

# KANE451

Flue Gas Analyser  
with direct CO<sub>2</sub> measurement



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# KANE451 Overview

The **KANE451** Combustion Analyser measures carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO) to 10,000ppm, differential temperature and differential pressure. The direct measurement of CO<sub>2</sub> is achieved using a Kane designed infra-red sensing system.

CO<sub>2</sub> is set to zero in fresh air automatically after the initial countdown.

If “RESET GAS ZERO” is indicated ensure that the unit is in fresh air before pressing the button with an “Enter” symbol.

It calculates oxygen (O<sub>2</sub>), CO/CO<sub>2</sub> ratio, losses, combustion efficiency (Nett, Gross or Condensing) & excess air.

The KANE451 Combustion Analyser can also measure CO levels in ambient air - useful when a CO Alarm is triggered. It can also perform a Room CO Test for up to 30 minutes duration.

The analyser has a protective rubber cover 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
- 30 room CO tests

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

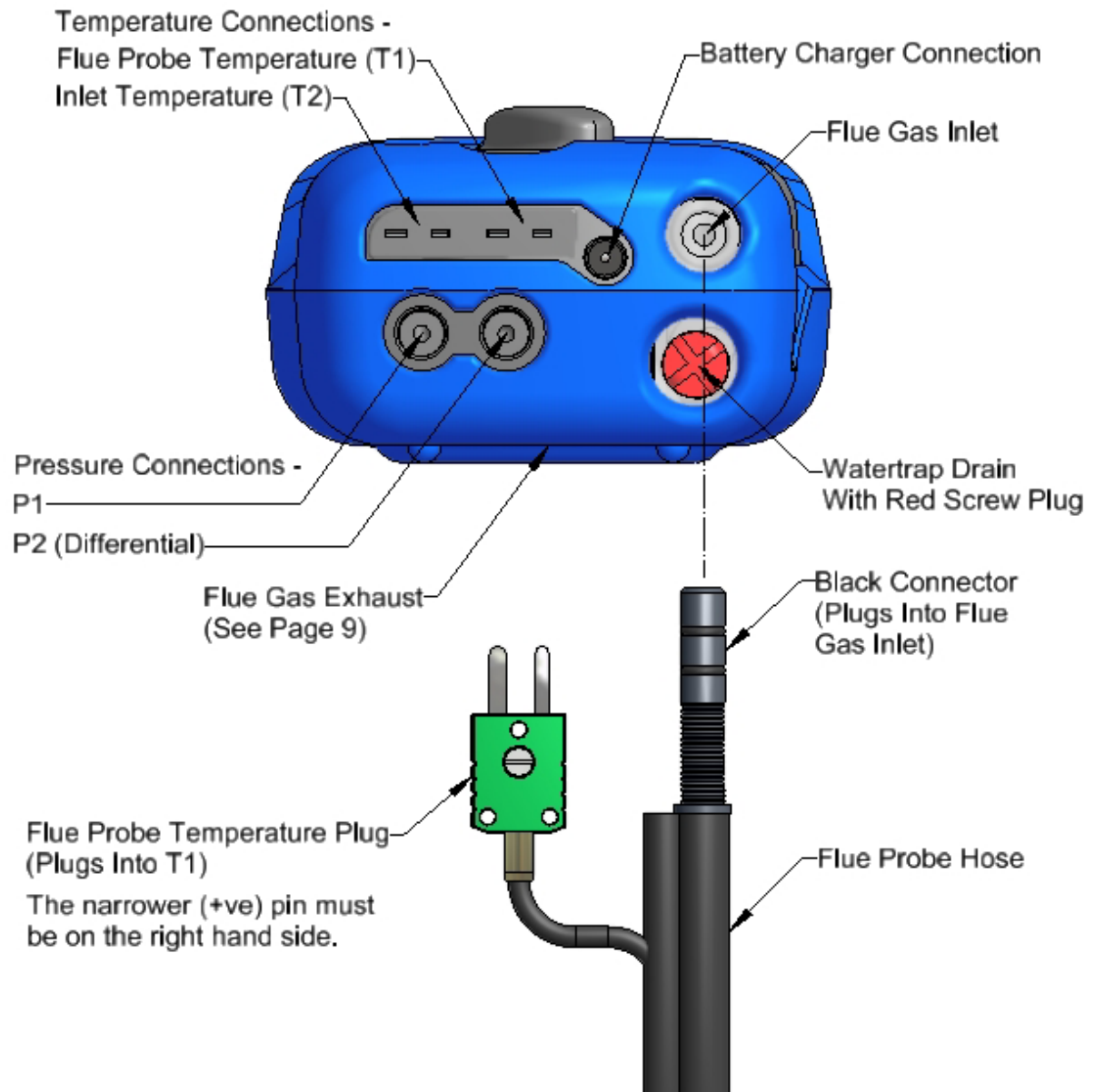
The analyser is controlled using 4 function buttons and a rotary dial.

The four buttons (from left to right) switch on and off the analyser, switch on and off the backlight and task 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

Tasklight and infra-red emitter





# 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 only 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 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:

Switch the KANE451 on.

The charger must then be connected and switched on.

When charging, the red Battery Charging Indicator will illuminate.

Now switch the KANE451 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 short 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, unscrew the red drain plug and re-plug once it is empty.
- To change the particle filter, remove 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  / . The analyser's pump starts and the analyser auto-calibrates for approximately 90 seconds. When complete:

Select "Ratio" on the dial. *In fresh air the CO reading should be zero.*

Select "O<sub>2</sub>/Eff" on the dial. *In fresh air the O<sub>2</sub> reading should be 20.9% ± 0.1%.*



This message indicates that the analyser needs to be reset in fresh air. To do so, ensure that the analyser is in fresh air and press  / .

