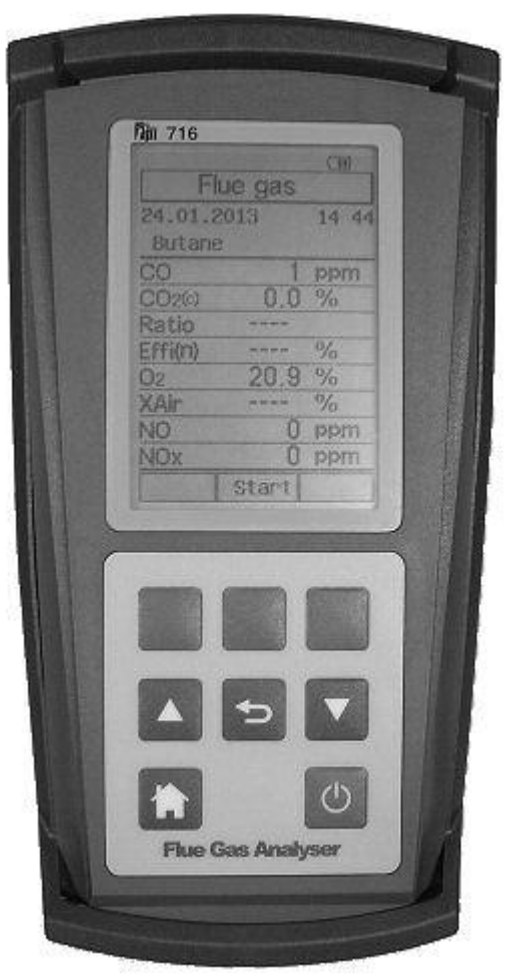
Flue Gas Analyser

TPI 716



The Value Leader™

Contents

Introduction

Thank you for purchasing TPI brand products. The TPI 716 Flue Gas Analyser is a state of the art, easy to use analyser designed not only to display and calculate the required readings from a flue but also to cover most of the other measurements associated with combustion. The instrument is ruggedly constructed and comes with a 6 Year Guarantee subject to annual servicing being carried out by TPI or one of their approved service centres.

General Overview

The following guidelines will help prevent damage to your sensors:

Always use the mini pump filter when testing flue gases.
Periodically check and replace the mini pump filter as needed.
Always make sure the in-line filter / water trap is installed properly.
Periodically check and replace the in-line filter as needed.
Always remove water or condensation from the inside of the in-line filter / water trap assembly prior to performing tests.
Always use the optional oil filter (p/n A773) when performing tests on oil burning equipment ***unless you are using the 716 with an NO sensor fitted. Do not use the A773 on the 716 with NO sensor fitted because the A773 will filter out Nitric Oxide (NO).***
Never over saturate your sensors by performing tests on equipment with gas levels beyond the capability of you analyser.
Always keep the A796 water trap / filter assembly clean & dry and replace the internal filter as necessary. (Replacement filter part number is A796-F.)

General Overview (Continued)

This manual will guide you through the functions of the TPI 716 which will give you many years of reliable service.

Your TPI 716 Flue Gas Analyser comes complete with the following standard accessories:

( ) Denotes part number

- TPI 716 Analyser
- Rubber Boot (A765) 1 each installed on analyser
- Soft Carrying Case (A768) - 1 each
- Flue Sampling Probe (A770) - 1 each
- In-Line Filter / Water Trap installed on Flue probe (A796) - 1 each
- Disc water filter installed in water trap (A796W) - 1 each
- Spare In-Line Filter - 1 each (A796F is a package of 10 filters)
- Temperature Probe (GK11M) - 1 each
- Battery Charger (A766) - 1 each
- Mini Pump Protection Filter Assembly (A763) - 1 each
- Exhaust Spigot Removable (A764) - 1 each
- Pressure Adaptors - Pair (A772) - 1 pair
- PC Software and cable for communication to a PC (A807).
- Instruction Manual

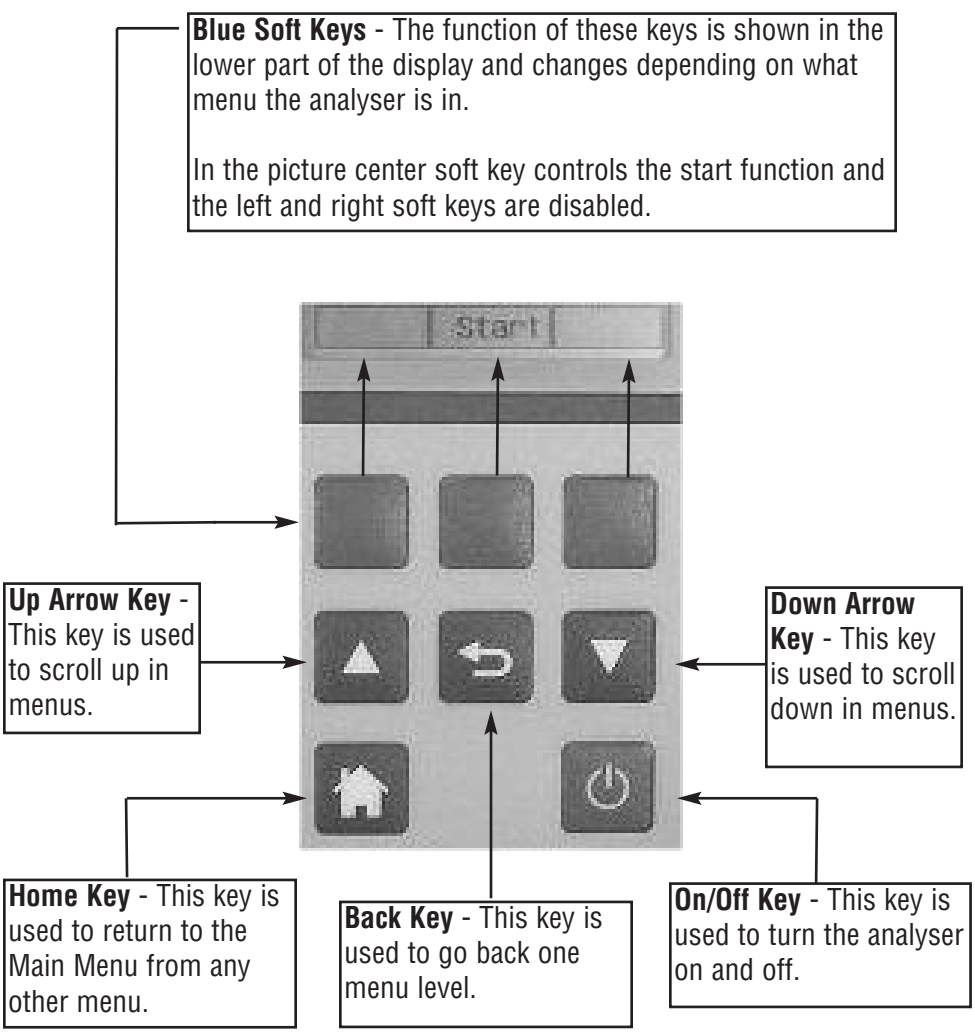
Your TPI 716 Flue Gas Analyzer has the following options/upgrades available:

- Plug-In Combustible Gas Sniffer Leak Probe (716-Leak)
- Upgrade to Bluetooth connectivity (716-BT)
- Upgrade to NO sensor for Calculated NOx (716-NO)
- Upgrade to High CO Sensor-up to 10% range (716-HCO)
- Infra Red Printer (A740)
- Temperature Pipe Clamps - pair (CK21M/Pair)
- CPA1 Probe Kit (CPK3)
- Smoke Pump (A788)
- Oil (Sulfur) Filter (A773)

Instrument Overview
Front View

Rubber Boot	Protects the instrument from accidental damage
Display	Large graphical backlit LCD Display
Keypad	Selects all available functions

Keypad



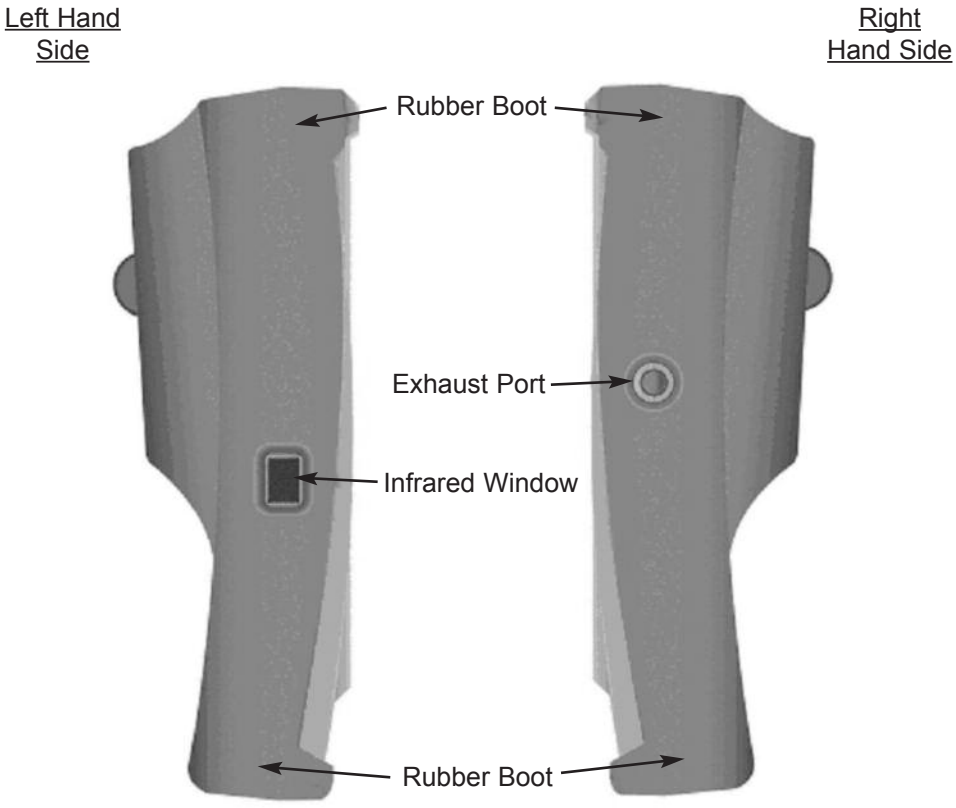
Back View

Calibration and Information Label: Displays calibration information and serial number

