Care Points

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.

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.

Safety First. Be Protected.

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Gunson®

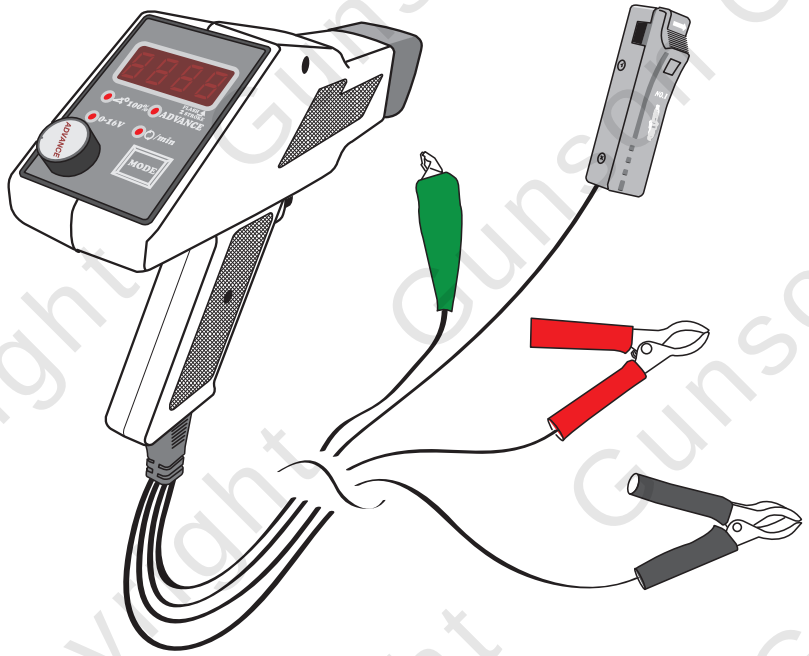
Superstrobe Professional

Advance Timing Light

Part No. G4123

Supastrobe Professional is an advance timing light of robust construction, and is intended for heavy duty applications where it may be subjected to regular or continuous use. It also features a built-in dwell meter, a voltmeter and an engine tachometer (rev-counter) suitable for both four and two-stroke engines.

Instructions



G4123
Superstrobe Professional

Overview

Setting the correct ignition timing is crucial in the performance of an engine. Sparks occurring too soon or too late in the engine cycle can be responsible for poor performance, poor fuel economy, excessive hydrocarbon (HC) emissions, excessive vibrations and even engine damage. Modern engines that are controlled by an engine management system use a computer to control the timing throughout the engine's RPM and load range. However, older engines that use mechanical spark distributors or early electronic ignition distributors rely on a mechanical method (for example, by using rotating weights and springs) and manifold vacuum in order to set the ignition timing throughout the engine's RPM and load range.

The need for advancing the timing of the spark is because fuel does not completely burn the instant the spark fires, the combustion gases take a period of time to expand, and the angular or rotational speed of the engine can lengthen or shorten the time frame in which the burning and expansion should occur. In a vast majority of cases, the angle will be described as a certain angle advanced before top dead center (BTDC). 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.

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 manufacturer's documentation will also state 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 fan belt 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. It should be noted that car manufacturers usually provide no timing marks for engine speeds other than idle, even though timing data may be given for other speeds in 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 fan belt pulley or flywheel.

for a single cylinder vehicle:	**Dwell% = Dwell° / 3.6**
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.

The instruction for measuring ignition points dwell are as follows:

- Obtain the correct data on points dwell from the workshop manual.
- Convert the data to percent (%) if necessary.
- Connect the red clip (I) to the battery positive (+) terminal, and the black clip (J) to the battery negative (-) terminal. Connect the green clip (H) to the ignition coil low tension (-) terminal (may be called CB
- Press the Mode button (E) on Supastrobe Professional until Dwell is indicated on the control panel (indicated by 100% LED).
- Start the engine. The ignition points dwell is indicated on the display.

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 (1) increasing points gap reduces dwell, (2) reducing points gap increases dwell.

Occasionally an engine will not run well (or at all) at idle with the points dwell as specified. 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.

Notes on Voltmeter Mode:

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 clip (I) to the battery positive (+) terminal.
- Connect the black clip (J) to the battery negative (-) terminal.
- Press the Mode button (E) on Supastrobe Professional until Volts is indicated on the control panel (indicated by 0-16v LED).
- Connect the green clip (H) to the DC voltage to be measured.
- Observe the voltage on the display panel of the instrument.

