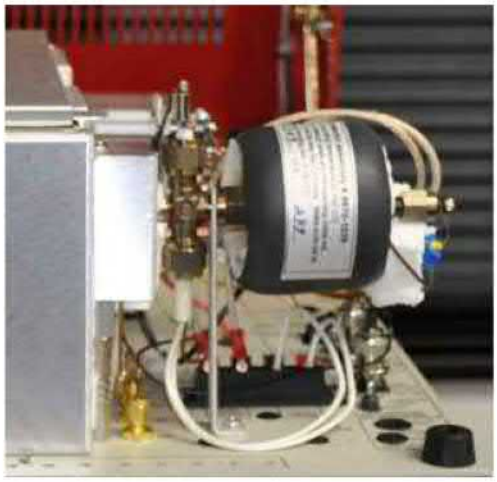
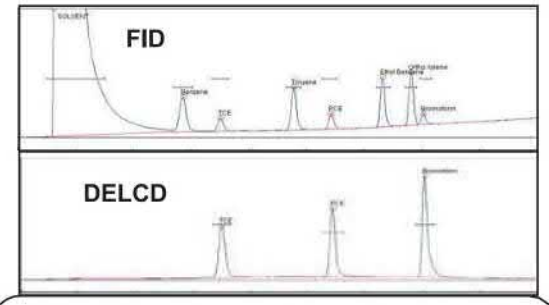
FID/DELCD Combination Detector

- **The FID detects Hydrocarbons and the DELCD identifies which are Halogenated**
- **No Electrolytes needed for the DELCD**
- **High and Low sensitivity modes**
- **Detects to the Low ppm range**



The FID/DELCD is one of the most useful detector combinations because it allows the operator to reliably identify hydrocarbon peaks detected by the FID as halogenated or not



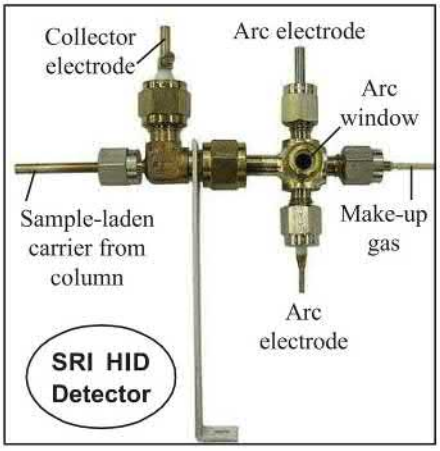
The top FID trace shows the hydrocarbons in a 100ppm BTEX plus sample, while the bottom DELCD trace shows only the halogenated compunds. The DELCD completely rejects the large solvent peak.

While less sensitive than the ECD detector, the DELCD is much more selective, eliminating interferences which would complicate an ECD analysis. Sample preparation which might be required for ECD work is not required for the DELCD because of its total selectivity to chlorine and bromine, and because the FID pre-combusts any contaminants. In the high sensitivity mode (hydrogen off, using dry tank air), the DELCD can detect down to the low picogram range. In this mode, the DELCD is about 100 times more sensitive than when used with the FID exhaust in the low sensitivity mode.

The DELCD measures the ClO_2 present in the FID exhaust gas. Because the FID combusts the sample upstream of the DELCD, all hydrocarbons are converted to CO_2 and H_2O prior to the DELCD, thereby completely preventing large hydrocarbon peaks from contaminating the DELCD. Because the DELCD operates at close to 1000°C, it can tolerate the water saturated FID effluent and measure the chlorine or bromine content simultaneously with the FID hydrocarbon content measurement. This is especially beneficial for measuring chlorinated VOCs under a solvent peak, or in measuring PCB peaks obscured under large amounts of diesel fuel. This detector combination is often used with our Thermal Desorber or Purge & Trap, which concentrate the sample to achieve lower detection limits.

8690-2026	FID/DELCD detector

HID - Helium Ionization Detector



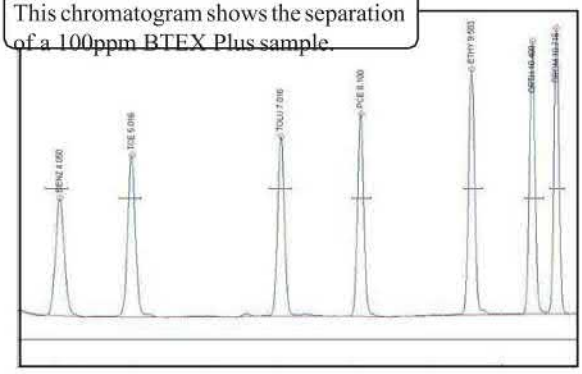
- **Universal (except neon)**
- **Detect from 1-2% down to 10ppm**
- **Requires only helium carrier and make-up gas**
- **Perfect Complement to the TCD!**

The Helium Ionization Detector is a "universal" detector which responds to all molecules except neon. The HID is particularly useful for volatile inorganics like NOx, CO, CO_2, O_2, N_2 and H_2 which do not respond on the FID or other detectors. Unlike an FID, the HID needs no hydrogen or air. The HID requires only helium carrier and make-up gas, and delivers sensitivity in the low ppm range. Many labs are reluctant to store hydrogen fuel gas for safety reasons, so the fact that the HID requires only helium is a significant advantage.

The HID is especially useful in combination with a Thermal Conductivity Detector. The TCD is not sensitive enough to detect low ppm concentrations, while the HID saturates in the low percent range. When using both detectors in series, it is possible to cover 10ppm to 100%.

Unlike other HID designs, the SRI HID can be heated to 350°C and can easily be disassembled for cleaning. The HID incorporates robust, easily serviceable electrodes which support a low current arc through the helium make-up gas flow. This elevates the surrounding helium to a metastable state. When the metastable helium molecules collide with sample molecules as they elute from the column, the sample molecules are ionized and attracted to a collector electrode, amplified, and output to the data system. Our HID features a window through which the low current arc is visible, so it is easy for the operator to verify that the detector is functioning.

This chromatogram shows the separation of a 100ppm BTEX Plus sample.

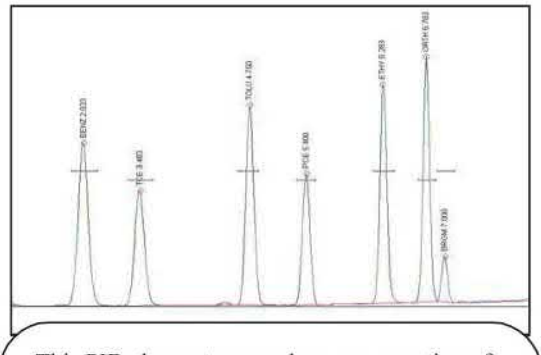


8690-0030	**HID detector**

PID - Photo Ionization Detector

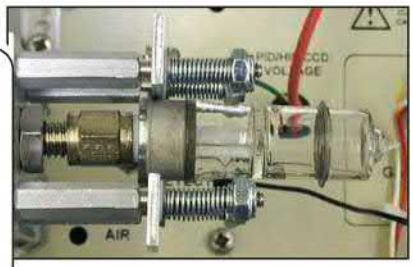
- **Responds to molecules with carbon double bonds and aromatics**
- **Sensitive (down to 10ppb) and nondestructive**
- **Mandated in several EPA Methods**
- **Extremely long lamp life!**

Use of the Photo Ionization Detector is mandated in several EPA methods (8021, TO-14, etc.) because of its sensitivity and selectivity. Detection limits for aromatics are in the low picogram (ppb) range. Because it is nondestructive, the PID is often run in series with other detectors—typically the FID/DELCD combination detector—for multiple chromatograms from a single injection. The PID is also able to run on air carrier, which can be useful in situations where no gas is available, or for stream monitoring applications where no column is used to separate compounds.



This PID chromatogram shows a separation of a 100ppm BTEX plus sample using a 0.53, 15 meter capillary column and helium carrier gas.

Unlike other PID designs, the lamp on the SRI PID can be easily removed, without tools, for periodic cleaning of the lamp window to avoid interference from column bleed build-up. Lamps can last years on the SRI PID because only the lamp window is heated, not the entire body of the lamp.



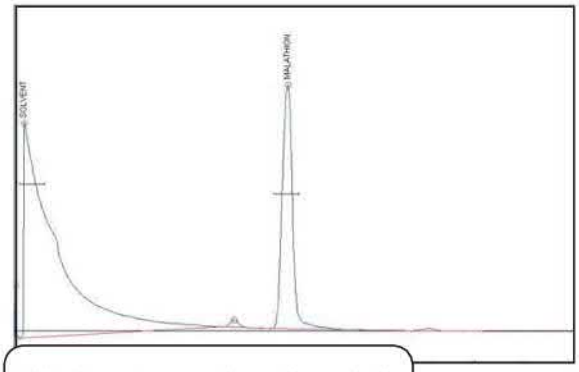
The SRI design uses the industry standard 10.6eV PID lamp in a spring-loaded mount, which allows the lamp to be removed, cleaned and reinstalled in seconds without tools.

