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KANE QUINTOX

Flue Gas Analyser

Stock No: 19712-3 March 2016

CONTENTS

SAFETY WARNING

This analyser must only be used in well-ventilated locations by trained and competent persons after due consideration of all the potential hazards and with regard to local and National regulations and guidelines.

The analyser extracts combustion gases that may be toxic in relatively low concentrations. These gases are exhausted from the bottom of the instrument.

Users or portable gas detectors are recommended to conduct a “bump” check before relying on the unit to verify an atmosphere is free from hazard.

A “bump” test is a means of verifying that an instrument is working within acceptable limits by briefly exposing to a known gas mixture formulated to change the output of all the sensors present. (This is different from a calibration where the instrument is also exposed to a known gas mixture but is allowed to settle to a steady figure and the reading adjusted to the stated gas concentration of the test gas).

KANE QUINTOX OVERVIEW

The KANE QUINTOX is broadly based on the KM9106 and whilst retaining many of its core features has been significantly enhanced. The most visible difference is the large graphical display on the handset. Up to 15 lines of text/data can be displayed. The handset links to the main analyser unit using wireless communications or the normal cable. It also has a USB connector to link to a PC via a cable and has an infra-red output to link to the portable Kane KMIRP-2 printer.

The main analyser unit also contains significant enhancements over the KM9106.

STANDARD FEATURES:

19301	Battery charger
18277	UK mains lead
18276	EU mains lead
18275	US mains lead
19332	Instruction manual

Kane 'LIVE' software download from Kane website

HANDSET: KBHS

Wireless and cable connectivity to analyser unit.
Wireless and USB connectivity to PC
GPS location
IR connectivity to Kane IRP portable printers
Monster data storage memory (64k records)
Graphical display with choice of large or small fonts.
Battery rechargeable via main unit or mains charger

MAIN ANALYSER UNIT: AS STANDARD KANE QUINTOX

Measures:
Oxygen
Carbon monoxide
Ambient temperature
Atmospheric pressure
Inlet temperature
Flue temperature
Differential pressure

Features:
Main purge
Flow control*
NiMh battery packs
Plain paper printer

*Flow control

To compensate for different suction levels in flues, hose lengths and filter contamination levels, all of which can affect the flow of sample gases, there is an active flow control system fitted to the KANE QUINTOX.

It operates as follows:

Every time the instrument is turned on and finishes its first fresh air purge cycle from inside the analyser, it measures and records the pump pressure just prior to the sensor manifold whilst the pump is at 100% flow rate. During service calibration & normal use, the pump speed is automatically adjusted to 70% of the purge flow rate to maintain consistent flow.

The flow control can cope with typically 100 mbar suction in a flue and still maintain the same nominal flow as that present under ambient conditions.

OPTIONS:

ELECTROCHEMICAL SENSORS : (UP TO 5 SENSORS)

CHOOSE FROM:

KNO1L/Q	Nitric oxide (low range)
KNO1H/Q	Nitric oxide (high Range)
KNO2/Q	Nitrogen dioxide
KSO2L/Q	Sulphur dioxide (low range)
KSO2H/Q	Sulphur dioxide (high range)
KH2S/Q	Hydrogen sulphide

OTHER OPTIONS:

KHSA	Heater for toxic sensors
KHC/Q	IR triple bench (CO, HC, CO_2)
KHPUR/Q	High/low CO protection (solenoid and pump)
WTS9206P	Pumped water trap
KMHL3000	Heated line
KMHP1200	Heated probe
KMDM220	Gas Conditioning Module

PROBE OPTIONS:

KMCHLP6	High temperature 1 metre removable shaft
KMCHP6	High temperature 285mm removable shaft
KMCHSLP6	Smoke probe with high temperature 1 metre removable shaft
KMCHSP6	Smoke probe high temperature 285mm removable shaft
KMCSP6	Smoke probe with 285mm removable shaft
KMCLP6	1 metre removable shaft
KMCP6	285mm removable shaft

SPARE PARTS LIST:

OS11	Oxygen Sensor
KCO1/Q	Carbon monoxide (H_2 compensated)
IMP3R	Printer ribbon
IMP10P	Printer paper
SF1/5	Chemical filter
AF2	Particle filter assembly
PF2/10	Particle filter filter pack
WN8	Water trap filter pack
BP9206	Battery pack
WTS9106	Water trap assembly
19403	Peri pump tubing

KANE QUINTOX WITH KANELIVE PC SOFTWARE

KANELIVE is a free download that runs on Windows based PCs and allows live display and graphing of data. It can be downloaded from the Kane website (www.kane.co.uk) once an analyser has been registered in the MY KANE section of the website.

In the current configuration, the handset needs to be connected to the main unit by a cable and the wireless setting for the handset needs to be changed to TO PC using MENU, SETUP, WIRELESS SETUP.

Once this has been selected, go to the PC and select DEVICES & PRINTERS.

Click ADD A DEVICE.

All devices within range will be displayed in icon form. The KANE QUINTOX handset will be displayed as:

KANE QUINTOXHS
999999107

where the 9 digit number is the serial number of the handset.

Double click on this. Now follow the instructions.

Then enter the passkey: 1111

Click on the TICK BOX and then AT SERIAL CONFIGURE and then FINISH.

Now click on KANELIVE to initiate the programme.

Select your analyser type by clicking on the analyser name displayed on the middle of the bottom line of the screen. If more than one analyser has been enabled a drop down will appear. Click on the analyser of your choice.

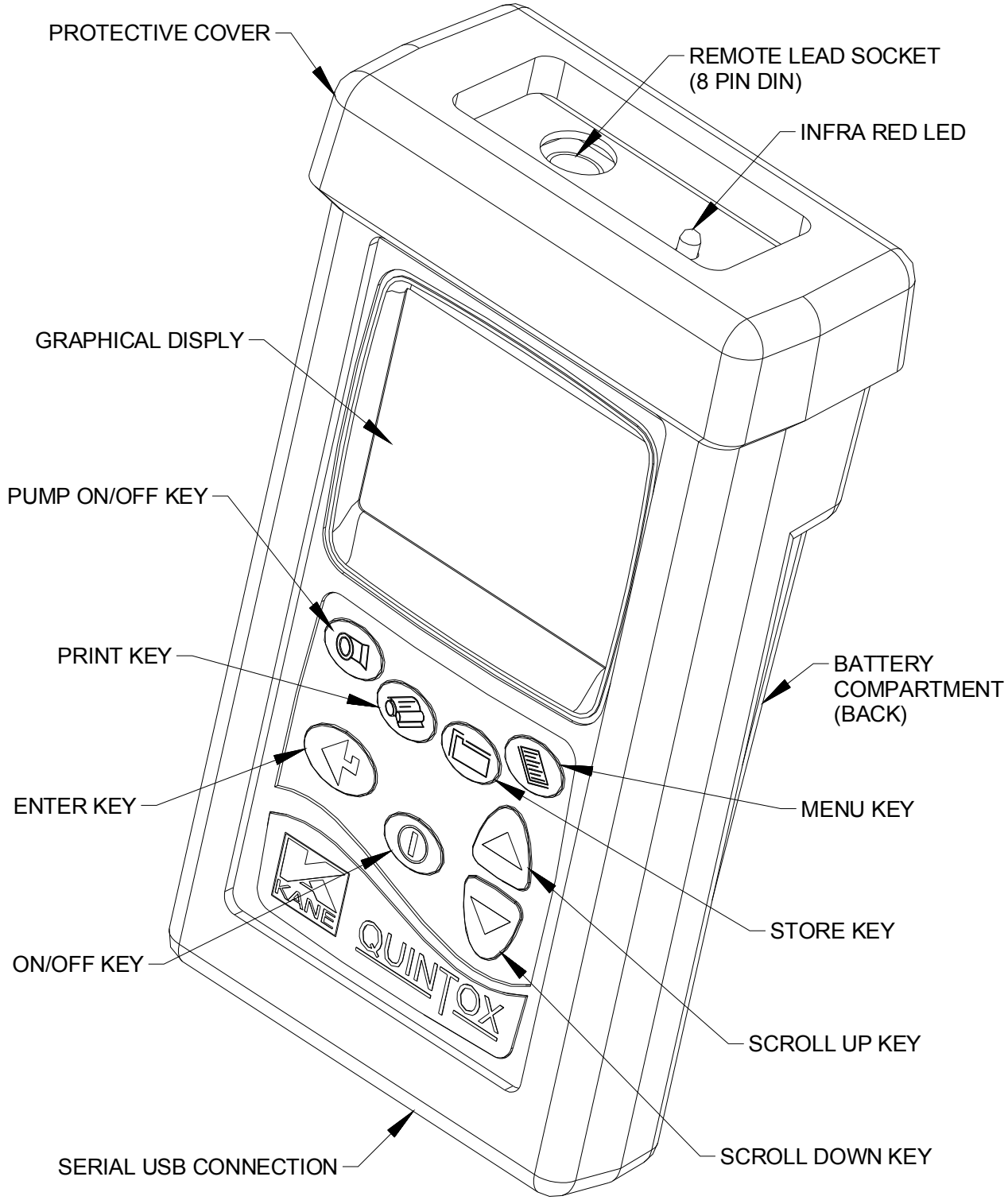
Then click CONNECT and wait for its colour to change to green.

Then click START which will change to green.

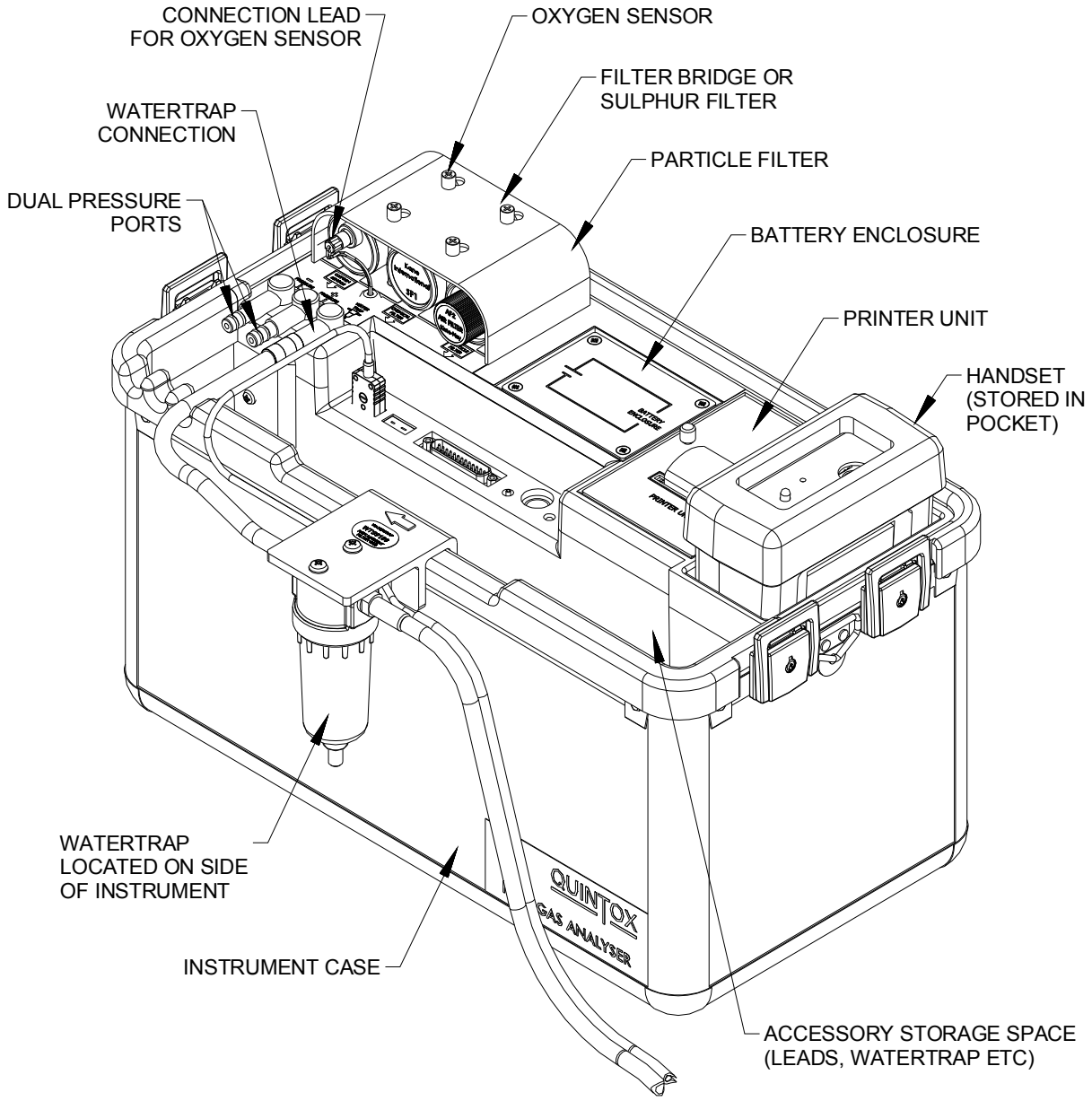
After a few seconds live data will be displayed.

