



LetRipp Fuel Tuner Technical Guide

Version 1.2



FUEL TUNER TECHNICAL GUIDE V1.2

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1 INTRODUCTION

The Fuel Tuner Preliminary Technical Guide has been created in order to assist you to install and understand the Fuel Tuner's technical aspects. In this Technical Guide, the Fuel Tuner will be referred to as either "Fuel Tuner" or "FT" for short.

Some information will be given in this guide, however for more detailed instructions and information on how to tune and setup your Fuel Tuner with the LetRipp Windows Tuning Software, please refer to the LetRipp Software Guide.

2 THE AIM OF THE FUEL TUNER

The purpose or aim of the FUEL TUNER is to provide a fuel-controlling unit with a "Plug-and-Play" facility. The Fuel Tuner is slightly more expensive than traditional piggy-back products, but it requires no engineering, no cutting of wires and installs in minutes. In other words, it is GUARANTEED to work!

The Fuel Tuner applies to the environmentally conscious installer, who would like to reduce fuel consumption or maximize the best possible fuel consumption in various situations. The Fuel Tuner also applies to the "performance" enthusiast, who would like to run his/her engine at the most powerful fuel ratio possible. Equally, the Fuel Tuner applies to aftermarket turbo and supercharger installations, which require more fuel under full boost.

In any event, the Fuel Tuner simply connects to the fuel-injected petrol engine's injector connectors, and this completes the minimum or basic installation for modifying fuel.

The Fuel Tuner can also be used for EXTENDING the RPM limit of an engine imposed by the stock ECU. The unit learns what the ECU is doing just before the injection is cut and then carries on with providing the fuel. In the same token, the Fuel Tuner can impose an RPM limit which is lower than the stock ECU. All these fancy applications can be achieved by connecting and tee-ing in some more wires (Full Installation) for the purpose of monitoring the engine.

All Fuel Tuner products can be tuned with the LetRipp Windows Tuning Software.

3 FUEL TUNER VERSIONS

The FUEL TUNER comes in three versions:

FT20	For 2 Cylinder Engines
FT40	For 4 Cylinder Engines
FT60	For 6 Cylinder Engines

If the need arises, the Fuel Tuner can be applied to 8 cylinder engines, by combining 2 x FT40 units. If the demand is high for a specific 8 cylinder unit, having an FT80 may be a possible product in the near future.

4 INSTALLATION

The “Minimum Installation” is a good way to start getting acquainted with your Fuel Tuner. It is quick, requires very few tools but does not allow you to enjoy the full potential of the product. The Fuel Tuner (FT for short), can do so much more, and its power and the benefits to you are unleashed when you connect a few more wires (see the section on the [Full Installation](#)).

4.1 MINIMUM INSTALLATION

is installation is the absolute minimum and will provide you with a “One Dimensional” map with 24-RPM sites spread over the calibrated RPM range. The number of sites on a map is an indication of the amount of tuning that can be done for a specific area, in this case RPM.

4.1.1 PRACTICAL STEPS

The Minimum Installation, has been broken down into 6 (six) practical steps, with photos. These steps cover the installation of the unit into the vehicle and the unit is not connected to a computer. Once the physical installation has been completed the engine will run as before. For the purpose of tuning the engine you need to consult the:

LETRIPP SOFTWARE GUIDE

This manual covers all aspects of the PC (Laptop) operation.

STEP 1 : FINDING A SUITABLE LOCATION TO MOUNT/INSTALL THE UNIT



- a. Find a suitable location for the unit, i.e.:
 - Away (or shielded) from hot surfaces
 - Within harness reach of the injectors and the vehicle’s ECU (Engine Control Unit)
 - Protected from water, water spray, or high pressure water cleaning. This is because the unit is not water-resistant or water-proof
 - If possible, in a ventilated area

The ideal location would be as close as possible to the battery of the vehicle, in the engine bay. This is the coolest place in an engine. However, you would need to

seal the unit in a plastic bag to ensure that it would not get wet.

