

Flue Gas Analyzer

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1. Introduction

Thank you for purchasing TPI brand products. The TPI 714 Flue Gas Analyzer is a state of the art, easy to use analyzer 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 3 Year Guarantee.

This manual will guide you through the functions of the TPI 714 which will give you many years of reliable service.

Your TPI 714 Flue Gas Analyzer comes complete with the following standard accessories:

- TPI 714 Instrument
- Rubber Boot
- Infrared Printer (model 712A740 only)
- Soft Carrying Case
- Flue Sampling Probe (c/w Type "K" Thermocouple)
- In-Line Filter installed on Flue probe (c/w Spare Filter)
- GK11M Temperature Probe
- Battery Charger
- Mini Pump Protection Filter Assembly and spare filters
- Exhaust Spigot (removable)
- Pressure Tubing (2 x 1 metres)
- Barbed to 1/8" npt fitting (2 each)
- Instruction Manual

Your TPI 714 Flue Gas Analyzer has the following options available:

- PC Software for analysis of Data Logging results (see 9 & Appendix B)
- Infrared PC link for non compatible PCs (see 9 & Appendix B)
- Various Temperature Probes (see Appendix B)

2. Instrument Overview

2.1 Front View



Rubber Boot	Protects the instrument from accidental damage
Display	Large 3 Parameter Backlit LCD Display
Battery Condition Icon	Shows condition of rechargeable batteries.
Keypad	Selects all available functions
Selected Fuel Type	N GAS, LPG, LIGHT OIL, HEAVY OIL

The following are consumable parts for the instrument: -

In-Line Filter Element	User Replaceable	A762
Leak Detector Mini Filter Element	User Replaceable	A763
Oxygen Sensor	Factory Replaceable	A761
Carbon Monoxide Sensor	Factory Replaceable	A760

The following are accessories for the instrument: -

Flue Temperature Probe w/k-type	Standard	A742
'K' Type Temperature Probe	Standard	GK11M
In-Line Filter Complete	Standard	A762
Mini Pump Protection Filter Assem.	Standard	A763
Battery Charger	Standard	A766
Rubber Boot	Standard	A765
Infrared Printer	Optional	A740
Soft Carrying Case	Standard	A768
Exhaust Spigot	Standard	A764
PC Software	Optional	A769
IRDA-RS232C Adapter	Optional	A767

Appendix C: GUARANTEE

Your TPI 714 Flue Gas Analyzer 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, written description of the problem and proof of purchase date. Carefully package and return to TPI.

This guarantee does not affect your statutory rights.

Display	Backlit LCD
Data Storage	10 sets of readings
Data Logging	400 sets of readings on 'Timed Interval Logging'
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)



Scrolls through selectable fuels (see 3.1)
 Switches between Gross and Nett Efficiency (see 4.1.2)
 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)
 Increases data logging time intervals (see 8)



Zeroes pressure reading (see 4.3.1)
 Moves down through the Stored Data Addresses (see 5, 6 & 7)
 Decreases data logging time intervals (see 8)



Scrolls through Flue Gas Analysis
 Function Screens (see 4.1)
 Turns temperature differential calculation ON/OFF (see 4.2.1)
 Turns ch2 temperature ON/OFF (see 4.3.1)
 Allows you to change the Date and Time (see 4.5)
 Allows you to choose a Stored Data Address (see 5, 6, 7, & 8)

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

	Range	Resolution	Accuracy
Oxygen	0-25%	0.1%	+/- 0.3%
Carbon Monoxide	0-10,000 ppm	1 ppm	+/- 5 ppm or 5%
Nitric Oxide (NO)	0-5,000 ppm	1 ppm	+/- 5 ppm or 5%
NOX Measurement	0-5,250 ppm	1 ppm	Calculated
Carbon Dioxide	0-25%	0.1%	Calculated
CO/CO2 Ratio	0-0.999	0.001	Calculated
Combustion Efficiency	0-100%	0.1%	Calculated



