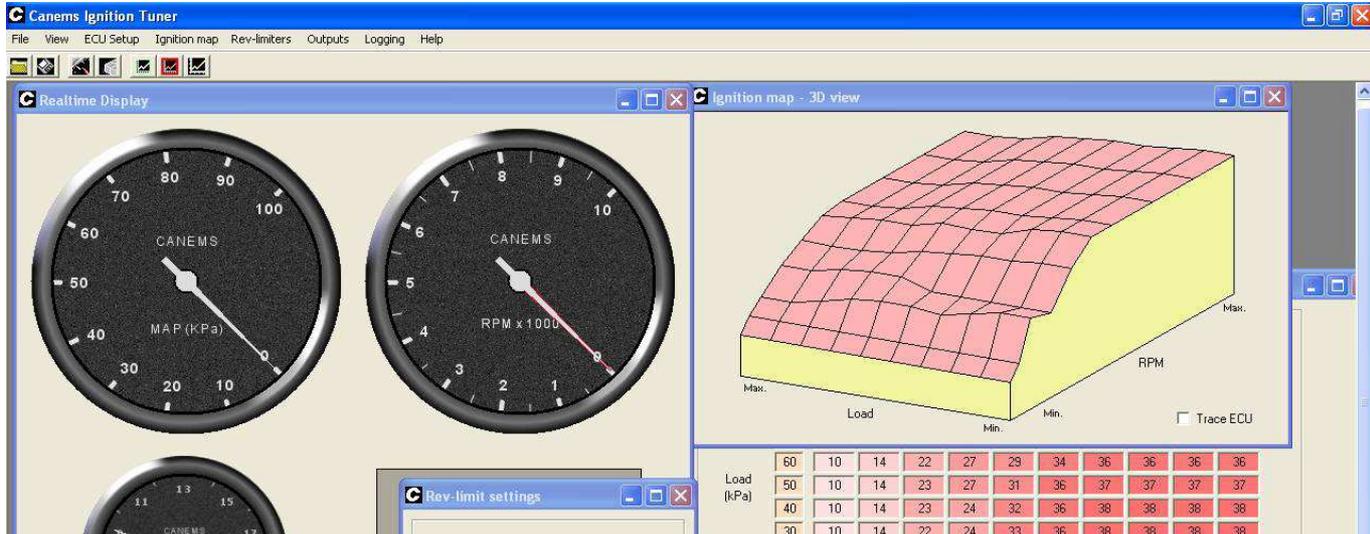


CANEMS – GEMS ROVER V8 ENGINE MANAGEMENT KIT - INSTALLATION INSTRUCTIONS

Rev. 1.6 – Fuel & Ignition with Custom Loom - GEMS
Nathan J. Lloyd BA & Daniel R. Lloyd BEng - February 2010



The screenshot shows the Canems Ignition Tuner software interface. The main window is titled "Canems Ignition Tuner" and contains several sub-windows:

- Realtime Display:** Shows three gauges: a MAP (kPa) gauge (0-100), an RPM x 1000 gauge (0-10), and a smaller gauge (0-17).
- Ignition map - 3D view:** A 3D surface plot showing the ignition map. The vertical axis is labeled "Max." and "Min.", and the horizontal axes are labeled "Load" and "RPM". A "Trace ECU" checkbox is visible.
- Rev-limit settings:** A window showing a table of rev-limit settings.

Load (kPa)	10	14	22	27	29	34	36	36	36	36
60	10	14	22	27	29	34	36	36	36	36
50	10	14	23	27	31	36	37	37	37	37
40	10	14	23	24	32	36	38	38	38	38
30	10	14	22	24	33	36	38	38	38	38

Below the software screenshot, there are three images:

- A photograph of the engine bay showing the fuel system and wiring.
- A diagram of a gear with a central hole and a serrated outer edge.
- A photograph of the custom wiring harness (loom) with various connectors and sensors.

INTRODUCTION

The Lloyd Specialist Developments Fully Programmable Rover V8 Engine Management kit combines the excellent Canems ECU with all other required components into a simple and affordable package, complete with full installation instructions.

