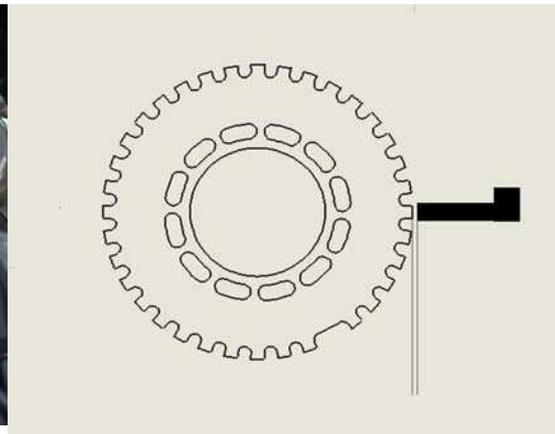
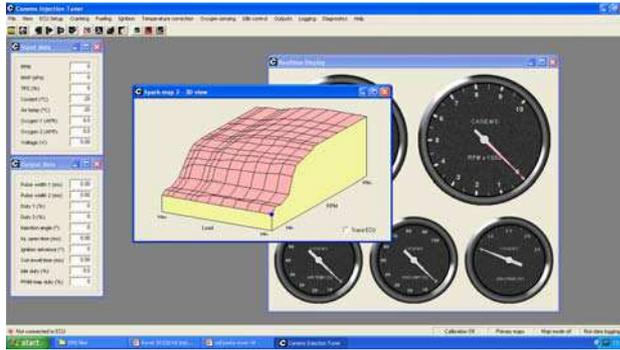


DIS ROVER V8 ENGINE MANAGEMENT KIT - INSTALLATION INSTRUCTIONS

Manual. 1.4 – Ignition Only with Custom Loom
Nathan J. Lloyd BA & Daniel R. Lloyd BEng - February 2010



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SPECIALIST DEVELOPMENTS

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INTRODUCTION

The Lloyd Specialist Developments DIS Rover V8 kit is the most cost-effective distributor-less ignition package available for the Rover V8, combining the outstanding Canems ECU with all other required components into a simple & affordable package.

Our engine management kits use brand new OEM-sourced components throughout to maintain or exceed OEM reliability and parts support.

This engine management system is designed to completely replace the entire OEM distributor-based ignition system, including the single coil. Our ignition system operates completely standalone of the original ignition, so the distributor ignition may be completely removed or retained as a complete second ignition backup.

Clear and concise instructions, as well as test procedures, are supplied with each and every kit.

A crank pulley trigger wheel and VR sensor, along with 2 coil packs, 8 ignition leads and ignition loom replace the original distributor unit, coil, and ignition leads. A MAP sensor (supplied) provides a load input for the ECU whilst the trigger wheel provides an accurate speed and crankshaft position reference.

3D ignition timing maps can be easily altered in real-time for optimum spark timing at ***all*** load/ rpm combinations to ensure maximum performance and efficiency. The crankshaft-triggered ignition results in much more accurate timing control whilst the wasted spark coil-packs provide vastly more ignition energy than the original distributor-based system. This wasted spark ignition has four independent coils mounted within 2 separate coil packs. Each coil fires 2 cylinders simultaneously, one cylinder on a firing stroke and the other on an exhaust stroke, when cylinder no. 1 is firing, cylinder no. 6 is on an exhaust stroke and visa versa.

Dual ignition map capability is included as standard with this Engine Management System. Essential for alternative fuels & LPG vehicles. Please specify when ordering whether this feature is required.

The logo for Lloyd Specialist Developments features the name 'Lloyd' in a large, elegant, cursive script. Below it, the words 'SPECIALIST DEVELOPMENTS' are written in a smaller, clean, sans-serif, all-caps font.

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KIT CONTENTS

Please check you have the following kit contents:

- CANEMS ECU
- CUSTOM WIRING LOOM INC. OEM WEATHERPROOF CONNECTORS
- TRIGGER WHEEL KIT (INCLUDING TRIGGER WHEEL, CRANK SENSOR & SENSOR BRACKET)
- 2X COIL-PACKS INC. 8 CUSTOM HT LEADS & STAINLESS FIXINGS
- 1X CUSTOM COIL-PACK BRACKET
- 1X LAPTOP COMS CABLE
- 1X TUNING SOFTWARE/ BASEMAP/ SETUP CD

