Omitec
Modular Integrated Diagnostics

OM1700 Smokemeter

Operating Instructions

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OM1700 SMOKEMETER PROGRAM
(UK MOT/05/01/01)

OPERATING MANUAL

I321521 Issue 2.0

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Introduction

Preliminary information

Note: This Manual only describes the software controlled procedures. For all other information, refer to the Smokemeter Hardware Operators Manual.

Important

Every reasonable effort has been made to ensure that information within these Operating Instructions is correct at the time of release, but Omitec cannot accept responsibility for any errors that may occur. Errors and Omissions excepted.

The information in these Operating Instructions is subject to change without notice, and does not represent a commitment on the part of the company.

Service and warranty

The reliability of this equipment is fully supported by our service agents, with repair workshops and field service engineers able 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 full details.

Note: Your attention is drawn to our Terms & Conditions of Sale. 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.

WARNING: Do not attempt to operate this equipment unless you have read and understood these instructions.

Extremes of Weather Conditions

Extremes in weather conditions can give very low temperatures. In such weather conditions and where temperatures are likely to fall below freezing, we recommend that you leave the unit switched on at all times.

This is particularly beneficial if there is no background heating in your garage, or if there are high levels of cold through draft in low overnight temperatures.

Please note that the operating temperature range of this equipment is -15 to +40ºC.

Safety Precautions

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.

   WARNING: 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.

Introduction

OM1700 Smokemeter

Specification

Omitec has a programme of continued product development and therefore reserve the right to amend product specifications without prior notice.

While every effort is made to ensure the accuracy of the particulars contained in this document, the Manufacturers and the Authors shall not in any circumstances be held liable for any inaccuracy or the consequences thereof.

Copyright

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MOT testing

The Omitec OM1700 Diesel Smokemeter, when used with the software described in this manual, is approved by VOSA for MOT testing of the following classes of vehicle:

Category A	Cars, Light Commercial Vehicles and Private Buses (M.0.T. classes 4, 5 and 7)
Category B	Public Service Vehicles, Heavy Goods Vehicles

Introduction

The Smokemeter program is a Windows® program and uses the normal control methods associated with these programs.

A series of icons on the right hand side of the screen indicate what actions are possible. Use the mouse to move the pointer over the required icon and press the left mouse button.

Icons

MOT- initiates the test procedure.

LIVE READINGS- displays a page of live smoke readings.

EXIT- used to end current activity.

PROCEED- used to accept current selection and continue.

RETURN- used to return to the previous screen.

SUB-MENU - used to open a sub-set of Tools & Setup icons.

RETURN to Main Menu - used to return to the previous screen.

CANCEL- used to reject a setting or continue without a particular function.

REPEAT- used to restart a particular procedure.

OK- used to agree a particular setting/indication and continue.

HELP- presents a page of help information.

INFO- displays a page of information about the system.

PRINT- used to initiate a printout.

RESET PEAK- in live readings this resets the peak smoke display to zero so another peak can be displayed.

RPM SETTING- used to display RPM reading as it comes from the transducer.

RPM SETTING /2- used to display RPM reading at half the value that comes from the transducer.

BATTERY TACH RPM SETTING- used to set the number of cylinders on the vehicle engine.

TIME DATE- used to adjust clock in smokehead (please note that restrictions apply).

UKAS CALIBRATION- used to start the annual calibration procedure, password protected for use by authorised engineers only.

VTS FORM- used to enter garage details.

ZERO/SPAN- used to force a zero, span and calibration check - this is automatically performed when required.

BYPASS HANDSET- used to proceed without the use of the remote handset.

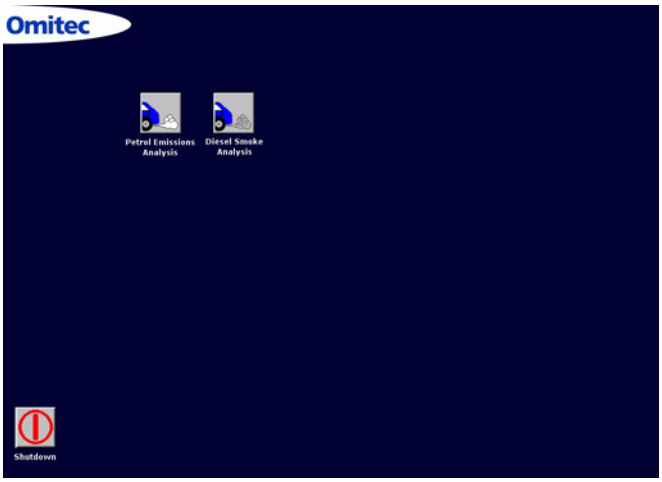
TIME PROGRESS- used to proceed using time intervals - this operation is only available for Category B testing.

OM1700 Smokemeter

NOTE: The following instructions assume that the Smokemeter software has already been installed on the computer using the instructions supplied with the software, and that the user is familiar with the operation of Windows.

For details of product hardware refer to I321526.