Battery Compartment: Holds rechargeable battery

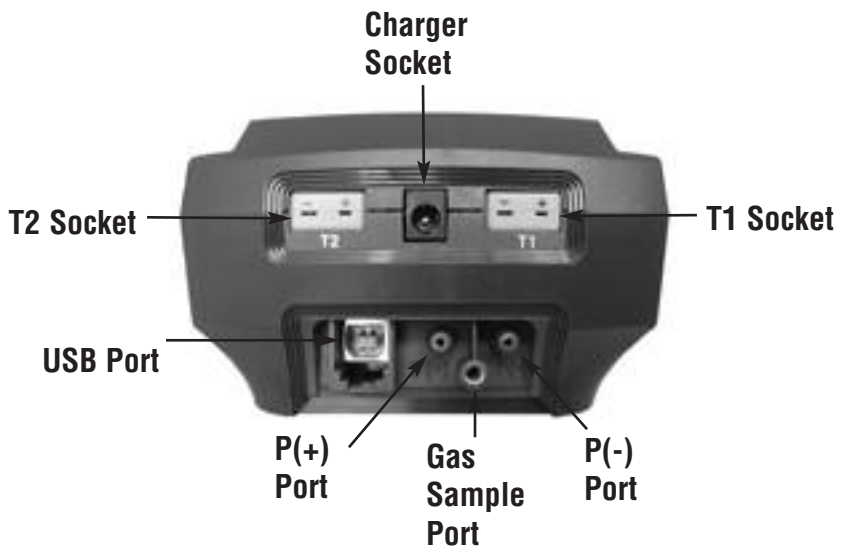
Rubber Boot Protects the instrument

Side Views



Exhaust Port	Port for connection of Exhaust Adapter
Infrared Window	Window for sending stored data to IR Printer
Rubber Boot	Protects the instrument from accidental damage

Top View



Charger Socket Connection for 220V/115V charger

T1 Socket Connection for thermocouple plug on flue probe

Connection for any 'K' type thermocouple probe

T2 Socket Connection for ambient 'K' type thermocouple probe

Connection for any 'K' type thermocouple probe

Gas Sample Port Connection for Mini Pump Protection Filter and Flue Probe

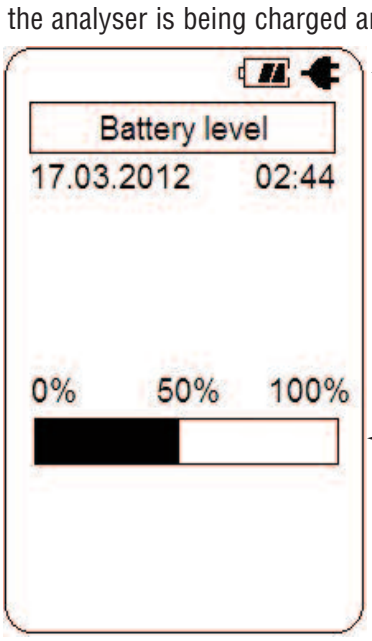
P (+) Port
P (-) Port Connections for Pressure Tubing

USB Port Connection for A807 cable for communication to a PC or connection for 716-Leak combustible gas leak detection sniffer probe.

BASIC ANALYSER FUNCTIONS

Charging The Analyser

Plug the charger into the charger socket on the instrument (see page 7). When the charger is plugged in the battery level display will turn on. This display indicates the analyser is being charged and the status of the charge.



The plug symbol confirms the analyser is connected to the charger. The battery symbol shows the charge level when the analyser is on too.

The charge level is represented in graph form as well. The charge is displayed in percentage. (0 to 100%)

During operation the analyser will display charge status and battery condition in the top right corner of the display.

 Battery is at full capacity.

 Battery is at 2/3 capacity.

 Battery is at 1/3 capacity. The charger should be connected soon.

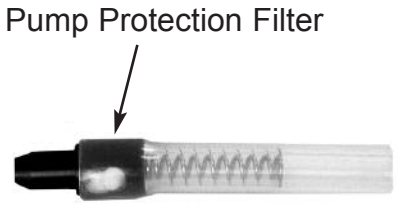
 Battery is very low and needs to be recharged immediately

 Indicates the analyzer is connected to the charger.

If a beeping noise is heard during charging disconnect the charger. This is an indication the battery pack needs to be replaced.

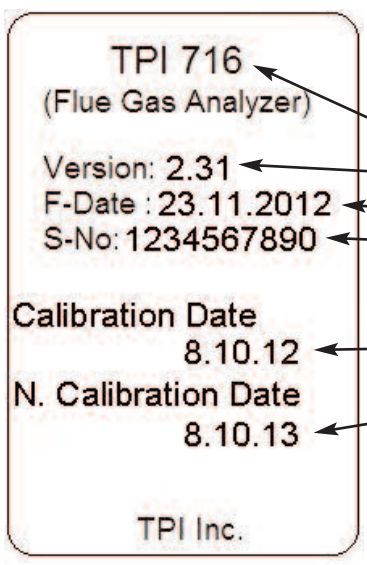
Turning The Analyser On

Always: - ***Before turning on please ensure that ONLY the in-line pump protection filter is connected to the Gas Sample Port. This in-line pump protection filter MUST be fitted to the instrument at all times!!***



Please **DO NOT** have the gas sampling probe attached at this point. The gas sampling probe needs be fitted to the 716 only at the point where combustion analysis begins. See page 14

Press and hold the ON/OFF key down for approximately 3 seconds. The 716 will beep and the initial start up screen will be displayed.

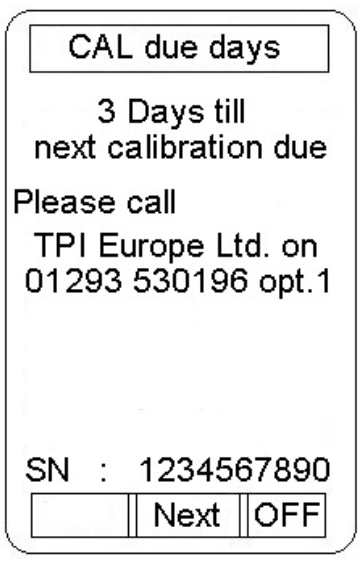


The initial start up screen displays the following information:

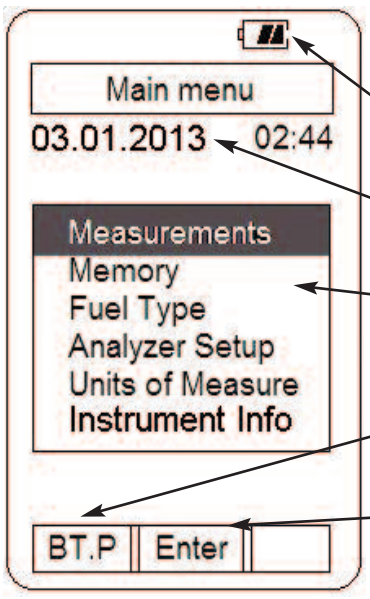
- Model number of the analyser
- Firmware version
- Firmware date
- Serial number of the analyzer
- Date Last Calibration was carried out
- Date Next Calibration is due

After approximately 5 seconds the Main menu will be displayed & the 716 is ready to use. However, as the Next Calibration Due Date Approaches or is Overdue one of the following screens may appear:-

Turning The Analyser On (continued)



Choosing “Next” will move you onto the Main Menu Screen as displayed below.
Please Note: It is a requirement of BS7967 that an FGA is within calibration and used in conjunction with the manufacturers instructions therefore it is NOT recommended that “Next” be chosen by the user if the “Calibration Overdue” Screen appears. Doing so will contravene the requirements of BS7967.



The main menu displays the following information:

Battery status

Date (dd.mm.yyyy format) and time (24hr clock)

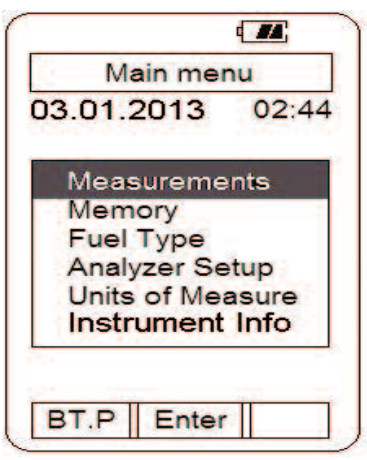
Menu Selections

Left blue soft key activates Bluetooth (Only models equipped with this option.)

