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Assuring you of our best attention at all times

Boston Garage Equipment

CHAP. 1 - GENERAL INFORMATION

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CHAP. 3 - SAFETY CONDITIONS

3.1 IMPORTANT INFORMATION CONCERNING PERSONAL SAFETY



DANGER OF ASPHYXIATION

PETROL (GASOLINE) FUELLED ENGINES

The exhaust gas of petrol (gasoline) fuelled engines contains carbon monoxide, a colourless and odourless gas which can cause serious physical problems if inhaled. Pay particular attention if you work in a pit as some exhaust gas components are heavier than air and will deposit at the bottom of the pit itself. Great care should also be taken with gas fuelled vehicles.

DIESEL ENGINES

The composition of the exhaust gas produced by a Diesel engine is not always the same. It can change according to: the type of engine, aspiration, the conditions of use and the composition of the fuel used. Diesel exhaust consists of (CO, CO₂, NOX and HC), gas and particulate (soot, sulphates). The tiny particles of carbon that form the soot remain suspended in the air and can therefore be inhaled. Small amounts of toxic components are also present.

SAFETY MEASURES

- Always ensure that the place in which you work is correctly ventilated and that any fumes are exhausted (particularly in pits).
- Always operate an exhaust extraction system in closed rooms.



DANGER OF BEING CRUSHED

You could be crushed against a work bench unless vehicles are correctly locked in place by mechanical means.

SAFETY MEASURES

- Make sure that the vehicle is unable to move by applying the hand brake.
- Allow the engine to cool.
- Do not use naked flames or components that produce sparks.
- Do not smoke.
- Clean up any spilt fuel.
- Operate exhaust extraction fans in closed rooms.



INJURIES

There are mobile parts in stationary or running engines (belts and so forth) that can cause serious injury hands and arms. Amongst the various engine components, pay the greatest attention to electric fans since they can start operating unexpectedly even when the engine is off.

SAFETY MEASURES

- Never place your hands near moving parts whilst the engine is running
- If you must work near electric fans, first allow the engine to cool and remove the fan plug from the motor.
- Keep the connection cables of test instruments well away from the moving parts of the engine.



RISK OF BURNS

Some of the engine components (eg. exhaust gas manifolds) can become very hot, as can some of the sensors. Take great care to avoid touching these components.

SAFETY MEASURES

- Wear protective gloves.
- Allow the engine and any self-contained accessory heaters to cool down.
- Do not route the connection cables of test instruments over or near hot parts.
- Do not keep the engine running after the tests.



DANGER OF FIRE OR EXPLOSION

There could be a risk of fire outbreak or explosion when work is carried out on the fuel system (fuel pump, injectors and carburettor, etc.) due to the fuels used and/or the vapours they create.

SAFETY MEASURES

- Disconnect the ignition system.
- Allow the engine to cool.
- Do not use naked flames or components that produce sparks.
- Do not smoke.
- Clean up any spilt fuel.
- Operate exhaust extraction fans in closed rooms.

**NOISE LEVEL**

The noise level can exceed 90dB when vehicles are tested, particularly at high engine rates. If a person is subjected to these noise sources for a lengthy period of time, his or her hearing could be damaged.

SAFETY MEASURES

- If necessary, the user is obliged to protect the work areas near to the places where tests are carried out.
- The operator must use personal protective equipment if necessary.

**DANGEROUS VOLTAGE**

There are dangerous voltages in residential, industrial and vehicle electric systems. When a person comes into contact with test instruments or engine parts to which voltage is applied, there is a danger of electric shock. This danger exists both in relation to the primary and secondary side of the ignition system and to the test instrument connections.

SAFETY MEASURES

- Connect test instruments to a socket that has a protection contact and that is correctly earthed.
- Only use the supplied cables to connect the test instrument and make sure that the insulation is not damaged.
- Make sure that the test instrument has been earthed before you turn it on.
- Always disconnect the power (e.g. battery) before you work on the electrical system.
- Make sure that you do not touch live parts of the vehicle when carrying out inspections and adjustments with the engine running.

**DANGER OF INTOXICATION**



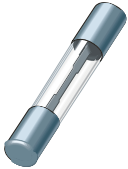

If subjected to high temperatures, the pipes used to sample exhaust gas release a highly toxic gas which can be harmful if inhaled.

SAFETY MEASURES

- Immediately consult a physician if you inhale this gas.
- Wear neoprene or PVC gloves to eliminate combustion residues.
- The remains of fire outbreaks can be neutralized with a solution of hydrated lime. This creates calcium fluoride which can be easily removed with water.

3.2 IMPORTANT INFORMATION ABOUT THE SAFETY OF THE INSTRUMENT

The work and operations described below are not permitted when the instrument is used in certain circumstances, they can endanger persons and lead to permanent damage to the instrument itself.

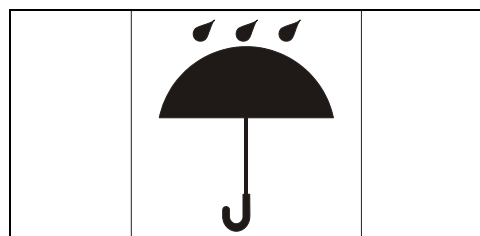
	<ul style="list-style-type: none"> - It is forbidden to remove the decals and/or danger signs affixed to the instrument.
	<ul style="list-style-type: none"> - It is forbidden to cut out the safety devices with which the instrument is equipped.
	<ul style="list-style-type: none"> - Only use original fuses with the indicated ampere capacity! The instrument must be immediately disconnected if the electricity supply is faulty. Defective fuses must not be repaired or cut out. They must be replaced with fuses of the same type.
	<ul style="list-style-type: none"> - The electrical components of the instrument must be inspected/checked at regular intervals. Defects, such as loosened connections or burnt wires, must be immediately eliminated.

3.3 GENERAL NOTES

3.3.1 INSTALLATION

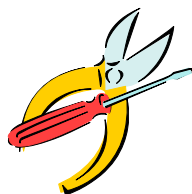


- Specialized personnel must install the instrument in strict compliance with the instructions in the installation manual.



- Protect the instrument from the rain and excessive damp to prevent damage.

3.3.2 IMPORTANT INFORMATION ABOUT THE BATTERY



- Never attempt to dismantle the battery or to modify it in any way. Damage could result in heat or smoke escaping, leaking liquids, fire outbreaks and explosion of the battery itself.



- Never allow the positive and negative terminals of the battery to be connected together. Never transport or store the battery near metal objects (necklaces, hair clips, etc.) which could cause a short circuit. Such action could cause the battery to explode, create heat and fumes, while the object that connects the two terminals could catch fire.

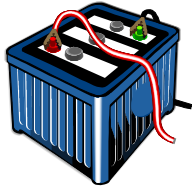


- Never use or leave the battery near flames, stoves or any other place where high temperatures could develop (80 °C or higher) as these could damage the seal of the battery itself. All this could lead to short circuits, explosion of the holder and fire outbreaks.

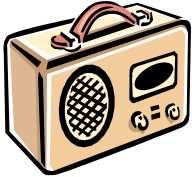


- Never wet the battery holder with either fresh water, salt water or any other liquid. Water can damage the battery causing heat and fumes to escape, explosion and fire outbreaks.