- b. The unit does not have to be clamped down, but should not rattle. The housing is insulated, but should not touch any live wires, except the chassis. Once the tuning is complete, the unit can be packaged into a plastic bag and sealed, and left in the suitable location.

STEP 2 : LOCATING THE INJECTORS OF THE ENGINE

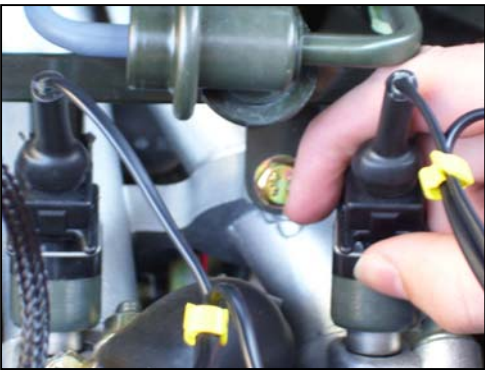


- a. Look around your vehicle’s engine and locate the injectors of the fuel injected petrol engine.
- b. Connect the loose wire (ground) of the injector harness(es) to a suitable place on the metallic chassis. This is to GROUND the unit.

STEP 3 : CONNECTING THE PLUG-AND-PLAY INJECTOR HARNESS(ES)



a. Remove the existing injector caps/plugs, by unclipping them. As shown in the photo on the left.



b. Using the plug-and-play harness(es) supplied with the FT kit, connect the injector harness to the injectors (if you are installing on a 4-cylinder engine, you'll have two sets of plug-and-play injector harnesses). As shown in the photo on the left.



c. The photograph on the left shows the injector plug of the engine and the harness injector clip.

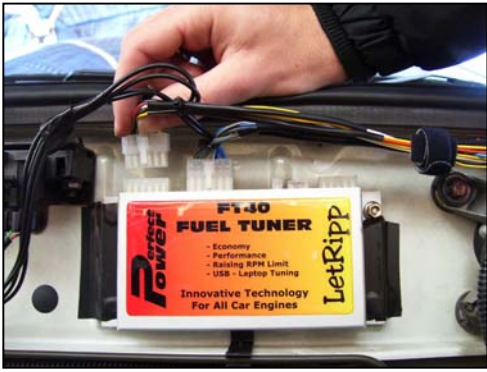
STEP 4 : CONNECTING THE GROUND WIRES



a. Connect the ground wire(s) to a suitable metallic place on the chassis. In the photo on the left, there were two screws in the chassis, which made it easy to attach the lugs to the chassis.

NOTE: If there is no metallic section exposed on your vehicle's chassis, you may need to scratch some of the paint off to expose the metal.

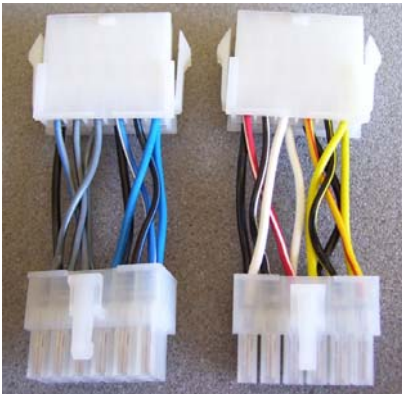
STEP 5 : CONNECTING THE HARNESS TO THE UNIT



- a. Connect the connector plugs from the harness to the matching connector on the unit. As shown in the photo on the left.

4.2 FINDING THE INJECTOR WIRING POLARITY

A very important Step in the Minimum Installation is ensuring that you have the Injector Harness connected correctly to the injectors of the engine. The injectors can be wired in two ways, and therefore we have supplied a "reversing" plug which will recognize the different wirings that vehicle manufacturers use. You will need to determine whether your particular engine will need to make use of the special "reversing" plug. There is a "reversing" plug per connector on each injector harness. You will notice that the "reversing" plug matches the wire colours of the relevant part of the injector harness.



You will know when your installation requires the use of the "reversing" plugs when you do not get a green LED, after the injector harnesses have been connected. You will need to do a test, on one of the injector harnesses, to confirm the need for the "reversing" plug.

