KANE425
Flue Gas Analyser

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Stock No: 18366   October 2006

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KANE425 Overview

The **KANE425** Combustion Analyser measures O_2, CO, differential temperature and differential pressure.

It calculates CO_2, CO/CO_2 ratio, losses, combustion efficiency (Nett, Gross or Condensing) & excess air.

The KANE425 Combustion Analyser can measure carbon monoxide levels in ambient air - useful when a CO Alarm is triggered. It can also perform a 15 minute duration Room CO Test.

The analyser has a protective rubber sleeve with a magnet for "hands–free" operation and is supplied with a flue probe with integral temperature sensor.

The large display shows 4 readings at a time and all data can be printed via an optional infrared printer. The printed data can be 'live' data or 'stored' data.

The memory can store up to:
> 99 combustion tests
> 20 pressure tests
> 20 let-by/tightness tests
> 20 temperature tests
> 20 room CO tests

Two lines of 20 characters can be added to the header of printouts.

The analyser is controlled using 4 function buttons and a rotary dial.

The four buttons (from left to right) switch on and off the analyser, switch on and off the backlight and torch light, switch on and off the pump and send data to a printer or to the memory. The buttons with UP, DOWN and ENTER arrows also change settings such as date, time, fuel, etc. when in MENU mode.

ANALYSER LAYOUT & FEATURES

Torchlight and infra-red emitter

Socket for gas leak detector

P 0.000

R 0.0000

CO 00

O2 20.9

Menu controls

Scroll up/down

Enter

Function buttons x 4

On/Off ✳ Pump Send

O2/Eff Ratio Prs Tightness

Aux

Diff Temp

Status

Room CO

Menu

Particle Filter

Rotary Switch

Battery Compartment (behind rubber sleeve)

KANE 425

Water Trap

"Battery Charging" indicator

Temp and pressure connections

Flue Gas Inlet

Temperature Connections -
Flue Probe Temperature (T1)
Inlet Temperature (T2)

Battery Charger Connection

Flue Gas Inlet

Pressure Connections -
P1
P2 (Differential)

Watertrap Drain
With Rubber Plug

Flue Gas Exhaust
(See Page 9)

Black Connector
(Plugs Into Flue
Gas Inlet)

Flue Probe Temperature Plug
(Plugs Into T1)

The narrower (+ve) pin must
be on the right hand side.

Flue Probe Hose

1. BATTERIES

Battery Type

This analyser has been designed for use with disposable alkaline batteries or rechargeable Nickel Metal Hydride (NiMH) batteries. No other battery types are recommended.

WARNING
The battery charger unit must <u>only</u> be used when NiMH batteries are fitted.

Replacing Batteries

Turn over the analyser, remove its' protective rubber sleeve and fit 4 "AA" batteries in the battery compartment. **Take great care to ensure they are fitted with the correct battery polarity.** Replace the battery cover and protective rubber sleeve.

Switch the analyser on and select "Status" to check that the analyser's time and date are correct. To reset see **USING THE MENU, Section 5.**

Charging NiMH Batteries

Ensure that you use the correct charger. The part number is KMCU250/UK.

To fully charge NiMH batteries:
> The KANE425 must be switched on.
> The charger must then be connected and switched on.
> When charging the red Battery Charging Indicator will illuminate.
> When the KANE425 is switched off the display will show "BATTERY CHARGING"

The first charge should be for 12 hours continuously. NiMH batteries are suitable for top up charging at any time, even for shorts periods.

An in-vehicle charger can be used to top up the analyser's batteries from a 12 volt vehicle battery. The part number is KMCU450/12

Battery Disposal

Always dispose of depleted batteries using approved disposal methods that protect the environment

2.   BEFORE USING THE ANALYSER EVERY TIME:

Check the water trap is empty and the particle filter is not dirty:

- To empty water trap, carefully pull out the rubber drain plug and re-plug once it is empty.

- To change the particle filter, remove the analyser's protective rubber sleeve, slide the water trap unit from the analyser, remove the particle filter from its' spigot and replace. Reconnect the water trap unit and rubber protective sleeve.

