Kane Automotive Gas Analyser Manual for Auto 4-1/MID & 5-1/MID

Description

The Kane Automotive range of emission analysers covering the models Auto 4-1/MID & Auto 5-1/MID has been designed to be used on petrol, LPG or CNG powered engines*. All models measure carbon monoxide (CO), unburnt hydrocarbons (HC), Oxygen (O2) and carbon dioxide (CO2) with nitric oxide (NO) included in five-gas variant. The four-gas analyser Auto 4-1/MID has an upgrade facility for Nitric Oxide (NO).

Using the measured parameters CO, HC, O2 and CO2, additional parameters such as Lambda, Air to Fuel ratio and corrected carbon monoxide (COK) can also be calculated and displayed.

All measured and calculated parameters can be printed on the optional infrared printer or saved to the analyser's memory.

All models are equipped to measure oil temperature and engine speed in revolutions per minute (RPM).

Both the Auto 4-1 and Auto 5-1 analysers carry a declaration of conformity to OIML R99, Edition 1998 (E), Class 1 and type examination in accordance to Directive 2004/22/EC on Measuring Instruments (MID). The MID EC type examination certificate is available on request.

All models are battery powered to give true portability in the workshop environment. The battery can be charged via a mains adapter or 12V cable supplied. Emission testing is restricted to the battery mode only.

* In the diesel fuel mode, HC is not displayed.

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1. ANALYSER LAYOUT AND FEATURES

1.1 Instrument Features and Keypad

ON/OFF

MENU
Allows access to all menu functions

PUMP
Turns pump on and off

ENTER
Accepts a command, i.e. enters a menu option

UP
Scrolls up through options, i.e. Fuel

DOWN
Scrolls down through options

STORE
Enters data storage menu

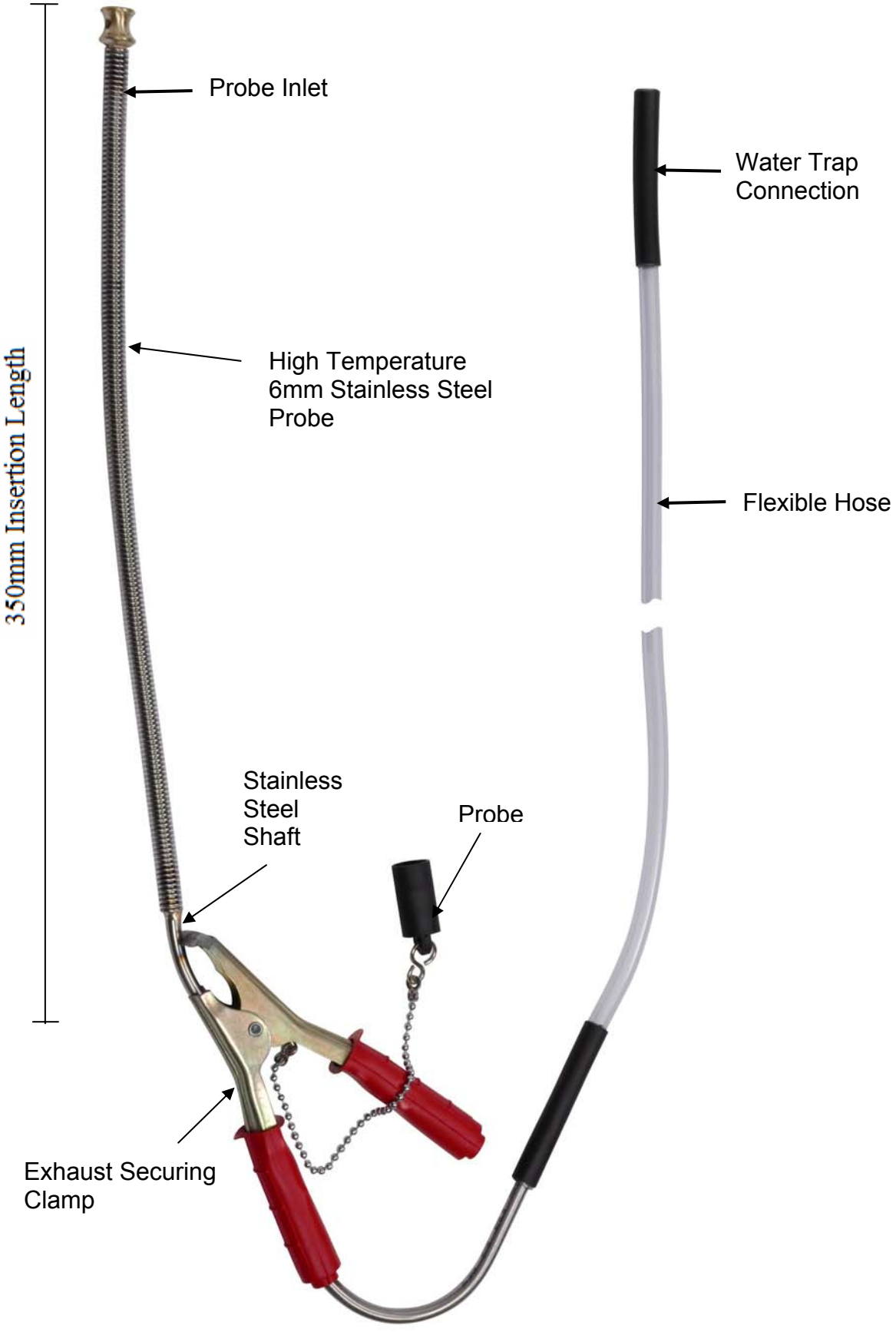
PRINT
Prints current data

1.2 Instrument Layout (Rear)

*** NOTE! DO NOT cover exhaust port as this will severely affect analyser operation**

1.3 Standard Probe Configuration – EPAUTO2

CAUTION: Probe may be hot when removing from exhaust.



2. SAFETY WARNING

This analyser extracts combustion gases that may be toxic in relatively low concentrations. These gases are exhausted from the top of the instrument. This instrument must only be used in well ventilated locations. It must only be used by trained and competent persons after due consideration of all the potential hazards.

Protection Against Electric Shock (in accordance with EN 61010-1 : 1993)

This instrument is designated as Class III equipment and should only be connected to SELV circuits. The battery charger is designated as:

Class II equipment
Installation category II
Pollution degree 2
Indoor use only
Altitude to 2000m
Ambient temperature 0°C-40°C
Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50%RH at 40°C
Mains supply fluctuations not to exceed 10% of the nominal voltage.

3. FIRST TIME USE

Charge the battery for 12 hours, following this an overnight charge should be sufficient for an average 8 hour day (turning pump off to save power between tests). See Main Parameter displays for Battery Indicator. The analyser has a rechargeable lead acid battery, use only the mains charger or 12 volt adapter supplied or damage may occur to the instrument and battery. Do not leave the battery is a state of discharge for long periods. Ensure sufficient charging to power the analyser for the required emission testing. No emission testing is permitted with the charger or 12 V cable connected.

