



**FTIR**

**Gas Analysis**

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# MultiGas™ 2030 HS

## 5 Hz COMBUSTION ANALYSIS

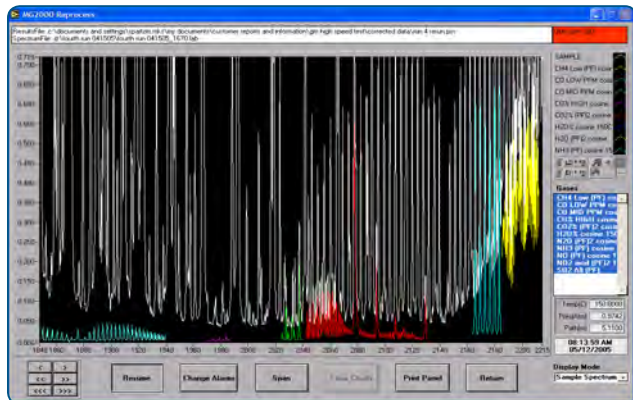
The MultiGas™ 2030 HS is a high resolution FTIR based gas analyzer designed to monitor automobile, diesel and catalyst combustion exhaust at 5 Hz sampling frequencies. The analyzer is designed to allow gas flows up to an exceeding 100 L/min with no back pressure or acoustic gas cell noise generated that could degrade the quantitative measurement. Twenty plus (20+) gases can be quantified simultaneously at this frequency without any reporting delays. Samples containing up to 30% absolute water content can be monitored without chillers by maintaining the gas temperature and appropriate particulate filtration. Detection limits of 1 ppm or less are achievable with this analyzer by using higher sensitivity and narrower range MCT detectors. The system comes calibrated for 1 atm gas pressures at both 150°C and 191°C (for diesel applications).

The MultiGas 2030 HS analyzer is composed of a high speed 0.5 cm<sup>-1</sup> process hardened FTIR spectrometer. The spectrometer is coupled to a patented 5.11 m high-optical-throughput 200 mL gas sampling cell with ½ inch plumbing to reduce backpressure and allow for higher flows. The analyzer generally incorporates a high sensitivity liquid nitrogen cooled MCT that can maintain cryogenic temperatures for up to 12 hours on a single charge. The system is delivered complete with easy to use software and health diagnostics, calibration, installation and training.

### Features & Benefits

- 5 Hz monitoring of combustion species
  - Greater emissions knowledge
- Single analyzer to measure traditional and non-traditional emissions
  - Reduced equipment requirements and cost
  - Reduced maintenance
  - Reduced cost of ownership
  - Expandable to new or future emission components
- High resolution FTIR spectrometer, 0.5 cm<sup>-1</sup>
  - Reduced spectral interferences of critical analytes due to water and CO<sub>2</sub>
  - Greater calibration linearity
- 200 mL – 5.11 m gas cell
  - Reduced volume produces faster response time
  - Longer path lengths produce lower detection limits
- Calibrated @ 1.0 atm for 150°C and 191°C
  - Drift-free calibration
  - Configured for both diesel and automotive emissions
- Complete diagnostics
  - Analyzer health diagnostics to trouble shoot hardware problems
  - Calibration diagnostics to prevent calibration drift
- High speed computer supplied
  - Factory configured software and calibration
  - Reduced probability of timing glitches due to high frequency analysis
  - Up and running on first day of installation
- Numerous communication protocols
  - Connectivity to current customer systems





A section of the mid-IR combustion gas spectrum (white) is shown above along with quantification regions (in color and below the sample) for some species. CO is monitored in three regions to allow for measurements from low ppm to %.

Designed specifically for process and environmental monitoring, the 2102 Process FTIR Spectrometer is compact and rugged. Capable of operating at spectral resolutions up to  $0.5\text{ cm}^{-1}$ , it is the fastest, most sensitive and stable process FTIR available. In addition, it can operate in hostile environments with a high degree of immunity to vibration and temperature changes. An advanced, high-speed data processing system is standard, and provides low-noise infrared spectra for analysis.