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 8)
 Starts and Stops data logging (see 8)



Moves you through the 5 Functions (see 4)
 Turns Backlight ON and OFF (see 4)



Turns the instrument ON and OFF (see 3.1 & 3.2)

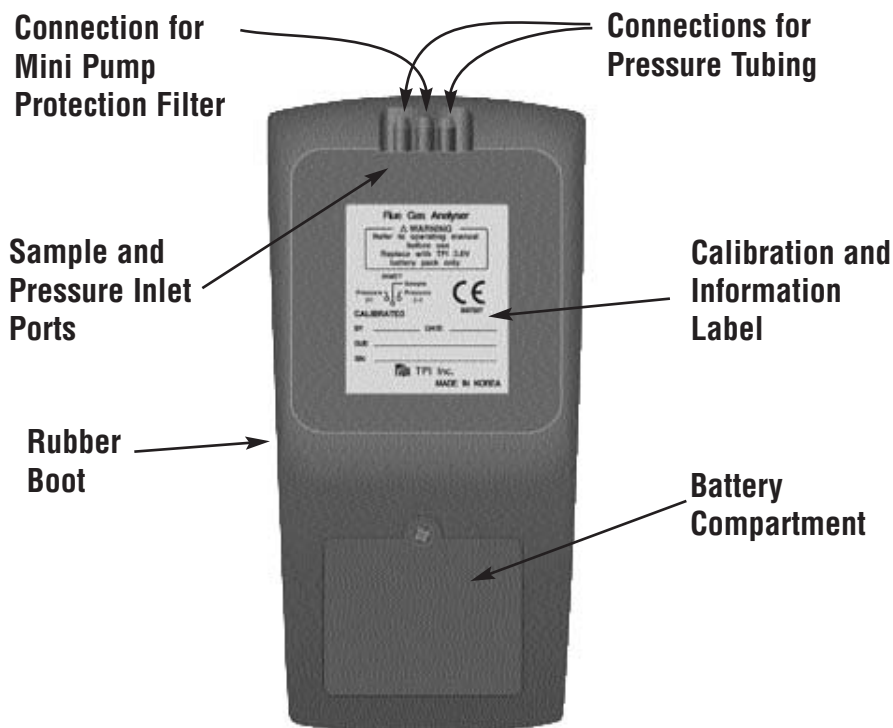
Pressure Measurement

Selectable Ranges	mbar, kPa and inH2O
Range	- 150 mbar to + 150 mbar -15 kPa to + 15 kPa -60 inH2O to 60 inH2O
Resolution	0.01 mbar
Accuracy	+/- 0.5% fsd

Appendix B: CALIBRATION & SERVICE

It is recommended that the instrument be calibrated every 12 months.
 Please consult Test Products International for further details.

2.2 Back View



Sample and Pressure Inlet Ports: Connection for Gas Sampling Probe (see 2.4 & 4.1)

Connection for Mini Pump Protection Filter (see 2.4 & 4.4)

Connections for Pressure Tubing: (see 2.4 & 4.3)

Calibration and Information Label: Displays calibration information and Displays serial number

Battery Compartment: Holds rechargeable battery

Rubber Boot Protects the instrument

8. TIMED LOGGING

1. Press and hold down the Store/Logger Key for approximately 2 seconds 'S-t' will be displayed with '05 S' flashing indicating that the instrument will log a set of 100 readings every 5 seconds. You can choose from the following logging times
'05 S' (100 readings every 5 seconds)
'10 S' (100 readings every 10 seconds)
'20 S' (100 readings every 20 seconds)
'30 S' (100 readings every 30 seconds)
'01 M' (100 readings every 1 minute)
'03 M' (100 readings every 3 minutes)
by pressing either the Up or Down Arrow Keys
2. Press the Scroll/Enter Key once
'PAGE PA ' will be displayed and a page number from 0 to 3 will be flashing. Select the required page location that you wish to log the saved data to by pressing the Up and Down Arrow Keys
3. Press the Scroll/Enter Key once
The instrument will return to the previous screen/function with 'Logger' flashing on the top line.
The instrument will continue logging until all 100 readings have been saved or you press and hold down the Store/Logger Key.
WARNING: - The instrument will not Turn Off if datalogging is commencing. A beep will be heard to warn you of this fact if you try to turn the instrument off.

