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# KANE456

## Flue Gas Analyser
## with direct $CO_2$ measurement


Stock No: 19738 March 2016

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**Page No:**

# KANE456 OVERVIEW

The KANE456 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. Below 1% $CO_2$ the readings of $CO_2$ are displayed to two decimal places

$CO_2$ is set to zero in fresh air automatically after the initial countdown. The countdown varies between 90 and 30 seconds dependent on ambient temperature.

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 ($O_2$), $CO/CO_2$ ratio, losses, combustion efficiency (Net or Condensing Gross).

The KANE456 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.

A structured Commissioning Test has been included for the installation of boilers.

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.

A low flow detection system warns of low flow and switches the pump off. This also helps to prevent water ingress from overfilled water traps.
Its LCD display is protected with a toughened screen.

The large display shows 6 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:

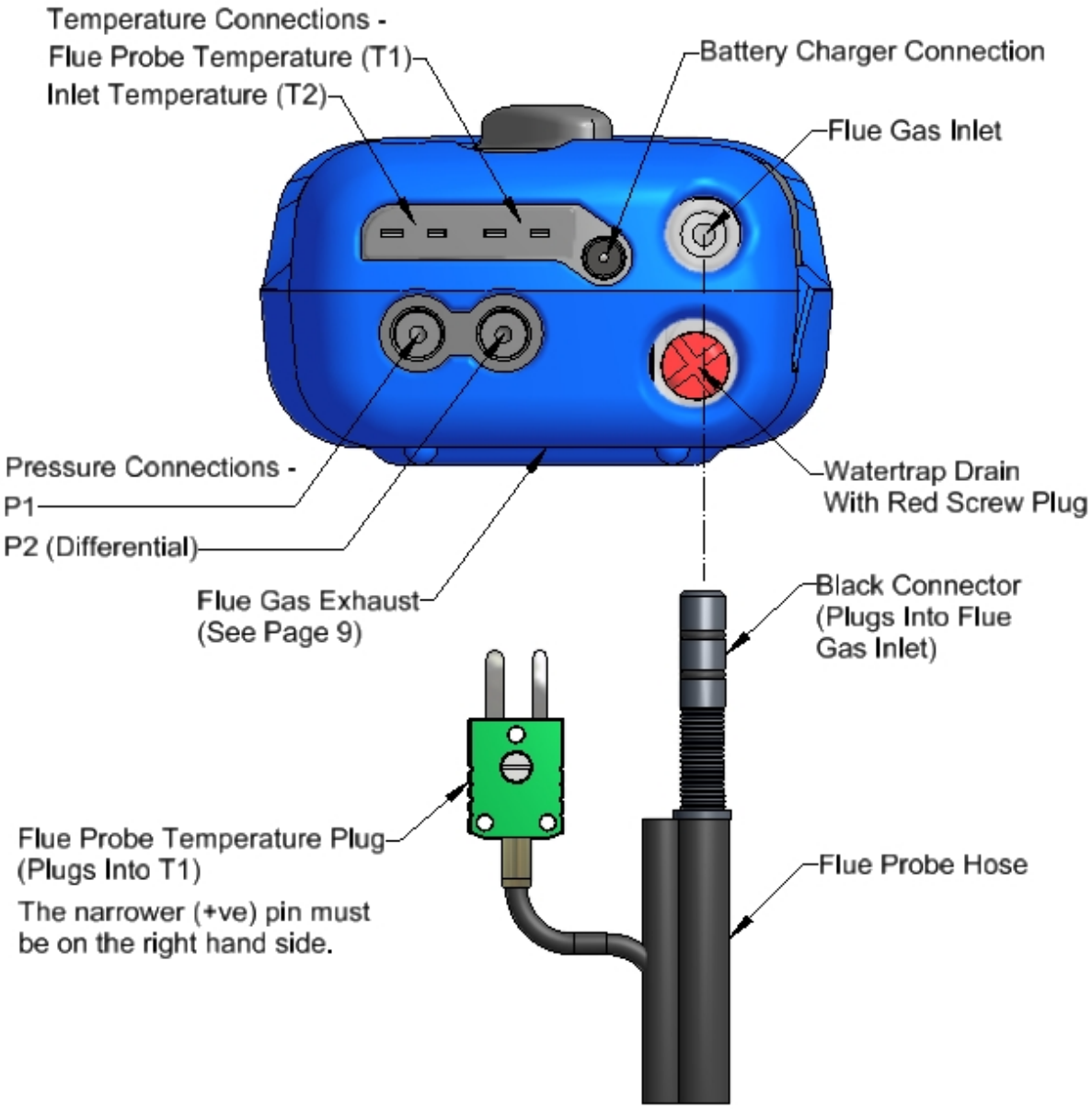
- 60 combustion tests
- 20 AUX tests
- 20 let-by/tightness tests
- 20 temperature & pressure tests
- 20 room CO tests
- 20 commissioning Tests

Two lines of 20 characters can be added to the header of printouts. Printouts can be made on the optional Kane IRP printers with ‘fast print’ capability using the IRP2 printer. Alternatively the analyser can be equipped with optional wireless communications to either Android or Apple devices.

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 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


Temperature Connections -
Flue Probe Temperature (T1)
Inlet Temperature (T2)
Battery Charger Connection
Flue Gas Inlet
Pressure Connections -
P1
P2 (Differential)
Watertrap Drain
With Red Screw 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. Do not mix NiMH cells of different capacities or from different manufacturers. All four cells must be identical**

## Replacing Batteries

Turn over the analyser, remove its protective rubber cover 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 cover.

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 19278.

To fully charge NiMH batteries:

The charger must be connected and switched on.
When charging, the red Battery Charging Indicator will illuminate.
After a few seconds, the display will show “ CHARGING BATTERY” if they need extra charge.

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 18342.

## 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 screw plug and re-tighten once it is empty.

- To change the particle filter, remove protective rubber cover, 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 cover.