To perform a manual 'Gas Zero', select 'Ratio' on the dial, hold down the  key and you will see the message above.



## 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 30.
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.

**NOTE: The BAT status number for fully charged NiMH batteries or new professional alkaline batteries is typically 99.**







## 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.**









Users of 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).

### 3. USING THE FOUR FUNCTION BUTTONS:

<p>Switching ON the Analyser</p>	<p>Press  /  button to switch the unit ON. This must be done in fresh air to ensure that the analyser auto calibrates its sensors properly.</p> <p>When switched on, the analyser beeps and briefly displays battery %, fuel and pressure units. Its bottom line counts down from 90 until the sensors are ready to use. If the analyser will not auto calibrate, its sensors need to be replaced or recalibrated by an authorised repair centre.</p> <p>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.</p> <p>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.</p> <p>If neither probe is connected during countdown the analyser's internal ambient temperature will be used as the inlet temperature.</p>
<p>Switching OFF the Analyser</p>	<p>Press  /  button to switch the analyser OFF. The display counts down from 30 with the pump on to clear the sensors with fresh air – If the probe is still connected, make sure analyser and probe are in fresh air.</p> <p>Press  /  if you want to stop the countdown and return to making measurements.</p> <p><b>Note: The analyser will not switch off unless the CO reading is below 20ppm.</b></p>

<p>Backlight &amp; Tasklight</p>	<p>Press  /  to switch the display's backlight and tasklight on and off.</p> <p><b>NOTE: Use of the backlight/tasklight significantly increases the current drain on the batteries.</b></p>
<p>Switching PUMP on / off</p>	<p>The analyser normally operates with the pump on.</p> <p>Press  /  to switch the pump off and on.</p> <p>When the pump is switched off "-PO-" is displayed instead of the O<sub>2</sub>, CO &amp; CO<sub>2</sub> readings. The analyser also displays "PUMP OFF" on the top line approx every 20 seconds.</p> <p><b>NOTES:</b></p> <p><b>1) The pump will not switch off if the CO reading is above 20ppm . This helps to protect the CO sensor from damage.</b></p> <p><b>2) The pump will automatically switch itself off when the rotary switch is set to Menu, Status, Pressure, Tightness or Differential Temperature.</b></p>
<p>Zeroing the pressure sensor</p>	<p>To re-zero the pressure sensor when "Prs" is selected on the dial, press and hold  /  until the top line display shows CAL ZERO.</p>
<p>Printing Data</p>	<p>Press and quickly release  /  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.</p> <p>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).</p>

<p>Storing a set of readings</p>	<p>Press and hold  /  for approx. 2 seconds.</p> <p>The top line briefly displays the log number.</p> <p><b>Note: This STORE function is inhibited in normal operation if the pump is switched off.</b></p>
<p>Using  /  /  Buttons</p>	<p>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.</p>

## 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.

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

#### RATIO Display



<b>NAT GAS</b>	→ Fuel type can be changed via "Menu".
<b>R      0.0008</b>	→ CO/CO <sub>2</sub> ratio.
<b>COp      52</b>	→ Carbon monoxide (ppm).
<b>CO<sub>2</sub>%      6.3</b>	→ Carbon dioxide (%).



Press  /  to print a full combustion test, (or send to PC via optional Bluetooth).

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

#### O<sub>2</sub>/EFF display

<b>O<sub>2</sub>%      9.8</b>	→ Oxygen (%) left after combustion. Should be 20.9% ± 0.1% in fresh air.
<b>TFc      145.1</b>	→ Flue temperature (°C).
<b>TIc      5.4</b>	→ Inlet temperature (°C). Normally set by flue probe during fresh air purge.
<b>EfC      91.3</b>	→ 'Net', 'Gross' or 'Condensing' efficiency (%) can be selected via "Menu".

Press  /  to print a full combustion test, (or send to PC via optional Bluetooth).

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



## AUX display



P	0.00
R	0.0008
COp	52
CO <sub>2</sub> %	6.3

→ The AUX (auxillary) display can be customised via MENU / SCREEN / AUX.

The parameters displayed on lines 1, 2, 3 and 4 can be set by the user.

They remain the AUX parameters until changed by the user.



Press  /  to print a full combustion test, (or send to PC via optional Bluetooth).



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



## Viewing / printing a logged combustion test

Select MENU / REPORT / COMB'N / VIEW



Use ,  and  to select the log number to be viewed.

Use  and  to scroll through the individual readings on lines 2 & 3.

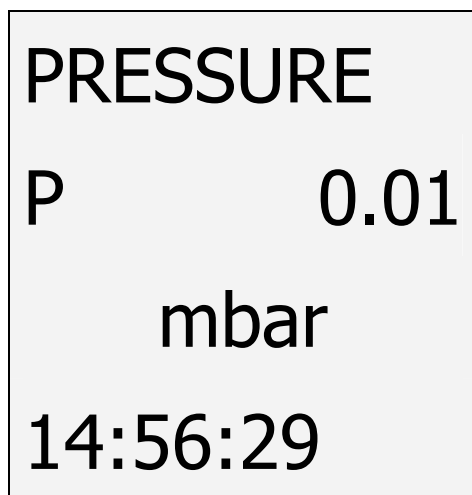
Hold  or  for 2+ seconds to scroll to the next / previous log number.

