



**Custom Chip for '86/87 Turbo Buick or '89 Turbo TA
For converting from a MAF system to Speed Density
SD2 version 1.2 with Flexfuel**



Bailey Engineering

This product is intended for off-road use only. TurboTweak cannot be held responsible for any damage resulting from the use of this product.

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Contents

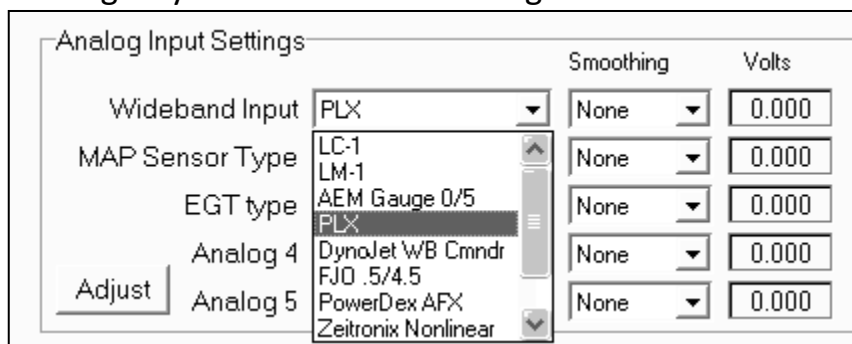
Read before install.....	3
Setup checklist.....	4
Programmable Features.....	5
Chip parameter adjustment.....	6
Powerlogger parameter adjustment.....	9
Chip Parameter Descriptions.....	10
Powerlogger Parameter Descriptions.....	7, 14
Basic Tuning, Saving Tune.....	15
Setup Notes.....	17
Fuel Trim Chart.....	18
MAP and Wideband Connection.....	19
Wideband Setup.....	20
Powerlogger Updating.....	22
Advanced Tuning.....	23
Extra Tables	25
Flexfuel Update.....	26

Please read before installing!

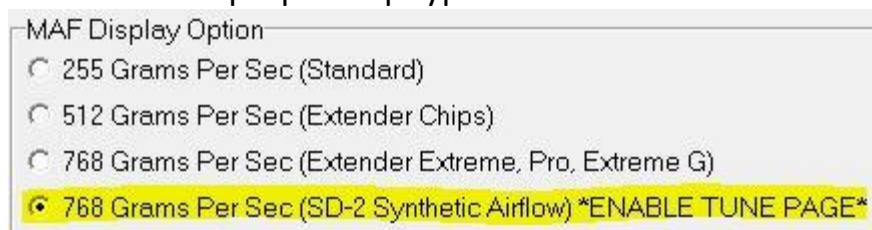
1. This chip must be used with a Powerlogger. Make sure the Powerlogger is updated with the latest software (see info near the end of this document). A MAP sensor must be properly connected to the Powerlogger. Make sure the MAP sensor gets its 5 volt supply from the ECM. You can splice into the 5 volt supply to the TPS sensor. The MAP signal wire connects to the Powerlogger input module.
2. This chip does not require the factory style O2 sensor. A wideband O2 system is highly recommended for tuning, and using the closed loop features of the chip.
3. A noisy ignition system can cause data corruption and other problems. Do NOT use any type of “non-resistor” spark plug (many racing plugs are non-resistor).
4. The chip uses manifold air temperature for fuel corrections. You should move the factory air temp sensor to somewhere after the intercooler. You can mount it in the plenum or in the up-pipe. Try to mount it before any alcohol nozzle, so the alcohol doesn’t affect the reading (however it can still be tuned this way).
5. Before installing the chip, disconnect the power to the ECM by unplugging the orange wire with the black connector by the battery. After gaining access to the ECM and removing the cover, remove the old chip, and carefully insert the new chip. Sometimes you may have to squeeze the sides of the chip slightly for it to fit into the socket. The chip will only go in one way. The notch on one end of the chip should be the same direction as the notch in the ECM socket.
6. Reconnect the ECM power wire. (**Important!** Always reset the ECM when changing chips, even from one TurboTweak chip to another TurboTweak chip.) With the SD2 chip, the Powerlogger will remember all your settings, so they will not be erased if the ECM loses power. If you want to reload the chip’s default settings, see parameter #16.
7. Turn the key on. The “Service Engine Soon” light should come on, blink once and stay on. If the “Service Engine Soon” light flashes on and off rapidly, do not start the car. Try to re-insert the chip, checking for bent pins. Also, check the ECM chip socket for any pins that are bent in too far, possibly making poor contact with the chip. The ECM socket pins can be carefully bent back out with a pin or needle. If the SES light still flashes, then the chip may be defective, or damaged during shipment, and will need to be replaced.
8. As a starting point, set the fuel pressure to 43psi (vacuum line off) for injectors 80lb/hr and smaller. For injectors bigger than 80lb/hr, start around 38psi.
9. If this is a brand new install, before starting the car, you should use parameter #16 to load the default settings by setting it to “1”, and keying off. Then you should be good. Check to make sure the PL parameter “Injector PPH” is set up for your injectors. You should be ready to start, but go through the checklist on the next page.

Checklist for SD2 Chip Setup

- ✓ Powerlogger is installed and operating correctly, using the latest software (version 2.5.2 or newer). You can check for updates at my message board, www.turbotweak.com/forum. Look in the SD2 Chip section. Also the Powerlogger has been flashed with the latest file "PL044.s19" or newer. This file will appear when you run the newest PLC.exe the first time. (Currently, the newest version of PLC.exe is 2.5.2 and newest flash file is PL044.)
- ✓ The MAP sensor is connected properly to the Powerlogger's analog input block. There are 3 wires from the MAP sensor: 5v supply(grey), 0-5v signal(green), ground (black). The 0-5v signal (green) gets connected to the Powerlogger's I2 input. The original 5v supply came from the dash, which can be inconsistent. It is preferred that this is changed to the 5v supply and ground from the ECM. This can be done by tapping into the TPS 5v supply, which is pin C14 at the ECM, and D12 which is ground. See this link for more details: <http://www.vortexbuicks-etc.com/PowerLogger.htm> (you can cut and paste this link into your internet browser or try clicking on it). Thanks to Steve Wood for the info!
- ✓ Your wideband system is properly connected to the Powerlogger's analog input block (terminal I1 at the analog input block).
- ✓ You have selected the proper wideband setting in the PLC software, and select the right MAP sensor. These must be set properly! Also make sure they go back to the right settings if you view some else's log.



- ✓ You have selected the proper chip type in the PLC software.



Programmable Features

There are many areas of this chip that can be adjusted by the user. A wideband O2 system is recommended so you can monitor air/fuel ratios to get your car running its best.

Use Caution! The adjustments available to you with this chip have the capability to do serious harm to your engine if you do not monitor your fuel mixture and knock retard with some type of scanning device.

There are 2 types of parameters: The Chip Parameters, which can be adjusted using any scantool with the throttle method (or adjusted in the PLC software), and the Powerlogger Parameters, which are adjusted in the PLC software only by pressing the "Tune" button at the top.

