

## FIXED GAS ANALYZER (FGA)

Productivity remains the primary goal of most work environments. Utilizing a gas chromatographic system capable of performing multiple analyses on a series of samples without hardware changes or modifications between runs helps meet that goal. The Multi-Purpose Gas Analyzer (MPGA) from Lotus Consulting is designed to perform six different measurements on the same sample – either concurrently or sequentially. With the standard 16-position automated sampler, these measurements can be switched during the sampling sequence to suit the requirements for each sample.

The analyzer is kept fully busy by loading samples with different analytical needs. The appropriate valving is activated, the proper column is selected, the correct detector is turned on and optimized, and full calibrations and control checks are performed for any of the six available methodologies – all automatically.

The system is based on the Varian 3800 Gas Chromatograph and takes advantage of virtual every feature available on the instrument. Three detectors are installed and fully operational at all times. Valves are mounted



valves. Three electronic flow controllers and two detector electronic flow controllers are included. All seven thermal zones set temperatures for columns, valves, catalysts and detectors. Additional digital flow controllers and pressure regulators provide extra flows. And three external temperature controllers provide for heated sample lines and other thermal zones. The oxidation catalyst is located within its own oven mounted on the instrument's side.

The automated sampler is controlled through special software with the Varian Star Workstation. The sample position is user-specified in the Star SampleList with each sample line. The order is not mandated; samples can be examined in any order and even repeated later in the sequence. The sampling position is documented in the Star MessageLog and can be listed through a Star Custom Report along with the final results.



in three separate valve ovens. All seven external events are employed to activate



Built-in measurements include:

**CLASSICAL NATURAL GAS (C<sub>1</sub>-C<sub>5</sub>, C<sub>6+</sub>)** –

Following GPA methodology, the sample is injected into a valve/column scheme that performs a column sequence reversal with backflush to elute the C<sub>6+</sub> composite as a single peak prior to elution of C<sub>1</sub> through nC<sub>5</sub>.

**FULL SPECIATION OF NATURAL GAS** –

For full speciation of the C<sub>6+</sub> peak, the same sample can be injected into a capillary column outfitted with a splitter (to reduce the injection volume for optimum capillary chromatography).

**NON-METHANE ORGANIC CARBON (NMOC)** –

Adapted from EPA Method 25, all organics including propane and heavier are back-flushed off the column set and oxidized to CO<sub>2</sub> with a catalyst and then reduced to CH<sub>4</sub> with another catalyst. The total carbon count is accurately measured with an FID.

**FIXED GASES** –

The valve/column configuration properly separates Hydrogen, Oxygen, Nitrogen, Carbon Monoxide and Carbon Dioxide. Detection is performed with a Pulsed Discharge Detector.

