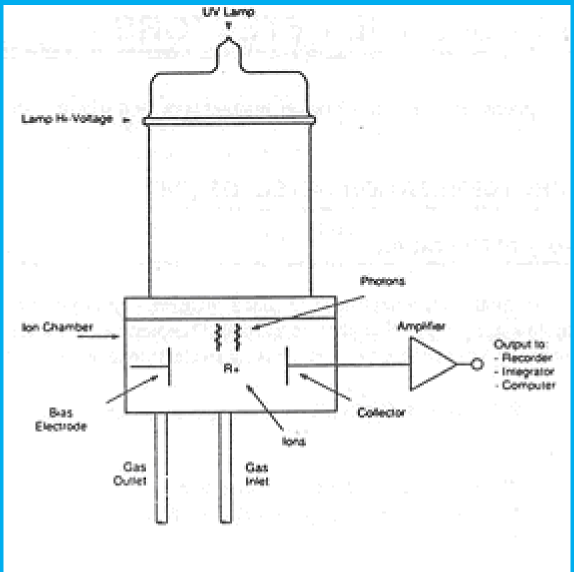
PID Detector

Add-on to any GC

For R&D, QC, Industrial Hygiene, and Environmental & Routine ppb Analysis



PID Model-52-02-C/
PID Model-51-02-C

Benzene, Chemical Agents, Halogenated HC, Sulfur Compounds

Benzene detection limit - 0.5 ppb

PID ANALYZERS

Model 51/52-02C Photoionization Detector

Benzene, VC, H_2S, 1,3 BD, Methane, LNG, Nitro cpds, explosives, Sulfur & Phosphorus Cpds., Nerve gases,Hydrocarbons, SF_6, PH_3, AsH_3, NH_3, Air, Water, IH, Process, Stacks, & Building security

Introduction

HNU developed the first commercial PID in 1974 and introduced the first GC detector in 1976. Now, nearly 30 years later, we introduce the Model 52-02C that has improved detection limits by nearly five fold.

Should you upgrade your GC?

More than 70%? of the GC's sold in the last decade have only single detector capability (FID or TCD). This configuration is ideal for the measurement of hydrocarbons or inorganic gases at high levels but if your requirements extend to the measurement of other species, environmental or trace levels, why buy another GC? Simply add a selective or general purpose detector that will enhance the capabilities of your present GC. This can expand the capabilities of your laboratory without wiping out your budget. It can also extend the lifetime of your present GC.

Why Upgrade?

- Have you had to add a derivitization step to your method to make up for poor sensitivity to a target compound? Why waste precious time? Analyze directly by upgrading your detector capability instead
- Eliminate H_2 and air (for an FID) by adding a PID or FUV detector · Add years to the lifetime of your capital equipment with a detector upgrade
- Reduction of capital costs- Why buy a new GC with autosampler, data system and other expensive items when you can just add capabilities with a new detector at a fraction of the cost?
- Extend your lab budget- spend approximately $5K for a detector instead of $25K for a new GC detector
- Save $. Are you sending out analyses which could be more profitably done in your own lab?
- Save time on fast turnaround analyses needed for manufacturing processes or effluent analyses by using a more specific . Easily

Adaptable to Any GC- These detectors are easy to use with any gas chromatograph.

- Save $. Are you sending out analyses which could be more profitably done in your own lab? · Save time on fast turnaround analyses needed for manufacturing processes or effluent analyses by using a more specific ***detector.***

PID- Principle of Operation

PID The PID provides a response to a wide range of organic and some inorganic compounds at part per billion (ppb) levels. The HNU PID consists of an ultraviolet lamp and an ion chamber. The detector measures the concentration of gases present in a sample using the method of pbotoionization. Photoionization occurs when a molecule absorbs a photon (light energy) of sufficient energy, creating a positive ion and an electron as shown below:

$$R + hv = R^+ + e^-$$

The sample exits the column, goes into the ion chamber and is exposed to photons generated by the ultraviolet lamp. Molecules in the sample with ionization potentials less than or equal to the energy level of the lamp are ionized. The ionization potential is that energy in electron volts (eV) needed to free an electron from a molecule. A positively biased accelerator electrode repels these ions, causing them to travel to the collecting electrode, where an analog signal proportional to the concentration of the sample is generated. The signal is amplified to provide an analog output for graphic recording or electronic integration. Ultraviolet lamps are available in four energies; 8.3, 9.5, 10.6, and 11.7 electron volts (eV). Detector selectivity (and sensitivity) varies with each lamp. The PID becomes more selective as the lamp energy decreases since it is capable of ionizing fewer compounds. The detector becomes less selective as the lamp energy increases. It is capable of ionizing a larger number of compounds. The 10.6 eV lamp provides the. maximum sensitivities for those compounds it detects.The PID has a linear range of better than seven decades (>107), is nondestructive, and can be used in series with other detectors.

