



Fireye® 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."



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.

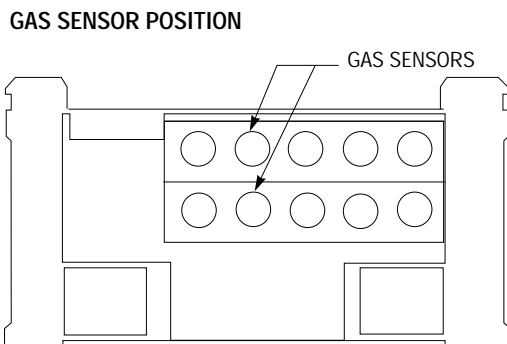
Chemical Filter. (P/N 703.145). The 3rd filter (chemical filter) is situated at the side of the 2nd filter and also plugs into the side of the instrument. This is a disposable filter that reduces the SO₂ and NO_x cross interference with the CO measurements. The instrument is programmed to estimate and 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.



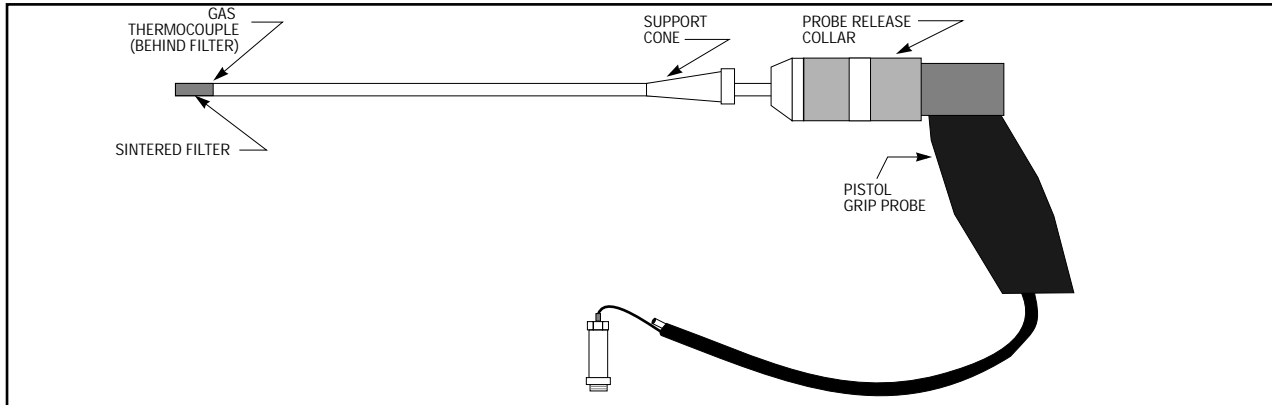
Gas Sensors are accessed by unscrewing the 2 retaining screws on the pack panel. Sensors are precalibrated and simple to replace. See the Maintenance section for more details on changing gas sensors.

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 Fireeye 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.



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.

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.