

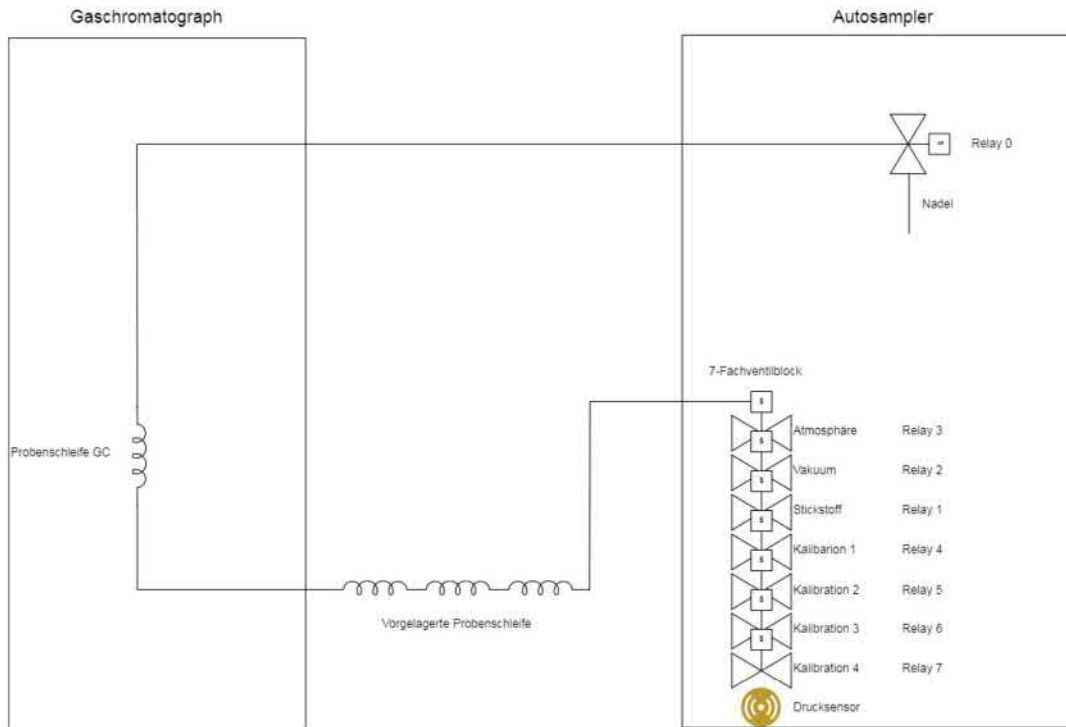
AS-210 Greenhouse Workstation

- 210 Positions Headspace Vials or 360 Positions Labco Exetainer
- Combinable with all GC's which are fit with a 10-Port-Valve and Sample-Loop
- 4 Methodes
- Direct connection of up to 4 Calibration Gases



- 4 methods
- 9 sequences
- Openly programmable step rates
- User-specific rack size possible
- Maximum path X= 380 mm Y=480 mm Z= 150 mm
- 4.3" Touch Screen
- System can be purged with Nitrogen
- Evacuation of sample system with rotary vacuum pump (down to 2 mbar)
- Pressure control by sensor
- Up to 4 calibration gases can be used
- Can be used with each GC which is equipped with a sample loop

AS-210 Greenhouse Workstation



Theory of sampling:

1. System flushed with Nitrogen
2. Evacuation of sample system
3. Needle pierces Vial - sample streams to the evacuated system
4. Pressure compensation to ambient pressure
5. Pre sample loop avoids that ambient is coming to the sample loop

Online Sampler for Purge & Trap

- For use with SRI Method 5030 Purge & Trap
- Automatically fills and empties the Purge Vessel
- Valve and 5mL loop for precise sampling
- Data System Control



GC Injectors

The Online Sampler for Purge & Trap is designed for applications where a single water stream needs to be measured automatically and repeatedly by purge & trap. The Online Sampler automatically fills and empties the test tube purge vessel of the SRI Method 5030 Purge & Trap with a precisely metered 5mL volume of water. This is useful when monitoring a single stream of contaminated groundwater, or a wastewater stream. A valve with a 5mL loop, special plumbing, and a custom purge head make up the Online Sampler. The stream to be monitored is plumbed to the Online Sampler and a 10-100mL/minute flow is established to continuously flush the 5mL loop with fresh sample.

When used with an SRI Purge & Trap GC, the PeakSimple data system controls the sampler to transfer the 5mL loop contents into the purge vessel of the purge & trap. When the purge is complete, the purge vessel is emptied to waste.

The valve may be optionally configured with a second loop so that an internal standard can be injected along with the water sample.

8690-0075

Online Sampler for Purge & Trap

Methanizer (for low level CO and CO₂ by FID)



- Converts CO & CO₂ to Methane without changing retention times
- Enables the FID Detector to detect low levels of CO & CO₂
- Three possible configurations for your application needs
- Thermostatted to 380°C

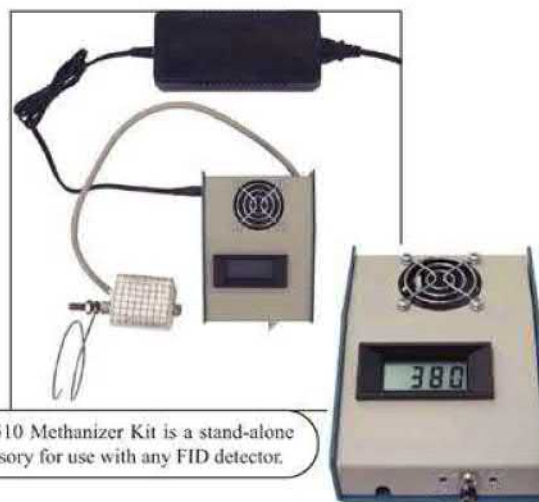
The Methanizer option enables the Flame Ionization Detector to detect low levels of CO and CO₂. The Methanizer is packed with a nickel catalyst powder. During analysis, the Methanizer is heated to 380°C. When the column effluent mixes with the FID hydrogen supply and passes through the Methanizer, CO and CO₂ are converted to methane.

Since the conversion of CO and CO₂ to methane occurs after the sample compounds have passed through the column, their retention times are unchanged. Hydrocarbons pass through the Methanizer unaffected. The special Methanizer FID detector assembly operates like the regular FID detector, except that the FID temperature must be set to 380°C. Due to the chemical relationship between nickel and sulfur, the Methanizer can be poisoned by large quantities of sulfur gas.

The Methanizer accessory is available in three configurations:

1. Built into the FID detector.
2. Built into the valve oven ducts on the side of an 8610 GC.
3. As a stand-alone unit for use with any FID detector.

When choosing the second option, a valve oven must also be ordered (part #8690-0088; see price list below).



The 510 Methanizer Kit is a stand-alone accessory for use with any FID detector.

8690-0082	Methanizer Jet installed in special FID detector body
8670-1082	Replacement Methanizer Jet
8690-0081	Methanizer accessory built into valve oven
8690-0088	Heated, thermostatted valve oven mounted on an 8610C GC
8670-1081	Replacement Methanizer tube
0510-0081	510 stand-alone Methanizer Kit for use with any FID
0510-1081	510 Methanizer replacement tube

Hydrogen/Hydrocarbon Leak Detector/Monitor

- Detects Hydrogen and Hydrocarbons down to 500ppm
- Find Leaks or monitor H₂ and HC concentrations
- General purpose Voltmeter included

The Hydrogen/Hydrocarbon Leak Detector & Monitor is useful for sniffing the fittings on your GC for leaking hydrogen or Argon/Methane. It can also be used for detecting leaking natural gas, propane, or other volatile hydrocarbons. Detection limit is approximately 500ppm. The H₂/HC Leak Detector is also useful for long term monitoring of hydrocarbon concentrations in a flowing stream or static chamber. The sensor element is the same CCD (Catalytic Combustion Detector) that is used as a GC detector on SRI GCs.



The leak detector is attached to the included voltmeter to provide a digital readout. As the H₂/HC concentration increases, the voltmeter numbers increase. By utilizing a voltmeter as a readout device, the cost of the leak detector can be kept low. Unlike other leak detectors which use a row of LEDs as a low resolution readout, the voltmeter's high resolution display allows the user to notice small changes which would be hard to see on an LED display. The 115 volt AC unit comes with a 9 volt power supply, but can also be run on battery power using any battery source with voltage between 8 and 15 volts DC. Power consumption is approximately 200 milliamps. The H₂/HC leak detector can also be built into the Model 203 PeakSimple data system for longer term strip-charting, monitoring, or data logging.

8690-5600	Hydrogen/Hydrocarbon Leak Detector/Monitor (115 volt AC)
8600-5655	Model 333 PeakSimple Data System with Hydrogen/Hydrocarbon Sensor installed

Sample Stream Dryer



- Uses rechargeable Molecular Sieve dessicant beads and Nafion tubing
- Water is absorbed while gases pass through unaffected
- For use with water sensitive columns
- A simple, economic way to dry gas samples for GC



8670-5850

Sample Stream Dryer

Built-in “Whisper Quiet” Air Compressor

- Built into the GC Chassis
- Powerful enough to supply FID air (300mL/minute)
- Convenient—Recommended for Field Work

The Built-in “Whisper Quiet” Air Compressor provides an infinite and nearly silent supply of air for the FID, FID/DELCD, NPD, FPD, TID, or CCD detector. It mounts unobtrusively inside the 8610 or 310 GC chassis, and delivers unfiltered air to the detector.



With the built-in air compressor, no air cylinders are required. This simplifies field operations, and saves the expense of regularly replacing air cylinders.

8690-0070	Built-in “Whisper Quiet” Air Compressor
8690-2270	Same as above but 230 VAC

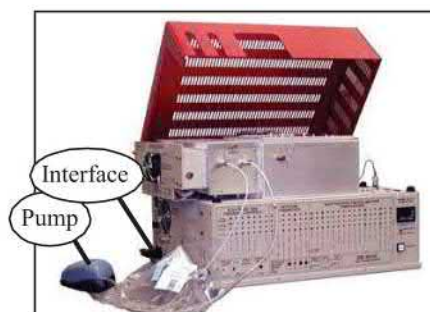
Vacuum Pump Interface

- Draw air samples through traps or load the loop of a gas sampling valve
- Retrofit Tekmar, O.I., & SRI Purge & Trap Systems
- Thermostatted & Mechanically Agitated VOA vial sleeve

The Vacuum Pump Interface is a data system controlled main power outlet (115 or 230 VAC) on the side of an 8610 or 310 GC for an external vacuum pump. The PeakSimple data system can turn the power to this receptacle ON/OFF, thus controlling the vacuum pump.

Typically, the vacuum pump is used to draw gaseous samples through the traps for ambient air monitoring applications, or to load the loop of a gas sampling valve by pulling sample gas from a remote location.

Because the vacuum pump can be turned ON for a precise length of time, the gas flow through the traps is very reproducible (approximately 100mL/minute).



8690-0073	Vacuum Pump Interface and Pump
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PeakSimple Chromatography Data Systems



6 channel data system built into an 8610C GC

- Built into Every SRI GC
- Available separately for use with most GCs and HPLCs
- Easy Connection to your Windows™ PC
- 1 and 6 Channel Models available
- PeakSimple Software Included

6 channel stand-alone data system



PeakSimple Chromatography Data Systems consist of hardware and software. The hardware is available as a stand-alone data system for connection to almost any model GC, HPLC or CE system. The same hardware is supplied as standard equipment with every SRI HPLC, 8610 and 310 GC. No hardware is installed in your computer, so a portable laptop may be used instead of a full-sized desktop PC. PeakSimple chromatography acquisition and integration software for Windows is provided with each data system, and updates are FREE from the SRI website: www.srigc.com.

The data system hardware comes in two versions:

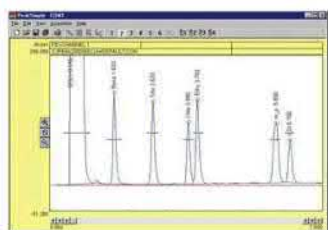
- 1) 1 channel USB Model 333 for one detector
- 2) 6 channel USB Model 302 for up to 6 detectors on 1-4 instruments

Both models use the same PeakSimple software.



Model 333 Single Channel Data System

- Easy USB Connection to your Windows™ PC
- Eight TTL Outputs and One Remote Start Input
- Four optional Contact Closures
- Includes PeakSimple Software



The Model 333 is standard in every 8610, 410 or 310 GC and 210 HPLC. It can also be mounted in a separate box, ready for connection to other manufacturers' GC detectors. The Model 333 Data System consists of PeakSimple for Windows software and a single channel, 20-bit high resolution A/D board.

When mounted in an SRI GC, the Model 333 controls the column oven temperature program, and the pressure program of the carrier gas electronic pressure controller (EPC). The eight available TTL outputs are connected internally within the GC to control functions such as valve rotation, gas solenoid actuation, autosampler injection, etc.

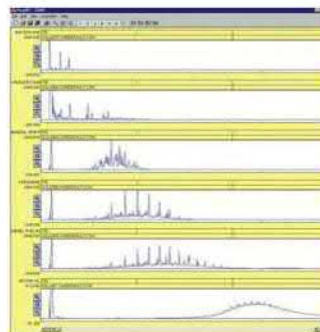
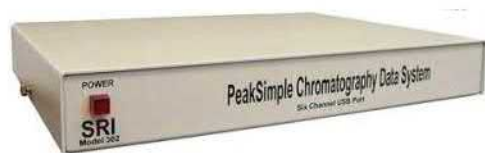
When mounted in a separate box, the temperature and pressure control outputs are available for use, but not connected to anything. The eight TTL outputs can optionally be wired to a bank of four single-pole, dual-throw mechanical relays with screw terminals for easy connection to any user device which operates from a contact closure. A remote start input allows run initiation from the user's GC. Data can be acquired at rates up to 50Hz.

The 230 volt system is supplied with a UL, CSA, and CE/VDE approved universal power supply, which will operate on any AC voltage from 100-250 volts. For computers with USB ports only.

8600-1050	Model 333 Single Channel Data System
8600-1250	Model 333, 230VAC
8600-1051	Optional 4 Contact Closures

Model 302 Six Channel USB Data System

- 6 Channels, 4 separate Time Bases, 4 Remote Start Inputs
- Independent Start & Stop times for 4 separate instruments
- Easy USB Connection to your Windows™ PC
- Includes PeakSimple Software



The Model 302 Data System is for analysts who prefer the hot-swappable, plug-and-play capabilities of Universal Serial Bus devices. The Model 302 can be mounted inside the 8610C or 310 GCs, or it can be mounted in a separate box, ready for connection to other manufacturers' GC. The Model 302 Data System consists of PeakSimple for Windows software and a six channel, 24-bit high resolution A/D board.

When mounted in an SRI GC, the Model 302 controls the column oven temperature programs, and the pressure program of the carrier gas electronic pressure controller (EPC). When mounted in the Model 210 HPLC system, the Model 302 controls the pump speed and gradient profile. The eight available TTL outputs are connected internally within the GC or HPLC to control functions such as valve rotation, gas solenoid actuation, autosampler injection, etc.

When mounted in a separate box, the temperature, pressure, and gradient control outputs are available for use, but not connected to anything. The eight TTL outputs are wired to a bank of eight single-pole, dual-throw mechanical relays with screw terminals for easy connection to any user device which operates from a contact closure. Four remote start inputs allow run initiation from the user's GC.

Each of the six channels of data can be randomly assigned to one of four time bases, which allows independent start and stop times for four separate instruments. Data can be acquired at rates up to 50Hz per channel for 1 or 2 channels, or 20Hz for all 6 channels. The Model 302 is for use with Windows computers that have USB 2.0 ports (manufactured in 1998 or later).

