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S O F T A C O R P O R A T I O N

Model 300 ELSD Manual

Version 2.7.0 December 2004

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Chapter

1

INTRODUCTION

ELSD Principle of Operation

Introduction

ELSDs are near universal detectors, primarily used in High Performance Liquid Chromatography (HPLC) though they have been used successfully in other types of chromatography as well. Their principal requirement is that the analyte be less volatile than the mobile phase. An ELSD cannot detect highly volatile analytes. However, most analytes of interest are less volatile than the eluting solvents.

Evaporative light scattering detectors are replacing ultraviolet (UV) detection because they can detect most analytes, even those that do not absorb UV radiation, are stable during gradient elution, and respond to the relative mass of the analyte -an important feature that is useful when detecting unknown materials. The ELSD is superior to the refractive index detector (RID), it can be used with gradient chromatography, it is not susceptible to ambient temperature changes, and it does not produce negative peaks, which can be difficult to quantify. The ELSD does not respond to the mobile phase disruption seen as solvent front peaks in the void volume with UV and RI detectors, so early eluting analytes can be easily quantified. Mass spectrometry (MS) detection is also a universal detector, but its high cost and complexity have kept it from being widely used. In fact, the operation requirements of MS closely match that of the ELSD. This allows the less expensive and complicated ELSD to be used as a method development detector for methods to be used on the MS systems.

Operation

The SofTA ELSD employs a unique method of detection. The process involves the nebulization of the column eluent, transforming it into an aerosol cloud. As this cloud travels through a heated zone within the instrument, the more volatile mobile phase evaporates, leaving a smaller cloud of analyte particles. These particles pass through a beam of light, scattering some of the light, which is converted into an electronic signal.

Nebulization

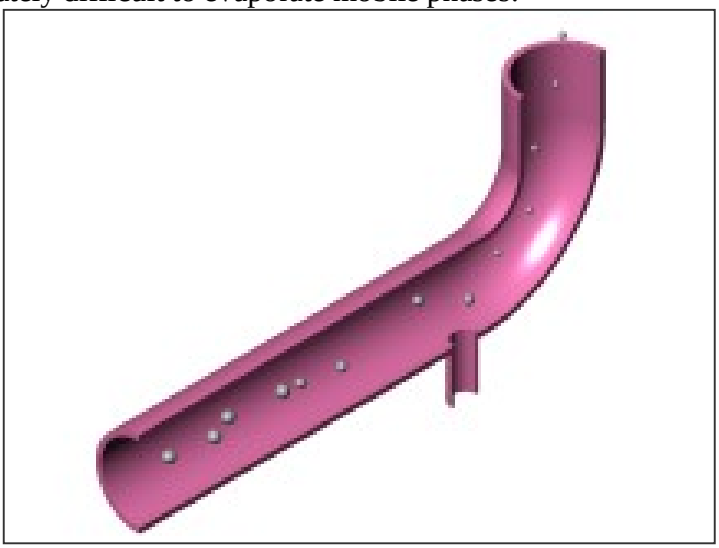
Nebulization transforms the liquid phase leaving the column into an aerosol cloud of fine droplets. The size and uniformity of the droplets are extremely important in achieving sensitivity and reproducibility. The SofTA ELSD uses a concentric gas type nebulizer and a constant flow of an inert gas to ensure a narrow droplet size distribution.

To handle flow rates and mobile phases common in HPLC, all ELSDs need a way to divert part of the aerosol cloud to waste. One of the earliest successful approaches to aerosol splitting involved a nebulization chamber with a flow restriction and sharp turn. The larger particles in the cloud would fail to make the turn, hit the wall, and ultimately run out a drain. When this geometry is optimized for

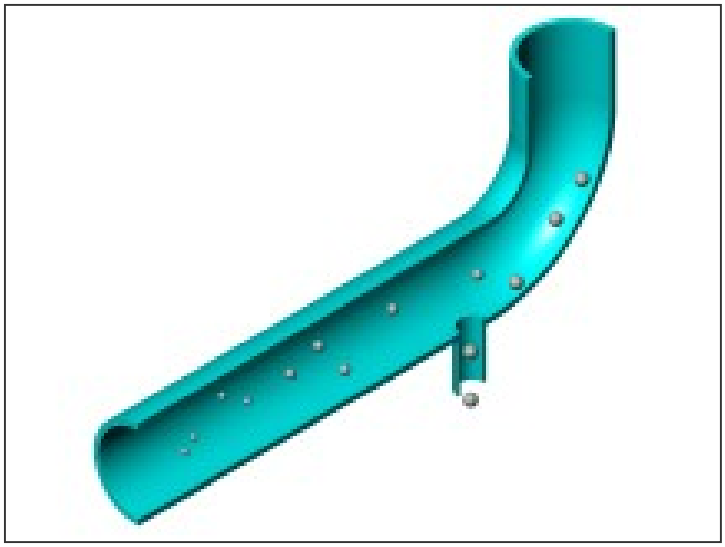
high flow rates or difficult to evaporate mobile phases, too much will be sent to waste under less severe operating conditions. This limits sensitivity in many processes.

A more recent solution to the problem is the plate impactor. For high flow rates, or aqueous mobile phases, the plate is perpendicular to the flow. Larger particles hit the plate, condense, and go out a drain. Smaller particles make it through the annular space and continue on to the evaporative zone. When less severe conditions are encountered, the plate is turned parallel to the flow, allowing all particles to pass. In this design, the impactor is either on, or off. There is no in between setting for processes which have moderate flows, or moderately difficult to evaporate mobile phases.

Softa has improved upon all of these splitting techniques with our patent pending **Thermo-Split technology. Thermo-Split technology** provides the ability to vary the split ratio smoothly over a wide range. Our **Thermo-Split** chamber combines a gentle bend with temperature controlled (heated or cooled) walls. For an easily evaporated mobile phase, the walls are heated. As the aerosol traverses the chamber, it partially evaporates, shifting the particle size distribution low enough for essentially all the particles to negotiate the bend. When highly organic mobile phases are used, the **Thermo-Split** chamber is used at ambient or elevated temperatures. Under these conditions a majority of the aerosol particles pass through the chamber and are carried into the evaporative zone.



With heat, the particles decrease in size and all pass the bend in the Thermo-Split chamber.



With cooling, the particles condense and increase in size. They are carried into the walls of the bend and exit via the drain.

For difficult to evaporate mobile phases, or high flow rates, the walls of the **Thermo-Split** chamber are cooled. When the aerosol exiting the nebulizer encounters a cooled environment, it partially condenses into larger particles whose momentum carries them into the wall and down the drain. By making the walls suitably cold, 99+% of an aqueous stream can be diverted away from the evaporative zone.

The real benefit of Thermo-Split technology is that it can be controlled in a smooth analog fashion, by simply controlling a temperature. The temperature of the nebulization zone can be set from 0°C to 80°C, in l°C increments. This achieves split ratios of approximately 99% to 1%. Unlike some ELSDs our splitter isn t ålways on. And unlike others, it isn't constrained to the two choices of either on or off. Instead, it can be on, off, or anything in between.

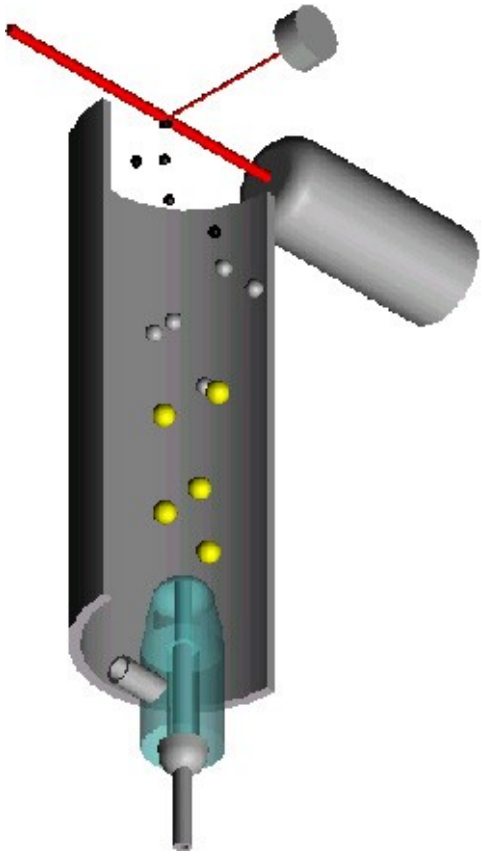
Evaporation

After passing through the Thermo-Split chamber the aerosol cloud is propelled through the heated evaporation tube assisted by the carrier gas. In the evaporation tube the solvent is volatilized to produce particles or droplets of pure analyte.

The temperature of the drift tube is set at the temperature required to evaporate the solvent. The temperature should be kept as low as possible to avoid particle shape distortion, evaporation of the analyte or when working with thermally sensitive compounds.

Detection

The particles emerging from the evaporation tube enter the optical cell, where the sample particles pass through the light emitted by a low power laser. The particles scatter the light, which is detected by a silicon photodiode located at a 90° angle from the laser. A light trap is located opposite the laser to collect the light not scattered by particles. The quantity of light detected is proportional to the solute concentration and solute particle size distribution. The photodiode produces a signal, which is sent to the outputs for collection.



Graphical representation of the Evaporative Light Scattering Detection process.

Chapter

2

UNPACKING AND INSTALLATION

What you will need

In addition to the Model 300 ELSD and its accompanying accessories you will need:

Gas Supply: Clean, dry, inert gas regulated to 50 psi with less than 1 psi variation is needed for nebulization.

Exhaust Device: The carrier gas containing volatilized mobile phase and sample components will exit the ELSD. You should provide a means of removing this from the laboratory. The ELSD should be located close to a fume hood or other ventilation device.

Tubing, fittings and tools to connect your HPLC system to the ELSD.

Unpacking

The Model 300 ELSD is shipped with the accessories listed in Appendix 1. Unpack carefully and confirm that all the items are present. SofTA ELSDs come in a high quality shipping container, engineered to avoid damage in transit. Save the shipping container and packaging for future shipments.

