KANE455

Flue Gas Analyser
with direct CO_2 measurement

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benchmark
The code of practice for the installation, commissioning & servicing of gas fires and wall heaters

CONTENTS

KANE455 Overview

The **KANE455** Combustion Analyser measures carbon dioxide (CO_2), carbon monoxide (CO), differential temperature and differential pressure. The direct measurement of CO_2 is achieved using a Kane designed infra-red sensing system.

CO_2 is set to zero in fresh air automatically after the initial countdown.

If "RESET CO2 ZERO" is indicated ensure that the unit is in fresh air before pressing the button with an "Enter" symbol.

It calculates oxygen (O_2), CO/CO_2 ratio, losses, combustion efficiency (Nett, Gross or Condensing) & excess air.

The KANE455 Combustion Analyser can also measure CO 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 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
- 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 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

Socket for gas leak detector

Menu controls
Scroll up/down

Enter

Function buttons x 4

Particle Filter

Rotary Switch

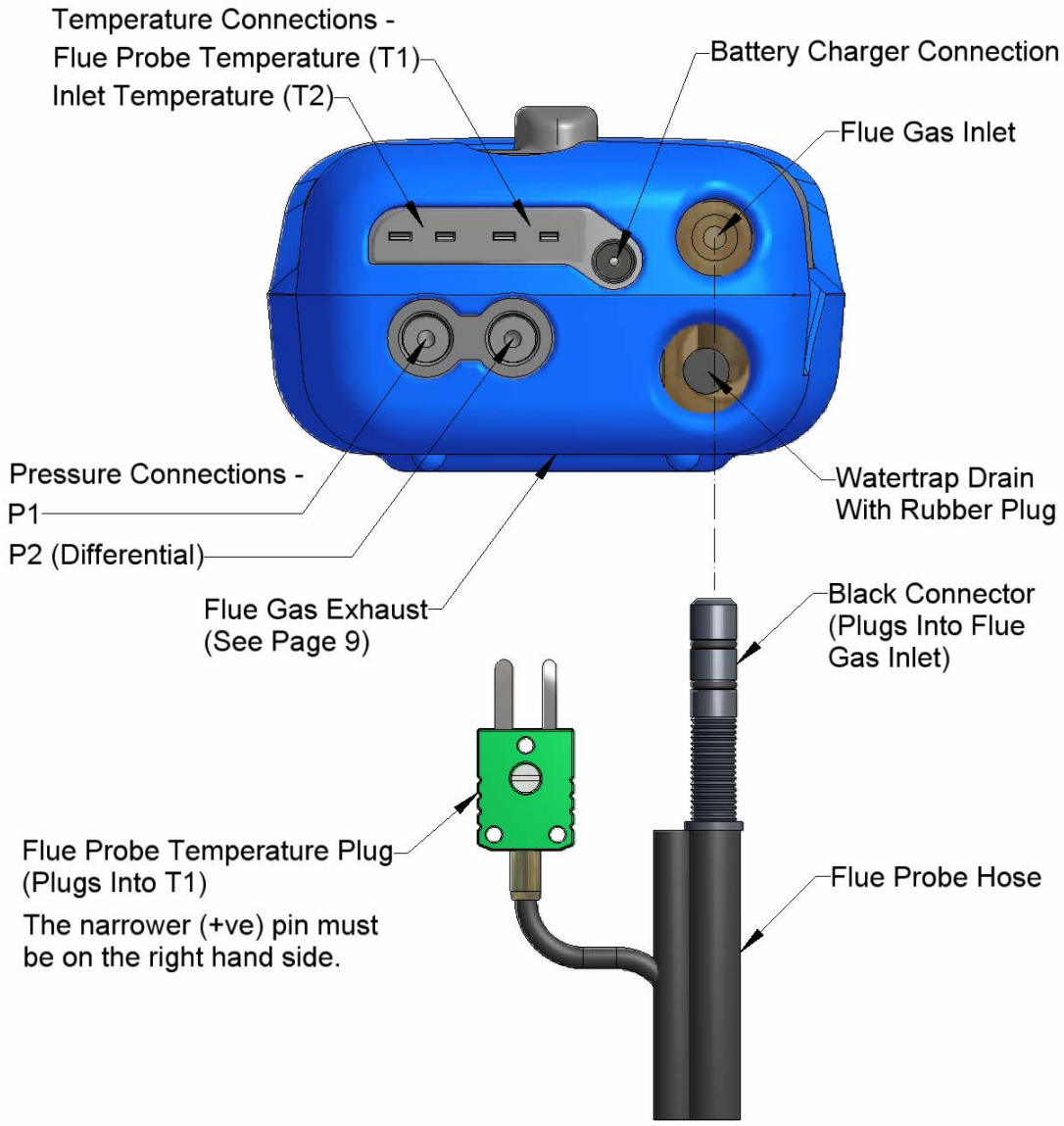
Battery Compartment (behind rubber sleeve)

