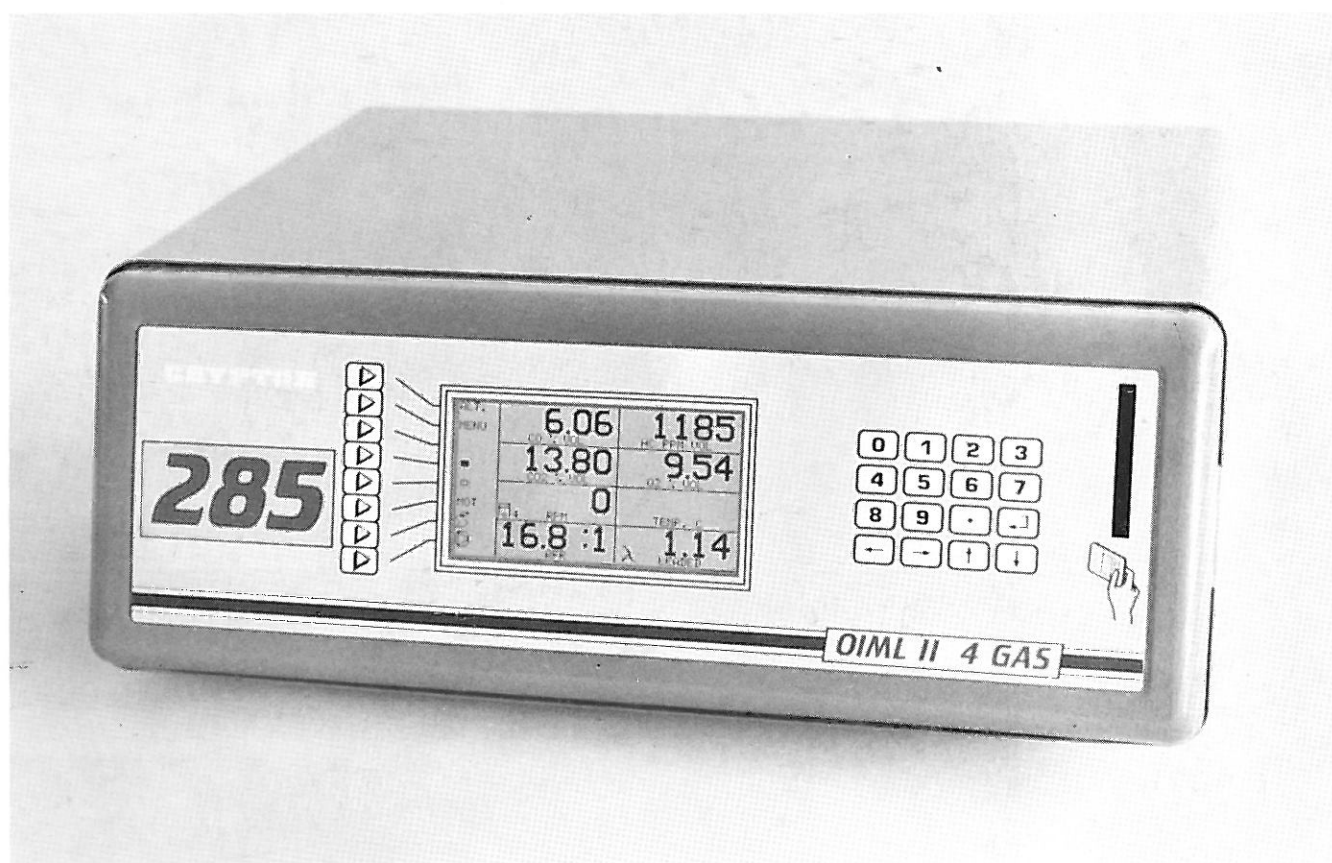


CRYPTON

283/285 OIML II - SPEC EMISSION ANALYSERS



Operating & Maintenance Instructions

TES 1085/2
Feb. 1993

283 CO/HC
285 CO/HC/CO₂/O₂
OIML II SPEC
EMISSION ANALYSERS

OPERATING INSTRUCTIONS

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 FKİ 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.

NOTE:

Your attention is drawn to our Terms & Conditions of Sale, particularly paragraph 2 (an extract of which can be found at the back of this manual and full Terms & Conditions on our current Price List). If a service engineer is called out under service warranty where, upon inspection and test the equipment is found to be in full working order and no fault found, the user is liable to be charged the cost incurred for this call out. Before calling out an engineer, ensure your equipment is faulty by checking its operation, particularly mains supply and fault codes/self test if applicable.

Several replaceable parts of the analyser are considered to be consumable items; please refer to the list on page 23 of this manual.

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HEALTH AND SAFETY

1. The equipment is not weatherproof and should not be used outside in rain or snow.
2. The internal circuits and components of the analyser should not be tampered with. No internal parts are operator serviceable.
3. Operators should exercise due caution with regard to the engine fan and associated belts.
4. Always provide ventilation by using an exhaust gas extraction system or by having an adequate supply of fresh air.

Carbon Monoxide is a highly poisonous gas. If breathed in, it is absorbed by the blood and will result in greatly slowed reactions and if absorbed in sufficient quantity can be fatal. Published figures show that a concentration of 0.3% CO in the air can be fatal if inhaled for 30 minutes.

5. Before starting an engine, ensure that the gear selector is in neutral or park.
6. Care should be taken with regard to scalding from the cooling system, burns from the exhaust system and electric shocks from the ignition HT system.
7. When disconnecting the fuel system of a hot engine beware of the fire hazard caused by petrol spilling onto manifolds, ignition distributor, etc.
8. Position the mains cable and sampler pipe in such a manner that they do not present a hazard to anyone.
9. The earth lead of the mains supply cable MUST ALWAYS be connected to a good earth point.

Handling Precautions

The oxygen sensors are sealed and under normal circumstances the contents of the sensors do not present a health hazard. The following information is given as a guide in the event that a cell leaks.

Protective Clothing: Rubber gloves, chemical splash goggles.

Clean-up Procedures: Wipe down the area several times with a wet paper towel. Use a fresh towel each time.

Protective Measures during Cell Replacement: Before opening the bag containing the cell, check the cell for leakage. If the cell leaks, do not open the bag. If there is liquid around the cell while in the instrument, put on gloves and eye protection before removing the cell.

Disposal: Should be carried out in accordance with all applicable local and national regulations.

In the event of contact carry out the following First Aid Procedures:

Eye Contact: Flush eyes with water for at least 15 minutes and get immediate medical attention.

Skin Contact: Wash affected area with plenty of water and remove contaminated clothing. If burning persists, seek medical attention.

Ingestion: Give plenty of cold water. Do not induce vomiting. Get medical attention.

Inhalation: Liquid inhalation is unlikely.

INTRODUCTION

The FKI Crypton 283/285 OIML-Spec Analyser is a fully microprocessor controlled exhaust gas analyser employing Non-Dispersive Infra-Red (NDIR) Techniques. The 283 measures carbon monoxide and hydrocarbons. The 285 has an additional channel for measuring carbon dioxide plus a further channel employing Electrochemical measurement of Oxygen. Zero calibration may be commanded at any time by the operator, and automatically executed by the analyser. An automatic auto zero check is performed every thirty minutes when the analyser is switched on.

The analyser is designed for long term stability. The inbuilt electrical Zero compensation extends the gas calibration period to six monthly intervals, unless local legislation dictates more frequent checks.

The Crypton 283/285 OIML-Spec Emission Analysers have been approved to OIML Class II specification and have a Certificate of Acceptance from the D.Tp for M.O.T. use.

The 283/285 may be used in three ways:

- a. Stand alone;
- b. With Host computer, without on-board emission analyser LCD display (*NOT* 400 series);
- c. With Host computer, with on-board emission analyser LCD display.

This Operating Manual details the operation of the 283/285 when used as a stand alone unit, or with a Host computer with on-board emission analyser LCD display. For use without on-board emission analyser LCD display please refer to the Addendum at the back of this manual for operation.

Note:

When used with a Host computer with on-board emission analyser LCD display, the Host has priority control over the 283/285. Some of the emission analyser front panel controls may, therefore, not respond if the Host computer is operating the 283/285 (refer to 'Switch On' section on page 6).

RECEPTION

The 283/285 OIML-Spec will operate on an A.C. mains supply voltage of 180 to 250 volts, 50/60 Hz (100 to 120 volts A.C. to special order). There is no requirement to adjust the unit for supply voltages within this range.

Note:

As with any microprocessor based equipment a good earth connection is needed.

Refer to Fig.1.

1. Connect sample probe hose to inlet port 12. It has a quick-release coupling for ease of maintenance.
2. Check that the filters are securely connected.
3. Remove the oxygen sensor from the sealed packet and screw into housing 10. **Do not overtighten.** Fit electrical connection to the top of the sensor 10. (285 only).
4. If required, connect the printer to Printer Port 2 using lead PIL 1.
5. If required, connect printer mains lead to socket 8.
6. If required, the 283/285 may be connected to an host engine analyser by the appropriate lead:

900 series	GIL 4
800 series	GIL 4
700 series	GIL 4
400 series	GIL 2

Note:

If you have an analyser with on-board LCD display please read section 1.3 (page 13) before using in conjunction with an host engine analyser.

7. Connect mains supply to socket 7.

The 283/285 OIML-Spec is now ready for use. Proceed to page 6 for Switch On procedure.

Personalised Header Facility

A personalised header facility is available through a programmable header card (PHC 2), available on order from the Technical Publications department at FKI Crypton. An order form can be found at the back of this manual which allows you to complete your own personal design.

The card must be inserted into the slot on the front panel with the label on the left and the metal connectors on the right. For details of how to load and print the header refer to page 13.

CONNECTIONS & CONTROLS

External Connections

The external connections are shown below in the diagram of the rear panel of the 283/285 OIML-Spec.

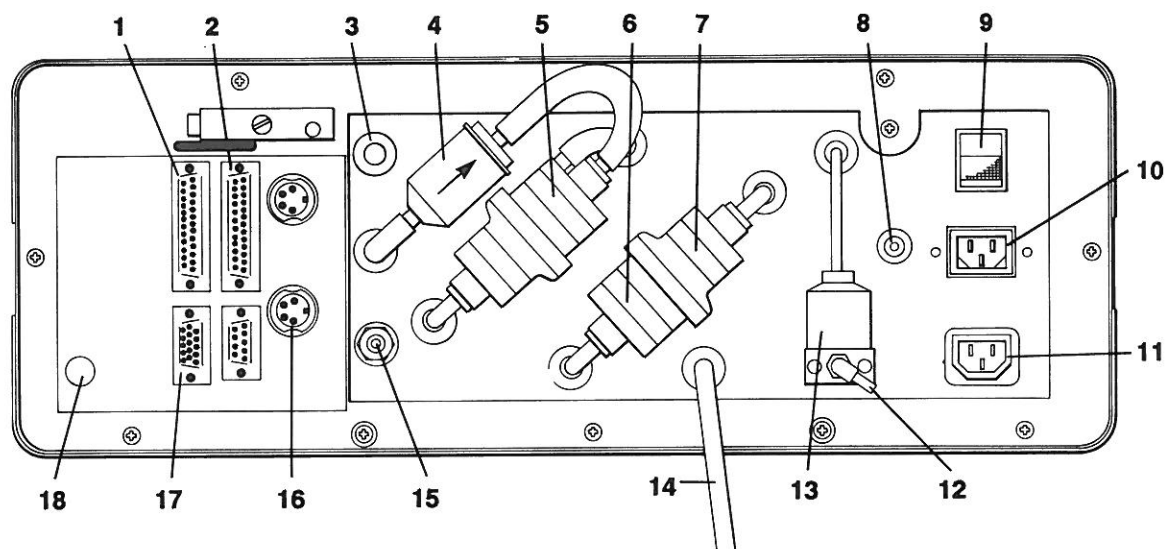


FIG. 1 External Connections

- | | | | |
|---|---|----|--|
| 1 | Parallel Port - 400 Series Communications | 10 | Mains Input |
| 2 | Parallel Port - Printer | 11 | Mains Auxiliary Output (for printer) |
| 3 | CAL Port Zero (Clean Air Input) | 12 | Sample Exhaust |
| 4 | Preliminary Filter | 13 | Oxygen Sensor |
| 5 | Water Trap | 14 | Water Output |
| 6 | Gas Filter - Coarse | 15 | Sample Probe Inlet |
| 7 | Gas Filter - Fine | 16 | Temperature Probe Input |
| 8 | Thermal Trip | 17 | RS485 Port - 900/800/700 Series Communications |
| 9 | Mains On/Off | 18 | Tachometer Probe (Red Probe) Input |

Connection To Vehicle

Carefully insert the sample probe into the vehicle exhaust noting that it is not necessary to insert the whole length of the flexible section. Do not allow the flexible steel probe end to be kinked. Use the adjustable clip to secure the probe to the exhaust. Do not force the probe into the exhaust - some vehicles have very short tail pipe sections and it is possible to damage the probe and the exhaust itself.

