

A-NOxBO-X



Operating Instructions

AUTODIAGNOS

A-NOxBO-X

Operating Instructions

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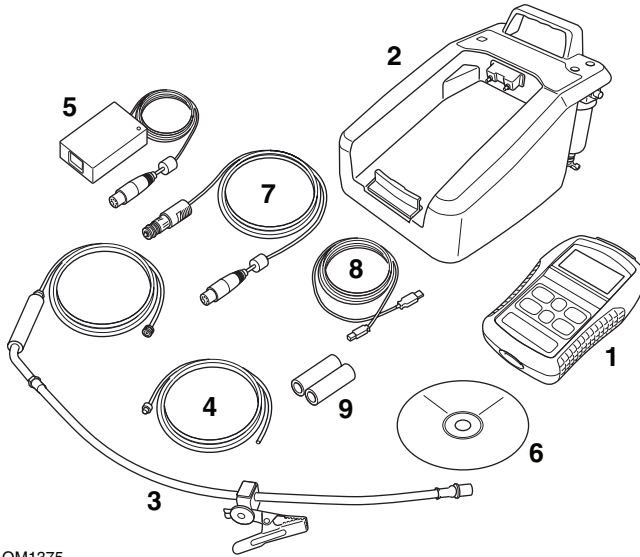
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Introduction

A-NOxBO-X is an exhaust gas analyser for spark ignition vehicles and comprises a fully portable handset with a base station and optional software to install on a PC.



OM1375

1. Handset
2. Base unit
3. Exhaust Probe attachment
4. Base unit exhaust pipe extension
5. Mains power converter supply
6. CD ROM with PC software (optional)
7. Vehicle power supply cable (optional)
8. USB cable handset to laptop (optional)
9. Filters

Spark ignition vehicles includes both catalyst and non-catalyst, supercharged (including Turbo) and lean-burn engines, vehicles that are fuelled by Petrol, Liquid Petroleum Gas (LPG) and Compressed Natural Gas (CNG) and also injection or carburettor fuel control.

NOTE: Diesel engine vehicles are specifically excluded from testing using the A-NOxBO-X system.

Introduction

There are two options available:

1. OM4710/5PCUK

- Measures 5 gases, provides live readings of all gases and λ
- Pre-MOT Tests (Using BETS or MOT default CAT limits)
Catalyst test
- PC software to graph and/or diagnose emissions faults from gas readings

2. OM4710/5UK

- Measures 5 gases, provides live readings of all gases and λ
- Pre-MOT Tests (Using BETS or MOT default CAT limits)
- Catalyst test

The A-NOxBO-X system enables the measurement of four or five of the main exhaust gases emitted from a spark ignition engine. The gases measured are: Carbon Dioxide (CO₂), Carbon Monoxide (CO), Hydrocarbons (HC), Oxygen (O₂) and Nitric Oxide (NOx) (optional). Measurement accuracy meets or exceeds requirements for OIML Class 0 and BAR97:

- CO:Range - 0% to 15%; accuracy typically 3% relative
- CO₂: Range - 0% to 20%; accuracy typically 3% relative
- O₂: Range 0% to 25%; accuracy typically 1% relative
- HC n-hexane: 0 to 2000ppm; accuracy typically 3%
- HC n-propane: 0 to 30000ppm; accuracy typically 5%
- NOx :Range - 0 to 5000ppm, accuracy typically 3% relative (optional)

The optional PC based system provides enhanced facilities for data capture and graphing as an additional feature.

The A-NOxBO-X handset communicates with the base station using *Bluetooth*[®] Wireless Technology and with the PC option, the handset communicates with a PC via a USB port.


Power Management


The handset monitors both itself and the base station for the charge status of the battery packs. If either battery pack voltage falls below a predetermined level the handset will display a warning to cease testing and recharge the units. Approximately five minutes before the batteries reach the automatic shutdown point, a message is flagged to warn you of the low battery state and thus the imminent shutdown.

1. Low Base Station Battery
 - Indicated by the handset battery symbol flashing 'empty' and the green LED on the base station flashing
2. Low Handset Battery
 - Indicated only by the battery symbol on handset display flashing empty.

NOTE: Once the units have been put on charge, both LED and battery symbol will stop flashing.


Safety Precautions


 **WARNING: Exhaust gases are poisonous and contain carbon monoxide, which can cause unconsciousness and can be fatal - NEVER start or leave the test vehicle engine running in an unventilated area.**

 **WARNING: DO NOT handle the A-NOxBO-X exhaust probe tip, or place the exhaust probe on plastic or combustible surfaces after the test procedure. The probe may become extremely hot during the test and could cause burns and a risk of fire.**

Electrical Safety Precautions

 **WARNING: Any power or extension cord must have an earth conductor.**

 **WARNING: When replacing fuses make sure the correct type and rating are used.**

 **WARNING: Any adjustment, maintenance or repair must be carried out by an approved service engineer.**

Introduction

Assembling the A-NOxBO-X Analyser

Unpack the units carefully, checking off each item and component against the itemised packaging list included. If any component is missing or damaged, contact your supplier immediately.

- The batteries in the base unit and the handset will need to be installed and charged before either unit can be used (see *'Power Management', page 3*).
- The base station battery compartment is on the underside of the unit, secured by two cross-headed bolts. Unscrew the cover, and secure the bigger battery pack into the cover tray with the velcro strap; connect the in-line connector to the base station. Refit the cover and tighten the two screws (do not overtighten).
- Remove the handset rubber protection cover to access the underside of the case cover; remove the four cross-headed screws and place to one side. Lift off the bottom cover and place to one side. Connect the smaller of the battery packs to the in-line connector and place the battery pack in the recess through the PCB; taking care to keep the supply cables from catching the cover. Position the cover and replace the four screws (do not overtighten). Refit rubber protection cover.
- Place the handset in the base station ensuring that it is pushed firmly into place and clips into the bottom securing clip.

IMPORTANT: BATTERY PACKS SHOULD ALWAYS BE FITTED BEFORE CHARGER UNIT CONNECTED

- Connect the mains charging unit into the round XLR connector at the rear of the base station and the mains plug into a wall socket. With the mains switched on, the middle red LED on the top surface of the base station should illuminate to indicate that the base station is charging. The handset display will switch ON automatically and the battery symbol in the top right hand corner will indicate progressive charging.
- If applicable, while the batteries are charging, install the Analyser software onto your PC (see *'Installation', page 36*).
- When fully charged the red base station LED will extinguish and the lower amber LED will illuminate to indicate the base station battery is on trickle charge until the charging unit is disconnected. Likewise, the battery symbol on the handset will remain static showing a fully charged battery, which will be on trickle charge until mains charging unit is disconnected.



CAUTION: Before connecting the base station to the mains, ensure that you have read and fully understand the operating instructions given in this document.

- Attach the exhaust sample probe to the water trap fitting (2) at the rear of the base station.

- Attach the exhaust outlet pipe to the Exhaust Gas outlet (4). The exhaust outlet pipe is used to expel the sampled exhaust gases from the test vehicle well away from the active working area, to prevent technicians inadvertently inhaling the gases. Run the outlet pipe to a well ventilated area.

NOTE: With the charger unit connected to the base station, the gas analyser will be in charge mode, consequently gas measurement is disabled.

A-NOxBO-X Sample Probe

⚠ WARNING: *Before attaching any A-NOxBO-X probe to the test vehicle, ensure that you have read and understand the safety precautions listed earlier in this manual.*

Exhaust probe

The exhaust probe collects gas samples from the test vehicle exhaust, which are then analysed by A-NOxBO-X.

The probe connects between the Sample Gas Input fitting (item 2 under 'Assembling the A-NOxBO-X Analyser', page 4) and the test vehicle exhaust pipe. Insert the probe as far into the vehicle exhaust as possible and secure by attaching the alligator clip to the end of the exhaust pipe.

⚠ WARNING: *Take care to avoid contact with the exhaust system when inserting or removing the exhaust probe. The exhaust system will be hot and severe burns could occur.*

The exhaust probe is supplied with a sealing cap (Part No. OM 4700/23) which must be fitted over the end of the probe when a leak test is performed. Keep the cap in a safe place when not in use (see 'System Checks', page 25, for further details of a leak test).

Getting Started

Emissions Testing


Before attempting to test vehicle emissions levels, ensure that the base station and handset are fully charged (see 'Power Management', page 3) for remote operation.

Note: Emission testing is disabled whilst batteries are charging.

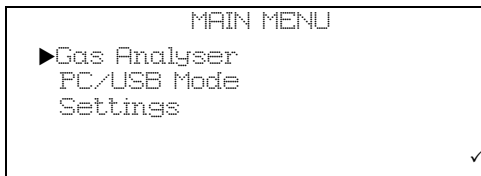
For on-road testing if the base station batteries are low, connect the base station to the vehicle supply cable (optional). With this configuration the batteries will not charge but the supply to the base station is maintained.

A-NOxBO-X emissions testing can be undertaken by using the handset separated from, or in position on, the base station.

Handset Navigation

Press the 'Power up' buttons  on the base station and then on the handset, the handset screen displays the 'Main Menu' and lists the functions available:

- Gas Analyser
- PC/USB Mode
- Settings



The handset will automatically start searching for the *Bluetooth*[®] Wireless Technology address specific to the base station. The handset and the base station are 'paired' together to prevent any interference or acquisition from other *Bluetooth*[®] Wireless Technology devices such as laptop PCs or mobile telephones. After a few seconds an antenna icon will appear in the top LH corner of the screen indicating that the *Bluetooth*[®] Wireless Technology link has been established. This icon will always be displayed whilst the link is made.

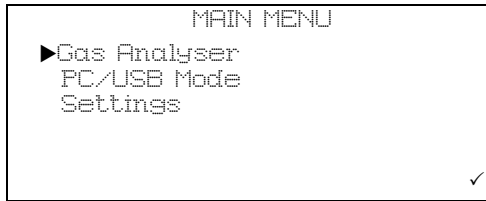
The battery icon in the top RH corner reflects the charge status of the handset battery pack.

NOTE: The battery icon will flash empty to indicate a low battery charge for either the handset or the base station - see 'Power Management', page 3.

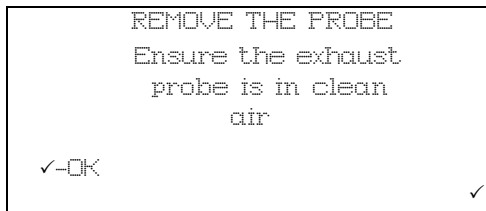
The Main Menu has three options:

- Gas Analyser - *Emission testing and analyser system checks*
- PC/USB Mode - *Used for down loading test result and updating handset*
- Settings - *Results record, clock and general system settings*

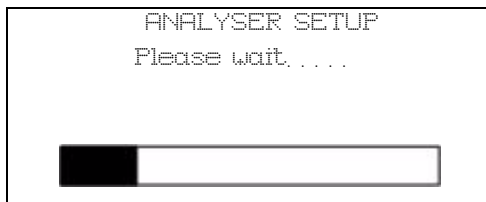
Gas Analyser



To access Emission Menu press the ✓ button with the ▶ pointing at Gas Analyser.



Follow the instructions and press the ✓ button.



The handset will display 'Analyser SetUp - Please Wait' and a progress bar. On completion the progress bar will be replaced briefly by 'Passed'.

During this time the analyser is initialising settings ready to conduct emissions testing. Once completed the display screen will change back to the 'Main Menu'.

The handset has an automatic power saving facilities, if no action is taken after one minute the display backlight powers down. Pressing any button will turn the backlight back on. If the handset does not detect a button press for more than 15 minutes it will assume that the A-NOxBO-X is not in use and the Base Station and the Handset will automatically power down.

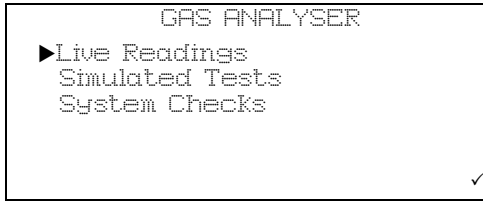
NOTE: The automatic shutdown feature is disabled during 'Live Reading' test.

Manual Power Down

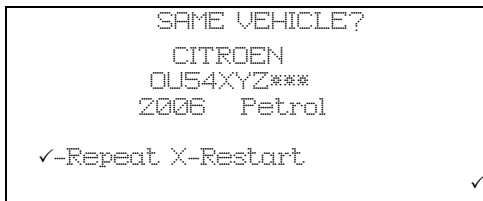
To power down both Handset and Base station at the same time, simply press and hold power button on handset for >1 second.

Getting Started

Live Readings



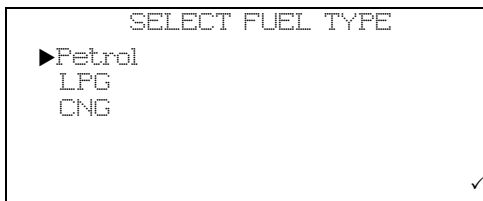
Press the ✓ again to enter the 'Gas Analyser' menu and again to start 'Live Readings'.



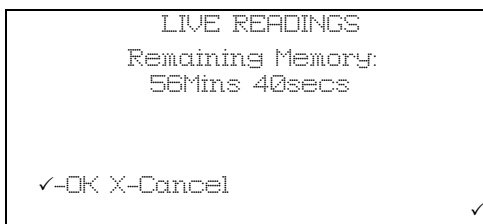
The screen momentarily displays 'Live Readings', then 'Please wait' then asks the technician to 'Repeat' ✓ or 'Restart' ✕ a test, displaying the vehicle data from the last test: Manufacturer, Licence plate, year and fuel type.

NOTE: When using for the first time, there will not be any previous tests stored, therefore the handset will proceed directly to the series of screen reminders before starting a test.