9. DOWNLOADING LOGGED DATA TO PC

This function requires the optional A767 IrDA Adapter. Please refer to the A767 manual for complete instructions.

Appendix A : SPECIFICATIONS

Instrument

Operating Temperature Range	14°F to +122°F (-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
Pressure Ranges	mbar, kPa & inH2O

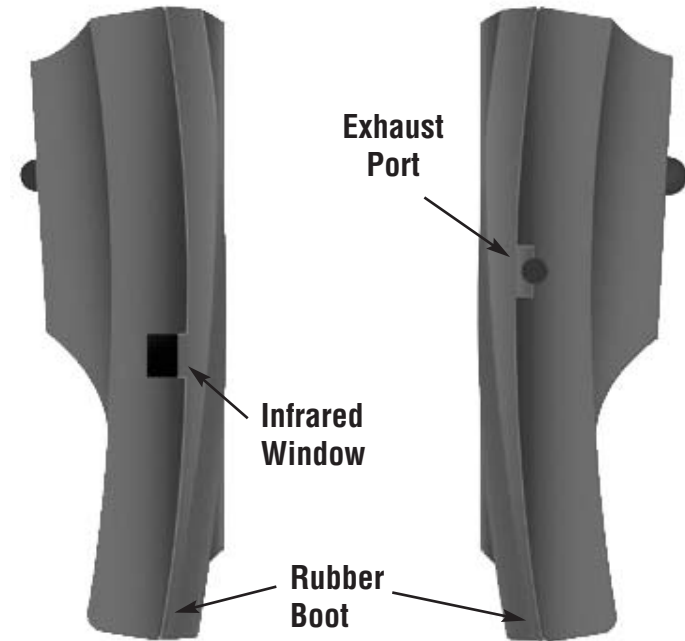
data from by pressing the Up and Down Arrow Keys

3. Press the Scroll/Enter Key once
The Time & Date of the Saved Data from the selected address location will be displayed flashing on the screen.
The rest of the Saved Data at this address location can be reviewed by pressing the Up and Down Arrow Keys
4. Press the Scroll/Enter Key once
'End' will be displayed with 'YES' flashing
5. Press the Scroll/Enter Key once to EXIT
or
6. Press the Up or Down Arrow Keys
'End' will be displayed with 'no' flashing
7. Press the Scroll/Enter Key once to CHOOSE another address location to review and repeat steps 2 to 5

7. PRINTING DATA

1. Press the Print Key once
'Print & IR' will be displayed on the top line along with 'Stor' flashing on the screen with "REAL" also on the display.
You can choose to print stored readings which have been already saved (Stor) or select "REAL" by pushing the up arrow button so that the "REAL" is flashing you can print the current realtime readings on the display.
Press the Scroll/Enter Key once 'Addr SA ' will be displayed and a location number from 0 to 9 will be flashing. Select the required address location that you wish to print the saved data from by pressing the Up and Down Arrow Keys
Press the Scroll/Enter Key once 'Print, Wait, Send & IR' will be displayed on the top line along with 'out' on the screen
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)
After all the saved data has been sent to the printer 'End' will be displayed with 'YES' flashing
Press the Scroll/Enter Key once to EXIT or Press the Up or Down Arrow Keys 'End' will be displayed with 'no' flashing
Press the Scroll/Enter Key once to CHOOSE another address location to print and repeat steps 2 to 4