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

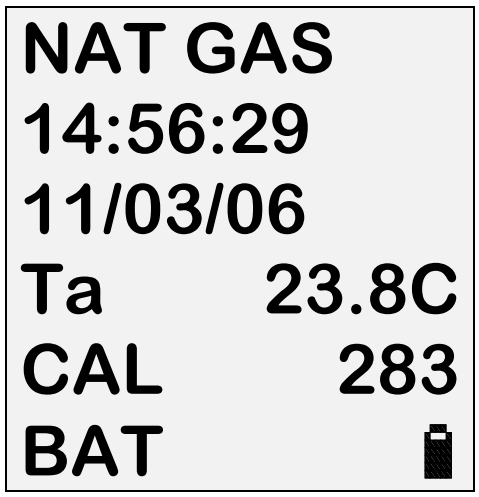
Position the flue probe in fresh air, then press On/Off / ⏻. The analyser's pump starts and the analyser auto-calibrates. When complete:

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% ± 0.3%.*


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 '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:




→ Current fuel selection

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

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

→ Ambient temperature of the analyser

→ Shows number of days until next calibration is due

→ Shows the charge level of the batteries

## 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:

| | |
|---|---|
| Switching ON the Analyser | Rotate the dial to the mode you want to use before switching on. This may eliminate the need for a full countdown in some of the modes and save you time.<br><br>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.<br><br>When switched on, the analyser beeps and briefly displays software version, date and time. Its bottom line counts down 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.<br><br>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.<br><br>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.<br><br>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 /  & hold for 2 seconds to switch the analyser OFF. The display counts down from 30 or less 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.<br><br>Press Send /  if you want to stop the countdown and return to making measurements.<br><br>**Note: The analyser will not switch off unless the CO reading is below 40ppm.** |
| Torch Light | Press  /  to switch the torch light on and off.<br><br>**NOTE: Use of the torch light significantly increases the current drain on the batteries.** |

| | |
|---|---|
| Switching PUMP on / off | The analyser normally operates with the pump on.<br><br>Press Pump /  to switch the pump off and on.<br><br>When the pump is switched off “-PO-" is displayed instead of the $O_2$, CO & $CO_2$ readings. The analyser also displays "PUMP OFF" on the top line approx every 40 seconds.<br><br>**NOTE:**<br><br>**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 | To re-zero the pressure sensor when “Prs/Temp” is selected on the dial, press and hold Pump /  until the top line display shows CAL ZERO.<br><br>Always disconnect the pressure hose before zeroing. |
| 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.<br><br>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.<br><br>The top line briefly displays the log number.<br><br>**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. |

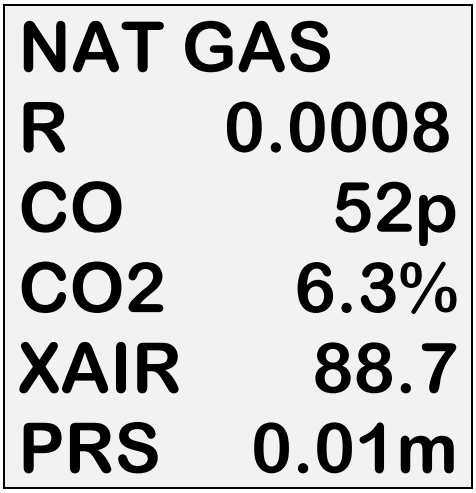
# 4. USING THE ANALYSER:

## 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




→ Fuel type can be changed via “Menu”.

→ $CO/CO_2$ ratio.

→ Carbon monoxide (ppm).

→ Carbon dioxide (%).

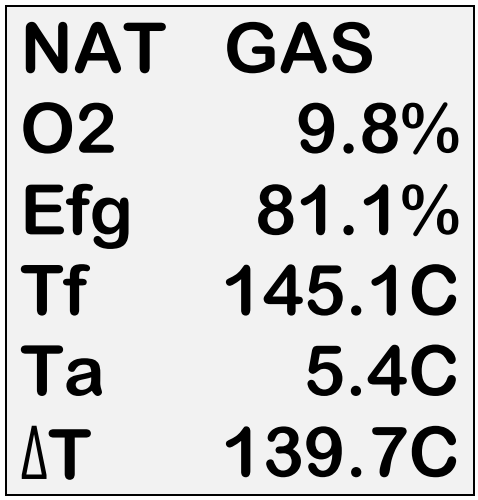
→ Excess air %

→ Pressure reading

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

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

## O2/EFF display




→ Fuel type

→ Oxygen (%) left after combustion. Should be 20.9% ± 0.3% in fresh air.

→ Gross efficiency

→ Flue temperature (°C).

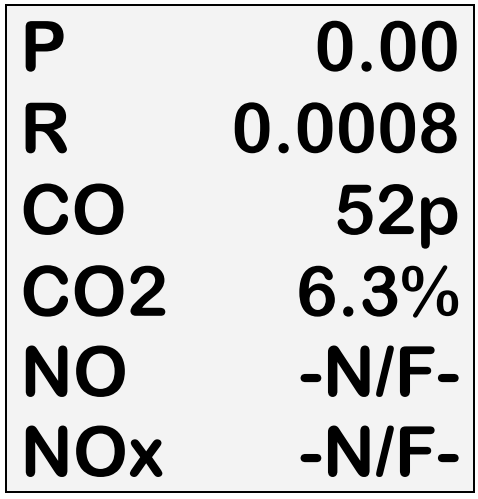
→ Inlet temperature (°C). Normally set by flue probe during fresh air purge.

→ Differential temperature

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

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

## AUX display




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

→ The parameters displayed on lines 1, 2, 3, 4, 5 and 6 can be set by the user.

→ They remain the AUX parameters until changed by the user.

→

→ NO sensor not fitted

→ NO sensor not fitted

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

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

## Viewing / printing overview

The side lights on the display point to the active line.

Use △ or ▽ to change the pointer.

Press Send /  to select a line. The side lights now flash.

Use △ or ▽ to scroll or change the selected line.

Press Send /  to exit a line.

## To view / print a logged report

Select MENU / REPORT / COMBUSTION / VIEW.

The side lights will point to the top line.

Press Send /  to select this line. The side lights will flash.

Use △ or ▽ to scroll or change the Log No. ( If only one report is logged, number will not change).

Press Send /  to confirm a Log No. The side lights will stop flashing.

To view logged data press △ or ▽ to move the pointer to another line.

Press Send /  . Sidelights will flash on that line.

Use △ or ▽ to scroll through data.

To finish, press Send /  . Sidelights stop flashing.

Use △ or ▽ to scroll down to “PRINT”

Press Send /  to print.

## Viewing / printing a logged combustion test

Press Send /  to print the test, (or send to PC via optional Wireless module).

