

Important!

- DO NOT** invert the instrument with the sparge bottle attached.
- DO NOT** transport or store the instrument with liquid in the sparge bottle.
- DO NOT** handle or carry system when sample is being analyzed.

Powering the FROG

The FROG may be run on battery or an AC power source.

Battery:

- The battery is already installed in the FROG.
- There is a battery indicator on the back of the FROG. Five bars show that the FROG is fully charged.

AC Power Source:

- The FROG can be run on an AC Power Source. To run on power, plug power supply (Figure 3) into power source and then into 12 VDC Power port on side of FROG (Figure 2).

To turn the FROG on, slide the power switch located on the side of the instrument into the up position. A green light should appear (Figure 4).

Installing the Ellvin GC Software

The Ellvin GC Software is located on a USB Drive in the zipper pouch of the FROG's case. To install the software run the setup file located in the folder labeled Defiant Tech Ellvin.

Recommended Computer Specifications: Pentium dual core or faster, Windows 7 or more current, and 2 GB memory.

Connecting The FROG to Ellvin

- Open the Ellvin GC Software
- Plug serial data cable (Figure 5) into data port on side of FROG (Figure 2).
- Turn FROG on
- In Ellvin select the dropdown menu to the right of the port icon (Figure 6) and select a COM port (the FROG is usually the last port on the list).
- If connection is successful in the lower left corner of the software it will display: **CONNECTED PARAMS LOADED**
- If a connection was unsuccessful it may be necessary to install the proper drivers. These can be installed manually by opening the CDM application on the software USB drive under Defiant Tech Ellvin\USB to Serial Drivers\ CDM 2.04.06.exe.

Setting up the FROG for Sampling

Water/Soil Sampling will require:

Sparge Tube and 5 mL Syringe. For blank water samples use distilled or de-ionized water.

Air Sampling will require:

FROG Air Sampling Kit (pg 6). For blank air samples the carbon filter tube in the air sampling kit can be used to filter the air or any other source of clean air may be used.

Refer to the following pages for further details: Water Analysis page 4, Soil Analysis page 5, Air Analysis pages 6 and 7.

Before sampling:

- Make sure instrument settings are correct for the application
- Calibrate or have the Frog calibrated for the application
- Run a blank before attempting sample analysis. A blank run should produce a clean baseline (Figure 7)
- (Optional) Adjust Retention Times if using the Frog at a different location than the one where it was calibrated. Elevation changes will affect retention times.



Figure 1: Do not invert FROG with sparge bottle attached.



Figure 2: FROG-5000 and close up of data and power ports



Figure 3: Power Cable



Figure 4: Power switch (on position)



Figure 5: Serial Data Cable

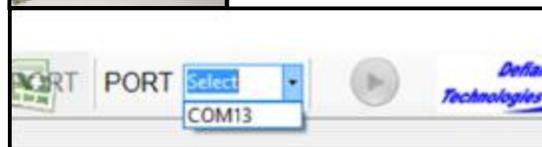


Figure 6: Selecting a COM port to connect FROG to software

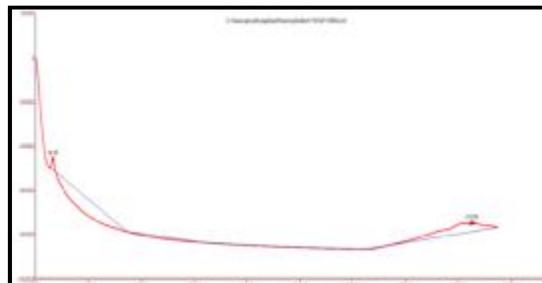


Figure 7: Clean baseline in Ellvin, free of peaks (Note: there is a slight peak in the beginning, this is normal and acceptable)

Software Tabs

In the Ellvin GC Software there are four different windows that are accessed with tabs at the top left of the screen (Figure 8). Each tab is used for the following:

- Live Data: live viewing of a Frog sample run with the Frog connected to the software
- Analysis Tab: analysis of completed instrument runs
- Calibration Tab: creating, loading or viewing a calibration file
- Settings Tab: viewing or modifying instrument settings.

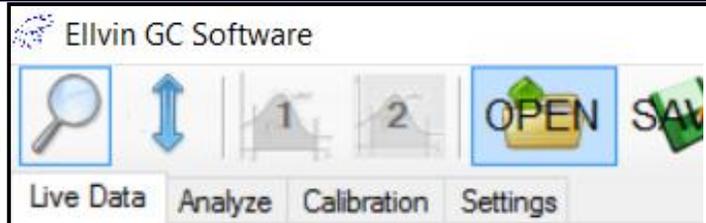


Figure 8: Tabs in Software

Setting the Frog up for an Application

It is important to make sure the Frog is using the correct settings for an application. If the Frog was calibrated by Defiant or another company the settings have already been established and set for you.

The settings define temperature and duration parameters for various phases of the instrument's analysis cycle. The settings for optimal instrument performance depend on the target analyte and should be set accordingly. Figure 9 diagrams the settings described in Figure 10.

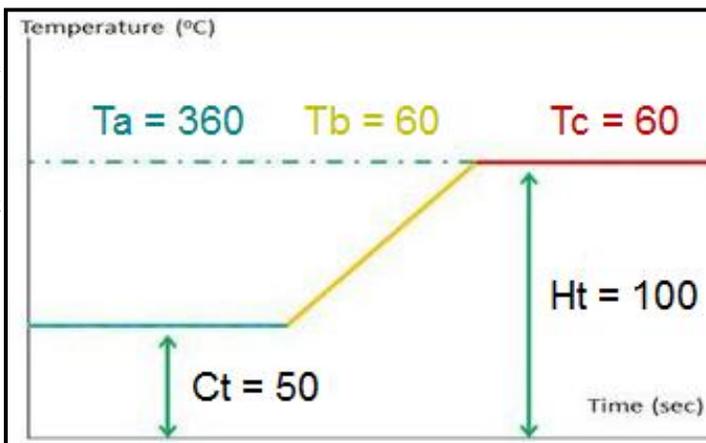


Figure 9: Diagram of FROG Instrument Settings.