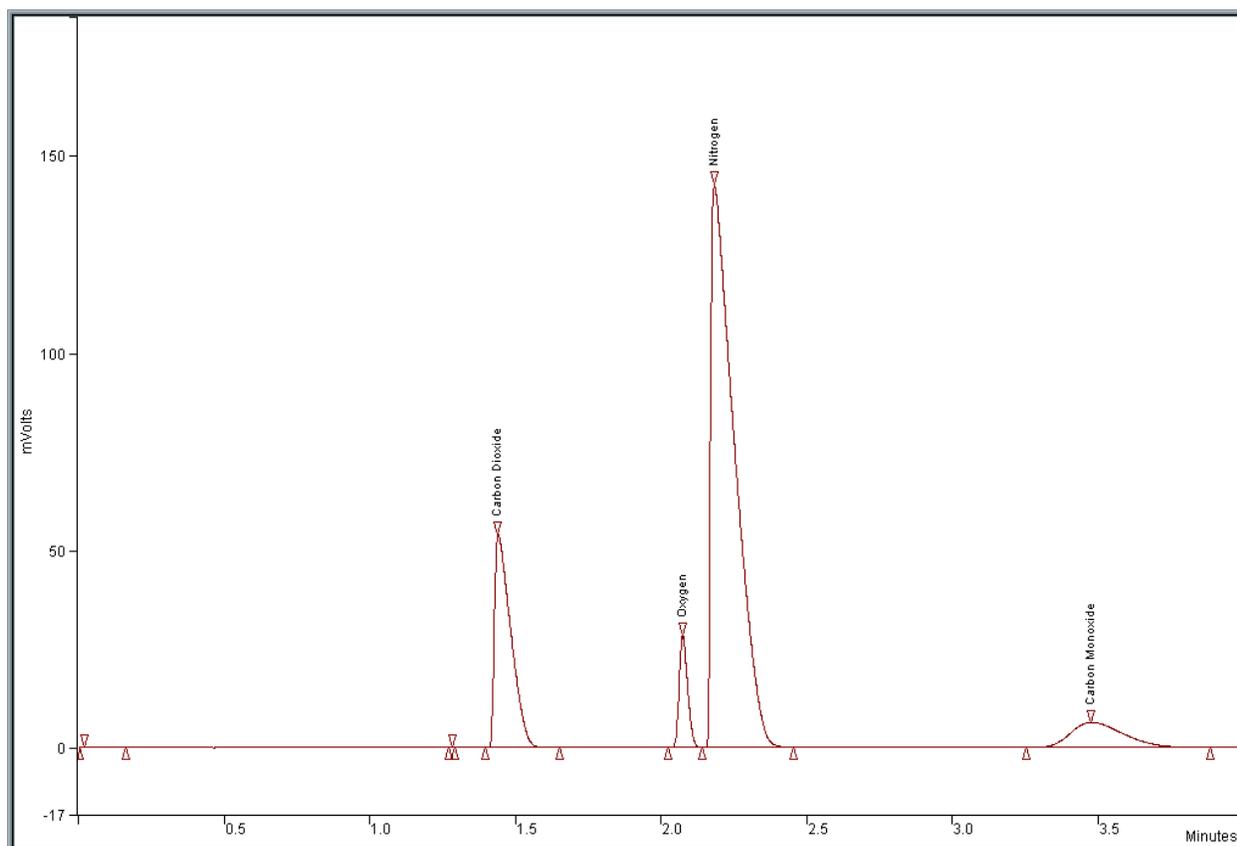
**C<sub>2</sub>S** –

Ethane, Ethene and Ethyne are separated with a custom valve/column setup. Results can be mathematically added to the NMOC for total Non-Methane.