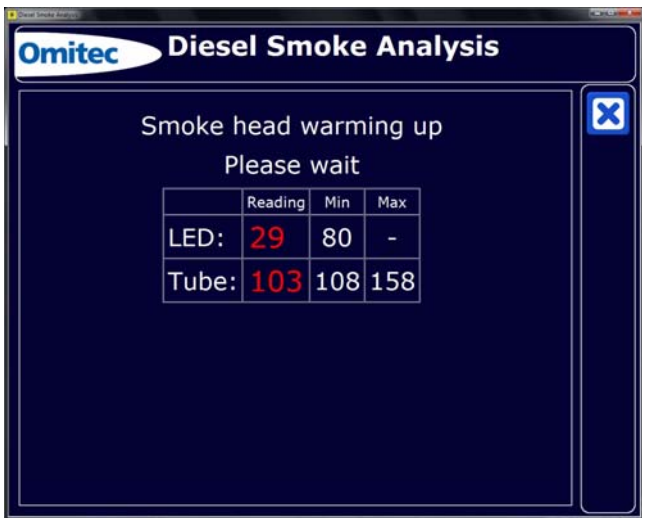
To start the Smokemeter program



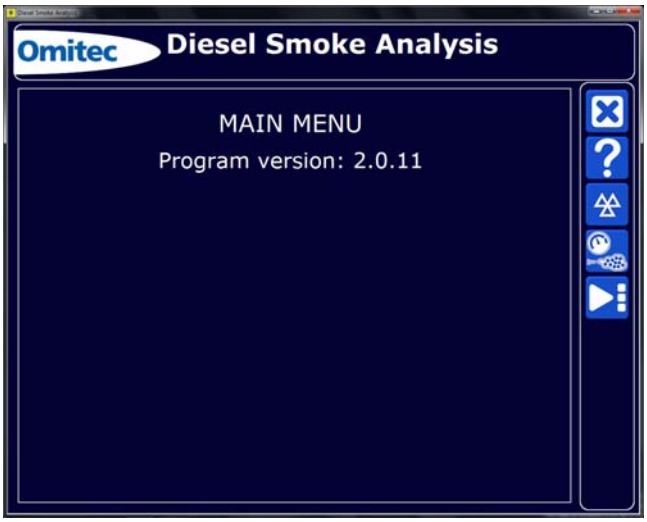
1. Switch on and wait for the menu system to be displayed.
2. Select the Smokemeter icon.

   The Smokemeter program will start and the warm up screen will be displayed.

   The first warm up of the day may take some time, possibly up to 15 minutes. Subsequent warm up periods will be approximately 30 seconds.



3. At this stage any communication problem messages will be displayed if they are appropriate.
4. After warming up the main menu will be displayed.



5. A warning alerting of ancillary equipment that has not been correctly connected will be displayed at this stage.

Menu options

Options available from this menu are given below.

EXIT- select to exit Smoke program and return to the Omitec desktop.

HELP- presents a page of help information.

MOT- initiates the MOT test procedure.

LIVE- displays a page of live smoke readings for testing and adjustment purposes.

SUB-MENU - used to open a sub-set of Tools & Setup icons.

Tools & Setup options available from the Sub-Menu:

ZERO/SPAN- used to force a zero, span and calibration check - this is also automatically performed when required.

UKAS CALIBRATION- used to start the annual calibration procedure, password protected for use by authorised engineers only.

TIME DATE- used to adjust clock in smokehead (restrictions may apply).

VTS FORM, used to enter garage details.

INFO - displays a page of information about the program and system.

RETURN to Main Menu - used to return to the previous screen.

Shut down procedure

IMPORTANT: Always follow the correct shut-down procedure before turning the power off. This prevents the hard disk being filled with unwanted files and causing operational problems at a later date.

1. Exit the main menu using the EXIT icon.
2. Double click the SHUT DOWN icon from the PC desktop.
3. After a short period the computer will shut down. It is then safe to turn the power off.

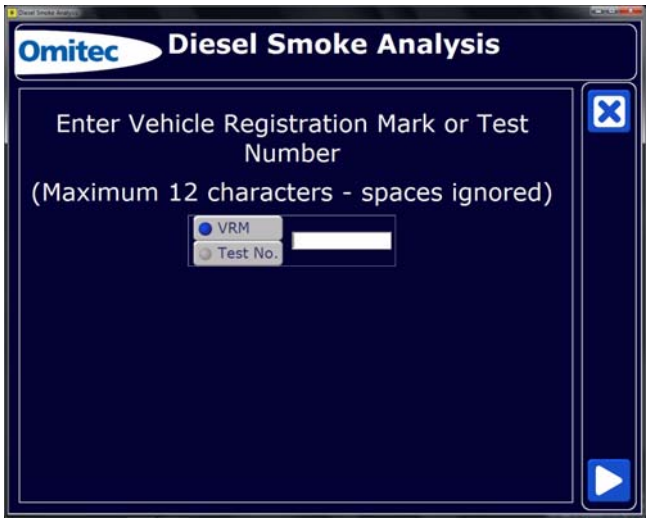
MOT test procedure

The engine must be at normal operating temperature before performing the test, either apply the test immediately the vehicle is presented or warm up thoroughly before testing.

WARNING:

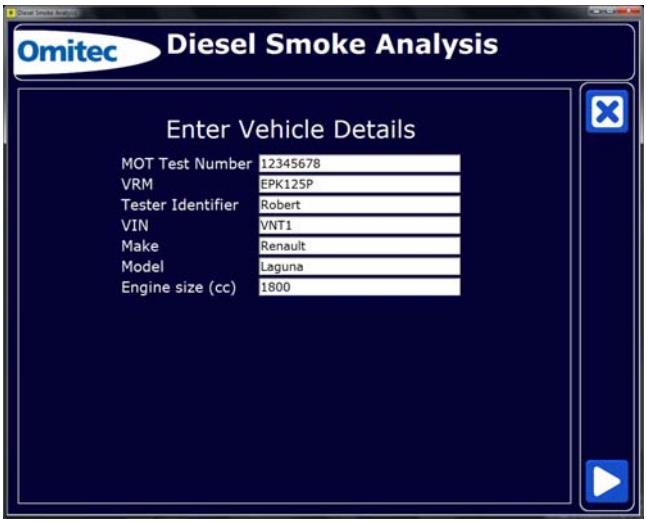
- ***If carrying out tests in a workshop, the area should be well ventilated. Alternatively, outdoor testing is permissible (see 'Outdoor Testing' in the Hardware Operators Manual).***
- ***Ensure that the vehicle is parked on level ground with hand brake applied and gear lever in neutral or park position.***
- ***Turbocharged engines should be allowed to idle for 10 to 15 seconds before switching off to ensure maximum turbocharger life.***
- ***It is recommended that prior to carrying out the M.0.T. test, the engine speed governor is checked as follows:***
- ***Fit the engine speed adapter (see section 'Engine Speed Adapters' in the Hardware Operators Manual).***
- ***SLOWLY raise the engine speed and check that the engine manufacturer's maximum speed cannot be exceeded. Do not proceed further if the engine speed exceeds the manufacturer's figures.***

1. Select the icon to initiate the MOT test.
2. Type the Vehicle Registration Mark or Test Number in the box using the keyboard. Spaces between letters/numbers are not important as they will be ignored.

