

# Lugtronic Tuning Manual

Thank you for choosing Lugtronic for your engine management needs.

With this manual, you will learn how to use the tuning software, along with some general engine tuning information, to help your project be powerful and reliable.

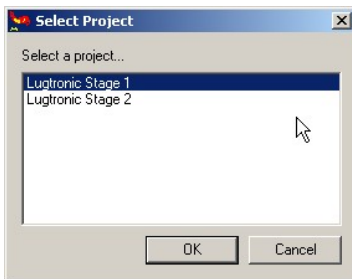
## Software Installation:

In your email package you will find the Lugtronic tuning software.

Click on the Lugtune file to install this onto your computer.

When the software install is complete, click on the desktop icon to start.

You will be prompted to select a project - Lugtronic Stage 1, or Lugtronic Stage 2.



Choose the stage to match your ecu order.

Your ECU will already have a base map for your engine loaded into it.

There is also a copy of your base map in the folder.

You are now ready to install the ECU.

## ECU Installation:

Install the ECU in your vehicle according to the ECU Installation Instructions.

Please take your time and follow the checklist to ensure success.

Connect the Communication cable to your computer.

Click on the desktop icon to start the Lugtune program.

Select Lugtronic Stage 1 or Stage 2 based on your ECU.

You will now see the Main Screen.

Turn the vehicles key to Ignition-ON.

You should see the gauges on the main screen change color from pink to white, and they will display real values.

It is almost time to start tuning!

Now we will look at the Tuning Software.

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## Tuning Menu:

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## Outputs Menu:

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## Advanced Menu:



## Advanced Menu:

- All output channels on one page 1
- All output channels on one page 2
- H2, check that all these settings are zero

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## Help Menu:

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## **Basic Tuning:**

Your Lugtronic PnP ECU has the tedious configuration work done already.

If the setup information given with the ECU Order was correct, and the car is in good running condition (runs with the stock ECU and injectors) - then the Lugtronic PnP should allow the engine to start with no issue.

Below we will cover the basic functions and procedures needed to tune your engine.

## **Basic Functions:**

### **1) How to Make and Save Tuning Changes:**

To save changes to the ECU:

- Make a tuning change as needed.
- Click on "Burn to ECU" (Or hold the "Control" and "B" keys).
- Exit the window by clicking "Close" (Or hold the "Control" and "C" keys).

To save changes to the Calibration File:

- Go to "File" - "Save As" - Type in a new File name, and click on "Save".

### **2) Quick Keys:**

- "Alt" underlines all of the items on the Main Menu.
- "Left / Right" and "Up / Down Arrow" keys will navigate through the menu items.
- "Tab" key will scroll through the settings in a tuning window.
- "F1" key will bring up the Help Window if applicable.
- "Shift" and "Arrows" will make tuning changes in Graph Mode.
- "Shift and Ctrl" and "Arrows" will make faster tuning changes in Graph Mode.
- "N" and "M" keys will rotate the Graphs in Graph Mode.
- "Right Click" on any Gauge in the Main Screen will allow you to choose a different Gauge.

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## **File Menu**

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**Open:**

This will allow you to open a Configuration File.

**Save:**

This will allow you to save a Configuration File to the current File name.

**Save As:**

This will allow you to save a Configuration File to a new File name.

**Datalogging:**

Starts and Stops the Data Logger.

**Exit:**

Exits the program. You will be asked to save your changes to a File.



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## Configuration Menu

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### Basic Settings:

#### - Req Fuel

This setting is the main Fuel adjustment. It affects the fueling during all conditions. This should be adjusted to make large fueling changes, instead of the Fuel VE Table. Higher setting = More Fuel. Lower setting = Less Fuel.

Your PnP ECU will have a known good Req Fuel setting already.

If you change injectors and / or fuel pressure, this is adjusted to correct the fueling.

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### TPS Settings:

#### - TPS High

This setting allows full throttle to display as 100%.

#### - TPS Low

This may need changed depending on where the throttle idle screw is set. If the Idle Valve is deleted; you will have to adjust the idle screw out to open the throttle blade. This will necessitate a change of the setting to get 0% when the throttle is closed.

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### Fuel Cut:

#### - Overboost Fuel Cut (KPA)

This setting will keep the engine from running too much boost. Set this low during initial tuning, in case you have a problem with the boost, knock, etc.

#### - Fuel Cut RPM

This setting will keep the engine from over-revving. There is also a spark cut at 200 RPM below this setting. This is found under "Outputs - RPM Limiters."

#### - Overrun Fuel Cut Under (KPA)

This setting will cut the fuel when you are coasting down, which saves fuel and keeps the spark plugs clean. Set this to 8-10 KPA less than your idle KPA reading. If you are cruising at very low load and throttle and you experience severe bucking, check, and if necessary, increase this setting.