FITTING THE TRIGGER WHEEL KIT

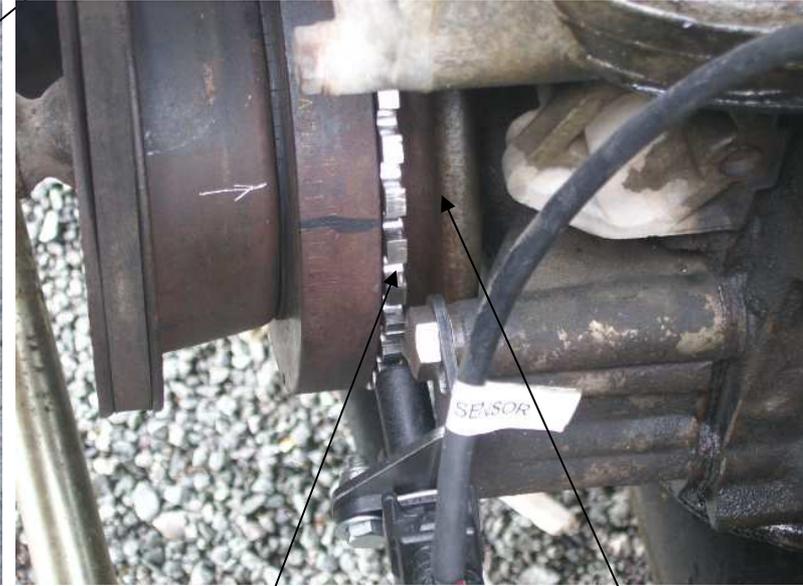
- The first job to tackle is the fitting of the trigger wheel. The majority of 3.5/3.9/4.2/4.6 and all TVR serpentine engines use a 6 hole trigger wheel and this is what we normally supply. However, if you find your engine has a 4 hole pulley we can exchange these for the 4 hole type at no extra cost.
- The trigger wheel is located on the original crankshaft front damper/ pulley using the existing bolt holes.
- The trigger wheel kit consists of a 36-1 toothed wheel, 1x crank sensor bracket and 1x crank sensor.
- The exact location of the trigger wheel on the front damper/ pulley is dependent on what type of damper/ front pulley you have fitted. There is a large amount of adjustment available on the crank sensor bracket to allow the trigger wheel to be fitted in a number of locations.
- Damper/ front pulley specific fitting guidance with pictures are given overleaf although exact methods of fitting can vary between applications.
- We often find a degree of misalignment between pulleys on serpentine belt engines, as found in many TVR and later Range Rover/ Discovery engines. In these cases it is often possible to fit the trigger wheel between the front damper assembly and removable drive pulley and correct this misalignment in the process. If this is not possible it will be necessary to modify the trigger wheel.

Please note that whatever method is used, it is necessary to ensure a good fit on the damper/ pulley assembly with a run-out not exceeding 0.25mm. The procedure for doing this is detailed overleaf.

FITTING THE TRIGGER WHEEL: TYPICAL INSTALL PRE-SERPENTINE ENGINES

Original dowel/ roll pin, note locating hole drilled in trigger wheel.

5/16 UNF bolt holes.



Crankshaft damper

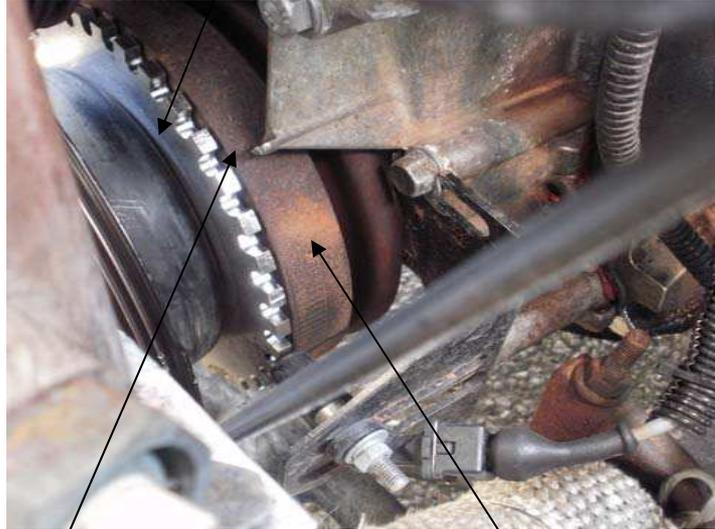
Trigger wheel

Balancing rim

Typical trigger wheel install: Pre Serpentine 3.5 depicted. The 36-1 Trigger wheel is mounted between crankshaft damper & balancing rim on original bolts.