For 'Repeat' see page 18, 'Restart' sequence follows.

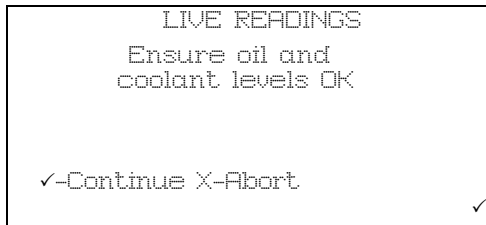


Pressing Restart ✕ will display a screen asking for fuel type.

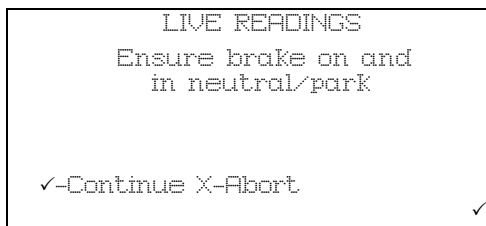


Getting Started

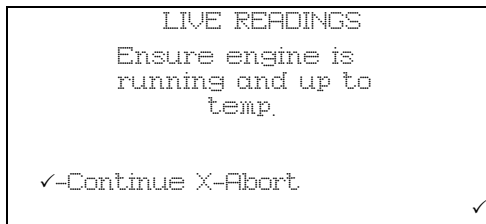
The remaining memory will be shown, on pressing ✓-OK the series of screens and procedures.



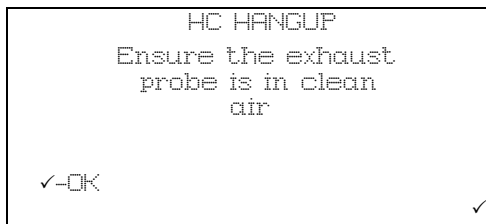
A series of screen reminders are displayed: 'Ensure oil and coolant levels OK', press ✓ to continue, or press X to abort'.



'Ensure brake on and in neutral/park, press ✓ to continue, or press X to abort'.

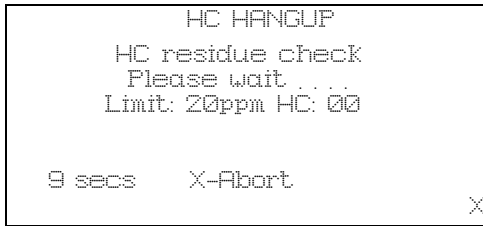


'Ensure engine is running and up to temp., press ✓ to continue, or press X to abort'.



'HC HANGUP Ensure the exhaust probe is in clean air, press ✓ to continue.

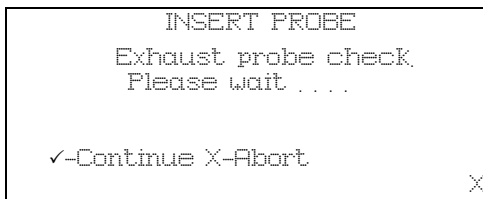
Getting Started



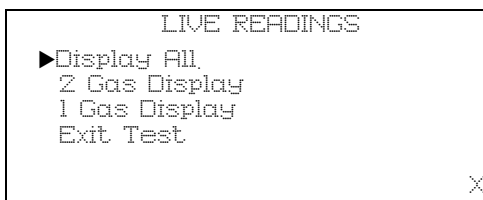
HC HANGUP' 'HC residue check', 'Please wait', Lim: 20ppm HC: XX', 'XXsecs', press **X** - to abort. On completion of the countdown the screen will briefly display 'HC residue check passed.'



The base station will automatically carry out a ZERO CALIBRATION, on completion the progress bar will be replaced briefly by 'Passed'.



On completion there is a prompt to 'INSERT PROBE'.



As soon as a gas is sensed there is a request for the number of gases to display, all, two or one and also an 'Exit Test'.

If '1 Gas Display' or '2 Gas Display' is selected, an additional menu will be displayed listing the gases that can be displayed, which are CO, HC, O₂, CO₂, Lambda, NOx, AFR and COK.

Getting Started

To make a selection, scroll up or down and press ✓. In '2 Gas Display' option, the selection will be tagged with an arrow. To deselect press ✓ again. Once the second gas has been selected, the handset will exit the menu and display the selected gases.

```
LIVE READINGS
HC:  0          λ: 0.00
CO: 0.001%     CO2: 0.00%
O2: 21.02%     NOx: 0ppm

✓-Start X-Go back X
```

On selection the screen will display the gas and the gas level in % or ppm, as appropriate.

```
LIVE READINGS
HC:  0          λ: 0.00
CO: 0.001%     CO2: 0.00%
O2: 21.02%     NOx: 0ppm

✓-Stop  [M]-Mark X-Go back X
```

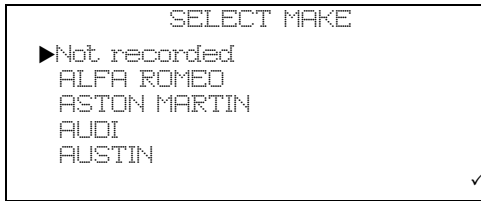
There is no fixed time for this test, however, there is a prompt to 'Start' and 'Stop' using the ✓ button. When sampling, a 'Mark' can be made at a specific point in the test by pressing the [M] button. This will set a marker in the data that is displayed in the analyser data graph on the PC.

```
TEST RESULTS 1
Live Readings
Time: 09:11
Date: 20 Feb. 08

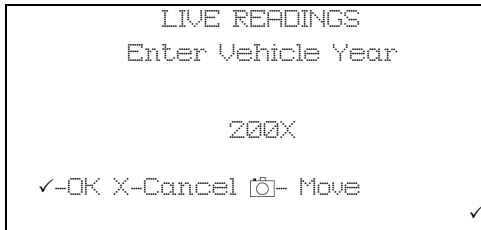
✓-Save X-Erase X
```

When stop is pressed the screen displays 'Test Result XX' 'Live Readings' 'Time: XX:XX' 'Date: XX/XX/XX' press ✓ to save, or press X to erase.

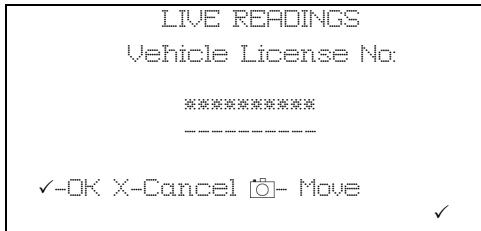
Getting Started



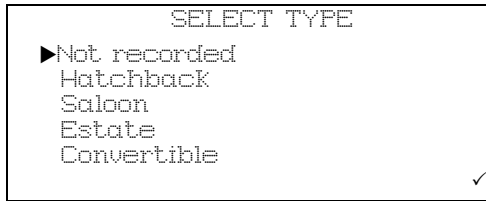
If saving, the next screen displays 'SELECT MAKE' and a list of manufacturers can be scrolled using the ▲ and ▼ buttons. Press ✓ to select the manufacturer.



The next screen displays 'ENTER VEHICLE YEAR', 200X (model year) and the ▲ and ▼ buttons will scroll through the years, press ✓ to select the year, the bottom line, i.e. ✓-OK ✕-Cancel [camera]-Move will flash until ✓ is pressed to confirm.



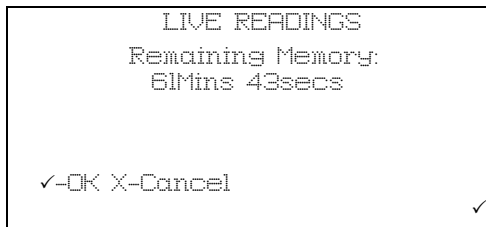
The next screen displays 'LIVE READINGS' 'Vehicle License No:' 'XXXXXXXXXXXX'. The ▲ and ▼ buttons will set each character from A to Z and 0 to 9, when the first character is correct press the camera [camera] button. Move to the next character and repeat the procedure until the registration number has been added press ✓. The bottom line, i.e. ✓-OK ✕-Cancel [camera]-Move will flash until ✓ is pressed again to confirm.



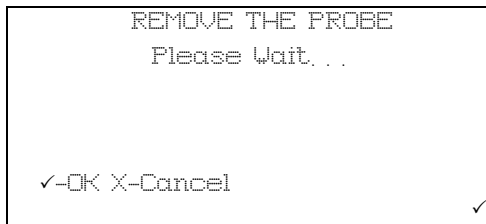
Next screen displays 'SELECT TYPE' and a list of vehicle type, i.e. Hatchback, Saloon, Estate, Convertible, People Carrier, Coupe and 4x4.



The next screen displays 'TESTER NAME' and a list of stored testers, a default list shows 'Tester 1', 'Tester 2' etc.

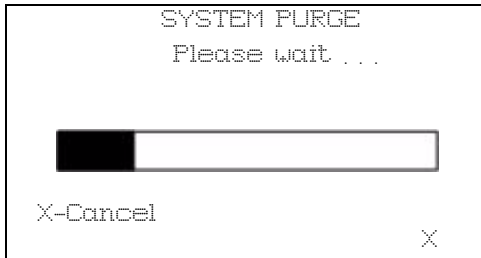


On selection of the tester the remaining memory is displayed.

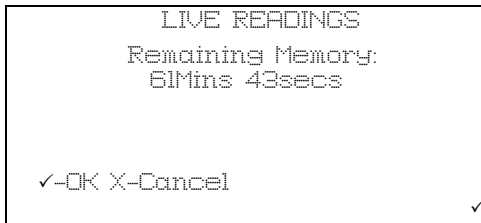


Pressing the ✓-OK will start a 'System Purge' procedure to remove any residue exhaust gases in the probe and pipework.

Getting Started

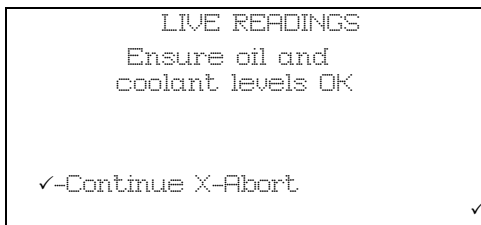


On completion of the 'System Purge' the display will return to the Gas Analyser menu. If pressing 'Repeat' the following sequence will occur:



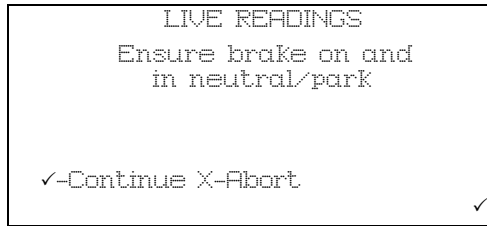
Pressing ✓ will display 'Remaining memory: XXMins XXsecs' ✓-OK, X-Cancel. If there is insufficient time available to complete another test the handset will need to have the existing files deleted (see 'Settings', page 27). For 'Restart' see ", page 8.

NOTE: If you have the PC option, make sure that any tests you wish to keep/analyse are down loaded to the PC before deleting the files.

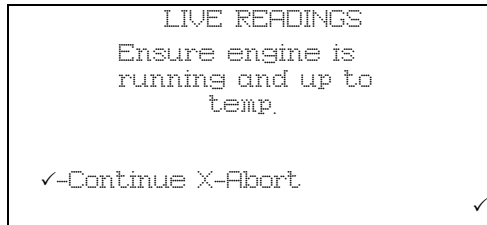


A series of screen reminders are displayed: 'Ensure oil and coolant levels OK', press ✓ to continue, or press X to abort'.

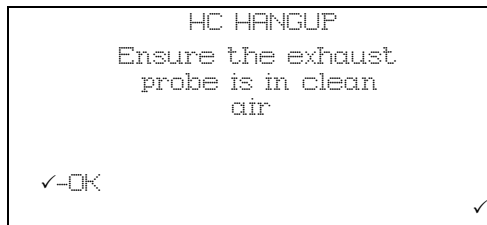
Getting Started



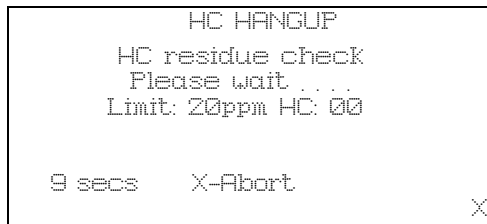
'Ensure brake on and in neutral/park, press ✓ to continue, or press X to abort'.



'Ensure engine is running and up to temp., press ✓ to continue, or press X to abort'.

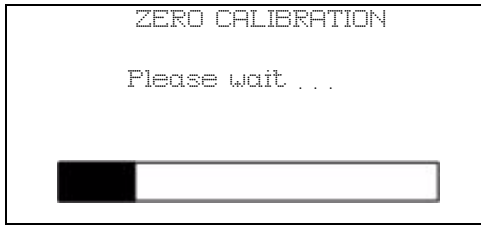


'HC HANGUP Ensure the exhaust probe is in clean air, press ✓ to continue.

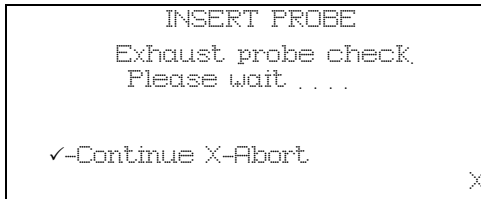


'HC HANGUP' 'HC residue check', 'Please wait', 'Lim: 20ppm HC: XX', 'XXsecs', press X - to abort. On completion the screen will briefly display 'HC residue check passed.'

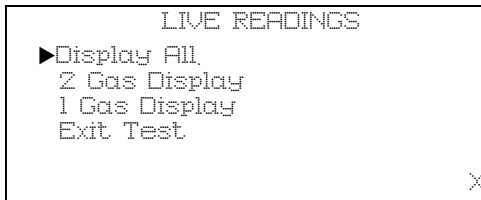
Getting Started



The base station will automatically carry out a ZERO CALIBRATION, on completion the progress bar will be replaced briefly by 'Passed'.



