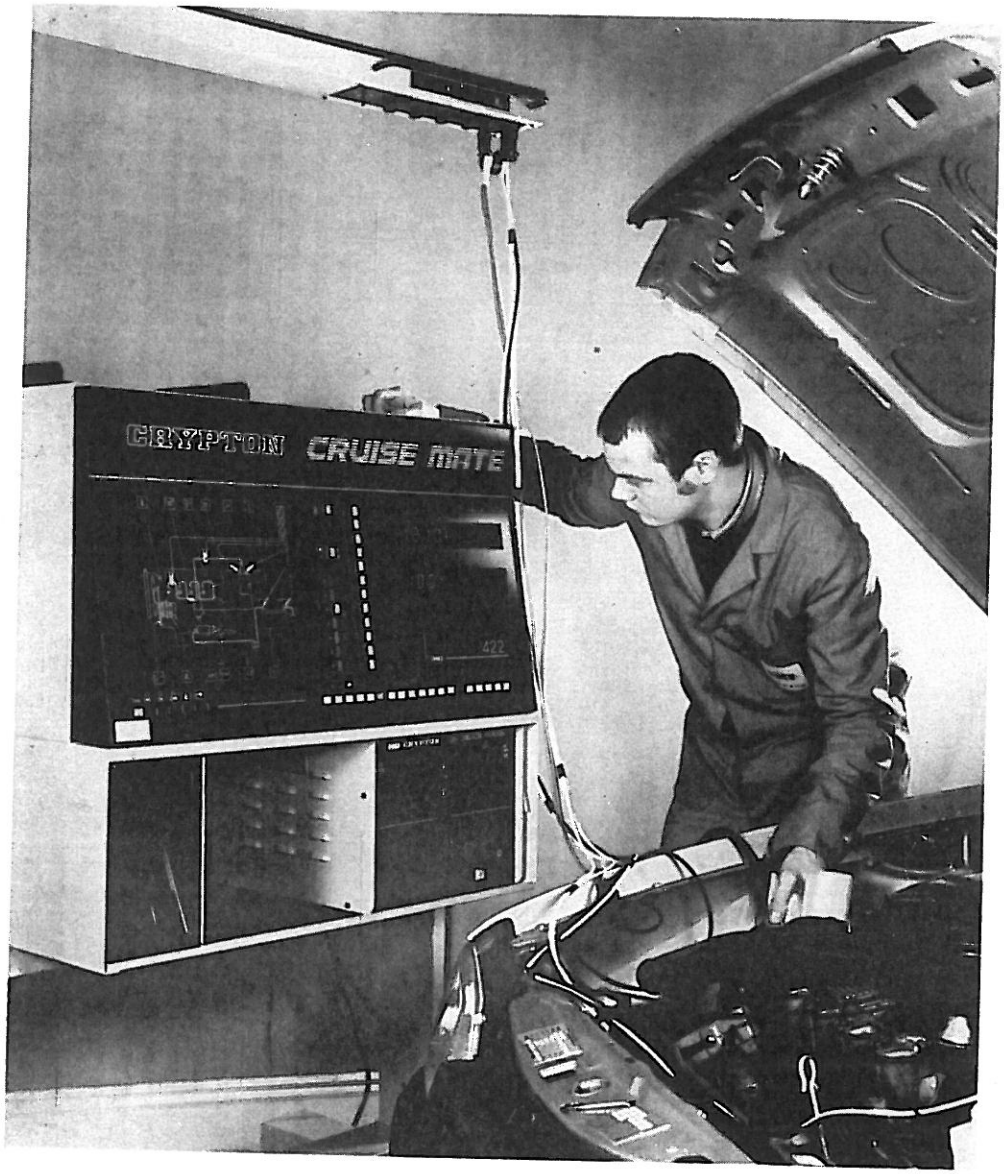
MASTER.

FKI CRYPTON



422 Cruise Mate

Operating & Maintenance Instructions

TES 997
April 1989

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FKI CRYPTON

422 Cruise Mate

WARNING: DO NOT ATTEMPT TO OPERATE THIS EQUIPMENT UNLESS YOU HAVE READ AND UNDERSTOOD THESE INSTRUCTIONS

The reliability of this equipment is fully supported by FKI Transervice with repair workshops and field service engineers to provide a full range of after-sales care, including installation, contract maintenance, factory overhaul and emergency repairs on-site. Please refer to the page at the end of this manual for details of your local service area.

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important notes

1. This equipment leaves the factory connected for 240 volts nominal single phase 50Hz a.c. mains supply.

   Where the mains voltage differs from this it is essential that the mains tappings situated inside the cubicle are adjusted as described on page 3 of this manual.

2. The Cruise Mate should be stored and kept in a dry condition.

safety precautions — general

1. Operators should not allow themselves to come into contact with water or other similar conductors when using the equipment.

2. The equipment is not weatherproof and should not be used outside in rain or snow.

3. The internal circuits and components of the equipment should not be tampered with while the mains supply is switched ON as high voltage circuitry is used.

4. When testing a vehicle, never allow HT sparks to short to the battery or engine dipstick as this can cause an explosion of hydrogen or oil fumes.

5. Most electronic fault diagnosis is performed with the engine running; therefore, operators should exercise due caution with regard to the fan and associated belts, shock from ignition components and burns from the exhaust and cooling systems.

   Care should also be taken to keep the test leads clear of the fan.

6. The earth lead of the mains supply cable MUST ALWAYS be connected to a good earth point.

7. Where the test area is confined, provision should be made to extract the exhaust gases.

8. Equipment should be sited in an area designated and clearly marked:

FOR USE BY AUTHORISED PERSONNEL ONLY

safety precautions — fuel

Petrol will remain at high pressure in petrol injection systems for several hours after switch-off. Always take the following precautions when fitting or removing injection test equipment even if the system has been depressurised.

To depressurise the system, crank or start the engine with the petrol pump disabled.

1. Wear eye protection.

2. Avoid petrol spray when loosening pipes by covering the point with an absorbent, disposable towel.
   Beware of petrol spray at all times.

3. Never use the petrol test equipment for any purpose other than petrol system measurement as this could cause damage or injury.

4. Always ensure that the petrol pump is OFF before connecting or disconnecting measuring equipment.

5. NEVER allow smoking or naked lights in the vicinity of a vehicle where fuel tests are in progress.

6. Always use a hose clip when connecting the push-on hose connector to a fuel pipe.

reception & general information

1. Unpack the equipment and examine for any damage.

2. Check contents against the despatch schedule enclosed for any loss or discrepancy.

   Report to the supplier immediately any breakage, loss or discrepancy.

3. The 422 Cruise Mate leaves the factory connected for a 240V a.c. single phase 50Hz mains supply. If your mains supply differs from this voltage proceed as follows:

   ENSURE THAT MAINS SUPPLY IS DISCONNECTED FROM EQUIPMENT.

   Remove rear panel by unscrewing the fixing screws.
   Locate mains tapping block (shown on page 3).

   Adjust as follows:

   (a) Required mains tapping - 240V, 220V, 200V, 120V and 100V:

   Move BROWN wire to terminal marked with appropriate voltage and BLUE wire to terminal marked '0'. Example '2' on page 3 shows connections for 200V.

   (b) Required mains tapping - 250V, 230V, 210V, 130V and 110V.

   Move BROWN wire to terminal numbered 10V BELOW the required voltage and BLUE wire to terminal marked '10'. Example '1' on page 3 shows connections for 110V.

   Secure rear panel in position using the screws removed previously.

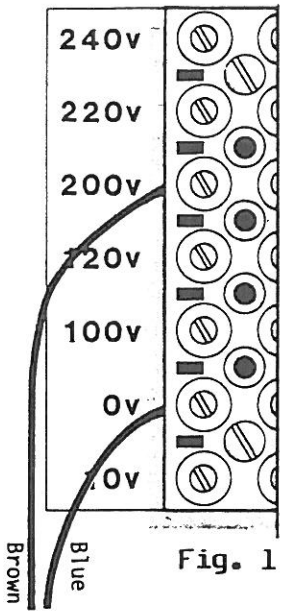


Fig. 1

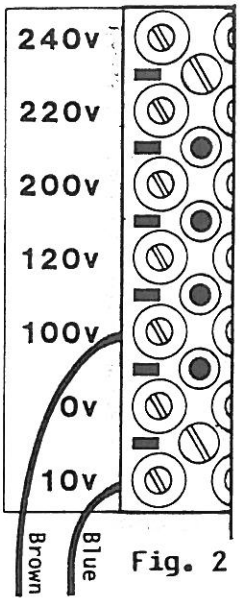


Fig. 2

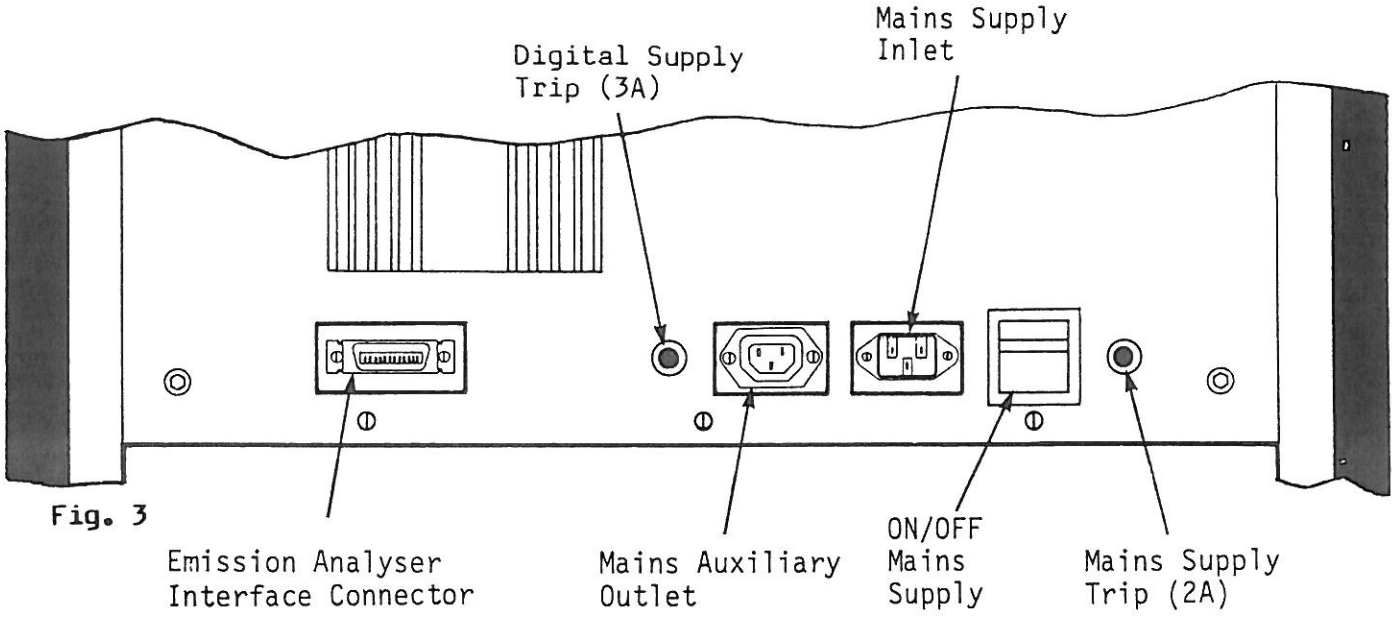


Fig. 3

4. Connect the equipment to the mains supply using a suitable plug fused at 5 amps and observe the following colour code:

BROWN	lead to LIVE
BLUE	lead to NEUTRAL
GREEN/YELLOW	lead to EARTH

NEVER use a mains fuse exceeding 5 amps.

5. Each time the Cruise Mate is switched on, a 'self test' routine is initiated to check important areas of the internal electronics circuitry. If a fault is detected a code number will appear on one of the digital displays. This number should be passed on to the FKI Transervice Regional Office (see back of manual), or Agent if overseas, to enable the Service Engineer to recognise the fault before arriving on site.

If during normal usage the equipment appears to function abnormally, switch the mains supply off, wait 10 seconds then turn on again, to perform a self-test and thereby determine if there is a circuit malfunction.

6. The boom assembly may arrive detached from the machine and be stowed below the main console in packing material. The boom will be attached to internal circuitry by a wiring harness.

If the boom is detached it should be erected as follows:

a) Unpack the boom from the base of the machine.

b) Unpack the carton containing a cover plate, six 2.5mm screws and washers.

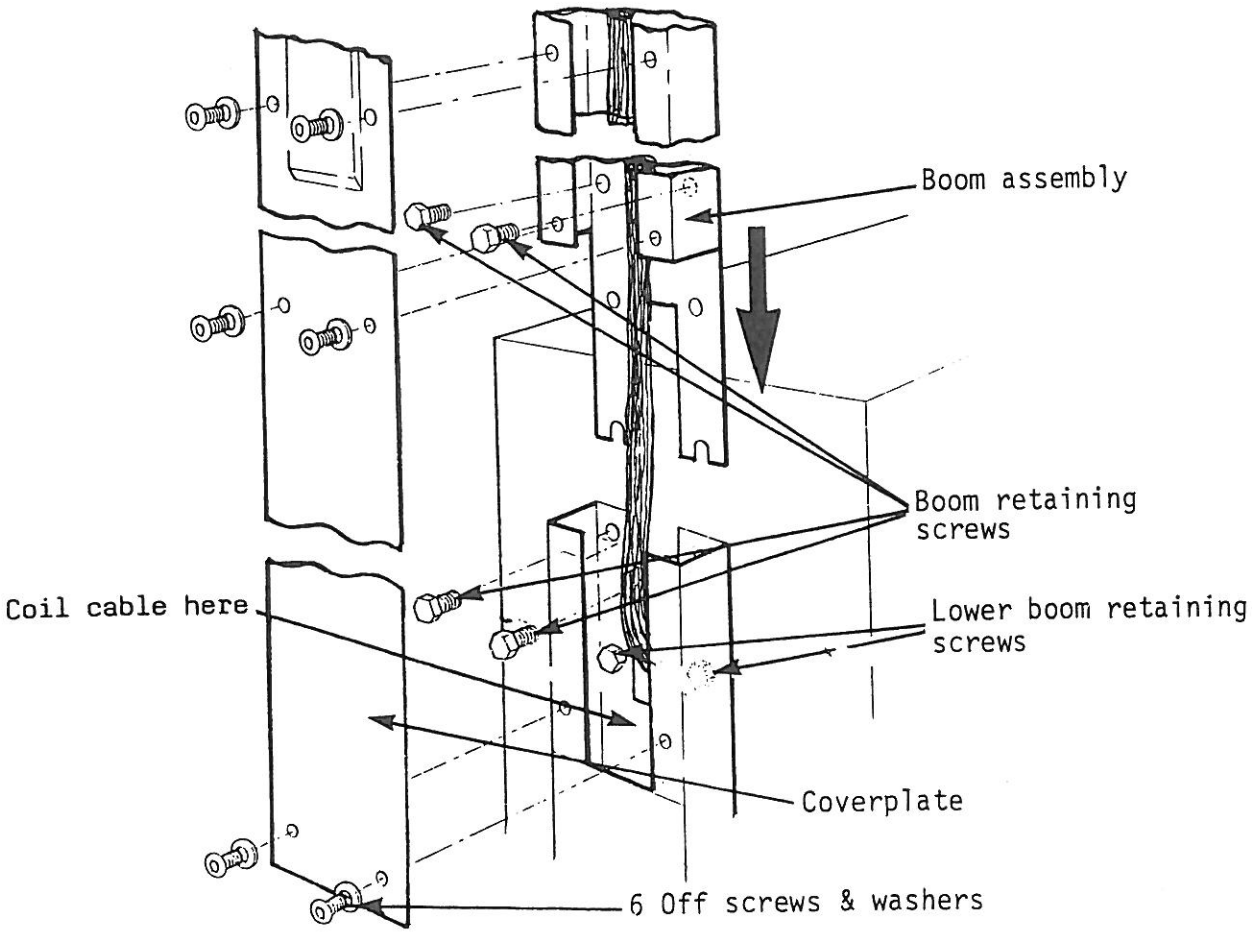
c) Loosen the lower boom retaining screws in the side frame and remove the top retaining screws.
Refer to the illustration below for this operation.

d) Carefully raise the boom assembly and slide it down inside the frame taking care not to damage or strain the wiring harness. The slotted holes at the base of the vertical boom support pillar must locate behind the hexagonal screws loosened in step (c).

e) Fit and tighten the top boom retaining screws and tighten the bottom retaining screws.

f) Fit the side cover using the six 2.5mm socket head screws and washers. An 'Allen' wrench will be required for this operation.

g) Ensure that sufficient cable is coiled in the lower boom area in order to be able to pull out drawer assembly of 422 and that cable is free to move when doing so.



7. The 422 is switched ON by a rocker switch located at the rear of the equipment. When ON, the rocker switch is illuminated in RED.

8. The electronic components of the machine are protected by two automatic thermal overload trip switches positioned at the back of the equipment on the right side (viewed from rear). It is possible for the switches to trip out even though there is no fault. To reset, allow a short time to elapse, then press the switch button firmly.

   If either switch trips out immediately or operates persistently, there is an equipment fault and an FKI Transervice Engineer or Agent (overseas users) should be called. For Service Centres see Page **91.**

9. A mains outlet is located at the rear of the equipment to provide power for accessories, e.g. emission analyser. The outlet becomes live when the mains switch is ON and carries the same voltage as that supplying the 440 equipment.

   The optional emission analyser, if subsequently ordered, must be fitted as stated on page **84.**, The aperture for this analyser is below the the main console on the right.

10. A moulding on the left side of the equipment below the main console is used to hold the timing light when not in use. The timing display control and flash activator button are both housed in the timing light moulding.

11. Calibration details and part numbers of test leads are given on pages 78 and 8 respectively.

12. Storage space for the test leads and accessories is provided in the centre section beneath the main console behind a sliding panel.

13. The 422 is suitable for testing electronic ignition and petrol injection systems.

14. The optional printer unit (PRH 1) if subsequently ordered, must be fitted as described on page 85.

15. A petrol flow transducer is available as an option with the 422 CRUISE MATE. The read-out for flow is selected from button '7' (see page 15). When using the flow transducer, certain readings on the lower digital displays are frozen or updated slowly. The flow select button '7' should therefore only be pushed in when a specific flow measurement is being made, the tachometer button '4' should normally be selected.

16. An 'automatic snapshot' is available from the 422 engine analyser. In this test mode, the analyser gathers data from a number of principal components of the engine and, on command from the printer handset, presents them as hard copy. Test 18 on page 54 gives precise details.

    NOTE: The 422 must be fitted with both a Printer and Handset (PRH 1) to enable the test to be run and results obtained.

optional equipment

A range of optional equipment is available for use with the 422 as follows:

Printer - PRH1

Provision is made beneath the right hand top panel to house an 80 column dot matrix printer unit. The 8 1/2" width paper exits through a slot in the replacement removable top panel which comes with the printer kit. The printer is operated by a handset which connects with a socket on the test lead boom. Good and bad test results can be recorded with the bad ones highlighted in heavy type. The printer can be commanded to print a 'Header' and Footer' above and below the test results. Fitting instructions are given on page 85.

Emission Analyser - Models 267 and 270

NOTE: A separate Operating Manual is supplied with these analysers.

Two models of emission analyser can be specified with the 422 Cruise Mate. Model 267 is a two-gas analyser giving CO and HC readings, while model 270 is a four-gas instrument with CO, HC, CO^2 and O^2 available. The 270 is of particular use on engines where CO and HC have been almost entirely removed by the catalytic exhaust system and fresh air pump. Fitting instructions are given on page 84.

Amps Probe - AMP 1

A clip-on amps probe, which connects to the test lead boom, can be fitted to check charging and starting current of both petrol and diesel engined vehicles.

Temperature Probe - TMP1

A temperature probe, which connects to the test lead boom, is available to verify the temperature at, for example, the coolant sensor when a test is being performed on an injection system. An increasing use is being made of temperature sensitive devices in engine management systems, which demand accurate knowledge of operating temperature to assess their performance. Readings in both Celsius and Fahrenheit are available.

Vacuum Pressure Transducer - VPT1

A vacuum and pressure measuring device is available for attachment to a connection on the test lead boom.

Units of vacuum measurement are then shown on the digital display in inches of mercury (in Hg) or kPa. An FKI Transervice Engineer should be called if it is desired to change the units.

Pressure readings up to 14 lbf/in^2 are available for checking petrol pump pressures of carburated engines. The transducer is NOT suitable for petrol injection systems. Metric measurements of vacuum and pressure can be specified for certain overseas areas.

Flow Transducer - FMT1

A flow transducer, which connects to the test lead boom, is available to measure petrol flow. When this is connected in the main fuel line of a petrol injected engine, flow rate in litres per hour can be measured on the digital display.

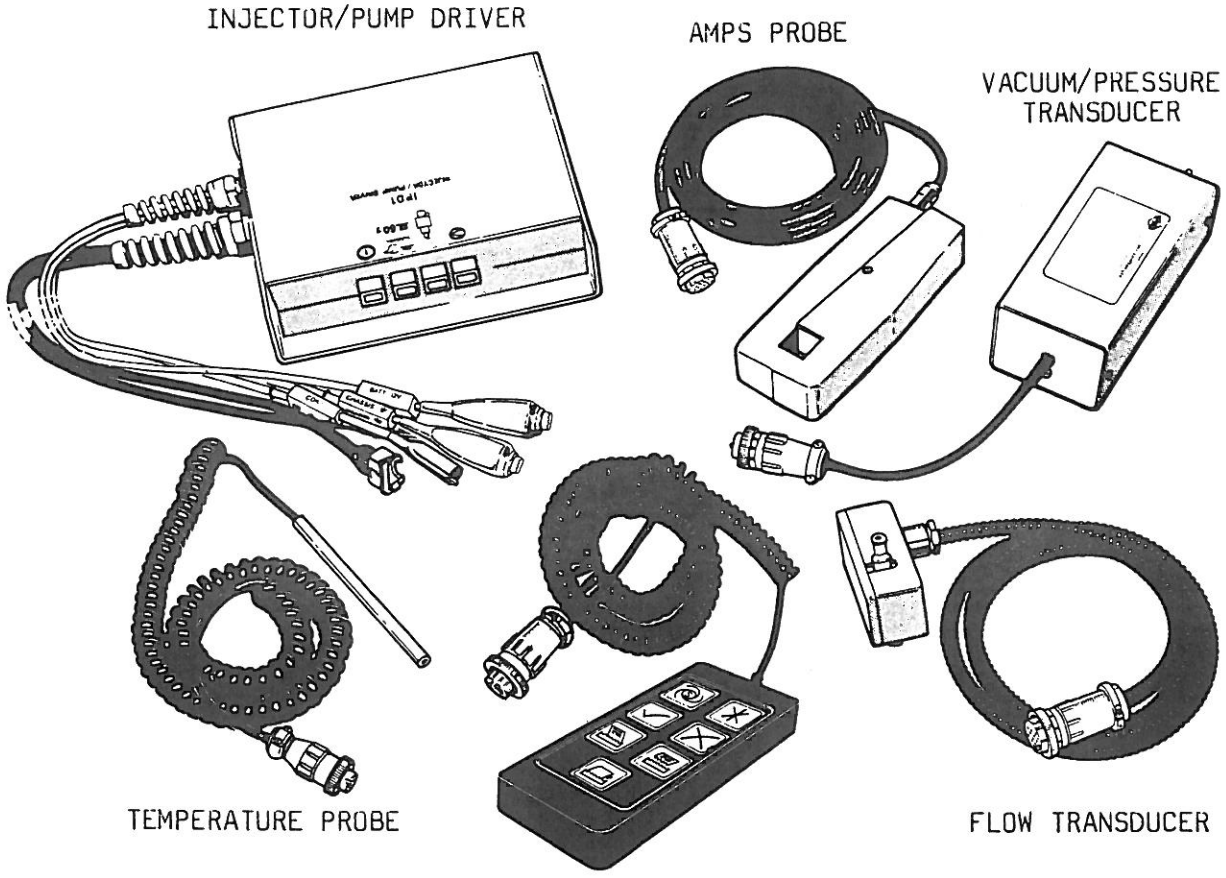
Injector/Pump Driver - IPD1

This hand held unit, which is powered from the vehicle battery, gives the ability to drive an injection system either through the relay base or coil CB (-) wire.

Also provided is an injector operating lead to power the injector and so enable spray formation and flow to be assessed.

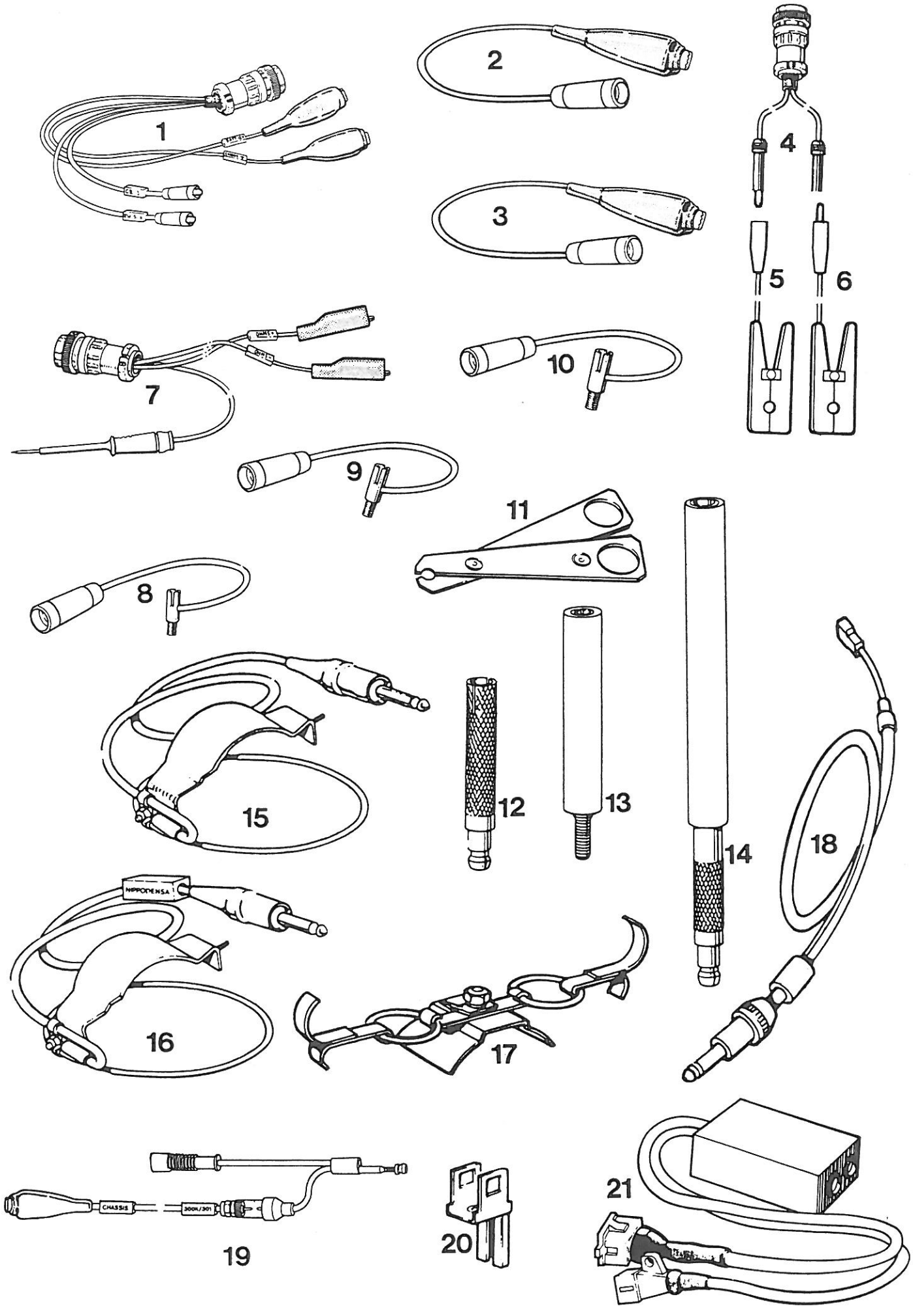
An injector adaptor lead is provided to facilitate easy connection to various sensors in the injection system.

Detailed information on popular systems is given in the Crypton manual 'Testing Petrol Injection Systems'.



accessories

ITEM NO.	PART NO.	DESCRIPTION AND USE
1	2-AS-05022	Standard test lead Assembly.
2	3-AS-05018	Coil CB (-) lead coloured GREEN.
3	3-AS-05019	Coil SW (+) lead coloured YELLOW.
4	300K/302	Connects red and grey probes to boom.
5	AS-C-72284	Red probe - connects to No. 1 plug lead.
6	AS-B-72287	Grey probe - connects to coil HT lead.
7	2-AS-04802	'Scope input lead and ohms test lead assembly. Supplies low voltage information for electronic ignition and computer testing.
8	3-AS-05015	Vauxhall/Opel and Ford ignition coil LT adaptor. Fits on standard test lead.
9	3-AS-05016	Ford coil LT adaptor. Fits on standard test lead.
10	3-AS-05017	Ford coil LT adaptor. Fits on standard test lead.
11	AS-B-04736	Insulated pliers for removing plug leads.
12	DL-B-48441 (8 off)	Spark plug adaptors. Fit between spark plug terminals and plug leads to enable earthing of plug leads.
13	4-AS-03427	Spark plug adaptor. Continental plug lead stand-off adaptor.
14	4-AS-03429	Long plug adaptor. Used to stand off plug leads on engines with recessed spark plugs.
15	3-AS-03284	HEI adaptor. Fits Nippon Denso distributors with early in-built coils on Toyota cars.
16	3-AS-03929	HEI adaptor. Fits Nippon Denso distributors from 1985 with in-built coils on Toyota cars.
17	2-AS-02257	HEI adaptor. Fits AC Delco distributors with in-built coils on General Motors U.S.A. vehicles.
18	AS-B-72304	Connecting lead for AC Delco HEI adaptor. Fits in place of GREY HT clip.
19	300K/301	Plug lead spark gap. Used in conjunction with coil kV test on electronic ignition systems.
20	M32 'Lucar' (2 off)	Lucar double adaptor. Fits on GM HEI distributor tacho terminal to allow connection of GREEN test clip.
21	300K/303	Injector adaptor lead. Enables safe connection to measure injector voltage, resistance etc.


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21
NIPPONDENSO
CHASSIS

test lead boom connections

All connections between the engine analyser and vehicle, except the timing light and emission analyser, are made via the overhead boom as shown opposite and listed below.

