Gunson

SUPASTROBE PROFESSIONAL

Advance Timing Light

PART NO G4123

HANDBOOK

SUPASTROBE PROFESSIONAL

Advance Timing Light

INDEX

1. Precautions

Using this timing light necessarily involves working under the bonnet while the engine is running. This is a potentially hazardous situation, and the user should take every precaution to avoid any possibility of injury. The following guidance should always be followed:

Never wear loose clothing, particularly ties, long sleeves etc that can catch in moving engine parts, and always tie-up or cover long hair.

Ensure that the car is on firm level ground, and is out of gear and the handbrake firmly applied at all times.

If for any reason the car is jacked up or the wheels removed, always ensure that the car is well supported, and never rely on a car jack alone, always use ramps or axle stands. Be wary of axle stands and jacks sinking into soft ground, and remember that asphalt surfaces may appear firm, but may give way under the concentrated load of a jack or axle stand.

Do as much of the work as possible with the engine not running.

Always route cables well away from hot or moving parts, (particularly the exhaust pipe and cooling fan) and check that cables are in a safe position before starting the engine.

Always guard against getting the timing light or fingers too close to moving, hot or electrical parts. Be especially wary of the fan, fanbelt, fanbelt pulley, exhaust manifold, exhaust pipe, and HT parts of the ignition system. Remember that thermostatically controlled fans may suddenly start with no warning.

Take care to avoid placing metal tools where they may cause an electrical short, such as near the car battery.

Take care not to place tools etc where they may be dislodged by engine vibration.

Treat High Tension components with respect, remembering that electrical shocks can cause involuntary movement which may result in secondary injury. Remember that sparks can jump quite a distance. Also remember that severe unexpected HT shocks can be received from old, worn, damaged or wet components (eg HT leads, coil, distributor).

Keep all sensitive electronic equipment away from HT voltages, and do not make any electrical connection to HT voltages except as expressly advised by the makers of the electronic equipment.

Remember that Low Tension Voltage, present on the LT terminal of the ignition coil and at the contact breakers, can also give quite an electrical shock.

Never ever attempt to use automotive diagnostic equipment intended for 12v applications on domestic AC mains 240V supplies.

Make all electrical connections with power off, so as to avoid the possibility of electrical sparks, which can ignite fuel vapour or inflammable battery gas emissions.

Take care not to inhale exhaust gas. Never run the engine inside a garage or in a confined space. When running the engine, always ensure that there is adequate circulation of fresh air. Ensure that there are no leaks in the exhaust system near where you are working.

Keep children and pets away from the car while work is being carried out.

2. What is ignition timing?

Petrol engines operate on the principle of using a spark plug to ignite a compressed mixture of petrol and air in the cylinders of the engine. In practice, each spark plug fires slightly before a piston has reached the top of its compression stroke. This is so that the petrol/air mixture has time to fully ignite before the commencement of the power stroke. The faster that the engine is rotating, the greater is the angle before top dead centre (BTDC) that the spark plug has to fire.

Besides engine speed, the optimum timing of the spark depends on other factors, including the degree of suction in the inlet manifold (manifold vacuum), and whether leaded or unleaded petrol is being used.

If the ignition timing of the engine is not correct, then either the performance or the economy of the engine will suffer, or both, and the engine exhaust will be high in hydrocarbons (HC), to a degree that might cause the vehicle to fail statutory exhaust emissions tests.

Car manufacturers vary in the amount of service data on ignition timing that they make available information on the user. They also vary on the facilities that they provide on the engine to enable the timing to be measured, and also on the facilities that they provide on the engine to enable the timing to be set or adjusted.

In some modern engines, no service data is provided, and no method is provided for measuring or adjusting the ignition timing.

However, many manufacturers continue to provide data on ignition timing, and provide timing marks on the engine to enable the timing to be measured using a timing light, and provide some means by which the timing can be adjusted.

Usually, the data is provided at a particular engine idle RPM (the handbook usually also states whether the vacuum pipe should be connected or disconnected). This is generally referred to as "STATIC" timing. There are often corresponding timing marks on the fanbelt pulley or engine flywheel ("STATIC timing marks"), and the STATIC timing can be adjusted by rotating the distributor in its housing.

