GOYEN INNOVATIVE ENVIRONMENTAL SOLUTIONS

PGA3000
Portable Flue Gas Analyser
Part No 770.030

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The products are designed and manufactured under ISO9001 system; and are supported by our committment to quality policy:

“Tyco Environmental Systems will deliver cost effective, defect free goods and services to meet agreed schedules”.

This instrument complies with current European directives relating to electromagnetic compatability and safety (EMC directive 89/336/EEC; Low voltage directive 73/23/EEC).

Operation of radio transmitters, telephones or other electrical/electronic devices in close proximity to the equipment while the enclosure doors of the instrument or its peripherals are open, may cause interference and possible failure where the radiated emissions exceed the EMC directive.

The protection provided by both CE and IP classifications to this product may be invalidated if alterations or additions are made to the structural, electrical, mechanical or pneumatic parts of this system. Such changes may also invalidate the standard terms of warranty.

Packaging material used with this product is recycable.

All measurements are given in millimetres/inches, unless otherwise stated.

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1.0 PREFACE

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1.1 TECHNICAL SPECIFICATION

Fuels:
Wood
Light Fuel Oil
Heavy Fuel Oil
Natural gas
Propane
Coal
4- User definable fuels

Accuracy:
O_2 - Better than 1% vol.
Other gases - Better than 4% of reading

Display:
40 x 8 Matrix Liquid Crystal, electroluminescent backlighting when in use

Keyboard:
Tactile membrane (integral with display)
function keys and cursors

Printer:
Thermal

Indicators:
LED type for ON (Power), Stand-by, Service, Charge, Low Batt., Fault

Power Supply:
95 - 265V a.c. $\pm$10%, 50-60Hz, 30 Watts.
Rechargeable battery 2 x 6V 4 Ampere hours. Typical 8 hr. operation dependent on options fitted

Ambient Temperature:
-5 to 50°C / +23 to 122°F

Sensor type:

O_2, CO(low)	(Electrochemical Cells)
CO (low H_2 compenstated)	(Electrochemical Cells)
NO, CO(high)	(Electrochemical Cells)
Flue Gas Temp	(Type K Thermocouple)
Ambient Temp	(Solid State sensor)
SO_2, NO_2	(Electrochemical Cells)
Hydrocarbons	(Pellister)
Draught	(Pressure transducer)
CO_2	(Optical IR)
H_2 S	(Electrochemical Cell)

Calibration Check Program:
3 minute zero calibration check on all cells (O_2 check 20.9%)

Ranges:

Gas cells	**Range**	**Accuracy the larger of**		**Resolution**
Oxygen, O_2	0 to 25%	0.2% Vol.	1% of reading	0.1% Vol.
Carbon Monoxide, CO Low	0 to 2000ppm	4ppm	4% of reading	1ppm
Carbon Monoxide, CO Low (H_2 compensated)	0 to 2000ppm	4ppm	4% of reading	1ppm
Carbon Monoxide, CO High	0 to 40000ppm	40ppm	4% of reading	10ppm
Sulphur Dioxide, SO_2	0 to 2000ppm	4ppm	4% of reading	1ppm
Nitrogen Monoxide, NO	0 to 1000ppm	4ppm	4% of reading	1ppm
Nitrogen Dioxide, NO_2	0 to 100ppm	4ppm	4% of reading	1ppm
Carbon Dioxide, CO_2	0 to 25%	0.5% Vol.	4% of reading	0.1% Vol.
Hydrogen Sulphide, H_2S	0 to 200ppm	4ppm	4% of reading	1ppm
Hydrocarbons	0 to 50,000ppm	(Application dependent)		
Flue Gas Temperature	Measured			
	0-1000°C	±5°C		
Ambient Temp	-5 to 45°C / +23 to 113°F			
*Draught	±20" Water Gauge			
Carbon Dioxide, CO_2	Calculated where no sensor is fitted			
Efficiency	Calculated			
Excess air	Calculated			
Loss	Calculated			
Flow Measurement (velocity)	1 to 50m/s			

** ±10" Water Gauge where instrument is specified with flow measurement*

Special ranges:

Carbon Monoxide, CO	0 to 500ppm	4ppm	±4% of reading	±1ppm
	0 to 1000ppm	4ppm	±4% of reading	±1ppm
	0 to 10%	4ppm	±4%of reading	±100ppm
Nitrogen Monoxide, NO	0 to 500ppm	4ppm	±4% of reading	±1ppm
	0 to 2000ppm	4ppm	±4% of reading	±1ppm
	0 to 4000ppm	4ppm	±4% of reading	±1ppm
Sulphur Dioxide SO_2	0 to 1000ppm	4ppm	±4% of reading	±1ppm
Nitrogen Dioxide NO_2	0 to 500ppm	4ppm	±4% of reading	±1ppm

Special ranges are determined before purchase. These ranges only apply where requests have been made at the time of purchase.

Standard Accessories:
Pistol grip probe (300mm/12")
Integral water catchpot & filter
Rechargeable lead acid battery (internal).

Max Probe Temp:
600°C/1112°F continuous; 1000°C/1832°F intermittent.

Gas Tubing:
Silicon rubber hose 3m/10ft length.

Case:
Medium density blended polyethelyne

Weight:
6Kg/13 lbs

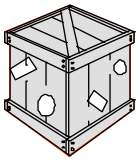
Dimensions:
453mm(W) x 120mm(D) x 245mm(H) / 17.8"(W) x 4.7"(D) x 9.6"(H)

Options:

Draft measurement.
Flow Measurement Probe - 0.7, 1.2, 2.2, 3.0m
Heated Smoke Probe - 0.3, 0.75 and 1.0m
Thermal Printer.
RS232 or RS422 serial interface
PGA3000 Capture (computer) program
Analogue outputs; (12 current loops. Independently configurable)
Probe length options; 1m/39.4", 1.5m/60" & 3m/118"
Semi-continuous monitoring with sleep and wake facility
Data logging
Carrying case

Continuous product development may make it necessary to change these details without notice.

1.2 UNPACKING



Check all packages for external signs of damage. Check the contents against the packing note and identify them against the System Description.

IMPORTANT

If any item has been damaged in transit, this should be reported to the carrier and to the supplier immediately. DO NOT RETURN a damaged instrument to the sender as the carrier will not then consider a claim. Save the packaging with the damaged article for inspection by the carrier.

1.3 SAFETY ASPECTS

Important: Read carefully and comply with the following:-

The PGA3000 portable flue gas monitor is an electrical safety Class 2 instrument (as specified in EN 61010-1993).

1. Before switching on the apparatus make sure that the power supply is suitable for the instrument.

2. The mains/power plug should only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor.

WARNING!

3. Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.

4. When the apparatus is connected to its supply, terminals may be live, and the opening of covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts.

5. Any adjustment, maintenance and repair of the opened apparatus under voltage shall be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.

6. Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders are prohibited.

7. Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

   The protection is likely to be impaired if, for example, the apparatus:

   - shows visible damage

   - fails to perform the intended measurements

   - has been subjected to prolonged storage under unfavourable conditions

   - has been subjected to severe transport stresses

1.3 SAFETY ASPECTS continued

CAUTION

Due **caution** should be exercised when installing, operating and servicing this equipment. Attention is drawn to the following safety points:

POWER

Ensure that main supplies are isolated, when making access to the equipment for maintenance or servicing purposes. Read the instructions carefully to ensure correct connection of all mains, signal leads and probe connections.

EYE PROTECTION

Eyes and face should be suitably protected by goggles when looking into hot furnaces. Precautions should also be taken when removing instruments from pressurised ducts.

PROTECTIVE CLOTHING

When working in the vicinity of hot boilers and furnaces protective clothing should be worn at all times, particularly protection of the hands.

FAULT FINDING

The instrument must be fully isolated from the power supply before internal, electrical maintenance or servicing work, and should only be undertaken by a suitably authorised/qualified engineer.

STATIC DISCHARGE

Under certain boiler conditions a high static charge may build up. With non-conductive stack entry points the normal procedure to avoid damage to the instrument or person, is to make a connection from the probe extension to ground /earth before inserting into stack. With conductive (metallic) entry points the metal surround should be grounded. Situations may occur, for instance where the sampled hot gases have just passed through electrostatic precipitators, where a high static charge would build up on the instrument probe if ungrounded. Further contact by any grounded object, i.e. a person touching the keyboard and forming a discharge path, may then result in damage to the instrument.

HAZARDOUS GASES

All recognised safety procedures should be used when operating with hazardous gases.

Goyen accepts no responsibility for damage to the instrument, or injury to the person while following procedures, nor will the company accept liability for failure to comply with safety precautions.

1.4 DESCRIPTION OF INSTRUMENT

The PGA3000 Portable Gas Analyser has been designed to give maximum choice to the customer within a single instrument.

The PGA3000 is a portable analyser for 3 to 9 gas and draught measurements. CO_2 can be measured, efficiency and excess air values can be calculated dependent on the gas sensors chosen. Flue gas and ambient temperature measurements are standard. **The PGA3000 is not intended to be used as a continuous gas monitor,** but it may be used to monitor repetitive cycles using the optional Semi-continuous monitoring option.

The carrying case holds the accessories and 12" probe. The water catchpot is contained in the side of the PVC instrument case and is easily accessible for emptying.

The sealed lead acid battery will maintain the operation of the instrument for a full working day (dependent on options) when fully charged. The instrument accepts a wide range of power supplies (90 to 265V, 50/60Hz).

Operational procedure is carried out by following the user friendly menu on the liquid crystal display and using the keyboard on the same front panel. Simultaneous display of all measured and calculated values gives a complete overview of the combustion situation. Every menu incorporates a “HELP” facility for use if any difficulty is found during operation.

The printer uses thermal paper rolls. Changing paper is simple. Hard copies with customer selectable headings and footnotes are directly available after each measurement cycle or data can be stored for later output to the local printer, or a serial printer, connected to the optional serial interface.

Optional output facilities are available for a range of configurable analogue output channels and a serial communication link (RS232). The latter enables data to be output into a computerised database.

Automatic protection of the CO (low) sensor is incorporated when levels exceed 2000ppm of CO.

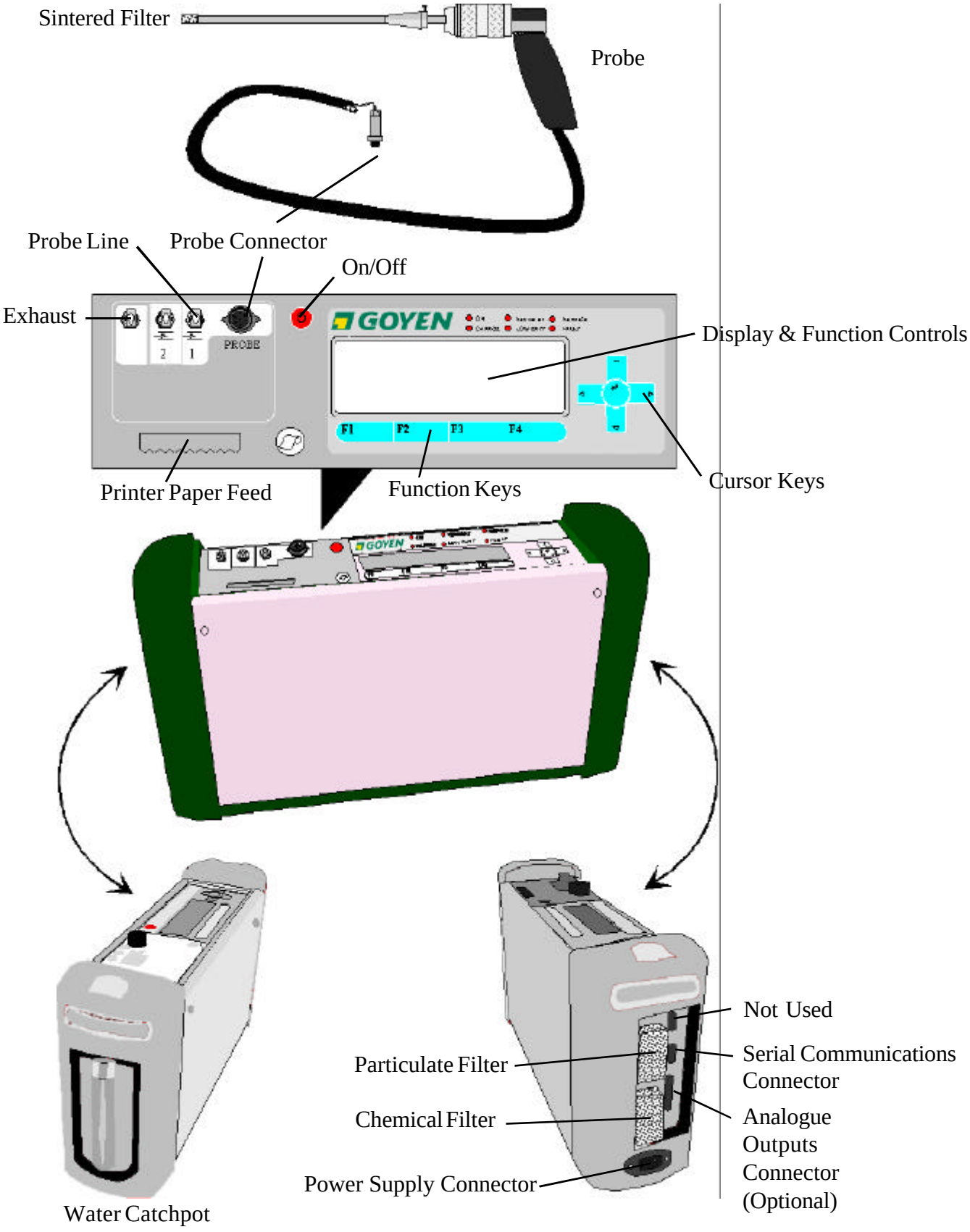
A facility for automatic air purging of the sensors occurs every time the instrument is switched off. This ensures accuracy of readings and conserves the sensor life.

Original selection of options can be upgraded when required, for example a 3 gas version can have additional sensors retro-fitted. Output options can also be added.

NOTE

Implementing upgrades requires the instrument to be returned to the factory.

All facilities and options are fully described later in the manual.


Sintered Filter
Probe
Probe Line
Probe Connector
On/Off
Exhaust
Display & Function Controls
Printer Paper Feed
Function Keys
Cursor Keys
Not Used
Particulate Filter
Serial Communications Connector
Chemical Filter
Analogue Outputs Connector (Optional)
Power Supply Connector
Water Catchpot

2.0 GETTING STARTED

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2.1 PREPARATIONS FOR USE

2.1.1 Essential User Information

A. The instrument can be operated whilst still in its shoulder bag (optional).

B. Check all equipment is fully functioning and all parts present.

- PGA3000 instrument
- Probe pistol grip handle and tubing
- Probe extension with primary filter fitted
- Carrying strap
- Water Catchpot unit
- Power Supply lead
- plus any options ordered ie. heated smoke probe, smoke filters, Bacharach chart

C. Water Catchpot - refer to Section 2.2.9

Check the water container is secure, air leaks will occur if loose, resulting in incorrect readings. To remove or empty the water container, pull the bottom of the container out from the securing clip, the unit is hinged and will swing out to about 45°. Unscrew the container and empty out any water.

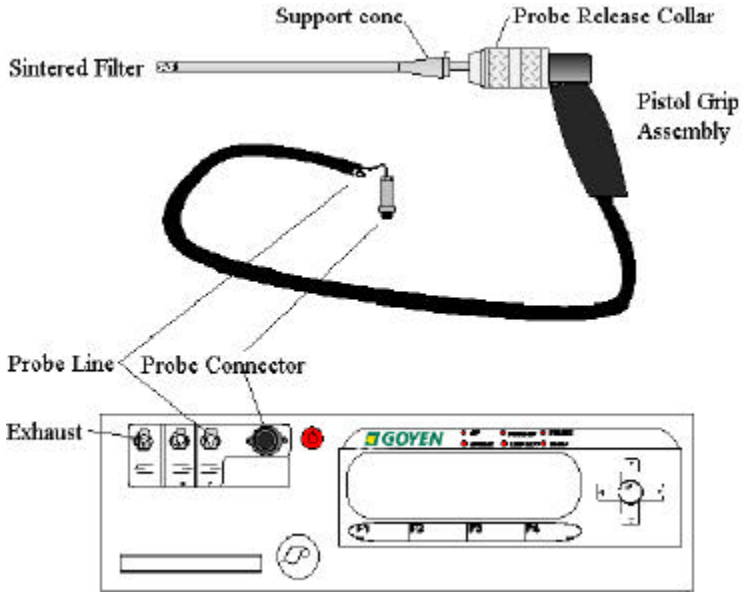
NOTE

Do not force the hinge beyond 45°, otherwise damage to the hinge may occur. Do not over-tighten.

D. Pistol Grip Assembly

Screw the probe extension onto the pistol grip handle.

Connect the probe tubing and connector as shown.



E. Power Supply Lead and Battery Charging

Power Supply Lead

The mains power lead (supplied) connects into the inlet socket on the side of the instrument. (See page 12 - Description of Instrument).

Battery Charging

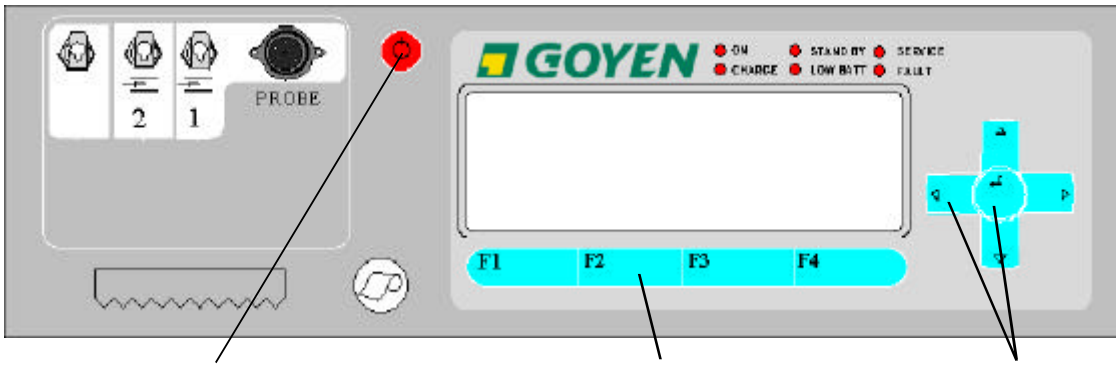
The integral battery charger is universal and operates from a wide range of mains supplies (95 - 265V 50 - 60Hz).

When the instrument is being charged, by plugging in the mains connector and switching on, the front panel 'CHARGE' LED will illuminate and continue to trickle charge even while in use.

The instrument may be operated on either the internal batteries or direct from the power supply. Two re-chargeable 6V 4 ampere hour batteries are fitted within the case. A half charge can be achieved in 3 - 4 hours. The instrument will operate for approximately 8 hours after a full charge.

2.2.1 'ON/OFF' Switch

This switch is located on the upper part of the front panel and powers up the instrument. Pressing and holding down the button for 2-3 seconds will switch the instrument - On or Off. When the instrument is switched off it will perform a 30 second purge - the display will show 'SYSTEM CLOSING DOWN PURGING'. After completion of the purging cycle the instrument will then be completely shut down.



ON/OFF SWITCH **FUNCTION KEYS** **CURSOR KEYS**

2.2.2 Cursor and Enter Keys

The instrument is totally menu operated. There are 4 cursor keys and 1 Enter key for scrolling and selection of displayed items.

The Enter key is normally used for selecting the item required, but on some displays, where the requests are more complex, the Enter key may have a different function.

2.2.3 Function Keys

Four function buttons are located underneath the display. Their specific functions change dependent upon the menu selected i.e. HELP, MENU, EXIT, NEXT etc.

2.2.4 Help Facility

All displays have an individual 'HELP' related information.

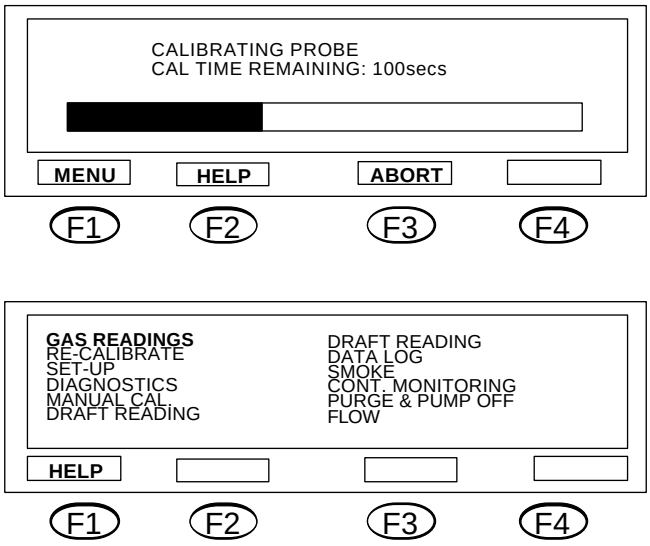
2.2.5 LEDS Display Panel

The LED panel indicates certain operating conditions of the instrument. When switching ON only the 'ON' LED should illuminate. The 'LOW BATT' LED will indicate if the battery requires charging. If the 'FAULT' LED is illuminated, check for faults at the DIAGNOSTICS ->FAULT MENU.

2.2.6 Quick Start Procedure

The operator may require to have the instrument functional immediately to read gas readings. The following procedure will have the instrument operational in a few minutes.

1. The instrument may be run direct from the power supply or internal battery.
2. Connect power supply (if required).
3. Connect the probe.
4. Insert probe into the stack or other measurement point.
5. Press and hold the On/Off ⏻ button for approximately 2-3 secs.
6. Wait for the recalibration to finish, the display will show the time progress of the calibration



7. After 3 minutes the main menu display will appear with GAS READINGS menu highlighted.
8. Press ↵ ENTER on the front panel cursor keys, then the function key.
   The display will show gas readings.
9. The display will prompt for 'GO'. Press the function key. The display will show gas readings.
10. To switch the instrument off press and hold the ⏻ button for approximately 2-3 seconds. The instrument will purge the gas sensors with fresh air for 30 seconds, then completely shut down.

2.2.7 Probe Insertion

Loosen the support cone on the probe to allow free movement. (See Description of Instrument)

The probe should be inserted in to the ducting carrying the gas flow through a 11mm to 16mm / 7/16" to 5/8" sampling hole.

The probe insertion length can then be adjusted and the support cone re-tightened when the tip of the probe is in contact with the main stream of the gas flow. The thermocouple measurement reading may assist in determining the best position.

Avoid the ingress of air at the sampling point.

Static Discharge - refer to Section 1.3, Page 10 for details.

2.2.8 High gas concentrations

Measurement periods are only restricted by the concentration of the gases being measured. i.e. Low concentrations in 10 or 20 ppms will not effect the **continuous operation**. High concentrations in 10,000 ppms will quickly saturate the sensors.

2.2.9 Water Catchpot

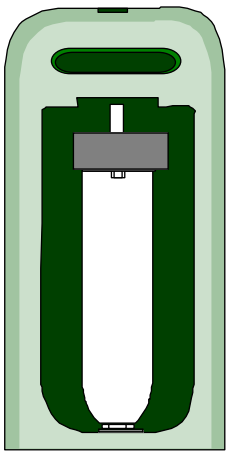
The other limiting factor of the sampling period is water filling the catchpot. **The catchpot should be periodically checked and emptied before it overflows into the pump.**

To empty the water catchpot.

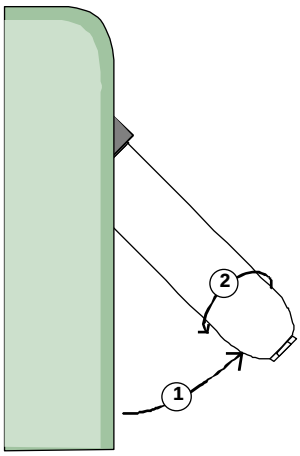
1. Unclip the container and pull out the bottom. **The container is hinged at the top and must not be over extended, more than 45°.**

2. Unscrew the catchpot, remove and empty out water.

Replace in reverse and ensure the catchpot makes a good seal. **Do not over-tighten.** Air leakage will cause errors in gas readings.



