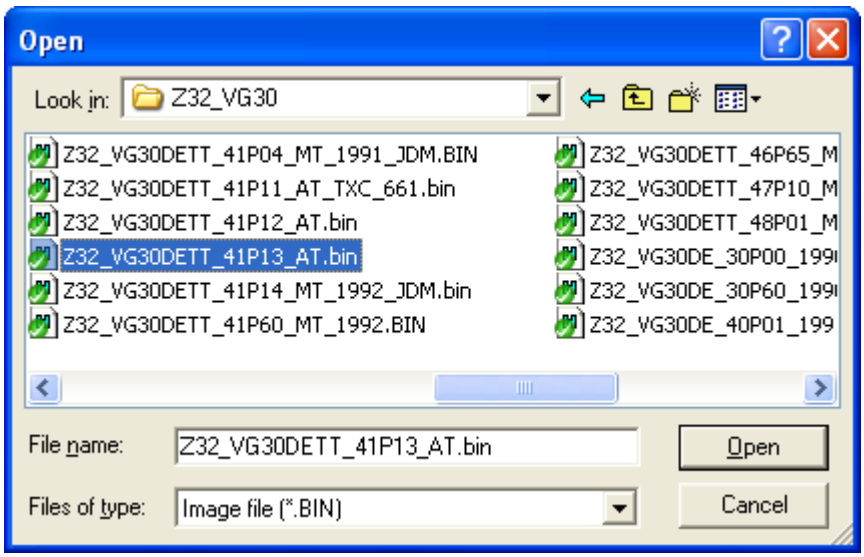


As can be seen from this Z32 file above, the empty tables are high lighted in orange and filled with the '255' value. If this image was uploaded then the warmup timing functionality would not work properly and first time injection may result in flooding of the engine.

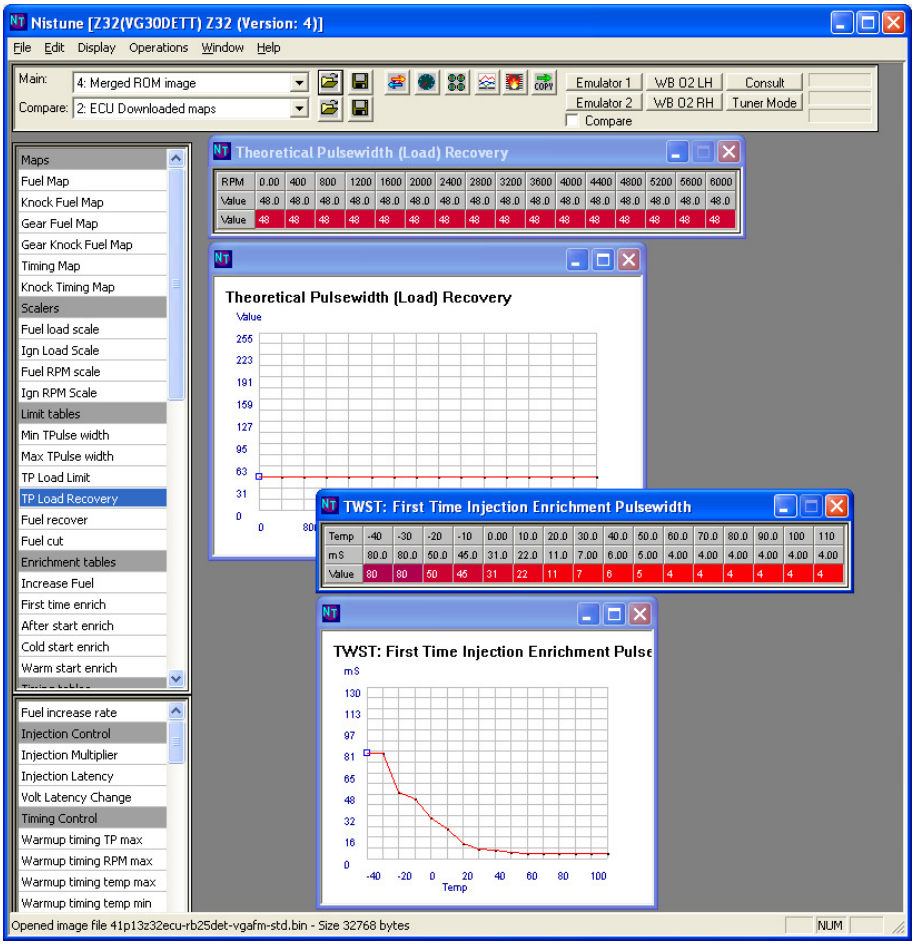
Those identified potential problematic tables are highlighted in orange and require fixing. We suggest using the merging feature when first opening the file to fix this. The merging feature will attempt to automatically load (if possible) or prompt the user for a complete base image ROM file.

These ROM files are available from the Nistune ROM image pack available on our downloads page at www.Nistune.com

Clicking 'Yes' on merge question above after loading the synced file, in this case prompts us to load a file:



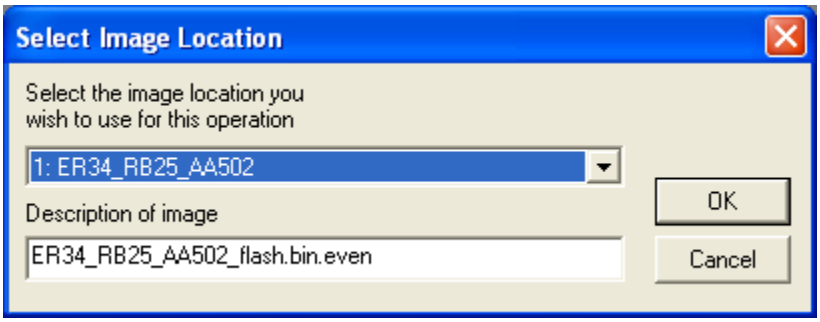
After doing this, those orange tables are fixed up properly as can be seen in the screen shot below.



Load ROM Image from ECU

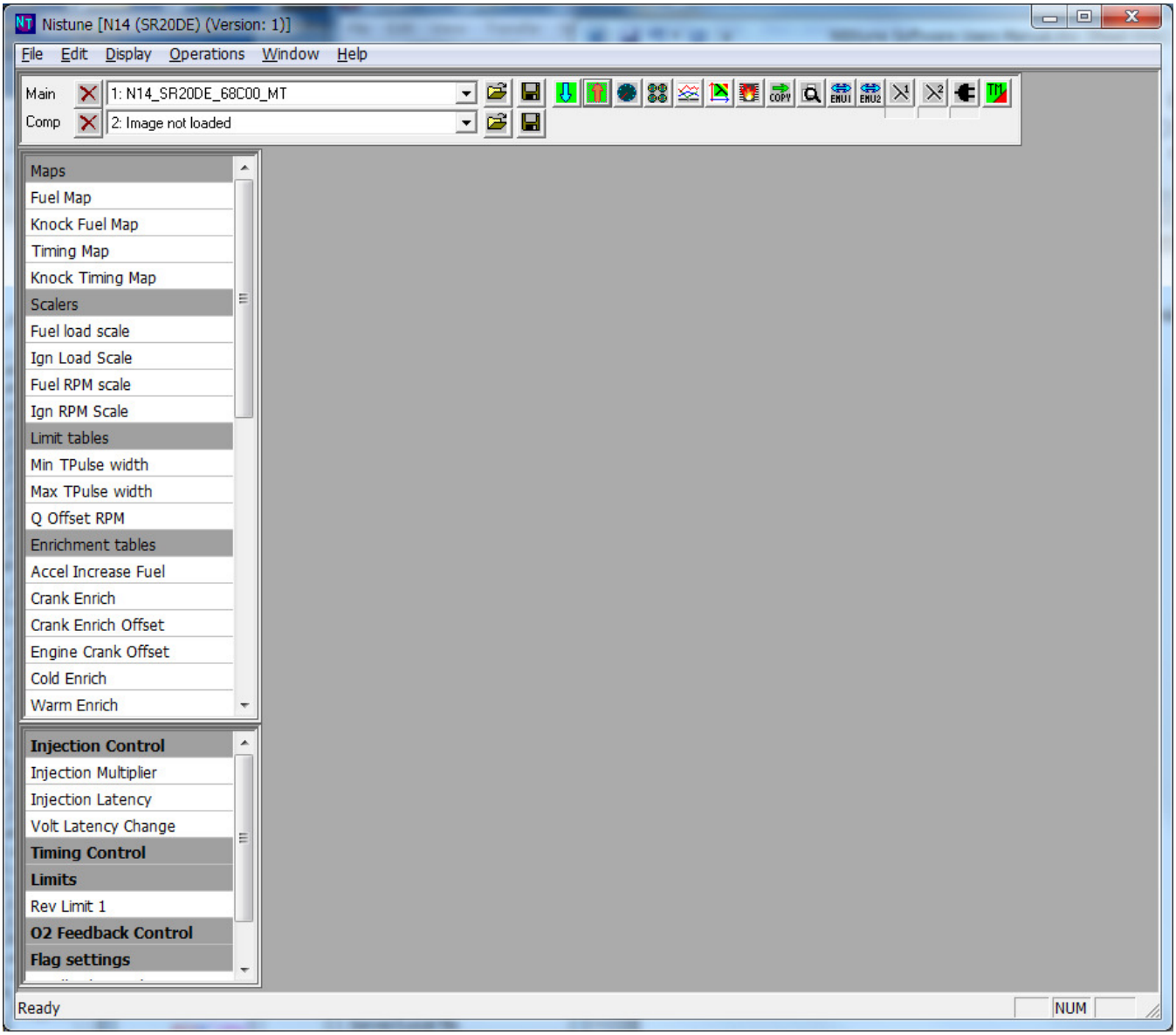
You must be connected to the ECU before this operation is possible: **see Chapter 6 “Connecting”**

Nistune can provide up to 5 ECU image locations for storage and comparison. When more than one image has been updated you will be asked where you wish to load subsequent images. You can change the description of your image file if you wish.



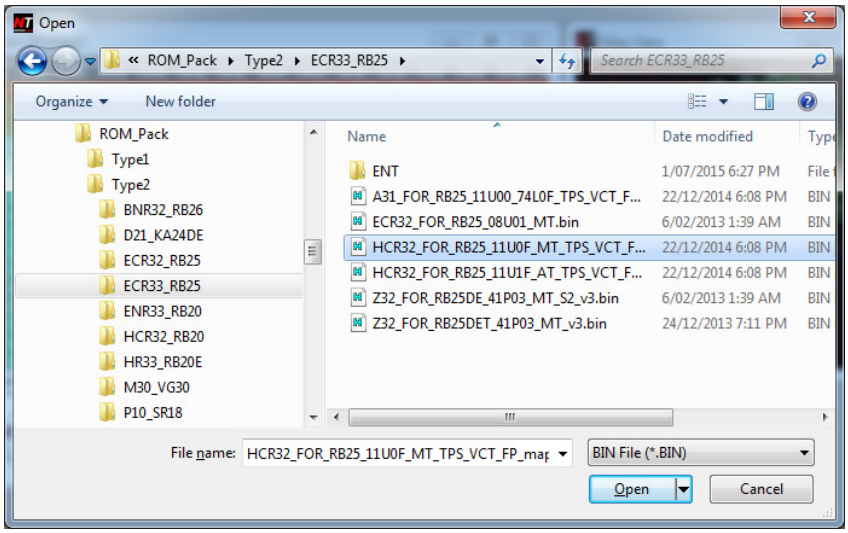
Tip : Avoid overwriting your original ECU image. If you will be modifying your maps then always save the image under a new name as your first step.

Many constants, tables and maps of the ECU are now available for viewing. Click on the object of interest to view the data. Refer to our **Nistune Mapping Guide** and our **Training Documentation** for more information how to get started.

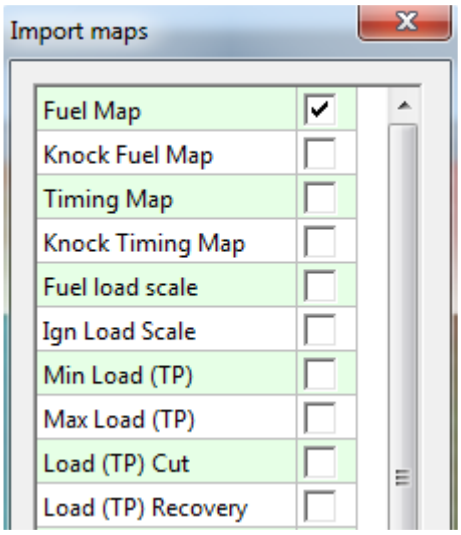


Import selected maps from file

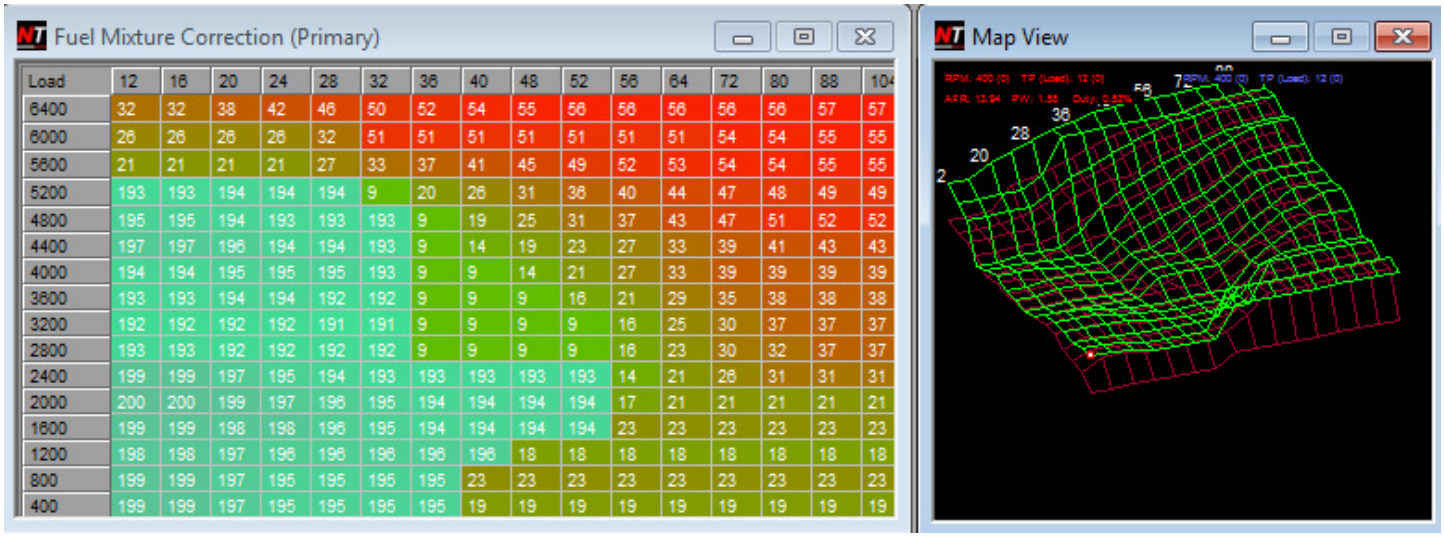
This feature allows you to load in only a few selected maps from another tune file into the current tune.



Nistune will work out which maps from the loaded file are different to the current tune file and display those maps. This provides a selection for you to choose which maps to import



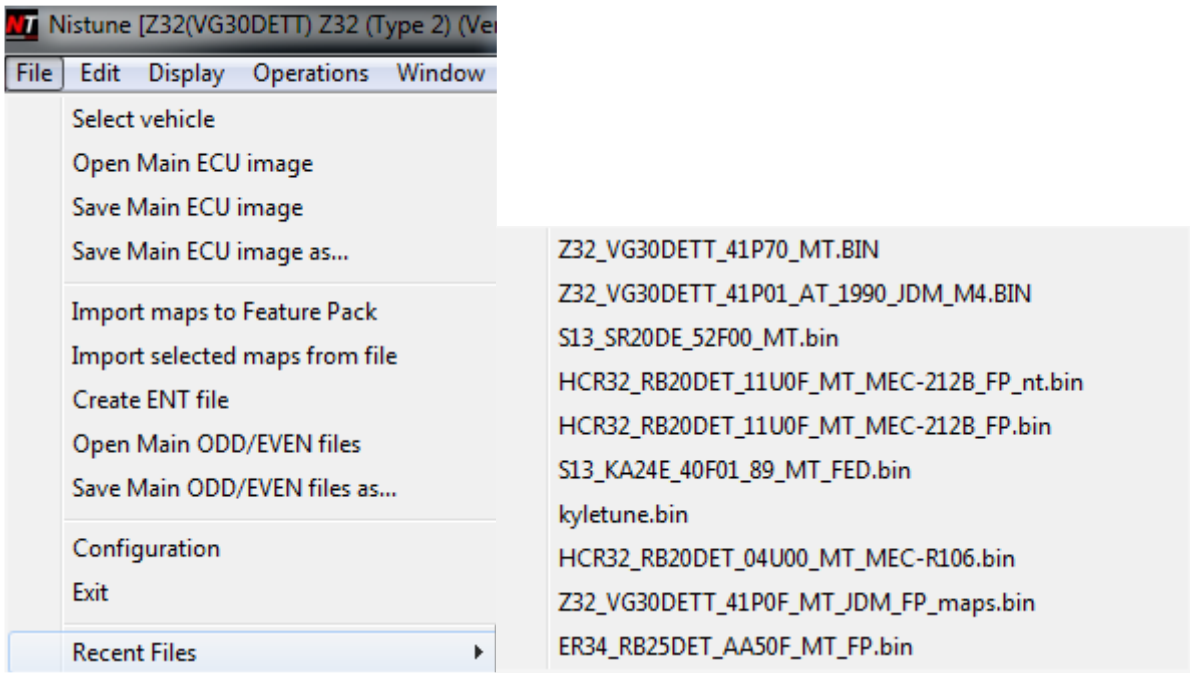
Select the desired maps to import to the tune and they will be copied in, as you can see below:



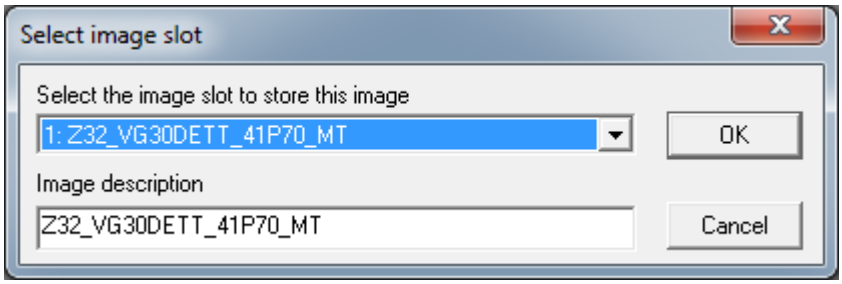
Hint: Use the comparison icon to see the differences between the original and imported maps

Most Recently Used List

Recently loaded and saved tune files are saved to the MRU (Most Recently Used) list. You can select one of these items to load an older tune file from the File > Recent Files menu



You will be prompted for an image slot to load the file when selecting a file.

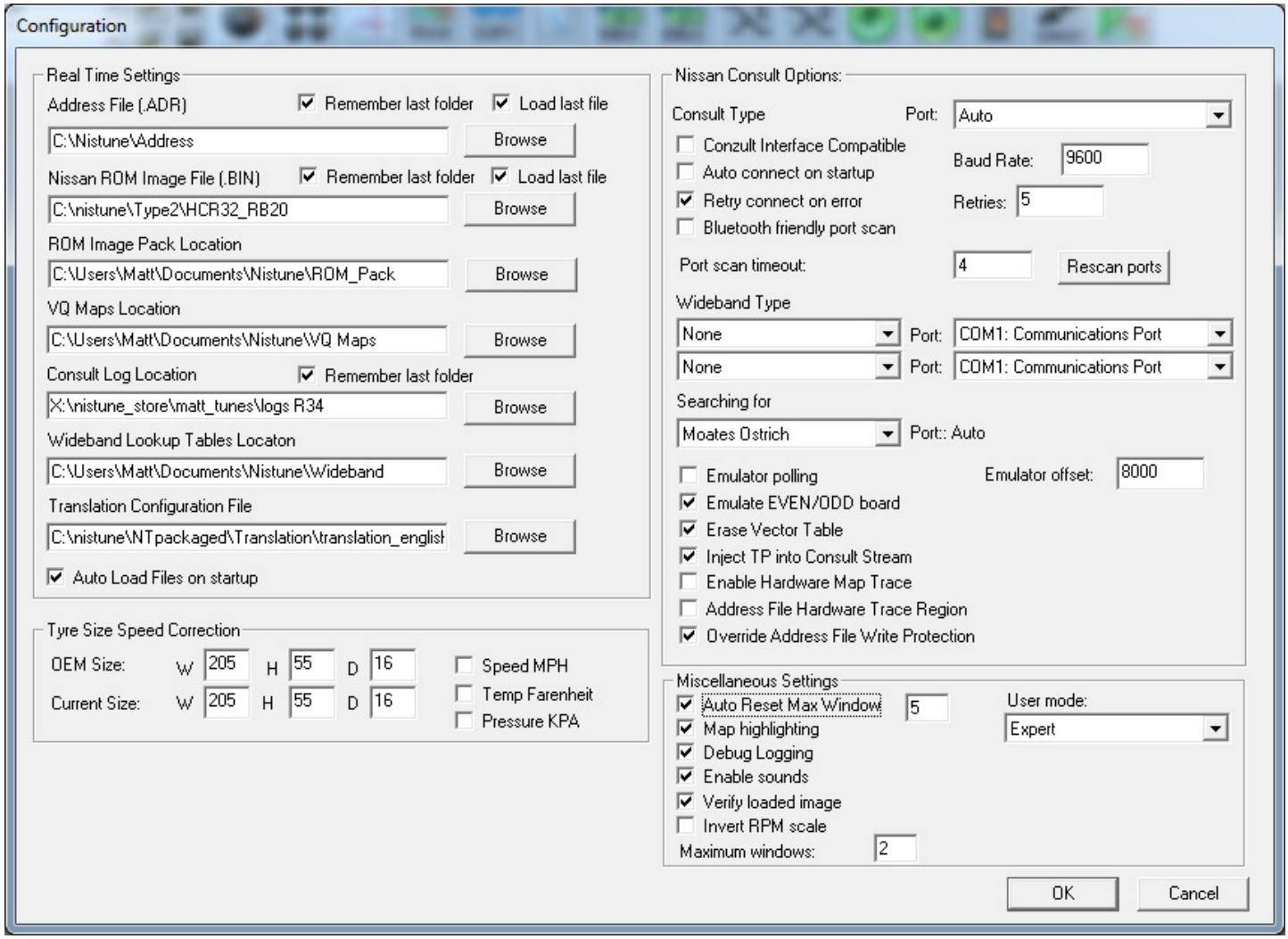


This allows you to select files for comparison quickly and easily.

7. Using Emulators with Nistune

Configuring Nistune for your emulator

Configure your emulators from the ***File, Configuration*** window



Select your emulator type. This can either be the Moates Ostrich, Pocket Romulator or CalumSult emulator board. You can then configure how you want to use your emulators:

8 bit ECUs (single EPROM chip)
Leave "***Emulate EVEN/ODD"*** off. Use the Romualtor/Ostrich and ensure ***"Erase Vector Table"*** is ticked. This stops the ECU functioning when performing an upload.

16 bit ECUs (aftermarket daugherboard)
If your daugtherboard uses the same EPROM image on both chips, then it is a SPLIT mode daughterboard. Leave ***'Emulate EVEN/ODD'*** turned off.

If your daughterboard uses an ODD chip in one socket, and EVEN chip in the other socket, then tick ***'Emulate EVEN/ODD***'.

Calum Daughterboard
This is a 16 bit daughterboard which is compatible with some Romulator commands. Select 'Romulator Compatible' from the Emulator type. Ensure 'Erase Vector Table' is not ticked.

Connecting to emulator

You can use the Emulator buttons to connect to your emulator (or multiple emulators for 16 bit ECUs) and upload your ROM images to them, and then start the vehicle, ready for real-time tuning.

NOTE: When using 16 bit Even/Odd boards, you need to get the order correct when connecting the emulators. It is suggested that you connect both emulators to the ECU first, only then connect the serial port of the EVEN emulator to your PC. Click 'EVEN' emulator button first and get this to connect. Next connect your ODD emulator to your PC and then click 'ODD' emulator button to connect.

The address file provides all the information to tell Nistune where your maps, tables and constants are located in the ROM file. It also provides a lookup index for real-time maptracing facilities inside the Nistune software.

Map Tracing with emulators

For later model vehicles which support Nissan Consult, maptracing will be performed via the consult port. This is automatically configured based on address file selected for the vehicle you are tuning.

To increase maptracing speed, it is suggested that you select fewer registers for display/logging to that data overhead is reduced.

8. Using Consult

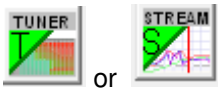
In the ‘Image Selection’ window are a series of buttons to be used with consult:

- Consult Displays
- Consult Gauges
- Log Player
- Input tracer (Wideband AFR, knock count etc)
- Copy changes between main and comparison maps
- Compare image files
- Connect to Emulator 1 and Emulator 2
- Connect to Wideband 1 and Wideband 2
- Burn changes (Store changes permanently to Nistune board)
- Sync Maps (Download from ECU, Upload to ECU)
- Connect to Consult
- Switch between Tuner Mode and Stream Mode (used for logging)

Consult Display

This will firstly prompt for which consult registers you wish to view. More registers selected means slower response times. It is recommended you only view what you need to use.

