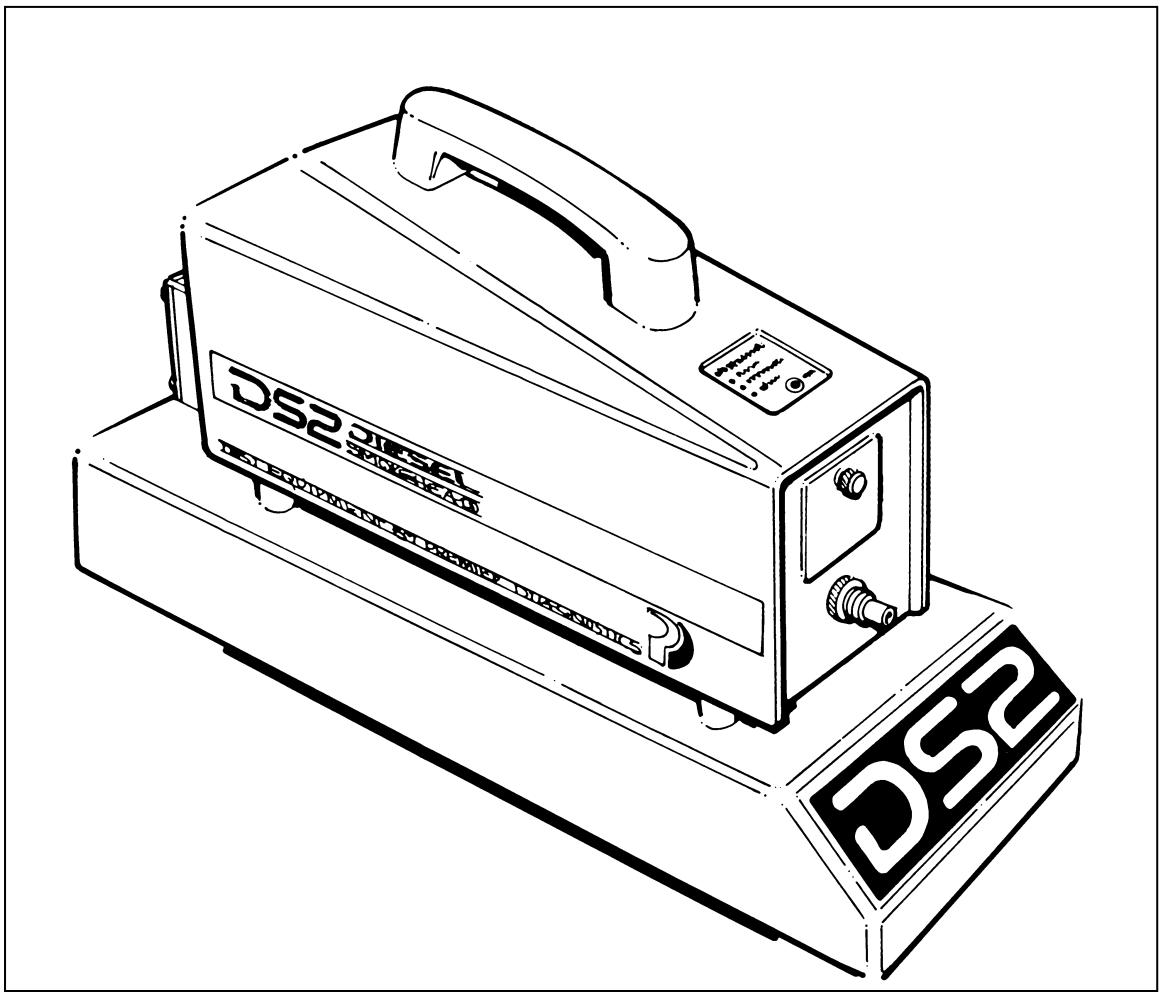
PREMIER DIAGNOSTICS' DS2-2M

DIESEL SMOKEMETER



The Premier Diagnostics' DS2-2M Diesel Smoke Meters have been developed to connect to the Premier Micro Exhaust Gas Analyser and any IBM™ compatible Pc Platform. The screen display is 'Auto-Sizing' to ensure compliance with minimum 'Alfa/Numeric' sizes specified by V.O.S.A. *(Refer to technical information for details).* Communication with the Smoke Head is via a Radio Link, eliminating the need for cables and the trip hazards and service problems associated with cable connections. The Smoke Meter is of robust design and requires little user maintenance.

Premier Diagnostics Ltd has a programme of continual research and development and reserves the right to change product specifications without prior notice. Please refer to any appendices for details of product changes.

This product is covered under UK Patent Application Nos: 0224671.8 and 0310960.0.

CONTENTS

DECLARATION

The Premier Diagnostics' DS2-2M Diesel Smoke Meter, in conjunction with any IBM™ compatible Pc Platform, is accredited for statutory testing within the MOT Scheme of Category 'A' and 'B' Diesel Engine Vehicles.

The DS2 Smoke Meter complies with the Vehicle and Operator Services Agency Specification MOT/05/01/01, including MOT/08/19/01 issued October 2001and 1st Revision dated April 2002.

THEORY OF OPERATION

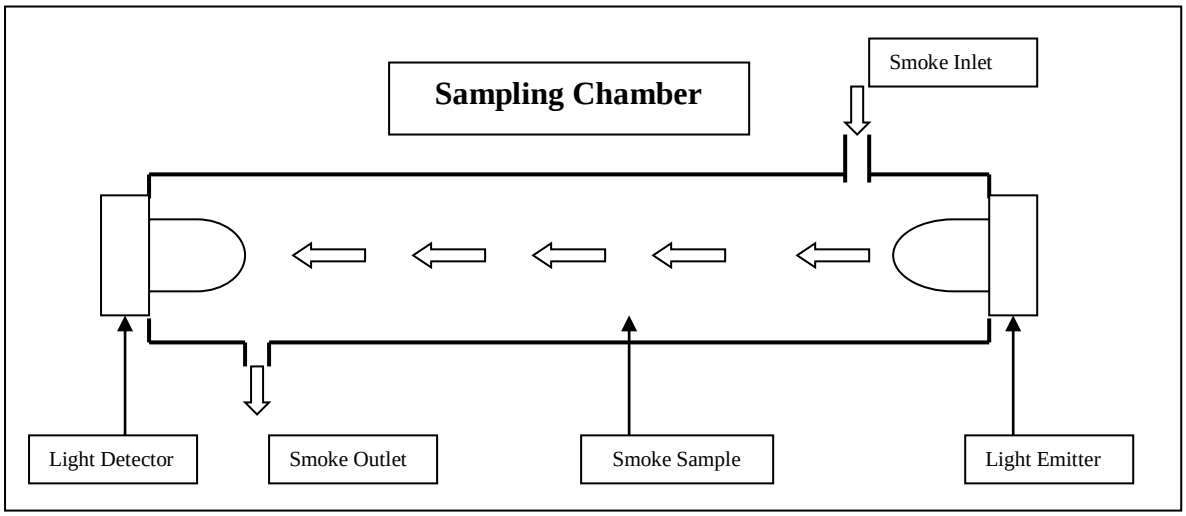
The Premier Diagnostics' DS2-2M Diesel Smoke Head is an Opacimeter, which measures the amount of light transmitted between the light source and the light detector (photo electric cell) over a known distance within the Smoke Sample chamber.

When the Sample Head is drawing clean air, 100% of the light transmitted in the chamber will strike the light detector. As exhaust samples are taken and drawn into the Sample Chamber the light transmitted from the source is obscured depending on the density of smoke. The darker the smoke the less amount of light will be able to penetrate and reach the detector.

The detector in turn transmits a variable output according to the amount of light to which it is exposed. By monitoring the detectors output the equipment can measure the density of smoke being emitted by the vehicle on test.