2102 Process FTIR Spectrometer

This spectrometer is coupled to a patented low volume (200 mL) multi-pass gas cell with a 5.11 meter effective pathlength. The patented design of this cell incorporates aspheric, aberration-correcting mirrors which provide more than twice the optical throughput of a conventional multi-pass gas cell. The gas cell can be set and main-tained at any temperature up to  $191^{\circ}\text{C}$ . Normally it is operated at  $150^{\circ}\text{C}$  or  $191^{\circ}\text{C}$  for combustion applications.

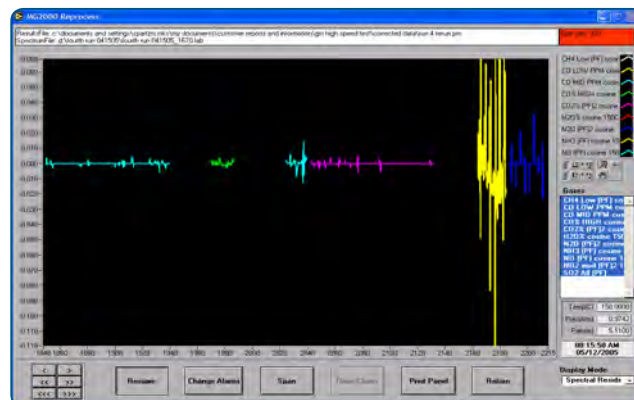


The 5.11m pathlength, 200 mL volume, long path gas cell measures  $8\text{-}1/2'' \times 2'' \times 3\text{-}1/2''$ , and uses a patented aberration correcting optics for maximum sensitivity.

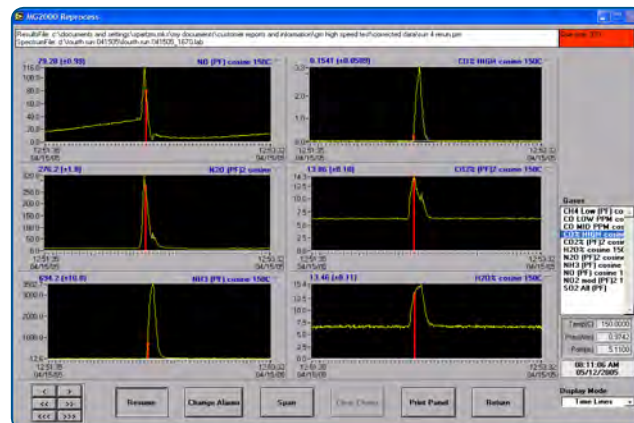
## Spectral Analysis

The MultiGas analyzer features robust quantitative analysis software, which can analyze and report concentrations for dozens of compounds simultaneously. The software, which is installed on a high speed computer, performs automatic corrections for gas temperature and pressure variations, which are measured directly by the analyzer. Samples can be acquired and analyzed in less than 0.2 seconds, making transient analysis possible.

During data collection the MultiGas software continuously acquires and processes spectra while computing the concentrations of the gases that are selected in the setup. Display formats include concentration histories in graphical and tabular formats, the measured spectrum and spectral residuals. The residual spectrum can be utilized to visually determine error in the analysis, making QA/QC checking easy and straight forward to accomplish. The spectral residuals represent the "left-over" spectral information once all the reference spectra have been accounted for. Once spectra have been collected and saved, these spectra may be reprocessed at any time using the same or different calibration sets.



Each residual spectrum above (different color) shows the quantification region for that compound. Ideally the residual spectrum should be close to the noise level of the analyzer. At high concentrations, as in the low CO quantification region (in yellow) shows a high residual, the residual should be 1% of the sample peak height or less for accurate measurements.

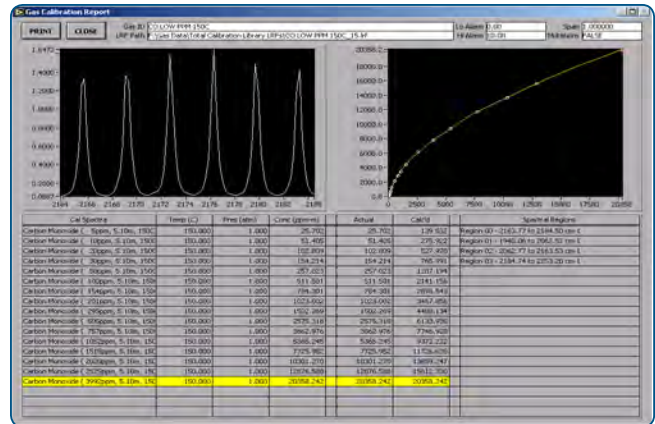


Above are timelines of combustion gases during a 2 minute low NOx trap cycle. Note: the different rise times for each component, demonstrating the high speed nature of the analyzer.