Check that you have all the items you have ordered.
Take time to read this manual fully.
When using the analyser for the first time you will need to choose from:-

Language selection
Time
Printed header name and telephone number

The SET UP MENU (Section 5.2.) gives details of how to change the above settings.

4. NORMAL START UP SEQUENCE

4.1 Every Time You Use The Analyser

BEFORE SWITCH-ON CHECK THAT:

no charging cables are connected (only used for charging)

the particle filter is dry and not dirty or damaged

the water trap and probe line are empty of water

all hose connections, etc, are properly made

the probe is sampling CLEAN AMBIENT air

the water trap is correctly fitted and the instrument upright

the oil temperature probe is connected if required

the RPM clamp is connected if required

the internal battery of the analyser has been charged sufficiently

* DO NOT RUN ANALYSER WITHOUT WATER TRAP FITTED *

* REMOVE RUBBER FILTER SEAL WHEN USING CARBON FILTER*

Switch ON the instrument by pressing 

4.2 Automatic Initialisation Procedure with Zero-calibration via the carbon filter and Leak Test

During this sequence of about 3 ½ minutes the analyser follows a pre-programmed initialisation procedure with various displays, check sum test, a zero through the Carbon filter to set O2 to 20.9 % and a leak test.

After switch-on, the pump will start and the analyser will briefly display header information:

```
KANE AUTOMOTIVE
(44)-1707-375550
```

And then show the eight digit serial number of the analyser and software version on the screen. The serial number also appears on the print out:

```
No: XXXXXXXX
Version: 0.5M
```

The screen will then display “PLEASE WAIT 15 SECS” followed by a Checksum test and the display of the calibration check date, which corresponds to the date input of the last official calibration as per the example below and valid for this version of software:

```
CHECKSUM CALC.  280B
CHECKSUM SAVED 280B
CHECKSUM PASSED
```

```
CAL. DATA CHECK  8EFF
CAL. DATA SAVED  8EFF
CAL. CHECK PASSED
CAL. DATE 11/02/11
```

If the Checksum test fails, switch off the analyser and reboot. If the problem persists, please contact Kane Service or an authorised service agent for further assistance.

The initialisation sequence will then proceed in two phases, one with a countdown from 60 and the second from 75, taking about 2 minutes. After initialisation a zero-calibration through the carbon filter is requested taking about 40 seconds.

The zero-calibration procedure is as follows:

```
ZERO-CALIBRATION
REMOVE PROBE & WTRAP
FIT CARBON FILTER
THEN PRESS ENTER
```

Unless the carbon filter is already fitted, detach the water trap and particle filter housing from the instrument and replace with the carbon filter. **REMOVE** rubber seal from the bottom of the carbon filter before proceeding.

Press  when in place with rubber seal removed

NOTE! The analyser will not continue with the test if it does not detect the carbon filter is in place. Use of the analyser is prohibited unless the zero-calibration via the carbon filter is completed successfully.

The analyser will then perform the zero-calibration with PLEASE WAIT displayed on the screen.

If the sequence has been successfully completed, the pump will switch off and the following screen will be displayed:

REMOVE CARBON FILTER REFIT WATER TRAP AND PROBE THEN PRESS ENTER

Once the zero-calibration is complete remove the carbon filter, refit rubber seal and store in the instrument case. Fit the water trap housing to the analyser, connect probe and press enter. The analyser will now request a leak check.

The following screen will be displayed:-

LEAK CHECK REMOVE EXHAUST PROBE FIT PROBE SEAL THEN PRESS ENTER

The analyser and probe should be in **fresh air** during initialisation and zeroing sequences

Fit the probe seal as detailed in Section 10.3 and press 

Once the test has PASSED remove the probe seal and press 

If the test fails see Section 10.3.

The pump will be running unless connected to the charger or 12v supply and the analyser is now reading for emission testing.

If the analyser is connected to the mains via the charger or to an auxiliary 12 v supply, the pump will not run and the display will indicate the analyser is in charging mode:

```
CHARGING
BATTERY
```

The next screen is the **MAIN DISPLAY** of the analyser:-

```
CO    % vol  . . .  00.00
HC     ppm vol . .   0000
CO2   % vol  . . .   00.0
O2  % vol    . . .   20.90
```

Use  to change the display.

```
CO    % vol  . . .  00.00
HC     ppm vol . .   0000
CO2   % vol  . . .   00.0
LAMBDA  . . . . .  0.000
```

All parameters are detailed in Appendix A - MAIN DISPLAY PARAMETERS.

4.3 Main Display Parameters

The main display shows 4 parameters at one time. Two options are available when 4 parameters are selected.

- **Line scroll mode** allows you to customise the display to show the data you require.
- **4 Page Mode** displays 4 lines of data in set format, each page is predefined.

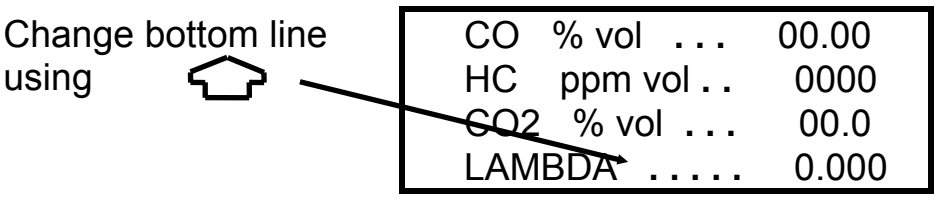
Changing between the different modes is detailed in **Display Menu Section 5.2.4**.

TIP! To increase battery life do not leave the backlight on.

4.3.1 Line Scroll Mode

Line scroll mode allows you to customise the bottom line of the display. This is the default mode following analyser turn on.

Use the ⌂ key to change the bottom line of the display.



4.3.2 4 Page Mode

Use the ⌂ key to change the information that is displayed on the screen. The following pages are available, depending on model the sequence of displayed parameters may differ from those in the examples which follow.

```
FUEL      . . . PETROL
DATE      . . . 07-08-96
TIME      . . . 12:31:35
BATTERY %     . .  54
```

```
CO   % vol  . . .  00.00
HC    ppm vol . .  0000
CO2  % vol   . . .  00.0
O2    % vol  . . .  20.90
```

