# EMERALD
WWW.EMERALDM3D.COM

**EmeraldM3D K6**

**Engine Management System**



*Quick start Guide – Pre-configured ECU*

Rev3.00

**Thank you for purchasing the EmeraldM3D K6 engine management system.**

This Quick start guide will walk you through the necessary steps to setup and configure the EmeraldM3D K6 to suit your engine and installation. It is strongly advised that during the initial ECU fitment and setup process **both the engines ignition coils and fuel injectors are unplugged.** It is important to note that permanent damage to the ECU and/or engine components can result if the engine physical configuration (particularly the ignition system) does not match the ECU configuration correctly. **Please note that damage sustained in this way is not covered by the ECU's warranty.**

## *Installing the EmeraldM3D PC software*

The first thing you will need to do is install the EmeraldM3D PC software onto your PC. The software is included with your ECU on CD or alternatively you can download it from our website – www.EmeraldM3D.com. To install the software simply double click on the setup.exe icon and follow the instructions.

Please note that if you are using a USB to serial adapter, prior to connecting it, you will need to install its software. There is a specific "Emerald Comms Setup – USB to Serial Adapter" document included with the ECU for your convenience and this is also downloadable from our website.

## *Connecting to the ECU*

**Serial comms lead connection**

- Boot up your PC and wait for it to complete its normal start up process.
- Insert the Green 9 pin connector of the Serial comms lead into the socket on the ECU marked "COMMS."
- Insert the White 9 pin connector of the Serial comms lead into your PC's serial com port, or connect via a valid USB-serial adapter.
- Start the EmeraldM3D PC software by double clicking on the shortcut icon found on the desktop and select the appropriate com port. Usually, selecting the com port with the highest number will be successful. Refer to the "Emerald Comms Setup – USB to Serial Adapter" document for assistance if required.
- A message stating "ECU Connected" will be displayed in the bottom right hand corner of the EmeraldM3D software when the ECU is powered up and connected.

## *Retrieving the ECU map & saving a copy on your PC*

Irrespective of whether you purchased your EmeraldM3D K6 as a Generic ECU or Pre-configured it is advisable to retrieve and save the supplied base map to your PC.

- With the ECU & PC connected select "Read MAP" from the "Comms" menu
- Click OK on the confirm pop-up window
- When the map/s have been retrieved from the ECU you can save it to disk
- Save the map to disk by selecting "Save map file" from the "File" menu.  Fill in the file name and set the file location

The ECU map file contains data specific to the calibration of your engine, such as fuelling and ignition figures, engine speed limits and many more parameters.

## *Retrieving the ECU configuration & saving a copy on your PC*

As per the advised retrieval and saving of the supplied base map, it is also recommended that you retrieve a copy of the supplied ECU configuration and save it to your PC.

- With the ECU & PC connected select "ECU configuration" and then "ECU version info."
- The configuration settings will be retrieved by the PC and will be displayed.  Note: The status bar on the bottom of the ECU configuration screen should be coloured blue (if not, select "Read ECU configuration" from the "ECU" menu).
- Save the configuration settings to disk by selecting "Save configuration to disk" from the "File" menu
- Enter any useful information in the next window that appears and then click OK - you will then have the option to set the file name and file location.

The ECU configuration contains base settings specific to your engines physical setup.  Once correctly set, the ECU configuration should not require further adjustment unless physical modifications are made to the engines configuration.

## *Over checking the ECU configuration*

**Pre-configured K6 ECU**

A K6 Pre-configured ECU will have been setup to suit your engine configuration based on information provided at the point of ordering.  Nevertheless it is advisable to spend a few moments running through the more fundamental areas of the ECU configuration to ensure that everything is in order and to familiarise yourself with these important areas.

- With the ECU & PC connected select "ECU configuration" and then "ECU version info."  Click on the respective tabs to display them.

