



Fireeye® Series 2000 FIRETRON® Analyzer Models FT-2300, -2400, -2500, -2600, -2700

SPECIFICATIONS

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.		
Indicators:	LED type for ON (Power), Standby, Service, Charge, Low Batt., Fault.		
Power Supply:	95 - 265VAC ±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), NO, CO (high)		(Electrochemical Cells)
	Flue Gas Temp.		(Type K Thermocouple)
	Ambient Temp.		(Solid State sensor)
	SO ₂ , CO(high), NO ₂		(Electrochemical Cells)
	Hydrocarbons (HyCx)		(Electrochemical Cell)
	Draft		(Pressure transducer).
Calibration:	3 minute zero calibration check on all cells (O ₂ check 20.9%).		
Printer:	Thermal		
Model Numbers:	FT-2300	3 gas	O ₂ , CO (low), NO
	FT-2400	4 gas	O ₂ , CO (low), NO, HyCx
	FT-2500	5 gas	O ₂ , CO (low), NO, HyCx, CO (high)
	FT-2600	6 gas	O ₂ , CO (low), NO, HyCx, CO (high), NO ₂
	FT-2700	7 gas	O ₂ , CO (low), NO, HyCx, CO (high), NO ₂ , SO ₂

NOTE: O₂, CO(low), and NO are always provided. The models listed above and model numbers are typical configurations. Modification of the 4th, 5th, and 6th gases can be made (for an additional fee) when ordering.



Ranges			
Gas cells	Range	Accuracy	Resolution
Oxygen, O ₂	0 to 25.0% Vol.	± 1%	± 0.1% vol.
Carbon Monoxide, CO.Low	0 to 2000ppm	± 4%	± 1ppm
Carbon Monoxide, CO.High 0 to 40000ppm	0 to 40,000ppm.		± 100ppm (above 2000 ppm)
Sulphur Dioxide, SO ₂	0 to 2000ppm	± 4%	± 1ppm
Nitrogen Monoxide, NO	0 to 1000ppm	± 4%	± 1ppm
Nitrogen Dioxide, NO ₂	0 to 100ppm	± 4%	± 1ppm
Hydrocarbons	0 to 50,000ppm	(Application dependent)	
Ambient Temp	-5 to 50°C / +23 to 122°F.		
Draft	± 20" Water Column		
Carbon Dioxide, CO ₂	Calculated.		
Efficiency	Calculated.		
Excess air	Calculated.		
Loss	Calculated.		
Special ranges			
Carbon Monoxide, CO	0 to 500ppm	± 4%	± 1ppm
	0 to 1000ppm	± 4%	± 1ppm
	0 to 10%		± 100ppm
Nitrogen Monoxide, NO	0 to 500ppm	± 4%	± 1ppm
	0 to 2000ppm	± 4%	± 1ppm
	0 to 4000ppm	± 4%	± 1ppm
Sulphur Dioxide, SO ₂	0 to 1000ppm	± 4%	± 1ppm
Nitrogen Dioxide NO ₂	0 to 500ppm	± 4%	± 1ppm

Standard Accessories

Pistol grip probe (300mm/12"), Integral water catchpot and filter, Rechargeable lead acid battery (internal), Thermal Printer, 32.5 ft. sampling hose, Data Logging, FIREYE CAPTURE PROGRAM. RS232 port, draft measurement.

Options

Minimum of 3 to maximum of 7 gas sensors.
 Other gas ranges may be available on request.
 Analog output; (12 current loops, independently configurable).
 Probe length options; 1m/39.4," 1.5m/60" & 3m/118."
 Continual monitoring with sleep and wake facility.
 Dual language display option. (Choice of language dependent on availability.)

- Max Probe Temp:** 600° C/1112° F continuous; 1000° C/1832° F intermittent.
- Sampling Hose:** Silicon rubber 10m/32.5 ft length.
- Case:** Medium density blended polyethylene.
- Weight:** 6 Kg/13lbs.
- Dimensions:** 453mm(W) x 120mm(D) x 245mm(H) + 20mm stand. / 17.8"(W) x 4.7"(D) x 9.6"(H) + 0.8."

SAFETY

Important: Read carefully and comply with the following:

The Fireye Series 2000 flue gas monitor is a safety Class 2 instrument.

- 1. Before switching on the apparatus make sure that the power supply is suitable for the instrument.**
- The power plug must 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.
- 3. WARNING: Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.**
- When the apparatus is connected to its supply, terminals may be live, and opening cover or removing parts (except those accessible by hand) is likely to expose live parts.
- 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.
- 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.
- 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 unfavorable conditions.
- has been subjected to severe transport stresses.



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

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

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 pressurized 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 authorized/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 past 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 recognized safety procedures should be used when operating with hazardous gases. Fireye 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.



DESCRIPTION OF INSTRUMENT

The Fireeye Series 2000 Portable Gas Analyzer gives maximum choice to the customer within a single instrument. The Fireeye Series 2000 is a portable analyzer for 3 to 7 gas and draft measurements. CO₂, efficiency and excess air values can be calculated dependent on the gas sensors chosen. Flue gas and ambient temperature measurements are standard. The Fireeye Series 2000 is not intended to be used as a continuous gas monitor, but it may be used to monitor repetitive cycles using the sleep and wake facility.

The carrying case holds the accessories and 12" (300m) probe. The water catchpot is contained in the side of the PVC instrument case and is easily accessible for emptying. The lead acid battery will maintain the operation of the instrument for a full working day (dependent on options) when fully charged. The main power source is a wide range (90 to 265V 50/60Hz) power supply.

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 analog output channels and a serial communication link (RS232). The latter enables data to be output into a computerized database.

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

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 further additional sensors fitted. Output options can 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.

STANDARD FEATURES AND OPTIONS

FUELS: Standard fuel settings available on the menu display:- Wood/ Light Fuel Oil/ Heavy Fuel Oil/ Natural Gas/ Propane/ Coal plus 4 other user definable fuels. The fuel type being used should be selected from the menu.

GAS SENSORS: The unit requires a minimum of 3 gas measurements with a maximum of 7. Basic 3, 4, or 5 gas instruments can be upgraded at a later date. All the gas sensors are simple to replace. Replacement is made with a pre-calibrated sensor. Unused sensor positions are blanked off. Gas sensors and options fitted are programmed into the instrument before shipment. Upgrading entails a return of the portable to the factory for adding gas sensors, re-programming and calibration.

Special notes on gases.

Attempted continuous monitoring of high concentrations may reduce the sensitivity of the gas sensors. This is equally applicable when using the continual monitoring mode. Oxygen sensors have a shelf life of 6 months after which the typical operating life of 9 months will start to be reduced.

NOTE: Operating life is very much influenced by conditions and amount of use. In this control, the effect of auto flushing the sensors after the instrument is shut off extends the sensor life. Other gases have a typical life of up to 2 years in fresh air, but again subject to use and concentration levels of gases.

When replaced, new NO sensors require a period of not less than 4 hours settling time before use. For maximum accuracy a period of 24 hours is recommended. If NO and NO₂ sensors are fitted then NO, NO₂ and NO_x readings will be displayed. When only a NO sensor is fitted, then NO_x measurements will be displayed as a NO reading and a calculated NO_x reading. The percentage compensa-

tion figure for NO₂ will be established for the particular application by the operator and entered at the SETUP menu.

Sensor Storage: All sensors are to be considered as consumable items and if stored should be kept at temperatures less than 20° C / 68° F.

Filters and protection warnings on gas measurement

Sintered filter (stainless steel) (P/N 702.182). The primary or 1st filter is a 316 stainless steel sintered filter. This is fitted to the tip of the pistol grip probe, and can be removed for cleaning by unscrewing and gently cleaning with a wire brush. This filter protects the system from initial large particulate matter and it is recommended that this is left in place. A small side effect of this filter is the reduction of the thermocouple response time since it is situated directly behind the filter. This normally is quite acceptable, but in cases where the operator feels the need for a faster response to flue gas temperature measurement then this filter may be removed.

Particle filter (disposable) (P/N 703.144). The 2nd filter is a disposable particle filter plugged into a recess at the side of the instrument. This filter removes 99.9% of all particles over 0.9 microns in size. The state of the filter can be viewed through its case and should normally have a long life. When it shows signs of severe contamination it should be replaced.

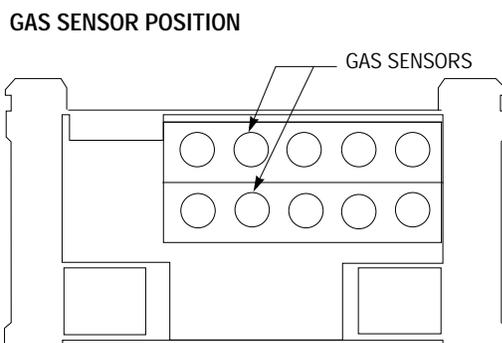
Chemical Filter. (P/N 703.145). The 3rd filter (chemical filter) is situated at the side of the 2nd filter and also plugs into the side of the instrument. This is a disposable filter that reduces the SO₂ and NO_x cross interference with the CO measurements. The instrument is programmed to estimate and display a warning when this should be replaced. (The Service LED on front display panel is illuminated when the software decides that the filter needs cleaning.) (See Diagnostics). To replace the chemical filter, see maintenance section in this manual.

Automatic CO (low) sensor protection.

The CO (low) sensor is sensitive to high concentrations above 2000 ppm. Normally minor excesses may not damage the sensor, but would affect sensor life. The instrument protects the CO (low) sensor by automatically flushing the system with fresh air for 10 seconds, then closing the solenoid controlling the gas feed to the CO (low) sensor when concentrations of CO above 2000 ppm are detected.

NOTE: The CO (low) sensor may be manually enabled or disabled when CO (high) sensor is fitted by use of the SETUP->SYSTEM->LOW RANGE CO SENSOR menu option. Disabling disconnects the CO low sensor and keeps it purged with air during the gas reading. (Useful facility when high concentrations may saturate the CO sensor).

FIGURE 1.



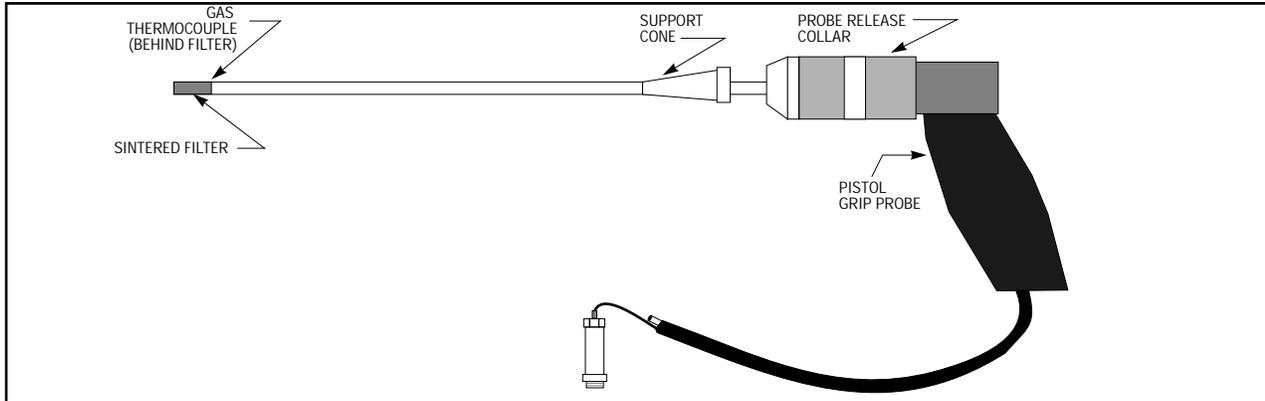
Gas Sensors are accessed by unscrewing the 2 retaining screws on the pack panel. Sensors are precalibrated and simple to replace. See the Maintenance section for more details on changing gas sensors.