Press  /  to print the test, (or send to PC via optional Bluetooth).



## 4.2 PRESSURE TEST



Select "Prs". The pump stops automatically. Press  /  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





- Normal response or smoothed (damped) response can be selected via "Menu".
- 'High' or 'Low' resolution readings can be selected via "Menu".
- Pressure units can be selected via "Menu".
- Displays time to enable manually timed tests.



Press  /  to print a full pressure test, (or send to PC via optional Bluetooth).

Hold  /  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 printed.

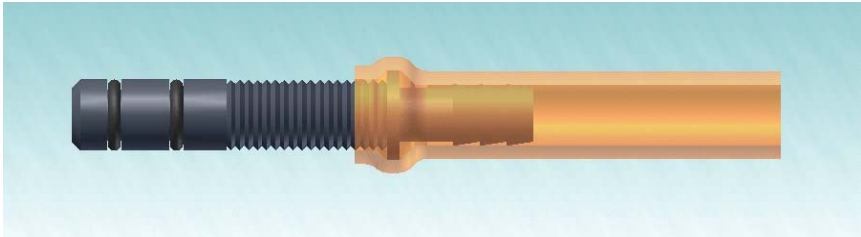
Press  /  to print the test, (or send to PC via optional Bluetooth).

### WARNING

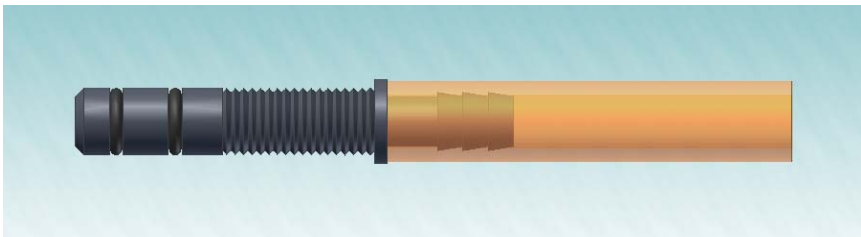
Before using the KANE451 to measure the pressure of a gas/air ratio valve, read the boiler manufacturer's instructions thoroughly. If in doubt contact the boiler manufacturer.

After adjusting a gas/air ratio valve it is essential that the CO, CO<sub>2</sub> and CO/CO<sub>2</sub> ratio readings are within the boiler manufacturer's specified limits.

If using larger bore tubing when performing pressure tests:





Push 'orange' tube over the rim of the spigot to ensure a gas tight seal.





This may not produce a gas tight seal.



## 4.3 LET-BY & TIGHTNESS TESTING


Select "Tightness". The pump stops automatically. Press  /  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:

<b>LET BY</b>		→	The let-by test is automatically stored in the memory.
<b>P1</b>	<b>10.15</b>	→	Pressure at start of let-by test.
<b>P2</b>	<b>10.15</b>	→	Real time pressure reading.
<b>TIME</b>	<b>59</b>	→	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:

<b>STABIL'N</b>		
<b>P1</b>	<b>20.01</b>	→ Real time pressure reading.
	<b>mbar</b>	→ Pressure units.
<b>TIME</b>	<b>59</b>	→ Stabilisation default time is 1 minute. Can be changed via "Menu".

When complete readjust the gas pressure if necessary then press  to start the tightness test:



<b>TIGHTN'S</b>		
<b>P1</b>	<b>20.01</b>	→ Pressure at start of tightness test.
<b>P2</b>	<b>20.01</b>	→ Real time pressure reading.
<b>TIME</b>	<b>119</b>	→ Tightness default time is 2 minutes. Can be changed via "Menu".



When complete the display will show:

<b>LOG</b>	<b>01</b>	→ The tightness test is automatically stored in the memory. See <b>Note:</b> below
<b>P1</b>	<b>20.01</b>	→ Pressure at start of tightness test.
<b>P2</b>	<b>19.98</b>	→ Pressure at end of tightness test.
<b>PRINT</b>		→ Press  to print the complete test.


## Viewing / printing a logged Let-by and Tightness test

Select MENU / REPORT / TIGHTN'S / VIEW

Use  or  to select the log number to be printed.

Press  /  to print the test, (or send to PC via optional Bluetooth).

### Note:



The analyser's memory can store up to 20 tightness tests. Tightness tests are logged automatically therefore the tightness section of the memory will be full after the 20<sup>th</sup> tightness test is complete. Before the 21<sup>st</sup> tightness test can be performed the tightness section of the memory must be cleared. To do this select MENU / REPORT / TIGHTN'S / DEL ALL / YES then press .



## 4.4 DIFFERENTIAL TEMPERATURE

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

### DIFF TEMP display



TEMP		
T1c	60.4	→ Pump stops automatically when dial is moved to Diff Temp.
T2c	55.2	→ Use the T1 connection for the flow temperature sensor.
$\Delta Tc$	5.2	→ Use the T2 connection for the return temperature sensor.
		→ Real time temperature difference.



Press  /  to print a differential temperature test, (or send to PC via optional Bluetooth).

Hold  /  for 2+ seconds to log a differential temperature report.

