COBB TUNING™

AccessTUNER

USDM MAZDASPEED
Table Descriptions and Tuning Tips
v1.01

Note: This is a list of tables available on all MAZDASPEED AccessTUNER products. Not all tables are available in your software.

Boost Tables

The MAZDASPEED boost control system uses a closed loop system consisting of desired boost pressure or desired torque and a duty cycle to run the electronic boost control solenoid necessary to allow the turbocharger to generate the desired boost pressure. In addition to these basic functions, there are a multitude of environment compensations, vehicle running condition compensations, and a PI (a variant of a proportional-integral-derivative) based controller system to correct any errors between desired boost pressure and actual boost pressure, or desired load and actual load. The end result is a very robust and manageable boost control system superior to most, if not all, after market systems available to the public. To allow for tuning of this system, we've broken the necessary controls down into two separate sections: Boost Targets with Turbo Dynamics (PID Control), and Load Targets with Load Dynamics (PID Control). A comprehensive description of the MAZDASPEED boost control system can be found here.

Boost Comp : 1st - 2nd Gear A

Boost Comp : 1st - 2nd Gear B

Boost Comp : 3rd - 2nd Gear A

Boost Comp : 3rd - 2nd Gear B

Boost Comp : 4th - 2nd Gear A

Boost Comp : 4th - 2nd Gear B

Boost Comp : 5th - 6th Gear A

Boost Comp : 5th - 6th Gear B

Table Description – These tables represent a multiplier that is applied to the boost control system on a per gear basis. The table is referenced by Engine RPM on the x-axis and by Engine RPM on the y-axis. Table values are percentage corrections applied to the boost control system. A value of 1.00 will allow the ECU to run 100% of what is was calculating in order to achieve its target, which is effectively no change. A value of 0.90 will have the ECU run 90% of what it was going to run for that gear, and a value of 1.10 will have the ECU run 110% of what it was going to run for that gear.

Tuning Tips – These tables are one way to effectively tune boost per gear. These tables can be used to compensate for traction limitations of a front-wheel drive vehicle.

Precautions and Warnings – The connecting rods are known to be the weaker point in the MZR engines and you can use these tables to help prevent the engine from overboosting in the lower RPM ranges. Overboosting in the lower RPM ranges allows the combustion forces to exert excessive force on the connecting rods for longer periods of time at lower RPM ranges.

Boost Dynamics

Table Description – The Boost Dynamics table is used as a feedback control system to correct for errors in the desired Boost Target versus the Actual Boost measured in the inlet manifold. The feedback control method used is known as a Proportional-Integral controller.

Boost Error = (Desired Boost Target) – (Actual Boost)

This table represents a compensation (correction) necessary to counteract the Boost error that has occurred. The table is referenced by Boost Error (represented in mm Hg) on the x-axis. Table values are the percentage change made to the Wastegate Duty Cycle value.

Tuning Tips – This table can be used to refine boost control characteristics for under and over boost conditions.

Boost Limits

Table Description – This table is defined by Engine RPM on the x-axis and by barometric pressure on the y-axis, and is populated with relative boost pressure values. The maximum boost pressure allowed is a function of both barometric pressure and engine speed. If boost pressure exceeds these values for the given conditions, the engine will be abruptly interrupted through fuel cut. This temporary engine power loss is designed to avoid catastrophic consequences of over-boosting.

Tuning tips – The maximum boost allowed should be at least 2 PSI above your target boost. This allows some variation in the normal operation of the closed loop boost control system without fear of frequent boost cut.

Precautions and Warnings – The maximum boost pressure of the stock manifold pressure sensor (MAP) is somewhere above 23 PSI and its accuracy is very poor above 22 PSI. As a result, any boost cut set to above this level may be totally ineffective. For example, a boost limit of 25 PSI will never be encountered on a vehicle equipped with the stock MAP sensor despite the fact that pressures may indeed be well above 25 PSI. This is because the maximum value reported to the ECU will never be above the sensor max. In order to reliably run boost pressures above this level you should replace the stock MAP sensor with one of a higher pressure range. MAP sensor adapters are available from COBB Tuning that allow the use of after market MAP sensors such as the AEM or GM 3.5 bar.

Boost RPM Comp A

Boost RPM Comp B

Table Description – These tables represent a multiplier that is applied to the boost control system on a RPM basis. The table is referenced by Engine RPM on the x-axis. Table values are percentage corrections applied to the boost control system. A value of 0.00 will allow the ECU to run 0% of what is was calculating in order to achieve its target. A value of 0.14 will have the ECU run 14% more than what it was going to run for that RPM, and a value of .05 will have the ECU run 5% of what it was going to run for that RPM.

Tuning Tips – These tables are one way to effectively tune boost per gear. These tables can be used to compensate for traction limitations of a front-wheel drive vehicle.

Precautions and Warnings – The connecting rods are known to be the weaker point in the MZR engines and you can use these tables to help prevent the engine from overboosting in the lower RPM ranges. Overboosting in the lower RPM ranges allows the combustion forces to exert excessive force on the connecting rods for longer periods of time at lower RPM ranges.

Boost Limit (Throttle Close)

Table Description – This table represents a secondary boost limit that is applied to the boost control system on a RPM basis. The table is referenced by Engine RPM on the x-axis. Table values are relative boost pressure values. If the relative boost pressure exceeds these values for a given RPM, then the throttle control sub-system will shut the throttle until the boost levels come below these values.

Tuning Tips – These tables can be used as a primary boost limit or a secondary boost limit safety table.

Precautions and Warnings – The connecting rods are known to be the weaker point in the MZR engines and you can use these tables to help prevent the engine from overboosting in the lower RPM ranges. Overboosting in the lower RPM ranges allows the combustion forces to exert excessive force on the connecting rods for longer periods of time at lower RPM ranges. When the throttle is closed, due to relative boost pressure exceeding the values in this table, the throttle will shut at a slower rate. Due to this latency, you may wish to set these boost limits a little lower if you wish to use this table as a primary boost limits table.

Boost Comp. - Baro.