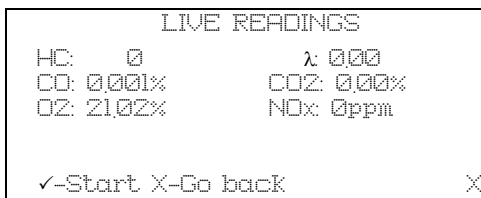
On completion there is a prompt to 'INSERT PROBE'.



As soon as a gas is sensed there is a request for the number of gases to display, all, two or one and also an 'Exit Test'.

If '1 Gas Display' or '2 Gas Display' is selected, an additional menu will be displayed listing the gases that can be displayed, which are CO, HC, O₂, CO₂, Lambda, NO_x, AFR and COK.

To make a selection, scroll up or down and press ✓. In '2 Gas Display' option, the selection will be tagged with an arrow. To deselect press ✓ again. Once the second gas has been selected, the handset will exit the menu and display the selected gases.



Getting Started

On selection the screen will display the gas and the gas level in % or ppm, as appropriate.

```
LIVE READINGS
HC: 0          λ: 000
CO: 0001%     CO2: 000%
O2: 2102%     NOx: 0ppm

✓-Stop  [M]-Mark X-Go back  X
```

There is no fixed time for this test, however, there is a prompt to 'Start' and 'Stop' using the ✓ button. When sampling, a 'Mark' can be made at a specific point in the test by pressing the [M] button. This will set a marker in the data that is displayed in the analyser data graph on the PC.

```
TEST RESULTS 1
Live Readings
Time: 09:11
Date: 20 Feb. 08

✓-Save  X-Erase          X
```

When stop is pressed the screen displays 'Test Result XX' 'Live Readings' 'Time: XX:XX' 'Date: XX/XX/XX' press ✓ to save, or press X to erase.

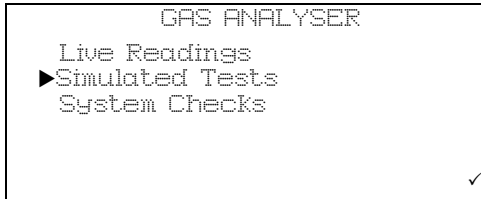
```
LIVE READINGS
Remaining Memory:
56Mins 40secs

✓-OK X-Cancel          ✓
```

Pressing ✓ -Save will store the results and the screen will change to live readings available memory. Pressing ✓ -OK will display the Gas Analyser menu.

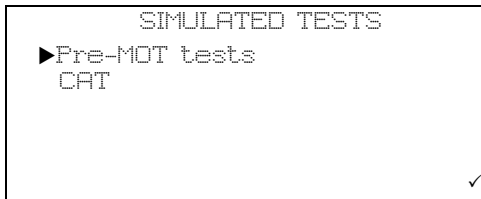
Getting Started

Simulated Tests



Simulated tests has two test procedures:

- Pre-MOT test
- CAT



Pre-MOT Tests

Pre-MOT is a simulated test measuring emission levels for Fast Idle and Natural Idle using either BETS limits or default MOT CAT limits. Limits for BETS, 1992 onwards, or CAT default can be selected during the test.

NOTE: The default values for the gas levels are set to known specifications, which are listed in the 'View Thresholds', see 'Settings', page 27.



A warning screens displays the fact that this test routine is not an official test and can be used only as a guide to gas levels pass/fail the preset gas levels.


```
FUEL:
Vehicle must be
Petrol for Pre-MOT
tests

✓-OK, X-Cancel                X or ✓
```

The Pre-MOT tests are only valid for a petrol vehicle.

```
TEST LIMITS
▶BETS
VOSA Def. Cat.

X or ✓
```

The test limits that are to be applied can be selected, BETS or VOSA Def. Cat.

```
BETS
CO < 0.20          HC < 200ppm
0.97 < λ < 1.03
Nat. Idle         CO < 0.30

✓-OK, X-Cancel                X or ✓
```

Select BETS and the limits are displayed. Select ✓ to proceed.

```
VOSA DEF. CAT.
CO < 0.30          HC < 200ppm
0.97 < λ < 1.03
Nat. Idle         CO < 0.50

✓-OK, X-Cancel                X or ✓
```

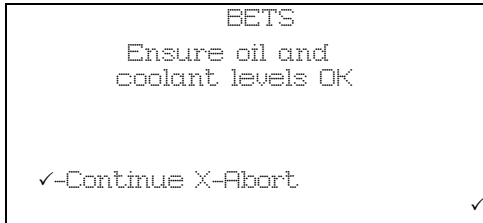
Select VOSA Def. Cat. and differing limits are displayed.

```
BETS
Remaining Memory:
59 mins 44 secs

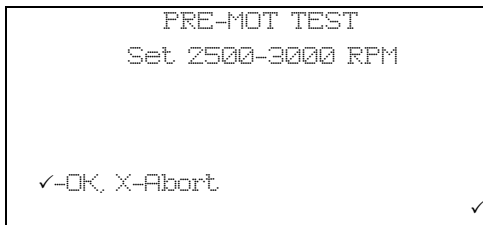
✓-OK, X-Cancel                X or ✓
```

Getting Started

For both BETS and VOSA Def. Cat. the remaining recording time available will be displayed with the respective headers showing, if insufficient memory remains the saved files must be transferred to a PC or deleted.



Starting with this screen for both tests, a series of screens is shown prompting the checking of the parking brake and engine running and at temperature. These are followed by the HC Hangup and Zero Calibration and then a prompt for the exhaust probe to be put into the exhaust pipe.



The screens from this point are the same for both BET and Nat. Idle and the engine must be run at the request idle speed before continuing to the next screen.



On completion of the preconditioning a result screen will be shown.

Getting Started

```
FAST IDLE
  HC (200):  0ppm
  CO (0,200): 0,000%
  Lambda (~): 0,000

XX secs X-Abort                X or ✓
```

The results will be displayed for the period of the 30 sec test.

```
OUTSIDE LIMITS
  CO(0,20): 0,00%
  HC(200): 0ppm
  Lambda(~): 0,00

✓-OK X-Abort                    ✓
```

The result of the test will be displayed as either a pass or outside limits.

Regardless of the result pressing the ✓ button will move the test onto natural idle.

```
PRE-MOT TEST
  Set 450-1500 RPM

✓-Continue X-Abort              ✓
```

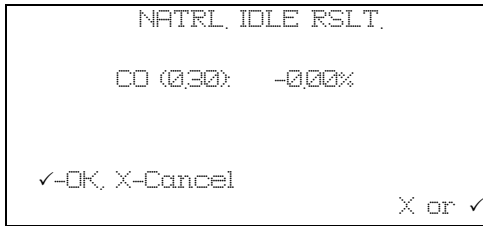
Check that the vehicle speed is within the range displayed and continue.

```
NATURAL IDLE
  Preconditioning
  10 secs

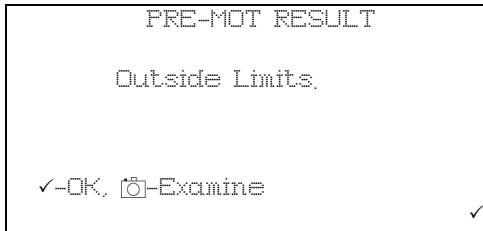
██████████████████████████████
X-Abort                          X
```

After 10 seconds the results will be displayed.

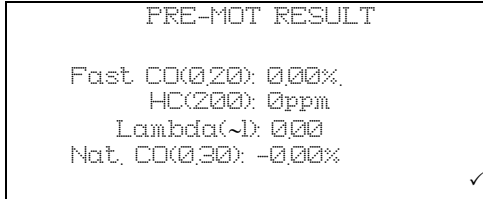
Getting Started



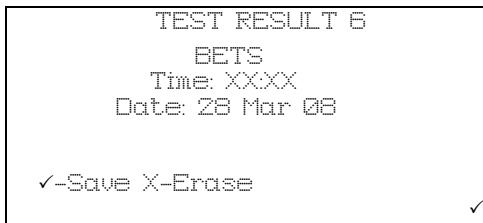
With no CO output this would be a failure.



Pressing [F5] button will display a summary of the results of the fast and natural idle tests.



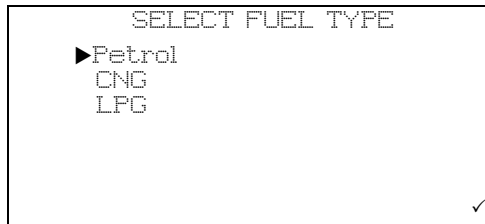
Press ✓ will go back to 'Outside Limits' screen, press ✓ again to continue.



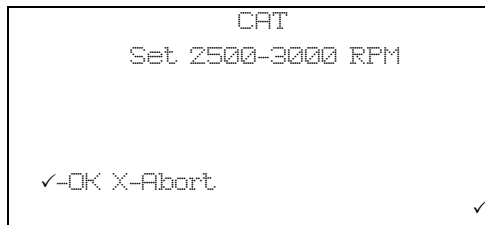
Pressing ✓ returns to the 'BETS Remaining Memory' screen.

CAT

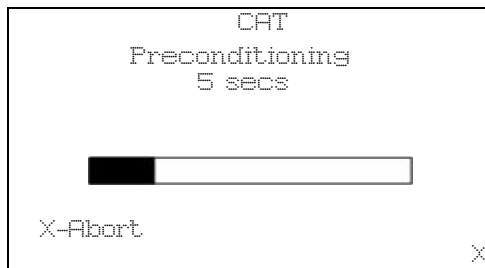
CAT test is a simulated test for the regulation Catalyser test where HC, CO, NO_x, O₂ and CO₂ are tested (only available for 5-gas options).



Selecting petrol will start a sequence of screens, remaining memory, oil and coolant levels, hand brake and engine running and up to temperature. HC Hangup sequence will be started ending with a Zero Calibration and a prompt to insert probe into the exhaust pipe. The process will continue with fast idle.

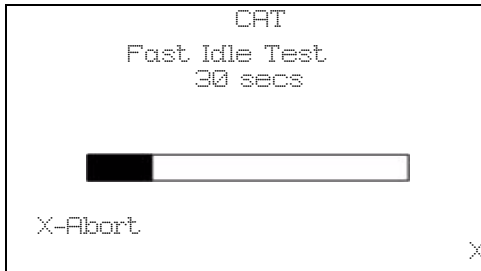


Open the throttle to increase engine speed to within the indicated RPM.

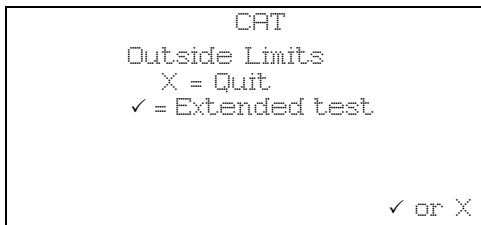


A short preconditioning before continuing the fast idle test.

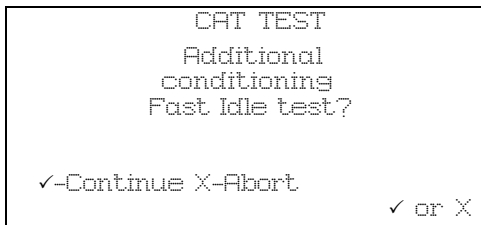
Getting Started



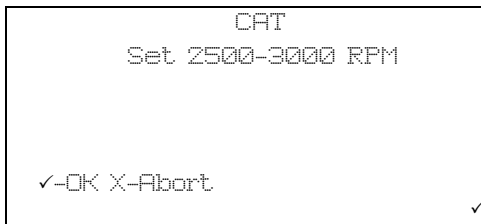
If the gas level is within the limits the test will be complete and a report of 'Within Limits' will be displayed.



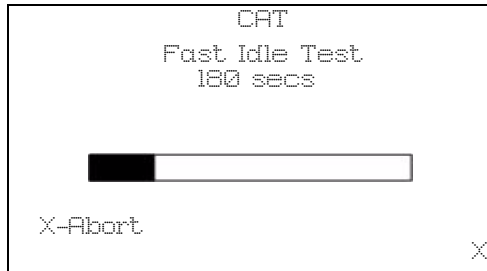
If the test fails an extended test can be started.



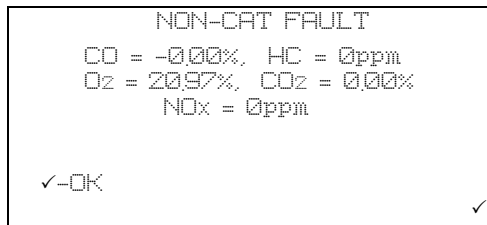
The additional conditioning comprises an extended period at fast idle to ensure that the catalyser is at the correct temperature to start and maintain the catalytic reaction.



The vehicle engine speed must be set to within the range indicated.

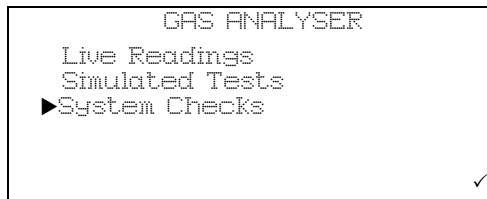


If the cat fails again a results page is displayed.



The test results can be saved or erased as required.

System Checks



There are eight system checks:

- Leak Test
- Manual HC HangUp
- Display PEF
- Environmental Data
- O₂ Cell Functions
- Zero Calibration
- Base Stn Battery
- Bench Data
- 4/5-gas setup

Getting Started

Leak Test - Follow on screen instruction to check integrity of water trap and probe.

Manual HC Hangup - Follow the on screen instructions to clear the system of residual HC gas.



Display PEF - Displays the current Petrol Equivalent Factor.

