



The Value Leader™
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TPI 709R



Combustion Analyser

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1. Introduction

Thank you for purchasing TPI brand products. The TPI 709R Combustion 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 desirable parameters associated with appliance installation and maintenance. The instrument is ruggedly constructed and comes with a limited 3 Year Warranty.

This manual will guide you through the functions of the TPI 709R, which will give you many years of reliable service. The TPI 709R software has in-built self-diagnostics that can easily be interrogated by our fully qualified and professional engineers should an error occur. Please call the number below before returning your instrument to your distributor should an error occurs. We can rectify over 75% of proposed faults over the phone.

TPI HELPLINE **01293 530196**

Your TPI 709R Combustion Analyser comes complete with the following items as standard: -

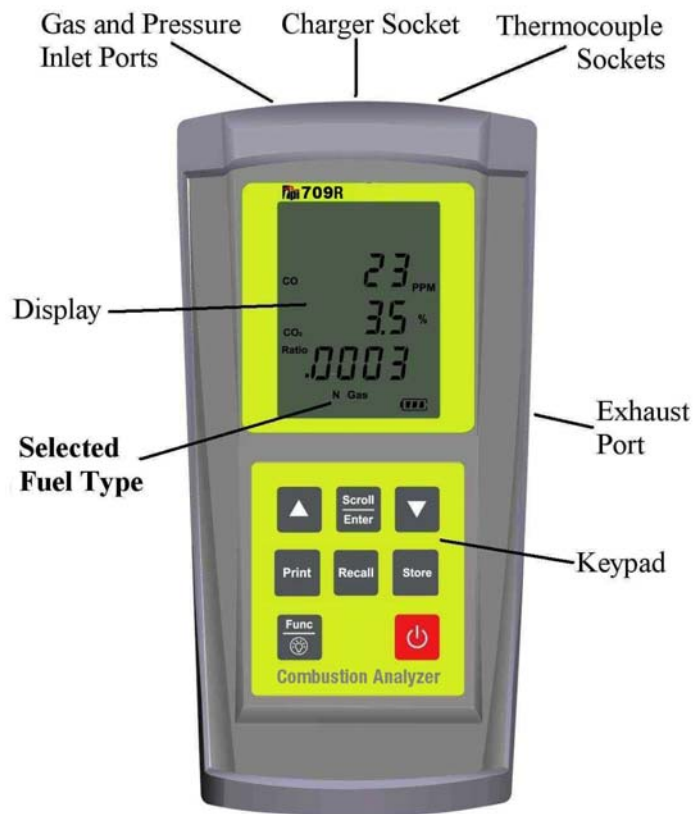
- TPI 709R Instrument
- Rubber Boot
- Soft Carrying Case
- Sampling Probe (c/w Type "K" Thermocouple)
- In-Line Water Trap Bowl Filter (c/w Spare Particle Filter)
- Battery Charger
- Mini In-Line Pump Protection Filter (c/w 5 spare filters)
- Exhaust Spigot (removable)
- Pressure Tubing (2 x 1 metres)
- GK11M Air Probe
- Instruction Manual

Your TPI 709R Combustion Analyser has the following options available: -

- Infrared Printer (see Appendix B)
- Various Temperature Probes (see Appendix B)
- Oil Filter (see Appendix B)
- Smoke Test Pump (see Appendix B)

2. Instrument Overview

2.1 Front View



<u>Rubber Boot</u>	Protects the instrument from accidental damage
<u>Display</u>	Large 3 Parameter Backlit Display
<u>Battery Indicator</u>	Showing battery life
<u>Selected Fuel Type</u>	N Gas, LPG, Light Oil or Heavy Oil



Scrolls through selectable fuels (see 3.2)
Switches between Gross and Nett Efficiency (see 4.1.4)
Switches between °C and °F (see 4.2.1)
Scrolls through mbar, kPa and inH₂O (see 4.3.1)
Moves up through the Stored Data Addresses (see 5, 6 & 7)



Zeroes pressure reading (see 4.3.1)
Moves down through the Stored Data Addresses (see 5, 6 & 7)



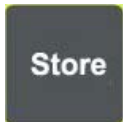
Scrolls through Flue Gas Analysis Function Screens (see 4.1)
Turns ch₂ temperature ON/OFF (see 4.3.1)
Allows you to change the Date and Time (see 4.4)
Allows you to choose a Stored Data Address (see 5, 6 & 7)