There are two modes of display for consult,

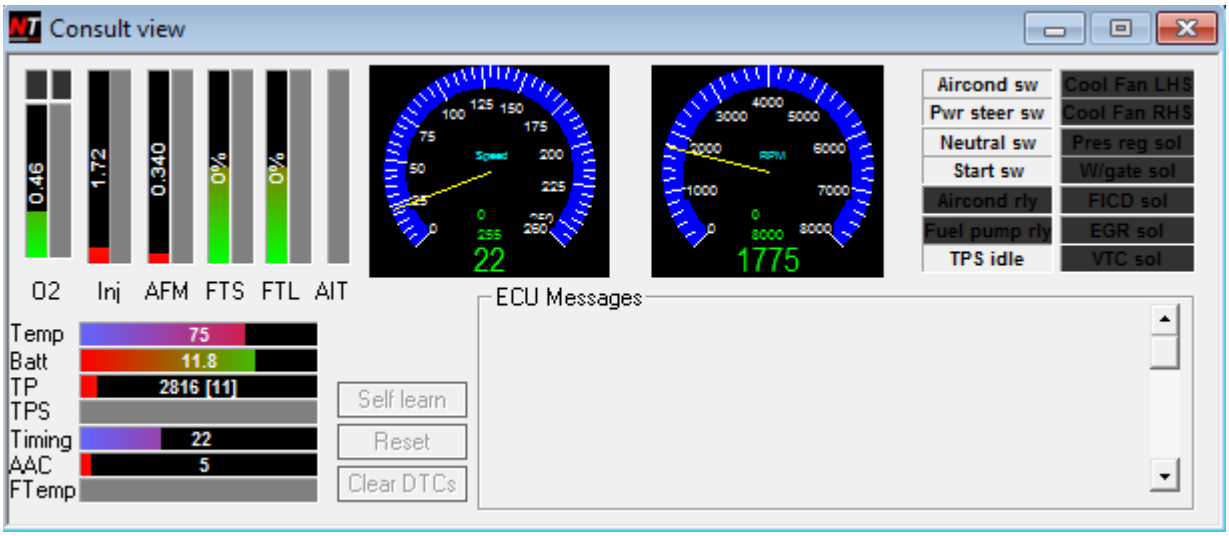


or

- Tuner mode and Stream Mode work the same for Type 1 boards.
- Tuner mode means that with a Nistune board you can make changes to your vehicle (both live changes as well as syncing maps) whilst receiving consult monitoring data
- Stream mode does not provide tuning but the sample rate of data is substantially increased. Stream mode should be used when using the log recorder

- There may be some items which your vehicle does not support, these will be off by default and not displayed in the available register selection list.

ECU Diagnostic Terminal Code (DTC) messages may be displayed and cleared by using the ***Clear DTCs*** button. Ensure that all DTC codes are resolved (especially ones like temperature and knock codes) before tuning the vehicle.



Gauges Explanation

The gauges panel inside Nistune contains the following parameters for most ECUs:

O2 Voltage

Voltage from the O2 feedback sensor. Normally this swings between 0 - 1 volts based on the reading from the O2 sensor mounted in the vehicle exhaust system. Some vehicles may have two O2 sensors fitted (with the second O2 sensor available for selection)

If Digital Control Register 4 is selected, then the O2 bank lean indicator (above the gauge) will highlight red when the ECU reports the bank is too lean

If the O2 sensor voltage is around 0.3 then either it is not heated up yet, or there is a fault with the sensor or the wiring to it

Injection time

The injection time is calculated by the ECU based on fueling parameters including the fuel map, enrichment (temperature, throttle etc), airflow and K constant. The final injection time is reported by consult on this gauge. It is the

amount of time the injector is open for. There may be an option for LHS and RHS injector reporting on some ECUs (eg Z32 300ZX)

AFM (Mass airflow meter)

Mass airflow sensor voltage. Normally 0 - 5 volts for most Nissans. Earlier model Nissans will report 2-7 voltage range (there is a MAF offset applied to this ECU). Should match the input sensor voltage to the ECU from the MAF.

Note: Some vehicles (R32 GTR) will have two sensor inputs which are added together internally. The VQ map for the R32 GTR is half the values of other Nissans for this reason

FTS (Fuel Trim Short)

The short term fuel trim is a temporary trim which starts from 0% each time the vehicle is started. Based on the O2 sensor feedback, fuel is trimmed based on if more/less fuel is to be added to the base mixtures. The adjustments to this trim are fairly quick. Aim for 0% fuel trim by making sure your base mixtures (by adjusting K constant, or Total Injection Multiplier in feature pack ECUs) whilst in closed loop cruising conditions

FTL (Fuel Trim Long)

The long term fuel trim uses trim information from the short term value and keeps this trim for future vehicle starts by holding the value using backup battery voltage to the ECU. Use the "self learn" button to clear this trim value

Aim for 0% fuel trim. If the vehicle has a fuel trim too far from this, then it will add/remove this much fueling each startup.

AIT (Air intake temp)

Air intake temperature. Only for specific vehicles (eg R32 GTR) where ignition timing is adjusted based on current air temperature. Reports value in degrees celcius

BSe (Boost sensor)

Boost sensor input. Only for specific vehicles (eg NEO RB25 ECUs)

Speed

Vehicle speed in kph by default (can be changed in File > Configuration menu to imperial mph)

RPM

Vehicle rotations per minute

Temp (Coolant temperature)

Vehicle coolant temperature. The coolant temperature is measured through a resistor, converted by the Temp Conversion table and its value is displayed here. Default reading is Celsius but can be changed to Fahrenheit (through the File > Configuration menu)

TP (Theoretical pulsewidth / Load)

Theoretical pulsewidth is basically the load measured by the MAF. The actual calculation is:
TP = MAF lookup / RPM x K constant

As airflow increases, so does the TP load value, and as RPM increases, then TP decreases.

"K constant" parameter in the ECU is adjusted to based on load measured by the MAF (altered when MAFs are resized typically)

TP is used for two purposes:

1. **Table load indexing** (index value displayed in square brackets in the Consult view window)
Index various maps inside the ECU including fuel map, timing map, closed loop feedback, knock feedback and acceleration tables (depending on ECU type)

Note: Moving TP too far from factory scales can have adverse effects. Standard Nissan tuning involves moving K constant. This may will affect the load range referenced by TP. Attempt to keep TP operating in the normal factory scale ranges. Adjust TP scales for all available maps where necessary

2. TP is used as a **final injection calculation multiplier**

TPS (Throttle position sensor)

Reports the value of the TPS (where avialable). Should match the voltage of the TPS. The throttle position sensor is used on some ECUs for determining throttle is closed (and vehicle to use idle maps). TPS is also used for acceleration enrichment on most ECUs too

Timing

Reports ignition timing in degrees BDTC

AAC (Auxillary Air Control)

AAC valve is used for idle stablisation. Adjusts duty cycle along with timing to achieve target RPM at idle

Fuel Temperature

Mainly for Z31 and Z32 300ZX ECUs which will adjust fueling mixtures based on current fuel temperature

Switches

These switches are only available when the following registers are ticked when connecting to consult

> Digital Control 1 register

TPS idle - when throttle is closed position. Should be red when throttle shut, and turn off when throttle touched open
Start switch - indicates when engine is cranking
Neutral switch - indicates gear position is in neutral. Used in some ECUs for adjusting timing at idle
Power steer switch - when active the power steering oil pressure switch is enabled and ECU will increase fueling slightly to assist engine stability
Air cond switch - indicates when air conditioner switch is on

> Digital Control 2 register

Air conditioner relay - indicates when compressor running.
Fuel pump relay - normally on once engine running
Coolant fan lo - indicates when first cooling fan is active
Coolant fan high - indicates when second cooling fan is active
VTC Sol - Variable cam timing solenoid is active when this is illuminated

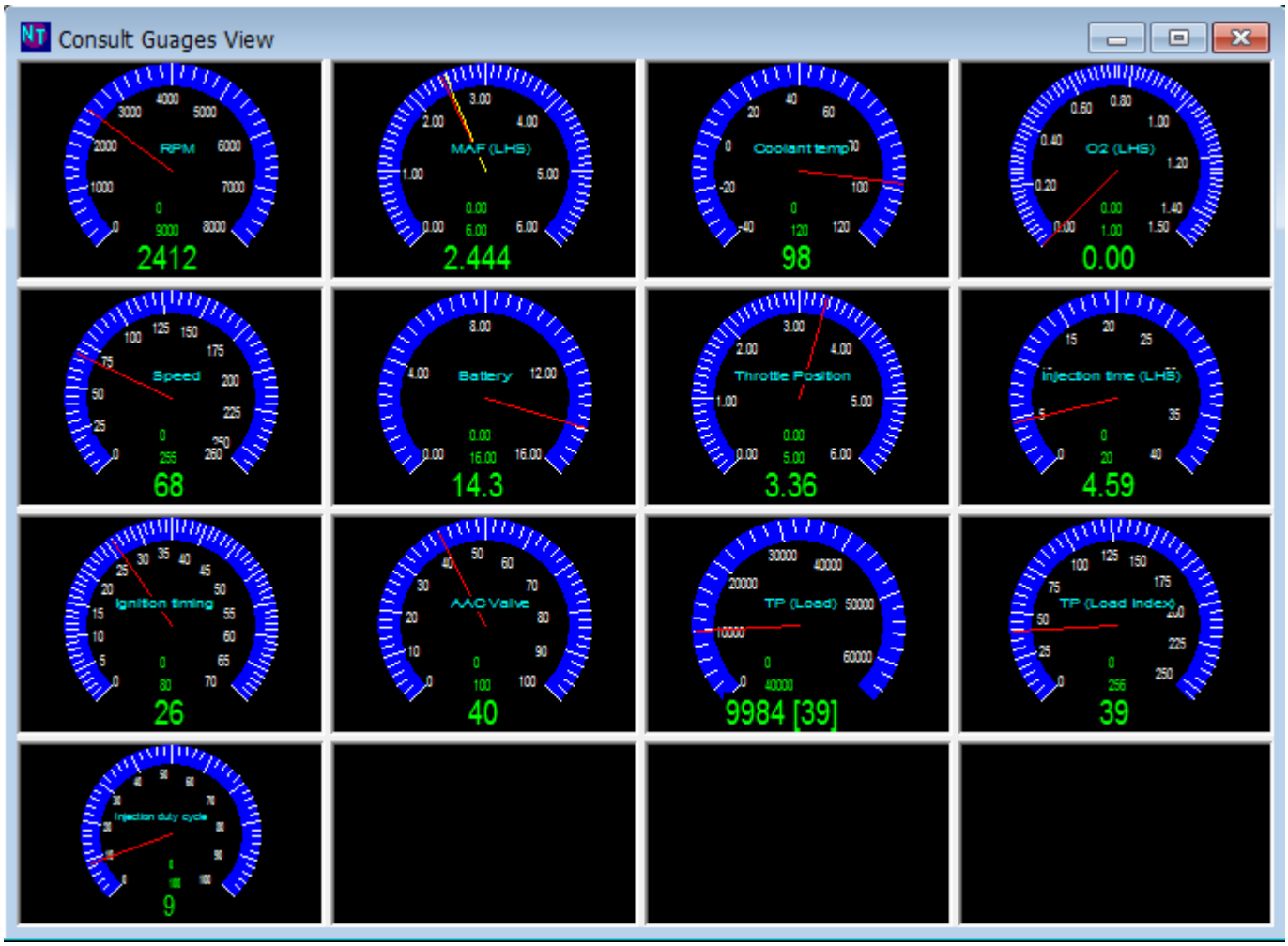
> Digital Control 3 register

Pressure reg solenoid - Pressure regulator control valve is active
Wastegate solenoid - When wastegate is opened
FICD solenoid - When Fast Idle Control Device solenoid is active (used with air conditioner to increase idle speed)
EGR solenoid - Exhaust Gas Regulator solenoid active

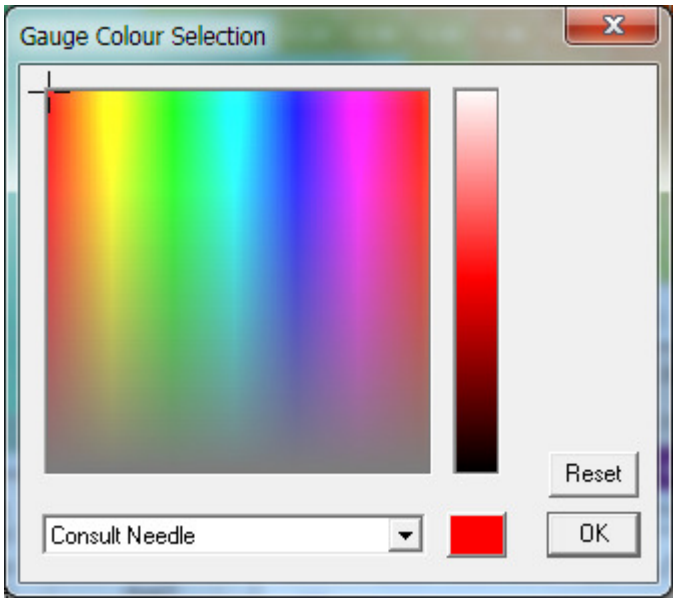
Consult Gauges

These display in a graphical format the gauges for all the parameters which are available for display.

Gauges display:



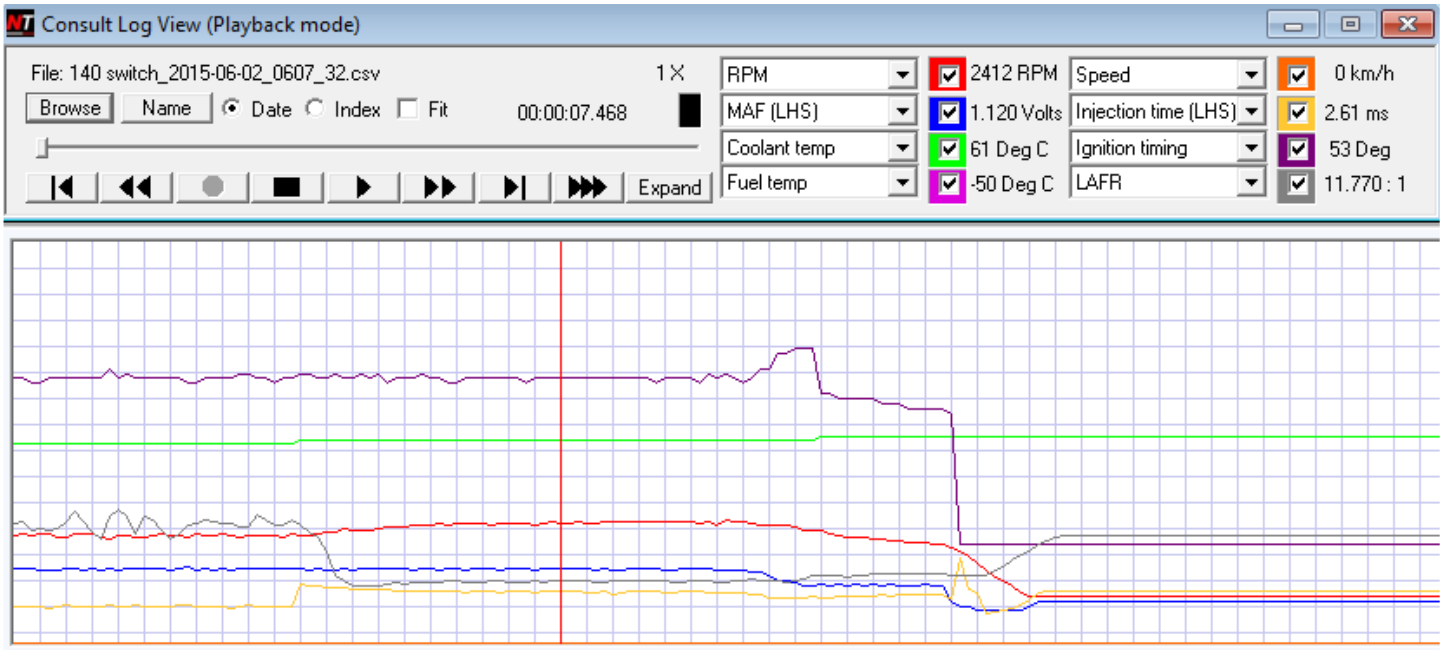
The gauges **selected** and their **colours** are adjustable by **right clicking** on the gauges and selecting what you wish to change. Colours of the gauges:



Log Player / Recorder

The Consult Log Player / Recorder is an integrated feature with Nistune which allows you to record the vehicle parameters and then play them back at a later time. It is important to note that there are two modes of operation – ***Record Mode*** and ***Playback Mode***. By default when consult or wideband is connected, the logger is in Record Mode.

If consult and wideband inputs are disconnected, then the log player will resort to playback mode. This will allow you to review the log just recorded. To record again, reconnect consult or wideband to put the logger back into record mode



Operation Notes

If during recording the wideband input or consult input becomes disconnected then the logger will stay in record mode. Only once the operator has disconnected both consult and wideband inputs via the connection buttons will logger enter playback mode.

Loading a log file from disk whilst connected to consult or wideband will disconnect those inputs so the user can review/playback previously recorded data and view this in the rest of the software

Recording

To record data from consult, simply press the record button to record to a standard time/date stamped file or click 'Browse' to call it a specific file name. Select the parameters you wish to change from the drop down lists and tick which ones you wish to see.

Pressing STOP twice will force save of the log file.

Keyboard short cuts

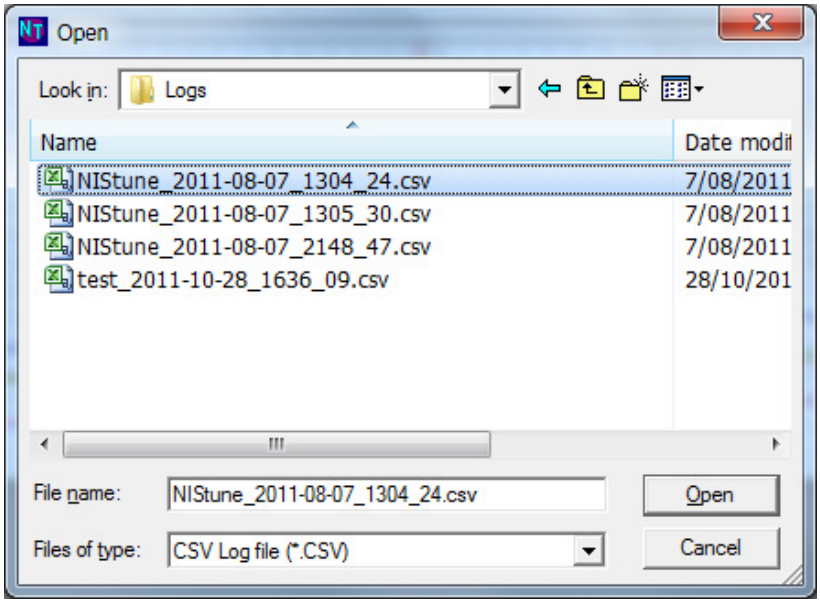
F8 button will provide a short cut to start/pause log recording. You can also use the following keys:

R = Record log
P = Play log
T = sTop log
ENTER = Mark area of interest in the log
SPACE = Pause log

Log Names

You can also change the name of your log files by clicking on ***Name*** and on the next log record that name will be used. Name suffixing is provided by either ending with a ***Date*** stamp or by ***Index*** number

To play back data, when in Playback Mode (consult disconnected), click browse and select a log to open.

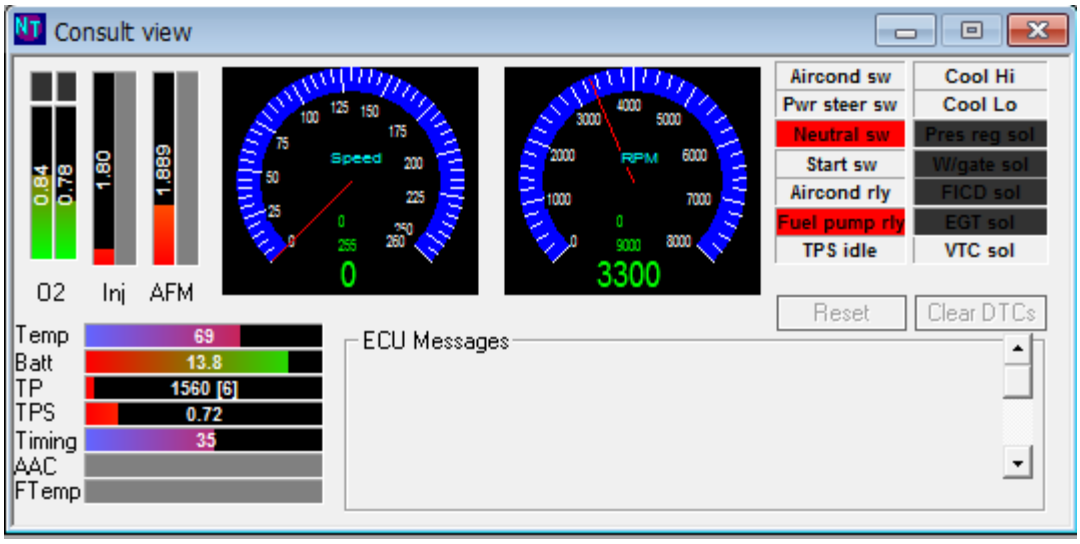


Once the log file is opened, pressing the play button will start the logging. You are able to use the navigation controls or the sliding bar to move around the log. There is a timestamp at the top of the log to indicate the position during duration.

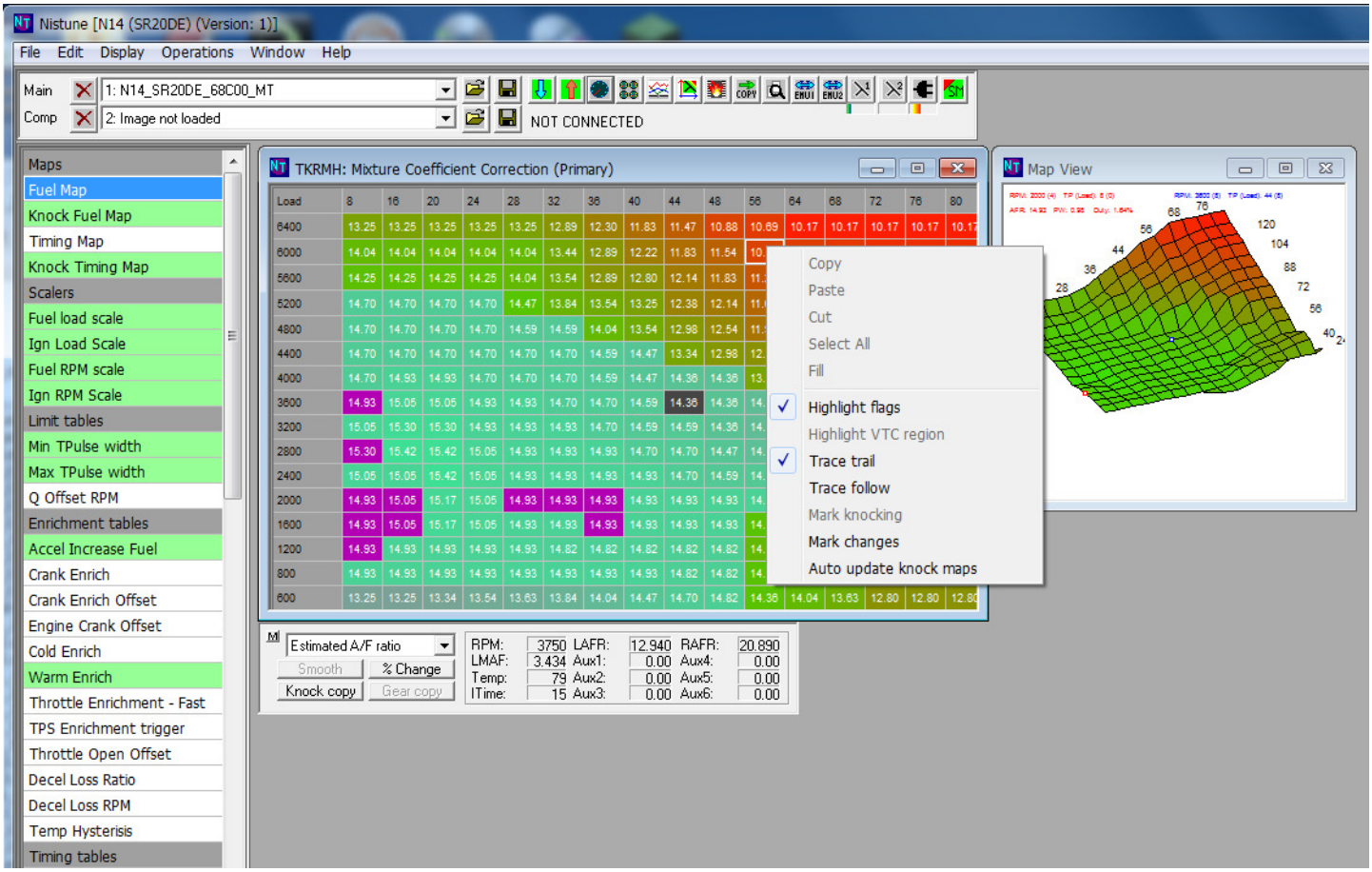
Clicking on the red indicator will highlight at that particular point in time the values and time of that position.

Using the logger in conjunction with the consult display and standard map trace features provides powerful reviewing facilities.

Below is the consult log display being played back. All items apart from DTC codes are played back from the log file.



Below is the maptrace being played back from the log file. The purple cell on the grid and blue dot on the graphic map indicate the interpolated position of the ECU reading that particular map.



The right click on the map grid view offers ‘Trace trail’ to show where the trace has been as well as other trace and highlight operations on the fuel map.

Burn permanent changes

Modifications made to the maps on a Nistune daughterboard are always temporary until they are committed by the user. This allows for provision against operator error and accidental corruption of daughterboard memory contents.

When the user is satisfied with the changes they have made to the vehicle. It is highly recommended they firstly review those changes. This is done by selecting Reconcile – PC to read back current temporary data stored on the daughterboard.

Once changes have been reviewed and the vehicle performs satisfactory, clicking the Burn changes button will store this to Nistune daughterboard non-volatile memory.

Note: If the ECU is powered off and changes are not burnt those changes will be lost

Retrieve last stored changes

This will clear out any current changes to the Nistune daughterboard and restore last stored/powered on changes.

This is used to reset to the known state of mapping stored in the ECU. Use this feature to reset the maps to last saved state. Then Reconcile – PC to see what these changes are.

Copy selected maps

This feature allows you to copy maps from one ECU binary image to another. Selected maps, tables and constants of Main image are copied to Comparison image.

This provides the ability to copy maps, tables and constants from other ECU binary images to your Nistune daughterboard or emulator.