2.3 Side Views



Exhaust Port

Port for connection of Exhaust Adaptor

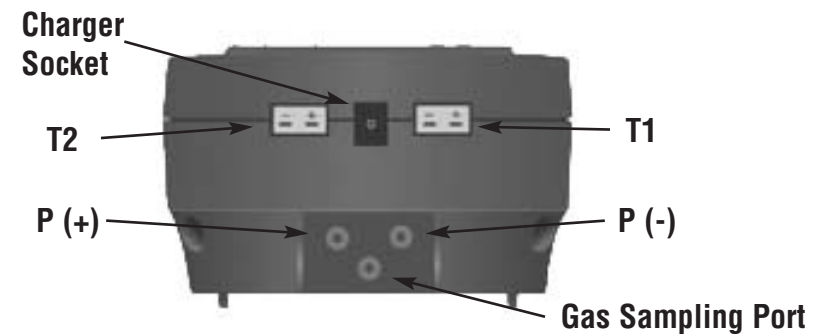
Infrared Window

Window for sending stored data to IR Printer or PC (see 7 & 9)

Rubber Boot

Protects the instrument from accidental damage

2.4 Top View



Charger Socket

Connection for 220V/115V charger (see 3.3)

T1 Socket	Connection for thermocouple plug on flue probe (see 4.1) Connection for any 'K' type thermocouple probe (see 4.2)
T2 Socket	Connection for any 'K' type thermocouple probe (see 4.2)
Gas Sampling Port	Connection for Gas Sampling Probe (see 4.1)
P (+) Port	Connections for Pressure Tubing (see 4.3)
P (-) Port	Connections for Pressure Tubing (see 4.3)

3. Turning On & Off and Charging

3.1 Turning On

Always: - Before turning on please ensure that the Mini Pump Protection Filter assembly and the Temperature Sampling Probe complete with In-Line Filter or the Tubing are **not** connected to the Gas Sample Port (see 2.2 or 2.4)

Press the Power Key and the TPI 712 will start its 30 second countdown 'PURGE' will be displayed: - The instrument should be turned on in a clean air environment as the 30 second purge will set the Carbon Monoxide level to Zero and the Oxygen to 20.9%.

Ensure that the filters are clean and dry as dirty or wet filters will result in a loss of flow rate and 'Lo Flo' will be displayed to inform you that filters should be changed

During the last 20 seconds of the 30 second purge time the user can scroll through the following Fuels: - Natural Gas, LPG, Light Oil, Heavy Oil by pressing the Up Arrow Key to select the Fuel they are working with. When desired fuel is displayed release the key, displayed fuel is now selected.

After the 30 second countdown the instrument is ready to take Flue, Temperature, Pressure or Leak Detection readings and will Display Screen 1 from Function 1 as described in The 5 Functions Section (see 4.1.1)

NOTE: When selecting oil as fuel be sure to use the optional oil filter (A733) or readings could become erratic.

4.3 Function 4: - Date/Time

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

4.5.1 Screen 1 Displays the current Time, Date and Year

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

1. Press the Store/Logger Key once
'Save' will be displayed on the top line along with 'SA ' and a location number from 0 to 9 will be flashing on the screen.
Select the required address location that you wish to save the data to by pressing the Up and Down Arrow Keys
2. Press the Scroll/Enter Key once
The location number which you have chosen will stop flashing and after about 2 seconds the instrument will return to the screen/function you were previously on.

You have just successfully stored a set of readings which can be either reviewed on screen (see 6) or sent to the IR printer (see 7)

6. REVIEWING DATA

1. Press the Recall Key once
'Stor' will be flashing on the display
2. Press the Scroll/Enter Key once
'SA ' will be displayed and a location number from 0 to 9 will be flashing.
Select the required address location that you wish to review the saved

WARNING: - There is ONLY one correct way to connect the 'K' type thermocouple plug into the socket (see 4.2). Forcing the plug into the socket the wrong way may result in damage to the instrument.

