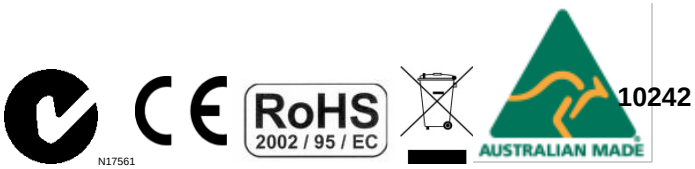
User Manual
Version 1.39

AUTO*TEST*™ Diesel Smoke Meter

AUTO SMOKE

AUTO TEST
Products Pty Ltd



DECLARATION OF CONFORMITY
We, Auto Test Products Pty Ltd. declare under our sole responsibility that the product AutoTest Diesel Smoke Meter is in conformity with the provisions of the following Council Directive: 1999/5/EC.
A copy of the Declaration of Conformity is available from http://www.autotest.net.au

AUTO TEST
Products Pty Ltd

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1. FOR YOUR SAFETY

Read these simple guidelines. Not following them may be dangerous. Read the complete user guide. Further detailed information is given in this manual.

SWITCH ON SAFELY

Do not switch the device on when wireless device use is prohibited or when it may cause interference or danger.

INTERFERENCE

All wireless devices may be susceptible to interference, which could affect performance.

SWITCH OFF WHEN REFUELING

Do not use the device at a refuelling point. Do not use near fuel or chemicals.

USE SENSIBLY

Use only in the positions as explained in the product documentation.

QUALIFIED SERVICE

Only qualified personnel may install or repair this product.

WATER-RESISTANCE

This device is not water-resistant. Keep it dry.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user guide for detailed safety instructions. Do not connect incompatible products.

BE MINDFUL OF HOT SURFACES

Watch out for hot temperature zones of vehicles, particularly the engine head, exhaust pipe, and radiator hoses.

BE MINDFUL OF MOVING PARTS

Watch out for engine cooling fan. Watch out for any moving parts of a running engine. Watch out for the engine cooling fan and any other moving parts of a running engine.

RISK OF FUMES INHALATION

Inhalation of fuel and exhaust fumes is harmful to health. Never start vehicles in a closed area. Always work in a well-ventilated area.

RISK OF DAMAGE TO EYES

Wear safety goggles when operating near vehicle battery as Battery acid, fumes, oil and dust particles might cause damage to the eyes.

2. **ACRONYMS**

AC	Alternate Current – Mains supply
CC	Cubic Centimetre
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DC	Direct Current – Battery supply
DSM	Diesel Smoke Meter
ECU	Engine Control Unit
EGA	Exhaust Gas Analyser
HC	Hydro Carbon
KM	Kilometre
Lambda (λ)	Engine efficiency
MOT	Ministry of Transport
NO_x	Nitrogen-Oxides
O_2	Oxygen
PC	Personal Computer – Desktop or a Laptop computer
PEF	Propane/hexane Equivalency Factor
PPM	Parts per million
RPM	Revolution Per Second – Engine speed
SPI	Serial Peripheral Interface Bus

3. **UNPACKING AND FIRST TIME USE**

Congratulations on your choice of AUTO*TEST*™ Diesel Smoke Meter (Auto Smoke). Please take the time to read this document before using Auto Smoke in the field. Incorrect or inappropriate use of this instrument may void the warranty. Please retain the packing materials for future shipping and transport of the unit for periodic calibration.

Please complete the warranty registration card and post it to AUTO*TEST*™ Products Pty Ltd, alternatively visit our website www.autotest.net.au and complete your warranty registration on line. Your warranty registration ensures that you are kept up-to-date on any software or hardware changes to your AUTO*TEST*™ Diesel Smoke Meter (Auto Smoke). It also helps us to provide you with faster services.

4. PRODUCT DESCRIPTION

4.1 Overview

AUTO*TEST*™ Diesel Smoke Meter (AUTO SMOKE) is intended for measurement of smoke opacity of diesel-run engines. Auto Smoke is intended for passenger cars and light commercial vehicles, and is approved for MOT testing of Category A vehicles (including MOT Class IV, VII and Single Vehicle Approval Scheme vehicles). Auto Smoke measures smoke opacity in terms of *light absorption coefficient* (K) or m^{-1}.

Auto Smoke has a built-in wireless device to communicate with Auto Gas. Smoke tests can be carried out using a PC connected to Auto Gas. When Auto Gas and Auto Smoke are both powered up in a close range, a wireless connection will automatically be established between the two.

Auto Smoke is durable and resistant against shocks and vibrations, dirty environment, light rain, EMI emission. The equipment complies with the EC requirements (CE certified). Auto Smoke is compliant with the following standards:

ISO:
- ISO3173
- ISO11614

CE Directive (Smoke measurement):
- 72/306/CEE
- 91/441/CEE

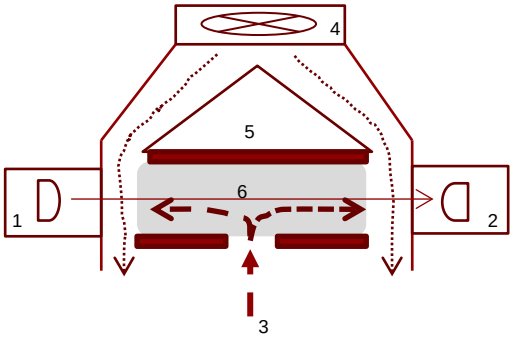
CE Directive (Emission test in Europe)
- 96/96/CE (20 Dec 1996)
- 2003/27/CE (03 Apr 2003)

4.2 Auto Smoke Mainframe

The mainframe of Auto Smoke contains all the necessary electronic and mechanical assemblies required for measuring the smoke opacity. The side panel of the mainframe unit contains power input plug and an On/Off switch, as well as all the necessary input/output connector ports. A smoke sampling probe provided with the unit allows the exhaust smoke to pass into the sampling chamber, where the intensity of the smoke is measured.

4.3 **Measurement Technology**

Auto Smoke uses light emitting diode (LED) to determine the opacity of the exhaust smoke. The following diagram outlines the smoke opacity measurement principle used in the Auto Smoke.



1	Light Source	4	Ventilation fan
2	Light Detector	5	Heating elements
3	Exhaust Gas Input	6	Measurement cell

The exhaust smoke flows through the smoke inlet port through the measurement cell or smoke chamber and out from the outlet ports. At one end of the measurement chamber, an LED light source emits visible light between 480 nm and 680 nm with a peak value of 565 nm. The light is emitted in pulses every 20 millisecond to reduce the effects of ambient static light. The light source is protected by a convex lens, which reduces reflections on the walls of the measurement cell.

On the opposite end of the smoke chamber, a detector receives the emitted light by the LED light source. The lens of the detector is protected and the temperature is maintained at 45°C to avoid variation in measurement due to the effects of variations in temperature. The detector detects the amount of light that is lost on its way from the emitter to the detector and correlates it to the opacity of the smoke/gas in the gas bench.

The temperature of the smoke bench tube is maintained at 80°C to eliminate condensation building up in the smoke chamber.

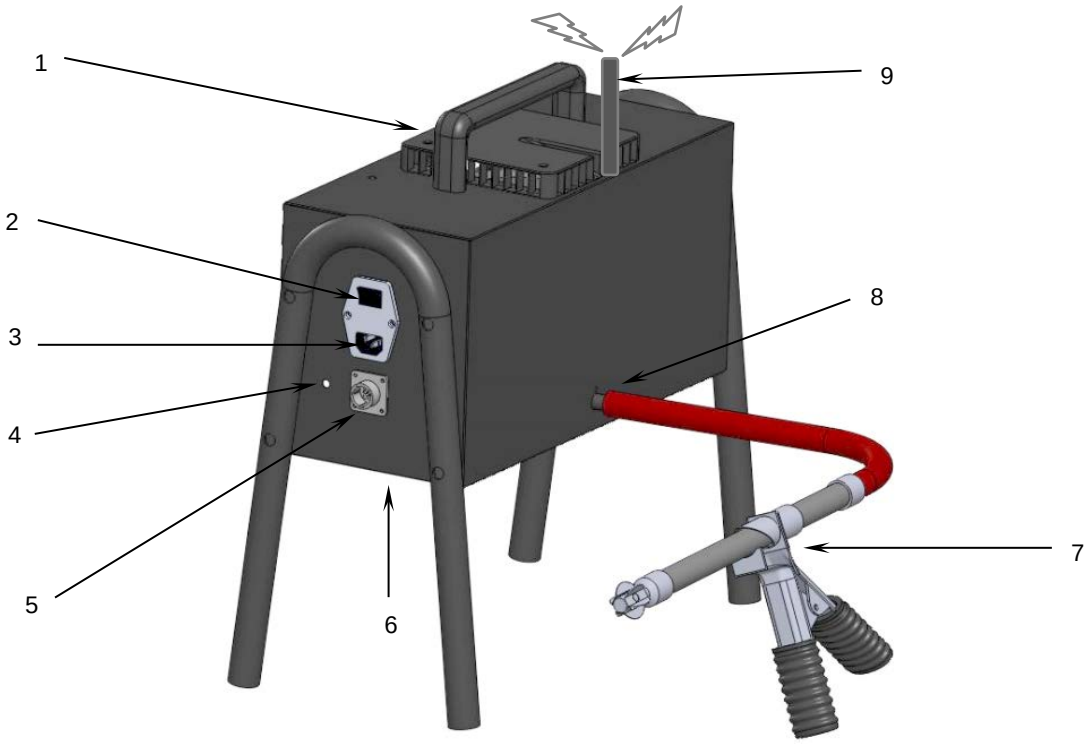
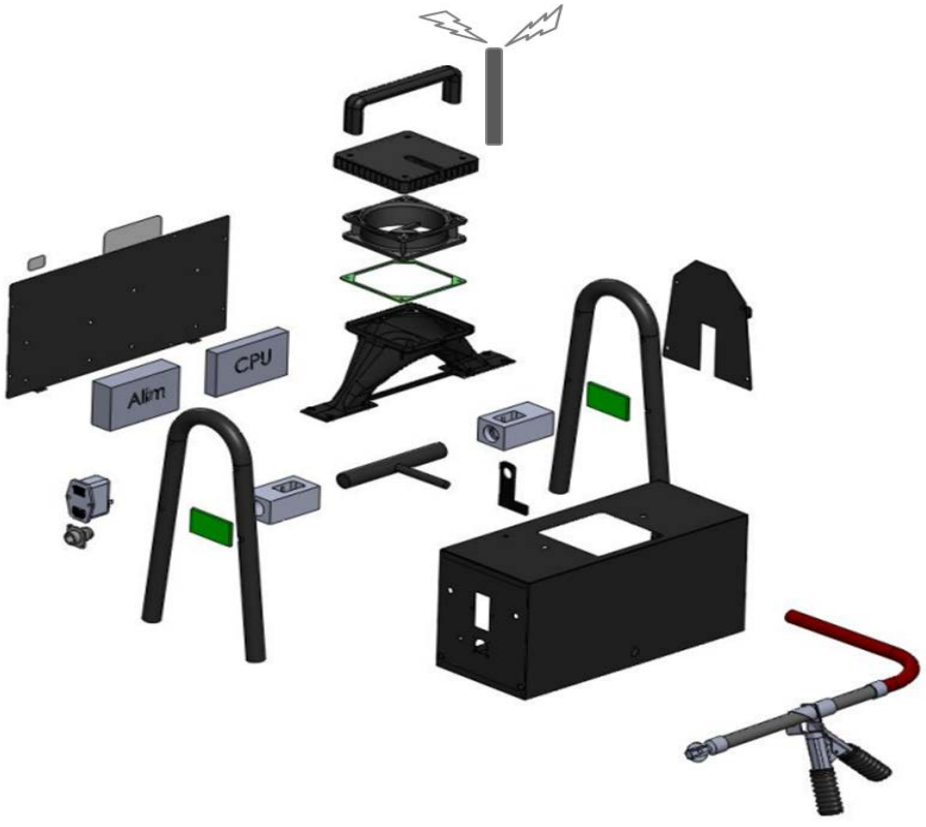


Fig. 1

1	Exhaust fan	6	Gas outlet port
2	ON/OFF switch	7	Sampling probe
3	AC input	8	Smoke gas inlet
4	Status Indicator LED	9	Wireless RF antenna
5	PC connector		



When Auto Smoke is first started, it will go through its initial warmup process. The warmup time should not be longer than 10 minutes over a temperature range of 0-50°C. Once the warmup is complete, Auto Smoke will try to maintain the temperature of the measurement cell at 80°C.

A built-in fan aids in preventing the lenses from sooting, in maintaining the effective length and in favouring gas evacuation. The fan is equipped with an RPM sensor, which is used to monitor the constant speed of the ventilation fan. Smoke sooting may deposit over glass windows of the sensor and detector over time. Cleaning of the class windows once a month is sufficient under most cases. The lenses must be cleaned with a dry cotton-duster.

The surface of the measurement cell is made of black-mat-anodic-aluminium, thus the reflection of the emitted light on the inner walls is eliminated. The chamber tube has a length of 186 mm (±0.5 mm) and a diameter of 21 mm.

4.4 **Standard Accessories**

The following table lists the standard accessories supplied with Auto Smoke.

Smoke sampling probe Adjustable up to 26 mm length with diameter of 34 mm (Code: 151016)	
AC Power Cord (Code: 151019)	
Cleaning brush (Code: 151025)	
Optical filter (weekly check filter) (Code: 151026)	

4.5 Turning On the Device

AUTO*TEST*™ Diesel Smoke Meter (Auto Smoke) can be powered up using AC power supply (AC mains, wall socket). Some selected smoke meters can also operate on vehicle's 12V battery.

4.5.1 Using AC Mains

When running Auto Smoke using AC mains, please ensure that the AC supply meets the following conditions:

110 – 230 V_{AC} (+10% to -15%) at 50-60 Hz (±2%) frequency

Ensure the live phase is on the right side of wall socket. Phase to Neutral voltage should be 230V_{AC} and Phase to Earth should be 230 V_{AC}.

4.5.2 Using Vehicle Battery (DC power supply) (Selected models only)

When running Auto Smoke via the vehicle's battery, please ensure the rating of the vehicle's battery is over 60 AH. The battery voltage must not exceed the maximum rated voltage.

The tolerance of the DC power supply is given below:

- 13.5 V_{DC} ±15%
- 65 W power rating

To power up Auto Smoke using a vehicle's 12V_{DC} battery, connect one end of the supplied battery cable to DC input of the Auto Smoke and connect the other end, which contains two clamps, to the terminals of the vehicle's battery. Ensure that the red clamp connects to the positive (+) terminal of the battery, and the black clamp connects to the negative (-) terminal.

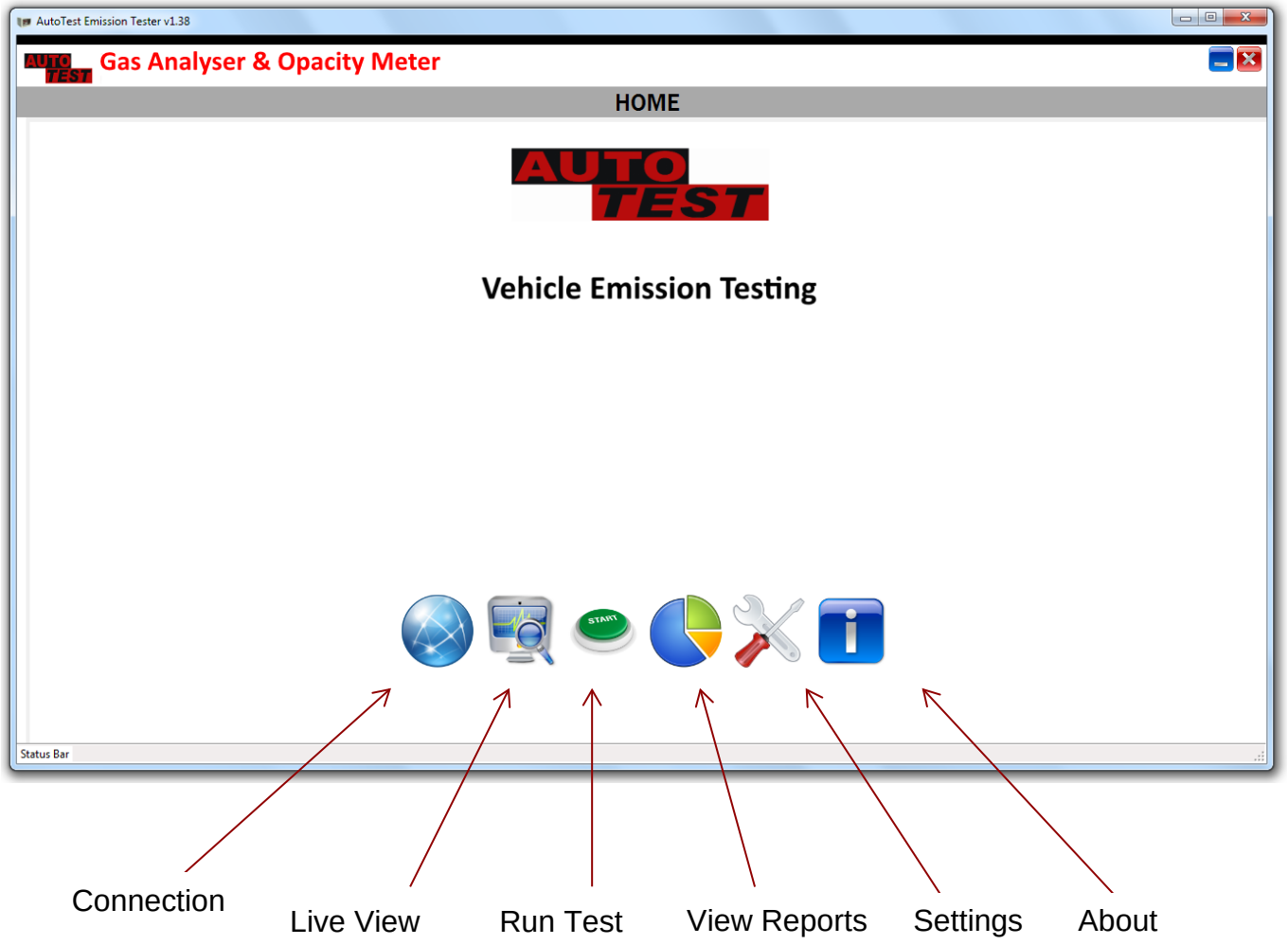
Once the battery cable is connected, use the ON/OFF switch to turn ON or OFF the device.

5. INTERFACING AUTO GAS WITH PC

Turn ON Auto Gas and let it go through its initialisation. Connect one end of the PC interface cable to the back of Auto Gas and connect the other end to a PC. If the PC does not have a serial port, use a USB-to-serial cable. Once the PC interface cable is connected, turn ON the PC and run the AutoTest Emission Test software.

5.1 Using PC Software

AutoTest Emission Tester software allows users to configure a smoke meter as well as to perform an MOT smoke test.