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 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 KANE455 on.
The charger must then be connected and switched on.
When charging, the red Battery Charging Indicator will illuminate.
Now switch the KANE455 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, unplug its rubber stopper 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

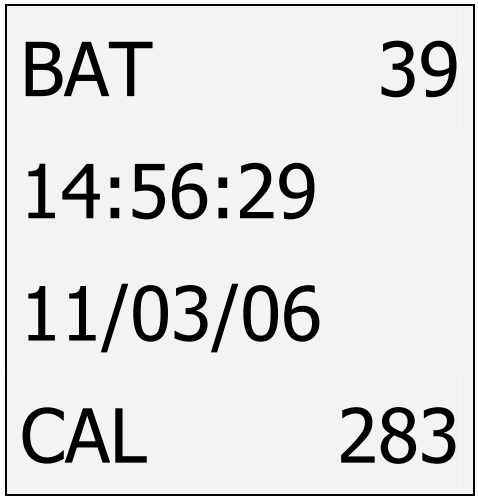
Position the flue probe in fresh air, then press On/Off / ⏻. The analyser's pump starts and the analyser auto-calibrates for approximately 60 seconds. When complete:

Select "Ratio" on the dial. *In fresh air the CO reading should be zero.*
Select "O_2/Eff" on the dial. *In fresh air the O_2 reading should be 20.9% $\pm$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 Send / 🖨.
To perform a manual CO_2 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:



→ Replace alkaline batteries if less than 10. Recharge NiMH batteries if less than 20.

→ Current time. Can be re-set via the “Menu”.

→ Current date. Can be re-set via the “Menu”.

→ 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  /  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. 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  /  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. Press  /  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 & Tasklight	Press  /  to switch the display's backlight and tasklight on and off. **NOTE: Use of the backlight/tasklight significantly increases the current drain on the batteries.**
Switching PUMP on / off	The analyser normally operates with the pump on. Press  /  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  /  until the top line display shows CAL ZERO.
Printing Data	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).

Storing a set of readings	Press and hold Send /  for approx. 2 seconds. The top line briefly displays 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.

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

RATIO Display

NAT GAS	→	Defaults to natural gas on start-up. Can be changed via "Menu".
R 0.0008	→	CO/CO_2 ratio.
CO 52	→	Carbon monoxide (ppm).
CO_2 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.

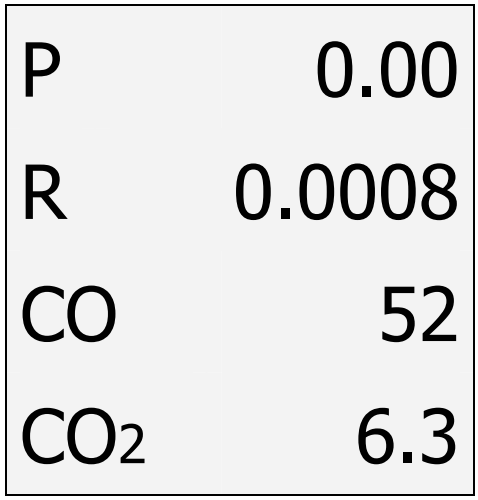
O2/EFF display

O_2 9.8	→	Oxygen (%) left after combustion. Should be 20.9% $\pm$0.1% in fresh air.
TF 145.1	→	Flue temperature (^oC).
TI 5.4	→	Inlet temperature (^oC). 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



→ The default AUX (auxillary) display is shown including pressure.

The AUX display can be customised via MENU / SCREEN / AUX.

The parameters on lines 1, 2, 3 and 4 can be set independently.

They remain the AUX parameters until changed 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.

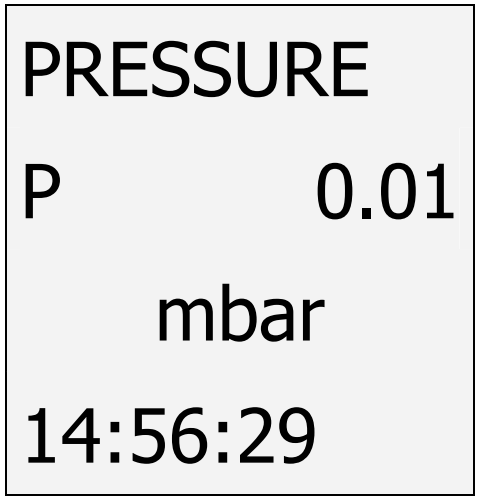
Use △ and ▽ to scroll through the individual readings on line 2 & 3.