Example screen shots are provided over the next pages to illustrate the specific parameters that should be checked and verified.  Please note that these screen shots are not intended to represent your engine.
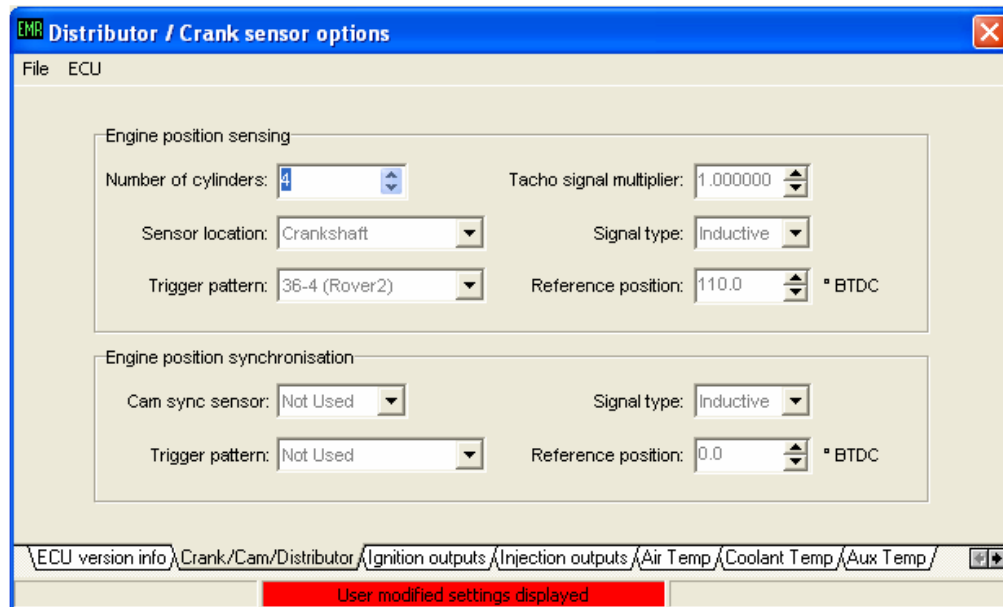
**Distributor / Crank sensor options:** Check to ensure that the parameters set match the physical configuration of your engine.
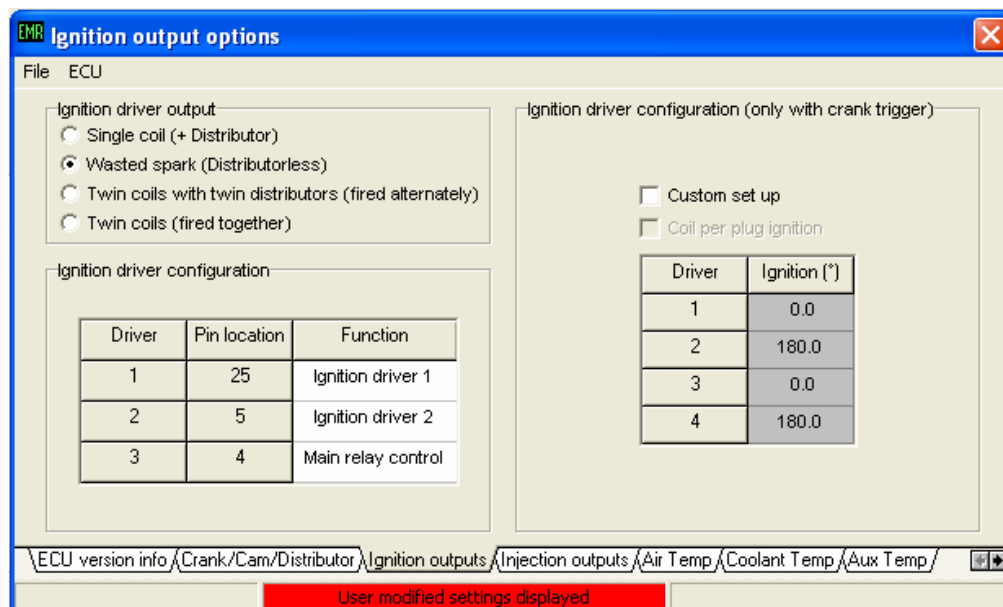


