Agilent 380 & 385 ELSD Driver for EZChrom Elite

User Guide v1.01

Reference 6-28258
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Agilent Technologies

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Contents

1. General Information

1.1 Introduction

The Agilent 380-ELSD & 385-ELSD Evaporative Light-Scattering Detector (ELSD) is a unique and highly sensitive detector for semi-volatile and non-volatile solutes in a liquid stream. It is mainly used as a concentration detector for High Performance Liquid Chromatography (HPLC). The solvent stream containing the solute material is nebulized and carried by a gas flow through an evaporation chamber. The solvent is volatilized, leaving a mist of solute particles that scatter light to a photosensitive device. The signal is amplified and a voltage output provides the concentration of the solute particles passing through the light.

The Agilent ELS Detector may be used alone, or as one of several detectors in a GPC or HPLC system. As the solvent or eluent is evaporated in the course of the analysis, the ELSD must be the last in series if used in conjunction with other detectors

This manual instructs the user in the installation and operation of the Agilent 38X ELS detector using Agilent Technologies EZChrom Elite Chromatography software.

1.2 Pre-installation Requirement

The ELSD driver is compatible with Ver 3.1.6 of EZChrom Elite only.

EZChrom must already be installed on the computer and you must have administrator rights for the PC.

The ELSD driver software is compatible with the following models of Agilent ELS detector:

- Agilent 380-ELSD
- Agilent 385-ELSD
- Varian 380-LC
- Varian 385-LC
- PL-ELS 2100
- PL-ELS 2100 ICE

Note: The driver does not provide control for the PL-ELS 1000 ELSD.

The ELSD firmware must be version 1.5 or later to operate with the EZChrom Elite software.

To operate the ELS Detector with the EZChrom Elite, a free Serial (RS-232) communications port (1 to 255) is required on your PC. Most computers are supplied with at least one serial port as standard, but if your PC does not provide a serial port or you are already using the existing serial ports for other devices, then there are a couple of options available to you:

1. Use a Universal Serial Bus Interface (USB)

- If your PC has one or more Universal Serial Bus (USB) connectors then you can use a "USB – Serial Port Adaptor" (Part No. PL0860-0620), which provides a Serial Port connection to your PC.

2. Adding an Extra Serial Card to your PC - Using Multiple Serial Ports

Multiple Port Serial cards are available, which allow 4, 8 and 16 extra serial ports to be added to your PC using a single PCI card.

1.3 Conventions

The following conventions have been used throughout the documentation:

- Menus, menu options and field names (e.g., choose **Copy** from the **Edit** menu) have been typed in bold. Bold is also used to signify the buttons appearing throughout the software (e.g., click **OK**).
- ALL CAPITALS indicate keyboard commands (e.g., press the F2 key) and text you must type in from the keyboard (e.g., type SETUP at the prompt).

- **Note:** The various screens displayed during installation and configuration of the driver and when using the software to control the ELS detector contain references to the Varian 385/380 ELSD. These references are purely textual and have no affect on the functionality of the software.

2. Installation

To install the ELSD driver for EZChrom, the system must be configured appropriately as outlined in this chapter.

2.1 ELSD Connections

All power, signal and communication connections are made on the rear panel of the ELS detector. Figure 1 shows the electrical connections for communication to a range of devices, such as PC, autosampler, pumps, valves and injectors.

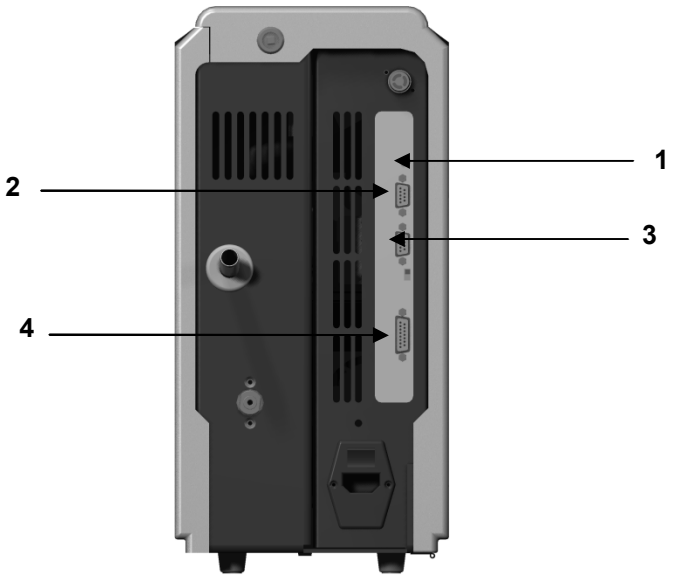


Figure 1. *Rear view of the Agilent ELS Detector*

1. Analogue Output (1V
2. Serial RS232 connector
3. Service Connector
4. I/O connector

2.1.1 Serial output

The Serial RS232 connection provides direct communication between the detector and the PC running EZChrom software.

2.1.2 Analogue output

The ELS detector is supplied with a 1V analogue output cable (Part No.

PL0890-0300) that allows data collection via an A/D interface, such as an 38900E module. The gold end fitting of the analogue cable plugs into the gold pin on the rear of the detector and the opposite end connects to the positive and negative inputs of the A/D interface.