Center blue soft key confirms selection

MEASUREMENTS - Flue Gas

Note: It is recommended you perform routine general maintenance on your analyser to ensure proper function. Please refer to Appendix A for further details



Turn the 716 on as outlined on page 9. After the initial start up screen the Main Menu will be displayed.

Using the Arrow keys select Measurements by highlighting it.

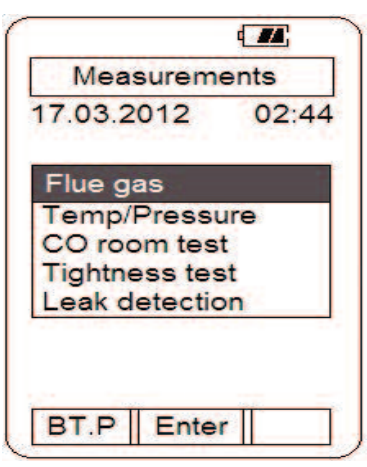
Press the Enter key (centre soft blue key) to confirm the selection.

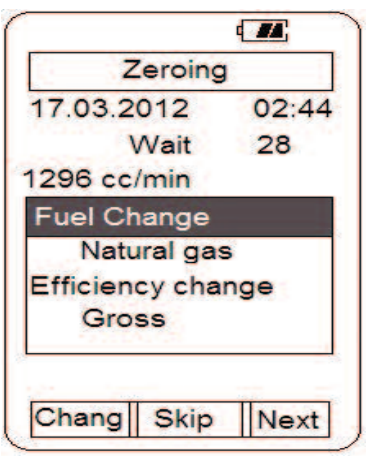
The Measurements menu will be displayed.

Using the Arrow keys select Flue gas by high lighting it.

Make sure the analyser is in a clean air environment with only the in-line pump protection filter connected to the input.

Press the Enter key (centre soft blue key) to confirm the selection.





The pump will start and the Zeroing screen will display. The analyser is initializing and self testing the sensors during this 30 second cycle.

The selected fuel type will be displayed and can be changed as necessary (see pg 12).

The selected unit of efficiency is displayed and can be changed as necessary (see pg 13).

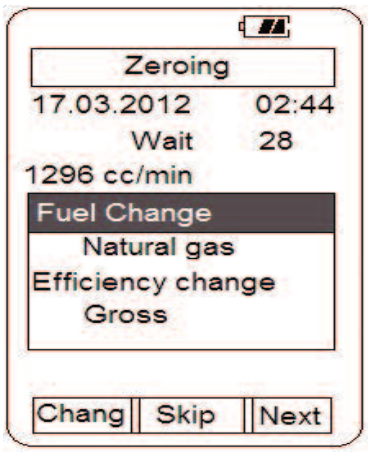
If the analyser is ready for use, “Skip” will appear above the center soft key. Pressing this will bypass the 30 second countdown.

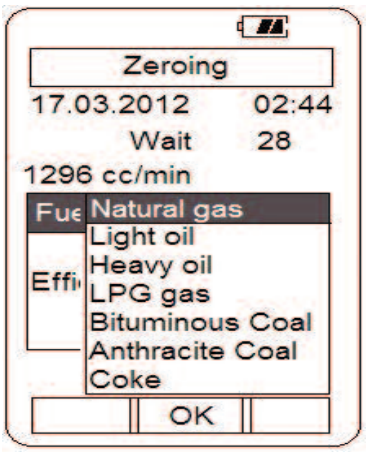
MEASUREMENTS - Flue Gas (continued)

As necessary, the fuel type can be changed to match the fuel type of the equipment under test. The fuel type is used in the CO2, Ratio & efficiency calculations and therefore it is important the fuel type is correct in order for the calculation to be accurate.

To change the fuel type use the Arrow keys to highlight “Fuel change”.

Press the Chang key (left soft blue key) and the fuel menu will display.





The Arrow keys are used to scroll through the available fuel types.

The available fuels are Natural gas, Light oil, Heavy oil, LPG, Bituminous coal, Anthracite coal, Coke, Butane, Wood (dry), and Bagasse.

Once the desired fuel type is highlighted press the center soft key (OK) to confirm the selection.

The analyser will return to the Zeroing display and the countdown will continue.

NOTE: When selecting oil as fuel be sure to use the optional oil filter (A773) or readings could become erratic. See Appendix E for installation instructions.

Do NOT use the A773 with a 716 analyser with the NO Sensor Upgrade.

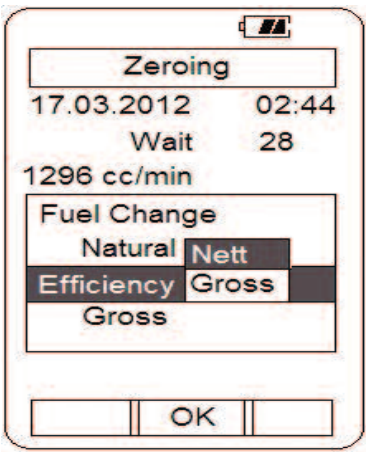
MEASUREMENTS - Flue Gas (continued)

The unit of efficiency can be changed as needed between Nett, Gross & Condensing. Nett efficiency doesn't take into account wet losses while Gross efficiency does. Condensing efficiency is a common calculation applied is some European Countries.

Press the right soft key (Next) to highlight "Efficiency change" in the display.

Press the Chang key (left soft key) and the efficiency menu will display.

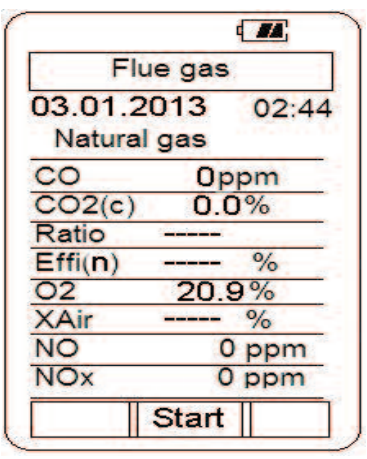
Use the Arrow keys to select the desired efficiency unit and press the center soft key (OK) to confirm the selection.

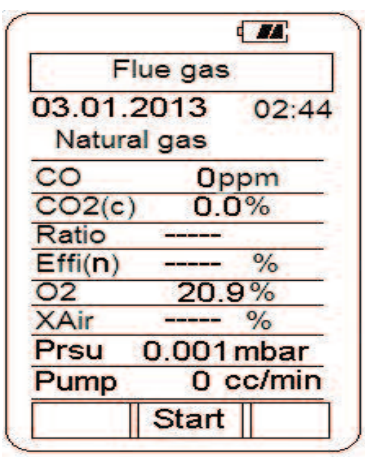


After the initial purge cycle is complete or skip is pressed the Flue gas measurement screen will display.

This screen displays all combustion parameters including NO & NOx (if fitted), temperature, pressure, excess Air and Pump Speed.

If an NO sensor is fitted then the Right Hand Down Arrow Key needs to be pressed to see Pressure & Pump Speed as well as Temperature.



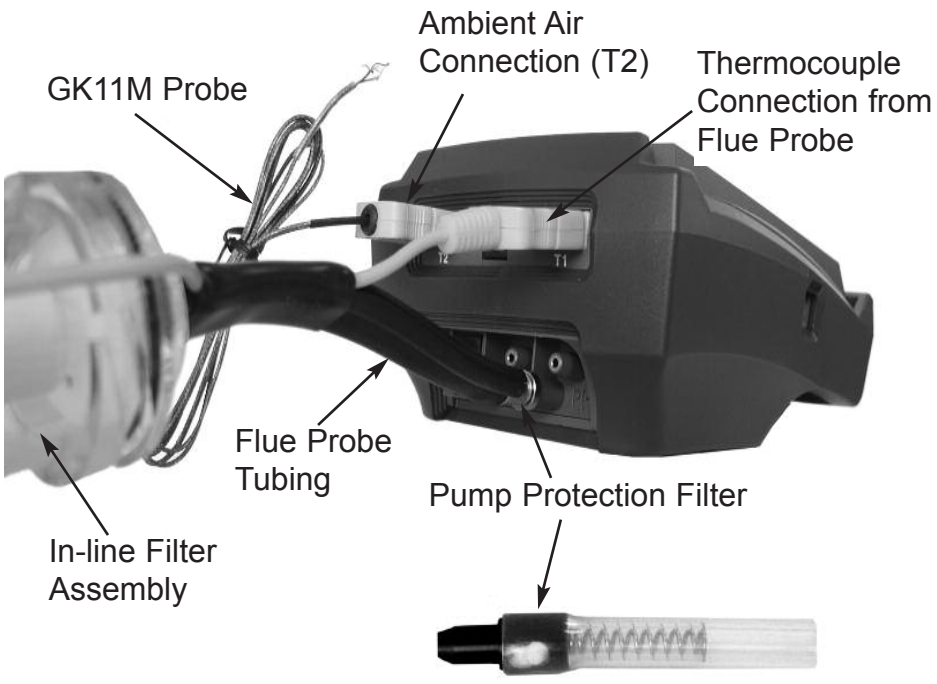


If only CO & O2 sensors are fitted then the bottom 2 spaces on the initial front Flue Gas Measurements Screen will display Pressure & Pump Speed. Pressing the Right Hand Down Arrow Key will scroll through and display the other parameters such as Temperature etc...