To test the wiring of the injector harness #1:

- 1) Identify the harness #1 (it will be marked with a yellow tab on the wiring). It is the one closest to the LED lights. Use only the pair of injector connectors at the end of it.
- 2) Connect the ground lead/wire to a suitable place on the chassis.
- 3) Connect harness #1 to cylinder #1, and the connect to the Fuel Tuner connector, without the "reversing" plug.
- 4) Start your engine, and observe that the GREEN LED flashes, and the RED LED is off.
- 5) If this is not the case, switch off the engine.
- 6) Insert the applicable reversing plug (matching wire colour), and try again.

Usually all injectors are wired in a consistent fashion. If you would like to confirm this, you can then repeat the steps above for each cylinder.

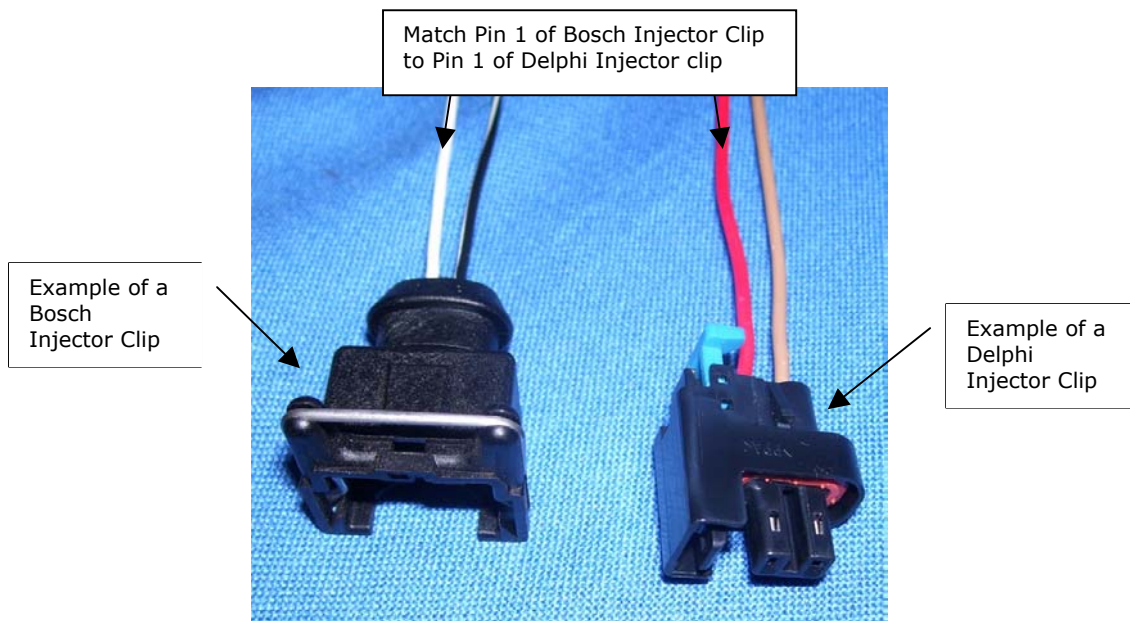
NOTE: The Fuel Tuner unit receives power from harness #1 (close to the LED) and from the GROUND wire you have connected to the chassis. It then tests that the injector is "pulsed" and indicates this on the GREEN LED.

4.3 ADAPTING THE PLUG-AND-PLAY INJECTOR HARNESS

The Fuel Tuner plug-and-play injector harness has been manufactured to clip onto Bosch injectors. If you find that your vehicle does not have Bosch injectors, you will need to replace the Bosch injector clips on the Fuel Tuner plug-and-play harness, with the applicable injector clips for the injectors in your vehicle.

