COBB Nissan GT-R Accesstuner

v500 Real Time Tuning - MAF and Speed Density – CBA and DBA ignition timing

07/07/2014

Table of Contents

Features for Accesstuner GT-R and mapping 2
MAF or Speed Density Tuning and their Common features 4
    1) Selecting MAF or SD tuning strategies: 4
    2) Switching between MAF and SD tuning strategies: 4
    3) How to create MAF based calibrations: 5
    4) How to create starting point calibrations for Speed Density based tuning: 5
    5) Real Time Tuning (available for both MAF and SD tuning strategies) 5
    6) Real time map switching: 9
    1) Upgrading Manifold Absolute Pressure Sensors 12
    2) 5 Bar MAP sensor upgrade – toggles promoting proper High capacity MAP sensor calibrations 12
    3) Removing Speed Limiter Cap from JDM GT-Rs 12
    3) MAF Bank Switching toggle 13
Tuning Guide Part I – MAF-Based Tuning 14
    Step 1 – What is the mechanical configuration of the vehicle? 14
    Step 2 – What fuel is the vehicle using? 14
    Step 3 – What type of air intake is on the vehicle? 14
    Step 4 – Calibration refinement on a load-based chassis dynamometer. 15
        A: Configure and Connect the Accesstuner software to the Accessport equipped GT-R. 15
        B: Display and Log critical engine parameters while testing. 15
        C: Perform initial testing at lower boost 19
        D: Tuning for appropriate Air to Fuel ratios 19

E: Tuning Ignition Timing (CBA 2008 to 2010 world market, 2009-2011 USDM) 22
F: Tuning Ignition Timing (DBA 2011+ world market, 2012+ USDM) 22
....25
G: Tuning Boost - Proportional Gain COBB custom boost control 26
H: Tuning variable Cam Timing 27
I: Integrating all tuning parameters for the ideal Calibration 28
J: Precautions: 28
Table definitions and Tuning Tips– MAF-Based Tuning 30
Tuning Guide Part II– Speed Density 38
Switching between MAF and SD tuning strategies: 38
How to create starting point calibrations for Speed Density based tuning: 38
Step 1 – Air Temperature sensors relocated ? 39
Step 2 – What fuel is the vehicle using? 39
Step 3 – Calibration refinement on a load-based chassis dynamometer. 39
A: Configure and Connect the Accesstuner software to the Accessport equipped GT-R. 39
B: Display and Log critical engine parameters while testing. 40
C: Perform initial testing at lower boost 43
D: Tuning for appropriate Air to Fuel ratios using Speed Density 43
E: Tuning Ignition Timing (CBA 2008 to 2010 world market, 2009-2011 USDM) 46
F: Tuning Ignition Timing (DBA 2011+ world market, 2012+ USDM) 46
....49
G: Tuning Boost - Proportional Gain COBB custom boost control 50
H: Tuning variable Cam Timing 51
I: Integrating all tuning parameters for the ideal Calibration 51
J: Precautions: 52
Table definitions and Tuning Tips - Speed Density 54

Features for Accesstuner GT-R and mapping

1) **Real Time Tuning Support** – Accesstuner Pro users can now change critical tuning parameters in real time without the need to flash the ECU. This makes the tuning process much faster.
2) Full support for “DBA” 2011 world market (USDM 2012) vehicle support added
3) Launch control limits removed from ECU
4) LC4 and LC5 now fully supported with TCM adjustment features as well as launch limits removed and launch permitted with traction control OFF.
5) **Speed limiters** removed from JDM vehicles
6) **Speed density Tuning support** – In stock form, the R35 ECU measures airflow directly through the Mass Airflow (MAF) sensor located in the intake system just before the turbocharger. All Cobb off the shelf mapping included with the Accessport uses this system for engine calibration. Larger turbo and high HP applications often move so much air that direct measurement with a MAF sensor is impractical. For these types of vehicles, GTR Accesstuner software and firmware now support custom mapping using manifold pressure and manifold air temperature along with an internal density calculation to calculate airflow. So called speed (SD) density or MAP (manifold absolute pressure) based tuning is now supported in this software revision. Details on how to select or switch between SD and MAF based tuning are detailed below.
7) **“Pass Through” Tuning calibration Flashing.** Previous iterations of GTR Accesstuner used a direct connection from the computer to the vehicle for data monitoring and tuning and required calibrations to be uploaded to the Accessport before loading a new map to the vehicle. This extra step to load calibrations to the Accessport and reconfigure communications (computer or Accessport) depending upon the tuning process (flash or monitor) slowed the tuning process. Current GTR Accesstuner software and Accessport firmware allows a single tuning configuration where the Accessport is

connected "In-Line" between the computer and vehicle. Now, when ready to flash a new calibration, the tuner simply enters a command into GTR Accesstuner software and the calibration is automatically loaded to the Accessport, then flashed to the vehicle. Tuners are no longer required to reconfigure cabling intermittently for calibration flash and data monitoring functions. This feature improves tuning work flow and saves time.

8) Real time map switching with the cruise control buttons.

This Accessport firmware update, together with the newest v500 and later calibrations from COBB or custom calibrations from GT-R Accesstuner professional tuners now enables users to switch between realtime maps. Once the appropriate calibration is flashed to the ECU via the Accessport, the end user can use the factory cruise control system to switch between 9 different maps. The number of available real time maps is adjustable with Accesstuner GT-R software.

9) Faster map flashing.

End users also have the luxury of using the fast map flash function in this release. Fast map flash allows users to switch maps in a fraction of time (~30-40 secs.) compared to the full map flash which takes up to 11 minutes.

10) Heads up display based engine knock warning.

Another break-through in this release includes the ability to monitor knock through the factory heads-up-display. Once the knock monitoring system detects knock the boost gauge will start flashing on the heads up display. This is adjustable from Accesstuner GT-R software for all GT-R year models including CBA and DBA cars.

11) Load (Theoretical Pulse Width) range doubled.

The calculated load cap of 25.5 was a hindrance to properly tune higher power and optimized stock turbo GT-Rs. The range of this value is now doubled to 51.

12) Injector scalar in easy to understand units.

Earlier versions of GT-R Accesstuner software have used injector scalar values with somewhat arbitrary units. Program values have been changed such that injector scalar is now entered in common CC values (i.e. stock size = 570).

13) Higher boost cut values.

Boost cut can be set to any value. Pre and post throttle body pressure sensor calibrations are now included and can be altered to accept higher reading aftermarket sensor.

14) Accesstuner auto update.

Accesstuner GT-R software will connect to the Internet and automatically update. This will ensure tuners are using the latest software at all times.

15) Adjustable Knock Sensitivity.

Motors with aftermarket camshafts or pistons create a different noise profile that a relatively quiet stock motor. Accesstuner software now allows tunes to fine tune knock sensitivity to match the noise profiles of comparatively loud forged component motors.

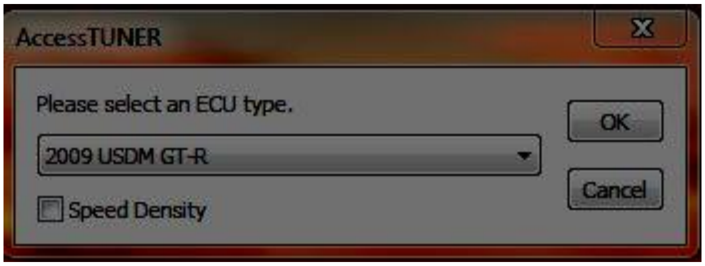
16) **MAF switching.** Some aftermarket intercoolers switch the airflow from one side of the motor to the other. In order to keep closed loop fuel systems in balance the airflow meters must be switched from one side to the other. This can now be accomplished with a simple toggle in Accesstuner GT-R software.

17) **Cranking enrichment** – great for cold start and ethanol tuning

18) **End of injection control** – full injector timing control to reduce black smoke common with large injectors and pump fuels.

MAF or Speed Density Tuning and their Common features

1) Selecting MAF or SD tuning strategies:



AccessTUNER

Please select an ECU type.

2009 USDM GT-R

☐ Speed Density

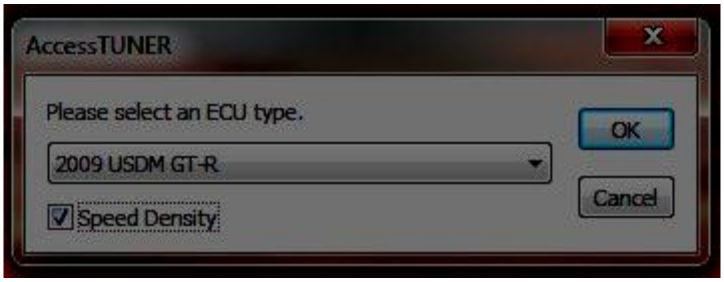
Choose Vehicle type, Year, and Speed Density or M

The first screen to appear when opening a new GTR Accesstuner session provides two initial choices. First, the year and type of GTR is selected from a drop down menu. In the screen shot below USDM 2009 GTR is selected. The software will now create calibrations used for this car and no other. This calibration is also limited to MAF based tuning.

When the software is set up for MAF based tuning the upper left corner of the program will display the following vehicle ID.

Vehicle type and listed at upper left of software. Here

The second choice to be made at this point is to tune using MAF based strategies (box not selected as above) or to enable SD tuning. To enable SD tuning the vehicle type and year is chosen and the Speed density check box is enabled as below.



Please select an ECU type.

2009 USDM GT-R

☑ Speed Density

USDM 2009 GTR selected along with Speed density

With the options selected as above the software will open with specific SD tuning tables enabled and will display the speed density-specific vehicle ID in the upper left corner of the software as below.

Vehicle type and listed at upper left of software. Here

2) Switching between MAF and SD tuning strategies:

In order to prevent an unwanted mixing on MAF and SD tuning on any vehicle only one type of tuning can be enabled for any specific Accessport installation. If an Accessport is installed with a non-SD calibration starting point you cannot load an SD based calibration. The vehicle identity is linked to the type of calibration first loaded on the car during Accessport installation. So, in order to switch from MAF to SD or SD to MAF the Accessport must first be **uninstalled** from the vehicle and then reinstalled using a calibration with the desired tuning strategy (ie, MAF or SD)

3) How to create MAF based calibrations:

Start with current v500 or higher Accesstuner calibrations. GT-R Accesstuner software integrates new logic for faster map flashing, integrated map switching with cruise control, and several other critical changes in coding controlling basic engine functions. These mapping changes are highly integrated and dependent upon coding contained within version 300 COBB GT-R mapping. Do not use older versions of your base maps. Please start all tuning with COBB v500 maps. Open an off the shelf map for the appropriate vehicle and make sure that Speed density is NOT selected in the start up screen on GTR Accesstuner software.

4) How to create starting point calibrations for Speed Density based tuning:

GT-R Accesstuner software for SD integrates custom logic and new tables to allow SD based tuning. In order to create a new starting map open the software and select Speed Density option and the appropriate year and world region of the car. The proper base parameters are automatically loaded to allow SD tuning.

> There are a few key parameter that need to be set up in order to create a base Speed density tuning calibrations.

1) Set the fuel multiplier to STOCK. This value is often increased as part of tuning larger diameter intakes with MAF based tuning. This value must be STOCK for SD calibrations.
2) Set MAF calibration A to stock values
3) Set MAF calibration B to stock A values (A=B at all MAF voltages)
4) Set the injector scalar to match the flow of the installed injectors (570 for stock)
5) Certain codes will need to be turned off in order to run Speed Density Tune (CTO!)

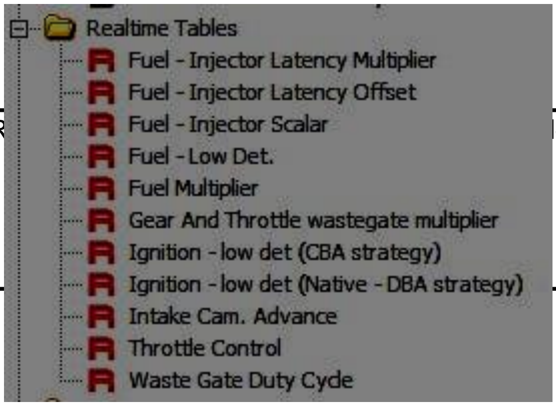
P0101
P0102
P0103
P010b
P0236
P0238
P0240
P0328
P0700

These basic parameter are the starting point for all SD based calibrations.

5) Real Time Tuning (available for both MAF and SD tuning strategies)

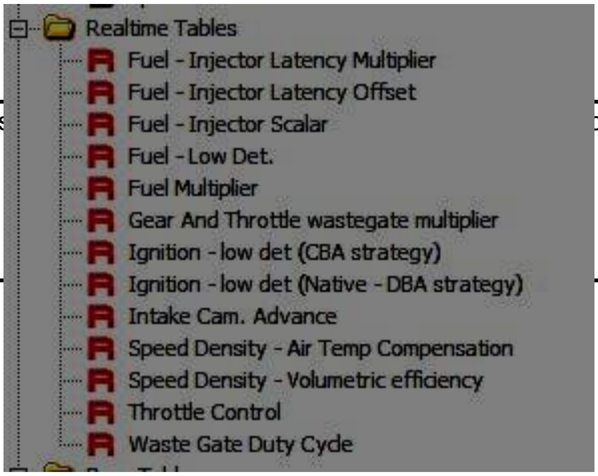
A) What is "real time" tuning? Previously released versions of Accesstuner Pro software required the ECU to be reflashed in order to load and test iterative calibrations. Because the ECU reflashing process takes several minutes to complete, the iterative testing of large numbers of calibrations requires a lot of time and patience. In order to produce a more efficient calibration process the later versions of GT-R Accesstuner Pro incorporates "real time" tuning strategies. Nearly all critical ECU tuning tables can now be changed live and in "real time". Changes are immediately loaded to the ECU and can be tested WITHOUT reflashing the ECU. This new feature, an exclusive of Accesstuner Pro, promotes efficiency with a more precise calibration as the final product.

B) Which tables are in real time? Most tables critical to an engine calibration can be accessed via "real time" tables. These tables are denoted by the red "R" in front of the table. Both MAF and Speed Density tuning is supported via real time. However, just as with non-real time tuning you must choose which strategy to use and complete the appropriate starting point calibration.

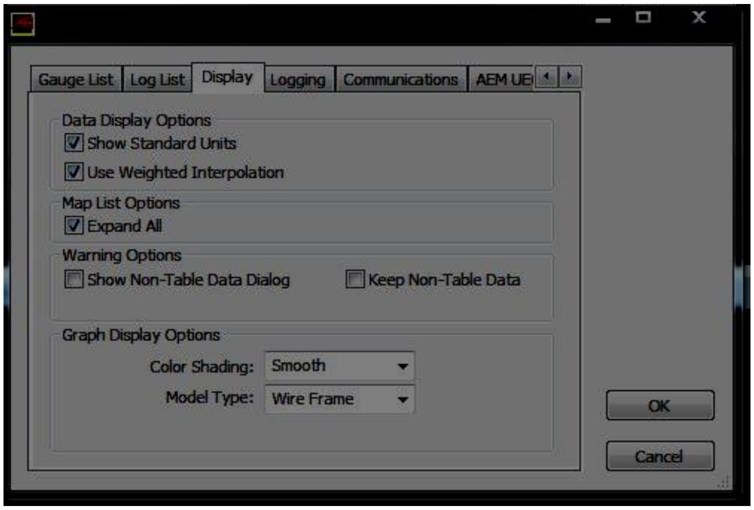


Real Time tables for MAF based GT-R lete calibration can be changed in real time

Real Time tables for Speed Density bas complete calibration
can be changed in real time


Realtime Tables
- Fuel - Injector Latency Multiplier
- Fuel - Injector Latency Offset
- Fuel - Injector Scalar
- Fuel - Low Det.
- Fuel Multiplier
- Gear And Throttle wastegate multiplier
- Ignition - low det (CBA strategy)
- Ignition - low det (Native - DBA strategy)
- Intake Cam. Advance
- Speed Density - Air Temp Compensation
- Speed Density - Volumetric efficiency
- Throttle Control
- Waste Gate Duty Cycle

C) Are my older maps a good starting point for real time tuning? No, your old maps are likely NOT a good place to start creating new calibrations with the latest Accesstuner software. We recommend starting with a recent OTS map opened and saved in the latest software. Copy and paste critical tables into the new calibration. Always make sure the "keep non-table data" button is unchecked as below.
* **Note**: as of 1.9.1.0-5796 - "Keep Non-Table Data" has been disabled.



Data Display Options
☑ Show Standard Units
☑ Use Weighted Interpolation

Map List Options
☑ Expand All

Warning Options
☐ Show Non-Table Data Dialog ☐ Keep Non-Table Data

Graph Display Options
Color Shading: Smooth
Model Type: Wire Frame

D) Workflow for real time tuning:

1) Create a starting point calibration using real time capable software.

2) Flash this map onto the ECU using the Accessport or Accesstuner pass through flash.

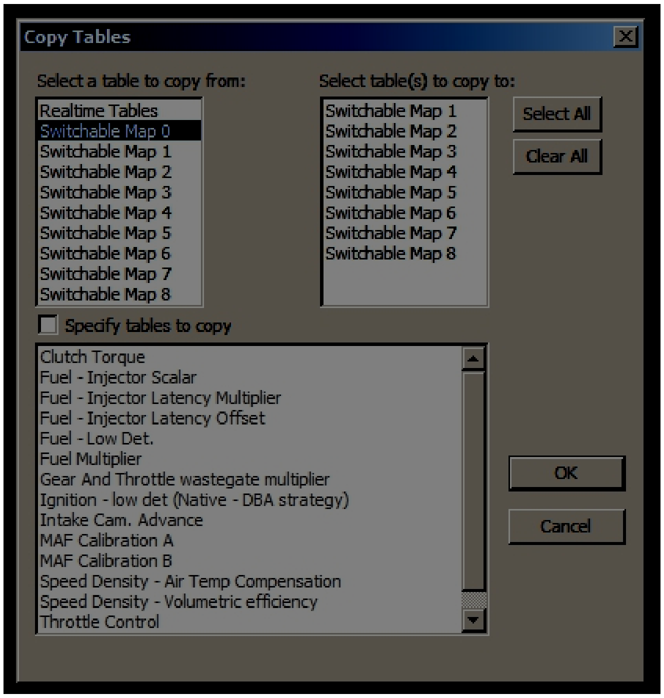
3) Start the car and connect to the Accessport and ECU using "pass through" mode where the ECU, Accessport, and computer are connected in a serial manner.

4) Using the cruise control map switching feature select the appropriate map slot (Active Map Slot) you wish to tune. Verify the active map slot by viewing the "Active Map Slot" monitor in the dashboard after you connect to the car in step 5.

5) Press “Ctrl L” to connect to the live ECU. The real time tables will now contain the ECU values in from the map slot you just loaded. DO NOT change active maps using the cruise control while tuning in real time.

6) Make changes in the “real time” tables and watch the monitor icon in the lower right hand corner of the Accesstuner go from green (indicating an online status of a live ECU) and briefly to red (indicating a write process to real time data).

7) Real time tables are stored in RAM in the ECU and are therefore volatile. In order to save changes permanently in a calibration copy and paste the table into the corresponding switchable table in the map slot of your choice. Switchable tables are denoted by a blue “S”.
8) To copy changes from realtime to any switchable table you can use the “Map Slot Copy” tool. “Ctrl + Shift + C” or “Edit” --> “Copy Tables” will bring up the map slot copy dialogue box.



9) When copying a map slot you have a choice to copy every table within said map slot or select specific tables (toggle “Specify tables to copy” check box).
10) Once a fully acceptable calibration is created and all data saved to the appropriate switchable map save the calibration under an appropriate name and then flash it to the ECU.

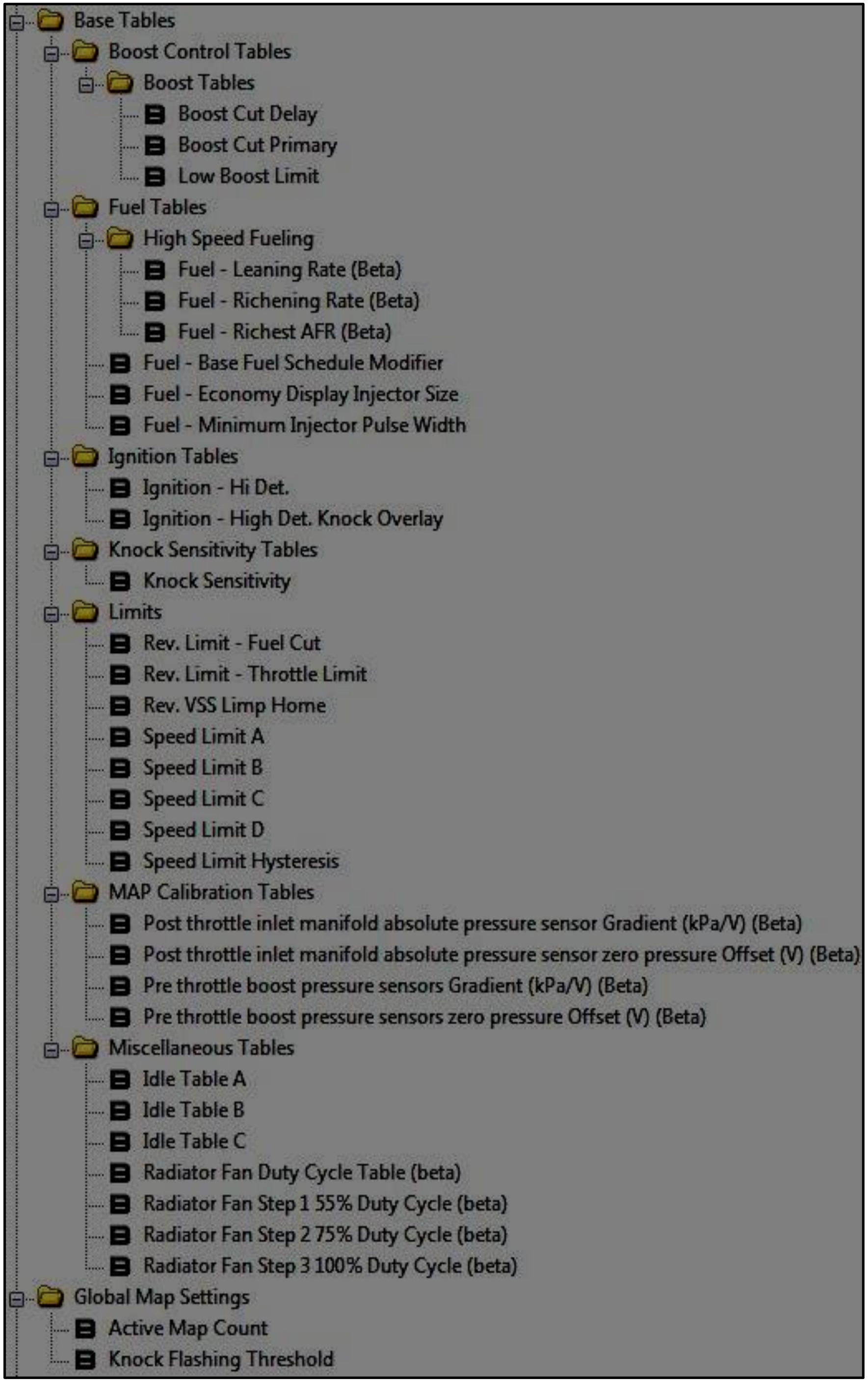
11) Switch through active map slots using the cruise control map switching feature and refresh real time tables (press F5) and make sure real time tables match corresponding map slot data.

6) Real time map switching:

A single calibration contains 9 individual maps accessed with cruise controls (both MAF or SD Tuning).

7) Base Table

Note that some tables are marked with black letter “B” as below. These tables are used in all of the switchable maps (up to 9) contained in each calibration file. In other words, these tables are referenced for every functional map in a single calibration. Base tables are the SAME for MAF or SD based tuning.



