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# 1. Quick Start Guide

## Unpacking the Instrument

Carefully remove the straps and shipping container lid. The container includes 2" of protective foam insulation around the entire instrument. Make sure not to rip or tear the foam and the shipping container can be reused many times. Place the instrument on a flat surface and remove the protective layer of plastic sheet. Inspect the instrument for any damage that may have been caused during shipping. Report any damage immediately.

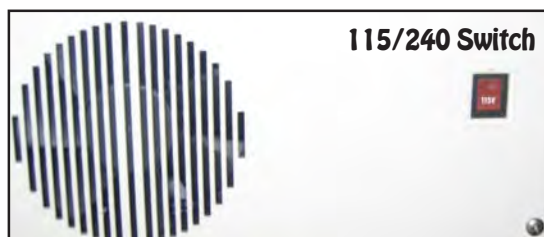
Remove the Electronics Module cover housing using a screwdriver. The power cord and spare parts are packed in the rear of the electronics module.

## Electrical Connections

### Power Requirements

For optimal performance we recommend that the instrument be connected to a dedicated 20 amp circuit. For a dual oven configuration, we recommend a dedicated 30 amp circuit. If multiple instruments, or other devices are on the same circuit, the maximum oven ramp rates and upper temperatures listed in our specifications can not be achieved! Variations in line voltages will affect the performance of the instrument. It is wise to use a line conditioner to limit any voltage spikes.

Before plugging in the instrument, verify that the 115/240 switch on the back of the Oven Module is in the proper position for the voltage being applied. This is the only external voltage selection setting and is used exclusively for the oven heating elements. The remaining power used by the instrument is generated from internal power supplies that are rated from 85-240 Vac.



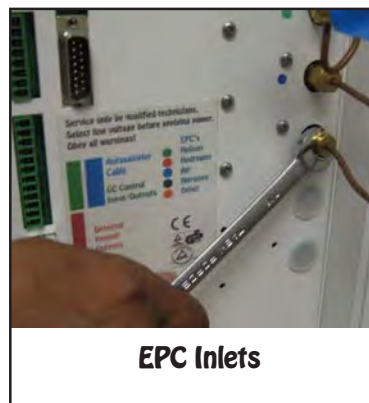
Power Cord

Plug the power cord into the rear of the Electronics Module and the other end into the supply line. We use a special high current power cable, so be careful not to lose it.

## Gas Connections

### EPC Connections

Up to 6 Electronic Pressure Controllers (EPC's) may be mounted on the rear of the Electronics Module. These devices precisely measure and control the gases used inside the instrument. The EPC's are color coded by type of gas (Blue-Air, Red-Hydrogen, Black-Nitrogen, Green-Helium, & Light Brown-Carrier

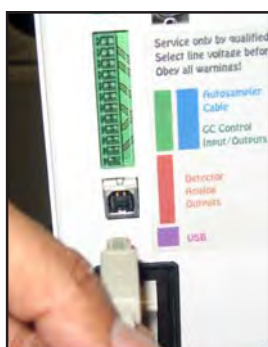


EPC Inlets

Gas). Connect the supply gas lines to the 1/8" EPC inlets. Multiple EPC's can be fed from one supply line. For optimal performance the supply pressure needs to be at least 100 kPa higher than the setting requested by the instrument. For instrument gas settings see the GC Methods section.

## Tanks and Regulators

For the best instrument sensitivity and performance make sure to use Ultra High Purity gases. While the EPC's, Injectors, and Columns will perform fine on less expensive gases, the baseline noise of the detector may suffer. We also highly recommend 2 stage regulators for all of your supply tanks. Make sure that the lines from the supply tank to the instrument have been heated and flushed with inert gas to remove impurities.



## Computer Connection

All GC systems are supplied with an Internal Computer. In some cases you may want to connect the system to an External Computer. If you just want to collect Chromatography Data on the External Computer, then connect a standard USB cable to the square connector on the GC and the other end to an available USB slot on your External computer. To allow for complete Remote control you will need to connect a cable between Ethernet port on the GC and your network

## Autosampler Connection

If you have purchased an autosampler with your system attach the 15 pin connector side of the cable to the autosampler socket on the back of the Electronics Module. The other end attaches to the "GC" connector on the back of the autosampler.



## Installing a Column

One end of the column connects to the injector. If you have an on-column injector, feed the column through the nut and ferrule into the injector body. The column should be positioned 1 cm below the septum. Tighten the nut within the GC oven. Your syringe should now slide through the injector septum nut into the column. With beveled syringes the needle may catch on the edge of the column; simply rotate the syringe and it should slide easily into the column for injection.



Place Column into Injector



Place Column into Detector

The other end of the column is inserted into the appropriate detector. A glass or stainless steel column connects directly to the detector fitting inside the GC oven. A capillary column feeds through the detector insert into the body of the detector. Refer to the specific detector to determine where the column should be positioned.

# Graphical User Interface (GUI) and Color Touch Screen

## Navigating Around - Overview

Getting familiar with the look and feel of the GC Control Software

The screenshot shows the 'Method Editor' window with the following callouts:

- Program Name:** Points to the 'MTH1' label at the top left of the window.
- Save the current name or create a new one:** Points to the 'SAVE' and 'APPLY' buttons.
- Apply the selected files to the GC Program:** Points to the 'APPLY' button.
- Minimize & Close:** Points to the window control icons (minimize, maximize, close) in the top right corner.
- Arrows allow you to Scroll through Filenames.:** Points to the left and right arrow buttons next to the parameter lists.
- Total time of the GC Program:** Points to the 'Duration 14.5 Min' text.
- File Editing Buttons:** Points to the parameter lists (OTP, Timeline, Detector, Carrier1, Carrier2, Trap) which have scroll arrows.

The 'Alphabetic Entry' screen displays a full QWERTY keyboard layout. The word 'SPLIT' is entered at the top. At the bottom, there are 'CLEAR' and 'CANCEL' buttons.

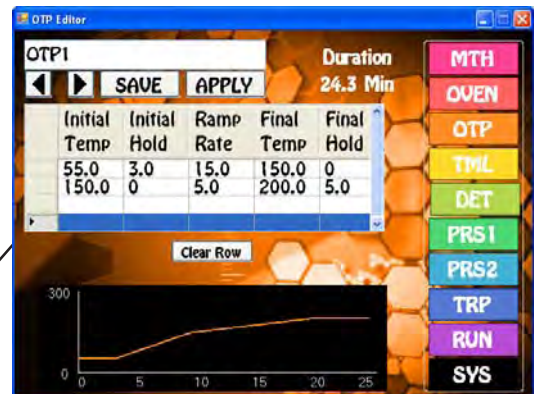
**Keyboard to Enter Filenames**

**Navigation Buttons to Quickly jump from one screen to another**

The 'Numeric Entry' screen shows '100.0' entered in the 'DET - TEMP Set Point' field. Below the field is a numeric keypad with buttons for digits 0-9, a 'BKSP' (backspace) button, and an 'ENTER' button. 'CLEAR' and 'CANCEL' buttons are at the bottom.

**Number Pad for entering Values**

Editors let you customize the files associated with the method.



Oven Temp Program Editor



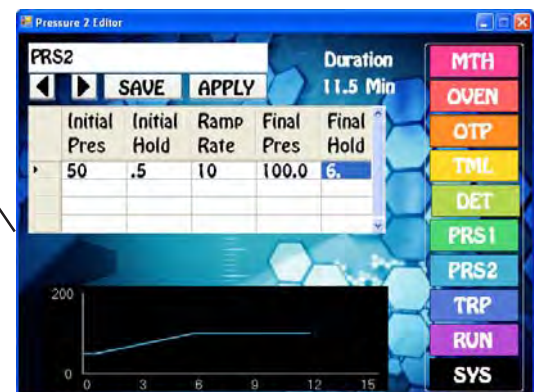
Timeline Editor



Method Editor



Carrier Pressure 1 Editor



Carrier Pressure 2 Editor

Status pages display parameters associated with the method, both graphically and as text and values.



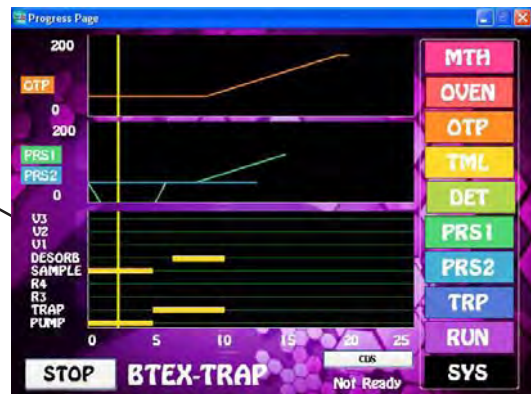
Oven Status



Detector Status



Method Editor



Run Status

The Navigation Bar is placed on all commonly used pages. Most pages can be reached with one press of a button.

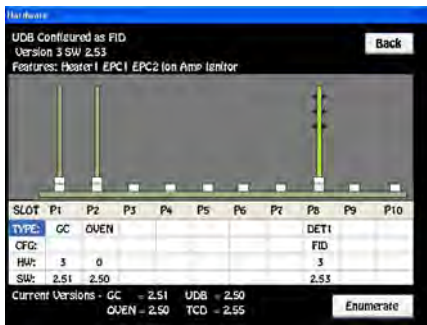


Navigation Bar



System Status



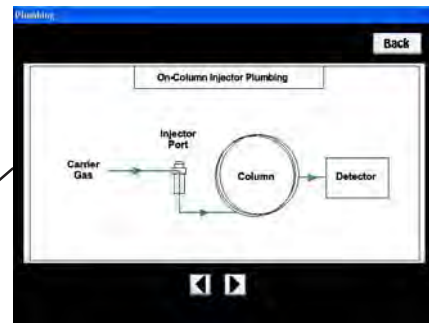


**Hardware**



**Diagnostics**

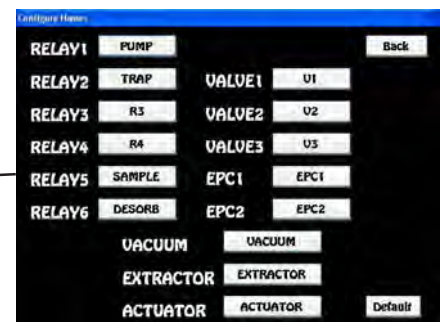
System status pages display the health and viability of the instrument.



**Plumbing**

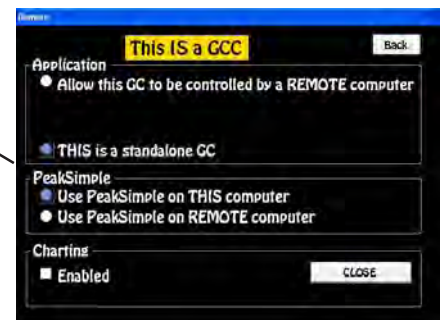


**Systems Status**



**Configure Names**

**Software Updates**



**Remote Control**



**Language**

## 2. GC Control Software Manual

### Method Editor



**GC Method Overview** - In one convenient location all of the files associated with a particular method can be accessed and edited. The color coded editors for the Oven Temperature Program (OTP), Timeline (TML), and Pressure (PRS) programs can be displayed by pressing the buttons in the middle, or through the Navigation bar. The Navigation bar is so handy that we placed it on all of the screens that you need to get to on a regular basis. The Method Button is located at the top of the Navigation Bar. The Method screen can be reached quickly from almost anywhere in the program by pressing on the MTH button. The current Oven Status and Detectors used by the Method are also a press away.

**Method Files** - By pressing the left and right arrows beside the Method name you can scan through the existing Methods on the system to select the appropriate one. While scanning you will notice that the Program files associated with the Method change accordingly. When creating new Methods, we recommend that you name the Program files associated with a Method with the same name as the Method for easy recollection. For Example, if you are creating a Method for Pesticides, we would recommend naming the OTP, TML, PRS Program and Detectors with the name PEST. For the simplest Method you only need an OTP and PRS program, then turn ON the Detector.

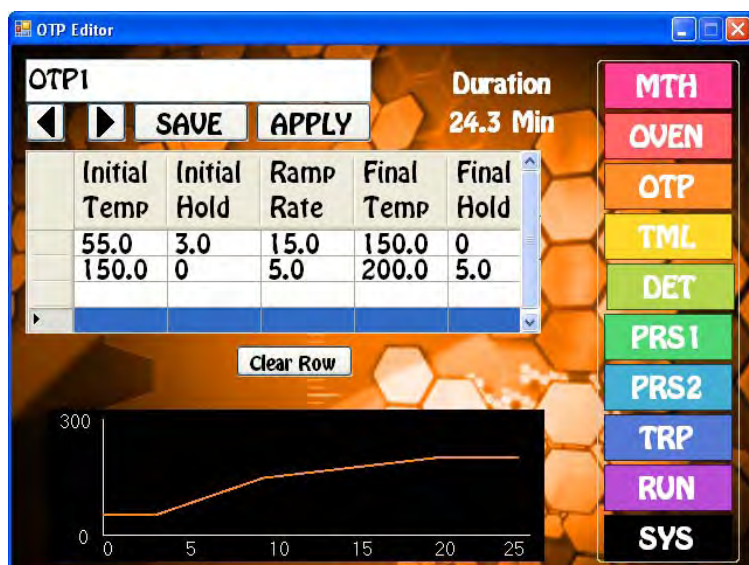
**Program Files** - All of the Program files in the middle of the screen are linked to the Method Name. You can use the left and right arrows to scan through Program files and select new ones to build a new Method. When doing this you will notice a pair asterisks to the right of the Program Name. The asterisks alert you that these Program files have not been Saved to the current Method.

**Blank Names** - It makes sense to only display the Program files in the Method that are really performing a function. The system comes pre-loaded with Blank Program names for those occasions where a particular program file is not needed for the Method.

**Saving Methods** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Method, or enter a completely new Method Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. All of the files displayed on the Method screen will be SAVED under this Method name.

**Duration** - The system calculates the length of the Method by using the Duration associated with the longest Program file.

## Oven Temperature Program Editor



**Oven Temperature Program (OTP) Overview** - The OTP controls the temperature program of the GC oven. It is essential for the Oven temperature to be consistent and reproducible for the best chromatographic separation and analysis. By pressing the left and right arrows under the OTP name you can scan through the existing OTP's on the system to select the appropriate one. The OTP can be as simple as an isothermal run, or as complex as needed. We allow 4 program lines, which equal 8 lines in other systems, because we added the Final Hold column to each line. Most OTP's are only one line in DPS GC systems. As you build the OTP the graphical display follows along.

**OTP Fields** - You create an OTP by entering the Initial Oven Temperature of the analysis. If there is a hold time during the start of the chromatographic run enter it next under Initial Hold. The Temperature Ramp rate of the analysis is entered next. Make sure that you do not exceed the ramp specifications of the system. The Final temperature for the analysis is entered next along with the Final Hold time. If another line is needed start off the Initial Temperature on line 2 with the Final Temperature of line 1. Continue on as needed to complete the OTP. We allow both positive and negative Temperature Ramps. But be advised, that our Ovens are designed for and work best with positive ramps.

**Entering Values** - By pressing on a cell the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Clear Row** - Any row can be highlighted by pressing the cell to the left of the Initial Temperature and then Deleted with the CLEAR ROW button. The entire OTP can be cleared by pressing on the top left cell and then pressing CLEAR ROW. This is convenient when you want to start fresh and enter a brand new OTP.

**Saving an OTP** - When you press the SAVE button the Keyboard will display allowing you to overwrite the current OTP, or enter a completely new OTP Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button.

**Apply** - When you are scanning through OTP's and find the one you are looking for, simply press the APPLY button and this OTP will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not

yet been linked to the Method. If you like what you have done, simply **SAVE** the Method and the new **OTP** is ready for action. After creating a new **OTP**, you can also **APPLY** this to the Method following the same steps.

**Duration** - The Duration of each individual line is calculated as the sum of the **Initial Hold**, the **Final Hold** and the time required to ramp from the **Initial Hold** to the **Final Temp**. The **Ramp** time is calculated automatically using the **Ramp Rate**. The total of all of the lines are displayed as the **Duration** for the **OTP**.

## Timeline Editor



**Timeline Overview** - The Timeline (TML) is a table that contains a sequence of events for a particular Method. Items that can be controlled include, Valves, Relays, Traps, and other devices such as a Vacuum pump, or Purge Gas. The TML sequence only needs to be entered one time and then it can be linked to various Methods. The Timeline is a powerful tool that takes advantage of the modularity of our instruments to create vast flexibility. The Timeline is a smart program that automatically sorts rows by the Initial Start Time.

**Timeline Fields** - To create a TML start by entering the Start time of the function and then press the Action Field. The device Selection screen comes up and there you can select the particular device and the control function, ON or OFF. When this is selected the program returns you back to the Timeline screen so that you can now enter the Duration of the action. For example you want to activate the Split Vent for 1 minute. You would enter the Start Time, Select SPLIT ON, and then enter 1.0 for the Duration. At the end of the Duration period the device, in this case the Split Vent, automatically changes back to it's original state. By using this simple Start, Device and Duration sequence the system takes care of the Timing for you.



You can delay the start of the OTP, or Pressure Program for those cases when you want to perform another task before collecting data. For example, if you would first like to turn ON a Vacuum Pump for 5 minutes to collect a sample, and then rotate a Sample Valve to Inject the sample, and only then Start the OTP. This sequence is readily handled by the TML. You can use the same OTP whether or not there is a Vacuum sequence prior to injecting the sample. To delay an OTP or PRS Program file, simply select the Device and then press OK. Once you are returned back to the TML enter the Start time. To see what this looks like graphically, press the RUN button.

**Entering Values** - By pressing on the Start of Duration cell the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the cell selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Clear Row** - Any row can be highlighted by pressing the cell to the left of the Start Time and then Deleted with the CLEAR ROW button. The entire Timeline can be cleared by pressing on the top left cell and then pressing CLEAR ROW. This is convenient when you want to start fresh and enter a brand new Timeline.

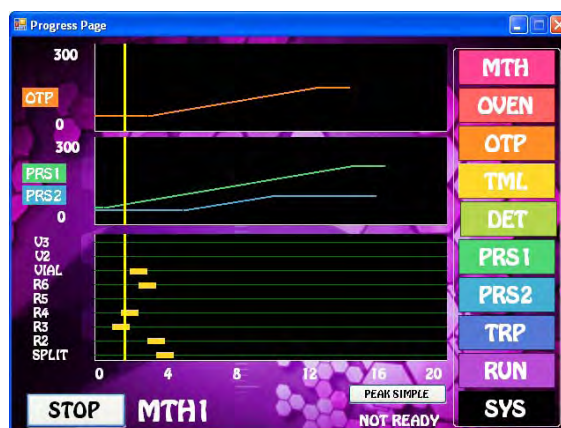
**Insert, Delete, Up & Down** - These buttons appear when you select any line of the TML. Use them to Insert a new row, or Delete one that you are not using anymore. The UP & Down arrows allow you to scroll through the TML to the line of your choice.

**Saving a Timeline** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Timeline, or enter a completely new Timeline Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button.

**Apply** - When you are scanning through Timeline's and find the one you are looking for, simply press the APPLY button and this Timeline will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different for the one associated with the current Method. If you like what you have done, simply SAVE the Method and the new Timeline is ready for action. After creating a new Timeline, you can also APPLY this to the Method following the same steps.

**Duration** - The total time of the entire sequence.

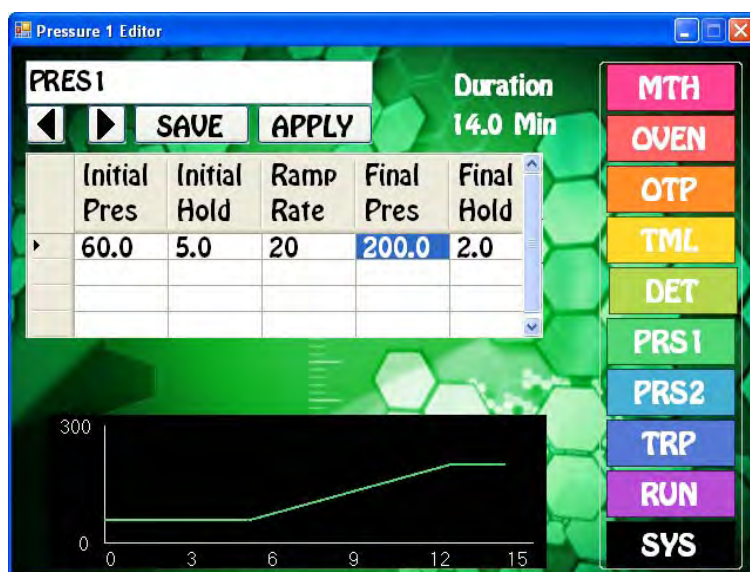
**View** - To view a graphical representation of the Timeline after you Apply it to the current Method, use the Navigation buttons to switch to the Run screen. The Duration of the selected devices will appear as solid yellow lines. As the vertical Progress bar passes through each Timeline event the device will be activated as you have programmed it.



**Start Times** - We have added a feature to help make TML Program files easier to read. If you do not enter a Start Time for a particular device, then the system will assume that the Start Time is the same as the line above and enter quote marks. Rest assured, all of the lines with quote marks will execute at the same time as the previous line with an actual Start Time. For example, if you want 4 events to occur at 1 min., then you only have to enter 1 min for the first event, the other 3 events will use the same Start Time. Once a later Start Time is entered then the subsequent events will use that time.

...The TML automatically sorts using the Start Time. If you Insert a row and then enter an earlier Start Time, that line will be moved where it belongs in the sequence of events.

## Carrier Pressure 1 Program Editor



### Pressure Program Overview -

Each injector has its own pressure program. If there are 2 injectors on the system then both PRS1 and PRS2 are available to use. A consistent pressure is essential for consistent and reproducible chromatographic separation and analyses. By pressing the left and right arrows under the PRS1 name you can scan through the existing PRS1's on the system to select the appropriate one. The PRS1 can be as simple as a single pressure, or as complex as needed. We allow 4 Pressure ramp lines, which equal 8 lines in other systems, because we added the Final Hold column to each line. Most Pressure Programs are only one line in DPS GC systems. As you build the Pressure Program the graphical display follows along.

**Pressure Program Fields** - You create an Pressure Program by entering the Initial Pressure of the analysis. If there is a hold time during the start of the chromatographic run enter it next under Initial Hold. The Pressure Ramp rate of the analysis is entered next. Make sure that you do not exceed the ramp specifications of the system. The Final Pressure for the analysis is entered next along with the Final Hold time. If another line is needed start off the Initial Pressure on line 2 with the Final Pressure of line 1. Continue on as needed to complete the Pressure Program. We allow both positive and negative Pressure Ramps. But be advised, that our is designed and works best with positive ramps.

**Entering Values** - By pressing on a cell the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the cell selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Clear Row** - Any row can be highlighted by pressing the cell to the left of the Initial Pressure and then Delete with the CLEAR ROW button. The entire PRS1 can be cleared by pressing on the top left cell and then pressing CLEAR ROW. This is convenient when you want to start fresh and enter a brand new PRS1.

**Saving PRS1** - When you press the SAVE button a keyboard will display allowing you to overwrite the current PRS1, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button.

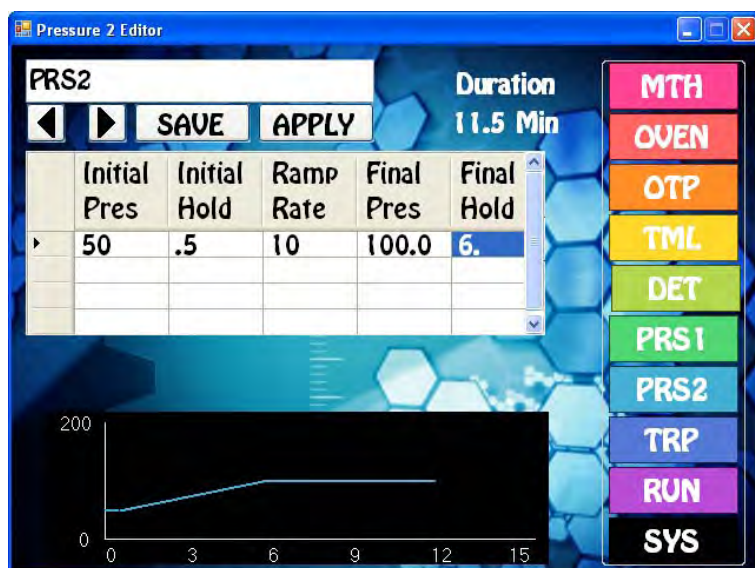
**APPLY** - When you are scanning through Pressure Programs and find the one you are looking for, simply press the APPLY button and this PRS1 will transfer to the Method screen. The program will

also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method and the new PRS1 is ready for action.

**Duration** - The Duration of each individual line is calculated as the sum of the Initial Hold, the Final Hold and the time required to ramp from the Initial Hold to the Final Temp. The Ramp time is calculated automatically using the Ramp Rate. The total of all of the lines are displayed as the Duration for the OTP.



## Carrier Pressure 2 Program Editor



### Pressure Program Overview -

Each injector has its own pressure program. If there are 2 injectors on the system then both PRS1 and PRS2 are available to use. A consistent pressure is essential for consistent and reproducible chromatographic separation and analyses. By pressing the left and right arrows under the PRS2 name you can scan through the existing PRS2's on the system to select the appropriate one. The PRS2 can be as simple as a single pressure, or as complex as needed. We allow 4 Pressure ramp lines, which equal 8 lines in other systems, because we added the Final Hold column to each line. Most Pressure Programs are only one line in DPS GC systems. As you build the Pressure Program the graphical display follows along.

**Pressure Program Fields** - You create an Pressure Program by entering the Initial Pressure of the analysis. If there is a hold time during the start of the chromatographic run enter it next under Initial Hold. The Pressure Ramp rate of the analysis is entered next. Make sure that you do not exceed the ramp specifications of the system. The Final Pressure for the analysis is entered next along with the Final Hold time. If another line is needed start off the Initial Pressure on line 2 with the Final Pressure of line 1. Continue on as needed to complete the Pressure Program. We allow both positive and negative Pressure Ramps. But be advised, that our is designed and works best with positive ramps.

**Entering Values** - By pressing on a cell the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the cell selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Clear Row** - Any row can be highlighted by pressing the cell to the left of the Initial Pressure and then Delete with the CLEAR ROW button. The entire PRS1 can be cleared by pressing on the top left cell and then pressing CLEAR ROW. This is convenient when you want to start fresh and enter a brand new PRS1.

**Saving PRS2** - When you press the SAVE button a keyboard will display allowing you to overwrite the current PRS2, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button.

**APPLY** - When you are scanning through Pressure Programs and find the one you are looking for, simply press the APPLY button and this PRS2 will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the

current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method and the new PRS2 is ready for action.

**Duration** - The Duration of each individual line is calculated as the sum of the Initial Hold, the Final Hold and the time required to ramp from the Initial Hold to the Final Temp. The Ramp time is calculated automatically using the Ramp Rate. The total of all of the lines are displayed as the

## Oven Status

	Actual	Target	Set Point
Oven Temp (°C)	50.1	50.0	50
Ini1 Temp. (°C)	125.0	125.0	125.0
Ini2 Temp. (°C)	22.1	225.0	225.0
VI (C)	27.7	0.0	
Carrier1 (kPa)	49.8	50.0	50.0
Carrier2 (kPa)	0.0	0.0	

Program Time 3.9 (minutes)

**Oven Status Overview** - In our never ending quest to make all of our systems as friendly as possible we have placed all of the Oven Functions on one convenient screen. On this screen you can monitor the temperature Program, the Carrier Pressure Programs, and the Temperature of the Injectors and the optional Single Valve under the main column oven.

**Oven Fields** - The Actual column is the current temperature. The Target field comes from the OTP, or Pressure Program. As the program ramps the target changes and the Oven temperature, or pressure follows as closely as it can. During a ramp the Setpoint will display the Final Temperature of the current line in the

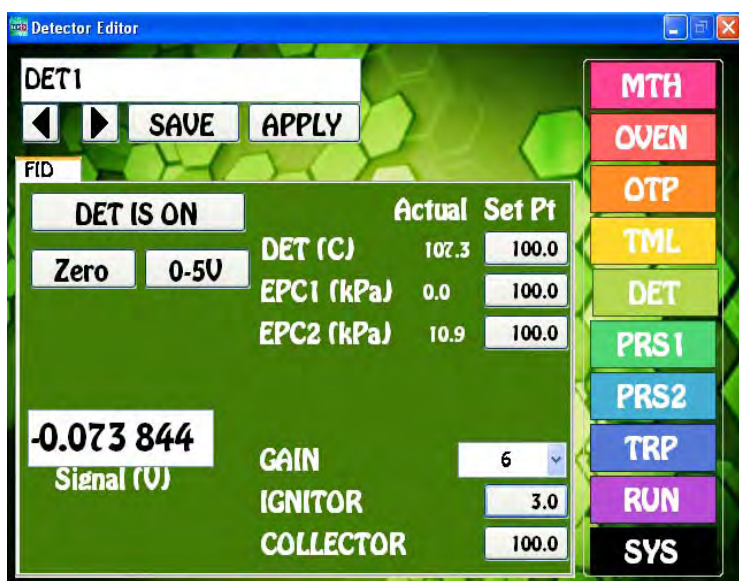
OTP, or Pressure Program. At any time, you can manually override this value by entering a new Setpoint. If the setpoint is not Saved, by Saving the GC Method, the Setpoints will return to the previous values stored in the GC Method.

**Entering Values** - By pressing on a button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the cell selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Saving Oven Settings** - When you SAVE the current GC Method the Injector and Valve temperatures are saved too. The Oven and Carrier Pressures are Saved within the OTP, or PRS1 & PRS2 programs.

**Program Time** - During a Run the Program Time displays at the bottom of the screen. You can follow along as a ramp starts.

## Detector Status



### Detector Parameters Overview -

While striving to make all of our systems as friendly as possible we have placed all of the Parameters necessary for any one Detector on one convenient screen. If there are multiple detectors in the GC System then additional tabs will appear with the description of each detector on the tab. By simply pressing each tab you can pull up the parameters for each detector. We have designed each Detector screen to display only those parameters necessary for each individual Detector. Please refer to the Detector section of this manual for further details on each detector.

Common functions like Detector Temperature and EPC pressures are always ON. The Detector ON button turns

ON the other control functions, such as High Voltage, Cell Temperatures, and the Collector Voltage. We purposely make you turn ON each detector manually. The DET ON function is not included as a part of the GC Method. We do this to purposely protect all detectors from being automatically turned ON without being properly set up.

**Detector Fields** - The Detector Parameters are each set individually. For the EPC's we have tried to make this as easy as possible and set the default values to 100 kPa. We have adjusted each detector restrictor to deliver the proper flow using this 100 kPa value. The Cell Temperature is the secondary temperature setting for the BCD, TCD, and ECD cells. High Voltage is used for the PID, HID, and FPD detectors. The Ignitor is used for the FID and FPD detectors and the Bead is used for the TID and NPD detectors. The Collector voltage is set at -100V for all Ion Amplification detectors. In all cases the default values are close to optimal and once again we only display the fields for each detector that pertain to that specific detector.

**Entering Values** - By pressing on a button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Saving Detector Parameters** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button.

**Apply** - When you are scanning through Detector Files's and find the one you are looking for, simply press the APPLY button and this Detector File will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. If you like what you have done, simply SAVE the Method and the new Detector

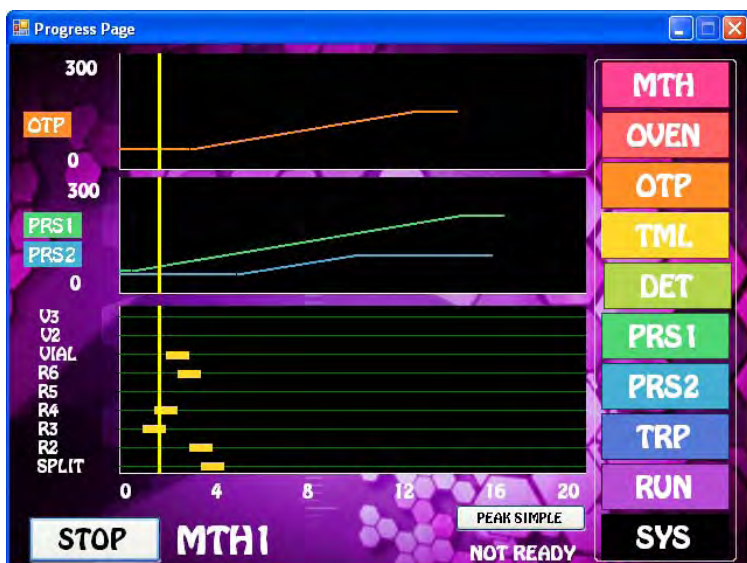
File is ready for action.

**Zero** - Some detectors have an inherent offset as you increase the gain to achieve more sensitivity. We have included a hardware ZERO function that compensates for this offset. There is a range limit of 2.5V.

**Detector Output** - For analog outputs to other data systems we have included 3 voltage range settings. 0-1V, 0-5V, and 0-10V. By pressing on the button these values will cycle. Select the one that you want and SAVE the setting.

**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black. If there are multiple signals, as for the TCD, both Signals come ON with the Detector ON function.

## Run & Progress Status



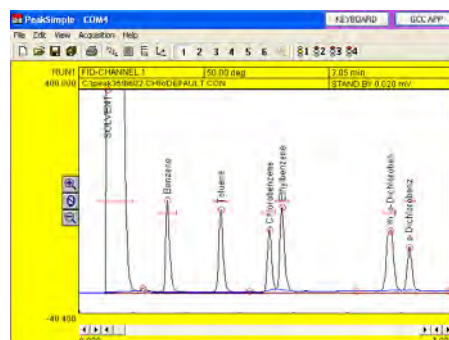
**Run & Progress Overview** - It just made all of the sense in the world to include a graphical representation of the GC Method. The Run screen gives you a real time view of the GC Method and what is happening in the Method during an analysis. On the Run screen we have placed the Temperature Program, Pressure Programs, and the Timeline, all on a common time scale. This is also the screen where you START the analysis, transfer to the Chromatography Data System, and check to see if the Oven is READY. Once the analysis has started the yellow progress bar shows you what is currently going on in the GC Method.

**Method** - The current Method name is at the bottom of the screen next to the START/STOP button. To load the

current Method to the graphs, simply press the START button. This will load all of the parameters of each of the individual GC Method files into the GC. You can STOP the run at any time. You may need to wait for a few minutes for all of the temperatures and pressures to equilibrate.

**START/STOP** - By pressing this button the Run will either Start or Stop. The button function is logical, to Start a run press the START button. Once a run is started you will be immediately be transferred to the Chromatography Data System to verify that the run actually started and the data system is collecting data.

**CDS Button** - The Chromatography Data System (CDS) button in the bottom right had corner of the screen. Use this button to view the CDS and the run in progress. A convenient button is also included on the CDS screen to quickly transfer you back to the GC Control software.



**Duration** - We calculate the longest of the OTP, PRS, and Timeline for the Duration of the GC Method. All of the programs do not have to have the same total time. For example, if the Pressure Program does not ramp, then it can be only a minute, or so. In this case, the Pressure will remain constant for the duration of the run. The same is true for the OTP, at the end of the run it will remain at the Final Temp until the other two graphs are complete.

**OTP** - A graphical representation of the current OTP in the current GC Method. The time scale is common to all graphs and is on the bottom of the screen. If the start of the OTP is delayed in the Timeline, the graph will be shifted to the right.

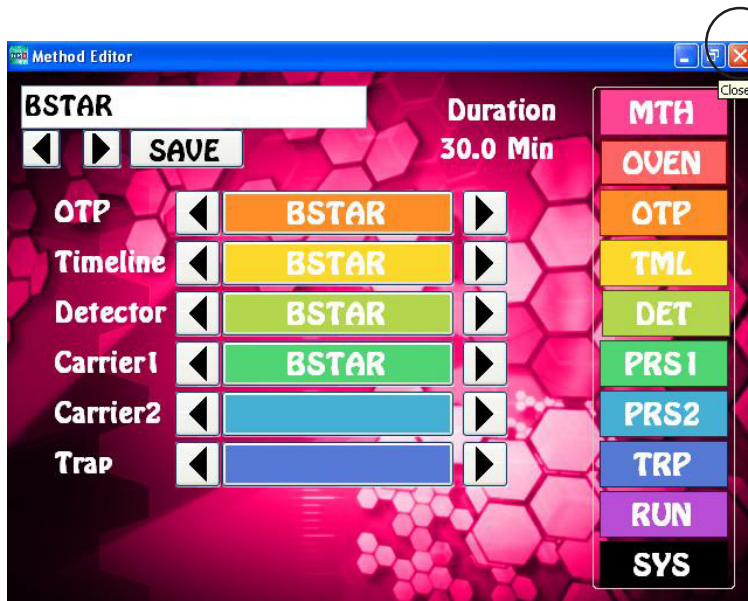
**Pressure Programs** - A graphical representation of the current PRS1 & PRS2 in the current GC Method. If the pressure is not ramping during the run, then the pressure program Duration can be very short. If the start of the PRS is delayed in the Timeline, the graph will be shifted to the right. If one of the PRS programs is blank, then it will not display.

**Timeline** - Relay, Valve, and other functions entered in the Timeline will be displayed as yellow bars using the same time scale as the OTP and PRS. During the Run the vertical Progress Bar will pass through the yellow bars as the functions occur.

**Progress Bar** - Once the analysis has started the vertical yellow Progress Bar shows you where you are in the current GC Method and what is going on.

**Oven Status** - The Oven Status indicator will change from NOT READY to READY when the oven temperature is stable and ready for the next injection. During the run the Oven Status will always display NOT READY, so an Autosampler will inject prematurely.

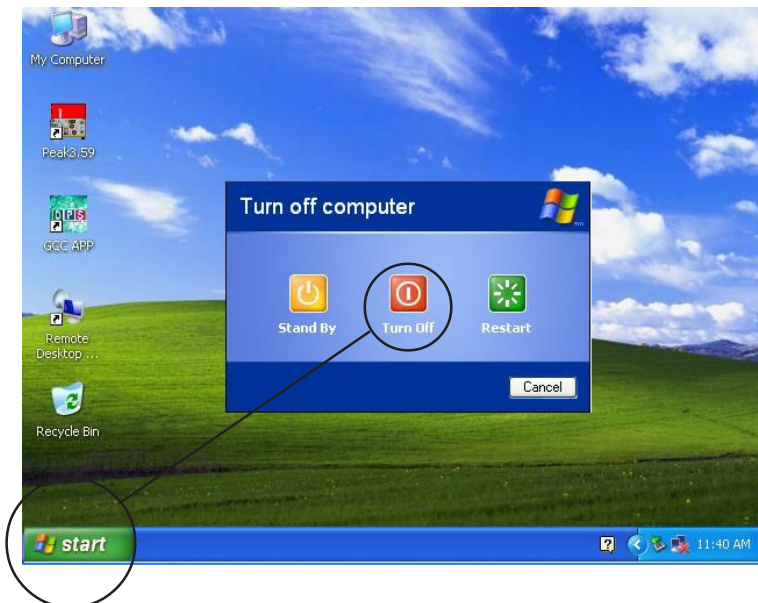
### Shutting Down - 1. GC Application, 2. Windows, 3. Power OFF GC



**1. Red X** - Click on the red X at the right top of the window to close the GC application.

**Saving Settings** - The GC Application will automatically save the current parameters as a Default. In this way when you Turn On the GC the next time the same method will be loaded.

You will see the following red screen during this process. Please do not power OFF the GC during this time.



**2. Windows** - Once the Windows Desktop displays you can close down Windows from the Start button.

**3. Turn OFF GC** - Only after Windows finishes shutting down is it safe to turn OFF the GC Power Switch.

## System Status



**System Status Overview** - In one convenient place we have presented all of the System Control, Diagnostic, and Performance functions. Using these screens, you can check to see the health and status of the Hardware, manually turn on Relays and rotate Valves in the Diagnostics, change the Names of Relays and Valves according to their function, view the Plumbing on your GC, set up the GC to allow Remote Control, change the language displayed in the GC Control software, and verify that you have the most current software Updates.

**Hardware** - This screen provides a visual representation of the boards installed in the system including hardware and software versions.

**Diagnostics** - There are several tabs within this section. Under the Control tab you can manually turn ON and OFF various accessories installed in your system. The Test Data tab sends a computer generated SINE wave through the entire system to the CDS allowing you to verify that no data points are being lost. The Logging section lets you select information to be logged and sent via e-mail to a service engineer to access the health of your system. In the Com Ports section you can see the internal transfer of data across our network, and the external transfer of data to the CDS.

**View Plumbing** - The specific plumbing diagram of your system is displayed in the Plumbing Section. If a valve is installed, there will be multiple views of the valve in both the ON and OFF positions.

**Configure Names** - In this section you can change the names of devices associated with Relays to something that makes more sense for your particular system. For example, if you have a Split/Splitless injector installed, it makes more sense to call the associated Relay SPLIT, rather than Relay 1. The word SPLIT will now appear in the Device selection screen of the Timeline.

**Remote** - We allow the entire GC and CDS to be controlled by a remote computer. This is handy if the GC is installed in Antarctica and you want to run and control the GC from the warmth of your office. Or, you can just transfer the CDS to an external computer if you like a bigger screen, or want to use the keyboard on your own computer.

**Language** - By selecting the Language button of your choice, the GC Control software will display in that Language. More Language selections are continually being added.

**Update** - You can always have the most current firmware and software available. This section allows you to download the most current version for your instrument from our website. Simply connect the instrument to the internet via the ethernet connector and follow the instructions.



## Hardware

Hardware

UDB Configured as FID  
Version 3 SW 2.53

Features: Heater 1 EPC1 EPC2 Ion Amp Ignitor

SLOT	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
TYPE:	GC	OVEN						DET1		
CFG:								FID		
HW:	3	0						3		
SW:	2.51	2.50						2.53		

Current Versions - GC = 2.51 UDB = 2.50  
OVEN = 2.50 TCD = 2.55

Enumerate

**Hardware Overview** - If you are ever unsure of the configuration of your instrument, all of the information that you need is contained on the hardware page. When the instrument boots up it reads information from every board that is installed. The boards display on the chart with detailed information about each one in the table below.

**Boards** - By clicking on any board you will see additional information about each one in the upper left of the page. The highlighted board will change colors and have arrows pointing to it.

**Type** - Refers to the type of board. We have GC for GC Control Board, OVEN for the Oven board, UDB for the Universal Detector Board, TRAP for the Trap

Concentrator Board, and TCD for the TCD/ECD Detector Board

**CFG** - Refers to the specific configuration of the Detector boards and the Trap Board. For the UDB & TCD Boards the Configurations are (PID, FID, NPD, HID, FID, FPD, TID, ECD, or TCD), and the TRAP Board for the specific type of Concentrator Configuration (Purge & Trap, Air Concentrator, or Microextractor).

**HW**- Is the current hardware Version of the Board.

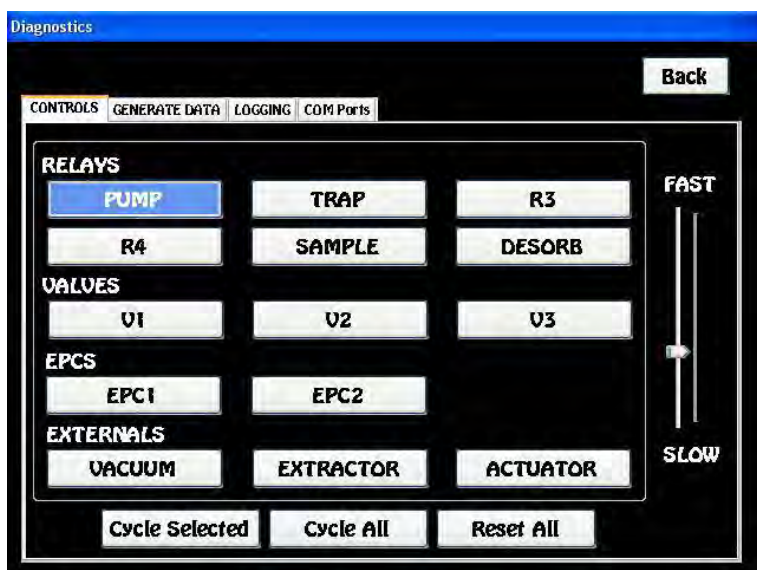
**SW**- Is the current software Version of the Board.

**Ping** - If you click on (P1, P2...P10), we will Ping the selected board. The system will either respond with a check mark, indicating that the board is found and in good shape, or a Red "X" indicating that either there is no board, or it is not functioning properly. We communicate between boards through an internal CAN network. The ping here is similar to the ping in an external network used to verify an IP address.

**Versions** - The current hardware and software version of the board is displayed in the table below each board slot. If any field is Red, it means that the GC Application is aware of a newer version of Firmware. An older Version may not be causing any problem with the functioning of the instrument, or cause any problems. The current Versions are displayed in the bottom left hand corner of the screen. The GC Application will automatically transfer you to this screen if it detects an older version, otherwise, the GC Application boots up to the GC Methods screen.

**Enumeration** - By clicking on Enumeration the instrument performs a soft boot and the boards are reset and read all over again. The oven door also calibrates its full open and closed positions and the current GC Method is loaded. The Detectors are also turned OFF.

## Diagnostics - Control



**Diagnostics - Control Overview -**  
Under the Control tab you can manually turn ON and OFF various accessories installed in your system. If no Device is attached the button will still change colors, but nothing else will happen.

**Relays -** By pressing ON (turns to Blue) and OFF any particular Relay, the device attached to it will function. Relays are usually hooked up to solenoids (like the Split Vent for the Split/Splitless Injector) and various other accessories that you want to control through the Timeline.

**Valves -** By clicking ON (turns to Blue) and OFF any particular Valve, you can rotate the Valve manually.

**EPC's -** Use these buttons to manually turn ON and OFF the 2 Carrier gas EPC'S.

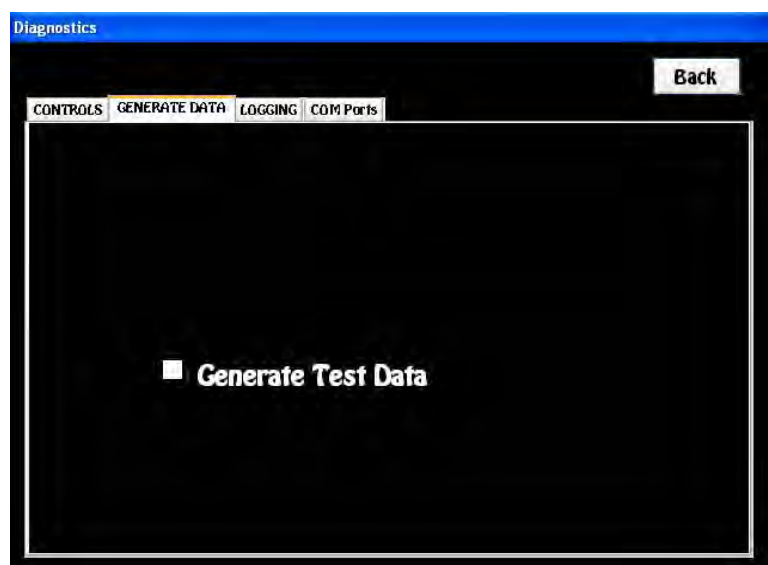
**Externals -** Use these buttons to manually turn ON and OFF each particular device.

**Cycle Selected -** By selecting a number of devices, they can be Cycled to verify that they are working properly. You can use the vertical speed bar, SLOW to FAST to control the speed of the cycling process. To Stop Cycling, press the Reset All button.

**Cycle All -** All of the devices can be Cycled to verify that they are working properly. You can use the vertical speed bar, SLOW to FAST to control the speed of the cycling process. To Stop Cycling, press the Reset All button.

**Back -** Returns you to the previous page.

## Diagnostics - Generate Data



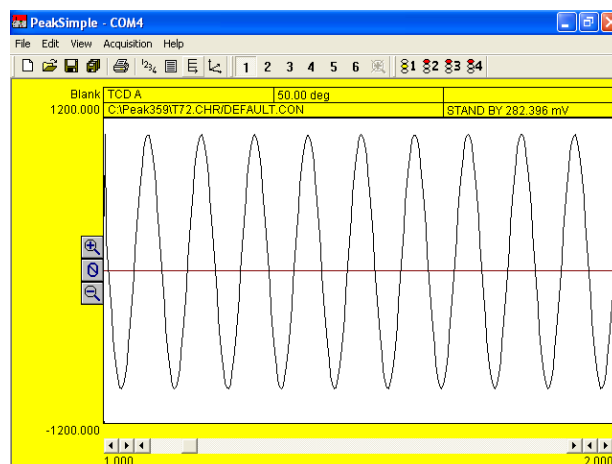
### Diagnostics - Generate Data

**Overview** - The Generate Data button sends a computer generated SINE wave through the entire system to the CDS, allowing you to verify that no data points are being lost. A SINE wave with the range of +1V to -1V is generated from the ETX computer and sent through the network to the detector board and then out to the CDS. This test verifies that a signal can travel through all of the hardware in the entire instrument and remain stable.

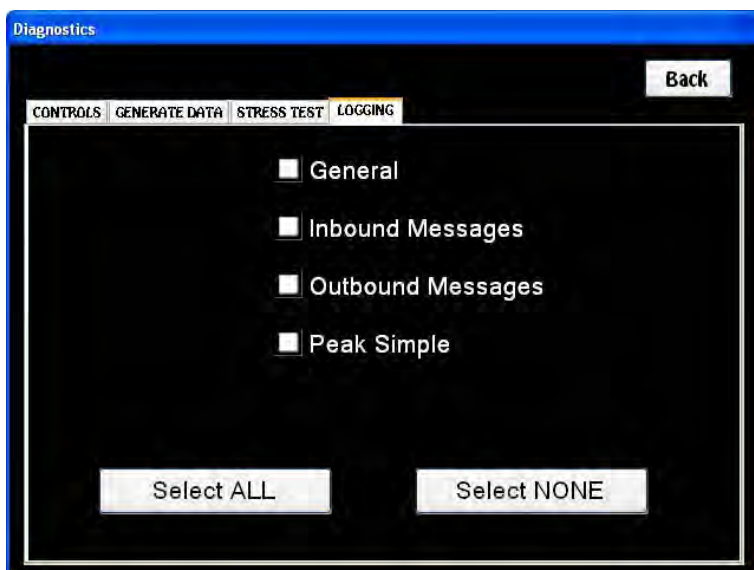
To check the suitability of the signal, simply collect the resulting SINE wave on the CDS, at any sample rate, and look closely at the smooth SINE wave to verify that no data points are lost,

missing, or inaccurate. It is best to start the CDS first and then click the Generate Test Data button. Also verify that the signal is exactly 2V from peak to peak. We use this hardware validation test for Initial Qualification (IQ) and Operational Qualification (OQ) purposes.

**Back** - Returns you to the previous page.



## Diagnostics - Logging



### Diagnostics - Logging Overview -

The Logging section lets you select information to be viewed, logged, bundled up and sent via e-mail to a service engineer to check the health of your system for trouble shooting purposes. Additionally, in conjunction with the Remote function of the system, the same service engineer can also collect this information directly from your instrument at their desk, wherever it may be. We have designed our instruments for field trouble shooting and repair. The logging system helps our service engineers pinpoint the specific problem. In most instances corrections can be performed remotely. In the rare case that an instrument needs field service, the information received from the logging system helps our field engineers find and fix the

problem quickly.

**General** - These are General messages that the system produces during normal communications between the ETX computer and the individual boards. Depending on where the malfunction occurred, the two most useful streams of messages happen during boot up, and at the specific time that the error occurs.

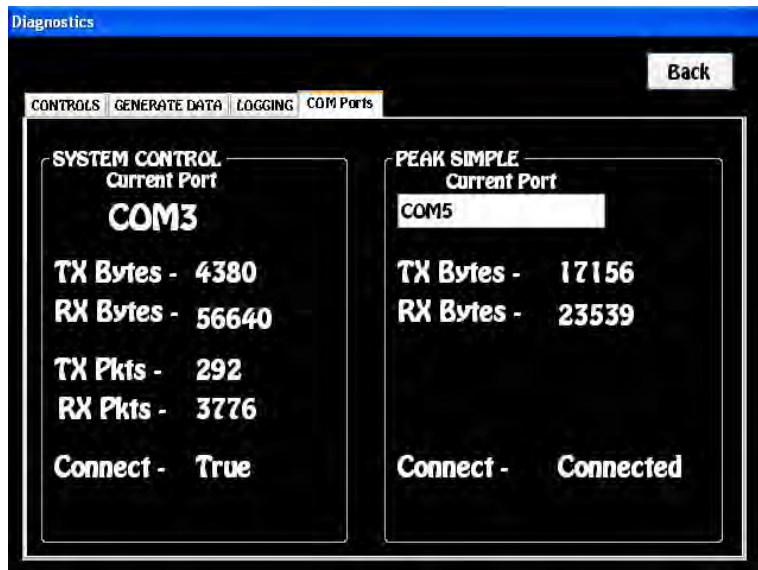
**Inbound Messages** - These are messages that the ETX computer receives from the individual boards.

**Outbound Messages** - These are messages that the boards receive from the ETX computer.

**CDS** - These are messages between the ETX computer and the Chromatography Data System (CDS).

**Back** - Returns you to the previous page.

## Diagnostics - Com Ports



### Diagnostics - Com Ports

**Overview** - In the Com Ports section you can see the internal transfer of data across our network, and the external transfer of data to the CDS.

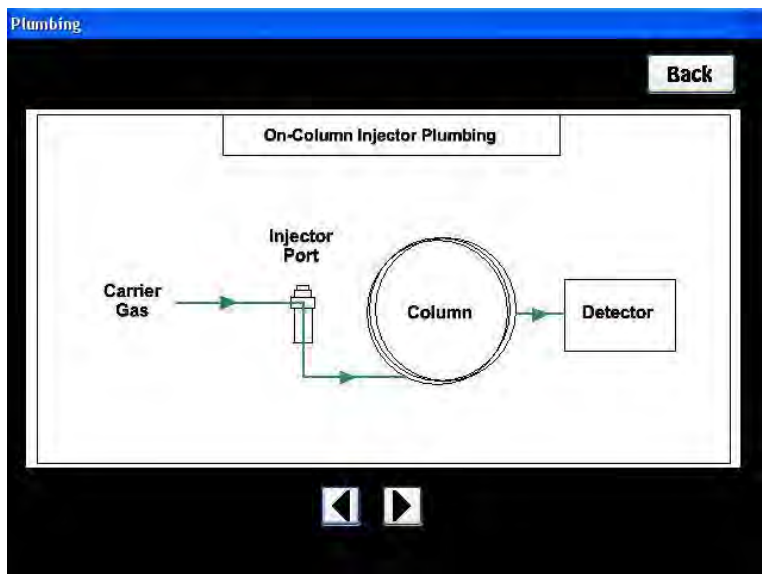
**System Control** - If the system is up and healthy the Connection at the bottom of the screen will be True. You will also notice the number of bytes and packets that are sent (TX) and received (RX) steadily increase. The name of the current Com Port is displayed at the top.

**CDS Control** - If the CDS is connected and functioning that Connection at the bottom of the page will say Connected. You will be also notice the number of bytes that are

sent (TX) and received (RX) steadily increase. The name of the Com Port is displayed at the top.

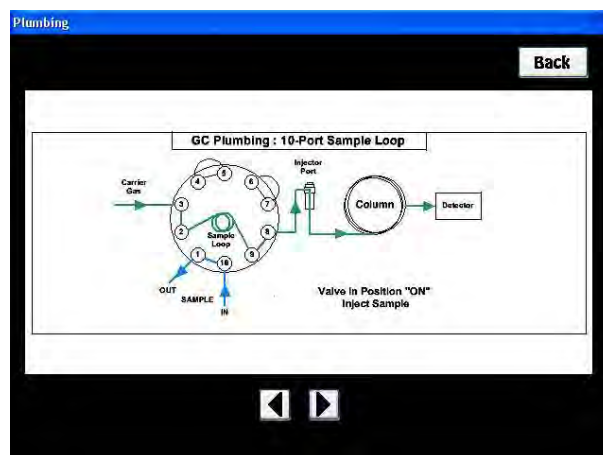
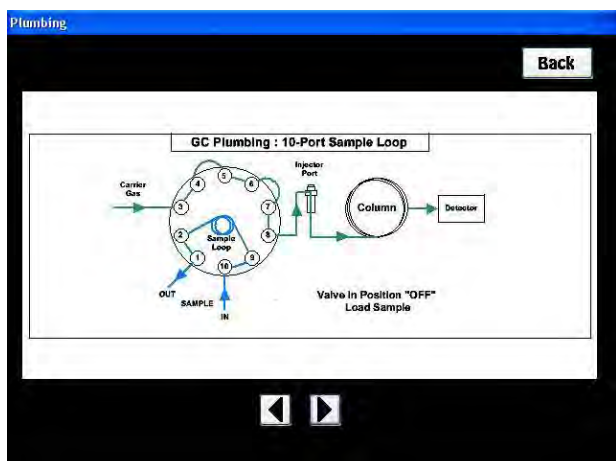
**Back** - Returns you to the previous page.

## View Plumbing



**View Plumbing Overview** - The specific plumbing diagram of your system is displayed in the Plumbing Section. If one, or more valves are installed, there will be multiple views of each valve in both the ON and OFF positions.

**Back** - Returns you to the previous page.



## Configure Names

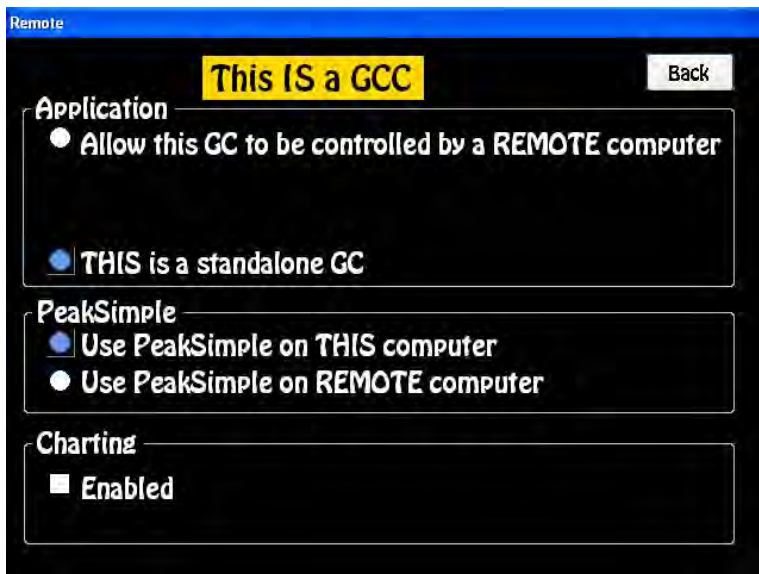
**Configure Names Overview** - On this screen you can change the names of devices associated with Relays, Valves, EPC's, etc. to something that makes more sense for your particular system. For example, if you have a Split/Splitless injector installed, it makes more sense to call the Relay SPLIT, rather than Relay 1. The word SPLIT will now appear in the Device selection page of the Timeline. In most instances we make these changes for you at the factory. In the Timeline below you will notice that at 0.1 min., "SPLIT ON" occurs. If we had not changed the name of Relay 1 to Split, the same Timeline would have displayed "Relay 1 ON".

**Default** - Changes all of the devices back to their original names. You are not allowed to use any of the Default names for another Device. For example, you can not rename Relay 1 to Relay 2, or Vacuum. The system will give you an error message and not allow you to make the change.

**Back** - Returns you to the previous page.

Start Time	Action	Duration
0.10	SPLIT ON	1.00
0.25	VIAL ON	0.50
0.50	R2 ON	2.00

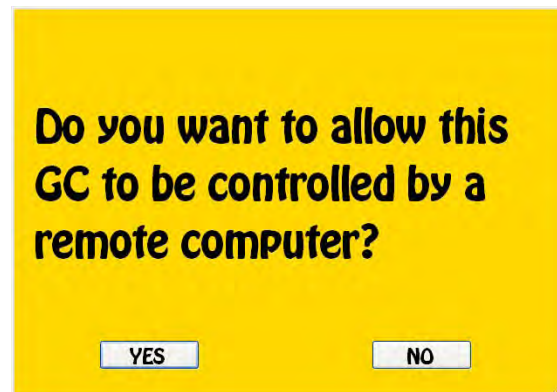
## Remote Control



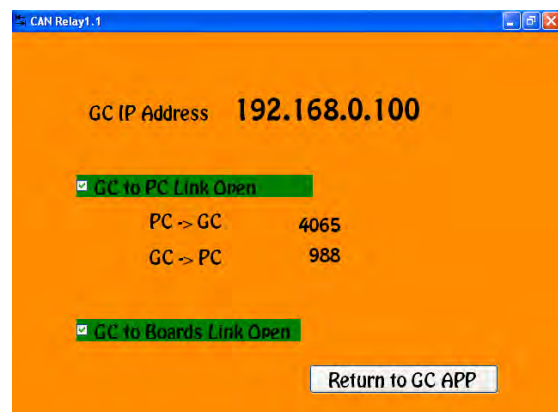
**Remote Control Overview** - We allow the entire GC and CDS to be controlled by a remote computer. This is handy if the GC is installed in the control room and you want to run and control the GC from the warmth of your office. Or, you can just transfer the CDS to an External computer if you like a bigger screen and want to use the keyboard on your own computer.

**Internal Computer - This IS a GCC** - The current GC Control is from the Internal ETX computer.

**Application** - There are 2 radio buttons. If the GC is controlled by the Internal ETX computer then "This is a stand-alone GC" is highlighted. When you want to transfer control to an External computer check the "Allow this GC to be controlled by a REMOTE computer" button. A dialog page will come up asking if you are sure you want to transfer control to a REMOTE computer and then the system will open the CAN Relay page and shut down the GC Control Application.



**CAN Relay** - On the top of the CAN relay we display the IP address of the Internal computer for convenience. You will need to input this address in the External computer so it will know what GC it is supposed to control. There are boxes that check themselves when the network PC to GC connections are made. You will notice transmit and receive packets once a good link is established.

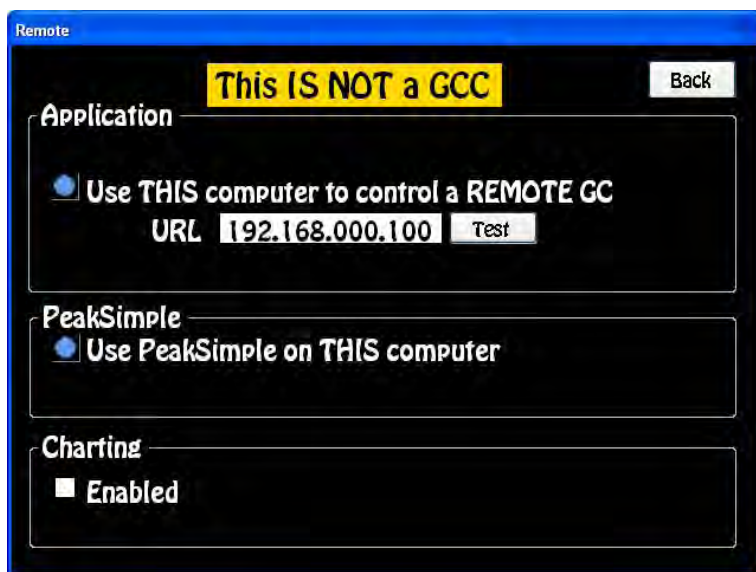


**Return to GCC APP** - This button releases the Remote Control of the GC, by shutting down the CAN Relay, and returning control to the Internal GC Control Application running on the ETX computer.



**Remote CDS Only** - When you just want to run the CDS on an External computer and leave the GC Control where it is, select the “Use CDS on a Remote Computer” radio button. First you must connect the External computer via a USB cable from the doghouse connection on the GC to an available USB connection on your computer. Additionally, for some CDS there is software to open a Com Port that must be installed on the External computer. Once the USB connection is made, start the CDS on the External computer and collect your data there.

**Charting** - When this radio button is highlighted a chart will appear on the detector screen displaying the real time detector signal.



### External Computer -

**Overview** - Start the GC Control application on the External computer. Navigate through the Systems screen to the Remote screen. Here you will enter the Internal IP address of the GC to be controlled and verify that a connection is possible using the Test button. For certain CDS you also need to install the a Virtual Com port so you can collect data, refer to the Setting up an External Computer section of the manual. The Internal ETX computer already comes with this software installed at the factory.

**This IS NOT a GCC** - Is the header of the screen when the current GC

Control is from an External computer.

**Application** - The “Use this computer to Control a REMOTE GC” radio button is highlighted on the External computer. Enter the IP address from the GC that you want to Remotely Control.

**Test** - Pressing the Test button will ping the network to locate the GC. The Test will be successful anytime that a valid IP address is found, even if it is not the GC you are searching for. Anytime the Test is successful, the Test button will change to Apply.

**Apply** - Will restart the GC Application and connect the External computer with the GC. Now all of the GC Control and data acquisition will be done on the External computer.

**Back** - Returns you to the previous page.

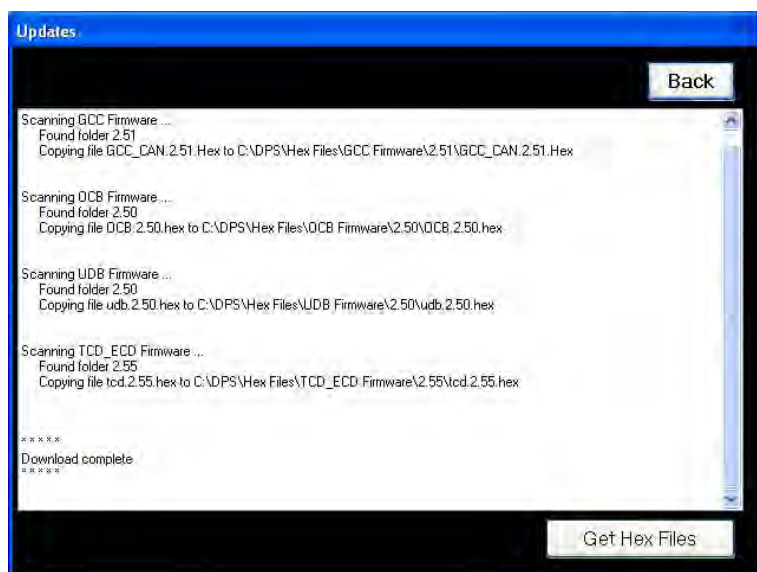
## Language



**Language Overview** - By selecting the Language button of your choice, the GC Control software will display in that Language. More Language selections are continually being added.

**Back** - Returns you to the previous page.

## Updates



**Updates Overview** - The Updates screen is a powerful systems tool that allows you to always keep your instrument up to date. Periodically new firmware (the software installed on the microprocessor chip common to every board) is available to download. You can only currently install the firmware from an External computer (laptop or desktop) directly to each board. To find out if you need an update, simply navigate to the Hardware page and look for a version number in Red. If there is not a version in Red, then your system is current and there are no upgrades necessary.