To replace the injector clips on the Fuel Tuner plug-and-play harness, follow the steps below:

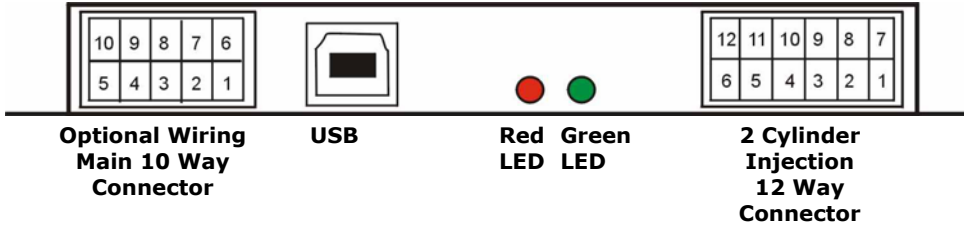
- 1) Confirm which type of injectors you have in your vehicle, for example, Delphi injectors.
- 2) Source the injector clips that will fit onto your type of injectors.
- 3) Cut off the Bosch injector clips off the Fuel Tuner's plug-and-play harness.
- 4) Connect the new injector clip wires to the wires of the Fuel Tuner plug-and-play harness in the SAME PIN ORDER of the injector clips, and follow this order for each injector. This means that pin 1 on the harness MUST BE MATCHED to pin 1 of the injector clip wire. See below for an example of a Bosch injector and a Delphi injector and the matching of wires.



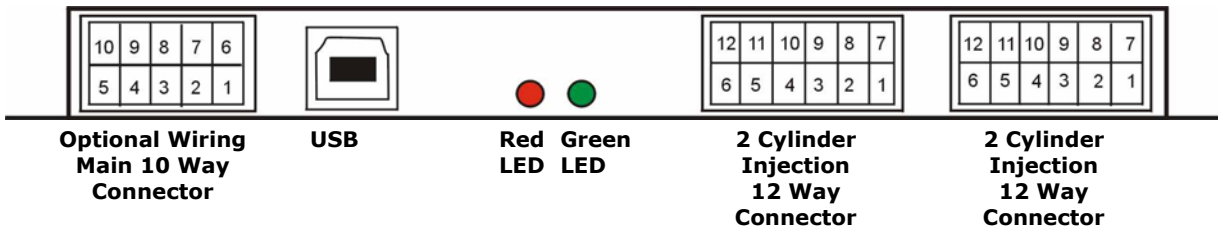
5 FULL INSTALLATION

This section provides information on pin locations for all units, as well as details of wiring in the harness for optional connections.

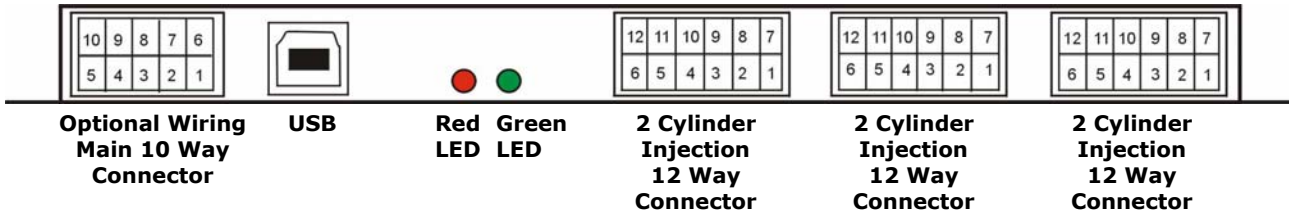
5.1 FT20 CONNECTIONS



3.2 FT40 CONNECTIONS



5.3 FT60 CONNECTIONS



5.4 CONNECTOR PIN ASSIGNMENT

5.4.1 MAIN 10 WAY CONNECTOR (FOR OPTIONAL WIRING)

PIN	Function	Description	Wire Colour
1	On/Off	Short to Switch OFF	Brown
2	Map Switch	Short to Activate MAP "B"	Pink
3	Air Temperature	0 - 5V	Orange
4	TPS Input	0 - 5V	Yellow
5	GND	Chassis	Black
6	+BAT (12V)	Supply (Needed with RPM sync)	Red
7	SYN Input	Required to extend RPM Limit	Purple
8	AMP (MAP) Input	0 - 5V	Grey
9	Eng Temp Input	0 - 5V	White
10	GND	Chassis	Black

5.4.2 2 CYLINDER INJECTION 12 WAY CONNECTOR (REPEATED UP TO 6 CYLINDERS)