End View



Side View

3.0 SOFTWARE DESCRIPTION

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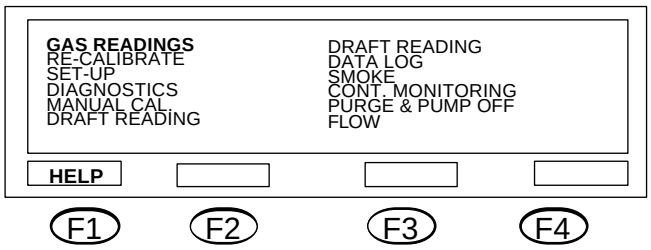
3.1 MAIN MENU

The information contained in this manual is provided for an instrument fitted with all sensors and available options. Therefore, some menus and associated options will not be available on individual instruments.

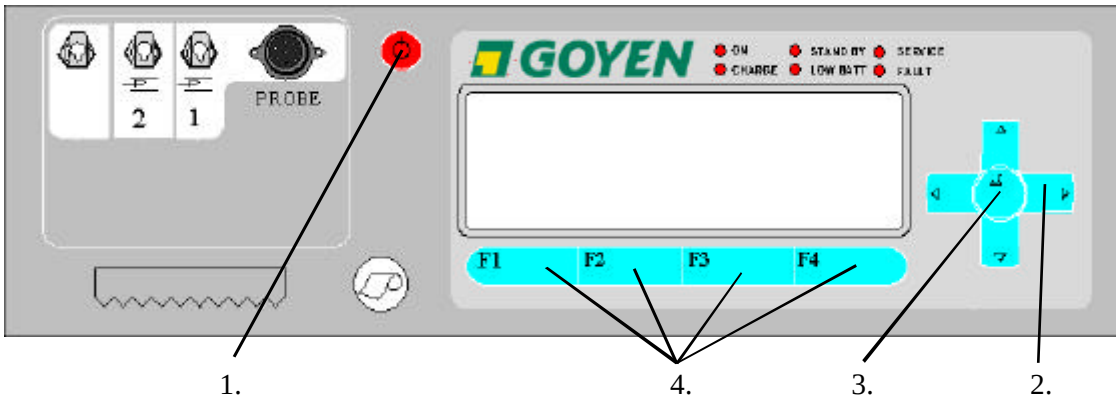
NOTE

Gas readings cannot be accessed during re-calibration. When initiating the gas readings mode, a confirmation of FUEL TYPE display will appear.



The main menu provides access to all other display menus.This is undertaken by using the the keypad and cursor keys.

1. ON/OFF KEY: Switch between ON/OFF
2. CURSOR KEYS: Scrolls up and down menus and also for selecting arithmetic values or other options.
3. ENTER KEY: Confirms selection.
4. FUNCTION KEYS: F1 selects HELP.



3.2 GAS READING

This menu and sub-menus provide access to all information regarding the measurement of the gases.

3.2.1 Explanation of Terms

The following represents detailed explanations of information presented on screen.

Unit No.
The unique identification number of the instrument which applies to the measurement of gases in a particular location. Any number between 0 and 99 can be used, to provide up to 99 unique measurement locations.

To change this unique identification number requires access to the Setup menu, Section 3.4

Fuel Type
This represents the fuel type used at the specific location. This refers to the original fuel used by the burner or furnace all of which have different burning characteristics and emission properties.
The options are: Wood, Light Fuel Oil, Heavy Fuel Oil, Natural Gas, Propane, Coal and four alternative fuel option choices.

To change the Fuel type refer to the Setup menu, Section 3.4

Analysis
The Series II would normally display analysis type as dry. The conversion to wet analysis requires information on the % water content of the flue gas.
As an example, the typical water content for coal burning boilers is approximately 6 - 8%.

Where the analysis is wet, the water content in % terms is also displayed.

The formula for wet analysis is as follows:

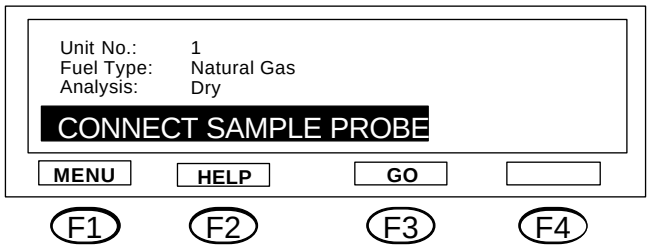
$$\text{ppm (wet)} = (1 - \frac{H_2O}{100}) \text{ (ppm) dry}$$

where H_2O = % water content

To change the analysis from wet to dry refer to the Setup menu, Section 3.6

3.2.2 Making the Gas Measurement

If and attempt is made to make a gas measurement prior to connecting the sample probe the following message will be displayed. It will also reflect the settings used the last time the instrument was used.



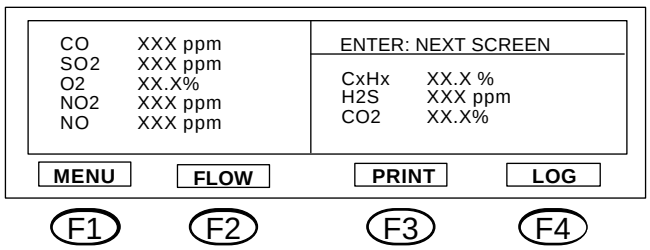
NOTE

Gas concentration measurements will only be shown for gases where the cell is fitted and was selected at the time of purchase.

To make a Gas measurement reading press 'GO'

*Measurement units can be changed. Refer to the Setup menu, Section 3.4.*Gas Measurement Display.

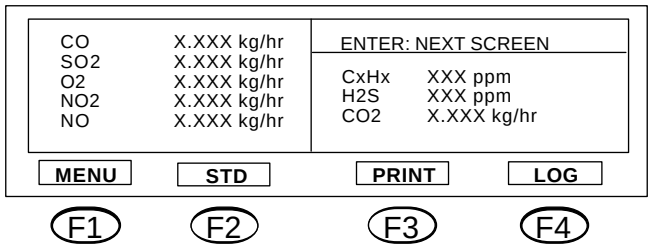
The measurement display is shown below. Gas measurements are displayed in their respective units, i.e ppm or %.



NOTE

This menu will display "O2 norm.on" if Oxygen normalisation is selected.

If the 'Flow' key is depressed the following screen is displayed.



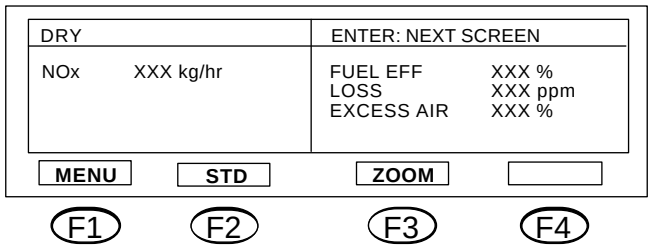
The flow measurements for the individual gases are displayed. Flow Measurement capability is an option on the PGA3000 series.

NOTE

These will only display values where a flow measurement has been taken prior to a gas reading. (See Flow, Section 3.12)

Wet/Dry Measurement - Calculated values

The display is shown below.



NOTE

Pressing the F2 key will toggle between the gas concentration and the flow measurement values. STD - standard gas concentration values , FLOW - flow measurement values

NOx Factor
The concentration of NOx is determined according to which sensors are fitted. i.e NO and NO_2.

The following table indicates how the NOx concentration is determined.

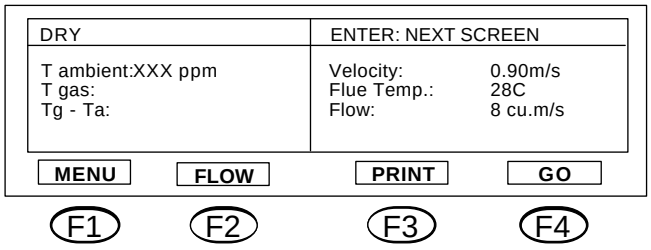
	NO_2 fitted	NO_2 not fitted
NO fitted	NOx = NO conc + NO_2 conc	NOx = NO conc x NO factor*
NO not fitted	NOx = 0	NOx = 0

* - NO factor is the menu entered percentage.
The units of concentration are set in the Setup Menu.

Fuel Efficiency
This is displayed as a percentage and indicates how efficient the burner system operates with the fuel being burnt. This calculation is performed within the instrument and is determined by various factors including: maximum amount of CO_2 in a given fuel; K1 and K2 factors; Vo(dry)/Ao and the F factor. Each fuel has predetermined characteristics which have been pre-programmed into the PGA3000. Where user defined fuels are used these factors may be changed in the Setup menu.

Loss
The loss indicates the inefficiency of the burners and is displayed as a percentage.

Excess Air
This indicates the amount of air not being burnt in the process. This calculation is performed by the instrument and is determined as with Fuel Efficiency, by the use of various factors.



T.Ambient
The probe has in-built ambient temperature sensors. The units i.e °C/°F can be changed in the Setup menu.

T.Gas
The probe has a type K thermocouple which when inserted into the flue gas can determine the exact temperature of the gas. The units i.e °C/°F can be changed in the Setup menu.

Tg - Ta
A calculation of the temperature rise in the combustion process. The units, i.e °C/°F can be changed in the Setup menu.

Velocity
The gas velocity is determined by using the optional Flow probe.

Flue Temp
The flue gas temperature displayed here is made by the optional Flow probe.

Flow
The flow measurement displayed here is made by the optional Flow probe.

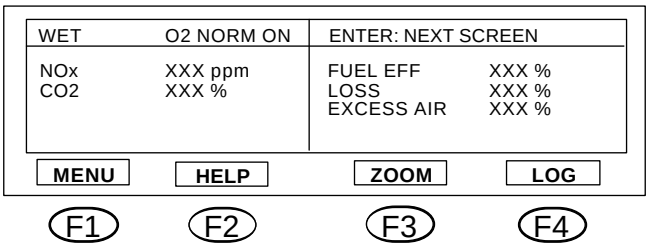
O2 Normalisation
To comply with certain environmental legislation, readings of flue gases are required to be given in relationship to a specific oxygen content (normalisation).
Oxygen normalisation may be selected through the Setup menu. The Oxygen normalisation factor may be entered as a percentage through this same menu option.

The formula for Oxygen normalisation is:

$$Go = G \frac{(20.9 - 0c)}{(20.9 - 0a)}$$

where Go = normalised gas readings
G = gas reading
Oc = O_2 normalisation factor (%)
Oa = O_2 reading (%)

Wet Measurement
The display for measurements using wet analysis are identical as for dry. The water content in the flue gas will have to be determined and entered for reading accuracy. Refer to Setup Menu.



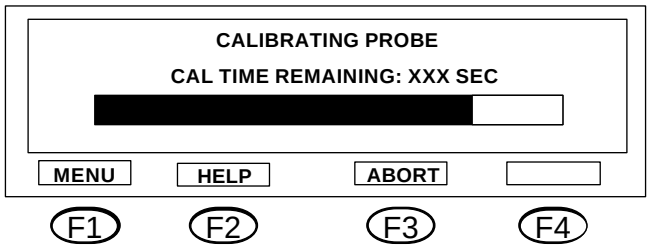
3.3 RECALIBRATE

When the PGA3000 is first switched on, it automatically performs a zero calibration. A zero calibration may be initiated manually by selecting recalibrate at the main menu. The ABORT function key allows early termination of the zero cal cycle (Note: aborting the recalibration cycle may cause incorrect gas readings). The completion or abortion of a zero calibration cycle records the voltage outputs of the cells as exposed to fresh air. The fresh air inlet is independent of the probe, therefore calibration is not effected if the probe is exposed to other gases.
The cell zero values are displayed under: DIAGNOSTICS -> CELL ZEROS, or may be printed out using the DIAGNOSTICS -> REPORT facility.

NOTE

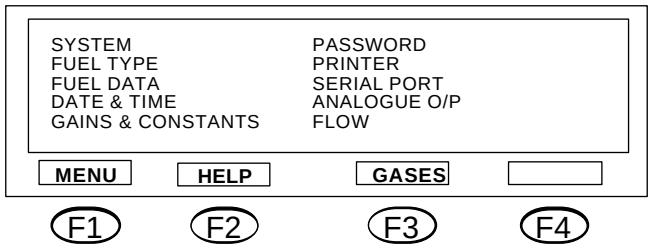
Cell zeros should be virtually 0.0v (offset should be less than 200mV), except for:

O_2 (span value) which should be around 1.8V.
HxCy which should be around 1.0V
CO_2 which should be around 100mV



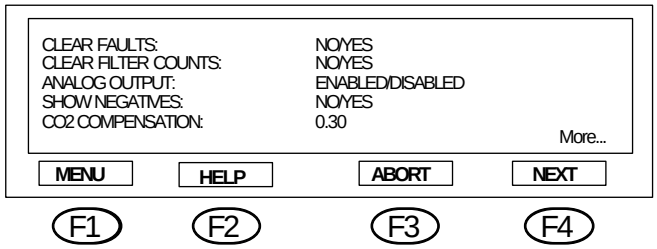
3.4 SETUP

The Setup menu enables both essential measurement parameters and units to be setup. See display below.



3.4.1 System

Within the system sub-menu are the following displays:



Clear Faults

If the 'Fault' LED is lit - selecting the 'Yes' option will attempt to clear the indicated faults.

Clear Filter Counts

When a new particulate filter is fitted, the existing filter count must be cleared to zero. Measurement inaccuracy may result if this is not undertaken.

Analog Output

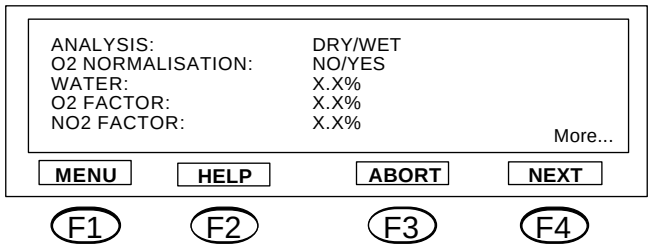
This either enables or disables the Analog output option.

Show Negatives

Negative values for gas concentrations and all parameters can be displayed. Switched to On/Off.

CO2 Compensation

The Oxygen sensor has a small cross-sensitivity to CO_2 which is corrected automatically. The normal value for CO_2Compensation is 0.30.



Analysis

Switches between wet or dry analysis. See 'Making the Gas Measurement' for explanation of Wet and Dry measurement.

O_2 Normalisation
To comply with certain environmental legislation, readings of flue gases are required to be given in relationship to a specific oxygen content (normalisation).Oxygen normalisation may be selected through the Setup menu. The Oxygen normalisation factor may be entered as a percentage through this same menu option.

The formula for Oxygen normalisation is:

$$Go = G \frac{(20.9 - 0c)}{(20.9 - 0a)}$$

where Go = normalised gas readings
G = gas reading
Oc = O_2 normalisation factor (%)
Oa = O_2 reading (%)

Water
This represents the percentage of water contained in the flue gas when undertaking 'WET' analysis. The amount for coal is typically 6 - 8%.

Where the analysis is wet, the water content in percentage terms is also displayed.

The formula for wet analysis is as follows:

$$ppm\ (wet) = (1 - \frac{H_2O}{100})\ (ppm)\ dry$$

where H_2O = % water content

O_2 Factor
See Oxygen normalisation for method of calculating the O_2 factor above.

NOx Factor

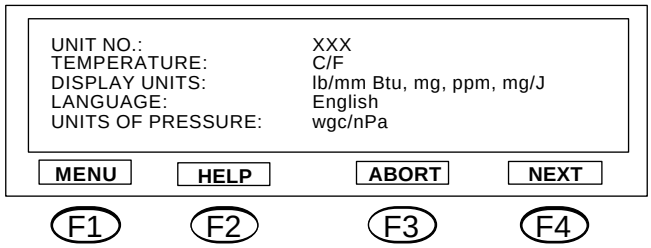
The concentration of NOx is determined according to which sensors are fitted. i.e NO and NO_2.

The following table indicates how the NOx concentration is determined.

	NO_2 fitted	NO_2 not fitted
NO fitted	NOx = NO conc + NO_2 conc	NOx = NO conc x NO factor*
NO not fitted	NOx = 0	NOx = 0

* - NO factor is the menu entered percentage used

The NOx Factor is a percentage correction required for NOx readings if the NO_2 sensor is not fitted. This is typically less than 5%.



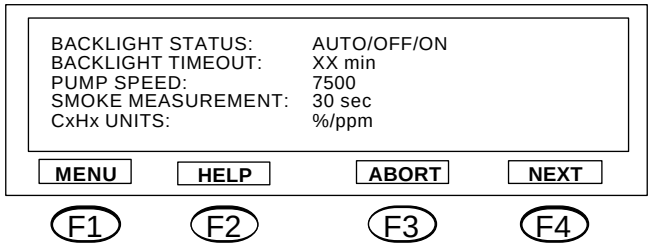
Unit No.
The unique identification number assigned to the instrument which represents the measurement of gases in a particular location. Any number between 0 and 99 can be used, to provide up to 99 unique measurement locations.

Temperature
User selectable Units of temperature measurement. Degrees Celsius or Fahrenheit

Display Units
User selectable measurement units - ppm; mg; lb/mmBtu or ng/J

Units of Pressure
User selectable pressure units - hPA or wgc

Language
This selects the language types available to the user.
Please note that languages other than English have to be requested at the time of placing the order. Alternative languages cannot be retrofitted.



Backlight Status
User selectable - Automatic; ON or OFF.

Automatic
After any key press on the instrument the display backlight will be illuminated for the time period set in 'Backlight Timeout', after which it will switch off automatically. The 'Timeout' period is user selectable.

On/Off
This will enable the backlight permanently On or Off.

NOTE

Selecting Backlight Status to either ON or Automatic with a high Backlight Timeout period will reduce Battery operating life.

Backlight Timeout
User selectable - Range 1 to 180 minutes.

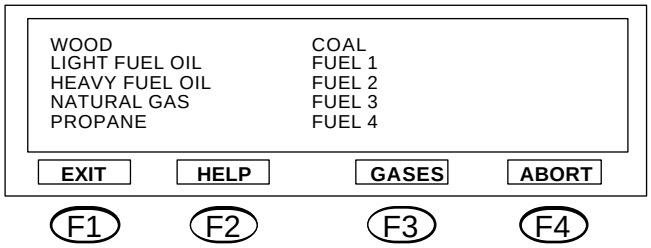
Pump Speed
This value is only applicable when making smoke measurements. It is necessary to either increase or decrease the flow of smoke through the probe to obtain an acceptable quantity measurement. The standard time/flow regulation is subject to local regulations.

Smoke Measurement (option)
This option is only available where a heated smoke probe has been purchased as an option with the instrument. The time period (user selectable - range 1 - 500 seconds) is the time the instrument draws smoke into the sensor before a measurement is made. See Section 3.9.

CxHx Units (if fitted)
Determines whether the hydrocarbons reading is displayed in ppm or as a percentage.

3.4.2 Fuel Type

The following display shows the options available.



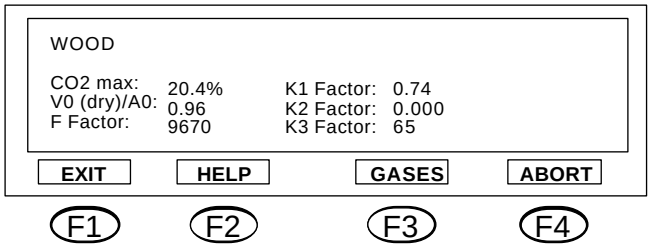
Select from the list the appropriate type of fuel being burned.

NOTE

If a user specified fuel has been selected it is important to enter all information in the 'FUEL DATA' menu. Failure to comply may result in reading inaccuracy.

3.4.3 Fuel Data

The pre-programmed fuels all have corresponding fuel data pre-determined.



NOTE

Displays similar to the above for Wood, are also available for Light Fuel Oil, Heavy Fuel Oil, Natural Gas, Propane and Coal.

Calculation of the maximum CO_2 value

The CO_2 max. value is that proportion of CO_2 in the flue gas, in percentage terms, that would result from the stochiometric oxidation of the fuel. In general, for hydrocarbon fuel, the flue gas will consist of the combustion products - water and CO_2 plus the balance of nitrogen from the combustion air. If it is assumed that efficient combustion takes place, then any oxygen present in the flue is due to excess air being supplied to the combustion process. Thus, a linear relationship exists between the amount of oxygen in the flue, and the amount of dilution of the theoretical maximum value.

NOTE

Where a CO_2 sensor is fitted to the instrument a direct gas measurement is made in place of the calculated method.

$$CO_2 = \frac{CO_2 \text{ max } X \ (20.9 - O_2)}{20.9}$$

where CO_2 is the calculated value in %, O_2 is the measured oxygen concentration. Ambient oxygen concentration is asumed to be 20.9%.

For simple hydrocarbon fuels, CO_2 max. can be calculated:
For a fuel containing 'c' carbon atoms and 'h' hydrogen atoms per molecule, it will take:

$c + \frac{h}{4}$ oxygen molecules to fully oxidise producing:
c - CO_2 molecules and h/2 water molecules.

For stochiometric conditions, the volume ratio of combustion products to inlet oxygen is thus:

$$VR = \frac{c + h/2}{c + h/4}$$

The maximum CO_2 concentration is therefore:

$$CO_2 \text{ max}(\%) = \frac{c}{c + h/2} * \frac{VR*20.9}{(VR*20.9) + 79.1}$$

The calculated CO_2 max value is only valid for perfect conditions in the combustion process. It must be asumed that:

The fuel is dry. Any water present in the fuel will represent a further dilution factor on the maximum value.
The Oxygen measurement from which the CO_2 is calculated is a true wet measurement. i.e. all the water produced by combustion is present as steam, and hasn't condensed out.
There is no further dilution of the flue gas, for example from air leaks in the flue.

Where one or more of these factors is undetermined, it may be better to use a maximum CO_2 determined from actual measurements on the process.

FUEL	CO_2 Max(%)
Wood	20.4
Natural Gas	12.1
Light Fuel Oil	15.6
Heavy Fuel Oil	15.9
Propane	13.5
Anthracite Coal	18.6
Lignite (Peat)	18.6
Bituminous Coal	18.6
Coke Oven Gas	8.97
Enriched B.F.	15.06
Lean B.F.	15.77
BOS Gas	28.6

Table - CO_2 max values

Vo (dry)/Ao
This is pre-determined for all pre-programmed fuel types and represents the gross calorific value of the fuel. It will have to be calculated for Fuel types 1 - 4. Most fuel types have known gross calorific values.

F Factor
This is pre-determined for all pre-programmed fuel types. Look-up tables provide information for most fuel types.

The fuel efficiency calculation is:

efficiency = 100 - % loss due to carbon - % loss due to hydrogen and water - % loss from unburnt fuel

Loss due to Carbon

%loss = K1 (Tstack - Tambient)/$^{\#}CO_2$%

where K1 = (253 x C)/Qgr
C = %carbon by weight in fuel
Qgr = gross calorific value of fuel in KJ/kg
$^{\#}$ - Where a CO_2 sensor is fitted a direct gas measurement is used to calculate fuel efficiency

Loss due to Hydrogen and Water

%loss = K2(1185 -2Tambient + Tstack)

where K2 = 2.1(%wt.H_2O + 9 x %wt.H)/Qgr
Qgr = gross calorific value of fuel in KJ/kg

Loss due to Unburnt fuel

$$\%loss = K3 \frac{(CO + HxCy)}{CO2 + (CO + HxCy)}$$

where:
K3 = a fuel dependent constant
CO = carbon monoxide %
HxCy = Hydrocarbons %

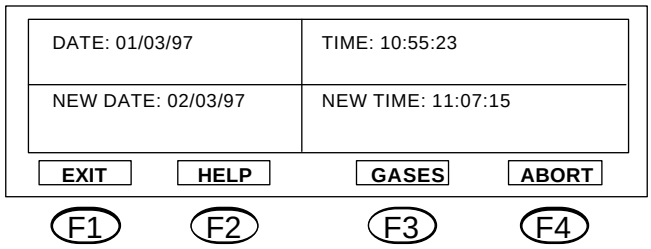
K1 Factor
This is predetermined for all pre-programmed fuel types. It will have to be calculated for Fuel types 1 - 4.

K2 Factor
This is predetermined for all pre-programmed fuel types. It will have to be calculated for Fuel types 1 - 4.

K3 Factor
This is predetermined for all pre-programmed fuel types. It will have to be calculated for Fuel types 1 - 4.

3.4.4 Date and Time

The following display is shown when this sub-menu is entered.