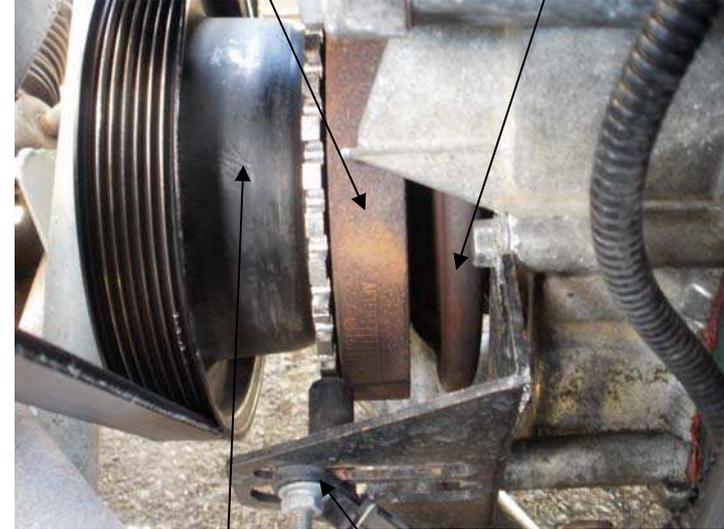
FITTING THE TRIGGER WHEEL: TYPICAL INSTALL SERPENTINE ENGINES

36-1 Trigger wheel mounted between crankshaft damper & pulley rim on original bolts.



OEM Timing pointer

OEM Timing marks on damper



Crankshaft damper

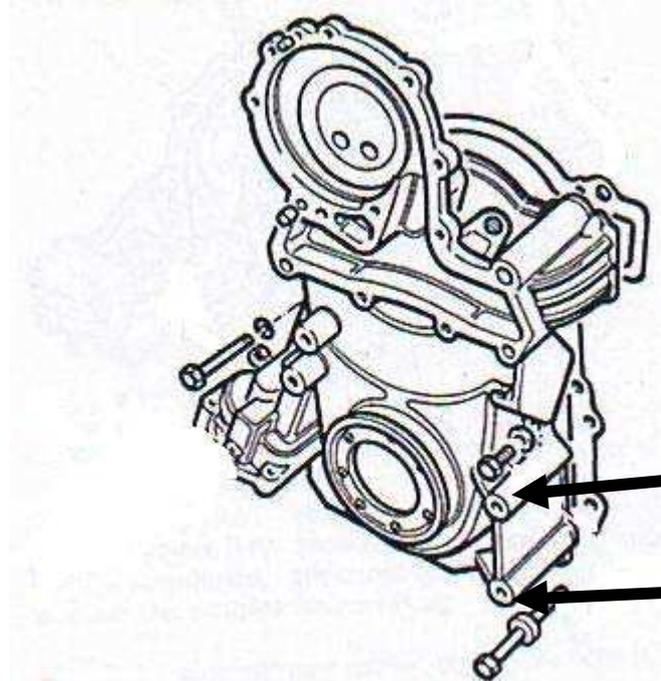
Crankshaft damper balancing rim

Pulley rim

Crankshaft position (VR) Sensor & bracket

Typical trigger wheel install: 1995 4.0 Rover V8 (Serpentine) depicted. Note trigger wheel installation between crankshaft damper and pulley rim. The trigger wheel fitment has effectively moved the pulley rim forward 2.5mm. We often find this *improves* belt alignment on Serpentine belt engines

