SofTA 1300 ELSD

Installation and Operation Guide

TELEDYNE ISCO
Everywhereyoulook™

#8-243104

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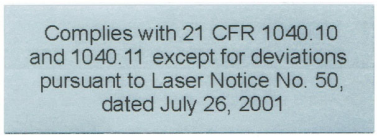
Before installing, operating, or maintaining this equipment, it is imperative that all hazards and preventive measures are fully understood. While specific hazards may vary according to location and application, take heed in the following general warnings:

⚠ WARNING

LASER SAFETY: This ELSD is a Class I laser product with a Class IIIa (3R) embedded laser. The embedded laser beam is less than 5 mW, 650 nm, and is collimated. There are no user adjustments for power, alignment, or collimation. Under use conditions, the laser is never visible, and presents no special safety considerations.

As required by regulation, the back panel has the following laser related labels, in addition to a serial number label.



Internal components may have the following label:

Never remove a component with this label. Doing so could expose a user to a potentially hazardous laser beam. Always refer service to qualified personnel.

⚠ WARNING

Do not use gases that support combustion with combustible solvents. Always use inert gases.To avoid inhaling harmful organic solvents and other materials, the detector exhaust should not be allowed to enter the laboratory atmosphere.

⚠ DANGER

To avoid burns, turn off the power at least 30 minutes before performing maintenance procedures.

⚠ WARNING

Liquids associated with this instrument may be classified as carcinogenic, biohazard, flammable, or radioactive. Should these liquids be used, it is highly recommended that this application be accomplished in an isolated environment designed for these types of materials in accordance with federal, state, and local regulatory laws, and in compliance with your company's chemical/hygiene plan in the event of a spill.

⚠ WARNING

Avoid hazardous practices! If you use this instrument in any way not specified in this manual, the protection provided by the instrument may be impaired.

⚠ WARNING

If you are using flammable solvents or chemicals with this system, vapor concentration levels may exceed the maximum exposure levels as recommended by OSHA Guide 1910.1000. To reduce those levels to a safe exposure, Teledyne Isco recommends that you place the system in a laboratory hood designed for the purpose of ventilation. This hood should be constructed and operated in accordance with federal state and local regulations. In the event of a solvent or chemical spill, your organization should have a plan to deal with these mishaps. In all cases, use good laboratory practices and standard safety procedures.

Hazard Severity Levels

This manual applies *Hazard Severity Levels* to the safety alerts. These three levels are described in the sample alerts below.

⚠ CAUTION

Cautions identify a potential hazard, which if not avoided, may result in minor or moderate injury. This category can also warn you of unsafe practices, or conditions that may cause property damage.

⚠ WARNING

Warnings identify a potentially hazardous condition, which if not avoided, could result in death or serious injury.

⚠ DANGER

DANGER – limited to the most extreme situations to identify an imminent hazard, which if not avoided, will result in death or serious injury.

Hazard Symbols

The equipment and this manual use symbols used to warn of hazards. The symbols are explained in the table below.

Hazard Symbols	
Warnings and Cautions	
	The exclamation point within the triangle is a warning sign alerting you of important instructions in the instrument's technical reference manual.
	The lightning flash and arrowhead within the triangle is a warning sign alerting you of "dangerous voltage" inside the product.
Symboles de sécurité	
	Ce symbole signale l'existence d'instructions importantes relatives au produit dans ce manuel.
	Ce symbole signale la présence d'un danger d'électocution.
Warnungen und Vorsichtshinweise	
	Das Ausrufezeichen in Dreieck ist ein Warnzeichen, das Sie darauf aufmerksam macht, daß wichtige Anleitungen zu diesem Handbuch gehören.
	Der gepfeilte Blitz im Dreieck ist ein Warnzeichen, das Sei vor "gefährlichen Spannungen" im Inneren des Produkts warnt.
Advertencias y Precauciones	
	Esta señal le advierte sobre la importancia de las instrucciones del manual que acompañan a este producto.
	Esta señal alerta sobre la presencia de alto voltaje en el interior del producto.

For Additional Information

Technical assistance for the 1300 ELSD can be obtained from:

Teledyne Isco
4700 Superior St.
Lincoln NE 68504

Phone: (800) 775-2965 or (402) 464-0231
Fax: (402) 465-3001
E-mail: IscoService@teledyne.com

SofTA 1300 ELSD

Table of Contents

Section 1 Introduction

Section 2 Unpacking and Installation

Section 3 Operation

Appendix A Speciations

SofTA 1300 ELSD

Section 1 Introduction

1.1 ELSD Principle of Operation

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 complementing ultraviolet (UV) detection because they can detect most analytes, are stable during gradient elutions, and respond to the relative mass of the analyte (even those that do not absorb UV radiation). This is an important feature that is useful when detecting unknown materials. The ELSD is superior to the refractive index detector (RID) as 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 nearly universal detector, but its high cost and complexity may be unnecessary in many applications. In fact, the operation requirements of MS closely match that of the ELSD. This allows the less expensive and less complicated ELSD to be used as a method development detector for methods to be used on the MS systems.