The SRI PID consists of an industry standard UV lamp mounted on a thermostatted, low-volume, flow-through cell. The temperature is adjustable from ambient to 250°C. The 10.6 electron volt UV lamp emits energy at a wavelength of 120 nanometers, which is sufficient to ionize most aromatics (benzene, toluene, xylene, etc.) and many other molecules (H_2S, hexane, ethanol) whose ionization potential is below 10.6eV. Methanol and water, for instance, have ionization potentials greater than 10.6eV and do not respond on the PID.

8690-0040	**PID detector**

NPD - Nitrogen/Phosphorus Detector

- **Very Selective to Nitrogen and Phosphorus**
- **Detects down to 100ppb**
- **Exceptionally rugged NPD bead**
- **Similar in design to the FID**



This chromatogram shows the analysis of a 10ppm malathion sample.

The Nitrogen Phosphorus Detector responds to nitrogen-phosphorus compounds about 100,000 times more strongly than normal hydrocarbons. Due to this high degree of selectivity, the NPD is commonly used to detect pesticides, herbicides, and drugs of abuse.

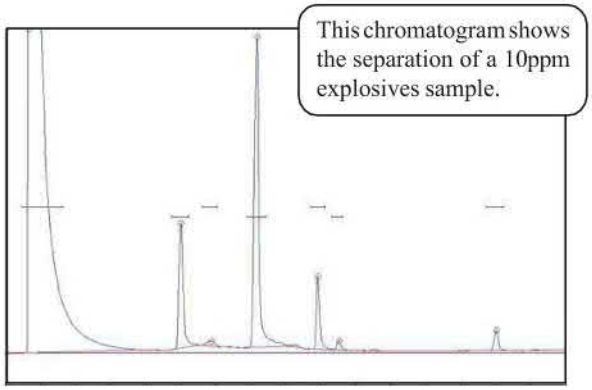
The NPD is similar in design to the FID, except that the hydrogen flow rate is reduced to about 3mL/minute and an electrically heated thermionic bead (NPD bead) is positioned near the jet orifice. Nitrogen or phosphorus containing molecules exiting the column collide with the hot bead and undergo a catalytic surface chemistry reaction. The resulting ions are attracted to a collector electrode, amplified, and output to the data system.

The SRI ceramic NPD bead is exceptionally rugged and long-lasting, offering service from 100 to 1000 hours, depending on operating conditions.

8690-0015	**NPD detector**
8690-2615	**NPD/DELCD combination detector**

TID - Thermionic Ionization Detector

- **Highly Selective to Nitro Functional Groups**
- **Also responds to chlorinated phenols**
- **Detects down to 1ppb**
- **Convenient bead design**
- **Can be run Gasless in the field!**



This chromatogram shows the separation of a 10ppm explosives sample.

The TID is similar in design to the FID and NPD. The electrically heated thermionic bead (TID bead) is positioned so that the column effluent contacts the hot bead surface. Analyte molecules containing NO_2 (nitro) functional groups such as TNT (trinitrotoluene) undergo a catalytic surface chemistry reaction. The resulting ions are attracted to a collector electrode, amplified, and output to the data system.

The Thermionic Ionization Detector is extremely selective, having little or no response to most aromatic and aliphatic hydrocarbons. The TID also responds to chlorinated phenols such as pentachlorophenol (PCP) at slightly less sensitivity.

For best sensitivity, the TID requires air for operation. If air is used as the carrier gas, no other detector gases are required. An air makeup gas is provided so that nitrogen or another gas can be used as a carrier. The TID can also be operated in a nitrogen only environment with similar but not identical response characteristics.

(ETV) program for measuring explosives in soil!
Tested by the EPA's Environmental Technologies Verification

Download the ETV report and verification statement at www.epa.gov/etv/verifications/vcenter1-4.html
Also, download "On-Site Characterization of Explosive Residues in Soils and on Range Scrap Using GC-TID Analysis" by Alan Hewitt of the US Army Corps of Engineers at www.srigc.com

8690-0017	TID detector

FPD - Flame Photometric Detector

FPD, Dual FPD, FPD/FID, FID/Dual FPD

- **Bandpass Filters for Sulfur or Phosphorus**
- **Use the Dual FPD for Simultaneous Sulfur and Phosphorus Detection**
- **Detects Sulfur Compounds to 200ppb, Phosphorus Compounds down to 10ppb**
- **Use the FPD/FID or Dual FPD/FID for Simultaneous Hydrocarbon Speciation**

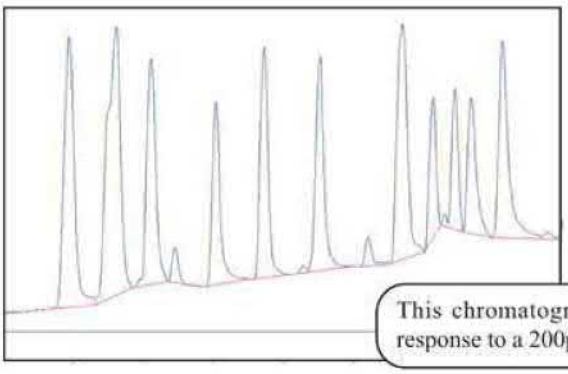
The Flame Photometric Detector can detect sulfur compounds, such as H_2S or SO_2, down to about 200ppb and phosphorus compounds to 10ppb. While not 100% selective, the FPD is 100,000 times more sensitive to sulfur and phosphorus compounds than hydrocarbons. The phosphorus response is linear, and the sulfur response is exponential (twice the sulfur yields four times the peak area).

The FPD is similar to the FID except that the detector body is light tight and a second flow of hydrogen purges the optical path between the photomultiplier tube (PMT) and the hydrogen rich flame. A bandpass filter (at 393nm for sulfur and 525nm for phosphorus) mounts in front of the PMT, so only the emissions from sulfur or phosphorus are detected while other wavelengths are rejected. The Dual FPD detector is equipped with two PMTs and filters for the simultaneous detection of sulfur and phosphorus.

The two chromatograms shown at right were produced by an SRI GC equipped with an FPD detector. The top chromatogram shows the FPD response to 10ppm H_2S. The bottom chromatogram shows the FPD response to 10ppm malathion, a pesticide containing both sulfur and phosphorus.

8690-0080	**FPD detector**
8690-1080	**FPD/FID combination detector**
8690-0085	**Dual FPD with sulfur and phosphorus filters**
8690-2085	**Dual FPD with sulfur and phosphorus filters, and FID collector electrode**

ECD - Electron Capture Detector



This chromatogram shows the ECD response to a 200ppb pesticide sample.

- Detects Electronegative Compounds
- Offers Extreme Sensitivity - down to 10ppt
- Thermostatted from Ambient to 375°C
- Mandated for Pesticides and PCBs

The SRI Electron Capture Detector can be operated with either nitrogen or argon-5% methane (P5) makeup gas, and nitrogen, P5, or helium carrier (as long as the helium flow is less than 10 milliliters per minute). The ECD may be thermostatted from ambient to 375°C.

The ECD detects electronegative compounds, especially chlorinated, fluorinated, or brominated molecules such as carbon tetrachloride, bromoform, PCBs and pesticides such as DDT. The ECD offers extreme sensitivity (parts per trillion for SF_6).

The ECD consists of a stainless steel cylinder containing radioactive Nickel-63. The Nickel-63 emits beta particles (electrons) which collide with the carrier gas molecules, ionizing them in the process. This forms a stable cloud of free electrons in the ECD cell. When electro-negative compounds enter the cell, they immediately combine with some of the electrons, temporarily reducing the number remaining in the electron cloud. The detector electronics, which maintain a constant current (of about 1 nanoampere) through the electron cloud, are forced to pulse at a faster rate to compensate for the decreased number of free electrons. The pulse rate is converted to an analog output, which is connected to the data system.

Because it contains only 5 millicuries of Nickel-63, the ECD is covered by a "general license," which requires a periodic wipe test and the filing of a form with your state's Department of Health. In most states, no annual fee is required.

8690-0020	ECD detector

RGD - Reduction Gas Detector

- **Detects reducing gases, such as CO to 50 ppb level, and H2 to 0.5 ppm**
- **Heated UV detection cell with absorbance**
- **User packable reaction tubes (requires mercuric oxid, not included**

The SRI reduction gas detector is sensitive to volatile reducing compounds down to the ppb level, and is often used to detect atmospheric carbon monoxide and hydrogen.