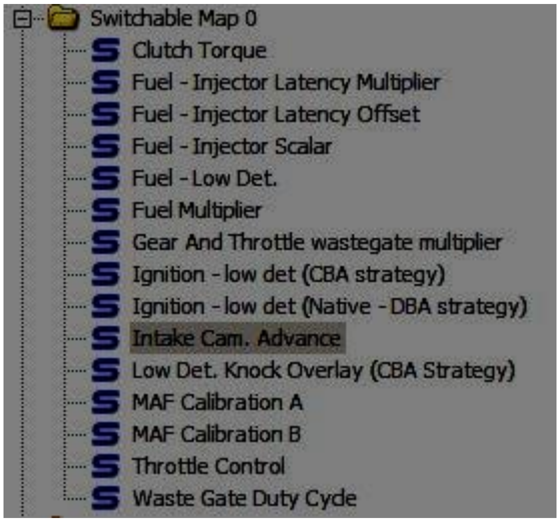
- Base Tables
  - Boost Control Tables
    - Boost Tables
      - Boost Cut Delay
      - Boost Cut Primary
      - Low Boost Limit
  - Fuel Tables
    - High Speed Fueling
      - Fuel - Leaning Rate (Beta)
      - Fuel - Richening Rate (Beta)
      - Fuel - Richest AFR (Beta)
    - Fuel - Base Fuel Schedule Modifier
    - Fuel - Economy Display Injector Size
    - Fuel - Minimum Injector Pulse Width
  - Ignition Tables
    - Ignition - Hi Det.
    - Ignition - High Det. Knock Overlay
  - Knock Sensitivity Tables
    - Knock Sensitivity
  - Limits
    - Rev. Limit - Fuel Cut
    - Rev. Limit - Throttle Limit
    - Rev. VSS Limp Home
    - Speed Limit A
    - Speed Limit B
    - Speed Limit C
    - Speed Limit D
    - Speed Limit Hysteresis
  - MAP Calibration Tables
    - Post throttle inlet manifold absolute pressure sensor Gradient (kPa/V) (Beta)
    - Post throttle inlet manifold absolute pressure sensor zero pressure Offset (V) (Beta)
    - Pre throttle boost pressure sensors Gradient (kPa/V) (Beta)
    - Pre throttle boost pressure sensors zero pressure Offset (V) (Beta)
  - Miscellaneous Tables
    - Idle Table A
    - Idle Table B
    - Idle Table C
    - Radiator Fan Duty Cycle Table (beta)
    - Radiator Fan Step 1 55% Duty Cycle (beta)
    - Radiator Fan Step 2 75% Duty Cycle (beta)
    - Radiator Fan Step 3 100% Duty Cycle (beta)
- Global Map Settings
  - Active Map Count
  - Knock Flashing Threshold

Base Tables use for MAF or SD-based from a single switchable map to create a c

Switchable maps 0 through 8. A separate set of tables is repeated for each of the switchable maps. The tables contained within an individual switchable map are referenced in addition to the base tables and constitute a complete calibration. The screen shot below shows the tables that constitute switchable maps 0. Each calibration can hold up to 9 switchable maps (0-8). Switchable tables are different for MAF or SD based tuning but they operate similarly within each tuning type.

A complete Calibration = base tables + real time switchable tables

Tables in switchable map for MAF based tuning.



Switchable Map 0
- Clutch Torque
- Fuel - Injector Latency Multiplier
- Fuel - Injector Latency Offset
- Fuel - Injector Scalar
- Fuel - Low Det.
- Fuel Multiplier
- Gear And Throttle wastegate multiplier
- Ignition - low det (CBA strategy)
- Ignition - low det (Native - DBA strategy)
- Intake Cam. Advance
- Low Det. Knock Overlay (CBA Strategy)
- MAF Calibration A
- MAF Calibration B
- Throttle Control
- Waste Gate Duty Cycle

Switchable Tables use for MAF based Tuning in a single s

Tables in switchable map for SD based tuning.

- Switchable Map 0
  - Clutch Torque
  - Fuel - Injector Latency Multiplier
  - Fuel - Injector Latency Offset
  - Fuel - Injector Scalar
  - Fuel - Low Det.
  - Fuel Multiplier
  - Gear And Throttle wastegate multiplier
  - Ignition - low det (CBA strategy)
  - Ignition - low det (Native - DBA strategy)
  - Intake Cam. Advance
  - Low Det. Knock Overlay (CBA Strategy)
  - MAF Calibration A
  - MAF Calibration B
  - Speed Density - Air Temp Compensation
  - Speed Density - Volumetric efficiency
  - Throttle Control
  - Waste Gate Duty Cycle

Switchable Tables use for SD based Tuning in a single sw

Default Switchable Map Count: The number of switchable maps is determined by the tuner. From 1 to 9 maps can be enabled. The default number of enabled switchable maps is 4 (0 – 4 active, 5 slots).

- Global Map settings
  - Active Map Count
  - Knock Flashing Threshold

Global Map settings: Active Map Count

4

Active Map Count

Real time switchable map changes with cruise control: The active switchable map is chosen and selected with the use of cruise control buttons. The selected map is temporarily displayed on the gauge function screen. To enter map selection routine press the “cancel” button on wheel. The boost gauge will temporarily display the current map with small steady proportional jumps in displayed boost. While in this mode toggle up and down with the set and coast button to incrementally step through maps.

Incremental changes in displayed boost represent the selected switchable map.

MAP 0

MAP 1

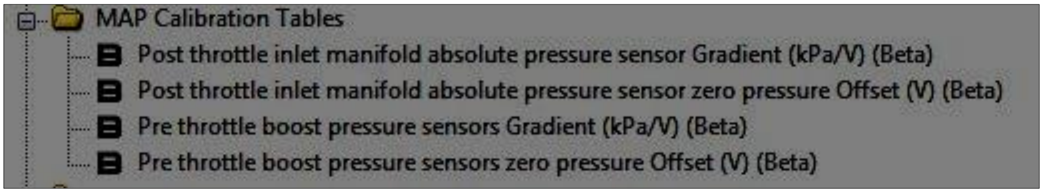
MAP 2

For a video demonstration of this feature click here.

Advanced Tables,Software Toggles, and Special Features

1) Upgrading Manifold Absolute Pressure Sensors

As turbo options and built motors have become common in R-35 GTR aftermarket tuning so has a need to introduce higher reading manifold absolute pressure sensors. There are a total of 3 MAP sensors in a GTR. Two sensors are located before the throttle bodies on each side of the manifold. The third map sensor is located on the manifold. Importantly, it is this third map sensor is used to calculate load for speed density tuning. It is also important to use a MAP sensor that reads higher than desired boost – even when using MAF based tuning – so that a usable boost limit is maintained.



MAP Calibration Tables
- Post throttle inlet manifold absolute pressure sensor Gradient (kPa/V) (Beta)
- Post throttle inlet manifold absolute pressure sensor zero pressure Offset (V) (Beta)
- Pre throttle boost pressure sensors Gradient (kPa/V) (Beta)
- Pre throttle boost pressure sensors zero pressure Offset (V) (Beta)

There are two values used to calibrate both the pre and post throttle the MAP sensor: gradient and offset. The post throttle MAP sensor is the critical sensor used for load measurement on Speed Density calibrations.

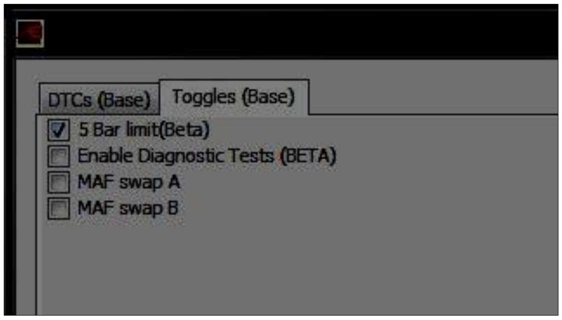
Precautions for map sensor saturation.

Sensor limits – Engine control is dependent upon accurate readings from the MAP sensor. Beyond the limits of the stock MAP sensor (Approx. 4.84 volts) the ECU has no way to properly control the engine. Any turbocharger upgrade must also be accompanied by an appropriate MAP sensor. If the sensor limitations are met, the car can produce a fuel cut condition. The problem results from maxing out the Pre-throttle MAP sensors. When this occurs an alternate fuel state is entered and any load then produces a fuel cut. A data log will show this as injector pulse-width returning to a near idle value. If this issue is experienced, (CTO!) disabling DTC's P0241 and P0242 will remove the sensor checks allowing the engine to run outside of the sensors range. These DTC's should **only** be used as a diagnostic aid as this removes the ECU's ability to determine if a sensor is defective. If this test isolates the issue, appropriate MAP sensors should be selected for the vehicles targeted boost level.

2) 5 Bar MAP sensor upgrade – toggles promoting proper High capacity MAP sensor calibrations

Any 5 bar MAP sensor requires a larger calibration value for gradient than is allowed in the ECU. For example, an AEM 5.0 bar map sensor reads from 0.5 to 4.5 volts. So, the desired gradient value is 125 KPa/V. Unfortunately the maximum input for this is 102. To obviate this issue and properly calibrate similar sensors you must check the “toggle” under advance engine parameters (control-alt-A). By checking the “5 Bar limit” toggle you HALVE the needed gradient value for the MAP sensor calibration. In this example, the needed value of 125 Kpa/V, with the toggle checked, can now be entered as 62.5 (125/2 = 62.5). This is below the allowable unit limit of 102 for the ECU but is understood and calibrated correctly because the toggle adds an extra logic step to effectively double to value within the ECU.

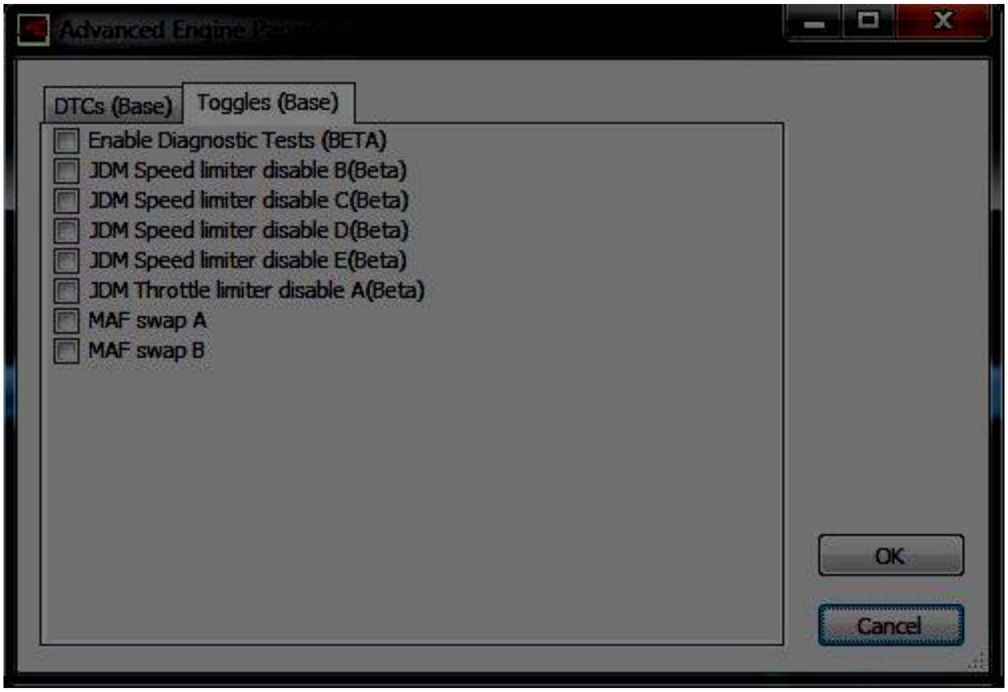
This 5 bar MAP sensor calibration is only available in Speed density based calibrations. It is assumed that any tuner who needs to run this much boost will not attempt to do so with MAF based conventional GTR tuning.



☑ 5 Bar limit(Beta)
☐ Enable Diagnostic Tests (BETA)
☐ MAF swap A
☐ MAF swap B

3) Removing Speed Limiter Cap from JDM GT-Rs

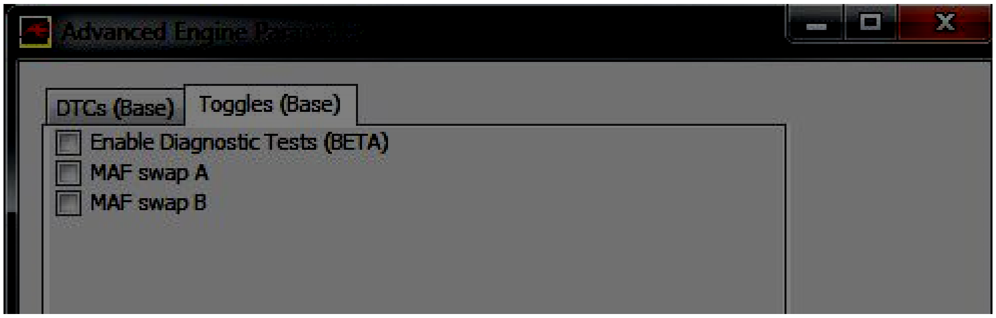
Model year 2009-2011 JDM GT-Rs have additional limiter toggles to address the speed limiter cap. See the “Advanced Engine Parameters” toggle list for a complete listing. These toggles are currently in a “BETA” state since they haven’t been appropriately labeled. When using these toggles be sure to review the Speed Limit tables as well, the appropriate speed limiter value needs to be set accordingly.



☐ Enable Diagnostic Tests (BETA)
☐ JDM Speed limiter disable B(Beta)
☐ JDM Speed limiter disable C(Beta)
☐ JDM Speed limiter disable D(Beta)
☐ JDM Speed limiter disable E(Beta)
☐ JDM Throttle limiter disable A(Beta)
☐ MAF swap A
☐ MAF swap B

3) MAF Bank Switching toggle

Some aftermarket intercoolers change the airflow through the motor in such as way as to swap MAF sensor banks. In order to correct this the tuner can either re-wire the MAF sensors to read from the appropriate side of the motor OR the tuner can now simply enable the MAF bank switch toggle to change MAF banks inside the ECU.



☐ Enable Diagnostic Tests (BETA)
☐ MAF swap A
☐ MAF swap B

Tuning Guide Part I – MAF-Based Tuning

This tuning guide is broken into the basic components of tuning the Nissan GT-R and the tables associated with each of these components. For each major tuning category, the guide outlines basic tuning strategies and defines tables within this category (for example: Boost Control, Fueling, and Ignition Timing).

Step 1 – What is the mechanical configuration of the vehicle?

The first step in MAF based tuning for a GT-R is to choose a COBB Tuning base map that best matches the components of the vehicle to be tuned.

The Stage1 calibrations are designed for vehicles with a stock or axle-back exhaust system. The Stage1 COBB mapping was designed with optimized ignition, boost, and fuel targets for enhanced performance and responsiveness on a vehicle with mainly stock hardware.

The Stage2 mapping is designed for vehicles equipped with exhaust system modifications including replacement of at least the restrictive “y-pipe”. Additional performance can be obtained by fitting a cat back exhaust which replaces the restrictive factory mufflers.

Step 2 – What fuel is the vehicle using?

Please note that COBB Tuning offers calibrations for different fuels including 91, 93, and 100 octane as well as 95, 98, and 102 RON. The Nissan GT-R is available throughout the world and we've developed calibrations for the most readily available fuel types throughout the world markets. If you fuel does not meet the standard of the available COBB maps you will need to adjust the calibration accordingly. The higher the octane/RON the higher the fuel quality. Higher-octane fuels burns more slowly and can support higher cylinder pressure. Take a moment to compare and contrast timing, boost, and ignition tables from each type of calibration. Higher octane fuels support more ignition timing, higher boost levels, and leaner air to fuel mixtures compared to lower octane. Using a map designed for high-octane with low-octane fuels can produce engine damage.

Step 3 – What type of air intake is on the vehicle?

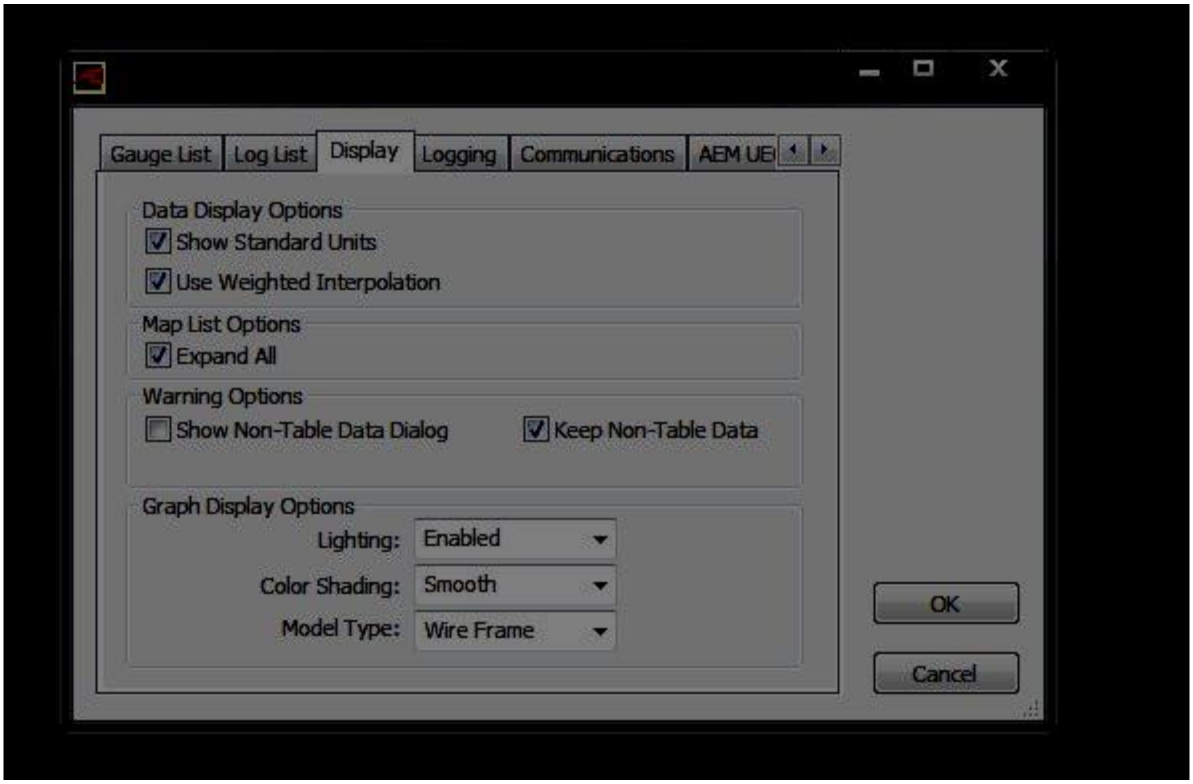
The GT-R utilizes a mass air flow (MAF) sensor located downstream to the air filters and before the turbos to measure the amount (mass) of air entering the engine. This air flow measurement is CRITICAL for ignition timing and fuel. This sensor reports the amount of air entering the engine and this is used to determine load, based on a fuel schedule. Fuel Schedule (theoretical pulse width), in the GT-R, is used synonymously with “load” in other platforms. Many tables inside the ECU use theoretical pulse width and engine speed as axis values. Therefore, it is the MAF sensor reading and calculated load (theoretical pulse width) that determines the table values used to control the engine.

The MAF sensor readings depend entirely upon the type of intake system. Aftermarket intakes rarely promote laminar airflow around the MAF sensor that is equivalent to the stock system. As a result, the stock MAF sensor calibration is not appropriate for most after market intakes. If an after market intake is used the tuner will have to spend considerable effort to ensure that the MAF sensor scaling matches the true airflow characteristics of the chosen intake. We highly suggest that the initial tuning is done with the stock intake system so that a proper tune can be established with a known MAF sensor calibration. Once the tune is optimized for the stock intake the after market intake can be installed and only those components of the tune related to this intake change need be altered. For intake tuning details see “tuning for proper AF ratio” below.

Step 4 – Calibration refinement on a load-based chassis dynamometer.

A: Configure and Connect the Accesstuner software to the Accessport equipped GT-R.

Open the selected starting point calibration in the Accesstuner software. Configure the Accesstuner software to connect to your vehicle. Attach the OBDII dongle/cable to the vehicle and the associated USB cable to your computer (direct tuning). Alternatively, connect the Accessport to the vehicle and then simultaneously connect the Accessport to the computer. Used in this so called “pass through” configuration the tuner can connect to and collect data from the vehicle and, without changing any physical configuration, flash a new calibration to the car's ECU.



Data Display Options
☑ Show Standard Units
☑ Use Weighted Interpolation

Map List Options
☑ Expand All

Warning Options
☐ Show Non-Table Data Dialog
☑ Keep Non-Table Data

Graph Display Options
Lighting: Enabled
Color Shading: Smooth
Model Type: Wire Frame

Press “Ctrl+F” to configure the program. Select the directory in which to store your data logs under the “logging” tab. Select the type of tuning cable and its associated com port under “communications.” You can also integrate a wide-band oxygen (WBO2) sensor signal into the data logs. Select the specific oxygen sensor you wish to use and indicate its associated com port.

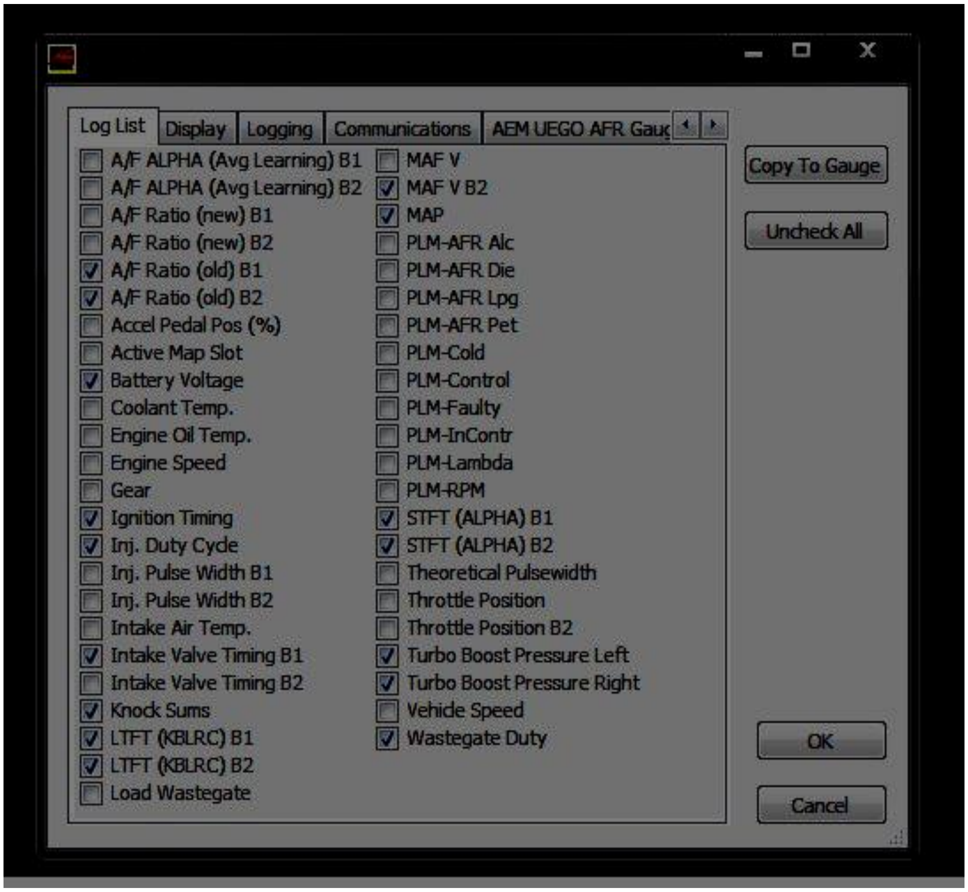
B: Display and Log critical engine parameters while testing.

Accesstuner software allows the user to visualize, sample, and record critical engine parameters. This data includes sensor information and commanded engine function.

To connect to a live ECU:
Open Accesstuner and load the calibration currently flashed into the vehicle. Attach the OBDII cable to the vehicle and the computer (V2 Accessport). If the vehicle is equipped with a version v2b “pass through” Accessport attach the OBDII cable to the vehicle and Accessport to the computer. With the vehicle ignition on, press “Ctrl+L” to connect to the active ECU. If Accesstuner is connected to the vehicle the message in the lower right corner of the program will read “on-line.”