2.2 Connecting the Detector to your PC

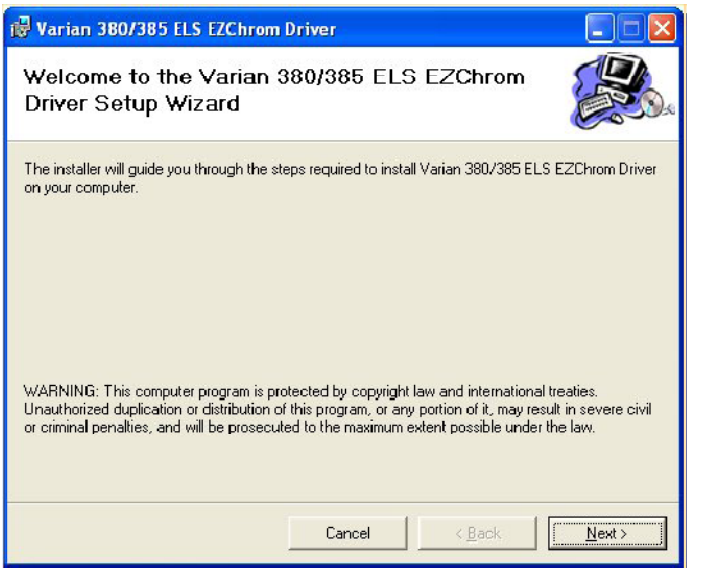
Using the supplied serial cable, connect a serial port on your PC to the port labeled "RS232" on the rear of the detector. Ensure that the service switch, (see Figure , page 7) is located in the RUN position (i.e. Upwards). If you do not have an available serial port on your PC, please see section 1.2 for further information.

2.3 Installing the Agilent 380/385 ELSD driver for EZChrom Elite

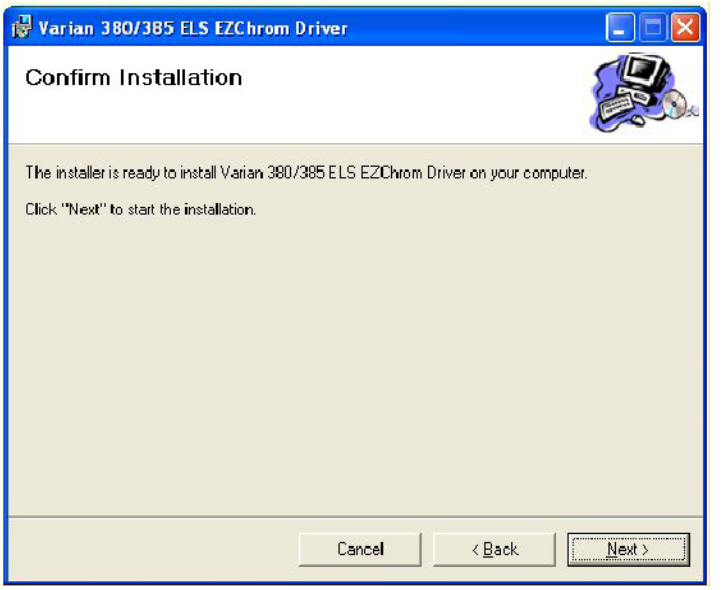
Note: There is no need to install the control software that is supplied with the detector. Part Number PL0890-0370.

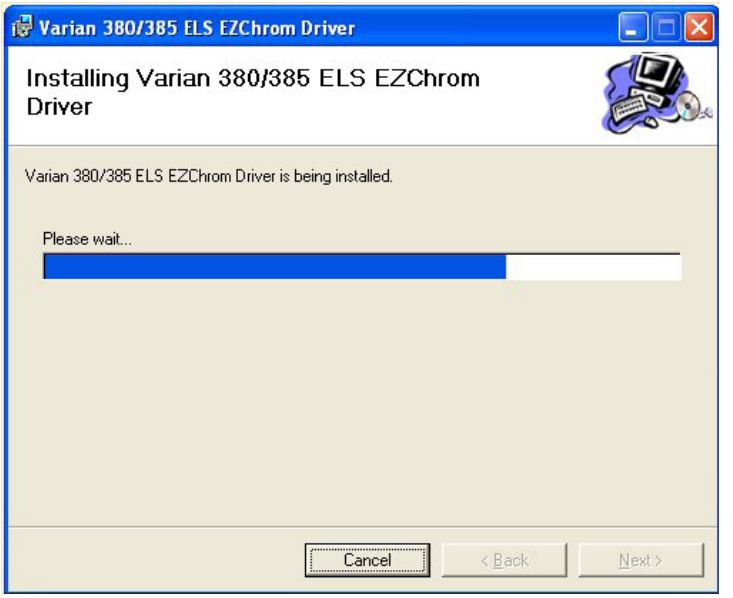
The EZChrom driver is located on the control software CD supplied with the detector. When you insert the CD into your PC CD drive, the CD browser should start automatically. If it does not, you can launch the browser by the running “Launch.exe” from the root directory of the CD. The CD Browser provides an option to install the EZChrom driver.

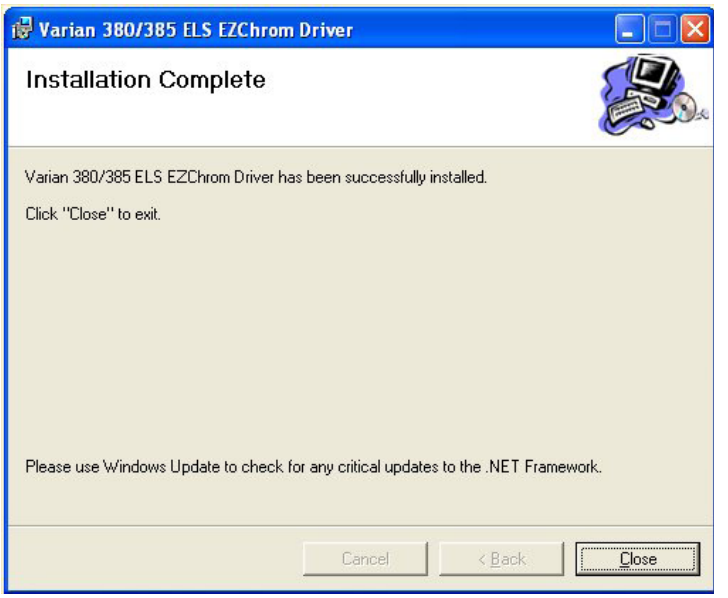
Click on **Next** to start the installation.



Click on **Next** to continue the installation.