### Viewing / printing a differential temperature test

Select MENU / REPORT / TEMP / VIEW

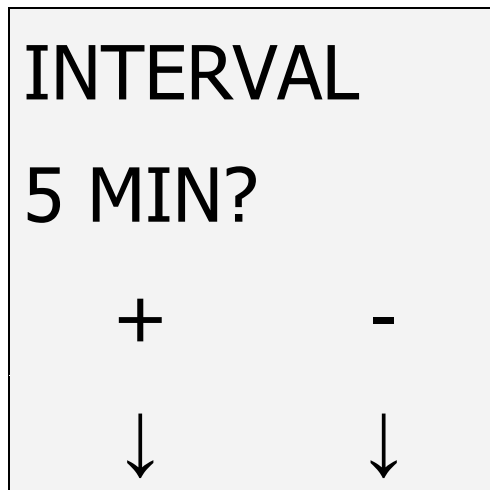
Use  or  to select the log number to be printed.

Press  /  to print the test, (or send to PC via optional Bluetooth).




## 4.5 ROOM CO TESTING

Select "Room CO" to measure and record CO readings. Up to 30 CO tests can be stored in each Log.

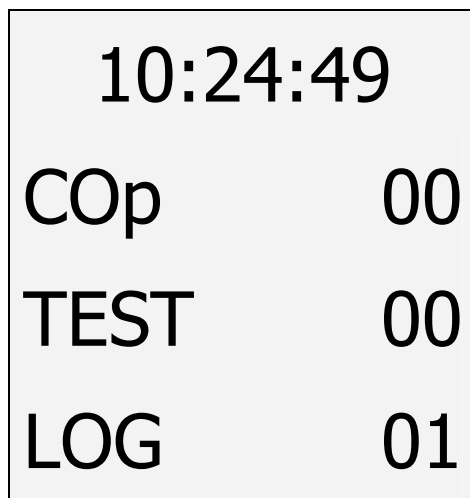
### i) Interval and Start Screen



→ The test interval can be set to 1, 5 or 10 minutes

→ Use the  and  buttons to select the required test interval then press  to start measuring and recording.

### ii) Measure and Record Screen



→ The clock is displayed

→ Real time CO reading (ppm)

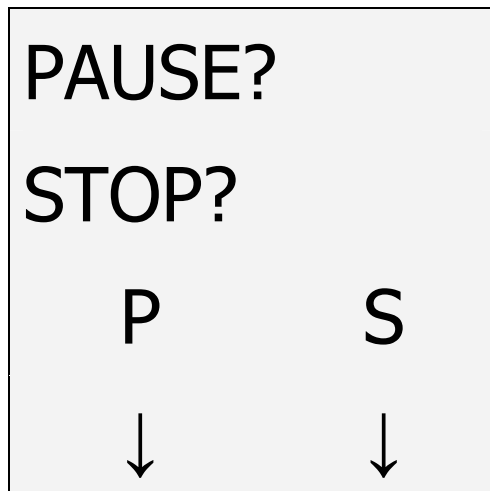
→ Test 00 = initial CO test in series.  
Up to 30 tests can be stored in each Log.


→ The CO test series is automatically stored in the memory as a log number. The analyser's memory can store 30 Logs.


If  or  are pressed the 'Pause / Stop Screen' will be displayed.

If not stopped earlier, the Room CO test will automatically end after the 30<sup>th</sup> test. The display will change to the 'View and Print Screen'.

### iii) Pause / Stop Screen



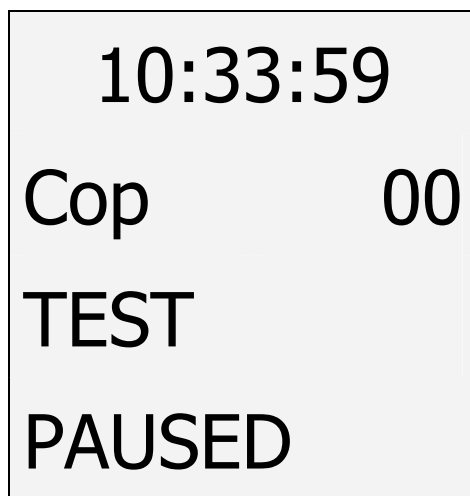
→ Press  to PAUSE recording

→ Press  to STOP recording

If PAUSE is selected the display will change to 'Paused Screen'. In paused mode the 'live' CO readings are displayed but not recorded.

If STOP is selected the CO test series is ended. The display changes to the 'View and Print Screen'.

### iv) Paused Screen



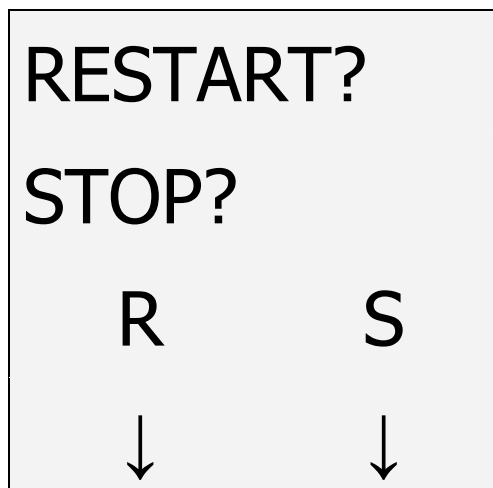
→ The clock is displayed

→ Real time CO reading (ppm)


Recordings of the CO test series is paused until the user restarts it.

If  or  are pressed the 'Restart / Stop Screen' will be displayed.