Take care when removing the probe from the exhaust at the end of the test. Do not roll up the sample pipe whilst it is still connected to the analyser as excessive amounts of water may enter the filter unit.

Oil Temperature

CAUTION: GREAT CARE MUST BE TAKEN WHEN PERFORMING THIS TEST TO ENSURE THAT NO DAMAGE TO THE OIL TEMPERATURE PROBE AND/OR ENGINE IS INCURRED BY CONTACT WITH MOVING ENGINE PARTS.

Remove the dipstick from the engine and check that the oil is at a reasonable level. Compare the temperature probe to the dipstick and adjust the rubber bung so that the length of probe inserted into the engine is 10-15 mm shorter than that of the dipstick. There must, therefore, be sufficient oil to reach the probe. Insert the probe into the engine via the dipstick hole. The oil temperature will be displayed on the Host equipment during carburettor/injection test modes in steps of one degree.

Controls

All test, calibrate and set-up functions are accessed by the operator from the soft key controls and LCD screen on the front of the 283/285.

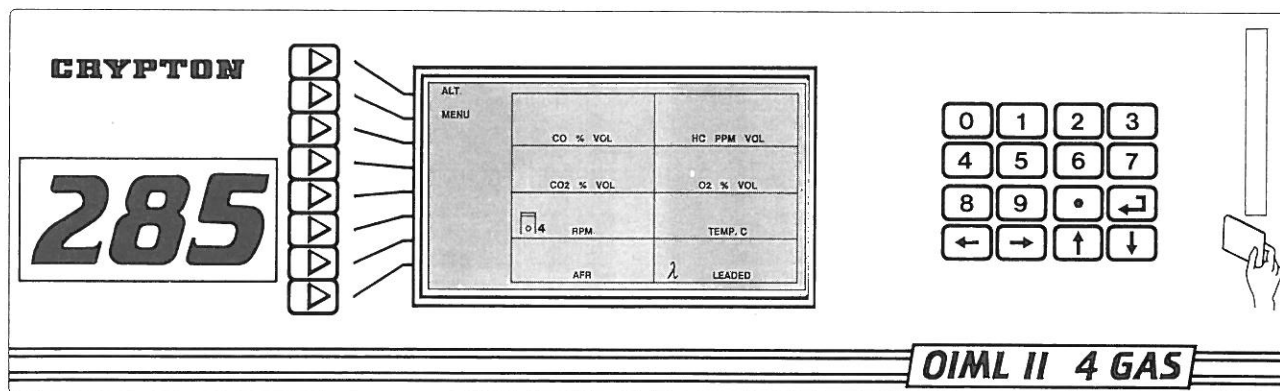


FIG. 2 Controls

The soft keys to the left of the screen allow the operator to select:

-  DARKENS the screen background.
-  LIGHTENS the screen background.
- MOT** Activates M.O.T. Test
-  Activates PRINTER to print results (flashes when printing).
-  Switches pump ON and OFF.

The keypad is used for keying in the date/time during set-up.

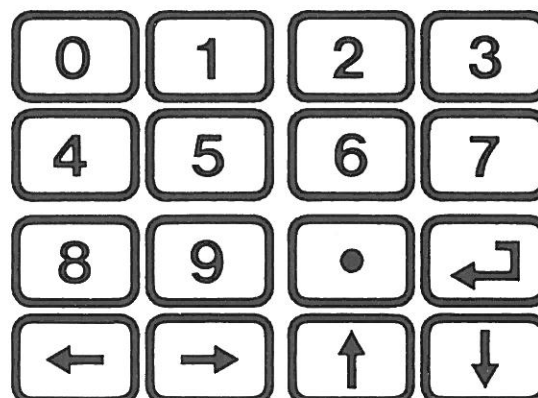


FIG. 3 Keypad

SWITCH ON

When the 283/285 OIML-Spec is first received, certain parameters should be set by the operator. This is a first time set-up but may be changed at a later date to suit requirements.

1. Switch on 283/285 OIML-Spec.

**CRYPTON
285**

2. Allow to warm up.

WARMING UP

5.00

PLEASE WAIT

CHECK FILTER BOWL
REMOVE ANY EXCESSIVE WATER

→ PRESS WHEN DONE

3. 283/285 executing Auto Zero routine.

PERFORMING AUTO ZERO

PLEASE WAIT

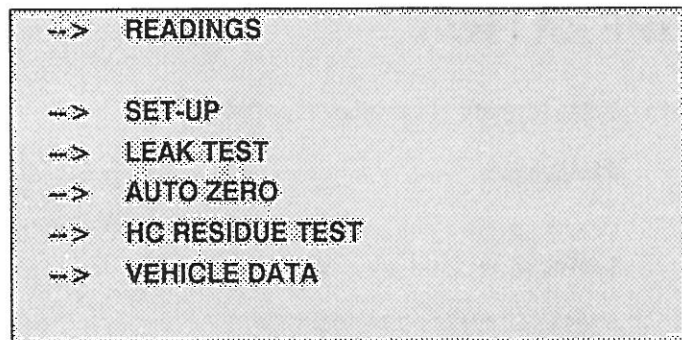
4. This is the main display screen of the 285. Select MENU.

Note:

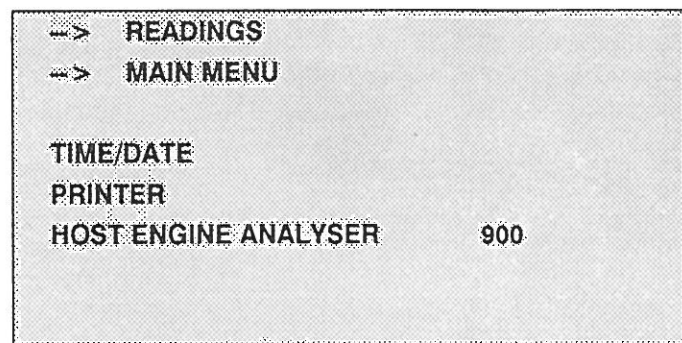
If any gas test is selected when the analyser is being used in conjunction with Crypton 700 or 900 series hosts, the main menu cannot be entered. De-select the gas test on the host before continuing.

ALT. MENU	CO % VOL	HC PPM VOL
	CO ₂ % VOL	O ₂ % VOL
	 4 RPM	TEMP. C
	AFR	λ LEADED

5. From this menu select SET-UP.



6. Select TIME/DATE.



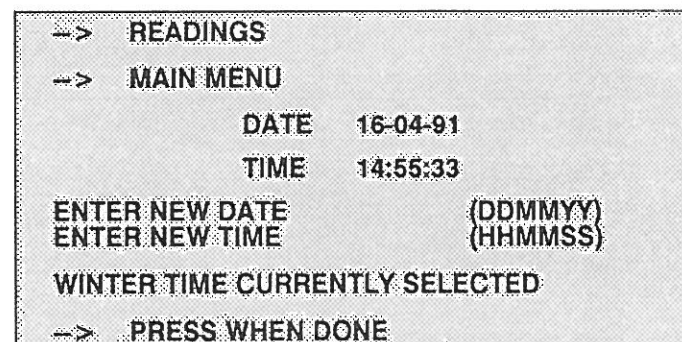
7. Select WINTER TIME or SUMMER TIME.

Select ENTER NEW DATE.
The text will flash until the date has been entered in the correct format. Use the numeric keypad and enter in the format shown. Press  when done. The new date will then appear on the display.

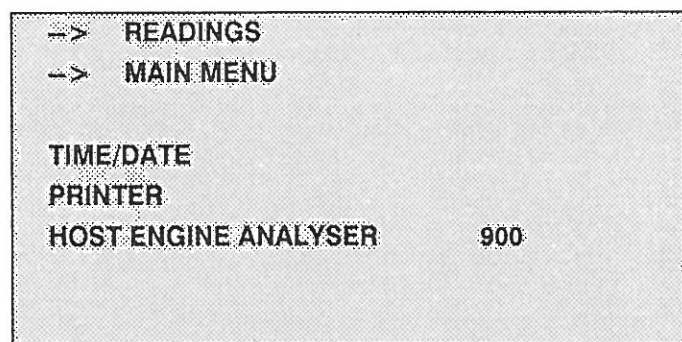
Select ENTER NEW TIME.
Set time using the same procedure as for setting the date.

Select PRESS WHEN DONE.

NOTE: Exiting by pressing READINGS or MAIN MENU will not save any changes.



8. Select READINGS.



OPERATION

Two display formats are available for the 285:

i. READINGS.

This is always selected from power-up and from any menu.

Press ALT for alternative display.

ALT. MENU	CO % VOL	HC PPM VOL
	CO2 % VOL	O2 % VOL
	4 RPM	TEMP. C
	AFR	λ LEADED

ii. ALTERNATIVE DISPLAY.

-> READINGS		
-> MAIN MENU		
CO cor % VOL	=	0.00
CO % VOL	=	0.00
HC PPM VOL	=	0
CO2 % VOL	=	0.00
O2 % VOL	=	20.81
RPM	=	4
TEMP. C	=	
AFR	=	
LAMBDA	=	LEADED

The 283 also has the READINGS and ALTERNATIVE DISPLAY screens, but without the CO₂/O₂ and AFR/Lambda readings.

ALT. MENU	CO % VOL	HC PPM VOL
	4 RPM	TEMP. C
	LEADED	

-> READINGS		
-> MAIN MENU		
CO % VOL	=	0.00
HC PPM VOL	=	0
RPM	=	4
TEMP. C	=	
LEADED		

Methods Of Use

The CO and HC readings can be used in various ways as follows (see also page 16):

1. To adjust the CO and HC contents of the exhaust gas to the level permitted by government legislation where applicable.

or
2. To adjust the contents of the exhaust gas to the vehicle manufacturer's specification. Available in UK for cars built after October 1976 (not a legislative requirement for in-service use).

or
3. To adjust the contents of the exhaust gas to a reasonable level, consistent with good engine performance. Applies in UK to cars built before October 1976.

or
4. To check the high speed economy of a vehicle by monitoring the CO level at 3000 rpm.

Lambda

The Greek letter Lambda (λ) is a comparative measurement of the air/fuel ratio (AFR). Every fuel type has a specific AFR at which chemically correct combustion occurs, i.e. all the fuel is burned and all the oxygen in the air is used so that the mixture is neither rich nor lean. This is the "stoichiometric" AFR and for leaded petrol it is approximately 14.8:1. At this point $\lambda = 1$. When Lambda is less than 1 the AFR is rich; when it is more than 1 the AFR is lean.

MOT Test

Pressing MOT on the Readings screen allows access to a prompted, automatic MOT test sequence with the option of a printed test certificate at the end. Ensure that the RPM (Red) Probe and the Oil Temperature Probe are fitted if available.

Select MOT Test.

1. Follow the instructions on the screen to check the sample probe.

Ensure exhaust extractor is fitted.

Select PRESS WHEN DONE when completed.