OPA-100



- Never use the battery if its outer part is very damaged or deformed. Use of a battery in these conditions could cause heat and fumes to escape, explosion and fire outbreaks.



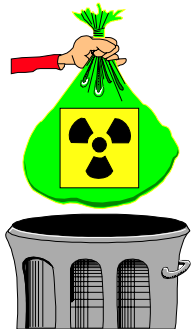
- Never use the battery for any purpose other than that for which it has been explicitly designed for. Such action could impair the performance of the battery, shorten its working life and lead to a power fault which could damage the battery itself.



- Only use a correct battery charger to carry out recharging. Ensure adequate space and where the temperature is between 10 °C and 45 °C. The wrong type of charger could overload the battery.





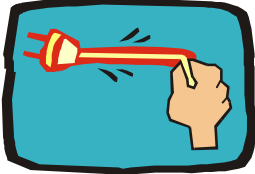


- If battery acid comes into contact with your eyes, do not rub them. Rinse the affected part with tap water and immediately consult a physician. Failure to rinse out all the battery acid could seriously damage the eyes.



- Batteries are considered a hazardous waste and must be disposed of in the correct way.

3.3.3 IMPORTANT INFORMATION ABOUT OPERATING SAFETY

	<p>When you work on engines, always protect your face, hands and feet by wearing adequate clothing. Do not touch hot components such as spark plugs, radiators, pipes of the cooling system and exhaust pipes. Catalytic converters become extremely hot and can cause burns or fire outbreaks.</p>
	<ul style="list-style-type: none"> - Do not smoke or use naked flames when working on engines.
	<ul style="list-style-type: none"> - If inhaled, exhaust gas (carbon monoxide) can be lethal or cause serious damage to health.
	<ul style="list-style-type: none"> - The cooling fan of vehicles can sometimes operate on its own, even when the engine is turned off. Take the utmost care when working near this component and disconnect it if necessary.
	<ul style="list-style-type: none"> - Never move the instrument by pulling the cables to which it is connected.

3.3.4 WHEN THE INSTRUMENT IS NOT USED



- Turn off all the power switches or unplug the power cable when the instrument is not in use for a long period of time.

3.3.5 CLEANING





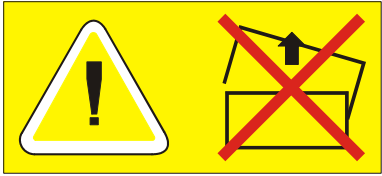


- When necessary, clean the outer surfaces of the equipment with neutral detergents and a soft, slightly damp cloth. Do not use detergents containing spirits, ammonia or petrol.

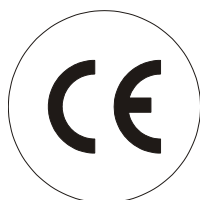
3.4 SYMBOLS

The safety symbols are described in this section.

3.4.1 SAFETY

	<p>ALTERNATE CURRENT</p>
	<p>EARTH</p>
	<p>CONSULT THE INSTRUCTION MANUAL</p>
	<p>DANGER! RISK OF ELECTRIC SHOCK</p>
	<p>WARNING! DO NOT REMOVE COVER (this may only be done by a qualified electrician)</p>

3.4.2 MARKING



CE CONFORMITY MARKING

OPA-100

CHAP. 4 - GENERAL DESCRIPTION

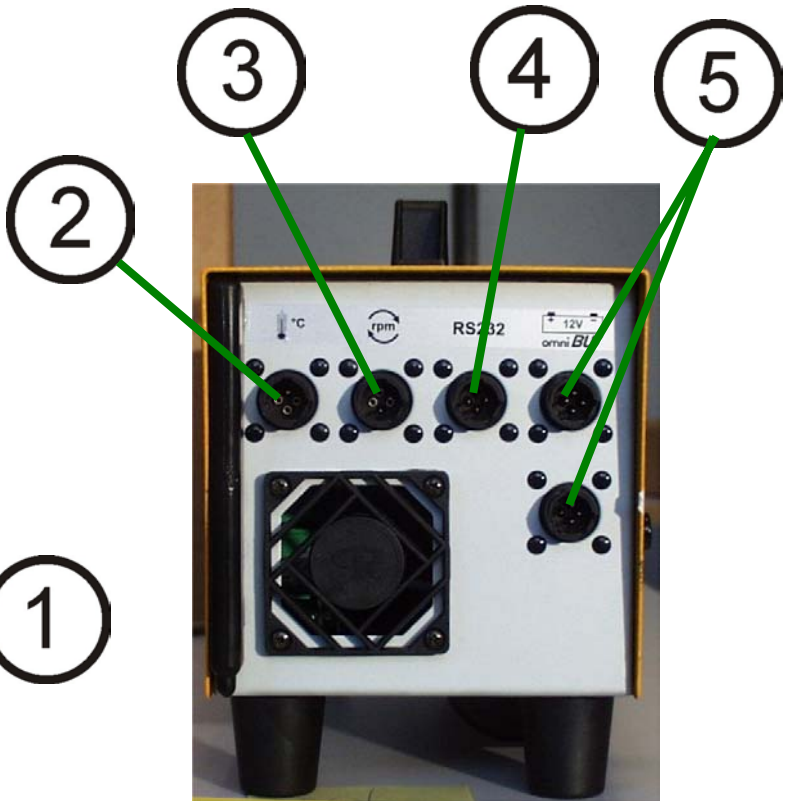
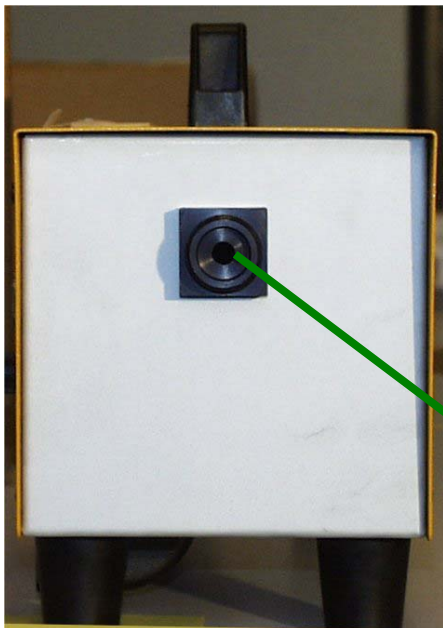
4.1 CONSTRUCTIONAL SPECIFICATIONS OF OPA-100

4.1.1 EXTERNAL ASPECT OF OPA-100

OVERALL VIEW



FRONT PANEL



- 1) SMOKE INLET
- 2) ENGINE TEMPERATURE SENSOR INPUT
- 3) ENGINE RPM SENSOR INPUT
- 4) SOCKET FOR RS-232 SERIAL LINK
- 5) 12 Vdc POWER SUPPLY AND COMMUNICATION

4.1.2 SUPPLIED ACCESSORIES

The OPA-100 is supplied with the following accessories:



SMOKE SAMPLING PROBE WITH TUBE



REFERENCE FILTER

CHAP. 5 - GENERAL SPECIFICATIONS

5.1 GENERAL SPECIFICATIONS

Measuring ranges:

- Opacity from 0 to 99.9 % Res. 0.1
- Opacity from 0 to 9.99 m-1 Res. 0.01
- Revolution counter from 300 to 9990 rpm Res. 10
- Oil temp. from 20 to 150°C Res. 1
- Smoke temp. from 20 to 400°C Res. 1

- Light source with green LED diode
- Photoconductive diode type light receiver
- Automatic pressure monitoring of the measuring chamber
- Measuring chamber temperature stabilization at 99°C
- Automatic monitoring of the slide cleaning system
- Automatic autozero
- Warm up time from cold - 10 minutes.
- Automatic monitoring of dirty slides
- Revolution counter pulse reception via cable or via wireless radio system
- Oil temperature input by direct connection or via wireless radio system
- RS 232 serial link
- 485 serial link in network
- 12 Volt DC power supply
- Consumption 1A DC, 5A DC with heating system active
- Operating temperature from 5 to 40°C
- Dimensions 200 x140 x 430 mm
- Weight 5 Kg

CHAP. 6 - PRELIMINARY OPERATIONS

6.1 INSTALLATION

Carefully unpack and remove the OPA-100 from its shipping packaging

If you have a TRO-030 or TRO-010 trolley, place OPA-100 in its appropriate support as shown in the figures below.