Varian 380/385 ELS EZChrom Driver
Confirm Installation
The installer is ready to install Varian 380/385 ELS EZChrom Driver on your computer.
Click "Next" to start the installation.
Cancel
< Back
Next >

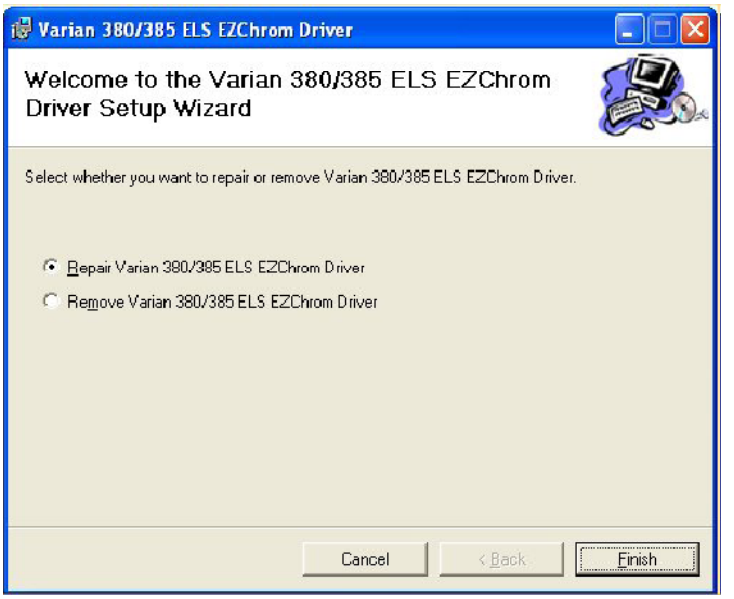

Varian 380/385 ELS EZChrom Driver
Installing Varian 380/385 ELS EZChrom Driver
Varian 380/385 ELS EZChrom Driver is being installed.
Please wait...
Cancel
< Back
Next >



Click on **Close** at the end of the installation.

2.4 Repairing or removing the driver

If you want to repair or remove your driver, you will need to run the setup again.



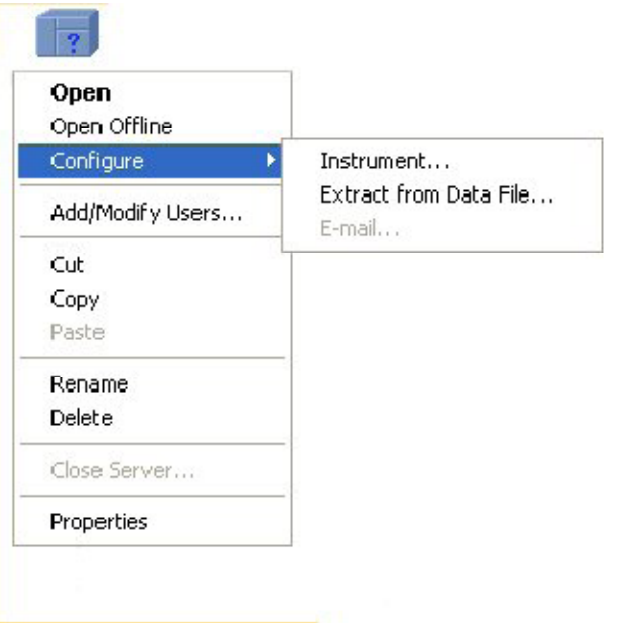
Select “Repair Varian 380/385 ELS EZChrom Driver” to automatically reinstall or upgrade the software.

Select “Repair Varian 380/385 ELS EZChrom Driver” to uninstall the software from your PC.

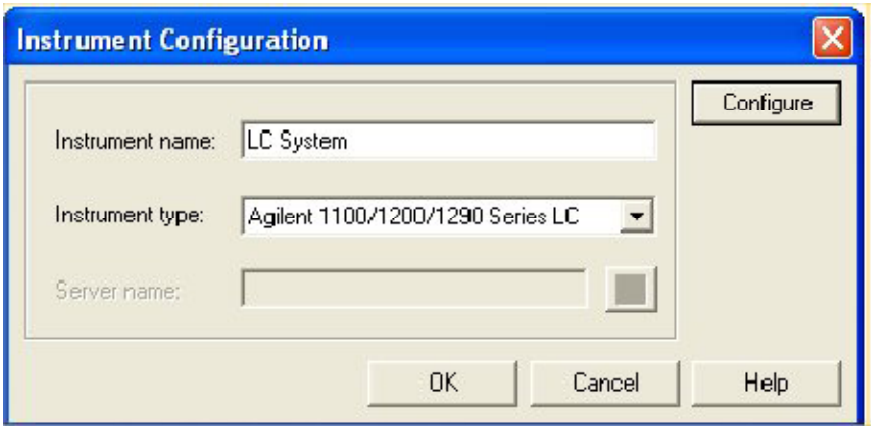
Click on Finish at the end of the installation to exit the process.

2.5 Configuring the Agilent 380/385 ELS Detector in EZChrom Elite

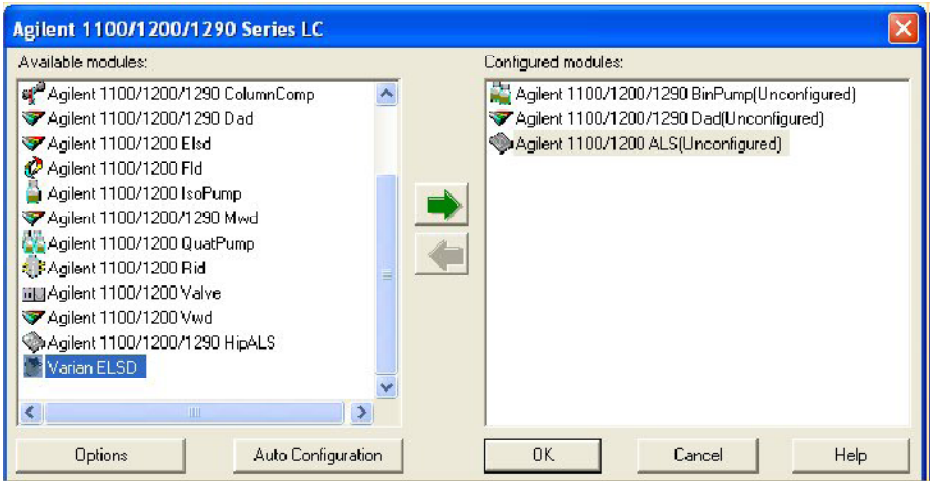
To communicate with the ELS Detector, the RS232 Interface must be configured within the EZChrom Elite. Select the Instrument that the ELSD will be connected to and select Configure| Instrument from the menu, as shown.