This engine management system is designed to completely replace the original GEMS fuel injection ECU, its restrictive air-flow meter and the entire engine management wiring. The original 3-wire stepper-motor idle valve is replaced with a 2-wire idle valve for increased reliability.

The original injectors & OEM sensors are retained.

This engine management system uses a MAP sensor and air temperature sensor to replace the mass air-flow meter.

The Canems ECU supports both MAP (vacuum/boost) and ALPHA-N (throttle position based) load inputs in order to dispense with the restrictive OEM mass airflow meter. This normally liberates some extra performance due to the better induction air-flow.

3D fuel and ignition timing maps can be easily altered in real-time for optimum air/fuel ratio's and ignition timing at **all** load/ rpm combinations to ensure maximum performance and efficiency.

KIT CONTENTS

Please check you have the following kit contents:

- ✓ Canems ECU;
- ✓ Custom Wiring Loom - Inc. Connectors & Main Relay;
- ✓ Air Temperature Sensor;
- ✓ 2-Wire PWM Idle Valve;
- ✓ Silicon Reducer Hoses x2;
- ✓ MAP Sensor;
- ✓ 4mm Vacuum Hose – 2m;
- ✓ Serial & USB Adaptor Cables;
- ✓ USB Convertor CD;
- ✓ Canems Injection Software CD;
- ✓ Canems Injection Software Manual.

AIR-FLOW METER REMOVAL, AIR TEMP. & MAP SENSOR FITMENT

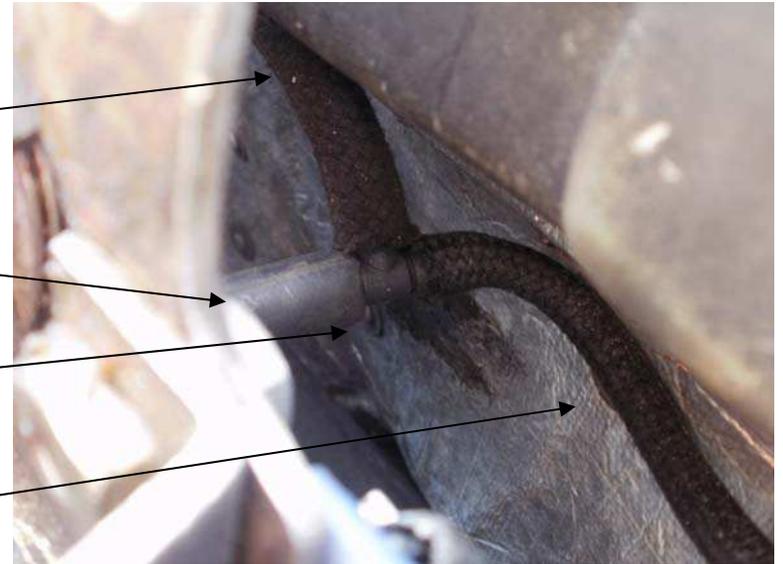
1. Un-plug the air-flow meter multi-plug, two jubilee clips and retaining bolts, where fitted.
2. Remove the air-flow meter.
3. Replace air-flow meter with suitable diameter intake tubing.
4. Choose where you wish to locate your air temp. sensor, it can be located in the intake tubing or in the plenum / throttle housing. Anywhere that sees intake airflow will work although we do not want to place the sensor in a location that will become heat soaked (e.g. near exhaust manifolds). Drill and tap the M12 x 1.5 thread and screw the sensor into place.
5. Mount the MAP sensor in suitable location (e.g.: bulkhead). Fit the MAP sensor 4mm tubing to the intake plenum via the vacuum take-off on the left hand side of the manifold base. Alternatively cut the vacuum pipe between the plenum and the fuel pressure regulator, and fit a 4mm t-piece. Connect the MAP sensor tubing to this t-piece.

OEM fuel pressure regulator vacuum pipe take-off located on the rear of the plenum, at the bottom of the stepper motor housing.

OEM fuel pressure regulator vacuum pipe

Cut into original vacuum piping here and insert 4mm t-piece.

New 4mm vacuum pipe (supplied) connects between T-piece and MAP sensor.