Connect the flue probe hose to the analyser's flue gas inlet and connect the flue probe's temperature plug to the T1 socket – check the plug's orientation is correct - see Page 6.

2.1   FRESH AIR PURGE

Position the flue probe in fresh air, then press On/Off. The analyser's pump starts and the analyser auto-calibrates for approximately 30 seconds. When complete:

Select "Ratio" on the dial. *In fresh air the CO reading should be 0 ppm.*
Select "O$_2$/Eff" on the dial. *In fresh air the O$_2$ reading should be 20.9% $\pm$0.1%*

2.2   STATUS DISPLAY

Select "Status" on the dial to view the following:

BAT 39 →	Replace alkaline batteries if less than 10% Recharge NiMH batteries if less than 20%
14:56:29 →	Current time. Can be re-set via the "Menu".
11/03/06 →	Current date. Can be re-set via the "Menu".
CAL 283 →	Shows number of days until next calibration is due.

SAFETY WARNING

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

3. USING THE FOUR FUNCTION BUTTONS:

Switching ON the Analyser	Press [On/Off] button to switch the unit ON . This must be done in fresh air to ensure that the analyser auto calibrates its' sensors properly.
	When switched on, the analyser beeps twice and briefly displays battery %, fuel and pressure units. Its' bottom line counts down from 60 until the sensors are ready to use – This normally takes 20 - 30 seconds but may take longer as sensors get older. If the analyser will not auto calibrate, its' sensors need to be replaced or recalibrated by an authorised repair centre.
	If an inlet temperature probe (optional) is connected into the T2 socket during its' countdown, the measured temperature from the inlet probe will be used as the inlet temperature.
	If an inlet temperature probe is not connected to the analyser during countdown the measured temperature from the flue probe will be used as the inlet temperature.
	If neither probe is connected during countdown the analyser's internal ambient temperature will be used as the inlet temperature.
Switching OFF the Analyser	Press [On/Off] button to switch the analyser OFF. The display counts down from 30 with the pump on to clean the sensors with fresh air – If the probe is still connected, make sure analyser and probe are in fresh air.
	Press [Send] if you want to stop the countdown and return to making measurements.
	Note: The analyser will not switch off unless the CO reading is below 20ppm

Backlight & Torchlight	Press [✳] to switch the display's backlight and torchlight on and off. **NOTE: Use of the backlight/torchlight increases the current drain on the batteries**
Switching PUMP on / off	The analyser normally operates with the pump on. Press [Pump] to switch the pump off and on. When the pump is switched off "---PO--" is displayed instead of the O_2, CO & Ratio readings. The analyser also displays "PUMP OFF" on the top line approx every 40 seconds. **NOTES:** **1) The pump will not switch off if the CO reading is above 20ppm .** This helps to protect the CO sensor from damage. **2) The pump will automatically switch itself off when the rotary switch is set to Menu, Status, Pressure, Tightness or Differential Temperature.**
Zeroing the pressure sensor	Press and hold [Pump] until the top line display shows CAL ZERO.
Printing Data	Press and quickly release [Send] to start the analyser printing. The analyser displays a series of bars until this is completed. Press and release the key again to abort printing. Make sure the printer is switched on, ready to accept data and its' infrared receiver is in line with the analyser's emitter (on top of the analyser).

Storing a set of readings	Press and hold **Send** for approx. 2+ seconds. The top line briefly display the log number. **Note: This STORE function is inhibited in normal operation if the pump is switched off.**
Using △ / ▽ / ⇐ Buttons	The function buttons below the symbols △ / ▽ / ⇐ are used to navigate through the menu when the rotary switch is set to MENU – See USING THE MENU, Section 5

4.   USING THE ANALYSER:

4.1   COMBUSTION TESTS:

Insert the tip of the flue probe into the centre of the flue. The readings will stabilise within 60 seconds assuming the boiler conditions are stable (see Measuring Flue Gases – Section 7).