Sends stored data to a separate infrared printer (see 7)



Allows you to view stored data on the display (see 6)



Stores readings to memory (see 5)

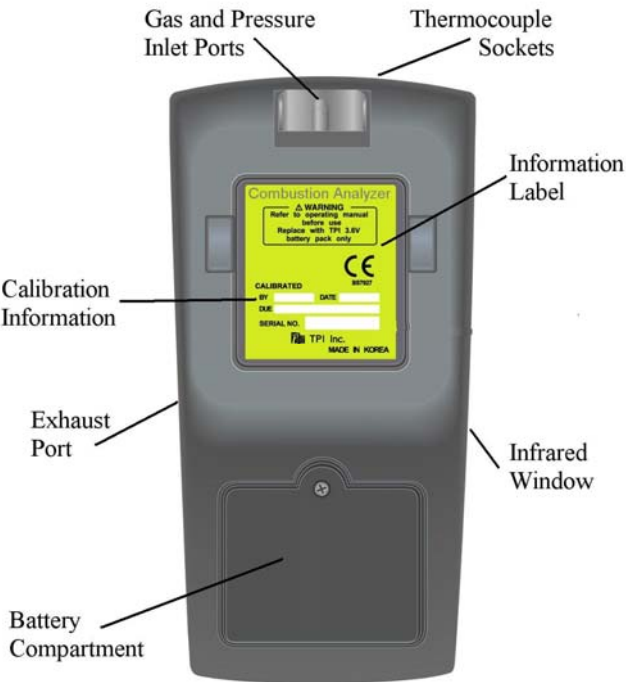


Moves you through the 4 Functions (see 4)
Turns Backlight ON and OFF (see 4)



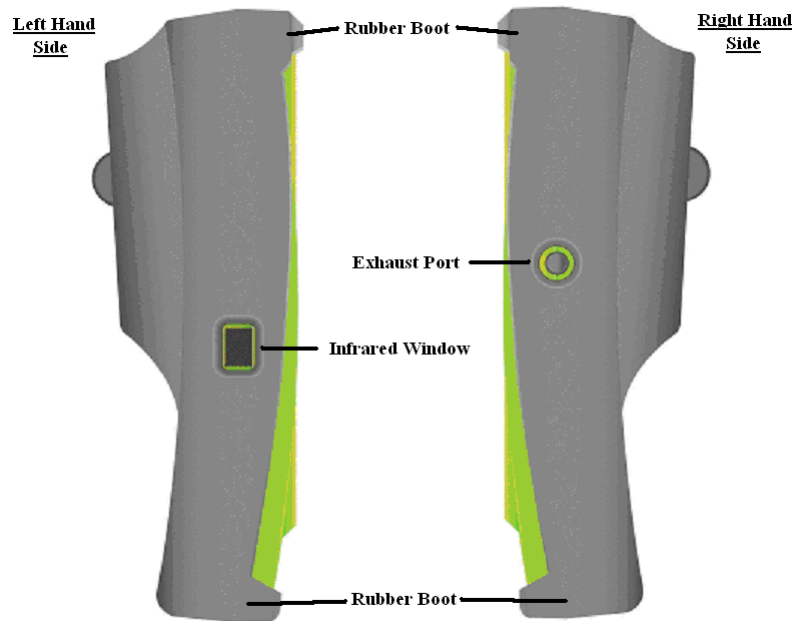
Turns the instrument ON and OFF (see 3.1 & 8)

2.2 Back View



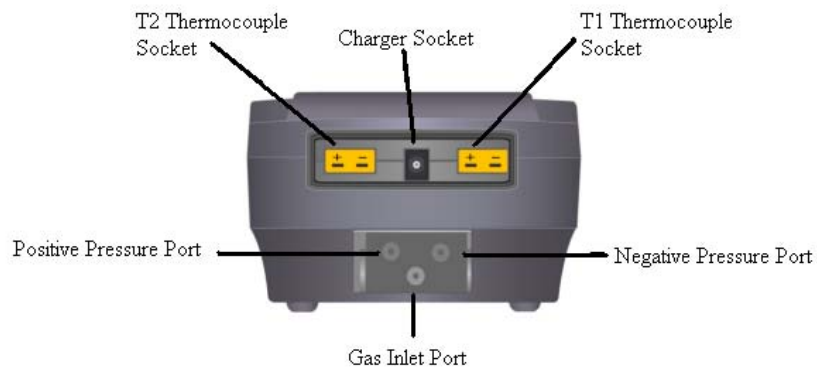
- Gas and Pressure Inlet Ports Connection for In-Line Pump Protection Filter (see 2.4 & 3.1)
Connections for Pressure Tubing (see 2.4 & 4.3)
- Calibration and Info Label Displays calibration information
Displays serial number
- Battery Compartment Holds rechargeable battery
- Rubber Boot Protects the instrument from accidental damage

