

# Flanike<sup>®</sup>

## DIAGNOSTIC



## DIGITAL ENGINE ANALYSER

Model No. CA500



Part No. 45010480

## OPERATING & MAINTENANCE INSTRUCTIONS

0507

Thank you for purchasing this CLARKE Digital Engine Analyzer, designed for use by automotive technicians both professional and DIY alike.

Please read this leaflet thoroughly and follow the instructions carefully, in doing so you will ensure the safety of yourself and that of others around you, and you can look forward to the Analyzer giving you long and satisfactory service.

## GUARANTEE

This CLARKE product is guaranteed against faulty manufacture for a period of 12 months from the date of purchase. Please keep your receipt as proof of purchase.

This guarantee is invalid if the product is found to have been abused or tampered with in any way, or not used for the purpose for which it was intended. Faulty goods should be returned to their place of purchase, no product can be returned to us without prior permission. This guarantee does not effect your statutory rights.

## INTRODUCTION

The purpose of this instruction manual is to provide the information necessary to service and carry out adjustments to keep an engine in peak running condition. Once understood, the complexities of car engine tune-up become relatively simple.

The few basic tools required are available through your local CLARKE dealer. The specifications contained in the owner's handbook are indispensable for a safe and satisfactory tune-up, and should be used in conjunction with this manual.

## SAFETY PRECAUTIONS

### (Before Starting the engine)

1. When working on an engine, always wear appropriate clothing. Ideally, long sleeves securely buttoned. Long hair should be contained, and all jewellery - rings bracelets etc., removed.
2. Ensure that all electrical leads are secured well away from moving parts, or hot parts of the engine.
3. Ensure that all tools have been removed from the area, and they are not left in a place where it is possible for them to drop into the engine bay, due to engine vibration.
4. When employing an assistant to start the engine, ensure they are aware of the dangers of starting before being told to do so.
5. When starting, stand well clear until the engine is running smoothly.
6. Take great care to avoid touching the exhaust, and keep hands well clear of moving parts.
7. Take care to ensure that any disconnected HT leads are well away from fuel lines, and that they cannot be accidentally touched.

**Please Note: A remote Starter Switch is available from your local CLARKE dealer, Part No. 4500450.**

## PREPARATION BEFORE USING THE ANALYZER

1. The engine must be warm, i.e. at normal working temperature.
2. The distributor points must be in good condition and properly adjusted according to the manufacturers specifications..
3. The spark plugs must be clean and properly gapped.
4. Engine idling speed must be set according to the manufacturers specifications.

## FRONT PANEL - DESCRIPTION

### A. Function and Range Switch

This control is located in the center of the front panel, and it combines the operations of selecting the function and desired range as well as having an "OFF" position. To extend the life of the battery, the switch should be in the "OFF" position when the instrument is not in use.

### B. Display

3-1/2 digit, 7 segment, 18mm high LCD.

### C. Input Terminals

Input Terminals comprise three jacks.

#### 1. "COM" - Common Jack

Plug in connection for black (negative) test lead.

#### 2. "4° Ω V" Jack

Plug in connection for red (positive) test lead for all VOLTAGE, RESISTANCE, DWELL ANGLE and RPM (TACH) measurements.

#### 3. "10A" Jack.

Plug in connection for red (positive) test lead for current measurements.



Fig.1

## SPECIFICATIONS

### 1. General Specifications

<b>Display:</b>	18mm (0.7") LCD (Liquid Crystal Display), 3-1/2 digits. Max. indication $\pm 1999$ .
<b>Measurement:</b>	24 ranges covering: DCV, RPM, DWELL ANGLE, OHMS, DIODE and AUDIBLE CONTINUITY.
<b>Polarity:</b>	Automatic Switching, "-" indicates negative polarity.
<b>Zero Adjustment:</b>	Automatic
<b>Over-input:</b>	Display shows "1" or "-1"
<b>Sampling Time:</b>	Approx. 0.4 second.
<b>Operating Temp:</b>	0°C to 50°C
<b>Operating Humidity:</b>	Max. 80% RH
<b>Power Supply:</b>	One 9V battery.
<b>Low Batt. Indication:</b>	Sign "BAT" on the left top of LCD display
<b>Dimensions:</b>	150x70x35mm
<b>Weight:</b>	Approx. 200g (including battery)
<b>Test Leads:</b>	2 Sets (1x probe attachment, 1x clip attachment)

### 2. Electrical Specification

<b>Accuracies:</b>	$\pm$ (%reading + No. of digits) guaranteed for 1 year
<b>Temperature:</b>	23°C $\pm$ 5° C
<b>Relative Humidity:</b>	<75%