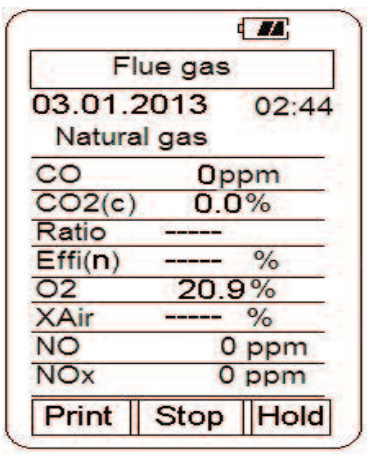
MEASUREMENTS - Flue Gas (continued)

Connect the Gas Sampling Flue Probe Tubing complete to the In-Line Pump Protection Filter (see below) and the 'K' Type Thermocouple Plug from the Flue Probe into Thermocouple (T1) Socket. The GK11M ambient air temperature probe is connected to the (T2) socket.

WARNING: - Ensure the 'K' type thermocouple probes are inserted into the sockets correctly (see page 7). The plugs are polarity marked and forcing the plug into the socket the wrong way may result in damage to the instrument.



Press the center Blue Soft Key (Start) and the pump will start. The following screen will display:-

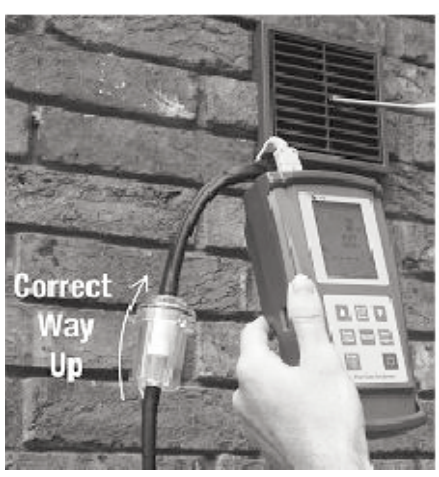


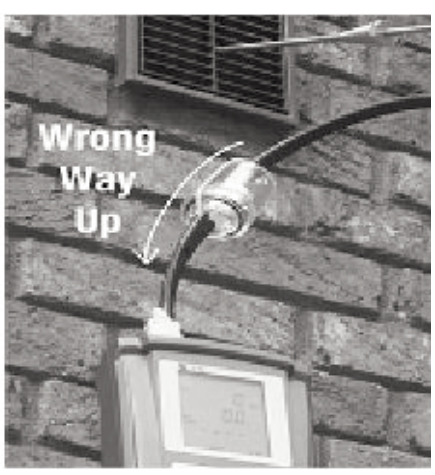
Press the Left Blue Soft Key to send the Displayed Readings Directly to the Optional A740 IR Printer
Press the Right Blue Soft Key to Hold the desired readings on the screen giving you the option to Save or Send them to Memory, IR Printer or PC.
Press the Centre Blue Soft Key to Stop the Pump Running. The Pump will only stop running if the CO level is below 10ppm otherwise this option is disabled.

MEASUREMENTS - Flue Gas (continued)

Insert the flue probe into the sample hole of the device under test. The probe tip should be in the middle of the flue pipe or exhaust stream.

Ensure the In-Line Filter / Water Trap hangs below the analyser in the proper vertical position when readings are being taken. Failure to comply reduces the effectiveness of the water trap and may result in damage to the instrument. Refer to the pictures below for correct and incorrect use.





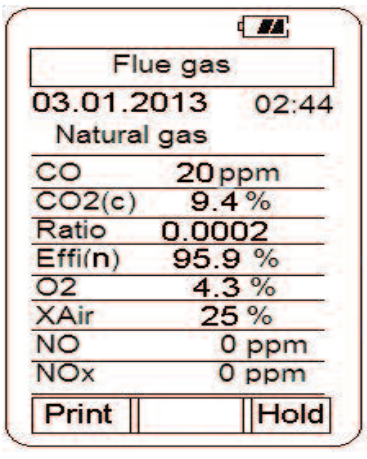
WARNING: - Should the CO reading rise above 2,000ppm a continuous series of Alarm Beeps will be heard. The Probe should immediately be disconnected from the instrument and the instrument returned to a clean air environment. This Alarm alerts the user that there is a high concentration of CO, and this procedure will protect the sensors within the instrument. The alarm level can be changed. Please see Appendix D

Make sure to check the water trap periodically during testing to ensure it does not fill with condensate and empty it as necessary. If the filter begins to fill during a test, open the lid and empty out the condensate. After closing the lid, allow readings to stabilize again.

IMPORTANT: The water trap is fitted with a water block filter (p/n A796-D) in the lid to prevent water from flowing down into the pump. If the water trap fills the water block filter will stop the flow to the analyzer and FLO ERR will display. The water trap should be emptied immediately if this happens. The water block filter may need to be dried out or replaced before testing can resume.

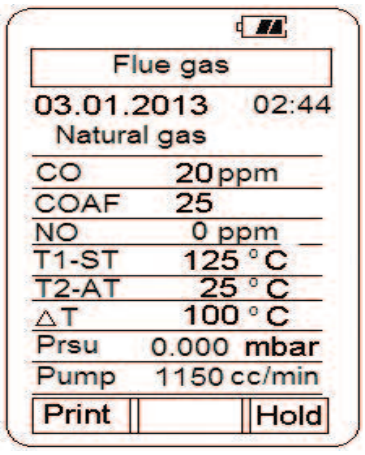
MEASUREMENTS - Flue Gas (continued)

Allow the readings to stabilise. Multiple parameters can be seen in the display.



- Carbon Monoxide (CO) reading in parts per million (ppm)
- Carbon Dioxide (CO2) figure in percentage (%) (calculated)
- CO/CO2 (Ratio) figure.
- Calculated Efficiency (Eff.) figure in percentage
- Oxygen (O2) reading in percentage (%)
- Excess Air (X Air) in percentage
- Nitric Oxide (NO) (measured) and Nitrogen Oxide (NOx) (calculated). ***If Fitted.***

Pressing the Up / Down Arrow keys enables the rest of the screen to be displayed.

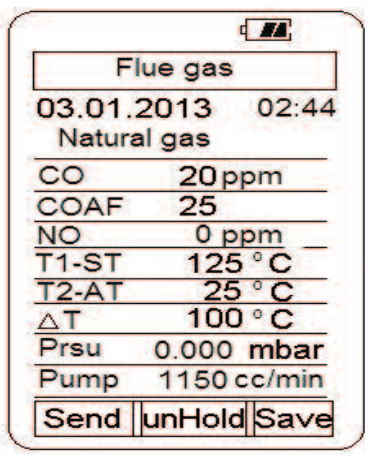


- Carbon Monoxide (CO) reading in parts per million (ppm)
- Carbon Monoxide Air Free (COAF) in parts per million (ppm) (calculated).
- Nitric Oxide (NO) (measured). ***If Fitted***
- Temperature T1-ST (stack temperature)
- T2-AT (ambient temperature).
- Temperature T1 - T2 (DT)
- Pressure (Prsu)
- Pump speed in cc/min.

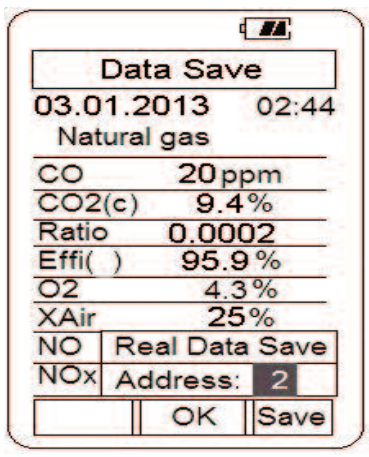
Once the combustion readings have stabilised they can be “Printed” directly to the optional IR (A740) Printer by lining up the IR window on the side of the FGA (see page 6) & the IR window on the Printer. Alternatively the stabilised readings can be “HELD” on the screen. Once the readings are held on the screen the following options are available:- “Send” the held readings to the A740 Printer or to a Compatible PC or “Save” the readings to a memory location of your choice. These options are explained in further details on page 17.

MEASUREMENTS - Flue Gas (continued)

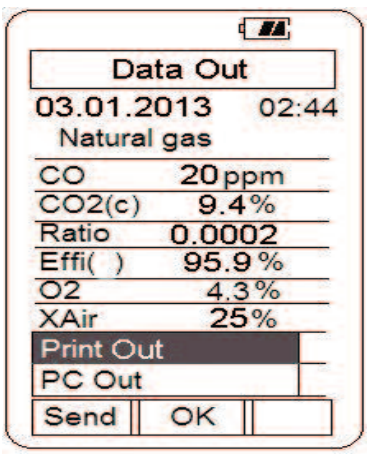
Choosing the “HOLD” option will display the following screen:-
Please note the 3 new options on the Soft Blue Keys



The TPI 716 will continue to monitor live readings in the background whilst the “Held” readings are on the display until the “unHold” option is chosen.
You can “Save”, “Print” or “Send” out as many sets of these readings as you require whilst the 716 is in “Hold” mode.
Once the “unHold” button is pressed then the 716 will return to Live readings as explained on Page 16.