ANALYSER LAYOUT AND FEATURES

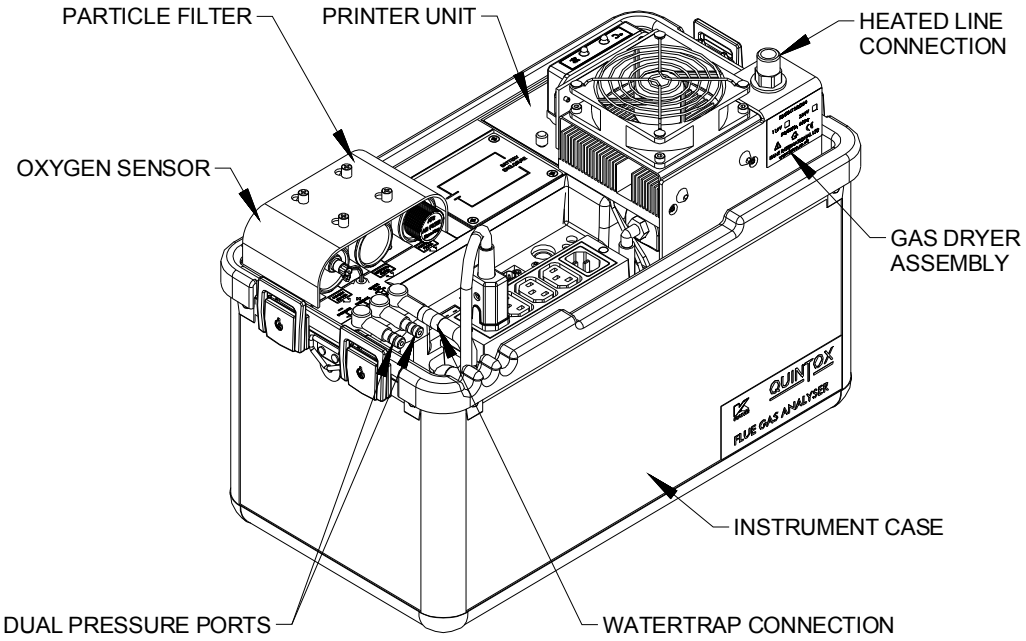
HANDSET FEATURES

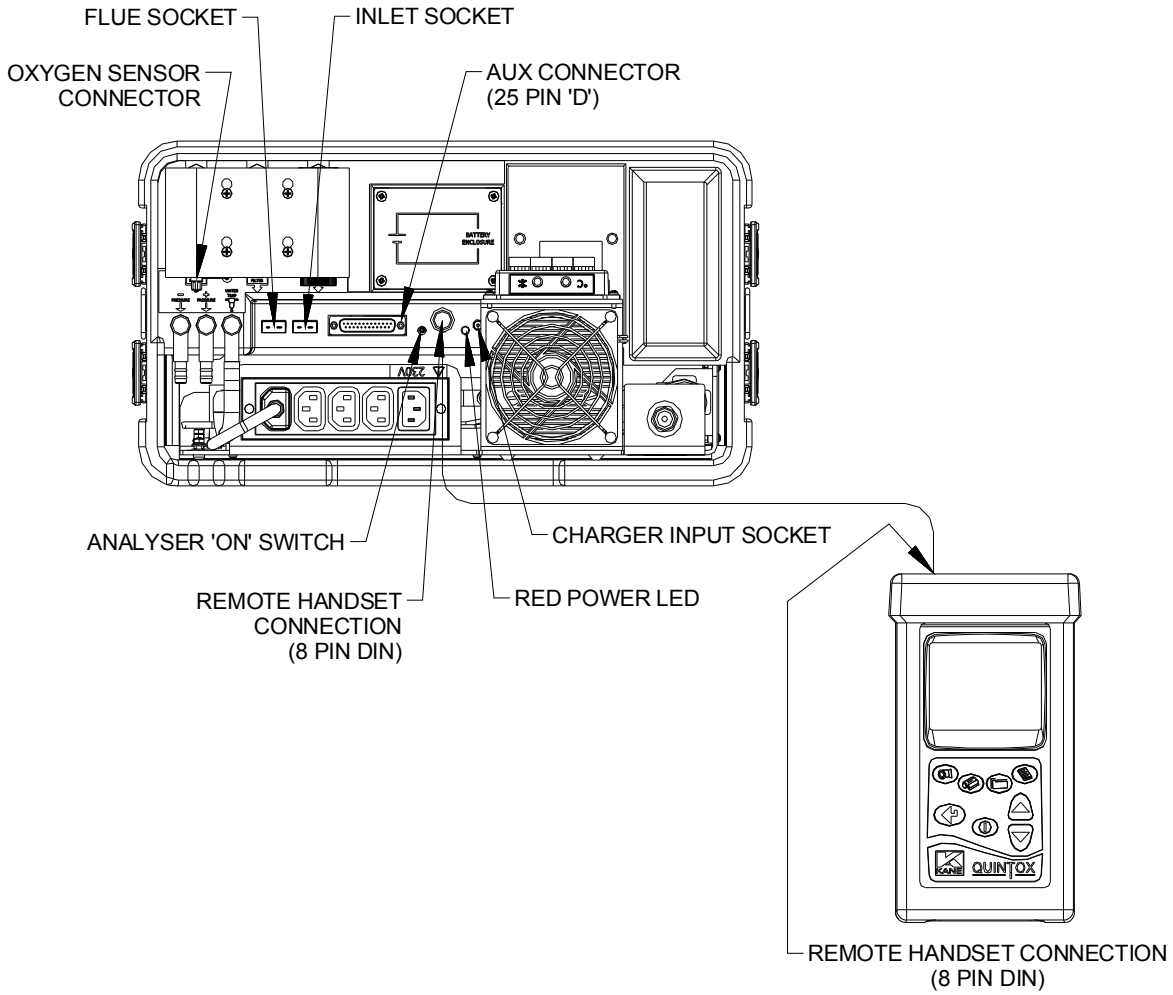


ANALYSER LAYOUT

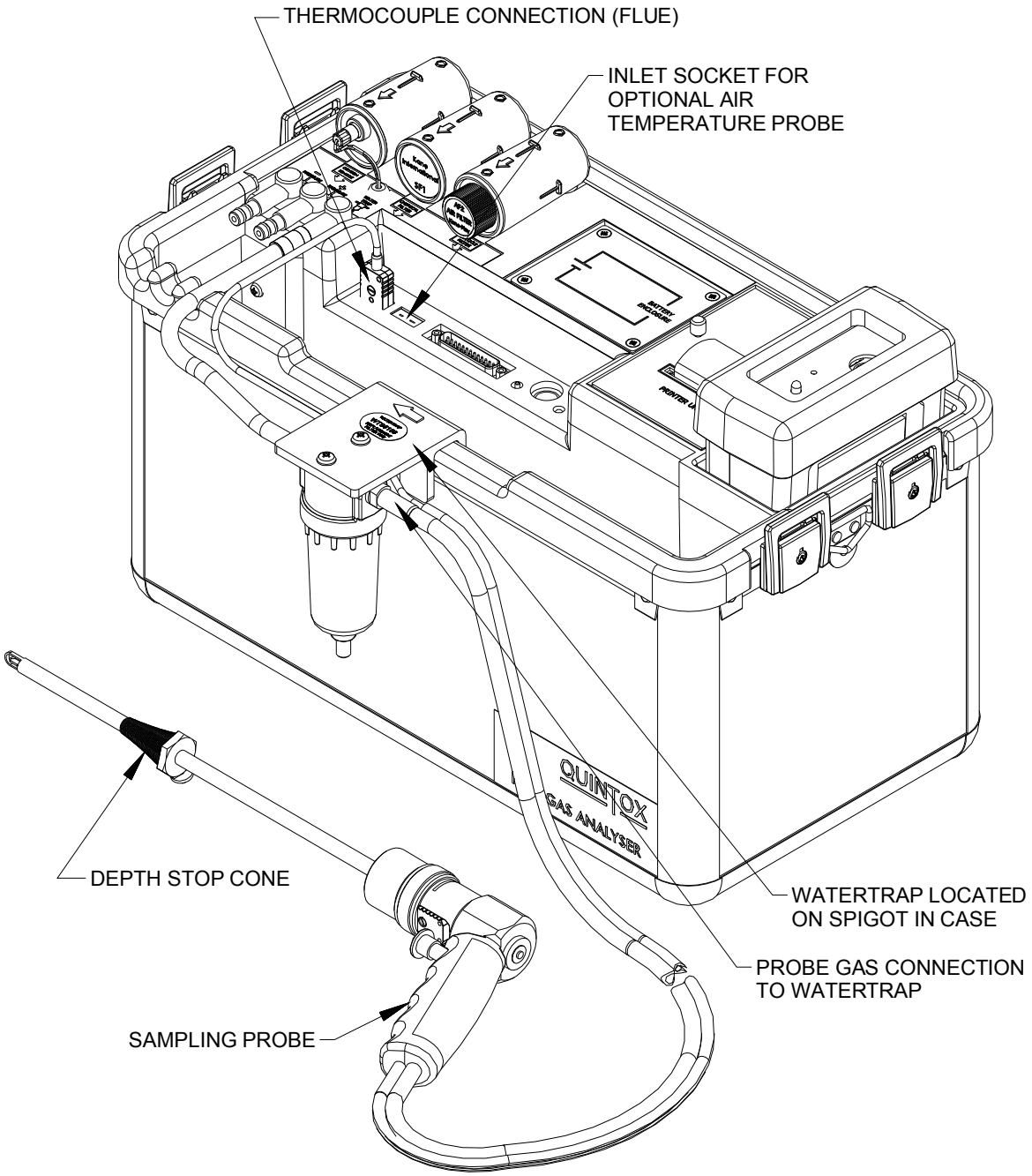

CONNECTION LEAD
FOR OXYGEN SENSOR
OXYGEN SENSOR
FILTER BRIDGE OR
SULPHUR FILTER
WATERTRAP
CONNECTION
PARTICLE FILTER
DUAL PRESSURE
PORTS
BATTERY ENCLOSURE
PRINTER UNIT
HANDSET
(STORED IN
POCKET)
WATERTRAP
LOCATED ON SIDE
OF INSTRUMENT
INSTRUMENT CASE
ACCESSORY STORAGE SPACE
(LEADS, WATERTRAP ETC)
QUINTOX
GAS ANALYSER

ANALYSER LAYOUT WITH KMDM110/230GAS CONDITIONING MODULE FITTED

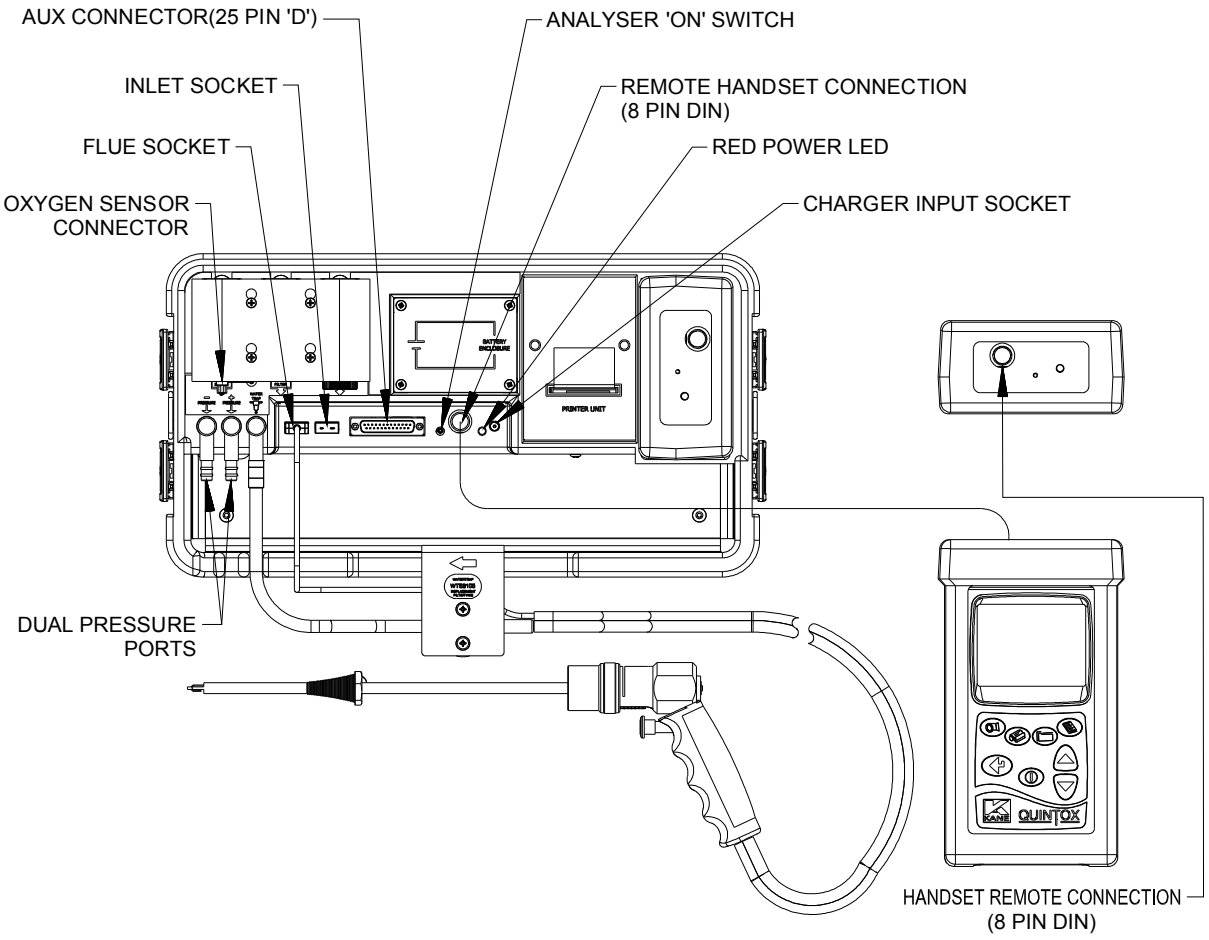




TYPICAL PROBE CONFIGURATION (KMCP6)



ANALYSER CONNECTIONS



GETTING STARTED

Check that you have all the items you have ordered.

Before attempting to use the analyser to take readings it is recommended that the batteries are fully charged.

When the charger is connected to the analyser and powered up the red LED by the charger socket will flash until the batteries are fully charged. Once the batteries are fully charged the LED will no longer be illuminated.

To charge the handset; connect the handset to the main analyser unit using its cable. Whilst switched off, but charging, the display will show the Kane logo and a battery charging icon in the bottom right hand corner of the handset screen. Note: the handset battery is charged via the external battery charger and not from the analyser's internal battery. Once the handset battery is fully charged the icon will disappear from the screen.

The handset can also be charged directly using the mains charger as used for the analyser.

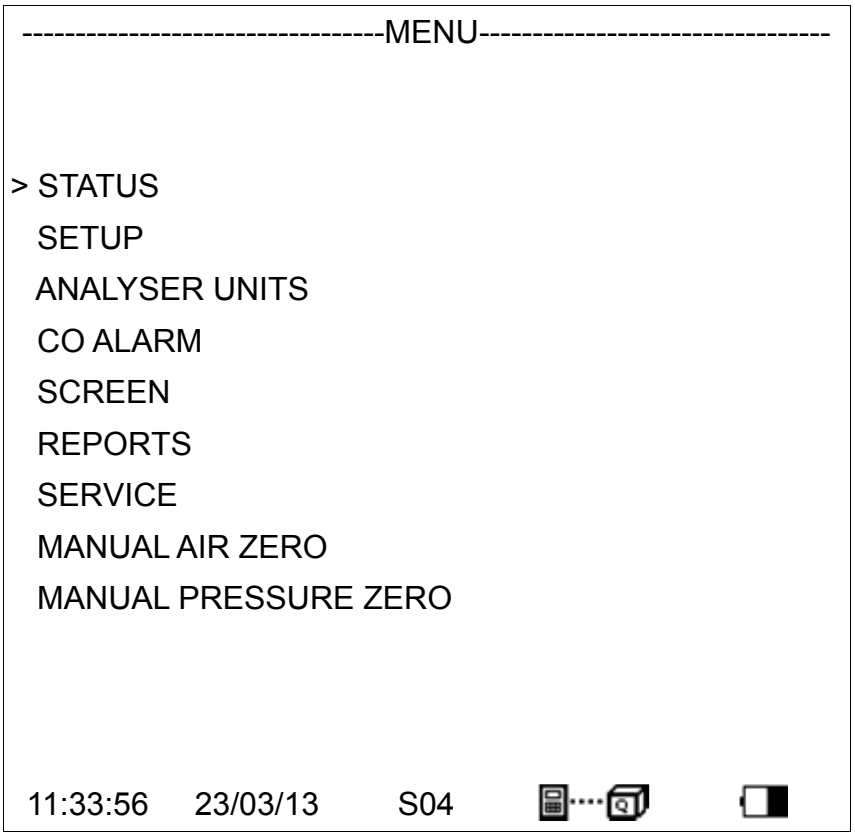
BEFORE TAKING READINGS

You need to establish the current set up of the analyser and then make the changes that you need to suit exactly what you want to do.

So press the MENU key and then select STATUS as described below.

MENU: ALL THE OPTIONS

Press the MENU key.



The **>** symbol acts as the cursor. It can be moved up or down by pressing the UP or DOWN keys.