The rotary switch can be used to display the following information:

RATIO Display

NAT GAS	→ Can be changed via "Menu".
R 0.0008	→ CO/CO_2 ratio
CO 52	→ Carbon Monoxide (ppm)
CO2 6.3	→ Carbon Dioxide (%)

Press **Send** to print a full combustion test (also sends to PC if Bluetooth fitted).

Hold **Send** for 2+ seconds to log a full combustion report.

O2/EFF display

O2 9.8	→ Oxygen (%) left after combustion. Should be 20.9% $\pm$0.1% in fresh air.
TF 145.1	→ Flue temperature (^{o}C)
TI 5.4	→ Inlet temperature (^{o}C). Normally set by flue probe during fresh air purge.
Ef C 91.3	→ Defaults to Condensing boiler efficiency (EfC). Can be changed via "Menu".

Press **Send** to print a full combustion test (also sends to PC if Bluetooth fitted).

Hold **Send** for 2+ seconds to log a full combustion report.

AUX display

O₂ **20.9**	→
CO **00**	
15:04:11	
BAT **39**	

O_2 20.9
CO   00
15:04:11
BAT   39

→ The default AUX (auxillary) display is shown including Oxygen, Carbon Monoxide, current time & battery status.

The AUX display can be customised via MENU / SCREEN / AUX to change the parameters on lines 1, 2, 3 and 4.

They remain the AUX parameters until changed again by the user

Press **Send** to print a full combustion test (also sends to PC if Bluetooth fitted).

Hold **Send** for 2+ seconds to log a full combustion report.

Viewing / printing a logged combustion test

Select MENU / REPORT / COMB'N / VIEW

Hold △ or ▽ for 2+ seconds to select the log number to be viewed.

Use △ and ▽ to scroll through the individual readings on line 2 & 3.

Press **Send** to print the test (also sends to PC if Bluetooth fitted).

NOTE: The "AUX" display can be used to time and manually record ambient CO levels to comply with BS7967 (see "ROOM CO" – Section 4.5).

4.2   PRESSURE TEST

Select "Prs". The pump stops automatically. Press **Pump** to auto-zero the pressure sensor. Using the black connectors and manometer hose, connect to P1 for single pressure or P1 and P2 for differential pressure.

PRS display
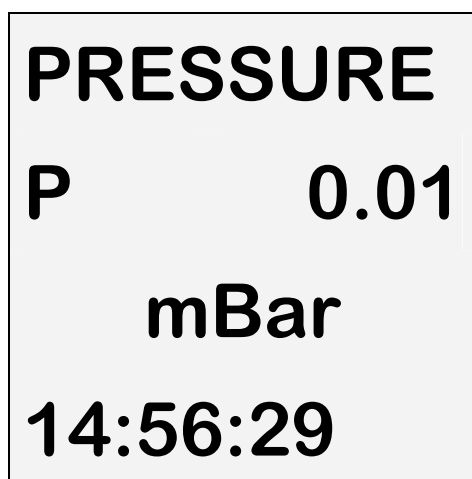
PRESSURE	→ Defaults to smoothing off on start-up. Can be changed via "Menu".
P 0.01	→ Defaults to low resolution on start-up. Can be changed via "Menu".
mBar	→ Pressure units can be changed via "Menu".
14:56:29	→ Displays time to enable manually timed tests

Press **Send** to print a pressure test (also sends to PC if Bluetooth fitted).

Hold **Send** for 2+ seconds to log a pressure report.

Viewing / printing a logged pressure test

Select MENU / REPORT / PRESSURE / VIEW

Use △ or ▽ to select the log number to be viewed / printed.

Press **Send** to print the test (also sends to PC if Bluetooth fitted).

SAFETY WARNING

Before using the KANE425 to measure the pressure of a gas/air ratio valve, read the boiler manufacturer's instructions thoroughly. If in doubt contact the boiler manufacturer.

After adjusting a gas/air ratio valve it is essential to confirm that the CO, CO2 and CO/CO2 ratio readings are within the boiler manufacturer's specified limits.

