



Hydrocarbons, VOCs, benzene, 1,3 BD, VC, ETO, H<sub>2</sub>, CO, CO<sub>2</sub>, fixed gases, O<sub>2</sub>, H<sub>2</sub>S, Dimethyl sulfate, DMS, Methylene chloride, Freons...

## PROCESS GCs

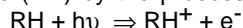
### Introduction

The **Model 301-C PGCs** are flexible and versatile Analyzers that are in their fourth generation. These Models are, by far, the most powerful and versatile (with their embedded Pentium PCs) developed by us since 1985.

The addition of these new Analyzers greatly improves the capability and range of Process Analyzers from PID.

### PID-Description

The process of photoionization is initiated by the absorption of a photon of ultraviolet radiation energetic enough to ionize a molecule (RH) by the process shown below:



where  $h\nu$  represents a photon with an energy  $\geq$  the ionization potential of species RH. The ions are collected in an ionization chamber which is adjacent to the lamp and contains an accelerating electrode (biased positively) and a collection electrode where the current is measured. After amplification, the current measured is proportional to concentration. The response measured will be a summation (total) of the hydrocarbons ionized.

### FID Description

In the FID, the sample is burned in a hydrogen-air flame and the ions formed from carbon containing compounds are collected by applying a positive potential to the jet and measuring the current at collection electrode just above the flame. After amplification, the current measured is proportional to concentration. The response measured will be a summation (total) of the hydrocarbons ionized.

### TCD Description

Measures difference between the thermal transfer characteristics of the sample gas and a reference gas, generally helium. The sample and reference filaments are two legs of a Wheatstone Bridge. A constant current is applied with a resultant in a rise in filament temperature. As the sample passes through the detector, the resistance changes as the reference gas is replaced by the sample which has a lower thermal conductivity. The resistance is proportional to the concentration.

### Applications: PID, FID, ECD, TCD, FPD

Monitoring effluents from chemical pharmaceutical manufacturing, carbon beds (Gasoline, CI HC)  
Leak detection- from process equipment  
Stack & Vent monitoring  
Drying ovens for removing solvents  
Incineration  
BTX, VC, ETO, freons, solvents in ambient, waste site or plant atmospheres  
Remediation site monitoring  
Oil and gas exploration  
Sulfur cpds in air or stacks  
Odorants in natural gas  
Natural gas composition  
VOC's in water with optional Sparging system (Model 650)

### Features-

**Embedded Pentium Computer** with color VGA display, Microsoft Windows XP Professional & PeakWorks Chromatography Software

**Wide Range of Universal to Specific Detectors** Universal: TCD, FUV; Selective: PID, FID, Specific: FPD (S or P), ECD

**Automatic Restart-** In the event of a power outage

**Automatic calibration;** automatically adjusts response on timed frequency;

**Autozero** each run

**Wide operating range-** 16 Bit ADC with 3 decades of autoranging

**Compact** 19" Rack- NEMA 2 enclosure (301B only) & Wall Mount NEMA 4 enclosure

**PID- lamp out alarm; FID/FPD-flame out- shuts off hydrogen and provides alarm, TCD carrier out**

**RS232 digital output; 0-1 VDC analog output**

Data storage on 40 GByte hard drive

Output Signals- RS232, RS485, MODBUS...

## PROCESS GCs

### Specifications

**Detectors available:** PID, TCD, FID, FUV, ECD, FPD (S, P)

**Measurement mode:** Continuous  
**Zero drift-** Automatic Zero compensation; <1% per month

**Span drift-** Auto cal each 24 hours (remotely with contact closure): less than 1% every 24 hours

**Wide range of response-** from sub ppm on PID to % on the FID or TCD

**Support gases:** FID & FPD require  $\text{H}_2$  and zero air

**Readout-** Color VGA display

**Standard output:** 1 VDC, RS232

**Enclosures:** Rack (NEMA 2)

19" W x 11"H x 17"D

Weight: 32 pounds

Wall (NEMA 4)- 301C

23"W x 30"H x 17"D

Weight: 80 pounds-301C

Weight: 140 pounds (2 x NEMA 4 enclosures)-

Power requirements- 100-240VAC, 1.5 /0.75 amp

### Detector Range/Species

**PID range** - ppb-ppm; ppm- %; sub ppb with optional concentrator

hydrocarbons > C4 plus, VOC's, inorganic species such as  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{I}_2$ ,  $\text{PH}_3$ ,  $\text{AsH}_3$ , etc.