Such ignition systems are designed so that if the user sets the "static" timing correctly, then the automatic advance mechanisms will take over and ensure that the ignition timing correctly adjusts to other driving conditions.

Manufacturers also commonly provide a Top Dead Centre (TDC) mark in addition to a "static" timing mark. Some manufacturers provide a TDC mark and no "static" timing mark.

Perversely, car manufacturers usually provide no timing marks for engine speeds other than idle, even though timing data may be given for other speeds the workshop manual. It is in such situations that Supastrobe Professional is very useful, since it can be used to measure the degrees of advance of ignition timing with respect to static timing, or TDC (or with respect to any other timing marks), and hence can be used to check service data where no suitable timing marks are provided on the fanbelt pulley or flywheel.

3. What is an advance timing light?

Before describing an advance timing light, it might be useful to describe the principle of operation of an ordinary (non-advance) timing light.

A timing light is a device that works on the stroboscopic principle. That is, a rotating part of an engine is made to appear stationary by being illuminated by a brief flash of light which occurs once per revolution (or multiples of a revolution), at the same rate that the engine is rotating.

The particular part of the engine that is made to appear to be stationary when using a timing light is a timing mark (or marks) that the car manufacturer has put on some rotating part of the engine, such as the fanbelt pulley or the engine flywheel. There is also always a fixed mark on the engine, close by where the moving mark passes, which is used as a reference position for the moving mark.

A timing light takes its cue from the spark plug of No l cylinder, and flashes each time that spark plug fires. A non-advance timing light fires at exactly the same instant that the spark plug fires.

The timing mark on the rotating part of the engine therefore appears to be stationary in exactly the position it has at the time of the spark to No l cylinder spark plug. From the apparent position of the moving mark in relation to the fixed mark the timing of the engine can be determined.

For example, if the rotating mark represents 8∞ BTDC, and appears to be exactly opposite the fixed reference mark, then the ignition timing is 8∞ BTDC.

This is fine if all the user wishes to do is check that the timing is 8∞BTDC. However, maybe the moving mark is not exactly opposite the fixed mark, and the user still wishes to know what the timing is. Maybe he wishes to set the timing to some value for which there is no timing mark. Or maybe he wishes to check the timing at higher RPM, for which the car manufacturer has provided data in the handbook, but has not provided timing marks on the fanbelt pulley. For these jobs a simple non-advance timing light is not adequate, and the user needs an advance timing light.

An advance timing light includes electronic circuitry which can apply a small but precise delay between the time the spark plug fires, and the time that the timing light flashes. Delaying the flash of the timing light has the same effect on the apparent position of the timing marks as advancing the ignition timing by the same amount. This can be seen to be true by considering that, if two timing marks are brought into conjunction by delaying the timing light flash, then the actual spark from the spark plug must have occurred some time earlier.

In Supastrobe professional, the time of the flash is controlled by the Advance Knob on the rear control panel of the instrument. Rotating this knob fully anticlockwise applies no delay to the flash, and Supastrobe Professional behaves as an ordinary, non-advance timing light. (the display shows 00.00).

However, rotating the knob clockwise causes the flash of the timing light to be delayed by the angle shown on the display, that is, the angle shown on the display needs to be added to whatever advance angle is being indicated by the timing marks on the engine.

To illustrate this by an example, consider the example mentioned above, of a "static" timing mark on a fanbelt pulley representing 8∞BTDC. Using Supastrobe Professional, this mark would still represent 8∞BTDC if the display on the timing light was 00.00, but it would represent 28∞BTDC if the knob was rotated to show 20.00 on the display.

The use of this timing light is particularly simple where the engine timing marks have an indication for top dead centre (TDC), which many engines have. Using the TDC marks, the ignition timing is simply as shown on the rear panel display of Supastrobe Professional. For example, if the TDC mark is opposite the fixed mark when the display shows 00.00, then the timing is TDC, if the display shows 08.00 then the ignition timing is 8∞BTDC, if the display shows 20.00, then the ignition timing is 20∞BTDC.

NOTE 1: In practice, the display can never quite reach 00.00, the lowest reading being typically 00.20.