2.3 Side Views



<u>Exhaust Port</u>	Port for connection of Exhaust Adaptor
<u>Infrared Window</u>	Window for sending stored data to IR Printer (see 7)
<u>Rubber Boot</u>	Protects the instrument from accidental damage

2.4 Top View



<u>Charger Socket</u>	Connection for 220V/115V charger (see 10.1)
<u>Thermocouple (ch1) T1 Socket</u>	Connection for thermocouple plug on probe (see 4.1) Connection for any 'K' type thermocouple probe (see 4.2)
<u>Thermocouple (ch2) T2 Socket</u>	Connection for any 'K' type thermocouple probe (see 4.2)
<u>Gas Inlet Port</u>	Connection for In-Line Pump Protection Filter (see 3.1)
<u>Pressure (+) Port</u>	Connections for Pressure Tubing (see 4.3)
<u>Pressure (-) Port</u>	Connections for Pressure Tubing (see 4.3)

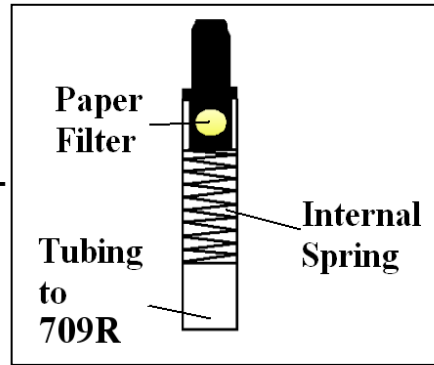
3. Turning On & Fuel Selection


3.1 Turning On

Always: - Before turning on please ensure that the **In-Line Pump Protection Filter** (shown across) is connected to the Gas Sample Port (see 2.2 or 2.4).

****THIS MUST REMAIN ON THE UNIT AT ALL TIMES.****

Failure to do so may result in pump failure and will invalidate the warranty.



Press the **Power Key**  for approximately 2 seconds and the TPI 709R will start up and display ALL Segments on the display for approx. 1 second. The 709R will then enter its 30-second purge period countdown with the following screen being displayed.




The instrument should **ALWAYS** be turned on in a clean air environment as the 30 second purge will attempt to set the Carbon Monoxide level to 0 ppm and the Oxygen to 20.9%.

*If there is insufficient clean air in the sensor chamber after the 30 second purge period an error indicating this **may** be displayed, please see troubleshooting guide (appendix D) for appropriate remedy. If the error is still present after attempting the suggested remedy please call the*

TPI HELPLINE
01293 530196

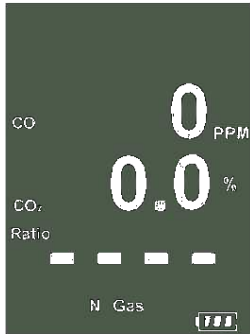
3.2 Fuel Selection

During the last 20 seconds of the 30 second purge time (i.e. as the 709R counts down from 19 to 0) the user can scroll through the following Fuels: - Natural Gas, LPG, Light Oil & Heavy Oil by repeatedly pressing the


Up Arrow Key  to select the Fuel they are working with.


4. THE 4 FUNCTIONS

After the 30-second countdown the instrument is ready to take **Flue Gas**, **Temperature** or **Pressure** readings and will Display the following Screen.



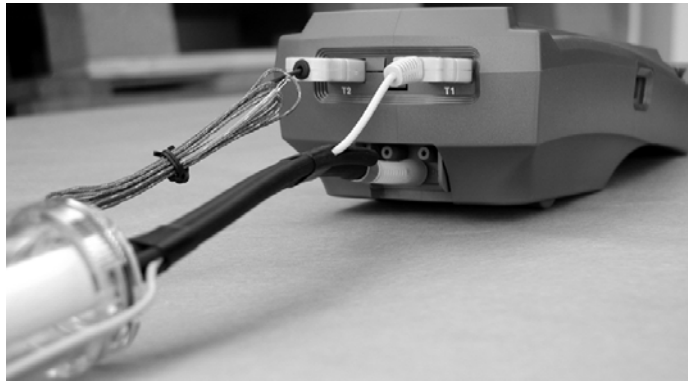
You are now ready to take Flue Gas Analysis Readings. Please continue on with the manual from Section 4.1 (below) which will guide you through the various Analysis Screens.