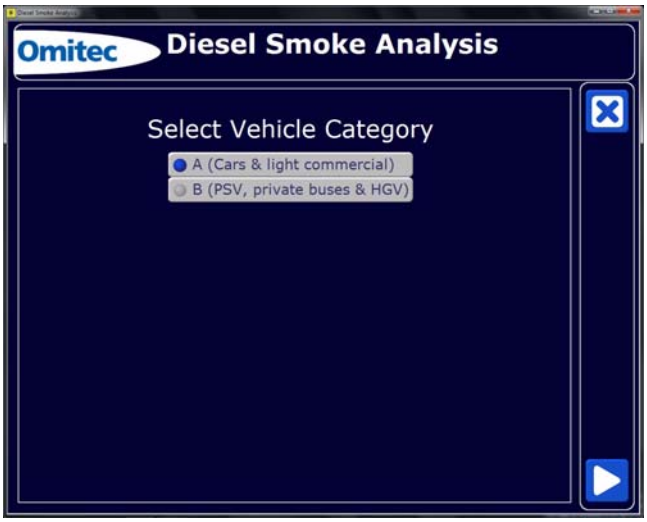


3. Provided all is well the screen will display the complete test selection to be used for this MOT

test. Check the details are correct and click the PROCEED icon to continue. Clicking the EXIT icon will ABORT the test back to the main menu.



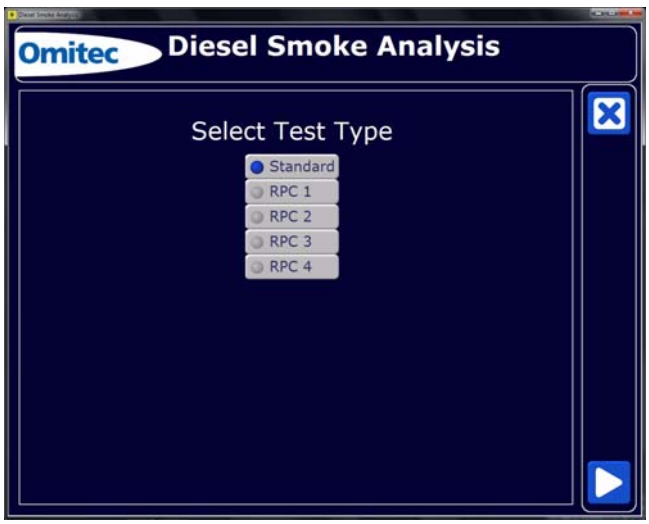
4. Select the vehicle category type then click on the PROCEED icon to continue.



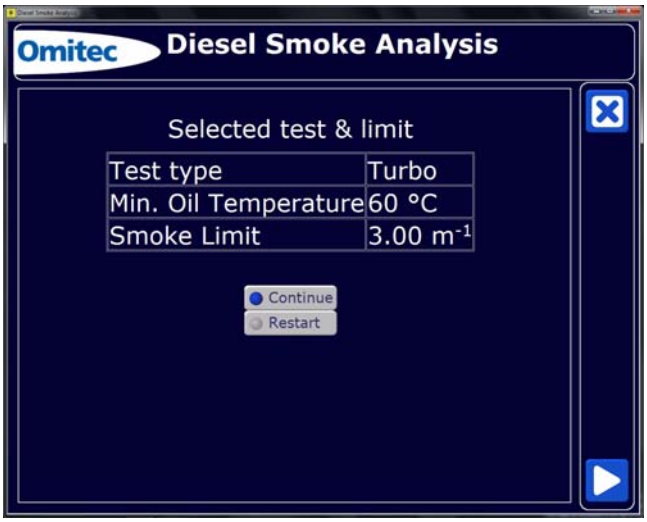
5. If Category A test for Cars & light commercial is selected then a limited choice screen is displayed.

6. If Category B test for HGV/PSV is selected then an RPC (Reduced Pollution Certificate) option is enabled.

NOTE: RPC options are only available for Category B tests.