When selecting this option you will see a map copy screen. Tick the applicable items you wish to copy and then click OK. These will be copied immediately. You can view these changes by selecting the current comparison image as ‘Main image’

9. Map Grid Operations

General

The map grid views will be the basis of most of your tuning. These are accessible by clicking on Fuel, Timing etc maps from the Tables window on the left side.

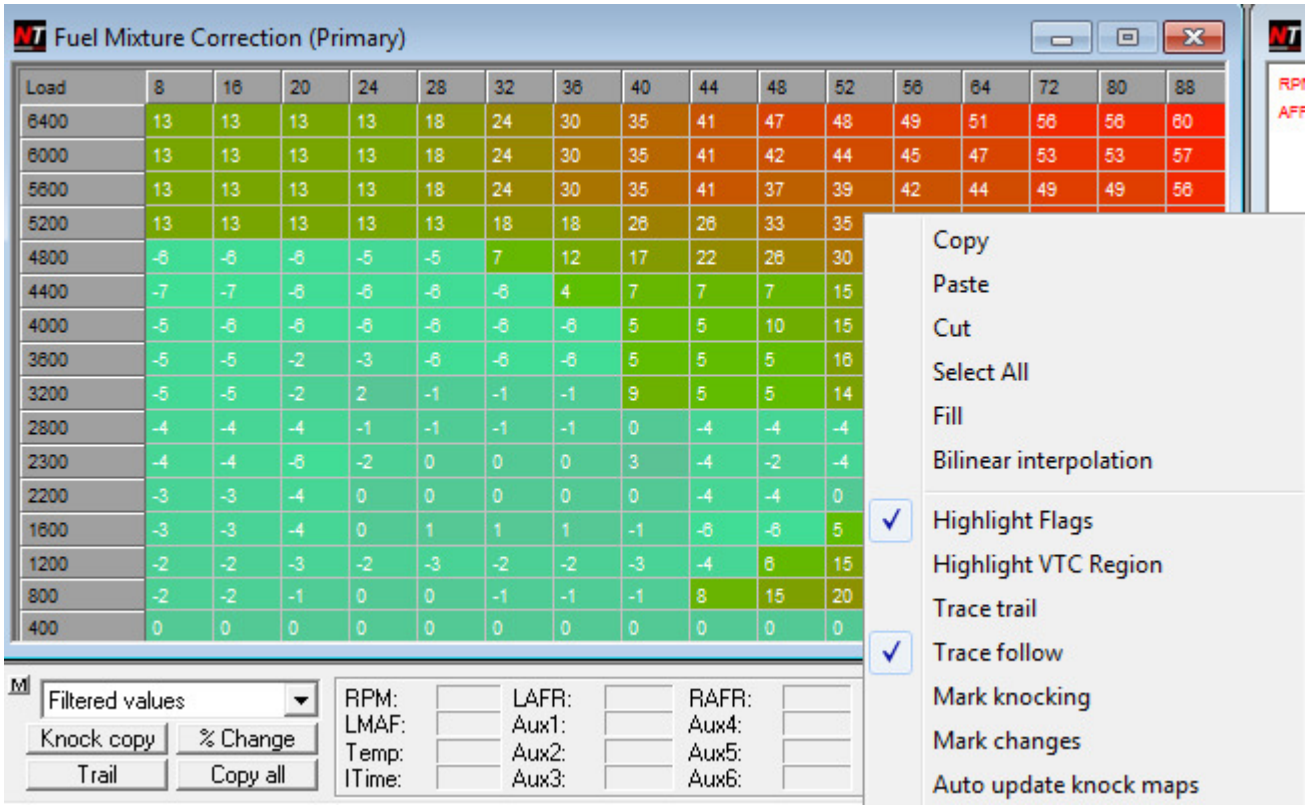
Such a grid as below will be displayed. Correct address file selection and matching binary file will ensure correct display. Any obviously incorrect Load/RPM scales or map data indicate an address file/binary image mismatch. For fuel maps more green means leaner mixtures and more red means richer mixtures. Currently only values in raw/filtered modes can be directly edited.

For the Fuel maps, selecting other modes such as Estimated A/F ratio, duty cycle and injector pulsewdith give a better picture of how these coefficient ratios affect the injection of fuel.

Note: A/F ratio, duty cycle and injector pulsewidth display are only an approximation of what the fuel map may deliver. The ECU uses the raw numbers in the table and multiplies these against TP (theoretical pulsewidth or load) and various enrichment factors (such as temperature and throttle enrichment) and closed loop fuel trims for the final injection pulsewidth.

Wideband AFR readings should always be used to determine actual AFRs and the fuel map adjustments affect fueling as a multiplier over the base injection for the current load and RPM point.

Nissan ECUs use knock sensor and O2 flags in the data to indicate where the sensors should be utilised. These can be highlighted by clicking 'Highlight Flags' option on the Right Click context menu.



'Highlight VCT region' is available on ECUs which have VCT control. This will indicate the RPM and load range at which the VCT solenoid is used. These are adjustable in the lower LHS VCT parameters section inside Nistune.

'Trace trail' provides a trail of where the maptrace cursor has been during a live session or playback. Clearing and reselecting this option will clear the trail

'Trace follow' makes the user cursor follow the map tracing cursor

'Mark knocking' is only available on ECUs which have knock detect firmware supported. Where it is not available this option is greyed out

‘Mark changes’ will change the colour of the cell to a darkened colour to show the tuner where they have made modifications to the map

‘Auto update knock maps’ will adjust the knock map cell values in the same position as the main map has been updated.

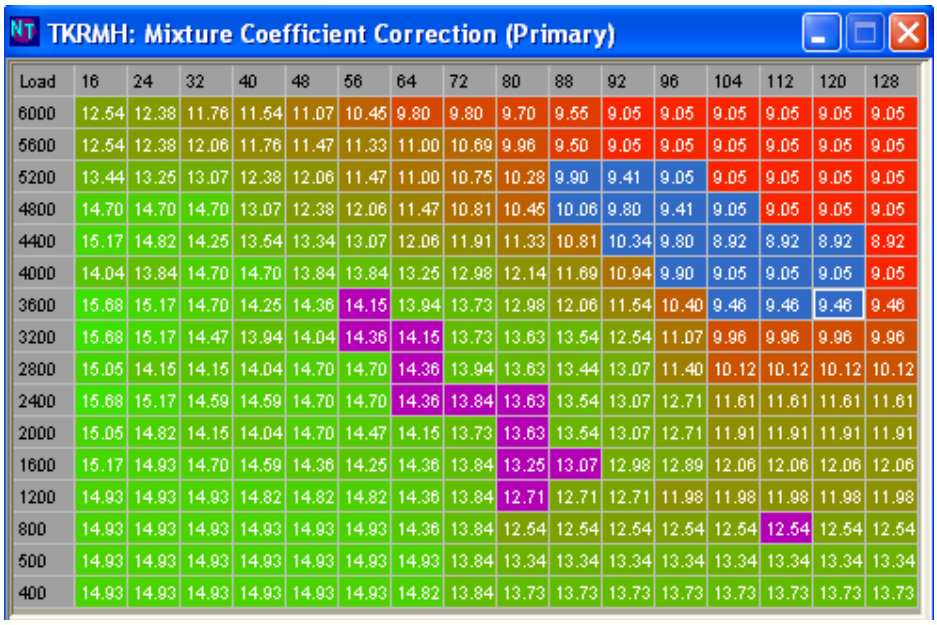
Map Editing

- CTRL + Mouse click will select individual cells
- Mouse drag or [SHIFT + Arrow keys] will select a block of cells
- CTRL-A will select the entire
- “+” or PAGE UP will increase values
- “-“ or PAGE DOWN will decrease values
- '*' will apply a percentage adjustment to the map
- Pressing K will toggle the knock flag (IGN maps)
- Pressing O will toggle the O2 feedback flag (fuel maps)

Raw, Filtered and AFR views only:

- CTRL-F will fill the entire area with the value in the white selected box cells values
- CTRL-A will select the entire grid area. Useful for copy/paste
- Pressing a key on a cell value in raw/filtered view will put the cell into edit mode. You may edit the value of that cell with an integer value.
- SHIFT-DEL will delete the selected cell contents (replacing with 0) and put the items onto the clipboard
- CTRL-COPY will copy the selected cell contents and put the items onto the clipboard
- SHIFT-INSERT will paste the items from the clipboard at the cursor position.
- Right click copy/paste/delete are also available from the mouse
- Right click bilinear interpolation. This will smooth the grid based on the values of the four corners of the selected area.

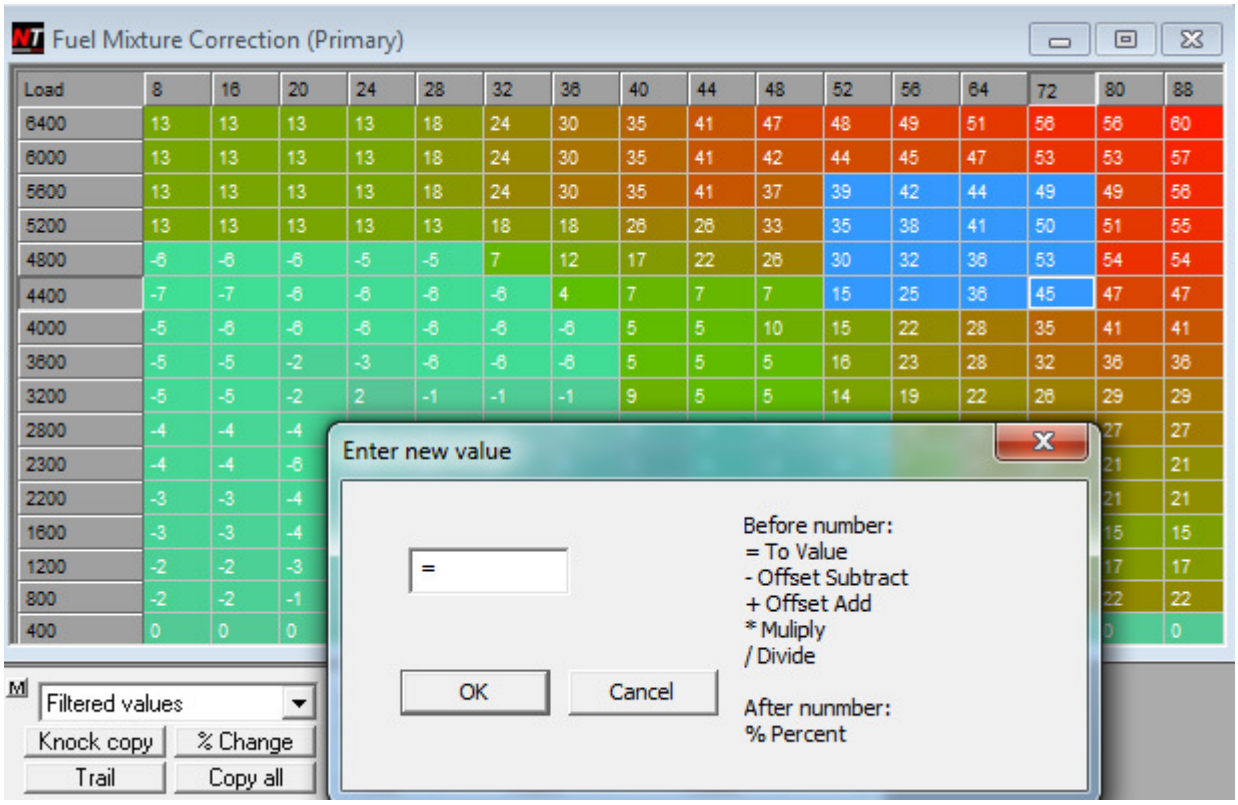
Note: These operations are not available in **duty cycle** and **pulse width** display modes since other factors such as TP scaling affect the final display representation of the numbers in the map. Direct modifcation is therefore disabled when viewing in these two display views.



Load	16	24	32	40	48	56	64	72	80	88	92	96	104	112	120	128
6000	12.54	12.38	11.76	11.54	11.07	10.45	9.80	9.80	9.70	9.55	9.05	9.05	9.05	9.05	9.05	9.05
5600	12.54	12.38	12.06	11.76	11.47	11.33	11.00	10.69	9.96	9.50	9.05	9.05	9.05	9.05	9.05	9.05
5200	13.44	13.25	13.07	12.38	12.06	11.47	11.00	10.75	10.28	9.90	9.41	9.05	9.05	9.05	9.05	9.05
4800	14.70	14.70	14.70	13.07	12.38	12.06	11.47	10.81	10.45	10.06	9.80	9.41	9.05	9.05	9.05	9.05
4400	15.17	14.82	14.25	13.54	13.34	13.07	12.06	11.91	11.33	10.81	10.34	9.80	8.92	8.92	8.92	8.92
4000	14.04	13.84	14.70	14.70	13.84	13.84	13.25	12.98	12.14	11.69	10.94	9.90	9.05	9.05	9.05	9.05
3600	15.68	15.17	14.70	14.25	14.36	14.15	13.94	13.73	12.98	12.06	11.54	10.40	9.46	9.46	9.46	9.46
3200	15.68	15.17	14.47	13.94	14.04	14.36	14.15	13.73	13.63	13.54	12.54	11.07	9.96	9.96	9.96	9.96
2800	15.05	14.15	14.15	14.04	14.70	14.70	14.36	13.94	13.63	13.44	13.07	11.40	10.12	10.12	10.12	10.12
2400	15.68	15.17	14.59	14.59	14.70	14.70	14.36	13.84	13.63	13.54	13.07	12.71	11.61	11.61	11.61	11.61
2000	15.05	14.82	14.15	14.04	14.70	14.47	14.15	13.73	13.63	13.54	13.07	12.71	11.91	11.91	11.91	11.91
1600	15.17	14.93	14.70	14.59	14.36	14.25	14.36	13.84	13.25	13.07	12.98	12.89	12.06	12.06	12.06	12.06
1200	14.93	14.93	14.93	14.82	14.82	14.82	14.36	13.84	12.71	12.71	12.71	11.98	11.98	11.98	11.98	11.98
800	14.93	14.93	14.93	14.93	14.93	14.93	14.36	13.84	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54
500	14.93	14.93	14.93	14.93	14.93	14.93	14.93	13.84	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34
400	14.93	14.93	14.93	14.93	14.93	14.93	14.82	13.84	13.73	13.73	13.73	13.73	13.73	13.73	13.73	13.73

Direct data entry:

Customer requests for an ENTER field box have been added to the software. Selecting on a single cell, or a group of cells (using SHIFT key to select more than one cell) will allow modification through an additional window box.



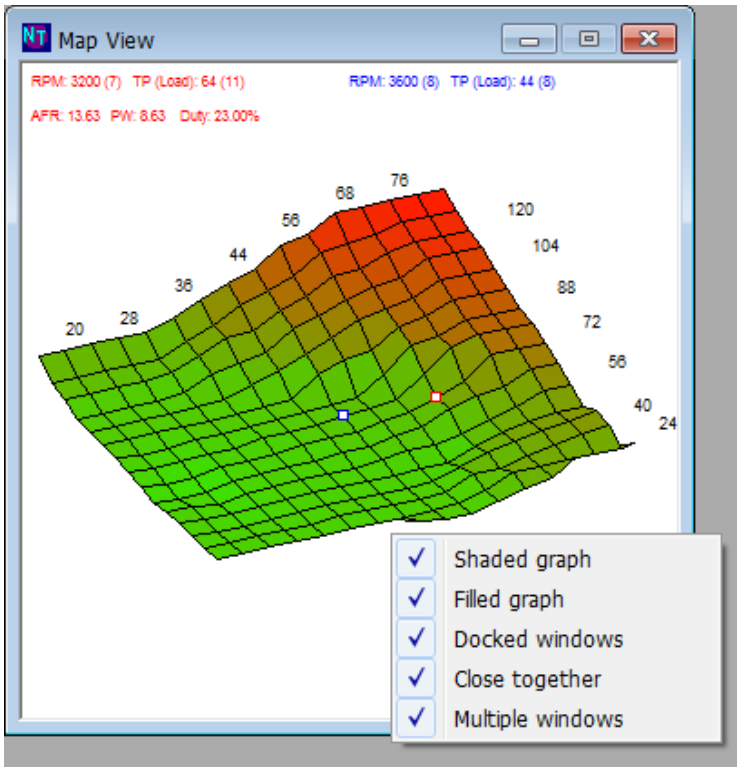
Enter new value

= will set the cells to the selected value
- reduce the cells by the entered value
+ increase the cells by the entered value
* multiply cells by the entered value
/ divide cells by the entered value
% will perform the same percentage adjustment as * key
(50% = halve, 200% = double current cell value)

Graph Editing Functions

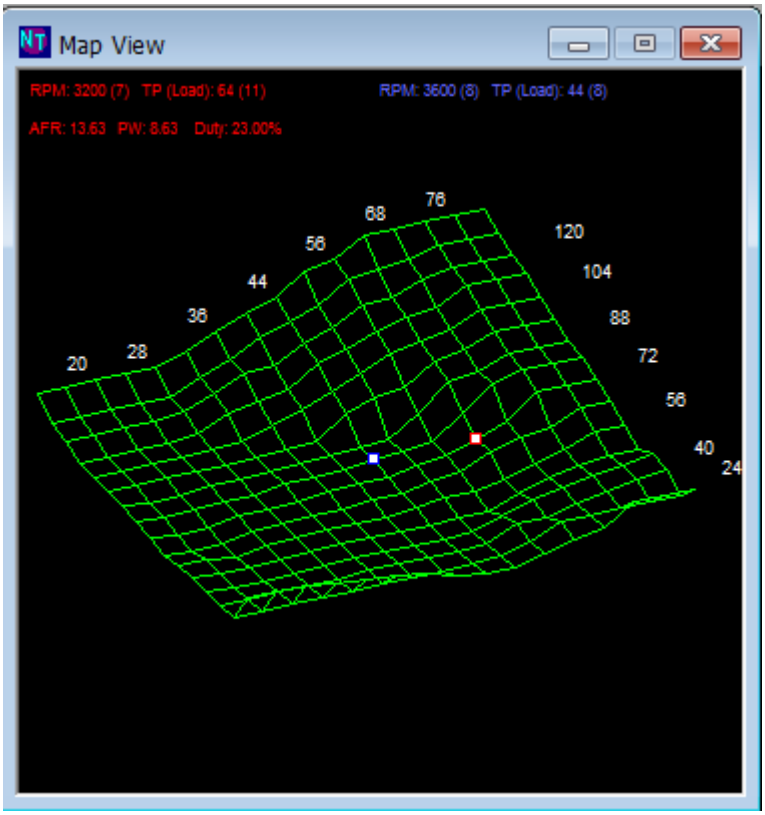
Graph editing provides a 3D graphical representation of the maps. The display shows current selected and maptrace cursors in addition to details associated with the cursor position. The raw TP (load) scales are on the left and RPM on the right.

Use a combination of the Arrow Keys and CTRL/SHIFT keys to adjust tilt/rotation/scaling of the 3D map view.



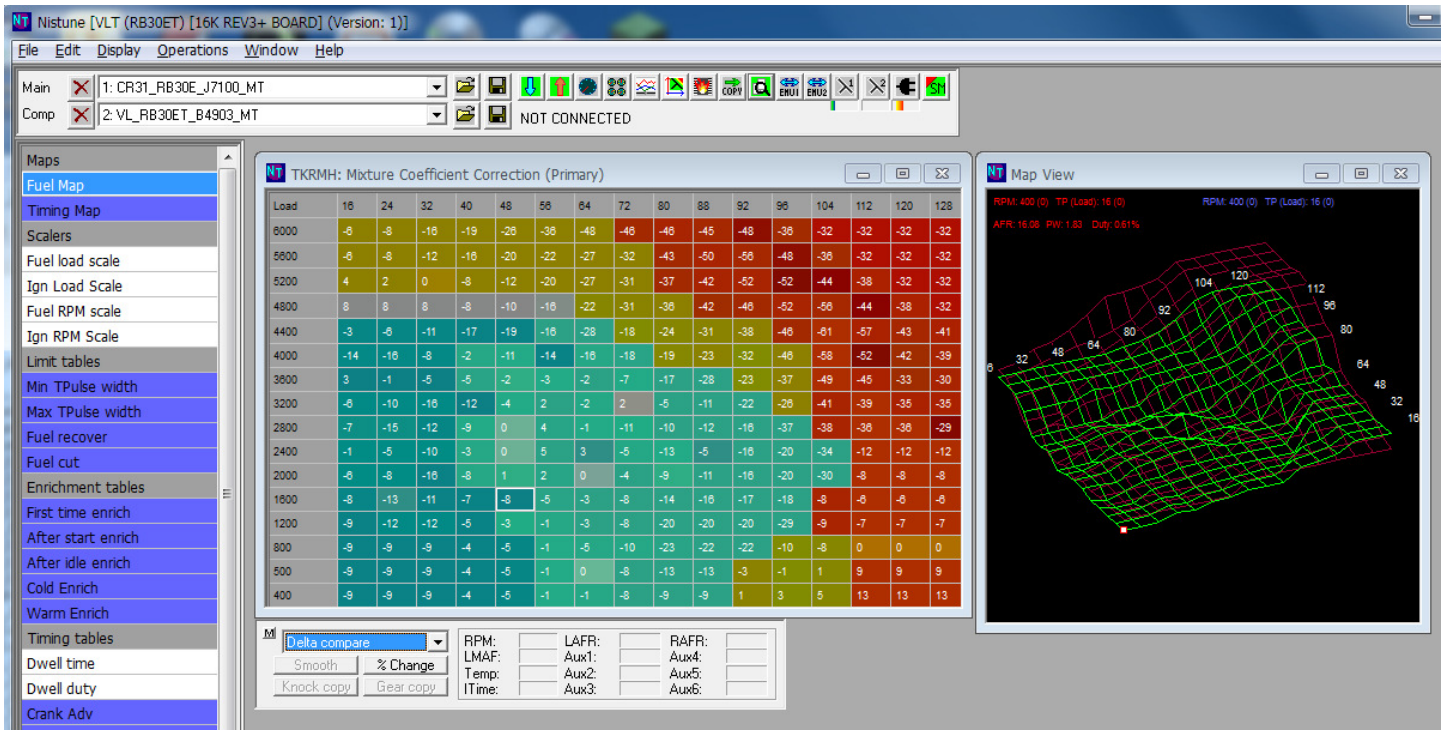
Arrow keys are used to move the red cursor through the maps. The map grid view will match what is selected in this map.

Right click context menu options on the grid view panel allow on/off control of the shading (colourisation) and solid-fill/wire-frame options.



Clicking the magnifying ‘compare’ option on the Image Selection window will display the main image against the comparison image. This can be used with the ‘delta’ option to see the difference between two maps.

Also all the maps which have differences are highlighted in light blue in the tables/constant windows.



10. Resize Injectors

This option allows you to resize your injectors for standard Nissan factory retuning. If your vehicle has **Feature Pack** firmware installed on it then skip this section

Feature Pack - Refer to the following guides:
http://www.nistune.com/support-documentation-general.php

Nistune Feature Pack 1 Documentation
Nistune Feature Pack Training Notes

Standard Nissan Nistune firmware:

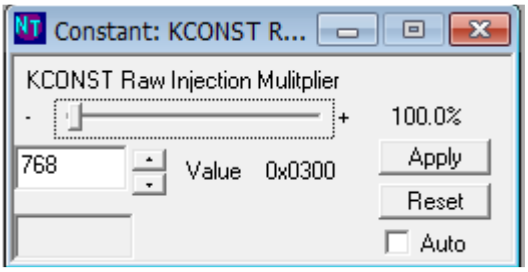
The base injector size displayed in this section comes from a parameter in your address file called INJECTORCC. You can change the base injector size temporarily inside Nistune or edit the address file directly (see next section).

Ensure the engine is not running while performing this operation otherwise damage may result

1. Download the maps from your ECU

2. Note the value of your Injection Multiplier (K Constant) and Total Injection Multiplier (TIM) and Total Injection Divisor (DIM) before adjustment

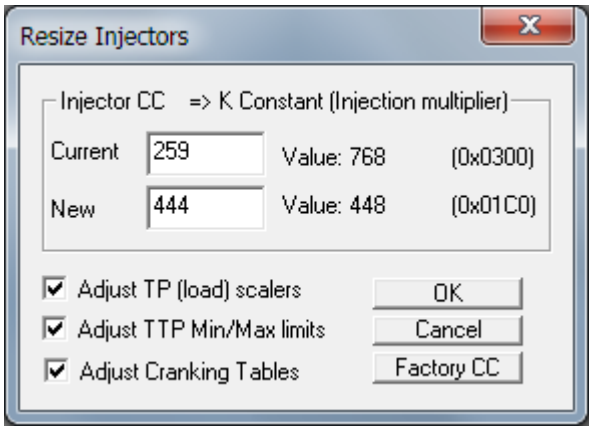
Note: TIM is only available on Feature Pack Enabled ECUs
Note: DIM is only available on later model Nissan ECUs (A32 Maxima, RB25DET NEO etc)



3. Select ***Operations - Resize Injectors***

Tick the boxes if you wish to adjust the scalers, limiters and cranking tables. Read the tuning guide for more information on the scalers.

(a) K Constant adjustment:

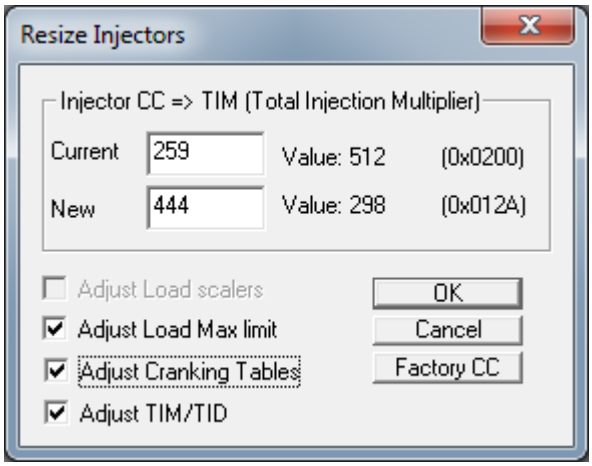


This will adjust K constant which is a load multiplier:
Current load (TP) = MAF (VQ lookup) x K constant / RPM

This consequently affects the total fueling required to compensate for larger injectors. However this will adjust the load positioning (TP) in the various maps of the ECU. Subsequently rescaling load (TP) scales in fuel, timing and other maps will be required when using this operation.