Chip Parameters - displayed in the BLM grid

Param #	Name	Description
1	Idle Base Fuel	Fuel when RPM is under 1300, Throttle closed
2	Target A/F at Idle	Target A/F at Idle if using Closed Loop
3	Target A/F at Cruise	Target A/F during normal driving if using Closed
4	Target A/F at WOT	Target A/F at WOT, Closed Loop
5	Fuel table low map	40kpa (18" vac) and lower
6	Fuel table Mid map	100kpa, 0psi
7	Fuel table Mid/hi map	160kpa, 8psi
8	Fuel table high	220kpa (17psi) and higher
9	WOT Spark Advance Adder	Spark advance adjustment for WOT
10	Launch Spark Adder	Adds spark at WOT under 2mph
11	Cold Start Fuel	Fuel during cold start (once engine is running)
12	AE Fuel	Acceleration Enrichment Fuel
13	Fuel Composition	Increase this for E85, +30% is 166, 128 is for gas
14	Knock Retard Ignore	Knock retard ignore threshold
15	SES Shift Light RPM	SES light comes on at this RPM
16	Reload Defaults	Setting to "1" reloads all original defaults

BLM Grid Display in PLC (chip parameters)

Block Learn Values			
INT	128	BLM	128
¹ 128	² 098	³ 098	⁴ 098
⁵ 128	⁶ 128	⁷ 128	⁸ 128
⁹ 000	¹⁰ 000	¹¹ 128	¹² 128
¹³ 128	¹⁴ 010	¹⁵ 254	¹⁶ 000

Powerlogger Parameters

Target AFR
 VE
 Spark
 Tables
 Parameters

<input type="text" value="5.0"/>	Fan idle compensation	<input type="text" value="0"/>	Airflow Mode	<input type="text" value="200"/>	Injector PPH
<input type="text" value="84.7"/>	Boost Solenoid DC (1/2)	<input type="text" value="23"/>	Injector Offset	<input type="text" value="80.0"/>	Boost DC (3rd gear)
<input type="text" value="170"/>	Fan Temp (Degrees F)	<input type="text" value="80.0"/>	Boost DC (4th gear)	<input type="text" value="44"/>	3rd gear TCC MPH
<input type="text" value="0.0"/>	crank fuel trim	<input type="text" value="44"/>	4th Gear TCC MPH	<input type="text" value="15.0"/>	Lean Cruise AFR
<input type="text" value="150"/>	WOT TCC MPH	<input type="text" value="100"/>	Lean Cruise min MPH	<input type="text" value="0"/>	Lean Cruise Max MAP
<input type="text" value="0.0"/>	Timing reference adjust	<input type="text" value="0.0"/>	Cylinder 1 fuel trim	<input type="text" value="0.0"/>	Cylinder 2 fuel trim
<input type="text" value="0.0"/>	Cylinder 3 fuel trim	<input type="text" value="0.0"/>	Cylinder 4 fuel trim	<input type="text" value="0.0"/>	Cylinder 5 fuel trim
<input type="text" value="0.0"/>	Cylinder 6 fuel trim	<input type="text" value="6200"/>	Rev Limit (0=disable)	<input type="text" value="0"/>	Options
<input type="text" value="1.49"/>	TPS max for PT TCC	<input type="text" value="185"/>	Spool mode Max MAP	<input type="text" value="1.28"/>	Spool mode time limit
<input type="text" value="2000"/>	DFCO Enable RPM	<input type="text" value="1500"/>	DFCO Disable RPM	<input type="text" value="1.00"/>	DFCO Enable Delay
<input type="text" value="45"/>	DFCO Enable MPH				

Powerlogger Parameters – displayed on the Tune Page

Param Name	Description
Fan Idle Compensation	Adds/Subtracts fuel when cooling fan is ON
Airflow Mode	Not currently used
Injector PPH	Injector size used in fuel calcs, unit is lbs/hr
Boost solenoid DC 1/2	Boost solenoid duty cycle for 1 st /2 nd gear
Injector Offset	Adjusts for injector opening/closing speed
Boost solenoid DC 3rd	Boost solenoid duty cycle for 3rd gear
Fan ON Temp	Turns fan ON at this temp (F)
Boost solenoid DC 4th	Boost solenoid duty cycle for 4th gear
TCC Lock, 3 rd gear cruise	MPH to lock TCC during cruising in 3 rd gear
Cranking Fuel Trim	Adds/Subtracts cranking fuel
TCC Lock, 4th gear cruise	MPH to lock TCC during cruising in 4th gear
Lean Cruise AFR	Sets the AFR during lean cruise conditions
TCC Lock WOT	MPH to force TCC lock at WOT
Lean Cruise min MPH	MPH must be over this to allow lean cruise
Lean Cruise max MAP	MAP must be under this to allow lean cruise (kPa)
Timing Reference Adj	Adjust base timing +/- if balancer is incorrect
Cyl 1-6 trim	Adjust fuel for each cylinder (up to +20%)
Rev limiter	Fuel cut rev limiter RPM, max 6375 or 0=off (for alky)
Options	Misc options, including antitheft
TPS max for PT TCC	TPS volts above which part throttle TCC will unlock
Spool mode max MAP	kPa above which closed loop will enable when in boost
Spool mode time limit	If above 105kPa, a timer starts to enable closed loop, if above kPa setting is never met
DFCO enable RPM	Decel fuel cutoff, allowed above this RPM
DFCO disable RPM	Decel fuel cutoff, not allowed below this RPM
DFCO enable delay	DFCO allowed if all conditions met for this time
DFCO enable MPH	DFCO allowed above this MPH
Overboost Immediate PSI	Immediately set wastegate to 0% at this PSI
Overboost Delayed PSI	Set wastegate to 0% after this PSI and the overboost delay
Overboost Delay seconds	Used with above, set wastegate to 0% after this time

Chip Parameter Adjustment Procedure without Laptop

You adjust the chip parameters without a laptop using a scantool. You will need a scantool that can display LV8 and BLM (L8 and BL on Scanmaster). This applied only to chip params, not PL params!

Select a parameter:

1. With key on/engine off, look at LV8 on your scantool. It will display the parameter you will be adjusting. It should display "0" to begin with.
2. Press the gas pedal fully and release 3 times, *except* on the 3rd press, hold it to the floor. Like this:
 1. Press/Release
 2. Press/Release
 3. Press/Hold -- don't let go!You must complete this sequence in under 3 seconds! If not, you'll have to turn the key off, then back on to start over.
3. Keep holding the gas pedal. After about 2 seconds, LV8 will start to cycle from 1 to 21, over and over again.
3. When you get to the parameter you want to adjust, release the gas pedal. Wait a couple seconds to make sure the number stopped on the parameter you wanted.

Adjust the parameter you just selected:

4. Switch your scantool over to BLM. This will show you what the current setting is of the parameter you selected.
5. If you want to change the setting, press the gas pedal a little bit (under half) and the number will decrease slowly. Press a little more (over half) and the number will increase slowly. Mash the pedal to the floor and the number will increase rapidly. When the number gets to its max or min, it will wrap around and keep going. When you get to the number you want, release the gas pedal.
6. Key off **for at least 3 seconds** and the process is complete. If you want to adjust another parameter, key off for 3 seconds and back on, and start the process over.

Notes:

This chip is designed to save all the user parameters into the Powerlogger's flash memory. So if the battery or ECM is disconnected, your settings should remain in the memory. I recommend periodically looking at the saved values to make sure they have been retained. If they are not being saved, make sure there is a good connection between the Powerlogger board and the ECM. Make sure the ECM connector is clean. Sometimes sliding the board on and off the ECM connector a few times will help it "dig in" to make a better connection.

Troubleshooting

If you can't get the adjustable parameters to work, then the TPS is probably not adjusted correctly. Make sure the TPS voltage reads .40-.46 in the throttle closed position and 4.20-4.80 when your foot is to the floor (engine off/key on). Make sure you are not using any type of "TPS Enhancer".