When compared to the FID detector, the RGD is ten times more sensitive to unsaturated hydrocarbons, and virtually unresponsive to saturated hydrocarbons. This combination of sensitivity and selectivity allows the analysis of atmospheric pollutants such as ethylene, benzene, carbonyl sulfide, phosphine, and methanol.

Our RGD uses a mercuric oxide reaction tube and a mercury lamp in a heated UV detector cell. When a reducing gas elutes from the column into the hot reaction tube, it reacts with the mercuric oxide to form mercury vapor. As it flows through the detector cell, the gaseous mercury absorbs the UV light from the mercury lamp inside the cell. The change in transmittance is converted by the data system into an absorbance output, which is proportional to the amount of reducing gas. A carbon filter at the UV detector cell outlet traps the condensed mercury vapor for safe disposal.

High concentrations of chlorinated and aromatic compounds can easily contaminate the mercuric oxide bed, resulting in the need for replacement. Reaction tubes are easily replaceable, and blank reaction tubes can be economically packed by the user.

8690-0009	ASD detector

GC Injectors

SRI offers a wide variety of GC injectors and injection systems. Up to five injectors may be mounted simultaneously on the Model 8610C or 8610D. The Model 310 will accommodate a single On-column, Heated Flash Vaporization, Heated Split/Splitless, or PTV injector. Injector types are selected by the user depending on the particular measurement application, detection limit, and regulatory requirements. The On-Column Injector is standard equipment on every 8610, 410 and 310 GC. Heated Flash Vaporization, Heated Split/Splitless, and PTV Injectors are all upgrades to the On-Column Injector. All injectors must be installed at the SRI factory.

1. **On-Column Injector**
2. **On-Column PTV Injector**
3. **Heated Flash Vaporization Injector**
4. **Heated Split/Splitless Injector**
5. **PTV - Programmable Temperature Vaporization Injector**
6. **10-Port Gas Sampling Valves & 22-port Selector Valves**
7. **Sample Preconcentration and Enrichment Options:**
   - **Heated Adsorbent Traps**
   - **DGA Permeation Loop Accessory**
8. **Heated Static Headspace Injector**
9. **Method TO-14 Air Concentrator (1 Trap or 2)**
10. **Thermal Desorber**
11. **Method 5030/5035 Compliant Purge & Trap**
12. **10-Sample 5030 Purge & Trap Autosampler**
13. **110 and 120 Vial Autosamplers**
14. **28, 40 and 50 Vial Headspace Autosampler**

SAMPLE TYPES AND APPROPRIATE INJECTORS	
LIQUIDS	• On-column, Heated Split/Splitless, Heated Flash Vaporization, PTV, Heated Static Headspace, Purge & Trap, Liquid Injection Valve, Liquid Autosamplers, or Headspace Autosampler
SOLIDS	• Thermal Desorber, Heated Static Headspace, PTV, or Headspace Autosampler
GASES	• On-column, Gas Sampling Valve, Method TO-14 Air Concentrator, or Heated Static Headspace
SPME FIBERS	• Heated Flash Vaporization with Low Volume SPME Liner, or Heated Split/Splitless

On-Column Injector

- **Simple and Reproducible**
- **For Liquids and Gases with Low AND High Boiling Analytes**
- **For 0.53mm Capillary and 1/8" Packed Columns**
- **No Boiling Point Discrimination**
- **Low thermal mass**

The On-Column Injector is supplied as standard equipment with the 8610, 410 and 310 GC mainframes.

For most applications, where a wide-bore 0.53mm capillary or 1/8" packed column is used, the On-column Injector will give the BEST results. In most cases the On-Column Injector is simpler and less expensive than heated injectors.

The On-Column Injector is perfect for liquids and gases with high and low boiling analytes. Even very high temperature analyses are easily performed using simple, reproducible on-column injection.

The On-Column Injector's low mass and small size ensure that the injector body temperature closely follows the column oven temperature.

The injector's low thermal mass and small size ensure that the syringe needle deposits the liquid sample well inside the column oven, so that as the column temperature increases, even high boiling point samples are completely vaporized. The On-column technique of sample introduction puts the sample into the bore of the column itself, which is often more inert than a glass injection liner. Unlike split/splitless injection, on-column injection puts the entire sample volume into the column without the possibility of boiling point discrimination or other uncertainties, and the gradual volatilization of the sample starting from a liquid droplet yields sharper peaks than flash vaporization followed by recondensation.

The On-column Injector is supplied with carrier gas from the included Electronic Pressure Controller (EPC), and the carrier gas is conveniently filtered with an internally mounted Molecular Sieve filter which can be baked out simply by flipping a switch on the GC's front control panel. A second EPC is available for operating a column connected to a gas sampling valve (or for backflushing) without the injector fitting. Also available is a second injector fitting connected to the first EPC for applications where two columns are used in parallel, sharing the same carrier gas pressure.

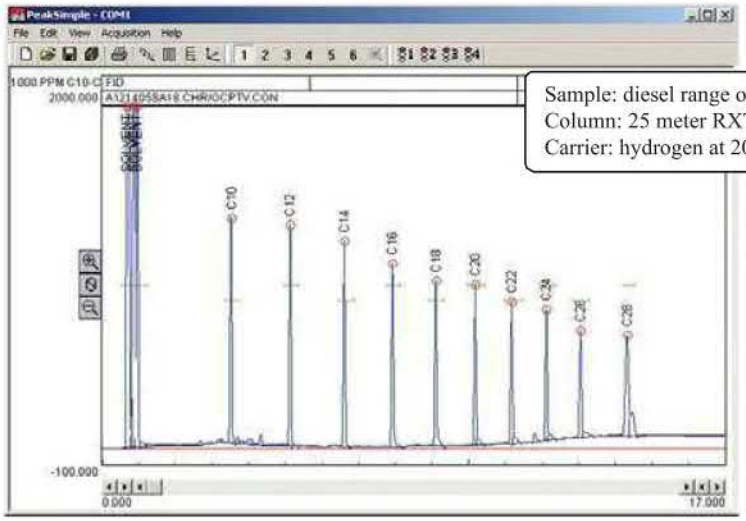
8690-0023	**On-Column Injector for 0.53mm capillary and 1/8" packed columns. Includes EPC carrier gas controller and molecular sieve filter**
8690-2022	**Second carrier gas EPC without injector port fitting**
8690-2023	**Second injector port fitting without EPC**

On-Column PTV Injector

- Inject Larger Volumes onto Narrow Bore Columns
- Concentrate Sample and Focus Peaks
- Simpler than Split/Splitless Injectors
- Less Bulky than Conventional PTVs
- Great for Semivolatile Samples

The On-Column PTV is a resistively heated precolumn, which is connected to your narrow bore column with a special, electrically insulated split "T" inside the GC column oven. The 5 micron nonpolar phase in the OCPTV precolumn has a high capacity to absorb high boiling compounds, and is stable at high temperatures. Like in-tube SPME, the precolumn discriminates in favor of high boiling semivolatile analytes, concentrating them in the phase. Like the Split/Splitless injector, the OCPTV has a split vent and needle valve for venting solvent while concentrating sample. Unlike a normal Heated Split/Splitless injector, the OCPTV vents the solvent without expanding it to a gas. Therefore, the OCPTV is capable of larger liquid injections than a regular heated split/splitless injector.

The GC operator injects sample via syringe through the on-column injection port with the split vent open to vent the solvent. After injection and solvent venting, the precolumn heats up while the carrier gas flows through it to sweep focused analytes from the precolumn to the analytical column. At this point, the precolumn is hotter than the column oven. The temperature difference between the hotter precolumn and cooler analytical column causes the analytes to focus on the analytical column, resulting in sharp peaks on the chromatogram.

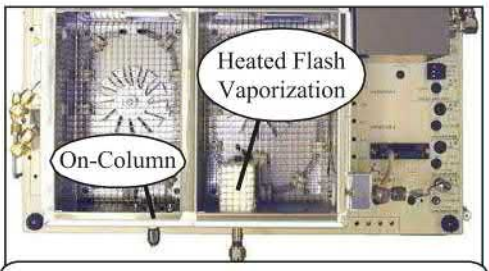


This chromatogram was generated by an SRI GC equipped with an OCPTV injector and an FID detector. A 25 meter narrow bore capillary column was used to separate 100ppm diesel range organics (DRO).