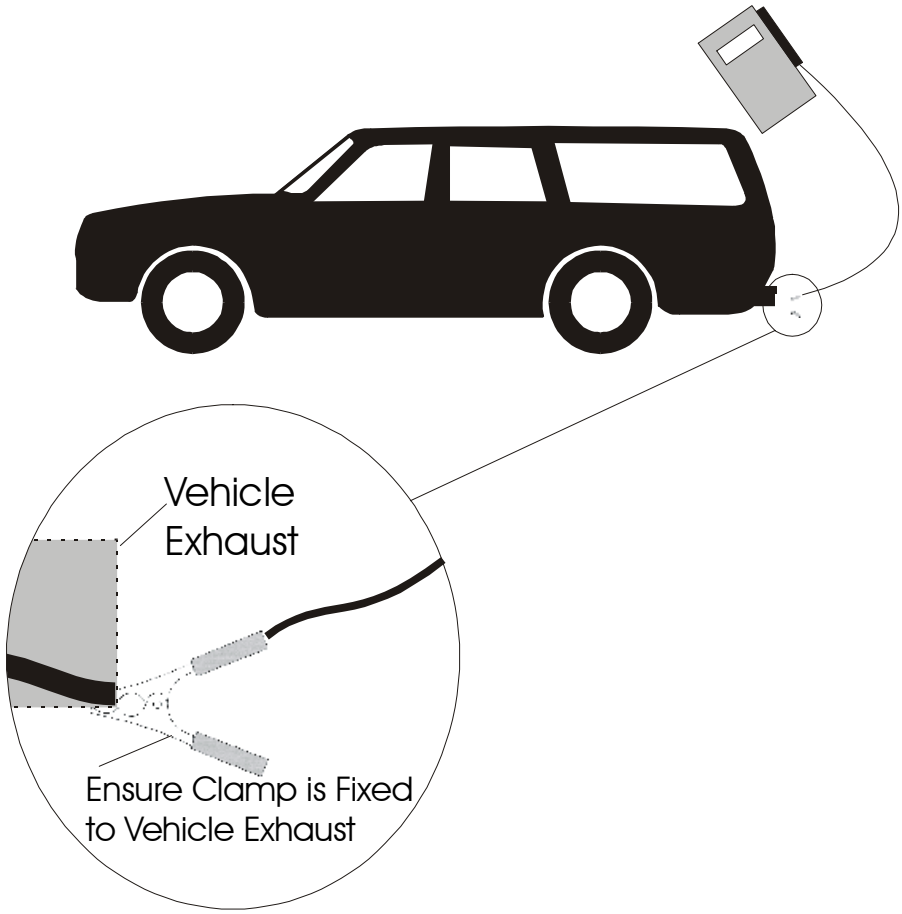
```
LAMBDA  . . . . .  0.000
NO    ppm  NOT FITTED
TIME TO ZERO . .      10
OIL     deg  C . . . .  50
```

```
RPM       . . . . .  0000
CO   % vol  . . .  00.00
HC    ppm vol . .  0000
O2    % vol  . . .  20.90
```

4.4 Sampling the Exhaust Gas

Once the zero calibration and test procedures have been completed and the fuel has been selected (See SELECT menu) the probe can be inserted into the desired vehicle exhaust.

Ensure the probe is inserted into the exhaust pipe so as to not allow air into the probe. The exhaust of a car can pulse, especially at low RPM, drawing air in causing bad readings, ensure the flexible probe is fully inserted and the clip attached to the exhaust pipe.



4.5 Turning the pump ON/OFF

The analyser is fitted with a pump to draw gas from the vehicle exhaust. To conserve battery power, switch off the pump when you are not taking a measurement. Zero-calibration via the carbon filter is required when the pump is reactivated. Follow the instructions on the screen or see section 10.2 for further details.

Use the  key and  key to turn the pump OFF.

Before switching off the pump, a reminder is displayed to confirm that zero calibration via the carbon filter is required afterwards when the pump is reactivated as follows:

```
PUMP OFF WILL FORCE
ZERO-CAL ON RESUME
PRESS RET TO CONFIRM
MENU KEY TO CANCEL
```

Press  if you do not wish to switch the pump off.

The analyser will block readings while the pump is off and display '----' on all gas channels. It will also display PUMP OFF every 30 seconds.

```
      PUMP OFF
HC    ppm vol . .    - - - -
CO2   % vol  . . .   - - - -
O2    % vol  . . .   - - - -
```

It is recommended that the analyser samples fresh air for 60 seconds before the pump is turned off. Refer to 10.2 for Zero-calibration procedure. Press  to activate zero calibration via the carbon filter and pump ON for further testing.

4.6 Taking an oil temperature reading

Connect the oil temperature probe to the instrument and check it reads ambient temperature. Turn off the vehicle engine. Remove the oil dip stick from the engine and set the depth of the probe to that of the dip stick using the stop. Insert the probe into the engine.

The oil temperature will be displayed :-

```
LAMBDA . . . . .  0.000
NO    ppm  NOT FITTED
TIME TO ZERO . .     10
OIL    deg  C . . . .  50
```

4.7 Reading the engine speed (RPM)

Connect the induction pickup to one of the spark plug leads ensuring the side indicated by 'SPARK PLUG SIDE' points to the spark plug. Connect the pickup to the instrument ensuring correct polarity, "+" to red and "-" to black. Set 4 cycle/2 cycle or DIS as detailed in section 5.2.2.

RPM	. . . . .	1000
CO	% vol . . .	00.00
HC	ppm vol . .	0000
O2	% vol . . .	20.90

Note: If the pickup is positioned close to other leads false readings may occur. For some types of ignition system (e.g. DIS) the probe may need to be fitted "reversed" to produce readings or use the 2 cycle setting.

4.8 Regular Checks During Sampling

Care must be taken at all times not to exceed the analysers operating specifications, in particular ensure the following :-

- DO NOT PLACE THE INSTRUMENT IN THE ENGINE BAY.
- The analyser is not exposed to temperatures outside its normal operating range.
- DO NOT PLACE THE INSTRUMENT ON A HOT SURFACE.
- Hold the analyser upright during sampling
- Liquid in the water trap does not go over the level indicator. Water condenses in the probe line and can quickly fill the water trap when the probe is moved. **Take care,** watch the water trap closely and empty any water when it is noticed.
- The in-line particle filter is clean and does not become blocked. If this filter is allowed to become dirty then damage may occur inside the analyser. Please remember the filter may still look clean from the outside, when contaminated from the inside. To check please remove and look inside. Replace if discoloured.

4.8.1 Low Flow

During sampling or at any time the pump is running the screen may display LOW FLOW. This is an indication of the following:

- The particle filter needs replacing (a visual check is also necessary)
- Probe or tubing is blocked.
- Internal filters are blocked (Contact service agent)

WARNING! Under LOW FLOW conditions, the PUMP will stop, an audible tone will be heard and readings will be blocked. The following screen shows the action to be taken:

LOW FLOW EMPTY WATER TRAP CLEAR HOSE AND PROBE THEN PRESS ENTER

Check the following for water:-

- Probe line, water trap and particle filter

When the blockage is cleared the instrument should resume normal operation. If it is not possible to clear the problem then internal damage may have occurred and the unit should be returned to a service centre.

4.9 Normal Shutdown Sequence

DO THIS EVERY TIME YOU USE THE ANALYSER

Remove the probe from the vehicle exhaust **- TAKE CARE ! THE PROBE WILL BE HOT -** and allow it to cool naturally. Do not immerse the probe in water as this will be drawn into the analyser and damage the pump and sensors.