Parameter Adjustment Procedure using Laptop

To adjust chip parameters:

With key on and PLC in monitor mode, double click on any of the parameters in the BLM grid. A new box will appear where you can enter a new value. Enter your desired value and press Enter. You should see the value in the BLM grid change to your new value.

To adjust PL parameters:

With key on and PLC in monitor mode, go to the Tune Page. You can select the parameters, VE table, AFR table, Spark table, etc. In any of these, select the parameter you want to change, type in your new value, and press Enter.

Descriptions of Chip Parameters

Parameter 1 – Idle Base Fuel

This number is a fuel trim with 128 being “the middle” or 0%. Higher than 128 adds fuel.

This adjustment affects fuel at idle, with the throttle closed and under 1300rpm. If you’re running in closed loop mode using a wideband, you can use this adjustment to get the correction closer to 0%. For example, if your correction is running high, say +10%, then increase this parameter to 140 and check results.

Parameter 2 – Target Air/Fuel Ratio at Idle

This number is an actual target A/F ratio.

This applies when the throttle is closed and RPM under 1300.

If you have a wideband connected properly to the Powerlogger, you can set a target A/F ratio and the ECM will try to maintain that A/F. Divide by 10 to get the A/F, so 115 is an A/F of 11.5, 105 is 10.5, etc.

There are a few different options here:

Set to 9.7 to turn ON closed loop and use a target A/F from the PL AFR table.

Set to 9.8 to turn OFF closed loop, but still use a target A/F from the PL AFR table.

Set to 9.9 to turn OFF closed loop, and use a target A/F preset in the chip.

Set to 10.0 and higher and this will be your target A/F.

You can monitor how much correction is being applied on the Powerlogger by looking at “AFR Correction”. On a Scanmaster you can look at “CF”. There is a correction range of -10 to +33%. The idea is get the correction close to 0%, but it’s not critical. You can either change the chip parameter #1 (idle fuel), or change the PL VE table to tune this area.

Parameter 3 – Target Air/Fuel Ratio at Cruise

This number is an actual target A/F ratio.

This applies when the throttle is open, and normal driving in vacuum.

If you have a wideband connected properly to the Powerlogger, you can set a target A/F ratio and the ECM will try to maintain that A/F. Divide by 10 to get the A/F, so 115 is an A/F of 11.5, 105 is 10.5, etc.

There are a few different options here:

Set to 9.7 to turn ON closed loop and use a target A/F from the PL AFR table.

Set to 9.8 to turn OFF closed loop, but still use a target A/F from the PL AFR table.

Set to 9.9 to turn OFF closed loop, and use a target A/F preset in the chip.

Set to 10.0 and higher and this will be your target A/F.

You can monitor how much correction is being applied on the Powerlogger by looking at “AFR Correction”. On a Scanmaster you can look at “CF”. There is a correction range of -10 to +33%. The idea is get the correction close to 0%, but it’s not critical. You can either change the chip parameter #5 (low MAP fuel), or change the PL VE table to tune this area.

Parameter 4 – Target Air/Fuel Ratio at WOT

This number is an actual target A/F ratio.

This applies when the throttle is open, and boost exceeds approximately 13psi.

If you have a wideband connected properly to the Powerlogger, you can set a target A/F ratio and the ECM will try to maintain that A/F. Divide by 10 to get the A/F, so 115 is an A/F of 11.5, 105 is 10.5, etc.

There are a few different options here:

Set to 9.7 to turn ON closed loop and use a target A/F from the PL AFR table.

Set to 9.8 to turn OFF closed loop, but still use a target A/F from the PL AFR table.

Set to 9.9 to turn OFF closed loop, and use a target A/F preset in the chip.

Set to 10.0 and higher and this will be your target A/F.

You can monitor how much correction is being applied on the Powerlogger by looking at “AFR Correction”. On a Scanmaster you can look at “CF”. There is a correction range of -10 to +33%. The idea is get the correction close to 0%, but it’s not critical. You can either change the chip parameter #7 or #8 (Mid/Hi and High MAP fuel), or change the PL VE table to tune this area.

Parameter’s 5 through 8

These numbers are a fuel trim with 128 being “the middle” or 0%. Higher than 128 adds fuel.

1	128	2	098	3	098	4	098
5	128	6	128	7	128	8	128
9	000	10	000	11	128	12	128
13	128	14	010	15	254	16	000

These 4 parameters form a “table” of fuel trims. This would be a “quick-tune” table if you don’t want to get into the PL VE table to tune individual cells.

These trims apply with the throttle open.

Param kPa affected

5 40 and lower (about 18” vac and lower, but not idle)

6 100 (0psi boost)

7 160 (8psi boost)

8 220 and higher (about 17psi and higher)

These adjustments blend together (called interpolation), so if you add fuel to one parameter, it will blend in with the parameters around it. For example, if I added 10% fuel at parameter 6 (100kPa), 10% will be added at that MAP level, then it will taper down to 0% as you move to the MAP levels in the parameters next to it (if they are at 0%). This way, there are no abrupt changes to the fueling. For parameter 5, if you add 10%, that 10% will apply to any MAP below 40kPa, and smoothly blend into the parameter 6 setting when above 40kPa. Parameter 8 applied to any MAP over 220kPa, and blends to parameter 7 when below 220 kPa.

Parameter 9 – WOT Spark Advance Adder

This number is spark advance in degrees. One number equals approximately 1 degree advance. The max that can be added is 10 degrees (even though you might be able enter a higher number). There is normally always 2 degrees added for the low gears (unless the chip was customized). Also, if using E85, there is another table that may add timing based on ethanol content (see the Extra Tables page for SPK_Alc).

The spark advance is dictated by the PL Spark table. If you want to quickly add some advance at WOT, use this adjustment. If you change it to “1”, then 1 degree will be added at about 14psi boost and higher.

Parameter 10 – Launch Spark Advance Adder

This number is spark advance in degrees. One number equals approximately 1 degree advance. The max that can be added is 10 degrees (even though you might be able enter a higher number).

The spark advance is dictated by the PL Spark table. If you want to quickly add some advance during launch conditions (under 2mph), use this adjustment. If you change it to “1”, then 1 degree will be added at about 14psi boost and higher.

Parameter 11 – Cold Start Fuel

This number is a fuel trim with 128 being “the middle” or 0%. Higher than 128 adds fuel.

This adjustment will allow you to add or reduce fuel during the cold start routine, under 130° F coolant temp. This has no effect on cranking fuel, only when the engine is running. Go as lean as possible without causing the car to stall when dropping it into gear.

Parameter 12 - Acceleration Enrichment Fuel

This number is a fuel trim with 128 being “the middle” or 0%. Higher than 128 adds fuel. The adjustment modifies the AE fuel. AE fuel is only applied during “tip in”, while the throttle is moving. So if you have a tip-in stumble right when you move the throttle, you can try adjusting this to improve response. I would go at least 10 numbers at a time to see a difference. Don't be afraid to go very high (255) or very low to see the results. This can be adjusted by sitting in the driveway, car idling, and stab the throttle a little bit to hear any stumbles. Do not place too much emphasis on the A/F reading as it's typical to see a small lean spike, then a rich dip afterwards. Just make sure it responds well and sounds smooth. Sometimes it helps to not stab and release, but to stab and let the motor accelerate up a bit, then let off, to avoid false rich readings.

Parameter 13 – Fuel Composition

This number is a fuel trim with 128 being “the middle” or 0%. Higher than 128 adds fuel.