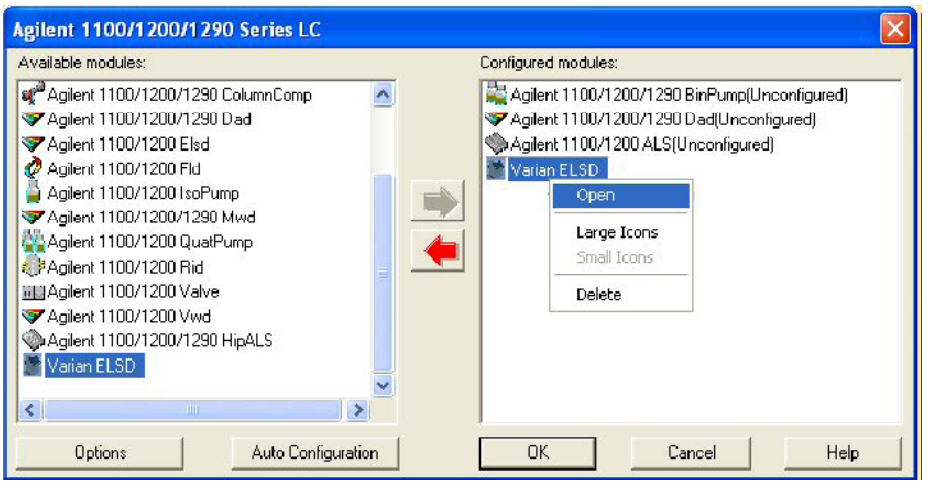
Within the Instrument Configuration dialog select Configure:



To add the ELSD as a configured module in the instrument, highlight the ELS detector in the left-hand window and click on green arrow button.

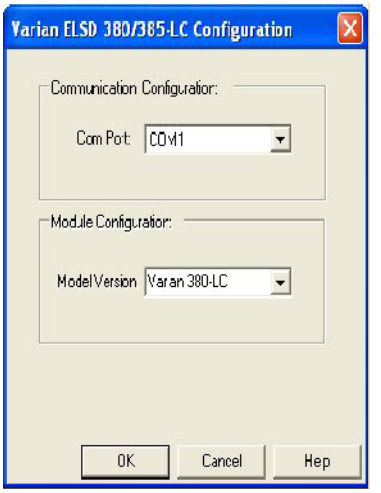


To configure the ELS detector's RS232 communication settings, right-click on the Varian ELSD and select Open, as shown.



Select the appropriate COM port for the ELS detector.

Select the correct ELSD model



Select OK to exit the configuration process, then close and restart the EZChrom Elite software to implement the new changes.

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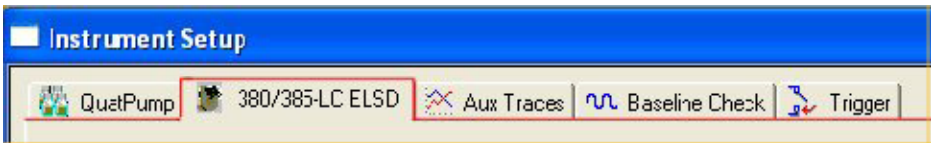
3. Controlling the Detector

The Agilent 380/385 ELSD (Varian ELSD) EZChrom Elite driver provides full control and digital data acquisition for the Agilent 380/385 ELSD within the EZChrom Elite software v3.1.6 to v3.X. The driver provides the following features:

- Digital data acquisition at 24bit precision
- Collection rates at 10 or 40Hz
- Control of the Operational Modes of the detector.(Standby / Run)
- Autozeroing of the detector
- Setting of detector parameters
- The ability to monitor ELSD parameters in real-time
- Changing detector parameters during a sample run
- View real-time plots
- The ability to store and print ELSD parameters alongside the Chromatographic data

The ELSD can be automated within a sequence or even shutdown following an analysis.

Control of the detector is available from the Instrument Setup menu within the CONTROL menu of the software.



3.1 Operational Modes

The ELS Detector can be operated in two modes; **STANDBY** or **RUN (Operational)**, both of which are described below:

3.1.1 Standby

The STANDBY mode is the "ground state" of the ELS detector, which is by default initiated automatically after power on. The default 'ground state' can be changed using the Power Mode option, page 20.

In STANDBY mode the heaters are switched off, and the gas manifold valve is closed at power on. The STANDBY mode gives the user a control platform in which to set-up the operational parameters (gas flow, nebulizer and evaporator temperatures) before switching the unit into RUN mode.

The instrument will default to STANDBY mode should an error occur on the instrument.

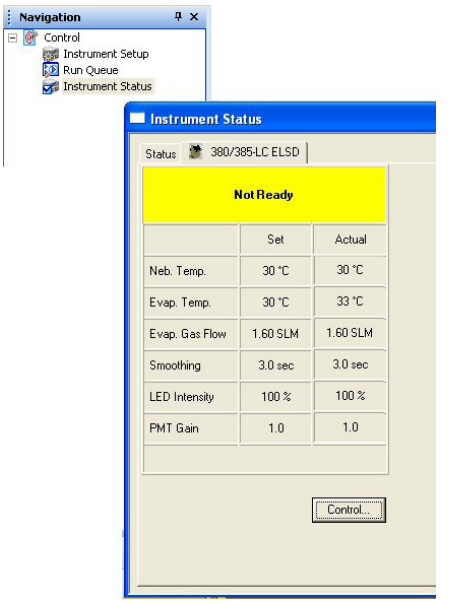
When the instrument is switched from RUN mode to STANDBY mode, following a command or error, then the gas management system is invoked and the gas flow set to a minimum flow of 1.2 SLM for 15 mins before the gas manifold valve is closed. This minimum "blanket" gas is enough to nebulizer and evacuate solvent should the instrument default to STANDBY mode with solvent still flowing.