However, if you do not wish to perform a Flue Test at this moment Press the Func/Backlight Key and move onto Section 4.2 of the manual. 

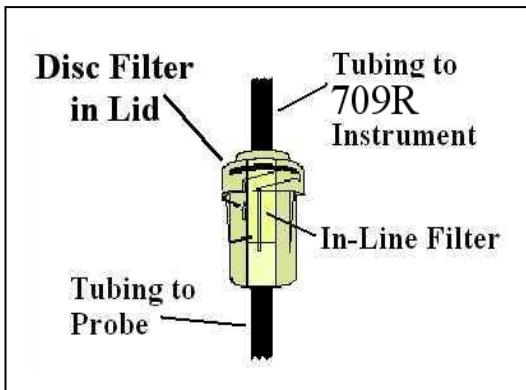
At any time you can activate the Backlight by **holding down** the **Func/Backlight Key**  for 2 seconds.

4.1 Function 1: - Flue Gas Analysis

Ensure you have connected the Temperature Sampling Probe complete with In-Line Water Trap Bowl Filter to the In-Line Pump Protection Filter (See 3.1) which should **ALWAYS** be connected to the Gas Sample Port (see 2.2 or 2.4) and that the 'K' Type Thermocouple Plug is in Thermocouple Socket (ch1) (see 2.4). Also ensure that a 'K' Type Air Probe is connected to Thermocouple Socket (ch2) (see 2.4) in order to calculate efficiency.

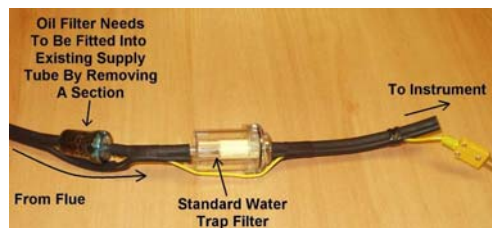


Your temperature-sampling probe comes complete with an In-Line Water Trap Bowl Filter as standard.

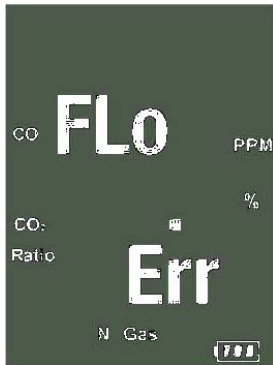


This consists of a Particle Filter in the Bowl Compartment and a Disc Filter in the Lid (as shown in the diagram across). The Disc Filter in Lid will prevent any excessive water from entering the 709R Combustion Analyser if used correctly.

If you are working with **OIL** then you **MUST** ensure that you also use the optional Oil Filter as shown below. **Failure to do so will result in erroneous readings.**



If any of the filters become excessively dirty or blocked then the following screen will be displayed as a warning and no further readings will be able to be taken until either the dirty filters are replaced or the blockage removed:-




The 709R will also give off an audible Beeping Alarm to warn that a "FLO Err" is being detected

WARNING: - Ensure that the In-Line Water Trap Bowl Filter hangs in a vertical position whilst readings are being taken, particularly if water is visible (see below). **Failure to comply may result in damage to the instrument and will invalidate the warranty.**

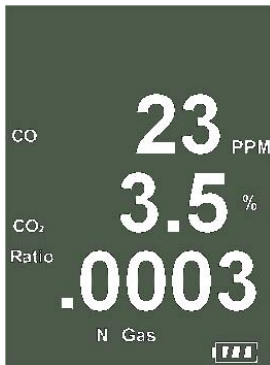


WARNING: - There is **ONLY** one correct way to connect the 'K' type thermocouple plug into the socket (see 2.4). The thermocouple plug is designed with one thick (negative) and one thinner (positive) prong. Forcing the plug into the socket the wrong way round may result in damage to the instrument. **Failure to comply may result in damage to the instrument and will invalidate the warranty.**



Pressing the **Scroll/Enter Key**  will take you through the following Flue Gas Analysis Screens

4.1.1 Screen 1



Displays Carbon Monoxide (CO) reading in parts per million (ppm)