5.2 Software Installation

Installing the PC software:
(System Requirements: Microsoft Windows 2000 or greater, .NET Framework 2.0, one unused serial port, 100 MB of hard disk space)

1. Insert AutoTest Emission Test Software CD into your CD-ROM drive.
2. Select and run file "*setup.exe*"
3. Follow on-screen prompts to complete installation

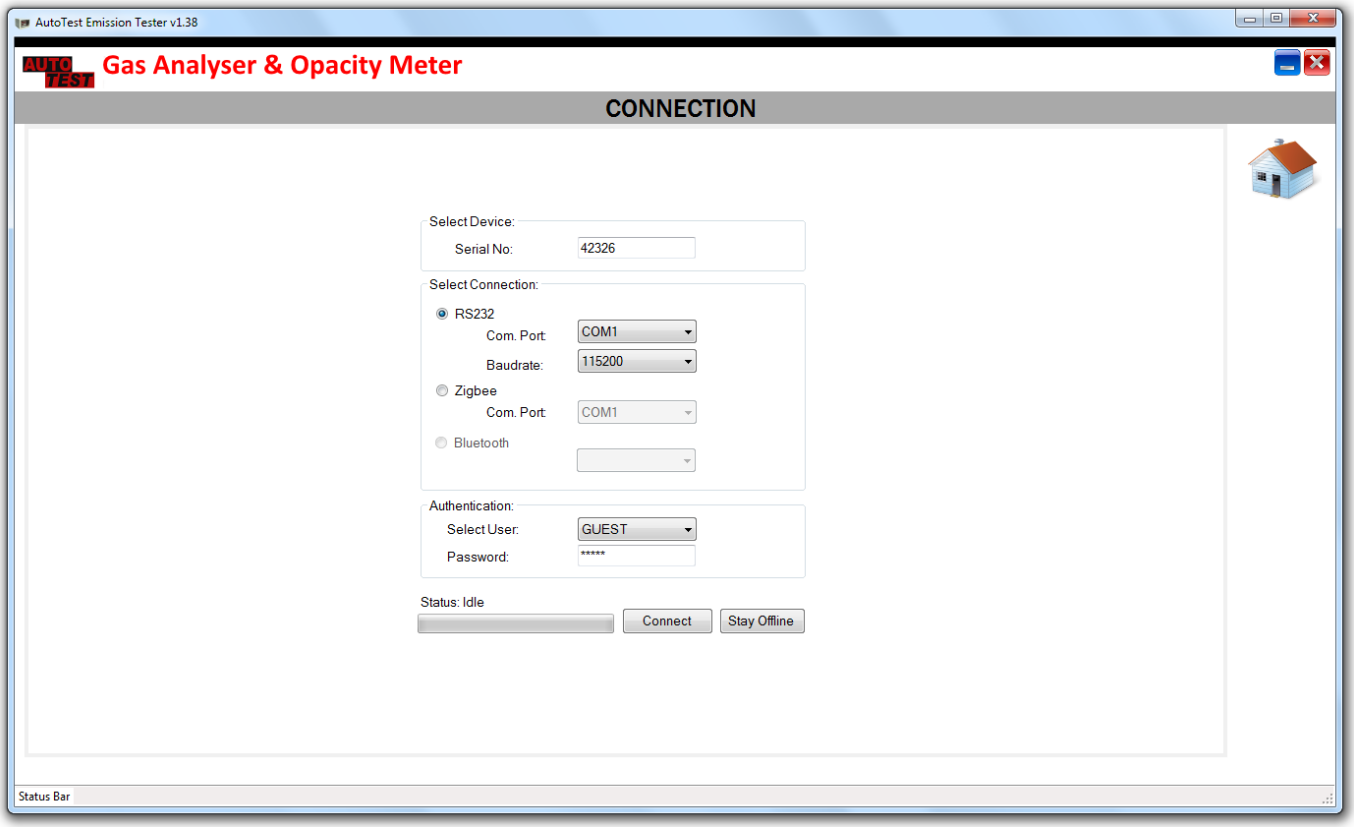
Start the PC software once it has been installed successfully.

5.2.1 Interfacing via RS232 Serial cable

Connect one end of the supplied serial cable to the Auto Gas Analyser and connect the other end to the PC. If the PC does not support RS232 connectivity, a USB-to-Serial adapter can be used.

Turn ON Auto Gas Analyser. On the PC, run the AutoTest Emission Test software.

Once the application is started, click on  connection icon to start the connection.



Select the serial COM port to which the Auto Gas is connected. For desktop computers with RS232 support, the communication port is likely to be COM1. If a USB-to-serial adapter is used with the serial cable, then enter the communication port number that the computer displays on

the lower-right corner of the screen (near clock) when the USB connector is attached to the computer. The baud rate should be selected as 115200.

For the authentication, select user as "GUEST" and the password as "guest". Click on Connect button to start the connection.

Licence activation

AutoTest Emission Test software requires a valid licence to connect to the gas analyser. When the software prompts to enter a licence code, enter licence code supplied with the software and then click on Activate. If the activation code is valid, the serial number of the gas analyser will appear in "Devices Currently Activated" list.

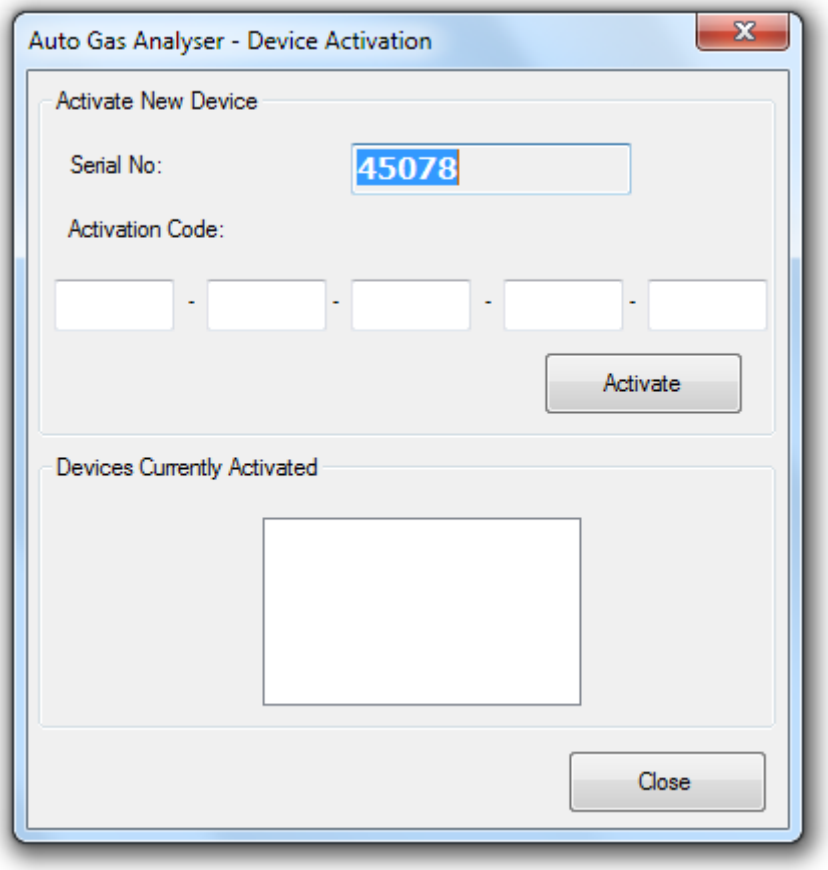
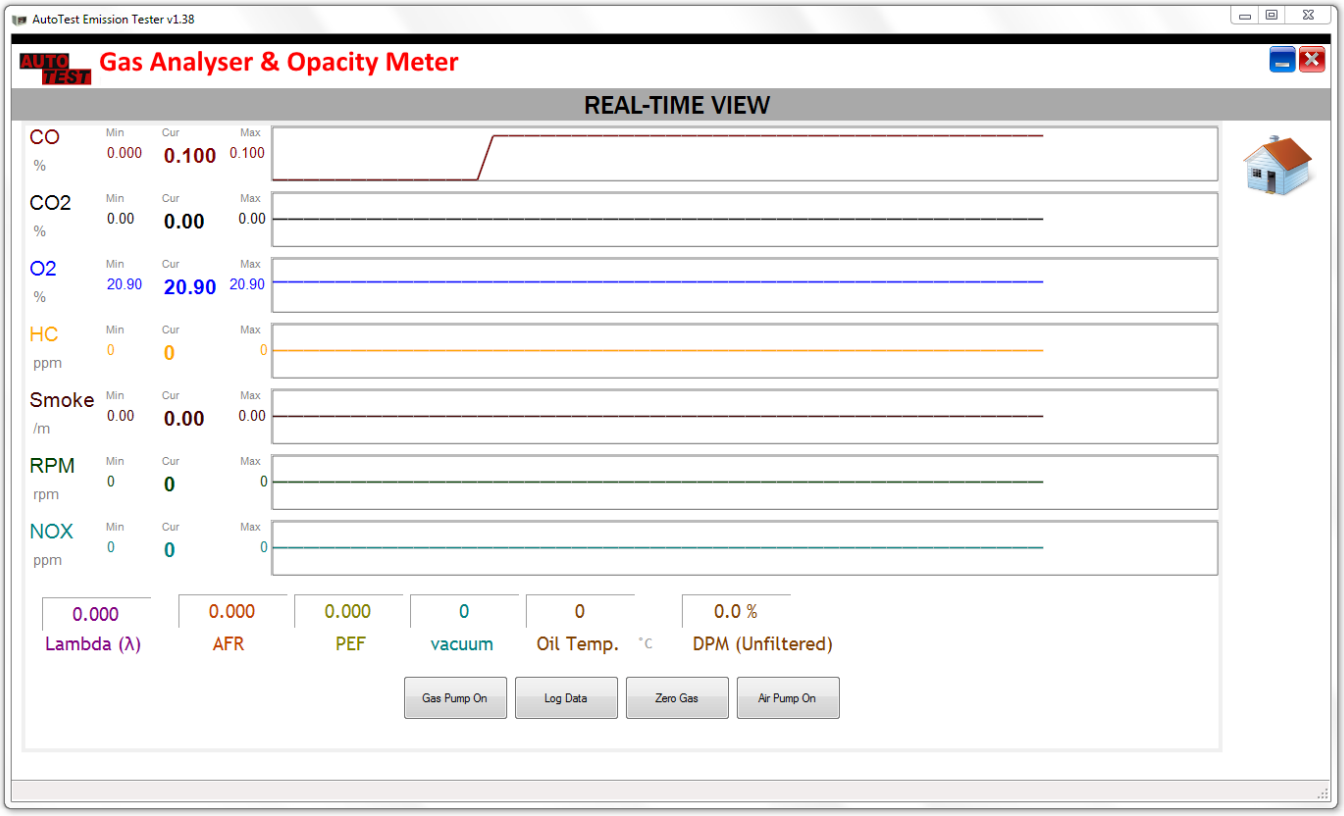


Figure 1 – Device Activation Window.

Note: It is important that you keep the licence code in a safe place in case if you need to reuse the code on another computer or on the same computer after system reset.

5.3 **Live gas readings view**

When the gas analyser is connected to the PC software, click on  "Live view" icon to view real-time gas readings on the PC screen.



Click on "Pump On" button start the gas pump to sample gas readings.

6. INTERFACING AUTO SMOKE WITH AUTO GAS

Auto Smoke can be interfaced with Auto Gas via the built-in wireless device. To operate Auto Smoke via Auto Gas, turn ON both devices. When both devices are operating in a close range, a wireless connection will be automatically established between the two devices.

6.1 Pairing Smoke Meter

It is not necessary to pair the Auto Smoke to the Auto gas if they were purchased together. However, in case you have purchased the Auto Smoke alone, you will need to pair it with the Auto Gas.

To pair an Auto Smoke opacity meter with Auto Gas, run the AutoTest Emission software and then connect to Auto Gas. Turn ON Auto Smoke if it is switched off. Click on Settings icon () then select "General" page. Click on "Pair Smoke Meter" button to pair a smoke meter. When prompted to enter the serial no, enter the serial number of the smoke meter that is intended to be paired. The serial number can be found on side of the smoke meter. The smoke meter should now have paired with Auto Gas.

7. DIESEL SMOKE TEST VIA AUTO GAS

7.1 Preliminary checks

Make sure the vehicle is securely parked. The vehicle should be running at normal operating temperature. Do not carry out the test in an enclosed area. Always take caution when working near engine or moving parts. Make sure the vehicle contains sufficient engine oil.

7.2 Equipment Setup

Securely park and connect all necessary accessories to the gas analyser and smoke meter and make sure the vehicle engine is OFF.

Turn ON Auto Gas and let it go through its initialisation. Turn ON Auto Smoke and let it warm up to its operating temperature.

7.3 Engine oil temperature measurement

Connect the supplied oil temperature probe to Auto Gas. Before inserting the oil temperature probe into the oil dipstick, take out the oil dipstick from the vehicle and extent the oil temperature stopper by pressing its lock button until the length of the oil temperature probe equals with the length of the oil dipstick. Insert the temperature probe in place of the oil dipstick until the cable stopper prevents it going deeper any further. Turn ON the vehicle and you will notice the oil temperature value rising as the vehicle heats up.

If the oil dipstick housing tube is wide enough to hold the oil temperature-sensing probe and the dipstick together, then insert the oil dipstick over the previously inserted oil temperature probe to prevent any dust entering into the engine compartment.

Note: Always ensure the oil dipstick and oil temperature probe are clean before inserting them into engine housing.

Warning: If the oil temperature probe is longer than the dipstick, it could get in contact with the moving parts of an engine and cause damage to the engine compartment and the temperature-sensing element.

Note: If OBD-II device is used during the test for RPM measurement, it is not necessary to attach oil temperature probe as the engine oil temperature reading will be taken from OBD-II.

7.4 Engine RPM measurement

If engine RPM is required to during the smoke test, make sure you setup the engine RPM measurement device before the test is started. The engine RPM can be measured using one of the following methods:

1. Using an OBD-II reader plugged into the car
2. Using an optional accelerometer sensor
3. By running Auto Gas via vehicle battery

7.4.1 RPM using OBD-II interface

Engine RPM and oil temperature can be obtained from the vehicle's engine via the OBD-II interface. If the vehicle does not support the OBD-II interface, the OBD-II scanner should not be used to measure the RPM.

OBD-II scanner connects to the vehicle's OBD-II interfacing port and transmits the engine RPM and oil temperature readings of the vehicle to the gas analyser via Bluetooth.

Locate the OBD-II port on the vehicle, which is usually located under the steering wheel or near the fuse box. Once the OBD-II port is located, plug the OBD-II scanner. Make sure the engine is switched off and the key is positioned to the OFF position before plugging in the OBD scanner.

Once the OBD-II is plugged into the vehicle, start the smoke test and then select "OBD-II" as the RPM source during the test.

Note: If the BT OBD-II is enabled, it might take the gas analyser up to 20 seconds at the start of the test to scan the OBD-II scanner device.

7.4.2 RPM using Battery Cable

To measure engine RPM via the vehicle battery, run Auto Gas via vehicle's 12V battery. Disconnect AC Mains cable from Auto Gas. Connect one end of the battery cable to back of the gas analyser and connect the other end to the vehicle's battery.

When the test procedure is started, select "Battery" during RPM source selection step.

If the RPM reading indicated by the gas analyser differs significantly with vehicle's actual RPM at various engine speeds, try to turn ON headlights, fan, heater and other electrical load in the car to amplify the electrical load signal across the battery.

7.4.3 RPM using optional Accelerometer Sensor

Connect the accelerometer cable to the back of Auto Gas. Make sure the magnetic base is attached to the accelerometer.

Place the accelerometer on the engine mount. Try to place accelerometer at various spots on the engine and notice the spot where vertical vibration is greatest. The location where engine vibration is maximum might be the most appropriate location to stick accelerometer. Check the RPM reading and compare with the RPM readings indicated in the cluster panel. If the RPM readings measured by the gas analyser vary significantly, try to place the accelerometer in a different location. When the right location is found, firmly stick the accelerometer on the engine mount.

Warning: components of a running engine can cause fatal injuries. Engine head and radiator hosing can get very hot. Make sure the accelerometer remains on the engine mount all the time. A loosely mounted accelerometer can get stuck in moving engine parts, which could cause injury, and badly damage the sensor as well as engine components.

Warning: the maximum operating temperature for the accelerometer is 130 °C. Make sure the accelerometer is not mounted on surfaces that exceed the maximum temperature (such as exhaust body).

7.5 Weekly Calibration Check

Auto Smoke will routinely require the user to carry out a calibration verification check once every seven and a half days. Once the weekly calibration check is overdue, the Auto Smoke will prompt the user to insert the weekly calibration check filter and carry out the check. If the weekly calibration check is failed or the user opts to skip the check, the Auto Smoke will return to the previous menu. Auto Smoke will not permit the user to carry out a smoke test until the weekly calibration check has been performed.

To perform the weekly calibration check, insert the supplied calibration filter into the slot of the smoke meter. Auto Smoke will then measure the opacity level when the filter is inserted into the filter slot. If the measured value differs with the pre-set reference value by more than 0.1 m^{-1}, the Auto Smoke will report an error and will not let the user carry out any smoke test. The weekly check has to be passed successfully before Auto Smoke permits the user to carry out any smoke test.

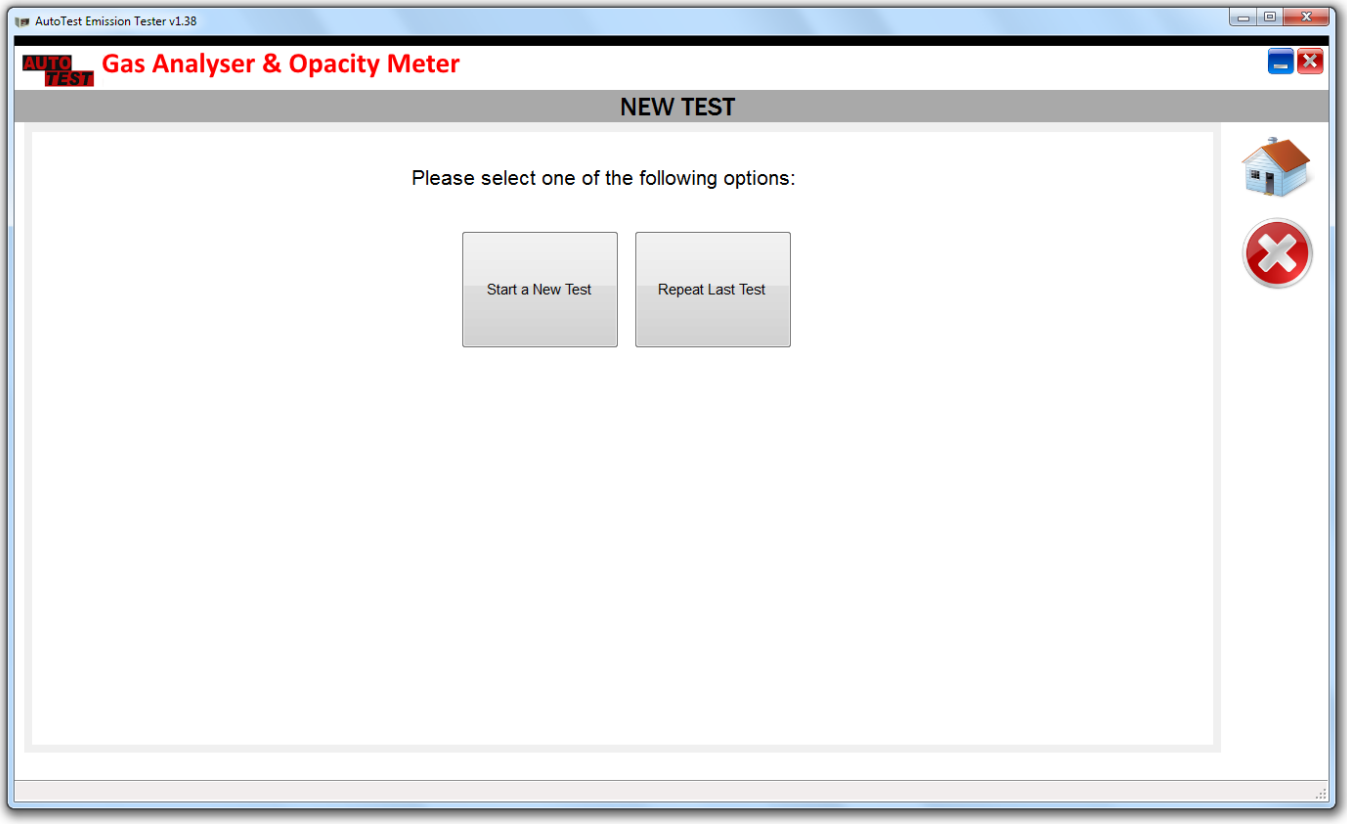
7.6 **Starting a smoke test**

Do not insert the smoke probe in the tail pipe at the start of the test.

To start a new gas test from a PC, first establish communication with the gas analyser using one of the methods described in section 5.1. Also, make sure the gas analyser is operating in main screen (showing live readings).