Changing Instrument Settings

1. With the Frog connected to the software, in the settings tab, locate the settings box you like to modify (Figure 11).
2. In the empty box to the right of the setting: Enter a non-zero integer then click SET to apply the settings to the instrument.

Note: Changes to the settings are stored on the instrument and **DO NOT** revert to the default settings when power is removed or computer is disconnected.

Settings	Description	Setting Range
T_a	Hold time at lower GC temperature (seconds)	2-900 (seconds)
T_b	Ramp time from GC cold to GC hot temperature (seconds)	2-900 (seconds)
T_c	Hold time at hot GC temperature (seconds)	2-900 (seconds)
C_t	Initial cold GC temperature (°C)	1-99 (°C)
H_t	Final hot GC temperature (°C)	30-300 (°C)
COLLECT	Collection time of analytes onto PC (seconds)	10-900 (seconds)
CLEAN	Time cleaning PC by heating (seconds)	2-10 (seconds)
PRESETTLE	Time PC cools after cleaning (seconds)	2-20 (seconds)
SETTLE	Time allowed for pressure to stabilize before PC FIRE (seconds)	2-20 (seconds)
FIRE	Time PC is heated to release analytes (seconds)	2-10 (seconds)

Figure 10: Settings Descriptions

Settings		
T_a	360	<input type="text"/>
T_b	60	<input type="text"/>
T_c	30	<input type="text"/>
C_t	40	<input type="text"/>
H_t	100	<input type="text"/>
COLLECT	30	<input type="text"/>
CLEAN	4	<input type="text"/>
PRESETTLE	4	<input type="text"/>
SETTLE	2	<input type="text"/>
FIRE	6	<input type="text"/>
<input type="button" value="SET"/>		

Figure 11: Table of current instrument settings, with adjustment boxes.

Calibration

It is necessary to calibrate the FROG for a desired application. A calibration must be opened in the Ellvin Software for the FROG to correctly analyze samples. Calibration files can be created (with analysis data from chemical standards) or loaded (if someone else calibrated the FROG) with the software. Defiant recommends re-calibrating the FROG at least every three weeks for the most accurate analyses.

Loading an Existing Calibration File

If the FROG was calibrated by someone else, the calibration file will must be loaded along with the software. The calibration file can be found on the USB Drive located in the zipper pouch in the FROG's case. To load a calibration file complete the following steps:

1. Locate the file on the USB Drive. It is a file ending in .ana. Copy and paste the file to a location on the computer that is easy to find.
2. In the calibration tab of the Ellvin GC Software click on the open icon to the right of the "analyte file" box, locate the file that was copied and pasted and open it (Figure 12).
3. Verify that the target analytes are listed under the analytes list (Figure 13).
4. If the FROG was calibrated at a different elevation than the one it will be used, adjust retention times.

Creating a Calibration File

To create a calibration file do the following:

1. Create a new calibration file by clicking on the "new" icon to the right of the calibration file box (Figure 14).
2. Label and save your new calibration file.
3. Add your analytes by clicking on the "new" icon underneath the analyte list (Figure 13). Type in the analyte name and alias (which will appear on the display when running in standalone mode) and select OK. Repeat this step for each target analyte until all desired analytes have been added.

Generating and Adding Data to a Calibration

To create a calibration, a series of different known concentration samples must be run on the FROG. Defiant recommends running five calibration standards from lowest to highest concentration. Refer to later sections regarding running samples and analyzing the data. The steps to generate and add data to a calibration are as follows:

1. Run 5 known samples on the FROG starting with the lowest concentrations and ending with the highest concentration, noting which concentration corresponds to each run.
2. Analyze one of the sample runs in the analyze tab of the software (see page 9 for how to analyze data).
3. In the results table under the analyze tab, highlight the analyte you would like to add calibration data for and enter in the known concentration
4. With the desired analyte selected in the results list, **right click** on the highlighted row and select the correct analyte from the list. Select yes when the software asks if you want to copy the peaks to the current calibration, this sends the data to the calibration file. Repeat steps 3 and 4 for all analytes at each concentration run.

Calibration Curve and Equations

Once data has been added to a calibration, Ellvin will create a calibration curve for the target analyte(s). Figure shows an example curve. The calibration curve displays the degree of correlation (R^2 value) between analyte standards of varying concentrations and the instrument's response to them. The correlation is calculated as both a linear equation and a second-order quadratic equation. The user may view the equations and chart for either Peak Area correlation or for Peak Height correlation. Ellvin uses these parameters to calculate concentrations for future samples. Note that for sample screening, a one point calibration may be used, this point should be the same concentration of the action level for the screening.



Figure 12: Opening a Calibration File.

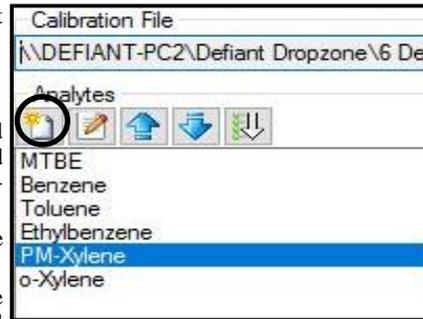


Figure 13: Analytes List and adding new analytes.