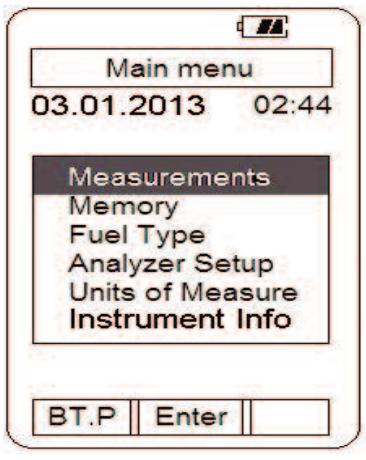


The “Held” data can be saved to a memory location by pressing the Save key (right blue soft key) and “Real Data Save” and “Address:” will be displayed.
Using the Up and Down Arrow keys select the memory location to save the data.
Press the OK key (center blue soft key) to save the data to the 716 internal memory.
Press the “Back” key at anytime to go back to “Held” Readings



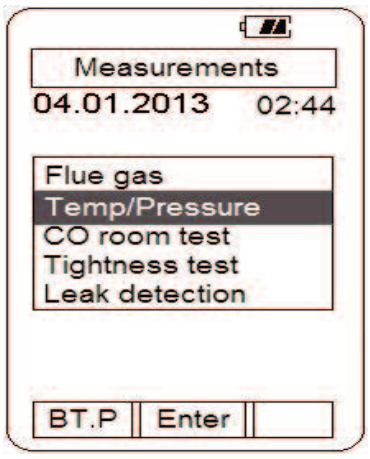
The “Held” data can also be sent to an optional infrared printer (p/n A740) or to a PC using optional cable and software by pressing the Send key (left blue soft key) and “Print Out” and “PC Out” will be displayed.
Using the Up and Down arrow keys select the type of output you require. If sending data to a PC, connect the USB cable to the analyzer and computer and run the 716 PC software.
Press the OK key (center blue soft key) to print or send data to a PC.
Press the “Back” key at anytime to go back to “Held” Readings

Measurements - Temperature & Pressure



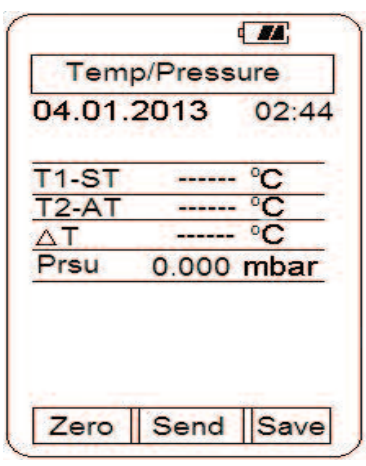
From the Main menu screen using the Up / Down Arrow keys select “Measurements” in the menu.

Press “Enter” (center blue soft key) to confirm the selection.



From the Measurements menu use the Up / Down Arrow keys to select “Temp/Pressure” in the menu.

Press “Enter” (center soft blue key) to confirm the selection.



The Temperature / Pressure screen will display.

This screen displays both T1 and T2 channels of temperature as well as the difference between T1 and T2 (DT).

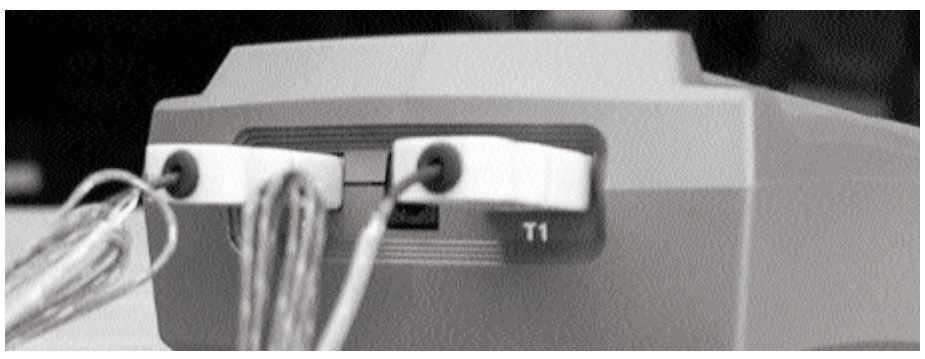
If no probe is connected to the input “-----” will be displayed indicating an open connection.

Pressure (Prsu) is also displayed in this screen.

Measurements - Temperature & Pressure (continued)

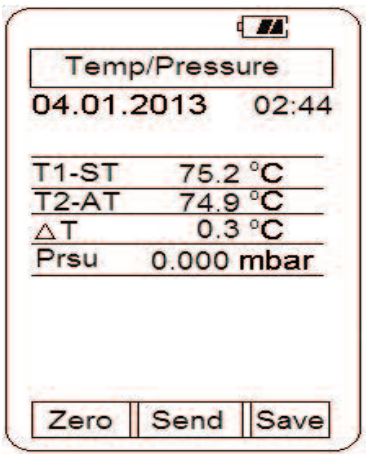
Measuring Temperature -

1. Ensure you have a 'K' type probe connected to one or both of the thermocouple sockets T1 / T2 (refer to figure below)



WARNING: - There is ONLY one correct way to connect the 'K' type thermocouple plug into the socket (see page 7). Forcing the plug into the socket the wrong way may result in damage to the instrument.

2. Touch the temperature probe to the item under test and read the displayed temperatures on the LCD.



Other Features:

• Pressing “Send” (center blue soft key) activates a sub-menu and allows information to be sent to the optional A740 infrared printer or to a PC using the optional USB interface cable and software.

• Pressing “Save” (right blue soft key) activates a sub-menu that allows the screen data to be saved in a memory location (0 to 99) for later retrieval.

• Pressing “Zero” (left blue soft key) zeros the manometer. This is used prior to measuring pressure.

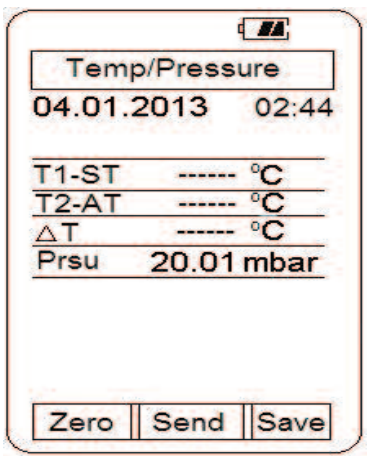
NOTE: Analyser shown in picture above with optional second GK11M probe. Analyser ships with one GK11M as standard.

Measurements - Temperature & Pressure (continued)

Measuring Pressure -

1. Ensure you have Pressure Sampling Tube connected to one or both of the Pressure Ports and there are no restrictions in the tubing (see figure below). The 716 is supplied with a pair of pressure adaptors to allow 1/4” bore hose to be attached to the pressure ports.

2. Zero the display by pressing the “Zero” Key (left blue soft key).
3. Connect the tube(s) to the device under test and read the pressure on the display.



Other Features:

• Pressing “Send” (center blue soft key) activates a sub-menu and allows information to be sent to the optional A740 infrared printer or to a PC using the optional USB interface cable and software.

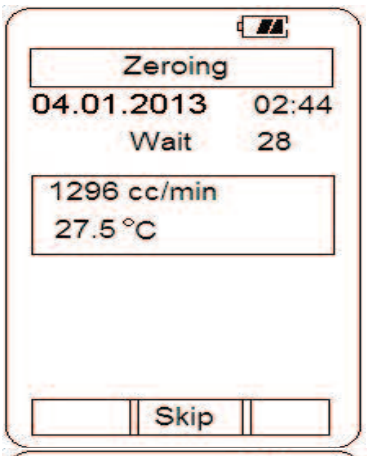
• Pressing “Save” (right blue soft key) activates a sub-menu that allows the screen data to be saved in a memory location (0 to 99) for later retrieval.

• Pressing “Zero” (left blue soft key) zeros the manometer. This is used prior to measuring pressure.

The 716 incorporates a differential manometer. Pressure applied to the (-) port is subtracted from the pressure applied to the (+) port.

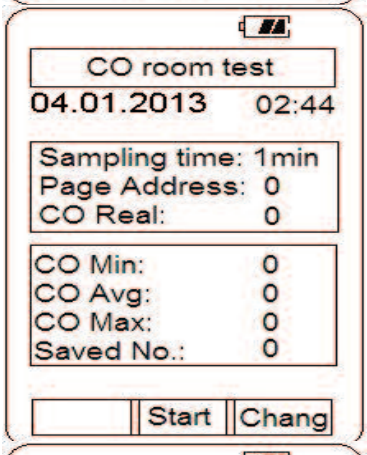
Measurements - CO Room Test

The CO room test function enables the 716 to monitor and log ambient CO levels in a room or office space at 1 minute intervals. This data can be retrieved later via the optional infrared printer or serial cable and software.



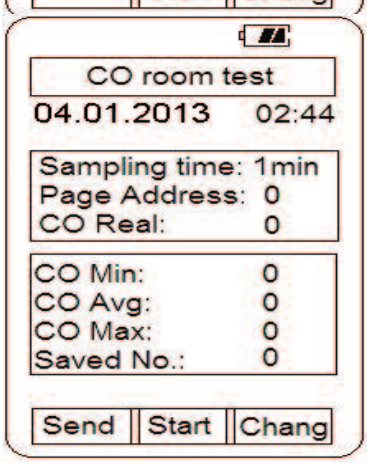
1. Begin with the 716 in a fresh air environment outside of the test area. From the main menu select “Measurement” as outlined on pages 10 & 11. From the “Measurements” menu select “CO room test” and the zeroing screen will display.