Responds to wide range of organic and inorganic compounds

The photoionization detector can be used to analyze a wide variety of compounds. Any compound with an ionization potential (IP) < 12 eV will respond. This allows the detection of aliphatics (except CH4), aromatics, ketones, aldehydes, esters, heterocyclics, amines, organic sulfur compounds, and some organometallics. The detector also responds to inorganics such as 02, arsine, ammonia, hydrogen sulfide, HI, chlorine, iodine, and phosphine. When used with a 10.2 eV lamp, it does not respond to several commonly used solvents such as methanol, or to extraction solvents such as chloroform, dichloroethane, carbon tetrachloride, and acetonitrile. These can be used as extraction solvents and produce a minimal response.

Sensitivity and detection limits

One of the most significant characteristics of the HNU photoionization detector is its sensitivity. The lower limits of detection for organics are 10-200 times better than those of a flame ionization detector (FID). Lower limits of detection for inorganics are often 10-20 picograms, which makes the PID 2- 10 times more sensitive than the flame photometric or Hall detectors. Wide dynamic range The PID has the widest dynamic range of any GC detector, extending from 2 picograms through 30 micrograms. This covers virtually the entire dynamic range of many of the other GC detectors. The range and detection limits for the most common GC detectors are shown below.

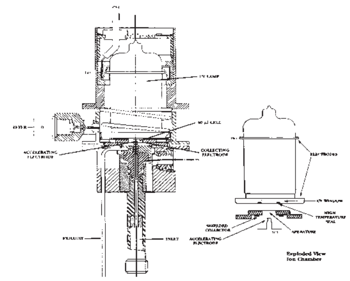
Selectivity

Four ultraviolet light sources (8.3 eV, 9.5 eV, 10. 6 eV, and 11.7 eV) are offered by PID analyzers. The 10.6 eV is the most common, but the other sources either increase the number of compounds detected (11.7 eV), or allow additional selectivity in detection (9.5 or 8.3 eV).

Non destructive detector

Photoionization itself is virtually a non destructive technique The PID can be connected in series with other detectors

PID & Its characteristics

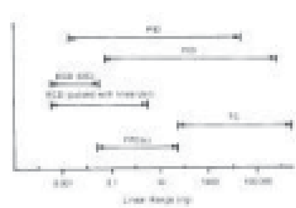


Detector Selection Guide

Application	PID	FUV	ECD	FPD (P)	FPD (S)
	Detector				
Alkanes	>C4 G	G			
Aromatics	G	G			
Sulfur Cpds.	G	G			S
PCB's	G		S		
Pesticides	G		S	S	S
Inorganics-O2, CO	0	G	0	0	0
Freons	M	G	S	0	0
Nitro cpds.	G		S	0	0
Phorphorus Cpds.	G	G		S	0
Chlorinated HC	G	G	S	0	0

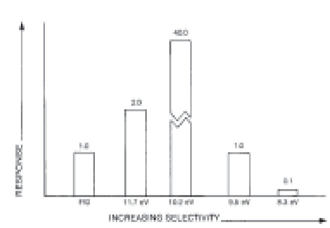
S= specific; G= general; 0 = No response

Comparison of Linear Dynamic Ranges of Various GC Detectors



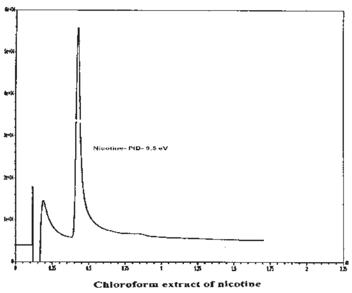
Responses for the Various Ultraviolet Lamps.

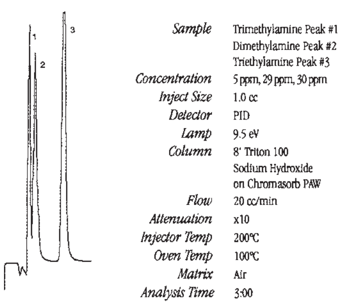
RELATIVE SENSITIVITY vs. FID (benzene or biphenyl)

