IRGAS FieldView for measuring HCs in Natural Gas

IRGAS SYSTEM

CIC Photonics, Inc. is dedicated to providing today's growing industries with the highest sensitivity and fastest time response instrumentation. Our analyzers are used worldwide in a variety of different arenas, and although CIC Photonics has a set of core systems, we pride ourselves on truly meeting the needs of our customers by adapting the core analyzers to their specifications.

Our IRGAS Long Path Gas Analyzer incorporates a rugged FTIR spectrometer with a stainless steel 4m to 6m, or a 9.6m gas cell. This combination produces an analyzer that can handle some of the most demanding applications, while still providing high energy thru puts of 36-48 %. The IRGAS Long Path Gas Analyzer is ideal for applications requiring limits of detection in the ppm level to 5 ppb, and has rapid gas exchange due to its low internal volume.

Included with the IRGAS Long Path Gas Analyzer is CIC Photonics patented SPGAS analytical software package. This package does everything from concentration tracking and hardware managing allowing the user to recalculate previously collected data within minutes.

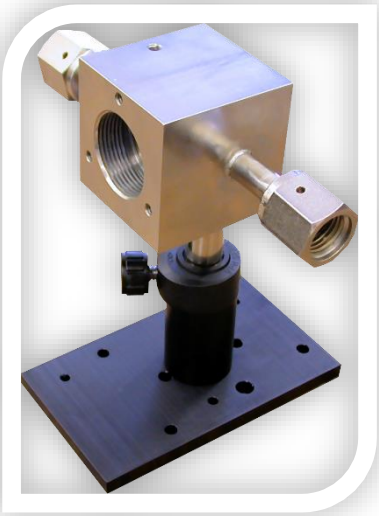
The software package includes the following software: IRGAS 100 or IRGAS 100 with SpectraStream, QMax, Configuration Manager, and Reprocessing Tool. These programs provide a unique solution to analytical problems. All of the programs are extremely user friendly so that the programs can be operated by anyone regardless of skill level.

The IRGAS 100 software provides real-time monitoring of species concentration, while also having the capabilities to control various hardware components within the system. Some of the hardware components that can be managed by the software are valves, pressure transducers, temperature controllers, etc....

CIC Photonics has more than 15 years of experience in the gas analysis market, and 10 years of experience with our IRGAS systems as a solution to the needs of our customers.

The robustness, small foot-print and high level of performance of our equipment, together with our software makes them ideal for production or laboratories environments.

2CM SCOUT GAS CELL



APPLICATIONS

- Petrochemical Composition
- Semiconductor Gases
- Combustion Analysis
- Impurity Analysis
- Toxic and corrosive gases
- Process stream measurements
- Vacuum and high pressure environments
- Batch or flow samples
- Concentrations of pph(%) to ppm

STANDARD SPECIFICATIONS

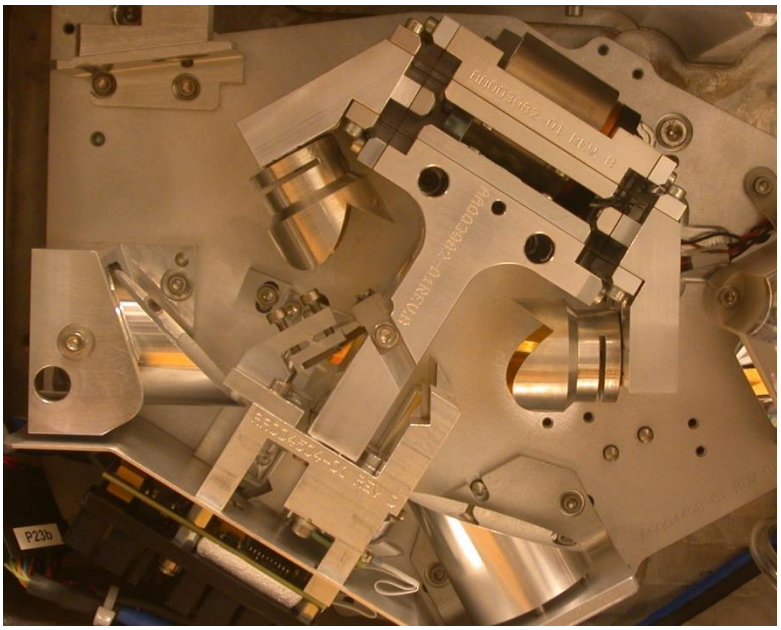
- Low volume for fast gas exchange - 6 ml volume for at 2cm pathlength.
- 316L stainless steel body with nickel plating for durability, high pressure loadings, wide chemical compatibility, simplified cleaning and effective heating. Available also in Hastelloy.
- 7090 Kalrez™ O-rings for chemical resistance and temperature considerations
- AgBr, KBr, CaF2, ZnSe, quartz, or sapphire window materials for UV-VIS and NIR applications
- Integral stainless steel VCR fittings
- Evacuable and pressurizable: 10-6 Torr to 150 psig. Leak rate < 1.0x10-8 cc/sec of Helium
- Heatable to 300° C with heating mantle, tape, or dual bands

ENHANCED MB3000 INTERFEROMETER

As a standard, the MB3000 comes with a DTGS detector and a 24bits ADC. The ADC module is an integral part of the detector module, and the instrument's rugged aluminum case provides an additional layer of protection against electromagnetic interference. The state of the art electronics, and careful design, allows the system to provide a Maximum Signal to Noise RMS of 50,000:1.