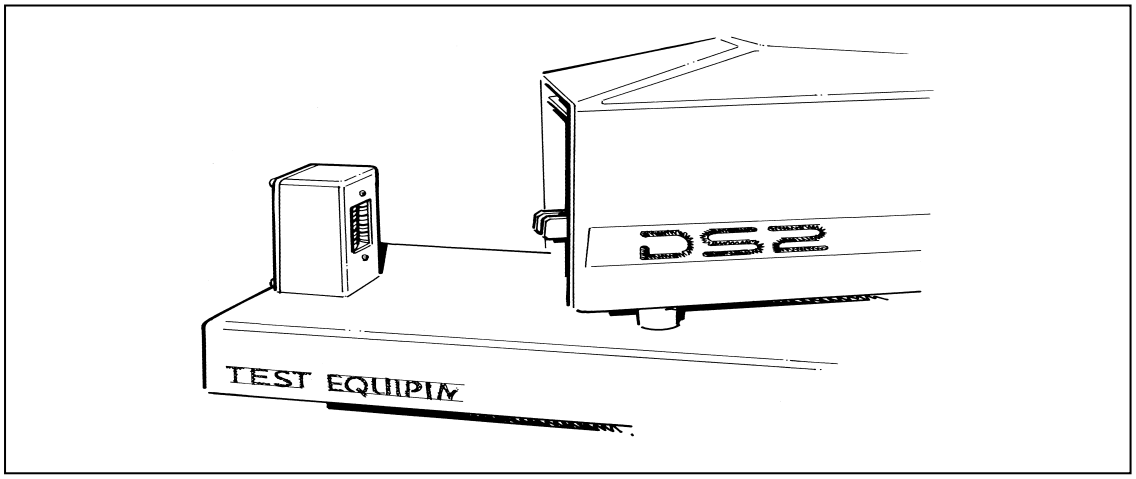
The equipment displays the smoke density in 'K' values (the co-efficient of light absorption). The Smoke Meter operates at 12Vac, and is suitable for use in all weather conditions down to temperatures as low as –15ºC. The sampling chamber is heated to a temperature of 90ºC to prevent condensation developing on the lens. Additionally, an 'Air Curtain' protects both the Emitter and the Detector from contaminates transported into the chamber by the Exhaust Gas Sample.

Communications to the Host Pc is Via a Radio Link. The elimination of cables to the Smoke Head frees the operator from cable tangles. Where appropriate, the Free Acceleration Test can be completed in the open air, preventing exhaust gasses and noise polluting the workshop, a very real benefit for all personnel. The Radio Link operates up to a distance of 100 meters.



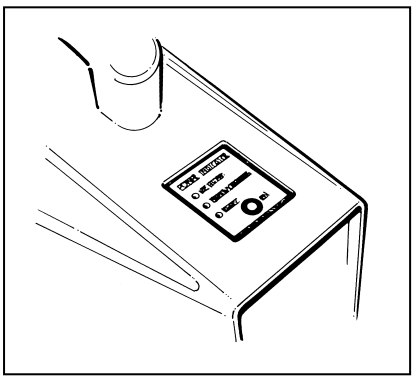
CHARGING and HEATING the SMOKE METER

Your Premier DS2-2M Smoke Meter is completely cable free. It is therefore necessary to charge and heat the unit on the 'Docking Station' (See Diagram Below). The Docking Station can either be mounted on the side of your Exhaust Gas Analyser or free standing. The Smoke Meter is 12Vdc. The Docking Station is 230Vac.



An internal battery powers the Smoke Meter electronics and intake fan, allowing these components up to 8 hours operation without recharging. The Heaters are powered directly from the Docking Station. After the completion of each MOT, returning the Smoke Meter to the Docking Station will maintain temperature ready for the next test.

LED's on the Power Indicator Panel, mounted on the top of the Smoke Meter, indicate the operational state of the Smoke Head. The 'Traffic Light' format (Red, Amber and Green), makes interpretation simple. The LED panel also includes an 'On' button. (See Diagram Below).



LED STATES

RED STEADY ON	=	Smoke Head is below operating temperature and cannot be used.
RED FLASHING	=	Finish the test you are on and return the Smoke Meter to the Docking Station. (Temp 60 to 69^{O}C)
AMBER	=	Indicates communications. If the LED is flickering the Smoke Head is communicating with the Pc.
GREEN FLASHING	=	The Smoke Head is hot enough to perform an MOT. (Temp 70 to 79^{O}C)
GREEN STEADY ON	=	The Smoke Head is at full Temperature. (Temp 80 to 90^{O}C)
ON BUTTON	=	'Wakes' the Smoke Meter from Sleep Mode.

In addition to the LED indicators, all Smoke Meter States are reported on the screen.

SAFETY INSTRUCTIONS and CAUTIONS

BEFORE USING YOUR ANALYSER

As with all workshop equipment safe operation of the equipment is essential. Please read the following carefully to ensure the implementation of safe working practices.

POWER SUPPLY: If you are installing the Premier DS2-2M Smokemeter onto a Premier Emission Analyser, your Premier engineer will ensure the safe fitting of the product. If you are attaching the 'Docking Station' to a wall or free standing, the 'Docking Station' must be plugged into a suitable 230Vac power socket. This socket must have an Earth connection. If the Docking Stations power cord is not long enough to reach the socket do not be tempted to use an extension lead. Arrange for your workshop mains supply to be extended to the location where the Docking Station will be sited. It is recommended that *Surge Protection* be fitted to your mains supply.

MOISTURE: **Docking Station.** Keep your Docking Station dry at all times. Should the Docking Station become wet - DO NOT OPERATE. Call your manufacturer immediately to arrange a thorough inspection and safety check.

MOISTURE: **Smoke Head.** Your Smoke Head operates at 12Vdc, and is designed to operate in virtually all weather conditions. However, sensible precautions should be taken to avoid 'Extreme Exposure' to the elements. Do not stand your Smoke Meter in water. Your Smoke Head is designed to operate in temperatures ranging from -15°C to 40°C. Relative humidity should not exceed 90% RH (Non-Condensing).

EXHAUST FUMES: **Inhalation of exhaust fumes is highly dangerous. Never use your Smoke Meter in a closed workshop without using professionally installed exhaust extraction equipment. Alternatively, use the equipment in an area of your workshop which is fully open to the atmosphere.**

LOOSE CLOTHING: Never wear loose clothing when working on a vehicle.

HOT SURFACES: When working on vehicles there are many excessively hot surfaces such as manifolds and heat shields. Avoid all skin contact with these surfaces and ensure harnesses or hoses do not touch excessively hot areas.

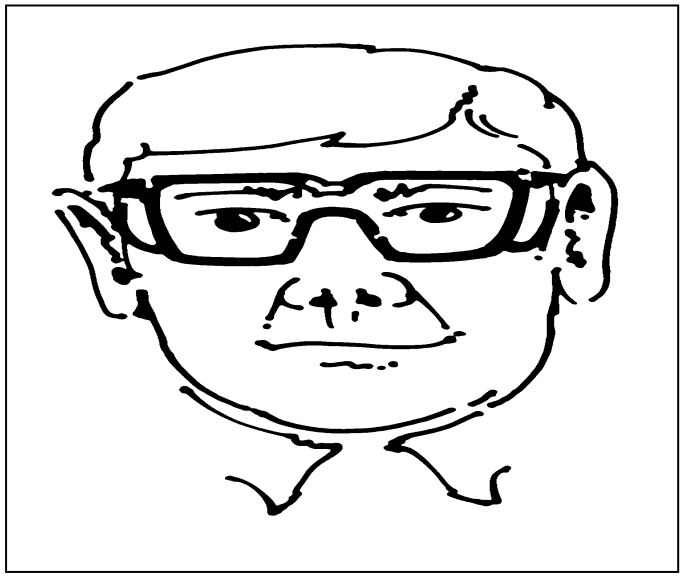
MOVING PARTS: Avoid contact with any moving parts (Pulleys and Drive Belts, etc). Never allow the Smoke Meters harnesses or hoses to touch these components.

DIESEL FUMES and VAPOUR: **Diesel fumes and Vapour are often present when working on a vehicle. Never smoke or use naked flames when working on any vehicle. Always repair fuel and vapour leaks before commencing any test sequence.**

ROUTINE MAINTENANCE

Your Premier Diagnostics' DS2-2M Smoke Meter requires little user maintenance. It is in your interest to keep the Smoke Head clean and free from exhaust smoke staining. When inserting the probe into the vehicle's exhaust pipe do not place the Smoke Head in direct line of the exhaust fumes. Ideally keep the Smoke Head at right angles to the exhaust. Periodically wipe the case clean with a soft cloth using a propriety, non- abrasive cleaner.