OPA-100

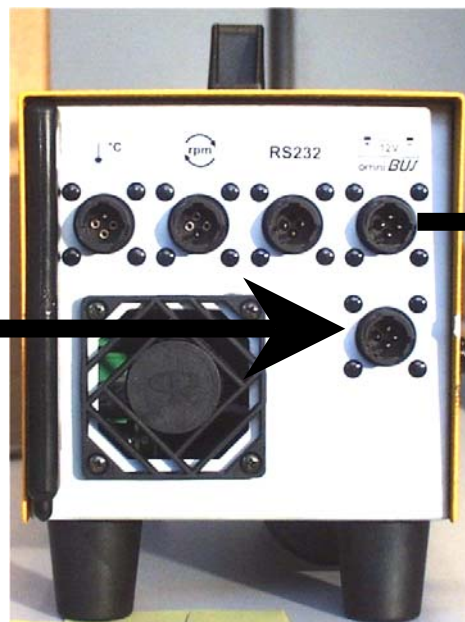
PERSONAL COMPUTER



PSI-60



OPA-100



AGS-200



6.2 HOW TO INSTALL THE SOFTWARE

The PC software comes as a suite of programs that handle other **BOSTON** instruments and is supplied in two formats: Software for use in the Microsoft Windows environment and Software for use in the DOS environment. The programs operate in exactly the same way. Only the software for the Windows environment is supplied as standard.

6.3 INSTALLATION IN THE Windows ENVIRONMENT

The software required to operate OPA-100 in the Windows environment is supplied on CD-ROM.

To install the software, insert the CD-ROM into the drive and open the **index.htm** file (this file will be automatically opened if the autorun function is activated). As soon as the prompt appears, select **MANAGER Pro-800 Win** and installation will automatically start.

6.4 SETTINGS

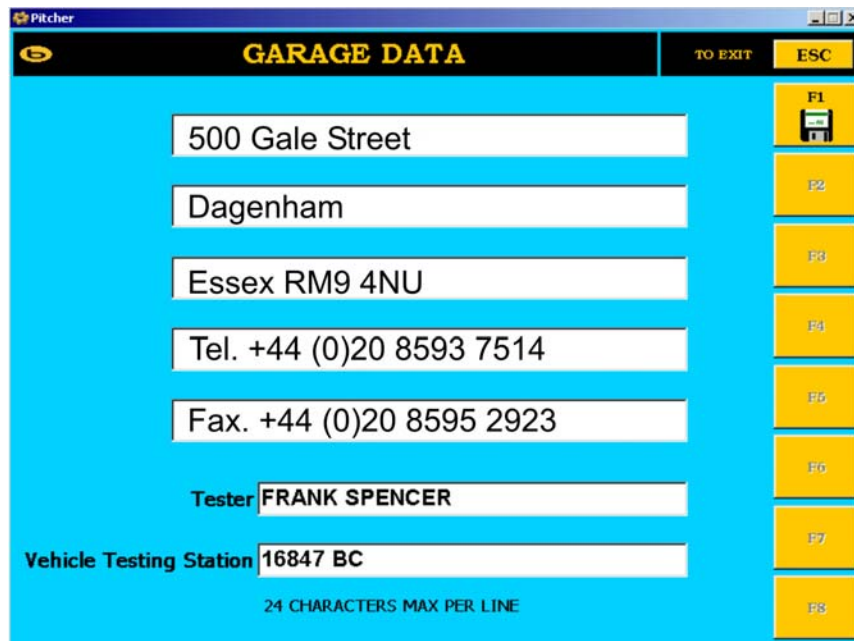
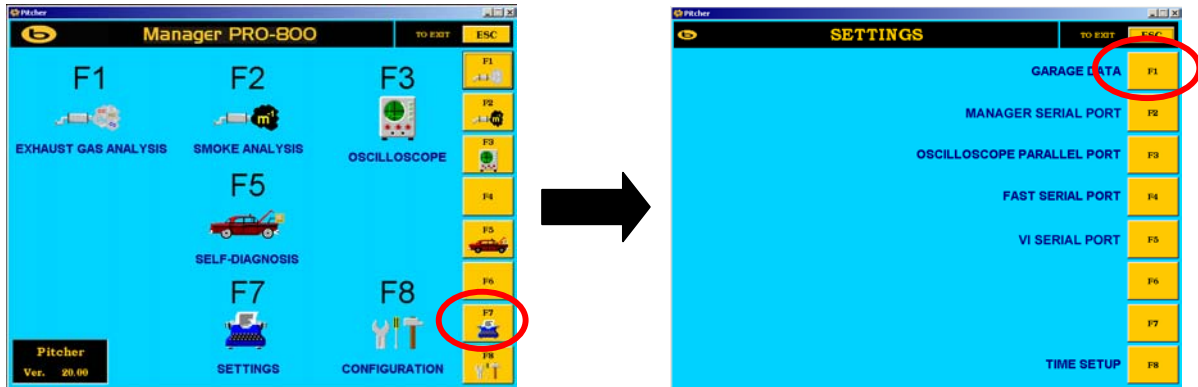
Once the software has been installed, there are a few settings that need to be set. After the BOSTON presentation screen, which can be quit by pressing any key or by clicking with the mouse, the main menu is displayed. The main menu gives access to all the attached equipment and all the necessary settings that need to be made.



OPA-100

6.4.1 GARAGE DATA ENTRY

Press F7 "SETTINGS" in the main menu and then press F1 "GARAGE DATA"



This page allows the user to enter the company name and address. The information entered here will be printed on all test reports. Five lines of 24 characters each are available, plus a line where the test technician's name can be written. Press "ENTER" to move the cursor to the next field to be edited.