NOTE 2: Superstrobe Professional can not apply a retardation to timing marks (ie it can not be used to set timing After Top Dead Centre (ATDC), where the timing marks are TDC or BTDC), since this would imply causing the timing light to flash before it received the signal from the spark plug, but there are other ways round this problem, as described later, should it ever be needed.

4. Product description

Supastrobe Professional is of robust construction, and is intended for heavy duty applications where it may be subjected to regular or continuous use. It comprises the following main parts:

1. BODY

A metal die cast body, with a sturdy handgrip and trigger, and with a soft rubber nose cone which minimises the danger to the timing light or car from inadvertent contact with moving parts such as the fan, fan belt or pulley.

2. TRIGGER

Before the trigger is depressed, the instrument operates as a dwellmeter, voltmeter, or rpm counter, depending on the mode of operation selected (see Mode Switch below).

When the trigger is depressed, the instrument operates as a timing light and displays the Advance Angle as set by the ADVANCE ADJUSTMENT KNOB, irrespective of the mode selected at the Mode Button.

3. LAMP/LENS

A Xenon discharge lamp of very high energy output is provided, combined with a lens which gives a wide beam of brilliant white light, enabling the timing marks to be readily seen even under conditions of high ambient light. Should the lamp ever need replacing, spares can be obtained from Gunson Ltd, or the timing light can be returned to Gunson for service.

4. LEAD/PICKUP SET

A plug-in lead and pick-up set is provided which is detachable for safe keeping, and for ease of replacement should it become damaged (damage may be caused by inadvertent contact of the leads and plastic parts with hot exhaust pipes, and fracture of the ferrite by dropping or crushing). Replacement lead kits are available from Gunson or through your normal supplier.

The leads/pickups comprise:

RED and BLACK clips for connecting to the car battery.

RED INDUCTIVE PICKUP, for clipping over the spark plug lead of No1 cylinder, for detecting the instant of firing of the spark plug, and also for the measurement of engine RPM. Note that the body of the pickup shows an arrow sign, and the pickup should be attached with this arrow pointing along the HT lead towards the spark plug (connecting it the other way round may result in reduced pickup sensitivity).

GREEN clip for use depending on the mode of use of the instrument, either or connecting to the coil primary for measuring DWELL, or as a probe for measuring VOLTS.

5. MODE BUTTON

This is a touch-sensitive area of the control panel at the rear of the instrument, indicated by "MODE".

Repeated depression of the MODE button causes the instrument to step through its various modes of its operation. Small LED lamps indicate on the display panel which mode is currently selected.

Note that pressing the TRIGGER of the timing light causes the ADVANCE ANGLE mode to be selected irrespective of the mode selected by the MODE button.

The modes of operation of the instrument are as follows:

DWELL METER (indicated on the control panel by 100%). In this mode, the instrument measures ignition DWELL % (ie the percentage of time that current is flowing in the ignition coil). For this function to operate, the GREEN clip needs to be connected to the appropriate terminal of the ignition coil.

VOLT METER (indicated on the control panel by 0-16V). In this mode the instrument measures the voltage between the GREEN clip and the BLACK clip. The GREEN clip ceases to be a DWELL pickup, and becomes a VOLTAGE probe.

TACHOMETER (indicated on the control panel by /MIN). In this mode, the instrument measures the Revolutions Per Minute (RPM) of the engine. For this mode to operate, the INDUCTIVE PICKUP needs to be connected to the lead of a spark plug. This mode assumes a one spark per cylinder every alternate engine revolution. This mode is therefore suitable for all "conventional" engines, (ie engines operating on the 4-stroke cycle, and not having a "wasted spark" ignition system).

TACHOMETER (indicated on the control panel by /MIN, the display flashing). As above, but the flashing display indicates that the instrument is assuming one spark per cylinder each engine revolution. This mode is therefore suitable for engines that operate on the 2-stroke cycle, or 4-stroke engines that have a "wasted spark" ignition system.

6. ADVANCE ADJUSTMENT KNOB.

This knob is situated on the control panel at the rear of the instrument. It sets the advance angle, which is shown on the display panel whenever the trigger of the timing light is depressed.