8600-6055	Model 302 Six Channel USB Data System, 115VAC
8600-6255	Model 302 Six Channel USB Data System, 230VAC

PeakSimple for Windows™ Software



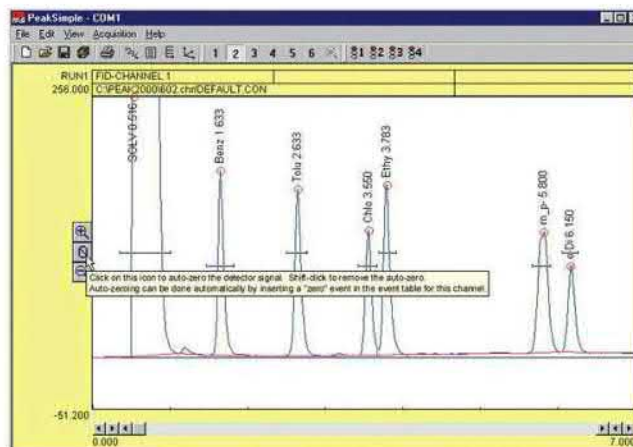
- Easy USB Connection to your Windows™ PC
- Eight TTL Outputs and One Remote Start Input
- Four optional Contact Closures
- Includes PeakSimple Software

PeakSimple software has been continuously developed, refined, and improved since 1988 by a dedicated team of working chromatographers. These chromatographers use the software on a daily basis, and strive to simplify and enhance every aspect of PeakSimple so our customers will benefit. New features are added to PeakSimple several times per year, and the latest version is always FREE to download online, along with helpful tutorials. When you call SRI technical support, a knowledgeable technician will answer your questions right away. No complicated phone menus, and no waiting on hold!

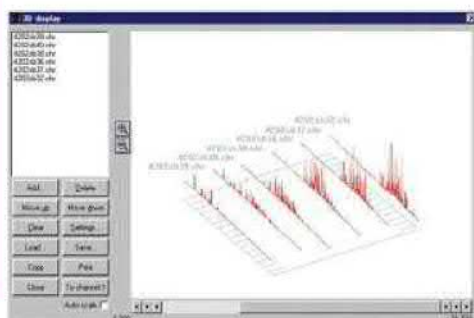
FEATURES

- | | |
|------------------------------------|------------------------------|
| • 3D Multiple Chromatogram Display | • Report Generation |
| • Built-in FTP capability | • Multi-level Calibrations |
| • Click & Drag Retention Windows | • Data Merge across channels |
| • Baseline Subtraction | • Autosampler Queue |
| • Chromatogram Overlay | • Batch Reprocessing |
| • DDE Links | • Built-in Data Validation |
| • Peak Alarms | ...and more! |


Most PeakSimple functions are launched from the chromatogram window, and are so user friendly that most operators can produce results almost immediately. ToolTips makes learning your way around PeakSimple even easier—just hold your mouse cursor over any icon or checkbox to read the onscreen How-To instructions.



PeakSimple Software Features



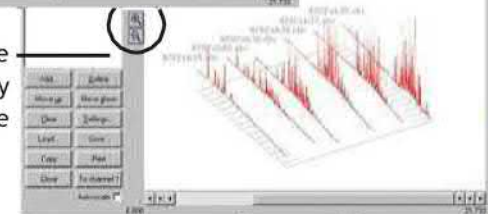
3D MULTIPLE CHROMATOGRAM DISPLAY

Right-click in any channel window to load its data into the 3D display feature. Click on the 3D icon  to display multiple chromatogram traces in orthographic or perspective renditions, with Auto-scaling and Zoom. Add, delete, and

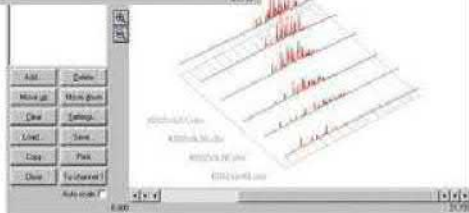
arrange the displayed chromatograms using the buttons in the 3D display window. The point of view may be placed at any point on an imaginary sphere around the data, using the click-and-drag interface—almost like flying around the data in a helicopter. Grab the 3D display with your mouse and spin it

around in realtime. Print your 3D display, or copy it to your clipboard for pasting into Excel, Word, etc.

Magnify or reduce the 3D display by clicking on the Zoom icons.



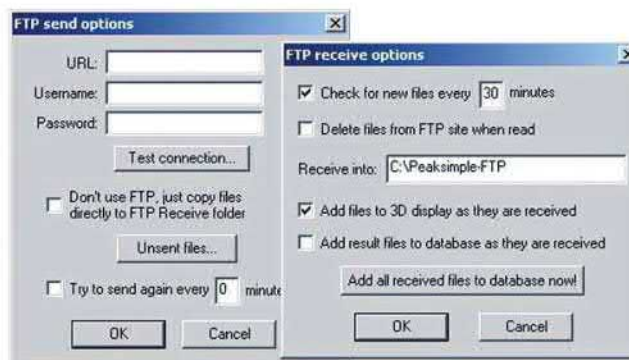
Grab the 3D display with your mouse and spin it around in realtime.



BUILT-IN FTP CAPABILITY

With PeakSimple's FTP capability, you can upload data at the end of every run via the Internet. Using this powerful feature, one person can monitor a GC network around the world. Compared to the ongoing cost of manning each individual instrument, the savings potential is significant.

PeakSimple provides several options for receiving files into the folder of your choice. PeakSimple can automatically check for new files at user-specified intervals. You can choose to automatically add files to a database as they are received, or add them manually with the click of a button. You can even choose to add files to the 3D display as they are received.

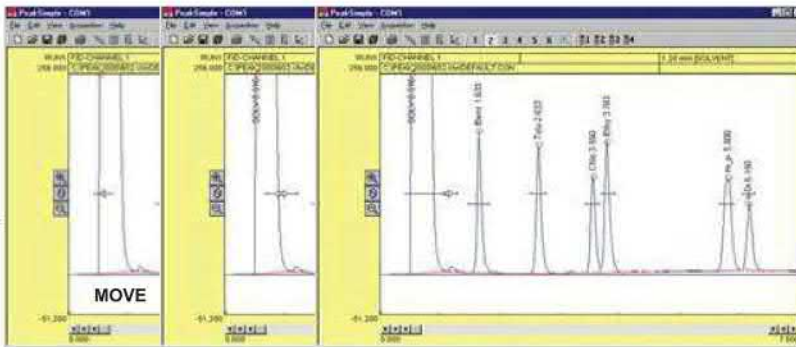
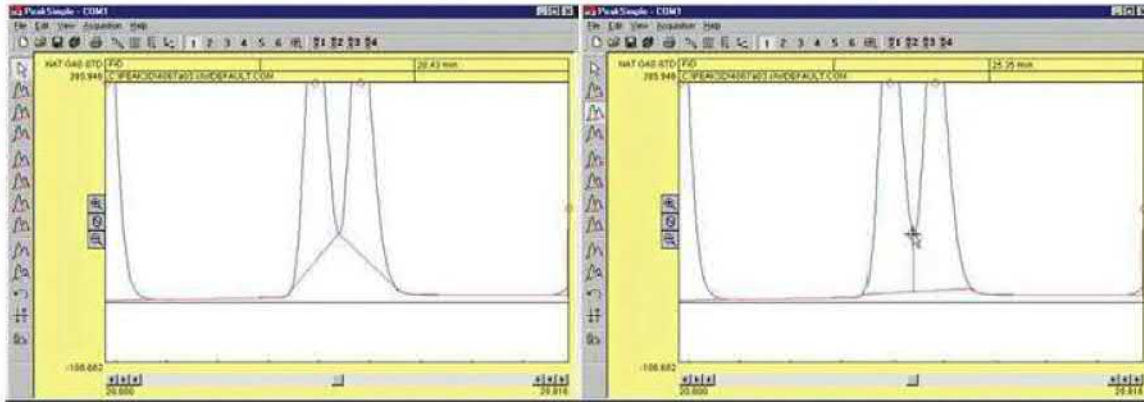


The number of instances of PeakSimple you can have running at one time is limited only by the resources of your computer. Therefore, you could monitor from your lab remote GC systems working anywhere they can connect to the Internet.

PeakSimple Software Features

MANUAL INTEGRATION

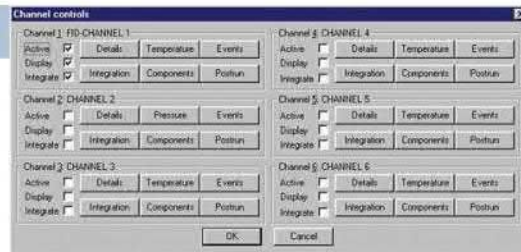
Manual integration tools allow the user to refine the integration method applied to any peak. Baseline projection may be “rubber-banded” from point to point, forced to a valley, dropped vertically, skimmed, etc. The example below shows the use of the “Drop” tool to drop a vertical line from the valley of the conjoined peaks to the baseline.



Retention window brackets are visible onscreen and may be grabbed and dragged onto a peak, widened, or narrowed with the mouse. The component table is automatically updated when a retention window is graphically modified.

CONTROL FILES

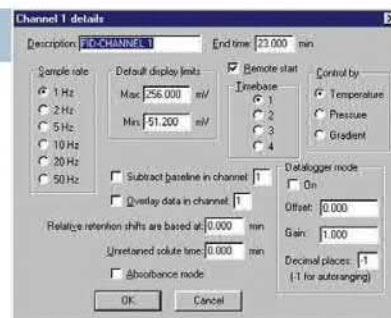
Save any changes you make in an analysis to a control file and use it again and again for method reproducibility. Control files contain temperature or gradient programming, component tables, external events, channel details, integration, post-run actions, and more! Create a control file for each method you typically perform. The number of control files you can have is limited only by your disk space.



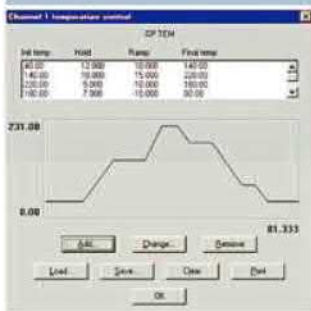
PeakSimple Software Features

CONTROL FILES

Operators can set channel parameters for each channel via the Channel details dialog box. Set the sampling rate and default display limits; choose temperature, pressure, or gradient control; subtract the baseline from another channel; overlay the data from another channel; turn Data Logger mode ON or OFF; designate a start time to compensate for relative retention shifts, and more.



CONTROL FILES



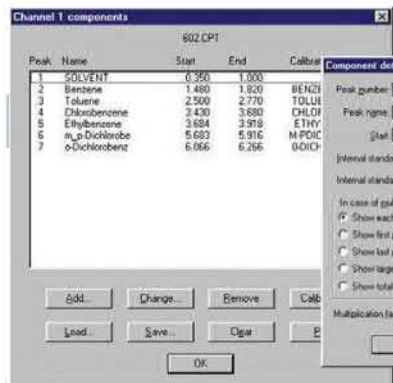
Program one or two SRI GC column ovens from ambient to 400°C with unlimited ramps and holds, 0.01 degree resolution, and negative programming.

Program the carrier gas pressure with unlimited ramps and holds on SRI GCs equipped with electronic pressure control (EPC).



MANUAL/AUTOMATIC EXTERNAL EVENT CONTROL


In addition to performing timed integration events, control up to eight external contact closure relay outputs to actuate sampling valves, autosamplers, solenoids, pumps, or any external device using TTL or relay contact closure triggers.

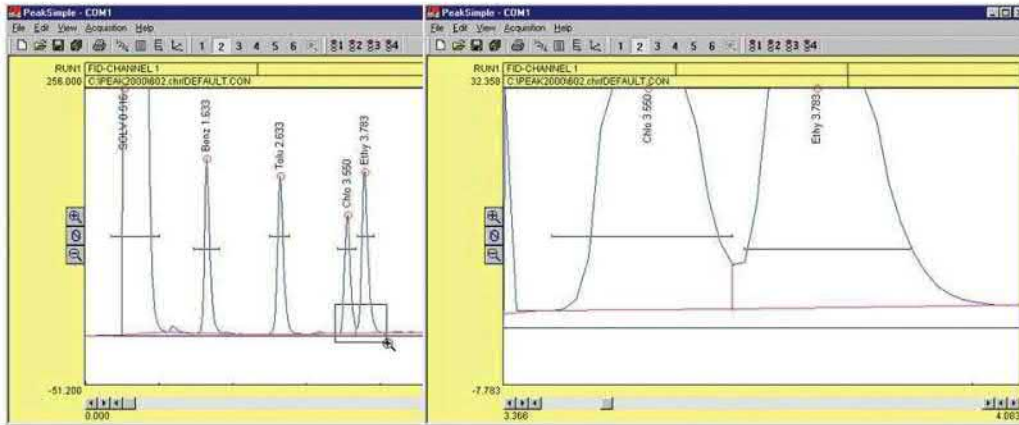


Create, save, and edit component tables with an unlimited number of compounds. Enter expected retention times, control peak display, and more! Component details may be viewed and edited by double-clicking on any retention window in the chromatogram, or by double-clicking on any component in the list.

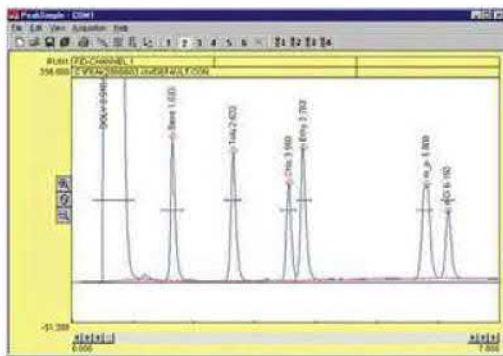
PeakSimple Software Features

ZOOM TWO WAYS

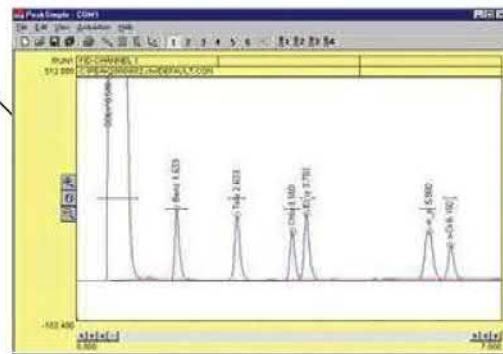
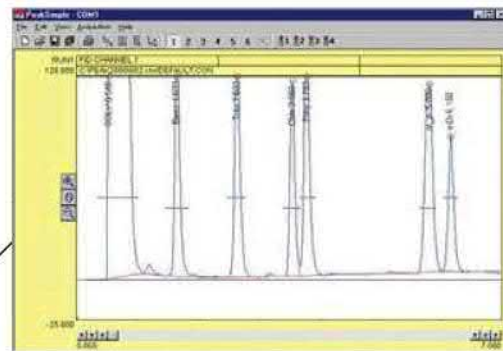
Click and drag the mouse cursor to draw a rectangle around an area you wish to enlarge, and that area will expand to fill the chromatogram window. This may be done multiple times. Clicking on the unzoom icon  in the toolbar unzooms the view one level at a time until it returns to the original resolution.



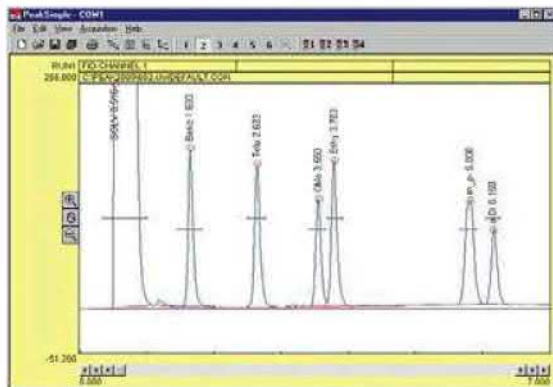
A mouse click on one icon vertically enlarges the peaks in the chromatogram, decreasing the y-axis display limits by a factor of two.



A click on another icon increases the display limits by a factor of two, vertically shrinking the peaks.