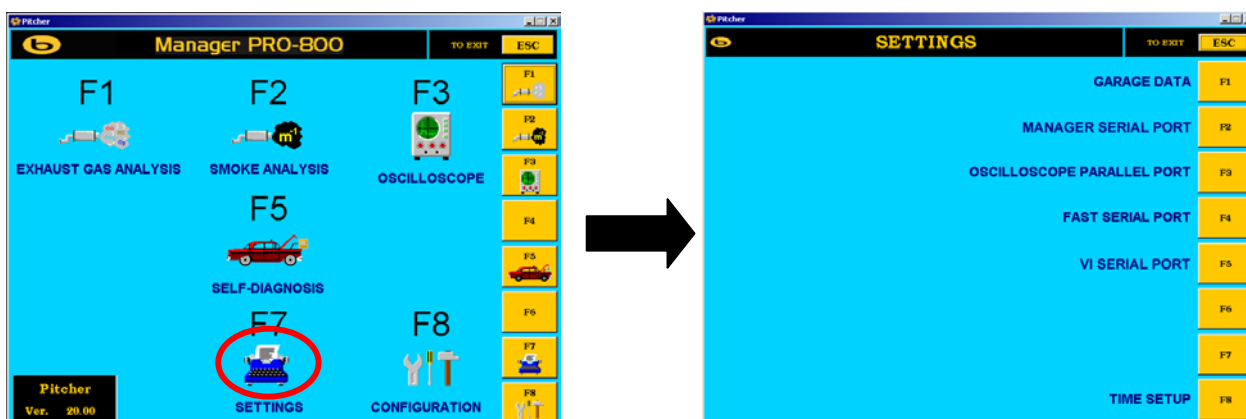
Press F1 to save the data.

6.4.2 DATE AND TIME SETTING

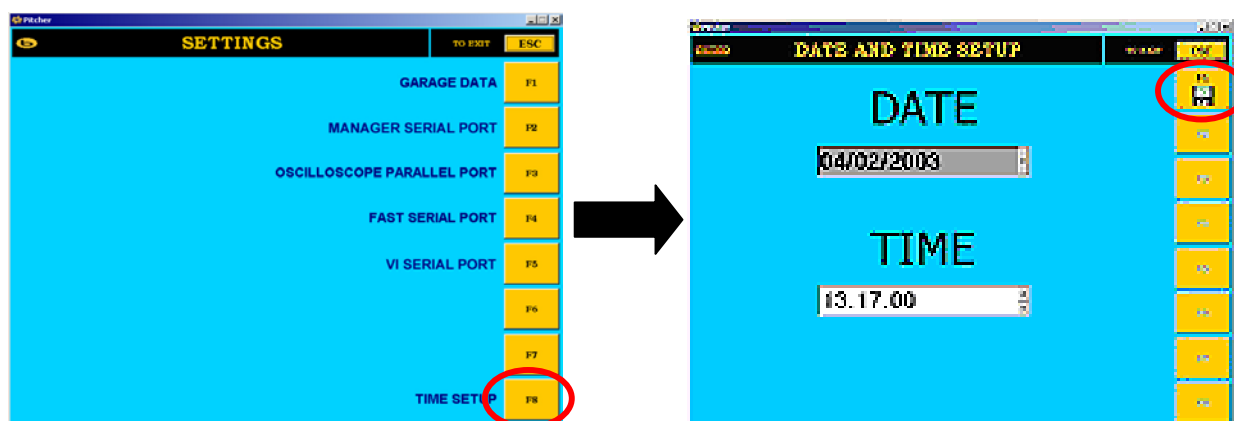


Attention ! It is not possible for the operator to change the date. This option is only available to an authorised engineer.

The time can be adjusted in the following way. Press F7 "SETTINGS" from the main menu.



Press F8 to select the "TIME SETUP" menu.

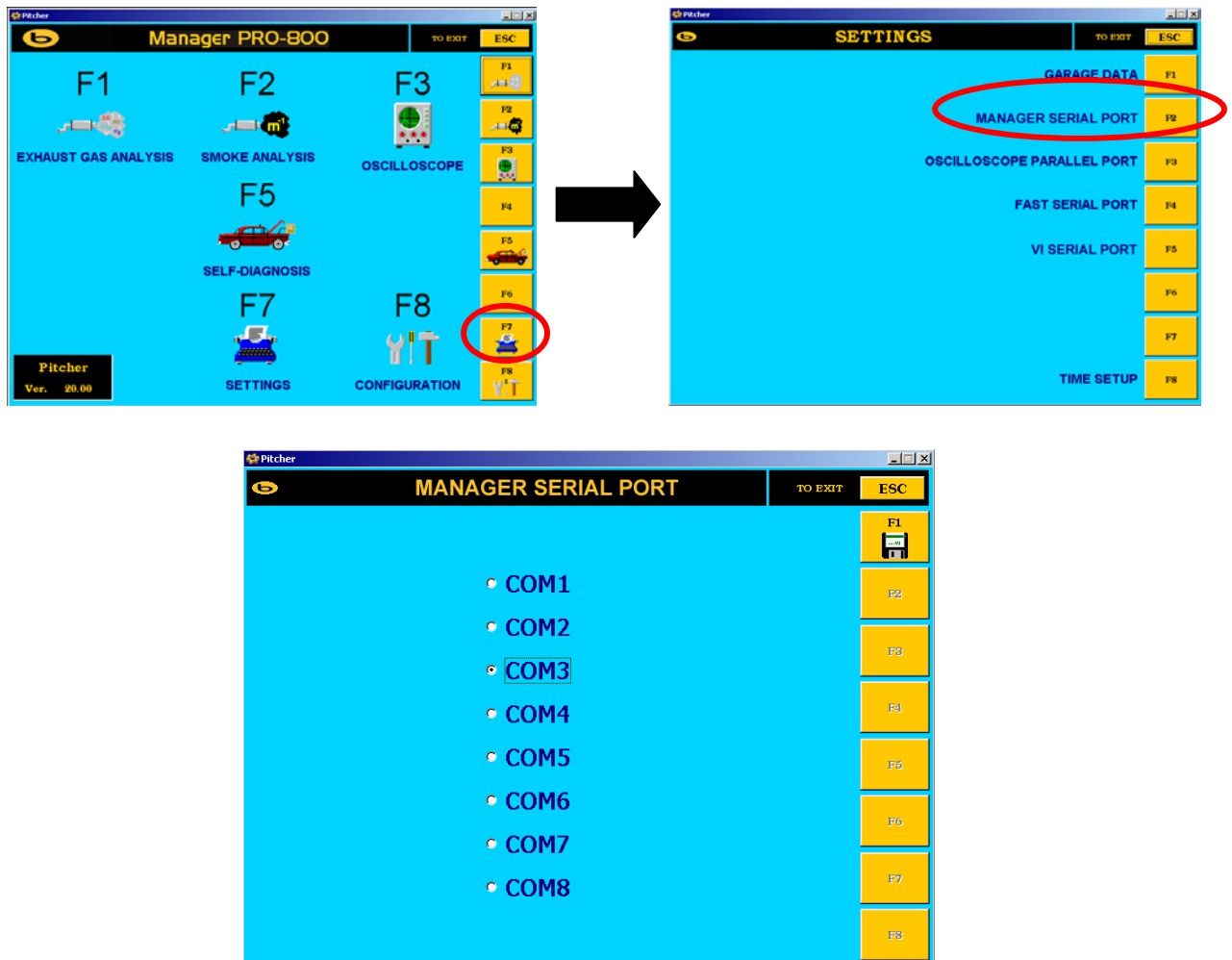


This page allows the operator to change the time. Adjust as necessary and press F1 to save changes.

OPA-100

6.4.3 SERIAL PORT SETUP

The software must be told which serial port on the computer will be connected to the Analyser / Smokemeter. Because the computer uses a USB to SERIAL adapter cable, which is connected to one of the USB ports on the computer, you must check to see which port has been set for this connection within Windows. In most cases, COM3 or COM4 will be used for this selection, but for further information then please contact the BOSTON technical team or your agent. Select F7 "SETUP" in the main menu and then press F2 "MANAGER PORT SETUP".