7. DISPLAY

A 4 digit display, reading up to 99.99, or 9999. ***decimal point flashing depending on 2s/4s/ws/

5. Instructions for use

5.1 Ignition Timing

1) **Ensure that relevant prior service has been carried out on the car. For instance, for contact breaker ignition systems, ensure that the points dwell has been correctly set, since adjusting the points can affect ignition timing.**

2) **Obtain the correct technical ignition timing data for the vehicle from the vehicle's workshop manual. In particular, note at what engine RPM the timing should be checked, and check whether vacuum pipe should be left connected or disconnected. Also from the workshop manual, find where to look for the timing marks (usually on the fanbelt pulley or on the engine flywheel), and what the timing marks mean, ie whether there is a timing mark for Top Dead Centre (TDC), (this is often indicated by a "0" or "V"), and whether there are other marks, and what angles these marks represent.**

3) **Find the timing marks on the engine of the vehicle. Preferably, highlight the marks using white paint (typing correction fluid is ideal).**

4) **Bring the car to its correct operating temperature. Ensure that the car is out of gear, and the handbrake firmly applied.**

5) **If the handbook says that the vacuum pipe between the carburettor and the distributor should be disconnected, then disconnect it at one end, taking care that the loose pipe is not near hot or rotating machinery. If disconnecting the pipe causes the engine to falter, then it may be necessary to block the open end of pipe.**

6) **With the engine of the car switched off, make the connections of Superstrobe Professional to the car, ie:**

Connect the RED lead to the battery positive terminal (+),
Connect the BLACK lead to the battery negative terminal (-),

Attach the INDUCTIVE PICK-UP to the plug lead of No1 Cylinder, with the arrow on the pick-up pointing towards the spark plug. Preferably choose a loop of plug lead that is well separated from other leads, so as to minimise possible interference from nearby HT cables. Note that No1 cylinder is the front one of the engine (ie at the fan belt end), unless otherwise stated in the workshop manual.

Take care to not let any leads or clips come into contact with hot or moving components of the engine, and similarly route all leads well clear of hot or moving parts.

7) **Start the engine and set the engine speed to the correct RPM as recommended in the workshop manual. Check the speed setting with Supastrobe Professional, (See xx below).**

8) **Ensure that, if the engine is 4-stroke wasted spark, or 2-stroke, that the mode switch is set so that the display is flashing.**

9) Rotate the **ADVANCE CONTROL KNOB** fully anticlockwise. Press the trigger; the light should start to flash and the display should read 00.00. Direct the timing light at the timing marks of the engine (taking care not to touch any rotating parts with the timing light). Rotate the advance control knob slowly clockwise until a moving timing mark comes in line with the fixed mark. If the marks that are in line represent Top Dead Centre (TDC), then the ignition timing of the car is the number of degrees shown on the display. for instance if the display reads 08.00, then the timing is 8∞ BTDC. If the timing marks represent some other timing advance angle, then add this to the angle shown on the display. For instance, if the timing marks represent 8∞BTDC and the display shows 00.00, the ignition advance is 8∞BTDC; if the display shows 02.00, the timing is 10∞BTDC, etc.

FURTHER NOTES:

1) **6 AND 24 VOLT VEHICLES:** a separate 12 volt battery should be used to power the instrument.

2) **MAGNETO IGNITION SYSTEMS:** Operation should be satisfactory, but see below.

3) **UNSTEADY READING:** If the illuminated moving mark is not steady, but jumps around, then this indicates that the inductive pick-up is not detecting a clean indication of the ignition spark. Either it is missing sparks, or detecting extra ones. Check that the inductive pick-up is not broken and is correctly attached. Try moving the pick-up to a different position on the HT lead. Ensure that the HT leads are well separated so that one lead is not picking up a signal from an adjacent lead. Check for faults in the vehicle's ignition system. Check the plug gap. This problem is more likely to be encountered on engines in which the electrical polarity of the spark alternates, ie a (+) spark followed by a (-) spark, etc. In this case, increase the spark plug gap slightly to cause a stronger signal.

4) **RETARDED IGNITION:** One relatively common problem is that an engine has only a mark for static timing, but the user needs to set more retarded timing than this for use with unleaded petrol.