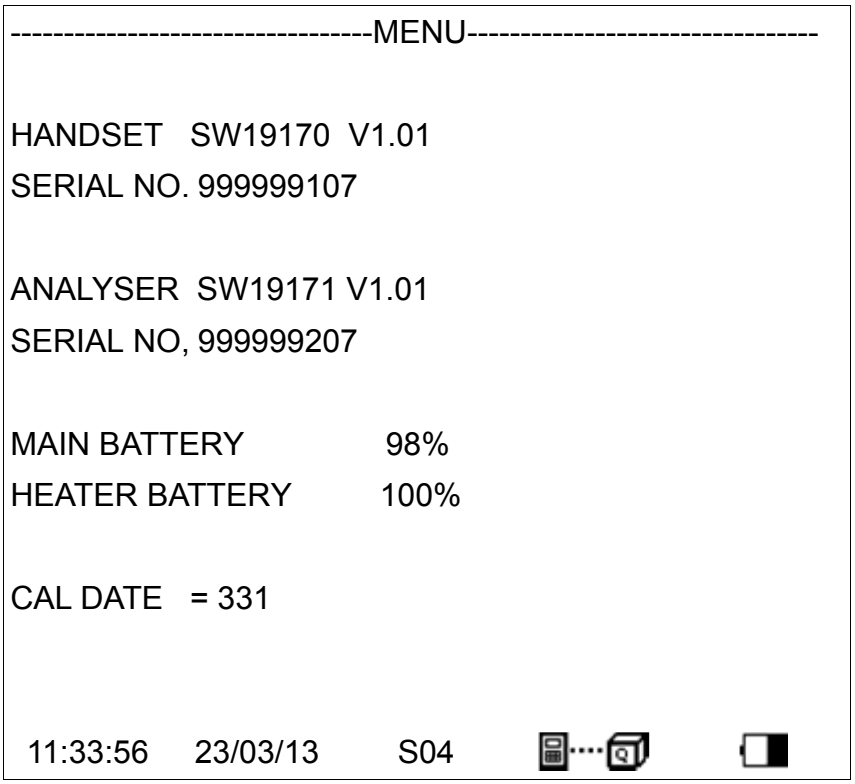
Having made a selection press the ENTER key.

The bottom line of this screen lists:

- the time
- the date
- the number of satellites being received
- the wireless connection status
- the estimated charge in the handset battery

STATUS: ESTABLISHING THE ANALYSER'S SET-UP

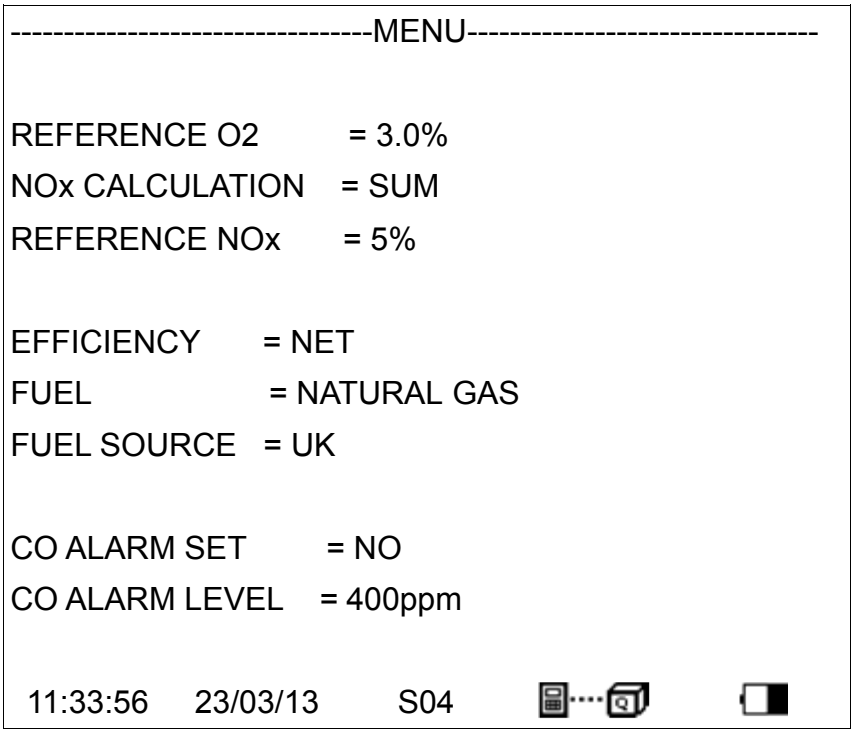
Press MENU and then select STATUS by pressing ENTER.



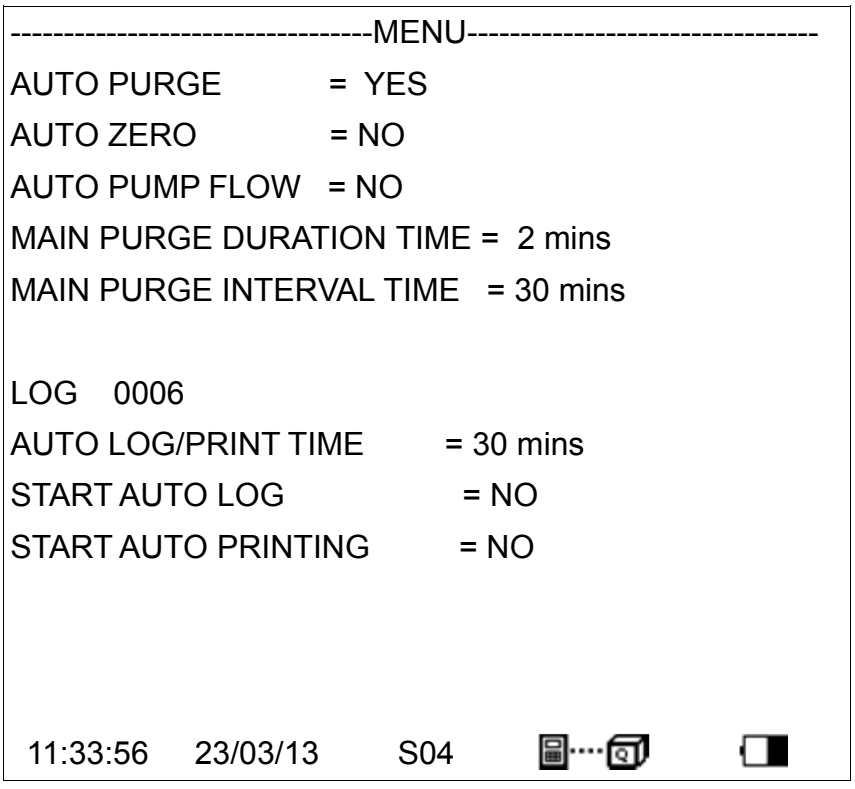
This screen lists :

- the software version in the handset
- the handset serial number
- the analyser unit software version number
- the analyser unit serial number
- the estimated charge in the main battery
- the estimated charge in the heater battery (if fitted)
- the number of days before annual re-calibration is due

Press DOWN to move to the next screen.



Press DOWN to move to the next screen.

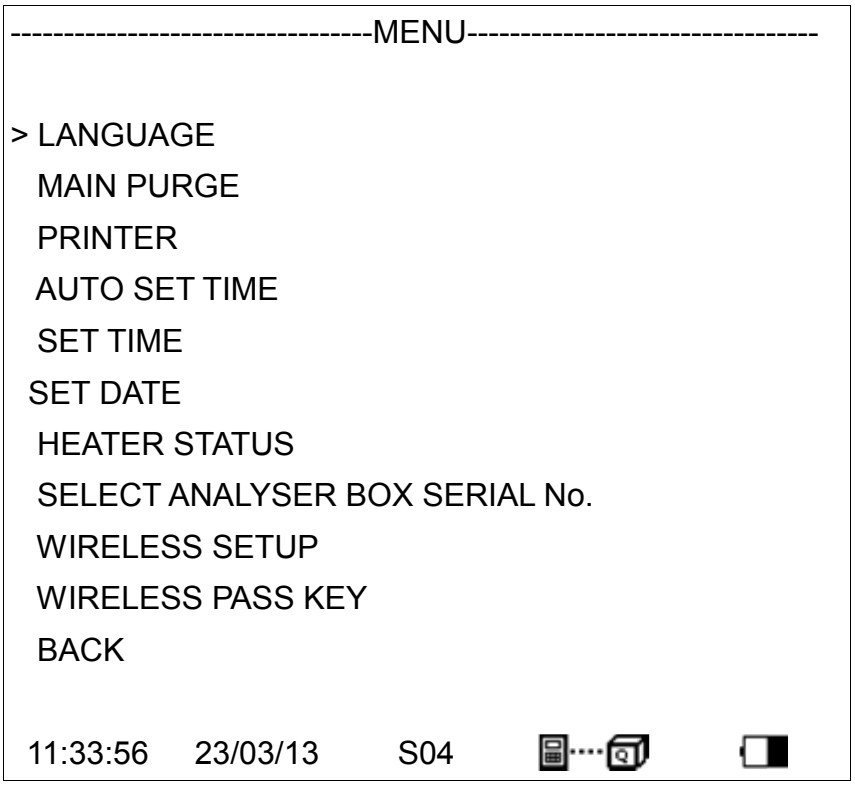


Press DOWN to move back to the first screen.

Press PRINT to print this status on the analyser's printer.

Press MENU to EXIT.

SETUP: CONFIGURING THE ANALYSER'S SETUP



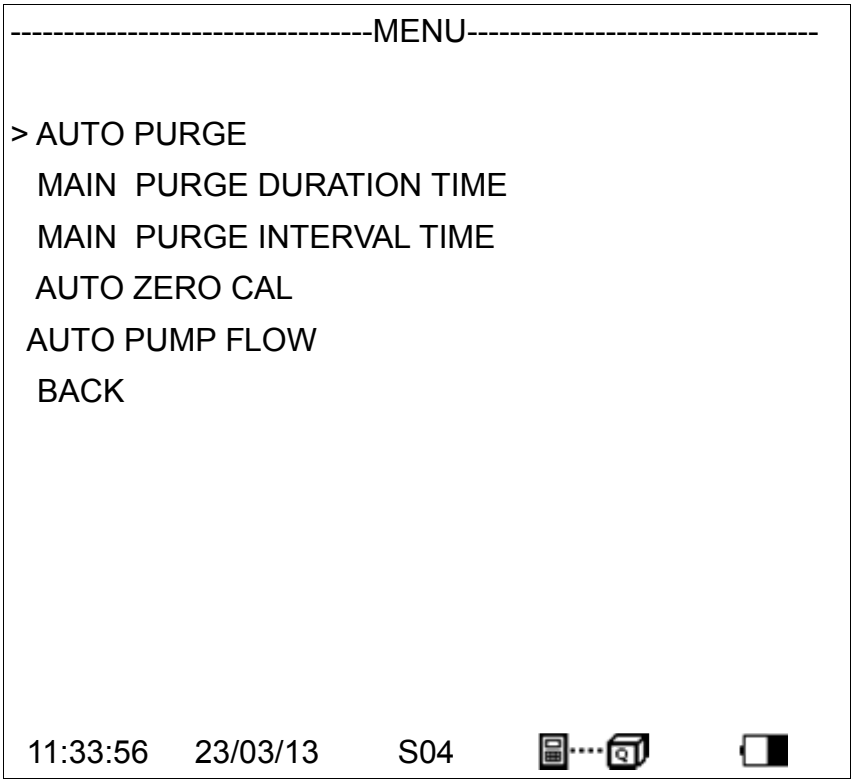
LANGUAGE:

Align cursor using UP or DOWN keys, then press ENTER.

Use UP or DOWN keys to scroll through the selection.

Press ENTER to select.

MAIN PURGE:



AUTO PURGE:	Set YES or NO
AUTO PURGE DURATION TIME:	Set fresh air purge duration to between 2 and 30 minutes
MAIN PURGE INTERVAL TIME :	Set the interval between fresh air purges to between 10 and 120 minutes.
AUTO ZERO CAL:	Set YES or NO to automatically re-zero sensors at the end of a main purge cycle.
AUTO PUMP FLOW:	Set YES or NO to automatically control the pump flow. This may be required for some regulatory test protocols

After switch on, the first purge interal is automatically set to 10 minutes if the optional IR module is fitted. Changes in the purge interval are implemented after completion of the next purge cycle. To implement a change immediately do a “MANUAL AIR ZERO”.

PRINTER:

This sets the destination for outputs from the handset

The choices of outputs are:

- KANEIRP
- KANEIRP-2
- ANALYSER PRINTER
- SERIAL
- WIRELESS

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

AUTO SET TIME:

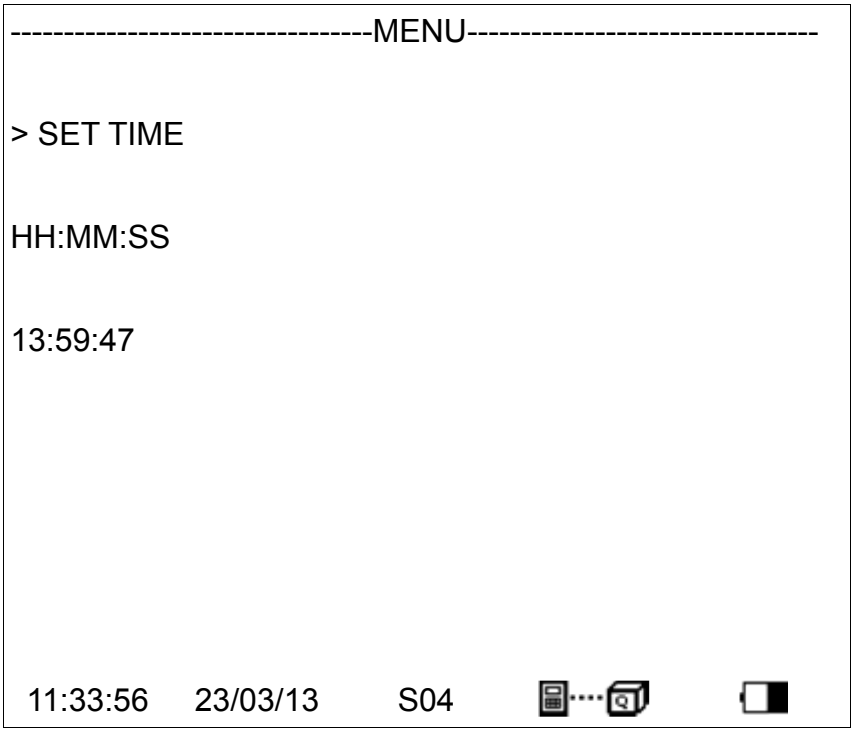
This function is locked off if reports have been stored. To allow the function to operate, delete the reports.

This allows the time to be set automatically from the GPS signals. Select NO to maintain manual setting

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

SET TIME:

This function is locked off if “AUTO SET TIME” is activated or reports have been logged. If this function is locked, delete the reports.



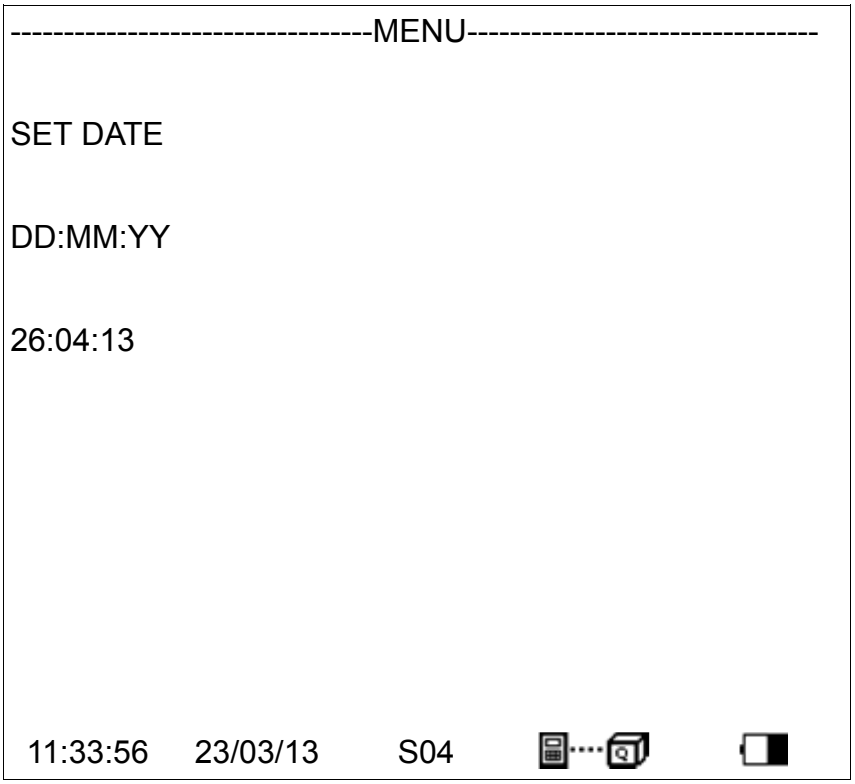
If manual setting is enabled use UP or DOWN keys to change values.