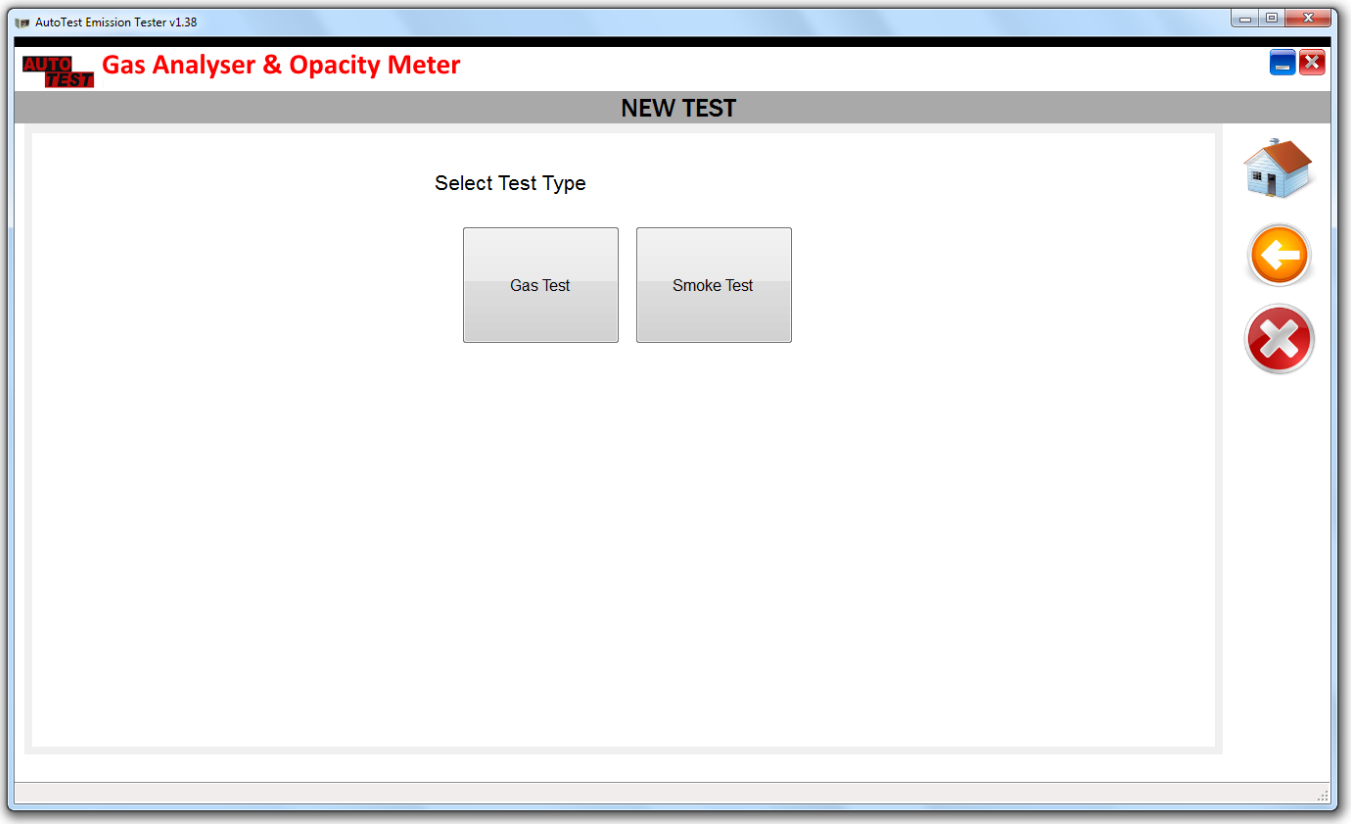
Press 

("Run New Test") on the PC software to start a new test. If the connection to Auto Gas is established, the gas analyser will prompt for the test information.

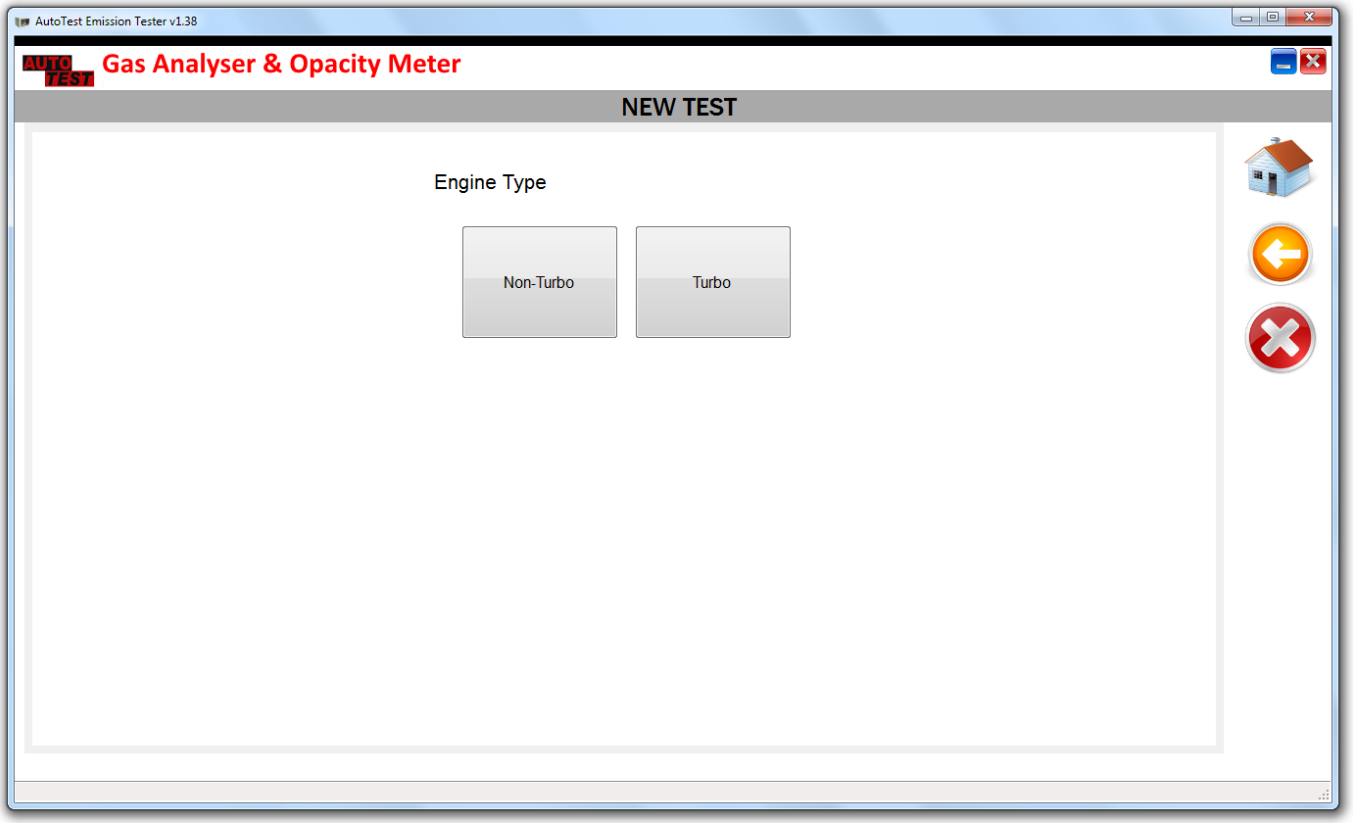


Select "Start a New Test" to start a new test with new vehicle details. Alternatively, you can select "Repeat last test" to reload the last test's information and use that to carry out a new gas test.
If a new test is selected, select the examiner information and the vehicle type. The examiner information can be edited in the settings.

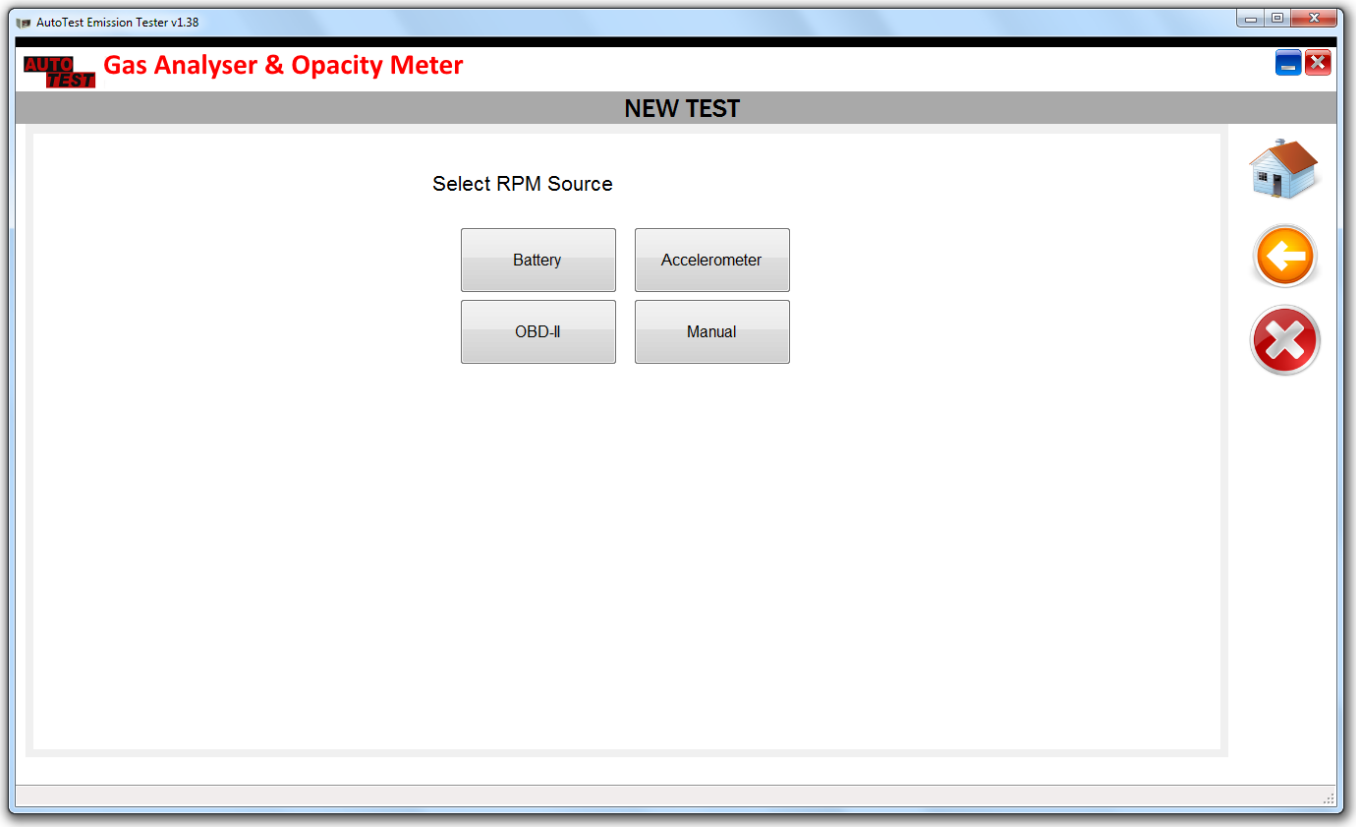
The next step will prompt for the test type. Select "Smoke Test" to start the smoke test.



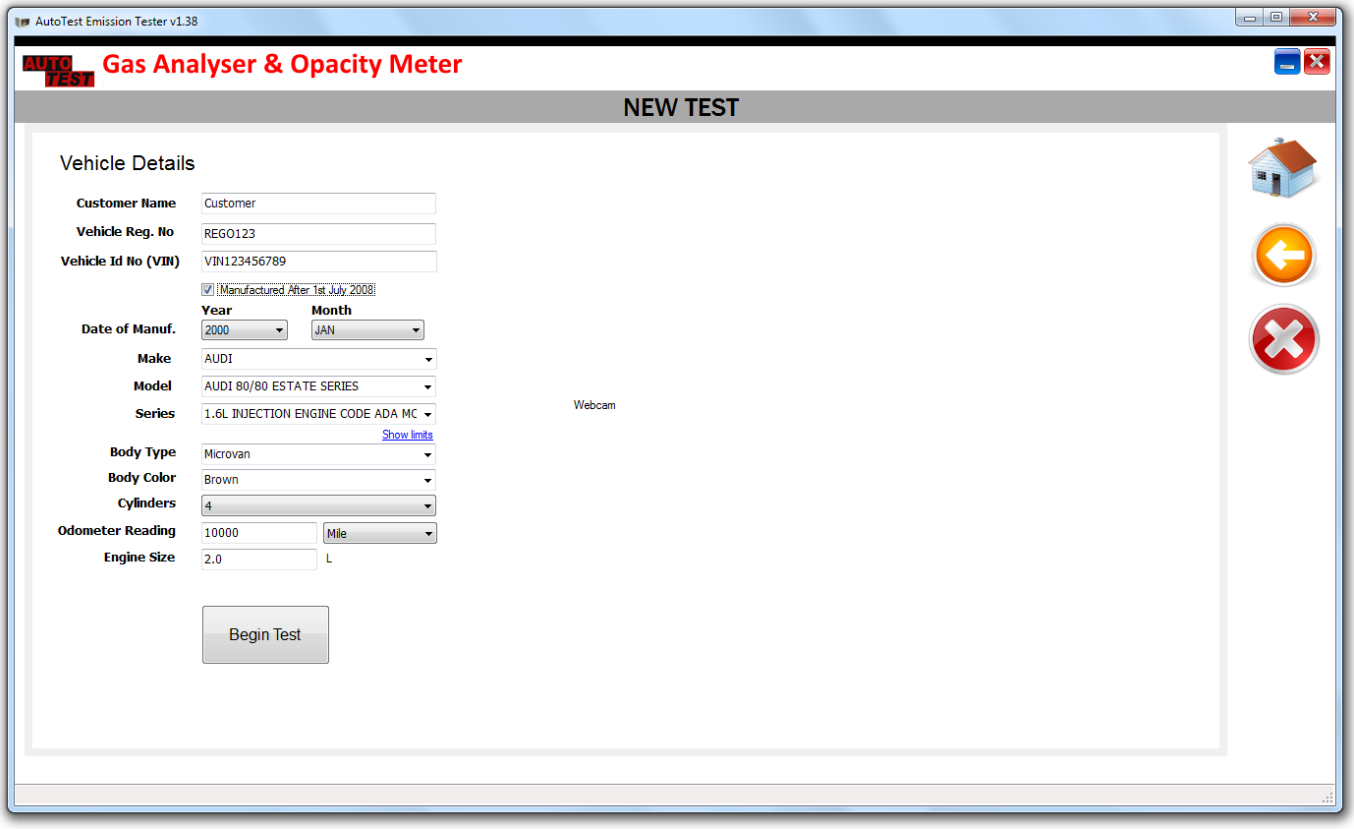
The next step will prompt for engine type.



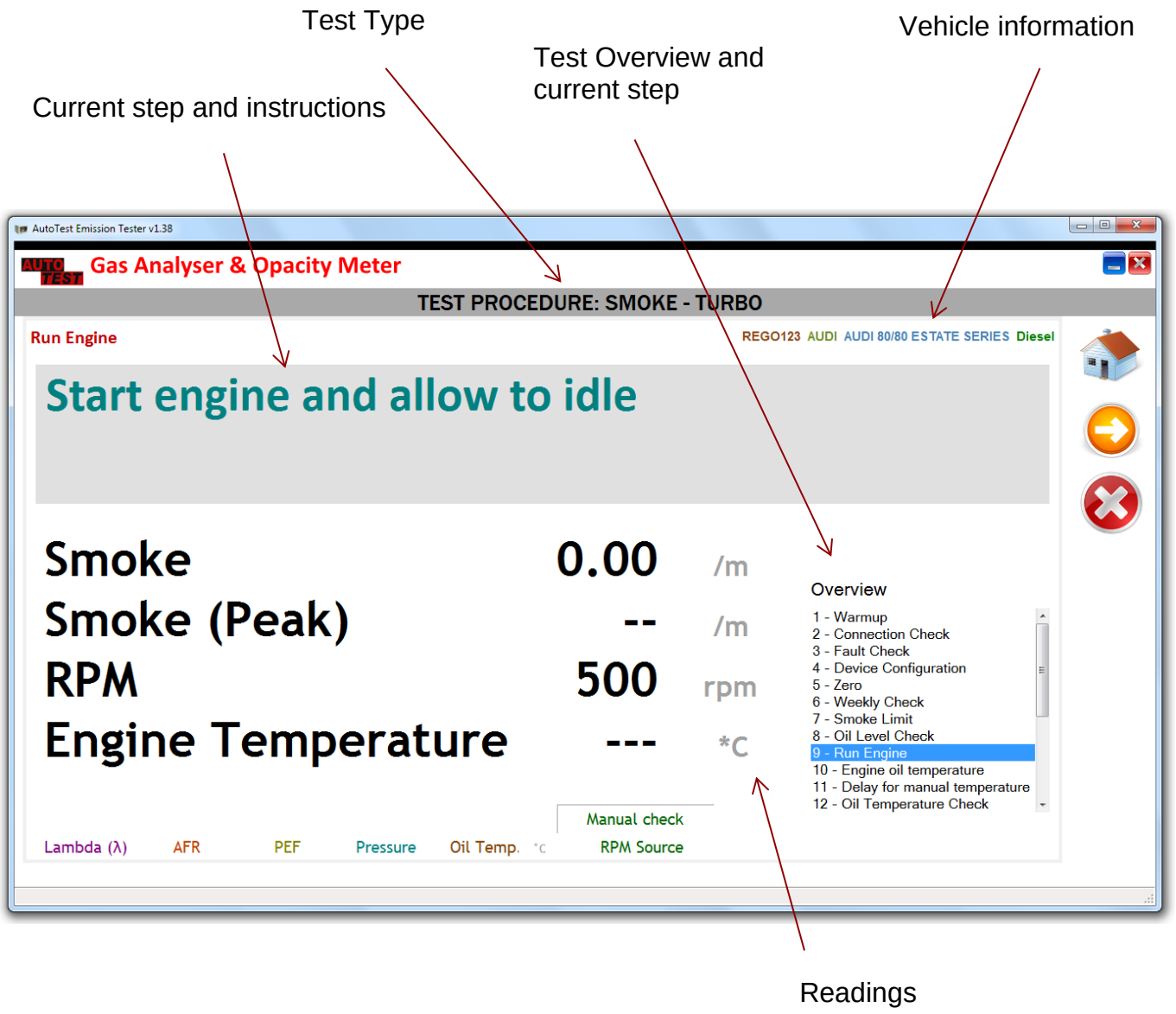
The next step will prompt for RPM type.



The next step will ask for details such as registration number, VIN, model, make, cylinders, engine size etc. Once the vehicle details are entered, press Begin Test to start the test.



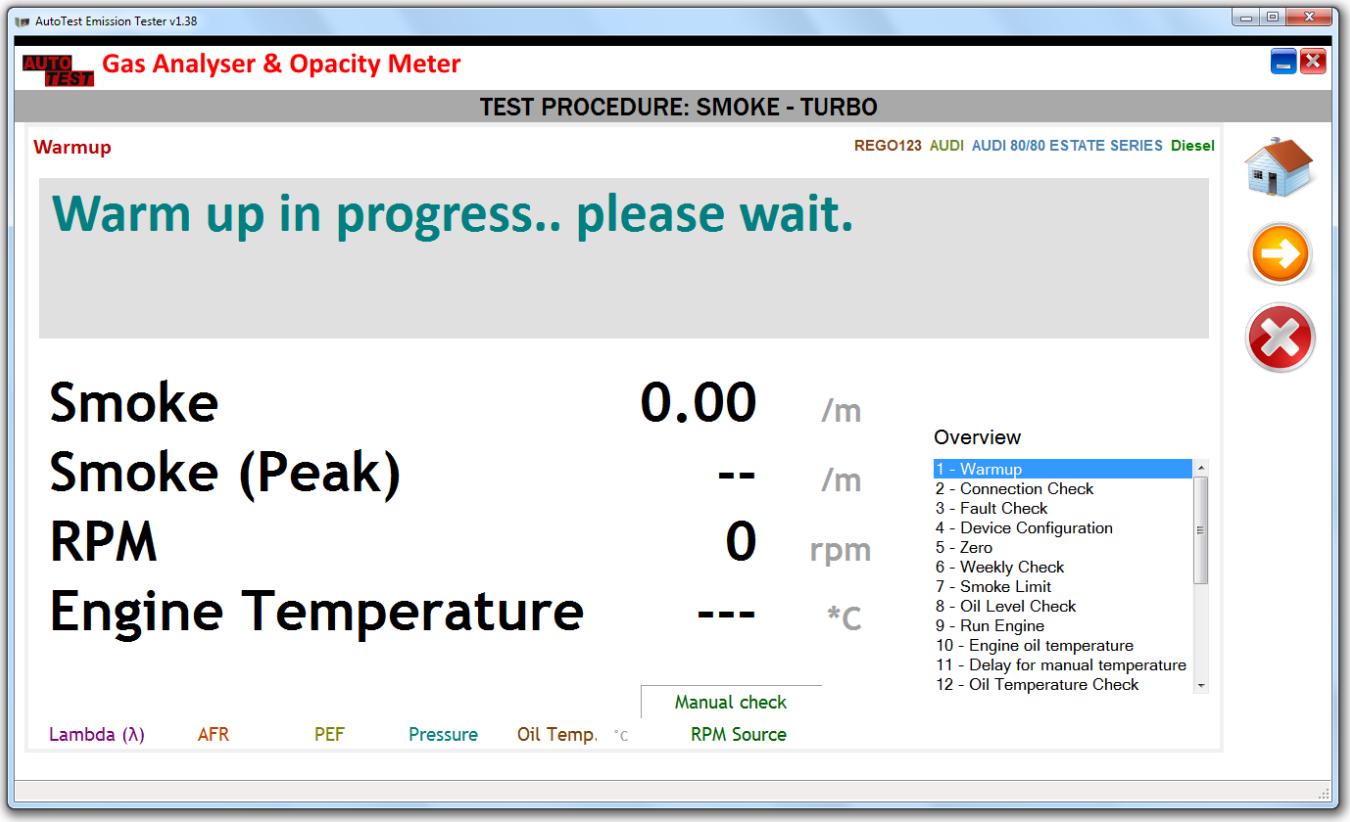
Once the smoke test is started, the PC software will display step-by-step instructions on the screen. It will also show a graph of currently sampled gas measurements and the test limit values.