Table Description – This table represents the amount of compensation, or correction, made to the Boost Targets values based on current barometric pressure (atmospheric air pressure). The table is referenced by Engine RPM on the x-axis (columns), and Barometric Pressure on the y-axis (rows). Table values are the percentage change made to the Boost Target value. Table values are percentage corrections applied to the boost control system. A value of 1.00 will allow the ECU to run 100% of what is was calculating in order to achieve its target, which is effectively no change. A value of 0.90 will have the ECU run 90% of what it was going to run for that gear, and a value of 1.10 will have the ECU run 110% of what it was going to run for that gear. Barometric pressure decreases as altitude increases. This means as you climb up into the mountains, barometric (air) pressure decreases. This decrease in pressure means your turbocharger has to work harder to supply the same desired Boost Target it did at sea level. Often times this can push the turbocharger beyond it's optimal efficiency and actually result in less power than you might achieve running slightly lower boost levels. Sea Level barometric pressure is normally around 100 kilopascal (kPa), or 14.5 psi if you have Standard units selected.

Tuning Tips – When using the stock turbocharger, this table normally does not need to be changed from the Off-The-Shelf (OTS) maps. The MAZDASPEED OE tuning is slightly conservative, so if you want to make it more aggressive at the potential expense of some reliability, you can decrease the reduction in boost targets based on barometric pressure. This is done by changing the values in the table to be closer to zero. If you are using an after market/larger turbocharger, you may be able to safely use less conservative values. You will need to contact your turbocharger manufacturer for advice.

Boost Targets

Table Description – The Boost Targets table is used to determine how much boost the ECU will try to achieve when the ECU is not targeting torque. This table represents the desired Boost Targets you wish to run and has been converted by our software to be shown in relative pressure, assuming 1 atmosphere of barometric pressure (760 mm Hg, 14.5 psi). The table is referenced by the Engine RPM on the x-axis and by the Throttle Position Sensor on the y-axis. Table values are the relative (boost) pressure the boost control system will attempt to target when it is not targeting torque. Higher values mean more boost pressure, lower values mean less boost pressure.

Tuning Tips – The values you use in these tables cannot overcome any mechanical limitations. The desired boost level is determined by many factors including turbo design, engine displacement and volumetric efficiency, and fuel quality. For stock turbo applications please reference Cobb Tuning calibrations for direction regarding desired boost. For determining boost targets with after market turbochargers please contact the manufacturer.

Precautions and Warnings – Increasing boost does not always increase power. Boost levels above a turbochargers efficiency can damage both the turbocharger and the motor. ***Uncontrolled cylinder pressure and detonation as a result of high boost is perhaps the single most common way to destroy your motor.*** Do not take boost control lightly. If the system does not respond to your inputs stop tuning and check to make sure all mechanical components are in place and functioning.

WG Duty - Baro. Comp.

Table Description – This table represents the amount of compensation, or correction, made to the Wastegate Duty Cycle value based on current Barometric Pressure. The table is referenced by Barometric Pressure on the x-axis. Table values are the percentage change made to the Wastegate Duty Cycle value. A value of 1.00 will allow the ECU to run 100% of what is was calculating in order to achieve its target, which is effectively no change. A value of 0.90 will have the ECU run 90% of what it was going to run for that gear, and a value of 1.10 will have the ECU run 110% of what it was going to run for that gear. Barometric pressure decreases as altitude increases. This means as you climb up into the mountains, barometric (air) pressure decreases. This decrease in pressure means your turbocharger has to work harder to supply the same desired boost target it did at sea level. Often times this can push the turbocharger beyond it's optimal efficiency and actually result in less power than you might achieve running slightly lower boost levels. Sea Level barometric pressure is normally around 100 kilopascal (kPa), or 14.5 psi if you have Standard units selected.

Tuning Tips – When using the stock turbocharger, this table normally does not need to be changed from the Off-The-Shelf (OTS) maps. The MAZDASPEED OE tuning is slightly conservative, so if you want to make it more aggressive at the potential expense of some reliability, you can decrease the reduction in wastegate duty cycles based on barometric pressure. This is done by changing the values in the table to be closer to zero. If you are using an after market/larger turbocharger, you may be able to safely use less conservative values. You will need to contact your turbocharger manufacturer for advice.

WG Duty - Battery Comp.

Table Description – This table represents the amount of compensation, or correction, made to the Wastegate Duty Cycle value based on current Battery Voltage. The table is referenced by Battery Voltage on the x-axis. Table values are the percentage change made to the Wastegate Duty Cycle value. A value of 1.00 will allow the ECU to run 100% of what is was calculating in order to achieve its target, which is effectively no change. A value of 0.90 will have the ECU run 90% of what it was going to run for that gear, and a value of 1.10 will have the ECU run 110% of what it was going to run for that gear.

Tuning Tips – When using the stock turbocharger, this table normally does not need to be changed from the Off-The-Shelf (OTS) maps.

WG Duty - IAT Comp.

Table Description – This table represents the amount of compensation, or correction, made to the Wastegate Duty Cycle value based on current Intake Air Temperature. The table is referenced by Intake Air Temperature on the x-axis. Table values are the percentage change made to the Wastegate Duty Cycle value. A value of 1.00 will allow the ECU to run 100% of what is was calculating in order to achieve its target, which is effectively no change. A value of 0.90 will have the ECU run 90% of what it was going to run for that gear, and a value of 1.10 will have the ECU run 110% of what it was going to run for that gear.

Tuning Tips – None at this time.

WG Duty Cycles

Table Description – This table represents the Wastegate Duty Cycle necessary to achieve the Boost defined in the Boost Target tables, when boost targeting is used. The table is referenced by Engine RPM on the x-axis and by TPS (opening angle) on the y-axis. Table values are the duty cycles the boost control system will drive the electronic boost control solenoid at in order to regulate how much boost the turbocharger generates. Higher values mean more duty cycle which should result in higher boost pressure, lower values mean less duty cycle which should result in lower boost pressure.

Tuning Tips – When using the stock turbocharger, this table normally does not need to be changed from the Off-The-Shelf (OTS) maps.

The OEM MAZDASPEED boost control system employs a closed-loop, targeting system for tuning boost. Start with low values in this table and slowly increase them to achieve your designed Boost Target. If you have less wastegate duty cycle than required to hit your desired Boost Target, the Turbo Dynamics system will attempt to compensate.

If you are increasing or holding wastegate duty cycles steady and boost is dropping then you have most likely reached the threshold of the mechanical efficiency of the turbo or your exhaust gas back pressure prior to the turbo is too high and is forcing the wastegate valve to open.

If you are having a small boost spike you may need to decrease the WGDC percentage a few hundred RPM prior to the over boosting event to allow the exhaust energy to be released past the turbine wheel.