1. Main LT Test Harness.
2. Red and Grey HT Clip Harness.
3. Ohms Test/'Scope Input Probe Harness.
4. Temperature Probe (optional).
5. Handset for Printer (optional).
6. Vacuum/Pressure Transducer (optional).
7. Flow Transducer (optional).
8. Current (amps) Probe (optional).
9. Optical (LED) Probe (optional).
10. Electronic Ignition Switch.

The electronic ignition switch is used when unwanted signals from an engine with electronic ignition cause the oscilloscope trace and rev. counter to become unstable. When this occurs, move the switch to the LO position to stabilise the displays. In severe cases the switch may have to moved to the HI position. ALWAYS return the switch to OFF after the test.

connnecting to the vehicle

Using appropriate adaptors where necessary connect the test leads as follows:

Adaptors 8, 9, and 10 shown on page 9 are used for Ford and Vauxhall/Opel coil LT connections.

(a) The RED HT CLIP onto No. 1 spark plug lead (No. 6 on Rover 2300 & 2600).

(b) The GREY HT CLIP onto the coil HT lead.

(c) The YELLOW test lead to the coil SW (+) terminal.

(d) The GREEN test lead to the coil CB (-) terminal.

(e) The RED test lead to the battery live terminal.

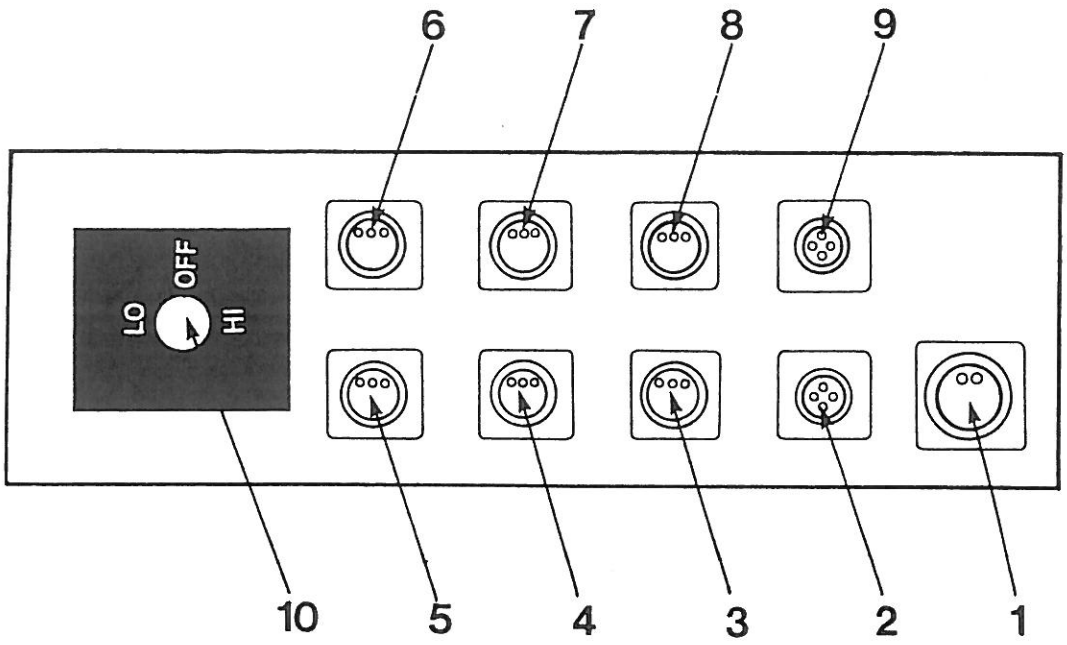
(f) The BLUE test lead to battery earth if possible or a good engine earth.

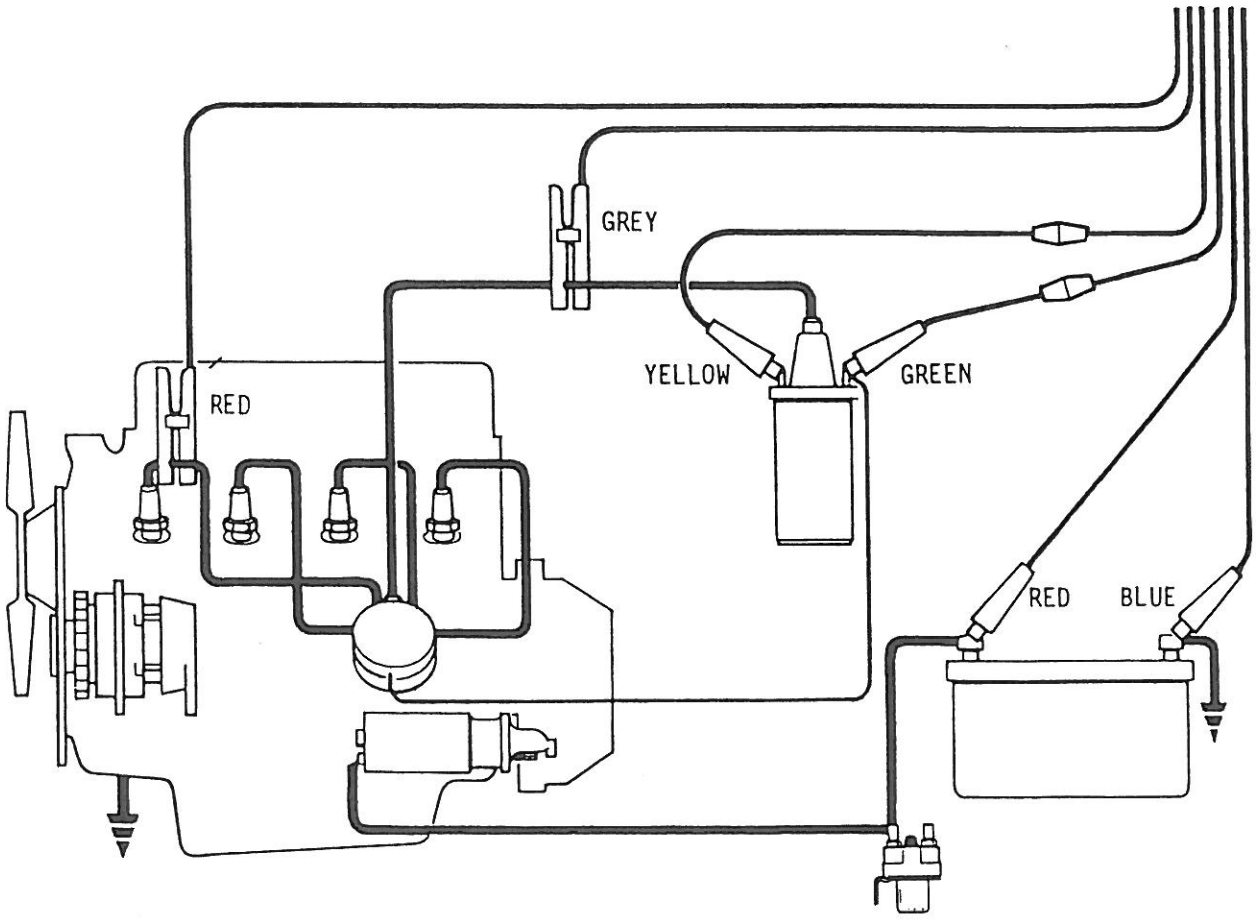
Connection of the six leads is shown on page 11.

WARNING: Keep test lead hoods clean and never allow the YELLOW test clip to short the coil SW terminal to earth as this can damage the vehicle wiring.

Always ensure that the gear lever is in neutral or park (automatic) before starting the engine.

Care must be taken to keep the test leads clear of the fan and other rotating components.


6
7
8
9
OFF
LO
HI
10
5
4
3
2
1


GREY
YELLOW
GREEN
RED
RED
BLUE

using the printer

The printer unit, available to option, is an 80 column dot matrix unit using two ply A4 width paper on a roll. A handset is used to control the printer operation, as shown below.

In addition to information shown on the digital displays, the printer will also print test titles, header and footer messages. In this way a report sheet can be constructed as shown. The operator can choose to print either 'good' or 'bad' readings at his or her discretion, the bad readings being highlighted by a bold X with the actual reading shown in bold type.

Example:

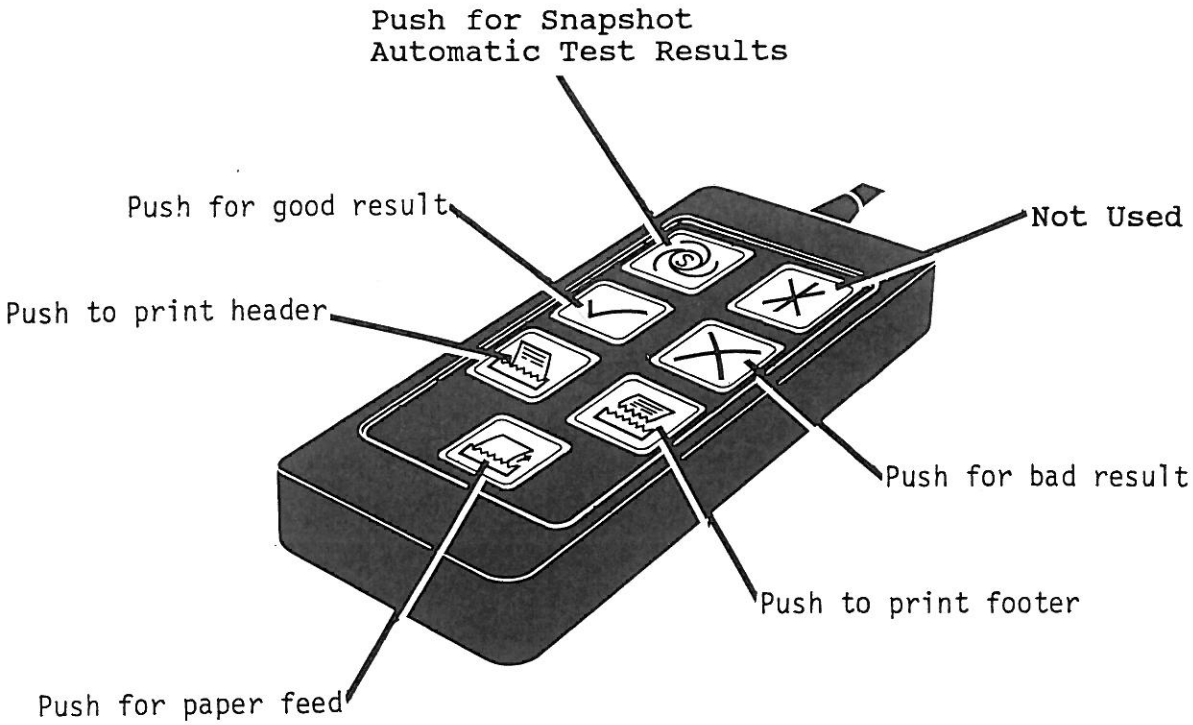
X Dwell at 840 rpm = **57** Deg

In addition to the standard "Header", a Personalised Header may be fitted enabling the Dealer's name, address and Sales message to be printed on each results sheet. Contact your local Distributor or Agent for details.

If an operator decides to perform an automatic cylinder balance test the results will be stored during the test and then printed out automatically at the end of the test. In all other test modes, the printer must be operated manually.

Two rolls of paper are supplied with each machine, one in the printer and one spare roll.

To ensure that main test results are printed during a standard tune-up always ensure that the tachometer button (4) is selected. Auxiliary test results e.g. ohms, flow etc. will be printed according to the button selected.



```
*****************************************************************************
* SERVICE STATION NAME/ADDRESS :-                                           *
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*****************************************************************************
*                                                                           *
*        DATE :                        MAKE/MODEL :                         *
*                                                                           *
*    CUSTOMER :                          REG. NO. :                         *
*                                                                           *
*    OPERATOR :                           MILEAGE :                         *
*                                                                           *
*****************************************************************************
```

CRYPTON CRUISE MATE ----- RESULTS

NOTE : **X** indicates service action is required. COMMENTS
CYLINDERS ARE SHOWN IN FIRING ORDER.

STARTING/CHARGING

Battery volts - cranking	at	230 rpm = +	10.7 V
Current - cranking	at	340 rpm = -	121 A
Battery volts	at	2820 rpm = +	13.6 V
Current	at	2930 rpm = +	4 A

COIL SUPPLY

Coil '+' volts - cranking	at	350 rpm = +	10.2 V
Coil '+' volts	at	1980 rpm = +	12.1 V

IGNITION ECU/DISTRIBUTOR

Electronic module/CB volt drop	at	2040 rpm =	1.66 V
Dwell	at	930 rpm =	13 deg.
Dwell overlap	at	930 rpm =	1 deg.
Dwell	at	2770 rpm =	37 deg.
Dwell overlap	at	2770 rpm =	2 deg.

STROBE TIMING (Timing mark used deg.)

Strobe advance	at	720 rpm and	0.1 psi	=	9.8 deg.
Strobe advance	at	2870 rpm and	0.1 psi	=	30.0 deg.
Strobe advance	at	3020 rpm and	19.9 inHg	=	44.7 deg.

PLUGS/PLUG LEADS

Plug kV difference	at	980 rpm =	4 kV

Plug kV

CYL1	CYL2	CYL3	CYL4
14	13	16	12

Coil output voltage	at	970 rpm = -	43 kV
Sparkline kV	at	970 rpm	

CYL1	CYL2	CYL3	CYL4
3.2	3.0	2.8	3.2

CARBURATION/INJECTION

CO level	at	720 rpm =	2.9 %
CO2 level	at	720 rpm =	11.6 %
O2 level	at	720 rpm =	3.0 %
HC level	at	720 rpm =	400 ppm
CO level	at	1840 rpm =	0.1 %
CO2 level	at	1840 rpm =	10.7 %
O2 level	at	1850 rpm =	4.8 %
HC level	at	1850 rpm =	340 ppm

CYLINDER CONDITION

Power balance at 1140 rpm (100% = 244 rpm, limit = 75%)

CYL1	CYL2	CYL3	CYL4
+84%	+100%	+79%	+82%

HC variation (ppm)

CYL1	CYL2	CYL3	CYL4
1360	1380	1360	1360

.....

Operator's signature .

.....

.... (V 2.0).....

CRYPTON CRUISE MATE

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.....

button functions

The equipment is principally controlled by 45 push buttons on the front panel. Each button will show one of two colours depending on whether it is depressed or released.

Symbols are used to indicate the function of each button or group of buttons and these should be found simple to use with a minimum of experience.

To further simplify the explanation in this manual, each button or group of buttons has been numbered as shown in the illustration on page 15.

Buttons 8 to 20 select the chief engine tune-up facilities and all are interlocking i.e. to release one button, another must be pressed.

Buttons 10, 12, 15, 16, 17 and 19 show YELLOW when pressed to indicate that a YELLOW button in GROUP 24 can be used to display an individual function for one particular ignition circuit, cylinder etc.

To identify the individual reading being displayed, use the engine firing order and count the YELLOW buttons from top to bottom starting with No. 1.

Example

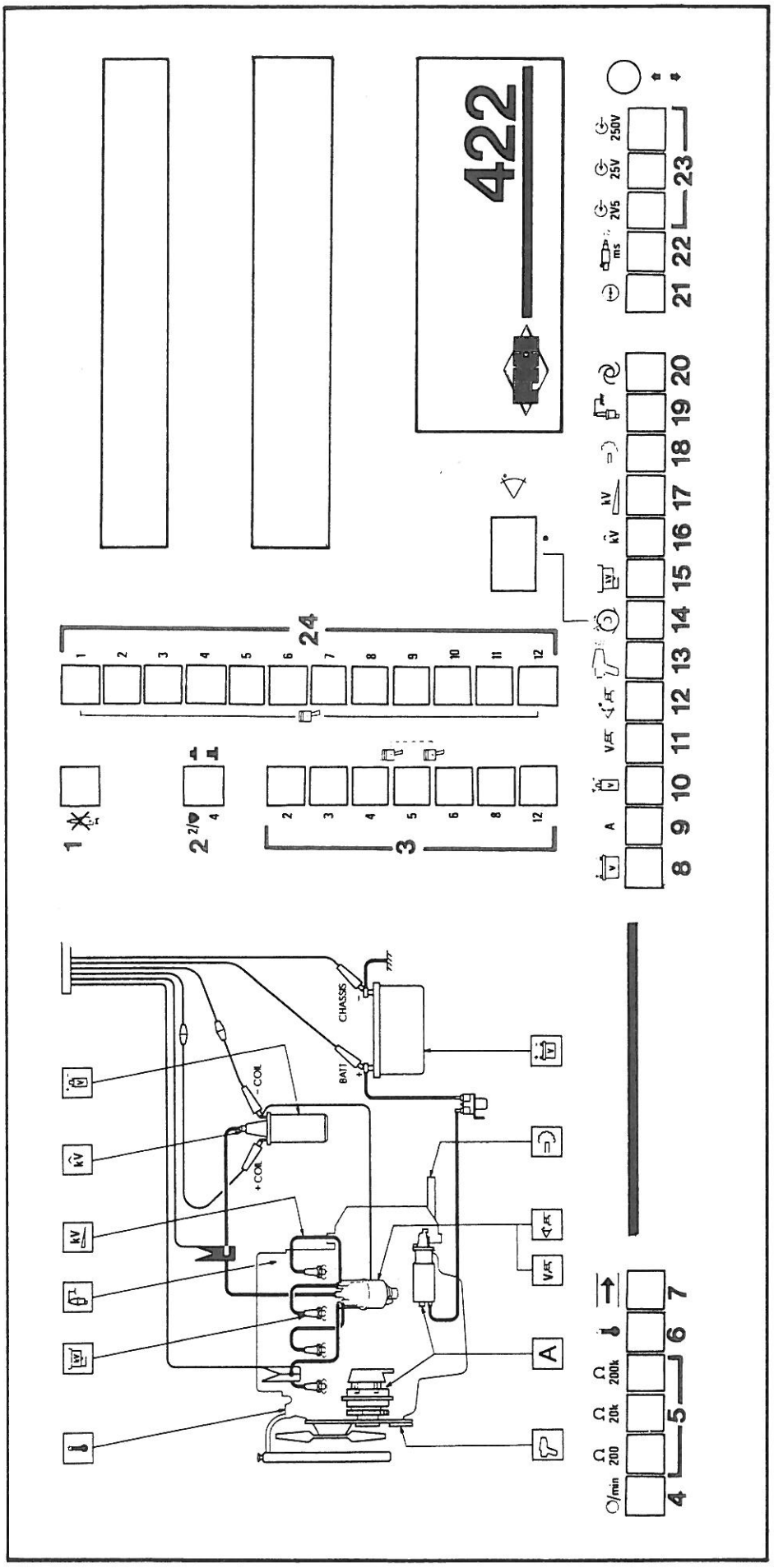
Button Number:	1 2 3 4 5 6 7 8 9 10 11 12
Firing Order of Engine:	1 8 4 3 6 5 7 2

It will be seen from the example that button numbers higher than the number of cylinders in the particular engine under test are not used.

table of button functions

BUTTON	COLOUR OUT	COLOUR IN	FUNCTION
1	GREEN	RED	Push to STOP ENGINE. Push to release.
2	GREEN	RED	Push when testing 2-stroke or Wankel engine. Push to release.
GROUP 3	BLACK	GREEN	Push to select number of cylinders in engine. Buttons in GROUP 3 are interlocking.
4	BLACK	GREEN	Push to select TACHOMETER. Interlocking button.
GROUP 5	BLACK	RED	Push to select OHMS RANGE indicated. Interlocking buttons.
6	BLACK	RED	Push to select TEMPERATURE measurement.* Interlocking button.
7	BLACK	RED	Push to select PETROL FLOW measurement.* Interlocking button.
8	WHITE	BLUE	Push to read BATTERY VOLTS Interlocking button.
9	WHITE	RED	Push to read AMPS * Interlocking button.
10	WHITE	YELLOW	Push to read coil SW (+) volts. Interlocking button.
11	WHITE	RED	Push to read DISTRIBUTOR VOLTAGE DROP. Interlocking button.
12	WHITE	YELLOW	Push to read AVERAGE DWELL ANGLE. Interlocking button.
13	WHITE	RED	Push to use TIMING LIGHT. Interlocking button.
14	WHITE	RED	Push to read MAGNETIC or LED ignition timing. Interlocking button.
15	WHITE	YELLOW	Push to view AVERAGE PLUG VOLTAGE on digital display. Interlocking button.
16	WHITE	YELLOW	Push to view PEAK PLUG VOLTAGE on digital display. Interlocking button.
17	WHITE	YELLOW	Push to view PLUG ARCING VOLTAGE. Interlocking button.
18	WHITE	RED	Push to start PUMP OF EMISSION ANALYSER* Interlocking button.
19	WHITE	YELLOW	Push to activate CYLINDER BALANCE test. Cylinders are disabled by buttons in GROUP 24. Interlocking button.
20	WHITE	RED	Push momentarily to start AUTOMATIC CYLINDER BALANCE test. Works only with button 19 pushed IN. Gives automatic print out of HC and balance results*.
21	WHITE	RED	Push to read VACUUM or PRESSSURE. Interlocking button.
22	WHITE	RED	Push to read injection duration. Interlocking button.
GROUP 23	WHITE	BLUE	Push as required to read voltage on digital display via auxiliary 'scope input lead.
GROUP 24	YELLOW	BLACK	Push to read INDIVIDUAL FUNCTIONS. Used only in conjunction with buttons 10, 12, 15, 16, 17 and 19. Push button to release.

* = If option fitted.


422
CHASSIS
BAT
-COIL
+COIL

language selection

The language required is selected by a small rotary switch located in the calibration panel.

The language is preset at the factory for the destiny of the machine and can be verified on the printout after the 'self test' message each time the equipment is switched ON.

The switch setting is shown by a white line on the spindle which lines up with the appropriate number shown below. A small screwdriver may be required to rotate the switch.

The language selections are listed in the table below.

NOTE: The table may be extended in future software releases.

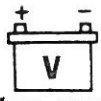
Switch Setting	Language/Country Selected
0	English
1	English/USA
2	German
3	French/France (with emission module SIM details)
4	Spanish
5	Dutch
6	Italian
7	French/NOT France
8	Same as 0
9	Same as 1

TEST SEQUENCE

An Automatic 'Snapshot' Test may be carried out, at one or more fixed engine speeds, as an alternative to individual Manual Tests. See Test 18 on Page 56 onwards. This can provide a detailed 'Health Check' printout of the engine in less than 2 minutes. Note that the 422 must be fitted with a Printer and Handset (PRH 1) to enable this Test to be run and results obtained.

test 1

battery volts
(starter cranking)



button symbol

PURPOSE:

To assess the battery condition and ensure that the mechanical operation of the starter is normal.

PROCEDURE:

1. Push button indicated above and the engine stop button.

2. Operate the engine starter for at least 10 seconds.

WARNING: Ensure that test leads are clear of fan before commencing tests.

OBSERVE:

Battery voltage on digital display. This should not fall below 9.8V.

Note: The printer (available to option) may be operated at will via the handset to record any result shown on the digital display. Additional information not on display but stored in the microprocessor, e.g. engine speed, will also be printed.

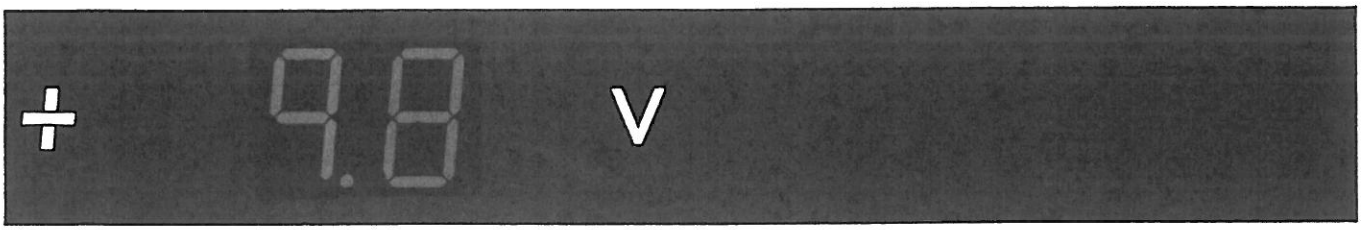
EXTRA FACILITY

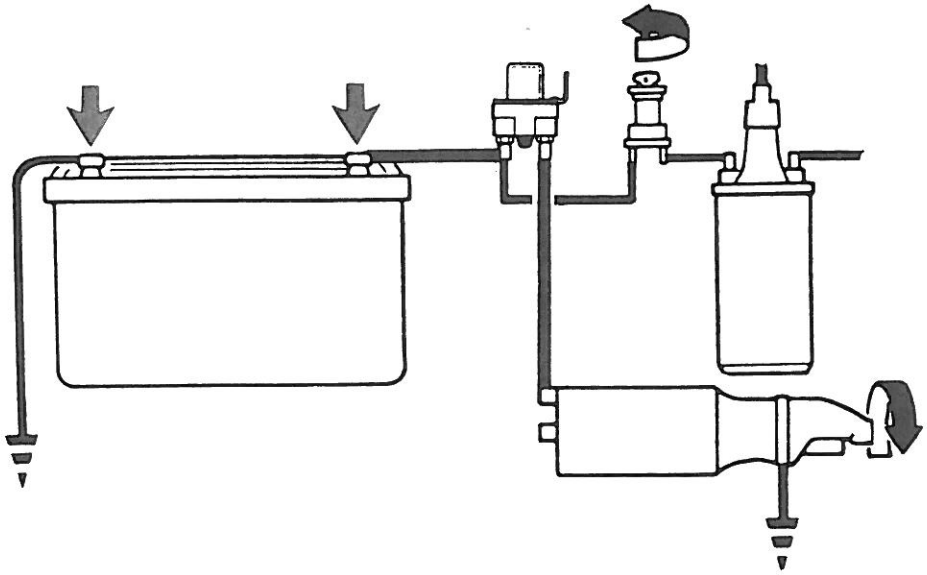
button symbol A

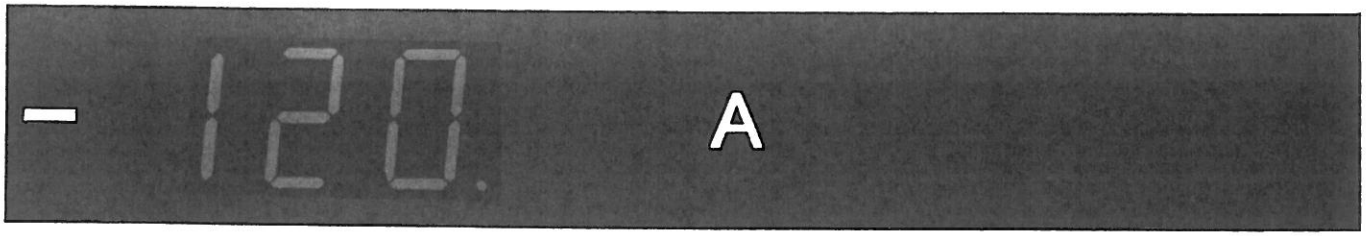
If the optional current probe is clamped around one of the battery cables, the starter current can be checked while the starter is being operated.

Button 9 marked A must be pressed for this test.

The average starter current for a typical range of vehicles is between 70 and 160 amps. Engine temperature has a considerable effect on starter cranking current.


+
9.8
V




−
120
A

test 2

battery volts
(generator charging)



button symbol

PURPOSE:

1. To check that the generator is charging and that the voltage regulator operates.

PROCEDURE:

1. Push button indicated above and switch off heavy electrical loads, e.g. back window heater.

2. Start engine and raise speed slowly to 2500 rpm.

3. Lower speed to fast idle, i.e. 800 - 1000 rpm.

4. Use printer (optional) to record the results if required.

OBSERVE:

1. The speed at which the alternator cuts in. This is normally between idle and 2000 rpm.

2. The stable voltage while the alternator is charging, i.e. the regulated voltage. Alternator systems should have a regulated output of 13.6 - 15V.

NOTES

a) Dynamo systems should give a voltage rise between 0.5V and 3V at an engine speed of 2500 rpm.

b) To check for alternator or fan drive belt slipping, switch on heater fan, lights, heated rear screen etc. and run engine at 3000 rpm. Ensure voltage is a minimum of 13.5V.

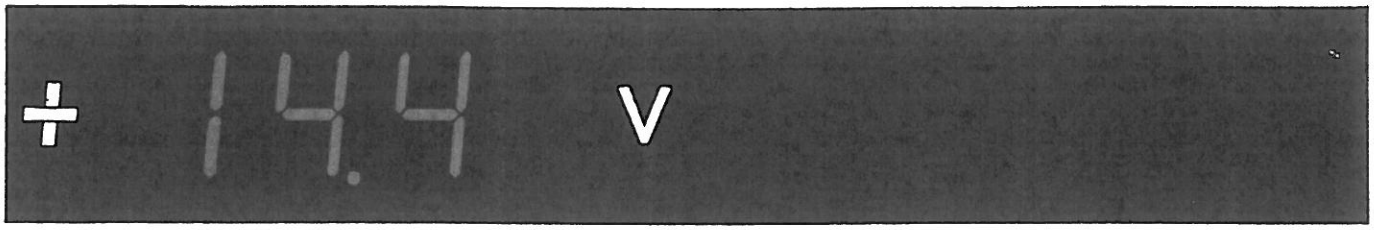
Alternator Testing - Diesel Vehicles

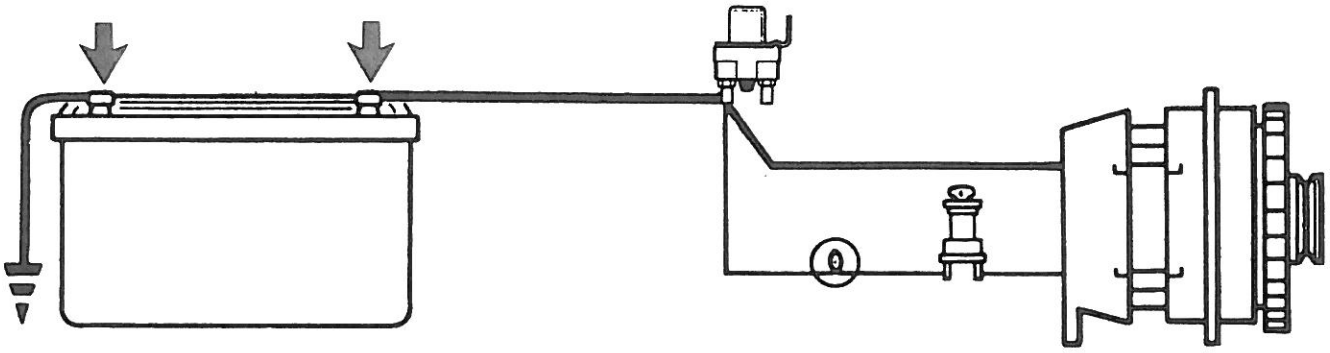
1. Push button shown above

2. Connect the RED & BLUE test leads to the battery (+) and (-) terminals respectively then start the engine and run at a fast idle speed.