Connections

Power Connection

The Model 300 ELSD operates at either 120V or 240V, 50/60 Hz. Confirm that the SofTA Model 300 ELSD is configured for the correct voltage before plugging it in to line voltage. If the power input module is set to the wrong voltage, unplug the power cord form the module. Open the fuse compartment by gently prying the cover from the module with a flat blade screwdriver. Remove the fuse block. Remove the voltage configuration card from the module by gently pulling with pliers or tweezers. Rotate the plastic voltage selector until the correct voltage appears on the side opposite the voltage selector. Replace the card and fuse block. Confirm that the correct voltage is indicated through the cover before securing the cover. Plug the modular power cord provided into the power input module on the back of the detector.

Note: For 100Vac to 120Vac line voltage, set the configuration to 120V. For 200Vac to 240Vac line voltage, set the configuration to 240V.

Exhaust

The ELSD ships with an adapter which converts the 1 ëxhaust (on the rear of the instrument) to a ½ ťube. Connect tubing to this adapter, and direct to a fume hood during operation. Alternately, connect tubing and direct to a cooled collection vessel for later disposal.

Communication

An output jack can be found on the back of the Model 300 ELSD for connection to a chart recorder, computing integrator or computerized data system. The maximum signal output is 5V for 5V FS setting and 10mV for 10mV FS setting. The factory setting is 5V FS.

I/O Connections

Pin 1 and Pin 2: A contact closure output. Pins are shorted when no error conditions exist.

Pin 3 and pin 4: A contact closure input to turn on/off gas remotely. Gas control toggles with electrical continuity between these two pins. Maintain connectivity for a minimum of 500mS. A subsequent toggle command within 2 seconds may be ignored.

Pin 5 and pin 6: A TTL version of Pins 1 and 2. A TTL low indicates no error conditions exist. Pin 5 is the signal pin. Pin 6 is the ground reference pin.

Pin 7 and pin 8: A contact closure input to reset baseline and/or start a run. Maintain connectivity for a minimum of 500mS. A subsequent toggle command within 2 seconds may be ignored.

Gas Connections

Connect a supply of clean, dry, inert gas regulated to 50 psi with less than 1 psi variation to the GAS INLET port on the front of the unit.

Fluid Connections

Connect the outlet from your column to the inlet the in-line filter (optional) with the Model 300. Connect the outlet of the filter to the Model 300 LIQUID INLET on the front of the unit. See Figure 2.1. The length and volume between the column outlet and the detector inlet should be kept as short as possible to avoid unnecessary band broadening.



Figure 2.1: Fluid Connection

Thermo-Split Drain

Place the ¼ stainless steel nut and ferrule on the bent Viton tube, both provided in the accessory kit. Secure the fitting to the drain outlet on the front of the Model 300 ELSD. Fill a 100mL glass beaker with approximately 1 of water. Place the beaker under the attached drain tube. See Figure 2.2. Watch the liquid level in the beaker during operation and empty when full, especially when running the spray chamber (Thermal-Split chamber) at sub-ambient temperature.

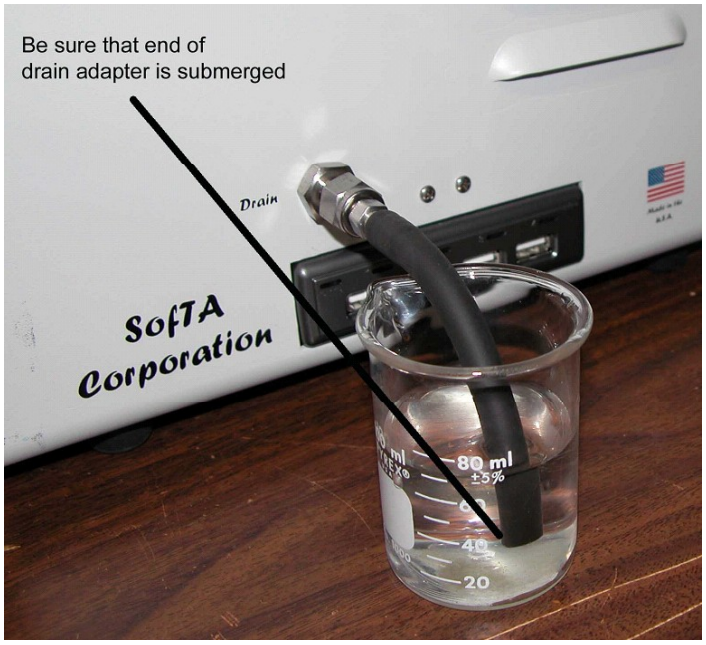


Figure 2.2: Thermo-Split Drain

During unattended operation, you may wish to direct the drain tube to a larger reservoir placed below the Model 300 ELSD. In this case, you should pump mobile phase without gas flow for 5 minutes or until you see liquid coming out of the drain. This procedure fills the instrument s internal P trap. Restricting the drain port with liquid is very important to ensure detection sensitivity.

Chapter

3

OPERATION

Instrument Controls

Introduction

Control of the Model 300 is achieved from the LCD screen on the front of the unit. This screen is touch sensitive. **A stylus should be used on the screen.** Never use a sharp object as LCD damage will result. Alternately, a keyboard and mouse may be attached to the USB ports on the front of the unit to aid in operation.

Control of the Model 300 is achieved via two screens; Control Panel and Chart View. Control Panel (Figure 3.1) provides the means to set the Model 300 operating, data collection, and method conditions. The Chart screen (Figure 3.2) provides a means to view the detector signal in real time, access to the help menu and memo functions.

Large buttons are provided on Control Panel and Chart View for easy touch-sensitive operation. On Control Panel, use "Select" button to make a selection. The title of a selected item turns blue. Use "Enter" button to enter Edit mode, which will turn the title red. Use the "+" and "–" buttons to change a value. Use the "Save" button to save and apply the changes. You can always use "ESC" button to exit without applying the change.

The face on the upper left of the Control Panel indicated the status of the Model 300. Tap the Face to display any error conditions.

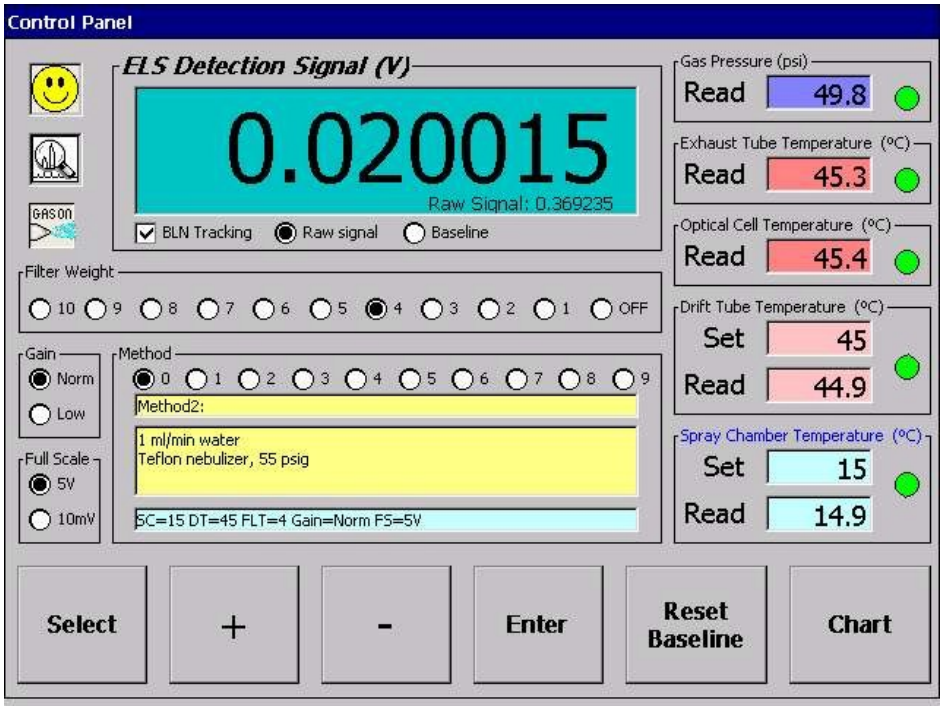


Figure 3.1: Model 300 Control Panel

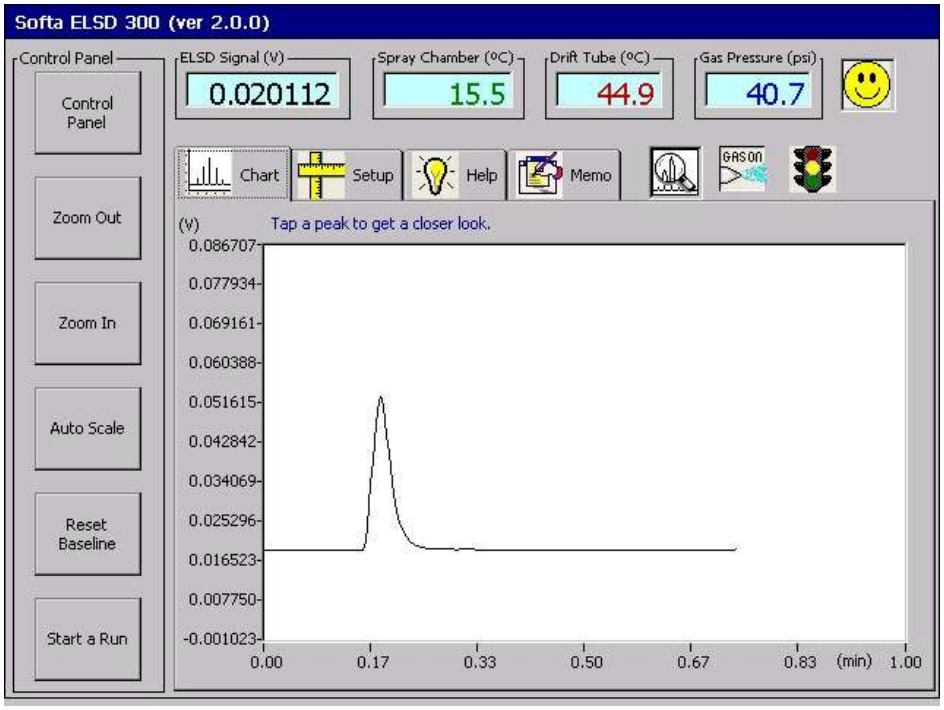


Figure 3.2: Model 300 Chart Screen

Control Panel

[Figure 3.1]

Icons

System Status:



A happy face indicates the system is ready. A sad face indicates an error condition exists. A calm face indicates the system is in standby mode. Tap the face for information regarding the condition of the detector and recommendations to correct errors. See Figure 3.3.