# Tuning Menu

## - Fuel VE Table

This allows you to correct the Fuel for different Engine RPM and Load (KPA or Vacuum/Boost) until the Lambda (Air/Fuel Ratio) matches the value in the Lambda Table. The settings can range from 0 to 255, it is recommended to keep them near or over 100. If the settings are not near these values, use the "Configuration" - "Base Settings" - "Req Fuel" to increase or decrease fuel.

kPa	800	900	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500
326	100	100	106	112	125	140	160	160	160	165	175	170	165	160	150	145
300	100	100	106	112	125	140	155	155	155	160	170	165	160	155	145	140
276	100	100	106	112	125	140	150	150	155	165	160	155	150	140	135	135
250	100	100	105	110	120	135	140	145	145	150	160	155	150	145	135	130
226	100	100	105	110	110	120	130	140	140	145	155	150	145	140	130	125
200	100	100	105	110	110	120	125	135	135	140	150	145	140	135	125	120
150	93	93	102	110	110	115	120	130	130	135	145	140	135	130	120	115
100	93	93	102	110	115	120	123	130	135	137	140	140	135	130	120	115
90	93	93	99	105	111	115	119	128	132	137	133	130	125	120	110	105
80	93	93	98	103	108	110	113	115	120	127	122	115	110	105	103	100
70	93	93	95	99	102	103	105	110	115	115	108	100	100	100	100	100
60	83	83	89	98	100	100	100	100	100	100	100	100	100	100	100	100
50	85	85	87	97	100	98	98	100	100	100	100	100	100	100	100	100
40	80	90	90	97	100	97	97	100	100	100	100	100	100	100	100	100

## - Spark Table

This allows you to correct the Ignition Timing for different Engine RPM and Load (KPA or Vacuum/Boost)

## - Lambda Table

This is the Target Lambda (Air/Fuel Ratio) for different Engine RPM and Load (KPA or Vacuum/Boost). If you want to run a different Lambda value, type the desired values into this table and the fueling will be adjusted.

## - Starting Enrichments

These allow you to correct the fueling during start-up and after-start conditions.

## - Warmup Enrichments

This allows you to correct the fueling, after the start-up, from cold to warm engine temps.

## - Acceleration Enrichments

This allows you to correct the fueling during acceleration (Tip-In) conditions.

## - Real-Time Display

This is a different view of the engine sensors.

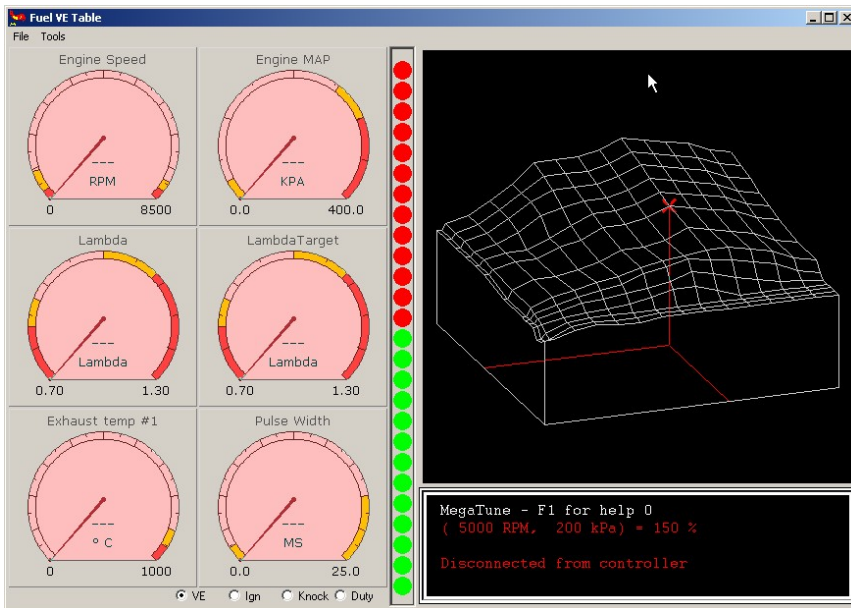
- Fuel VE Graph
- Spark Graph
- Lambda Graph

These allow the same corrections as the Tables above, to be made much more quickly.

Also this screen gives you a 3d Graph view of the tables.

Use the Shift and Up/Down Arrow Keys to make changes. Hold the CTRL Key to change faster.

Use the M and N Keys to rotate the graph for a different viewpoint.



- Warmup Enrichment Graph
- Acceleration Enrichment Graph

These allow the same corrections as the Tables above, and also have a 2D Graph view.