7. If Turbo is selected the test limits will be displayed.

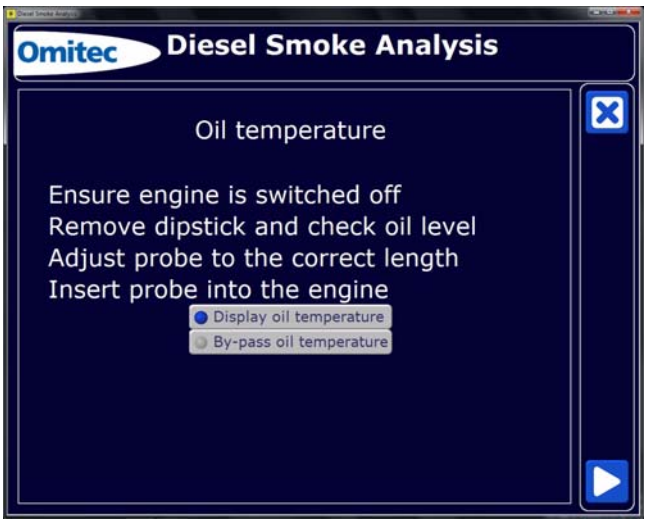


8. OIL TEMPERATURE - only applicable to classes 4 and 7.

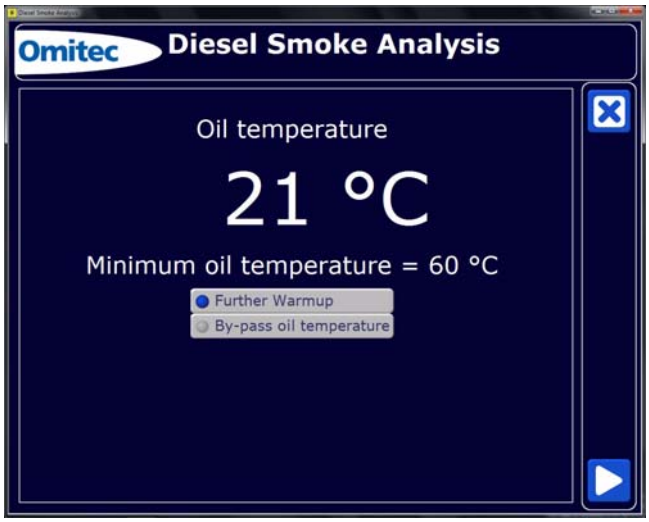
NOTE: The oil temperature procedure will be automatically bypassed if a temperature probe is not fitted.

WARNING: Ensure the oil temperature probe is set to the correct length before inserting into the engine. Failure to do so may result in serious damage to the probe and/or engine.

9. To set the probe length, remove the dipstick from the engine. Offer the probe up to the dipstick and set the moveable stop so that the effective length of probe is approximately 10mm shorter than the dipstick.



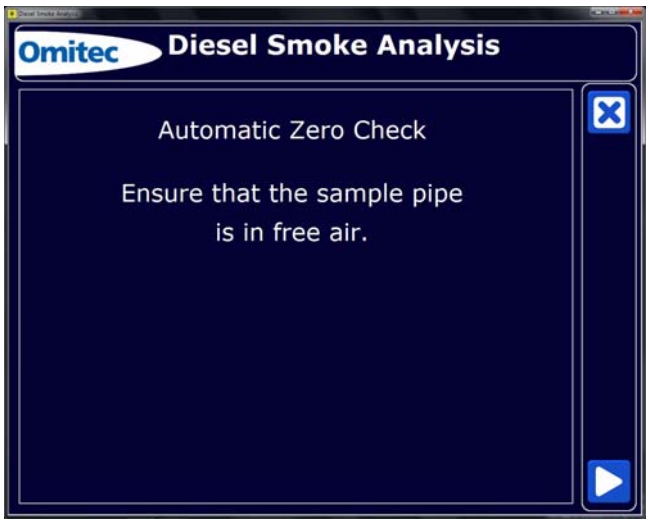
10. Select 'Display.....' or 'Bypass.....' then click the PROCEED icon to continue. The screen will then display the measured oil temperature.



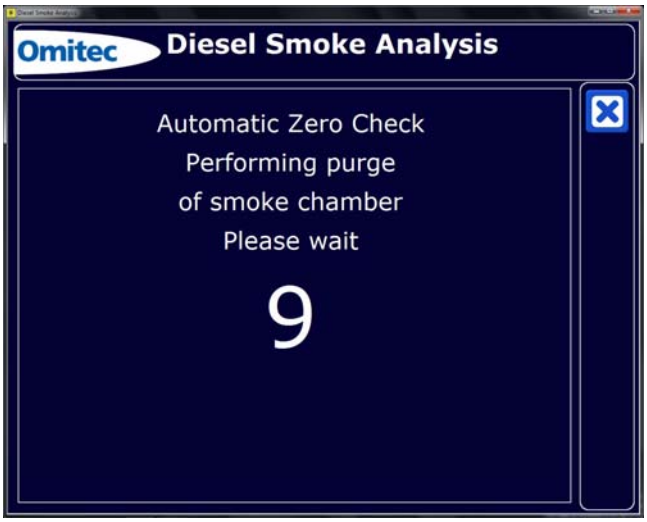
11. If the oil temperature probe is not used, the measurement may be bypassed. This will force a 40-second countdown before the procedure continues. However, it is imperative that the engine is fully warmed up before proceeding. Selecting further warm up will take the operator to an additional screen displaying engine speed to allow additional warm up of the engine if required.

12. Ensure the vehicle dipstick is refitted and then click the PROCEED icon to continue.

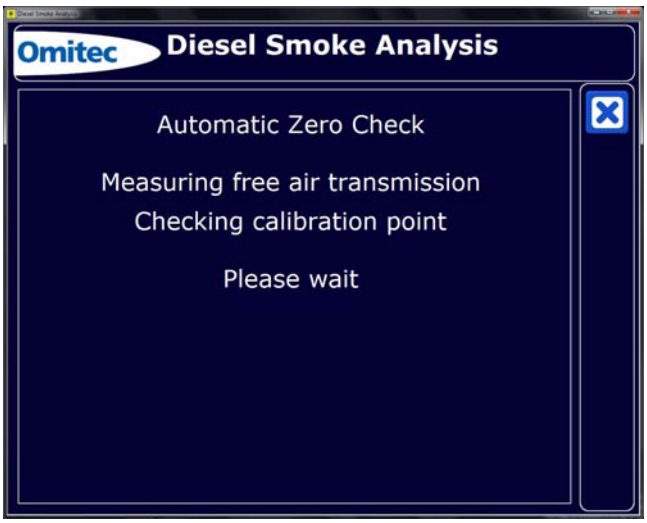
13. The equipment will perform a zero/span check during which, the following screens will be displayed:



14. Click on the PROCEED icon to continue. The unit will perform a 10 second countdown whilst purging the smoke chamber.

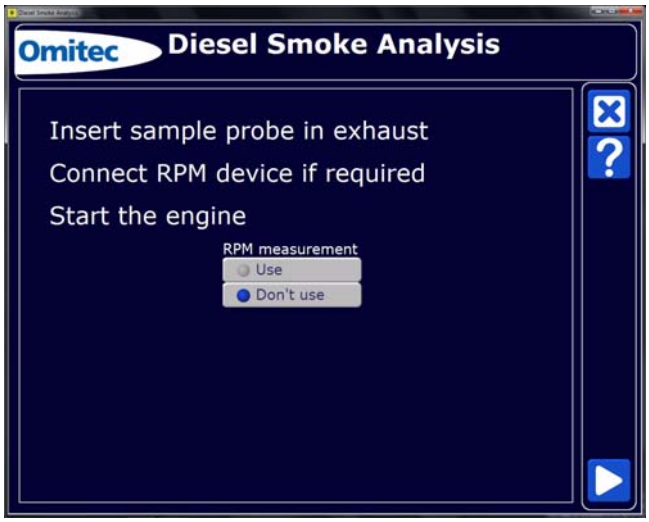


15. The following measurement and results screens are then displayed.



16. If the zero/span check fails, a warning screen will be displayed. No further testing/readings will be possible until the optics have been cleaned. Please refer to the Equipment Manual for details of lens cleaning.

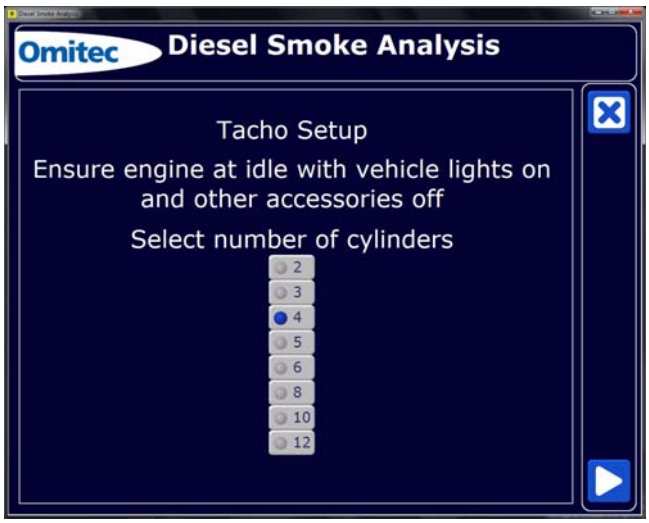
17. Once the Zero check is complete. Click the PROCEED icon to continue.



18. The RPM device will need to be initialised so that accurate readings are established and confirmed.
19. Connect the engine speed measurement device and ensure that it has been set up and is reading correctly before continuing. Refer to the on-screen set-up procedure for the appropriate device.
20. Use the buttons shown below to change the indicated engine speed where necessary.

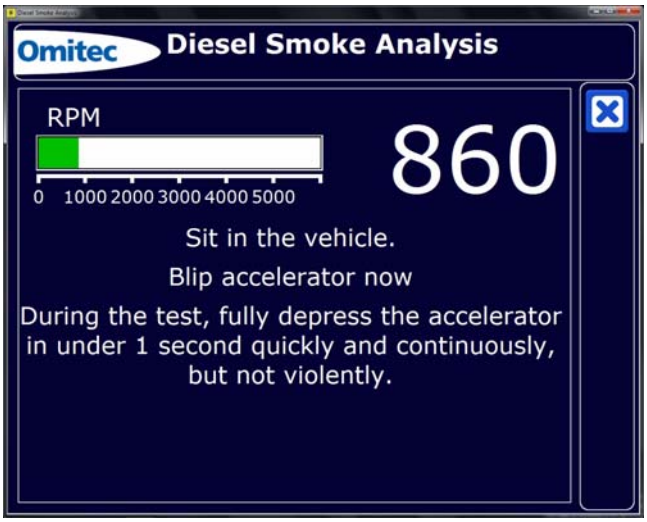
Tachometer setup

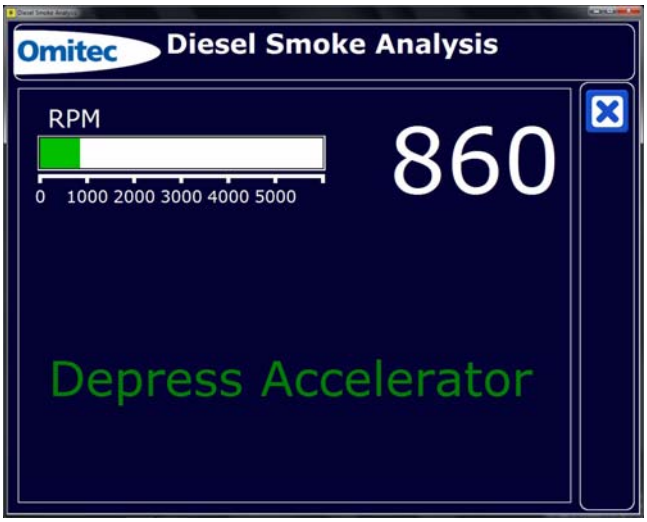
1. ***BATTERY TACH OM4600/1:*** Ensure engine is off. **BEWARE ROTATING PARTS.** Set the correct number of cylinders on the screen as prompted and attach the Battery clips to the battery noting the correct polarity. Start the engine and allow to idle. Check that the engine has reached operating temperature. Ensure all other accessories, internal blower, screen heater etc. are off but turn on the vehicle headlights. Allow the engine to idle while the OM4600/1 initialises, approximately 17 seconds. When complete the unit will read engine speed on the bar graph.