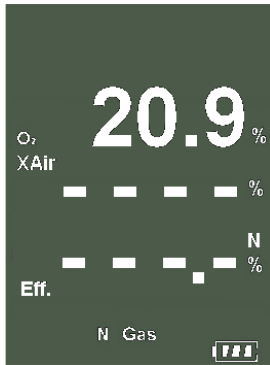
Displays calculated Carbon Dioxide (CO₂) figure in percentage (%)

Displays calculated CO/CO₂ (Ratio) figure

4.1.2 HIGH CO ALARM

Should the CO reading rise above 2,000ppm a continuous series of Alarm Beeps will be heard. This Alarm alerts the user that there is a high concentration of CO and that there may be a potential problem with the appliance. The instrument will continue to monitor CO up to 10,000ppm but the longer the probe is left attached to the instrument sampling at these high levels the longer the recovery time back to ambient air before the instrument will be able to be switched off (see 4.1.8 – Failsafe Turn Off).

4.1.3 Screen 2



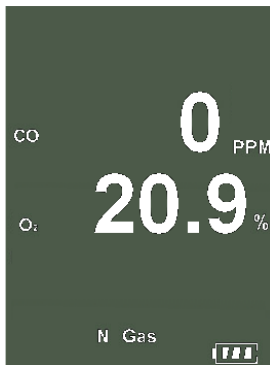
Displays Oxygen (O₂) reading in percentage (%)

Displays calculated Excess Air (X Air) figure in percentage (%)

Displays calculated Efficiency (Eff.) figure in percentage (%)

Pressing the Up Arrow Key  will toggle between Gross & Nett Efficiency

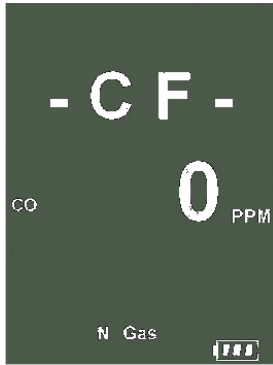
4.1.4 Screen 3



Displays Carbon Monoxide (CO) reading in parts per million (ppm)

Displays Oxygen (O₂) reading in percentage (%)

4.1.5 Screen 4



Displays CO air free calculated reading

4.1.6 Screen 5



Displays Temperature reading of Channel 1 (ch1) in degrees Centigrade (°C)

Displays Temperature reading of Channel 2 (ch2) in degrees Centigrade (°C)

Displays the Differential Temperature (Diff.) between ch1 and ch2 in °C

'oPEn' will be displayed if no 'K' type probe is connected to the thermocouple socket

4.1.7 CO above 15ppm (Failsafe) Protection Beep

The 709R will not allow the user to either Turn the instrument OFF or to move to another Function whilst the CO level is above 15ppm. A short beep will be heard should the user attempt either of the above with the CO above 15ppm.

This is a Failsafe Feature of the 709R to protect the instrument from giving false readings when next turned on. The 709R should be run in a clean air environment with just the In-Line Pump Protection Filter attached until the CO level drops below 15ppm. The 709R will then be able to be moved to a different function screen or be turned OFF.

4.2 Function 2: - Temperature Reading

The pump will stop running when in this function

Remember:- It was the **Function Key**  that got you here!!!

Ensure you have a 'K' type probe connected to one or both of the thermocouple sockets ch1 or ch2 (see 4.2)



WARNING: - There is **ONLY** one correct way to connect the 'K' type thermocouple plug into the socket (see 2.4). The thermocouple plug is designed with one thick (negative) and one thinner (positive) prong. Forcing the plug into the socket the wrong way round may result in damage to the instrument.
Failure to comply may result in damage to the instrument and will invalidate the warranty.



4.2.1 Screen 1



Displays Temperature reading of Channel 1 (ch1) in degrees Centigrade (°C) or degrees Fahrenheit (°F)
Displays Temperature reading of Channel 2 (ch2) in degrees Centigrade (°C) or degrees Fahrenheit (°F)
Displays the Differential Temperature (Diff.) between ch1 and ch2 in °C or °F

Pressing the Up Arrow Key  will toggle between °C and °F

'oPEn' will be displayed if no 'K' type probe is connected to the thermocouple socket

4.3 Function 3: - Pressure Testing

The pump will stop running when in this function

Remember:- It was the **Function Key**  that got you here!!!