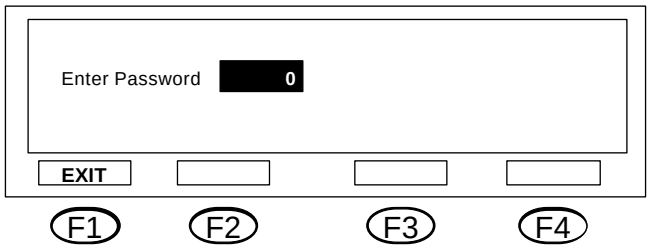


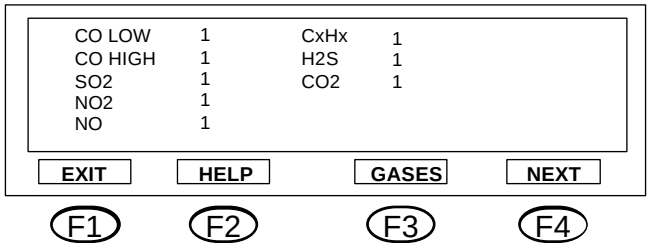
Used for setting of the exact date and time.
Please note order of day:month:year

3.4.5 Gains and Constants (Service Information Only)

NOTE

This menu is password protected. Enter the code 417 to gain entry. Press and hold the 'up' arrow key until 417 is reached.



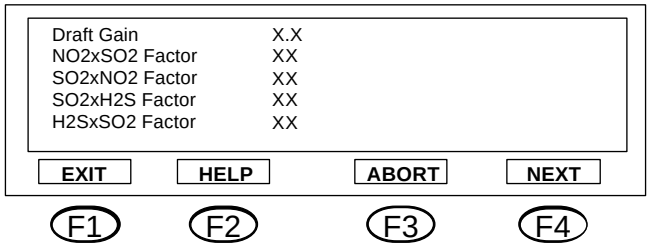


The Gains and Constants correspond to the individual sensors fitted to the PGA3000. The values are entered during the factory calibration. The menu is password protected to prevent unauthorized actions resulting in the need for a complete sensor re-calibration.

Replacing a Gas Sensor
When the life of a sensor has expired and requires replacement, the new sensor will have to be manually calibrated using the correct calibration gas. Once calibration is completed, the new values will automatically be recorded and displayed in this menu.

The values are expressed as ppm/volts (except for the CO_2 and HxCy sensors).

Draft Gain
The Draft sensor (option) has a gain factor, which is only updated when a new sensor is fitted.



Cross Sensitivity Factors

NO_2 x SO_2 Factor, SO_2 x NO_2 Factor, SO_2 x H_2S Factor,
H_2S x SO_2 Factor, CO x H_2 Factor, H_2 x CO Factor
These represent the cross-sensitivity factors associated with the use of certain sensors. These only apply where combination of associated sensors are fitted. For example, NO_2xSO_2 Factor - if only a NO_2 sensor is fitted this factor does not apply and no value need be entered. Default values are automatically entered when the unit leaves the factory. These values only require adjustment or entering when a new or replacement sensor is fitted. Each new or replacement sensor will be accompanied with cross sensitivity information.

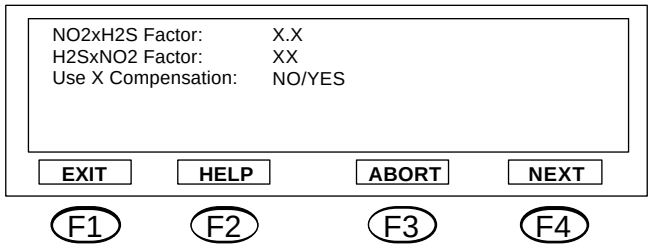
NOTE

Cross sensitivity compensation is applied using simultaneous equations that, in conjunction with the cross sensitivity parameters, eliminate the unwanted effects. The compensation gives good results for steady gas readings.

Where gas concentrations change rapidly, false indications may be obtained due to the differences in response speeds between the sensors. If this problem is suspected, cross compensation can be switched off by setting the item 'Use X compensation' in the SETUP: GAINS and CONSTANTS menu to 'NO'.

NOTE

Cross Sensitivity Factors are displayed on the diagnostic report printout.



NOTE

For correct operation of CO (H_2 compensated) cell the 'Use X Compensation' must be set to 'YES'.

Typical sensor responses

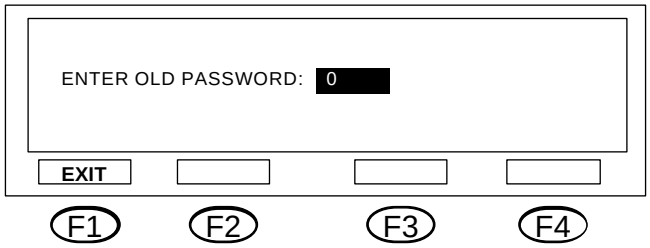
Uncorrected, the sensors have the following relative sensitivities.

Sensor	H_2S gas	SO_2 gas	NO_2 gas
H_2S	1	0.2	-0.2
SO_2	1.3	1	-0.89
NO_2	-0.2	-0.02	1

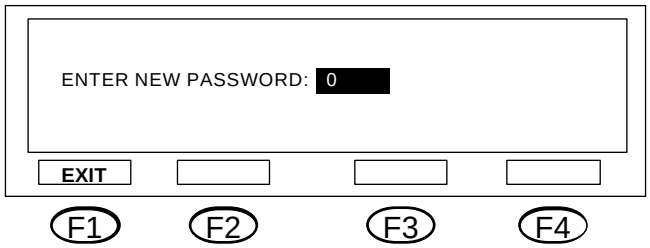
3.4.6 Password

This options permits the user to set up a unique password or 'entry code'. This is to prevent unauthorized adjustment of instrument settings.

The PGA3000 password is factory set at 417

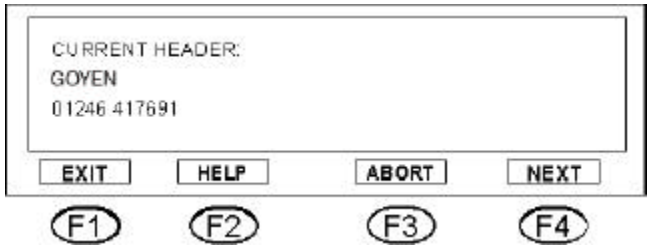


Simply enter the old password i.e. 417 by holding down the 'up' arrow key until the number is reached. Press 'Enter' and you will be asked to enter the new password.

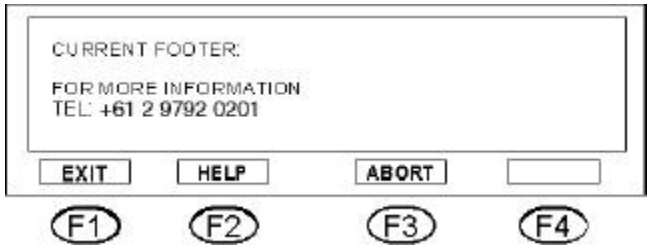


3.4.7 Printer

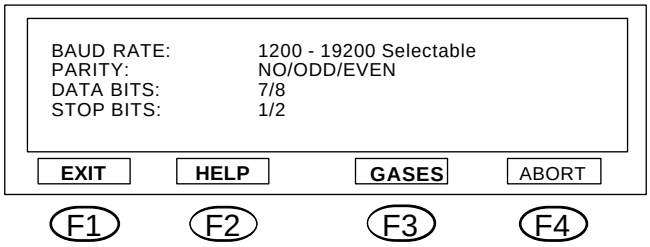
The Printout header and footer can be amended to reflect the company name, phone number etc.



Press 'Next' and the Footer will be displayed.



3.4.8 Serial Port



NOTE

The Serial Port on the PGA3000 must be set for:

9600 baud; no parity; eight bits; one stop bit

There are user selectable options also available. These are available for future system expansion only and should only be set as for the PGA3000 shown above. **Adjustment of the default values may cause problems when the instrument is used with a PC.**

Baud Rate: 1200 - 19200
Parity: No/Odd/Even
Data Bits: 7/8
Stop Bits 1/2

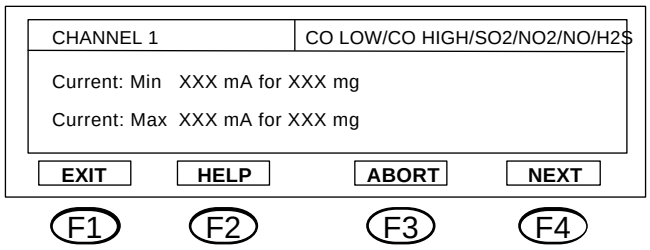
3.4.9 Analogue Output

There are 12 analogue outputs available. The channel numbers correspond to:

Channel No.	Designation
1	CO Low
2	CO High
3	SO_2
4	O_2
5	NO_2
6	NO
7	CxHx
8	H_2S
9	CO_2
10	*User Selectable
11	*User Selectable
12	*User Selectable

*User Selectable - Efficiency, Loss, Probe Temperature, Excess Air and NOx.

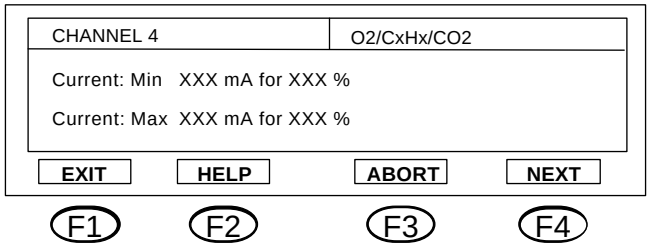
Output Channels for CO Low, CO High, SO_2, NO_2, NO, H_2S



Outputs are given in mA for a designated gas concentration. Concentration will be shown in units (selected in the Set up menu) of mg, ppm, lb/mmBtu or ng/J.

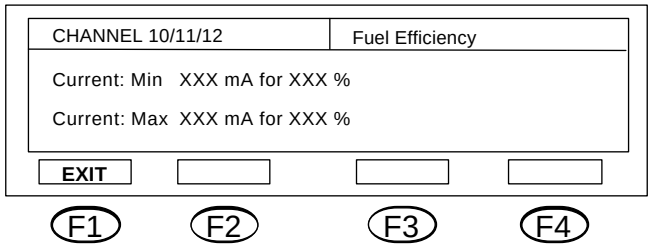
Output Channels for O_2, CxHx and CO_2

Outputs are given in mA for a designated percentage concentration.



User Configurable Output Channels (10 - 12)

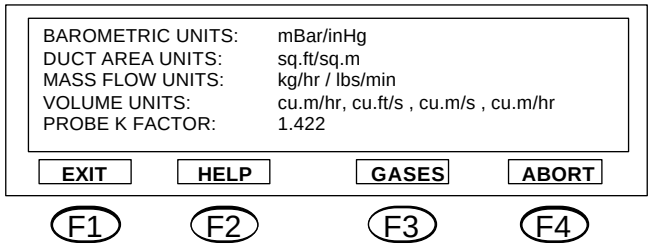
Outputs are given in mA for a designated user selectable output.



User Selectable - Efficiency, Loss, Probe Temperature and NOx.

3.4.10 Flow

For details on using the optional flow probe, please refer to Section 3.12, Flow.



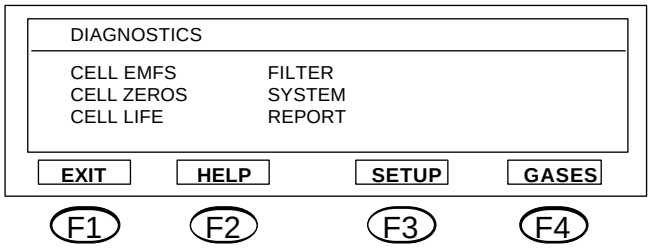
The units used for Flow measurement are user selectable as shown above.

Probe K Factor

The K Factor displayed is the factory default setting given to the Goyen supplied Flow probe (optional). This should not normally require adjustment. If however you are using an alternative flow probe it is necessary to enter the K Factor for the specific probe, otherwise an incorrect measurement will be made.

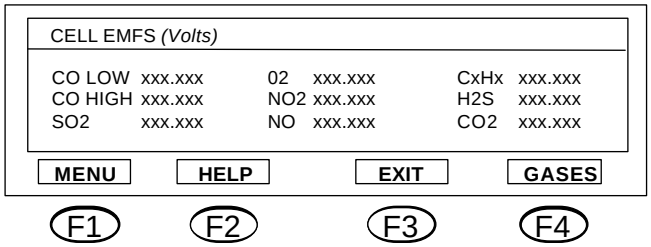
3.5 DIAGNOSTICS

The Diagnostics menu provides analysis of system performance with reference to individual cells, filters etc.



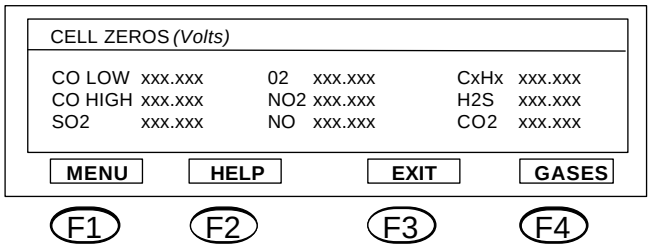
3.5.1 Cell EMFs

This is maintenance information which indicates the current output from each gas sensor in volts. This is specifically of use when the product is being serviced and is a diagnostic tool only.



3.5.2 Cell Zeros

Indicates the zero calibration voltage of the cells after the last calibration was completed. The value for O_2 represents the span voltage (V).

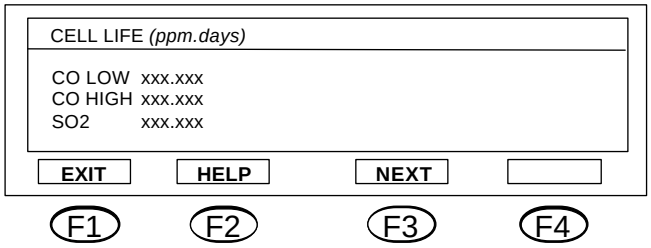


3.5.3 Cell Life

Indicates the total amount of gas through the cell in ppm days. Each count may be individually cleared from within the menu.

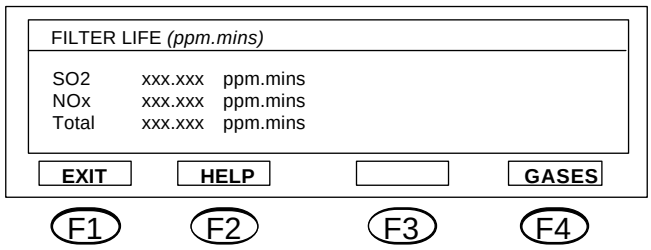
NOTE

The count must be set to zero whenever a sensor is replaced.



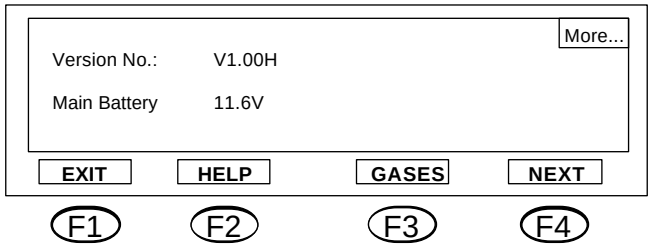
3.5.4 Filter Life

The Filter Life display shows the total amount of SO_2 and NOx which has passed through the chemical filters. The units are displayed in ppm.mins. When the total value exceeds 120,000 ppm.mins the 'Service' LED will light on the instrument front panel. This provides a useful aid in assessing filter life. An alternative method is to note the colour change experienced throughout its life cycle.
The colour change associated with the chemical filter which indicates its position on the life cycle are as follows: i.e Purple - Brown - White. The filter should be replaced when or before it completely turns white. Filter counts can be cleared and reset in the Setup: System menu.



3.5.5 System

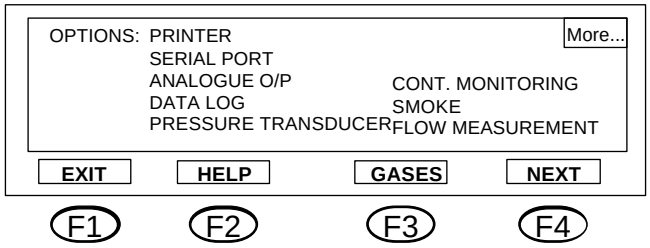
This provides a system overview of the instrument.



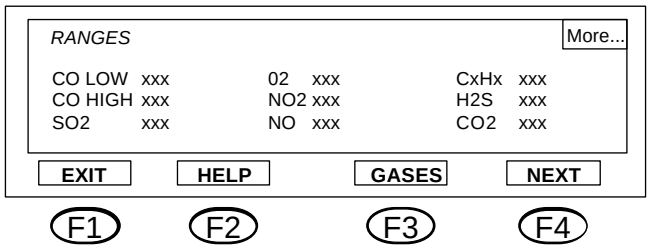
Version No.
Indicates the version of software installed in the instrument.

Main Battery
Indicates the current battery output voltage. When running directly off the mains adaptor the voltage will be between 12.5 and 12.9V. When the battery voltage falls below an acceptable level (11.5V) to maintain optimum performance the 'LOW BATT' indicator LED will light.

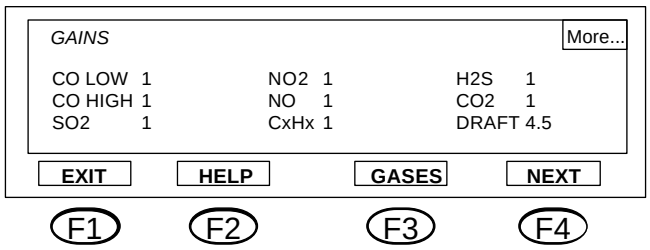
Options
This indicates the options fitted to the instrument.



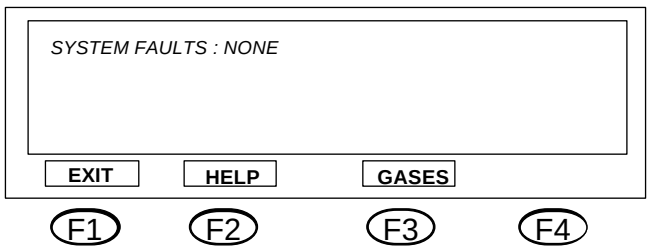
Ranges
This indicates the measurement range capability of the individual cells. i.e CO Low 0 - 2000ppm.



Gains
This indicates the working gain settings for the individual cells.

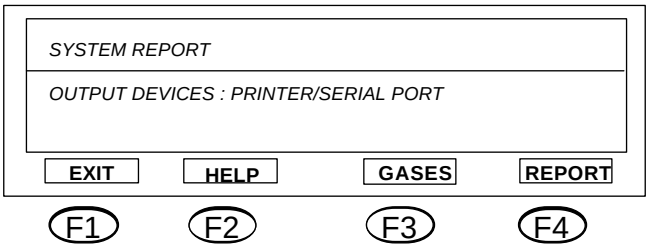


System Faults
This indicates any faults that the system will detect automatically.



Report

A diagnostic report can be output to either the serial port or to the printer which summarises the information contained within the Diagnostics menu. See below for an example report.



Version No. : V2.04

Options:
- PRINTER
- SERIAL PORT
- ANALOGUE O/P
- DATA LOG
- PRESSURE TRANSDUCER
- CONT. MONITORING
- SMOKE
- FLOW

Ranges:

CO LOW	2000
CO HIGH	40000
SO_2	2000
O_2	25
NO_2	100
NO	4000
CxHx	50000
H_2S	1000
CO_2	25

Gains:

CO LOW	-2500
CO HIGH	24250
SO_2	1700
NO_2	-600
NO	-3750
CxHx	16000
H_2S	900
CO_2	1001
Draft	4.5

Zeros:

CO LOW	-0.010V
CO HIGH	-0.491V
SO_2	-0.116V
O_2	-0.004V
NO_2	-0.572V
NO	0.000V
CxHx	-0.355V
H_2S	-0.522V
CO_2	-0.236V

ppm.days:

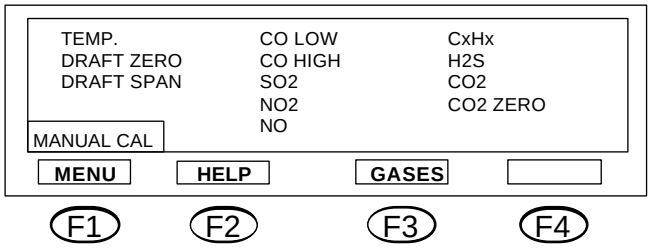
CO LOW	0
CO HIGH	0
SO_2	0
NO_2	0
NO	0
CxHx	0
H_2S	0
CO_2	0

NO2xSO2:	0
SO2xNO2:	0
SO2xH2S:	0
NO2xH2S:	0
H2SxNO2:	0

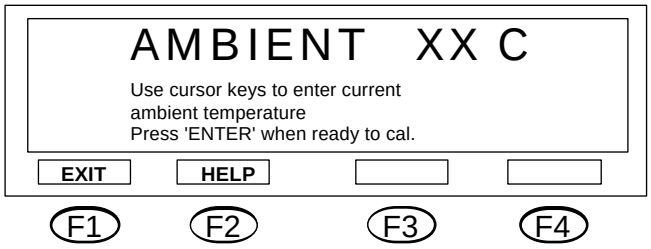
3.6 MANUAL CALIBRATION

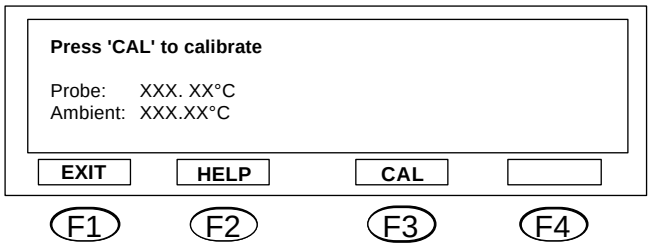
The information contained in this section refers to the Manual Calibration section of the software. To complete a full manual calibration refer to Section 7.

Enter Password
Prior to performing any calibration on the instrument it is necessary to enter the password (417). This is to prevent unauthorized access which may result in a reduction in performance of the instrument.



Temp.
Calibration of the Temperature sensor. This is normally factory set and should not require any adjustment.





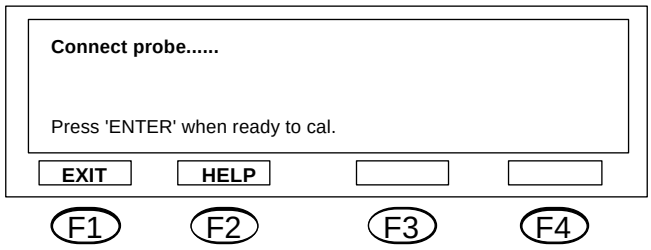
Both the probe and ambient temperatures are displayed and should indicate the entered ambient temperature following calibration.

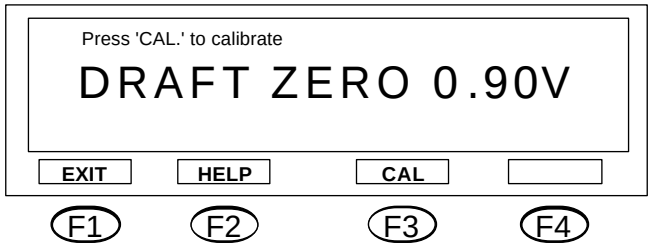
NOTE

The probe should be at ambient temperature when calibrated.

3.6.1 Draft Zero

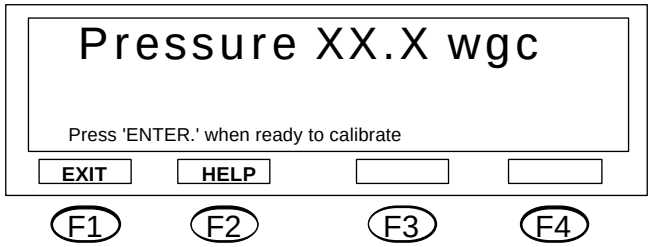
The Draft Sensor is optional on the PGA3000. The Draft sensor is pre-calibrated at the factory. This menu option is used where the sensor requires re-calibration. Draft Zero is a measure of ambient air pressure, with an output displayed in Volts. For details on how to complete a Draft calibration refer to Section 7.6, Calibrating the Draft Sensor.