3. Check the charging voltage on 12 or 24 system as appropriate.

NOTE: On 24V systems the charging voltage should be 27.2 - 29.5V.


+ 14.4 V



test 3

coil SW volts
(engine running/cranking)



button symbol

PURPOSE:

1. To check on electronic systems the condition of the primary ignition circuit, battery (+) to coil (+) terminals.

2. To check on ballasted systems the coil (+) voltage under running and cranking conditions.

PROCEDURE

1. Push button indicated above.

2. Run engine at 800 - 1000 rpm and read voltage on digital display.

3. Push 'stop engine' button (1) and operate starter.

4 Recheck reading on digital display.

5. Use printer (optional) to record the results if required.

NOTES: 1. Tests 3 and 4 are used on ballasted systems only.

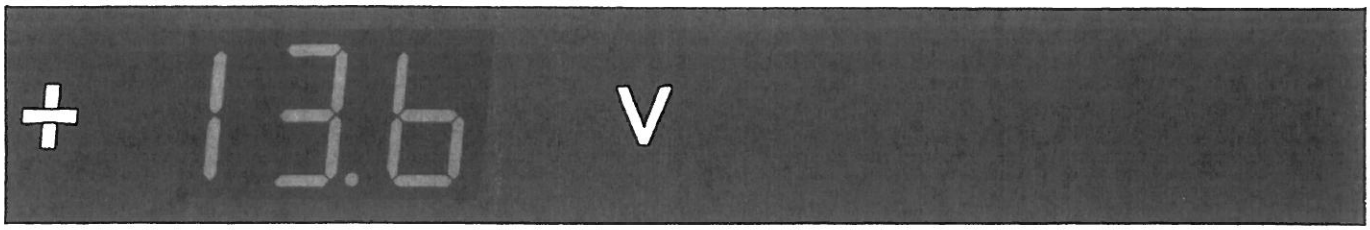
2. To obtain the true coil supply voltage when the engine is running, the GREEN test clip must be fitted to the coil CB (-) terminal.

OBSERVE:

1. Voltage at step 2 which should be within 1V of battery reading checked in Test 2 for electronic systems or 5 to 8V for ballast systems.

2. Voltage at step 4 (ballast systems only) which should be 8.5 to 10.5V as shown opposite.

NOTE: On VW/Audi vehicles with contact breaker systems the reading with the engine running should be 9V.



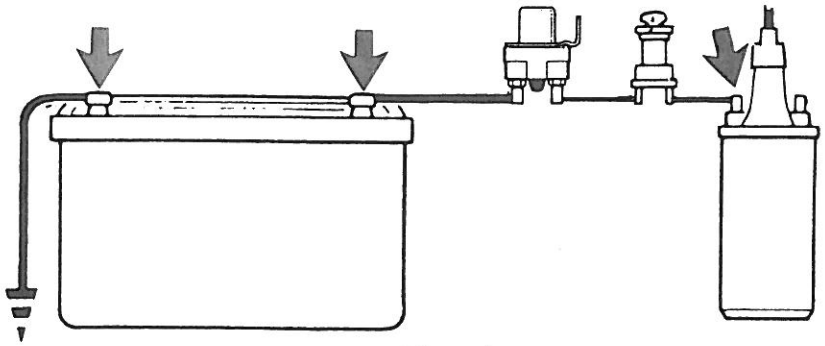
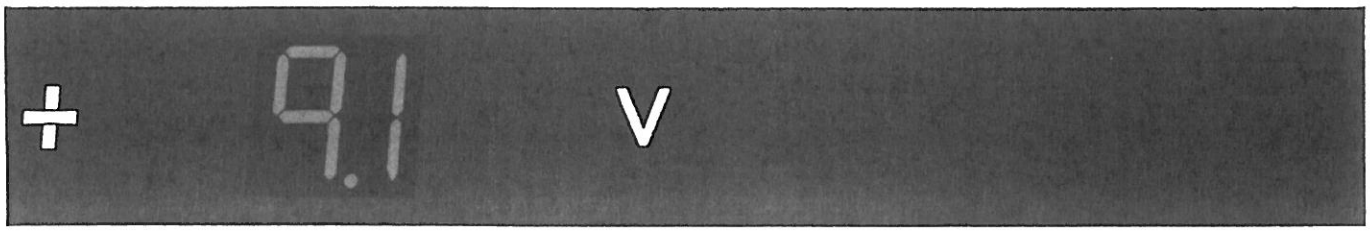


Fig. 1



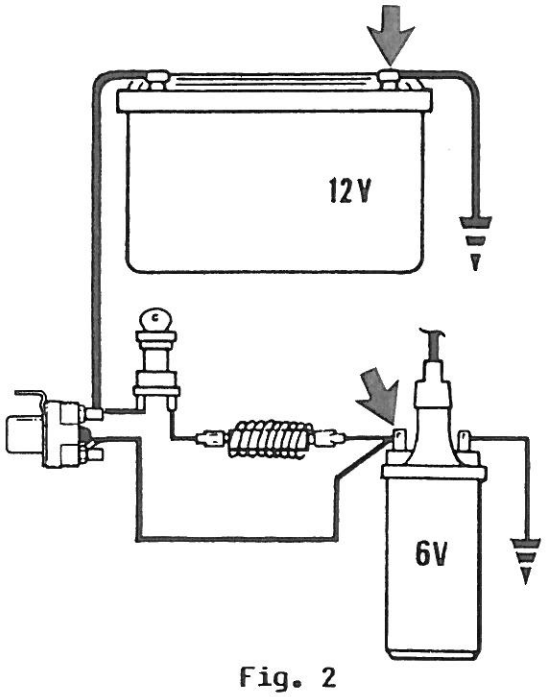


Fig. 2

test 4 distributor voltage drop (dynamic)

V button symbol

PURPOSE

1. To check condition of wiring between coil CB (-) terminal and earth, including electronic module switching circuit.

2. To check on contact breaker systems, the wiring between coil CB (-) terminal and distributor and the breaker points voltage drop.

PROCEDURE:

1. Push button indicated above.

2. Run engine at idle speed, then at 3000 rpm and back to idle.

3. Use the printer (optional) to record the results if required.

WARNING: Check that all test leads are clear of fan before starting.

OBSERVE:

1. Voltage reading at idle.

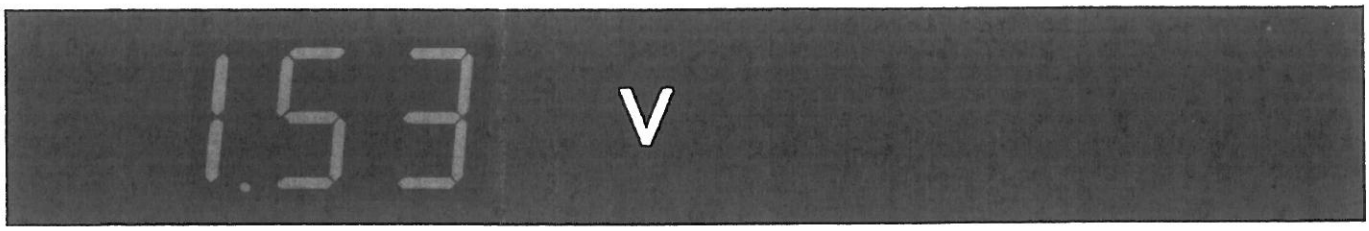
2. Voltage reading at 3000 rpm which should not rise by more than 0.05V.

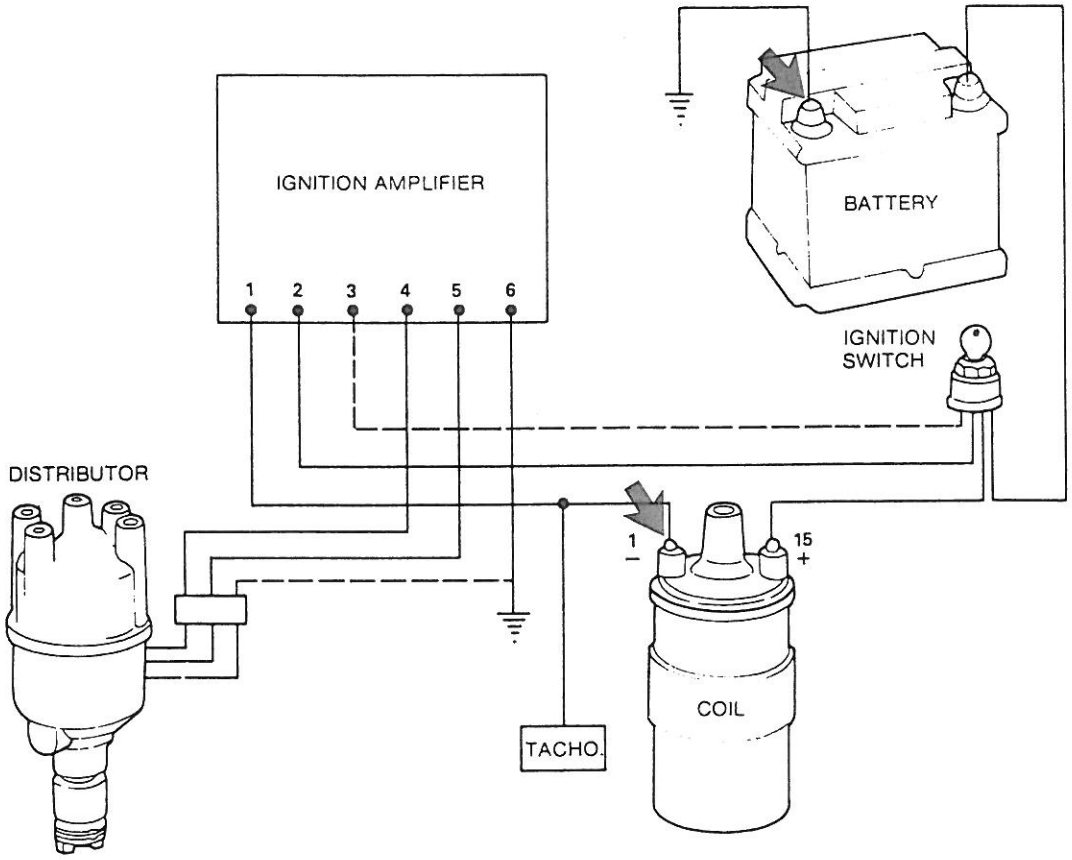
   Maximum readings are as follows: Electronic systems = 2.0V maximum except Vauxhall/Opel = 2.3V maximum and Mitsubishi = 3.15V maximum.

   Points systems = Delco and Ducellier 0.25V; Bosch, Denso, Hitachi, Lucas, Marelli, Mitsubishi, PAL and SEV 0.35V; Motorcraft 0.4V or 0.6V with vehicle tacho fitted.

3. Use printer (optional) to record the results if required.

NOTE: The green 'points closed' indicator lamp will not light on most electronic systems when the engine is stopped with the ignition ON owing to the ignition amplifier switching OFF under these conditions.


1.53
V


IGNITION AMPLIFIER
1
2
3
4
5
6
BATTERY
IGNITION
SWITCH
DISTRIBUTOR
1
15
+
COIL
TACHO.

test 5 dwell overlap


button symbol

Purpose:

1. To check for difference in individual dwell angles which may cause variations in ignition timing between one cylinder and another.

2. To ensure correct pulse generator and amplifier operation on electronic systems.

Procedure:

1. Push button indicated above.

   NOTE: The lower digital display will now read average dwell angle.

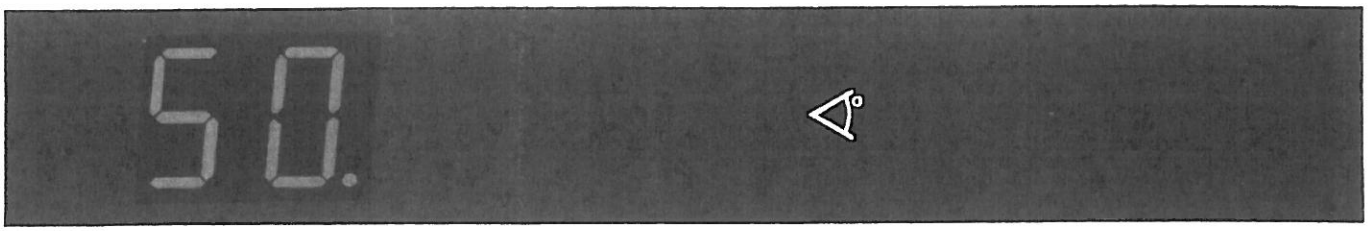
2. Press either the ✓ or X button on the printer handset.

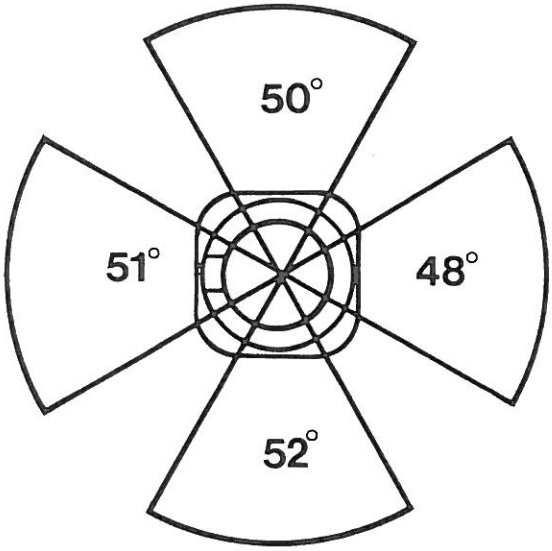
3. Raise the engine speed to 2000 rpm and repeat step 2.

Observe:

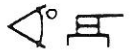
1. The dwell overlap in degrees or percentage on the printout. The reading should not exceed 5°.

   NOTE: The units of measure can be selected from a switch beneath the calibration panel flap in the lower right corner of the console.


50.


50°
51°
48°
52°

test 6 dwell angle


button symbol

PURPOSE:

1. To ensure that the contact breaker points are correctly adjusted.

2. To check coil primary circuit condition, correct coil type and pulse generator polarity on electronic systems.

PROCEDURE:

1. Push button indicated above.

2. Run engine at 1000 rpm approximately.

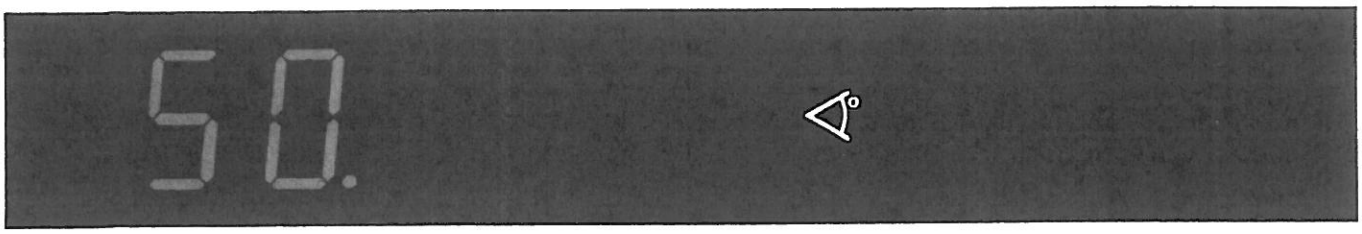
3. Ensure that all buttons in group '24' show yellow.

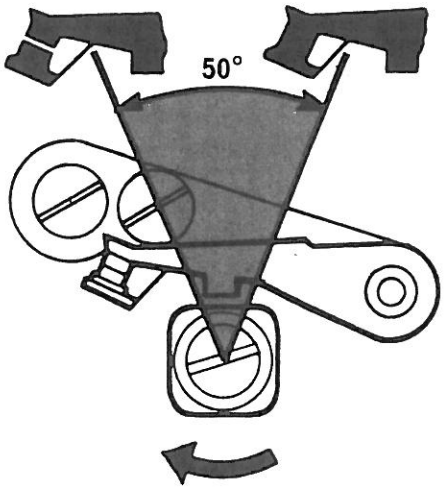
4. Use printer (optional) to record results if required.

OBSERVE:

Average dwell angle on digital display and compare reading with FKI Crypton tune-up data.

NOTES: A switch in the calibration panel enables dwell to be measured in degrees or percentage. The illustration opposite shows, in green, the dwell reading for a distributor with a correct setting of 50^{o}. With electronic systems, although the dwell angle is not normally adjustable, it is important to make a note of the usual dwell for a particular system. When a considerable difference is noted, this may indicate an earth or amplifier fault; that the wrong type of coil is fitted or that the polarity of the pulse generator wiring to the distributor has been reversed.


50.


50°

test 7 dwell adjustment


button symbol

PURPOSE:

To adjust dwell angle or percentage to manufacturer's specification using digital display.

PROCEDURE:

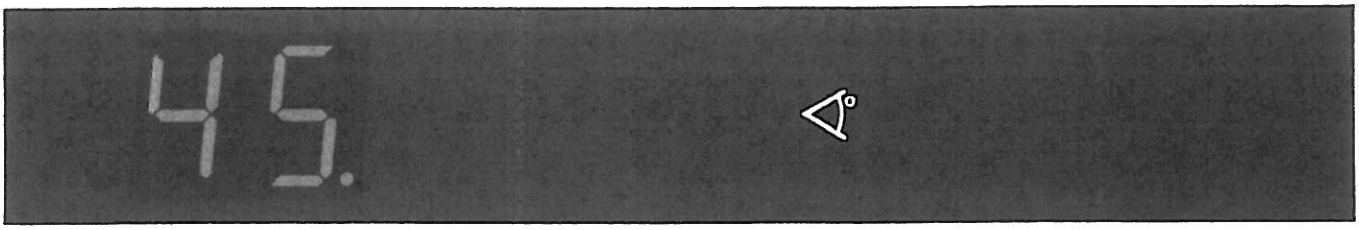
1. Push button indicated above.
2. Stop engine using button '1'.
3. Remove distributor cap and rotor.
4. Loosen points locking screw and move points, crank engine continuously until new points reading appears. Continue process until reading is correct.
5. Tighten points locking screw and re-check dwell.
6. Refit rotor and distributor cap.
7. Start engine and record new dwell using printer (optional) if required.

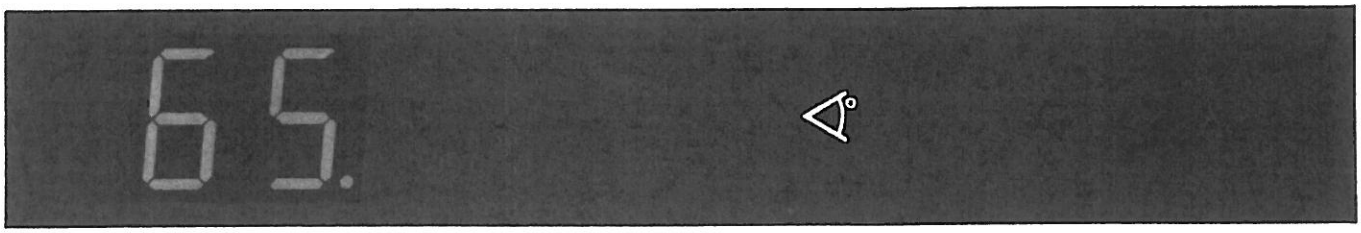
WARNING: Beware of the danger from rotating components, shocks from the ignition system and scalds or burns from water and exhaust systems.

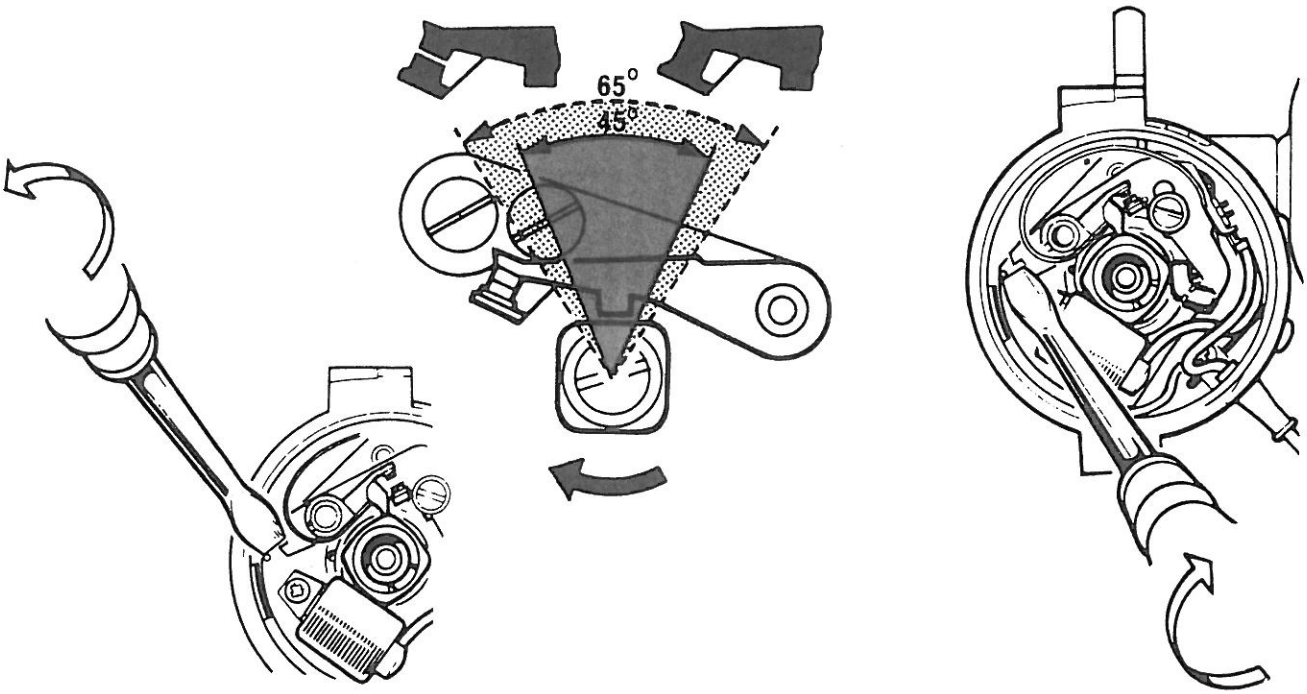
NOTE: Certain engines, e.g. Rover V8 and Renault have facilities for adjusting the dwell angle with the engine running.

OBSERVE:

Dwell reading on completion of adjustment, which should agree with tune-up data.


45.
D°


65.
D°


65°
45°

test 8 dwell variation


button symbol

PURPOSE:

To measure the variation of dwell angle caused by a change in engine speed.

PROCEDURE:

1. Push button indicated above.
2. Start engine and raise speed to 2500 - 3000 rpm or manufacturer's recommended speed for dwell variation test.
3. Use printer (optional) to record test results if required.
4. Lower speed to idle rpm.

OBSERVE:

1. Dwell angle at 2500 - 3000 rpm.
2. Dwell angle at idle rpm.

   The change in dwell angle is dwell variation and should not exceed 3^{o}.

   NOTE: Constant energy electronic ignition systems have 'built-in' dwell variation to achieve the constant energy effect. The amount of variation will differ according to the ignition system manufacturer.

test 9 coil polarity



button symbol

PURPOSE:

To ensure that the SW (+) and CB (-) coil wires are connected to the correct coil terminals, thus ensuring a NEGATIVE HT voltage supply to the spark plugs.

PROCEDURE:

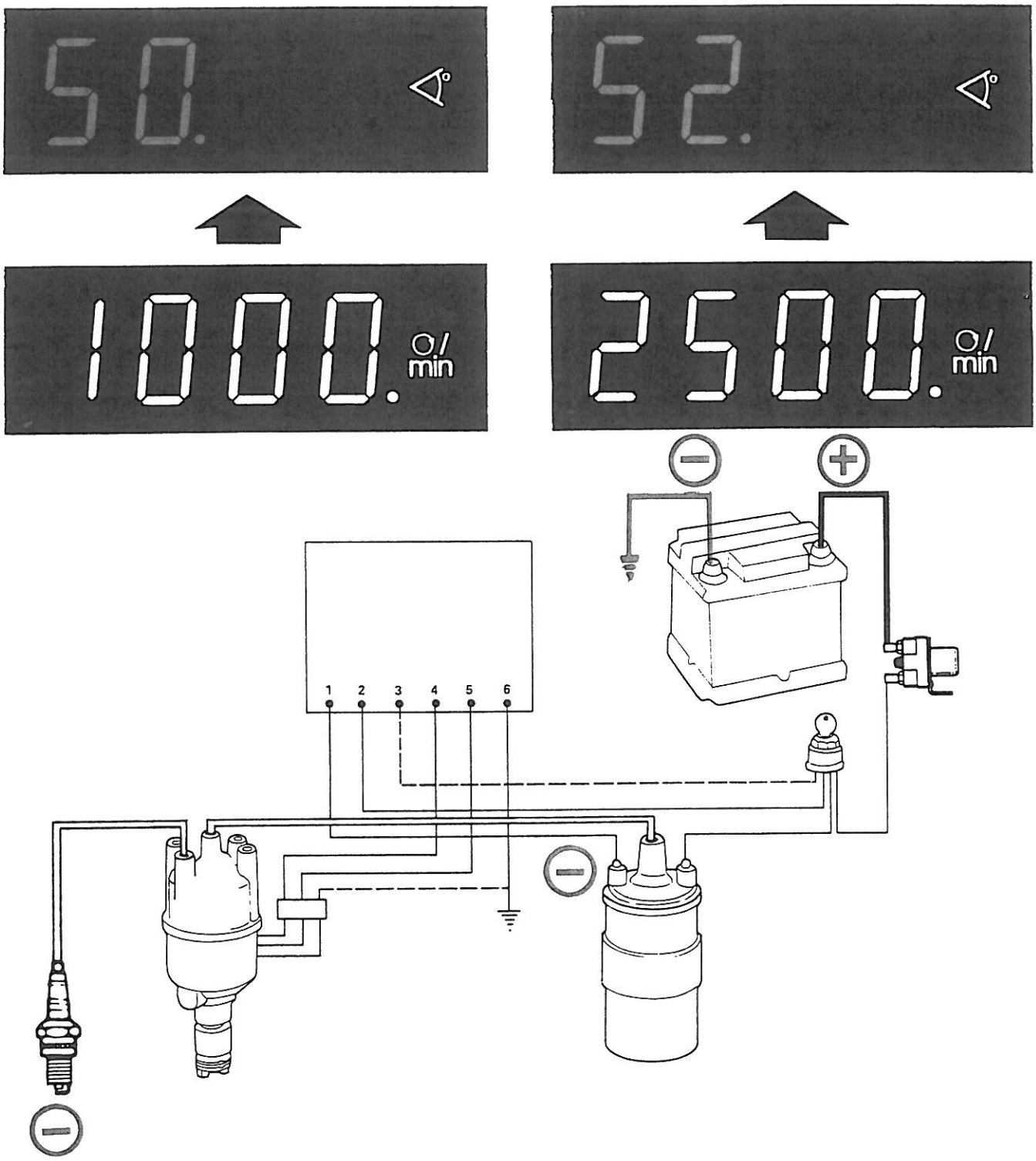
1. Push button indicated above.
2. Run engine at 1000 rpm.
3. Ensure that all buttons in group '24' show yellow.

Observe:

Reading on digital display. This should be above 4kV. If the reading is below 4kV the coil LT connections should be reserved.

NOTE: Always ensure, after reconnecting the LT wires correctly, that the coil markings are then correct for the battery polarity. If not, the wrong ignition coil may be fitted.

Vehicles with double-ended coils will give a positive output from one end. This is normal.


50.
52.
1000. o/min
2500. o/min
1
2
3
4
5
6

test 10 strobe timing check



PURPOSE:

To verify that the ignition timing is correct at the manufacturer's check point as quoted in the Crypton Tune-up data.

PROCEDURE:

1. Push button indicated above.

2. Disconnect vacuum advance pipe from distributor or carburettor. If retard pipe is fitted check data for instruction on whether or not to disconnect.

3. Adjust engine speed to that recommended in FKI Crypton Tune-up Data.

   IMPORTANT: Where no speed is given, run engine BELOW the 'NO ADVANCE' speed quoted in the tune-up data. On computer controlled systems where no timing check figure is given, always check that timing changes with speed and vacuum.

4. Press button shown at 'B' opposite to activate timing light and direct the light towards the timing marks. The timing degrees shown on the digital display can only be adjusted while the light is flashing. When button 'B' is released the digital reading of both timing degrees and engine speed are frozen and will continue to display readings measured at the instant the button was released.

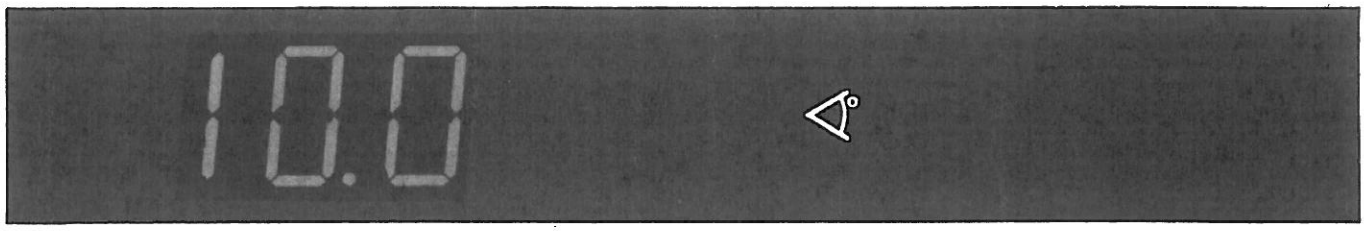
   IMPORTANT: The timing delay control (shown at 'A' opposite) MUST be turned OFF when timing on an ignition mark, e.g. 10^{o}. When using the TDC mark the delay control must be turned until the digital display reads the number of degrees shown in the test data.