PeakSimple Software Features



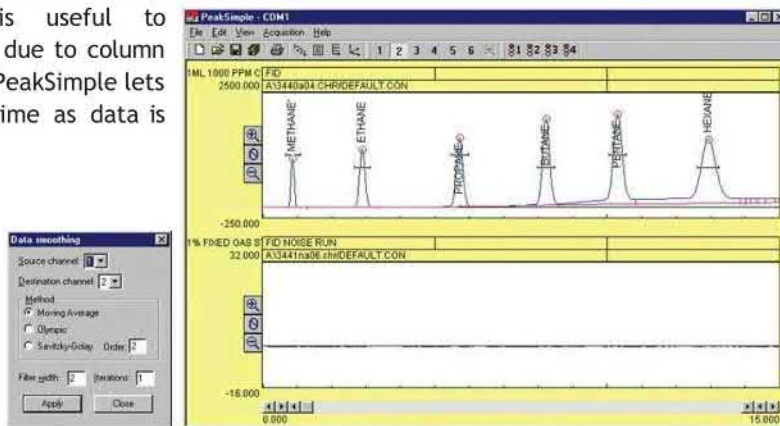
OVERLAY CHROMATOGRAMS

Overlay the data in any channel onto any other channel for retention time comparison or multiple detector correlation. The Overlay Adjust feature lets you shift and stretch overlaid data for pattern matching.

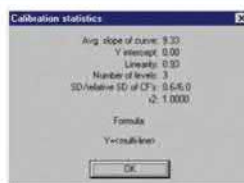
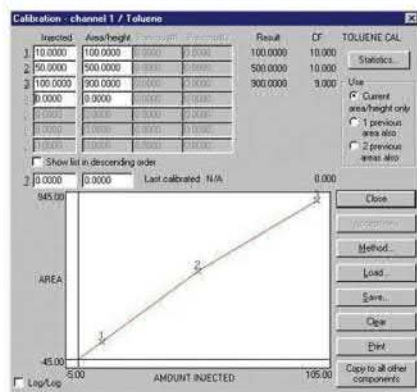
BASELINE SUBTRACTION and DATA SMOOTHING

Blank baseline subtraction is useful to compensate for baseline drifting due to column bleed and temperature ramping. PeakSimple lets you subtract baselines in real time as data is collected, or post run.

Noisy detector signals can be smoothed manually or automatically at the end of a run. Smoothing algorithms include Olympian, Moving Average, and Savitsky-Golay.

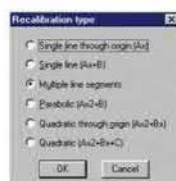


CALIBRATION



Calibration Averaging

PeakSimple allows up to three replicate calibration standards at seven levels of concentration to be averaged when constructing calibration curves.



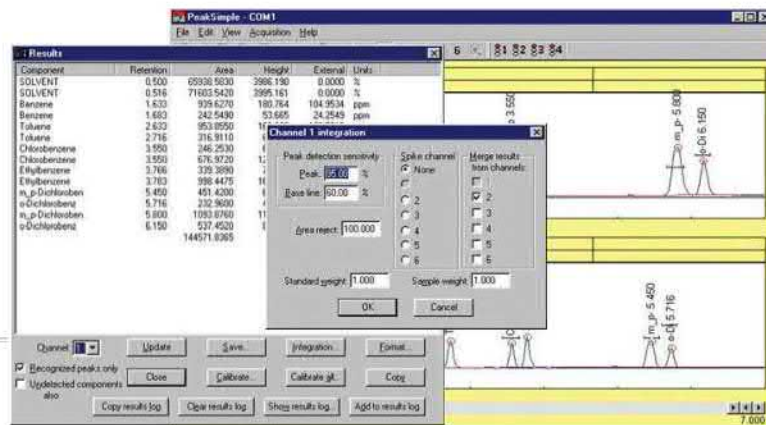
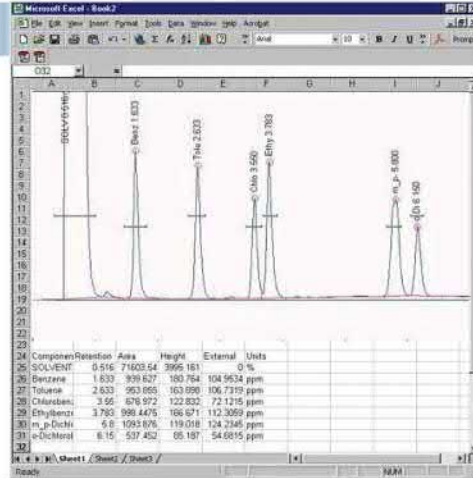
Multi-Level Calibration Curves

Calibrate peaks six ways (multi-line, quadratic, parabolic, etc) using single or averaged data at up to seven concentration levels. Statistics for evaluating line fit quality, modification date audit trail, and curve printout help to ensure defensible results.

PeakSimple Software Features

DYNAMIC DATA EXCHANGE

Link PeakSimple to your DDE compatible spreadsheet or word processor (Excel, Word, etc.). Analytical results are automatically transferred after every run, or may be accumulated within PeakSimple and copied as a block of data. Use the Copy Picture option to paste the chromatogram itself into Excel, etc. along with the results.

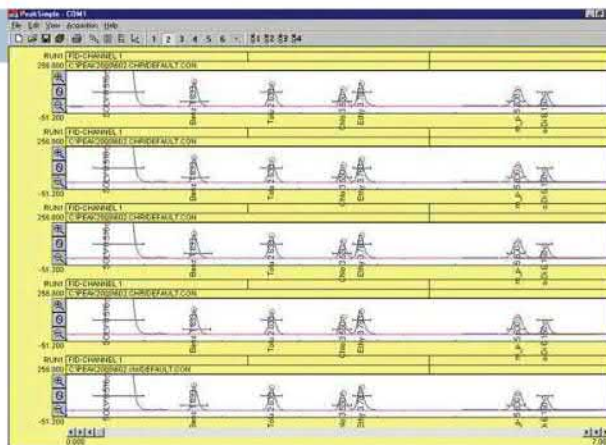


MERGE RESULTS FROM MULTIPLE CHANNELS

PeakSimple lets you merge the results from any or all channels into one report. This feature is useful for combining results from different detectors for export to Excel, etc.

SELF-VALIDATING HARDWARE

PeakSimple will play back and reacquire any chromatogram multiple times, establishing the precision and accuracy of the data system using real data, not "canned" chromatograms. PeakSimple's validation can be performed by the user anytime, without extra hardware.



PeakSimple Software Features

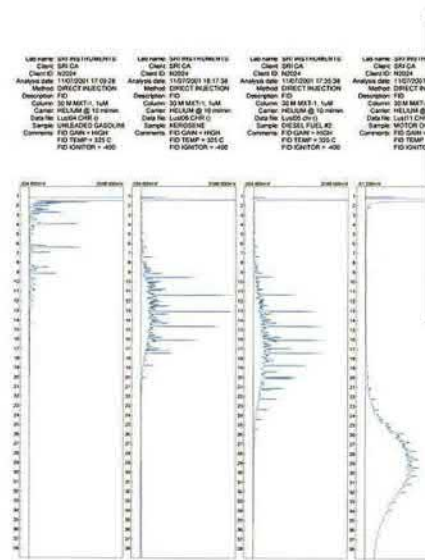
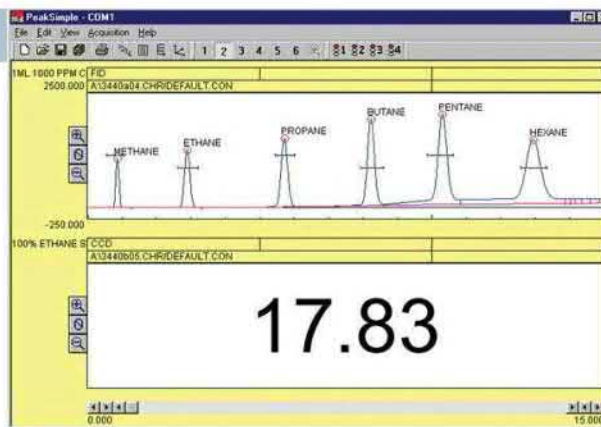


AUTOSAMPLER QUEUE and BATCH REPROCESSING

Create customized autosampler sequences—for liquid injections, purge and trap autosamplers, gas sampling valves, and stream selectors—including unique, predefined sample information, auto-calibration, and batch reprocessing of previously run samples.

DATA LOGGER MODE

PeakSimple's Data Logger Mode allows you to display a scaled and calibrated result in large numbers instead of the usual strip chart data presentation. Data Logger Mode is especially useful when monitoring total hydrocarbons on one channel, while performing a separation on another channel.



PRINT CHROMATOGRAMS IN COLOR

Use any Windows supported color printer to create multiple chromatograms per page for easy detector-to-detector comparisons and paperwork consolidation. Print overlaid data in contrasting colors with adjustable line weight.



DETECTORS

Dry Electrolytic Conductivity Detector - DELCD

Overview

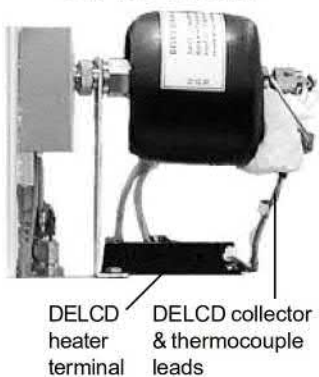
The Dry Electrolytic Conductivity detector, or DELCD, is selective to chlorinated and brominated molecules. It differs from the traditional wet ELCD in that it does not use a solvent electrolyte, and the reaction products are detected in the gaseous phase. The SRI DELCD is available alone or in combination with the FID detector. On its own, the detection limits of the DELCD are in the low ppb range. In combination with the FID, its detection limits are in the low ppm range. The FID/DELCD combination enables the operator to reliably identify hydrocarbon peaks detected by the FID as halogenated or not. Because the DELCD operates at 1000°C, it can tolerate the water-saturated FID effluent, measuring the chlorine and bromine content simultaneously with the FID measurement of the hydrocarbon content. All hydrocarbons are converted by the FID flame to CO₂ and H₂O prior to reaching the DELCD, thus preventing contamination of the DELCD by large hydrocarbon peaks.



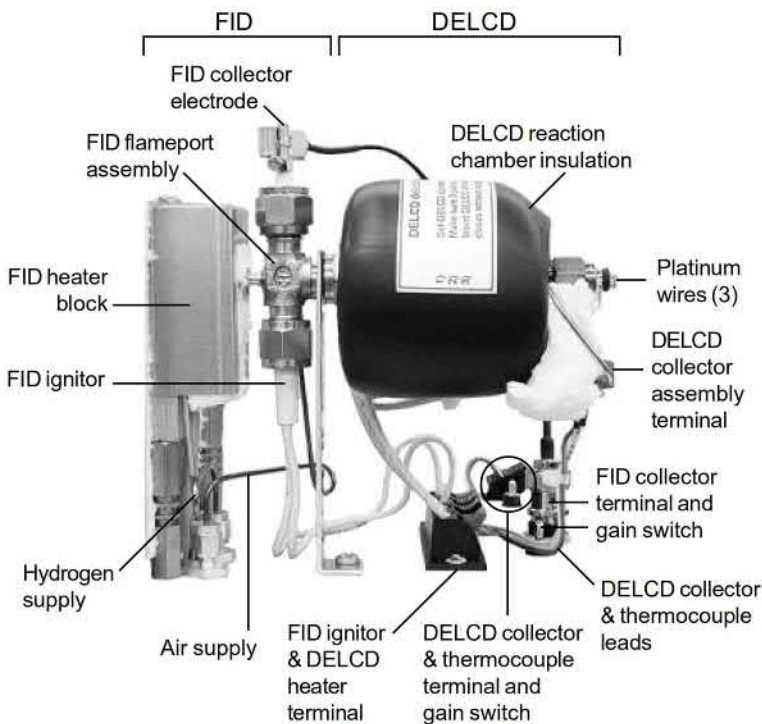
DELCD on an 8610C GC

DELCD - À la carte

Close-up of the same DELCD detector



FID / DELCD Combo Detector



DETECTORS

Dry Electrolytic Conductivity Detector - DELCD

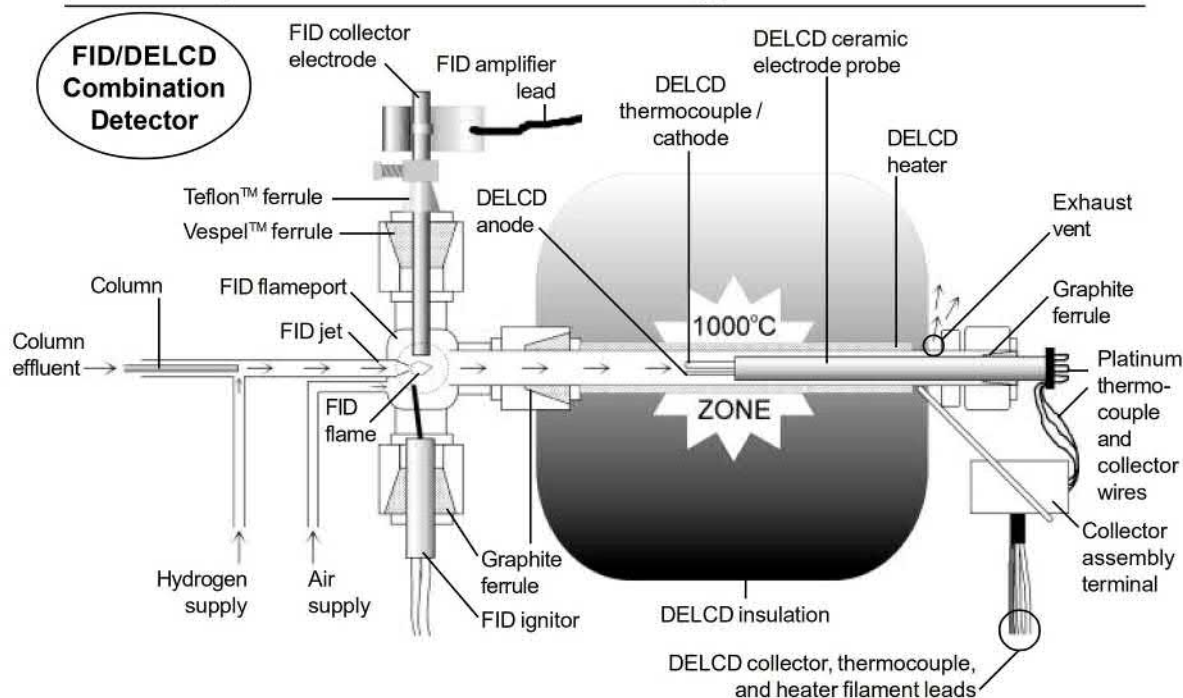
Theory of Operation

The DELCD consists of a small ceramic tube—the DELCD reactor—heated to 1000°C. Inside the reactor, a platinum thermocouple measures the detector temperature, and a nichrome collector electrode measures the conductivity of the gases flowing through the DELCD. The detector response is dependent upon its temperature. Therefore, the control circuit must maintain the temperature, within a fraction of a degree, at 1000°C.

When combined with the FID detector, the DELCD is mounted on the FID exhaust. Column effluent enters the FID flame where hydrocarbons are ionized and combusted. Electrons freed in the ionization process are collected by the FID collector electrode, which has an internal diameter of 1 mm (0.040"). Due to its small I.D., the collector electrode acts as a restrictor, splitting the FID exhaust gases so that it takes about half of the flow, and the remainder is directed to the DELCD. The FID exhaust gases consist of un-combusted hydrogen and oxygen, nitrogen, and water and carbon dioxide from the combustion of hydrocarbons. The reaction of chlorine

or bromine and hydrogen forms HCl and HBr, and the reaction of chlorine or bromine and oxygen forms ClO_2 and BrO_2 . The DELCD detects the oxidized species of chlorine and bromine, such as ClO_2 and BrO_2 . It does not detect the acids HCl or HBr like the conventional wet ELCD. In the hydrogen rich effluent from the FID flame, the chlorine and bromine preferentially react with hydrogen (or the hydrogen in water) to make HCl-HBr. Given equal availability of hydrogen and oxygen molecules, a chlorine atom is 100 times more likely to react with the hydrogen than the oxygen. Therefore, the FID/DELCD combination is 100 times less sensitive than the DELCD operated with the FID off. The SRI FID/DELCD is operable as a combination detector, as an FID only, or as a DELCD only.