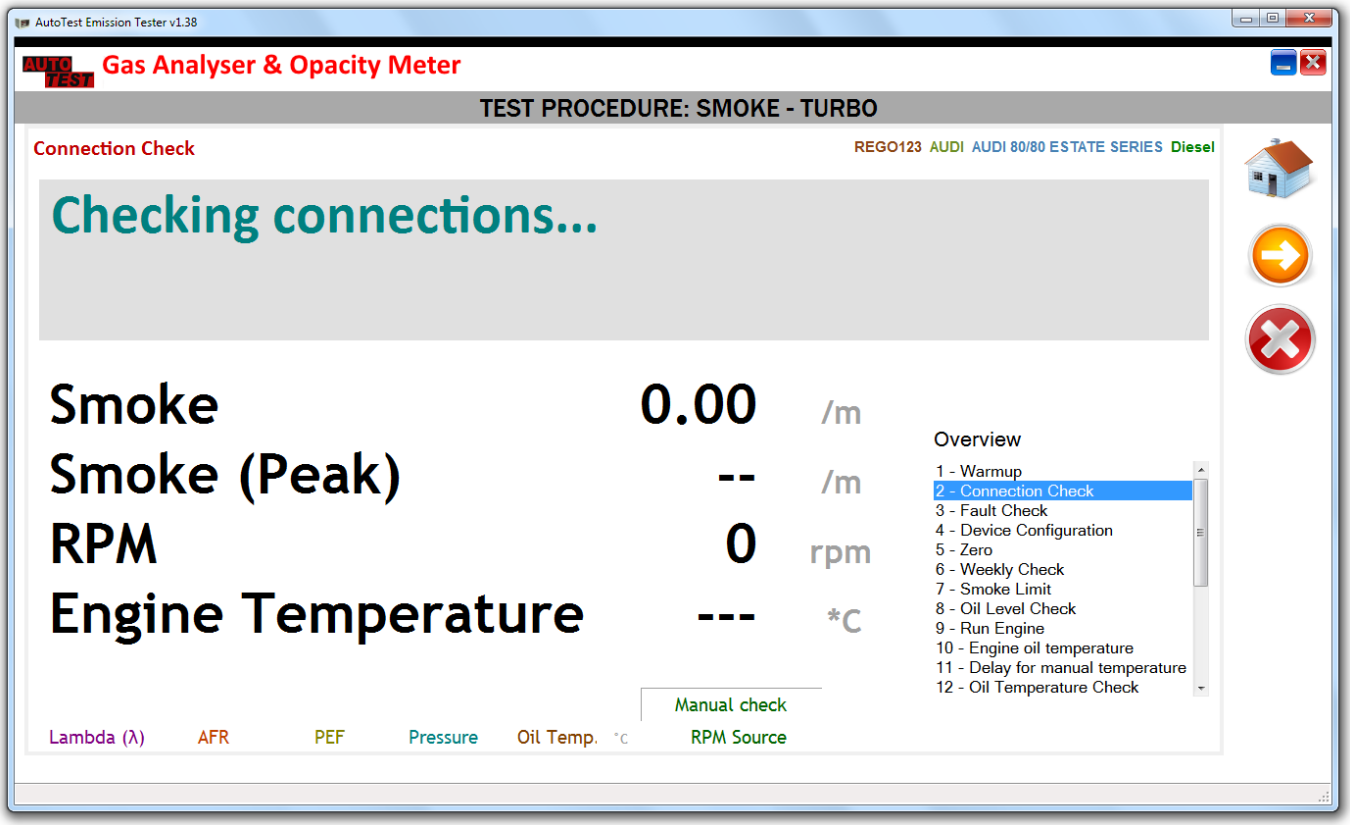
User can abort the test at any time by pressing  icon. At some stages during a test, user can opt to press  to skip that step (not all steps can be skipped).

The following table outlines the test steps involved in a smoke test.

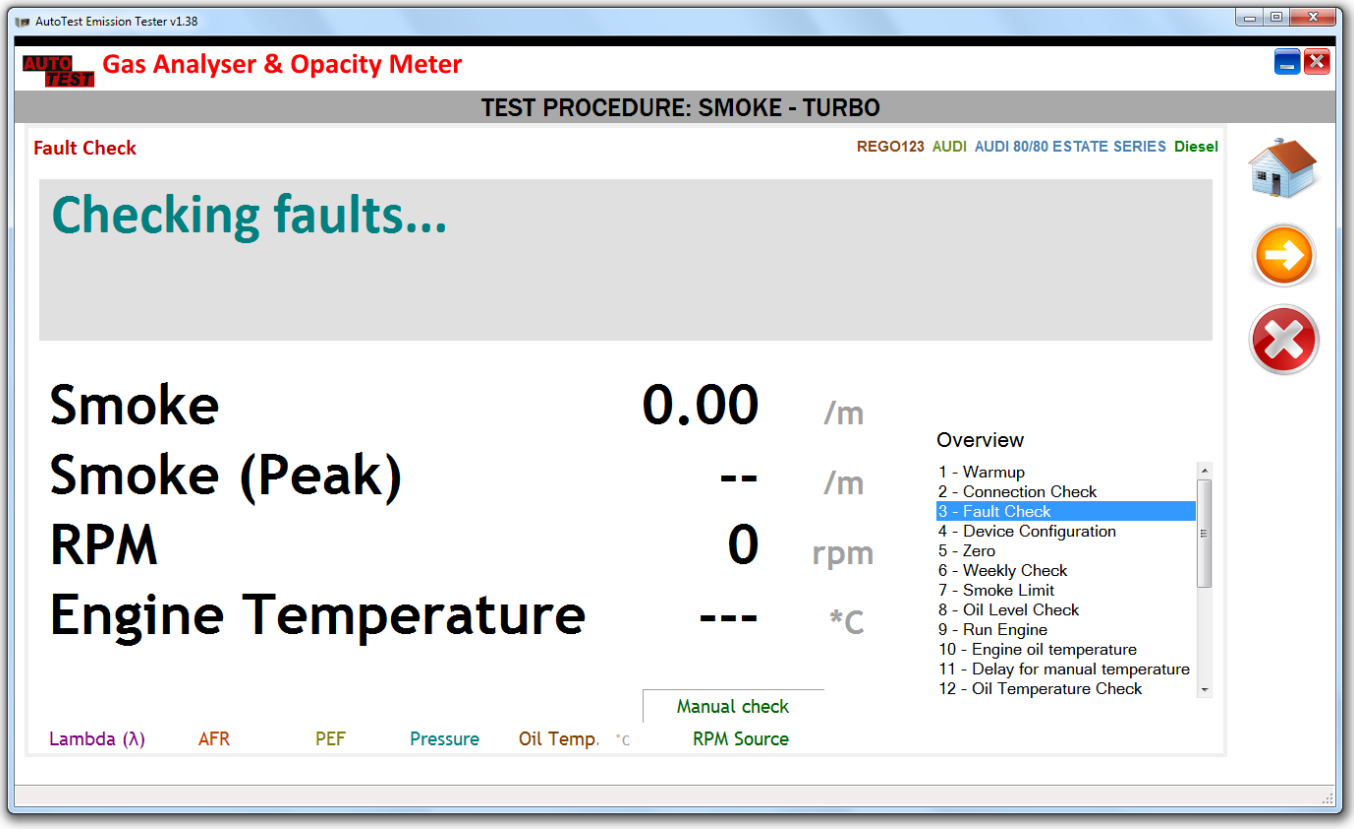
No	Step	Description
1	Warmup	Device is being warmed up. Please wait until the warmup is complete.
2	Connection Check	Checks RF connection
3	Fault Check	Checks for any faults in the device
4	Device Configuration	Checks device configurations
5	Zero	Sets the measurement values to zero
6	Weekly Check	Performs weekly check if required.
7	Smoke Limit	Displays the smoke limit value (Pass/Fail Limit)
8	Oil Level Check	Prompts the user to make sure the engine oil level is adequate
9	Run Engine	Prompts the user to start engine and let it run at idle
10	Engine oil temperature	Prompts the user whether to perform oil temperature check
11	Delay for manual temperature check	If oil temperature check is bypassed, a delay of 40 seconds will be added
12	Oil Temperature Check	Checks the oil temperature and waits until the temperature is above 60 °C
13	Remove Oil Probe	Prompts to remove the oil temperature probe from the engine
14	Zero	Performs zero
15	Insert Smoke Probe	Prompts user to insert smoke probe into the exhaust tail pipe
16	Acceleration	Asks the user to press accelerator
17	Release Accelerator	Prompts user to release accelerator
18	Sampling	Smoke peak monitor & measurement
19	Idle Engine	Asks the user to keep the vehicle running at idle
20	Zero Drift Check	Zero drift check at the end of the test sequences. Asks the user to remove smoke probe from the tail pipe.
21	Calculate	Calculates the test result
22	Save Test	Saves the test data to the database
23	Display Report	Displays the test report



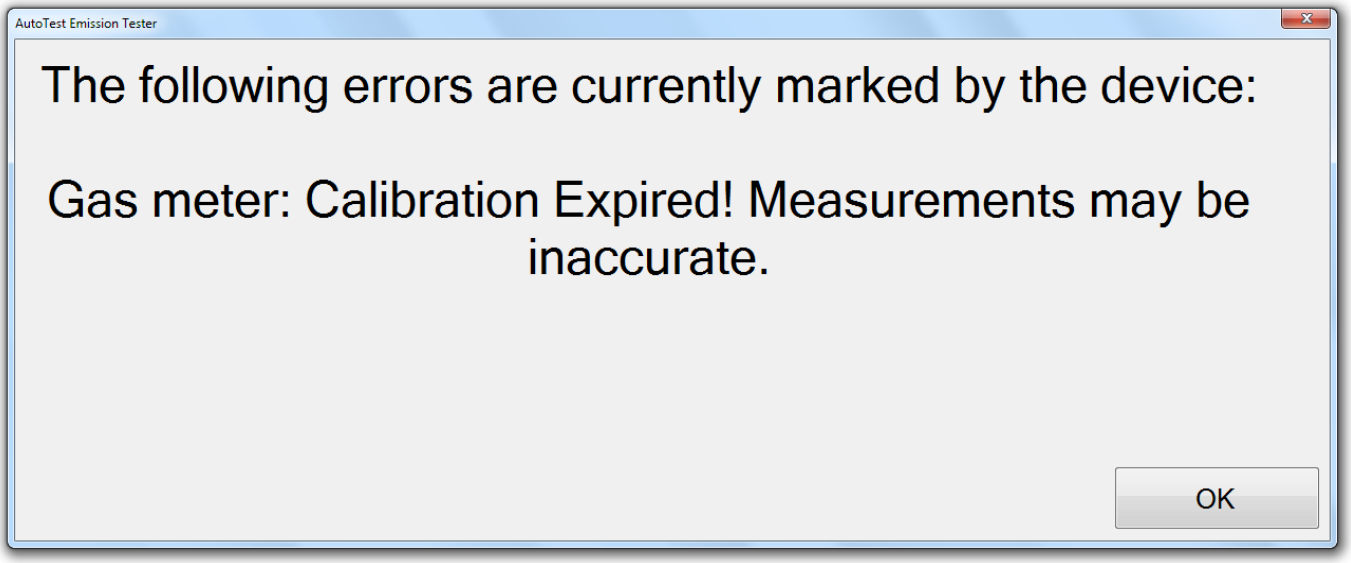
During the warmup stage of the smoke test, the software will wait until the smoke meter is warmed up to its normal temperature.



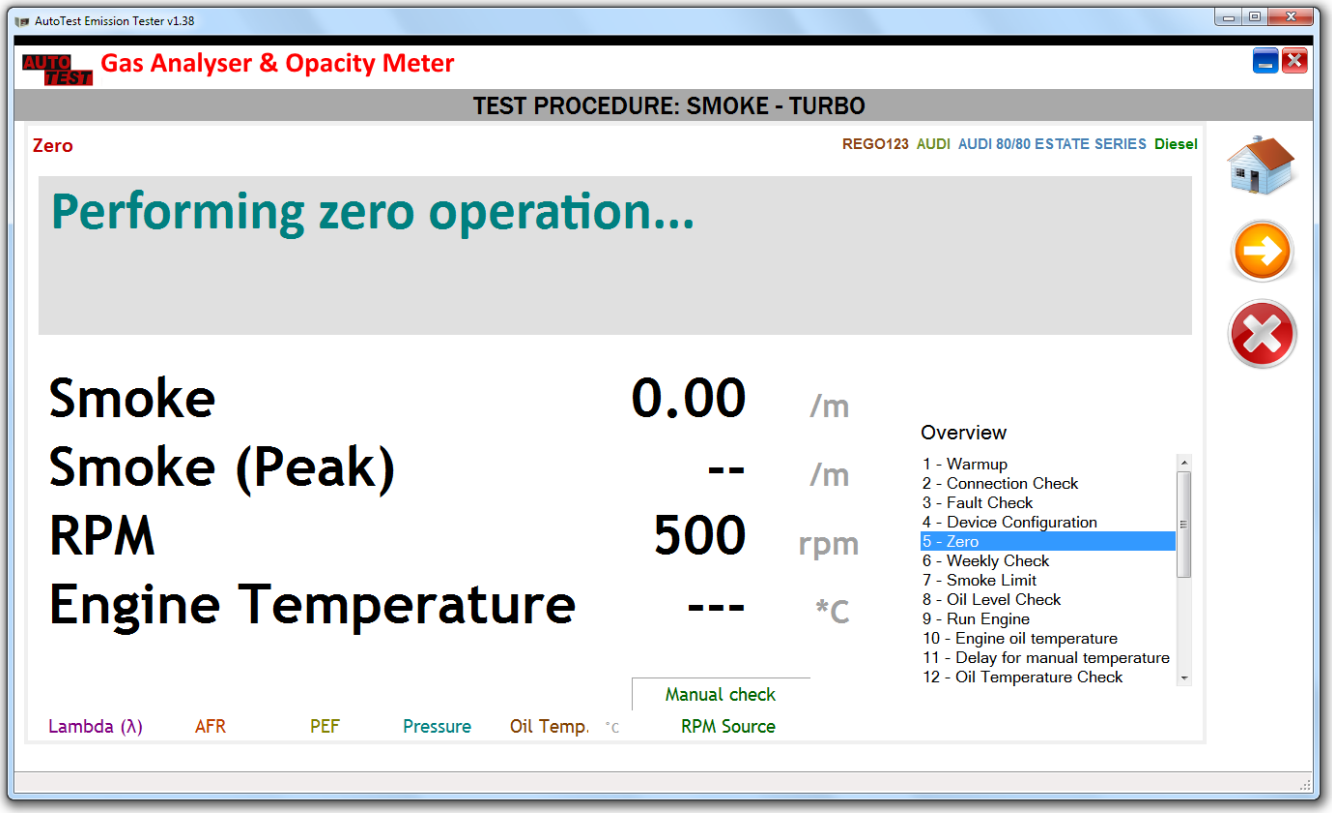
The emission tester software will then check for devices and connections.



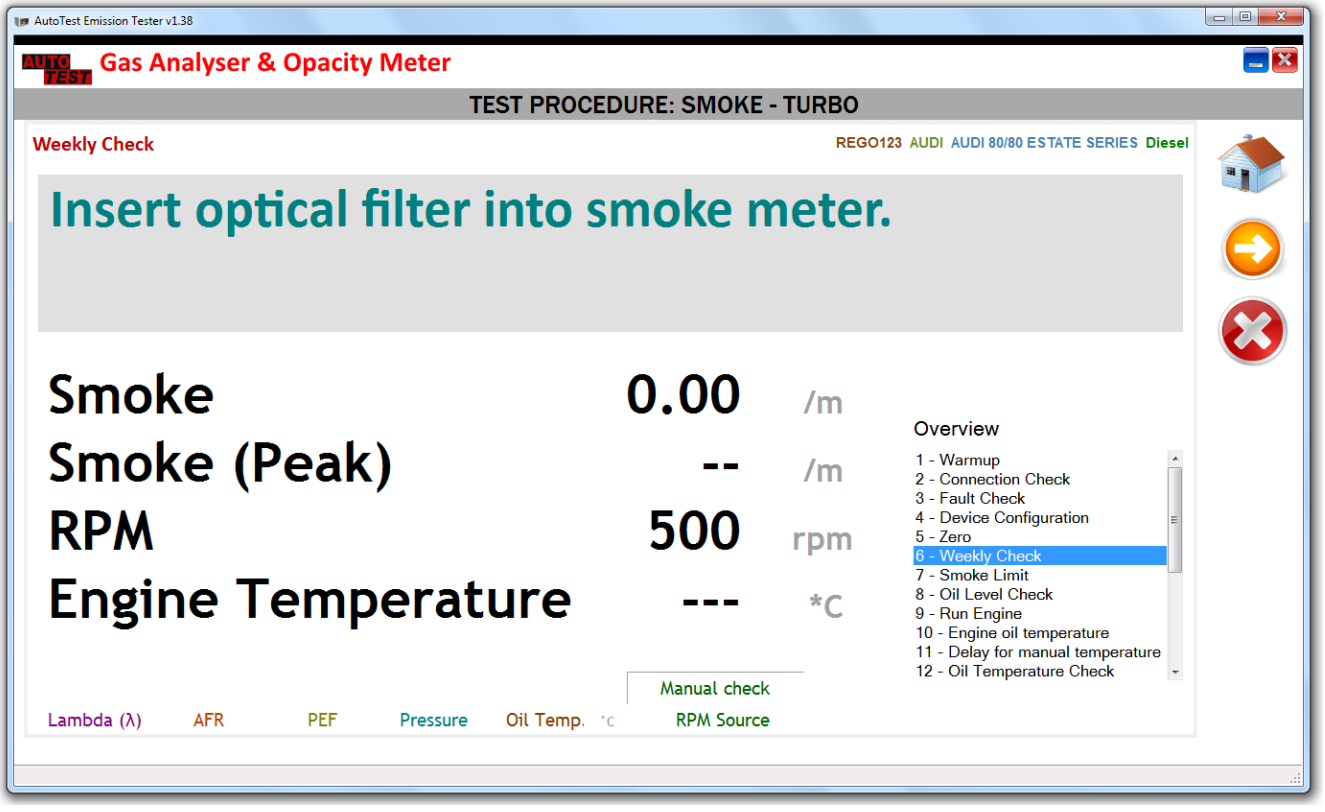
During the Fault Check stage, the emission tester software will determine any fault that has been marked by the device. The faults include such as calibration expiry, sensors failure, bench failure etc. The emission tester may display the following message when the calibration has expired.



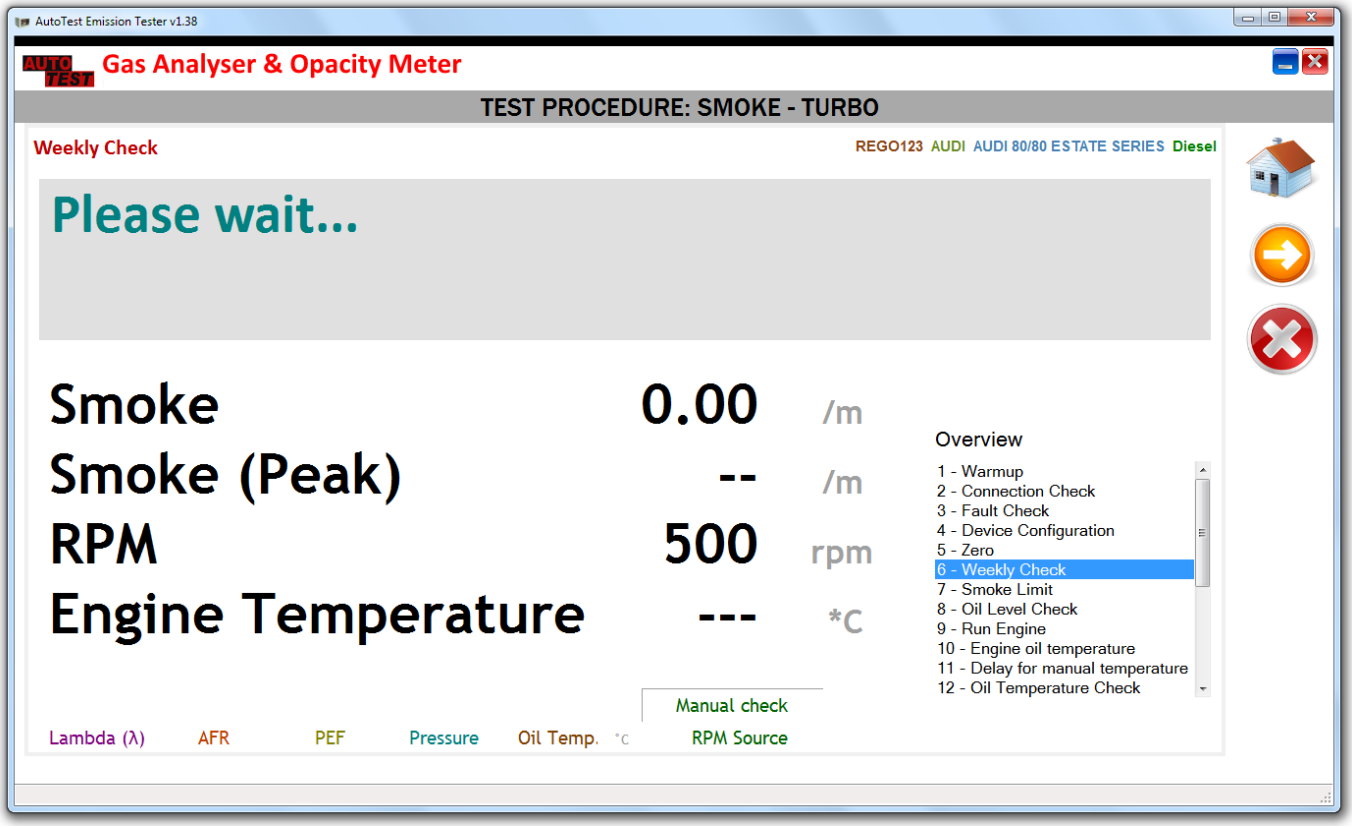
The emission tester software will perform zero. The smoke values are set to zero during the zero operation.