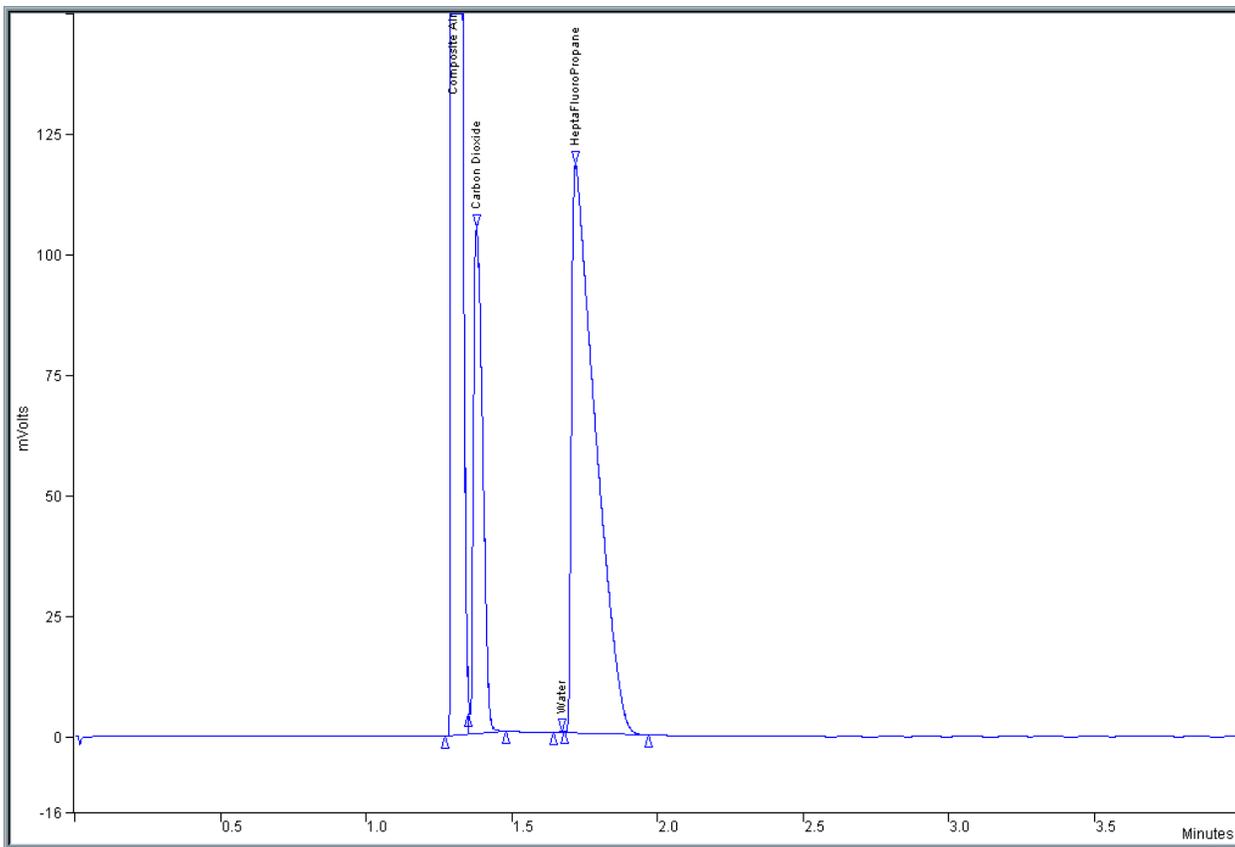
**TOTAL HYDROCARBONS** –

Injecting a sample loop directly to an FID generates a composite peak that represents the total hydrocarbon content of a sample.