## 4.2 COMMISSIONING TEST

The Commissioning Test is based on TB143

Rotate the dial to to COM TEST position and follow the instructions on the screen

**TEST 1** check the boiler at Max Gas rate.

The boiler is switched on at Max rate.

The analyser is first zeroed in fresh air.

Once the boiler is stable at max gas flow rate the probe is inserted into the air inlet of the flue and the CO2 level is measure. The reading needs to be stable and less than or equal to 0.20%.

**TEST 2**

The probe is then inserted into the exhaust outlet of the boiler and the RATIO, CO and CO2 levels are measured. These levels must be as per manufacturers instruction. Where manufacturers instructions are not available the CO must be less than 350 ppm and the RATIO must be less than 0.0040.

**TEST 3** checks the boiler at minimum gas flow rate where this is possible.

With the boiler operating stabley at minimum gas rate the RATIO, CO and CO2 levels are measured.

These levels must be as per manufacturers instruction. Where manufacturers instructions are not available the CO must be less than 350 ppm and the RATIO must be less than 0.0040.

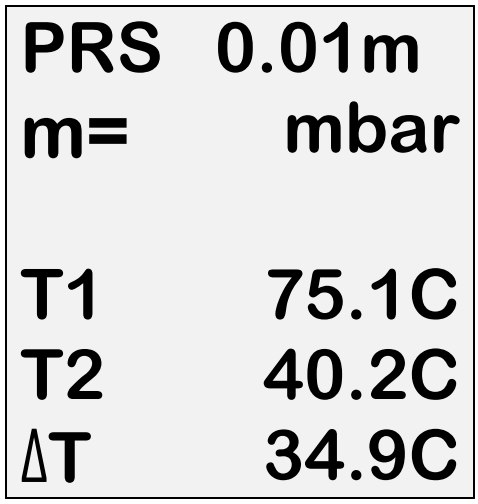
**TEST 4** Measures Flow and Return Temperatures from the boiler

All the measured readings are logged and can be printed or transmitted to PC if an optional wireless module is fitted.

## 4.3 PRESSURE/TEMPERATURE TESTING

Select “Prs/Temp”. 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/TEMP 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”.

→ Eg Flow Temp

→ Eg Return Temp

→ Differential Temp

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

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

### Viewing / printing a logged pressure/temp test

Select MENU / REPORT / PRS-TEMP / VIEW

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

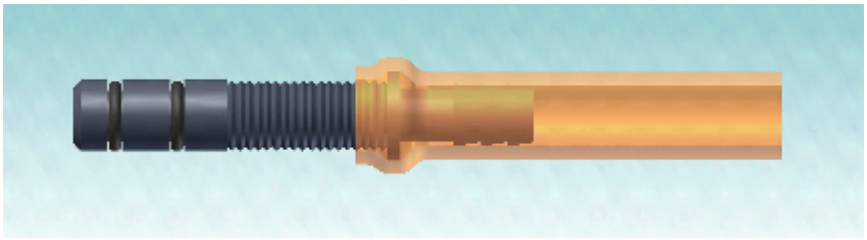
Press Send / to print the test, (or send to PC via optional Wireless module).

## WARNING

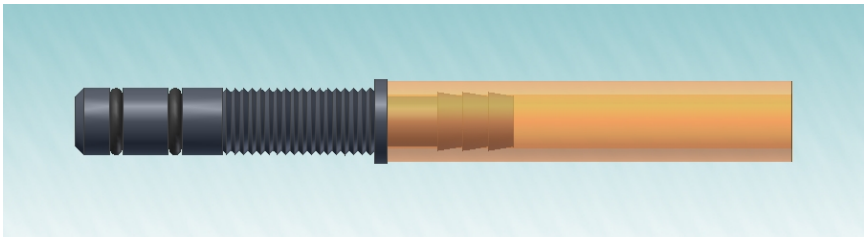
Before using the KANE456 to measure the pressure of a gas/air ratio valve, read the boiler manufacturer’s instructions thoroughly. If in doubt contact the boiler manufacturer.

After adjusting a gas/air ratio valve it is essential that the CO, $CO_2$ and $CO/CO_2$ 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.



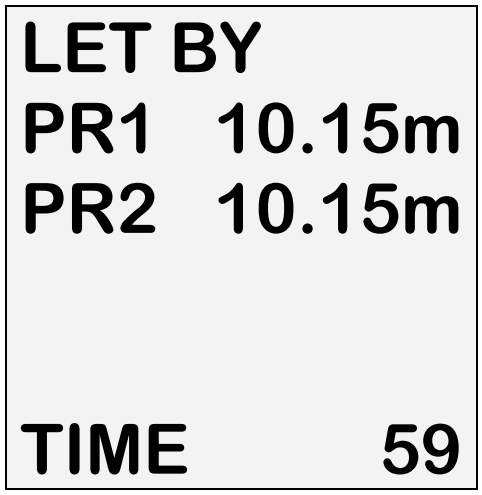
This may not produce a gas tight seal.

## 4.4 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:




→ The let-by test is automatically stored in the memory.

→ Pressure at start of let-by test.

→ Real time pressure reading.

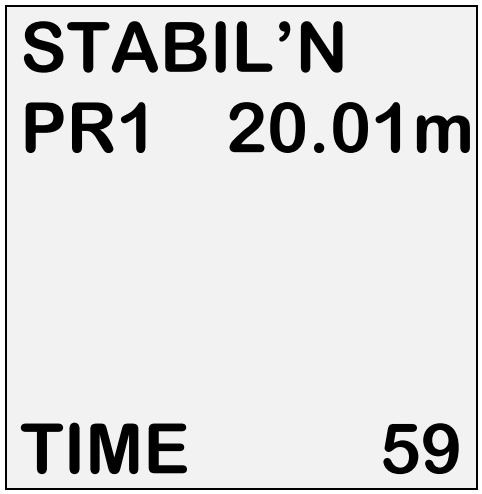
→

→

→ 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:

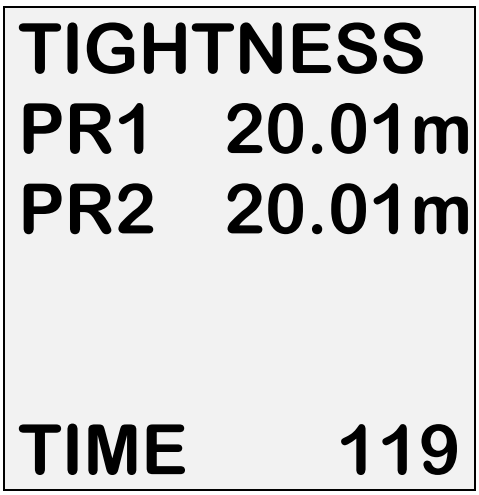



→

→ Real time pressure reading.