## v) Restart / Stop Screen



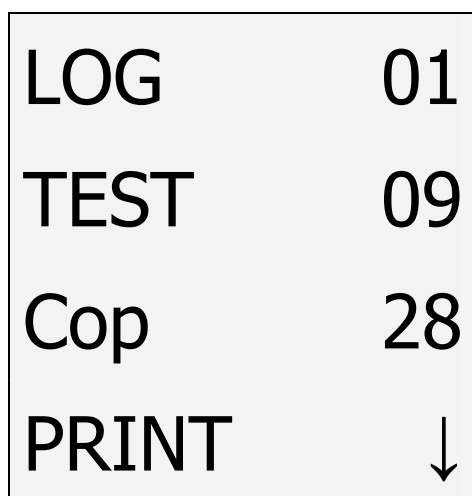
→ Press  to RESTART recording

→ Press  to STOP recording


If RESTART is selected the display recerts to the 'Measure and Record Screen'. CO readings are displayed and recorded at the interval originally selected.

If STOP is selected the CO test series is ended. The display changes to the 'View and Print Screen'.



## vi) View and Print Screen



The CO test readings were automatically stored in the memory as this Log number.



→ To scroll through the CO reading for each test in this LOG press  quickly.



→ This is the CO reading for test 09.


When completed the log can be printed immediately by pressing  /  for 2 seconds.

## Viewing / printing a logged Room CO test

Select MENU / REPORT / ROOM CO / VIEW

Use  or  to select the log number to be printed.

Press  /  to print the test, (or send to PC via optional Bluetooth).

**NOTE:** The analyser's memory can store up to 30 Room CO Logs. Room CO tests are logged automatically, therefore the Room CO section of the memory will be full after the 30<sup>th</sup> Room CO Log is complete. Before the 31<sup>st</sup> Room CO Log can be performed the Room CO section of the memory must be cleared. To do this select MENU / REPORT / ROOM CO / DEL ALL / YES then press  .

## 4.6 KANE451 PRINTOUTS

**KANE451 v 1.04B**  
YOUR COMPANY NAME &  
PHONE NUMBER HERE

SERIAL NO. 123456789

DATE 31/01/11  
TIME 12:00:08

**COMBUSTION**

.....

FUEL		NAT
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.

.....

**KANE451 v 1.04B**  
YOUR COMPANY NAME &  
PHONE NUMBER HERE

SERIAL NO. 123456789

**PRESSURE**

TIME 12:56 31/01/11

PRS mbar -0.037

.....

Customer

.....

Appliance

.....

Ref.

.....

**KANE451 v 1.04B**  
YOUR COMPANY NAME &  
PHONE NUMBER HERE

SERIAL NO. 123456789

**DIFF TEMP**

TIME 12:10 31/01/11

T1 °C 60.1  
T2 °C 47.0  
ΔT °C 13.1

.....

Customer

.....

Appliance

.....

Ref.

.....

**KANE451 v 1.04B**  
YOUR COMPANY NAME &  
PHONE NUMBER HERE

SERIAL NO. 123456789

**ROOM CO TEST**

LOG 01  
DATE 31/01/11

TIME	COppm
10:22:08	00
10:27:08	00
10:32:08	00
<b>Gap = readings paused</b>	
10:42:08	05
10:47:08	08
10:52:08	13
10:57:08	28
11:02:08	47
11:07:08	88
11:12:08	152
<b>Up to 30 tests per Log</b>	
COppm MAXIMUM	152

.....

Customer

.....

Appliance

.....

Ref.

.....

**KANE451 v 1.04B**  
YOUR COMPANY NAME &  
PHONE NUMBER HERE

SERIAL NO. 123456789

LOG 04  
TIME 11:53 31/01/11

**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
ΔPRS	mbar	-0.02
STABIL'N	MINS	1:00
TIGHTN'S	MINS	2:00

.....

Customer

.....

Appliance

.....

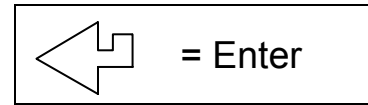
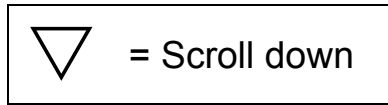
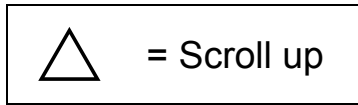
Ref.

.....



## 5. USING THE MENU

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









MAIN MENU	SUB MENU	OPTIONS / COMMENTS
SETUP	SET FUEL	NAT GAS, L OIL, PROPANE, BUTANE, LPG, PELLETS (wood)
	N ← C → G	Ef(C) = condensing boiler nett efficiency Ef(N) = nett efficiency, Ef(G) = gross efficiency
	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
	RESOLVE	LOW = e.g. 0.01mBar resolution. HIGH = displays to an extra decimal place
	PS UNITS	mBar, mmH <sub>2</sub> O, Pa, kPa, PSI, mmHg, hPa, InH <sub>2</sub> 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.
BLUE COM*		

\* Bluetooth is a factory fitted optional extra.

**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 KANE451 AS A THERMOMETER OR PRESSURE METER

With the KANE451 switched off, press and hold down the  /  button and then press and release  / . Release  /  after MANO\_MOD is displayed on top line.

The KANE451 will now operate as a fixed display thermometer/pressure meter with the pump off and inhibited. The readings can be printed but not stored.

The display will show:

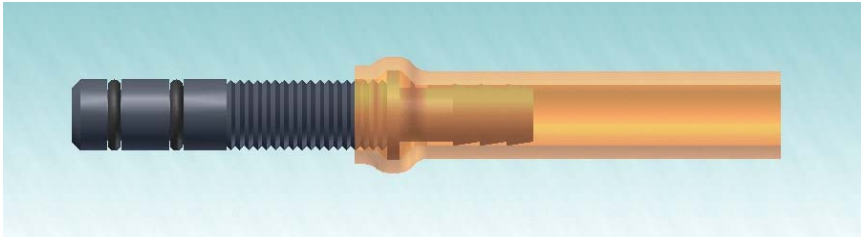
P	0.00	→ Real time pressure reading.
T1	21.3	→ Use the T1 connection for the flow temperature sensor.
T2	21.3	→ Use the T2 connection for the return temperature sensor.
$\Delta T$	0.0	→ Real time temperature difference.