CRANK SENSOR BRACKET LOCATION



**CRANK SENSOR
BRACKET MOUNTS
HERE WITH ORIGINAL
TIMING HOUSING
BOLTS**

Fig. 2: CRANK SENSOR BRACKET LOCATION

CLOCKWISE ROTATION

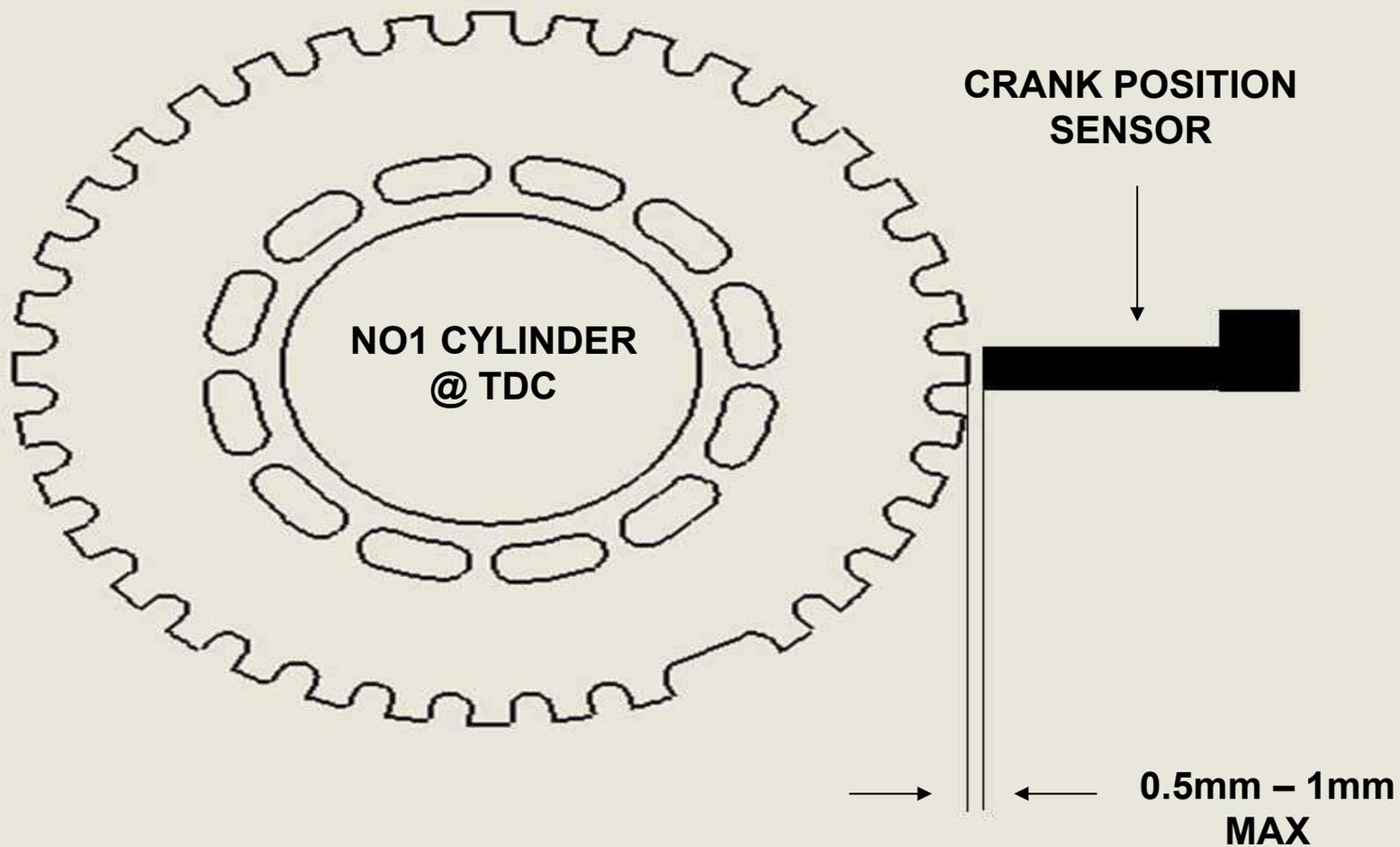


Fig. 3: TRIGGER WHEEL SETUP

**SET GAP 6 TEETH AFTER CRANK POSITION SENSOR
WITH ENGINE AT TDC**

FITTING THE TRIGGER WHEEL: RECOMMENDED LOCATION

LOCATIONS FOR TRIGGER WHEEL

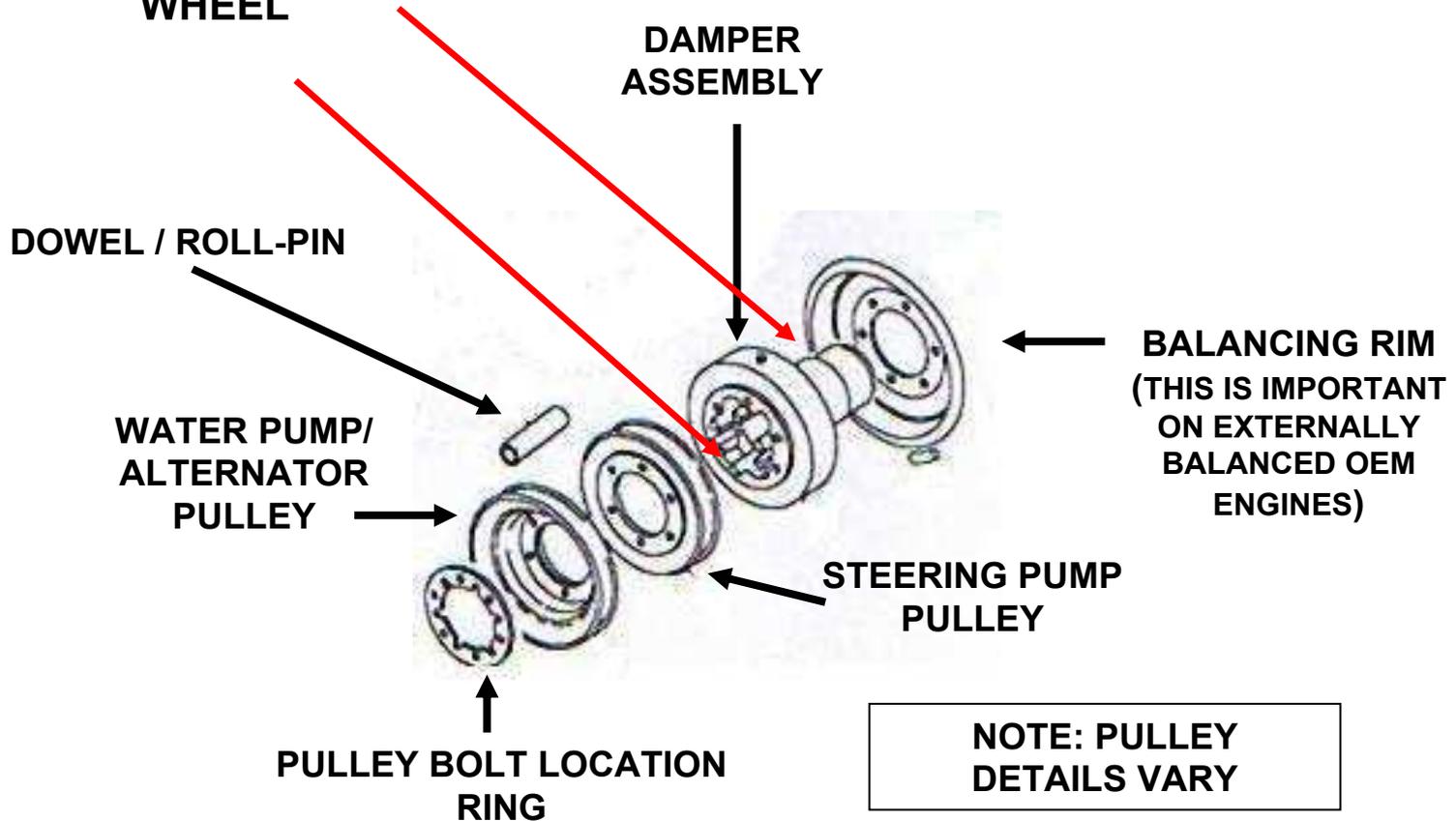


Fig. 1: POLYVEE BELT 6 HOLE DAMPER/ PULLEY ASSEMBLY

FITTING THE TRIGGER WHEEL: METHOD 1

1. Check the alignment of the ancillary drive belts, it is sometimes possible to fit the trigger wheel *between* the damper assembly and removable pulley. This method has the advantage of not having to remove the damper assembly itself from the engine. We often find this works on interim serpentine engines as fitted to later TVR models. **Caution:** Pulley alignment is critical: do not be tempted to locate here if pulley alignment is impaired as a result. Refer to method 2 overleaf.
2. Slacken the ancillary belt tension adjustment – remove ancillary belts.
3. Remove 6 x 5/16 UNF bolts fixing the pulley rims to the damper assembly & carefully remove pulley rims from the damper assembly.
4. Loosely fit crank sensor bracket & sensor on front timing housing bolts. See Fig. 2.
5. Rotate engine to TDC on number 1 cylinder as indicated by OEM timing marks. Check No1 cylinder *is* at TDC 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!)