NOTE: With porting a wastegate, you are trying and make the wastegate valve function potentially work better which means that your turbo is going to lower boost quickly when the wastegate door/valve opens or not run as much boost as it was engineered to. If you make your wastegate react quicker then boost will be very difficult to stabilize and reach peak #s at an earlier RPM. If you make the wastegate flow better, then the exhaust energy your turbo needs to make and maintain boost will have less opportunity to flow across the turbine wheel. Generally speaking, air/pressure/exhaust gases will always flow along the path of least resistance.

Precautions and Warnings – The ECU switches from boost targeting to torque targeting logic. We have found the ECU uses the torque targeting system for most heavy and WOT load conditions. Although, you will still want to have positive values in this table so the Turbo Dynamics table functions appropriately when Boost Targeting is active and Load Dynamics table functions appropriately when Load Targeting is active since these tables modify WGDC based on a multiplier.

Closed Loop Tables

Closed Loop – Exit Delay A

Closed Loop – Exit Delay B

Closed Loop – Exit Delay C

Table Description – These tables are used to adjust how long the car stays in closed-loop. A lower value will cause the ECU to enter into open-loop earlier. A higher value will create a processing delay and will force the car to stay in closed-loop for longer.

Tuning Tips – None at this time.

Precautions and Warnings – Running a car without any high-flow catalyst can allow the turbo to overboost or boost spike. These tables may need to be modified in order to allow for open-loop fueling during WOT conditions. Please take into account that changing these table settings will effectively change how the vehicle drives and transitions from part throttle to WOT, and from closed-loop to open-loop.

Closed Loop – Max Load A

Closed Loop – Max Load B

Closed Loop – Max Load C

Closed Loop – Max Load D

Closed Loop – Max Load E

Table Description – These tables are used to adjust if the ECU stays in closed-loop based on calculated engine load values. A lower value in these tables will cause the ECU to enter into open-loop at lower engine loads. A higher value will create a delay and will force the car to stay in closed-loop until higher calculated engine load values are achieved. When calculated engine loads are above these values the car MAY run in closed loop if other conditional parameters are met.

Tuning Tips – None at this time.

Precautions and Warnings – Running a car without any high-flow catalyst can allow the turbo to overboost or boost spike. These tables may need to be modified in order to allow for open-loop fueling during WOT conditions. Please take into account that changing these table settings will effectively change how the vehicle drives and transitions from part throttle to WOT, and from closed-loop to open-loop.

Closed Loop – Max Throttle A

Closed Loop – Max Throttle B

Closed Loop – Max Throttle C

Closed Loop – Max Throttle E

Closed Loop – Max Throttle E

Table Description – These tables are used to adjust if the ECU stays in closed-loop based on throttle position values. A lower value in these tables will cause the ECU to enter into open-loop at lower throttle values. A higher value will create a delay and will force the car to stay in closed-loop until higher throttle position values are achieved. When throttle position values are above these values the car MAY run in closed loop if other conditional parameters are met.

Tuning Tips – None at this time.

Precautions and Warnings – Running a car without any high-flow catalyst can allow the turbo to overboost or boost spike. These tables may need to be modified in order to allow for open-loop fueling during WOT conditions. Please take into account that changing these table settings will effectively change how the vehicle drives and transitions from part throttle to WOT, and from closed-loop to open-loop. Some of the factory setting may look a bit odd, but this simply means that the factory calibration has set the TPS values above what is achievable. This effective does not allow the function to be turned off (or on) during these conditions.

Fuel Tables

Fuel CL Commanded EQ (base)

Table Description – This is a large 3 dimensional table defined by engine RPM on the horizontal axis and calculated engine load on the vertical axis. The numbers in the table represent the Lambda value (or air/fuel ratio) the ECU will try to target during closed-loop (CL) conditions.

Tuning Tips – The values in this table are critical to engine performance. The values indicated in the lower load regions are used as targets under closed loop fuel control. In other words, these values are actively targeted by the ECU using feedback from the front oxygen sensor (which can be datalogged as Actual AFR). If the MAF is calibrated correctly then the corrections used to target low load fuel mixtures will be small (typically + or – 8% or less). Under higher load the ECU will switch from closed loop fueling to an open loop strategy. The transition (or blending) from closed to open loop fueling is determined by many factors outlined in the tables under closed loop. If the MAF curve is properly calibrated then the observed air fuel mixtures under higher load will be very close to those indicated in the Fuel OL/WOT Commanded EQ (No Knock) table. A large difference in the observed and indicated fuel indicates that the MAF calibration is incorrect.

Precautions and Warnings – Overly lean fuel mixtures under boost can quickly damage the motor and other components. Always monitor Air Fuel ratios with the Actual AFR variable when performing calibrations. If you are unsure of what kinds of fuel mixtures to target please examine stock calibrations and Cobb Tuning OTS calibrations for guidance (can be found here). Please be sure to replace your primary WBO2 sensor if any signs of sensor inaccuracy or ware are present.

Fuel Commanded EQ Max Enrichment Allowed

Table Description – A single row of the richest fuel targets that can be targeted. If richer fuel targets are set in the WOT fuel tables, the ECU will not allow the car to run richer than the settings in this table.

Tuning Tips – None at this time.

Fuel CL Commanded EQ (Throttle Closed)

Table Description – This is a large 3 dimensional table defined by engine RPM on the horizontal axis and calculated engine load on the vertical axis. The numbers in the table represent the Lambda value (or air/fuel ratio) the ECU will try to target during closed-loop (CL) conditions when the throttle is closed.

Tuning Tips – None at this time.

Fuel OL Commanded EQ (base)

Table Description – This is a large 3 dimensional table defined by engine RPM on the horizontal axis and calculated engine load on the vertical axis. The numbers in the table represent the Lambda value (or air/fuel ratio) the ECU will try to target during some open-loop (OL) conditions, except Wide-Open-Throttle (WOT).

Tuning Tips – None at this time.

Fuel OL/Part Throttle Commanded EQ (Knocking)

Fuel OL/Part Throttle Commanded EQ (No Knock)

Fuel OL/Part Throttle Commanded EQ (unused)

Table Description – These are large 3 dimensional tables defined by engine RPM on the horizontal axis and calculated engine load on the vertical axis. The numbers in the table represent the Lambda value (or air/fuel ratio) the ECU will try to target during some open-loop (OL) conditions, and whether the Knock is present or not.