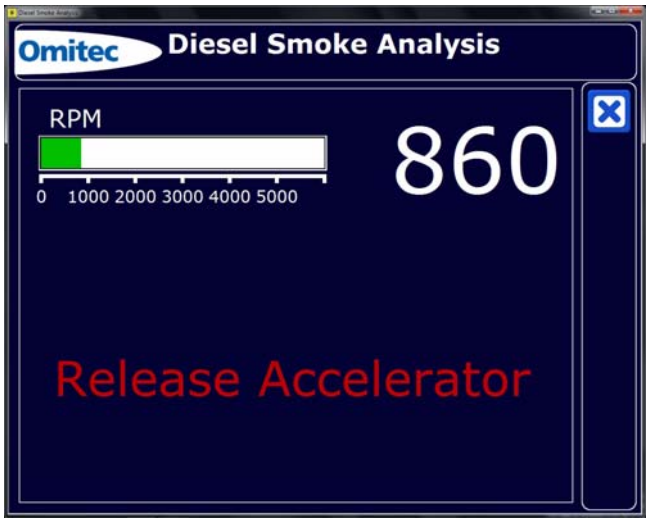
Smoke measurement

1. Sit in the vehicle so that the screen is visible and prepare to open the throttle.
2. 'Blip' the throttle briefly and then allow the engine to idle for 10 seconds. A countdown will be displayed during this period.

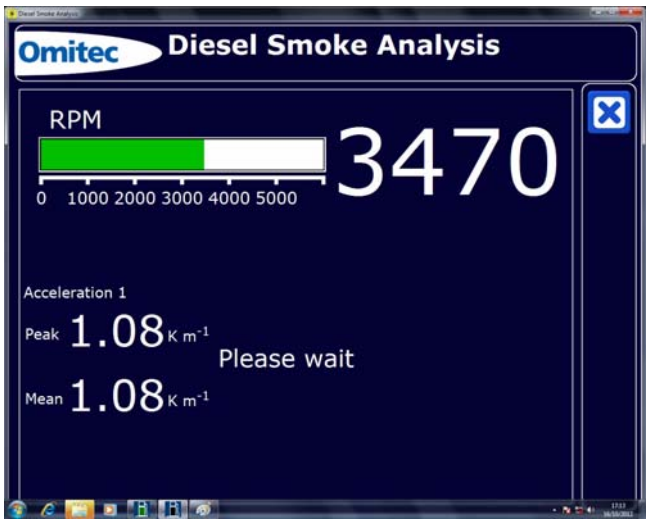




3. When instructed fully depress the accelerator pedal and hold.



4. Release the accelerator pedal immediately when instructed and wait.
5. The result of that free acceleration will be displayed and the engine allowed to idle for 10 seconds.

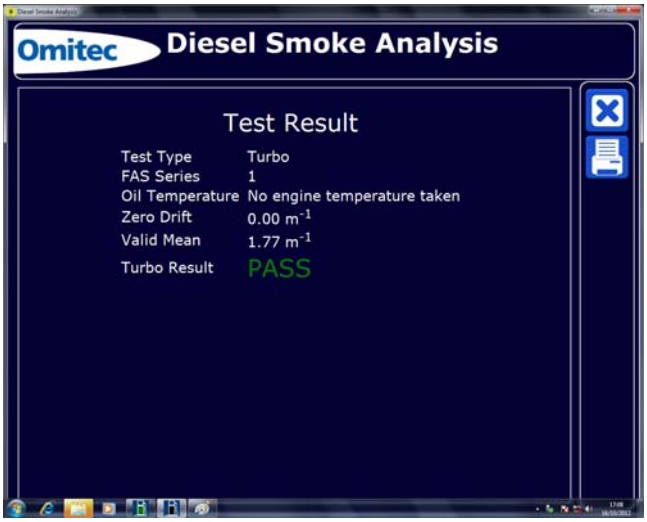


6. The MOT procedure allows a 'fast pass', the default limit of which is 1.5 m^{-1}. If the vehicle emissions are below this limit on the first free acceleration, the vehicle will be considered to be a pass and the test will end. However this feature will be disabled if RPC test is selected (Cat B Vehicles only). If the vehicle emissions are above the limit, further free accelerations will be prompted up to a maximum of six. The program will then perform another zero/span check to ensure that the optics of the smokehead have not become contaminated causing inaccurate readings. If the Zero/Span check has passed, the results will then be displayed and a printout may be obtained.

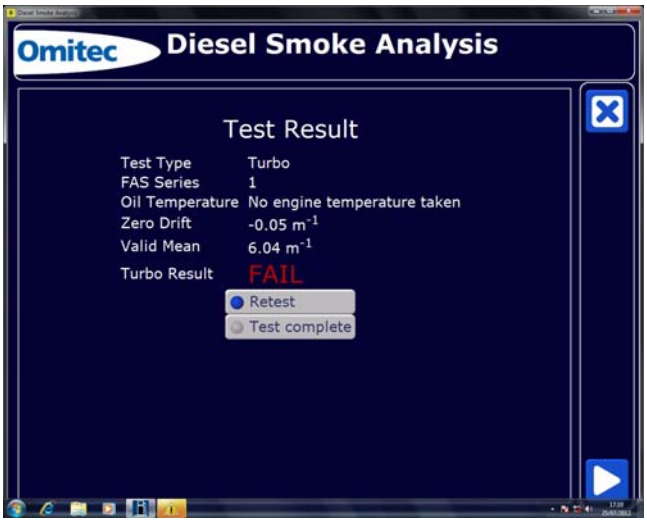
   NOTE: During the zero check, if the drift is positive but less than the allowed limit of +0.1m^{-1} or 5% of arithmetic mean (whichever is greater), it is simply subtracted from the calculated mean. If the drift is above the limit, the results are void and will not be displayed or printed. The optics should be cleaned and a retest carried out.