Use the arrows "↑" and "↓" to select the correct serial port. Press 'ENTER' to confirm and save the setting.



IMPORTANT !!!!

The correct serial port must be selected whenever the software is upgraded.

6.4.4 REVOLUTION COUNTER SET-UP

The OPA-100 must be told whether or not the wireless RF revolution counter MGT-300 will be used for RPM and Oil Temp measurement. From the main menu, press F2 "OPACITY ANALYSIS", then select F6 "CONTROLS" and lastly select F2 "TYPE OF REV COUNTER". Make the required selection.



If the operator selects to use 'OIL PROBE/RPM PIEZO CLAMP' then the oil temperature probe and RPM cables must be connected directly to the appropriate sockets on the rear of the OPA module.

If the operator selects to use the MGT300/R, then the above mentioned 'direct' connections are not necessary. The MGT obtains power from either the lighter socket inside the vehicle or by connecting to the vehicle's battery directly. The MGT is able to obtain the RPM reading from either connection, but in the event that this is not possible then the operator may use the magnetic transducer supplied with the MGT. The oil temperature probe is connected to the socket on the bottom of the MGT. All measurements taken from the MGT are transferred by Radio Frequency to the OPA. This negates the need for any trailing cables and gives greater flexibility to the operator when testing vehicles. See MGT instruction manual for further information on RPM measurement.

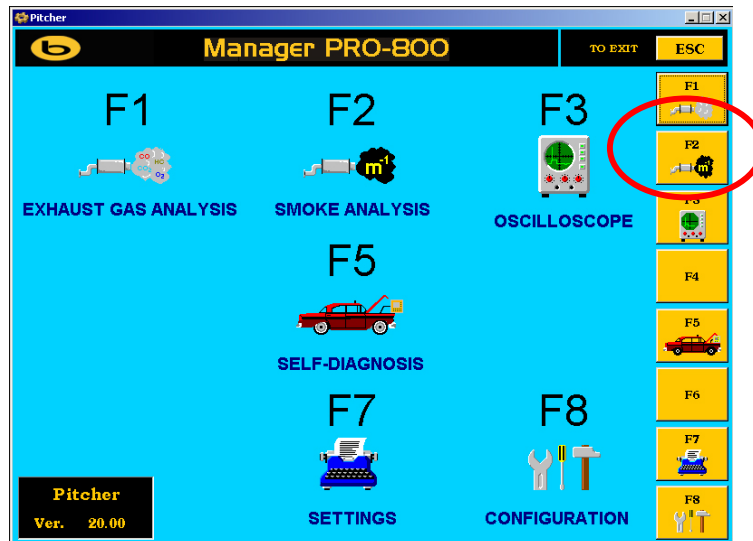
Use the arrows "↑" and "↓" to select the type of revolution counter required and then press 'F1' to confirm and save the setting.

All other setup pages relate to service and calibration and are not detailed in this manual. This information is only available to authorised engineers.

CHAP. 7 - USE OF THE INSTRUMENT

7.1 PROGRAM USE ON A PERSONAL COMPUTER

From the main menu select F2 "OPACITY ANALYSIS"



The SMOKEMETER menu will appear.



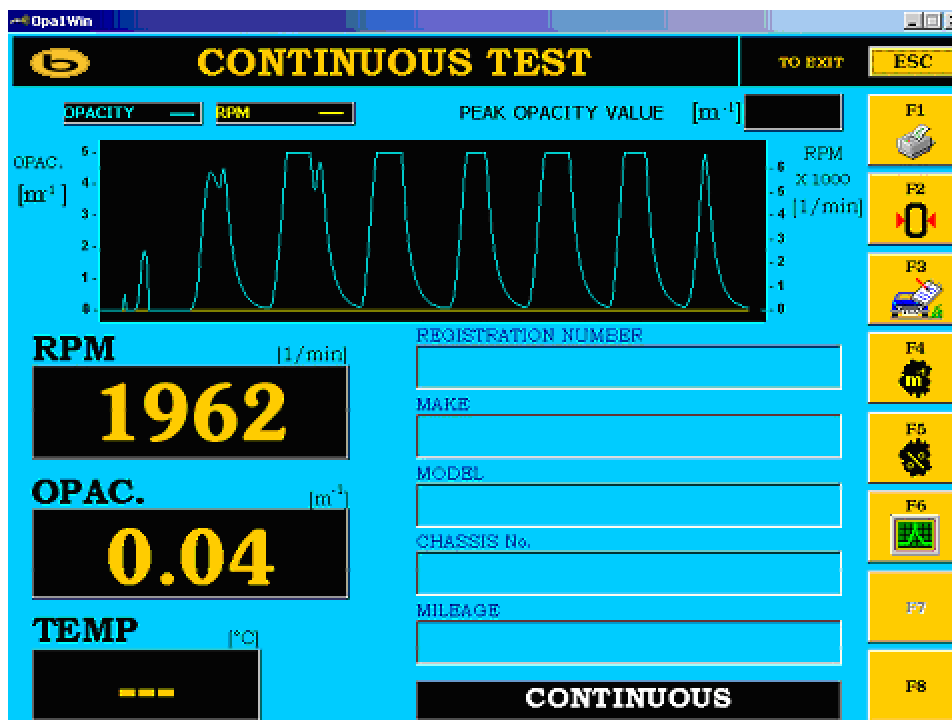
The latest software version that resides within OPA-100 is shown in the indicated box.

7.1.1 SMOKE VALUE READING IN CONTINUOUS MODE

From the SMOKEMETER menu select F1 "CONTINUOUS TEST"



The CONTINUOUS TEST page is now shown.



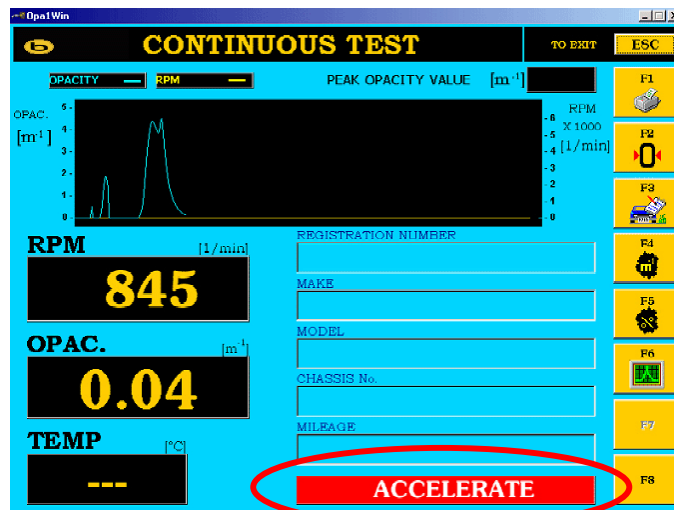
The Smokemeter will only operate after the WARM-UP period is complete. This will take approximately 5 minutes from cold. The following parameters are displayed on this page:

- OPACITY value
- Engine oil temperature
- Engine RPM
- Vehicle data
- Graph of opacity trend
- Graph of engine RPM trend