NOTE: The high and low range CO sensors take some time to recover following a high concentration of CO (> 5000 ppm). This is dependent on how long the high concentration was present.

DRAFT MEASUREMENT. An internal pressure transducer and control solenoid are fitted to allow measurements to be made in positive or negative pressure ducts within +51cm ± 20" Water Gauge.

FLUE GAS TEMPERATURE MEASUREMENT (Standard). A type K thermocouple is fitted in the tip of the pistol grip probe. Compensating cable is used to transfer the millivolt output to the instrument where it is cold junction compensated for the effects of ambient temperature. Cold junction measurement is made with a solid state sensor located within the probe plug

FIGURE 2. PROBE ASSEMBLY



NOTE: Ensure the probe extension is fully tightened to avoid air leaks. Check 'O' ring seal. 'O' ring is located on the pistol grip handle between Thermocouple connector and the guild rod.

AMBIENT TEMPERATURE MEASUREMENT (Standard). The ambient temperature is detected by a thermistor located inside the probe connecting plug.

DUAL LANGUAGE FACILITY (Option). Another operating language as well as English may be selected. Choice of a second language is dependent on availability and should be made to Fireye.

PRINTER. The printer uses thermal paper rolls. The 2 quick release screws on the side of the instrument allow access to the printer unit by removing the side panel.

PRINTER READOUT. 3 line headers and 3 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. (See Operating procedure. Printer Menu).

DATA LOGGING

The Fireye Series 2000 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 Fireye Series 2000 also has the serial port option fitted.

THE LOG RECORD

Each data log record contains the following data:

Fuel Type	Unit No.
Wet/dry Analysis	O ₂ Normalization ON/OFF
Date	Time
Ambient Probe Temperature	Probe Temperature
Up to 7 Gas Readings	NO _x Concentration
CO ₂ Concentration	Fuel Efficiency
Loss	Excess Air
Percent Water	O ₂ Normalization Factor



MANUAL DATA LOG

The Manual Data Log may be selected by setting the system parameter LOG TYPE to MANUAL via the DATA LOG->LOG SETUP menu option. In this mode individual log records may be made by pressing the 'LOG' key in Gas Readings Display.

AUTO DATA LOGGING

Auto Data Logging may be selected by setting the system parameter LOG TYPE to AUTO via the DATA LOG->LOG SETUP menu option. In Auto Data Log mode the Fireye Series 2000 will log system data at specified intervals for a specified period of time.

The length of time that Auto Logging runs for is determined by the system parameter LOG PERIOD in DATA LOG->LOG SETUP (2 - 60 mins). The interval between log samples during the Auto Logging period is set by the system parameter LOG INTERVAL (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.

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 Fireye Series 2000 will place a log record to the selected output device (see 'WHERE DATA LOG RECORDS ARE PLACED' below) 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.

DATA LOG RECORDS

There are three options for where Data Logging places the data log records. These are available via the DATA LOG->LOG SETUP menu option. The system parameter LOG TO may be set to MEMORY/PRINTER/RS232 to determine where log records are placed.

LOG TO MEMORY. The Fireye Series 2000 can log up to 280 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 Fireye Series 2000 will not allow a log interval of less than 2 minutes when outputting data to the printer.

LOG TO RS232. Each log record may be output to the RS232 channel. The data is output as ASCII data which may be received by the FIREYE CAPTURE PROGRAM for use with a spreadsheet. See FIREYE CAPTURE PROGRAM section. 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 continual monitoring system options. Clearing the log memory will erase all log records.

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

*NOTE: The data log memory is **not** 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 RS232 port (if fitted). The output is in ASCII text to provide a hard copy report to a serial printer with XON / OFF 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 FIREYE CAPTURE PROGRAM section).

FIREYE CAPTURE PROGRAM. The FIREYE CAPTURE PROGRAM may be used to transfer data from the Fireye Series 2000 system memory to a dBaseIII type file, for use with spreadsheets. (See FIREYE CAPTURE PROGRAM section).

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.

CONTINUAL MONITORING (Option)

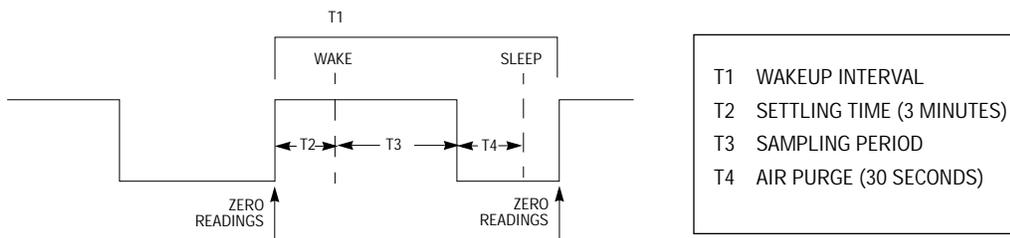
Continual Monitoring is a means to cyclically sample and log gas concentrations over a period of time. This is achieved by alternate 'WAKE' and 'SLEEP' phases. During the 'SLEEP' phase the instrument is switched to air intake and the pump is off. During the 'WAKE' phase the instrument takes a specified 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 continual monitoring option it is recommended that the Fireye Series 2000 is also fitted with a serial port and capture program.

The continual monitoring cycle is as follows:

1. The instrument is purged with air for 30 seconds 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, 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 and the pump is switched on. The system enters the SETTLING phase allowing the gas sensors to respond. This phase lasts 3 minutes.
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. The instrument returns to step 1.



SETTING UP THE CONTINUAL MONITORING. Continual Monitoring may be setup via the CONT. MONITORING->SETUP menu option.

THE CONTINUAL MONITORING SETUP PARAMETERS

Wake-up Interval: The length of time between each wakeup period is 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 interval samples. 2 - 15 minutes.

First Wakeup: The clock time for the first wakeup after continual monitoring is enabled (instrument clock).

LOG TO

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

— **Memory.** Up to 280 log records may be made to non-volatile system memory.

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

— **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 Fireye Series 2000 does not allow a sample interval of less than 2 minutes when this option is selected.

— **RS232.** Each log record is made 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.

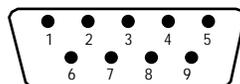
Note: Data in this format may not be directly incorporated into a spreadsheet package.

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

The **analog output** may be enabled or disabled during continual monitoring. The **low range CO** sensor may be disabled during continual monitoring to protect the sensor if CO concentrations are known to be >2000 ppm.

Continual 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 Continual Monitoring Mode and shows the current status. Continual monitoring may be aborted at any time - except when it is purging - by pressing the ABORT function key.

SERIAL PORT CONNECTIONS.



Front view of 9 pin D connector on front panel

RS232

Rx= pin 2

Tx= pin 3

Common = pin 5

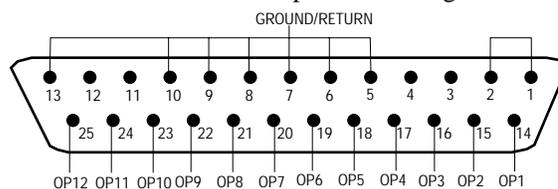
CURRENT LOOP ANALOG OUTPUT (Option)

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.

8 channels are available, numbered 0 to 7. These are directly related to the sensor positions in the display order. Channel 6 & 7 are user configurable channels, for monitoring fuel efficiency/loss/ excess air/CO₂/NO_x 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



RS232 SERIAL OUTPUT

Either a RS232 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 computer style full page printer. For example an Epson printer (printer must have XON/XOFF protocol).
2. For communicating to a personal computer running the FIREYE CAPTURE PROGRAM or terminal mode.

CAPTURE PROGRAM

For incorporating logged data into a spreadsheet or database package, Fireeye can supply their Capture Program on a 3.5" disk which will run under MS-DOS on a PC compatible computer with at least EGA graphics capability.

The Capture Program interfaces with the Fireeye Series 2000 via the instrument's serial port and the computer's COM1: serial port. The Capture Program will work in either of two modes:

1. The Capture Program requests data packages from the Fireeye Series 2000 and places them in a dBASE III type data file on disk. When all the logged data is received the program terminates.
2. The Capture Program runs continuously, until stopped via the computer keyboard. It receives data packages from a Fireeye Series 2000 running in either auto data logging mode or continual monitoring mode and set for logging to the RS232 serial port. Data packages are written to a dBASE III type file on disk.

NOTE 1: The Capture Program has been tested using LOTUS 1-2-3 (Release 3), Quattro Pro and Excel but should work with any spreadsheet package which can read in dBASE III type (.dbf) data files.

NOTE 2: The Capture Program is only for use with Fireeye Series 2000 instruments which are fitted with the Serial Port option and either the Data Logging option and/or the Continual Monitoring option.

FIREYE CAPTURE PROGRAM includes: a 3.5" floppy disc.

SERIAL INTERFACE

Computer Serial Port (When used with the FIREYE CAPTURE PROGRAM). The capture program assumes the first serial port (COM1:). It automatically configures this port for 9600 baud, 8 data bits, one stop bit and no parity.

The Fireeye Series 2000 Serial Port (When used with the FIREYE CAPTURE PROGRAM). The serial port on the Fireeye Series 2000 instrument must be set for **9600 baud, no parity, eight bits, one stop bit.**

CABLES

SERIAL PORT COMMUNICATIONS CABLES: The following cable connections have been shown to work for connecting external hardware to the Fireeye Series 2000 serial port when configured for RS232. No data is available for connection off a printer using RS422.

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

2000 SERIAL PORT 9 Pin	SERIAL PRINTER 25 Pin
Pin 2	----->Pin 2
Pin 3	----->Pin 3
Pin 5	----->Pin 7

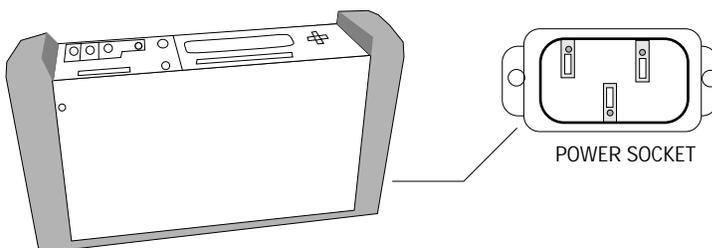
HOST COMPUTER: To communicate with a host computer for Capture program or other applications, the following connections are required:

2000 SERIAL PORT	COMPUTER 9 Pin or	COMPUTER 25 Pin
	Pins 1, 6 & 7 linked	Pins 8, 6 & 4 linked
	Pins 8 & 4 linked	Pins 5 & 20 linked
Pin 5 -----> Pin 5	-----> Pin 7	
Pin 2 -----> Pin 3	-----> Pin 2	
Pin 3 -----> Pin 2	-----> Pin 3	

POWER SUPPLY

The power supply is universal. The voltage range is 90 to 265v 50/60Hz

Fuse replacement (See MAINTENANCE section).