Once the probe is removed from the exhaust allow the readings to return to zero and press  the analyser will count down from 30 to switch off.

OFF 30 MENU TO ESCAPE

If you have not finished but press  by mistake, you can press  to return to normal operation and not switch OFF.

5. MOVING THROUGH THE MENUS

5.1 Basic Operation

From the MAIN DISPLAY

```
CO   % vol  . . .  00.00
HC   ppm vol . .   0000
CO2  % vol  . . .   00.0
O2   % vol  . . .  20.90
```

Press 
to access the MAIN MENU

```
          MAIN MENU

1. SELECT    3. DISPLAY
2. UNITS     4. SETUP
```

Press  and 
to move cursor up and down

```
          MAIN MENU

 1. SELECT    3. DISPLAY
 2. UNITS     4. SETUP
```

Press 
to access selected Menu

```
          MAIN MENU

1. SELECT    3. DISPLAY
2. UNITS     4. SETUP
```

Press 
to select parameter

```
SET          : ZERO
FUEL         : PETROL
RPM          : 4 CYCLE
```

Use  and 
to change setting i.e. fuel selected

```
SET          : ZERO
FUEL         : PETROL
RPM          : 4 CYCLE
```

Press 
to enter value and move to next parameter

```
SET          : ZERO
FUEL         : PETROL
RPM          : 4 CYCLE
```

Press 
to save settings and return to the MAIN MENU

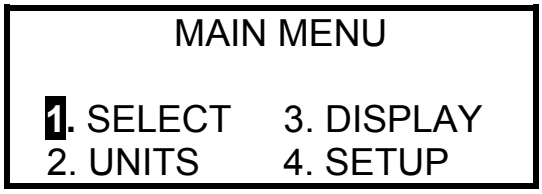
```
          MAIN MENU

1. SELECT    3. DISPLAY
2. UNITS     4. SETUP
```

Press  to return to the MAIN DISPLAY

5.2 Menu Options and Settings

5.2.1 Main Menu

The MAIN MENU consists of 3 or 4 sub menus which are shown below and detailed on the following pages.

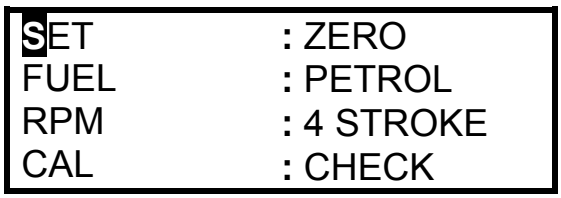


All sub-menus are accessed using  and exited using 

The  and  keys move the cursor within a menu and allow parameters to be changed.

TIP Holding down one of these keys scrolls through the data quicker.

5.2.2 Select Menu



This menu allows selections to be made for the parameters detailed below.

		OPTIONS
SET :	Allows manual activation of zero setting and leak checking functions. More details on these functions can be found in Section 10 – Zeroing, Zero Calibration via the Carbon Filter and Leak Test.	**ZERO** **HC RESIDUE** **LEAK CHECK**
FUEL :	Select the fuel the vehicle is using from a standard fuel stored in the analyser. Select from: Note: For diesel HC will not be displayed.	**PETROL** **LPG** **CNG** **DIESEL**
RPM :	To allow the analyser to determine the correct revolutions per minute of the engine it must know if it is a 2 or 4 stroke (use 2 stroke for DIS systems) when using the inductive clamp. Select the number of cylinders if connecting to the low tension side of the coil. E.g. /12 (test leads are optional)	**2 STROKE** **4 STROKE** **/12, /8, /6, /5, /4, /3, /2**

5.2.3 Units Menu

DATA	: T123 ABC
TEMP	: C
EFF	: LAMBDA
PEF	: 0.512

Allows the vehicle registration number to be changed and all displayed units to be changed.

Vehicle Registration Data

DATA	: T123 ABC
TEMP	: C
EFF	: LAMBDA
PEF	: 0.512

Allows the vehicle registration number to be entered. The format for the data is 8 characters alphanumeric as follows:

1234567890:;<>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ/space/

The cursor **T** indicates this character can be changed. Select the correct character from the list using  and  press  when correct.

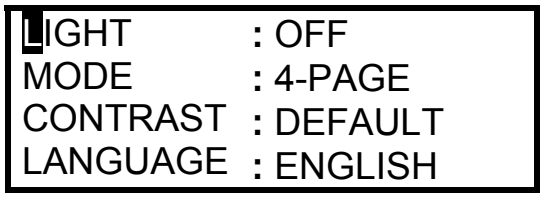
Repeat until all the vehicle registration is correct .

TEMP : Choose selections from Centigrade °C or Fahrenheit °F.

EFF : Changes the calculation used in the Lambda calculation. Change from **LAMBDA** to **AFR.** Formulas used in the analyser are detailed in appendix B.

PEF : Propane equivalence factor or n-hexane to propane ratio as set in the instrument. This is not a user variable parameter but is displayed for reference.

5.2.4 Display Menu



Allows the configuration of the display to be changed.

		OPTIONS
LIGHT :	Turns the backlight ON or OFF.	**ON** **OFF**
MODE :	Select 4 Page Mode or Line Scroll Mode as detailed in section 4.3 Main Displays.	**4 PAGE** **LINE**
CONTRAST :	The contrast is set to a DEFAULT value or can be adjusted ⇧ LIGHTER or ⇩ DARKER. Note the display may jump from dark to clear.	
LANGUAGE :	Changes the analysers displayed and printed language. In the software identification, the letter M refers to the mix of languages listed. A maximum of 5 languages can be saved per variant.	**ENGLISH** **POLSKI** (POLISH) **DEUTSCH** (GERMAN) **NEDERLANDS** (DUTCH)

5.2.5. Set-Up Menu

The set up menu allows the following parameters to be set / altered.

- Format of the date.
- Time
- Printout Header

FORMAT	: DD-MM-YY
DATE	: 02-03-99
TIME	: 09:10:31
HEADER	: NO

FORMAT : Changes the date format set on the analyser. Contact your service centre if this is incorrect.

DD-MM-YY
MM-DD-YY
YY-MM-DD

DATE: Allows the user to change the date. Change each number of the day, month and year until correct.

Change each number using  and 

TIME: Allows the user to change the time. Change each number of the hours and minutes until correct, the seconds will reset to zero automatically.

Change each number using  and 

Header : Allows two lines of 20 characters to be programmed into the analyser. The header appears on the top of the standard printout. This can be used to print your company name and/or phone number.

Name/Phone
KANE AUTOMOTIVE
(44)-1707-375550
'LEFT' USE STORE KEY

The screen above shows the standard header setting with the cursor now shown underlining the K in KANE. By using  and  any letter or number can be chosen.

Once the correct character is displayed, use  to move right to the next. Move along until all characters spell the desired name or phone number. If you need to go back and change a character use  to move left.