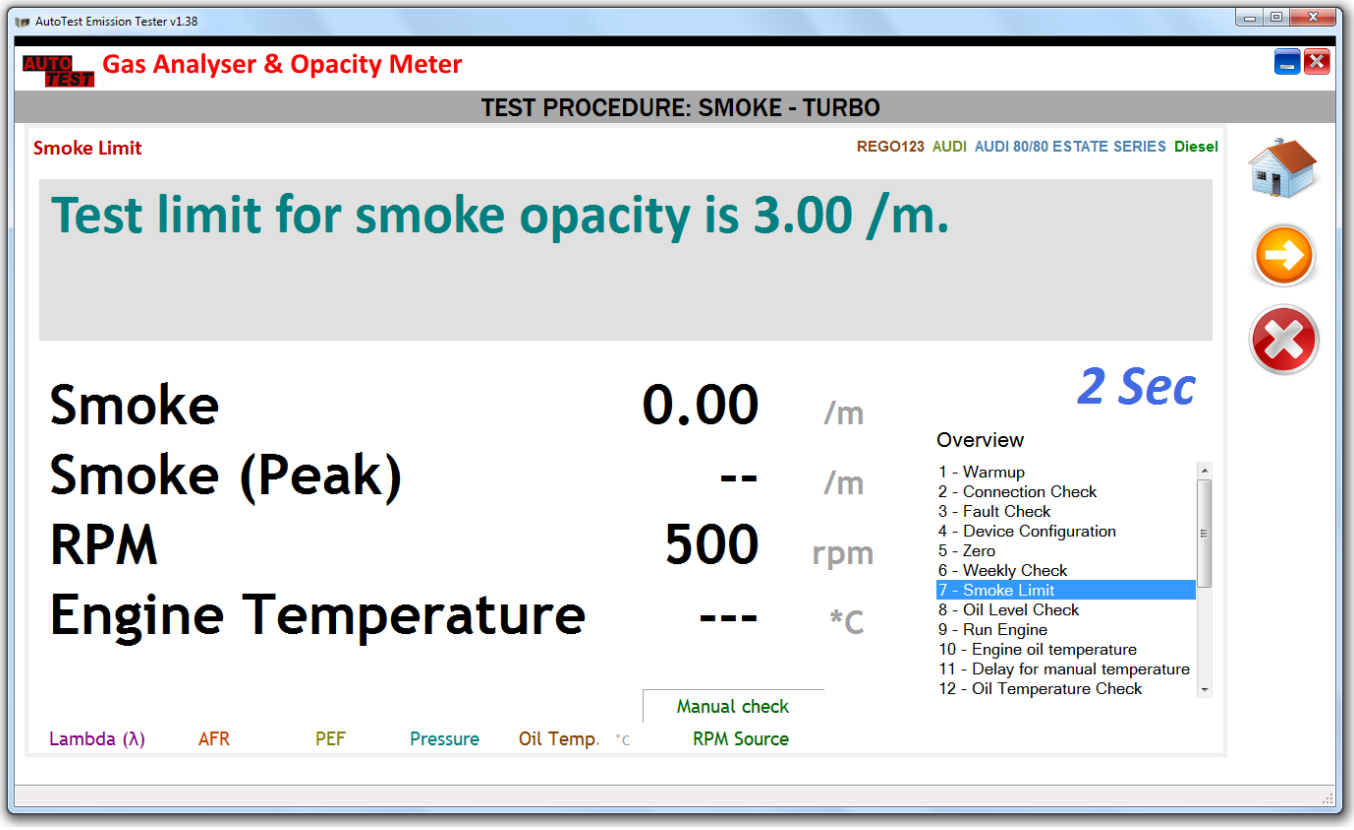
After zero is done, the emission tester will perform weekly check if it is required. When the software prompts "Insert optical filter into smoke meter", insert the weekly check filter into the opacity meter and then wait for a few seconds.



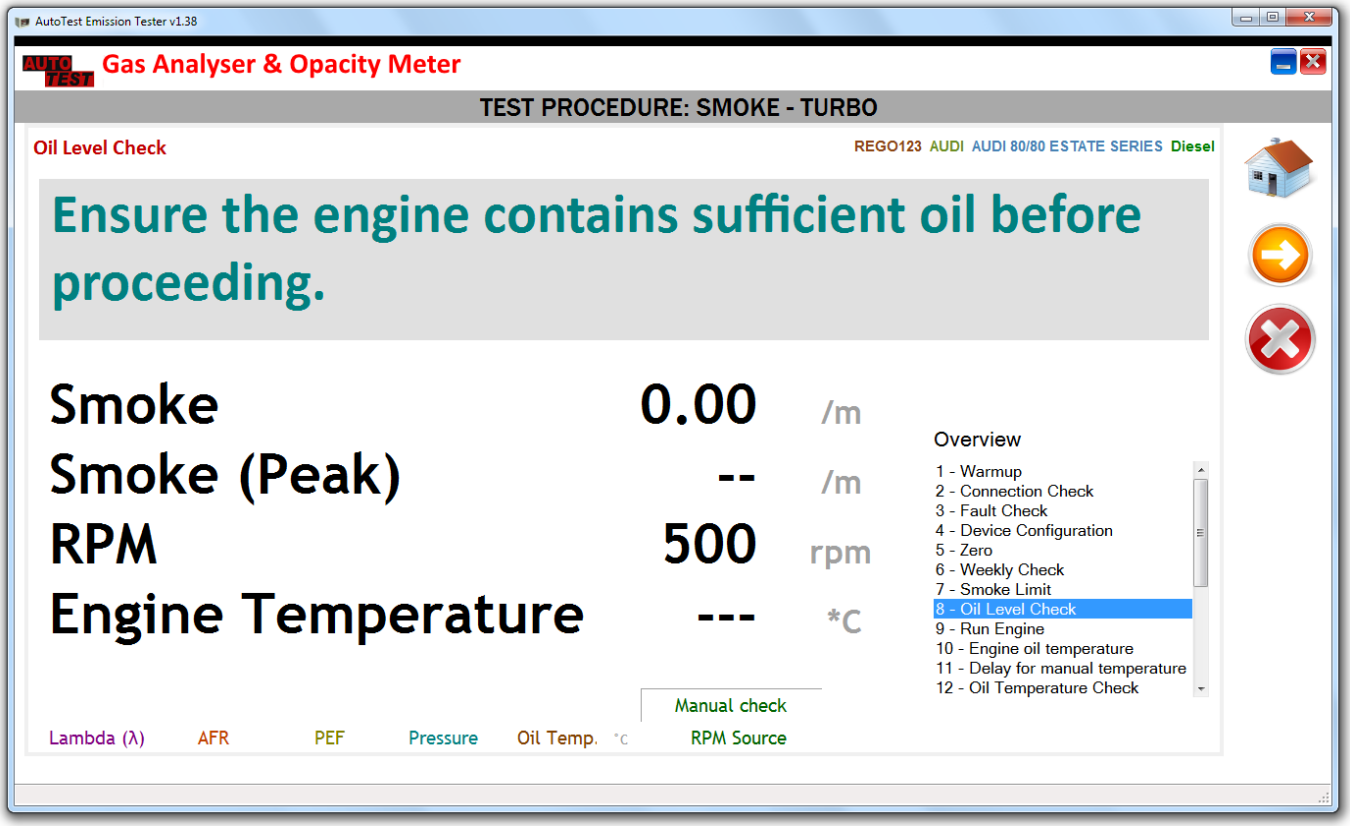
When the weekly check filter is inserted, the software will display "Please wait". Keep the filter inserted for a few seconds until the weekly check is over.



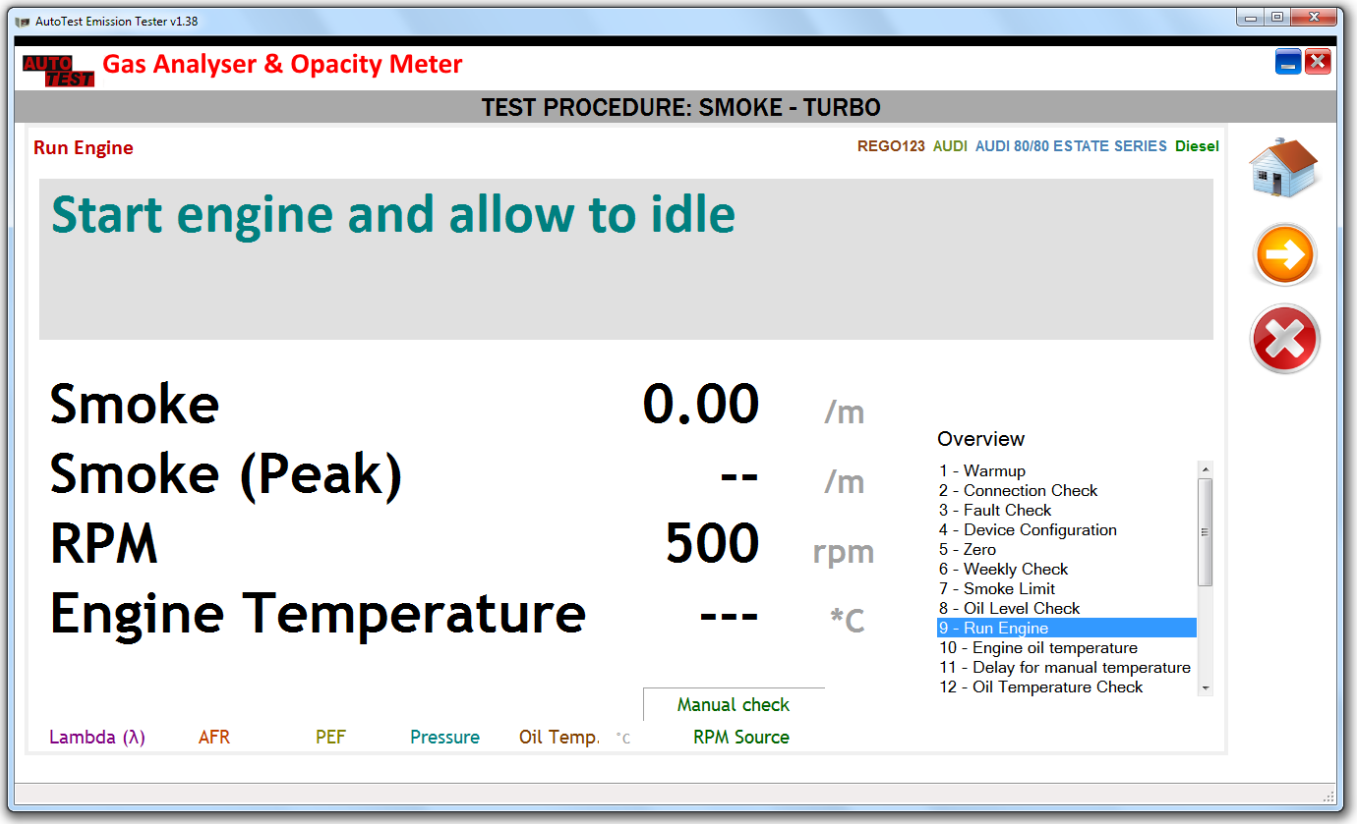
Once the weekly check is over, the software will display smoke limit value. The limit value is the pass/fail value for the smoke test.



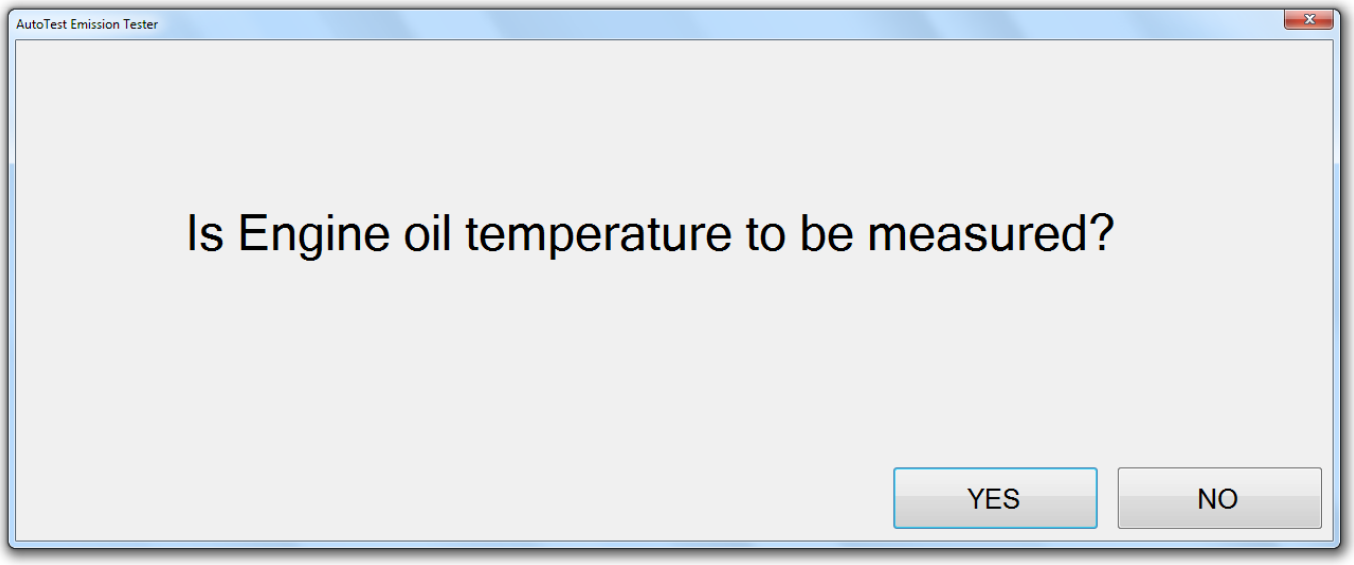
Before starting the engine, make sure the vehicle has sufficient amount of oil.



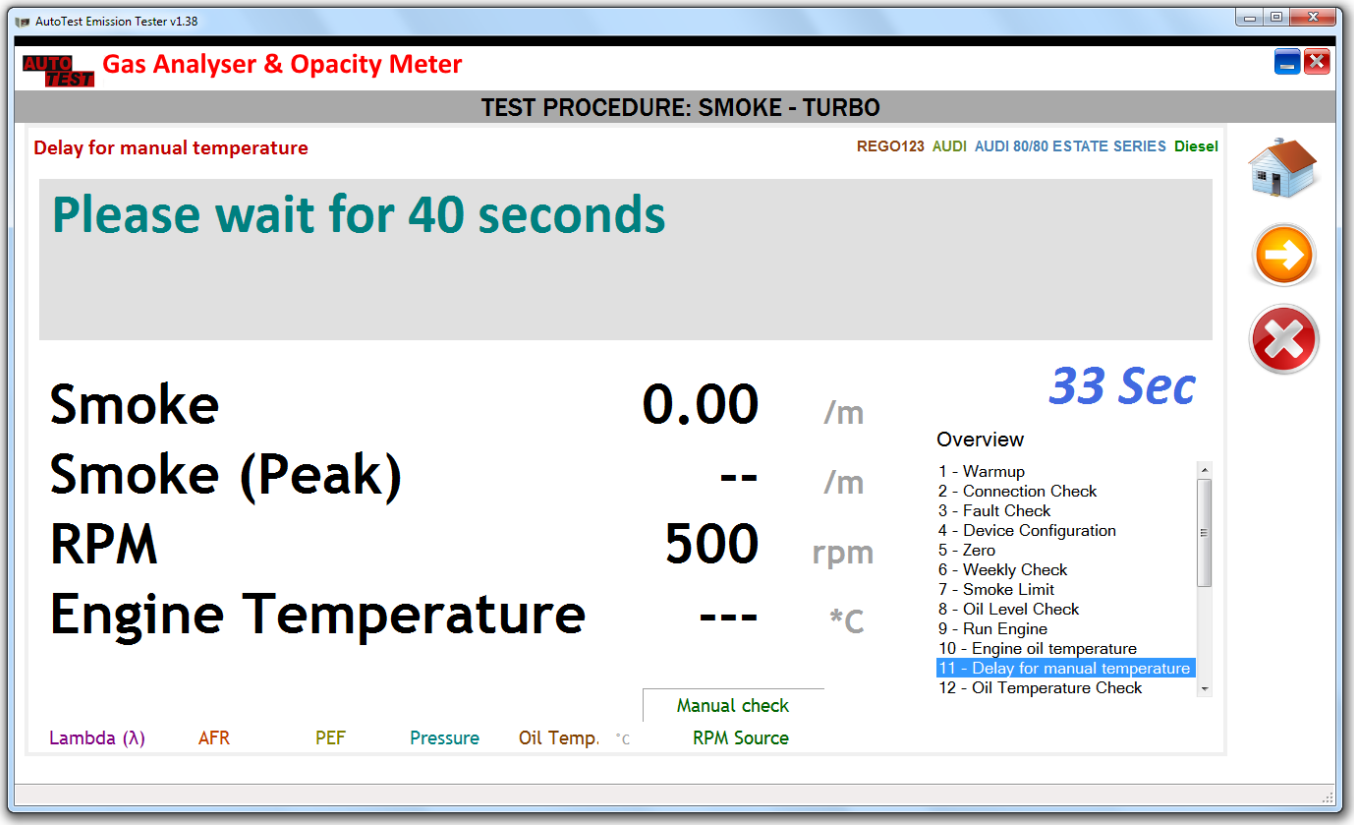
When the software displays "Run Engine", run the vehicle's engine.
Make sure the smoke probe is not inserted into the tail pipe.



The software will then prompts whether to perform an oil temperature check. If the engine oil temperature check is to be performed, select "Yes".

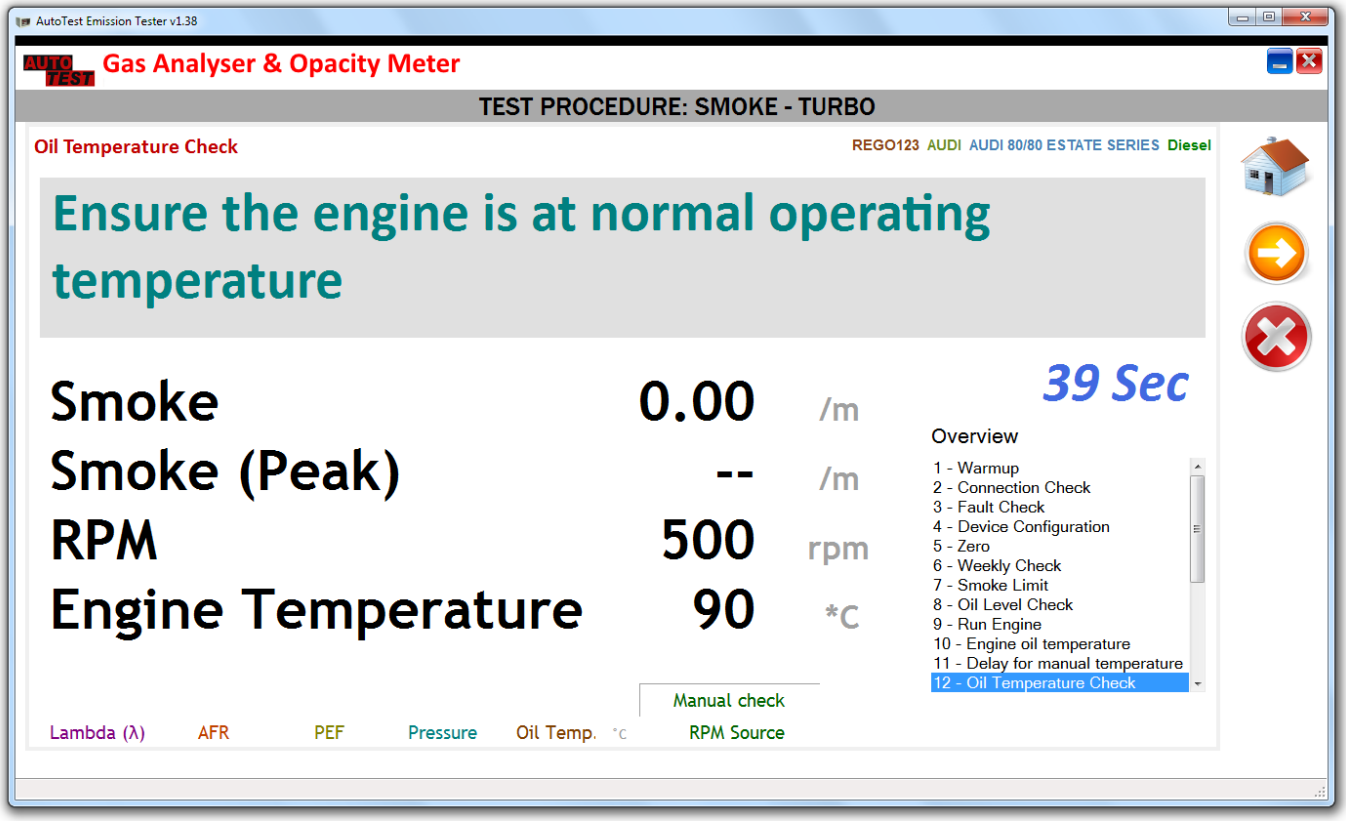


If the oil temperature check is bypassed, the software will add a delay of 40 seconds.