ALARM INDICATORS (facility) Situated on the keyboard display panel are 6 LED indicators.

ON LED is illuminated when the instrument is switched on.

BAT. LOW LED is illuminated when the main battery requires re-charging.

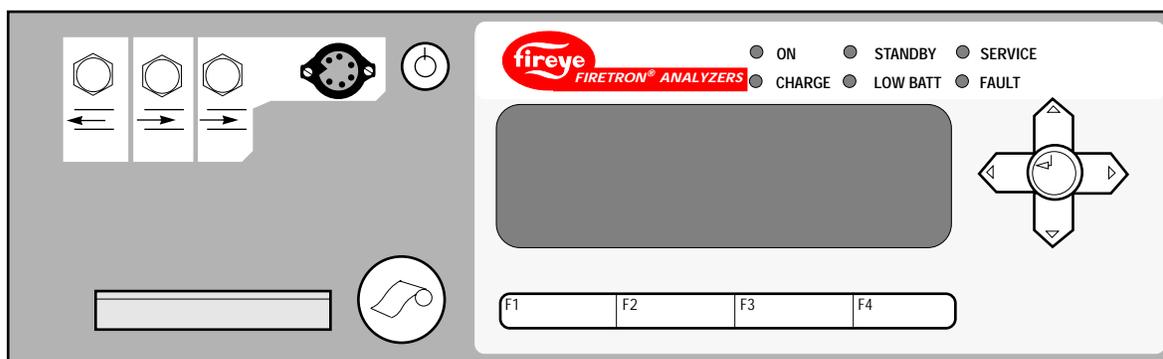
SERVICE LED is illuminated when the chemical filter requires replacing.

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

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

Standby LED this LED indicates sleep and wake facility is active.

Charge LED this LED indicates instrument battery is being charged.



MENU DISPLAY

The instrument is operated by a series of menus on the liquid crystal display panel. Menu options on each display are selected with the cursor and enter keys. Up to 4 "soft" function keys provide additional options appropriate to each display. If any difficulty is encountered then a help facility is available for each display. The display will automatically time out after 2 minutes if no key is pressed, on all displays except gas readings. During start up, the instrument goes through a zero calibration routine for 3 minutes. During this period gas measurements cannot be made, but systems diagnostics and setup screens are available.



Help Menu. Helps with problems. The HELP facility is available on all Menu displays.

Display contrast. The display is temperature compensated to give a reasonable contrast under wide temperature variations. The contrast of the display screen may be manually adjusted by pressing the F1 and either the UP or Down cursor keys simultaneously.

Display Backlight. The backlight to the liquid crystal display is illuminated after pressing a key (if this feature is enabled in software), and automatically goes out after 2 minutes if no further key is pressed.

DISPLAY PARAMETER FORMATS. Both the temperatures and gas readings may be displayed in a choice of formats. These formats are configurable from the keyboard.

GAS READINGS (ppm, mg/Nm³, lb/mBtu or ng/J). The gas concentrations may be displayed as ppm values, mg/Nm³, lb/mBtu or ng/J. These options are available from the SETUP->SYSTEM menu.

NOTE: The analog output span values will be displayed in the selected units.

NOTE: Overrange gas readings will result in the display values flashing on and off.

The Fireeye Series 2000 software works in ppm values and converts to the selected units for display purposes. The conversion is applied to the concentrations AFTER any adjustments for wet analysis and/or O₂ normalization have been made.

TEMPERATURES (°C or °F). The temperatures may be displayed as °C or °F. This option is available under SETUP->SYSTEM.

DRAFT (Water Gauge Column(inches) or hPa). The draft (differential pressure) may be expressed as inches Water Gauge Column or in the SI unit of Hecto Pascals (100 Pascals).

GASES

CO₂ and NO_x may be calculated if the appropriate sensors are fitted. The choice of gas measurements available to the user allows the selection of 3 to 7; O₂, CO(low), CO(high), SO₂, NO, NO₂, and Hydrocarbons.

CALCULATED GASES

NO _x : The NO _x concentration is calculated according to which of the NO and NO ₂ sensors are fitted.		
	NO₂ fitted	NO₂ not fitted
NO fitted	NO _x = NO conc + NO ₂ conc	NO _x = NO conc x NO factor **
NO not fitted	NO _x = 0	NO _x = 0
** NO factor is the menu entered percentage used for the total NO _x calculation.		

CO₂

The following formula is used to calculate the CO₂ concentration:

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

Where CO₂ max is determined by the fuel type:

FUEL	CO ₂ MAX (%)
Wood	20.4
Light Fuel Oil	15.6
Heavy Fuel Oil	15.9
Natural Gas	12.1
Propane	13.5
Coal	18.6

ADJUSTMENTS

WET/DRY ANALYSIS. The Fireeye Series 2000 display values would normally be given as a dry analysis, conversion to a wet analysis reading requires entering the % water content of the fluegas. i.e. Typical % water content for coal burning boilers is approximately 6-8%.

The user has the option of selecting wet or dry analysis display values, the selection is made in the SETUP->SYSTEM menu. The percentage of water content may also be entered through this menu option.

The formula for wet analysis is:

$$(\text{ppm}) \text{ wet} = \frac{(1 - \text{H}_2\text{O}) (\text{ppm}) \text{ dry}}{100}$$

where H₂O = % water content

O₂ NORMALIZATION

To comply with certain environmental legislation, readings of flue gases are required to be given in relationship to a specific oxygen content. (Normalization).

O₂ normalization may be selected through the SETUP->SYSTEM menu. The O₂ normalization factor may be entered as a percentage through this same menu option.

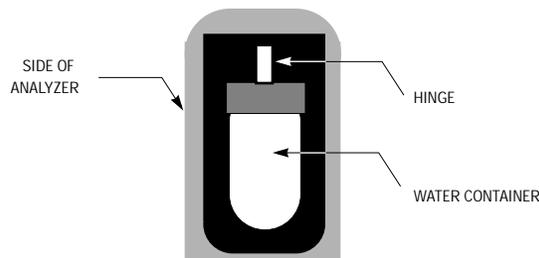
The formula for O₂ normalization is:

$$\text{Go} = \frac{G(20.9 - \text{Oc})}{(20.9 - \text{Oa})}$$

where GO = normalized gas reading
G = gas reading
Oc = O_x normalization factor (%)
Oa = O₂ reading (%)

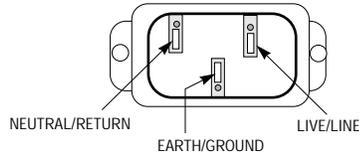
PREPARATION FOR USE

1. This instrument can be operated while still in the shoulder bag.
2. Check all items;
 - 1-Probe pistol grip handle and tubing.
 - 1-Probe extension with primary filter fitted.
 - 1-Carrying strap (part of the carrying bag).
 - 1-Water trap unit (catchpot assembly).
 - 1-Power supply lead.
 - 1-Spare primary (1st) filter.
 - 1-Spare 2nd filter (air).
 - 1-Spare 3rd (Chemical) filter.
3. **Water trap.** Verify that the water container is secure. Air leaks will result 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.

4. **Pistol grip probe assembly.** Screw the probe extension onto the pistol grip handle. Connect the probe tubing and connector as shown in the illustration.
5. **Power supply lead & battery charging.** Connect the power lead to the power socket. The charger is universal, operates 95-265V 50-60Hz.



Connect the power lead to the socket on the side of the instrument as illustrated. When the instrument is being charged, by being plugged into the power supply, the front panel 'CHARGE' LED will illuminate and will continue to trickle charge even while in use.

The flexible cable has 3 conductors, these should be connected to the users own plug as follows:

Europe

- Brown is the Live/Line.
- Blue is the Neutral/Return.
- Yellow/Green is the Earth/ground.

USA

- Supply complete plug and cord.

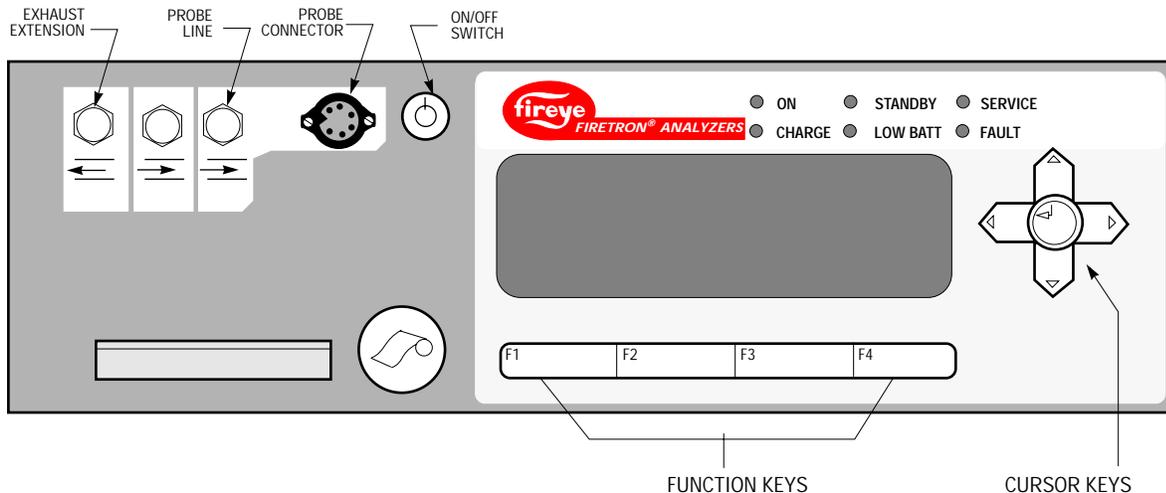
The instrument may be operated on either the internal batteries or direct from the power supply. Two re-chargeable 6V 4 ampere hour batteries are fitted within the case. A half charge can be achieved in 3-4 hours. The instrument will operate for approximately 8 hours dependent on options fitted.

6. **Carrying bag.** This soft shoulder carrying bag carries the instrument and accessories. The instrument can still be operated in this situation.
7. **Sample exhaust.** The sample exhausts from the port on the front panel. If the instrument is operated in an enclosed area, it is advisable for safety reasons to extend the exhaust with suitable tubing to a more remote point from the operator.

GETTING STARTED

'ON/OFF' SWITCH

This switch is located on the upper part of the front panel and powers up the instrument. Pressing and holding down for 1 second, the red colored button will switch the instrument - On or Off. The instrument can run from the internal battery or from a main power source. When the instrument is switched off it will perform a 1 minute purge - the display will show 'SYSTEM CLOSING DOWNPURGING.'



CURSOR & ENTER KEYS. The instrument is totally menu operated. There are 4 cursor 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.

FUNCTION KEYS. Four function buttons are located underneath the display. Their operations change and are highlighted on every individual display. They offer varying facilities i.e. HELP, MENU, EXIT, NEXT etc.

HELP MENU. All displays have an individual 'HELP' related display, which gives guidance on the current display.