**Systems / Hardware** - The GC Application is smart, if there are no new upgrades the system transfers

you to the Method screen when you boot up the GC Application. However, if the firmware on one of the boards is out of date, upon booting up the system transfers you directly to the Hardware screen and there you will find a version number in Red. An out of date version may not cause any problems with your Instrument, but it is an indicator that something better is available.

**Updates** - The Updates button is not available on the internal ETX computer, because there is no current method of loading the software from the EXT computer to the boards installed on the same Instrument. On an External computer running the GC Application the Updates button is available. It is only from an External computer using a serial cable connected directly to the board that the firmware can be loaded.

**Get Hex Files** - First establish an internet connection on an External computer. Once established press the Get Hex Files button and the most current versions of all the Hex files (firmware) will be downloaded from the DPS website onto your External computer. Once the download is complete, you can then load the individual files onto the boards using the program Flash Magic. This program is also available on the DPS website for qualified users.

**Flash Magic** - Is a program supplied by the manufacturer of the microprocessor chips that we use on our boards. The file format of the control software has the extension .hex, thus we call them HEX files. The Get Hex Files button downloads the HEX files to C:\DPS\Hex Files directory. You will need to navigate to this folder, from Flash Magic, to find the appropriate HEX file to Flash the Firmware onto the boards.

**Back** - Returns you to the previous page.

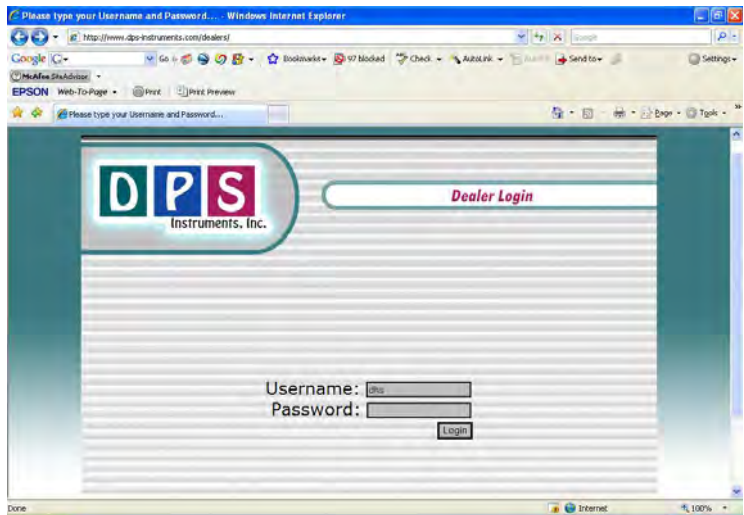
# 3. Installing Software & Firmware

## Reinstalling DPS Software

For instruments in the field that have already had their hard drive configured at the factory, there are a few simple steps to completely change the software on the system. On the instrument all of the GC Application and control files are stored in the C:/DPS folder. By deleting this folder and replacing it with the current DPS folder on our website, the GC software will be reinstalled.

**STEP 1:** Go to the DPS website, [www.DPS-Instruments.com](http://www.DPS-Instruments.com) and navigate to the Login Page.

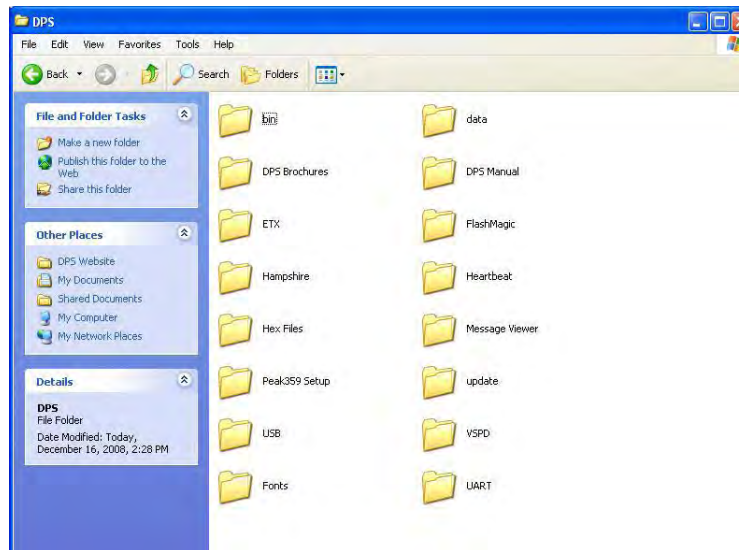
**STEP 2:** Enter your USER ID and PASSWORD



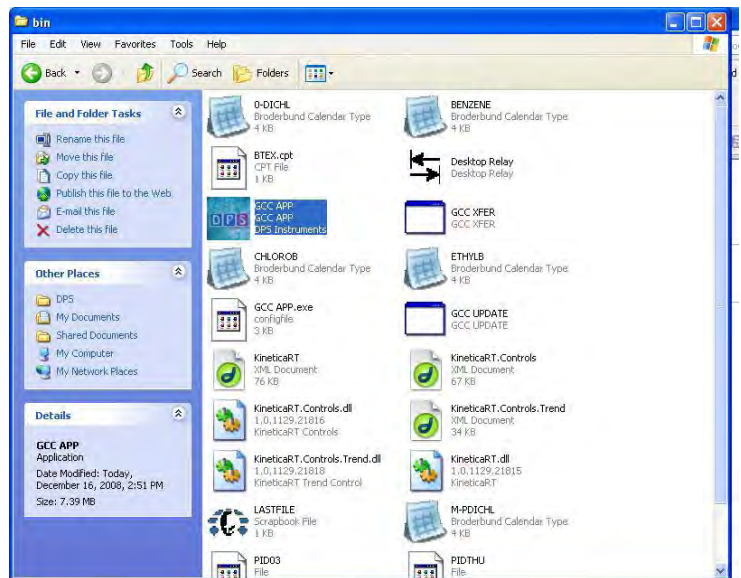
**STEP 3:** Open the DPS folder and copy the file DPS.zip to your computer, or memory stick. Use the "Save Target As" command.



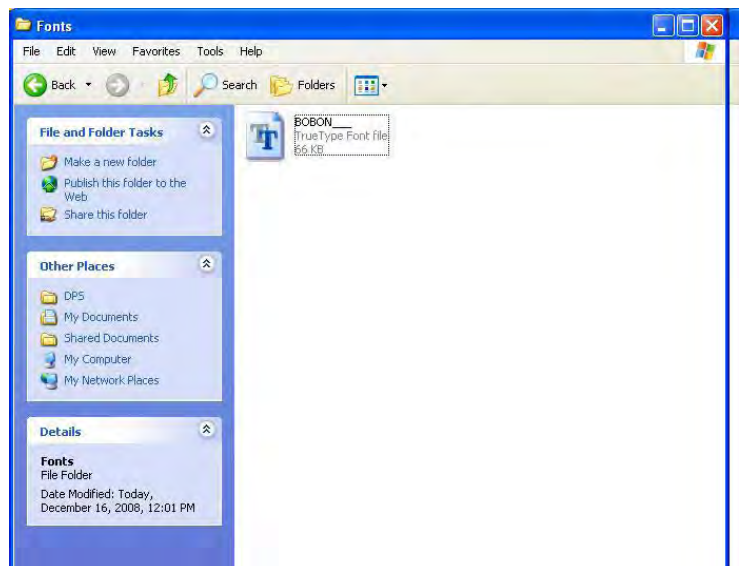
**STEP 4: Unzip the DPS folder and use it to replace the old C:\DPS on your Instrument. These are all of the Folders in the DPS folder.**



**STEP 5: Go to C:\DPS\Bin and make a shortcut of GCC APP to your desktop. You are now ready to run the GC Application software.**



**STEP 6: We use a special font called BOBO for the GC Application Software. Copy this font from C:\DPS\Fonts into the Windows Fonts folder.**



## Installing DPS Firmware

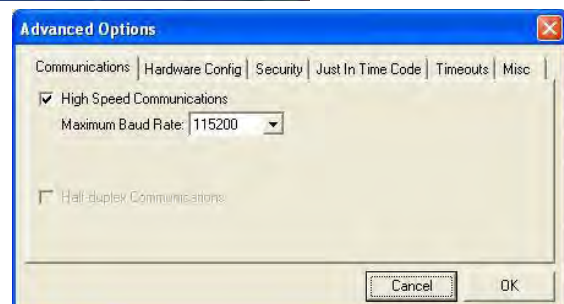
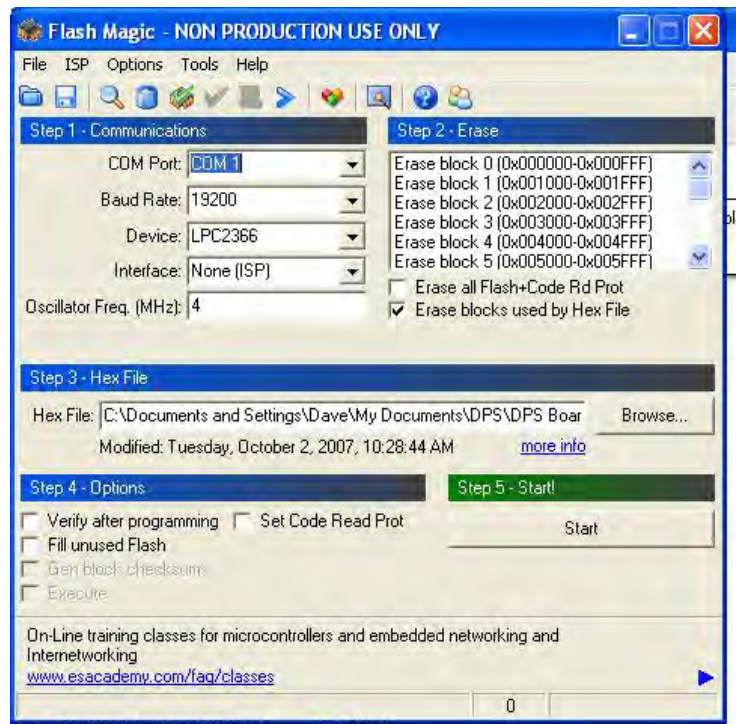
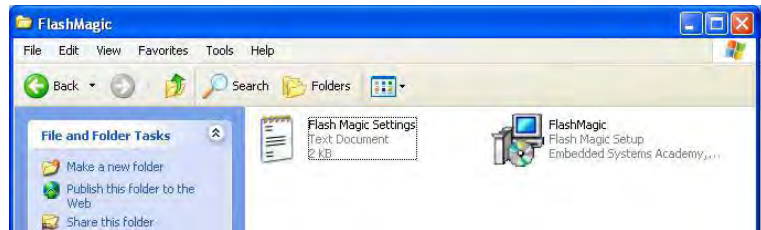
If the system asks for new firmware (software resident in the microprocessors on each board), then we use a program called Flash Magic to load the new firmware. Flash Magic can be found in C:\DPS\Flash Magic. Double click on the install program to load the program on your Laptop, or desktop computer. You can not install firmware from the computer on the Instrument, the Firmware must be “Flashed” from an External PC.

You will need either a 9 pin Serial cable, or a 9 pin Serial to USB cable to install the Firmware. Connect the serial end of the cable to the serial port on the board and the other end to your computer. Next to the Serial port on the board is a switch, which should be placed in the PROG/LOAD position, or Flash Magic will not connect.

**STEP 1: Open Flash Magic and set the values to those on the right. Make sure the COM setting matches the port on your PC.**

**STEP 2: Make sure that the Advanced Options settings for the Hardware are correct**

**STEP 3: Make sure that the Communications settings are correct.**

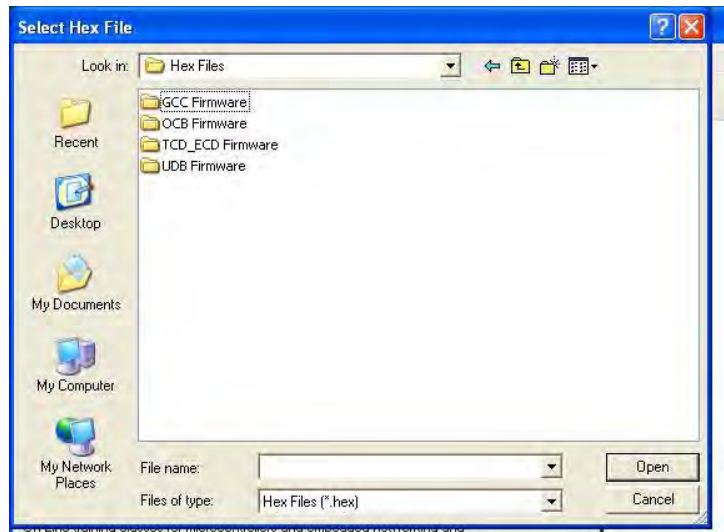


**STEP 4:** Use the Browse button to navigate to the C:\DPS\HEX Files folder.

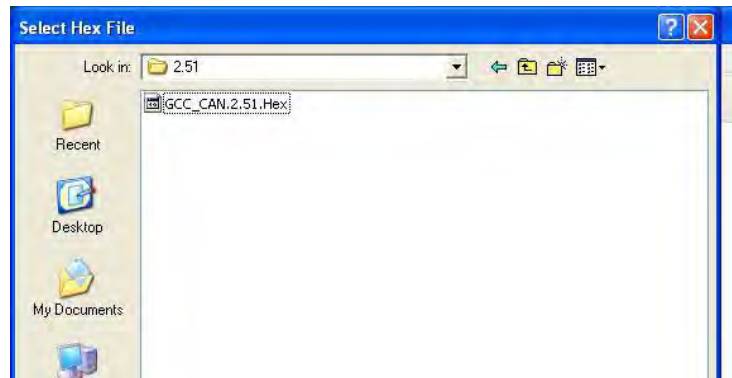
**GGC Firmware folder - Firmware for the GC Control Board.** This is the board with the 6 black Relays and has the ETX computer attached.

**OCB Firmware folder - Firmware for the Oven Control Board.** This board has the 8 pin fan connector

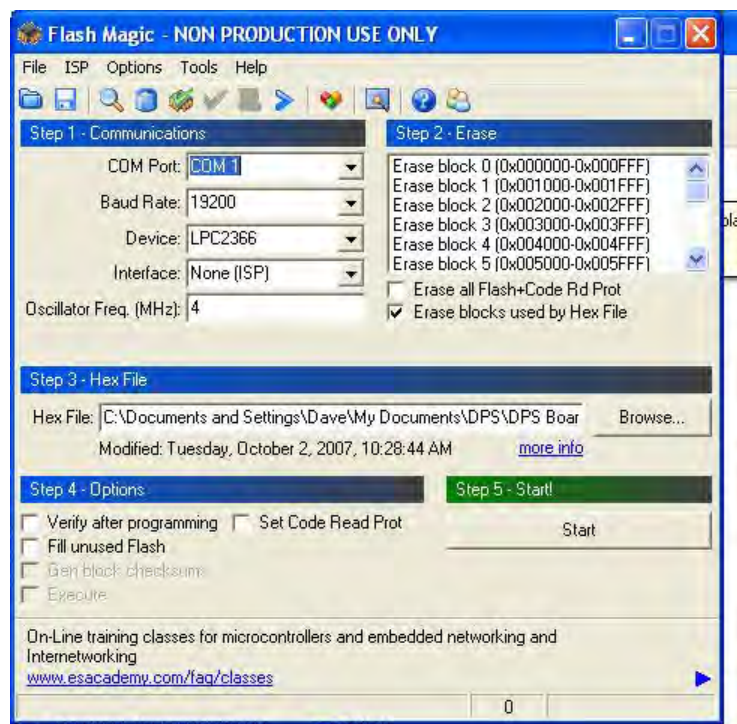
**UBD Firmware folder - Firmware for the Universal Detector Board.** This is the board with the serial connector on the edge.



**STEP 5:** Open the HEX file of the board you are going to Flash. The GCC hex file for the Control Board is shown.



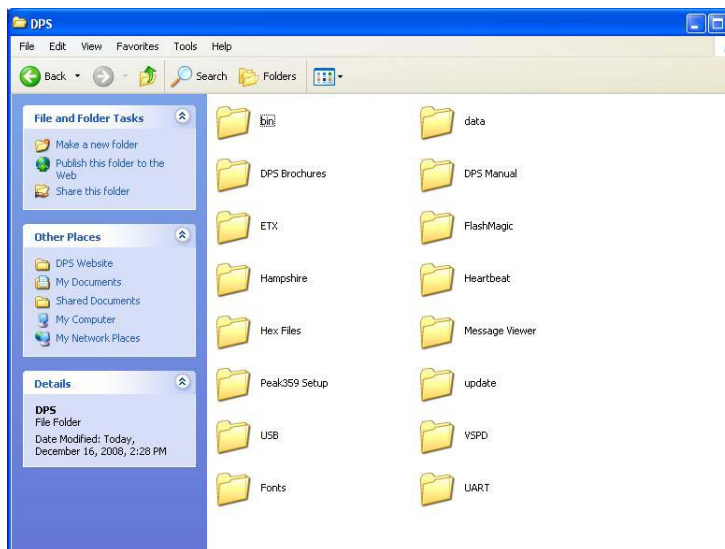
**STEP 6:** Press the Start button to “Flash” the board. The process will take less than a minute. If you get an “Autobaud Error” message, either the COM port is not correct, or the switch on the board is in the DEBUG position.



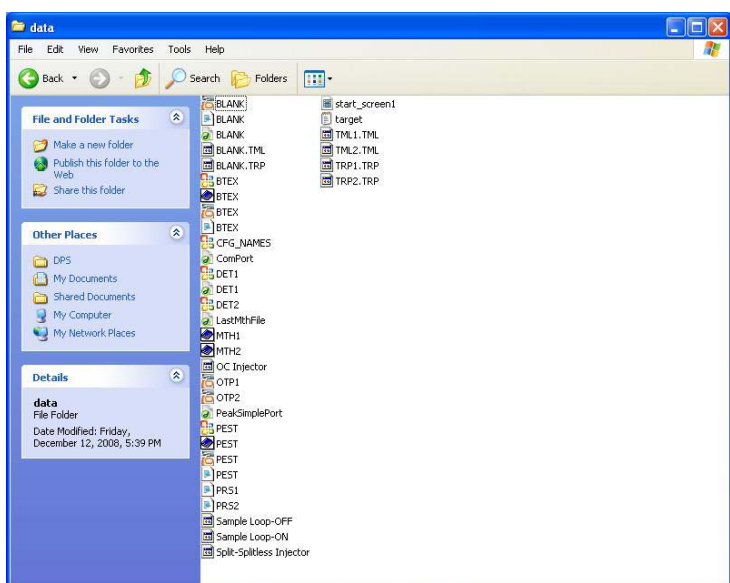
## Setting up an External Computer

In some cases you might want to collect data on an External computer instead of the computer supplied with the Instrument. This may be because you just want a larger viewing screen and a keyboard. In other cases you might want to run a Remote GC from the comfort of your desk. These setup procedures will allow you this flexibility. These steps need to be followed for each External Computer that you want to connect to an Instrument.

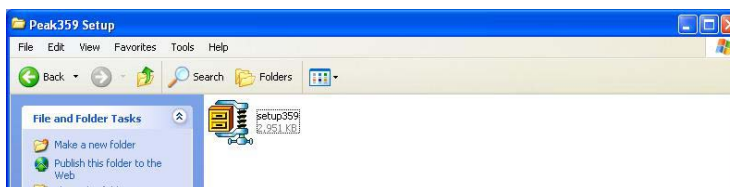
**STEP 1: Copy the DPS folder from the GC to your External Computer into the root directory C:\DPS. This folder contains all of the Methods in the GC as well as the drivers that you will need.**



**STEP 2: Delete the File "target.txt" from the C:\DPS\DATA folder. This file is only used in the Instrument to tell the GC Application that it has an Internal ETX computer.**



**STEP 3: Install PeakSimple on your laptop, or desktop computer by opening the zip file and clicking on the install icon. The Setup program is found in the C:\DPS\Peak359 Setup folder.**

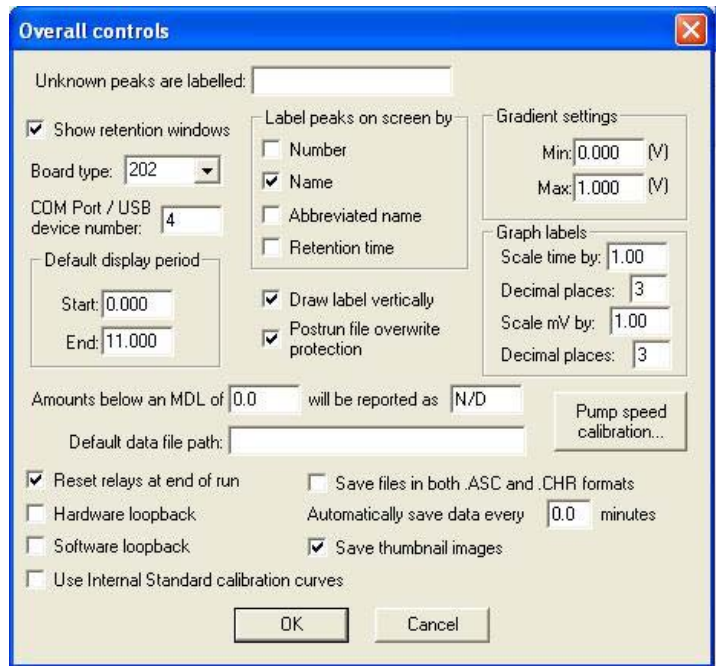


Next copy the contents of the Peak359 folder from the GC into the new Peak359 folder on the external GC. This will save time, because all of the Control and Data files from the GC will now be on the external computer.

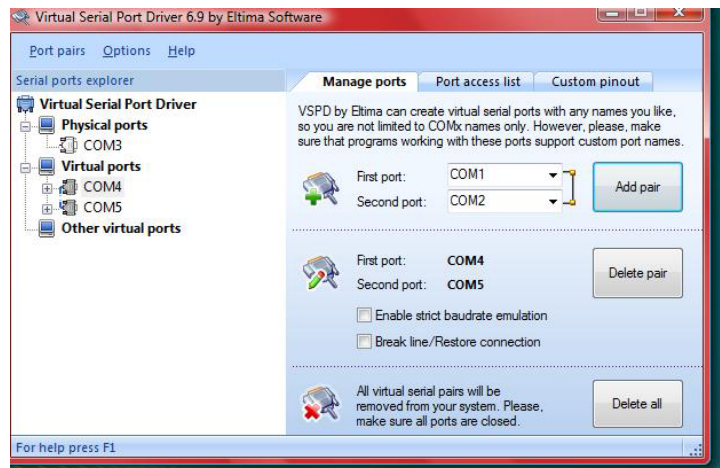


**STEP 4:** After starting PeakSimple, by double clicking on the Peak359 icon, make sure that in EDIT/OVERALL the board type is set to 202 and at least one channel is ACTIVE on the CHANNELS screen. Set the COM port to 4 to run the GC Application software and PeakSimple on the External PC.

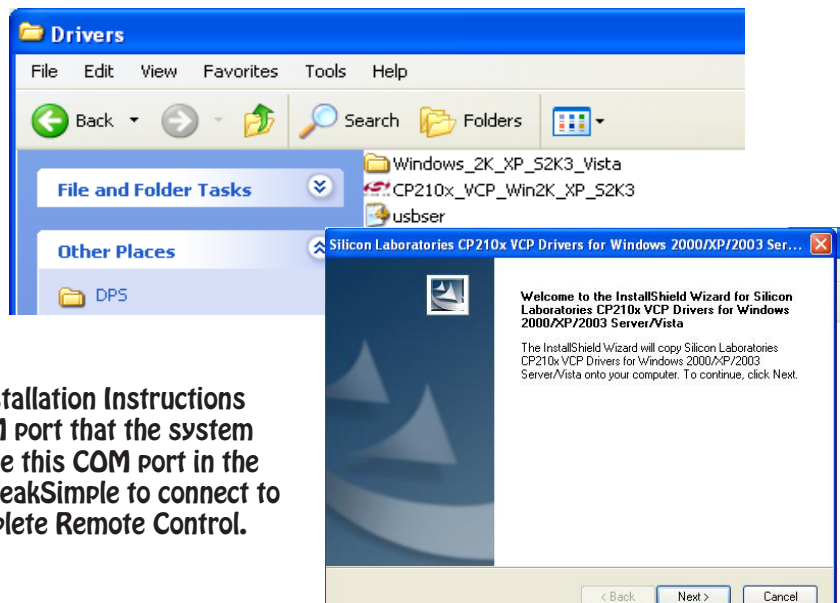
Set the COM port to 2 to only run PeakSimple on the external computer.



**STEP 5:** Go to the C:\DPS\USPD folder and install the Virtual Serial Port Device software. Set up the following Virtual pair of COM ports: COM4 to COM5. This will allow PeakSimple to run on the External computer along with the GC Application software for complete External control and Data Acquisition from the Instrument.



**STEP 6:** Install the Driver to use the "Dog-house" USB connector on the GC to connect directly to an USB on an External Computer. This will allow just PeakSimple to be run Remotely. The Install program can be found in the C:/DPS/DRIVERS folder



**STEP 7:** Follow the installation Instructions and make a note of the COM port that the system assigns. You will need to use this COM port in the EDIT/OVERALL screen in PeakSimple to connect to the GC over a LAN for complete Remote Control.

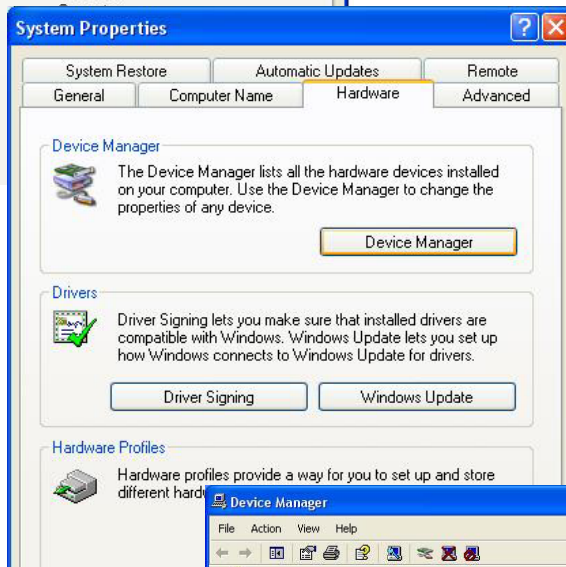
In some versions of Windows the Silicon Labs driver installs right away, in others the COM port is installed after the system re-boots. In other systems the COM port only shows up when the USB cable is plugged from the computer into the GC. Plug in the USB cable first, if you can not see the new COM port in the Device Manager, then it is time to reboot.



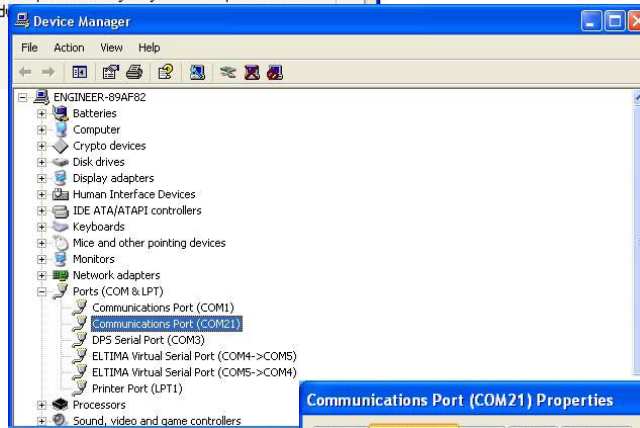
After the Silicon Labs program runs follow these steps to make the new port COM 2.

Open the System Properties page and select the Hardware tab.

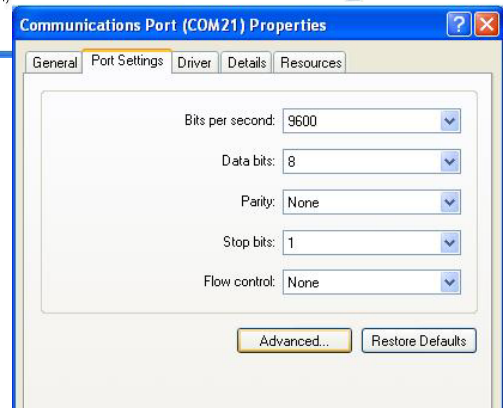
Select the Device Manager.



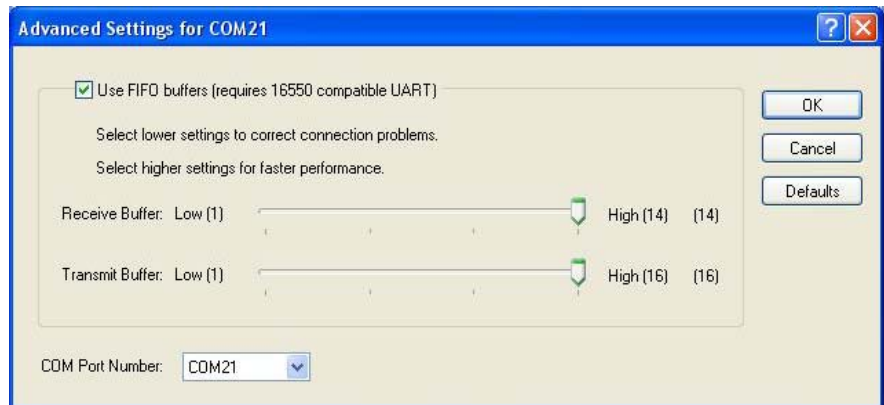
Select the COM Port that was assigned by Silicon Labs. In this example we are selecting COM21, which was assigned as the new COM Port. Double click on COM21 to open the Port.



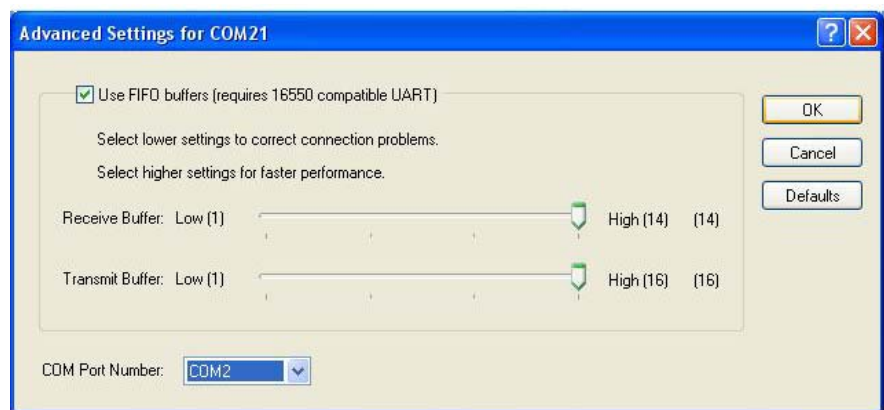
On the Port Settings page select the Advanced button.



Using the scroll selector, change COM21 to COM2.



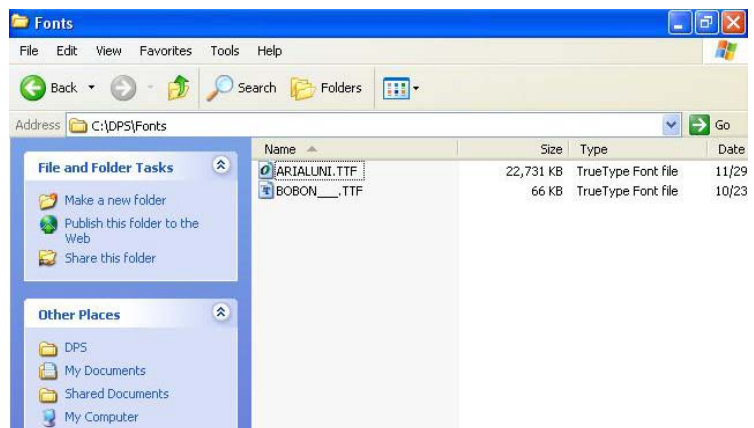
Click OK to save COM2 as the name of the new Port.



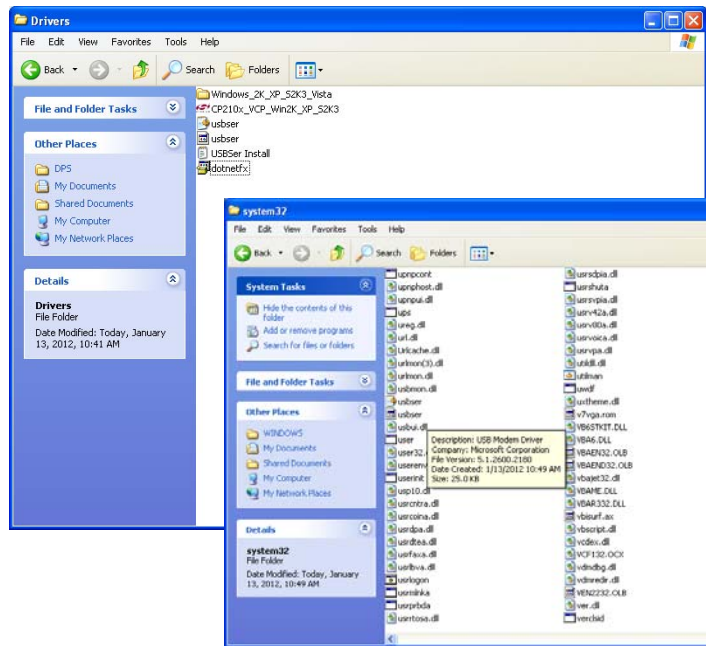
When you only want to run PeakSimple on the remote computer and leave the DPS Control Software running on the GC, then in the EDIT/OVERALL screen in PeakSimple set the port to COM2.

When running both PeakSimple and the DPS Control Software on the remote computer, in the EDIT/OVERALL screen in PeakSimple set the port to COM4.

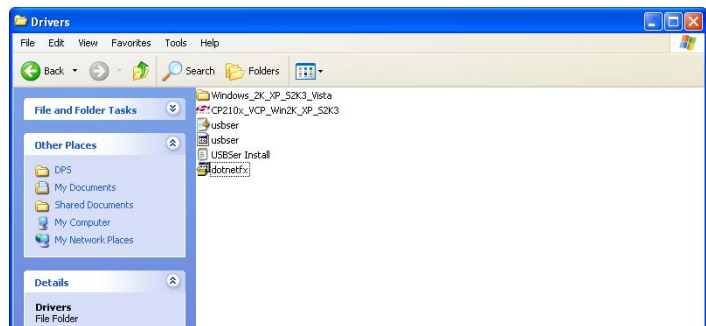
**STEP 8:** We use a special Font called BOBO for the DPS Control Software. Copy this font from the C:\DPS\FONTS folder into the C:\WINDOWS\FONTS folder of the external computer. For additional languages copy ARIALUNI into the C:\WINDOWS\FONTS folder too!



**STEP 9: Copy the 2 programs named usbser from the C:\DPS\DRIVERS folder into the Windows System 32 folder. This will allow PeakSimple to run on the external Computer.**



**STEP 10: Go to the C:\DPS\DRIVERS folder and install the program dotnetfx.exe. This will update the Windows library of tools to let the GC Control Software run on the External Computer. This is a 32 bit program and will not run on newer 64 bit computers. This will be OK, because the library of tools are already on newer computers.**



**STEP 11: This is the end of the Installation steps. Reboot the external computer to load all of the changes.**

## Running PeakSimple on an External Computer

1. Copy all of the data and files from the folder C:\PEAK359 on the GC to a memory stick, or other storage device. Paste the contents of this folder on the external PC into the same folder C:\PEAK359. Now all of the data, control files, temperature programs, events, and other files are on the external PC. This will also set the COM 2 in the EDIT/OVERALL screen.

2. Connect a USB cable to the square “Doghouse” connector on the GC and connect the other end to a USB port on the PC.

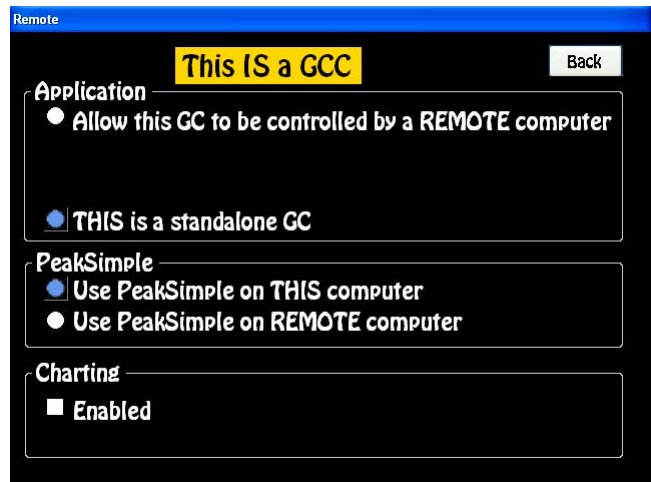
3. Start PeakSimple on the external PC. It will not connect yet, so don’t be alarmed. We need to first transfer the signal from the GC.

4. Go to the SYSTEMS/REMOTE page on the GC and press the button “Use PeakSimple on REMOTE Computer”. It will probably take a few seconds for the button to turn blue. The signal will now be transferred to the external computer and you will see PeakSimple signing in and calibrating on the external PC.

You will now be able to Start the GC from the external PC by hitting the SPACE BAR, or RUN button. PeakSimple will also begin an acquisition if the START button is pressed on the GC.

To transfer the signal back to the GC, simply press the “Use PeakSimple on THIS computer” button.

**NOTE:** If you shut down the GC when the external computer is connected all of these parameters will be saved. You should start up again with the external computer connected. If you forget and disconnect the USB cable, the GC will still think that an external computer is connected. To correct this, press the “Use PeakSimple on THIS computer” button.



## Running PeakSimple and the GC Software on an External Computer

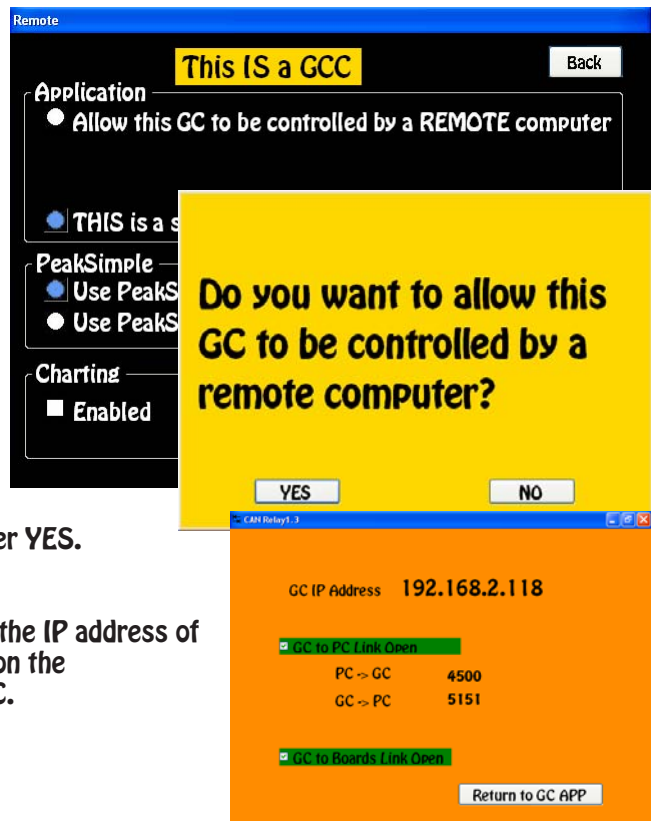
1. All of the files were previously copied to the external PC in Step 2 of the installation.

2. Connect an ethernet cable from the GC to a local LAN. The external PC also needs to connect to the same LAN, this can either be through another ethernet cable, or through a wireless connection.

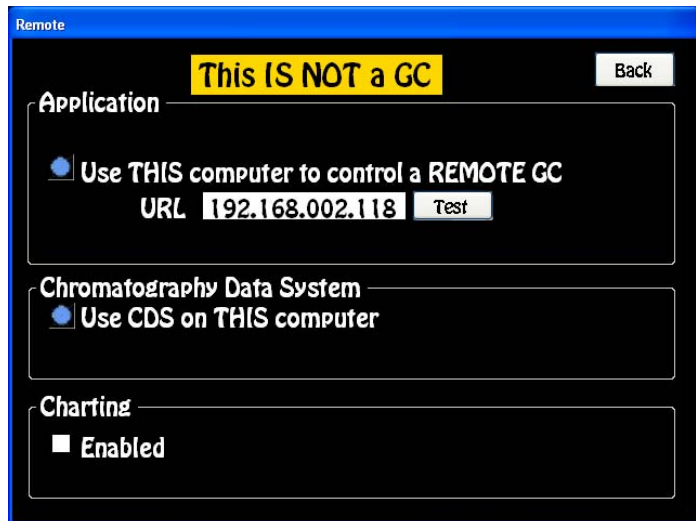
3. Go to the SYSTEMS/REMOTE page on the GC and press the button “Allow this GC to be controlled by a REMOTE Computer”.

4. It will ask you if you are sure, answer YES.

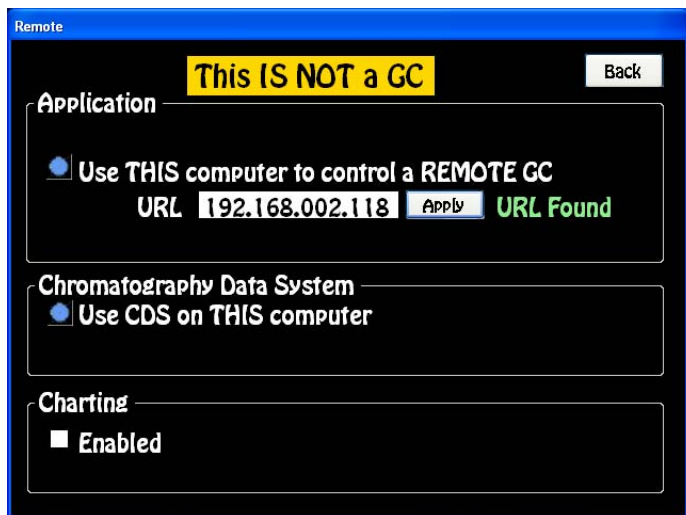
5. The Desktop Relay will then display the IP address of the GC. You will need to enter this address on the SYSTEMS/REMOTE page of the external PC.



6. Enter the IP address on the SYSTEMS/REMOTE page of the external PC by clicking on the URL field and entering the IP address using the number pad.



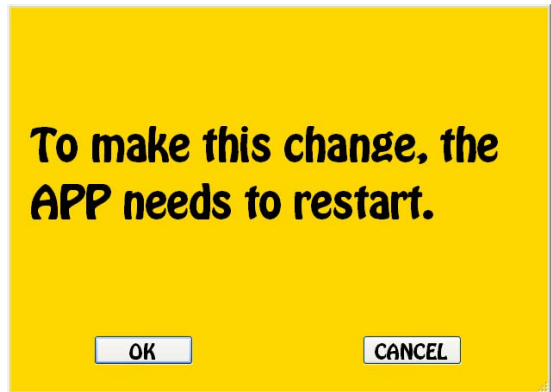
7. Press the TEST button. If the external PC sees the GC computer on the LAN, then a message URL Found will appear.



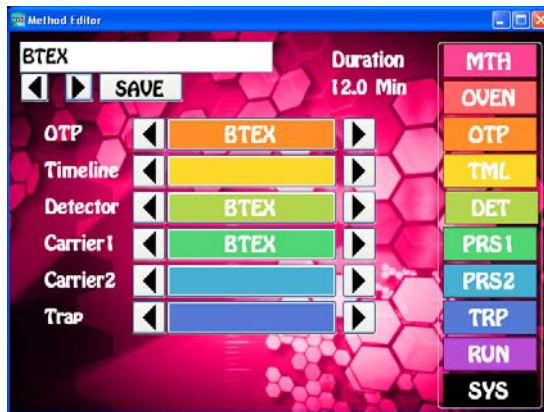
8. Press the Apply button to connect to the GC. A message will appear asking if you want to use the new URL, answer Yes!



9. A message will then appear asking to restart the GC Application Software, answer Yes! The GC Control Software will now reboot and the external PC will have complete control of the GC.

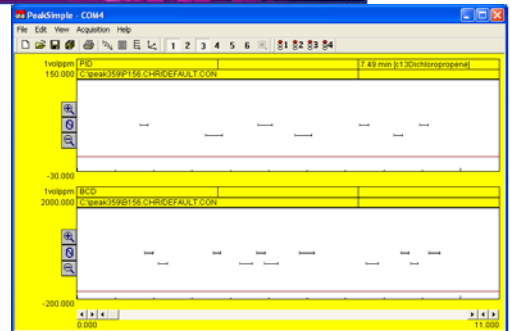


Both the GC Control Software and the PeakSimple data acquisition software will display on the external computer.



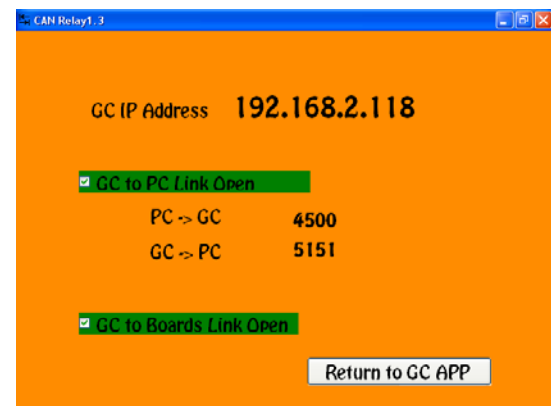
In the EDIT/OVERALL screen you will need to select COM4.

Once again, if your are only renning PeakSimple on the External Computer select COM2, however if your are running both PeakSimple and the DPS Control Software on the External Computer, then you need to select COM4.



10. On the GC you will see the following Desktop Relay screen. Both boxes should be checked. The PC to GC fields show the packets of data being transferred back and forth

11. To disconnect from the external PC press the "Return to GC APP" button and the GC will reboot and control of both the GC Control Software and PeakSimple will return to the GC.



## 4. GC Hardware Manual

### BCD - Bromine Chlorine Detector



**BCD Overview** - The BCD detector is highly selective to Bromine and Chlorine compounds. The BCD sensitivity to these compounds approaches the sensitivity of the radioactive ECD detector, while being completely nonradioactive. At very high temperatures, the aluminum in the ceramic collector acts as a catalyst to cleave Bromide and Chloride ions from the molecule. The resultant positively charged Molecule is attracted to the negatively charged Collector Electrode. Catalytic activity starts around 700° C and increases exponentially, as the temperature of the Reaction Cell, and the efficiency of the catalytic process increases. We limit the Reactor Cell to 1000° C for safety purposes.

**Detector ON/OFF** - This button turns ON, or OFF the Reaction Cell and Collector Electrode Voltage. The Detector Temperature and EPC are always ON to stabilize the Detector.

**Entering Values** - By pressing on any Setpoint button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Actual** - Is the value that the instrument returns for any specific parameter. All parameters shown for a detector are required for the operation of that detector. If the Actual values are not very close to the Setpoint values, then the detector is probably not functioning within specifications. If there are dashes, then either the Detector is not turned ON, or the board is not functioning properly.

**Save** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. If there are multiple detectors, all of the Detector Parameters will be Saved to the same file.

**Apply** - When you press the APPLY button the Program file will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method.

**Detector Temperature** - Is the Temperature of the Detector Block mounted next to the Column Oven. The Detector Temperature should be set at 25° C above the Final Temperature of the OTP



ensure that compounds coming off the column do not hit a cold zone. All detectors have individual insulated enclosures and the Detector Temperature maintains the constant temperature of the enclosure.

**EPC** - Although, the BCD Detector will function properly, we use helium make-up gas at 25-50ml/min to help sharpen the peaks. For all of our Detector EPC's, the rule of thumb, is to set the EPC value to 100 kPa. We install calibrated restrictors regulating the desired flow from 100 kPa of pressure. Do not use Hydrogen as a carrier, or Make-up gas for the BCD detector. Hydrogen is known to poison the sensitivity of the BCD detector.

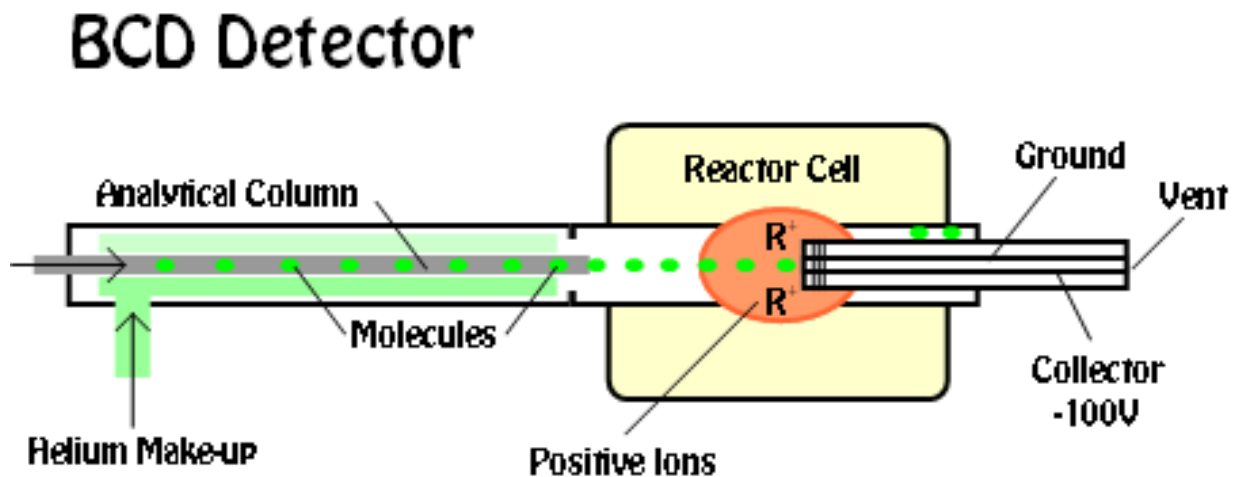
**Cell Temperature** - Is the temperature of the Reaction Cell. The normal working range of the Cell is 700° C to 950° C, although we allow the cell to heat to 1000° C. It is common to experience an order of magnitude of increased sensitivity when increasing temperature 100° C within this range.

**Gain** - A properly performing and heated Reaction Cell will demonstrate an Offset in the Detector Signal. We can correct for some of the Offset using the Zero function, but we are limited to 2.5V of correction. The signal from the Collector Electrode is amplified by the Gain setting, where Gain 1=10, Gain 2=100, Gain 3=1000, and Gain 4=10000. Under most circumstances, this is plenty of range. Since the BCD is a highly sensitive detector, you can also reduce the sensitivity of the BCD detector by lowering the Cell Temperature.

**Collector** - Is the voltage applied to the Collector Electrode. The voltage displayed is actually negative, but our Number Pad just allows for the entry positive values, so the system takes care of the sign for you. We recommend using -100V for the Collector Electrode.

**Zero** - The BCD Detector has an inherent offset as you increase the gain to achieve more sensitivity. We have included a hardware ZERO function that compensates for this offset. There is a range limit of 2.5V. When you press the Zero button you will notice the Signal fluctuating back and forth for a few seconds until a value is achieved within a few millivolts of Zero.

**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black.



# BCD Detector

## Detector Body

The BCD detector uses helium as a make-up gas. Although a make-up gas is not necessary for the catalytic reaction to occur, it does help sharpen the peaks. The helium is set to 25-50mls/min. In the picture to the right the helium comes into the detector body through the green tube. The same color is easily traced back to the EPC supplying the make-up gas.



## Reactor Cell

The ceramic tube of the reactor cell slides into the detector body and secures with a 1/4" graphite ferrule. Be sure to just snug the fitting down, too much pressure will crack the ceramic tube. The collector assembly is secured to the reactor cell in the same way. Be sure not to over tighten.

The BCD is a highly sensitive detector for Chloride and Bromide containing compounds. The Detector must be clean for optimum performance. The detector body and reactor cell are cleaned by baking, overnight is best. Before baking, we recommend that you shoot several injections of a high standard mix through the column into the detector. High levels of chloride or bromide ions will coat the active sites before baking. Once the BCD is cleaned and the sensitivity is controlled by the Reactor Cell Temperature. Normal operating temperatures are between 800 and 950C. An increase in temperature of 25C in this range can bring on a great increase in sensitivity.

Detector Body    Reactor Cell    Collector



The collector has to be in the center of the hottest part of the Reactor Cell. Although, we manufacture each cell to perform the same, there can be slight differences in the position of the hottest part of the cell. Sometimes, turning the cell around (Detector Block side to Collector Side), will make a big difference in sensitivity. The collector will be in the middle in either direction.



## Side View

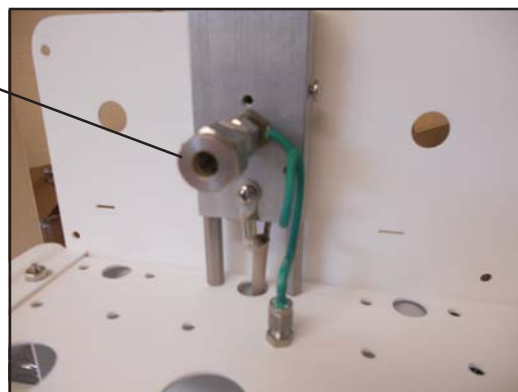
Once the detector cover is installed the Collector Base protrudes outside of the heated zone. The Collector Base will still be very hot as it conducts heat from the Reactor Cell. The Collector and ground wires attach to the Collector Base.



## Column Positioning

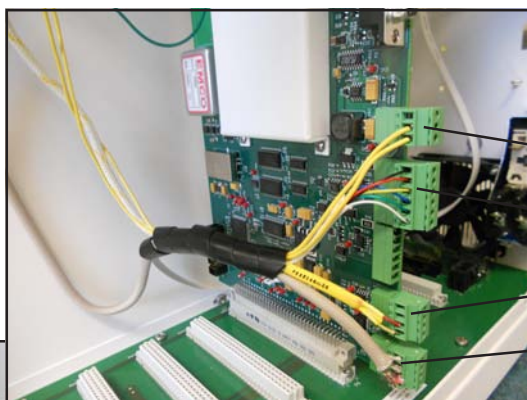
When using a capillary column with the BCD, feed the column through the Detector Heater Block fitting to a distance just flush with the 1/4" nut. With the Reactor Cell installed the column will be about 1 cm inside the Reactor Cell. An insert is supplied to keep the column in the center. This will allow the compounds exiting the column to be completely catalyzed by the Reactor Cell before being attracted to the platinum wires of the collector.

A packed column can also be inserted all of the way through the detector block to the front of the BCD Cell. The detector insert should be removed.

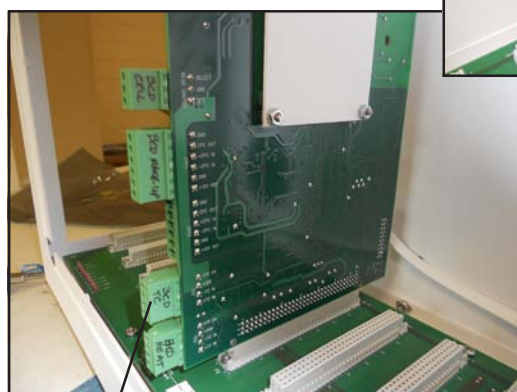


## Detector Board

The components of the BCD plug directly into the detector board. The same universal detector board is used for multiple detectors. We use the same board in both the Series 600 and the Companion GC's. Each of the green connectors are clearly marked. Please refer to the pictures to the right for the electrical connections.



- Detector Ground
- Reactor Cell
- Helium EPC1
- Cell Temperature
- Detector Heat



Clearly marked  
Connectors

BNC connector for Collector

Amplifier Shield  
(Both sides)

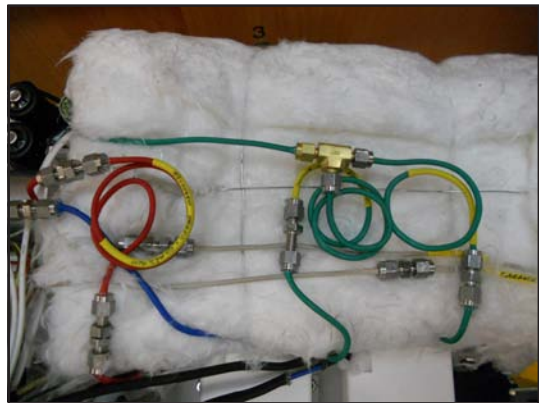
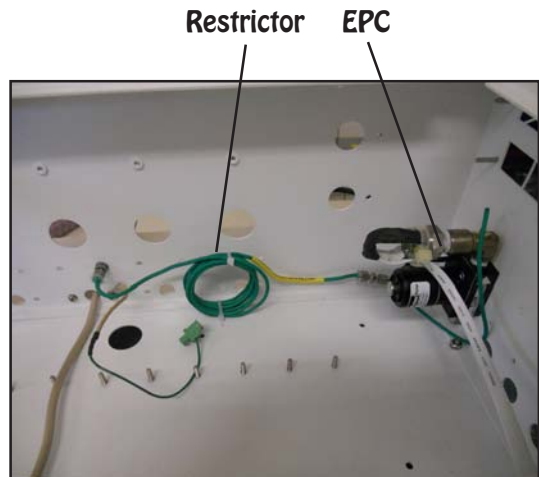


## Plumbing Connections

The make-up gas pressure is controlled by the EPC at the far right in the picture and then connects through a restrictor to cut back the flow to the 50mls/min. The restrictor is plumbed into the bulkhead fitting under the detector body. Helium is always green. The restrictor values are clearly written on the yellow portion of each restrictor. The BCD DOES NOT need Make-Up gas to operate properly. Since the Reactor Cell has a large volume compared to the flow from capillary columns, peaks normally exhibit tailing. The Make-up Gas is only there to help reduce peak tailing. The carrier gas and the make-up gas flow through the center of the ceramic tube with the collector making sure that all ions come in contact with the collector.

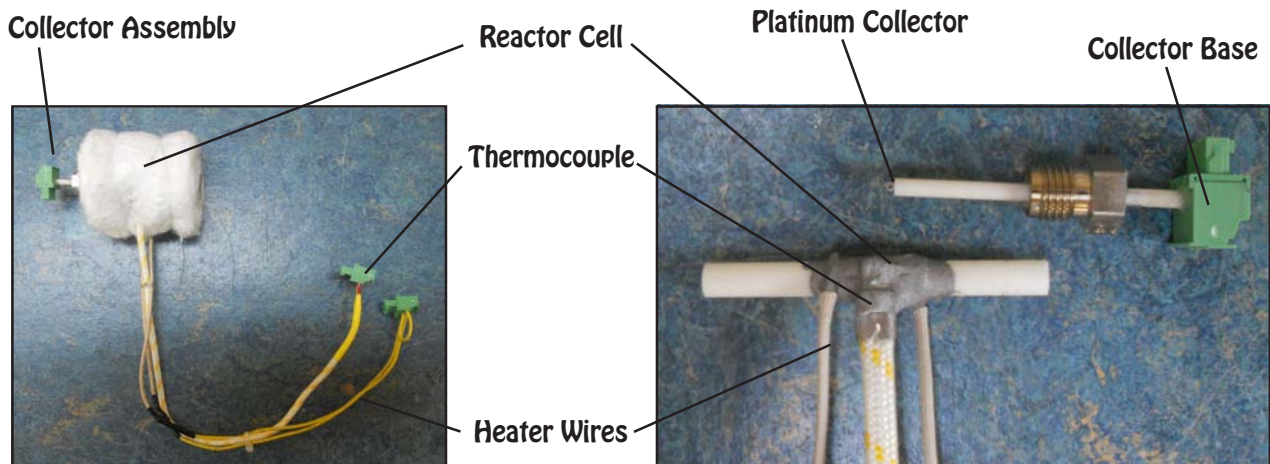
Hydrogen should not be used as the carrier gas for the BCD as it will interfere with the catalytic reaction inside the BCD Cell. You can expect a 100X drop in sensitivity if hydrogen is introduced into the BCD Cell as a carrier gas, or as a make-up gas.

In the Companion GC's the restrictors are under the oven. Hydrogen is Red, Air is Blue, and Helium is always Green.



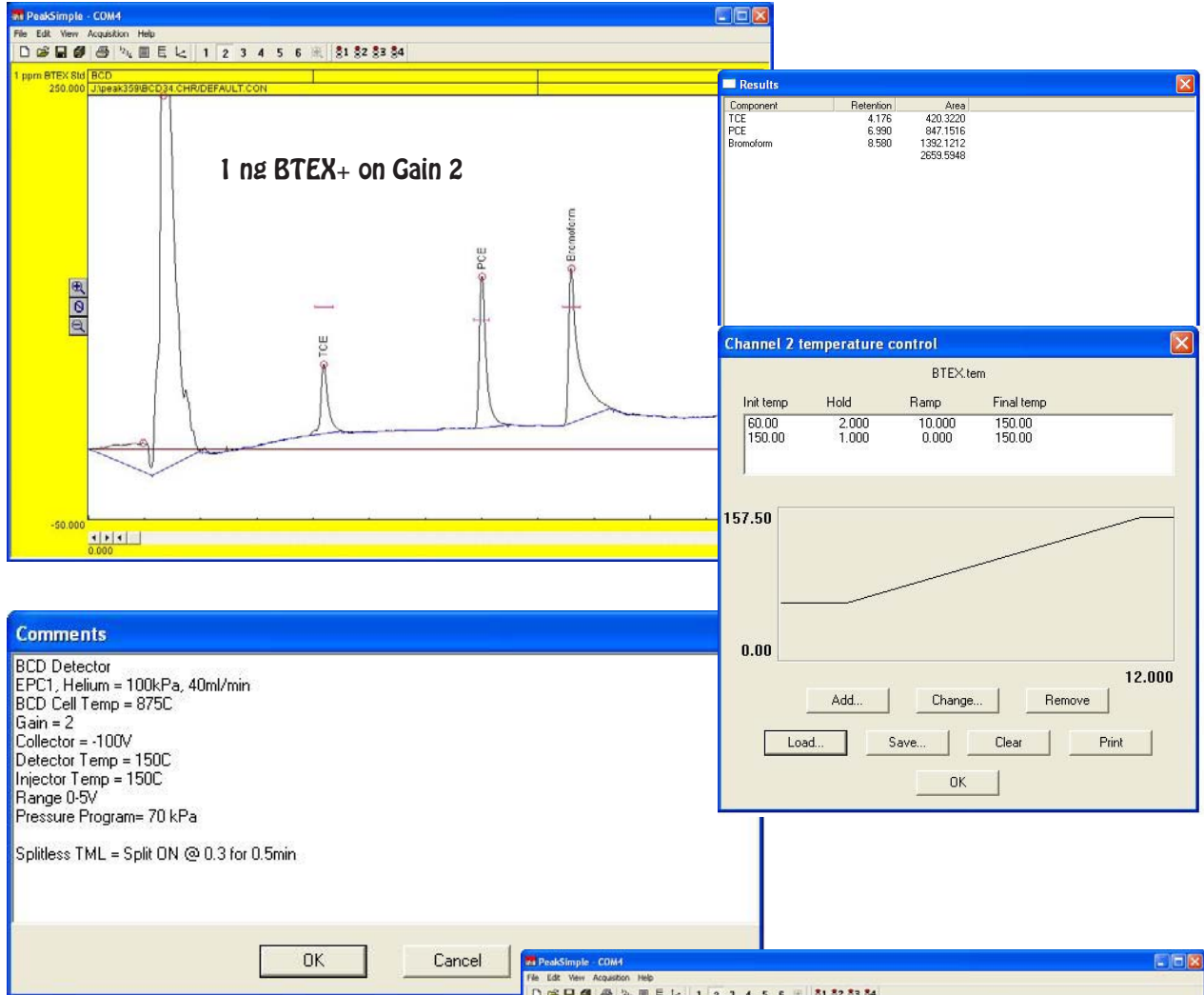
## Collector Connections

The Collector is a platinum wire that extends through the ceramic tube from the collector base to the center of the reactor cell. The ground wire also extends through the ceramic tube. The collector Cable attaches to the collector base on one end and the Detector Board on the other with a BNC connector. The ceramic tube is secured into the fitting so that the depth the collector always goes to the center of the reactor cell. A high temperature thermocouple is used to measure the reactor cell temperature.

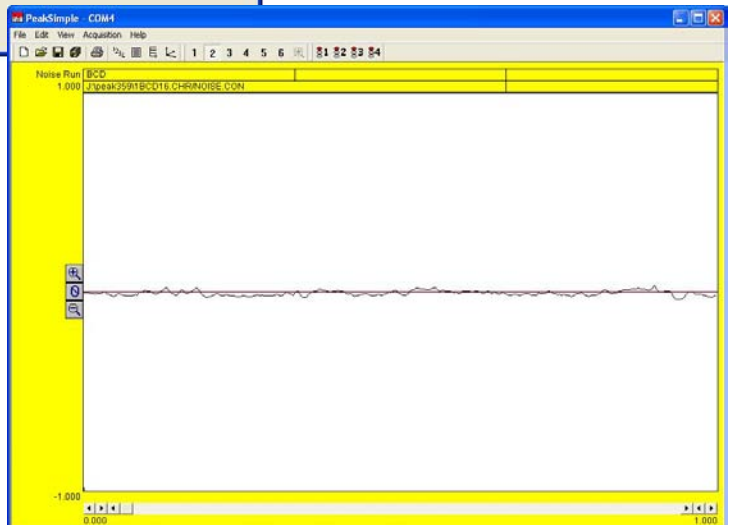


## Expected Performance

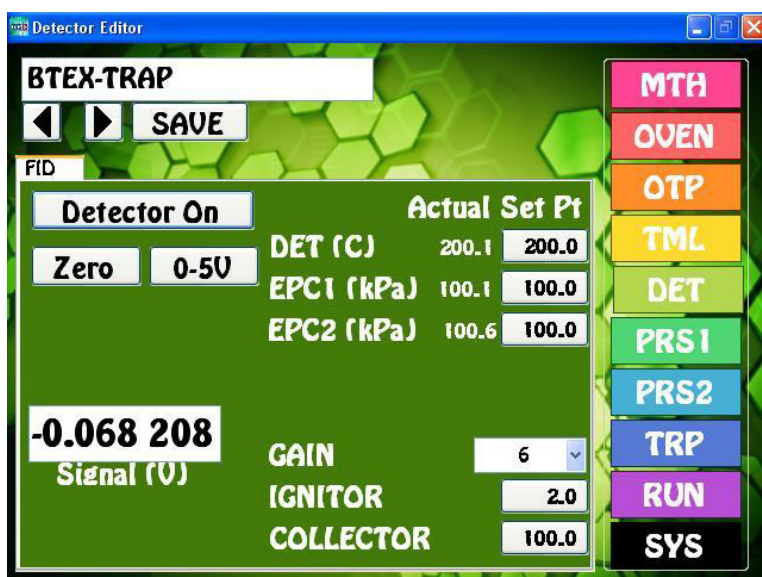
We measure detector performance by analyzing a 1 ng BTEX+ standard. This standard has TCE, PCE and Bromoform added to test chlorinated and brominated compounds. For our acceptance criteria the response of PCE should be greater than 500 area counts. Depending on the BCD Cell temperature this may be achieved on either Gain 1, or 2.