Figure 14: Creating a New Calibration File

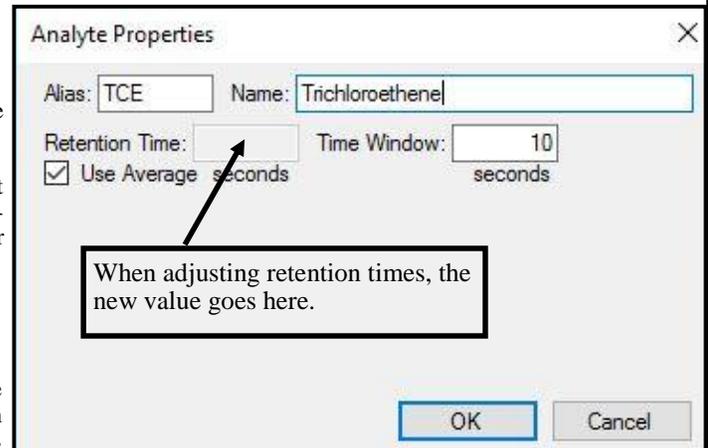


Figure 15: Adding a New Analyte to a Calibration File

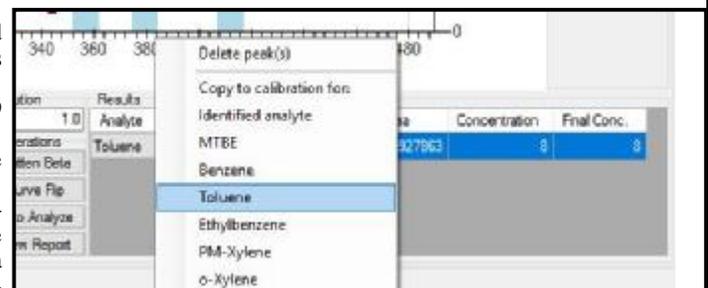


Figure 16: Sending Data to a Calibration File

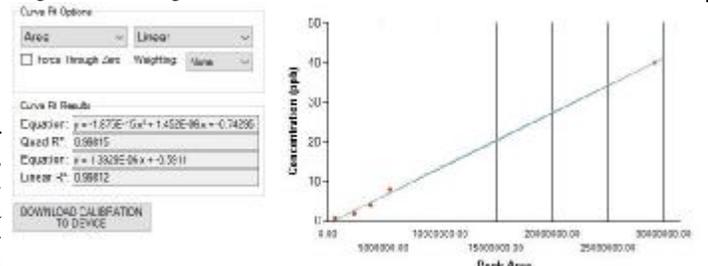


Figure 17: Correlation Equations and Calibration Curve

Water Sample Preparation Tips

- The sample volume for the FROG will always be 5mL. The system was calibrated with 5mL samples, all testing must be performed using 5mL samples.
- It is acceptable for water samples to have particulate matter or sediment in them. This will not damage the FROG.
- If the water is silty, it is best to load the sample directly into the sparge bottle.
- Be mindful of the concentration of the sample. If the sample smells, it is a good idea to dilute it.
- **Do not** run neat (undiluted) materials like crude oil or solvents with the FROG.

Loading a Water Sample

1. Load 5mL of the water sample into the 5mL glass syringe that comes with the FROG or into a plastic 5mL syringe. This can be done by either pulling the liquid up through the front of the syringe or by removing the plunger and filling the syringe through the back.
2. Thread the green sparge needle into the sparge bottle, leave the bottle in the dropped (down) position (Figure 18).
3. Connect Syringe to sample inlet on the instrument, it is a luer-lock connection and the syringe will stay in place (Figures 19 and 20).
4. Set valve on top of instrument to the “load water” position so the red arrow points toward the connected syringe (Figure 21).
5. Inject sample into the instrument; the sparge bottle now holds the sample (Figure 22).
6. Lift the sparge bottle up into the raised (up) position. Tighten sparge nut (counter clockwise) to hold bottle in place (Figure 23).
7. Set the valve on top of instrument to the “run water” position. The red arrow will now point toward the blue tubing (Figure 24).
8. Remove empty syringe from instrument.

Running a Sample

Once a water sample has been loaded, it is ready to be run with the Frog.

1. With the FROG connected to the software use the play button to start a run (Figure 25).
2. When the Frog is finished running the sample, empty the sparge bottle, clean glassware by rinsing 3 times with water, run a blank if there was a detection and then proceed with sampling.



Figure 25: Play Button to start run in Software



Figure 18: Sparge Bottle in Dropped (Down) Position

Step 2

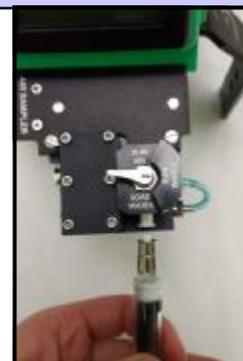


Figure 19: Attaching and Detaching Syringe from Sample Inlet

Steps 3,8



Figure 20: Sparge Bottle in Dropped (Down) Position with 5mL Syringe attached to FROG, Sample is ready to be loaded

Step 3



Figure 21: Valve set to “Load Water”

Step 4

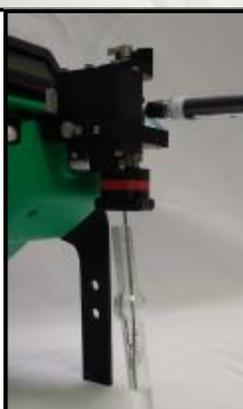
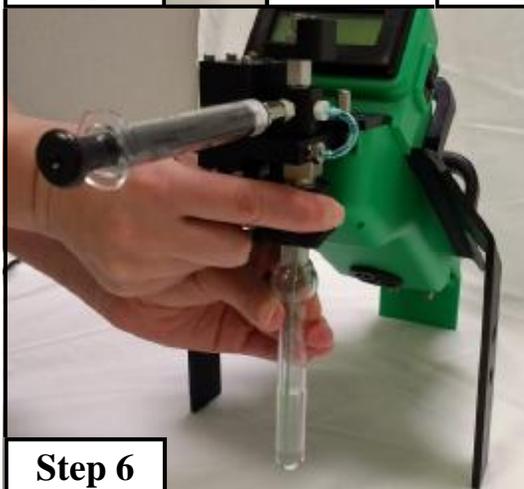