Soot and carbon deposit 'build up' in the sample hose can affect the performance of the equipment. Periodically remove the sample hose from the Smoke Head and carefully blow the deposits out using your airline. Wear eye protectors when cleaning the hose and always 'blow' contaminates into a suitable container.



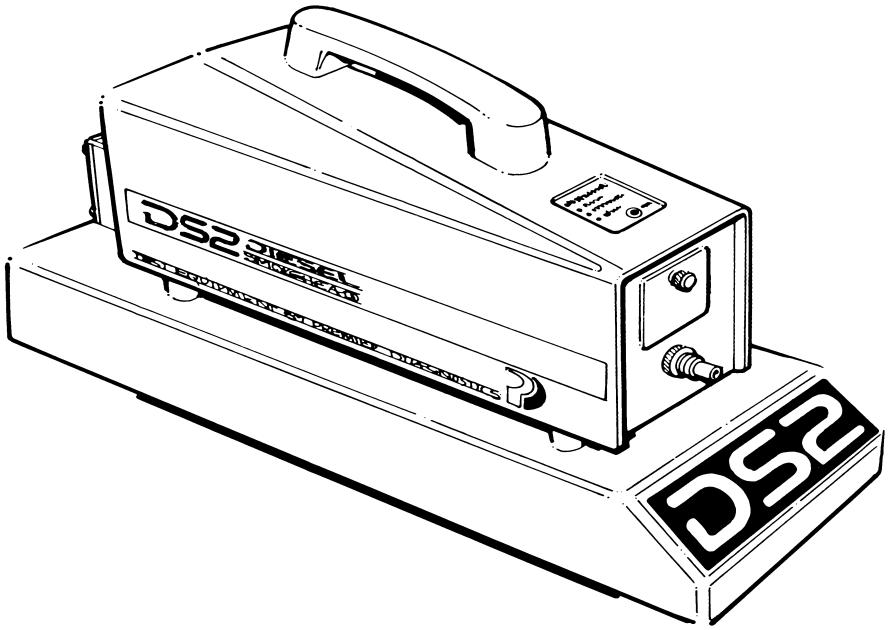
Always Wear Eye Protectors When Cleaning Soot and Contaminates From The Sample Hose and Sample Chamber

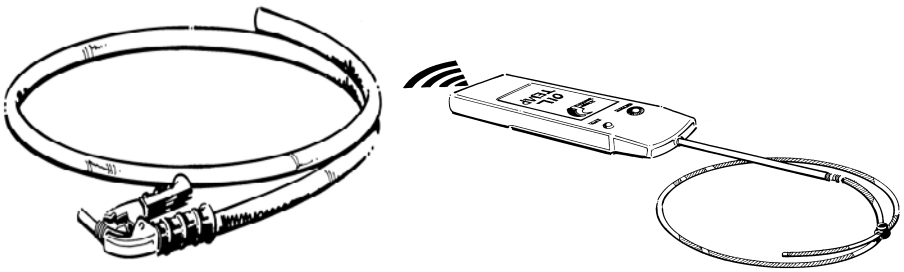
INSTALLATION

If you have ordered your Premier Diagnostics DS2-2M Smoke Meter as part of a 'Combi' Diesel and Petrol Emission Analyser, your equipment will be delivered ready for use.

If you have ordered the Smoke Meter as an 'Up-Grade' to either your existing Petrol Emission Analyser or other Pc platform, an authorised engineer will visit your site to install the product. Upon successful installation, all relevant Certificates and Documentation will be issued.

Some configurations of equipment require a 'Wireless' Radio Linked Temperature Probe. This will be delivered with the product when required or if ordered as an optional extra.



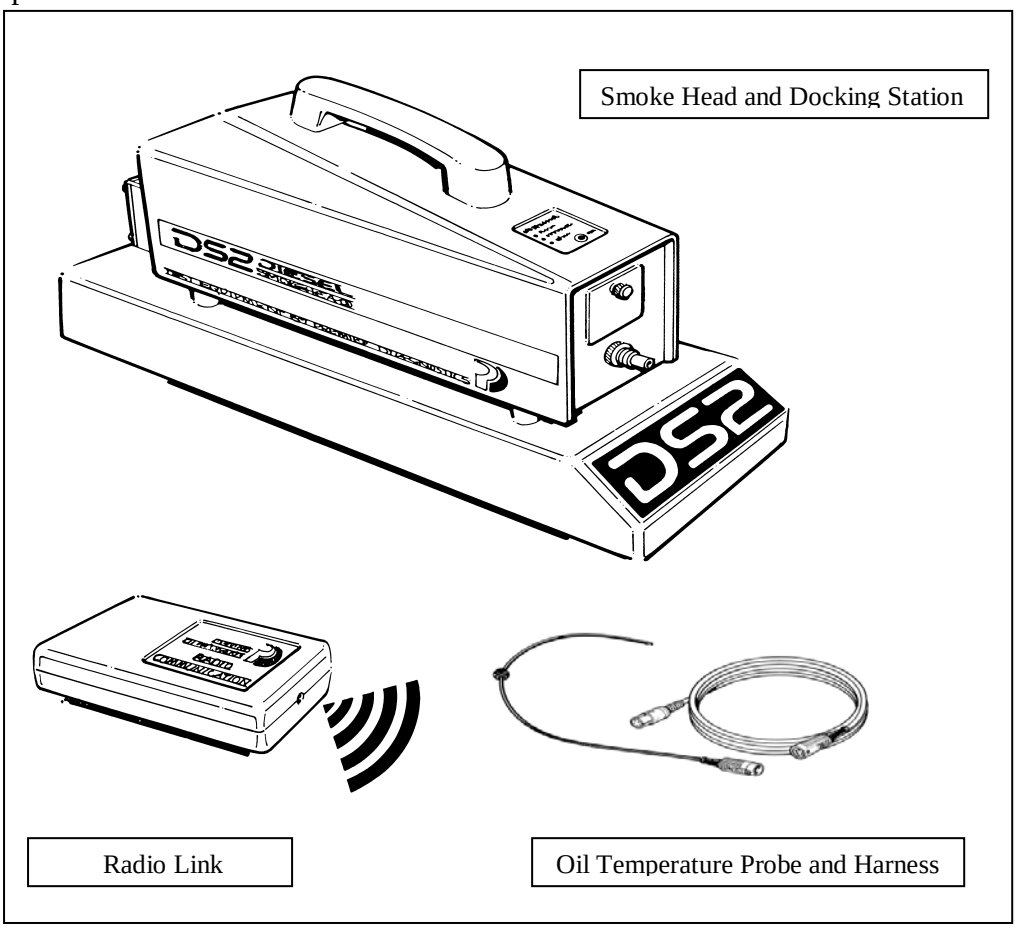


GENERAL DESCRIPTION AND OPERATION

Your Premier DS2-2M Smoke Meter is designed to comply with the Vehicle and Operator Services Agency's, (formally known as The Vehicle Inspectorate) latest regulations for testing Diesel Engine Vehicles. This includes stringent correlation and accuracy testing and compatibility with the 'Computerisation Programme', due for introduction shortly. Computerisation will require the use of a Smart Card by Authorised Examiners and the attachment of a Smart Card Reader to the Smoke Meter. Your Premier DS2-2M Smoke Meter is equipped to accept the Smart Card Reader, which will be 'Issued' on the authority of V.O.S.A.

The Premier DS2-2M Smokemeter is the world's first completely 'Cable Free' Smoke Meter. The innovative 'Radio Communications' design offers significant benefits over older, cable attached products. The radio link allows you to test 'Heavily Polluting Vehicles' in the open air, thereby preventing dangerous fumes filling the workshop and removes Noise Pollution associated with high revving engines in the workshop. You can also position the equipment without consideration to the length of the cable. Radio also removes poor connection and broken wire problems associated with cables, and removes trip hazards caused from harnesses trailing across floors.