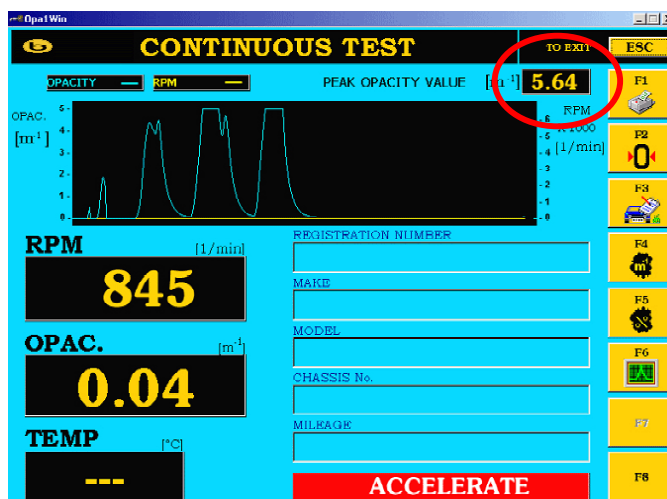
There is no pre-set time limit on this type of test, hence testing can continue for as long as required. The functions of the keys that appear on the right hand side of the display are listed below:

- F1 Immediately prints the displayed values
- F2 Performs an AUTOZERO
- F3 Vehicle data entry (only during numeric display phase)
- F4 Selects opacity measurement unit m-1
- F5 Selects opacity measurement unit %
- F6 Starts peak measurement procedure

The software is able to measure the opacity peak reading from any acceleration. To do this, press F6. The message "PEAK MEASUREMENT" will appear for a few seconds at the bottom right of the page followed by the word "ACCELERATE", as shown in the figure below.



After the engine has been accelerated, the measured peak value will appear in the top right window of the screen. This is also shown on the graphical display.



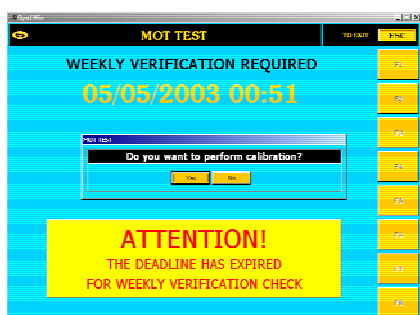
7.1.2 OFFICIAL UK MOT TEST PROCEDURE

From the main menu, press F2 to access the "OFFICIAL TEST" procedure.

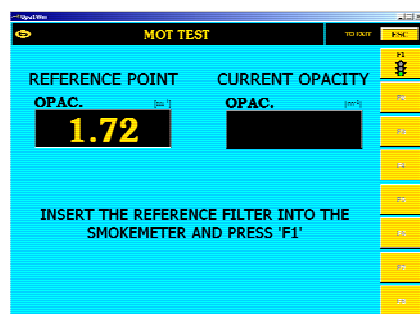
The official test procedure requires the operator to perform a calibration check every week. The OPA-100 stores the date and time of the last weekly check and will automatically display a message asking for calibration when it is required.

The operator need only follow the on-screen prompts – see the following procedure.

7.1.2.1 WEEKLY CALIBRATION CHECK

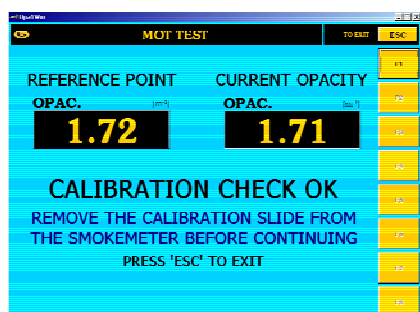


The operator is automatically notified when the weekly calibration check is required



There are two filter slide housings on the OPA-100, one on the right and one on the left. The housing on the left contains two slides. The operator must remove the glass-free slide from the left hand side of the two filters and insert the sample filter supplied with the OPA-100.

Press 'F1' when the filter has been inserted.

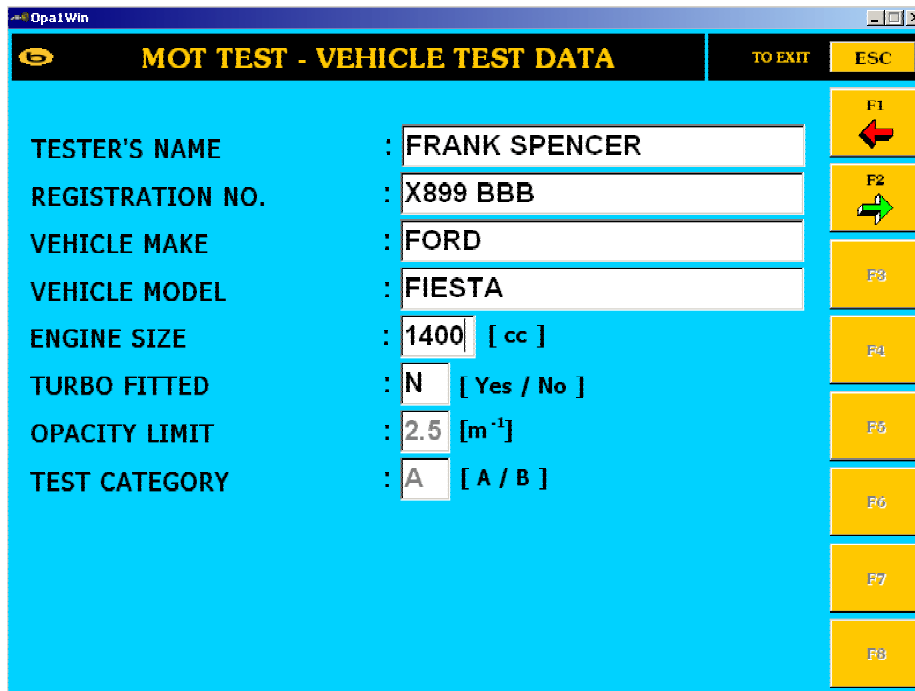


The filter value is checked against a pre-programmed reading taken at the time of official calibration. Provided the measured value of the sample filter is within high and low limits of the pre-programmed value, then the weekly check has passed. Replace the sample filter with the glass-free filter and press 'ESC' to continue.

7.1.2.2 VEHICLE DATA ENTRY

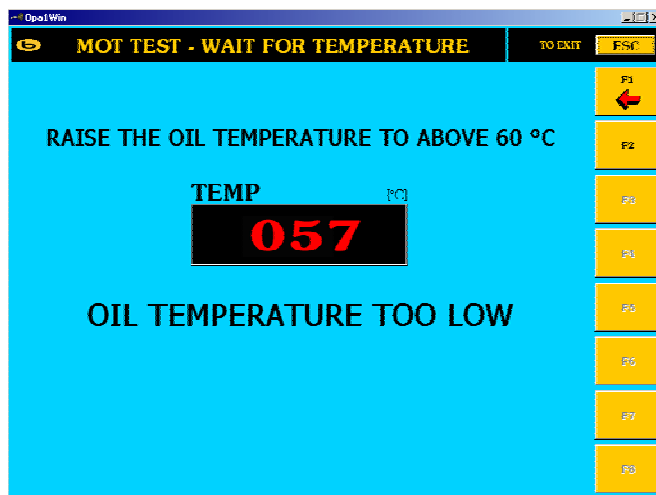
On this page the operator must enter information about the test vehicle such as the make, model, engine size etc... The operator must also select whether or not a turbo if fitted to the vehicle. The emission limits shown on the page will change automatically depending on this selection.