**Ignition output options:** It is important to ensure that the ECU is configured correctly for the type of ignition system in use on your engine. This is particularly important for cars with Coil on Plug (COP) ignition systems as damage can occur to the coils and/or the ECU if incorrectly configured. **Ensure coils are disconnected during modifications to the "Ignition output options" page and update the ECU configuration after completing any changes.**
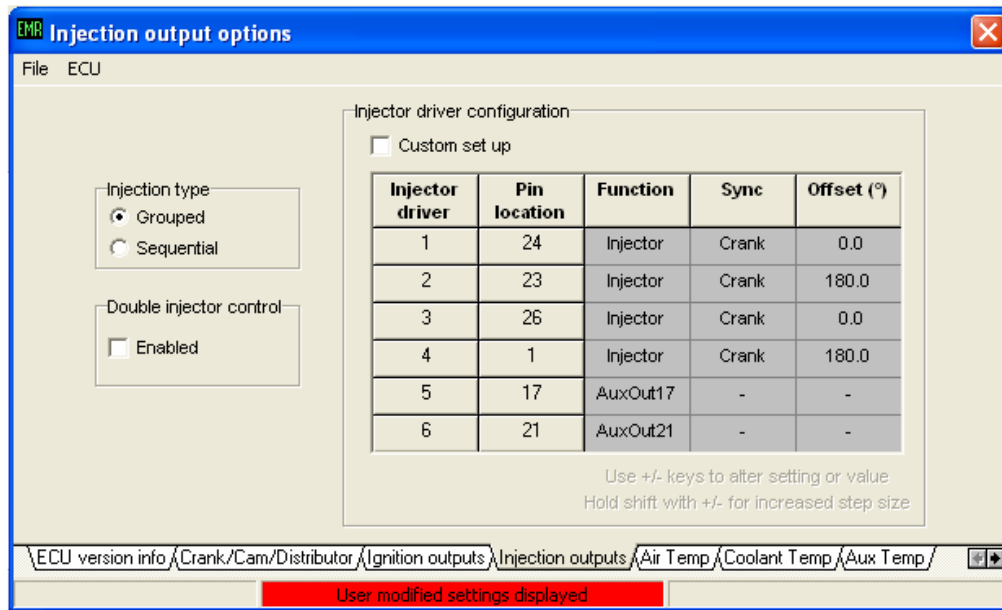