→ Stabilisation default time is 1 minute. Can be changed via “Menu”.

When complete press ⇦ to start the tightness test:



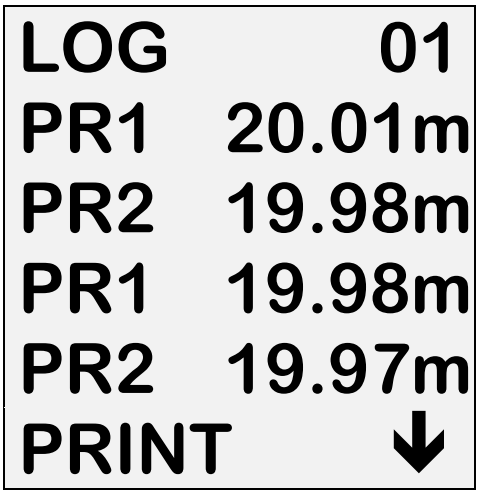

→

→ 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:




→ The tightness test is automatically stored in the memory.

→ Pressure at start of stabilisation test.

→ Pressure at end of stabilisation test.

→ Pressure at start of tightness test

→ Pressure at end of tightness test

→ Press ⇦ to print the complete test.

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

Select MENU / REPORT / TIGHTNESS / VIEW

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

Press Send / 🖶 to print the test, (or send to PC via optional Wireless module).

**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 20th tightness test is complete. Before the 21st tightness test can be performed the tightness section of the memory must be cleared. To do this select MENU / REPORT / TIGHTNESS / DEL ALL / YES then press ⇦ .

## 4.5 ROOM CO TESTING

Select “Room CO” to measure and record CO readings for up to 30 minutes.

**SELECT**
**ROOM CO**

→

→

**TEST TYPE**
**GENERAL**

→

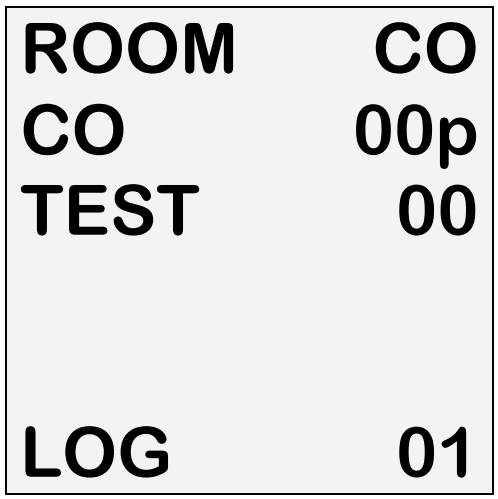
→ Use △ / ▽ to select the test type from the following:

### TEST TYPES

| | | |
|---|---|---|
| GENERAL: | 15 minute test with results stored every minute | LIMIT = 10ppm<br>ALARM = 30 ppm |
| SWEEP TEST: | 2 minute test with max reading stored at end | LIMIT = 10ppm<br>ALARM = 30 ppm |
| MIGRATION TEST: | 15 minute test with results stored every minute | LIMIT = 10ppm<br>ALARM = 30 ppm |
| TYPE C SEALED APPLIANCE: | 15 minute test with results stored every minute | LIMIT = 10ppm<br>ALARM = 30 ppm |
| TYPE B BOILER OPEN FLUE: | 15 minute test with results stored every minute | LIMIT = 10ppm<br>ALARM = 30 ppm |
| TYPE A COOKER: | 30 minute test with results stored every miute | LIMIT = 30ppm<br>ALARM = 90 ppm |
| TYPE A WATER HEATER: | 5 minute test with results stored every minute | LIMIT = 10ppm<br>ALARM = 30 ppm |
| TYPE A SPACE HEATER: | 30 minute test with results stored every 1 minute | LIMIT = 10ppm<br>ALARM = 30 ppm |

Press Pump /  to start Room CO testing.

## ROOM CO display




→ CO readings are recorded every minute for up to 30 minutes.

→ Real time CO reading (ppm).

→ Test 00 = initial CO test in series.
Test 30 = maximum of 30 tests in series.

→ The CO test series is automatically stored in the memory as a log number.

The user can stop the Room CO test at any time by pressing Pump / .

If not stopped earlier, the Room CO test will automatically end after the designated time.

The CO test series is automatically stored in the memory as a log number.

When completed the log can be printed immediately by pressing .

## Viewing / printing a logged Room CO test

Select MENU / REPORT / ROOM CO / VIEW

When LEDs are not flashing

Use the △ / ▽ keys to change line.

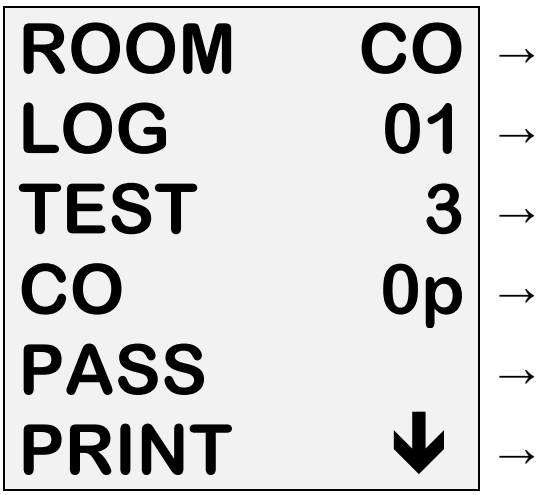
Press ⇦ to cause the LEDs on that line to flash.

With the LEDs flashing, press △ / ▽ to allow the parameter on that line to be changed.

Press ⇦ to select that change.

The LEDs stop flashing and △ / ▽

Use △ / ▽ to change the line again.




With no LEDs flashing

Use the △ / ▽ keys to move the lit LEDs to the line you want.

You can change the LOG number and the TEST number so that you can view individual test results.