Test results page

Click on the printer icon to obtain a printout.



A failure will result in the option of a re-test.



Printout

The following is a typical PASS printout:

VTS Name:	Omitec
VTS Address:	Hopton Estate London Road Devizes, Wilts SN10 2EU
VTS No.:	12345

Date & Time:	25/7/2012 17:10	**Tester ID:**	Robert
MOT No.:	12329	**VRM:**	1234567
Make:	Renault	**Model:**	5
VIN:	WEY234	**Size (cc):**	1200

Omitec - Diesel MOT Smoke Test program	**Program** - Version 2.0.11.19552

MOT SMOKE TEST - Fast Pass

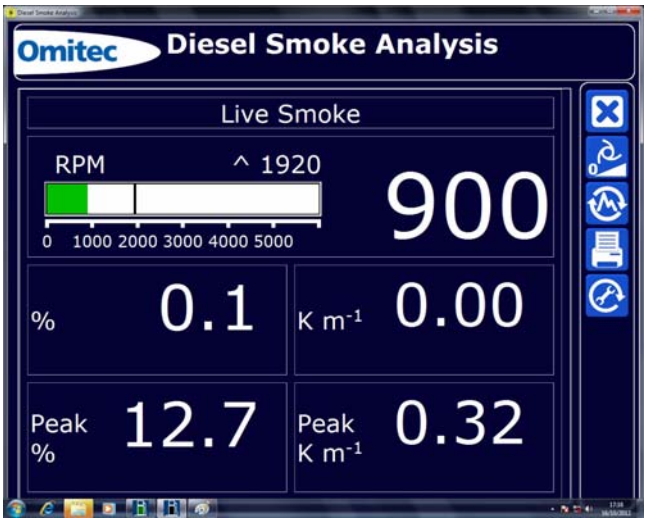
RESULT			DIAGNOSIS	LIMITS Min	Max
Oil temperature	= No engine temperature taken			60	-
Smoke Reading					
Peak 1	= 0.52	m^{-1}		-	-
Zero Drift	= 0.00	m^{-1}	**PASS**	-	0.10
Average	= 0.52	m^{-1}			
MOT Test Result					
Fast Pass	= 0.52	m^{-1}	**PASS**	-	1.50

Omitec	Diesel Smoke Analysis	

Live readings

To enter Live Readings, select the following icon.

This selects a continuous 'live' and peak readings mode enabling a single free acceleration to be carried out. The unit will perform a zero/span check and then display the live readings screen. A printout of the readings is also available.



Used to force a zero/span if necessary.

Resets the peak value.

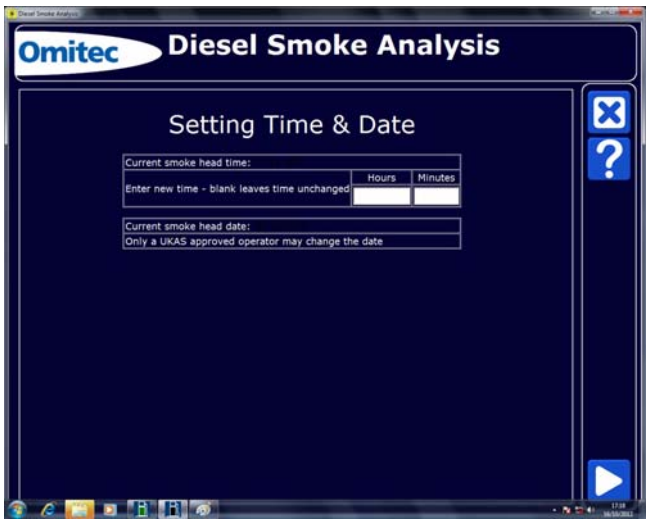
PRINT, press this to operate printer.

RPM setting.

Time adjustment

To alter the time setting, select the following icon.

This allows setting of the time only. The date setting can only be carried out by a UKAS accredited engineer.



The new time must be entered in 24-hour clock format then click on PROCEED icon. To exit without changing the time, click on EXIT icon. The unit will automatically compensate for daylight saving changes between summer time and winter time.

Calibration

To recalibrate the system, select the following icon.

VOSA Calibration Checks

It is a VOSA requirement that all makes of smokemeter used for M.O.T. testing are calibrated at intervals specified by them. Currently these are:

a. A check by the operator at least once a week.

Because the automatic calibration check described below occurs every time the Smokemeter is switched on there is no requirement for a weekly check.

b. UKAS calibration once a year.

A manual calibration check must be carried out by an approved technician; please contact the manufacturer for this service.

Automatic Calibration Check (electronic method)

The Smokemeter takes its smoke readings on a percentage scale; 0% denotes clean air (i.e. no smoke at all), and 100% denotes total obscuration of the light beam (i.e. totally black smoke). These two values are set automatically; the first by having the light beam in clean air, and the second by switching the beam off so that the sensor sees no light at all.

A calibration check at a light level of 37.5% is then performed (equivalent to $k = 1.88m^{-1}$). No optical filters are used for this check; the light level is electronically generated by special circuitry (patented).