Press  to return to the SET UP menu.

6. PRINTING INFORMATION – OPTIONAL EXTRA ONLY

Supplied as an accessory for the analyser is an infra-red thermal printer. Read the manual supplied with the printer prior to operation. Connections to the analyser are detailed below :

- **Infra-red thermal printer** - this does not require a cable to transmit the data but uses an infra-red (IR) link similar to a TV remote control. The IR emitter is positioned on the top of the Analyser and the bottom of the printer. Ensure they are pointing at each other and within 300 mm, with no obstructions in the way.
- Data redundancy and cross checking will ensure that only secured and uninterrupted data is printed. Keep the Analyser pointing at the printer until the printout has finished. If the the data transmission is interrupted, the printer will not print and a message ERROR Try again is printed.

Data can either be printed from a 'live' test or from stored data. Printing of stored data is detailed in STORING AND RETREIVING DATA.

6.1 Printing a 'Live' Test

During a vehicle test the Analyser will print data on request. With the analyser showing the MAIN DISPLAY press  and hold until the second bleep. Current data will be sent to the printer.

The display will show the following until data transmission is complete.

6.2 Standard Printout

The standard printout is shown below :-

```
Kane Automotive
(44) 1707 375550

NO. (S/N of analyser)

VEHICLE: T123 ABC

FUEL:        PETROL

DATE: 17-03-99
TIME: 09:10:31

CO   % vol . . .    0.5
HC    ppm vol . .  100
CO2 % vol . . .     14
O2    % vol . . .    0.5

LAMBDA    . . . 1.010

NO  ppm vol . .   00
OIL deg C         00
RPM   4           00
```

7. STORING AND RETRIEVING DATA

The Analyser can store up to 255 emissions tests. Once stored, the data can be viewed on the display or downloaded to a printer.

7.1 Storing a 'Live' Test

While performing a test and viewing the data on the MAIN display access the STORE menu as follows :-

Press  to access the STORE MENU

```
      STORE MENU
MODE      : STORE
TEST      : 3
PRESS 'STORE' TO LOG
```

Mode: Select from the following :-

- **STORE** - Allows data to be stored in memory.
- **VIEW / PRINT** - Stored data can be viewed or printed.
- **DELETE** - Clears all data in memory.
- **AUTO STORE** – Automatically stores data at a preset interval.

Location: Automatically allocates a location in the memory of the instrument for the next test. On the display shown above the next location will be 3.

To store a test, set **MODE** to **STORE** and press  . The current readings will be stored in the analysers memory.

NOTE: The analyser will stop logging once it has reached 255 readings and will return to the main display if the store key is pressed. Data can still be viewed and printed.

TIP : Make a note of the location number for your particular test as it may be useful when printing.

7.2 Viewing and Printing a 'Stored' Test

Press  to access the STORE MENU

```
        STORE MENU
MODE        : VIEW
TEST        : PRINT
            : 001 TO 010
PRESS 'ENTER' TO VIEW
```

Move the cursor to Location and press  . The cursor will move to the first digit of the first number, use  to select the correct digit and enter when correct. Repeat on the second digit until the location to view from is correct.

Press  to move the cursor to the second number, select the last location to view using the same procedure.

To view the stored data press  :-

```
TEST      ...        1
VEHICLE     T123 ABC
DATE      ... 07-08-96
TIME      ... 12:31:35
```

Use  and  to page through data as in MAIN DISPLAYS.

```
TEST      ...        1
FUEL           PETROL
CO   % vol   ...  00.00
HC ppm vol   h .   0000
```

```
TEST      ...        1
O2    % vol  ...   20.90
CO2   % vol   ...   00.0
LAMBDA  .....   0.000
```

```
TEST      ...        1
AFR       ....     00.00
NO    ppm  NOT FITTED
```

Press  to advance to the next test.

```
TEST      ...        2
VEHICLE      P456 DEF
DATE      ...  07-08-96
TIME      ...  13:31:10
```

Press  to go back to the previous test. Press  to return to the MAIN MENU.

A printout of the test being displayed can be obtained by pressing 

TIP : Stored and displayed with the data are actual time and date of the test.

7.3 Deleting Data

To delete the data in stored memory press  to obtain the STORE MENU (as above) :-

Press  to access the STORE MENU

```
        STORE MENU
MODE        : DELETE
TEST        : 3
PRESS 'ENTER' TO DELETE
```

Press  to access delete data screen

```
ENTER to ERASE DATA
  MENU to  ESCAPE
```

Press  to delete data in memory, press  to exit delete data screen.

WARNING: ALL DATA WILL BE REMOVED

Ensure you have printed the data you require before clearing the memory.

7.4 Auto Store

```
      STORE MENU
MODE        : AUTO STORE
TEST        : 10 S
PRESS 'ENTER'
```

Press  to enter Auto Store Mode.

```
      STORE MENU
MODE        : AUTO STORE
TEST        : 0 S
PRESS 'ENTER'
```

Press  or  to change the interval between Auto Stores (interval can be set between 3 and 99 secs).

Press  to initiate Auto Store sequence.

During the Auto Store sequence the store number appears on the top line of the display, accompanied by a double beep.

To disable Auto Zero store mode:

Press  .

```
STORE MENU
MODE        : STORE
TEST        :
PRESS 'STORE' TO LOG
```

Then press  .

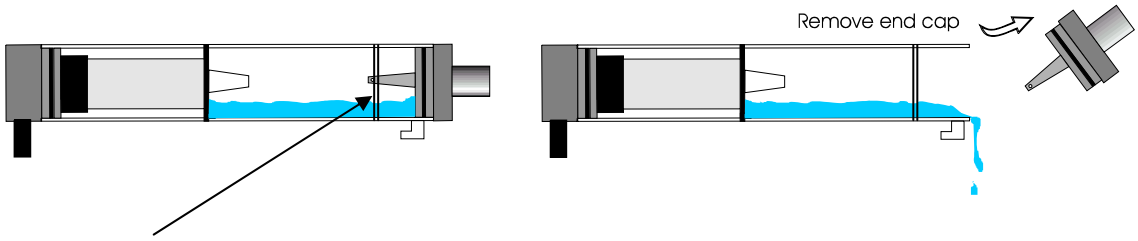
Press  to escape.

8. MAINTENANCE

8.1 Emptying and Cleaning the In-line Water Trap

The in-line water trap should be checked and emptied on a regular basis. Water vapour will condense and gather in the probe line. This may move suddenly to the trap when the probe is moved. Care should be taken at all times.