Figure 22: Sample Injected in Sparge Bottle

Step 5



Step 6

Figure 23: Lifting Sparge Bottle up and tightening sparge nut to hold it in place



Step 7

Figure 24: Changing Valve position to “Run Water”

Soil Sample Tips

- Soil sampling is similar to water sampling.
- Soil can be run directly in the sparge bottle. For this method, the mass of the soil run will always be 1g; 5mL of water is then added to the soil prior to running.
- Keep track of any dilution performed.
- Methanol Extraction can be performed on the soil if highly contaminated.
- Rinse between soil samples and make sure sparge needle is kept clean.

Loading a Soil Sample

1. Weigh out 1g of soil, pour into sparge bottle (Figures 26 and 27).
2. Fill 5mL glass syringe with 5mL of clean water and dispense directly into sparge bottle, rinsing down any soil that may be stuck to the sides of the bottle (Figure 28).
3. Lift sparge bottle with soil and water into the raised (up) position on the FROG and tighten sparge nut (counter clockwise) to hold bottle in place (Figure 29).
4. Set the valve on top of instrument to the “run water” position. The red arrow will now point toward the blue tubing (Figure 30).

Running a Sample

Once a soil sample has been loaded, it is ready to be analyzed with the FROG.

1. With the FROG connected to the software use the play button to start a run (Figure 31).
2. Make note of the dilution of the sample. If 1g of soil was diluted in 5mL of water, this gives a dilution factor of 5, so any concentration results will need to be multiplied by 5 to obtain the true concentration of analyte in the soil.
3. When the Frog is finished running the sample, empty the sparge bottle, and clean glassware by rinsing 3 times with water. Make sure all soil is removed from the sparge bottle. If there is soil stuck to the sparge needle, a clean damp Kimwipe may be used to wipe it off.
4. Run a blank if there was a detection and then proceed with sampling.

Methanol Extraction

Methanol Extraction may be performed on highly contaminated soils. If the soil has a strong odor, it is a good idea to perform methanol extraction on it. Methanol Extract is diluted to a 5mL sample volume and then run the same way a water sample is. For details on Methanol Extraction please see the application note at: www.defiant-tech.com.

Home



Figure 26: 1g of soil weighed out.

Step 1



Figure 27: Pouring Soil into Sparge Bottle



Figure 28: Rinsing Soil Down Sparge Bottle with 5 mL water.

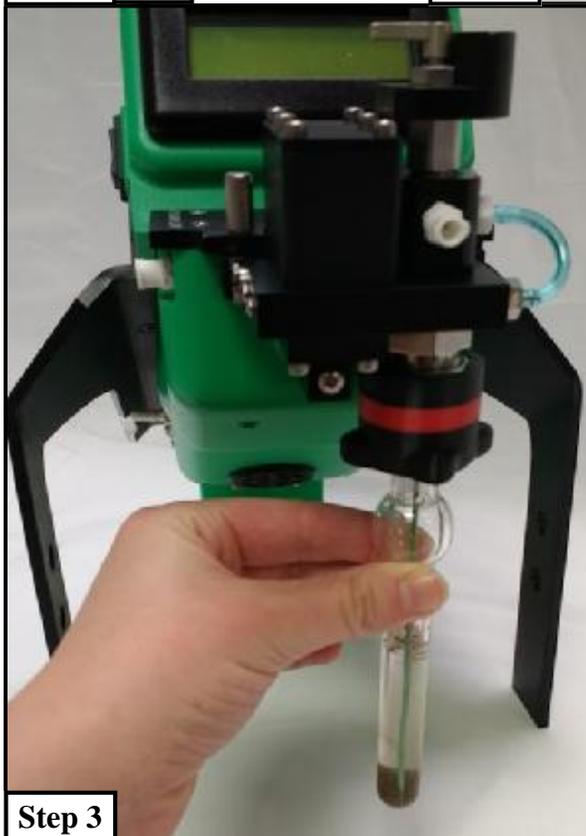
Step 1

Step 2

Running a Sample

Once a soil sample has been loaded, it is ready to be analyzed with the FROG.

1. With the FROG connected to the software use the play button to start a run (Figure 31).
2. Make note of the dilution of the sample. If 1g of soil was diluted in 5mL of water, this gives a dilution factor of 5, so any concentration results will need to be multiplied by 5 to obtain the true concentration of analyte in the soil.
3. When the Frog is finished running the sample, empty the sparge bottle, and clean glassware by rinsing 3 times with water. Make sure all soil is removed from the sparge bottle. If there is soil stuck to the sparge needle, a clean damp Kimwipe may be used to wipe it off.
4. Run a blank if there was a detection and then proceed with sampling.



Step 3

Figure 29: Lifting Sparge Bottle into the Raised (Up) Position on the Frog



Step 4

Figure 30: Valve set to “Run Water” Position



Figure 31: Play Button to start run in Software

Air Sample Tips

- Make sure ferrules and air sampler are installed correctly
- Avoid pulling particulates with the air sampler. Filters are available for air sampling in high particulate matter environments

Installing the Air Sampler

1. Slide green sparge needle into opening on top of air sampler. Lift air sampler up and secure by tightening sparge nut (counter clockwise) around air sampler (Figure 33).
2. Install coupler line; the white fitting will attach underneath the air sampler label on the FROG (Figure 34).
3. Plug in power cable, the port is in underneath the air sampler label on the FROG (Figure 35).
4. Make sure the valve on the top of the FROG is set to "Run Air" (Figure 36)
5. Connect end of transfer line to:
 - Tedlar Bag adapter (for sampling a Tedlar Bag)
 - Carbon Scrubber (for providing a blank air sample)
 - Air Sampler Wand (for collecting an air sample)

Note that the transfer line does not need anything attached to it if sampling ambient air. See next page for more detail on sampling methods.