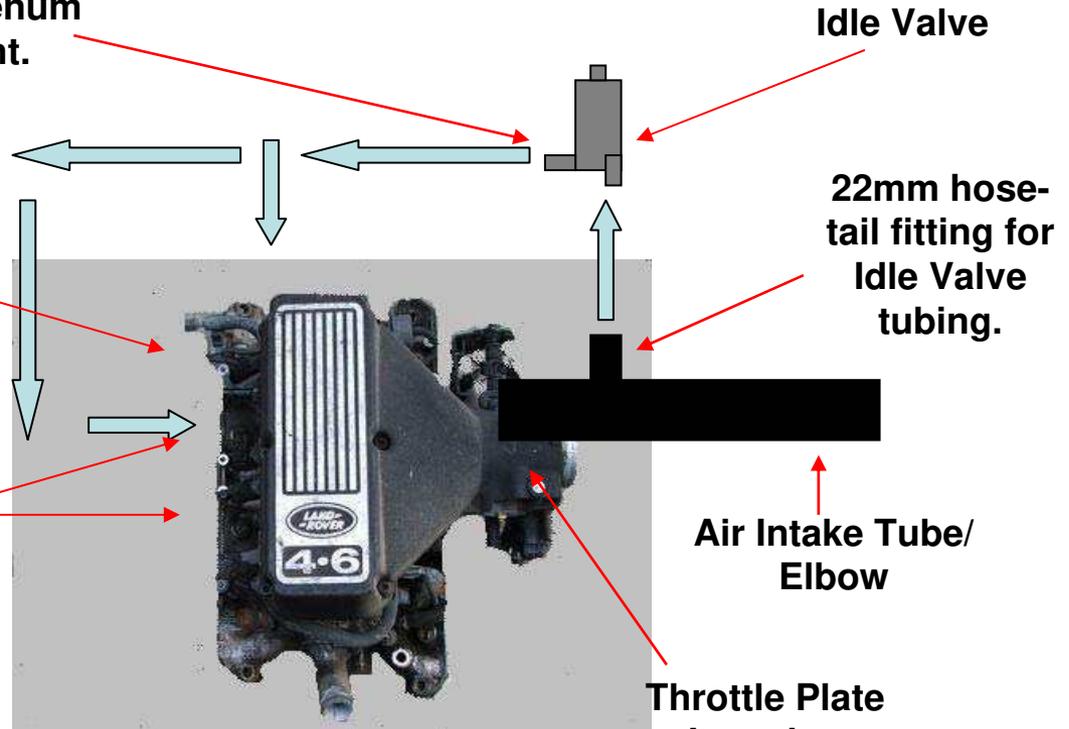


Fitting Bosch 2-wire PWM Idle Valve to GEMS Rover V8

This connection can be connected into the plenum wherever is convenient.

Vacuum take-off for brake servo at base/side of plenum.

Spare vacuum take-off points typically located on lower base here.



Idle Valve

22mm hose-tail fitting for Idle Valve tubing.

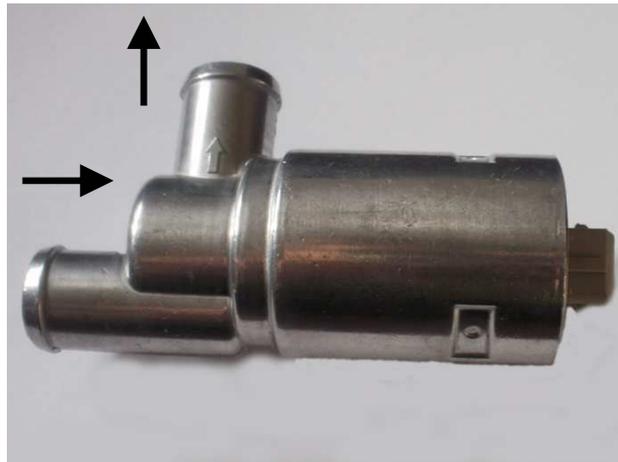
Air Intake Tube/Elbow

Throttle Plate Location

OEM Stepper Idle Valve is left in place. Note: The existing air bleed hole can be plugged or the Stepper Idle Valve seat can be sealed with a suitable sealant.