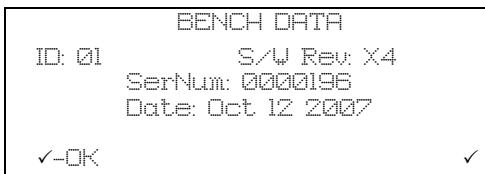
Environmental Data - This function is for use by a calibration engineer and has no user functionality.

O₂ Cell Functions - There are two items:

- Oxygen Cell Value
 - Displays the output sensor voltage in mV
- Renew Oxygen Cell
 - This resets the cell error code and recalibrates the analyser with the new cell (see '*Oxygen cell replacement procedure*', page 62)

Zero Calibration - Follow the on screen instructions to zero the measurement gases by reading fresh air.

Base Stn Battery - Displays current base station battery level and whether or not it is being charged 0 for off charge, >200 if on charge.

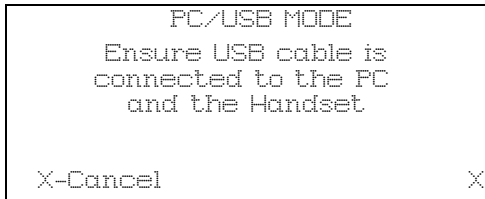


Bench Data - Provides data about the gas bench, has no user functionality.



4/5-gas setup - This indicates whether or not a NOx sensor has been fitted, which will determine if the CAT simulated test is activated.

PC/USB Mode



Option on OM4710/5PCUK only. Simply follow on screen instructions.

Settings



Under 'Settings' there are seven items:

- Manage Files
- Display Clock
- Change Contrast
- View Thresholds
- Wireless Setup
- S/W Version
- Factory Default

Manage Files



There four items under Manage Files:

- Summary
- List by Date
- List by Plate
- Actions

Getting Started

```
STORAGE SUMMARY
2 results
Mem Left: 61m 43s

✓-OK
```

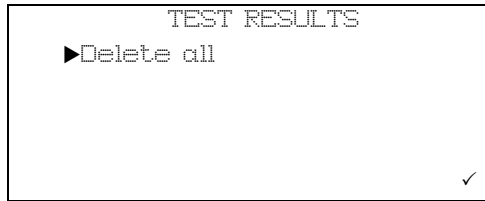
The '**Summary**' screen displays the number of results stored and the amount of time left in memory, to exit from the screen press ✓.

```
✓-VIEW X- GOBACK
▶05/02/08 10:50
 31/01/08 14:20
✓
```

The '**List by Date**' screen displays the list of stored tests by date in DD/MM/YY and time of the test. Each result is also listed by 'Last Test First'. Where relevant, a test result will be listed, e.g. CAT test may list 'CAT OK' or 'Suspect CAT'. The integrity of the data saved will also be listed, e.g. if the test is cut short. To select a test use ▲ or ▼ keys, to view the test details press ✓ - VIEW or to return to 'Manage Files' menu press X - GOBACK. When viewing files the following data is displayed: Date and time (of test), Plate (Registration N°), Type: (live Readings, Simulated tests), Durn: (length of test), Manuf: (vehicle manufacturer), Year (vehicle MY), Fuel: (fuel type), Class: (saloon, estate, 4x4 etc.), Opr: (name of the Technician carrying out the test).

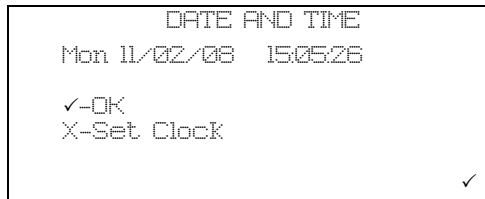
```
✓-VIEW X- GOBACK
▶0U54XYZ***
--
✓
```

The '**List by Plate**' screen displays the list of stored by license plate (Registration N°). Each result is also listed by 'Last Test First'. Where relevant a test result will be listed, e.g. CAT test may list 'CAT OK' or 'Suspect CAT'. The integrity of the data saved will also be listed, e.g. if the test is cut short. To select a test use ▲ or ▼ keys, to view the test details press ✓ - VIEW or to return to 'Manage Files' menu press X - GOBACK. When viewing files the following data is displayed: Date and time (of test), Plate (Registration No.), Type: (live Readings, Simulated tests), Durn: (length of test), Manuf: (vehicle manufacturer), Year: (vehicle MY), Fuel: (fuel type), Class: (saloon, station wagon etc.) and Opr: (name of tester).

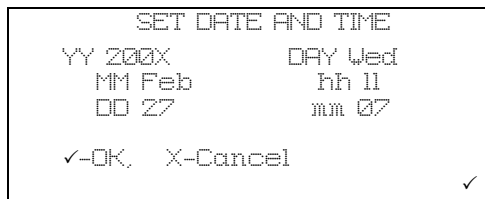



The **'Actions'** screen displays 'TEST RESULTS' and 'Delete all' the bottom right of the screen will alternately display ✓ and ✕. Press ✓ and the screen will display 'DELETE FILE' 'Do you really want to delete ALL results?'. Press ✓ to delete and ✕ to return to 'Manage Files' menu.

Display Clock



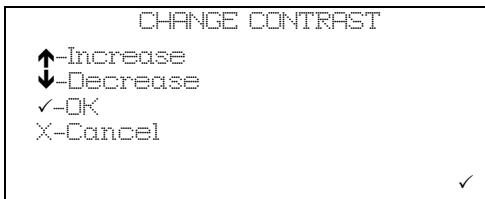
When you select 'Display Clock' the screen displays 'DATE AND TIME' and the day, date, and time in hours/mins/secs. If date and time are correct, press ✓ - 'OK' returns to the 'Settings' menu, press ✕ - 'Set Clock' will allow you to change the year, month, day and time.



The screen will display 'SETUP DATE AND TIME', 'YY 200X', 'X' will flash to indicate that it can be changed by using the ▲ and ▼ will increase or decrease the number. When the next number needs to be changed, e.g. if the year is 2009 and needs to be changed to 2010, the 9 will flash, when changed to 0, press the  to move to the preceding number to change that to 1; this procedure is used for days, hours and minutes. When the correct year is set, press ✓ and cursor moves to 'MM' and 'XXX' will flash, month can be set by using the ▲ and ▼ buttons until the correct month is set, press ✓. 'DD', 'Day', 'hh', 'mm' are changed and set in the same manner. On completion of setting 'mm', the bottom line containing ✓ - OK, ✕ - Cancel will flash, press ✓ to accept the settings and return to 'DATE AND TIME' screen, press ✕ to abort settings and return to 'DATE AND TIME' screen.

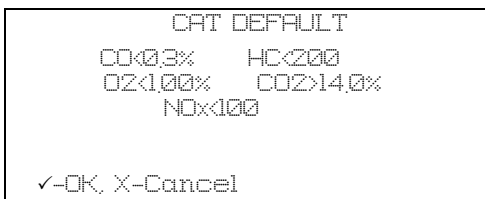
Getting Started

Change Contrast



When you select 'Change Contrast', the screen displays 'CHANGE CONTRAST' and there are four options press ▲ to increase, ▼ to decrease, ✓ - OK to retain changes and return to 'Settings' menu, or ✕ - Cancel to exit without saving changes and return to 'Settings' menu.

View Thresholds



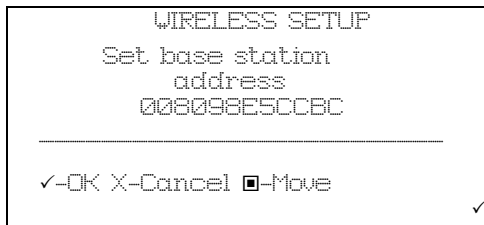
When you select 'View Thresholds' the screen will display the threshold levels of the various gases for all of the simulated test procedures, Pre-MOT, MOT default CAT (1995 - 2002) and CAT. Press ✓ to toggle through thresholds one at a time.


Wireless Setup



When you select 'Wireless Setup' the screen will display 'WIRELESS SETUP' with item:

- Base Station



In 'Base Station' the screen displays 'Set base station address', e.g. '008098E5CCBC' (this address is preset on build and would not normally require changing). The address is an alphanumeric address and ensures that the handset talks only to that *Bluetooth*[®] Wireless Technology address. The *Bluetooth*[®] Wireless Technology address should be written in the Quick Guide in the area provided. Use the ▲ and/or ▼ on the handset to set each address character; when correct, press the  button to move to the next character. On completion of entering all of the characters, press ✓ to save, the bottom line (✓-OK X-Cancel ▣-Move) will flash until ✓ is pressed again to confirm the address and exit. Press ✕ to cancel change and exit.

S/W Version



With selection of 'S/W Version' the screen will display the current down loaded handset software version; for example 00:01:31. This is not a user changeable item, press ✓ to exit.

Getting Started

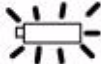
Factory Defaults



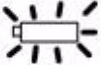
With selection of 'Factory Defaults' pressing ✓ will over write any lists that have been downloaded from the PC. Lists that are affected are: Tester Name, Vehicle Type and Vehicle Make.

Note: Stored test results will not be affected by this function.

Low Battery Indication

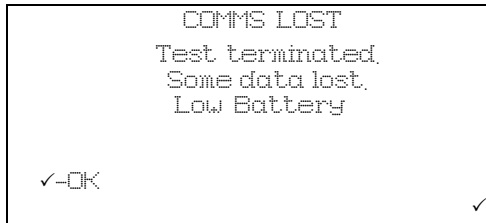
Base station Low Battery - *The battery icon  on the handset flashes empty and the 'POWER/LO BATT' LED on the base station flashes.*

- POWER / LO BATT
- FAST CHARGE
- TRICKLE CHARGE

Handset Low Battery - *The battery icon  flashes empty and the 'POWER/LO BATT' LED on the base station is not affected.*

- POWER / LO BATT
- FAST CHARGE
- TRICKLE CHARGE

The low battery warning is five minutes, if the analyser is not either placed on charge or switched OFF within that time, the base station will power down automatically, in this event the handset will display the following screen.



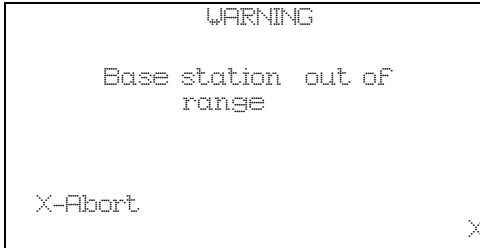
Press ✓ to proceed and the handset will prompt you to save the results and to remove the probe from the exhaust.

Note: Any saved data will state 'Some Data Lost' due to loss in Comms when the base station is powered down. Likewise if the data is analysed on the PC software, any data lost will be clearly indicated and all the gas readings for that part of the test will be recorded as zero. After Data has been either saved or discarded, the handset will automatically shut down.

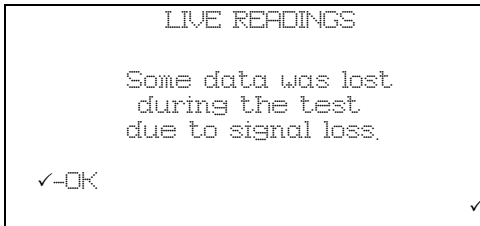
Getting Started

Out of Range

The A-NOxBO-X should function normally with the handset up to at least 10 metres away from the base station. However, if the handset is taken out of range the display communication icon will disappear and the following text will be displayed:

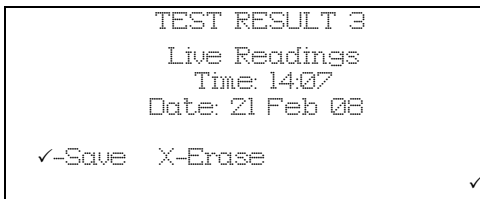


If the handset is taken back within range within a few seconds of the handset will revert to the previous screen.

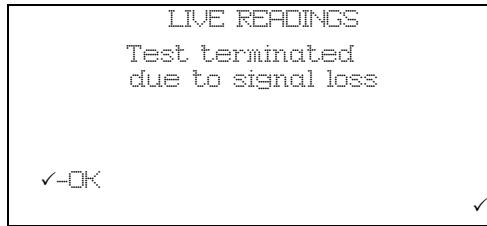


At the end of the test the handset will give a warning 'Some Data Lost' giving the option to save the test.

Note: Any saved data will state 'Some Data Lost' due to loss in communications when the base station is powered down. Likewise if the data is analysed on the PC software, any data lost will be clearly indicated and all the gas readings for that part of the test will be recorded as zero.



If, when out of range, the handset stays out of range the message above will be displayed:



You will be given the option of saving the data that was captured up to the point of lost communications.

PC Analyser Software

PC Based Systems

System requirements

The minimum PC system requirements to load the A-NOxBO-X Analysis Utility software are:

- Windows 2000 (Service pack 3), Windows 98, Windows 98 2nd Edition, Windows ME, Windows Server 2003, Windows Vista Business, Windows Vista Business 64-bit edition, Windows Vista Enterprise, Windows Vista Enterprise 64-bit edition, Windows Vista Home basic, Windows Vista Home Basic 64-bit edition, Windows Vista Home Premium, Windows Vista Home Premium 64-bit edition, Windows Vista Starter, Windows Vista Ultimate, Windows Vista Ultimate 64-bit edition, Windows XP Service pack 2.

Required software: Windows Installer 3.0 (Windows 98/ME require 2.0 or later), 3.1 or later is recommended.

IE 5.01 or later (required for loading .NET Framework)

- Intel Pentium II 500 MHz processor or higher
- 256 MB RAM
- 330 MB (x86), 660 (x64) of free disk space
- 1024 X 768 minimum screen resolution
- CD ROM drive
- USB 1.1 or USB 2.0

The requirements above are the minimum, the higher the PC specification the better the operation of the analysis software.