8690-0037	On-Column PTV Injector for GC

Heated Flash Vaporization Injector

- **Desorption of SPME Fibers**
- **Extremely Dirty Samples**
- **Adjustable from ambient to 300°C**
- **Includes On-Column Mode**



This 8610D GC has a standard On-Column Injector on the first oven, and an optional Heated Flash Vaporization Injector on the second oven.

The SRI Heated Flash Vaporization Injector is useful for applications which require flash vaporization of the sample prior to the column, such as desorption of SPME fibers or injection of extremely dirty samples where the nonvolatile residue must be trapped in the injection liner.

The injector's heater block can be thermostatted up to 300°C, and includes as standard equipment two injector liners: an inert SilcosleeveTM liner, and an unbreakable stainless steel liner, which also allows for on-column mode.

The Heated Flash Vaporization Injector option is an upgrade to an existing On-column Injector. Two heated injectors may be installed on the Model 8610C GC, but only one on the smaller Model 310. Where no need for a heated injector exists, SRI recommends using the standard On-column Injector.

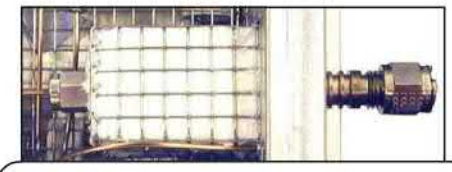
Heated Injection vs. On-column Injection: PROS and CONS

In the early days of GC, the column oven insulation was typically several inches thick. It was not then possible to insert a syringe through the oven wall to deposit the sample on the column and be assured that the sample would completely vaporize unless the injector was heated. On today's SRI GC, the oven wall insulation is much thinner. This allows the syringe needle to penetrate well inside the column oven, thus depositing the sample into the bore of the column itself. As the temperature is programmed up, the sample is completely vaporized. Even high boiling analytes such as C_{44} hydrocarbons chromatograph well using on-column injection, since the area of the column where the sample is deposited follows the column temperature and ultimately heats to a point where the C_{44} begins to migrate down the column. There is no need to employ a heated injector unless the sample needs to be split, or if the sample needs to be desorbed from a SPME fiber. In fact, the heated injector has some distinct disadvantages. The internal surfaces of the injector liner are more chemically active than the very inert interior of the column, so undesired adsorption and tailing can result when the sample is violently expanded in the hot interior of the heated injector. Also, the heated injector transmits some heat into the column oven because of its close proximity, making it harder for the oven to cool down close to ambient temperature.

8690-0025	**Heated Flash Vaporization Injector upgrade**
8670-0072	**Narrow bore SPME injector sleeve**

Heated Split/Splitless Injector

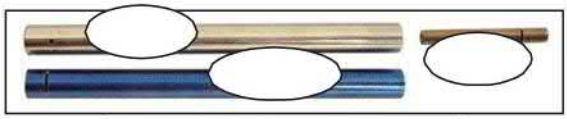
- **Split, Splitless, or On-Column Modes**
- **Narrow or Wide Bore Capillary Columns**
- **Adjustable from Ambient to 300°C**
- **Adjustable Split Flow**



The Split/Splitless Injector is insulated to help maintain its temperature independently of the column oven temperature.

The split flow is adjustable by a precision needle valve on the front of the GC valve oven. The GC pictured here is also equipped with a gas sampling valve, with the sample IN and OUT also on the front of the valve oven.

The Heated Split/Splitless Injector permits the use of narrow-bore capillary columns (0.32mm I.D. and smaller) in split or splitless modes. Capillary columns with 0.53mm I.D. and 1/8" packed columns can be used in split, splitless, or on-column modes. The injector temperature is adjustable from ambient to 300°C. The split flow is adjustable by means of a precision needle valve, and can be turned ON/OFF with a timed Event from the PeakSimple data system. One Silcosleeve liner and one unbreakable stainless steel liner are supplied as standard equipment with the injector.

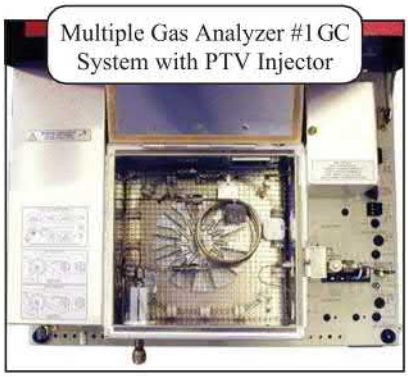


Stainless steel and Silcosleeve liners with megabore column adapter

The Split/Splitless Injector option is an upgrade to an existing On-column Injector, which is standard equipment on every SRI GC. When it is desired to add the Split/Splitless Injector as the second injector, an On-column Injector must be ordered as well (part number 8690-0023, page 54).

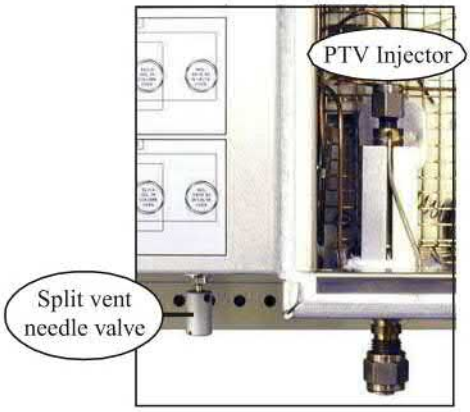
8690-0034	**Heated Split/Splitless Injector upgrade**

PTV - Programmable Temperature Vaporization Injector



- **Ballistic Heating**
- **Ability to Stop carrier gas**
- **Large Volume Injections—to 1.0mL+**
- **Achieve Low Detection Limits without pre-concentration**
- **Split/Splitless & On-Column Modes**
- **Thermal Desorption Applications**
- **PeakSimple Control**

The Programmable Temperature Vaporization (PTV) option adds ballistic heating capability to the Heated Split/Splitless Injector to accommodate large volume injections or thermal desorption applications. In the PTV mode, the insulation is removed from the Split/ Splitless Injector, so that the oven fan can cool the PTV Injector down between analyses.



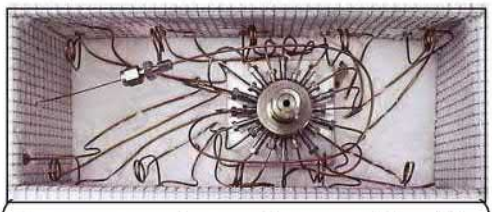
A small amount of adsorbent material, like Tenax, is packed inside the PTV injector sleeve. The initial column oven temperature, which maintains the injector cool-down temperature, should be set slightly higher than the boiling point of the solvent. As a large volume of sample is injected, the solvent vaporizes and passes through the adsorbent material and out the split vent. The split vent and carrier gas are under PeakSimple control. The carrier gas can be turned OFF during the PTV ballistic heating, in order to preheat the adsorbed analytes prior to desorbing onto the column.

The Silcosleeve™ liner can be packed with adsorbents like Tenax, loaded with sample offline, then inserted into the PTV for desorption.

8690-7034	**PTV & Split/Splitless Injector upgrade**

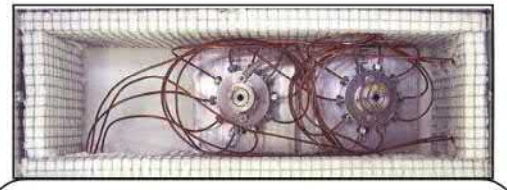
10-Port Gas Sampling Valves and 22-Port Selector Valves

- **Heated, Thermostatted Valve Oven**
- **Standard & Custom Plumbing Configurations**
- **Electronically Actuated with PeakSimple Control or Manually Actuated**
- **1, 2, or 3 Valve Capability**



22-port stream selector valve on our 10 position Method 5030 Purge & Trap Autosampler

SRI uses 10-port gas sampling valves because they provide more analytical flexibility for the same cost as 4 or 6 port valves. 10-port gas sampling valves can easily be plumbed to replicate the function of the simpler valves, while offering many other possible configurations. SRI offers standard plumbing configurations, including: Inject Only, Inject and Backflush, Precolumn Backflush to Vent, Column Sequence Reversal, Alternate Loop Inject, and Dual Loop-Dual Column. Many more plumbing configurations are possible, especially when multiple valves are plumbed together.



Dual 10-port gas sampling valves in the heated valve oven of a customized dual TO-14 injector

The optional valve oven, mounted on the 8610C GC, can accommodate two electrically operated plus one manually operated valve, and can be adjusted from ambient to 175°C (up to 300°C for the manual valve). Because the valve oven is immediately next to the column oven, tubing runs are short with no cold spots, which results in sharper peaks.