Ensure you have Pressure Sampling Tube connected to one or both of the Pressure Ports (see 2.2 or 2.4)



4.3.1 Screen 1





Displays Pressure reading in either millibars (mbar), kiloPascals (kPa), or inches of Water (inH₂O)

Pressing the Up Arrow Key  will scroll through mbar, kPa and inH₂O

Pressing the Down Arrow Key  will Zero the Pressure reading

Pressing the Scroll/Enter Key  will toggle the ch2 temperature reading ON and OFF

Pressure Resolution





The pressure resolution can be toggled between 0.01mbar & 0.1mbar by pressing and holding down both the Up  & Down  Arrow Keys simultaneously.

4.4 Function 5: - Date/Time

The Time, Date and Year can be changed whilst in this function as below:-




4.4.1 Screen 1

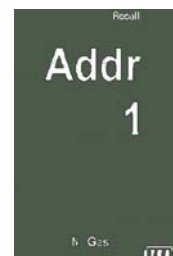


1. Press the **Scroll/Enter Key**  once to allow you to change the Time, Date and Year
2. Press the **Up Arrow Key**  to Increase the Minutes
3. Press the **Down Arrow Key**  to Decrease the Minutes
4. Press the **Scroll/Enter Key**  to confirm the desired Minute and move onto the Hours
5. Repeat steps 2 to 4 to change the Hour, the Day, the Month and the Year
6. The unit will return to normal after the desired Year has been confirmed





5. SAVING DATA

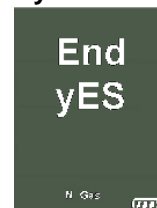
It is possible to save complete combustion readings, temperature and single pressure readings as follows:-

1. Have the 709R analyser set to the relevant screen for the readings that you wish to save (i.e. Any of the combustion screens (see 4.1) for combustion readings or pressure screen (see 4.3.1) for single pressure reading)
2. Press the **Store Key**  once
3. '**Addr**' will be displayed and a location number (0 to 49) will be flashing on the screen.
4. Select the required address location that you wish to save the data to by pressing the **Up**  and **Down Arrow Keys** 




****Please Note:-** Choosing the same Address Location on which previously Stored Data is being held will OVERWRITE the previous readings with the New Stored Data. This will be the case regardless of the particular readings you are attempting to save (i.e. should you have Combustion Readings stored at Address 1 and you Save Temperature Readings to Address 1 then the Previous Combustion Readings will be overwritten with the New Temperature Readings) and the previously Stored Readings will not be retrievable.

5. Press the **Scroll/Enter Key**  once and the readings will be stored to the location that was chosen in step 3 and "**End yES**" with "**yES**" flashing will be displayed
6. If you do not wish to save any further readings at this moment press the **Scroll/Enter Key**  and you will be returned to the screen you were originally on.
7. However if you wish to continue and save another set of readings then press the **Up Arrow Key**  so that "**no**" is flashing and press the **Scroll/Enter Key**. 





The information that you just stored can be either be Reviewed on the screen (see 6) or Printed to a compatible IR Printer (see 7)



6. REVIEWING DATA

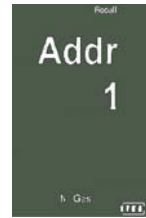
1. Press the **Recall Key**  once and the following screen will be displayed.






'Stor' will be flashing on the display. If you wish to review the Last Time Calibrated Date then press the **Down Arrow Key**  to have 'CAL' flashing rather than 'Stor'



2. Press the **Scroll/Enter Key**  once and if you have chosen to view the Last Time Calibrated Date (**CAL**) then the Date that the Last Time the 709R was calibrated will be displayed flashing on the screen. (Go To Step 6)

3. However if you have chosen to view Stored (**Stor**) Readings then 'Addr' will be displayed and a location number will be flashing. **Select the required address location that you wish to review by pressing the Up Arrow Key**  **and**  **Down Arrow Keys.**





4. Press the **Scroll/Enter Key**  once and the **Time & Date of the Saved Data** from the selected address location will be displayed flashing on the screen. ****If there is no data present at that location then 'nULL dAtA' will be displayed flashing****

5. **The rest of the Saved Data at this address location can be reviewed by pressing the Up Arrow Key**  **and**  **Down Arrow Keys**


6. Press the **Scroll/Enter Key**  once and "**End YES**" with "**YES**" flashing will be displayed. Should you not wish to view any further stored data then press the **Scroll/Enter Key**  once to Exit and be returned to the screen you were originally on.