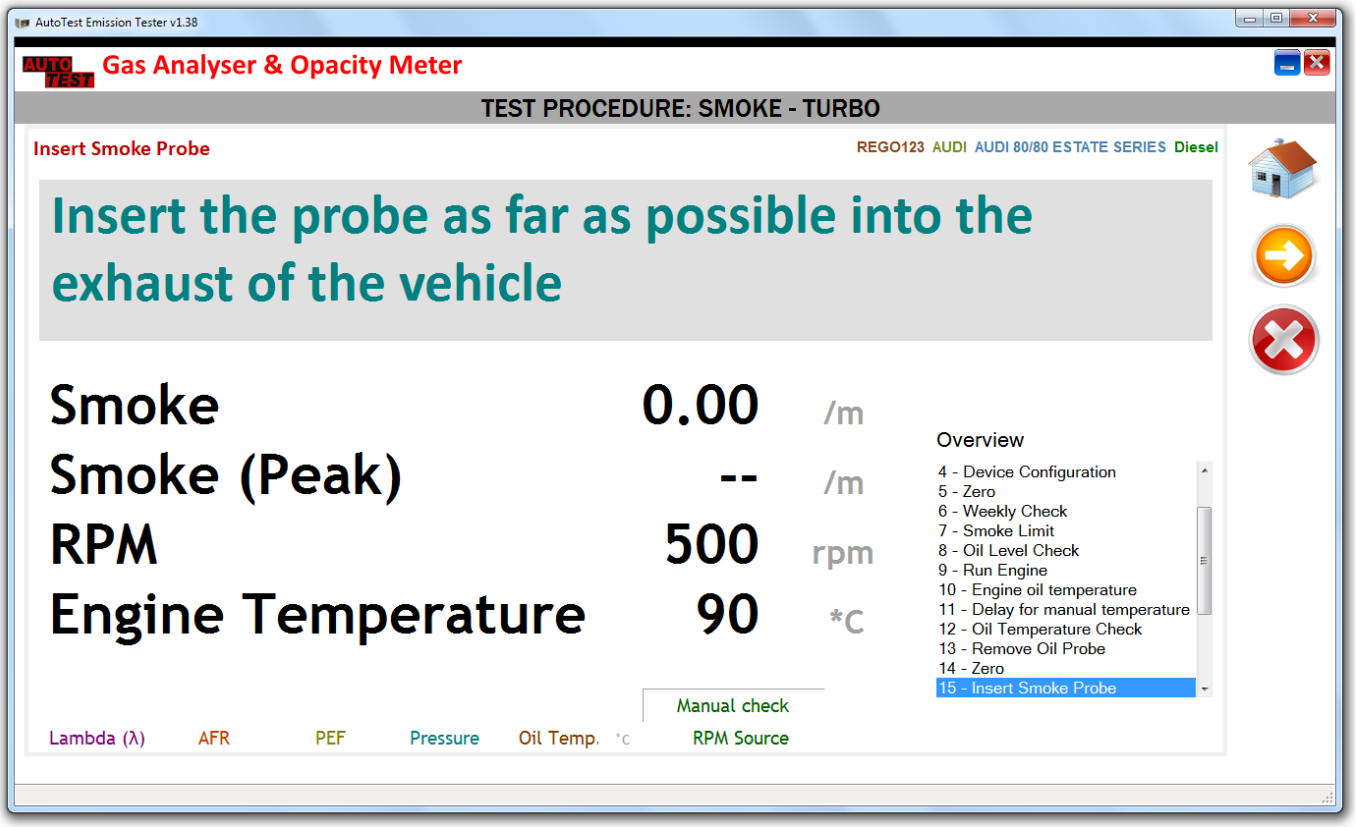


If the oil temperature probe is not inserted, the software will prompt the user to attach the oil temperature probe. Once the oil temperature probe is attached to the machine and the sensor is inserted into the vehicle engine, the software will wait until the vehicle's temperature is at 60°C or above.

Caution: Always take care when inserting oil temperature probe into the engine's dipstick housing. Be mindful of the hot surfaces and moving engine parts.

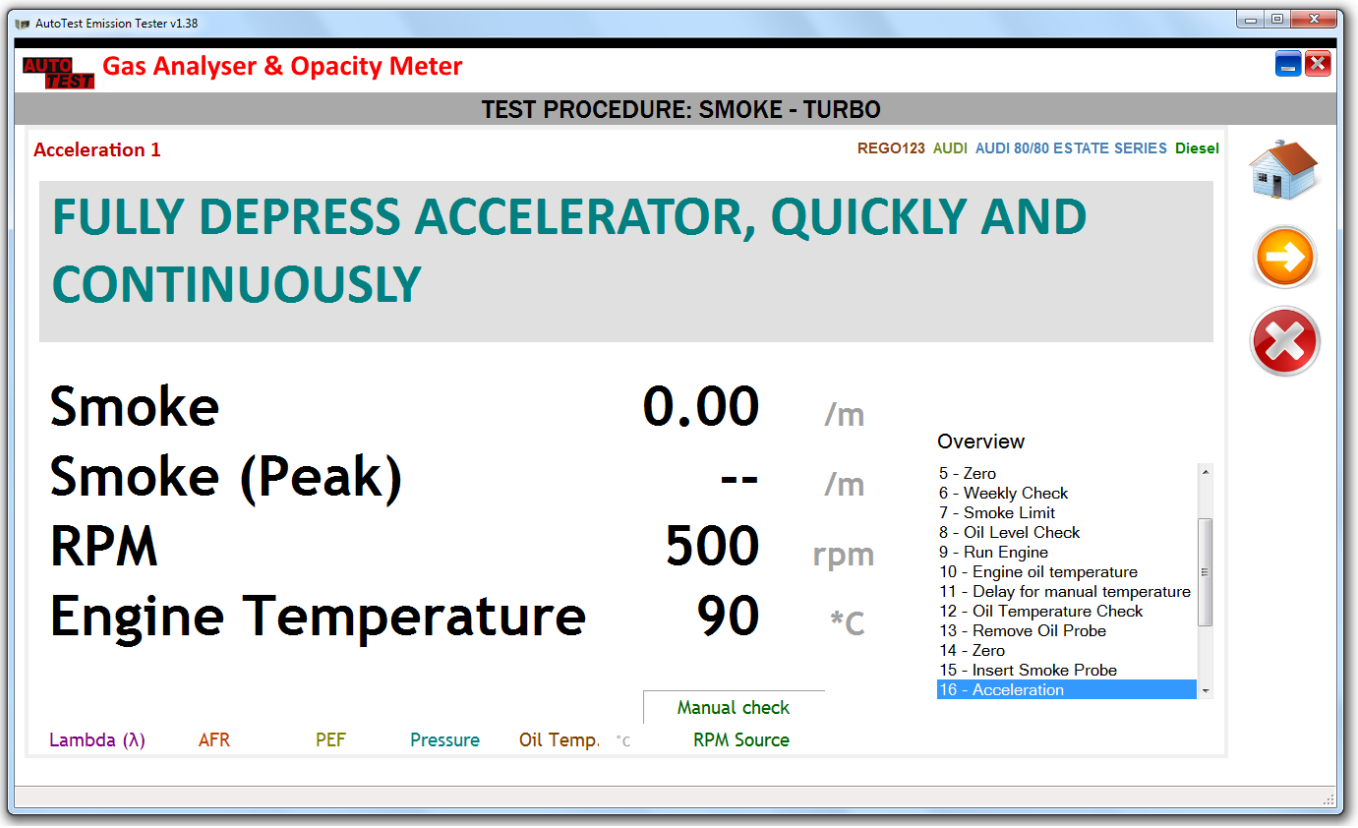


When prompted to insert smoke probe as far as possible into the exhaust tail pipe. Once the smoke probe is inserted, press "Yes" to acknowledge.

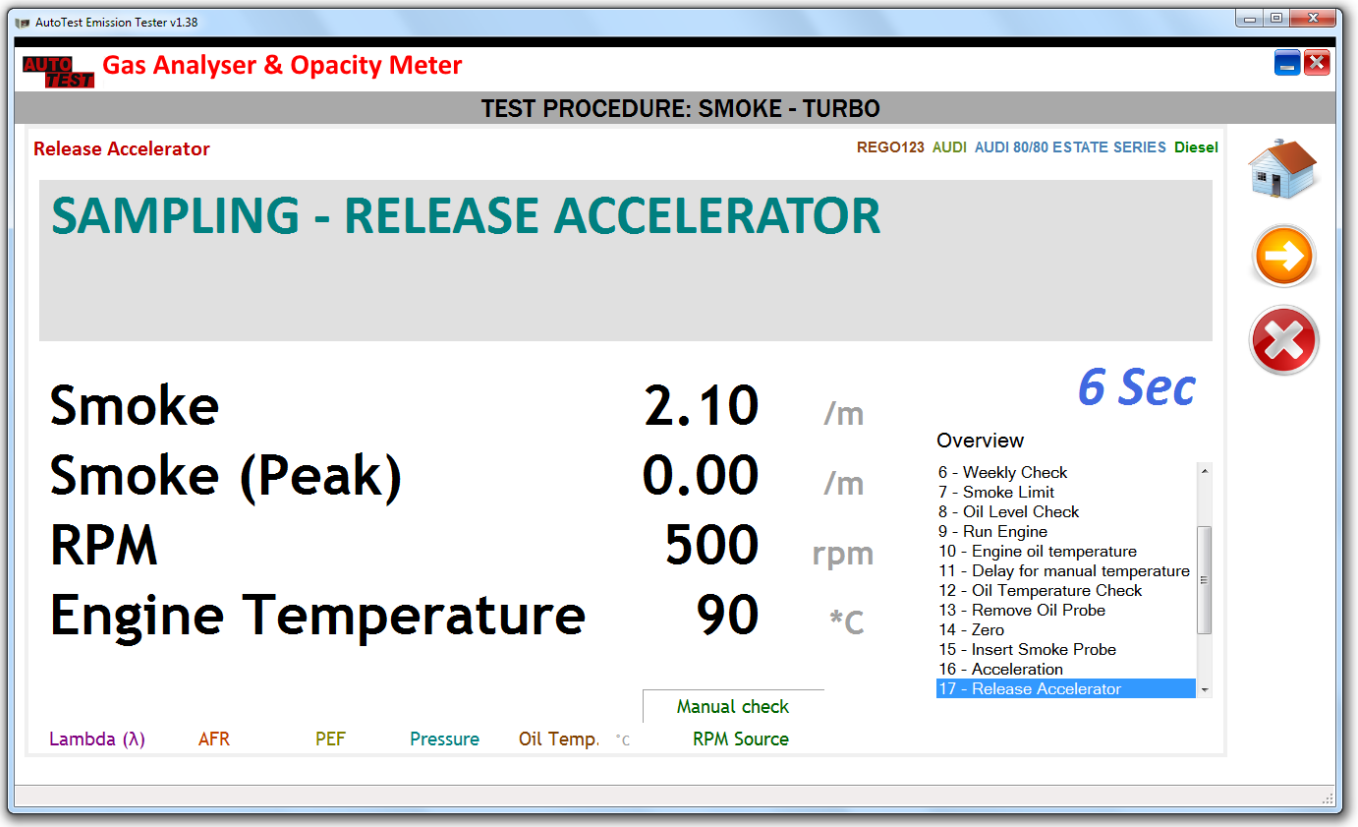


Caution: Make sure the vehicle's hand brake is fully applied. Also, make sure the gear is disengaged.

When prompted to press the accelerator, fully depress the accelerator, quickly and continuously for about 2 seconds until the screen displays "Release accelerator".

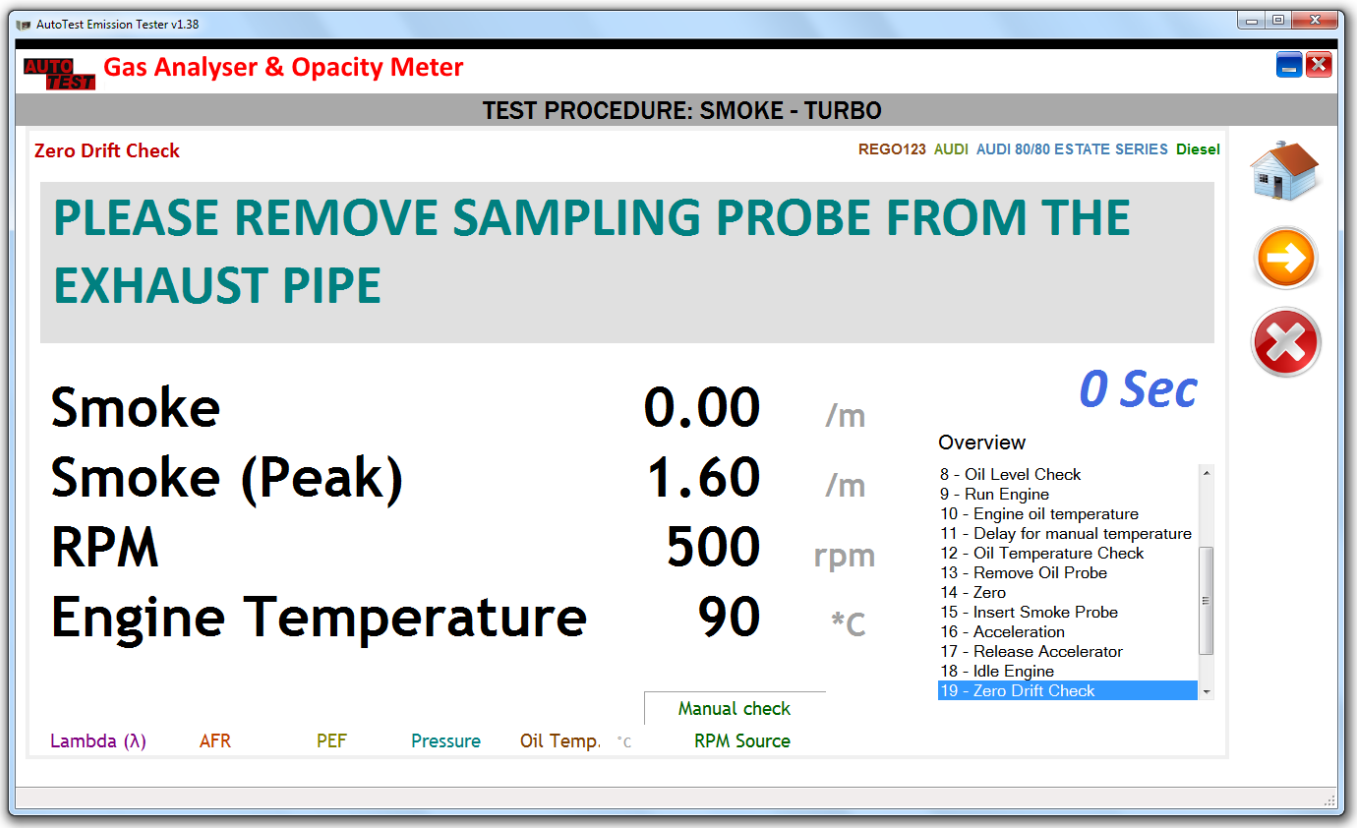


Release the accelerator when the software displays "Release Accelerator".



The software will carry out up to six acceleration cycles. If the reading of the first acceleration test is less than the fast pass limit (1.5 /m), the software will conclude the test as Fast Pass.

The software will perform zero drift check at the end of the test. Remove the smoke sampling probe from the exhaust tail pipe and put it away from the exhaust. Once done, press "Yes" to acknowledge it.



At the end of the test, the test data will be prepared and automatically saved in the software database. A saved test report can be recalled by the user and a printout can be generated.

Sample Report:

Exhaust Emissions Test Results

Operator ID: Bruce William
Test No. 222 **Test Date:** 30/01/2017 2:21:30 PM

Vehicle Details

(No Image Available)

Customer Name:	Customer Name
Vehicle Reg.:	REGO123
VIN :	VIN123456789
Vehicle Make:	FORD
Vehicle Model:	FIESTA ENGINE TYPE HCS
Vehicle Series:	1.3L ENGINE CODE J6
Odometer Reading:	115,870 mile

Test Results

Smoke Test *Non-Turbo*

No engine temperature taken.

Index	Absorption (k)	Limits	Result
1	8.15 /m	2.50 /m	
2	0.60 /m	2.50 /m	
3	0.65 /m	2.50 /m	
4	0.12 /m	2.50 /m	
5	0.55 /m	2.50 /m	
6	1.11 /m	2.50 /m	
Mean value	0.83 /m	2.50 /m	
Zero Drift	0.00 /m		
Overall Result			Pass

Operator: Bruce William
Signature:

RMI Training Academy
VTS12345
BUILDING 2-3, WELSH RD Southham CV47 1NA

7.7 Viewing Test Results on PC

Run AutoTest Emission Tester software and then click on "Show test reports". In the test reports page, select the desired test record by clicking on it. Then click on "Show report" to view test information on a new page. To print report, click on the "Print Report" button. A new window will appear showing the printable test report. To print a report using a printer, click on the "Print" button. To close the report page, click on "Close".

7.8 Using Search feature

Stored gas tests can be searched for fast retrieval using a vehicle registration number, customer name, or test date. To search a gas test, perform the following steps:

- Run Auto Gas PC software
- Establish communication using one of the methods described in section 5.1.
- Once the connection is established, click on "Show test reports".
- To search using a vehicle registration number, enter the Rego number in "Registration no." text field.
- Or to search using a Customer Name, enter the customer's name in the "Customer name" text field.
- Or to search by date, enter a date range in the "within date range" field.
- To begin your search, press "Filter".