Fitting Bosch 2-wire PWM Idle Valve to GEMS Rover V8

- The purpose of the Idle Valve is to regulate the amount of air that can bypass the throttle plate at idle. More air bypass results in a faster idle / less air bypass results in a slower idle.
- Idle too fast? Simply lower the idle duty cycle at the relevant temperature in the Idle valve warm-up map.
- Idle too slow? Simply increase the idle duty cycle in the idle valve warm-up map.
- The higher the duty cycle = more air bypass and faster idle. Less duty cycle = less air bypass and slower idle. .
- When the engine is cold, it will require extra air to increase idle speed and support combustion of the extra fuel that is injected during cold start enrichment.
- The 2-wire PWM system is generally regarded as more reliable and is much simpler to set-up correctly than the OEM 4-wire stepper valve setup.
- The Idle Valve must be plumbed before and after the throttle plate. One connection draws clean, filtered air from before the throttle plate and allows it to bypass the throttle plate via a second connection in the intake plenum.



Fitting Bosch 2-wire PWM Idle Valve to GEMS Rover V8

- The 2 wire Bosch PWM Idle Valve we supply has two hose connections with a directional arrow on one connection. The Idle Valve needs to be plumbed into the intake system before and after the throttle plate with 22mm rubber or silicon tubing.
- The first hose connection (marked with a directional arrow) should be plumbed into the plenum/ plenum base on the engine side of the throttle plate. On many injected engines there are suitable spare manifold vacuum take-off points located alongside the brake servo vacuum take-off on the lower left hand side of the plenum base (facing the engine). If a spare vacuum take-off is available, remove it's blanking bung and insert a suitable M16x1.5 hose-tail adaptor. Note that suitable fittings will be required to use the 22mm hose with this size adaptor.
- If there are no suitable points spare in your manifold base, it may be necessary to remove the plenum top to drill and tap a suitable thread for a 22mm hose-tail end fitting. The rear of the plenum top offers an ideal location. Alternatively, Lloyd Specialist Developments can modify a plenum top to your specifications.
- The second hose should be connected to the air filter side of the throttle plate so that it draws in air *before* the throttle plate. The simplest way to achieve this is to install a 22mm hose-tail fitting into the air intake tube/ elbow. Suitable fittings are available for mounting a hose tail into plastic, silicone or even plastic intake tubes. This hose could also be connected directly to the air filter box itself (if fitted) via a 22mm hose-tail fitting. The important point here is that the idle Valve is drawing filtered air from before the throttle plate. Lloyd Specialist Developments can fabricate a tube that replaces the old air-flow meter with a large bore 68mm tube that has a suitable 22mm fitting on it along with a M12 x 1.5 boss for the inlet Air Temperature Sensor if required.
- Carefully remove the existing Stepper Idle Control Valve. Apply a bead of petrochemical resistant sealant to the pintle conical seat. Refit Stepper Idle Control Valve in plenum housing.
- Ensure the 2-Wire PWM Idle Valve is securely mounted and plug in the two pin connector labelled "Idle Valve" if you are using one of our custom wiring looms.

FITTING THE WIRING LOOM

1. Lay the complete wiring harness alongside the vehicle's engine or engine bay and make a note of the correct orientation of the loom. All connections are clearly labelled. The crankshaft position sensor (VR) two pin plug should be at the rear L/H side of the engine. The ECU end of the loom should face to the rear of the engine bay / bulkhead. Note the position of the various connections and main relay location.
2. The widest connector is located on the ECU end of the loom. You may wish to begin inside the vehicle so you do not have to feed the larger connector through any holes or wiring grommets.
3. Carefully feed the wiring loom into place. The wiring loom and connectors are fed through a suitable grommet in the bulkhead/ firewall on the left-hand side. All connectors are plugged into their respective positions, as they are labelled.
4. In the engine bay, check correct connections have been made to the following components:
 - 1: Crank Sensor (VR)** = 2-pin connector – sensor located on LH rear of engine on the flywheel housing.
 - 2: Throttle Position Sensor (TPS)** = 3-pin connector – sensor located on plenum throttle body.
 - 3: Idle Valve (2-wire PWM)** = 2-pin connector – Idle Valve should be plumbed in and located between pre- and post throttle plate positions.
 - 4: Air Temperature Sensor** = 2-pin connector – sensor located in the intake ducting to the throttle body.
 - 5: Left-Hand Injector Bank** = 4x 2-pin connectors – the connectors are led in the correct orientation for cylinders 1, 3, 5 & 7.