When this is done press 'F2' to continue.



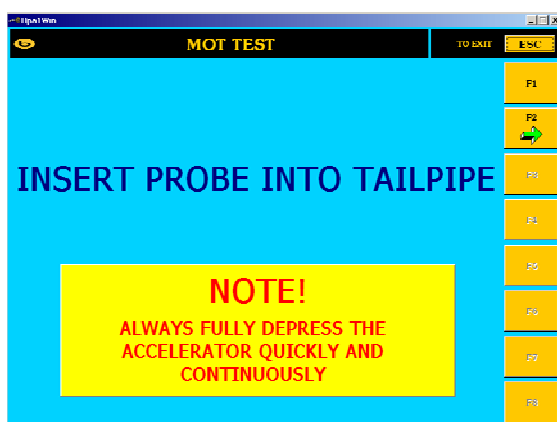
Field Label	Value	Function Key
TESTER'S NAME	FRANK SPENCER	F1 (Left Arrow)
REGISTRATION NO.	X899 BBB	F2 (Right Arrow)
VEHICLE MAKE	FORD	F3
VEHICLE MODEL	FIESTA	F4
ENGINE SIZE	1400 [cc]	F5
TURBO FITTED	N [Yes / No]	F6
OPACITY LIMIT	2.5 [m ⁻¹]	F7
TEST CATEGORY	A [A / B]	F8

7.1.2.3 OIL TEMPERATURE MEASUREMENT



The MOT procedure requires that the engine oil temperature must be AT LEAST 60°C and AS CLOSE AS POSSIBLE to 80 degrees. The operator is asked if oil temperature can be measured. If the operator selects NO, then the software will automatically perform a time penalty countdown of 40 seconds before allowing the operator to continue. This is done to stop the operator from by-passing the temperature measurement to save time.

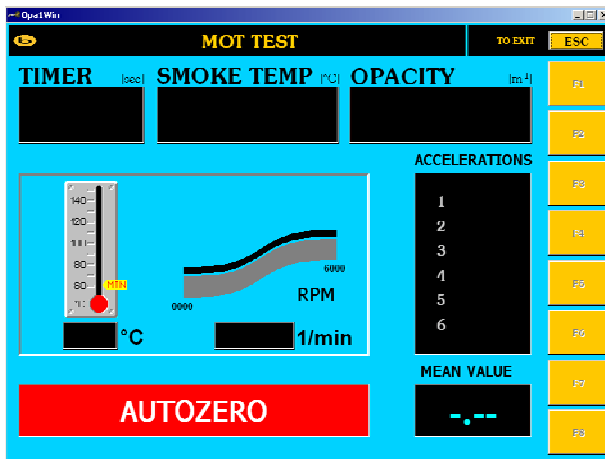
To measure the temperature, remove the dipstick from the engine and insert the oil temperature probe. When the minimum temperature has been reached (60°C), the software will allow the operator to continue by pressing 'Enter' or F2. At this point the operator may wish to wait a little longer with the oil probe in the engine so as to raise the oil temperature to as close to 80°C (or higher) before continuing. The temperature shown at the time the operator chooses to continue is that which is stored and shown on the printout at the end of the test. If at any time the temperature falls below 60°C in this page, the option to continue will be disabled.



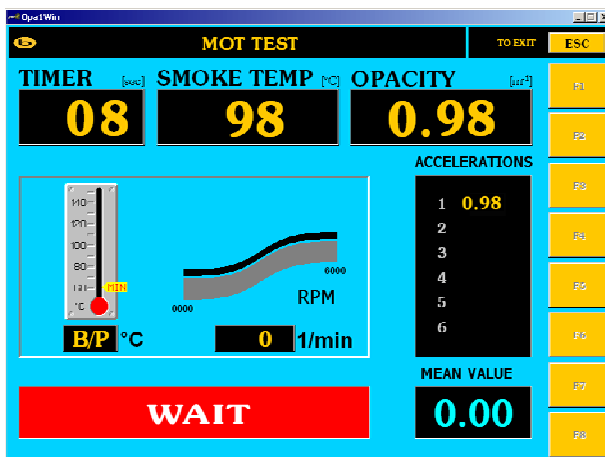
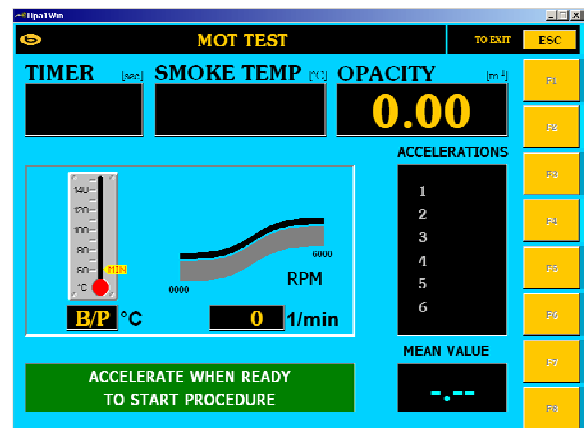
The next page instructs the operator to insert the probe into the exhaust of the vehicle. Ensure it has been correctly inserted and that it is secure. Press 'Enter' or F2 once this is done.

7.1.2.4 OPACITY READING

The software will perform an autozero before starting the test procedure. Once this is complete, the message to accelerate the engine will be shown. Rapidly accelerate the engine and maintain the engine speed until the word 'STOP' is displayed, release the accelerator pedal immediately.



At this point, the software is waiting for the first acceleration. The program will not start until this has been done.

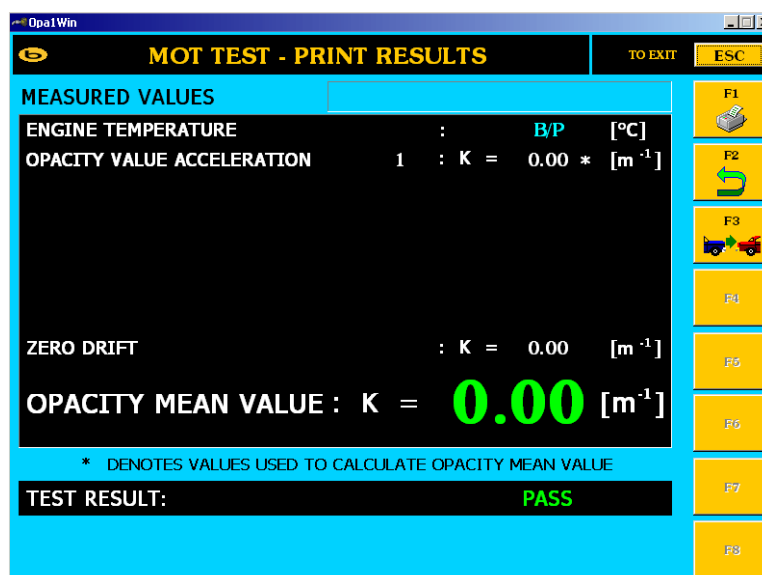


Once the program has started, there will be a 10 second countdown timer between accelerations (see top left hand corner of display). When the timer reaches 0, then the red box at the bottom of the display will turn green and the word ACCELERATE will be shown. Repeat the acceleration as before.