6. Locate trigger wheel on central spigot on damper assembly ensuring the missing tooth is exactly 60 degrees or 6 teeth *after* the crank sensor centre point (clockwise rotation), Mark this position carefully with a scribe line and remove trigger wheel from damper. See Fig. 3.
7. Carefully mark and centre punch the trigger wheel where it contacts against the original dowel/ roll pin.
8. Double check dowel/ roll pin location and position of missing tooth on trigger wheel. Ensure the engine is still located at TDC on No1 cylinder. (See Fig.3)
9. Drill a small hole through the centre punched mark on the trigger wheel just large enough to clear the dowel/ roll pin located in the crankshaft damper assembly.
10. Locate trigger wheel on the central spigot on damper assembly ensuring the missing tooth is exactly 60 degrees or 6 teeth after the crank sensor centre point (clockwise rotation). The small hole should now locate on the dowel/ roll pin in the damper assembly.

11. Re-fit pulley rims over trigger wheel/ damper assembly and apply thread locking compound (e.g.: Loctite 572) before loosely fitting the 5/16 UNF bolts through the pulley rims/ trigger wheel/ damper assembly.
12. Rotate engine carefully whilst checking the clearance between the crank sensor and the edge of the trigger wheel teeth. The air gap between sensor and trigger teeth should be less than 0.5mm and run-out should not exceed 0.25mm. See Fig. 3.
13. Torque all 5/16 bolts to 28NM.
14. Double check the adjustment of the crank sensor and sensor bracket. The crank sensor centre point should align with the centre of the 6th tooth *after* the missing tooth. (See Fig. 3)