**FID Range-** 1- 200,000 ppm

measures hydrocarbons only

**TCD Range-** ppm to 100%-Fixed gases,  $\text{H}_2$ , inorganic gases & hydrocarbons

**FPD Range-** ppb-ppm- S cpds; P cpds ppb-ppm

**ECD Range-** sub ppb to ppm, Cl HC, nitro cpds

**FUV Range-** ppb to %- Organic & inorganic cpds, Fixed gases

### Options

Gas or liquid sampling systems

4-20 mA output; RS485 output, 10/100 network card,

See Table I

Data acquisition and storage using **PeakWorks C-** runs under Windows or Windows NT on a Remote Pentium PC

**2, 4, 8, 12 point sequencers for 301B; 2, 8, 16, 32 point sequencers for 501-B-**(with contact closure to indicate point being sampled, Display of Concentration, Sampling Point & Sample Flow (measured by mass flowmeter-501B only)

**Mass flow sensor** for column flow for 501B; optional for 301B

**Applications Engineering:** Dual columns, column switching valves, concentrator

**X or Z purged** for Zone 1 and Zone 2 respectively- requires NEMA enclosure

### Sampling Systems

A variety of sampling systems are available for the 301B and 501B including the following:

- Removal of particulate
- Removal of water
- Electrically heated sampling lines
- Steam traced sampling lines
- Heat exchangers for hot samples

A typical sampling system is shown below:



# Comparison of Model 301C Process GC & Typical Installations

Table I  
Comparison of Model 301C Process GCs

|                             | Model 301B  | Model 501B              |
|-----------------------------|-------------|-------------------------|
| Enclosures                  |             |                         |
| 19" Rack                    | Yes         | No                      |
| NEMA 4                      | Yes         | Yes                     |
| Separate enclosure for oven | No          | Yes (optional)          |
| Second oven                 | No          | Optional                |
| Purged enclosures (X or Z)  | Optional    | Optional                |
| Multipoint Sequences        | 2, 4, 8, 12 | 2, 8, 16, 32            |
| Sampling point programming  | Optional    | Included                |
| Programmable Equilibrate    | Optional    | Included                |
| Additional valve relay      | Optional    | Included                |
| Sample ahead                | Optional    | Included                |
| Mass flowmeter-sample       | Optional    | Included                |
| Mass flowmeter- carrier     | Optional    | Included                |
| Pentium PC                  | Yes         | Yes                     |
| VGA Display                 | Yes         | Yes                     |
| Operating System            | Windows XP  | Windows XP Professional |
| Chromatography Data         | PeakWorks   | PeakWorks               |
| PeakWorks C SW              | Option      | Included                |
| MODBUS                      | Option      | Included                |
| RS232                       | Included    | Included                |
| 0-1 VDC                     | Included    | Included                |
| 4-20 mA                     | Optional    | Optional                |

## Definitions

**MODBUS**- communications protocol that allows external PC or PLC to request data

**PeakWorks**- Windows based chromatography data & analyzer control software

**PeakWorks C**-Communications software run on a remote PC (through the RS232 port) that displays and stores data remotely

**Sample ahead**-sampling for the next point starts as soon as sample is injected- faster sampling times

**Sample point programming**-Instead of sample points being 1,2,3... they can be customer programmed to 1,1,5,9,1...

**Additional valve relay**- more complex analyses can be run



301C installed at a natural gas odorant facility for measuring THT & TBM on-line.



Model 301 C (above) in instrumentation housing at a Chlorine plant measuring  $H_2$ ,  $O_2$ ,  $N_2$  &  $CO_2$ . TCD with hastelloy valves & fittings. The Analyzer and oven (lower enclosure) are purged to keep corrosive atmosphere from Analyzer.



Sampling system for wet chlorine (above) has teflon valves and multipoint. sampling system is heated to prevent condensation. The sampling system valves are controlled by air actuated valves in the 301C.



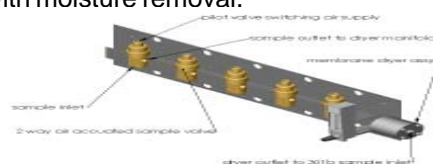
Model 301C (Above) mounted downstream of a waste incinerator measuring  $H_2S$  &  $CH_3SH$  at ppb levels via PID.



Sampling system for moisture removal and measurement of S cpds at ppb levels.



Explosion proof (Z purge) 301C (above) with external air activated multi (5) point system with moisture removal.



# MODEL 650 SPARGING OPTION FOR MODEL 301C SPECIATED VOC'S IN WATER

## INTRODUCTION

The measurement of low concentrations of organics in water can be accomplished through the application of Henry's Law which states that, at equilibrium, the solubility of a gas in a liquid is proportional to the partial pressure of a gas in contact with a liquid as given below:

$$\text{Benzene (aq)} = K P_{\text{Benzene}}$$

where Benzene (aq) is the concentration of benzene in the liquid phase, K is the Henry's Law constant which governs the solubility of gases in water, and  $P_{\text{Benzene}}$  is the partial pressure of benzene in the gas phase.

As a result of the above equation, it can be seen that if the concentration of benzene in the gas phase and at equilibrium is measured, this is related to the concentration of benzene in the dilute aqueous solution by a proportionality constant (K) that can be determined by calibration.