Supastrobe Professional Technical Specification:

Advance ignition timing: 0.2° - 60° +(0.7% RDG + 1%RNG)
Tachometer: 200 – 9990 RPM
Dwell: 0 - 99.9%
Volts: 0 - 16v
Operating Temperature: 0 - 40°C

Useful diagnostic tests using a timing light

1. Centrifugal advance mechanism: This is intended to advance the ignition timing with increase in engine speed. To test:

   Disconnect the vacuum pipe from the distributor and observe the timing marks with the engine at idle.

   Gradually increase the engine speed. The rotating 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 normally begins between 500-1500 RPM and ends between 4500-5500 RPM).

   If excessive advance with increasing RPM is observed, the cause is usually due to wear or broken advance weight springs. If advance is too low, the cause is usually sticking or wear at the pivot point of the advance weights.

2. Vacuum Advance: To test:

   Re-connect the vacuum pipe and again 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 of about 2500 RPM. This increase in ignition advance will be in addition to that observed due to the centrifugal advance.

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

   If the vacuum advance is operating at idle speed, or the vacuum advance is too high, this could be due to incorrect carburettor settings.

3. Vacuum Retard: This may be fitted for emission control reasons and only operates at idle and during deceleration. To test:

   Disconnect the vacuum retard connection; observe the timing marks with the engine at idle.

   Reconnect the vacuum retard connection and 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 also fire when the timing marks are aligned (No 4 or a four-cylinder engine, for example). By connecting to this opposite lead to No 1 on the distributor cap, the difference can be checked.

   Alternatively, connection can be made the main input HT lead running from the ignition coil to the distributor (sometimes referred to as a 'king lead') which will give flashes as each cylinder fires. The difference between various cylinders can then be observed.

   This is a useful method for synchronising distributors fitted with dual points. Stop the engine and adjust the points; check the timing with the engine running, then stop the engine again and adjust the opposite set of points. Adjust until the timing is consistent on opposite cylinders.

Notes on Dwell Meter Mode:

Dwell measurement is mainly intended for setting up contact breaker points in this type of ignition system. 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 (º).

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 45º for a 4 cylinder vehicle, 90º for a 2 cylinder vehicle, and 22.5º 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% = Dwellº x No of cylinders / 3.6.

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

A timing light is controlled from the spark plug of No1 cylinder, and flashes each time that spark plug fires. A standard, (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 1 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 8º BTDC, and appears to be exactly opposite the fixed reference mark or tag, then the ignition timing is 8º BTDC.

This is fine if all the operator wishes to do is check that the timing is 8º BTDC. However, if the rotating mark is not exactly opposite the fixed mark or tag then the current ignition timing cannot be ascertained. Additionally, if the operator wishes to set the timing to some value for which there is no timing mark, or 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 fan belt pulley, then a standard timing light is not adequate, and the operator 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.

In Supastrobe Professional, the time of the flash is controlled by the advance control knob on the 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).

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

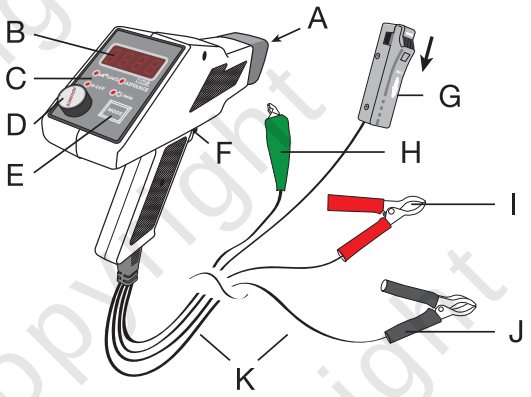
For example, considering the example mentioned above, of a static timing mark on a fan belt pulley representing 8º BTDC. Using Supastrobe Professional, this mark would still represent 8º BTDC if the display on the timing light was 00.00, but it would represent 28º BTDC if the knob was rotated to show 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 8º BTDC, if the display shows 20.00, then the ignition timing is 20º BTDC.

Notes:

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

Components



A	Lamp / Lens
B	Display
C	LED mode indicators
D	Advance control knob
E	Mode button
F	Trigger
G	Inductive pick-up
H	Green clip: dwell connector / voltage probe
I	Red clip: battery positive
J	Black clip: battery negative (ground)
K	Lead / Pick up set (detachable)

A: Lamp / Lens
Xenon discharge lamp of very high output, combined with a lens which provides a wide beam of brilliant white light, enabling the timing marks to be readily seen, even under conditions of high ambient light.

B: Display
Digital display shows results of mode selected, or degrees when trigger is depressed.

C: LED mode indicators
LED illuminates to show which mode is selected.

D: Advance control knob
Sets the advance angle, which is then shown in the display when the trigger is depressed. Fully anticlockwise is zero (00.00).