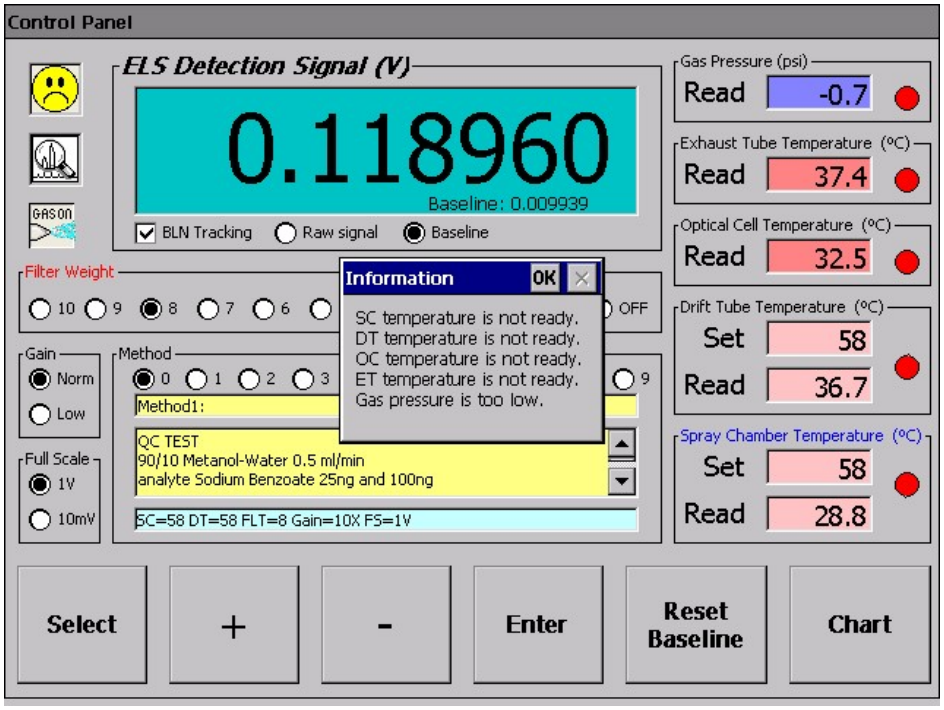


Figure 3.3: Pop-up screen to show error conditions

Standby Mode:



The night icon indicates that the detector is in standby mode. In standby the gas flow is shut off and all of the heaters are turned off. Tap the icon to switch between modes. *NOTE: You should only enter standby mode when the detector will not be used for a few hours or overnight because the detector needs about 30 minutes to stabilize when re-entering the run mode.* Alternatively, instead of entering standby mode you can use the gas icon to shut off the gas when not using the detector.

Gas On/Off:



Tap this icon to turn the gas flow on or off as indicated.

Control Buttons

The buttons at the bottom of the screen are used to set the detector parameters. The Control Buttons will change according to the parameter selected.

Select: Tap this button to cycle through the parameters in the Control panel.
ESC: exit edit mode without accepting the change.
+: Increase the selected parameter.
-: Decrease the selected parameter.
Enter: Used to enter edit mode so a value can be changed.
Save: Used to accept and store any changes made to a parameter.
Load: Load a method from detector memory.
Reset Baseline: Force the detector signal to be set to near zero.
Chart: Tap this button to switch to the Chart Screen.
Keyboard: Bring up a keyboard for entering descriptions of a method.

Control Parameters

ELS Detection Signal (V): The largest number in the window indicates detector signal voltage.

Raw Signal and Baseline: These two radio buttons change the value displayed under the larger voltage signal. The baseline number is the value subtracted from the raw signal for baseline correction. Because of the auto-zero function, a baseline problem may be hidden from the ELS detection signal readings. The two readings provide diagnostic information. For example, if the baseline reading is much higher then during previous operation the exhaust tube adaptor may not be properly installed or mobile phase is not being effectively evaporated or the optical cell (or the light trap) is dirty and needs to be cleaned.

BLN Tracking: This check box turns on and off baseline tracking. If the box is checked baseline tracking is active. Baseline tracking monitors the detector signal and electronically corrects for baseline drifting. The use of baseline tracking will result in a smooth and flat baseline. BLN Tracking does not affect the peaks.

Gas Pressure (psi): This window displays the gas pressure entering the detector. The light will be green if the value is stable and within the acceptable parameters. If the light is red, confirm that the gas on icon is displayed then adjust the incoming gas flow until it is within acceptable parameters and the light is green. The light will be yellow when the detector is in standby mode.

Exhaust Tube Temperature (°C): This window displays the actual temperature of the exhaust tube. The light will be green if the temperature is within the acceptable parameters. If the light is red, the temperature is not within acceptable parameters. Wait for the temperature to reach equilibrium. The light will be yellow when the detector is in standby mode.

Optical Cell Temperature (°C): This window displays the temperature of the optical cell. The light will be green if the temperature is within the acceptable parameters. If the light is red, the temperature is not within acceptable parameters. Wait for the temperature to reach equilibrium. The light will be yellow when the detector is in standby mode.

Drift Tube Temperature (°C): The bottom window, "Read," displays the actual drift tube temperature. The top window, "Set" displays the temperature set point. To change the temperature set point, select the parameter, then use the up and down buttons to change it. Tap "Save" to apply the new set point. The light will be green if the temperature is at or near the set point. If the light is red, the temperature is not within acceptable parameters. Wait for the temperature to reach equilibrium. The light will be yellow when the detector is in standby mode.

Spray Chamber Temperature (°C): The bottom window, "Read," displays the actual spray chamber temperature. The top window, "Set," displays the temperature set point. To change the temperature set point, select the parameter, then use the up and down buttons to change it. Tap "Save" to apply the new set point. The light will be green if the temperature is at or near the set point. If the light is red, the temperature is not within acceptable parameters. Wait for the temperature to reach equilibrium. The light will be yellow when the detector is in standby mode.

Filter Weight: These radio buttons select the level of the signal filter used for data smoothing. The larger the number the higher the signal correction. "OFF" can be selected for no filtering.

Gain: These radio buttons select the gain level. There are two gain settings: norm and low. The "Low" setting results in signal 10 times lower than "Norm". If the sample concentration is too high, the detector input A/D converter will be saturated, appearing as a flat top peak. In this case, switch to low gain to keep the signal on scale.

Full Scale: These radio buttons select the full-scale level of the analog signal output. Choose 5 V or 10mV. Please notice that the selection of FS affects neither the *ELS Detection Signal* reading nor the chart scale on the Chart Screen which always correspond to 5V full scale.

Method: These radio buttons select the number of the methods saved previously. The top window displays the currently selected method. The middle window displays information regarding the method entered by the user. The lower window displays the actual detector conditions saved with the method.

Entering Methods

When you select the method parameter either by tapping the screen with the stylus or mouse pointer or cycling through with the "Select" button the word "Method" will turn red. You may then select the radio button associated with the desired pre-saved method. Select "Load" from the bottom buttons to apply the method. See Figure 3.4.

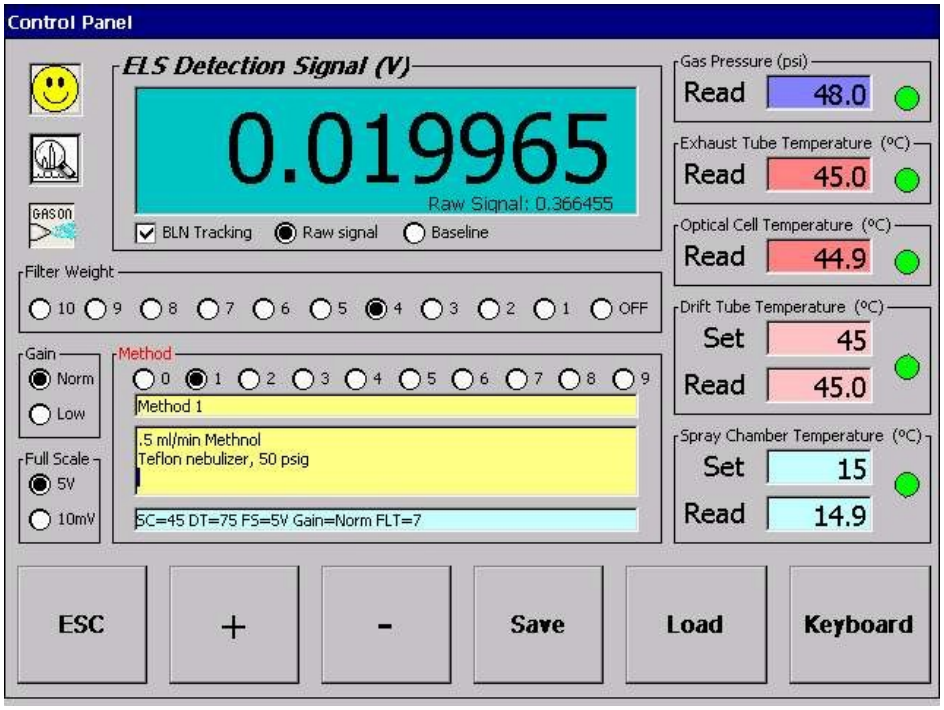


Figure 3.4: Entering a Method

Editing and Saving Methods

Set the detector parameters as desired. Select the desired method number as described above. A button labeled "Keyboard" appears at the bottom of the screen. Select this button to bring up a keyboard to use to enter information in the method window. If an external keyboard is attached via the USB port it can be used once the method window is selected. Select "Save" after any changes have been made. Tap "ESC" to leave the method parameter without applying changes.