Key items are:

- Maintenance Free
- Non-hygroscopic optics
- IR-Source: 10 year average lifetime
- 24bit ADC
- Maximum Signal to Noise RMS: 50,000: 1 or better. (Ultimate 250,000: 1).
- Frequency Repeatability of 0.001cm^{-1} at 1918cm^{-1}
- Frequency Accuracy of 0.01cm^{-1} at 1918cm^{-1}
- High-throughput double pivot Michelson, fully jacketed interferometer
- VCSEL solid state laser is fully self calibrating and ensures better wavelength accuracy with precise results. 20 years lifetime average
- A permanently aligned optical system
- Rugged and durable modules



24BIT ADC AND EASY INTERCHANGEABLE DETECTOR MODULE

The 24bit ADC of the MB3000 is an integral component of the detector's PCB board. The conversion from analog to digital is performed directly within the same board. This greatly reduces the possibility of internal electromagnetic interference and noise to be added to the analog signal before conversion. The whole spectrometer and its compartments are encased into a rugged aluminum enclosure.

Once the analog signal has been converted, the digital values are then transmitted digitally to the spectrometer control board. The detector's electronic board and the spectrometer's electronic control board are physically separated by different compartments.

This allow the instrument to achieve with a DTGS detector a maximum signal to noise RMS of 50,000: 1 or better. (Ultimate 250,000: 1 with a more sensitive detector)

IRGAS FIELDVIEW FOR HYDROCARBON MEASURMENTS IN NATURAL GAS

The combination of the IRGAS software and the high sensitivity hardware, in conjunction with the 2cm Scout high energy throughput makes the IRGAS system for HC Composition analysis.

The low volume of the sampling cell (Only 6 sccm) makes it ideal for fast analysis. A T90 gas exchange is achieve with only 3 volume exchanges.

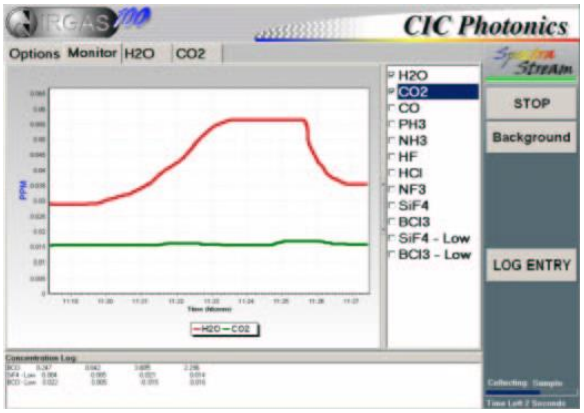
The quantification analysis result are provided every 5 seconds.

The system calibration is set to work an internal pressure just slightly above atmospheric pressure, and the sensitivity of the system is independent of the flow rate.

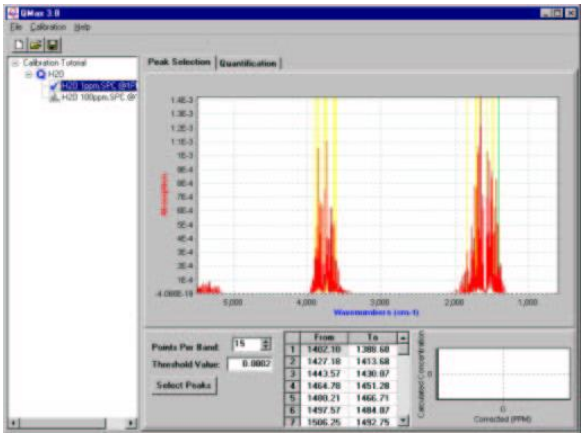
A flow rate between 50 sccm to 250 sccm is advisable. A flow rate of 250 sccm will allow a T90 volume exchange every 5 seconds.

SPGAS SOFTWARE SUIT,

IRGAS100 with SpectraStream allows the user to view changes in species concentrations within seconds of the changes happening through the program's Fast Concentration Tracker by decreasing the response time that is typically associated with FTIR. A concentration estimation is reported with each scan of the instrument.



The system calibrations are generated in the QMax program which permits the user to easily generate calibrations and/or add new species to preexisting

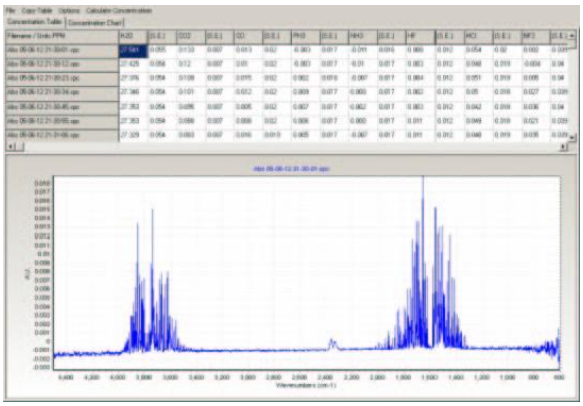


calibrations. In addition to creating new calibrations, QMax can be used to apply correction factors to current calibrations.