The background BCD detector noise should be less than 1 mV from peak to peak on Gain 1. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 0.2 mV peak to peak.



## FID - Flame Ionization Detector



**FID Overview** - The FID detector is selective to all compounds that burn and is commonly used for the analysis of hydrocarbons. A precisely controlled Hydrogen and Air mixture is ignited and burns as a small flame at the end of a jet within the Detector Body. All compounds exiting the column pass through the flame and those that are combustible ionize. The resultant positively charged ions are attracted to the negatively charged Collector Electrode.

**Detector ON/OFF** - This button turns ON, or OFF the Ignitor and Collector Electrode Voltage. The Detector Temperature and EPC's are always ON to stabilize the Detector.

**Entering Values** - By pressing on any Setpoint button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Actual** - Is the value that the instrument returns for any specific parameter. All parameters shown for a detector are required for the operation of that detector. If the Actual values are not very close to the Setpoint values, then the detector is probably not functioning within specifications. If there are dashes, then either the Detector is not turned ON, or the board is not functioning properly.

**Save** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. If there are multiple detectors, all of the Detector Parameters will be Saved to the same file.

**Apply** - When you press the APPLY button the Program file will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method.

**Detector Temperature** - Is the Temperature of the Detector Block mounted next to the Column Oven. The Detector Temperature should be set at 25° C above the Final Temperature of the OTP to ensure that compounds coming off the column do not hit a cold zone. All detectors have individual insulated enclosures and the Detector Temperature maintains the constant temperature of the enclosure.

**EPC** - The FID Detector uses two EPC's to control the make-up gases required for operation. For all of our Detector EPC's, the rule of thumb, is to set the EPC value to 100 kPa. We install calibrated restrictors regulating the desired flow from 100 kPa of pressure. For Hydrogen the flow is 25ml/min, and for Air the flow is 250mls/min.

**Ignitor** - When the DET ON button is pushed the Ignitor voltage raises to 10V for 3 sec. Igniting the Flame. The Setpoint value is the resting voltage of the Ignitor, which in most cases can be set to 2V. The flame can be automatically re-ignited in the event it is blown out by a pressure change, due to a valve rotation, for example. A FID Re-ignite circuit is included in FID GC System with a valve. The flame can be re-ignited at any time using the Timeline.

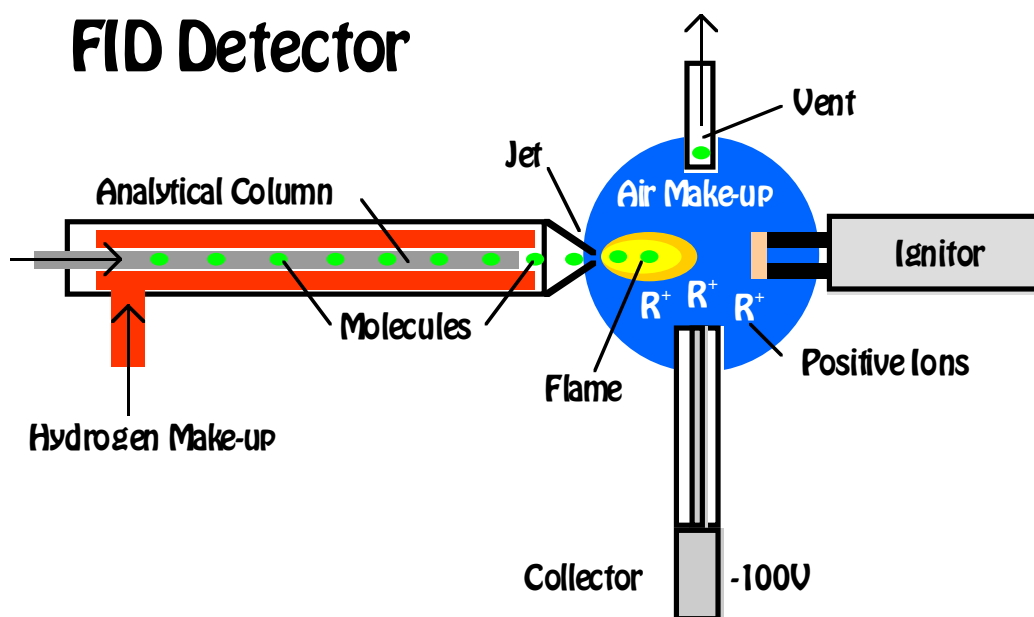
**Gain** - The FID Detector can perform properly at any Gain setting from 1 to 6. The signal from the Collector Electrode is amplified by the Gain setting, where Gain 1=10, Gain 2=100, Gain 3=1000, Gain 4=10,000, Gain 5= 100,000, and Gain 6=200,000.

**Collector** - Is the voltage applied to the Collector Electrode. The voltage displayed is actually negative, but our Number Pad just allows for the entry positive values, so the system takes care of the sign for you. We recommend using -100V for the Collector Electrode.

**Zero** - We have included a hardware ZERO function that compensates for a Signal offset. There is a range limit of 2.5V. When you press the Zero button you will notice the Signal fluctuating back and forth for a few seconds until a value is achieved within a few millivolts of Zero.

**Detector Output** - For analog outputs to other data systems we have included 3 voltage range settings. 0-1V, 0-5V, and 0-10V. By pressing on the button these values will cycle. Select the one that you want and SAVE the setting.

**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black.



# FID Detector

## Detector Body

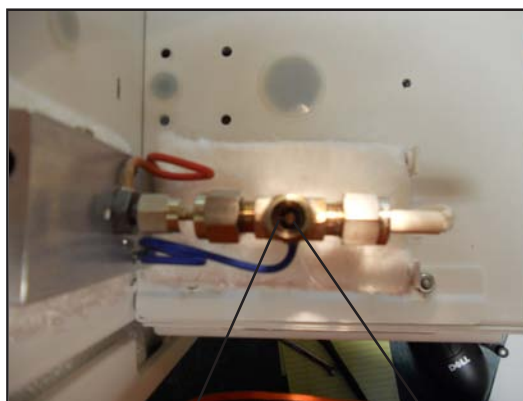
The FID detector requires both hydrogen and air to ignite the flame inside the detector. The proper mixture is 10:1 air to hydrogen. Usually the air is set to 250mls/min and the hydrogen to 25mls/min. In the picture to the right the air comes into the detector through the blue tube and the hydrogen through the red tube. The same colors are easily traced back to the EPC supplying the gas. The Igniter is on the right and the collector is connected to the bottom of the cross fitting. The FID detector vent is at the top.

Detector Block    Detector Body    Igniter



## Top View

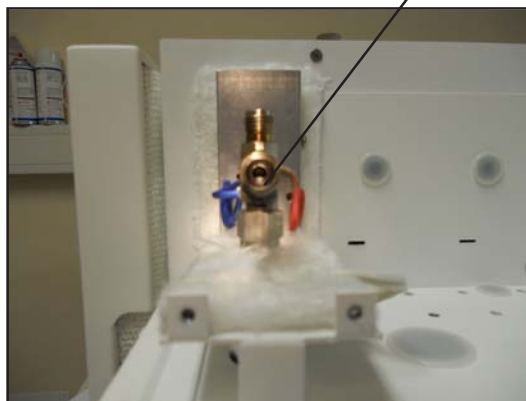
With the vent fitting removed, the collector can easily be seen from the top of the detector. The white ceramic shields the collector electrode in the middle from any possible shorts to the detector body. The Igniter is positioned just to the right side of the FID cell. It gets plenty hot enough to light the flame from this position. You can also see the FID jet coming into the cell from the left. The tip of the jet should be just to the left of the white ceramic insulator of the collector. The column is positioned slightly back of the tip of the jet. If you are using a capillary column, push it through until you can see it and then pull it back inside the jet a little bit. The hydrogen gas enters the jet from the back, sweeping the effluent from the column directly into the flame. The air comes into the FID Detector from the side of the collector and just bathes the cell with oxygen. With a packed column place the column inside the inlet as far as possible.



Detector Jet    Collector

## Side View

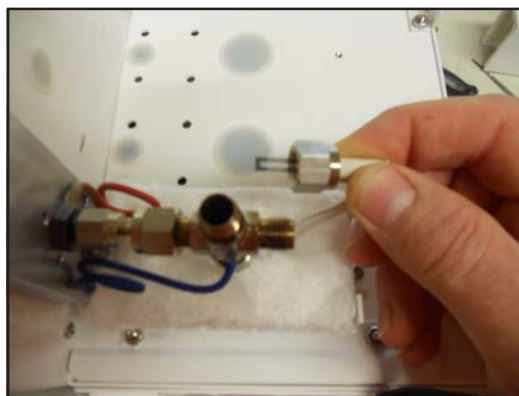
The collector should be positioned at the bottom of the FID cell just below the jet entrance. If the collector is too high the flame will heat the collector and the signal will be noisy. If the collector is too low, then the signal will be diminished. It is always best to position the collector at the base of the FID jet, just like the picture to the right.





## Igniter

The FID igniter will last forever if taken good care of. It is very brittle and always a little off center. Please do not try and straighten it. This is the main cause of failure. We pass a voltage through the igniter for 3 seconds. This is enough time for it to glow bright orange and light the FID flame. Usually you can hear a “pop” noise when the flame ignites. The igniter should be positioned just to the left side of the FID cell. A graphite ferrule secures it in place, so it just needs to be snug, do not overtighten.



## Condensation

The products of combustion are CO<sub>2</sub> and H<sub>2</sub>O, so when the flame is lit there is condensation produced. To verify that the FID is ON, place a shiny object, such as a wrench, over the vent hole for a few seconds and then check that it has picked up condensation. If the detector did not light, press the Detector ON button on the Detector page once again and check for condensation. If you do not see any condensation, then first check the to see if the air and hydrogen are at their setpoints.



## Detector Board

The components of the FID plug directly into the detector board. The same universal detector board is used for multiple detectors. We use the same board in both the Series 600 and the Companion GC's. Each of the green connectors are clearly marked. Please refer to the pictures to the right for the electrical connections.



Detector Ground

Igniter

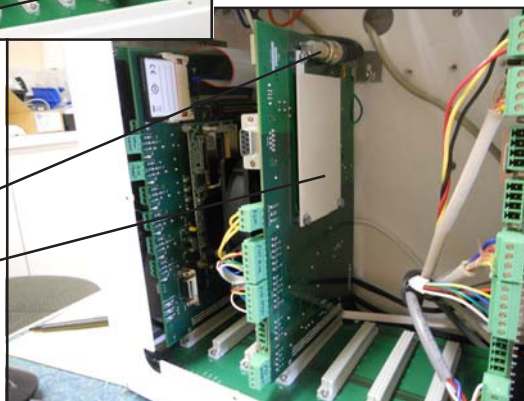
Air EPC1

Hydrogen EPC2

Detector Heat

BNC connector for Collector

Amplifier Shield  
(Both sides)

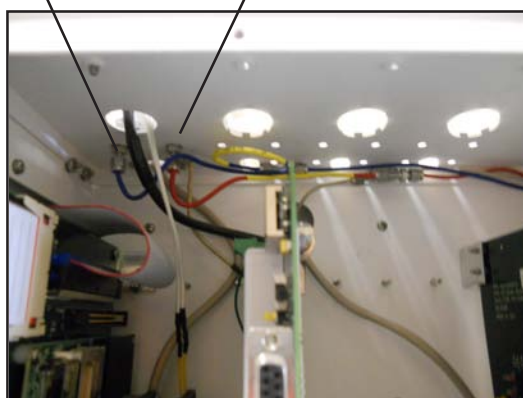


## Plumbing Connections

The make-up air pressure is controlled by the EPC and then connects through a restrictor to cut back the flow to the 250mls/min. The restrictor is plumbed into the bulkhead fitting under the detector body. Air is always blue. The restrictor values are clearly written on the yellow portion of each restrictor. In the same way hydrogen comes from the EPC through a restrictor to the bulkhead on the right. Hydrogen is always red. The total hydrogen flow to the detector should be 25mls/min. In some cases we use hydrogen as the carrier gas, the total of both the carrier gas and the make-up gas to the FID should still be 25mls/min. We can adjust the total flow, by changing the restrictor, or adjusting the carrier pressure.

In the Companion GC's the restrictors are under the oven. In the picture to the right the hydrogen carrier comes from the EPC to the brass "T" where it splits. Equal pressures go to the injector and through the red Restrictor. In this case the hydrogen carrier EPC pressure is set in PRS1 and displayed on the Oven page, and the hydrogen EPC2 value on the detector Page is set to zero.

Air (Blue)      Hydrogen (Red)



Pressure Program



Oven Page



Detector Page

## Collector Connections

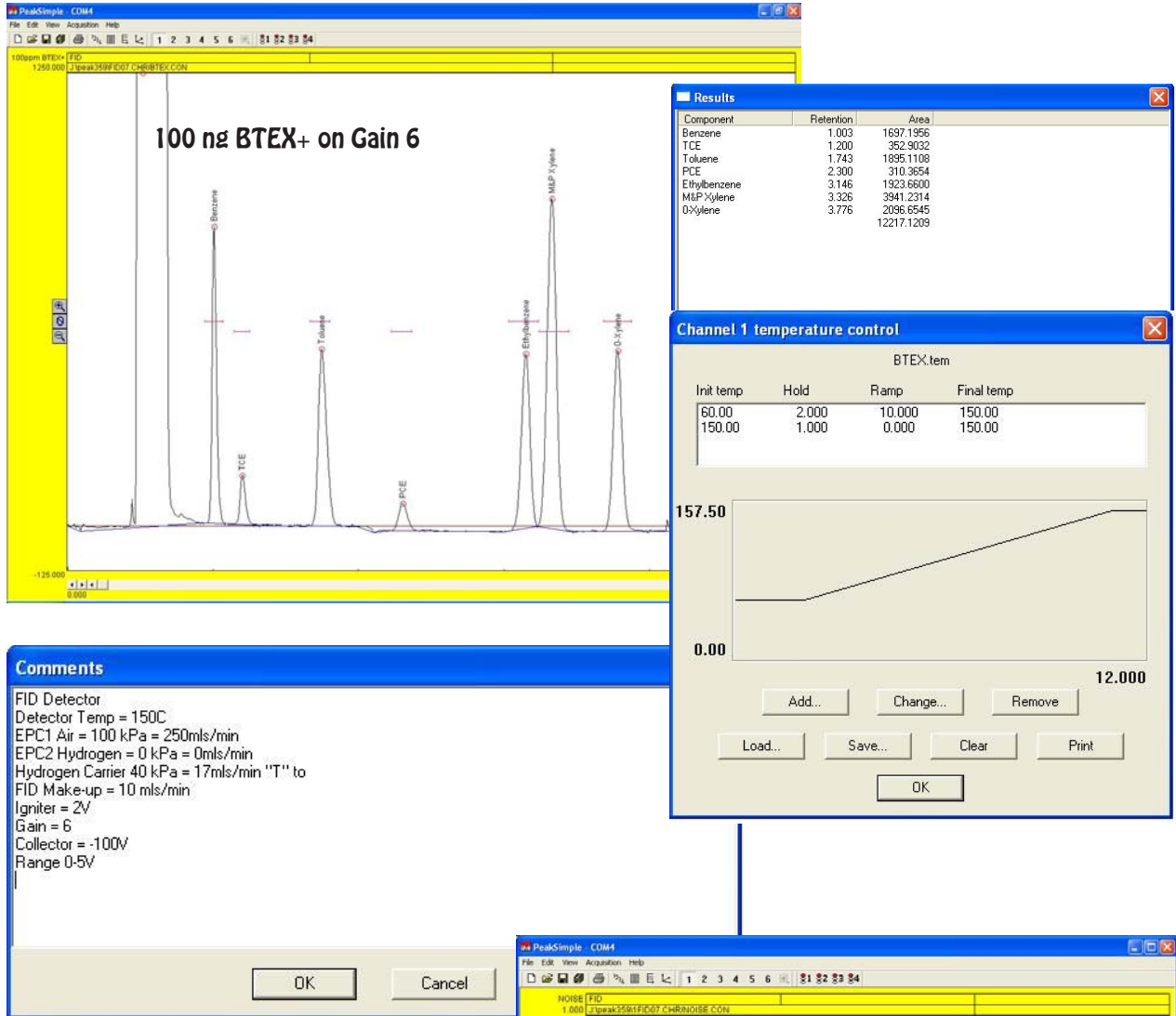
The collector has a solid metal core surrounded by a ceramic insulator. A soft graphite ferrule holds the ceramic in the detector body.

Take care not to over tighten the ferrule and crack the ceramic insulator. A spring inside the shielded collector cable slips over the solid end of the collector making a secure electrical connection.

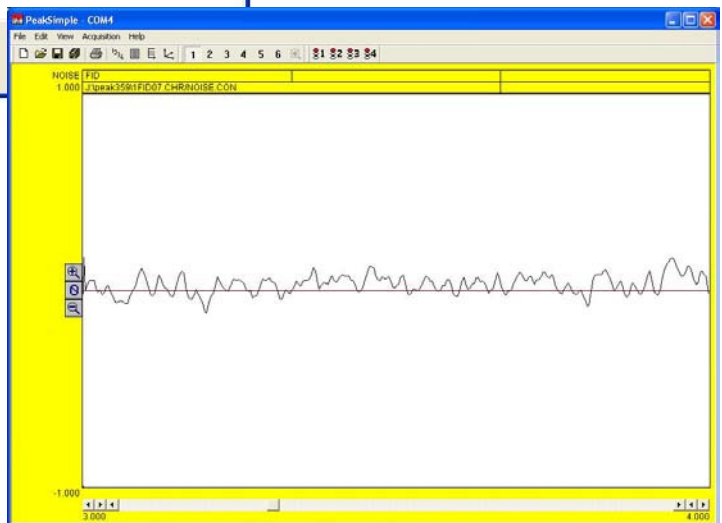


# Expected Performance

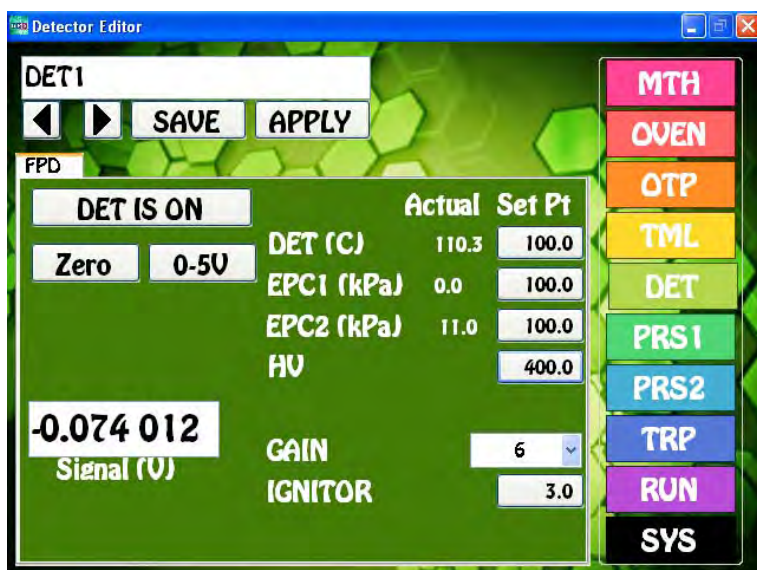
We measure detector performance by analyzing a 100 ng BTEX standard. We also add chlorinated compounds and use the same standard solution for various detectors. For our acceptance criteria, the Toluene response should be greater than 1500 area counts on Gain 6.



The background FID detector noise should be less than 200 uV from peak to peak on Gain 6. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 100 uV peak to peak.



## FPD - Flame Photometric Detector



**FPD Overview** - The FPD detector is can be configured for 2 modes of operation, one is highly selective for Sulfur compounds and the other mode highly selective for Phosphorus compounds. A precisely controlled Hydrogen and Air mixture is ignited and burns as a small flame at the end of a jet within the Detector Body. All compounds exiting the column pass through the flame and those that are combustible ionize. As the excited Sulfur and Phosphorus containing compounds return to their ground state they emit photons. Specific wavelength filters within the detector body let these photons pass through to a Photo Multiplier Tube (PMT) where they are detected and amplified.

**Detector ON/OFF** - This button turns ON, or OFF the Ignitor and High Voltage to the PMT. The Detector Temperature and EPC's are always ON to stabilize the Detector.

**Entering Values** - By pressing on any Setpoint button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Actual** - Is the value that the instrument returns for any specific parameter. All parameters shown for a detector are required for the operation of that detector. If the Actual values are not very close to the Setpoint values, then the detector is probably not functioning within specifications. If there are dashes, then either the Detector is not turned ON, or the board is not functioning properly.

**Save** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. If there are multiple detectors, all of the Detector Parameters will be Saved to the same file.

**Apply** - When you press the APPLY button the Program file will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method.

**Detector Temperature** - Is the Temperature of the Detector Block mounted next to the Column Oven. The Detector Temperature should be set at 25° C above the Final Temperature of the OTP to ensure that compounds coming off the column do not hit a cold zone. All detectors have individual

insulated enclosures and the Detector Temperature maintains the constant temperature of the enclosure.

**EPC** - The FPD Detector uses two EPC's to control the make-up gases required for operation. For all of our Detector EPC's, the rule of thumb, is to set the EPC value to 100 kPa. We install calibrated restrictors regulating the desired flow from 100 kPa of pressure. For Hydrogen the flow is 25ml/min, and for Air the flow is 100mls/min.

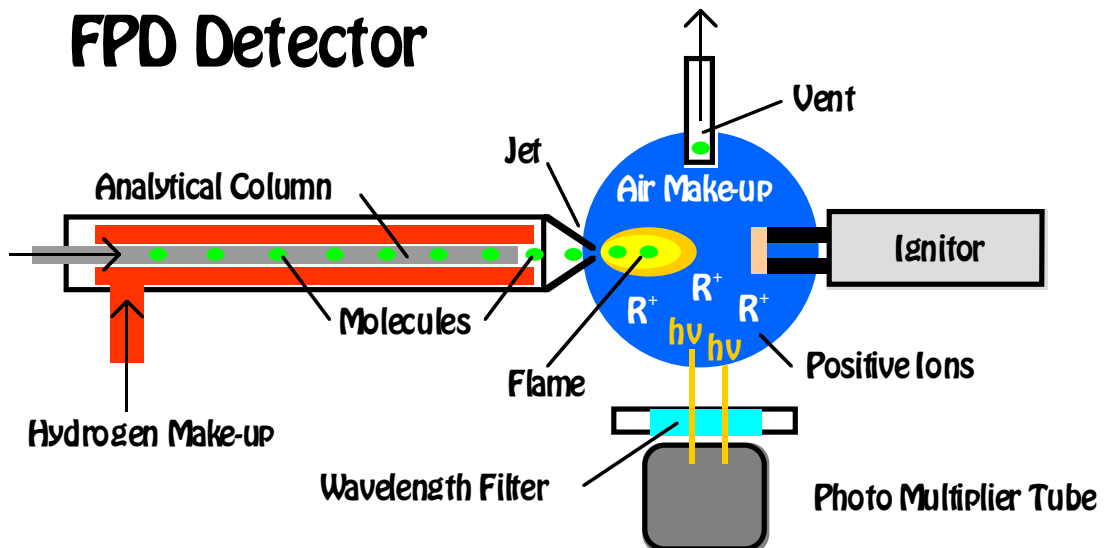
**Ignitor** - When the DET ON button is pushed the Ignitor voltage raises to 10V for 3 sec. Igniting the Flame. The Setpoint value is the resting voltage of the Ignitor, which in most cases can be set to 2V. The flame can be automatically re-ignited in the event it is blown out by a pressure change, due to a valve rotation, for example. A FPD Re-Ignite circuit is included in FID GC System with a valve. The flame can be re-ignited at any time using the Timeline.

**Gain** - The FPD Detector can perform properly at any Gain setting from 1 to 6. The signal from the Collector Electrode is amplified by the Gain setting, where Gain 1=10, Gain 2=100, Gain 3=1000, Gain 4=10,000, Gain 5= 100,000, and Gain 6=200,000.

**Zero** - We have included a hardware ZERO function that compensates for a Signal offset. There is a range limit of 2.5V. When you press the Zero button you will notice the Signal fluctuating back and forth for a few seconds until a value is achieved within a few millivolts of Zero.

**Detector Output** - For analog outputs to other data systems we have included 3 voltage range settings. 0-1V, 0-5V, and 0-10V. By pressing on the button these values will cycle. Select the one that you want and SAVE the setting.

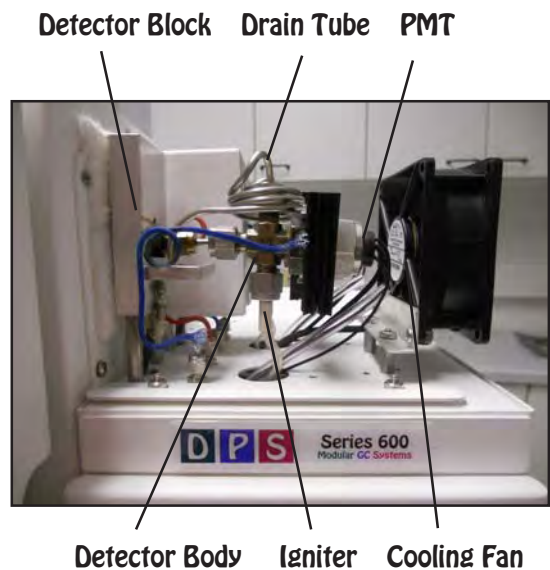
**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black.



# FPD Detector

## Detector Body

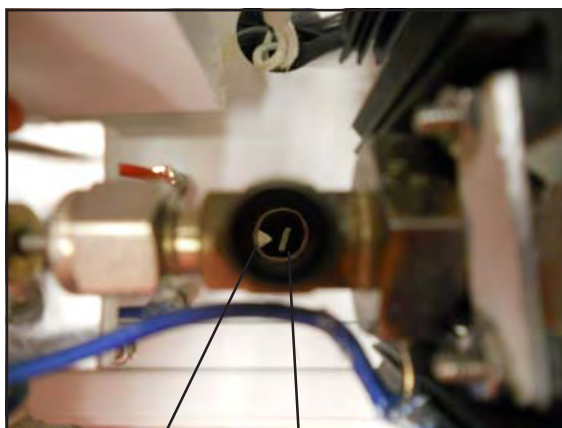
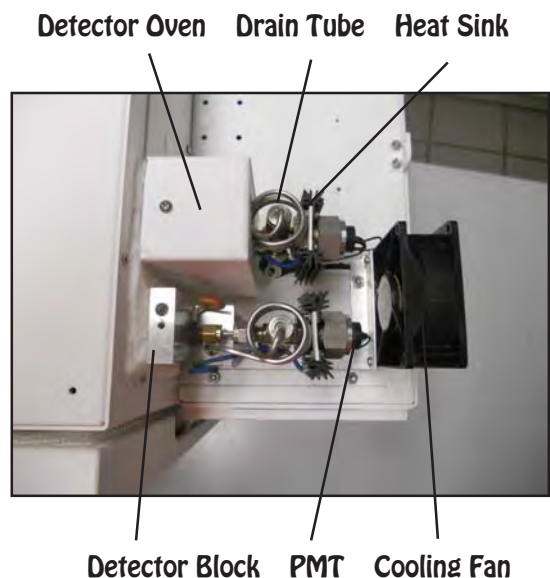
The FPD detector requires both hydrogen and air to ignite the flame inside the detector. The proper mixture is 4:1 air to hydrogen. Usually the air is set to 100mls/min and the hydrogen to 25mls/min. In the picture to the right the air comes into the detector through the blue tube and the hydrogen through the red tube. The same colors are easily traced back to the EPC supplying the gas. The Igniter is on the bottom of the cross fitting and the Photomultiplier is on the right. The FPD detector vent tube is at the top. The FPD PMT detects photons, so the vent tube is coiled to keep the detector body light tight. A cooling fan keeps the PMT at a low temperature even if the Detector Block is hot enough to keep heavy boiling compounds from sticking on the column.



## Top View

In the picture to the right there are two FPD detectors mounted on a GC. We use a small detector oven around detector block, because the PMT is sensitive to temperature and we want to keep it as cool as possible. We have also added a heat sink to help cool the portion of the detector body that houses the PMT.

With the vent fitting removed, the Igniter can easily be seen from the top of the detector. The Igniter is positioned just below the FPD cell. It gets plenty hot enough to light the flame from this

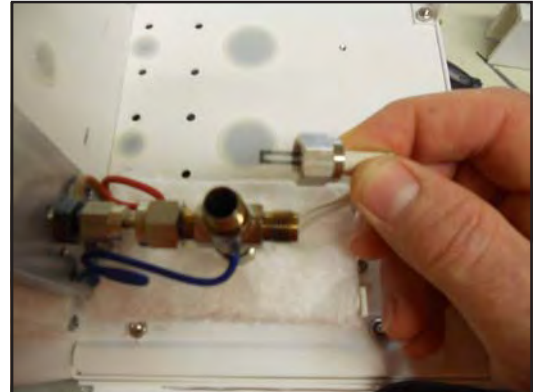


FPD Jet Igniter Blade

position. The FPD jet comes into the cell from the left just like in a FID. The tip of the jet should be just to the left of the cell middle. The column is positioned slightly back of the tip of the jet. If you are using a capillary column, push it through until you can see it and then pull it back inside the jet a little bit. The hydrogen gas enters the jet from the back, sweeping the effluent from the column directly into the flame. The air comes into the FID Detector from the side of the collector and just bathes the cell with oxygen. With a packed column place the column inside the inlet as far as possible.

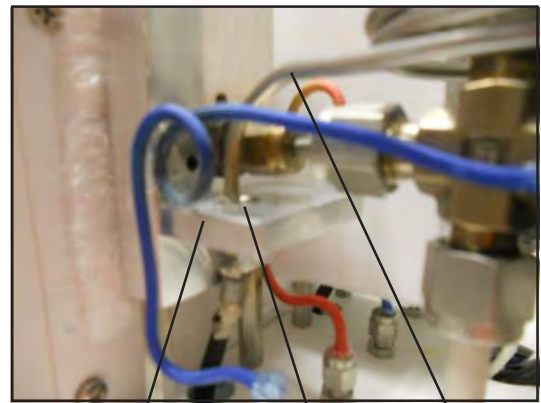
## Igniter

The FPD igniter will last forever if taken good care of. It is very brittle and always a little off center. Please do not try and straighten it. This is the main cause of failure. A graphite ferrule secures it in place, so it just needs to be snug, do not overtighten. We pass a voltage through the igniter for 3 seconds. This is enough time for it to glow bright orange and light the FPD flame. Because the gas mixture is rich, you will hear a LOUD noise when the flame ignites. If the detector did not light, press the Detector ON button on the Detector page. If the detector is on you will see condensation come out the Vent Tube.



## Vent Tube

The products of combustion are CO<sub>2</sub> and H<sub>2</sub>O, so when the flame is lit there is condensation produced. The FPD produces so much condensation that water drips out of the Vent Tube. To get rid of the excess water we have the Vent Tube drip into a special Vent Well connected to the detector block. Always run the detector temperature over 125C so the water immediately vaporizes as soon as it drips out the vent tube. You may hear a periodic sizzling sound as the water drips and then vaporizes.



Detector Body Vent Well Vent Tube

## Detector Board

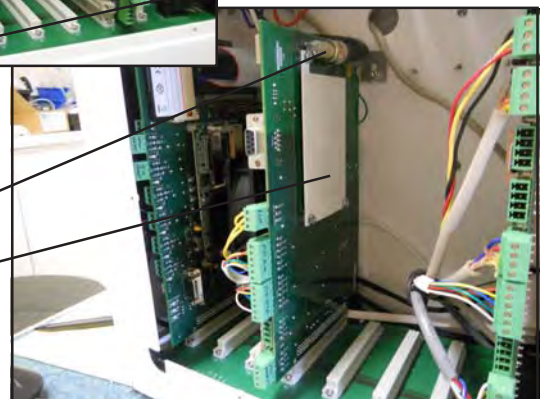
The components of the FPD plug directly into the detector board. The same universal detector board is used for multiple detectors. We use the same board in both the Series 600 and the Companion GC's. Each of the green connectors are clearly marked. Please refer to the pictures to the right for the electrical connections.



- Detector Ground
- Igniter
- Air EPC1
- Hydrogen EPC2
- Detector Heat

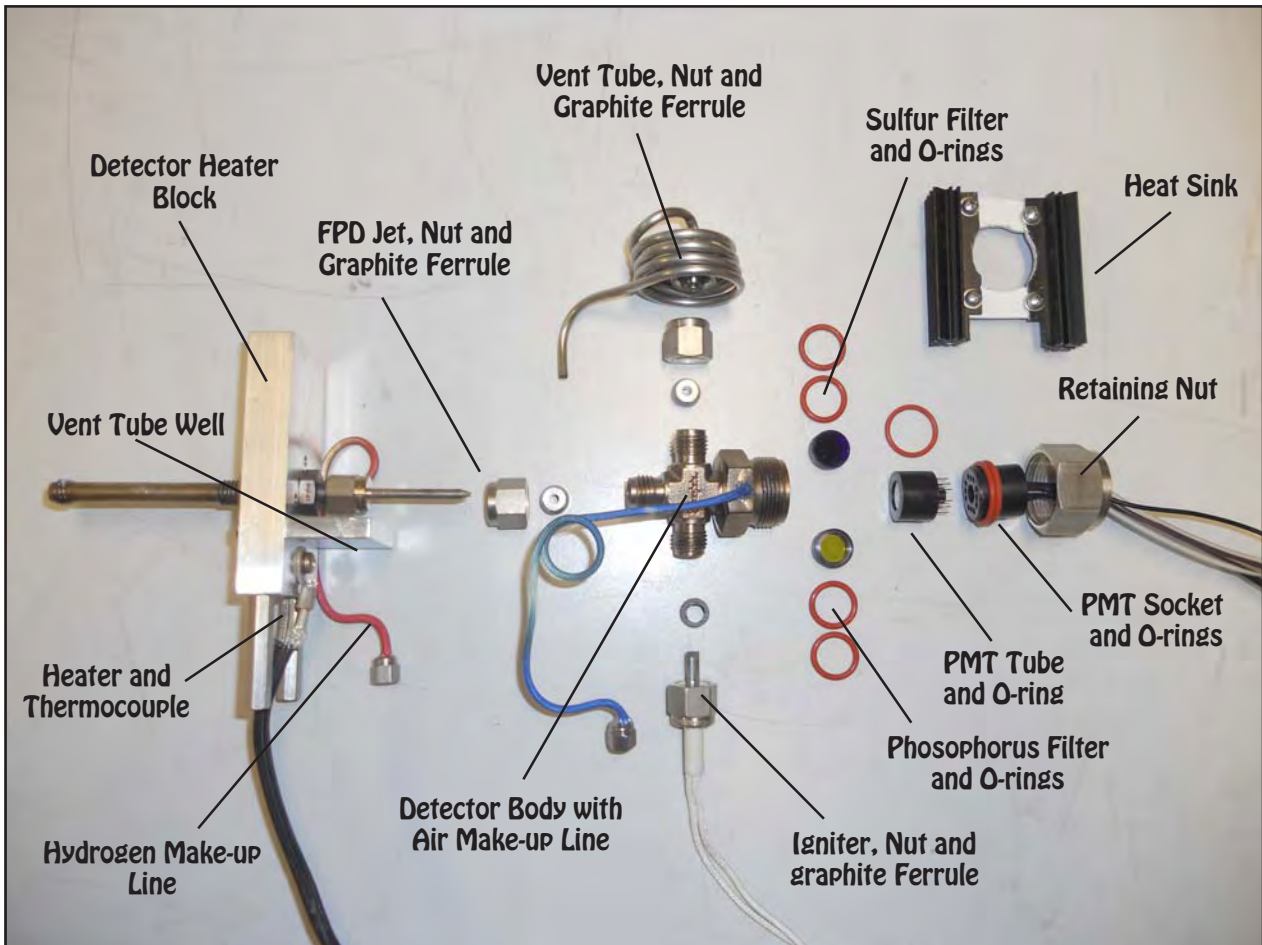
BNC connector for Collector

Amplifier Shield  
(Both sides)

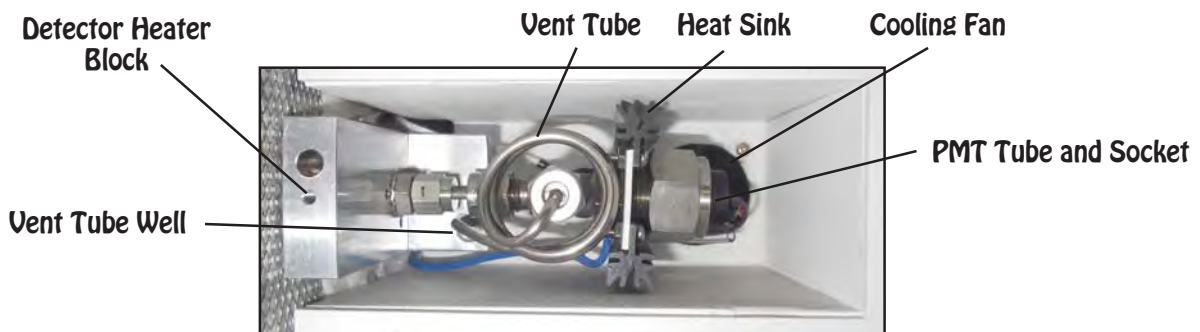


## Exploded View of FPD Detector

The FPD can either come configured for Sulfur, or for Phosphorus. The only difference between these two versions is the wavelength filter. The Sulfur filter (394 nm) is Blue and the Phosphorus filter (525nm) is Yellow. Both filters have a side with a mirror finish, which is the side that faces the jet. The PMT measures photons that pass through the filter, so it is very important that the detector be light tight to prevent photons from entering by other means. We use soft graphite ferrules, and O-rings to seal the detector body from light. Each of these connections should be snug, but not overtightened. The retaining nut should be finger tight.



## FPD Detector on Companion





## Plumbing Connections

The make-up air pressure is controlled by the EPC and then connects through a restrictor to cut back the flow to the 100mls/min. The restrictor is plumbed into the bulkhead fitting under the detector body. Air is always blue. The restrictor values are clearly written on the yellow portion of each restrictor. In the same way hydrogen comes from the EPC through a restrictor to the bulkhead on the right. Hydrogen is always red. The total hydrogen flow to the detector should be 25mls/min. In some cases we use hydrogen as the carrier gas, the total of both the carrier gas and the make-up gas to the FID should still be 25mls/min. We can adjust the total flow, by changing the restrictor, or adjusting the carrier pressure.

Air (Blue)      Hydrogen (Red)



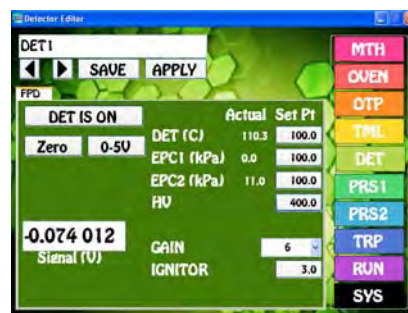
In the Companion GC's the restrictors are under the oven. The cooling fan is mounted on the bottom cover of the detector oven.



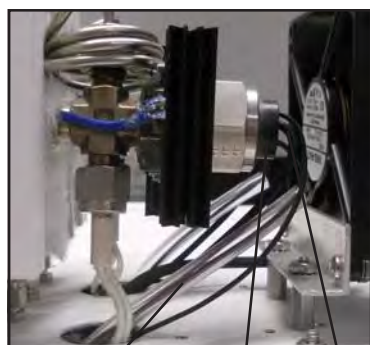
Pressure Program



Oven Page



Detector Page



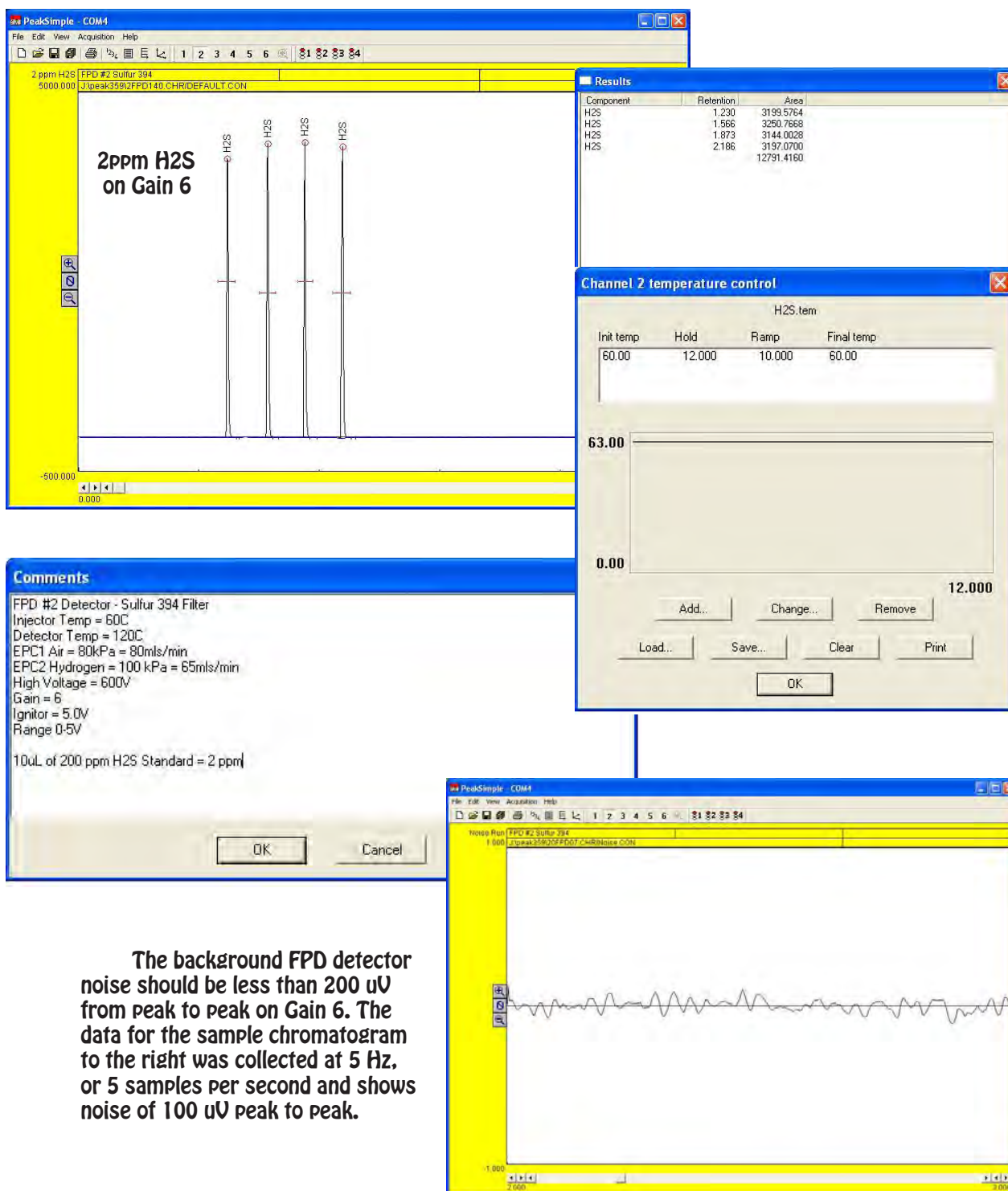
High Voltage    PMT    Signal

## Photomultiplier Tube

The FPD needs a negative high voltage supply to power the PMT. We run this wire through tubing to keep it separated from other wires. The PMT fits snugly inside the detector body, but we also use O-rings to keep it light tight. The wavelength filter also uses O-rings to hold it in place. The filter is positioned immediately in front of the PMT tube. The only difference between the Sulfur and Phosphorus version of the FPD detector is the filter. The filter can be changed from one to the other if necessary. The signal wire plugs into the BNC connector on the Detector Board.

## Expected Performance - Sulfur 394 nm

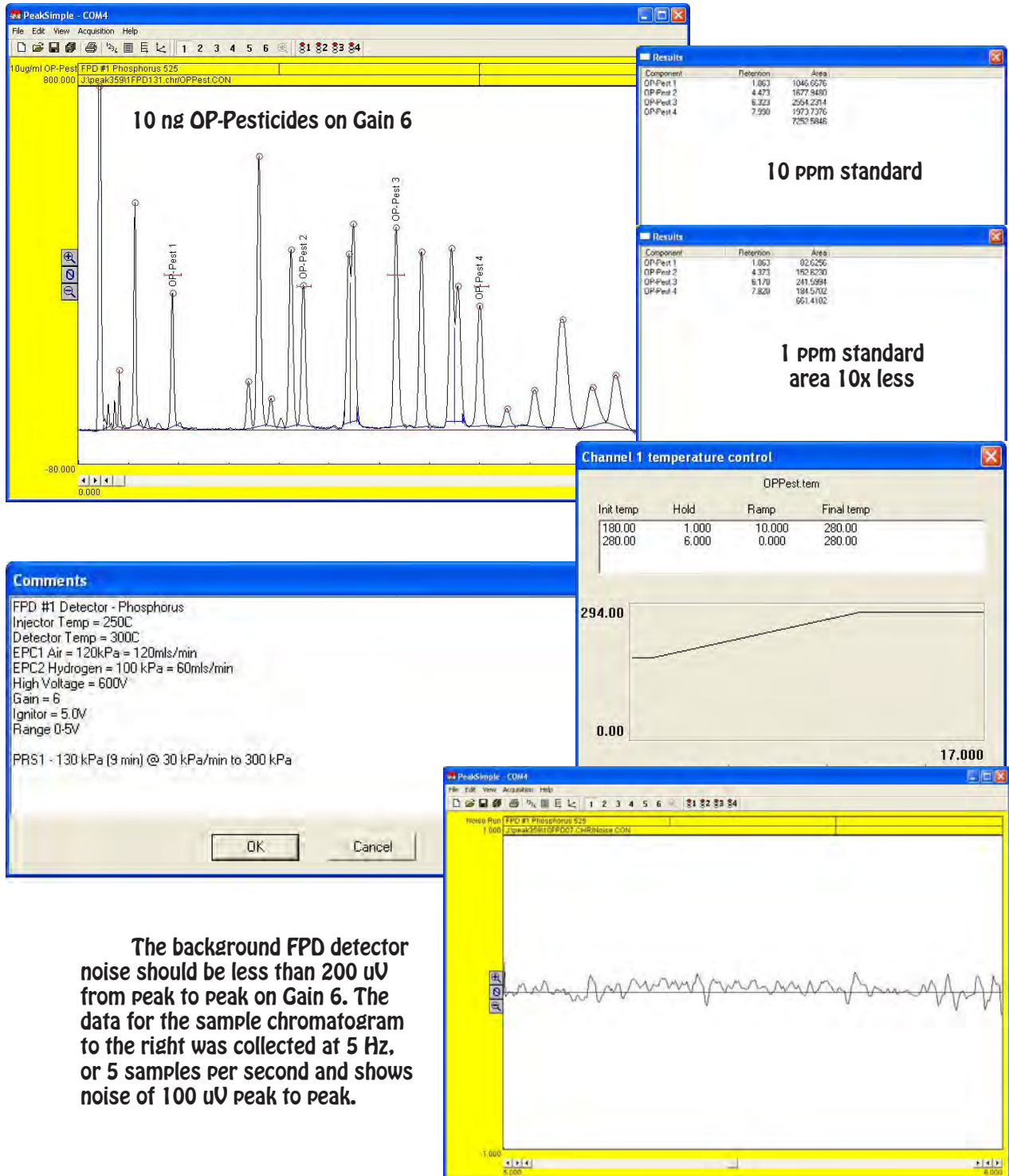
We measure FPD Sulfur detector performance by analyzing a 2 ppm H<sub>2</sub>S standard. Since this is a gas standard we analyze it several times in sequence and look at reproducibility. For our acceptance criteria, the H<sub>2</sub>S response should be greater than 1500 area counts on Gain 6. The FPD response to Sulfur is not linear, it is exponential ( $\text{Conc} = 1/\text{area}^2$ ). Therefore, if want to go from a concentration of 10ppm to a concentration of 1ppm the area will be 100 times smaller.



The background FPD detector noise should be less than 200 uV from peak to peak on Gain 6. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 100 uV peak to peak.

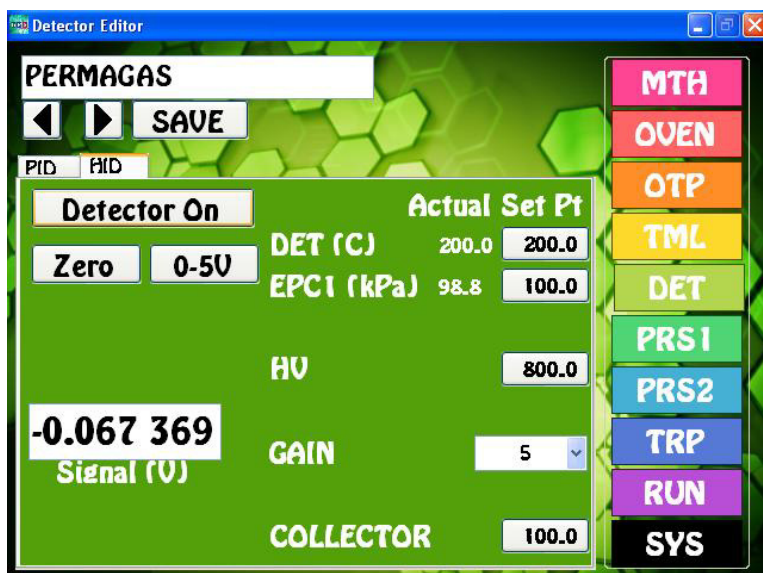
## Expected Performance - Phosphorus 525 nm

We measure FPD Phosphorus detector performance by analyzing a 10 ppm Organophosphorus standard. For our acceptance criteria, we look at 4 representative peaks and the total response should be greater than 5000 area counts on Gain 6. The FPD response to Phosphorus is linear. Therefore, if you want to go from a concentration of 10 ppm to a concentration of 1 ppm the area will be 10 times smaller. The results for these two standard analyses are below.



The background FPD detector noise should be less than 200 uV from peak to peak on Gain 6. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 100 uV peak to peak.

## HID - Helium Ionization Detector



**HID Overview** - The HID detector is a universal broad range detector highly sensitive to almost all compounds. In a helium environment a current flows between two electrodes creating a plasma of high energy short wavelength photons. As the compounds exit the column they are bombarded by these photons and are ionized. The resultant positively charged ions are attracted to the negatively charged Collector Electrode. The energy of these photons are 24 eV, and this is sufficient to ionize most compounds.

**Detector ON/OFF** - This button turns ON, or OFF the High Voltage and Collector Electrode Voltage. The Detector Temperature and EPC are always ON to stabilize the Detector.

**Entering Values** - By pressing on any Setpoint button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Actual** - Is the value that the instrument returns for any specific parameter. All parameters shown for a detector are required for the operation of that detector. If the Actual values are not very close to the Setpoint values, then the detector is probably not functioning within specifications. If there are dashes, then either the Detector is not turned ON, or the board is not functioning properly.

**Save** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. If there are multiple detectors, all of the Detector Parameters will be Saved to the same file.

**Apply** - When you press the APPLY button the Program file will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method.

**Detector Temperature** - Is the Temperature of the Detector Block mounted next to the Column Oven. The Detector Temperature should be set at 25° C above the Final Temperature of the OTP to ensure that compounds coming off the column do not hit a cold zone. All detectors have individual insulated enclosures and the Detector Temperature maintains the constant temperature of the enclosure.

**EPC** - The HID Detector uses one EPC to control the make-up gases required for operation. For all of our Detector EPC's, the rule of thumb, is to set the EPC value to 100 kPa. We install calibrated restrictors regulating the desired flow from 100 kPa of pressure. We use 2 restrictors for the HID detector, the side leading to the fitting surrounding the column is set to 5mls/min, and the other side feeding the tail of the detector is set to 20mls/min.

**High Voltage** - Is the voltage required to produce a helium plasma. The normal operating range should be set between 700 and 1000V. You should see an Offset in the detector Signal when the plasma is produced by the current flowing between the electrodes.

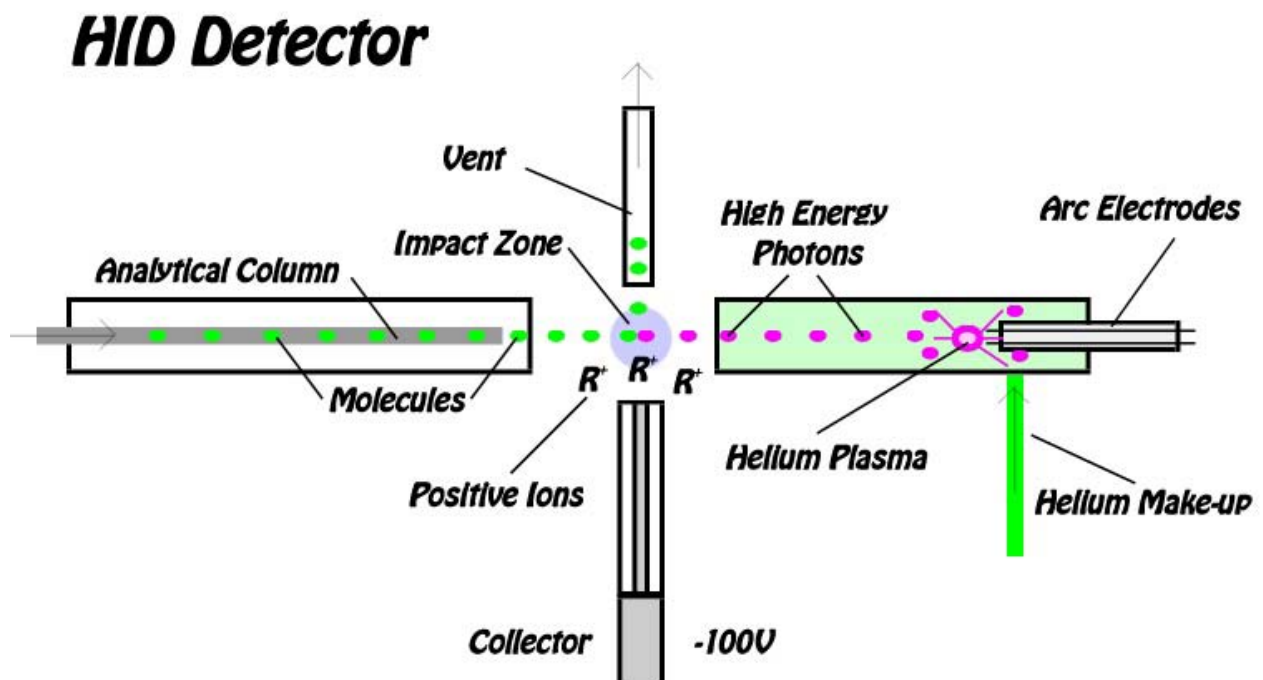
**Gain** - A properly performing HID will demonstrate an Offset in the Detector Signal. We can correct for some of the Offset using the Zero function, but we are limited to 2.5V of correction.

**Collector** - Is the voltage applied to the Collector Electrode. The voltage displayed is actually negative, but our Number Pad just allows for the entry positive values, so the system takes care of the sign for you. We recommend using -100V for the Collector Electrode.

**Zero** - We have included a hardware ZERO function that compensates for a Signal offset. There is a range limit of 2.5V. When you press the Zero button you will notice the Signal fluctuating back and forth for a few seconds until a value is achieved within a few millivolts of Zero.

**Detector Output** - For analog outputs to other data systems we have included 3 voltage range settings. 0-1V, 0-5V, and 0-10V. By pressing on the button these values will cycle. Select the one that you want and SAVE the setting.

**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black.



# HID Detector

## Detector Body

The HID detector requires ultra pure helium to operate (Helium 5.0, 99.999 or better). With lower quality helium the plasma will not form!. The more pure the helium, the lower detection limits will be. There are two parts that make up the HID detector. The HID Detector Body is similar to a FID, there is the Jet coming from the left, the Collector is on the bottom, and the Vent is at the top. The Arc Electrode Body is where the helium is energized with a high voltage supply to form a plasma. These high energy ions (17.7 eV) bombard and ionize the compounds exiting the column. Helium enters the Arc Body from the right and flows toward the vent. Helium also enters the Detector Block sweeping the contents of the column out the jet. The flow through the Arc Body is greater too keep the arc from being contaminated by column effluent. It is important that the entire detector body is filled with helium not allowing any air to seep in, so we use a restrictor on the vent to keep positive pressure inside the HID Body and Arc Body.

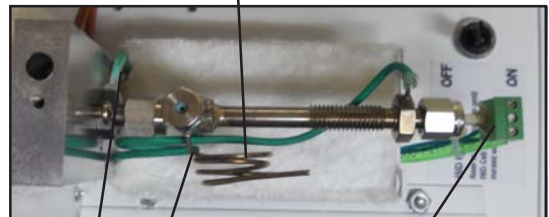
Detector Heater Block    HID Body    Arc Body



## Top View

The HID helium make-up lines are in Green. The make-up tubes and the vent tube are welded into the bodies to prevent leakage. We use plugs to seal the bodies, and ferrules to seal the removable parts.

Vent Tube



Helium Make-up

Arc Electrodes

## Plumbing Connections

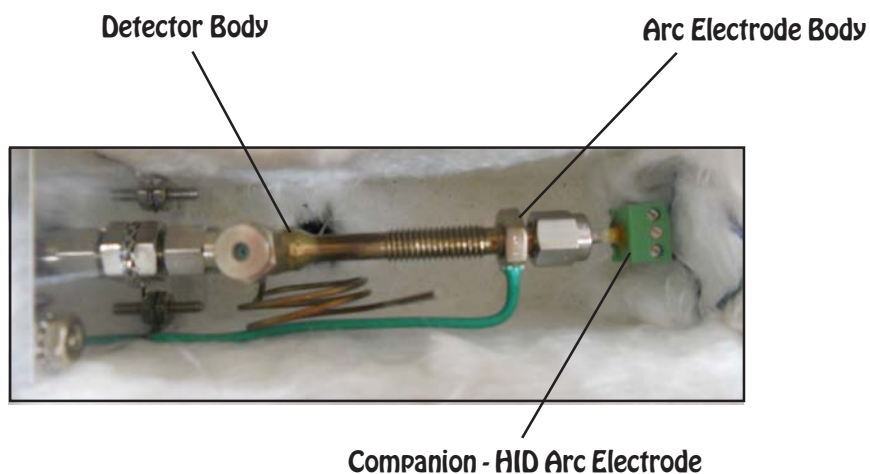
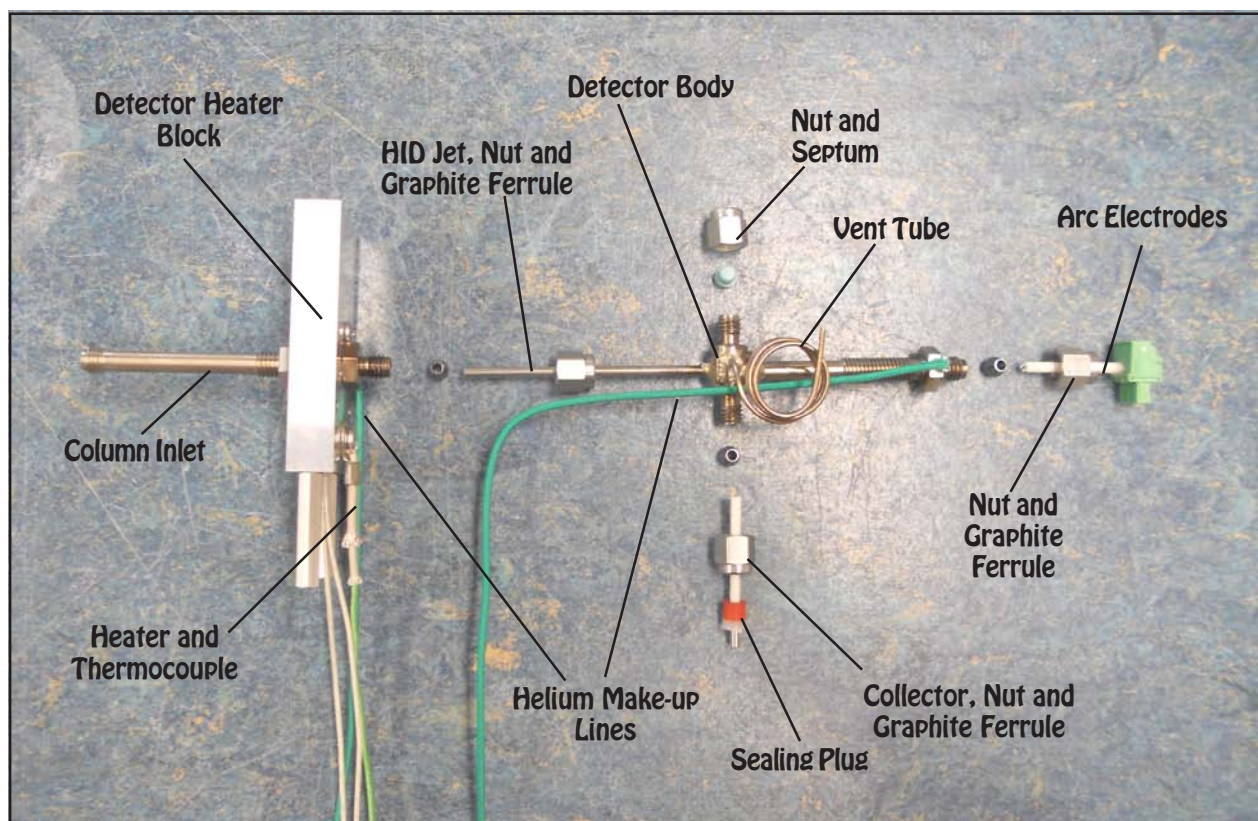
The make-up helium pressure is controlled by an EPC and then connected into 2 restrictors to cut back the flow to 10 mls/min through the detector body and 15 mls/min through the arc electrode body. The restrictors are plumbed into the bulkhead fitting under the detector body. Helium is always green. The restrictor values are clearly written on the yellow portion of each restrictor. Depending on the carrier flow through the column (for example high flow packed columns) the detector make-up flow can be increased to keep the arc portion of the detector body filled with pure helium.

In the Companion GC's the restrictors are under the oven. In the picture to the right you can see the "T" that splits the helium flow through both restrictors.



## Exploded View of HID Detector

The HID Arc Electrodes are isolated from one another by a 2 hole ceramic tube. The electrodes extend inside the arc electrode body where the helium plasma is formed. It is very important that all connections are sealed tight. We use graphite ferrules for the arc electrode, collector, and HID jet. The arc electrodes are inserted from the right side for a Series 600 and Companion GC. The coils should be positioned past the make-up inlet of the arc body. The gap between the electrodes is set at the factory and never needs to be adjusted. The nut and septum at the top seal the viewing port for positioning a capillary column.



## Collector Connections

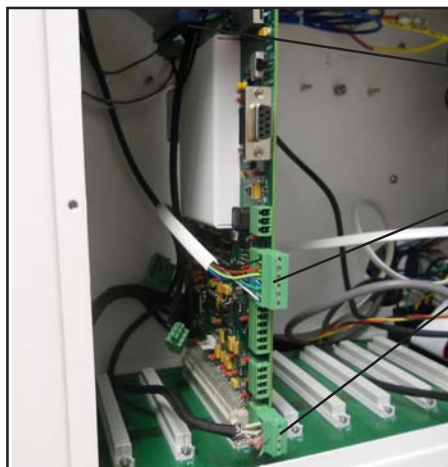
The collector has a solid metal core surrounded by a ceramic insulator. A soft graphite ferrule holds the ceramic in the detector body. Take care not to over tighten the ferrule and crack the ceramic insulator. We put an additional seal

between the collector and ceramic insulator in the HID to prevent Helium gas from leaking out. A spring inside the shielded collector cable slips over the solid end of the collector making a secure electrical connection.



## Detector Board

The components of the HID plug directly into the detector board. The same universal detector board is used for multiple detectors. We use the same board in both the Series 600 and the Companion GC's. Each of the green connectors are clearly marked. Please refer to the pictures to the right for the electrical connections.



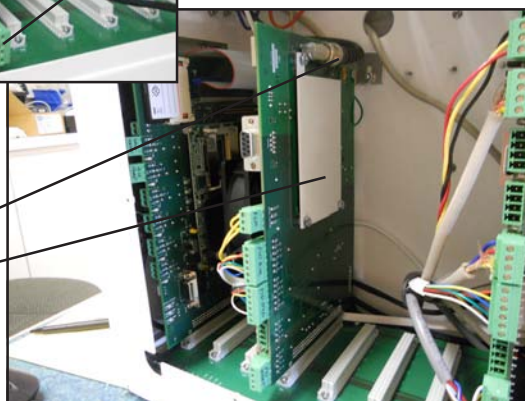
Detector Ground and High Voltage

Helium EPC

Detector Heat

BNC connector for Collector

Amplifier Shield (Both sides)



## High Voltage Switch

A High Voltage bypass switch is installed on the top of the Companion. This switch should be in the OFF position when the instrument is turned ON and the software is booting up. Keep the switch in the OFF position for a few minutes until the HID cell is completely purged with Helium.

Once the system is purged, turn the HV switch ON and then turn ON the HID Detector normally.