A similar problem is where the user has only a static timing mark, but the data for higher RPM is with reference to TDC, and the user wishes to avoid continual mental arithmetic in making the conversion (ie adding the static timing to the measured timing).

The solution to these problems is to paint a TDC mark onto the fanbelt pulley or flywheel (using white paint or typing correction fluid), or on the casing of the engine, using a protractor scale as a guide, and use this TDC mark as a reference in further timing measurement. A suitable card protractor scale is available from Gunson Ltd, and may be included with this timing light.

SOME USEFUL DIAGNOSTIC TESTS USING A TIMING LIGHT

1) **TESTING CENTRIFUGAL ADVANCE MECHANISM**

This mechanism should cause the ignition timing to advance with increase in engine speed. The instructions are as follows:

Remove vacuum advance/retard connections.

Observe the timing marks with the engine running at idle.

Gradually increase the engine speed. The timing mark should remain aligned initially, and then begin to move in the opposite direction to the pulley/flywheel rotation, and then stop. (Centrifugal advance usually begins between 500 & 1500 R.P.M. and ends between 4500 & 5500 RPM).

If excessive ignition advance with increase in RPM is observed, the cause is usually due to wear or broken advance springs.

If the ignition advance is too low, the cause is usually sticking or wear at the pivot point of the rotating weights.

2) TESTING VACUUM ADVANCE

Re-connect vacuum advance connection only.

Observe the timing marks with the engine running at idle.

Gradually increase the engine speed. Vacuum advance should operate smoothly from around 1000 RPM, reaching a maximum at about 2500 RPM.

This increase in ignition advance will be in addition to that due to the centrifugal advance.

Note that if the throttle is opened rapidly the vacuum advance will operate and return quickly as use of the throttle affects the vacuum).

If vacuum advance is operating at idle this may well be due to incorrect carburettor setting on Solex/Weber carburettors which have both throttle "bypass" and "throttle stop" adjustment; or this may be due to incorrect air balance on twin carburettors.

If the vacuum advance is too low, the cause is usually due to sticking contact breaker base plate, punctured diaphragm or blocked vacuum pipe.

If the vacuum advance is too high, the cause may be due to incorrect carburettor adjustment.

Note that some distributors are adjustable for vacuum advance (examine the area around the vacuum advance or retard operating rod).

3) TESTING VACUUM RETARD

This feature may be fitted for emission control, and only operates at idle and during deceleration.

Observe the timing mark with the engine running at idle.

Re-connect the vacuum retard connection.

Observe the difference in timing. The timing mark should move in the same direction as pulley/flywheel rotation.

4) DETECTION OF DISTRIBUTOR WEAR OR INACCURACY

Most engines are timed on No 1 cylinder, but other cylinders (No 4 on a 4 cylinder engine) should also fire when the timing marks are aligned. By connecting to the opposite lead to No 1 on the distributor cap the difference can be checked.

Alternatively connection can be made to the king lead (the input HT lead to the distributor) which will give flashes as each cylinder fires. The difference between various cylinders can then be observed.

These methods can also be used to synchronise double points - stop the engine and adjust the

position of the moveable points with the engine stationary, until the timing is consistent on appropriate cylinders.

To check other cylinders (2 & 3 on 4 cylinder engines) accurate marking of the pulley at 180∞ is required.

A regular error (of more than 2-3 degrees) in the ignition timing between separate cylinders indicates distributor cam error or wear, bent or worn distributor shaft or large error in points setting.

Erratic errors in ignition timing on all cylinders indicates wear in distributor drive, shaft or points base plate. A very erratic idle speed or pitted contact breaker points will also cause ignition timing "scatter".

5) EFFECTS OF INCORRECT IGNITION TIMING

Ignition that is too advanced may cause audible "pinking" or detonation and engine damage, and also causes increased emission of hydrocarbons (HC) inthe vehicle's exhaust. Ignition is too retarded causes engine overheating, poor economy and performance,and burnt exhaust valves.

5.2 Tachometer (Rpm)

1) Connect Supastrobe Professional as described above (1e).