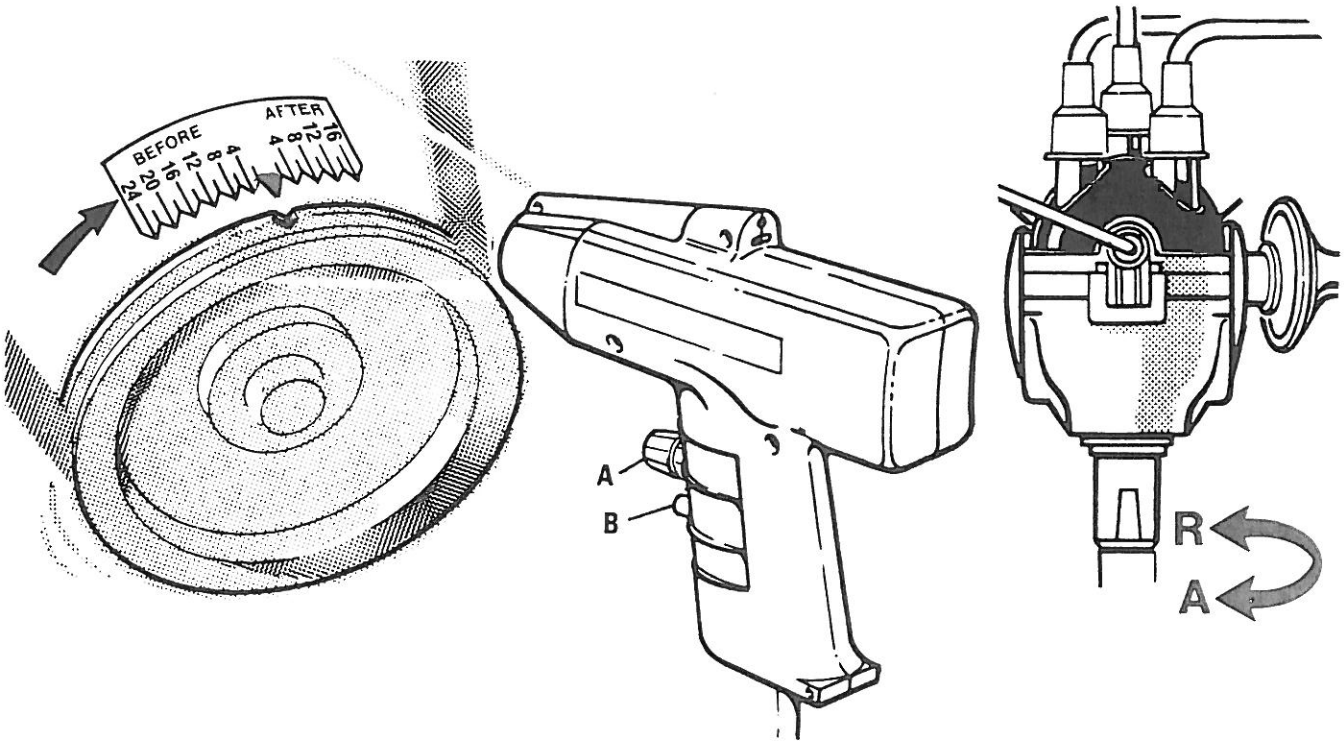
5. Use printer (optional) to record test results if required.

WARNING: Beware of the danger from rotating components. The timing light gives the impression that engine components are stationary; never touch the components or attempt to clean timing marks during this operation.

OBSERVE

The position of the appropriate timing marks and align them by moving the distributor if necessary.


10.0


BEFORE
AFTER
24
20
16
12
8
4
4
8
12
16
A
B
R
A

test 10a sensor timing check



PURPOSE:

1. To verify that the ignition timing is correct at the manufacturer's check point as quoted in the Crypton tune-up data.

   NOTE: Many engines have in-built magnetic sensors but in some cases the magnetic sensor is part of the test harness and must be temporarily fitted in the appropriate engine receptacle. Where the engine is fitted with a slotted disc for optical timing, the optical sensor must be placed in a receptacle with one limb at each side of the disc.

PROCEDURE:

1. Push button indicated above.
2. Disconnect vacuum advance pipe from distributor or carburettor. If retard pipe is fitted check data for instruction on whether or not to disconnect.
3. Adjust engine speed to that recommended in tune-up data. On computer controlled systems where no timing check figure is given, always check that timing changes with speed and vacuum.

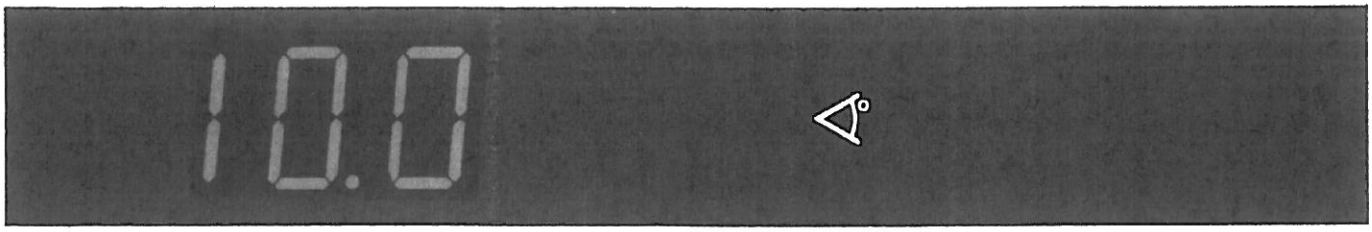
   IMPORTANT Where no speed is given, run the engine BELOW the 'NO ADVANCE' speed quoted.
4. Use printer (optional) to record test results if required.

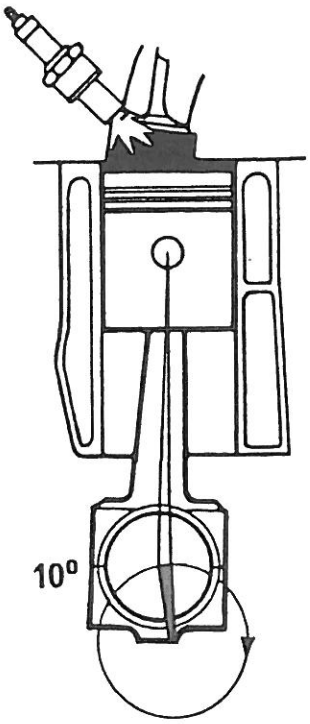
WARNING: Beware of the danger from rotating components.

NOTE: For details of the test harnesses used for optical and magnetic timing see pages 78 to 80.

OBSERVE:

The ignition timing on the digital display. The illustration opposite shows the timing angle and digital reading for an engine with a correct initial timing of 10 degrees.


10.0


10°

test 11

automatic advance
(strobe method)



PURPOSE:

1. To check for correct centrifugal advance operation.
2. To check for correct vacuum aovance operation.
3. To check on computer controlled systems that timing changes in response to speed and load (vacuum).

PROCEDURE:

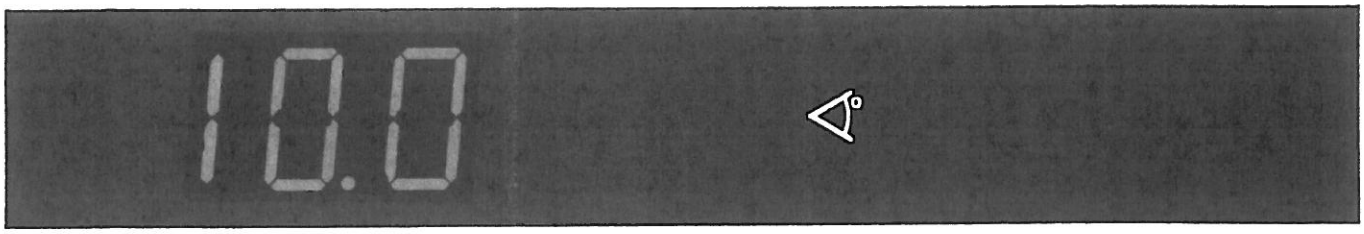
1. Push button indicated above.
2. Start engine and raise speed to a higher rpm selected from the tune-up data.
3. Reconnect the vacuum advance pipe.
4. Press button 'B' opposite to activate timing light then turn control 'A' to re-align timing marks used during initial timing check after steps 2 and 3.
5. Release button 'B' when marks are in line.
6. Use printer (optional) to record test results if required.

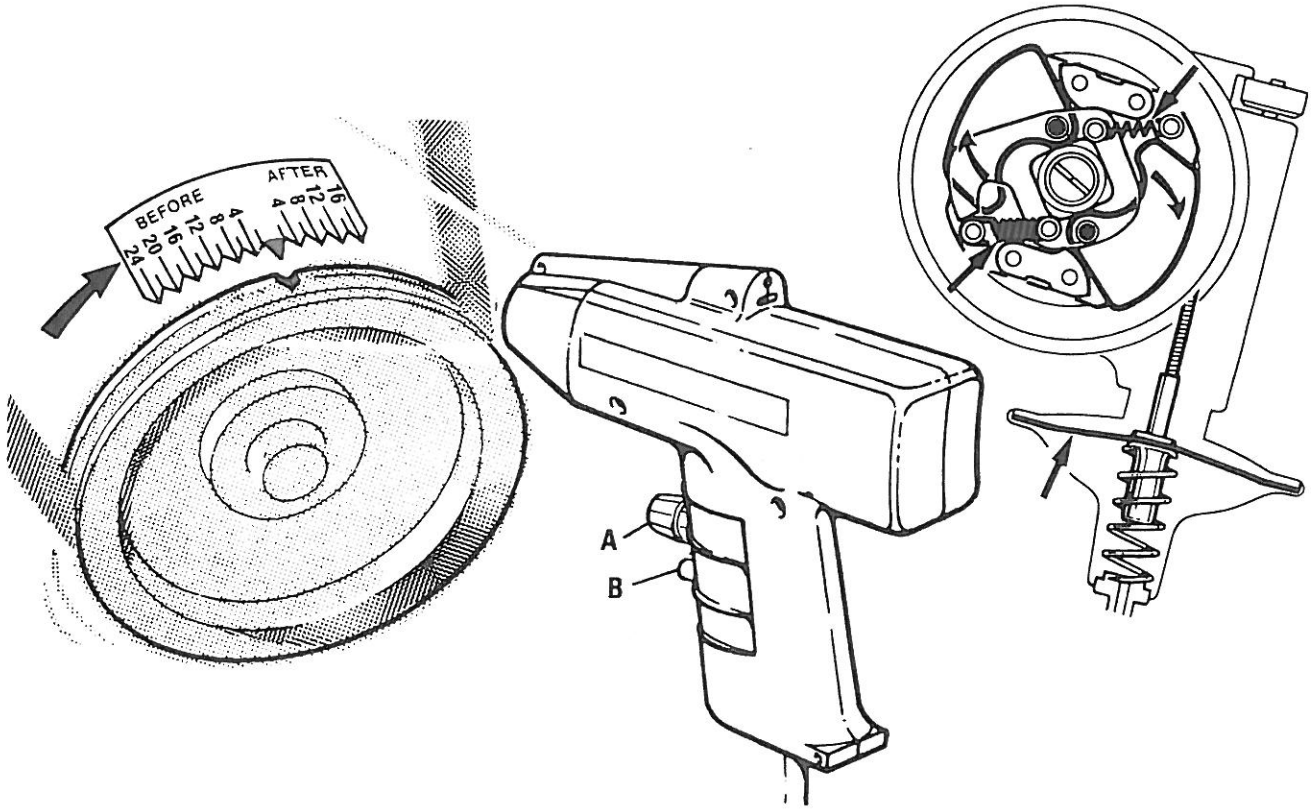
OBSERVE:

Automatic advance and rpm on digital display. The readings will be held until button 'B' is pressed again. Compare timing reading with tune-up data.

WARNING: Beware of the danger from rotating components.

NOTE: A heavy foot (300K/300) is available to order from FKI Crypton to adjust the accelerator pedal and so achieve any desired engine speed.


10.0


BEFORE
AFTER
24
20
16
12
8
4
4
8
12
16
A
B

test 11a

automatic advance
(sensor method)



PURPOSE:

1. To check for correct centrifugal advance operation.

2. To check for correct vacuum advance operation.

PROCEDURE:

1. Push button indicated above.

2. Raise engine speed to a higher rpm selected from the tune-up data.

3. Reconnect vacuum advance pipe.

4. Check, if digital reading is unstable or fails to read, that the sensor signal is correct as shown opposite.

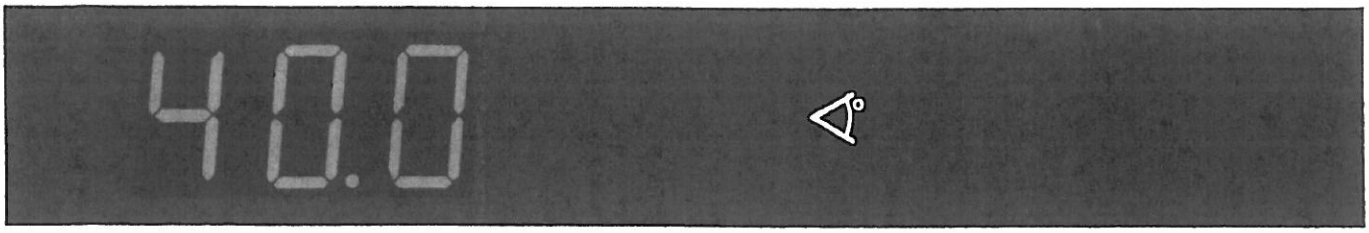
5. Use printer (optional) to record test results if required.

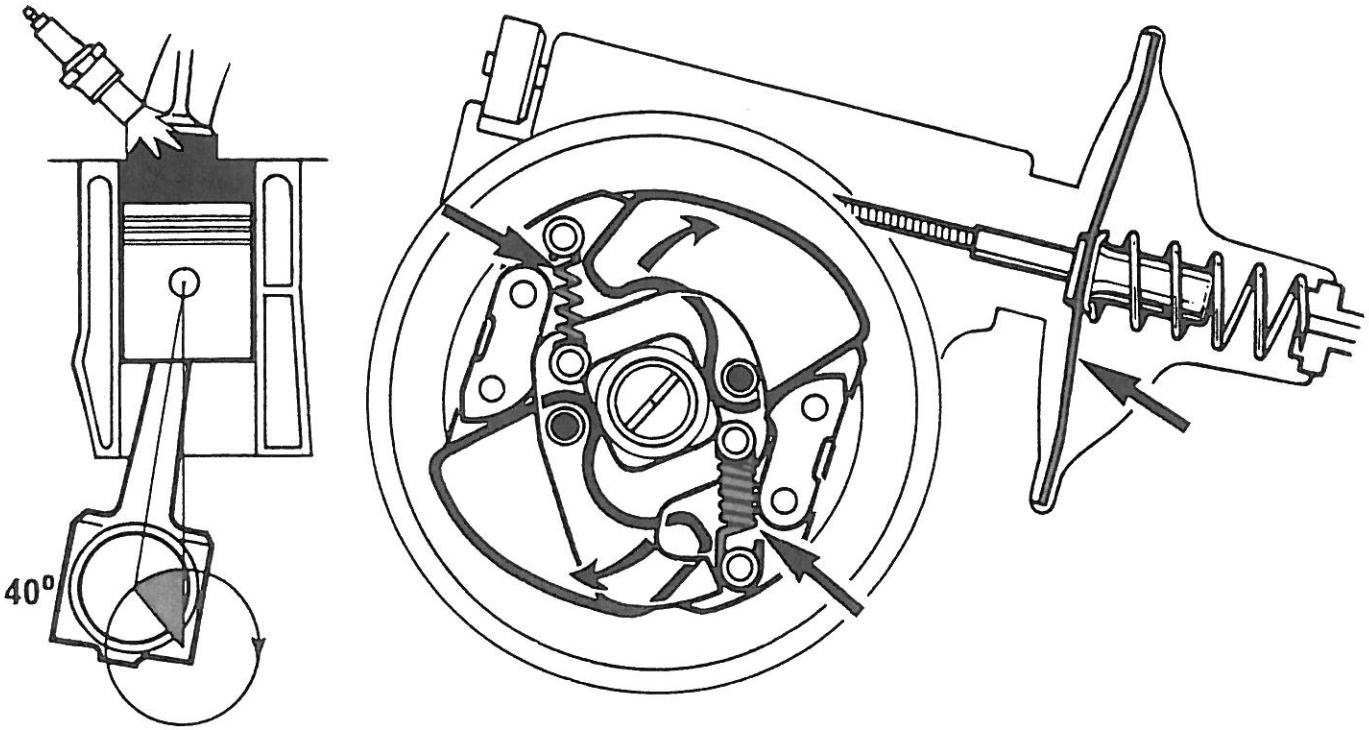
WARNING: Beware of the danger from rotating components.

OBSERVE:

The number of degrees of centrifugal and vacuum advance and the engine speed on the digital display. Compare the reading with the tune-up data. The illustration opposite shows the timing angle and digital reading for an engine with a correct total automatic advance of 40 degrees.

NOTE: A heavy foot (300K/300) is available from FKI Crypton to adjust the accelerator pedal and so achieve any desired engine speed.


40.0
°


40°

test 12 plug wiring & plug insulation

button symbol kV

Purpose:

To check plug leads for breaks, shorts, high resistance or open circuits and spark plugs for oil or carbon fouling.

Procedure:

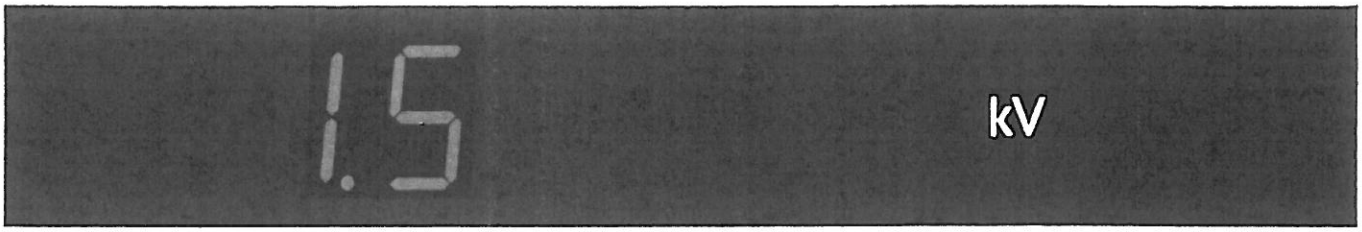
1. Push button indicated above.
2. Run engine at 1000 rpm.
3. Push YELLOW button in group '24' corresponding with No.1 cylinder. The button will now show BLACK.
4. Repeat step (3) for the remaining cylinders ONE AT A TIME. Two or more buttons pressed together will give misleading results.

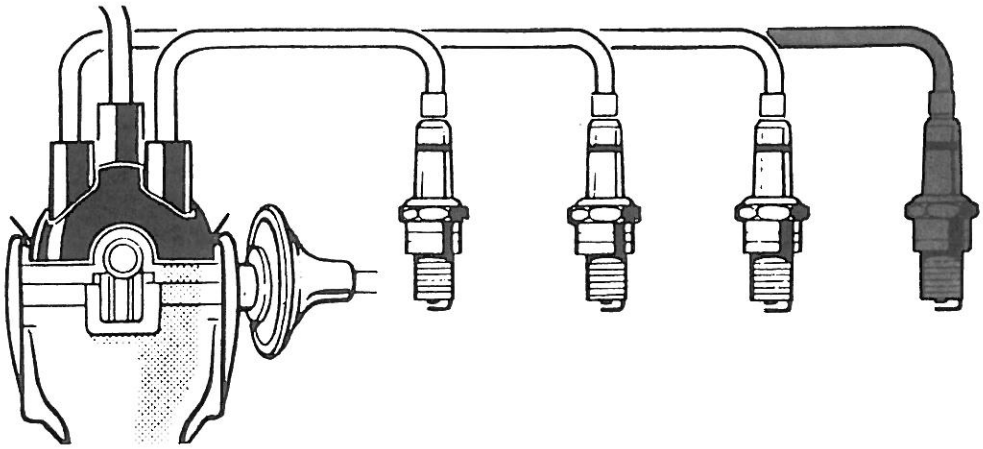
Observe:

The kV reading for each HT circuit. The readings should be similar for each circuit and may be between 1 and 3kV for contact breaker systems. Some electronic systems, e.g. Montego may be as high as 3.5kV.

NOTE: This test is measuring the arcing voltage between the plug electrodes AFTER the initial firing voltage. The arcing voltage, though fairly uniform, is liable to sudden fluctuations caused by cylinder conditions. The fluctuations will sometimes be seen as a rapid rise on the digital display and do not always indicate a fault. Where a plug lead fault is suspected, test the lead with the ohmmeter as indicated on page 60.

NOTE: Use printer (optional) to record test results if required. The printer will record all the sparkline voltages and diagnose AUTOMATICALLY a faulty plug lead or sooted plug which is shorting. A faulty circuit is indicated by bold type. The kV symbol on the digital display will flash to indicate that the computer is sampling the voltage prior to printer operation. DO NOT change tests during this period.


1.5
kV



test 13 spark plug condition button symbol 

Purpose:

To assess the condition of the spark plugs by measuring their firing voltages.

Procedure:

1. Push button indicated above.
2. Run engine at 1000 r.p.m.
3. Push YELLOW button in group '24' corresponding with No.1 cylinder. The button will now show BLACK.
4. Repeat step (3) for the remaining cylinders ONE AT A TIME. Two or more buttons pressed together will give misleading readings.
5. Use printer (optional) to record test results if required. The kV symbol will flash while measurements are being taken. DO NOT change the test buttons during this period or the information will be lost.

Observe:

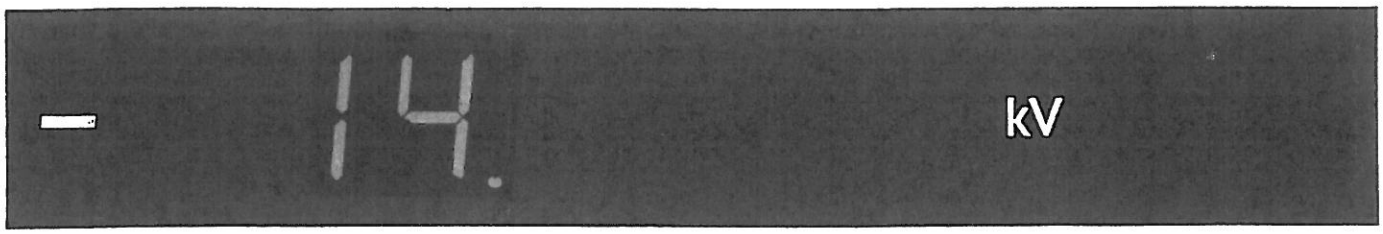
Plug firing voltages on digital display. All plugs should fire between 8 and 14 kV and be within 3kV one to another.

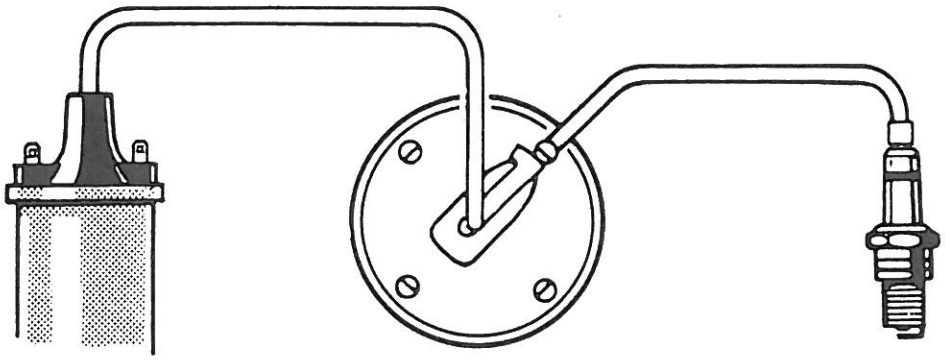
NOTES: To determine the cylinder under test, count the buttons in group '24' from left to right using the firing order of the engine.

Example:	Button Number	1	2	3	4	5	6	7	8	9	10	11	12
	Firing Order	1	8	4	3	6	5	7	2				

Button Numbers higher than the number of cylinders in the engine are not used.

NOTE: Engines running on exceptionally lean mixture with wide plug gaps, e.g. engines with management systems, will have plug firing voltages above the tolerance of 8-14kV when in good condition. In such cases the plugs may fire between 14 and 20kV, however, a better indication of plug condition is the rise in kV on acceleration. This should not exceed 6kV.


14.
kV



test 14 plug kV on acceleration

$\hat{kV}$ button symbol

PURPOSE:

To measure plug voltages under load conditions.

PROCEDURE:

1. Push button indicated above and one button in group '24'.
2. Run engine at 1000 rpm.
3. Snap throttle open smartly 3 or 4 times and release. DO NOT OVER-REV ENGINE.
4. Repeat step '3' for each cylinder pressing the appropriate YELLOW button each time.
5. Use printer (optional) to record test results if required.

NOTE: When earlier models of vehicle are under test, e.g. up to 1970 and the coil output is in the range of 16 to 24kV, the plug kV on acceleration should NOT EXCEED 2/3rd of the coil open circuit kV.

Observe:

The peak plug firing voltages. Peak readings will be held after each test until the action of changing from one YELLOW button to the next cancels the reading.

NOTE: To enable the printer to print 'Acceleration kV', one of the YELLOW buttons in group '24' must be pressed. The acceleration kV for THAT cylinder will then be printed on command by the handset.

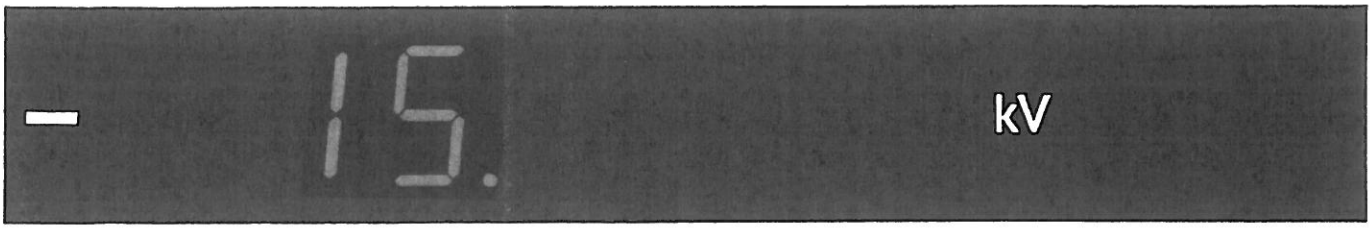
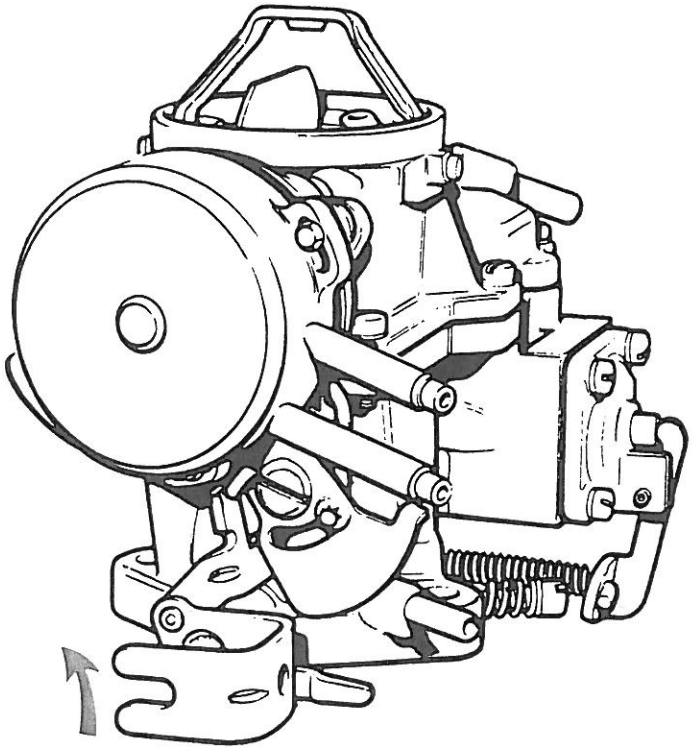


Fig. 1



test 15 rotor & lead kV



25kV
button symbol

PURPOSE:

To measure the firing voltage between rotor tip and distributor cap segments and check for broken plug leads.

PROCEDURE:

1. Push button indicated above.
2. Fit plug adaptors as shown opposite.
3. Run engine at 1000 rpm.
4. Push YELLOW button in group '24' corresponding with No.1 cylinder. The button will now show black.
5. Short No.1 plug completely to earth.
6. Repeat steps 4 & 5 for the remaining cylinders ONE AT A TIME. Two or more buttons pressed together will give misleading results.

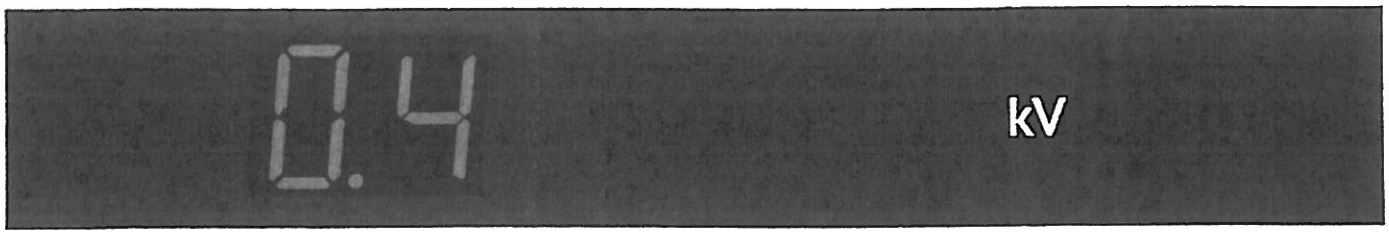
WARNING: Do not short plug leads to dipstick, cam/rocker cover or other components not directly earthed as this can cause an explosion of crankcase fumes.