Installation

The PC software, including the necessary drivers for the handset USB connection, is on the CD that is supplied as part of the A-NOxBO-X optional PC kit.

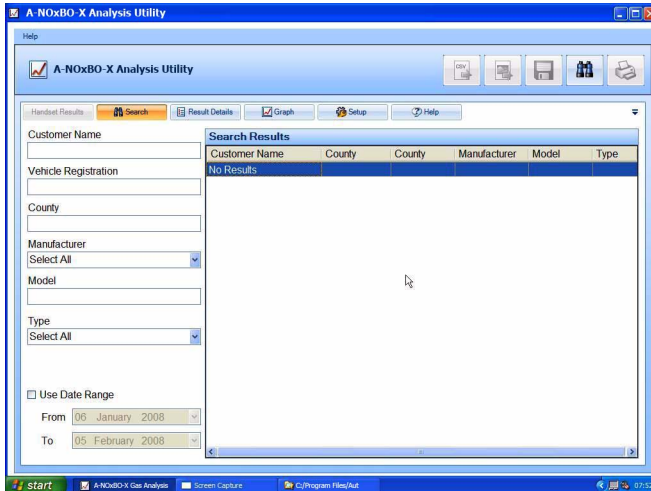
Insert the CD into the CD drive of the PC and the installation program should AutoStart, if there is no response, start Windows Explorer, click on the CD drive and identify the setup.exe file. Double click on this file and the installation should now proceed.

Using the software






Double click on the A-NOxBO-X icon on the desktop. The A-NOxBO-X application will start to load. You can also use the 'All Programs' menu to access the application; press the start button at the bottom left hand side of the screen, press 'All Programs'. From the displayed list select Autodiagnos\A-NOXBOX\A-NOxBO-X Gas Analysis Utility.

Analyser Software Functions

The A-NOxBO-X Analyser provides the facility to view the data collected by the A-NOxBO-X handset, which is transferred to the PC. The data is analysed in bar or line graph format.



The title bar displays 'A-NOxBO-X Gas Analysis Utility' and five 'buttons':

- CSV File  - Export the current test as a Comma Separated Values (CSV) file
- Bitmap file  - Export the currently visible graph section as a bitmap
- Save  - Saves the test currently being quick viewed
- Search  - Searches the tests saved to PC using the selected search criteria
- Print  - Prints the test details and the visible graph section




The buttons will be 'disabled' if they are not applicable to the function currently on screen.

There are six tabs to select screens and the default screen is 'Search', which is the second of the tabs:

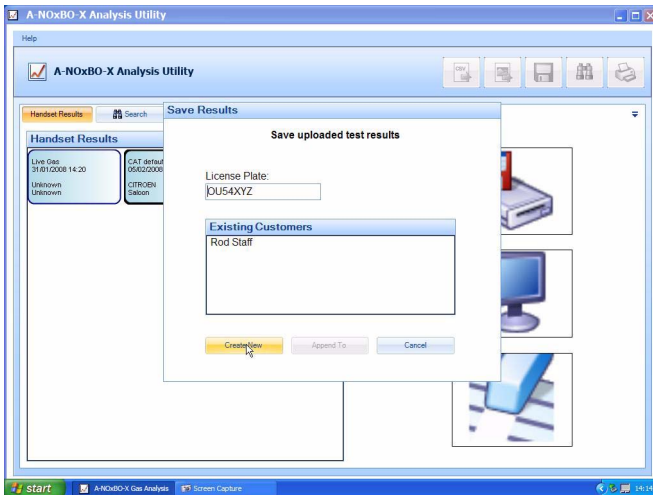
- Handset Results
- Search
- Results Details
- Graph
- Setup
- Help

PC Analyser Software

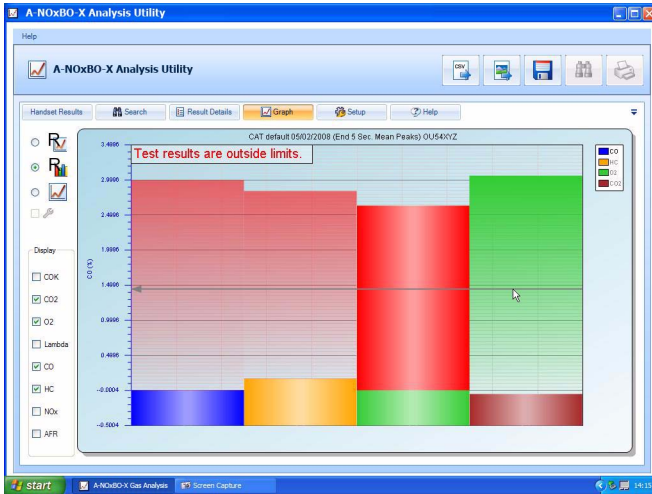
Handset Results

When the handset is connected to the PC with the USB cable, communication with the handset is established; the left hand pane displays all of the stored vehicle test results in the handset identified by test type, date, license plate details and manufacturer. The right hand side displays three icons representing the functions of 'Save data' , 'Display data'  and 'Delete data' . To activate any of these functions, click and hold the left mouse button over the data item, drag the item over the desired function, release the left mouse button.

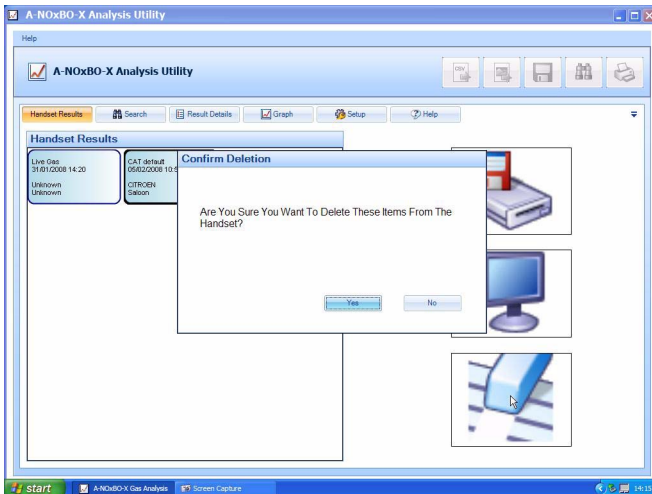
Note: Handset Results tab will be disabled if the handset is not connected.



'Save Data' will display a dialog box prompting you to select either 'Create New' or 'Append To' one of the list of existing customers. When the data is saved the screen will automatically change to 'Results Detail'. To use the 'Append To' save option the vehicle registration, or part of it, must be entered.



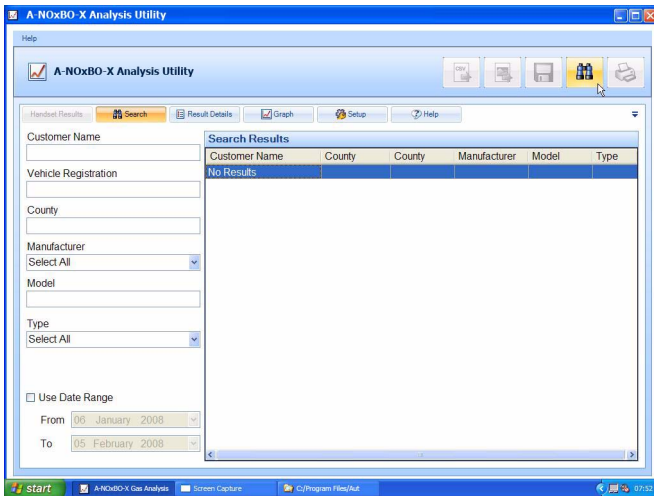
'Display Data' will automatically load the data into the 'Graph' screen. The 'Save' button in the title bar is now activated and when pressed displays the same dialog box as in 'Save Data' above.



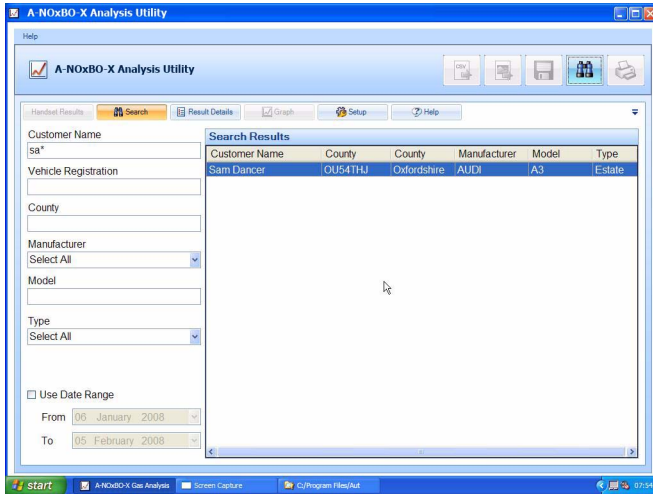
'Delete Data' displays a dialog box asking you to confirm deletion.

PC Analyser Software

Search



'Search' allows stored data to be retrieved for later analysis, reference, historical recall etc. A general search for all stored data files can be started by pressing the 'Search' button (binoculars).



A specific search can be initiated from one or all of the following input cells:

- Customer Name
- Vehicle Registration
- County
- Manufacturer
- Model
- Type
- Use Date Range with 'From' and 'To' date selection

Any text item used as a search parameter can have a 'wildcard' character '*' within it if the whole text is not known. For example, if searching for a vehicle but the whole registration is not known, entering 'OU5*' will match with any registration starting with those characters.

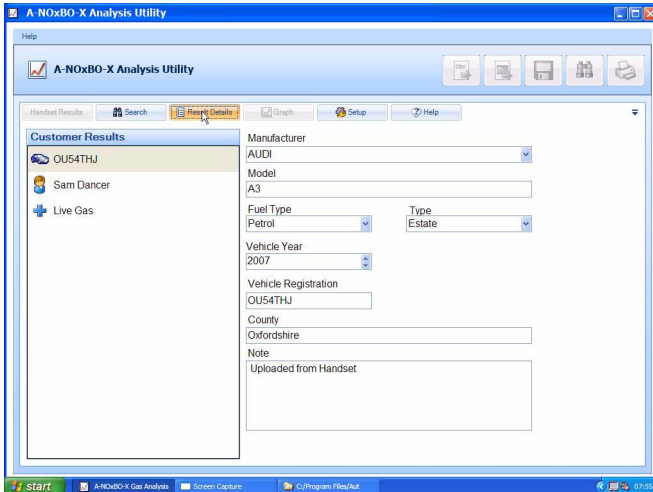
With data input, pressing either 'Enter' on the keyboard or the 'Binocular' button in the title bar will invoke a search with the result/s displayed on the right hand side of the screen.

Select and double click on a file and the screen will change to 'Result Detail'. The left pane will list all of the test completed on the vehicle; the test list is expanded by double clicking on the '+' sign. Double clicking on a specific test will change the screen to 'Graph' displaying the data from that test. Selecting a test and then clicking on the 'Graph' tab will also display that data in graphical detail.

PC Analyser Software

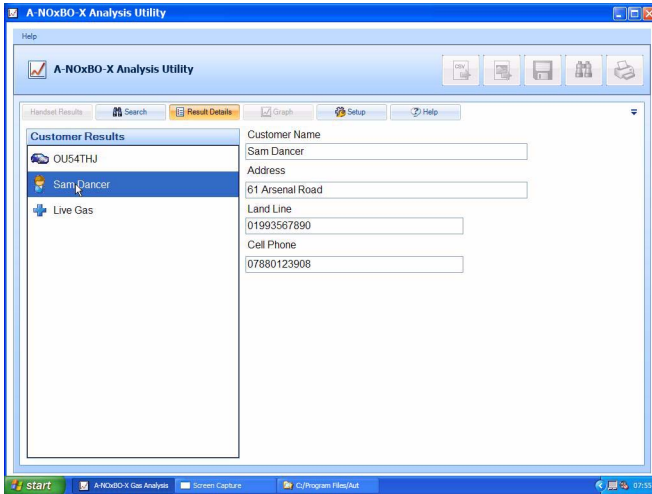
Results Detail

The 'Results Detail' saves the test data under the vehicle rather than customer, therefore any new data from an already saved vehicle will be added to the vehicle records. The vehicle records are listed in the left pane in three areas.



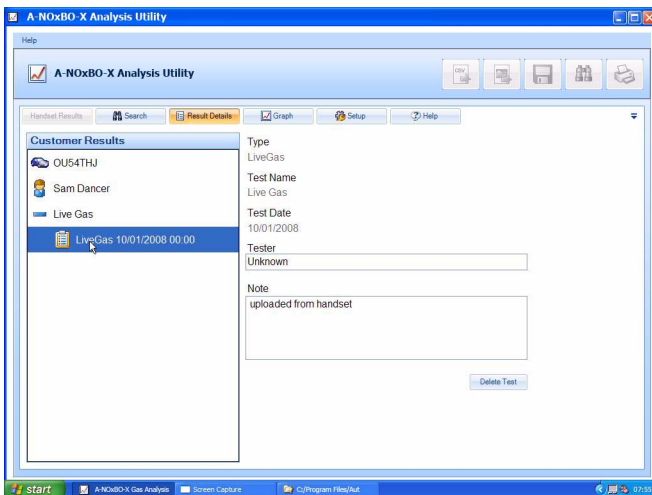
Car Symbol (Registration)

- This lists details of manufacturer, type, year, fuel type, County and an area for you to add notes. (The data is down loaded from the handset but can be edited.)



Man Symbol (Customer)

- Cells are available to enter customer's details.