6: Coolant Temperature Sensor = 2-pin connector, located on the left-hand side on top of intake manifold.

7: Right-Hand Injector Bank = 4x 2-pin connectors – the connectors are led in the correct orientation for cylinders 2, 4, 6 & 8.

8: Ignition Coil-Packs = 1x six pin connector.

9: Tacho. Signal = un-terminated wire - Connect this to your Tachometer, if fitted. This gives a standard 8-cylinder tachometer output.

Once you have fitted your ECU, mount the main relay and MAP sensor in a suitable location. Then make the following connections:

1: Fuel Pump 12V Feed = un-terminated Purple wire – this provides 12V direct to the fuel pump. Please note that we recommend the fitment of an inertia switch between this wire and the fuel pump.

2: 12V Ignition Live = un-terminated White wire – connect this to a suitable 12V Ignition Live.

3: ECU Multi-plug Connection = Connect to ECU. ¼” socket required.

4: 12V Battery Connection = Red wire with ring-type terminal – connect this to battery-positive lead.

5: Battery Earth Connection = Black wire with ring-type terminal – connect this to the battery-earth lead.

6: MAP Sensor Connection = 3-pin Connector, connect to MAP Sensor.

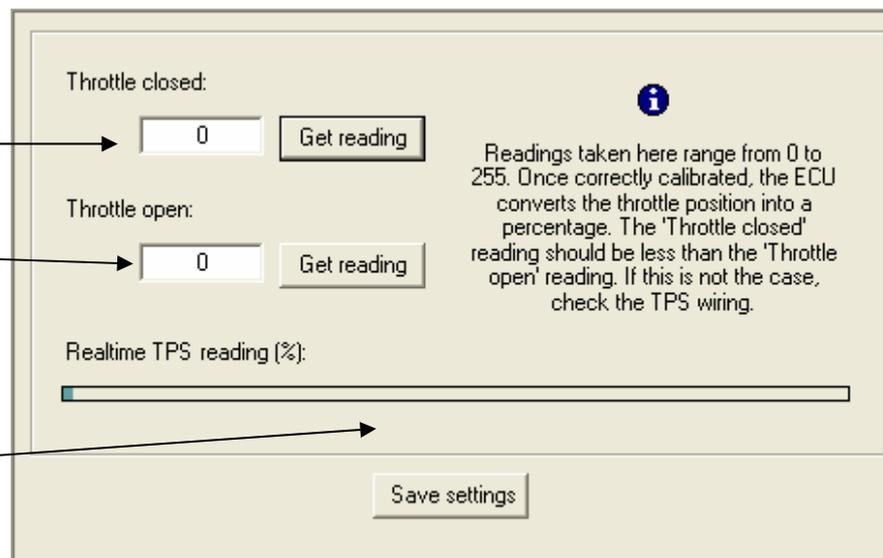
CONNECTING WITH THE ECU

1. Now the main installation is complete we must connect with the ECU using a basic lap-top or PC to set the static trigger wheel timing position and verify that all sensors are working correctly.
2. To install the software, insert the CD into your CD-ROM drive. The software installation process should begin automatically.
3. If the software does not load automatically Click on the **My Computer** icon on your desktop and right click the CD-ROM drive. Click **Browse** and double click the icon named **Setup** to start the installation process.
4. A message will appear when once the installation has completed successfully.
5. You can now start the Canems Injection Tuner software by double clicking on the Canems icon on your desktop or by accessing the **Start > Programs** menu.
6. Close the Canems injection tuner software and connect the supplied USB communication adaptor cable between the ECU and your Laptop.
7. Turn on the ignition and verify the ECU is receiving power by noting the power LED is illuminated on the front of the ECU casing.
8. Open the Canems Injection Tuner. The Canems software will automatically detect the ECU. Once the software has located the ECU communication is established. The ECU static timing settings can be set and fuel & ignition advance maps altered in real-time if required.
9. Check all gauges for realistic values for battery voltage, manifold pressure (MAP) / throttle position (TPS) if fitted.
10. Caution! Set static timing / trigger wheel position in the software as detailed overleaf before attempting to start engine!