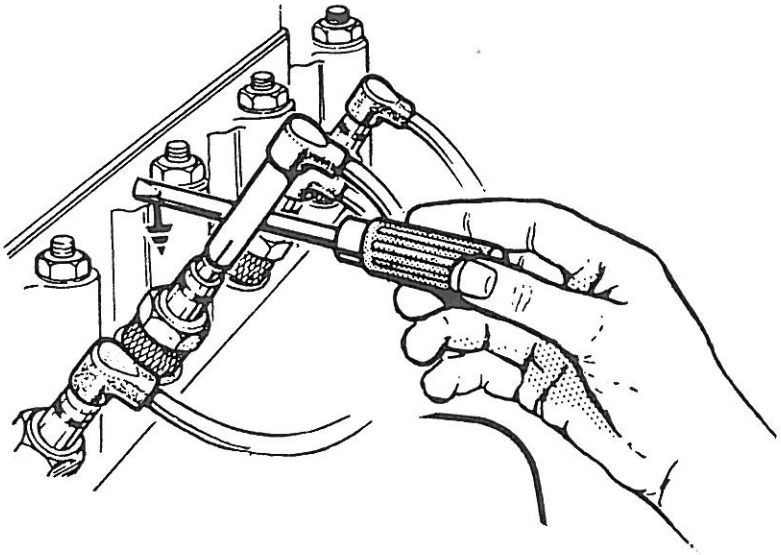
OBSERVE:

Rotor voltage for each cylinder. This should be 5kV or less indicating that the clearance is correct between rotor tip and segments and that plug lead condition is satisfactory.

In certain cases, e.g. Volvo, adaptor 4AS-03427 will be needed.

NOTE: Electronic ignition systems, may have a rotor gap larger than a contact breaker system. On these systems the MAXIMUM rotor voltage should be 8kV.


0.4
kV



test 16 coil kV

kV̂

button symbol

PURPOSE:

To measure the maximum coil output voltage on open circuit, if permitted by vehicle manufacturer, and check for good HT insulation.

PROCEDURE:

1. Push button indicated above.
2. Consult vehicle manufacturer's workshop manual when vehicle has electronic ignition. If manufacturer forbids full open circuit kV measurement, e.g. Vauxhall 'Cavalier', fit plug lead spark gap (300K/301) as shown in Fig. 1.
3. Run engine at 1000 rpm.
4. Remove any plug lead and hold clear of earth. If the plug lead spark gap is in use, REMOVE THAT LEAD ONLY, at the plug terminal.
5. Use printer (optional) to record test results if required. In order to print the words 'Coil Output Voltage', all the buttons in group '24' must be released (showing YELLOW).

WARNING: Do not allow sparks to short onto dipstick, cam/rocker cover or battery as this can cause an explosion of oil or hydrogen fumes.

OBSERVE:

Maximum coil kV when plug lead is removed as shown in Fig.2. The reading should be correct for the type of coil under test.

The following table gives the MINIMUM open circuit kV output for some popular types of coil, measured with a 14V primary input at an engine speed of 1000 rpm, at normal operating temperature. Where a ballast resistor is specified this must be incorporated in the circuit.

Make	Part No.	O.C.kV
Delco-Remy	7952666 (ballasted)	29.0
Delco-Remy	1115043	23.0
Delco-Remy	H.E.I.	30.0
Motorcraft	DG5001-1 (ballasted)	32.0
Motorcraft	DG5003 (ballasted)	32.0
Motorcraft	DG5002	30.0

NOTE: Vehicles fitted with an alternator should have a regulated voltage of approximately 14V at 1000 rpm. However, where a dynamo is fitted the engine speed will need to be raised to approximately 1500 rpm to achieve this voltage.

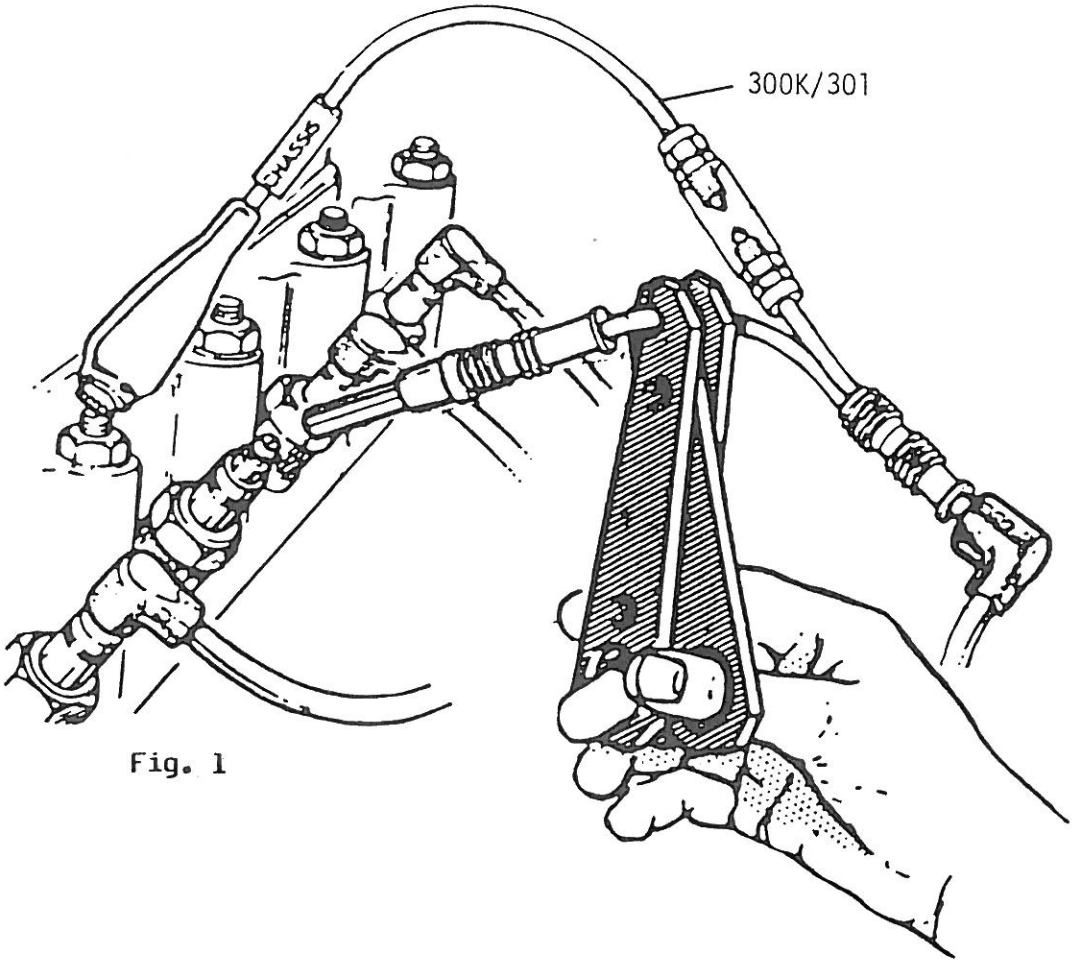


Fig. 1

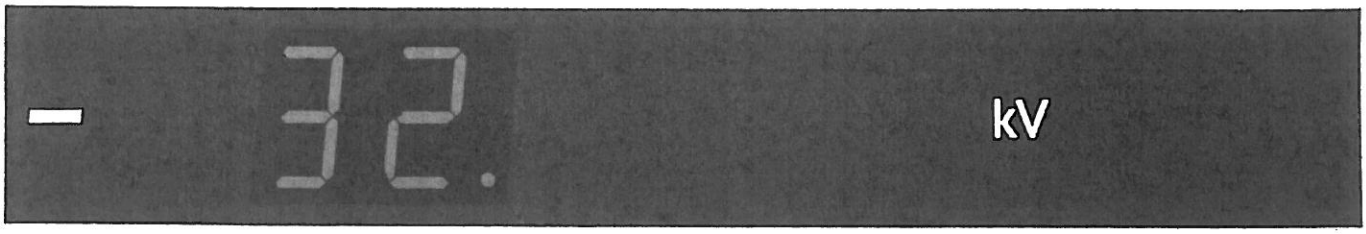


Fig. 2

test 17

cylinder balance
(automatic)

button symbols

PURPOSE:

1. To compare the power output from each cylinder, measured as a fall in crankshaft rpm and so assess the mechanical condition of the tappets, valves, pistons etc.
2. To measure the change in hydrocarbon level in the exhaust gas as individual cylinders are cut out electronically.

NOTES:

1. The HC analyser is an optional accessory. See operating manual for relative HC information.
2. The cylinder balance test can be set for a cylinder disablement time of 3 or 10 seconds. This is controlled by a switch in the calibration panel at the right lower corner of the console. To open the calibration door, push firmly IN at the top edge then release.

PROCEDURE:

1. Ensure that all buttons in group '24' show YELLOW.
2. Balance multi-carburettor systems before the cylinder balance test and run the engine at a stable fast idle.
3. Ensure that tachometer button '4' is depressed together with the cylinder balance test button shown above.
4. Connect the exhaust gas sample probe if relative HC is to be checked.
5. Press button '20' shown above momentarily to start the automatic cylinder balance test.

NOTES:

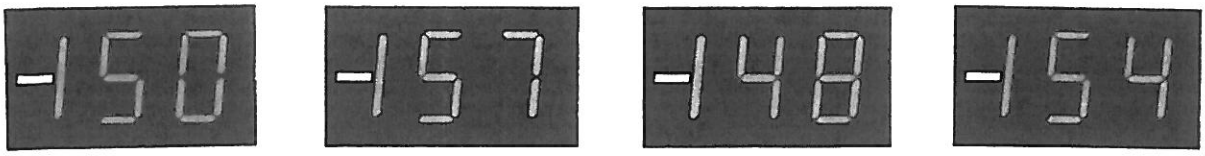
1. The engine analyser will now check each cylinder automatically. At the end of the test the printer will operate and display the cylinder efficiency expressed as a percentage together with the relative HC readings. A sample print-out is shown opposite.

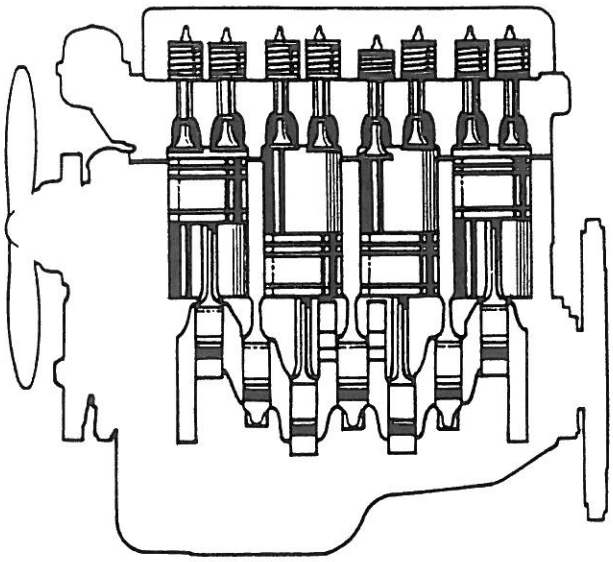
CAUTION: Do not operate the cylinder balance button after the last cylinder has been tested and before the printer has operated automatically. This is indicated by the rpm symbol flashing. If this is done, the results of the test will be lost.

2. Cylinders with a possible problem are highlighted on the print-out.
3. During the test, the top digital display will read engine speed and the lower display INDIVIDUAL cylinder rpm drop.
4. The rpm drop will freeze and the rpm symbol will flash after the cylinder has recommenced firing. The reading should be recorded if no printer is available in the 422 analyser.
5. On engines with an idle speed stabiliser, the engine should be run at a speed above it's cut-in threshold. In general 1500 rpm is suitable.

OBSERVE:

1. The drop in engine rpm which should be within 25% highest to lowest cylinder on 4 cylinder engines.
2. The HC peak for each cylinder. This is of major importance on an injected engine.
3. The difference in peak HC for each cylinder.





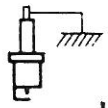
CYLINDER CONDITION

Power balance at 1320 rpm (100% = 240 rpm, limit = 70%)

CYL1	CYL2	CYL3	CYL4	CYL5	CYL6
+88%	+100%	+96%	+96%	+92%	+88%

test 17a

cylinder balance (manual)



button symbol

PURPOSE:

1. To compare the power output from each cylinder, measured as a fall in crankshaft rpm and so assess the mechanical condition of the pistons, tappets, valves etc.

2. To measure the change in hydrocarbon level in the exhaust gas as individual cylinders are cut out electronically.

   NOTE: The HC analyser is an optional accessory.

PROCEDURE:

1. Ensure that multi-carburettor systems are balanced for air and petrol flow.

2. Push button indicated above.

3. Run engine at a stable fast idle speed, e.g. 1000 rpm.

   NOTE: On engines with an idle speed stability control the engine should be run at a speed above it's cut-in threshold. In general 1500 rpm is suitable.

4. Push YELLOW button in group '24' corresponding with No. 1 cylinder. The button will show BLACK.

5. Repeat step (4) for the remaining cylinders one at a time.

NOTES:

(a) The emission analyser must be connected to the vehicle tailpipe in order to read relative HC.

(b) The duration of time for shorting a cylinder can be switched to 3 or 10 seconds. The switch is housed in the calibration panel at the front right corner. To open the calibration door, push firmly IN at the top edge then release.

(c) The 'heavy foot' (300K/300) may be used to regulate the engine speed. This is an optional accessory.

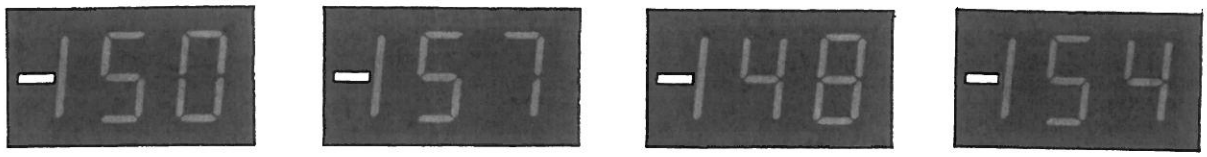
OBSERVE:

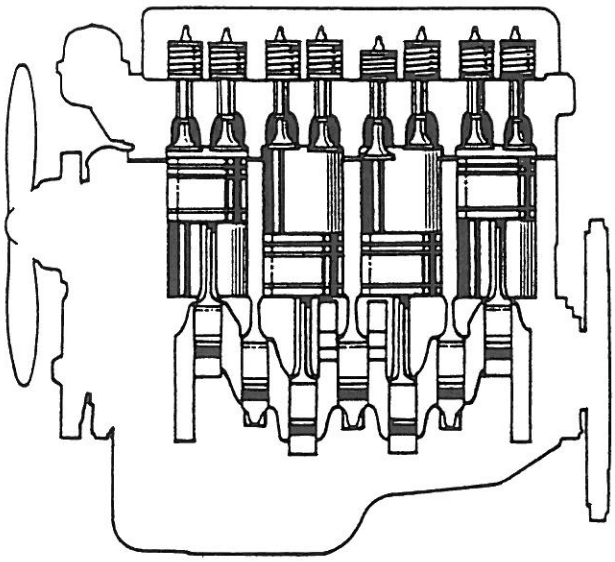
1. The drop in engine rpm as each cylinder is tested.

2. The HC peak which occurs a short time AFTER the cylinder has started firing when the 10 second test is completed.

3. The difference in peak HC readings of each cylinder.

See emission analyser manual for full details of HC variation test.


-150
-157
-148
-154



automatic snapshot

PURPOSE:

To run a number of principal engine tests automatically and check the results on the printout.

PROCEDURE:

1. Push cylinder balance button and run engine at 1000 rpm. Ensure that all the individual cylinder buttons (YELLOW) are de-selected.

2. Push header button on printer handset to print header if required.

   IMPORTANT: The emission analyser calibrates automatically every 30 minutes IF NO CO GAS IS PRESENT. To prevent the analyser from calibrating during the 'snapshot' test the analyser should be run briefly prior to the test until the CO reading is zero. If no calibration occurs then the snapshot can proceed. If calibration occurs, wait for calibration to finish before starting the snapshot.

3. Push button on handset and wait while analyser measures principal engine functions concluding with cylinder balance test. Lower digital display legend will flash to indicate tests in progress.

   NOTE: If the snapshot button on handset is pressed when an incorrect button selection has been made, a printed message indicating the error will be produced.

4. Wait for angle symbol to flash on lower digital display after completion of the cylinder balance test and then press the strobe or sensor timing button. DO NOT CHANGE ENGINE SPEED DURING TIMING.

5. Once timing is completed then press the button on the printer handset to end snapshot. The stored results will now be printed as shown in the example opposite.

6. Repeat steps 3 to 5 with the engine running at a higher speed, say 2500 rpm to show variation of results with speed.

   NOTE: If any buttons, other than those detailed above, are selected during the test, the test will be aborted and the results already stored will be printed, with a message indicating why the test stopped.

```
**********************************************************************************
* SERVICE STATION NAME/ADDRESS :-                                                *
*                                                                                *
*                                                                                *
*                                                                                *
*                                                                                *
*                                                                                *
*                                                                                *
*                                                                                *
**********************************************************************************
*                                                                                *
*        DATE :                          MAKE/MODEL :                            *
*                                                                                *
*    CUSTOMER :                            REG. NO. :                            *
*                                                                                *
*    OPERATOR :                             MILEAGE :                            *
*                                                                                *
**********************************************************************************
```

..... CRUISE MATE SNAPSHOT ! .....

STARTING/CHARGING

Battery volts	at	1020 rpm = +	14.6 V
Current	at	1020 rpm = +	1 A

COIL SUPPLY

Coil '+' volts	at	1020 rpm = +	13.8 V

IGNITION ECU/DISTRIBUTOR

Electronic module/CB volt drop	at	1020 rpm =	1.44 V
Dwell	at	1020 rpm =	15 deg.
Dwell overlap	at	1020 rpm =	1 deg.

PLUGS/PLUG LEADS

Plug kV difference	at	1020 rpm =	3 kV

Plug kV

CYL1	CYL2	CYL3	CYL4
8	8	5	8

CARBURATION/INJECTION

CO level	at	1020 rpm =	2.2 %
CO2 level	at	1020 rpm =	12.5 %
O2 level	at	1020 rpm =	0.7 %
HC level	at	1020 rpm =	160 ppm

CYLINDER CONDITION

Power balance at 1020 rpm (100% = 157 rpm, limit = 75%)

CYL1	CYL2	CYL3	CYL4
+84%	+100%	+99%	+82%

HC variation (ppm)

CYL1	CYL2	CYL3	CYL4
1420	1480	1460	1460

STROBE TIMING (Timing mark used deg.)

Strobe advance at 1020 rpm and 0.0 psi = 11.8 deg.

..... CRUISE MATE SNAPSHOT ! .....

exhaust gas analysis


button symbol

Refer to Separate Emission Tester Manual

Test Results Obtained From The Optional 4-Gas Or 2-Gas Analyser May Be Printed As Required By The Operator

ADDITIONAL TESTS

ohmmeter tests (general)

PURPOSE:

To check the resistance of any vehicle circuit or component.

PROCEDURE:

1. Push one of the three ohms buttons according to the expected resistance range of the component or circuit to be tested.
2. Connect red and black ohms test clips together.
3. Adjust YELLOW potentiometer in calibration panel (situated under hinged flap on front panel) to bring digital display to zero if necessary.
4. Connect the red and black test leads one to each end of the component or circuit to be tested as illustrated opposite.
   NOTE: Existing vehicle wiring must be removed from any component before conducting an ohms test.
5. Use the printer (optional) to record the test results if required.

IMPORTANT: If an incorrect ohms range is selected for the component under test, the digits will flash to indicate and over-range condition.

OBSERVE:

The resistance of the component or circuit on the digital display.

NOTE: The approximate resistance of carbon impregnated textile core plug leads is as follows:

Leads up to 300mm (12in) long 25-34k ohms per metre (39in)
Leads over 300mm (12in) long 15-24k ohms per metre (39in)

ohmmeter tests (diodes)

PURPOSE:

To test rectifier diodes in vehicle alternators.

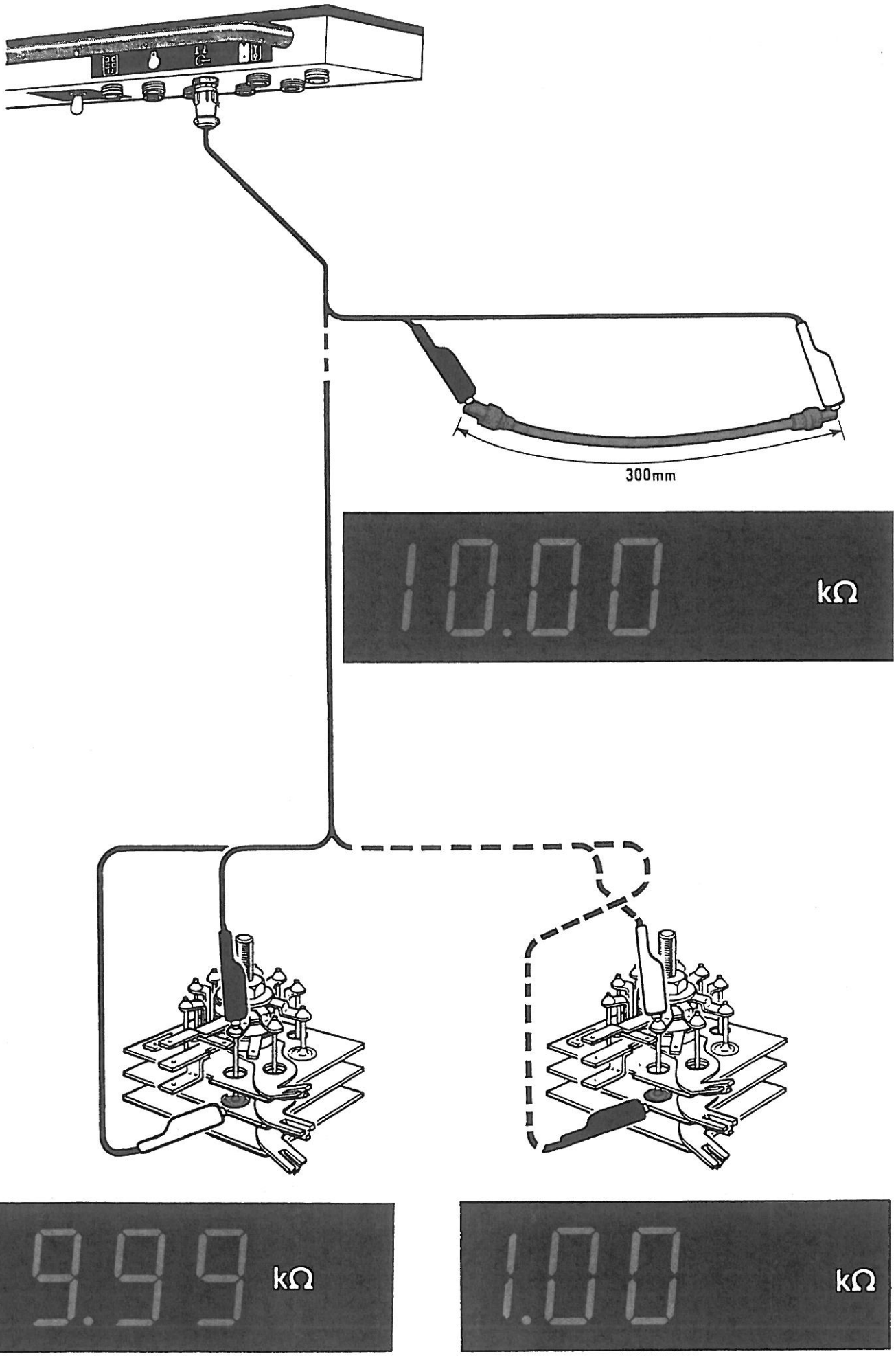
PROCEDURE:

1. Push the 20k ohms button.
2. Connect the red and black ohms test clips together.
3. Adjust YELLOW potentiometer in calibration panel (situated under hinged flap on front panel) to bring digital display to zero if necessary.
4. Gain access to the alternator diode pack and connect the red test lead to the (+) side of a diode and the black test lead to the (-) side, then check the meter reading.
5. Reverse the lead connections to the same diode and recheck the meter reading.
6. Repeat steps 4 and 5 for the complete diode pack.

OBSERVE:

That the digital display reads 199.9k ohms approximately when the test leads are connected as in step 4 and 1.00k ohm approximately when the test connections are reversed.

A reading considerably lower or higher indicates that the diode pack should be replaced.


300mm
10.00
kΩ
19.99
kΩ
1.00
kΩ

the AC-Delco HEI system

The High Energy Ignition system is manufactured for 4, 6 and 8 cylinder engines. In-line 4 and 6 cylinder engines with HEI systems have the coil mounted separately from the distributor but on V6 and V8 engines the coil is an integral part of the distributor cap.

The system is designed to produce an HT output in excess of 35kV. Centrifugal and vacuum advance is achieved in the conventional manner.

The 422 Cruise Mate is designed to test HEI systems and a suitable coil pick-up plate is supplied to enable HT voltage measurement to be made on the built-in coil types.

PRECAUTIONS

1. The tachometer terminal on the distributor cap must not be connected directly to earth. Refer to AC-Delco manual for precise information.

2. Do not damage any part of the HT insulation, e.g. by puncturing spark plug boots. Imperfections in HT insulation are likely to cause high voltage arcing.

TEST CONNECTIONS (Built-in-Coils)

1. Connect the test leads to the usual points in the electrical circuit with the exception of the GREEN LT clip and the GREY HT clip.

2. Connect the GREEN test lead to the tachometer terminal (shown opposite) next to the ignition supply terminal on the distributor cap. A female 'Lucar' type connector will be needed to make the connection. Adaptor M32 'Lucar' shown on page 9 is suitable for this purpose. The +12V supply to the distributor must be re-connected to make the system functional.

3. Remove the GREY HT clip at the push-in connector and plug in adaptor lead AS-B-72304 (page 9). Connect pick-up plate 2-AS-02257 (page 9) to the adaptor lead using the 'Lucar' type connector and clip the pick-up plate onto the coil as shown opposite.

TESTING THE SYSTEM

1 The dwell angle (test 6) should be disregarded together with dwell variation (test 8) as this is not adjustable and is designed to change with engine speed.

2. Check the plug kV. This may be considerably higher than normal for two reasons:

   (a) The rotor gap voltage of HEI distributors is approximately 8kV.

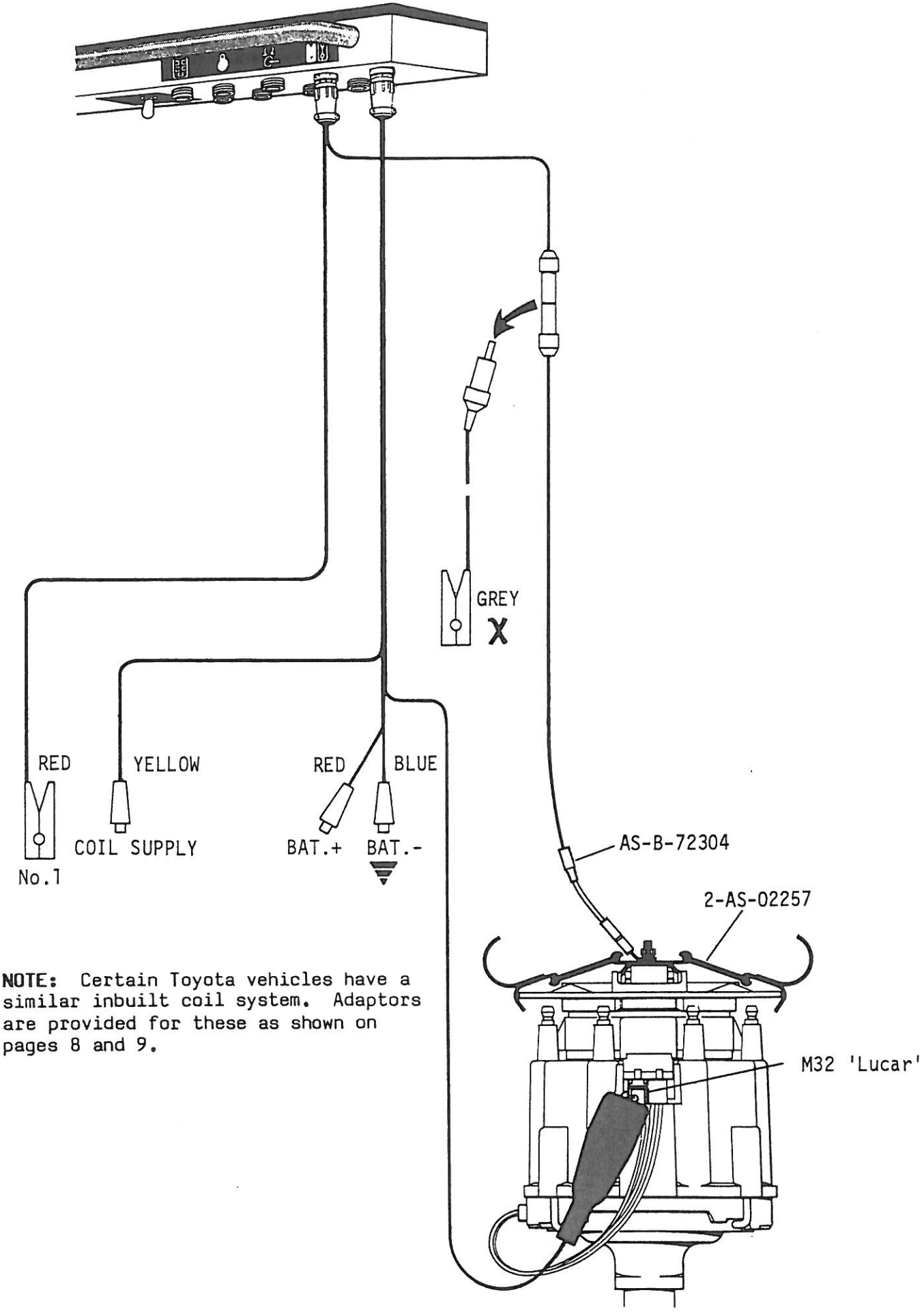
   (b) Vehicles with HEI usually have a wide plug gap specification, often as wide as 1.5mm (0.060in). Under these conditions, new plugs can fire as high as 18kV at 1000 rpm.

   Do not attempt to reduce the rotor gap below 8kV.

3. Check the coil kV. This should be a minimum of 30kV. If less, the coil should be replaced. Most systems will give an output of 35-50kV.

4. Check the ignition timing in the normal manner using appropriate vehicle data.

5. Conduct a cylinder balance test in the usual manner.



NOTE: Certain Toyota vehicles have a similar inbuilt coil system. Adaptors are provided for these as shown on pages 8 and 9.

vacuum/pressure tests


button symbol

PURPOSE:

To assist in the adjustment of carburettors and check engine efficiency.

NOTE: The vacuum/pressure transducer is optional equipment.