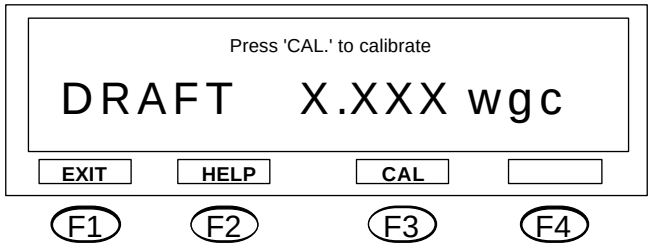




3.6.2 Draft Span

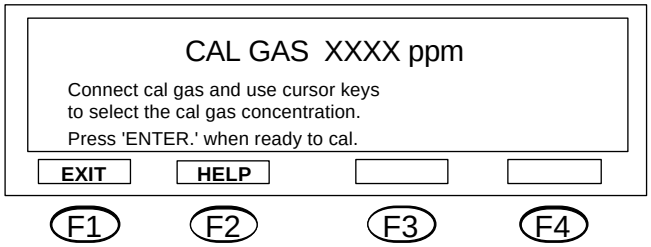
The Draft Sensor is optional on the PGA3000. A Draft Span calibration involves the use of a monometer and squeeze bulb. Refer to Section 7.6, Calibrating the Draft Sensor. A differential pressure reading will be made.



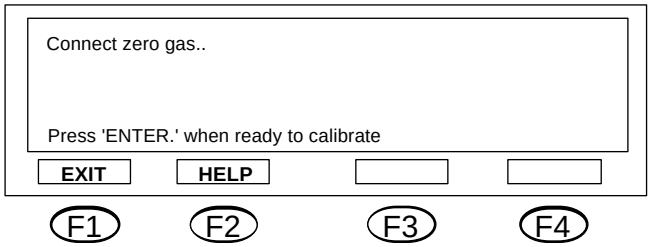


3.6.3 Calibrating the Gas Sensors

The individual gas sensors can be calibrated using the appropriate calibration gas concentration, preferably one that corresponds to the ranges likely to be used. For details of how to carry out a full calibration refer to Section 7.4, Manual calibration - Span calibration.



It is necessary to have information on the individual calibration gases i.e. type and concentrations. This information has to be entered to perform an accurate calibration of the sensors. It is recommended that a zero calibration i.e. a recalibrate function, is performed immediately prior to performing a gas span calibration.



NOTE:

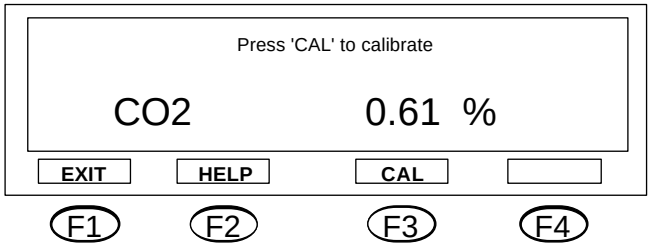
The CO (H_2 compensated) cell requires calibration for both CO and H_2.

CO_2 Zero

The CO_2 sensor needs 2 calibration points for accurate performance. It first calibrates with a calibration gas with zero CO_2, and then a known CO_2 level i.e. 10%. Refer to Section 7.0 SYSTEM CALIBRATION.

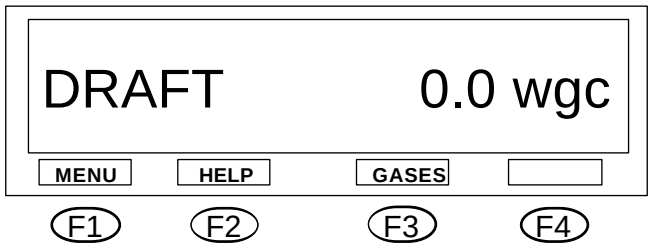
IMPORTANT

When performing a CO_2 zero calibration, it is important to use one calibration gas with zero CO_2 and the other with a known quantity (recommended 10%). Air cannot be used as a CO_2 zero cal gas, as it contains approximately 300 - 400ppm CO_2. Use N_2 or one of the other sensor calibration gases.



3.7 DRAFT READING (Optional)

The Draft Reading indicates the internal stack pressure in water gauge column inches or hPa. The figure represents a differential pressure between the stack pressure at the probe tip and the ambient pressure. It enables the flow rate of the chimney/stack to be determined. For details of how to perform a calibration of the draft sensor refer to Section 7.6, Calibrating the Draft Sensor.



There are two alternative draft sensors available. These are factory fitted and determine what range of pressure can accurately be measured.

Draft Sensor ±20" Water Gauge - Land Part No. 405.405
*Draft Sensor ±10" Water Gauge - Land Part No. 703.862

*** NOTE**

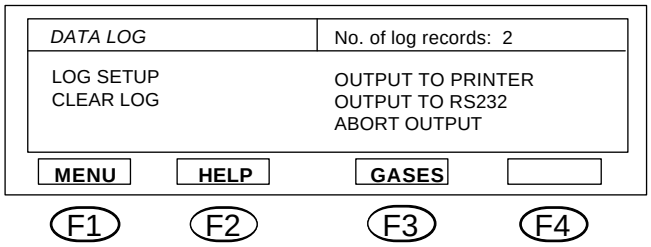
This draft sensor is factory fitted to the instrument where the user has purchased an optional Flow Probe. Refer to section 3.12.

Where there is **no** requirement for Flow measurement (specified at the time of purchase) draft sensor, Goyen Part No. 405.405, is factory fitted.

3.8 DATA LOG (Option)

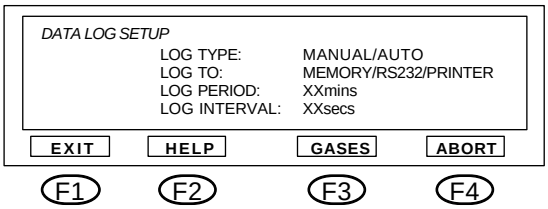
The PGA3000 has data logging as an option. It provides the means of storing measurement data samples for recording or printing, and subsequent analysis.

The menu options permit the user to configure the data log to meet individual requirements.



3.8.1 Data Log Setup

There are four parameters to set up before data logging can begin.



LOG TYPE

There are two options: Manual or Automatic

Manual

The manual data log provides an instantaneous log of data. This can be undertaken by pressing the 'LOG' key in the Gas Readings Display.

Automatic

The automatic data log enables data to be logged at specific time intervals for a specified time period of logging, e.g. Log Period 2 mins, Log Interval 10 secs.

The 'Log Period' has a range 2 - 60 mins.

The 'Log Interval' has a range 10 -1800 secs

NOTE

Although the log interval may be set as low as 10 seconds, the system response to changes in gas concentrations is not less than 1 minute.

Starting the AUTO log
Auto Data Logging does not commence until the 'AUTOLOG' key is pressed in Gas Readings Display.

NOTE

The 'AUTOLOG' key does not appear in Gas Readings Display until Auto Data Logging is selected. Once the Auto Log is initiated the PGA3000 will place a log record to the selected output device at the interval specified by the system parameter 'LOG INTERVAL'. Auto Logging will stop when the specified log period is completed.

Aborting the Auto Log
Auto Data Logging may be aborted before the completion of the Auto Data Log period by pressing the 'STOPLOG' key in Gas Readings Display.

NOTE

The 'STOPLOG' key does not appear in Gas Readings Display until the Auto Data Log has been started.

LOG TO
There are three options available to enable data logging storage/output - Memory, Printer or RS232.

Log to Memory
The PGA3000 can log up to approx. 1000 log records of data in non-volatile system memory.

NOTE

When the log memory is full no subsequent logs are recorded.

Log to Printer
Log records may be output as ASCII text to the local printer (if fitted).

NOTE

Due to the limitations of printer speed the PGA3000 will not allow a log interval of less than 2 minutes when outputting data direct to the printer.

Log to RS232
Each log record may be output to the RS232/RS422 channel (if fitted). The data is output as ASCII data which may be received by the Goyen Capture PROGRAM for use with a spreadsheet.
See Goyen CAPTURE PROGRAM Section 11.

Clearing the Log Memory
The non-volatile system memory used for data logging may be cleared by the DATA LOG->CLEAR LOG menu option.

NOTE

Data log memory is shared by both the data logging and the Semi-continuous monitoring system options. **Clearing the log memory will erase all log records.**

Outputting the Data Log from the Data Log Memory

There are three methods of outputting the log records in system memory. Each method will output ALL the records in the log memory.

NOTE

The data log memory is <u>not</u> automatically cleared following a log output.

OUTPUT TO PRINTER
The data log records in system memory may be output to the local printer (if fitted). The DATA LOG->OUTPUT TO PRINTER menu option provides this selection.

OUTPUT TO RS232
The data log records in system memory may be output to the optional RS232 port. The output is in ASCII text to provide a hard copy report to a serial printer with XON / XOFF protocol, or to a computer running a suitable communications package. The DATA LOG->OUTPUT TO RS232 menu option provides this selection.

NOTE

This method does not present the logged data in a format directly suitable for inclusion in a spreadsheet package (see Goyen CAPTURE PROGRAM Section 11).

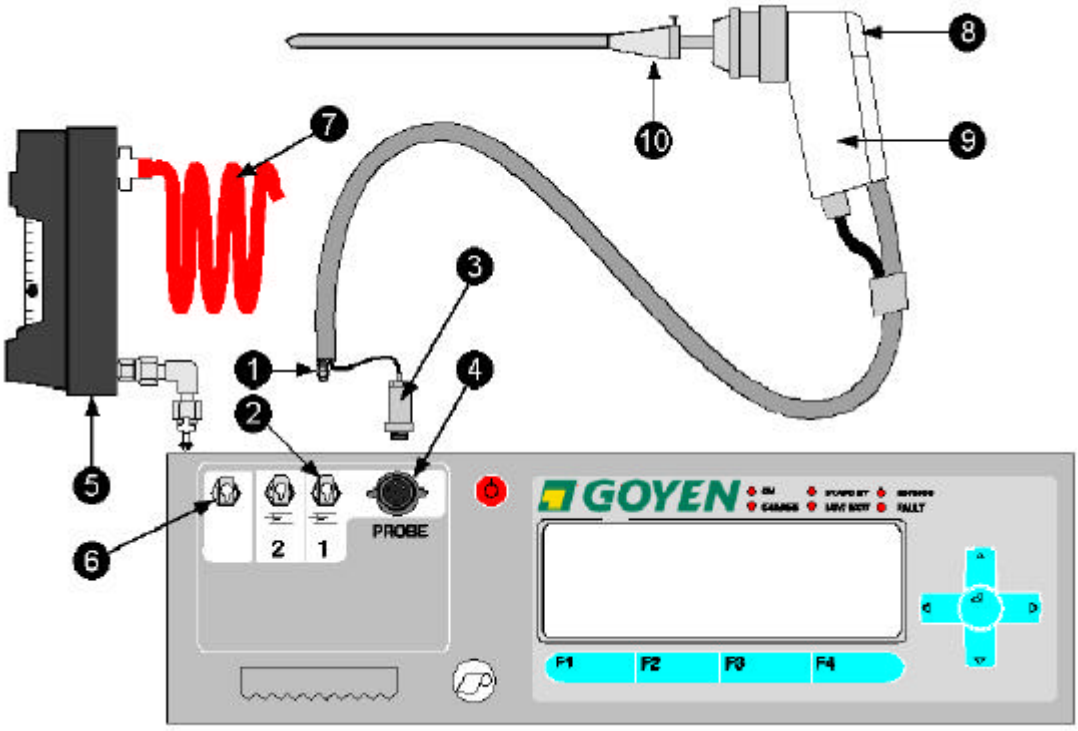
GOYEN CAPTURE PROGRAM
The Goyen Capture program may be used to transfer data from the PGA3000 system memory to a dBaseIII type file, for use with spreadsheets. (See GOYEN CAPTURE PROGRAM Section 11).

ABORTING THE OUTPUT
The output of data from the data log system memory may be aborted at any time by selecting the DATA LOG->ABORT OUTPUT menu option.

3.9 SMOKE (Option)

The 'Smoke' option of the PGA3000 uses a Heated Smoke Probe to take a measurement sample of flue gas. The smoke probe is supplied with 3m / 9.84ft of hose, filter paper (part number 701.616) and a Bacharach Smoke Chart (part number 702.035). The probe is available in the following lengths:

0.30m / 0.98ft (part number 703.374)
0.75m / 2.46ft (part number 703.383)
1.00m / 3.28ft (part number 703.384)



Key.

1. Probe Line
2. Flow Gas Input
3. Power Connector
4. Connector
5. Flow Meter
6. Exhaust Outlet
7. Silicon Tube Exhaust
8. Filter Paper Holder
9. Pistol Grip Handle
10. Support Cone

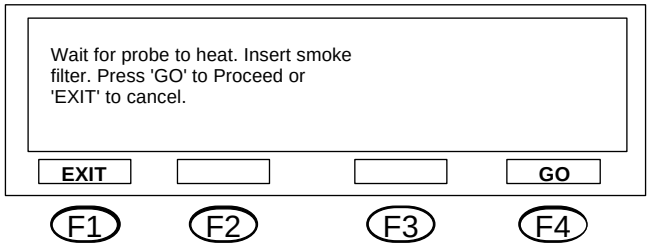
NOTE

Before using check that the probe entry point is clear of any buildup of debris that may incur a false reading.

Attach the probe line (1) to the Flow Gas Input (2) and the power connector (3) to the 'probe' connector (4) on the PGA3000 Unit as shown above.

3.9.1 Determining the Flow Rate

Connect a flow meter (5) (available from Goyen, part number 703.935) to the exhaust (6).



Select the 'SMOKE' option from the main menu and insert the probe into the flue gas upto the Support Cone (10).

Press 'GO' (F4) and note the flow meter reading. It will be required for 'Sample Time' calculations.

Now calculate the Sample Time (Smoke Measurement)

3.9.2 Calculating the Sample Time (Smoke Measurement)

Calculate the sampling time using the equation below or read off the graph opposite.

$$\text{Sample Time} = \left(\frac{V_A}{F}\right) . \left(\frac{60}{1000}\right)$$

where:
- F = measured flow rate in litres litres per minute
- V_A = volume of gas (in cubic centimetres) to be passed through filter paper (probe smoke spot diameter 6mm/0.24").
- 60 = conversion from minutes to seconds
- 1000 = conversion from litres to cubic centimeters

EXAMPLE

Measured flow rate (F) = 1.7 litres per minute

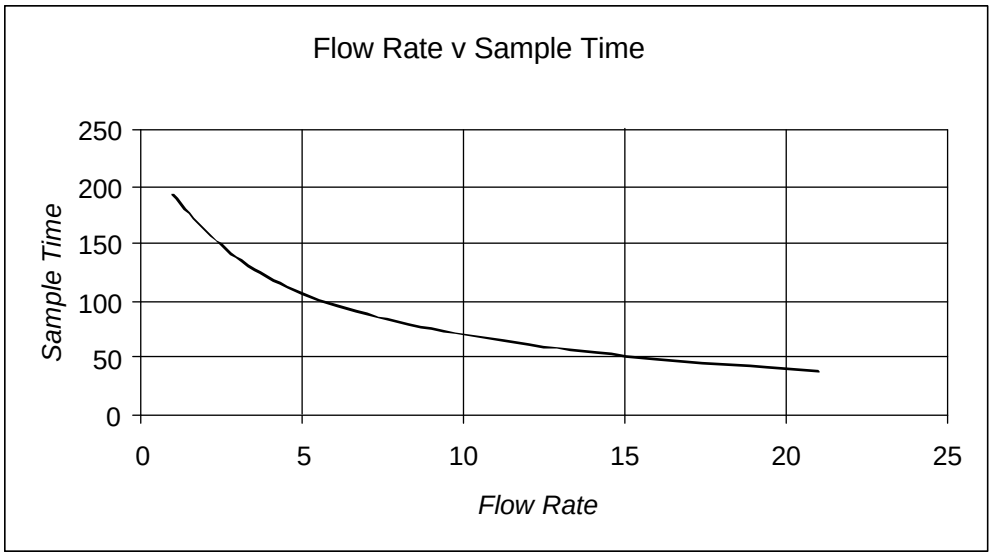
$$\text{Sample Time} = \left(\frac{V_A \times 60}{1.7 \times 1000}\right)$$

$$= \frac{95.64}{1.7} = 56 \text{ seconds}$$

NOTE

Goyen uses Bacharach Smoke Reference Charts as the basis for the above calculations. This standard requires a volume equivalent to 5720cc at STP per 1cm^2 (or 36900cc at STP per 1inch^2 as stated in ASTM D 2156) to be used as the sample. Check for local regulations to ensure the measurement meets the accepted standard.

Once the flow has been measured a Sample Time (Smoke Measurement) may be read off the graph below.



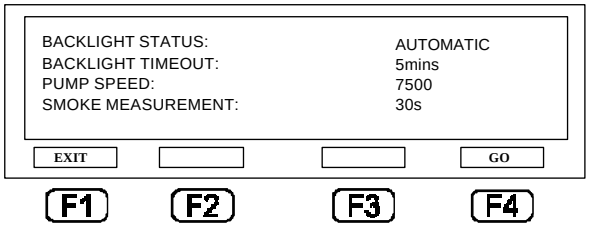
Flow Rate verses Sample Time

NOTE

The above graph may only be used with the Goyen Smoke Probe as another device may not have the same size smoke spot.

3.9.3 Making the Measurement

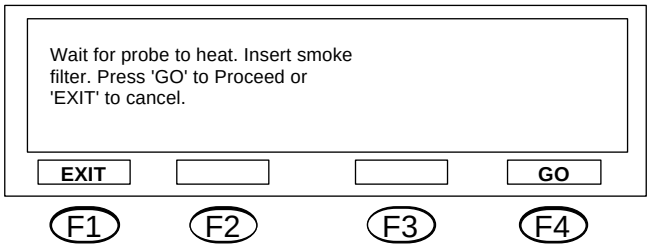
Set the instrument 'SMOKE MEASUREMENT' (sample time) to the calculated value and return to the 'SMOKE' option. The default setting is 30 seconds. Enter the menu as shown below and adjust this time to the calculated sample time.



From the main menu 'SMOKE MEASUREMENT' is found on the fourth screen of 'SYSTEM'>'SETUP'. Press the 'ENTER' key to move through the options and the 'UP' and 'DOWN' keys to set the value. Once the required value is set press 'EXIT' (F1) twice to return to the main menu.

Place the probe into the stack/flue and allow the probe to warm up for 1 minute.

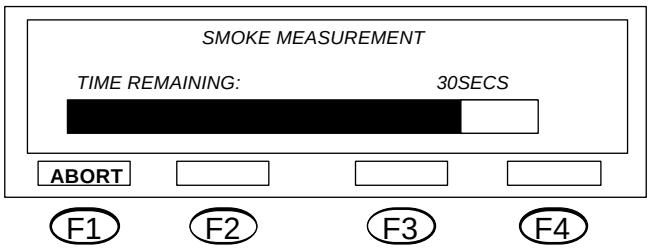
Select the 'SMOKE' option from the main menu and follow the instructions on the screen.



Inset the filter paper into the holder on the probe handle and then press 'GO' (F4).

Important

Check that the flow meter remains at the same reading as previously measured.



If during the measurement the flow varies greatly repeat the measurement. When the 'SMOKE MEASUREMENT' time has elapsed the screen displays 'REMOVE SMOKE FILTER'. The filter paper should be removed from the holder on the probe handle immediately.

Compare the filter paper with the Bacharach Smoke Scale.

IMPORTANT

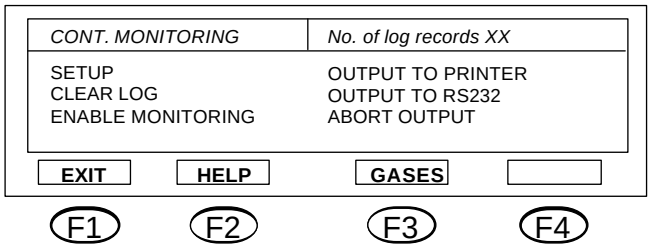
The Heated Smoke Probe will operate from the batteries inside the PGA3000. However, prolonged use (i.e. in excess of 20 minutes) may render some instrument facilities inoperable. It is recommended that for extended use with the Heated Smoke Probe, the instrument should be run from a suitable mains supply using the power cable supplied with the instrument.

3.10 SEMI-CONTINUOUS MONITORING (Option)

Semi-continuous Monitoring is a means to cyclically sample and log gas concentrations over a period of time. This is achieved by alternate 'WAKE' and 'SLEEP' phases. During the 'SLEEP' phase the instrument is switched to air intake and the pump is off. During the 'WAKE' phase the instrument takes a specified number of gas samples at a specified interval and logs the data to non-volatile system memory, the local printer or the RS232 port.

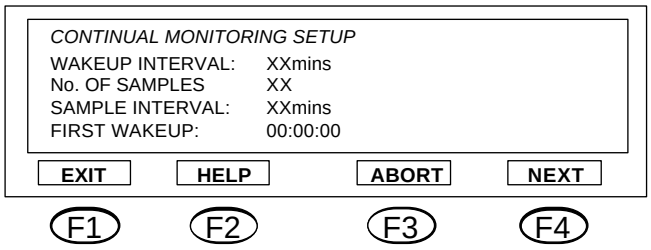
NOTE

In order to make full use of the Semi-continuous monitoring option it is recommended that the Goyen PGA3000 is also fitted with a serial port and capture program, and/or Analog outputs.



3.10.1 Setup

The following parameters have to be set before Semi-Continuous Monitoring can begin - Wake-up Interval; Number of Samples; Sample Interval and First Wakeup.



Wakeup Interval

This is the length of time between each wakeup time - user selectable range 10 - 180mins. 'Wakeup' is the time when the PGA3000 is actively monitoring.

No. of Samples

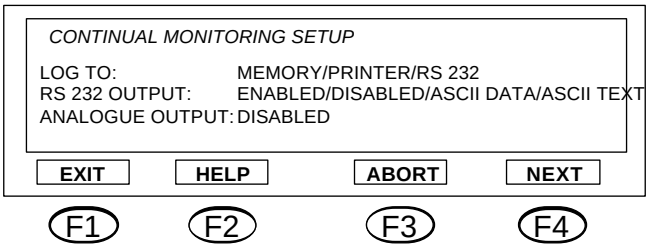
The number of samples to be taken between each wakeup period - user selectable range 1 - 100 samples.

Sample Interval

The time interval between samples being taken during the wakeup period - user selectable range 2 -15mins.

First Wakeup

The instrument clock time for the first wakeup after continual monitoring is enabled - user selectable Hrs/Mins/Secs



LOG TO
This parameter determines where the data records will be placed. Options are Memory, Printer, RS232.

Memory
Up to 1000 log records may be stored to the non-volatile on-board memory.

NOTE

When the log memory is full - no further logs can be stored.

Printer
Each log is downloaded as an ASCII text file to the local printer (if fitted).

NOTE

Due to the speed limitations of the local printer output the PGA3000 does not allow a sample interval of less than 2 minutes when this option is selected.

RS232
Each log record is downloaded to the RS232 channel (if fitted). The data is output in the format determined by the RS232 Output setup parameter.

RS232 OUTPUT
When the 'LOG TO' parameter is selected as RS232 this parameter determines the output format of the data.

ASCII Text
Data is output as ASCII text.

A serial printer with XON / XOFF protocol may be connected to the serial channel for a hard copy report of the samples. Alternately a PC with a suitable communications package could capture the data for output to a disk-based data file.

NOTE

Data in this format may not be directly incorporated into a spreadsheet package.

ASCII Data
Data is output as ASCII data in a format which may be received by the GOYEN CAPTURE SOFTWARE for use with a suitable spreadsheet package.

ANALOGUE OUTPUT
The analogue output may be enabled or disabled during Semi-continuous monitoring.

3.10.2 Clear Log

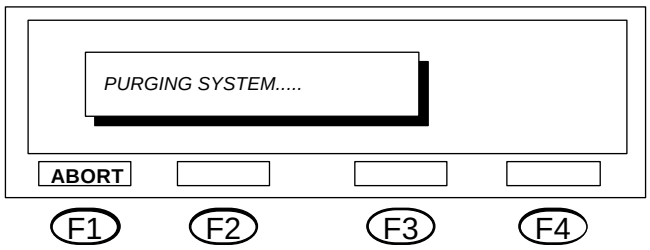
A simple key press will empty the entire log.

NOTE

ALL data stored in the log will be deleted after this command. Data is NOT recoverable.

3.10.3 Enable Monitoring

Prior to the system starting in the Semi-Continuous Monitoring cycle the system is purged of all flue gases.



3.11 PURGE & PUMP OFF

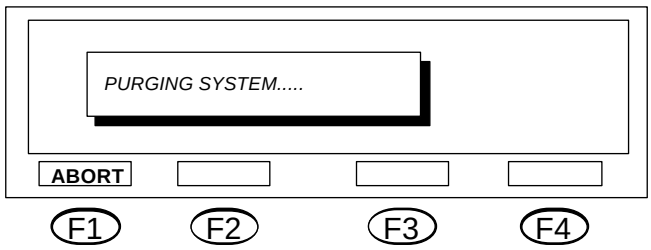
The PURGE selection will allow air to be drawn through the system for 30 seconds in order to purge the cells. The pump will then be switched off.