If the Instrument is left in STANDBY mode for longer than 15 minutes, gas flow to the unit is stopped to minimize gas usage.

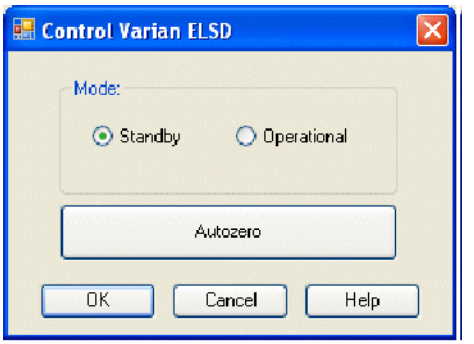
3.1.2 Run (Operational)

The RUN mode is the detector's operational mode. In this mode the instrument is controlled at the set temperatures and gas flow, and the system is fully operational. During heating or cooling the instrument will display NOT READY to show the system has not reached the set conditions. When the instrument has equilibrated READY will be displayed and the instrument is ready for use.

To display the current mode of the ELSD, select the Control option from the INSTRUMENT STATUS menu, as shown.



The ELSD can also be Autozeroed directly from this menu screen by selecting the Autozero button.



3.2 Operational Parameters

3.2.1 Nebulizer Temperature

The nebulizer temperature can be used to optimize signal response in addition to evaporator temperature. Higher nebulizer temperatures increase peak response, but the nebulizer temperature must not exceed the boiling point of the mobile phase.

The nebulizer temperature range for both models is: OFF, 25-90 °C (1 °C increments). The default value is 30 °C.

3.2.2 Evaporator Temperature

The evaporator temperature is the most important setting on the ELS detector. This should be set according to the volatility of the compound(s) being analyzed. If the compound is non-volatile, e.g. sugars, then the evaporator temperature should be set to 80-90 °C. If the compound is semi-volatile, or has a low molecular weight, e.g. pharmaceutical drug, then the evaporator temperature should be set between 20-30 °C.

The evaporator temperature ranges for the ELS models are as follows:

380-ELSD - OFF, 25-120 °C (1 °C increments)

385-ELSD - OFF, 10-80 °C (1 °C increments)

The default evaporator temperature for both models is 30 °C.

3.2.3 Evaporator Gas Flow

The evaporator gas flow is used to control the ELS detector's evaporation process. The evaporator gas value is set according to the mobile phase composition, with higher gas flows (e.g. 1.6 SLM) being used for aqueous eluent compared to those containing organic solvents. The higher the evaporator temperature the lower the evaporation gas setting required (e.g. 1.0-0.9 SLM), regardless of mobile phase composition. Likewise, as the evaporator temperature is reduced to ambient and sub-ambient temperatures, the gas flow needs to be increased to compensate (e.g. 1.6-1.8 SLM).

The evaporation gas range for both models is: 0.9-3.25 SLM (0.05 increments). The default value is 1.6 SLM.

3.2.4 Light Source Intensity (LED)

The detector's LED intensity can be adjusted in order to bring the peak response back on-scale. The intensity range can be set between 0-100%, with the default factory setting being 100%, for maximum sensitivity. The LED setting is stored in memory and is retained even after a power on/off cycle.

This feature is extremely useful for preparative chromatography where samples of high concentration can be analysed which would otherwise exceed the dynamic range of the detector.

Please note that the instrument performs an automatic auto-zero (i.e.10mV) following an LED change in order to keep the signal on-scale.

3.2.5 Response Time (Smoothing)

The data outputted from the detector can be averaged to produce a smoother response. The smoothing width is set to the number of data points over which the data is averaged and can be regarded as a digital time constant. The smoothing range is settable from 1-50, (in increments of 1) which translates to 0.1-5.0 secs.

For most HPLC applications the default value of 30 (3 secs) is satisfactory. However, for rapid resolution separations where peak widths < 3 secs, a setting of 1(0.1 secs) is recommended.

For GPC applications where peak widths can be >30 secs, a value of 50 (5 secs) is recommended.

3.2.6 Detector Gain (PMT)

This parameter sets the factor by which the detector output signal is amplified. The gain setting does not change the sensitivity of the detector, but merely amplifies or divides the captured signal by the inputted factor.

The gain can be adjusted from 1 to 10 in increments of 0.1.

When setting the PMT (or Gain), both the signal and noise are simply amplified by the value set, so S/N values are unaffected. The raw signal output displayed on the parameter screen will reflect this increase or decrease in signal amplification.

Please note that the instrument output displayed on the main operating screen does not alter following a PMT change, thus the recorded baseline position will remain unchanged. Confirmation of a PMT change will be obvious by the change in baseline noise.

3.3 Additional Detector Parameters

The following parameters only controllable from the front panel of the detector.

3.3.1 Power Mode

The instrument can be configured from the front panel to start in either RUN or STANDBY mode when the unit is switched on via the rear power button. If RUN mode is selected as the desired Power mode, then the instrument will use the operating parameters stored in memory. In the unlikely event that the instrument encounters a fault during power-up the unit will automatically switch to STANDBY mode.

3.3.2 Data Output Rate (Hz)

The rate at which the Agilent ELS Detector outputs data can be selected from the detector's front panel. A choice of 10Hz or 40Hz is available depending on the LC application. The ELSD EZChrom Elite driver will automatically adjust for the data rate setting of the ELSD. If the data on the ELSD is changed then the EZChrom Elite must be restarted for the change to be registered.