4.3   LET-BY & TIGHTNESS TESTING

Select "Tightness".   The pump stops automatically.   Press Pump to auto-zero the pressure sensor. Connect from the test point to P1 using a black connector and manometer hose.

The display shows "LET BY?". Use △ , ▽ and ⇐ to select YES or NO.

If YES is selected set the let-by pressure then press ⇐ to start the let-by test. The display shows:

LET BY	→ The let-by test is automatically stored in the memory
P1 10.15	→ Pressure at start of let-by test
P2 10.15	→ Real time pressure reading
TIME 59	→ Let-by default time is 1 minute. Can be changed via "Menu"

If the let-by test fails simply move the rotary switch to any position other than "tightness" to abort the test.

If the let-by test passes adjust the gas pressure for the tightness test and press ⇐ to start the stabilisation test. The display shows:

STABIL'N	
P1 20.01	→ Real time pressure during the stabilisation test
mBAR	→ Pressure units
TIME 59	→ Stabilisation default time is 1 minute. Can be changed via "Menu".

When stabilisation is complete press ⇐ to start the tightness test:

TIGHTN'S	
P1 20.01	→ Pressure at start of tightness test
P1 20.01	→ Real time pressure reading
TIME 119	→ Tightness default time is 2 minutes. Can be changed via "Menu".

When complete the display will show:

LOG 01	→ The tightness test is automatically stored in the memory. The log number for the test is displayed.
P1 20.01	→ Pressure at start of tightness test
P2 19.98	→ Pressure at end of tightness test
PRINT ↓	

Press **Send** to print the tightness test (also sends to PC if Bluetooth fitted).

Viewing / printing a logged tightness test

Select MENU / REPORT / TIGHTN'S / VIEW

Use △ or ▽ to select the log number to be viewed / printed.

Press **Send** to print the test (also sends to PC if Bluetooth fitted).

4.4   DIFFERENTIAL TEMPERATURE

Select "Diff Temp" to measure flow, return and differential temperatures

DIFF TEMP display

TEMP	→ Pump stops automatically when dial is moved to Diff Temp
T1 60.4	→ Use the T1 connection for the flow temperature sensor
T2 55.2	→ Use the T2 connection for the return temperature sensor
ΔT 5.2	→ Real time temperature difference

Press [Send] to print a differential temperature test (also sends to PC if Bluetooth fitted).

Hold [Send] for 2+ seconds to log a differential temperature report.

Viewing / printing a differential temperature test

Select MENU / REPORT / TEMP / VIEW

Use △ or ▽ to select the log number to be printed.

Press [Send] to print the test (also sends to PC if Bluetooth fitted).

4.5   ROOM CO TESTING

Select "Room CO" for CO investigations.

Press (Pump) to start the 15 minute duration room CO test.

ROOM CO display

ROOM CO	→ When complete the room CO test is automatically stored in the memory
CO 00	→ Real time CO reading (ppm)
TEST 00	→ Test 00 = initial reading Test 15 = final reading
LOG 01	→ The log number for the test is displayed.

Press (Send) to print the room CO test (also sends to PC if Bluetooth fitted)

Viewing / printing a logged Room CO test

Select MENU / REPORT / ROOM CO / VIEW

Use △ or ▽ to select the log number to be viewed / printed.

Use ⇦ to view individual readings.

Hold (Send) for 2+ seconds to print the test (also sends to PC if Bluetooth fitted).

NOTE: To abort a room CO test move the rotary switch to any position other than "Room CO".

NOTE: The "AUX" display can be used to time and manually record ambient CO levels to comply with BS7967 – see Page 14.