Configure displayed parameters on the live “Dashboard” and those data collected during a log:

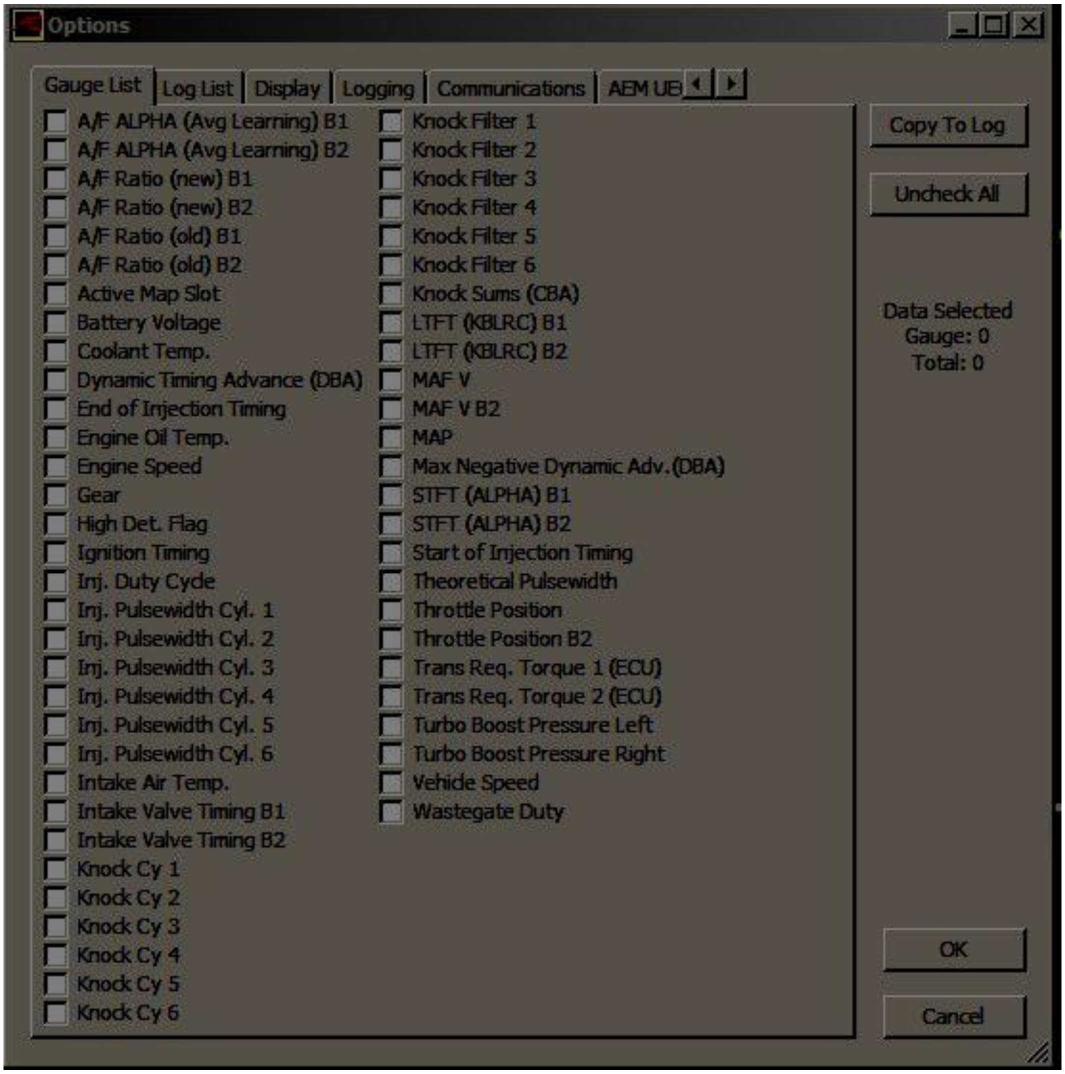
The parameters selected in the “Gauge List” tab will be displayed in the live dashboard when connected to a vehicle and the live dashboard is enabled. See an example of this live dashboard below. This screen is the single best way to assess the condition of the engine during tuning. It is critical to actively monitor these parameters while tuning. These data allow the tuner to determine if a calibration is performing correctly. Accurate and deliberate assessment of engine data is the only way to avoid conditions that may damage the engine.



☐ A/F ALPHA (Avg Learning) B1
☐ A/F ALPHA (Avg Learning) B2
☐ A/F Ratio (new) B1
☐ A/F Ratio (new) B2
☑ A/F Ratio (old) B1
☑ A/F Ratio (old) B2
☐ Accel Pedal Pos (%)
☐ Active Map Slot
☑ Battery Voltage
☐ Coolant Temp.
☐ Engine Oil Temp.
☐ Engine Speed
☐ Gear
☑ Ignition Timing
☑ Inj. Duty Cycle
☐ Inj. Pulse Width B1
☐ Inj. Pulse Width B2
☐ Intake Air Temp.
☑ Intake Valve Timing B1
☐ Intake Valve Timing B2
☑ Knock Sums
☑ LTFT (KBLRC) B1
☑ LTFT (KBLRC) B2
☐ Load Wastegate
☐ MAF V
☑ MAF V B2
☑ MAP
☐ PLM-AFR Alc
☐ PLM-AFR Die
☐ PLM-AFR Lpg
☐ PLM-AFR Pet
☐ PLM-Cold
☐ PLM-Control
☐ PLM-Faulty
☐ PLM-InContr
☐ PLM-Lambda
☐ PLM-RPM
☑ STFT (ALPHA) B1
☑ STFT (ALPHA) B2
☐ Theoretical Pulsewidth
☐ Throttle Position
☐ Throttle Position B2
☑ Turbo Boost Pressure Left
☑ Turbo Boost Pressure Right
☐ Vehicle Speed
☑ Wastegate Duty

<u>To configure logged parameters in the recorded “Log List” tab:</u>
While connected to a live ECU Press “Ctrl+F” and select the “Log List” tab to select the parameters displayed in saved Accesstuner logs. When data logging is enabled these parameters will be permanently written to a comma delimited data file.

<u>NO more than 32 parameters can be selected at any one time! The rate of data collection will be lower than optimal when more parameters are selected. For example, you will see a higher sample rate with 4 parameters, than 7 parameters.</u>



☐ A/F ALPHA (Avg Learning) B1
☐ A/F ALPHA (Avg Learning) B2
☐ A/F Ratio (new) B1
☐ A/F Ratio (new) B2
☐ A/F Ratio (old) B1
☐ A/F Ratio (old) B2
☐ Active Map Slot
☐ Battery Voltage
☐ Coolant Temp.
☐ Dynamic Timing Advance (DBA)
☐ End of Injection Timing
☐ Engine Oil Temp.
☐ Engine Speed
☐ Gear
☐ High Det. Flag
☐ Ignition Timing
☐ Inj. Duty Cycle
☐ Inj. Pulsewidth Cyl. 1
☐ Inj. Pulsewidth Cyl. 2
☐ Inj. Pulsewidth Cyl. 3
☐ Inj. Pulsewidth Cyl. 4
☐ Inj. Pulsewidth Cyl. 5
☐ Inj. Pulsewidth Cyl. 6
☐ Intake Air Temp.
☐ Intake Valve Timing B1
☐ Intake Valve Timing B2
☐ Knock Cy 1
☐ Knock Cy 2
☐ Knock Cy 3
☐ Knock Cy 4
☐ Knock Cy 5
☐ Knock Cy 6
☐ Knock Filter 1
☐ Knock Filter 2
☐ Knock Filter 3
☐ Knock Filter 4
☐ Knock Filter 5
☐ Knock Filter 6
☐ Knock Sums (CBA)
☐ LTFT (KBLRC) B1
☐ LTFT (KBLRC) B2
☐ MAF V
☐ MAF V B2
☐ MAP
☐ Max Negative Dynamic Adv.(DBA)
☐ STFT (ALPHA) B1
☐ STFT (ALPHA) B2
☐ Start of Injection Timing
☐ Theoretical Pulsewidth
☐ Throttle Position
☐ Throttle Position B2
☐ Trans Req. Torque 1 (ECU)
☐ Trans Req. Torque 2 (ECU)
☐ Turbo Boost Pressure Left
☐ Turbo Boost Pressure Right
☐ Vehicle Speed
☐ Wastegate Duty

Data Selected
Gauge: 0
Total: 0

This image cannot currently be displayed.

Below is a list of logged parameters for the GT-R (MAF or SD based tuning). The selected parameters are those that are critical to record under most conditions. Other parameters may be selected or removed based upon the objectives of any specific tuning process.

A/F ALPHA (Avg. Learning) B1 – Average learned fuel correction bank 1.

A/F ALPHA (Avg. Learning) B2 – Average learned fuel correction bank 2.

A/F Ratio (new) B1 – Internal wide-band oxygen sensor bank 1. A newer calibration – reads a bit rich – non-preferred calibration

A/F Ratio (new) B2 – Internal wide-band oxygen sensor bank 2. A newer calibration – reads a bit rich – non-preferred calibration

A/F Ratio (old) B1 – Internal wide-band oxygen sensor bank 1. Older original calibration, reads a bit leaner than tailpipe WBO2 -preferred calibration

A/F Ratio (old) B2 – Internal wide-band oxygen sensor bank 2. Older original calibration, reads a bit leaner than tailpipe WBO2 -preferred calibration

Active Map Slot – Real time switchable map currently in use by the ECU (0-8)

Battery Voltage

Coolant Temp. – Engine coolant temperature.

Dynamic Advance (DBA) – monitor used for DBA ignition timing only. Degrees of advance added or subtracted due to current engine noise or detonation

End of injection Timing – Timing for end on injection in rotational degrees after top dead center.

Engine Oil Temp. – Engine oil temperature.

Engine Speed – Engine speed in revolutions per minute.

Gear

High Det. Flag – monitor that reports normal low detonation (0) or high detonation (1) conditions.

Ignition Timing – Ignition timing in degrees before top dead center. This is the final commanded ignition timing after all correction and adjustments.

Inj. Duty Cycle – Total injector pulse width as a percentage of available injector open time.

Inj. Pulse Width Cyl 1-6 – Total open time of fuel injector.

Intake Air Temp. – Sensor value intake air temperature.

Intake Valve Timing (B1 and B2) – Position in degrees of variable intake camshaft.

Knock Cy 1-6 – raw knock value from each cylinder

Knock Filter 1-6 – knock sensitivity threshold level for each cylinder

Knock Sums (CBA)– A monitor that reports active ignition timing adjustment in response to engine noise – an increment of 300 is equivalent to 1 degree of ignition removed. Used ONLY in CBA ignition strategy cars

LTFT (KBLRC) B1 – Long-Term Fuel Trim Bank 1. This long-term fuel trim indicates an average learned fuel correction needed to maintain the closed loop target for Bank 1.

LTFT (KBLRC) B2 – Long-Term Fuel Trim Bank 2. This long-term fuel trim indicates an average learned fuel correction needed to maintain the closed loop target for Bank 2.

MAF V Bank 1 – Mass air flow sensor output voltage for Bank 1.

MAF V Bank 2 – Mass air flow sensor output voltage for Bank 2.

MAP – Manifold Absolute Pressure (reported as negative values in vacuum and positive values in boost) – logged from pressure sensor in the intake manifold.

Max negative dynamic advance (DBA) – largest negative DA currently recorded in ECU memory

STFT (ALPHA) B1 – Active short-term fuel trim for bank 1 needed for the ECU to meet fuel targets in fuel table A.

STFT (ALPHA) B2 – Active short-term fuel trim for bank 2 needed for the ECU to meet fuel targets in fuel table A.

Start of injection Timing – Timing for end on injection in rotational degrees after top dead center.

Theoretical Pulse Width (ms) – Load calculation based upon theoretical injector open time. This is used as load axis scaling for several critical tables throughout the ECU.

Throttle Position B1 and B2 – throttle plate opening 0 to 100%

Turbo Boost Pressure Left – Boost pressure on left side of motor - sensor located in front of left throttle body.

Turbo Boost Pressure Right – Boost pressure on right side of motor - sensor located in front of right throttle body.

Vehicle speed – Speed calculated by vehicle speed sensor.

Wastegate Duty – Percentage of boost control wastegate solenoid duty cycle % (0 to 100).

C: Perform initial testing at lower boost

After choosing the most appropriate starting point calibration, prepare to test and refine the calibration on a load-based chassis dynamometer. When creating a custom tune, it is best to begin testing under low load conditions. **Proportional Gain COBB custom boost control -** COBB Tuning GT-R calibrations discard the factory Nissan boost control in favor of our own boost control system that is throttle position, gear and RPM dependent. COBB Tuning GT-R calibrations include special coding that support a more simple and elegant proportional gain based boost control system. To lower boost reduce wastegate duty cycle in “wastegate duty cycle”. This boost control system is further refined by changing the wastegate gain as a function of throttle position and gear.

D: Tuning for appropriate Air to Fuel ratios

The ideal air to fuel ratio depends upon fuel quality. Higher octane fuels are more detonation resistant and therefore can be run at leaner air to fuel ratios. Leaner Air to Fuel ratios produce higher power but also create more heat. Excessive heat can lead to detonation. Lower octane fuels such as 91 octane or 95 RON are more prone to detonation and therefor require a richer air to fuel ratio. Rich air to fuel ratio combustion produces less heat and therefore less detonation. We have found that the GT-R engine can run mid to high 11 Air to Fuel Ratios (AFR) when running quality fuels. Lower quality fuels require mid to low 11 air to fuel ratios.

Several tables directly impact fueling ratios in these cars. **Primary Fuel** is the primary table dictating fuel mixtures. These tables are referenced by “theoretical pulse width” and engine speed. This is a target table. It is used by the ECU to set a desired AFR.

The R-35 GT-R uses two internal wide-band oxygen sensors to monitor fuel mixtures on left and right engine banks. The ECU will constantly adjust fuel to reach this air to fuel target. As a result, the values in **Fuel – Low Det** are a closed loop target that the ECU will always work to achieve. The active adjustments made by the ECU are monitored at **STFT (ALPHA) B1** and **STFT (ALPHA) B2**. These short-term fuel trims will gradually enter a long-term learned state that can also be monitored - **LTFT (KBLRC) B1** and **LTFT (KBLRC) B2.**

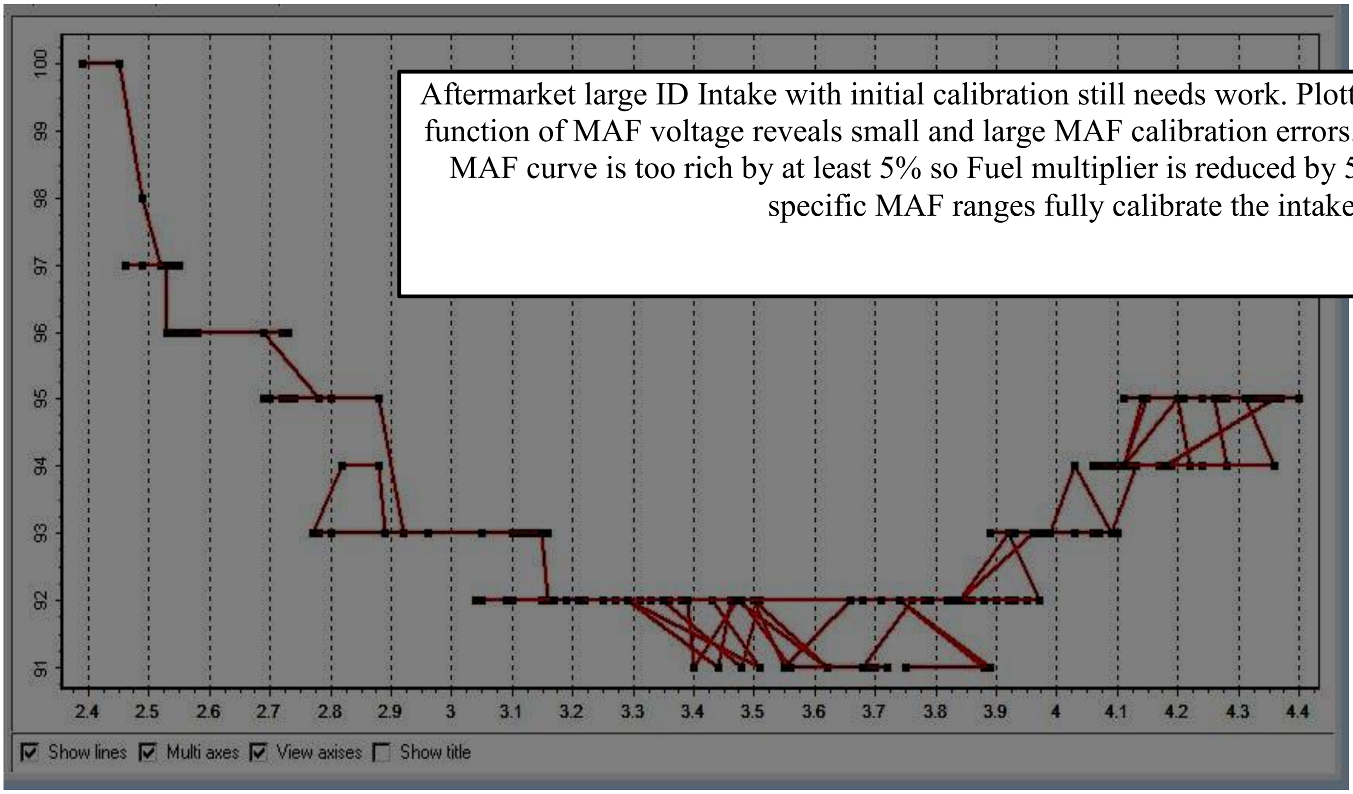
MAF A and B. The MAF sensor calibration indicates the mass of air entering the engine at a particular MAF voltage. Using intakes other than stock will require that the MAF sensor is calibrated to match their specific airflow pattern.

Calibration for Larger Diameter Intake systems. Fuel Multiplier (FM) is a single value that influences the Base Fuel Schedule. This value is a multiplier for mass air flow. For example, if a larger inner diameter intake is used the Fuel Multiplier can be used to increase the MAF proportional to the increase in MAF sensor housing cross sectional area. For example, New fuel multiplier = stock fuel multiplier * (new MAF diameter squared) / (old MAF diameter squared).

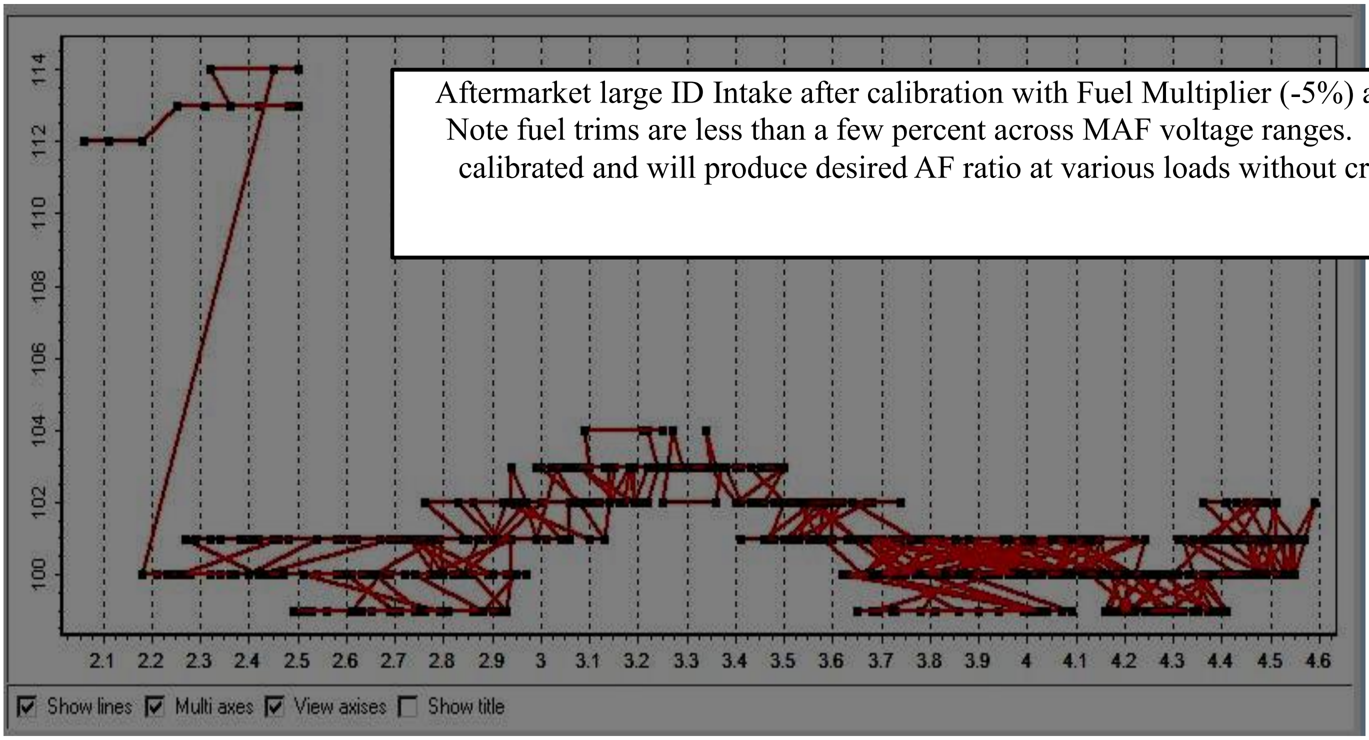
For Example.
Stock FM = 26806
Stock intake ID = ~2.5”

New intake ID = 2.75”
New FM = 26806*(2.75*2.75)/(2.5*2.5)
New FM = 32435

This new higher FM is a transform factor for the MAF calibration that adds additional airflow to account for the larger cross sectional area of the MAF sensor at the intake. This is an overall offset for the MAF calibration. Further refinement of the MAF calibrations must be completed to account for smaller changes in airflow at various points in the MAF voltage rage. This is best accomplished by looking at Short-term Fuel Trim (STFT) as a function of MAF voltage.



Aftermarket large ID Intake with initial calibration still needs work. Plotting short
function of MAF voltage reveals small and large MAF calibration errors. In this e
MAF curve is too rich by at least 5% so Fuel multiplier is reduced by 5%. addit
specific MAF ranges fully calibrate the intake.



Aftermarket large ID Intake after calibration with Fuel Multiplier (-5%) and MAI
Note fuel trims are less than a few percent across MAF voltage ranges. This inta
calibrated and will produce desired AF ratio at various loads without creating lo

Injector latency offset and multiplier– When using injectors other than stock it is critical to adjust these values to reflect the voltage response characteristics of the new injectors. Injectors need a different dead time compensation at different voltages. Generally, lower battery voltage requires longer dead times while higher voltage requires less. This relationship is defined by two variables in the GT-R ECU:

1) Injector "offset" is the amount of open time/latency added to a calculated open time at 14 volts battery voltage.
2) Injector "multiplier" defines the slope of the linear relationship between battery voltage and injector latency.

Injector scalar – The injector scalar is defined in cubic centimeters (CC). The stock injector size is 570cc. To change the injector size simply input the new injector scalar in cc. (conversions of arbitrary units as was needed in earlier versions of the software are no longer required.)

E: Tuning Ignition Timing (CBA 2008 to 2010 world market, 2009-2011 USDM)

Ignition Timing tables - The most important tables for ignition timing are **Ignition-Low Det** and **Ignition HI Det**. These tables are referenced by Theoretical Pulse Width and engine speed. Logging these parameters will allow you to reference the specific regions of these table that may need to be edited to produce optimized ignition timing.

Dynamic Ignition timing computation - The Nissan GT-R uses a complex computational process to constantly calculate optimal ignition timing. An internal mathematical model of engine function together with an array of sensor information is used to calculate ignition timing. The values in the timing tables are referenced within this computational process but are NOT traditional ignition timing in degrees before top dead center as most tuners will recognize. These numbers are best thought of in terms of fuel burn time. The numbers in these tables do heavily impact timing calculations so timing can be adjusted. Higher values will lead to higher ignition timing and lower values lower ignition timing. For example, a one increment increase in table values will lead to 1 degree increase in ignition timing.

Detonation based timing adjustment - Ignition timing is also adjusted in response to detonation. The ECU actively reduces timing in response to detonation. Timing adjustments in response to detonation are logged with the "knock Sum" monitor. Each knock event results in a -307 knock sum change. 1 degree of ignition timing is removed for each 256 of knock sum below zero. Only at very high knock levels will the ECU switch to the High Detonation Ignition map.

Generally speaking, higher ignition timing supports higher torque and greater power. However, ignition timing should be increased with great caution. Higher timing yields higher cylinder pressures and this is limited by fuel quality and the mechanical limitations of the engine. Too much timing will produce knock correction when fuel quality is limiting. When fuel quality is high, ignition timing should ONLY be added when its addition produces a substantive increase in torque and power. If increased timing does not increase torque the extra cylinder pressure is simply producing unnecessary stress on engine components.

F: Tuning Ignition Timing (DBA 2011+ world market, 2012+ USDM)

For 2011+ world market (UDSM 2012+) GT-R Nissan began using a new strategy for controlling ignition timing. This new timing control strategy, designated DBA, represents a completely different approach to ignition control, compared to earlier CBA GT-R, but one which will be more familiar to engine calibrators. Earlier CBA ignition control used a complex calculation of burn time to actively determine ignition timing and referenced tables were, consequently, referencing unfamiliar units. In contrast, DBA strategy look up tables are all referencing ignition timing in Degrees Before Top Dead Center (DBTDC) and thus use a more commonly understood quantization of timing control. Despite the familiar language, DBA ignition control strategy is very complex utilizing an elegant timing adjustment, initiated by knock sensor activity, that can both add and subtract ignition timing. This so called Dynamic Advance (DA) and its control is key in producing a stable DBA ignition based calibration. In addition to DA based timing adjustment there are multiplier and threshold based timing adjustments for Coolant and Intake air temperature.

Degrees before top dead center for all DBA tables: DBA ignition does NOT use a 'burn time" type of calculation used for CBA. DBA ignition tables are traditional degrees before top dead center. The most important table for high load DBA timing strategy is "**Ignition Low Det (Native - DBA strategy)**". This is the main timing table for DBA vehicles and is noted in traditional degrees before top dead center.

Final timing = base timing + knock (Dynamic Advance) + temperature compensations
High load DBA ignition timing = Base timing table (low or high det depending upon detonation history) + Dynamic Advance (timing actively and quickly added or removed based upon current knock levels) + Temperature correction (Timing added or removed based upon air and coolant temperature corrections).