FITTING THE TRIGGER WHEEL: METHOD 2

1. With pre-serpentine engines it is often necessary to remove the complete crankshaft damper/pulley assembly.
2. Slacken the ancillary belt tension adjustment – remove ancillary belts.
3. With an assistant to stop crankshaft rotation (in gear, footbrake and handbrake applied), remove crankshaft pulley assembly retaining bolt. **Note:** this bolt is tight and will require a good fitting socket, short extension bar and an air impact wrench, or long breaker bar. If in doubt employ professional help.
4. With the pulley bolt removed the crankshaft damper assembly can usually be pulled off by hand or given a blow on the damper circumference with a soft mallet to remove it. Occasionally it is necessary to use a puller to remove stubborn damper assemblies.
5. Place crankshaft damper assembly on the bench/in a vice, taking care not to damage seal surface or pulley rims. Remove the small round steel seal guard from the rear of the damper assembly by carefully prying it off with two screwdrivers / pry bars.
6. Remove the 6x 5/16 UNF nuts & bolts fixing the pulley rims to the damper assembly. Carefully remove the pulley rims and place to one side.
7. Remove the Crankshaft damper balancing rim from the rear of the crankshaft damper. Place trigger wheel on damper where the balancing rim was originally located and temporarily locate with 5/16 UNF nuts and bolts. Note that the trigger wheel will not sit flat against the damper yet due to a small dowel / roll pin.
8. Rotate engine to TDC on number 1 cylinder as indicated by OEM timing marks. Check No1 cylinder is at TDC 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!)
9. Loosely fit crank sensor bracket & sensor on front timing housing bolts. See Fig. 2.

10. Carefully trial-fit the damper/ trigger wheel/ balancing rim assembly on the crankshaft and adjust the trigger wheel position until the missing tooth on the trigger wheel is exactly 60 degrees or 6 teeth after the crank sensor centre point (clockwise rotation), Mark this position carefully with an accurate scribe line. See fig. 3.
11. Check that the engine is still positioned at TDC on No.1 cylinder and that the missing tooth is positioned 6 teeth after the crank sensor as in fig. 3. Check all scribe lines are correct.
12. Remove damper assembly and place on bench/ in vice.
13. Locate trigger wheel on rear of damper assembly ensuring scribe marks made in step 10 align and the trigger wheel is the same way around as when it was trial fitted (not back to front!). Carefully mark and centre punch the trigger wheel where it contacts against the original dowel/ roll pin.
13. Double check dowel/ roll pin location and position of missing tooth on trigger wheel. Ensure the engine is still located at TDC on No1 cylinder. (See fig.3)
14. Drill a small hole through the centre punched mark on the trigger wheel just large enough to clear the dowel/ roll pin located in the crankshaft damper assembly.
15. Locate trigger wheel on rear of damper assembly ensuring that it locates cleanly on the dowel/ roll pin in the damper assembly. Refit balancing rim on rear of damper, the front pulley rims and six 5/16 UNF bolts. Do not refit the small round steel seal guard (it can come loose causing damage).
16. Torque all 5/16 bolts to 28NM.
17. Carefully refit crankshaft damper assembly to crankshaft, check position of missing tooth/ crank sensor before refitting main pulley/ damper assembly bolt. Torque to 280NM.
18. Double check the adjustment of the crank sensor and sensor bracket. Rotate engine carefully whilst checking the clearance between the crank sensor and the edge of the trigger wheel teeth. The air gap between sensor and trigger teeth should be less than 0.5mm and run-out should not exceed 0.25mm. See Fig. 3.
19. Refit ancillary belts and tension.