2. If “Skip” is displayed the analyser sensor is zeroed and ready for use. Press the center blue soft key to move to the next screen. If “Skip” is not displayed, wait for the zero process to finish and the next screen will be displayed automatically.



3. After the zero process the CO room test display will appear. At this time the page address where the data will be stored can be changed as necessary. Press the “Chang” key (left blue soft key) and use the Arrow keys to change the address location.

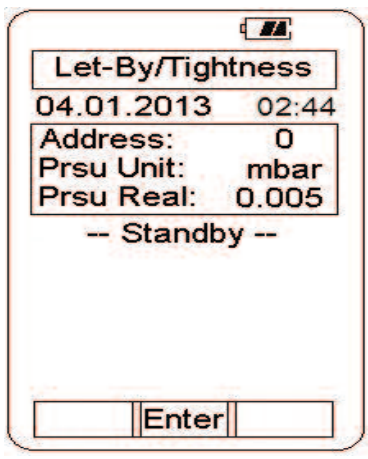
4. Press the “Start” key (center blue soft key) to begin CO monitoring. The pump will start and the 716 will begin storing readings every minute. The number of readings stored can be seen at the bottom of the screen. The real, minimum, maximum, and average CO measured will be displayed too.



5. When the 30 minute test period is up (or the desired number of readings have been taken and the test stopped by pressing “Stop” - centre blue soft key) the 716 will move to the next screen and give you the options in point 6.

6. Stored readings can be sent to a PC or printer by pressing the “Send” key (left blue soft key) and selecting “Print Out” or “PC Out”.

Measurements - Tightness Test



This function is designed to step you through each stage of the Let-By/Timed Tightness Test allowing you to Pass/Fail at the end of each stage and record the results either to memory for future use or directly to the optional IR (A740) printer.

1. From the main menu select “Measurement” as outlined on page 10. From the “Measurements” menu select “Tightness test” and the standby screen will be displayed.

2. Press the center blue soft key to “Enter” and begin the Let-By/Stablisation/Tightness Test.

3. On the first Let-By screen you can Zero the pressure before connecting up any pressure tubes and beginning the series of tests.

4. The memory location (0 - 99) can also be changed at this point before the test commences by pressing the right blue soft key to highlight the address location number. Use the Up/Down arrow keys to select the required numbered location then the centre blue soft key “OK” to confirm the change.

5. Once you have selected the desired memory address location and the pressure has been zeroed you can begin the test procedures as follows.

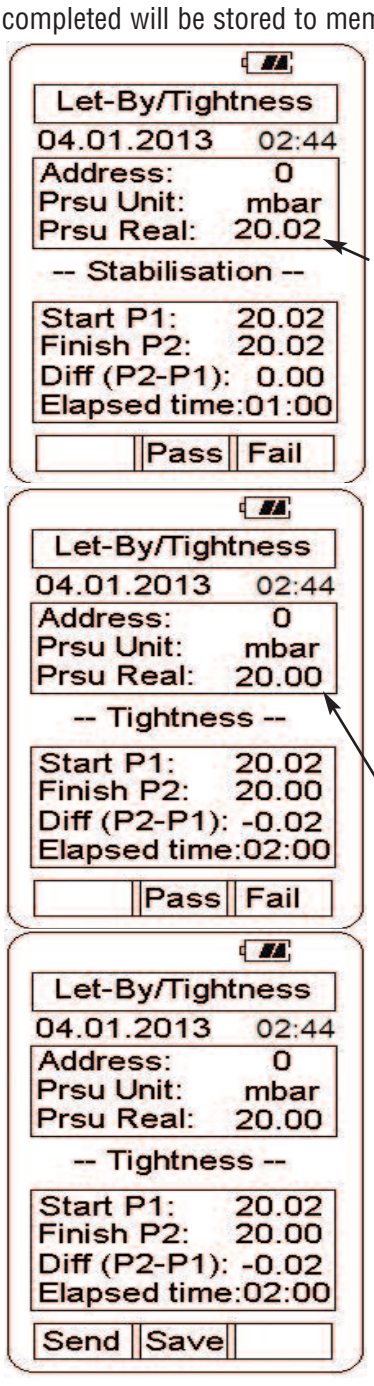
6. Connect the pressure tube to the desired test point and pressure up the 716 to the required pressure. The Live Pressure Readings can be viewed in the top box on all the following screens.

7. Once the desired pressure is reached the press the centre blue soft key “Start” to begin the procedure.

8. The Let-By test will run for 1 minute then “Pass” & “Fail” will be displayed as options on the centre & right blue soft keys. ***Please note:** at any point during any of the tests you have the option to “Stop” the test by pressing the centre blue soft key. Stopping the test will move you onto the Pass/Fail option and the length of time the test had run for will be displayed.

Measurements - Tightness Test (continued)

***Please note:** Choosing “Fail” at any point during the tests will take you immediately to the “Send/Save” Screen & only those parts of the procedure which have been completed will be stored to memory or will be printed (see below).



9. If the readings are within the allowable tolerances press the center blue soft key to “Pass” them and move onto the Stabilisation part of the test.

10. Pressure up the 716 to the required pressure. The Live Pressure Readings can be viewed in the top box on all the following screens.

11. Once the desired pressure is reached the press the centre blue soft key “Start” to begin the procedure.

12. The Stabilisation test will run for 1 minute then “Pass” & “Fail” will be displayed as options on the centre & right blue soft keys. Again, please note the option to “Stop” the test at any point.

13. If the readings are within the allowable tolerances press the center blue soft key to “Pass” them and move onto the Tightness part of the test.

14. Pressure up the 716 to the required pressure. The Live Pressure Readings can be viewed in the top box on all the following screens.

15. Once the desired pressure is reached the press the centre blue soft key “Start” to begin the procedure.

16. The Tightness test will run for 2 minute then “Pass” & “Fail” will be displayed as options on the centre & right blue soft keys. Again, please note the option to “Stop” the test at any point.

17. Test results (either “Passed” or “Failed”) can be sent to a PC or printer by pressing the “Send” key (left blue soft key) and selecting “Print Out” or “PC Out”. Pressing the “Save” key (centre blue soft key) will store the results to the chosen memory location and return you to the “Standby” screen.

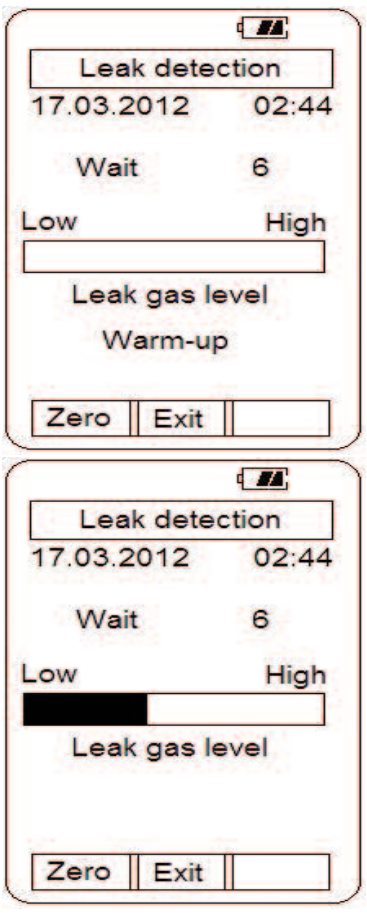
Measurements - Leak Detection

The Leak Detection function enables the 716 to test for combustible gas leaks in gas valves and fittings using the included gooseneck probe.

1. Connect the combustible gas probe to the USB connector located on the top of the 716. See picture below.

Combustible Gas Probe (716-Leak)

Connect the combustible leak probe here.



2. From the main menu select “Measurement” as outlined on page 10. From the “Measurements” menu select “Leak detection” and the following screen will display.

3. The 716 will begin to countdown from 30. During this time the combustible sensor is being warmed up and prepared for use. A light in the sensor cage will illuminate and can be used to aid in seeing fittings in dark areas.

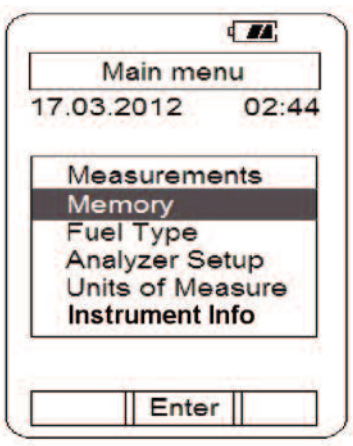
4. After the warm-up period is complete the Leak detection screen will display and a constant tick will be heard. Use the combustible gas probe to begin looking for leaks.

5. When a leak is encountered the tick rate will increase and the Low to High bar graph will visually indicate a leak. Press the “Zero” key (left blue soft key) to reset (nullify) the tick and continue looking for the leak. Repeat this process until the probe is directly over the source of the leak.

6. Press the “Exit” key (center blue soft key) to return the 716 to the “Measurements” menu.

Menu Navigation - Memory

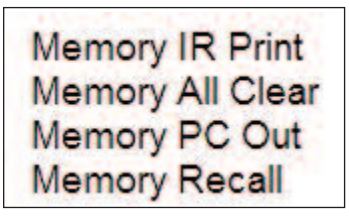
From the Main menu there are several sub menus that allow analyser set up, memory maintenance and other parameters to be accessed. Here is a list of each and what function they perform.