Tuning Tips – Tune appropriately.

Fuel OL/WOT Commanded EQ (Knocking)

Fuel OL/WOT Commanded EQ (No Knock)

Fuel OL/WOT Commanded EQ (unused)

Table Description – These single row tables indicates the desired air-fuel mixture utilized when the the car is in open-loop (OL) and WOT conditions. The table is defined on the horizontal axis by engine RPM. The values in the table represent target air fuel mixtures and are only accurate if the MAF calibration is properly set up.

Tuning Tips – The values in this table are critical to engine performance under open-loop WOT conditions. If the MAF is calibrated correctly then the corrections used to target low load fuel mixtures will be small (typically + or – 8% or less) under WOT conditions. Under higher load the ECU will switch from closed loop fueling to an open loop strategy. The transition (or blending) from closed to open loop fueling is determined by many factors outlined in the tables under closed loop and fueling. If the MAF curve is properly calibrated then the observed air fuel mixtures under higher load will be very close to those indicated in the Fuel OL/WOT Commanded EQ (No Knock) table. A large difference in the observed and indicated fuel indicates that the MAF calibration is incorrect.

Every motor and every kind of fuel may indicate a different fuel ratio. However, most MAZDASPEED turbo applications utilize a rich mixture of fuel to air when under high load. Depending upon fuel quality a normal “on boost' fuel mixture may be lower 12s (0.78 to 0.83 lambda) to high 10s (0.7 to 0.74 lambda). Under more moderate load conditions, fuel ratios can be run much leaner.

Precautions and Warnings – Overly lean fuel mixtures under boost can quickly damage the motor and other components. Always monitor Air Fuel ratios with the Actual AFR variable when performing calibrations. If you are unsure of what kinds of fuel mixtures to target please examine stock calibrations and Cobb Tuning OTS calibrations for guidance (can be found here). Please be sure to replace your primary WBO2 sensor if any signs of sensor inaccuracy or ware are present.

Idle Tables

Idle Speeds A

Idle Speeds B

Table Description – A single row of target idle speeds that vary as a function of engine coolant temperature. The various tables in these series (A through B) are indicated by an an assortment of conditional parameters.

Tuning Tips – Vehicles with stock camshafts and other engine components should idle at stock levels. Some larger camshafts, and or/fuel injectors, or balance shaft removal kits, may require a higher target idle for stable operation. When running larger fuel injectors we have found it has been helpful to maintain an Idle Speed which is 100-400 RPM higher than the factory calibration. At idle, the vehicle is in closed-loop operation trying to maintain 1 Lambda or an AFR Petrol of 14.68:1 and the ECU might modify the injector pulse width (IPW) to a point where the ECU will not allow a fuel injector to fully open and close due to the short pulse width is running in order to his this fuel target. Larger fuel injectors need a minimum injector pulse width in order to fully open and close; if the motor is idling too low then the pulse width is too short to allow the injector to work properly and an occasional miss-fire can occur.

If your idle RPM or AFR at idle has a slight fluctuation then you may need to modify your intake calibration table settings around the MAF voltage the vehicle idles. We have found that the stock calibration settings at idle can be too far apart and they may need to be adjusted so they are closer together at the MAF voltage where the vehicle idles. For this example we will say that the vehicle is idling around 1.29 MAF volts, please refer to the below pictures to see how the settings may be optimized.

Ignition Tables

Ign Table – Low Throttle/OL (Knocking)

Ign Table – Low Throttle/OL (No Knock)

Table Descriptions – These tables are all large 3 dimensional and defined by engine RPM on the horizontal axis and calculated engine load on the vertical axis. The numbers in the table represent the rotational angle in degrees before top dead center that the coil is fired in each cylinder's combustion cycle. These two tables are populated with the same values from the factory.

Tuning Tips – To tune the ignition advance curve for WOT, you must tune boost first, while running a excessively rich fuel curve (something around Lambda of 0.68 or a low 10:1 AFR Petrol). You will need to datalog the following variables: RPM, Ignition Timing, Throttle Position, Knock Retard, Boost, Wastegate Duty, and Actual AFR. For tuning of these we suggest you start of with less total ignition advance than is optimal, that way you can work your way up from there. Generally speaking, a turbo-charged MAZDASPEED engine will run the least amount of ignition advance near peak torque and ignition advance will generally rise as RPM rise in order to keep up with the increasing piston speed. This trend is normal for most internal combustion spark ignition motors; as VE (Volumetric Efficiency) increases the amount of ignition advance a motor needs will decrease. As you cruise a motor's VE will not be the highest on a turbocharged motor because the turbo is not producing much boost under cruise conditions so ignition advance will usually be higher. As VE increases at WOT (when the turbo is producing boost) ignition advance will go down to its lowest point (even negative) by peak torque then it will slowly increase during the torque plateau. Once torque begins to fall off you will see ignition advance increase at higher rates. This is due to the decreasing VE and is also done in order to keep up with the increasing piston speeds; you have to start the burn earlier so that the pressure wave expansion occurs at the optimal time.

We have found that one must have a chassis dyno to help find the thresholds for maximum ignition advance for a particular motor and the fuel that is being used. The following section should give you a much better understanding as to how the factory ignition system works and what you are trying to do by tuning your ignition advance curve. The objective of ignition tuning is very simple. You are trying to start the flame front, BEFORE TDC, so that the peak of the combustion chamber pressure wave pushes down on the piston AFTER TDC at the same time. This is why values in the ignition advance tables are in degrees of ignition advance before TDC or ATDC. We must first go over how the ECU calculates total ignition advance before we can attempt to tune the ignition advance curve:

Total Ignition Advance =

The ECU will look-up the p**rimary ignition table value** for the corresponding RPM and Calculated Load breakpoint, then

- removes **Knock Retard adjustments made by ECU within the Knock Detection range**. Within the Knock Detection range, the ECU can make a final adjustment to remove ignition advance is it hears the engine noise is getting too close threshold. The ECU will do what it can to protect the motor. **As the ECU removes ignition advance through a Knock Retard report, it will also increase fueling to the engine.**

With the above said, what you will be trying to do is to get the total ignition advance curve as close to optimal for your motor and the fuel you are using. If your ECU and motor are happy with your calibration you will generally see that your Knock Reports stay at less than 1 during most WOT runs.