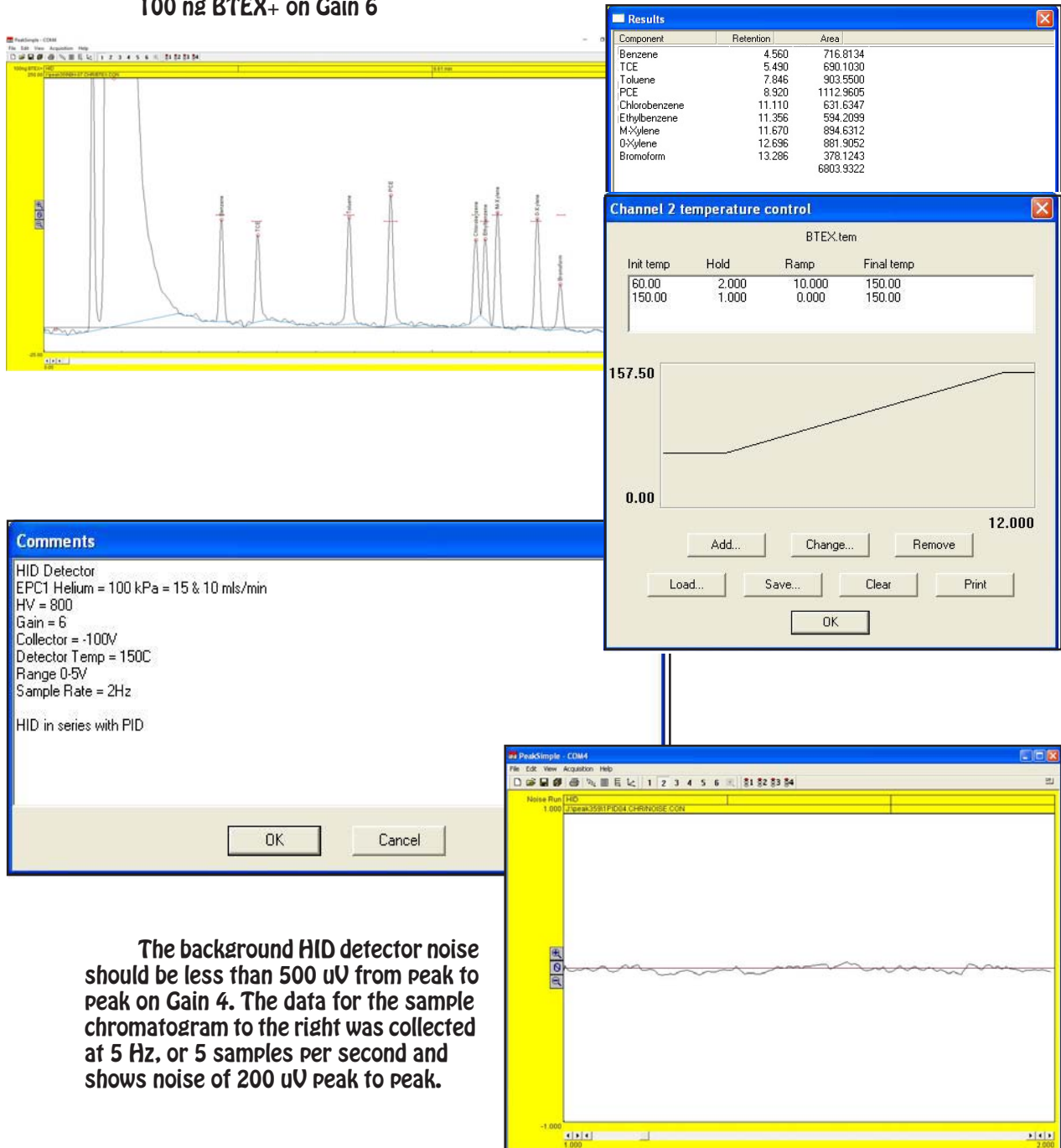




## Expected Performance - High Sensitivity

For high sensitivity analyses we measure the HID detector performance by analyzing a 100 ng BTEX standard. We also add chlorinated compounds and use the same standard solution for various detectors. The HID detects most compounds at the same concentration, both the hydrocarbons and chlorinated hydrocarbons have about the same area. For our acceptance criteria, the Toluene response should be greater than 800 area counts on Gain 6.

100 ng BTEX+ on Gain 6

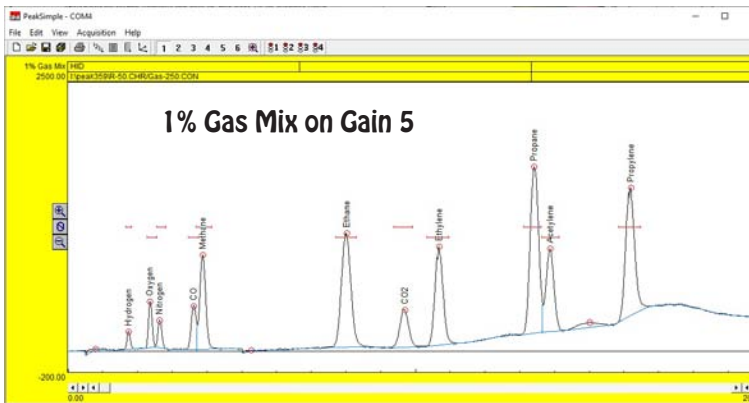


The background HID detector noise should be less than 500 uV from peak to peak on Gain 4. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 200 uV peak to peak.

## Expected Performance - Percent Range

For HID analyses in the percent range we measure detector performance by analyzing a 1% Gas Mix standard. The HID detects most compounds at the same concentration, both the hydrocarbons and inorganic compounds have about the same areas. For our acceptance criteria, the Methane response should be greater than 9000 area counts on Gain 5, using a 250uL sample loop.

The HID detector is prone to saturate when concentrations are in the high % range using a large volume injection. In the chromatogram at the bottom of the page, you will see that the Nitrogen peak is split showing this effect. To counter this effect, the sample size is reduced so that all peaks are on scale.



**Results**

Component	Retention	Area	External	Units	Internal
Hydrogen	1.725	1096.5630	1.0000	%	1.0000
Oxygen	2.341	2860.6305	1.0000	%	1.0000
Nitrogen	2.616	1802.7250	1.0000	%	1.0000
CO	3.600	3893.7630	1.0000	%	1.0000
Methane	3.858	9949.2420	1.0000	%	1.0000
Ethane	8.000	19561.5320	1.0000	%	1.0000
CO2	9.886	6049.5220	1.0000	%	1.0000
Ethylene	10.858	14219.0860	1.0000	%	1.0000
Propane	13.391	25546.9010	1.0000	%	1.0000
Acetylene	13.858	11983.3093	1.0000	%	1.0000
Propylene	16.175	20847.5560	1.0000	%	1.0000
		117770.8297	11.0000		11.0000

**Channel 2 temperature control**

GAS.TEM

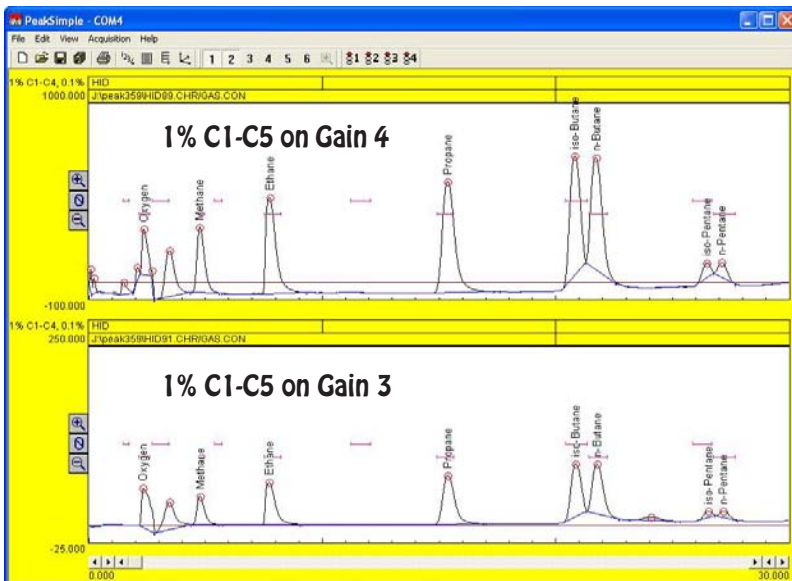
Inlt temp	Hold	Ramp	Final temp
80.00	2.000	10.000	240.00
240.00	12.000	0.000	240.00

**Comments**

HID Detector  
 EPCI Helium = 150 kPa = 37 & 15 mls/min  
 HV = 800  
 Gain = 3  
 Collector = -100V  
 Detector Temp = 200C  
 Range 0-5V  
 Sample Rate = 2Hz  
 Valve = 100C

OK Cancel

In the chromatograms below are a 1% C1-C5 Standard at Gain 4 (top) and Gain 3 (bottom). Each Gain step between 1 and 5 increases the response by a factor of 10. Note the area results are 10X greater on Gain 4.



**Results**

Component	Retention	Area	External	Units
Oxygen	2.316	3935.5235	11.7880	%
Methane	4.725	7756.8055	9.6483	%
Ethane	7.716	15221.2943	9.6639	%
Propane	15.333	22104.2558	9.7326	%
iso-Butane	20.783	19085.2268	9.5301	%
n-Butane	21.683	19322.0965	9.5537	%
iso-Pentane	26.441	1945.1715	0.9546	%
n-Pentane	27.075	2031.4690	0.9688	%
		91401.8427	61.8203	

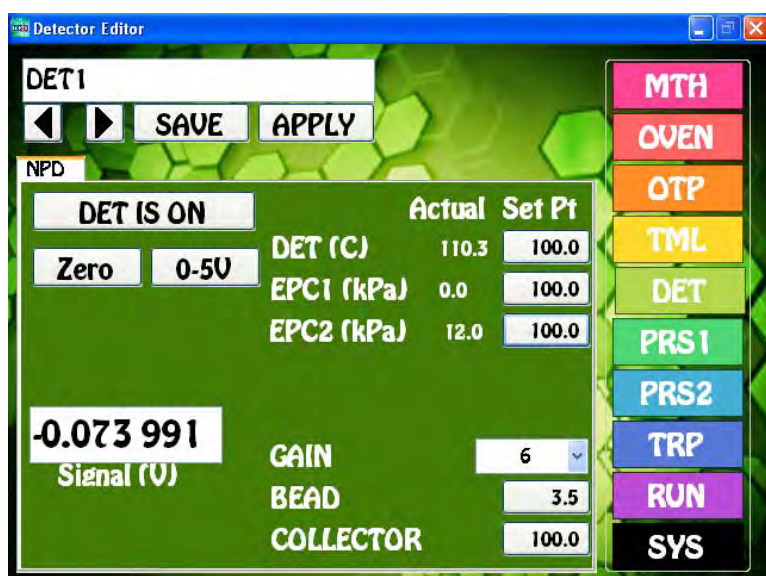
**Gain 4 Results**

**Results**

Component	Retention	Area	External	Units
Oxygen	2.291	1349.1475	4.0342	%
Methane	4.733	832.2350	1.0352	%
Ethane	7.691	1627.9900	1.0336	%
Propane	15.325	2331.8945	1.0267	%
iso-Butane	20.825	2096.7235	1.0470	%
n-Butane	21.733	2112.7180	1.0446	%
iso-Pentane	26.491	212.9245	0.1045	%
n-Pentane	27.133	216.2110	0.1031	%
		10779.8520	9.4290	

**Gain3 Results**

## NPD - Nitrogen Phosphorus Detector



**NPD Overview** - The NPD detector is highly selective to Nitrogen and Phosphorus containing compounds. A precisely controlled Hydrogen and Air mixture surrounds the NPD bead within the detector body. A voltage is applied to the bead to activate the surface, which reacts with Nitrogen or Phosphorus compounds as they exit the column creating Ions. The resultant positively charged Ions are attracted to the negatively charged Collector Electrode.

**Detector ON/OFF** - This button turns ON, or OFF the Bead and Collector Electrode Voltage. The Detector Temperature and EPC's are always ON to stabilize the Detector.

**Entering Values** - By pressing on any Setpoint button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Actual** - Is the value that the instrument returns for any specific parameter. All parameters shown for a detector are required for the operation of that detector. If the Actual values are not very close to the Setpoint values, then the detector is probably not functioning within specifications. If there are dashes, then either the Detector is not turned ON, or the board is not functioning properly.

**Save** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. If there are multiple detectors, all of the Detector Parameters will be Saved to the same file.

**Apply** - When you press the APPLY button the Program file will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method.

**Detector Temperature** - Is the Temperature of the Detector Block mounted next to the Column Oven. The Detector Temperature should be set at 25° C above the Final Temperature of the OTP to ensure that compounds coming off the column do not hit a cold zone. All detectors have individual insulated enclosures and the Detector Temperature maintains the constant temperature of the enclosure.

**EPC** - The NPD Detector uses two EPC's to control the make-up gases required for operation. For all of our Detector EPC's, the rule of thumb, is to set the EPC value to 100 kPa. We install calibrated restrictors regulating the desired flow from 100 kPa of pressure. For Hydrogen the flow is 3ml/min, and for Air the flow is 100mls/min.

**Bead** - When the DET ON button is pushed the Bead voltage raises to the Setpoint. Start with a voltage of 3V and slowly increase the voltage looking at the Signal until you see the Signal start to rise. This is the point where the Bead will provide the correct surface temperature to react with the Nitrogen and Phosphorus containing compounds. Slightly higher voltages will increase the sensitivity, but higher voltages also result in a shorter Bead lifetime. We limit the upper voltage to 6V.

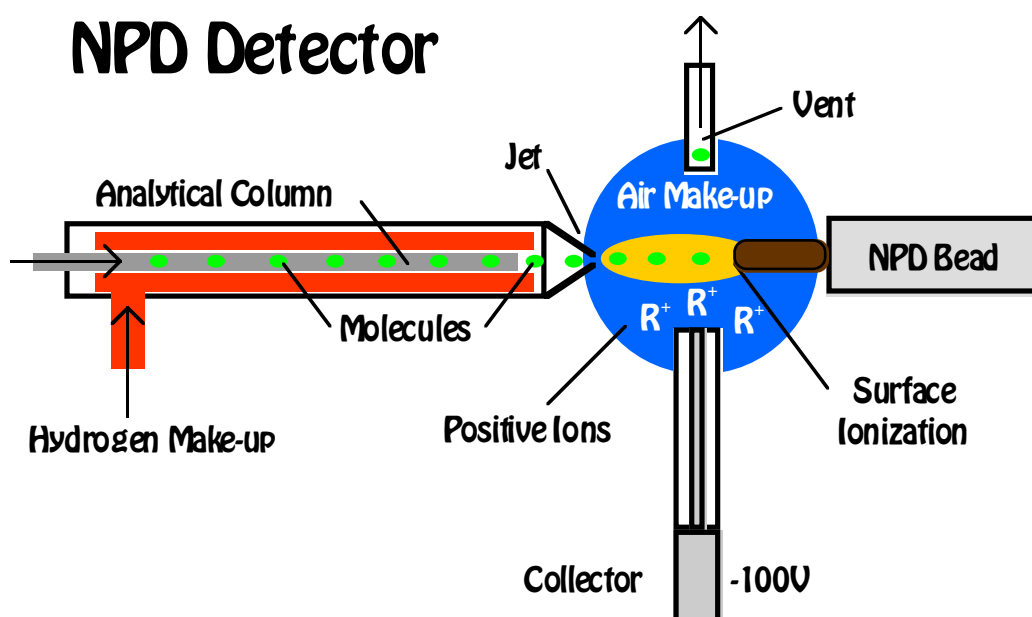
**Gain** - The NPD Detector can perform properly at any Gain setting from 1 to 6. The signal from the Collector Electrode is amplified by the Gain setting, where Gain 1=10, Gain 2=100, Gain 3=1000, Gain 4=10,000, Gain 5= 100,000, and Gain 6=200,000.

**Collector** - Is the voltage applied to the Collector Electrode. The voltage displayed is actually negative, but our Number Pad just allows for the entry positive values, so the system takes care of the sign for you. We recommend using -100V for the Collector Electrode.

**Zero** - We have included a hardware ZERO function that compensates for a Signal offset. There is a range limit of 2.5V. When you press the Zero button you will notice the Signal fluctuating back and forth for a few seconds until a value is achieved within a few millivolts of Zero.

**Detector Output** - For analog outputs to other data systems we have included 3 voltage range settings. 0-1V, 0-5V, and 0-10V. By pressing on the button these values will cycle. Select the one that you want and SAVE the setting.

**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black.

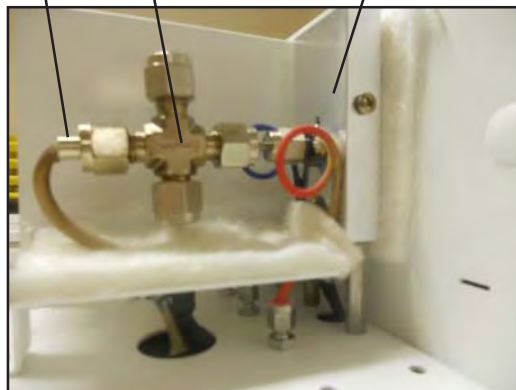


# NPD Detector

## Detector Body

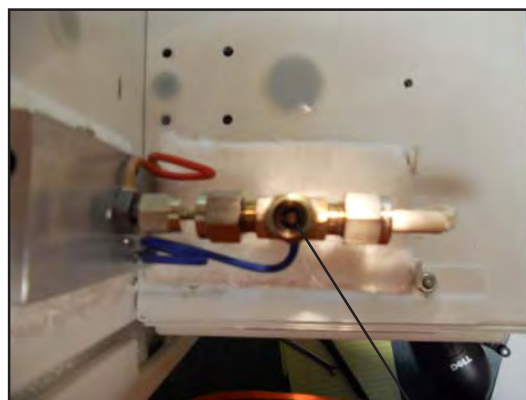
The NPD detector requires both hydrogen and air for the proper environment inside the detector. The mixture is 100:3 air to hydrogen. Usually the air is set to 100mls/min and the hydrogen to 3mls/min. In the picture to the right the air comes into the detector through the blue tube and the hydrogen through the red tube. The same colors are easily traced back to the EPC supplying the gas. The NPD Bead is on the left and the collector is connected to the bottom of the cross fitting. The NPD detector vent is at the top. The NPD uses the same detector body as the FID.

Bead Detector Body Detector Block



## Top View

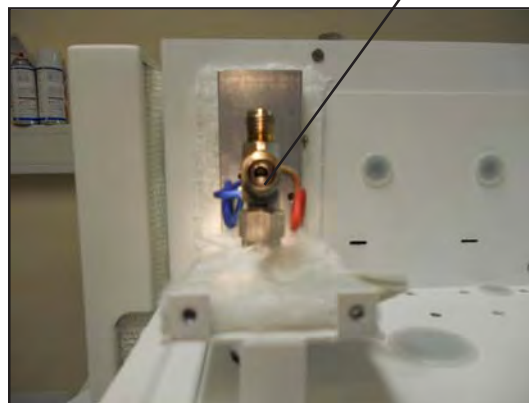
With the vent fitting removed, the collector can easily be seen from the top of the detector. The white ceramic shields the collector electrode in the middle from any possible shorts to the detector body. The Bead is positioned just to the right side of the collector. You can also see the NPD jet coming into the cell from the left. The tip of the jet should be just to the left of the white ceramic insulator of the collector. The column is positioned slightly back of the tip of the jet. If you are using a capillary column, push it through until you can see it and then pull it back inside the jet a little bit. The hydrogen gas enters the jet from the back, sweeping the effluent from the column directly onto the Bead. The air comes into the NPD Detector from the side of the collector and just bathes the cell with oxygen. With a packed column place the column inside the inlet as far as possible.



Collector

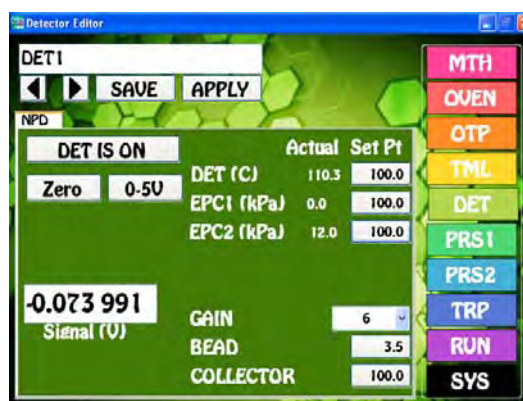
## Side View

The collector should be positioned at the bottom of the NPD cell just below the jet entrance. If the collector is too high the Bead may heat the collector and the signal will be noisy. If the collector is too low, then the signal will be diminished. It is always best to position the collector at the base of the NPD jet, just like the picture to the right.



## NPD Bead

The NPD Bead is very fragile and care must be taken not to bend, or break the Bead tip. The Bead should be positioned just to the side of the NPD cell. A graphite ferrule secures it in place, so it just needs to be snug, do not overtighten. There is a platinum filament inside the Bead that supplies the voltage to heat the special ceramic mixture on the Bead surface. As the Bead heats up, with the correct air and hydrogen mixture, the surface of the bead acts as a catalyst and reacts with compounds containing N or P. These compounds are ionized by the catalytic reaction and the resultant ions are picked up by the collector. You find the voltage where the catalytic reaction "Turns ON" by slowly increasing the Bead Voltage on the Detector Page (0.1V at a time) and observing the Detector Signal giving it some time between steps to equilibrate. At some point between 2.8V and 3.5V there will be a significant increase in the Signal (0.3V to 0.5V). This is the point where the NPD "Turns ON" and is the most sensitive to N and P containing compounds. Increasing the voltage more will increase the overall sensitivity, however the hotter the surface of the Bead the more it acts like a FID burning the compounds to create ions instead of being a selective catalytic reaction. Increased voltage will also shorten the life of the NPD Bead.



Detector Page

## Detector Board

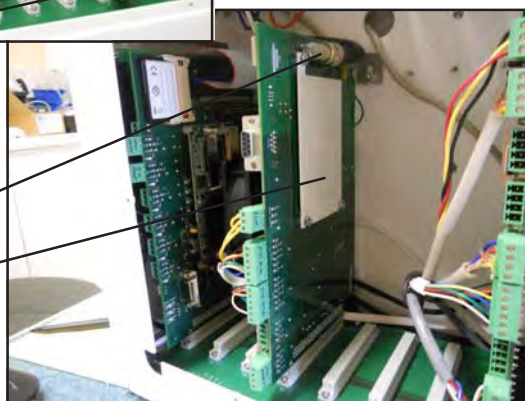
The components of the NPD plug directly into the detector board. The same universal detector board is used for multiple detectors. We use the same board in both the Series 600 and the Companion GC's. Each of the green connectors are clearly marked. Please refer to the pictures to the right for the electrical connections.



- Detector Ground
- Bead
- Air EPC1
- Hydrogen EPC2
- Detector Heat

BNC connector for Collector

Amplifier Shield  
(Both sides)

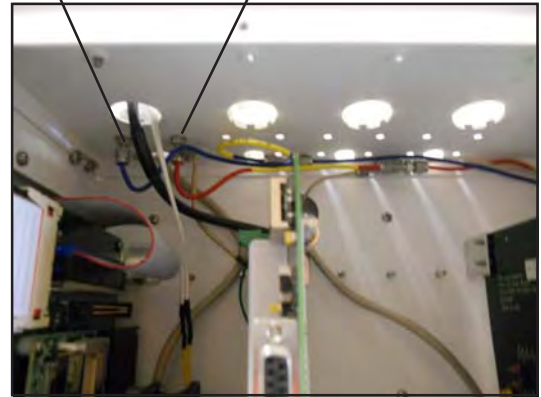


## Plumbing Connections

The make-up air pressure is controlled by the EPC and then connects through a restrictor to cut back the flow to the 100mls/min. The restrictor is plumbed into the bulkhead fitting under the detector body. Air is always blue. The restrictor values are clearly written on the yellow portion of each restrictor. In the same way hydrogen comes from the EPC through a restrictor to the bulkhead on the right. Hydrogen is always red. The total hydrogen flow to the detector should be 3mls/min.

In some cases we use hydrogen as the carrier gas, the total of both the carrier gas and the make-up gas to the FID should still be 3mls/min. We can adjust the total flow, by changing the restrictor, or adjusting the carrier pressure.

Air (Blue)      Hydrogen (Red)



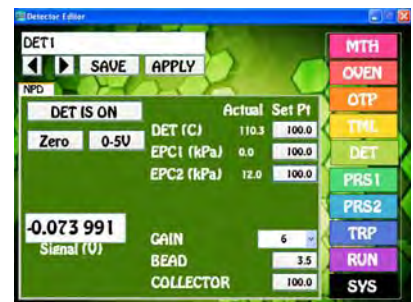
In the Companion GC's the restrictors are under the oven.



Pressure Program



Oven Page



Detector Page

## Collector Connections

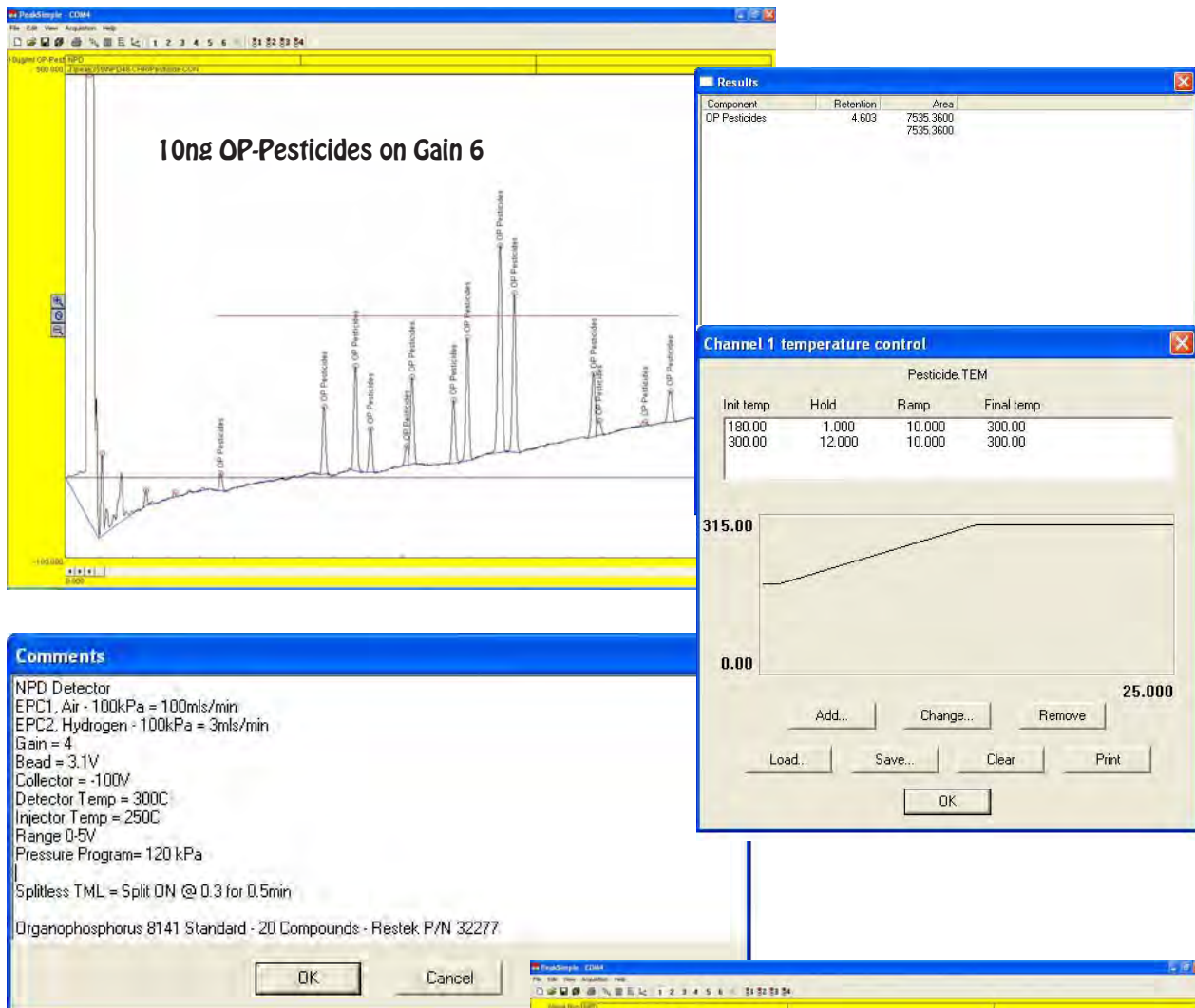
The collector has a solid metal core surrounded by a ceramic insulator. A soft graphite ferrule holds the ceramic in the detector body.

Take care not to over tighten the ferrule and crack the ceramic insulator. A spring inside the shielded collector cable slips over the solid end of the collector making a secure electrical connection.

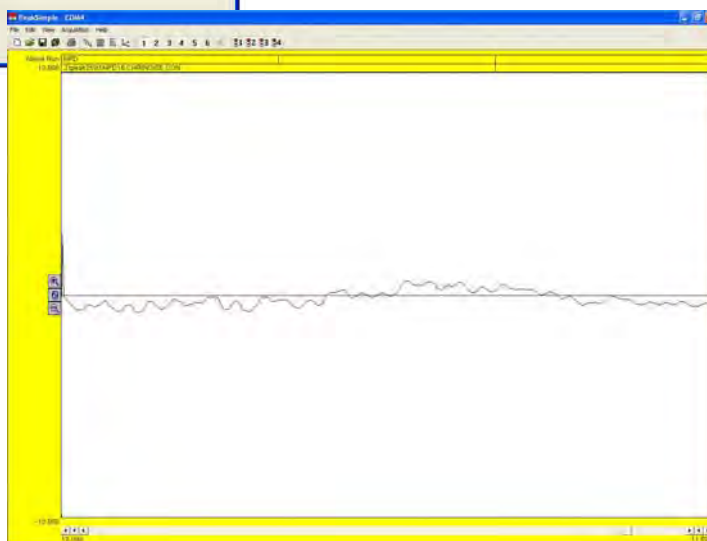


## Expected Performance

We measure detector performance by analyzing a 10 ng Organophosphorus Pesticide standard. For our acceptance criteria, the total response should be greater than 5000 area counts on Gain 6.

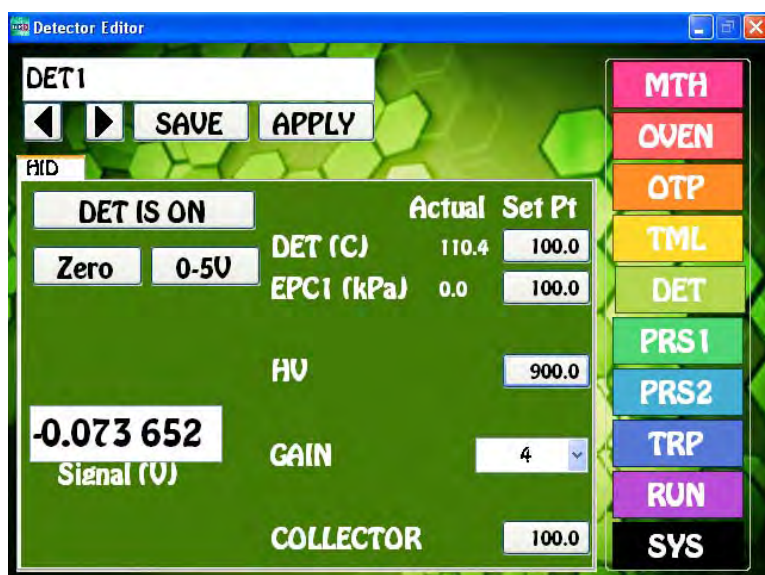


The background NPD detector noise should be less than 1 mV from peak to peak on Gain 6. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 0.8 mV peak to peak.





## PID - Photo Ionization Detector



**PID Overview** - The PID detector is highly sensitive to aromatic and hydrocarbons with double or triple bonds. The PID lamp emits 2 major wavelengths of high energy Ultraviolet light that travel through the window of the lamp. As the compounds exit the column they are bombarded by these UV photons and are ionized. The resultant positively charged ions are attracted to the negatively charged Collector Electrode. The energy of these photons averages 10.6 eV, and this is sufficient to ionize aromatic compounds, but not aliphatic compounds. Since the PID is nondestructive, the PID is commonly used in series with other detectors.

**Detector ON/OFF** - This button turns ON, or OFF the High Voltage and Collector Electrode Voltage. The Detector Temperature is always ON to stabilize the Detector.

**Entering Values** - By pressing on any Setpoint button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Actual** - Is the value that the instrument returns for any specific parameter. All parameters shown for a detector are required for the operation of that detector. If the Actual values are not very close to the Setpoint values, then the detector is probably not functioning within specifications. If there are dashes, then either the Detector is not turned ON, or the board is not functioning properly.

**Save** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. If there are multiple detectors, all of the Detector Parameters will be Saved to the same file.

**Apply** - When you press the APPLY button the Program file will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method.

**Detector Temperature** - Is the Temperature of the Detector Block mounted next to the Column Oven. The Detector Temperature should be set at 25° C above the Final Temperature of the OTP to ensure that compounds coming off the column do not hit a cold zone. All detectors have individual insulated enclosures and the Detector Temperature maintains the constant temperature of the enclosure.

**High Voltage** - Is the voltage required to light the PID lamp. The normal operating range should be set between 500 and 800V. You should see a violet glow from the lamp when it is ON.

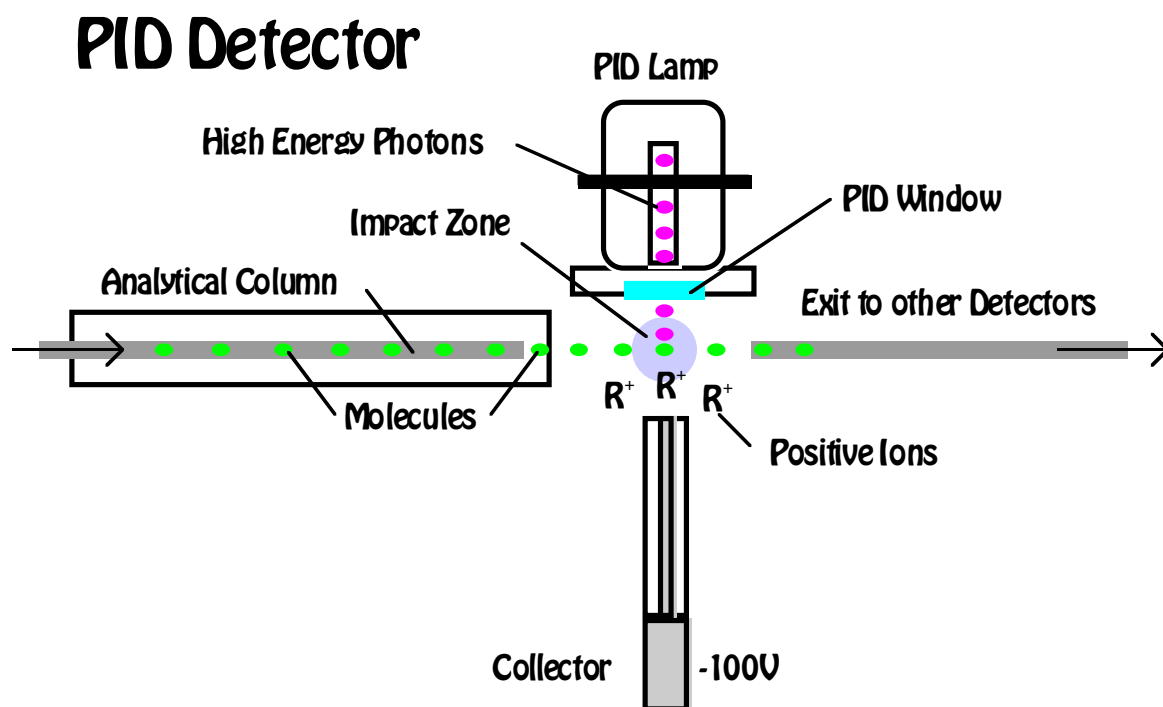
**Gain** - A properly performing PID will demonstrate an Offset in the Detector Signal at the higher Gain settings. We can correct for the Offset using the Zero function, but we are limited to 2.5V of correction. The signal from the Collector Electrode is amplified by the Gain setting, where Gain 1=10, Gain 2=100, Gain 3=1000, Gain 4=10,000, Gain 5=100,000, and Gain 6=200,000.

**Collector** - Is the voltage applied to the Collector Electrode. The voltage displayed is actually negative, but our Number Pad just allows for the entry positive values, so the system takes care of the sign for you. We recommend using -100V for the Collector Electrode.

**Zero** - We have included a hardware ZERO function that compensates for a Signal offset. There is a range limit of 2.5V. When you press the Zero button you will notice the Signal fluctuating back and forth for a few seconds until a value is achieved within a few millivolts of Zero.

**Detector Output** - For analog outputs to other data systems we have included 3 voltage range settings. 0-1V, 0-5V, and 0-10V. By pressing on the button these values will cycle. Select the one that you want and SAVE the setting.

**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black.

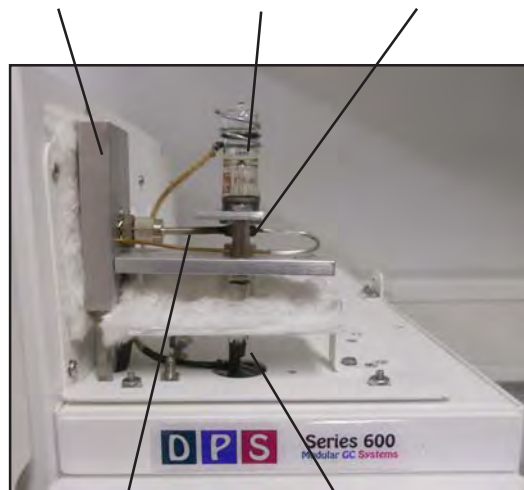


# PID Detector

## Detector Body

The PID lamp outputs high energy (10.0 & 10.6 eV) photons to ionize compounds exiting the column. The PID is also nondestructive, so we provide an Exit Tube for the effluent to be routed to another detector. It is very common to operate the PID in series with other detectors. The PID detector does not require a make-up gas if the carrier flow is sufficient to clear the low dead volume cell. We offer an optional make-up gas line if you are using a narrow bore column and the output is connected to a second detector. A high temperature O-rings provides a seal between the PID Lamp and the Detector Cell allowing the PID to perform most high temperature analyses.

Detector Heater Block    PID Lamp    Detector Cell

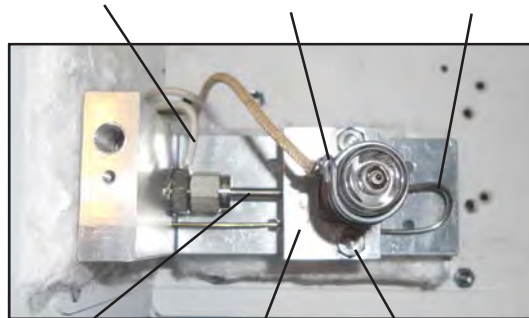


Column Inlet    Collector Cable

## Top View

The PID gas make-up line is Tan. The make-up tube and the Exit tube are welded into the body to prevent leakage. The High Voltage supply that lights the PID Lamp connects to the top of the Lamp with a spring. We always use high temperature wire inside the detector compartment. The Lamp Clamp securely holds the lamp in place and provides the Ground for the Lamp circuit. The PID Lamp Window is very brittle, but we set the distance so the Clamp Nuts can be tightened snugly without cracking the Lamp.

Optional Make-up    High Voltage Coil    Exit Tube



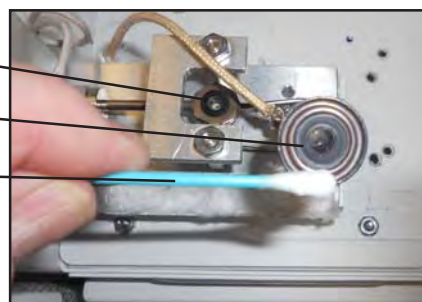
Column Inlet    Lamp Clamp    Clamp Nuts

## Lamp Removal and Cleaning

The PID Lamp periodically needs to have the window cleaned. To remove the PID Lamp loosen the 2 retaining nuts and then slide the lamp out from under the Clamp. The Window can usually be cleaned with a cotton swab and methanol. If the ring on the Lamp is persistent, you can use an abrasive cleanser. Also clean the collector face and cell. To replace the lamp slide it back under the Clamp making sure that the O-ring does not move and then tighten the 2 nuts.

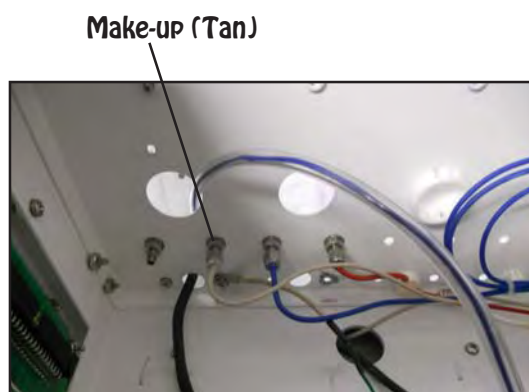


O-ring  
Lamp Window  
Cotton Swab  
Collector Face  
Clamp Nuts



## Plumbing Connections

The optional make-up gas pressure is controlled by the Carrier EPC. We add a "T" to split the carrier gas through a restrictor to cut back the make-up flow to 10 mls/min. The make-up gas sweeps the contents of the column into the PID Cell. The restrictor is plumbed into the bulkhead fitting under the detector body. Carrier gas is always tan. The restrictor values are clearly written on the yellow portion of each restrictor.



## Collector Connections

The collector has a solid metal core surrounded by a ceramic insulator. A soft graphite ferrule holds the ceramic in the detector body. Take care not to over tighten the ferrule and crack the ceramic insulator. A spring inside the shielded collector cable slips over the solid end of the collector making a secure electrical connection.



## Detector Board

The components of the HID plug directly into the detector board. The same universal detector board is used for multiple detectors. We use the same board in both the Series 600 and the Companion GC's. Each of the green connectors are clearly marked. Please refer to the pictures to the right for the electrical connections.



Detector Ground and High Voltage

Detector Heat

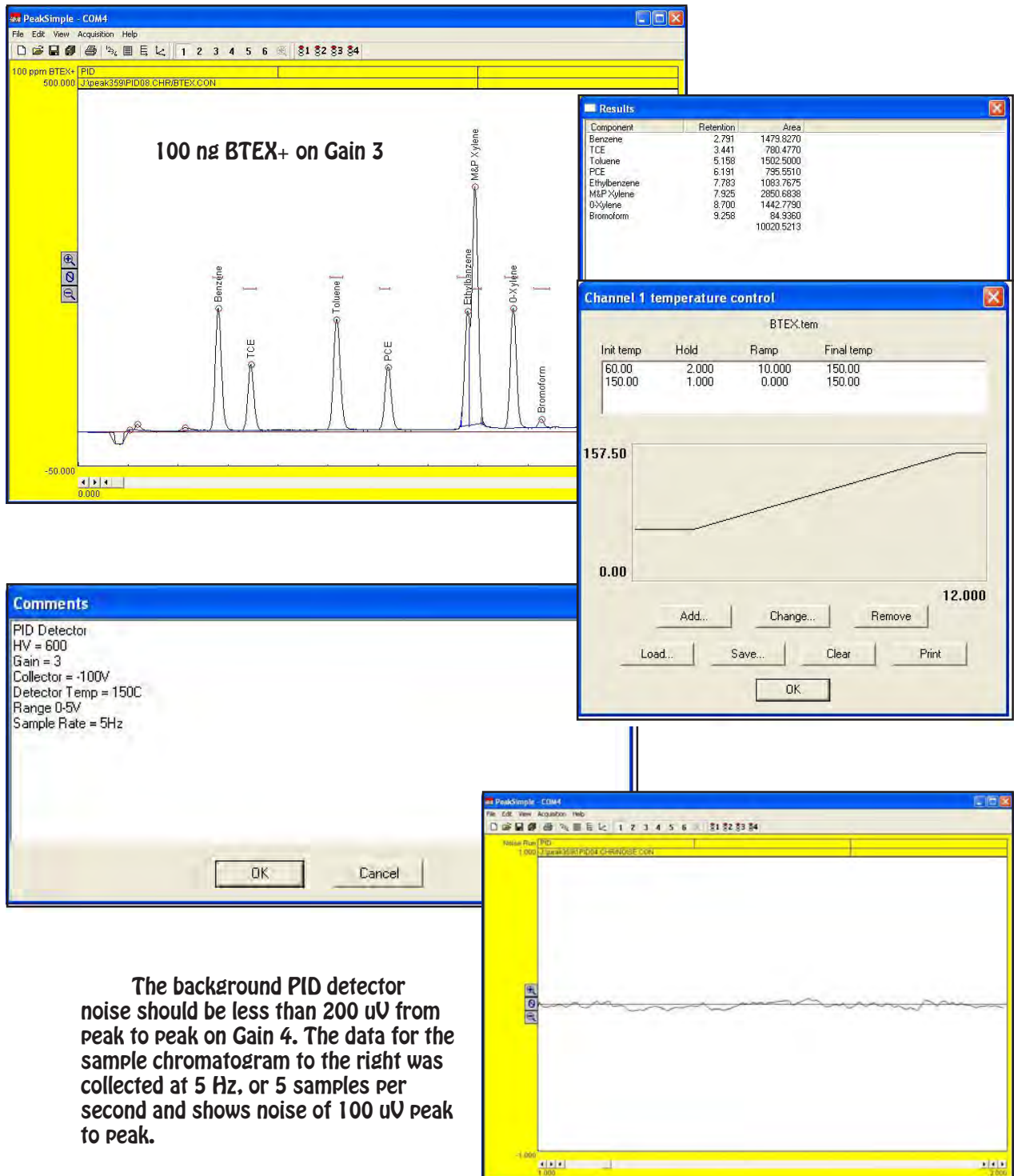
BNC connector for Collector

Amplifier Shield (Both sides)



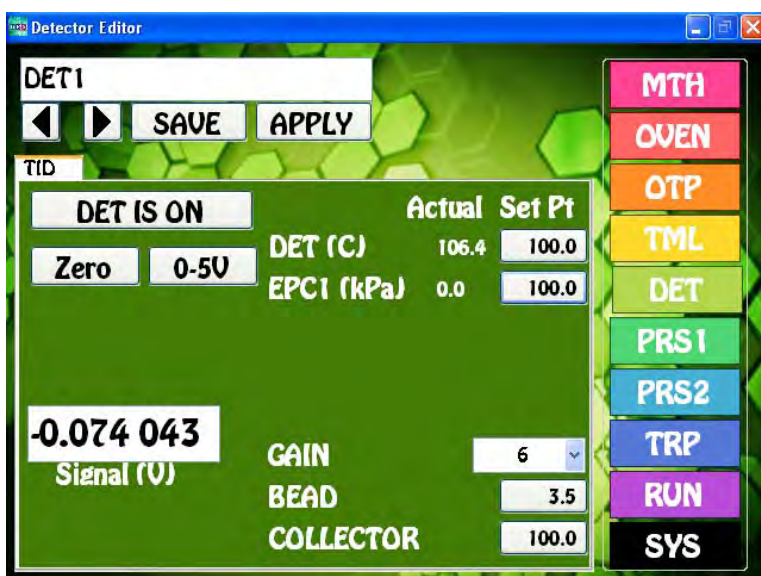
## Expected Performance

We measure the PID detector performance by analyzing a 100 ng BTEX standard. We also add chlorinated compounds and use the same standard solution for various detectors. The PID is a very sensitive detector about 20X more sensitive than a FID. For our acceptance criteria, the Toluene response should be greater than 1000 area counts on Gain 3.



The background PID detector noise should be less than 200 uV from peak to peak on Gain 4. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 100 uV peak to peak.

## TID - Thermo Ionic Detector



**TID Overview** - The TID detector is highly selective to Amines and Nitroaromatic compounds commonly found in explosives. A precisely controlled Nitrogen, or Air mixture surrounds the TID bead within the detector body. A voltage is applied to the bead to activate the surface, which reacts with Amines and Nitroaromatic compounds as they exit the column creating ions. The resultant positively charged ions are attracted to the negatively charged Collector Electrode.

**Detector ON/OFF** - This button turns ON, or OFF the Bead and Collector Electrode Voltage. The Detector Temperature and EPC are always ON to stabilize the Detector.

**Entering Values** - By pressing on any Setpoint button the Number Pad will appear. The value entered in the Number Pad will transfer back to the cell when you are done. The limits of the value selected will be displayed at the top of the Number Pad. For safety purposes, we do not allow numbers to be entered that are out of our specification.

**Actual** - Is the value that the instrument returns for any specific parameter. All parameters shown for a detector are required for the operation of that detector. If the Actual values are not very close to the Setpoint values, then the detector is probably not functioning within specifications. If there are dashes, then either the Detector is not turned ON, or the board is not functioning properly.

**Save** - When you press the SAVE button a keyboard will display allowing you to overwrite the current Detector Filename, or enter a completely new Name. If the name already exists a warning will display asking if you are sure. If you are not sure, then you can always press the NO, or CANCEL button. If there are multiple detectors, all of the Detector Parameters will be Saved to the same file.

**Apply** - When you press the APPLY button the Program file will transfer to the Method screen. The program will also transfer you to the Method screen if the name is different from the one associated with the current Method. Asterisks will also appear to the right of the Program file name, because this Program file has not yet been linked to the Method. If you like what you have done, simply SAVE the Method.

**Detector Temperature** - Is the Temperature of the Detector Block mounted next to the Column Oven. The Detector Temperature should be set at 25° C above the Final Temperature of the OTP to ensure that compounds coming off the column do not hit a cold zone. All detectors have individual insulated enclosures and the Detector Temperature maintains the constant temperature of the enclosure.

**EPC** - The NPD Detector uses one EPC to control the make-up gas required for operation. For all of our Detector EPC's, the rule of thumb, is to set the EPC value to 100 kPa. We install calibrated restrictors regulating the desired flow from 100 kPa of pressure. For Nitrogen, or Air the flow is 3ml/min, and for Air the flow is 25mls/min.

**Bead** - When the DET ON button is pushed the Bead voltage raises to the Setpoint. Start with a voltage of 3V and slowly increase the voltage looking at the Signal until you see the Signal start to rise. This is the point where the Bead will provide the correct surface temperature to react with the Amines and Nitroaromatic containing compounds. Slightly higher voltages will increase the sensitivity, but higher voltages also result in a shorter Bead lifetime. We limit the upper voltage to 6V.

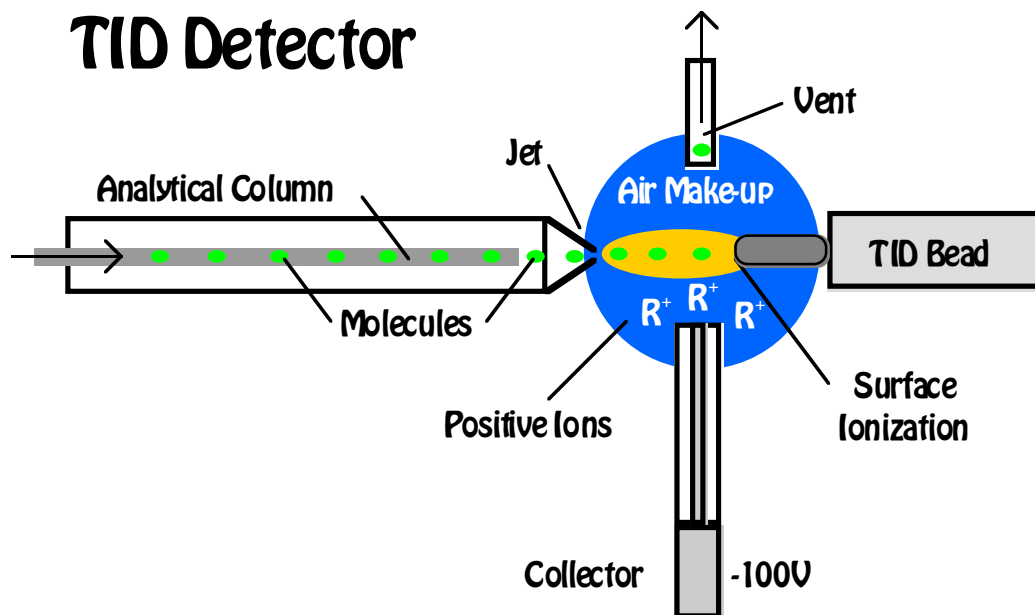
**Gain** - The NPD Detector can perform properly at any Gain setting from 1 to 6. The signal from the Collector Electrode is amplified by the Gain setting, where Gain 1=10, Gain 2=100, Gain 3=1000, Gain 4=10,000, Gain 5= 100,000, and Gain 6=200,000.

**Collector** - Is the voltage applied to the Collector Electrode. The voltage displayed is actually negative, but our Number Pad just allows for the entry positive values, so the system takes care of the sign for you. We recommend using -100V for the Collector Electrode.

**Zero** - We have included a hardware ZERO function that compensates for a Signal offset. There is a range limit of 2.5V. When you press the Zero button you will notice the Signal fluctuating back and forth for a few seconds until a value is achieved within a few millivolts of Zero.

**Detector Output** - For analog outputs to other data systems we have included 3 voltage range settings. 0-1V, 0-5V, and 0-10V. By pressing on the button these values will cycle. Select the one that you want and SAVE the setting.

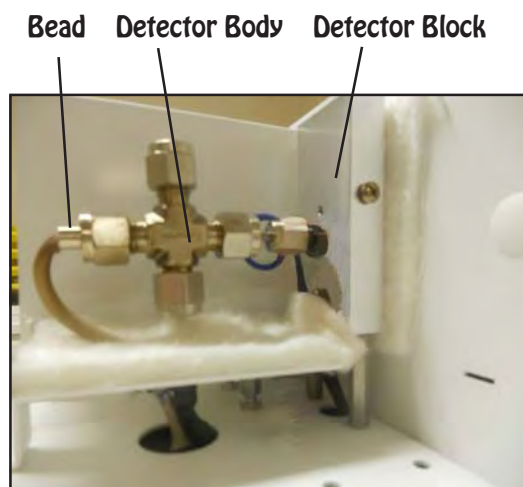
**Signal** - The detector output signal always updates with the value coming through the amplifier. Once you turn the Detector ON, the Signal turns from Gray to Black.



# TID Detector

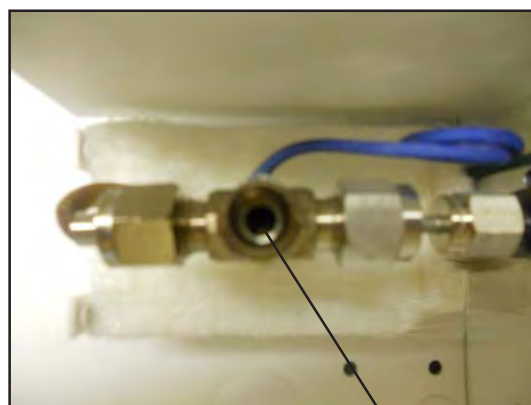
## Detector Body

The TID detector requires air, or nitrogen for the proper environment inside the detector. The air is set to 25mls/min. In the picture to the right the air comes into the detector through the blue tube. The same color is easily traced back to the EPC supplying the gas. The TID Bead is on the left and the collector is connected to the bottom of the cross fitting. The TID detector vent is at the top. The TID uses the same detector body as the FID.



## Top View

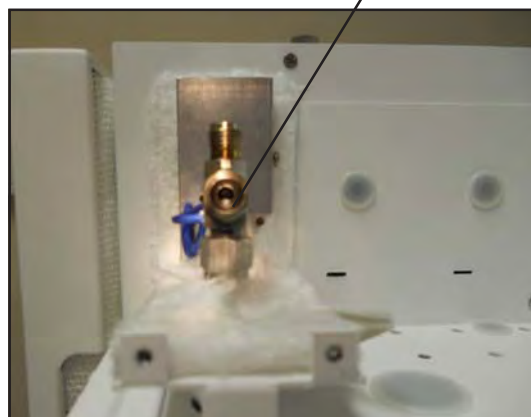
With the vent fitting removed, the collector can easily be seen from the top of the detector. The white ceramic shields the collector electrode in the middle from any possible shorts to the detector body. The Bead is positioned just to the right side of the collector. You can also see the TID jet coming into the cell from the left. The tip of the jet should be just to the left of the white ceramic insulator of the collector. The column is positioned slightly back of the tip of the jet. If you are using a capillary column, push it through until you can see it and then pull it back inside the jet a little bit. The carrier gas enters the jet from the back, sweeping the effluent from the column directly onto the Bead. The air comes into the TID Detector from the side of the collector and just baths the cell. With a packed column place the column inside the inlet as far as possible.



Collector

## Side View

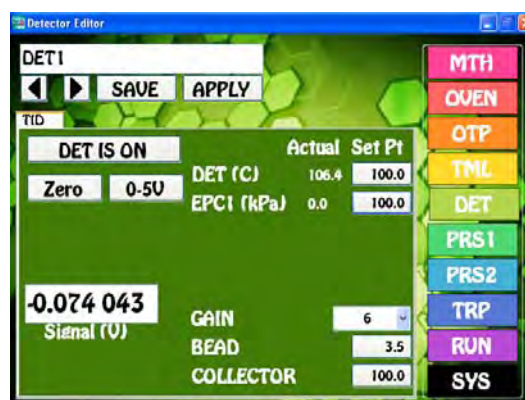
The collector should be positioned at the bottom of the TID cell just below the jet entrance. If the collector is too high the Bead may heat the collector and the signal will be noisy. If the collector is too low, then the signal will be diminished. It is always best to position the collector at the base of the TID jet, just like the picture to the right.





## TID Bead

The TID Bead is very fragile and care must be taken not to bend, or break the Bead tip. The Bead should be positioned just to the side of the TID cell. A graphite ferrule secures it in place, so it just needs to be snug, do not overtighten. There is a platinum filament inside the Bead that supplies the voltage to heat the special ceramic mixture on the Bead surface. As the Bead heats up, with the correct air mixture, the surface of the bead acts as a catalyst and reacts with amine and nitroaromatic compounds. These compounds are ionized by the catalytic reaction and the resultant ions are picked up by the collector. You find the voltage where the catalytic reaction "Turns ON" by slowly increasing the Bead Voltage on the Detector Page (0.1V at a time) and observing the Detector Signal giving it some time between steps to equilibrate. At some point between 2.8V and 3.5V there will be a significant increase in the Signal (0.3V to 0.5V). This is the point where the TID "Turns ON" and is the most sensitive to N in amine containing compounds. Increasing the voltage more will increase the overall sensitivity, however increased voltage will also shorten the life of the TID Bead.



Detector Page

## Detector Board

The components of the TID plug directly into the detector board. The same universal detector board is used for multiple detectors. We use the same board in both the Series 600 and the Companion GC's. Each of the green connectors are clearly marked. Please refer to the pictures to the right for the electrical connections.



Detector Ground

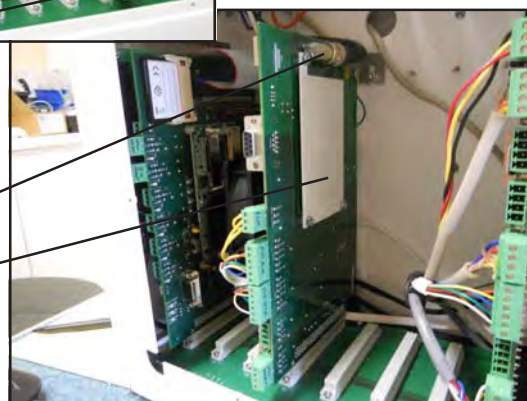
Bead

Air EPC

Detector Heat

BNC connector for Collector

Amplifier Shield  
(Both sides)



## Plumbing Connections

The make-up air pressure is controlled by the EPC and then connects through a restrictor to cut back the flow to the 25mls/min. The restrictor is plumbed into the bulkhead fitting under the detector body. Air is always blue. The restrictor values are clearly written on the yellow portion of each restrictor. I

Hydrogen should not be used as the carrier gas as it will change the gas mixture inside the detector body surrounding the TID Bead. With increased hydrogen and increased surface Bead temperature, the detector will act more like a FID burning the compounds and diminish its sensitivity toward amine and nitroaromatic compounds.

Air (Blue)



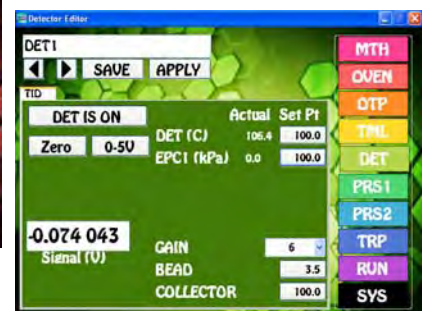
In the Companion GC's the restrictors are under the oven.



Pressure Program



Oven Page



Detector Page

## Collector Connections

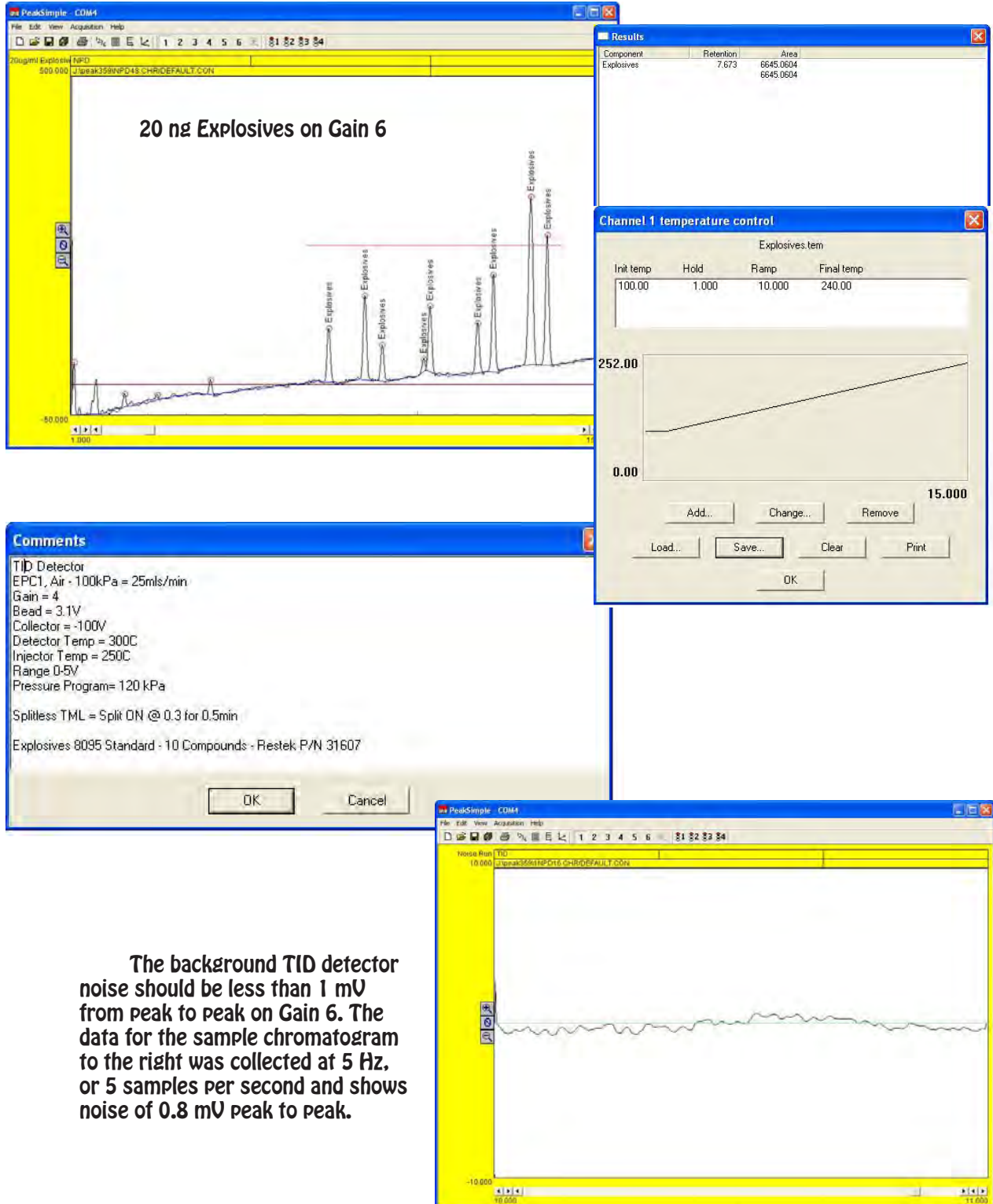
The collector has a solid metal core surrounded by a ceramic insulator. A soft graphite ferrule holds the ceramic in the detector body.

Take care not to over tighten the ferrule and crack the ceramic insulator. A spring inside the shielded collector cable slips over the solid end of the collector making a secure electrical connection.



## Expected Performance

We measure detector performance by analyzing a 20 ng Explosives standard. For our acceptance criteria, the total response should be greater than 5000 area counts on Gain 6.



The background TID detector noise should be less than 1 mV from peak to peak on Gain 6. The data for the sample chromatogram to the right was collected at 5 Hz, or 5 samples per second and shows noise of 0.8 mV peak to peak.

## Lab GC Column Oven



**Column Oven Overview** - The Column oven in the Laboratory GC System is so large that any size commercial column can easily fit inside. In some cases 2, or 3 columns can be installed. Two heated Injectors provide the entry for the sample into the Column Oven. The heated injectors can be either On-Column, or Split/Splitless, depending on the application. The Oven fan speed is automatically programmed to rev up to top speed for a Fast Cooldown, or just idle to keep the temperature in the Column Oven consistent. Our unique Soft Landing coordinates the Oven Fan, Heater Element, and Door Motor precisely to bring the Column Oven touchdown to Ready as quickly as possible. All you have to do is create an Oven Temperature Program (OTP) and the Column Oven control takes over to perform the OTP precisely, accurately, and repeatedly.

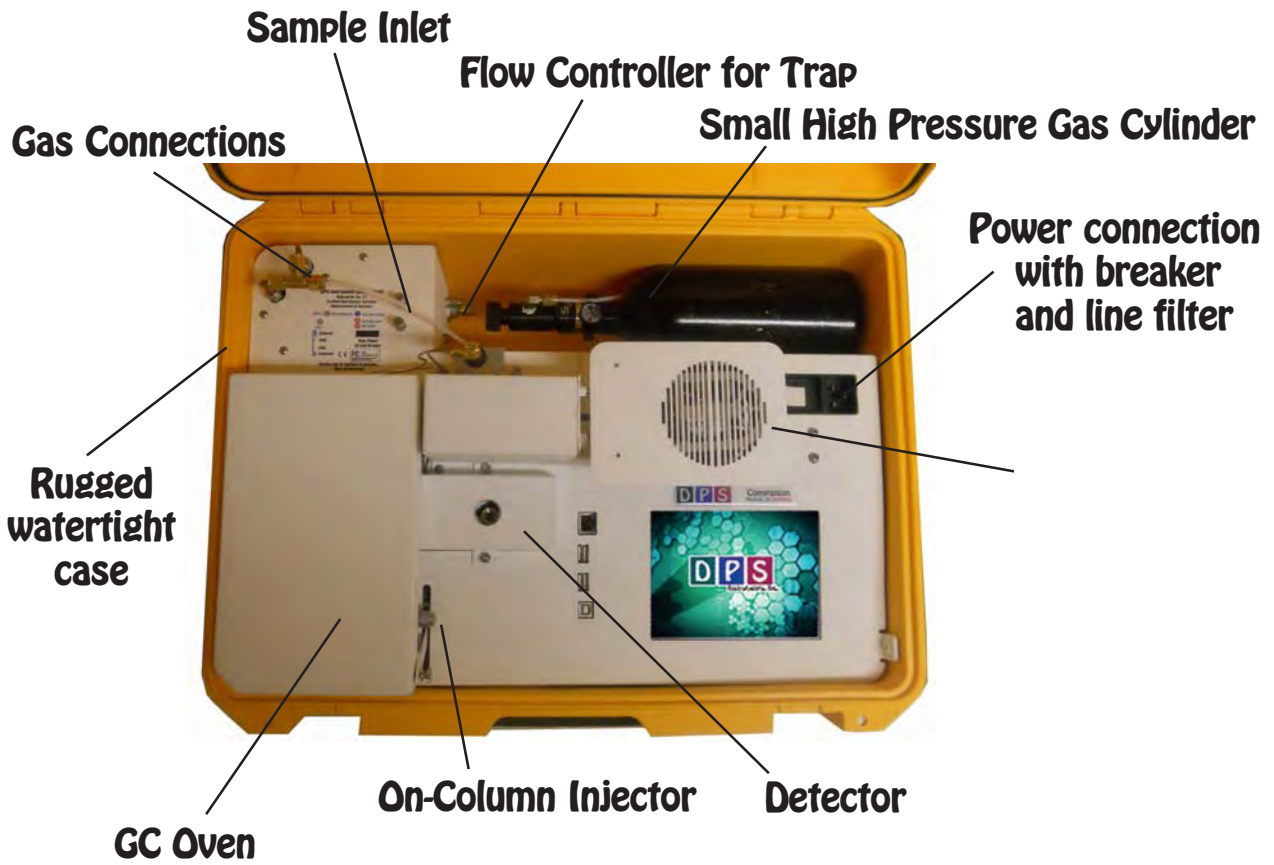
**Insulation** - We use space age compressed insulation on the walls of the Column Oven. You can literally put a torch to one side of the insulation and your bare hand on the other without feeling heat. The insulation properties of this material are exceptional, which is very important for a consistent ramp when heating up the oven. The additional benefit of our insulation is in the Cooldown process. When you fully open the Oven door to cool the GC down to the starting temperature, it is easy to blow out the hot air. However heat is also stored in the metal of the oven walls. This is a little more difficult to get rid of, but the real problem is the fiber insulation on the other side of the oven wall. Somehow this heat has to migrate out of the insulation, through the oven walls, and out into the air. In all other GC systems this takes a huge fan running at lightening speed. In our system the super efficient oven insulation does not retain very much heat at all, consequently we do not have to work as hard to get rid of the heat in the oven, which makes our Cooldown process seamless.