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

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



→ Defaults to smoothing off on start-up. Can be changed via “Menu”.

→ Defaults to low resolution on start-up. Can be changed via “Menu”.

→ Defaults to mBar on start-up. Can be changed via “Menu”.

→ Displays time to enable manually timed test.

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 pressure test

Select MENU / REPORT / PRESSURE / VIEW

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

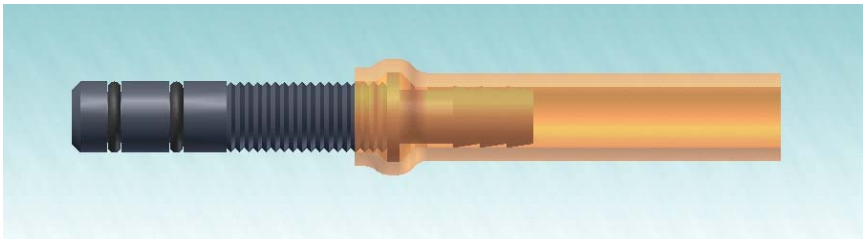
Press Send /  to print the test (also sends to PC if Bluetooth fitted).

<u>WARNING</u>

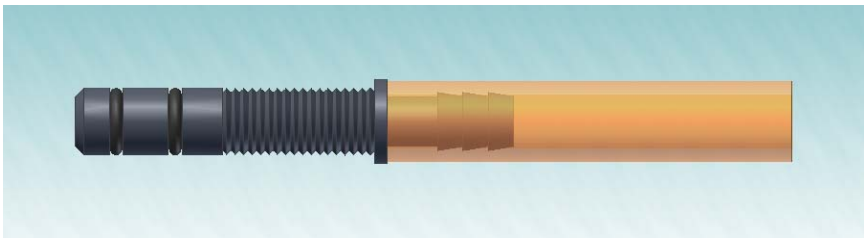
Before using the KANE455 to measure the pressure of a gas/air ratio valve, read the boiler manufacturer’s instructions thoroughly. If in doubt contact the boiler manufacturer.

After adjusting a gas/air ratio valve it is essential that the CO, CO2 and CO/CO2 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 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 complete press ⇦ to start the tightness test:

TIGHTN'S	
P1	20.01
P2	20.01
TIME	119

→ Pressure at start of tightness test.

→ Real time pressure reading.

→ Tightness default time is 2 minutes. Can be changed via "Menu".

When complete the display will show:

LOG	01
P1	20.01
P2	19.98
ΔP	0.03

→ The tightness test is automatically stored in the memory.

→ Pressure at start of tightness test.

→ Pressure at end of tightness test.

→ Pressure drop during tightness test.

To print a tightness test, select MENU / REPORT / TIGHTN'S / VIEW.

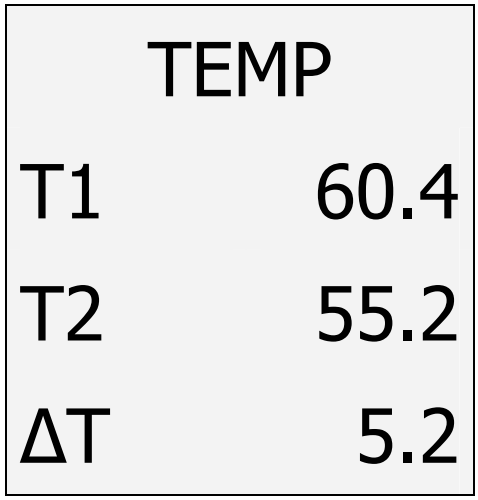
Use △ ▽ to select the log number to be printed.

Press Send /  to print the tightness 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



→ Pump stops automatically when dial is moved to Diff Temp.

→ Use the T1 connection for the flow temperature sensor.

→ Use the T2 connection for the return temperature sensor.

→ 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
CO	00
TEST	00
LOG	01

→ Real time CO reading (ppm).

→ Test 00 = initial reading.
Test 15 = final reading.

→ The room CO test is automatically stored in the memory. The log number for the test is displayed.

To print a room CO test select MENU / REPORT / ROOM CO / VIEW

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

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

NOTE: To abort a room CO test, press Pump /  for 1 second.

4.6 KANE455 PRINTOUTS

K455 1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

TEST

DATE		15/05/07
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.

.....