Low load or cruising timing is calculated more simply than high load (no knock based feedback but some temperature offsets). However, high and low load timing are always compared and the ECU uses the lower of the two, which under load is always, high load timing described in detail here.

Dynamic Advance (DA) DBA timing uses a complex strategy to both add and subtract timing in response to engine detonation levels. To optimize performance the stock ECU, in the absence of knock (low knock levels) can add as much as 1 to 5 degree of ignition timing. Under conditions where engine knock exceeds the noise threshold in the "**knock sensitivity**" tables the ECU can take out as much as 9 degrees of timing. Understanding how to limit these stock ECU induced timing variations is key to producing a stable DBA based performance engine calibration. The sequence of events that calculates DA is as follows:

1) Engine noise = (knock sensor)
2) Knock counter (calculation) = Short term knock history (Engine noise*time, based on engine noise and compared to **Knock Sensitivity**)
3) Dynamic Advance (DA) = knock counter * knock multiplier (Table)

Knock multiplier = (table based - decrement or increment). Knock counter is multiplied by the table based decrement (**Dynamic Advance – Decrement (DBA)**) to remove timing which removes timing in response to detonation. In the absence of detonation (low engine noise) timing is added according to the base timing increment multiplier (**Dynamic Advance – Increment (DBA)**).

4) Final DA is calculated as above and compared to limits as outlined in several tables that define the minimum and maximum DA under low or high det mode as the table name indicates.

High Detonation Mode – High Det, Limp or Safe mode is entered when the knock counter for DA stores a learned value of -4 degrees for a long duration. Entering high detonation mode switches active DBA mapping to the high det tables for ignition and fuel **(Ignition High Det. (DBA), Fuel High Det.**). Limp mode is maintained until the ECU is power cycled through a key on off.

Temperature Compensations.
Both Intake air temperature and coolant temperature compensations contribute to final DBA timing. Both are calculated values with a threshold (table), multiplier (table) and air temperature compensation is further controlled with a minimum activation point (table). Temperatures must be noted in Celsius in for the math to work appropriately as follows:

1) temperature sensor = observed temperature
2) temperature delta calculated = threshold (table) – temperature (sensor)
3) timing correction calculated = temperature delta*multiplier (table)
4) final timing correction enabled if current temperature above minimum activation limit (table, air temp. correction only)

Example (Air intake temperature)

Intake air temperature = 60 degrees
Threshold = 50 degrees (**Ignition – Intake Air Temp. Correction (Threshold)**)
Minimum activation = 50 degrees (**Ignition – Intake Air Temp. Correction (Min. Activation)**)

50 - 60 = -10,

-10 * multiplier value 0.152 (**Ignition – Air Temp. Correction (Multiplier)**) = -1.52

1.5 will be rounded to 2 full degree of timing removed.

Example (coolant temperature)

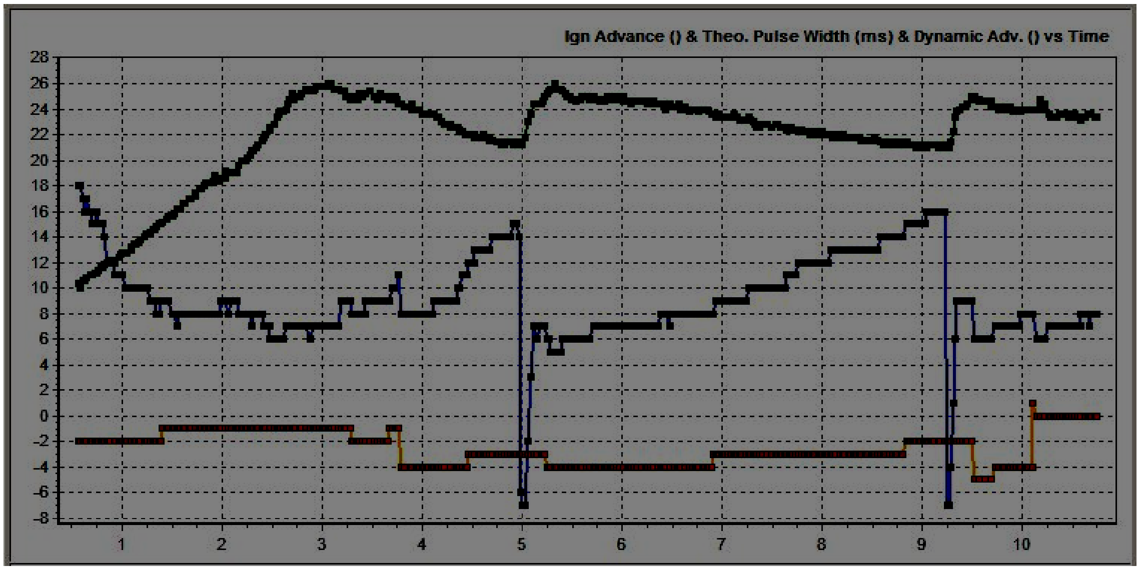
Coolant Temperature = 90 degrees
Threshold = 85 degrees (**Ignition – Coolant Temp. Correction (Threshold)**)

85 – 95 = -10

-10 * multiplier value 0.102 (**Ignition – Coolant Temp. Correction (Multiplier)**) = -1

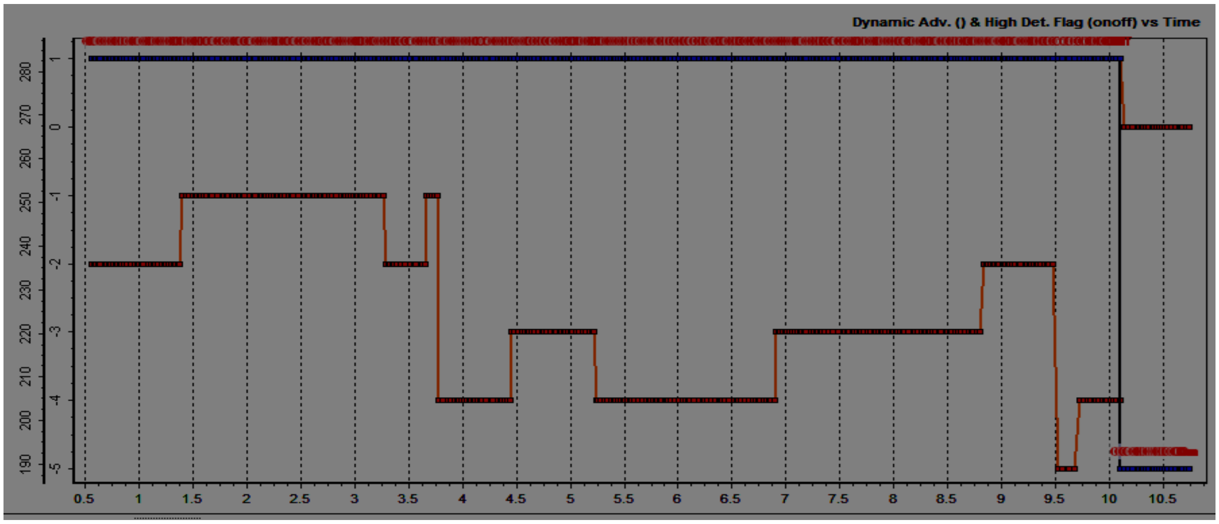
1 degree of timing will be removed.

Example Data 1 – large negative DA



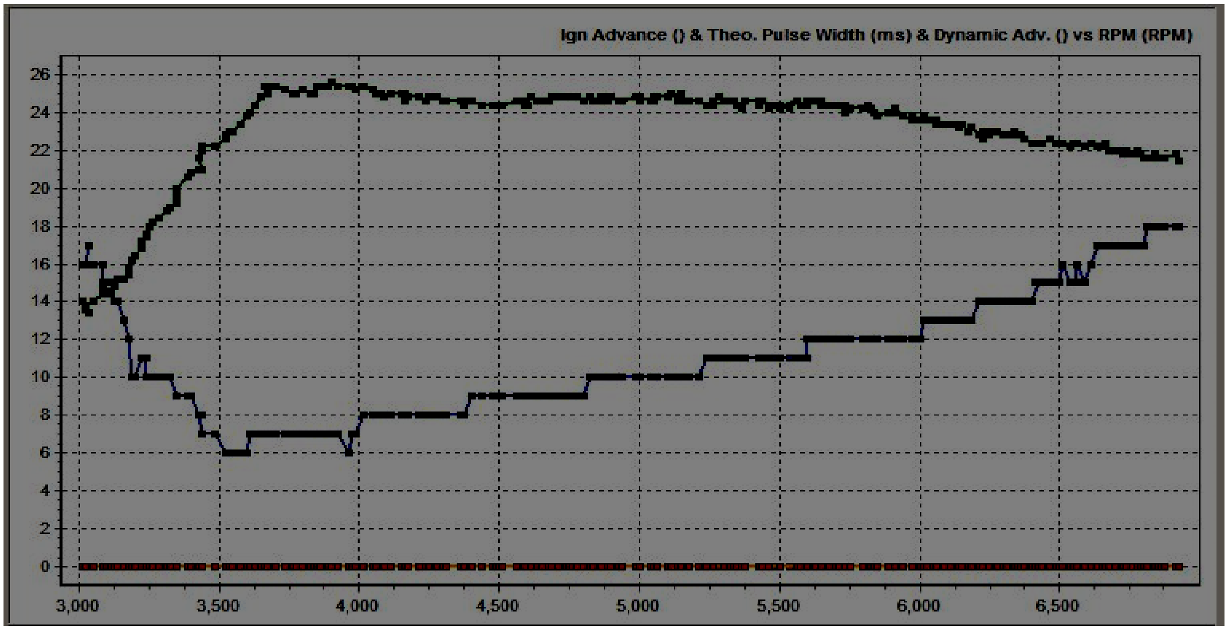
Large negative DA – Timing is removed from the DBA car (DA, yellow). Final ign timing is sh
blue and theoretical pulse width (TPW) in green. This is an excessive timing correction for a 2n
3rd gear on power pull.

Example Data 2 – High Detonation Flag



High Detonation Flag (red/blue - safe mode) activated – the same data from example one abo
With excessive negative DA (yellow) ECU switches from normal mode (OFF) to safe mode (ON
just past 10 seconds in this log.

Example 3 – Normal conditions with low dynamic advance correction (DA)

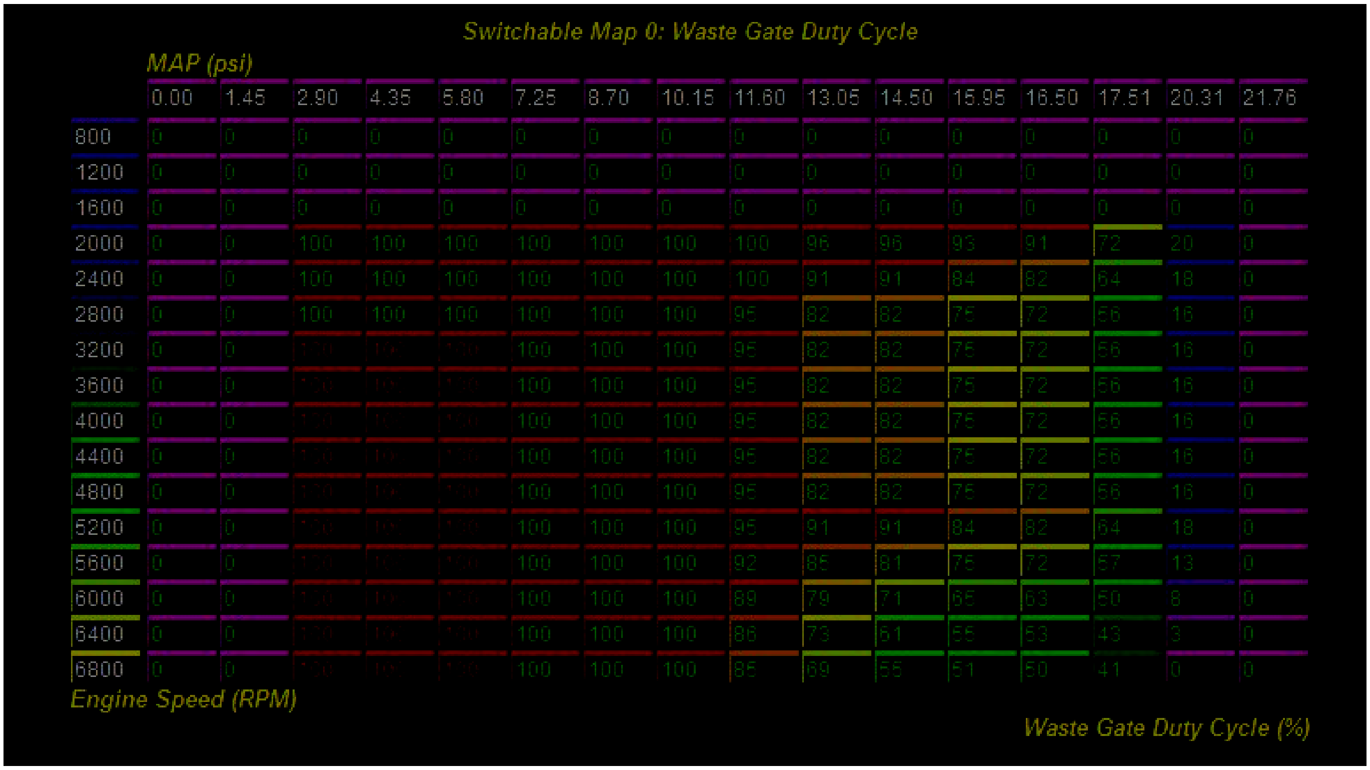


Low DA in 3rd gear high load – This is a log of a 3rd gear run showing load (theoretical pulse widt
(TPW), ignition timing (blue) and Dynamic Advance (DA, yellow). This "clean" pull had NO knoc
correction and consistent high timing. This is ideal.

G: Tuning Boost - Proportional Gain COBB custom boost control

COBB proportional gain boost control system has several advantages over the factory based boost control system. Boost levels can be reliably adjusted over a broad range in an RPM specific manner. Without any mechanical changes to the stock boost control system it is possible to achieve boost levels at the edge of the stock turbocharger capacity using the COBB proportional boost control coding. COBB proportional gain boost control system additionally support gear and throttle based compensations. Because the factory boost solenoid is an interrupt "3 port" style it with larger airflow capacity it will also support larger turbo and external wastegate applications.

Boost Cut Primary – As with the factory boost control system the v500 and later boost control uses a boost limit table. If boost goes above this table the ECU will cut fuel to lower boost and avoid engine damage. The factory MAP sensors read to 26 psi. Setting boost cut above this level results in no effective boost cut. Higher boost pressures can be achieved using aftermarket MAP sensors such as the AMS 4 bar MAP sensor.



Switchable Map 0: Waste Gate Duty Cycle

MAP (psi)

	0.00	1.45	2.90	4.35	5.80	7.25	8.70	10.15	11.60	13.05	14.50	15.95	16.50	17.51	20.31	21.76
800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	100	100	100	100	100	100	100	96	96	93	91	72	20	0
2400	0	0	100	100	100	100	100	100	100	91	91	84	82	64	18	0
2800	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
3200	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
3600	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
4000	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
4400	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
4800	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
5200	0	0	100	100	100	100	100	100	95	91	91	84	82	64	18	0
5600	0	0	100	100	100	100	100	100	92	85	81	75	72	57	13	0
6000	0	0	100	100	100	100	100	100	89	79	71	65	63	50	8	0
6400	0	0	100	100	100	100	100	100	86	73	61	55	53	43	3	0
6800	0	0	100	100	100	100	100	100	85	69	55	51	50	41	0	0

Engine Speed (RPM)

Waste Gate Duty Cycle (%)

Wastegate Duty Cycle – This is the primary table used for boost control. This table is referenced by RPM on the Y-Axis and boost pressure on the X-Axis. The Z data (table data) is direct wastegate duty cycle. There is no target based feedback in this simple boost control system. At any specific RPM and boost pressure there is a referenced wastegate duty cycle. If you desire the boost to rise above this particular level the wastegate duty cycle should be high enough to promote a rise in boost pressure. In this way, wastegate duty is higher at boost levels lower than desired. At close to the desired boost level the wastegate duty cycle is reduced to produce stable boost at this level. Above target boost the wastegate duty cycle is reduced. Using the table below, observed boost pressure is 17psi in the mid range RPM. Note that at higher boost pressure wastegate duty is reduced to near zero and zero. This provides instantaneous reductions in wastegate duty cycle that very effectively avoid over boost. The key to achieving a particular boost target is determining the wastegate duty cycle that holds a specific boost target.

Gear and throttle wastegate multiplier – v2.01 and later GT-R calibrations use a gear and throttle position based wastegate duty cycle adjustment table. Using this table a tuner can change boost as a function of throttle position and gear. Based upon the engaged gear and throttle position the look up table specifies a percentage multiplier. This multiplier transforms the final wastegate values and thus the boost response.
For example, at 45% throttle position the final boost control solenoid duty cycle will be reduced by 50%. Over 75% throttle the boost control solenoid will run at 100% of the values in the wastegate table.
In the example below each gear produces the same relationship for boost and throttle regardless of gear.

Switchable Map 0: Gear And Throttle wastegate multiplier

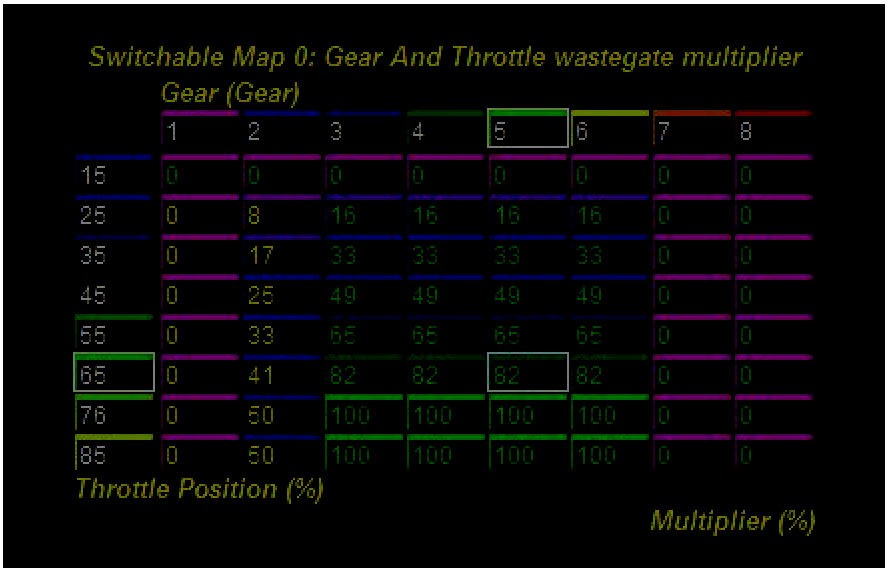
Gear (Gear)

	1	2	3	4	5	6	7	8
15	0	0	0	0	0	0	0	0
25	16	16	16	16	16	16	0	0
35	33	33	33	33	33	33	0	0
45	49	49	49	49	49	49	0	0
55	65	65	65	65	65	65	0	0
65	82	82	82	82	82	82	0	0
76	100	100	100	100	100	100	0	0
85	100	100	100	100	100	100	0	0

Throttle Position (%)

Multiplier (%)

In this next example 1st and 2nd gear are programed with lower wastegate multipliers. This will allow the boost control system to produce less boost is these gears. This scenario is desirable for a road race vehicle with larger turbochargers for example where traction is limited in lower gears.



Switchable Map 0: Gear And Throttle wastegate multiplier

Gear (Gear)

	1	2	3	4	5	6	7	8
15	0	0	0	0	0	0	0	0
25	0	8	16	16	16	16	0	0
35	0	17	33	33	33	33	0	0
45	0	25	49	49	49	49	0	0
55	0	33	65	65	65	65	0	0
65	0	41	82	82	82	82	0	0
76	0	50	100	100	100	100	0	0
85	0	50	100	100	100	100	0	0

Throttle Position (%)

Multiplier (%)

H: Tuning variable Cam Timing

A single map with load engine speed axis determines the position of variable intake cams. The COBB off the shelf maps are designed slightly modified camshaft phasing optimized for stock turbochargers, stock camshafts, and stock motor internals. We have designed the COBB mapping to enhance turbo responsiveness and mid range torque. These maps may need to be altered considerably for larger turbocharger, or after market engine components. For example, care must be taken to avoid valve to valve or valve to piston contact if after market camshafts or pistons are utilized.

I: Integrating all tuning parameters for the ideal Calibration

The ideal calibration for your GT-R is a combination of all major tuning areas outlined above. Like any performance vehicle, the GT-R will make the most power when run lean with the maximal amount of ignition timing that the ECU will allow without detonating. However, this ideal of 12.5:1 air to fuel ratio and high ignition timing is not realistic for most configurations and fuels in forced induction vehicles. The only way to determine if a calibration is ideal is to run the car on a load-based chassis dynamometer where the impact of calibration changes are easily measured. For example, addition of ignition timing that does not result in increased torque is a not ideal. If additional timing does not create power then you are simply adding stress to the engine components without tangible benefit. The same is true of boost and air to fuel ratio. If you can run the vehicle at a richer air to fuel ratio without losing power this is more ideal than running the car lean. If increasing boost does not yield considerable power gains the turbo may simply be out of its efficiency range. In this scenario less boost is actually more power. To get a coarse idea of how the ideal tune looks on your fuel type and mechanical configuration, examine the COBB OTS map notes.

J: Precautions:

Boost – The stock turbocharger can produce boost levels in excess of 20psi. This is enough cylinder pressure to cause engine damage. Be cautious when adjusting boost control parameters. Be particularly cautious when any mechanical component of the boost control system is altered.

Injector limits – The stock fuel injectors are ~570cc. These vehicles can create enough airflow to run these injectors at or above their maximal capacity at higher RPM. This is particularly true for vehicles equipped with high flow exhaust systems and intercoolers. Be cautious about running out of injector on similarly equipped vehicles. This is particularly true in cold weather when turbocharger efficiency is high.

Sensor limits – Engine control is entirely dependent upon accurate readings from the MAF sensor. Even stock vehicles produce sufficient airflow to push these sensors to their limit. Beyond the limits of the stock MAF sensor (5.0 volts) the ECU has no way to properly control the motor. Any turbocharger upgrade must also be accompanied by an appropriate MAF sensor or intake system upgrade.

Accesstuner Program shortcuts:

- **Ctrl+L –** Initiate live tuning, connect to or disconnect from a the ECU

- **Ctrl+B** - connect to ECU and initiate dash board live data

- **Ctrl+F –** Configure Program
- configures communication settings and WBO2 integration
- configures logged parameters for dashboard and saved data logs

- **Ctrl + Shift + C** – Map Slot Copy
  - Copy table data around from real-time to any map slot or from any map slot to another map slot.

- **Ctrl+D** – Initiate and terminate data log

- **Ctrl+T** – Initiate or terminate live tracing in tables

- **Ctrl+Alt+S –** Save Accesstuner Pro calibration

- **Ctrl+Alt+A –** Save Accesstuner Race calibration

- **Ctrl+Alt+O** – Open Accesstuner Pro calibrations

- **Ctrl+Alt+E** – Open Accesstuner Race calibrations

- **Ctrl+A –** Open advanced calibration settings – activate or deactivate Check Engine Lights (CEL) and advanced engine parameter toggles (CTO!)

- **Ctrl+G –** Change ECU

- **Ctrl+K** – Revert to stock calibration

- **Ctrl+Shift-F** – Flash map

- **Table editing shortcuts:**
  - **E** – Direct edit table cell(s)
  - **H** – Horizontal interpolation of selected table cells
  - **V –** Vertical interpolation of selected table cells
  - **M** – Multiplication of selected table cell(s) by factor

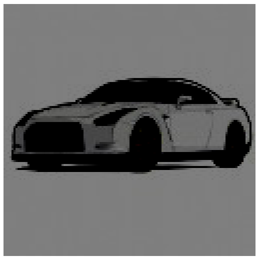


Table definitions and Tuning Tips– MAF-Based Tuning

BLACK = base table, non switchable map, used for every map slot in calibrations

BLUE = Switchable table for map slot 0-8

RED = Tunable in Real time with Accesstuner Software

Boost - Boost Cut Delay

This a counter value that must be satisfied after the vehicle sees an over-boost condition. Once normal boost levels, as defined in the Primary Boost table, are achieved, the vehicle will operate normally. If the vehicle exceeds the Primary Boost Cut table, it must return to the Low Limit Boost table for the Count as defined in this table.

Tuning Tips - None at this time.

Boost - Boost Cut Primary

This is the high limit for boost in all running conditions based on RPM breakpoints. These limits are in effect during shifting as well. Factory MAP sensor limits are 26 psi.

Tuning Tips – Set limit above your target boost but below the limit of the manifold MAP sensor.