**Door & Damper** - The Oven door and the damper door in the rear of the oven are controlled with the same motor. As the door opens, so does the damper, or back door allowing cool room air to flow through the oven replacing the hot air inside the Column Oven. As the Column Oven approaches the Setpoint temperature the Door and Damper slowly close for tighter temperature control.

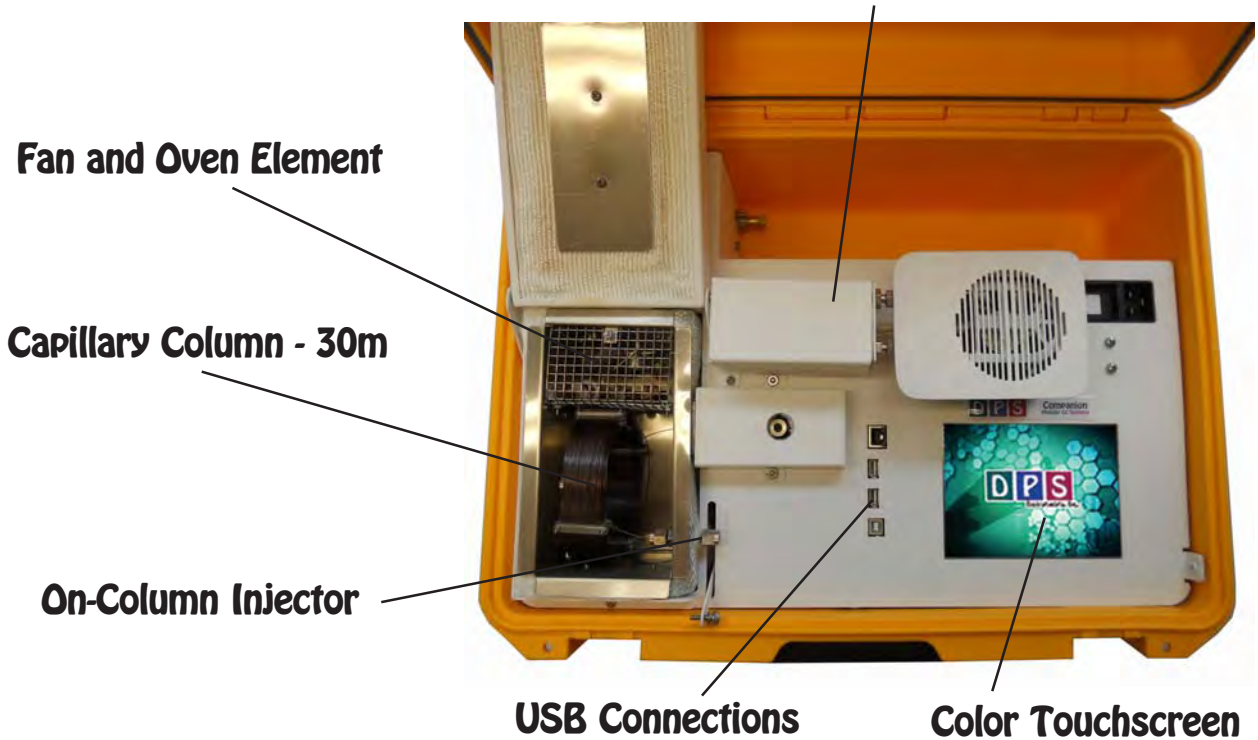
The Door and Damper are calibrated to their fully Open and Closed positions each time the GC Application is started, or enumerated on the Hardware screen. The door motor is powerful, but will not cause any harm if you get your fingers in the way. Once the system is ON, please do not try and overpower the Oven Door to open it. This could result in damage to the motor. To open the door simply depress the latch and open the Door. Once the door is open, the Interlock switch will be triggered and the Oven Element will no longer heat. To get back into action, close the door until the latch clicks into place.

**Injectors** - A single heated On-Column Injector comes standard with each GC system. A second can be added and one, or both can be upgraded to Split/Splitless Injectors. In our GC systems each Injector can be stabilized at a tightly controlled temperature for optimal injections and results. An On-Column Injection is the best of all worlds. There can not be a tighter band, resulting in sharper peaks, than placing the sample directly inside the column. There is never any discrimination between low and higher boiling compounds and the column can start out at the Initial Temperature of the OTP. The relative thin walls of our Column Oven allow the syringe to be inside the Column Oven when the sample is injected. Of course, if you want the means of diluting a sample, the Split/Splitless Injector is called for. The flow of our Split Injector is calibrated through a needle valve and the Septum Purge is always consistent no matter what the column pressure.

## Companion 1 GC Column Oven



## Sample Valve and Valve Oven



**Column Oven Overview** - The Column oven in the Companion GC System is large enough for 1 or 2 commercial metal capillary columns, or tightly coiled packed columns. Two heated Injectors provide the entry for the sample into the Column Oven. There can be either 1 or 2 cool On-Column Injectors, or 1 cool Split/Splitless Injector, depending on the application. The Oven fan speed is automatically programmed to rev up to top speed for a Fast Cooldown, or just idle to keep the temperature in the Column Oven consistent. Our unique Soft Landing coordinates the Oven Fan, Heater Element, and Door Motor precisely to bring the Column Oven touchdown to Ready as quickly as possible. All you have to do is create an Oven Temperature Program (OTP) and the Column Oven control takes over to perform the OTP precisely, accurately, and repeatedly.

**Insulation** - We use conventional fiber blanket insulation on the walls of the Column Oven. The insulation properties of this material are very good, with only 2cm of insulation we are assured of a consistent temperature ramp to a maximum of 325° C. The additional benefit of our small oven is in the Cooldown process. We use the same fan motor as in our Lab GC to blow out the hot air, which makes our Cooldown process seamless.

**Door** - The Oven door is controlled with the same motor as in our Lab GC's. As the door opens the fan revs up to blow out the hot air. When the Column Oven approaches the Setpoint temperature the Door slowly closes for tighter temperature control.

The Door is calibrated to the fully Open and Closed positions each time the GC Application is started, or enumerated on the Hardware screen. The door motor is powerful, but will not cause any harm if you get your fingers in the way. Once the system is ON, please do not try and overpower the Oven Door to open it. This could result in damage to the motor. To open the door simply unscrew the lift arm knurled nut. Once the door is open you can change, or inspect the column.. To get back into action, close the door and replace the knurled nut.

### **Injectors -**

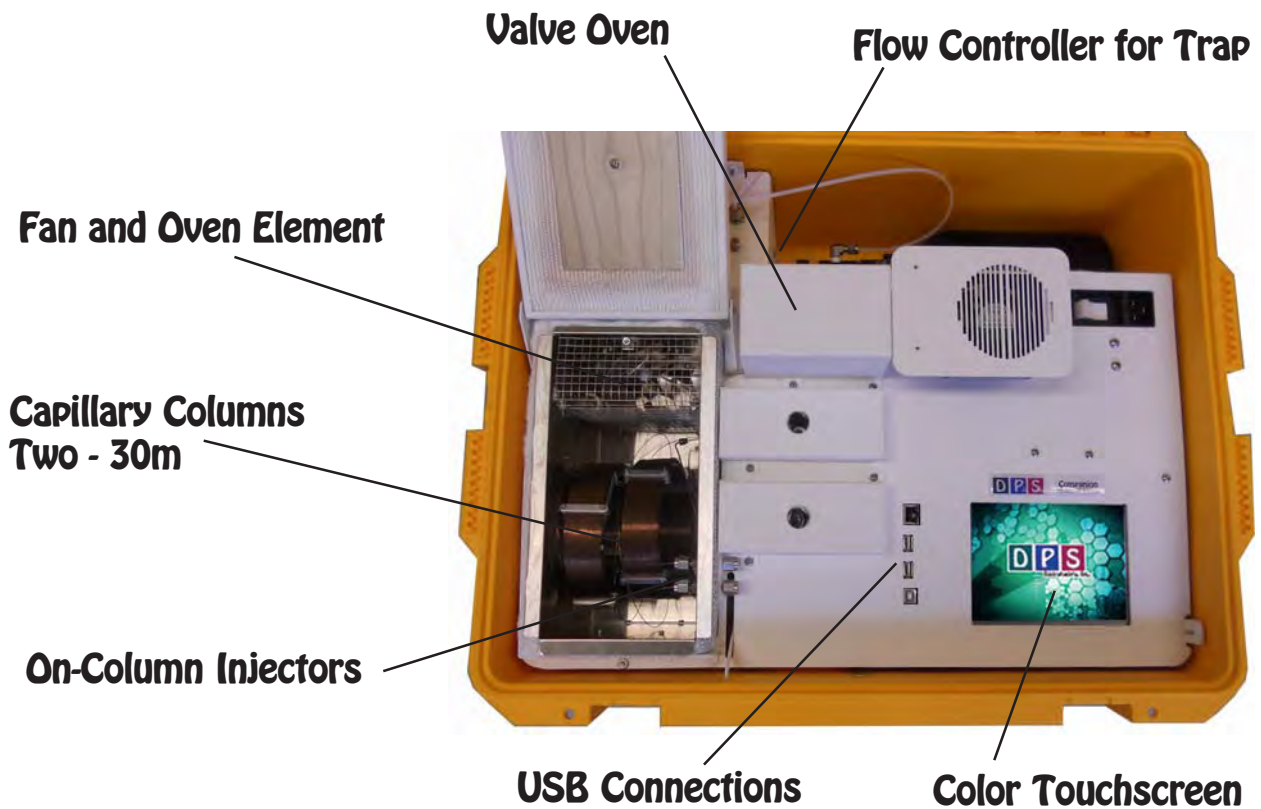
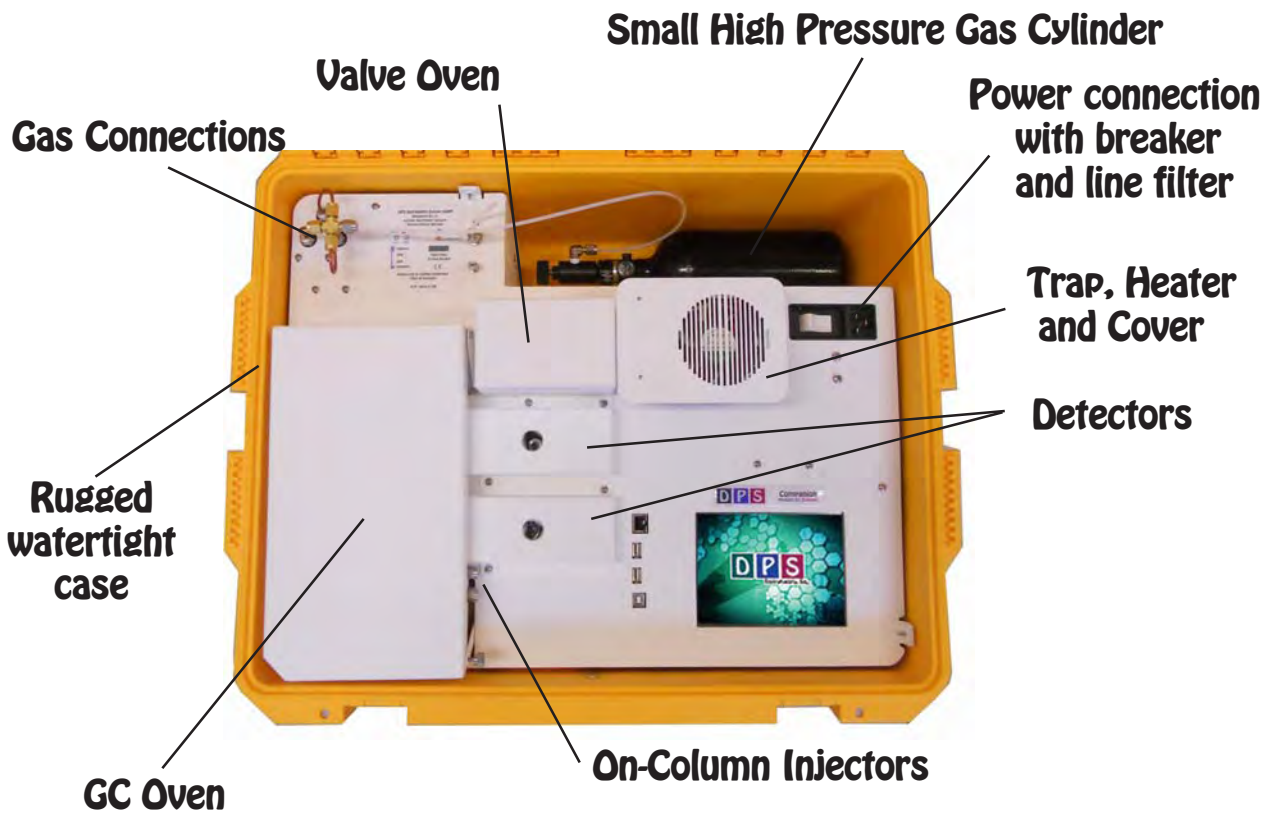
**On-Column** - A single cool Injector comes standard with each GC system. A second one can be added for a second column. An On-Column Injection is the best of all worlds. There can not be a tighter band, resulting in sharper peaks, than placing the sample directly inside the column. There is never any discrimination between low and higher boiling compounds and the column can start out at the Initial Temperature of the OTP. The relative thin walls of our Column Oven allow the syringe to be inside the Column Oven when the sample is injected.

**Heated On-Column** - We can also add an optional heater to the injectors body for heated On-Column injections. If there are two injectors, they will both be heated to the same temperature.

**Cool Split/Splitless** - One injector can be upgraded to a cool Split/Splitless Injector to dilute gas samples. The Split Flow of this Injector is controlled by a needle valve.

**On-Column Split/Splitless** - We do not have enough room for a conventional Split/Splitless injector with injector liner, but we can use a Guard Column as the injection volume and then split the sample between the Analytical Column and a line to a Split Vent for a Heated Split/Splitless Injection. Even though the injector is Heated, the injection temperature still becomes the initial temperature of the guard column inside Column Oven. The Split Flow of this Injector is controlled by a needle valve.

## Companion 2 GC Column Oven





**Column Oven Overview** - The Column oven in the Companion 2 GC System is larger than the Companion 1 and is big enough for 1 or 2 commercial metal capillary columns, or tightly coiled packed columns. Two heated Injectors provide the entry for the sample into the Column Oven. There can be either 1 or 2 cool On-Column Injectors, or 1 cool Split/Splitless Injector, depending on the application. The Oven fan speed is automatically programmed to rev up to top speed for a Fast Cooldown, or just idle to keep the temperature in the Column Oven consistent. Our unique Soft Landing coordinates the Oven Fan, Heater Element, and Door Motor precisely to bring the Column Oven touchdown to Ready as quickly as possible. All you have to do is create an Oven Temperature Program (OTP) and the Column Oven control takes over to perform the OTP precisely, accurately, and repeatedly.

**Insulation** - We use conventional fiber blanket insulation on the walls of the Column Oven. The insulation properties of this material are very good, with only 2cm of insulation we are assured of a consistent temperature ramp to a maximum of 325° C. The additional benefit of our small oven is in the Cooldown process. We use the same fan motor as in our Lab GC to blow out the hot air, which makes our Cooldown process seamless.

**Door** - The Oven door is controlled with the same motor as in our Lab GC's. As the door opens the fan revs up to blow out the hot air. When the Column Oven approaches the Setpoint temperature the Door slowly closes for tighter temperature control.

The Door is calibrated to the fully Open and Closed positions each time the GC Application is started, or enumerated on the Hardware screen. The door motor is powerful, but will not cause any harm if you get your fingers in the way. Once the system is ON, please do not try and overpower the Oven Door to open it. This could result in damage to the motor. To open the door simply unscrew the lift arm knurled nut. Once the door is open you can change, or inspect the column.. To get back into action, close the door and replace the knurled nut.

### **Injectors -**

**On-Column** - A single cool Injector comes standard with each GC system. A second one can be added for a second column. An On-Column Injection is the best of all worlds. There can not be a tighter band, resulting in sharper peaks, than placing the sample directly inside the column. There is never any discrimination between low and higher boiling compounds and the column can start out at the Initial Temperature of the OTP. The relative thin walls of our Column Oven allow the syringe to be inside the Column Oven when the sample is injected.

**Heated On-Column** - We can also add an optional heater to the injectors body for heated On-Column injections. If there are two injectors, they will both be heated to the same temperature.

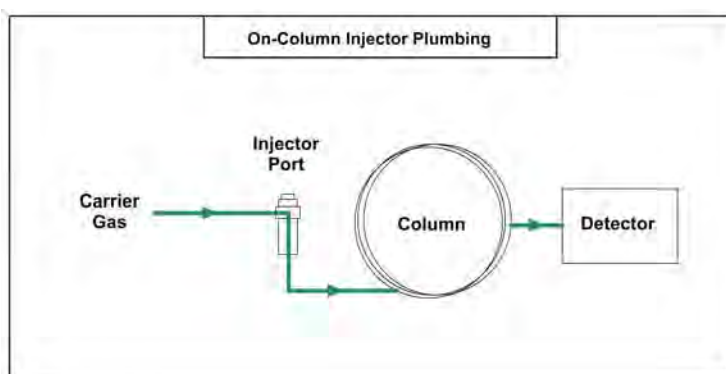
**Cool Split/Splitless** - One injector can be upgraded to a cool Split/Splitless Injector to dilute gas samples. The Split Flow of this Injector is controlled by a needle valve.

**On-Column Split/Splitless** - We do not have enough room for a conventional Split/Splitless injector with injector liner, but we can use a Guard Column as the injection volume and then split the sample between the Analytical Column and a line to a Split Vent for a Heated Split/Splitless Injection. Even though the injector is Heated, the injection temperature still becomes the initial temperature of the guard column inside Column Oven. The Split Flow of this Injector is controlled by a needle valve.

## On-Column Injector

**Theory of Operation** - An On-Column Injection is the best of all worlds. There can not be a tighter band, resulting in sharper peaks, than placing the sample directly inside the column. There is never any discrimination between low and higher boiling compounds as the column can start out at the Initial Temperature of the OTP. The relative thin walls of our Column Oven allow the tip of the needle of the syringe to be inside the Column Oven when the sample is injected. Carrier gas traveling through the injector pushes the compounds through the column towards the detector. On-Column injection is best suited for mega bore, 0.53mm or larger columns. If you are using 0.32mm or smaller columns, you can still use On-Column injection with a megabore guard column and union to the smaller diameter column. You also need to cut back on the volume of sample injected to match the loading capacity of the column.

**Plumbing** - The plumbing of the On-Column injector includes the Injector Body and injector Insert. The Injector Insert is used to help guide the syringe needle into the column.



**Installing the Column** - The injector insert guides the needle of the syringe into the column. It is a snug fit. You may have to insert the needle more than once into the injector, or twist the syringe to get the needle inside the column.



Remove the column by loosening the nut.



The column should be positioned near the back of the Injector Insert to give the syringe needle the best chance of entering the column.

While holding the column in position tighten the nut just until you can not move the column with your fingers. The septum is in the nut outside the oven wall.



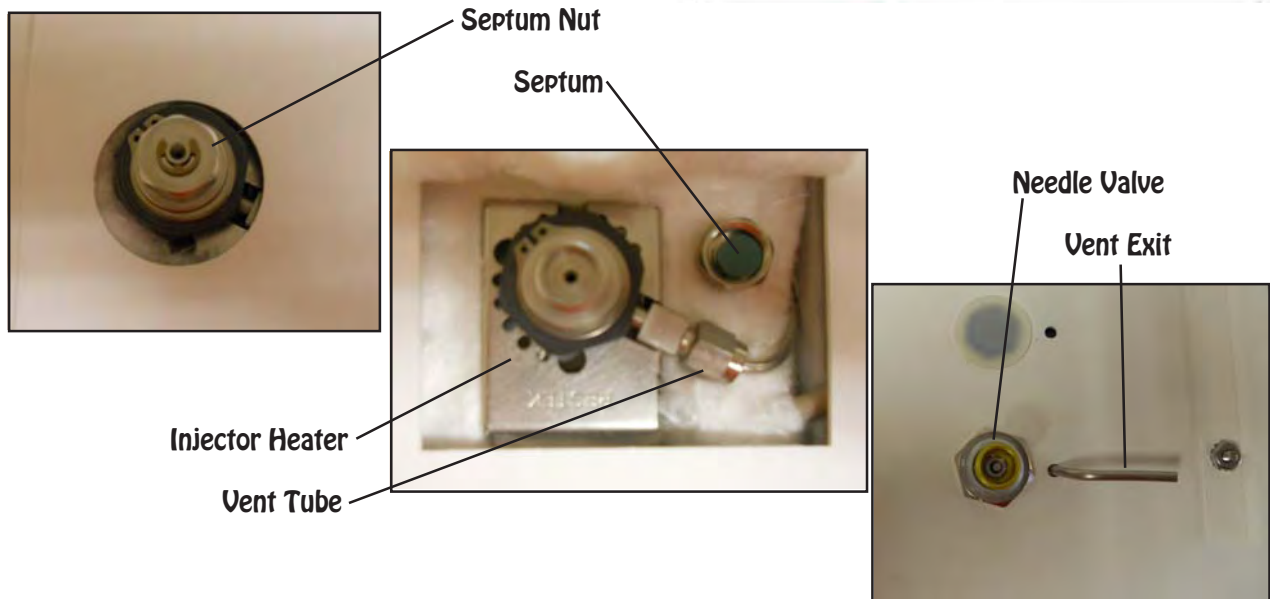
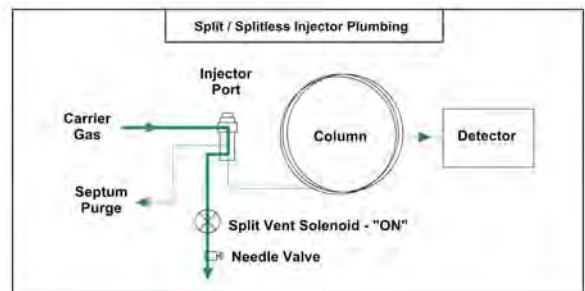
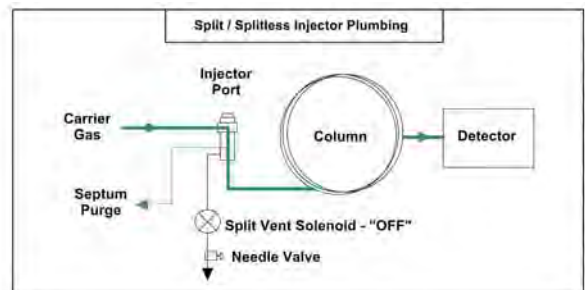
## Split/Splitless Injector

**Theory of Operation** - A sample is injected through a septum into the hot injector body, where it is vaporized. An removable injector insert helps mix and focus the sample being vaporized. Carrier gas traveling through the insert deposits the sample on the head of the column, which is usually much cooler than the injector, where the sample condenses. The remaining sample is then swept out of the injector through the vent. The Split flow is calibrated through a needle valve. The Septum Purge is set at a very low flow to constantly bleed off a little carrier gas to keep the injector clean. The Septum Purge is always consistent no matter what the column pressure. Care should be taken to understand the dynamics inside the injector body. The temperature of the injector, boiling point of the solvent, type of insert, and class of compounds to be analyzed all need to be taken into consideration. There is often discrimination between low boiling and high boiling compounds loading on the column. The discrimination can be used as an advantage to select either low, or high boiling compounds, or it can be a problem if you need to see both classes equally. By incrementally adjusting the injector temperature, loading time, and sweep flow you can fine tune the injector for your analysis.

**Plumbing** - The plumbing of the Split/Splitless injector includes the Injector Body, Septum Purge, Split Vent Solenoid and the Split Flow Control Valve.

In the Split mode, the Split Vent is open during the injection and a portion of the sample is vented out of the GC. The Split mode is for concentrated samples, where the injector is used as a dilution device.

In the Splitless mode the carrier gas continues to flow onto the column during the injection and the excess solvent is vented after the sample loads onto the column.



**Changing the Injector Liner** - Use the Injector Tool to remove the large injector retaining nut. The septum nut does not have to be removed first and the tool will fit through the round hole on the top of the GC, so you don't have to remove any covers to change the Injector Liner.



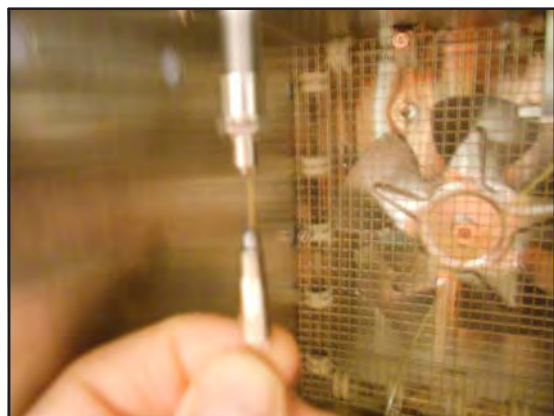
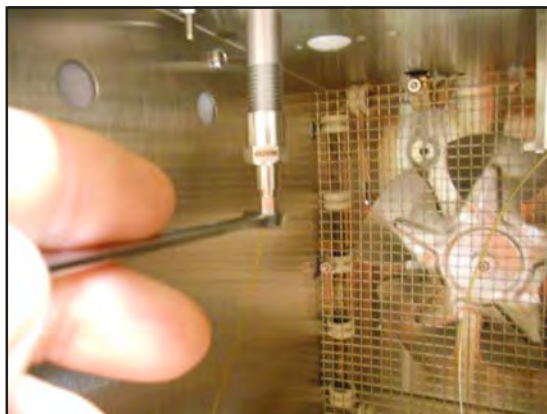
**Injector Nut** - The large O-ring seals the top of the injector liner. The 2 small O-rings seal the carrier and septum purge gas inlets to the injector body. The 2 pins are used to orient the Injector Nut in the injector body.

**Injector Liner** - Remove the Injector Liner. Be careful, it can be very hot!. In this picture you can see the O-ring on the top of the Injector Liner. Once the Injector Liner is cleaned, or changed, follow the reverse of these steps to replace the liner. Tighten the nut using the tool just until it is snug.

There are many styles of liners available on the market. We use the same size liners as found in Agilent GC's.

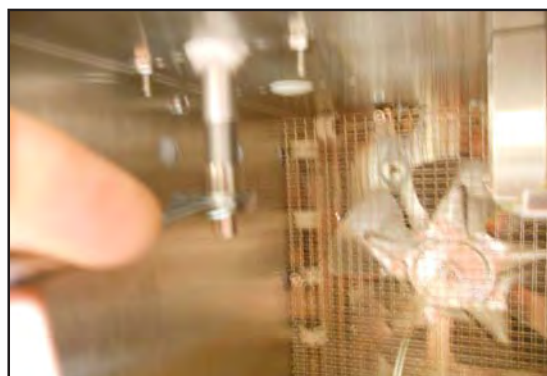


**Replacing the Column** - A 1/16" nut and ferrule secure the column inside the injector.



Feed the column up through the liner seal into the injector liner. Depending on the type of liner you have, position can be very different. If the bottom of the liner is shaped like a gooseneck, push the column up until you feel it hit the gooseneck and then pull it back 0.5 cm before tightening the nut and ferrule. We commonly use this type of injector liner and positioning for both the Splitless and Split modes of operation.

**Liner Seal** - To change the liner seal use a 1/2" wrench to loosen the seal retaining nut. The seal is fragile, do not overtighten, just tighten until it is snug.



**Adjusting the Split Flow** - The flow controller is located inside the detector compartment of the GC. We use a needle valve to adjust the split flow. The outer knob turns the Needle Valve ON and OFF. Keep the Needle Valve in the ON position. Use a slotted screw driver to adjust the flow with the Split Vent Solenoid ON. With an external flow meter, or bubble meter, measure the flow exiting the injector. A convenient fitting is located next to the Needle Valve to monitor the flow.



## Air Concentrator for Series 600 GC's

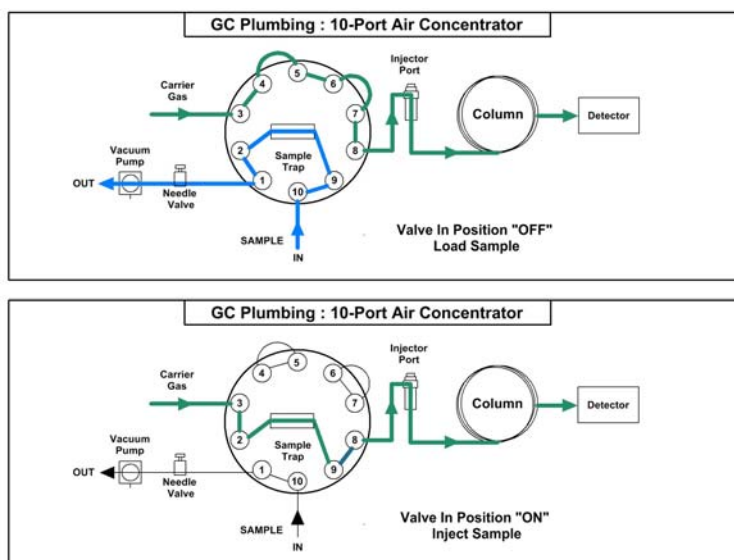


**Air Concentrator Overview** - The air concentrators for Series 600 GC's are built right in to the Electronics Module to provide both a compact sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The valve and sample lines are heated creating a inert sample path. The sample trap is plumbed in a true backflush fashion where the sample is loaded in one direction and desorbed in the opposite direction. The sample trap also can be equipped with a variety of packing materials to achieve the best concentration of the compounds being analyzed. The sample is loaded with the built-in vacuum pump and regulated with a variable flow controller for consistent sample trapping. The entire sequence of the Air Sample Concentrator is automated through the Timeline of the DPS Control Software for the analysis of one sample, or the system can be set up to run unattended 24/7, collecting and analyzing samples every hour, or so.

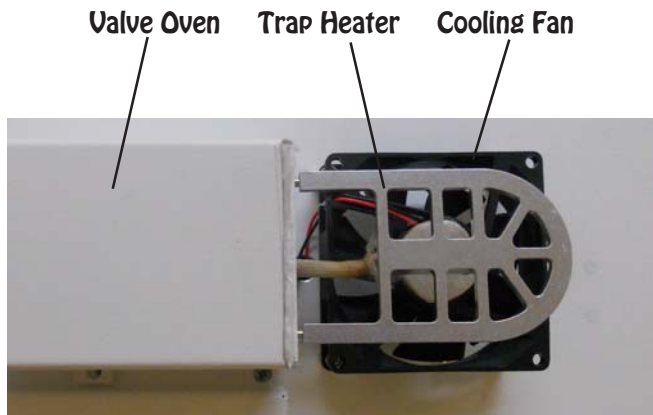
**Plumbing Diagram** - The sample is loaded onto the trap with the valve is in the **OFF** position. This is the Home position of the valve. When the software boots up the valve is automatically rotated to the home, or **OFF** position. The vacuum pump draws the sample from the inlet through the Trap and then to the flow controller and pump. With this configuration the flow controller and vacuum pump are down stream from the Trap to limit any possible cross contamination between samples. The sample valve and most of the sample path are heated. In the **OFF** position the carrier gas flows through the valve directly to the injector port and through the column.

The sample is injected by rotating the valve to the **ON** position and heating the sample trap. The carrier gas sweeps the components from the trap to the analytical column. With the vacuum pump **OFF** there is no flow through the other side of the valve.

In either the **OFF**, or **ON** position a sample can be injected manually through the injector port directly onto the column.

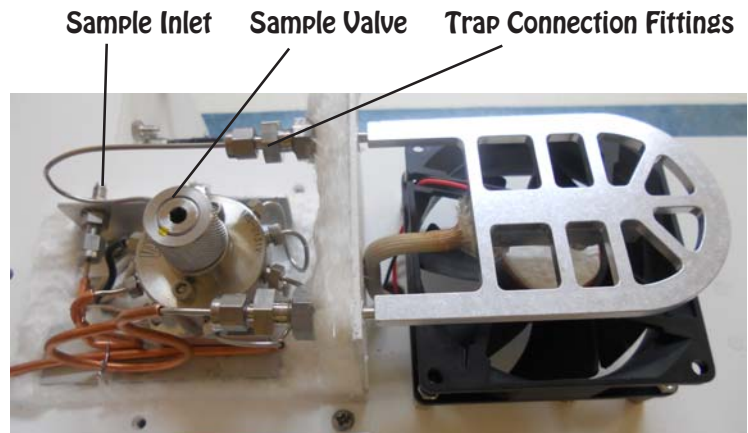


**Sample Trap Cover-** The sample trap may get very hot. To protect the user from potentially getting burned, a cover is installed over the sample trap. To remove the trap cover, loosen the securing nuts with a 5/16" wrench.



**Sample Trap & Heater** - After removing the Trap Cover the Cathedral Trap Heater is revealed. The innovative design of this trap heater radiates heat to the trap uniformly in all directions. The low mass design of the heater also allows the trap to cool quickly with the Trap Fan. The Trap material is placed inside a 1/8" stainless steel tube. The Trap secures tightly inside a groove on the underside of the Cathedral Trap Heater. Two fittings inside the Valve Oven connect the Trap to the Sample Valve.

**Sample Valve** - The Sample Valve is located in the Heated Valve Oven. Remove the 2 screws securing the Valve Oven Cover to access the Sample Valve. Since the inlet and outlet of the Trap are on the same side there is minimal distance between the Trap and Sample Valve. The entire sample path is heated to keep the lines at the same temperature as the sample valve.



**Cooling Fan** - The Cooling Fan is located directly beneath the Trap. The Cooling Fan is normally ON to keep the trap as cool as possible. The fan uses ambient air to cool the trap. There is no setpoint for Trap Cool. The Cooling Fan is turned OFF when the Trap is heating.

Trap in Heater Groove

**Flow Controller** - The flow controller is located inside the tank compartment of the GC. We use an needle valve to adjust the flow through the trap. To adjust the flow, connect an external flow meter, or bubble meter to measure the flow exiting the trap. Rotate the valve knob to adjust the flow. A convenient fitting is located next to the Needle Valve to connect the meter.



Sample Inlet      Flow Controller

**Sample Inlet** - The Sample Inlet is located on the Valve Oven. A Sample Line can be connected to the Sample Inlet. You can use up to 20' of 1/16" PEEK Tubing to conveniently collect the sample from anywhere around the GC. A Tedlar bag containing a gas standard can also be connected to the Sample Inlet. Or, a syringe can be inserted into the Sample Inlet to deposit a liquid standard.

**Syringe Injection to Trap** - The syringe needle is far inside a heated Sample Inlet line, so the liquid sample is vaporized inside the Valve Oven and transferred to the trap during the sampling process with the vacuum pump running. This is a very convenient method of injecting liquid standards and turning them to gas to trap. All of the sample lines leading to the trap are heated to ensure complete transfer of compounds.



Flow Controller      Vacuum Pump

**Vacuum Pump** - The Vacuum Pump is mounted inside the instrument. The inlet connects to the Flow Controller and the Outlet to the bulkhead fitting next to it. We place the Flow Controller and Vacuum Pump at the end of the sample path, so that they can not contaminate the sample path, or introduce carry over.



## Air Concentrator for Companion GC's



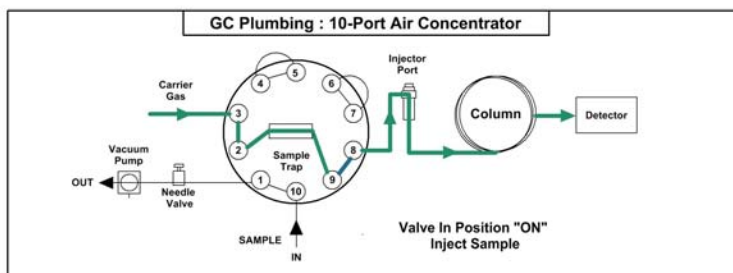
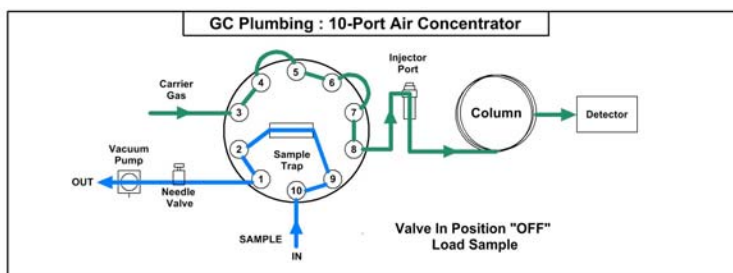
**Air Concentrator Overview** - The air concentrators for Companion GC's are built right in to provide both a compact portable sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The valve and sample lines are heated creating a inert sample path. The sample trap is plumbed in a true backflush fashion where the sample is loaded in one direction and desorbed in the opposite direction. The sample trap also can be equipped with a variety of packing materials to achieve the best concentration of the compounds being analyzed. The sample is loaded with the built-in vacuum pump and regulated with a variable flow controller for consistent

sample trapping. The entire sequence of the Air Sample Concentrator is automated through the Timeline of the DPS Control Software for the analysis of one sample, or the system can be set up to run unattended 24/7, collecting and analyzing samples every hour, or so.

**Plumbing Diagram** - The sample is loaded onto the trap with the valve is in the OFF position. This is the Home position of the valve. When the software boots up the valve is automatically rotated to the home, or OFF position. The vacuum pump draws the sample from the inlet through the Trap and then to the flow controller and pump. With this configuration the flow controller and vacuum pump are down stream from the Trap to limit any possible cross contamination between samples. The sample valve the entire sample path are heated. In the OFF position the carrier gas flows through the valve directly to the injector port and through the column.

The sample is injected by rotating the valve to the ON position and heating the sample trap. The carrier gas sweeps the components from the trap to the analytical column. With the vacuum pump OFF there is no flow through the other side of the valve.

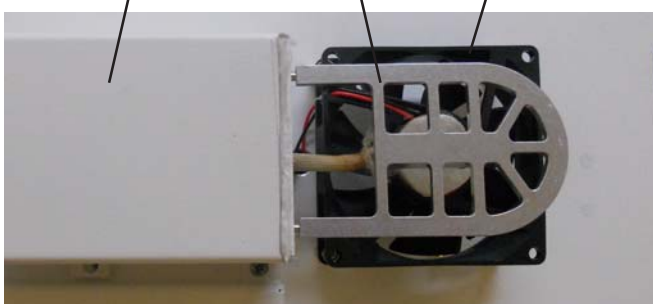
In either the OFF, or ON position a sample can be injected manually through the injector port directly onto the column.



**Sample Trap Cover-** The sample trap may get very hot. To protect the user from potentially getting burned, a cover is installed over the sample trap. To remove the trap cover, loosen the securing nuts with a 5/16" wrench.



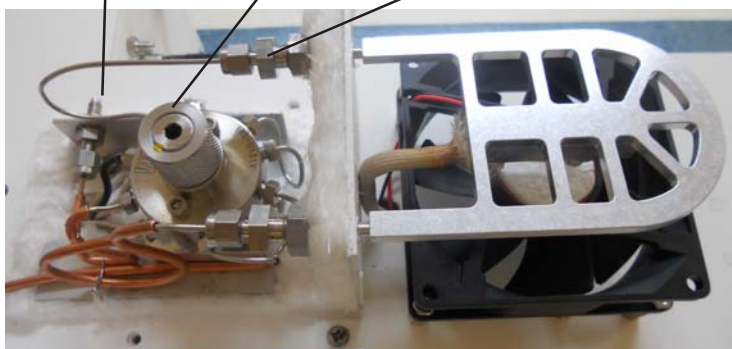
Valve Oven    Trap Heater    Cooling Fan



**Sample Trap & Heater** - After removing the Trap Cover the Cathedral Trap Heater is revealed. The innovative design of this trap heater radiates heat to the trap uniformly in all directions. The low mass design of the heater also allows the trap to cool quickly with the Trap Fan. The Trap material is placed inside a 1/8" stainless steel tube. The Trap secures tightly inside a groove on the underside of the Cathedral Trap Heater. Two fittings inside the Valve Oven connect the Trap to the Sample Valve.

**Sample Valve** - The Sample Valve is located in the Heated Valve Oven. Remove the 2 screws securing the Valve Oven Cover to access the Sample Valve. Since the inlet and outlet of the Trap are on the same side there is minimal distance between the Trap and Sample Valve. The entire sample path is heated to keep the lines at the same temperature as the sample valve.

Sample Inlet    Sample Valve    Trap Connection Fittings



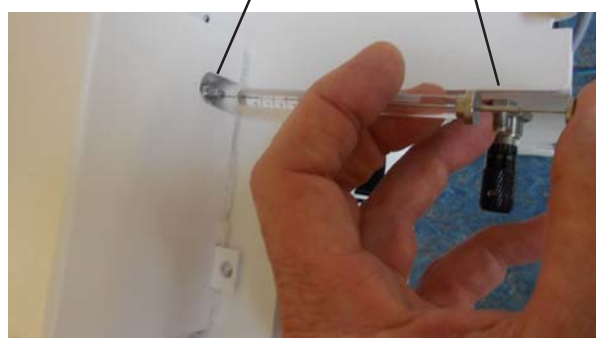
**Cooling Fan** - The Cooling Fan is located directly beneath the Trap. The Cooling Fan is normally ON to keep the trap as cool as possible. The fan uses ambient air to cool the trap. There is no setpoint for Trap Cool. The Cooling Fan is turned OFF when the Trap is heating.

Trap in Heater Groove

**Flow Controller** - The flow controller is located inside the tank compartment of the GC. We use an needle valve to adjust the flow through the trap. To adjust the flow, connect an external flow meter, or bubble meter to measure the flow exiting the trap. Rotate the valve knob to adjust the flow. A convenient fitting is located next to the Needle Valve to connect the meter.



Sample Inlet      Flow Controller



**Sample Inlet** - The Sample Inlet is located behind the Valve Oven. A Sample Line can be connected to the Sample Inlet. You can use up to 20' of 1/16" PEEK Tubing to conveniently collect the sample from anywhere around the GC. A Tedlar bag containing a gas standard can also be connected to the Sample Inlet. Or, a syringe can be inserted into the Sample Inlet to deposit a liquid standard.

**Syringe Injection to Trap** - The syringe needle is far inside a heated Sample Inlet line, so the liquid sample is vaporized inside the Valve Oven and transferred to the trap during the sampling process with the vacuum pump running. This is a very convenient method of injecting liquid standards and turning them to gas to trap. All of the sample lines leading to the trap are heated to ensure complete transfer of compounds.



Flow Controller      Vacuum Pump

**Vacuum Pump** - The Vacuum Pump is mounted inside the instrument. The inlet connects to the Flow Controller and the Outlet to the bulkhead fitting next to it. We place the Flow Controller and Vacuum Pump at the end of the sample path, so that they can not contaminate the sample path, or introduce carry over.

## Setting up a Method - The Air

Concentrator is controlled by the DPS GC Control Software. On the Method Page 4 files are necessary to run the automated Method.

**OTP - Oven Temperature Program**

**Timeline** - Is the sequence of events that control the Vacuum Pump, Sample Valve, Cooling Fan, and Trap Desorption of the Air Concentrator.

**Detector** - Detector Parameters

**Carrier1** - Pressure Program for the carrier gas.



**Oven Temperature Program**



**Timeline**



**Detector Parameters**



**Carrier Pressure Program**

**Timeline** - Is the sequence of events that control the Vacuum Pump, Sample Valve, Cooling Fan, and Trap Desorption of the Air Concentrator.

1. In the example to the right, the Vacuum Pump starts at time zero and loads the sample for 5 min.
2. Trap starts to heat at 5 min. There is a 2 min delay until the Valve rotates and the sample is injected, which allows the Trap to Pre-heat.
3. The Sample Valve rotates at 7 min to the ON position to inject the sample onto the column. This also lasts for 4 min.



4. Whenever the Trap is heating we turn the Trap Cooling fan off. They are controlled through the same circuit so this is always the case.
5. With a FID detector the Desorption of a trap sometimes blows out the flame. We can turn the FID Igniter ON after the water comes off the Trap to automatically relight the flame. The Duration of this event is only 6 seconds.

Any of the Start Times, Actions, or Duration Times can be easily changed by pressing on the desired cell and changing the value. New sequence events can be added by Inserting a new line and filling it out. Once you have completed any change, press the Save button.

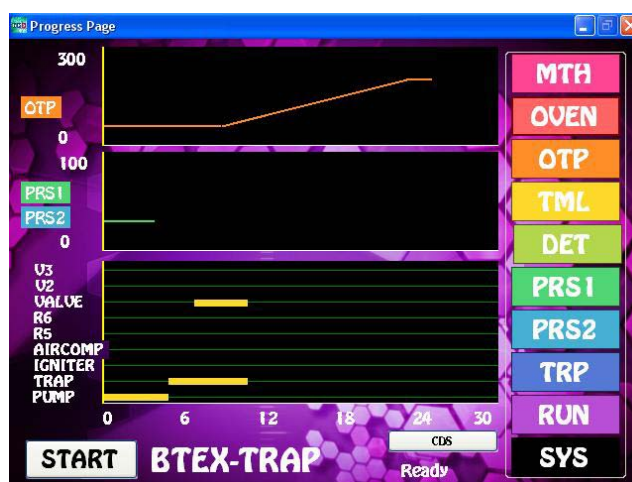
**Run Page** - Is the graphical presentation of the Method.

The top graph is the Oven Temperature Program.

The Middle graph is the Carrier Pressure Program.

The Bottom Chart is the Timeline. Note that the Vacuum Pump turns ON at 0 min for 5 min.

The START button initiates the sequence. A vertical yellow line travels from the left during the run following the run time.



**Trap Temperature** - Set the Trap Desorb Temperature on the Oven Page by entering the desired temperature in the Set Point for the Inj1 Temp. The Actual Temperature is the current Trap Temperature. Make sure that the Trap is cool before starting the next sequence to load the sample.

**Valve Temperature** - Set the Sample Valve temperature on the same page using the Valve Set Point.

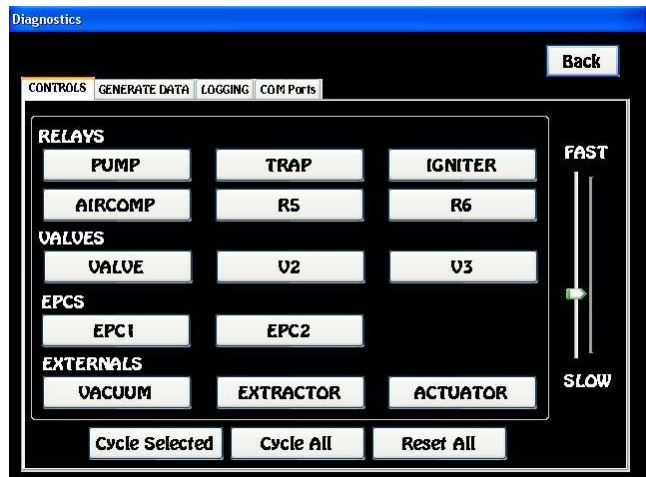


**Diagnostics** - By selecting the Systems page and then the Diagnostics Page you can manually turn ON, or OFF any of the devices.

For example, pressing the PUMP button will turn ON the Vacuum Pump. The button will highlight to Blue.

You can rotate the Valve by pressing the Valve button.

Heat the Trap with the Trap button.



The actions are handy to check if a device is working properly, or bake out a trap for an extended period of time. These are the same sequence events that are automated on the Timeline page.

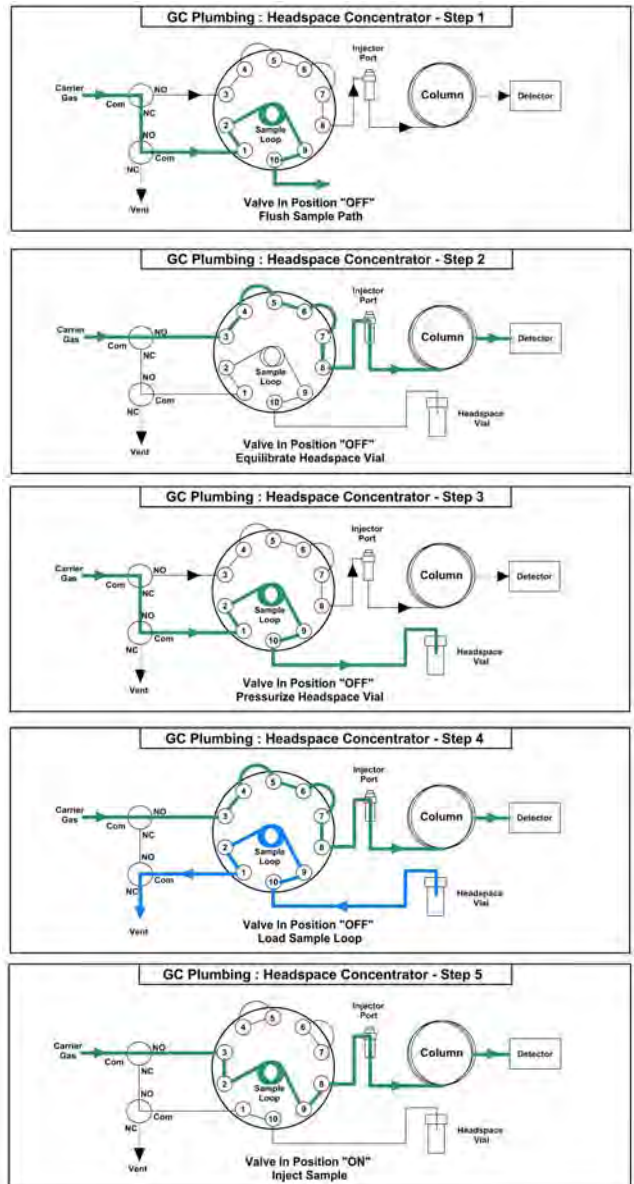
## Headspace Concentrator for Series 600 GC's



**Headspace Concentrator Overview** - The Headspace Concentrator for Series 600 GC's are built right in to the Electronics Module to provide both a compact sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The valve and sample lines are heated in a separate Valve Oven creating a inert sample path. The Sample Vials are also heated and then consistently Pressurized before loading the Sample Loop. A fixed Sample Loop ensures reproducible sampling and the sample lines are Flushed between analyses to limit any cross over contamination. The entire sequence of the Headspace Concentrator is automated through the Timeline sequence of the DPS GC Control Software for the analysis of one sample at a time.

**Plumbing Diagram** - The combination of a 10-port Gas Sampling Valve and two 3-way solenoids are the hardware needed for a complete Headspace analysis. The sequence is started with the Sample Valve in the OFF position. This is the Home position of the valve. When the software boots up the valve is automatically rotated to the home, or OFF position. During this 1st step the carrier gas is diverted to Flush out the Sample Lines. After the Flushing stops the Sample Probe is then manually inserted into the Headspace Vial. During the 2nd step the carrier gas flows to the analytical column and the Headspace Vial is heated by the Vial Heater and allowed to equilibrate. During the 3rd step the Headspace Vial is pressurized to the same pressure as the carrier gas for a few seconds. In the 4th step the sample is loaded onto the Sample Loop by releasing the pressure in the headspace vial. In the 5th step the Sample Valve is rotated to the ON position and the carrier gas sweeps the components from the Sample Loop onto the analytical column.

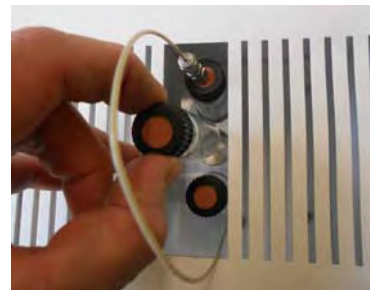
In either the OFF, or ON position a sample can be injected manually through the injector port directly onto the column.





**Multi-Vial Heater** - With the Electronics Module Cover removed, the Multi-Vial Holder, Valve Oven, and Detector Ovens are visible. The Multi-Vial Holder maintains the Headspace Vials at a constant temperature. While one vial is being analyzed, 2 more can be preheated and equilibrated. The Vial Heater is right next to the Heated Valve Oven to keep the sample path short.

**Changing Vials** - The Vials can be changed through the opening in the lid without removing the Electronics Module cover.



**Headspace Sample Probe** - The transfer line of the Headspace Probe is a low dead volume capillary tube that is coated on the inside with an inert material to prevent the sample components from adhering to the tube. The narrow diameter of the tube ensures a clean puncture of the headspace septum and a low possibility of leakage. The fitting holds the transfer line tightly, so that the penetration depth is always consistent.

**Sample Loop, Valve & Heater** - After removing the Valve Oven Cover by loosening the 2 securing screws, the Sample Loop, Valve and Valve Heater are exposed. The fixed sample loop is made from cleaned and deactivated tubing. The Sample Loop can be easily changed to vary the volume of sample injected. The 10-port Gas Sample Valve is heated to a stable temperature to prevent any compounds from sticking on their way to the Injector Port and Analytical Column.





## Headspace Concentrator for Companion GC's

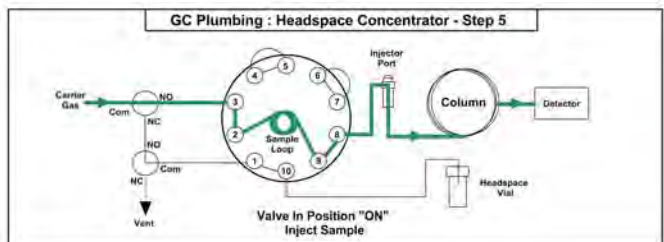
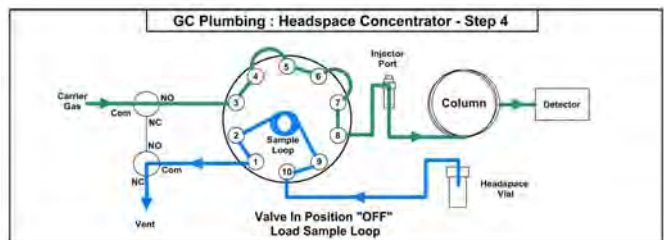
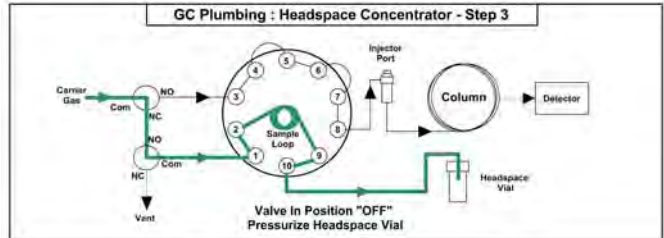
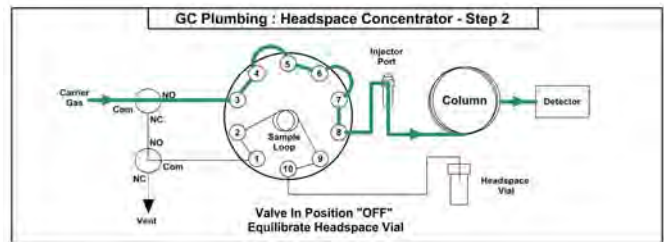
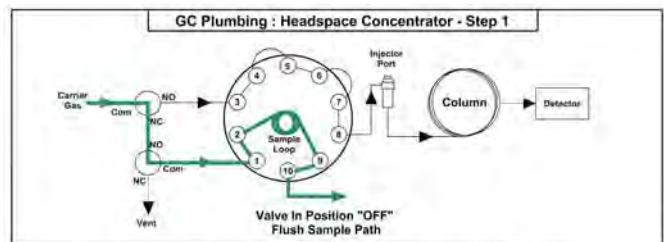


Headspace Concentrator is automated through the Timeline sequence of the DPS GC Control Software for the analysis of one sample at a time.

**Plumbing Diagram** - The combination of a 10-port Gas Sampling Valve and two 3-way solenoids are the hardware needed for a complete Headspace analysis. The sequence is started with the Sample Valve in the OFF position. This is the Home position of the valve. When the software boots up the valve is automatically rotated to the home, or OFF position. During this 1st sequence the carrier gas is diverted to Flush out the Sample Lines. After the Flushing stops the Sample Probe is then inserted into the Headspace Vial. During the 2nd step the carrier gas flows to the analytical column and the Headspace Vial is heated by the Vial Heater and allowed to equilibrate. During the 3rd step the Headspace Vial is pressurized to the same pressure as the carrier gas for a few seconds. In the 4th step the sample is loaded onto the Sample Loop by releasing the pressure in the headspace vial. In the 5th step the Sample Valve is rotated to the ON position and the carrier gas sweeps the components from the Sample Loop onto the analytical column.

In either the OFF, or ON position a sample can be injected manually through the injector port directly onto the column.

**Headspace Concentrator Overview** - The Headspace Concentrator for Companion GC's are built right in to provide both a compact portable sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The valve and sample lines are heated creating a inert sample path. The Sample Vial is heated and then consistently Pressurized before loading the Sample Loop. A fixed Sample Loop ensures reproducible sampling and the sample lines are Flushed between analyses to limit any cross over contamination. The entire sequence of the

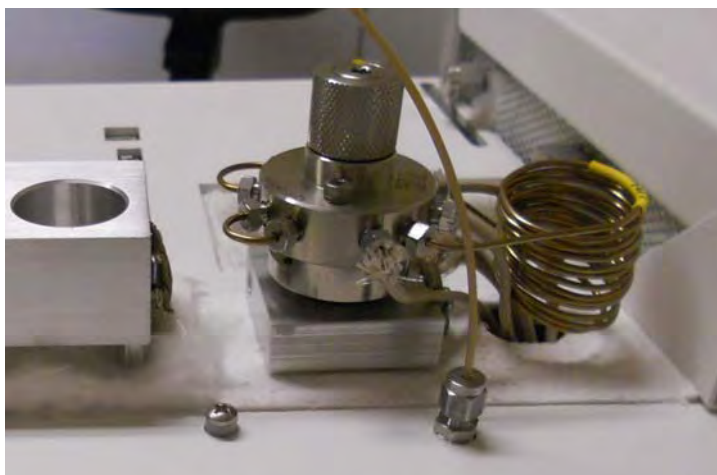


**Multi-Vial Heater** - The Multi-Vial Holder maintains the Headspace Vials at a constant temperature. There are several Vial heaters available depending on the size of headspace vial.



**Headspace Sample Probe** - The transfer line of the Headspace Probe is a low dead volume capillary tube that is coated on the inside with an inert material to prevent the sample components from adhering to the tube. The narrow diameter of the tube ensures a clean puncture of the headspace septum and a low possibility of leakage. The fitting holds the transfer line tightly, so that the penetration depth is always consistent.

**Sample Loop, Valve & Heater** - After removing the Valve Oven Cover by loosening the 2 securing screws, the Sample Loop, Valve and Valve Heater are exposed. The fixed sample loop is made from cleaned and deactivated tubing. The Sample Loop can be easily changed to vary the volume of sample injected. The 10-port Gas Sample Valve is heated to a stable temperature to prevent any compounds from sticking on their way to the Injector Port and Analytical Column.



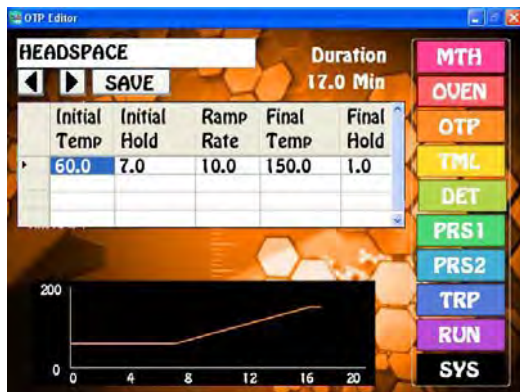
**Setting up a Method - The Headspace Concentrator** is controlled by the DPS GC Control Software. On the Method Page 4 files are necessary to run the automated Method.

**OTP - Oven Temperature Program**

**Timeline** - Is the sequence of events that control the Sample Line Flush, Vial Pressure, Gas Sample Valve, Load Sample, and Injection of the Headspace Concentrator.

**Detector** - Detector Parameters

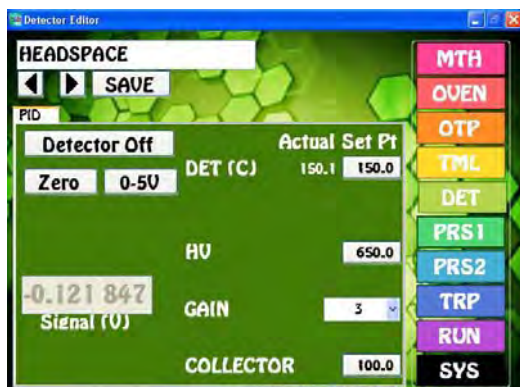
**Carrier1** - Pressure Program for the carrier gas.



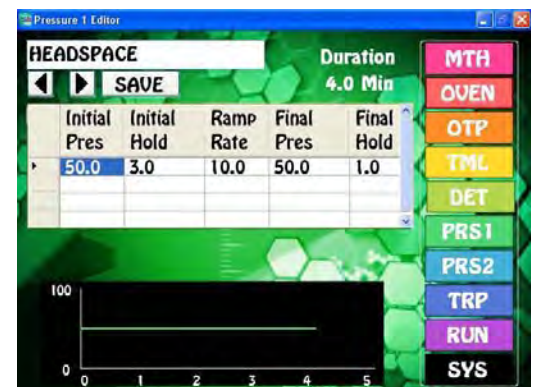
**Oven Temperature Program**



**Timeline**



**Detector Parameters**



**Carrier Pressure Program**

**Timeline** - Is the sequence of Headspace Concentrator events that control Flushing the sample lines, Equilibrating the Headspace in the Vial, Pressurizing the Headspace Vial, rotating the Gas Sample Valve, Loading the Sample Loop, and Injecting the Sample onto the Column .

1. In the example to the right, the Vial Gas starts at time zero to Flush the Sample Lines for 0.3 minutes.

2. Trap Vial Heater is always ON when the instrument is ON, but we include this event to time the Vial Heat and Equilibration.

3. The Vial Gas comes ON to Pressurize the vial for 6 seconds.

4. The Vent comes ON to load the Sample Loop with the Headspace of the vial for 6 seconds.

5. The Valve rotates to the ON position to Inject the sample onto the analytical column.

Any of the Start Times, Actions, or Duration Times can be easily changed by pressing on the desired cell and changing the value. New sequence events can be added by Inserting a new line and filling it out. Once you have completed any change, press the Save button.



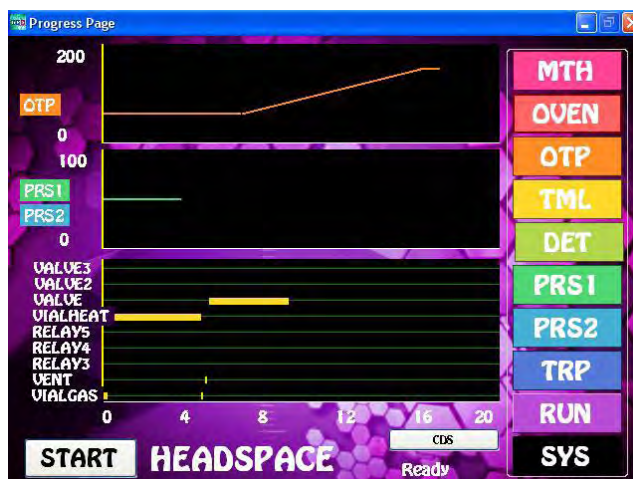
**Run Page** - Is the graphical presentation of the Method.

The top graph is the Oven Temperature Program.

The Middle graph is the Carrier Pressure Program.

The Bottom Chart is the Timeline. Note that the Headspace Vial Equilibrates for 5 min.

The START button initiates the sequence. A vertical yellow line travels from the left during the run following the run time.



**Headspace Vial Temperature** - Set the Vial Temperature on the Oven Page by entering the desired temperature in the Set Point for the Ini1 Temp. The Actual Temperature is the current Vial Heater Temperature.

**Valve Temperature** - Set the Sample Valve temperature on the same page using the Valve Set Point.

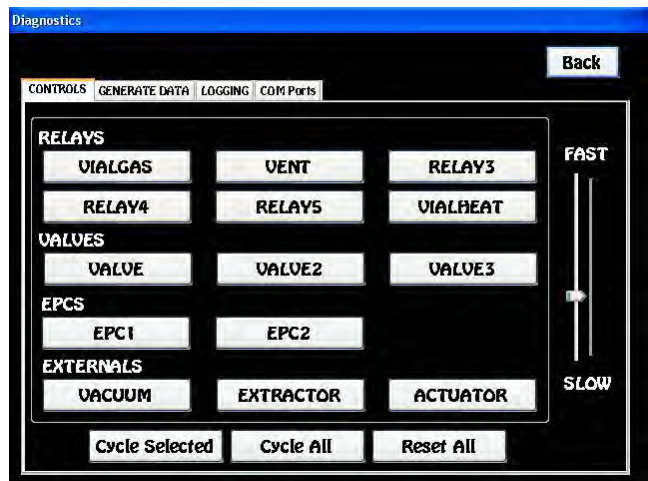


**Diagnostics** - By selecting the Systems page and then the Diagnostics Page you can manually turn ON, or OFF any of the devices.

For example, pressing the Vial Gas button will divert the Carrier gas to either Flush the Sample Lines, or Pressurize the Headspace Vial. The button will highlight to Blue.

You can rotate the Valve by pressing the Valve button.