K Constant (Injection Multiplier) should be the new value you have changed to when you have made this change.

(b) Total Injection Multiplier adjustment (Feature Pack ECUs only):

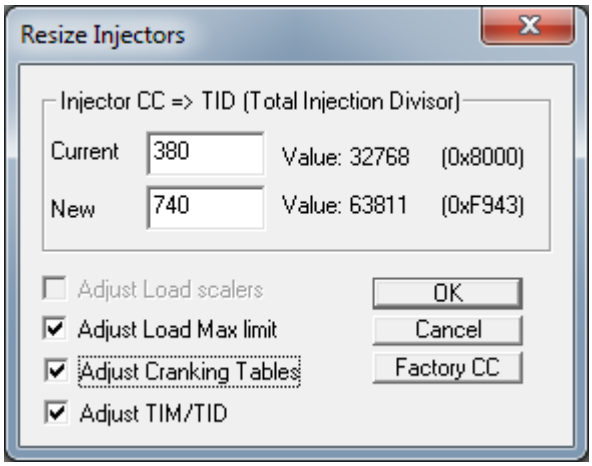


Instead of adjusting the loading of the fuel (which adversely affects TP load scale referencing), Feature Pack ECUs allow adjustment of fuelling for injectors with an additional parameter added to the Nissan ECU code.

Note: Load rescaling not available for this type of resize

If you wish to adjust K constant will then untick 'Adjust TIM/TID'

(c) Total Injection Divisor adjustment (Later model ECUs only):



For later model ECUs which do not have Feature Pack, but do have the Total Injection Divisor parameter from factory, Nistune now offers to resize this extra parameter for injector rescaling.

If you wish to adjust K constant will then untick 'Adjust TIM/TID'

Note: Total Injection Divisor works in reverse to K constant/TIM. If you increase this number, it will reduce fueling by the percentage changed. TID has a minimum usable value of 30,000 (fueling cannot be increased further than this) and maximum value of 63811. You cannot adjust injectors more than double factory value due to this limitation

If your injectors are more than double (eg 850CC), then do two resizes:
1. Resize from factory (eg. 380) to 740CC using TID
2. Resize from 740CC to 850CC using K constant (untick 'Adjust TIM/TID')

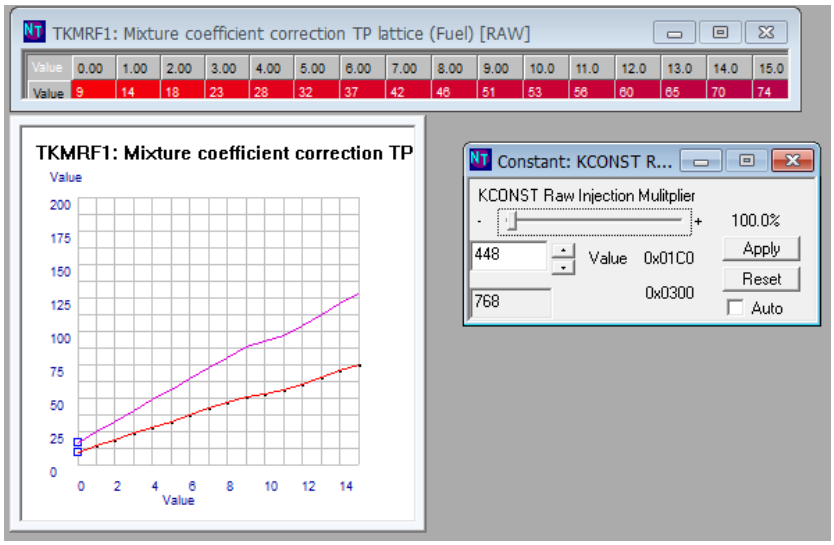
Note: Load rescaling not available for this type of resize

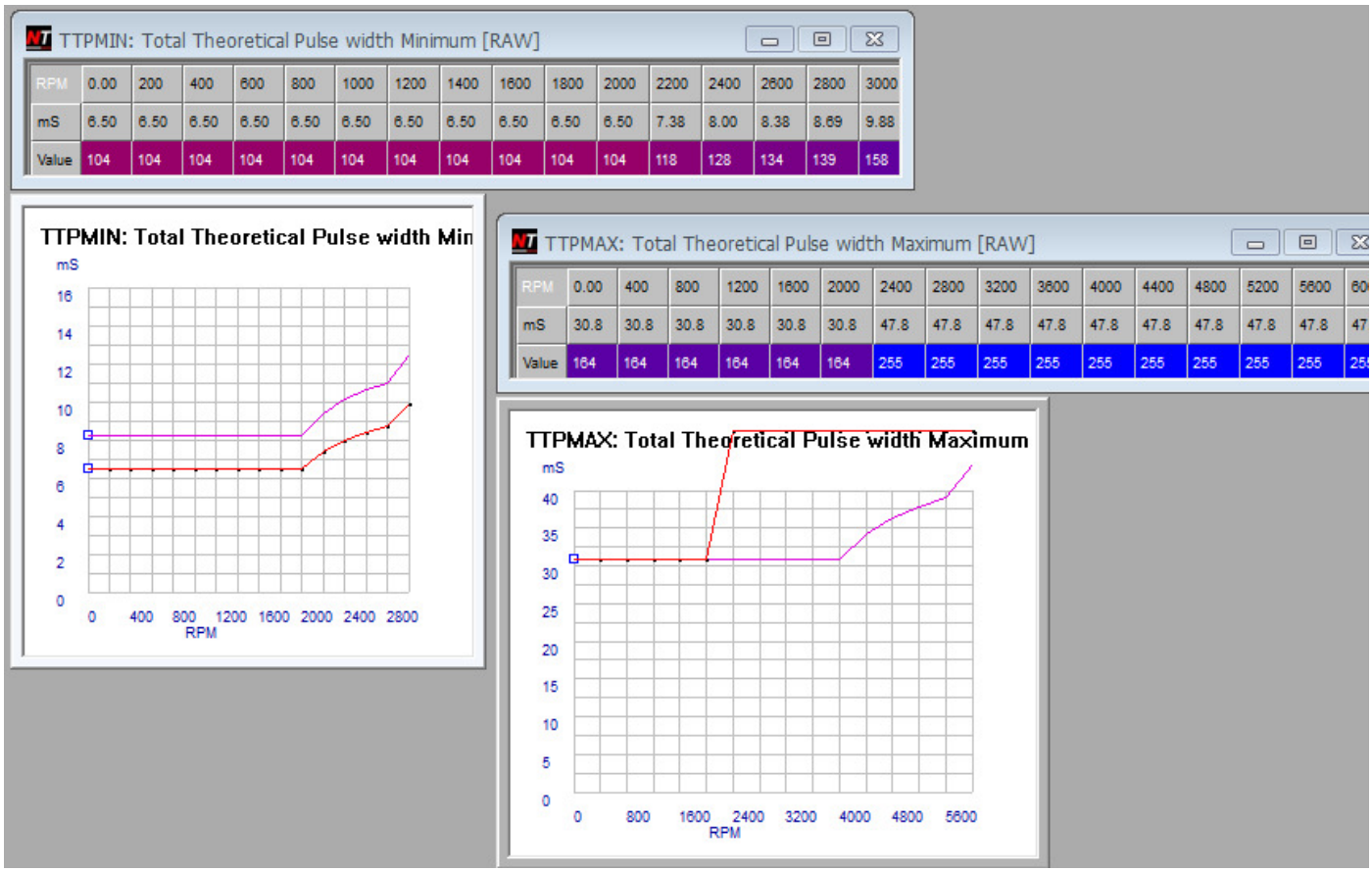
Load Scalers

Adjusting load scales should only be performed on Nissan ECUs without feature pack. Try to make minimal adjustments from factory TP scales as possible, since other operations in the ECU (such as O2 feedback, knock feedback and acceleration enrichment operate in the factory TP scale range)

Adjusting TP load scalers will make the scaling smaller. This is normally then offset by increasing TP scaling when resizing the MAF. If only resizing the injectors it is recommended to leave this unticked to default to factory scaling and then perform any additional scaling changes afterwards. Refer to the tuning guide for more detail

4. Open ***Injection Multiplier*** window and check that it contains the value you entered. If you opted to adjust ***TP Scales*** and /or ***TTP Min/Max*** then check these values also.





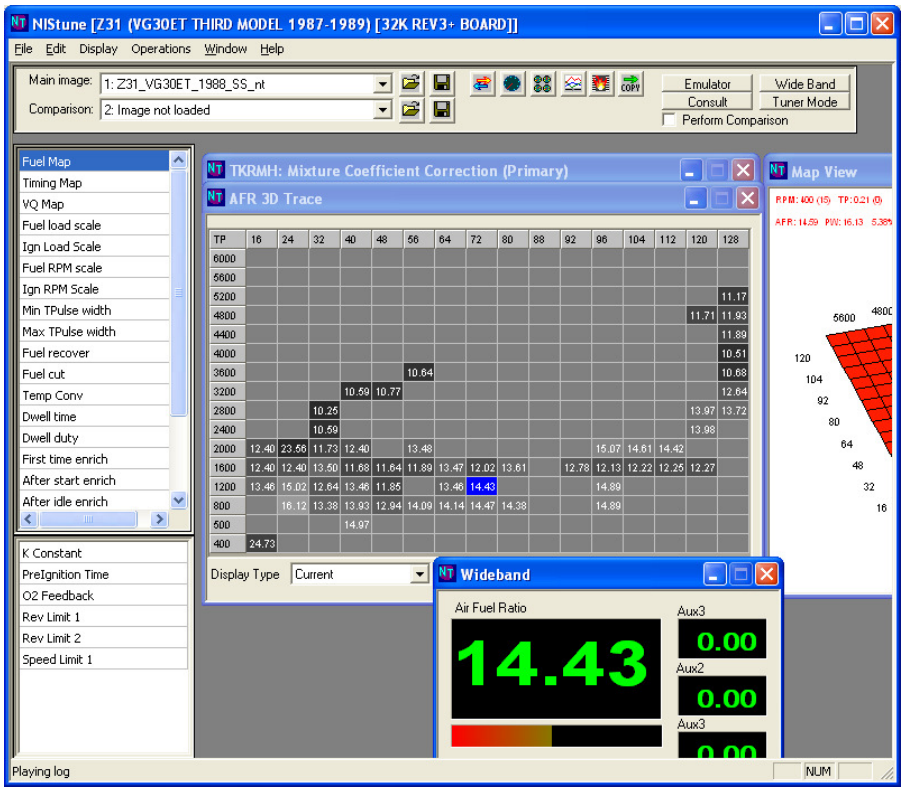
11. Injection Adjustment

Note: This procedure has been revised since previous versions of this document

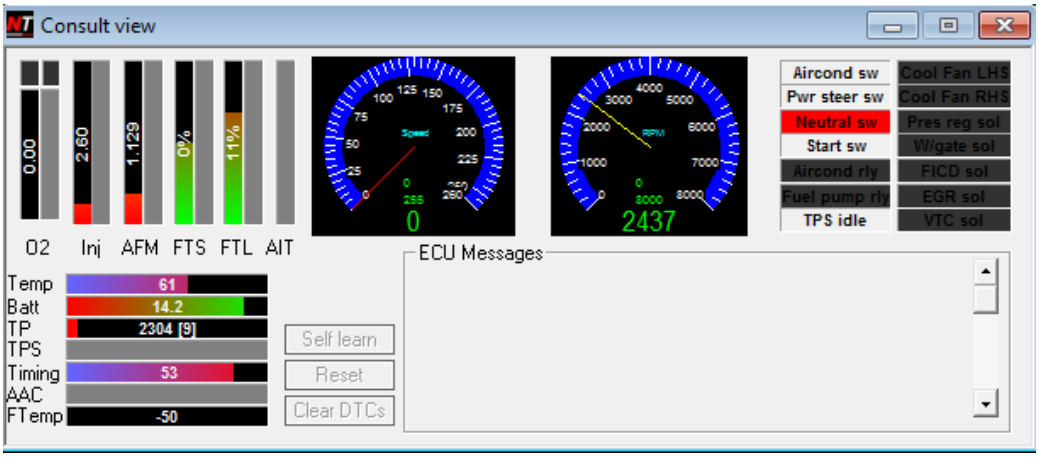
The following steps will show you how to use your AFR trace monitor and assist you with making adjustments to Injection Multiplier

1. Connect to your wideband unit and display the air fuel ratios

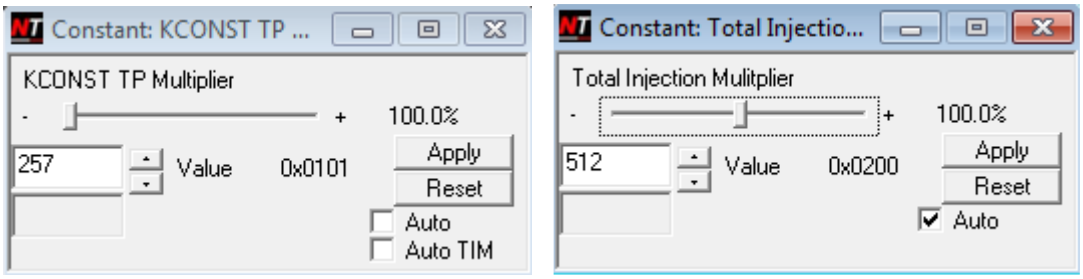
2. From the top panel press the **TRACE** button get an reading of the current air fuel mixtures against the fuel map. This will display your current AFR and keep track of it on the trace map.



3. Open up the Consult View display (first icon at top bar). Check you have no fault codes with the vehicle



4. Now from the constants list you can fine tune things by adjusting **Load Multiplier** (K Constant) for the global AFR settings (or **Total Injection Multiplier** for Feature Pack ECUs)



Note: **K constant** is a **magic numbe**r and it is modified by percentage. The value of this parameter will vary between various types of Nissan ECUs.

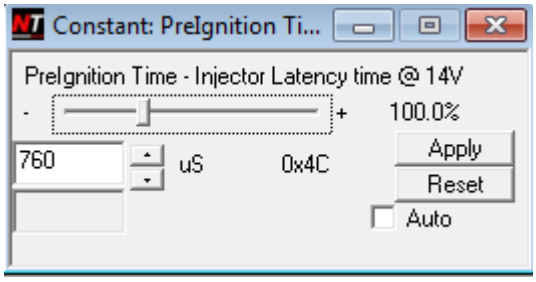
The **Total Injection Multiplier (TIM)** always starts at **512** and is lowered to reduce fuel and increased to add fuel

We recommend adjusting base fuel mixtures at **cruise**. This means around 2000rpm with some light load (for example: load cursor is around ¼ of the fuel map. This will enable the ECU to be in the closed loop area.

Do **not** make base fuel mixture adjustments at idle, only in the cruise area of the fuel map

Only adjust **latency** at idle to correct idle fuel mixtures

5. Adjust Injector Latency for the opening/closing latency difference with the new injectors you have installed

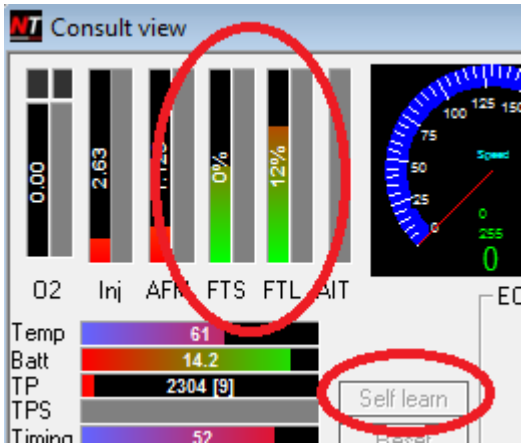


Note: Ticking the 'Auto' button will make changes to the engine on the fly. You can use the + and - keys to make adjustments in increments of 100 or the up/down buttons in this window to make adjustments by 1.

Example latency settings for 1000CC ID injectors are 1150uS and 740CC Nismo injectors around 700uS

6. Make adjustments to these parameters on light cruise with two aims:

(a) At stable cruise, ensure that the vehicle (with O2 sensors connected and working) is maintaining stoich air fuel ratios. Use the FTS (fuel trim short) and FTL (fuel trim long) to monitor the trims. Long term trims can be reset using the 'self learn' button and are stored by the better. It is important to maintain these close to 0%



When these are close to 0% then your wideband should show AFRs of around 14.7:1 at cruise. Try not to pay too much attention to variations in the trims around idle (since some ECUs like Z32 300ZX will actually set this parameter to the amount of throttle enrichment)

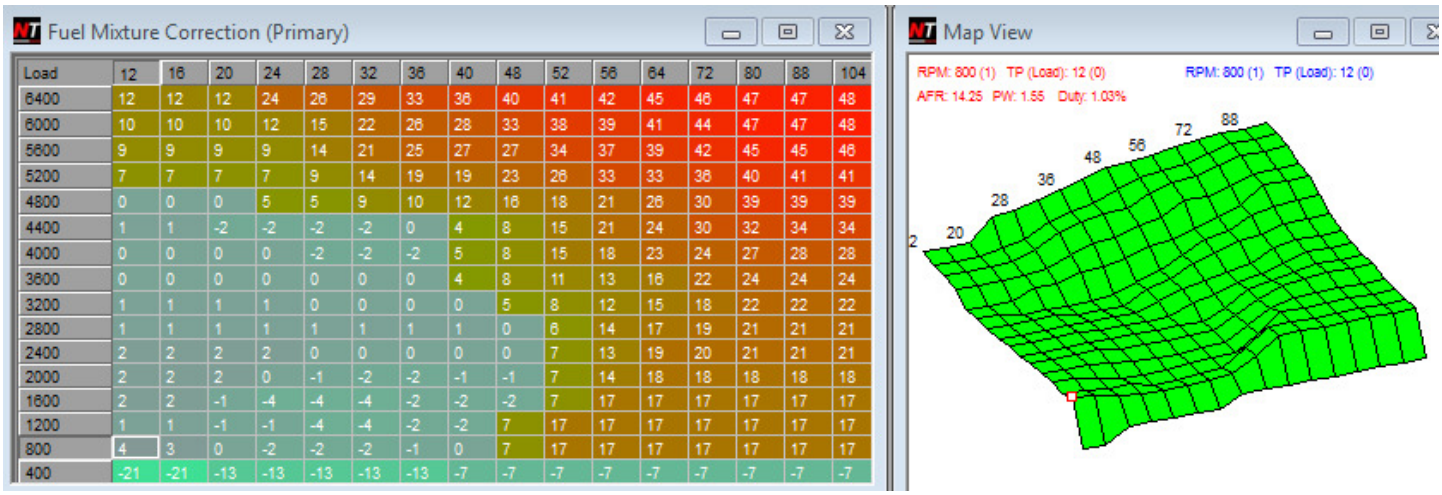
If you do not have a working O2 sensor, then ensure the O2 flags are disabled in the Feedback Flags section of the tune (or the O2 feedback temperature parameter is maximised if this flag parameter does not exist for your ECU). Then try and still ensure about 14.7:1 AFRs on light throttle in the closed loop area of the map

(b) When performing a full throttle run, ensure you are using the entire load range of the map. If the load reaches too short, or it climbs up the right hand of the fuel map then either

Feature Pack: Adjust K constant so the cursor operates within the factory TP scaling and use TIM to offset any fueling trim adjustments required (after K is changed)

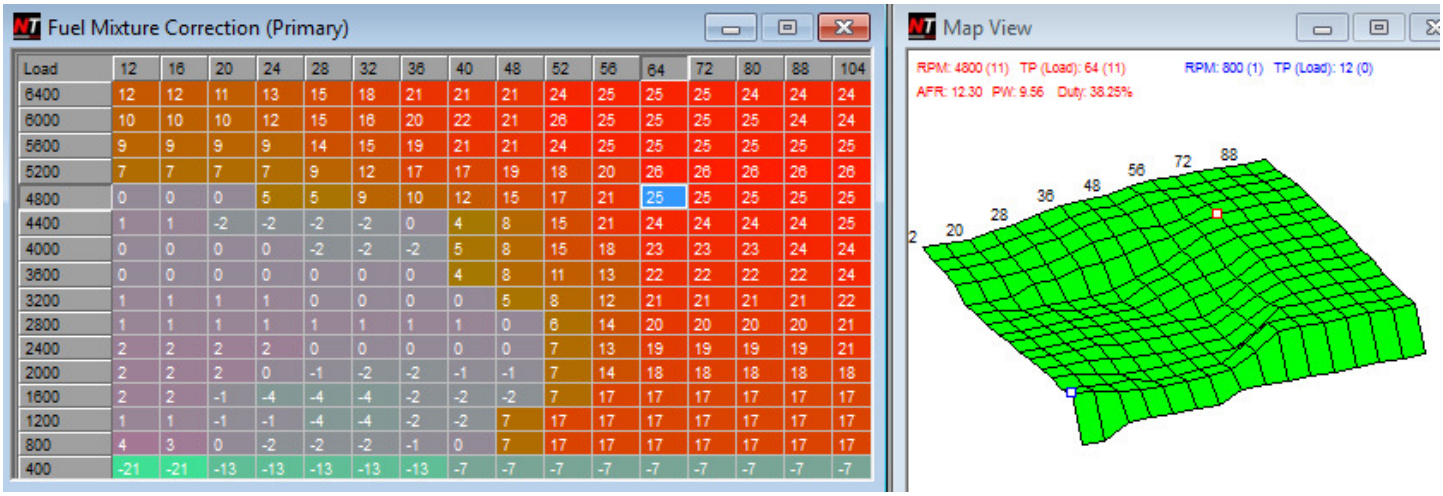
Normal: Adjust your fuel and load TP scaling to match the current TP range dictated by the K constant setting.

7. Larger injectors will result in a richer tune. You will need to flatten your fuel map by the percentage of injection adjustment. For example if your fuel map looks like this from factory (HCR32 Skyline example)



Load	12	16	20	24	28	32	36	40	48	52	56	64	72	80	88	104
6400	12	12	12	24	26	29	33	36	40	41	42	45	46	47	47	48
6000	10	10	10	12	15	22	26	28	33	38	39	41	44	47	47	48
5600	9	9	9	9	14	21	25	27	27	34	37	39	42	45	45	46
5200	7	7	7	7	9	14	19	19	23	26	33	33	36	40	41	41
4800	0	0	0	5	5	9	10	12	16	18	21	26	30	39	39	39
4400	1	1	-2	-2	-2	-2	0	4	8	15	21	24	30	32	34	34
4000	0	0	0	0	-2	-2	-2	5	8	15	18	23	24	27	28	28
3600	0	0	0	0	0	0	0	4	8	11	13	16	22	24	24	24
3200	1	1	1	1	0	0	0	0	5	8	12	15	18	22	22	22
2800	1	1	1	1	1	1	1	1	0	6	14	17	19	21	21	21
2400	2	2	2	2	0	0	0	0	0	7	13	19	20	21	21	21
2000	2	2	2	0	-1	-2	-2	-1	-1	7	14	18	18	18	18	18
1600	2	2	-1	-4	-4	-4	-2	-2	-2	7	17	17	17	17	17	17
1200	1	1	-1	-1	-4	-4	-2	-2	7	17	17	17	17	17	17	17
800	4	3	0	-2	-2	-2	-1	0	7	17	17	17	17	17	17	17
400	-21	-21	-13	-13	-13	-13	-13	-7	-7	-7	-7	-7	-7	-7	-7	-7

After flattening the fuel map to get your mixtures back to normal (around 11.5:1 or so recommended on boost) then it may end up looking like this:

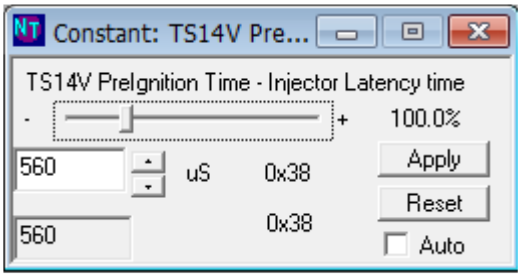


Load	12	16	20	24	28	32	36	40	48	52	56	64	72	80	88	104
6400	12	12	11	13	15	18	21	21	21	24	25	25	25	24	24	24
6000	10	10	10	12	15	16	20	22	21	26	25	25	25	25	24	24
5600	9	9	9	9	14	15	19	21	21	24	25	25	25	25	25	25
5200	7	7	7	7	9	12	17	17	19	18	20	26	26	26	26	26
4800	0	0	0	5	5	9	10	12	15	17	21	25	25	25	25	25
4400	1	1	-2	-2	-2	-2	0	4	8	15	21	24	24	24	24	25
4000	0	0	0	0	-2	-2	-2	5	8	15	18	23	23	23	24	24
3600	0	0	0	0	0	0	0	4	8	11	13	22	22	22	22	24
3200	1	1	1	1	0	0	0	0	5	8	12	21	21	21	21	22
2800	1	1	1	1	1	1	1	1	0	6	14	20	20	20	20	21
2400	2	2	2	2	0	0	0	0	0	7	13	19	19	19	19	21
2000	2	2	2	0	-1	-2	-2	-1	-1	7	14	18	18	18	18	18
1600	2	2	-1	-4	-4	-4	-2	-2	-2	7	17	17	17	17	17	17
1200	1	1	-1	-1	-4	-4	-2	-2	7	17	17	17	17	17	17	17
800	4	3	0	-2	-2	-2	-1	0	7	17	17	17	17	17	17	17
400	-21	-21	-13	-13	-13	-13	-13	-7	-7	-7	-7	-7	-7	-7	-7	-7

8. **Only when you are happy with the changes, hit the upload button to sync the tune with the vehicle and click the BURN button which will make those changes available next time you start the car.**

12. Injector Latency Adjustment

If AFRs are correct except around idle, then where larger injectors are used, sometimes latency will require adjustment. Latency is the opening/closing time of the injectors. This varies depending what type of injectors you use. Bigger injectors generally have a longer latency, so this constant may require adjustment (will mainly affect around idling range).