PROCEDURE:

1. Connect vacuum transducer to boom socket (6) see page 11.

2. Connect one end of the vacuum tubing part number 4-DL-05024 to the inlet manifold using a suitable adaptor. The brake servo take-off is a suitable connecting point.
   Connect the other end of the tubing to the transducer pipe.

3. Push button indicated above.

4. Start engine and run as follows:

   (a) at idle.

   (b) open and close throttle rapidly.

   (c) at highest safe speed (4000-5000 rpm).

WARNING: Do not drill water-heated manifolds to fit the vacuum gauge adaptor.

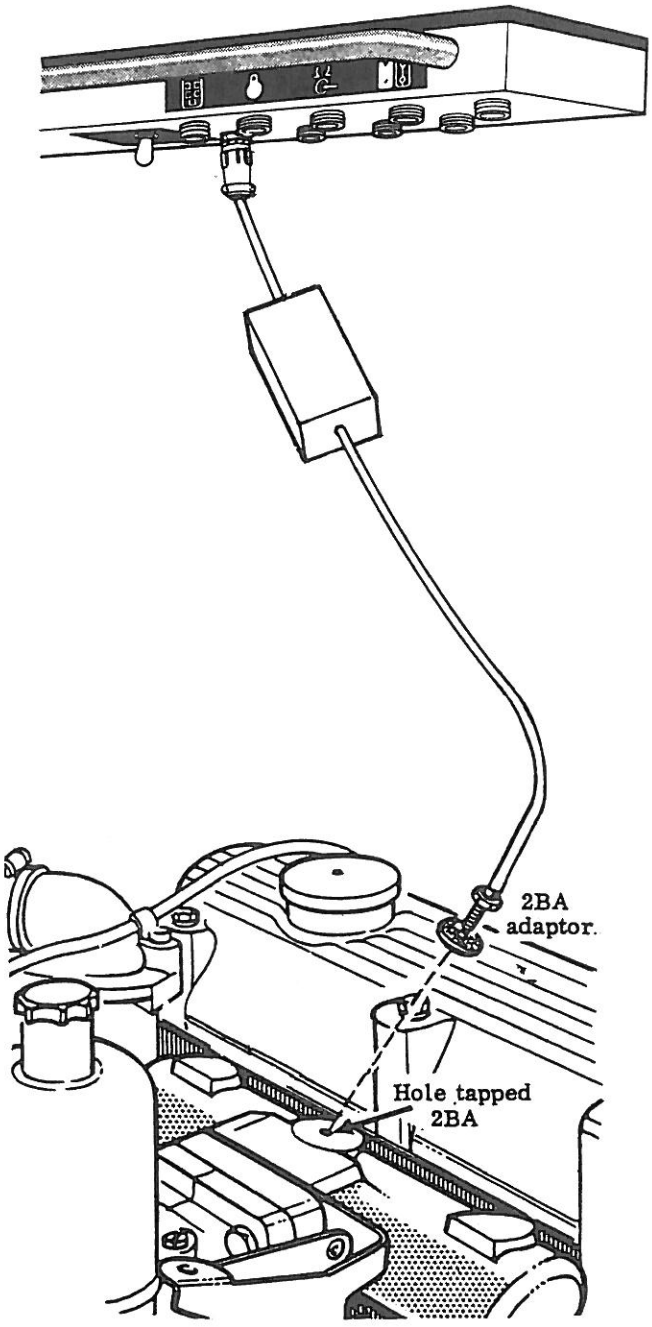
5. Use the printer (optional) to record the test results if required.

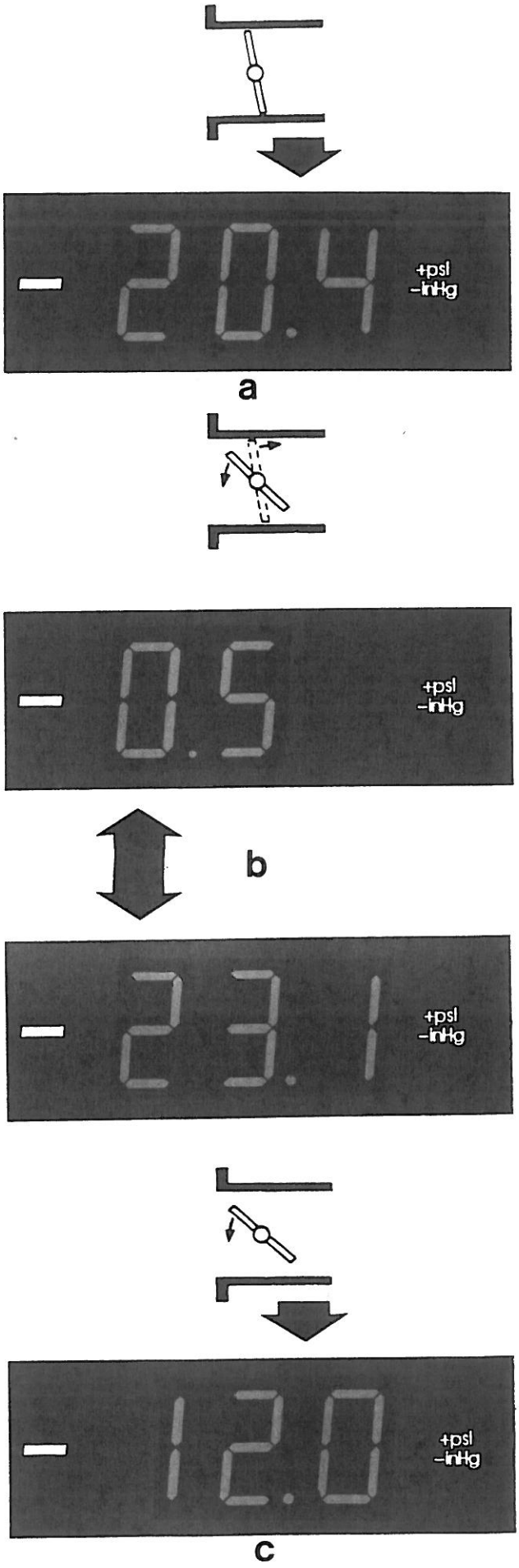
OBSERVE:

1. Reading at (a) above. This should be 18 to 22 in Hg and steady.

2. Reading at (b) above. The reading should fall almost to zero then rise momentarily above the idle indication.

3. Reading at (c) above. The reading should fall gradually as the speed rises but remain steady.


2BA
adaptor.
Hole tapped
2BA


- 20.4
+psi
-inHg
a
- 0.5
+psi
-inHg
b
- 23.1
+psi
-inHg
- 12.0
+psi
-inHg
c

vacuum/pressure tests (continued)


button symbol

PURPOSE:

To check petrol pump efficiency. (Not suitable for petrol injection systems).

PROCEDURE:

1. Connect vacuum tubing part number 4-DL-05024 to pipe on vacuum transducer.
2. Disconnect fuel delivery pipe from carburettor and connect vacuum tubing to fuel delivery pipe.

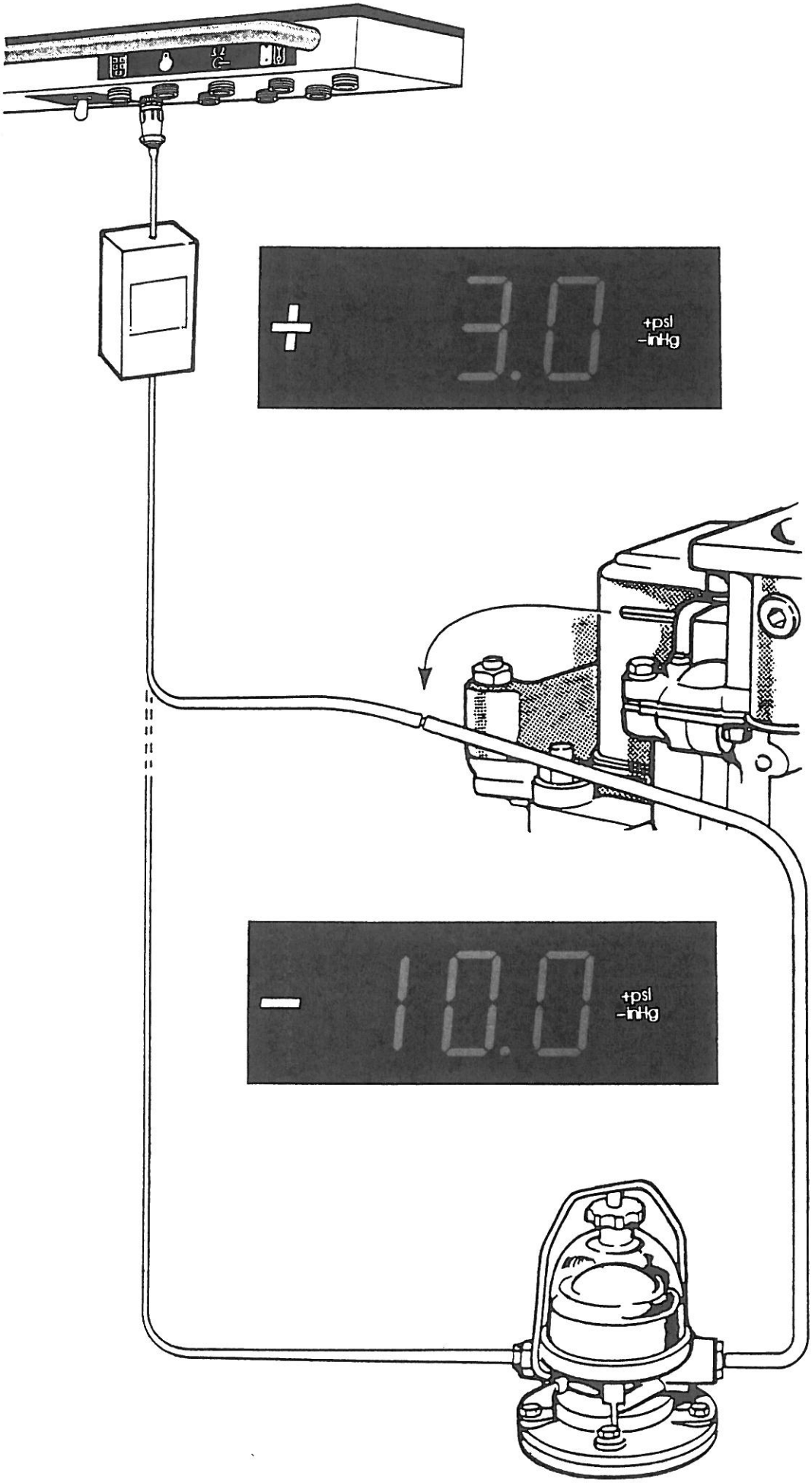
   WARNING: DO NOT SPILL PETROL ON HOT EXHAUST SYSTEM, STOP ENGINE BEFORE DISCONNECTING FUEL PIPE.
3. Push button indicated above.
4. Operate fuel pump either by running the engine (mechanical pumps) or by switching on the ignition (electric pumps).
5. Reconnect fuel pipe to carburettor and disconnect fuel inlet pipe to fuel pump.
6. Connect vacuum tubing to inlet side of fuel pump.
7. Operate fuel pump either by running engine (mechanical pumps) or by switching on ignition (electric pumps).

OBSERVE:

1. The fuel pump pressure and compare with tune-up data.
2. The fuel pump vacuum and compare with tune-up data.

Use the conversion tables below to obtain metric units of measure if required. A switch inside the 422 can be adjusted to give readings of kPa if required. This must be done by an FKI Transervice Engineer or Agent (overseas areas).

ENGINE & FUEL PUMP VACUUM				ENGINE & FUEL PUMP VACUUM				PETROL PUMP PRESSURE		
in.Hg	mm.Hg	kPa	bar	in.Hg	mm.Hg	kPa	bar	p.s.i.	kPa	kg/cm² bar
0.5	12.7	-1.7	0.017	13	330	-44.1	0.44	0.5	+3.4	0.034
1	25.4	-3.4	0.034	14	356	-47.5	0.48	1.0	+6.9	0.069
2	51.0	-6.8	0.068	15	381	-51	0.51	1.5	+10.3	0.103
3	76.0	-10.2	0.102	16	406	-54	0.54	2.0	+13.8	0.14
4	102	-13.6	0.136	17	432	-58	0.58	2.5	+17.2	0.17
5	127	-17.0	0.17	18	457	-61	0.61	3.0	+20.6	0.21
6	152	-20.4	0.20	19	483	-64.5	0.65	3.5	+24.1	0.24
7	178	-23.8	0.24	20	508	-68	0.68	4.0	+27.5	0.28
8	203	-27.2	0.27	21	533	-71	0.71	4.5	+31	0.31
9	228	-30.5	0.31	22	559	-74.5	0.75	5.0	+34.4	0.34
10	254	-34	0.34	23	585	-78	0.78	5.5	+38	0.38
11	280	-37.3	0.37	24	610	-81.6	0.82	6.0	+41.3	0.41
12	305	-40.8	0.41					6.5	+45	0.45
								7.0	+48.2	0.48
								7.5	+51.6	0.52
								8.0	+55	0.55
								8.5	+58.5	0.59
								9.0	+62	0.62


+
3.0
+psi
-inHg
−
10.0
+psi
-inHg

vacuum/pressure tests (continued)


button symbol

PURPOSE:

To adjust the throttle plate of low emission fixed jet carburettors by measurement of the depression at the vacuum advance take-off pipe.

PROCEDURE:

1. Disconnect vacuum advance pipe at carburettor and connect vacuum gauge tubing between carburettor take-off pipe and the vacuum transducer.

2. Push button indicated above.

3. Start engine and run at idle.

OBSERVE:

Vacuum gauge reading and compare with vehicle manufacturer's test data.

Adjust throttle plate stop screw if necessary to achieve correct idle vacuum reading.

NOTES:

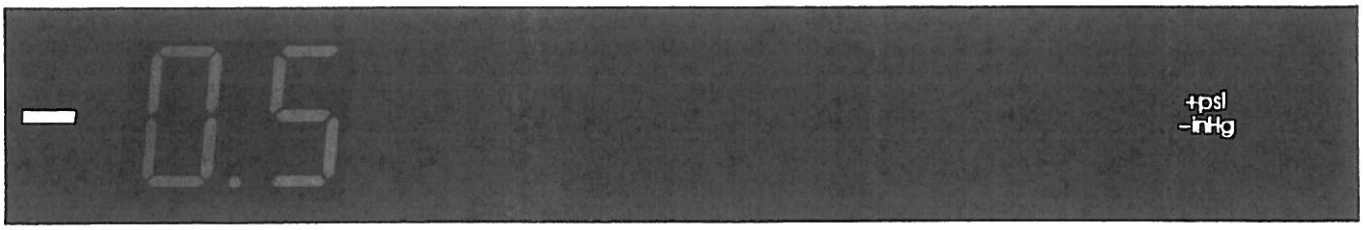
(a) Most modern carburettors have a tamperproof device on the throttle stop screw which must be removed to make an adjustment.

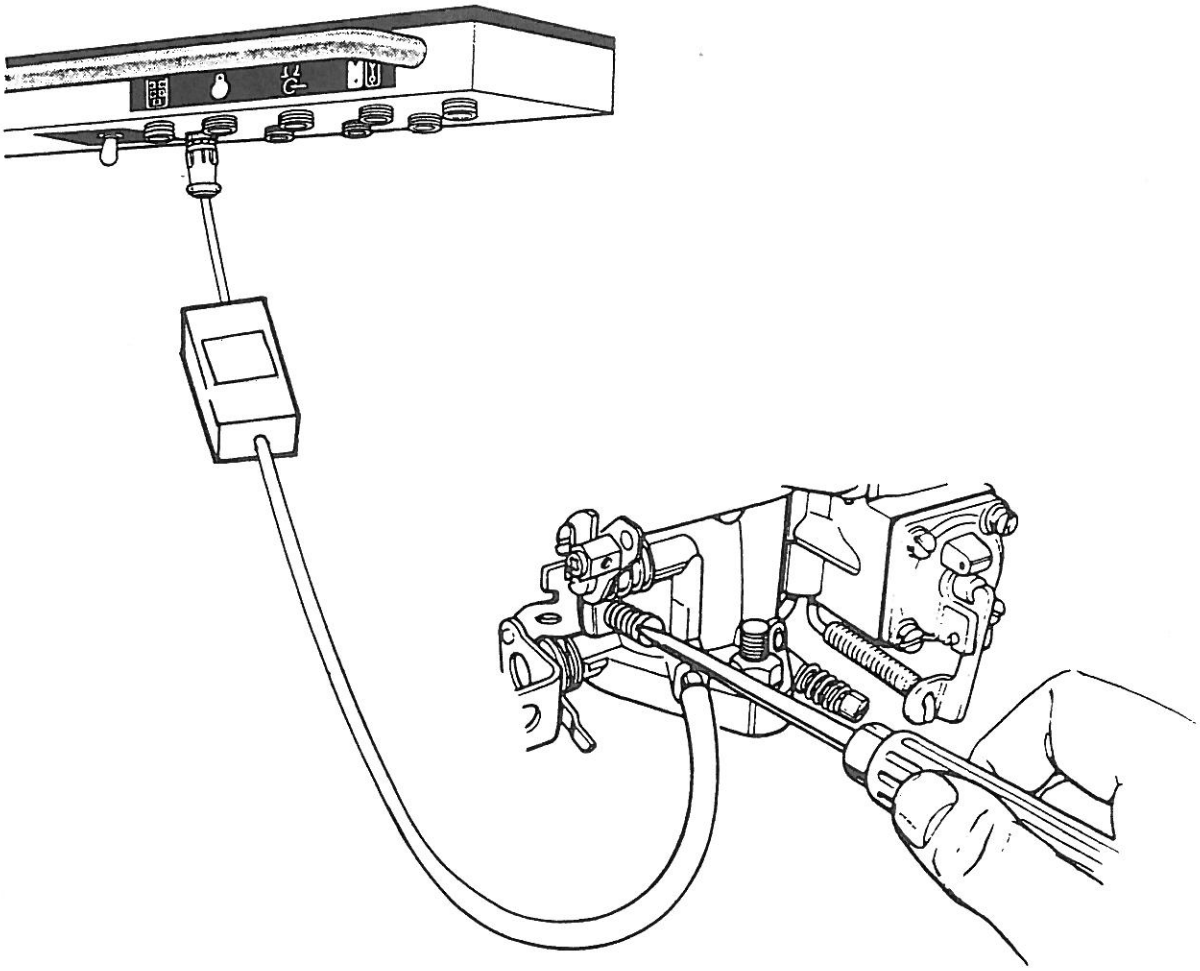
(b) The vacuum reading is displayed in in.Hg. To obtain metric and other units use the conversion table below.

(c) Engine speed and mixture adjustment must be made AFTER the throttle plate has been set correctly.

(d) On completion of adjustment reconnect the vacuum advance pipe.

in.HG	0	0.6	1.2	1.8	2.4	2.9	3.5	4.1	4.7
kPA	0	-2	-4	-6	-8	-10	-12	-14	-16
mb	0	-20	-40	-60	-80	-100	-120	-140	-160
in H_2O	0	8.0	16.1	24.1	32.2	40.2	48.2	56.3	64.4
mm Hg	0	15	30	45	60	75	90	105	120


0.5
+psi
-inHg



electronic component testing



button symbol

PURPOSE:

To measure voltage supplies to components of electronic control units used for electronic ignition, petrol injection systems etc.

PROCEDURE:

1. Select one of the buttons in group '23' shown above according to the voltage range of the component to be tested.

   NOTE: If an incorrect range is chosen for the voltage to be measured, the digits will flash to indicate over-range.

2. Connect the low voltage probe/ohms harness to socket (3) of the test lead boom. See page 11.

3. Connect the low voltage probe to the component to be tested. A throttle position switch is shown as an example opposite.

OBSERVE:

The voltage on the digital display as shown in Fig.1 opposite.

Fig.2 shows the supply voltage being checked on the throttle switch of an LE-Jetronic system from the Crypton publication 'Testing Petrol Injection Systems'.

IMPORTANT:

In addition to reading static voltages as shown opposite, the 422 analyser is also capable of reading the PEAK (+) and MINIMUM (-) voltages from dynamic sources such as flywheel sensors or stepper motors. To read these outputs, press the ✓ or X button on the handset whilst the device is operating and the result will appear on the printout.

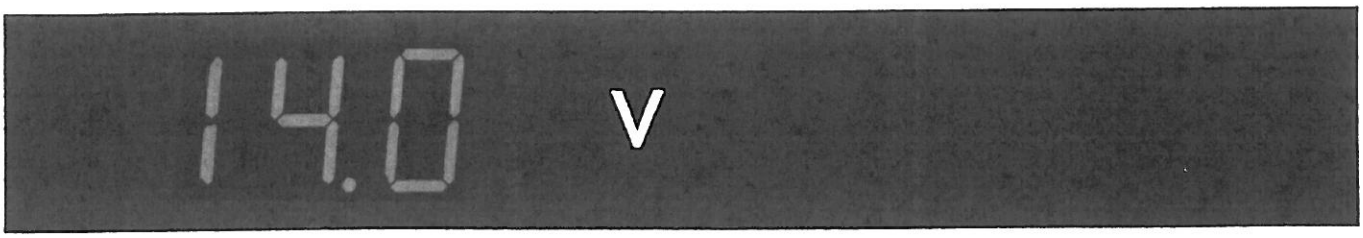


Fig. 1

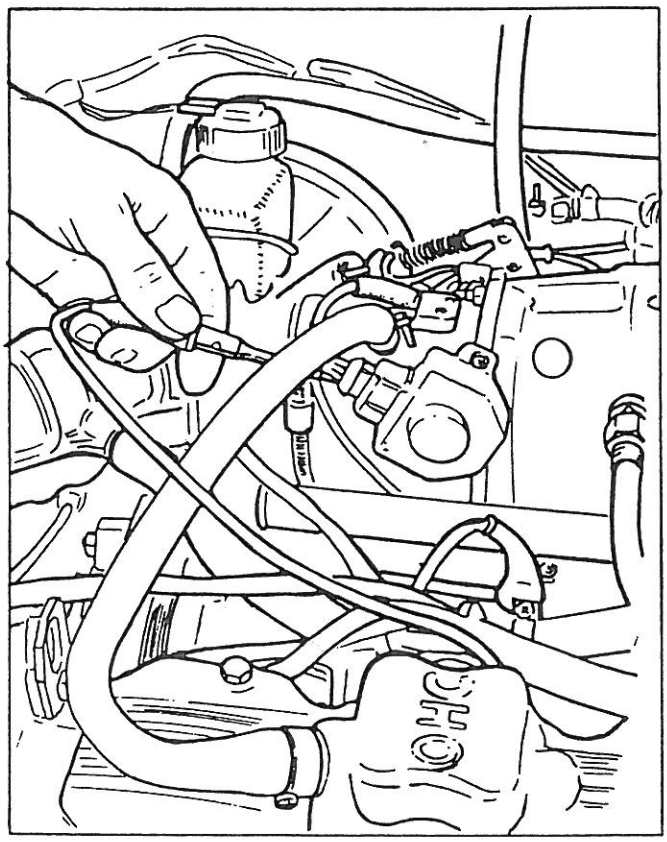


Fig.2

injection duration test



ms button symbol

PURPOSE:

To check the duration that an electronically operated petrol injector is opened under any desired engine condition.

PROCEDURE:

1. Connect the low voltage probe/ohms harness to socket (3) of the test lead boom (see page 11) and ensure that the RED and BLUE test leads and the RED HT clip are connected to the vehicle battery.
2. Push button indicated above. This button over-rides all other trigger inputs, triggering being taken via the low voltage probe only.
3. Connect the low voltage probe to the switch side of an injector and start the engine.

   NOTE: Injector adaptor 300k/303 improves accessibility and ease of connection to the injectors and other components using a common connector.
4. Use the printer (optional) to record the test result if required.

OBSERVE:

The injector duration on the digital display as shown in Fig.1 opposite. The desired operating conditions e.g. idle; snap acceleration; cold starting; warm-up etc. should be tested.

Fig.2 opposite shows connection to an injector via the 300K/303 adaptor.

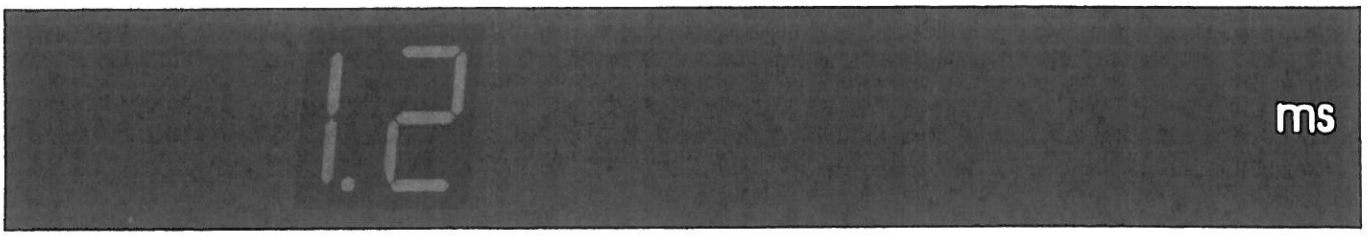


Fig.1

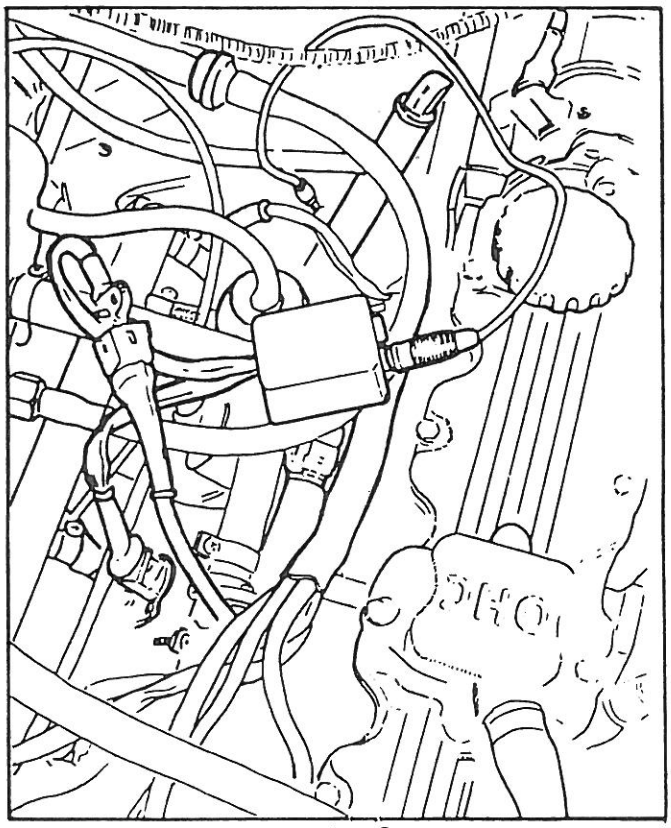


Fig.2

temperature measurement



button symbol

PURPOSE:

To check the temperature of electronic components which are affected in behaviour by changes in engine temperature.

PROCEDURE:

NOTE: The temperature probe is optional equipment.

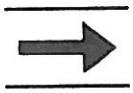
1. Connect the temperature probe to socket (4) on the test lead boom.
2. Push button indicated above.
3. Apply a drop of oil to the end of the temperature probe and hold it firmly against a metal part of the component to be tested, i.e. coolant sensor.
4. Wait for the reading to stabilise.

NOTE: If the temperature exceeds the range of the instrument (+150°C) or the temperature probe is disconnected, the digits will flash.

OBSERVE:

The temperature on the digital display. This is available in °F or °C and is controlled by a switch under the calibration flap at the lower right side of the console.

petrol flow measurement



button symbol

PURPOSE:

To check, on a petrol injected engine, the fuel flowing around the injection system.

PROCEDURE:

NOTE: The flow transducer is optional equipment.

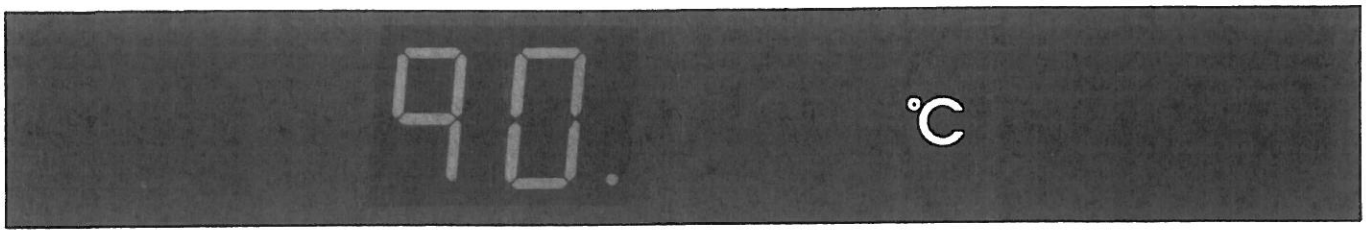
1. Disconnect the petrol supply pipe to the engine and insert the flow transducer into the system using suitable locally-made adaptors.

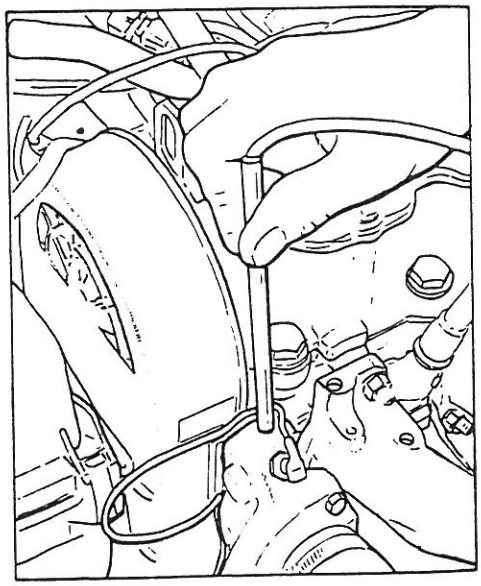
   WARNING: Beware of the danger of fire from petrol spillage.
2. Connect the lead of the flow transducer to socket (7) see page 11 on the test lead boom.
3. Press button indicated above.
4. Operate the petrol pump by ONE of the following methods:
   (a) Start the engine.
   (b) Use the IPD1 kit (optional) and connect the two 'Lucar' blades to terminals 30 and 87 of the petrol pump relay base.
   (c) Remove the coil CB (-) lead and connect the GREEN clip of the IPD1 kit (optional) to the lead. Press the button on the IPD1 to operate the pump.