Press ENTER to select.

SET DATE:

This function can only be set manually, not by GPS.

If this function is locked, delete the reports.



If manual setting is enabled use UP or DOWN keys to change values.

Press ENTER to select.

HEATER STATUS:

Allows the heaters to be switched off totally or to operate automatically.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

SELECT ANALYSER UNIT SERIAL NUMBER:

If more than one analyser unit is within Bluetooth range the handset needs to be set to communicate with the correct unit,

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

WIRELESS SET UP:

The handset can communicate with an analyser unit or a PC. Wireless can also be switched off and a cable can be used.

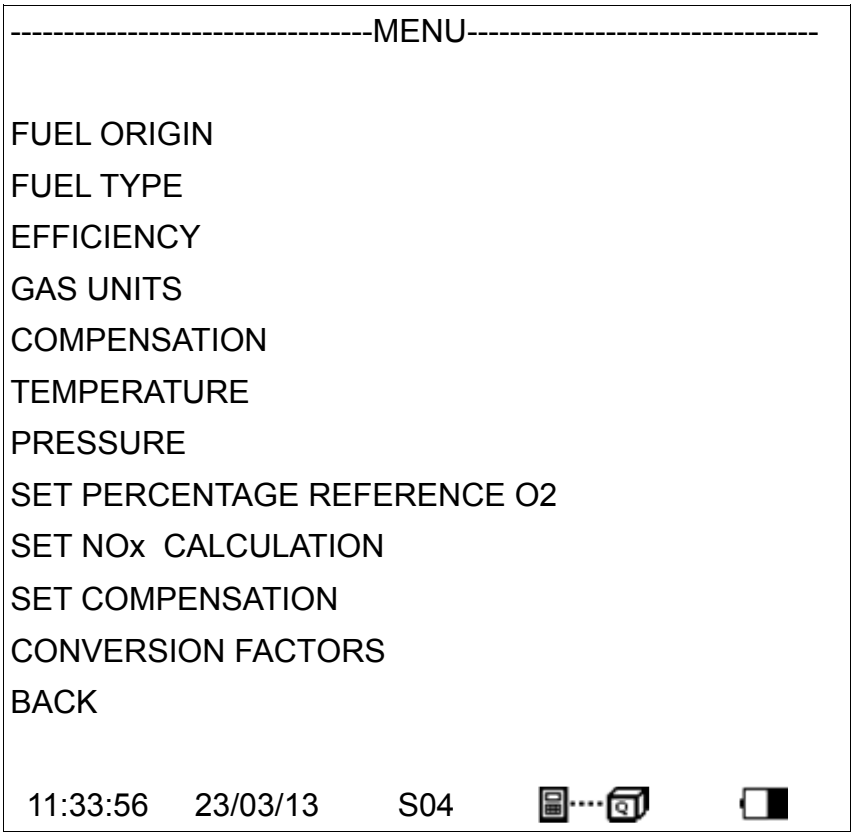
Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

WIRELESS PASSKEY:

This confirms the Passkey setting.

The wireless Passkey is 1111.

ANALYSER UNITS: CONFIGURES ALL THE DATA SOURCES AND SETTINGS



FUEL ORIGIN:

Select from a list of country specific fuel tables.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

FUEL TYPE:

Select from the list of fuel types associated with the chosen origin. The K values for the selected fuel are also shown.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

There are 5 User Fuels that can be loaded from a PC. The title of these user fuels can be edited using the keypad on the handset.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

EFFICIENCY:

Select NET or GROSS efficiency calculation

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

GAS UNITS:

Select ppm or ppm(n) or mg/m3 or mg/m3(n).

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

TEMPERATURE:

Allows the selection of Fahrenheit or Celsius.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

PRESSURE:

Allows the selection of pressure units.

Select from: mbar, In H_2O, mm H_2O, hPa, psi,.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

SET PERCENTAGE REFERENCE O_2:

Can be set between 0% (equivalent to OFF) and 10%.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

SET NOX CALCULATION:

Select from: SUM, NO_2 or NO

Set REFERENCE NOx to the percentage required or defined by local regulations. Typically 5% NO_2 is added to an NO reading. The value can be user set.

SUM adds the readings from an NO sensor and an NO_2 sensor when fitted

NO calculates an NOx reading from the NO reading where NOx = NO x 1.1
NO_2 calculates an NOx reading from the NO_2 reading where NOx = NO_2 x 2.05

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

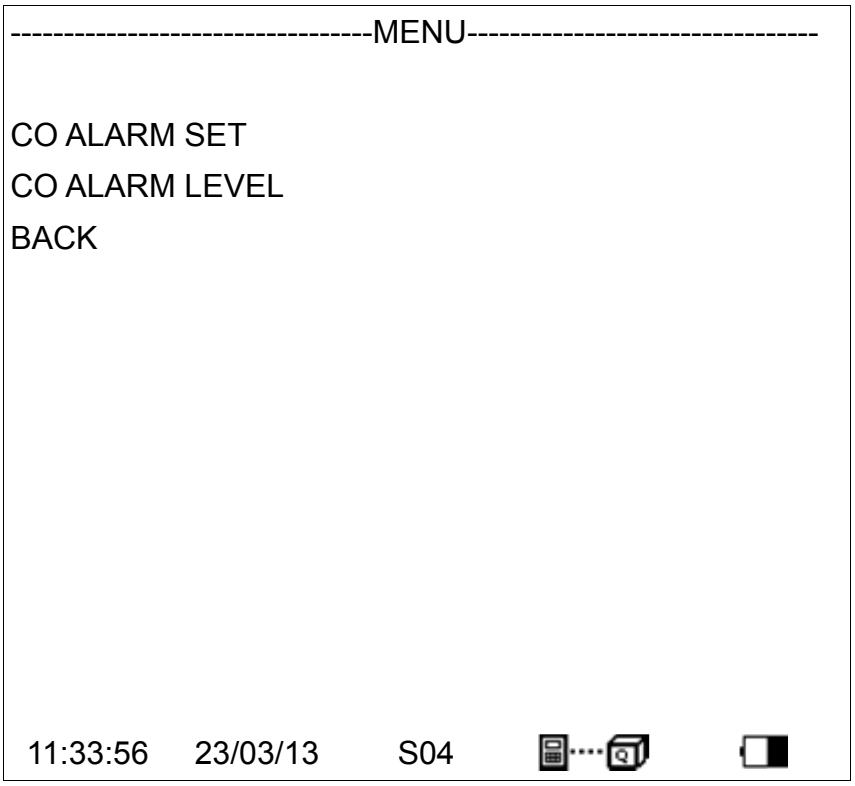
SET COMPENSATION:

Select from YES or NO

CONVERSION FACTORS:

Display the Propane Equivalency Factor PEF and the Methane Equivalency Factor for the IR module (if fitted) and the pitot factor – change from 0.10 to 1.00 as determined by the pitot tube being used.

CO ALARM:



CO ALARM SET:

Switch the alarm ON or OFF.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

CO ALARM LEVEL:

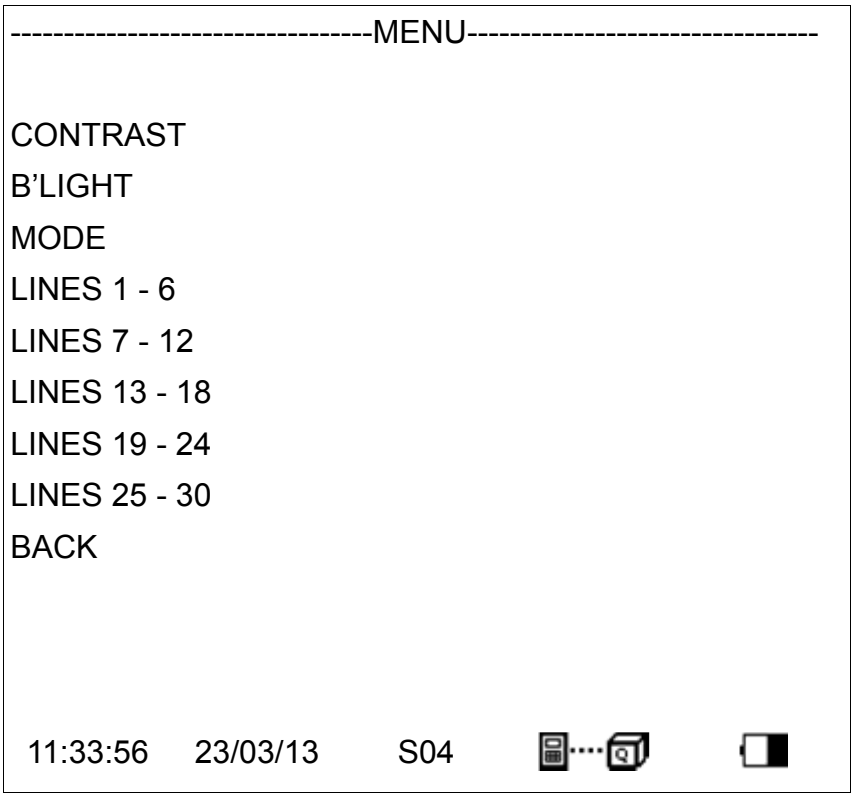
Allows a specific CO level in ppm to be set as the alarm trigger point.

Use UP or DOWN keys to change the digits. Press ENTER to select and move to the next digit.

The display will show ‘++++’ when the CO alarm is triggered.

SCREEN:

The screen display is fully configurable.



CONTRAST:

Allows the display to be darkened or lightened. Default value is 14.

Use UP or DOWN keys to change the digits. Press ENTER to select and move to the next digit.

B'LIGHT:

The switch off time for the backlight can be set for between 30 and 300 seconds,

Use UP or DOWN keys to change the digits. Press ENTER to select and move to the next digit.

During normal measurements press ENTER to switch the backlight on.

MODE:

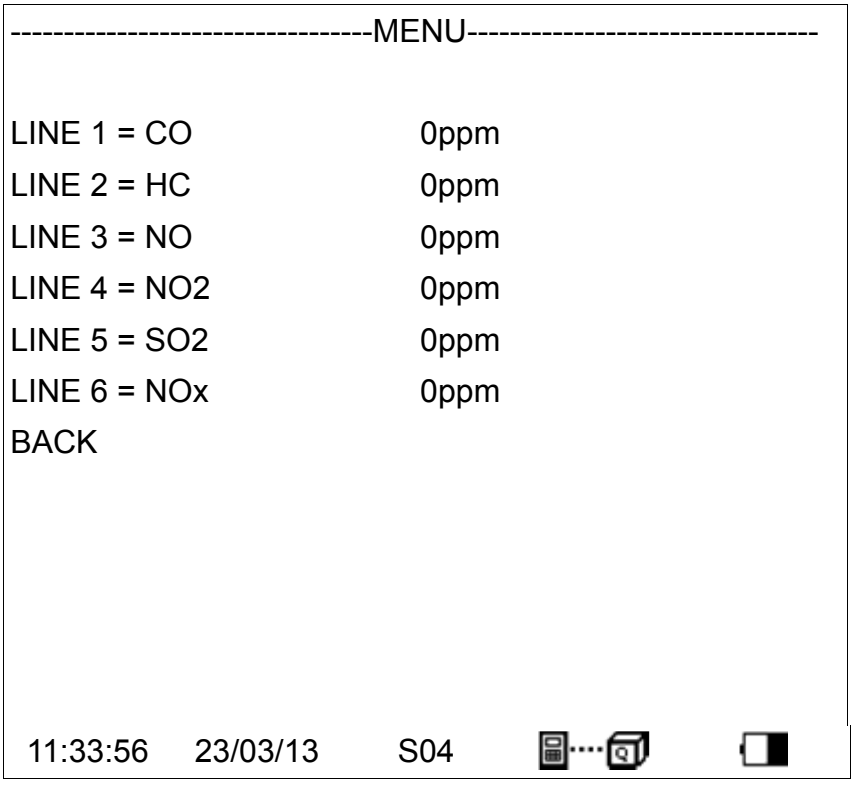
The main display can be set for SMALL font or LARGE font.

LINES:

This feature allows users to customise the screen display to suit their own requirements.

Use UP or DOWN keys to change the selection. Press ENTER to select and move to the next digit.

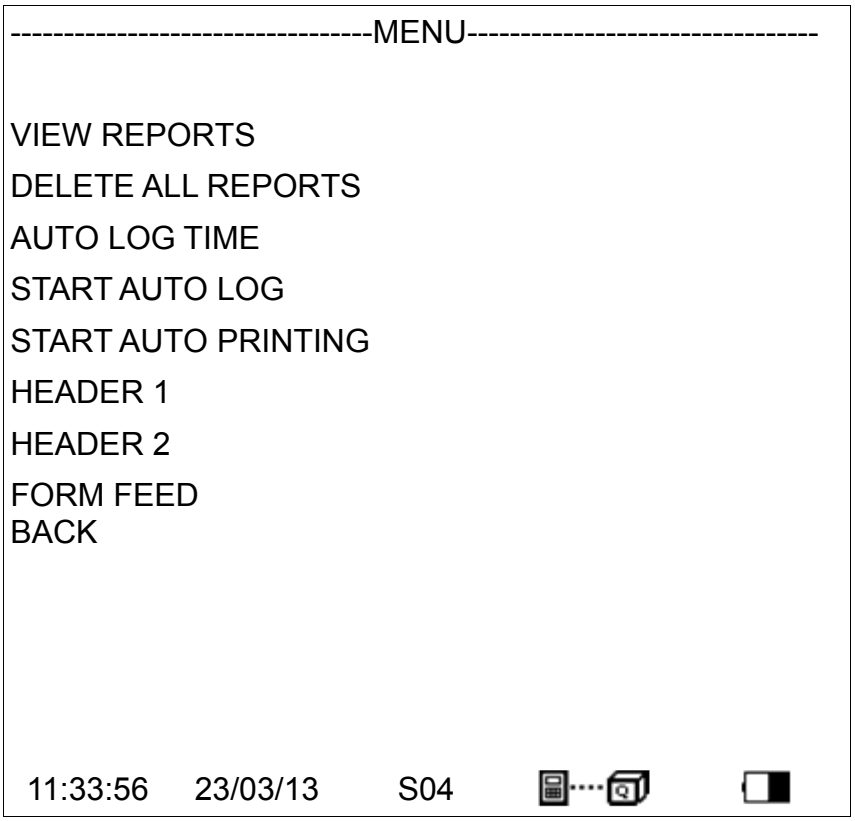
So for Lines 1-6, the screen shows:



The parameter to be displayed on each line can be individually selected.