Running an Air Sample

Once air sampler has been installed:

1. With the FROG connected to the software use the play button to start a run (Figure 38).
2. The FROG will pull an air sample for the first sixty seconds of the run, then it will analyze the sample.
3. The FROG can also be set for continuous air sampling. To do this, hold down the shift key while clicking on the play button. Select the type of continuous sampling you would like. This sequence will run until you pause the unit by clicking on the stop button in the Ellvin software.



Figure 38: Play Button to start run in Software

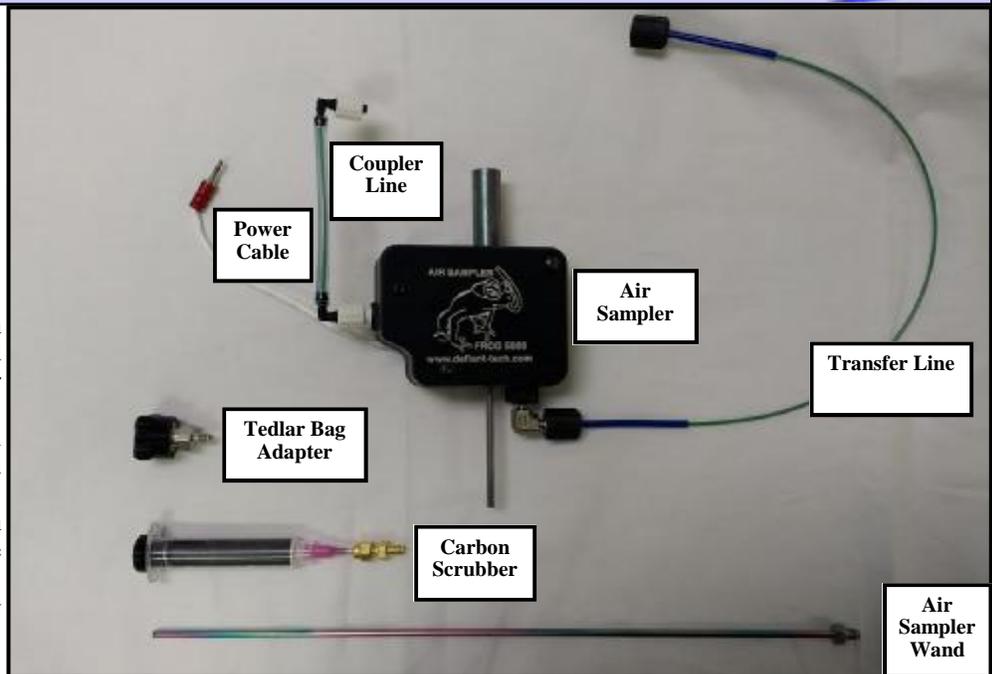


Figure 32: Air Sampler Kit.



Figure 33: Installing Air Sampler on FROG



Figure 34: Connecting Coupler Line to FROG



Figure 35: Plugging in Air Sampler Power Cable



Figure 36: Valve set to "Run Air"

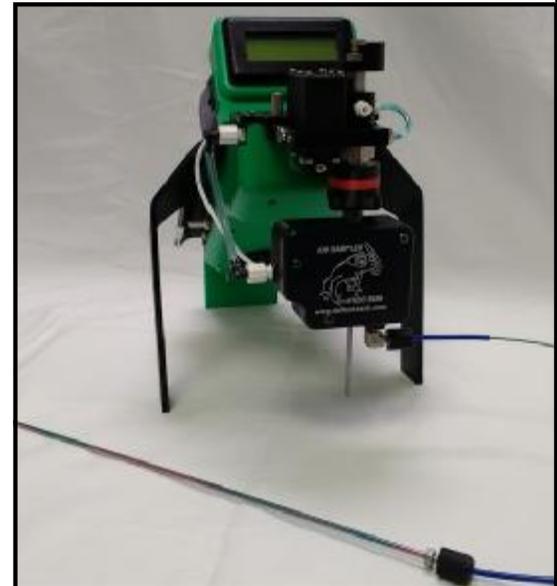


Figure 37: FROG Ready for Air Sampling

Air Sampling Methods

There are several different options for air sampling and how to take air samples. Note that finger tight connections are adequate (and recommended) for all of these methods.

Direct Sampling

1. No attachment is needed for the transfer line
2. The air sample will be pulled in through the end of the transfer line (Figure 39).

Clean Air (Blank) Sampling. Run a blank sample before starting analysis and in between samples.

1. Screw the carbon scrubber onto the air sampler transfer line (Figures 40 and 41).

Tedlar Bag Sampling.

1. Twist silver end of adapter onto the transfer line (Figure 42).
2. Loosen Black part of adapter from silver part (one turn is adequate). Slide black part of adapter onto the stem of the tedlar bag (Figure 43).
3. Twist black and silver parts of adapter to tighten the adapter around the tedlar bag stem (Figures 43 and 44).
4. Make sure tedlar bag valve is in the open position prior to sampling.

Air Sampler Wand. This wand is designed for sampling inside a small space, for example sampling inside a cabinet or drum.

1. Twist silver threaded end of air sampler wand (Figures 45 and 46).
2. If using in a dusty environment, use a particulate filter and adapter. This keeps particulates from damaging the air sampler.