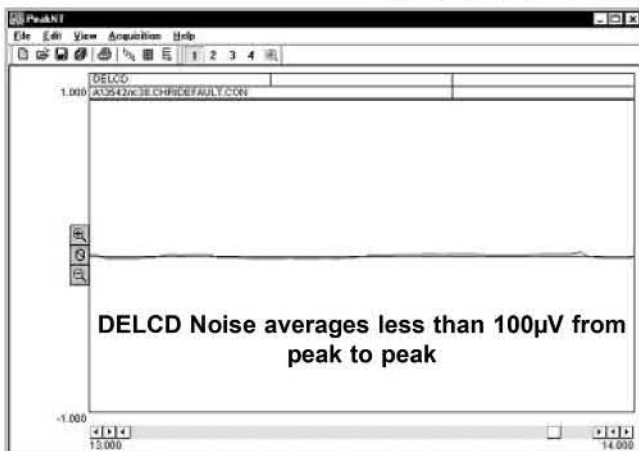
A DELCD only detector receives the sample laden carrier gas directly from the column or from a non-destructive detector outlet, like the PID. It is mounted on the heater block on the column oven wall so that the column effluent is maintained at a temperature consistent with the analysis. This type of high sensitivity DELCD uses helium or nitrogen carrier gas and air make-up gas.



DETECTORS

Dry Electrolytic Conductivity Detector - DELCD

Expected Performance



DELCD Noise Run

Column: 15m MXT-VOL
 Carrier: helium @ 10mL/min
 DELCD gain: LOW
 DELCD heater block temp: 150°C
 DELCD reactor setpoint: 260

Temperature program:
 Initial Hold Ramp Final
 80°C 20.00 0.00 80°C

FID / DELCD Combo Test Run

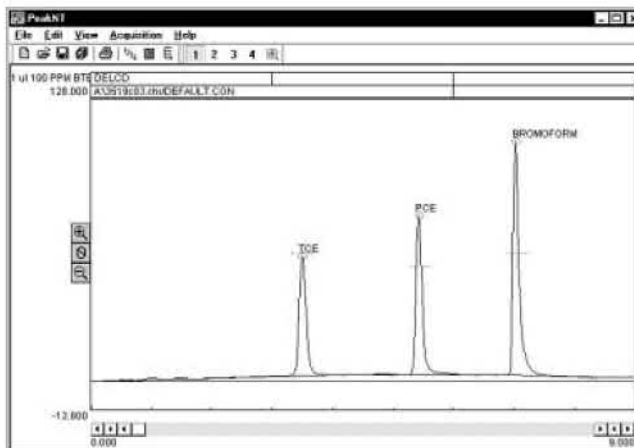
Sample: 1µL 100ppm BTEX Plus
 Column: 15m MXT-VOL
 Carrier: helium @ 10mL/min

Temperature program:
 Initial Hold Ramp Final
 40°C 2.00 15.00 240°C

DELCD gain: LOW
 DELCD heater block temp: 150°C
 DELCD reactor setpoint: 260

DELCD Results:

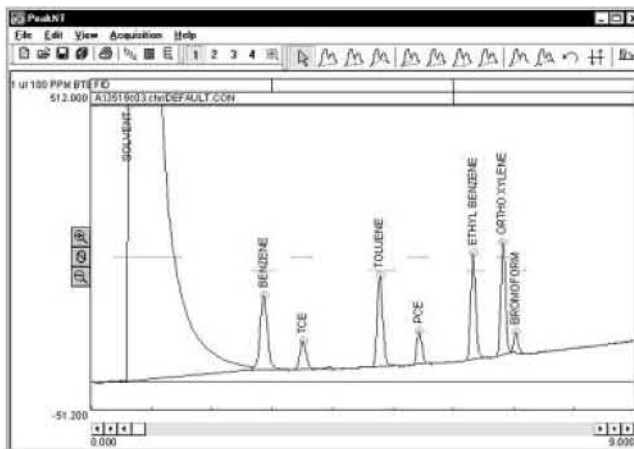
Component	Retention	Area
TCE	3.483	463.5080
PCE	5.416	532.2900
Bromoform	7.016	759.6650
Total		1755.4630



FID gain: HIGH
 FID temp: 150°C
 FID ignitor: -400

FID Results:

Component	Retention	Area
Solvent	0.600	144406.8420
Benzene	2.850	1074.0740
Toluene	4.766	1109.8590
PCE	5.416	364.5700
Ethyl Benzene	6.316	1103.6370
Ortho Xylene	6.800	1135.6855
Bromoform	7.016	220.3325
Total		149793.3505



DETECTORS

Dry Electrolytic Conductivity Detector - DELCD

General Operating Procedure

The FID/DELCD combination detector can be operated in the Combo Mode, the High Sensitivity Mode (DELCD only), or the FID only mode.

Combo Mode

In the Combo Mode, the DELCD is operated after the FID; the FID signal is usually connected to Channel 1 on the PeakSimple data system, while the DELCD signal is on channel 2 or 3. Each detector amplifier is factory labeled with the data channel to which it is connected. The DELCD response in this mode is useable from 1 to 1000 nanograms with a slightly quadratic calibration curve. EPA and other regulations allow the use of detectors with non-linear response if the operator calibrates with sufficient data points to accurately model the detector response curve. Therefore, the DELCD may require a 6 point calibration where 5 point calibration is normally required.

1. Set the hydrogen and air flows for normal FID operation: set the hydrogen flow to 25mL/min and the air flow to 250mL/min. The pressure required for each flow is printed on the right hand side of the GC chassis. (NOTE: If you're using a built-in air compressor, low levels of halogenated compounds in ambient air—even levels below 1ppm—can cause the DELCD to lose sensitivity, and fluctuations in the level of organics in ambient air may cause additional baseline noise. To avoid this, use clean, dry tank air.)
2. Set the DELCD temperature setpoint to 260 by adjusting the appropriate trimpot on the top edge of the GC's front control panel. The number 260 represents 1000°C; the DELCD will heat to about 254 and stabilize. The end of the ceramic tube will glow bright red due to the high temperature.
3. In this mode, the FID amplifier is normally operated on HIGH gain or, if the peaks are more than 20 seconds wide at the base, on HIGH FILTERED gain for a more quiet baseline.
4. The DELCD amplifier is normally operated on LOW gain.

High Sensitivity Mode

The DELCD can be operated alone in the high sensitivity mode by eliminating hydrogen. With hydrogen eliminated, oxygen in the air will react with the chlorinated and brominated molecules at 1000°C to form ClO_2 and BrO_2 , which are detected by the DELCD. Water must also be eliminated; at the high temperatures inside the DELCD, hydrogen disassociates from the H_2O molecule and becomes available as a reactant to form HCl and HBr, which the DELCD will not detect. The DELCD response curve is quadratic in the high sensitivity mode as in the FID/DELCD combo mode, but sensitivity is increased by 100 to 1000 times. In this mode, the DELCD can perform much like an ECD, except that the DELCD is more selective for halogens and blind to oxygen. When possible, quantitate by the internal standard method, using a chlorinated/brominated compound for the internal standard peak. Although the DELCD will not be damaged by large quantities of chlorine/bromine, there is a short term loss of sensitivity for about an hour following the injection of 1 μL of pure methylene chloride, for example.

1. Remove the hydrogen supply by turning it OFF, then disconnecting it at the GC's inlet bulkhead on the left hand side of the instrument.
2. Reduce the air flow to the DELCD to 25mL/min by turning the the air pressure trimpot setpoint down to 1 or 2psi. An additional 24" restrictor made of 0.001" I.D. tubing would be useful for fine pressure adjustment.
3. If you're using a capillary column, push the column through the FID jet until it just enters the ceramic tubing of the DELCD. This will improve peak shape as the column effluent will be discharged into the flowing airstream and immediately swept into the DELCD detector volume by the air make-up gas. (When switching back to the FID/DELCD combo mode, remember to pull the column back into the FID jet.)
4. The FID collector electrode allows some gas to escape from the FID combustion area, which is undesirable for the high sensitivity mode. Remove the FID collector electrode and replace it with a 1/4" cap fitting.

DETECTORS
Dry Electrolytic Conductivity Detector - DELCD

General Operating Procedure continued

FID/DELCD - FID Only

1. Remove the DELCD heater wires from the push terminals. Remove the three DELCD collector and thermocouple wires (yellow, white and red) from the screw terminals.
2. Disconnect the DELCD detector assembly from the FID exhaust by using a wrench to loosen the 1/4" Swagelok fitting securing the two detector parts together.
3. Use a cap nut to seal the DELCD connection on the FID flameport.
4. Set the FID amplifier gain switch to HIGH for most hydrocarbon applications. If peaks of interest go off the scale (greater than 5000mV), set the gain to MEDIUM. When peaks of interest are 20 seconds wide or more at the base and extra noise immunity is desired, set the gain switch to HIGH (filtered). This setting broadens the peaks slightly.
5. Set the FID hydrogen flow to 25mL/min, and the FID air supply flow to 250mL/min. The approximate pressures required are printed in the gas flow chart on the right-hand side of the GC.
6. Ignite the FID by holding up the ignitor switch for a couple of seconds until you hear a small POP. The ignitor switch is located on the front panel of your SRI GC under the "DETECTOR PARAMETERS" heading (it is labelled vertically: "FLAME IGNITE").
7. Verify that the FID flame is lit by holding the shiny side of a chromed wrench directly in front of the collector outlet. If condensation becomes visible on the wrench surface, the flame is lit.

DELCD Only

1. Set the helium carrier gas flow to 10mL/min and the air make-up flow to 25mL/min. Clean, dry tank air helps to obtain the best achievable DELCD sensitivity and signal stability.
2. Set the DELCD reactor temperature setpoint to 260 (= 1000°C) by adjusting the trimpot on the top edge of the GC's front control panel. The DELCD will heat to about 254 and stabilize. The ceramic tube will glow bright red from the heat.
3. By adjusting the appropriate trimpot, set the thermostatted DELCD heater block temperature to 25°C higher than the "Final" temperature you have entered in the temperature program.
4. The DELCD amplifier is normally operated on LOW or MEDIUM gain.

DETECTORS

Dry Electrolytic Conductivity Detector - DELCD

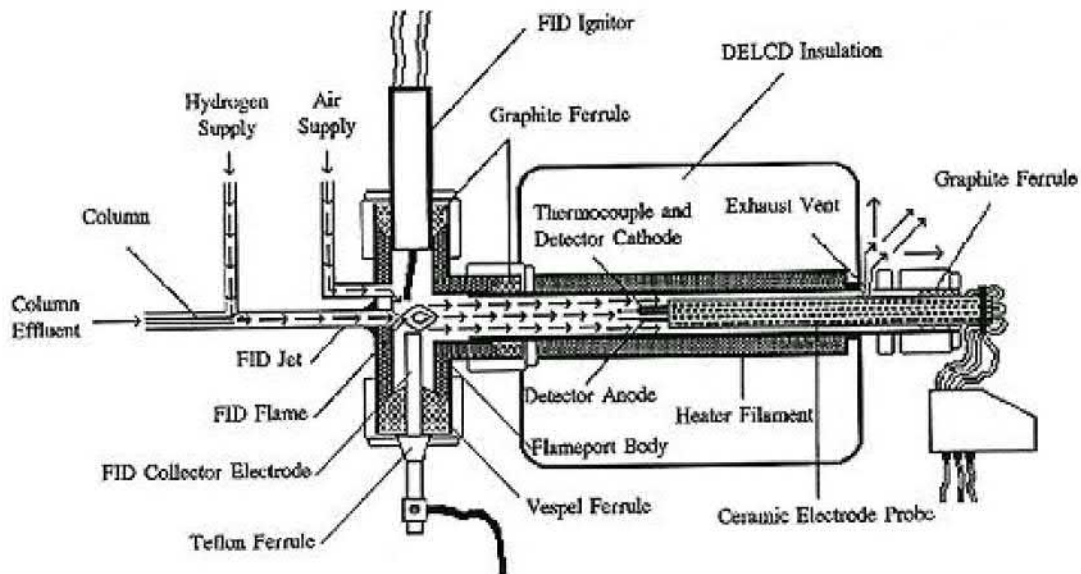
Troubleshooting and Maintenance

Installing the Spare DELCD Cell

Each SRI DELCD detector is shipped with a spare DELCD cell. Because the DELCD heater operates close to 1000°C, it will burn out and fail eventually. Follow the instructions below to remove the old cell and install the new one.

1. With the GC power OFF, remove the DELCD heater wires (2) from the push terminals and the DELCD thermocouple and collector wires (3) from the screw terminals.
2. Remove the DELCD cell by using a wrench to loosen the 1/4" fitting that secures it on the FID exhaust port or on the heater block. You may have to hold the insulation aside to freely access the fitting; it is soft and may be compressed by hand.
3. Position the new cell on the fitting with the label facing up, as the DELCDs are shown on the **Overview** page. Be sure to push the DELCD cell all the way into the FID.
4. Secure the new DELCD cell into place by tightening with a wrench the fitting that holds it onto the FID exhaust or the heater block.
5. Carefully lower the red lid to make sure that it does not touch the DELCD cell; the cell will crack if the lid hits it. There should be at least 0.5" of clearance between the red lid and the edge of the DELCD cell.
6. Sensitivity may improve for the first 24 hours of operating time with the new cell installed.

DETECTORS FID/DELCD



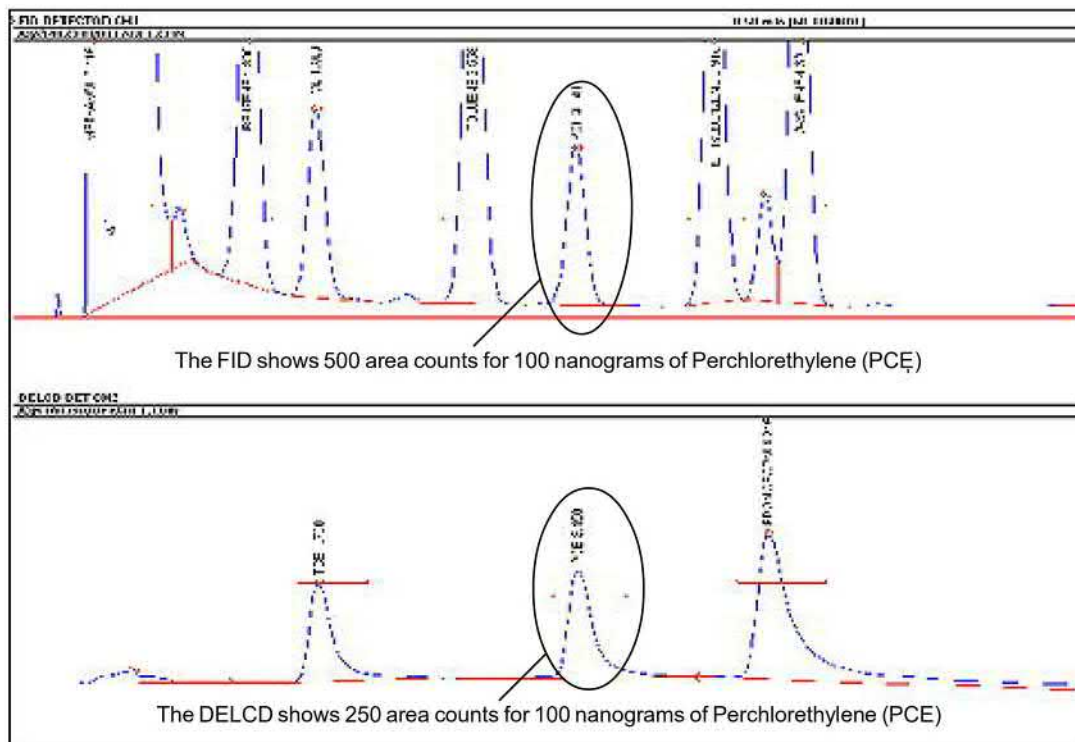
As diagrammed above, the sample enters the FID flame from the column where hydrocarbons are ionized and combusted. Electrons liberated in the ionization are collected by the FID collector electrode. About half the gas effluent (carrier gas + hydrogen + air + combustion products) flows out through the FID collector electrode which has an internal diameter of .040 (1 mm.). The restriction caused by the small collector i.d. splits the flow of exhaust gases so that the other half of the gases pass through the DELCD. The DELCD consists of a small ceramic tube which is heated to 1000°C. In the center of the heated tube is a platinum thermocouple which measures the temperature and a DELCD collector electrode which measures the conductivity of the gases flowing through the DELCD. Since the response is very dependent on the temperature, the control circuit must maintain the temperature within a fraction of a degree at 1000°C. $\text{ClO}_2\text{-BrO}_2$ exhibits extremely high conductivity at 1000°C. So the DELCD actually responds to the $\text{ClO}_2\text{-BrO}_2$ concentration of the gases in the FID exhaust. Because other molecules are not detected, the DELCD is almost completely selective for chlorine and bromine. Fluorine and iodine are not well detected.