1. Memory can be accessed from the main menu to enable maintenance to be performed. Use the Arrow keys to select “Memory” and press the “Enter” key (center blue soft key).

2. Use the Arrow keys to select the memory type to be accessed. Press the “Enter” key (center blue soft key) to confirm the selection.

3. Depending on the memory type selected all or some of the options shown below will be available.



Memory IR Print - Allows information printed in specific addresses to be printed to the optional infrared printer (p/n A740)

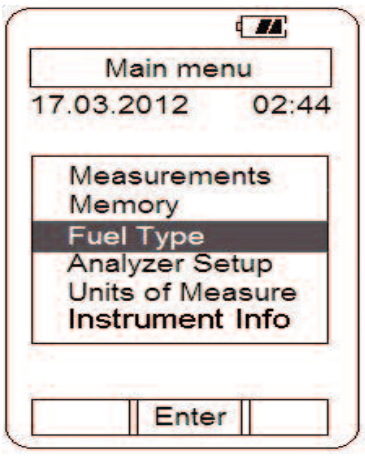
Memory All Clear - Clears information out of all memory locations.

Memory PC Out - Sends all information stored in memory to a PC. Requires optional USB cable and software.

Memory Recall - Enables information from memory locations to be recalled and displayed for viewing.

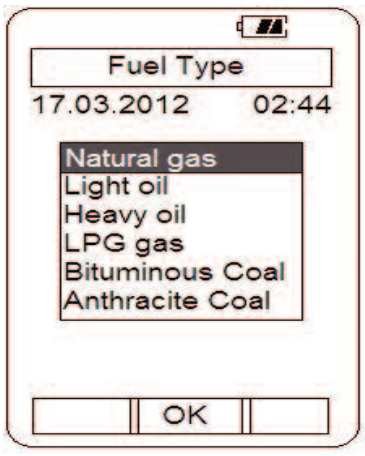
4. Use the Arrow keys and blue soft keys to access these functions.

Menu Navigation - Fuel Type



1. From the main menu use the Arrow keys to select “Fuel Type” and press the “Enter” key (center blue soft key).

2. Use the Arrow keys to select the fuel type. Scrolling down displays the rest of the available fuel types.



3. Press the “OK” key (center blue soft key) to confirm the selection.

Fuel type can also be changed from the flue gas zeroing screen as outlined earlier in this instruction manual.

Menu Navigation - Analyser Setup

1. From the main menu use the Arrow keys to select “Analyser Setup” and press the “Enter” key (center blue soft key).

2. The Analyser Setup menu will display. The following parameters are accessible in this menu. Use the Arrow keys and center blue soft key to select the appropriate parameter.

Display type - Allows the display to be switched between 8 line and 4 line.

Date / Time - Used to set the current date and time. The date is in dd:mm:yyyy format and the time is a 24 hour clock.

Contrast - Lighten or darken the display contrast.

Backlight - Adjust the backlight level from off to full brightness or set it to auto and the 716’s internal sensor will control the backlight brightness depending on ambient light.

Alarm limits - Set the level at which the CO alarms sounds.

Print Header - Enables the two line header on printouts sent to the infrared printer to be set with your companies information. After pressing “Enter” you will be asked for a password. Enter “**7160**” and press “OK”. Select Header Line 1 by pressing the centre blue soft key “Enter”. Use the Up/Down Arrow & Left/Right Blue Soft Keys to move to the required character then press the centre blue soft key “Enter” to choose this character. Repeat this process until the required details are displayed in the top box. Use the Up Arrow Key to have the cursor enter the top box and “Save” will appear as the Centre Blue Soft Key. Choosing “Save” records the information to memory and returns you to the “Printer Setting” screen. Highlight “Header Line2” by using the Down arrow Key and repeat the process for line 2 of the header.

Auto Power - Enables the auto power off time to be set. The timer can be disabled or set to one of the following times; 5, 10, 20, 30, or 60 minutes. If a key has not been pressed during the time set, the analyser will automatically begin to turn off.

Memory - Enables memory maintenance as outlined on page 25.

Menu Navigation - Units of Measure

1. From the main menu use the Arrow keys to select “Units of Measure” and press the “Enter” key (center blue soft key).

2. The Units of Measure menu will display. The following parameters are accessible in this menu. Use the Arrow keys and center blue soft key to select the appropriate parameter.

Temperature - Select between °C and °F for temperature measurements.

Pressure - Select between mbar, psi, inH2O, mmH2O, kPa, hPa, inHg, mH2O and mmHg units of measure for pressure readings..

Efficiency - Select between Nett and Gross efficiency.

Menu Navigation - Instrument Info

Provides the serial number, firmware version, and firmware date & Bluetooth Pin Code (if fitted) for reference.
Choosing “Next” also shows the Last Calibration Date of the unit, the Next Calibration Due Date, and Battery voltage & condition.

Menu Navigation - Calibration Mode

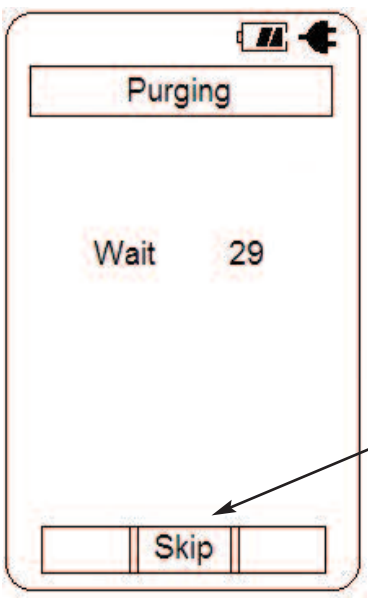
This is for factory use only.

Turning The Analyser Off

Always: - Before turning off, return the instrument to a clean air environment and allow the Carbon Monoxide level to return below 10ppm and the Oxygen level to return to 20.9% (± 0.3%). Then, remove the Temperature Gas Sampling Probe (if connected) making sure that the in-line pump protection filter remains connected to the gas sampling port.
Press the Power Key to turn the instrument off:-

NOTE The Instrument will not allow itself to be switched off if the CO is above 10ppm

When the 716 is turning off the following screen is seen:



The instrument has an auto shut off factory set for 10 minutes should no keys have been pressed for this period and the CO level is below 10ppm. The auto power off can be set to a different time or disabled.
Please refer to Menu Navigation - Analyser Setup on page ??.

If the CO level is close enough to 0ppm and the O2 level is close enough to 20.9% the analyser will display “Skip”. This allows you to skip the purge by pressing the middle soft key.

SPECIFICATIONS

Instrument

Operating Temperature Range	14°F to +122°F (-10°C to +50°C)
Battery / Battery Life	Rechargeable Ni-MH / > 6 Hours
Charger Input Voltage	115V or 230V : 50/60 Hz AC
Fuels	Natural Gas, LPG, Light Oil, Heavy Oil, Bituminous Coal, Anthracite Coal, Coke, Butane, Wood, Bagasse
Pressure Ranges	mbar, psi, inH2O, mmH2O, kPa, hPa, inHg, mmHg, mH2O
Display	Backlit Graphic LCD
Data Storage	100 sets of readings, multiple pages
Time & Date	24 Hour Real Time Clock
Dimensions	7.8" (200mm) x 3.5" (90mm) x 2.4" (60mm)
Weight	1.1lbs (500g)
Conforms to	EN50379

Flue Temperature Probe

Construction	Pistol Grip with Stainless Steel Shaft
Hose Length	8.2' (2500mm)
Insertion Length	7.9" (200mm)
'K' Type Thermocouple Accuracy	+/- 0.3% of fullscale, +/- 2°F (1°C)
Maximum Temperature	1472°F (800°C)

SPECIFICATIONS (Continued)

Gases	Range	Resolution	Accuracy
Oxygen	0-25%	0.1%	+/- 0.3%
Carbon Monoxide (low)	0-10,000 ppm	1 ppm	(<100ppm) +/- 5 ppm (>=100ppm) +/- 5%
Carbon Monoxide (high)*	0-100,000 ppm	0.001%	>10,000ppm: +/- 10%
Nitric Oxide *	0-5000ppm	1ppm	+/- 5ppm (<100ppm) +/- 5% (<1000ppm) +/- 10% (>1000ppm)
Carbon Dioxide	0-25%	0.1%	Calculated
CO/CO2 Ratio	0-0.999	0.0001	Calculated
Combustion Efficiency	0-100%	0.1%	Calculated
Gas Leak Sensor	100-10,000 ppm (calibrated to methane)		

*if fitted

Pressure Measurement

Selectable Ranges	mbar, psi, inH2O, mmH2O, kPa, hPa, inHg, mmHg, mH2O
Range	- 100 mbar to + 100 mbar -10 kPa to + 10 kPa -40 inH_2O to 40 inH_2O
Resolution	0.001 mbar (0~9.999 mbar), 0.01 mbar (10.00~99.99 mbar)
Accuracy	< 5 mbar: +/- 0.05 mbar > 5 mbar: +/- 1% of reading

Temperature Measurement

Input Type	K-Type thermocouple
Range	-58°F to 2372°F (-50°C to 1300°C)*
Resolution	1°F (1°C)
Accuracy	+/- (0.3% of rdg + 2°F) or +/- (0.3% of rdg + 1°C)

CALIBRATION & SERVICE

It is a British Standard requirement that your analyser be calibrated every 12 months.