Fill the Sample Loop with the Vent button.



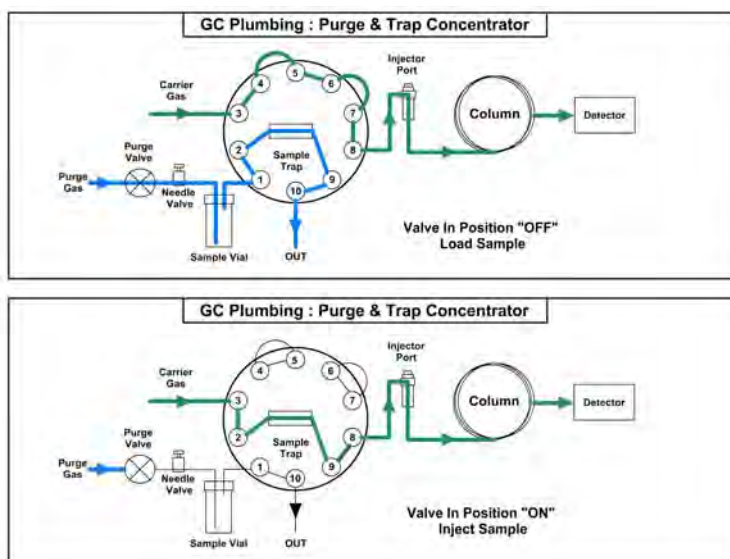
These manual actions are handy to check if a device is working properly, or Flush out the Sample Lines. These are the same sequence events that are automated on the Timeline page.

## Purge & Trap Concentrator for Series 600 GC's



**Purge & Trap Concentrator Overview** - The Purge & Trap concentrators for Series 600 GC's are built right in to the Electronics Module to provide both a compact sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The valve and sample lines are heated creating a inert sample path. The sample trap is plumbed in a true backflush fashion where the sample is loaded in one direction and desorbed in the opposite direction. The sample trap also can be equipped with a variety of packing materials to achieve the best concentration of the compounds being analyzed. The water sample is purged with inert gas to extract the sample compounds and load them onto the Trap. The Purge Gas is regulated with a variable flow controller for consistent sample trapping. The entire sequence of the Purge & Trap Concentrator is automated through the Timeline of the DPS Control Software for the analysis of one sample at a time.

**Plumbing Diagram** - The sample is loaded onto the trap with the valve is in the OFF position. This is the Home position of the valve. When the software boots up the valve is automatically rotated to the home, or OFF position. The Purge Valve turns ON to start the stream of gas flowing to the Purge Vial. With this configuration the flow controller is up stream from the Trap to limit any possible cross contamination between samples. The sample valve and most of the sample path are heated. In the OFF position the carrier gas flows through the valve directly to the injector port and through the column. The sample is injected by rotating the valve to the ON position and heating the sample trap. The carrier gas sweeps the components from the trap to the analytical column. With the Purge Valve OFF there is no flow through the other side of the valve. The Purge Valve can be turned ON to blow out the sample lines using a blank Vial.



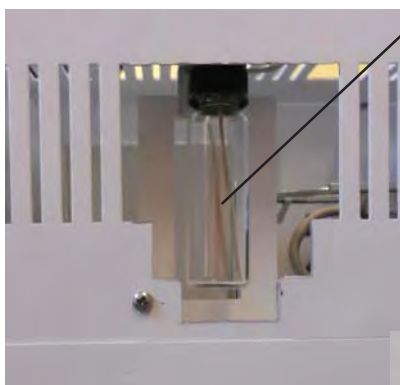
The sample is injected by rotating the valve to the ON position and heating the sample trap. The carrier gas sweeps the components from the trap to the analytical column. With the Purge Valve OFF there is no flow through the other side of the valve. The Purge Valve can be turned ON to blow out the sample lines using a blank Vial.

In either the OFF, or ON position a sample can be injected manually through the injector port directly onto the column.



**Vial Holder** - We use standard 20ml screw top headspace vials as the sparge vessel. The Vial Holder secures the cap, vial purge gas line, and the sample to trap transfer tubing. To change a sample, simply unscrew the previous vial and screw another in its place. The cap is held in place, so you can change a vial with just one hand. Make sure to just screw the vial in snugly, where the top of the vial will seal to the teflon faced septum inside the cap.

**Changing Vials** - The Vials can be changed with the Electronics Module lid removed, or they can be changed through the opening in the lid without removing the Electronics Module cover.



**PEEK Tubing**

**Purge Gas** - The purge gas enters through inert PEEK tubing to the bottom of the vial. PEEK tubing is very flexible, which makes it easy to change the vials through the opening in the lid.



**Flow Controller** - The flow controller is located next to the sample trap. We use a needle valve to adjust the flow through the trap. The outer knob turns the Needle Valve ON and OFF. Keep the Needle Valve in the ON position. Use a slotted screw driver to adjust the flow with the Sample Valve in the OFF position and the Purge Gas ON.

**Measuring the Flow** - With an external flow meter, or bubble meter measure the flow exiting the trap. A convenient fitting is located next to the Needle Valve to monitor the flow.

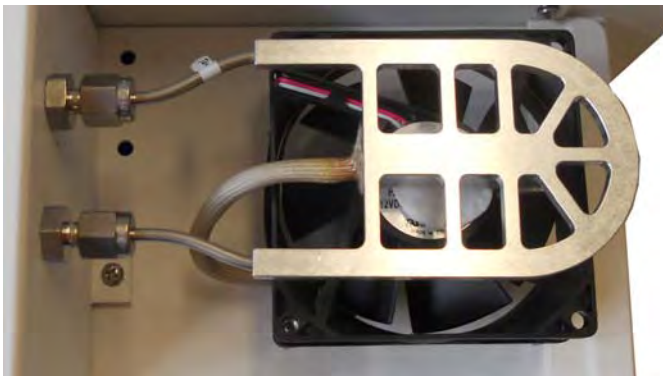
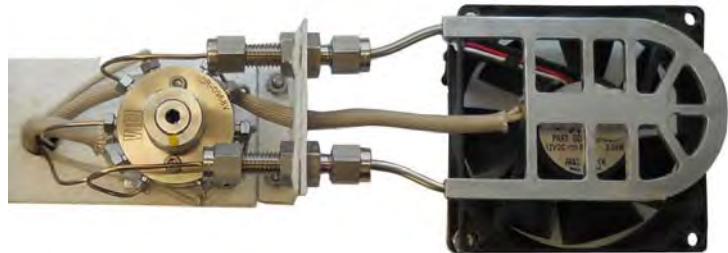


**Sample Trap Cover-** The sample trap may get very hot. To protect the user from potentially getting burned, a cover is installed over the sample trap. To remove the trap cover, loosen the securing nuts with a 5/16" wrench.



**Sample Trap & Heater** - After removing the Trap Cover the Cathedral Trap Heater is revealed. The innovative design of this trap heater radiates heat to the trap uniformly in all directions. The low mass design of the heater also allows the trap to cool quickly with the trap fan. The Trap material is placed inside a 1/8" stainless steel tube. The Trap secures tightly inside the groove on the underside of the Cathedral Trap Heater. Two bulkhead fittings connect the Trap to the Sample Valve

**Sample Valve** - The Sample Valve is located in the Heated Valve Oven. Remove the 2 securing the Valve Oven Cover screws to access the Sample Valve. Since the inlet and outlet of the Trap are on the same side there is minimal distance between the trap and sample Valve.



**Cooling Fan** - The Cooling Fan is located directly beneath the Trap. The Cooling Fan is normally ON to keep the trap as cool as possible. The fan uses ambient air to cool the trap. There is no setpoint for Trap Cool. The Cooling Fan is turned OFF when the Trap is in the Desorb Mode.



## Purge & Trap Concentrator for Companion GC's

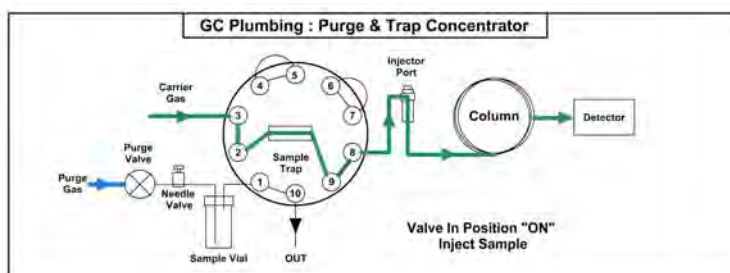
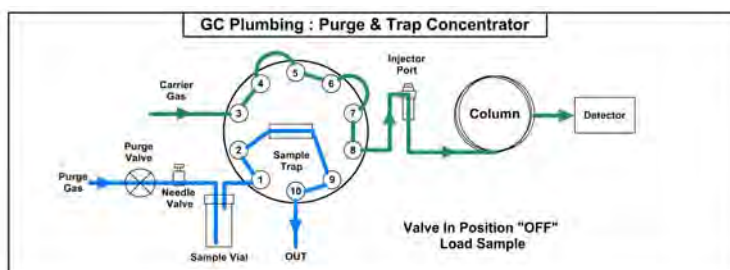


### Purge & Trap Concentrator

**Overview** - The Purge & Trap Concentrator for Companion GC's are built right in to provide both a compact portable sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The valve and sample lines are heated creating a inert sample path. The sample trap is plumbed in a true backflush fashion where the sample is loaded in one direction and desorbed in the opposite direction. The sample trap also can be equipped with a variety of packing materials to achieve the best concentration of the compounds being analyzed. The water sample is purged with inert gas to extract the sample compounds and load them onto the Trap. The Purge

Gas is regulated with a variable flow controller for consistent sample trapping. The entire sequence of the Purge & Trap Concentrator is automated through the Timeline of the DPS Control Software for the analysis of one sample at a time.

**Plumbing Diagram** - The sample is loaded onto the trap with the valve is in the OFF position. This is the Home position of the valve. When the software boots up the valve is automatically rotated to the home, or OFF position. The Purge Valve turns ON to start the stream of gas flowing to the Purge Vial. With this configuration the flow controller is up stream from the Trap to limit any possible cross contamination between samples. The sample valve and most of the sample path are heated. In the OFF position the carrier gas flows through the valve directly to the injector port and through the column.



The sample is injected by rotating the valve to the ON position and heating the sample trap. The carrier gas sweeps the components from the trap to the analytical column. With the Purge Valve OFF there is no flow through the other side of the valve. The Purge Valve can be turned ON to blow out the sample lines using a blank Vial.

In either the OFF, or ON position a sample can be injected manually through the injector port directly onto the column.

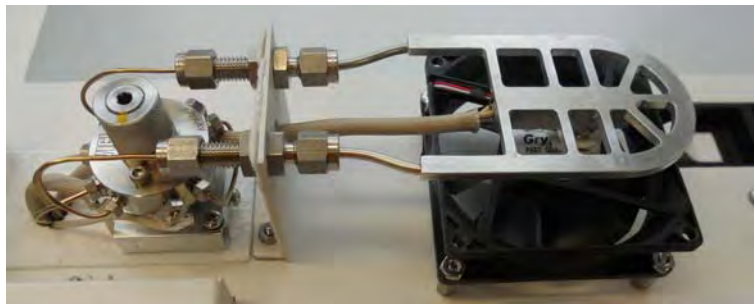
**Sample Trap Cover**- The sample trap may get very hot. To protect the user from potentially getting burned, a cover is installed over the sample trap. To remove the trap cover, loosen the 4 securing nuts with a 5/16" wrench.



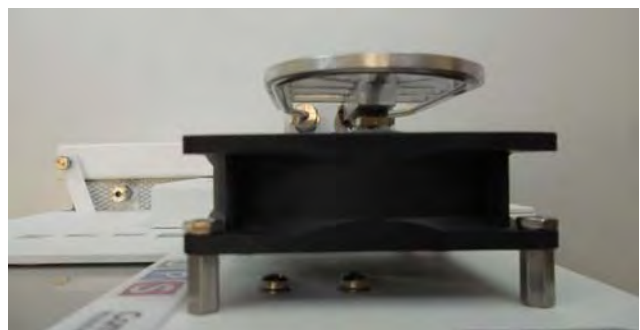
**Sample Trap & Heater** - After removing the Trap Cover the Cathedral Trap Heater is revealed. The innovative design of this trap heater radiates heat to the trap uniformly in all directions. The low mass design of the heater also allows the trap to cool quickly with the trap fan. The Trap material is placed inside a 1/8" stainless steel tube. The Trap secures tightly inside the groove on the underside of the Cathedral Trap Heater. Two bulkhead fittings connect the Trap to the Sample Valve



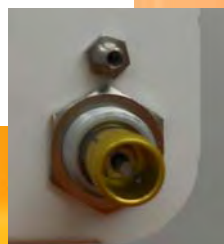
**Sample Valve** - The Sample Valve is located in the Heated Valve Oven. Remove the 2 securing the Valve Oven Cover screws to access the Sample Valve. Since the inlet and outlet of the Trap are on the same side there is minimal distance between the trap and sample Valve.



**Cooling Fan** - The Cooling Fan is located directly beneath the Trap. The Cooling Fan is normally ON to keep the trap as cool as possible. The fan uses ambient air to cool the trap. There is no setpoint for Trap Cool. The Cooling Fan is turned OFF when the Trap is in the Desorb Mode.



**Flow Controller** - The flow controller is located inside the tank compartment of the GC. We use a needle valve to adjust the flow through the trap. The outer knob turns the Needle Valve ON and OFF. Keep the Needle Valve in the ON position. Use a slotted screw driver to adjust the flow with the Sample Valve in the OFF position and the Vacuum Pump ON.



**Measuring the Flow** - With an external flow meter, or bubble meter measure the flow exiting the trap. A convenient fitting is located just above the Needle Valve to monitor the flow.

**Purge Head** - The unique purge head holds the Purge Vial. The Inlet Line, coming from the flow controller, goes to the bottom of the vial with the inert Purge Gas. The purged sample flows through the Outlet Line, which connects directly to the heated sample valve.



**Purge Vial** - A standard 20ml Headspace vial is used as the purge vial. The vial is easily changed between samples by unscrewing the old one and replacing it with the new vial containing the water sample.

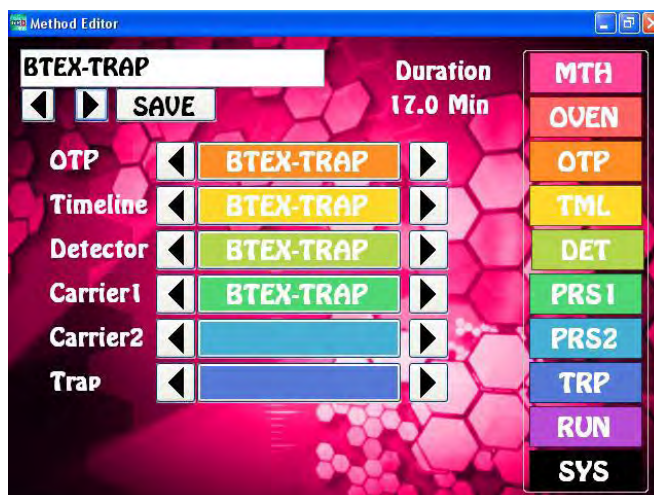
**Setting up a Method - The Purge & Trap Concentrator is controlled by the DPS GC Control Software. On the Method Page 4 files are necessary to run the automated Method.**

**OTP - Oven Temperature Program**

**Timeline - Is the sequence of events that control the Purge Gas, Sample Valve, Cooling Fan, and Trap Desorption of the Purge & Trap Concentrator.**

**Detector - Detector Parameters**

**Carrier1 - Pressure Program for the carrier gas.**



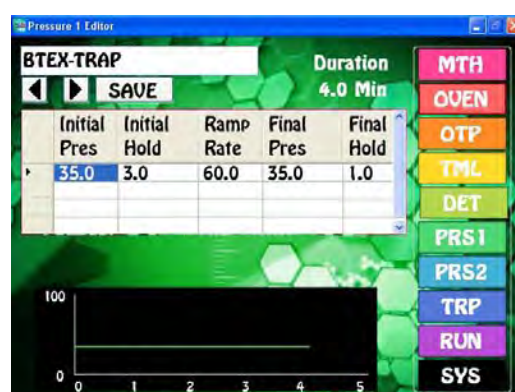
**Oven Temperature Program**



**Timeline**



**Detector Parameters**



**Carrier Pressure Program**

**Timeline** - Is the sequence of events that control the Purge Gas, Sample Valve, Cooling Fan, and Trap Desorption of the Purge & Trap Concentrator.

1. In the example to the right, the Purge Gas starts at time zero and loads the sample for 5 min.
2. Trap starts the Desorb sequence at 5 min. The Duration is the length of the action. After the 4 min Duration the Trap heater will shut off.
3. The Sample Valve rotates at 5 min to the ON position to inject the sample onto the column. This also lasts for 4 min.
4. When the Trap is desorbing, we turn the Trap Cooling fan off. Since the Fan is normally cooling the trap, we select Trap Fan ON to stop the Fan.
5. With a FID detector the Desorption of a trap frequently blows out the flame. We turn the FID Igniter ON at 6 min to automatically relight the flame. Notice that the Duration of this event is only 6 seconds.



Any of the Start Times, Actions, or Duration Times can be easily changed by pressing on the desired cell and changing the value. New sequence events can be added by Inserting a new line and filling it out. Once you have completed any change, press the Save button.

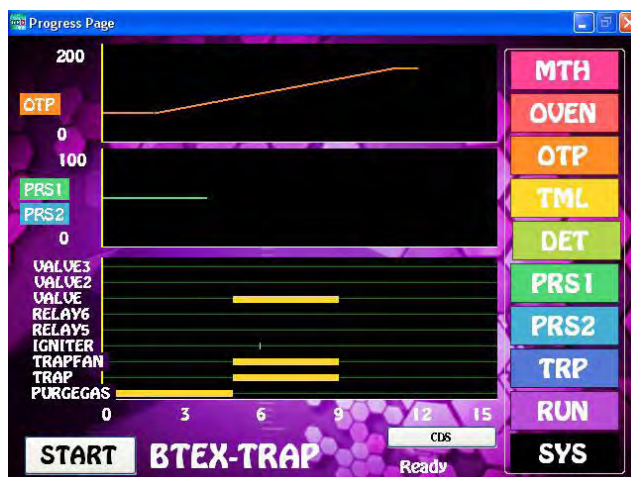
**Run Page** - Is the graphical presentation of the Method.

The top graph is the Oven Temperature Program.

The Middle graph is the Carrier Pressure Program.

The Bottom Chart is the Timeline. Note that the Purge Gas turns ON at 0 min for 5 min.

The START button initiates the sequence. A vertical yellow line travels from the left during the run following the run time.



**Trap Temperature** - Set the Trap Desorb Temperature on the Oven Page by entering the desired temperature in the Set Point for the Inj1 Temp. The Actual Temperature is the current Trap Temperature. Make sure that the Trap is cool before starting the next sequence to load the sample.

**Valve Temperature** - Set the Sample Valve temperature on the same page using the Valve Set Point.



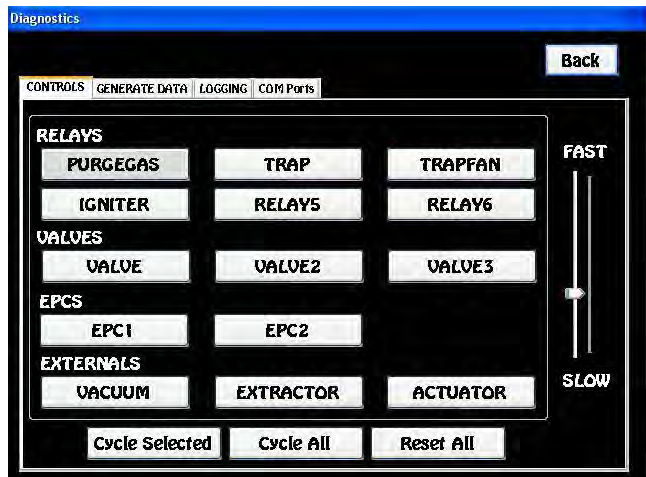
**Diagnostics** - By selecting the Systems page and then the Diagnostics Page you can manually turn ON, or OFF any of the devices.

For example, pressing the Purge Gas button will turn ON the Purge Gas. The button will highlight to Blue.

You can rotate the Valve by pressing the Valve button.

Heat the Trap with the Trap button.

Turn OFF the Trap Cooling Fan with the Trapfan button.



The actions are handy to check if a device is working properly, or bake out a trap for an extended period of time. These are the same sequence events that are automated on the Timeline page.

## MicroExtractor Concentrator for Series 600 GC's



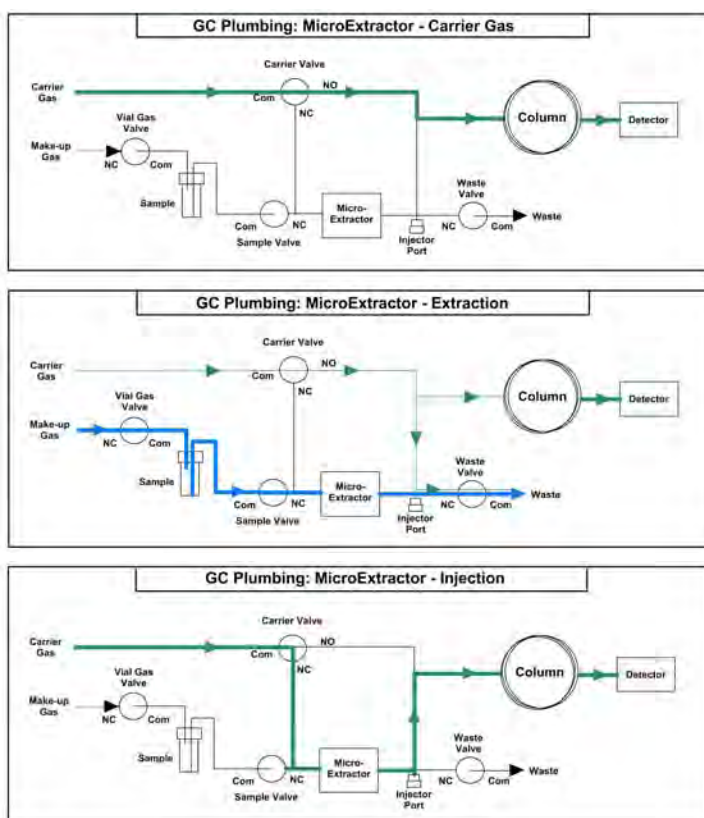
**MicroExtractor Concentrator Overview** - The MicroExtractor concentrator for Series 600 GC's are built right in to the Electronics Module to provide both a compact sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The MicroExtractor is a unique device that concentrates higher boiling compounds directly from water samples. The sample vial is pressurized and the water sample is pushed through the trap at ambient temperature where the compounds are concentrated. When the trap is heated the trapped compounds are directed to the analytical column. There is no sample valve, but the sample transfer lines are heated creating a inert sample path. The sample trap also can be equipped with a variety of packing materials to achieve the best concentration of the compounds being analyzed. The vial pressurizing gas is regulated with a EPC for consistent sample flow and trapping. The entire sequence of the MicroExtractor Concentrator is automated through the Timeline of the DPS Control

Software for the analysis of one sample at a time.

**Plumbing Diagram** - We use a series of solenoids, instead of a sample valve to control the flow of carrier gas and the water sample flow through the MicroExtractor. In the 1st diagram the carrier gas flows through the Carrier Solenoid to the analytical column.

In the Extraction step, the sample vial is pressurized and the water sample flows through the MicroExtractor and then out to a waste vessel. During the Extraction step the carrier gas pressure is reduced using the carrier pressure program. There is little, or no flow of carrier gas through the column during the Extraction step, but the column is not damaged, because it is at low temperature and still filled with carrier gas from the previous run.

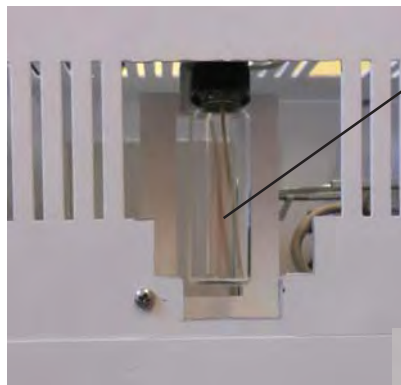
During the Injection step the carrier gas is directed through the MicroExtractor to sweep the compounds to the analytical column. Since we are extracting and analyzing higher boiling compounds, we moved the injector port to the exit of the MicroExtractor trap. To inject a standard manually, turn the carrier gas solenoid ON.





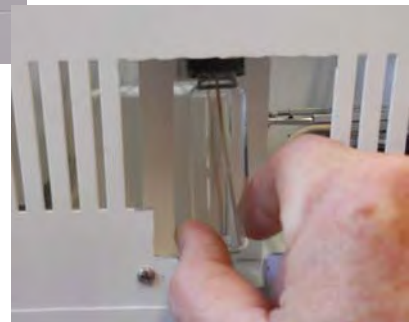
**Vial Holder** - We use standard 20ml screw top headspace vials as the sample vessel. The Vial Holder secures the cap, vial pressurizing gas line, and the sample to trap transfer tubing. To change a sample, simply unscrew the previous vial and screw another in its place. The cap is held in place, so you can change a vial with just one hand. Make sure to just screw the vial in snugly, where the top of the vial will seal to the teflon faced septum inside the cap.

**Changing Vials** - The Vials can be changed with the Electronics Module lid removed, or they can be changed through the opening in the lid without removing the Electronics Module cover.



**PEEK Tubing**

**Pressurizing Gas** - The vial pressurizing gas enters through the fitting into the top of the vial. The water sample is transferred through inert PEEK tubing from the bottom of the vial. PEEK tubing is very flexible, which makes it easy to change the vials through the opening in the lid.

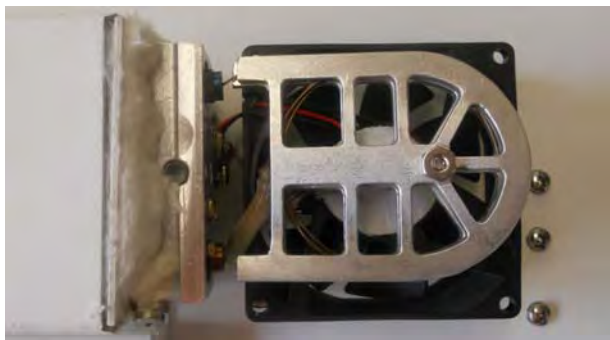


**Waste Outlet** - The waste outlet is located on the back panel of the Electronics Module below the EPC inlets. Connect a tube to the port and then into a waste vessel.

**Waste Outlet**

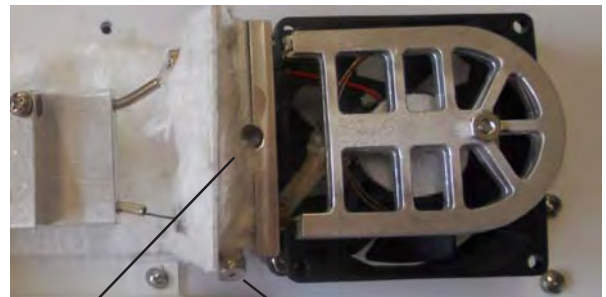


**Sample Trap Cover-** The sample trap may get very hot. To protect the user from potentially getting burned, a cover is installed over the sample trap. To remove the trap cover, loosen the securing nuts with a 5/16" wrench.



**Sample Trap & Heater** - After removing the Trap Cover the Cathedral Trap Heater is revealed. The innovative design of this trap heater radiates heat to the trap uniformly in all directions. The low mass design of the heater also allows the trap to cool quickly with the trap fan. The Trap material is placed between 2 trap heaters. Two bulkhead fittings connect the Trap to the Sample Valve

**Sample Transfer Block** - The Sample Transfer Block is cool when the water sample is extracted. It is then heated along with the Trap to allow the compounds to pass to the heated transfer line. The injection port is mounted on the Sample Transfer Block. To perform a manual standard injection heat the Sample Transfer Block and turn the Carrier Gas Solenoid ON.



**Sample Transfer Block**

**Injection Port**



**Cooling Fan** - The Cooling Fan is located directly beneath the Trap. The Cooling Fan is normally ON to keep the trap as cool as possible. The fan uses ambient air to cool the trap. There is no setpoint for Trap Cool. The Cooling Fan is turned OFF when the Trap is in the Desorb Mode.

## MicroExtractor Concentrator for Companion GC's



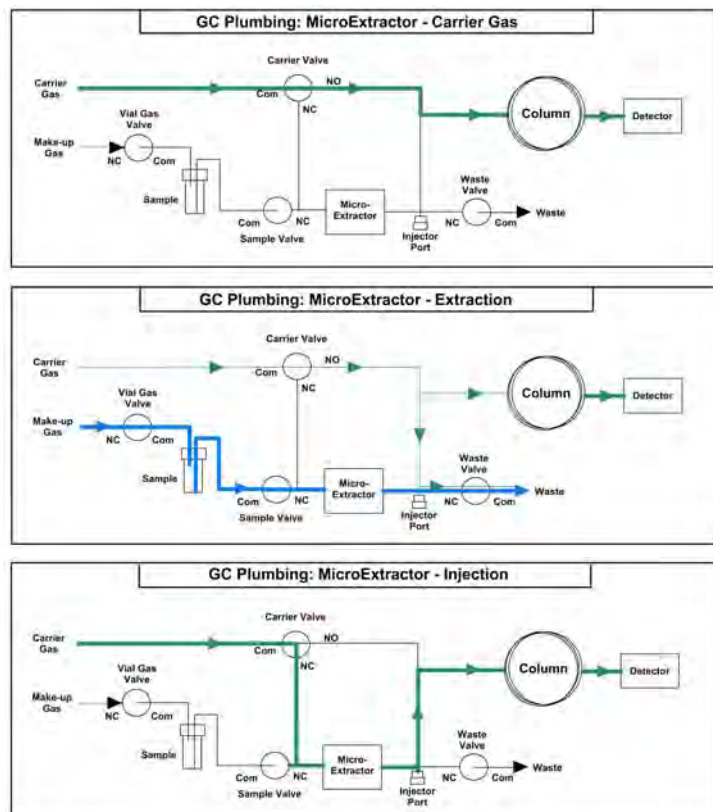
**MicroExtractor Concentrator Overview -** The MicroExtractor concentrator for Companion GC's are built right in to provide both a compact portable sample concentrator and a shortest possible sample path, without the need for a bulky heated transfer line. The MicroExtractor is a unique device that concentrates higher boiling compounds directly from water samples. The sample vial is pressurized and the water sample is pushed through the trap at ambient temperature where the compounds are concentrated. When the trap is heated the trapped compounds are directed to the analytical column. There is no sample valve, but the sample transfer lines are heated creating a inert sample path. The sample trap also can be equipped with a variety of packing materials to achieve the best concentration of the compounds being

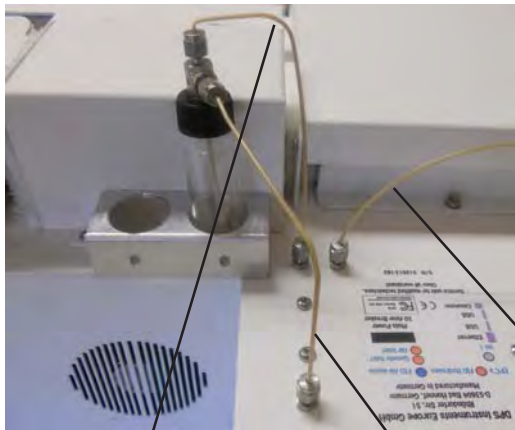
analyzed. The vial pressurizing gas is regulated with a EPC for consistent sample flow and trapping. The entire sequence of the MicroExtractor Concentrator is automated through the Timeline of the DPS Control Software for the analysis of one sample at a time.

**Plumbing Diagram -** We use a series of solenoids, instead of a sample valve to control the flow of carrier gas and the water sample flow through the MicroExtractor. In the 1st diagram the carrier gas flows through the Carrier Solenoid to the analytical column.

In the Extraction step, the sample vial is pressurized and the water sample flows through the MicroExtractor and then out to a waste vessel. During the Extraction step the carrier gas pressure is reduced using the carrier pressure program. There is little, or no flow of carrier gas through the column during the Extraction step, but the column is not damaged, because it is at low temperature and still filled with carrier gas from the previous run.

During the Injection step the carrier gas is directed through the MicroExtractor to sweep the compounds to the analytical column. Since we are extracting and analyzing higher boiling compounds, we moved the injector port to the exit of the MicroExtractor trap. To inject a standard manually, turn the carrier gas solenoid ON.





**Vial Holder** - We use standard 20ml screw top headspace vials as the sample vessel. The Vial Holder is just behind the transfer line oven. Going to the vial are the vial pressurizing gas line, and the sample to trap transfer tubing. To change a sample, simply unscrew the previous vial and screw another in its place. Make sure to just screw the vial in snugly, where the top of the vial will seal to the teflon faced septum inside the cap.

**Sample Line**

**Pressurizing Gas Line**

**Waste Line**

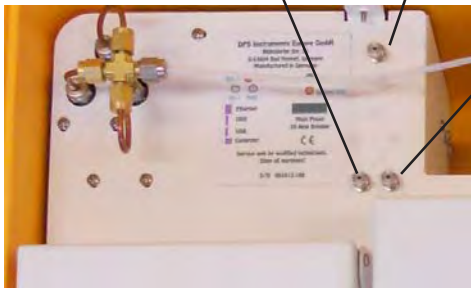


**Pressurizing Gas** - The vial pressurizing gas enters through the fitting into the top of the vial. The water sample is transferred through inert PEEK tubing from the bottom of the vial. PEEK tubing is very flexible, which makes it easy to change the vials.

**Pressurizing Gas**

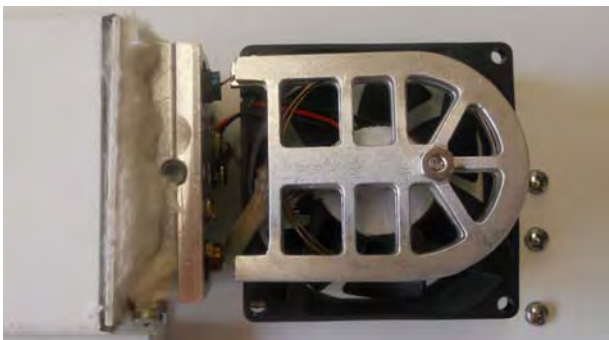
**Sample Inlet**

**Waste Outlet**



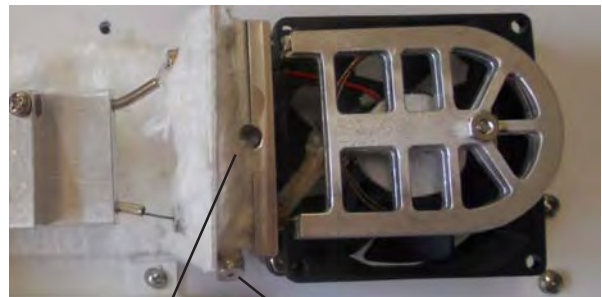
**Waste Outlet** - The waste outlet is located next to the sample inlet fitting. Connect a tube to the port and then into a waste vessel.

**Sample Trap Cover-** The sample trap may get very hot. To protect the user from potentially getting burned, a cover is installed over the sample trap. To remove the trap cover, loosen the securing nuts with a 5/16" wrench.



**Sample Trap & Heater** - After removing the Trap Cover the Cathedral Trap Heater is revealed. The innovative design of this trap heater radiates heat to the trap uniformly in all directions. The low mass design of the heater also allows the trap to cool quickly with the trap fan. The Trap material is placed between 2 trap heaters. Two bulkhead fittings connect the Trap to the Sample Valve

**Sample Transfer Block** - The Sample Transfer Block is cool when the water sample is extracted. It is then heated along with the Trap to allow the compounds to pass to the heated transfer line. The injection port is mounted on the Sample Transfer Block. To perform a manual standard injection heat the Sample Transfer Block and turn the Carrier Gas Solenoid ON.



**Sample Transfer Block**

**Injection Port**



**Cooling Fan** - The Cooling Fan is located directly beneath the Trap. The Cooling Fan is normally ON to keep the trap as cool as possible. The fan uses ambient air to cool the trap. There is no setpoint for Trap Cool. The Cooling Fan is turned OFF when the Trap is in the Desorb Mode.

# MicroExtractor Method Overview

## Oven Page



## Oven Temperature Program



## Analysis Method - MX8



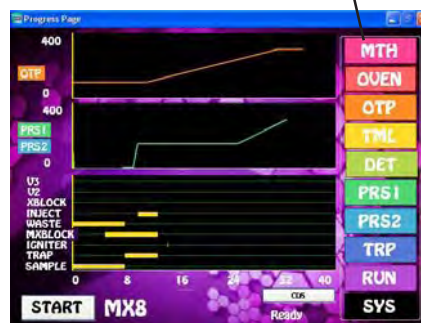
## Timeline



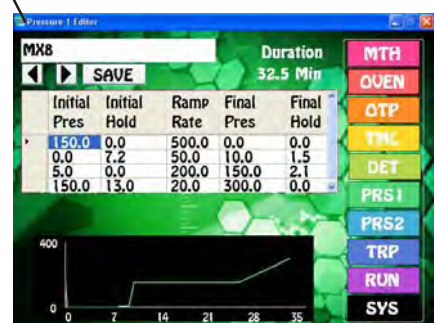
## Detector



## Run/Start



## Pressure Program





## Method - MX8

The Method links all of the programs necessary to perform the analysis. This would include the OTP, TML, DET, and PRS1 programs. We name all of them the same to make things simple. There can be unlimited methods on the GC.

## Oven Page

The Oven Page displays the current operating conditions of the GC Oven.

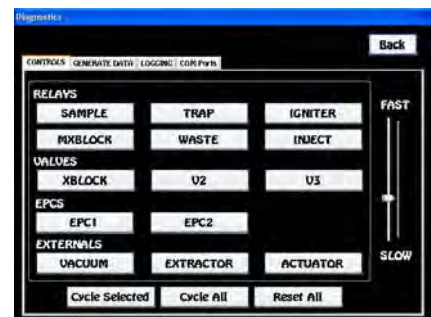
The Oven Temperature is the starting temperature of the OTP.

INJ1 is the MX Trap. We have set the Trap to heat to 300C when Relay 2 is energized. In a similar way the Transfer Block also heats to 300C when Relay 4 is energized. Both cool down to ambient temperature when the sample is being extracted.

INJ2 is the Transfer Line heater is set and always remains at 250C. The transfer line is the heated zone between the GC Oven and the MX Trap. The analytical column is fed through the Transfer Line to the junction with the MX Trap.

Carrier - Is the current pressure of the carrier gas through the column.

	Actual	Target	Set Point
Oven Temp (°C)	100.6	100.0	100.0
Inj1 Temp. (°C)	27.2	300.0	300.0
Inj2 Temp. (°C)	250.2	250.0	250.0
XBLOCK (°C)	32.3	300.0	300.0
Carrier1 (kPa)	152.9	150.0	150.0
Carrier2 (kPa)	0.3	0.0	



Start Time	Action	Duration
0.00	WASTE ON	8.00
0.20	SAMPLE ON	7.80
5.00	MXBLOCK ON	8.00
8.00	TRAP ON	5.00
10.00	INJECT ON	3.00
14.50	IGNITER ON	0.08

## Timeline

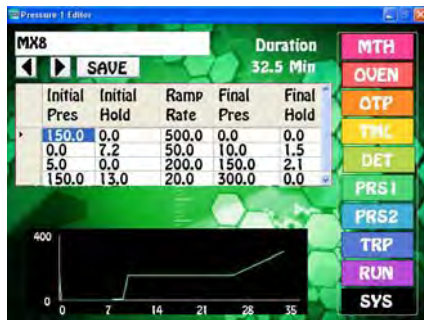
The Timeline stores the Sequence of Events that run the Method by energizing the Relays on the Diagnostics page above.

We start the extraction process by opening the Waste valve, this releases the Carrier pressure on the MX. The Sample valve opens which pressurizes the vial with the water sample. The sample is forced through the MX Trap to Waste. The extraction takes about 5 min, after which the vial gas is still allowed to flow through the MX

Trap to Dry Purge and remove excess water. During the Dry Purge we heat the MX Block to vaporize the excess water and remove it from the system.

Next we turn the Trap Heater ON to preheat the compounds on the MX Trap prior to the Sample Injection. This makes the peaks sharper.

There is always some water that gets onto the Column that blows out the FID flame. After the water goes through the column we reignite the FID flame.



## Carrier Pressure Program

We use our ability to have a Carrier Pressure Program in conjunction with the Timeline for the extraction and analysis. The Pressure program starts at 150 kPa, this maintains the flow through the column when it is cooling down from the previous run.

Once the system is Ready for the next sample, we turn off the Carrier Gas and vent it through the Waste Valve. We now allow the sample to be extracted without the carrier gas forming counter pressure.



After the Extraction, when the Transfer Block is heating to vaporize excess water, we turn on the carrier pressure slightly to blow the water out to Waste.

We then allow the Carrier Pressure to return to the normal operating pressure before the Sample is Injected.

Towards the end of the Run we ramp the pressure up to drive the compounds off the column faster making sharper peaks.

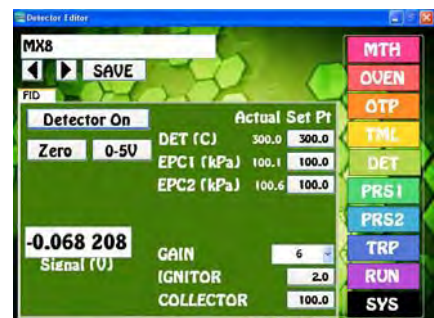
## Detector Parameters

The Detector Temperature is set high enough so the compounds exiting the column do not stick prior to being ionized.

EPC1 & 2 are the make-up gases needed for the operation of the FID. EPC1 is Air, which is set to 250mls/min, and EPC2 is Hydrogen, which is set to 25mls/min.

The detector amplifier has 6 Gain settings. For the highest sensitivity we set this to 6.

The Igniter lights the FID flame, and the Collector has a negative voltage to collect the positive ions produced in the FID flame.



## Run / Start Page

We graphically display the Temperature Program, Pressure Program, and Timeline Method parameters on one page for easy viewing.



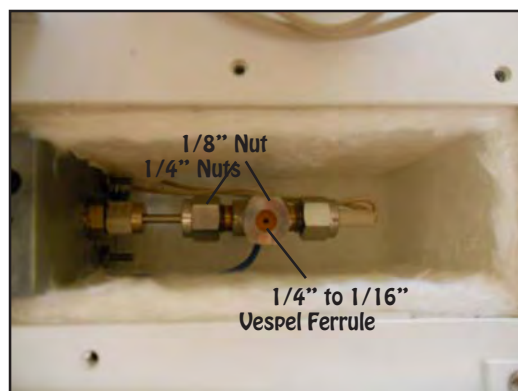
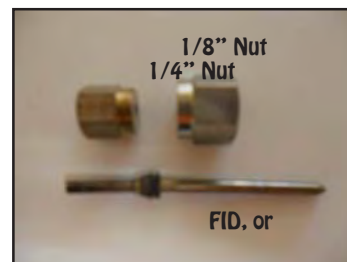
When the run Starts the yellow Status Bar moves from left to right during the run. As the Status Bar crosses the beginning of one of the Timeline functions, you can hear it energize.

For the TML section, the sample is extracted first, then the Block and Trap preheat and stay hot during the Injection. After this the Igniter relights the flame. Both the MX Trap and Block are cooled down by the end of the run.

# Methanizer Jet and FID Jet

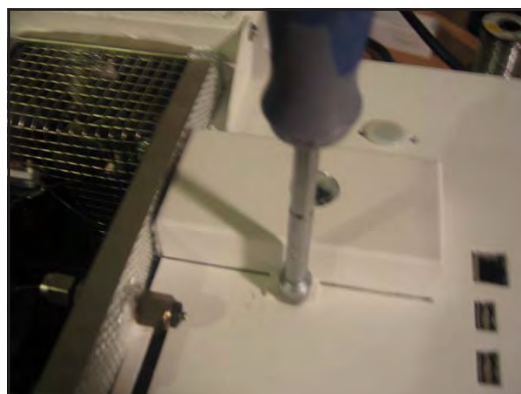
## Jet Parts

The FID Jet is a tube that inserts into the detector block fitting and the FID detector body. There is a cone shape on the detector block fitting side and a point, or Jet on the outlet, which inserts inside the detector body. From the outside the FID Jet and Methanizer Jet look identical. The difference is that the Methanizer is a thinner walled tube that is partly filled with a nickel catalyst (Sigma Aldrich Nickel - 65 wt., % on silica/alumina, P/N 208779). At temperatures above 375°C, with the presence of the nickel catalyst and excess hydrogen atoms, Carbon Monoxide (CO) and Carbon Dioxide (CO<sup>2</sup>) are converted to Methane (CH<sup>4</sup>) for detection by the FID Detector. Since the catalytic conversion of CO and CO<sup>2</sup> takes place after the analytical column has separated the compounds, their retention times are unchanged. Hydrocarbons pass right through the Methanizer and are unaffected. Please note that high concentrations of sulfur gas can poison the Methanizer.



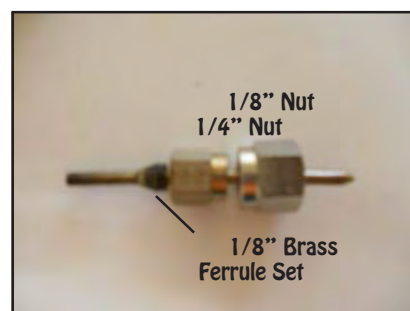
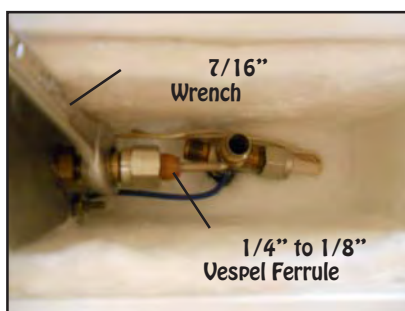
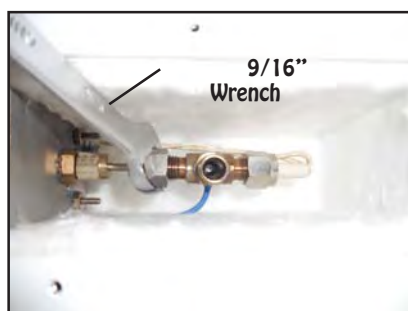
## Removing the Detector Cover

Remove the securing screws for the detector cover. There are 3 screws for the Series 600 GC's, and 2 screws on the Companions.



## Removing the Jet

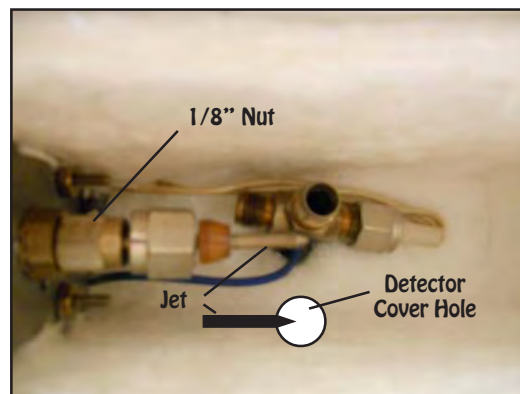
Remove the top vent 1/4" nut from the FID Body with a 9/16" wrench. Remove the 1/4" nut with the same wrench from the detector body. Slide the detector body off the Jet. You may have to slide off the Collector Cable to give yourself some more room. Remove the small 1/8" nut securing the Jet to the detector block fitting with a 7/16" wrench. Remove the Jet from the detector compartment.





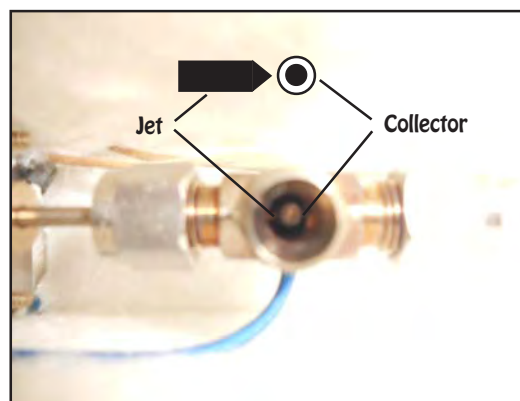
## Installing the new Jet

Place the Jet into the detector block fitting aligning the tip of the Jet just to short of the center of the detector cover collector hole. Tighten the 1/8" nut to secure the jet to the detector block. Slide the large 1/4" nut and vespel ferrule over the tip of the Jet and secure the nut to the Detector Body.



## Jet Alignment

When looking straight down into the detector body, the tip of the Jet should protrude just to the edge of the white ceramic insulator around the collector. We want the FID flame to be over the center of the Collector. If the jet tip is slightly short of the white ceramic, then this is perfect. Tighten the nut snugly. Replace the 1/4" Vent nut and ferrule. This fitting can be just past finger tight.

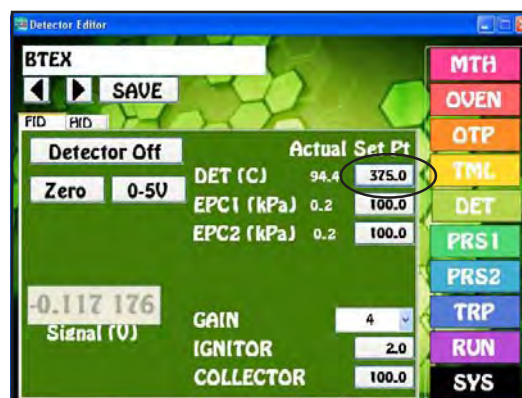


## Replace the Detector Cover

Secure the detector cover. There are 3 screws for the Series 600 GC's, and 2 screws on the Companions. Replace the Collector Cable if you removed it by sliding it up onto the Collector. The spring inside should secure tightly to the collector to make a good electrical connection.

## Detector Page

If you are installing a Methanizer make sure that the FID Detector Temperature is set to 375°C and SAVE the change. Once the Detector Block heats up to 375°C and is stable the Methanizer will convert CO and CO<sub>2</sub> to methane. At lower temperatures the catalyst will not work.



## Gas Line Installation Kit

Qty	
1	Single Stage Pressure Regulator
1	Tank Fitting installed in Regulator (He, N2, Air, H2)
1	1/8" Outlet fitting installed in Regulator
1	Tubing Cutter*
1	1/8" Copper Tubing (5m)
2	1/8" Nuts and Ferrules

\* Various Kits include Tubing Cutters, only one total per instrument.



## Maintenance Kit

Qty	
1	Wireless Keyboard & Mouse
1	Multi Function Volt Meter
1	5/16" Nut Driver
1	Stubby Phillips Screwdriver
1	Medium Phillips Screwdriver
1	Large Phillips Screwdriver
1	1/4" through 9/16" Wrench Kit
1	Adjustable Wrench
1	Tubing Cutter*
1	Injector Liner
2	Plastic Hole Plugs
4	Connectors - Various
2	1/16" SS Unions

\* Various Kits include Tubing Cutters, only one total per instrument. Contents may come from different manufacturers than those shown



## Companion Small Gas Cylinder, Regulator and Refill Kit

Qty	
1	Small High Pressure Cylinder*
1	Small High Pressure Regulator
1	Refill Regulator*
1	Refill Regulator Tank Adapter Installed (He, N2, Air, H2)
1	1/8 Teflon Tubing (1m)
1	1/8" Nuts and Ferrules

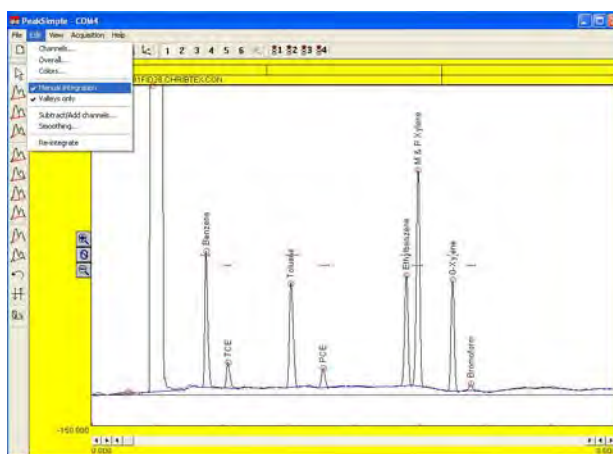
\* - Contents may be under high pressure! Obey all warnings! To be used by trained personnel only.



## 5. Chromatography Data System

### Pull Down Menus

All PeakSimple for Windows features may be accessed from pull-down menus. When you click on a menu bar item, a pull-down group menu will open to permit navigation to specific group features.



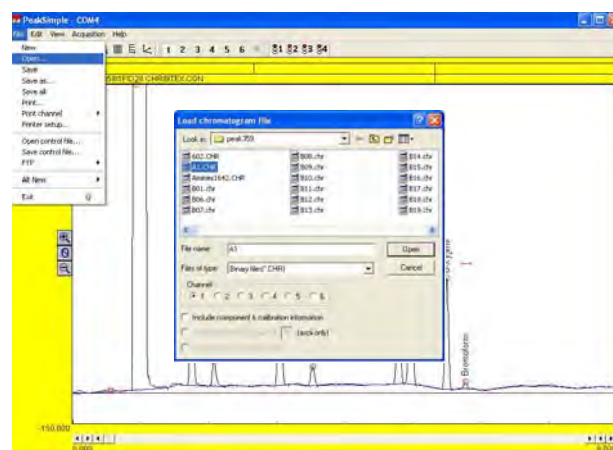
### FILE Pull-Down Menu

#### NEW

The **FILE-NEW** feature will clear all active channels in the **Main** timebase without starting a new chromatographic run.

#### OPEN

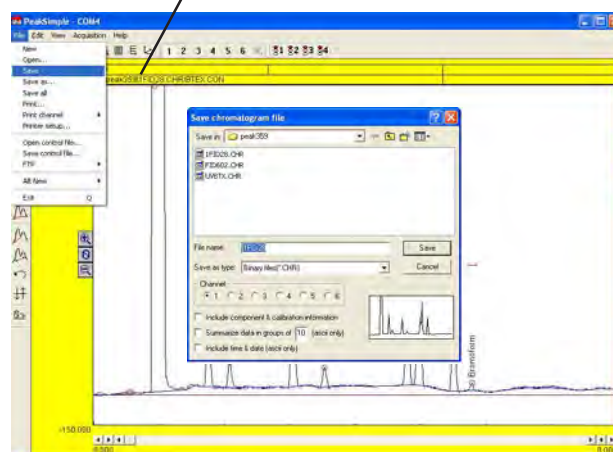
To open a previously saved chromatogram file, select **FILE-OPEN**. A **LOAD CHROMATOGRAM FILE** screen will appear which will allow you to select any file from any directory (folder) on your system. Choose the channel (1-6) in which you wish to display your saved chromatogram and then click **OPEN**.



Filename

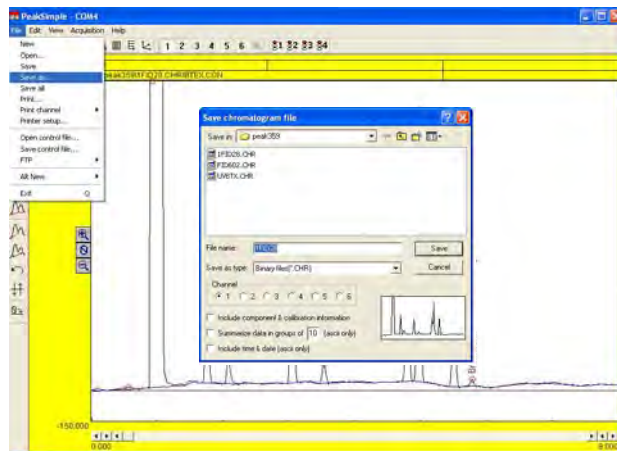
#### SAVE

The **FILE-SAVE** feature saves the displayed chromatograms on all active channels. The name given to the file(s) is the same name that is displayed in the Data Boxes below the menu bar and will be given the default.CHX extension. This file name can be edited by the user by changing information in the **EDIT-CHANNELS-POSTRUN** pull-down menu. See the **EDIT** section for more information.



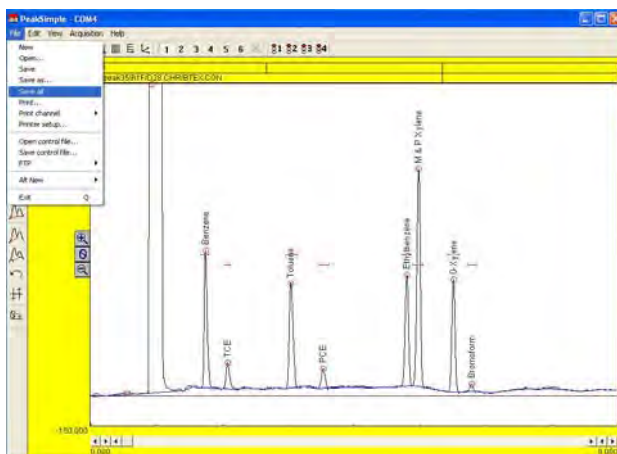
## SAVE AS

To save a newly created chromatogram file, select **FILE-SAVE AS**. A **SAVE CHROMTOGRAM FILE** screen will appear which will allow you to save the file in any directory (folder) on your system. Type a name into the **File Name** box and choose which channel (1-6) you wish to save and then click **SAVE**. The file will be saved as a binary file by default, with a **.CHR** extension. You may also select to save the file in **ASCII** format with a **.ASC** extension. **FILE-SAVE** feature saves the displayed chromatogram.



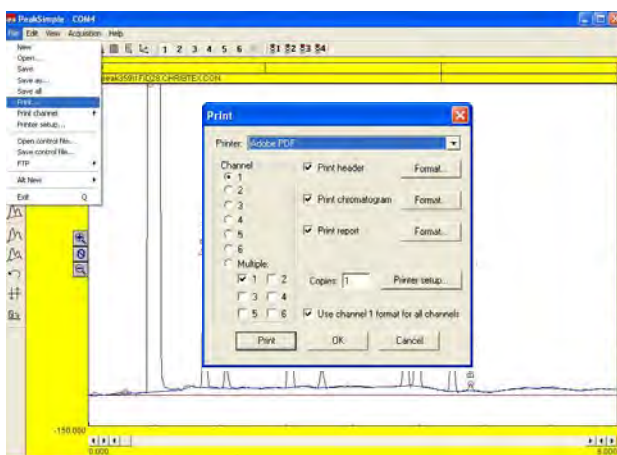
## SAVE-ALL

The **FILE-SAVE-ALL** feature will automatically save your chromatogram as a **.CHR** file; your temperature program as a **.TEM** file; your component table as a **.CPT** file; your event table as a **.EVT** file and then saves them all under a control file (**.CON** file). **DEFAULT.CON** will be used if no other name for the control file is specified using the **SAVE-CONTROL FILE** feature. All print information is also saved when you save a control file.



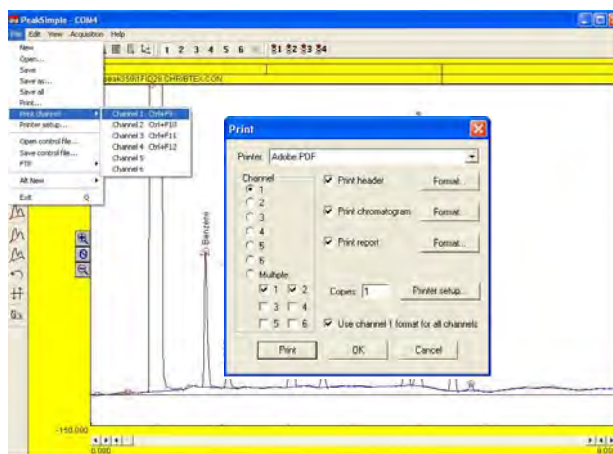
## PRINT

Numerous fields are available for print information. When you access the **FILE-PRINT** pull-down menu you will notice that any combination of one to six channels can be printed out on a single sheet of paper simply by marking the circle next to the channel number. Print information concerning the header, chromatogram, and report can easily be edited.



### PRINT - Channel 1

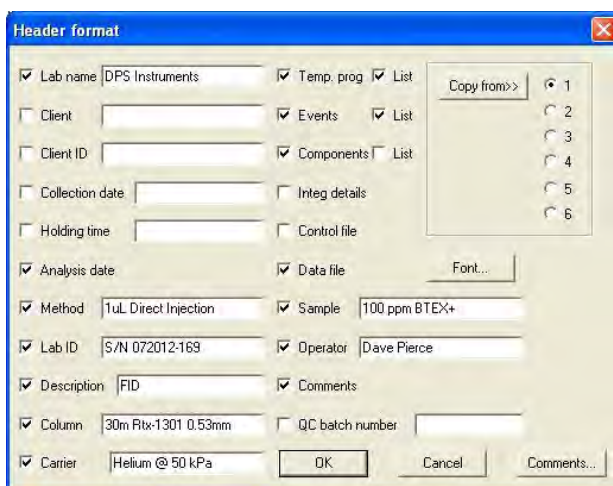
When you access the **FILE-PRINT** pull-down menu you will notice that you can select to print any combination of multiple channels by clicking on the circle next to the word **multiple**. You may also choose to print individual channels by clicking on the circle next to the desired channel. Click on **Channel 1** to edit the Channel 1 information in the **Print Header**, **Print Chromatogram** and **Print Report Format** fields. Rather than enter unique information for all four channels, you may wish to check the **Use channel 1 format for all channels** box.



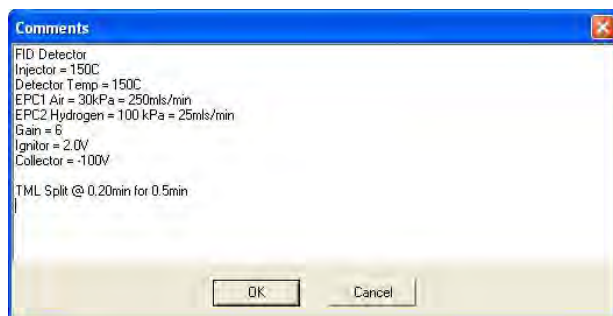
### PRINT HEADER FORMAT

Clicking on the **Print Header FORMAT** button will allow you to customize the appearance of your printed chromatogram header. Input your **Laboratory name**, **Analysis method**, **Sample type**, **Column**, etc. and check the box next to each field. **Analysis date** prints the date in your PC's BIOS.

Print out **Temperature Programs**, **Events** and **Components** file names by checking their boxes; or click on **List** to print the complete **Temperature Program**, **Event Table** of **Component List**. **Copy from:** selects which channel will provide the **List** information.



Check the **Comments** box and click on **Comments...** to enter customized information about your analysis. You can change the **Font**, style and size of your printed text by clicking on the **Font** box. Select a size that will provide readable text while still leaving room for your chromatogram and report. Then you access the **FILE-PRINT** pull-down menu **FILE-SAVE-ALL**



### PRINT CHROMATOGRAM FORMAT

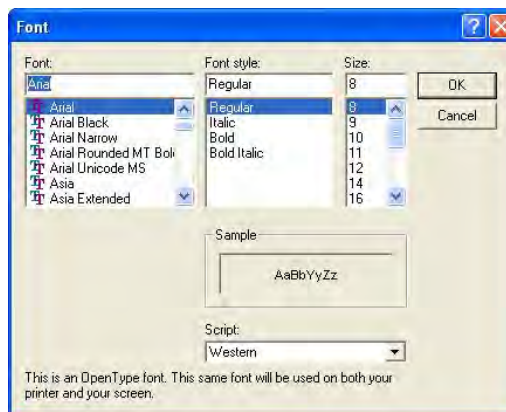
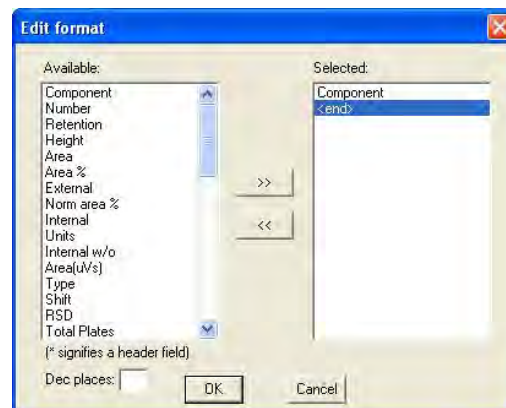
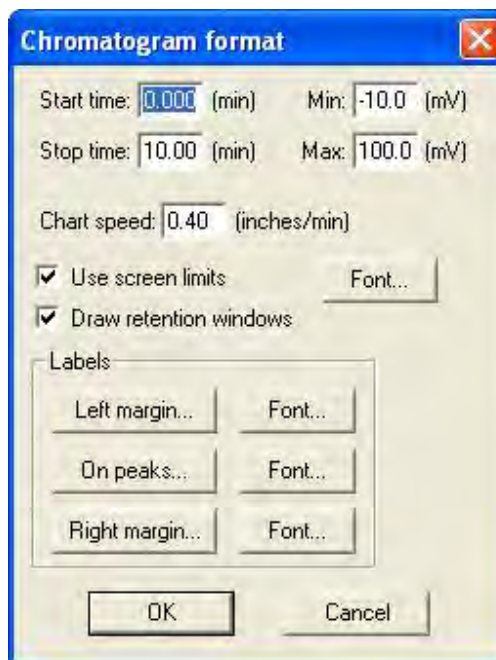
You can also edit the chromatogram print parameters when you access the **FILE-PRINT** pull-down menu. Check the **Print Chromatogram** box and select **Format**. The **Chromatogram Format** screen allows editing of the chromatogram **Start time** and **Stop time** and the **Min** and **Max** millivolt levels.

The **Chart speed** setting will determine the size of the chromatogram section of your printout. A setting of **1.0 inches/minute** for a 5 minute chromatogram will produce a 5 inch chromatogram print. You may need to experiment with the settings to fit your header, chromatogram and report information all on one printed page. When the **Use screen limits** box is checked only the displayed section of a chromatogram will be printed. The **Draw retention windows** box allows for retention windows to be printed as well.

The **Labels** section of the screen lets you select what useful information will be printed along the borders of the chromatogram, and above the peaks. Clicking of **On Peaks**, for example, will bring up the **Edit format** screen which will allow you to select from a list of measurements which will automatically be calculated and printed on the peak of your chromatogram.

To choose **Component**, for example, click on **Component** from the left column and then click on the right arrows (>>). **Component** will now appear in the selected column on the right. Click **OK** to close the window.

You can change the **Font**, style and size of your printed text by clicking on the **Font** box. Select a size that will provide readable text while still leaving room for your chromatogram and report.



## PRINT REPORT FORMAT

A report may be printed along with your chromatogram to summarize component retention time, area counts or other data. Clicking on the **View** pull-down menu and selecting **Results** will show a preview of your report.