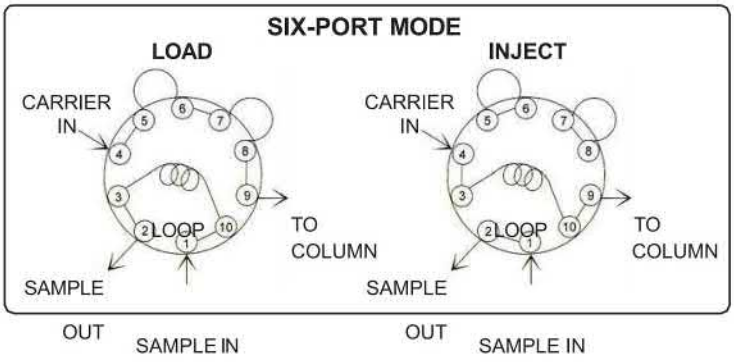
Each valve includes 1/8" stainless steel bulkhead fittings on the front of the optional valve oven for sample in/out connections. A single heated (375°C max) fast-cooling adsorbent trap plumbed as the loop of the gas sampling valve is also available for applications where sample concentration is desired. The trap cools to a user-controlled setpoint, not just to ambient temperature, so the adsorbent characteristics (water rejection, etc.) can be manipulated.

8690-0063	**10-Port Manually Actuated valve, plumbed & tested**
8690-0065	**10-Port Electrically Actuated valve, plumbed & tested**
8690-0077	**Automated 22-port, 10-Stream Selection valve, plumbed & tested**
8690-0088	**Heated, thermostatted valve oven mounted on an 8610C GC**

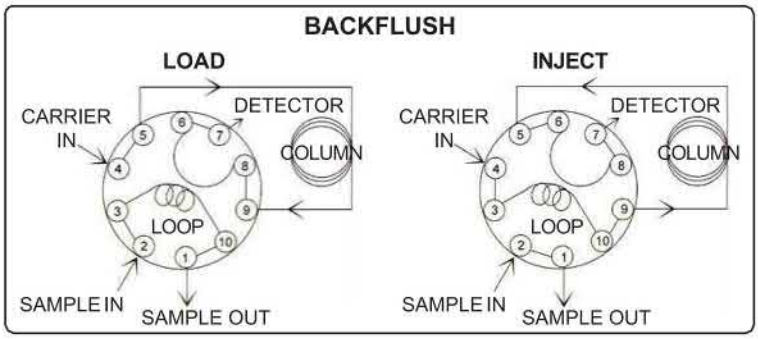
10-Port Gas Sampling Valve Plumbing Option Examples

The valve plumbing configuration shown at right is the standard 6-port configuration. The sample loop connected between ports 3 and 10 is inserted into the carrier gas stream

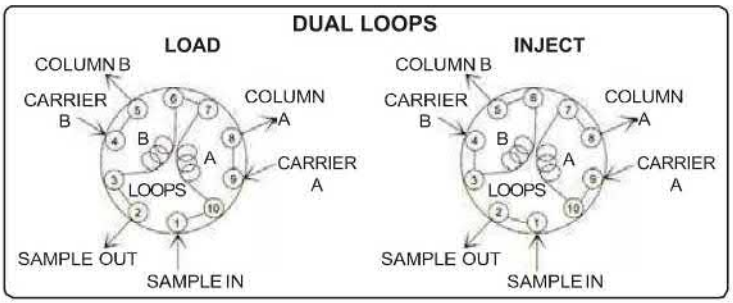
when the valve is rotated to the INJECT position.



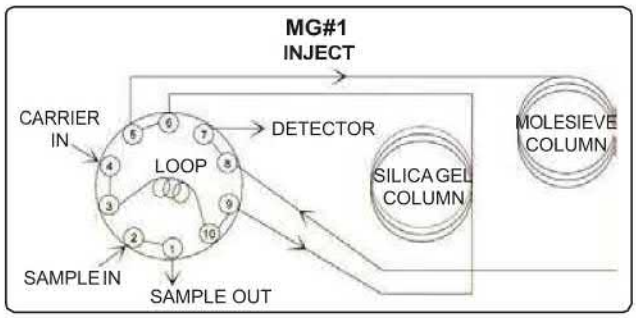
The same 10-port valve can also be configured to backflush the column when the valve is rotated. Backflushing can often shorten the analysis by eliminating the need to program the column temperature up to elute high boiling analytes.



A single 10-port valve can be plumbed to inject the same sample onto two separate columns using two separate loops.This is especially useful where two different carrier gas types are used, or where the detectors employed have very different sensitivities and need different sample sizes injected.



alve configuration shown at right is our Multiple Gas Analyzer #1 (MG#1) valve. In the LOAD position, the sample loop is filled with new sample gas, and the Silica Gel column is downstream of the MoleSieve column. In the INJECT position (shown), the contents of the loop are flushed into the Silica Gel column, which is now upstream. The lightest analytes blow through onto the MoleSieve for separation. The valve is then rotated back to the LOAD position, just prior to the elution of ethane for the separation of C_2-C_6.

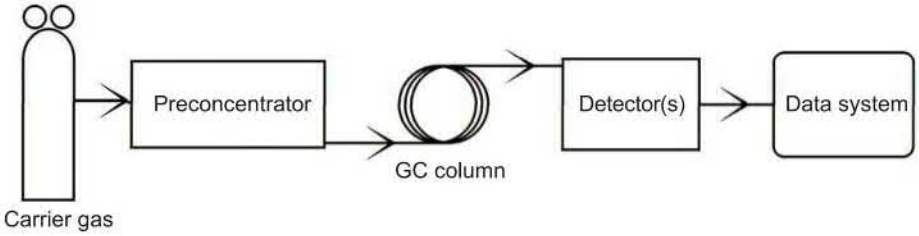


Sample Preconcentration and Enrichment Options

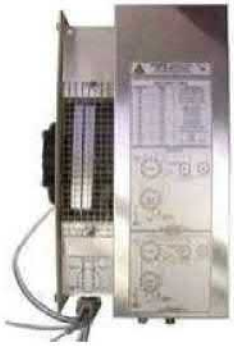
SRI offers a variety of trapping options for preconcentrating or enriching samples for GC analysis.

- **Traditional Heated Adsorbent Trap** for preconcentrating molecules between C_3 and C_{15}
- **Permeation Trap** for gases dissolved in liquid samples`
- **Enrichment Coil** for thermal modulation of gas streams

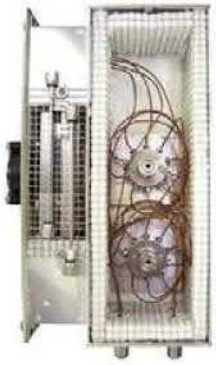
In terms of flow, the preconcentrator is always upstream of the GC column oven. Trap and valve ovens are mounted on the left-hand side of the GC.



Most of these options employ the versatile 10-port gas sampling valve described on the previous pages. Each valve in turn requires a heated valtve oven. The only exception featured here is the Enrichment Coil option, designed for use on the Model 110 detector chassis or in the GC column oven.



Permeation trap with DGA accessory



Dual TO-14 Concentrator (four traps, two valves)

Heated Adsorbent Traps

- **Dual setpoints for adsorption & desorption temperatures**
- **Preconcentrates molecules between C_3 and C_{15}**
- **Single (1/8") or Dual (1/4") Independently Heated Traps**
- **Requires a 10-port Valve & Valve oven**
- **Adsorbent packing of your choice**
- **PeakSimple Control**

ADSORBENTS

Carbosieve II MoleSieve 13X
Carbopack B Silica Gel
HayeSep-D Tenax-GR

Heated adsorbent traps are a simple and economical way to preconcentrate samples for the GC. A heated trap consists of a stainless steel tube packed with adsorbent. While sample is drawn through the tube, analytes of interest are trapped on the adsorbent bed. Then, the trap is heated and the valve rotated to desorb the analytes into the carrier gas stream, which deposits them in the analytical column for separation prior to reaching the detector.

Each SRI trap is plumbed as a sample loop of a 10-port gas sampling valve. A valve and heated valve oven must be ordered along with a heated trap. SRI heated traps are installed in the ducts of the valve oven on the left-hand side of an SRI 8610 GC.