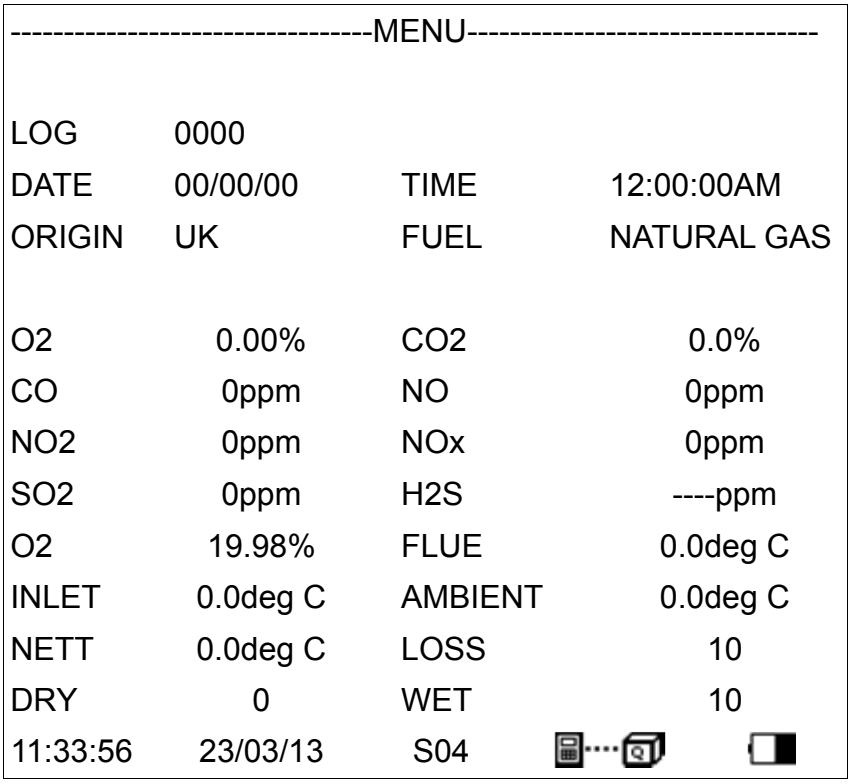
Use UP or DOWN keys to change the selection. Press ENTER to select and move to the next digit.

REPORTS: CONFIGURES REPORTS



VIEW REPORTS:

This selection displays a 'main screen' with a LOG No near the top left hand of the display. This number can be changed using UP or DOWN and the display automatically changes.



DELETE ALL REPORTS:

All reports can be deleted. A confirmation YES is required

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

AUTO LOG TIME:

Automatic logging/printing can be selected for intervals between 10 seconds and 90 minutes

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

START AUTO LOG:

Select YES or NO.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

START AUTO PRINTING:

Select YES or NO.

Use UP or DOWN keys to scroll through the selection. Press ENTER to select.

HEADER 1: 16 CHARACTERS

Allows the printed header line: YOUR COMPANY to be changed.

Use UP or DOWN keys to change the characters. Press ENTER to select and move to the next character.

HEADER 2: 16 CHARACTERS

Allows the printed header line: NAME & PHONE No. to be changed.

Use UP or DOWN keys to change the characters. Press ENTER to select and move to the next character.

FORM FEED:

Allows remote paper feeding on printers.

SERVICE:

CODE: For use by authorised service agents.

CAL DATE = number of days before annual re-calibration is due.

MANUAL AIR ZERO:

Select this and press ENTER to initiate a fresh air purge and sensor zeroing

MANUAL PRESSURE ZERO:

Select this and press ENTER to re-zero the pressure sensor

BEFORE USING THE ANALYSER FOR THE FIRST TIME.

SAFETY WARNING

This analyser extracts combustion gases that may be toxic in relatively low concentrations. These gases are exhausted from the bottom 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.

FIRST TIME USE

Charge the batteries for 12 hours, following this an overnight charge should be sufficient for an average 8 hour day. There may be three battery packs that need charging, the main battery, the optional heater battery and the handset battery. The handset battery can use the same charger as the analyser unit or can be charged via the main unit using a handset lead. All batteries are NiMh.

Whilst charging the red LED will flash.

We offer a wide choice of probes which are not supplied as standard and must be ordered as a separate item.

Take time to read this manual fully.

TIP: Take a look at the Spare Parts list and order some replacement filters and paper rolls now.

NORMAL START UP SEQUENCE

EVERY TIME YOU USE THE ANALYSER

BEFORE SWITCH-ON CHECK THAT:

- the oxygen sensor is connected
- the particle filter is not dirty
- the sulphur filter is fitted for heavy oil or coal
- the water trap and probe line are empty of water
- all hose connections, etc, are properly made
- the paper roll is fitted

- the analyser unit is in fresh air
- the water trap is vertical
- the flue temperature is connected
- the instrument is placed on a clean, flat, level surface

Switch ON the analyser by pressing ON/OFF on the handset. You also need to press the ON/OFF switch on the analyser main unit.

AUTOMATIC CALIBRATION

During this sequence the analyser pumps fresh air into the sensors to allow toxic sensors to be set to zero and the oxygen sensor to be set to 20.9 %.

During this sequence the handset display will show the following:

KANE QUINTOX

SW 19170 v1.01

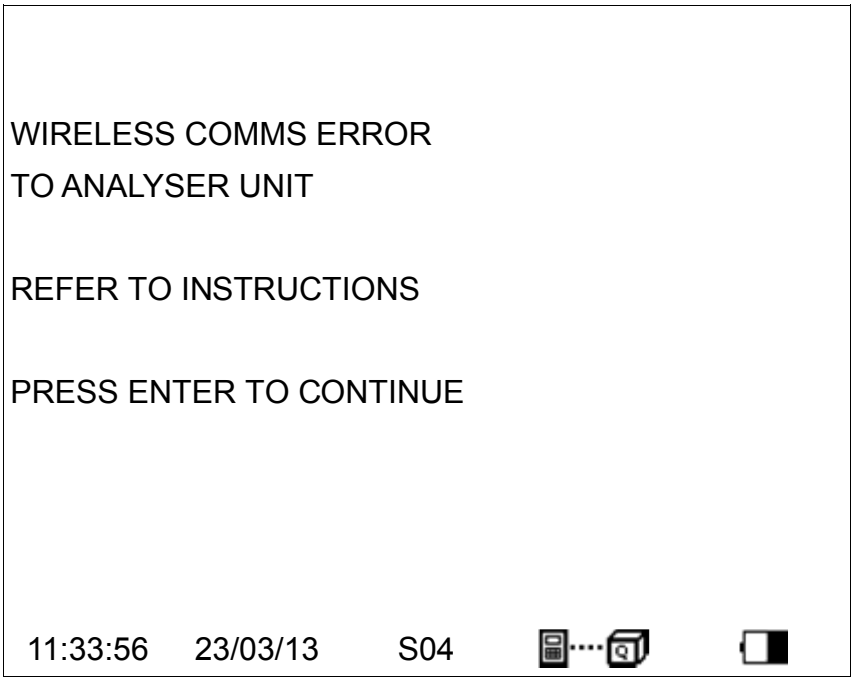
SERIAL NO. 999999107

GPS CONNECTED

WIRELESS CONNECTING ……..

Note: The software version number and serial number are examples only.

If there is no wireless communication between the handset and the main unit the following will appear on the screen.

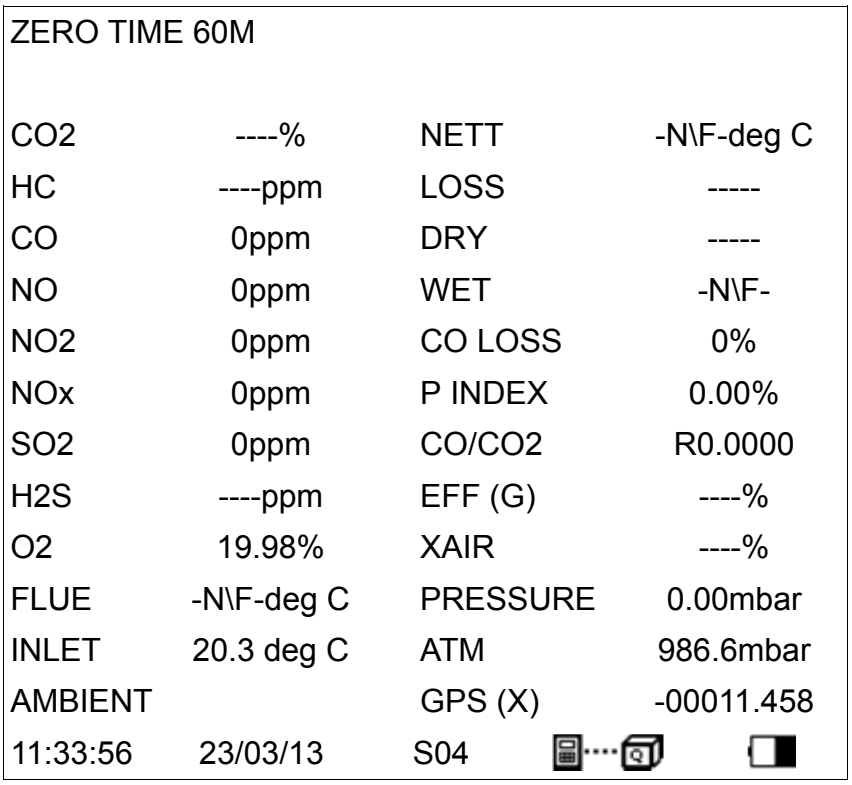


Press ENTER to continue and follow the instructions.

Once wireless communication is established the main measurement screen will appear:

MAIN MEASUREMENT SCREEN

IN SMALL FONT MODE



TOP LINE: shows status messages

GASES: O_2 and CO_2 are shown in %
other gases shown in ppm or other user selected units
CO can be shown in % if optional IR bench fitted

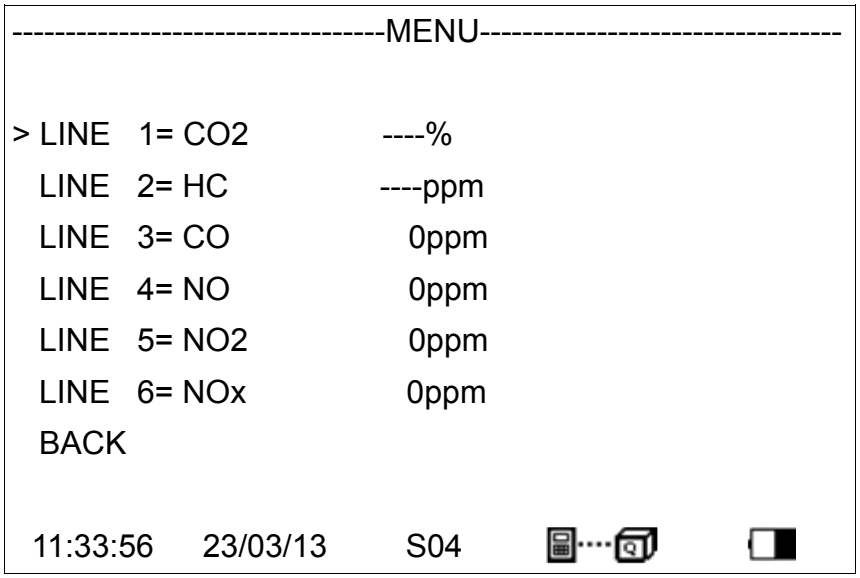
TEMPERATURES: displayed in C or F. N\F = not fitted
---- occurs for calculations when N\F applies

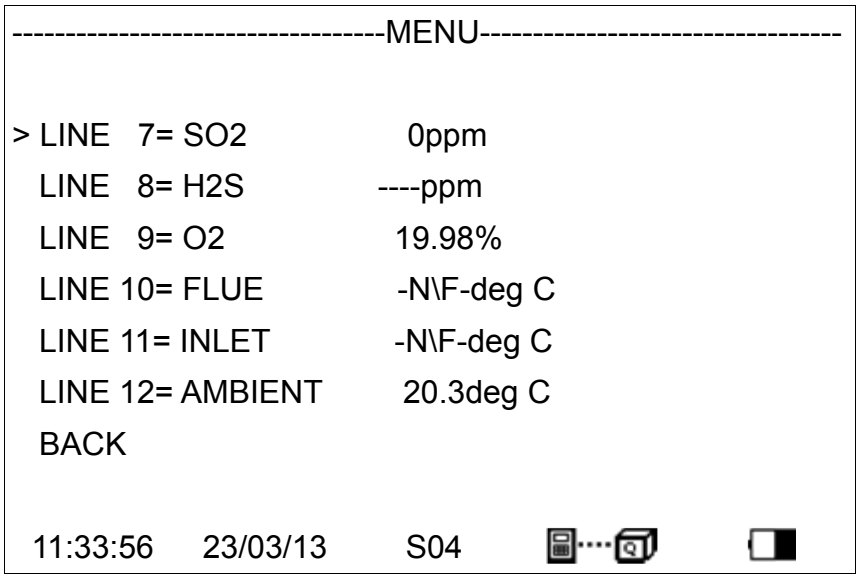
---- occurs when a calculation cannot be made due to an out of range value (Eg zero)

Atmospheric pressure (ATM) is always displayed in mbar.

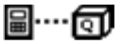
IN LARGE FONT MODE

There are 5 screens that are accessed using the UP or DOWN keys

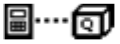




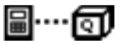
```
----------------------------------MENU---------------------------------

> LINE 13= NETT              -N\F-deg C
  LINE 14= LOSS              -----
  LINE 15= DRY               -----
  LINE 16= WET               -N\F-
  LINE 17= CO LOSS           0%
  LINE 18= P INDEX           0.00%
  BACK

  11:33:56     23/03/13       S04
```



```
----------------------------------MENU---------------------------------

> LINE 19= CO/CO2           R0.0000
  LINE 20= EFF (G)           ----%
  LINE 21= XAIR              ----%
  LINE 22= PRESSURE          0.00mbar
  LINE 23= ATM               986.6mbar
  LINE 24= GPS (X)           -00011.458
  BACK

  11:33:56     23/03/13       S04
```



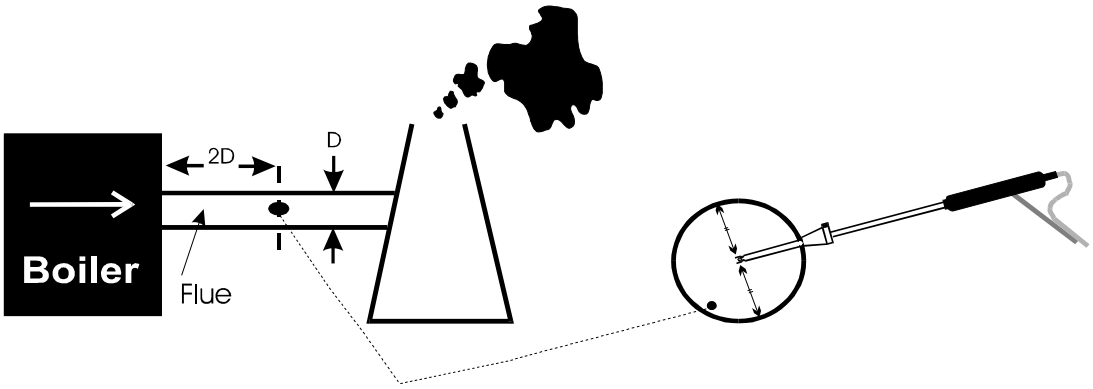
```
----------------------------------MENU---------------------------------

> LINE 25= GPS (Y)           +5148.0957
  LINE 26= MAIN BAT          24%
  LINE 27= HEAT BAT          100%
  LINE 28=
  LINE 29=
  LINE 30=
  BACK

  11:33:56     23/03/13       S04
```



SAMPLING THE FLUE GAS

Once the automatic calibration procedure has been completed and the specific fuel has been selected the probe can be inserted into the desired sampling point.