3.3.3 Stored Methods

On power up, the detector defaults to the parameters set in the Default Method ('XXX'). Modification of the detector parameters using the EZChrom Elite software or using the detector keypad change this default method. The detector also has 10 custom methods which are stored onboard the detector. These are for use when the detector is being used independently of an Chromatography Data System.

Each custom method contains the following three parameters:

- Evaporator temperature
- Nebuliser temperature
- Gas flow

These methods cannot be accessed by the EZChrom Elite software or edited via the keypad on the front of the detector.

To change a Custom Method on the detector, you must use the ELSD Method Editor Program supplied on the Control Software CD supplied with the detector. (Part Number PL0890-0370.)

3.3.4 Real-time Operation

The Agilent ELS Detector can store a series of time-based events, within a single timetable in the detector memory. This timetable allows the operational

settings of the ELSD to be changed in real-time during a run.

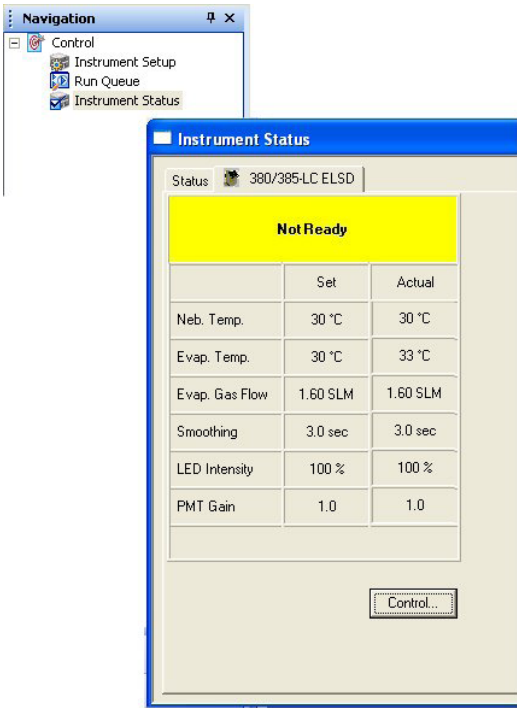
The temperatures, gas flow, LED, gain and smoothing parameters can all be configured within this timetable to change during a sample injection.

It is recommended not to run an active timetable on-board the ELSD whilst the EZChrom Elite is connected.

For changes to ELSD parameters in real-time, (e.g. LED) it is recommended to use the events table in the EZChrom Elite. See section Creating Timetable events, page 26.

3.4 ELSD Status Overview

The current status of the Varian ELSD is displayed in the Instrument Status window, as shown below:



This window displays the actual detector readings alongside the set parameters. The current status of the instrument is shown in the top box, as both a color and description. The ELSD statuses and associated color are given below:

- Not Ready - Yellow
- Prerun - Green
- Running - Blue
- Error - Red

Not Ready will be displayed if the detector is changing between set conditions.

Prerun indicates that the ELSD has reached set conditions and is ready for an injection.

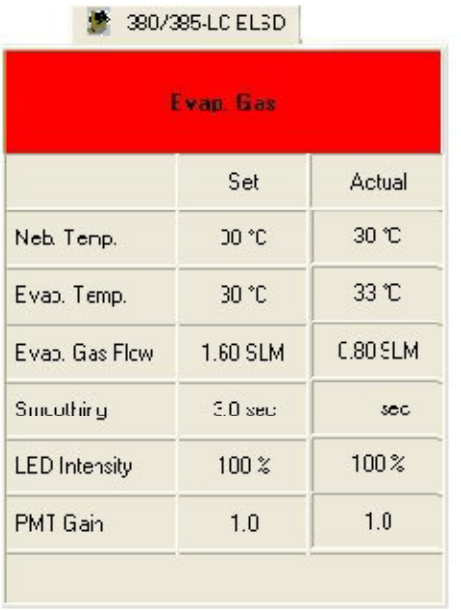
Running is displayed during an injection

Error is displayed when the ELSD reports a fault.

3.4.1 Error conditions

The ELS Detector is equipped with a number of sensors and error checking facilities to ensure safe operation. If an error is detected, the instrument gives an audible warning and a visible description of the error condition. In event of any error condition, the unit defaults into the STANDBY mode in which the heaters, LED and gas are turned off.

The type of error will be described in the Status window, (see below.)



For a complete list of instrument errors and remedial actions please refer to the troubleshooting section of the ELSD operation manual.

The Instrument Activity Log provides a record of the ELSD errors encountered within EZChrom Elite.