Emptying of the water trap is detailed below :-

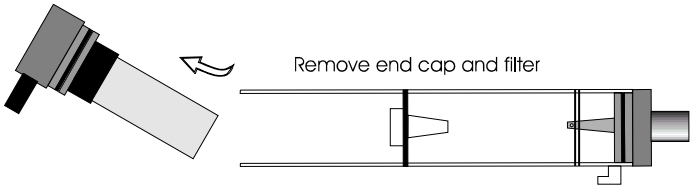


Water level indicator (do not exceed level while trap is vertical)

Carefully remove the end cap from the in-line housing. Dispose of the condensate in a suitable drain. Clean the inside of the water trap using a soft cloth

8.2 Changing the Particle Filter

This is a very important part of the analyser and should be changed regularly. It prevents dust and dirty particles entering the pump and sensors and hence causing damage. The filter MUST be changed when it is discoloured or if LOW FLOW is indicated and no obvious fault can be found.



Remove the end cap from the in-line filter housing. Carefully remove the paper filter element and dispose of it. Clean the inside of the filter housing with a suitable soft cloth. Insert a new filter element onto the spigot in the filter housing and carefully replace the end cap. A leak check is recommended after filter replacement.

IF THE FILTER IS NOT CHANGED REGULARLY DAMAGE WILL OCCUR TO THE SENSORS RESULTING IN A CHARGEABLE SERVICE. IT IS EVIDENT FROM AN INTERNAL INSPECTION OF THE INSTRUMENT IF THE FILTER HAS BEEN CHANGED REGULARLY.

9. PROBLEM SOLVING

The following is a list of problems that may occur on the instrument through its operating life. If the cause of the fault is not easy to identify then we advise you contact Kane Int. Technical Support or an International Distributor for expert advice.

Fault symptom	Causes & recommended actions
• Oxygen too high	• Air leaking into probe, tubing, water trap, connectors or internal to instrument. Pass a manual leak check before further testing. • Oxygen cell needs replacing.
• Oxygen Error (FAULT) • Infrared gas Error (FAULT)	• Zero calibration fault. • Instrument has been stored in a cold. .environment and is not at normal working temperature. • Oxygen cell or infrared bench needs replacing.
• Analyser not holding charge • Analyser not charging	• Battery exhausted. • Charger not giving correct output. • Fuse blown in charger plug.
• Analyser does not respond to exhaust gas	• Particle filter blocked. • Probe or tubing blocked. • Pump not working or damaged with dirt.
• Oil temperature readings erratic	• Temperature plug reversed in socket. • Faulty connection or break in cable or plug.
• Analyser automatically switches off in operation	• Battery below 10% charge level. • Ambient temperature above 50°C. • Battery quickly discharging and is faulty. • Low flow detected.

INTERNAL FILTER

To protect the analyser from water ingress a filter is installed inside the casing to protect the infrared measuring system. This filter will block if care is not taken during sampling:

- Ensure any build-up of water in the probe line and water trap are removed as soon as possible.
- The external particle filter is changed regularly.
- The instrument is allowed to sample fresh air on a regular basis.
- The instrument samples fresh air for 3 minutes before switch off.
- Do not blow smoke from a cigarette into the instrument.

If you suspect the internal filter is blocked perform the following:

- Remove the probe connection from the water trap.
- Empty and clean the water trap with a dry cloth.
- Fit a new external particle filter.
- Run the instrument in fresh air (pump ON) for at least one hour.

If the problem does not clear contact a service agent.

10. ZEROING, ZERO CALIBRATION VIA THE CARBON FILTER AND LEAK TEST

During normal operation of the analyser the following checks may be requested as required:

- Zero setting of all sensors (can also be selected manually)
- HC residue check (automatic)
- Leak test (can also be selected manually)

10.1 Zero setting

The zero setting function sets the working sensors to zero using fresh air. This function is activated as follows:

- On a timed basis. Following the analyser first being turned ON a zero will requested automatically at 7, 15 and then 30 minute intervals. Subsequent requests will be every 30 minutes.
- On request by the user from the **SELECT MENU**

The zero sequence is as follows:

ZERO CHECK REMOVE PROBE FROM EXHAUST THEN PRESS ENTER

Ensure the probe is removed from the vehicle exhaust and is sampling fresh air, in the garage environment this should be ½ metre or 18 inches above the ground. Once this is done press  to activate the pump.

WARNING : The sensors will only be reset if the probe is sampling fresh air for at least 60 seconds.

Once the zero is complete the screen will return to the **MAIN DISPLAY**.

If the analyser fails to zero and/ or detects HC hang up it may request a zero calibration through the carbon filter.

10.2 HC residue checking and zero calibration via the carbon filter

Hydrocarbon is a very ‘sticky’ gas and can cling to tubing in the analyser or probe. If HC % vol reading does not go below 20 ppm when in fresh air following a test then a residue check will be requested. Repeat tests will be carried out until the reading is below 20 ppm. The analyser is continuously looking for the conditions that would trigger a zero calibration via the carbon filter to avoid possible erroneous readings on HC. After pump switch off, an zero calibration via the carbon filter will also be required.

The zero calibration procedure via the carbon filter is as follows:

ZERO CALIBRATION REMOVE PROBE & WTRAP FIT CARBON FILTER THEN PRESS ENTER

As instructed remove the probe from the exhaust and detach the water trap and particle filter housing from the instrument. Fit the carbon filter in place of the water trap housing, remove the rubber seal from the end cap, and press  when in place.

NOTE! The analyser will not continue with the test if it does not detect the carbon filter is in place. Use of the analyser is prohibited if the filter is not used and a successful zero calibration is not completed.

Unless triggered due to pump switch off, during this check it is advisable to perform the following maintenance:

- Change the particle filter and clean the inside of the housing.
- Clear the probe line using a compressed air line. Note! This must only be done with the probe removed from both analyser and vehicle.

If the analyser cannot detect a reduction in the HC level to within preset limits then it will try again from the screen shown above. If the analyser continues to fail the test contact your service agent for advice.

Whilst the analyser is performing the zero calibration via the carbon filter, the screen will display PLEASE WAIT.

If the sequence has been successfully completed, the pump will switch off and the following screen will be displayed:

REMOVE CARBON FILTER REFIT WATER TRAP AND PROBE THEN PRESS ENTER

Once the zero calibration is complete; remove the carbon filter, refit rubber seal on end cap of carbon filter, reconnect the water trap housing and probe and press enter. The screen will return to the **MAIN DISPLAY.**

10.3 Leak check

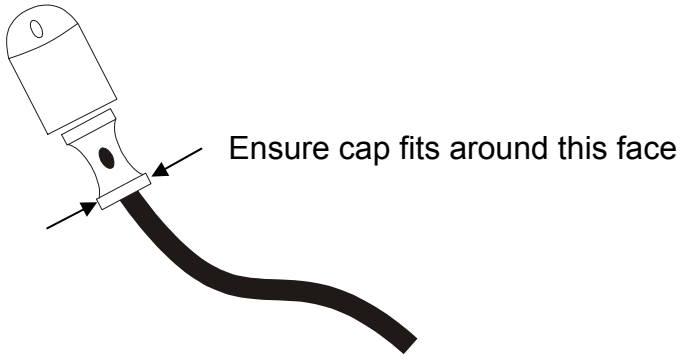
To ensure the gas sampling system is sealed correctly and not letting in air, the analyser will perform a leak check. This requires the user to block the probe inlet and perform the test. This check is done every time the analyser is switched on or as requested by the user. It is also advisable to perform a leak check if the water trap is removed and replaced i.e. for particle filter renewal.