## DC VOLTAGE

RANGE	ACCURACY	RESOLUTION
200mV 2V 20V 200V	$\pm(0.5\% \text{ reading} + 1 \text{ digit})$	100 $\mu$ V 1 mV 10mV 100mV
1000V	$\pm(0.8\% \text{ reading} + 1 \text{ digit})$	1V

Input impedance: 10M $\Omega$  on all ranges

Overload protection: 250V rms AC for 200mV range, 1000V DC or 750V rms AC for other ranges

## RESISTANCE

RANGE	ACCURACY	RESOLUTION
200 $\Omega$	$\pm(1.0\% \text{ reading} + 2 \text{ digits})$	0.1 $\Omega$
2K $\Omega$ 20K $\Omega$ 200K $\Omega$ 2M $\Omega$	$\pm(0.8\% \text{ reading} + 2 \text{ digits})$	1 $\Omega$ 10 $\Omega$ 100 $\Omega$ 1 k $\Omega$
20M $\Omega$	$\pm(1.2\% \text{ reading} + 2 \text{ digits})$	10k $\Omega$

Overload protection: 250V rms

## DC CURRENT

RANGE	ACCURACY	RESOLUTION
10A	$\pm(2\% \text{ reading} + 3 \text{ digits})$	10mA

Overload circuit protection: Unfused

## DWELL ANGLE

CYLINDER	RANGE	ACCURACY	RESOLUTION
3Cyl	0-120°	± (1.2% reading + 2 digits)	0.1°
4Cyl	0-90°		
5Cyl	0-72°		
6Cyl	0-60°		
8Cyl	0-45°		

## TACHOMETER

CYLINDER	RANGE	ACCURACY	RESOLUTION
3Cyl	500 - 10,000 RPM	± (1.2% reading + 2 digits)	10RPM
4Cyl			
5Cyl			
6Cyl			
8Cyl			

## DIODE and AUDIBLE CONTINUITY TEST

RANGE	DESCRIPTION	TEST CONDITION
	Display the approximate forward voltage of Diode	Open circuit voltage is 2.8V max.
	Built in buzzer sounds if continuity is present	

# 1. VOLTAGE MEASUREMENTS

For all tests, the RED test lead should be connected to the "400ΩV" input terminal, and BLACK test lead to "COM" input terminal.

Determine highest anticipated voltage (200mV, 2V, 20V, 200V or 1000V) and set the "Function Switch", to the corresponding position. If in doubt, select the highest value, and work down. Proceed to test the various functions as follows:

## A. CIRCUIT BREAKER POINTS: (Used the 2V DC range)

- 1) Disconnect the main, centre HT lead ("King Lead") from distribution cap, and earth it by taping to a bare metal surface.
- 2) Connect RED test probe to the "-" terminal of ignition coil, and the BLACK test probe to earth.
- 3) Turn ignition switch ON. If the voltage displayed is lower than 0.2V, then the contact resistance of the CB points is normal. Any higher than this, and the points should be +cleaned, by filing with a smooth file, or replaced.

## B. BATTERY LEAKAGE: (Used the 2V DC range)

- 1) Connect BLACK test probe to the negative (-) battery terminal, and the RED test probe to various spots on the surface of the battery.
- 2) If a value is displayed, then there is battery leakage. Clean any electrolyte or dirt from area around battery, and wash with bicarbonate of soda and water solution, ensure the area is wiped dry.

## C. BATTERY UNDER LIGHT LOAD: (Use the 200V or 20V DC range)

- 1) Connect the BLACK test probe to the negative (-) battery terminal, and the RED test probe to the positive (+) battery terminal.
- 2) Turn on headlights and all electrical accessories. Observe the meter for 2 minutes. If the reading is less than 11.5V on 12-volt systems, or 5.7V on 6 volt systems, the battery is insufficiently charged. Charge the battery and retest. If reading is still low, replace battery.
- 3) Do not continue this procedures for more than 2 minutes.

## D. BATTERY UNDER HEAVY LOAD: (Use the 20V or 200V DC range)

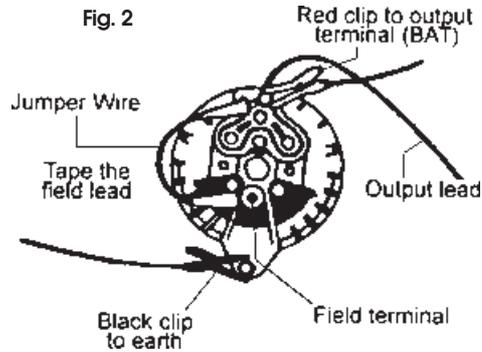
- 1) Disconnect the King Lead from the distributor cap, and earth it by taping to bare metal. This ensures the engine cannot start.
- 2) Connect the BLACK test probe to the negative (-) battery terminal, and the RED probe to the positive terminal.
- 3) Crank the engine on the starter for 15 seconds and note the voltage. If the reading is less than 9.5V on 12-volt system or 5.7V on 6-volt system, check the starter circuit for loose/dirty connections. If this is OK, recharge the battery and retest. If the reading is still low, replace the battery.