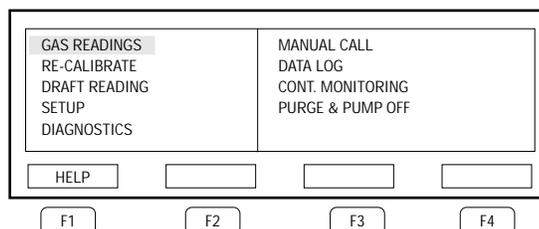
LEDS DISPLAY PANEL. The LED indicator panel indicates conditions of the instrument. When switching on only the 'ON' LED should illuminate. The 'LOW BATT' LED will indicate if the battery requires charging. If the 'FAULT' LED is illuminated, check for faults at the diagnostics ->FAULT MENU.

PREPARE PARAMETERS. Adjust the instrument parameters as required following the menu instructions.

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. Insert probe into the stack.
4. Press and hold the On/Off button for approximately 1 sec.
5. Wait for the recalibration to finish, the display will show the time progress of the cal.
6. After 3 minutes the main menu display will appear with GAS READINGS highlighted.



7. Press ENTER on the front panel cursor keys, then the function key F3. The display will show gas readings.
8. To switch the instrument off press and hold the button for approximately 1 sec. The instrument will purge the gas sensors with fresh air for 1 minute, then completely shut down.

MENU DISPLAYS

The main menu display offers 9 sub directory choices.

GAS READING	SETUP	DATA LOGGER
RECALIBRATE	DIAGNOSTICS	PURGE & PUMP OFF
DRAFT READIN	MANUAL CAL	CONT. MONITORING

SETUP

This menu is normally used when setting the instrument parameters for the first time, or when parameter changes are required.



SYSTEM

These are parameters that may need setting:

CLEAR FAULTS:	Select 'YES' to clear any fault flag that remains in the system.
CLEAR FILTER COUNTS:	Must be cleared whenever a new filter is fitted.
ANALOG OUTPUT:	Enabled or disabled.
ANALYSIS:	Select to convert to wet analysis. Percent water content will require entering.
O ₂ NORMALIZATION:	Select 'YES' if readings are required to be normalize for legislative reporting.
WATER:	Request for the percent water content in flue gas for wet analysis. i.e. Aprox 6-8% for coal.
O ₂ FACTOR:	Enter the required O ₂ percent for normalization of gas reading.
NO _x FACTOR:	Percent correction factor required for NO _x readings if NO ₂ sensor not fitted. Typically < 5%.
UNIT No:	Identification number when data logging multiple locations. Located on first line of the print out footer.
TEMPERATURE:	Select reading units of Centigrade or Fahrenheit.
DISPLAY UNITS:	Values of measured units selected: ppm, mg/Nm ³ (mg), lb/mBtu or ng/J.
UNITS OF PRESSURE:	Choice of w.g.c. or hPa.
LANGUAGE:	English or other language option.
FUEL TYPE:	There are 7 standard fuels available. The fuel type affects the calculated values of the CO ₂ and excess air and lb/mBtu.

FUEL DATA: There are five factors to each of the fuel types. For the six basic fuels these factors are fixed and may not be changed. For the user definable fuels, these factors may be changed via the keyboard. The factors are: CO₂ max, k1 factor, k2 factor, Vo(dry)/Ao, F factor. These factors are used in various calculations, such as, fuel efficiency.

DATE AND TIME: Provision for setting correct date and time. The date order is day:month:year.

PRINTER: A 3 line Header and 3 line Footer for the hard copy print outs, can be typed in and changed as required.

SERIAL PORT: Adjustable parameter settings for making the serial output compatible with output device.(i.e. Baud rate: Parity etc).

ANALOG OUTPUTS: 12 analog output channels available. Channels can be programmed by the user for measurements. Each channel has selectable min. and max. current zero and span settings.

MENU DISPLAYS

RECALIBRATE

When the Fireeye Series 2000 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 (**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 affected 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 the O₂ (span value) which should be around 1.5V.

MANUAL CAL

AMBIENT TEMPERATURE SELECTION. A request is made for the ambient temperature to be set. This should normally not need adjusting, as the instrument has been factory calibrated. The reason for this temperature setting is the small variance in accuracy of the 2 basic sources of ambient



temperature sensing in the instrument; the cold junction and the ambient temperature probe. These 2 sensors have different specifications as they are designed to function for different temperature bands. The cold junction operates with the flue gas probe type K thermocouple for up to a 1000°C, whereas the ambient temp probe is specifically designed for measurement accuracy in the 0 to 50° C band. If necessary by entering a true ambient temperature figure from an independent source, these 2 sensors may be calibrated to the entered value.

GAS CONCENTRATION SELECTION. Included in this menu selection is a procedure for span calibration of the instrument sensors (except oxygen). The procedure is to follow the step by step menu instructions, beginning with the request to indicate the value and type of the calibration gas to be used. It is strongly recommended that a zero calibration/recalibration is done immediately before performing a span calibration.

MENU DISPLAYS DIAGNOSTICS. Contains following menus:

- CELL EMFs: Maintenance information, that indicates true state of cells and electronics (for service engineers).
- CELL ZEROs: Shows zero calibration voltage of cells after last calibration.
O₂ is span voltage.
- CELL LIFE: Maintenance information, that indicates cell life in ppm x days (for service engineers use).
- FILTER: Maintenance information, that indicates chemical filter life in ppm x mins. Recommends a chemical filter change to customer.
- SYSTEM: Indicates: Main battery voltages; Lists options fitted; System faults.
- REPORT: Selects output for available printout of a full system report for service use. The diagnostics report can be sent to the local printer or the serial port.

SYSTEM ERRORS

PRINTER (The log output does not appear on the local printer.)	
CAUSE	ACTION
The printer is already in use.	Wait until the current printout is complete.
The Printer is out of paper.	Reload.
The printer buffer has overrun.	Check under DIAGNOSTICS > SYSTEM for the fault message. Report this fault.
SERIAL PORT (The log output does not appear on the serial port.)	
The serial port is already in use.	Wait until the current dump is complete.
The serial port is incorrectly set up.	Check under SETUP - Serial Port.
The serial cable is wired incorrectly.	Check wiring.
The serial port option is not available.	Check under DIAGNOSTICS - system.
The serial printer is not set for XON/XOFF.	Check serial printer settings.
The serial printer does not have a compatible baud rate.	Check against SETUP > SERIAL PORT.

DRAFT READING*: (Differential pressure). Indicates the stack pressure in water gauge column.(inches) or hPa.

GAS READING: On selection, first screen confirms the fuel type selected, and awaits the 'GO' function key being depressed before continuing to sample and display the flue gas readings. ZOOM selection allows larger alphanumeric displays of selected gases.

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 recalibrating or if it is already purging following a CO overrange. No other menu items are available during the 30 second purge cycle.

OPERATING PROCEDURE

1. Press and hold for 1 second the ON/OFF button on the keyboard display panel.
2. The instrument will immediately go into a zero calibration cycle for a period of 3 minutes. The time remaining on the calibration cycle will be displayed. During the zero calibration cycle the parameters of the instrument may be set using the SETUP menu.

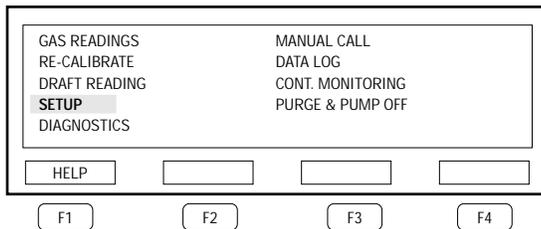
Only the measurement of gases is suspended for the calibration.

3. The warning LEDs on the display panel will indicate the instrument status. If everything is in order, then the Power On LED will be illuminated and the others not. If the fault LED is also on then enter the menu and using the cursor keys scroll until: DIAGNOSTICS is selected. SYSTEM is selected. Press ENTER to display the fault. Note: The display may have further information so observe the MORE sign and press the NEXT key.

- | | | |
|----------|------------|-----------|
| ● ON | ● STANDBY | ● SERVICE |
| ● CHARGE | ● LOW BATT | ● FAULT |

Refer to Maintenance section for further information on faults. If the ambient temperature probe is not inserted then the fault will display as PROBE NOT FITTED. Insertion of the ambient temperature sensor will automatically clear the fault light.

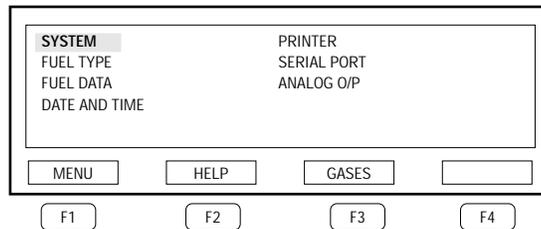
Note: Some of the more complex faults could have their status retained, and may have to be cleared by entering MAIN MENU->SETUP-> SYSTEM and setting CLEAR FAULTS to YES. Exiting the SETUP display will then clear the faults.



MAIN MENU

Provides access to all other display menus.

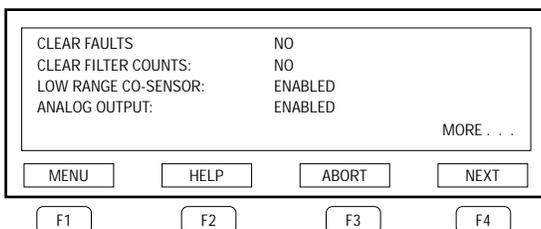
- CURSOR KEYS: Move to highlight SETUP.
 ENTER KEY: Confirms selection.
 FUNCTION KEY: F1 selects HELP.



SETUP MENU

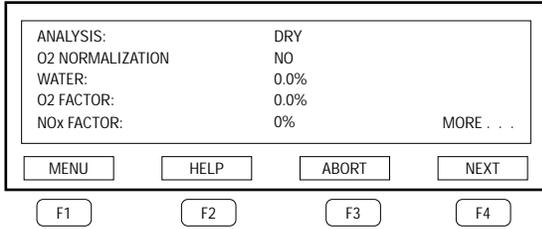
- CURSOR KEYS: Move to highlight SYSTEM.
 ENTER KEY: Confirms selection.

- FUNCTION KEYS:
 F1 MENU: Returns to MAIN MENU
 F2 HELP: Information on how to use display
 F3 GASES: Go to GAS READINGS display.



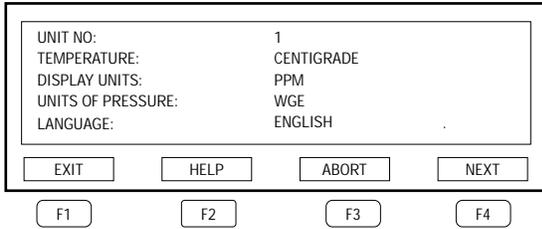
SYSTEM MENU (SCREEN 1)

- CURSOR KEYS: Changes highlighted selection.
 ENTER KEY: Moves cursor highlight.
 FUNCTION KEYS:
 F1 EXIT: Returns to SETUP menu saves changes.
 F2 HELP: Use of display information.
 F3 ABORT: Returns to SETUP menu, abandons any changes.
 F4 NEXT: More system parameters.



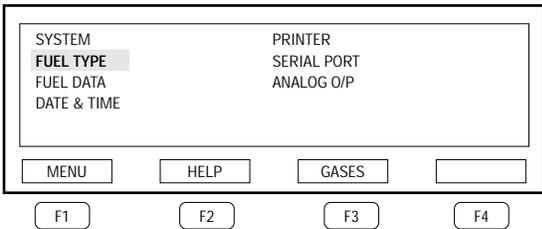
SYSTEM MENU (SCREEN 2)

- CURSOR KEYS: Changes highlighted selection.
- ENTER KEY: Moves cursor highlight.
- FUNCTION KEYS:
- F1 EXIT: Returns to SETUP menu saves changes.
- F2 HELP: Use of display information.
- F3 ABORT: Returns to SETUP menu, abandons any changes.
- F4 NEXT: More system parameters.