The PURGE function will not operate if the system is re-calibrating or if it is already purging following a CO over range.

No other menu items are available during the 30 second purge cycle.

NOTE

This function occurs automatically when the instrument is switched off.



3.12 FLOW

NOTE

Draught sensor module (Goyen Part No. 703.862) must be fitted to the instrument to enable flow measurements to be made.

The 'Flow' option involves the use of an alternative probe to the standard measurement probe. The flow probe can be used to provide the following measurements:

- Velocity
- Volume Flow
- Volume Flow dry
- Volume Flow dry (STP) i.e. standard temperature and pressure.

This information can also be used (stored by the instrument) with the individual gas readings (made using the standard probe) to provide the following measurement:

- Mass Flow i.e. unit volume over a given time period, kg/hr.

Information Required

In order to make accurate flow and subsequent mass flow measurements it is necessary to have the following information available prior to undertaking any measurements:-

- Pressure i.e. atmospheric pressure
- Flue gas water content - indicated as a percentage

NOTE

Accurate flow and mass flow measurements require a 'dry' measurement. The instrument compensates for the water content in the calculations of mass flow. It is therefore important to enter an accurate figure for water content into the instrument.

- Duct Area - the cross-sectional area of the duct expressed as either sq.ft or sq.m
- Density Correction - this value represents the relative density of the flue gas compared directly to the outside air. The default value is set to 1.00, and should only be adjusted where an accurate density comparison can be made.

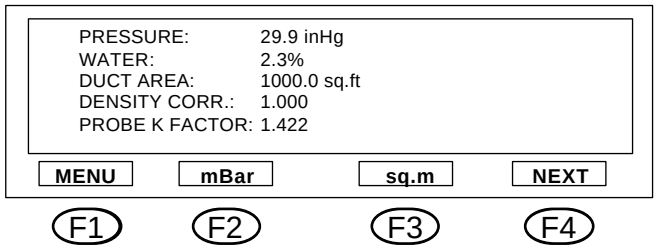
- Probe K Factor - the Goyen supplied probe has a factor of 1.422. This is the factory default setting and should not be adjusted. Where the user is supplying their own flow probe it is necessary to enter a K Factor for that individual probe. Failure to enter an appropriate value may adversely affect the reading accuracy.

Using the Flow Probe

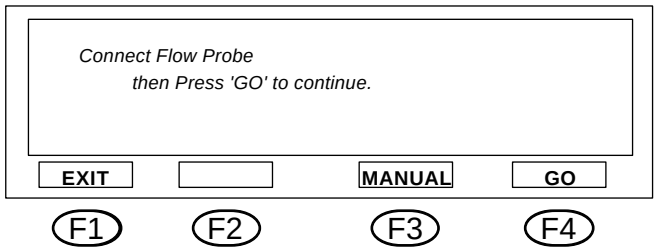
IMPORTANT

In order to make Mass Flow calculations it is necessary to make the flow measurements prior to the gas readings. The flow information is stored by the instrument, and is then used with the gas reading information to make the calculations. Ensure the flow measurements are made first.

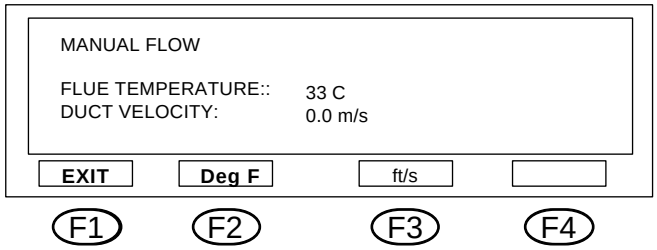
1. In the Main menu, select 'FLOW', and the following dispay will be shown.



2. As described earlier, it is necessary to have this information in advance. Enter the data for Pressure, Water, Duct Area, Density Correction (if applicable) and Probe K Factor (if not using a Goyen supplied probe). Once all the information has been entered correctly press 'NEXT'. The following display will be shown.

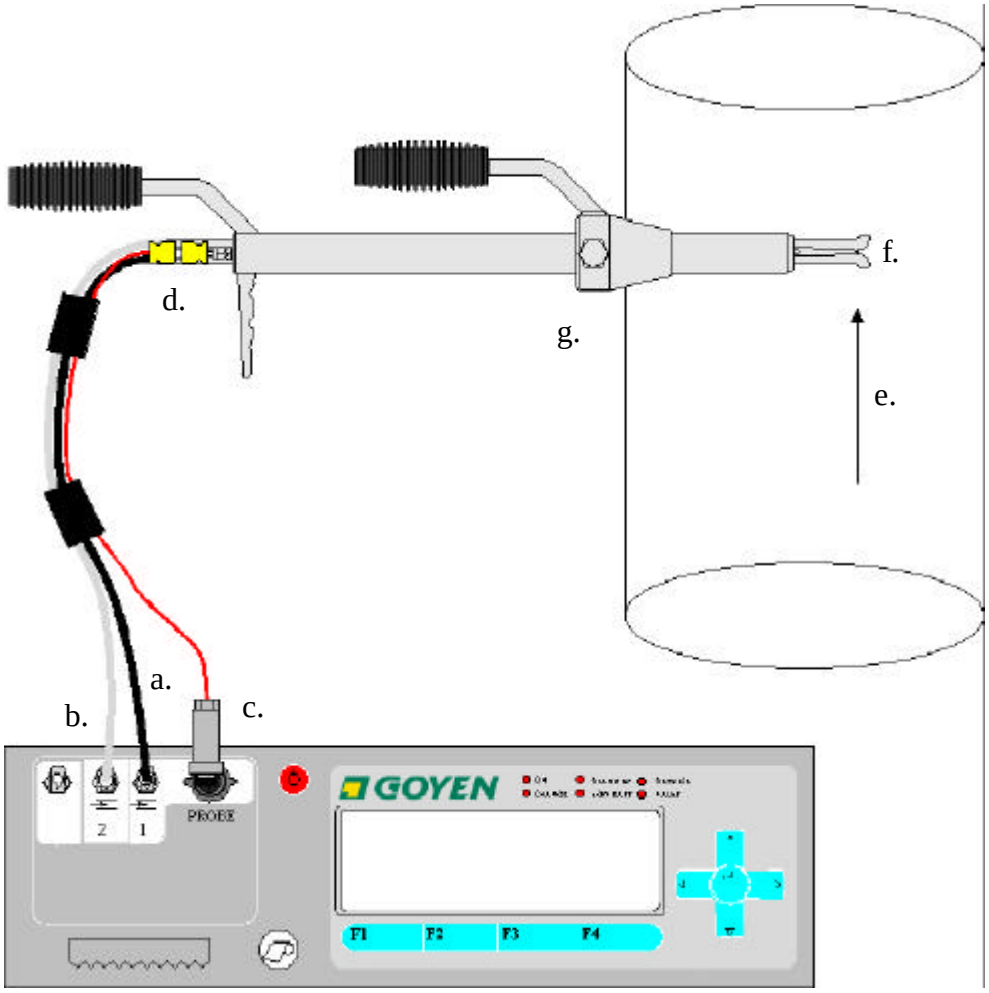


2b. Pressing the 'MANUAL' option will display a further display screen.



This option should be used when the flow probe is unavailable, or where an alternative flowmeter (not supplied) is being used. Once the information has been entered into the instrument, pressing 'EXIT' will store that information.

3. Remove the Gas Probe (if appropriate). Connect the Flow Measurement Probe. See Diagram below.



a. Connect Gas Reading tube (black) into Port 1 marked 'Flue Gas'.
b. Connect the Flow tube (clear plastic) into Port 2 marked 'Flow'
c. Connect the Electrical Connector into the Port marked 'PROBE'.
d. Connect the yellow connectors together. There is only one correct orientation as the pins are of differing sizes. Connect the clear and black tubes to the flow probe. They can connect to either metal tube.
e. The direction of gas flow is important when making a flow measurement.
f. Ensure the probe is placed in the flue gas in the orientation shown i.e parallel to the flow.
g. Locate the support cone in the measurement opening.

IMPORTANT

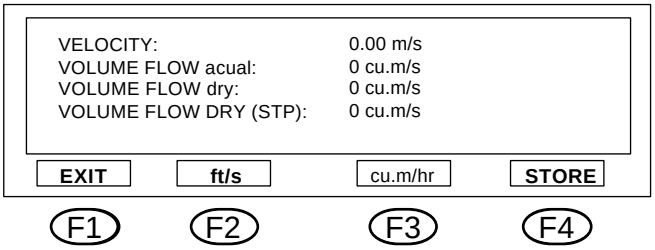
The flow probe comprises of two curved tube at the end. It is important to have one tube facing directly into the gas flow. The measurement is made by using the differential pressure across the two tubes. Positioning the probe at 90° to the flow will give an inaccurate reading.

4. Once the probe is assembled and in position in the flue gas stream press 'GO'.

IMPORTANT

If the Flow probe is being used at frequent intervals, ensure the two curved tubes at the end of the probe are regularly inspected for signs of a blockage. A blockage in either tube will give false measurement readings.

5. The flow measurements will then be made. The readings will be taken almost instantaneously.



6. Press 'STORE' to record the measurement information. Remove the probe from the flue gas stream.

Pressing either F2 or F3 will toggle the units of measurement between the available options. i.e. cu.m/s or cu.ft/s

7. The Flow information is now stored in the instrument.

IMPORTANT

To acquire Mass Flow information it is now necessary to take gas readings at the identical measurement point. The stored flow information will be combined with the gas readings, to calculate Mass Flow.

8. To obtain Mass Flow information follow the procedure for Gas Readings.

9. Once the gas readings have been made the instrument will display both concentrations and mass flow. Pressing the F2 key will toggle between STD (i.e. gas concentrations) and FLOW (Mass Flow information).

10. The information can then be logged or printed by the instrument.

4.0 OUTPUTS

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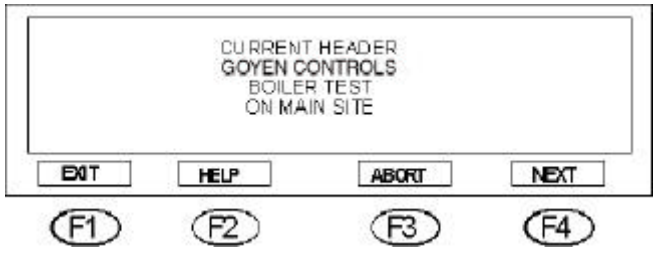
4.1 PRINTER

4.1.1 Header and Footer Displays

CURSOR KEYS:	LEFT/RIGHT move cursor
	UP/DOWN change character under cursor.
ENTER:	Move to next line.

FUNCTION KEYS:-

F1 EXIT:	Return to SETUP menu saving changes.
F2 HELP:	Information on how to use display.
F3 ABORT:	Return to SETUP menu abandoning changes.
F4 NEXT:	Moves between HEADER & FOOTER displays.



4.2 PRINTER READ-OUT

Three line headers and two line footers may be customer defined. Each line can support up to 24 characters. Entries are made by the Set Up menu, scrolling the characters and numbers, then selecting by use of the cursor keys.

4.2.1 Sample Printout

```
          GOYEN
       BOILER TEST                    -------- Header
       ON MAIN SITE
 ----------------------------------------
 Type of fuel:
 Light Fuel Oil
 Dry analysis
 O2 normalisation: off
 ----------------------------------------
 Date: 4.4.97

 Time: 10:23
 ----------------------------------------
 T ambient    :     25 C
 T gas        :    266 C
 Tg - Ta      :    241 C

 CO           : 2055 ppm  55mg/m3
 SO2          :  105 ppm
 NO2          :   43 ppm
 NO           :  272 ppm
 O2           :   1.71 %
 CxHx         :   0.65%
 H2S          :  742ppm
 CO2          :  14.32 %
 NOx          :  315 ppm

 Velocity     :  12.0ft/s
 Flue Temp.   :     32F
 Flow         :  36cu.ft/s

 efficiency   :   90.2 %
 loss         :    9.8 %
 excess air   :   10.8 %
 water        :    0.0 %
 O2 norm      :    0.0 %
 ----------------------------------------
 FOR MORE INFORMATION          --------- Footer
 TEL +61 2 9792 0201
```

The instrument can be specified with a dual unit printout facility i.e. ppm and mg/m³.

This facility must be specified at the time of ordering the instrument, as it is not selectable from the menu system.

4.3 DATA LOGGING

4.3.1 Data Logging Options

Log Type - Manual or Automatic

Log Storage - Memory, Printer or RS232

Log Output - Printer or RS232

4.3.2 Log Type

There are two options: Manual or Automatic

Manual
The manual data log provides an instantaneous log of data at that precise time. This can be undertaken by pressing the 'LOG' key in the Gas Readings Display.

Automatic
The automatic data log enables data to be logged at specific time intervals for a specified time period of logging i.e. Log Period 2 mins, Log Interval 10 secs.

The 'Log Period' has a range 2 - 60 mins.

The 'Log Interval' has a range 10 - 1800 secs

> **NOTE**
>
> Although the sample interval may be set as low as 10 seconds, the system response to changes in gas concentrations is not less than 1 minute.

4.3.3 Log Storage

There are three options available to enable data logging storage/output - Memory, Printer or RS232.

Log to Memory
The PGA3000 can log approx. 1000 log records of data in non-volatile system memory.

> **NOTE**
>
> When the log memory is full no subsequent logs are recorded.

Log to RS232
Each log record may be output to the RS232/RS422 channel (if fitted). The data is output as ASCII data which may be received by the Goyen Capture PROGRAM for use with a spreadsheet.
See GOYEN CAPTURE PROGRAM Section 11.

4.3.4 Log Output

RS232 OUTPUT
When the 'LOG TO' parameter is selected as RS232 this parameter determines the output format of the data.

ASCII Text
Data is output as ASCII text.

Alternately a PC with a suitable communications package could capture the data for output to a disk-based data file.

> **NOTE**
>
> Data in this format may not be directly incorporated into a spreadsheet package.

ASCII Data
Data is output as ASCII data in a format which may be received by the GOYEN CAPTURE SOFTWARE for use with a suitable spreadsheet package.

ANALOGUE OUTPUT
The analogue output may be enabled or disabled during Semi-continuous monitoring.

4.3.5 The Log Record

The PGA3000 Data Logging option provides a means of storing data samples for recording or analysis. The display menu options allow the user to configure the data log to a convenient format (See Operating Procedure -Data Logging).

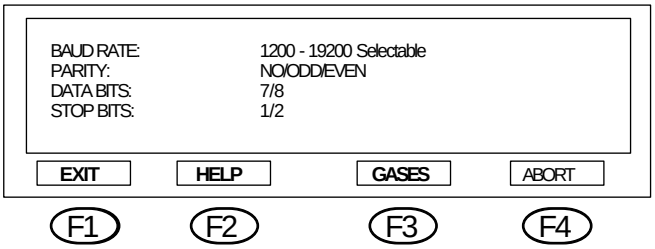
NOTE

In order to make full use of the data logging option it is necessary that the PGA3000 also has the serial port option fitted.

Each data log record contains the following data:

Fuel Type
Unit No.
Wet/dry Analysis
O_2 Normalisation ON/OFF
Date
Time
Ambient Probe Temperature
Probe Temperature
Up to 9 Gas Readings/Mass Flow Readings
NOx Concentration
CO_2 Concentration
Fuel Efficiency
Excess Air
Percent Water
O_2 Normalisation Factor

4.4 SERIAL PORT



NOTE

The Serial Port on the Series II must be set for:
9600 baud; no parity; eight bits; one stop bit

There are user selectable options also available. These are available for future system expansion only and should only be set as for the PGA3000 shown above.

NOTE

Failure to enter the values as above will render the serial port useless when running the Goyen Capture Program.

Baud Rate: 1200 - 19200
Parity: No/Odd/Even
Data Bits: 7/8
Stop Bits 1/2

4.4.1 RS232 Serial Output (Option)

Either a RS232 **or** RS422 channel may be fitted, but not both as they are terminated at the same plug point on the instrument and should have been selected to suit the customers requirements.
The serial output is user configured from the menu for baud rate, stop bits etc.

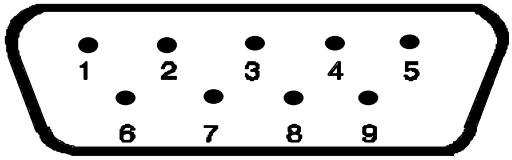
This port has 2 functions;

1. To use as an alternative to the instrument printer, by sending data to a Serial printer. For example an Epson printer (printer must have XON/XOFF protocol).

2. For communicating to a personal computer running the Goyen capture program or a suitable communications package in terminal mode.

SERIAL PORT CONNECTIONS.

9 Pin D type connector fitted to side panel of the instrument.



Front view of 9 pin D connector on side panel

RS232
Rx= pin 2
Tx= pin 3
Common = pin 5

RS485
A = pin7
B = pin8
Common = pin5

4.4.2 Goyen Capture Program (Option)

For incorporating logged data into a spreadsheet or database package, Goyen can supply their Capture Program on a 3.5" disk which will run under Microsoft Windows on a computer with EGA/VGA graphics capability.

The Capture Program interfaces with the Goyen PGA3000 via the instrument's serial port and the computer's COM1: or COM2: serial port. The Capture Program will work in either of two modes:

i) The Capture Program requests data packages from the Goyen PGA3000 and places them in a dBASE III type data file on disk. When all the logged data is received the program terminates.

ii) The Capture Program runs continuously until stopped via the computer keyboard. It receives data packages from a PGA3000 running in either auto data logging mode or Semi-continuous monitoring mode, and set for logging to the RS232 serial port. Data packages are written as an ASCII type file.

NOTE 1

The Capture Program is designed to work with Microsoft Excel, but should work with any spreadsheet package which can read in ASCII type text files.

NOTE 2

The Capture Program is only for use with PGA3000 instruments which are fitted with the Serial Port option and either the Data Logging option and/or the Semi-continuous Monitoring option.

Users purchasing the Goyen Capture Program will receive 3.5" floppy disc. Information on using the Capture Program is given in Section 11 of this manual.

4.4.3 Computer Serial Port

(When used with the Goyen Capture program).

The software automatically configures the serial port for 9600 baud, 8 data bits, one stop bit and no parity.

4.4.4 Goyen PGA3000 Serial Port

(When used with the Goyen Capture program).

The serial port on the Goyen PGA3000 instrument must be set for:
9600 baud, no parity, eight bits, one stop bit. (See Section 4.4)

For more information on the Goyen Capture Program refer to Section 11 of this manual.

4.4.5 RS232 Serial Output - Cable Connections

The following cable connections are used for connecting external hardware to the Goyen PGA3000 serial port when configured for RS232.

SERIAL PRINTER

To connect a serial printer to the RS232 serial port, the following connections are required:

9 Pin (Serial Port) (PGA3000)		**25 Pin (Serial Printer)** (Printer)
Pin 2	---------->	Pin 2
Pin 3	---------->	Pin 3
Pin 5	---------->	Pin 7

HOST COMPUTER

To communicate between the PGA3000 and a host computer for using the Capture program or other applications, the following connections are required:

Serial Port (PGA3000)	**9 Pin** (Computer)	or	**25 Pin** (Computer)
	Pins 1, 6 & 7 linked Pins 8 & 4 linked		Pins 8, 6 & 4 linked Pins 5 & 20 linked
Pin 5	----------> Pin 5		----------> Pin 7
Pin 2	----------> Pin 3		----------> Pin 2
Pin 3	----------> Pin 2		----------> Pin 3

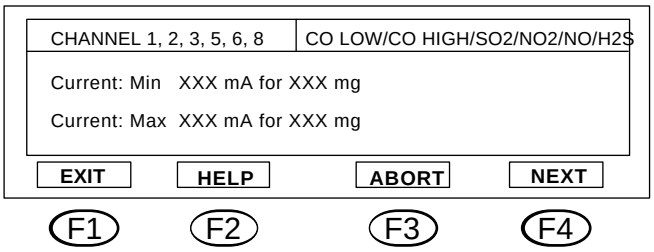
4.5 ANALOGUE OUTPUTS

There are 12 analogue outputs available. The channel numbers correspond to:

Channel No.	Designation
1	CO Low
2	CO High
3	SO_2
4	O_2
5	NO_2
6	NO
7	CxHx
8	H_2S
9	CO_2
10	*User Selectable
11	*User Selectable
12	*User Selectable

*User Selectable - Efficiency, Loss, Probe Temperature, Excess Air and NOx.

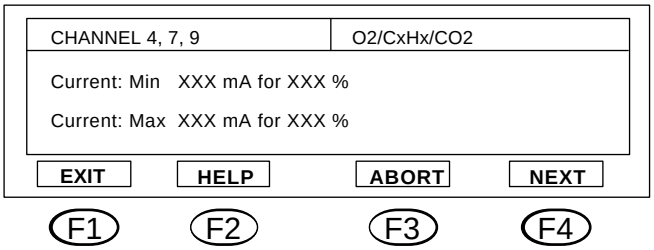
Output Channels for CO Low, CO High, SO_2, NO_2, NO, H_2S



Outputs are given in mA for a designated gas concentration. Concentration will be shown in selectable units mg, ppm, lb/mmBtu or ng/J.

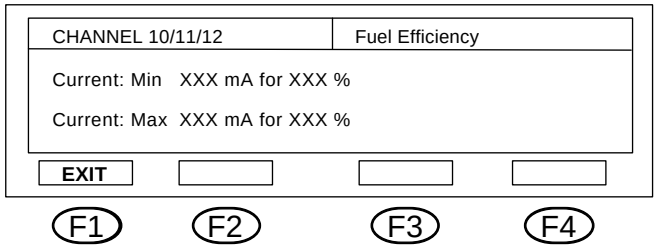
Output Channels for O_2, CxHx and CO_2

Outputs are given in mA for a designated % concentration.



User Configurable Output Channels (10 - 12)

Outputs are given in mA for a designated user selectable output.



User Selectable - Efficiency, Loss, Probe Temperature, Excess Air and NOx.

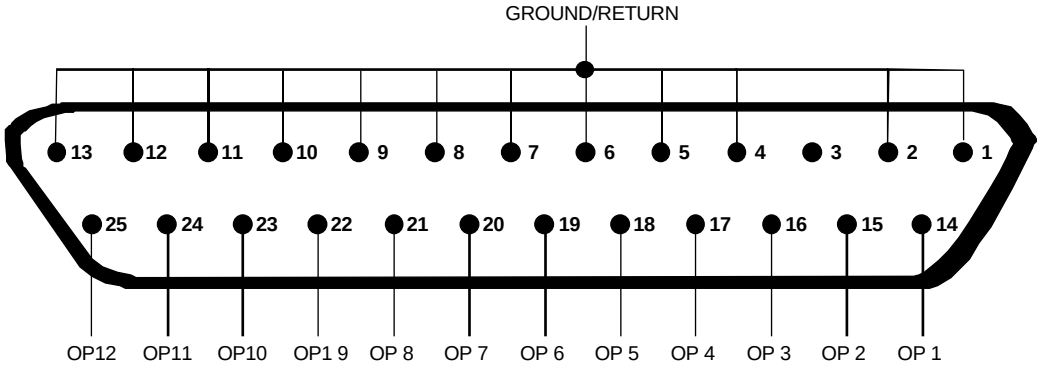
4.6 CURRENT LOOP ANALOGUE OUTPUT (Option)

Customer menu configurable, lower setting can be 0, 2 or 4 mA.
Upper setting can be 10 or 20 mA.

The output span ranges can also be pre-set from the menu.

12 channels are available, numbered 1 to 12. These are directly related to the sensor positions in the display order. Channel 10, 11 & 12 are user configurable channels, for monitoring fuel efficiency/loss/excess air/NOx or probe temperature.

Each individual channel can be pre-set for range and current parameters.



Front view of 25 pin D connector on front panel

Output

Output No.	Pin No.	Output Type
OP1	14	CO low
OP2	15	CO high
OP3	16	SO_2
OP4	17	O_2
OP5	18	NO_2
OP6	19	NO
OP7	20	HxCy
OP8	21	H_2S
OP9	22	CO_2
OP10	23	*
OP11	24	*
OP12	25	*

*Each selectable between:

Calculated Fuel Efficiency
Calculated Fuel Loss
Calculated Excess Air
Calculated Total NOx
Flue Temperature

Where a gas sensor option is not fitted, output will be zero.