The pump will stop running when in this function

- 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)
 - Pressing the Up Arrow Key will toggle between °C and °F
 - Displays the Differential Temperature (Diff.) between ch1 and ch2 in °C or °F
 - Pressing the Scroll/Enter Key will toggle the Differential Temperature ON and OFF
 - 'oPEn' will be displayed if no 'K' type probe is connected to the thermocouple socket

4.3 Function 3: - Pressure Testing

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



The pump will stop running when in this function

- 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

3.2 Turning Off

Always: - Before turning off return the instrument to a clean air environment 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 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 10 minutes 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

3.3 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, turn off automatically or be turned off when the charger is 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 when plugged into the charger.

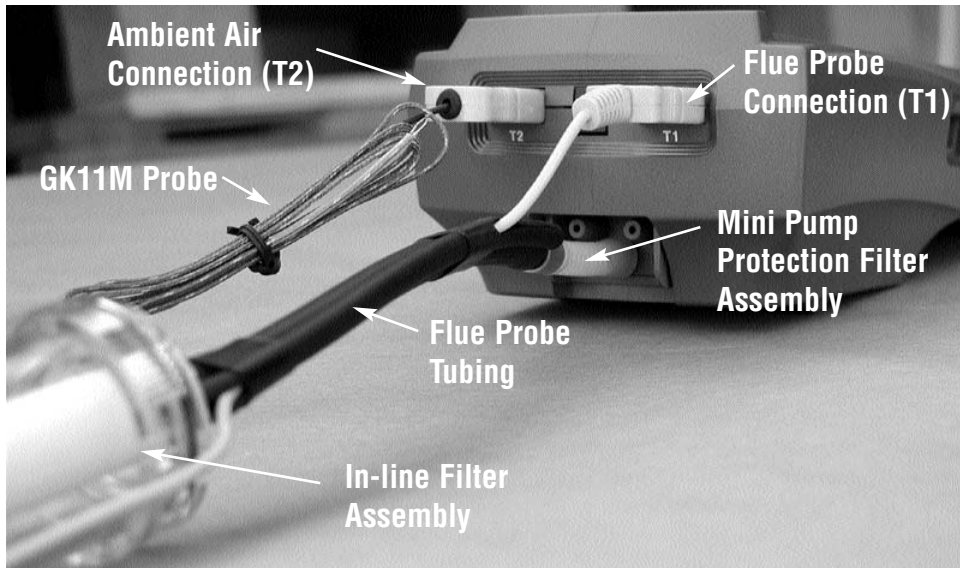
4. THE 4 FUNCTIONS

You can move through the following functions by pressing Func/Backlight.

At any time you can activate the Backlight by holding down the Func/Backlight Key for 2 seconds. The backlight will automatically shut off after 20 seconds to preserve battery life.

4.1 Function 1: - Flue Gas Analysis

Ensure you have connected the Mini Pump Protection Filter assembly and Temperature Sampling Probe complete with In-Line Filter to the Gas Sample Port (see 2.2 or 2.4) and the 'K' Type Thermocouple Plug into Thermocouple (T1) Socket (see 2.4). The GK11M ambient air temperature probe must be connected to the (T2) socket. (refer to figure below for correct hookup)



WARNING: - Ensure that the In-Line Filter hangs in a vertical position when readings are being taken, particularly if water is visible. Failure to comply may result in damage to the instrument.

WARNING: - There is ONLY one correct way to connect the 'K' type thermocouple plug into the socket (see 2.4). Forcing the plug into the socket the wrong way round may result in damage to the instrument.

You can move through the following Screens by pressing Scroll/Enter:

- 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

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.

- 4.1.2 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 & Net Efficiency

- 4.1.3 Screen 3**
- Displays Carbon Monoxide (CO) reading in parts per million (ppm)
 - Displays Oxygen (O₂) reading in percentage (%)

- 4.1.4 Screen 4**
- Displays CO air free

- 4.1.4 Screen 5**
- Displays Temperature reading of Channel 1 (T1) in degrees Centigrade (°C)
 - Displays Temperature reading of Channel 2 (T2) 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

4.2 Function 2: - Temperature Reading

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