→ READINGS	MOT GAS TEST
HC 12 PPM VOL	
ENSURE SAMPLE PROBE IN FREE AIR.	
CHECK HC BELOW 20 PPM AND FOR	
LEAKS IN SAMPLE PROBE.	
FIT EXHAUST EXTRACTOR.	
→ PRESS WHEN DONE	

2. Select the desired vehicle period.

The arrow next to the selected date will flash.

Select PRESS WHEN DONE when completed.

→ READINGS	MOT GAS TEST
→ AFTER	1ST AUG 1983
→ BETWEEN	1ST AUG 1975 & 31ST JUL 1983
→ BEFORE	1ST AUG 1975
CHOOSE DATE WHEN VEHICLE WAS FIRST USED	
→ PRESS WHEN DONE	

3.

→ READINGS	MOT GAS TEST
START ENGINE AND ALLOW TO IDLE	
→ PRESS WHEN DONE	

4. Note that oil temperature will only be displayed if the probe is fitted.

If a vehicle before 1st August 1975 has been selected from screen 2 above, then the test will proceed directly to screen 8 (page 11) after this screen.

→ READINGS	MOT GAS TEST
ENGINE SPEED = 740 RPM	
ENSURE ENGINE AT NORMAL OPERATING TEMPERATURE (COOLING FAN CUT-IN TWICE)	
OIL TEMPERATURE = 23 DEG. C	
WARNING BEWARE ROTATING PARTS	
→ PRESS WHEN DONE	

5.

SCAVENGING RUN

The engine must be run at 2500 RPM for 20 seconds continuously. The analyser will display a count-down during this time.

Note that if an RPM probe is not fitted, the analyser will not display a count-down; this will have to be done manually.

→ READINGS	MOT GAS TEST
ENGINE SPEED = 740 RPM	
RUN ENGINE AT 2500 RPM FOR	
20 SECONDS	
WARNING BEWARE ROTATING PARTS	

6.

Insert sample probe and reconnect exhaust extraction.

Select PRESS WHEN DONE when completed.

→ READINGS	MOT GAS TEST
ENGINE SPEED = 740 RPM	
ALLOW ENGINE TO IDLE	
INSERT SAMPLE PROBE INTO EXHAUST	
WARNING BEWARE ROTATING PARTS	
→ PRESS WHEN DONE	

7. The engine must be allowed to idle for 20 seconds continuously. The analyser will display a count-down during this time.

```

-> READINGS                                MOT GAS TEST

ENGINE SPEED = 740 RPM
ALLOW ENGINE TO IDLE FOR

                20 SECONDS

WARNING BEWARE ROTATING PARTS
  
```

8. Select whether the idle speed is acceptable. The arrow next to the chosen option will flash.

Select PRESS WHEN DONE when completed.

```

-> READINGS                                MOT GAS TEST

IS IDLE SPEED ACCEPTABLE ?

-> IDLE SPEED ACCEPTABLE
-> IDLE SPEED EXCESSIVE

WARNING BEWARE ROTATING PARTS

-> PRESS WHEN DONE
  
```

9. The arrow next to the selected smoke content will flash.

Select PRESS WHEN DONE when completed.

```

-> READINGS                                MOT GAS TEST

OBSERVE EXHAUST GASES AND CHOOSE
CORRECT SMOKE CONTENT

-> EXHAUST SMOKE ACCEPTABLE
-> EXHAUST SMOKE EXCESSIVE

WARNING BEWARE ROTATING PARTS

-> PRESS WHEN DONE
  
```

10. Selecting PRINT CERTIFICATE will print either a PASS or a FAIL certificate. The arrow will flash while the certificate is being printed. If the test passed, the certificate will be printed complete with footer. If the test failed, the footer will not be printed until END is selected. This will allow the results of rectification to be appended to the certificate if required.

```

-> END (READINGS)                          MOT GAS TEST

MOT GAS TEST = FAIL

RESULTS                                     LIMITS
                                     min  max
CO      4.60 % VOL FAIL              1.00 4.50
HC      100 PPM VOL PASS             -   1200
IDLE    0 RPM PASS                   -   -
SMOKE   PASS                         -   -

-> PRINT CERTIFICATE
-> ADJUSTMENTS
  
```

If the vehicle fails, an option to perform adjustments is displayed. If this option is selected a retest may be performed after the adjustments. At the end of the retest this screen will be displayed again and the Pass results may be appended to the printout by selecting PRINT CERTIFICATE.

Note that if a vehicle before 1st August 1975 has been selected from screen 2 (page 9) then the CO and HC values will just be displayed as dashes.

11. This screen displays live readings and allows the user to perform adjustments.

Selecting RESULTS returns to the previous screen with the previous results still displayed. This facility allows a FAIL certificate to be printed without performing a complete retest. This is useful if it is not possible to adjust the vehicle so that it passes.

-> READINGS		MOT GAS TEST	
CO % VOL		HC PPM VOL	
0.4	RPM	TEMP C	
-> RETEST		LIMITS	
-> RESULTS		CO - 4.50	
		HC - 1200	

Selecting RETEST returns to screen 3 (Page 10). A complete retest may then be performed, allowing the results of the rectification to be appended to the printout.

A typical printout, with header and footer, is shown below.

SERVICE STATION NAME/ADDRESS :- FKI CRYPTON TRAINING CENTRE			
King Edward Road Nuneaton, Warwickshire CV11 4DT Tel: 0203-375040		Operator Courses Engine Management Electronic Ignition Petrol Injection Exhaust Emissions Approved Technician Scheme	
ON THE RIGHT COURSE FOR THE FUTURE			
DATE	: 06/08/92	TIME	: 15:49
MILEAGE	:	REG. NO	:
CUSTOMER	:	MAKE/MODEL	:
Automatic Legislative Gas Test			
RESULTS		DIAGNOSIS LIMITS	
MOT GAS CERTIFICATE		min max	
VEHICLE CONDITION		PASS	
Idle speed	= 975 rpm	PASS	- -
CO level	at 891 rpm = 0.78 % Vol	PASS	- 4.5
HC level	at 891 rpm = 1133 ppm Vol	PASS	- 1200
Exhaust smoke		PASS	
285 OIML II SPEC ANALYSER			
Copyright FKI Crypton MCMXCII		*.....*	

FIG. 4 MOT Gas Certificate

Other Facilities

1. SET-UP

1.1 Time / Date

This is described in the 'Switch On' section of this manual.

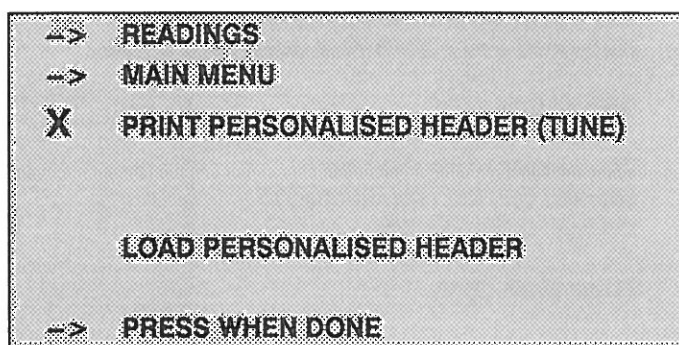
1.2 Printer

Pressing the PRINTER key displays a screen with an option to turn the personalised header on/off. Note that this is for the non-legislative test; the MOT certificate always has a header.

When the header facility is active, pressing the print key will print the header followed by the results. Subsequent print key presses will only print the results. To terminate this sequence, press the $\leftarrow$ (return) key on the numeric keypad (Fig.3) to print the footer. The next press of the print key will cause another header to be printed. Pressing the $\leftarrow$ key at any other time whilst the 'Readings' screen is displayed will produce a printer form feed.

Pressing PRINT PERSONALISED HEADER will alternate between a tick or a cross. If a tick is displayed the header will be printed; a cross prevents the header from being printed.

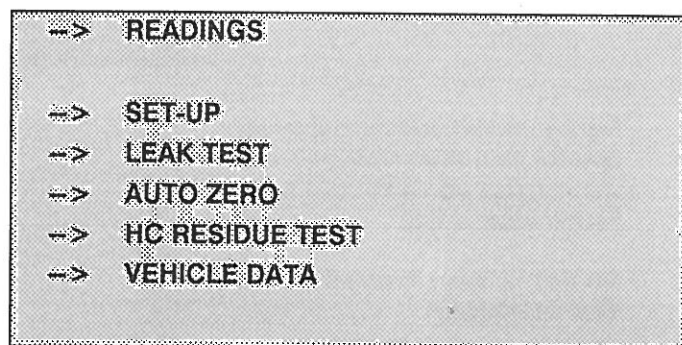
To load a header for the first time, or to load a new header, press LOAD PERSONALISED HEADER. Select PRESS WHEN DONE



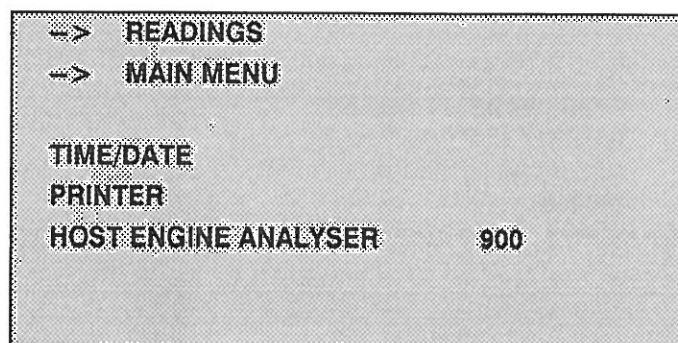
1.3 Host Engine Analyser

When using the emission analyser in conjunction with an engine analyser, the emission analyser must be set up for the correct Host to ensure that emission data will be transmitted to the Host.

From this menu select SET UP.



Pressing the HOST ENGINE ANALYSER key will alternate the display of the selected Host or series of Host Engine Analysers.



The following options are available:

900	900 Series (CUDOS)	450	CO and HC only
NONE		451	
422		452	
440		700	700 Series (CADET)

Note: RELATIVE HC READINGS ON 400 SERIES ENGINE ANALYSERS

As the delay time between HC peaks and cylinder kill is not identical to that of the original emission analyser, ignore these results.

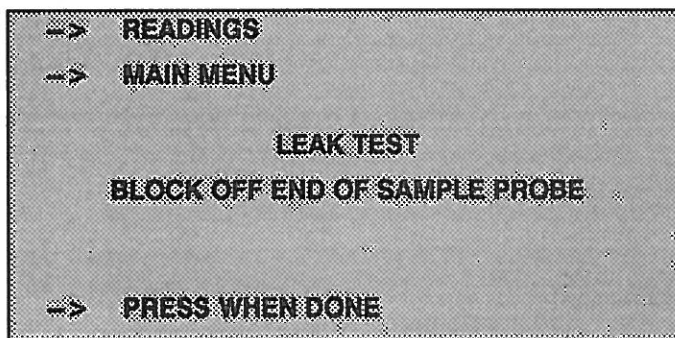
2. LEAK TEST

This test will check the gas sampling system for leaks. If a leak is detected, the problem must be rectified before performing further measurements. It is recommended that a leak test is performed every day before using the analyser.

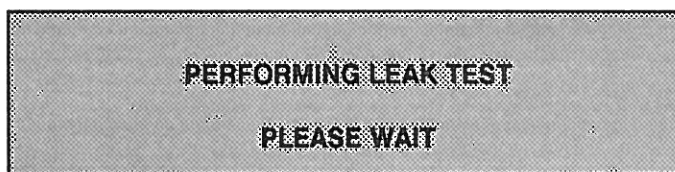
Select LEAK TEST.

The sample probe must be blocked with the cap attached to the rear of the 283/285.

Press when done.



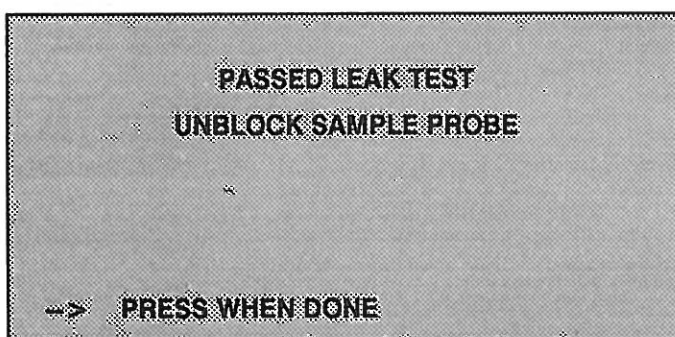
The Leak Test verifies gas-tight connection of sample probe, filtration system and internal connections.