4.6 KANE425 PRINTOUTS

```
K425  1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE


TEST        10

DATE        15/05/06
TIME        12:00:08



COMBUSTION
....................

FUEL        NAT  GAS

O2  %          5.4
CO2 %          8.8
CO  ppm         12
FLUE   "C     55.1
INLT   "C     17.2
NETT   "C     37.9

EFF (C)       98.3
LOSSES         1.7
XAIR %        34.8

CO/CO2      0.0001

PRS   mBAR    0.00


....................
Customer

....................
Appliance

....................
Ref.

....................
```

```
K425  1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

PRESSURE
....................

TIME   12:56 15/05/06

PRS   mBAR   -0.037


....................
Customer

....................
Appliance

....................
Ref.

....................
```

```
K425  1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

DIFF TEMP
....................

LOG               03
TIME   12:10 15/05/06

T1     "C       60.1
T2     "C       47.0
∆T     "C       13.1

....................
Customer

....................
Appliance

....................
Ref.

....................
```

```
K425  1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE


LOG               04
TIME   11:53 15/05/06

Let By Test
....................

PRS_1 mBAR    10.12
PRS_2 mBAR    10.11
LET BY   MINS  1:00

Tightness Test
....................

PRS_1 mBAR    20.12
PRS_2 mBAR    20.10
∆PRS  mBAR    -0.02
STABIL'N MINS  1:00
TIGHTN'S MINS  2:00

....................
Customer

....................
Appliance

....................
Ref.

....................
```

```
K425  1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

ROOM CO TEST
....................

LOG               01
TIME   12:50 15/05/06

TEST          CO ppm
0                 00
1                 00
2                 10
3                 04
4                 01
5                 00
6                 00
7                 10
8                 03
9                 00
10                00
11                00
12                07
13                11
14                02
15                00
....................
MAXIMUM CO        11

....................
Customer

....................
Appliance

....................
Ref.

....................
```

5.   USING THE MENU

Select "Menu" on the rotary switch and navigate using the function buttons:

| △ = Scroll up | ▽ = Scroll down | ◁⏎ = Enter |
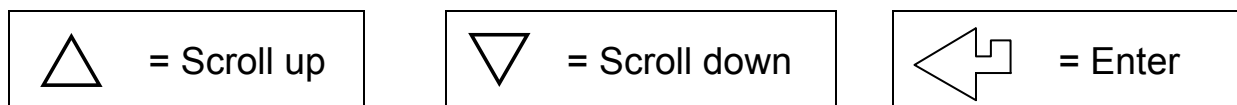
MAIN MENU	SUB MENU	OPTIONS / COMMENTS
SETUP	SET FUEL	NAT GAS, L OIL, PROPANE, BUTANE, LPG, PELLETS (wood)
	N ← C → G	EfC = condensing boilers EfN = nett efficiency, EfG = gross efficiency, **KANE425 always defaults to EfC on start-up**
	SET TIME	HH:MM:SS format e.g. 7 am = 07:00:00, 7pm = 19:00:00
	SET DATE	DD/MM/YY format
	EXIT	
PRESSURE	SMOOTH	OFF = normal response. ON = slower (damped) response **KANE425 always defaults to normal response on start-up**
	RESOLVE	LOW = e.g. 0.01mBar resolution. HIGH = displays to an extra decimal place. **KANE425 always defaults to low resolution on start-up**
	PS UNITS	mBar, mmH$_2$O, Pa, kPa, PSI, mmHg, hPa, InH$_2$O
	TIME	LET BY = Set duration of let-by test in minutes. Default = 1 minute STABIL'N = Set duration of stabilisation in minutes. Default = 1 minute TIGHTN'S = Set duration of tightness test in minutes. Default = 2 minute
	EXIT	

MAIN MENU	SUB MENU	OPTIONS / COMMENTS
REPORT	COMB'N	Stored combustion tests: VIEW, DEL ALL, EXIT
	PRESSURE	Stored pressure tests: VIEW, DEL ALL, EXIT
	TIGHTN'S	Stored tightness tests: VIEW, DEL ALL, EXIT
	TEMP	Stored differential temperature tests: VIEW, DEL ALL, EXIT
	ROOM CO	Stored room CO tests: VIEW, DEL ALL, EXIT
	EXIT	
SCREEN	CONTRAST	Factory setting is 04
	AUX	Enables users to customise the parameters on the AUX display: LINE 1, LINE 2, LINE 3, LINE 4, EXIT
	HEADER	Printout header, 2 lines, 20 characters per line: HEADER 1, HEADER 2, EXIT
	EXIT	
SERVICE	CODE	Password protected for authorised service agents only. Leave set to 0000 then press ⇐ four times to exit the SERVICE menu

NOTE: To EXIT the MENU at any time simply move the rotary switch to any position other than "Menu". Any changes that have not been "entered will be ignored.