The main purpose for this adjustment is for fuel type (E85 for example). This is an overall fuel correction that is similar to adjusting fuel pressure. It affects everything from idle to WOT fuel, and cranking fuel. This is used to compensate for differences in fuel types, engine displacement, etc. For E85, you would increase this number to the 166-170 range. Normal gasoline should be about 128.

Parameter 14 – Knock Retard Ignore

Some cars exhibit a “false knock” condition which can be caused by hard launches, etc. This parameter allows you to set up conditions to ignore false knock, so that timing will not be retarded.

This parameter has a dual function. The range of adjustment is 0-125. When using an **EVEN** number, the numbers will represent **MPH**. So if you set it to 34, knock will be ignored up to 34 MPH. If you set it to an **ODD** number, the number will represent **TIME**. So if you set it to 35, knock will be ignored for 3.5 seconds after full throttle. For TIME, always divide the number by 10, so 25 is 2.5 seconds, etc.

Parameter 15 – Shift Light (Service Engine Soon light)

Turns on the SES light at a set RPM. The adjustment range is 0 to 255. Multiply the number by 25 to get RPM. If you set it to 200, multiply by 25 to get 5000rpm.

Parameter 16 – Misc. modes

Setting to 1 and turning key off resets the BLM grid data, and the PL Tune “Parameters” page to defaults. It does not affect the PL tables (VE, spark, etc).

Setting to 2 and turning key off only resets the PL Tune Page “Parameters” back to defaults, not the BLM grid.

Setting to 3 while idling turns on diagnostic mode which forces timing to 15*.

Expanded Descriptions of Powerlogger Parameters

Injector Offset

Adjusts for injector opening/closing speed, average setting is 25. There are 5 ranges: 0-9, 10-19, 20-29, 30-39, and 40-49. Each range has slightly different characteristics. The 40-49 is the richest range, 0-9 is leanest. It's best to start in the middle of a range, say 25, and bump it up or down to achieve the least idle AFR correction, but stay within that range of 20-29. If you can't get it lean enough, then jump down to the next range and start at 15. If you can't richen it enough, jump up to the 30's and start at 35. This adjustment has the largest effect at idle.

Rev limiter

RPM to enable the fuel cut rev limiter (max 6375 or 0=off). When using alcohol injection, keep at 0 to turn off the fuel cut. You don't want fuel cut off when spraying alky.

Overboost Immediate PSI (default 100psi, which disables it)

Boost PSI above which the wastegate DC will immediately drop to zero %, and the SES light will come on.

Overboost Delayed PSI (default 100psi, which disables it)

Boost PSI above which the Overboost Delay timer will start. When the timer expires, the wastegate DC will drop to zero % and the SES light will come on. This parameter allows for an overboost condition for a short time before setting the wastegate to zero.

Overboost Delay (seconds, default 0.0)

Used with the above Overboost Delayed PSI parameter. After the Overboost Delayed PSI threshold is met, this amount of time will pass before setting the wastegate duty cycle to zero % and setting the SES light.

Overboost Note: You can also command the overboost parameters to set the injector duty cycle to zero % (in addition to wastegate) if you set the Options parameter to 8. If you have other options already set, then add 8 to those. (Don't do this when using alcohol injection.)

Options

- 1 = Turn on Antitheft. See separate instructions, or contact chip maker for antitheft sequence.
- 2 = Narrowband mode. Enables the stock O2 to control fuel during cruising if desired, as long as the command AFR is set to 14.5-14.7 in the AFR table.
- 4 = Flexfuel mode. See pages 25-26 for info.
- 8 = Overboost fuel cut enabled (don't use with alcohol injection)

Setting Up the Base Tune – Start with Idle Fuel

1. Start the car and see how it idles, if it's idling ok, let it warm up. If the car will not idle or surges badly, make sure the MAP signal is good. If that's ok, then it might be too lean. First try adding a few numbers to the Injector Offset PL setting and try again. You can also try adding some idle fuel.
2. Once warmed up, look at the idle fuel mixture on the wideband in Park. I usually target around 13.0 to 13.5 A/F for idle in Park. If it's too rich or too lean then try increasing/decreasing the Injector Offset PL setting a couple numbers at a time (higher is richer). See if you can get the A/F fairly close at idle with the Injector Offset, before you adjust idle fuel or VE.
3. Alternatively, if you have a wideband system connected, you can turn on closed loop control by setting chip parameter 2 to a target A/F, such as 13.5 (135 in the software). This will enable closed loop at idle using the wideband, after the car is warmed up (over 130°F coolant, and after 30 seconds of running). The chip will then automatically target 13.5 at idle and add/subtract fuel on its own. Then you can monitor closed loop correction (AFR correction) in the Powerlogger software on the data page. Once the car is fully warm, you can watch AFR correction to see if it's staying in the -5% to +5% range most of the time. If not, adjust Injector Offset or idle fuel to get it closer.
4. Once you have the idle fuel set up, the next time the car is cold, you can see if the cold start fuel is ok. If it seems to rich or too lean, adjust cold start fuel a few % at a time to fine tune it. You'll know it's too lean if it stalls when you drop it into gear.
5. This should get you going enough to drive around and fine tune other fuel parameters.

WOT Fuel

When using closed loop, the chip will attempt to maintain the target WOT Air/Fuel ratio that you set in the chip parameters, or the PL AFR Table. However, the program can only add or subtract a certain amount of fuel. This is the "correction factor". On the Powerlogger, it is displayed in the AFR correction box on the data page. It is allowed to reduce fuel by up to 10%, and add fuel up to 33%. We'll call this the "correction window". Therefore, the correction window is -10% to +33%. We need to keep the correction factor within this window, preferably around 0%, but try to keep it under +/-10%. It's best to monitor closed loop correction after the boost has stabilized. As long as the correction factor has not hit the upper and lower limit, then it should hold your air/fuel ratio pretty close to the target, typically +/- .3 once at full boost. You might see more variance during spoolup.

When at full boost (WOT), monitor closed loop correction and see where it ends up. If the correction is too far away from 0%, then you can either use the chip fuel parameters, or the PL VE Table, to get the correction closer to 0%. For example, if the correction ends up around +13% at 17psi or higher, then you could increase chip parameter 8 by 13% to bring the correction down. If the correction is stuck at the upper or lower limit no matter what, then you'll need to stop and figure out what's going on. Once you go through this process, you should not have to adjust the Base WOT Fuel much more, unless you make some type of radical change to the setup of the car.

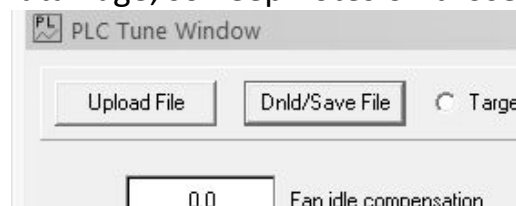
You can also leave closed loop off if you prefer and tune manually. Just watch the A/F on your wideband or Powerlogger and adjust fuel accordingly in the right areas.

Regarding target air/fuel ratios, I find that around 10.8-11.0 is a good place to start for WOT A/F in most situations whether it's street, race, or with alcohol injection. Start there and monitor for knock and performance. If the car is knocking at 10.8, then you may have to go richer, however you may want to evaluate your octane level or alcohol spray volume. Typically the idea is to go as lean as you can without knocking, but I wouldn't go much leaner than 11.5. Some cars can tolerate being leaner if running low boost, say 15-16psi, or on some race cars with very high octane.