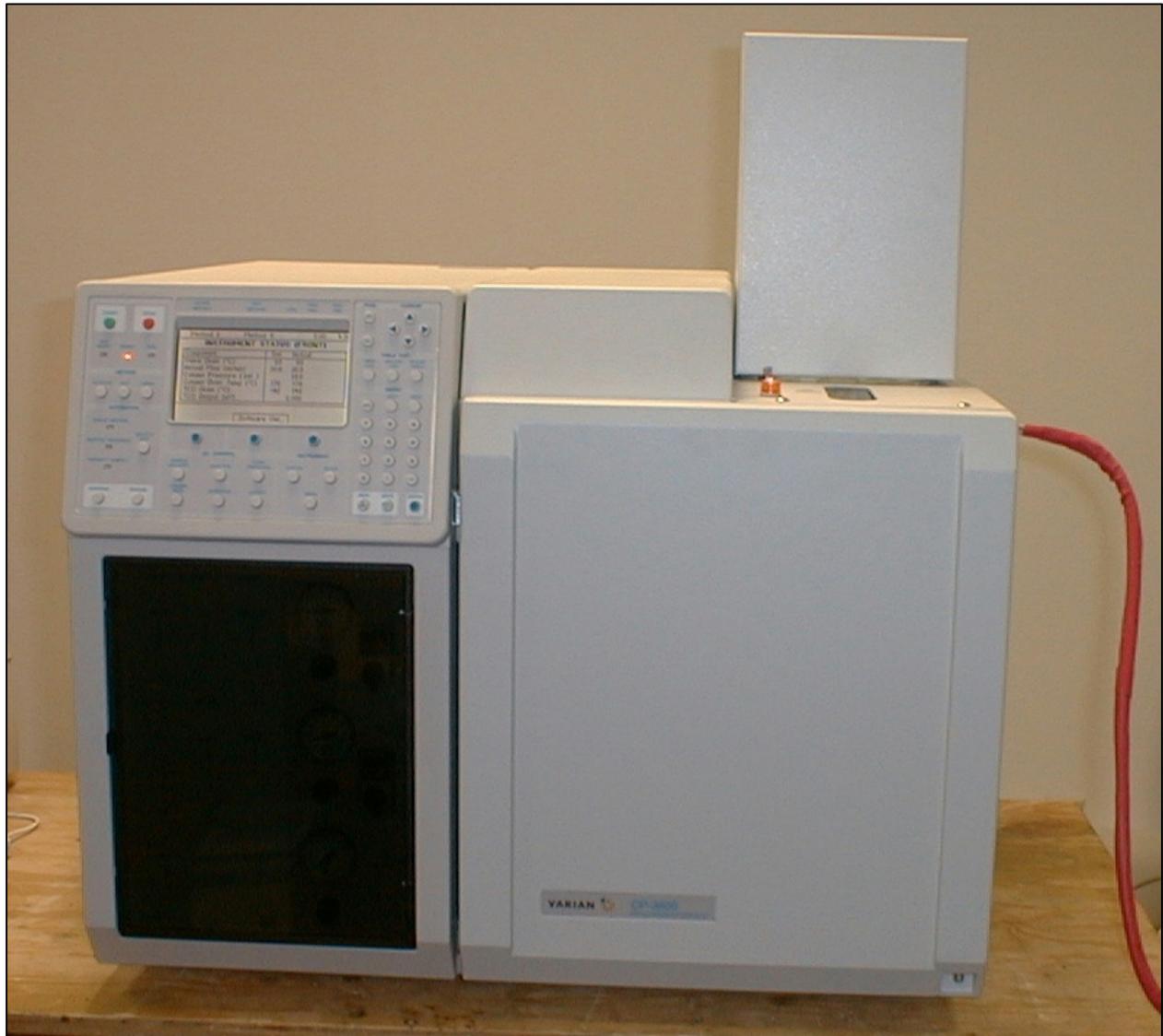
**Chromatogram of Natural Gas Sample with Pulsed Discharge Detector.** Column temperature 110 °C; injection volume – 6 µl; pulsed discharge detector detuned.



