# Hydrogen as a Fuel Gas

## Generating Hydrogen Fuel Gas for Flame Ionization Detectors in Gas Chromatography

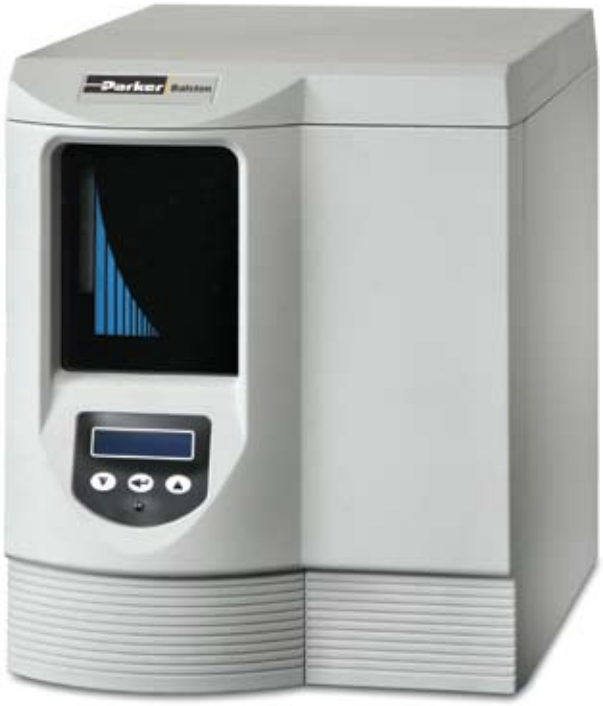
Market Application Publication

## Background:

The Flame Ionization Detector (FID) is a popular detector for gas chromatography which is based on the burning of the compounds of interest with a hydrogen/air or hydrogen/oxygen flame as they elute from the GC column. Ions formed by the flame are passed between two electrodes which provide a potential difference and strike an electrode to produce a current, which is then measured by a picoammeter.

There are two major benefits for the FID. It is a mass sensitive detector that measures the number of carbon atoms hitting the detector/unit time, rather than the concentration of the compound of interest. The signal is not greatly affected by the flow rate.

Typically, hydrogen for the FID is provided by a high-pressure gas cylinder. While this is satisfactory, an in-house generator to provide hydrogen is safer, more reliable convenient, and more economical than the use of cylinders. An in-house hydrogen generator is completely automatic and requires a minimum of maintenance.




## Features and benefits:

- Generates a continuous supply of 99.99999+% Hydrogen without additional filters
- Flow capacity up to 1200 cc/min at a pressure of 100 psig
- Enhanced laboratory safety, the system generates the required flow rate of Hydrogen. Certified by CSA, UL, IEC1010 and CE
- Prevents running out of gas during instrument operation
- Extremely low cost of operation, no hidden costs (demurrage, maintaining inventory). Payback period typically less than one year
- Operates on a 24/h/day, 7 day/week basis with minimum maintenance using automated water filling feature
- Compact and Reliable, requires approximately 1 $ft^2$ of bench space

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## Hydrogen Generation:

Hydrogen for fuel gas can be generated by the electrolysis of water using either metallic electrodes or a proton exchange membrane (PEM). The electrode based systems (H2PD-xxx and H2-xxxNA) employ a 20 % NaOH solution and a unique palladium membrane to exclude oxygen and other gases to ensure that 99.99999+ % pure hydrogen is consistently generated. The PEM based systems (H2PEM-xxx) use pure water (no caustic required) to generate hydrogen with 99.9995% purity. Both systems eliminate the need to keep dangerous and expensive hydrogen gas cylinders in the laboratory.

## Application:

An FID detector is the detector of choice in a broad range of applications. It is an ideal detector for hydrocarbons as these compounds are readily oxidized in the flame. In addition, it is commonly used for the analysis of compounds in which the carbon and hydrogen concentration is large. The detector is very frequently used in environmental applications for the determination of chlorinated hydrocarbons, pesticides, herbicides and related compounds. In the pharmaceutical and biotechnology arena, the FID is used for the analysis of drugs and their metabolites, as well as for peptides, proteins and, nucleotides. Many food chemists use an FID detector to determine nutritional content as well as to detect the presence of trace levels of undesired compounds such as pesticides, plasticizers, and related compounds. An additional advantage of the FID is that a large number of compounds in the atmosphere such as water and $CO_2$ do not burn and therefore do not influence the signal so that a small leak in the injection system can be tolerated.

From an operational perspective, there are many advantages for using a hydrogen generator rather than tanks for the fuel gas for an FID. Since the cost of generating hydrogen is considerably lower than the use of tank gas, most analysts provide fuel gas to the detector on a continual basis at a reduced level. This reduces the need to recalibrate the detector before analytical measurements can be taken and can save a significant period of time was expended before measurements could be taken and maximizes laboratory efficiency. In lieu of frequent calibration, the measurement of a standard sample at a user-specified interval to ensure that the system is operating properly. In-house generation of the gas also eliminates the need for periodic changing of the gas tank, which also required recalibration of the FID. An additional benefit of less frequent calibration is that it is no longer necessary to train each technician in the calibration process.