Top view of an SRI heated trap

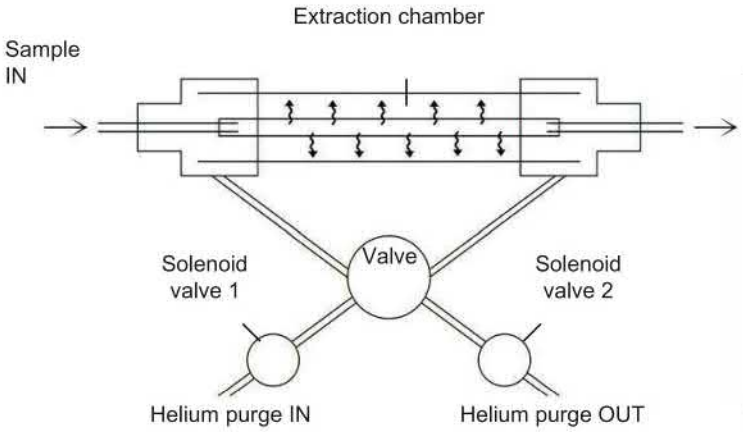
Choose one or two independently heated traps packed with your choice of adsorbent. Rather than using multiple adsorbents with different affinities and desorption temperatures in one trap, SRI uses a unique dual trap system for simultaneous trapping and desorption of dissimilar analytes. Dual heated traps are an integral part of the SRI Purge and Trap and the TO-14 Air Concentrator. For most applications, dual heated traps still require just one 10-port gas sampling valve.

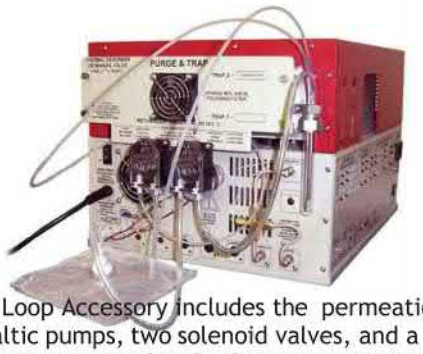
8690-0084	**Heated/fast cooling adsorbent trap and plumbing for existing gas sampling valve 1/8"**
8690-1084	**Heated/fast cooling adsorbent trap and plumbing for existing gas sampling valve 1/4"**
8690-0065	**10-Port electrically actuated valve, plumbed & tested**
8690-0088	**Thermostatted valve oven mounted on an 8610C GC**

DGA Permeation Loop Accessory

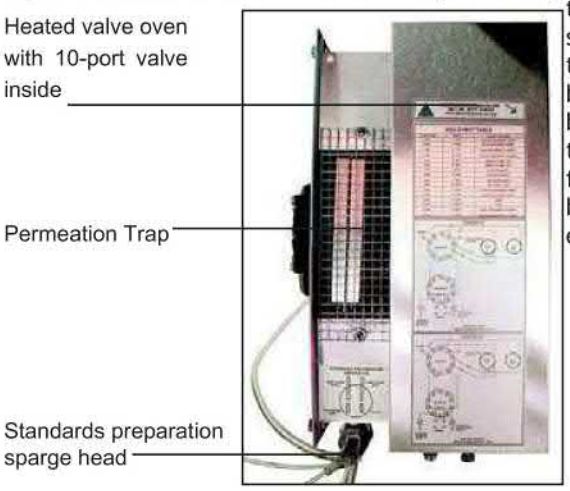
- **For Extracting and Preconcentrating Dissolved Gases in liquid samples**
- **Built-in Standards Preparation Module—Make Your Own Standards**
- **Requires a Valve Oven & one or two 10-port Valves**

The Permeation Loop consists of permeation membrane tubing encapsulated in a trap-heated glass tube. When sample liquid is pumped through the permeation tubing, the dissolved gases therein selectively permeate through the heated membrane into the surrounding extraction chamber, which is plumbed as the loop of a 10-port gas sampling valve.





Top view of the DGA-TOGA Permeation Trap Accessory

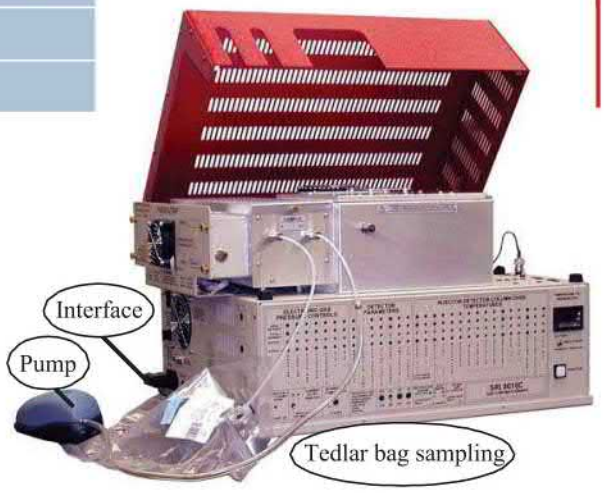


The Permeation Loop Accessory includes the permeation trap, two peristaltic pumps, two solenoid valves, and a standards preparation sparge head. By reconnecting a few tubing lines, the DGA-TOGA Permeation Loop Accessory can be configured to prepare dissolved gas standards. A Tedlar bag, or other container, filled with gas standard is connected to the standard pump. The standards preparation vessel is filled with sample liquid, such as water. The standard pump bubbles gas standard into the standards preparation vessel, equilibrating the liquid over time to a known concentration.

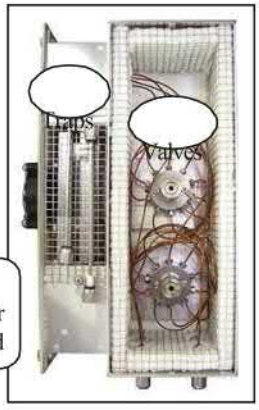
8690-0087	**DGA Permeation Trap accessory**
8690-0065	**10-Port electrically actuated valve, plumbed & tested**
8690-0088	**Thermostatted valve oven mounted on an 8610C GC**

Method TO-14 Air Concentrator (1 Trap or 2)

- **Sample from Source, Tedlar Bags, Canisters, or Ambient Air**
- **Vacuum Pump and Data System controlled Interface**
- **Independently Heated Dual Trap Design (optional)**
- **10-port Electrically Actuated Valve**
- **PeakSimple Control**



The SRI Method TO-14 Air Concentrator is equipped with a vacuum pump and interface, a 10-port gas sampling valve, and one or two independently heated adsorbent traps. The included external vacuum pump may be attached to the downstream side of the traps to load a gas sample automatically, under control of the PeakSimple data system.



Shown here is a dual TO-14 Air Concentrator with four traps and two gas sampling valves.

The gas sample may be contained in Tedlar bags or canisters, or may be sampled directly from the source. The vacuum pump is operated for several minutes or more to pass 100-200mL/minute of gas through the traps, where the organics are retained. Several liters or more may be concentrated, depending on the detection limit required. Once the analytes are trapped, they are desorbed and directed to the column for separation.

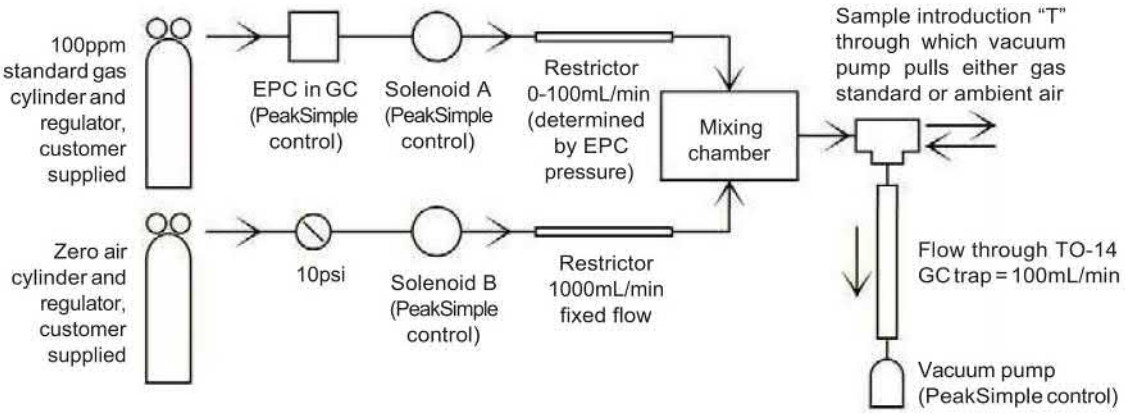
The TO-14 Air Concentrator comes with single or dual traps. The single trap option is good for most analyses. If vinyl chloride is a target analyte, order the dual trap option. Please see the Purge & Trap pages for an explanation of the benefits of our unique dual trap design.

8690-1051	**Method TO-14 Air Concentrator with 1 trap**
8690-1055	**Method TO-14 Air Concentrator with 2 traps**

Automated Calibration System (ACS)

For the SRI TO-14 Air Monitoring GC

The SRI Automatic Calibration System (ACS) allows for automatic, unattended recalibration when using an SRI GC equipped with the TO-14 Air Concentrator for ambient air analysis.