Fuel – Tables

Cranking Enrichment:

Cranking Inj. Pulsewidth Adder

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table are added to a base IPW. Increasing the values will increase the Injector Pulsewidth used while the engine is cranking. Decreasing table values reduces Injector Pulsewidth.This table has a smaller impact on cranking IPW, and can be used when making small, fine tuning adjustments.

Cranking Inj. Pulsewidth Multiplier

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table are multiplied against a base IPW. Increasing the values will increase the Injector Pulsewidth used while the engine is cranking. Decreasing table values reduces Injector Pulsewidth. It is possible to make very large changes in cranking IPW by manipulating this table.

Fuel – High Speed Fueling – Tables controlling high speed enrichment that begins at high vehicle speeds (over 145 mph).

Fuel – Learning Rate - the rate at which the ECU controls fuel system to meet closed loop target under high load. (Beta) – No tuning Tips

Fuel – Richening Rate - the rate at which the closed loop target is richened at high speed (Beta). No Tuning Tips

Fuel – Richest AFR – the richest closed loop AFR at high speed (Beta). Make leaner to avoid unwanted high speed fuel enrichment.

Fuel – Base Fuel Schedule Modifier

A single value to used by the ECU for all load calculations. Tuning Tips – Leave this stock.

Fuel Economy Display injector Size

Injector size (in cc/min) used by the on dash display system to calculate fuel economy and range.

Fuel – End of Injection

The end point of injector opening in degrees after top dead center (720 degrees in a full combustion cycle) - referenced by load and RPM.

Tuning Tips – slight increase in injection timing can reduce black smoke by reducing the injection of fuel into a high velocity intake charge while exhaust valves are still open. Reference optimized end of injection tables in 2012+ GT-R compared to earlier cars.

Fuel - High Det.

Target fuel mixture when car is in limp or High Detonation mode following prolonged knock induced ignition correction.

Fuel – Minimum Injector Pulse Width

Single value to determine the smallest commanded injector open time.

Tuning Tips - Decrease proportional to desired open time decrease. Larger injectors such as 2000cc will require ~1/2 standard Minimum Injector Pulse-width.

Fuel – Volumetric Efficiency

Underlying volumetric efficiency (VE) table used by the ECU for MAF tuning.

Tuning tips - Almost totally ineffective. Most calibrators ignore this table – leave stock.

Ignition Tables (All Year Models)

Maximum Ign. Timing

Maximum (highest) Ignition Timing value allowed by the ECU. Lowering this value decreases the maximum ignition advance the ECU can ever command. Increasing this value allows for higher maximum ignition advance. Does not otherwise alter your tuned ignition tables.

Minimum Ign. Timing A / Minimum Ign. Timing B

Minimum (lowest) Ignition Timing value allowed by the ECU. Lower this value to allow for more ignition retard. Increase this value to prevent the ECU from retarding timing below a desired amount.

Cranking Ignition Timing:

Cranking Ignition (Base)

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table represent a base ignition timing value used during cranking. Increasing the values in this table will increase the ignition advance angle. Decreasing the values will reduce the ignition advance angle. This is the primary table to use when tuning cranking ignition timing.

Cranking Ignition – ECT Correction

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table are used to apply a correction to the ignition timing used during cranking. A value of 100% applies no correction to the target cranking ignition timing value. Values less than 100% will decrease the target ignition timing. Values more than 100% will increase the target ignition timing.

Max Correction Allowed

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table represent the max allowed total correction factor to be applied to the ignition timing used during cranking. This is to prevent too many corrections being applied to the cranking ignition timing.

Ignition Tables (CBA – 2008 to 2010 world market, 2009-2011 USDM)

Ignition – High Det.

Look up table for CBA based ignition control under condition with high and sustained knock correction (knock sum of -1400 or more).

Ignition – High Det. Knock Overlay

Look up table to determine if knock control is ON (table value 1) or OFF (table value 0) during when in High Det. Mode.

Ignition Coolant Temp Compensation

Used to modify target ignition timing values based on engine coolant temperatures.

Ignition Tables (DBA – 2011+ world market, 2012+ USDM)

Dynamic Advance – Final Minimum High Det. (DBA)

Maximum amount of negative dynamic advance allowed during High Det. Mode. Undefined X axis but related to increased load and RPM from left to right. -

Dynamic Advance – Final Minimum Low Det. (DBA)

Maximum amount of negative dynamic advance allowed during Low Det. Mode. Undefined X axis but related to increased load and RPM from left to right. -

Dynamic Advance – Increment (DBA)

Multiplier used to increase DA (add timing) under condition when knock counter is low (little to no detonation).

Tuning tips – increase or decrease to expand or contract the amount of positive DA seen during conditions with low knock (ie, high octane).

Dynamic Advance – Knock Decrement (DBA)

Multiplier used to decrease DA (subtract timing) under condition when knock counter is high (detonation).

Tuning tips – decrease to contract the amount of negative DA seen during conditions with high knock (ie, low octane).

Dynamic Advance – Max High Det. (DBA)

Maximum DA under High Det. Conditions.

Tuning tips – none.

Dynamic Advance – Max Low Det. (DBA)

Maximum DA under Low Det. Conditions.

Tuning Tips – decrease these value to prevent the ECU from adding timing and making the tune too aggressive. Maximum value for stock USDM GTR is 3.1 COBB OTS maps use a max of 0.9 to prevent any positive DA under low detonation.

Dynamic Advance – Minimum Low Det. (DBA)

Floor for calculated DA under low det conditions. Some other limit tables will also limit DA such as “Final Minimum Low Det.” above.

Ignition – Cold Adder Knock Overlay (DBA)

Table to activate or inactivate (1 or 0 respectively)cold condition LOW load (cruise) DBA ignition timing.

Ignition – Cold Adder Low Load/Cruise (DBA)

Timing corrections for cold condition during LOW load (cruise) DBA ignition timing.

Ignition – Coolant Temp. Correction (Threshold) (DBA)

Threshold set point for calculated timing correction temperature delta.

Tuning tips - Calculate in degrees Celsius. Coolant temp delta = Threshold temp - current coolant temp. Coolant temp delta * coolant temp correction multiplier (table) = coolant temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease.

Ignition – Coolant Temp. Correction Multiplier (DBA)

Multiplier referenced by RPM and engine load use to determine final coolant temp based ignition correction. Coolant temp delta (calculated value above)

Tuning tips - Coolant temp delta (defined above) * coolant temp correction multiplier (table) = total coolant temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease. Decreased table values reduce the coolant temperature induced ignition timing correction.

Ignition – High Det (DBA)

Look up table for base timing under condition of high detonation (prolonged large negative DA)

Ignition – Hot Adder Knock Overlay (DBA)

Table to activate or inactivate (1 or 0 respectively) hot condition LOW load (cruise) DBA ignition timing.

Ignition – Hot Adder Low Load/Cruise (DBA)

Timing corrections for hot condition during LOW load (cruise) DBA ignition timing.

Ignition – Intake Air Temp. Correction (Threshold) (DBA)

Threshold set point for calculated timing correction Intake Air temperature delta.

Tuning tips - Calculate in degrees Celsius. Intake air temp delta = Threshold temp - current air temp. Air temp delta * air temp correction multiplier (table) = Final Air temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease. **For blow through setups with the air intake sensor reading post turbocharger air temperature these tables must be changed to reflect the much higher air temperatures.

Ignition – Intake Air Temp. Correction Multiplier (DBA)

Multiplier referenced by RPM and engine load use to determine final Air temp based ignition correction.

Tuning tips – Intake Air temp delta (defined above) * Intake Air temp correction multiplier (table) = total intake Air temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease. Decreased table values reduce the Air temperature induced ignition timing correction. For draw through MAF based intake the stock values are reasonable. **For blow through setups with the air intake sensor reading post turbocharger air temperature these tables must be changed to reflect the much higher air temperatures.

Ignition - Intake air Temp. Correction – Minimum activation. (DBA)

Temperature below which no intake Air temperature timing correction are applied.

Launch Control Ign. Retard (DBA)

Applied to Ignition Timing only during Launch Control. May be used to generate more/less boost during the LC function.

Knock Sensitivity (DBA and CBA)

A three dimensional map defined by cylinder and RPM as axis. The unit less Z axis values define acceptable background noise thresholds.

Tuning Tips – Larger values decrease knock sensitivity. Increase this values in small increments when tuning motors who's components produce noise and false knock. Stock motors are relatively quiet. Stock knock sensitivity values produce a knock detection system too sensitive for comparatively noisy forged component motors.

Limits

Max. Vehicle Speed Target (CC)

Maximum cruise control speed limiter.

Rev. Limit Fuel Cut

RPM above which the injectors are turned off to prevent further engine speed increase.

Rev. Limit – Launch RPM limit

Throttle based rev limit which is used when launch is activated.

Tuning Tips - Raise to 4100 for best resutls with stock turbocharger and LC-4 or LC-5 TCM programs.

Rev Limt – Throttle limit.

RPM above which the throttle is closed to prevent further engine speed increase.

Rev Limit – VSS – Limp home

Maximum RPM during fault induced limp mode.

Speed limit A through F

Maximum allowed vehicle speed

Speed limit hysteresis

Speed below limit that must be obtained before again allowing acceleration

MAP sensor Calibration Tables (pre and post throttle)

Post Throttle Inlet manifold absolute pressure sensor gradient (kPa/V)

Post Throttle Inlet manifold absolute pressure sensor zero pressure offset (V)

Pre Throttle boost pressure sensor gradient (kPa/V)

Pre Throttle Inlet manifold absolute pressure sensor zero pressure offset (V)

Offset and gradient values that define the linear pressure voltage relationship of pre and post throttle pressure sensors. Stock sensors can be switched for higher reading units and calibrations changed accordingly.

Tuning Tips – AMS 4.0 bar map sensor gradient = 83 and offset = 0

Misc Calibration Tables

Idle Table A through C –

Target Idle engine speed varying by coolant temperature

Radiator Fan Duty Cycle

Look up table for radiator fan speed – unknown axis.

Radiator Fan Step 1 through 3

Temperature for activation of 3 different radiator fan speeds

Sensor Calibrations

Intake Air Temperature Sensor - 0 to 5V sensor with associated temperature calibration.

Global Map Settings

Active Map Count

Number of active map slots contained in a calibration.

Boost Gauge – Mode (0 = Factory, 1 = Wrap)

Boost gauge wrap around “on” or “off”. Configure this table value to enable or disable the Multi-Function Display Boost gauge wrap around feature.

Boost Gauge – Wrap (Unit Optimization) (0 = psi, 1 = kPa)

Boost gauge wrap around unit type. Configure this table value to match the Multi-Function Display Boost gauge units. Failure to configure this table will result in improperly scaled boost gauge drawing (post wrap-around).

Knock Flashing Threshold (CBA)

Knock sum value below which the boost gauge will flash to report high detonation to the driver.

Knock Flashing – Activation (DBA)(Max. Dynamic Advance Threshold)

The threshold for DBA knock gauge flash.

Switchable Maps (contained in each of the 0 through 8 map slots, some tunable in REAL TIME as noted)

Transmission - Clutch Torque (Switchable map table)

Desired Clutch torque lockup as indicated by load (Theoretical Pulse Width) and RPM.

Tuning Tips **–** Under most circumstances this table should remain stock.

Fuel - Injector Latency Multiplier (switchable map table and REAL TIME tunable)

Injector “multiplier” defines the slope of the linear relationship between battery voltage and injector latency.

Fuel - Injector Latency Offset (switchable map and REAL TIME tunable)

Injector “Offset” defines the change of the linear relationship between battery voltage and injector latency at low and high battery voltages.

Tuning Tips - When using injectors other than stock it is critical to adjust these values to reflect the voltage response characteristics of the new injectors. Injectors need a different dead time compensation at different voltages. Generally, lower battery voltage requires longer dead times while higher voltage requires less.

Fuel - Fuel Injector Scalar (switchable map and REAL TIME tunable)

This value determines the size of fuel injectors in cubic centimeters (cc). Stock value is 570cc.

Tuning Tips - Raise this value to the approximate flow rate of the new injectors in cc/min

Fuel – low Det (switchable map and REAL TIME tunable)

This is the primary look up table for fuel targets. The ECU will reference this table to achieve the desired air fuel mixture. This table alone will not govern fueling. The vehicle will reference the MAF values reported. The table Z data is in Lambda or AFR. The higher the number the leaner the mixture, the lower the number the richer the mixture.

Tuning Tips - The GT-R is always operating in closed loop with feedback from two separate wide-band oxygen sensors. The ECU will target the fuel value in this table and will eventually learn sufficient fuel trims to archive this target.

Fuel - Fuel Multiplier (switchable map and REAL TIME tunable)

The **Fuel Multiplier** is a single value that influences MAF calibration. This value is a multiplier for mass air flow.

Tuning Tips - For example, if a larger inner diameter intake is used the Fuel Multiplier can be used to increase the MAF proportional to the increase in MAF sensor housing cross sectional area. For example, New fuel multiplier = stock fuel multiplier * (new MAF diameter squared) / (old MAF diameter squared).

Boost - Gear and Throttle wastegate multiplier (switchable map and REAL TIME tunable)

COBB GT-R calibrations use a gear and throttle position based wastegate duty cycle adjustment table. This table is defined by gear and throttle position. Based upon these conditions the defined Z data transforms the final duty cycle used by the boost control system. Wastegate Duty Cycle = (wastegate duty cycle as defined by engine speed and boost) * (multiplier percentage defined by throttle and gear)

Tuning Tips - Using this table a tuner can change boost as a function of throttle position and gear. Based upon the engaged gear and throttle position the look up table specifies a percentage multiplier. This multiplier transforms the final wastegate values and thus the boost response.

Ignition - Low Det. (CBA Strategy) (switchable map and REAL TIME tunable)

This is the primary table used to determine ignition timing under normal operating conditions and wide open throttle driving for CBA GT-R (2008-2010 world market and 2009-2011 USDM).

Tuning Tips - The Nissan GT-R uses a complex computational process to constantly calculate optimal ignition timing. An internal mathematical model of engine function together with an array of sensor information is used to calculate ignition timing. The values in the timing tables are referenced within this computational process but are NOT traditional ignition timing in degrees before top dead center as most tuners will recognize. These numbers are best thought of in terms of fuel burn time. The numbers in these tables do heavily impact timing calculations so timing can be adjusted. Higher values will lead to higher ignition timing and lower values lower ignition timing. One to two increment increase in table values will lead to a single degree increase in ignition timing.

Ignition Low Det. (DBA Strategy) (switchable map and REAL TIME tunable)

This is the primary table used to determine ignition timing under normal high load operating conditions and wide open throttle driving for DBA GT-R (2011+ world market and 2012+ USDM).

Tuning Tips – These DBA based tables are all referenced in degrees before top dead center. This table, referenced by load and engine speed, is the look up table for high load DBA timing. Final timing is a sum of Air and coolant temperature corrections, Dynamic Advance corrections, and the look up value from this table.

Intake Cam. Advance (switchable map and REAL TIME tunable)

Look up table for intake camshaft closed loop target position as a function of RPM and load.

Tuning tips – optimal intake camshaft advance for increased turbo response. Motors equipped with aftermarket Camshafts should be tuned with caution to avoid valve to piston interference. Tune only to recommended maximum allowable limits.

Low Det Knock Overlay (CBA strategy) (switchable map)

Lookup table for referenced by load and RPM that indicates if knock control is active (1) or inactive (0) for low detonation CBA timing.

MAF Calibration A (switchable map)

This is the calibration for the MAF sensor on Bank A. This table determines the grams/sec based on a specific voltage. Airflow vs. Volts. A mass airflow sensor is used to find out the mass of air entering a fuel-injected engine. The air mass information is necessary for the engine control unit (ECU) to calculate and deliver the correct fuel mass to the engine.

Tuning Tips - This table must be considered when changing the diameter of the MAF housing or the airflow of the intake. This typically applies to after market intakes and larger MAF housings. Changing this value changes the assumed airflow into the engine base on a specific voltage. Assuming the tube that the MAF sensor is housed in remains constant, increasing the numbers will richen the mixture and decreasing the numbers will lean the fuel mixture. The stock MAF calibrations are different across the two banks because of differences in the stock intakes. When using after market intakes it may be advisable to make the two banks similar.

MAF Calibration B (switchable map)

This is the calibration for the MAF sensor on Bank B. This table determines the grams/sec based on a specific voltage. Airflow vs. Volts. A mass airflow sensor is used to find out the mass of air entering a fuel-injected engine. The air mass information is necessary for the engine control unit (ECU) to calculate and deliver the correct fuel mass to the engine.

Tuning Tips - This table must be considered when changing the diameter of the MAF housing or the airflow of the intake. This typically applies to after market intakes and larger MAF housings. Changing this value changes the assumed airflow into the engine base on a specific voltage. Assuming the tube that the MAF sensor is housed in remains constant, increasing the numbers will richen the mixture and decreasing the numbers will lean the fuel mixture. The stock MAF calibrations are different across the two banks because of differences in the stock intakes. When using after market intakes it may be advisable to make the two banks similar.

Throttle control (switchable map and REAL TIME tunable)

Throttle plate opening as a function of accelerator pedal position.

Wastegate Duty Cycle (switchable map and REAL TIME tunable)

This is the primary table used for boost control. This table is referenced by RPM on the Y-Axis and boost pressure on the X-Axis. The Z data is direct wastegate duty cycle.

Tuning Tips - There is no target based feedback in this simple boost control system. At any specific RPM and boost pressure there is a referenced wastegate duty cycle. If you desire the boost to rise above this particular level the wastegate duty cycle should be high enough to promote a rise in boost pressure. In this way, wastegate duty is higher at boost levels lower than desired. At close to the desired boost level the wastegate duty cycle is reduced to produce stable boost at this level. Above target boost the wastegate duty cycle is further reduced. The key to achieving a particular boost target is determining the wastegate duty cycle that holds desired boost at a specific RPM.

Tuning Guide Part II– Speed Density

This second half of the tuning guide is to be used for speed density based tuning. Much of the logic and tables are the same for MAF or speed density so much of this second section of the tuning guide is a duplicate. However, there are critically different fuel and load calculation differences across these two tuning types and this section focuses on SD tuning strategies.

Switching between MAF and SD tuning strategies:

In order to prevent an unwanted mixing on MAF and SD tuning on any vehicle only one type of tuning can be enabled for any specific Accessport installation. If an Accessport is installed with a non-SD calibration starting point you cannot load an SD based calibration. The vehicle identity is linked to the type of calibration first loaded on the car during Accessport installation. So, in order to switch from MAF to SD or SD to MAF, the Accessport must first be **uninstalled** from the vehicle and then reinstalled using a calibration with the desired tuning strategy (ie, MAF or SD).

How to create starting point calibrations for Speed Density based tuning:

GT-R Accesstuner software for SD integrates custom logic and new tables to allow SD based tuning. In order to create a new starting point map open the software and select Speed Density option and the appropriate year and world region of the car. The proper base parameters are automatically loaded to allow SD tuning.

There are a few key parameter that need to be set up in order to create a base Speed density tuning calibrations.

1. Set the fuel multiplier to STOCK. This value is often increased as part of tuning larger diameter intakes with MAF based tuning. This value must be STOCK for SD calibrations.
2. Set MAF calibration A to stock values
3. Set MAF calibration B to stock A values (A=B at all MAF voltages)
4. Set the injector scalar to match the flow of the installed injectors (570 for stock)
5. (CTO!)Turn off MAF based codes P 0101, P0102, P0103, P010b, P236, P238, P240, P328, P420, P430, P0700

These basic parameter are the starting point for all SD based calibrations.

Step 1 – Air Temperature sensors relocated ?

Speed density based airflow calculations and fueling commands require an accurate measure of air temperature. The best place to measure air temperature is after the intercooler and just before the manifold. It is the temperature of the air entering the motor that is most important. The standard SD air temperature correction table is set up to produce fueling offsets consistent with this sensor placement. It is highly advised to move the stock MAF and air temperature sensors to a location just before the throttle body. Configured in a boost tube after the intercoolers the MAF sensors along with their associated Air Temperature Sensor are in a “blow through” configuration.

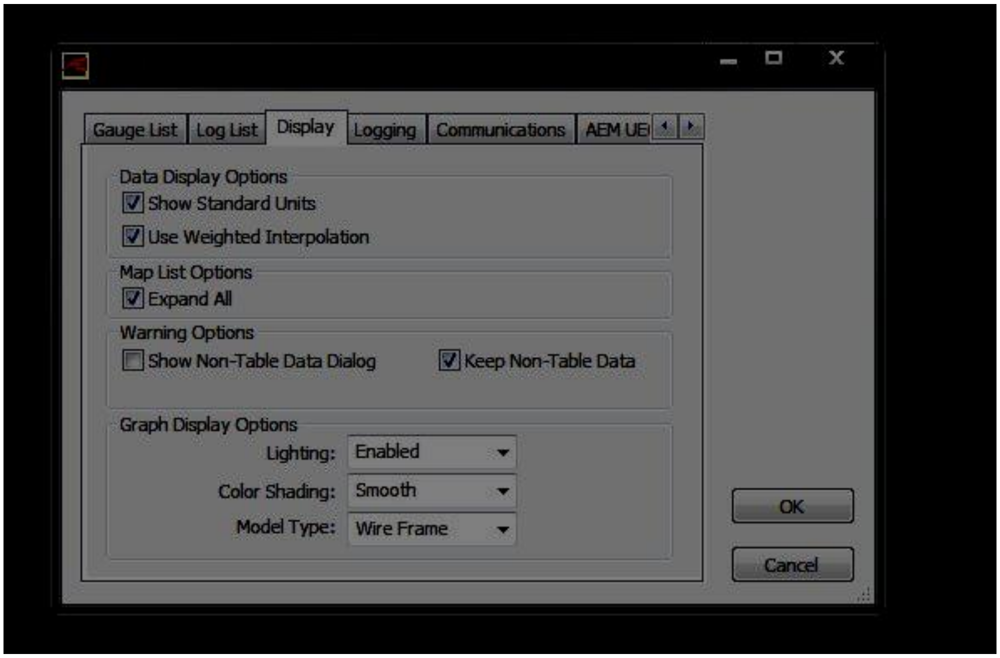
Step 2 – What fuel is the vehicle using?

Please note that COBB Tuning offers MAF based calibrations for different fuels including 91, 93, and 100 octane as well as 95, 98, and 102 RON. The Nissan GT-R is available throughout the world and we've developed calibrations for the most readily available fuel types throughout the world markets. To create a Speed density-specific starting point map open the SD software and start by copying and pasting the ignition and fuel mapping from the MAF based calibration that best matches your fuel type and car configuration.

Step 3 – Calibration refinement on a load-based chassis dynamometer.

A: Configure and Connect the Accesstuner software to the Accessport equipped GT-R.

With your starting point calibration in the Accesstuner software. Configure the Accesstuner software to connect to your vehicle. Attach the OBDII dongle/cable to the vehicle and the associated USB cable to your computer (direct tuning). Alternatively, connect the Accessport to the vehicle and then simultaneously connect the Accessport to the computer. Used in this so called “pass through” configuration the tuner can connect to and collect data from the vehicle and, without changing any physical configuration, flash a new calibration to the car's ECU.



Data Display Options

☑ Show Standard Units

☑ Use Weighted Interpolation

Map List Options

☑ Expand All

Warning Options

☐ Show Non-Table Data Dialog ☑ Keep Non-Table Data

Graph Display Options

Lighting: Enabled

Color Shading: Smooth

Model Type: Wire Frame

Press “Ctrl+F” to configure the program. Select the directory in which to store your data logs under the “logging” tab. Select the type of tuning cable and its associated com port under “communications.” You can also integrate a wide-band oxygen (WBO2) sensor signal into the data logs. Select the specific oxygen sensor you wish to use and indicate its associated com port.

B: Display and Log critical engine parameters while testing.