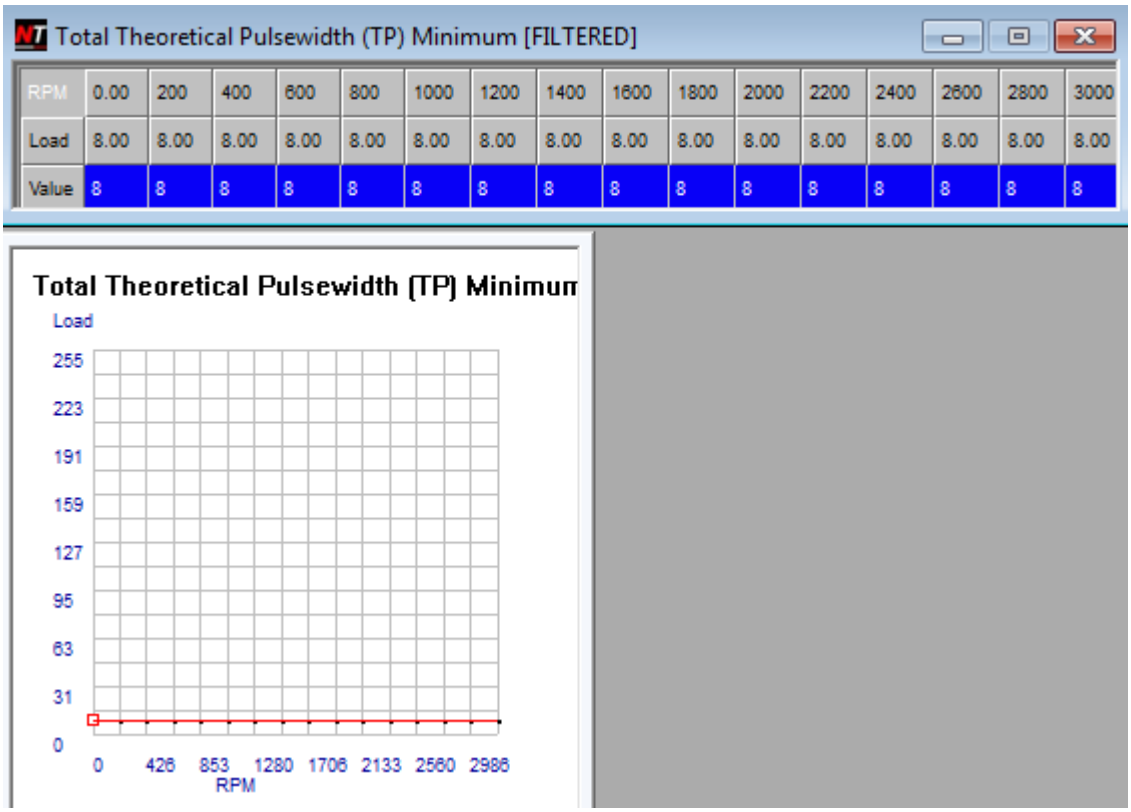


NOTE: Always tune using K Constant/TIM and values in the main fuel maps in cruise conditions (around 2000rpm, and ¼ load area), before adjusting Injector Latency.

Just because you have fitted larger injectors doesn't mean that you will have to adjust Injector Latency.

Injector Multiplier is a total multiplier to get the final injection opening time. Latency is a value in microseconds (uS) which is added to the total injection time. It has more affect around idle (due to smaller opening time) than when the injectors are open longer during higher load / RPM points.

Note: The minimum load table can also be used to manipulate injection pulse width and recovery around idle

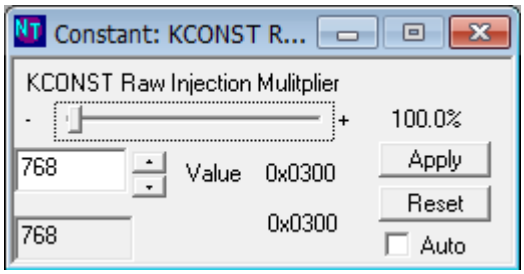


13. Change Mass Air Flow Meter

This option will allow you to select a new VQ map to use in place of the current one. HP figures are estimates only and affect the Injection Multiplier (K Constant). This may need to be adjusted after performing the Change MAF operation to obtain correct AFRs

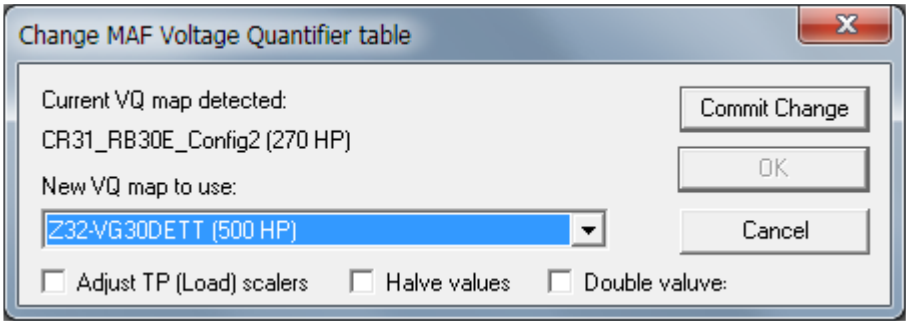
Ensure the engine is not running while performing this operation otherwise damage may result

1. Note your original Injection Multiplier (K Constant) value



2. Select Operations - Change Mass Airflow Meter. This should detect your current MAF and allow you to select a new one from the dropdown list.

Here we have selected a Z32 300ZX MAF



Options:

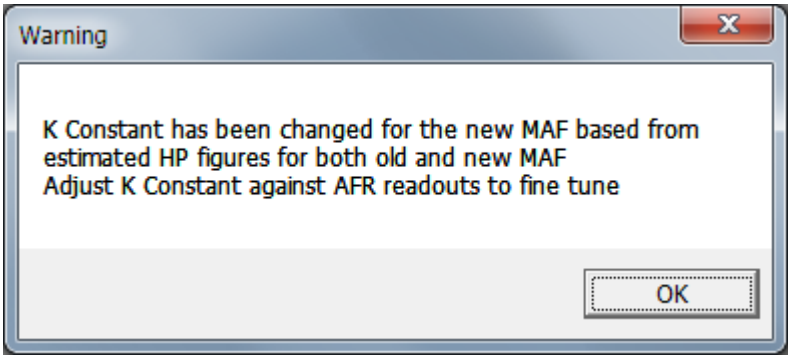
- Adjust TP Load scalers will increase the load scaling based on MAF resize. We suggest you adjust the TP load scalers manually by monitoring maximum TP index your vehicle can reach on maximum boost and then editing the table manually so it has a consistent slope

- Halve values is only used for BNR32 GTR ECUs where they have two MAF inputs and the VQ map used is actually halved. Select this when upgrading MAF on a BNR32 GTR

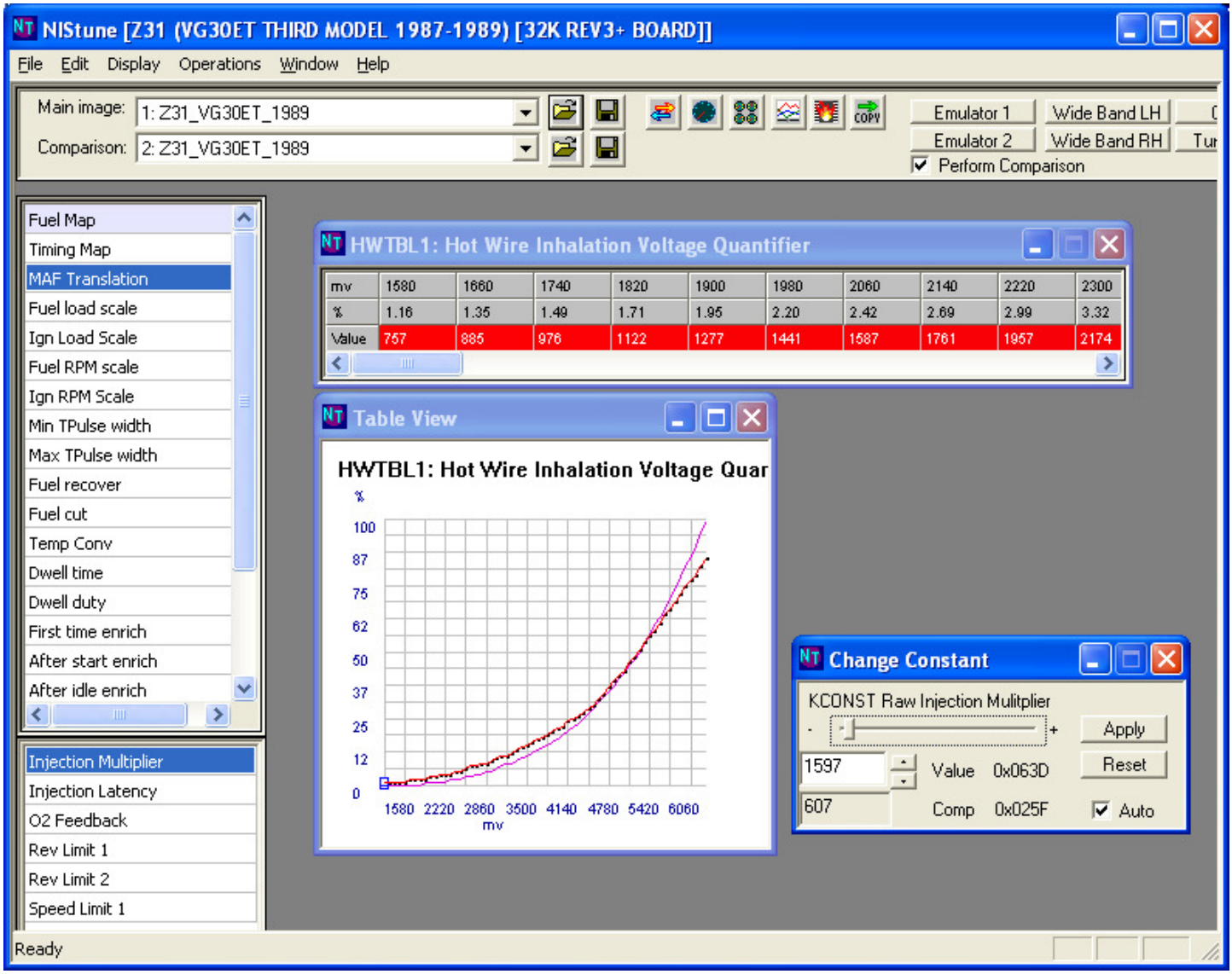
- Double values is only used if using a BNR32 GTR MAF on another vehicle. Since the BNR32 GTR VQ map is half the size of all the others, it needs to be doubled by using this tickbox.

3. Click ***Commit Change*** to verify that it will work. The status bar at the bottom of Nistune will say '***VQ Map Ford-Cobra committed'*** for example and OK will become available. Then click OK to close the window and make the change.

4. You will now get a warning window



5. The MAF Voltage Quantifier map (used for MAF calibration) and Injection Multiplier (adjusted for the different size MAF) will be changed. The screenshot below shows the difference:



6. Now start your vehicle and see if it runs OK. If it does not run smoothly you will need to adjust the injection multiplier.

Use your AFR meter as per Ch10 **Resize Injector** to get your AFRs correct with the new MAF.

Early ECU Install (R31/VL RB30 and Z31 VG30 ECU)
Upgrading to a larger MAF such as the Z32 will require hardware modifications. See **Type 1 installation manual** about these. The K constant (Injection Multiplier) calculated from the above has been specially adjusted to get a ball part figure. You will need to tune this to get proper results

During follow up tuning of this ECU it has been found that the VQ map for larger MAFs (such as ER34 and Z32 MAFs) needs to have the floor increased to values around 2000 mark to stabilise TP above a low voltage floor. Also the effects on the ECU of changing VQ map affect cold/warm start enrich tables and these need to be adjusted accordingly. Contact us if you require further assistance with tuning with larger MAFs on these vehicles

Low AFM voltage
Most Nissan ECUs have a low AFM voltage floor. When the AFM voltage falls below this value the ECU will set the voltage to 0.08 volts (viewable on the consult gauges) and set the CONSULT_AFM_DTC code. Later ECU models are able to have this value changed by modifying the “Low AFM Voltage” parameter. Earlier model ECUs will need to have special ECU code modification to change this parameter. Contact us for further information

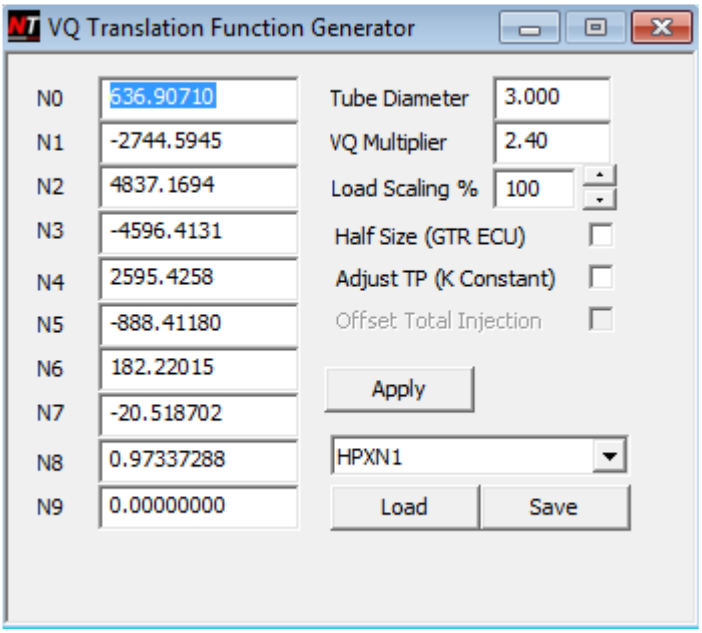
VQ Map Tuning
When performing ***Operations > Resize MAF*** Nistune detects the current MAF in use by comparing the VQ map in the ECU against ones in our database. If the VQ map for the MAF varies in any way (ie user modification) then it will no longer be detected and will display as ‘NONE FOUND’. This is normal since we are unable to determine which MAF is now being mapped in the ECU

When making adjustments to the VQ map, Nistune will provide the user the ability to use +/- held down to make rapid changes. The user can also select groups of cells and increase/decrease the group of cells

Some MAFs like HPX sensor will require further tuning depending on location of the sensor and general piping due to changes in airflow characteristics. It has been found that low AFM voltage will cause idling issues and increasing the floor of the VQ map to higher values will assist in stabilising idle.

Only once you are satisfied with the changes, click "***Burn***" to permanently store them in your Nistune board.

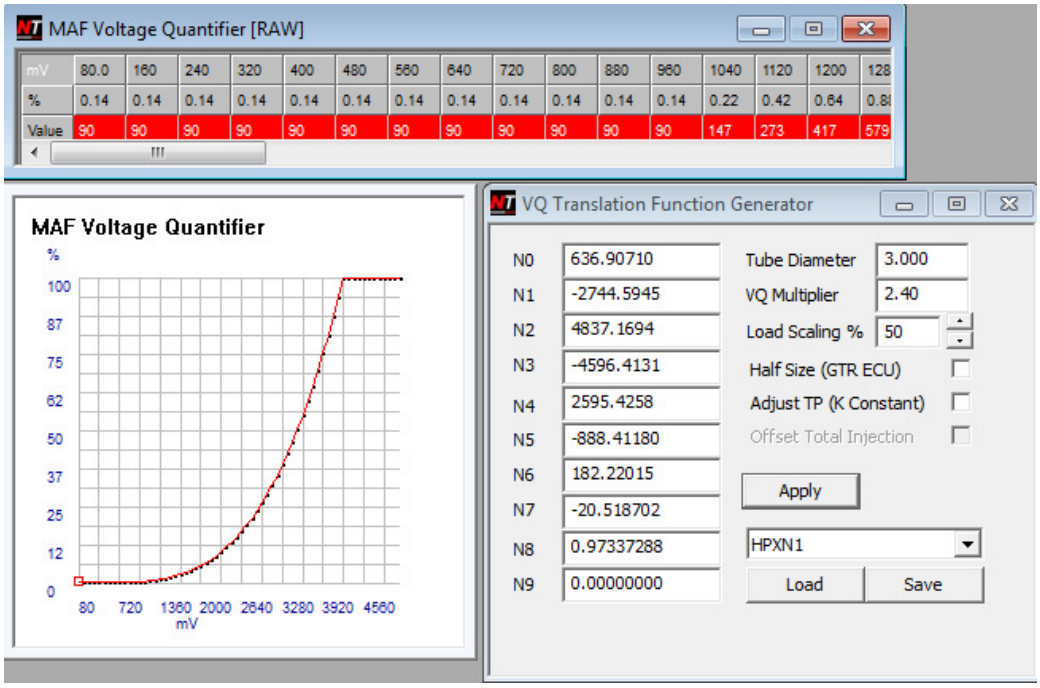
VQ Map Function Generator
Refer to the **Nistune MAF Tuning information** documentation on the Nistune website for further information. This operation is available under the Display > VQ Transfer Generator menu option



This function generator allows you to customise MAF curves for slot style sensors to use with your ECU. Select the MAF type you are using (eg HPX-N1, or R35 GTR). Then select the tube diameter it is to be installed in.

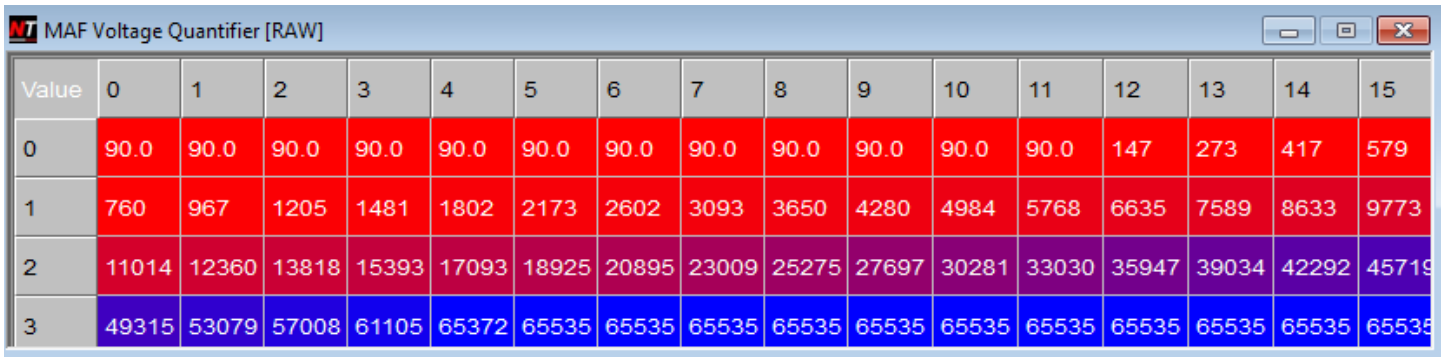
Some MAFs like the HPX-N1 can measure:
2.5″ housing 580 WHP
3″ housing 830 WHP
3.5″ housing 1130 WHP

Given this adjust the load scaling % for the amount of RWHP that the vehicle is likely to achieve with the modifications fitted to the vehicle. For example if using 3" housing with a vehicle capable of 400WHP then load scaling would be approximately 50%. The resulting curve will appear as:



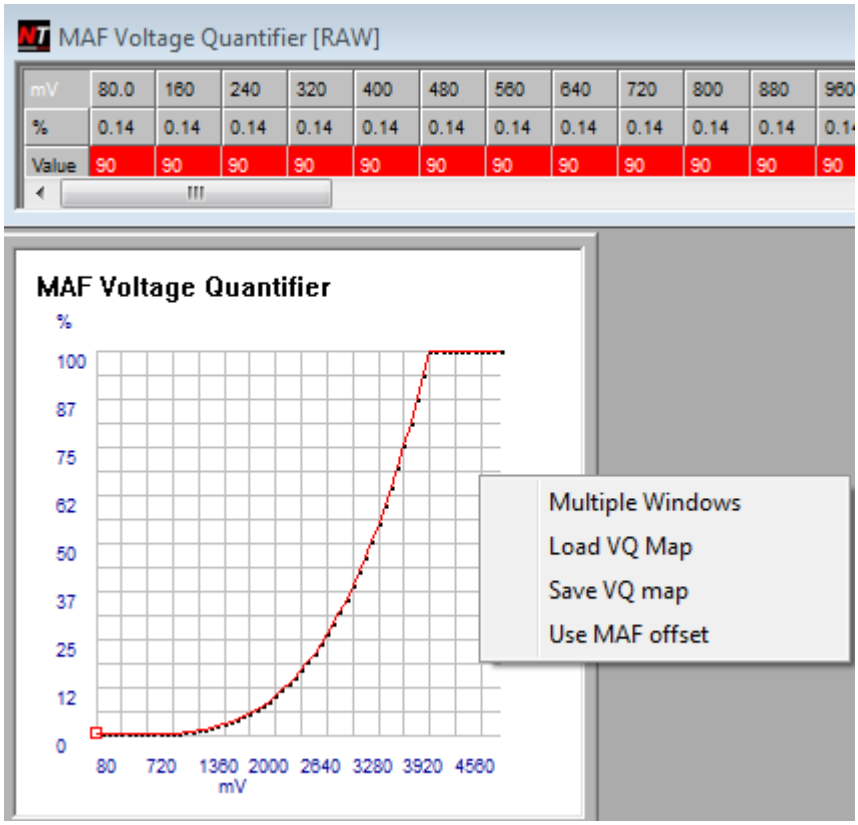
Customising VQ Maps

Changes have been made to Nistune for customisation of VQ maps. Some tuners prefer to directly manipulate the load values in the ECU. It is not something we normally recommend, but the feature has been added



Loading and Saving Custom VQ Maps

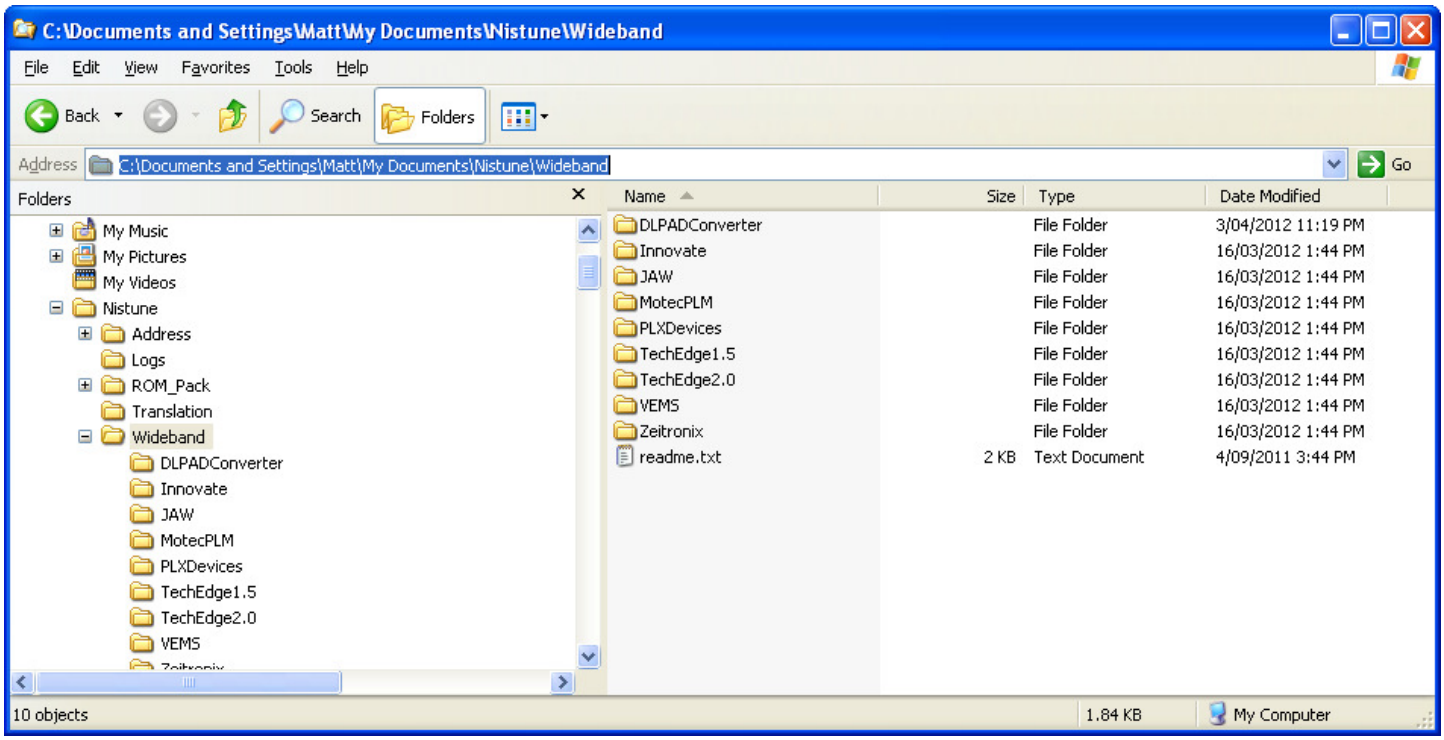
Nistune now offers the option to load and save custom VQ maps by right clicking on the MAF Voltage Quantifier graph. These will be saved in the VQ Map folder (Default location \Documents\Nistune\VQ Map)


MAF Voltage Quantifier [RAW]
mV 80.0 160 240 320 400 480 560 640 720 800 880 960
% 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14
Value 90 90 90 90 90 90 90 90 90 90 90 90
MAF Voltage Quantifier
%
100
87
75
62
50
37
25
12
0
80 720 1360 2000 2640 3280 3920 4560
mV
Multiple Windows
Load VQ Map
Save VQ map
Use MAF offset

14. Configuring Wideband Auxiliary Inputs

Files for Wideband Auxiliary inputs are located in the Wideband Folder under your Documents/<user>/Nistune installation folder

C:\Documents and Settings<user>\My Documents\Nistune\Wideband



There are eight files you can modify using Notepad, depending on Wideband Type:

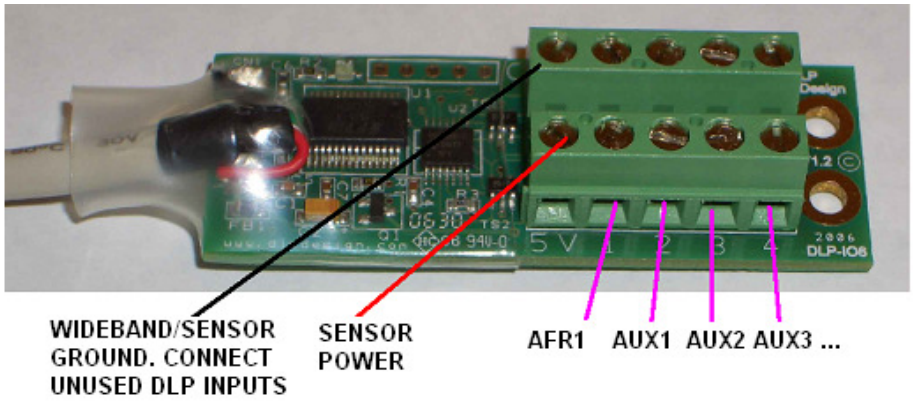
afr1.csv
afr2.csv
aux1.csv
aux2.csv
aux3.csv
aux4.csv
aux5.csv
aux6.csv

See next page for more details.