Figure 39: Air Sampler Transfer Line, no attachments, ready for direct sampling



Figure 40: Attaching Scrubber to Transfer Line



Figure 41: Scrubber Attached to Transfer Line, ready for clean air (blank) sampling

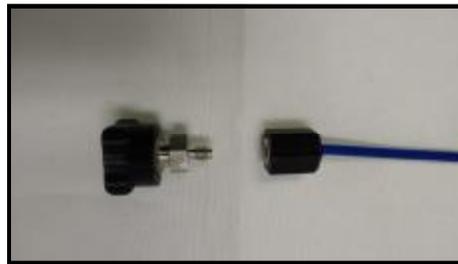


Figure 42: Attaching Silver Fitting on Tedlar Bag Adapter to Transfer Line



Figure 43: Connecting Adapter to Tedlar Bag

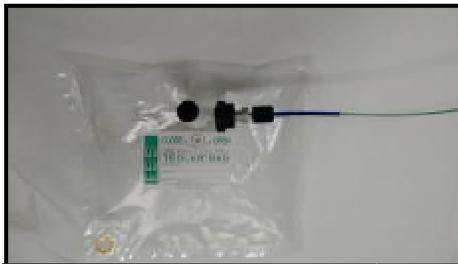


Figure 44: Tedlar Bag connected to Transfer Line via Adapter, ready for sampling.

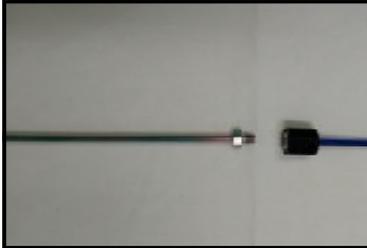


Figure 45: Attaching threaded fitting on Wand to Transfer Line



Figure 46: Wand attached to Transfer Line, ready for sampling.



Figure 47: Sampling with the Air Sampler Wand.

Running a Sample in the Live Data Tab

1. After setting FROG up to sample, make sure the live data tab is selected in the Ellvin GC software (Figure 48).
2. Connect FROG to software using the port drop down menu (Figure 49).
3. To start a sample, use the large play button in the top toolbar (Figure 50).
4. Beneath the chromatogram make any notes about the sample. The software will save these notes with the chromatogram (Figure 51).
5. After FROG is finished analyzing, the software automatically saves the data. A file location with the log number will be displayed at the top of the chromatogram (Figure 52).
6. To start a new sample, follow the procedures for loading a sample then repeat steps 1-3, making sure to update the notes.

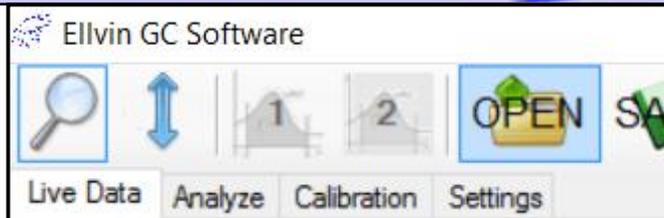


Figure 48: Live Data Tab in Ellvin Software

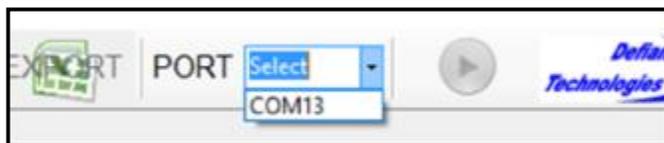


Figure 49: Selecting a COM port to connect FROG to software



Figure 50: Play Button to start run in Software

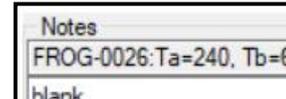


Figure 51: Making Notes for a sample run

Chromatogram Features (Figure 55)

- The red line is the data from the PID. The peaks on this line represent different compounds.
- The bottom (x) axis represents time (in seconds). The left (y) axis represents clicks from the PID, and the right axis is for GC temperature ($^{\circ}$ C).
- The purple line represents GC temperature.

Useful Tools/Features in Live Data

- The **Magnifying Glass** (Figure 53) may be used to zoom into a chromatogram. To use:
 1. Click and drag mouse over area to magnify.
 2. Release the mouse button.
 3. To zoom out, double click on the magnifying glass
- The **GC Temperature Indicator** (Figure 54) displays the GC temperature. The icon is **GREEN** when instrument is ready for analysis and **RED** when the GC is cooling



Figure 52: Saved File Location, note that data (and any associated notes) are automatically saved at the end of each run.