## ----- **Outputs Menu** -----

- Display Screen Settings
- Tachometer Output Settings

### - RPM Limiters

This allows you to set the overall Engine RPM Limit (controlled by Ignition Cut)

### - Launch Control

This allows you to set a starting line Engine RPM (controlled by Ignition Cut)  
The Timing Retard setting will allow turbo engine to build boost. (Drag Race Anti-Lag)

### - Advanced Anti-Lag System

Rally-car type Anti-lag - unsupported.

### - Shift-Cut Settings

This allows you to shift at full throttle, the engine will be "cut" based on the time setting.  
This is normally activated with a clutch pedal switch.

### - Fan / Water Pump / Fuel Pump Outputs

#### - WOT / RPM Outputs

2 auxiliary outputs based on Full Throttle and Engine RPM.

#### - RPM / TPS / MAP Outputs

3 auxiliary outputs based on Engine RPM, Throttle, and Load (Manifold Pressure)

### - Boost Controller Settings

Base Boost Control Valve settings.

### - Boost Alternate Settings

Additional Boost Control Valve settings, reference duty cycle, etc.

### - Boost vs. RPM Table

Allows you to request different boost levels across the Engine RPM range.

### - Boost vs. TPS Scaling

Allows you to request different boost levels across the Throttle Position range.

### - Idle Settings General

Base ISV and Idle Speed settings.

### - Idle Settings Advanced / PID

Allows you to modify the control strategy for the ISV.

### - Idle PID Reference Table, PWM

Allows you to correct the ISV base duty cycle for different engine temps.

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## Quick Start Tuning Guide / Flowchart

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Tuning Flowchart - adjust the settings in this order:

- 1) Req Fuel
- 2) Fuel VE Table
- 3) Spark Table
- 4) Acceleration Enrichments
- 5) Starting and Warmup Enrichments

Tuning Guide:

1) Follow the steps from "ECU Installation" above. This will have you on-line with the ECU.

2) Start the engine. If there is no Idle Valve, or it is not set-up, you may need to hold the throttle down 1/4 of the way, to allow enough air for the engine to start. DO NOT "Floor" the throttle, as anything over 60% TPS will cause all of the fuel to be cut and the engine will never start.

If the TPS is different than was specified in the order, (going from OBD1 to OBD2 TPS works "backwards", for example), then the TPS will read 100% at rest and this will cause a problem. In this case, go to "Configuration"- "Base Settings" - and swap the settings in "TPS High" and "TPS Low"

3) When the engine starts, allow it to settle to an idle. Go to "Configuration" - "Base Settings" - "Req Fuel" and write down the setting in the basemap. Then experiment with the setting to see if the engine runs better by ear with less or more fuel. Do this at low engine temp and then again when the engine is fully warm (about 80 Deg C). Write down both settings, adjusting the Req Fuel now might allow easier and quicker tuning later on.

For example, tuning the Req Fuel now, will save changing every cell in the Fuel VE Table. And, finding the engine needs more fuel when cold, will allow the tuner to know to add fuel in the "Warmup Enrichment Table" later on.

4) When the engine runs well at a warm idle, it is time to take a drive. It is a very good idea to use the Datalogger to record the tuning sessions. Go to "File" - "Datalogging" - "Record", and type in a name you will remember, or use the one in the box, and then click on "Save" Note that the "Logging" icon on the bottom right of the main screen is not highlighted.

5) Drive the car and work your way up gradually in RPM and Load. If you feel any surging, bucking, hesitation or misfires, note the RPM and Load where it happens and we can look at these areas later.

If the engine is turbocharged, then be very careful to watch the "Lambda" and "Lambda

Target" gauges on the main screen. Make sure the "Lambda" is equal to or lower than the "Lambda Target", or the engine is running too lean. This can be caused by settings, low fuel pressure, or fuel starvation issues.

Do not keep running the engine into boost if the fuel is too lean or very rich or the engine will be damaged. The "Golden Rule" is: "Save it for next time"

Keep the boost as low as possible until you get used to looking at everything, and you get a feel for how the engine is running. Remember to drive in and also out of boost, like you would every day.

6) Pull over and stop to analyze the data from the Datalogger. Go to "File" - "Datalogging" - and select "Off". Then open the log in the Megalogviewer program to analyze the engines sensor readings. You are mainly concerned with the Lambda (or Air/Fuel Ratio) and the Lambda Target, the RPM, Load (PSI boost or KPA), and the Coolant and Air Temperatures.

Look for areas on the Datalog where the Lambda is different than the Lambda Target.

"Tune" all of the cells you have reached in the Fuel VE Table by increasing or decreasing the settings to make the engine run the correct Lambda under all conditions.

If the Lambda value is leaner than the Lambda Target, especially under Boost, we need to ADD fuel to the engine immediately to avoid damage.

Example, at 4000 RPM, 150 KPA Boost (or approx. 7 PSI), your Lambda Target is .84, and the Lambda is .90, then we need to add fuel now to avoid engine damage.