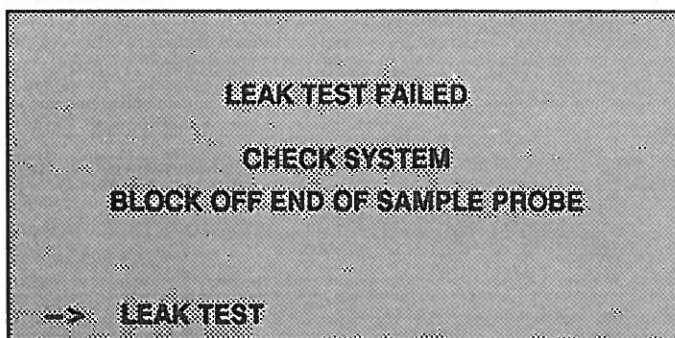
During the leak test the pump will operate for a short time, then a vacuum test will be initiated for a further short period.

Do Not Remove Probe Cap Until Test Completed.

Press when done.



If leak test fails, it must be repeated after first checking probe cap, probe connection and filter sealing.



3. AUTO ZERO

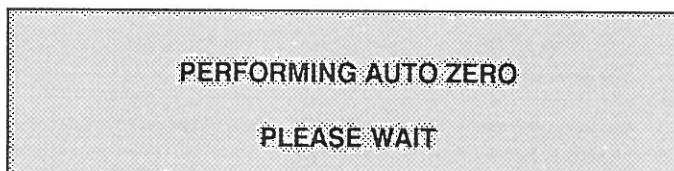
The analyser performs a zero check automatically every 30 minutes (this period may be shorter if the analyser is subjected to a sudden change in temperature). To ensure that the analyser does not interrupt an extended period of testing, the operator may force an auto zero. The next auto zero will then be performed 30 minutes later.

Note:

During the first 30 minutes of operation from power-up, the analyser will automatically perform auto zeros at much shorter intervals. These will be performed even if the unit is in use (the normal 30 minute auto zeros are inhibited if the analyser is in use).

Select AUTO ZERO.

Performing Auto Zero.



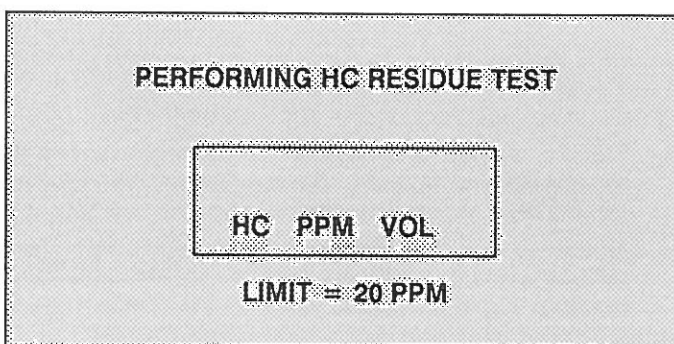
4. HC RESIDUE TEST

This test monitors the residual hydrocarbons in the gas sampling system. The sample probe must be removed from the vehicle exhaust before carrying out this test. If the level of HC does not drop below the limit, disconnect the sample hose from the analyser and blow out the hose with an air line. Reconnect the hose and repeat the test. If the limit is still not achievable, replace the filter element and repeat the test.

It is recommended that an HC residue test is carried out immediately before each legislative test.

Select HC RESIDUE TEST.

If HC residue is more than 20 ppm, then operator must remedy fault (e.g. blow out probe with air line).



5. VEHICLE DATA

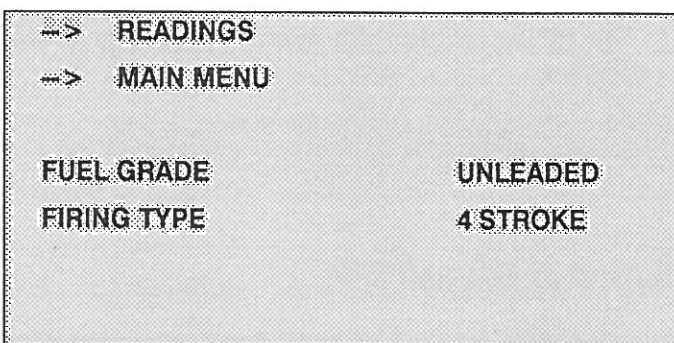
Selecting this option allows the operator to input details about the vehicle under test. The Firing Type switch must be set correctly to give valid RPM readings. The fuel grade switch affects the Calculated Lambda reading. The current setting for each of these switches is displayed on the Readings screen.

Select VEHICLE DATA.

Successive operations of the FUEL GRADE key will select UNLEADED/LEADED/L.P.G.

Successive operations of the FIRING TYPE key will select 4 stroke / 2 stroke.

Select READINGS or MAIN MENU when the correct vehicle details are displayed.



IMPORTANT:

If L.P.G. is selected and the analyser is used on a petrol vehicle, the HC reading will be approximately twice the reading obtained with LEADED/UNLEADED selected.

ANALYSIS OF TEST RESULTS (CO/HC)

CO - Carbon Monoxide is formed in the cylinders when there is incomplete combustion and an excess of fuel. Fig. 5 shows the level of CO to be high when the mixture is rich, falling considerably at around the ideal mixture of 14.7:1, then falling to zero before rising again when the air/fuel ratio exceeds 20:1.

Catalytic converters which can only be used with lead-free petrol, reduce the level of CO to near zero by chemical reaction.

On cars without converters, CO levels up to 5% or more may be needed for good engine performance.

In general, with older vehicles the CO level at 2500 rpm will be lower than at idle, a typical reading being around 2 to 3%.

WARNING: CO is a highly poisonous gas. If breathed in, it is absorbed by the blood and will result in greatly slowed reactions and if absorbed in sufficient quantity can be fatal. Published figures show that a concentration of 0.3% CO in the air can be fatal if inhaled for 30 minutes. Provision should therefore be made to extract the exhaust gases.

HC - Petrol is mainly composed of hydrocarbons, so the HC level in the exhaust gas is a result of incomplete combustion. The level is high when the mixture is rich, falling to a minimum at around 16:1 air fuel ratio. If the mixture is too lean, misfiring begins to occur, increasing in frequency as the mixture gets leaner. Every time the spark fails to ignite the mixture, a full cylinder charge of hydrocarbon/air mixture is pumped into the exhaust, so raising the HC reading. Fig. 6 shows the effect on HC due to mixture variation.

Some modern cars have catalytic converters installed which reduce the HC level close to zero by chemical reaction. A level of less than 50 ppm is typical.

On cars with a carburettor and without a converter, levels up to 400 ppm are normal, whereas about 300 ppm should be expected on later cars. Injected engines normally give between 80-300 ppm.

The HC level at 2500 rpm should be lower than at idle, generally being around half the idle reading.

Dilution of HC and CO

Dilution is caused by a leaking exhaust system. Always check the vehicle exhaust system for leaks. A serious leak will dilute the CO and HC level and give misleading results.