Note: Not all wideband units require CSV files for translation (such as AEM UEGO and ASPX which directly report AFR without need to convert the data)

WIDEBAND DEVICES

DLP A/D Converter



Select Wideband directory
C:\users\<name>\Documents\Nistune\Wideband\DLPADConverter

- AFM Auxiliary input 1 (0 - 5 volts, Ground) - **afr1.csv**
- Auxiliary input 2 (0 - 5 volts, Ground) - **aux1.csv**
- Auxiliary input 3 (0 - 5 volts, Ground) - **aux2.csv**
- Auxiliary input 4 (0 - 5 volts, Ground) - **aux3.csv**
- Auxiliary input 5 (0 - 5 volts, Ground) - **aux4.csv**
- Auxiliary input 6 (0 - 5 volts, Ground) - **aux5.csv**

TechEdge

Version 1.5 Select Wideband directory
C:\users\<name>\Documents\Nistune\Wideband\TechEdge1.5

Version 2.0 Select Wideband directory
C:\users\<name>\Documents\Nistune\Wideband\TechEdge2.0

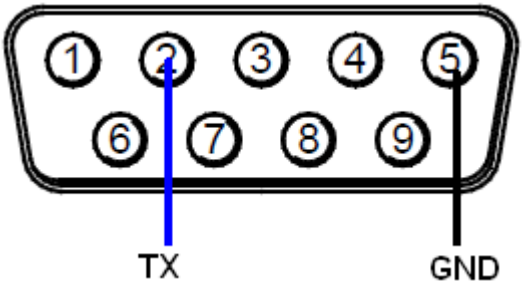
- Auxiliary input 1 (0 - 5 volts, Ground) - **aux1.csv**
- Auxiliary input 2 (0 - 5 volts, Ground) - **aux2.csv**
- Auxiliary input 3 (0 - 5 volts differential input) - **aux3.csv**
- Auxiliary input 4 - **aux4.csv**
- Auxiliary input 5 - **aux5.csv**
- Auxiliary input 6 - **aux6.csv**

Zeitronix

Select Wideband directory
C:\users\<name>\Documents\Nistune\Wideband\Zeitronix
- Exhaust Gas Temperature *(no lookup file)*
- Boost *(no lookup file)*
- TPS *(no lookup file)*
- Auxiliary input - **aux1.csv**

AEM UEGO
No lookup files

From AEM documentation using serial port:

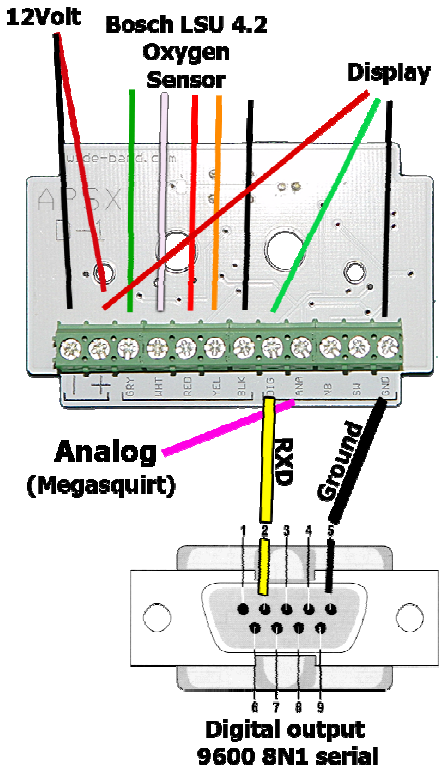


Serial Output
To run the data stream, a RS-232 (DB-9) Female Receptacle shall be purchased. Two wires need to be connected to a RS-232 serial port. The BLUE wire from the AEM UEGO Gauge shall be connected to Pin #2 (RX) on the serial port for receiving data. Pin # 5 (GND) on the serial port shall be grounded.

Check the serial output of your AEM UEGO using Hyperterminal, Teraterm or similar ASCII terminal program.

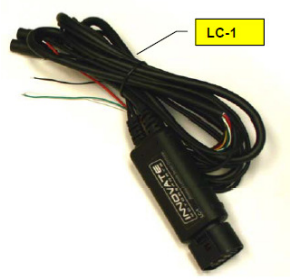
APSX Wideband

This wideband uses the same selection as the AEM UEGO in the software



Serial Output
To run the data stream, a RS-232 (DB-9) Female Receptacle shall be purchased. Two wires need to be connected to a RS-232 serial port. The YELLOW wire from the APSX Gauge shall be connected to Pin #2 (RX) on the serial port for receiving data. Pin # 5 (GND) on the serial port shall be grounded.

Innovate MTS



LC-1 Analog connections

Blue Heater Ground / **White** System Ground
Green Analog Ground (some models)
Yellow Analog out 1 (0-1 volt output default)
Brown Analog out 2 (0-5 volt output default)

LM-2 Analog connections

Using analog cable (0-5 volt output default)
Lime Green Analog Out 1+
Yellow Analog Out 1 -

Select Wideband directory
C:\users\<name>\Documents\Nistune\Wideband\Innovate

Configurable inputs:
First allocated auxiliary 5 volt input - **aux1.csv**
Second allocated auxiliary 5 volt input - **aux2.csv**
Third allocated auxiliary 5 volt input - **aux3.csv**
Fourth allocated auxiliary 5 volt input - **aux4.csv**
Fifth allocated auxiliary 5 volt input - **aux5.csv**
Sixth allocated auxiliary 5 volt input - **aux6.csv**

PLX R-Series

Select Wideband directory
C:\users\<name>\Documents\Nistune\Wideband\PLXDevices

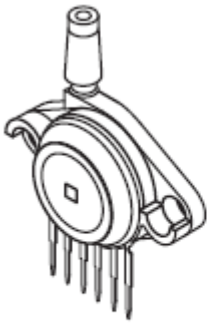
- Auxiliary input 1 - 5 volt input - **aux1.csv**
- Auxiliary input 2 - 5 volt input - **aux2.csv**
- Auxiliary input 3 - 5 volt input - **aux3.csv**

Ensure that auxiliary input 4 of your unit is configured to be AFR. This is what Nistune uses.
VEMS

Select Wideband directory
C:\users\<name>\Documents\Nistune\Wideband\VEMS

- Auxiliary input 1 - 5 volt input - **aux1.csv**
- Auxiliary input 2 - 5 volt input - **aux2.csv**
- Auxiliary input 3 - 5 volt input - **aux3.csv**

Motorola MPX2450 Boost Sensor



GAUGE PORT OPTION
CASE 867B, STYLE 1

PIN NUMBER			
1	V_{out}	4	N/C
2	Gnd	5	N/C
3	V_S	6	N/C

NOTE: Pins 4, 5, and 6 are internal device connections. Do not connect to external circuitry or ground. Pin 1 is noted by the notch in the lead.

Connect to an auxiliary input on your wideband unit (where supported). Must be supplied with 5 volts input, GROUND and outputs a 0 – 5signal on pin 3.

LOOKUP TABLES

Innovate LC1,LM-2, others

AFR
0000,7.35
1023,22.39

Other AUX inputs use 0-1023 input range mapping to 0-5V range for example, or your other preferred unit of measurement

AUX1
0,0
1023,5.0

PLX Devices

LPX-AFR
0000,10
5000,20

SLC Devices
(0[v] @ 0.68 Lambda linear to 5[v] @ 1.36 Lambda)

SLC-AFR
0000,10
5000,20

Zeitronix
(AFR = Volts * 2 + 9.6)

Zeitronix-AFR
0000,9.6
5000,19.6

Motorola MPX2450 Boost Sensor

AUX1-PSI
0000,-1.57
1000,6.134
2000,13.84
3000,21.54
4000,29.25
5000,36.97

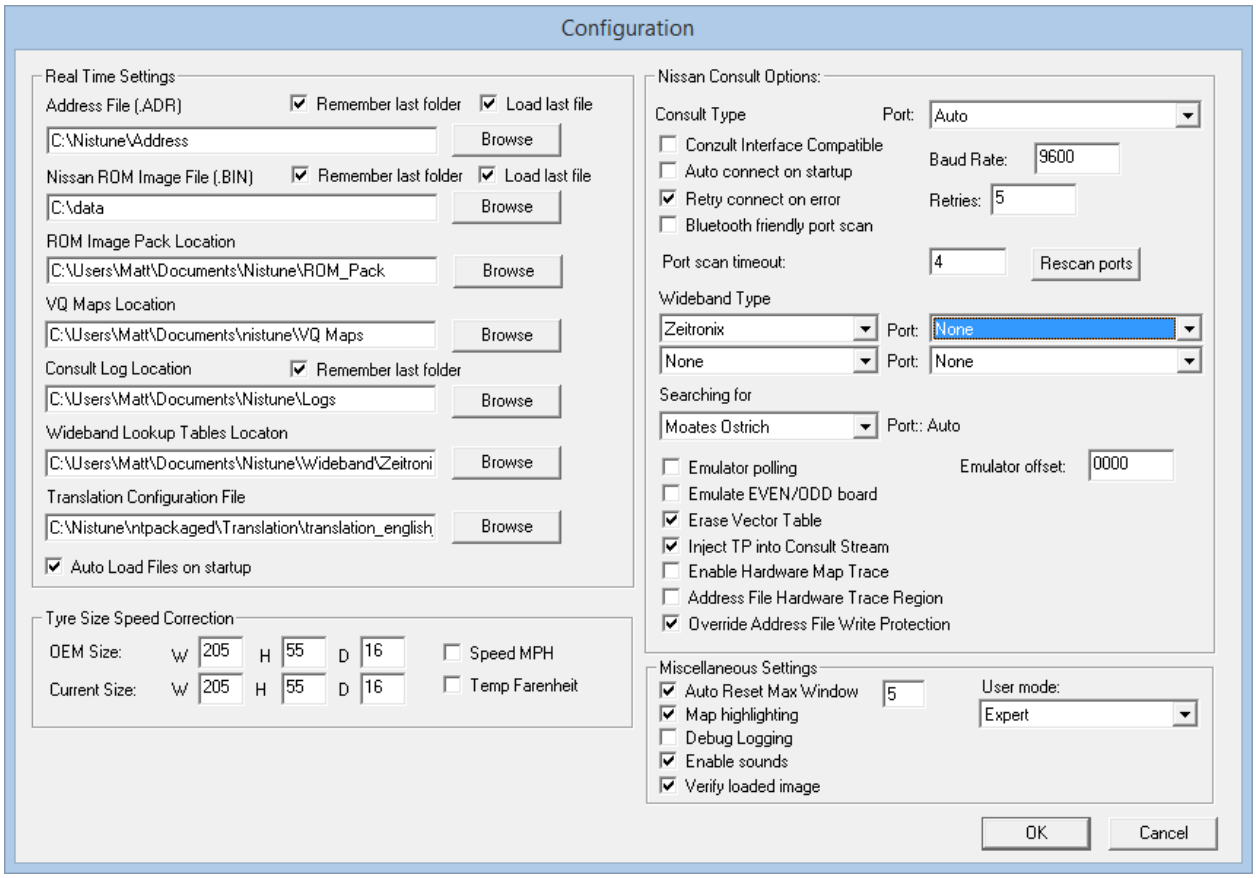
AEM UEGO

AEM AFR
0,10
160,10.32
310,10.62
470,10.94
620,11.24
780,11.56
940,11.88
1090,12.18
1250,12.50
1400,12.80
1560,13.12
1720,13.44
1870,13.74
2030,14.06
2180,14.36
2340,14.68
2500,15.00

2650,15.30
2810,15.62
2960,15.92
3120,16.24
3280,16.54
3430,16.86
3590,17.18
3740,17.48
3900,17.80
4060,18.10
4210,18.42
4370,18.74
4520,19.04
4680,19.36
4840,19.66
4990,19.98

15. Setting up Wideband

First setup your Wideband Type and Wideband Lookup Tables location.



The above example sets up Wideband for Zeitronix with the correct Tables Location, Wideband Type and Communications port (For example COM3)

Opening one of these files in a text editor (or Microsoft Excel and ensuring you save as CSV format) will show something similar to the following:

Aux1
0000,0
1000,1
1500,1.5
2000,2
2500,2.5
3000,3
3500,3.5
4000,4
4500,4.5
5000,5

This is an interpolation table. The voltages (in millivolts) are on the left hand side, and the onscreen value they translate to on the right hand side

You may have an auxiliary device which maps 0 - 5 volts into a temperature range or other measurement for example. The table can be changed to change reporting from raw voltages to something useful by adjusting this table. Values between those specified are linearly interpolated to give an estimated figure between.

The name of the input on your display can be changed, by altering from 'Aux1' for example to your own input description. This will be displayed as such within Nistune, next time you start the application.

There are also CSV files for your AFR which are reported. This is used by TechEdge and PLX units. Sample base files are provided for both units, so copy those into the files below when using the sensors.

afr1.csv (Wideband 1 AFR)
afr2.csv (Wideband 2 AFR)

Nistune now supports a second AFR sensor for two AFR inputs. All auxiliary inputs come off the first sensor unit.

If you require additional serial ports, we recommend a decent quality USB-Serial converter. Those with good quality chipsets such as FTDI usually give good results. Cheaper varieties sometimes do not transfer data correctly as per RS232 specifications.

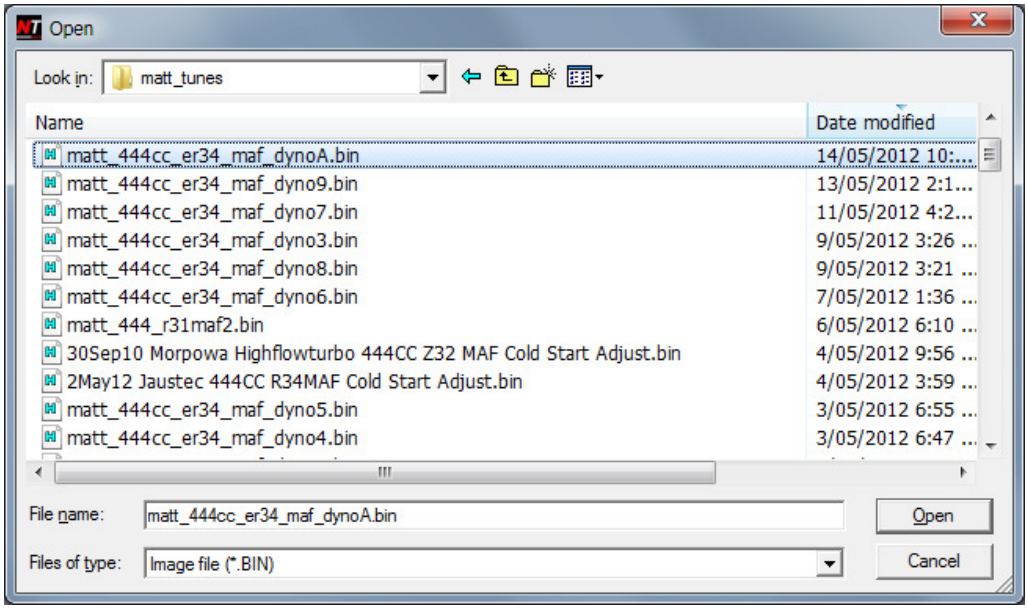
16. User Created ENT Files

Nistune boards are programmed with Nissan ROM (incorporating ECU program and Nissan tuned maps) and modifications to the Nissan Consult code to allow retuning of these maps.

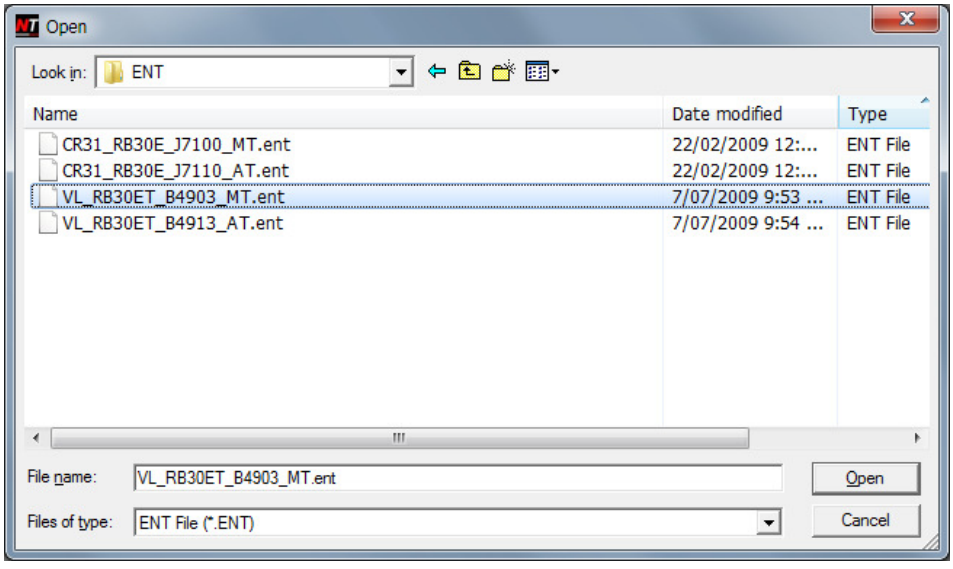
The files used to program these boards are called ENT files which are located in the ROM pack. Occasionally workshops wish to program up a board with a custom tune and send to the customer. Nistune now provides the functionality to perform this procedure

Load address file matching vehicle tune (File > Select Vehicle)

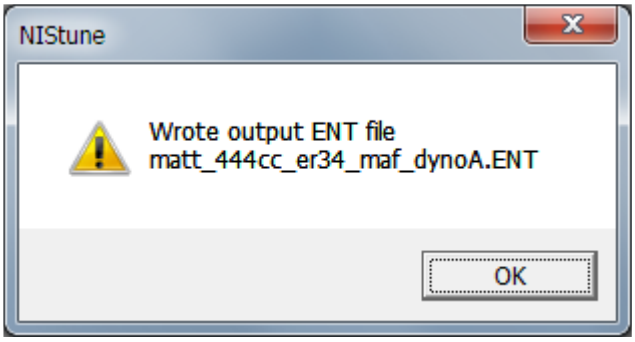
Load custom tune image matching address file (File > Open Main ECU Image)



Load the matching ENT file for this ECU from the ROM Pack (File > Create ENT File)



Output ENT file is now written to the ENT folder



NOTES

This procedure loads an ENT file and then copies the maps defined in the address file form the Main image loaded to the ENT file opened and then resaves the ENT file.

This procedure will not create an ENT file from scratch as that process is separate and can only be performed at Nistune where code patching utilities are used. If you have custom ROM code which needs to be generated please contact us with the BIN file you need patched.

17. PIN Locking Functionality

PIN locking provides workshops and owners with the ability to prevent unauthorised syncing with Nistune boards. Special software and firmware updates were created to allow this functionality

PIN locked boards can be determined by the (U) for unlocked or (L) for locked indicator after the ECU part number

The default PIN number used on all Nistune boards from factory is ***0000***.

To remove a previously programmed PIN, reset the current PIN to 0000

IMPORTANT NOTICE
PIN locking once performed cannot be undone without using the original PIN allocated.

Write down and remember your PIN. If you have lost your PIN the board will need to be reprogrammed with the factory base image containing the default PIN

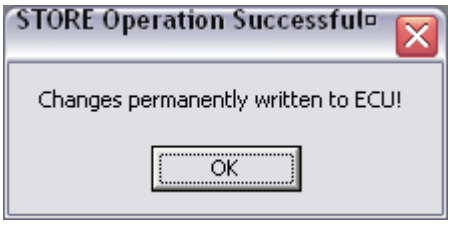
Nistune Developments will not retrieve PIN numbers from boards or pull maps from ECUs in order to protect the original tuners intellectual property. We will provide a base image however where required at the customers cost.

We provide this functionality the same as other aftermarket ECU manufacturers. We will not be involved in disputes involving workshops locking PIN numbers to boards. **You must send the board back to us for reflashing to factory, or use a base image programmer to reset to factory if the PIN is lost.**

ECU Locking
ECU locking can be performed from the menu **Operations** > **Write PIN to board**

Once a four digit PIN is entered the OK button becomes available

Burn operation is performed on the board to save the PIN



Successful PIN lock will be confirmed

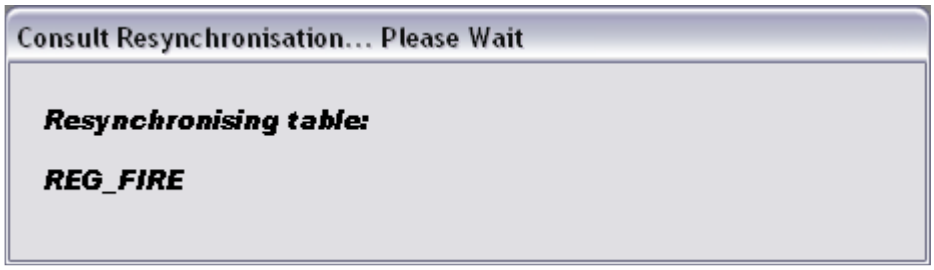
ECU Unlocking

A previously locked board will display (L) for locked next to the part number.

ECU: 23710-04U01 REV: 15 (L)

Normal operations can be performed with this ECU in regards to connectivity, data logging and active tests. However synchronising images from the board will require a pin number.

When using the upload/download buttons the user will be presented with an unlock request



18. Speed Trial

Speed trial is a feature which measures the amount of time to reach a particular speed (in km/h). It is accessed from the **Operations > Speed Trial** menu item.

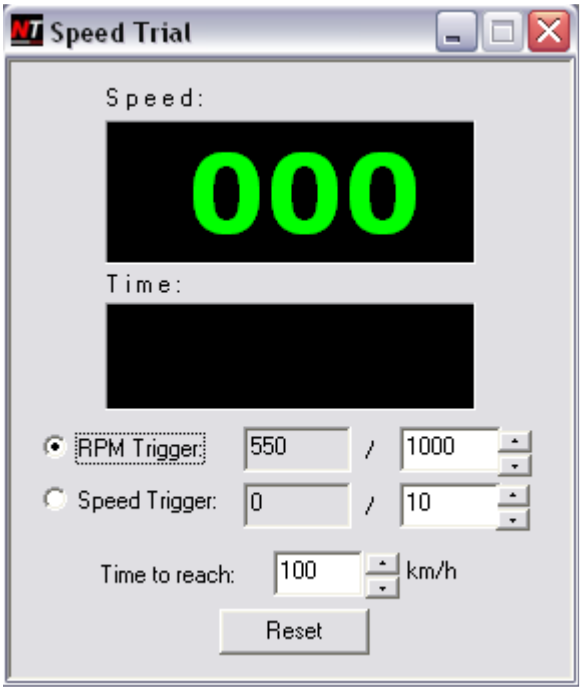
IMPORTANT NOTE

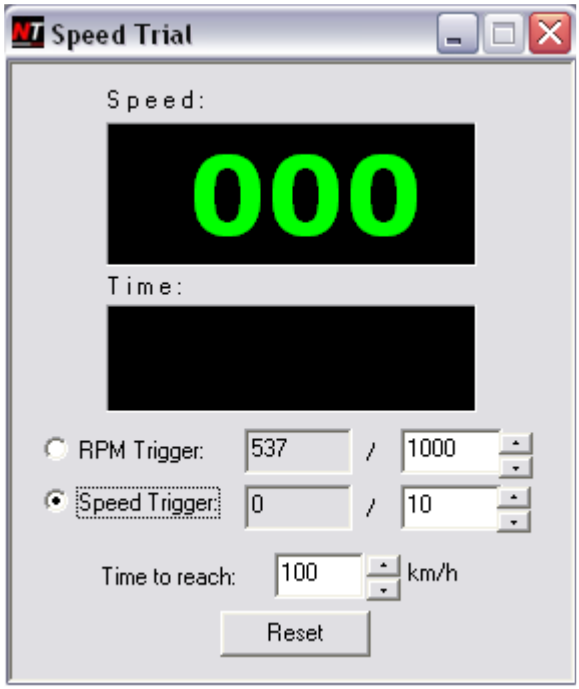
This feature should not be used on public roads. Laws in most countries state that electronic equipment should not be operated whilst driving a vehicle. Nistune advises that a second person should operate the computer whilst using this feature.

OPERATION

1. Speed trial is activated when either RPM or speed trigger is reached. Select the trigger you would like to use and then specify the trigger point on the right hand side. Current RPM and speed are displayed in the greyed left box. Once the selected item exceeds the inputted value the trial counter will commence.