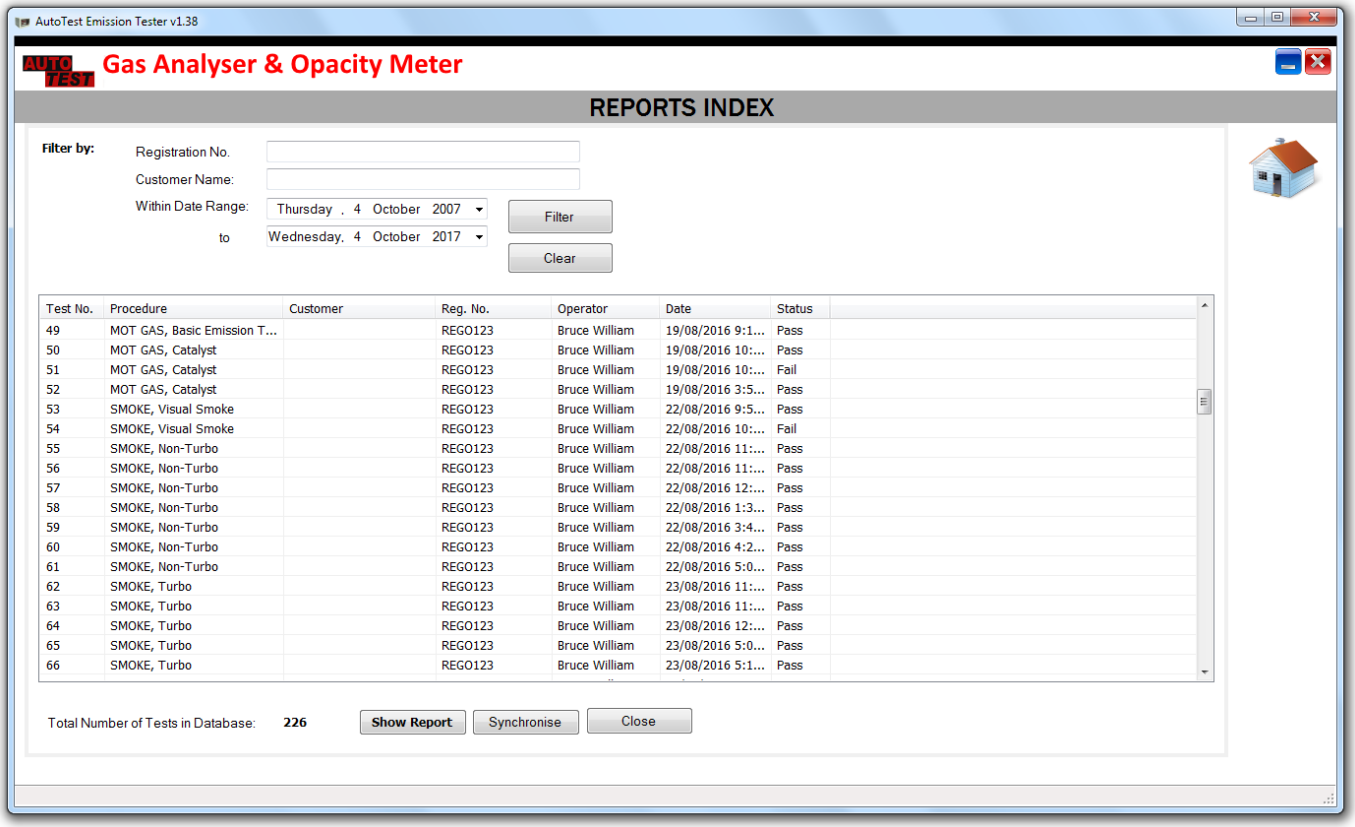


Figure 2 – "Test report filter option".

7.9 Configurations

To configure the PC software, press  icon from the main screen of the PC software.

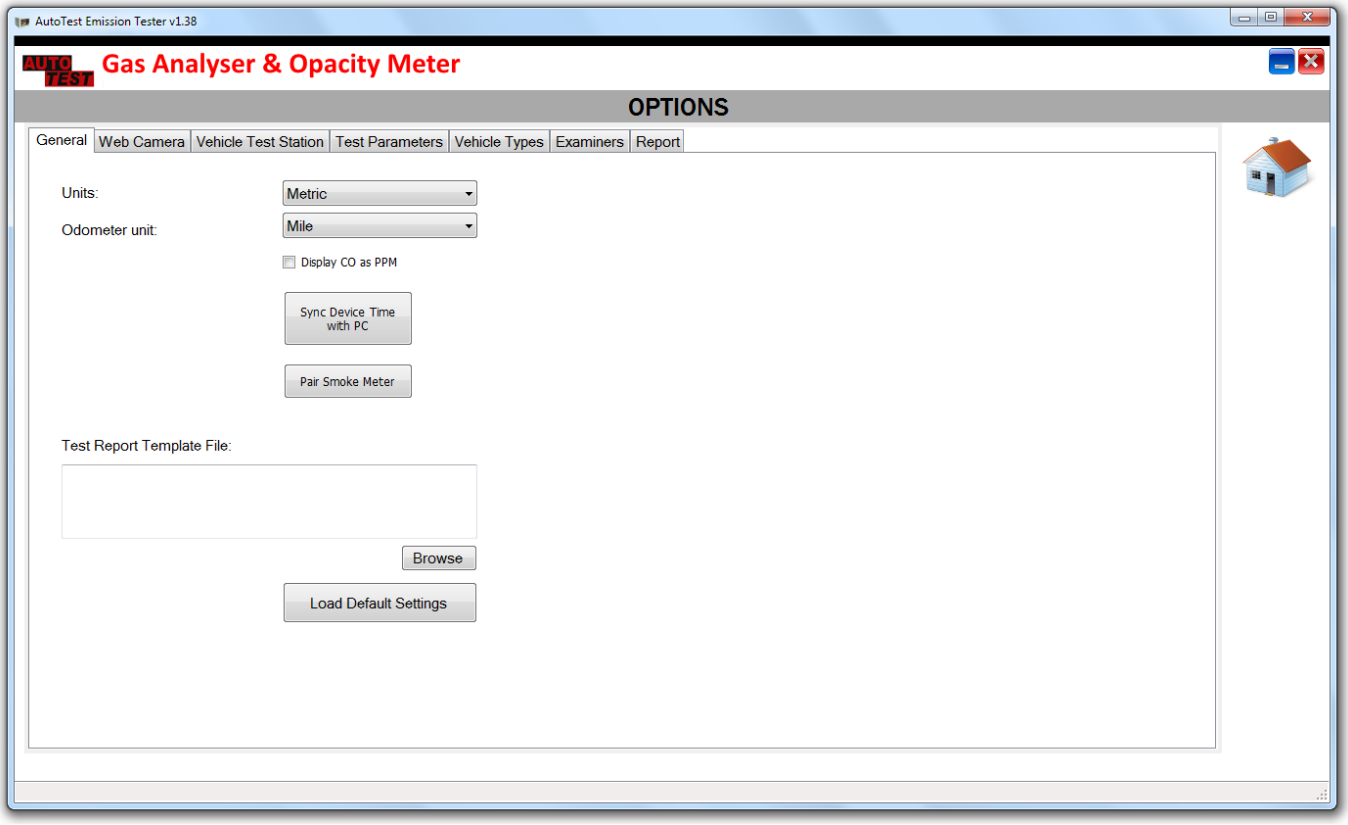
7.9.1 General settings

General settings allow units to be changed between Metric and Imperial.

Click on "Sync Device Time with PC" to set the PC time on the connected device. The date will remain the same on the device, only the time will be updated.

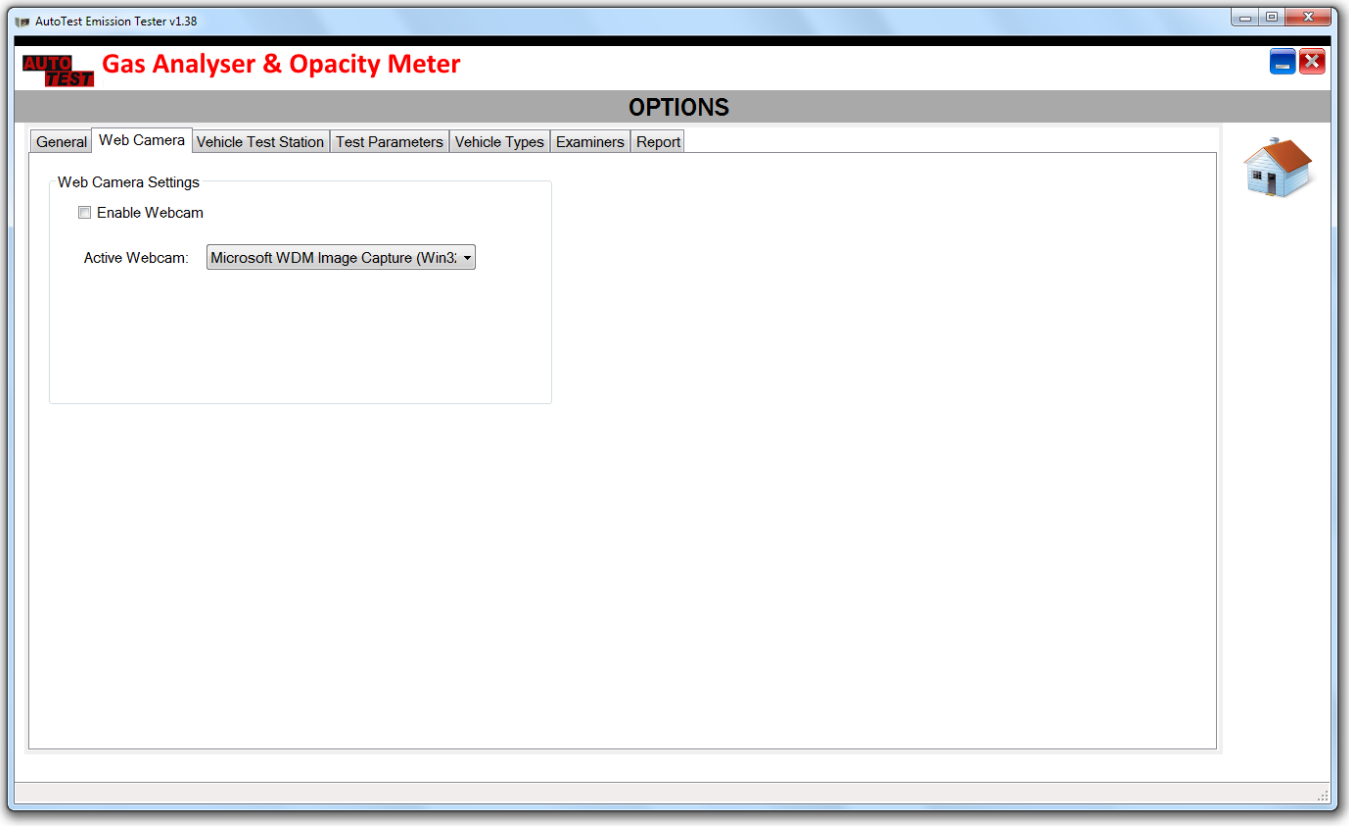
Click on "Pair Smoke Meter" to pair a new smoke meter with the connected Auto Gas meter.

Users can customise test reports by modifying a report template file stored in the "Templates" folder (in the same directory where Auto Gas PC software is installed). After modifying the test report template file, update the location of the template file in the "Test Report Template File:" field.



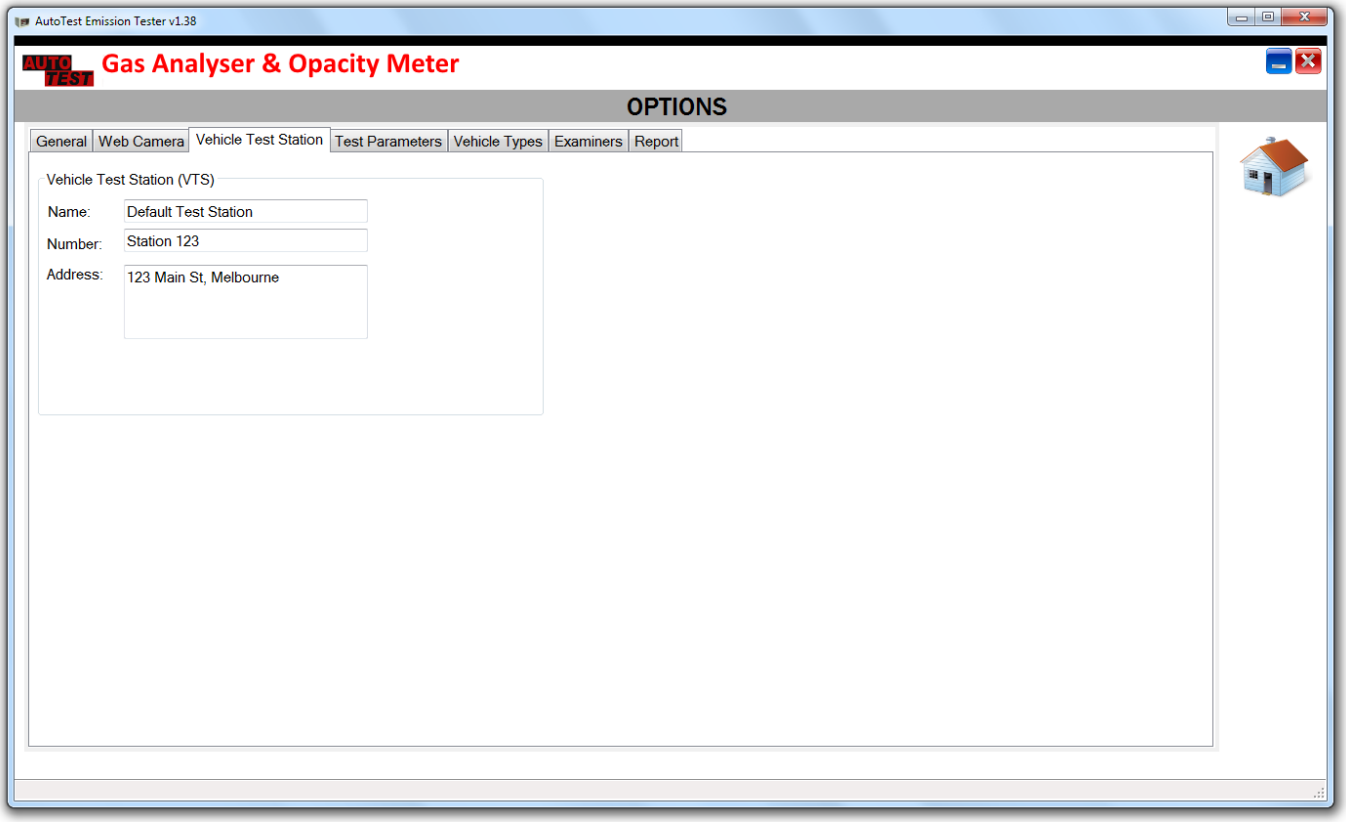
7.9.2 **Web Camera Option**

The Web Camera can be enabled to capture the vehicle registration number during the gas test. To enable the camera, check "Enable Webcam" and select from the list of available webcams.



7.9.3 Vehicle Test Station Information

Vehicle test station (VTS) information can be stored on the *Vehicle Test Station* page. If the gas analyser is currently connected to the PC, the PC software will load the VTS information from the gas analyser when the settings dialogue window is opened.

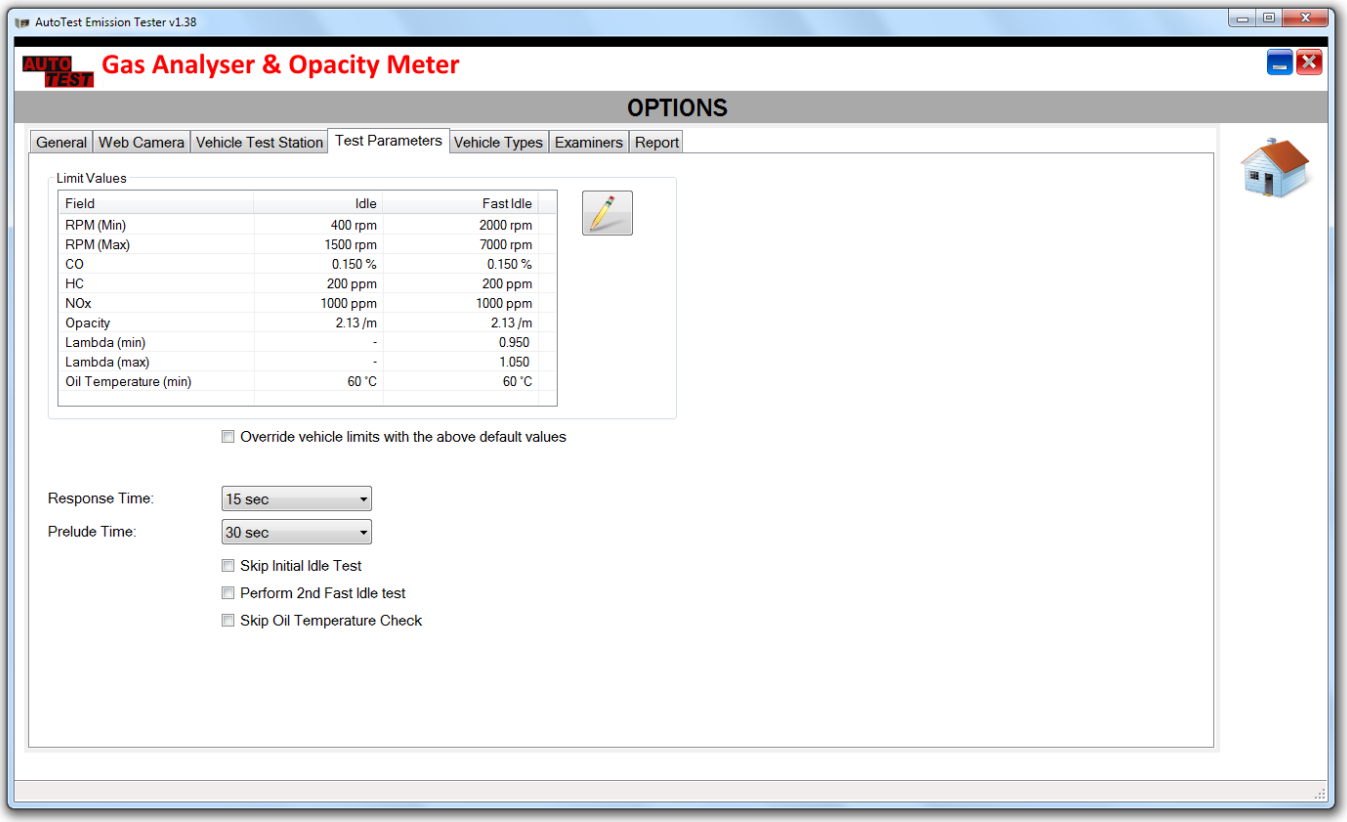


User can enter the following information regarding the test station.

Field	Description
Name	The name of the vehicle test station or workshop.
Number	The registration number or reference number of the test station.
Address	The address of the vehicle test station

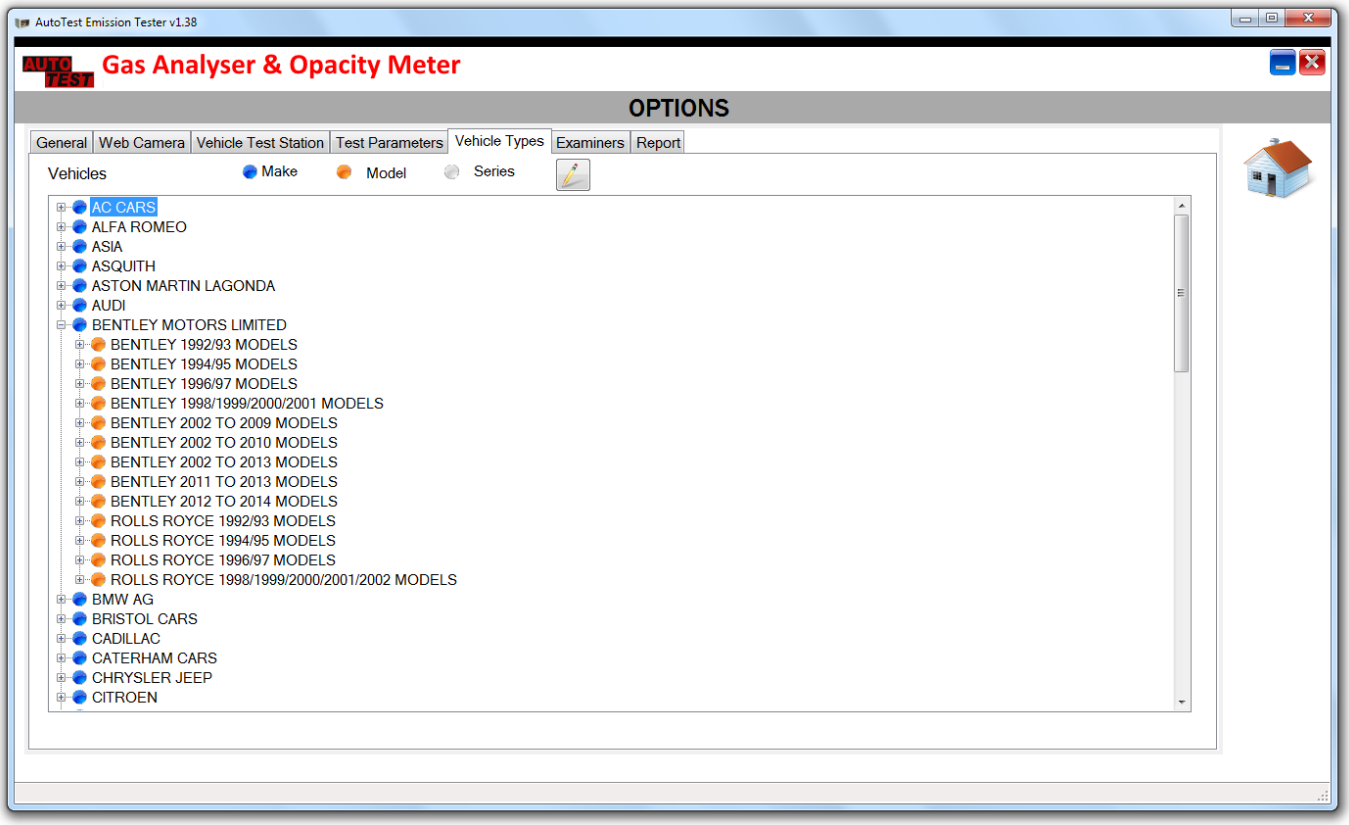
7.9.4 **Test Parameters**

The default test limit values are adjusted on this page. For MOT test procedures, these values will not be used, instead the limit values specified in the MOT procedure will be used.