It is necessary for the calibration to be checked regularly since the 0% point (full light through

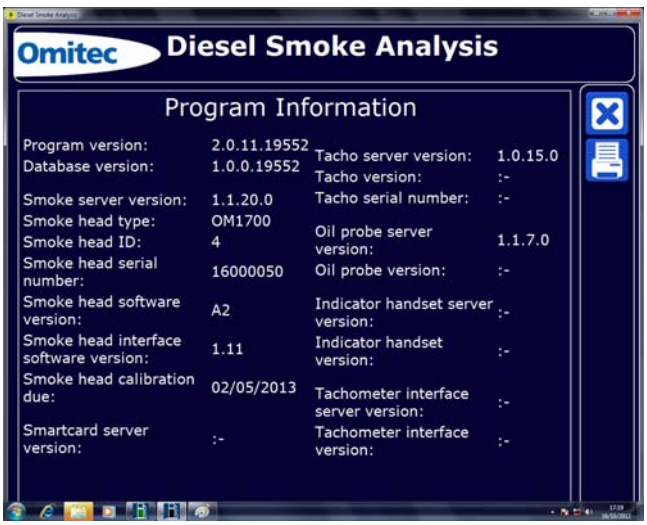
chamber) can be affected by any soot which may land on the lenses during use. For this reason, the Smokemeter automatically performs a zero/span check at the start of each test or at any time that the Calibrate icon is selected.

The tolerance on the 'mid point' calibration check is 35.9% to 39.0% (equivalent to k = 1.88 ± 0.1 m^{-1}). If it fails outside this limit, a warning is displayed and the 'MOT' test modes will be disabled. If this situation occurs - contact the manufacturer.

Information

To request program information select the following icon.

Clicking this icon displays a page with system information, including software version numbers. This can be printed and may useful when calling the product help line should any problems be encountered.



Conversion charts

Conversion chart for k, HSU, FSN and mg/m3. (Extracted from MIRA Report No. 1965/10, Nuneaton 1965, AG Dodd and Z Holubecki.)

k coefficient of light absorption m^{-1}	Hartridge Smoke Units	Filter Smoke Number	Mg/m^3	Cal % (*)
0,25	10	1,10	33	6.1
0,27	11	1,20	38	6.5
0,30	12	1,30	42	7.2
0,32	13	1,40	47	7.7
0,35	14	1,48	52	8.4
0,38	15	1,57	57	9.1
0,41	16	1,67	62	9.7
0,43	17	1,75	66	10.2
0,46	18	1,84	71	10.9
0,49	19	1,93	76	11.5
0,52	20	2,02	81	12.2
0,55	21	2,10	86	12.8
0,58	22	2,18	91	13.5
0,61	23	2,26	96	14.1
0,64	24	2,34	101	14.8
0,67	25	2,42	106	15.4
0,70	26	2,50	111	16.1
0,73	27	2,57	117	16.7
0,76	28	2,64	122	17.3
0,80	29	2,71	127	18.1
0,83	30	2,77	133	18.7
0,86	31	2,83	138	19.3
0,90	32	2,89	144	20.1
0,93	33	2,96	150	20.7
0,97	34	3,02	156	21.5
1,00	35	3,08	162	22.1
1,04	36	3,14	168	22.9
1,07	37	3,20	174	23.5
1,11	38	3,26	181	24.2
1,15	39	3,31	187	25.0
1,19	40	3,37	193	25.7
1,23	41	3,42	199	26.5
1,27	42	3,47	206	27.2
1,31	43	3,53	213	27.9
1,35	44	3,59	220	28.6
1,39	45	3,64	227	29.4
1,43	46	3,70	234	30.1
1,48	47	3,75	241	30.9
1,52	48	3,80	248	31.6
1,57	49	3,86	256	32.5

(*) Optical path length, L = 0,25 m

Conversion charts

NOTE: For the OM4600, all scales except 'Cal %' include compensation for the temperature of the smoke. Hence the Smokemeter's conversion from 'Cal %' to the other units will only follow this table if the smoke temperature is 100°C.

k coefficient of light absorption m^{-1}	Hartridge Smoke Units	Filter Smoke Number	Mg/m^3	Cal % (*)
1,61	50	3,91	264	33.1
1,66	51	3,96	272	34.0
1,71	52	4,01	281	34.8
1,76	53	4,07	290	35.6
1,81	54	4,12	299	36.4
1,86	55	4,17	308	37.2
1,91	56	4,22	317	38.0
1,96	57	4,27	326	38.7
2,02	58	4,32	335	39.6
2,07	59	4,37	345	40.4
2,13	60	4,42	355	41.3
2,19	61	4,47	365	42.2
2,25	62	4,52	375	43.0
2,31	63	4,57	385	43.9
2,38	64	4,62	395	44.8
2,44	65	4,67	406	45.7
2,51	66	4,72	416	46.6
2,58	67	4,76	428	47.5
2,65	68	4,81	439	48.4
2,72	69	4,86	450	49.3
2,80	70	4,91	462	50.3
2,88	71	4,96	475	51.3
2,96	72	5,01	489	52.3
3,04	73	5,07	501	53.2
3,13	74	5,12	514	54.3
3,22	75	5,17	529	55.3
3,32	76	5,23	544	56.4
3,42	77	5,28	559	57.5
3,52	78	5,34	575	58.5
3,63	79	5,40	591	59.6
3,74	80	5,45	609	60.7
3,86	81	5,51	626	61.9
3,99	82	5,57	648	63.1
4,12	83	5,65	669	64.3
4,26	84	5,72	691	65.5
4,41	85	5,80	712	66.8
4,57	86	5,87	737	68.1
4,74	87	5,95	760	69.4
4,93	88	6,04	786	70.8
5,13	89	6,13	815	72.3
5,35	90	6,22	844	73.7

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 only be carried out by an engineer from our Authorised Agents. Failure to observe these conditions will invalidate the guarantee.

On-Site Service / Overhaul / Spare Parts

UK Help lines

If you require a Service Engineer to attend ON SITE, either due to an equipment fault, or for machine calibration, or if the equipment covered by this manual requires to be sent back for factory overhaul, or if you need spare parts, please contact our Product Support Help line at the following number:

Email: support@omitec.com

Tel: 0844 665 7681

Fax: 0844 665 7605

Omitec provide information and contracts covering the following:

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