K455 1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

PRESSURE

TIME	12:56	15/05/07
PRS	mbar	-0.037

.....
Customer

.....
Appliance

.....
Ref.

.....

K455 1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

ROOM CO TEST
.....

LOG		01
TIME	12:50	15/05/07

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.

.....

K455 1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

DIFF TEMP

LOG		03
TIME	12:10	15/05/07
T1	°C	60.1
T2	°C	47.0
ΔT	°C	13.1

.....
Customer

.....
Appliance

.....
Ref.

.....

K455 1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

LOG		04
TIME	11:53	15/05/07

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

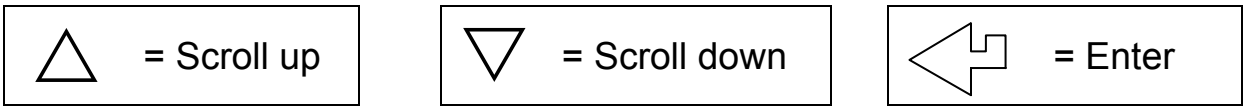
.....
Appliance

.....
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 **KANE455 always defaults to Nat Gas on start-up**
	N ← C → G	Ef(C) = condensing boilers Ef(N) = nett efficiency, Ef(G) = gross efficiency, **KANE455 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 **KANE455 always defaults to normal response on start-up**
	RESOLVE	LOW = e.g. 0.01mBar resolution. HIGH = displays to an extra decimal place. **KANE455 always defaults to low resolution on start-up**
	PS UNITS	mBar, mmH_2O, Pa, kPa, PSI, mmHg, hPa, InH_2O **KANE455 always defaults to mBar on start-up**
	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 KANE455 AS A THERMOMETER OR PRESSURE METER

With the KANE455 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 KANE455 will now operate as a fixed display thermometer/pressure meter with the pump off and inhibited.

The display will show:

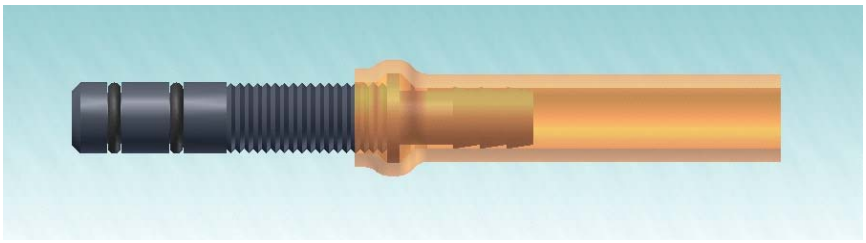
P	0.00	→	Real time pressure reading.
T1	21.3	→	Use the T1 connection for the flow temperature sensor.
T2	21.3	→	Use the T2 connection for the return temperature sensor.
ΔT	0.0	→	Real time temperature difference.

The rotor display indications will now be locked apart from MENU. Readings can be printed but not stored. Exit this mode by switching the KANE455 off.

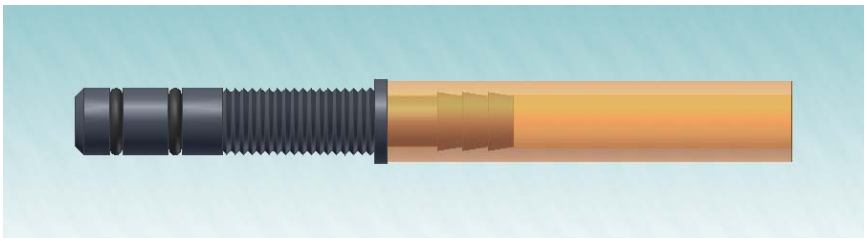
The standard printout for this mode is as follows:

```
K455      1.0
YOUR COMPANY NAME &
PHONE NUMBER HERE

DATE          15/05/07
TIME          13:00:47

.....

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

PRS           mbar    0.00
.....
Ref.

.....
```

If using larger bore tubing when performing pressure tests:



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



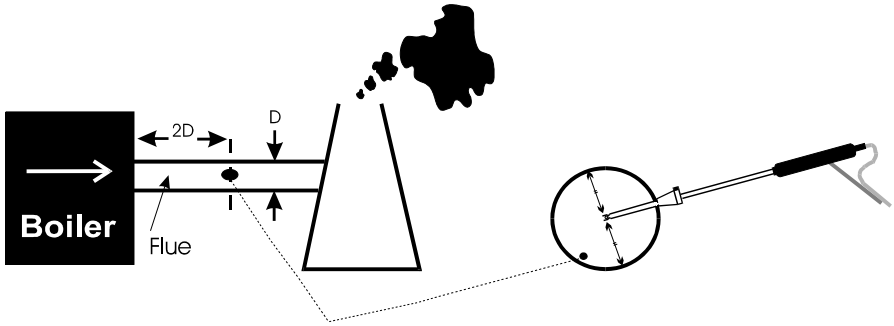
This may not produce a gas tight seal.