Note: When a change is made to a parameter, such as the Drift Tube temperature or the Filter Weight, the current operation condition is automatically saved to Method 0, preserving the original method. If a method number is selected and the method is saved, a copy of it is also saved to Method 0. When the detector is powered up, it automatically loads the Method 0 which is always the last run condition before powering off.

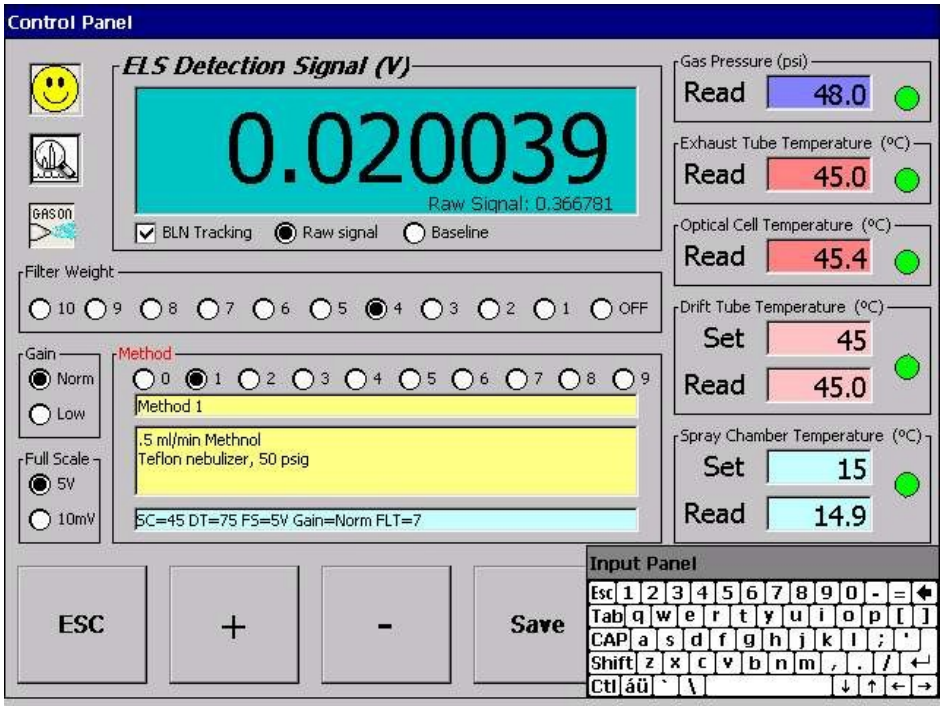


Figure 3.5: The Keyboard Input Panel

Chart Screen

[Figure 3.2]

Icons

System Status:  A happy face indicates the system is ready**.** A sad face indicates an error condition exists. A calm face indicates the system is in standby mode. Tap the face for information regarding the condition of the detector and recommendations to correct errors.

Standby Mode:  The night icon indicates that the detector is in standby mode. In standby the gas flow is shut off and all of the heaters are turned off. Tap the icon to switch between modes. *NOTE: You should only enter standby mode when the detector will not be used for a few hours or overnight because the detector needs about 30 minutes to stabilize when re-entering the run mode.*

Alternatively, instead of entering standby mode you can use the gas icon to shut off the gas when not using the detector.

Gas On/Off:  Tap this icon to turn the gas flow on or off as indicated.

Run Status:  The chart mode light is green when a data acquisition run is in progress, red when the run has ended or is stopped, yellow when the signal is being monitored.

Memo Flag:  The memo flag indicates that a memo has been saved and should be reviewed before continuing with operation. Tap the icon to go to the memo tab in the Chart screen.

Control Panel Buttons

Control buttons are grouped on a control panel to the left of the screen. Buttons are dynamically defined according to the function the detector is performing. They are discussed in details at the place where they are used.

Display Windows

There are four windows on the top of Chart screen to display real-time running conditions of the detector, independent of the operations on the Chart Screen and other panels.

ELS Detection Signal (V): The number in the window indicates detector signal voltage.
Spray Chamber Temperature (°C): This window displays the actual spray chamber temperature.
Drift Tube Temperature (°C): This window displays the actual spray chamber temperature.
Gas Pressure (psi): This window displays the actual gas pressure.

There are four tabs on the center panel of Chart screen, Chart, Setup, Help, and Memo. They are discussed in the following sections.

Chart



Basic operation

Select the charting panel by tapping Chart tab. This tab plots the actual detector signal in real time when charting is in monitoring mode. The yellow light on the chart mode light signal indicates monitor mode.  Tapping the "Zoom Out" and "Zoom In" or "Auto Scale" buttons changes the voltage scale displayed on the chart. The time scale of the chart is set on Setup tab, which is discussed in the next section.

Tap the white area of the chart to redraw a one-minute section of the signal auto scaled for closer examination of the chart. Tap again to return to the normal chart scale. Figure 3.6 shows baseline charting and Figure 3.7 shows a closer picture of a one-minute section of the baseline. See *"Integrate the Resulting Peaks"* section for more details of using this screen. Please notice that when an integration action is taken, the chart mode is automatically set to acquisition mode, furnishing a chance to print a report of the integration results.

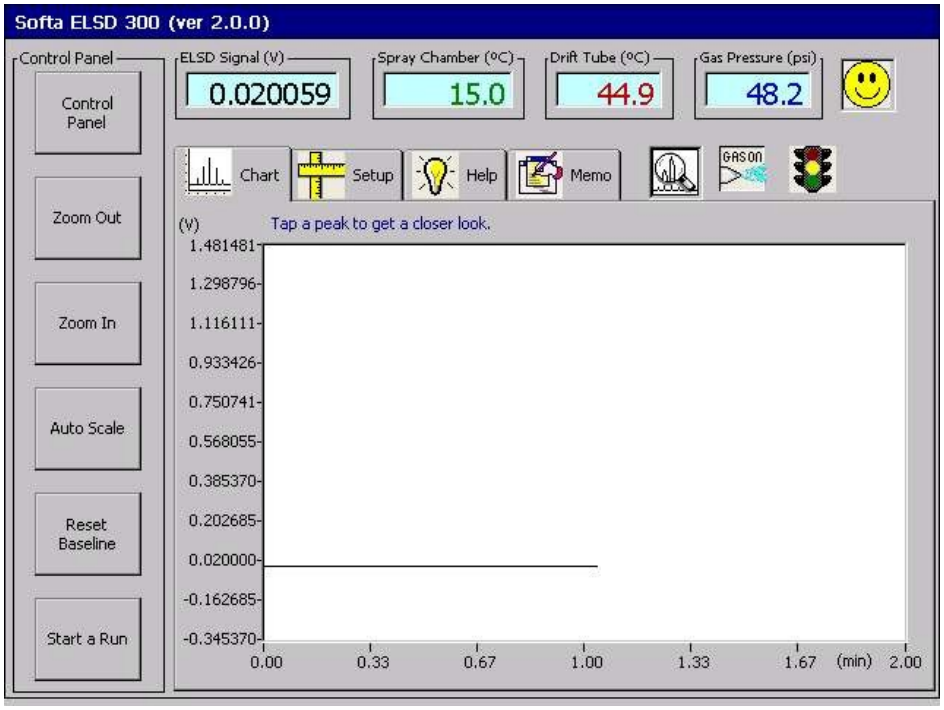


Figure 3.6: Normal signal chart

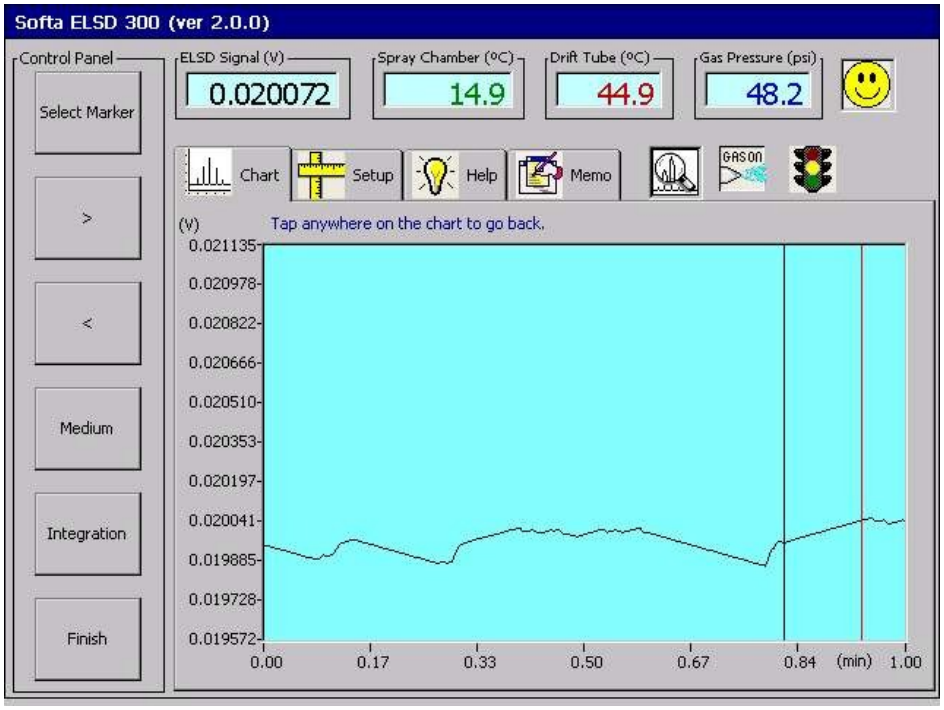


Figure 3.7: Signal redrew for close examination

The control buttons on the left are self-explanatory (see Figure 3.6). At this mode, they are defined as:

Control Panel: Tap this button to switch to the Control Panel.
Zoom Out: Increase the voltage scale of the chart.
Zoom In: Decrease the voltage scale of the chart.
Auto Scale: Fit the plot in between 2/10 to 8/10 of the chart.
Reset Baseline: Force the detector signal to near zero. Tap it when you can not see the signal trace on the chart.
Start a Run: Start recording the detector signal during a run. When selected the chart clears and the chart mode light turns green. 