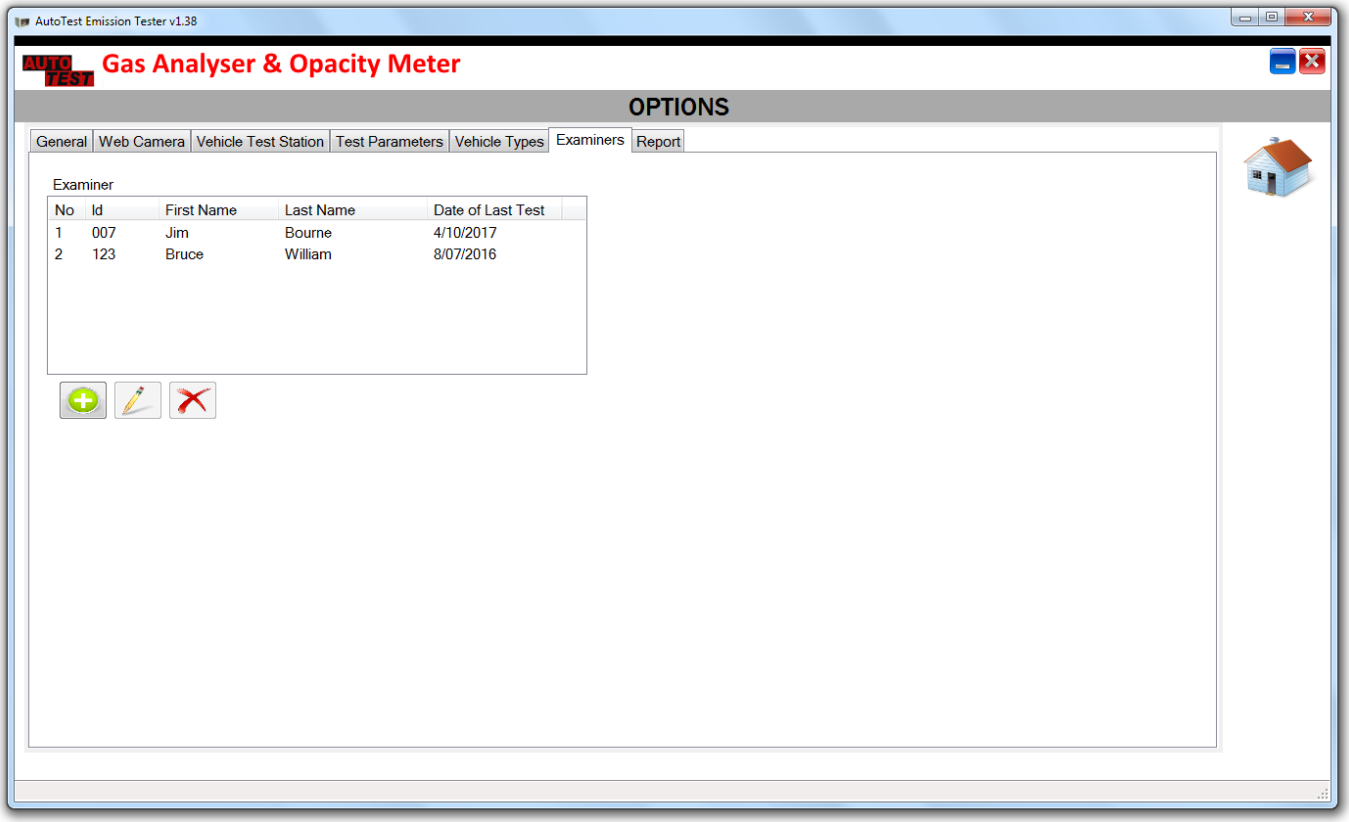
7.9.5 **Vehicle types (Vehicle Emissions Database)**

Under "vehicle types" page, the vehicle limit values for various vehicles are listed. These limit values will be used for Catalyst gas test.



7.9.6 **Examiners**

The examiners configuration page allows changing the examiners. The list of added examiners will be displayed at the start of a gas test for the user to choose the current examiner or tester.

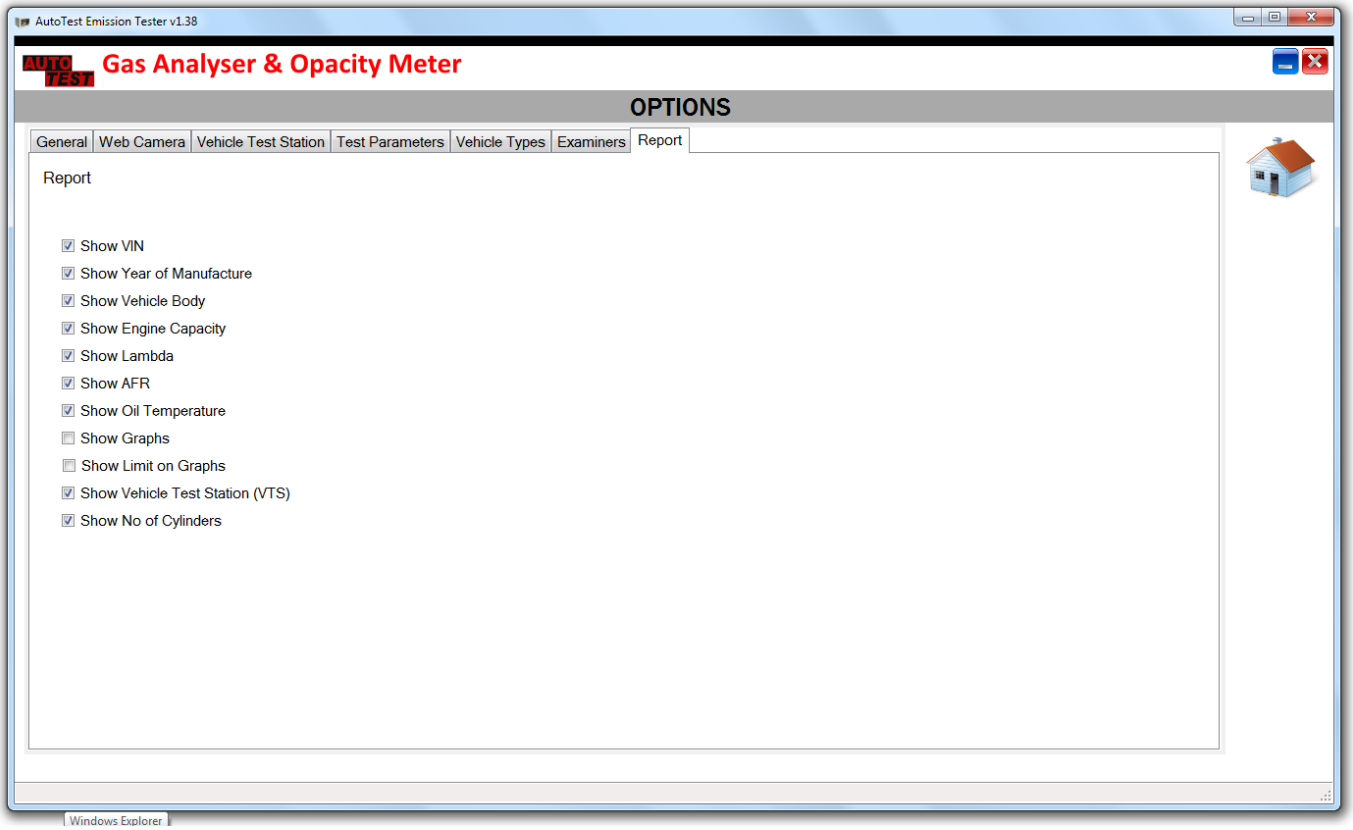


Click on  to add a new examiner record. Click on  to edit an existing record.

Click on  to delete a record.

7.9.7 **Report Configuration**

The report configuration page allows users to customise the test report by select what to show on the test report and what not to include in the test report.



8. MAINTENANCE AND CALIBRATION

8.1 Maintenance

AUTO*TEST*™ Diesel Smoke Meter(Auto Smoke) is designed to function without regular maintenance. The only components requiring periodic maintenance are the glass windows of the light emitter and detector.

Occasional heavy exhaust particles might stick to the glass windows of both the optical emitter and the detector during smoke tests. Cleaning operation on these windows should be performed regularly. Use a dry cotton rag to wipe off any carbon deposit from the surface of the glass windows. DO NOT USE ANY CLEANING FLUID.

A carbon deposit may also be deposited in the measurement chamber. Use the supplied cleaning brush to sweep out carbon deposits from the tube to eliminate the soot.

It is not necessary to open Auto Smoke's side cover to carry out these maintenance operations.

8.2 Calibration

Auto Smoke requires regular calibration. The interval of the calibration will depend on the local regulations but it is advised to recalibrate the unit once a year. Each time test results are printed, the printout will include the day and month of the last calibration. Once the calibration is due, Auto Gas will display "Calibration Expired" message on the screen and will prevent any further tests to be carried out.

There are two ways of calibrating Auto Smoke - either via your local authorised service centre or by returning the unit to AUTO*TEST*™ Products (See Section 8.2.1).

8.2.1 Returning Auto Smoke for Calibration

8.2.1.1 Packaging

Please remember that you are shipping an electronic instrument. Bubble pack or foam should surround the Auto Smoke, which should be inserted into a sturdy cardboard box.

8.2.1.2 Shipping

Labelling - A label noting "Electronic Device - Fragile" should be placed on the box.
Freight Carrier – Container should be sent **freight prepaid**. Auto Test Products has no preference on freight carriers. However, we prefer companies such as TNT, IPEC, UPS, or Federal Express to forward units, if a prompt delivery is required.

Ship to the following address:
The Service Department,
AutoTest Products Pty Ltd,
61-63 Parsons St,
Kensington, VIC 3031,
Australia.
Phone: (+61 3) 8840 3000.

Alternatively, contact your nearest service agent (see Section 12).

Users residing in the UK may ship the unit to the local authorised service centre:
Tecalemit Garage Equip. Co. Ltd
Unit 2,Eagle Road, Langage Bus Pk., Plympton, Plymoth, Devon, PL7 5JY
PH: (+017) 5221 9150

9. CONVERSION CHART

9.1 Absorption (K) to Opacity (%) based on 430mm EOPL

Absorption (k) m^{-1}	*Opacity (%)*	*Absorption (k) m^{-1}*	*Opacity (%)*	*Absorption (k) m^{-1}*	*Opacity (%)*
0	0	3.9	81.31	7.8	96.51
0.1	4.21	4	82.09	7.9	96.65
0.2	8.24	4.1	82.85	8	96.79
0.3	12.1	4.2	83.57	8.1	96.93
0.4	15.8	4.3	84.26	8.2	97.06
0.5	19.35	4.4	84.92	8.3	97.18
0.6	22.74	4.5	85.56	8.4	97.3
0.7	25.99	4.6	86.17	8.5	97.41
0.8	29.11	4.7	86.75	8.6	97.52
0.9	32.09	4.8	87.31	8.7	97.63
1.0	34.95	4.9	87.84	8.8	97.73
1.1	37.69	5	88.35	8.9	97.82
1.2	40.31	5.1	88.84	9	97.91
1.3	42.82	5.2	89.31	9.1	98.00
1.4	45.23	5.3	89.76	9.2	98.09
1.5	47.53	5.4	90.19	9.3	98.17
1.6	49.74	5.5	90.61	9.4	98.24
1.7	51.86	5.6	91	9.5	98.32
1.8	53.88	5.7	91.38	9.6	98.39
1.9	55.82	5.8	91.74	9.7	98.46
2.0	57.68	5.9	92.09	9.8	98.52
2.1	59.46	6	92.42	9.9	98.58
2.2	61.17	6.1	92.74	9.91	98.59
2.3	62.81	6.2	93.05	9.92	98.59
2.4	64.37	6.3	93.34	9.93	98.60
2.5	65.87	6.4	93.62	9.94	98.61
2.6	67.31	6.5	93.89	9.95	98.61
2.7	68.68	6.6	94.15	9.96	98.62
2.8	70	6.7	94.39	9.97	98.62
2.9	71.26	6.8	94.63	9.98	98.63
3.0	72.47	6.9	94.85	9.99	98.64
3.1	73.63	7	95.07		
3.2	74.74	7.1	95.28		
3.3	75.8	7.2	95.48		
3.4	76.82	7.3	95.67		
3.5	77.8	7.4	95.85		
3.6	78.73	7.5	96.02		
3.7	78.83	7.6	96.19		
3.8	80.49	7.7	96.35		

9.2 **Opacity (%) to Absorption (K) based on 430mm EOPL**

Opacity % (N)	*Absorption K (m^{-1}) Co-efficient*	*Opacity % (N)*	*Absorption K (m^{-1}) Co-efficient*	*Opacity % (N)*	*Absorption K (m^{-1}) Co-efficient*
1	0.02	40	1.19	79	3.63
2	0.05	41	1.23	80	3.74
3	0.07	42	1.27	81	3.86
4	0.09	43	1.31	82	3.99
5	0.12	44	1.35	83	4.12
6	0.14	45	1.39	84	4.26
7	0.17	46	1.43	85	4.41
8	0.19	47	1.48	86	4.57
9	0.22	48	1.52	87	4.74
10	0.25	49	1.57	88	4.93
11	0.27	50	1.61	89	5.13
12	0.30	51	1.66	90	5.35
13	0.32	52	1.71	91	5.60
14	0.35	53	1.76	92	5.87
15	0.38	54	1.81	93	6.18
16	0.41	55	1.86	94	6.54
17	0.43	56	1.91	95	6.97
18	0.46	57	1.96	96	7.49
19	0.49	58	2.02	97	8.15
20	0.52	59	2.07	98	9.10
21	0.55	60	2.13	99	10.71
22	0.58	61	2.19	99.1	10.95
23	0.61	62	2.25	99.2	11.23
24	0.64	63	2.31	99.3	11.54
25	0.67	64	2.38	99.4	11.90
26	0.70	65	2.44	99.5	12.32
27	0.73	66	2.51	99.6	12.84
28	0.76	67	2.58	99.7	13.51
29	0.80	68	2.65	99.8	14.45
30	0.83	69	2.72	99.9	16.06
31	0.86	70	2.80		
32	0.90	71	2.88		
33	0.93	72	2.96		
34	0.97	73	3.04		
35	1.00	74	3.13		
36	1.04	75	3.22		
37	1.07	76	3.32		
38	1.11	77	3.42		
39	1.15	78	3.52		

10. TROUBLESHOOTING

10.1 Fault Diagnostics

Fault Description	Possible Reasons	Possible Solution
Device not turning ON	• AC Fuse blown	Check the AC fuse located in the compartment where AC-in cable is connected. Notice the fuse value printed on a sticker next to the AC input socket.
Fan not running	• Smoke meter just started	Normal. The fan does not turn on during the initial warmed up phase.
	• Faulty Fan	If the FAN does not turn on after the warmup is done while the communication between Auto Smoke and Auto Gas is ok, replace the fan as it might be faulty.
Auto Gas unable to connect to Auto Smoke	• Signal reception problem	Change the angle and direction of the RF antenna located on the smoke meter
		Reduce the distance between Auto Gas and Auto Smoke
"Smoke Bench Failed" message appears on Auto Gas when starting a smoke test	• Smoke bench is faulty or dead	Contact Auto Test Service

10.2 Error Messages

Fault Description	Possible Reasons	Possible Solution
"Calibration Expired! Measurements may be inaccurate."	• Calibration has expired	Recalibrate the meter
"RTC clock on the device has failed."	• Internal clock chip fault or the 3V clock battery is flat	The meter needs to be repaired. Contact AutoTest Service Centre.
"Dirty window - needs cleaning"	• Smoke meter's glass / lens are dirty and need to be cleaned	Switch off the smoke meter. Clean the lens using a dry cotton rag
"Temperature sensor is faulty"	• Smoke meter's temperature sensor is faulty	The meter needs to be repaired. Contact AutoTest Service Centre.
"Gas bench board failed."	• Gas Bench board of the gas analyser is faulty	The meter needs to be repaired. Contact AutoTest Service Centre.

For other problems, contact Auto Test Products or any Authorised Service Centre in Australia on (61 3) 9647 9797 or fax details of the problem to (61 3) 9464 3427. Repairs should only be carried out by an authorised AutoTest service centre, in order to ensure that the gas analyser retains its calibration. Refer to Section 13 regarding warranty. For instructions on returning products for calibration or servicing, see Section11.1.

11. SPECIFICATIONS

11.1 Technical Specifications

	Measurement parameters	Value	Resolution	Notes
1	Smoke Opacity (%)	0 – 99.9 %	0.10 %	< 1.0 % (full range)
2	Smoke Absorption (m^{-1})	0 – 9.99 m^{-1}	0.01 m^{-1}	
3	Source LED (λ)	480 - 680 nm		
4	Source LED (λ_{peak})	565 nm		
5	Response time	0.2 sec		
6	Warm-up time	< 10 minute		Over 0 – 50 °C.
7	Zero Calibration	Automatic		
8	Detector temperature	40 °C		
9	Chamber temperature	80 °C		
10	Chamber tube length	186 mm		0.5 mm
11	Chamber diameter	21 mm		
12	Effective Optical Path Length (measured)	215 mm		
13	Effective Optical Path Length (compensated)	430 mm		
14	Ventilation Fan Speed	2600 RPM		Constant speed fan
	Using AUTO*TEST*™ Exhaust Gas Analyser (Auto Gas)			
15	Engine Speed	400 – 7000 RPM	10 RPM	
16	Engine Speed (via OBD-II)	0 – 16383 RPM	1 RPM	
17	Oil Temperature Sensing	0 – 110 °C	1 °C	
18	Oil Temperature Sensing (via OBD-II)	-40 – 210 °C	1 °C	

11.2 Electrical Specification

1	AC Power supply	110 – 230 V_{AC} (+10% to -15%) 50-60 Hz
2	DC Power supply	13.5 V_{DC} ±15% (65 W)

11.3 General Specifications

1	Operating temperature	+2°C to +45°C
	Gas Analyser & Smoke Meter	+2°C to +45°C
	Accelerometer Sensor	+2°C to +130°C
2	Storage temperature	-20°C to +70°C
3	Dimensions	200 mm x 400 mm x 170 mm
4	Weight	6.5 Kg
5	ISO-3173, ISO-11614	
6	CE Directive: 72/306/CEE, 91/441/CEE	
7	CE Directive 96/96/CE (20 Dec 1996), 2003/27/CE (03 Apr 2003)	

12. AUTHORISED SERVICE AGENTS

AUSTRALIA
AutoTest Products
69 Parsons Street.Kensington,VIC-3301
PH:+61 3 8840 3016

UNITED KINGDOM
Tecalemit Garage Equip. Co. Ltd
Unit 2,Eagle Road, Langage Bus Pk., Plympton, Plymoth, Devon, PL7 5JY
PH: (+017) 5221 9150

13. WARRANTY

AUTO*TEST* Products Pty Ltd or any Authorised AUTO*TEST* Service Centre warrants this product against defects in material and workmanship for a period of 12 months from the original date of purchase. This warranty applies only to products and components supplied by AUTO*TEST* Products which can be identified by the trade name or logo affixed to them or by other documents. AUTO*TEST* Products does not warrant any products not supplied by AUTO*TEST* Products.

During the warranty period, AUTO*TEST* Products or any Authorised Service Centre will repair (or at its option replace) any defective component(s) without charge for parts or labour, provided the product is returned freight prepaid to an authorised AUTO*TEST* Service Centre. Transit insurance and return freight will be at the owner's expense.

In order to obtain calibration, warranty or non-warranty service, ship the product, freight and insurance prepaid to your nearest AUTO*TEST* Service Centre. Attach to the product your name, address, contact phone numbers, description of the problem and if a warranty claim, proof of purchase (dated sales receipt or invoice).

AUTO*TEST* Products or any Authorised AUTO*TEST* Service Centre reserves the right to refuse warranty repair if accident, abuse, misuse or misapplication has damaged the product, or if the product has been damaged in transit or as a result of service or modification by other than an Authorised Service Centre, nor are any other warranties expressed or implied, including any regarding merchantability or fitness for any other particular purpose.

AUTO*TEST* Products or any Authorised Service Centre is not responsible for incidental or consequential damages resulting from the breach of any express or implied warranty, including damage to property and, to the extent permitted by law, damages for personal injury

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