2) Set the mode control button to indicate **RPM** (this is indicated on the display as /MIN). For a 4-stroke, non-wasted spark engine (the most common type of engine), ensure that the display is not flashing. For a 2-stroke engine, or a 4-stroke engine with wasted spark (eg certain small Ford and Peugeot engines), press the Mode Control Button one more time so that **RPM** is indicated, but the display is flashing.

3) Start the engine. The display reads **RPM**.

See **FURTHER NOTES** as above.

5.3 Dwell

Dwell measurement is mainly intended for setting up contact breaker points in those ignition systems that use contact breaker points.

Also, dwell measurement can often give a guide to the correct operation of electronic ignition in systems that do not have points, and can also sometimes be used to illustrate the correct operation of the opening and closing of petrol injectors in most types of petrol injection system, though in such applications some ingenuity on the part of the user may be required in making a suitable connection. These applications are described later.

Supastrobe Professional measures Dwell in percent (%), which is the percentage of the time that the points are closed compared with the time that they are open.

Data in the workshop manual on dwell may be presented in percent (%), or may be in degrees of rotation of the crank shaft (∞).

Percent is a more useful form for dwell data, since it is the same irrespective of the number of cylinders of the car. Moreover, when expressed as percent, the dwell of most vehicles is similar,

typically between 40% and 60%, and generally around 50%. When expressed in degrees, the numbers are widely different. For instance, 50% dwell is 45∞ for a 4 cylinder vehicle, 90∞ for a 2 cylinder vehicle, and 22.5∞ for an 8 cylinder vehicle.

If the data in the workshop manual is in degrees, then it needs to be converted to percent if it is to be measured by Supastrobe Professional.

To make the conversion, use the following formula:

DWELL% = DWELL∞ x NoCYLINDERS / 3.6

ie:
for a 1 cylinder vehicle: DWELL% = DWELL∞ / 1.8
for a 2 cylinder vehicle: DWELL% = DWELL∞ / 1.8
for a 3 cylinder vehicle: DWELL% = DWELL∞ / 1.2
for a 4 cylinder vehicle: DWELL% = DWELL∞ / 0.9
for a 5 cylinder vehicle: DWELL% = DWELL∞ / 0.72
for a 6 cylinder vehicle: DWELL% = DWELL∞ / 0.6
for a 8 cylinder vehicle: DWELL% = DWELL∞ / 0.45

It is assumed in the above calculations that the engine has a single distributor cam and a single set of points. Where a vehicle has a double distributor, it counts as an engine of half the number of cylinders. For example, a 12 cylinder vehicle with points ignition invariably has twin distributors, and therefore has the same dwell as though it was a 6 cylinder engine.

0The instruction for measuring Points Dwell are as follows:

1) Obtain the correct data on points dwell from the workshop manual.

2) Convert the data to percent (%) if necessary.

3) Connect the RED lead to the Battery Positive (+) terminal, and the BLACK lead to the Battery Negative (-) terminal. Connect the GREEN lead to the COIL low tension (-) terminal (may be called CB, or 1). If it is not clear which LT terminal is the (-) terminal, then both terminals may be tried by trial and error.

4) Press the Mode Change button on Supastrobe Professional repeatedly until DWELL is indicated on the control panel.

5) Start the engine. The Points Dwell is indicated on the display.

6) If the points dwell is out of tolerance, then adjustment to the width of the points gap is necessary. Follow instructions in the workshop manual. Remember that:

INCREASING POINTS GAP REDUCES DWELL
REDUCING POINTS GAP INCREASES DWELL

FURTHER NOTES:

1) WORN COMPONENTS. Occasionally an engine will not run well at idle with the points dwell as specified, and sometimes an engine will not run at idle at all. On investigation, the user finds that the points gap is very small, much smaller than if he used the feeler gauge method to set the points. This can lead the user to suspect that the dwell measurement is faulty. In fact, the usual cause of this problem is that the distributor cam lobes or bearings are worn. It was to guard against this possibility that the dwell method of setting points was introduced. Simply widening the points may solve the problem at idle, but will result in misfiring at high RPM, which

may not be so apparent to the user, but which will still adversely affect the performance and efficiency of the engine. The solution is to repair/replace the faulty components in the distributor.