Clipboard Symbol (Test results)

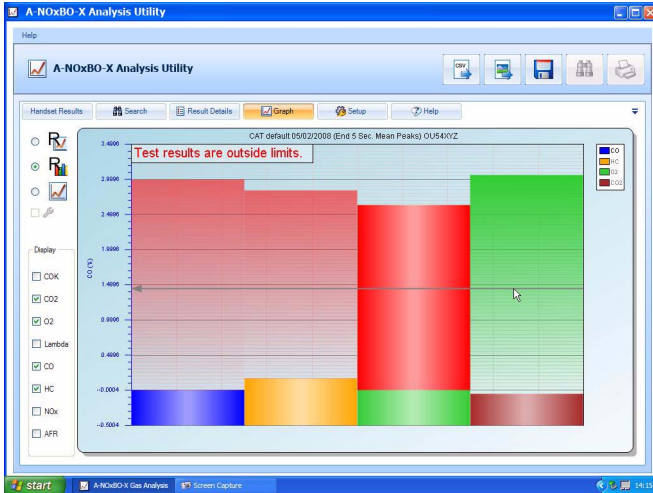
- Each test is identified by type, test name, date, tester's name and notes area.

Note: Selecting any test will enable the 'Graph' tab.

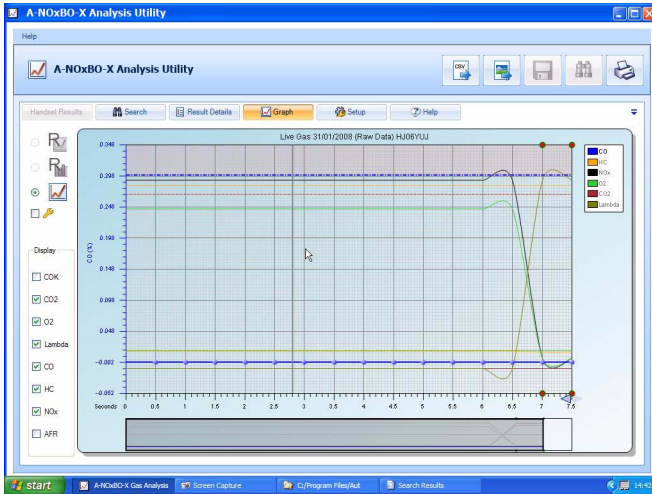
PC Analyser Software

Graph

Test Result can be presented in raw data line graph format or by test specific bar and line graphs. The available graph views depends upon the type of test carried out but the raw data line graph is always available.



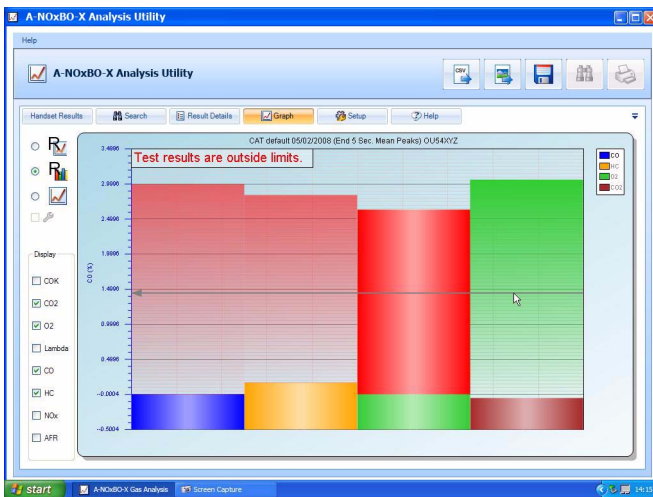
The test specific graphs (identified by 'R' on the graph icons) present a view of the data, but not the raw data, from only a portion of the entire gas recording. This may be, for example, the last 10 seconds of readings as an average. The bar graph option displays the highest levels within this data portion whilst the line graph will plot this data portion against time.



The raw data line graph is available for all tests and is a plot of non-adjusted values against time.

On the graph tab you can export the test results into a CSV file by pressing the file button on the top tool bar. You can also export the graph image as a bitmap by pressing the picture button on the top tool bar.

PC Analyser Software



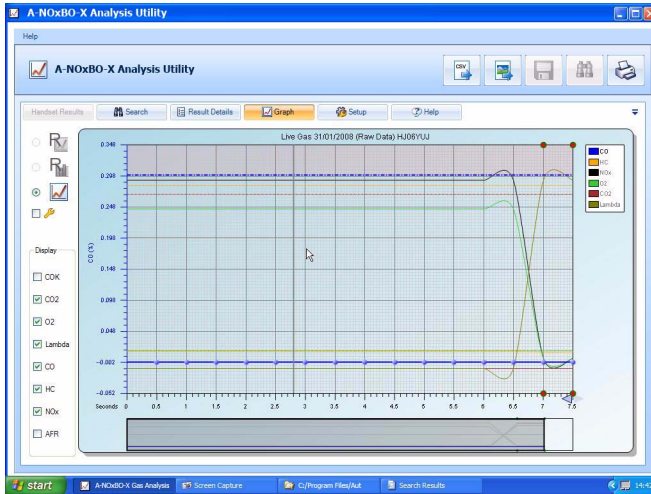
Bar graph: Readings that can be selected are: CO, CO₂, O₂, HC, NOx, MPH, AFR, and LAMBDA. On opening results the displayed readings will default to relevant gases. For example, if the test was a CAT then CO, CO₂, HC, NOx and O₂ will be displayed. Because all gases are recorded during a test they can be added to graph by clicking on the gases in the DISPLAY bar down the left hand side of the screen.

The scale of the Y axis can be changed to read any gas by selecting from the key down the right hand side of the screen, double click on the gas required.

If preset cut off points are set in test then the gas colour will change to red over the cut off point, therefore any area in red is in excess of the predefined acceptance level.

A horizontal guide line, moveable with the mouse, helps the user to read gas values.

For a print out of result, click on 'Printer' symbol in the top right hand corner of the screen, when pressed you are prompted for language of print out – English, Spanish, French, German, Dutch or Polish. A prompt will be displayed for which graph is to be printed. The Garage Details, vehicle details and time and date stamp will be added to the print out.



Line graph: CO, CO₂, O₂, HC, NO_x, MPH, RPM, AFR and LAMBDA are plotted against time.

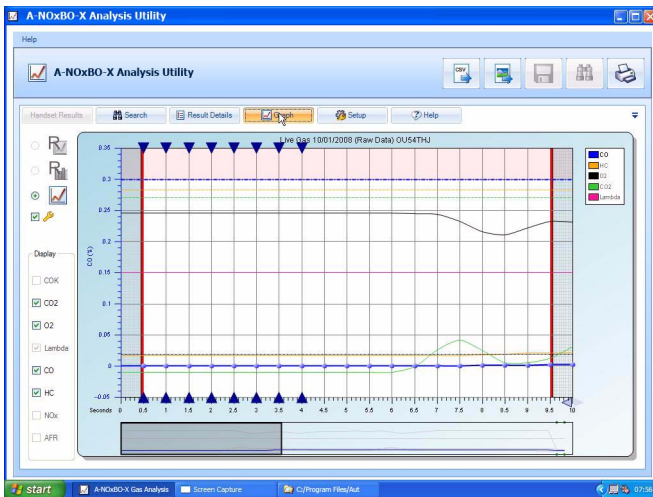
- Gases displayed depend on type of test, but like bar graph mode other gases can be added to plot.
- Y axis scale can be selected to a chosen gas and its graph will become bolder.
- Cut off limits will be shown on plot for the active series.
- A Landscape graph (only available on the raw data graph view), showing a complete record of the gas readings, is under the main display. The Main display seen on the screen will be presented as a window on the landscape graph. To view readings anywhere through out the test sequence simply click and drag landscape window. To zoom in or out further on a reading click on arrows in the bottom right hand corner of the main graph.
- To interrogate gas readings further, hold mouse anywhere in the main graph. A vertical 'Wand' will appear and when held over a reading a 'INFO' box (only available in raw data graph view) will appear. This box will:
 1. Display gas values on plot.
 2. Give Cut off Status – A green tick indicates all gases are below cut off points, a red exclamation mark will list all gases above limits whether they are on the plot or not.
 3. Information speech bubble – based on combination of gas readings a suggested diagnostic hint on what could be wrong with the vehicle will be displayed. Simply click on bubble to revert to a diagnostic guide.


PC Analyser Software

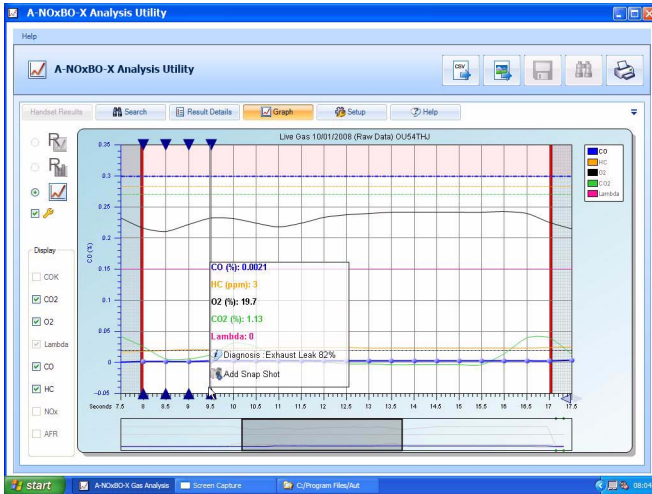
4. Add 'Snap Shot/View Snap Shot' Camera symbol – Click on camera symbol to add user comment and save. A green circle will be placed top and bottom of both graph displays to tag Snap shot.

Note: Any Snap shot made during a test by pressing the Camera button on the handset will be automatically tagged on graph. To view a Snapshot, click near the diamond on the landscape graph to set the window over snapshot, place mouse over reading on main graph to bring on the INFO box then simply click on 'VIEW SNAP SHOT'. To delete Snapshot click Delete when viewing Snap shot information.

5. Print out function is the same as Bar graph mode.



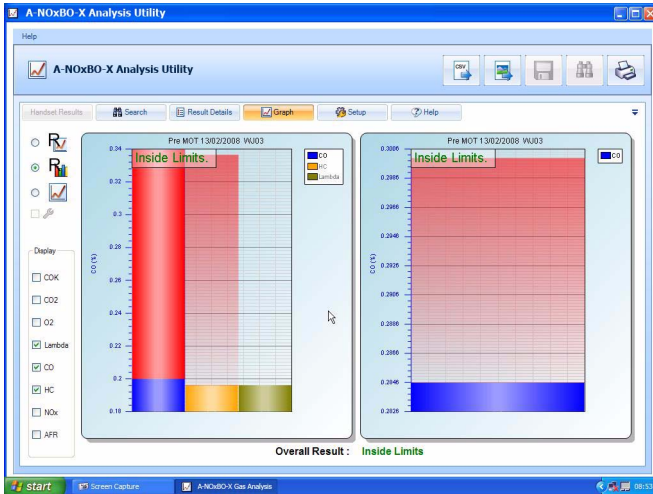
When the graph is in line view you can select the analyse button  (below the line graph button), left hand side of screen.



This will activate a visible diagnosis for the current visible frame of graph. Any possible diagnosis made within this section will be displayed as a blue triangle as a prompt to move the cursor to that graph point. Once the mouse is over that point, the 'INFO' box will be displayed as normal. The purpose of this is to be able to quickly check a section of graph for possible diagnosable problems.

PC Analyser Software

Pre-MOT Graphs

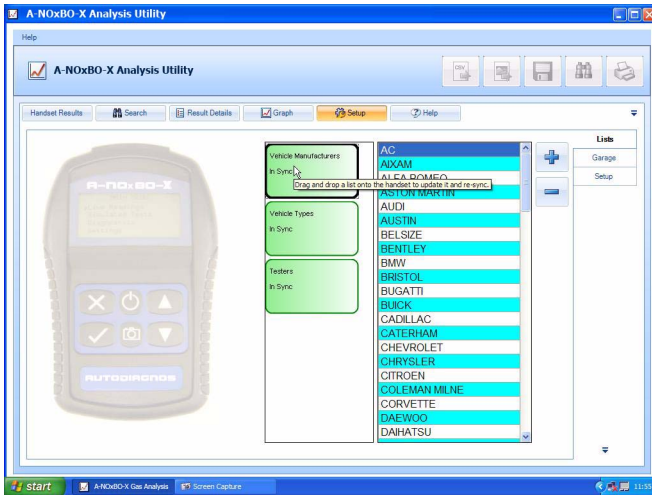


The left hand bar graph indicates the CO, HC and Lambda values at fast idle and the right hand graph shows just CO at natural idle. Both graphs will show whether the result falls within the test limits. A window in the top left of each graph will state 'Inside Limits' or 'Outside Limits' as the case may be.