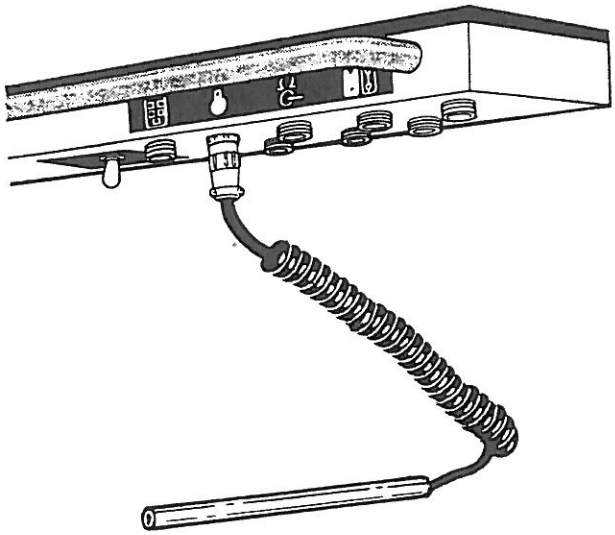
OBSERVE:

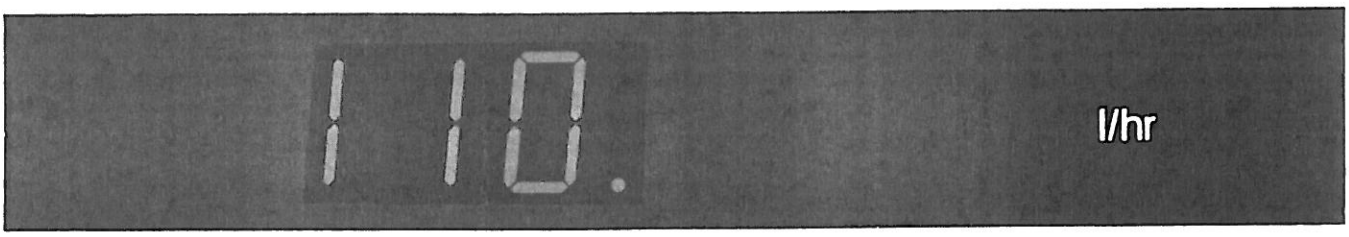
Flow rate in litres per hour on the digital display and compare with the manufacturers or Crypton tune-up data.

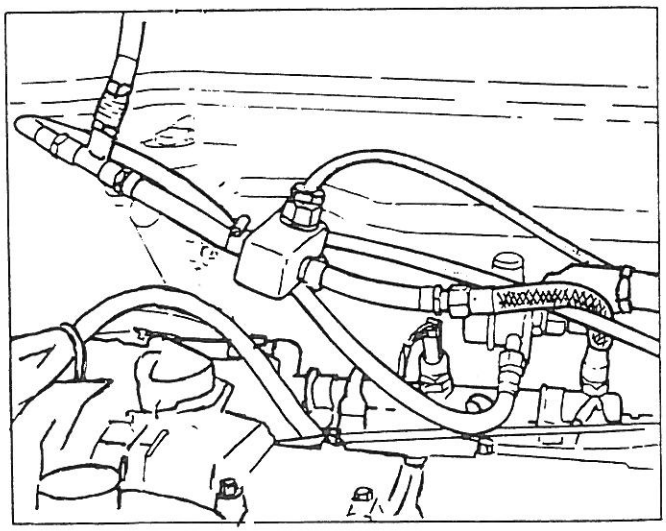
NOTE: Refer to page 5 paragraph 15 for flow button selection information.

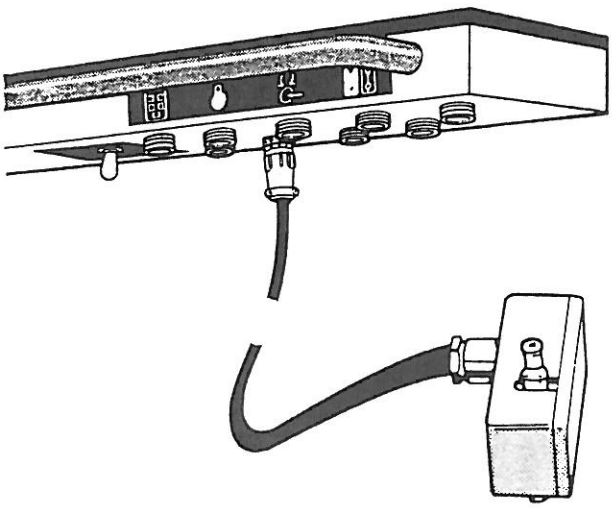

90.
°C






110.
l/hr





using the injector pump driver

PURPOSE:

1. To operate the electric petrol pump of a petrol injection system either via the pump relay base or the coil CB (-) connection.

2. To operate a solenoid type injector and thereby assess its spray quality.

3. To operate, on certain types of injection system, the control relay and so enable a system check to be performed when the engine is out of action.

PROCEDURE: pump drive

NOTE: The IPD1 Injector Pump Driver is optional equipment.

1. Connect the RED and BLUE test clips to the battery (+) and (-) terminals respectively.

2. Locate the ignition coil CB (-) terminal and disconnect the wire.

3. Connect the GREEN clip to the coil CB wire - NOT the coil terminal.

4. Switch the ignition ON and press the buttons marked  and  on the IPD1 box. The petrol pump should now be heard to run.

NOTE: Where this method fails to operate the pump, continue to step 5.

5. Locate the petrol pump relay and pull the relay from its base.

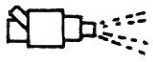
6. Insert the two 'Lucar' blades into terminals 30 and 87 of the relay base and operate the buttons  and  .

PROCEDURE: injector drive/timer

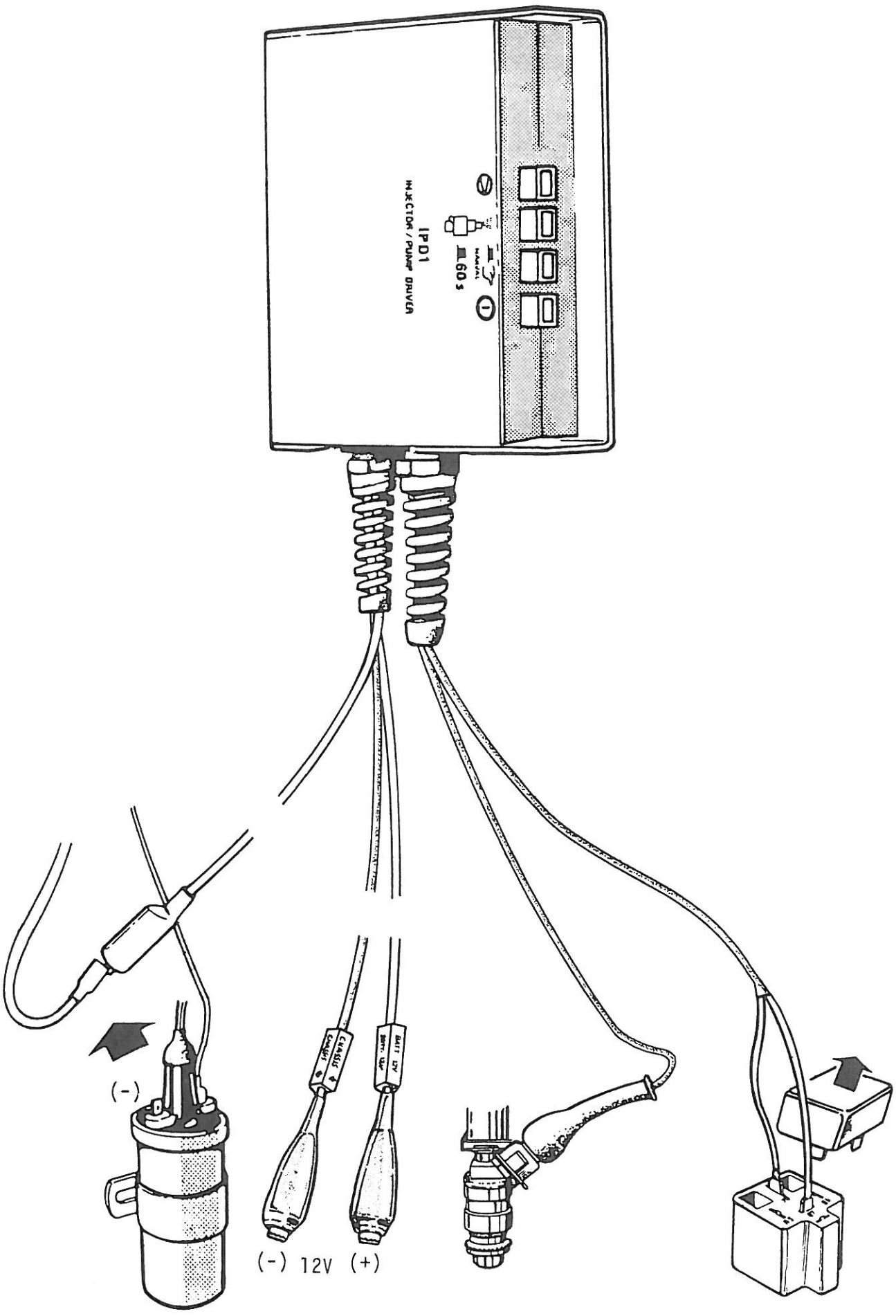
1. Remove the injector to be tested from the engine and place over a calibrated beaker.

2. Connect a petrol pressure supply from the vehicle to the injector.

WARNING: Beware of the danger of fire from petrol spillage.

3. Connect the injector plug of the IPD1 box to the injector and press buttons  and .

4. Check the spray pattern and delivery quantity. With the button marked 60S in the raised position, the injector will be operated for exactly 60 seconds enabling a flow rate to be measured.


IPD1
INJECTOR / PUMP DRIVER
MANUAL
60 s
(-)
CHASSIS
BATT 12V
(-) 12V (+)

connecting to diagnostic sockets

The 422 Cruise Mate has been designed for direct connection to vehicle diagnostic sockets provided that the appropriate test leads are screwed into the boom in place of the standard test leads. Vehicle test leads currently available to order are:

300K/1	Rover, 2300, 2600 and 3500 SD1, Rolls Royce/Bentley.
300K/2	Renault, Citroen, Peugeot and Talbot.* (B.N.A. connector).**
300K/3	Austin/Rover (optical).
300K/4	Mercedes.
300K/41	Mercedes electronic ignition (later models).
300K/5	Volvo.
300K/6	B.M.W. (Old).
300K/61	B.M.W. (New).
300K/7	SAAB.
300K/8	VW/Audi.
300K/14	Alfa-Romeo.
300K/15	RENIX adaptor e.g. Renault.
300K/16	Austin/Rover Montego 1600 and 2000.
300K/17	Digiplex - Fiat/Lancia.
300K/19	American vehicles: General Motors, American Motors Corp., Chrysler.
300K/22	Nissan Harness - used for shrouded ignition coil LT connections.
300K/24	Vauxhall/Opel.
300K/25	Asynchronous Injection Adaptor
300K/26	Lada/Samara
300K/100	Diesel interface unit and transducer for injection timing of most car and light commercial vehicles.

NB. Earlier leads labelled B322K/1 etc. are also suitable for use with the 422 Cruise Mate.

* **WARNING: The B322K/2 lead MUST NOT be used on TALBOT vehicles, the alternator will be damaged.**

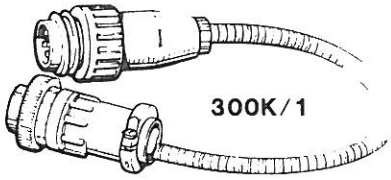
** Later models of Peugeot, Talbot and Citroen may not be fitted with the B.N.A. connector. To enable connection of these vehicles to the 300K/2, a special harness (Part No. 979744) is available through the Citroen Service Organisation.

These leads and adaptors are illustrated opposite and overleaf.

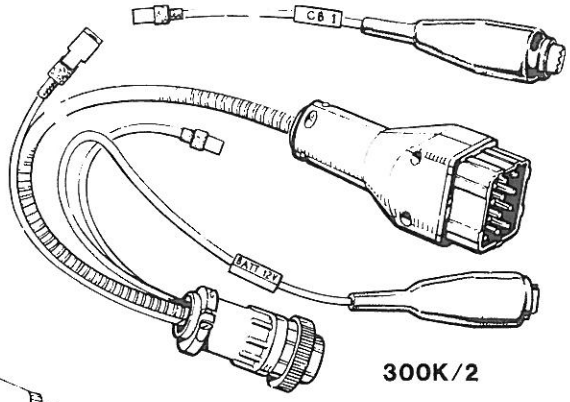
The above vehicles are fitted with or have facilities for an ignition timing sensor. Timing sensors fall into two categories, magnetic and optical.

MAGNETIC SENSORS

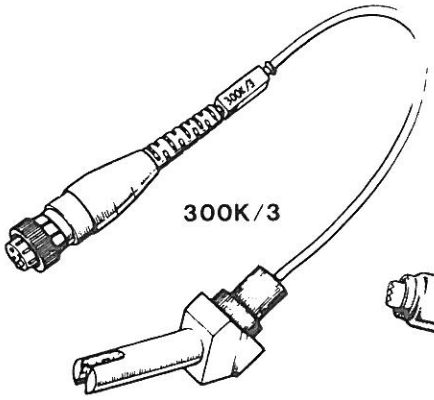
With the magnetic system a small sensor is fitted close to the crankshaft pulley or flywheel. This, together with the RED HT clip on No.1 spark plug lead or the lead from which the timing reference is taken, transmits signals to the test equipment. The digital display then shows the ignition timing when button '14' is pressed. The sensor may be built into the engine or be part of the test harness. In the latter case the sensor must be fitted into the engine receptacle when performing an ignition timing check.



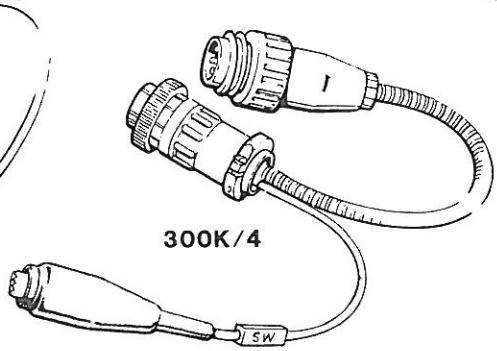
300K/1



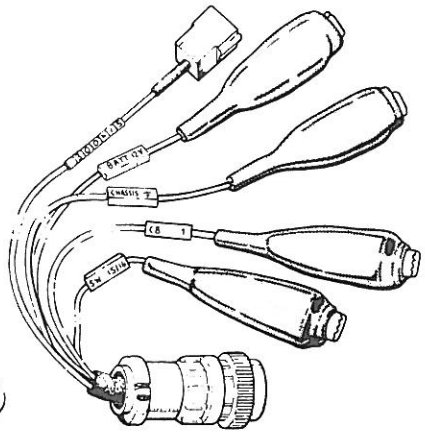
300K/2



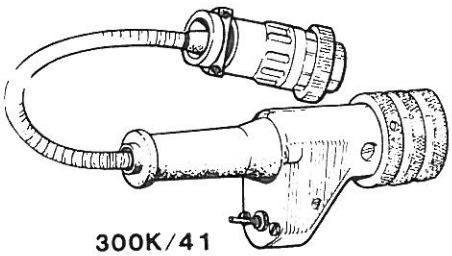
300K/3



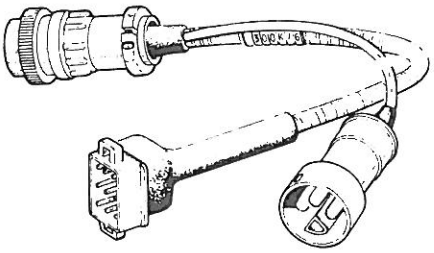
300K/4



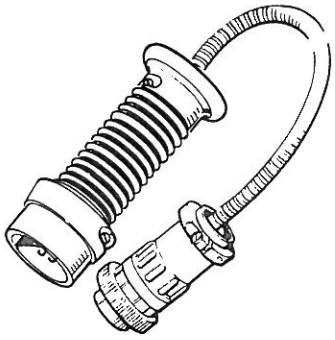
300K/5



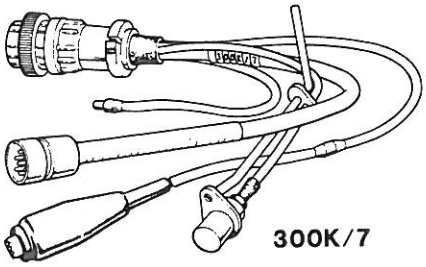
300K/41



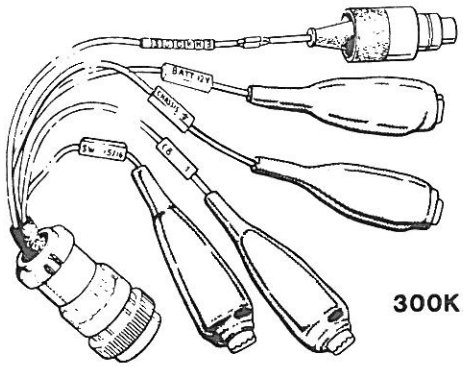
300K/6



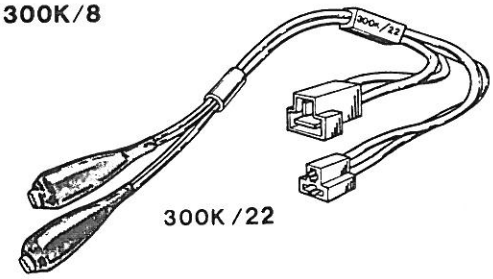
300K/61



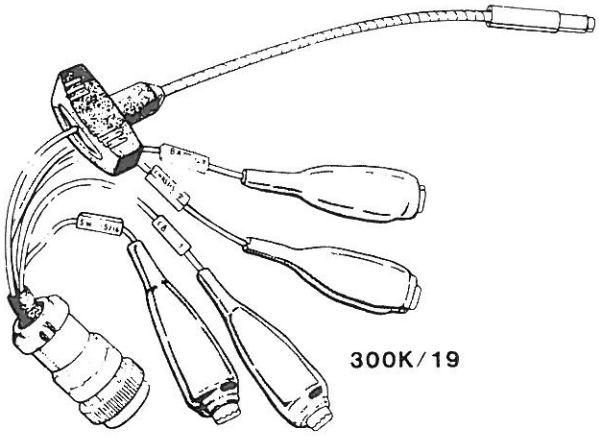
300K/7



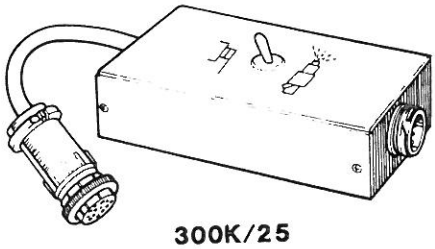
300K/8



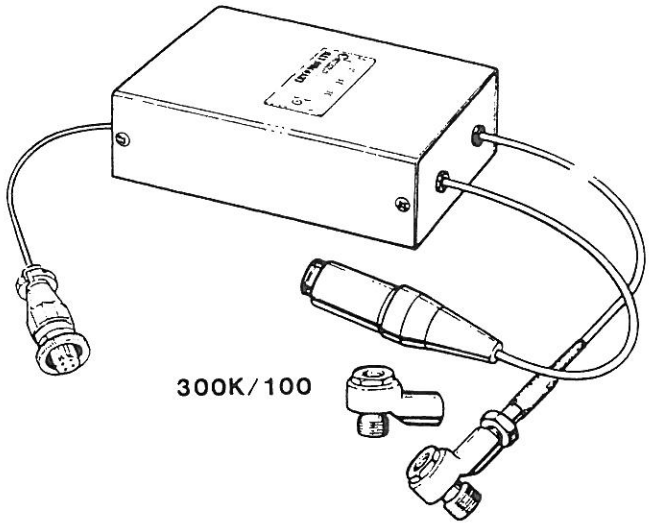
300K/22



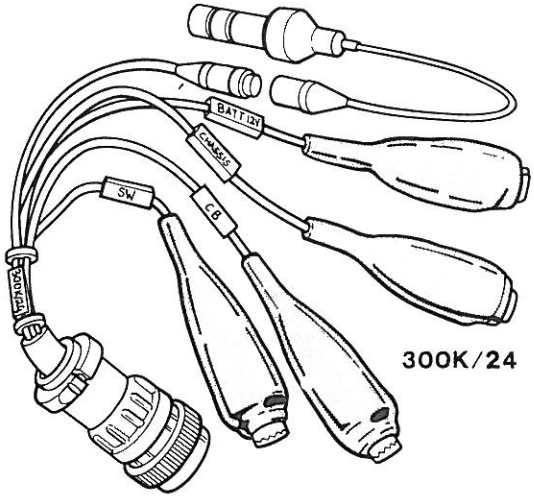
300K/19



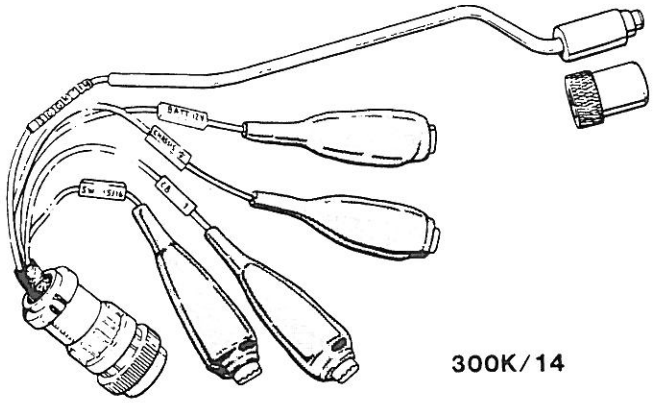
300K/25



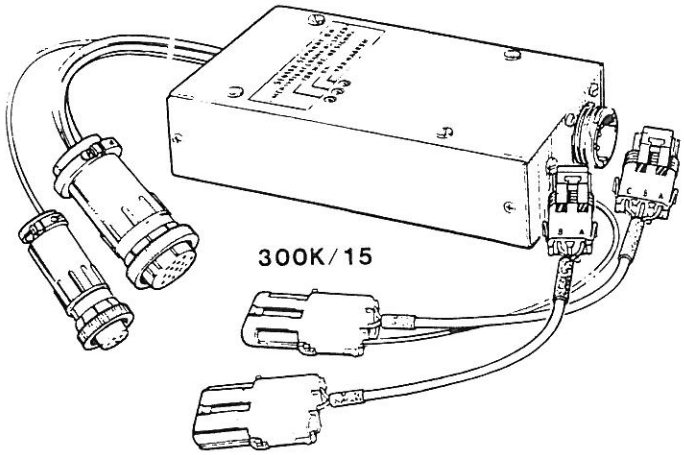
300K/100



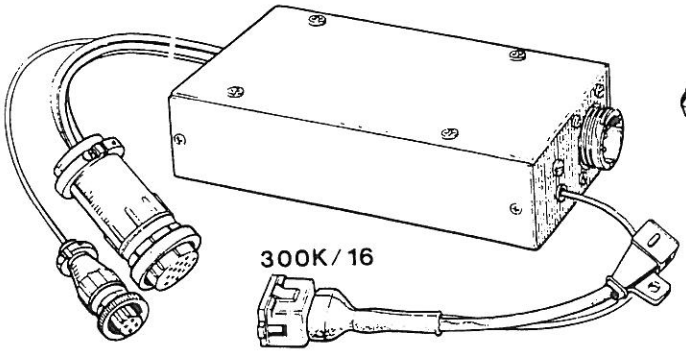
300K/24



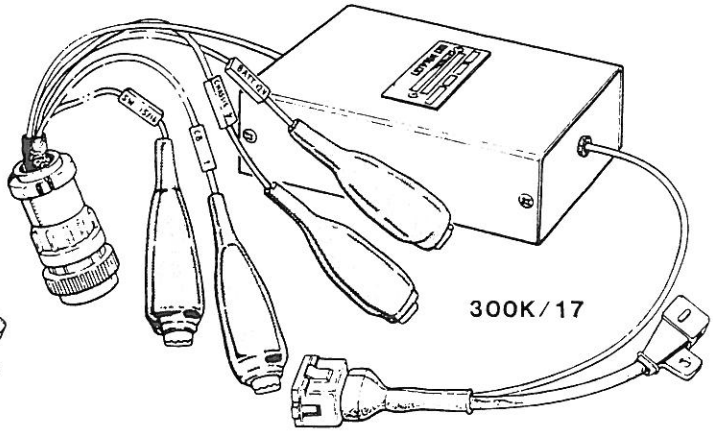
300K/14



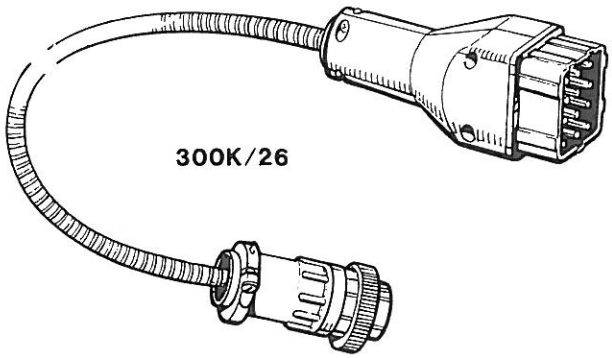
300K/15



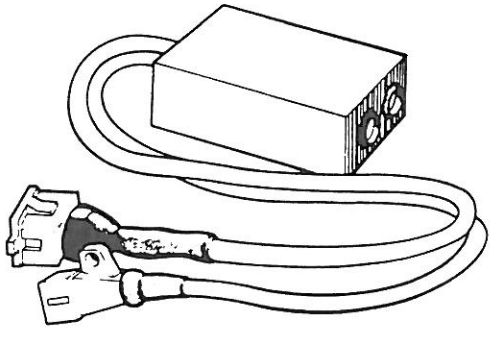
300K/16



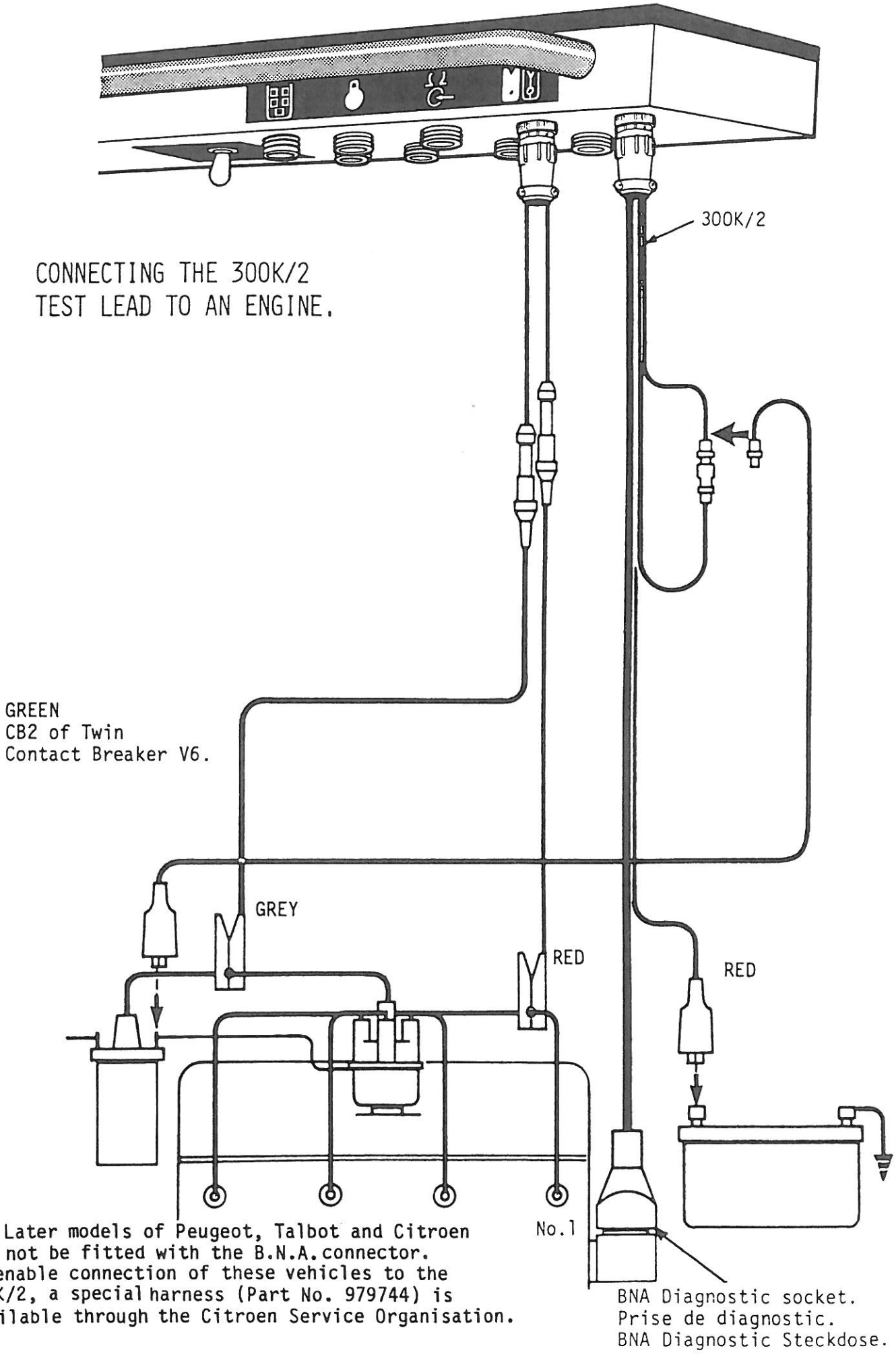
300K/17



300K/26



300K/303



** Later models of Peugeot, Talbot and Citroen may not be fitted with the B.N.A. connector. To enable connection of these vehicles to the 300K/2, a special harness (Part No. 979744) is available through the Citroen Service Organisation.

test connections — diagnostic sockets

OPTICAL SENSORS

The optical sensor as used by Austin Rover is the plug-in type; the sensor being attached to the test lead harness must be placed in a special bracket close to the crankshaft pulley. Once again signals are sent to the test equipment but with this system connections to CB and earth must also be made to provide the signals required for timing. This is done by means of the standard test lead connections.

NOTE: The timing degrees indicated on the Austin Rover optical system is an average figure taken from all the cylinders of the engine. With most magnetic systems the timing figure refers to one cylinder only (usually No.1).

WARNING: The sensing head is a delicate unit. Avoid a costly and unnecessary replacement by treating the sensing head with care. NEVER fit or remove the sensor from an engine which is running.