When Run Time is longer than 10 minutes, tapping the chart will first bring up a 5-minute section of the chart around the spot being tapped. A second tap will bring up the one-minute chart for closer examination. This 5-minute intermediate chart is useful for locating the one-minute section of the signal plotting for close examination, especially when the Run Time is set as long as 60 minutes.

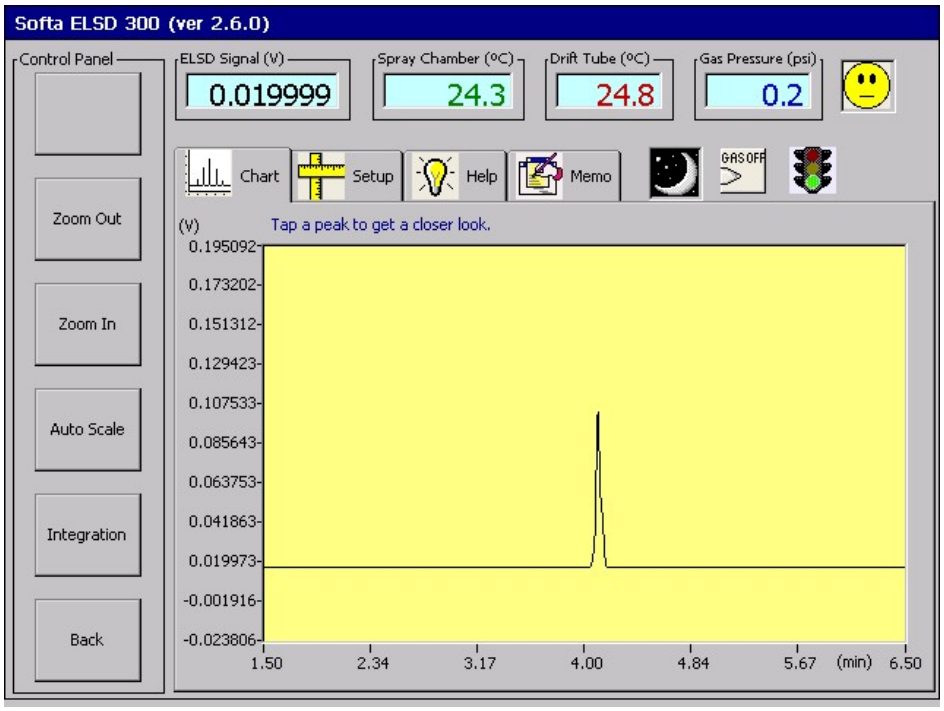


Figure 3.8: a 5-minute section of signal

The control buttons on the left are defined as:

Zoom Out: Increase the voltage scale of the chart.
Zoom In: Decrease the voltage scale of the chart.
Auto Scale: Fit the plot in between 2/10 to 8/10 of the chart.
Integration: Prompt how to do integration.
Back: Go back to the original chart.

Using the Data Acquisition

Start a Run

Tap the "Start a Run" button to start a run. After the run ends the chart mode light turns red . The buttons change to integration functions. See Figure 3.8.

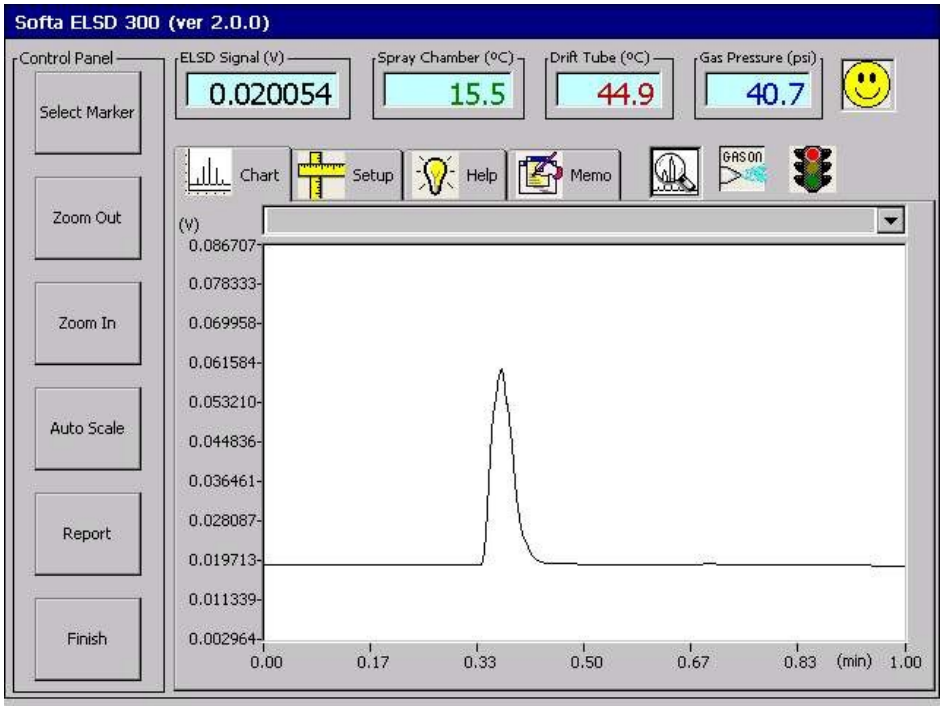


Figure 3.9: End of a run

The control buttons are re-defined as:

Select Marker: Prompt a user on how to set up markers for defining a peak.
Zoom Out: Increase the voltage scale of the chart.
Zoom In: Decrease the voltage scale of the chart.
Auto Scale: Fit the plot in between 2/10 to 8/10 of the chart.
Report: Send the results to a printer or a computer.
Finish: Completes the run and returns the chart screen to the monitor mode.

Integrate the Resulting Peaks

To integrate a peak, first tap the peak to define its boundaries. The peak will be redrawn on a blue screen. Two markers will be placed on both sides of the peak. If the Run Time is longer than 10 minutes, the first tap brings up a 5-minute section of the chart. A second tap will bring up the blue screen. The control buttons are re-defined as

Select Marker: Selects peak markers. The selected marker turns red.
> and < : Moves the markers to identify the peaks
Fine, Medium, Coarse: Selects the speed at which the peak markers move.
Integration: This function calculates the height, area, and width for the peak selected by the markers. The integrated peak is marked by a peak number. The results are stored in a pull-down window just above the chart.
Finish: Return to normal chart screen.

If the "Visual Integration" check box (on Setup tab) has been checked, the area being integrated will be filled with blue and a red line will mark the width of the peak. See Figure 3.9.

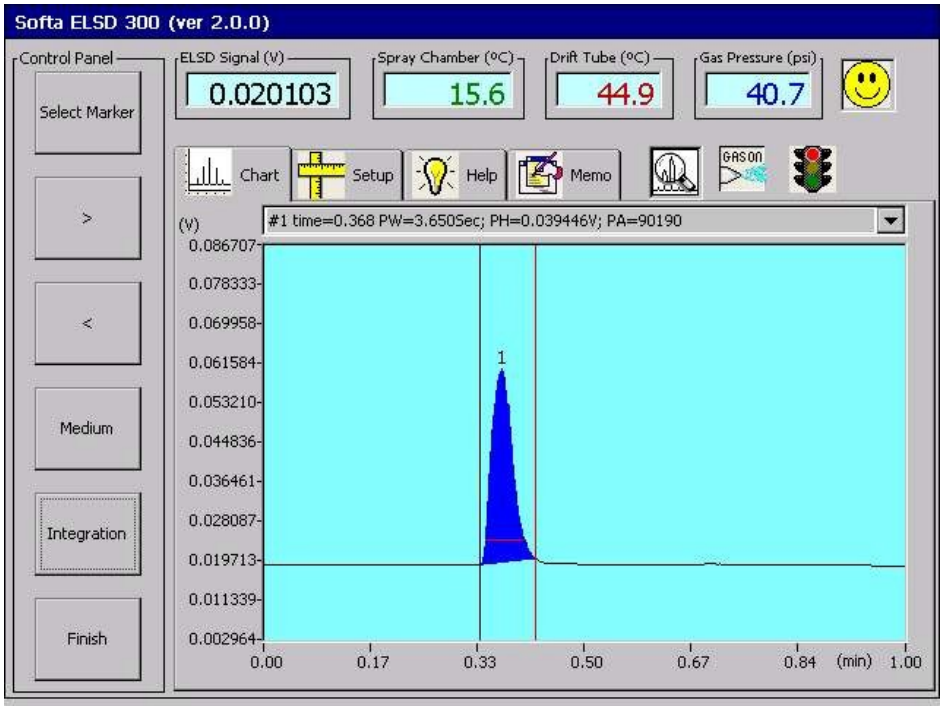


Figure 3.10: Selecting a Peak

If there is more than one peak shown on the screen, you can move the markers to define the boundaries of the next peak and integrate it. You may also re-integrate a peak. The previous result will be replaced. Instead of using the "Finish" control button, you can tap the screen to go back to normal chart screen. See Figure 3.10.