So we take  $.90 / .84 = 1.07$ , meaning we need to add 7% fuel. Go to "Tuning" - "Fuel VE Table" (or Graph) and multiply the setting at 4000 RPM and 150 KPA by 1.07. So, if the setting in that cell is "100" then the new setting would be "107".

Do this for all of the RPM and Load cells if they are different than the Lambda Target.

Look for "trends", if the engine runs leaner at the boost is increased, there may be a fuel pressure problem. Remember the Fuel VE Table settings can go to a maximum of 255.

Look at the Duty Cycle and make sure it is not over 80% under boost. If it is, you will need a stronger fuel pump or larger injectors. Often it is better to take care of this now and not waste the time tuning around the problems.

7) Start the Datalogger and make another run at the same boost. See that the changes were made, and that the engine runs the correct Lambda. If everything looks good, increase the boost and make some more runs. If the engine still runs lean, misfires, or has other problems, bring it back in to the driveway and look at the logs for problems.

Check the Troubleshooting Guide" for solutions.

Increase the boost in 2-5 psi increments and tune the Fuel VE Table in those areas.

TIP: set the boost to the KPA values in the Fuel VE table,

Example:

Tune at 100 kpa, then 150 kpa, then 175 kpa, etc, to allow the tuning to take place in those exact cells in the Fuel VE Table/Graph.

8) Once the fuel is correct, then the next step is the Ignition Timing. The timing is adjusted

in "Tuning" - Spark Table" (or "Spark Graph").

The basemap will have conservative values for ignition timing to prevent engine damage. It is easy to damage the engine with too much timing, and it is hard to feel the small HP increases from a few degrees of timing.

The best tool for setting up the ignition timing is a "Dynamometer" or "Dyno". This tool measures the HP and Torque produced by the engine and will show the small increases or losses as you make adjustments to the tune.

It is safer to make power with the boost than with the ignition timing.

**Example:**

An engine might be perfectly safe at 22 psi boost on 93 octane fuel, and 18 degrees timing. Or, it can melt the pistons at only 12 psi boost, but with 28 degrees timing and the same fuel.

Of course, there are limits to everything. Generally, you are balancing ignition timing vs. fuel octane vs. boost vs. compression ratio vs. cylinder head and piston design, vs. Knock. See "The Rules" for more info.

Turn the boost back down to the minimum, and tune the Ignition Timing for each KPA row in the Spark Table/Graph. More Ignition Timing = more HP, but too much = Engine Damage.

**TIP:**

If on the dyno, increase the Timing by 1-2 degrees at a time while making runs and watching the HP. If you see 10+ HP from 1-2 degrees of Timing, you are going in the right direction. If you then try 2 more degrees, and only make 5 HP, you are at the point of not needing any more Timing.

Some engines are "Knock Limited" (usually on pump gas), and some engines are "Torque Limited" Check the Spark Plugs after every new boost setting, and again after finishing the tuning. See "The Rules" for more info.

9) The Fuel and Spark Tables are tuned, you are ready to tune the Acceleration Enrichments. These allow the engine to "rev-up" smooth and clean with sudden throttle applications. Try to use the lowest Fuel settings that still allow the engine to "rev-up" cleanly.

10) Next are the Starting and Warmup Enrichments. With the Engine Warm, go to "Tuning" - Starting Enrichments" - and experiment with the "Crank Warm Pulsewidth". As with the Acceleration Enrichments, use the lowest fuel setting that still allows the engine to start well.

When the engine starts well at warm temperatures, stop it and allow it to cool down. Then, with the Engine Cold, go to "Tuning" - Starting Enrichments" - and experiment with the "Crank Cold Pulsewidth". Again, use the lowest fuel setting that still allows the engine to start well. You will notice that the engine needs 2 to 3 times more fuel to start when it is cold. This is normal. Also, you may need to hold the throttle down 1/4 of the way for cold starts.

**TIP:**

If the engine does NOT IDLE when cold, (stalls) WITHOUT holding the throttle open, then It will also NOT START without holding the throttle open.

**TIP:**

**Remember, do not "Floor" the throttle, anything over 60% TPS will cut ALL of the Fuel and the engine will NOT Start. This feature is called "Clear Flood Mode".**

**If we mess up and add way too much fuel, and "flood the engine", crank it with the throttle 100% open for 10 seconds.**

**This will help dry out the spark plugs and keep from having to clean or replace them.**

**11) You should now have an engine that starts, runs, and drives well and makes good power.**

**If you have problems or questions, send them in thru the contact form on [www.Lugtronic.com](http://www.Lugtronic.com) Include your Calibration File and some Datalogs if you can, it will most likely help.**

**12) Please be responsible and safe with your car, and have fun!**



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