# Principal Specifications:

| Description | Model Number | |
|---|---|---|
| Hydrogen Purity | H2-PEM Systems | 99.9995 % |
| | H2PD Systems | 99.99999+%<br>(Oxygen <0.01 ppm, Moisture < 1 ppm) |
| | H2NA Systems | 99.99999+%<br>(Oxygen <0.01 ppm, Moisture < 1 ppm) |
| Flow Rate | H2-PEM-100 | 100 cc/min |
| | H2-PEM-165 | 165 cc/min |
| | H2-PEM-260 | 260 cc/min |
| | H2-PEM-510 | 510 cc/min |
| | H2PD-150 | 150 cc/min |
| | H2PD-300 | 300 cc/min |
| | H2-500NA | 500 cc/min[1] |
| | H2-800NA | 800 cc/min |
| | H2-1200NA | 1200 cc/min |
| Hydrogen Outlet Pressure | H2-PEM Systems | 5-100 psig +/- 5 psig |
| | H2PD Systems | 0-60 psig |
| | H2NA Systems | 0-100 psig |
| Outlet Port | H2PEM Systems | 1/8" Compression |
| | H2PD Systems | 1/4" Compression |
| | H2-NA Systems | 1/4" Compression |
| Electrical Requirements (*) | H2PEM Systems | 120 VAC/230 VAC |
| | H2PD Systems | 120 VAC/60 Hz, 3.15 Amps |
| | H2NA Systems | 100-130 VAC, 5.3 Amps |
| Certifications | H2PEM Systems | |
| | H2PD Systems | IEC1010-1, CSA, UL3101, CE Mark |
| | H2NA Systems | IEC1010-1, CSA, UL3101, CE Mark |
| Dimensions | H2PEM Systems | 17"H x13"W x 18"D<br>43.58 cm x 34.29 x 45.6 cm |
| | H2PD Systems | 22"H x 12"W x 12"D<br>58 cm x 30 cm x 33 cm |
| | HPNA-500NA | 15"W x 18"D x 13"H<br>38 cm x 46cm x 33 cm |
| | HPNA -800NA, 1200NA: | 13"W x 17"D x 15.5"H<br>33 cm x 43cm x 39 cm |
| Shipping Weight | H2PEM Systems | 59 lb (27 kg) |
| | H2PD Systems | 58 lbs (26 kg) |
| | H2NA Systems | 45 lbs (20 kg) |

**Notes:**
***** Electrical requirements are for North America, see product catalog for electrical and plug configurations for other locations
**1** Does not include automatic water feed feature and has maximum pressure output of 90 psig. Outlet port is 1/8" compression

# Ordering Information H2-PEM Systems*:

| Description | Model Number |
|---|---|
| H2-PEM Systems | H2PEM-100, H2PEM-165, H2PEM-200, H2PEM-510 |
| Desiccant Cartridge | MKH2PEM-D |
| Service Kit | MKH2PEM-6M 6 Month Service Kit |
| | MKH2PEM-24M 24 Month Service Kit |
| Preventative Maintenance Plan | H2PEM-100-PM, H2PEM-165-PM, H2PEM-200-PM, H2PEM-510-PM |
| Installation Service | H2PEM-100-INST, H2PEM-165-INST, H2PEM-200-INST, H2PEM-510-INST |
| USB Remote Control Accessory | 604970894 |

*Part Numbers are for North America, see product catalog for electrical and plug configurations for other locations.

# Ordering Information H2PD Systems*:

| Description | Model Number |
|---|---|
| HH2PD Systems | H2PD-150, H2PD-300 |
| Electrolyte Solution | 900071 |
| Pressure Regulator | W-425-4032—000 |
| Preventative Maintenance Plan | H2PD-150-PM, H2PD300-PM |
| Installation Kit | IK7532 |
| Extended Support with 24 Month Warranty | H2PD-150-DN2, H2PD300-DN2 |

*Part Numbers are for North America, see product catalog for electrical and plug configurations for other locations.

# Ordering Information H2PD Systems*:

| Description | Model Number |
|---|---|
| H2PD Systems | H2-500NA[1], H2-800NA, H2-1200NA |
| Deionizer Bags (2 each) | 7601132 |
| Pressure Regulator | W-425-4032—000 |
| Preventative Maintenance Plan | H2-500-PM, H2-800-PM |
| Installation Kit | IK7532 |
| Extended Support with 24 Month Warranty | H2-500-DN2, H2- 800-DN2, H2-1200-DN2 |

*Part Numbers are for North America, see product catalog for electrical and plug configurations for other locations.

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