6. USING THE KANE425 AS A THERMOMETER & PRESSURE METER

With the KANE425 switched off, press and hold down the [Send] button and then press and release [On/Off]. Release [Send] after **MANO_MOD** is displayed on top line.

The KANE425 will now operate as a fixed display thermometer/pressure meter with the pump off and inhibited.

The display will show:

P	**0.00**	→	Real time pressure reading
T1	**21.3**	→	Use the T1 connection for the flow temperature sensor
T2	**21.3**	→	Use the T2 connection for the return temperature sensor
ΔT	**0.0**	→	Real time temperature difference

The rotor display indications will now be locked apart from MENU. Readings can be printed but not stored. Exit this mode by switching the KANE425 off.

The standard printout for this mode is as follows:

```
K425  1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE


DATE        15/05/06
TIME        13:00:47


..................

T1      °C      21.3
T2      °C      21.3
ΔT      °C       0.0

PRS     mBAR    0.00

..................
```

7. MEASURING FLUE GASES

After the countdown is finished and the analyser is correctly set up, put its' flue probe into the appliance's sampling point. The tip of the probe should be at the centre of the flue. Use the flue probe's depth stop cone to set the position.

With balanced flues, make sure the probe is positioned far enough into the flue so no air can 'back flush' into the probe.

NOTE: Ensure that the flue probe handle does not get hot!
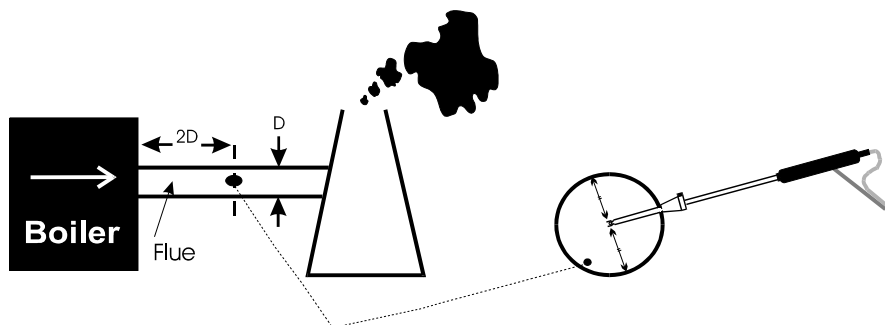
Make sure you do not exceed the analyser's operating specifications. In particular:

- Do not exceed the flue probe's maximum temperature ($600^{o}C$)
- Do not exceed the analyser's internal temperature operating range
- Do not put the analyser on a hot surface
- Do not exceed the water trap's levels
- Do not let the analyser's particle filter become dirty and blocked

View the displayed data to ensure that stable operating conditions have been achieved and the readings are within the expected range.

Press and quickly release **Send** to start the analyser printing. The analyser displays a series of bars until this is completed. Press and release the key again to abort printing.

Make sure the printer is switched on, ready to accept data and its' infrared receiver is in line with the analyser's emitter (on top of the analyser).

8.   ANALYSER PROBLEM SOLVING

If any problems are not solved with these solutions, contact us or an authorized repair center.

Fault symptom	Causes / Solutions
• Oxygen too high • CO_2 too low	• Air leaking into probe, tubing, water trap, connectors or internal to analyser. • Oxygen cell needs replacing.
• Oxygen reading (- - - -) • CO reading (- - - -)	• Analyser was stored in a cold environment and is not at normal working temperature. • Oxygen cell or CO sensor needs replacing.
• Batteries not holding charge • Analyser not running on mains adapter.	• Batteries 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.
• Net temperature or Efficiency calculation incorrect.	• Ambient temperature set wrong during Automatic Calibration.
• Flue temperature readings erratic	• Temperature plug reversed in socket. • Faulty connection or break in cable or plug.
• T flue or T nett displays (- - - -)	• Probe not connected.
• X-Air, Efficiency or CO_2 display (- O>-)	• Oxygen reading is above 18%

Fault symptom	Causes / Solutions
• Analyser just continually beeps	• Turn dial back to MENU and press ENTER
• BAT only shows 65 with fully charged NiMH batteries fitted	• This is not a problem and is to be expected as NiMH batteries only deliver 1.25 V per cell whereas Alkalines deliver 1.5 V per cell. Fresh alkalines might give a BAT value of 90 or so.