**Figure 2. Chromatogram of Carbon Dioxide, Oxygen, Nitrogen and Carbon Monoxide.** Column temperature: 60 °C; injection volume: 1 ml. Hayesep N and Molecular Sieve columns are plumbed in series/bypass with Hayesep N backflushed to vent. Baseline is not subtracted.



**Figure 3. Chromatogram of Carbon Dioxide, Water and HeptaFluoroPropane.** Column temperature: 170 °C; injection volume: 1 ml. Hayesep S plumbed in backflush-to-vent configuration. Baseline is not subtracted.

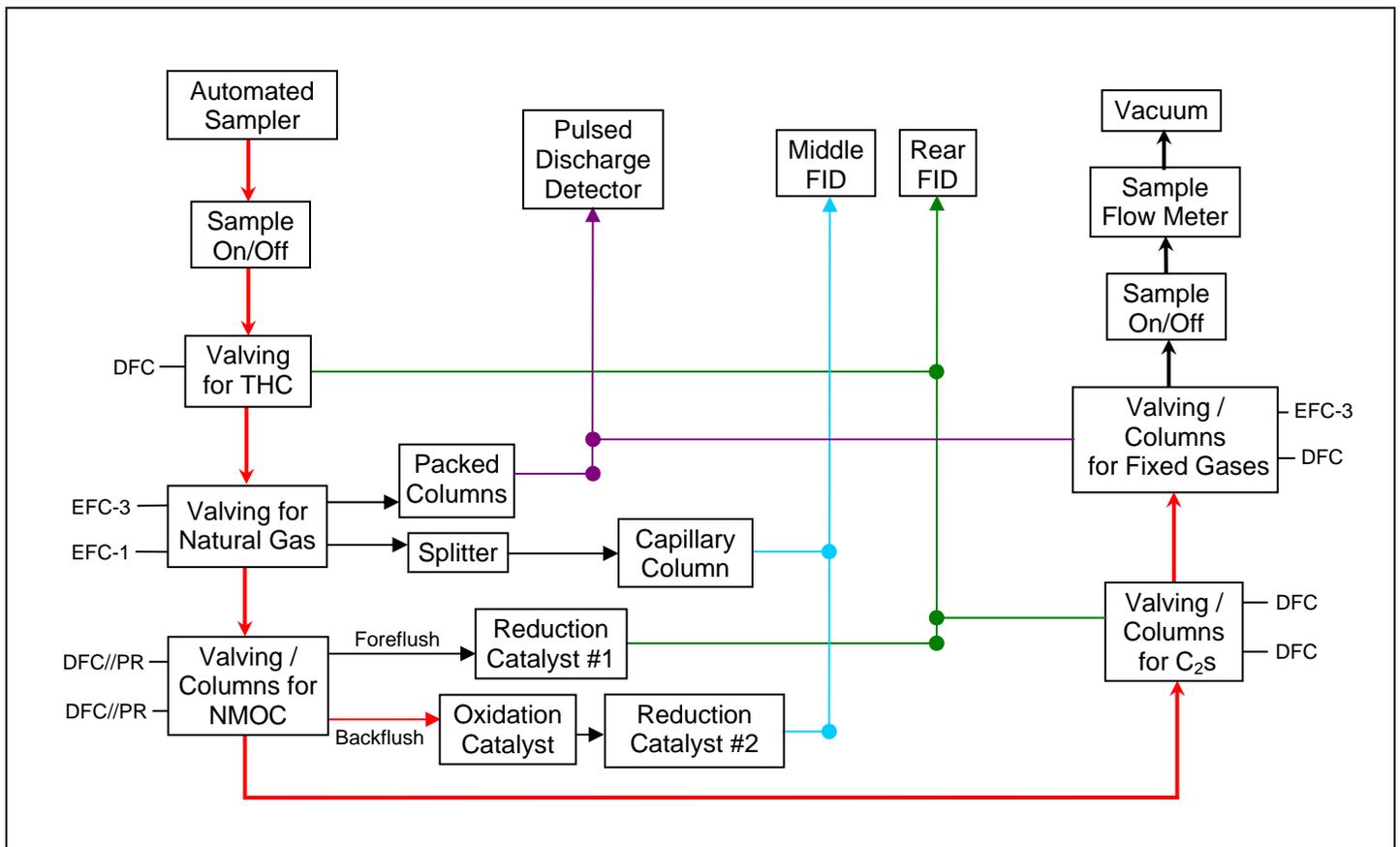


INTEGRATION STATUS @ 10:01:11

Peak	Area	Height	Width	Retention Time
1	100000	10000	100	10.000
2	200000	20000	200	10.100
3	300000	30000	300	10.200
4	400000	40000	400	10.300
5	500000	50000	500	10.400

VARIAN CP-3000

View of detector compartment with cover removed. Pulsed Discharge Detector is in front with the two Flame Ionization Detectors mounted on a common detector oven. The dual Reduction Catalysts are inside the oven in rear of picture.



# Specifications

## Fixed Gases (O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO, H<sub>2</sub>)

Injection volume – 1 ml

Detection Limit – O<sub>2</sub>, N<sub>2</sub>, , CO<sub>2</sub>, CO, CH<sub>4</sub> – <50 ppm V/V

- H<sub>2</sub> - < 300 ppm V/V

Linear Range – detection limit to 100% V/V

## Fluorocarbons

Injection volume – 1 ml

Detection Limit – typically < 50 ppm V/V

Linear Range – detection limit to 100% V/V

## Miscellaneous:

Detectors – Thermal Conductivity Detector, 2 each. TCDs operate in a constant mean temperature mode with filament protection. Available ranges include 5, 0.5 and 0.05.

Carrier Gas Flows – Primary column flows are controlled with Electronic Flow Controllers Type 3 with Pressure Regulators plumbed in parallel. Flows for backflush to vent are set with Digital Flow Controllers. Column pressures for primary flows are displayed on gauges visible from front of instrument.

Detector Gases Controls –Detector Electronic Flow Controller is employed for both detectors' reference flow. The “make-up” flow is used with the front Thermal Conductivity Detector's reference.

Sample Introduction – Tedlar™ bag, pressurized canister all standard and fully operational with no hardware changes; Multi-position Automated Sampler (up to 96 positions) with micro-electric actuation and control through Star Workstation optional.

Valving – All valves are high performance, low volume design by Valco Instruments and all valves involved in chromatography are heated.

Valve Actuation – All valves utilized in routine operation are fully automated under timed control of the gas chromatograph with micro-electric actuation.

Temperature Probes – All temperature zones within the gas chromatograph monitored with self-calibrating Platinum Probes and controlled with Fully Proportional Heating.

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