**Injection output options:** Check to ensure that the parameters set match the physical configuration of your engine. Note: Sequential injector operation can only be used where a CAM phase sensor is fitted and connected.
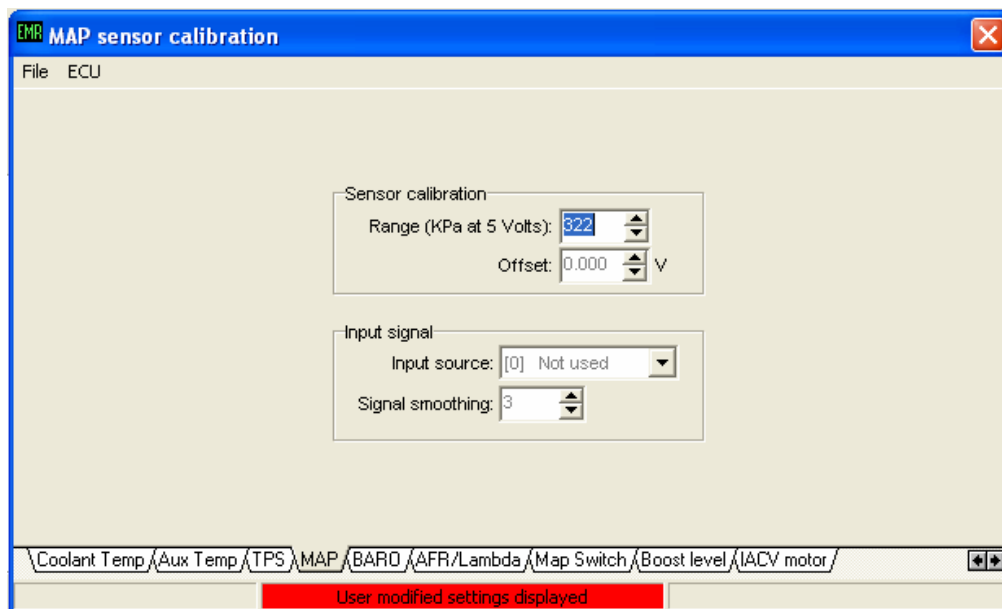
**MAP sensor calibration:** This page will be utilised when using a MAP sensor and should be configured appropriately to suit the range of the MAP sensor fitted.
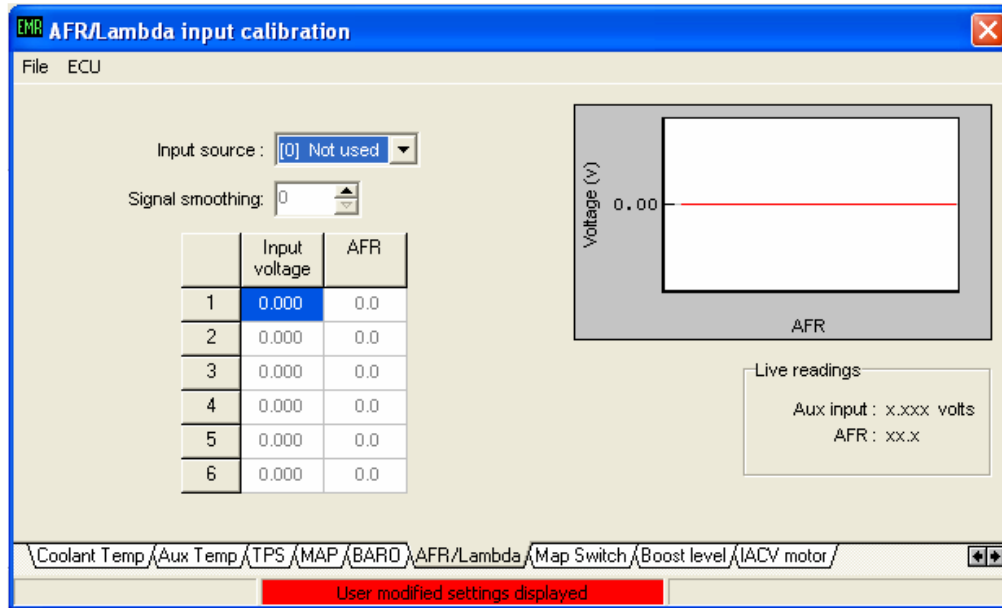
**AFR / Lambda input calibration:**  This page is used to provide the respective calibration curve for when a narrow or wide band Lambda sensor is used.
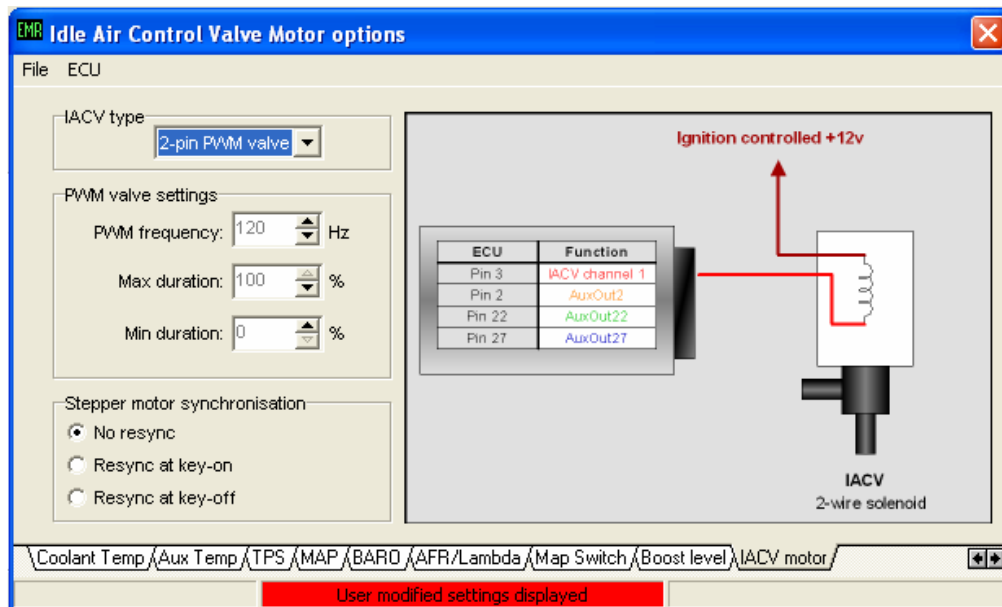