PIN	Function	Description
1	GND	Chassis
2	-	NC
3	ECU INJ #2	ECU Injection
4	GND	Chassis
5	-	NC
6	ECU INJ #1	ECU Injection
7	BAT #2	Common supply to injectors
8	INJECTOR #2(A)	To Injector #2
9	INJECTOR #2(B)	To Injector #2
10	BAT #1	Common supply to injectors
11	INJECTOR #1(A)	To Injector #1
12	INJECTOR #1(B)	To Injector #1

5.5 POWERING THE FUEL TUNER WITHOUT THE ENGINE RUNNING

The FT can get operating power from three sources:

- 1) From the injectors**
The injector power may be switched off when the engine is not running.
- 2) From the 10 Way connector Pin 6**
This wire can be connected to any fused 12V power point, which is switched off when the key is removed.
- 3) From the USB port**
This is the preferred method when operating the unit outside the vehicle.

The Fuel Tuner will use power sources 1) and 2) above, if available. Power source 3), is useful when you would like to connect to the PC, but don't want to run the engine. Connecting to the USB port and the PC or Laptop will provide the power to the unit. When you connect in this way, you are not powering the engine, or activating the injectors, you are just running the electronics.

5.6 RECOMMENDED OPTIONAL WIRING

5.6.1 OPTIONAL THROTTLE POSITION (TPS) INPUT (PIN 4 OF 10)

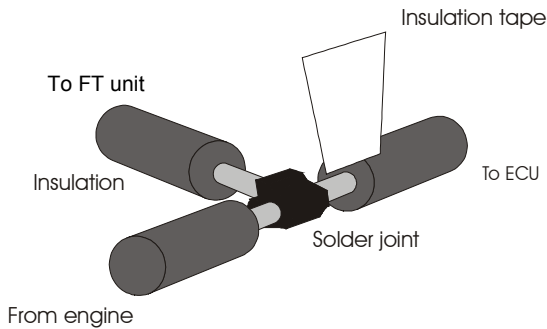
Wiring in the TP can be a little difficult, but is highly recommended. It will provide a "Two Dimensional" map. The difficulty is to find the correct throttle position signal wire amongst virtually hundreds of other wires.

The definition of the throttle position signal is: "It changes its voltage in unison to the change of the gas pedal". This can be measured with an ordinary multi-meter, or with the FT unit.

There are many ways to go about finding the correct TPS wire:

- 5) Trace the wire (colour) from the TPS sensor to the ECU.
- 6) Poke a needle into each wire and measure the signal in response to moving the gas pedal.
- 7) Locate an ECU connector layout from the vehicle manufacturer's service manual.
- 8) Get help from a qualified vehicle electrician.
- 9) Ask a friend.

Once the TPS wire has been found, you will then need to TEE the Fuel Tuner Yellow wire into it with the provided TEE-CONNECTOR. If you prefer to do the connection yourself follow the diagram below:



Try the installation of the TPS wire connection: Once the unit has been powered up, the TPS cursor must move in unison with the gas pedal. You can change the direction and calibration later. See the LetRipp Windows Software Guide on how to use the software to operate this feature.

Note: If you don't have a multi-meter, you can use the FT input and display the result on a PC. The FT input can be connected to any voltage EXCEPT the IGNITION (high tension!) without causing any harm.

5.6.2 OPTIONAL MANIFOLD PRESSURE INPUT (PIN 8 OF 10)

If a manifold pressure sensor is not used, then a MAF signal will be sufficient. In any event, you need to wire this option only if you would like to change the tuning of the engine by the manifold pressure. This is advised after a turbo installation, or with superchargers. Find the MAP (or MAF) wires the same way as you found the TPS wire (explained above) and connect to it the Fuel Tuner's wiring harness GREY wire, with the provided TEE-CONNECTOR.

Refer to the LetRipp Windows Tuning Software Guide on how to use the software to tune this input.

5.6.3 OPTIONAL ENGINE TEMPERATURE INPUT (PIN 9 OF 10)

This sort of connection is for the very particular tuner, and when you would like to change the "COLD" behaviour of the engine. Locate the engine temperature wire (best done by tracing) and TEE into it with the Fuel Tuner's White wire on the optional wiring harness. If you don't need the engine temperature, then leave this wire open.