Your Smoke Meter consists of 4 main components. These are the Smoke Head, the Docking Station, the Radio Link, and the Oil Temperature Probe. Details of each component are as follows:



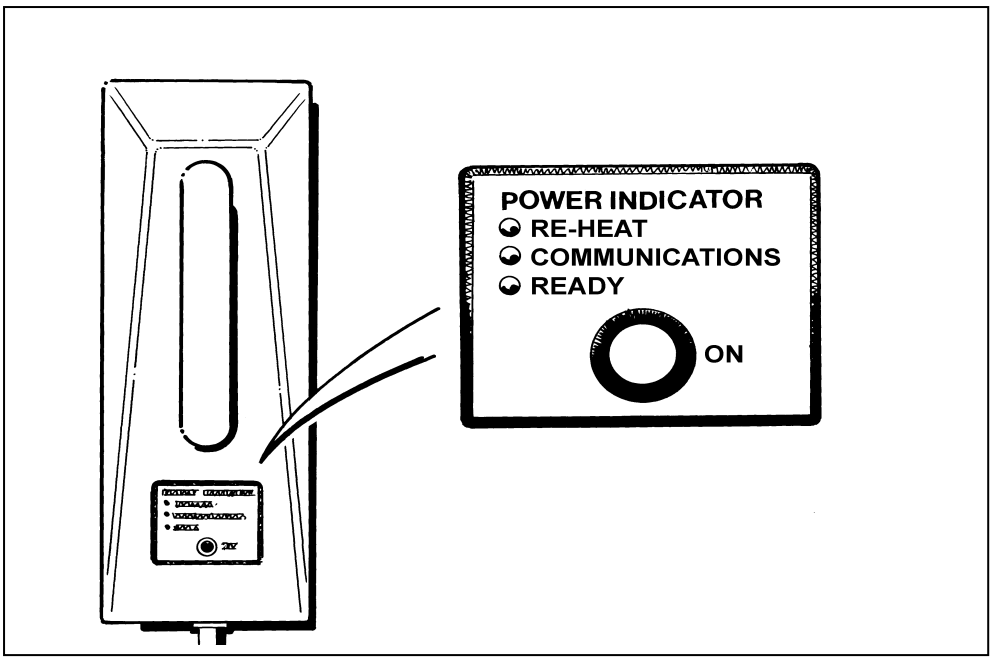
General Description of Operation Continued/:

Smoke Head. The Smoke Head's unique design is the heart of the Smokemeter. Using advanced manufacturing techniques, reliability has been the watchword of this product. The smoke measuring tube, optics and single printed circuit board (Pcb) are housed in a robust enclosure. The Pcb contains radio communication circuitry which matches that in the Pc and display system. All communications between the Pc and the Smokemeter are via the radio link. The Pcb has an 'on-card' battery to support the calendar and a separate rechargeable battery to support the other electrical and electronic components.

The Battery is recharged and the Smoke Sample Chamber is heated when the Smokemeter is on the Docking Station. The Smoke Sample Chamber is fully insulated to retain heat for prolonged periods. After removal from the Docking Station, the Smoke Chamber maintains heat to complete the M.O.T. cycle. This feature, plus the radio link, allows the unit to be used up to 100 meters range from the Pc without electrical cables.

The imbedded software controls the calibration and linearity checks (removing the need for mechanical filters) and calculates the peak opacity and K values before transmitting these values to the Pc and display. The Smokemeter status with regard to being ready to perform an M.O.T. test or any faults detected with the Smokemeter are also transmitted to the Pc.

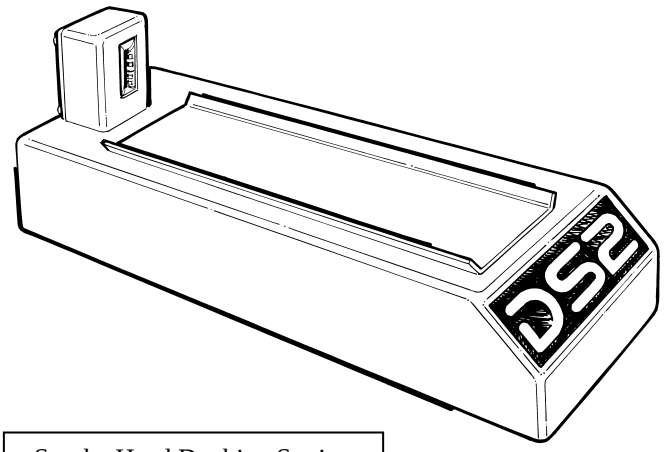
The M.O.T. sequence is controlled from the analyser, which also sets the pass/fail limits.



General Description of Operation Continued/:

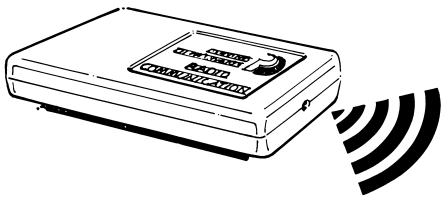
Docking Station. The Docking Station recharges the internal battery on the Smoke Head and powers the Heaters within the Smoke Sample Tube. The Docking Station requires 230Vac mains power, and can be switched to any international standard. The transformer within the Docking Station supplies 24Vac for the Heater circuits. This voltage is then rectified for the various power inputs required for the electronic components within the Smoke Head.

The Docking Station can be mounted on the side of existing analysers, on a wall or free standing.



Smoke Head Docking Station

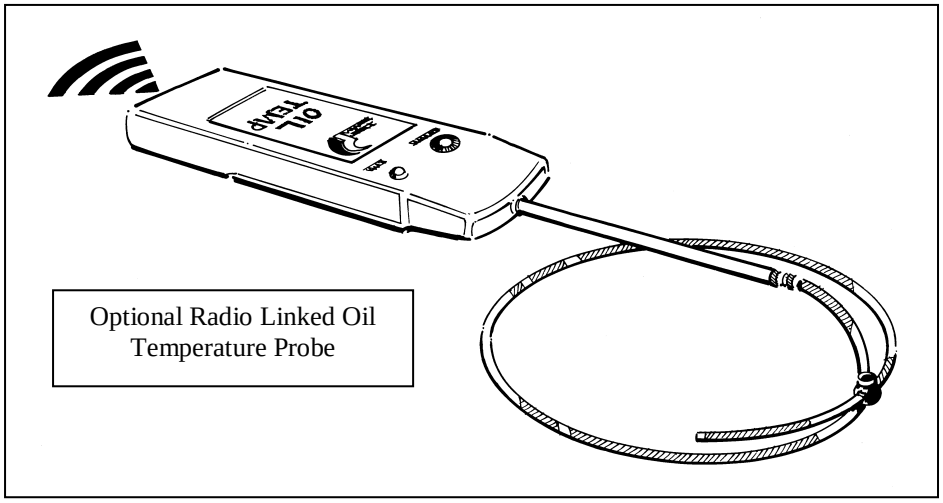
Radio Link. The Radio Link supplies communication between the Smoke Head, the Oil Temperature Probe (Optional) and the 'Host Pc Platform'. This radio plugs into any available RS232 or USB Communications Port on an IBM™ compatible Pc, and transmits and receives data between the various devices. It is powered from the Pc power supply. This module handles communications from all devices.



RS232 Radio Communications Module

General Description of Operation Continued/:

Oil Temperature Probe. The optional radio linked Temperature Probe is powered by two 1.5Vdc size 'AA' batteries. The Probe is controlled by the 'Host' Pc platform. When the Oil Temperature Measurement has been completed the temperature probe is sent into 'Sleep Mode'. To reactivate, press the 'On' button located on the front of the module case. The LED on the module case indicates the 'Communications State'. When the LED is flashing, the Temperature probe is communicating with the host Pc. An 'Off State' indicates no communications. The Aerial is internal on this device.



Optional Radio Linked Oil Temperature Probe

INITIAL WARM-UP

When switching your Smokemeter on from cold, initial warm-up will take between 7 and 15 minutes depending on ambient temperature. When you switch on the software will load automatically and the Smoke Head RED 'Temperature' LED will be on continuously. As the Smokemeter warms up the RED 'Temperature' LED will begin to flash. When the Smoke Head has reached a usable temperature the Red LED goes out and the GREEN 'Ready' LED will begin to flash. When the Smoke Head has reached full temperature the GREEN 'Ready' LED glows continuously. (A full description of the Smoke Heads LED functions is detailed on Page 4 of this manual).