DETECTORS FID/DELCD

Operating the FID/DELCD in the Combo mode

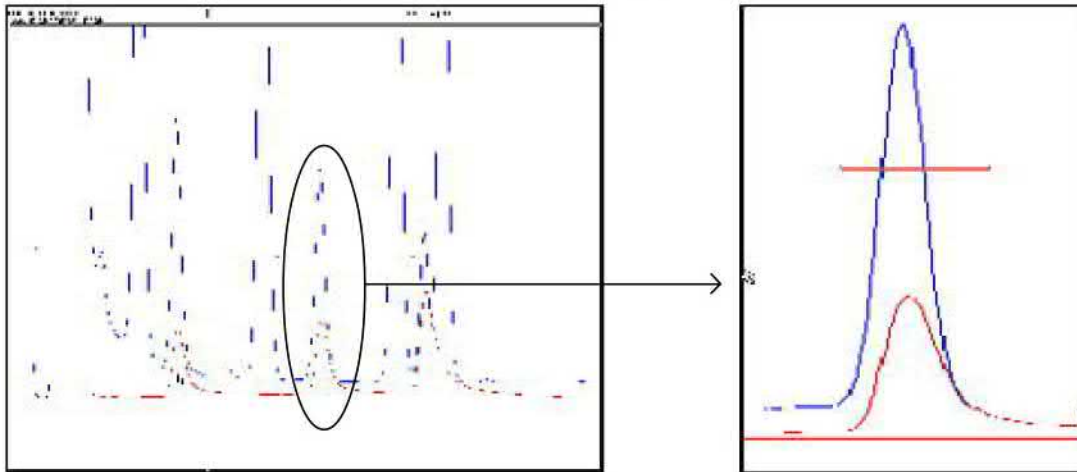
In the combo mode, the DELCD is operated after the FID. The FID signal is usually connected to Channel 1 on the PeakSimple data system. The DELCD signal may be on Channel 2 or 3. Each detector amplifier is labeled at the factory with the data channel to which it has been connected. Detector signals may be connected to any available data channel by simply attaching the white and black signal wires to the screw terminals on the A/D board inside the GC.

- 1) Set the FID hydrogen and air flows for normal FID operation. This is typically 25 ml/min hydrogen (corresponds to 25 psi) and 250 ml/min air (typically 6 psi). The exact pressure required for each flow is labeled on the GC's right hand side.
- 2) Set the DELCD temperature setpoint to 260 using the front panel adjustments. This number actually represents 1000°C. The DELCD will heat up to about 254 and stabilize. The quartz collector electrode will appear a bright red color due to the 1000C temperature.
- 3) In the FID/DELCD combo mode, the FID is normally operated on high gain or on hi-filtered gain if the peaks are more than 10 second wide at the base. The hi-filtered gain position is identical to the high gain except that extra noise filtering results in a quieter baseline. The DELCD amplifier is normally operated on low gain. In this configuration the FID and DELCD produce approximately the same response to chlorinated peaks such as TCE (same peak area counts). The FID will generate approximately 4 area counts per nanogram injected on column while the DELCD will generate 2-4 area counts per nanogram of chlorinated hydrocarbon. (see example chromatogram below).



DETECTORS FID/DELCD

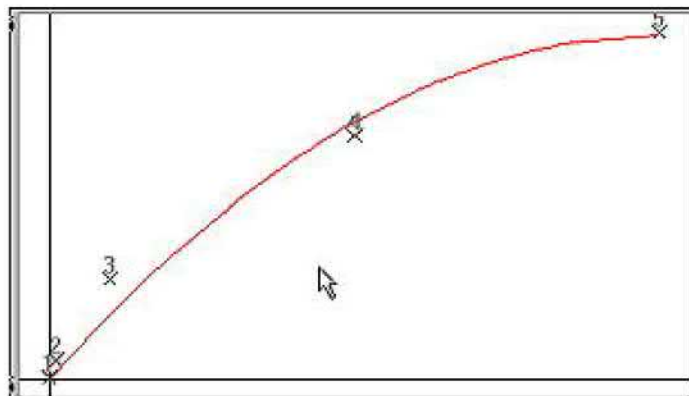
Operating the FID/DELCD in the Combo mode



DELCD peak overlaid on FID peak for PCE, then expanded for clarity. The smaller peak is the DELCD response.

- 1) As shown in the chromatogram above, the DELCD peak for PCE occurs at the same time as the FID peak for PCE. Notice that the DELCD peak exhibits a little bit of tailing compared to the FID response.
- 2) In the FID/DELCD combo mode, the minimum detectable amount is approximately 1 nanogram. Assuming a 1 microliter injection, this translates into approximately 1 ppm. The exact detection limit will depend on the analyte molecule (how much chlorine/bromine in the compound) and the chromatographic conditions. A sharp peak is always more detectable than a short fat peak.
- 3) The detection limit will be worse when using the built-in air compressor for FID/DELCD flame combustion instead of clean dry tank air. While the built-in air compressor is useful and convenient, low levels of halogenated compounds in the ambient air (even levels below 1 ppm) cause the DELCD to lose sensitivity, and fluctuations in the level of organics in the ambient air may cause additional baseline noise.
- 4) In the FID/DELCD mode the DELCD response is useable from 1 to 1000 nanograms with a slightly quadratic calibration curve. EPA and other regulations allow the use of detectors with non-linear response as long as the operator calibrates with sufficient data points to accurately model the detector response curve. Where a 5 point calibration would normally be required, the DELCD may demand a 6 point calibration.

The DELCD calibration curve shown at right illustrates the quadratic response from 1–1000 nanograms of TCE injected



DETECTORS

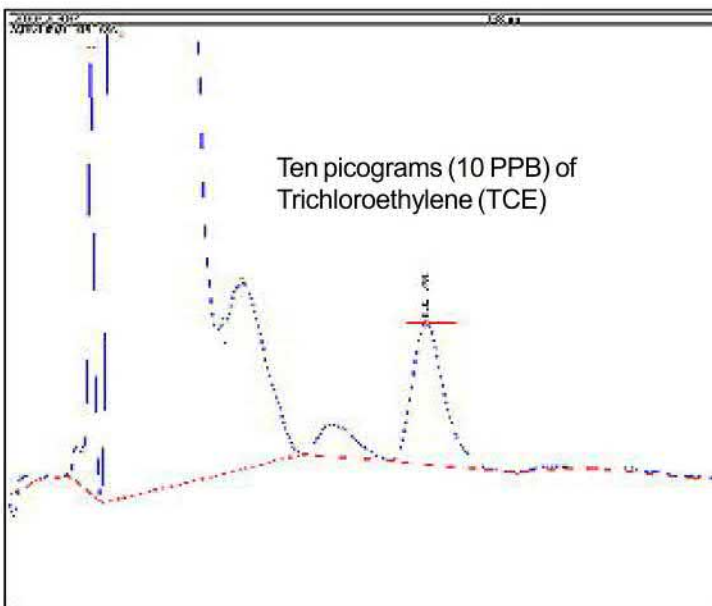
FID/DELCD

Operating the FID/DELCD in the high sensitivity DELCD only mode

- 1) The DELCD can be operated in a high sensitivity mode by eliminating the hydrogen from the reactions which lead up to the detection of the $\text{ClO}_2\text{-BrO}_2$. Because the chlorine/bromine atoms prefer to react with hydrogen to form non-detectable HCl-HBr , than with oxygen to form detectable $\text{ClO}_2\text{-BrO}_2$ by a factor of 100-1000 to 1, eliminating the hydrogen improves the DELCD sensitivity by at least 100 times. Water must also be eliminated as at the high temperatures inside the DELCD, hydrogen becomes dissociated from the H_2O molecule and available as a reactant. In practice, this means turning off the hydrogen and using clean dry tank air (not the built-in air compressor).
- 2) Remove the hydrogen supply from the GC by disconnecting the hydrogen supply at the GC's inlet bulkhead on the left hand side of the instrument. Reduce the air flow to the DELCD to 50 ml/min by turning the air pressure setpoint down to 1-2 psi. An additional air flow restrictor consisting of 12" of .067 tubing (1/16", 1.58mm) with an internal diameter of .010 (0.25mm) can easily be added to the air supply immediately below the detector to enable the flow to be controlled more precisely at higher pressures. With the extra restrictor installed a pressure setpoint of 10 psi will deliver an air flow of approximately 50 ml/min.
- 3) If using a capillary column, push the column through the FID jet until it just enters the ceramic tubing of the DELCD. This will improve the peak shape somewhat because the column effluent will be discharged into the flowing airstream and will be immediately swept into the DELCD detector volume. When switching back to FID/DELCD combo mode remember to pull the column back into the FID jet.
- 4) Remove the FID collector electrode and replace it with a 1/4" cap fitting. The FID collector electrode allows some gas to escape from the FID combustion area, and this is not desirable when operating in the high sensitivity mode.

The DELCD chromatogram shown at right illustrates the response to 10 picograms (1ul of 10 PPB) of TCE in the high sensitivity mode.

Note that in high sensitivity mode, there is some response to the methanol solvent.

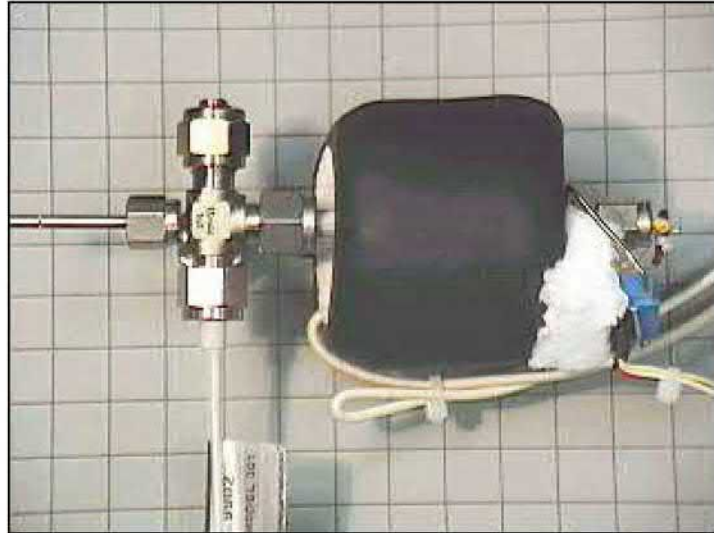


DETECTORS FID/DELCD

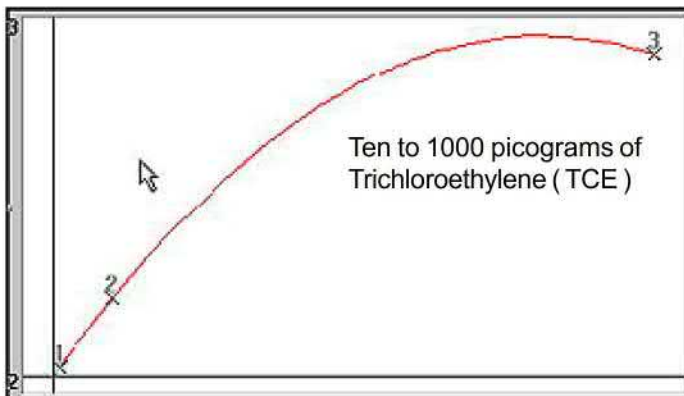
Operating the FID/DELCD in the high sensitivity DELCD only mode

The FID/DELCD detector is shown at right configured for the high sensitivity mode.

The collector electrode is removed and a 1/4" cap installed instead.



- 1) Just as the DELCD response curve is quadratic in the FID/DELCD combo mode, the response is also quadratic in the high sensitivity mode, but sensitivity is increased by 100-1000 times. In the high sensitivity mode the DELCD is most useful in the range of 1-1000 picograms which assuming a 1 microliter injection translates into 1-1000 PPB.
- 2) In the high sensitivity mode, the DELCD can perform much like an Electron Capture Detector (ECD) except that the DELCD is more selective for halogens and blind to oxygen.
- 3) Although the DELCD will not be damaged by large quantities of chlorine/bromine, there is a short term loss of sensitivity for an hour or so following the injection of 1 μ l of Methylene Chloride for example.
- 4) When possible quantitate by the internal standard method, using a chlorinated/brominated compound for the internal standard peak. Using an internal standard will correct for changes in the DELCD detector's response.



DELCD linearity in high sensitivity mode is shown at right from 10 to 1000 picograms (10-1000PPB).

At levels above 10 nanograms, the detector is saturated.

ASD Detector

October 2013

The SRI Aromatic Selective Detector (ASD) can be mounted on the 8610C chassis as shown at right.

The ASD is a heated (up to 350C) single beam UV spectrometer with a fixed wavelength of 254nm. The light comes from a small mercury lamp whose bluish glow you can see in the photo at right.

On this particular GC, a FID detector is also mounted in series with the ASD so the sample molecules flow first through the ASD and then on to the FID.

The light path is through a 15 cm tube which is mounted in a heated enclosure just above a massive heated aluminum block.



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ASD Detector

October 2013

The mercury lamp is rated for at least 10,000 hours and pushes onto a quartz rod which conducts the 254nm light but stays cool.

The quartz rods at each end of the flow cell isolate the mercury lamp and photodiode from the high heat of the flow cell.

The photodiode pushes onto the quartz rod at the rear of the enclosure.



SRI Tech Support: 310-214-5092

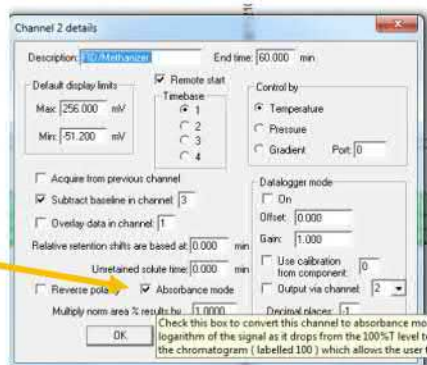
ASD Detector

October 2013

The column is inserted into the ASD inlet and secured with a graphite ferrule. The design allows the column to be inserted all the way through the tubing and into the flow cell if desired.

The ASD outlet is connected to the FID via a short section of 1/16' stainless tubing.

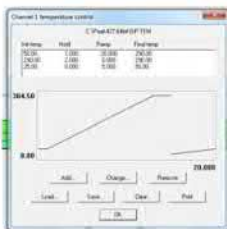
Since the ASD (which in this case is connected to Channel 2 on the data system) is an absorbance type detector, where the target molecule absorbs the UV light, the transmittance signal must be converted to absorbance units by clicking the box in the Channel 2 Details screen.