## E. CHARGING SYSTEM CHECK:

Run the engine, and gradually increase the speed whilst observing the meter:

- if the pointer climbs steadily to between 13.5 V and 15.5 V or to the value specified by the manufacturer, the charging system is operating satisfactorily.

- If voltage is above the specified value or fluctuates erratically, the regulator is defective.
- If the voltage is below the specified value, the regulator or alternator might be defective, proceed as follows:
  - a. Disconnect the negative (-ve) cable from the battery.
  - b. Remove the wire from the field (F) terminal of the alternator, do not allow it to be earthed.
  - c. Use a jumper wire to connect the field (F) terminal of the alternator, to its output (BAT) terminal. Refer to the owner's manual for more specific information.
  - d. Reconnect the negative battery cable, start the engine and slowly increase engine speed whilst watching the meter. If the voltage is now above 13.5V, the regulator is defective.
- If the voltage is still low, the alternator is defective.



**Caution: Perform this test as quickly as possible and do not exceed 17V.**

#### F. TESTING THE STARTER CIRCUIT:

1. Remove the king lead from the distributor cap and earth it.
2. Connect the BLACK test probe to the battery negative (-ve) post.
3. Connect the RED probe to the starter motor housing, ensuring a good electrical contact is made.
4. Crank the engine on the starter, whilst observing the meter. If it reads 2 volts or more, the the starter motor is poorly earthed. Repair as necessary.
5. Connect the RED test probe to the battery positive (+ve) post, and the black probe to the insulated terminal of the starter motor 6 Crank the engine on the starter If the reading is 2 volts or more, check for loose or dirty connections and repair as necessary

## 2. CURRENT MEASUREMENTS

- 1) For all tests, connect the RED test lead to the "bA" input terminal, and the BLACK test lead to the "COM" input terminal.
- 2) Set the function switch to the iQA position.
- 3) With the ignition switched OFF, open the circuit to be tested, and connect the test probes in series with the open ends of the circuit. Switch on the ignition, and take readings.

**IMPORTANT:**

**If the reading is from 10A to 20A, DO NOT exceed 15 seconds continuous operation. DO NOT exceed 20 Amps, as this will damage the instrument.**

### 3. RESISTANCE MEASUREMENT

1. For all tests, connect the RED test lead to the " $\Omega$ " input terminal, and BLACK test lead to 'COM' input terminal.
2. Determine highest anticipated resistance (200 $\Omega$ , 2k $\Omega$ , 20k $\Omega$ , 200k $\Omega$ , 2M $\Omega$  or 20M $\Omega$ ) and set the "Function Switch", to the corresponding position. If in doubt, select the highest value, and work down.
3. If the resistance to be measured is connected to a circuit, turn off the power to the circuit and discharge all capacitors.

#### A. TESTING THE CONTINUITY OF A CIRCUIT:

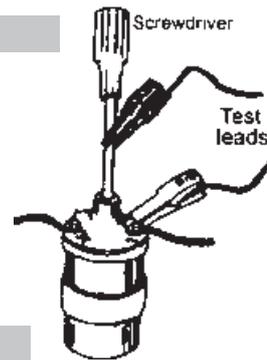
Connect the test probes across the component under test, and observe reading:

- If the reading is very low, i.e. the needle moves across the scale, then continuity exists.
- If the reading is very high, i.e. the needle fails to move, or hardly moves at all, then the component has an open circuit.

If the function switch is set to "diode", and the resistance value is less than approx 30 $\Omega$ , a beeper will sound from within the meter.

#### B. TESTING THE IGNITION COIL

1. Connect one test lead to the negative (-) terminal of the ignition coil, the other to the HT terminal at the center of the coil. If the reading is very low, the coil is short circuited. If it is very high, typically above 20K, the coil is open circuited. In both cases it needs to be replaced.
2. Repeat the same test between the center terminal and the positive terminal to test the primary coil resistance. The typical good value is 1 - 5 Ohms for a coil requiring a ballast resistor. Check manufacturers spec's for actual values.