When YES is selected, the leak check procedure is as follows:

LEAK CHECK REMOVE EXHAUST PROBE FIT PROBE SEAL THEN PRESS ENTER

CAUTION! When fitting the SEAL ensure the exhaust probe has been removed from the vehicle for some time and is cool.

When fitting the SEAL ensure the two inlet holes at the end of the probe are covered and are gas tight. If air leaks in at this point the test will fail.



Press  when the seal is in place. The check will take a few seconds. Following a successful test the analyser will return to the **MAIN DISPLAY**.

LEAK CHECK PASSED REMOVE PROBE SEAL THEN PRESS ENTER

If a leak is detected in the gas system the test will fail.

LEAK CHECK FAILED CHECK PROBE & SEAL THEN PRESS ENTER

Check for the following:

- The seal is correctly positioned over the holes in the end of the probe.
- There are not apparent cracks in the probe or tube.
- The water trap housing is not cracked and the ends are in place.
- All O-rings on the probe connections are in good condition and in place.
- There is no physical damage to the analyser case.
- The water trap fitting on the analyser is in good condition.

Once the above has been checked press  to perform the leak test again.

If the analyser continues to fail contact your service centre.

11. LIST OF CONTENTS AND CONSUMABLES/ SPARES

11.1 AUTO 4-1/MID & AUTO 5-1/MID

Part Number	Description
Auto 4-1/MID or Auto 5-1/MID	Gas analyser 4 or 5 gas c/w water trap & CC11585 cover
SM11816	Metal Carry Case with insert
SM11529	Carbon Filter for zero calibration
CU900/220	Charger 220v-in 10v-out 0.75A
PSL/EU	Mains lead, EU moulded plug
CA10733/2	12 V Adaptor Cable
EPAUTO 2	High Temperature Probe Assembly with 17523 probe seal
PF2/5	Filter Elements (pack of 5)
SM13640	Oil Temperature Probe
SM13639	RPM Clamp
KMIRP/2-MID	Infra red printer MID compliant with thermal paper roll
19025-4	English Manual
19035-2	Quick Reference Guide in English

11.2 Consumables & Spares

PF2/10	Filter Elements (Pack of 10)
TP5	Thermal Paper Rolls for KMIRP/2/MID (Pack of 5)
SM12633	Water Trap Bottom End with “O” rings
ASP-ORING	“O” Ring Kit (for 3 water traps)
CM10198/3	Water Trap Coupling
17523	Probe Seal
SM11629	Water trap c/w CM10198/3
2154	Rubber Seal for Carbon Filter

12. PRODUCT SPECIFICATION FOR HANDHELD AUTO 4-1/MID AND AUTO 5-1/MID

Parameter	Resolution	Accuracy	Range
Carbon Monoxide (Infrared)	0.01 %	+/- 5 % of reading [*1] +/- 0.06 % volume [*1]	0-10 % Over-range 20 %
Oxygen (fuel cell)	0.01 %	+/- 5 % of reading [*1] +/- 0.1 % volume [*1]	0-21 % Over-range 48 %
Hydrocarbon (Infrared)	1 ppm	+/- 5 % of reading [*1] +/- 12 ppm volume [*1]	0-5000 ppm Over-range: 20,000 ppm
Carbon Dioxide (Infrared))	0.1 %	+/- 5 % of reading [*1] +/- 0.5 % volume [*1]	0-16 % Over-range: 25%
Nitric Oxide[*2] (fuel cell)	1 ppm	0-4000ppm +/-4% or 25ppm; 4000-5000 ppm +/-5%	0-5000ppm
Oil Temperature	1.0°C/F	±2.0°C±0.3% of reading ±3.6°F ±0.3% of reading	0-150°C 32-302°F
RPM	1 rpm	50 rpm	200-6,000 rpm.
Carbon Monoxide Corrected CO	0.01%	Calculated	0-15%
Lambda AFR (Petrol) (LPG)	0.001 00.01		0.8 – 1.2 11.76 – 17.64 12.48 – 18.72
Sensor response T_{95}		<15 seconds for Auto 4-1/MID & Auto 5-1/MID	
Warm up		Less than 3 minutes	
Pre-programmed Fuels		Petrol, LPG, CNG, Diesel.	
Data-Logging		255 Tests	
Dimensions Weight Handset Probe		 1kg 220mm x 55mm x 120mm Insertion depth 350mm x Diameter 15mm Clip handle to secure to exhaust, 4m long hose	
Ambient Operating Range		+5°C to +45°C/10% to 90% RH non condensing	
Storage temperature		Minimum: 0°C Maximum: +50°C	
Battery Charger		Input: 110Vac/230 Vac nominal Output: 10 Vac off load	
Analyser battery run time		>4 hours from full charge with the pump running	

[*1] Using dry gases at STP and under referenced conditions

[*2] Standard on models Auto 5-1/MID only

To obtain the quoted specification an instrument should be calibrated with clean ambient air (normally outside the workshop) at standard temperature and pressure (STP).

APPENDICES

A - Main Display Parameters

The parameters and their meanings are detailed as follows : -

FUEL: The selected fuel will be displayed, i.e. PETROL. See **Select menu** section 5.2.2 to change.

- PETROL – Leaded or Unleaded petrol/gasoline.
- LPG – Liquid Petroleum Gas
- CNG – Compressed Natural Gas
- Diesel
-

DATE : Analyser date. See **Set-Up menu** section 5.2.5 to change.

TIME : Analyser time. Use **Set-Up menu** section 5.2.5 to change.

BATTERY : Displays the battery level from 0-100%. During normal data display operation the analyser will show **LOW BATTERY** briefly at intervals of about 45 seconds for less than 30% of charge. The analyser will turn off if less than 10% charge is detected. With the charger or 12v adaptor cable connected the display shows **CHARGING BATTERY.**
Note! Allowing the battery to discharge fully may destroy it.

O2 : Oxygen measured in the exhaust gas indicated in percentage %. With the pump off the analyser will display - - - -. If there is a fault with the oxygen sensor then **FLT** will be displayed.

CO : Carbon monoxide measured in the exhaust gas indicated in percentage %. With the pump off the analyser will display - - - -. If there is a fault with the CO reading then **FLT** will be displayed.

CO2 : Carbon dioxide measured in the exhaust gas in percentage %. With the pump off the analyser will display - - - -. If there is a fault with the CO_2 reading then **FLT** will be displayed.

HC : Hydrocarbons measured in the exhaust gas indicated in ppm (parts per million) n-hexane (petrol). With the pump off the analyser will display - - - -. If there is a fault with the HC reading then **FLT** will be displayed.