If you are seeing a rich spike or lean spike when the boost first comes up and peaks, then you may need to make adjustments to the PL VE Table. Especially with alcohol injection, you might see a rich spike as the boost first comes up. You can also look at chip parameter #7 for mid-boost fuel. Also consider experimenting with the settings on your alcohol system.

Saving Your Tune

You can save your tune to a file using the buttons at the top of the tune page. With the key on, press the "Save File" button, name the file, and press ok. You can reload that tune if necessary using the "Upload File" button. This currently does not include the BLM grid on the Data Page, so keep notes on those settings.



For viewing purposes, when you save a log with the key on, it will save the current tune into the log file. When you reload the log, the tune will load up with it. That enables you to look at a log later (offline) and also see what the tune looked like at that time.

Setup Notes

Here is some very basic info for setup and tuning.

Fuel pressure

-Start at 43psi (vacuum line off) for injectors 80lb and smaller. For larger injectors, use 38psi to start with. Normally fuel pressure should drop about 5-8psi when you put the vacuum line back on.

TPS Setup

-Idle .40 - .44 volts, WOT 4.2 - 4.8 volts, try not to exceed 4.80-4.90 volts as this could cause a malfunction code

IAC Setup

-Set the min air screw so the IAC is around 15 with car warmed up, in park.

Oxygen sensor (stock type)

Wideband readings are preferred, but if using the stock O2, here are some typical readings. Take WOT O2 readings in 3rd gear for consistency. The reading will generally be higher in the lower gears and drop some by the time you get to 3rd gear due to the O2 sensor heating up. These readings are typical for a Scanmaster and Powerlogger. Other scantools may read differently.

-Car warmed up at idle, .750-.850 is typical.

-At WOT on pump gas, .780-.850 is typical.

-At WOT on race fuel or alcohol injection, .750-.800 is typical.

Wideband A/F

-Typical idle warmed up should be in the 12.5 to 14.0 range. You can use the chip adjustments to go as lean as possible and still idle well. I usually end up around 13.0-13.5 for idle. With a big cam or really big injectors, you might need to idle around 12.5.

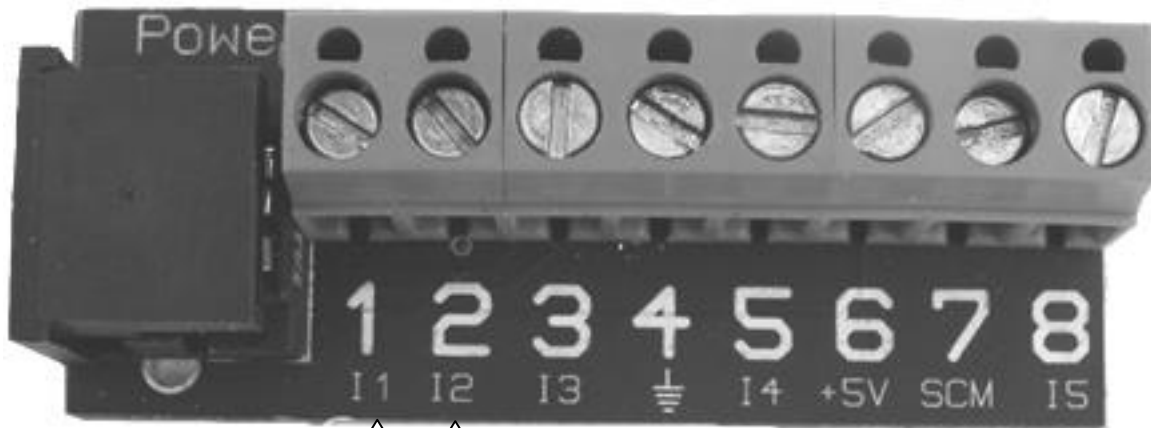
-At WOT, most cars end up in the 10.5 to 11.5 area. Leaner usually makes more power, but more detonation prone.

Quick Reference for Chip Fuel Adjustments

Fuel trim user adjustments	
Number on scantool	Change to Fuel
154	+20.3%
153	+19.5%
152	+18.8%
151	+18.0%
150	+17.2%
149	+16.4%
148	+15.6%
147	+14.8%
146	+14.1%
145	+13.3%
144	+12.5%
143	+11.7%
142	+10.9%
141	+10.2%
140	+9.4%
139	+8.6%
138	+7.8%
137	+7.0%
136	+6.3%
135	+5.5%
134	+4.7%
133	+3.9%
132	+3.1%
131	+2.3%
130	+1.6%
129	+0.8%
128	0.0%
127	-0.8%
126	-1.6%
125	-2.3%
124	-3.1%
123	-3.9%
122	-4.7%
121	-5.5%
120	-6.3%
119	-7.0%
118	-7.8%
117	-8.6%
116	-9.4%
115	-10.2%
114	-10.9%
113	-11.7%
112	-12.5%
111	-13.3%
110	-14.1%
109	-14.8%
108	-15.6%
107	-16.4%
106	-17.2%
105	-18.0%
104	-18.8%
103	-19.5%
102	-20.3%

Wideband and 3-BAR MAP Connection and Setup Notes

Powerlogger analog input block



This is the Powerlogger's **analog input** for the wideband.

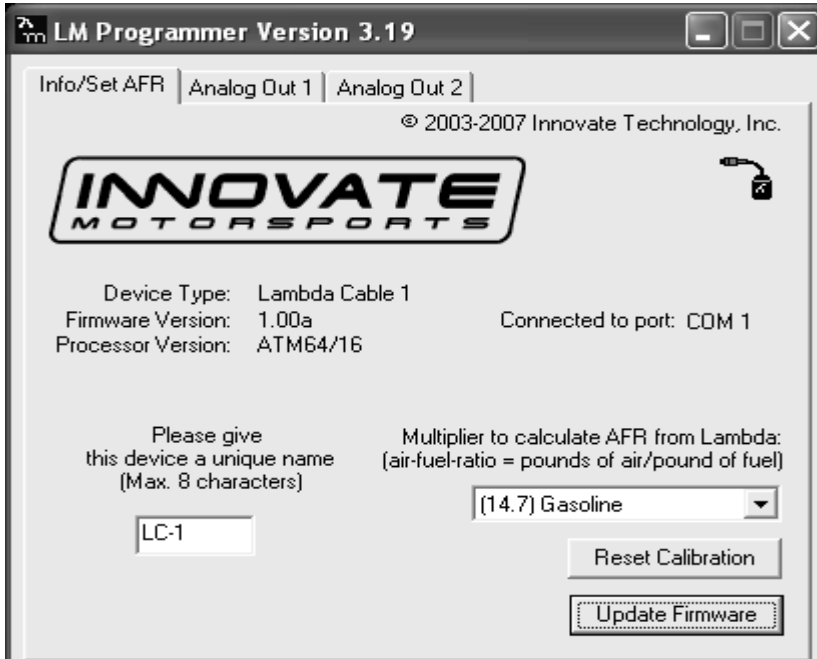
This is the Powerlogger's **analog input** for the MAP sensor.

Do not connect anything to terminal 4 (ground) and 6 (5V). These are only for use in special cases. Later versions of Powerlogger do not have these connections.

See the following pages for notes about your particular wideband system.