Figure 53: Magnifying Glass Tool



Figure 54: GC Temperature

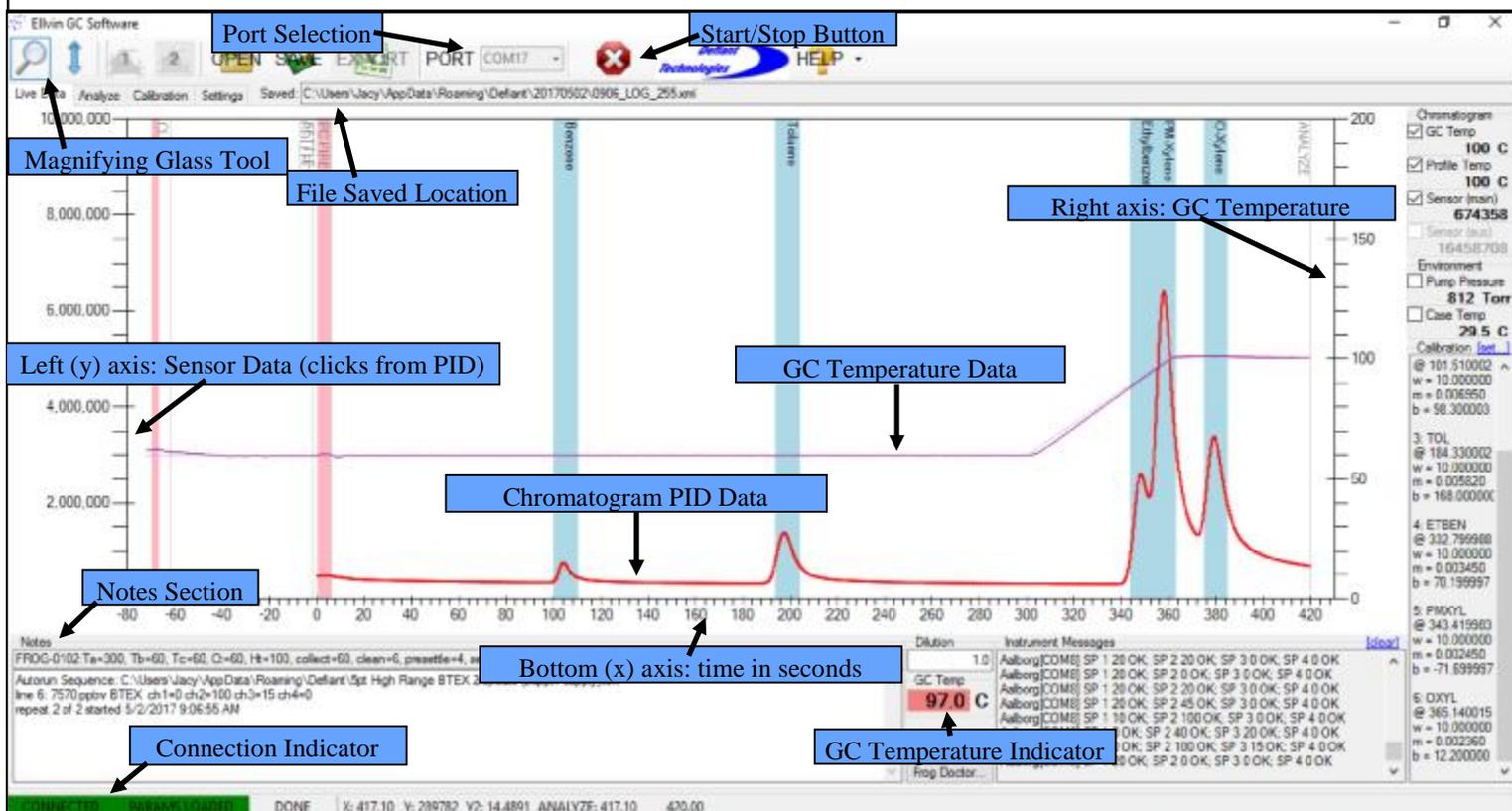


Figure 55: Chromatogram in Live Data Tab with Features labeled

Opening a File in the Analyze Tab

1. Make sure the analyze tab is selected in the Ellvin GC software (Figure 56).
2. Click on the open icon (Figure 57) in the top toolbar and navigate to the Ellvin data folder, the default file path is: C:\Users\Username\Documents\EllvinData
3. Locate the file you wish to open. Files are saved in folders by date and then each file has its own timestamp and log number. Clicking once on the file will show a preview of the chromatogram (Figure 58). Click on "select" to open the file.
4. The selected chromatogram should now appear in the analyze tab and is ready for analysis (Figure 59).



Figure 56: Analyze Tab in Ellvin Software



Figure 57: Open Icon

Analyzing a File

1. First, make sure the correct calibration is loaded in the calibration tab. Refer to page 4 of the quick start guide for details about loading a calibration. If a calibration is loaded, vertical blue analyte windows will be present on the chromatogram.
2. Look for peaks within the blue analyte windows. If there is a peak within a window it means that there is a detection. Note the peaks in the blue windows in Figure 59.
3. Integrate the chromatogram. There are a few methods for doing this; see section below.
4. Locate the results table below the chromatogram (Figure 63). Concentrations for each calibrated analyte peak will be listed.

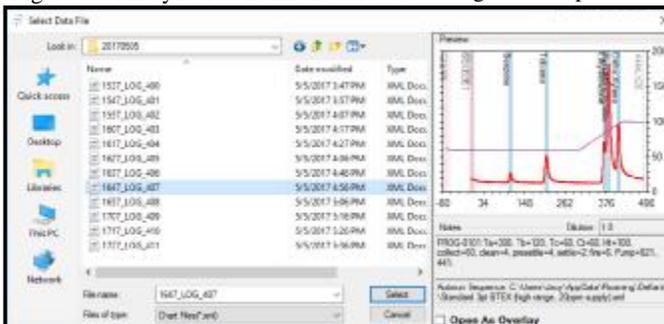


Figure 58: Opening a Chromatogram File

How to Integrate:

The goal of integration is to determine the peak area underneath the curve on the chromatogram.

Method A: Auto Analyze. Click on the Auto Analyze button. This will integrate all the peaks present on the chromatogram. The data will appear in the results table.

Method B: Manual Integration. There are two Integration Tools that may be used for manual integration. Integrator 2 is almost always the best choice for integration.

Integrator 1

The user creates a baseline and integrates peaks, then calculates the peak height and area to determine analyte concentrations. Beginning and ending points of the integration are based on the cursor position.

Integrator 2

With Integrator 2, Ellvin snaps to the vertical point on the data line closest to the cursor position. Integrator 2 is recommended for ease of use.

To Manually Integrate:

1. Based on retention times, determine which peaks to integrate.
2. Click and hold the mouse at the valley before the first peak to integrate (In Figure 62: Valley 1).
3. Drag the mouse to the valley after the peak to integrate (In Figure 62: Valley 2). Do not drag the line through the peaks. A highlighted area displays the integrated peaks. Multiple peaks may be integrated at the same time.
4. When the integration is complete, the data will appear in the results table.