5.6.4 OPTIONAL AIR TEMPERATURE INPUT (PIN 3 OF 10)

This sort of connection is recommended with inter-cooled engines and is a must with turbo charged installations. Find the correct wire in your engine and connect to it by TEE-ing into it with the Fuel Tuner's Orange wire on the optional wiring harness, as before. If you don't need to use the air temperature, then leave the wire open.

5.6.5 OPTIONAL MAP SWITCHING INPUT (PIN 2 OF 10)

The Fuel Tuner has two complete tuning maps.

The second map (Map B) is activated by shorting the MAPSWITCH wire (Pink - Pin 2 of 10) to ground. If left open, then Map A is active. This is indicated in the right upper corner of the display in the LetRipp Windows Tuning Software. This feature is recommended when you experiment with the tuning. It gives you two different choices of tuning while driving the car on the road. An absolute "must" if you would like to do economy tuning.

5.6.6 OPTIONAL ON/OFF SWITCHING INPUT (PIN 1 OF 10)

The Fuel Tuner has an ON/OFF function using the Brown wire on the Optional wiring harness. If the wire is left open, then the unit is ON and performs its logical function: it tunes the fuel. If the wire is shorted to the chassis, then the Fuel Tuner will not tune the engine. The "OFF" state is the same as entering zeros into all the map points in the software.

5.7 CALIBRATION

This is the process to adapt the Fuel Tuner to your engine. It requires that you have the respective input wired to the engine and that you can "exercise" or use the input. The Fuel Tuner comes with "PRESET" calibration maps, and you may make use them. But the display they provide may be incorrect for your engine or application. Therefore, calibration will be necessary and it is very easy to calibrate the inputs you use.

The CALIBRATION is performed via CONFIG, then Calibration in the LetRipp Windows Tuning Software. Please refer to the LetRipp Software Guide for a detailed explanation.

Any additional engine input you use adds a "Tuning Dimension". We highly recommend to install the:

- TPS - Yellow wire
- AMP (Manifold pressure) - Grey wire

The more concerned installer may want to install:

- Air Temperature - Orange wire
- Engine Temperature - White wire

6 TUNING

This is the process of changing the amount of fuel your engine gets with the same amount of air. Some or most engines run a closed loop system: it measures the exhaust fumes and adjusts the fuel accordingly. Changing the fuel with the FT will not help: whatever you put in extra, the stock ECU will take out again. However, and this is important, most closed loop systems stop operating at approximately 2500 RPM.

6.3 FUEL MAP ENTRIES AND THEIR EFFECT

When tuning with the LetRipp A positive number adds and a negative number subtracts fuel. A number of 100 means 1.00 MS (Milli Seconds = 0.001 Second) and is at idle - approx. 50% of your fuel injection. At full power it may be as little as 10% or less. Of course, the numbers change according to your engine. You can display the stock injection length and judge for yourself.

6.4 AFR, POWER AND FUEL ECONOMY

The AFR (Air Fuel Ratio) is one of the most important measurements in tuning fuel. Unfortunately, the Fuel Tuner has not been designed to measure it, but nonetheless an understanding of AFR is essential to choose an operating point which best suits its purpose.

AFR and Lambda are often used interchangeably. 1.00 Lambda = 14.7 AFR. Here are some important AFR numbers:

- 14.7 AFR = Normal Operation
- 13.2 – 13.8 AFR = Maximum Power
- 12.2 AFR = Maximum Power for Supercharged or Turbocharged Engines
- 15.5 AFR = Lean, point of Minimum Fuel Consumption

Modern engine technology can change the AFR numbers to a certain degree, but the principle remains: you can run the engine LEAN, but not on full power. Another way of looking at it – “if you want strong horses, you’ll need to feed them!”.