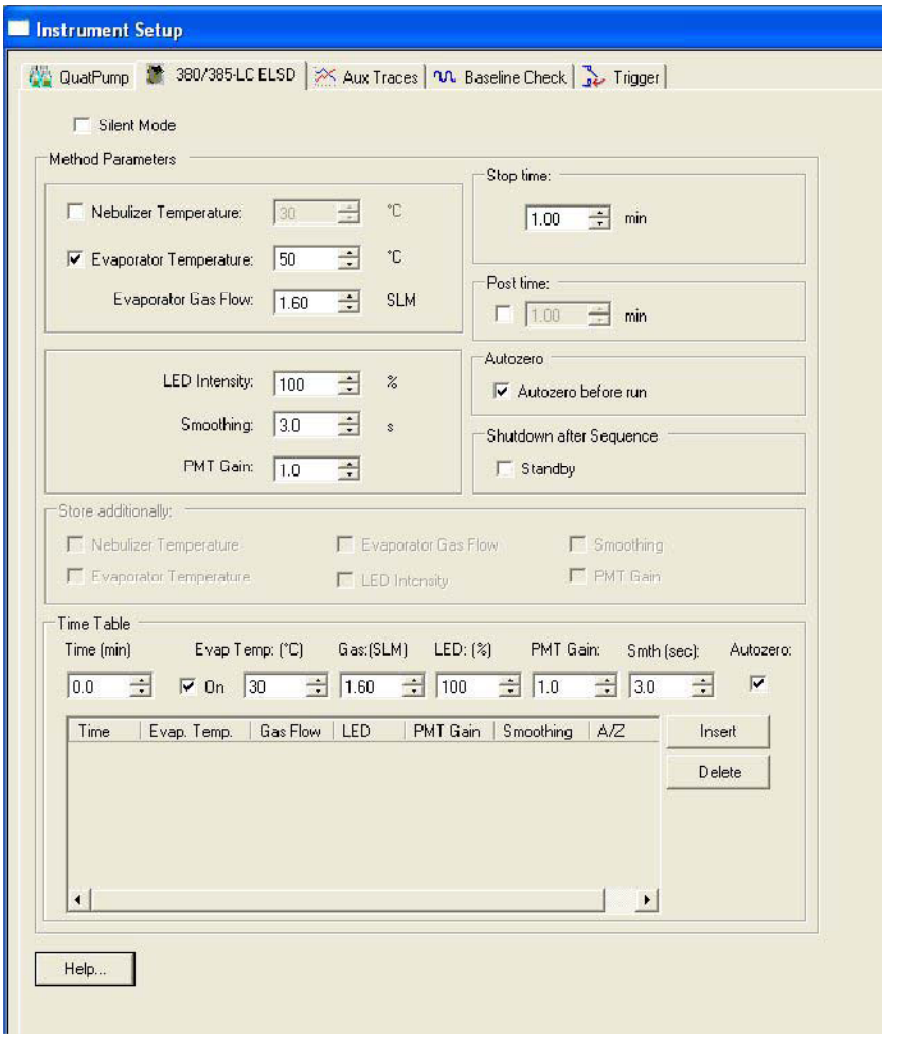
3.4.2 Clearing an Error

Once the source of the problem has been corrected, the error message will be cleared automatically on the instrument display and remain in STANDBY mode. Select the operational mode to switch the ELSD light source back-on and begin heating. If the problem has not been rectified, the ELSD will repeatedly error when operational mode is selected.

3.5 ELSD Method Parameters

The ELSD section under the Instrument Setup window is divided into several sections and allows the User to:

- Set ELSD parameters
- Store ELSD parameter signals
- Select the ELSD stop and post time
- Autozero the ELSD before a run
- Shutdown the detector after a sequence
- Program the ELSD parameters during an injection

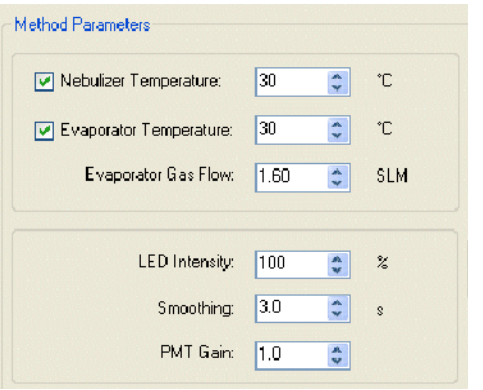


Note: The model of ELSD connected to the EZChrom Elite determines the permitted range on the evaporator temperature.

3.5.1 Detector Parameters

The following key detector parameters can be defined:

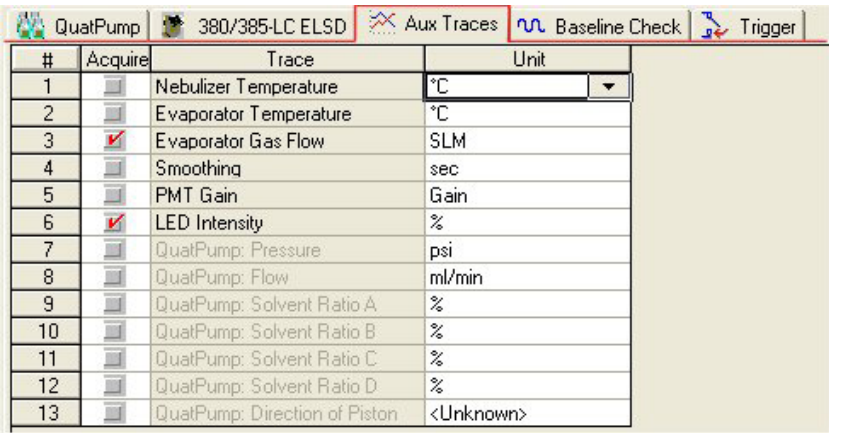
- Nebulizer temperature
- Evaporator temperature
- Evaporator gas flow
- LED intensity
- Smoothing value
- PMT Gain



3.5.2 Storing Additional ELSD Signals

In addition to the detector signal, EZChrom Elite can store additional ELSD parameters during an injection.

To select which additional ELSD parameters are stored during an injection Select the Aux Traces tab within the Instrument Setup window, as shown.



It is recommended to store additional signals when running a timetable of ELSD events.

3.5.3 Stop time

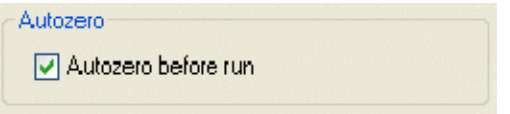
"Stop time" enables you to set a time at which the ELSD stops an analysis. If other modules are used, the ELSD "Stop time" will only stop the ELSD and does not stop any other module. When you select this box, set the corresponding duration in minutes.

If you require the Pump/Injector to control the analysis time then select the box "As Pump/Injector".

3.5.4 Post time

You can select the "Post time" so that your ELSD remains in the "not ready" state following an injection, defined by the length of the "Post time". Selecting this option will delay the start of the next analysis. For example, a "Post time" period can be used to allow your ELSD to thermally equilibrate following a timetable event or the analytical column to equilibrate between a change in solvents

3.5.5 Autozero



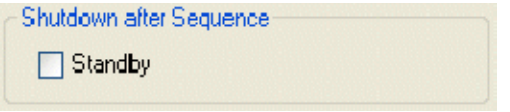
Select "Autozero before run" if you want to autozero the ELSD when a run starts. Please note that the ELSD is programmed with a 10mV offset, and the detector's response will go to 10mV following an autozero.