You should be satisfied with the ignition advance curve if while at WOT for several runs, hot ones even, the Knock Retard stays less than 1 across the RPM range and the ignition is a smooth predictable curve. This is not the only way to tune, just another perspective. You can sometimes try to allow more ignition advance so that the ECU will show me if the motor wants more ignition timing. You can increase the total ignition advance in small increments, .5 - 1 degrees of ignition advance. Once you are able to find the optimal ignition advance curve your motor wants for the particular fuel you are using you should see that your total ignition advance curve is consistent.

Generally speaking, ignition advance is used to increase the volumetric efficiency (VE) of an engine where the efficiency does not naturally exist. With this said, peak VE is found at peak torque so the engine will need the least amount of ignition advance under these conditions. After the engine's torque peak, you will typically need to increase ignition advance in order to keep up with the increasing piston speeds the engine will see as RPM increase. Please take into account that once you exceed MBT (Minimum spark advance for Best Torque output), it is possible to make less power with more ignition advance. This is when tuning on a load based chassis dynamometer can be very beneficial.

Precautions and Warnings – We cannot stress how important it is to properly populate the ignition advance tables. Do not make assumptions about how different ignition advance tables work together. Every model of MAZDASPEED is different so do not allow your experience with one model to influence others without direct experience validating those ideas.

This ECU will constantly try to run more ignition advance than is necessary at part throttle conditions. It does this in order to allow the ECU to detect MBT for each individual vehicle. Once the ECU exceeds MBT, the ECU will remove excess ignition advance through the Knock Retard function. This is normal and should not concern you, cylinder pressures at part throttle are not high enough to cause any damage. If consistent Knock Retard is reported or audible detonation is present, you are welcome to remove ignition advance during part throttle conditions, although your fuel economy may go down during these conditions.

Ign Table – High Throttle/OL (Knocking)

Ign Table – High Throttle/OL (No Knock)

Table Descriptions – These tables are all large 3 dimensional and defined by engine RPM on the horizontal axis and calculated engine load on the vertical axis. The numbers in the table represent the rotational angle in degrees before top dead center that the coil is fired in each cylinder's combustion cycle. These two tables are populated with the same values from the factory.

Tuning Tips – We highly suggest you datalog the following to see what ignition advance tables your ECU is using for part throttle and WOT conditions. You can datalog the following variables: RPM, Ignition Timing, Throttle Position, Knock Retard, Boost, Wastegate Duty, and Actual AFR to help you determine what tables you ECU is utilizing for ignition advance calculations.

Limiter Tables

Rev Limiter

Table Description – One engine speed value that represent the switch to define the maximum allowable engine speed. Fuel delivery is blocked and other overrun parameters enabled to keep engine speeds below this set point.

Tuning Tips – Stock engines with stock valvetrains should keep their stock maximum engine speed. In some case throttle mapping must be changed in order to effectively raise maximum engine speed.

Precautions and Warnings – Increasing engine speed produces exponentially higher forces on the engine components and oiling systems. Increasing allowable engine speeds may produce catastrophic engine failure.

Speed Limiter

Table Description – One of vehicle speed that represent the maximum allowable vehicle speed under a given set of other conditional parameters. This value limits speeds above these thresholds will result in throttle closure.

Tuning Tips – None at this time.

Speed Limiter Hysteresis

Table Description – Once the speed limiter value has been achieved, the throttle system will close the throttle until the vehicle speed has reduced speed by the value in this table. Ex: If the Speed Limiter table is set to 155 MPH and the Speed Limiter Hysteresis table is set to 4 MPH and the Speed Limiter value is achieved, the throttle will close until the car has slowed down by 4 MPH.

Tuning Tips – None at this time.

Load Tables

Abs Load Limits

Table Description – This table is defined by Engine RPM on the x-axis and by temperature on the y-axis, and is populated with calculated engine load values. The maximum calculated engine load allowed is a function of temperature and engine RPM. If calculated engine load exceeds these values for the given conditions, the engine will be abruptly interrupted through fuel cut. This temporary engine power loss is designed to avoid catastrophic consequences of running out of flow with the camshaft-driven fuel pump (CDFP).

Tuning Tips – Tune appropriately.

Precautions and Warnings – Please be sure to datalog your DI Fuel pressure during your tuning. If you see your DI Fuel Pressure drop below 1300psi (or 8960 kPa) while at WOT, then you are most likely running out of CDFP flow and will need to have this item upgraded to a higher flowing unit.

Abs Load Targets

Table Description – This table is defined by Engine RPM on the x-axis and by throttle position on the y-axis, and is populated with calculated engine load values.

Tuning Tips – None at this time.

Load Dynamics

Table Description – The Load Dynamics table is used as a feedback control system to correct for errors in the desired Load Targets versus the actual Load Targets calculated by the ECU. The feedback control method used is known as a Proportional-Integral controller.

Load Error = (Desired Load Target) – (Calculated Load)

This table represents a compensation (correction) necessary to counteract the Load error that has occurred. The table is referenced by Load Error (represented in calculate engine load) on the x-axis. Table values are the percentage change made to the load targeting calculations.

Tuning Tips – This table can be used to refine load control characteristics for under and over achievement conditions.

Throttle – Gear Based Req. Load – High BAT Flag Off

Table Description – If the BAT exceeds the value in the Throttle – Gear Based Req. Load – High BAT Flag On, the BAT will need to drop below this value before it switches the load targeting logic back to **Norm BAT** load targeting tables.

Tuning Tips – None at this time.

Throttle – Gear Based Req. Load – High BAT Flag On

Table Description – If the BAT exceeds the value in this table, the ECU will switch load targeting logic to the **High BAT** load targeting tables.

Tuning Tips – None at this time.

Throttle – Req. Load – 1st Gear (High BAT)

Throttle – Req. Load – 1st Gear (Norm BAT)

Table Description – **These tables are used in conjunction with the Throttle – Requested Load : Baro v. RPM and Throttle – Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when the car is driven in first gear. These tables are simply referenced by RPM and contain load target values. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in this table are lower than the target load values in the Throttle – Requested Load : Baro v. ROM and Throttle – Requested Load tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid.

Throttle – Req. Load – 2nd Gear (High BAT)

Throttle – Req. Load – 2nd Gear (Norm BAT)

Table Description – **These tables are used in conjunction with the Throttle – Requested Load : Baro v. RPM and Throttle – Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when the car is driven in second gear. These tables are simply referenced by RPM and contain load target values. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in this table are lower than the target load values in the Throttle – Requested Load : Baro v. ROM and Throttle – Requested Load tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid.