6.5 TUNING WITHOUT AFR

It is possible to tune without measuring the AFR, but it does require a bit more effort. From the start, running a “RICH” engine is safe - you will waste fuel, but you will not need to worry about damaging the engine. You should never run an engine at full power lean, as this could damage the engine. It is best to try to lean the engine at cruising, however there will come a point where the engine “hunts”, then you’ll need to make it richer again. Try reaching the ideal setting and keep it this way for a while.

6.6 ON THE ROAD TUNING FOR FUEL ECONOMY

Tuning your Fuel Tuner on the road as you drive is a very convenient way to establish the best settings for the best fuel economy. We suggest that you drive your vehicle (with the Fuel Tuner already installed on it) for a period and record your driving style, using the “History” feature in the LetRipp Windows Tuning Software. The “History” feature shows where and how long you used the engine at its various operating points. You can then use this information to tune the spots where you have spent most of the time.

6.7 PROVIDING TWO MAPS FOR DIFFERENT PURPOSES

The Fuel Tuner has two maps, called A and B. This feature allows you to have two different maps, with each map for different application or purpose. The map switching can be effected from three sources:

1) **HARDWARE (via a physical switch)**

Short the "MAPSW" input to GROUND = MAP B

2) **AUTOMATICALLY (via the LetRipp Windows Tuning Software)**

Enable the map switching (SYSTEM DEF) and either Air/Engine Temperature switch points (CONFIG: PARAMETER), for the Fuel Tuner to invoke Map "B" when either temperature is exceeded.

3) **PC (LAPTOP) (using the LetRipp Windows Tuning Software)**

The software can "force" a map (A or B), which allows the downloading and tuning of any item in them. During the "forced map" conditions the hardware and automatic map switching are disabled.

6.8 EXTENDING THE RPM LIMIT

In order for this feature to operate, you will need to wire the SYNC input (Purple wire - Pin 7 of 10) to a suitable crank or RPM signal. You will also need to have the TPS input wired up (see [OPTIONAL THROTTLE POSITION \(TPS\) INPUT](#) above). This is because this feature has been designed to work only at WIDE OPEN THROTTLE.

When using this feature, you must understand that the RPM limit has its purpose, and extending it has a **risk**. You should only need to do it in very special circumstances or when absolutely necessary.

You will need to set two points in the LetRipp Windows Tuning Software (under CONFIG, SYSTEM DEF):

- RPM from SYNC enable
- Extended RPM enable

Once set, and you are on full throttle, then the FT will measure the ECU injection, and when it stops it will inject the last measured fuel plus any tuning you may have done until the stock ECU injects again, or you take the foot off the gas pedal. It is normal for engine manufacturers to run the ignition well beyond the RPM (fuel) limit.

6.8.1 IMPOSING A NEW RPM LIMIT

The RPM limit of the Fuel Tuner is settable in the LetRipp Windows Tuning Software, under "Config" and then "Parameter Screen". The RPM limit is active BELOW the stock ECU limit, and when you have extended the RPM it is active as well (ABOVE the stock ECU limit).

7 BATCH INJECTION

Some manufacturers operate 2 injectors at a time. In most cases, one stock ECU injector output serves two injectors. One injector sprays into the closed valves, the other into the open valves. This is quite acceptable in some countries. However, it also means that injector activation happens EVERY crank turn, and not every TWO crank turns.

The Fuel Tuner can be made aware of this by setting in the LetRipp Windows Tuning Software:

- CONFIG, SYSTEM DEF, Batch Injection

Batch injection is indicated if the RPM shows double the normal or expected value. Click the option "ON" and the RPM will be indicated correctly!

If the stock ECU uses batch injection, then the INJECTOR TRIM entries should best be left at zero.

8 ERROR INDICATIONS

The **RED** LED shows whether all injectors are connected incorrectly. It actually monitors the time between any two following injections and compares it to the time of the previous two injections. In other words, it checks for REGULAR injection outputs. Irregular outputs are indicated when one injector is wrong phased, or not connected.

By connecting ONE injector harness only (any injector) the input and output time MUST be regular, and the **RED** LED must be "OFF".

If acceleration causes extra injector activation (acceleration enrichment), then the **RED** LED may flash.

In batch injection, it is also possible that the **RED** LED may flash as well.