Setup

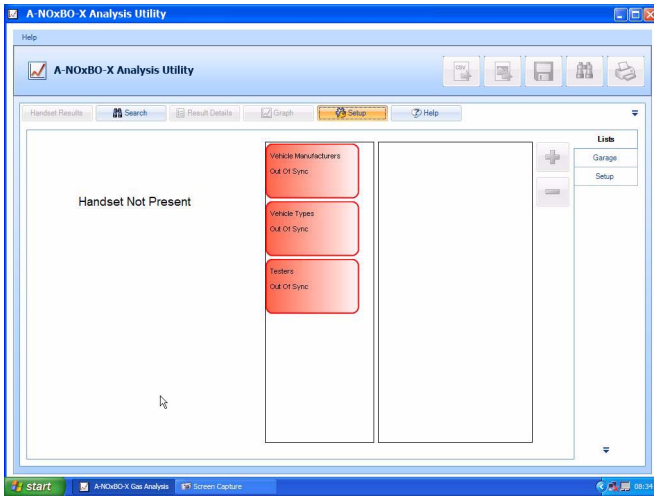
The setup section has three sub-sections selected by tabs on the right of the screen:

1. Lists
2. Garage details
3. Setup

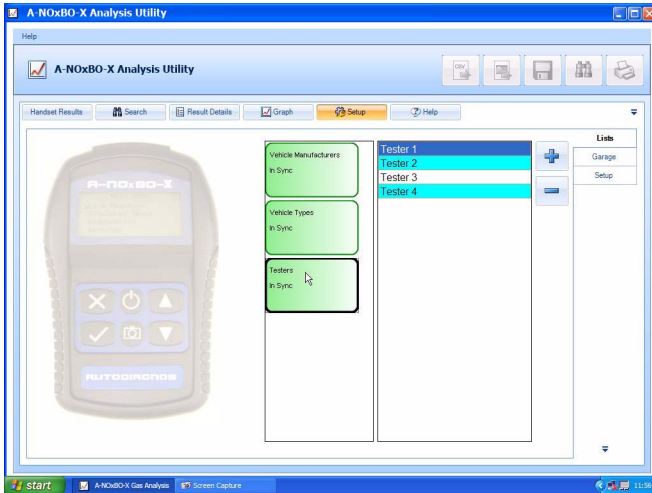
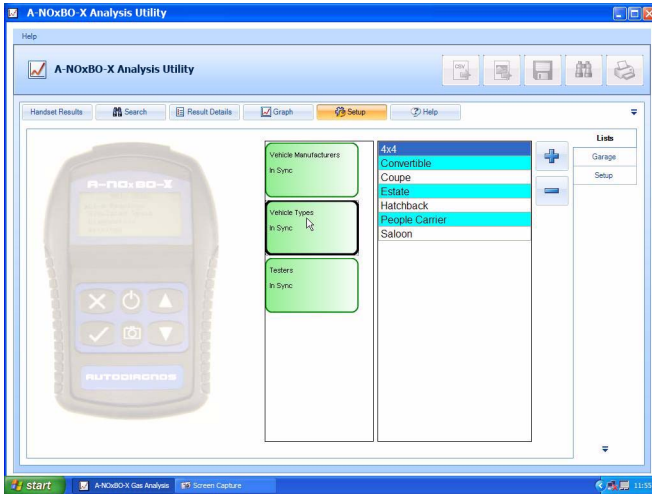


Lists: Vehicle manufacturer, vehicle types and testers can be edited and saved to the handset by using the drag and drop facility. Double click on any of the lists, 'Vehicle Manufacturers', 'Vehicle Types' or 'Testers' and the current data is shown in the right pane. The + button can be used to add to a list, likewise, the - button can be used to delete from a list. The red/green status indicates whether there is parity between PC and handset. Red, out of sync and green in sync.

PC Analyser Software



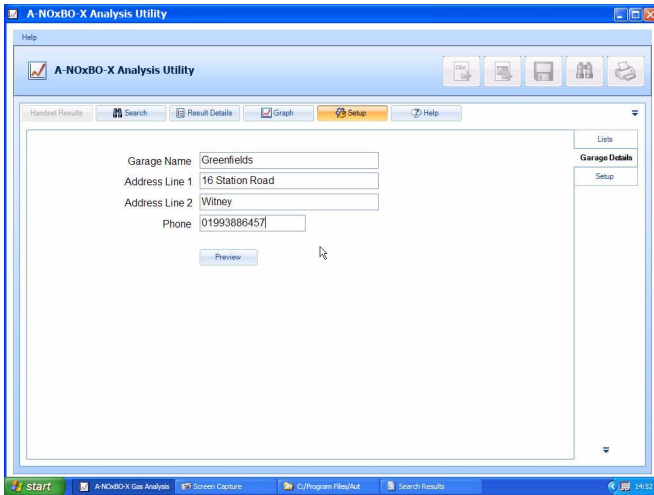
If the Handset is not connected to the PC there will be no picture of the Handset and a warning 'Handset Not Present' will appear in the left pane and the status will be red.



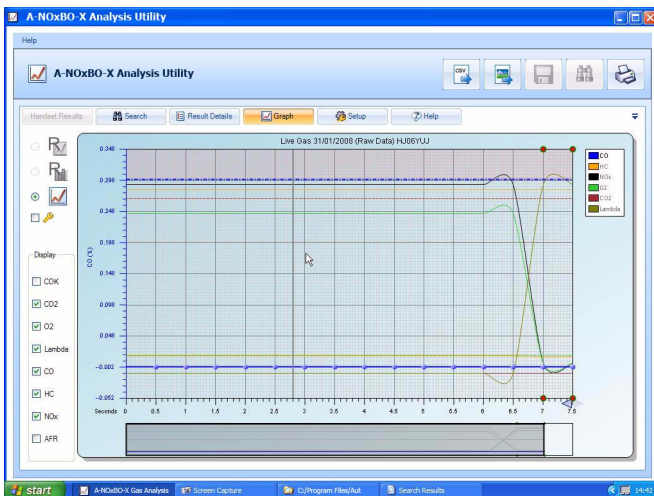
To update the handset to the list held in the PC, click and hold over the specific test to transfer, and drag the test over the handset image and release the mouse button. On completion of downloading, the list box will change from red to green.

Note: Drag and drop facility will be disabled whilst the handset is disconnected from the PC.

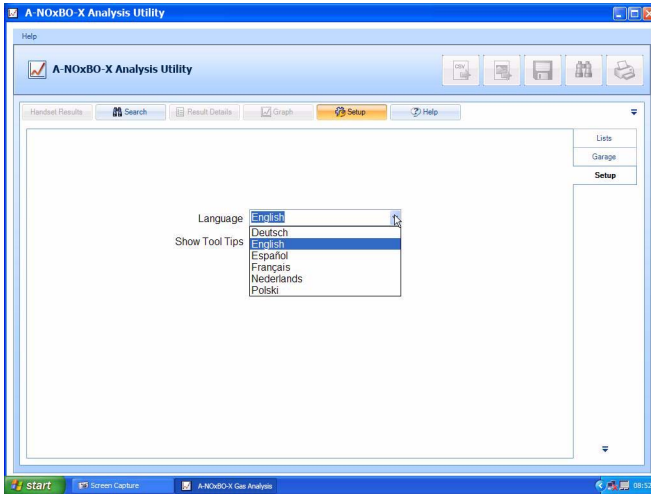
PC Analyser Software



Garage: Contained in the PC and is added to the print out.

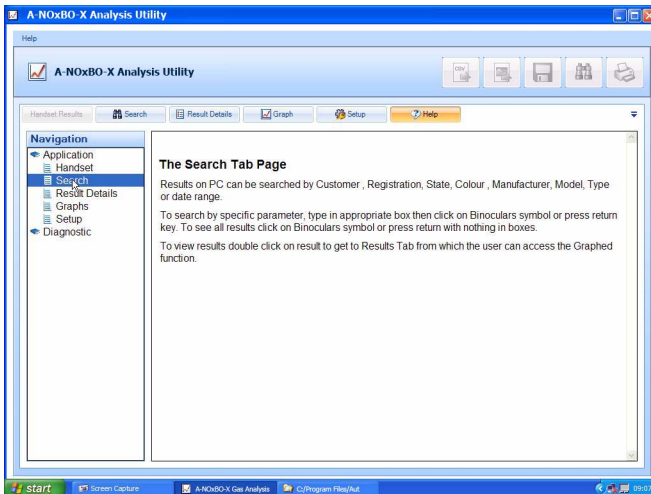


If no printer is installed on the PC a print preview is not available and warning will be shown if the 'Preview' button is pressed.



Setup: Sets language and enables/disables tool tips.

Help



The help tab will link to a document providing a guide to the functionality tabs. The Navigation pane on the left also allows access to the diagnostic documents that are linked from the dialog box in the 'Graph' section if any of the gases are out of limits.

PC Analyser Software

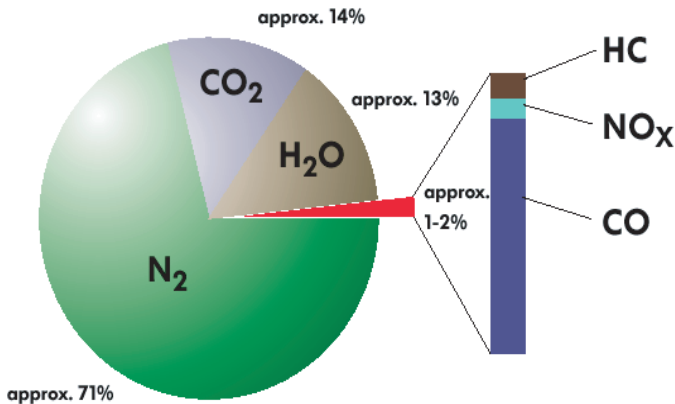
Communications

The *Bluetooth*[®] Wireless Technology communications provides connection between the base station and the handset. The base station has a unique address and it is advisable to note this address in the data section of this manual, especially if either unit is replaced.

Software Build

Details of the software version and build can be accessed from the 'Help' function in the top bar left hand side. Click on this function and then on 'About' will display a dialog box containing version and build details of the A-NOxBO-X PC Analyser Utility program.

A-NOxBO-X Analysis of Results



CO - Carbon Monoxide - Carbon Monoxide is the product of incorrectly burned fuel, so the obvious aim is to ensure that the CO level is as low as possible, the better the combustion the lower the CO. However, due to unavoidable inefficiencies with ICE there will always be an output of CO.

CO₂ - Carbon Dioxide - Carbon Dioxide is the result of correctly burned fuel so the obvious aim is to ensure that the CO₂ level is as high as possible, typically 13% - 15% for a catalytic converter vehicle. Non-cat would be typically 11% - 12.5%.

HC - Hydrocarbons - Hydrocarbons are basically unburned fuel and so the obvious aim is to have HC as low as possible but inefficiencies mean there is always an output of HC.

O₂ Oxygen - Oxygen has to be present for combustion to take place so obviously the aim is to have as little surplus oxygen as possible, typically up to 2%.

NO_x - Nitrous Oxide is a gas generated by high combustion temperature and pressure and this can be reduced by design of the exhaust and inlet valve overlap and exhaust gas recirculation where the inert exhaust gas introduced into the inlet will reduce the combustion temperature. NO_x can only be measured with the engine on load.

AFR/Lambda - Air Fuel Ratio (AFR) or Lambda is the ratio of air to fuel and is calculated from the amount of oxygen sensed in the exhaust gases.

From the exhaust gases the following relationships are formed:

- O₂ combines with CO to form CO₂
- CO is an indicator of air fuel mixture richness
- HC is an indicator of fuel mixture leanness or richness and misfires
- CO and O₂ are equal at the stoichiometric air/fuel ratio

Gas Analysis

- CO₂ and O₂ are indicators of the integrity of the exhaust system and/or the sample hose and probe
- CO₂ is an indicator of combustion efficiency that peaks at or near the stoichiometric air/fuel ratio and decreases with rich or lean air/fuel ratios
- If CO₂ increases, O₂ decreases (inversely related)
If O₂ increases, CO₂ decreases (inversely related)

During a cold start, and no secondary air injection, CO will be above 1% and the catalytic converter will be O₂ starved and will not 'fire' and the emissions will be the same as pre-cat levels

Corrected CO

The Live Readings test offers the selection of Corrected CO (COK).

Corrected CO takes into account any dilution of the sampled gas, for example leaks in the exhaust pipes and silencers. The formula to calculate COK is:

$$\text{COK} = \text{CO} \times 15/\text{CO}_2$$

When stoichiometric combustion is achieved and there is no dilution, the CO₂ value drops to approximately 15%, therefore, the correction factor is unity. If the sample is diluted with air, the CO₂ value falls below 15% and the correction factor is <1.

Non-Catalyst Systems

Perfect combustion in an ICE has an AFR of 14.7:1. This is measured by weight, any reading higher than 14.7 indicates a lean mixture and likewise any reading lower than 14.7 indicates a rich mixture. For diagnostics purposes the AFR must be settled at 14.7:1 before analysing any other gas reading. With AFR correct the following table shows how the levels of other gases can indicate a problem with the engine with relation to the time of combustion.

Non-Catalyst System Gases with AFR

		AFR	14.7	
Gas	Perfect	Minimum	Maximum	Problem
CO	In Specification			
CO ₂	Highest possible	11%		Before combustion
HC	Lowest possible		400ppm	During combustion
O ₂	Lowest possible		2%	After combustion

These readings are typical and reference should be made to the manufacturers' specifications, which usually only refer to CO and HC. Setting the CO level correctly should bring the other gases to high CO₂, low HC and low O₂.

Catalyst Systems

Where AFR is used for Non-Cat systems, Lambda is used for Cat systems and the engine management systems control Lambda to 1. Any value >1 is a lean mixture and anything <1 is a rich mixture.

Catalyst System Gases with Lambda

		Lambda	1	
Gas	Perfect	Minimum	Maximum	Problem
CO	In Specification		0.5	
CO ₂	Highest possible	12.5%	15	Before combustion
HC	Lowest possible		50ppm	During combustion
O ₂	Lowest possible		2%	After combustion

The catalytic converter converts CO and HC into water (H₂O) and extra CO₂. Cats increase the CO₂ level, therefore they are useful for reducing acid rain rather than the ozone layer. With a good operating system it should be possible to achieve 0 for both CO and HC under normal operating conditions.

Fault Diagnosis

The following tables show various relationships between gases and suggest a possible cause for these gas levels. H = High, VH = Very High, L = Low, VL = Very Low, N = Normal.