Throttle – Req. Load – 3rd Gear (High BAT)

Throttle – Req. Load – 3rd Gear (Norm BAT)

Table Description – **These tables are used in conjunction with the Throttle – Requested Load : Baro v. RPM and Throttle – Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when the car is driven in third gear. These tables are simply referenced by RPM and contain load target values. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in this table are lower than the target load values in the Throttle – Requested Load : Baro v. ROM and Throttle – Requested Load tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid.

Throttle – Req. Load – 4th Gear (High BAT)

Throttle – Req. Load – 4th Gear (Norm BAT)

Table Description – **These tables are used in conjunction with the Throttle – Requested Load : Baro v. RPM and Throttle – Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when the car is driven in fourth gear. These tables are simply referenced by RPM and contain load target values. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in this table are lower than the target load values in the Throttle – Requested Load : Baro v. ROM and Throttle – Requested Load tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid.

Throttle – Req. Load – 5th Gear (High BAT)

Throttle – Req. Load – 5th Gear (Norm BAT)

Table Description – **These tables are used in conjunction with the Throttle – Requested Load : Baro v. RPM and Throttle – Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when the car is driven in fifth gear. These tables are simply referenced by RPM and contain load target values. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in this table are lower than the target load values in the Throttle – Requested Load : Baro v. ROM and Throttle – Requested Load tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid.

Throttle – Req. Load – 6th Gear (High BAT)

Throttle – Req. Load – 6th Gear (Norm BAT)

Table Description – **These tables are used in conjunction with the Throttle – Requested Load : Baro v. RPM and Throttle – Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when the car is driven in sixth gear. These tables are simply referenced by RPM and contain load target values. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in this table are lower than the target load values in the Throttle – Requested Load : Baro v. ROM and Throttle – Requested Load tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid.

Throttle – Req. Load – Max A

Throttle – Req. Load – Max B

Table Description – These single row tables indicate a maximum load limit. The table is defined on the horizontal axis by engine RPM. The values in the table are calculated load values.

Tuning Tips – None at this time.

Throttle – Requested Load : Baro v. RPM

Table Description – **This table is used in conjunction with the Throttle – Requested Load Per Gear and Throttle – Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when and references engine RPM on the x-axis and Barometric Pressure for the y-axis. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in this table are lower than the target load values in the Throttle – Requested Load Per Gear and Throttle – Requested Load tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid. Modifying these table can greatly effect how the vehicle drives at part throttle and transitions from part throttle to WOT.

Throttle – Requested Load A

Throttle – Requested Load B

Throttle – Requested Load C

Table Description – **These tables are used in conjunction with the Throttle – Requested Load Per Gear and Throttle Requested Load tables. The ECU will target the lesser of the loads found between these three tables for the given conditions.** These tables are used for the load (torque) targeting system when and references engine RPM on the x-axis and Throttle Position for the y-axis. The higher value, the greater torque the ECU will try to achieve, usually by increasing boost through greater WGDC values. The lower value, the less torque the ECU will try to achieve, usually by decreasing boost through lower WGDC values.

Tuning Tips – We suggest you datalog the vehicle to see what type of boost it is trying to run. If you can run more boost for the given traction and fueling qualities, then you can increase the values in the Norm BAT table until you achieve your boost targets.

Precautions and Warnings – **This table will only be used if the target load values in these tables are lower than the target load values in the Throttle – Requested Load Per Gear and Throttle Requested Load : Baro v. ROM tables.** We do not suggest you run a wastegate duty cycle of more than 95% to prevent overheating or lock-up of the wastegate solenoid, and to promote the longevity of the wastegate solenoid. Modifying these table can greatly effect how the vehicle drives at part throttle and transitions from part throttle to WOT.

Sensor Cal. Tables

MAF Table A

MAF Table B

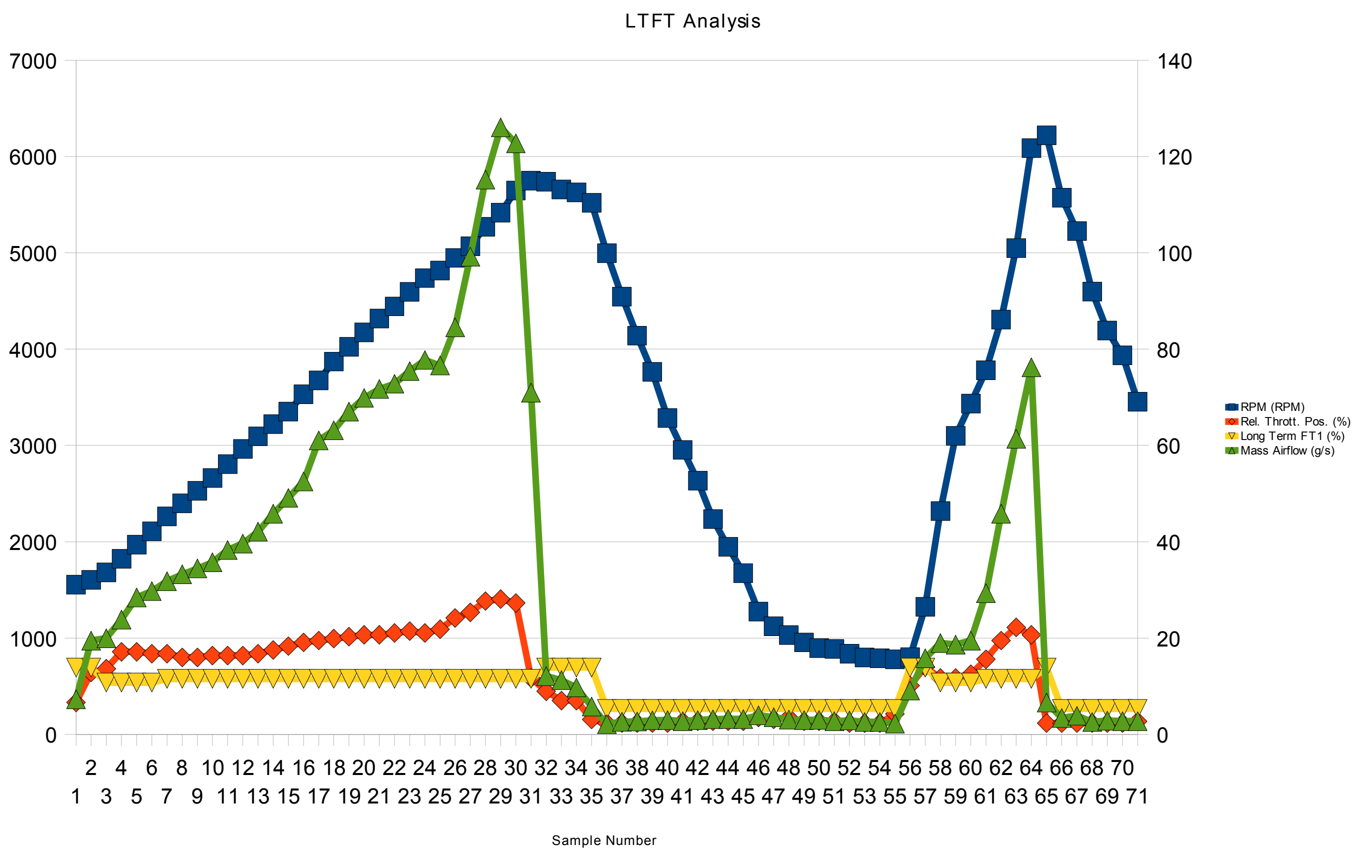
Table Description – This single row table describes the non-linear calibration of the stock mass air flow sensor over a voltage range over its useful output of zero to nearly 5 volts. The values in this table represent an stoichiometric mass of fuel to the amount of air moving through the stock intake. The MAF Calibration table contains values which tell the ECU the MASS of air entering the engine for the given MAF voltage. These values allow the ECU to properly calculate the mass of the fuel it needs to inject into the engine to get the air/fuel value dictated in the Primary Fuel table or by the closed loop control targets, 1 Lambda. The factory ECU airflow adjustments table is based on MAF Airflow. The data in this table is represented in grams per second; this is the only table that exists for the sole purpose of adjusting MAF transfer (or MAF calibration) values. Under closed loop conditions the ECU is always going to try and hit 1 Lambda or the stoichiometry of the fuel you are running. You will be most familiar with the associated petrol air/fuel ratio of 14.68:1 A/F, which is an air mass of 14.68 to every 1 fuel mass.