This method can be used with Total VOC Analyzers such as the 201s to provide Total VOCs in water. The Sparger can also be used with GCs such as the Model 301 or 501 to provide speciated VOCs in water. A summary is shown below.

|                 | 201-<br>FID  | 201-<br>PID          | 301<br>GC     | 501<br>GC     |
|-----------------|--------------|----------------------|---------------|---------------|
| Total VOC's     | X            | X                    |               | X             |
| Speciated VOC's |              |                      | X             | X             |
| Range           | Sub<br>ppm-% | High<br>ppb-low<br>% | Sub ppb-<br>% | Sub ppb-<br>% |

## FEATURES

### Sparging System Applies Henry's Law

VOC's in water are converted to the gas phase in the Model 650 and measured by a Process GC Analyzer

#### -Detectors

PID, FID, ECD, FPD (S or P)

#### - Range

From 0.1 ppb (detection limit) to high ppm

#### -Measure Specific VOC's in Water from ppb Levels

VOC's are measured with the Model 301-B or 501 B

#### -Range

From 0.1 ppb (PID) or 5 ppb (FID) to high ppm

#### -Fast Response

Sparging System response is < 1 minute

#### -Easy to Setup and Maintain

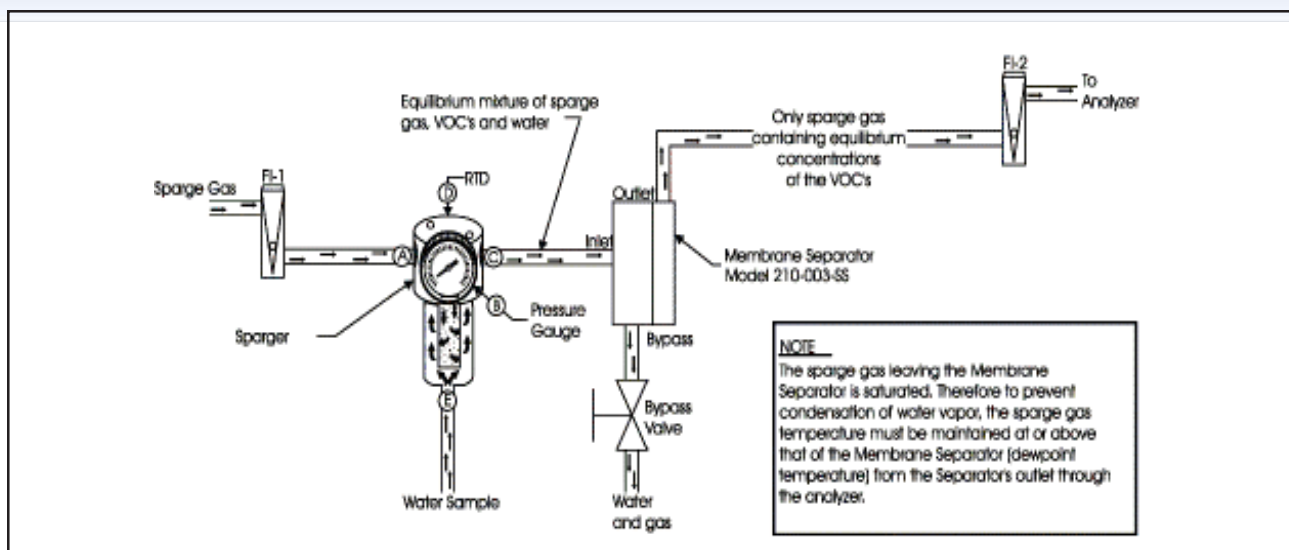
Auto calibration, simplicity of design and internal diagnostics make this analyzer ideal even for those with minimal instrumentation skills

## APPLICATIONS

- Clean water compliance
- Rapid spill detection
- Monitoring cooling water
- Monitoring process input water
- Leaks from process equipment
- Effluent from chemical, refining & manufacturing

# SPARGER (Continued)

□



## SPECIFICATIONS

**Species measured:** PID or FID- specific VOC's (hydrocarbons) in water (including chlorinated HC) in water

**Electrical classification:** General purpose (see below for options)

**Response time:** 1 min. to 90% response (system only); GC 1-5 min depending on application

**Liquid sample flow rate:** 250 cc/min.

**Reproducibility:** +/- 5%

**Sparging gas flow:** 1 LPM

**Zero drift:** <2% over 24 hours

**Span drift:** <3% over 24 hours

**Range:** ppb to ppm

**Detection Limit:**

301-B/501 B- <0.1 ppb- PID; < 5 ppb FID

Power requirements: 100V- 240VAC

Dimensions:

Wall- 20"W x 50"H x 16"D

Weight: 75 pounds

Power consumption: 220 watts max.

## OPTIONS

Speciated VOC's (301-C)

- 19" Enclosed rack version of the 301-B
- NEMA 4 Wall mounted unit (301-B or 501-B)
- Z purged unit meets class I division II NEC requirements-wall mount only
  - X purged unit meets class I division I NEC requirements-wall mount only
  - 4-20 ma output
  - **Multipoint sequencer-** sequential sampling systems are available for area monitoring for 2, 4, 8 or 12 points with the 301-B; 8,16 or 32 channels with the 501-AB-additional information available on request