Under control of the PeakSimple software included with the GC, the ACS can make dilutions of the customer-supplied standard gas and Zero Air at ratios of 10,000 to 1. For example, if the standard EPC on the TO-14 GC is set to 50psi, a 100ppm standard gas flows through the restrictor at a rate of 100 milliliters per minute; the Zero Air flows at a rate of 1,000 milliliters per minute. This produces a 10ppm diluted gas, which is sampled into the TO-14 Air Concentrator by the vacuum pump (supplied with the TO-14 Air Concentrator).

By manipulating both the EPC pressure and time, the 100ppm standard can be diluted over a 10,000 to 1 concentration. For example, let's say you've decided to use 300 seconds as the length of time the vacuum pump is sampling the standard gas. If the standard EPC pressure is reduced to 10psi, the standard gas flow rate is reduced to 10 milliliters per minute, and the resulting diluted concentration is 1ppm. If solenoid A is open for 30 seconds (10% of the total 300 second time period during which the vacuum pump is pulling sample through the TO-14 trap), the resulting time-averaged concentration is 100ppb. Because PeakSimple controls the dilution ratio, a multi-point calibration curve can be automatically constructed as part of the Autosampler Queue feature. The Autosampler Queue permits PeakSimple to periodically recalibrate without operator intervention.

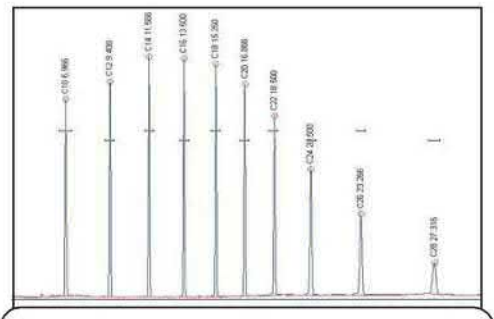
8640-0050	TO-14 Automatic Calibration System

Thermal Desorber

- Volatile & Semivolatile compounds in Solid Matrices
- Mounts in the Valve Oven on the 8610C GC
- High Temperature & High Sensitivity
- Manually Actuated 10-port Valve
- No solvent extraction required
- Simple to Use

The SRI Thermal Desorber accessory permits volatile and semivolatile compounds in soil, or other solid matrices, to be injected and analyzed with little or no sample preparation, and with very high sensitivity.

With the Thermal Desorber, no solvent extraction is required. This is a major convenience for field operations, and helps save on costs. Little operator skill is needed, and 4-10 analyses can be run per hour, depending on specific requirements.



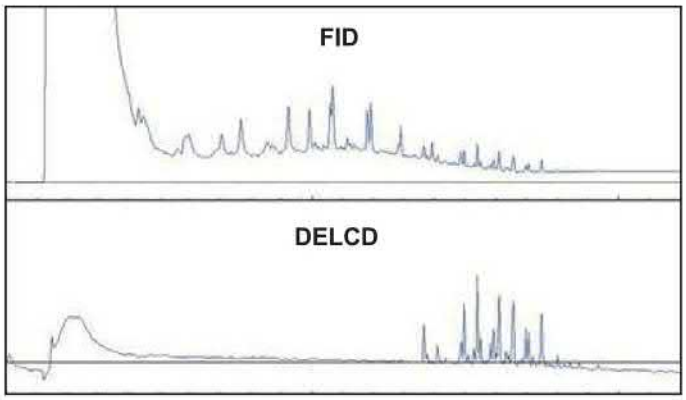
This chromatogram is from a GC with a Thermal Desorber and an FID detector. Synthetic diesel range samples like this are used to verify complete desorption. Sample: 2000ng synthetic diesel range organics desorbed from soil.

Up to one gram of soil is loaded into a reusable glass tube, and secured in place with plugs of glass wool. The tube is then inserted into the hot (275 °C) thermal desorber fitting, which is mounted in the heated valve oven compartment of the 8610C GC.

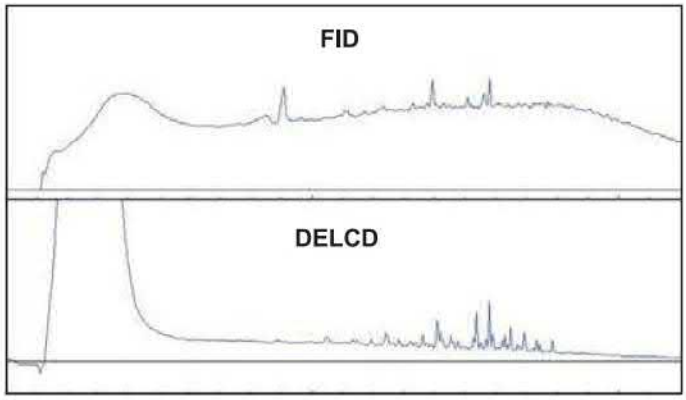
Because of the large sample size—up to 1 gram, an analyte present in the soil at 1ppm desorbs 1000 nanograms onto the GC column. This results in detection limits in the ppb range for most compounds. Sandy soil can typically be desorbed with no sample preparation at all. Clay soil is first mixed with sodium sulfate granules to break the clay into a fine powder coating the granules, then the clay and sodium sulfate mix is desorbed.

Thermal Desorber

Soil samples can typically contain 20-50% water. FID or FID/DELCD detectors are commonly used with the Thermal Desorber, because the SRI FID automatically relights the flame after the large water peak. The Thermal Desorber + FID/DELCD configuration is perfect for detecting PCBs, pesticides, PAHs, JP-4, kerosene, and diesel in soil. Due to the extreme selectivity of the DELCD, PCBs can be discriminated even in the presence of massive hydrocarbon contamination.



The top two chromatograms show the analysis of PCB 1254 standard in diesel oil with our PCB GC System, which is equipped with a Thermal Desorber and FID/DELCD detectors in combination. The FID shows the diesel hydrocarbons and the PCBs, but the PCB peaks are obscured by the diesel peaks. In contrast, the DELCD shows the PCBs only, revealing what was essentially hidden in the FID chromatogram.

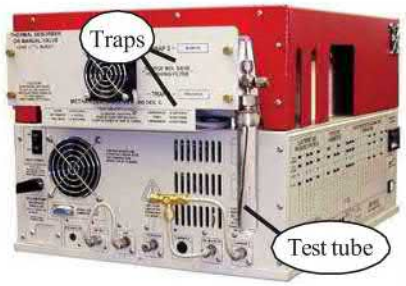


The bottom set of chromatograms show the analysis of a real-world standard: 0.3 grams of soil from a contaminated site. This real-world standard is NIST certified to contain 1.34ppm PCBs. The FID shows a large hydrocarbon matrix which is precombusted in the FID flame prior to reaching the DELCD, which shows a clean PCB 1254 chromatogram. Precombustion of the sample by the FID protects the DELCD from hydrocarbon contamination.

8690-1088	**Thermal Desorber on 8610C GC** Includes 10 reusable glass desorber tubes
8690-1087	**10-pack reusable ground glass desorber tubes**

Purge & Trap

For the SRI TO-14 Air Monitoring GC



The Method 5030 Compliant Purge & Trap uses disposable test tubes at ambient temperature.

- **Built into the GC for lower dead volume and better peak shape—no transfer line!**
- **Two Independently heated Adsorbent Traps**
- **EPA Methods Compliant**
- **PeakSimple Control**

Built-in to the Model 8610C GC, the SRI Method 5030/5035 Compliant Purge & Trap concentrates the volatile organic compounds (VOCs) in a gas, water, or soil sample onto two adsorbent traps, from which they are automatically desorbed onto the GC column. The Method 5030/5035 Compliant Purge & Trap is equipped with interchangeable purge heads. The 5035 purge head is a thermostatted (typically 40°C) sleeve which accepts standard 40mL VOA vials. The entire sleeve is mechanically agitated while purging to comply with the requirements of EPA Method 5035. The 5030 purge head uses low-cost, disposable 16mm test tubes which are purged at ambient temperature. For higher level soil samples or soil/methanol extractions, the test tube is more convenient and less expensive than VOA vials.