Tuning Tips – The equivalent fuel mass values derived from the intake calibration are the primary consideration when the ECU is calculating fuel, ignition timing, and load. It is this value and not boost that determines the engine load and thus all critical engine control parameters. With a stock intake it is rarely necessary to significantly alter this calibration. However, after market intakes pass air across the mass air flow sensor differently and ofter need considerable changes in order to yield acceptable results. This accurate calculation of engine load is critical for the dozens of other tables that use engine load to define a axis. To calculate your MAF Calibration adjustments, please follow the below steps.

Datalog and establish or verify the proper *part throttle* and *WOT* MAF Calibration settings for the fuel intake system and other hardware that will be used for calibrating the engine. To capture this data please follow the below directions:

This test should be done carefully. Allow the vehicle to idle for a few minutes, then drive for about 50 city miles at light throttle. Please make sure the ECU has not been reset or the battery disconnected for these 50 miles. Set the AccessPORT up to datalog the standard 10 variables along with MAF Flow, Short-Term Fuel Trim (STFT), and Long-Term Fuel Trim (LTFT). Be sure to have MAF Flow displayed on the screen as you prepare to log. Start in 2nd gear at 1500 RPM then **very slowly** modulate throttle from there over the next 20 seconds, please be sure to accelerate at a steady rate until you exceed 100 grams/sec airflow. After you have completed this test up to 100 grams/sec, please put the car in neutral and allow the car to idle for a few seconds. Then steadily open the throttle while the car is in neutral until you exceed 30 grams/sec, then stop the datalog. This will allow us to see what type of learning the stock ECU is doing to compensate for the intake system that is installed on this car. Ideally, you want your LTFT values to be closer to zero. Anything +/- 8% is acceptable, but closer to 0 LTFT is ideal.

The objective is to observe the various adjustment that have been saved by the ECU at various breakpoints along the MAF curve. These breakpoints are based on grams/second airflow values.



By analyzing the datalog recorded above, you can see what changes the ECU is making to compensate for the various hardware installed on the vehicle. You should only need to apply these adjustments once prior to continuing the tuning process. One objective is to calibrate the MAF sensor for part throttle conditions. The other objective is to calibrate the MAF sensor so the WOT fuel tables can be accurate. From what we have seen with these vehicles, the MAZDASPEED3 (MS3) and MAZDASPEED6 (MS6) have different learning breakpoints for the LTFT corrections.

The MS3 uses five different LTFT Breakpoints from;
0 – ~5 grams/sec
~5.01 – ~16 grams/sec
~16.01 – ~28 grams/sec
~28.01 – ~77 grams/sec
~28.01 grams/sec – full sensor range

The MS6 uses five different LTFT Breakpoints from;
0 – ~5 grams/sec
~5.01 – ~18 grams/sec

~18.01 – ~31 grams/sec
~31.01 – ~69 grams/sec
~69.01 grams/sec – full sensor range

If you are operating the engine with an intake system which has a larger diameter that the stock intake system then you will want to use the global multiplier value calculated from the “Intake Calibrations” tab located in the “AccessTUNER Calibration & Tuning Guide Worksheet for MAZDASPEEDs.” This multiplier should be applied to the entire MAF Calibration curve.

Your trim values will always adjust back and forth (+/-); let them, that is what they are supposed to do. Do not beat yourself up trying to get them at exactly 0...it is impossible (temperature, weather, gasoline, etc. changes will not keep anything constant while you are tuning).

If you are seeing plateaus, spikes, dips, or flat spots in the graph for the Intake Calibration table then you know something is wrong...replace the intake system with a properly designed one.

NOTE: Changing the Intake Calibration table will change your calculated load. If all other variables remain constant, the less airflow you calibrate in the ECU for a given MAF voltage; the less engine load will be calculated.

Precautions and Warnings – Modifying this table will then modify how the ECU calculates torque! Nearly every important table utilized for coordinated engine function is defined in part by engine load and this is derived from the mass air flow sensor calibration of the intake. A mistake in this table can cause catastrophic engine damage.