7. However if you wish to continue and review another set of readings then press the **Up Arrow Key**  so that "**no**" is flashing.
8. Press the **Scroll/Enter Key**  once and repeat from Step 2


7. PRINTING DATA


WARNING: - To operate correctly there must be a clear line of sight between the Infrared Window on the instrument (see 2.3) and the Infrared Window on the IR Printer (see Printer instructions)

1. Press the **Print Key**  once and the following screen will be displayed.



'rREAL' will be flashing.

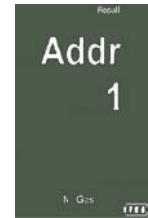
If you wish to Print Out previously Stored Data (**Stor**) or Last Time Calibrated Date (**CAL**) then press the **Down**  **Arrow Key** to have 'Stor' or 'CAL' flashing rather than 'rREAL'





2. Press the **Scroll/Enter Key**  once and if you have chosen to print out Real Time (**rREAL**) readings or Last Time Calibrated Date (**CAL**) then the 'Print Out' screen (below left) will be displayed and the Real Time (**rREAL**) readings or Last Time Calibrated Date (**CAL**) will be sent to the printer.

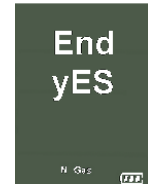


However if you have chosen to print the Stored Data (**Stor**) then 'Addr' will be displayed and a location number will be flashing.

Select the required address location that you wish to review the saved data from by pressing the **Up**  and **Down**  **Arrow Keys**



3. Press the **Scroll/Enter Key** . The 'Print Out' screen (above left) is displayed and the selected readings will be sent to the printer.
4. Once the selected data has been sent to the IR printer "End YES" with "YES" flashing will be displayed. Should you not wish to print any further stored data then press the **Scroll/Enter Key**  once to Exit and be returned to the screen you were originally on.
5. However if you wish to continue and review another set of readings then press the **Up Arrow Key**  so that "no" is flashing.
6. Press the **Scroll/Enter Key**  once and repeat.



8. Turning Off & Charging

Always: - Before turning off the TPI 709R return the instrument to a clean air environment ensuring that the **In-Line Pump Protection Filter** remains connected to the Gas Sample Port and allow the Carbon Monoxide level to return to below 15ppm and the Oxygen level to return to 20.9% ($\pm 0.3\%$).

Press the **Power Key**  once to turn the instrument off.

NOTE: Should you attempt to turn the instrument Off and the CO reading is above 15ppm then the instrument will remain On and a short Beep will be heard. The instrument can only be switched off if the CO is below 15ppm.

The instrument has an auto shut off after 10mins should no keys have been pressed for this period and, as mentioned above, that the CO is below 15ppm. Should the CO be above 15ppm then the 10-minute auto shut off countdown will not begin till the CO has gone below 15ppm.

8.1 Charging

Plug the Charger supplied into the charger socket on the instrument (see 2.4). If the instrument is turned on then a charging symbol will be displayed. Should the instrument then be turned off or turn off automatically with the charger plugged in then the charging symbol will not be displayed BUT the instrument will still be charging.

The instrument should be charged overnight for a period of 10 to 12 hours and will give over 6 hours Operating Time.

Alternatively the instrument can be used whilst plugged into the mains

Appendix A : SPECIFICATIONS

Instrument

Operating Temperature Range	-10°C to +50°C
Battery	Rechargeable Ni-MH
Battery Life	> 6 Hours
Charger Input Voltage	115V or 230V : 50/60 Hz AC
Fuels	Natural Gas, LPG, Light Oil, Heavy Oil & OPT 1 = Bituminous Coal OPT 2 = Anthrachite Coal OPT 3 = Coke OPT 4 = Butane OPT 5 = Wood (Dry) OPT 6 = Bagasse
Pressure Ranges	mbar, kPa & inH ₂ O
Display	Backlit LCD
Data Storage	50 sets of readings
Time & Date	24 Hour Real Time Clock
Dimensions	200mm x 90mm x 60mm
Weight	500g
Casing	Rubber Boot as Standard
Switch Off	Failsafe
Exhaust	Safety Spigot
Conforms to	BS7927 (and the draft BS7967)

Flue Temperature Probe

Construction	Pistol Grip with Stainless Steel Shaft
Hose Length	2500mm
Insertion Length	200mm
'K' Type Thermocouple Accuracy	+/- 0.3%, +/- 1°C
Maximum Temperature	800°C