FITTING THE COIL-PACKS

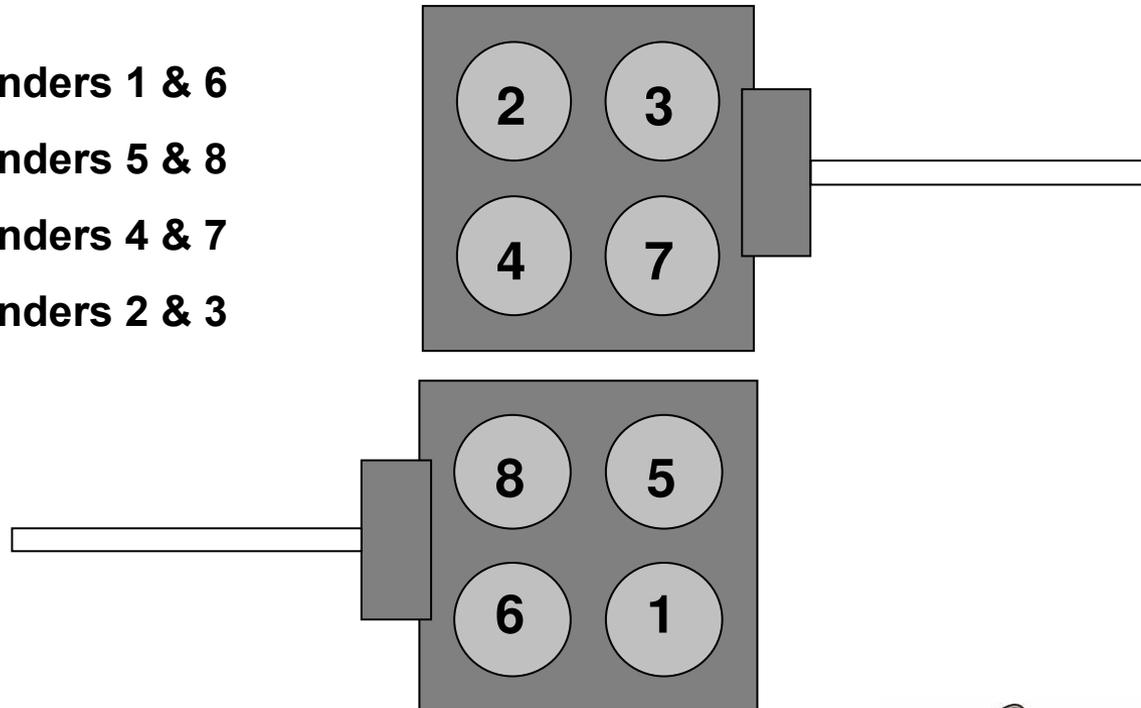
1. Remove distributor leads. Remove single coil and wiring making a note of the connections. Identify the 12v ignition feed to the coil + connection. Label this "ignition 12v+". The standard tachometer wire is often connected to the coil - connection. Locate the tachometer to coil connection and label this "tacho".
2. Bolt the two coil-packs to the coil-pack bracket using the stainless fixings provided.
3. Offer up coil-pack bracket noting the two existing bolts that line up with the holes in the bracket, remove these bolts.
4. Locate coil-packs/ bracket with the original bolts and tighten to 28NM.
5. Fit the weatherproof HT leads provided in the order shown below.

Spark output A = cylinders 1 & 6

Spark output B = cylinders 5 & 8

Spark output C = cylinders 4 & 7

Spark output D = cylinders 2 & 3



FRONT OF ENGINE

MAP SENSOR

1. Locate the MAP sensor using two suitable bolts or self-tapping screws. This sensor requires a 4mm vacuum tapping in the intake manifold, the engine side of the throttle plate/ plates.
2. Plug the vacuum hose onto the 4mm diameter hose fitting on the MAP sensor itself.
3. Fuel injection models: 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.
4. Carburettor models: Fit the MAP sensor 4mm tubing to a suitable vacuum take-off on the intake manifold.
Note: The vacuum connection must be located the engine side of the throttle plates to create vacuum when the throttle is shut, and vacuum drop as the throttle opens.

Note: Many carburettors have a ported vacuum connection located near the throttle plate for the original distributor vacuum advance connection. These are unsuitable for MAP sensor connection as it relies on a constant reference to intake manifold pressure. Make a connection directly into a manifold plenum/ runner instead.

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 front 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.
2. The widest connector is located on the ECU end of the loom. If you are planning on mounting the ECU inside the vehicle, 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 ignition loom into place. If mounting the ECU inside the vehicle, the smaller engine bay connectors and loom are fed through a suitable grommet & hole in the bulkhead/ firewall on the L/H side. The loom is then fed along the engine valley / intake alongside the OEM engine loom. All connectors are plugged into their respective positions beginning with the crank position sensor (VR), coil-pack connectors, ignition 12v connector, single spade connector to connect with the OEM coil-driven tachometer and three pin MAP sensor connector.
4. Check correct connections have been made to the following components:

A: Crank Sensor (VR) = Two pin junior timer plug on fully screened cable.

B: Coil packs = 2x Three pin weatherproof connectors labelled COIL 1 & COIL 2 (Note: Coil-pack 1 fires cylinders 1 & 6 and 5 & 8. Coil-pack 2 fires cylinders 4 & 7 and 2 & 3.

C: Tachometer wire = White 1.0mm wire with spade connector, plugs into original OEM single coil tachometer input - wire usually white/black or white/blue connection to tacho.

D: Ignition live = Connect ignition live connection from ignition loom to 12vdc ignition live source: e.g. original coil + 12v ignition feed. Usually white wire.

E: MAP Sensor = Three pin junior timer plug from ignition loom to MAP Sensor.