It is recommended that the sampling point be located at least two flue diameters downstream of any bend and that the probe tip is in the centre of the flue (this is normally the point of the hottest temperature). With balanced flues and other industrial units the probe should be positioned far enough into the flue so that no air can 'back flush' into the probe.



The probe depth stop cone provided with the instrument allows the probe to be used in holes whose diameters range from 8 mm to 21 mm ($^{5}/_{16}$ to $^{4}/_{5}$ inch).

The standard probe is rated at 650°C/1202°F. Temperatures of up to 1100°C/2012°F can be accommodated using an optional high temperature probe.

TIP: To conserve battery power, switch off the pump when you are not taking a measurement. Use the pump key to turn the pump ON and OFF.

LONG TERM MONITORING

There are a number of things that need to be considered for successful long term unattended monitoring:

- The provision of enough power for the duration of the test
- The capability to empty the water trap
- Regular fresh air purging of the sensors
- **Protection from rain or water spray from the process being monitored.**

 If a mains power source is being used it is strongly recommended that the supply cable is protected by a suitable Residual Current Device (RCD).

Unless the water trap is to be regularly inspected then a pumped water trap (WTS9206P) should be fitted.

The WTS9206P is an optional extra. When fitted it automatically empties the water trap. It is switched on for one minute and off for fourteen minutes. Care needs to be taken to ensure that the hose is straight, with no droops where condensate can collect, otherwise the water trap may still be swamped. The peristatic pump needs its flexible rotor replaced after every 1,000 hours of operation.

Electrochemical sensors need regular refreshing with fresh air, preferably at around 50% RH. They also need a small percentage of oxygen to be present in the sampled gas. If there is zero oxygen the output from the sensors will decay over time (10 mins or so). In such circumstances, fresh air purge should be programmed for a 50% duty cycle every 10 minutes.

The longest sampling time without purging should be limited to 2 hours and then purge for 30 mintues.

When the KHC infra-red module is fitted, for maximum accuracy it is recommended that purging occurs every 30 minutes.

KMDM110/230 SAMPLE CONDITIONING UNIT

This module is fitted in the front compartment of a standard KANE QUINTOX carry case and comprises a Peltier fan cooled chiller assembly, a peristaltic pump to automatically remove condensate, the control electronics and a power supply module. The module is supported on an aluminium alloy chassis.

The chiller is connected to a flue mounted electrically heated probe (KMHP1200) by a 3 metre long heated line with automatic temperature control (KMHL3000). Because the gas that is extracted from the flue is maintained at 120^{o}C no condensation occurs in the probe or the hose and so no sample gas is lost in the condensate. The chiller flash cools the sample gas to below the ambient dewpoint and any water in the gas immediately condenses. The condensate is then pumped away using a peristaltic pump. Because the gas has no chance to remain in contact with the condensate, volatile sample gas is not lost into the condensate. The chilled gas then naturally warms up as it passes through the sampling pump to the sensors and as it does so its humidity reduces and there is no risk of further condensation.

SETTING UP

The heated sample probe must be connected to the top of the heated line and a gas tight connection be made without over tightening the connections. This joint must then be thermally insulated. Both the heated probe and the heated line must be connected to a mains power source via a suitable Residual Current Device (RCD) and be left powered up for 20 minutes to achieve their operating temperature before attempting to extract sample gas.

When the probe is inserted into the sampling point is must be suitably supported to prevent bending and unnecessary strain. Likewise the heated line should be carefully supported and never be twisted or kinked as this may damage the internal heating elements.

The heated line is connected to the chiller by attaching the end of the line to the through bulkhead connection in the KANE QUINTOX carry case. A short flexible connection then links the hose to the chiller. The chiller needs to be powered up for at least 10 minutes before it is used.

The peristaltic pump operates automatically. Always check that the drain of the peristaltic pump is clear and that there are no blockages. The peristaltic pump needs to have its flexible rotor replaced after every 1000 hours of operation.

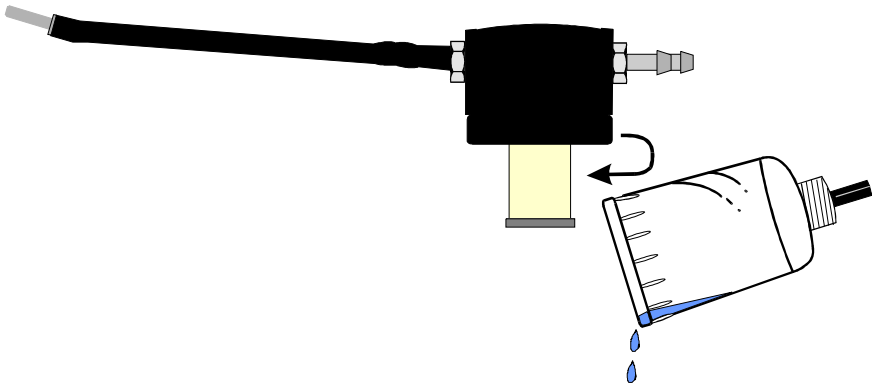
To operate efficiently the chiller needs to be well ventilated so the case lid must be removed, however the unit must be protected externally to prevent ingress of water from either the plant being tested or from rainfall.

MAINTENANCE

EMPTYING AND CLEANING THE IN-LINE WATER TRAP

The 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 time.

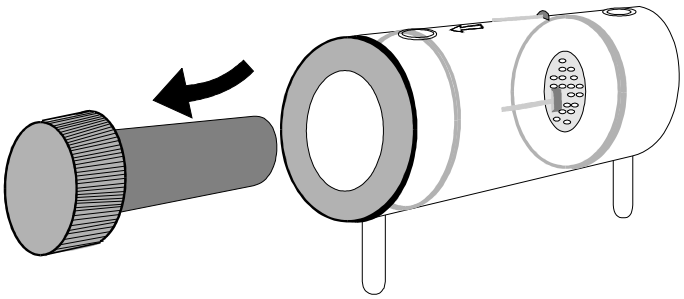
Emptying of the water trap is detailed below :-



Carefully remove the end cap from the in-line housing. Dispose of the condensate in a suitable drain, care must be taken as it could be acidic. If condensate spills onto the skin or clothing, clean off immediately using fresh water, seek medical advice if problems occur.

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 appears discoloured.



Remove the end cap from the 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 on the filter end cap and carefully insert it into the filter body.

CHARGING THE BATTERY

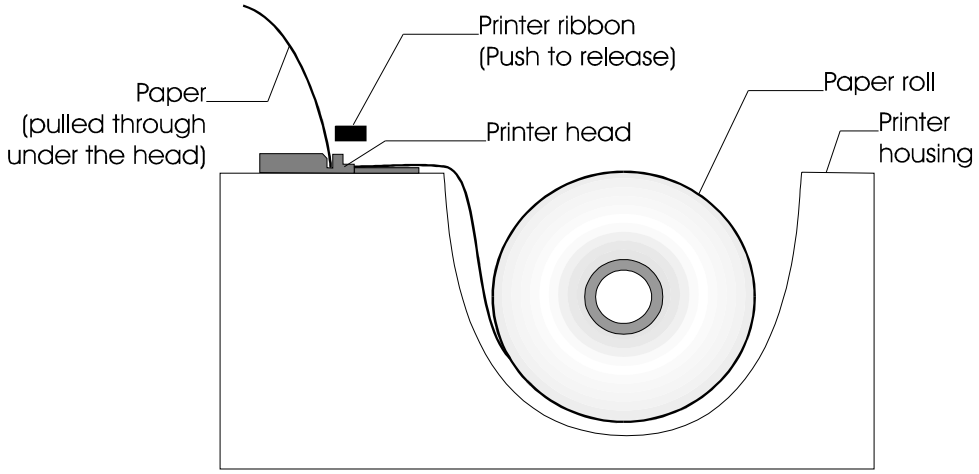
It is important that the battery is charged on a regular basis. The instrument constantly powers the internal sensors and may flatten the battery if left unattended for some months. Connect the charger supplied with the instrument to the correct mains supply.

Note: The correct charger type may be required for your local voltage i.e. 110 or 220 volts AC

Insert the plug in the socket marked CHARGER INPUT SOCKET
The CHARGER ON RED LED will flash showing the instrument is charging.

CHANGING THE PAPER ROLL

To change the paper roll remove the printer cover by loosening the two screws holding it down. Remove the old paper roll core and insert the new roll so that it sits as follows :-



Feed the free end of paper into the printer through the metal slot beneath the printer ribbon. Start the paper feed sequence until the paper has emerged from the top of the printer, feed the loose end through the cover and refit.

TO START PAPER FEED

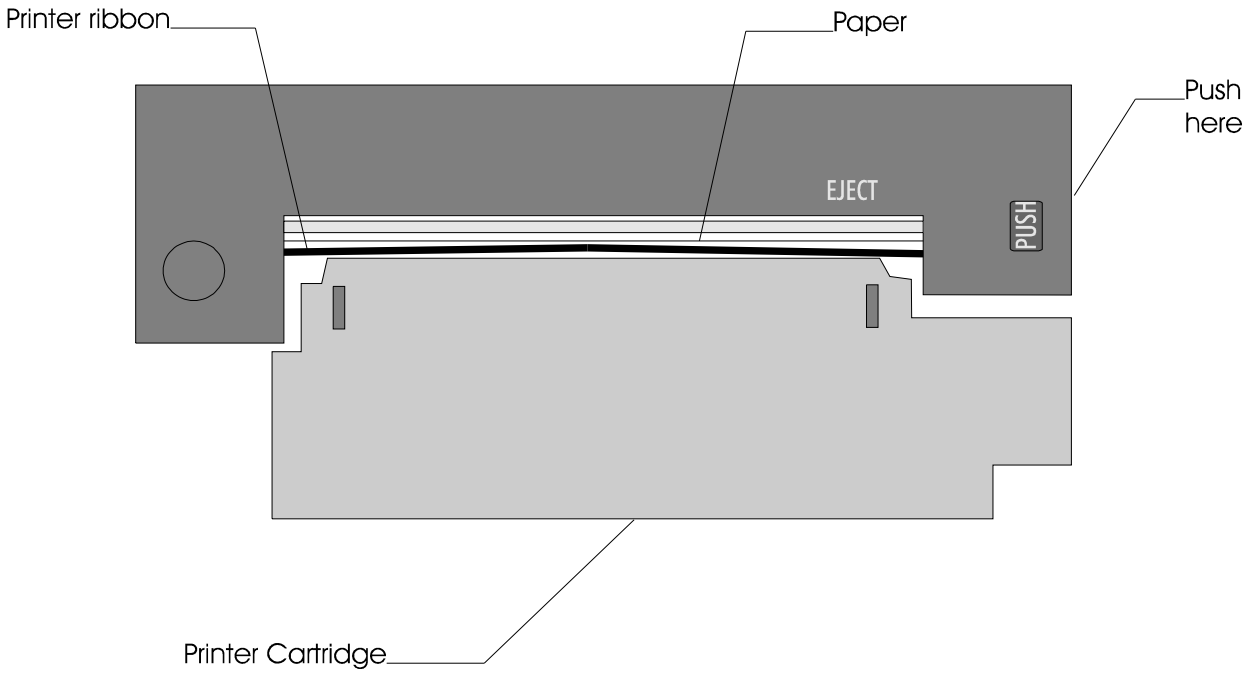
Go to MENU, REPORTS, FORM FEED

CHANGING THE PRINTER RIBBON

The printer ribbon cartridge will last for approximately two rolls of paper. Remove the printer cover as detailed above.

Marked on one end of the cartridge is PUSH. Gently press down on this end and the ribbon cartridge will pop up at the other end. Remove the cartridge and dispose of.

Fit a new ribbon guiding the paper roll between the exposed ribbon and cartridge body.



Refit printer cover.

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 to contact the Kane International Service Department or an International Distributor for expert advice.

Fault symptom	Causes
Oxygen too high CO_2 too low	Air leaking into probe, tubing, water trap, connectors or internal to instrument. Oxygen cell needs replacing.
Analyser not holding charge Analyser not charging	Battery exhausted. AC charger not giving correct output. Fuse blown in charger plug.
Analyser does not respond to flue gas	Particle filter blocked. Probe or tubing blocked. Pump not working or damaged with contaminants.
Flue temperature readings erratic	Temperature plug reversed in socket. Faulty connection or break in cable or plug.
Analyser automatically switches off in operation.	Battery below alarm level. Battery quickly discharging and is faulty.
Display is blank.	The contrast setting has been lost and requires resetting. Disconnect handset lead and reconnect. Set contrast as in MENU : SCREEN : CONTRAST

HOW TO GET EXPERT HELP

There will be occasions when despite having read the manual there will be problems that you cannot resolve and so you need external help.

Before calling Kane International or one of its International Distributors please first check the following:

Find the serial number of the instrument. It is located on the label close to where the charger and handset leads plug into the analyser. Also make a note of which sensor are fitted by observing the tick unites on the same label.

If the handset and analyser are operating you can also determine the issue of software loaded in the analyser and its handset by viewing STATUS. If you can, take a printout of STATUS and a printout of the measurement screen so that they can be faxed or emailed to your technical support advisor.

ANALYSER ANNUAL RECALIBRATION AND SERVICE

The analyser should be re-calibrated and serviced annually to stop any long-term sensor or electronics drift or accidental damage.

Local regulations may require more frequent re-calibration.

In the UK Kane International has service facilities at Atherton near Manchester (Tel: 01942-873434), the primary service centre for UK customers and at Welwyn Garden City in Hertfordshire (Tel: 01707-384834), the primary service centre for non-UK customers.

By sending your analyser back to Kane for an annual service (check www.kane.co.uk for details) you have the opportunity to extend the warranty on your analyser to 5 years.

RETURNING YOUR ANALYSER TO KANE

When returning your KANE QUINTOX, please always ensure that you enclose:

- ✓ Your full contact details
- ✓ A daytime telephone number
- ✓ Details of faults you might have experienced
- ✓ Any relevant accessories (eg. Probe, printer, adaptor and leak detectors). Any accessories that are returned will be checked. If an accessory has failed then we will quote you for a repair or a replacement.

PACKING YOUR ANALYSER

When returning your analyser, please pack it appropriately to prevent any damage during transit.

Before sealing your package, please ensure that you have enclosed the items listed above and that it is clearly marked for the attention of:

For UK customers:

Northern Service Centre
Kane International Ltd
Gibfield Park Avenue
Atherton
Manchester
M46 0SY

For non-UK customers:

Southern Service Centre
Kane International Ltd
Kane House, Swallowfield
Welwyn Garden City
Hertfordshire
AL7 1JG

SENDING YOUR ANALYSER

Once the analyser has been securely packed then your package is ready for shipment back to Kane. If you do not have an account with a courier company you can take your package to your local Post Office. It is advisable to send the package by Special Delivery so that it is insured and traceable while in transit.

WHEN WE RECEIVE YOUR ANALYSER

On receipt of your package, our Service Engineers will inspect the analyser and any accessories and confirm to you the total service cost. Once you have accepted this the work will be carried out, and upon completion the analyser returned to you.