NOTE: The Green 'Communications LED' on the Radio Linked Oil Temperature probe will not illuminate until you start a test.

You can commence testing as soon as the Green 'Ready LED' on the Smoke Head is flashing. It is recommended, when you first switch on each day, you wait until the Green LED state is 'Steady On' indicating the Smoke Head has reached full temperature. Returning the Smoke Head to the Docking Station after each test will maintain its temperature ready for the next MOT.

PERFORMING AN M.O.T. DIESEL SMOKE TEST

CAUTION! When performing a Diesel M.O.T. Smoke Test you will be accelerating the engine to full governor speed. Ensure the engine does not exceed the manufacturers recommended governor speed. You must also satisfy yourself that the engine has been regularly serviced and is mechanically sound. Testing suspect engines could result in serious engine damage. You should ask your customer sufficient questions to satisfy yourself that the engine is serviceable and suitable for testing. It is strongly advised you follow these instructions and, if in doubt, decline to test the vehicle.

When performing an M.O.T. Diesel Smoke Test, the screen displays the options available and prompts you through the procedure.

To commence Smoke Testing select 'M.O.T. Procedures' from the main menu. If you are using a 'Combi' Petrol and Diesel Analyser, you will be given the option of either a Petrol or Diesel MOT. Select Diesel MOT.

Three options will be displayed. 1. *Program by Smart Card.* 2. *Category 'A' Vehicles*. 3. *Category 'B' Vehicles*. (For abbreviations refer to the back of this manual). If you are going to select the test sequence using the Smart Card, refer to the 'Flow Chart' on page 15 of this manual for a fuller understanding of its operation. Detailed information on using the Smart Card will be issued by V.O.S.A. at the appropriate time.

Testing Cars, Light Commercial Vehicles and Single Vehicle Approvals.

If you have manually selected the test sequence follow the instructions on each screen as they are displayed. Enter the registration number when requested, select turbo or non-turbo as appropriate and sample the Oil Temperature when instructed. CAUTION! When measuring Engine Oil Temperature ensure you measure the Dipstick length accurately by laying the Temperature Probe and Dipstick side by side. Adjust the 'toggle' on the Temperature Probe ensuring the Probe is 1 inch shorter than the Dipstick and insert the Temperature Probe into the Dipstick Tube. The equipment will automatically proceed to the next stage in the sequence when the engine oil temperature reaches 80^{o}C. You can 'Manually Continue' the test when the Oil Temperature reaches a minimum of 60^{o}C by pressing the enter key. **The test will not continue until you have reached the minimum temperature.** When instructed on the screen remove the Temperature Probe and **Replace the Dipstick.** Please be aware that, if you have continued the test before the Engine Oil Temperature has reached 80^{o}C, and the vehicle Fails the Emissions Test, the equipment will offer you the opportunity to complete a second set of 'FAS' tests.

PERFORMING AN M.O.T. DIESEL SMOKE TEST

Testing Cars, Light Commercial Vehicles and Single Vehicle Approvals Continued/-

When you have completed the set-up procedure you will be instructed to insert the exhaust probe (DO NOT insert the probe before instructed). When inserting the probe keep the Smoke Head out of the direct line of the exhaust. At this stage you need to watch the screen carefully. After a 5 second countdown the instruction to accelerate appears on the screen. **Fully depress the accelerator continuously but not violently in under 1 second.**

When the screen displays 'Decelerate', but ONLY when the engine has reached 'Governor Speed', release the accelerator and allow the engine to idle. If the vehicle has 'Passed' the emission test on the first acceleration the test will end and a 'Fast Pass' has been achieved. If the vehicle did not achieve a Fast Pass, after the 5 seconds countdown, repeat the accelerations as instructed by the display until the equipment reports the test is completed. (Remember, you MUST wait for the engine to return to idle before every acceleration). At this stage you will be instructed to remove the exhaust probe and the readings will be displayed on the screen together with the result.

The equipment will allow you to print the results at the end of each test. Depending on the type of printer installed on your equipment, the print-out will either be in duplicate, or you can request a second copy by selecting the 'Print' button on the screen before 'Escaping' back to the Main Menu.

The results of all M.O.T. tests are stored on the Hard Drive. Selecting "Recall Results" from the Main Menu and, then selecting which results you wish to review will display the details on the screen. You can print the results by pressing the "Print Screen" key (Prt Scr) on the top right hand side of the keyboard.

A Typical printout is shown on Page 15 of this manual.

A Sample of a Typical Printout

MOT Exhaust Emission Test Results
Category 'A' Diesel Engine Vehicle

Test Station: Premier MOT Test Centre Tel: 01295 271985 Station No: 1234 AB
3 Cherwell Business Village. Banbury. Oxon. OX16 2SD

Date of Test: Tue Mar 11 2016 Time of Test: 11:54

Vehicle Details

Test Number: 12345ABC (Applicable to Smart Card Only)
Vehicle Registration: 123 ABC

Test	SMOKE K (1/m)	SPEED Min	SPEED Max
1	1.20	-	-
2	1.20	-	-
3	1.20	-	-

Oil Temperature: 61°C Tested Below 80°C
Average Reading: 1.20 1/m Test Applied: Non Turbo Limit 2.50 1/m
Zero Drift Check: 0.00 1/m

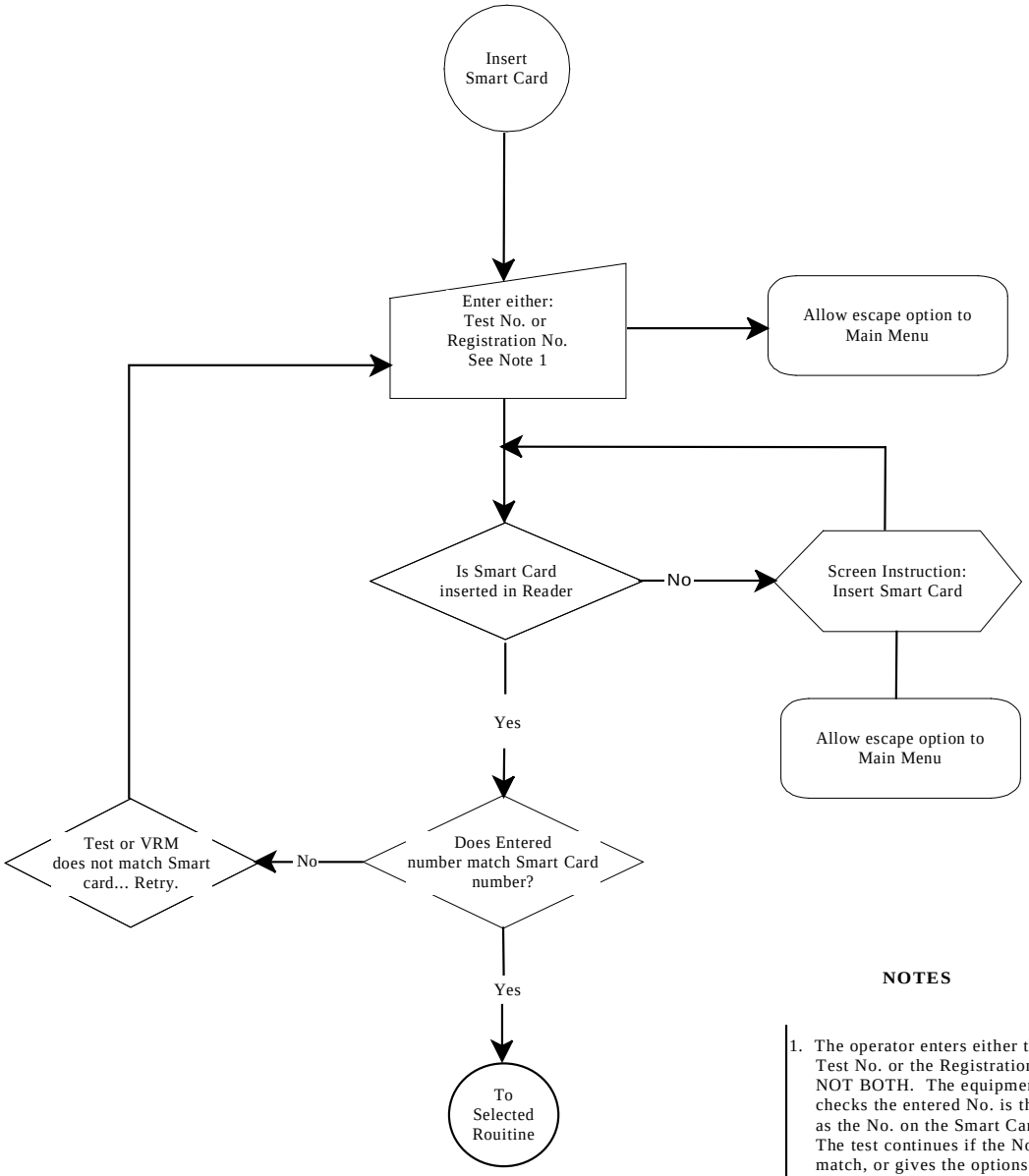
Test Result: PASS

Tested by: …….