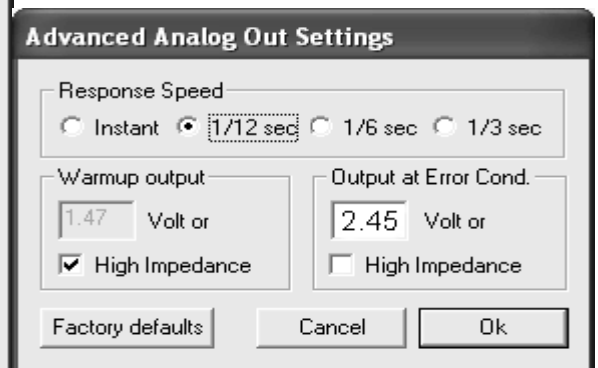
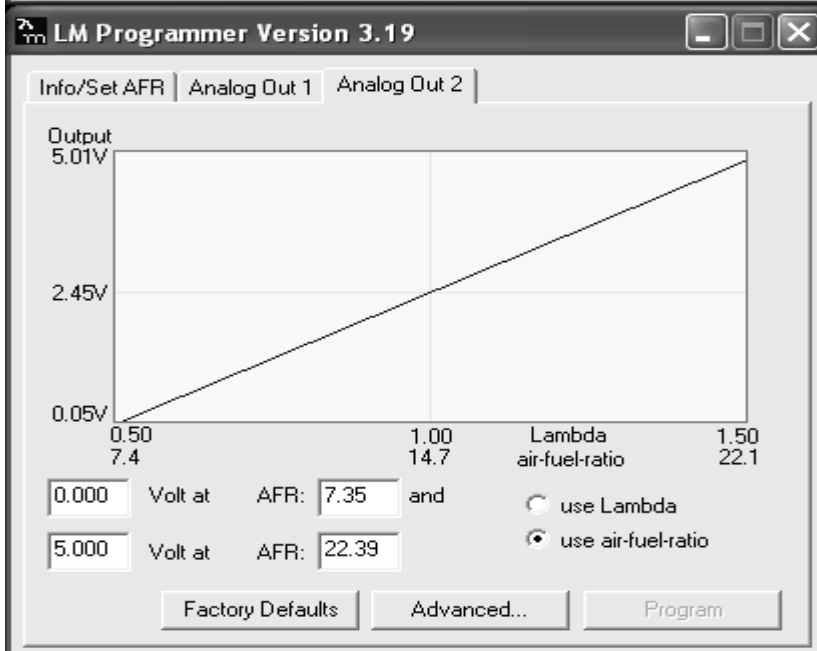
Innovate LM-1 or LC-1

Attention! Before you use the SD2 chip, make sure your LC-1 or LM-1 is programmed properly. For the LM-1, you will need to reprogram the analog output to match the LC-1 settings. For the LC-1 and LM-1, connect to your wideband using the LM Programmer software. Make sure the settings



match the screens shown below. You will be using "Analog Out 2" to connect to your Powerlogger. If you have an LM-1, once you reprogram it, you will tell the Powerlogger software that you have an LC-1. Select "LC-1" for the wideband input in the Powerlogger software.

Set the "Output at Error Cond." to 2.45 volts. That will make the LC-1 show an air/fuel ratio of 14.7 if it throws an error code, which will make the chip add fuel instead of subtract (safer).



Press "Advanced" for next window

Autometer Widebands

See your Autometer instructions for setting the “BGD Range”. You will need to set the LO to 10.0 and the HI to 18.0. In other words, 0 volts will equal an A/F reading 10.0, and 4 volts will equal an A/F reading of 18.0. In the Powerlogger software, you will select “PLX” for the wideband input.

You’ll be connecting the blue wire from the Autometer gauge to the Powerlogger wideband input, and the blue/black wire to the Powerlogger ground input.

Be aware that the Autometer wideband is set up to require at least 13.5 volts before it will turn on the wideband sensor. If your car will not supply 13.5 volts, then you will have to change the “Heater Control Mode” on the wideband. See your Autometer instructions for this.

PLX Widebands

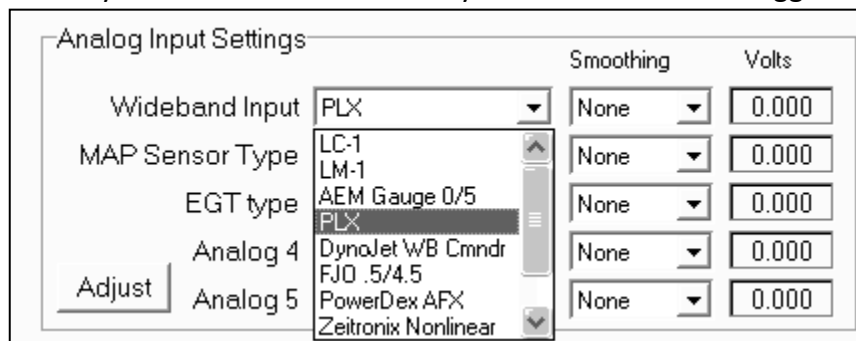
You will need to connect the 0-5v linear analog output wire to the Powerlogger wideband input. PLX supplies capacitors for the analog output to reduce electrical noise, but you **do not** need to use them. The Powerlogger has capacitors built in. Select “PLX” for the wideband input in the Powerlogger software.

AEM Widebands

You will need to connect the AEM’s 0-5v output wire to the Powerlogger wideband input. This is usually a white wire. For the AEM 30-4100 digital gauge type wideband, select “AEM Gauge 0/5” in the Powerlogger software. For the AEM Inline and AEM analog gauge 30-5130, select “AEM Inline” in the software.

Wideband Input Selection

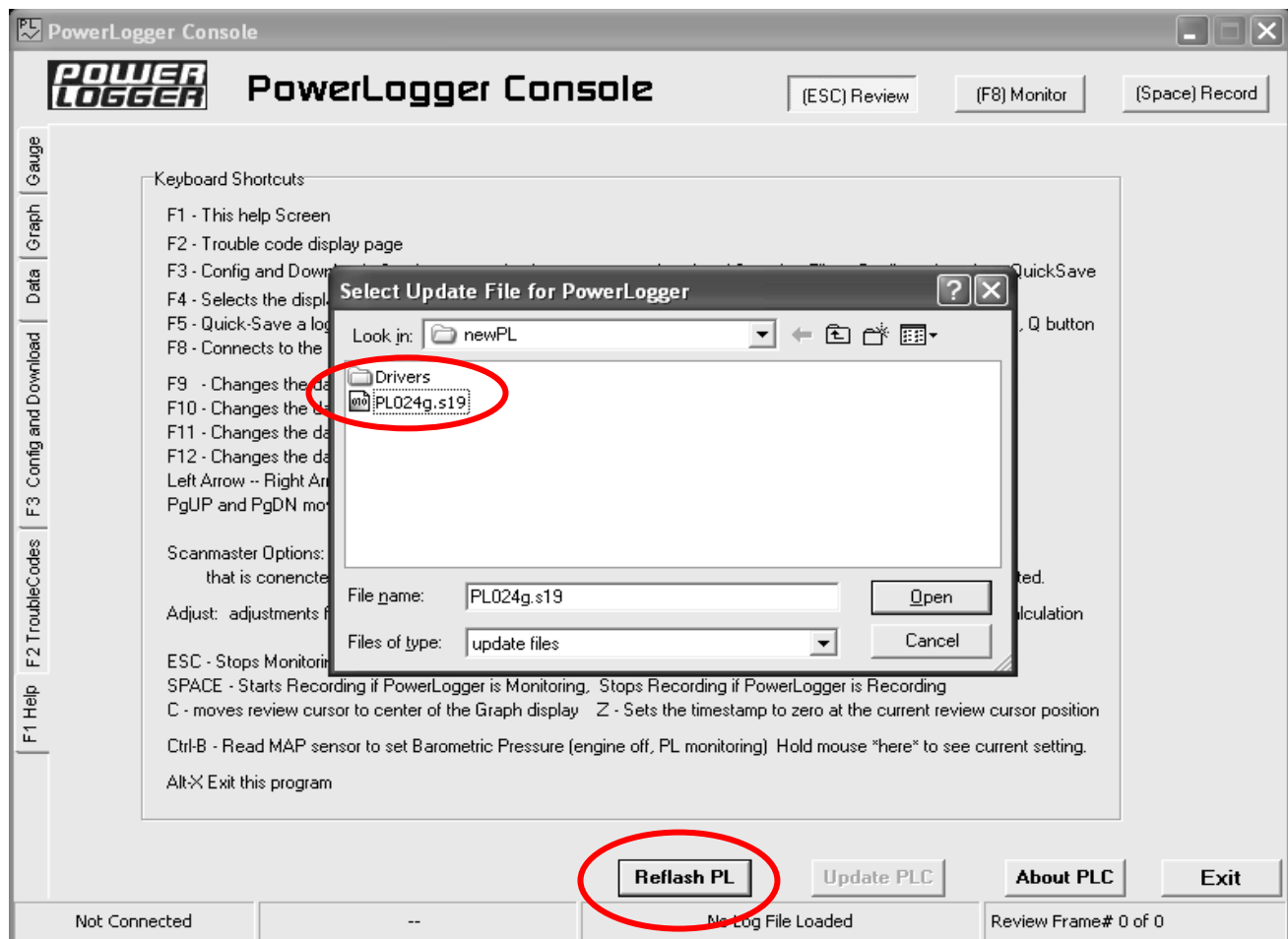
Here is where you select which wideband you have in the Powerlogger software.