The software will take a maximum of 6 accelerations to calculate the mean value. However, a valid test result can be obtained if the opacity value from the FIRST acceleration is below a pre-set limit. In this case, the operator only has to perform 1 acceleration and the software will produce a pass result. This type of test is called the 'FAST PASS'. When the software has sufficient data to calculate a valid test result the test will end.

7.1.2.5 PRINT-OUT OF RESULTS

The test results are printed automatically after every official test. Two copies are produced, one is marked 'GARAGE COPY' and the other 'CUSTOMER'S COPY'. The operator can print more copies if required by pressing 'F1' after the automatic copies have been printed. It is part of the MOT test that all MOT Testing Stations keep their copy of the printout from every official test.



7.1.2.6 EMISSION LIMITS

The current emission limits are shown on the display of the front page inside the official MoT program. At the time of printing, the emission test limits were as follows.-

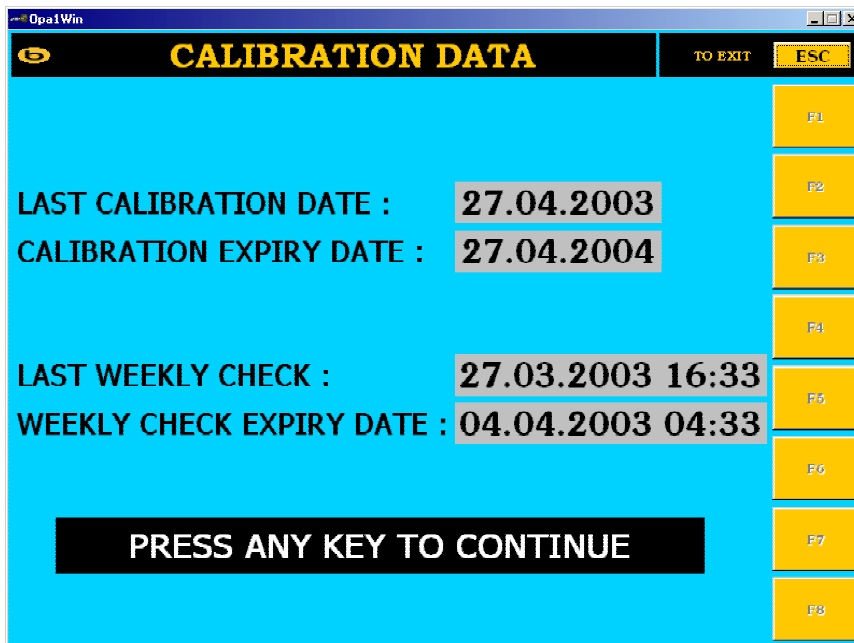
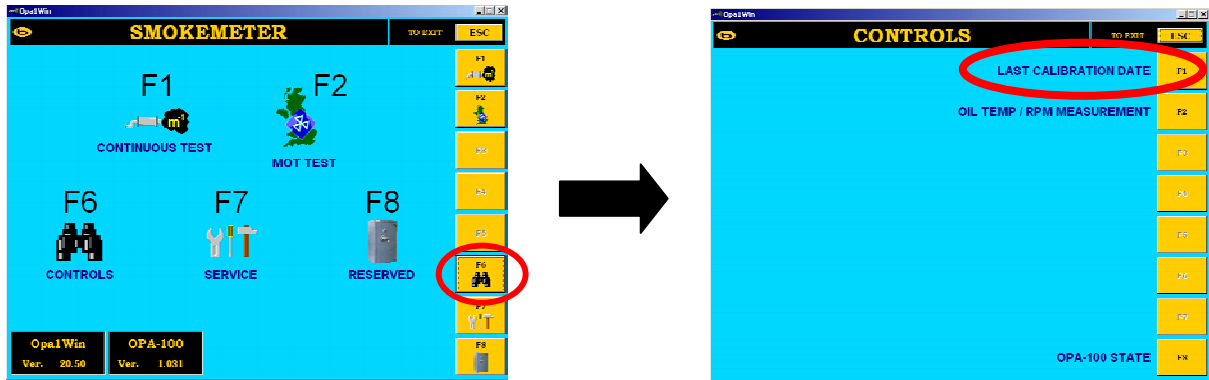
ASPIRATED ENGINES	2.5 m-1
TURBOCHARGED ENGINES	3 m-1

For current limits and further detailed information on the test procedure please call the BOSTON technical team or your service agent.

OPA-100

7.1.3 CHECKING THE CALIBRATION DUE DATE

Access the main menu and select F6 "SETUP". Now select F6 "CONTROLS" and then F1 "LAST CALIBRATION DATE".



CHAP. 8 - MAINTENANCE

This chapter contains information on how to keep your instrument in good operational condition.

The BOSTON Technical Department will be happy to supply information and answer any technical questions you may have.

8.1 How to clean the filtering system

The protective slides are very important since they prevent dirt from reaching and soiling the receiver and projector lenses. This is why it is essential to keep them clean.



The arrows point to the thumb screws and slides

To remove the slides from their housings, release the thumb screws and raise the protective covers as indicated in the figure. Grip and pull the slides out towards you.

Use a very soft non-abrasive cloth (reading glasses cloth) and correct glass cleaning detergents to clean the slides. Do not allow ring marks to remain when they dry.

8.2 ANNUAL RE-CALIBRATION OF THE OPA-100

The date of calibration expiry is shown on the printout from every official MoT test. It can also be checked at any time by following the procedure described in chapter '7.1.3 CHECKING THE CALIBRATION DUE DATE'.

It is mandatory to have the instrument checked and calibrated at least once a year. The annual inspection can only be performed by an authorised engineer, and the results from which are reported to a governing body.

The program warns the user when the annual calibration is due by means of a red page at the beginning of the OFFICIAL TEST PROCEDURE.

After the calibration expiry date has passed, the instrument can still be used, but the official test procedure is disabled until a new calibration has been carried out.

8.3 REPAIRS



All repairs that are related to the measurement and accuracy of the instrument must be documented, and if done so at the time of re-calibration, reported to the governing body.

It is the responsibility of the authorized engineers to determine the severity of repairs and the necessity of reports.

CHAP. 9 - ERRORS

This chapter lists all the errors that may appear as the instrument is used.

Full comments to all the errors displayed appear on the screen, thus further descriptions are not considered necessary.

ERROR	Cause	Remedy	Ref.
	<p>No connection between OPA /AGS and PC.</p>	<ul style="list-style-type: none"> ▪ Check serial connection cables 	
	<p>Calibration Expired</p>	<ul style="list-style-type: none"> • Call the technical service 	

CHAP. 10 - ACCESSORIES

	<p>RPM-020 Rpm measuring cable for piezo sensor. Fits OPA-100 Length 6 m.</p>
	<p>TSD-010 Piezo sensor (d. 6 mm.) to measure diesel engine rpm, for OPA-100.</p>
	<p>CA-020 12V battery power cable, with clamps, for OPA-100, AGS-200.</p>
	<p>ST-030 Temperature probe for MGT-300, (Length 2m.)</p>
	<p>ST-040 Temperature probe for AGS-200, OPA-100 (Length 6m.)</p>

For the latest information or updates to this manual, please contact your dealer or our visit our website at: www.boston-ge.com