Your Marketing Message Here

USING THE SMART CARD

Flow Chart

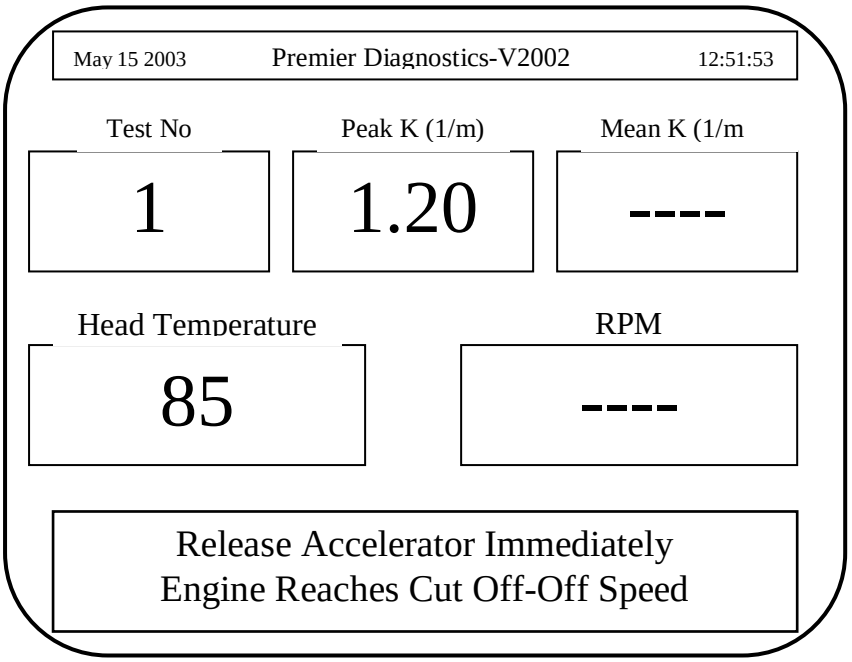


NOTES

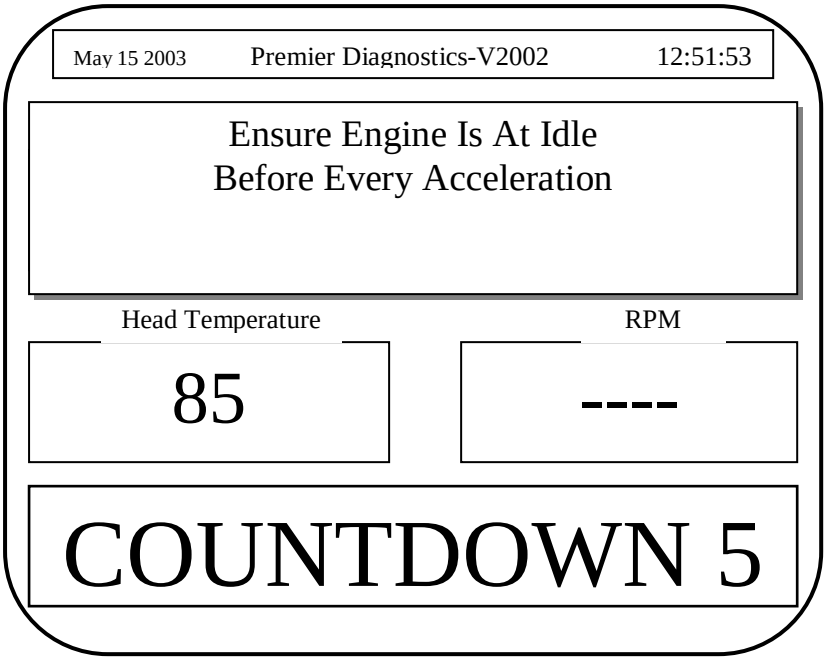
1. The operator enters either the Test No. or the Registration No. NOT BOTH. The equipment checks the entered No. is the same as the No. on the Smart Card. The test continues if the Nos. match, or gives the options to re-enter the No. or abort the test in the event the Nos. do not match.

Typical Screen Displays

MOT Test Screen



MOT Test Screen



Testing HGV and PSV Vehicles

All Category 'B' vehicles are tested at V.O.S.A. Testing Stations. However, if you are a HGV Workshop, Fleet or Taxi Operator and wish to complete an Emissions Check, prior to presenting the vehicle for Testing, the following procedures apply.

CAUTION! When performing a Diesel M.O.T. Smoke Test you will be accelerating the engine to full governor speed. Ensure the engine does not exceed the manufacturer's recommended maximum RPM. You must also satisfy yourself that the engine has been regularly serviced and is mechanically sound. Testing suspect engines could result in serious engine damage. It is strongly advised you follow these instructions and if in doubt decline to test the vehicle.

Advisory: Your analyser is Officially Correlated for testing Category 'B' Vehicles. All routines comply with HGV test sequences.

When performing an M.O.T. Diesel Smoke Test the screen displays the options available and prompts you through the procedure.

To commence Smoke Testing select M.O.T. Procedures from the main menu. If you are using a 'Combi' Petrol and Diesel Analyser you will be given the option of either a Petrol or Diesel MOT. Select Diesel MOT.

Three options will be displayed. 1. *Program by Smart Card.* 2. *Category 'A' Vehicles.* 3. *Category 'B' Vehicles.* (For abbreviations refer to the back of this manual).

Having manually selected the test sequence required follow the instructions on each screen as they are displayed. Enter the registration number when requested and select turbo or non-turbo as appropriate.

If you are presenting the vehicle for RPC (Reduced Pollution Certificate) certification, select the emission level you are applying on the appropriate screen. The emission levels are as follows:

RPC 1	Maximum Limit: 0.20k.
RPC 2	Maximum Limit: 0.40k.
RPC 3	Maximum Limit: 0.80k.
RPC 4	Maximum Limit: 1.00k.

When you have completed the set-up procedure you will be instructed to insert the exhaust probe (DO NOT insert the probe before instructed). When inserting the probe keep the Smoke Head out of the direct line of the exhaust. If the vehicle you are testing has an 'Exhaust Stack' select the appropriate sample probe.

Testing HGV and PSV Vehicles

At this stage you need to watch the screen carefully. After a 5 second countdown the instruction to accelerate appears on the screen. **Fully depress the accelerator continuously but not violently in under 1 second.**

When the screen displays 'decelerate', but ONLY when the engine has reached 'Governor Speed', release the accelerator and allow the engine to idle. If you are NOT testing for 'RPC Certification' and the vehicle has 'Passed' the emission test on the first acceleration, the test will end and a 'Fast Pass' has been achieved. If the vehicle hasn't met the limits on the first acceleration, repeat the accelerations as instructed by the display until the equipment tells you the test is completed. (Remember, you MUST wait for the engine to return to idle before EVERY acceleration). At this stage you will be instructed to remove the exhaust probe and the readings will be displayed on the screen together with the Pass or Fail result. It is valid to fail an 'RPC Test' and obtain an overall 'Pass'. This is due to the vehicle passing the Standard Maximum Turbo or Non-Turbo Smoke Limit but failing the lower RPC values.