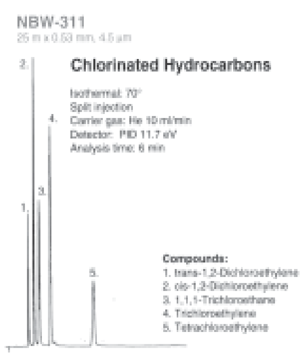


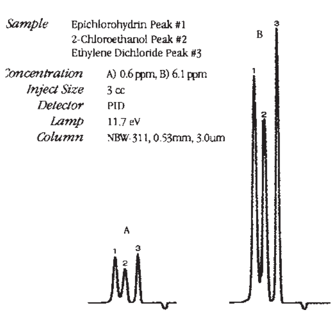
PID Applications

PID 9.5/11.7 Applications

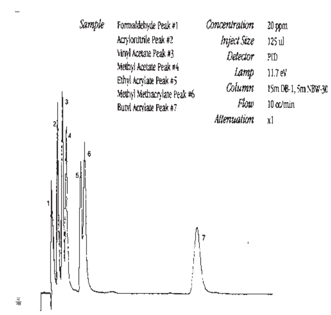


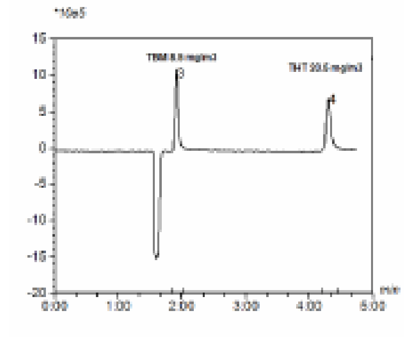


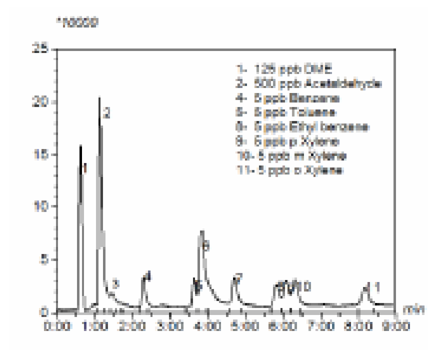


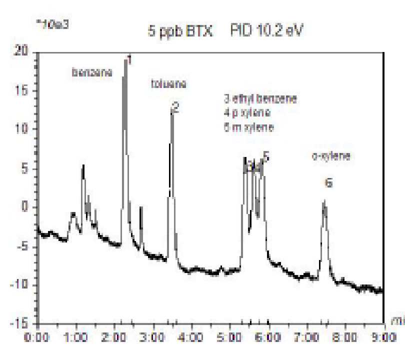


PID Applications



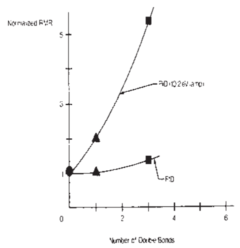


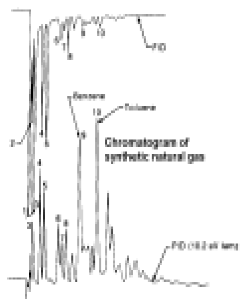


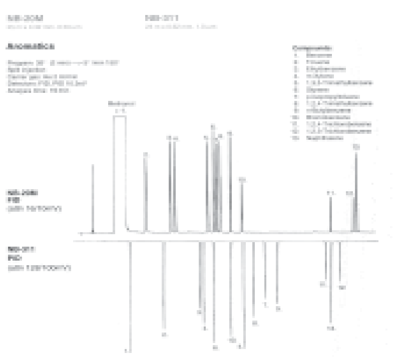


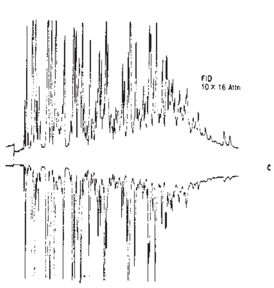
PID Applications

PID/FID/FUV Applications







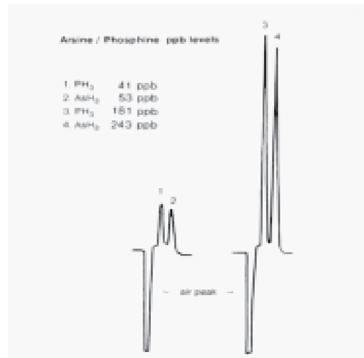


PID Inorganic Applications

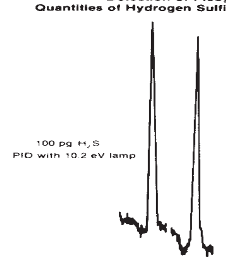
Detection Limits for Selected Inorganics

Compound	LLD (pg)
H_2S	15
PH_3	20
I_2	25
NO	52
$Pb(C_2H_5)_4$ (TEL)	150
NH_3	200
AsH_3	25

Many other inorganics may be detected - contact factory.



Detection of Picogram Quantities of Hydrogen Sulfide with PID



PID Configurations
Model PI51 & PI52

The PID Analyzers **Model PI51** consists of a PID and a constant current power supply that powers the PID lamp and supplies the accelerating voltage. It also comes with an adapter for the various GC's below. With this Model, the FIDpower supply already in the GC is used toamplify the PID signal.