The standard printout for this mode is as follows:

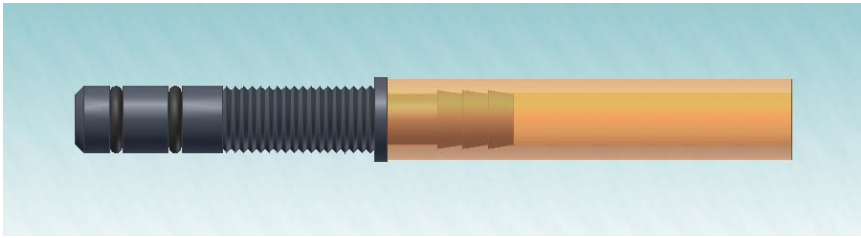
<b>K451 1.0</b>		
YOUR COMPANY NAME & PHONE NUMBER HERE		
DATE	15/05/07	
TIME	13:00:47	
.....		
T1	°C	21.3
T2	°C	21.3
$\Delta T$	°C	0.0
PRS	mbar	0.00
.....		
Ref.		
.....		

Exit 'Mano-Mod' by switching the KANE451 off. The 'Menu' and 'Tighness' positions still operate normally in 'Mano-Mod'

If using larger bore tubing when performing pressure tests:



Push 'orange' tube over the rim of the spigot to ensure a gas tight seal.



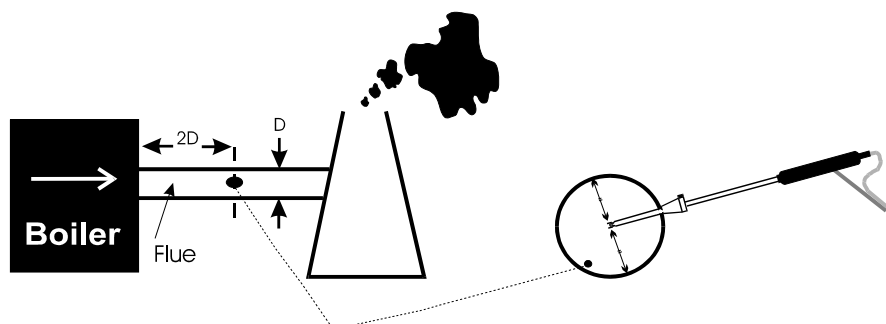
This may not produce a gas tight seal.

## 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°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  /  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
<ul style="list-style-type: none"> <li>• Oxygen too high</li> <li>• CO<sub>2</sub> too low</li> </ul>	<ul style="list-style-type: none"> <li>• Air leaking into probe, tubing, water trap, connectors or internal to analyser.</li> </ul>
<ul style="list-style-type: none"> <li>• CO reading (- - -)</li> </ul>	<ul style="list-style-type: none"> <li>• Analyser was stored in a cold environment and is not at normal working temperature.</li> <li>• CO sensor needs replacing.</li> </ul>
<ul style="list-style-type: none"> <li>• Batteries not holding charge</li> <li>• Analyser not running on mains adapter.</li> </ul>	<ul style="list-style-type: none"> <li>• Batteries exhausted.</li> <li>• AC charger not giving correct output.</li> <li>• Fuse blown in charger plug.</li> </ul>
<ul style="list-style-type: none"> <li>• Analyser does not respond to flue gas</li> </ul>	<ul style="list-style-type: none"> <li>• Particle filter blocked.</li> <li>• Probe or tubing blocked.</li> <li>• Pump not working or damaged with contaminants.</li> </ul>
<ul style="list-style-type: none"> <li>• Net temperature or Efficiency calculation incorrect.</li> </ul>	<ul style="list-style-type: none"> <li>• Ambient temperature set wrong during Automatic Calibration.</li> </ul>
<ul style="list-style-type: none"> <li>• Flue temperature readings erratic</li> </ul>	<ul style="list-style-type: none"> <li>• Temperature plug reversed in socket.</li> <li>• Faulty connection or break in cable or plug.</li> </ul>
<ul style="list-style-type: none"> <li>• T flue or T nett displays (-OC-)</li> </ul>	<ul style="list-style-type: none"> <li>• Probe not connected.</li> <li>• Faulty connection or break in cable or plug.</li> </ul>
<ul style="list-style-type: none"> <li>• Ratio, EFF, X-Air all display (- - -)</li> </ul>	<ul style="list-style-type: none"> <li>• CO<sub>2</sub> reading is below 2%.</li> </ul>

Fault symptom	Causes / Solutions
<ul style="list-style-type: none"> <li>Analysers just continually beeps</li> </ul>	<ul style="list-style-type: none"> <li>Turn dial back to MENU and press ENTER</li> <li>Turn dial back to Tightness and press ENTER</li> </ul>
<ul style="list-style-type: none"> <li>BAT only shows 65 with fully charged NiMH batteries fitted</li> </ul>	<ul style="list-style-type: none"> <li>This is not a problem and is to be expected. NiMH batteries only deliver 1.25 V per cell whereas Alkalines deliver 1.5 V per cell. Fresh alkalines give a BAT value of 90 or so.</li> </ul>