SYSTEM MENU (SCREEN 3)

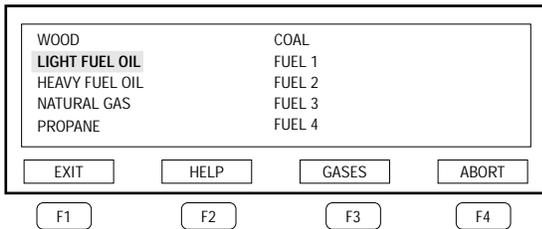
- CURSOR KEYS: Changes highlighted selection.
- ENTER KEY: Moves cursor highlight.
- FUNCTION KEYS:
- F1 EXIT: Returns to SETUP menu saves changes.
- F2 HELP: Use of display information.
- F3 ABORT: Returns to SETUP menu, abandons changes.
- F4 NEXT: More system param. (returns to screen 1)



Return to SETUP menu (F1)

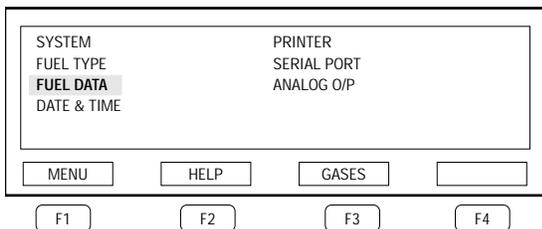
SETUP MENU

- CURSOR KEYS: Move to highlight FUEL TYPE
- ENTER KEY: Confirms selection.
- FUNCTION KEYS:
- F1 MENU: Returns to MAIN MENU
- F2 HELP: Information on how to use display
- F3 GASES: Go to GAS READINGS display.



FUEL MENU

- CURSOR KEYS: Move to select fuel used.
- ENTER KEY: Confirms selection.
- FUNCTION KEYS:
- F1 EXIT: Returns previous menu
- F2 HELP: Information on how to use display
- F3 GASES: Go to GAS READINGS display.
- F4 ABORT: Returns to SETUP, abandons changes.



Return to SETUP menu (F1)

SETUP MENU

- CURSOR KEYS: Move to highlight
- FUEL DATA ENTER KEY: Confirms selection.
- FUNCTION KEYS:
- F1 MENU: Returns to MAIN MENU.
- F2 HELP: Information on how to use display
- F3 GASES: Go to GAS READINGS display



WOOD	CO2 MAX:	20.4%
	k1 FACTOR:	0.68%
	K2 FACTOR:	0.006100
	Vo(dry) Ao:	0.96
	F FACTOR:	9670
EXIT HELP ABORT NEXT		
F1 F2 F3 F4		

FUEL DATA

CURSER KEYS:

Changes highlighted selection.

ENTER KEY:

Moves highlight.

F1 EXIT:

Returns to SETUP menu, saves changes

F2 HELP:

Information on how to use display

F3 ABORT:

Abort returns to SETUP menu, abandons changes.

F4 NEXT:

Next fuel Note: Parameters only changeable for fuels 1 to 4.

SYSTEM	PRINTER
FUEL TYPE	SERIAL PORT
FUEL DATA	ANALOG O/P
DATE & TIME	
MENU HELP GASES	
F1 F2 F3 F4	

Return to SETUP menu (F1)

SETUP MENU

CURSOR KEYS:

Highlight DATE & TIME.

ENTER KEY:

Confirms selection.

FUNCTION KEYS:

F1 MENU:

Returns to MAIN menu.

F2 HELP:

Information on how to use display

F3 GASES:

Go to GAS READINGS display.

DATE: 18/07/96	TIME: 10:54:17
NEW DATE: 28/07/96	NEW TIME: 10:54:00
EXIT HELP GASES ABORT	
F1 F2 F3 F4	

DATE & TIME MENU

CURSOR KEYS:

LEFT/RIGHT move cursor

UP/DOWN change value under cursor.

Moves between date and time.

ENTER:

FUNCTION KEYS:

F1 EXIT:

Returns to previous menu, saves changes.

F2 HELP:

Information on how to use display.

F3 GASES:

Go to GAS READINGS display, saves changes.

F4 ABORT:

Returns to SETUP menu, abandons changes

NOTE: Date order is expressed as Day/Month/Year.

SYSTEM	PRINTER
FUEL TYPE	SERIAL PORT
FUEL DATA	ANALOG O/P
DATE & TIME	
MENU HELP GASES	
F1 F2 F3 F4	

Return to SETUP menu (F1 or F4 on last display)

SETUP MENU

CURSOR KEYS:

Move to highlight PRINTER.

ENTER KEY:

Confirms selection.

FUNCTION KEYS:

F1 MENU:

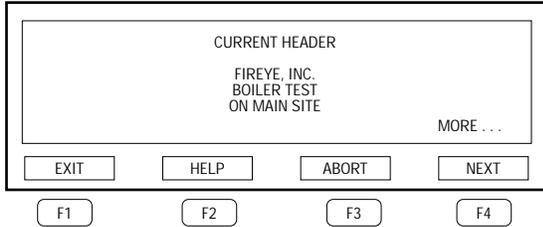
Returns to MAIN MENU

F2 HELP:

Information on how to use display

F3 GASES:

Go to GAS READINGS display.



HEADER & FOOTER DISPLAYS

CURSOR KEYS: LEFT/RIGHT move cursor
UP/DOWN change character under cursor.

ENTER: Move to next line.

FUNCTION KEYS:

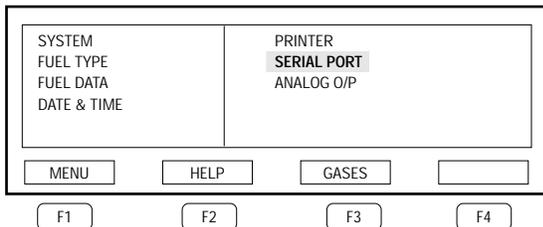
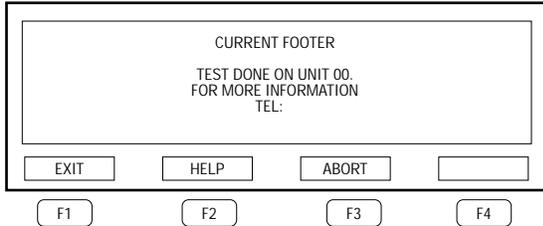
F1 EXIT: Return to SETUP menu saving changes.

F2 HELP: Information on how to use display.

F3 ABORT: Return to SETUP menu abandoning changes.

F4 NEXT: Moves between HEADER & FOOTER displays.

Note: First line on footer text can not be changed. The unit number is selected and entered in SETUP-SYSTEM menu (screen 3).



Return to SETUP menu (F1 last display)

SETUP MENU

CURSOR KEYS: Move to SERIAL PORT.

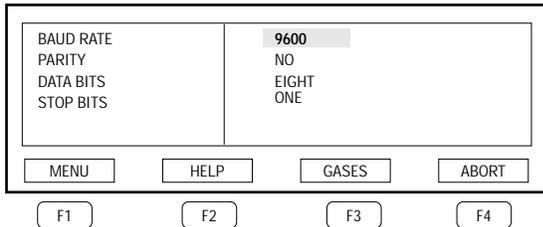
ENTER KEY: Confirms selection.

FUNCTION KEYS:

F1 MENU: Returns to MAIN menu

F2 HELP: Information on how to use display.

F3 GASES: Go to GAS READINGS display.



SERIAL PORT DISPLAY*

CURSOR KEYS: Changes value under cursor.

ENTER KEY: Confirms selection.

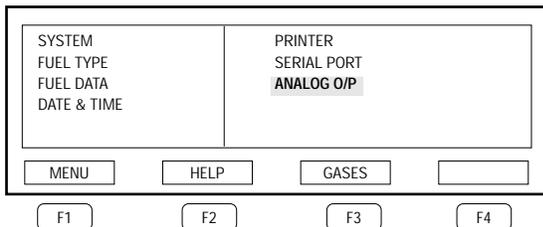
FUNCTION KEYS:

F1 EXIT: Returns to previous menu saving changes.

F2 HELP: Information on how to use display.

F3 GASES: Go to GAS READINGS display. saves changes

F4 ABORT: Returns to SETUP menu, abandons changes.



Return to SETUP menu (F1 last display)

SETUP MENU

CURSOR KEYS: Move to ANALOG O/P.

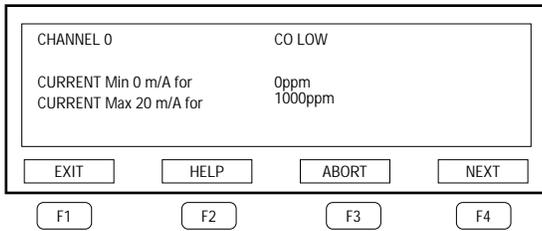
ENTER KEY: Confirms selection.

FUNCTION KEYS:

F1 MENU: Returns to MAIN menu

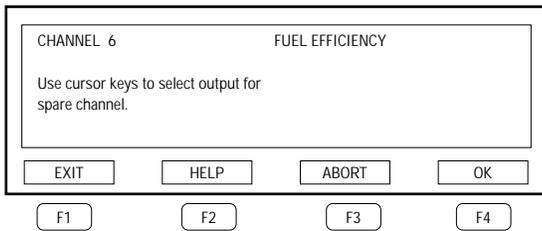
F2 HELP: Information on use of display.

F3 GASES: Go to GAS READINGS display.



ANALOG OUTPUT DISPLAYS (0 to 5)

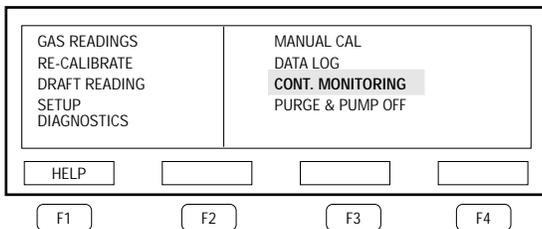
- CURSOR KEYS:** Changes the highlighted parameter.
ENTER KEY: Moves the cursor highlight.
FUNCTION KEYS:
F1 EXIT: Returns to SETUP menu saves changes
F2 HELP: Information on use of display.
F3 ABORT: Returns to SETUP menu, abandons any changes.
F4 NEXT: Selects next channel display.(0 to 5).
 i.e Channel 0 = CO low channel
 Channel 1 = CO high channel
 Channel 2 = SO₂ channel
 Channel 3 = NO₂ channel
 Channel 4 = O₂ channel
 Channel 5 = NO channel



ANALOG OUTPUT DISPLAYS (6 & 7)

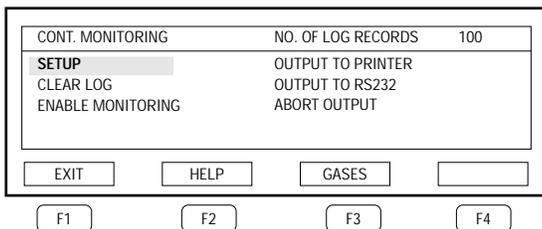
- CURSOR KEYS:** Changes the parameter.
ENTER KEY: Accepts the parameter displayed.
FUNCTION KEYS:
F1 EXIT: Returns to SETUP menu saves changes.
F2 HELP: Information on use of display.
F3 ABORT: Returns to SETUP, abandons changes.
F4 OK: Accepts the parameter displayed.
 i.e Channel 6 = Spare channel
 Channel 7 = Spare channel

CONTINUAL MONITORING*



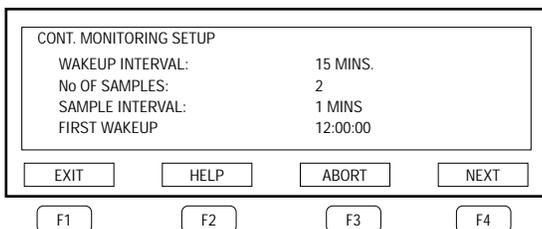
MAIN MENU

- Provides access to all other menus.
CURSOR KEYS: Move highlight to CONT. MONITORING.
ENTER KEY: Go to CONT. MONITORING menu.
FUNCTION KEY: F1 Selects HELP.