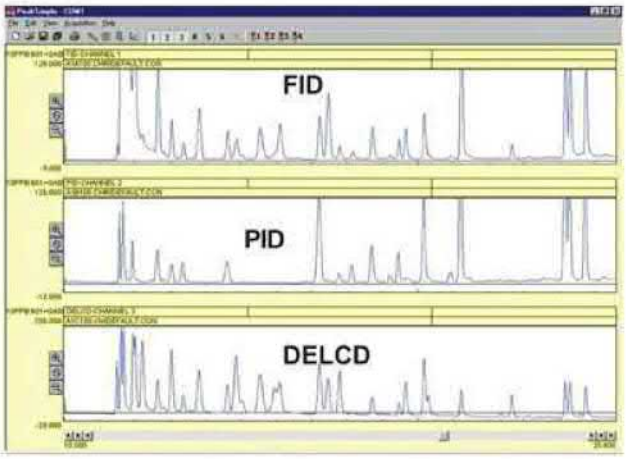
The Method 5030/5035 Compliant Purge & Trap has interchangeable purge heads, and a syringe port for adding internal standard or water. The 5035 purge head is heated and mechanically agitated under PeakSimple data system control.

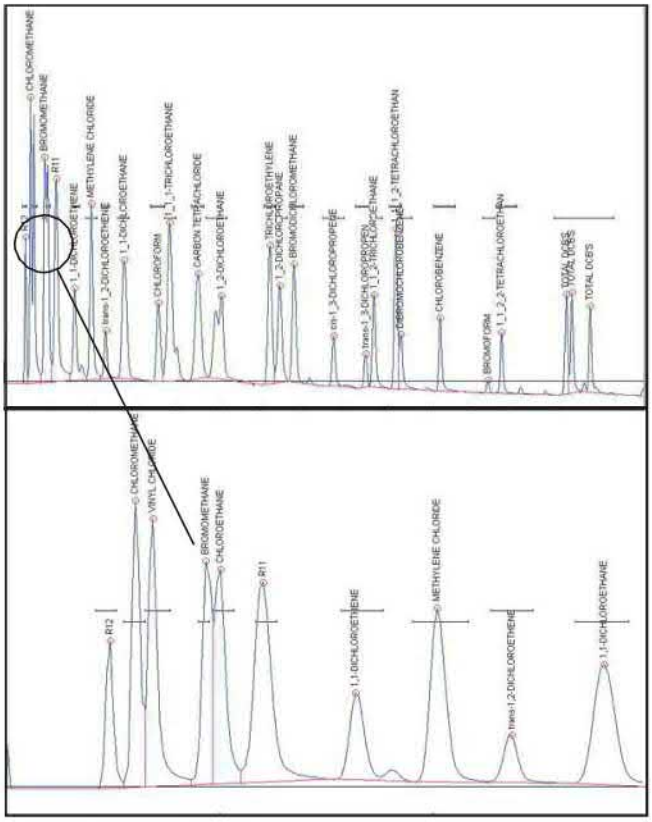
Operation of the Purge & Trap is completely automated by the PeakSimple data system that is built into the GC. Run parameters such as purge time, desorb preheat, bake-out, vial temperature, and mechanical agitation are adjusted in a PeakSimple Event table.

The SRI Purge & Trap is unique because it is equipped with two traps rather than one, and each trap can be heated independently at the adsorption temperature (typically 35-70°C), the desorption temperature (200°C), and the bake- out temperature (250°C). For most VOC applications, the first trap is Tenax-GR, and the second trap is Carbon Molecular Sieve. By setting the adsorption temperature of the Carbon MoleSieve to 50-60°C and the Tenax-GR to 35°C, water retention is dramatically reduced. By staggering desorption times, early eluting peaks from the hot Carbon MoleSieve trap are refocused on the temporarily cold Tenax-GR trap, resulting in much sharper peaks than otherwise possible (see the chromatograms on the following page).

Purge & Trap

By comparing the relative response, the three detectors make peak identification and confirmation easy. The FID responds to all hydrocarbons, the PID responds to some hydrocarbons and all aromatics, and the DELCD responds to halogens only.





The DELCD chromatogram is shown at left in more detail, and with the peaks labeled for identification. The DELCD is completely selective for compounds containing chlorine and/or bromine. Other analytes do not respond at all, even at very high levels. The DELCD actually operates on the FID's exhaust gases; therefore, all contaminants are precombusted by the FID to CO_2 and H_2O.

The first few peaks in the 8021 standard, including vinyl chloride, are of special interest to many analysts. The chromatogram to the left shows the expanded detail of the first few peaks in the analysis (the VOC gases). Note the exceptionally good resolution and peak shape delivered by the SRI system with its dual trap technology.

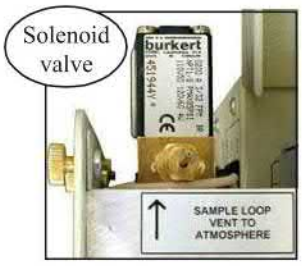
8690-0052	**Method 5030/5035 Compliant Purge & Trap** (with interchangeable purge heads)
8690-0051	**Method 5030 Compliant Purge & Trap**

Heated Static Headspace Injector

- **Uses standard 40mL VOA vials**
- **VOA Vial Sleeve thermostatted from Ambient to 90°C**
- **Gas Sampling Valve with fixed volume Loop**
- **Gauge displays Actual Vial Pressure**
- **Liquid, Solid, or Powder samples**
- **Complete PeakSimple Control**

The Heated Static Headspace Injector is useful for the analysis of volatiles, especially where the sample matrix is dirty. A 10-port gas sampling valve and fixed sample loop are used for maximum precision.

The thermostatted headspace sleeve accepts standard 40mL VOA vials with 10-20 mLs of sample.



As the vial is inserted into the headspace sleeve, two needles puncture the septum top of the vial. Purge gas enters through one needle to pressurize the vial, and the other needle carries headspace vapors to the loop of the gas sampling valve. A solenoid valve located at the loop exit is opened under PeakSimple data system control to allow headspace vapors to purge through the loop just prior to injecting the loop contents onto the column. The entire headspace sleeve is mechanically agitated under control of the data system.

The headspace sleeve is thermostatted from ambient to 90°C under PeakSimple data system control, and can be cooled down before removing the VOA vial.

8690-0045	**Heated Static Headspace Injector**

HT2000H Headspace Autosampler

- Interfaces with SRI and other GCs
- Holds 42 Standard 6/10/20mL Headspace Vials
- Injects Directly into the GC—No transfer lines
- 6 Position Incubator with Orbital Shaking
- Progressive Sample Transfer

It supports a 42 positions removable sample rack for 6, 10 or 20ml vials. The sample rack can be removed for sample loading or preparation, or to be stored elsewhere.

The HT2000H is the most compact autosampler on the market (no requirement for additional bench space, or for GC injector modification).

It fits all GC and GC/MS systems, available on the market - more or less recent.

It can use both the front and rear injector on the most of the supported GC. The injector selection is made directly by the sequence list, avoiding difficult set up operations or re-installation to pass from one injector to another one. Furthermore, rotating head design assures that the injection port is always free, for eventual manual injections.

COMPARE MODELS

	HT2100H	HT2000H	HT2000HT
Sample Capacity	14 samples: 20 or 10ml	42 samples: 20, 10 or 6ml	42 samples: 20, 10 or 6ml
Removable Rack	-	√	√
User Interface	Keypad	Touch Screen	Touch Screen
Oven Position(s)	1	6	3
Oven Temperature Range	Off; 40-150°C	Off; 40-170°C	Off; 40-300°C
Shaking Capability	YES (Sussultatory)	YES (Orbital)	YES (Orbital)
Programmable Injection Volume	√	√	√
Supported Headspace Syringe	1, 2.5 and 5ml	1, 2.5 and 5ml	1, 2.5 and 5ml
Software: HTA Autosampler Manager (Standard Version)	Included	Free trial (60 days)	Free trial (60 days)

HT2000H	HTA 42-Vial Headspace Autosampler

HT3000A Liquid Autosampler

- **Holds 121 2mL vials**
- **Interfaces with SRI and other GCs**
- **15-Step Automatic Injection Sequence**
- **Direct Injection, No Transfer Lines**

Just load your samples and run the analysis with no extra down time.

HTA is the first to offer GC liquid autosampler with a large, full-color touch screen interface, providing easier system accessibility and usability. In fact touch screen eliminates drilldown, simplifying instrument control for novices and experienced users.

HT3000A is the most compact autosampler on the market (no requirement for additional bench space) while offering top-class sample capacity. HT3000A is available in the standard version with 121 positions for 2ml vials, while optional racks are also available. For different sample capacity please check HT3100A (15 vials) or HT3200A (209 vials).

Applications:

- sampling: ambient headspace, multi-phase, small volume;
- injection: priority, with the internal standard technique, dual simultaneous injections (high-throughput and confirmation mode);
- controlled sampling speeds to work with a wide range of sample viscosities;
- syringe washes: with sample or with solvent, single or double wash step capability;

HT3000A	**HTA 121-Vial Liquid Autosampler**