#### C. DIODE TEST

**NOTE: For a correct functional test, the diode must be disconnected from the circuit.**

1. Set the function switch to the  $\blacktriangleleft$  position.
2. When connected with polarity as shown in fig. C1 (below), a forward current flow is established, and the approx. diode forward voltage (VF) will be displayed.  
A reading of "000" or near "000" indicates a short circuit, and the diode under test is good. A reading of "1", indicates a high resistance, and the diode is defective.
3. When connected in reverse, with polarity as shown in fig. C2, a reverse current is established. A reading of "000" or near "000" indicates a short circuit, and the diode under test is defective. A reading of "1", indicates a high resistance, and the diode is good.

Proper diode testing should include both forward and reverse checks.

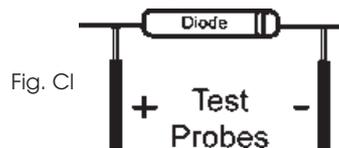


Fig. C1

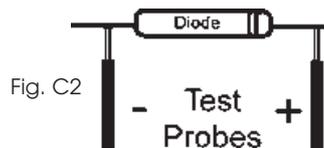


Fig. C2

## 4. TACHOMETER (RPM) MEASUREMENT

1. For all tests, the RED test lead should be connected to the "400Ω V" input terminal, and BLACK test lead to "COM" input terminal.
2. Set the function switch to the number of cylinders for the desired test on the 'TACH' range.
3. Connect the RED test probe to the (-) terminal of the ignition coil, and the BLACK test probe to the negative (-) terminal of the battery, as shown in Fig. 4.
4. When the engine is started, the display will indicate the engine RPM.

**NOTE:** Only use this function on engines with conventional ignition systems. DO NOT use on engines with electronic ignition systems. The tachometer may be used for several function tests, as follows:

### A. Carburettor Idling/Slow Running Adjustment

1. Remove the air filter.
2. Screw 'in' the idling mixture screw until it is lightly seated, then screw it out three full turns.
3. Re-start the engine, and allow it to idle for at least one minute.
4. Adjust the idling speed screw to obtain the idling speed specified by the manufacturer.
5. Adjust idling mixture by turning the idling mixture screw, in or out, to obtain an increase in engine speed. Readjust the idling speed screw to the correct idling speed.
6. Repeat these steps until no further increase in engine speed is obtainable.
7. Replace the air filter whilst observing the RPM reading, and check that the engine speed does not drop. If it does, the air filter may be dirty and needs to be cleaned or replaced.

#### IMPORTANT.

- a. When making any mixture adjustment, only turn the mixture screw 1/8 of a turn at a time to prevent engine stalling.
- b. Between adjustments, allow about 30 seconds for the engine speed to stabilise.
- c. On vehicles with emission control systems, air injection pumps and positive crankcase ventilation, refer to the manufacturers instructions for idle adjustment procedures.

#### NOTE:

- 1) Specialised equipment is required to carry out CO<sub>2</sub> emission tests. Refer to the relevant handbook, as certain engine adjustments may need to be carried out prior to its use.
- 2) 2-Stroke engines produce twice as many ignition sparks as 4-stroke engines. Thus, when testing 2-stroke engines, the indicated tachometer reading must be divided by 2 to determine the correct engine speed.

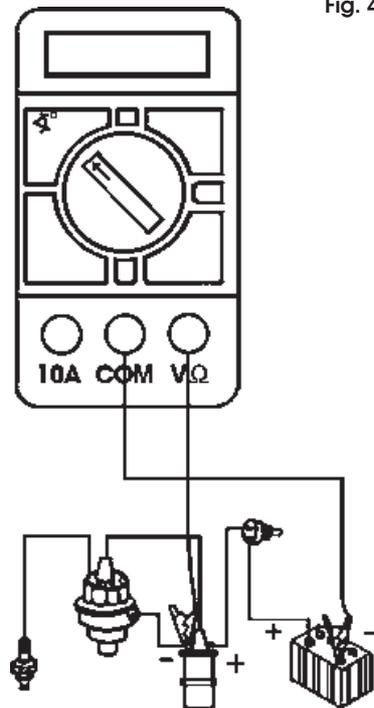


Fig. 4

## B. Testing Air/Fuel Mixture

1. Remove the air filter assembly.
2. Whilst observing the RPM reading, slowly block the air intake of the carburettor with a piece of cardboard.
3. If the air/fuel mixture is correct, the engine speed should not change until the intake is almost completely blocked up. If it increases, the mixture is lean, if it decreases, the mixture is rich. Readjust the idle mixture screw accordingly.  
If adjustments are made during the course of this test, check the slow running speed once again.