CALIBRATING THE TPS

You must calibrate the TPS before attempting to start the engine. An incorrectly calibrated TPS can cause starting problems.

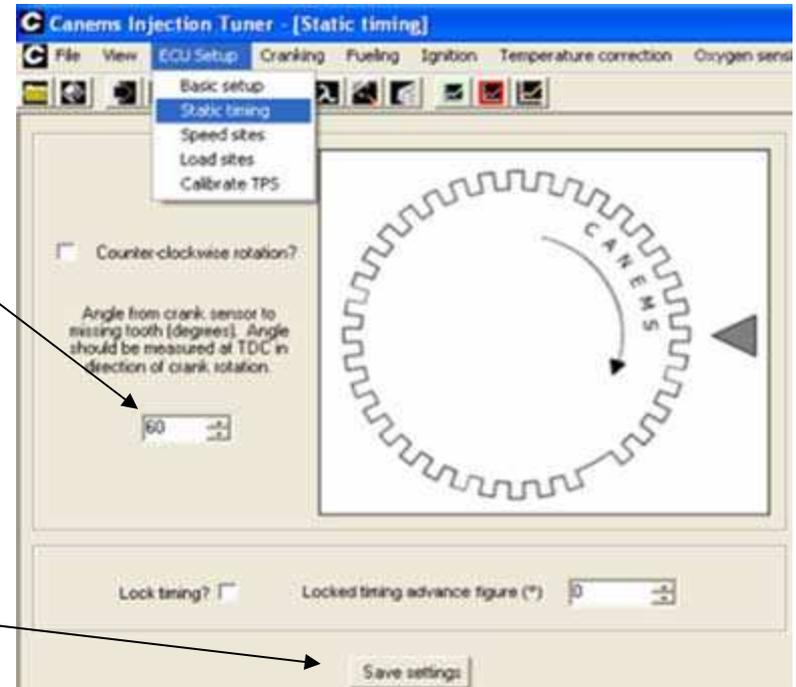
1. Connect with the Canems Injection Tuner software as detailed on the previous page.
2. Select **ECU setup > Calibrate TPS**.
3. With the throttle closed Click > **Get reading**.
4. With the throttle depressed (WOT) Click > **Get reading**.
5. Click **Save settings**.
6. Open and close the throttle several times and ensure that the Realtime TPS reading sweeps smoothly from 0-100%.



SETTING THE STATIC TIMING

It is important to set the static timing carefully before attempting to start the engine. Incorrect static timing can cause severe engine damage.

1. Rotate the engine until No.1 cylinder is at TDC as indicated by OEM timing marks. Check No.1 cylinder is at TDC very carefully with a long probe or screwdriver. Please do check the accuracy of damper rim TDC markings (we have seen them as far as 10 degrees out!)
2. Count the number of trigger wheel teeth between the Crank VR sensor to the missing tooth, in the direction of crankshaft rotation. In this example the missing tooth is 6 teeth or 60 degrees **after** the Crank VR sensor. This means the missing tooth passes the crank sensor 60 degrees before cylinder 1 is at TDC.
3. Connect with the ECU and Canems software as detailed on the previous page. Select **ECU Setup > Static timing**. Enter this angle into this box, Click **Save** settings and check that the on screen simulation matches your trigger wheel/ VR sensor positions.
4. In practice, even with careful measurement, the true trigger wheel position can be a few degrees out. We recommend you check the timing once the engine is running with a stroboscopic timing light. This procedure is described overleaf.