Press Send / 🖨 to select the line you want and the LEDs will start to flash.

Now use the △ / ▽ keys to change the number (the TEST number or the LOG number)

Press Send / 🖨 when you are happy with the changes. The LEDs will stop flashing. Now use the △ / ▽ keys to move the LEDs to the PRINT line.

Sending to the printer or wireless device will only occur when you move the LEDs to the print line and press Send / 🖨.

Press Send / 🖨 to print the test, (or send to PC via optional Wireless module).

## 4.6 PRINTOUTS

### COMBUSTION

KANE456 SW19392 V0.12

YOUR COMPANY NAME & PHONE NUMBER HERE

SERIAL NO. 9876543210

LOG NO. 01

DATE 19/01/16
TIME 11:06:09

CAL DUE ON 18/12/16

COMBUSTION
FUEL TYPE NAT GAS

| | | |
|---|---|---|
| CO2 | % | 9.0 |
| O2 | % | 5.1 |
| CO | ppm | 50 |
| NO | ppm | -N/F- |
| NOx | ppm | -N/F- |
| FLUE | °C | 65.2 |
| INLET | °C | 17.2 |
| NETT | °C | 48.0 |
| CO/CO2 | | 0.0005 |
| NET | % | 97.9 |
| LOSS | % | 2.1 |
| XAIR | % | 32 |
| PRS | mbar | 0.21 |

CUSTOMER

APPLIANCE

REFERENCE

### COMMISSION TEST

KANE456 SW19392 V0.12

YOUR COMPANY NAME & PHONE NUMBER HERE

SERIAL NO. 9876543210

LOG NO. 08

DATE 19/01/16
TIME 11:50:04

CAL DUE ON 18/12/16

COMMISSION TEST

ANALYSER ZERO

| | | |
|---|---|---|
| CO2 | % | 0.00 |
| CO | ppm | 0 |

FLUE INTEGRITY

| | | |
|---|---|---|
| CO2 | % | 0.00 |

MAX GAS FLOW

| | | |
|---|---|---|
| CO2 | % | 9.1 |
| CO | ppm | 50 |
| CO/CO2 | | 0.0005 |

MIN GAS FLOW

| | | |
|---|---|---|
| CO2 | % | 9.0 |
| CO | ppm | 48 |
| CO/CO2 | | 0.0005 |

FLOW & RETURN

| | | |
|---|---|---|
| T1 | °C | 65.5 |
| T2 | °C | 48.2 |
| ΔT | °C | 17.3 |

CUSTOMER

APPLIANCE

REFERENCE

### PRS/TEMP

KANE456 SW19392 V0.12

YOUR COMPANY NAME & PHONE NUMBER HERE

SERIAL NO. 9876543210

LOG NO. 20

DATE 19/01/16
TIME 12:23:59

CAL DUE ON 18/12/16

PRS/TEMP

| | | |
|---|---|---|
| PRS | mbar | 18.01 |
| T1 | °C | 75.5 |
| T2 | °C | 65.2 |
| ΔT | °C | 10.3 |

CUSTOMER

APPLIANCE

REFERENCE

## SWEEP TEST

KANE456 SW19392 V0.12

YOUR COMPANY NAME & PHONE NUMBER HERE

SERIAL NO. 9876543210

LOG NO. 06

DATE 19/01/16
TIME 10:11:11

CAL DUE ON 18/12/16

ROOM CO

SWEEP TEST

LIMIT 10ppm
ALARM 30ppm
TESTS 1

| M | CO ppm |
|---|---|
| 01 | 0 |
| MAXIMUM CO ppm | 0 |

CUSTOMER

APPLIANCE

REFERENCE

## TYPE C SEALED APPLIANCE

KANE456 SW19392 V0.12

YOUR COMPANY NAME & PHONE NUMBER HERE

SERIAL NO. 9876543210

LOG NO. 03

DATE 19/01/16
TIME 12:25:27

CAL DUE ON 18/12/16

ROOM CO

TYPE C SEALED APPLIANCE

LIMIT 10ppm
ALARM 30ppm
TESTS 15

| TEST | CO ppm |
|---|---|
| 01 | 0 |
| 02 | 0 |
| 03 | 0 |
| 04 | 0 |
| 05 | 0 |
| 06 | 0 |
| 07 | 0 |
| 08 | 0 |
| 09 | 0 |
| 10 | 0 |
| 11 | 0 |
| 12 | 0 |
| 13 | 0 |
| 14 | 0 |
| 15 | 0 |
| MAXIMUM CO ppm | 0 |

CUSTOMER

APPLIANCE

REFERENCE

## TIGHTNESS TEST

KANE456 SW19392 V0.12

YOUR COMPANY NAME & PHONE NUMBER HERE

SERIAL NO. 9876543210

DATE 19/01/16
TIME 11:09:16

CAL DUE ON 18/12/16

LET BY TEST

| | | |
|---|---|---|
| PRS 1 | mbar | 10.80 |
| PRS 2 | mbar | 10.78 |
| LET BY | MINS | 1:00 |

TIGHTNESS TEST

| | | |
|---|---|---|
| PRS 1 | mbar | 20.14 |
| PRS 2 | mbar | 20.13 |
| ΔP | mbar | -0.01 |
| STABILIS'N | MINS | 1:00 |
| TIGHTNESS | MINS | 2:00 |

CUSTOMER

APPLIANCE

REFERENCE

# AUX

KANE456 SW19392 V0.12

YOUR COMPANY NAME &
PHONE NUMBER HERE

SERIAL NO. 9876543210

LOG NO. 01

DATE 19/01/16
TIME 09:46:53

CAL DUE ON 18/12/16

AUX

| FUEL TYPE | | LIGHT OIL |
|---|---|---|
| CO2 | % | 0.53 |
| CO(n) | ppm | 02++ |
| CO/CO2 | | 0.0000 |
| O2 | % | 20.2 |
| FLUE | °C | -N/F- |
| INLET | °C | -N/F- |