Gases

	<u>Range</u>	<u>Resolution</u>	<u>Accuracy</u>
Oxygen	0-25%	0.1%	+/- 0.3%
Carbon Monoxide	0-10,000 ppm	1 ppm	<20 ppm : +/- 3 ppm >100 ppm : +/- 5 %
Carbon Dioxide (calculated)	0-25%	0.1%	+/- 0.3%
CO/CO ₂ Ratio (calculated)	0-0.999		
Combustion Efficiency	0-100%	0.1%	

Pressure Measurement

Selectable Ranges	mbar, kPa and inH ₂ O
Range	- 150 mbar to + 150 mbar
Resolution	0.01 mbar & 0.1 mbar
Accuracy	+/- 0.5% fsd

Appendix B : CALIBRATION & SERVICE

It is recommended, as written in the British Standard – BS7967, that the instrument be calibrated every 12 months. Please consult your instrument supplier for further details.

The following are consumable parts for the instrument: -

In-Line Water Trap Bowl Filter Element <i>Small</i> (pack of 10)	User Replaceable	Part No. TBC
In-Line Pump Protection Filter Complete	User Replaceable	Part No. A763
Oxygen Sensor	Factory Replaceable ONLY	
Carbon Monoxide Sensor	Factory Replaceable ONLY	

The following are accessories for the instrument: -

Flue Temperature Probe	Standard	Part No. A770
In-Line Water Trap Bowl Filter Complete	Standard	Part No. A794
Battery Charger	Standard	Part No. A766
Rubber Boot	Standard	Part No. A765
Soft Carrying Case	Standard	Part No. A768
Exhaust Spigot	Standard	Part No. TBC
Air Probe	Standard	Part No. GK11M
Infrared Printer	Optional	Part No. A740
Various 'K' Type Probes	Optional	See TPI Brochure
Oil Filter Complete	Optional	Part No. A773
Smoke Test Pump	Optional	Part No. A788

Appendix C : GUARANTEE

Your TPI 709R Combustion Analyser is guaranteed free from defects in materials and workmanship for 3 Years from the date of purchase.

Covered by TPI: - Repair parts and labour; or replacement of the product at the option of TPI. Normal transportation charges to the purchaser are also covered.

Not covered by TPI: - Damage to the product which are the result of abuse, improper use or maintenance are not covered. Any other expenses, consequential damages, incidental expenses including damages to property are not covered. Transportation expenses to the customer are not covered.

To obtain warranty performance: - Include with the product your name, address, phone number, fax number, written description of the problem and proof of purchase date. Carefully package and return to TPI.

This guarantee does not affect your statutory rights.

Appendix D : TROUBLESHOOTING GUIDE

Problem	Probable Cause	Possible Remedy
Unit does not turn on	Batteries are flat	Recharge batteries or run on mains.
Unit does not turn on	Dislodged battery	Disconnect and Re-connect battery
Unit does not turn off	CO level above 15ppm	Leave 709R running in clean air until CO drops below 15ppm
Unit will not move off combustions screens	CO level above 15ppm	Leave 709R running in clean air until CO drops below 15ppm
Continuous alarm Sounds	Excessive levels of CO are being detected	Remove probe from flue and run in clean air for 15/20 minutes
Negative pressure readings on Display	Pressure tubing connected to wrong pressure port	Reconnect pressure tubing to positive pressure port rather than negative pressure port
Negative pressure readings on display	Either there is suction or pressure was not zeroed in atmospheric air	Re-zero in atmospheric air.
Negative temperature readings on display	Thermocouple plug has been plugged in the wrong way round	Remove thermocouple plug and plug in the correct way round
"Flo Err" is displayed	Blockage in sampling probe or kink/blockage in sample tube	Check and rectify as necessary
"Flo Err" is displayed	Dirty/blocked filters	Remove and replace dirty/wet filters
Battery life shorter than usual	Excessive use of backlight	Turn off backlight when not needed
"Inlt O2 Err" is displayed	Instrument turned on in contaminated air.	Turn instrument off and then turn instrument on again in clean air.
"Inlt CO Err" is displayed	Instrument has turned off with Gas Sample still present	Run instrument in clean air until after turning the instrument on/off the error disappears. Depending on the level of CO present this may take up to 1 hr.

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This symbol indicates that at the end of its life this product must not be disposed of in household waste. This equipment should be environmentally disposed of. Please contact your supplier or manufacturer who will be able to advise you on the correct method of disposal