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5.0 SAMPLING OPTIONS

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5.1 SEMI-CONTINUOUS MONITORING (Option)

Semi-continuous Monitoring is a means to cyclically sample and log gas concentrations over a period of time. This is achieved by alternate 'WAKE' and 'SLEEP' phases. During the 'SLEEP' phase the instrument is switched to air intake and the pump is off. During the 'WAKE' phase the instrument takes a specified number of gas samples at a specified interval and logs the data to non-volatile system memory, the local printer or the RS232 port.

NOTE

In order to make full use of the Semi-continuous monitoring option it is recommended that the PGA3000 is also fitted with a serial port and capture program, and/or Analog outputs.

5.1.1 The Semi-Continuous Monitoring Cycle

The Semi-continuous monitoring cycle is as follows:

1. The instrument is purged with air for 2 minutes in order to flush out the gas sensors. This helps the gas sensors to recover after sampling gas and prolongs sensor life.

2. The instrument switches off the pump and enters the SLEEP phase.

3. When the instrument clock determines that a wakeup is due, the system is switched to air and the pump is switched on. Zero offset readings are taken for all gas sensors. The next wakeup time is automatically calculated by adding the wakeup interval to the current clock time.

4. The system is switched to gas sampling. The system enters a 3 minute SETTLING phase allowing the gas sensors to respond.

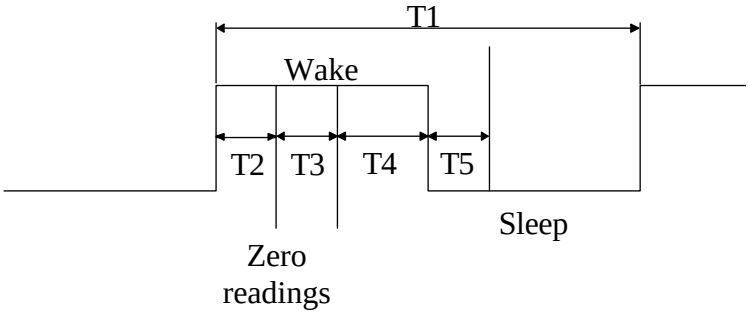
5. The first readings are logged.

6. The instrument samples gas for a period determined by:-

   No. of samples x sample interval

   Readings are logged at the sample interval.

7. The instrument returns to 1.



KEY
T1 - Wakeup interval
T2 - Zero Calibration (3 mins)
T3 - Settling Time (3 mins)
T4 - Sample period
T5 - Air purge (2 mins)

5.1.2 Setting Up the Semi-Continuous Monitoring

Semi-continuous Monitoring may be setup via the CONT. MONITORING->SETUP menu option. See Section 3.10.

Setup Parameters

Wakeup Interval

This is the length of time between each wakeup period.
10 - 180 mins.

No. of Samples

The number of samples to be taken during each wakeup phase.
1 - 100 samples.

Sample Interval

The time between samples. 2 - 15 minutes.

First Wakeup

The clock time for the first wakeup after Semi-continuous monitoring is enabled (instrument clock).

Log to

This parameter determines where the data records will be placed. Options are:-

1. **Memory**
   Up to 963 log records may be made to non-volatile system memory.

   NOTE

   When the log memory is full no subsequent logs are recorded.

2. **Printer**
   Each log is made as ASCII text to the local printer (if fitted).

   NOTE

   Due to speed limitations of the local printer output the PGA3000 does not allow a sample interval of less than 2 minutes when this option is selected.

3. **RS232**
   Each log record is made to the optional RS232 channel. The data is output in the format determined by the RS232 OUTPUT setup parameter.

5.1.3 RS232 Output

When the 'LOG TO' parameter is selected as RS232 this parameter determines the output format of the data.

ASCII Text
Data is output as ASCII text.

A serial printer with XON / XOFF protocol may be connected to the serial channel for a hard copy report of the samples. Alternately a PC with a suitable communications package could capture the data for output to a disk-based data file.

NOTE

Data in this format may not be directly incorporated into a spreadsheet package.

ASCII Data

Data is output as ASCII data in a format which may be received by the GOYEN CAPTURE SOFTWARE for use with a suitable spreadsheet package.

5.1.4 Analogue Output

The analogue output may be enabled or disabled during Semi-continuous monitoring.

5.1.5 Starting Semi-Continuous Monitoring

Semi-continuous monitoring is initiated by the CONT. MONITORING->ENABLE MONITORING menu option. The system will purge with air for 30 seconds and then enter the sleep phase. The display indicates that the system is running in Semi-continuous Monitoring Mode and shows the current status.

5.1.6 Aborting Semi-Continuous Monitoring

Semi-continuous monitoring may be aborted at any time - except when it is purging - by pressing the 'ABORT' function key.

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6.0 MAINTENANACE

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6.1 GENERAL

The instrument normally requires little maintenance, providing it is used as described in this operating manual.

Points to remember:

- Empty the water catchpot frequently.
- Avoid long sample periods of high gas concentrations. (Do not continuously monitor).
- Avoid air leaks, these will result in inaccurate readings.

6.1.1 Storage

If the instrument is unused for long periods, it is recommended that the power supply is connected periodically (every 4 weeks) to recharge the batteries. The sensor storage life may also be sustained by the automatic flushing of air through the sensors.

6.2 FILTER CLEANING AND REPLACEMENT

- The primary or **1st filter** on the tip of the probe may be unscrewed and carefully cleaned periodically with a wire brush.

- **Particulate or 2nd filter** located at one end of the instrument should be replaced when it has visible signs of contamination. Unclip the filter and unplug, when replacing check that the filter casing is not damaged and **no air leaks exist or errors in readings will occur.**

- **Chemical filter** will require changing when it has been subjected to 120,000 ppm x minutes of NOx & SO_2 concentration, as displayed on the SYSTEM menu.

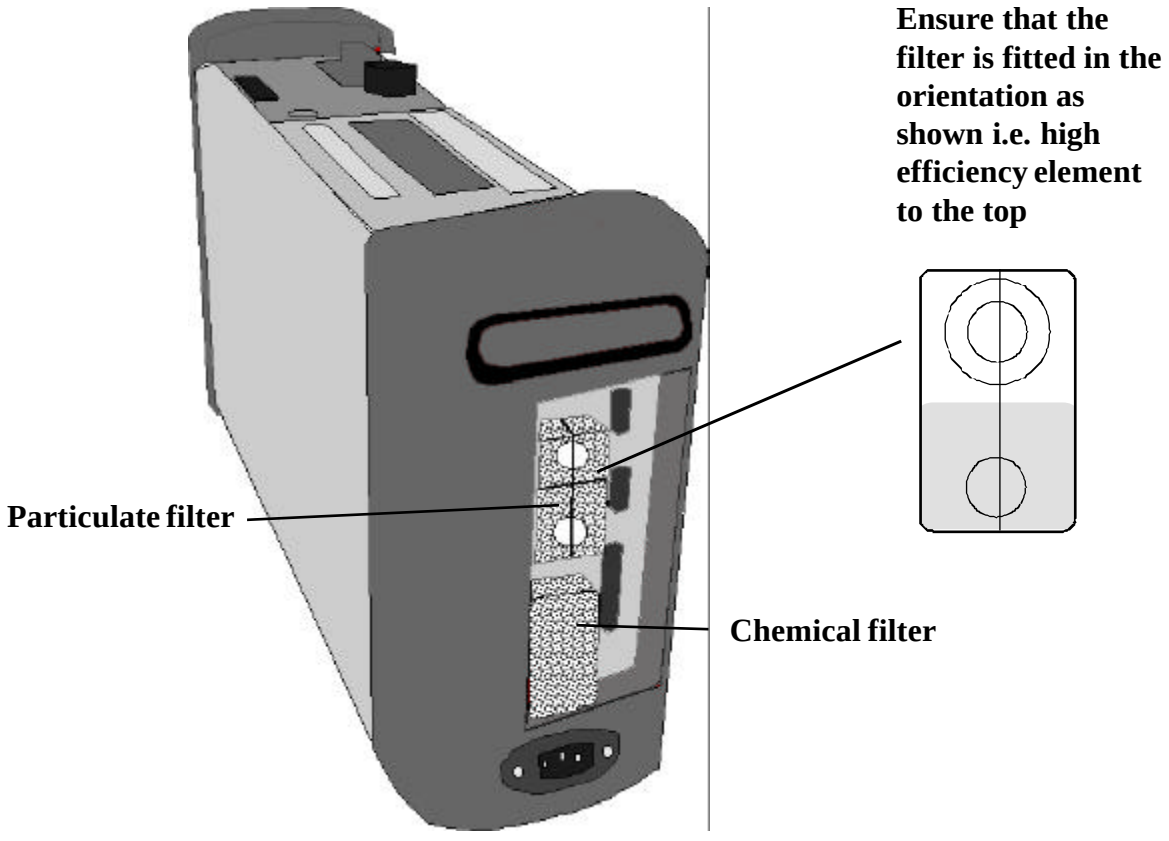
The colour cycle for the chemical is: purple - brown - white. Once the filter begins to show areas of white it requires replacement.

To replace the chemical filter:-

1. Unclip and remove old filter ; replace with new filter

NOTE: Ensure rubber protection caps are removed from filter ports prior to fitting. Do not remove in advance of fitting, as contamination may result.

2. Reset the filter count in the SETUP >SYSTEM menu to zero.



6.3 WATER CATCHPOT

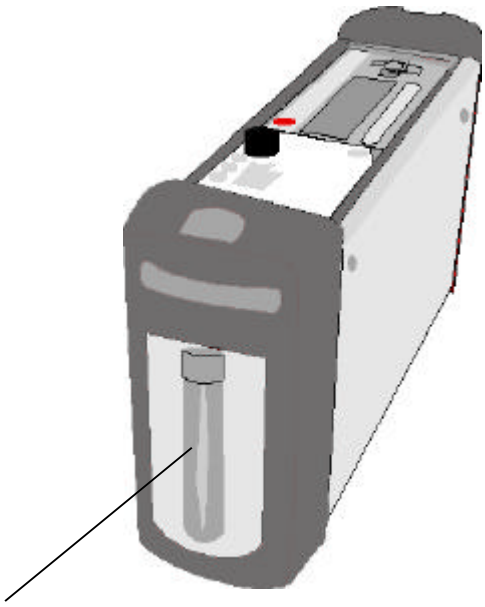
Points to remember:

- The water container should be removed after completion of operations and emptied
- Ensure when replacing that a **complete air seal is maintained**. Check the rubber gasket.

Check the water container is secure, air leaks will occur if loose, resulting in incorrect readings. To remove or empty the water container, pull the bottom of the container out from the securing clip, the unit is hinged and will swing out to about 45°. Unscrew the container and empty out any water.

NOTE

Do not force the hinge beyond 45°, otherwise damage to the hinge may occur. Do not over-tighten.



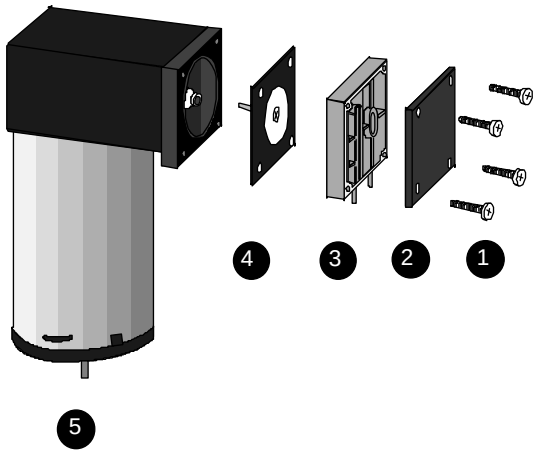
Water catchpot

6.4 PUMP SERVICING

Ensure the power supply is isolated before removing any panels to gain access to the instrument.
If the water catchpot does fill and enter into the pump, then it will be necessary to clean and dry the pump out. Care should be taken when dismantling the pump diaphragm not to damage the surfaces and replace them in the same order. (See illustration below).

To dismantle the pump:-

1. Remove the 4 screws securing the pump diaphragm assembly.
2. Carefully remove cover plate and pump inlet/outlet section .
3. Unscrew diaphragm screw, remove diaphragm, clean and dry.



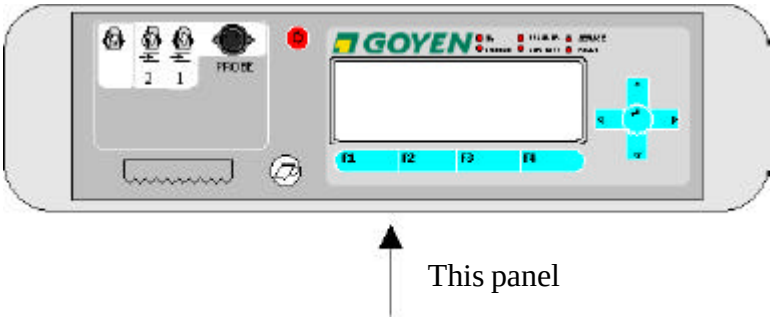
Key

1. 4 x securing screws
2. Cover plate
3. Inlet/outlet section
4. Diaphragm
5. Pump - main body

6.5 CHANGING THE PRINTER PAPER ROLL

The printer uses thermal paper rolls. Removal of the side panel of the printer (undo the 2 quick release screws) gives access to the paper roll and the paper feed mechanism.

The thermal paper roll has two different surfaces, one side is shiny and the other a dull matt finish. The shiny surface is the side that is printed on. The roll should be replaced so that the shiny side appears at the top when it leaves the printer exit slot.



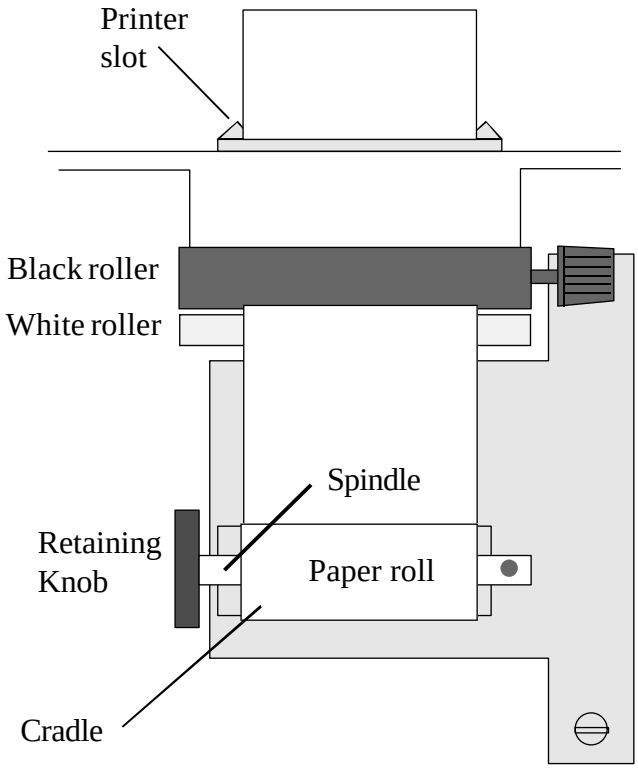
1. Remove instrument side panel.

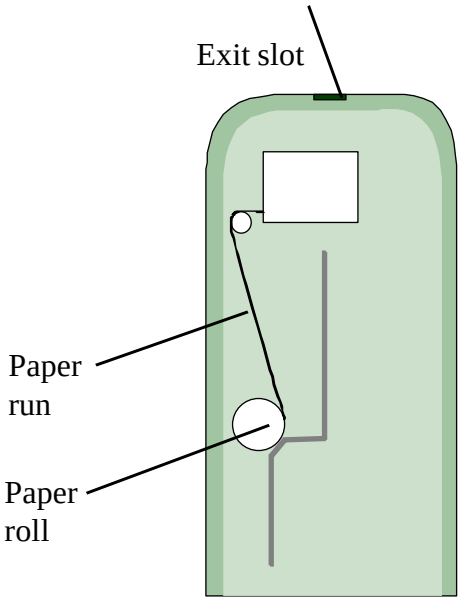
2. Remove the old printer roll from the support tube by unscrewing the Retaining Knob. Lift the spindle out of the support cradle, and slide old cartridge off.

3. Slide new paper roll cartridge onto spindle

4. Re-position the spindle in the cradle and re-attach retaining knob.

5. Prepare the leading edge by making a small fold or using a clean cut edge. DO NOT feed paper through the printer which has a jagged or torn leading edge - as it will cause paper misfeeds.





NOTE
The orientation of the printer paper is very important as only the gloss side accepts the printer ink.

6. Feed the folded edge between the white and black rollers.

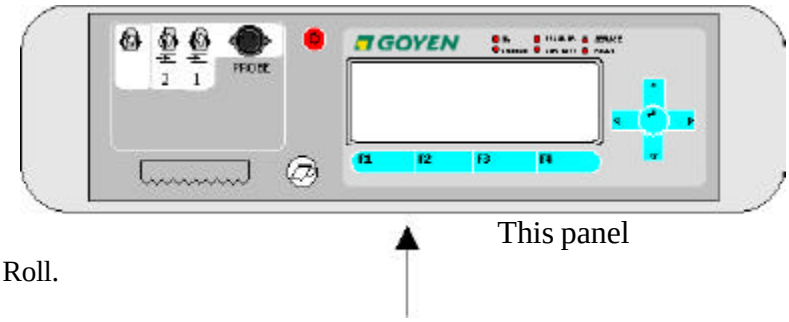
7. Press the printer button on the display panel until the paper appears at the exit slot on the display panel.

8. Replace the side panel and secure.

6.4.1 Clearing Paper Misfeeds

During normal operations the printer should scroll the paper through the outlet on the front panel. However, this mechanism may fail due to two reasons.

- The printer has run out of paper.
- The printer paper has misfed.



1. Remove instrument side panel.

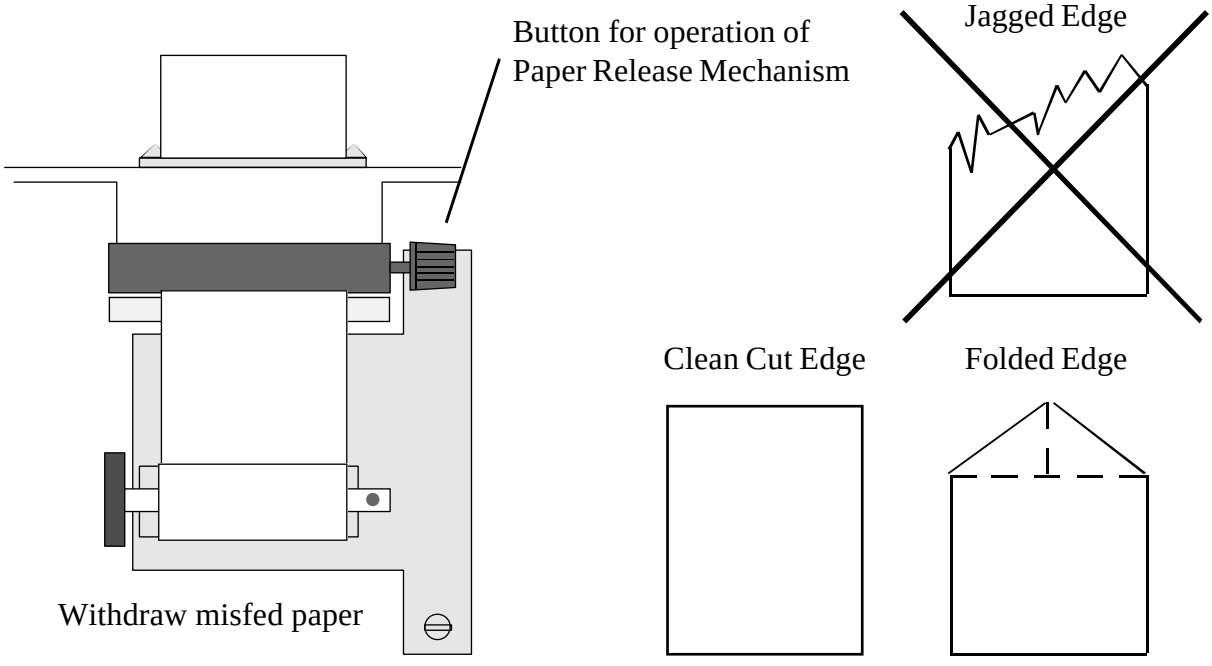
2. If the paper roll is empty, follow procedure in Section 6.4 - Changing a Printer Paper Roll.

3. If there is a clear misfeed complete the following steps.

4. Press the button on the paper release mechanism.

5. Withdraw all misfed paper. Release button.

6. Follow steps 5 onwards in previous section to re-feed paper roll.
Ensure a clean cut or folded edge is used when re-feeding the paper roll. (See below)



6.6 FUSE REPLACEMENT

Ensure the power supply is completely isolated before proceeding.

Fuses should always be replaced with the same type and rating.
Replacement of the fuse should only be carried out when the cause of failure has been rectified. Substitution of larger ratings or alternative forms of conductor may result in damage to the instrument.

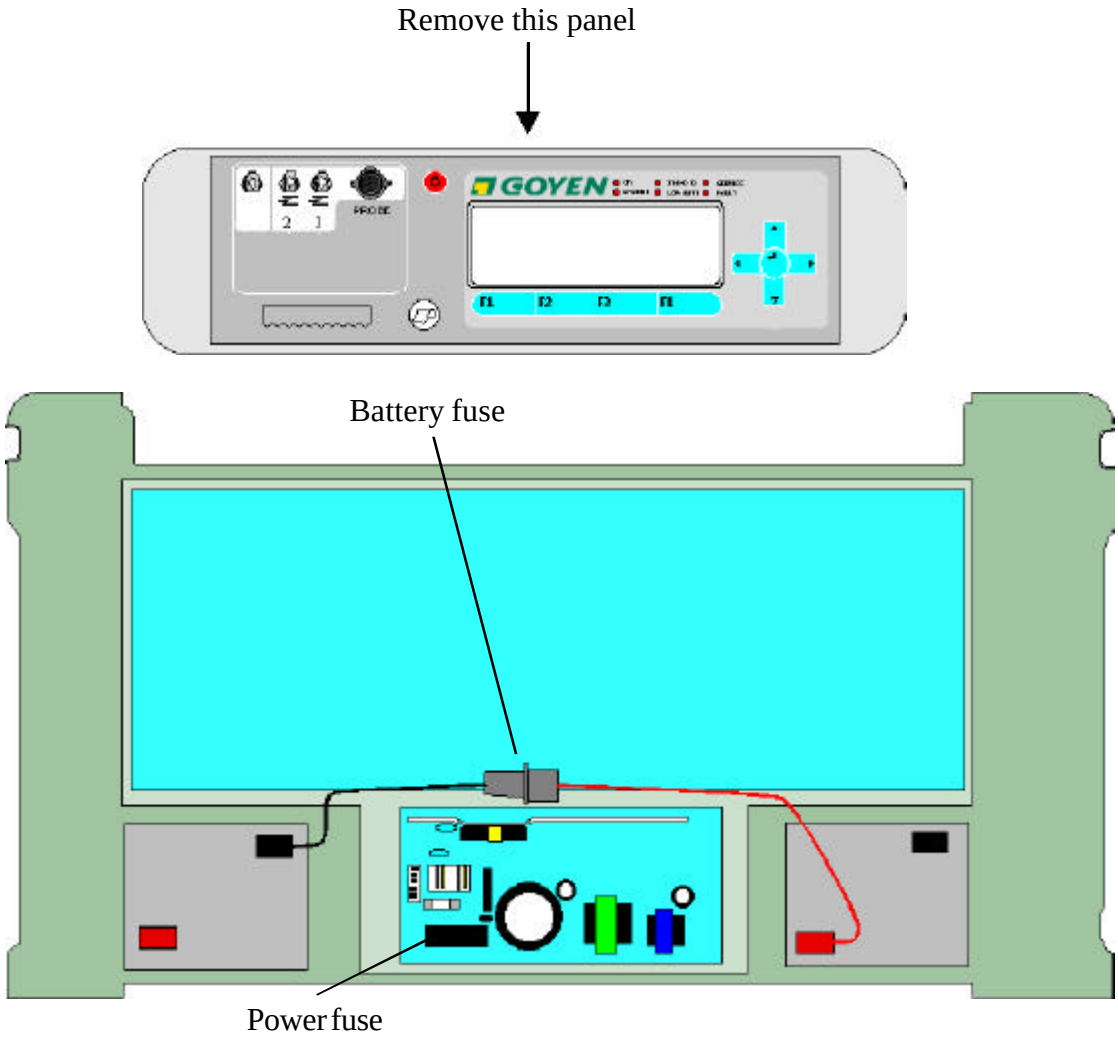
6.5.1 Battery Fuse

A 20mm 2A antisurge fuse protects the batteries. The fuseholder is located on the battery wiring harness.