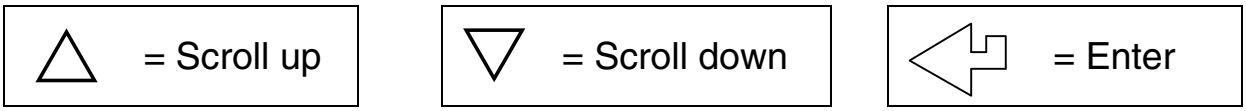
CUSTOMER

APPLIANCE

REFERENCE

# 5. USING THE MENU

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




**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.**

**MENU** →
**SETUP** →
**UNITS** →
**SCREEN** →
**REPORT** →
**SERVICE** →

As you scroll up or down the side LEDs illuminate to point to the active line

| MAIN MENU | SUB MENU | OPTIONS / COMMENTS |
|---|---|---|
| **SETUP** | Language | **English** |
| | SET TIME | HH:MM:SS format<br>e.g. 7 am = 07:00:00, 7pm = 19:00:00 |
| | SET DATE | DD/MM/YY format |
| | PRINTER | KM IRP<br>KM IRP-2<br>WIRELESS<br>SERIAL |
| | PASSKEY | 1111 ( wait 5 secs after entering last digit) |
| | BACK | |

As you scroll up or down the side LEDs illuminate to point to the active line

**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.**

| MENU | SUB MENU | OPTIONS / COMMENTS |
|---|---|---|
| **UNITS** | Fuel Type | NAT GAS, PROPANE, BUTANE, LPG, LIGHT OIL, PELLETS |
| | Fuel Origin | UK, N AMERICA, FRANCE |
| | EFFICIENCY | GROSS, NET, GROSS COND, NET COND |
| | PRESSURE | See next table below |
| | GAS | ppm, ppm(n) |
| | TEMP | C , F |
| | O2 REF | Up/down to set value (3% default) |
| | NOx CALC | Up/down to set value (5% default) |
| | BACK | |

As you scroll up or down the side LEDs illuminate to point to the active line

**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.**

| MENU | SUB MENU | OPTIONS / COMMENTS |
|---|---|---|
| PRESSURE | FILTER | OFF = normal response.<br>ON = slower (damped) response |
| | RESOLUTION | LOW = e.g. 0.01mbar resolution.<br>HIGH = displays to an extra decimal place |
| | UNITS | mbar, Pa, PSI, mmHg, hPa, $InH_2O$ |
| | TIME | LET BY = Set duration of let-by test in minutes. Default = 1 minute<br>STABIL'N = Set duration of stabilisation in minutes. Default = 1 minute<br>TIGHTN'S = Set duration of tightness test in minutes. Default = 2 minute |
| | BACK | |

As you scroll up or down the side LEDs illuminate to point to the active line

**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.**

| MENU | SUB MENU | OPTIONS / COMMENTS |
|---|---|---|
| SCREEN | CONTRAST | Factory setting is 14 |
| | BACKLIGHT | 0 to 300 secs |
| | AUX | Enables users to customise the parameters on the AUX display: LINE 1, LINE 2, LINE 3, LINE 4, LINE 5, LINE 6, BACK |
| | BACK | |

As you scroll up or down the side LEDs illuminate to point to the active line

**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.**

| MENU | SUB MENU | OPTIONS / COMMENTS |
|---|---|---|
| REPORT | AUX | Stored AUX tests<br><br>VIEW, DEL ALL, BACK |
| | COMBUSTION | Stored combustion tests:<br>VIEW, DEL ALL, BACK |
| | COMMISSION | Stored commission tests:<br>VIEW, DEL ALL, BACK |
| | PRS/TEMP | Stored pressure tests:<br>VIEW, DEL ALL, BACK |
| | TIGHTN'S | Stored tightness tests:<br>VIEW, DEL ALL, BACK |
| | ROOM CO | Stored room CO tests:<br>VIEW, DEL ALL, BACK |
| | HEADER | LINE 1<br><br>LINE 2<br><br>BACK |
| | BACK | |

As you scroll up or down the side LEDs illuminate to point to the active line

**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.**

| MENU | SUB MENU | OPTIONS / COMMENTS |
|---|---|---|
| SERVICE | CODE | Password protected for authorised service agents only. Leave set to 000000. |

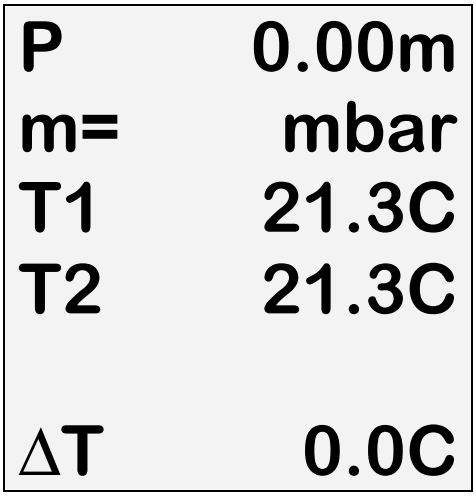
As you scroll up or down the side LEDs illuminate to point to the active line

**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 KANE456 AS A THERMOMETER OR PRESSURE METER

Rotate the dial to the PRS/TEMP position.

The display will show:




→ Real time pressure reading.

→ Use the T1 connection for the flow temperature sensor.

→ Use the T2 connection for the return temperature sensor.

→ Real time temperature difference.

The standard printout for this mode is as follows:

KANE456 SW19392 V0.12

YOUR COMPANY NAME &
PHONE NUMBER HERE

SERIAL NO. 9876543210

LOG NO. 20

DATE 19/01/16
TIME 12:23:59

CAL DUE ON 18/12/16

PRS/TEMP

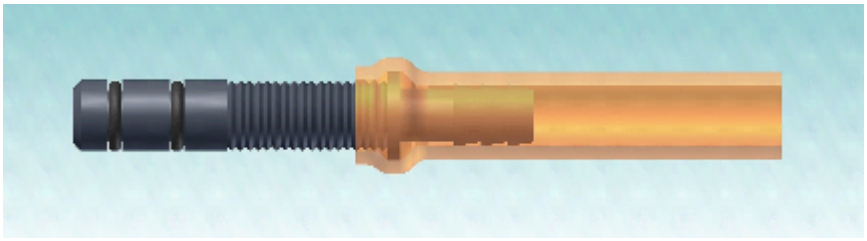
| | | |
|---|---|---|
| PRS | mbar | 0.01 |
| T1 | °C | 17.6 |
| T2 | °C | 17.4 |
| ΔT | °C | 0.2 |