Its exclusive Weighted Multi-Band Analysis provides greater discrimination against false positives, improved precision, and greater sensitivity.

The IRGAS Configuration Manager is a program that contains all of the information regarding the system in one central location. In the Configuration Manager the user can find various parameters for the system that can be altered to needs.

Our most recent program added to the software package is the Quantification Reprocessing Tool. This program allows the user to recalculate data that had been previously collected. Instead of having to recollect data for temperature and pressure changes, a user can enter the new parameters in the Quantification Reprocessing Tool and the program will recalculate the data with the new parameters. As well as recalculating new parameters it can reprocess using new calibration files that have more or less species being quantified. The Quantification Reprocessing Tool can also be used to determine the accuracy of a calibration file and help to determine the correction factor needed for calibrations. Collected spectra can also be displayed and viewed sequentially in the Quantification Reprocessing Tool, allowing the viewer to see slight changes in the spectra.



IRGAS ESTIMATED LOD'S (SIGMA-3)

2cm Scout Gas Cell

Compound	Range (%v)	LOD (ppmv)
Methane	0-100%	97
Ethane	0-20%	165
Ethylene	0-5%	7
Propane	0-5%	125
Propylene	0-1%	30
Butane	0-5%	155
Isobutane	0-5%	27
1-Butene	0-1%	43
2-Butene	0-1%	57
Isobutene	0-1%	11
Pentane	0-1%	233
IsoPentane	0-1%	120
Cyclopentane	0-1%	31
Hexane	0-1%	204
1-Hexene	0-1%	32
H2O	0-0.1%	10
CO2	0-2%	4

LOD's in PPM based on 16 scans, 50 Deg C, standard atmospheric pressure, and a DTGS detector.

The precision of the estimation is estimated to be better than 0.5% of the reading, or the LOD for the compound, whichever is greater.

SYSTEM ESPECIFICATIONS

MEASUREMENT TECHNIQUE: Fourier Transform Infrared Spectroscopy
DETECTOR TYPE: DTGS
BEAM SPLITTER: Non-Hygroscopic ZnSe
MEASURABLE SPECTRAL RANGE: 6000 to 600 cm^{-1}
ADC (ANALOG DIGITAL CONVERTER): 24 Bits ADC Integrated into detector module for low noise and electromagnetic radiation interference
MAXIMUM SIGNAL TO NOISE RMS: 50,000:1
SPECTROMETER MAINTENANCE: Maintenance Free
INTERFEROMETER: High-throughput double pivot Michelson, fully jacket
FREQUENCY REPEATABILITY: 0:001cm^{-1} at 1918cm^{-1}
FREQUENCY ACCURACY: 0.01cm^{-1} at 1918cm^{-1}
LASER: VCSEL solid state laser for fully self calibration and better wavelength accuracy with precise results (20 years lifetime average)
OPTICAL ALIGNMENT: Permanent aligned optical system, with rugged and durable modules
RANGE: low ppm to % levels
SOFTWARE: SPGAS Software Suite for continuous collection and quantification analysis. Spectral records compatible with Galactic SPC file format.
QUANTIFICATION ANALYSIS TECHNIQUE: Weighted Multi-Band Analysis
NUMBER OF COMPONENTS: Unlimited
THERMALLY STABLE SAMPLE GAS TEMPERATURE: Gas cell plenum area preheats gas before it enters the gas cell compartment (4Runner gas cell only)
GAS CELL EFFICIENCY: 100% Energy throughput w/o windows
GAS CELL WETTED PARTS: 316L SS Body, and Kalrez o-rings
RESPONSE TIME:

- 5 seconds scan time at 8cm-1
- Gas Exchange Flowrate dependent.
- 3 gas volume exchanges for T90

SYSTEM PRECISION: < +/- 1% FS with Temperature and Pressure correction factor module
SYSTEM ACCURACY: Span gas calibration source dependent

SYSTEM OPERATING TEMPERATURE (SPECTROMETER): 5-30°C
GAS CELL OPERATIONAL TEMPERATURE: Up to 300ºC.
DIMENSIONS: ≅ 17 in (W) x 14 in (D) x 17 in (H)
WEIGHT: ≅ 60lbs (Depends on components)
POWER: 120/240 VAC, 50/60 Hz, 800 Watts Max.
COMPUTER REQUIREMENTS:
PC with AMD or Intel Processor with recommended amount of memory per operating system
Microsoft Windows XP/Vista/Windows 7
20GB of free disk space for spectral record and Quantification Log storage
COMMUNICATION: Ethernet, MODBUS
WARRANTY: 2 years on system, and 3 months on optical components (Windows).