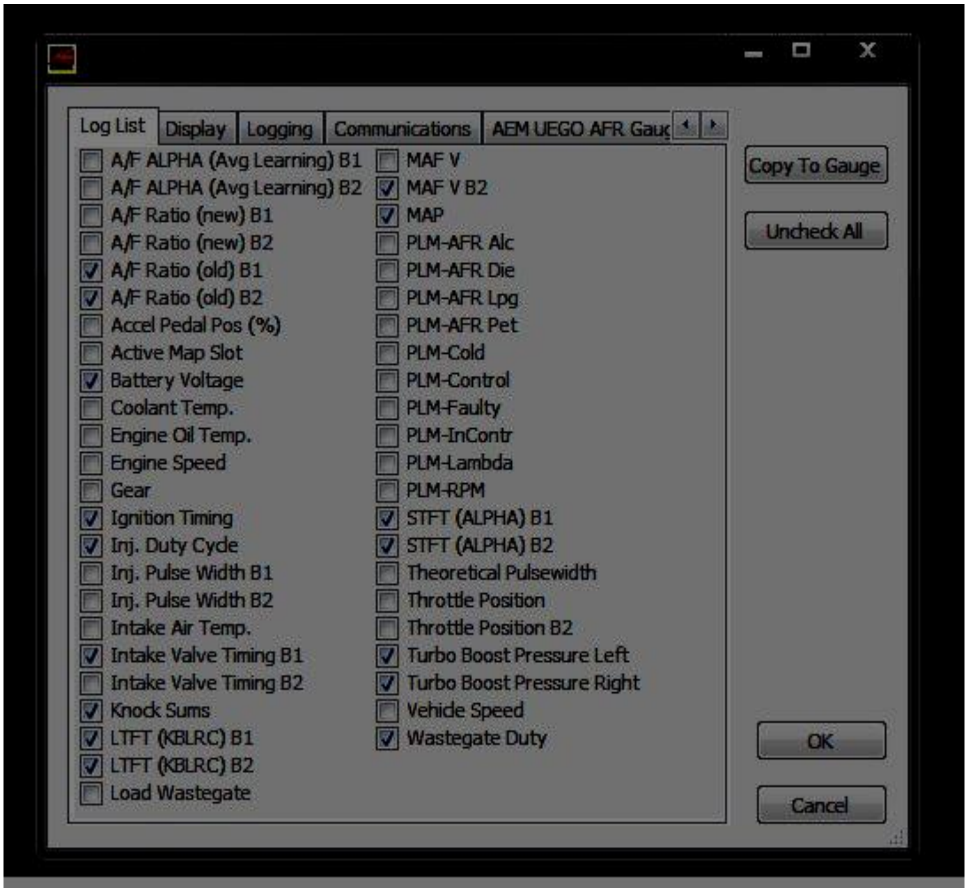
Accesstuner software allows the user to visualize, sample, and record critical engine parameters. This data includes sensor information and commanded engine function.

To connect to a live ECU:

Open Accesstuner and load the calibration currently flashed into the vehicle. Attach the OBDII cable to the vehicle and the computer (V2 Accessport). If the vehicle is equipped with a version v2b "pass through" Accessport attach the OBDII cable to the vehicle and Accessport to the computer. With the vehicle ignition on, press "Ctrl+L" to connect to the active ECU. If Accesstuner is connected to the vehicle the message in the lower right corner of the program will read "on-line."

Configure displayed parameters on the live "Dashboard" and those data collected during a log:

The parameters selected in the "Gauge List" tab will be displayed in the live dashboard when connected to a vehicle and the live dashboard is enabled. See an example of this live dashboard below. This screen is the single best way to assess the condition of the engine during tuning. It is critical to actively monitor these parameters while tuning. These data allow the tuner to determine if a calibration is performing correctly. Accurate and deliberate assessment of engine data is the only way to avoid conditions that may damage the engine.

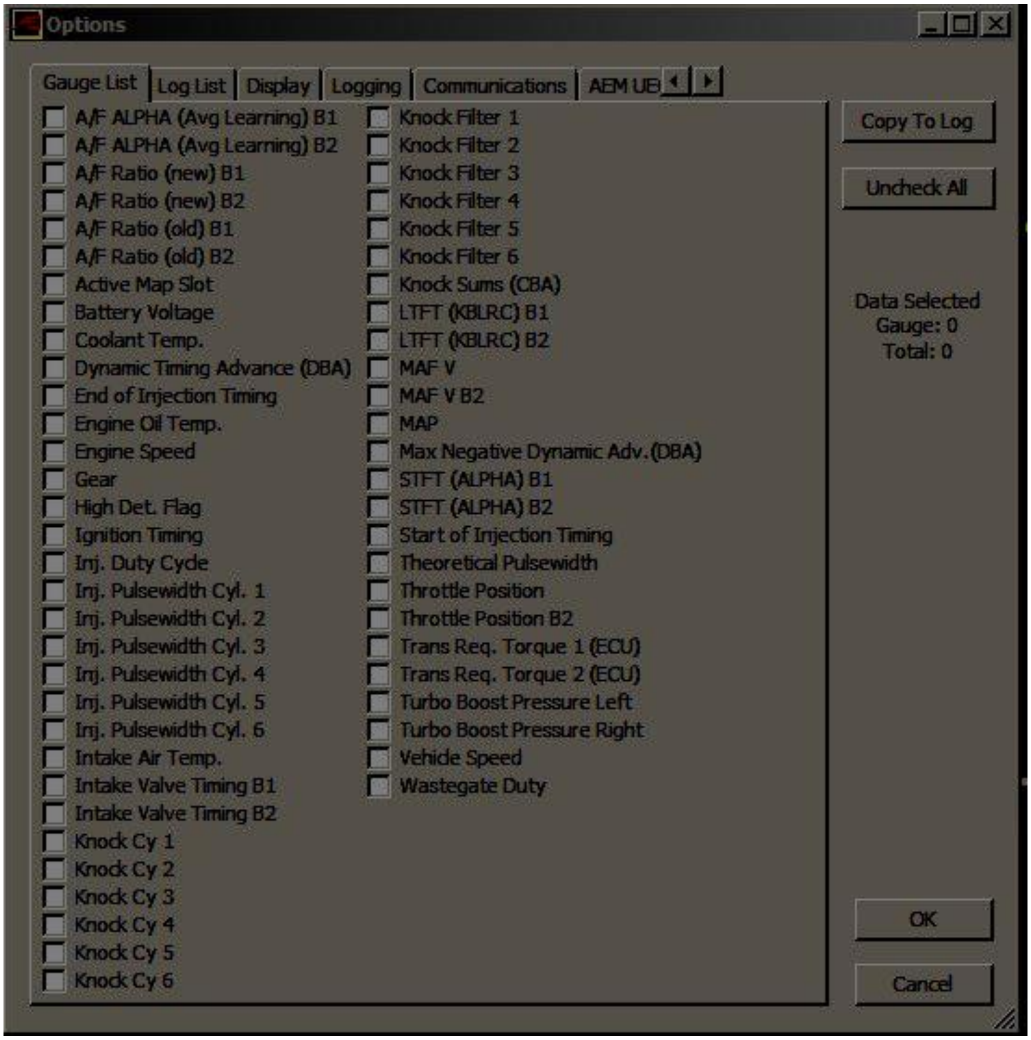


- ☐ A/F ALPHA (Avg Learning) B1
- ☐ A/F ALPHA (Avg Learning) B2
- ☐ A/F Ratio (new) B1
- ☐ A/F Ratio (new) B2
- ☑ A/F Ratio (old) B1
- ☑ A/F Ratio (old) B2
- ☐ Accel Pedal Pos (%)
- ☐ Active Map Slot
- ☑ Battery Voltage
- ☐ Coolant Temp.
- ☐ Engine Oil Temp.
- ☐ Engine Speed
- ☐ Gear
- ☑ Ignition Timing
- ☑ Inj. Duty Cycle
- ☐ Inj. Pulse Width B1
- ☐ Inj. Pulse Width B2
- ☐ Intake Air Temp.
- ☑ Intake Valve Timing B1
- ☐ Intake Valve Timing B2
- ☑ Knock Sums
- ☑ LTFT (KBLRC) B1
- ☑ LTFT (KBLRC) B2
- ☐ Load Wastegate
- ☐ MAF V
- ☑ MAF V B2
- ☑ MAP
- ☐ PLM-AFR Alc
- ☐ PLM-AFR Die
- ☐ PLM-AFR Lpg
- ☐ PLM-AFR Pet
- ☐ PLM-Cold
- ☐ PLM-Control
- ☐ PLM-Faulty
- ☐ PLM-InContr
- ☐ PLM-Lambda
- ☐ PLM-RPM
- ☑ STFT (ALPHA) B1
- ☑ STFT (ALPHA) B2
- ☐ Theoretical Pulsewidth
- ☐ Throttle Position
- ☐ Throttle Position B2
- ☑ Turbo Boost Pressure Left
- ☑ Turbo Boost Pressure Right
- ☐ Vehicle Speed
- ☑ Wastegate Duty

To configure logged parameters in the recorded "Log List" tab:

While connected to a live ECU Press "Ctrl+F" and select the "Log List" tab to select the parameters displayed in saved Accesstuner logs. When data logging is enabled these parameters will be permanently written to a comma delimited data file.

NO more than 32 parameters can be selected at any one time! The rate of data collection will be lower than optimal when more parameters are selected. For example, you will see a higher sample rate with 4 parameters, than 7 parameters.



- ☐ A/F ALPHA (Avg Learning) B1
- ☐ A/F ALPHA (Avg Learning) B2
- ☐ A/F Ratio (new) B1
- ☐ A/F Ratio (new) B2
- ☐ A/F Ratio (old) B1
- ☐ A/F Ratio (old) B2
- ☐ Active Map Slot
- ☐ Battery Voltage
- ☐ Coolant Temp.
- ☐ Dynamic Timing Advance (DBA)
- ☐ End of Injection Timing
- ☐ Engine Oil Temp.
- ☐ Engine Speed
- ☐ Gear
- ☐ High Det. Flag
- ☐ Ignition Timing
- ☐ Inj. Duty Cycle
- ☐ Inj. Pulsewidth Cyl. 1
- ☐ Inj. Pulsewidth Cyl. 2
- ☐ Inj. Pulsewidth Cyl. 3
- ☐ Inj. Pulsewidth Cyl. 4
- ☐ Inj. Pulsewidth Cyl. 5
- ☐ Inj. Pulsewidth Cyl. 6
- ☐ Intake Air Temp.
- ☐ Intake Valve Timing B1
- ☐ Intake Valve Timing B2
- ☐ Knock Cy 1
- ☐ Knock Cy 2
- ☐ Knock Cy 3
- ☐ Knock Cy 4
- ☐ Knock Cy 5
- ☐ Knock Cy 6
- ☐ Knock Filter 1
- ☐ Knock Filter 2
- ☐ Knock Filter 3
- ☐ Knock Filter 4
- ☐ Knock Filter 5
- ☐ Knock Filter 6
- ☐ Knock Sums (CBA)
- ☐ LTFT (KBLRC) B1
- ☐ LTFT (KBLRC) B2
- ☐ MAF V
- ☐ MAF V B2
- ☐ MAP
- ☐ Max Negative Dynamic Adv.(DBA)
- ☐ STFT (ALPHA) B1
- ☐ STFT (ALPHA) B2
- ☐ Start of Injection Timing
- ☐ Theoretical Pulsewidth
- ☐ Throttle Position
- ☐ Throttle Position B2
- ☐ Trans Req. Torque 1 (ECU)
- ☐ Trans Req. Torque 2 (ECU)
- ☐ Turbo Boost Pressure Left
- ☐ Turbo Boost Pressure Right
- ☐ Vehicle Speed
- ☐ Wastegate Duty

Data Selected
Gauge: 0
Total: 0

Below is a list of logged parameters for the GT-R (MAF or SD based tuning). The selected parameters are those that are critical to record under most conditions. Other parameters may be selected or removed based upon the objectives of any specific tuning process.

A/F ALPHA (Avg. Learning) B1 – Average learned fuel correction bank 1.

A/F ALPHA (Avg. Learning) B2 – Average learned fuel correction bank 2.

A/F Ratio (new) B1 – Internal wide-band oxygen sensor bank 1. A newer calibration – reads a bit rich – non-preferred calibration

A/F Ratio (new) B2 – Internal wide-band oxygen sensor bank 2. A newer calibration – reads a bit rich – non-preferred calibration

A/F Ratio (old) B1 – Internal wide-band oxygen sensor bank 1. Older original calibration, reads a bit leaner than tailpipe WBO2 -preferred calibration

A/F Ratio (old) B2 – Internal wide-band oxygen sensor bank 2. Older original calibration, reads a bit leaner than tailpipe WBO2 -preferred calibration

Active Map Slot – Real time switchable map currently in use by the ECU (0-8)
Battery Voltage

Coolant Temp. – Engine coolant temperature.

Dynamic Advance (DBA) – monitor used for DBA ignition timing only. Degrees of advance added or subtracted due to current engine noise or detonation

End of injection Timing – Timing for end on injection in rotational degrees after top dead center.

Engine Oil Temp. – Engine oil temperature.

Engine Speed – Engine speed in revolutions per minute.

Gear

High Det. Flag – monitor that reports normal low detonation (0) or high detonation (1) conditions.

Ignition Timing – Ignition timing in degrees before top dead center. This is the final commanded ignition timing after all correction and adjustments.

Inj. Duty Cycle – Total injector pulse width as a percentage of available injector open time.

Inj. Pulse Width Cyl 1-6 – Total open time of fuel injector.

Intake Air Temp. – Sensor value intake air temperature.

Intake Valve Timing (B1 and B2) – Position in degrees of variable intake camshaft.

Knock Cy 1-6 – raw knock value from each cylinder

Knock Filter 1-6 – knock sensitivity threshold level for each cylinder

Knock Sums (CBA)– A monitor that reports active ignition timing adjustment in response to engine noise – an increment of 300 is equivalent to 1 degree of ignition removed. Used ONLY in CBA ignition strategy cars

LTFT (KBLRC) B1 – Long-Term Fuel Trim Bank 1. This long-term fuel trim indicates an average learned fuel correction needed to maintain the closed loop target for Bank 1.

LTFT (KBLRC) B2 – Long-Term Fuel Trim Bank 2. This long-term fuel trim indicates an average learned fuel correction needed to maintain the closed loop target for Bank 2.

MAF V Bank 1 – Mass air flow sensor output voltage for Bank 1.

MAF V Bank 2 – Mass air flow sensor output voltage for Bank 2.

MAP – Manifold Absolute Pressure (reported as negative values in vacuum and positive values in boost) – logged from pressure sensor in the intake manifold.

Max negative dynamic advance (DBA) – largest negative DA currently recorded in ECU memory

STFT (ALPHA) B1 – Active short-term fuel trim for bank 1 needed for the ECU to meet fuel targets in fuel table A.

STFT (ALPHA) B2 – Active short-term fuel trim for bank 2 needed for the ECU to meet fuel targets in fuel table A.

Start of injection Timing – Timing for end on injection in rotational degrees after top dead center.

Theoretical Pulse Width (ms) – Load calculation based upon theoretical injector open time. This is used as load axis scaling for several critical tables throughout the ECU.

Throttle Position B1 and B2 – throttle plate opening 0 to 100%

Turbo Boost Pressure Left – Boost pressure on left side of motor - sensor located in front of left throttle body.

Turbo Boost Pressure Right – Boost pressure on right side of motor - sensor located in front of right throttle body.

Vehicle speed – Speed calculated by vehicle speed sensor.

Wastegate Duty – Percentage of boost control wastegate solenoid duty cycle % (0 to 100).

C: Perform initial testing at lower boost

After choosing the most appropriate starting point calibration, prepare to test and refine the calibration on a load-based chassis dynamometer. When creating a custom tune, it is best to begin testing under low load conditions.

Proportional Gain COBB custom boost control - COBB Tuning GT-R calibrations discard the factory Nissan boost control in favor of our own boost control system that is throttle position, gear and RPM dependent. COBB Tuning GT-R calibrations include special coding that support a more simple and elegant proportional gain based boost control system. To lower boost reduce wastegate duty cycle in “wastegate duty cycle”. This boost control system is further refined by changing the wastegate gain as a function of throttle position and gear.

D: Tuning for appropriate Air to Fuel ratios using Speed Density

The ideal air to fuel ratio depends upon fuel quality. Higher octane fuels are more detonation resistant and therefore can be run at leaner air to fuel ratios. Leaner Air to Fuel ratios produce higher power but also create more heat. Excessive heat can lead to detonation. Lower octane fuels such as 91 octane or 95 RON are more prone to detonation and therefor require a richer air to fuel ratio. Rich air to fuel ratio combustion produces less heat and therefore less detonation. We have found that the GT-R engine can run mid to high 11 Air to Fuel Ratios (AFR) when running quality fuels. Lower quality fuels require mid to low 11 air to fuel ratios.

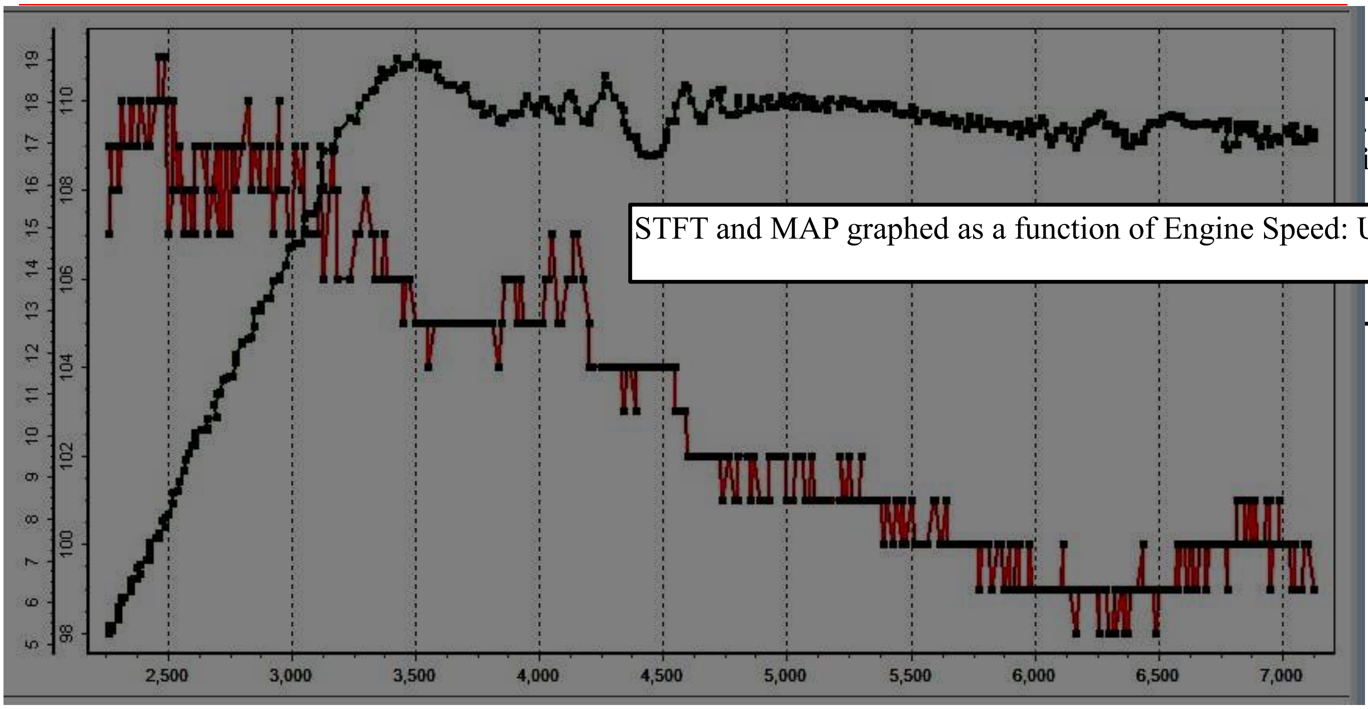
SD based tunes DO NOT directly measure Air Flow through the MAF sensor. Instead Air Flow is calculated based upon the ideal gas law. Air flow estimated based upon the manifold air pressure and air temperature. These two measures combined with an underlying estimate of engine volumetric efficiency (VE) allow the GTR to be calibrate using manifold absolute pressure as the primary load reference.

SD based tuning utilizes a slightly larger collection of tables to tune for proper AF.   Some of these tables are common to MAF based tuning strategies. Tables and values that impact fueling for SD based tuning are:1) injector scalar 2) injector latency multiplier and offset 3) Fuel multiplier (leave this STOCK) 4) MAF curve A and B) 5Primary fuel and) 6volumetirc efficiency

1) **Fuel - Injector scalar**: For SD based tuning set injector scalar to its flow is cc (for example, stock injectors are 570cc). *Exceptions to this include but are not limited to the use of heavily ethanol based fuels. In this case Injector scalar is 30 to 35% smaller than standard flow for pump fuels (e.g. 1000cc injectors are scaled to ~1000 for pump fuels but ~700 for E85 fuels)
2) **Fuel - Injector latency** (offset and multiplier – values sames as those use for MAF tuning
3) **Fuel Multiplier** – Leave this STOCK!
4) **MAF Curve A and B** = set both A and B to stock A values. The MAF curve is used in our custom coding for VE and also used to calculate theoretical pulse width (load for all but the VE table)
5) **Fuel-Low Det** – referenced by TPW and Engine speed. This map designates desired AF ratio. These values are part of the SD fueling model. Adjusting these values actively changes the calculated injector open time to generate desired AF based upon the internal SD model along with VE table. Just as with MAF based tuning the GTR references AF ration at all times and adjusts fueling with Sort and long term fuel trims.
6) **Fuel -Volumetric Efficiency (VE**). This table offers a means to adjust VE to best match the flow characteristics of a motor. Any component that changes airflow through the motor (e.g.,exhaust, intake, camshaft, turbocharger) will change VE. The default VE map is a good starting point for a stock car with stock turbocharger and no to mild exhaust upgrades.
7) **Speed Density – Air Temp Based Fuel** Correction Air tensity changes with temperature in a predicable manner. Higher air temperature indicates lower density and lower temperature more dense. Fuel calculations must change given this relationship. This table determines this relationship and is ideal for most cars with air temperature sensors located after the intercooler and just before the manifold. This table is tunable to allow for differences across cars.

Step 1: Set up the calibration for SD. Open a default SD calibration in the software and set up for the configuration of the car. Set up injectors, FM, MAF, and Primary Fuel table to best match the configuration of the car as well as the fuel type.   The default VE table is a good starting point for mildly modified cars.

Step 2: Run the car under low load conditions and adjust the primary fuel and VE map to create the smallest possible short and long term fuel trims. As in MAF based tuning, The R-35 GT-R uses two internal wide-band oxygen sensors to monitor fuel mixtures on left and right engine banks. The ECU will constantly adjust fuel to reach this air to fuel target. As a result, the values in **Fuel-Low Det** are a closed loop target that the ECU will always work to achieve. The active adjustments made by the ECU are monitored at **STFT (ALPHA) B1** and **STFT (ALPHA) B2**. These short-term fuel trims will gradually enter a long-term learned state that can also be monitored - **LTFT (KBLRC) B1** and **LTFT (KBLRC) B2.**



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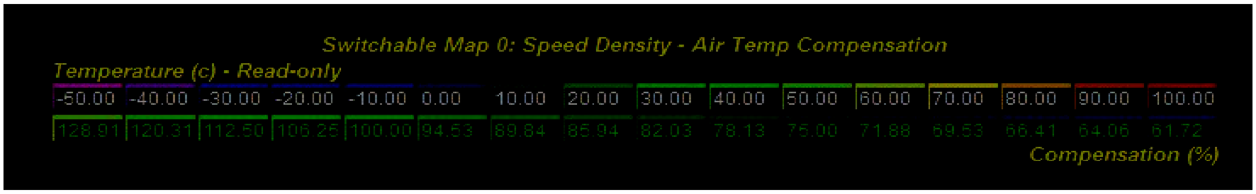
STFT and MAP graphed as a function of Engine Speed: Use STFT t

In the example above the short term fuel trims (STFT) are relatively small. To achieve desired AF ratio use short term fuel trims to direct changes in the VE table. For example, RPM and MAP areas with an average 5% positive short term fuel trim (105 as reported by the ECU), the VE table is increased by 5%. Areas with little to no short term fuel trim (above 4500 RPM at ~17 psi in the example above) the VE table is correct and needs no adjustment.

Step 3: Run the car at increasing higher manifold pressures until the VE map is tuned over the full range of pressures at which the motor will be operated.

Step 4: Adjust the Speed Density – Air Temperature Correction: The default Air Temperature fuel correction works well when the air temperature sensors are placed in the boost tubes just before the manifold. Air Temperature based fuel correction can be adjusted for specific vehicle/air temperature sensor location.



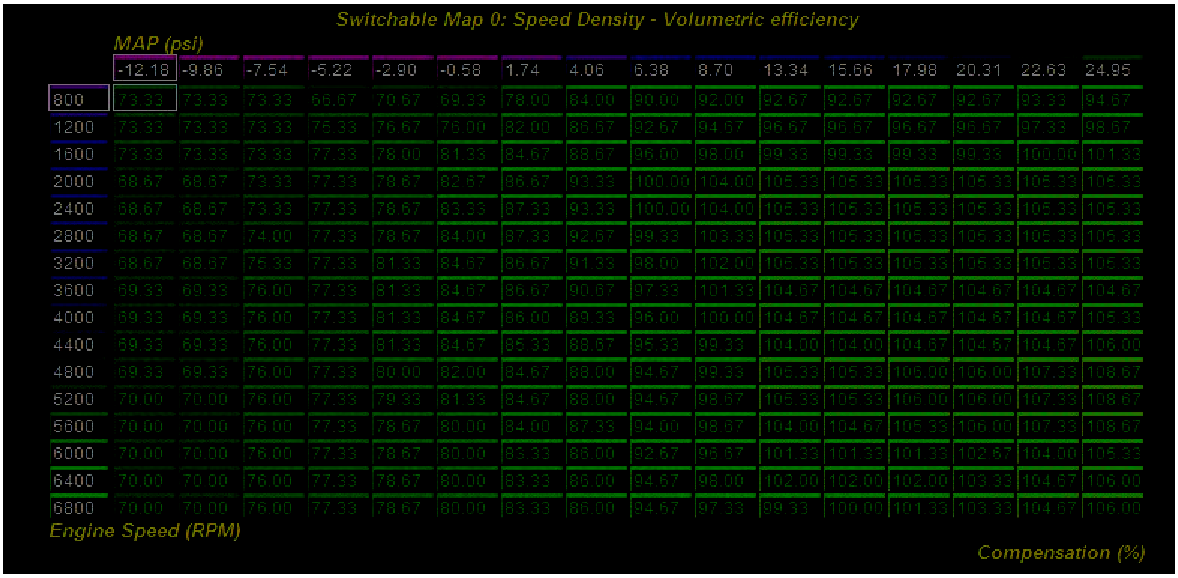
Switchable Map 0: Speed Density - Air Temp Compensation

Temperature (c) - Read-only

-50.00	-40.00	-30.00	-20.00	-10.00	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00
128.91	120.31	112.50	106.25	100.00	94.53	89.84	85.94	82.03	78.13	75.00	71.88	69.53	66.41	64.06	61.72

Compensation (%)

Below is an example of a fully tuned Volumetric Efficiency table for a GTR with larger turbochargers. Note the VE compensations are slightly higher for this car than those indicated in the default table for use with more stock like components.