MAP Scaler – Component A

MAP Scaler – Component A

MAP Scaler – Offset

Table Description – These tables represent the calibration for the Manifold Absolute Pressure (MAP) / Boost Air Temperature sensor (MAP sensor portion only).

Tuning Tips – None at this time. Below is some of the ECU logic that is used for calibrating the sensor using these tables.

Input: MAP Voltage (0-5)
Output: Absolute Pressure (kPa)

(((MAP Voltage) * (Scalar A)) * Scalar B) - Offset

Scalar A = 230
Scalar B = 0.23529412
Offset = 1.647

Testing will be needed to further discover if installing new MAP/BAT sensors is possible.

Throttle Tables

APP Translation : 0Neutral

APP Translation : 1st Gear

APP Translation : 2nd Gear

APP Translation : 3rd Gear

APP Translation : 4th Gear

APP Translation : 5th Gear

APP Translation : 6th Gear

Table Description – These tables represent how the Accelerator Pedal Position (APP) values are reported to the ECU on a per gear basis. The x-axis values in these tables are APP read-only values and the cell data is the reported APP values that are used by the ECU for throttle controls. These tables use read-only APP values to look up a APP value that is reported to the ECU for throttle controls.

Tuning Tips – The stock values work very well. If you are to modify these values, we highly suggest you drive the vehicle and datalog APP and TPS values to get a better idea about how this vehicle drives with the various changes.

Precautions and Warnings – These vehicles tend to use switching and blending functions for closed-loop to open-loop transitions. Please be aware of this as you start to modify any closed-loop functionality.

APP Translation : Baro. Comp.

Table Description – This table represents the amount of compensation, or correction, made to the APP Translation system values based on current Barometric Pressure. The table is referenced by Barometric Pressure on the x-axis. Table values are the percentage change made to the APP Translation values. A value of 1.00 will allow the ECU to run 100% of what is was calculating in order to achieve its target, which is effectively no change. A value of 0.90 will have the ECU run 90% of what it was going to run for the current barometric pressure, and a value of 1.10 will have the ECU run 110% of what it was going to run for the current barometric pressure. Barometric pressure decreases as altitude increases. This means as you climb up into the mountains, barometric (air) pressure decreases. Sea Level barometric pressure is normally around 100 kilopascal (kPa), or 14.5 psi if you have Standard units selected.

Tuning Tips – None at this time.

APP Translation : Speed Comp.

Table Description – This table represents the amount of compensation, or correction, made to the APP Translation system values based on current vehicle speed. The table is referenced by vehicle speed on the x-axis. Table values are the percentage change made to the APP Translation values. A value of 1.00 will allow the ECU to run 100% of what is was calculating in order to achieve its target, which is effectively no change. A value of 0.90 will have the ECU run 90% of what it was going to run for that gear, and a value of 1.10 will have the ECU run 110% of what it was going to run for hose conditions. Barometric pressure decreases as altitude increases. This means as you climb up into the mountains, barometric (air) pressure decreases. Sea Level barometric pressure is normally around 100 kilopascal (kPa), or 14.5 psi if you have Standard units selected.

Tuning Tips – These table values are set to 1.00 or are effectively not used.

DBW Throttle A

DBW Throttle B

DBW Throttle C

Table Description – These tables define the throttle duty cycles indicated under three separate conditions as a function of calculated engine load, and thus requested torque. The table is referenced by the Engine RPM on the x-axis and by the calculated engine load on the y-axis. Table values are the relative throttle duty cycle the torque targeting system system will drive the electronic throttle body in an attempt to target the associated torque. Higher values mean more duty cycle, lower values mean less duty cycle.

Tuning Tips – The factory ECU settings use these table values to control the torque produced by the MZR engine. These tables most directly effect how the throttle system works during part throttle and WOT conditions. The requested torque values on the y-axis indicate how much or little to duty cycle to drive the electronic throttle body with. A value of 80% throttle duty cycle represents the maximum amount the electronic throttle body can be driven. The OTS map settings are very effective and we suggest you start there.

VVT Tables

VVT Intake Cam Adv.

VVT stands for Variable Valve timing and is a variable camshaft phasing control technology used by Mazda. Hydraulic oil pressure is used to advance the intake camshaft timing in an effort to optimize power through the entire engine speed and load range.

Table Description – This table represent the amount of intake camshaft advance represented in camshaft degrees. The table is referenced by Engine Speed on the x-axis and by Calculated Engine Load on the y-axis. Table values are the degrees of timing advance (shown in camshaft degrees) the VVT system will attempt to target. Higher values mean more intake camshaft advance, lower values mean less advance. You cannot retard (use a value less than zero) the intake camshafts. The system is closed loop and will make attempts to compensate for differences in oil pressure, temperature, oil viscosity, etc. As the system is hydraulically controlled by engine oil, changes may not instantaneously occur.

Tuning Tips – Tuning these tables takes patience and the ability to accurately quantify if changes are resulting in improvements or not. Depending on your level of modification, there are appreciable gains to be made through VVT intake camshaft advance tuning. For most cars that are not very heavily modified, the gains will be focused at low to mid-range Engine Speed across all Engine Loads. Partial throttle (ie: not full load, WOT) gains can be significant as well, provided you have the equipment (load bearing dyno) capable of accurately quantifying any gains from these changes. It is ultimately your responsibility to understand in more precise details about what setting work best for your hardware combination. This is part of the job of tuning. Keep in mind that the engine is an air pump and functions as a system of all it's parts. Changes in your VVT intake camshaft advance can result in changes in your measured A/F Ratio, fuel consumption, optimal ignition advance, boost control, etc.

Precautions and Warnings
1) If you data log slightly different VVT intake camshaft advance from what you've tuned for in the table, this is typically normal. However if your data logs show large disparities between the commanded VVT intake camshaft advance shown in this table and what you are data logging, this potentially means you have a mechanical issue with the hydraulic oil pressure control system.
2) The system has safe guards to prevent valve-to-piston interference ONLY when using stock pistons designed for the cylinder heads used and stock valvetrain including stock camshafts. If you are using after market pistons or camshafts, you are advised to contact the supplier as to the safe amount of VVT intake camshaft advance you may run.
3) If you increase the VVT intake camshaft advance values and the VVT data you are logging does not increase, this may mean you have reached a designed mechanical limitation. The camshaft advancing mechanism may simply not be able to increase intake camshaft phasing beyond a mechanically limited point by design.