2. Set the desired maximum speed that you intend to reach

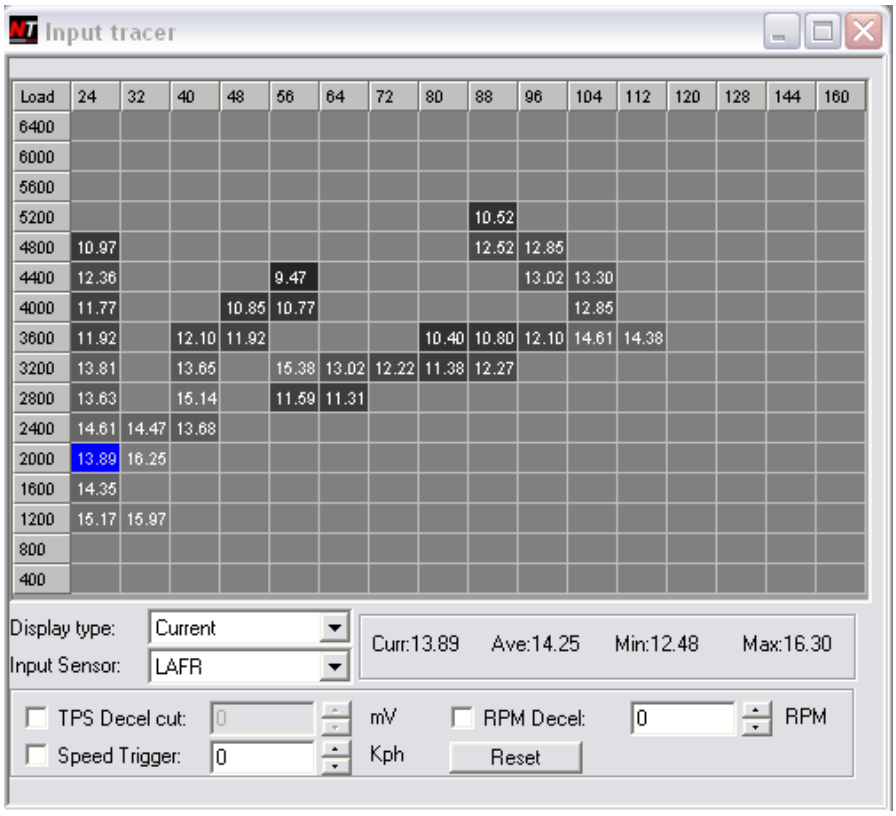




3. Accelerate the vehicle and the computer will quickly beep. Once the vehicle reaches the 'time to reach' speed then the computer will beep a second time and the acceleration can be ceased. The time resulting is displayed and can be reset for subsequent trials.

19. INPUT TRACER

Input tracing offers the tuner the ability to monitor live data and playback (using the log player) current boost, knock count (selected ECUs only), AFR, EGT as well as consult input data against an RPM and TP (load) grid



Operations

1. Select the display type of data:
   (a) Current is the most recent data which is read from input sensors (either live or from the log files).
   (b) Min is the lowest value read
   (c) Max is the higher value read
   (d) Average is the sampled average of values read
   (e) Count will display the number of samples of data read so far

2. Select the current input sensor to display. All data recorded live or during logging is recorded in the background. You can change the data you wish to display (eg from AFR to boost) at any time.

3. Select your conditions for filtering the trace. There are times that you may not wish to record data (for example last recorded data on deceleration or during idle will affect display results). There are filtering options available using the tickboxes on the display

(a) ***TPS Decel cut***. Specify the minimum TPS voltage (when available) to not record data. Note: Earlier ECUs with no variable TPS input will only use the TPS idle switch

(b) ***Speed trigger***. Specify the starting point to begin the trace. This is a once only switch on condition (for example all recording will begin from 20km/h)

(c) ***RPM Decel***. Specify the amount of RPM to stop updates on. For example if RPMs fall below a set 900rpm then no data is recorded until going above this value again after deceleration.

4. Once the vehicle is driven or log is played back then when these conditions are exceeded the trace will be displayed. Clicking on any particular cell will show current, average, minimum and maximum values for that cell

5. The log player >>> speed up button can be used to fast run a log for display using this feature

6. Click on a cell to display the current cell details (as well as min, max and average for the cell)

20. ACTIVE TESTING

Consult active testing is a feature of the Nissan standard factory ECU. It is available on vehicles with no Nistune board fitted however it is not implemented on Nistune Type 1 boards. So early model ECUs do not have this facility available.

NOTE

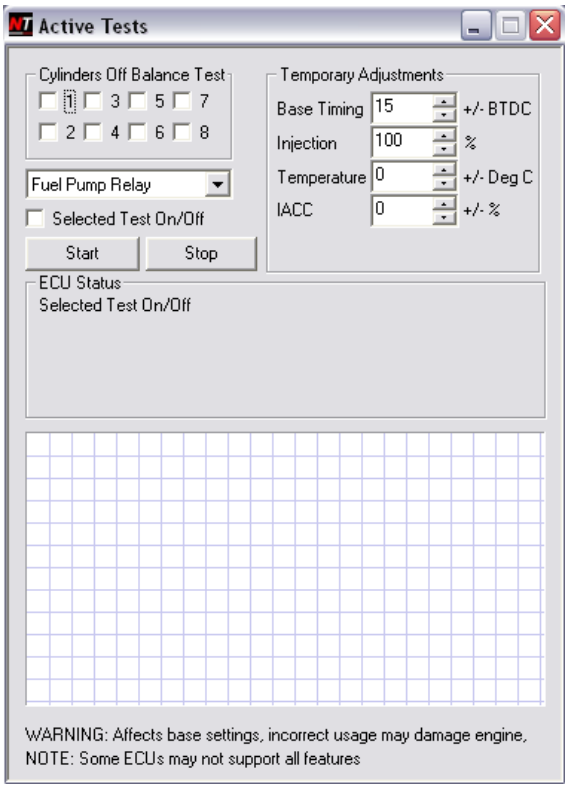
The functionality of active testing varies between model of vehicle. For example on HCR32 Skyline there are only 2 injector drivers for the 6 injectors on the vehicle, so 'cylinder off balance test' is not possible on this vehicle. Similar applies with some other functionality on different ECUs.

IMPORTANT

There is no checking of data by the ECU so improper settings can be sent to the ECU which may cause damage (including improper timing and overly rich or lean injection). Ensure the settings that you use are correct for the vehicle

OPERATION

Active testing is available from the ***Operations > Active Tests*** menu option



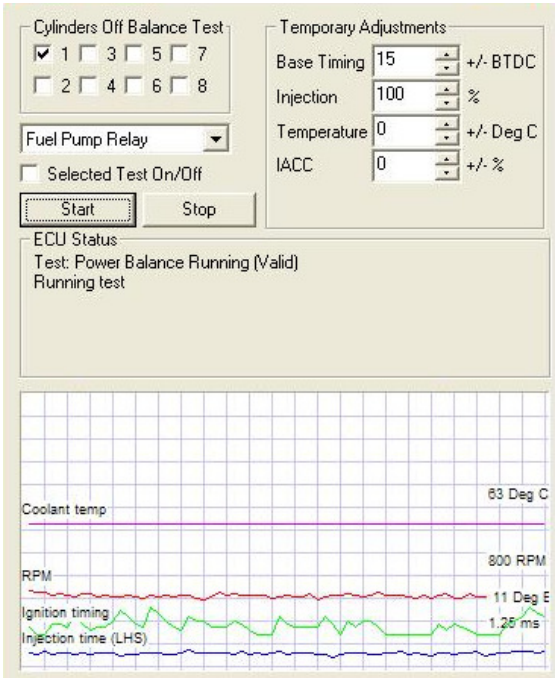
Usage requires selecting the tests required by changing their parameters. The test will be displayed under 'ECU Status' as being 'Set' and then clicking ***Start*** to begin the testing will change the status to 'Run'.

Regular consult functionality will cease whilst the active tests are operational. A subset of consult parameters are available for display (note these are different to the initial register selection when first connecting to consult)

TESTS

1. ***Cylinder off balance test***

Select the cylinders to turn off whilst the engine is running and then hit ‘start’. Used to determine a non functioning injector or ignition source by cutting each cylinder one by one

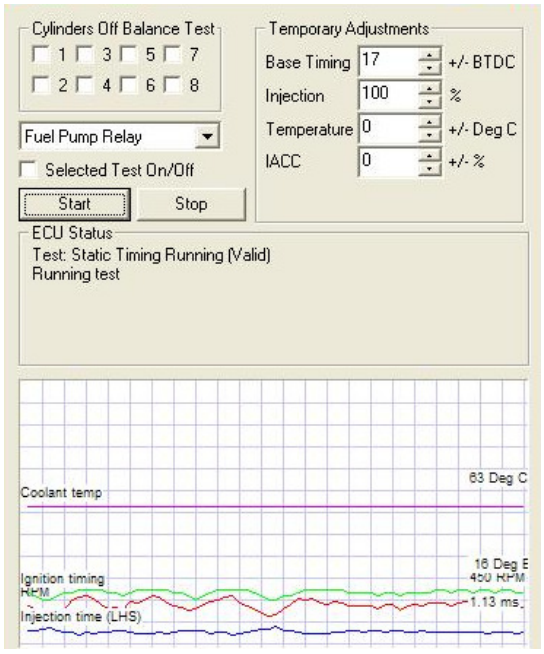


The vehicle will adjust ignition timing based on the current RPMs and the target idle RPM table (normally about 800-850rpm on most Nissans)

2. Base Timing

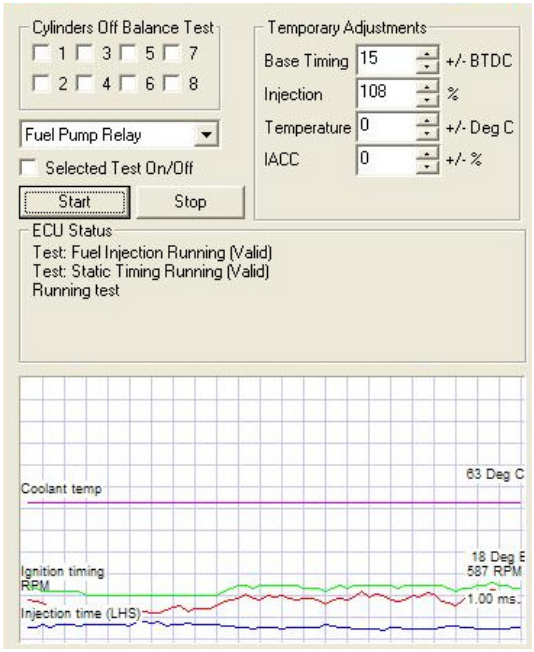
Makes the ECU aim its base timing on the set amount. This must be changed from the default 15 BDTC in order to register the test “Test: Static Timing”

Note that not all ECUs will show the current timing parameter in the scrolling log window. Timing will need to be observed using a timing light on those ECUs.



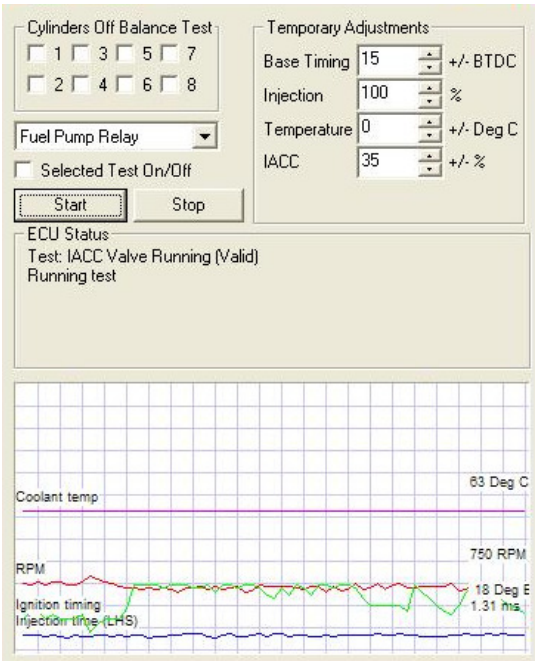
3. Injection adjustment

Adjusts the amount of injection by percentage



4. IACC Valve adjustment

Changes the duty cycle of the IACC valve by a set percentage. This will affect idle operation of the vehicle

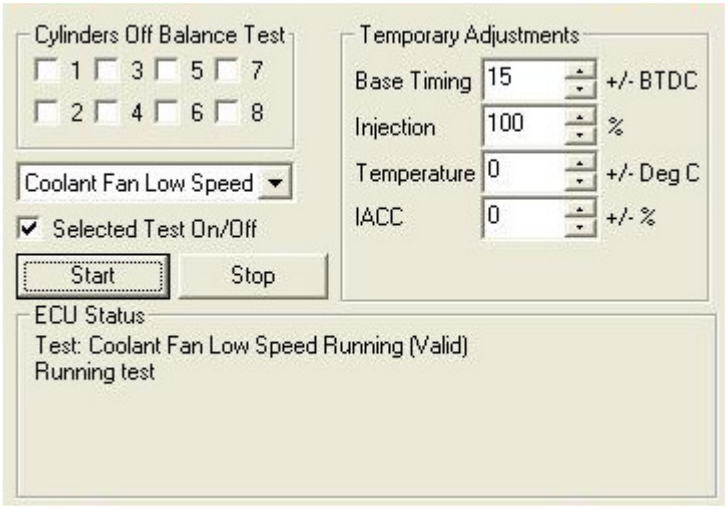


5. Other ECU Selected On/Off tests

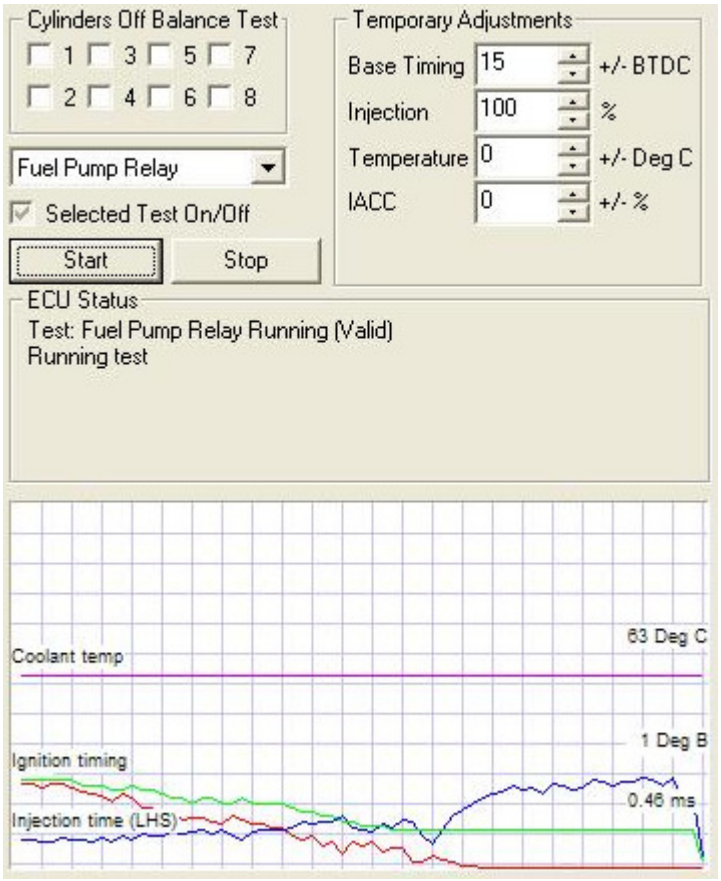
Other ECU dependent tests can be run from the Drop Down list showing ‘Fuel pump relay’ at the top of the list.

Select the test(s) from the drop list and then tick once to enable the operation, twice to disable the operation or third time to undo the selection

For example with the R34 Skyline the coolant fan can be switched on and off. The following operation turns on the fan:



The following operation to disable the fuel pump relay will stall the car after it runs out of fuel:



Closing the Active Tests window will resume to normal consult functionality inside Nistune.

21. Knock / Warning Panel

The knock / warning panel is available by pressing ‘D’ inside Nistune as a short cut key or from the menus via
Display > Knock Warning Panel

This panel allows you to view parameters in a large font and also assign warning limits against the numbers which will cause the laptop to ‘beep’ when a parameter has been exceeded.

KNOCK COUNT

Most Nissan ECUs contain knock sensing functionality. These use one or two knock sensors bolted to the engine block and inside the ECU circuitry containing narrow band frequency filter. Once the knock signal has passed through the filter, an input to the Nissan ECU firmware is provided as a digital pulse

On earlier model ECUs Nistune has been modified to collect the pulse counts and provide these to the operator. Knock detection counting is provided on the following earlier model vehicles:

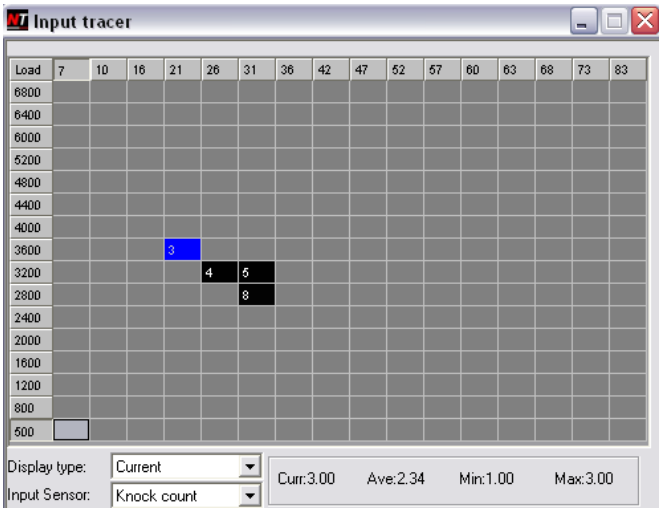
VL Turbo RB30ET
HR31 RB20DET
S13 CA18DET
HCR32 RB20DET

(Note vehicles with knock sensing firmware but no knock sensor fitted, or a NA ECU with no knock board fitted may continuously increase knock count due to the knock input being active. In this case the warning should be ignored)

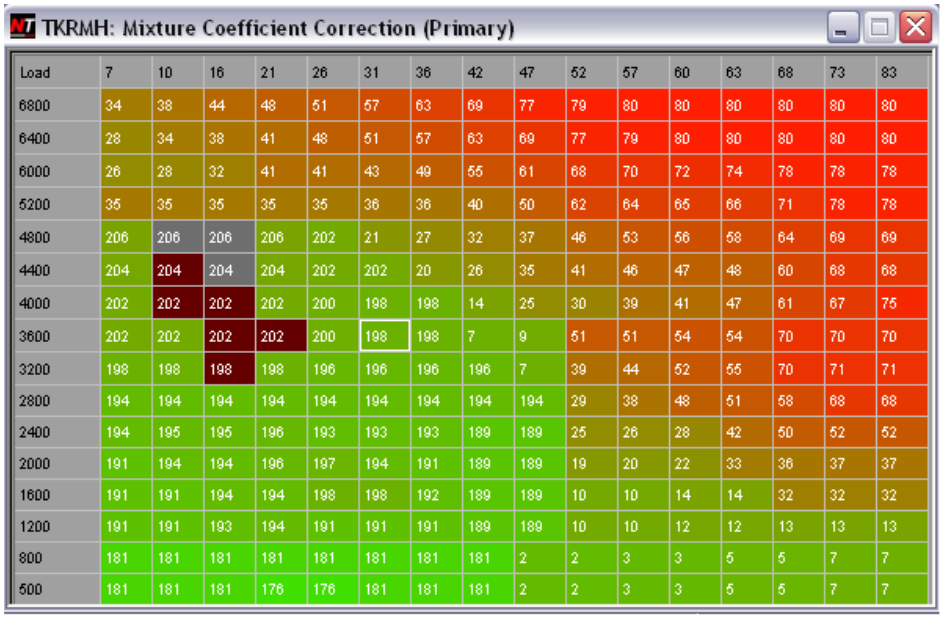
Knock detection counting firmware is also in progress for the BNR32 RB26 and Z32 VG30DETT at this time. Once these are completed and working then knock detection and counting will be worked on for other vehicles such as SR20 based vehicles. Vehicles without this feature supported in later versions of Nistune will have the top part of this panel greyed out.

The knock count will increase and ‘knock’ will flash for a short time each time the knock count exceeds the set minimum pulse count (in the below example using a default of ‘5’ minimum counts).

The counts are number of pulses per cell basis as can be seen in the input tracer window

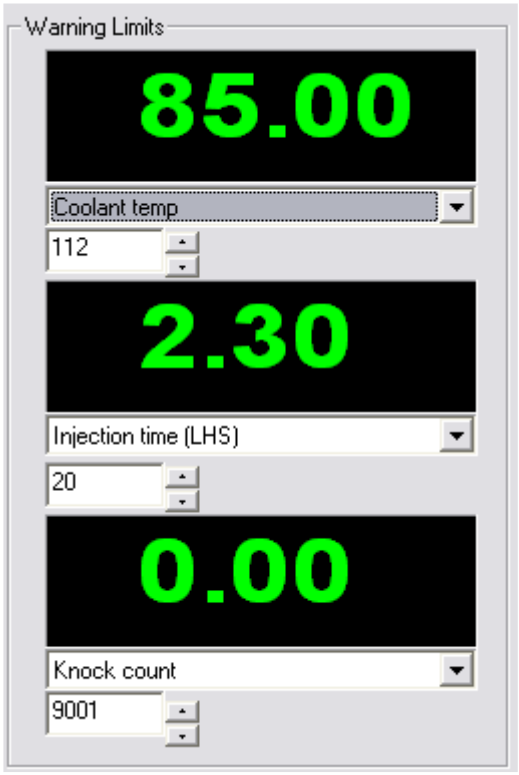


This is also available for display on the fuel map window displayed as darker reddish cells when the knock count has exceeded the value in the knock warning panel.



Load	7	10	16	21	26	31	36	42	47	52	57	60	63	68	73	83
6800	34	38	44	48	51	57	63	69	77	79	80	80	80	80	80	80
6400	28	34	38	41	48	51	57	63	69	77	79	80	80	80	80	80
6000	26	28	32	41	41	43	49	55	61	68	70	72	74	78	78	78
5200	35	35	35	35	35	36	36	40	50	62	64	65	66	71	78	78
4800	206	206	206	206	202	21	27	32	37	46	53	56	58	64	69	69
4400	204	204	204	204	202	202	20	26	35	41	46	47	48	60	68	68
4000	202	202	202	202	200	198	198	14	25	30	39	41	47	61	67	75
3600	202	202	202	202	200	198	198	7	9	51	51	54	54	70	70	70
3200	198	198	198	198	196	196	196	196	7	39	44	52	55	70	71	71
2800	194	194	194	194	194	194	194	194	194	29	38	48	51	58	68	68
2400	194	195	195	196	193	193	193	189	189	25	26	28	42	50	52	52
2000	191	194	194	196	197	194	191	189	189	19	20	22	33	36	37	37
1600	191	191	194	194	198	198	192	189	189	10	10	14	14	32	32	32
1200	191	191	193	194	191	191	191	189	189	10	10	12	12	13	13	13
800	181	181	181	181	181	181	181	181	2	2	3	3	5	5	7	7
500	181	181	181	176	176	181	181	181	2	2	3	3	5	5	7	7

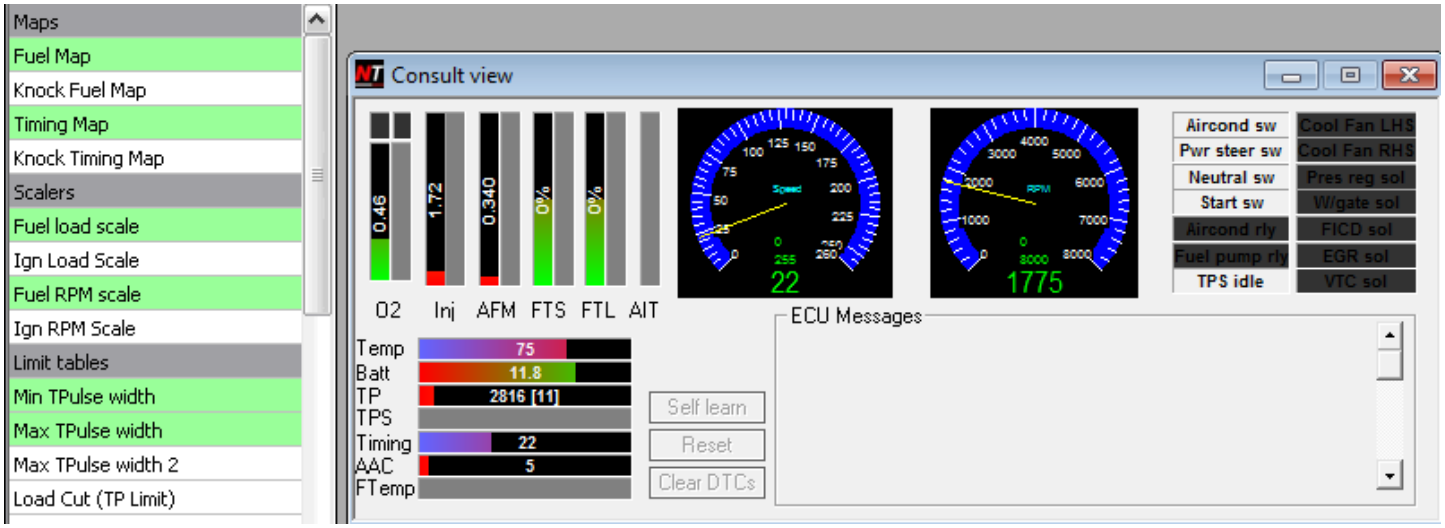
Other items for display can also be set on this panel. Further improvements to the software for dynamic gauges will be implemented in the future for better customisation.



22. Map Highlighting

Nistune also provides an indication of which current maps are being accessed by the ECU. This functionality has been made available for all vehicles which use knock sensing.

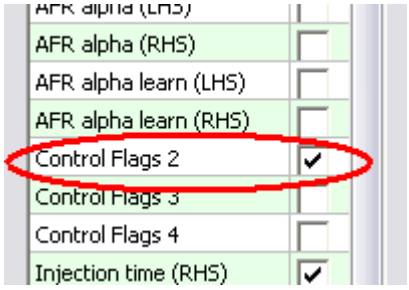
These indications are provided by the form of green highlighting in the map listings on the left hand side of the Nistune screen, and text display on the knock / warning panel screen. The highlighting is based on inputs from the ECU including if knock maps are being detected as well as TPS idle switch, neutral switch, RPMs, crank signal, coolant temperature etc.



23. Variable Cam Timing

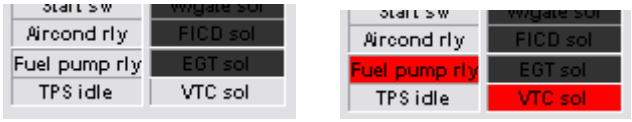
Nissan provides Variable Cam Timing (VCT) on later model vehicles. This may also be refered to as VTC (Variable Timing Control) for control by the ECU. The Nissan ECU provides control of the VCT solenoid on the engine and Nistune allows you to monitor and change the conditions to switch the solenoid on and off.