Please call TPI Service Helpline on

01293 530196 opt. 1

or return your FGA to the distributor that you purchased the unit from.

The following are user replaceable consumable parts for the instrument:

In-Line Filter Element (pkg of 10)	A796-F
Disc water filter	A796-D
Mini Pump Protection Filter	A763

WARRANTY

Your TPI 716 Flue Gas Analyser is guaranteed free from defects in materials and workmanship for 6 Years from the date of purchase subject to the unit being returned annually and serviced/calibrated by TPI or an approved Service Centre.

Appendix A: General Maintenance

All combustion analysers use consumable items such filters and probes. These items are user serviceable and can be taken care of by the operator.

The consumable items that will require operator attention are the water trap / filter assembly, flue probe, pump protection filter, and ambient temperature probe.

The following maintenance checks should be performed before each boiler analysis to ensure that the filters are clean & dry and free from any dirt or moisture. ***Failure to ensure filters are clean and dry may result in slow &/or inaccurate readings.**

That the pump is running at OK and that the probe has no loss of integrity which could result in in-accurate readings

Water Trap Check
Visually check the water trap for:

1. Cracks in the bowl.
2. Broken ears on the bowl where the lid locks on.
3. Broken ears on the lid.
4. Worn out o-ring on the lid.
5. Loose connection to the flue probe tubing.

Filter Check

Signs of dirty or water saturated filters are a slow pump, flow error displayed when the flue probe is connected, and measurements that take longer than normal.

TPI analysers use three filters to protect the pump and sensors. The first filter to check is the A763 mini pump protection filter. (see picture below)

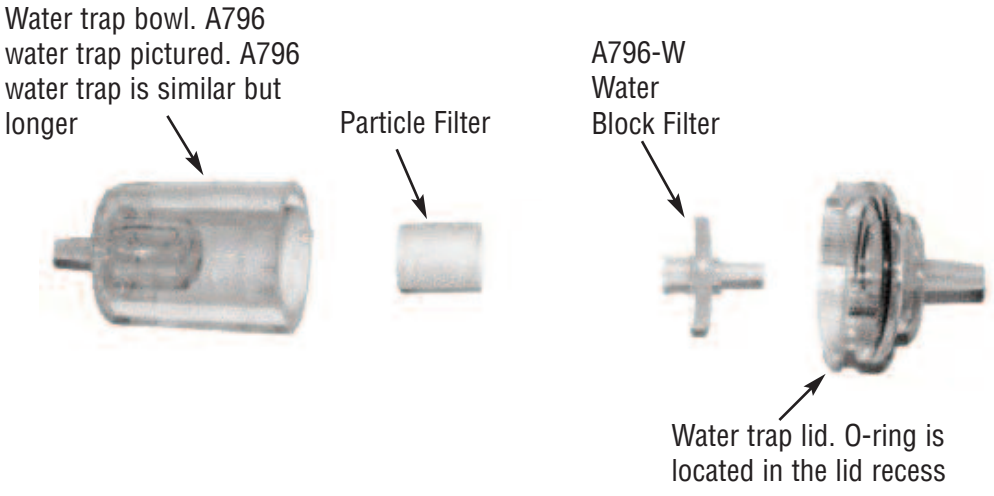
Pump Protection Filter

Look in the inspection window to check the filter. When the filter material becomes dark, pull the black nose cone out of the tubing and replace the ball filter inside.

Appendix A: General Maintenance (continued)

Filter Check Continued

The other two filters are located in the water trap. The main filter is the A796-F particle filter. This filter stops debris and dust from traveling down to the analyser. The secondary filter is the A794-D water block filter. This filter stops flow in the event the water trap fills with condensate. Refer to the picture below.



Open the water trap and look at the particle filter. The filter will typically get dirty from the outside first. If the filter is dark on the outside a replacement filter should be installed.

If the particle filter is clean but saturated with water a replacement should be installed to ensure proper flow. The saturated filter can be left to dry and reused later.

Pump Operation Check

1. Turn the analyser on as outlined on pages 11 to 14. Wait until the analyser has completed the initial purge and sensor check and is operating normally prior to proceeding to step 2.

2. With the pump running, cover the analyser gas inlet port with your finger. The analyser should display “FLO ERR” and a rapid beeping should be heard.

If the analyser does not beep and does not display “FLO ERR” this may be an indication the flow sensor requires calibration, the pump is faulty, or there is an internal leak. The Technical Helpline should be contacted on 01293 530196 opt. 1

Appendix A: General Maintenance (continued)

Flue Probe Integrity Check

NOTE: Perform this check **AFTER** performing the Pump Operation Check outlined on the previous page.

1. Turn the analyser on as outlined on page 9. Wait until the analyser has completed the initial purge and sensor check and is operating normally prior to proceeding to step 2.

2. Connect the flue probe assembly to the in-line pump protection filter which should be connected to the analyser and the yellow thermocouple connector to input T1.

3. Navigate to “Flue Gas” screen and start the pump running as outlined in pages 11 to 14. Press the down arrow key so that temperature is displayed. If the displayed temperature is approximately the ambient temperature the thermocouple is operating properly and you may proceed to the next step to continue the test. If the displayed temperature is “OL” the thermocouple is open and the probe may be in need of factory service. Please call the Technical Helpline on 01293 530196 opt. 1

4. Cover the end of the flue probe with a small piece of tube and pinch the end closed. After a short period of time the analyser should display “Flow Error” and a rapid beeping should be heard. If this happens the flue probe his operating properly and the integrity test is complete. If the analyser does not display “Flow Error” this is an indication of a possible leak somewhere in the flue probe and you may proceed to the next step for further tests.

5. Pinch the hose below the handle of the flue probe. If the analyzer displays “Flow Error” there is a leak in the handle assembly and the probe may need to be factory serviced. If the analyser does not display “Flow Error” proceed to the next step for further tests.

6. Pinch the hose between the analyzer and the water trap. If “Flow Error” still does not display there may be an internal leak, pump problem, or other issue and the analyser may need to be factory serviced. If “Flow Error” is displayed there is a leak in the water trap assembly and the water trap assembly should be checked as outlined on page 34.

At any stage the Technical Helpline is available by calling 01293 530196 opt. 1

Appendix B: ERROR CODES & TROUBLESHOOTING

Code Displayed	Code Definition	Possible Causes	Corrective Action
Flow Error	Pump not drawing sample at correct flow rate.	Blockage / kink in flue probe hose. Dirty or blocked filter(s). Worn pump.	Check and rectify. See Appendix A. Replace filter(s). See Appendix A. Call Technical Helpline on 01293 530196 opt. 1
Sensor Error	Oxygen sensor failed to initialize	Flue probe connected to 716 prior to power up. 716 did not purge completely from last sample. Worn or defective oxygen sensor.	Disconnect probe and restart. Purge for 20 minutes and restart. Call Technical Helpline on 01293 530196 opt. 1
Sensor Error	Carbon monoxide sensor failed to initialize.	Flue probe connected to 716 prior to power up. 716 did not purge completely from last sample. Worn or defective carbon monoxide sensor.	Disconnect probe and restart. Purge for 20 minutes and restart. Call Technical Helpline on 01293 530196 opt. 1
Lo bat	Low battery.	Battery needs to be charged.	Charge battery. If the battery won't hold a charge, replace the battery.
oFL	Overflow indication. The pressure being measured is outside the maximum measurement capability.	Pressure being measured is too high or low. Pressure sensor damaged or defective.	Remove pressure source. Call Technical Helpline on 01293 530196 opt. 1
oFL	Overflow indication. The temperature being measured is outside the maximum measurement capability.	Temperature being measured is too high or low.	Remove pressure source.
oPEn	Unable to read thermocouple (temperature).	Temperature probe not connected to input. Worn temperature sensor.	Connect temperature probe to analyser. Replace temperature probe or flue probe.

Appendix B: ERROR CODES & TROUBLESHOOTING (Continued)

Problem	Possible Cause	Corrective Action
Efficiency reading incorrect	NET/GROSS efficiency incorrectly selected. Ambient temperature probe not plugged in to T2. Incorrect fuel selected.	Select correct efficiency. Plug ambient probe into T2. See page 14. Select the proper fuel for the appliance being tested. See page 12 or 26.
Readings are erratic when working on oil fired equipment.	Oil filter not installed or installed incorrectly.	Make sure the optional sulfur filter (A773) is installed correctly.
One or all of the following parameters; Ratio, CO air free, excess air, and efficiency read and print dashes.	Measured values are such that the calculated values of these parameters are out of range.	Redo combustion test. Since these are calculated values, the measure values must be within certain levels for these to display. If the measured oxygen level is above 19.9% these parameters won't read. These parameters might not display or be applicable in some tests.
Pressure prints as "N/A" on my combustion analysis print out.	During combustion analysis if a pressure measurement is not being made this parameter will print as not being used.	Perform the combustion test and also connect the manometer and monitor pressure.
Battery will not charge or hold a charge.	Defective charger or battery.	Replace the charger or battery. Call Technical Helpline on 01293 530196 opt. 1
Beeping noise heard during charging.	Defect in charging circuit or shorted battery.	Disconnect from the charger and Call Technical Helpline on 01293 530196 opt. 1
Analyser won't turn off	Oxygen and/or carbon monoxide levels outside limits.	Allow the analyser to purge longer.
Pressure sensor will not zero.	Pressure sensor needs to be reset.	Call Technical Helpline on 01293 530196 opt. 1