CUSTOMER

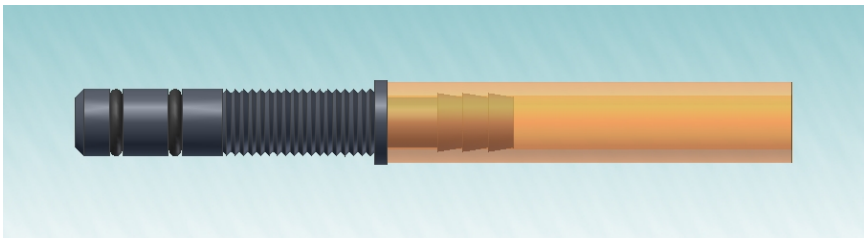
APPLIANCE

REFERENCE

## If using larger bore tubing when performing pressure tests:



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



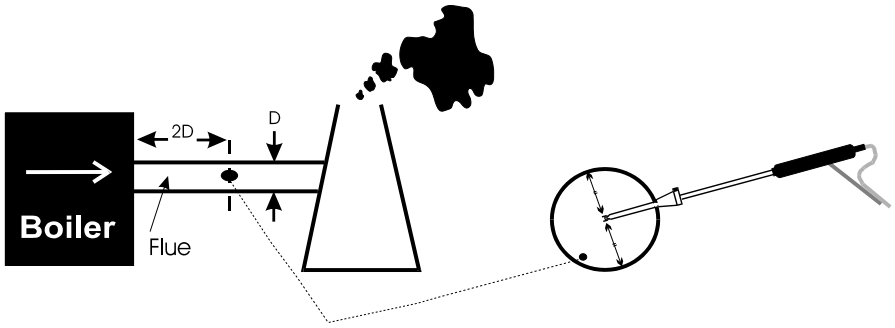
This may not produce a gas tight seal.

# 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<br>• $CO_2$ too low | • Air leaking into probe, tubing, water trap, connectors or internal to analyser. |
| • Batteries not holding charge<br>• Analyser not running on mains adapter. | • Batteries exhausted.<br>• AC charger not giving correct output.<br>• No fuse |
| • Analyser does not respond to flue gas | • Particle filter blocked.<br>• Probe or tubing blocked.<br>• 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.<br>• Faulty connection or break in cable or plug. |
| • T flue or T nett displays (-N/F-) | • Probe not connected.<br>• Faulty connection or break in cable or plug. |
| EFF or X-Air displays (- O2++-) | • $CO_2$ reading is below 2%.<br>• 02 > 18% |
| • Analyser just continually beeps | • Turn dial back to MENU and press ENTER<br>• Turn dial back to Tightness and press ENTER |

# 9. FREQUENTLY ASKED QUESTIONS

Q: What is the countdown time on a KANE456

A: There are three levels of countdown (aka fresh air purge) on a KANE456.

From first switch on if ‘cold’ (more than 5°C from the temperature at which calibrated) = 90 secs.

From first switch on if ‘warm’ (within 5°C of the temperature at which calibrated) = 60 secs

If switched on within 10 minutes of last switch off and had been on for at least 10 mins and is still ‘warm’ = 30 secs

# 10. ANALYSER ANNUAL SERVICE & RE-CERTIFY

Although sensor life is typically more than five years, the analyser should be serviced and re-certified annually to counter any long-term sensor or electronics drift or accidental damage.

Local regulations may require more frequent re-certification.

Kane International has service facilities at Atherton near Manchester Tel: 01942-873434 (the primary service centre for UK KANE456 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 6 years.

# 10.1 RETURNING YOUR ANALYSER TO KANE

When returning your KANE456, please always ensure that you enclose:

- ✓ Your full contact details
- ✓ A daytime telephone number
- ✓ Details of faults you might have experienced

## Packing your analyser

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

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

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.

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

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

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

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

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

# 11. 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<br>±0.3% reading |
| Inlet Temperature (Internal sensor) | 0-50°C | 0.1°C | ±1.0°C<br>±0.3% reading |
| Inlet Temperature (External sensor) | 0-600°C | 0.1°C | ±2.0°C<br>±0.3% reading |
| **Flue Gas Measurement** | | | |
| Oxygen[*2] | 0-21% | 0.1% | ±0.3% |
| Carbon monoxide [*1] | 0-20ppm<br>21-2,000ppm nom<br>4,000ppm max for 15 mins | 1ppm | ±3ppm<br>±5% reading |
| Carbon dioxide [*1] | 0-20% | 0.1% | ±0.3% volume |
| Efficiency (Net or Gross) [*2] | 0-99.9% | 0.1% | ±1.0% reading |
| Efficiency High (C) [*2] | 0-119.9% | 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)**<br>Nominal range ±80mbar<br>Maximum over range without damage to sensor is ±400mbar | ±0.2 mbar<br>±1 mbar<br>±80 mbar | Maximum 0.001 mbar <25mbar | ±0.005 mbar<br>±0.03 mbar<br>±3% of reading |
| **Pre-programmed Fuels** | Natural gas, Propane, Butane, LPG, Light Oils (28/35 sec), Wood Pellets | | |
| **Storage Capacity** | 60 Combustion tests<br>20 Pressure & Temperature tests<br>20 Tightness tests<br>20 Temperature tests<br>20 Room CO tests<br>20 Commissioning tests | | |

[*1] Using dry gases at STP

[*2] Calculated

**Carbon Dioxide resolution is 0.01% below 1% measured value.**

| | |
|---|---|
| **Ambient Operating Range** | 0°C to +45°C 10% to 90% RH non-condensing |
| **Battery Type / Life** | 4 AA cells<br>>8 hours using Alkaline AA cells |
| **Chargers (optional)** | 220v charger, for NiMH batteries only<br>12v in vehicle charger, for NiMH batteries only |
| **Dimensions**<br>Weight:<br>Handset:<br>Probe: | <br>0.8kg handset with protective rubber cover<br>200 x 45 x 90mm<br>300mm long including handle.<br>6mm diameter x 240mm long stainless steel shaft with 3m long neoprene hose. Type K thermocouple |

# 12. 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:

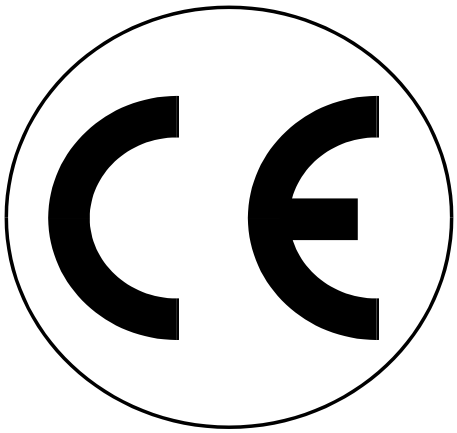
Use the normal start up sequence in the location where the analyser will be used.