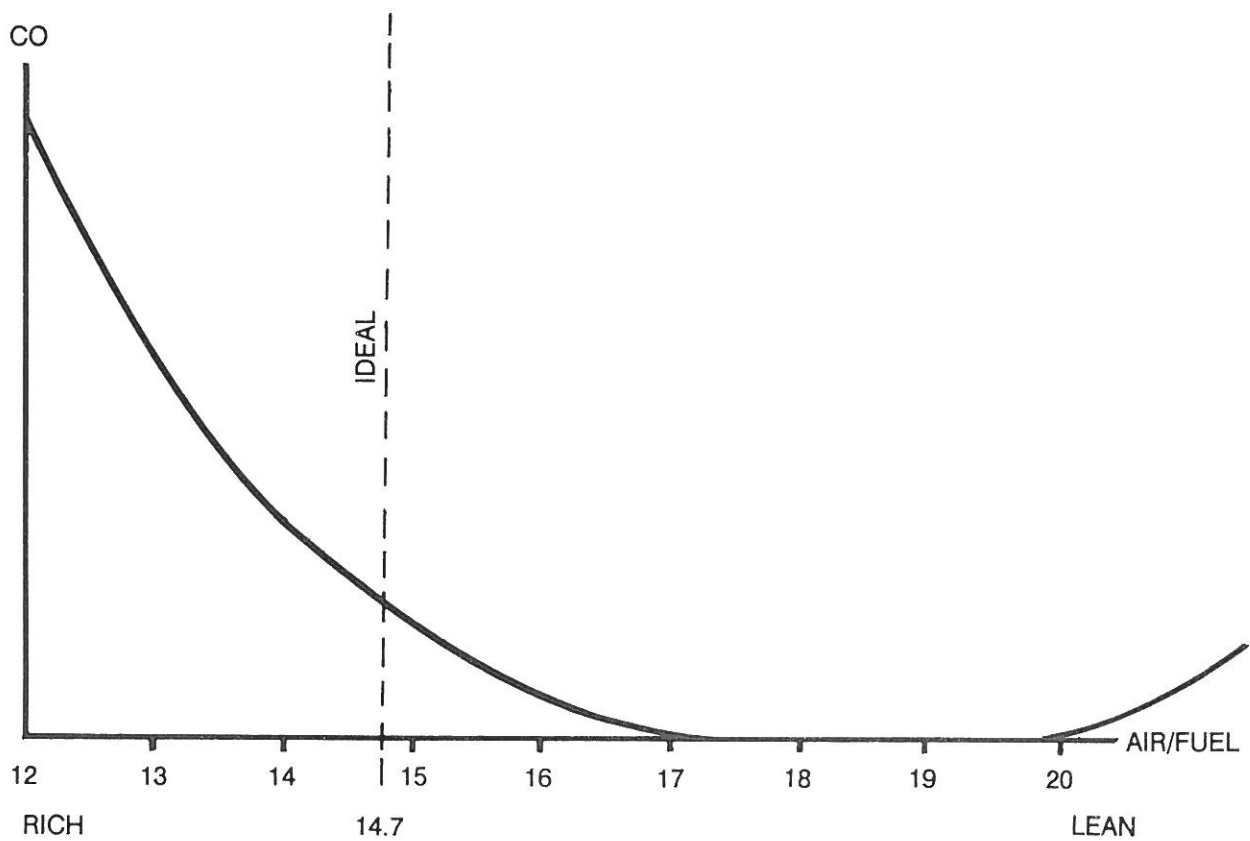


FIG. 5

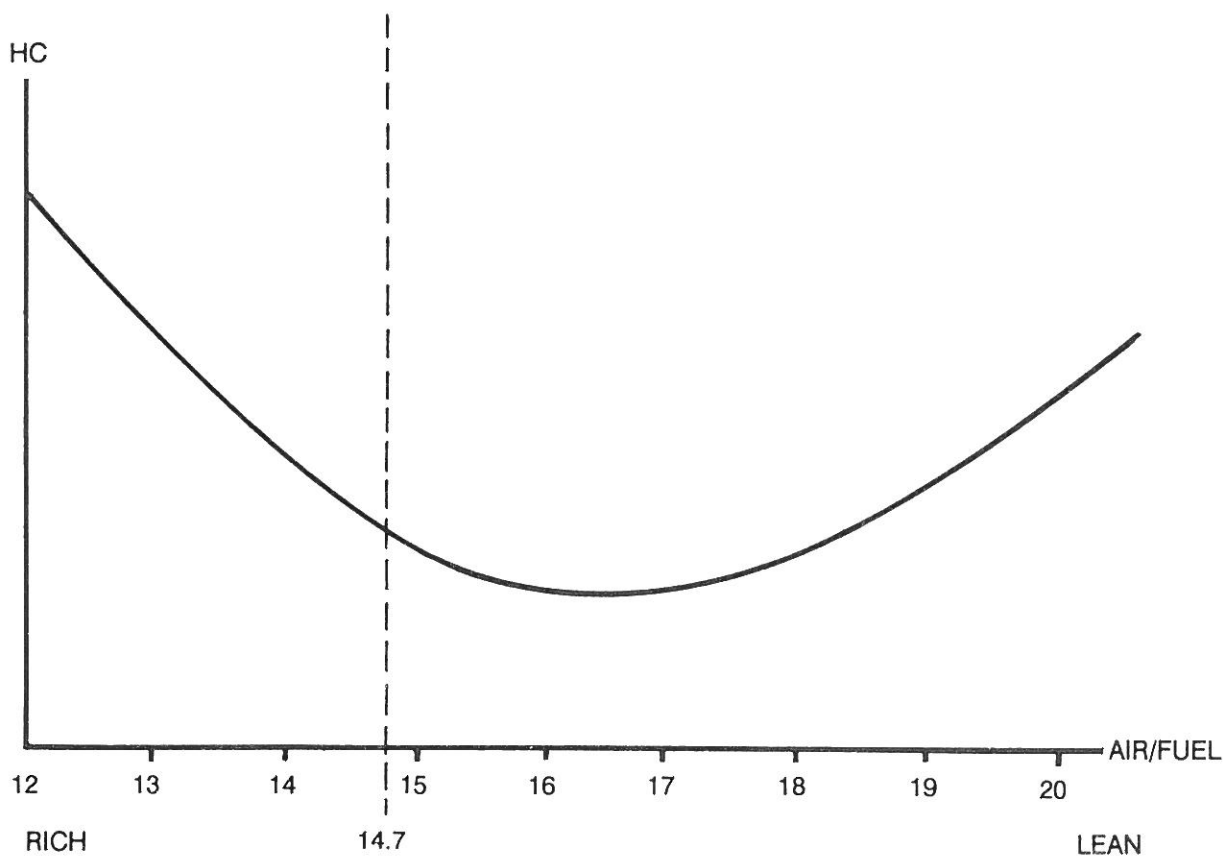


FIG. 6

ANALYSIS OF TEST RESULTS (CO₂/O₂ - 285 only)

CO₂ - This gas gives a direct indication of combustion efficiency. Fig. 7 shows that as the air/fuel ratio moves from rich through ideal (stoichiometric) and then to lean, the level of CO₂ rises to a peak and then falls back again. It will generally be found that the level of CO₂ will be 1-2% higher at 2500 rpm than at idle. This is due to the improved gas flow resulting in better combustion efficiency. The maximum level of CO₂ possible is close to 16%.

O₂ - This is the oxygen level present in the exhaust gas. With rich mixtures most of the oxygen is burnt during combustion. With very lean mixtures much more oxygen escapes the combustion process so the level rises. Fig. 8 shows the result. Levels between 0.5% and 4% oxygen will be present for an engine which is correctly adjusted.

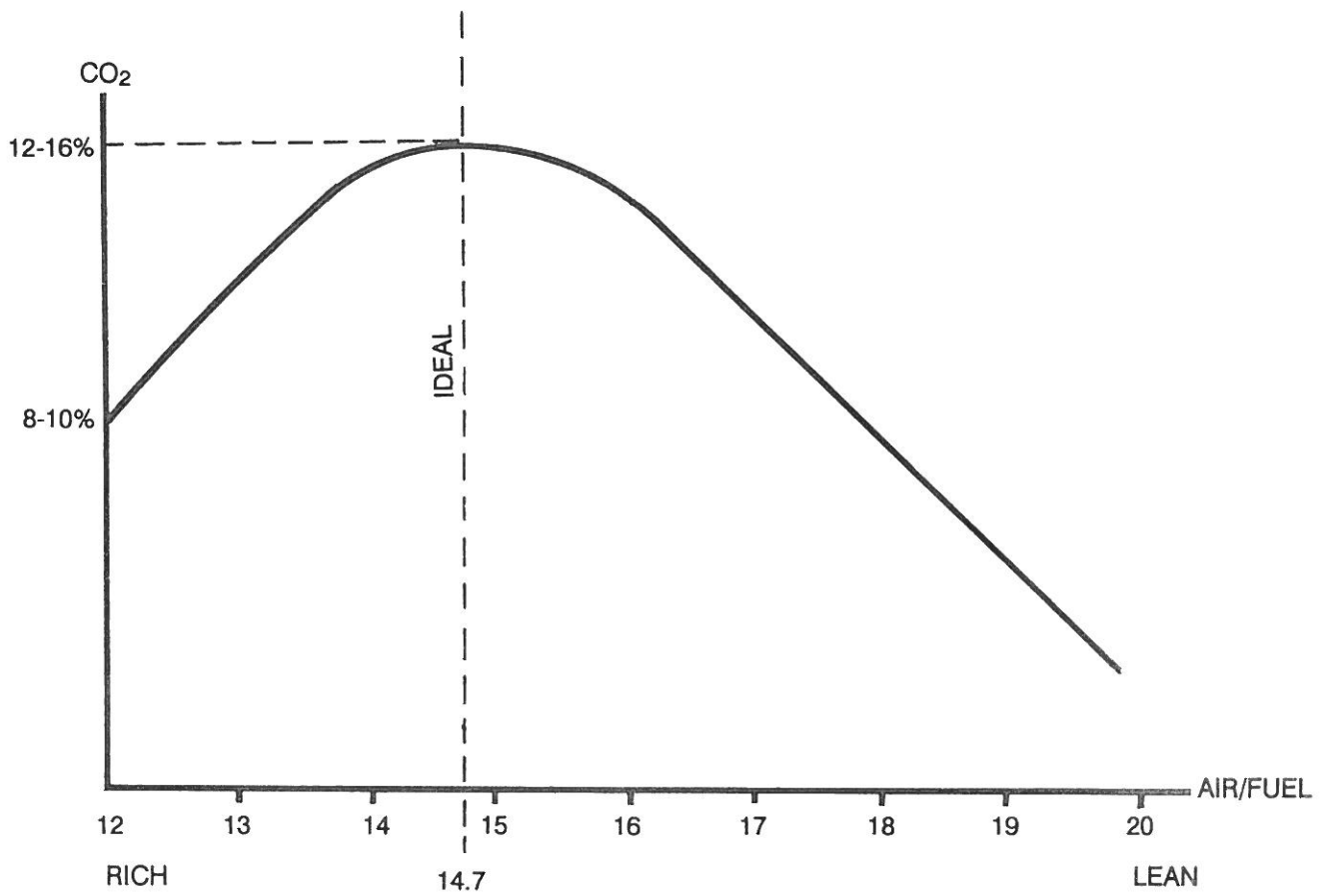


FIG. 7

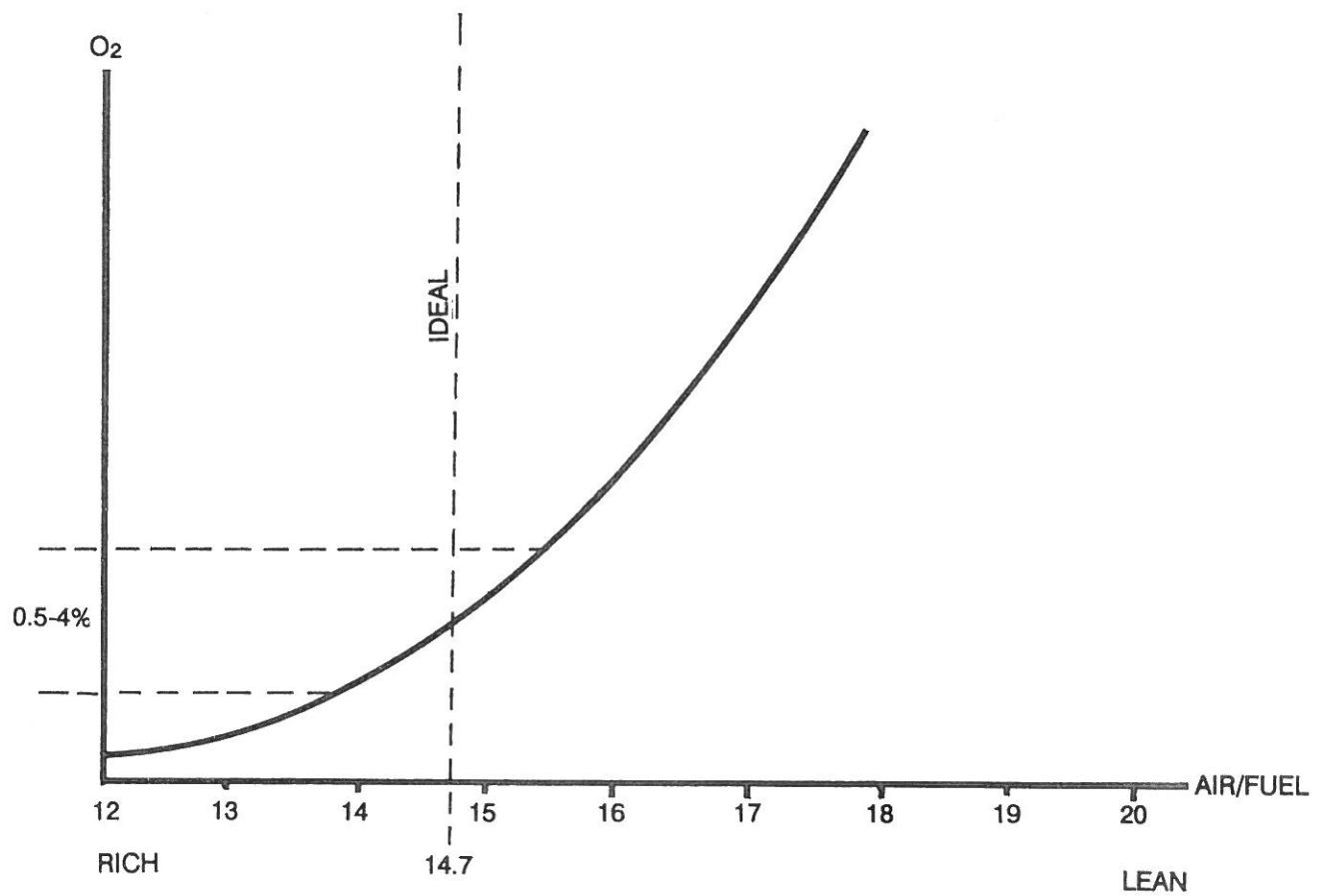


FIG. 8

ROUTINE MAINTENANCE

Daily

1. Check filter condition visually and replace as necessary. **DO NOT ALLOW TO BECOME BLOCKED** (see GAS SAMPLING FILTRATION SYSTEM below).
2. Perform leak test.

Six Monthly - Or as required by local legislation

Perform Gas calibration - call Transervice.

NOTE:

Each time the 283/285 OIML-Spec is used, ensure there is no residual moisture present in sample probe/hose. This will considerably increase the life of the filters.

Replacement of Oxygen Sensor (285 only)

The sensor used to measure oxygen concentration has a limited life and will need to be replaced after a period of time. This time is very much dependent on the useage of the analyser. When this is required the analyser will display the message 'REPLACE O2 CELL'. This operation may be carried out by the user (local legislation permitting), **with the mains power off**, using the following procedure:

1. Disconnect the electrical connector at the top of the sensor noting the orientation.
2. Unscrew and discard the sensor. Note that the sensor contains caustic which causes severe burns and may be fatal if swallowed. A damaged sensor must be handled with extreme caution and as with all hazardous materials dispose of the sensor in a suitable manner.
3. Screw in a new sensor taking care not to cross-thread it. Also ensure that the 'O' ring makes a good seal between the sensor and the housing. **Do not overtighten**. New sensors are stored in sealed packets. Ensure that the packet is undamaged before removing and fitting the sensor. Return any sensor in a damaged packet to the supplier.
4. Reconnect the electrical connector and switch on the unit. The new sensor will be calibrated automatically during the first Auto zero after the warm up period.