There are a number of adaptors available for the for the PID- Model 51. These are described below-choose one adaptor:

Note that the Model PI51 does not come with an electrometer. That Model is the PI52 that is described below:

The PID Analyzers **Model PI52** consists of a low dead volume PID and a constant current power supply for the PID lamp. The supply also generates the accelerating voltage for the ionization chamber. It also comes with your choice of an adapter for the various GC's above. This Model, also has the PID power supply to amplify the PID signal.

Adaptors for the PID Models 51/52

With adapter for the HP

GC 5890	-H5890
GC 6890	-H6890

With adapter for the Agligent

GC 6890	-A6890

With adapter for Varian GC's

GC 3400	-V3400
GC 3600	-V3600

With adapter for Perkin Elmer GC's

Clarus 500	-P500
Earlier Models	

Withadapter for Shimadzu GC's

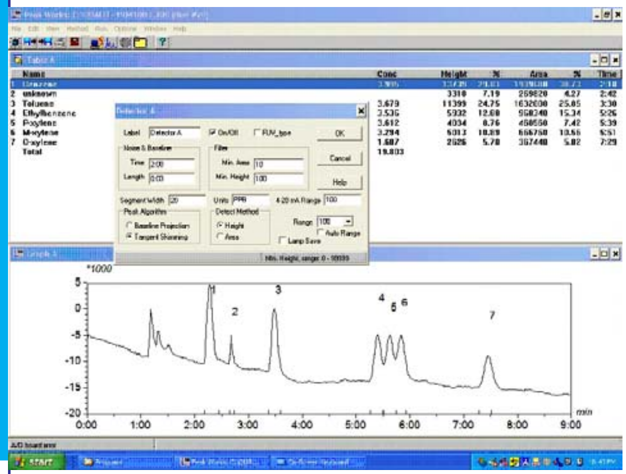
GC14	-S14
GC17A	-S17A

A typical part # for a Model PI for an HP 5890 would be # PI51-01-C-H5890.

PeakWorks Data Acquisition Systems

The output from the PID electrometer cab be fed into the ADC system for the GC, typically with a special card or an external data acquisition system can be used. These will require a PC for operation of the sofware and data acquisition card.

PeakWorksTM is PID's Windows based chromatography software that can be used tocontrol the GC parameters, integrate & display thechromatograms and store the data for the GC 301-B.The software is written in C++ as an overlay/interfacefor the Windows operating system. Low and highalarm levels and concentration range can be set inthe PC. A 24 hour graph of each point can bedisplayed on the VGA color screen. Each day atmidnight, a new file is created and named (by date).These files can be directly imported into EXCELand plotted. A copy of the screen for 3 ppb ofbenzene is shown in the Figure below. PeakWorks has multipoint calibration capabilitiesand response factors that can be calculatedautomatically or entered manually. Windows areadjustable for each compound. A typical chromatogram of 3 ppb of btx is shown in the figure below:



PID Features & Other Add-On Detectors

Features-

- *Selectivity- improves separations and analysis of trace species*
- Wide linear dynamic range- > 10^7 ·
- 50-200 times more sensitive than the FID
- High sensitivity- pg or sub pg detection limits- most sensitive PID available
- Adaptability- Is readily adaptable to any chromatograph
- Non destructive; detectors can be run in-series
- Used by environmental agencies worldwide

Specifications

- **Detection limit:** 0.5 ppb of benzene
- **Range:** > 5 x 10^7
- **Detector:** 2.5 " D x 5.5" L
- **Electronics enclosure:**

  Weight: 4.5 lbs.

  Size: 6" W x 7" L x 3" H
- **Controls:** Attenuation, T (degrees C)

Applications

- Detection of aromatic hydrocarbons in air, soil, water at ppb levels
- EPA Method 602, 502, SW846
- Hydrides (H_2S, PH_3, ASH_3) at ppb levels in air, water
- Chloroalkanes in soil, water & air
- at ppb levels (11.7 lamp)
- VOC's in soil, air & water at ppb levels

Other Add-On GC Detectors

TCD

The compact design for this universal detector enables it to be easily added to any gas chromatograph. There are two Models: one interfaces directly to a PID Analyzers data acquisition system (12 or 16 bit); the other is a standalone detector with electronics.

FUV

Novel photodiode and ultra stable UV lamp provides nearly universal response and low or sub ppm detection limits. the detection limit of the FUV for methane is approximately the same as the FID. At the same time, this detector will respond to oxygen and water at low or sub ppm levels.

FPD

This detector is selective for S or P compounds depending upon the filter employed. The S output is linearized to provide dynamic range > 10^4. A dual S/P detector is also available. Specs are below:

Table I
Brief Detector Specs

Detector	Model #	Dyn. Range	Conc. Range
FID	53	> 2 x 10^4	ng-mg
FUV	54	10^5	pg-ng
FPD (S)	56S	10^4	pg-ng
FPD (P)	56P	10^4	pg-ng

PID ANALYZERS

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