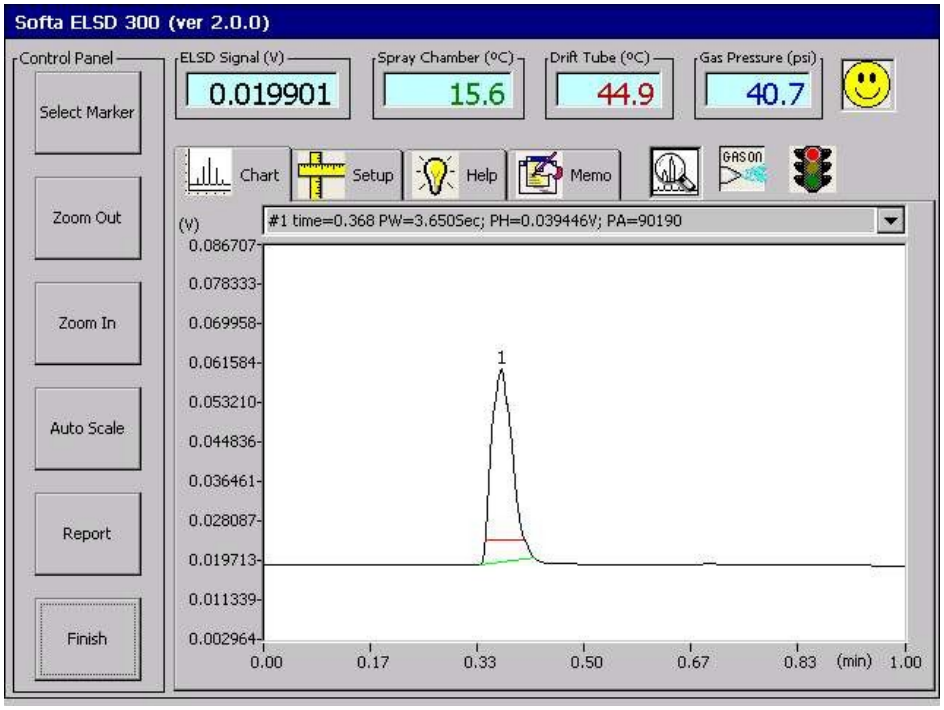


Figure 3.11: Integrated Peak

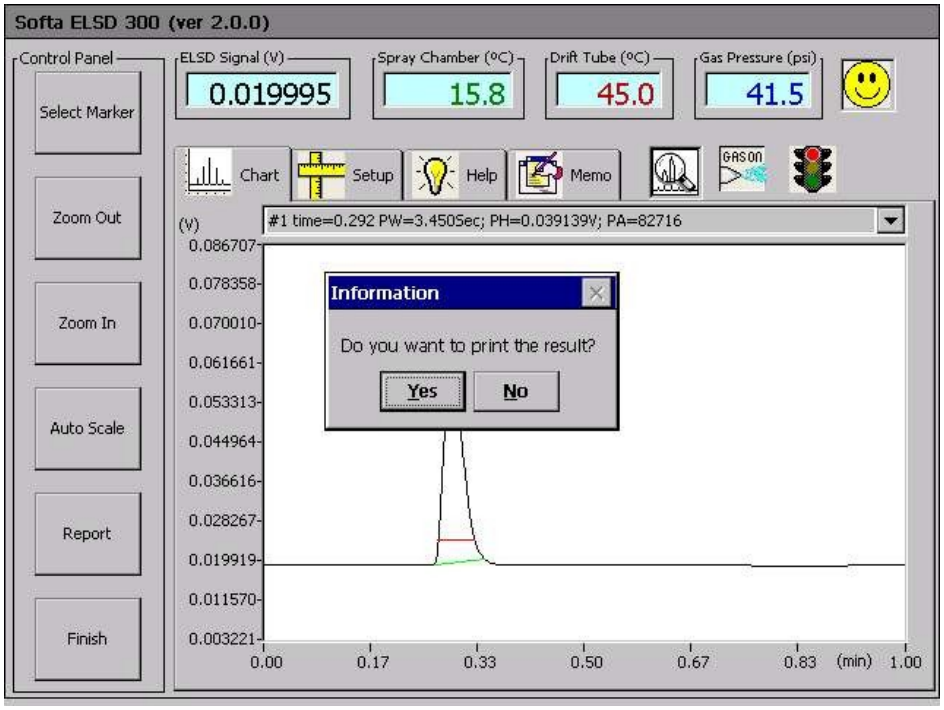


Figure 3.12: Print Request

After completing the integration, tap the "Finish" button and return the chart to the monitor mode. Before exiting, if "Enabling Printing" check box on Setup tab has been checked a pop-up window will

appear asking if you want to print the results. See Figure 3.11. You can also use the "Report" button to print a report.

If your printer is not supported by the SofTA ELSD 300, you can send an ASCII file of the report to a computer through the RS232 port. See relative topics in appendix for more details.

Setup



Select the Setup panel by tapping Setup tab. Control Panel buttons change to:

Group Select: Tap this button to cycle through the groups of parameters on the Setup tab.

Item Select: Tap this button to cycle through the parameters within each group.

+ and -: Tap these buttons to increase or decrease the values of each parameter.

Step=x: Tap this button to change the integral that the + and - buttons change the parameter from x = 1 to 10. This speeds the entry of larger numbers.

Save Setup: Tap this button to save changes made in Report Setup group and in Utilities group. Please notice that the changes made in Acquisition Setup group is saved with a method, but not by this button.

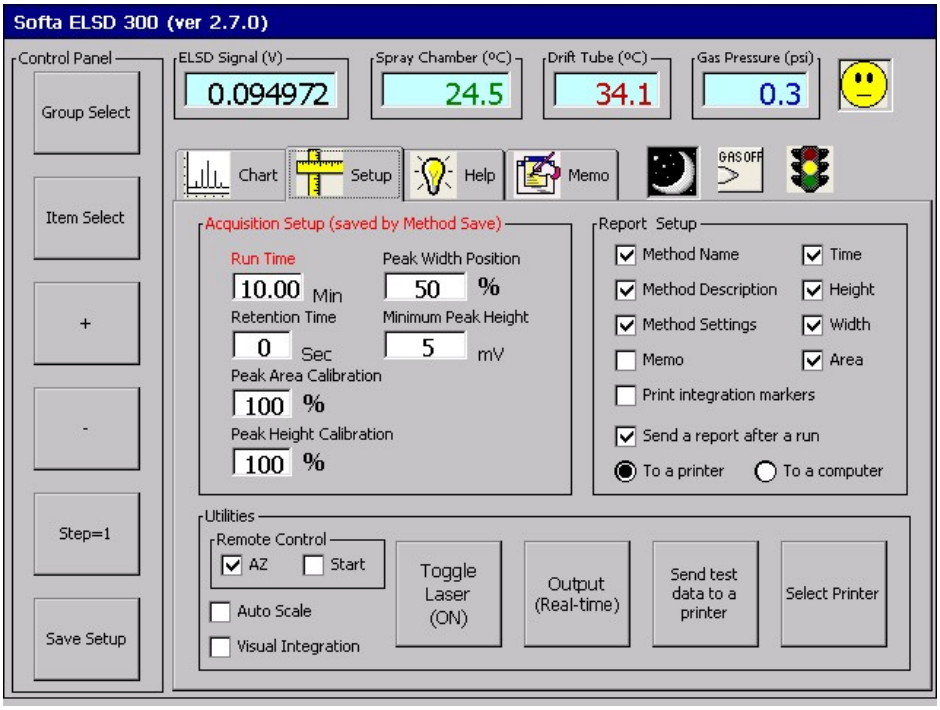


Figure 3.13: Setup Tab

Acquisition Setup

The chart display parameters are entered from this group. They are saved with a method save on the Control Panel.

Run Time: This value sets the time scale of the chart from 1 to 60 minutes in 1-minute increments.

Retention time: This is used to set the start delay of an acquisition run from 0 to 100 seconds.

Peak Area Calibration: You can use this parameter to normalize the value of peak areas to a more convenient scale.

Peak Height Calibration: This function changes the resulting output of the detector from 200% to 10% to amplify or attenuate the signal output. There are three uses for the Peak Height Calibration: 1) normalize a peak height; 2) make peaks of the same concentration from different detectors look about the same; 3) to avoid saturating an external data system. For example, the data system may have 5V full scale. So it may be required to attenuate the 5V FS output to 0.2V FS (20% of 5V FS) to match it. Please notice that this setting only affects the analog signal output. It does not affect the signal reading and charting on the screen of the detector.

Peak Width Position: Determines where the width measurement is taken relative to the height of a peak.

Minimum Peak height: Threshold for auto-integration algorithm to recognize a peak.

Report Setup

Use the check boxes next to each item to include it on a report. When "Send a report after a run" is checked, the detector will automatically integrate peaks and send a report to a computer or a printer, depending on whether "To a printer" or "To a computer" checkbox is selected. Please notice that this detector only supports a limited number of printers. Instead, you may send a report to your computer and print it on the printer attached to your computer. Report Setup is saved by pressing "Save Setup" button.

Utilities

The utilities are used for additional controls. They are saved by pressing "Save Setup" button.

AZ: When selected, a contact closure input at pin 7 and 8 of I/O connection will reset the baseline. It is recommended to have it selected when "Send a report after a run" check box is selected.

Start: When selected, a contact closure input at pin 7 and 8 of I/O connection will start an acquisition run.

Auto Scale: When selected, the detector will automatically scale the chart after a data acquisition run.

Visual Integration: When selected, the calculated peak area is filled with blue and a red line marks the width for user to check how the calculation is done.

Toggle Laser: This action checks both the laser and the light detector. The signal voltage should drop when the laser is turned off. NOTE: The laser should not be turned off unless you suspect a problem or have been instructed to do so. When turned off the laser needs 30 minutes to reestablish a stable beam.

Output: This function tests the signal connection between the detector and the external data system. It replaces the actual output with fixed output signals of 5V, 2.5V, 1.25V, 0.625V, 0.312V, 0.156V, 0.078V and 0V.

Send test data

to a printer: This function sends a short message to a printer attached to this detector to see if the connection is good and if the printer prints test message correctly. This function is available when "To a printer" in "Report Setup" group is selected.

Select Printer: This function pops up a screen for selecting printers. See Figure 3.13. Please notice that this list of printers is said to be supported by the printing driver purchased by SofTA Corporation. SofTA Corporation has tested only a few listed printers and does not guaranty your printer will work with the detector.

Send test data to a computer: This function sends a short message to a computer attached to this detector to see if the connection is good and if the RS232 port of the computer is set up correctly. This function is available when "To a computer" in "Report Setup" group is selected.