Gas Sampling Filtration System

Description

A 3-stage filtration system is employed to remove carbon particles and water from the exhaust gases.

The first stage comprises a disposable preliminary filter which removes the larger carbon particles.

The second stage is a water trap which is used as a reservoir to hold any excess water. This is continuously drained when the pump is on. There are no filtration components in this stage.

Finally, a two element gas filter removes all other particles. This stage comprises a nylon, washable, coarse filter and a paper, disposable, fine filter. The paper filter should be replaced regularly - it should not be allowed to become heavily sooted.

Important:

A considerable amount of water can accumulate in the gas sample pipe during normal use. NEVER roll up the pipe towards the analyser whilst it is still connected, as this may result in flooding of the gas filters and, if the pump is off, water may enter the analyser.

If a blockage occurs in the gas sampling system, the message 'POOR GAS FLOW' will be displayed. To determine the fault, follow the procedure below:

Remove sample hose. If fault message clears, the blockage is in the hose or probe. Blow out the hose and probe with an air line (with the hose disconnected from the analyser) or replace faulty part. If the message persists, remove and service/replace filters as described below.

Servicing The Filters**1. PRELIMINARY FILTER**

This filter cannot be cleaned, so if it is heavily sooted it must be replaced.

To change the filter, release it out of the clip and then remove the pipes from either end. When replacing the filter ensure that the two pipes are secure and not kinked when the unit is pushed back into the clip.

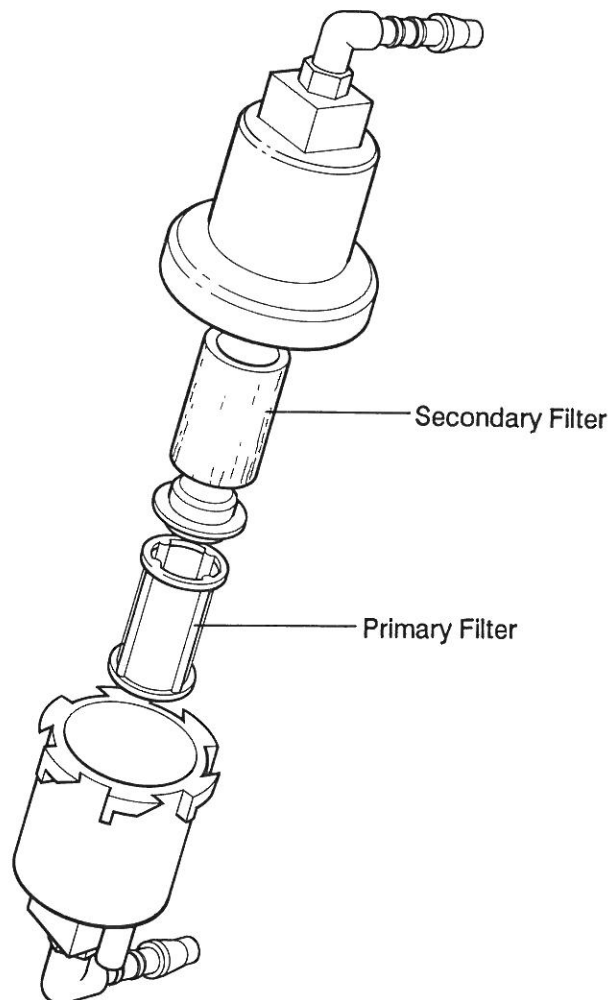


FIG. 9 Exploded View of Filters

2. GAS FILTERS - refer to Fig. 9

The gas filters may be removed by pulling the filter housing out of the clips and away from the rear panel. The two halves of this housing may be separated by twisting anticlockwise whilst gently pushing the halves together. Both filters may now be removed, taking care not to lose the rubber seat. The nylon mesh can be washed in a mild detergent solution (NOT SOLVENT). The paper filter should be discarded if heavily sooted.

Note:

It is not possible to clean this element.

Reassembly is the reverse of dismantling, but care must be taken so that both filter elements seal correctly on the rubber seat. The nylon mesh must be at the bottom. Ensure that the pipes are not kinked when the filter assembly is pushed back into the clips.

3. WATER TRAP

Although there are no parts to replace in this assembly, the state of this component indicates how efficient the water extraction is. It is normal to have a small quantity of water in the bottom of the trap. If the water level rises above the centre of the trap and is not removed when the pump is running, make sure that there are no kinked pipes and drain the trap. This may be done as follows:

Pull the housing out of the clips and away from the rear panel. The two halves of this housing may be separated by twisting anticlockwise whilst gently pushing the halves together. After draining the water, reassemble the unit by twisting clockwise ensuring that the two pipes line up correctly and are not kinked.

If the water trap continues to fill up and is not drained by the pump, call Transervice. Do not use the analyser if the water level is above the centre of the trap.

CONSUMABLE SPARES

The following items are consumable and will be charged as such. Failure to fit genuine spares as listed below may invalidate your warranty.

The following parts can be ordered from FKI Transervice, quoting the Transervice part numbers given below:

Hose	127172
Sample Probe (Flexible)	127171
Handle	127174
Oxygen Sensor	105126
Preliminary Filter	113076
Primary Filter	113072
Secondary Filter	113066

FAULT CODES

The 283/285 OIML-Spec can detect fault conditions and indicate the relevant message on the display. Faults with code numbers are internal faults that can only be rectified by a Service call. It is unlikely that one of these will occur, but if one does **do not attempt to carry out any repair. Under no circumstances should the unit be dismantled.** Faults without code numbers can be rectified by the user. The following table details the faults and the required actions.

Fault Message	Required Action
'POOR GAS FLOW'	Clean out sample pipe and/or replace filters. See pages 20 - 22.
'REPLACE O2 CELL'	The oxygen cell is exhausted. Replace with new part. See page 20.

TECHNICAL SPECIFICATIONS

CO Channel

Range:	0.0 - 10.0 %	Resolution:	0.01 %
Accuracy:	0.0 - 3.5 %	$\pm 7.0 \%$	Relative Reading
	3.5 - 10.0 %	$\pm 0.3 \%$	Absolute
Repeatability:	0.0 - 3.5 %	$\pm 5.0 \%$	Relative Reading
	3.5 - 10.0 %	$\pm 0.2 \%$	Absolute
Noise:	0.05 %	Absolute	

HC Channel

Range:	0 - 5000 ppm	Resolution:	5 ppm
Accuracy:	± 60 ppm		
Repeatability:	± 40 ppm		
Noise:	± 10 ppm		
PEF Range:	0.490 to 0.540		

CO₂ Channel (285 only)

Range:	0.0 - 20.0 %	Resolution:	0.02 %
Accuracy:	0.0 - 10.0 %	$\pm 0.90 \%$	Absolute
	10.0 - 16.0 %	$\pm 0.48 \%$	Absolute
	16.0 - 20.0 %	$\pm 1.44 \%$	Absolute
Repeatability:	$\pm 0.4 \%$	Absolute	
Noise:	0.1 %	Absolute	

O₂ Channel (285 only)

Range:	0.0 - 25.0 %	Resolution:	0.01 %
Accuracy:	$\pm 0.20 \%$	Absolute	
Repeatability:	$\pm 0.10 \%$	Absolute	

RPM

0 - 6000 rpm with 2/4 stroke selection

Oil Temperature

0 - 199 °C

AFR (285 only)

From 5:1 to 25:1

Calculated Lambda (285 only)

From 0.35 to 1.70 with selection of fuel type (Leaded, Unleaded or LPG)

Environmental

Temperature:	Operating	+2	to	+50 °C
	Storage	-20	to	+60 °C
	Accuracy	+15	to	+50 °C

Humidity (Non-condensing):	Operating	0	to	90 %	Relative Humidity
	Storage	0	to	85 %	Relative Humidity
	Accuracy	0	to	85 %	Relative Humidity

Warm-up Time

5 minutes

Response Time

10 seconds to 95% of final reading with 8 metre sample hose

Flow Rate

Gas Sample Inlet:	7.5 lts/min nominal
	3.0 lts/min minimum

Zero Gas Inlet:	5.0 lts/min nominal
-----------------	---------------------

Power Requirements

180 - 250 volts AC, 50 - 60 Hz

Power Consumption

100 watts maximum

Size

495mm (19.5") W x 368mm (14.5") D x 175mm (7") H

Weight

16.5kg (36.3lb)

OPTIONAL ITEMS

Trolley MET 3

The optional Mobile Equipment Trolley, MET 3 provides mobility around the workshop. It is designed to hold the 283/285 and comes complete with a toolbox for paper storage and printer location.

The 283/285 can be fitted to the trolley in one of two positions:

- i. On the middle shelf. To secure the 283/285 in position remove the hexagon headed screws from all the feet of the emission analyser, remove the feet (store if required in the future) and refit two of the screws to the two rear holes of the emission analyser, through the holes in the base of the shelf.
- ii. On the top shelf. On later models of the MET 3 the shallow tool tray on the top shelf can be removed by unscrewing the two fixing screws with an Allen key. The 283/285 can then be located on the top by following the same procedure as detailed in i. above.

Note:

The water outlet hose may be pushed down into the trolley support leg for safety.

Printer PTR 3

Installation - (Refer to Fig. 10)

When a printer is purchased as an optional accessory it should be fitted on the top of the trolley toolbox as follows:

Ensure that the 283/285 mains power is turned OFF

1. Unpack the printer kit which comprises PTR 3, PIL 1 (printer interface lead) and MIL 1 (male to female mains lead).

Remove printer access cover, remove transit packing and fit ribbon as detailed under 'Changing the Printer Ribbon' (see page 29). Refit printer access cover.
2. Loosen the rear bracket on the trolley tray, this is factory fitted to secure the printer.
3. Place the printer on the tray with the mains connection facing the rear.
4. Move the printer forward so that the front edge is in contact with the bracket on the front of the tray.

With the printer in this position, bring up the rear bracket firmly against the printer so that the two lugs locate in the printer case and tighten the TWO securing screws in the rear bracket.

Lead Connections

1. Connect the printer interface lead (PIL 1) between the printer and 283/285 connectors. **Note the shape of the 'D' connector and always ensure that the tapered sides of the plug and socket are fitted together. Reversal of the connector could result in an expensive repair!** See Fig. 1 for connection to the 283/285.
2. Connect the mains lead (MIL 1) between the printer and mains outlet on the 283/285.

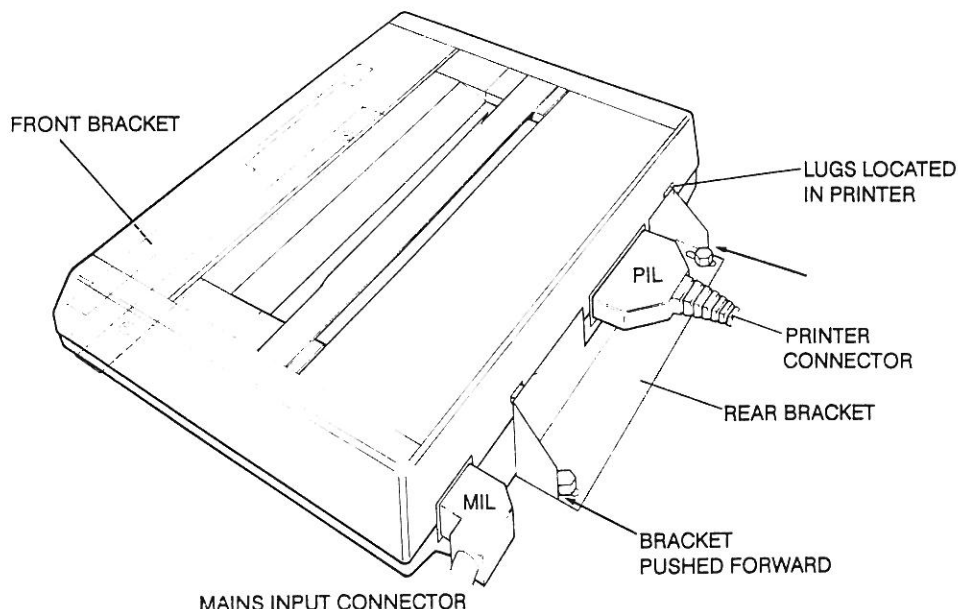


FIG. 10 PTR 3 - Printer installation

Loading The Paper - Refer to Fig. 11

1. Switch mains power off using Printer ON/OFF switch.

Unpack the box of tractor paper supplied and place the paper on the top tray of the trolley tool box so that the COLOURED copy side of the twin paper faces toward the rear when the top sheet is lifted.