In order to view when the VCT solenoid is enabled you must select the Consult Digital Control Register #2 from the selection when first connecting to the ECU



Consult Register Selection

When selecting this register the VCT Sol indicator in the 'Consult View' window becomes available. Light grey means that it is switched off and RED means that it is enabled. This functionality requires Nistune 0.10.17 or later for correct indication in Tuner Mode.

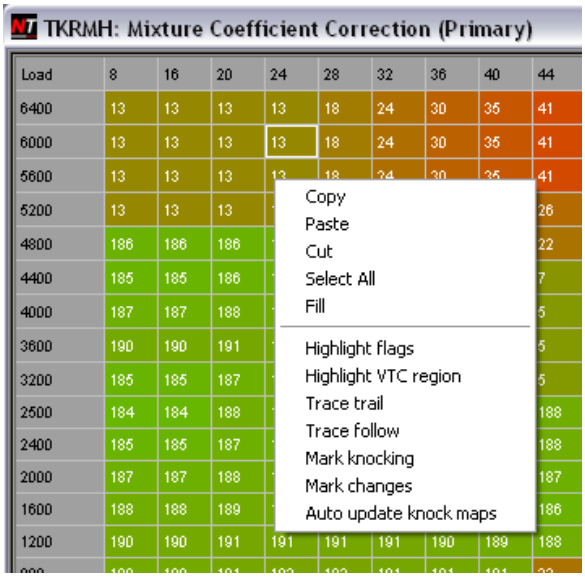


Consult View Indicators

In order to view when the VCT solenoid is enabled you must select the Consult Digital Control Register #2 from the selection when first connecting to the ECU

Important: For VCT to function on your vehicle the ECU must have a valid speed signal. There is a VTC Min speed enable parameter which must be met before VCT will enable.

Right clicking on the fuel map will pull up a context menu. This provides a 'Highlight VTC region' option which enable you to view the VCT area enabled

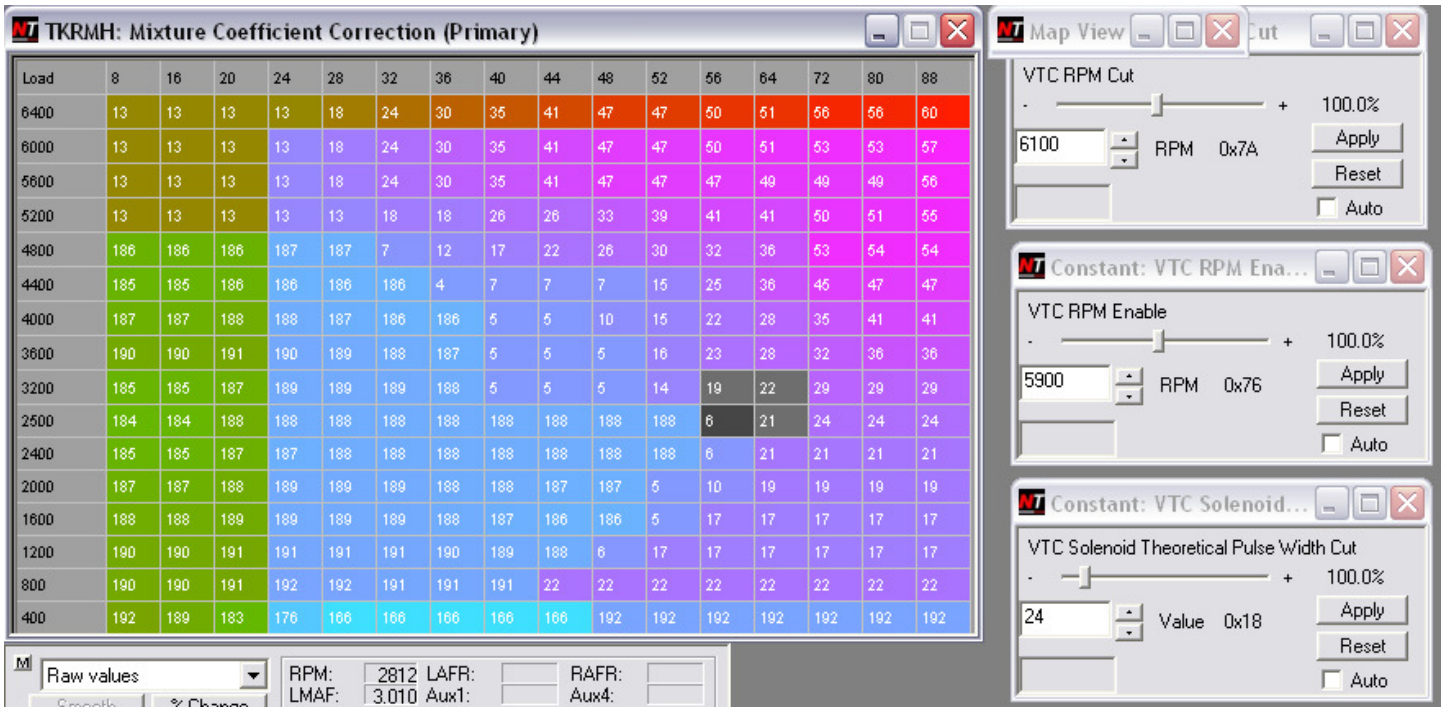


VTC Highlight Menu Option

The following screen shows the fuel map with the VTC overlays. These overlays show the point at which the VTC is enabled (based from a minimum TP load input) up to the RPM cut point.

On deceleration the VTC will be reenabled at the VTC RPM enable point. Some ECUs have this as the same parameter and use an inbuilt hysteresis point to add a delay between enable and disable of the solenoid.

There is also an RPM offset used in the Nissan code so the parameters used are relative to where you see the VCT enable and disable in consult so the parameters may not match exactly where the solenoid enables/disables.



24. Auto Adjust AFR Settings

Nistune provides assisted Fuel map tuning using wideband feedback in the software. This is now available for earlier model Nissans (those which do not have VE trim maps).

*Note: It is only available in **Expert** user mode*

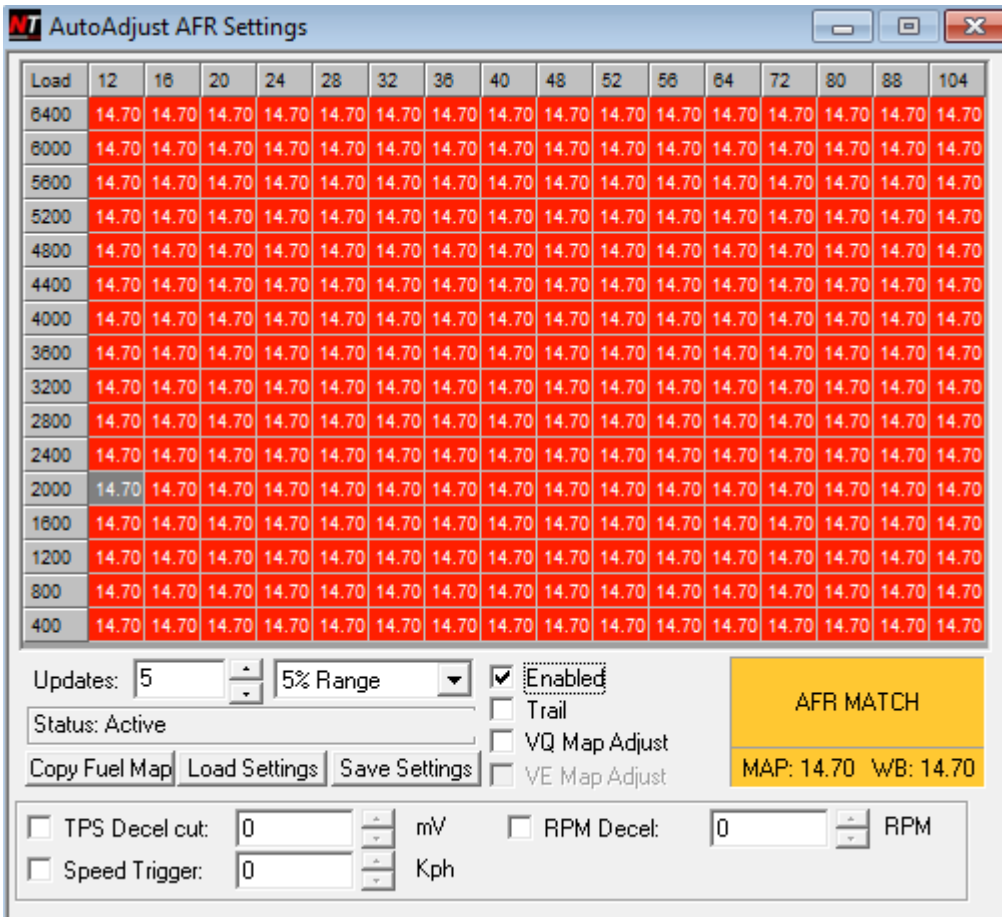
WARNING

Watch the fuel map during adjustments from the AFR adjustment. If the map appears to be going too rich or too lean, disable the AFR adjustment immediately and revert the map to a previously saved copy

Do not use this on later model vehicles (ER34, S14 KA24DE, B14 SR20DE etc) which have VE maps as these vehicles still need further developments. VE map operation is disabled in current releases of the software.

OPERATION

Access this functionality from ***Operations > AFR Auto Tuner*** in the menus. The following window will appear:



A single cursor maptrace cell will appear on the AFR adjust screen. This is the targeted cell to be modified.

It is best to start with the estimated AFRs in the fuel map and then adjust these to what you want your target AFRs to be when reading back the values on the dyno.

NOTE

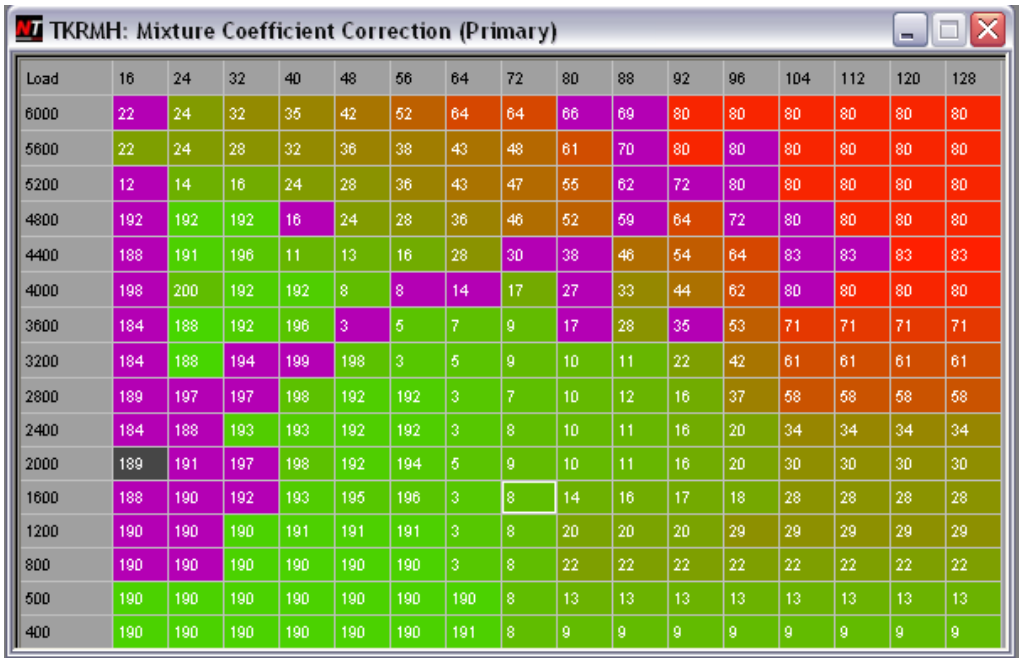
One mistake a few tuners make is assume that the displayed ‘estimated AFR’ values in the actual Fuel maps are what the ECU is targeting. This is not the case. The fuel map contains raw numbers used to adjust for final injection pulse width.

The ECU uses the fuel table to command injection, but there is no feedback to the ECU (apart from targeted stroichmetric operation targeting 14.7:1 in closed loop mode)

The concept of the AFR tuner here is to take wideband feedback and then adjust the fuel map to meet the actual read back wideband values.

TRACING RESTRICTIONS

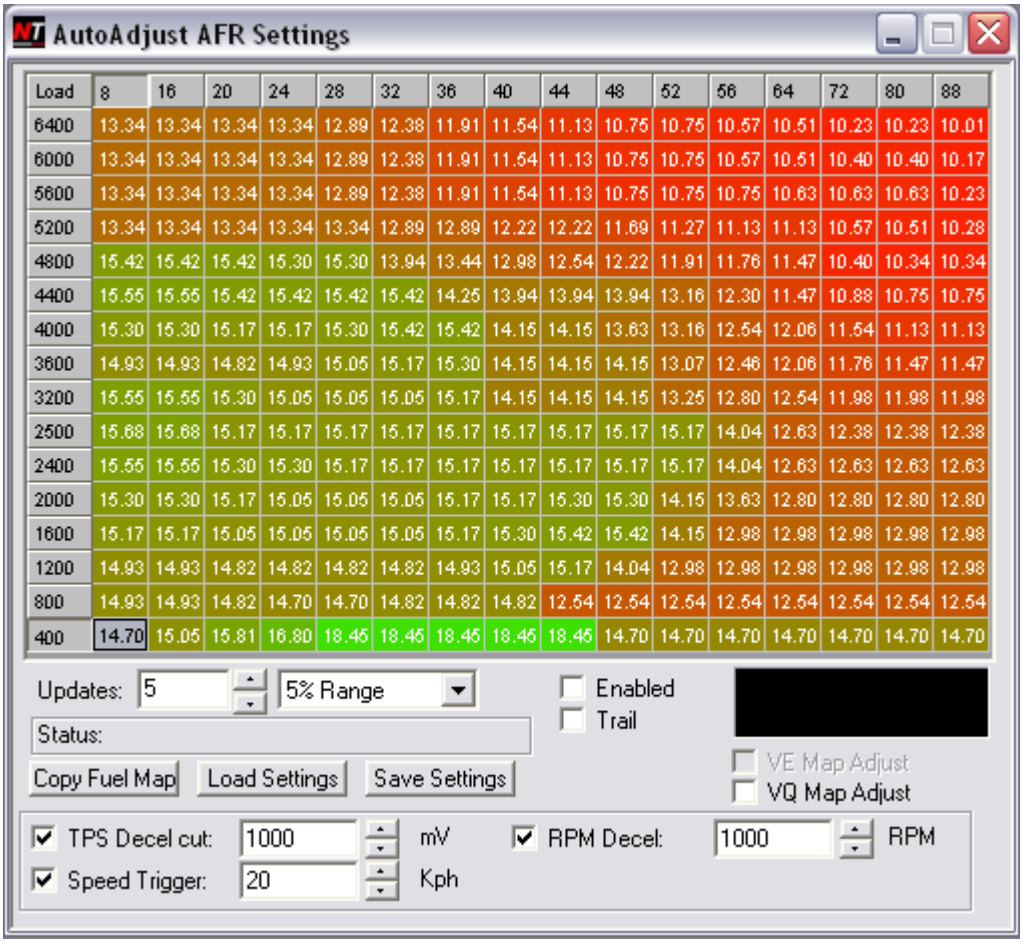
During testing we have found that the ECU will only access parts of the map. It is highly unlikely that certain areas of the map such as high load, low RPM will be reached under normal scenarios (perhaps under problematic scenarios such as bad MAF reading or during deceleration conditions)



Load	16	24	32	40	48	56	64	72	80	88	92	96	104	112	120	128
6000	22	24	32	35	42	52	64	64	66	69	80	80	80	80	80	80
5600	22	24	28	32	36	38	43	48	61	70	80	80	80	80	80	80
5200	12	14	16	24	28	36	43	47	55	62	72	80	80	80	80	80
4800	192	192	192	16	24	28	36	46	52	59	64	72	80	80	80	80
4400	188	191	196	11	13	16	28	30	38	46	54	64	83	83	83	83
4000	198	200	192	192	8	8	14	17	27	33	44	62	80	80	80	80
3600	184	188	192	196	3	5	7	9	17	28	35	53	71	71	71	71
3200	184	188	194	199	198	3	5	9	10	11	22	42	61	61	61	61
2800	189	197	197	198	192	192	3	7	10	12	16	37	58	58	58	58
2400	184	188	193	193	192	192	3	8	10	11	16	20	34	34	34	34
2000	189	191	197	198	192	194	5	9	10	11	16	20	30	30	30	30
1600	188	190	192	193	195	196	3	8	14	16	17	18	28	28	28	28
1200	190	190	190	191	191	191	3	8	20	20	20	29	29	29	29	29
800	190	190	190	190	190	190	3	8	22	22	22	22	22	22	22	22
500	190	190	190	190	190	190	190	8	13	13	13	13	13	13	13	13
400	190	190	190	190	190	190	191	8	9	9	9	9	9	9	9	9

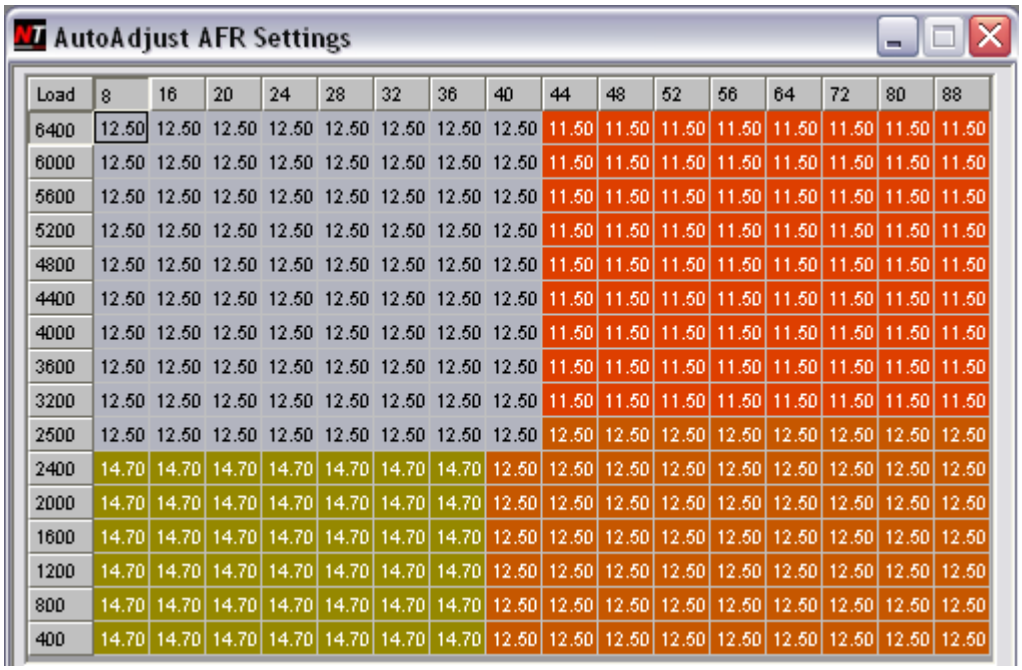
The above trace shows a vehicle going on boost. The trace goes up diagonally and then hits the start load cells on deceleration.

1. Enable 'TPS Decel cut' and specify the amount of mV to avoid any adjustment from (eg 1000mv) as well as picking a starting speed trigger (eg 20 km/h) and what RPM to stop making changes (eg from 1000rpm). Some vehicles like RB30 equiped will not have a variable TPS voltage input



Load	8	16	20	24	28	32	36	40	44	48	52	56	64	72	80	88
6400	13.34	13.34	13.34	13.34	12.89	12.38	11.91	11.54	11.13	10.75	10.75	10.57	10.51	10.23	10.23	10.01
6000	13.34	13.34	13.34	13.34	12.89	12.38	11.91	11.54	11.13	10.75	10.75	10.57	10.51	10.40	10.40	10.17
5600	13.34	13.34	13.34	13.34	12.89	12.38	11.91	11.54	11.13	10.75	10.75	10.75	10.63	10.63	10.63	10.23
5200	13.34	13.34	13.34	13.34	13.34	12.89	12.89	12.22	12.22	11.69	11.27	11.13	11.13	10.57	10.51	10.28
4800	15.42	15.42	15.42	15.30	15.30	13.94	13.44	12.98	12.54	12.22	11.91	11.76	11.47	10.40	10.34	10.34
4400	15.55	15.55	15.42	15.42	15.42	15.42	14.25	13.94	13.94	13.94	13.16	12.30	11.47	10.88	10.75	10.75
4000	15.30	15.30	15.17	15.17	15.30	15.42	15.42	14.15	14.15	13.63	13.16	12.54	12.06	11.54	11.13	11.13
3600	14.93	14.93	14.82	14.93	15.05	15.17	15.30	14.15	14.15	14.15	13.07	12.46	12.06	11.76	11.47	11.47
3200	15.55	15.55	15.30	15.05	15.05	15.05	15.17	14.15	14.15	14.15	13.25	12.80	12.54	11.98	11.98	11.98
2500	15.68	15.68	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17	14.04	12.63	12.38	12.38	12.38
2400	15.55	15.55	15.30	15.30	15.17	15.17	15.17	15.17	15.17	15.17	15.17	14.04	12.63	12.63	12.63	12.63
2000	15.30	15.30	15.17	15.05	15.05	15.05	15.17	15.17	15.30	15.30	14.15	13.63	12.80	12.80	12.80	12.80
1600	15.17	15.17	15.05	15.05	15.05	15.05	15.17	15.30	15.42	15.42	14.15	12.98	12.98	12.98	12.98	12.98
1200	14.93	14.93	14.82	14.82	14.82	14.82	14.93	15.05	15.17	14.04	12.98	12.98	12.98	12.98	12.98	12.98
800	14.93	14.93	14.82	14.70	14.70	14.82	14.82	14.82	12.54	12.54	12.54	12.54	12.54	12.54	12.54	12.54
400	14.70	15.05	15.81	16.80	18.46	18.46	18.46	18.46	18.46	14.70	14.70	14.70	14.70	14.70	14.70	14.70

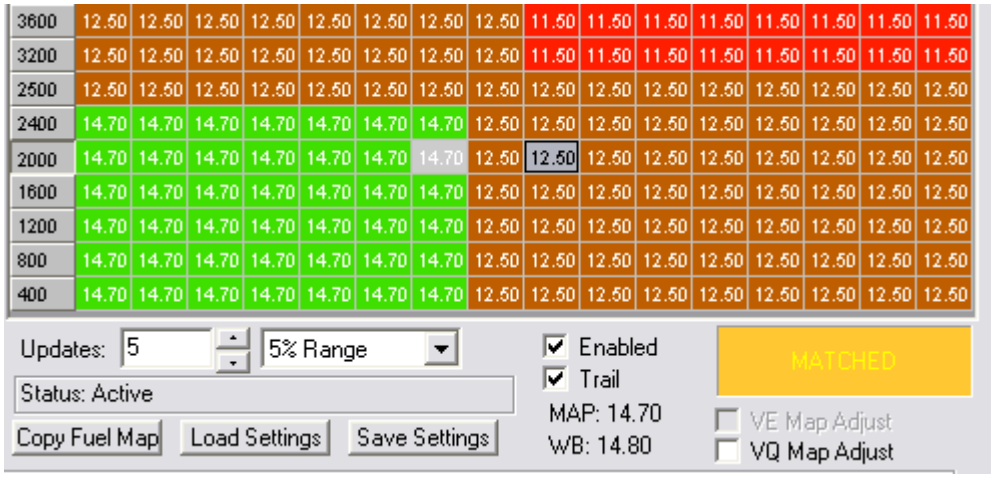
2. Next work out what AFRs you are wanting to tune against. For example on boost you may be aiming for 11.5:1 and mid range about 12.5:1 and off boost 14.7:1



4. Using keyboard short cuts with SHIFT selection allows for the operator to highlight bunches of cells and perform +/- adjustments against them. Direct entry is also available to enter in target AFRs and then using CTRL-F to fill an area of the map with those values such as the example above.

5. Connect to your wideband unit and start the vehicle. Open your fuel map to observe the changes and then tick 'Trail' in the AFR adjust window

6. Once you click enable Nistune will use the wideband (WB) feedback value to adjust the fuel map to target the cell changes towards the MAP value currently selected. When the values are in the % range required the status will highlight 'MATCHED'



7. If the wideband values are too rich then the fuel map will be pulled 'LEANER' otherwise if wideband values are too lean then the fuel map will be pulled 'RICHER' to reach the required AFRs.

8. VQ Map adjust will alter the MAF VQ map to achieve the required AFRs. Open and monitor the VQ map instead when using this functionality. Always observe the fuel map / VQ Map during adjustments to make sure it does not over compensate. Afterwards manual smoothing of the tune will be required on surrounding cells.

REVISION HISTORY

DATE	VERSION	DESCRIPTION	AUTHOR
24APR06	1.0	Document Creation	MB
03MAR07	1.0.1	Updates to use template and newer software screens	MB
29APR07	1.0.2	Updates for wideband configuration	MB
02JUL07	1.2	Updates for Injection and AFM resize	MB
10AUG07	1.2.1	Improve Formatting, readability etc.	PL
20NOV07	1.2.2	Updates based on latest software and wideband	MB
12MAY08	1.2.3	Update with AFM zener diode. Configuration page	MB
14JUN08	1.2.4	Add HR31 zener diode	MB
10JUL08	1.2.5	Update AFM Z32 and R31/VLT information	MB
13AUG08	1.2.6	Update address file for R31/VLT/Z31 information	MB
24MAY09	1.3	Moving AFM info, address selection, syncing files	MB
28MAR12	1.4	Updates from PL	PL
28MAR12	1.5	Formatting updates. Screen shot and version updates	MB
24JUL12	1.6	Updates for extra functionality added	MB
21OCT14	1.7	Updates for APSX wideband and new screenshots	MB
15JUL15	1.8	Updates for shortcuts, gauge operation	MB
29JUL15	1.9	Updates for feature pack, updated map entry, tuning	MB
18DEC18	1.10	Updates for recent software revisions, cleaning up	MB

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