## 9. ANALYSER SPECIFICATION

(NOTE: MAY BE SUBJECT TO CHANGE)

Parameter	Range	Resolution	Accuracy
<b>Temp Measurement</b>			
Flue Temperature	0-600°C	0.1°C	±2.0°C ±0.3% reading
Inlet Temperature (Internal sensor)	0-50°C	0.1°C	±1.0°C ±0.3% reading
Inlet Temperature (External sensor)	0-600°C	0.1°C	±2.0°C ±0.3% reading
<b>Gas Measurement</b>			
Oxygen <sup>*2</sup>	0-21%	0.1%	±0.2% <sup>*1</sup>
Carbon monoxide	0-5,000ppm nom 10,000ppm max	1ppm	±10ppm <sup>*1</sup> or ±5% reading whichever is greater
Carbon dioxide	0-20%	0.1%	±0.2% reading
Efficiency (Net or Gross) <sup>*2</sup>	0-99.9%	0.1%	±1.0% reading
Efficiency High (C) <sup>*2</sup>	0-119.9%	0.1%	±1.0% reading
Excess Air <sup>*2</sup>	0-250%	0.1%	±0.2% reading
CO/CO <sub>2</sub> ratio <sup>*2</sup>	0-0.999	0.0001	±5% reading
<b>Pressure (differential)</b>			
Nominal range ±80mBar	±0.2 mBar	0.001 mBar	±0.005 mBar
Maximum over range without damage to sensor is ±400mBar	±1 mBar  ±80 mBar		±0.03 mBar  ±3% of reading
<b>Pre-programmed Fuels</b>	Natural gas, Propane, Butane, LPG, Light Oils (28/35 sec), Wood Pellets		
<b>Storage Capacity</b>	99 Combustion tests 20 Pressure tests 20 Tightness tests 20 Temperature tests 20 Room CO tests		

\*1 Using dry gases at STP

\*2 Calculated



<b>Ambient Operating Range</b>	0°C to +40°C 10% to 90% RH non-condensing
<b>Battery Type / Life</b>	4 AA cells >8 hours using Alkaline AA cells
<b>Chargers (optional)</b>	220v charger, for NiMH batteries only 12v in vehicle charger, for NiMH batteries only
<b>Dimensions</b> Weight: Handset: Probe:	0.8kg handset with protective cover 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

## 10. 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:

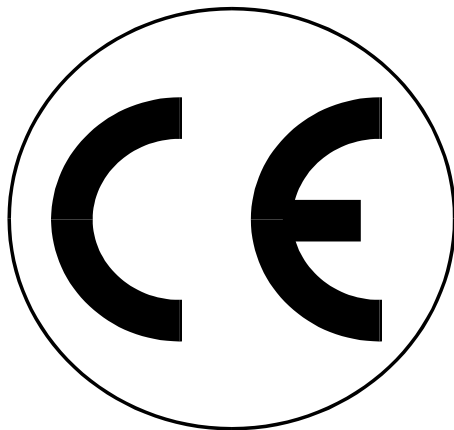
Use the normal start up sequence in the location where the analyser will be used.

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 (October 2011) 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 : 2001

EN 61000-6-1 : 2001

and is certified to be compliant

Specification EC/EMC/KI/K451 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.

# 11. EN 50379 REGULATED INSTRUCTIONS

EN 50379 Section 4.3.2 “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 KANE451 is designed to be compliant with EN 50379 Part 2 and Part 3.

b) The KANE451 is intended to be used with the following fuels:

Natural gas

Light oil (28/35 sec)

Propane

LPG

Wood pellets

Butane

c) The KANE451 is designed for use the 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 battery charger supplied with the KANE451 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 0.3 A. The chargers output voltage is 9 V dc at a maximum of 0.66A.

The charger has no user serviceable components.

Only a correctly specified and rated charger must be used with the KANE451.

d) The KANE451 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 1 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) The recommended minimum time required to perform one checking procedure in EN 50379 Part 3 is 110 seconds as described in section f) above.

- h) Some commonly occurring materials, vapour or gases may affect the operation of the KANE451 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 KANE451 is fitted with an electrochemical CO sensor and an infra-red CO<sub>2</sub> sensor which have an expected life of more than 2 years and 5 years respectively. 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 KANE451 is designed to operate at ambient temperatures in the range 0°C to +45°C with relative humidity of 10% to 90% non-condensing. 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 KANE451 has an initial start up delay following switch on of approx. 90 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 KANE451 must have its calibration checked on an annual basis and be issued with a traceable Certificate of Calibration.

The sensors within the KANE451 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 2 of this manual.

m) **WARNING!**

When using a KANE451 to test an appliance a full visual inspection of the appliance, in accordance with its manufacturer's instructions, must also be carried out.

## 12. CLEANING

This product can be cleaned using a damp lint free cloth and a small amount of non-abrasive detergent. Take care to avoid moisture entering the sensor's grill and after cleaning leave the product in a warm dry place to allow any surface dampness to evaporate. Under no circumstance should any solvent cleaner be used as this may cause damage to the plastic case, display and sensor.

## 13. ANALYSER ANNUAL RECALIBRATION AND SERVICE

The analyser should be re-calibrated and serviced annually to counter 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](http://www.kane.co.uk) for details) you have the opportunity to extend the warranty on your analyser to 5 years.

## 14. RETURNING YOUR ANALYSER TO KANE

When returning your KANE451, 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 an analyser with its probe, please send them back in their carry bag. The bag should be put into a suitable sized box (approx 45cm x 20cm x 23cm).