2. Remove the access cover from the printer, and spring back the bar.
3. Taking the paper in the left hand, thread the top sheet up through the metal slot in the top of the toolbox so that it contacts the forward underside of the platen.
4. Turn the platen to feed up a short length of paper with the right hand while ensuring that the sprockets at each end of the platen engage with the holes in the paper correctly.

IMPORTANT:

The paper must engage evenly at each side, so that the paper is correctly aligned.

NOTE:

The sprocket at the thumb wheel end of the platen is adjustable by operation of a lever in the event of the holes across the width of the paper not aligning correctly.

5. Move the bar back onto the platen.
6. Ensure that the lever near the platen thumb wheel is set for TRACTOR paper, i.e towards the front.
7. Replace the access cover on the printer and turn the platen until the tear off perforation is exactly on the edge of the front, smoked plastic. Tear off the sheet above the access cover and then, **if the equipment is already powered up, switch the printer OFF & ON using its own mains switch.**

NOTE:

The mains switch for the printer is on the right behind the thumb wheel.

IMPORTANT:

After the paper has run out or been removed for any reason the printer mains switch must be set to OFF and ON before printer operation recommences.

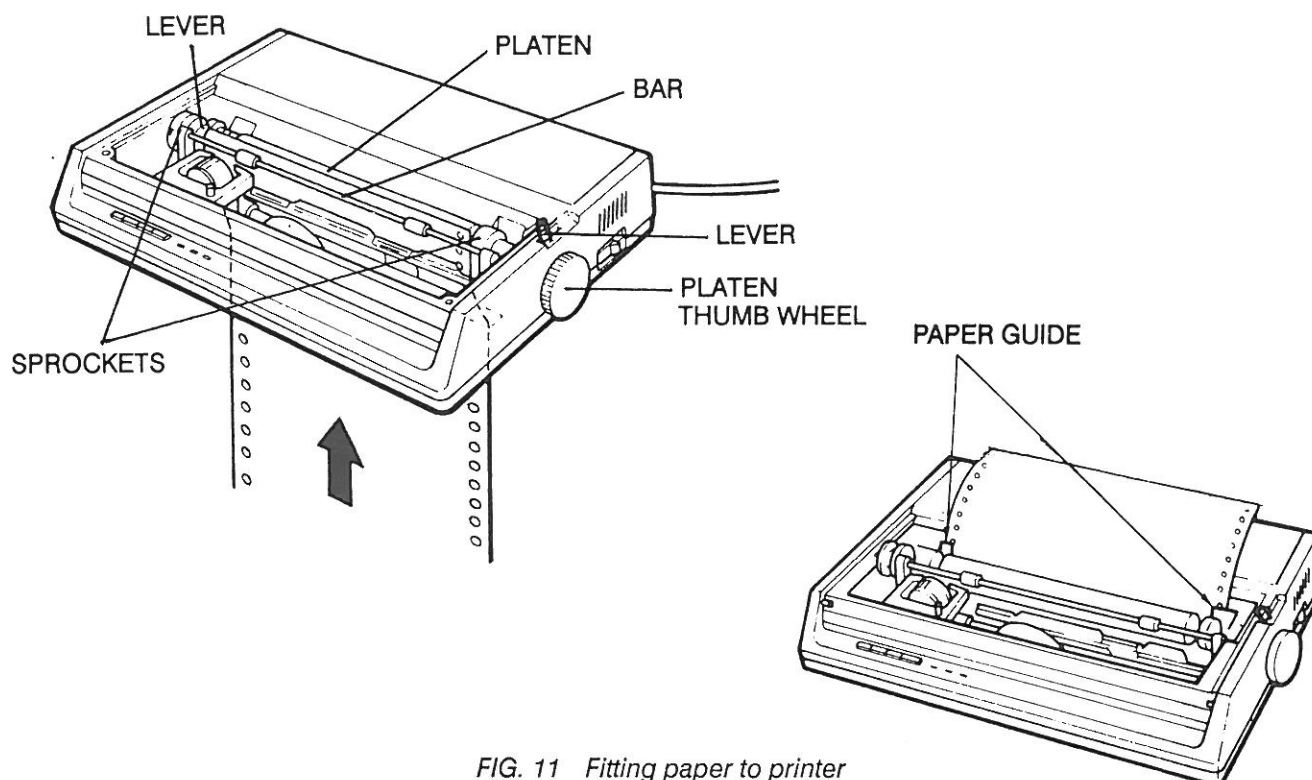


FIG. 11 Fitting paper to printer

Changing The Printer Ribbon - Refer to Fig. 12

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

CAUTION: The print head can become extremely hot with use. Take care not to handle.

1. Move the mains switch on the printer to OFF.
2. Lift off access cover.
3. Move the print head to the centre position using the ribbon cartridge if the head is hot.
4. Grasp the ribbon cartridge and lift upward to remove.
5. Place the new ribbon cartridge 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.
6. Press down on the cartridge until it snaps into place on the lower plate.
7. Adjust the blue lever on the left of the cartridge towards the print head to suit two-ply paper.
8. Replace the access cover and switch on the printer supply.

NOTE: After fitting a new ribbon, switch the printer mains supply ON. Check that the green LED indicators at the front left side of the printer are ON.

DO NOT touch the other controls near the LED displays.

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

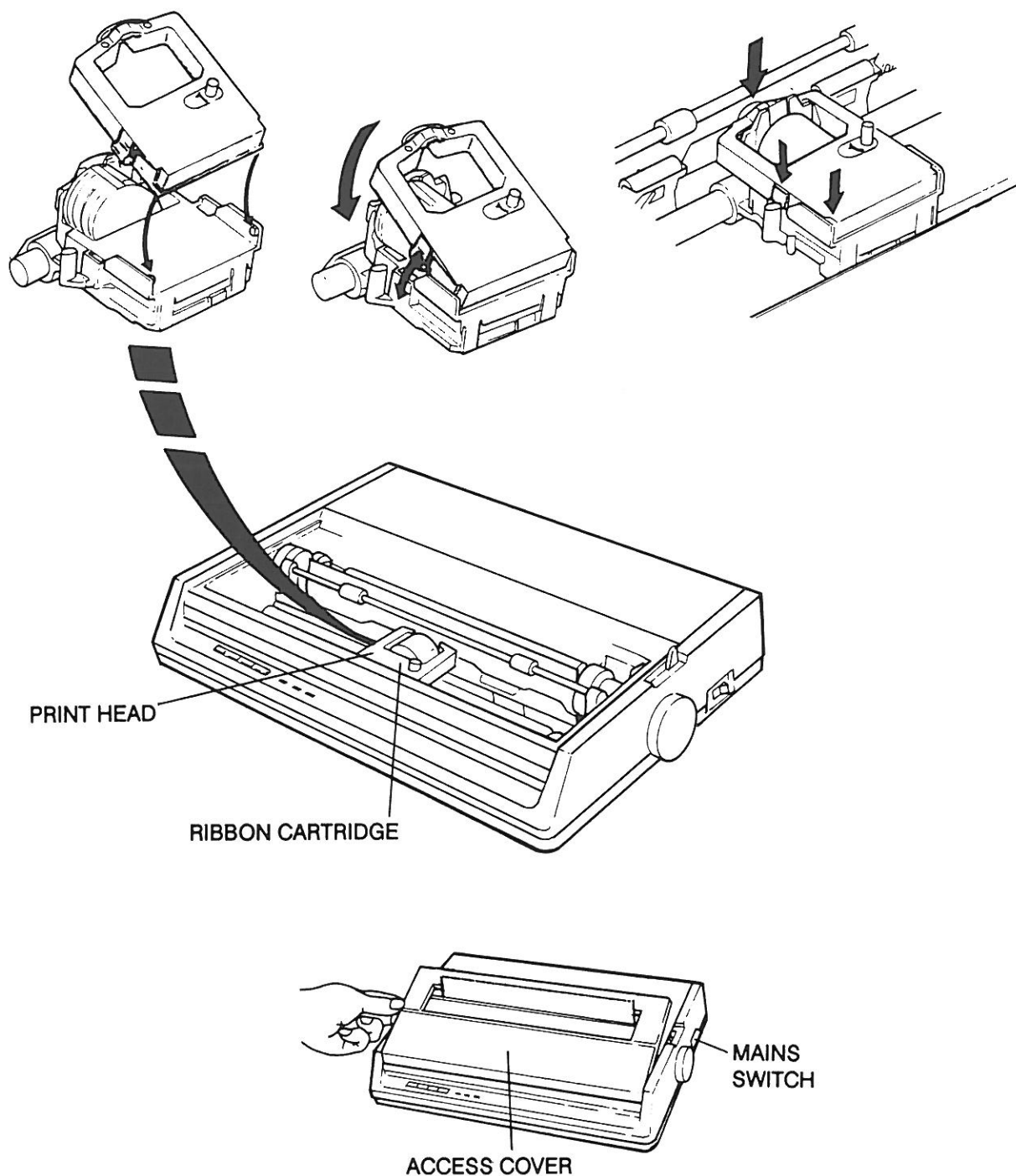


FIG. 12 Replacing printer ribbon

Printer Operation

The printer can be operated on command from the readings screen or when the PRINT CERTIFICATE option is available on screen (see page 11).

Normally, printed text will comprise test results plus Header and Footer personalised details. Personalised Headers containing garage details are provided by the use of a special programmable card available to order.

Stop Pump

Choosing this option stops the pump in the 283/285.

Note 1:

The HELP facility is available at all times from the Host by pressing the 'HOME' key on the keyboard, or the 'HELP' button on the handset.

Note 2:

If at any time the 283/285 is busy, for example when performing an autozero, a message will appear on the Host display until the condition clears.

Time/Date

When the 283/285 is used with a Host computer, the time and date displayed on the Host screen is that of the 283/285. This overrides the time and date previously in the Host. Any changes made to the time/date using the Utilities menu whilst the 283/285 is connected will change the time/date in both the Host and the Emission Analyser.

APPENDUM

Control By Host Computer (*NOT* 400 Series)

When the 283/285 is used with a Host computer without on-board emission analyser LCD display, gas readings follow the normal procedure as detailed in the Operating Instructions for the Host. To perform the other emission analyser functions it is necessary to enter the Emission Analyser Set-up menu.

From the 'Utilities' menu select EMISSION ANALYSER SET-UP. The menu shown below then appears.

Note:

This option is only available when a 283/285 is connected to the Host.

F1	LEAK TEST
F2	AUTOZERO
F3	HC RESIDUE TEST
F4	STOP PUMP

Leak Test

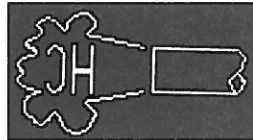
If Leak Test is selected the 283/285 will carry out a leak test as per normal operation. A message stating that a leak test is in progress will appear on the Host display. If the test fails it should be repeated after first checking probe cap, probe connection and filter sealing. If 'ESC' is pressed during the test the leak test will continue, but the operator will be able to carry on with other functions on the Host.

Autozero

If Autozero is selected the 283/285 will carry out an autozero as per normal operation. A message stating that an autozero is in progress will appear on the Host display. If 'ESC' is pressed during this period the autozero will continue, but the operator will be able to carry on with other functions on the Host.

HC Residue Test

If HC Residue Test is selected the 283/285 will carry out an HC residue test as per normal operation. A message stating that an HC residue test is in progress will appear on the Host display together with a symbol showing the current HC value.