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 (January 2016) 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 : 2011
EN 61000-6-1 : 2007

and is certified to be compliant

Specification EC/EMC/KI/KANE456 details the specific test configuration, performance and conditions of use.

# 13. END OF LIFE DISPOSAL

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

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

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

# 14. 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 KANE456 is compliant the EN 50379 Part 2 and Part 3.

b) The KANE456 is intended to be used with the following fuels:
Natural gas
Light oil (28/35 sec)
Propane
LPG
Wood pellets
Butane

c) The KANE456 is designed for use with either non-rechargeable alkaline AA cells or rechargeable NiMH AA cells. Four cells are needed. Types cannot be mixed. Under no circumstances should any attempt be made to recharge alkaline cells.

The battery charger supplied with the KANE456 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 KANE456.

d) The KANE456 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 KANE456 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 KANE456 is fitted with an electrochemical CO sensor and an infra-red CO2 sensor which have an expected life of more than 5 years. The calibration of these sensors must be confirmed on an annual basis.

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

j) The KANE456 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 KANE456 has an initial start up delay following switch on of between 90 and 30 seconds dependent on ambient temperature. 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 KANE456 must have its calibration checked on an annual basis and be issued with a traceable Certificate of Calibration.

The sensor within the KANE456 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 KANE456 to test an appliance a full visual inspection of the appliance, in accordance with its manufacturer’s instructions, must also be carried out.

# Appendix 1 - Main Parameter:

Here are the legends used and what they mean:

**$O_2$ :** 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.

**COn** carbon monoxide normalised

**$CO_2$ :** Carbon dioxide (Measured) reading in percentage (%).

**Ra:** CO to CO2 ratio

**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.

**$CO/CO_2$:** $CO/CO_2$ 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.
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).

## Pressure units:

| | |
|---|---|
| m: | millibar |
| s: | psi |
| h: | hPa |
| P: | Pa |
| g: | mmHg |
| i: | inH2O |

## **SYMBOLS** used on the display

| | |
|---|---|
| PRS | Pressure |
| Ra | $CO/CO_2$ |
| XAIR | Excess Air |
| Tf | Flue temperature |
| Ta | Inlet temperature |
| ΔT | Nett temperature / Differential temperature |
| EfG | Gross efficiency |
| EfCG | Gross condensing Efficiency |
| EfN | Nett efficiency |
| EfCN | Nett condensing efficiency |
| - PO - | Pump off |
| 'O2++% | Calculated oxygen greater than 18% so calculation is disabled |
| N/F | Temperature input not fitted |
| CAL | Number of days left before recalibration is due |
| BAT | Battery level symbol  |
| N/F | Not fitted. |
| INT | Interval in seconds |
| ppm | parts per million |
| p | parts per million |
| ppm(n) | parts per million normalized |
| O2ref | reference level in % for normalization calculation |

# ADDENDUM

# Instructions for KANE456 analysers fitted with optional Nitric Oxide (NO) sensors

# DISPLAYING THE NO READING

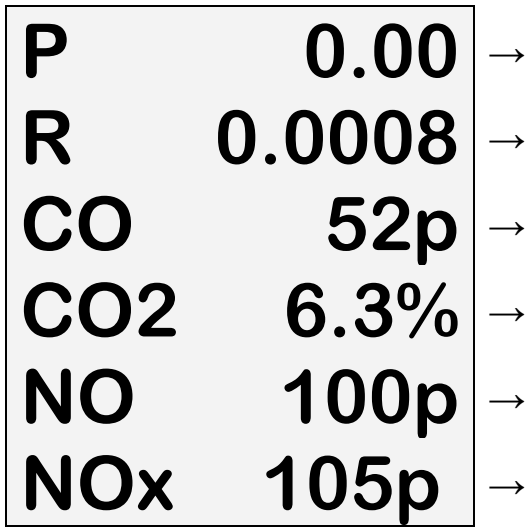
Select “Menu” on the rotary switch and navigate using the function buttons:

| △ = Scroll up | ▽ = Scroll down | ⇦ = Enter |
|---|---|---|

Select SCREEN and then select AUX

Choose a line to display the required readings as below

## AUX display




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

The parameters displayed on lines 1, 2, 3, 4, 5 and 6 can be set by the user.

They remain the AUX parameters until changed by the user.

**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.

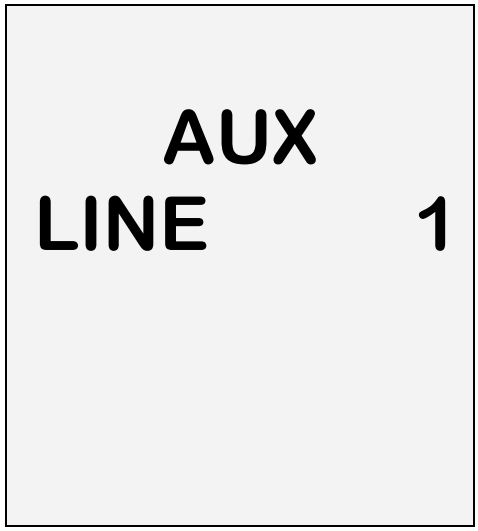
Use △ or ▽ to navigate to the main menu option SCREEN.

Press ⇦.

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

Press ⇦.

The display will show




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) | 1ppm | ± 2ppm <30ppm*1<br>±5ppm <100ppm*1<br>±5% reading >100ppm | 0 to 100 ppm<br><br>Overrange to 1500 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**<br>*Note: Proof of Purchase may be required for warranty claims.* | |
|---|---|
| Date Purchased:<br>as numbers (28.01.14): | |
| Purchased From: | |
| Model Number: | **KANE456** |
| Product Serial Number:<br>located on the rear product label beneath the protective rubber sleeve | |

Why did you buy a Kane Product?

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

What brand was your previous analyser?

How did you hear about Kane?

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

Which do you read most often?

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

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Before use, please register on our website

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