CONT. MONITORING MENU

- CURSOR KEYS:** Move highlight to SETUP
ENTER KEY: Go to CONT. MONITORING SETUP menu.
FUNCTION KEYS:
F1 EXIT: Returns to MAIN MENU.
F2 HELP: Displays help on highlighted option.
F3 GASES: Go to GAS READINGS display.



CONT. MONITORING SETUP

- CURSOR KEYS:** Changes highlighted selection.
ENTER KEY: Moves highlight.
FUNCTION KEYS:
F1 EXIT: Returns to CONT. MONITORING menu, saves changes.
F2 HELP: Displays help information.
F3 ABORT: Returns to CONT. MONITORING menu abandoning changes.
F4 NEXT: Next screen of parameters.

CONT. MONITORING	NO. OF LOG RECORDS	100
SETUP	OUTPUT TO PRINTER	
CLEAR LOG	OUTPUT TO RS232	
ENABLE MONITORING	ABORT OUTPUT	

Return to CONT. MONITORING menu (F1 or F3 from prev. display).

CONT. MONITORING MENU

- CURSOR KEYS:** Moves highlight.
- ENTER KEY:** Selects highlighted option.
- CLEAR LOG:** Clears log memory.
- ENABLE MONITORING:** Start continual monitoring.
- OUTPUT TO PRINTER:** Output log records from memory to local printer.
- OUTPUT TO RS232:** Output log records from memory to the serial port (as ASCII text).
- ABORT OUTPUT:** Stops output of log to printer/RS232.
- FUNCTION KEYS:**
- F1 EXIT:** Returns to MAIN MENU.
- F2 HELP:** Displays help on highlighted option.
- F3 GASES:** Go to GAS READINGS display.

DATA LOGGING

GAS READINGS	MANUAL CAL
RE-CALIBRATE	DATA LOG
DRAFT READING	CONT. MONITORING
SETUP	PURGE & PUMP OFF
DIAGNOSTICS	

MAIN MENU

- Provides access to all other menus.
- CURSOR KEYS:** Move highlight to DATA LOG.
- ENTER KEY:** Confirms selection.
- FUNCTION KEY:** F1 Selects HELP.

DATA LOG	NO. OF LOG RECORDS	100
LOG SETUP	OUTPUT TO PRINTER	
CLEAR LOG	OUTPUT TO RS232	
	ABORT OUTPUT	

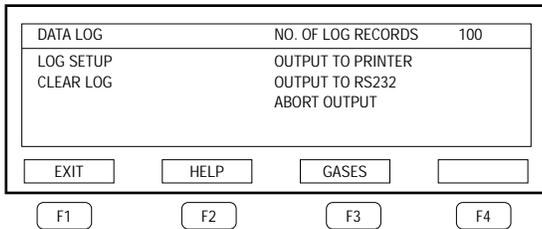
DATA LOG MENU

- CURSOR KEYS:** Move highlight to LOG SETUP.
- ENTER KEY:** Goes to LOG SETUP display.
- FUNCTION KEYS:**
- F1 EXIT:** Returns to MAIN MENU.
- F2 HELP:** Displays help on highlighted option.
- F3 GASES:** Go to GAS READINGS display.

DATA LOG SETUP	
LOG TYPE:	MANUAL
LOG TO:	MEMORY
LOG PERIOD:	10 MINS.
LOG INTERVAL:	10 SECS.

LOG SETUP

- CURSOR KEYS:** Changes highlighted selection.
- ENTER KEY:** Moves highlight.
- FUNCTION KEYS:**
- F1 EXIT:** Returns to DATA LOG menu, saves changes.
- F2 HELP:** Displays help information.
- F3 GASES:** Go to GAS READINGS display, saving changes.
- F4 ABORT:** Returns to DATA LOG menu, abandoning changes.

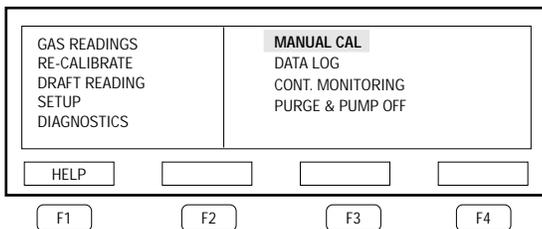


Return to DATA LOG menu (F1 or F4 from previous display).

DATA LOG MENU

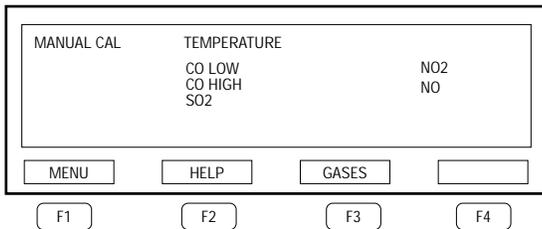
- CURSOR KEYS:** Moves highlight.
ENTER KEY: Selects highlighted option.
CLEAR LOG: Clears log memory.
OUTPUT TO PRINTER: Output log records from memory to local printer.
OUTPUT TO RS232: Output log records from memory to the serial port (as ASCII text)
ABORT OUTPUT: Stops output of log to printer/RS232.
FUNCTION KEYS:
F1 EXIT: Returns to MAIN MENU.
F2 HELP: Displays help on highlighted option.
F3 GASES: Go to GAS READINGS display.

MANUAL CALIBRATION AMBIENT TEMP CAL



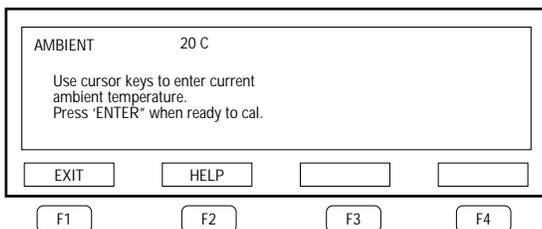
MAIN MENU

- Provides access to all other display menus.
CURSOR KEYS: Move to highlight MAN CAL.
ENTER KEY: Confirms selection.
FUNCTION KEY: F1 selects HELP.



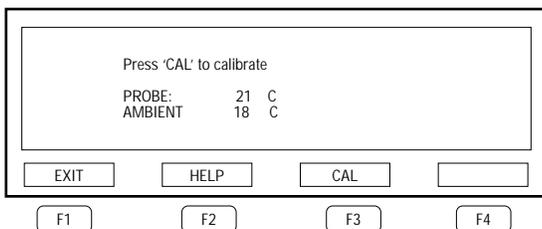
MANUAL CAL DISPLAY

- CURSOR KEYS:** Moves the cursor highlight.
ENTER: Selects the highlighted item.
FUNCTION KEYS:
F1 MENU: Returns to MAIN menu display.
F2 HELP: Information on currently highlighted item.
F3 GASES: Go to GAS READINGS display.



AMBIENT TEMPERATURE DISPLAY

- CURSOR KEYS:** Change ambient tempt. value.
ENTER: When ready to calibrate. Moves to next display.
FUNCTION KEYS:
F1 EXIT: Return to manual calibration.
F2 HELP: How to use display. Input ambient temperature value from an independent source.



AMBIENT TEMPERATURE DISPLAY

- CURSOR KEYS:** No function.
ENTER: No function.
FUNCTION KEYS:
F1 EXIT: Return to manual calibration.
F2 HELP: How to use display.
F3 CAL: Calibrate

NOTE: Calibration should not be necessary, as the instrument is factory adjusted.

MANUAL CALIBRATION (SPAN CAL)

See suggested calibration method on later page.

GAS READINGS RE-CALIBRATE DRAFT READING SETUP DIAGNOSTICS	MANUAL CAL DATA LOG CONT. MONITORING PURGE & PUMP OFF		
HELP			
F1	F2	F3	F4

MAIN MENU

Provides access to all other display menus.

CURSOR KEYS: Move to highlight MAN CAL

ENTER KEY: Confirms selection.

FUNCTION KEY: F1 selects HELP.

MANUAL CAL	TEMPERATURE		
	CO LOW	NO2	
	CO HIGH	NO	
	SO2		
MENU	HELP	GASES	
F1	F2	F3	F4

MANUAL CAL DISPLAY

CURSOR KEYS: Moves the cursor highlight.

ENTER: Selects the highlighted item.

FUNCTION KEYS:

F1 MENU: Returns to MAIN menu display.

F2 HELP: Information on highlighted item.

F3 GASES: Go to GAS READINGS display. From the displayed menu select the gas required by using the cursor keys and then press ENTER.

CAL GAS	1000 ppm		
Connect cal gas and use cursor keys to select the cal gas concentration. Press: 'ENTER' when ready to cal.			
EXIT	HELP		
F1	F2	F3	F4

CAL GAS CONCENTRATION DISPLAY

CURSOR KEYS: Change the gas conch. value.

ENTER: Ready to calibrate.

FUNCTION KEYS:

F1 EXIT: Return to manual calibration display.

F2 HELP: How to use the display. The Cal Gas display menu will show the last cal gas concentration used. Apply the calibration gas.

Press 'CAL' to calibrate			
CO LOW	792 ppm		
EXIT	HELP	CAL	
F1	F2	F3	F4

CAL GAS DISPLAY

CURSOR KEYS: No function.

ENTER: No function.

FUNCTION KEYS:

F1 EXIT: Return to manual calibration display.

F2 HELP: How to use the display.

F3 CAL: Calibrate Wait for the cal gas reading to stabilize then press the CAL key. The CAL key may be repeatedly pressed until the gas reading is correct. Use the EXIT key to return to the gas selection display and remove the calibration gas.



CAUTION: 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.

Select the gas type before connecting the calibration gas. This is to protect the low range CO sensor from high CO concentrations. The reading displayed is that of the cal gas based on the cal constant determined by the last calibration.

DIAGNOSTICS

GAS READINGS RE-CALIBRATE DRAFT READING SETUP DIAGNOSTICS	MANUAL CAL DATA LOG CONT. MONITORING PURGE & PUMP OFF		
HELP			
F1	F2	F3	F4

MAIN MENU

Provides access to all other display menus.

CURSOR KEYS: Move to highlight DIAGNOSTICS
ENTER KEY: Goes to DIAGNOSTICS menu.
FUNCTION KEY: F1 selects HELP.