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 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.
• CO reading (- - - -)	• Analyser was stored in a cold environment and is not at normal working temperature. • CO sensor needs replacing. • Pump is switched off
• 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, EFF display (- - - -)	• CO_2 reading is below 2%.

Fault symptom	Causes / Solutions
• Analyser just continually beeps	• Turn dial back to MENU and press ENTER • Turn dial back to Tightness 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 give a BAT value of 90 or so.

9. ANALYSER ANNUAL RECALIBRATION AND SERVICE

Although sensor life is typically more than five years, 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* 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°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
Gas Measurement			
Oxygen [*2]	0-21%	0.1%	±0.2% [*1]
Carbon monoxide	0-2,000ppm nom 4,000ppm max for 15 mins	1ppm	±10ppm <100ppm [*1] ±5% reading
Carbon dioxide	0-30%	0.1%	±0.3% reading
Efficiency [*2]	0-99.9%	0.1%	±1.0% reading
Excess Air [*2]	0-250%	0.1%	±0.2% reading
CO/CO_2 ratio [*2]	0-0.999	0.0001	±5% reading
Pressure (differential)			
Nominal range ±80mBar	±0.2 mBar	0.001 mBar	±0.005 mBar
Maximum over range without damage to sensor is ±400mBar	±1 mBar		±0.03 mBar
	±80 mBar		±3% of reading
Pre-programmed Fuels	Natural gas, Propane, Butane, LPG Light Oils (28/35 sec)		
Storage Capacity	99 Combustion tests 20 Pressure tests 20 Tightness tests 20 Temperature tests 20 Room CO tests		

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

Ambient Operating Range	0^{o}C to +40^{o}C 10% to 90% RH non-condensing
Battery Type / Life	4 AA cells >8 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 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

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:

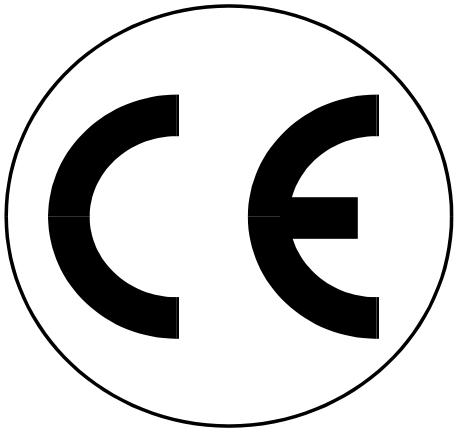
Use the normal start up sequence in the location where the analyser will be used.

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 (May 2007) 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/K455 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:

O_2 : Oxygen (Calculated) 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.

CO_2 : Carbon dioxide. This is only displayed when a combustion test is being carried out. '**-O>-**' is displayed while in fresh air.

T F: Temperature measured by the flue gas probe in centigrade (^oC). It displays '**- OC -'** if the flue probe is disconnected.

T I: 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, '**-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 calculated oxygen. 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 (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.

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

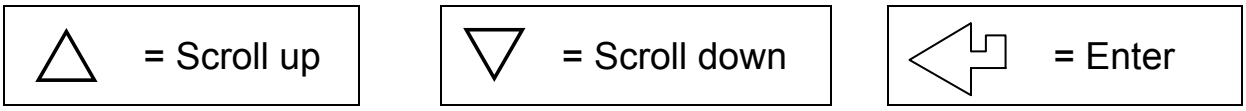
P	Pressure
R	CO/CO_2
λ	Excess Air
◿	Loss %: 100% minus loss % = efficiency %
TF	Flue temperature
TI	Inlet temperature
ΔT	Nett temperature
EfG	Gross efficiency
EfN	Nett efficiency
EfC	Condensing efficiency
- PO -	Pump off
-O>-	Calculated oxygen greater than 18% so calculation is disabled
-OC-	Open circuit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

ADDENDUM

Instructions for KANE455 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

AUX
LINE 1

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_2/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	± 2ppm <30ppm*1 ±5 ppm > 30ppm	0 to 100 ppm
Nitric Oxide (NO) (high range)	1ppm	±5ppm <100ppm*1 ±5% reading >100ppm	0 to 1000 ppm

*1 Using dry gases at STP

Thank you for buying this instrument.

Before use,
please register on our website
www.kane.co.uk