The equipment will allow you to print the results at the end of each test. Depending on the type of printer installed on your equipment the print-out will either be in duplicate, or you can request a second copy by selecting the 'Print' button on the screen before 'Escaping' back to the Main Menu.

The results of all M.O.T. tests are stored on the Hard Drive. Selecting "Recall Results" from the Main Menu and then selecting which results you wish to review will display the details on the screen. You can print the results by pressing the "Print Screen" key (Prt Scr) on the top right hand side of the keyboard.

A sample of a typical printout is on Page 15 of this manual.

MANUAL OPERATIONS

Your Premier DS2-2M Smokemeter can be used in Manual Mode to assist in diagnosing engine faults and check repairs have been completed satisfactorily prior to re-testing. In this mode a range of "measurement units" can be selected. This facility has been added due to different Engine Manufacturers publishing smoke density figures in different measurement values. Therefore you can compare the vehicle's reading against the published unit of measurement used by the manufacturer without the need of conversion charts. To change the measurement scale or reset the peaks use the cursor keys to highlight the options button and press enter (pressing the space bar will achieve the same objective). Select your requirement using the cursor keys and press enter. If you decide not to make changes press the escape key to return to the manual display. To print the values displayed on the screen, press the enter key.

N.B. You can only measure smoke values in "K units" (co-efficient of light absorption) during the M.O.T. Test.

When selecting the Manual Page, the following information is displayed:-

RPM. (Optional).	
Oil temperature.	
Opacity in %.	
Smoke values in K.	
Smoke values in HSU (Hartridge smoke units).	Selected from the Option menu
Smoke values in FSN (filter smoke number).	Selected from the Option menu
Smoke values in milligrams per cubic meter.	Selected from the Option menu

The peak values of opacity and 'k' values are shown to the right.

K and Opacity are the pre-selected unit.

When you have finished with the manual page press the escape key to return to the main menu.

Smoke Head Maintenance

Lens Fouling

The Premier DS2-2M Smokemeter has been designed for minimum operator maintenance. This is limited to keeping the case of the unit clean and cleaning the transmitter and receiver lenses when advised by the automatic monitoring system. A gradual build up of dirt on the light source or receiver lenses is automatically compensated during the Zero/Span check prior to every test. This is achieved by the electronics driving the light source harder to maintain the required 100% light transmission. Before the light source reaches its maximum range, to compensate for fouling of the lenses, a warning to clean the lenses is triggered. If the warning is not heeded and fouling becomes excessive, operation of the unit will be inhibited. Cleaning the lenses will restore its operation.

In extreme cases of smoke pollution the smoke sample chamber may require cleaning. This can be determined with a visual inspection through the chamber when the transmitter and receiver are removed.

Cleaning

See Diagram on Page 22 of this manual.

IMPORTANT – The main cover must NOT be removed from the unit (other than by an accredited UKAS engineer). Breaking the integrity seal on the Smoke Head case will **Invalidate the Warranty and the Calibration Certificate**.

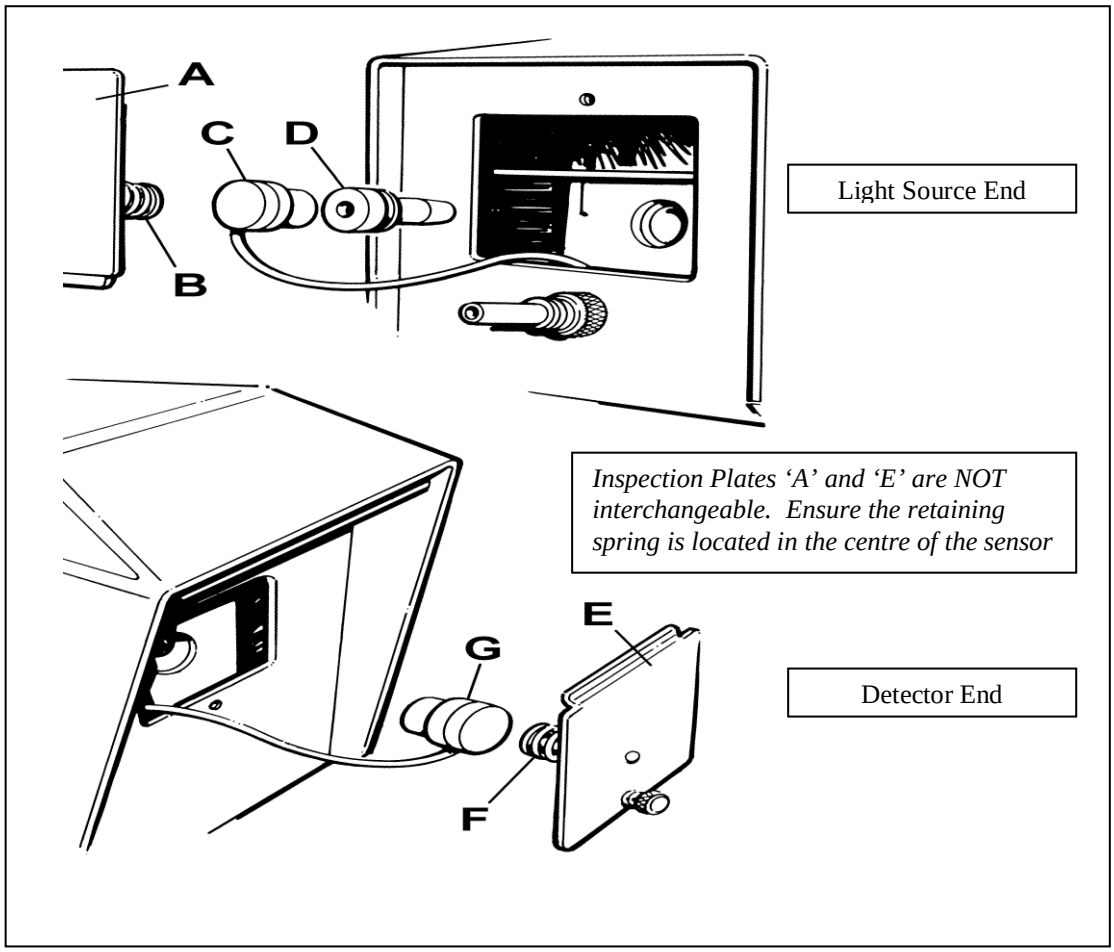
WARNING: When carrying out cleaning of the unit

a) Ensure the Smoke Head is switched off.
b) Take precautions when removing the transmitter and receiver. Heat from the Smoke Measuring Chamber will transfer to these units and they will remain VERY HOT for some time after the unit is switched off.
c) Take precautions to ensure contaminates being cleaned from the unit are not breathed in or come into contact with the skin.
d) If the smoke chamber is cleaned, always clean the lenses *after* cleaning the chamber.

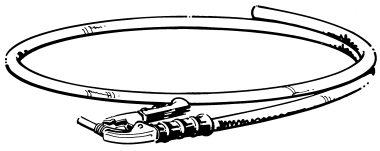
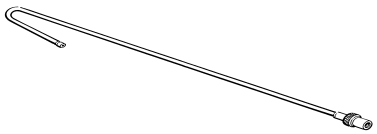
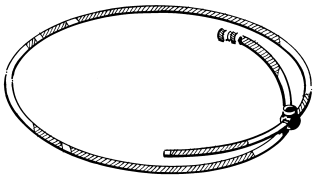
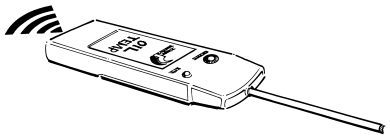
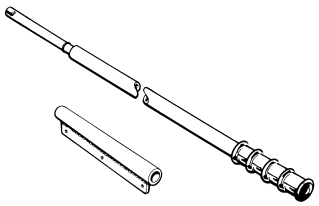
- Undo finger screw and remove Inspection Plate “A” to gain access to the transmitter and nozzle.
- Undo finger screw and remove Inspection Plate “E” to gain access to the receiver.
- The transmitter “C”, nozzle “D” and receiver “G” are push fits and are easily withdrawn from the assembly for cleaning.
- Any residue that forms on the lenses can normally be removed with a dampened paper towel material and then wiped dry. Stubborn stains may require the towel dampened with a glass-cleaning agent, such as a windscreen wash.