SRI Tech Support: 310-214-5092

ASD Detector

October 2013

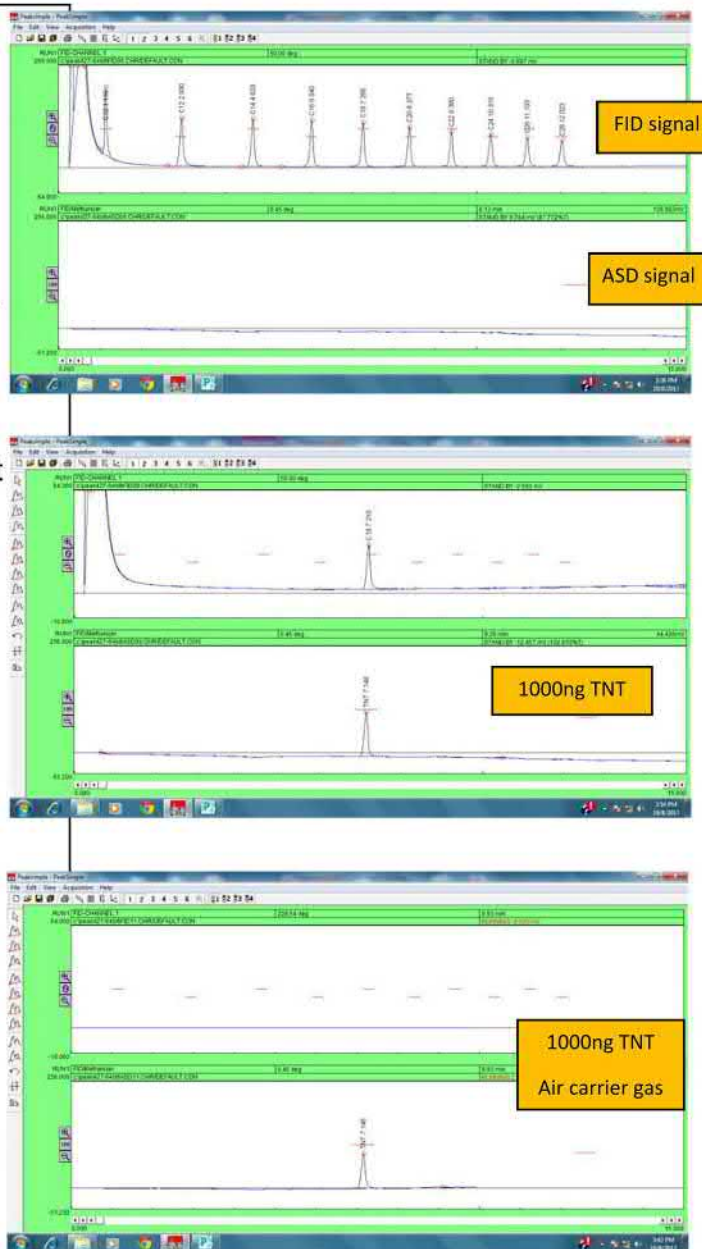


With the temperature program shown, hydrogen carrier gas and

the ASD and FID in series, a synthetic diesel standard composed of even aliphatic hydrocarbons (C10, C12... C28) shows nice peaks on the FID (top trace), but has no response on the ASD.

A 1ul injection of TNT (dynamite) shows a nice peak on both detectors. Note that the acetonitrile solvent shows no response on the ASD.

The same 1ul injection of TNT using air carrier gas sourced from the GC's built-in air compressor illustrates that the ASD equipped GC is capable of operating without gas cylinder of any kind. Of course without hydrogen the FID does not work, so no peaks are detected



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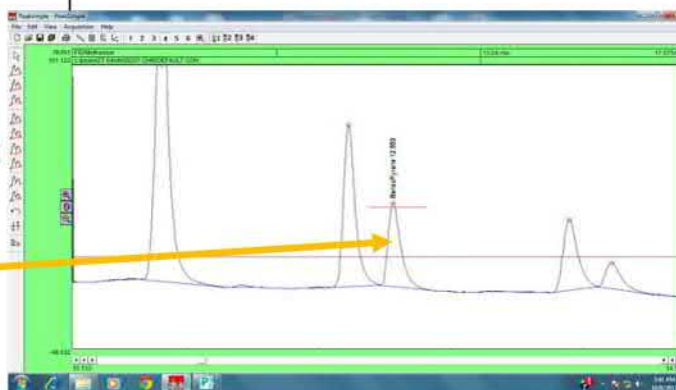
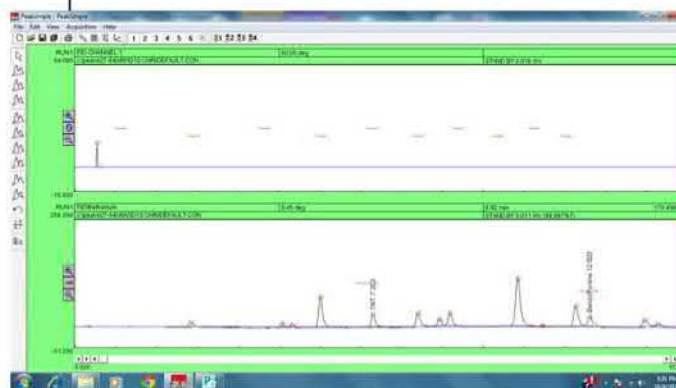
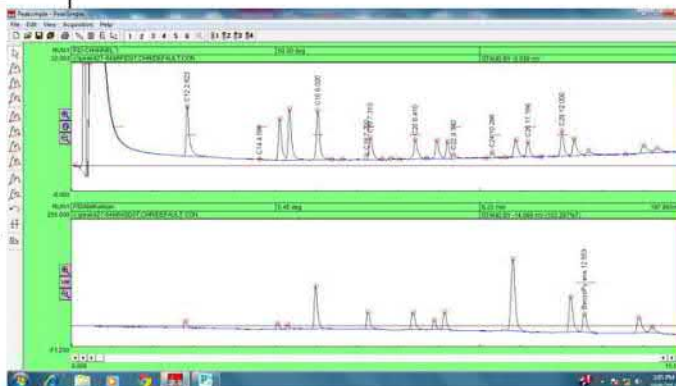
ASD Detector

October 2013

1ul of 50-100ng/ul each PAH standard was injected with hydrogen carrier. Nice peaks are observed on both FID and ASD.

The same standard was injected with air carrier. The ASD peaks are virtually identical, but of course, no peaks at all show on the FID.

Notice that Benzo-Pyrene, a PAH of particular concern is easily detected at the 50ng level.



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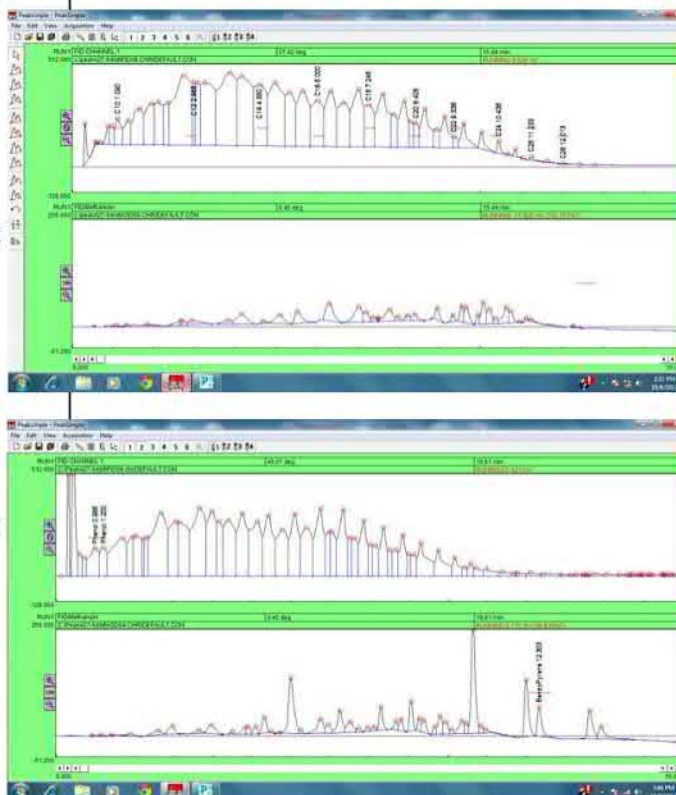
ASD Detector

October 2013

1ul of fresh diesel fuel was injected with hydrogen carrier.

The FID trace shows the typical diesel profile with thousands of overlapping peaks. The ASD just responds to the aromatic molecules in the fuel.

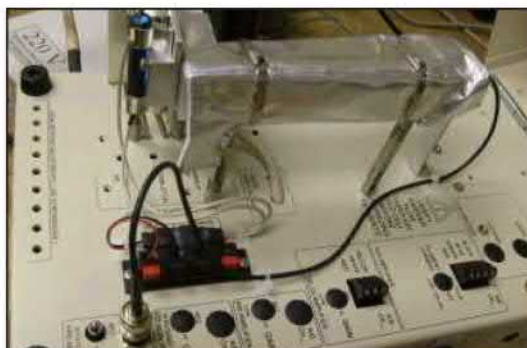
The sample diesel sample was injected this time with PAHs at 50-100 ng/ul in the mix. The additional PAHs clearly show on the ASD trace.



SRI Tech Support: 310-214-5092

ASD - Aromatic Selective Detector

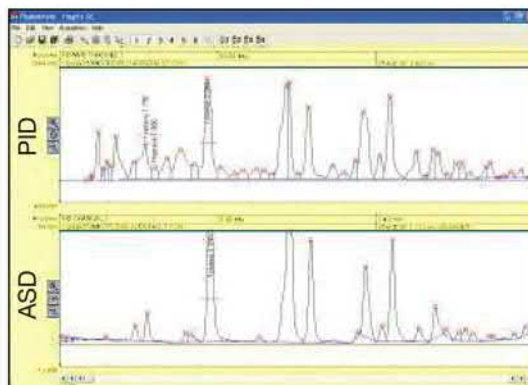
- Heated to permit use with a GC and semi-volatile analytes such as gasoline and diesel
- Detects down to 100ppm
- Conversion of transmittance to absorbance is done with the PeakSimple Software



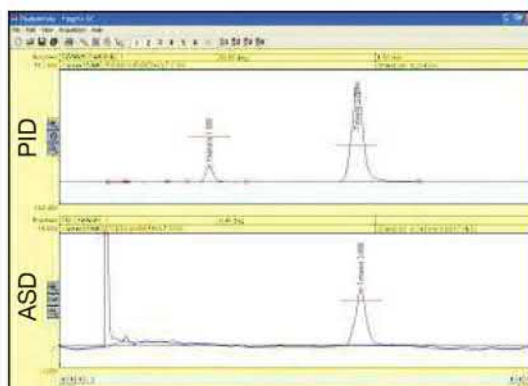
The SRI Aromatic Selective Detector (ASD) is useful for the detection of aromatic compounds like benzene and toluene even in the presence of interfering molecules like gasoline.

The ASD consists of a 15cm long heated tube with a mercury lamp mounted at one end and a photodiode at the other. It can be mounted on an SRI GC or on the separate Model 110 chassis which is then connected to any GC. The ASD detects only those molecules which absorb the 254nm wavelength produced by the mercury lamp. Aromatic compounds such as Benzene and Toluene absorb strongly at this wavelength while aliphatic compounds such as Hexane and Heptane do not.

This chromatogram shows the comparative response of the PID and ASD to .2 μ l gasoline. The PID detects all the gasoline compounds while the ASD detects only the aromatics.



Notice the comparative chromatograms here showing the response of the PID and ASD detectors plumbed in series to an injection of 1000ppm each Heptane and Toluene. The ASD shows no response to the Heptane but good response to the Toluene.



8690-0006

ASD detector

Certifications

SRI products are CE, TUV, NRTL, and GS approved, having met all electrical safety requirements. We can ship our products to any destination worldwide, with any voltage. We follow ISO-9000 manufacturing practices, as evidenced by these certifications.



Equivalent to CSA and UL



Upon request, we will provide Certifications and a Declaration of Conformity letter for any instrument we manufacture.

Our knowledgeable and hardworking staff build each SRI instrument at our state-of-the-art facility in Las Vegas, Nevada, USA.



Warranty

SRI Instruments | 310-214-5092 20720 Earl Street Torrance, CA 90503 USA

SRI will repair or replace any defective parts within two years from the date of shipment. Consumable items such as TCD filaments, NPD beads, DELCD heaters, FPD photomultiplier tubes, ECD detector cells, lamps, heaters, septa, traps, filters, columns, syringes, etc, are excluded. Replacement or repair shall be the purchaser's only remedy, and in no case shall SRI's liability exceed the original purchase price. The equipment is purchased without any other warranty expressed or implied, including, without limitation, any warranty of merchantability, any warranty arising from a course of dealing, performance of usage of trade and/or any warranty that the equipment is fit for any particular purpose or trade. The purchaser agrees to assume all risks of defects relating to the design, construction, purchase, operation, condition, maintenance, possession and use of the equipment, and to release SRI, to the maximum extent allowed by law, from any and all liabilities, claims, or demands of any nature, including without limitation any claims based on incidental or consequential damages (foreseeable or not), lost earnings, negligence (active or passive), strict liability, breach of agreement or misconduct. The purchaser is aware of and waives the provisions of California Civil Code Section 1542, ("A general release does not extend to claims which the creditor does not know or suspect to exist in his favor at the time of executing the release, which if known by him must have materially affected his settlement with the debtor"), and/or all other laws, local, state, federal, or international, of similar intent, scope or purpose, relating to the release of unknown or unexpected claims. It is expressly agreed that the possibility of such unknown or undiscovered claims exist. This has been explicitly taken into account in determining the equipment's purchase price. That consideration has been adjusted, having been bargained for in full knowledge of the possibility of such unknown claims. In the event the equipment is sold, loaned, or otherwise transferred, purchaser agrees to bind the third party to the terms of this agreement as a condition of transfer. Purchaser is aware of the dangers, and hazards inherent in operating chromatographs and data systems including but not limited to the warnings listed in the SRI Instruments Products Operation and Service Manual. No agent, representative, distributor, or employee of SRI has authority to amend this warranty in anyway. In the event that any term or provision of this warranty is subject to valid claim of unenforceability, such term or provision shall be narrowly construed, the remaining provisions shall nevertheless survive, granting SRI the greatest possible protection then available under law.



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DR 6000™ UV-VIS SPECTROPHOTOMETER

Applications

- Beverage
- Drinking Water
- Industrial Water
- Pharmaceutical
- Power
- Wastewater



The industry's most advanced lab spectrophotometer.

With UV and Visible Spectrum capabilities, over 250 pre-programmed methods including the most common testing methods used, guided procedures, and integrated quality assurance software, the DR 6000 ensures you are ready to handle your comprehensive water testing needs.

Your Water Testing Needs, All in One Spectrophotometer

The DR 6000 has the most pre-programmed testing methods, including high-speed wavelength scanning across the UV and Visible Spectrum.

Accessories for High Volume and High Accuracy Testing Needs

A carousel sample changer allows up to seven sequential measurements. The Sipper Module, an instrument-controlled sample delivery system, increases precision by constant optical characteristics.

Advanced Quality Assurance at Your Fingertips

The DR 6000 comes with integrated QA software for scheduling, documenting and interpreting all of your needed quality measurements.

Guided Procedures and Elimination of False Readings

The DR 6000, when used with TNTplus® reagent vials, provides the accurate results you need by guiding you step-by-step through your testing procedures. With TNTplus, the instrument averages 10 readings and eliminates outliers, making scratched, flawed or dirty glassware a non-issue.

Automatically Avoids Errors

RFID* technology automatically updates the program calibration factors when you place a TNTplus reagent box near the DR 6000. The instrument identifies chemistry expiration dates via a barcode on the vials, and detects chemistry coefficient factors to avoid errors that can occur in lot-to-lot variations in the chemistry.