The test will continue until the level is within statutory levels. If this is not achieved within a reasonable time disconnect the sample hose from the analyser and blow out the hose with an air line. If this does not reduce the level follow the instructions in the 'MAINTENANCE' section of the manual to clean/replace the filter.

If 'ESC' is pressed the HC residue test will be abandoned.

Please complete your header design layout in the box below.

DATE	:	TIME	:
MILEAGE	:	REG. NO	:
CUSTOMER	:	MAKE/MODEL	:

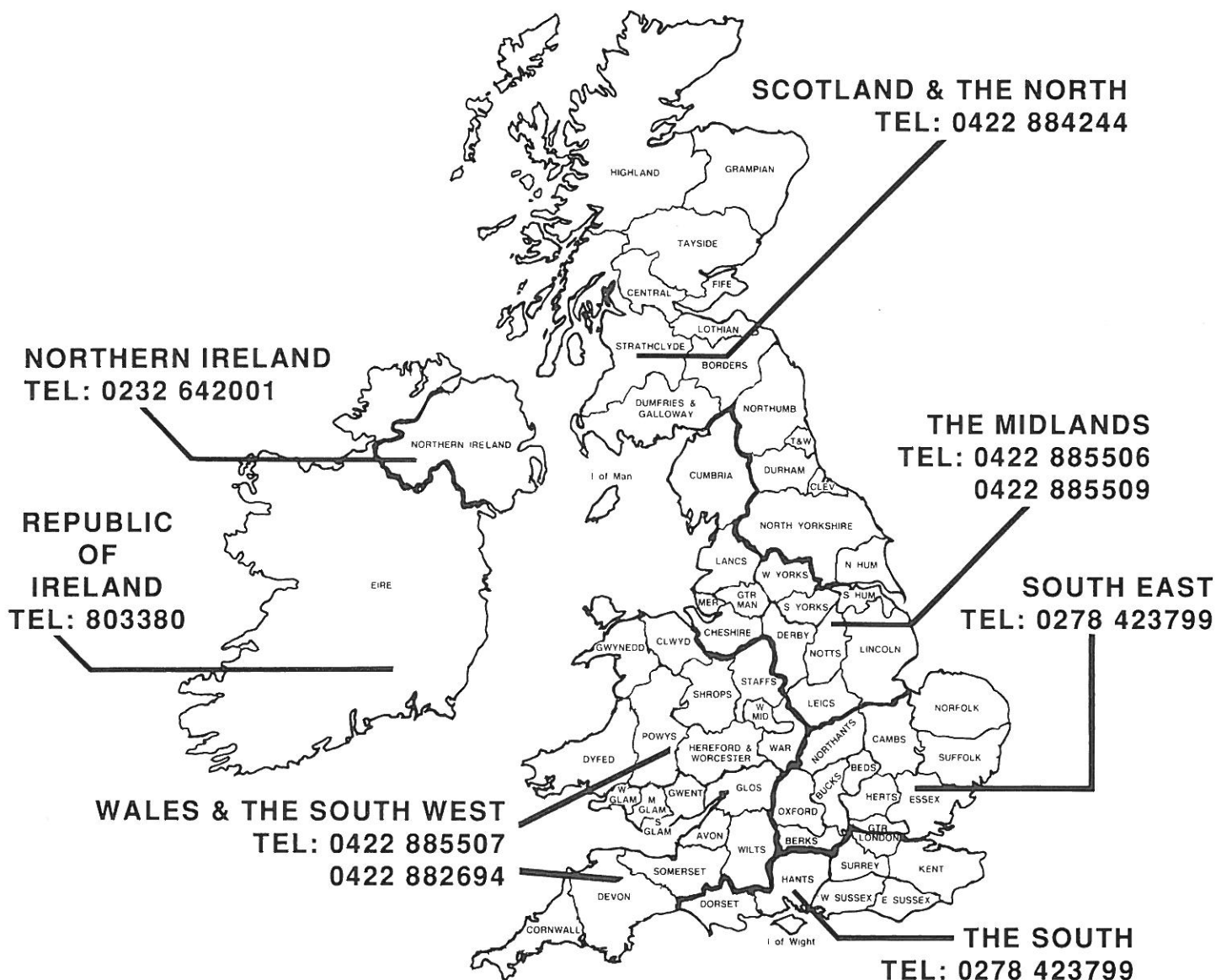
+

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.



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.

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
Fax: (0278) 422053



TRANSERVICE
The Service Organisation for CRYPTON • BRADBURY

FKI Transervice Limited
Brearley Works
Luddendenfoot, Halifax
West Yorkshire HX2 6JB
Tel: (0422) 882383
Fax: (0422) 884071

Terms and Conditions of Sale

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, immediately 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 Purchaser 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 from 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 of 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 quality, suitability or 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 if purchased the goods in a competitive market and that the bargaining strength of the Company was in no way a relevant 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 1979.

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., unless otherwise specified in the relevant equipment manual.

The above guarantee is given in lieu of all other terms, conditions, warranties, guarantees, undertakings and representations, express or implied, statutory or otherwise, which, except to the extent that this provision is held to be void or unenforceable under or by virtue of any provision contained in the Sale of Goods Act 1979 or the Unfair Contract Terms Act 1977 or any statutory modification or re-enactment thereof for the time being in force, are hereby expressly excluded.

DESIGN

We reserve the right to alter the design or construction of equipment at any time without notice.

LAW OF CONTRACT

All contracts for the sale of the Company's products shall be deemed to be made and executed in England, and the same shall be construed, performed and enforced in accordance with English Law and the parties submit to the jurisdiction of the English Courts. The application of the Uniform Laws of International Sales shall be excluded. This condition shall not prevent the Company instituting proceedings in the Courts of any other country to enforce such contract against the customer.

DELIVERY

Delivery dates, given in good faith, are approximate and reflect conditions prevailing at that time. No liability can be accepted arising from delays in delivery, irrespective of the cause of any such delay.

CANCELLATION AND VARIATION

Orders once accepted by us are binding and cannot be cancelled or varied unless we at our discretion accept the cancellation or variation. We will make every effort to meet our Purchasers in this respect but

- (a) we cannot accept cancellation for non-standard products; and
- (b) we cannot accept cancellation changes in delivery dates or other variations notified to us later than the end of the penultimate month prior to the month fixed for delivery; and in such circumstances and any other cancellations or variations to which we have not agreed we shall enforce our contractual rights and/or impose an appropriate charge.

TERMS

Quotations given are open for acceptance within 14 days and are subject to revision should the state of the raw material market or other circumstances render this action necessary.

Orders, whether received as a result of a quotation or not, can only be accepted for execution at prices ruling at date of despatch.

Payment - except where otherwise stated in our invoice, or agreed in writing, our terms are net cash and payment is due on presentation of invoice. Where we have agreed to open an account with the Purchaser invoices are due for payment by the 25th of the month following month of invoice and interest will be charged on overdue accounts at the prevailing County Court rate.

VALUE ADDED TAX

VAT is not included in our prices and will be shown separately on all invoices at the rate ruling at date of despatch and subject to current legislation.

CARRIAGE

Carriage is paid to destinations on the mainland of England, Scotland and Wales on all orders of £500 Nett or over, except accessories, spare parts and repairs. Where carriage is chargeable its cost is added to the invoice value at current rates.

PACKING AND UNLOADING

Damages or shortages must be signed for as such and claim made on the carriers, in writing, within three days of delivery. Where Company vehicles are used the driver must be notified at the time of unloading and the consignment note marked to indicate the damage or shortage. The practice of signing for the goods "not examined" does not absolve the Purchaser from this condition.

The consignee is responsible for unloading.

Packing cases and slings, when used, are charged extra but credited in full on return, carriage paid and in good condition.

LOSS IN TRANSIT

British Rail, Public Transport Companies and the Post Office only accept claims for loss in transit made within a limited period. If goods are not received within 14 days of the date of our invoice, we must be advised immediately otherwise neither the carriers nor ourselves will be liable for any loss involved.

PASSING OF RISK

The risk in the goods shall remain in us until delivery to the Purchaser or his agent. In the absence of written notice from the Purchaser to us and the carriers, as prescribed above, the goods shall be deemed to have been delivered complete and in satisfactory condition.

PASSING OF PROPERTY

Until such time as all sums due to the Company from the Purchaser whether in respect of goods delivered by the Company to the Purchaser or otherwise have been paid the provisions of this Condition shall have effect:

- (a) All goods delivered by the Company to the Purchaser will remain the property of the Company to the intent that the whole legal and beneficial interest therein shall remain that of the Company.
- (b) If the Purchaser becomes or threatens to become insolvent or being a body corporate has a Receiver appointed or passes a resolution for winding up or if a Court makes an Order to that effect or being an individual or partnership makes any composition or arrangements with his or their creditors or has a receiving order made against him or them or if the Purchaser shall be in breach of these Conditions, then the Company shall be at liberty to forthwith remove and repossess all goods which remain the property of the Company in accordance with this Condition and enter upon any property to do so or to inspect goods to identify the Company's goods.
- (c) The Purchaser shall only be at liberty to resell the goods purchased from the Company prior to the passing of title on the understanding that if it does not resell the goods then it will hold on trust for the Company so much of the proceeds of sale received by it under contracts which include any of the goods hereby sold either in their original or altered state as are necessary to discharge payment in full to the Company.
- (d) No provision of this Condition shall be deemed to cause a Mortgage or Charge of the Property or undertaking of the Purchaser or any part thereof to have been created by the Purchaser in favour of the Company.

SEPARABILITY

Any failure by us in respect of one delivery shall not entitle the Purchaser to treat the contract as repudiated, each delivery being, for such purpose, deemed a separate contract.

INSTALLATION

The Purchaser is responsible for the preparation of the site, where such a site is necessary, together with the provision of any supplies and services that may be required. The specifications and the responsibilities of agents, distributors and end-users are clearly set forth in separate leaflets, available on the various products concerned.

If failure to fulfil this responsibility extends the time taken to commission equipment or results in extra visits by engineers the Purchaser is fully liable for the extra cost. If installation of equipment is unduly delayed, the Company reserves the right to pass on cost inflation as a supplementary charge.

REFUSAL

Goods consigned to the order of end-users and/or distributors render them liable for all carriage and handling charges incurred, if delivery of the goods is refused on arrival at destination.

RETURNED EQUIPMENT

In exceptional conditions, subject to agreement in writing, and the equipment being of current standard design, new equipment in good condition will be accepted, carriage paid to factory, subject to a handling charge. Any costs incurred in making the equipment as new will be charged in addition to the handling charge.

SPARES AND AFTER SALES SERVICE

Service is available through our service company FKI Transervice, Brearley Works, Luddendenfoot, Halifax, West Yorks, HX2 6JB. Tel: Halifax (0422) 882383. Telex 517249. Spare parts are available from FKI Transervice, Bristol Road, Bridgwater, Somerset, TA6 4DD. Tel: Bridgwater (0278) 426891. All spare parts purchases are subject to minimum order values.

RIGHT TO TERMINATE

If the Purchaser breaks any of these conditions or becomes insolvent or subject to any law relating to bankrupts or being a corporation goes into liquidation, whether voluntary or compulsory or has a receiver appointed over its assets, we may suspend deliveries or, by notice to the Purchaser, terminate the contract and such termination shall be without prejudice to any other rights or remedies to which we may be entitled.

- All quotations and tenders are given and contracts are made by the Company subject to the above terms and conditions and unless previously agreed in writing by an authorised officer of the Company:
- (i) no verbal, written or other addition hereto or variation hereof including (without prejudice to the generality of the foregoing) any representation or warranty relating to the goods or services to be provided by the Company shall be effective; and
 - (ii) these terms and conditions supersede any other terms and conditions appearing elsewhere and shall prevail over and exclude any course of dealing established between the Company and the Purchaser and any other terms and conditions stipulated or incorporated or referred to by the Purchaser or his agent or any third party; and
 - (iii) it shall be a pre-condition of the Company giving any quotation or tender or entering into any agreement for the supply of any goods or services that such agreement be made subject to these terms and conditions