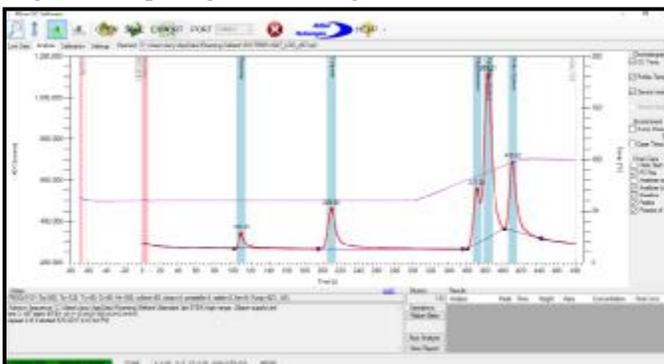


Figure 59: Chromatogram File Opened in Analyze Tab

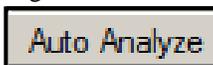


Figure 60: Auto Analyze

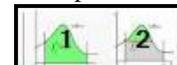


Figure 61: Manual Integration Tools

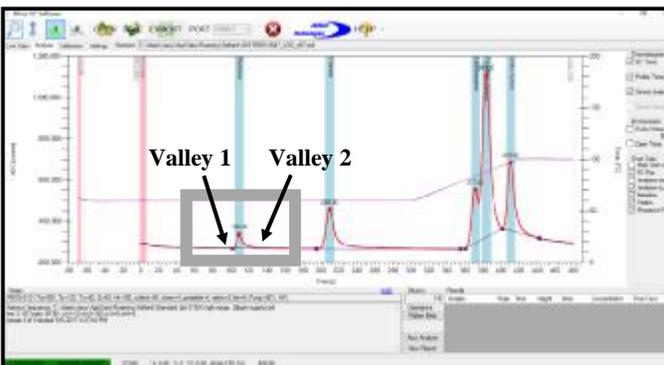


Figure 62: Chromatogram with Valleys labeled for manual integration

Exporting Data from Ellvin

The easiest way to export data from Ellvin is to use the view report tool.

1. Click on View Report (Figure 64). Ellvin will generate a report with the chromatogram and results table.
2. Once the report is generated it can be saved as a pdf, word document or excel file (Figure 65).

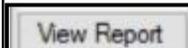


Figure 64: View Report

Peak Analyte Name	Time	Height	Area	Concentration	Final Conc.
1 Benzene	410.33	89968	674396	1162.14	1162.14
2 Toluene	209.59	152710	264828	1074.71	1134.71
3 Ethylbenzene	371.86	281600	284274	529.817	529.817

Figure 65: Report with Save Icon Circled.

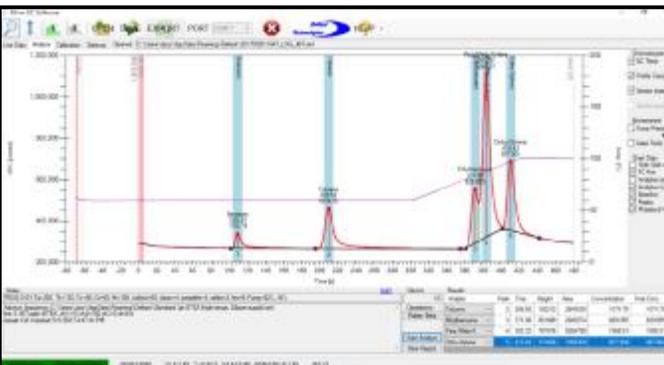
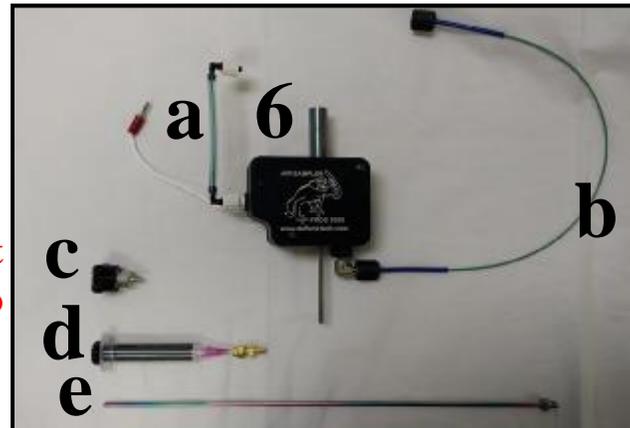


Figure 63: Chromatogram Integrated, Data shown in Results Table.

1. Syringe
2. Sparge Bottle
3. Frog (With Sparge Tube Protector)
4. Serial Data Cable
5. Battery
6. Air Sampler
 - a. Air Sampler Coupler Line
 - b. Transfer Line
 - c. 1/16-3/16 Adapter
 - d. Activated Carbon Scrubber
 - e. Air Sampler Wand
7. Power Supply
8. Power Cord
9. 60 mL Rinsing Syringe
10. Software on USB drive
11. Micro SD to USB Adapter



NOTE: The battery should be left inside the unit for ground and air cargo shipping.

For passenger air cargo, the battery should be removed, safely packed and carried on board. In this case, the battery should have less than a 30% charge.

If the battery is shipped outside of a unit it should have less than a 30% charge before transport.



1. Syringe
2. Sparge Bottle
3. Frog (With Sparge Tube Protector)
4. Serial Data Cable
5. Battery (In Frog)
6. Air Sampler
 - a. Air Sampler Coupler Line
 - b. Transfer Line
 - c. 1/16-3/16 Adapter
 - d. Activated Carbon Scrubber
 - e. Air Sampler Wand
7. Power Supply
8. Power Cord
9. 60 mL Rinsing Syringe
10. Software on USB drive
11. Micro SD to USB Adapter