5 Gas Relationship

HC	O ₂	CO	CO ₂	NOx	Possible cause
H	VH				Vacuum leak
H	H			VL	Overactive EGR valve
H	L	H	L	L	Running rich
H	H	H	L	H	Running lean
				H	Increased combustion pressure or VH O ₂ after combustion
VH	N	VL	VL	Zero	Blown head gasket
H	H	H	L	H	Faulty CAT

Gas Analysis

High Gas Levels

Gas	Possible cause
High CO	EVAP system problem
	PCV system problem
	Fuel system problem
	Control system problem
High HC/CO	Fuel system problem
	Running rich
	Blown head gasket
High HC	Mechanical system problem
	Electrical system problem
	Fuel system problem
	Running lean
	Warm air intake problem
	Cat problem
	EVAP system leak
High NOx	High combustion pressure
	High combustion temperature
	High O ₂ content
High HC/NOx	Cat problem

4 Gas Relationship

CO	CO ₂	HC	O ₂	Problem
H	L	H	H	Rich mixture with ignition misfire
H	L	H	L	Faulty thermostat or ECT sensor - rich mixture fault
L	L	L	H	Exhaust leak after Cat
L	H	L	H	Injector misfire with Cat at operating temperature
H	L	N	H	Rich mixture
H	H	H	H	Injector misfire, Cat not working - Rich mixture & vacuum leak
L	L	H	H	Ignition misfire; lean mixture; unmetered air leak
L	H	L	L	Good combustion efficiency with Cat at operating temperature

Lambda status

Condition	Result
Too lean	Poor engine power Misfiring at cruise speed Burnt valves Burnt pistons Scored cylinders Spark knock
Slightly lean	High gas mileage Low exhaust emissions Reduced engine power Slight tendency to knock
Stoichiometric	Best all round performance
Slightly rich	Maximum engine power Higher emissions Higher fuel consumption Lower tendency to knock
Too rich	Poor gas mileage Misfiring Increased air pollution Oil contamination Black exhaust

5 Gas - Catalytic Vehicle Typical Readings

These are typical limit values of the 5 gasses for fuel injected vehicles and are not specific to any vehicle:

- CO < 0.3%
- CO₂ > 14%
- HC < 200 ppm
- O₂ < 1%
- NOx < 100 ppm

Routine Maintenance & Cleaning

Routine Maintenance

To ensure that the analyser gives long and reliable service, regular cleaning and changing of the filters is necessary. Failure to change the disposable coalescing filter elements regularly may void warranty and service agreements.

Check the cleanliness of the disposable coalescing filter (Part No. FL5720A or OM 4700/11/10 (Pack of 10)) at the start of each day. If the filter shows signs of severe contamination or a build up of deposits has occurred, remove and clean out the housing using a lint-free cloth. Ensure that no deposits are pushed into the exit pipes of the filter housing. Renew the disposable filter if heavily contaminated.

NOTE: Any dismantling of probe tip, sample hose or filters MUST be followed by a manual leak test.



CAUTION: DO NOT run the analyser without the filters in place!

At the beginning of each day, drain any water collected in the sample pipe and the water trap.

The sample probe tip can be replaced as a separate item, or may be removed for cleaning. Assembly will require a small quantity of “Loctite 222”, or similar thread sealant, to be used on the threads to ensure a good gas seal.

At the start of each day, clean any accumulated deposits from the Sample Probe tip, making sure that the two cross-drillings in the tip are clear and check that the analyser outlet pipes are not kinked or blocked in any manner.

Ensure that the analyser is not operated in a dusty environment, especially areas where paint spray and dust spray are present.



CAUTION: Contamination of the analyser by paint spray or excessive dust may void the warranty and/or service agreements!

Oxygen cell replacement procedure

When an exhausted oxygen cell is identified during a zero calibration, the handset automatically links to ‘System Checks/O₂ Cell Functions’. Select ‘Oxygen Cell Value’ to ensure that the O₂ cell output is outside of the expected level of between 9mV and 11mV. If the cell has failed, change the cell as detailed:

1. Firstly ensure there are no leaks or blockages in the gas handling system. If a blockage is found, clear and retest ‘Zero Calibration’, else proceed to 2.
2. Ensure power to the unit is switched off, then go to the rear of the unit and locate the O₂/NO_x cells cover (see ‘Assembling the A-NO_xBO-X Analyser’, page 4).
3. Remove the two retaining screws and remove the cover.
4. Disconnect the cable from the red oxygen cell. It may be advantageous to gently prise the locking tab of the connector away from the mating half, to facilitate disconnection.

Routine Maintenance & Cleaning

5. Unscrew the cell by hand (unscrew counter-clockwise). If discarding the cell, place to one side for later safe disposal.
6. With the new cell, ensure the “O” ring is properly seated against the thread abutment. Screw in the cell (clockwise) to hand-tightness but do not over-tighten. Ensure a gas tight seal. Refit the connector and screw the ground lead to the centre post, making sure the NOx cell ground lead is also secured.
7. Ensure the Oxygen Cell is properly seated in the housing and provides a gas tight seal.
8. Refit the cover, make sure the gas tubing is not crushed or trapped and secure cover to the back of the unit.
9. Turn on the power to the unit and allow it to warm up. Ensure that the analyser is fully warmed up (i.e. that it has had at least 5 minutes since power on).
10. Use handset to configure the A-NOxBO-X with the new O₂ cell:
 - Select ‘Renew O₂ Cell’.
 - This will reset the error code and recalibrate the Analyser with the new cell.
11. If the unit still fails, contact your service engineer.

The O₂ cell can be monitored to see if it is approaching the end of its life. This can be done by checking its cell voltage. This should be done with the probe in clean air and accessing the following menu on the handset:

- Select ‘Gas Analyser’ – ‘System Checks’ – ‘O₂ Cell functions’ – ‘Oxygen Cell Value’

A good cell should read between 9mV and 11mV. The Analyser will automatically flag up an error if the cell voltage falls below 7mV. It is recommended that the cell is changed if voltage is nearing the 7mV threshold.

NOx Cell Replacement

In theory the NOx cell should have a life expectancy of 2 years. Unlike the O₂ cell, the A-NOxBO-X will not flag an error in the NOx cell.

It is recommended, therefore, that the NOx channel, like the rest of the A-NOxBO-X, is regularly tested with calibration gases of known concentration. This can be carried out by an Autodiagnos authorised Service agent.

NOTE: Due to the operating characteristics of the NOx sensor, any necessary replacement will need to be calibrated by an authorised Autodiagnos authorised Service agent using a NOx calibration gas.

Routine Maintenance & Cleaning

Calibration and Accuracy Checks


It is recommended that periodic Calibration and Accuracy testing should be carried out on the A-NOxBO-X Analyser to ensure reliable and accurate testing.


It is also recommended that this be done once every 12 months on average. This can be carried out by an Autodiagnos authorised Service agent

Cleaning

A-NOxBO-X unit

The surfaces of the analyser cabinet can be cleaned with a soft sponge, dampened with a mild soap and water solution.

 CAUTION: ENSURE that the unit is disconnected from the mains before cleaning. Be careful not to wipe electrical connections or connectors while cleaning.

 CAUTION: On no account use solvents or strong detergents to clean the unit.

Technical Specification

The A-NOxBO-X unit (Part No. OM 4710/1)

Environmental	
Operational temperature range	0°C (32°F) to 45°C (113°F)
Operational temperature (nominal)	20°C (68°F)
Storage temperature range	-4°C (24.8°F) to 70°C(158°F)
Relative Humidity (operational)	95% RH (non-condensing)
Relative Humidity (storage)	99% RH (non-condensing)
Atmospheric pressure range	813 to 1060 mBar
Atmospheric pressure (nominal)	1013 mBar
Altitude (operational)	-300 m (-984 ft) to +3000 m (+9836 ft)
Sunlight	No direct exposure to sunlight
Operating Constraints	Designed for covered use only Not for external use

Mechanical	
Operating Position	Horizontal
Ventilation	Still Air Free from strong drafts
Weight	Total 2.21 kg (4.9 lbs) Handset 400g (0.88 lbs) Base 1.81 kg (3.97 lbs)
Dimensions of main unit	192 mm wide 283 mm deep 180 mm high (including 10mm feet)
Dimensions of handset	108 mm wide 160 mm deep 38 mm high

Charger Power Supply	
Mains voltage range	100 – 240V AC
Mains frequency range	50-60 Hz
Power input	60 W
Base station battery pack	9.6V Nom. 8 cell rechargeable NiMH
Handset battery pack	2.4V Nom. 2 cell rechargeable NiMH

Technical Specification

Measurement range (OIML Class 0)	
Carbon monoxide (CO) range	0 to 15% vol.
CO accuracy	±0.03% abs or ±5% rel.
Carbon dioxide (CO ₂) range	0 to 20% vol.
CO ₂ accuracy	±0.5% abs. or ±5% rel.
Hydrocarbons as n-hexane (HC) range	0 to 2000 ppm vol.
HC accuracy - 0 to 2000ppm	±10 ppm or ±5% rel.
PEF Factor	0.490 to 0.540

Transducer measurement range	
Carbon monoxide (CO) range	0.00 – 15.00%
CO accuracy: 0.00% to 10.00% 10.01% to 15.00%	±0.02% abs. or ±3% rel. ±5% rel.
Carbon dioxide (CO ₂) range	0.00 to 20.00%
CO ₂ accuracy: 0.00% to 16.00% 16.01% to 20.00%	±0.3% abs. or ±3% rel. ±5% rel.
Hydrocarbons as n-hexane (HC) range	0 to 2000 ppm
HC accuracy: 0 to 2000ppm	±3% rel.
Hydrocarbons as propane (HC) range	0 to 30000 ppm
HC accuracy 0 to 4000 ppm 2001 to 15000 ppm 15001 to 3000 ppm	±3% rel. ±5% rel. ±8% rel.

Measurement of Oxygen	
Oxygen range	0.00% to 25.00%
Accuracy	±0.01% abs.
Response time	< 30s to 95% of final value < 60s for change from 20.9% to < 0.10% vol.

Measurement of Nitric Oxide (NOx)	
NOx range	0 to 5000 ppm
Accuracy	±3% rel.

Technical Specification

Response time of analyser: <15 secs to display 95% of final values (CO, CO₂ & HC)

Lambda Calculation (by Brettschneider formula)	
Lambda range	0.0 to 2.0
Resolution	0.01

Calculation of Lambda value according to Brettschneider (Source: Bosch Technische Berichte, VOL. 6 (1979) No. 4, p177-186) – As listed in OIMLR99 specification.

Simplified Lambda calculation:

$$\lambda = \frac{[\text{CO}_2] + \frac{[\text{CO}]}{2} + [\text{O}_2] + \left(\frac{H_{CV}}{4} \times \frac{3.5}{3.5 + \frac{[\text{CO}]}{[\text{CO}_2]}} - \frac{O_{CV}}{2} \right) ([\text{CO}_2] + [\text{CO}])}{\left(1 + \frac{H_{CV}}{4} - \frac{O_{CV}}{2} \right) ([\text{CO}_2] + [\text{CO}] + K1 [\text{HC}])}$$

- [] Concentration in % vol (ppm vol for HC)
- K1 Conversion factor for HC if expressed in ppm vol *n*-hexane (C₆H₁₄) equivalent. Its value in this formula is 6x10⁻⁴
- H_{CV} Atomic ratio hydrogen to carbon (H_{CV} = 1.7261)
- O_{CV} Atomic ratio oxygen to carbon (O_{CV} = 0.0176)

General Data

Real time clock

The handset has:

- Day and date, time in hours, minutes and seconds with automatic leap year compensation.
- Time is user adjustable.

Handset

- *Bluetooth*[®] Wireless Technology Comms
Range typically 10m (30 feet)

PC Interface

- USB 1.1 or 2.0

Technical Specification

Ancillary Equipment

Vehicle Supply Lead	
Cable length	1 metre
For vehicles with auxiliary socket in the luggage compartment	

Pneumatic Specifications

Flow Rate	
Analyser Outlet (nominal)	1.0 l/min
Sample inlet	1.0 l/min

Filtration	
Coalescing element-PVDF Fluorocarbon 95%+ efficiency at particles > 0.1 microns	57 mm length

Oxygen Cell	
City Technology	CiTicel AO2

Calibration Gas	
Minimum pressure	700 mBar above atmospheric pressure
Flow rate	1.5 l/min
Composition (4 Gas):	
Carbon dioxide	14% vol.
Carbon monoxide	3.5% vol.
Propane	2000 ppm vol.
Nitrogen	Balance
Composition NOx Calibration Gas:	
NOx	1000 ppm
Nitrogen	Balance

EMC Specification

Complies with EN 300 328 V1.6.1 (2004-11) in line with the R&TTE directive 1999/5/EC.

Service and calibration frequency

Calibration

At 6 monthly intervals

Service	
Replace disposable filter element (0.1 µm) – Part No. OM 4700/11/10 (Pack of 10)	Weekly – if in continuous use, else as necessary
Single disposable coalescing filter (0.1 µm) – Part No. FL5720A	Weekly – if in continuous use, else as necessary
In Line hydrophobic pancake filter – Part No. FL5718A	As necessary
Cleaning of sample probe and hose	Weekly – if in continuous use, else as necessary
Replace oxygen cell - OM4000/12	Two years, or as needed
Replace NOx sensor - OM4700/12	Two years, or as needed

Technical Specification

Spare Parts List

Description	Part number
Top level kit	OM4710
Base station	OM 4710/1
A-NOxBO-X Handset	OM 4710/2
PC Analyser Application Software CD	OM 4710/3
Instruction Manual	OM 4710/4
Exhaust Sample Probe complete with hose	OM 4700/5
Battery Charger PSU	OM 4710/6
Handset 2 battery pack	OM 4700/7
Base Station 4 battery pack	OM 4700/8
Sample Probe Hose extension	OM 4700/10
Coalescing Filter (box of 10)	OM 4700/11/10
NOx sensor	OM 4700/12
Vehicle power lead	OM 4700/13
Oxygen Sensor Cell	OM 4000/12
Sample Probe Cap	RB4001A
USB Lead	CB9166A
In line hydrophobic pancake filter	FL5718A
Coalescing Filter	FL5720A

Please quote the part number when ordering or enquiring about the availability or price of spares for your A-NOxBO-X analyser.

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