

Application Brief AB-057

GASID™ HAZARDOUS VAPOR AND GAS IDENTIFIER

What is "GasID?"

Infrared (IR) technology has changed the way First Responders deal with chemical events. In particular, the HazMatID™ and its predecessor, the TravellIR HCI™, have become standard equipment in the HazMat toolbox for rapidly identifying solid and liquid samples. These instruments use a process called **molecular fingerprinting**, in which the IR spectrum of a potentially toxic or dangerous product is compared to reference databases of 1000's of known compound fingerprints. Virtually any product with covalent molecular bonds, such as solvents, fuels and white powders, can be measured on the diamond sensor and identified within seconds. The GasID is basically a HazMatID for vapors and gases. The GasID also uses IR technology and molecular fingerprinting to identify products, but instead of a diamond sensor, it employs a gas cell to obtain the spectrum of a sample. The GasID is a unique tool for rapid identification of potentially hazardous gases and vapors, making it an ideal compliment to other gas meters that can detect, or at best classify unknown products.

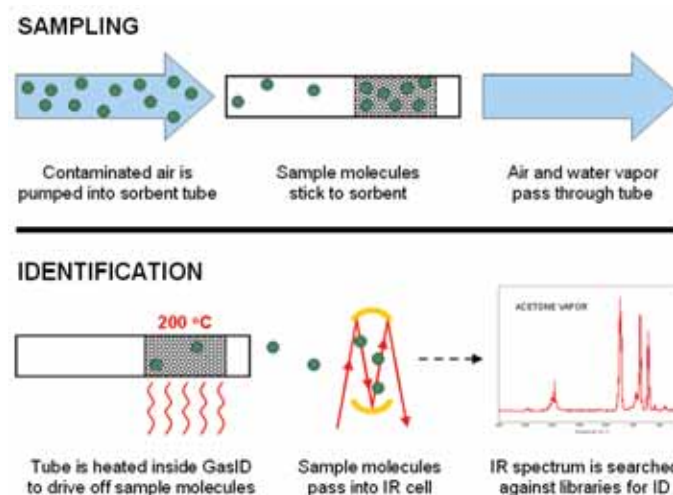


Gas and Vapor Sampling

The method in which gaseous samples are collected is what makes the GasID unique. Hazardous gases and vapors are filtered from contaminated air samples using a methodology that was originally developed for Gas Chromatography (GC). This process is called **thermal desorption** (TD), and it provides a way for gases and vapors to easily be captured and isolated, then subsequently identified at low concentrations

A specialized sampling device is used to capture a sample and bring it out of the hotzone to the IR analyzer. The device is a sealed sample holder that attaches to an intrinsically safe

handheld pump. To identify a gas or vapor, the responder places a special tube (similar to a colorimetric tube) into the holder, seals the holder, and attaches it to the pump. The device is then carried into the hotzone where the contaminated air is sampled for some amount of time, typically 10 minutes. The tube contains a TD sorbent material that selectively filters organic and many inorganic compounds out of the air, while allowing most of the water vapor, CO₂ and other air molecules to pass through. Once the sample is collected, the holder is released from the pump and decontaminated. The holder is then attached to the GasID instrument outside of the hot zone.



Thermal Desorption Sampling and Analysis: In the hot zone, a hand-held pump is used to pull contaminated air through a tube containing sorbent material that grabs a chemical sample out of the air. The tube is then taken through decon and to the GasID, where the tube is heated to release the sample and the IR spectral analysis is conducted.

At the instrument, the tube inside the holder is rapidly heated to 200°C to drive off, or **desorb**, the sample molecules. The sample is then pumped into a gas cell where its spectrum is obtained. The spectrum is then compared to gas and vapor phase reference spectra of known compounds, allowing the sample to be identified. The heating and analysis process takes 2-3 minutes, and multiple tubes and holders can be used in tandem to allow several samples to be processed. Highly concentrated air samples can be acquired and analyzed with standard Tedlar™ bags.