9. ANALYSER ANNUAL RECALIBRATION AND SERVICE

Although sensor life is typically more than two years, 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: 01707-375550), the primary service centre for non-UK customers.

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

10. ANALYSER SPECIFICATION
(NOTE MAY BE SUBJECT TO CHANGE)

Parameter	Range	Resolution	Accuracy
Temp Measurement Flue Temperature	0-600°C	0.1^{o}C	$\pm$2.0^{o}C $\pm$0.3% reading
Inlet Temperature (Internal sensor)	0-50°C	0.1^{o}C	$\pm$1.0^{o}C $\pm$0.3% reading
Inlet Temperature (External sensor)	0-600°C	0.1^{o}C	$\pm$2.0^{o}C $\pm$0.3% reading
Gas Measurement Oxygen	0-21%	0.1%	$\pm$0.2%[1]
Carbon Monoxide	0-2,000ppm nom 4,000ppm max for 15 mins	1ppm	$\pm$10ppm <100ppm[1] $\pm$5% reading
Carbon Dioxide [2] Efficiency [2] Excess Air [2] CO/CO$_2$ ratio [2]	0-30% 0-99.9% 0-250% 0-0.999	0.1% 0.1% 0.1% 0.0001	$\pm$0.3% reading $\pm$1.0% reading $\pm$0.2% reading $\pm$5% reading
Pressure (differential) Nominal range $\pm$80mBar (Maximum over range without damage to sensor is $\pm$400mBar)	$\pm$0.2 mBar $\pm$1 mBar $\pm$80 mBar	Maximum 0.001 mBar <25mBar	$\pm$0.005 mBar $\pm$0.03 mBar $\pm$3% of reading
Pre-programmed Fuels	Natural gas, Propane, Butane, LPG, Light Oils (28/35 sec), Wood Pellets		
Storage Capacity	99 Combustion tests 20 Pressure tests 20 Tightness tests 20 Temperature tests 20 Room CO tests		
Ambient Operating Range	0°C to +40°C 10% to 90% RH non-condensing		
Battery Type / Life	4 AA cells >12 hours using Alkaline AA cells		

Chargers (optional)	220v charger, for NiMH batteries only 12v in vehicle charger, for NiMH batteries only
Dimensions Weight: Handset: Probe:	 0.8kg handset with boot 200 x 45 x 90mm 300mm long including handle. 6mm diameter x 240mm long stainless steel shaft with 3m long neoprene hose. Type K thermocouple

[*1]   Using dry gases at STP
[*2]   Calculated

11. ELECTROMAGNETIC COMPATIBILITY

European Council Directive 89/336/EEC requires electronic equipment not to generate electromagnetic disturbances exceeding defined levels and have adequate immunity levels for normal operation. Specific standards applicable to this analyser are stated below.

As there are electrical products in use pre-dating this Directive, they may emit excess electromagnetic radiation levels and, occasionally, it may be appropriate to check the analyser before use by:

Use the normal start up sequence in the location where the analyser will be used.

Switch on all localized electrical equipment capable of causing interference.

Check all readings are as expected. A level of disturbance is acceptable.

If not acceptable, adjust the analyser's position to minimize interference or switch off, if possible, the offending equipment during your test.