1. Connect the standard test harness to the usual points of the ignition system, see page 11.

2. Connect the RED and GREY HT clips to No.1 plug lead and the coil HT lead respectively.

3. Screw the optical sensor plug into the small socket (3) on the test lead boom shown on page 11.

4. Locate the holder for the optical sensor on the engine (near crankshaft pulley) and carefully insert the sensing head with one limb at each side of the thin slotted disc.

5. Follow the normal test sequence indicated earlier in this manual.

MAGNETIC SENSORS (built-in type)

1. Disconnect the standard test lead harness at the screw-on boom connection.

2. Connect the appropriate harness to the same large connector on the end of the boom.

3. Plug the other end of the harness into the vehicle diagnostic socket or sockets where two are fitted.

   NOTE: Some diagnostic sockets do not provide all the LT signals required for a complete electrical diagnosis. Where this applies, the test harness is equipped with test clips for connection to the appropriate points.

4. Connect the RED HT clip to No.1 plug lead or the plug lead from which the timing reference should be taken, e.g. No.6 on Rover 2300 & 2600.

5. Connect the GREY HT clip to the coil HT lead.

6. Follow the normal test sequence indicated earlier in this manual.

MAGNETIC SENSORS (plug-in type)

1. Disconnect the standard test harness at the screw-on boom connection.

2. Connect the appropriate harness to the same large connector on the end of the boom.

3. Either plug harness into diagnostic socket (if fitted) or connect test clips to appropriate points.

4. Plug magnetic sensor into bracket provided on vehicle. This may necessitate the removal of a blanking plug.

5. Connect the RED HT clip to No.1 plug lead or the plug lead from which the timing reference should be taken.

6. Connect the GREY HT clip to the coil HT lead.

7. Follow the normal test sequence indicated earlier in this manual.

fitting an emission analyser into the 422 Cruise Mate

The following instructions should be used when fitting an emission analyser into a 422 already in service in the workshop.

1. Disconnect the 422 from the mains supply.

2. Unpack the emission analyser (Model 267 or 270) and enter it from the rear into the left hand side (viewed from rear) of the lower cubicle.

3. Secure the emission analyser to the shelf from below by two screws near the front of the analyser.

NOTE: The rubber mat will need to be punched at the required position.

4. Feed water drain tube hanging from rear of analyser down through the 15mm hole in the shelf at the centre of the analyser. The rubber mat will have to be punched to align with the hole in the shelf.

5. Attach the interface connecting lead coming from the centre top rear of the emission analyser to the strip connector at the left side of the 422 top cubicle. Close the two latches on the connector to secure in position.

6. Connect the short mains supply lead between the mains outlet at the rear of the 422 top cubicle and the mains inlet at the rear of the emission analyser.

IMPORTANT:

The mains outlet at the back of the 422 carries the same voltage as the mains supply to the equipment. Ensure that the emission analyser supplied is tapped for the same mains supply as that supplying the 422.

If the mains voltage is incorrect, refer to the operating manual for the emission analyser for mains tapping details.

7. Switch the mains supply to emission analyser ON and refer to emission analyser manual for operating procedures.

fitting a printer into the 422 Cruise Mate

(Refer to the illustration on the next page)

The following instructions should be used when fitting a printer into a 422 already in service in the workshop.

1. Disconnect the 422 from the mains supply.

2. Unpack the printer from its carton together with fixing brackets, hardware and handset and remove the top cover from the 422 by turning the two plastic fasteners.

3. Fit the cross bracing plate supplied to the floor of the printer tray and leave the two fixing screws loose.

4. Fix the paper roll holder to the base of the printer tray using the four screws and washers provided. Leave the screws slighly loose to enable the paper roll to be aligned with the paper guide in step 9. Then tighten the screws.

5. Place the printer in the tray so that the model number faces the front of the 422. Lower the front edge first so that it slides into the two locating lugs.

6. Move the cross bracing plate into contact with the rear of the printer so that the two lugs on the plate enter the slotted recesses in the printer, then tighten the two screws to secure the cross bracing plate.

7. Locate the printer interface signal lead lying in the printer tray. Connect this lead to the top (unmasked) connector at the rear of the printer unit. Enter and tighten the two screws in the connector to secure it to the printer.

8. Locate the printer mains supply cable lying in the printer tray and connect this to the mains socket at the left rear corner of the printer (viewed from rear).

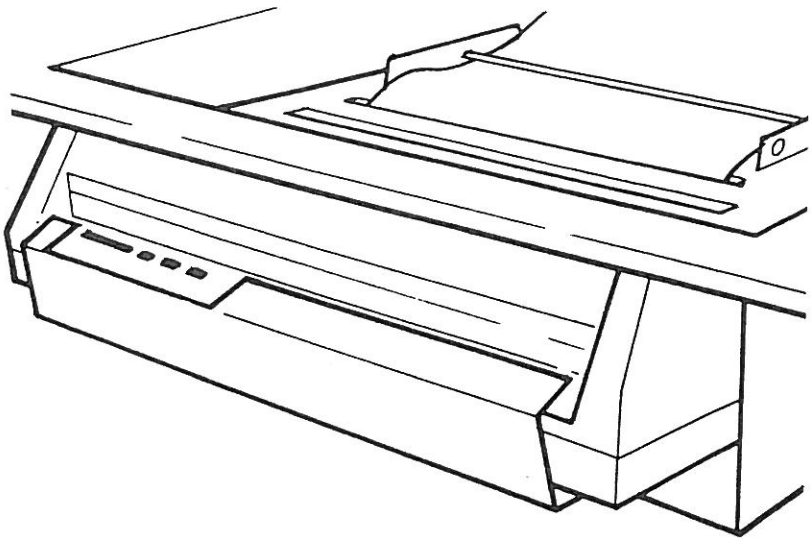
NOTE: Disregard the 240V label on the printer. The 422 will supply the correct mains voltage to the printer regardless of the supply voltage in the workshop.

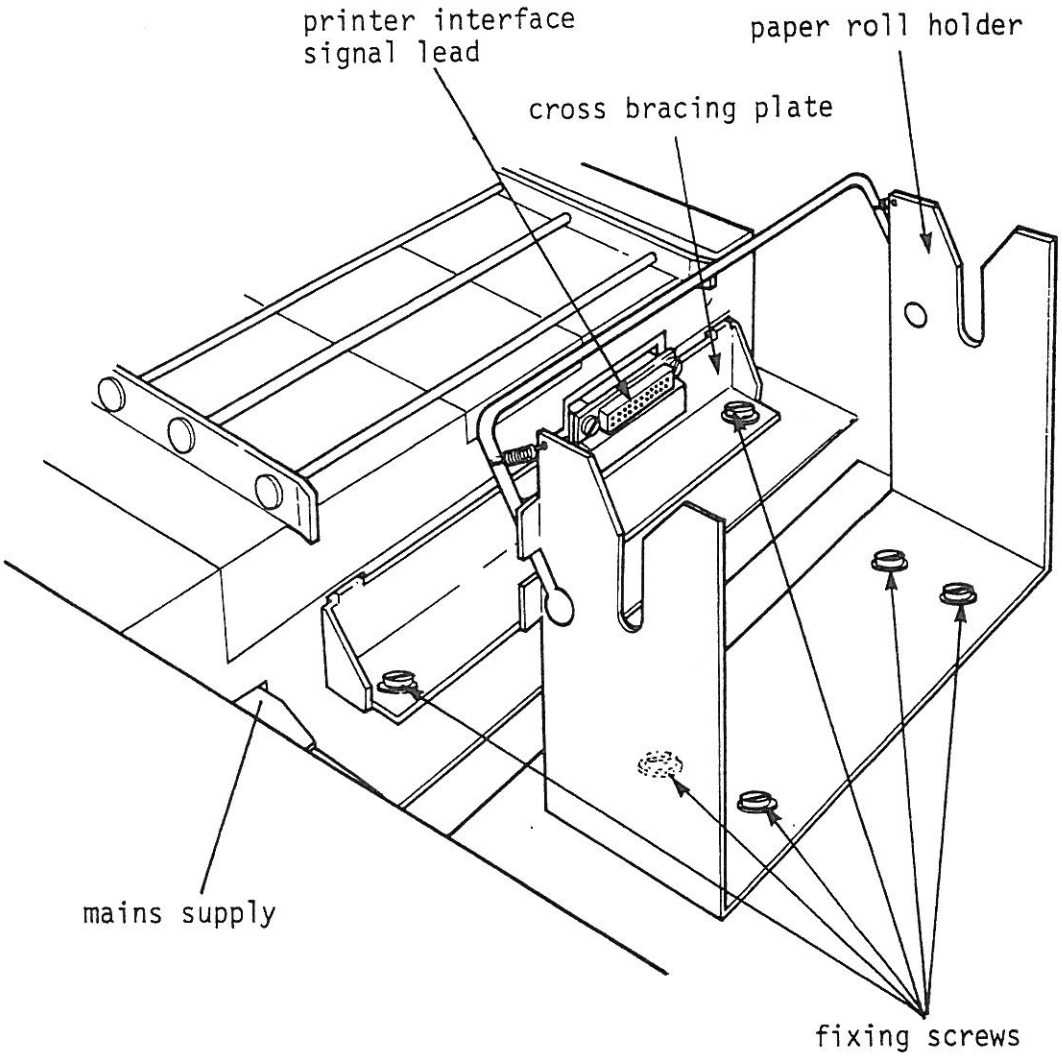
9. Referring to page 87 fit a paper roll to the printer and thread it around the mechanism.

10. Ensure that the mains supply and printer interface cables are clear of the paper roll and switch on the mains supply to the 422 and the printer. The mains switch for the printer is located at the right side of the printer behind the paper advance knob.

11. Fit the new top cover incorporating paper exit slot on the 422 ensuring that the paper feeds out through the tear-off slot.

12. Plug the handset into boom connector (5) and refer to 'Using the Printer' on page 12.




printer interface
signal lead
paper roll holder
cross bracing plate
mains supply
fixing screws

servicing the printer

Changing the paper roll

When the paper roll is nearing its end, a red warning marker will appear on the print-out at the left side. It is strongly recommended that the roll is changed as soon as the red line appears rather than allowing the paper to run out during a vehicle test.

Replace the paper roll as follows:

1. Tear off any loose paper and lift up the yellow cover by turning the two catches to expose the printer.

2. Open platen using lever (Fig. 1-2), lift out spent paper roll carefully sliding free end of paper from beneath platen.

3. Lift off cover (Fig. 1-3) fitted with transparent window.

4. Withdraw rubber spindle bush (Fig. 1-4) from used paper roll and discard spent roll. Retain spindle bush (Fig. 1-5) from opposite end of roll.

5. Take new paper roll and fit the spindle bush (Fig. 1-5) into the left hand end with the paper feeding off the bottom.

6. Slide the roll onto the spindle ensuring that the spindle groove is on the left side. The left spindle bush (Fig. 1-5) must be pressed right up to its collar.

7. Fit the right hand spindle bush (Fig. 1-4) into the cardboard centre. Push it in firmly so it grips the paper and left spindle bush. Place the assembly into the roll holder so that the paper feeds off the roll forward from beneath.

8. Check that roll revolves freely on the spindle and pull about 300mm (1ft) of paper free to thread around the mechanism.

9. Pass the paper over the top of the rear roller of the paper guide assembly, beneath the centre roller and out on top of the front roller. See Fig. 1.

10. Pull the bar (Fig. 1-6) forward and close the platen lever (Fig. 1-2).

11. Feed the free end of paper down behind the platen and turn the knob (Fig. 1-7) to feed the paper right around the platen and up at the front. The paper must pass behind the bar (Fig. 1-6).

12. Open the platen using lever (Fig. 1-2) and draw enough paper through to reach the paper roll at the rear.

13. Check that the first and second copies are both tensioned, lined up at the sides and centred on the platen. If a printer unit is being installed, line up the roll carrier and tighten the carrier fixing screws. Push back the bar (Fig. 1-6) and close the platen lever (Fig. 1-2).

14. Tear off excess paper, replace cover (Fig. 1-3) and switch on printer supply (Fig. 1-1).

15. Close yellow cover and operate print button on Cruise Mate handset ensuring that paper feeds out through slot in yellow cover.

When ordering paper rolls please quote FKI Transervice part number 110012.

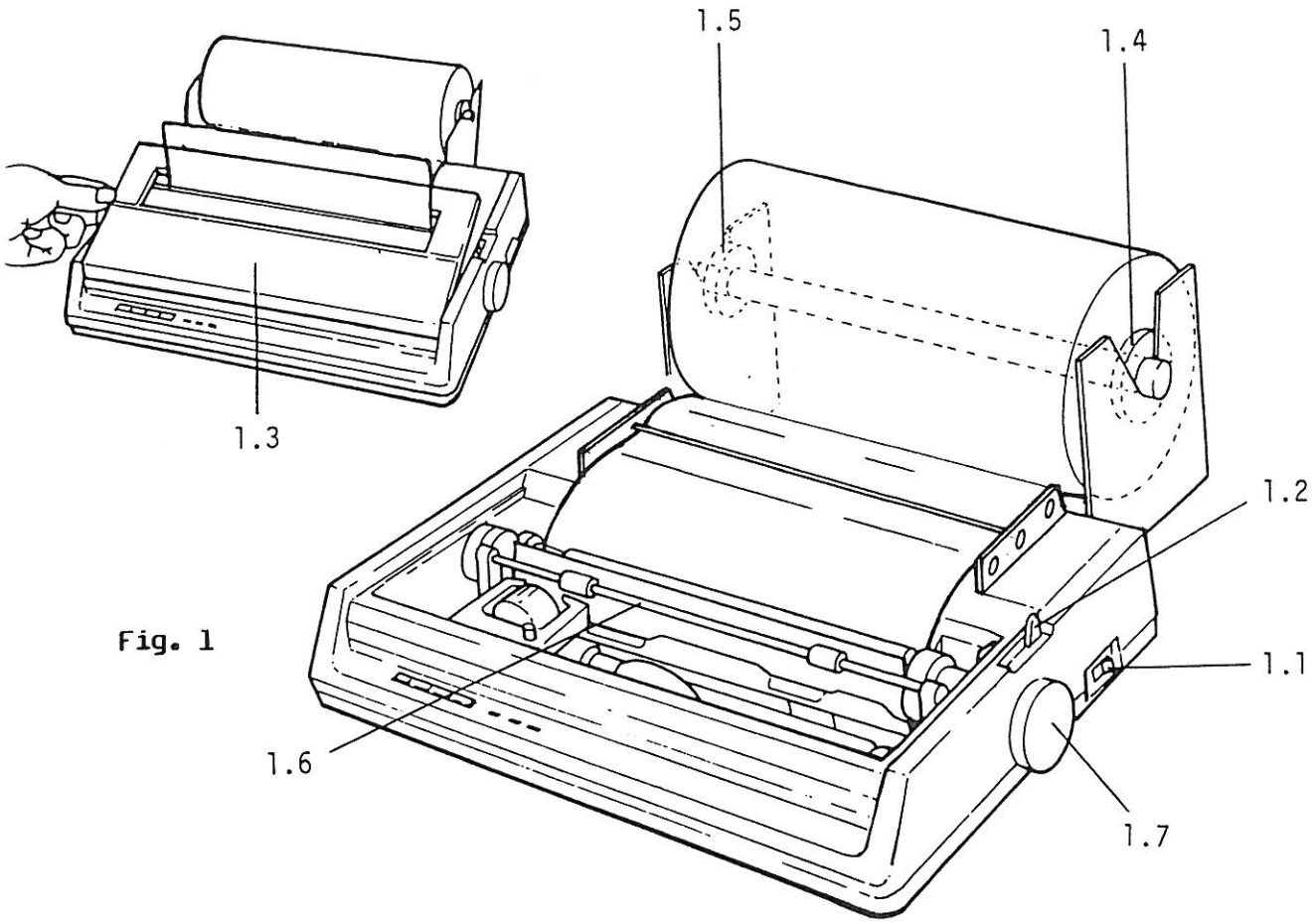


Fig. 1

Changing the Printer Ribbon

Eventually the print quality of the top copy will deteriorate. When this occurs the ribbon cartridge must be replaced.

1. Tear off any loose paper and lift up the yellow cover by releasing the two catches to expose the printer unit.

2. Switch off printer using switch (Fig. 1-1).

3. Lift off cover (Fig. 1-3) fitted with transparent window.

4. Move the print head (Fig. 2-1) to the centre position.

5. Grasp the ribbon holder (Fig. 2-2) and lift upward to remove.

6. Place the new ribbon holder onto the print head assembly so that it sits in the front first, then lower the ribbon over the print head with the tabs on each side of the holder perfectly in line with the inserts arrowed on the print head plate.

7. Press down on the cartridge until it snaps into place on the lower plate.

8. Adjust the blue lever on the left of the cartridge towards the print head to suit two-ply paper.

9. Replace the top cover (Fig. 1-3) and switch on the printer supply (Fig. 1-1).

NOTE: After fitting a new ribbon, check that the green LED indicators at the front left side of the printer are ON. If not, switch the printer mains supply off and on, pausing for a few seconds in the OFF position.

DO NOT touch the other controls near the LED displays.

When ordering spare ribbons please quote FKI Transervice part number 101023.

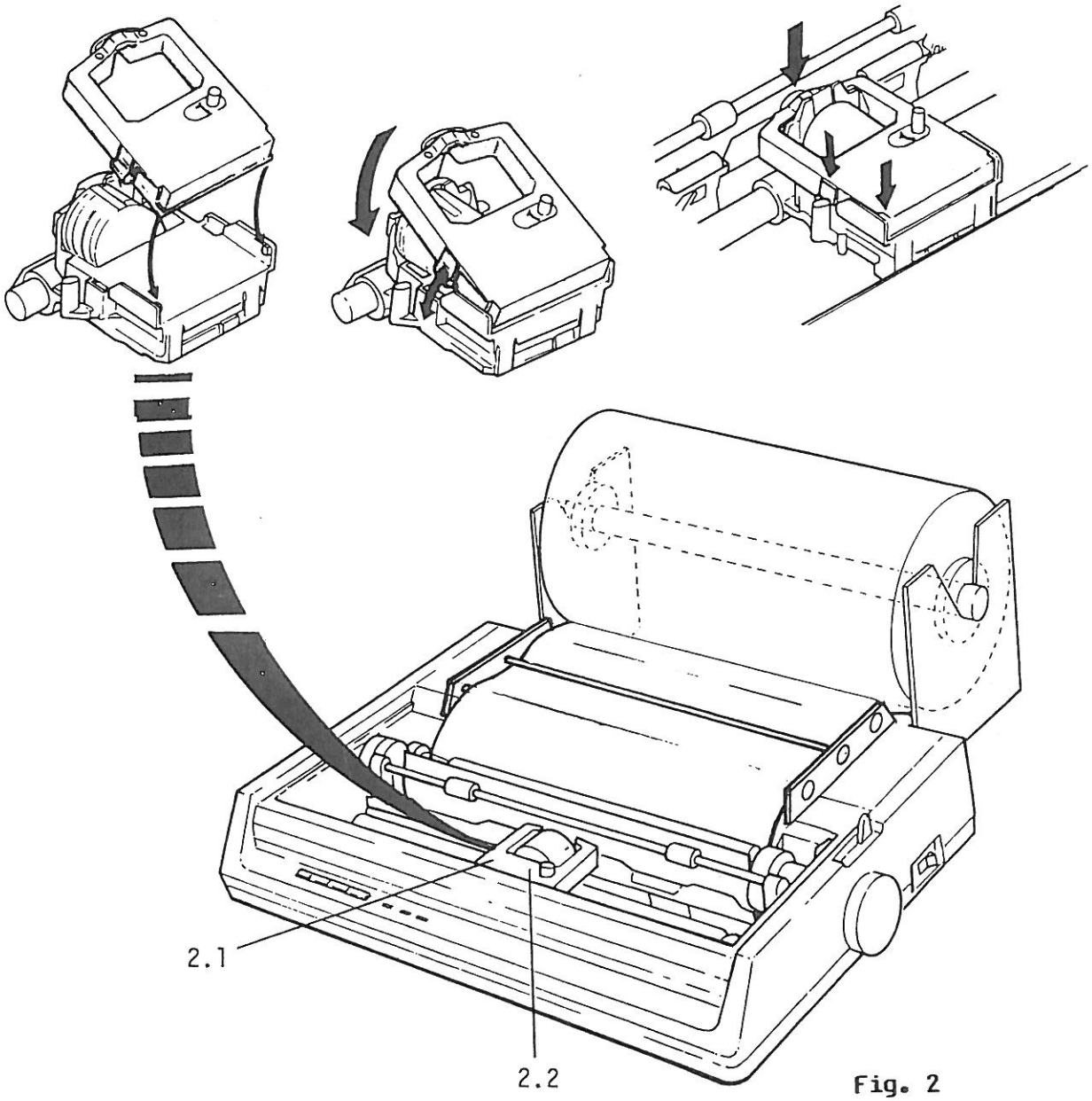


Fig. 2

amps calibration

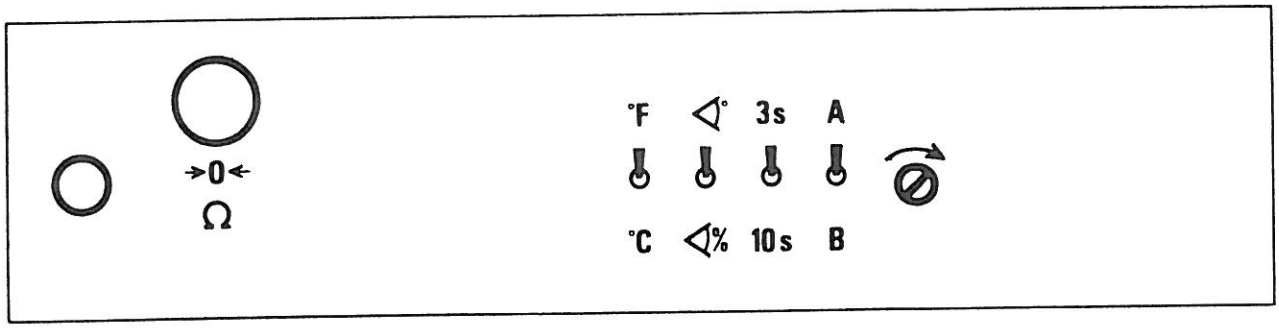
Before making the following adjustments, the equipment should be switched on for 30 minutes.

Amps

1. Push the amps button (9).
2. Plug in the CURRENT measuring probe to the appropriate boom socket.
3. Place the current measuring probe around the clip rail on the boom. This is to keep it clear of any current source.
4. Adjust potentiometer number 3 to bring the amps reading on the digital display to -0, then turn the control clockwise carefully until the instant that +0 appears.

pressure/vacuum

1. Push button (21).
2. Adjust potentiometer number 4 until 0 appears on the digital display.

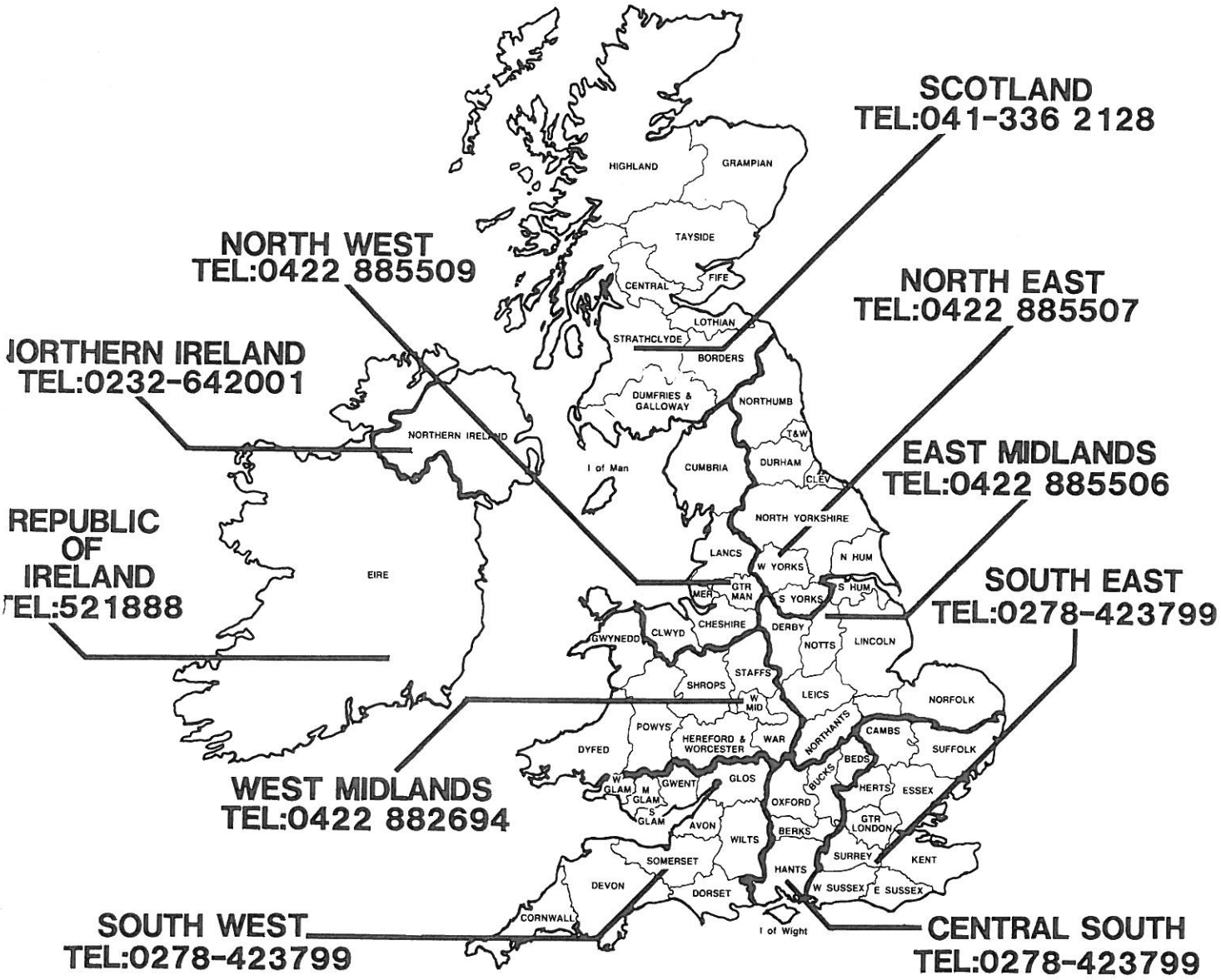


AFTER SALES SERVICE

Apart from the routine maintenance and adjustments stipulated in this manual the equipment must not be tampered with in any way. All further servicing must be carried out only by a Transervice engineer or Authorised Agent, as below. Failure to observe these conditions will invalidate the Guarantee.

ON-SITE SERVICE

If you require a Service Engineer to attend ON SITE, please contact the Service Office shown in your area. All have 24hr. answering services.



OVERHAUL CENTRE

If the equipment covered by this manual requires to be sent back for factory overhaul, please send it to:

FKI Transervice Limited,
P.O. Box 4, Bristol Road,
BRIDGWATER,
Somerset. TA6 4DD
TEL: 0278-426891
TELEX: 46356
(24 hour answering service)

FULLY COMPREHENSIVE AFTER-SALES SERVICE

Installations. Contract Maintenance. Factory Overhaul. Repairs on Site. Spare Parts. Certification and Calibration of Equipment. Lift Safety Kits. Car Data. Technical Manuals.

OVERSEAS

Service abroad is provided by the agent from whom your equipment was purchased

FKI **TRANSERVICE**
The Service Organisation for **CRYPTON · BRADBURY**

FKI Transervice Limited
Brearley Works
Luddendenfoot Halifax
West Yorkshire HX2 6JB
TEL: Halifax (0422) 882383
TELEX: 517249 FKE TUL G

Extract from Home Market Terms & Conditions of Sale of FKI Crypton Ltd.

(Overseas customers should refer to their Agent or supplier of equipment who will furnish guarantee terms on request.)

MANUFACTURER'S GUARANTEE

'We guarantee our products as free from defects due to faulty material or bad workmanship for a period of 12 calendar months for all products. The period of the guarantee commences from the date of delivery to the purchaser, either by us or by our distributor. Our liability is limited to the replacement of parts found defective and making good defects found within the prescribed period arising solely from faulty material or bad workmanship, in the products of our own manufacture, properly used solely for the purposes for which they were intended, and not due to wear and tear, misuse, neglect or improper adjustment.

Any product alleged to be defective shall be forwarded to us, carriage paid, immediatley the alleged defect is discovered, for identification, examination and report or if not capable of being so forwarded, notice in writing shall be sent to us immediately. The customers will be charged for engineers time and travelling expenses if a warranty repair is carried out on site, other than for fixed items of equipment such as brake testers. If we accept liability the repaired or new product, in replacement, will be delivered free our works. We give no guarantee in respect of any proprietary electrical or other equipment made by other manufacturers, and supplied with our products, but will so far as possible, transfer the benefit of such guarantee, if any, given by such other manufacturers. We are in no circumstances liable for any consequential or other loss or damage arising through any defect in our product. In lieu of any express or implied statutory or other warranties, guarantees, conditions or liabilities (whether as to fitness, quality, standard or workmanship or otherwise) which are hereby excluded, the following provisions shall apply:

(a) The Purchaser shall not be entitled to rescind the contract or to claim damages on the grounds of any statement whatsoever as to the suitability of the goods for any particular purpose, and the Purchaser assumes responsibility for the capacity and performance of the goods being sufficient and suitable for his purpose, and for his premises being suited to the installation and operation of the plant and machinery. The Purchaser agrees and confirms that apart from the express terms of the contract, no statement or representation has been made by the Company relating to the goods to be supplied under the contract or, if any has been made, he has not relied on it.

(b) The Company's liability in respect of any defect whether of quality, suitability of performance or otherwise in any goods supplied or for any loss, injury or consequential damage attributable thereto is limited to the terms of this guarantee and the Purchaser hereby acknowledges:
(i) that it purchased the goods in a competitive market and that the bargaining strength of the Company was in no way a relevent factor in the purchase of the goods from the Company.
(ii) that the Purchaser knows the extent of the meaning of this Condition and the limitations thereby imposed by it under Sections 13, 14 and 15 of the Sale of Goods Act 1893.

Our guarantee does not apply should equipment be operated or stored under adverse conditions e.g. outside installations or in areas used for steam cleaning or pressure washing etc.'



CRYPTON

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