MOUNTING THE ECU

1. Identify a suitable location for your ECU, giving consideration to wiring lengths. This Canems ECU is IP67 weatherproof making it suitable for under bonnet mounting in off-road applications although many prefer to mount inside the vehicle.
2. There are two ceramic heat-sinks mounted on the base of the waterproof ECU casing to enable the high power coil drivers to dissipate heat from within a sealed casing. Mount the ECU on a suitably flat metal surface.
3. Place ECU in chosen position and plug in the pigtail harness and connector to the ECU. The standard custom Rover V8 loom we supply in this kit is 4 metres. This is more than enough wire supplied for most standard applications although we can supply a longer harness if necessary.
4. If a flat location is not available then a heatsink mounting platform can be constructed from a flat piece of aluminium plate and the ECU mounted to this.

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 coil/ leads as illustrated in fig. 4. Note that the 4 individual coil outputs line up with the pair of cylinders that coil output controls.
2. Unplug both coil pack connectors
3. Re-connect battery.
4. Switch on ignition and check the status of the twin colour ECU status LED on the front of the ignition ECU, the LED should light up red. This indicates that the ECU has a 12v power supply and is awaiting a crankshaft signal.
5. Crank the engine over on the starter motor, the status LED should turn green when the engine is rotating indicating the ECU has detected a crank reference signal. It is normal for the LED to occasionally oscillate between red and green whilst cranking. If the LED does not change to green refer to troubleshooting section.
6. Turn off ignition. Re-connect coil pack connectors.
7. Attempt to start engine: engine should start within a few rotations, if the engine does not fire or only coughs or backfires – stop cranking engine immediately and refer to troubleshooting section.
8. With the engine running it is recommended that you can 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. There are mechanical and/ or software methods for checking and correcting ignition timing. The first method can be used temporarily if a laptop is not available.

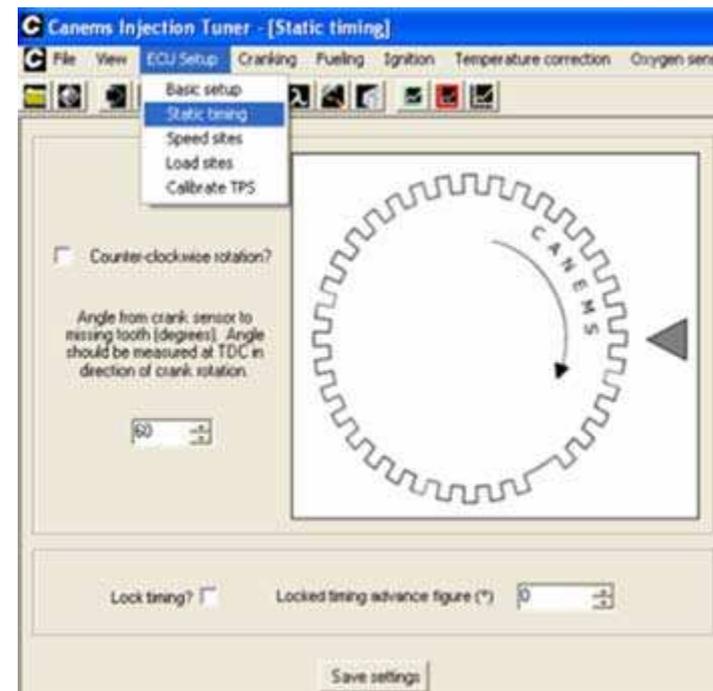
STATIC TIMING CORRECTION PROCEDURE

1. The mechanical method of checking the timing involves connecting a stroboscopic timing light to no.1 cylinder.
2. Start the engine and set idle to approx 800 rpm (+ or - 50 rpm) and make a note of the ignition timing as indicated by the timing light.
3. Ignition timing should match the idle advance figure of ____ degrees BTDC. Adjust trigger wheel rotation to advance/ retard timing or refer to the simple software correction procedure overleaf.
4. Note: This check assumes that there are no vacuum leaks and the MAP sensor is connected correctly. Faulty MAP readings can alter the base idle timing.

STATIC TIMING CORRECTION PROCEDURE

A V8 owner needs to verify the static timing figure. By measuring the angle from the crank sensor to the missing tooth, the owner has already set the static timing at 60 degrees as indicated in the main install instructions. The engine has started and is running with this static timing figure, so we know the timing isn't far 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**.



FORD TYPE VR CRANK POSITION SENSOR

PIN 1 = VR / CRANK POSITION SIGNAL + (CHECK FOR CONTINUITY WITH PIN 3D ON ECU)

PIN 2 = VR / CRANK POSITION EARTH - (CHECK FOR CONTINUITY WITH PIN 3C / GROUND)

TWO PIN JUNIOR TIMER VIEWED AS UNPLUGGED FROM SENSOR AND FACING YOU.