## Instrument Independent Calibration

The MultiGas software features multi-point calibration curves that provide a dynamic range up to 9 orders of magnitude (ppb to 100%). Calibrations for many species are provided with the instrument, and additional calibrations can be generated by the user from gases of known concentration. Utilities in the MultiGas software verify the performance of each instrument, which allows a calibration generated on one MultiGas to be used on any other MultiGas without alteration.



Graphical User Interface for Calibration

## Specifications

### Analyzer

Measurement Technique	FTIR Spectrometry
Gases and Vapors Measurable	Most molecules except for N <sub>2</sub> , H <sub>2</sub> , and O <sub>2</sub>
Ranges	Concentration setting between 100ppb and 100% full scale
FTIR	2102 Process FTIR
Spectral Resolution	0.5 – 128cm <sup>-1</sup>
Scan Speed	5 scans/sec @ 0.5cm <sup>-1</sup>
Scan Time	0.2 sec or longer
Infrared Source	Silicon Carbide @ 1200°C
Reference Laser	Helium Neon (15798.2cm <sup>-1</sup> )
Detector	LN <sub>2</sub> -cooled MCT; TE-cooled MCT
Purge Pressure	20 psig (1.5 bar) max.
Spectrometer Purge Flow	0.2 L/min of dry nitrogen or CO <sub>2</sub> free clean dry air with dewpoints below -70°C
Optics Purge Flow	0.2 L/min of dry nitrogen or CO <sub>2</sub> free clean dry air with dewpoints below -70°C
Pressure Transducer	MKS Baratron®
Purge Connection	Swagelok® quick connect
Computer	High speed Xeon™ processor supplied with analyzer
Communications	RJ-45 cross-over Ethernet
Output Options	XML, analog, AK, others (please inquire)
Dimensions	17.5"W x 12.5"H x 25.5"D
Installation	19" rack mount chassis
Power	120 or 240 VAC, 50/60 Hz, 3 amps
Weight	110 lbs. (50 kg)



## Specifications (continued)

### Sampling Parameters

Sample Temperature	Ambient to 200°C (calibration temperature dependant)
Sample Flow	1 - 100+ L/min
Sample Pressure	0.0 – 1.3 atm (calibration pressure dependent) 0.95 - 1.05 atm (nominal)

### Gas Cell

Construction	Nickel coated Al; Welded 316 stainless steel optional
Fittings	½" Swagelok®
Tubing	Heated ½" stainless steel
Mirrors	Nickel plated aluminum substrate, with rugged gold coating
Windows	KBr; CaF <sub>2</sub> (others available)
O-rings	Viton® (others available)

### Detection Limits

Low-level detection limits for the 5.11 meter gas cell and a mercury-cadmium-telluride (MCT) detector at 0.5 cm<sup>-1</sup> resolution for typical gases in the absence of interfering species are as follows:

Name	Formula	Lowest Detectable Limit with 20/20™ Cell and 0.2 sec Measurement
Ammonia	NH <sub>3</sub>	0.5ppm
Carbon Dioxide	CO <sub>2</sub>	0.2ppm
Carbon Monoxide	CO	1.0ppm
Formaldehyde	H <sub>2</sub> CO	0.6ppm
Methane	CH <sub>4</sub>	1.0ppm
Nitrogen Dioxide	NO <sub>2</sub>	0.5ppm
Nitric Oxide	NO	1.0ppm
Sulfur Dioxide	SO <sub>2</sub>	1.0ppm
Xylenes	C <sub>8</sub> H <sub>10</sub>	1.0ppm

## Ordering Information

Please contact your local MKS office for price and availability information.



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