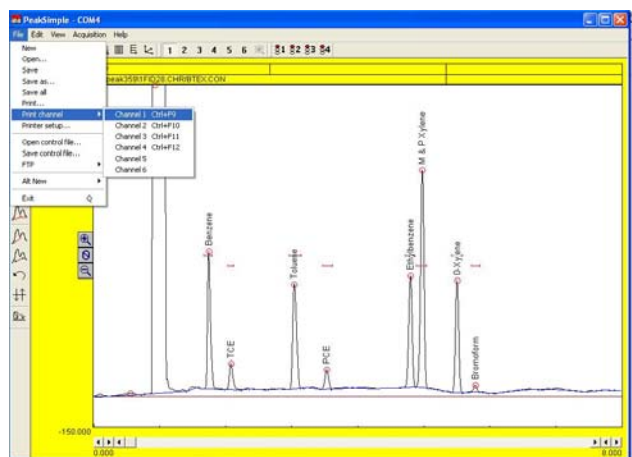
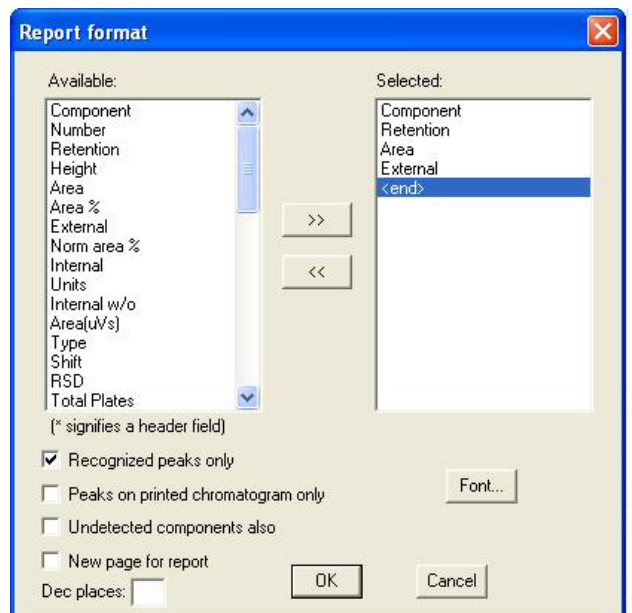
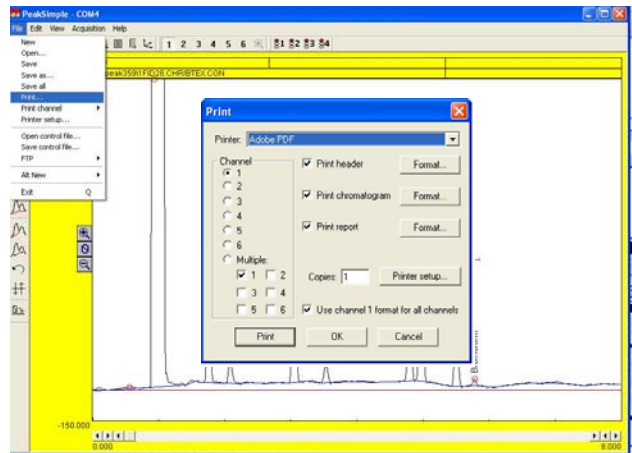
Click on the **Print Report** box and select **Format**. The **Report Format** screen will appear which will allow you to select from a list of measurements which will automatically be calculated and printed on the bottom of your chromatogram. To choose **AREA**, for example, click on **AREA** from the left column and then click on the right arrows (>>). **AREA** will now appear in the **Selected** column on the right.

Clicking on the box next to **Recognized peaks only** will place a check mark in the box and only those peaks which integrate properly within named retention windows will be printed in the report. Checking the **Peaks on printed chromatogram only** box will allow the report to show only those peaks defined by the **Chromatogram format- Start time and Stop time**. This feature allows you to set up your report to ignore all peaks that appear outside your window of interest.

Checking the **Undetected components** also box will report information about all named peaks even if no peak is present in the retention window. Checking **New page for report** will print all report information on a separate page. Click **OK** to close the **Report format** window. You may print out as many **Chromatogram Copies** as you need by entering a number in the **Copies** box and selecting **Print**.

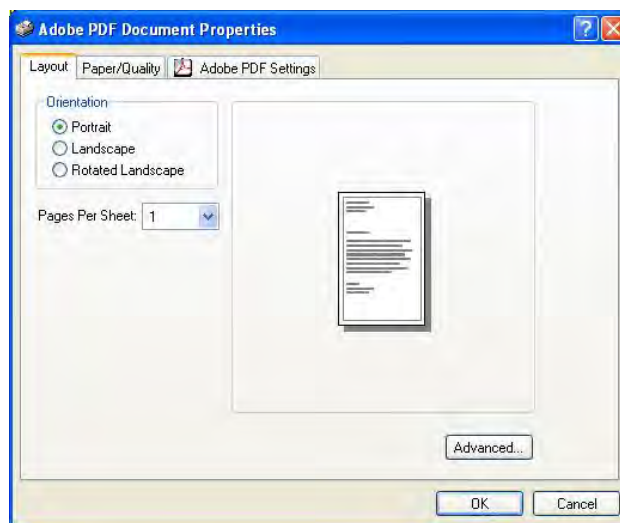
## PRINT CHANNEL

After all **Print** parameters have been set up, the easiest way to print out a chromatogram is to use the **File-Print Channel** quick keys. Hold down the **Ctrl** (control) key and then press **F9** (function #9) to instantly print the **Channel 1** chromatogram. Press **Ctrl F10** to print **Channel 2**, **Ctrl F11** for **Channel 3** or **Ctrl F12** for **Channel 4**. Of course you may also select these commands from the pull-down menu.



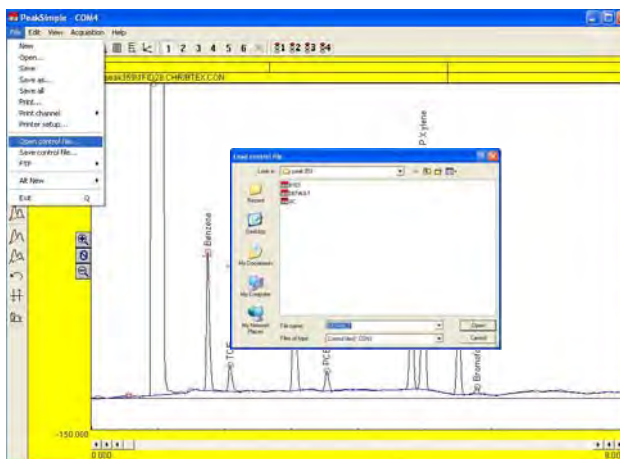
## PRINTER SETUP

Selecting **Printer setup** from the **FILE** pull-down menu will allow you to enter the **Printer Properties** screen for your specific printer. This screen is similar to Windows **Printer Properties** screen that is accessible from the Windows **Control Panel**. Typically, using your printer default settings with **portrait** orientation will produce a visually appealing printout.



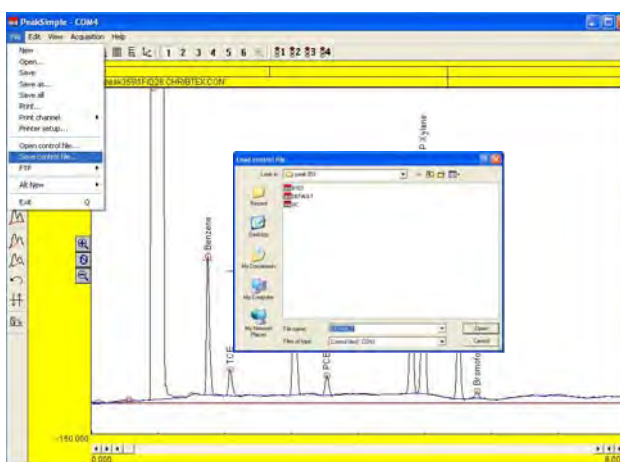
## OPEN CONTROL FILE

PeakSimple for Windows uses **Control Files**, identified with the **.CON** extension, to save the operating settings of specific methods. To load a **Control File**, drop down the **FILE** menu and select **OPEN CONTROL FILE**. A window will open which will allow you to use standard Windows navigation tools to select from a list of **.CON** files, located on the **Drive** or **Directory** of your choice. Click on the desired **File Name** and then click **OK**.



## SAVE CONTROL FILE

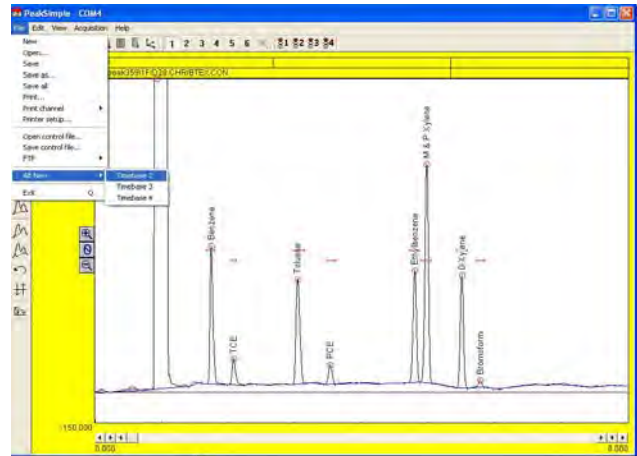
Once you have set up all of the user-definable parameters within PeakSimple for Windows that meet the requirements of your system and/or your specific analytic method, it is wise to save these settings for future use. PeakSimple uses **control files**, identified with a **.CON** extension, to save the operating settings of specific methods, this includes the event table, temperature program, component table, print information, calibration table, etc.



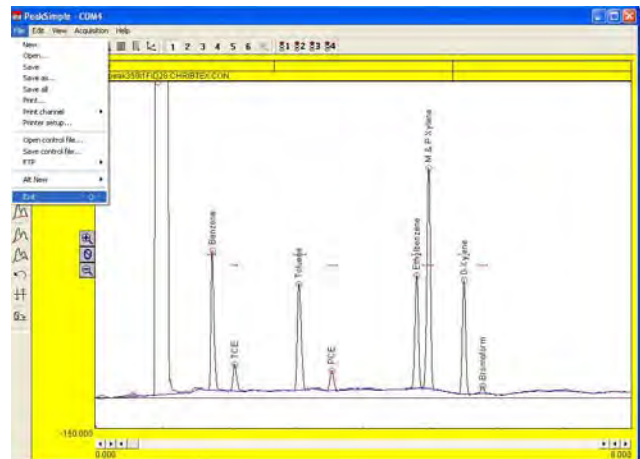
A control file is like a photocopy of your operating settings that you can reload for use at any time. When using control files, you only need to set analysis parameters once and then save them using a descriptive filename, followed by the **.CON** extension, (for example, **BTEX.CON**). To save the control file, drop down the **File** menu and select **Save Control File**. Enter the name for your file in the **File name** box and click **OK**. If you want these current settings to be loaded by default each time you start PeakSimple, name the control file **Default.con**.



**ALT NEW**  
 The **FILE-ALT NEW** feature will clear the display of all active channels in the **Alternate** timebase without starting a new chromatographic run.

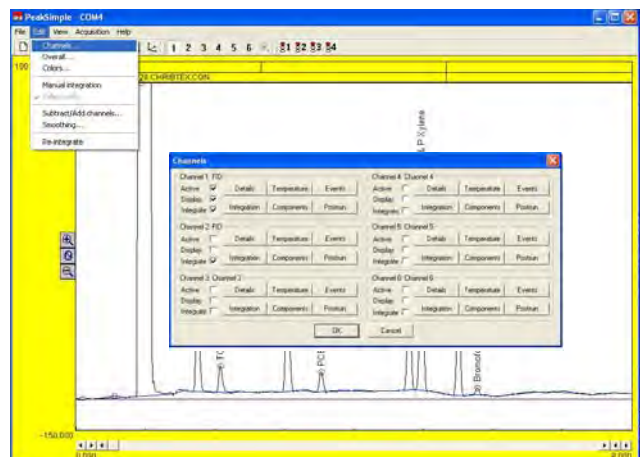


**EXIT**  
 Exits PeakSimple for Windows. Click **Yes** to save any changes made to your control file parameters.



## EDIT Pull-Down Menu

The **EDIT** pull-down menu allows you to modify most of the operating parameters for your specific application. Selecting **EDIT-CHANNELS** will bring up a screen which will enable you to select which of the six channels are active, displayed and integrated. Each channels' operating parameters such as **Details, Temperature, Events, Integration, Components** and **Postrun** information can be easily modified.



## CHANNELS DETAILS

Clicking on the Details box for Channel 1 will bring up a screen where you can enter a Description of your analysis. End time displays the length of the chromatographic run in minutes. By default, the End Time is determined by the length of the temperature program but you may modify this field to end the chromatographic run at any time.

The Sample Rate should be set to a rate sufficient to ensure that 20 data samples are collected from each peak. For example: a Sample Rate of 1 Hz will allow the collection of 20 data points from a peak 20 seconds wide from base to base. And a Sample Rate of 10 Hz will allow the collection of 20 data points from a peak 2 seconds wide from base to base. The analog to digital converter is limited in its ability to sample high rates when many channels are active. The limits are: 50 Hz with one channel active, 10 Hz with two channels active and 5 Hz with three or four channels active.

Channel 1 details

Description: FID End time: 12.000 min

Sample rate:  1 Hz  2 Hz  5 Hz  10 Hz  20 Hz  50 Hz

Default display limits: Max: 1500.000 mV Min: -150.000 mV

Remote start

Timebase:  1  2  3  4

Control by:  Temperature  Pressure  Gradient

Datalogger mode:  On Offset: 0.000 Gain: 1.000 Decimal places: -1 (-1 for autoranging)

Subtract baseline in channel: 1  Overlay data in channel: 1

Relative retention shifts are based at: 0.000 min Unretained solute time: 0.000 min

Reverse polarity  Absorbance mode

Multiply norm area % results by: 1.0000

OK Cancel

The Default Display Limits can be adjusted to view data above and below the 0 mV baseline. A minus (-) setting for minimum will display negative going peaks. The ratio of min./max. display limits are maintained when you click on the Display minus and plus buttons in the main data acquisition screen.

The Remote Start feature allows the user to start a chromatographic run using an external signal such as an autosampler. Check the box to enable Remote Start.

### Unretained Solute Time

If resolution has been selected to be printed in the chromatogram report, then a Unretained Solute Time value needs to be entered to ensure correct resolution calculations. Enter the number of minutes an Unretained Solute takes to pass through the column. This value is used in the determination of the peak resolution statistics.

### Timebase

The Timebase selection assigns the channel to a trigger group. The software can trigger four separate chromatographs, however we only use Timebase 1. Any Channel with the Timebase trigger group selected will start running when the SPACEBAR is pressed and end when the END key is pressed.

### Temperature, Pressure, Gradient, Absorbance

The Temperature button is used for GC analysis, the other buttons are used for HPLC analyses.

### Datalogger

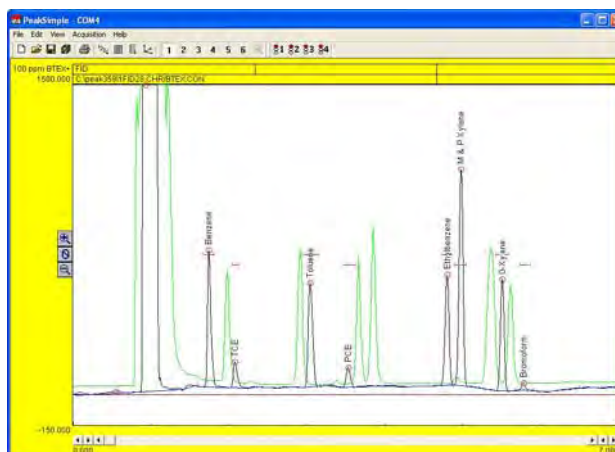
The datalogger button will display just the mV signal in the chromatogram section. This is used to monitor the change in detector signal when no column is present, such as a Total Hydrocarbon analysis, where the sample bleeds directly into the detector.

### Subtract Baseline in Channel "X"

Checking Channel 1's box for Subtract Baseline in Channel "X", where "X" is 1,2,3,4,5 or 6, will cause the chromatogram in Channel 1 to subtract the baseline stored in Channel "X", while running in real-time. Load the baseline to be subtracted into an inactive channel to ensure that the data is not deleted by the start of a new run on that channel. (Uncheck the active box, see **Edit-Channels**). Baseline subtraction can also be performed using PeakSimple's **Edit-Subtract/Add Channels** feature, however, this is not a real-time function, but a post-run function, done at the end of the chromatographic run.

### Overlay Data in Channel "X"

Checking Channel 1's box for **Overlay Data in Channel "X"**, where "X" is 1,2,3,4,5 or 6, will overlay the data stored on Channel "X" onto Channel 1 using contrasting colors. The channel selected for overlay can be either an active or inactive channel. When the overlay channel is active then the overlay will be seen in real-time.

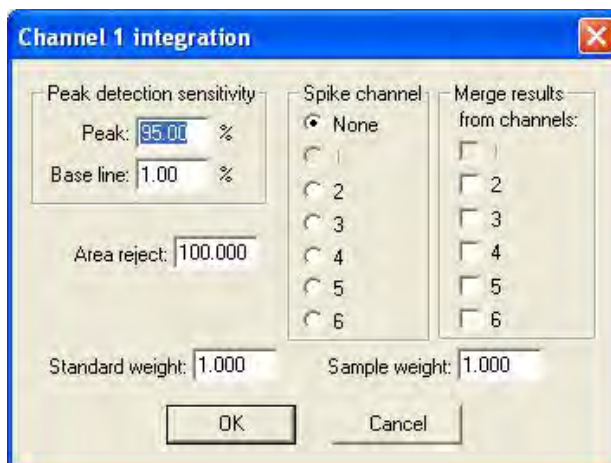


### Relative Retention Shifts Are Based At "X" Minutes

Enter into this box the time, in minutes, that the sample is actually injected onto the column. This is done to ensure the relative retention times are correctly calculated. See the **EDIT-CHANNEL-COMPONENTS** section of this manual for more details.

### CHANNELS-INTEGRATION

PeakSimple for Windows allows you to define specific integration parameters necessary for the proper analysis of your sample data, such as peak and baseline sensitivity and area reject. Any of the **Integration** parameters described next may be modified either before or after data collection. Pressing the **ENTER** key will update the report and the results of the chromatogram currently being displayed.

A dialog box titled 'Channel 1 integration' with a close button (X) in the top right corner. The dialog contains several settings: 'Peak detection sensitivity' with 'Peak: 95.00 %' and 'Base line: 1.00 %'; 'Area reject: 100.000'; 'Spike channel' with radio buttons for 'None', '1', '2', '3', '4', '5', and '6'; 'Merge results from channels:' with checkboxes for '1', '2', '3', '4', '5', and '6'; 'Standard weight: 1.000'; and 'Sample weight: 1.000'. At the bottom are 'OK' and 'Cancel' buttons.

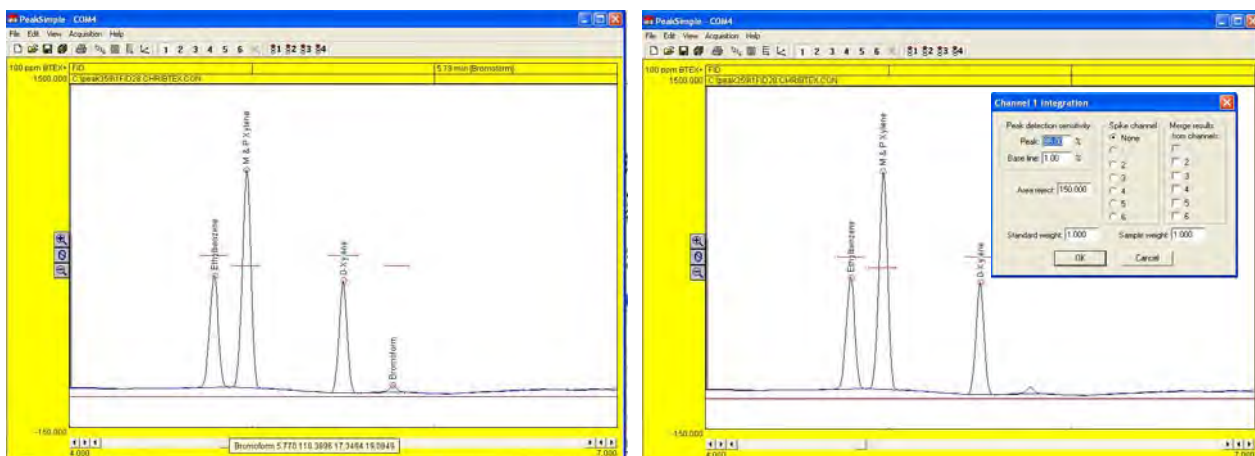
### Peak Detection Sensitivity

The **Peak sensitivity** setting determines how PeakSimple detects the beginning and end of a peak. A high **Peak** number requires only a small slope change to initiate the start or end of the peak. A low **Peak** number requires a very large slope change to initiate the start or the end of the peak. We typically set the value to 95.

The **Baseline sensitivity** setting determines how PeakSimple attaches the baseline to the data line. The larger the **Baseline** number; the more likely PeakSimple will draw the baseline to a valley between two peaks. The smaller the **Baseline** number; the more likely PeakSimple will drop a vertical line from a valley to a horizontally constructed baseline below the peak. We typically set the value to 1.

### Area Reject

If a chromatogram contains peaks whose area counts fall below the threshold defined by the **Area Reject** for that channel, the peak will be ignored and no integration will occur. If the peak area is of interest, you can lower the **Area Reject** value until the peak in question is integrated. Integrated peaks are marked with a circle at the top of the peak. In the example below Bromoform has an area of 118, if the **Area Reject** is increased to 150, bromoform is no longer integrated.



### Standard Weight

PeakSimple for Windows determines the internal or external standard results by the ratio of the **STANDARD** divided by the **SAMPLE**. The **Standard Weight** setting maybe changed to adjust the channel's quantification, affecting internal or external peak results by the factor entered. For instance: A setting of 2.000 will double the weight of the **standard** thereby doubling the internal or external standard results.

Component	Retention	Area	External	Internal
Benzene	1.733	1864.1348	45.4508	50.0000
TCE	2.066	426.8238	49.3897	53.2331
Toluene	3.030	1963.6464	34.7583	38.2373
PCE	3.520	327.3028	46.5537	51.2133
Ethylbenzene	4.790	1775.6680	43.1271	47.4437
M & P Xylene	4.966	3448.3014	80.6080	88.6762
O-Xylene	5.496	1663.8840	38.6347	42.5017
Bromoform	5.770	118.3896	8.6742	9.5424
		11489.1508	346.1956	380.8478

### Sample Weight

The Sample Weight setting may also be changed to adjust the channel's quantification, affecting internal or external peak results by the factor entered. For instance: A setting of 2.000 will double the weight of the sample thereby halving the internal or external standard results.

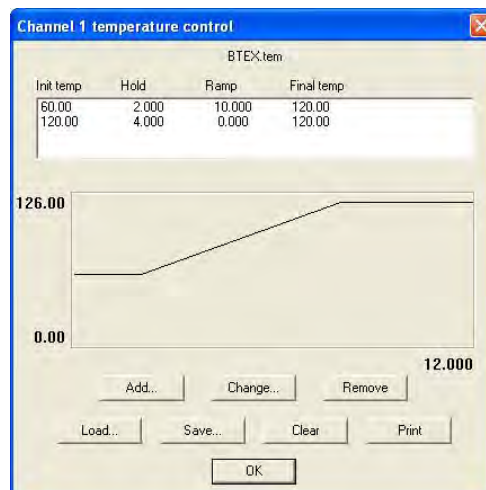
Component	Retention	Area	External	Internal
Benzene	1.733	1864.1348	45.4508	50.0000
TCE	2.066	426.8238	48.3897	53.2331
Toluene	3.030	1863.6464	34.7583	38.2373
PCE	3.520	327.3026	46.5537	51.2133
Ethylbenzene	4.790	1775.6690	43.1271	47.4437
M & P Xylene	4.866	3448.3014	80.6080	88.6762
O-Xylene	5.496	1663.8840	38.6347	42.5017
Bromoform	5.770	11488.1508	346.1366	380.8478

### Spike Channel

Another feature of PeakSimple for Windows allows you to display the results of a matrix Spike Channel subtraction.

### EDIT-CHANNELS-TEMPERATURE

PeakSimple for Windows features temperature-programming of the GC's column oven(s). Access the Edit-Channel 1 Temperature screen to specify the temperature parameters to be used during the analytical run. The temperature program is capable of executing an unlimited number of temperature ramp and hold periods during the analysis as well as maintaining a single temperature throughout the run for isothermal operation.



### Temperature Segment Details

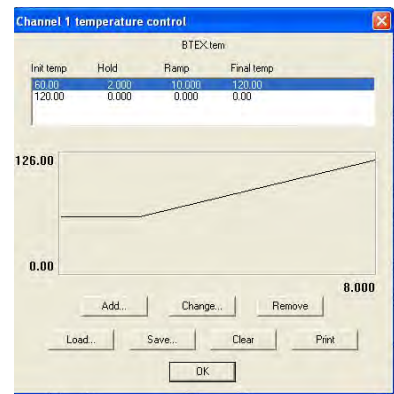
#### Add Button

Click on the Add button from a blank channel 1 temperature control window to create a new temperature program for column oven #1. Type the required data in the following fields: Initial temperature, the Hold period in minutes, the Ramp rate in °C / min and the final Temperature, or the duration of the Ramp.

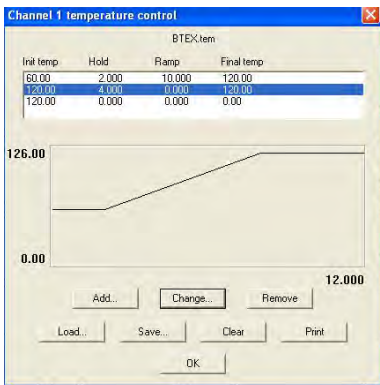
The length of the run is automatically calculated by PeakSimple based on the information provided in these fields, and is also displayed in the EDIT-Channel-Details End Time field. Additional ramp segments may be added by clicking Add button again.

In isothermal operation, the Initial and the final temperature are the same, so a Ramp rate of 0.000 is entered. The Hold period determines the length of the analytical run.

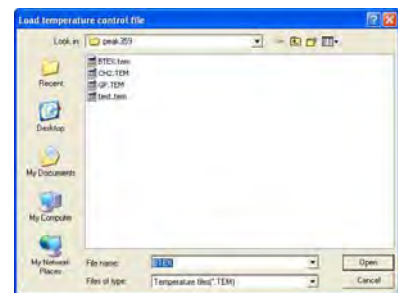
**Change Button**  
 Click on an existing temperature program segment to select it. Click on the **Change** button to change the parameters of the segment.



**Remove Button**  
 Click on the **Remove** button to remove the segment from the current program.



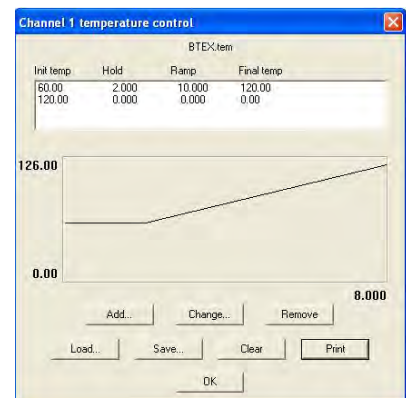
**Load Button**  
 Click on the **Load** button to load an existing temperature control file, or to update an existing one. Remember to use the **.TEM** extension when naming the temperature control file. The saved file name appears at the top of the temperature control window indicating the file in use.



**Clear Button**  
 Clicking on the **Clear** button deletes all temperature data from the temperature control window. The temperature program name is also removed.



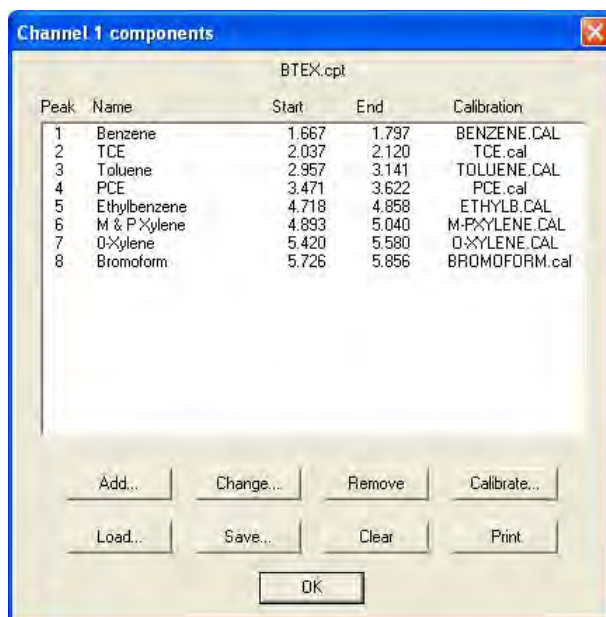
**Print Button**  
 Clicking on the **Print** button sends the file data and temperature program profile to the printer.



## CHANNELS-COMPONENTS

PeakSimple for Windows can identify and quantify sample components through the use of a component table. The component table enables PeakSimple to recognize each peak by its retention time and compare the area counts against the calibration curve to produce actual concentration data. The user can edit the component table for each channel by accessing the **Edit-Channel-Components** screen.

When a component table is loaded, the table will show each component by its peak number, peak name, the start time for the retention window, the stop time for the retention window, and the associated calibration file name. Different component tables may be used for each active channel and any component table can be saved as a component file for future use. Component files are designated with a **.CPT** extension. The component filename appears at the top of the Components screen.



Peak	Name	Start	End	Calibration
1	Benzene	1.667	1.797	BENZENE.CAL
2	TCE	2.037	2.120	TCE.cal
3	Toluene	2.957	3.141	TOLUENE.CAL
4	PCE	3.471	3.622	PCE.cal
5	Ethylbenzene	4.718	4.858	ETHYLB.CAL
6	M & P Xylene	4.893	5.040	M-PXYLENE.CAL
7	O-Xylene	5.420	5.580	O-XYLENE.CAL
8	Bromofom	5.726	5.856	BROMOFORM.cal

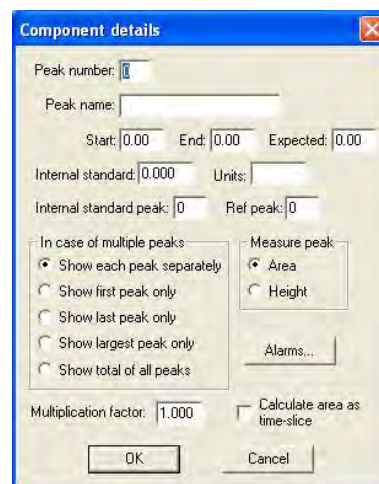
Buttons: Add..., Change..., Remove, Calibrate..., Load..., Save..., Clear, Print, OK

## COMPONENT DETAILS

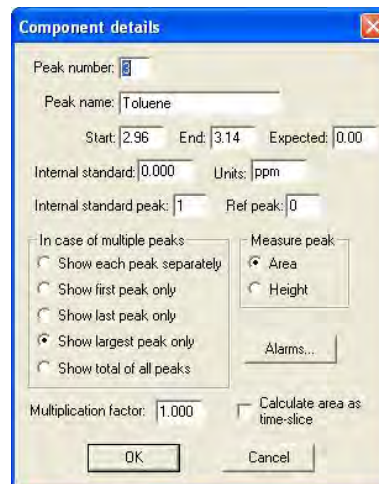
Select **Add** to add a new component to a blank or existing component table. The Component Details screen will open allowing the user to input specific peak parameters. As a minimum, enter the **Peak Number**, **Peak Name**, **Start time** and **End time**. Other optional parameters are the **Expected peak time**, the concentration **Units** to be reported, any **Internal Standard** or **Reference peak** information, peaks measured by **Area** or **Height**, handling of **Multiple Peaks**, the **Multiplication Factor** and **Alarm** parameters.

### Peak Number, Peak Name, Start and End

A blank Component Details screen is opened by selecting the **Add** button. Enter a unique **Peak Number** for each component, typically starting with 1 and incrementing for each additional peak. Then enter a unique **Peak Name** for each component. **Start** and **End** define the beginning and ending of the retention windows, which are used to identify the peak. The width of the retention window should be set wide enough so that small fluctuations in the peak's retention window will still allow for proper integration.



Peak number: 1  
Peak name:   
Start: 0.00 End: 0.00 Expected: 0.00  
Internal standard: 0.000 Units:   
Internal standard peak: 0 Ref peak: 0  
In case of multiple peaks:  
 Show each peak separately  
 Show first peak only  
 Show last peak only  
 Show largest peak only  
 Show total of all peaks  
Measure peak:  
 Area  
 Height  
Alarms...  
Multiplication factor: 1.000  Calculate area as time-slice  
OK Cancel



Peak number: 3  
Peak name: Toluene  
Start: 2.96 End: 3.14 Expected: 0.00  
Internal standard: 0.000 Units: ppm  
Internal standard peak: 1 Ref peak: 0  
In case of multiple peaks:  
 Show each peak separately  
 Show first peak only  
 Show largest peak only  
 Show total of all peaks  
Measure peak:  
 Area  
 Height  
Alarms...  
Multiplication factor: 1.000  Calculate area as time-slice  
OK Cancel

### Internal Standard and Units

Internal Standard calculations are used to correct for injection size variations, or to compensate for changes in detector sensitivity. An internal standard peak is added to the sample prior to injection at a known concentration. The internal standard peak is calculated just like any other peak using a calibration curve, typically a single point calibration. The known concentration of the internal standard peak is entered into the Internal Standard dialog box of the Component Details screen. In the example shown below, Benzene has been chosen as the internal standard peak. The known concentration of Benzene is entered as 100, and ppm is entered in the Units dialog box. When a chromatogram is integrated and a report is produced, the external calculation yields a result which is the peak area x calibration factor (slope of the calibration curve) = external standard result.

Component details

Peak number: 1

Peak name: Benzene

Start: 1.67 End: 1.80 Expected: 0.00

Internal standard: 100.000 Units: ppm

Internal standard peak: 0 Ref peak: 0

In case of multiple peaks:

- Show each peak separately
- Show first peak only
- Show last peak only
- Show largest peak only
- Show total of all peaks

Measure peak:

- Area
- Height

Alarms...

Multiplication factor: 1.000  Calculate area as time-slice

OK Cancel

The internal standard calculation yields a result which is the external result times the ratio of the known concentration of the internal standard peak divided by the external result for the internal standard peak. As shown in the example to the right, note that while the external result for Benzene yields exactly 100 (the known concentration) as a result of the calculation  $90.90 \times 100/90.90$ . In the same way, the internal result for every analyte peak which is referenced to Benzene is calculated as external result  $\times 100/90.90 =$  internal standard result.

Component	Retention	Area	External	Internal
Benzene	1.22	104.1342	90.9016	100.0000
TCE	2.066	426.0236	58.7794	106.8652
Toluene	3.030	1963.8464	68.5187	76.4747
PCB	3.537	327.2628	33.1074	109.4056
Dichlorobenzene	4.793	1778.5380	86.2542	94.0075
M.I. Polystyrene	4.866	3448.2014	181.2161	177.3524
Dibutyltin	5.459	1963.0940	77.2034	85.0034
Bromobenzene	5.770	116.3696	17.3484	19.0849
		1488.1568	652.3933	781.6868

Channel: 1 Update Save Integration Format

Recognized peaks only: Copy results log Discard results log Show results log Add to results log

Undetected components also

### Internal Standard Peak

Peaksimple allows any peak to be referenced to any other peak for internal standard calculations. Typically all analyte peaks will be referenced against a single Internal Standard Peak. In this example Toluene is referenced to Benzene (Peak #1) by entering 1 in the Component Details screen dialog box labeled Internal Standard Peak. Notice that the Results screen (View Results), will reflect the new value for all peaks' internal results.

Component details

Peak number: 8

Peak name: Toluene

Start: 2.96 End: 3.14 Expected: 0.00

Internal standard: 1.000 Units: ppm

Internal standard peak: 1 Ref peak: 0

In case of multiple peaks:

- Show each peak separately
- Show first peak only
- Show last peak only
- Show largest peak only
- Show total of all peaks

Measure peak:

- Area
- Height

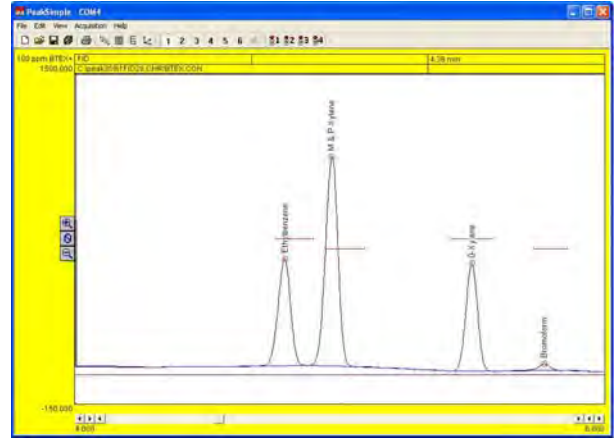
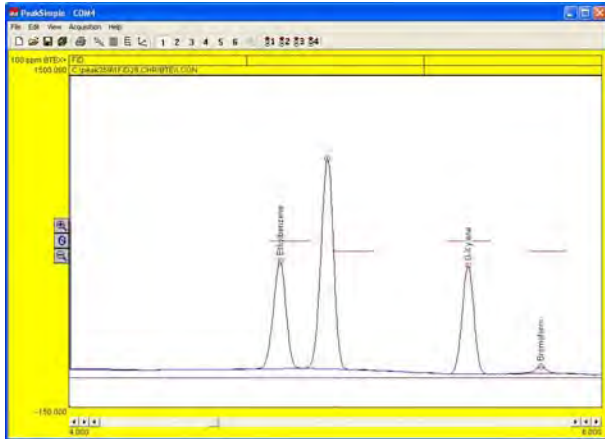
Alarms...

Multiplication factor: 1.000  Calculate area as time-slice

OK Cancel



A Reference Peak is used to shift the retention windows of other peaks. In the example below, M&P-Xylenes eluted prior to their retention window and were not integrated. By entering a value of 5 in the Reference Peak box, M&P-Xylenes retention windows are referenced to ethylbenzene, (peak #5). M&P-Xylenes retention window is then shifted by a percentage equivalent to chlorobenzene's distance from the middle of its retention window. This shift in the ethylbenzene retention window allows M&P-Xylenes to be integrated.



### Change Button

Click on an existing component to select it. Click on the Change button to change the parameters of the component.

Channel 1 components

Peak	Name	Start	End	Calibration
1*	Benzene	1.670	1.800	BENZENE.CAL
2(1)	TCE	2.040	2.120	TCE.cal
3(1)	Toluene	2.920	3.100	TOLUENE.CAL
4(1)	PCE	3.470	3.620	PCE.cal
5(1)	Ethylbenzene	4.762	4.902	ETHYLB.CAL
6(1)	M & P Xylene	4.930	5.140	M-PXYLENE.CAL
7(1)	O-Xylene	5.420	5.580	O-XYLENE.CAL
8(1)	Bromofom	5.730	5.860	BROMOFORM.cal

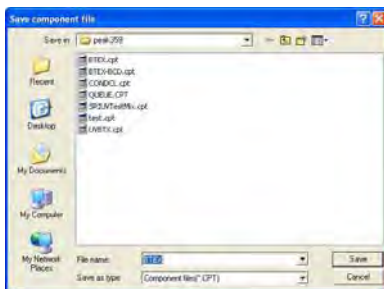
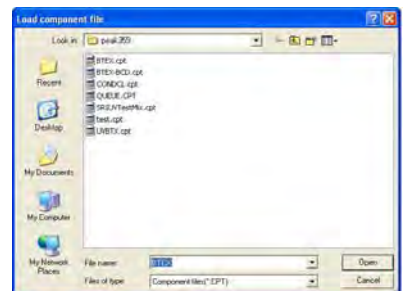
Channel 1 components

Peak	Name	Start	End	Calibration
1	Benzene	1.667	1.787	BENZENE.CAL
2	TCE	2.037	2.120	TCE.cal
3	Toluene	2.957	3.141	TOLUENE.CAL
4	PCE	3.471	3.622	PCE.cal
5	Ethylbenzene	4.718	4.958	ETHYLB.CAL
6	M & P Xylene	4.893	5.040	M-PXYLENE.CAL
7	O-Xylene	5.420	5.580	O-XYLENE.CAL
8	Bromofom	5.726	5.856	BROMOFORM.cal

**Remove Button**  
Click on the Remove button to remove the component from the component table.

### Load Button

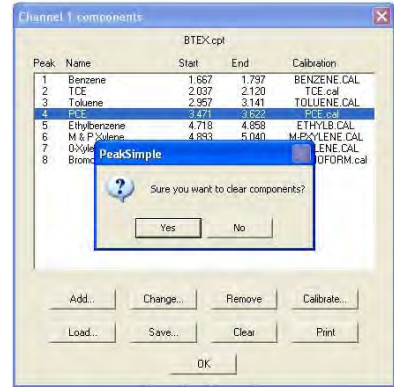
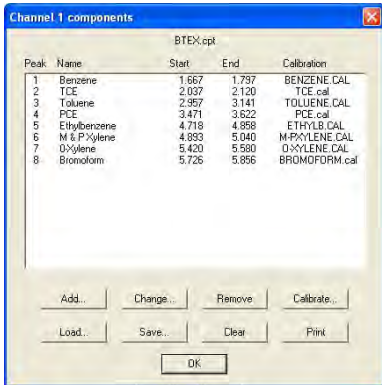
Click on the Load button to load an existing component file, designated with the .CPT file extension.



### Save Button

Click on the Save button to save a new component file, or to update an existing one. Remember to always use the .CPT extension when naming the component file. The saved file name appears at the top of the components window indicating the file in use.

**Clear Button**  
 Clicking on the Clear button deletes all component data from the component window. The component file name is also removed.



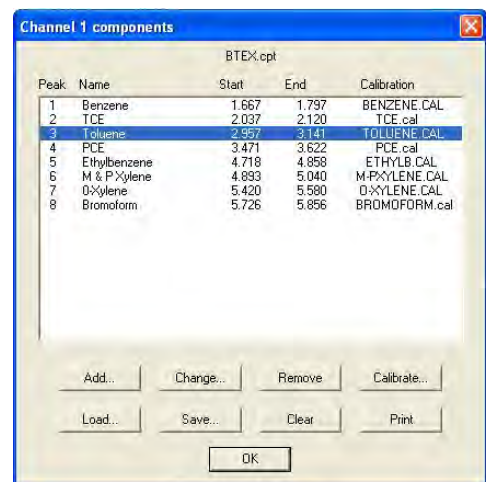
**Print Button**  
 Clicking on the Print button sends the file data and the component table information to the printer.

**Calibrate Button**  
 After creating a component table, each component in the table will need to be calibrated. This allows PeakSimple for Windows to not only identify each analyte peak, but also to quantify each use peak using a calibration curve. The calibration curve is calculated from user-generated results obtained at several different concentrations that span the expected range to be encountered in actual samples

Inject a standard containing known concentration of the component you wish to calibrate. Use a concentration higher than what you would expect to encounter in your analyses. Another few samples should be run at lower levels, using precise dilutions of your standard. Make note of the area or peak height at each concentration or use the shortcut method described in the next section.

**Calibration Window**  
 In the Edit-Channels-Components screen, highlight the component to be calibrated and select Calibrate. If this is the first time calibrating a component, an error message will appear which says "Not enough data points". This is simply a warning to inform you that PeakSimple currently does not have enough data points for the calibration method in use. Once enough data is entered for the calibration curve, this message will no longer appear. Click OK to bypass the error message and continue to the calibration window.

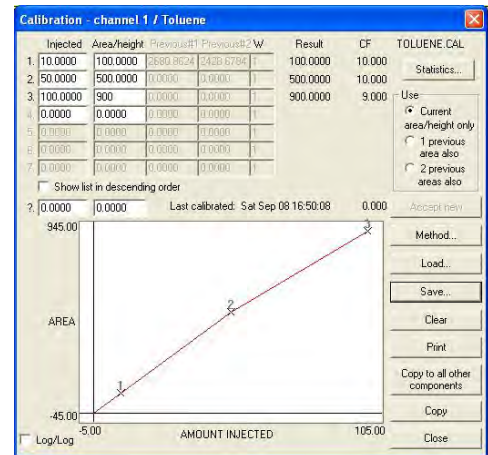
The Calibration will open and allow you to enter



the raw data that you previously obtained. In the example shown, data is entered into the table in the upper left corner of the calibration screen, beginning with the lowest concentration and ending with the highest concentration. If you wish to enter the data in descending order, check the **Show list in descending order** box. When entering data into the table, first enter the concentration injected, then the area count or peak height obtained.

As data is entered for each concentration, a data point will be added to the calibration curve displayed in the lower screen of the window. You may use as many as seven concentration levels for your calibration curve. In the fictitious example on the right, a Toluene standard was injected in concentrations of 10 ppm, 50 ppm, and 100 ppm. The area counts from the FID detector were 100, 500 and 900, respectively. Notice the three corresponding data points on the newly created calibration curve.

When calibration for each component has been completed, click on the **Save** button to save and name the component's calibration file. Then click on the **Close** button to close the calibration window. In our example, a unique file named **T-Test.cal** was created. The **T-Test.cal** file name will now appear in the **Components** window next to Toluene.



Peak	Name	Start	End	Calibration
1	Benzene	1.667	1.797	BENZENE.CAL
2	TCE	2.037	2.120	TCE.cal
3	Toluene	2.957	3.141	T-Test.cal
4	PCE	3.471	3.622	PCE.cal
5	Ethylbenzene	4.718	4.858	ETHYLB.CAL
6	M & P Xylene	4.893	5.040	M-PXYLENE.CAL
7	O-Xylene	5.420	5.580	O-XYLENE.CAL
8	Bromofom	5.726	5.856	BROMOFORM.cal

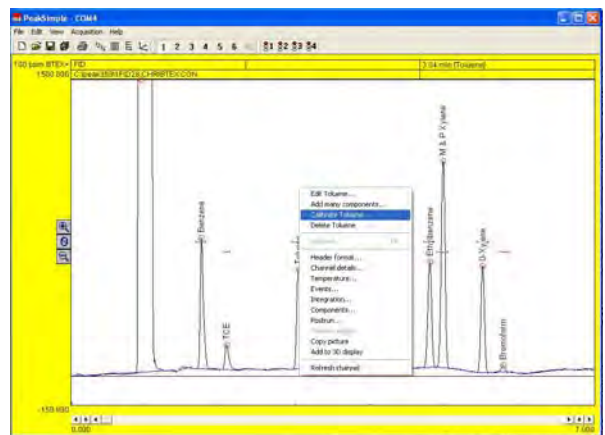
**WARNING:**

Do not use the same calibration curve file name for two different channels or detectors since each detector requires its own calibration curve (ie BenzFID.cal; BenzPID.cal; etc.)

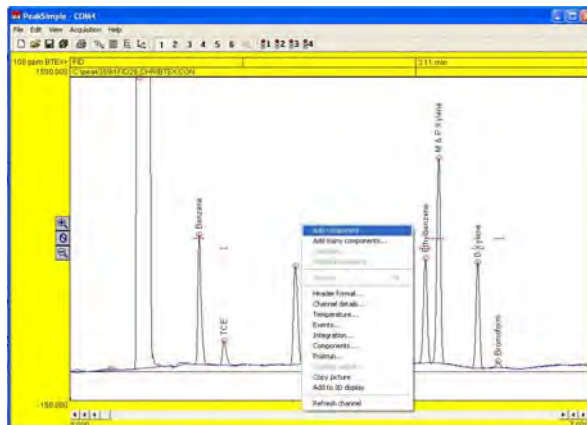
Calibration is required for each component you expect to be present in your sample, and for each detector you will be using in your analysis. Once calibration curves have been completed, and calibration files saved, every component in the component table should show an associated calibration file. PeakSimple will now be able to quantify each component when actual samples are injected.

**Calibration Screen Shortcuts**

As an added convenience, PeakSimple for Windows offers shortcuts to commonly used screens. These shortcuts may be accessed by pointing to the peak on the desired channel and clicking once on the **right mouse button**. The following pages describe the shortcuts available to set up calibration tables and calibrate components.



After a known standard has been run and peaks have been identified, a new component table may be constructed by simply positioning the mouse pointer over a peak clicking once on the right mouse button, (“right-clicking”). The shortcut menu will appear. Select **Add component** from the menu. A retention window will be drawn horizontally across the peak.



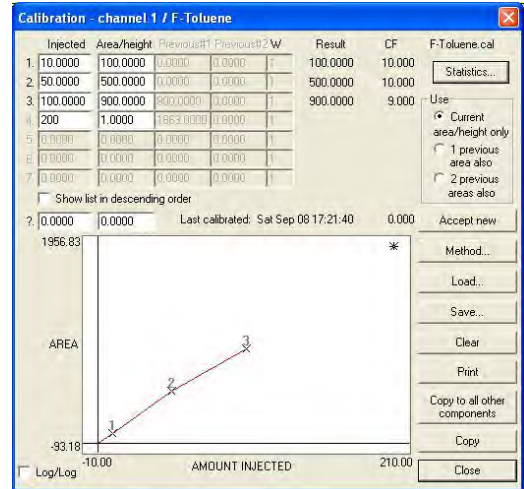
Right-click again over the peak and select **Edit component**. The **Component details** screen will open allowing the peak to be named and numbered. The example below shows Toluene as peak #3. The component has been named **F-Toluene** to avoid confusion with a toluene peak from another detector such as a PID.

**Note:** It is important that you choose the component name carefully since the calibration file name is derived from the component name. The **F-Toluene** calibration file would be named **F-Toluene.cal**.

Right-click over the peak again and select **Calibrate**. If no calibration curve exists for the peak, a window will open asking if you would like to use a calibration file. PeakSimple offers a template calibration file aptly named **TEMPLATE.CAL**. Click **yes** to use the default **TEMPLATE** calibration file or select your own by clicking **Browse**. This example uses the template calibration file. Another window will open asking you to select the **Recalibration Level**. Select **100** for 100 ppm standards, **50** for 50 ppm, etc.

Click **OK** to accept the **Recalibration level**. The calibration screen will open and a flashing asterisk (\*) will appear along the existing calibration curve depicting the new data point. Notice that the calibration curve has been named **F-Toluene.CAL**. If the new calibration data point is acceptable, click **Accept New** to update the calibration curve data.

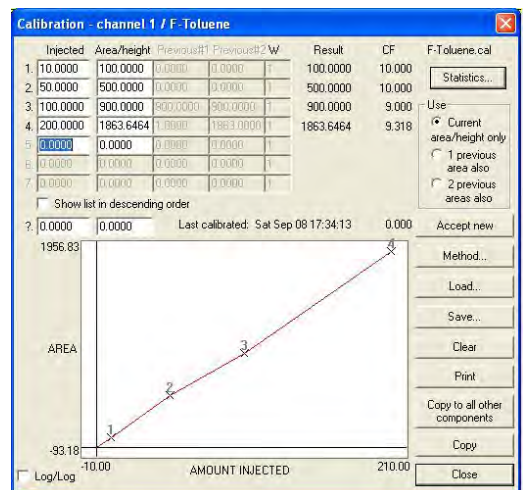
In the example to the right the **F-Toluene.CAL** calibration table reflects the new area count of **1862** at the new concentration level of **200 ppm**. At this point, if the new calibration curve data is deemed to be acceptable, click on **Close** to automatically save the new calibration file, and close the **Calibration** window.



**Calibrate All**  
PeakSimple offers a timesaving feature for recalibrating all peaks with just one mouse click. After a calibration curve has been created for each component, click on **View-Results** to bring up the result window. Select **Calibrate All** and choose an appropriate **Recalibration Level**, then click **OK**. PeakSimple will automatically recalibrate all components at the selected level and save each component's updated calibration file.

Component	Retention	Area	External	Internal
Benzene	1.733	1864.1348	90.9016	90.9016
TCE	2.065	426.9238	96.7784	96.7784
F-Toluene	3.030	1863.6464	200.0000	200.0000
PCE	3.520	327.3028	93.1074	93.1074
Ethylbenzene	4.790	1775.6680	86.2542	86.2542
M & P Xylene	4.965	3448.3014	161.2161	161.2161
Oxylene	5.495	1663.8940	77.2694	77.2694
Bromofom	5.770	118.3956	17.3484	17.3484
		11488.1508	822.8766	822.8766

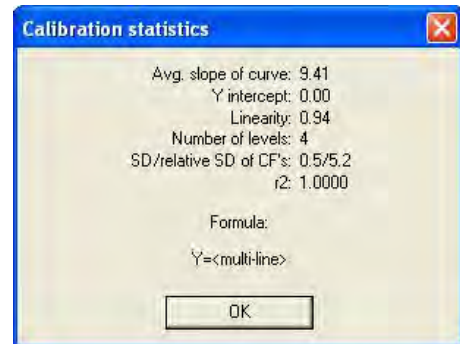
**Calibration – Use and Statistics Radial Buttons**  
To improve the calibration accuracy, chromatographers may prefer to average the areas 1, 2 or 3 replicate injections. The **Use** radio button allows the user to select how many injections are used in the calculation of calibration factors (CF). Calibration factors are used to construct the calibration curve using the formula:  $CF = \text{area count} / \text{the amount injected}$ . The example to the right shows the calibration data at the 200 ppm concentration level, with the **Use** button set to the default setting of **Current Area / Height Only**. This setting uses only the latest calibration data to calculate the calibration factor for the #4 data point. ( $CF = 1863 / 200 = 9.318$ )



If you have injected multiple samples of the same standard, they can be averaged by setting the calibration to use **Previous Areas Also**.

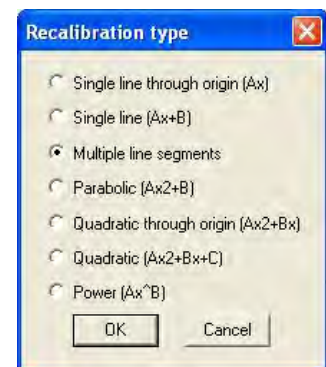
Setting **Use to 2 Previous Areas Also** will average the last three areas to derive the calibration factor.

The **Calibration Statistics** screen shows calibration curve details such as the **Average Slope of the Curve**, the **Y Intercept**, the **Linearity** of the curve, the **Number of (calibration) Levels**, the **Standard Deviation and Relative Standard Derivation of Calibration Factors**, the **R2** and the **Formula** used which is based on the **Method** selected.



#### Calibration Window – Methods

The **Method** button opens the **Recalibrate Type** window which allows the selection of one of six formulas used to draw the calibration curve. The algorithms are described below and corresponding calibration statistics are shown.



In the following:

**X** is the sum of the external measures over the calibration levels

**Y** is the sum of the corresponding areas at those calibration levels

**n** is the number of active calibration levels

Several other sums are used, for instance:

**X2** is the sum of the squares of the external measures

**Y4** is the sum of the (area to the 4th power)

**XY** is the sum of the (external measure \* area)

**X2Y** is the sum of (external measure squared \* area)

**Y/X** is the sum of the (area / external measure) etc.

#### Single line through origin:

The resulting calibration curve is defined as

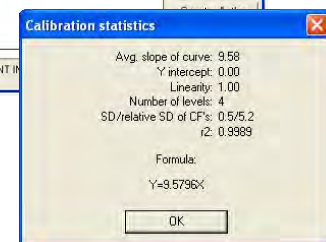
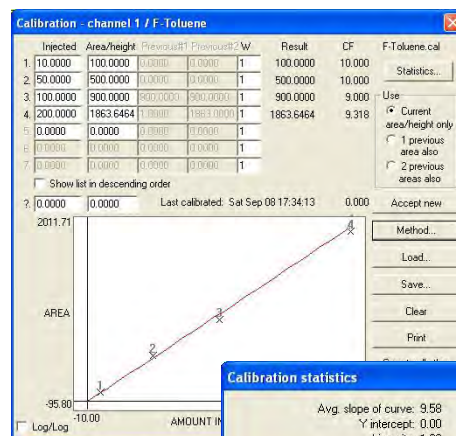
$$y = Ax$$

where:

**x** is external measure

**y** is area

$$A = (Y/X)/n$$



**Single line:**

The resulting calibration curve is defined as  $Y = Ax + B$

where:

x is external measure

y is area

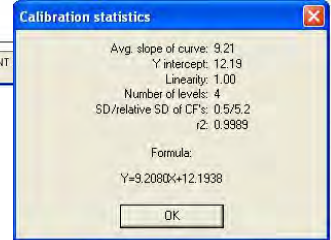
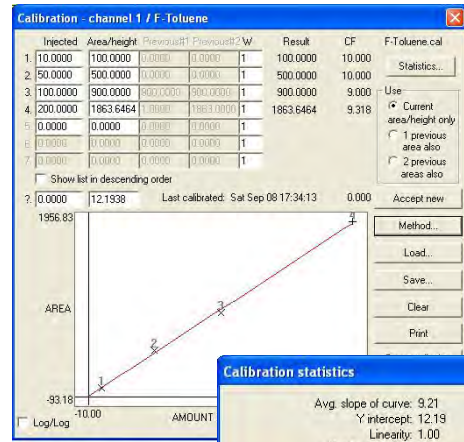
$$A = ((XY * n) - (X * Y)) / D$$

$$B = ((X * Y^2) - (XY * X)) / D$$

$$D = ((X^2 * n) - (X * X))$$

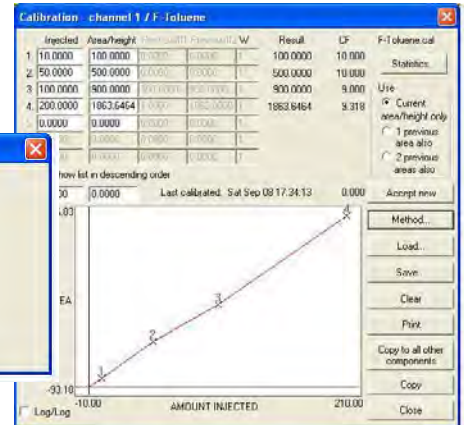
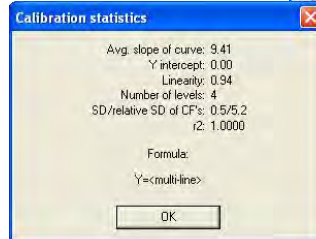
**Notes:**

This is a least square fit algorithm over the calibration levels. A point at (0,0) is also assumed (by incrementing n) unless there is already a value at x=0, or if (Statistics)R2IncludeZero is set to = in the PEAKWIN.INI file. There must be at least 2 calibration levels. EPA rules allow the use of Single Line Fit provided that the standard deviation of calibration factors is <20%.



**Multiple line segments:**

There is no resulting formula here, just interpolation between the levels and the origin. There must be at least one calibration level.



**Parabolic:**

The resulting calibration curve is defined as  $Y = Ax^2 + B$

where:

x is external measure

y is area

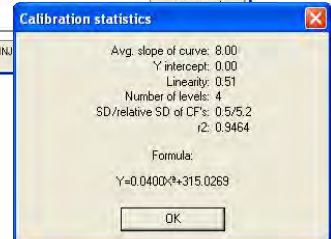
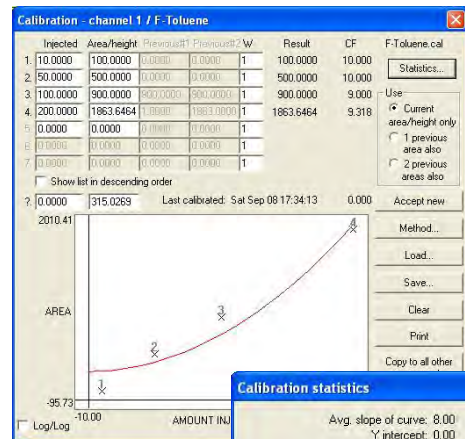
$$A = ((X^2Y * n) - (Y * X^2)) / D$$

$$B = ((Y * X^4) - (X^2Y * X^2)) / D$$

$$D = ((X^4 * n) - (X^2 * X^2))$$

**Notes:**

This is a least squares fit algorithm over the calibration levels. A point at (0,0) is also assumed (by incrementing n) unless there is already a value at x=0, or if (Statistics) R2includeZero is



set to 0 in the PEAKWIN.INI file. There must be at least 2 calibration levels (3 if the origin is not assumed).

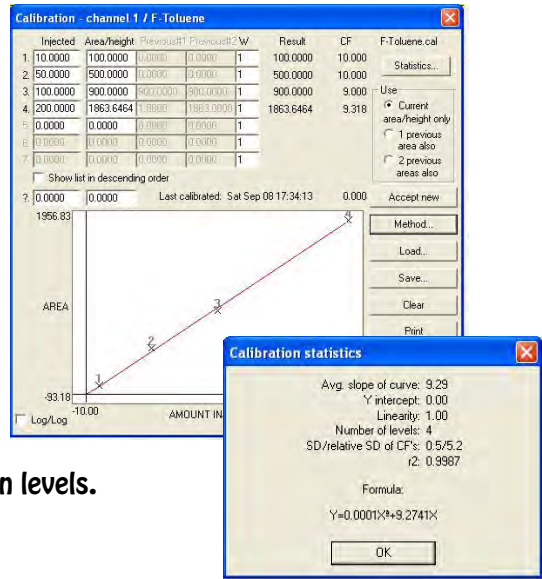
**Quadratic through origin:**

The resulting calibration curve is defined as  $Y = Ax^2 + Bx$

where:  $x$  is external measure  
 $y$  is area  
 $A = ((XY * X3) - (X2Y * X3)) / D$   
 $B = ((XY * X4) - (X2Y * X3)) / D$   
 $D = (X3 * X3) - (X4 * X2)$

**Notes:**

This is a least squares fit algorithm over the calibration levels. There must be at least 2 calibration levels.



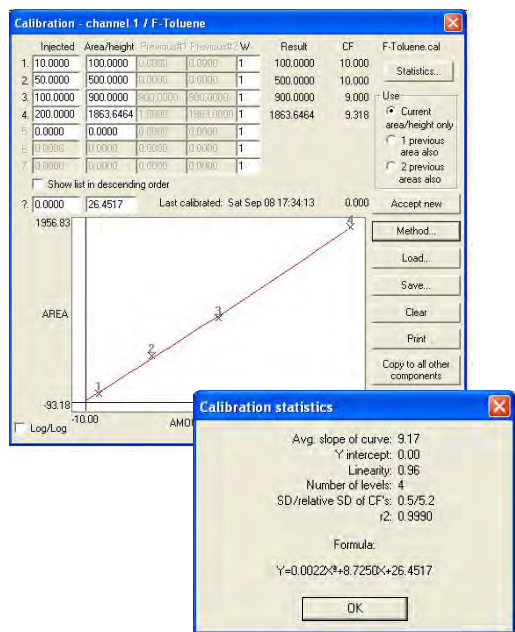
**Quadratic:**

The resulting calibration curve is defined as  $Y = Ax^2 + Bx + C$

where:  $x$  is external measure  
 $y$  is area  
 $A = ((XY * X - Y * X2) * (X2 * X2 - X * X3) - (X2Y * X2 - XY * X3) * (X * X - X2 * n)) / D$   
 $B = ((XY * X2 - Y * X3) * (X2 * X3 - X * X4) - (X2Y * X3 - XY * X4) * (X2 * X2 - X * X3)) / E$   
 $C = ((XY * X2 - Y * X3) * (X3 * X3 - X2 * X4) - (X2Y * X3 - X * X4) * (X2 * X2 - X * X3)) / F$   
 $D = ((X3 * X - X2 * X2) * (X2 * X2 - X * X3) - (X4 * X2 - X3 * X3) * (X * X - X2 * n))$   
 $E = ((X2 * X2 - X * X3) * (X2 * X3 - X * X4) - (X3 * X3 - X2 * X4) * (X * X2 - X3 * n))$   
 $F = ((X * X2 - X3 * n) * (X3 * X3 - X2 * X4) - (X2 * X3 - X * X4) * (X2 * X2 - X * X3))$

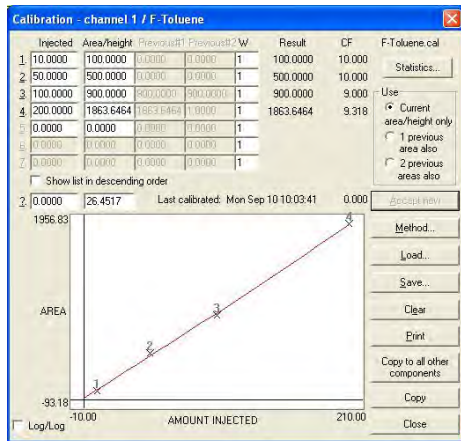
**Notes:**

This is a least squares fit algorithm over the calibration levels. A point at (0,0) is also assumed (by incrementing n) unless there is already a value at x=0, or if (Statistics) R2includeZero is set to 0 in the PEAKWIN.INI file. There must be at least 2 calibration levels (3 if the origin is not assumed).

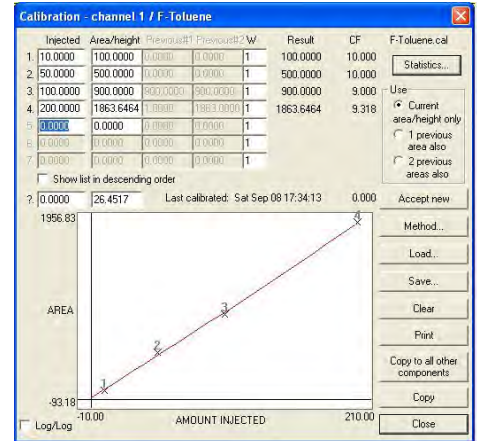




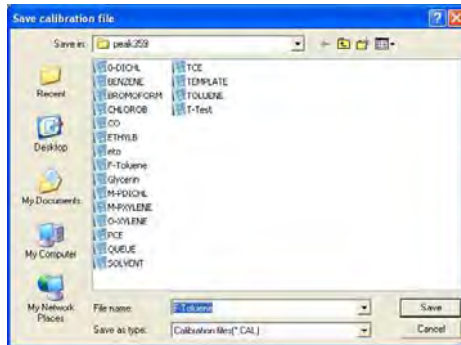
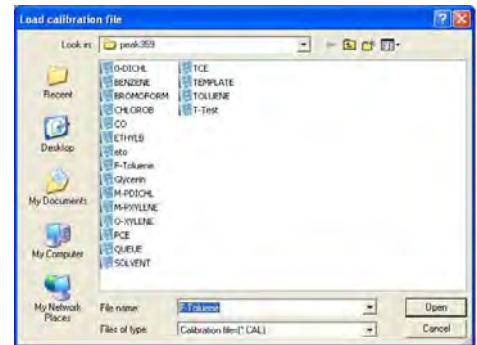
**Accept New**  
If the calibration data is acceptable, click **Accept New** to update the calibration curve data.