STARTING THE ENGINE

1. Check all wiring connections have been made correctly. Carefully check the order of the HT ignition leads and ensure each coil output is connected to the correct cylinder. Check that each of the 4 individual coil outputs line up with the correct pair of cylinders.
2. Re-connect battery.
3. Open the ECU software and connect to the ECU. Check that all gauges for air temp., coolant temp. and load are displaying realistic figures. The coolant temp. and air temp. are typically close to ambient from a totally cold start whilst the load would be expected to be around atmospheric pressure (typically 101kpa) with the ignition on but engine off.
4. Carry out the static timing check as described under '**SETTING THE STATIC TIMING**'
5. With the engine running it is recommended that you double-check the trigger-wheel/ crank-sensor alignment. Even with the most careful measurement, trigger-wheel alignment and therefore ignition timing can be a few degrees out. It is therefore advised that you check or get the ignition timing checked as soon as possible after installation.

This ECU has been supplied with a Base Map only, the Fuel Map and Idle settings will need to be checked and mapped by a knowledgeable tuner with a minimum of a wide-band AFR gauge.

- Full Load fuel mixtures should be in the range 11.8 – 13.0 AFR;

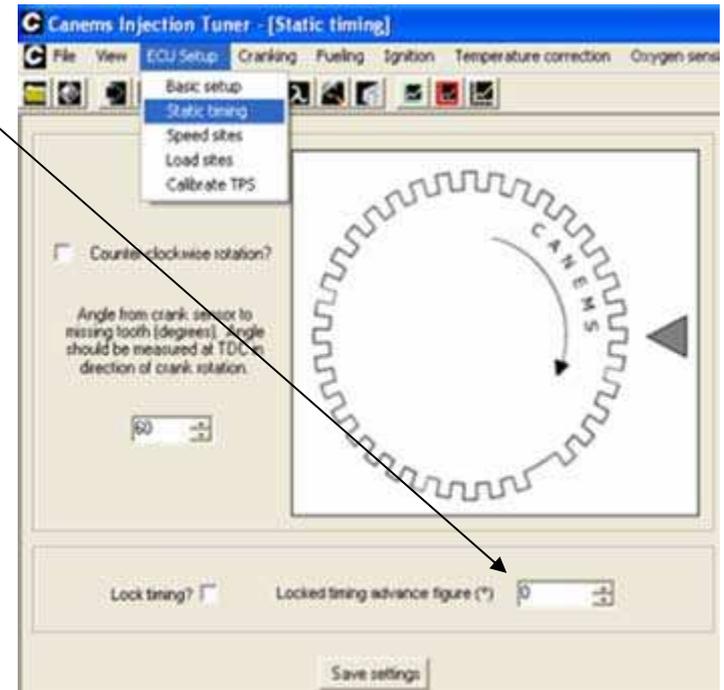
- Cruise mixtures should be in the range 13.5 – 15.5 AFR;

- Idle mixtures should be set for smoothest idle / highest vacuum, regardless of fuel mixture This depends upon state of tune but typically is around 12.5 – 13.5 AFR..

IGNITION TIMING CORRECTION PROCEDURE

It is very important you check the ignition timing carefully once the engine is started and running. Even with careful measurement the trigger wheel and therefore the ignition timing can be a few degrees out.

1. Lock the ignition timing at 10 degrees by selecting **ECU Setup > Static timing** and then tick **Lock timing**. Enter a figure of 10 degrees and click **Save settings**.
2. Attach strobe light inductive pickup to number one HT lead and run the engine at approximately 1200 rpm. The timing marks should align at 10 degrees BTDC when strobe is pointed at OEM timing marks.
3. If marks do not align make a clear note of the timing error. e.g. Stroboscopic timing light/ OEM timing marks on crank indicate 8 degrees BTDC but software locked at 10 degrees = 2 degrees error in the retarded direction.
4. Select **ECU Setup > Static timing** and then add or subtract the timing error from the static timing setting. E.g. Default static timing setting = 60 degrees from missing tooth to crank sensor with no1. cylinder at TDC. If we add two degrees and set the static timing at 62 degrees then this will compensate for the 2 degrees of trigger wheel misalignment.
5. Click **Save settings** and re-check step 2 to verify that the timing marks now align at 10 degrees BTDC.
6. Select **ECU Setup > Static timing** and un-tick the **Lock timing** selection to return ignition operation to normal. Click **Save settings**.



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