*RFID technology currently available only in US, Anguilla, American Samoa, Australia, Bolivia, Canada, Cayman Islands, Columbia, Dominican Republic, El Salvador, Federated States of Micronesia, Guam, Guatemala, Marshall Islands, New Zealand, Northern Mariana Islands, Palau, Panama, Puerto Rico, and US Virgin Islands.



Be Right™

Specifications*

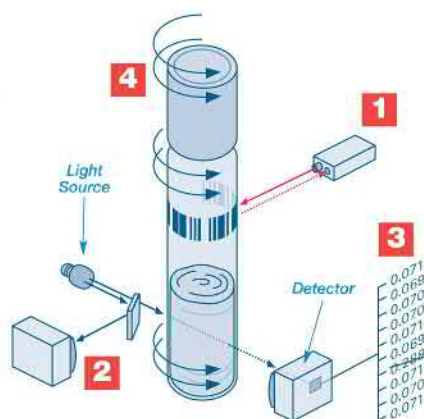
Operating Mode	Transmittance (%), absorbance and concentration (wavelength, time)	Display	TFT 7 inch WVGA color touch
Source Lamp	Tungsten (visible range), deuterium (UV range)	Data Logger	5000 data points (result, date, time, sample-ID, user-ID)
Wavelength Range	190 - 1100 nm	Preprogrammed Methods	> 250
Wavelength Accuracy	± 1 nm	User Programs	200
Wavelength Reproducibility	< 0.1 nm nm	Sample Cell Compatibility	Rectangular: 10, 20, 30, 50 mm, 1 inch; round: 13 mm, 16 mm, 1 inch
Wavelength Resolution	0.1 nm		Optional 100 mm rectangular cell with additional adapter
Wavelength Selection	Automatic, based on method selection	Dimensions (H x W x D)	8.5 in x 19.7 in x 18.1 in (215 mm x 500 mm x 460 mm)
Spectral Bandwidth	2 nm	Weight	24.25 lbs. (11 kg)
Scanning Speed	900 nm/min (in 1 nm steps)	Operating Conditions	10 at 40 °C, max. 80% relative humidity (non-condensing)
Photometric Measuring Range	± 3 Abs	Storage Conditions	-25 to 60 °C max. 80% relative humidity (non-condensing)
Photometric Accuracy	5 mAbs at 0.0-0.5 Abs <1% at 0.5-2.0 Abs at 546 nm	Enclosure Rating	IP20 with closed lid
Photometric Linearity	0.005 - 2 Abs ≤ 0.01 at > 2 Abs with neutral glass at 546 nm	Interfaces	USB type A (2), USB type B, Ethernet, RFID module
Stray Light	KI-solution at 220 nm < 3.3 Abs/ < 0.05%	Warranty	1 year

*Subject to change without notice.

Principle of Operation

Hach's TNTplus chemistries and spectrophotometers are made to work seamlessly with each other.

- Many of the tests are EPA compliant.
- Over 35 tests available including these popular EPA Approved Parameters:
 - Ammonia
 - COD
 - Chlorine
 - Chromium
 - Iron
 - Nitrate
 - Nitrite
 - Nitrogen
 - Phosphorus
 - Sulfate



How TNTplus Works

- 1 Barcode Recognition**
Simply drop in the vial and get results immediately with automatic method detection.
- 2 Reference Detector**
Monitors and compensates for optical fluctuations.
- 3 10X Measurement and Outlier Elimination**
Dirty, scratched, or flawed glassware, including fingerprints, is no longer an issue—instrument averages 10 readings and rejects outliers.
- 4 Self-Contained Packaging—Reagents Inside Sealed Cap**
Reduces exposure to chemicals—no need to open pillows or clean glassware.

See our TNTplus video at: www.hach.com/tntplus

Available Tests

The following table lists available tests and overall ranges for the Hach DR 6000 Benchtop Spectrophotometer. The ranges may represent more than one available test for the instrument. Consult your Hach representative, Customer Service, the Hach Master Catalog, or the Hach web site at www.hach.com for complete details of all available tests for this instrument.

Parameter	Range	TNTplus Test	Parameter	Range	TNTplus Test
Alachlor	0.1 to 0.5 ppb, threshold		Lead	3 µg/L to 2.0 mg/L	•
Alkalinity, Total	25 to 400 mg/L	•	Manganese	0.006 to 20.0 mg/L	
Aluminum	0.002 to 0.800 mg/L	•	Mercury	0.1 to 2.5 µg/L	
Ammonia, Nitrogen	0.015 to 50.0 mg/L	•	Methylethylketoxime (MEKO)	15 to 1000 µg/L	
Arsenic	0.020 to 0.200 mg/L		Molybdenum, Molybdate	0.02 to 40.0 mg/L	
Atrazine	0.5 to 3.0 ppb, threshold		Nickel	0.006 to 6.0 mg/L	•
Barium	2 to 100 mg/L		Nitrate, Nitrogen	0.01 to 35 mg/L	•
Benzotriazole	1.0 to 16.0 mg/L		Nitrite, Nitrogen	0.002 to 250 mg/L	•
Boron	0.2 to 14.0 mg/L		Nitrogen, Simplified Total Kjeldahl	0 to 16 mg/L	•
Bromine	0.05 to 4.50 mg/L		Nitrogen, Total	0.5 to 150 mg/L	•
Cadmium	.7 µg/L to 0.30 mg/L	•	Nitrogen, Total Inorganic	0.2 to 25.0 mg/L	
Carbohydrazide	5 to 600 µg/L		Nitrogen, Total Kjeldahl	1 to 150 mg/L	
Chloramine, Mono	0.04 to 10.0 mg/L		Ozone	0.01 to 1.50 mg/L	
Chloride	0.1 to 25.0 mg/L		PCB (Polychlorinated Biphenyls)	1 to 50 ppm, threshold	
Chlorine Dioxide	0.01 to 1000 mg/L		Phenols	0.002 to 0.200 mg/L	
Chlorine, Free	0.02 to 10.0 mg/L	•	Phosphonates	0.02 to 125.0 mg/L	
Chlorine, Total	2 µg/L to 10.0 mg/L	•	Phosphorus, Acid Hydrolyzable	0.06 to 100.0 mg/L	
Chromium, Hexavalent	0.010 to 1.00 mg/L	•	Phosphorus, Reactive (Orthophosphate)	19 µg/L to 100.0 mg/L	•
Chromium, Total	0.01 to 0.70 mg/L	•	Phosphorus, Total	0.06 to 100.0 mg/L	•
Cobalt	0.01 to 2.00 mg/L		Potassium	0.1 to 7.0 mg/L	
Color	3 to 500 units		Quaternary Ammonium Compounds	0.2 to 5.0 mg/L	
COD (Chemical Oxygen Demand)	0.7 to 15,000 mg/L	•	Selenium	0.01 to 1.00 mg/L	
Copper	1 µg/L to 8.0 mg/L	•	Silica	3 µg/L to 100 mg/L	
Cyanide	0.002 to 0.240 mg/L		Silver	0.005 to 0.700 mg/L	
Cyanuric Acid	5 to 50 mg/L		Sulfate	2 to 900 mg/L	•
DEHA (Diethylhydroxylamine)	3 to 450 µg/L		Sulfide	5 to 800 µg/L	
Dissolved Oxygen	6 µg/L to 40 mg/L		Surfactants, Anionic	0.002 to 0.275 mg/L	
Erythorbic Acid (Isoascorbic acid)	13 to 1500 µg/L		Suspended Solids	5 to 750 mg/L	
Fluoride	0.02 to 2.00 mg/L		Tannin and Lignin	0.1 to 9.0 mg/L	
Formaldehyde	3 to 500 µg/L		TOC (Total Organic Carbon)	0.3 to 700 mg/L	
Hardness, Total (Calcium and Magnesium as CaCO ₃)	4 µg/L to 4.00 mg/L		Tolyltriazole	1.0 to 20.0 mg/L	
Hydrazine	4 to 600 µg/L		Toxicity	0 to 100% Inhibition	
Hydroquinone	9 to 1000 µg/L		TTHM (Trihalomethanes, Total)	10 to 600 µg/L	
Iodine	0.07 to 7.00 mg/L		TPH (Total Petroleum Hydrocarbons)	2 to 200 ppm, threshold	
Iron, Ferrous	0.02 to 3.00 mg/L		Volatile Acids	27 to 2800 mg/L	•
Iron, Total	0.009 to 6.0 mg/L	•	Zinc	0.01 to 3.00 mg/L	

Ordering Information

DR 6000 UV VIS Spectrophotometer includes a multi adapter for round and rectangular vials, basic user manual, CD with manual and procedure manual in PDF format. Power cords for US and EU. RFID version available only in a limited number of countries, including US, Australia, Bolivia, Canada, Guatemala, and New Zealand. For complete information, visit hach.com or contact your sales representative.

LPV441.99.00012 DR 6000™ UV VIS Spectrophotometer with RFID Technology

LPV441.99.00002 DR 6000™ UV VIS Spectrophotometer without RFID

Accessories

LQV157.99.20002 SIP 10, sipper set for Pour-Thru methods, 1 inch vial

LQV156.99.10012 LOC 100: Kit for Radio Frequency ID (RFID) based sample tracking

LZV902.99.00002 Carousel Holder 7x1 cm

LZV902.99.00012 Carousel Holder 5x1 inch

LZV943 Application Software Enzymatic Food Analysis

LZV942 Application Software Brewery Analysis

LZV941 Application Software Drinking Water Analysis



Service Options

BSPPLUSDR6000 Bench Service Plus Partnership

The Bench Service Plus Partnership includes repairs at the Hach Service Center, one on-site start-up or preventative maintenance/calibration visit, unlimited technical support calls, and free software upgrades.

BSPDR6000 Bench Service Partnership

The Bench Service Partnership includes repairs and one annual preventative maintenance/calibration service per year at the Hach Service Center, unlimited technical support calls, and free software upgrades.

HACH COMPANY World Headquarters: Loveland, Colorado USA

United States:	800-227-4224 tel	970-669-2932 fax	orders@hach.com
Outside United States:	970-669-3050 tel	970-461-3939 fax	int@hach.com

hach.com

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*In the interest of improving and updating its equipment,
Hach Company reserves the right to alter specifications to equipment at any time.*



Be Right™

AS950 REFRIGERATED SAMPLERS

Sampling has never been this easy.

The AS950 Refrigerated Sampler makes programming, data transfer and operation more intuitive and virtually error-free.



Applications

- Wastewater
- Collections
- Industrial Pretreatment
- Environmental Monitoring
- Stormwater



Easiest and Most Intuitive Operation

The large full color display and intuitive programming give you access to all your programmable criteria on a single screen—eliminating scrolling through menus and supporting error-free operation.

Most Convenient Data Transfer and Programming Available

The AS950 is the only sampler that utilizes a USB drive to upload and download data and copy programs from one sampler to another.

Confidence in Your Sampling Process

The program status screen instantly communicates alarms, missed samples and program progress for quick and easy troubleshooting.

Resists Corrosion

The Refrigerated Sampler base is designed to endure humid and highly corrosive environments, minimizing damage caused by corrosive gases, rodents, and standing water to guarantee environmental integrity.

Accurate and Consistent Sample Preservation

The custom-designed air-sensing thermostat controls temperature in accordance with USEPA and international guidelines, preserving samples regardless of outside temperatures and conditions.

Easy Maintenance at Low Cost

Spring-mounted rollers provide long tubing life keeping maintenance costs low. The desiccant and pump tubing can easily be accessed; the replacement is possible without any tools. The rugged see-through pump cover is made for a quick visual inspection.



Be Right™

Specifications*

Sampling Features

Dual Programs

Up to 2 sample programs can be run sequentially, in parallel, or according to day of week scheduling; enabling a single sampler to function like multiple samplers

Sampling Modes

Pacing:

Time Weighted, Flow Weighted, Time Table, Flow Table, Event

Distribution:

Single bottle composite, multi-bottle composite, multi-bottle discrete, bottles per sample, samples per bottle or a combination of bottles per sample and samples per bottle

Run Modes

Continuous or non-continuous

Status Screen

Communicates what program is running, if there are any missed samples, when the next sample will be taken, how many samples remain, number of logged channels, time of last measurement, memory available, number of active channels, if alarms were triggered, when alarms were triggered, active sensors and cabinet temperature

Alarms

Configurable alarms that show on status screen and are recorded in diagnostics alarm logs. Alarms can be set for system diagnostics and logging such as program end, sample complete, missed samples and full bottle. Channel alarms are setpoint alarms for the recorded measurements (channels), such as pH, level and power supply voltage.

Manual Sample

Initiates a sample collection independent of program in progress

Automatic Shutdown

Multiple Bottle Mode: After complete revolution of distributor arm (unless Continuous Mode is selected)

Composite Mode: After preset number of samples have been delivered to composite container, from 1 to 999 samples, or upon full container.

Sample Volume

Programmable in 10-mL (0.34 oz) increments from 10 to 10,000 mL (3.38 oz to 2.6 gal)

Interval Between Samples

Selectable in single increments from 1 to 9,999 flow pulses (momentary contact closure 25 ms or 5 to 12 Vdc pulse; 4-20 mA interface optional), or 1 to 9,999 minutes in one minute increments

Set Point Sample Trigger

When equipped with flow sensor or pH/temperature sensor or peripheral monitoring options, sampling can be triggered upon an upset condition when field selectable limits are exceeded

Datalogging

SAMPLE HISTORY

Stores up to 4000 entries for sample time stamp, bottle number and sample status (success, bottle full, rinse error, user abort, distributor error, pump fault, purge fail, sample timeout, power fail and low main battery)

MEASUREMENTS

Stores up to 325,000 entries for selected measurement channels in accordance with the selected logging interval

EVENT LOG

Stores up to 2000 entries. Records Power On, Power Fail, Firmware Updated, Pump Fault, Distributor Arm Error, Low Memory Battery, Low Main Battery, User On, User Off, Program Started, Program Resumed, Program Halted, Program Completed, Grab Sample, Tube Change Required, sensor communication errors, cooling failed, heating failed, thermal error corrected

Diagnostics

View event and alarm logs as well as maintenance diagnostics

**Subject to change without notice.*

Specifications*

AS950 Refrigerated Sampler

Refrigerator	22 gauge steel (optional stainless steel) with vinyl laminate over-coating	AC Power Backup (Pump Controller Only)	Rechargeable 6 amp-hour gel lead acid battery takes over automatically with AC line power failure
Refrigeration Components and Copper Plumbing	Corrosion protected with conformal coating; all exposed copper tubing is insulated to avoid sweating and condensation	Dimensions (W x D x H)	61 x 61 x 112 cm (24 x 24 x 44 in.)
Sample Cooling	1/7 HP, 75 Watt, 400 BTU/hr compressor 120 CFM condenser fan Three-sided wraparound plate type evaporator Rigid foam insulation Air sensing thermostat capable of maintaining sample liquid at 4°C (39°F) in ambient temperature to 49°C (120°F) maximum; accurate to ±0.8°C (1.5°F) Magnetic door seal	Weight	63 kg (140 lb.)
Sample Containers	SINGLE BOTTLE: 10 L (2.5 gal) glass or polyethylene, or 21 L (5.5 gal) polyethylene MULTIPLE BOTTLES: Two 10 L (2.5 gal) polyethylene or glass, four 10 L (2.5 gal) polyethylene or glass, eight 2.3 L (0.6 gal) polyethylene or 1.9 L (0.5 gal) glass, twelve 2 L (0.5 gal) polyethylene, twenty-four 1 L (0.3 gal) polyethylene or 350 mL (12 oz.) glass	Certifications	CE, UL, CSA
Temperature	Operating: 0 to 50°C (32 to 122°F) Liquid Crystal Display (LCD): -10 to 70°C (-14 to 158°F) Storage: -40 to 60°C (-40 to 140°F)	AS950 Controller	
Power Requirements	115 Vac, 60 Hz (230 Vac optional) Compressor Current: 1.5 to 2.0 amps running Locked Rotor Current: 12 amps Overload Protection: 5 amp dc line fuse for pump, 1 amp dc line fuse (ac power converter) Compressor: Thermal overload relay opens at 110 °C (230 °F)	Housing	PC/ABS blend, NEMA 4X, 6, IP68, corrosion and ice resistant
		Graphics Display	1/4 VGA, Color; self-prompting/menu-driven program
		User Interface	Membrane switch keypad with 2 multiple function soft keys
		Program Languages	Chinese, English, French, German, Italian, Spanish, Portuguese, Turkish, Hungarian, Czech, Polish, Romanian, Croatian, Greek, Slovenian, Slovak, Finnish, Russian, Japanese, Korean
		Program Lock	Access code protection prevents tampering
		Memory	Sample history: 4000 records; Data log: 325,000 records; Event log: 2000 records
		Communications	USB and optional RS485 (Modbus)
		AUX port inputs	One 0/4-20 mA input for flow pacing
		Certifications	CE, UL

*Subject to change without notice.