GasID Identification Capabilities

Like any technology, the GasID has capabilities and limitations, and knowing them is critical to making good decisions about what instruments to use in a chemical event. Because it uses IR spectroscopy, the GasID can only be used to measure covalently-bonded organic and inorganic compounds, except for homonuclear diatomic gases (two of the same atoms bonded together, such as Cl_2). As shown below, this includes many compounds of interest to HazMat. The current GasID libraries contain over 5,000 spectra of gas and vapor phase spectra for searching.

GasID Can Identify (for example):

- ✓ Organic Solvents (Acetone, Benzene)
 - ✓ Flammables (Propane, Hexane)
 - ✓ TICs and TIMs (Ammonia, Freon)
 - ✓ Corrosives (Hydrochloric, Nitric)
 - ✓ Pesticides (Alachlor, Warfarin)
 - ✓ Chemical WMD (VX, Mustard)
- Many more ...

GasID Cannot Identify (for example):

- ✓ Homonuclear Diatomics (Cl_2 , O_2 , etc.)
- ✓ Noble gases (He, Ar, etc.)

In an IR gas cell, the strength of the measured IR signal is directly related to how much gas or vapor sample is present in the cell (in other words, the sample concentration in parts-per-million, or ppm). Laboratory tests are continually being conducted on hazardous gases and vapors to determine the lowest concentrations that produce reliable identifications with the GasID. This is called the limit of identification (LOI), and it literally means the ppm of sample that produces an IR spectrum which matches its library spectrum with at least 0.95 similarity. The LOI is somewhat sample-dependent, but tests have shown that for most gases and vapors it ranges from 50-100 ppm in air when TD sampling is used. Without TD, the sample molecules are not concentrated from the air prior to analysis, and the LOI values are as high as 500 ppm. In any case, the GasID is capable of identifying most compounds well below their IDLH levels (often 100's to 1,000's of ppm), making it very useful for First Responders.

To make the identification process even more accurate, the GasID software performs an automated compensation for water vapor and CO_2 gas that may interfere with the sample spectrum. In addition, users can perform simple mixture analysis by spectral subtraction, and spectra can be added to a customer user library with one button click. And of course, Reachback support for instrument questions and spectral analysis is available 24 hours a day, 7 days a week.

General Use and Maintenance

The GasID features an easy-to-use software interface that steps its user through the entire analysis procedure. No calibration or regular maintenance is required, as the system uses an internal laser to provide a constant and reliable reference. If desired, instrument validation checks can be performed using gases such as isobutylene or methane that are already used with other gas meters (like Four Gas and PIDs). The TD tubes remain sealed prior to use, and they have a 4 year shelf life. In terms of cleaning, only the inside of the gas cell, the sampling pump, and the TD tube holder are exposed to sample gases and vapors. The gas cell and sampling pump are cleaned by flushing with

fresh air, the TD tubes are disposable, and the TD tube holder can be fully immersed in bleach solution for decon. A list of general specifications for the GasID instrument and sampling accessories are given here.

General Specifications:

GasID Instrument

- ◆ Fourier transform infrared (FT-IR) analyzer with 44 cm multipass gas cell
- ◆ 4000 - 650 cm^{-1} spectral range, 4 cm^{-1} spectral resolution
- ◆ Integrated 400 MHz computer with 1 Gb solid state memory and touch screen interface
- ◆ Ethernet, PS/2 and USB ports
- ◆ Powered by 110/220 Vac or rechargeable 2 hour Li-ion battery
- ◆ - 7 to 50°C operating range

Sampling Device

- ◆ Thermal desorption (TD) technology with dual sorbent packing to cover wide range of sample vapor pressures
- ◆ Fully sealable TD tube holder with quick connect valve fittings
- ◆ Intrinsically safe pump (UL, cUL, CE, and ATEX approved) capable of 20-225 mL/min flow rate
- ◆ Powered by rechargeable NiMH battery
- ◆ TD heater on GasID powered by 110/220 Vac or rechargeable battery pack
- ◆ Optional Tedlar bag interface



The GasID is an FT-IR analyzer that identifies gases and vapors through spectral library searching. The Sampling Device (right) is taken into a hot zone to obtain a sample, and is then decontaminated and taken to the GasID for analysis.