Switchable Map 0: Speed Density - Volumetric efficiency

MAP (psi)

Engine Speed (RPM)

Compensation (%)

	-12.18	-9.86	-7.54	-5.22	-2.90	-0.58	1.74	4.06	6.38	8.70	13.34	15.66	17.98	20.31	22.63	24.95
800	73.33	73.33	73.33	66.67	70.67	69.33	78.00	84.00	90.00	92.00	92.67	92.67	92.67	92.67	93.33	94.67
1200	73.33	73.33	73.33	75.33	76.67	76.00	82.00	86.67	92.67	94.67	96.67	96.67	96.67	96.67	97.33	98.67
1600	73.33	73.33	73.33	77.33	78.00	81.33	84.67	88.67	96.00	98.00	99.33	99.33	99.33	99.33	100.00	101.33
2000	68.67	68.67	73.33	77.33	78.67	82.67	86.67	93.33	100.00	104.00	105.33	105.33	105.33	105.33	105.33	105.33
2400	68.67	68.67	73.33	77.33	78.67	83.33	87.33	93.33	100.00	104.00	105.33	105.33	105.33	105.33	105.33	105.33
2800	68.67	68.67	74.00	77.33	78.67	84.00	87.33	92.67	99.33	103.33	105.33	105.33	105.33	105.33	105.33	105.33
3200	68.67	68.67	75.33	77.33	81.33	84.67	86.67	91.33	98.00	102.00	105.33	105.33	105.33	105.33	105.33	105.33
3600	69.33	69.33	76.00	77.33	81.33	84.67	86.67	90.67	97.33	101.33	104.67	104.67	104.67	104.67	104.67	104.67
4000	69.33	69.33	76.00	77.33	81.33	84.67	86.00	89.33	96.00	100.00	104.67	104.67	104.67	104.67	104.67	105.33
4400	69.33	69.33	76.00	77.33	81.33	84.67	85.33	88.67	95.33	99.33	104.00	104.00	104.67	104.67	104.67	106.00
4800	69.33	69.33	76.00	77.33	80.00	82.00	84.67	88.00	94.67	99.33	105.33	105.33	106.00	106.00	107.33	108.67
5200	70.00	70.00	76.00	77.33	79.33	81.33	84.67	88.00	94.67	98.67	105.33	105.33	106.00	106.00	107.33	108.67
5600	70.00	70.00	76.00	77.33	78.67	80.00	84.00	87.33	94.00	98.67	104.00	104.67	105.33	106.00	107.33	108.67
6000	70.00	70.00	76.00	77.33	78.67	80.00	83.33	86.00	92.67	96.67	101.33	101.33	101.33	102.67	104.00	105.33
6400	70.00	70.00	76.00	77.33	78.67	80.00	83.33	86.00	94.67	98.00	102.00	102.00	102.00	103.33	104.67	106.00
6800	70.00	70.00	76.00	77.33	78.67	80.00	83.33	86.00	94.67	97.33	99.33	100.00	101.33	103.33	104.67	106.00

Fully Tuned VE table for a 2009 GTR with larger turbochargers. Note higher than default values and the generally smooth shape of the VE relationship as manifold pressure increases.

E: Tuning Ignition Timing (CBA 2008 to 2010 world market, 2009-2011 USDM)

Ignition Timing tables - The most important tables for ignition timing are **Ignition-Low Det** and **Ignition HI Det**. These tables are referenced by Theoretical Pulse Width and engine speed. Logging these parameters will allow you to reference the specific regions of these table that may need to be edited to produce optimized ignition timing.

Dynamic Ignition timing computation - The Nissan GT-R uses a complex computational process to constantly calculate optimal ignition timing. An internal mathematical model of engine function together with an array of sensor information is used to calculate ignition timing. The values in the timing tables are referenced within this computational process but are NOT traditional ignition timing in degrees before top dead center as most tuners will recognize. These numbers are best thought of in terms of fuel burn time. The numbers in these tables do heavily impact timing calculations so timing can be adjusted. Higher values will lead to higher ignition timing and lower values lower ignition timing. For example, a one increment increase in table values will lead to 1 degree increase in ignition timing.

Detonation based timing adjustment - Ignition timing is also adjusted in response to detonation. The ECU actively reduces timing in response to detonation. Timing adjustments in response to detonation are logged with the "knock Sum" monitor. Each knock event results in a -307 knock sum change. 1 degree of ignition timing is removed for each 256 of knock sum below zero. Only at very high knock levels will the ECU switch to the High Detonation Ignition map.

Generally speaking, higher ignition timing supports higher torque and greater power. However, ignition timing should be increased with great caution. Higher timing yields higher cylinder pressures and this is limited by fuel quality and the mechanical limitations of the engine. Too much timing will produce knock correction when fuel quality is limiting. When fuel quality is high, ignition timing should ONLY be added when its addition produces a substantive increase in torque and power. If increased timing does not increase torque the extra cylinder pressure is simply producing unnecessary stress on engine components.

F: Tuning Ignition Timing (DBA 2011+ world market, 2012+ USDM)

For 2011+ world market (UDSM 2012+) GT-R Nissan began using a new strategy for controlling ignition timing. This new timing control strategy, designated DBA, represents a completely different approach to ignition control, compared to earlier CBA GT-R, but one which will be more familiar to engine calibrators. Earlier CBA ignition control used a complex calculation of burn time to actively determine ignition timing and referenced tables were, consequently, referencing unfamiliar units. In contrast, DBA strategy look up tables are all referencing ignition timing in Degrees Before Top Dead Center (DBTDC) and thus use a more commonly understood quantization of timing control. Despite the familiar language, DBA ignition control strategy is very complex utilizing an elegant timing adjustment, initiated by knock sensor activity, that can both add and subtract ignition timing. This so called Dynamic Advance (DA) and its control is key in producing a stable DBA ignition based calibration. In addition to DA based timing adjustment there are multiplier and threshold based timing adjustments for Coolant and Intake air temperature.

Degrees before top dead center for all DBA tables: DBA ignition does NOT use a 'burn time” type of calculation used for CBA. DBA ignition tables are traditional degrees before top dead center. The most important table for high load DBA timing strategy is “**Ignition Low Det (Native - DBA strategy)**”. This is the main timing table for DBA vehicles and is noted in traditional degrees before top dead center.

Final timing = base timing + knock (Dynamic Advance) + temperature compensations
High load DBA ignition timing = Base timing table (low or high det depending upon detonation history) + Dynamic Advance (timing actively and quickly added or removed based upon current knock levels) + Temperature correction (Timing added or removed based upon air and coolant temperature corrections).

Low load or cruising timing is calculated more simply than high load (no knock based feedback but some temperature offsets). However, high and low load timing are always compared and the ECU uses the lower of the two, which under load is always, high load timing described in detail here.

Dynamic Advance (DA). DBA timing uses a complex strategy to both add and subtract timing in response to engine detonation levels. To optimize performance the stock ECU, in the absence of knock (low knock levels) can add as much as 1 to 5 degree of ignition timing. Under conditions where engine knock exceeds the noise threshold in the “**knock sensitivity**” tables the ECU can take out as much as 9 degrees of timing. Understanding how to limit these stock ECU induced timing variations is key to producing a stable DBA based performance engine calibration. The sequence of events that calculates DA is as follows:

5) Engine noise = (knock sensor)
6) Knock counter (calculation) = Short term knock history (Engine noise*time, based on engine noise and compared to **Knock Sensitivity**)
7) Dynamic Advance (DA) = knock counter * knock multiplier (Table)

Knock multiplier = (table based - decrement or increment). Knock counter is multiplied by the table based decrement (**Dynamic Advance – Decrement (DBA)**) to remove timing which removes timing in response to detonation. In the absence of detonation (low engine noise) timing is added according to the base timing increment multiplier (**Dynamic Advance – Increment (DBA)**).

8) Final DA is calculated as above and compared to limits as outlined in several tables that define the minimum and maximum DA under low or high det mode as the table name indicates.

High Detonation Mode – High Det, Limp or Safe mode is entered when the knock counter for DA stores a learned value of -4 degrees for a long duration. Entering high detonation mode switches active DBA mapping to the high det tables for ignition and fuel **(Ignition High Det. (DBA), Fuel High Det.**). Limp mode is maintained until the ECU is power cycled through a key on off.

Temperature Compensations.
Both Intake air temperature and coolant temperature compensations contribute to final DBA timing. Both are calculated values with a threshold (table), multiplier (table) and air temperature compensation is further controlled with a minimum activation point (table). Temperatures must be noted in Celsius in for the math to work appropriately as follows:

1) temperature sensor = observed temperature
2) temperature delta calculated = threshold (table) – temperature (sensor)
3) timing correction calculated = temperature delta*multiplier (table)
4) final timing correction enabled if current temperature above minimum activation limit (table, air temp. correction only)

Example (Air intake temperature)

Intake air temperature = 60 degrees
Threshold = 50 degrees (**Ignition – Intake Air Temp. Correction (Threshold)**)
Minimum activation = 50 degrees (**Ignition – Intake Air Temp. Correction (Min. Activation)**)

50 - 60 = -10,

-10 * multiplier value 0.152 (**Ignition – Air Temp. Correction (Multiplier)**) = -1.52

1.5 will be rounded to 2 full degree of timing removed.

Example (coolant temperature)

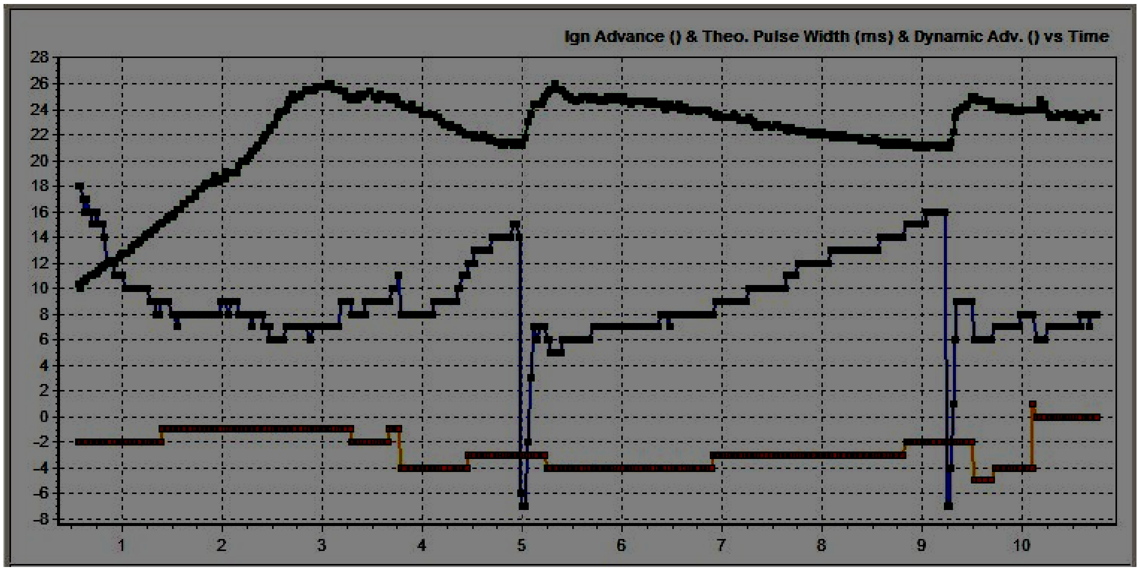
Coolant Temperature = 90 degrees
Threshold = 85 degrees (**Ignition – Coolant Temp. Correction (Threshold)**)

85 – 95 = -10

-10 * multiplier value 0.102 (**Ignition – Coolant Temp. Correction (Multiplier)**) = -1

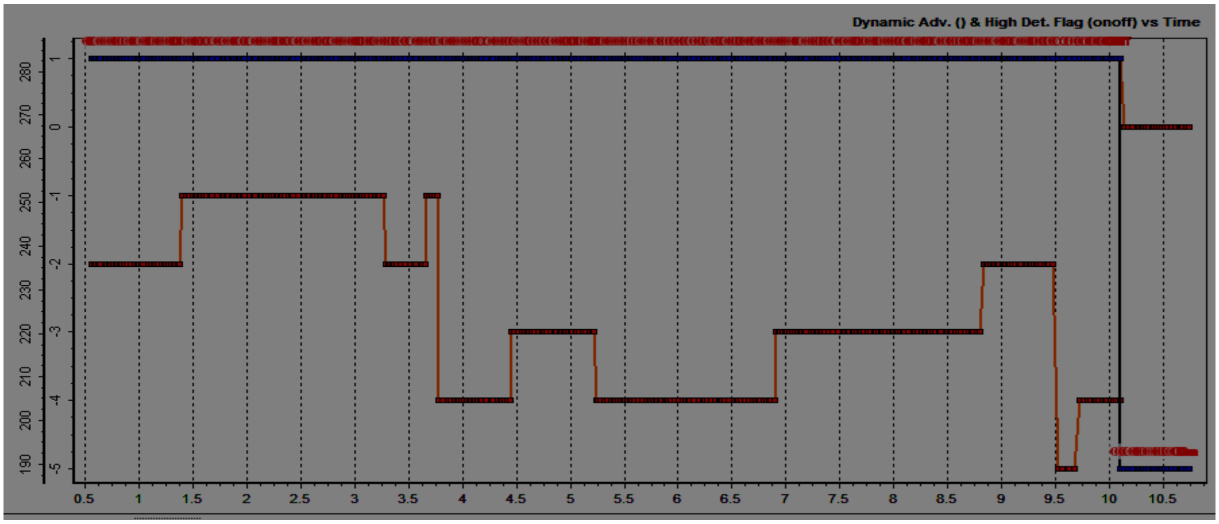
1 degree of timing will be removed.

Example Data 1 – large negative DA



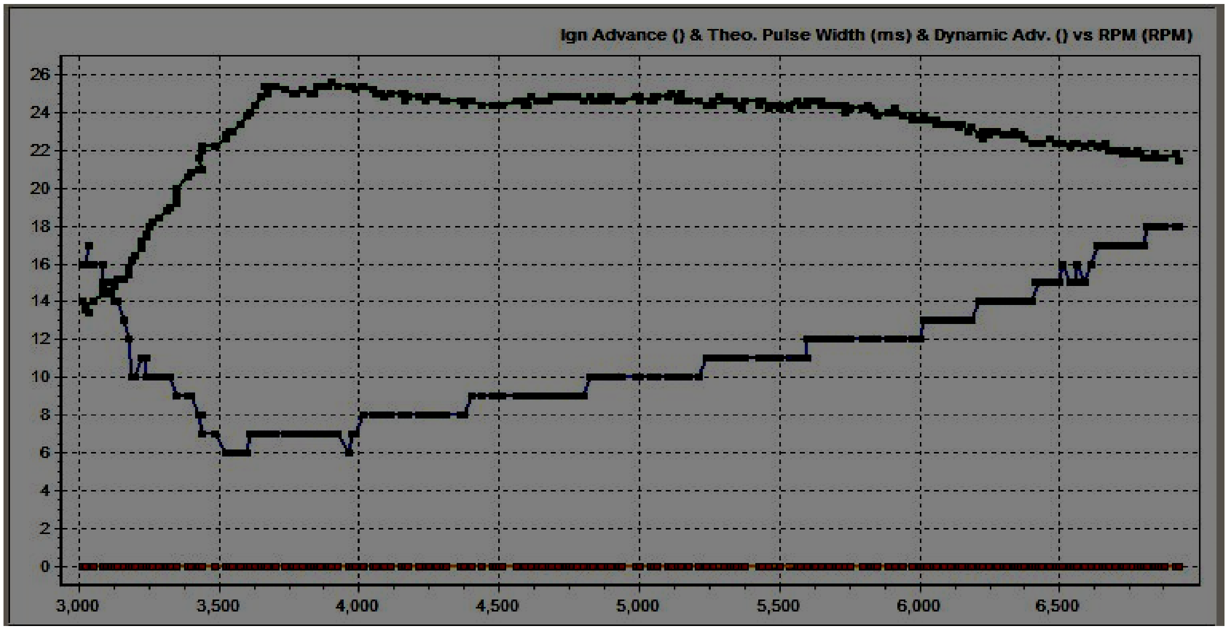
Large negative DA – Timing is removed from the DBA car (DA, yellow). Final ign timing is sh
blue and theoretical pulse width (TPW) in green. This is an excessive timing correction for a 2n
3rd gear on power pull.

Example Data 2 – High Detonation Flag



High Detonation Flag (red/blue - safe mode) activated – the same data from example one abo
With excessive negative DA (yellow) ECU switches from normal mode (OFF) to safe mode (ON
just past 10 seconds in this log.

Example 3 – Normal conditions with low dynamic advance correction (DA)



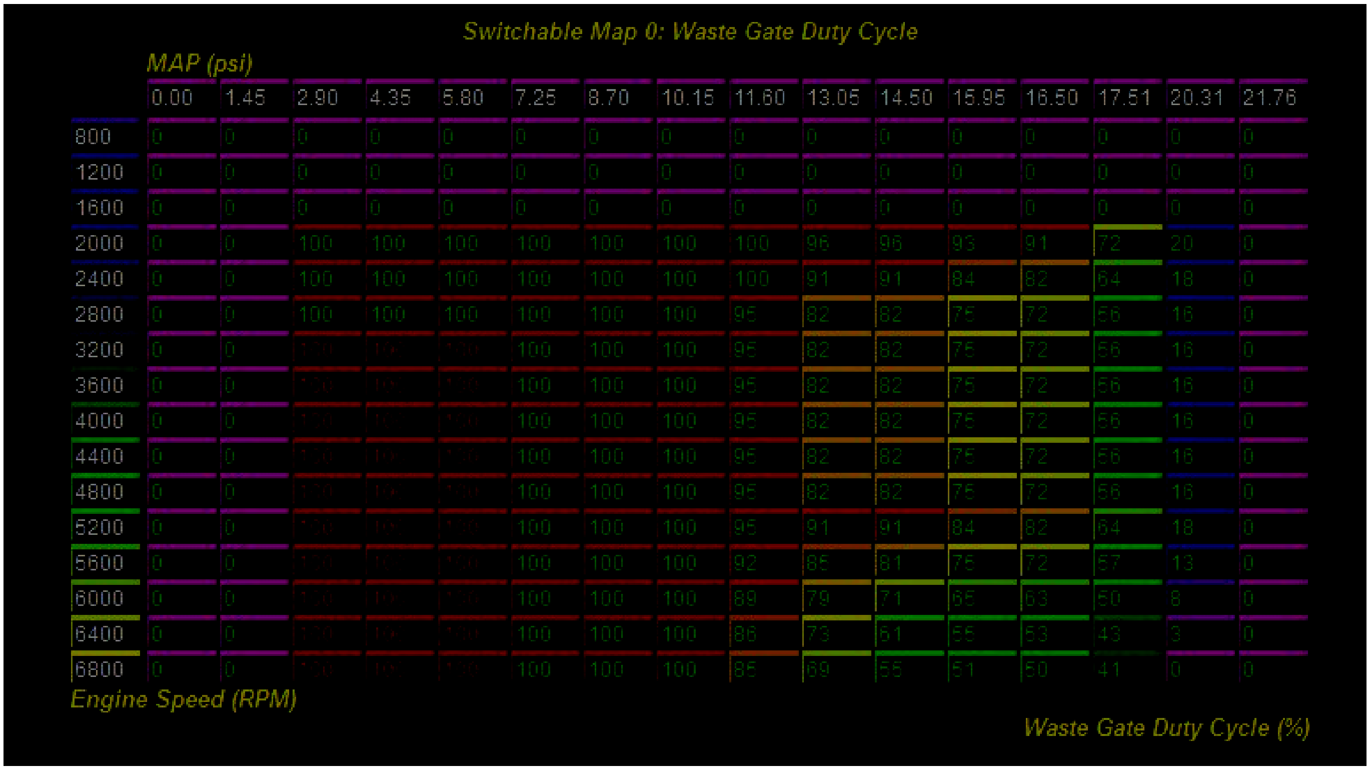
Low DA in 3rd gear high load – This is a log of a 3rd gear run showing load (theoretical pulse
(TPW), ignition timing (blue) and Dynamic Advance (DA, yellow). This "clean" pull had NO
correction and consistent high timing. This is ideal.

G: Tuning Boos

COBB proportional gain boost control system has several advantages over the factory based boost control system. Boost levels can be reliably adjusted over a broad range in an RPM specific manner. Without any mechanical changes to the stock boost control system it is possible to achieve boost levels at the edge of the stock turbocharger capacity using the COBB proportional boost control coding. COBB proportional gain boost control system additionally support gear and throttle based compensations.

Boost Cut Primary – As with the factory boost control system the v500 and later boost control uses a boost limit table. If boost goes above this table the ECU will cut fuel to lower boost and avoid engine damage. The factory MAP sensors read to 26 psi. Setting boost cut above this level results in no effective boost cut. Higher boost pressures can be achieved using aftermarket MAP sensors such as the AMS 4 bar MAP sensor.

Wastegate Duty Cycle – This is the primary table used for boost control. This table is referenced by RPM on the Y-Axis an d boost pressure on the X-Axis. The Z data (table data) is direct wastegate duty cycle. There is no target based feedback in this simple boost control system. At any specific RPM and boost pressure there is a referenced wastegate duty cycle. If you desire the boost to rise above this particular level the wastegate duty cycle should be high enough to promote a rise in boost pressure. In this way, wastegate duty is higher at boost levels lower than desired. At close to the desired boost level the wastegate duty cycle is reduced to produce stable boost at this level. Above target boost the wastegate duty cycle is reduced. Using the table below, observed boost pressure is 17psi in the midrange RPM. Note that at higher boost pressure wastegate duty is reduced to near zero and zero. This provides instantaneous reductions in wastegate duty cycle that very effectively avoid over boost. The key to achieving a particular boost target is determining the wastegate duty cycle that holds a specific boost target.



Switchable Map 0: Waste Gate Duty Cycle

MAP (psi)

Engine Speed (RPM)	0.00	1.45	2.90	4.35	5.80	7.25	8.70	10.15	11.60	13.05	14.50	15.95	16.50	17.51	20.31	21.76
800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	100	100	100	100	100	100	100	96	96	93	91	72	20	0
2400	0	0	100	100	100	100	100	100	100	91	91	84	82	64	18	0
2800	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
3200	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
3600	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
4000	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
4400	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
4800	0	0	100	100	100	100	100	100	95	82	82	75	72	56	16	0
5200	0	0	100	100	100	100	100	100	95	91	91	84	82	64	18	0
5600	0	0	100	100	100	100	100	100	92	85	81	75	72	57	13	0
6000	0	0	100	100	100	100	100	100	89	79	71	65	63	50	8	0
6400	0	0	100	100	100	100	100	100	86	73	61	55	53	43	3	0
6800	0	0	100	100	100	100	100	100	85	69	55	51	50	41	0	0

Waste Gate Duty Cycle (%)

Gear and throttle wastegate multiplier – v2.01 and later GT-R calibrations use a gear and throttle position based wastegate duty cycle adjustment table. Using this table a tuner can change boost as a function of throttle position and gear. Based upon the engaged gear and throttle position the look up table specifies a percentage multiplier. This multiplier transforms the final wastegate values and thus the boost response.

For example, at 45% throttle position the final boost control solenoid duty cycle will be reduced by 50%. Over 75% throttle the boost control solenoid will run at 100% of the values in the wastegate table.

In the example below each gear produces the same relationship for boost and throttle regardless of gear.