DIAGNOSTICS			
CELL EMFS CELL ZEROS CELL LIFE	FILTER SYSTEM REPORT		
MENU	HELP	SETUP	GASES
F1	F2	F3	F4

DIAGNOSTICS MENU

CURSOR KEYS: Move highlight.
ENTER KEY: Confirms highlighted selection.
FUNCTION KEYS:-
F1 MENU: Returns to MAIN menu
F2 HELP: Information on item currently highlighted.
F3 SETUP: Returns to SETUP menu
F4 GASES: Go to GAS READINGS display.

CELL EMFS			
CO low CO high SP2	NO2 O2 NO		
MENU	HELP	EXIT	GASES
F1	F2	F3	F4

Display selected from DIAGNOSTICS menu

CELL EMFS DISPLAY

CURSOR KEYS: No function.
ENTER KEY: No function.
FUNCTION KEYS:-
F1 MENU: Returns to MAIN menu
F2 HELP: Information on display.
F3 EXIT: Returns to DIAGNOSTICS menu.
F4 GASES: Go to GAS READINGS display.

CELL ZEROS			
CO low CO high SO2	NO2 O2 NO		
MENU	HELP	EXIT	GASES
F1	F2	F3	F4

Display selected from DIAGNOSTICS menu

CELL ZEROS DISPLAY

CURSOR KEYS: No function.
ENTER KEY: No function.
FUNCTION KEYS:
F1 MENU: Returns to MAIN menu.
F2 HELP: Information on display.
F3 EXIT: Returns to DIAGNOSTICS menu.
F4 GASES: Go to GAS READINGS display.

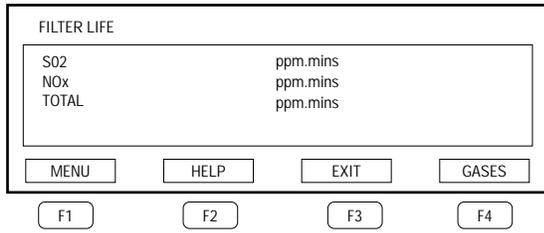
CELL LIFE	CO low 14721 CO high 1262 SO2 340 NO2 71 NO 136		
ppm.days			
MENU	HELP	EXIT	CLEAR
F1	F2	F3	F4

Display selected from DIAGNOSTICS menu

CELL LIFE DISPLAY

CURSOR KEYS: Moves cursor highlight.
ENTER KEY: No function.
FUNCTION KEYS:
F1 MENU: Returns to MAIN menu
F2 HELP: Information on display.
F3 EXIT: Returns to DIAGNOSTICS menu.
F4 CLEAR: Clears count currently highlighted.

NOTE: Further detail or interpretation of diagnostic parameters may be obtained from Fireeye Combustion technical services.



Display selected from DIAGNOSTICS menu

FILTER LIFE DISPLAY

CURSOR KEYS: No function.

ENTER KEY: No function.

FUNCTION KEYS:-

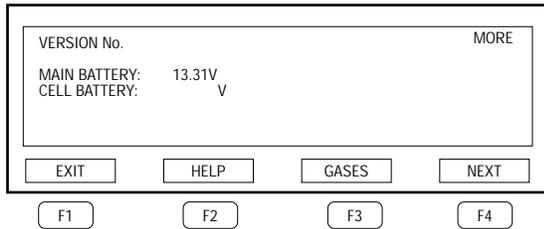
F1 MENU: Returns to MAIN menu.

F2 HELP: Information on display.

F3 EXIT: Returns to DIAGNOSTICS menu.

F4 GASES: Go to GAS READINGS display.

Display selected from DIAGNOSTICS menu



SYSTEM (report) DISPLAY (Screen 1)

CURSOR KEYS: No function.

ENTER KEY: No function.

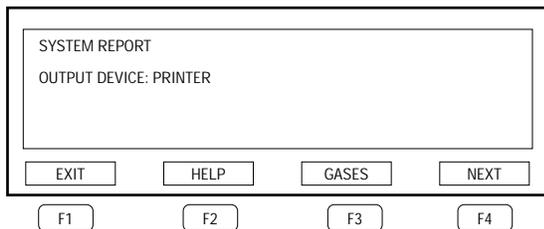
FUNCTION KEYS:-

F1 EXIT: Returns to previous menu

F2 HELP: Information on display.

F3 GASES: Go to GAS READINGS display.

F4 NEXT: Display more system data or fault messages.



Display selected from DIAGNOSTICS menu

REPORT DISPLAY

CURSOR KEYS: Changes output device.

ENTER KEY: No function.

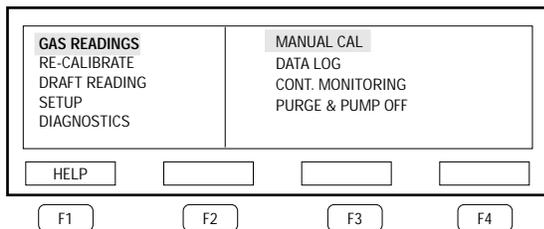
FUNCTION KEYS:-

F1 EXIT: Returns to DIAGNOSTICS menu.

F2 HELP: Information on display.

F3 GASES: Go to GAS READINGS display.

F4 REPORT: Initiates a full system report to selected device. (Mainly for Service Engineers use).



MAIN MENU

Provides access to all other display menus.

CURSOR KEYS: Moves highlight to Draft READING.

ENTER KEY: Confirms selection.

FUNCTION KEY: F1 selects HELP.

Draft DISPLAY*

CURSOR KEYS: No function.

ENTER: No function.

FUNCTION KEYS:-

F1 MENU: Return to main menu.

F2 HELP: Information on display.

F3 GASES: Go to GAS READINGS display.

Main menu

Provides access to all other display menus.

CURSOR KEYS: Select GAS READING.

ENTER KEY: Confirms selection.

FUNCTION KEY: F1 selects HELP.



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

DRY	ENTER : NEXT SCREEN		
CO	ppm	O ₂	%
SO ₂	ppm	NO	ppm
NO ₂	ppm	PROBE TEMP.	120C
MENU	HELP	PRINT	LOG
F1	F2	F3	F4

GAS READINGS DISPLAY (2 Screens)

CURSOR KEYS: No function.
ENTER: Toggles between screen 1 & screen 2.
FUNCTION KEYS:-
F1 MENU: Returns to MAIN menu.
F2 HELP: Information on use of keys.
F3 ZOOM: Enter ZOOM display.
F3 PRINT: Produce a hard copy on local printer.
F4 LOG: Logs the current readings.

WET	O ₂ NORM 0	ENTER : NEXT SCREEN	
AMBIENT	ppm	FUEL EFF%	
NO _x	ppm	LOSS%	
CO ₂	%	EXCESS AIR%	
MENU	HELP	ZOOM	
F1	F2	F3	F4

NOTE: WET/DRY reading is indicated if selected. O₂ NORM ON if O₂ normalization is selected.

EXCESS AIR	5.2%		
LOSS	3.7%		
EXIT	HELP	EXIT	
F1	F2	F3	F4

ZOOM DISPLAY

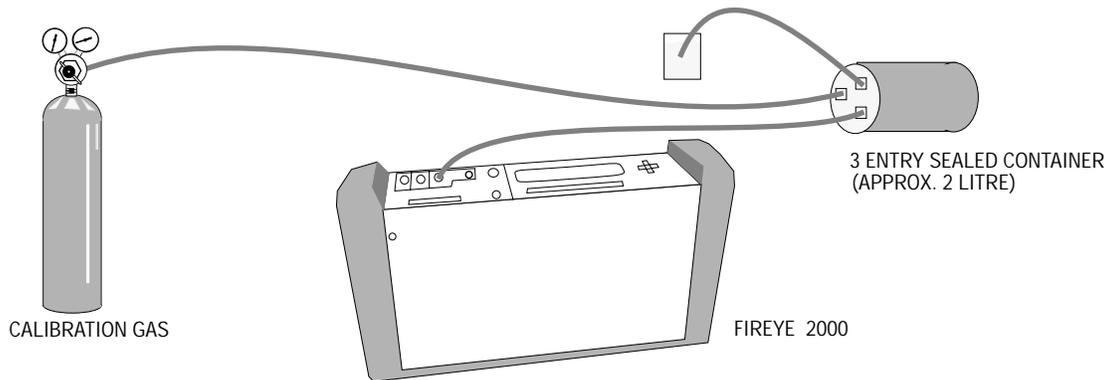
CURSOR KEYS:
UP Changes top parameter
DOWN Changes bottom
LEFT/RIGHT No function.
ENTER: No function.
FUNCTION KEYS:
F1 MENU: Return to MAIN menu.
F2 HELP: Information on use of keys.
F3 EXIT: Returns to GAS READINGS display.

GAS READINGS	MANUAL CAL		
RE-CALIBRATE	DATA LOG		
DRAFT READING	CONT. MONITORING		
SETUP	PURGE & PUMP OFF		
DIAGNOSTICS			
HELP			
F1	F2	F3	F4

MAIN MENU

Provides access to all other display menus.
CURSOR KEYS: Select PURGE & PUMP OFF.
ENTER KEY: Confirms selection-purges system.
FUNCTION KEY: F1 selects HELP as highlighted menu option.

SUGGESTED METHOD FOR SPAN CALIBRATION



The above arrangement allows a sufficient reservoir of gas to accommodate the requirements of the Firetron 2000 pump. The bubbler or beaker of water indicates that there is a gentle flow and the reservoir is being purged with the calibration gas at all times.



WARNING: The water trap must be fitted into the gas line. Failure to do this or empty the water trap when full may damage the instrument. All necessary safety precautions should be taken when handling gases.

Fireye accepts no responsibility for damage to the instrument, or injury to the person while following procedures.

GAS SAMPLING

Loosen the support cone on the probe to allow free movement.

The probe should be inserted in to the ducts 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.

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 affect the continuous operation. High concentrations in 10,000 ppms will quickly saturate the sensors.

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. Air leakage will cause errors in gas readings.

MAINTENANCE

The instrument normally requires little maintenance, if it is used as described in this 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.

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

FILTER CLEANING AND REPLACEMENT

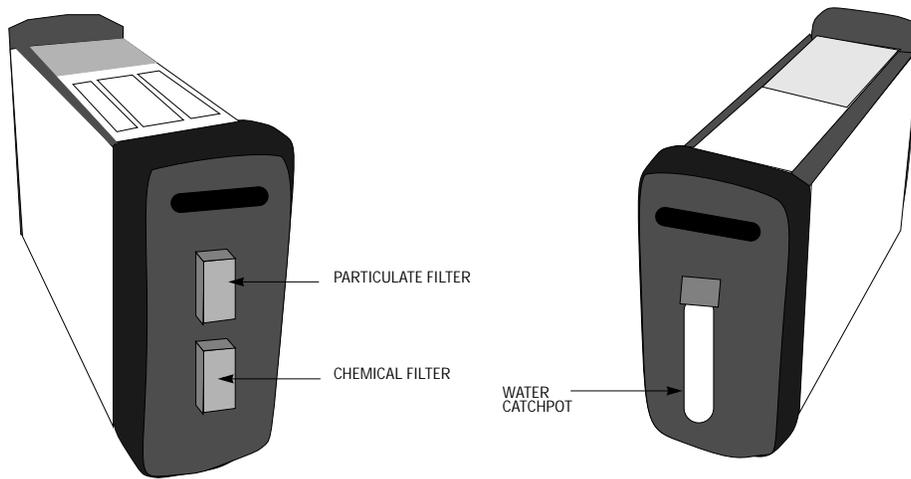
The primary or 1st filter on the tip of the probe may be unscrewed and carefully cleaned periodically with a wire brush.