**Idle Air Control Valve Motor options:**  For engine configurations using an IACV the control parameters for the valve should be set using this page.
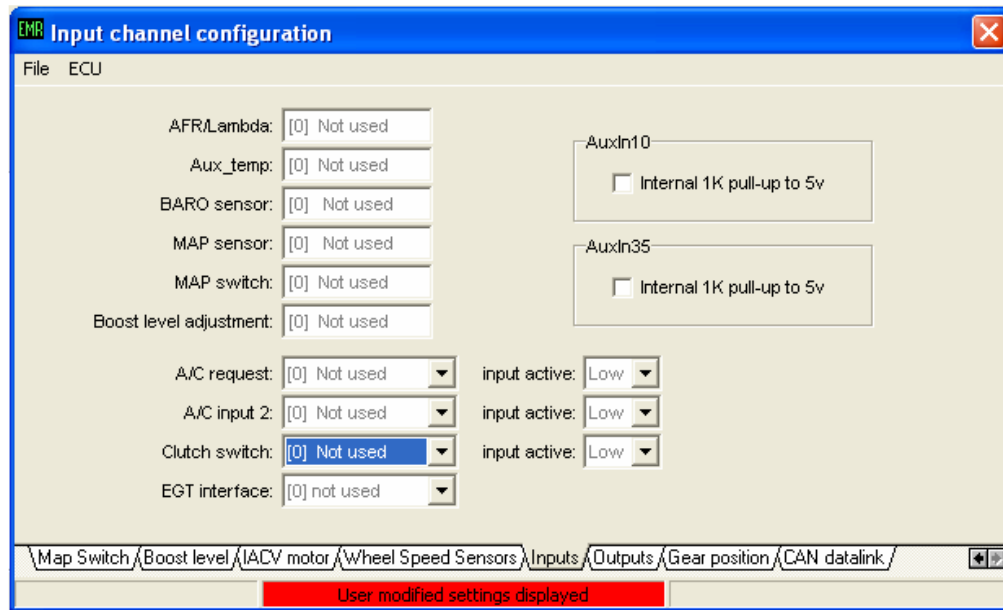
**Input channel configuration:**  This page is used to assign ECU pins for various different input functions.  Check that AFR and MAP sensor inputs etc are correctly configured if used on your engine configuration.
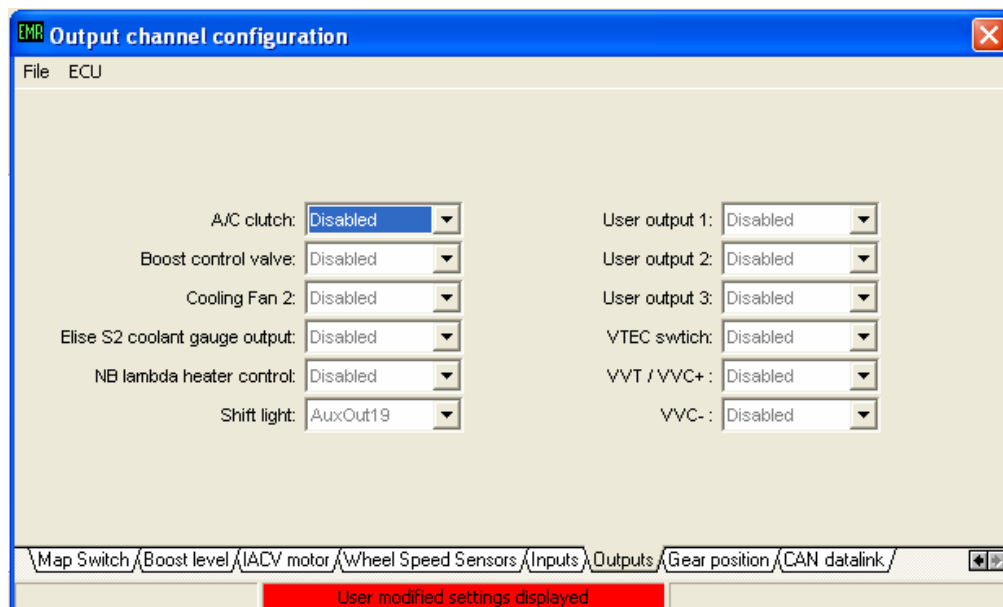
**Output channel configuration:**  This page is used to assign ECU pins for various different output functions.  Check that Boost valve's and VVT outputs etc are correctly configured if used on your engine configuration.