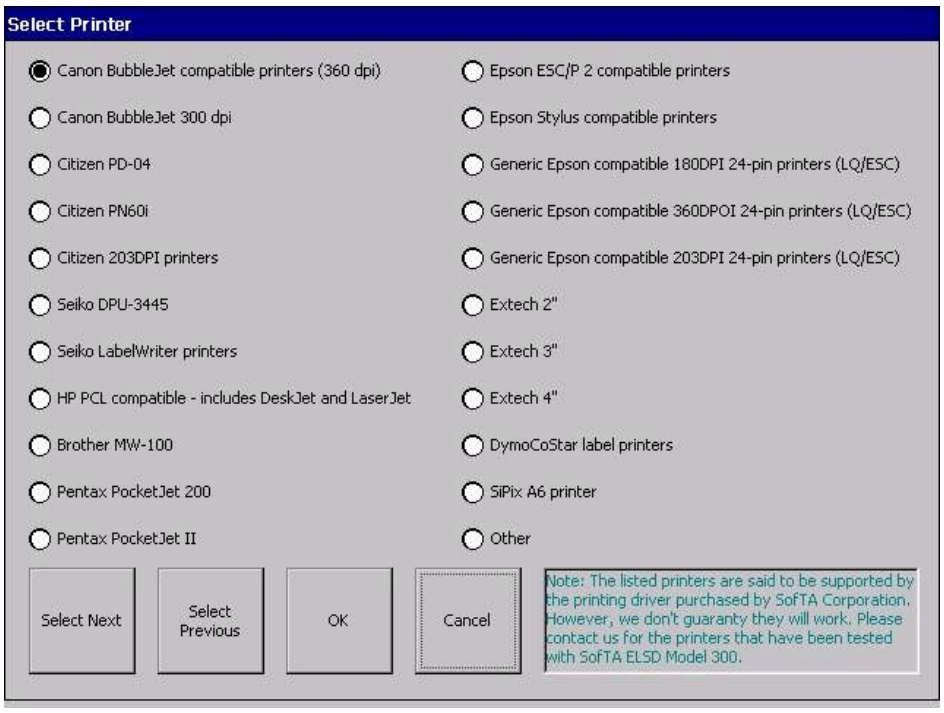


Figure 3.14: Select Printer

Select Printer

Select Next: Tap the button and select the next listed printer. As mentioned above, not all of the printers have been tested with the SofTA ELSD 300.

Select Previous: Tap the button and select the previous listed printer.

OK: This action will initialize the printing driver for the newly selected printer to print and close the "Select Printer" screen.

Cancel: This action will close the screen without selecting a new printer to print.

Help



Tap the Help tab to get quick suggestions during operation of the detector. Select a topic from the buttons on the left.

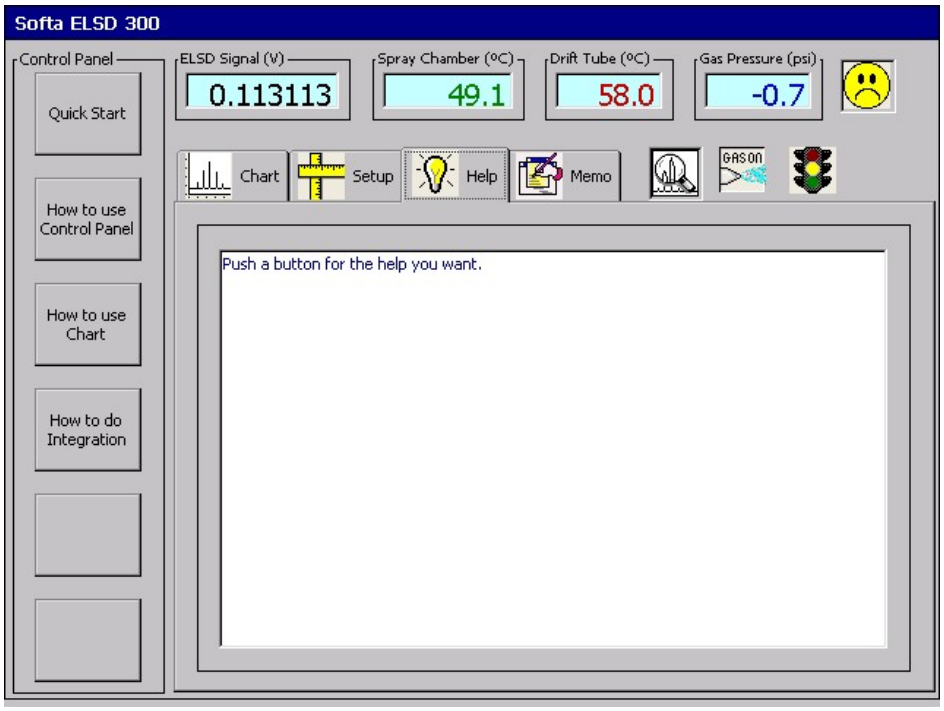


Figure 3.15: Help Screen

Memo



The memo tab allows the user to save notes. This is useful to leave messages to other users or as a to-do list for yourself.

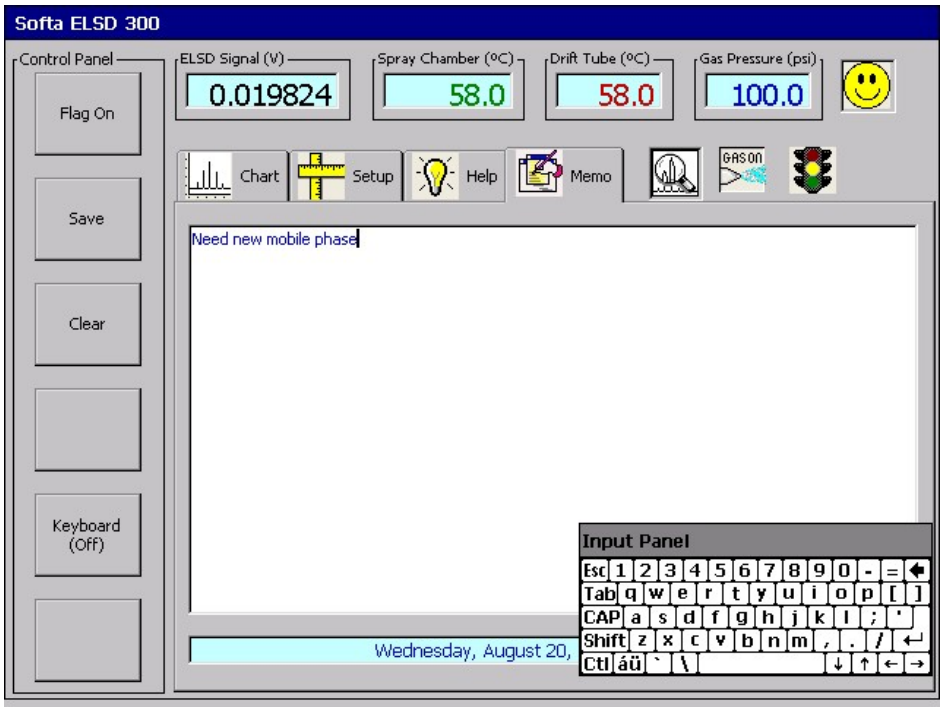


Figure 3.16: Memo Screen

Control Panel buttons

Flag On: This button activates the  flag icon.

Save: This button save any changes made to the memo window.

Clear: This button clears the memo window.

Keyboard: This button brings up a keyboard to use to enter information in the memo window. If an external keyboard is attached via the USB port it can be used once the memo window is selected.

Change Date and Time Setting

The detector date and time is displayed in the memo tab of the Chart view screen. Change the setting by tapping on the date/time window. Make the desired changes in the pop up window. Select apply to save the changes. Select the X box to close the window without making changes.

Operating Conditions

Start Up Procedure

If this is the first time you have operated the detector, please refer to the Model 300 Quick Start Guide. It is very important that you reproduce the QC tests found in the Quick Start Guide before beginning your analysis.

On power up the Model 300 will default to the last conditions used before the power-off, not the last method loaded. However, customized methods for specific applications can be stored and loaded.

1. Make all connections; gas, liquid, power, communications, exhaust, and drain as described in Chapter 2. Don t turn on your gas supply yet.

2. Turn the power on to the Model 300 using the switch on the back of the unit.

3. The LCD screen will display the Control panel screen (Figure 3.1). Select Yes on the warning window to exit standby mode. The  icon on the upper left side of the Control Panel indicates standby mode. The Model 300 is in run mode when the icon changes to .

4. Confirm that the parameters are correct for your application. If incorrect, modify the setting or load a previously defined method.

5. Start your HPLC pump to deliver 1.0ml/min mobile phase to the detector. When you see liquid coming out of the drain port, which may take as long as 5 minutes, stop the pump and place a beaker filled with approximately 1 öf water under the drain port (see Figure 2.2.). Now you are ready to do analysis.

6. Before the conditions of the detector are ready, a sad face  will blink at the upper left corner on the display, indicating errors. Tap the face to check what the problem is. Wait for temperatures to reach their set points then start the HPLC pump and the gas flow.

7. When the face smiles , tap Reset Baseline button to reset the baseline. Monitor your data system and ELSD Signal for stability. The signal should be stable in the 3th decimal place (±0.002). If the detector has just been powered up, wait at least 30 minutes for all of the electronics of the detector to stabilize.

8. If you see an excessive amount of large noise spikes, you may be flooding the Drift Tube with non-vaporized mobile phase. Turn off your pump and let the drift tube dry for at least a half hour. Then adjust the Spray Chamber to a lower temperature before introducing the mobile

phase. If the detector does not stabilize, modify detector settings. See section on Choosing Operating Conditions.

9. When the signal is stable, begin the external HPLC data collection system, if connected, and monitor the baseline.

10. When the baseline is stable, select "Start a Run" from the Chart View screen, inject your standard or sample and begin analysis. Or, use your external data collection system for your work and use the chart view of your Model 300 detector as a monitor.