The **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.

The **chemical filter** will require changing when it has been subjected to 120,000 ppm x minutes of NOx & SO2 concentration, as displayed on the SYSTEM menu. The filter will normally turn a whitish color when the need to change occurs. To replace the chemical filter:

1. Unclip and remove old filter; replace with new filter
2. Reset the filter count in the SETUP >SYSTEM menu.

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, Particulate filter, chemical filter and water catchpot.



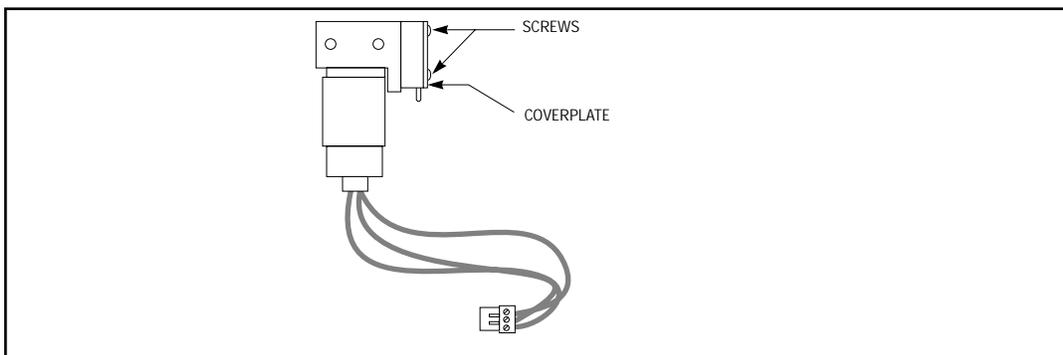
PUMP SERVICING

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. 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.

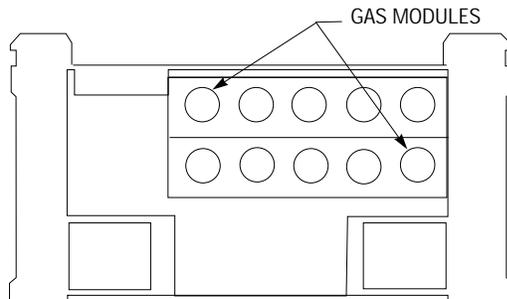
FIGURE 3.

PUMP



CHANGING 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. (Spare calibrated sensors may be quickly substituted). The oxygen sensor is a bayonet fitting. Replacement is made by simply unplugging the old sensor and replacing with a new one. All other gas sensors are replaced by removing the 3 retaining screws, removing the old sensor and replacing with a new pre-calibrated one - securing with the same 3 screws and replacing the back panel.

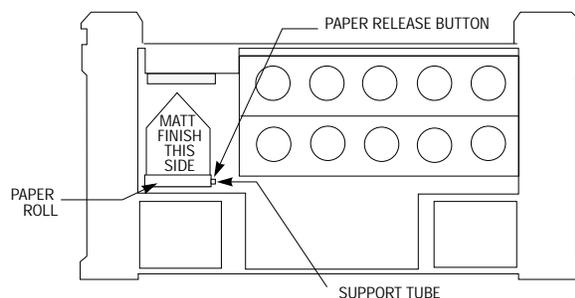


CHANGING PRINTER PAPER ROLL

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 aperture.

1. Remove the old printer roll from the support tube by depressing the paper release button.
2. Place a new roll of thermal paper on the paper support tube as shown.
3. Prepare the leading edge by cutting it to a 'V' shape.
4. Feed this into the slot in the side of the printer.
5. Press the printer button on the display panel until the paper appears at the exit slot on the display panel.

Replace the side panel and secure.



FUSE REPLACEMENT

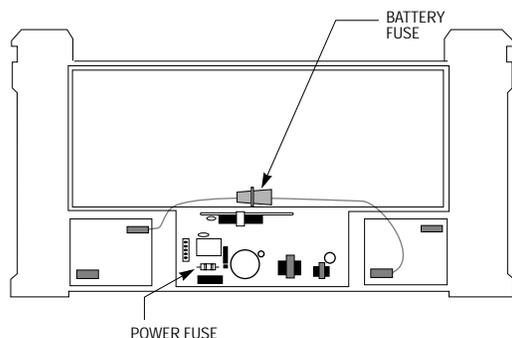
Ensure the power supply is completely isolated before proceeding.

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.

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

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 power supply.



DISPLAYED FAULTS

Faults are indicated when the front panel fault LED is illuminated. Fault detail can be accessed via **DIAGNOSTICS** on the main menu.

NON-VOLATILE SYSTEM FAULTS: These faults remain logged following a power down. They are only cleared through manually operating the **SETUP-SYSTEM-CLEAR FAULTS** option. Both the fault LED and fault message will remain on until manually cleared.

MESSAGE	"Error writing to non-volatile memory"
DESCRIPTION	There was an error when attempting to write to the EEPROM device. This may result in a parameter change not being made correctly.
CAUSE	Possible EEPROM device failure.
ACTION	Report the fault and return instrument to Fireye.

MESSAGE	"Invalid parameter"
DESCRIPTION	The system failed to locate one of the system parameters. This may result in garbled information appearing on the display.
CAUSE	Possible memory corruption.
ACTION	Clear the flags by operating the SETUP -SYSTEM-CLEAR FAULTS option. If the fault re-occurs then report the problem.

VOLATILE SYSTEM FAULTS: These faults and fault LED are cleared after a power down. They may also be cleared manually through the **SETUP-SYSTEM-CLEAR FAULTS** option.

MESSAGE	"ADC fault"
DESCRIPTION	The on-board ADC device failed to complete a conversion.
CAUSE	Possible device failure/rail voltage failure.
ACTION	Report the fault to Fireye COMBUSTION.
MESSAGE	"CO low overrange"
DESCRIPTION	The CO low sensor was disabled following measurement of a high concentration of CO gas.
CAUSE	High concentration of CO gas.
ACTION	The sensor may be re-enabled from the SETUP-SYSTEMLOW RANGE CO SENSOR option, but will always shut off automatically if the condition persists.



MESSAGE	"Printer buffer overrun"
DESCRIPTION	The printer data buffer was overrun. Information would be lost on the printout.
CAUSE	The printer buffer was sent more data than it could handle.
ACTION	Report the problem if it occurs repeatedly.
DISPLAYED FAULTS	
VOLATILE SYSTEM FAULTS:	These faults and fault LED are cleared after a power down. They may also be cleared manually through the SETUP-SYSTEM-CLEAR FAULTS option.

MESSAGE	"Zero O ₂ reading following re-cal"
DESCRIPTION	The oxygen sensor reads zero following a re-calibration. This affects any calculated values such as CO ₂ and excess air. Gives erroneous O ₂ readings.
CAUSE	A possible sensor failure.
ACTION	Try another re-cal. Report the fault if persistent.

MESSAGE	"Main battery low"
DESCRIPTION	The main battery voltage is less than 11.5v.
CAUSE	Battery or charging failure.
ACTION	Re-charge battery if this fails replace battery.

MESSAGE	"No Message." Display remains completely blank when instrument is switched on.
DESCRIPTION	Instrument will not operate from main power supply and battery will not re-charge.
CAUSE	Battery completely discharged and appears not to re-charge.
ACTION	Check that main fuse in voltage selector socket is intact. Replace if necessary. Recharge instrument battery with mains input switch on and front panel switch off.
DISPLAYED FAULTS	
VOLATILE SYSTEM FAULTS:	These faults and fault LED are cleared after a power down. They may also be cleared manually through the SETUP-SYSTEM-CLEAR FAULTS option.

MESSAGE	"Probe not fitted"
DESCRIPTION	If the ambient temperature probe is lower than a temperature of -20° C / -6° F then it is assumed that the ambient temp. probe is not fitted to the instrument.
CAUSE	Probe not fitted. Temperature sensor failed.
ACTION	Fit the probe. Report the fault.



MESSAGE	"Filter change recommended"
DESCRIPTION:	The Chemical (3rd) filter has probably reached the end of its useful life. A filter change is recommended.
	<i>Note: When a new filter is fitted the filter ppm counts must be cleared by the SETUP-SYSTEM-FILTER COUNTS option.</i>
CAUSE	The filter count limit has been reached.
ACTION	Replace the chemical filter, and clear the filter ppm counts.

MESSAGE	"Checksum Error"
DESCRIPTION	Error in PROM data detected
CAUSE	Data corruption: Prom failure
ACTION	If the message appears on power up contact Fireeye Combustion

APPENDIX

Modem Communications for remote configuration.

The principal aim of the remote configuration system for Firetron 2000 is to allow the existing P.C. hosted configuration program to run remotely from the instrument it is configuring. In this way, then configuration changes and elementary diagnostics that would normally be performed on the test bench can be performed at a remote site.

System requirements

The P.C. must be equipped with a Hayes compatible modem connected to its COM1: serial port (see Fig.1 for connection details). It must be running the Firetron 2000 monitor software version 1.08 or later.

The Firetron 2000 must be equipped with a serial port, connected to a Hayes compatible modem. (See Fig. 1 for connection details). The Firetron 2000 must be fitted with version 2.0 or later of its software.

This allows Firetron 2000 configuration and elementary diagnostics (as currently performed on the test bench) to be performed over the phone line, from the office to a Firetron 2000 on site anywhere in the world.

Communication

1. **Operation.** The modem must be correctly connected to the telephone line and the Firetron 2000, 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 version 2.xx of the Firetron 2000 software, simply by switching on the modem before the instrument: version 2.xx software sends out a Hayes compatible 'auto-answer' command when it is powered up.

2. **PC/monitor Operation.** 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 Firetron 2000 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.



Functions available

The functions available over the modem link are all of those currently available in the Firetron 2000 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.

RECOMMENDED SPARES

Spare Parts	Part Number
Sinter Filter for Probe	702.182
Gas Pre-Filter (Particle filter)	703.144
CO Compensation Filter (Chemical filter)	703.145
Thermal Paper Roll	405.109
Nylon Hose Connector	317.109
O-Ring for Pistol Grip	319.211
Replacement Detectors	
O ₂ Cell	703.083
CO Cell	703.130
NO Cell	702.160
SO ₂ Cell	703.135
CxHx Cell	703.213
Other Spares	
300mm Probe Pipe	702.141
1.0M Probe Pipe	702.205
1.5M Probe Pipe	702.206
3.0M Probe Pipe	702.207
Pistol Grip/Hose Assembly 3M	703.128
Pistol Grip/Hose Assembly 10M	703.163
Sampling Pump	703.164
Rechargeable Battery	403.415



NOTICE

When Fireeye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireeye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireeye products and not to any other equipment or to the combined system or its overall performance.

WARRANTIES

FIREYE guarantees for one year from the date of manufacture of its products to replace, or, at its option, to repair any product or part thereof (except lamps, electronic tubes and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireeye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireeye be liable for consequential or special damages of any nature which may arise in connection with such product or part.



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