**Generic K6 ECU**

All Generic K6 ECU's are supplied with a base map suitable for normally aspirated, conventional 4 cylinder 16v engines fitted with port throttles and producing circa 200 bhp. All ECU configuration parameters should be checked and set to suit your engine configuration prior to attempting to start and run the engine. The above over-view of a Pre-configured ECU provides an introduction to the most fundamental parameters but it is recommended that when configuring a Generic K6 for the first time you take the time to work through our separate "ECU configuration guide" – included with you Generic K6 ECU.

## Throttle Pot Alignment

Please check, adjust and ensure that the throttle body/s on your engine have unobstructed movement across its/their entire range and open fully when the throttle pedal is depressed. With these checks completed you can now set the throttle position sensor alignment.

- With the ECU & PC connected select "Throttle Position Sensor" from the "Setup" menu
- Click OK and follow the on screen instructions. You will be asked to apply full throttle and release. The software will capture the throttle pot readings and use these to calibrate the ECU
- Offsets will automatically be set for overrun cut and idle position – the default values are 8

.

## Live mapping screen – preparations for 1st start.

With the ECU & PC connected press F8 to display the Live Adjustments screen.



With the ignition on but the engine not running it should look similar to above.

As you move the throttle, the load site number will change and the site target will move from top to bottom. Once the throttle position sensor has been setup, the load site should read 0 with no throttle applied and then move to 15 when the throttle is opened fully.



If either the Air or Coolant temperature figures have red backgrounds (as shown above) it means a sensor fault is present and the ECU is using a default substitute value. If this occurs, check for an unplugged sensor, faulty wiring or faulty sensor etc and rectify the fault accordingly. When first connecting to an engine that has not been recently run both air and coolant temperature values should be very similar and close to the ambient temperature.

If you are using a MAP sensor then under the ignition on, engine off condition the "MAP Pressure" display on the Live Adjustments screen should read, or be close to, atmospheric pressure – in most cases circa 100KPa.

You should also note that when the ignition is turned on the ECU, if wired to do so, will operate the fuel pump for a few seconds to prime the fuel system, and then stop. This is a safety feature and the pump will run again as soon as the ECU sees a valid engine speed signal during cranking.

## *Cranking the engine.*



If you have not done so already, disconnect all fuel injector's & coils in preparation for cranking the engine.

At this stage it is both convenient and timely to check the impedance of the fuel injectors. Using a multi-meter measure the resistance present across the 2 pins of the fuel injectors - be sure to measure the resistance of the fuel injector and not the plug on the wiring harness! A reading of between 12 to 16 ohms categorises the injector as "High impedance" and is suitable for use with the K6 ECU. A reading of between 2 and 4 ohms means the injectors are "Low impedance" and that they can not be used with the K6 ECU unless suitable Ballast resistors are fitted.

With the ECU & PC connected, and the Live Adjustments screen displayed you are now ready to crank the engine and confirm that the ECU status led (shown above) goes from red to green during cranking and that an engine speed is seen on the Live Adjustments screen. After cranking the engine, now is a good time to check for obvious coolant, engine oil and/or fuel leaks!

If you do not see the ECU status LED turn from red to green during cranking, please refer to our FAQ section on our website (http://www.emeraldm3d.com/faq#Initial%20Start-up) for further advice.

You are now almost ready to start the engine.  If your engine is using independent throttle bodies per cylinder (Jenvey's for example), it is recommended to have an airflow synchroniser ready to check the throttle body balance once the engine has been started and is idling.  If an airflow synchroniser is not available a suitable piece of pipe can be used to "listen" to the hiss from each body.

## 1st start and establishing an idle.

Re-connect all injectors and ignition coils and crank the engine.  It should start or fire intermittently depending on how close the base map is to meeting the requirements of your actual engine.  To add or remove fuel as necessary to assist getting the engine running, and to trim the fuelling once it is running use keys 2 & 3 when the Live Adjustments screen is displayed.



Allow the engine to warm and run up to normal operating temperature and continue to make adjustments using keys 2 & 3 as necessary.  If a larger trim that +/- 25 is required to maintain a suitable AFR then appropriate changes to the ECU's Micro Seconds Per Bit (MSPB) value can be made.  The default MSPB value is 61 - to enrich the entire map, increase the MSPB value and conversely, reduce the MSPB to achieve a leaner map.