**Close Button**  
Automatically saves the new calibration file and closes the Calibration window.



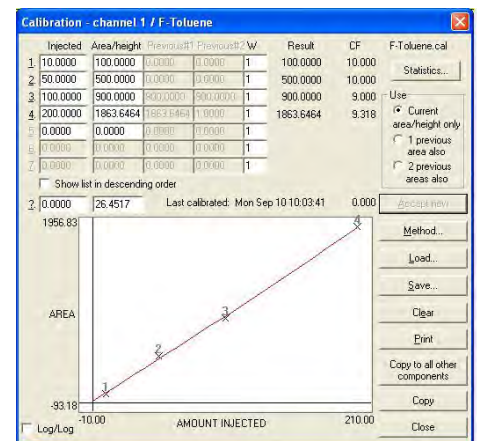
**Load**  
Click on the **Load** button to load an existing calibration file, designated with the .CAL file extension.



**Save**  
Click on the **Save** button to save a new calibration file, or to update an existing one. Remember to always use the .CAL extension when naming the calibration file. The saved file name appears at the top of the calibration window indicating the file in use.

**Clear**  
Clicking on the **Clear** button deletes all calibration data from the calibration window. The calibration file name is also removed.

**Print**  
Clicking on the **Print** button sends the file data and the calibration curve information to the printer.



### Channels-Events

The Events Screen is used to place integration events in a chromatogram for easier data processing. Any of the integration events can be saved to the events file where they can be used for subsequent runs.

### Change

Click on an existing event to select it. Click on the Change button to change the parameters of the event.

### Add

Click on the ADD button to add a new event to the events table. The events details screen will appear to select the new event from. To add an integration event, click on the event and enter the start time at the bottom left of the screen, then click OK.

Events A-G are not used in the DPS GC. We use event H to allow PeakSimple to stop the GC program sequence and temperature program.

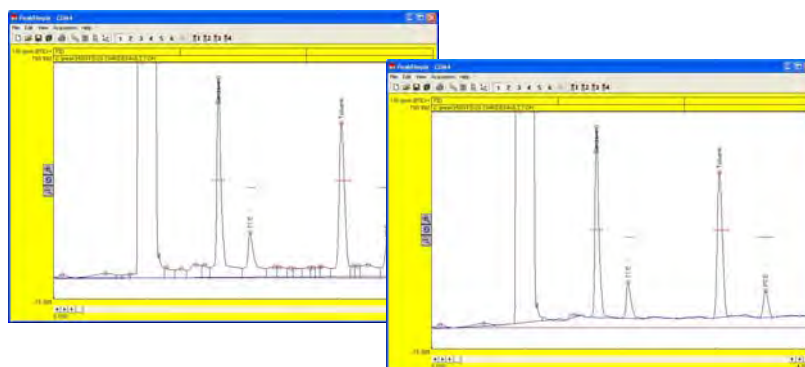
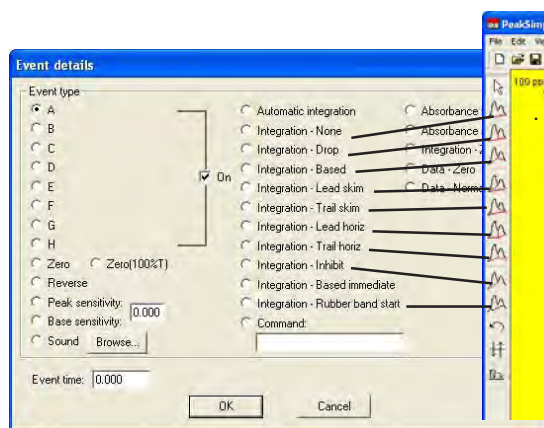
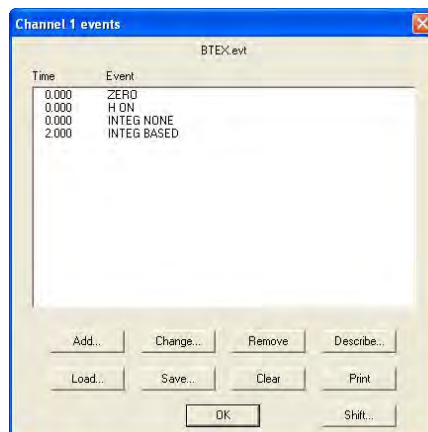
Using the Zero function zero's the detector signal at the start of the run. This will start the signal at the baseline for better looking chromatograms.

The peak sensitivity features are explained in the Integration section of the manual.

The integration events in the middle of the table follow the same sequence at the Manual Integration events, and are described in detail in that section of the manual. Any of the events can be used multiple times during a run.

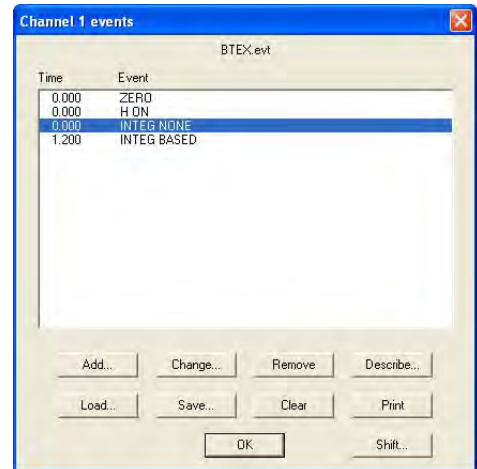
In the example above, the left chromatogram does not have the event Based. In the right chromatogram the event Based is placed at 1.2 min. This event fixes the baseline at the time selected. After this event all of the peaks are quantitated correctly.

The Absorbance buttons on the right side of the screen are for HPLC and not used in DPS GC's.



**Remove**  
Click on an event and then the Remove button to remove the event from the event table.

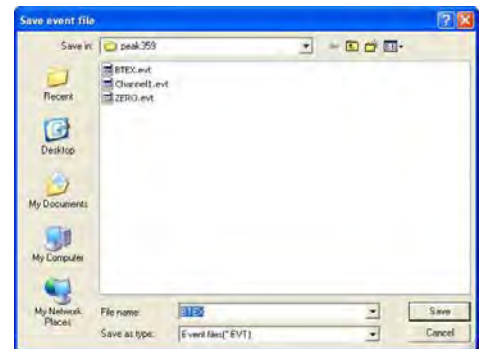
**Describe**  
The describe button is for other GC's where they label the events (A-H). The DPS Control Software performs this function in the Systems screen under Configure Names.



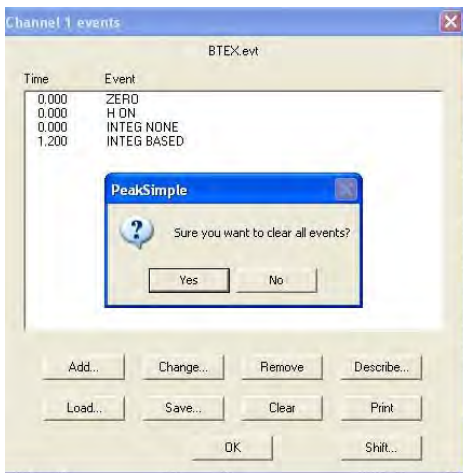
**Load**  
Click on the Load button to load an existing events file with the .EVT file extension.



**Save**  
Click on the Save button to save an events file, or to update an existing one.



**Clear**  
Clicking on the Clear button deletes all events from the window.



**Print**  
Clicking on the Print button sends the events table to the printer.

### Channels-Postrun

The Postrun Screen is used to determine all the actions that are to be done in PeakSimple after a chromatogram run. Clicking on the Postrun box for channel 1 in the Channel controls window will open up the Channel 1 postrun actions window.

#### Save file as "X"

The Save file as checkbox, when selected, automatically saves a chromatogram file to disk after a run is completed. The file will be saved under the file name entered in the information field to the right of the checkbox. Please use the default PeakSimple folder for all Saved data!

#### Auto-increment

When selected, the Auto-increment checkbox will incrementally add a numeric digit to the entered filename after each run. For example, a chromatogram run saved as RUN.CHR would be saved as RUN1.CHR after the second run and RUN2.CHR after the third run.

The Save results checkbox, when selected, will save the data in the results screen to disk after a chromatogram run (*Note: This is not the raw data but instead the ASCII results*). The Add to results log "X" checkbox adds the results of a run to the results log specified in the information field to its right. It will be saved under the same filename as the raw data but with the extension .RES, for example RUN1.RES.

The Print results checkbox will print whatever is specified to be printed in the Print format window, this might include the chromatogram and its results data. The Update DDE link checkbox, when selected, will automatically update the Dynamic Data Exchange link once the run is completed.

#### Execute "X"

The Execute information field opens any executable file (.exe, .bat, .bas) after the chromatogram run is completed. *Note: Be sure to include the full filename and path for the executable file.* Control is returned to PeakSimple when the called application closes.

#### Restart run after "X"

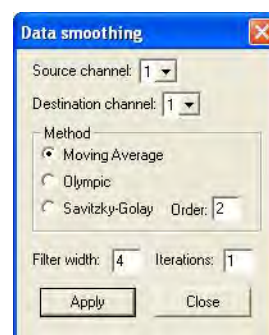
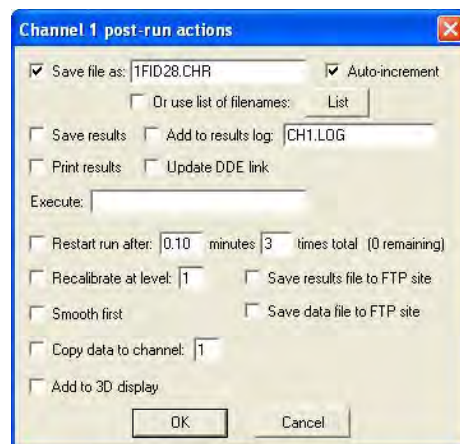
The Restart run after "X" checkbox and information field restarts a chromatogram run after an inputted delay time. The delay time is inputted in minutes and can be repeated as many times as is entered into the times total information field. *Note: If 0 is entered into the times total information field then the run will be restarted after infinite number of times.*

#### Recalibrate at level "X"

The recalibrate at level "X" checkbox and information field recalibrates all identified peaks at the end of a run at a given level from 1 to 7. This feature is normally implemented as part of an autosampler queue. Detailed instructions are given in the Autosampler queue documentation section.

#### Smooth first

The smooth first checkbox runs the smoothing algorithm as is was last applied to the chromatogram before the final integration is done. If the box is left unchecked no smoothing will be done to the chromatogram run.



### Copy data to channel "X"

The Copy data to channel "X" checkbox and information field inputs the chromatogram run into whatever channel is selected in the information field. Only the values 1 to 6 can be inputted into the information field as there are six chromatogram channels in PeakSimple.

### Overall Window

The Overall controls window is used to define and control many of the options in PeakSimple. Clicking on Edit in the PeakSimple menu bar and then Overall from the drop down menu will open up the Overall controls window.

### Unknown peaks are labeled "X"

The Unknown peaks are labeled information field, when filled out, labels all unknown peaks the value that is in the information field. If the word "Peak" was entered into the information field then all unknown peaks would be labeled "Peak".

Show retention windows checkbox is checked by default and thus retention windows are visible in PeakSimple; un-checking the Show retention windows checkbox removes the retention windows from sight.

### Board Type

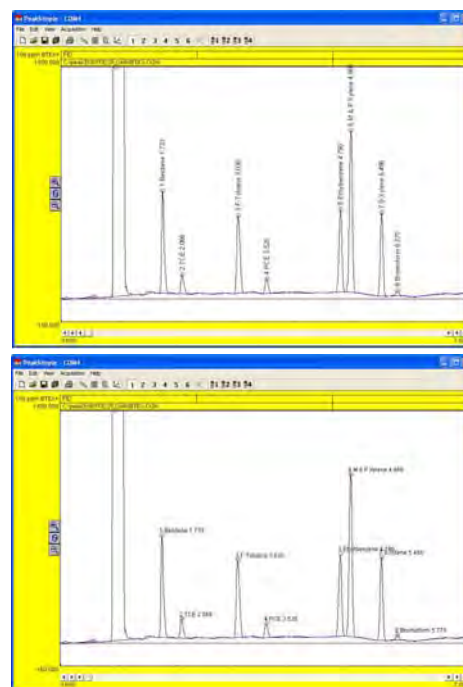
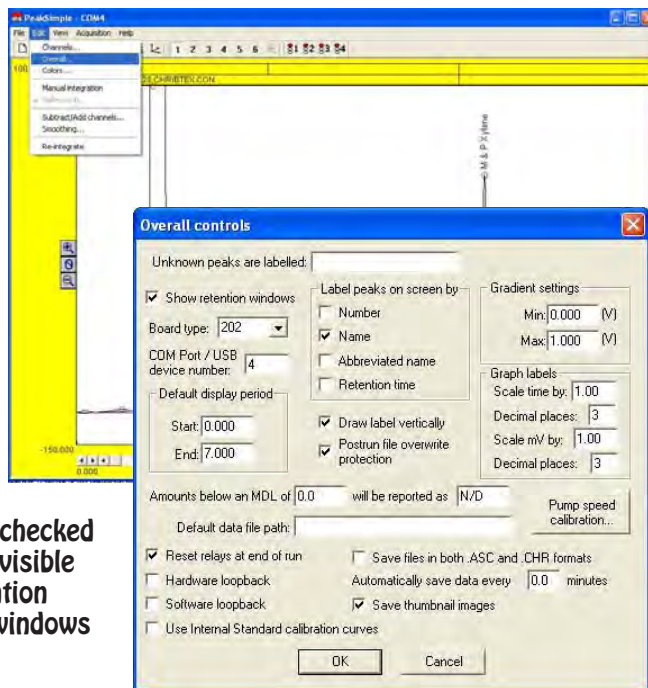
By default the board type is set to 202 for all DPS GC's.

COM Port / USB device number "X" information field specifies the COM port or USB device number that is to be used for the connection between PeakSimple and the hardware. In all DPS GC's where the computer is running in the GC we use COM4. When PeakSimple is running on an external computer we use COM2. We do not use the USB device number.

### Label peaks on-screen by

The label peaks on-screen by options box enables a peak to be labeled by as many as four options. The Number checkbox labels all peaks with their peak number. The Name checkbox labels all peaks with their full name. The Abbreviated name checkbox labels all peaks with a shorter, four character abbreviated name while the Retention time checkbox labels all peaks with their retention times.

Draw label vertically checkbox specifies whether peaks should be labeled horizontally or vertically on the chromatogram screen. When the box is checked the peak labels will be drawn vertically when it is deselected they will be drawn horizontally.

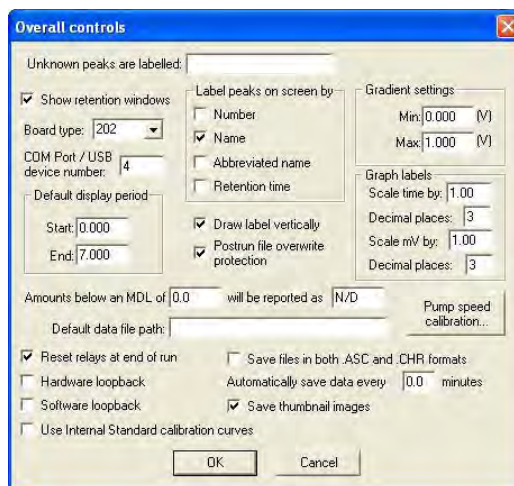


### Default display period

The default display period options box is used to define the default display limits for a PeakSimple chromatogram. The Start information field is used to specify the default beginning limits while the End field is used to specify the end of the default display limits. The start and end display limits can also be adjusted by the left and right arrows below the chromatogram in the main display window.

### Postrun file overwrite protection

Postrun file overwrite protection protects a saved file from being written over when the auto-increment feature is selected in the Postrun window. Instead of writing over a used filename an auto-incremented run will select the next unused number in the sequence to save the file to disk. For example, if file TEST02.CHR already exists on disk PeakSimple will save the file as TEST03.CHR.



### Amounts below an MDL of “X” will be reported as “Y”

Peaks with a value below a specified Minimum Detection Level, or MDL will be reported as whatever is specified in the second information field, typically N/D or not detected. The number that is below the MDL will not be reported, only the entry in the second information field will be seen.

### Default data file path

Typically all PeakSimple files are saved to the PeakSimple directory but by entering a full directory path into the Default data file path information field another directory can be selected to save files to. *Note: It is recommended that users save all PeakSimple files to the PeakSimple directory. If necessary export files to a different directory after saving them to the PeakSimple directory.*

### Reset relays at end of run

The Reset relays at end of run checkbox, when selected, turns off all relays (A-H) at the end of a chromatogram run. If the box is left un-selected the relays will not be shut off after a chromatogram run. In DPS GC's we only use the H relay, all of the other relays are not connected to the GC. The same functions are handled through the TIMELINE feature of the DPS GC Control software.

### Save files in both .ASC and .CHR formats

The Save files in both .ASC and .CHR format checkbox, when selected, saves files in the .ASC format (ASCII) and the .CHR format (chromatogram). If the checkbox is not selected files will be saved only in the .CHR format.

### Automatically save data every “X” minutes

The Automatically save data every “X” minutes checkbox and information field, when selected, saves the data during a chromatogram run at intervals specified by the information in the information field. This feature is useful for runs where power outages are frequent and data can be lost.

## Colors

The Colors window determines the color schemes that are to be used throughout PeakSimple. Open the colors window by selecting **Edit** from the PeakSimple menu bar and then **Colors** from the list of options.

Selecting the **Background** button with the mouse cursor opens up the Background color window. The background color can be chosen from a set of 48 colors by selecting a color and then affirming the choice by clicking on the **OK** button.

The Graph background window is opened up by selecting the **Graph background** button in the Colors window. The graph background color is changed by selecting a color and then clicking on the **OK** button to make the color change.

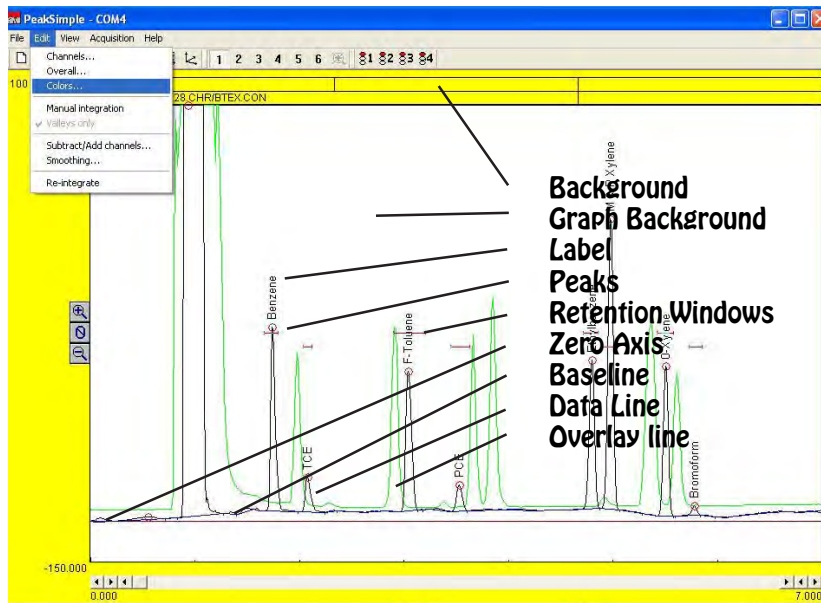
The color of the labels controls the color of the words that belong to the peaks. The color of the labels is changed by selecting the **Labels** button to open up the Labels color window. In the Labels color window select a color and press the **OK** button to make the change to the label color.

The peak color is the color of the circle at the top of each identified peak and is determined by the **Peak color** window which is opened up by selecting the **Peak** button in the Color window. Select the desired peak color and then click on the **OK** button to close the window and affirm the change.

The color of the zero axis is chosen by clicking on the **Zero axis** button and then selecting a color from the Zero axis color window. Clicking on the **OK** button closes the window and makes the change to the color of the zero axis. Don't set the zero axis color to the same color as the Graph background because they won't be distinguishable from each other.

The baseline is the line that runs along the bottom of the peaks and its color is changed by selecting the **Baseline** button and then choosing a color from the Baseline color window. The change is made once the **OK** button is selected and the window is closed.

The data line is the signal line that makes up the peaks in PeakSimple and its color is defined by selecting the **Data line** button in the Colors window and then selecting a color from the Data line colors window. Once the desired color is selected apply the color change by clicking on the **OK** button to close the window.



The overlay line is a data line from a chromatogram that has been overlaid on top of an existing chromatogram and its color is changed by selecting the **Overlay line** button in the Colors window and then selecting a color with the mouse cursor in the Overlay line colors window. The color changes are made once the OK button is selected and the window closes.

Retention windows are the horizontal bars that appear on-screen and their color can be changed by clicking on the **Retention windows** button in the Colors window and then selecting the desired color in the Retention window colors window. To apply the color changes click on the OK button to close the window.

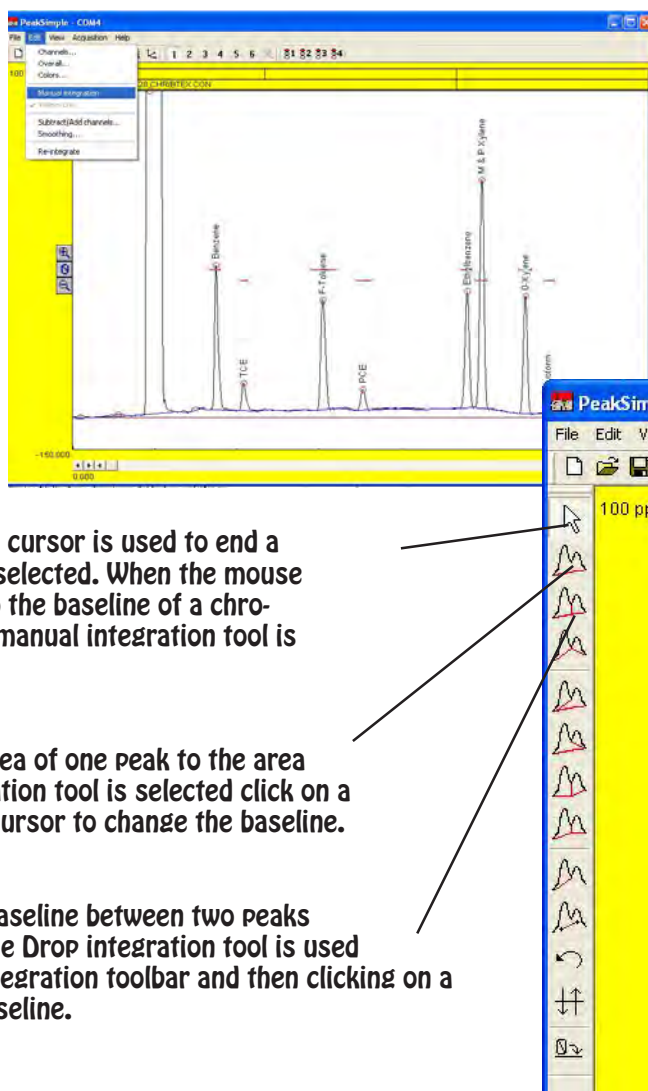
#### Printed line thickness

The thickness of the Data line and the Overlay line when a chromatogram is printed is determined by the **Data line** information field and the **Overlay line** information field. The thickness of the Data line is determined by the numerical value in the Data line information field, larger numerical values will result in thicker lines.



#### Manual Integration

The manual integration tools are used to manually draw in a baseline in a PeakSimple chromatogram. The manual integration toolbar is opened up by selecting **Edit** from the PeakSimple menu bar and then clicking on the **Manual integration** option. The manual integration toolbar appears to the right of the PeakSimple toolbar in the upper right hand corner of the screen.



#### Off Integration Tool

The Off Integration tool or the mouse cursor is used to end a manual integration mode once it has been selected. When the mouse cursor icon is selected no more changes to the baseline of a chromatogram can be performed until another manual integration tool is selected.

#### None Integration Tool

The None integration tool adds the area of one peak to the area of an adjacent peak. Once the None integration tool is selected click on a valley between two peaks with the mouse cursor to change the baseline.

#### Drop Integration Tool

The Drop integration tool drops the baseline between two peaks straight down onto an existing baseline. The Drop integration tool is used by selecting the Drop tool in the manual integration toolbar and then clicking on a valley between two peaks to change the baseline.



### **Based Integration Tool**

The Based integration tool raises the baseline to a valley between two specified peaks. To change the baseline select the Based tool and click on a peak with the mouse cursor to raise the baseline up to the valley.

### **Lead Skim Integration Tool**

The Lead skim integration tool skims a peak's area off the leading edge of an adjacent peak. To skim a peak off the leading edge of another peak select the lead skim tool from the manual integration toolbar and then click on the valley between the two specified peaks with the mouse cursor.

### **Trail Skim Integration Tool**

The Trail skim integration tool skims a peak's area off the trailing edge of another, adjacent peak. To skim a peak off the trailing edge of another peak select the Trail skim tool and click on the valley between two peaks with the mouse cursor to make a change.

### **Lead Horizontal Integration Tool**

The Lead horizontal integration tool draws the baseline horizontally for the leading peak while the trailing peak's baseline stretches from the horizontal line to the next valley. The Lead horizontal tool is selected in the manual integration toolbar and once a valley is selected the change to the baseline is made.

### **Trail Horizontal Integration Tool**

The Trail horizontal integration tool draws a baseline horizontally for the trailing peak while the leading peak's baseline stretches from the horizontal line to the previous valley in the chromatogram. The Trail horizontal tool is used by selecting the Trail horizontal tool in the manual integration toolbar and then clicking on a valley with the mouse cursor to make the change.

### **Inhibit integration Tool**

The Inhibit integration tool ends a baseline after a valley thereby stopping the peak's area from being counted along with the rest of the chromatogram. To use the Inhibit tool select the tool in the manual integration toolbar and then click on the valley between two peaks to end the baseline.

### **Rubber Band Integration Tool**

The Rubber band integration tool is used to manually draw the baseline in a chromatogram. The Rubber band tool is selected in the manual integration toolbar and is clicked and dragged on the chromatogram to draw the baseline.



### Undo Integration Tool

The Undo integration tool removes all changes done to the baseline of a chromatogram with the manual integration tools. To use the Undo tool click on the tool in the manual integration toolbar and all changes will be undone.

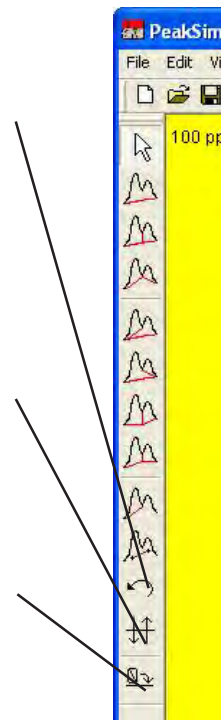
*Note: Changes made to a chromatogram with the Reverse and Zero integration tools cannot be undone with the Undo tool.*

### Reverse Integration Tool

The Reverse integration tool inverts a selected peak or a selected group of peaks in a chromatogram. A peak is inverted by selecting the Reverse tool in the manual integration toolbar and then clicking and dragging the mouse cursor over the peak.

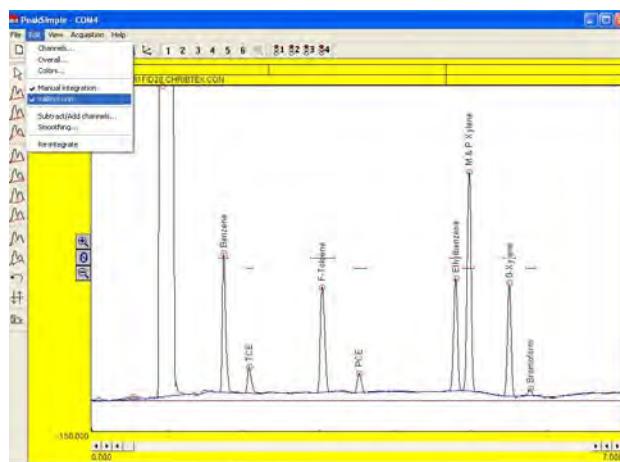
### Zero Integration Tool

The Zero integration tool sets the value of the data line at zero starting at a selected point. To zero the data line at a given point select the Zero tool from the manual integration toolbar and click on the data line with the mouse cursor.



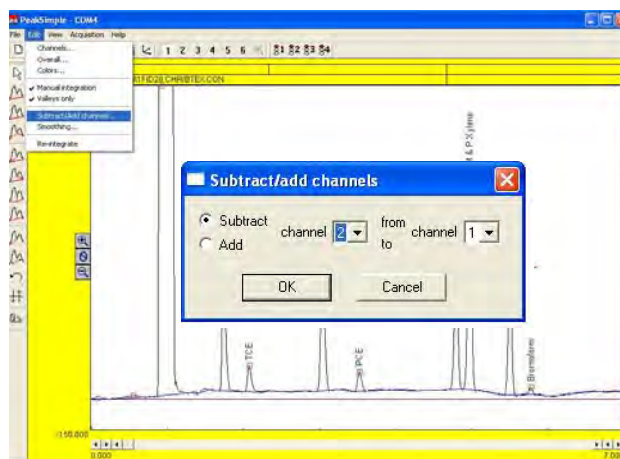
### Valleys Only Option

The Valleys only option is available only when the Manual integration toolbar is open in PeakSimple. The Valleys only option can be selected by opening up the Manual integration toolbar in the Edit menu and then selecting the Valleys only option immediately below Manual integration in the drop down menu. When the Valleys only option is selected all changes made to the baseline of a chromatogram will snap only to the valleys of the chromatogram. When the Valleys only option is turned off changes made to the baseline of a chromatogram will go to wherever the mouse cursor was clicked.



### Subtract/Add Channels Menu

The Subtract/Add channels menu removes or adds the analog data signal from/to one channel in PeakSimple from/to another channel. The Subtract/Add channels menu is opened by selecting the Edit menu and then by clicking on Subtract/Add channel in the drop down menu.



### Subtracting a Channel

To subtract one channel from another channel click on the Subtract radio button with the mouse cursor and select the channel that is to be taken away in the first dialogue box. In the second dialogue box select the channel that is to have the first selection taken away from. Click on OK with the mouse cursor to effect the changes.



### Adding a Channel

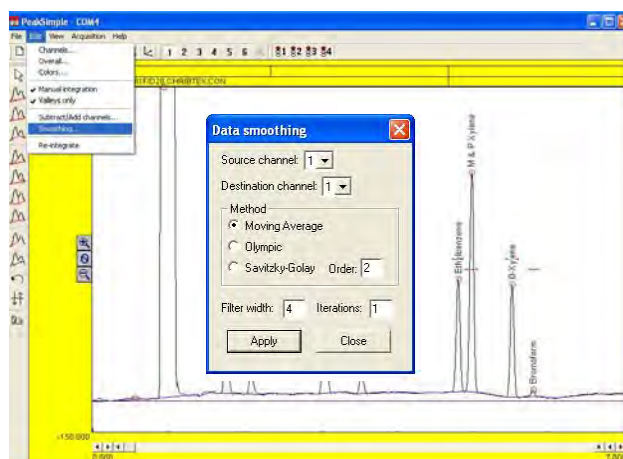
To add one channel to another channel select the Add radio button in the Subtract/Add channels menu. Select the channel that is to be added by selecting a number in the first dialogue box and then choose the channel that it is to be added to by selecting a number in the second dialogue box. All changes are made once the OK button is selected.



### Smoothing Window

The Data smoothing window determines all the smoothing options that are to be performed on a data line. The Data smoothing window is opened by selecting Edit from the PeakSimple menu bar and then selecting Smoothing from the list of options.

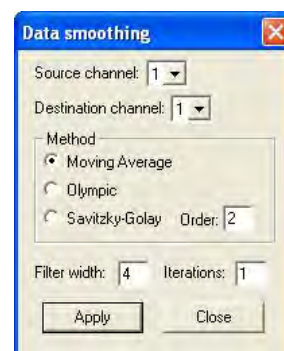
The Source channel dialogue box specifies which channel the data line that is to be smoothed is in. The Destination channel is the channel that the smoothed data line from the source channel will be displayed in.



### Method

The method of smoothing is determined by the smoothing algorithm selected in the Method box. The Moving Average algorithm sets each sample to the average of the samples around it including itself. The number of samples taken into account depends on the Filter width. The Olympic algorithm is similar to the Moving Average but the highest and the lowest values in the set of samples are discarded before the average is taken. The Savitzky-Golay algorithm is similar to the Moving Average but each of the samples is weighted according to a set of weighting factors. Increasing the number of in the Order dialogue box gives more weight to the central samples when using the Savitzky-Golay method.

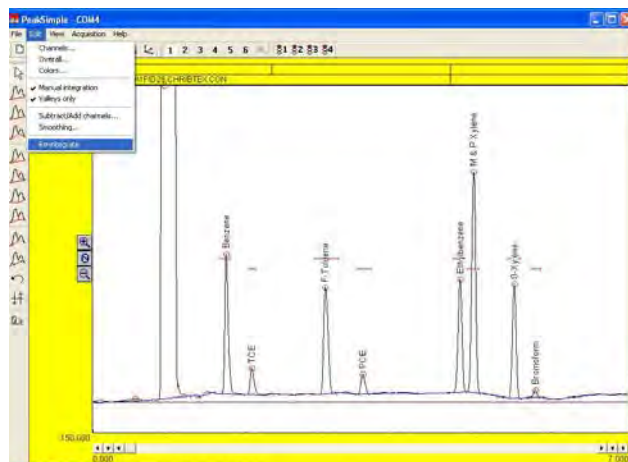
**Filter Width** The Filter width dialogue box controls the number of samples that are to be taken into account when using the Moving Average smoothing method. A filter width of 2 means that 2+1+2 samples are taken while a filter width of 5 means that 5+1+5 samples are taken.



### Iterations

The Iteration dialogue box controls the number of items a smoothing method is to be applied to a chromatogram peak. Every iteration smooths the data line more than the previous iteration eventually making the data line flat.

**The Re-Integration Option**  
 The Re-Integration option is used to fully re-integrate a baseline in PeakSimple. When changes are made to a baseline often a partial integration will occur, selecting Re-integrate will perform a full integration on the baseline. The Re-integrate option can be selected by clicking on Edit in the PeakSimple menu bar and then Re-integrate from the list of options.



## View Pull-Down Menu

**EDIT-View-Results Window**  
 The Results window displays the results of the chromatogram runs performed in PeakSimple. The Results window is opened by clicking on View in the PeakSimple menu bar and then selecting Results from the list of options.



The Channel option scroll bar specifies which of the six channels the results data should be displayed for. When the Recognized peaks only checkbox is selected only the results for named peaks will be displayed. The Undetected components also checkbox displays the results for the undetected components as well as the detected components in the chromatogram run when the option is selected.

**Results**

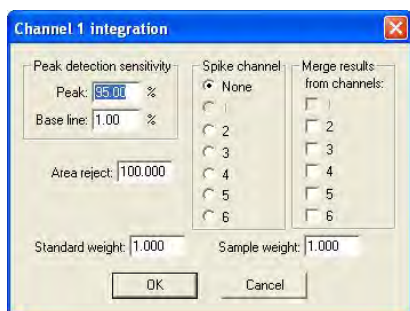
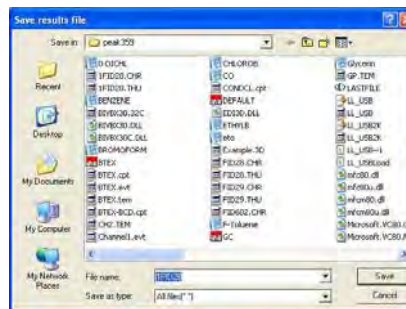
Component	Retention	Area	External	Internal
Benzene	1.733	1864.1348	90.9016	90.9016
TCE	2.066	426.8238	96.7794	96.7794
F-Toluene	3.030	1863.6464	200.3482	200.3482
PCE	3.520	327.3028	93.1074	93.1074
Ethylbenzene	4.790	1775.6680	86.2542	86.2542
M & P Xylene	4.966	3448.3014	161.2161	161.2161
O-Xylene	5.496	1663.8840	77.2694	77.2694
Bromoform	5.770	118.3896	17.3484	17.3484
		11488.1508	823.2248	823.2248

Channel: [dropdown]    Update    Save...    Integration...    Format...  
 Recognized peaks only    Close    Calibrate...    Calibrate all...    Copy  
 Undetected components also  
 Copy results log    Clear results log    Show results log...    Add to results log

**Update**  
 The Update button in the Results window updates the DDE link between the Results data and the DDE host program (typically Excel).

## Save

Selecting the Save button in the results window opens up the Save results file window. In the Save results file window the results file is saved with a .res extension. The file is an ASCII file and not the raw chromatogram data.

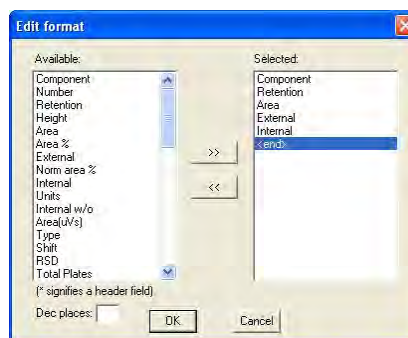


## Integration

As a convenience the integration button in the results window opens upon the same integration window that can be accessed in the Channels window. For more information on the integration window consult the Channels-Integration portion of this manual.

## Format

Selecting the Format button in the Results window opens up the Edit format window. The Edit format window allows the user to specify the information that is to be included in the Results table. The Available options box in the Edit format window displays all the available options that can be included in the results but that aren't selected. An option is added to the Selected options box by highlighting the item in the Available box and clicking on the right facing arrow button. To deselect an option from the Selected box highlight the item and click on the left facing arrow button. The Dec. places dialogue box specifies how many decimal places a highlighted unit will display in the Results table.

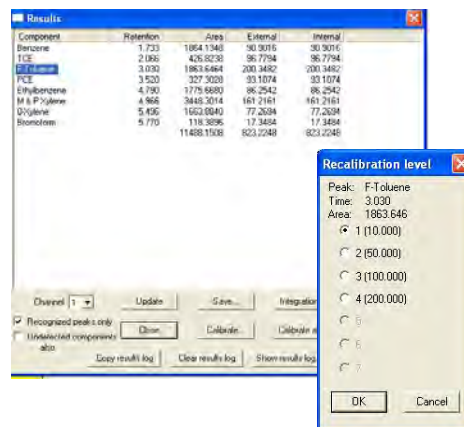


## Close

The Close button exits the Results window and returns the user to the main screen.

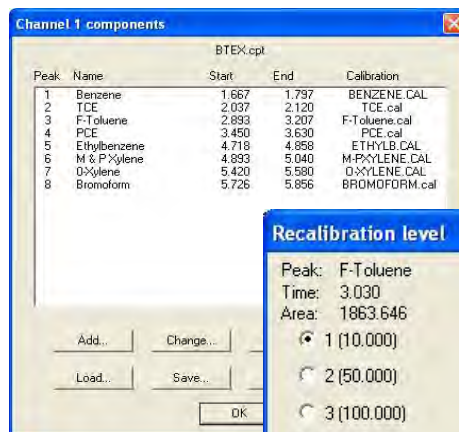
## Calibrate

The Calibrate button recalibrates a recognized peak in the Results table. Highlighting a peak name and selecting the Calibrate button opens up the Recalibration Level window. The window specifies which peak level should be calibrated. Following the Recalibration level window is the Calibration window which is discussed at further length in the Calibration section of this document.

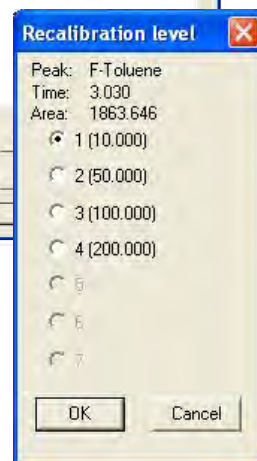


### Calibrate All

The Calibrate all button recalibrates all the recognized peaks at once. The Calibrate all button calibrates all peaks with existing calibration curves on a particular calibration level. If named peaks are in the results table without calibration curves an error message (NOT ENOUGH DATA POINTS), will be displayed. Check the Components table to make sure that all compounds have Calibration curves associated with them.



Peak	Name	Start	End	Calibration
1	Benzene	1.667	1.797	BENZENE.CAL
2	TCE	2.037	2.120	TCE.cal
3	F-Toluene	2.893	3.207	F-Toluene.cal
4	PCE	3.460	3.630	PCE.cal
5	Ethylbenzene	4.718	4.858	ETHYLB.CAL
6	M & P Xylene	4.893	5.040	M-PXYLENE.CAL
7	O-Xylene	5.420	5.580	O-XYLENE.CAL
8	Bromoforn	5.726	5.856	BROMOFORN.cal



Recalibration level

Peak: F-Toluene  
Time: 3.030  
Area: 1863.646

1 (10.000)  
 2 (50.000)  
 3 (100.000)  
 4 (200.000)  
 5  
 6  
 7

OK Cancel

### Copy

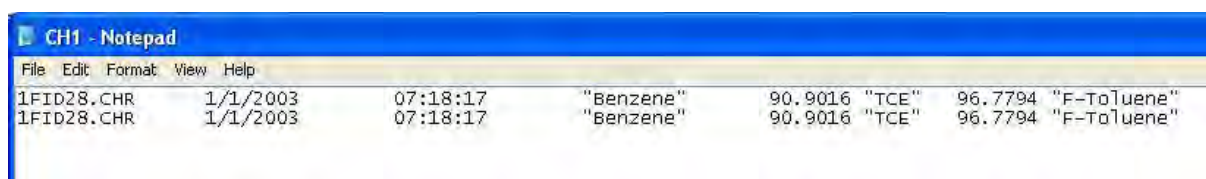
The Copy button in the results window copies the results report to the Clipboard. Once the report is copied it can be pasted into other programs i.e. Excel.

### Copy Results Log

The Copy results log button copies the .log file for the results to the Clipboard. This log file can be pasted into any Windows program. A certain number of lines in the results log will always be copied, by default the number is 20. If more than 20 lines are needed for an application the user must modify the peakwin.ini file located in the Windows folder. The default entry in the files is (SpareLines=20), delete the number 20 and insert the number of lines that are needed (up to a maximum of 100).

### Clear results Log

Clicking on the Clear results log button erases the results log file.



File	Edit	Format	View	Help	
1FID28.CHR	1/1/2003	07:18:17	"Benzene"	90.9016 "TCE"	96.7794 "F-Toluene"
1FID28.CHR	1/1/2003	07:18:17	"Benzene"	90.9016 "TCE"	96.7794 "F-Toluene"

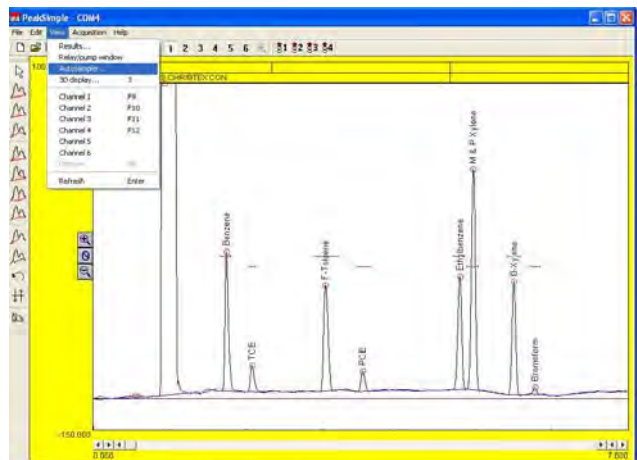
### Show Results Log

The Show results log button opens up the Windows Notepad to view the results log.

### Add to Results Log

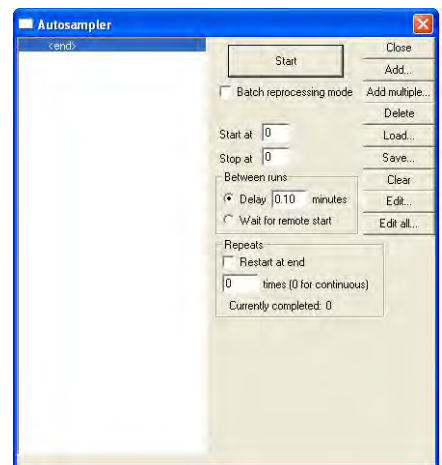
To add the current report to the results log click the Add to results log button. The report can automatically be added to the results log at the end of each chromatogram run by checking the Add to results log checkbox in the Postrun window.

**View Autosampler Window**  
 The Autosampler window allows a list of control files to be run automatically. Control files are the master files which specify all parameters including temperature programming, component, and event files. These control files run tasks in PeakSimple. To open up the Autosampler window click on the View menu in the menu bar and then select Autosampler from the available options.



**Start/Stop**  
 The Start button, when pressed, begins the operation of the autosampler queue or reprocessing queue. A queue must be created or loaded before the control files can run. Once the autosampler is in operation the Start button changes into the Stop button. The Stop button ceases the autosampler operations that were previously running.

**Batch Reprocessing Mode**  
 To select Batch reprocessing mode click on the check box to the options left. While using the Batch reprocessing mode the user loads a list of previously stored chromatogram files in the list box of the left and then selects a control file which reprocesses the data files. When the operation begins PeakSimple will load each data file in the list into channel 1, perform the specified functions, and then increment to the next data file in the list.



**Start at** dialogue box specifies which control file number to begin operation first. If no number is entered the autosampler will begin at the first control file.

**Stop at** dialogue box specifies the last control file to be run before operations of the autosampler cease. If no number is entered in the dialogue box the autosampler will end after the last control file in the list is run.

**Delay "x" minutes** radio button, when selected, specifies how many minutes PeakSimple will wait before running the next control file in the list box.

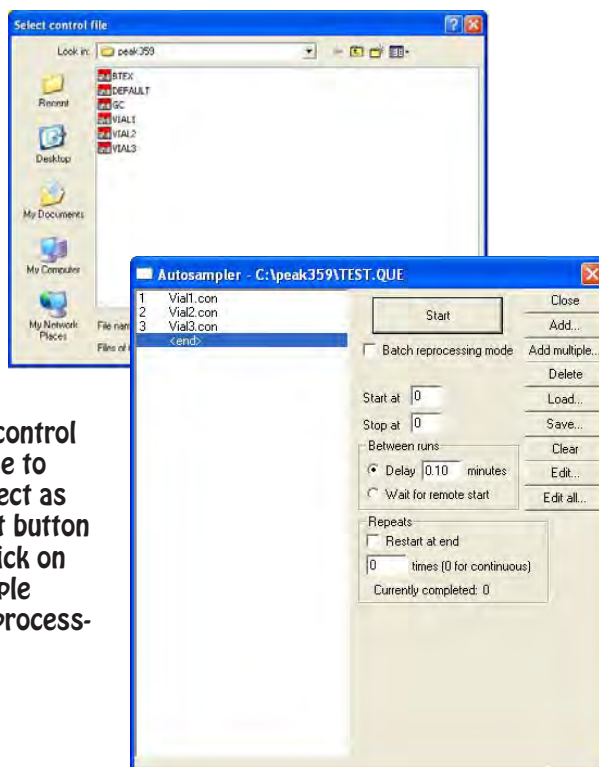
**Wait for remote start** radio button, when selected, instructs the autosampler to wait for a remote start signal before advancing to the next control file.

**Restart at end** checkbox restarts the queue after getting to the end of the control files in the list box. In the "x" times information field the user enters the number of times the control files in the list box should be cycled if the Restart at end checkbox is selected. If the value 0 is selected, the queue will be cycled continuously.

**Close**  
 The Close button closes the Autosampler window when it is selected.

### Add

Select the Add button to add a control file to the queue. Selecting the button opens the Select control file window where the file can be loaded into the list box. Each control file in the queue must have a different name even though almost identical actions are performed.



### Add Multiple/Batch Reprocessing

The Add multiple button allows the user to load multiple data files into the list box. Click on the button to open up the Select control file window and then click on a control file name to open up the Select data filenames window. Select as many data files as needed by pressing the shift button and clicking with the mouse cursor and then click on OK to load them into the queue. The Add multiple button is only useful for use with the Batch reprocessing mode.

### Delete

After highlighting a control file in the list box to the left select the Delete button to remove that control file from the queue.

### Load

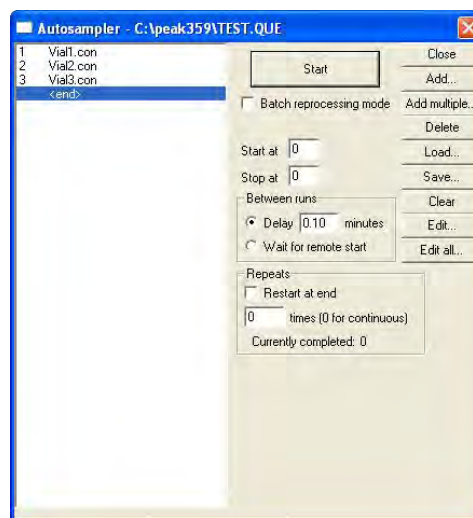
Select the Load button to open up a previously saved queue file. Clicking on the Load button opens up the Load autosampler queue window where the queue file can be selected and loaded.

### Save

Selecting the Save button opens up the Save autosampler queue window. Save the queue in the file box by naming the file and selecting Save. It is recommended that all files are saved to the PeakSimple directory.

### Clear

The Clear button erases the entire queue.



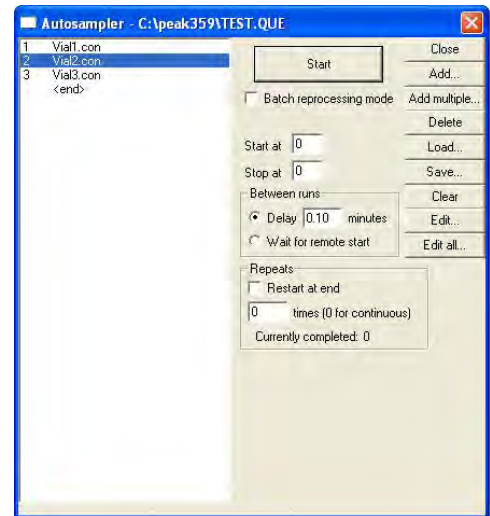


### Edit

After highlighting a control file select the **Edit** button to modify that control file. Selecting the **Edit** button loads the control file on the PeakSimple main screen. To make any changes click on the main screen, do all modifications, and then select **Save all** from the PeakSimple file menu

### Edit All

To edit all the control files in the queue at once click on the **Edit** button to open up the Autosampler queue spreadsheet. Many of the commonly adjusted control file parameters are displayed in the spreadsheet enabling the user to input changes to the queue. Not all control file parameters can be modified by using **Edit all** (only parameters that are selected in **Format**) and so must be done individually with the **Edit** function.



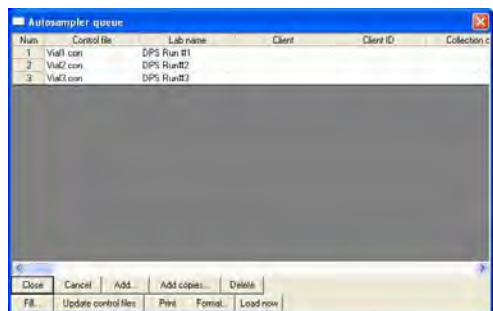
### Autosampler Queue Window

#### Close

The **Close** button exits the window after prompting the user to save the spreadsheet.

#### Cancel

The **Cancel** button exits the spreadsheet window without prompting the user to save.

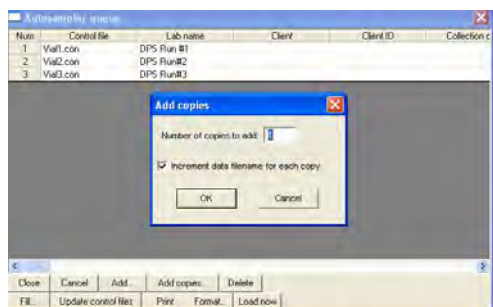


#### Add

Selecting the **Add** button opens up the **Select control file** window where an existing control file can be added to the queue.

#### Add Copies

After highlighting a control file in the spreadsheet select the **Add copies** button to add copies of the file to the list. Once the **Add copies** window pops up input the number or copies to be made in the dialogue box and specify whether the file names should be incremented. The **Add copies** button is useful for creating a queue from scratch with a single control file.

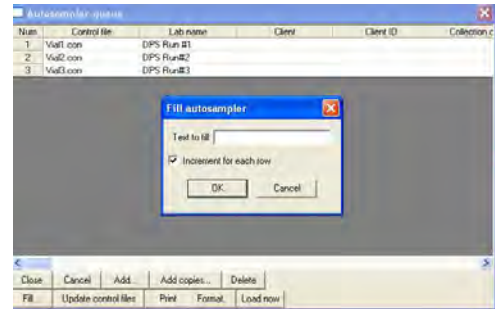


#### Delete

The **Delete** button deletes a highlighted control file off the list. If no file is highlighted then the last file will be deleted from the queue.

### Fill

The Fill button fills a spreadsheet column, row, or cell with selected text. Once the desired cells are highlighted clicking the Fill button opens up the Fill autosampler options box. Input the text to fill in the information field and specify whether the text should be incremented for each row.



### Update Control Files

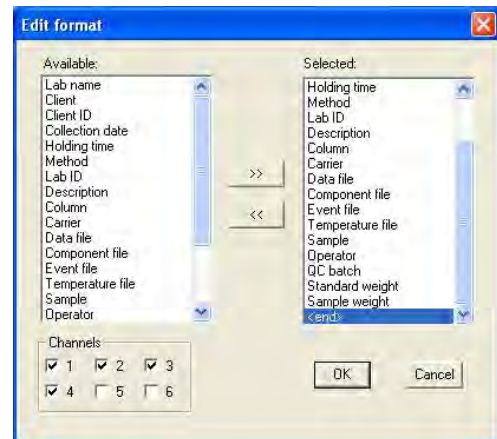
Selecting the Update control files button saves all changes to the control files in the list.

### Print

The Print button prints the queue spreadsheet.

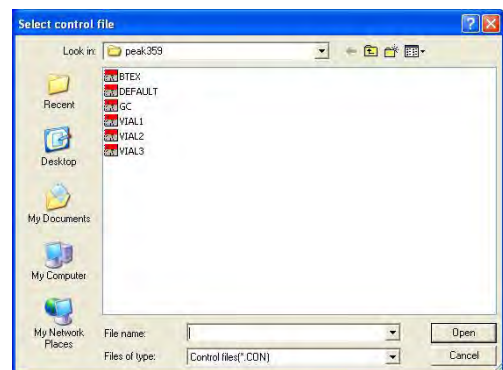
### Format

To change the format of the queue spreadsheet and open the Edit format window select the Format button. In the Edit format window a format type can be added by selecting it in the Available window and then hitting the right facing arrow button. To remove a format type from being displayed in the spreadsheet highlight the format type in the Selected box and click on the left facing arrow.



### Load Now

After highlighting a control file select the Load now button to load that control file to the main PeakSimple screen. Click on the screen and make any changes to the control file and then select Save all to save the changes.

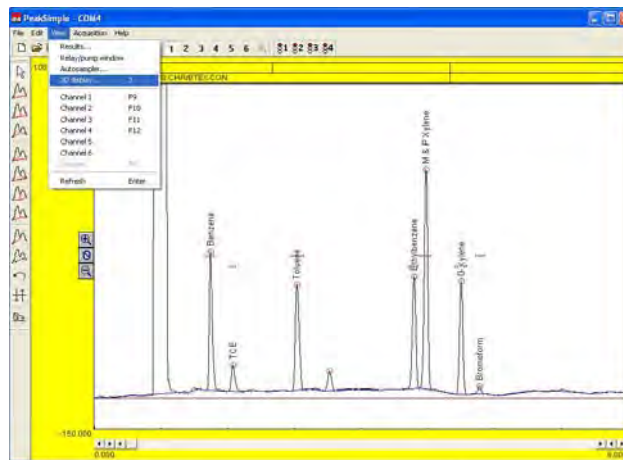


### 3D Display Window

To view the 3D Display, select 3D in the View window. The 3D display allows you to load multiple chromatograms and view the in 3D. The display can be rotated to view trends over time. No quantitative data can be generated through the 3D display, but it is a valuable tool for viewing trends.

#### Add

To Add chromatograms to the display, select the individual chromatograms.



#### Delete

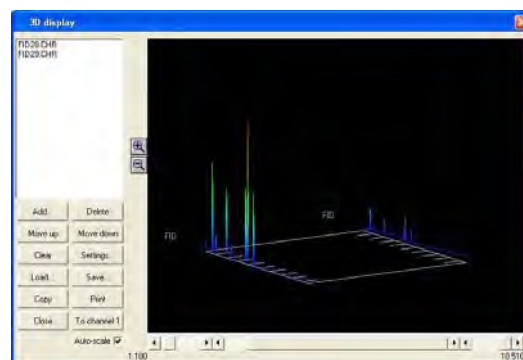
The Delete button will Delete the highlighted chromatogram.

#### Rotate

By holding down the right mouse button you can rotate the 3D display 360 degrees to view trends.

#### Move Up

Moves the selected chromatogram up one position.



#### Move Down

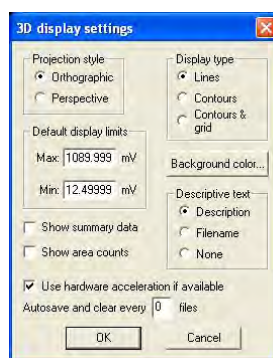
Moves the selected chromatogram down one position.

#### Clear

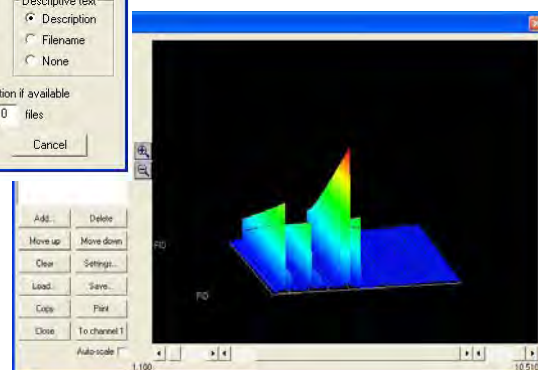
The Clear button clears all data from the 3D display.

#### Settings

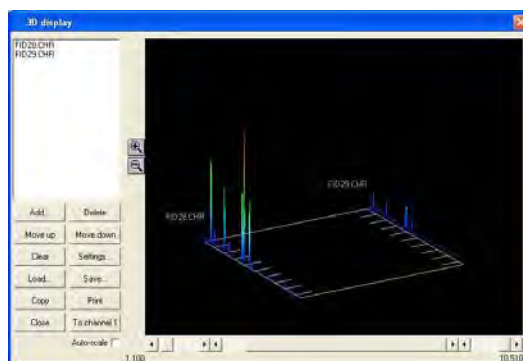
The Settings screen allows you to change many variables in the 3D display. The Display type, Colors, data Description, and default limits can be easily be changed.



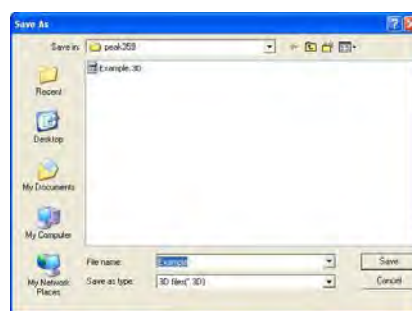
An example of contours and grid is shown to the right.



**Load**  
Loads a chromatogram into the 3D display.



**Save**  
Saves the contents of the current 3D display. The display can be viewed again using the Load command.

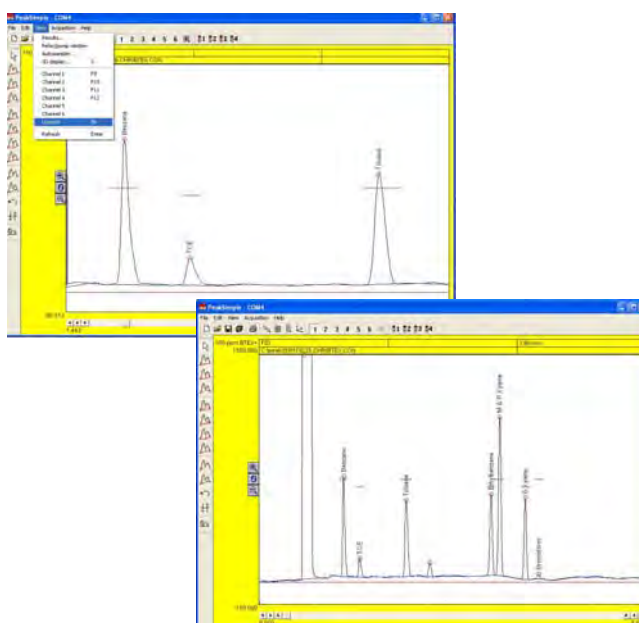


**Copy**  
Copies the current display to the the Windows clipboard.

**Print**  
Prints the display to the default printer.

**Close**  
Closes the 3D display.

**View Unzoom**  
To unzoom from a close up view of a chromatogram select the Unzoom tool from the View menu or hit F6. Peak-Simple will zoom out to the first level with the original display units of the chromatogram when the Unzoom tool is used. The Unzoom button in the Peak-Simple toolbar can also be used to unzoom a chromatogram or F6 on the keyboard.



## Refresh

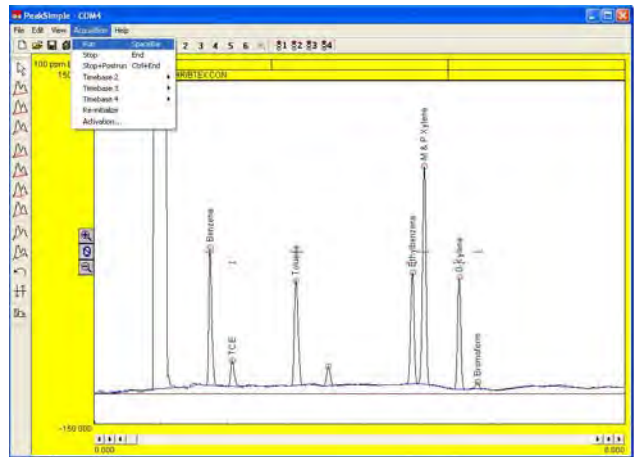
The Refresh tool in the View menu redraws the chromatogram screen to fix any glitches or resolve an error. Pressing Enter on the keyboard also refreshes the screen.

## Acquisition Pull-Down Menu

The Acquisition menu contains the commands to run a chromatogram run when hardware is connected to the PeakSimple data system. All Acquisition menu commands have corresponding keyboard hot-keys for convenience.

### Run

The Run command begins a chromatogram run on the main trigger group when hardware is connected to the data system. The error message “No active channels in group” appears when no hardware is available to make a chromatogram run. The spacebar can be used to start a run.

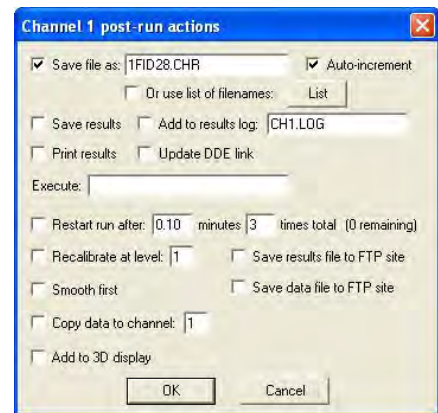


### Stop

The Stop command is used to end a chromatogram run once it has been started. Using the Stop command ends the chromatogram run without running any of the Postrun operations. The End button can also stop a chromatogram run.

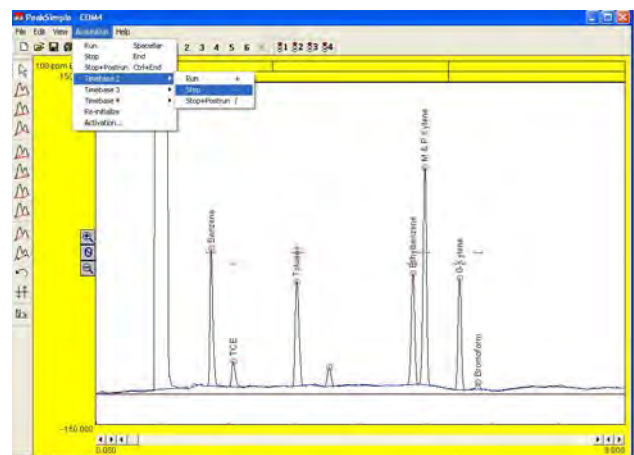
### Stop + Postrun

The Stop+Postrun command ends a chromatogram run and executes the operations specified in the Postrun section. Holding the Control button and pressing End on the keyboard is the same as the Stop+Postrun command.



### Timebase

The Timebase function in PeakSimple allows you to remotely trigger up to 4 chromatographs. We do not use this function in DPS GC's. All channels on a single GC start with the RUN, or SPACEBAR buttons.

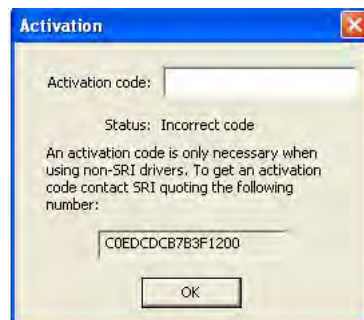


### Re-initialize

The Re-initialize command reestablishes the connection between the hardware and the PeakSimple data system. A connection between hardware and the data system has to exist for re-initialization to occur.

### Activation

The copy of PeakSimple is already activated when it arrives in the GC. A Serial Number accompanies the paperwork with the GC. Activation is for customers that have downloaded PeakSimple and want to demo the software before purchasing. Once they have purchased it, the manufacturer supplies an activation number. There is no need to look for, or enter an activation number.

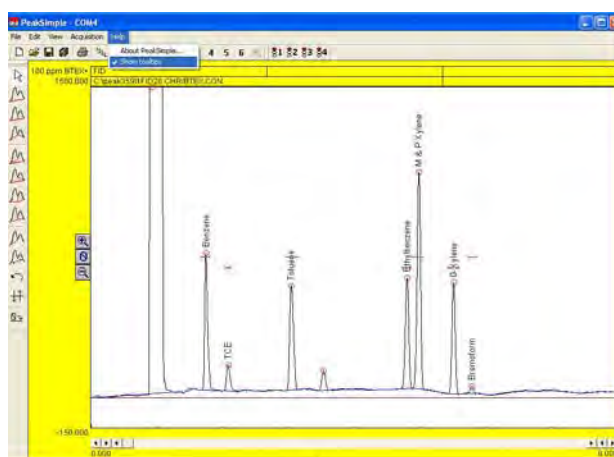


## HELP Pull-Down Menu

The **EDIT** pull-down menu allows you to modify most of the operating parameters.

### About PeakSimple

To view program information about PeakSimple click on the **About PeakSimple** option in the **Help** menu. The PeakSimple window will pop up and display the information.



### Show Tooltips

The Show tooltips option in the **Help** menu toggles the PeakSimple tooltips off or on. When Show tooltips is checked a helpful text tip will appear when the mouse cursor is held over a tool or button in PeakSimple. The tooltips provide relevant information to the operation and use of the PeakSimple data system. Most of this manual is contained on the tool tips, which is a convenient way of learning the software.