At the time of writing this manual (August 2005) Kane International Ltd are not aware of any field based situation where such interference has occurred and this advice is only given to satisfy the requirements of the Directive.
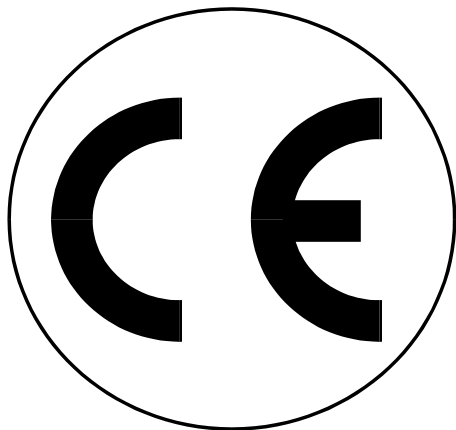
This product has been tested for compliance with the following generic standards:

EN 61000-6-3
EN 61000-6-1

and is certified to be compliant

Specification EC/EMC/KI/K450 details the specific test configuration, performance and conditions of use.

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

At the end of the product's life it should be re-cycled in accordance with current legislation and local guidelines.

Appendix 1 - Main Parameter:

Here are the legends used and what they mean:

O₂ :   Oxygen reading in percentage (%)

CO: Carbon Monoxide reading displayed in ppm (parts per million).
'**- - -**' is displayed if there is a fault with the CO sensor or the
instrument has not set to zero correctly, switch off instrument
and try again.

CO₂ :   Carbon Dioxide calculation determined by fuel type. This is only
displayed when a combustion test is being carried out. '**-O>-**' is
displayed while in fresh air.

T Flue: Temperature measured by the flue gas probe in Centigrade (^{o}C).
It displays '**- OC -**' if the flue probe is disconnected.

T Inlet: If an inlet temperature probe (optional) is connected into the T2
socket during its' countdown, the measured temperature from the
inlet probe will be used as the inlet temperature.

If an inlet temperature probe is not connected to the analyser
during countdown the measured temperature from the flue probe
will be used as the inlet temperature.

If neither probe is connected during countdown the analyser's
internal ambient temperature will be used as the inlet
temperature.

T Nett :   Nett temperature calculated by deducting the **INLET**
temperature from the measured **FLUE** temperature in Centigrade
(°C). It displays '**- OC -**' if the flue probe is not connected.

EFF :   Combustion efficiency calculation displayed in percentage either
as Gross (G) or Nett (N) or Condensing Nett (C) - Use **MENU**
to change. The calculation is determined by fuel type and uses
the calculation in British Standard BS845. The efficiency is
displayed during a combustion test, '**-O>-**' is displayed while in
fresh air.

Loss :   Losses calculated from Oxygen and type of fuel. Displays
reading during a combustion test. '**-O>-**' is displayed while in
fresh air.

X - AIR :   Excess air calculated from the measured oxygen and type of fuel used. Displays reading during a combustion test. '**-O>-**' is displayed while in fresh air.

CO/CO$_2$:   CO/CO$_2$ Ratio: measured CO (ppm) divided by calculated CO$_2$ (%) x 10,000.

PRS: Pressure reading, either single point or differential

BAT   Displays the Battery power available in %

When the LO BAT symbol appears this indicates the batteries are at less than 10% of charge and should be replaced, readings may be affected if used with low power batteries.

DATE :   Date shown as day, month and year, DD/MM/YY. Date is recorded when each combustion test is printed or stored.

TIME :   The time shown is expressed in "Military" time HH:MM:SS. Time is recorded when each test is printed or stored.

Note! When changing the batteries on the instrument the memory will store the date and time for up to one minute, if outside this time it may be necessary to re-enter the details. Date and time may also need to be reset if re-chargeable batteries are allowed to totally discharge.

SYMBOLS used on the display

P	Pressure
R	CO/CO_2
λ	Excess Air
◢	Loss %: 100% minus loss % = efficiency %
TF	Flue Temperature
TI	Inlet Temperature
ΔT	Nett Temperature
EfG	Gross efficiency
EfN	Nett efficiency
EfC	Condensing efficiency
- PO -	Pump off
-O>-	Oxygen greater than 18% so calculation is disabled
-OC-	Open circuit temperature input
CAL	Number of days left before recalibration is due