When making changes to the MSPB value, keep the changes fairly small, (for example steps of 4 or less at a time) and remember to program the map to the ECU for the change to take affect - you can do this with the engine running.
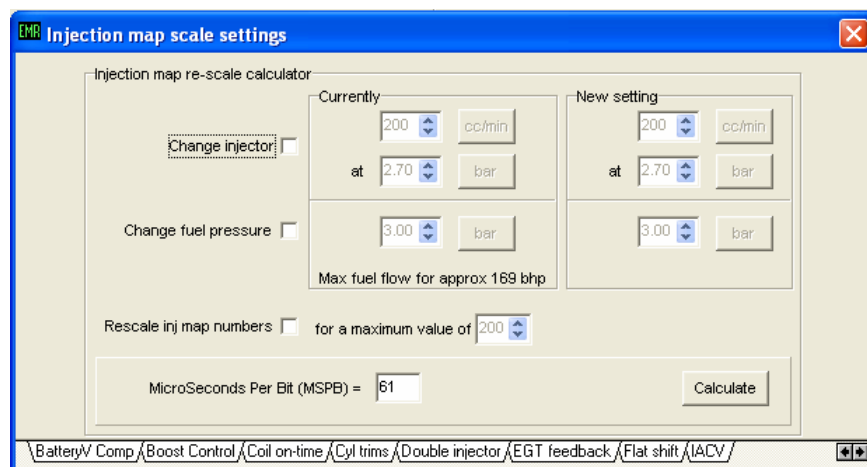


To change the MSPB value, select the "Injector Scaling" option from the "Additional Maps" menu.  Simply change the MSPB value, close the window and program the map.  It is not necessary to click "Calculate."

As the engine warms up it may be necessary to adjust the physical throttle stop and/or throttle body balance (if using independent throttle bodies) to achieve a suitable idle speed. If adjustments to the throttle body stop or balance are made, remember to turn off the engine and re-align the throttle position sensor via the PC software. Re-start and make further adjustments to the fuel trim and or MSPB number as required.

The engine should now start and react correctly to throttle inputs enabling the car to be moved around.

## *Checking the Ignition reference.*

If you are using an OE factory crank sensor and trigger wheel setup then the ignition reference value supplied in the base ECU configuration for a Pre-configured K6 should be correct. However, if your engine is using a retro-fitted crank trigger wheel and sensor arrangement it is recommended that the ignition reference value is checked and verified using a suitable ignition timing light.

Note: If your engine is using a wasted spark ignition system be sure to use an ignition timing light that can be set accordingly for wasted spark ignition. If not, the engine speed and ignition advance figures displayed on the timing light will be doubled.

To check the ignition reference value it is necessary to suitably mark the crank pulley at the appropriate position that coincides with TDC for cylinder 1. With this done, attach the ignition timing light and start the engine and allow it to idle.
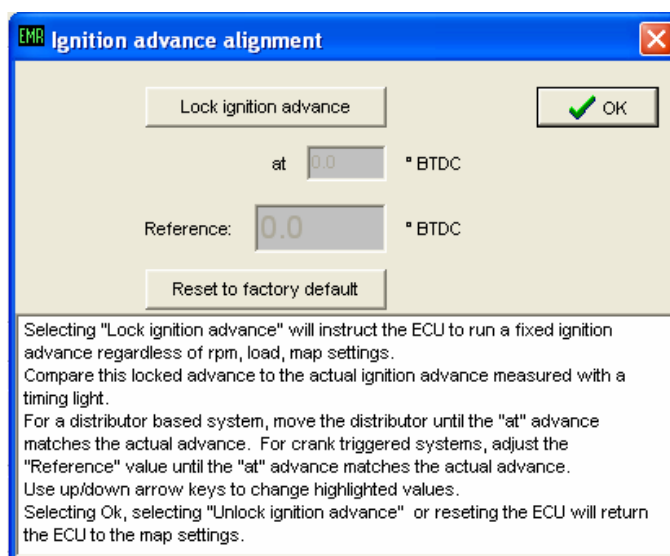


In the PC software select "Ignition Alignment" from the "Setup" menu and read the on-screen instructions. Lock the ignition (for example) at 20 degrees and adjust the reference value as necessary so that the PC software and ignition timing light match. If the reference value requires significant adjustment which consequently results in a significant change in engine speed, then it may be necessary to re-visit and adjust the physical throttle stop adjustment and AFR trimming to re-establish the desired idle.

At this point the basic setup of your K6 ECU is complete and you are now ready to have the car fully mapped on a suitable rolling road / chassis dynometer.