E: Mode button
Press this button to select the four different modes available:

- Dwell Meter (indicated by 100% LED). In this mode the instrument measures ignition dwell %. For this function to operate, the green clip (H) has to be connected to the appropriate terminal of the ignition coil.
- Voltmeter (indicated by 0-16v LED). In this mode the instrument measures the voltage between the green clip (H) and the black clip (J).
- Tachometer (indicated by /min LED). In this mode the instrument measures the revolutions per minute (RPM) of the engine. For this function to operate, the inductive pick-up (G) needs to be connected to the lead of a spark plug. Measures one spark per cylinder and thus suitable for conventional four-stroke engines that do not have a wasted-spark system. Pressing the mode button (E) once more enters two-stroke mode (indicated by flashing marker on lower right-hand corner of display) where one spark per engine revolution is assumed and measured. Thus suitable for two-stroke engines or four-stroke engines using a wasted-spark ignition system.

F: Trigger
When trigger is depressed the instrument overrides the selected mode (see above) and operates as a timing light and displays the timing advance angle as set by the advance control (D).

G: Inductive pick-up
For clipping over the high tension spark plug lead of No 1 cylinder to detect the spark. Place thumb on slide (adjacent to white arrow) and press down to open. The pick-up should be attached with the white arrow pointing along the HT lead towards the spark plug.

H: Green clip
For connecting to the ignition coil primary when in Dwell Meter mode or as the positive probe when in Voltmeter mode (see E Mode button above).

I: Red clip
Connected to battery positive.

J: Black clip
Connected to battery negative (ground).

K: Detachable Lead / Pick-up set
The plug-in lead / pick-up set is detachable for safe keeping and for ease of replacement should it become damaged. Supastrobe Pro Pickup Lead: part no: G4123P.

Instructions

Ignition Timing

1. Make sure the ignition system is serviced and in good condition; spark plugs, contact points, clean and correctly gapped, etc.
2. From the vehicle's workshop manual (or appropriate manufacturer's documentation) ascertain the correct ignition timing data. In particular, note at what engine RPM the timing should be checked, and whether the vacuum pipe connected to the distributor should be left in place or disconnected.
3. Find the timing marks on the engine (usually on the flywheel or front belt pulley); ascertain what the timing marks represent, for example, Top Dead Centre, or if there are additional markings, degrees BTDC. Highlight the marks using white paint or typing correction fluid.
4. Engine should be at operating temperature.
5. Engine will be running during tests, so ensure that handbrake is applied, car is not in gear and that exhaust fumes can be ventilated.
6. Disconnect the vacuum pipe from the distributor if the timing data calls for it. If engine falters, block the open end of the pipe. Make sure the loose vacuum pipe is not near hot or rotating engine parts.
7. Before you start the engine, connect the red clip (I) to the battery positive terminal and the black clip (J) to the battery negative terminal (If the battery is in the boot/trunk there will be suitable positive and negative connections in the engine bay).
8. Attach the inductive pick-up (G) to the HT plug lead of No 1 cylinder with the white arrow on the pick-up pointing towards the spark plug. Choose a loop of plug lead that is well separated from the other HT leads, so as to minimise interference. No 1 cylinder is usually the first one at the front of the engine (unless specified differently by the manufacturer — on some Jaguar models No 1 is at the back of the engine, for example).
9. Take care not to let any leads or clips come into contact with hot or moving engine components.
10. Start the engine and set the engine idling speed to the correct RPM as recommended in the workshop manual or other manufacturer's documentation.
11. Rotate the advance control knob (D) fully anticlockwise. Press the trigger; the light will flash and the display will show 00.00. Direct the timing light at the timing marks on the engine. Rotate the advance control knob slowly clockwise until a rotating timing mark lines up with the fixed mark or tag. If the marks that are lining up represent TDC, then the ignition timing of the engine is the number of degrees shown on the display. For example, if (when the marks line up), the display reads 08.00, then the timing is 8° BTDC. If the timing marks do not represent TDC, but some other timing angle, then add this to the display angle. For example, if the timing marks represent 8° BTDC and the display is showing 00.00, then the ignition advance is 8° BTDC; similarly, if the display shows 02.00, the timing is 10° BTDC, etc.

Notes:

- 6 and 24 volt vehicles: a separate 12 volt battery should be used to power the instrument.
- Unsteady readings: If the illuminated rotating mark is not steady and is jumping around, then the inductive pick-up (G) is not detecting a clean indication of the ignition spark. Check that the inductive pick-up is correctly attached and try moving the pick-up to a different position on the HT lead. Ensure the HT leads are well separated and that on No 1 lead the pick-up is not also detecting a signal from an adjacent lead. Check for faults in the ignition system, in particular check the spark plug gap.