Smoke Head Maintenance

- Visually inspect the smoke measuring chamber "H". The chamber should appear black when viewed through it. Cleaning need only be undertaken if there is evidence of heavy soot build up or loose soot particles. If required use the bottlebrush provided to clean through the chamber. A low-pressure airline will assist with completely cleaning all particles away. If using a low pressure airline *only aim down the length of the chamber.* DO NOT aim into the fan housing as this will damage the fan.
- When working on the Smoke Head ensure that the Transmitter and Receiver connecting cables are not put under strain and the lenses are not scratched.
- The nozzle can be cleaned in the same way as the lenses. Check the cross drilled hole is clear.
- The Transmitter, Nozzle and Receiver are all reinstalled dry and contact faces must be clean.
- Check that the connecting cable on the Transmitter and Receiver are not fouling or being forced by the insulation.
- Replace Inspection Plates ensuring the springs are located in the *centre* of the sensors. NOTE: The Inspection Plates are not interchangeable and MUST be reinstalled with the retaining springs centrally located over the Sensor.



Spares and Accessories

	**Part No: DS1002.** **Standard 1 Meter Sample Hose**
	**Part No: DS1011A.** **1.5 Meter Sample Pipe for Vertical Stack Exhausts** (Optional)
	**Part No: P1142.** **Oil Temperature Probe (Tip Only)** **Part No: P1141.** **Main Harness. (From Equipment to Temperature Probe. *Not Shown*).**
	**Part No: DS1300.** **Radio Linked Oil Temperature Module Complete. (Optional).**
	**Part No: P1133-1.** **Infra Red Keyboard for Remote Operation. (Optional) (Blue Tooth Keyboards also Optionally Available)**
	**Part No: DS 1012** **1.5 Meter Extension Pole for High Vertical Stacks.** **Part No: DS 1019** **Extension Pole Bracket (Fits to Smoke Head).** **Part No: DS1013** **Complete Kit. (DS1011A+DS1012+DS1019)**
	**Part No: DS 1158** **Smart Card Communications Cable.**

TECHNICAL SPECIFICATIONS

HOST Pc PLATFORM (Minimum Requirements)	
IBM™ Compatible Pc Platform:	486 Processor or above.
Screen Display: (14" VGA or 12.1" LCD)	800 x 600 x 256 colours. Auto-Sizing to ensure compliance with V.O.S.A. Minimum Alfa/Numeric size specifications.
Minimum Operating System:	Windows™ 3.11. or above.
USB or Serial Ports:	1 Minimum.
SMOKE SAMPLING HEAD	
Sampling Method:	Partial Flow
Light Source:	Green LED (wave length 560 to 570 mm)
Optical Path Length:	260mm
Measurement Range:	0-100% Opacity (0 to 10.00^{-1})
Warm-Up Time	From -25ºC to 90ºC (Full Temp') @ 15ºC Ambient = 14 minutes.
Re-Heat Time:	4 Minutes from 70ºC to 90ºC
Operational Temperature:	-15ºC to +40ºC 90% Relative Humidity (Non-Condensing)
Smoke Sample Hoses:	1 Meter Flexible Hose (Supplied as Standard) 1.5 Meter Vertical Stack Pipe (Optional)
Linearity Check:	Electronic (Automatic)
Fault Reporting:	Low Battery States, Calibration Errors Dirty Lenses, Hardware Errors and Communication Errors
Power Requirements:	24Vac, 5 amps (from Docking Station) 3.3Vdc to 13.7Vdc (Supplied by Internal Battery)
Reliability:	20,000 Hours
Accuracy:	<1.0%
Resolution:	0.10
Radio Range:	100 Meters (Optimum)

TECHNICAL SPECIFICATIONS

DOCKING STATION

Power Input:	230Vac (Switchable to all international Standards)
Power Output:	24Vac, 5 amps

OIL TEMPERATURE MODULE

Power:	3Vdc (2 x Size AA Batteries)
Temperature Range:	0^{o}C to 150^{o}C
Measuring Probe:	Length 1 Meter (Longer available)
Radio Range:	100 Meters (Optimum)
Green LED:	Communications Indicator
Power Saver:	Sleep Mode (After 2 minutes Non-Activity)

RS232 or USB RADIO LINK

Power Supply:	5Vdc (Supplied by Pc Power Supply)
Communications:	To All Radio Modules
Radio Range:	100 Meters (Optimum)
Radio Conformity:	The Radio Manufacturers Certify the Radio Modules within this product, comply with EN 301 489-3 (Ed.00) in accordance with European Harmonised Legislation.

PHYSICAL SPECIFICATIONS

SMOKE SAMPLING HEAD

Dimensions	Length:	15.50 inches (Excluding Sample Probe)
	Height:	9.50 inches (Including Handle)
	Width:	4.75 Inches
	Weight:	6.0. Kgs (Including Battery)
Enclosure	All Steel (Corrosion Resistant)	

DOCKING STATION

Dimensions	Length:	19.50 inches
	Height:	6.75 inches (Including Charging Socket)
	Width:	7.00 inches
	Weight:	4.0. Kgs
Enclosure	All Steel (Corrosion Resistant)	

OIL TEMPERATURE MODULE
(Radio Link)

Dimensions	Length:	6.50 inches
	Height:	0.80 inches
	Width:	2.75 inches
	Weight	0.20. Kgs (Including Batteries)
Enclosure	ABS (Impact Resistant)	

RADIO LINK MODULE

Dimensions	Length:	5.60 inches
	Height:	1.10 inches
	Width:	3.20 inches
	Weight:	0.15. Kgs
Enclosure	ABS (Impact Resistant)	

ABBREVIATIONS USED IN THIS MANUAL

1\m:	Co-eficient of Light Absorption. The unit of measurement used by V.O.S.A. to determine the density of smoke emitted from Diesel Engine Vehicles.
Category 'A' Vehicles:	Cars and Light Commercial Vehicles (including MOT Class IV, V11 and Single Vehicle Approval Scheme Vehicles).
Category 'B' Vehicles:	Public Service Vehicles and Private Busses (including MOT Class V and VI Vehicles and Heavy Goods Vehicles).
'K' Values:	Co-eficient of Light Absorption. The unit of measurement used by V.O.S.A. to determine the density of smoke emitted from Diesel Engine Vehicles.
LED:	Light Emitting Diode.
Prt Scr:	Print Screen. The keyboard key used to print a copy of 'Recalled Results'.
RPC:	Reduced Pollution Certificate.
RPM:	Revolutions Per Minute.
V.O.S.A:	Vehicle and Operator Services Agency. (Formerly known as the Vehicle Inspectorate).

WARRANTY

DS2-2M

Premier Diagnostics Ltd warrants the DS2-2M Diesel Smoke Meter, delivered to the original purchaser, to be free under normal use and service from defects in materials and faulty workmanship, for the period stated on the delivery note / invoice, from the date of delivery to the original purchaser.

This warranty shall be fulfilled by the repair or replacement, at the option of Premier Diagnostics Ltd, of any defective parts free of charge including labour.

This Warranty shall not apply when failure is caused by accidental damage, misuse, abuse, neglect or unauthorised alterations or repairs.

Replacement parts carry a warranty of 180 days, or until the expiry of the original Warranty Period whichever is the longer.

Exclusions:
A 180 day warranty shall apply to all external Harnesses, Sample Probe, Hose, Bulbs, Fuses and external pipe work. Warranty is only considered where such items are returned to Premier Diagnostics, either directly or via its Service Engineers

This Warranty shall not apply to consumable items, including filters, 'o' rings, flexi tips, filter bowls or printer paper.

This Warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty, or merchantability or fitness of any purpose, and of any other obligation on the part of the seller.

Under no circumstances shall Premier Diagnostics Ltd be liable for any consequential loss or damage.

Premier Diagnostics Ltd neither assumes nor authorises any person to assume for it any obligation or liability other than herein expressly stated.

October 2010.
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