2) **6 AND 24 VOLT VEHICLES.** Use a separate 12v battery, and connect the negative terminal (-) of the secondary battery to the negative terminal (-) of the vehicles battery.

3) **POSITIVE EARTH VEHICLES.** The connections are as for negative earth vehicles, but the dwell indication on the display will be the percentage of time that the points are open, not closed. Therefore, a reading should be subtracted from 100 to give the correct reading.

4) **DWELL IN ELECTRONIC IGNITION.** Modern electronic ignition systems do not have mechanical contact breaker points, and utilise DWELL which is seen to vary with engine RPM. Precise DWELL% measurements are not very meaningful in such a system, but observing how the dwell varies with RPM can be an indicator of whether the system appears to be working as it should. In most ignition systems, the dwell will be seen to be typically 8% - 10% at idle, rising to 50% - 60% at high RPM. A useful procedure is to observe and note the dwell characteristic when the engine is working well, so that should a fault develop, the user can check whether the dwell characteristic was as it was before. The connections for measuring dwell in an electronic ignition system are the same as when measuring dwell in a contact breaker ignition system, one difference being that the coil, and its LT terminals, can be more difficult to find and recognise. Refer to a wiring diagram of the car if in doubt, to identify the location and terminals of the coil.

5) **DWELL IN PETROL INJECTION.** Current Petrol injection vehicles use a system in which each injector "Dwells" open for a short period each revolution of the engine, or each alternate rotation of the engine. Some older petrol injector systems used a different method where the injectors were open all the time, for which dwell measurement is not relevant.

For measuring petrol injector dwell, it is necessary to connect the green clip to one of the two conductors in the injector connector. The correct connection may be found by trial and error, but the user will need to contrive a connection that can be made while leaving the connector attached. Petrol injector dwell varies with engine power ie throttle setting, (as distinct from engine RPM). it will be seen to be very low at idle, usually 5 - 8%, rising perhaps to 50 - 60% when the throttle is "blipped". On the engine over-run (ie the time that engine speed is falling when the foot is removed from the accelerator), many systems reduce injector dwell to zero. Operation of the choke should be seen as increased injector dwell.

5.4 Volts

Supastrobe Professional can be used for measuring volts in the range 0 to 16 volts. Although it will correctly show voltages higher than this, its use to measure higher voltages is not recommended because of the possibility of overload and damage to the instrument.

The input impedance on the voltage range is 10 MOHMS, which makes the equipment safe to use on the most sensitive electronic circuitry.

Supastrobe Professional will only measure voltage with respect to the earth of its external power supply (ie the Black clip). That is, it can not measure a floating voltage).

The instructions for using Supastrobe Professional to measure voltage are:

Connect the RED lead to the Battery Positive (+) terminal.

Connect the BLACK lead to the Battery Negative (-) terminal.

Press the Mode Button until Volts is indicated on the control panel.
Connect the GREEN lead to the DC voltage to be measured.

Observe the voltage on the display panel of the instrument.

Typical applications are as follows:

1) ALTERNATOR OUTPUT. Before conducting this test, ensure that the battery is recently charged, and that the alternator connections are good.

Connect the Black lead to battery negative (-), and both the red and Green lead to battery positive (+). Set the Mode Button to show Volts, and start the engine.

All alternators include a voltage regulator which limits the voltage applied to the battery to about 14.5V (cars vary slightly, check the car workshop manual if available). Voltages significantly higher than 14.5V cause the battery to gas and fail. The voltage should be near 14.5V at all engine speeds with no electrical load. If it rises much above this (say above 15V), at high RPM, then the alternator is overcharging and a faulty regulator is indicated. If it falls below 13.9V at low engine speeds under full electrical load (eg headlamps etc on), then the alternator is undercharging and is faulty.

A voltage check is better than a current check, since it can detect both over and under charging.

2) BATTERY CHARGER CHARGE MONITORING. This test is particularly useful to avoid over charging a sealed or maintenance-free battery, when using an ordinary (non-automatic) battery charger.