It is recommended that the ELSD is not repeatedly autozeroed before a run in order to prevent putting the detector into a "false" zero condition.

If LED changes are used during an injection then it is recommend that this

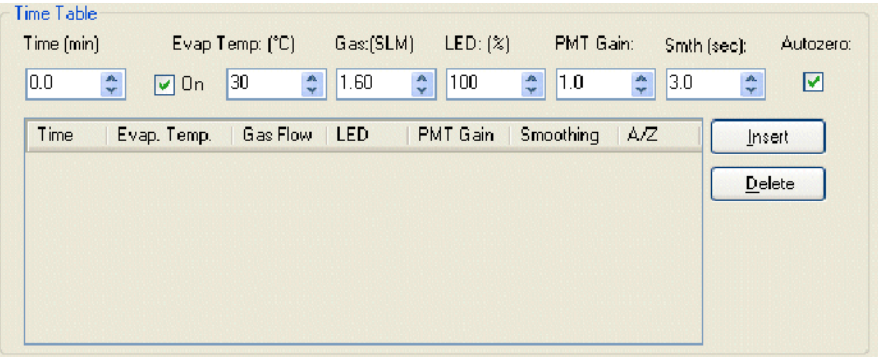
option is selected in order to keep a constant baseline and prevent the signal falling to zero mV.

3.5.6 Shutdown after Sequence



The ELSD can be switched to Standby mode using this option, following a sequence of injections. This is recommended if you want to shut-off the detector's gas overnight.

3.5.7 Creating Timetable events



The timetable menu allows the User to change detector parameters during an injection. For example, changing gas flow during gradient elution can maintain the detectors optimum sensitivity. The table can be edited using the following functions

"Insert" will add the new event in the table chronologically.

"Edit" will modify the selected line.

"Delete" will delete the selected line.

Note: The evaporator temperature on the Agilent 380-LC cannot be controlled during an injection.

3.5.8 Silent Mode

If the ELSD is not required for analysis then "Silent" Mode can be implemented.

Silent Mode allows the ELSD to remain connected to the system without having to re-configure the complete instrument system in EZChrom.

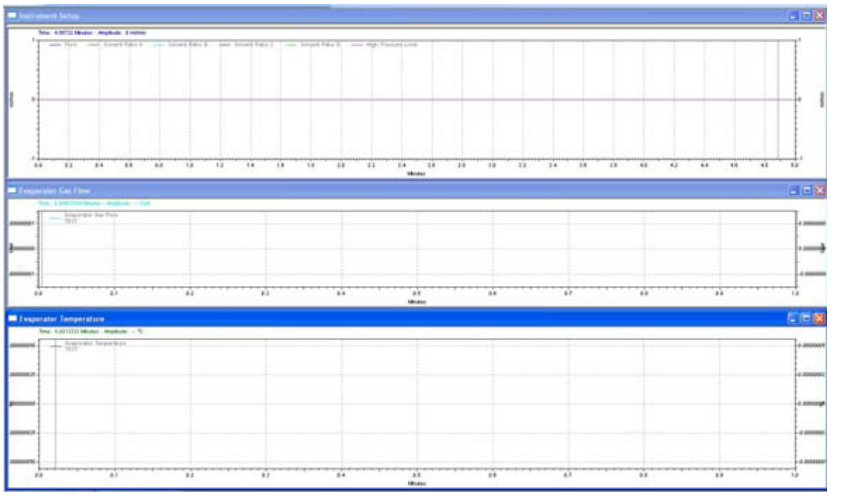
When Silent Mode is initiated EZChrom ELite will ignore the detector's status and will not collect any data from the ELSD.

When this mode is chosen, the ELSD parameters are greyed out and cannot be altered.

3.6 Viewing ELSD output

The output voltage from the ELSD is viewed in the on-line plot window.

Additional windows can be opened to give real-time information of parameters such as evaporator temperature and gas flow. The ELSD signals can be stacked in the single view as shown below:



For further information on how to use the on-line plot window, please refer to your EZChrom Elite operation manual.

3.7 Automating the ELS Detector

The Sequence table dialog box within the EZChrom Elite can be used to run a sequence of injections or instrument methods for complete automation.

If a EZChrom Elite method is created whereby the detector control is included, then the ELSD will become part of the automated sequence process.

The ELSD can also be shut down after a sequence in order to maintain lamp lifetime or gas supply. This option is available in the ELSD methods dialog as described in section 3.5.6.

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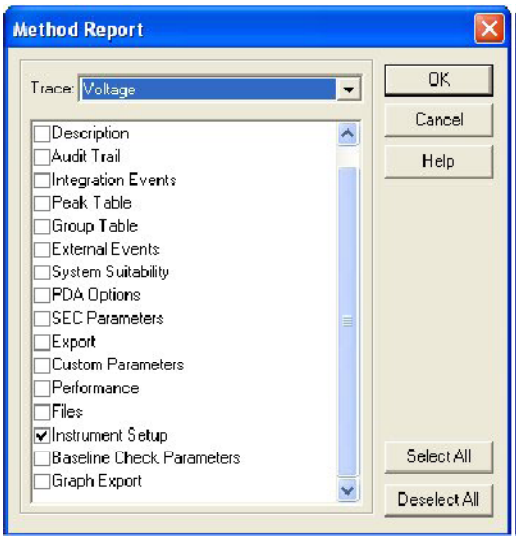
4. Data Analysis & Reporting

The Agilent 380/385 ELSD data signal acquired by the EZChrom Elite software is treated like any other detector input within the data analysis and reporting section. The ELSD output can be integrated and overlaid with other detector signals.

4.1 Reporting & Printing ELSD Method Details

Details of the ELS detectors conditions used to collect the data file can be obtained by creating and printing an EZChrom Elite report.

To include the ELSD information within the EZChrom report, insert the Method Report field into the report and choose the Instrument Setup option, as shown:



For a further detailed description of how to analyze, report and print your ELSD data, please refer to the EZChrom Elite operation manual.

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