Switchable Map 0: Gear And Throttle wastegate multiplier

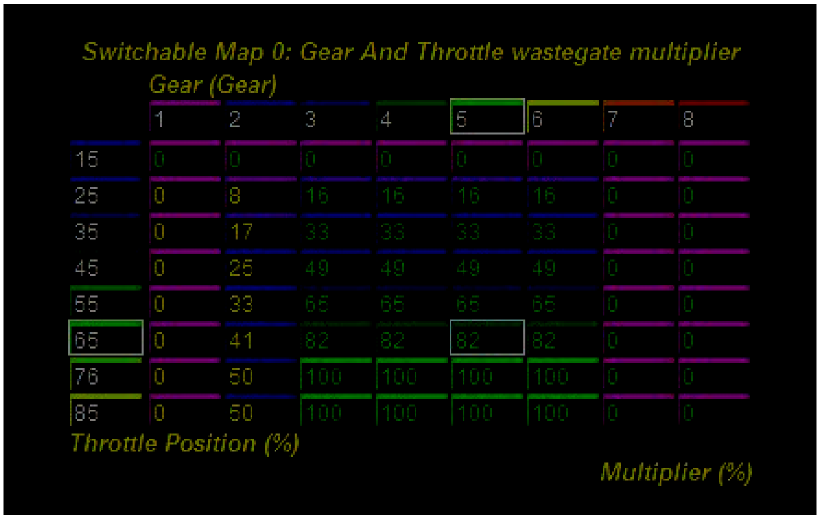
Gear (Gear)

	1	2	3	4	5	6	7	8
15	0	0	0	0	0	0	0	0
25	16	16	16	16	16	16	0	0
35	33	33	33	33	33	33	0	0
45	49	49	49	49	49	49	0	0
55	65	65	65	65	65	65	0	0
65	82	82	82	82	82	82	0	0
76	100	100	100	100	100	100	0	0
85	100	100	100	100	100	100	0	0

Throttle Position (%)

Multiplier (%)

In this next example 1st and 2nd gear are programed with lower wastegate multipliers. This will allow the boost control system to produce less boost is these gears. This scenario is desirable for a road race vehicle with larger turbochargers for example where traction is limited in lower gears.



Switchable Map 0: Gear And Throttle wastegate multiplier

Gear (Gear)

	1	2	3	4	5	6	7	8
15	0	0	0	0	0	0	0	0
25	0	8	16	16	16	16	0	0
35	0	17	33	33	33	33	0	0
45	0	25	49	49	49	49	0	0
55	0	33	65	65	65	65	0	0
65	0	41	82	82	82	82	0	0
76	0	50	100	100	100	100	0	0
85	0	50	100	100	100	100	0	0

Throttle Position (%)

Multiplier (%)

H: Tuning variable Cam Timing

A single map with load engine speed axis determines the position of variable intake cams. The COBB off the shelf maps are designed slightly modified camshaft phasing optimized for stock turbo chargers, stock camshafts, and stock motor internals. We have designed the COBB mapping to enhance turbo responsiveness and mid range torque. These maps may need to be altered considerably for larger turbocharger, or after market engine components. *However, care must be taken to avoid valve to valve or valve to piston contact if after market camshafts or pistons are utilized.*

I: Integrating all tuning parameters for the ideal Calibration

The ideal calibration for your GT-R is a combination of all major tuning areas outlined above. Like any performance vehicle, the GT-R will make the most power when run lean with the maximal amount of ignition timing that the ECU will allow without detonating. However, this ideal of 12.5:1 air to fuel ratio and high ignition timing is not realistic for most configurations and fuels in forced induction vehicles. The only way to determine if a calibration is ideal is to run the car on a load-based chassis dynamometer where the impact of calibration changes are easily measured. For example, addition of ignition timing that does not result in increased torque is a not ideal. If additional timing does not create power then you are simply adding stress to the engine components without tangible benefit. The same is true of boost and air to fuel ratio. If you can run the vehicle at a richer air to fuel ratio without losing power this is more ideal than running the car lean. If increasing boost does not yield considerable power gains the turbo may simply be out of its efficiency range. In this scenario less boost is actually more power. To get a coarse idea of how the ideal tune looks on your fuel type and mechanical configuration, examine the COBB OTS map notes.

J: Precautions:

Boost – The stock turbocharger can produce boost levels in excess of 20psi. This is enough cylinder pressure to cause engine damage. Be cautious when adjusting boost control parameters. Be particularly cautious when any mechanical component of the boost control system is altered.

Injector limits – The stock fuel injectors are ~570cc. These vehicles can create enough airflow to run these injectors at or above their maximal capacity at higher RPM. This is particularly true for vehicles equipped with high flow exhaust systems and intercoolers. Be cautious about running out of injector on similarly equipped vehicles. This is particularly true in cold weather when turbocharger efficiency is high.

Fuel Deliver Limits – the stock GTR fuel pumps are inadequate for larger power applications with aftermarket turbochargers or with highly optimized stock turbochargers. Any application requiring larger injectors will also need a fuel pump upgrade.

MAP Sensor limits for SD Tuning - Engine control is entirely dependent upon accurate readings from Manifold pressure sensor. The stock MAP sensor is limited. In order to run over 24 psi an aftermarket MAP sensor must be added and calibrated.

Camshaft Timing – Be careful when using with aftermarket camshafts or built motors with unknown valve to piston clearance. Excessive camshaft advance could produce value to piston interference.

Accesstuner Program shortcuts:

- **Ctrl+L –** Initiate live tuning, connect to or disconnect from a the ECU

- **Ctrl+B** - connect to ECU and initiate dash board live data

- **Ctrl+F –** Configure Program
- configures communication settings and WBO2 integration
- configures logged parameters for dashboard and saved data logs

- **Ctrl + Shift + C** – Map Slot Copy
  - Copy table data around from real-time to any map slot or from any map slot to another map slot.

- **Ctrl+D** – Initiate and terminate data log

- **Ctrl+T** – Initiate or terminate live tracing in tables

- **Ctrl+Alt+S –** Save Accesstuner Pro calibration

- **Ctrl+Alt+A –** Save Accesstuner Race calibration

- **Ctrl+Alt+O** – Open Accesstuner Pro calibrations

- **Ctrl+Alt+E** – Open Accesstuner Race calibrations

- **Ctrl+A – (CTO!)**Open advanced calibration settings – activate or deactivate Check Engine Lights (CEL) and advanced engine parameter toggles

- **Ctrl+G –** Change ECU

- **Ctrl+K** – Revert to stock calibration

- **Ctrl+Shift-F** – Flash map

- **Table editing shortcuts:**
  - **E** – Direct edit table cell(s)
  - **H** – Horizontal interpolation of selected table cells
  - **V –** Vertical interpolation of selected table cells
  - **M** – Multiplication of selected table cell(s) by factor

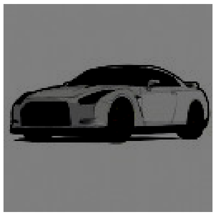


Table definitions and Tuning Tips - Speed Density

BLACK = base table, non switchable map, used for every map slot in calibrations

BLUE = Switchable table for map slot 0-8

RED = Tunable in Real time with Accesstuner Software

Boost - Boost Cut Delay

This a counter value that must be satisfied after the vehicle sees an over-boost condition. Once normal boost levels, as defined in the Primary Boost table, are achieved, the vehicle will operate normally. If the vehicle exceeds the Primary Boost Cut table, it must return to the Low Limit Boost table for the Count as defined in this table.

Tuning Tips - None at this time.

Boost - Boost Cut Primary

This is the high limit for boost in all running conditions based on RPM breakpoints. These limits are in effect during shifting as well. Factory MAP sensor limits are 26 psi.

Tuning Tips – Set limit above your target boost but below the limit of the manifold MAP sensor.

Fuel – Tables

Cranking Enrichment:

Cranking Inj. Pulsewidth Adder

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table are added to a base IPW. Increasing the values will increase the Injector Pulsewidth used while the engine is cranking. Decreasing table values reduces Injector Pulsewidth.This table has a smaller impact on cranking IPW, and can be used when making small, fine tuning adjustments.

Cranking Inj. Pulsewidth Multiplier

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table are multiplied against a base IPW. Increasing the values will increase the Injector Pulsewidth used while the engine is cranking. Decreasing table values reduces Injector Pulsewidth. It is possible to make very large changes in cranking IPW by manipulating this table.

Fuel – High Speed Fueling – Tables controlling high speed enrichment that begins at high vehicle speeds (over 145 mph).

Fuel – Learning Rate - the rate at which the ECU controls fuel system to meet closed loop target under high load. (Beta) – No tuning Tips

Fuel – Richening Rate - the rate at which the closed loop target is richened at high speed (Beta). No Tuning Tips

Fuel – Richest AFR – the richest closed loop AFR at high speed (Beta). Make leaner to avoid unwanted high speed fuel enrichment.

Fuel – Base Fuel Schedule Modifier

A single value to used by the ECU for all load calculations. Tuning Tips – Leave this stock.

Fuel Economy Display injector Size

Injector size (in cc/min) used by the on dash display system to calculate fuel economy and range.

Fuel – End of Injection

The end point of injector opening in degrees after top dead center (720 degrees in a full combustion cycle) - referenced by load and RPM.

Tuning Tips – slight increase in injection timing can reduce black smoke by reducing the injection of fuel into a high velocity intake charge while exhaust valves are still open. Reference optimized end of injection tables in 2012+ GT-R compared to earlier cars.

Fuel - High Det.

Target fuel mixture when car is in limp or High Detonation mode following prolonged knock induced ignition correction.

Fuel – Minimum Injector Pulse Width

Single value to determine the smallest commanded injector open time.

Tuning Tips - Decrease proportional to desired open time decrease. Larger injectors such as 2000cc will require ~1/2 standard Minimum Injector Pulse-width.

Fuel – Volumetric Efficiency

Underlying volumetric efficiency (VE) table used by the ECU for MAF tuning.

Tuning tips - Almost totally ineffective. Most calibrators ignore this table – leave stock.

Ignition Tables (All Year Models)

Maximum Ign. Timing

Maximum (highest) Ignition Timing value allowed by the ECU. Lowering this value decreases the maximum ignition advance the ECU can ever command. Increasing this value allows for higher maximum ignition advance. Does not otherwise alter your tuned ignition tables.

Minimum Ign. Timing A / Minimum Ign. Timing B

Minimum (lowest) Ignition Timing value allowed by the ECU. Lower this value to allow for more ignition retard. Increase this value to prevent the ECU from retarding timing below a desired amount.

Cranking Ignition Timing:

Cranking Ignition (Base)

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table represent a base ignition timing value used during cranking. Increasing the values in this table will increase the ignition advance angle. Decreasing the values will reduce the ignition advance angle. This is the primary table to use when tuning cranking ignition timing.

Cranking Ignition – ECT Correction

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table are used to apply a correction to the ignition timing used during cranking. A value of 100% applies no correction to the target cranking ignition timing value. Values less than 100% will decrease the target ignition timing. Values more than 100% will increase the target ignition timing.

Max Correction Allowed

This table is referenced by Engine Coolant temp and is used only while the engine is cranking (starter motor active). The values in this table represent the max allowed total correction factor to be applied to the ignition timing used during cranking. This is to prevent too many corrections being applied to the cranking ignition timing.

Ignition Tables (CBA – 2008 to 2010 world market, 2009-2011 USDM)

Ignition – High Det.

Look up table for CBA based ignition control under condition with high and sustained knock correction (knock sum of -1400 or more).

Ignition – High Det. Knock Overlay

Look up table to determine if knock control is ON (table value 1) or OFF (table value 0) during when in High Det. Mode.

Ignition Tables (DBA – 2011+ world market, 2012+ USDM)

Dynamic Advance – Final Minimum High Det. (DBA)

Maximum amount of negative dynamic advance allowed during High Det. Mode. Undefined X axis but related to increased load and RPM from left to right. -

Dynamic Advance – Final Minimum Low Det. (DBA)

Maximum amount of negative dynamic advance allowed during Low Det. Mode. Undefined X axis but related to increased load and RPM from left to right. -

Dynamic Advance – Increment (DBA)

Multiplier used to increase DA (add timing) under condition when knock counter is low (little to no detonation).

Tuning tips – increase or decrease to expand or contract the amount of positive DA seen during conditions with low knock (ie, high octane).

Dynamic Advance – Knock Decrement (DBA)

Multiplier used to decrease DA (subtract timing) under condition when knock counter is high (detonation).

Tuning tips – decrease to contract the amount of negative DA seen during conditions with high knock (ie, low octane).

Dynamic Advance – Max High Det. (DBA)

Maximum DA under High Det. Conditions.

Tuning tips – none.

Dynamic Advance – Max Low Det. (DBA)

Maximum DA under Low Det. Conditions.

Tuning Tips – decrease these value to prevent the ECU from adding timing and making the tune too aggressive. Maximum value for stock USDM GTR is 3.1 COBB OTS maps use a max of 0.9 to prevent any positive DA under low detonation.

Dynamic Advance – Minimum Low Det. (DBA)

Floor for calculated DA under low det conditions. Some other limit tables will also limit DA such as “Final Minimim Low Det.” above.

Ignition – Cold Adder Knock Overlay (DBA)

Table to activate or inactivate (1 or 0 respectively)cold condition LOW load (cruise) DBA ignition timing.

Ignition – Cold Adder Low Load/Cruise (DBA)

Timing corrections for cold condition during LOW load (cruise) DBA ignition timing.

Ignition – Coolant Temp. Correction (Threshold) (DBA)

Threshold set point for calculated timing correction temperature delta.

Tuning tips - Calculate in degrees Celsius. Coolant temp delta = Threshold temp - current coolant temp. Coolant temp delta * coolant temp correction multiplier (table) = coolant temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease.

Ignition – Coolant Temp. Correction Multiplier (DBA)

Multiplier referenced by RPM and engine load use to determine final coolant temp based ignition correction. Coolant temp delta (calculated value above)

Tuning tips - Coolant temp delta (defined above) * coolant temp correction multiplier (table) = total coolant temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease. Decreased table values reduce the coolant temperature induced ignition timing correction.

Ignition – High Det (DBA)

Look up table for base timing under condition of high detonation (prolonged large negative DA)

Ignition – Hot Adder Knock Overlay (DBA)

Table to activate or inactivate (1 or 0 respectively) hot condition LOW load (cruise) DBA ignition timing.

Ignition – Hot Adder Low Load/Cruise (DBA)

Timing corrections for hot condition during LOW load (cruise) DBA ignition timing.

Ignition – Intake Air Temp. Correction (Threshold) (DBA)

Threshold set point for calculated timing correction Intake Air temperature delta.

Tuning tips - Calculate in degrees Celsius. Intake air temp delta = Threshold temp - current air temp. Air temp delta * air temp correction multiplier (table) = Final Air temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease. **For blow through setups with the air intake sensor reading post turbocharger air temperature these tables must be changed to reflect the much higher air temperatures.

Ignition – Intake Air Temp. Correction Multiplier (DBA)

Multiplier referenced by RPM and engine load use to determine final Air temp based ignition correction.

Tuning tips – Intake Air temp delta (defined above) * Intake Air temp correction multiplier (table) = total intake Air temp timing correction. Cold temp (less than threshold) = timing increase. Hot temp (greater than threshold) = timing decrease. Decreased table values reduce the Air temperature induced ignition timing correction. For draw through MAF based intake the stock values are reasonable. **For blow through setups with the air intake sensor reading post turbocharger air temperature these tables must be changed to reflect the much higher air temperatures.

Ignition - Intake air Temp. Correction – Minimum activation. (DBA)

Temperature below which no intake Air temperature timing correction are applied.

Launch Control Ign. Retard (DBA)

Applied to Ignition Timing only during Launch Control. May be used to generate more/less boost during the LC function.

Knock Sensitivity (DBA and CBA)

A three dimensional map defined by cylinder and RPM as axis. The unit less Z axis values define acceptable background noise thresholds.

Tuning Tips – Larger values decrease knock sensitivity. Increase this values in small increments when tuning motors who's components produce noise and false knock. Stock motors are relatively quiet. Stock knock sensitivity values produce a knock detection system too sensitive for comparatively noisy forged component motors.

Limits

Max. Vehicle Speed Target (CC)

Maximum cruise control speed limiter.

Rev. Limit Fuel Cut

RPM above which the injectors are turned off to prevent further engine speed increase.

Rev. Limit – Launch RPM limit

Throttle based rev limit which is used when launch is activated.

Tuning Tips - Raise to 4100 for best resutls with stock turbocharger and LC-4 or LC-5 TCM programs.

Rev Limt – Throttle limit.

RPM above which the throttle is closed to prevent further engine speed increase.

Rev Limit – VSS – Limp home

Maximum RPM during fault induced limp mode.

Speed limit A through F

Maximum allowed vehicle speed

Speed limit hysteresis

Speed below limit that must be obtained before again allowing acceleration

MAP sensor Calibration Tables (pre and post throttle)

Post Throttle Inlet manifold absolute pressure sensor gradient (kPa/V)

Post Throttle Inlet manifold absolute pressure sensor zero pressure offset (V)

Pre Throttle boost pressure sensor gradient (kPa/V)

Pre Throttle Inlet manifold absolute pressure sensor zero pressure offset (V)

Offset and gradient values that define the linear pressure voltage relationship of pre and post throttle pressure sensors. Stock sensors can be switched for higher reading units and calibrations changed accordingly.

Tuning Tips – AMS 4.0 bar map sensor gradient = 83 and offset = 0

Misc Calibration Tables

Idle Table A through C –

Target Idle engine speed varying by coolant temperature

Radiator Fan Duty Cycle

Look up table for radiator fan speed – unknown axis.

Radiator Fan Step 1 through 3

Temperature for activation of 3 different radiator fan speeds

Sensor Calibrations

Intake Air Temperature Sensor - 0 to 5V sensor with associated temperature calibration.

Global Map Settings

Active Map Count

Number of active map slots contained in a calibration.

Boost Gauge – Mode (0 = Factory, 1 = Wrap)

Boost gauge wrap around "on" or "off". Configure this table value to enable or disable the Multi-Function Display Boost gauge wrap around feature.

Boost Gauge – Wrap (Unit Optimization) (0 = psi, 1=kPa)

Boost gauge wrap around unit type. Configure this table value to match the Multi-Function Display Boost gauge units. Failure to configure this table will result in improperly scaled boost gauge drawing (post wrap-around).

Knock Flashing Threshold (CBA)

Knock sum value below which the boost gauge will flash to report high detonation to the driver.

Knock Flashing – Activation (DBA)(Max. Dynamic Advance Threshold)

The threshold for DBA knock gauge flash.

Switchable Maps (contained in each of the 0 through 8 map slots, some tunable in REAL TIME as noted)

Transmission - Clutch Torque (Switchable map table)

Desired Clutch torque lockup as indicated by load (Theoretical Pulse Width) and RPM.

Tuning Tips **–** Under most circumstances this table should remain stock.

Fuel - Injector Latency Multiplier (switchable map table and REAL TIME tunable)

Injector "multiplier" defines the slope of the linear relationship between battery voltage and injector latency.

Fuel - Injector Latency Offset (switchable map and REAL TIME tunable)

Injector "Offset" defines the change of the linear relationship between battery voltage and injector latency at low and high battery voltages.

Tuning Tips - When using injectors other than stock it is critical to adjust these values to reflect the voltage response characteristics of the new injectors. Injectors need a different dead time compensation at different voltages. Generally, lower battery voltage requires longer dead times while higher voltage requires less.

Fuel - Fuel Injector Scalar (switchable map and REAL TIME tunable)

This value determines the size of fuel injectors in cubic centimeters (cc). Stock value is 570cc.

Tuning Tips - Raise this value to the approximate flow rate of the new injectors in cc/min

Fuel – low Det (switchable map and REAL TIME tunable)

This is the primary look up table for fuel targets. The ECU will reference this table to achieve the desired air fuel mixture. This table alone will not govern fueling. The vehicle will reference the

MAF values reported. The table Z data is in Lambda or AFR. The higher the number the leaner the mixture, the lower the number the richer the mixture.

Tuning Tips - The GT-R is always operating in closed loop with feedback from two separate wide-band oxygen sensors. The ECU will target the fuel value in this table and will eventually learn sufficient fuel trims to archive this target.

Fuel - Fuel Multiplier (switchable map and REAL TIME tunable)

The **Fuel Multiplier** is a single value that influences MAF calibration. This value is a multiplier for mass air flow. LEAVE STOCK for Speed Density calibrations. The MAF sensors are not used but this value is used for background calculations critical for proper SD fueling.

Tuning Tips – Under most circumstances leave STOCK for SD Tuning. Can be used as a simple multiplier for the SD VE table to adjust overall fueling.

Boost - Gear and Throttle wastegate multiplier (switchable map and REAL TIME tunable)

COBB GT-R calibrations use a gear and throttle position based wastegate duty cycle adjustment table. This table is defined by gear and throttle position. Based upon these conditions the defined Z data transforms the final duty cycle used by the boost control system. Wastegate Duty Cycle = (wastegate duty cycle as defined by engine speed and boost) * (multiplier percentage defined by throttle and gear)

Tuning Tips - Using this table a tuner can change boost as a function of throttle position and gear. Based upon the engaged gear and throttle position the look up table specifies a percentage multiplier. This multiplier transforms the final wastegate values and thus the boost response.

Ignition - Low Det. (CBA Strategy) (switchable map and REAL TIME tunable)

This is the primary table used to determine ignition timing under normal operating conditions and wide open throttle driving for CBA GT-R (2008-2010 world market and 2009-2011 USDM).

Tuning Tips - The Nissan GT-R uses a complex computational process to constantly calculate optimal ignition timing. An internal mathematical model of engine function together with an array of sensor information is used to calculate ignition timing. The values in the timing tables are referenced within this computational process but are NOT traditional ignition timing in degrees before top dead center as most tuners will recognize. These numbers are best thought of in terms of fuel burn time. The numbers in these tables do heavily impact timing calculations so timing can be adjusted. Higher values will lead to higher ignition timing and lower values lower ignition timing. One to two increment increase in table values will lead to a single degree increase in ignition timing.

Ignition Low Det. (DBA Strategy) (switchable map and REAL TIME tunable)

This is the primary table used to determine ignition timing under normal high load operating conditions and wide open throttle driving for DBA GT-R (2011+ world market and 2012+ USDM).

Tuning Tips – These DBA based tables are all referenced in degrees before top dead center. This table, referenced by load and engine speed, is the look up table for high load DBA timing. Final timing is a sum of Air and coolant temperature corrections, Dynamic Advance corrections, and the look up value from this table.

Intake Cam. Advance (switchable map and REAL TIME tunable)

Look up table for intake camshaft closed loop target position as a function of RPM and load.

Tuning tips – optimal intake camshaft advance for increased turbo response. Motors equipped with aftermarket Camshafts should be tuned with caution to avoid valve to piston interference. Tune only to recommended maximum allowable limits.

Low Det Knock Overlay (CBA strategy) (switchable map)

Lookup table for referenced by load and RPM that indicates if knock control is active (1) or inactive (0) for low detonation CBA timing.

MAF Calibration A (switchable map)

This is the calibration for the MAF sensor on Bank A. This sensor is not used for Speed density tuning but the values in the table ARE used for some of the background calculations in the SD fueling model. LEAVE STOCK for SD Tuning

Tuning Tips – For SD tuning this table must be left STOCK

MAF Calibration B (switchable map)

This is the calibration for the MAF sensor on Bank B. This sensor is not used for Speed density tuning but the values in the table ARE used for some of the background calculations in the SD fueling model. Copy STOCK values from MAF A table into MAF B for SD Tuning

Tuning Tips – For SD tuning this table must be STOCK MAF A values. MAF A must = MAF B

Speed Density – Air Temp Based Fuel Correction (switchable map and REAL TIME tunable)

Air density changes with temperature in a predicable manner. Higher air temperature indicates lower density and lower temperature more dense. Fuel calculations must change given this relationship. This table determines this relationship and is ideal for most cars with air temperature sensors located after the intercooler and just before the manifold. This table is tunable to allow for differences across cars.

Tuning Tips – Default values work well when air temperature sensors are located post intercooler and just before the manifold. Different sensor location, climate or other vehicle differences may indicated changes in this table.

Speed Density – Volumetric Efficiency (switchable map and REAL TIME tunable)

This table offers a means to adjust VE to best match the flow characteristics of a motor. Any component that changes airflow through the motor (e.g.,exhaust, intake, camshaft, turbocharger) will change VE. The default VE map is a good starting point for a stock car with stock turbocharger and no to mild exhaust upgrades.

Tuning Tips - The GT-R is always operating in closed loop with feedback from two separate wide-band oxygen sensors. The ECU will target the fuel value in **Fuel – Low Det** and will eventually learn sufficient fuel trims to archive this target (within 25% total fuel trim). Adjust VE map to match and compensate for Short Term Fuel Trims until trims are consistently small (<5%).

Throttle control (switchable map and REAL TIME tunable)

Throttle plate opening as a function of accelerator pedal position.

Wastegate Duty Cycle (switchable map and REAL TIME tunable)

This is the primary table used for boost control. This table is referenced by RPM on the Y-Axis and boost pressure on the X-Axis. The Z data is direct wastegate duty cycle.