## C. Testing Centrifugal Advance

1. Slacken off the distributor securing bolt, or clamp bolt depending upon design.
2. Rotate the distributor in either direction, to obtain the fastest possible engine speed, and hold in this position.
3. Increase engine speed to 1000RPM, and try to obtain a further increase by again rotating the distributor in either direction.  
If the speed can be increased by 100RPM or more, the centrifugal advance and retard mechanism is faulty, and should be serviced or replaced as necessary.

## D. Positive Crankcase Ventilator (PCV) Test

1. Remove the engine ventilator hose and block the valve with a finger to stop all air flow.
2. Check that the idle speed drops by 50 RPM or more. If the idle speed does not drop, or drops less than 50 RPM, the ventilator valve must be cleaned or replaced.

# 5. DWELL ANGLE MEASUREMENT

Dwell angle refers to the degrees, or time, during which the contact breaker points are closed in every rotation of the distributor cam. The closed points serve as a path for current flow from the battery to the ignition coil, so that energy can be built up to give a spark. If the dwell angle is too small, the points gap is too wide, resulting in a weak spark, giving poor acceleration or high speed performance. If the dwell angle is too large, the points gap is too narrow and often causes rapid deterioration of the points.

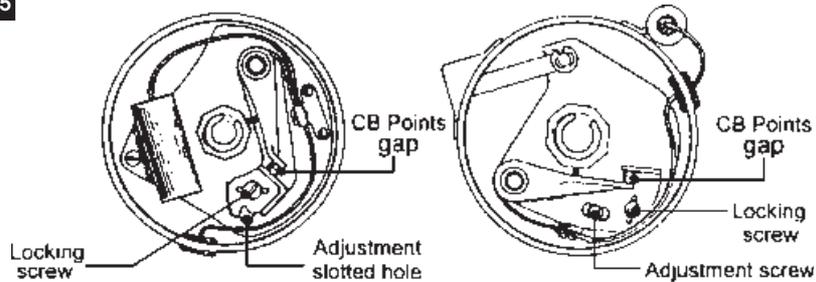
## A. Adjusting the Dwell Angle, or Contact Breaker Adjustment

1. Connect the RED test lead should be connected to the " $\ominus$  Ω V" input terminal, and BLACK test lead to "COM" input terminal.
2. Set the function switch to the number of cylinders for the desired test on the 'DWELL' range.
3. Connect the RED test probe to the (-) terminal of the ignition coil, and the BLACK test probe to the negative (-) terminal of the battery, as shown in fig. 4.
4. Run the engine to normal working temperature, then stop the engine.
5. Remove the distributor cap and rotor. Remove the king lead from the distributor cap and earth it.
6. Slacken off the CB points locking screw (see figure 5).
7. Turn the engine on the starter motor, whilst turning the CB points adjustment screw until the proper dwell angle is obtained. Tighten the locking screw.

NOTE: Only use this function on engines with conventional ignition systems. DO NOT use on engines with electronic ignition systems.

#### Typical internal type Contact Breaker Adjustments

**Fig. 5**



### Testing Distributor Cam Wear

1. Connect the meter as described above and start the engine. Note the dwell angle at idling speed.
2. Increase engine speed to about 2000 RPM whilst observing the dwell angle. If the dwell angle varies more than the amount specified by the manufacturer (usually 3°), the cam is worn out or the distributor shaft is bent. Repair or replace as necessary.

## MAINTENANCE

The analyser requires no specific maintenance, except for the occasional battery change. This is accomplished by removing the two screws from the rear of the unit, and gently prizing off the front cover. Unclip and replace the battery, and reassemble. It should be noted that when the meter is not in use, the function switch should always be in the OFF position. Ensure the Analyser is kept in a cool, dry location, and not at risk of damage from other tools or machinery.

## ACCESSORIES

1. Test leads with probes ..... Part No. CN50001
2. Test Leads with Clips ..... Part No. CN50002

 When disposing of this product, do not dispose of with general waste. It must be disposed of according to the laws governing Waste Electrical and Electronic equipment, at a recognised disposal facility.

## PARTS AND SERVICE CONTACTS

For Spare Parts and Service, please contact your nearest dealer, or CLARKE International, on one of the following numbers.

**PARTS & SERVICE TEL: 020 8988 7400**

**PARTS & SERVICE FAX: 020 8558 3622**

**or e-mail as follows:**

**PARTS: [Parts@clarkeinternational.com](mailto:Parts@clarkeinternational.com)**

**SERVICE: [Service@clarkeinternational.com](mailto:Service@clarkeinternational.com)**