Make the connections as in 1) above, simultaneously with the charging by the charger battery charger. Disconnect the charger when the voltage at the battery terminals reaches 14.5v to avoid overcharging and gassing of the battery.

If the charger is and "automatic" charger (ie voltage regulated), then the voltage function of Supastrobe Professional can be used to monitor the performance and voltage regulation of the charger. Typically, the charger should not allow the voltage at the battery terminals to rise above 14.5V.

3) BATTERY CHARGE MEASURING. Careful measurement of the steady-state voltage at the terminals of a battery can be used to give an approximate but reasonable indication of its state of charge. For this test the battery must not have been recently used (either recently charged, or used to deliver current). Preferably, the battery should be disconnected from the car and left for at least 1 hour to settle down.

Make the connections as in 1) above, and note the voltage at the battery terminals.

Diagnosis is as follows:

11.90V - 12.20V	**0 - 25% charge**
12.20V - 12.50V	**25 - 50% charge**
12.50V - 12.90V	**50 - 100% charge**

4) CRANKING TESTS. A measurement of the voltage at the battery terminals while the engine is being cranked on the starter can be used by an experienced mechanic to deduce various faults

in the starter circuit, including a faulty battery and faulty battery.

Make the connections as in 1) above. Disable the engine from starting (eg disconnect the CB lead at the coil). Crank the engine on the starter for a few seconds, and observe the voltage reading.

Results can be interpreted as follows (but noting that some degree of experience is required in correctly diagnosing faults):

1) The voltage falls maybe a couple of volts, to 10 - 11 V, and the engine rotates briskly: This is normal.

2) The voltage falls to 9 - 10 volts after a few seconds, and the engine cranking becomes slow and laboured: This implies a faulty or flat battery.

3) The voltage falls hardy at all, and remains at around 12v, but the engine is not turning, or is only turning very slowly: This implies a high resistance in the starter circuit, caused by either: poor connectors to the battery, faulty solenoid, loose earth connection to the bodywork of the car or engine, or a faulty starter motor.

4) The voltage quickly falls to around 8 - 9 volts, but the starter motor or engine makes no attempt at all to turn: This implies a jammed starter motor.

6. Technical Specification

ADVANCE IGNITION TIMING:	0.2∞ - 60∞	+(0.7% RDG + 1%RNG)
TACHOMETER:	200 - 9990RPM	
DWELL:	0 - 99.9%	
VOLTS:	0 - 16V	
Operating Temperature:	0 - 40∞C	

7. General Warning

This equipment has been designed to operate in the harsh environment close to spark ignition engines but the user should be aware of the following:

1. Spark ignition engines and related electronics can emit high levels of interference which could effect test and maintenance equipment together with other electrical items such as radio or television receivers, computers etc.

2. Any interference emitted from the engine area could be increased by:
(a) Opening the engine compartment cover.
(b) Making electrical connections to the vehicle wiring loom or the vehicle battery.
(c) Any faulty components particularly those associated with the ignition system.

3. If this equipment has any display which behaves in an erratic nature the user is advised to refer to the advice given in the detailed instructions to minimise the possibility of interference. In cases of difficulty the user is advised to check for the following.
a) A faulty vehicle battery or poor connections to it.
b) Poor ground connection to engine or other electrical equipment
c) Faulty ignition components particularly rotor arms, ignition coils or HT leads with an internal break or with a resistance outside vehicle manufacturers limits.

The user is therefore advised, due to the potential emitting of interference, that vehicle maintenance and testing should be undertaken with due care and not in an area close to sensitive electronic equipment.

8. Warranty

This warranty is in addition to the statutory rights of the purchaser.
The Tool Connection has made every effort to ensure that this product is of the highest quality and value to the customer. However, The Tool Connection can accept no responsibility for consequential damage howsoever caused arising from the use of this product.
All technical enquiries regarding this product should be made to:

The Tool Connection Technical Service Department: ++44 (0) 1926 818181

Please note that The Tool Connection cannot provide technical information or advice or service data on particular motor vehicles.
If this product should require service or repair, it should be returned to:

The Tool Connection,
Kineton Road,
Southam,
Warwickshire,
CV47 0DR,
England.

Please give full details of faults requiring attention when sending goods for service or repair