If you have any questions that we haven't answered, please feel free to contact our Southern Service Centre:

For UK customers:

Tel: 01942 873434
Fax: 01942 873558
Email: nservice@kane.co.uk

For non-UK customers:

Tel: 01707 384834
Fax: 01707 384833
Email: sservice@kane.co.uk

Service Returns (Simply cut out and attach to your package)

Southern Service Centre
Kane International Ltd
Kane House, Swallowfield
Welwyn Garden City
Hertfordshire
AL7 1JG

Northern Service Centre
Kane International Ltd
Gibfield Park Avenue
Atherton
Manchester
M46 0SY

Southern Service Centre
Kane International Ltd
Kane House, Swallowfield
Welwyn Garden City
Hertfordshire
AL7 1JG

PRODUCT SPECIFICATION

UNIT

Temp Measurement	Resolution	Range	Accuracy
Flue Temperature	0.1° (C/F)	0-1100°C 32-2140°F * Use high temperature probe for gases >600°C/1112°F	1.0 ° C ±0.3% of reading
Inlet Temperature	0.1° (C/F)	0-600°C 0-999°F	1.0 ° C ±0.3% of reading

Gas Measurement[*1]	Resolution	Range	Overrange	Reading	Accuracy
Oxygen (0_2):	0.01%	0-25%	30%	-	-0.1% +0.2%
Carbon monoxide (CO): (standard: H compensated)	1ppm	2000	4000	<100ppm >100ppm <2000ppm >2000ppm <4000ppm	+/-5ppm +/-5% of reading +/-10% reading
Nitric oxide (NO): (high range0)	1ppm	1000	5000	<100ppm >100ppm <1000ppm >1000ppm <5000ppm	+/-5ppm +/-5% of reading +/-10% reading
Nitric oxide (NO) (low range)	1ppm	100	300	<100ppm >100ppm <300ppm	+/-5ppm +/-10% of reading
Nitrogen dioxide (NO_2):	1ppm	100	1000	<100ppm >100ppm <1000ppm	+/-5ppm +/-10% of reading
Sulphur dioxide (SO2) (low range):	1ppm	100	500	<100ppm >100ppm <500ppm	+/-5ppm +/-10% of reading
Sulphur dioxide (SO_2) (high range):	1ppm	2000	5000	<100ppm >100ppm <2000ppm >2000ppm <5000ppm	+/-5ppm +/-5% of reading +/-10% reading
Hydrogen sulphide (H_2S):	1ppm	200	300	<100ppm >100ppm <200ppm >200ppm <300ppm	+/-5ppm +/-5% reading +/-10% of reading

Gas Measurement[*1]	Resolution	Range	Accuracy
Pressure	0.01mbar	0-150 mbar	± 0.5% Full Scale
Carbon dioxide (CO_2)[*2]	0.1%	0 – Fuel Value	± 0.3%
Efficiency [*2]	0.1%	0-100%	± 1%

[*1] using dry test gases at STP
[*2] calculated
NB: all ppm reading can be displayed in mg/m^3 and can be normalised

OPTIONAL IR MODULE

Hydrocarbons:			
Range:	Accuracy	Overrange	Resolution
0-5,000ppm (Hexane)	±5% of reading and ± 12ppm vol.	10,000ppm	1ppm
CO_2:			
Range:	Accuracy	Overrange	Resolution
0-20%	±5% of reading and ± 0.5% vol.	40%	0.1%
CO:			
Range:	Accuracy	Overrange	Resolution
0-10%	±5% of reading and ± 0.2% vol.	20%	0.1%

Response time T90:	30 seconds
Warm up time:	3 minutes
Operating temperature range:	5 to 50 deg C.
Operating humidity:	10-80% non condensing
Power:	Supplied by KANE QUINTOX

Conversion Factors from a Hexane Calibration	
Hexane	multiply by 1
Propane	multiply by 2
Methane	multiply by 20

NOTE: The IR module is factory calibrated using Hexane. The above correction factors need to be applied when measuring Hydrocarbons that originate from other gaseous fuel types.

For Fuel Type - LPG: a displayed HC reading of 500ppm would convert to 1000ppm of Propane.

For Fuel Type - Natural Gas: a displayed HC reading of 50ppm would convert to 1000ppm of Methane.

HANDSET

Dimensions	240 mm long 135 mm high 70 mm wide
Keypad	tactile keys
Display	graphical with backlight and contrast control

ANALYSER

Dimensions	420 mm long 345 mm high 225 mm wide

EXTENSION CABLE

Specification:	8 pin DIN cable
Cable lengths:	10m Standard 5-20m-Optional

MAIN BATTERY AND OPTIONAL HEATER BATTERY

Type:	NiMH Rechargeable (12V, 2AH)
Life:	8 hours from full charge
Charge time:	12 hours trickle 4 hours fast charge

BATTERY CHARGER

Input:	100V-240V AC 60 watts
Output:	15V DC @ 4 amps

PUMP

Flow rate:	2 Litres/Minute nominal 500 mbar static suction

INTEGRAL PRINTER

16 character dot matrix.
Plain paper

AMBIENT OPERATING RANGE

-10°C to + 55°C

< 85% RH non condensing

Storage: -10°C to 55°C

For regulated testing to EN50379, ambient temperature range: 0°C to + 55°C

KMHL3000: HEATED SAMPLE LINE

Power supply: 220V ac @ maximum 300 watts

KMHP1200: HEATED PROBE

Power supply: 220V ac @ maximum 100 watts
1200mm insertion length, 8 mm diameter rated to 1000 ^{o} C

KMDM110/230: SAMPLE CONDITIONING UNIT

Power supply: 220 Vac @ 5 amps peak.

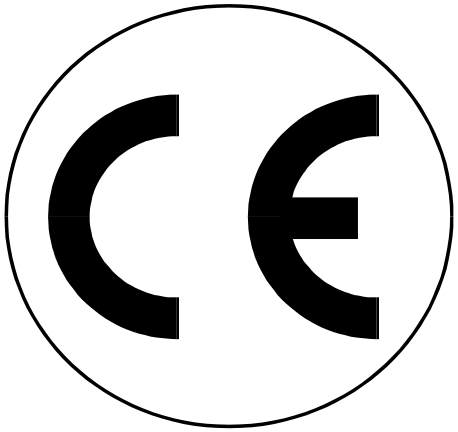
PROBE

Choose from a range of probe options**. See probe leaflet.**

OPTIONAL PORTABLE PRINTERS

Compatible with KANE IRP-2

ELECTROMAGNETIC COMPATIBILITY (CE) STATEMENT



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

EN 61000-6-3 : 2011
EN 61000-6-1 : 2007

and is certified to be compliant

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

SAFETY STANDARD

This product complies with the EN61010 Safety Standard (Safety requirements for electrical equipment for measurement, control and laboratory use):

EN61010-1 : 2010

Protection Class 3 (SELV)

END OF LIFE DISPOSAL

The Waste Electrical or Electronic Equipment (WEEE) Directive requires countries in the EU to maximise collection and environmentally responsible processing of these items.

Products are now labelled with a crossed out wheeled bin symbol to remind you that they can be recycled.

BATTERY DISPOSAL

All the user replaceable batteries used in this product are NiMh and are suitable for recycling through any local waste portable battery recycling scheme.

Please note: Batteries used in this instrument should be disposed of in accordance with current legislation and local guidelines.

EN 50379 REGULATED INSTRUCTIONS

EN 50379 Section 4.3.3 “Instructions” defines a number of specific points that must be included in the relevant instruction manuals. The paragraph numbering below relates to that section of EN 50379.

a) The KANE QUINTOX is compliant the EN 50379 Part 2 as detailed in the third party approvals issued by TÜV.

b) The KANE QUINTOX is intended to be used with the following fuels:

Natural gas, Natural gas 2, Light oil (28/35 sec), Heavy oil, Coal, Anthractite, Coke, Propane, Butane, Gascor, Kinsale gas, LPG, Bio gas, Wood pellets and 5 user fuels.

c) The KANE QUINTOX handset is designed for use with either non-rechargeable alkaline AA cells or rechargeable NiMH AA cells. Four cells are needed. Types cannot be mixed. Under no circumstances should any attempt be made to recharge alkaline cells.

The KANE QUINTOX analyser is designed for use with a KANE QUINTOX rechargeable NiMH battery pack. Under no circumstances should any attempt be made to use another type of battery pack other than the manufacture specified one.

The battery charger supplied with the KANE QUINTOX is rated for indoor use only. Its voltage input must be in the range 100 – 240 V ac at 50 – 60 Hz with a current capability of 1.5A. The chargers output voltage is 15 V dc at a maximum of 4A.

The charger has no user serviceable components.

Only a correctly specified and rated charger must be used with the KANE QUINTOX.

d) The KANE QUINTOX is not designed for continuous use and is not suitable for use as a fixed safety alarm.

e) An explanation of all the symbols used on the analyser’s display is given in Appendix A of this manual.

f) The recommended minimum time required to perform one complete measurement cycle and achieve correct indication of the measured values in EN 50379 Part 2 is 110 seconds. This is based on the T_{90} times defined in the standard, always assuming that parameters being measured have reached stability. This time is the summation of the times for a draught test (10 secs) and a combustion test (90 secs) plus the time to move the hose connection from the pressure input to the water trap (10 secs)

g) This section is non-applicable.

h) Some commonly occurring materials, vapour or gases may affect the operation of the KANE QUINTOX in the long or the short term though in normal use Kane International Ltd is not aware of any specific issues that have affected the product. The following list is included to satisfy the stated requirements of EN 50379:

Solvents
Cleaning fluids
Polishes
Paints
Petrochemicals
Corrosive gases

i) The KANE QUINTOX can be fitted with up to 6 electrochemical sensors although only CO, NO, SO2 & O2 are covered under EN50379. They have an expected life of more than 2 years. The calibration of these sensors must be confirmed on an annual basis.

The batteries have an expected operational life of more than 500 re-charge cycles.

j) The KANE QUINTOX is designed to operate at ambient temperatures in the range -10^{o}C to +55^{o}C with relative humidity of 10% to 90% non-condensing although the analyser was only tested under EN 50379 with ambient temperatures in the range -0^{o}C to +55^{o}C. Whilst it is recommended that the analyser is given the protection of a carry case during transportation it is not required for normal operation.

k) The KANE QUINTOX has an initial start-up delay following switch on of approx. 180 seconds. There is no additional delay after battery replacement.

l) Most sensors used in combustion analysers give a zero output when they fail and it is widely recommended that analysers are regularly checked (also known as a bump test) using either a can of test gas or a known source of combustion products.

The KANE QUINTOX must have its calibration checked on an annual basis and be issued with a traceable Certificate of Calibration.

The sensor within the KANE QUINTOX can only be replaced by Kane International Ltd or one of its trained and approved service partners.

The water trap should be checked on a regular basis whilst the analyser is in use (every few minutes) as the amount of condensate generated varies with the fuel type, atmospheric conditions and the appliances operating characteristics.

The particle filter should be checked at least on a daily basis when using ‘clean’ fuels and more often when using liquid or solid fuels.

Detailed instructions regarding the changing of the filter and the emptying of the water trap are given in Section Maintenance of this manual.

m) **WARNING!**
When using a KANE QUINTOX to test an appliance a full visual inspection of the appliance, in accordance with its manufacturer's instructions, must also be carried out.

n) **WARNING!**
When using a KANE QUINTOX, a regular inspection of the water trap and filter must be carried out as blockages can lead to inaccurate measurements.

o) Instructions for testing for leaks and blockages of the gas sample system is covered in the Section Problem Solving of this manual

p) The KANE QUINTOX changeable parameters and their valid ranges are:

Languages:	English, French, German & Dutch
Auto purge:	Yes & No
Main purge duration time:	2 to 60 minutes
Main purge interval time:	10 to 120 minutes
Auto zero:	Yes & No
Auto pump flow:	Yes & No
Printer:	KANE IRP, KANE IRP-2, Serial, Wireless, Analyser printer
Auto set time:	Yes & No
Set time:	00:00:00 to 23:59:59
Set date:	01/01/01 to 31/12/99
Heater status:	Auto & Off
Wireless setup:	Off, To PC & to Analyser
Wireless passkey:	0000 to 9999
Fuel origin:	UK, France, Germany, Netherlands, Italy, Spain, Hungary, Poland, Finland, Sweden, China, North America.
Fuel type:	Natural gas, Natural gas 2, Light oil (28/35 sec), Heavy oil, Coal, Anthractite, Coke, Propane, Butane, Gascor, Kinsale gas, LPG, Bio gas, Wood pellets and 5 user fuels.
Efficiency:	Net, Gross, Condensing Net & Condensing Gross.
Gas units:	ppm, ppm(n), mg/m3 & mg/m3(n)
Temperature:	Celsius and Fahrenheit
Pressure:	psi, hPA, mm H2O, In H2O, mbar & m/s
Set percentage reference O2:	0.0% to 10.0%
Set NOx Calculation:	NO, NO2 & SUM
Reference NOx:	0% to 20%
Set compensation:	on & off
Pitot:	0.10 to 1.00
CO alarm set:	on & off
CO alarm level:	0000 to 9999
Display contrast:	0 to 15
Display backlight:	30 to 300 seconds
Display mode:	small font & large font

Display Lines (1 to 30):	Analyser main battery, Analyser heater battery, CO2 reading, HC reading, CO reading, NO reading, NO2 reading, NOx reading, SO2 reading, H2S reading, O2 reading, flue temperature reading, inlet temperature reading, ambient temperature reading, nett temperature reading, total loss reading, dry loss reading, wet loss reading, CO loss reading, poison index reading, CO_CO2 ratio reading, efficiency reading, excessive air reading, pressure reading, atmospheric pressure reading, GPS longitude reading, GPS latitude reading, blank & lambda reading.
Auto log /print time:	10seconds to 90 minutes
Start auto log:	yes & no
Start auto printing:	yes & no
Printer header line 1:	16 alpha numeric characters
Printer header line 2:	16 alpha numeric characters

q) The KANE QUINTOX data storage based on EEPROM & flash technology and has a data retention if the battery is removed of greater than 100 years

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

ZERTIFIKAT
Certificate

Industrie Service

14 10 91306 004

Hiermit wird bescheinigt, dass das
Herewith we certify, that the

tragbare elektrische Gerät zur Messung von Verbrennungsparametern an Heizungsanlagen, Typ
portable electrical apparatus, designed to measure combustion flue gas parameters of heating appliance, type

Kane 9206 Quintox

mit den Messparametern
for the parameters

O_2/CO_2, $CO_{mittlerer\ Bereich}$ / $CO_{hoher\ Bereich}$, NO, SO_2
T_{Abgas}, T_{Luft}, $Druck_{Förderdruck}$, $Druck_{Differenzdruck}$

O_2/CO_2, CO_{medium} / CO_{high}, NO, SO_2
$T_{flue\ gas}$, $T_{inlet\ air}$, $pressure_{draught}$, $pressure_{differential}$

hergestellt durch die Firma
manufactured by

Kane International Ltd.
Kane House
Swallowfield
Welwyn Garden City
Hertfordshire,AL7 1JG
United Kindom

den Anforderungen der folgenden Normen genügt.
fulfils the requirements of the following standards

DIN EN 50379-1:2012-04 und DIN EN 50379-2:2012-04

In Verbindung mit der regelmässigen Überwachung der Fertigung und der QM-Maßnahmen nach der Zertifizierungsordnung der TÜV SÜD Industrie Service GmbH erhält der Hersteller mit diesem Zertifikat das Recht, die Geräte mit dem in diesem Zertifikat dargestellten Zeichen zu kennzeichnen.
In connection with a periodical surveillance of the production and the quality control according the certification regulations of TÜV SÜD Industrie Service GmbH this certificate permits to sign the apparatus with the TÜV mark as shown in this certificate.