(This is just an example of the wideband selection screen, do not select PLX if you don’t have one.)

Powerlogger Updating

Make sure your Powerlogger is updated with the latest software (you can download the newest PLC.exe from the TurboTweak message board, www.turbotweak.com/forum). The Powerlogger unit must be flashed with the file "PL044.s19" or newer (the 44 is the version). The chip will not work right with older versions! Make sure you have at least version 2.5.2 of PLC.exe.



Advanced Tuning

More advanced tuning can be achieved by utilizing the Powerlogger's VE table, Spark table, and others.

The VE (volumetric efficiency) table is used to look up a number that is used for the fuel calculation. A higher number increases fuel, lower decreases fuel. The number in the table is looked up based on RPM and MAP (manifold pressure). Any time the engine is running, it looks at the current RPM and MAP, and then looks at that position in the table to get the VE number for the fuel calculation. You can see this in action by connecting to the Powerlogger, go into monitor mode, press the "Tune" button, and click on "VE". You will see a floating bubble in the table that indicates the current RPM and MAP position, and what VE number is being used.

The screenshot shows the 'PLC Tune Window' interface. At the top, there are buttons for 'Upload File' and 'Download File', and radio buttons for 'Target AFR', 'VE' (selected), 'Spark', and 'Parameters'. Below this is a large table with 'RPM' on the horizontal axis and 'MAP' on the vertical axis. A red box labeled 'FLOATING BUBBLE' points to the cell at 45 RPM and 52.96 MAP. Below the table, several engine parameters are displayed in input fields:

- VE: 52.96
- RPM: 800
- Target AFR: 14.00
- MAP: 44.73
- Actual AFR: 14.14
- TPS: 0.42
- Correction Factor: 0.0
- Density Factor: -0.78

	RPM																
	800	1000	1200	1400	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
1:1	800	1000	1200	1400	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
20	41.0	42.5	45.0	49.0	50.5	51.0	50.5	49.5	49.0	48.5	48.0	48.0	47.5	47.5	47.0	46.0	45.5
25	45.0	46.0	50.0	52.0	55.0	56.0	59.0	59.0	58.5	57.5	56.5	55.5	54.5	53.5	53.0	51.5	50.0
30	46.0	46.0	56.0	57.0	59.0	63.5	63.5	63.5	63.5	63.5	64.0	63.5	62.5	60.0	57.5	54.5	52.5
35	47.0	47.0	57.5	59.0	64.5	66.0	66.0	66.0	66.0	66.0	68.0	67.0	65.5	63.0	60.5	57.5	56.5
40	51.0	52.0	61.5	62.0	67.0	69.0	70.0	70.0	70.5	70.5	70.0	69.0	67.5	65.0	62.5	59.5	57.5
45	53.0	54.0	62.5	66.0	70.0	77.0	77.0	74.0	73.0	72.5	71.5	70.0	68.0	66.0	64.0	60.5	59.0
50	58.0	63.0	64.0	70.0	77.0	79.0	80.0	77.0	74.5	73.5	72.0	70.5	69.0	68.0	65.5	62.5	60.5
60	63.5	65.0	70.0	74.0	78.5	80.5	81.0	80.5	78.5	76.5	74.5	72.5	70.0	68.5	66.0	63.0	61.0
70	64.5	66.0	71.5	76.5	79.5	81.0	82.0	82.0	81.5	80.5	79.0	77.0	74.5	72.5	69.0	65.5	64.0
80	64.5	68.0	72.5	77.0	80.0	82.5	83.5	84.0	84.0	83.0	81.5	79.5	77.5	75.5	72.5	69.5	68.0
90	65.5	68.5	73.0	77.0	80.0	83.0	84.0	85.5	86.5	86.0	84.0	81.5	79.5	76.5	74.0	71.0	69.0
100	65.5	70.0	74.0	77.0	80.0	83.0	85.0	87.5	89.5	89.5	86.5	83.5	81.0	77.5	75.5	72.0	70.0
140	65.5	70.5	74.5	77.0	80.0	83.0	85.0	87.5	89.5	89.0	87.0	84.5	81.5	79.0	75.5	72.5	71.0
180	65.5	70.5	74.5	77.0	80.0	83.0	85.0	87.5	89.5	89.0	87.0	84.5	81.5	79.0	75.5	72.5	71.0
220	65.5	70.5	74.5	77.0	80.0	83.0	85.0	87.5	89.5	89.5	87.5	84.5	81.5	79.0	75.5	72.0	70.0
260	65.5	70.5	74.5	77.0	80.0	83.0	85.0	87.5	89.5	89.5	87.5	84.5	81.5	79.0	75.5	72.0	70.0
300	65.5	70.5	74.5	77.0	80.0	83.0	85.0	87.5	89.5	89.5	87.5	85.0	81.5	79.0	75.5	72.0	70.0

When the bubble is in between cells, it uses an averaging process called interpolation, to take into account all of the closest cells.

When you want to change one of the cells, click on it, type in the new number, then press Enter. Currently, these changes need to be made while your laptop is connected to the Powerlogger, key-on, and in Monitor mode.

You can use the correction factor to help you decide how much of a change to make. For example, using the example VE table on the previous page: if the correction factor was at -5.0% (subtracting 5% fuel), then you would go to the current cell where the floating bubble is (in this case 53%), and subtract 5% from that cell. 5% of 53 is 2.6%, so you would type 50.4 into the box and press Enter. (It might round the number a little higher or lower, but that's ok.) The correction factor should now come up closer to 0%. You may want to change some of the cells around the current cell, in order to blend it in, so there are no abrupt changes in fueling.

When you load up a log file, you can also look at the VE or Spark table. When you step through the log, you should see the floating bubble move around to help with tuning.