When returning just an analyser, use a container the size of a shoe box and ensure that you pack out the empty space (newspaper will do for this).

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

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

### 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 by Fed Ex "Next Day Service".

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

Tel: 01942 873434  
Fax: 01942 873558  
Email: [nservice@kane.co.uk](mailto:nservice@kane.co.uk)

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

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



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



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







## Appendix 1 - Main Parameter:

Here are the legends used and what they mean:

- O<sub>2</sub>** : Oxygen (Calculated) reading in percentage (%)
- CO** : Carbon monoxide (Measured) reading displayed in ppm (parts per million). If ' - - - ' is displayed there is a fault with the CO sensor or the instrument has not set to zero correctly. Switch off instrument and try again.
- CO<sub>2</sub>** : Carbon dioxide (Measured) reading in percentage (%).
- TF** : Temperature measured by the flue gas probe in centigrade (°C). It displays ' - **OC** - ' if the flue probe is disconnected or faulty.
- TI** : 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. It displays ' - **OC** - ' if the flue probe is not connected or broken.
- EFF** : Combustion efficiency calculation displayed in percentage either as Gross Ef(G) or Nett Ef(N) or Condensing Nett Ef(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, ' - - - ' is displayed while in fresh air.
- Loss** : Losses calculated from oxygen and type of fuel. Displays reading during a combustion test. ' - - - ' is displayed while in fresh air.
- X - AIR** : Excess air calculated from the calculated oxygen and type of fuel. Displays reading during a combustion test. ' - - - ' is displayed while in fresh air.
- CO/CO<sub>2</sub>**: CO/CO<sub>2</sub> Ratio: measured CO (ppm) divided by (CO<sub>2</sub> (%) x 10,000).
- PRS** : Pressure reading, either single point or differential.

- BAT :** Displays the Battery power available.  
 Replace alkaline batteries if reading is less than 10  
 Recharge NiMH batteries if reading is less than 20  
 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.***

- FULL :** The maximum number of tests have been stored in the memory. To delete the stored memory, Select Reports then select the tests to be deleted (see Page 23).

#### **SYMBOLS** used on the display

P	Pressure
R	CO/CO <sub>2</sub>
$\lambda$	Excess Air
$\triangle$	Loss %: 100% minus loss % = efficiency %
TF	Flue temperature
TI	Inlet temperature
$\Delta T$	Nett temperature
EfG	Gross efficiency
EfN	Nett efficiency
EfC	Condensing efficiency
- PO -	Pump off
' - - - '	Calculated oxygen greater than 18% so calculation is disabled
-OC-	Open circuit temperature input
CAL	Number of days left before recalibration is due

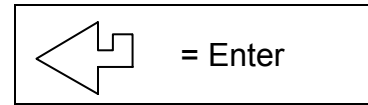
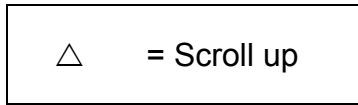


# **ADDENDUM**

## **Instructions for KANE451 analysers fitted with optional Nitric Oxide (NO) sensors**

# DISPLAYING THE NO READING

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






The MENU main structure is as follows:



MAIN MENU	SUB MENU	OPTIONS / COMMENTS
SETUP		
PRESSURE		
REPORT		
SCREEN	CONTRAST	
	AUX	Enables users to customise the parameters on the AUX display: LINE 1, LINE 2, LINE 3, LINE 4, EXIT
	HEADER	
	EXIT	
SERVICE		
BLUE COM*		


\* Bluetooth is a factory fitted optional extra.

**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.

Use  or  to navigate to the main menu option SCREEN.


Press .

Use  or  to navigate to the sub menu option **AUX**.


Press .

The display will show

<b>AUX</b>	
<b>LINE</b>	<b>1</b>

Press  and a third line will appear.

Use  or  to navigate to the desired parameter to be displayed on line 1.

Press  to select the parameter for Line 1 and repeat the process to select the display parameter for all four lines and then EXIT

Rotate the dial from MENU to AUX to display all your chosen settings.

## **PRINTING and STORING**

The NO reading are printed and stored in the same way as the other combustion gas readings. On the printouts the NO readings appear directly below the flue CO readings.

Note the rotor needs to be in the AUX, O<sub>2</sub>/Eff or Ratio positions to print or store flue combustion readings

# NITRIC OXIDE SENSOR SPECIFICATION

Gas Measurement	Resolution	Accuracy	Range
Nitric Oxide (NO) (low range)	1 ppm	$\pm 2\text{ppm} < 30\text{ppm}^{*1}$ $\pm 5\text{ ppm} > 30\text{ppm}$	0 to 100 ppm
Nitric Oxide (NO) (high range)	1ppm	$\pm 5\text{ppm} < 100\text{ppm}^{*1}$ $\pm 5\% \text{ reading}$ $> 100\text{ppm}$	0 to 1000 ppm

\*1 Using dry gases at STP



## 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	
<i>Note: Proof of Purchase may be required for warranty claims.</i>	
Date Purchased as numbers (05.01.10):	
Purchased From:	
Model Number:	KANE451
Product Serial Number:	



Why did you buy a Kane Product?

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

What brand was your previous analyser?

How did you hear about Kane?

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

Which do you read most often?

	Often	Sometimes	Hardly Ever
Registered Gas Engineer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gas Installer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P.H.P.I.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P.H.A.M. News	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heating Ventilating & Plumbing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heating & Plumbing Monthly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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](http://www.kane.co.uk)**

or complete, detach  
and return the  
Product Registration page.