Using the Integration Capability

1. Use the Setup tab to configure the Model 300 for your analysis.
2. Tap "Start a Run" from the Chart View screen and inject your sample to begin a run.
3. When run ends, the button names will change to those shown in Figure 3.8.
4. Use "Zoom in" or "Zoom Out" buttons to make the height of the peak you want to integrate to be about 2/3 of the chart height. Then tap the peak. A close-up screen will give you a one-minute chart, and automatically place two markers around your peak.
5. To fine tune the markers, use "Select" to select a marker to move. The selected marker becomes red. Use "<" and ">" buttons to move the markers to the right places. Use the 4th button to select how fast you want to move the marker. There are three choices: Fine, Medium, and Coarse.
6. After placing the markers, tap the Integration button to start the peak calculations. A number will mark the peak. The result will be displayed in a pull-down window above the chart screen.
7. Then tap the screen to go back to the full run screen. If you have more than one peak, tap another peak and repeat the peak selection and integration.
8. You can tap "Report" button to send a report to a printer or a computer depending on what you have selected on "Setup" screen.
9. Tap Finish to complete the integration and return to the monitor mode. The chart mode light turns yellow.

Shut Down Procedure

1. Stop the flow of mobile phase to the system. Wait for the pressure to return to zero.
2. Keep gas flowing for about 5 more minutes to clear the vapor inside the system. Then turn off the gas supply at the source.
3. Turn the power off to the Model 300 ELSD or set the unit to standby mode to save energy. Tap the  icon to switch between modes. The night icon  indicates that the detector is in standby mode. In standby the gas flow is shut off and all of the heaters are turned off.

Choosing Operating Conditions

The drift tube temperature and the Thermo-Split spray chamber temperature are selected to provide the maximum detector response with minimum baseline noise. The temperatures are selected based

on the solvent volatility and mobile phase flowrate. The drift tube temperature can be set from ambient to 120°C. The Thermo-Split Spray Chamber can operate from 0°C to 80°C. Some experimentation will be required to optimize the Model 300 ELSD.

As a general rule, higher spray chamber temperature may give you a higher peak but also a noisier baseline, and vice versa; higher drift tube temperature may give you a quieter baseline but smaller peak, and vice versa. Also the drift tube temperature should always be higher than the spray chamber temperature.

A mobile phase that is highly organic and volatile will require a moderately high drift tube temperature and an ambient or elevated spray chamber temperature. Highly aqueous mobile phases will perform best at elevated drift tube temperatures and sub-ambient spray chamber temperatures. Mobile phase flowrate will also affect the optimum temperature set point. The higher the flowrate of an aqueous mobile phase, the lower the spray chamber temperature will need to be. High flowrates of volatile mobile phases may require a higher drift tube temperature. The Model 300 ELSD may perform best at sub-ambient temperatures if the flowrate is extremely high, even for volatile mobile phases.

If the characteristic of your mobile phase is similar to one used in the QC tests, select the appropriate QC method to start. If you don't know where to start, select 35°C for spray chamber temperature and 60°C for drift tube temperature and optimize from there for the best signal to noise ratio.

For gradient separations, select the system temperatures required for the least volatile segment of the gradient program.

Suggested Operating Temperatures

Solvent @ 1.0mL/min	Drift Tube Temperature, °C	Spray Chamber Temperature, °C
90/10 WATER/METHANOL	**45**	**10**
90/10 METHANOL/WATER	**65**	**50**
50/50 METHANOL/WATER	**60**	**30**
ACETONITRILE	**60**	**50**
METHANOL	**60**	**50**
WATER	**45**	**10**

QC Test Conditions

Please refer to the QC report shipped with your ELSD Model 300 for the exact conditions used to test your ELSD. The general conditions are:

Aqueous Low Temperature

1.0 ml/min of 90/10 Water/Methanol
Spray Chamber 10°C
Drift Tube 45°C
Filter 4

Organic High Temperature

0.5 ml/min of 90/10 Methanol/Water
Spray Chamber 50°C
Drift Tube 65°C
Filter 6

Buffer Compatibility

The Model 300 ELSD is not compatible with mobile phase modifiers that are not volatile at the temperature selected for operation, such as salts. Some modifiers are volatile and can be uses. These include but are not limited to acetic acid, trifluoroacetic acid (TFA), formic acid, triethylamine, and ammonia. The concentration of buffer in the mobile phase should be as low as possible.

Chapter

4

MAINTENANCE & TROUBLESHOOTING

Routine Maintenance

The Model 300 ELSD does not require regular user maintenance. There are no user serviceable components inside the Model 300 ELSD. Opening the case will void your warranty. Please call SofTA Corporation before attempting any service.

The Model 300 ELSD must be serviced once a year by a SofTA qualified technician. During this service O-ring integrity, drain line condition and many other parameters relating to safe operation are checked.

Troubleshooting

Please check the SofTA Corporation website, www.softacorporation.com, for troubleshooting assistance and helpful advice for the operation of your Model 300 ELSD. Or you may call us or email us for assistance.

Chapter

5

APPENDIX

Accessories

	Part No.
Recorder Cable	200/300-001
Nebulizer Gas Supply Line	200/300-002
Fuses, 3AG 6A, or 3A	200-003
Operating Manual	200/300-004
Exhaust Kit	200/300-005
Power cord	

Specification

Dimensions	Approximately 24"H x 20"L x 12"W
Weight	451b.
Display	6.5 Full VGA TFT 64K Colors
User Interface	Resistive Touch Screen
Operating Conditions	Intended for indoors operation only. 60°F to 85°F and <90% R.H. non condensing
Evaporative Zone temperature range	Ambient to 120°C
Nebulization Chamber temperature range	0°C to 80°C
Gas Requirement	40 60 psi Argon or Nitrogen
Gas Consumption	Approximately 1 SLPM
Liquid Flow Rate	Up to 5ml/min
Electrical Requirement	100-126 V AC, 50/60 Hz or 200-252 V AC, 50/60 Hz 600 Watts
Wetted Materials	Stainless Steel, Anodized Aluminum, Teflon and Viton
Light Source	670 nM Laser Diode, <5 m W
Detector	Hermetically Sealed Photo-Diode/Operational Amplifier
Output Signal	0-10 mV DC, or 0-5 VDC. RS232 Computer Interface
Options (option number)	Custom Colors (006) User must specify a PMS # or Cardinal powder coat choice

Warranty

SofTA Inc. warrants its products against defects in workmanship or material under normal use or service for one year. All obligations or liabilities under this warranty are limited to repair or replacement, at SofTA Inc. s'option, F.O.B. Thornton, CO, of parts that are returned, freight prepaid and which are accepted as being defective upon inspection of SofTA Inc.

Components that are subject to normal wear and/or are scheduled for routine replacement within the warranty period, and/or parts that are subjected to effects of corrosion or deterioration by chemical or other action are excluded from the above warranty. Repair or replacement will not be made under warranty for malfunction because of inadequate facilities, operating conditions or utilities.

The nebulizer is not warranted unless broken during the shipment from our factory to the end-user.

Equipment and components must be returned with SofTA Inc. s'prior approval and contain a SofTA Inc. Return Authorization Number. Call SofTA Inc. (303-465-1106).

Guarantees/Warranties on accessories and equipment included by SofTA Inc. from other manufacturers are limited to the guarantees given on such equipment by the respective manufacturers.

Any modifications made to equipment covered by this warranty, without written permission from SofTA Inc. will void the warranty. SofTA Inc. reserves the right not to honor this warranty if the products are obviously mishandled by the user.

SofTA Inc. assumes no responsibility for consequential, economic, incidental damages of any nature, or on-site re-installation costs arising out of future alleged failure of any of its products or their accessories.

This warranty supersedes any and all previous warranties unless otherwise agreed upon at the time of sale, such as for customized equipment.

Shipments

All shipments are made F.O.B. Thornton, CO. Instruments and major components will be packed and shipped via surface, unless otherwise requested. Supplies and/or replacement parts are packed and shipped via UPS, UPS Blue, air parcel post, or parcel post, unless otherwise requested.

Damaged Shipments

The Interstate Commerce Commission has held that carriers are as responsible for concealed damage as for visible damage in transit. Unpack shipment promptly after receipt, as there may be concealed damage even though no evidence of it is apparent. When concealed damage is discovered, cease further unpacking of the unit involved and request immediate inspection by the local agent or carrier and secure a written report of the findings to support a claim. This request must be made within 15 days of receipt. Otherwise, the carrier will not honor the claim. Do not return damaged goods to the factory without first securing an inspection report and contacting SofTA Inc. for a return authorization number.

Filing of Claims

After a damage inspection report has been secured, SofTA Inc. will cooperate in supplying replacements and handling a claim that may be initiated by either party.

Returns

No returns may be made without prior notification and authorization. If for any reason, it is necessary to return material to us, please contact our customer service department for a return authorization number and forwarding instructions.

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Printing and RS232 communication Port

The SofTA ELSD 300 has a DB-25 female connector at the back for printing or sending a report to a computer. It is configured as DCE (Data Communication Equipment) port and can be connected to a computer directly. To connect to a printer, an adaptor cable is needed to convert the port to DTE (Data Terminal Equipment) port and a converter (Model 232SPS2) from B&B Electronics (www.bb-elec.com) is also needed to connect the port to a parallel port of a printer.

RS232 port configuration:

Baud Rate: 38400
Data bits: 8
Parity: No
Stop bit: 1
Handshake: None

An example of a report sent to a computer:

Tuesday, December 30, 2003 - 11:15:17 AM
Method 1
0.5 ml/min Methnol
Method settings: SC=15 DT=45 FLT=0 Gain=Norm FS=5V
Conditions: SC=15.1 C DC=45.1 C OC=44.9 C ET=45.5 C Gas Pressure=45.1 psi FLT=0 Gain=Norm FS=5V

Peak #	Time(Min)	Width(Sec)	Height(V)	Area
1	0.173	2.450	2.998203	4176575
2	0.401	2.250	1.908075	2428995
3	1.111	2.000	0.264727	329281

# of data points=400
0,0.318596
150,0.318592
300,0.318582
450,0.318572
600,0.318564
750,0.318559
900,0.318551
1050,0.318544
1200,0.318539
1350,0.318541
…
^Z

(Note: The first column is time in millisecond. The second column is detection signal in volt)

Model 232SPS2 Dip Switch Configuration:

Dip Switch Position							
1	2	3	4	5	6	7	8
ON	OFF	ON	OFF	OFF	OFF	OFF	OFF

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