KPA	800	1000	1200	1400	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
20	23.7	27.0	28.0	29.0	30.7	33.7	38.0	38.7	39.3	40.0	40.3	40.3	40.3	40.3	40.3	40.3	40.3
25	23.7	27.3	28.3	29.7	32.0	35.0	38.3	38.7	39.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3
30	23.7	27.7	28.7	30.3	33.0	36.0	38.3	39.0	39.7	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3
35	23.7	27.7	29.3	31.7	34.7	37.0	38.7	39.0	39.7	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3
40	23.7	27.7	30.0	34.7	36.3	37.7	38.7	39.0	39.7	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3
45	23.7	27.7	31.0	35.3	36.7	37.7	38.7	39.0	39.7	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3
50	23.7	27.7	31.3	35.0	36.3	37.3	38.3	39.0	39.7	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3
60	23.7	27.3	31.7	34.3	35.7	36.7	37.7	38.3	39.0	39.3	39.7	39.7	40.0	40.0	40.0	40.0	40.0
70	23.7	26.7	30.7	32.7	34.3	34.7	35.3	36.0	36.7	37.3	37.7	38.0	38.3	38.3	38.7	38.7	39.0
80	23.7	25.3	29.3	31.3	32.3	33.3	33.7	34.7	35.3	36.0	36.3	36.3	36.7	37.0	37.0	37.0	37.3
90	23.7	24.7	26.0	26.7	27.3	28.7	30.0	30.7	31.3	33.0	34.7	35.0	35.0	35.0	35.3	35.3	35.3
100 0psi	23.7	24.0	24.7	25.0	25.7	26.7	28.3	29.3	30.3	31.3	33.0	33.3	33.7	33.7	33.7	33.7	33.7
140 6psi	23.7	23.0	22.7	22.0	22.0	22.0	22.0	22.3	22.7	23.0	23.3	23.3	23.3	23.3	23.3	23.3	23.3
180 12psi	23.7	23.0	21.7	20.7	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
220 17psi	23.7	23.0	21.0	20.7	19.7	19.3	18.0	17.0	17.0	17.7	18.3	18.7	19.0	19.3	19.7	19.7	19.7
260 23psi	23.7	23.0	21.0	20.0	19.0	18.0	17.0	17.0	17.0	17.7	18.3	18.7	19.0	19.3	19.7	19.7	19.7
300 29psi	23.7	23.0	21.3	19.3	18.0	17.0	17.0	17.0	17.0	17.7	18.3	18.7	19.0	19.3	19.7	19.7	19.7

Extra Tables

There are several tables for extra fine tuning on the tune page. This can be accessed by selecting "Tables" at the top of the tune page. These tables are defined as follows:

BST_T

Boost duty cycle multiplier based on throttle position percent. Table setup is 0 to 100% TPS. 100% means you get the full duty cycle specified on the parameters page (based on gear).

BST_R

Boost duty cycle multiplier based on RPM. Table setup is 0 to 6400 RPM. If you enter 100%, that means you get the full duty cycle specified on the parameters page (based on gear).

BST_Alc

Boost duty cycle offset based on ethanol content (when flex fuel mode is enabled). Table setup is 128 (0% eth) to 192 (100% eth).

The number you enter is added on to the duty cycle specified on the parameters page (based on gear).

SPK_Alc

Spark advance offset based on ethanol content (when flex fuel mode is enabled). Table setup is 128 (0% eth) to 192 (100% eth).

If you enter 0, then zero extra advance will be added. If you enter 6.0, then 6 degrees spark will be added to the whole table, but blended back to zero near idle.

AirT

Fuel added/subtracted based on intake air temperature. Table setup is -46°F to 306°F. This is entered as a percent. 5.00 would add 5%, -5.00 would subtract 5%.

CoolT

Fuel added/subtracted based on coolant temperature. Table setup is -40°F to 306°F. This is entered as a percent. 5.00 would add 5%, -5.00 would subtract 5%.

Blend

This table dictates how the AirT and CoolT tables are blended together, based on mass airflow. Table setup is 0 to 48 grams/sec.

If the whole table was set to 0.00, then only the CoolT table would affect fuel compensation. If the whole table was set to 100%, then only AirT table would affect fuel compensation. It is normally set up so that mostly coolant temp affects fuel down around idle (low airflow), then it increases favoring airtemp as the airflow increases.

ETH_C

Fuel add/subtracted based on ethanol content (when flex fuel mode is enabled). Table setup is 0 to 100% ethanol content.

The number entered at 0% ethanol is 128, which means 0% fuel is added. At 100% ethanol content, the number is 176, which means 37% fuel is added.

Inj_Offst (vs battery volts)

If you want to define your own injector offset table, set the injector offset parameter on the parameters page to "5". Then this table will be used as the injector offset. Table setup is 0 to 25.5 volts. The number entered is in milliseconds.

Flexfuel Update

We have added the addition of flexfuel capability. In other words, you can connect a flexfuel sensor to the ECM, it will read the fuel composition, and automatically adjust fuel, spark, and boost duty cycle (if using the stock type solenoid).

There are a few ethanol sensors that may work, but GM part# 13577394 has been confirmed to work so far. You will need a wiring pigtail with connector for it. The 12v, ground, and signal should be wired into the 12v, ground, and signal of the stock MAF connector on the vehicle. If you already have a flexfuel sensor working, then you only need to connect the signal wire from the sensor itself to the car's MAF signal wire. The signal wire is grey/red, 12v is pink/black, ground black/white.

The amount that fuel, spark, and boost are adjusted can be changed by the user in the Powerlogger software (PLC). Some tables have been added in the software to allow these adjustments.

The ethanol content is displayed in PLC, as well as the Scanmaster. When flexfuel mode is enabled, it will automatically adjust the Fuel Composition parameter (param 13) based on ethanol content. This mode is turned on by entering "4" into the Options box on the parameters page. Note that if you are using other options, they need to be added together and entered into this box.

There are some other tables that have been added. They look like this:

The screenshot shows the 'Tables' tab selected in the software interface. Below the navigation bar, there are six data tables, each with 18 columns. The first column of each table is a label, and the second column is a header value. The remaining 17 columns contain numerical data points.

BST_T	0	6.25	12.5	18.75	25	31.25	37.5	43.75	50	56.25	62.5	68.75	75	81.25	87.5	93.75	100
	20.00	20.00	20.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	67.84	80.00	99.61	99.61

BST_R	0	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61	99.61

BST_Alc	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188	192
	0.00	0.00	0.00	1.96	3.92	5.88	7.84	9.80	11.76	13.73	15.69	17.65	20.00	20.00	20.00	20.00	20.00

SPK_Alc	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188	192
	0.00	0.00	0.00	1.00	1.33	2.00	2.33	3.00	3.33	4.00	4.33	5.00	5.33	6.00	6.00	6.00	6.00

AirT	-46	-13	10	26	39	51	63	72	81	92	102	115	129	149	172	216	306
	12.50	10.50	8.50	7.00	5.00	3.00	1.00	-1.00	-3.00	-4.50	-6.50	-8.50	-10.50	-12.50	-14.50	-16.00	-18.00

CoolT	-40	-19	3	25	46	68	90	112	133	154	176	198	219	241	262	284	306
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The ones that have to do with ethanol content are labeled BST_Alc, SPK_Alc, and ETH_C. On the previous page "Extra Tables", it explains these tables in more detail.

For further details or questions, please post to my support forum www.turbotweak.com/forum or email me at eric@turbotweak.com.