Specifications*

Sample Pump and Strainer

Sample Pump

High-speed peristaltic, dual roller, with 0.95 ID x 0.16 OD cm (3/8 ID x 5/8 in. OD) pump tube

Pump Body

IP37, polycarbonate cover

Vertical Lift

8.5 m (28 ft) using 8.8 m (29 ft) maximum of 3/8-in vinyl intake tube at sea level at 20 to 25 °C (68 to 77 °F)

Tubing

Pump tubing:
9.5 mm ID x 15.9 OD mm (3/8-in ID x 5/8-in. OD) silicone

Intake tubing: 1.0 to 4.75 m (3.0 to 15.5 ft) minimum length, 1/4-in. or 3/8-in. ID vinyl or 3/8-in. ID PTFE-lined polyethylene with protective outer cover (black or clear)

Sample Volume Repeatability (typical)

±5% of 200 mL sample volume with: 4.6 m (15 ft) vertical lift, 4.9 m (16 ft) of 3/8- in vinyl intake tube, single bottle, full bottle shut-off at room temperature and 1524 m (5000 ft) elevation

Sample Volume Accuracy (typical)

±5% of 200 mL sample volume with: 4.6 m (15 ft) vertical lift, 4.9 m (16 ft) of 3/8- in. vinyl intake tube, single bottle, full bottle shut-off at room temperature and 1524 m (5000 ft) elevation

Transfer Velocity (typical)

0.9 m/s (2.9 ft/s) with: 4.6 m (15 ft) vertical lift, 4.9 m (16 ft) of 3/8-in. vinyl intake tubing, 21 °C (70 °F) and 1524 m (5000 ft) elevation

Pump Flow Rate

4.8 L/min (1.25 gpm) at 1 m (3 ft) vertical lift with 3/8-in intake tube typical

Internal Clock

±1 second per day at 25 °C (77 °F)

Intake

Strainers: Choice of PTFE and 316 stainless steel construction, or all 316 stainless steel in standard size, high velocity, and low profile for shallow depth applications

Purge: Air purged automatically before and after each sample; duration automatically compensates for varying intake line lengths

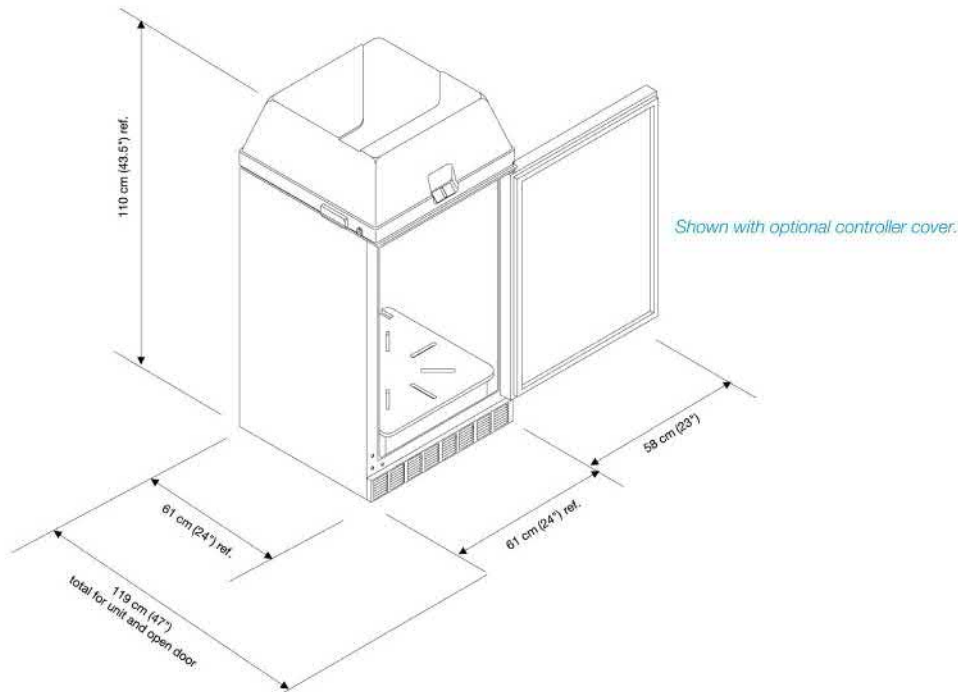
Rinse: Intake line automatically rinsed with source liquid prior to each sample, from 1 to 3 rinses

Retries or Fault: Sample collection cycle automatically repeated from 1 to 3 times if sample not obtained on initial attempt

*Subject to change without notice.

Dimensions

The AS950 Refrigerated Sampler is designed for indoor use—or for outdoor use with a secondary enclosure. Allow complete drainage of the intake line and prevent cross-contamination between samples. Install the sampler as close to the sample source as site conditions permit to increase pump tube life and optimize overall sampler performance. Install the sampler above the sample source, with the intake tubing sloping downward to the sample. (This sampler is not designed for hazardous locations where combustible environments may exist.)



Ordering Information

AS950 Refrigerated Sampler Bundles

Includes refrigerated base (115V), sample bottle, vinyl intake tubing (25 ft.), and PTFE/stainless steel strainer. To order different combinations, please contact Hach Company.

ASR.CXXX1X21XX Refrigerated Sampler with AS950 controller, vinyl, with 2.5 gal polyethylene bottle, 115 Vac

ASR.CXXX1X11XX Refrigerated Sampler with AS950 controller, vinyl, with 5.5 gal polyethylene bottle, 115 Vac

Bottle Options

Other container options are available. Please contact Hach or a local distributor for details.

- 732** 350-mL Glass Bottles; set of 24, with PTFE-lined caps
- 737** 1-liter Polyethylene Bottles; set of 24, with caps
- 1918** 2.5-gallon Polyethylene Container; with cap
- 6494** 5.5-gallon Polyethylene Container; with cap
- 6559** 2.5-gallon Glass Container; with PTFE-lined cap

Bottle Accessories

- 1511** Bottle Tray for 24 and 8 bottle sets
- 1322** Retainer for (24) 1 Liter Polyethylene and (8) bottle sets
- 1056** Retainer for (24) 350 mL Glass bottle sets
- 3527** Extension Tube for 6559 and 1918 Containers
- 8838** Composite Tube Support for all Composite Containers
- 8847** Full Bottle Shut-off for all Composite Containers
- 8986** Tubing Support Assembly, with tubing insert

Distributors

- 8562** Distributor with Arm for 12 and 24 Bottle Configurations
- 8565** Distributor with Arm for 8 Bottle Configuration
- 8568** Distributor with Arm for 2 and 4 Bottle Configurations

Intake Tubing and Strainers

- 920** Vinyl Tubing; 25 ft., 3/8-in. ID
- 922** PTFE-lined Polyethylene Tubing; 25 ft., 3/8-in. ID (requires Connector Kit Prod. No. 2186)
- 926** Strainer; PTFE/stainless steel
- 2070** Strainer; stainless steel
- 2071** Strainer; for shallow depth applications, 316 stainless steel
- 2186** Connector Kit; for PTFE-lined polyethylene tubing

Pump Tubing

- 4600-15** Pump Tubing; 15 ft.
- 4600-50** Pump Tubing; 50 ft.
- 8957** Pump Tube Insert
- 9501400** Pump Tube Insert, Non-contact liquid detect

Factory Installed Options (contact sales representative)

Two Sensor Ports

Accepts Hach digital Differential pH, Hach digital AV9000 analyzer with submerged area velocity flow and/or Hach digital US9000 ultrasonic level sensors

Rain/RS485 Port

Accepts Hach Rain Gauge (not included) or can be used as RS485 communications

Non-Contact Liquid Detect

Sample volume accuracy for applications that require complete tubing replacement

Inputs/Outputs

- 9494500** IO9001 Module (connects through auxiliary port) Includes 1 relay (high voltage)
- 9494600** IO9004 Module (connects through auxiliary port) Includes multiple 0/4-20 mA outputs and inputs for recorded measurements and to receive measurements from external instruments, four low voltage, contact closure, and four relays controlled by alarms.

Accessories

- 6994** Weatherguard fiberglass enclosure 111.12 x 111.12 x 127 cm (43.75 x 43.75 x 50 in)
- 6880** Weatherguard enclosure heater, 120 Vac
- 9504700** USB Cable, A to A
- 8520600** Pressurized sampling relay module

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In the interest of improving and updating its equipment, Hach Company reserves the right to alter specifications to equipment at any time.



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U. S. Department of Homeland Security
United States Coast Guard
Certificate of Approval

Coast Guard Approval Number: 162.050/9018/1

Expires: 13 March 2017

OIL POLLUTION PREVENTION EQUIPMENT
The following device has been tested in accordance
with IMO Resolution MEPC.107 (49)

Turner Designs Hydrocarbon Instruments, Inc.
2023 North Gateway Boulevard
Suite 101
Fresno CA 93727-1623

TD-4100; 15 ppm Bilge Alarm

This is to certify that the bilge alarm listed has been examined and tested in accordance with the requirements of the specifications contained in IMO Resolution MEPC.107(49).

Equipment manufactured by Turner Designs Hydrocarbon Instruments, Inc. to general arrangement drawings located within the TD-4100 Design, Installation, & Operations Guide, Revision 1, dated December 21, 2004.

A copy of this certificate should be carried aboard a vessel fitted with this equipment at all times.

IMO Certificates of Type Approval do not expire and are valid for equipment manufactured at any time during the period of validity of this certificate.

Test data and results attached in the appendix.

This certificate documents compliance with 46 CFR 162.050.

*** END ***

THIS IS TO CERTIFY THAT the above named manufacturer has submitted to the undersigned satisfactory evidence that the item specified herein complies with the applicable laws and regulations as outlined on the reverse side of this Certificate, and approval is hereby given. This approval shall be in effect until the expiration date hereon unless sooner canceled or suspended by proper authority.



GIVEN UNDER MY HAND THIS 13th DAY OF
MARCH 2012, AT WASHINGTON D.C.

S. J. KELLY
Chief, Engineering Division
U.S. Coast Guard Marine Safety Center

TERMS: The approval of the item described on the face of the Certificate has been based upon the submittal of satisfactory evidence that the item complies with the applicable provisions of the navigation and shipping laws and the applicable regulations in Title 33 and/or Title 46 of the Code of Federal Regulations. The approval is subject to any conditions noted on this Certificate and in the applicable laws and regulations governing the use of the item on vessels subject to Coast Guard inspection or on other vessels and boats.

Consideration will be given to an extension of this approval provided application is made 3 months prior to the expiration date of this Certificate.

The approval holder is responsible for making sure that the required inspections or tests of materials or devices covered by this approval are carried out during production as prescribed in the applicable regulations.

The approval of the item covered by this certificate is valid only so long as the item is manufactured in conformance with the details of the approved drawings, specifications, or other data referred to. No modification in the approved design, construction, or materials is to be adopted until the modification has been presented for consideration by the Commandant and confirmation received that the proposed alteration is acceptable.

NOTICE: Where a manufacturer of safety-at-sea equipment is offering for sale to the maritime industry, directly or indirectly, equipment represented to be approved, which fails to conform with either the design details or material specifications, or both, as approved by the Coast Guard, immediate action may be taken to invoke the various penalties and sanctions provided by law including prosecution under 46 U.S.C. 3318, which provides:

"A person that knowingly manufactures, sells, offers for sale, or possesses with intent to sell, any equipment subject to this part (*Part B. of Subtitle II of Title 46 U.S.C.*), and the equipment is so defective as to be insufficient to accomplish the purpose for which it is intended, shall be fined not more than \$10,000, imprisoned for not more than 5 years or both."

APPENDIX

United States Coast Guard Certificate of Approval
 Coast Guard Approval Number: 162.050/9018/1
 Expires: 13 March 2017

**TEST DATA AND RESULTS OF TESTS CONDUCTED ON A 15 PPM BILGE
 ALARM IN ACCORDANCE WITH THE GUIDELINES AND SPECIFICATIONS CONTAINED
 IN IMO RESOLUTION MEPC.107(49)**

15 ppm Bilge Alarm submitted by:

Turner Designs Hydrocarbon Instruments, Inc.

Test location:

Testing Engineers International, Inc.
 Testing Services-Plumbing Laboratory
 4121 South 500 West
 Salt Lake City, UT 84123-1399

Method of sample analysis:

ISO 9377-2-2000(E)

Samples analyzed by:

Director, Tei-Testing Services-Analytical Laboratory

Environmental testing of the electrical and electronic sections of the 15 ppm Bilge Alarm has been carried out in accordance with the guidelines and specifications contained in IMO resolution MEPC.107(49). The equipment functioned satisfactorily on completion of each test specified on the environmental test protocol.

Calibration Test and Response Time Test

	"A"		"B"		"C"	
	Measured	Grab	Measured	Grab	Measured	Grab
0 ppm	0.0	< 0.5	0.0	< 0.5	0.0	< 0.5
15 ppm	15.0	15.7	15.2	17.3	14.4	18.1
Full Scale	29.3	28.1	30.4	33.7	31.2	34.5
Water Temperature	25 - 27.5°C		25 - 27.8°C		24 - 26.8°C	
Re-zero	No		No		No	
Recalibrate	No		No		No	
Response Time (seconds)	1.2		0.9		1.3	

Contamination and Color Test

	Oil Content Meter Reading
Clean Water and Test Fluid "B" at 10 ppm	9.7 ppm
Very Salt Water and Test Fluid "B" at 10 ppm	9.3 ppm
Iron Oxide at 10 ppm	9.7 ppm
Iron Oxide at 50 ppm	9.6 ppm
Iron Oxide at 100 ppm	9.7 ppm

Sample Pressure or Flow Test

15 ppm Bilge Alarm reading shift at 50% of normal	14.7 ppm
15 ppm Bilge Alarm reading shift at 200% of normal	14.2 ppm
Deviations:	No deviations to the test method were made.

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Shut Off Test

15 ppm Bilge Alarm reading before shut off	15.6 ppm
15 ppm Bilge Alarm reading after shut off	15.1 ppm
Damage to 15 ppm Bilge Alarm:	No damage was caused by this test to the 15 ppm Bilge Alarm.

Utilities Supply Variation Test

110% Voltage Effects	There was no change in the Bilge Alarm reading.
90% Voltage Effects	There was no change in the Bilge Alarm reading.
110% Air Pressure Effects	There was no change in the Bilge Alarm reading.
90% Air Pressure Effects	There was no change in the Bilge Alarm reading.
110% Hydraulic Pressure Effects	There was no change in the Bilge Alarm reading.
90% Hydraulic Pressure Effects	There was no change in the Bilge Alarm reading.

Calibration and Zero Drift Test

Calibration Drift	0.1 ppm
Zero Drift	0.0 ppm

Diagram of test rig attached.
Diagram of sampling arrangement attached.

*** END ***