München, 2014-10-27

Johannes Steigerwald

TÜV SÜD INDUSTRIE SERVICE GMBH, WESTENDSTRASSE 199, D-80686 MÜNCHEN

APPENDICES

A – PARAMETER MEANINGS

The parameters and their meanings are detailed as follows : -

DATE : Analyser date.

TIME : Analyser time.

MAIN BATTERY/ HEATER BATTERY: Displays the battery level from 0-100%. The analyser will flash **RECHARGE BATTERY** at less than 10 % of charge. The analyser may show levels greater than 100% when the charger is connected.

----- : Displayed when a calculation cannot be performed because a probe is not fitted or a parameter is out of range.

FUEL : The fuel used in calculation of efficiency and carbon dioxide.

K1g: Gross calorific fuel constant. See Appendix for calculation.

K1n : Gross calorific fuel constant. See Appendix for calculation.

K2 : Percentage Maximum theoretical CO_2 (dry basis).

K3: Percentage wet loss.

K4 : Percentage unburnt carbon loss.

O2r : Toxic gas measurements can be referenced to defined oxygen levels.

Oxygen referencing is required by some regulations such as TA-LUFT. If a reference value is selected the toxic gas measurements will be displayed with the symbol **n** attached to the units. i.e.ppmn
What does oxygen reference mean ?
If 3 % O_2 reference is selected and 5 % O_2 is measured in the flue then toxic gas values will be recalculated as if 3 % were measured. The equation for referencing is detailed in the Appendix.
oxygen referencing prevents false readings being submitted, e.g. allowing more air into the boiler will increase the oxygen level in the flue and hence dilute any toxic gas reading. Oxygen referencing gives readings as if they were undiluted.

NETT : Nett temperature calculated by deducting the internal AMBIENT temperature from the measured FLUE temperature. Displays in either Centigrade C or Fahrenheit F and will display NOT FITTED if flue probe not connected.
If an external INLET probe is used then INLET is deducted from FLUE.

O_2 :	Oxygen reading in percentage %.
CO :	Carbon monoxide reading indicated in ppm or mg/m3. If the figures are referenced to oxygen then the display will show ppmn or mg/m3n. Note with a high CO sensor fitted the reading will be displayed in percentage %.
EFF (G) :	Combustion Efficiency calculation displayed in percentage. Gross (G) or Net (N) can be set. The calculation is determined by fuel type see Appendix for calculation. The efficiency is displayed during a combustion test, 00.0 is displayed while in fresh air.
CO_2:	Carbon dioxide reading in percentage % when measured , not calculated
CO_2c:	Carbon dioxide calculation determined by the type of fuel. This only shows a reading when a combustion test is being carried out. Zero (0.0) is displayed while in fresh air.
FLUE :	Temperature measured by flue gas probe in Centigrade or Fahrenheit. Will show ambient temperature after fresh air calibration and N\F if probe disconnected.
INLET :	Temperature measured by the optional inlet air probe or stored using the Flue probe. The air probe is plugged into the instrument through the INLET socket. This figure is used to calculate the NET temperature instead of AMBIENT when fitted. Will show N\F if not fitted.
AMBIENT :	Temperature measured by the internal sensor, used in the NET temperature
CO/CO_2 R :	The CO/CO_2 ratio, is the ratio of measured CO divided by CO_2. It gives an indication of the following :- How good a gas sample the instrument is reading. How clean the boiler is running. For example : A new or clean domestic boiler will display a ratio of less than 0.004, a unit in need of cleaning 0.0040-0.0080 and a unit in need of major overhaul will show greater than 0.008. This only shows a reading when a combustion test is being carried out. 0.0000 is displayed while in fresh air.
P INDEX :	The CO/CO_2 ratio expressed as a percentage %, called the ‘Poison Index” i.e. P INDEX % = 100 x CO/CO_2. 0.00 is displayed while in fresh air.
XAIR % :	Excess air calculated from the measured oxygen and type of fuel used. Displays reading during a combustion test +++ is displayed while in fresh air.

PRESSURE:	Pressure reading. Units can be changed to different scales.		
NO:	Nitric oxide reading in ppm or mg/m3. Displayed when nitric oxide sensor fitted. Reading can also be referenced to oxygen ppmn or mg/m3n.		
NO_2:	Nitrogen dioxide reading in ppm or mg/m3. Displayed when nitrogen dioxide sensor fitted. Reading can also be referenced to oxygen ppmn or mg/m3n.		
NOx :	Calculated total nitric oxides displayed in ppm or mg/m3. Reading can also be referenced to oxygen ppmn or mg/m3n.		
SO_2 :	Sulphur dioxide reading in ppm or mg/m3. Displayed when sulphur dioxide sensor fitted. Reading can also be referenced to oxygen ppmn or mg/m3n.		
H_2S:	Hydrogen sulphide reading in ppm or mg/m3. Displayed when Hydrogen sulphide fitted. Reading can also be referenced to oxygen ppmn or mg/m3n.		
HC :	Unburnt Hydrocarbon reading ppm of hexane, the sensor is calibrated with hexane. Displayed when an infra red module is fitted. Use equivalent factors for propane and methane.		
LOSS :	Total losses calculated from Combustion Theory. This is the summation of the next three parameters.		
DRY :	Calculated heat lost in turning the carbon in the fuel to carbon ioxide (CO_2).		
WET :	Calculated heat lost in turning the hydrogen in the fuel into water (H_2O).		
CO LOSS % :	Calculated loss due to partially burnt carbon. Any carbon monoxide (CO) in the flue has the potential to be turned into carbon dioxide and release more heat, hence this heat is lost up the flue.		
GPS (Y):	Latitude	DDMM.MMM	5148.1060
GPS (X):	Longitude	DDDMM.MMM	-00011.450
ATM:	Atmospheric pressure in mbar		

B. NOx CALCULATIONS

ONLY AN NO SENSOR FITTED

WORKING IN PPM: NOX REFERENCED TO NO

The user can select the assumed NO_2 percentage and the O_2 normalised level

then: *NOx in ppm = NO in ppm multiplied by (1 + assumed NO_2 percentage)*

in this setup NOx can only be displayed as NOx = NO

then normalising:

NO in ppmn = NO in ppm multiplied by (21 minus the O_2norm setting) and then divided by (21 minus the actual O_2 reading)

For a worked example assume:

NO is 1000ppm
NO_2 is 5% of NO
O_2norm is set to 3%
actual O_2 is zero

NOx in ppm = 1000 x (1 +5/100) =1000 x1.05 = 1050 ppm

NO ppmn = 1000 x (21 - 3)/(21-0) = 1000 x 18 / 21 = 857 ppmn

NOx ppmn = 1050 x 18 / 21 = 900 ppmn

or

NOx ppmn = 857 x 1.05 = 900 ppmn

WORKING IN mg/m^3: NOX REFERENCED TO NO OR NO_2

The user can select the assumed NO_2 percentage, the O_2 reference level and whether the NOx reading is referenced to NO or NO_2

WORKING IN mg/m^3: REFERENCED TO NO

NO in mg/m^3 = NO in ppm multiplied by 1.34

NOx in mg/m^3 = NO in mg/m^3 multiplied by (1 + assumed NO_2 percentage)

WORKING IN mg/m^3: NOX REFERENCED TO NO_2

NOx in mg/m^3 = NO in ppm multiplied by 2.05 multiplied by (1 + assumed NO_2 percentage)

or

NOx in mg/m^3 = NO in mg/m^3 divided by 1.34, multiplied by 2.05 and multiplied by (1 + assumed NO_2 percentage)

NORMALISING READINGS

normalised reading = initial reading multiplied by (21 minus the O_{2norm} setting) and then divided by (21 minus the actual O_2 reading)

BOTH NO AND NO_2 SENSORS FITTED

WORKING IN PPM: NOX = NO + NO_2

normalising readings

ppmn = initial reading in ppm multiplied by (21 minus the O_{2norm} setting) and then divided by (21 minus the actual O_2 reading)

WORKING IN MG/M^3

The user can select how the readings are referenced.

NOx = SUM
NOx = NO
NOx = NO_2

NOX = SUM

NOx in mg/m^3 = NO in ppm multiplied by 1.34 plus NO_2 in ppm multiplied by 2.05

NOX = NO

NOx in mg/m^3 = (NO in ppm plus NO_2 in ppm) multiplied by 1.34

NOX = NO_2

NOx in mg/m^3 = (NO in ppm plus NO_2 in ppm) multiplied by 2.05

NORMALISING READINGS

ppmn = initial reading in ppm multiplied by (21 minus the O_{2norm} setting) and then divided by (21 minus the actual O_2 reading)

mg/m^3n = initial reading in mg/m^3 multiplied by (21 minus the O_{2norm} setting) and then divided by (21 minus the actual O_2 reading)

ONLY AN NO_2 SENSOR FITTED

When there is only an NO_2 sensor fitted the NOx function is disabled

NO_2 in mg/m^3 = NO_2 in ppm multiplied by 2.05

NORMALISING READINGS

ppmn = initial reading in ppm multiplied by (21 minus the O_2norm setting) and then divided by (21 minus the actual O_2 reading)

mg/m^3n = initial reading in mg/m^3 multiplied by (21 minus the O_2norm setting) and then divided by (21 minus the actual O_2 reading)

HIGH CO PURGE OPERATION

If there is a requirement to measure CO to concentrations above 10,000ppm then a High Purge module should be fitted (this comprises both a purge pump and a solenoid) in addition to the IR triple gas bench.

The CO measurement reading uses the electrochemical sensor's reading from 0 to 4000ppm and the IR gas module takes over at 4000ppm to instruments upper limit.

When the electrochemical sensor's reading passes 5500ppm, the solenoid operates and the high CO purge pump switches on and pumps fresh air across the electrochemical CO sensor. When the IR gas module reading goes below 5500ppm, the solenoid is deactivated and the high purge pump is stopped.

C. COMBUSTION EFFICIENCY CALCULATION

The efficiency calculation is based upon British Standard BS845.

This identifies three sources of loss associated with fuel burning:

LOSSES DUE TO FLUE GASSES:	Dry Flue gas loss, Moisture and hydrogen Sensible heat of water vapour Unburned gas
LOSSES DUE TO REFUSE:	Combustible in ash Combustible in riddlings Combustible in dust
OTHER LOSSES:	Radiation Convection Conduction Other unmeasured losses

Net efficiency calculations assume that the energy contained in the water vapour (formed as a product of combustion and from wet fuel) is recovered and the wet loss term is zero. Gross efficiency calculations assume that the energy contained in the water vapour is not recovered.

Since the fuel air mixture is never consistent there is the possibility of unburned/partially unburned fuel passing through the flue. This is represented by the unburned carbon loss.

Losses due to combustible matter in ashes, riddlings, dust and grit, radiation, convection and conduction are not included.

EFFICIENCY CALCULATION:

Known Data - Fuel: Qgr = Gross Calorific Value (kJ/kg)
Qnet = Net Calorific Value (kJ/kg)
K1 = Constant based on Gross or Net Calorific Value:
K1g = (255 x %carbon in fuel)/Q_{gr}
K1n = (255 x %carbon in fuel)/Q_{net}
K2 = % max theoretical CO_2 (dry basis)
K3 = % Wet Loss

Measured Data: Tf = Flue Temperature
Ti = Inlet Temperature
O_2m = % Oxygen in flue gas

Calculated data: Tnet = Net Temperature
% CO_2 content in flue gas
% Dry Flue Gas losses
% Wet losses
% Unburned carbon loss
% Efficiency

$\%CO_2$ = (20.9 - $\%O_2m$) x K2 / 20.9

Tnet = Flue Temperature - Inlet Temperature

Dry flue gas loss = 20.9 x K1n x (Tnet) / K2 x (20.9 - $\%O_2m$)

Wet loss = 9 x $\%H_2$ + $\%H_2O$ / Qgr x [2488 + 2.1Tf - 4.2 Ti]
simplified = [(9 x $\%H_2$ + $\%H_2O$) / Qgr] x 2425 x [1 + 0.001 Tnet]

Wet loss = K3(1+0.001xTnet)

Where K3 = [(9 x $\%H_2$ + $\%H_2O$) / Qgr] x 2425

Net Efficiency = 100% - dry flue gas losses

= 100% - 20.9 x K1n x (Tnet) / K2 x (20.9 - % O_2m)

Gross Efficiency = 100% - {dry flue gas losses + wet losses}

= 100% - [20.9 x K1g x (Tnet) / K2 x (20.9 - $\%O_2m$)] +
[K3 x (1 + 0.001 x Tnett)]

Excess Air % = [(20.9% / (20.9% - $0_2m\%$)) – 1] x 100%

Air Index = 20.9% / (20.9% - $0_2m\%$)

NB: Either Excess Air or Air Index can be referred to as LAMBDA in the context of flue gas analysis dependent on local preferences.

For typical condensing gas boiler Excess Air = 31% and Air Index = 1.31

CO_2% = [(20.9% - $O_2m\%$) x K2% / 20.9%]

Unburned fuel Loss = K4 x CO% / (CO% + CO_2%)

Where K4 = 70 for coke
= 65 for anthracite
= 63 for Bituminous coal
= 62 for coal tar fuel
= 48 for liquid petroleum fuel
= 32 for natural gas

The formula for K4 is based on the gross calorific value Qgr. To obtain the loss based on net calorific value multiply by Qgr/Qnet. Since this loss is usually small this conversion has been ignored.

OXYGEN REFERENCE

$$CO(n) = CO \times \frac{(20.9 - O_2r)}{(20.9 - O_2m)}$$

D. CALCULATION OF FUEL DATA

For any fuel not specified by Kane International the net calorific value, gross calorific value and composition should be obtained from the fuel supplier.

The following fuel data has been calculated with reference to the efficiency calculation.

Example 1:

Chemical composition:	C	25%	
	H_2	3%	
	H_2O	50%	
	Q_{net}	8.35 MJ/kg	
	Q_g	9.3 MJ/kg	*
	Max CO_2	20.4%	

K1n = (255 x % carbon in fuel) / Q_{net} (kJ/Kg)
= (255 x 25) / 8350 = **0.763**

K1g = (255 x % carbon in fuel) / Q_g (kJ/Kg)
= (255 x 25) / 9300 = **0.685**

K2 = Max % CO_2 = **20.40**

K3 = Wet Loss = [(9 x %H_2 + %H_2O) / 9300] x 2425
= [(9 x 3 + 50) / 9300] x 2425
= (77 / 9300) x 2425 = **20.08**

K4 = **65** (an approximation for wood) *

The fuel values to program into the Analyser are as follows:

NATURAL GAS			
K1g	: 0.763	K1n	: 0.685
K_2	: 20.4	K_3	: 20.08
K_4	: 65	O2r	: 8.0

* Assumed values in the absence of supplied data. See previous appendix for other fuels.

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 (28.01.14):	
Purchased From:	
Model Number:	**KANE QUINTOX**
Product Serial Number: located on the rear product label beneath the protective rubber sleeve	

Why did you buy a Kane Product?

☐ Made in the UK
☐ Value for Money
☐ Kane Brand
☐ Not your Decision
☐ Previous Owner
☐ Our Fixed Price Servicing Programme
☐ Dealer Recommendation
☐ Other:

What brand was your previous analyser?

How did you hear about Kane?

☐ Magazine Advert
☐ Training School
☐ Personal Recommendation
☐ Exhibition
☐ Trade Counter
☐ Previous Owner
☐ Internet Search
☐ Other:

Your feedback is important to us, please add any additional comments you would like to make with regard to your recent Kane purchase:

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

Scan the QR code to go directly to Register your Product on-line

or complete, detach and return the Product Registration form in this manual.