6.5.2 Main Power Fuse

A 20mm 3A 230V slow blow, glass fuse soldered into the main power supply card. This fuse will only be damaged when a serious fault occurs. Failure should only be investigated by a service engineer.

Before attempting to change fuses the instrument must be disconnected from the mains power supply.



6.7 BATTERY CHARGING

The PGA3000 can operate for up to 8 hours continuously depending upon which facilities are being used. After this time period has elapsed the batteries have to be re-charged. This is undertaken by connecting the mains power supply cable to the side mounted socket (see description of instrument). The PGA3000 is fitted with an on-board battery charger. The unit will recharge the batteries overnight.

If the PGA3000 is not used for extended periods i.e. 1-2 months, it is advisable to re-charge the batteries at this interval or alternatively disconnect the terminal connectors to the battery.

6.6.1 Battery Replacement

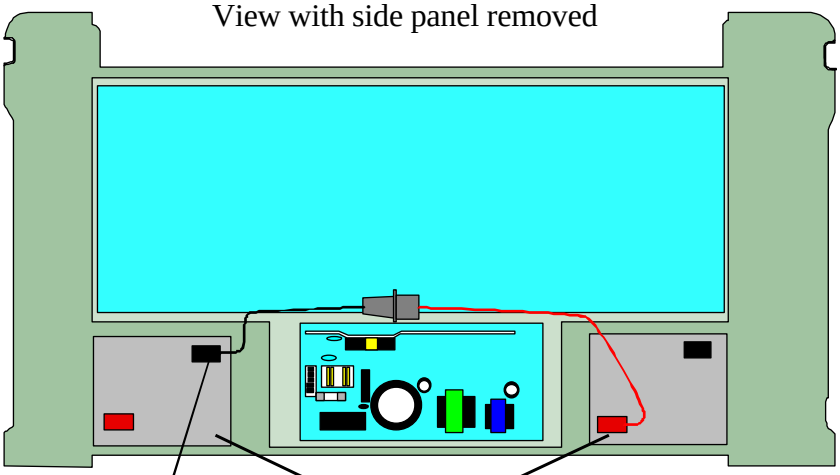
If the batteries need replacement, follow the procedure given below:

Ensure the power supply is completely isolated before proceeding.

Remove this panel

1. Remove side panel by release of retaining screws.
2. Disconnect the two spade terminal connectors per battery i.e. red and black per battery.
3. Remove the battery by pulling outwards.
4. Before fitting the new battery it is important to ensure that foam padding is attached to the sides of the battery. This should have been completed in the factory; if not attach new foam strips as per the battery that has been removed.
5. Push new battery into holder.
6. Re-attach spade terminal connectors.
7. Re-attach side panels.

View with side panel removed



Disconnect plug before replacing battery

Batteries

7.0 SYSTEM CALIBRATION AND SENSOR REPLACEMENT

WARNING

IF A MANUAL CALIBRATION IS PERFORMED WHEN NO CALIBRATION GAS OR THE WRONG CALIBRATION GAS IS PRESENT, THEN THE INSTRUMENT WILL PRODUCE INCORRECT GAS READINGS. THIS MAY ALSO CORRUPT THE ORIGINAL GAS SENSOR CONSTANTS IN MEMORY. REPEAT WITH CORRECT CAL PROCEDURE.

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7.1 PREPARATION FOR CALIBRATION

HAZARDOUS GASES

All recognised safety procedures should be used when operating with hazardous gases.
(See Gas 'Safety Data Sheets' attached to the end of this manual)

Goyen accepts no responsibility for damage to the instrument, or injury to the person while following procedures, nor will the company accept liability for failure to comply with safety precautions.

7.1.1 Calibration Gas Concentrations

It is important to use concentrations of certified calibration gas which represent between 70 and 100% of the working range of the instrument.

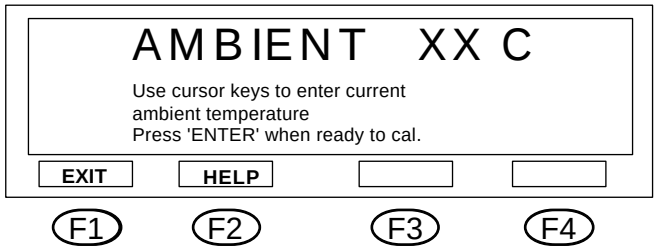
7.2 MANUAL CALIBRATION - AMBIENT TEMPERATURE

The PGA3000 contains an ambient temperature sensor to enable the probe temperature to be calibrated against the ambient air temperature. This should not normally need adjusting, as the instrument has been factory calibrated.

1. From the main menu, select 'Manual Cal'.

2. Select Temperature.

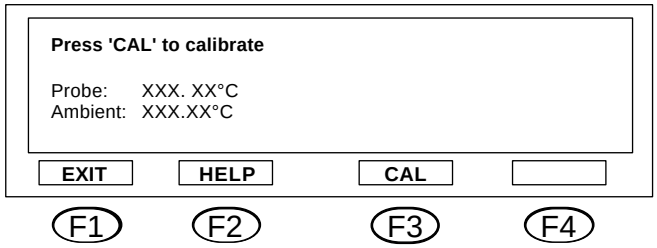
3. Enter the ambient air temperature using the cursor keys.



4. Both the probe and ambient air temperatures are displayed prior to calibration.

5. Press 'CAL' to calibrate.

6. Calibration is now complete.



Tg - Ta
A calculation of the temperature rise in the combustion process. The units i.e °C/°F can be changed in the Setup menu.

7.3 METHOD FOR ZERO CALIBRATION

The PGA3000 automatically performs a zero calibration each time it is switched on. A zero calibration may also be initiated by manually selecting the 'Recalibrate' option from the main menu. The ABORT function key allows early termination of the Zero calibration cycle. The completion or abortion of this cycle records the voltage outputs of the cells as exposed to fresh air. The fresh air inlet is independent of the probe, therefore calibration is not effected if the probe is exposed to other gases.

The cell zero values are displayed under the 'Diagnostics' menu.

NOTE

Cell zeros should be virtually 0.0V (offset should be less than 200mV) except:

the Oxygen sensor (span value) which should be around 1.8V
the HxCy sensor which should be around 1V
the CO_2 sensor which should be around 100mV

7.4 SUGGESTED METHOD FOR SPAN CALIBRATION

The individual gas sensors can be calibrated using the appropriate calibration gas preferably with a concentration value that corresponds to the ranged to be measured. For example, a span calibration of around 750ppm would be suitable for a gas cell with a range of 0-1000ppm. Customers may prefer to choose a calibration gas concentration that is nearer the normal measurement reading for the gas in question.

NOTE:

When calibrating the O_2 cell clean filtered air may be used as a span calibration gas.

It is necessary to have information on the individual calibration gases i.e. type and concentrations. This information has to be entered to perform an accurate calibration of the sensors. It is recommended that a zero calibration (Refer to Section 7.3) is performed immediately prior to performing a gas span calibration.

1. Follow all precautions for using hazardous gases. (See attached Gas 'Safety Data Sheets' at the end of this manual)

2. Assemble the following equipment: Certified Calibration Gas with Pressure regulator; Suitable gas pipe; 'T' junction connector; Bubbler or water-filled beaker or similar.

3. On the PGA3000 select 'Manual Cal'.

4. Connect the PGA3000 to the Calibration Gas and Bubbler as indicated in the diagram. Set bottle regulator to 10psi output pressure. With the PGA3000 drawing sample gas, adjust needle valve to get slight overflow of gas, as indicated by bubbles in the overflow pipe.

5. Enter the concentration of the calibration gas and press enter.

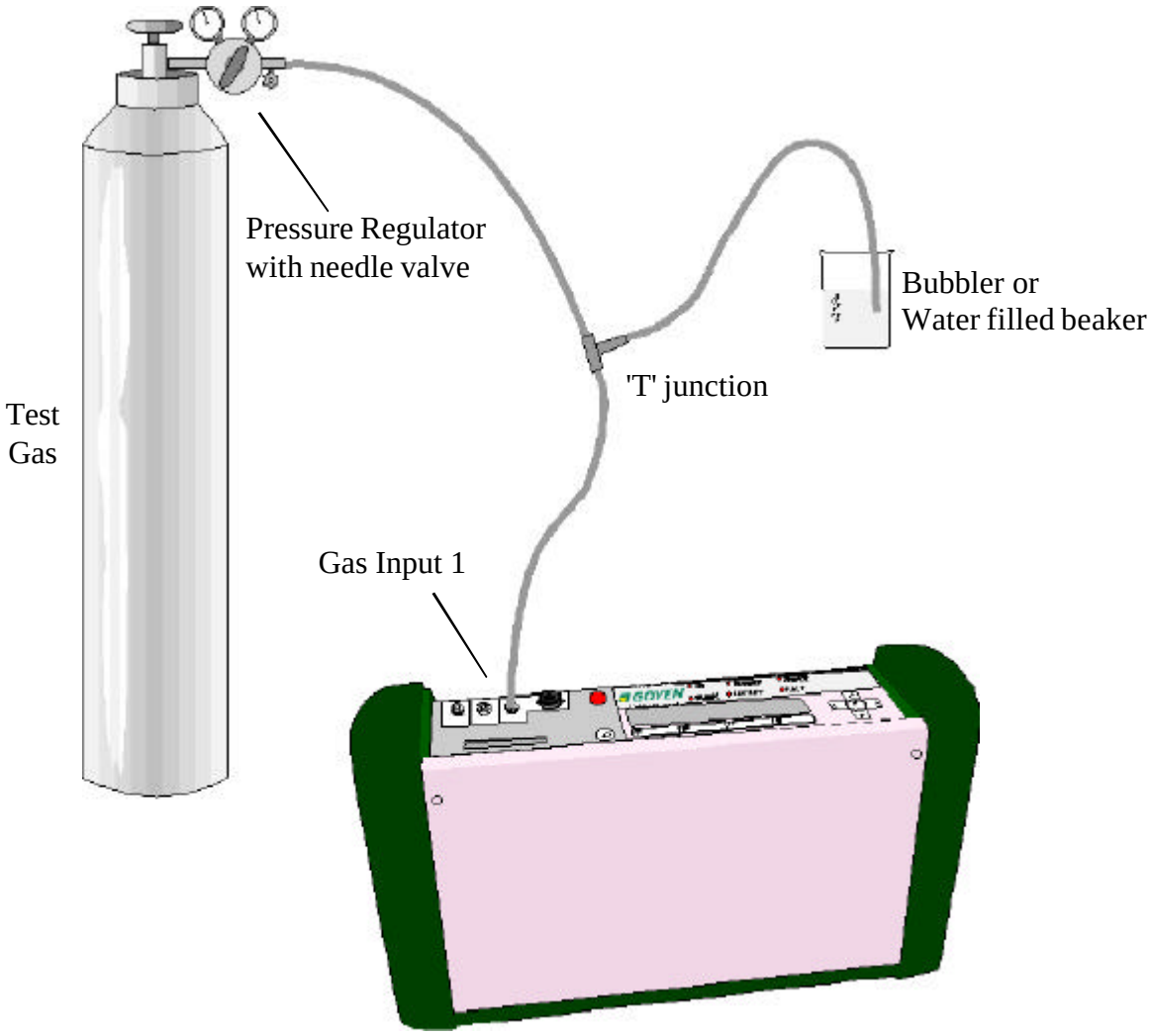
6. Wait for the gas reading to stabilise before pressing the 'CAL' key.

7. Press 'CAL' to begin calibration.

8. Use the 'EXIT' key to return to the gas selection display. Turn off calibration gas and remove connecting pipe.

NOTE

When calibrating the CO (H_2 compensated cell) both CO and H_2 gases are required.



NOTE

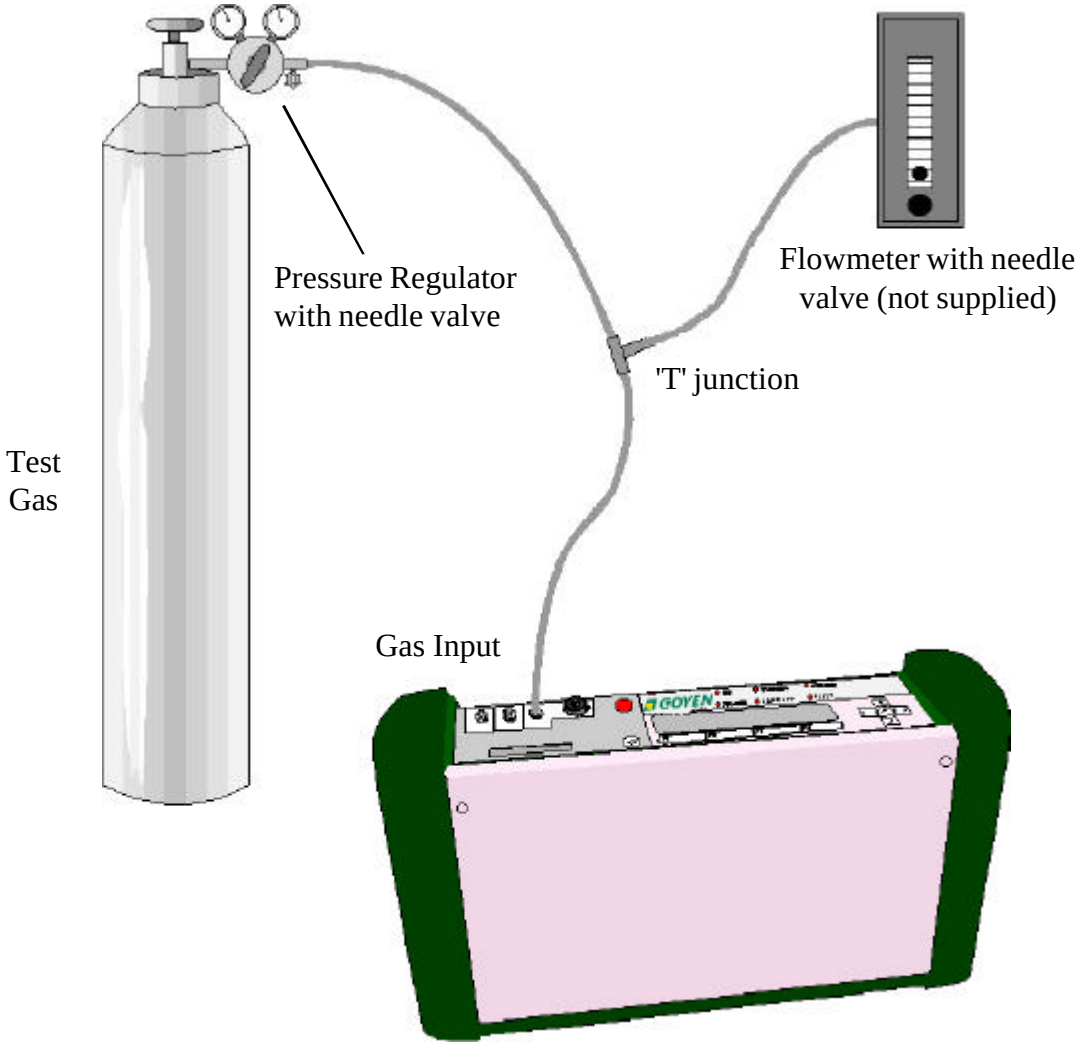
This arrangement enables the pressure at the gas inlet on the PGA3000 to be controlled.

7.5 CALIBRATION USING A FLOWMETER (not supplied)

As an alternative indication of gas overflow, the beaker in the Section 7.4 can be replaced with a flowmeter. Adjust the needle valve in the flowmeter to indicate a positive flow.

CAUTION

Calibration gas can be poisonous. Only use the unit in areas that have adequate ventilation. If you begin to feel dizzy or lightheaded, immediately turn off your calibration gas supply and seek out an area of fresh air.



NOTE

This arrangement enables the pressure at the gas inlet on the PGA3000 to be controlled.

Use a concentration of certified gas that is in the range required for your application. The gas ordered should be a mixture of the gas desired with a balance of nitrogen (N_2), ie 100 ppm NO bal N_2 or 400 ppm SO_2 bal N_2. Your Gas bottle should have a pressure regulator that can be adjusted to the 30psi range.

7.6 CALIBRATING THE DRAFT SENSOR

The Draft Reading indicates the internal stack pressure in water gauge column inches or hPa. The figure represents a differential pressure between the stack pressure and the ambient pressure. It enables the flow rate of the chimney/ stack to be determined.

The Draft sensor is pre-calibrated at the factory. If however the sensor requires re-calibration the following procedure must be adhered to.

1. Connect the probe

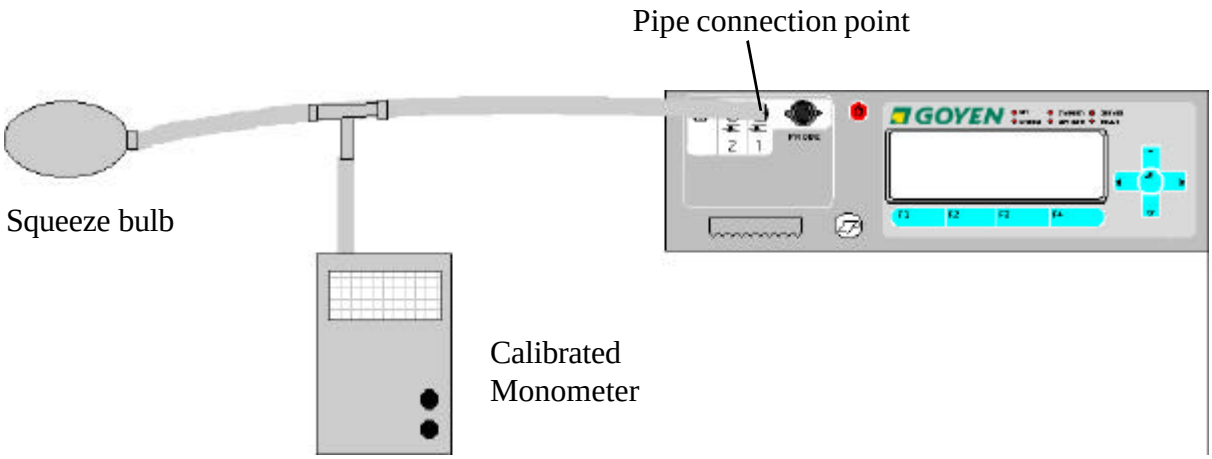
2. Go to 'Manual Cal' in the main menu.

3. Select 'Draft zero'. Since the probe is of ambient pressure, press 'Cal' then 'Exit'.

4. Select 'Draft span'.

5. Arrange for a calibration pressure to be applied to the probe inlet. This is done in the factory as illustrated below.

6. Dial in the calibration pressure. Press 'Enter'. Press 'Cal' when ready.



7.7 REPLACING GAS SENSORS

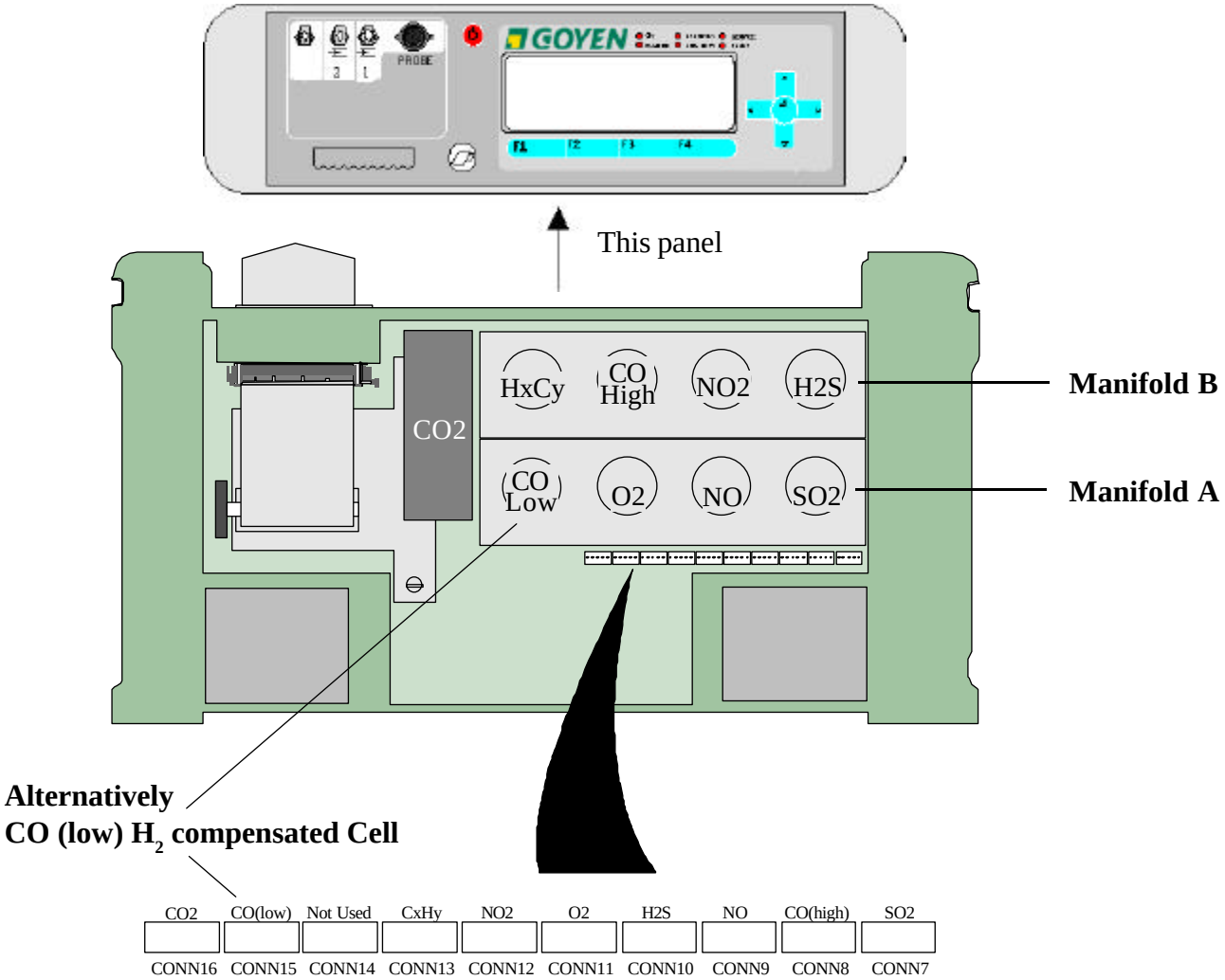
Unplug the unit from the power supply

Replacement of gas sensors is extremely simple. Undo the 2 back panel retaining screws and remove the panel.

The oxygen sensor is a bayonet fitting. Replacement is made by simply unplugging the old sensor and replacing with a new one. The replacement Oxygen sensor does not require calibration.

All other gas sensors are replaced by removing the 3 retaining screws, removing the old sensor and replacing with a new one - securing with the same 3 screws and replacing the back panel. The connectors from the sensors must be attached to the relevant 'CONN' position. See diagram below for 'CONN' positions for each sensor.

IMPORTANT
All replacement sensors (excluding Oxygen) must be manually calibrated prior to use.



Gas Modules are positioned as indicated in the diagram above.

8.0 SYSTEM DIAGNOSTICS

NOTE

FURTHER DETAIL OR INTERPRETATION OF DIAGNOSTIC PARAMETERS MAY BE OBTAINED FROM GOYEN TECHNICAL SERVICES.

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8.1 STATUS LEDS

Situated on the keyboard display panel are 6 LED status indicators:-

ON
This is illuminated when the instrument is switched on.

LOW BATT
This is illuminated when the main battery requires re-charging.

SERVICE
This is illuminated when the chemical filter requires replacing.