COK : Generally known as corrected CO. This value is calculated and used for comparison with the actual infra-red measured CO value.
COK = (Cox15)/(CO + CO2), for normal car exhaust CO + CO2 = about 15%. In this case CO is approximately equal to COK. If COK is clearly higher than CO this indicates defects such as exhaust leaks. At near zero COK is not valid.

OIL : Oil temperature as measured by the dip stick probe. Displays in either °C (deg C) or °F (deg F) and will display -- if the probe is not connected.

RPM : Revolutions per minute of the engine as detected by the induction pickup clamp. This probe is plugged into the two connectors on the bottom of the instrument case, ensure correct polarity. 00 will be displayed if the probe is not connected.

LAMBDA : (λ) The value of Lambda gives an indication of the burning efficiency of the engine. This can be replaced with the Air Fuel Ratio (AFR) below. See section 5.2.3.to change between displays. Appendix B gives the formula used.

When sampling fresh air and lambda is outside operation range this indication will show '-----'.

AFR : Air Fuel Ratio is another method for displaying the efficiency of an engine. The calculation for the AFR is Lambda multiplied by 14.7 for Petrol and 15.6 for LPG (typically). When sampling fresh air this indication will show '-----'.

NO : Nitric oxide reading in ppm (parts per millions) of the exhaust gas. Displayed on screen and print out when Nitric oxide sensor fitted, also indicated on the rear label. Displays N/F (not fitted) when sensor not fitted and FLT (FAULT) if failed.

NOx : A calculated value based on the measured level of Nitric Oxide to display total oxides of Nitrogen. Only available on screen.

LOW FLOW: During sampling or at any time the pump is running the screen may display LOW FLOW. Readings are automatically blocked.

PUMP OFF: Indicates the pump has been manually turned off using the  key.

TIME TO: ZERO The analyser requires to regularly zero the sensors. Once a zero has been performed the time to the next zero is displayed in minutes. Check there is sufficient time remaining before starting a test and perform a manual zero if not.

AMB deg C The internal temperature of the analyser.

PRSD mbar Pump pressure in mbar.

PRS mbar Air pressure in mbar as measured by the internal pressure sensor.

B. LAMBDA CALCULATION

The value for Lambda is a determinant for the burning efficiency of an engine. The value depends on the composition of the fuel, the air that is used for the combustion and on the combustion products as found in the exhaust gases.

A basic formula, taking into account:
- Components of the fuel: carbon, hydrogen, oxygen and water content;
- Water content of the air;
- Components of the exhaust gases: carbon dioxide, carbon monoxide, hydrocarbons and nitrogen oxide;

has been developed by J. Brettschneider and published in Bosh Technishe Berichte, Volume 6 (1979), No. 4, page 177-186.

A simplified formula, derived from the basic formula, and based upon the assumption that the water content of the fuel and air and the NOx content in the exhaust gases are negligible, allows the computation of Lambda when certain components of the exhaust are measured.

B.1 Oxygen balance formula

For Lambda calculation, based upon measurements of CO, CO2, HC and O2, the following formula is standardised: Displayed on the instrument as LAMBDA (O)

$$\lambda = \frac{CO_2 + (CO/2) + O_2 + [H_{CV}/4 \times \{3.5 / (3.5 + CO/CO_2)\} - O_{CV}/2] \times (CO_2 + CO)}{(1 + H_{CV}/4 - O_{CV}/2) \times \{(CO_2 + CO) + (K_1 \times HC)\}}$$

Where:

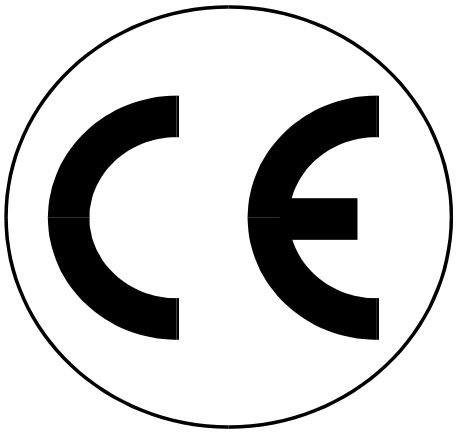
CO = Carbon monoxide % volume measured.
CO_2 = Carbon dioxide % volume measured.
HC = Hydrocarbon ppm volume measured.
O_2 = Oxygen % volume measured.
K_1 = Conversion factor for HC is expressed in ppm vol n-hexane (C_6H_{14}) equivalent. Its value in this formula is 6.10^{-4}
H_{cv} = Atomic ratio hydrogen to carbon in the fuel. Nominal value is 1.7261
O_{cv} = Atomic ratio oxygen to carbon in the fuel. Nominal value is 0.0176

C. Procedure for changing Oxygen fuel cell.

The Oxygen fuel cell is housed within the case of the instrument. It should be changed at an approved service centre when readings of oxygen are erratic or when the unit will not set to 20.9% following a zero.

Note! The oxygen reading in fresh air may drift between 20.7 and 21 % this is normal.

D. ELECTROMAGNETIC COMPATABILITY (CE) STATEMENT



This product has been tested for compliance with the following generic standards:

EN 61000-6-3: 2007
EN 61000-6-1: 2007

and is certified to be compliant

Specification EC/EMC/KI/AutoAnalyser details the specific test configuration, performance and conditions of use.

Product Registration

Please complete, detach and return to: Kane International Ltd,
Kane House, Swallowfield, Welwyn Garden City, Hertfordshire, AL7 1JG

Your Details	
Name:	
Job Title:	
Company Name:	
Company Address 1:	
Address 2:	
Town/City:	
County:	
Postcode:	
Country:	
Phone Number:	
Fax Number:	
Mobile Number:	
Email Address:	

Product Details *Note: Proof of Purchase may be required for warranty claims.*	
Date Purchased as numbers (05.01.10):	
Purchased From:	
Model Number:	
Product Serial Number:	

Why did you buy a Kane Product?

☐ Dealer Recommendation	☐ Other Recommendation
☐ Value for Money	☐ Our Fixed Price Servicing Programme
☐ Kane	☐ Previous Owner
☐ Not your Decision	☐ Other:

What brand was your previous analyser?

How did you hear about Kane?

☐ Magazine Advert	☐ Trade Counter Literature
☐ Personal Recommendation	☐ Internet
☐ Exhibition	☐ Other:

Which do you read most often?

	Often	Sometimes	Hardly Ever
Registered Gas Engineer	☐	☐	☐
Gas Installer	☐	☐	☐
P.H.P.I.	☐	☐	☐
P.H.A.M. News	☐	☐	☐
Heating Ventilating & Plumbing	☐	☐	☐
Heating & Plumbing Monthly	☐	☐	☐

Thank you for completing this survey.
All the information we have collected is confidential.
We do not sell or share data with any other company or organisation.

Thank you for buying this analyser.

Before use, please register on our website

www.kane.co.uk

or complete, detach and return the Product Registration page.