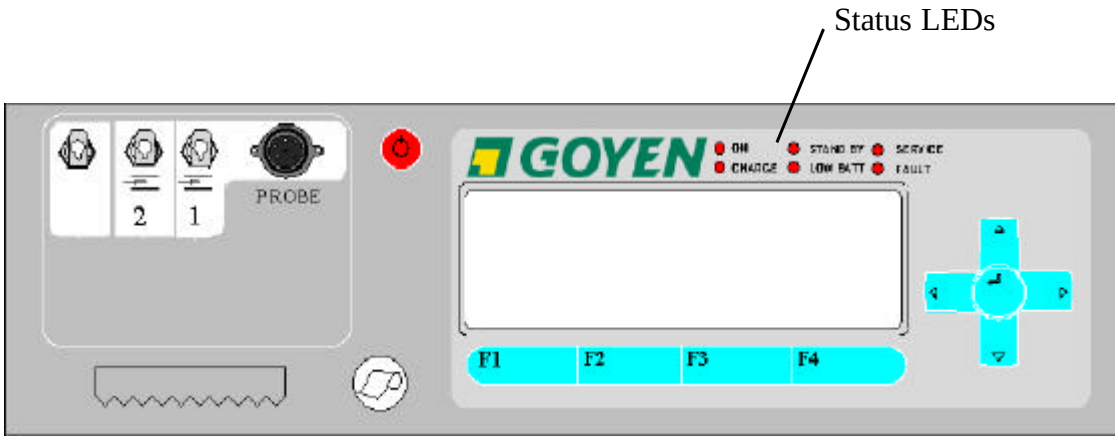
FAULT
This is illuminated when a fault or warning situation arises, for further detail see the DIAGNOSTICS -> SYSTEM menu option.

IMPORTANT

Certain faults remain indicated even after the condition has been cleared. These may be manually cleared through the SETUP->SYSTEM->CLEAR FAULTS menu option.

STAND BY
This LED indicates sleep and wake facility is active.

CHARGE
This LED indicates instrument battery is being charged.



8.2 SYSTEM DIAGNOSTICS

The Diagnostics menu provides analysis of system performance with reference to individual cells, filters etc.

8.2.1 Cell EMFs

This is maintenance information which indicates the true state of the cells and electronic system. This is specifically of use when the product is being serviced.

8.2.2 Cell Zeros

Indicates the zero calibration voltage of the cells after the last calibration was completed. The value for O_2 represents the span voltage (V).

8.2.3 Cell Life

Indicates the cell life in ppm days. Indicates the history of usage of the cell. This information is useful when a product is being serviced.

8.2.4 Filter Life

This is essential maintenance information, that indicates chemical filter life in ppm x mins. Recommends a chemical filter change to customer.

8.2.5 System

This provides a 'system overview' of the PGA3000.

Version No.
Indicates the version of software installed in the instrument.

Main Battery
Indicates battery output voltage. When the battery is fully charged it should indicate approximately 14.8V. When running directly off the mains adaptor the voltage will be between 12.5 and 12.9V. When the battery voltage falls below an acceptable level (11.5V) to maintain optimum performance the 'LOW BATT' indicator light will show.

Options
This indicates the options fitted to the instrument.

Ranges
This indicates the measurement range capability of the individual cells. i.e CO Low 0 - 2000ppm.

Gains
This indicates the gain settings available for the individual cells.

System Faults
This indicates the gain settings available for the individual cells.

8.2.6 Report

A diagnostic report can be output to either the serial port or to the printer which summarises the information contained within the Diagnostics menu. See below for an example report.

Version No. : V2.04

Options:
- PRINTER
- SERIAL PORT
- ANALOGUE O/P
- DATA LOG
- PRESSURE TRANSDUCER
- CONT. MONITORING
- SMOKE
- FLOW

Ranges:

CO LOW	2000
CO HIGH	40000
SO_2	2000
O_2	25
NO_2	100
NO	4000
CxHx	50000
H_2S	1000
CO_2	25

Gains:

CO LOW	-2500
CO HIGH	24250
SO_2	1700
NO_2	-600
NO	-3750
CxHx	16000
H_2S	900
CO_2	1001
Draft	4.5

Zeros:

CO LOW	-0.010V
CO HIGH	-0.491V
SO_2	-0.116V
O_2	-0.004V
NO_2	-0.572V
NO	0.000V
CxHx	-0.355V
H_2S	-0.522V
CO_2	-0.236V

ppm.days:

CO LOW	0
CO HIGH	0
SO_2	0
NO_2	0
NO	0
CxHx	0
H_2S	0
CO_2	0

NO2xSO2:	0
SO2xNO2:	0
SO2xH2S:	0
NO2xH2S:	0
H2SxNO2:	0

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9.0 MODEM SUPPORT

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9.1 MODEM COMMUNICATIONS FOR REMOTE CONFIGURATION

The remote configuration system for the PGA3000 enables Goyen personnel to interrogate the instrument, without having to return the instrument to the factory. In this way configuration changes and elementary diagnostics which would normally be performed on the test bench can be performed at a remote site.

NOTE

This activity should only be performed by Goyen personnel. The information detailed here enables the user to make preparations for remote configuration of their instrument by use of a PC, modem and telephone connection.

9.1.1 System Requirements

The P.C. must be equipped with a Hayes compatible modem connected to its COM1: serial port (see next page for connection details). It must be running the latest version of the PGA3000 monitor software.

The PGA3000 must be equipped with a serial port, connected to a Hayes compatible modem. (See next page for connection details).

This allows PGA3000 configuration and elementary diagnostics (as currently performed on the test bench) to be performed over the phone line, from the office to a PGA3000 on site anywhere in the world.

9.1.2 Operation

PGA3000
To operate correctly, the modem must be correctly connected to the telephone line and the PGA3000, and both must be switched on.

The modem must be configured to 'auto-answer' i.e. to automatically pick up the line when it rings. This configuration can be done automatically with the PGA3000 software, simply by switching on the modem before the instrument: version x.xx software sends out a Hayes compatible 'auto-answer' command when it is powered up.

PC/monitor
Call up the monitor software by typing 'monitor' in the usual way. Ensure that the modem is connected to the COM1 serial port, the telephone line, and is powered up. Select function F2 'Control modem'. If all is well, it will respond by requesting the number to dial. Enter this number, including any local exchange access numbers. The modem will then dial out, and await connection with the remote modem. When connection is established, the program will report this, and return to the main menu. At this point the operator can select function F1 'Set Monitor' and proceed just as if the PGA3000 were connected directly to the P.C.

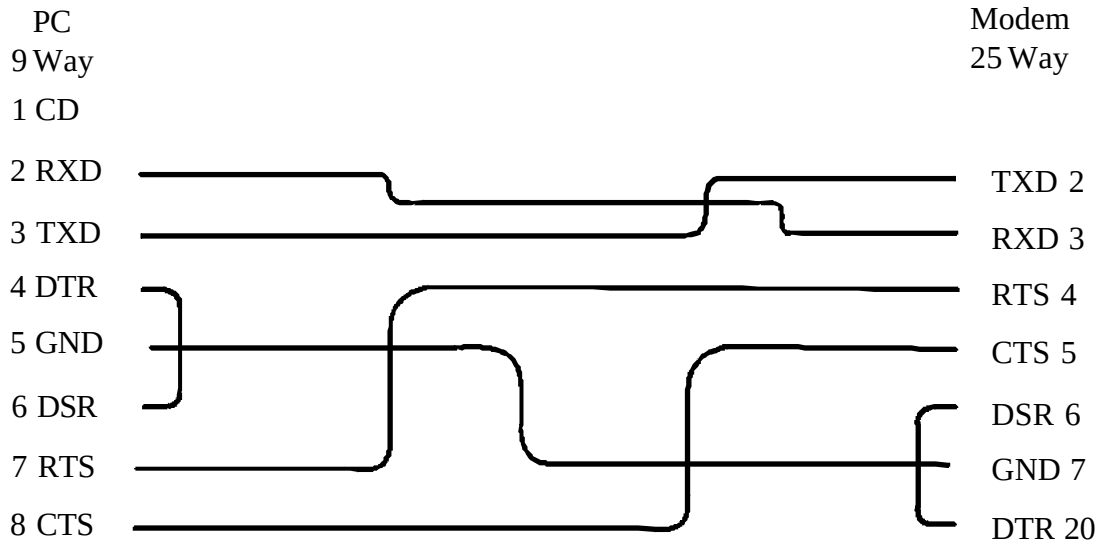
When the configuration session is finished, return to the main menu and select function F2 'Control modem' again. The program will prompt 'Disconnect line', and will do so if this is confirmed.

9.2 FUNCTIONS AVAILABLE

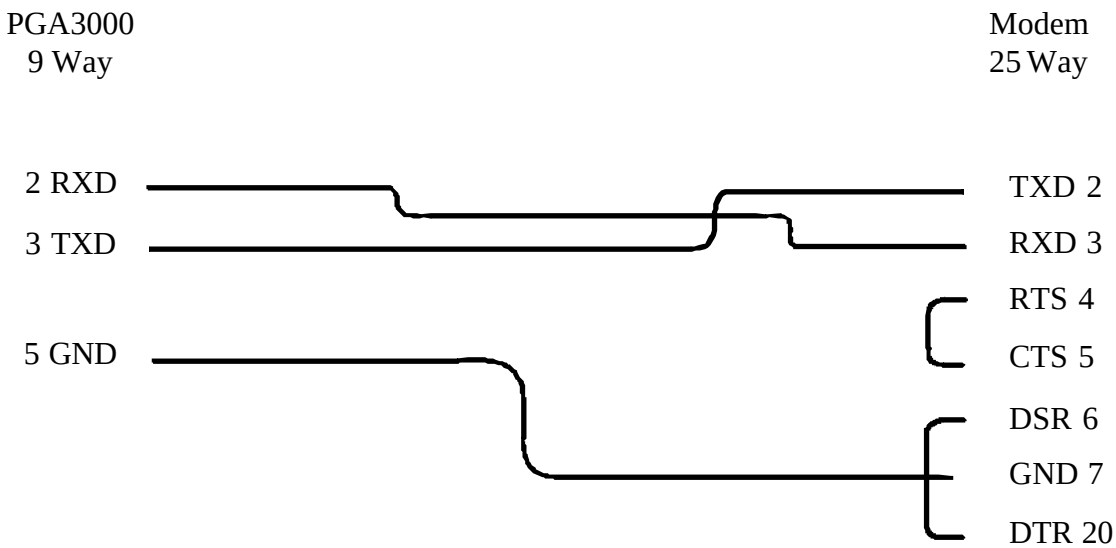
The functions available over the modem link are all of those currently available in the PGA3000 monitor software: Adjustment of sensor calibration parameters, changes to text headers, installation of printer and sensors, and recalculation of EEPROM checksum. In addition, the instrument settings and parameters can be downloaded and saved to disk.

There is currently no facility for uploading instrument readings, or for directly controlling the instrument. However, modem control will be added to the existing data capture program in the near future.

PC to Modem Connections



PGA3000 to Modem Connections



10.0 SPARE PARTS

WHEN REQUESTING SERVICE OR SPARE PARTS
FROM GOYEN, PLEASE QUOTE THE
INSTRUMENT SERIAL NUMBER

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10.1 SPARES KIT

Description	Part No
Spares Kit includes: Gas Pre-Filter, CO Compensation Filter Sinter Filter for Probe, Nylon Hose Connector	703.314

10.2 RECOMMENDED SPARE PARTS

Description	Part No
Primary Probe Filter (1st filter - Sinter filter)	702.182
Gas Pre-Filter (Particulate)	703.144
CO Compensated Filter	703.145
Printer Paper Roll	405.109
Nylon Hose Connector	317.109
O-Ring for Pistol Grip	319.211

10.3 REPLACEMENT SENSORS

Description	Part No
O_2 Cell	703.083
CO (low) Cell	703.236
CO (low) H_2 compensated	703.915
CO (high) Cell	703.248
NO Cell	703.239
NO_2 Cell	703.246
SO_2 Cell	703.241
CxHx Cell	703.249
CO_2 Cell	703.326
H_2S Cell	703.373
Draft Sensor ±20" Water gauge	405.405
*Draft Sensor ±10" Water gauge (Flow Adaptor Sensor PCB)	703.862

**Must be specified for use a with Flow Probe*

NOTE

See Section 3.4.5 Replacing a Gas Sensor

10.4 OTHER SPARES

Description	Part No
300mm Probe Pipe	702.141
1.0M Probe Pipe	702.205
1.5M Probe Pipe	702.206
2.0M Probe Pipe	703.440
3.0M Probe Pipe	702.207
Pistol Grip/Hose Assembly - 3M	703.128
Pistol Grip/Hose Assembly - 10M	703.163
Water Catch-Pot Assembly	701.828
Sampling Pump	703.164
Rechargeable Battery	403.415
Compensation Cable	403.836 per mtr
Mains Lead & Plug	406.460
3.0M Silicon Rubber Hose	702.097
Pipe Coupling with Metal Clip (Probe connection)	317.115
Pipe Coupling with Metal Clip (Exhaust and Flow)	703.149
2A antisurge fuse	404.536
Heated Smoke Probe Accessories	
Pack of Smoke Filter papers (10)	701.616
Bacharach Greyscale Charts	702.035
0.3M Probe Pipe	323.089
0.75M Probe Pipe	323.090
1.0M Probe Pipe	323.100

11.0 LAND CAPTURE SOFTWARE PROGRAM

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11.1 INTRODUCTION

The Goyen Capture Program is a PGA3000 option. It is provided by Goyen as software program which runs under Microsoft Windows™ on a computer with EGA or VGA graphics. The software program is used in conjunction with the Data Log or Semi-Continuous Monitoring option of the PGA3000. The software is designed to allow data logged during operation to be downloaded into a spreadsheet for analysis.

11.2 THE CAPTURE PROGRAM

The Goyen software may be provided on a 3.5" floppy disk for use with PC compatible computers with EGA or VGA. The capture software uses the computer's serial port (COM1 or COM2) and the PGA3000 serial port which has to be set as follows:

9600 Baud
8 data bits
One stop bit
No parity

The software automatically configures the computer's serial port for the correct transmission settings.

11.2.1 Capturing Data from the PGA3000 Data Log memory

Data which is logged into the PGA3000's data log memory may be captured and placed in a ASCII type record file.

> **NOTE**
> The PGA3000 data log memory is NOT erased once the data is captured. This must be done from the instrument itself.

11.2.2 dBASE III Table

The following table shows the field names within type dBASE III database table generated by the capture program along with the field types and field widths.

Field name	Data Type	Field Width
Date	Date	8
Hours	Numeric	2,0
Minutes	Numeric	2,0
Seconds	Numeric	2,0
T_AMB	Numeric	6,0
T_GAS	Numeric	6,0
CO	Numeric	6,0
O_2	Numeric	6,2
NO	Numeric	6,0
NOx	Numeric	6,0
EFF	Numeric	6,1
XS_AIR	Numeric	6,1
WATER	Numeric	6,1
NORM_VAL	Numeric	6,1
ANALYSIS	Character	3
O_2_NORM	Character	3
UNIT NO.	Numeric	2,0
FUEL	Numeric	1,0

11.3 SPREADSHEET

The Goyen Capture Program was developed for use with Microsoft™ Excel™ and is not guaranteed to work with all existing spreadsheet packages. However, if your spreadsheet program will enable the import of ASCII type text files then you may access the data captured by Goyen's capture program.

11.4 SERIAL PORTS

11.4.1 The Computer

The capture program assumes the first serial port (COM1 or COM2). It automatically configures this port for 9600 baud, 8 data bits, one stop bit and no parity.

11.4.2 The PGA3000

The serial port on the PGA3000 must be set for:
9600 baud, no parity, eight bits, one stop bit

11.4.3 Cables

For cabling information refer to Section 11.9.

11.5 THE LOG RECORDS

11.5.1 Data as sent from the PGA3000

The Wet/Dry and Oxygen normalisation flags, the unit number and fuel type which are each one byte long. Values are sent right-justified within the fields and are padded with spaces. Data is sent as ASCII. The capture program converts the wet/dry analysis flag to the text 'WET' or 'DRY' and the Oxygen normalisation flag to 'ON' or 'OFF' for the dBASE III type output file.

The data which is sent from the PGA3000 only carries information which corresponds to the gases and options fitted to the instrument.

NOTE

The gas readings are NOT adjusted for wet/dry analysis or O_2 normalisation. The state of these options at the time that each log record is captured is included in the database. This allows for these calculations to be made by the spreadsheet.

11.6 FAULT DIAGNOSIS

If the capture software generates a fault message then 'Exit' out of the program and start again. A list of the possible causes of failure and the recommended action to be taken are detailed below.

Failure to open the designated serial port

Check that the chosen port actually exists on the computer. (Under Windows™ 95 the port configuration for the PC may be found in the Control Panel within My Computer. It is located under System->Device Manager->Ports.)

Problems creating or writing to the output file

Make sure there is adequate space on the chosen destination drive.

I/O timed out

(This indicates a failure to communicate with the PGA3000 instrument)

Check that the serial port of the PGA3000 is set for 9600 baud, 8 bits, 1 stop bit and no parity. This is located under Setup->Serial Port.

Check under the Data Log display that there is data in the log memory.

Check that you specified the computer serial port.

Check the Cabling (see Section 11.9)

11.7 HOW TO INSTALL AND RUN THE SERIES II CAPTURE PROGRAM

The host computer must have a floppy disk drive fitted, adequate space on the hard disk drive and have Microsoft Windows™ 95 installed.

These instructions assume some familiarity with computers, disk drives and Microsoft Windows™ 95 operating system.

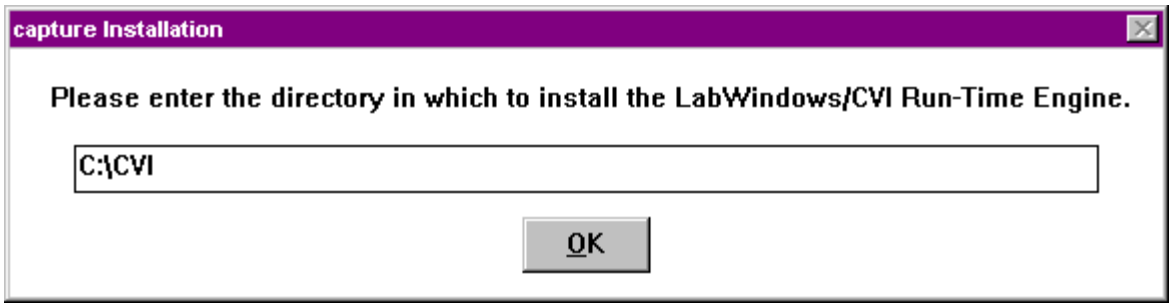
Microsoft Windows™ 95

1. Insert the Goyen Capture Software installation disk into the floppy disk drive (normally designated a:\).

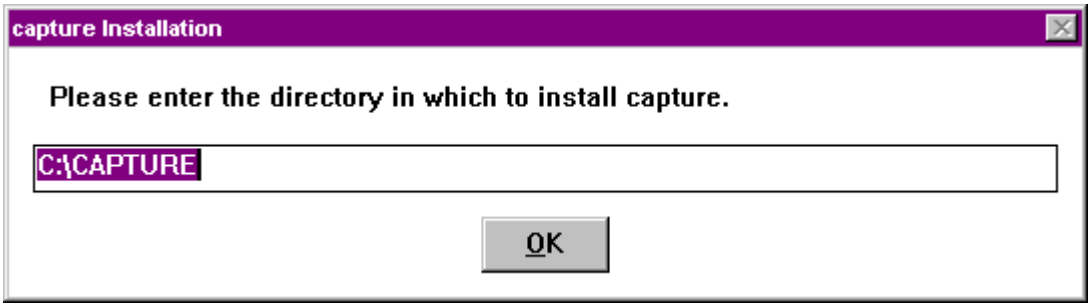
2. Using the 'Run' command from the menu and select a:\.

3. Using the 'Browse' command (where necessary) select 'setup.exe' and press 'OK'.

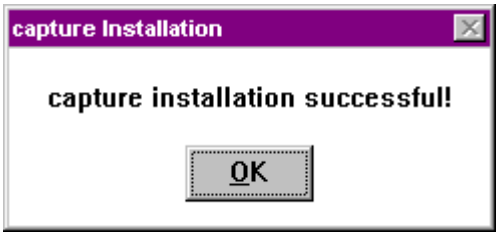
4. Select a directory in which to install the run-time engines.



5. Select a directory in which to install the capture software.



6. Click on the 'OK' button to complete the installation.



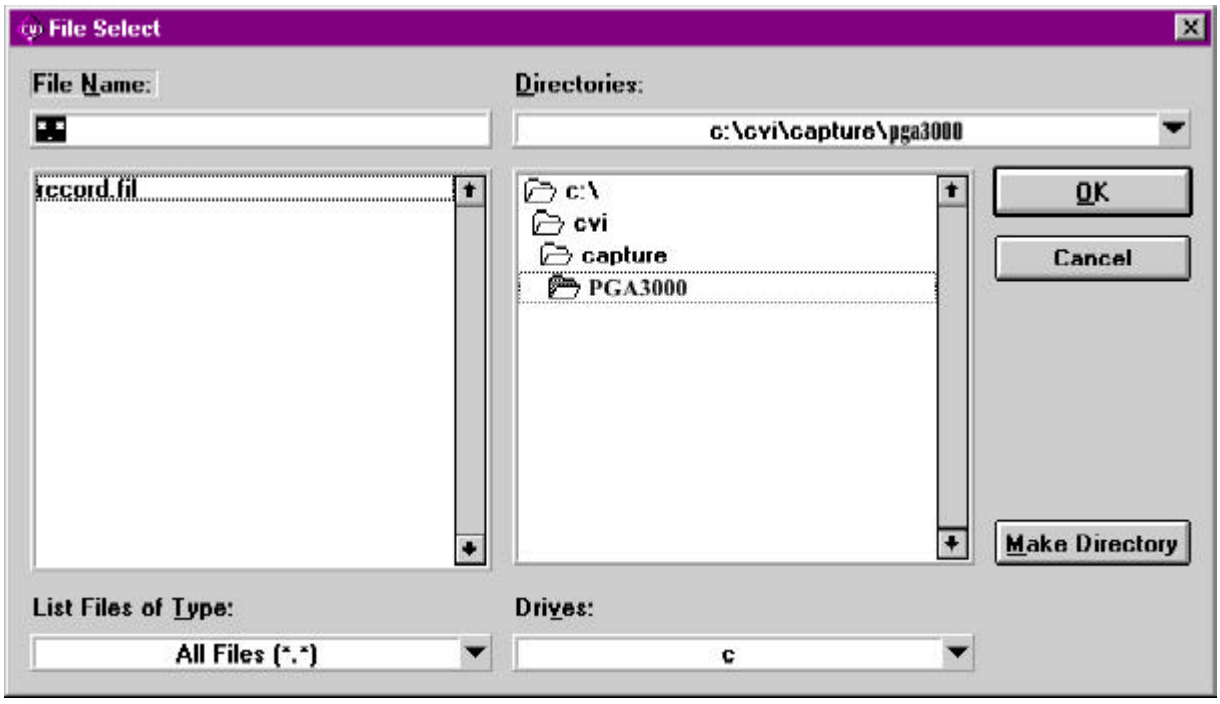
11.8 USING THE CAPTURE PROGRAM

The Goyen PGA3000 instrument should be connected via its serial port to a spare serial port on the host PC (See Section 11.9 for connection details).

The Serial Port control on the Capture Software display panel should be set to reflect the chosen port. i.e. COM1 or COM2.

The 'Output File' control is initially dimmed. When you click on the 'Capture Logged Data' button:

A File Selection dialog box appears:



This allows the selection of the device, path and filename to be determined for the captured data.

Once the selections have been completed, press 'OK' to continue.

The path and filename will appear on the 'Output File' control and the 'Status' line should indicate: 'Downloading..'

The 'No. of Records:' counter will increment as each log record is captured from the PGA3000 instrument:

The 'Cancel' button will now be active, and may be used to stop the data transfer.

NOTE

The Output file will contain all log records up to the point of cancellation.

The 'Status' line will indicate 'Download cancelled':

Otherwise, when all the logged data has been captured the 'Status' line indicates 'Download complete':

The logged data may be recaptured into another file if required by repeating the above procedure, or use the 'Quit' button to exit the Capture Program.

Importing the Logged Data into a Spreadsheet

The logged data in the output file is in ASCII format with tab delimited data fields. It should import directly into most spreadsheets, e.g. Microsoft Excel™ uses a text import wizard to load the file.

Consult your spreadsheet manual regarding how to save the imported data as a worksheet using the 'Save As' file option.

11.9 SERIAL PORT COMMUNICATIONS CABLES

The following cable connections have been shown to work for connecting external hardware to the PGA3000 serial port when configured for RS232.

11.9.1 Host Computer - PGA3000

To communicate with a host computer for the Goyen Capture program or other applications, the following connections are required:

PGA3000 Serial port	Computer 9 pin	Computer 25 Pin
	Pin 1, 6 & 7 tied back	Pin 8, 6 & 4 tied back
	Pin 8 & 4 tied back	Pin 5 & 20 tied back
Pin 5	Pin 5	Pin 7
Pin 2	Pin 3	Pin 2
Pin 3	Pin 2	Pin 3