1.1.1 Operation

The 1300 ELSD employs a unique method of detection. The process involves the nebulization of the column eluent which transforms it into an aerosol cloud. As this cloud travels through a heated zone within the instrument, the more volatile mobile phase evaporates and leaves a smaller cloud of analyte particles. These particles pass through a beam of light and scatters 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 1300 ELSD uses a special concentric flow nebulizer and a constant flow of an inert gas to ensure a narrow droplet size distribution. This nebulizer is constructed entirely from PTFE which accumulates fewer deposits than either glass or stainless steel.

To handle flow rates and mobile phases common in HPLC, all ELSDs need a way to divert part of the aerosol cloud to waste. The 1300 ELSD uses patented Thermo-Split technology.

The Thermo-Split chamber combines a gentle bend with temperature-controlled walls. When the aerosol exiting the nebulizer encounters a cool environment, it partially condenses into larger particles whose momentum carries them into the wall and down the drain (Figure 1-1).

Figure 1-1 Thermo-Split chamber without heating

To increase sensitivity with easy-to-evaporate solvents, the temperature of the spray chamber may be elevated. As the aerosol traverses the chamber, it partially evaporates and shifts the particle size distribution low enough for essentially all the particles to negotiate the bend. Under these conditions, a majority of the aerosol particles pass through the chamber and are carried into the evaporative zone (Figure 1-2).

Figure 1-2 Thermo-Split chamber with heating

Evaporation

After passing through the nebulization 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 is 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.

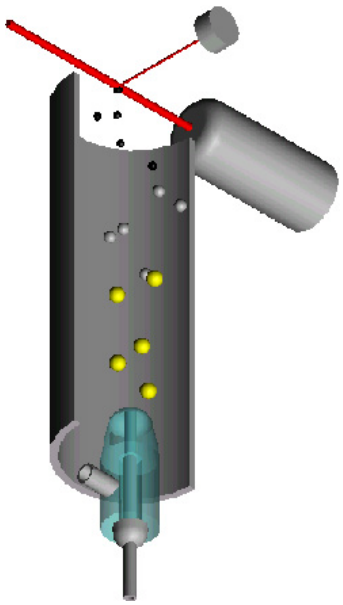


Figure 1-3 Nebulization chamber

SofTA 1300 ELSD

Section 2 Unpacking and Installation

2.1 Requirements and Steps

In addition to the 1300 ELSD and its accompanying accessories, you will need:

- Gas Supply: Clean, dry, inert gas regulated to 65 ± 5 psi is needed for nebulization. Either Argon or Nitrogen is acceptable. Do not use gases that support combustion.
- Exhaust Device: The carrier gas containing volatilized mobile phase and sample components will exit the 1300 ELSD. You should provide a means of removing this from the laboratory. The 1300 ELSD should be located close to a fume hood or other ventilation device.
- Tubing, fittings, and tools to connect your HPLC system to the 1300 ELSD.

2.1.1 Unpacking

Carefully unpack the accessory items included with the ELSD shipment and confirm that all the items are present. The 1300 ELSD comes in a high-quality shipping container engineered to avoid damage in transit. Save the shipping container and packaging for future shipments.

2.2 Connections

Power Connection

The 1300 ELSD operates at either 120 V or 240 V, 50/60 Hz.

⚠ CAUTION

Confirm that the 1300 ELSD is configured for the correct voltage before plugging it into line voltage. Plug the modular power cord provided into the power input module on the back of the detector.

If the power input module is set to the wrong voltage:

1. Unplug the power cord from the module.
2. Open the fuse compartment by gently prying the cover from the module with a flat blade screwdriver.
3. Remove the fuse block.
4. Remove the voltage configuration card from the module by gently pulling with pliers or tweezers.
5. Rotate the plastic voltage selector until the correct voltage appears on the side opposite the voltage selector.
6. Replace the card and fuse block.
7. Confirm that the correct voltage is indicated through the cover before securing the cover.

8. Plug the modular power cord provided into the power input module on the back of the detector.

Exhaust

A portion of the solvent and analyte sent to the ELSD will exit the exhaust as vapors or aerosol particles. To manage this exhaust, the 1300 ELSD uses a 1" O.D. stainless steel tube. The included black corrugated exhaust tube extension must be installed to eliminate sensitivity to ambient lighting conditions. The outlet of this tube must be routed to a fume hood during operation. Alternatively, connect the tubing and direct exhaust to a cooled collection vessel for later disposal.

RS-232

The 1300 ELSD should be connected to a Windows computer for access of its full list of functions. Connect the serial port of a 1300 ELSD to the computer serial port.

Communication

An output jack can be found on the back of the 1300 ELSD for connection to a chart recorder, computing integrator, or computerized data system. The maximum signal output is 1 V.

I/O Connections

Pin 1 and Pin 2: A contact closure output. Pins are open when 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 500 ms. A subsequent toggle command within 2 seconds may be ignored.

Pin 5 and Pin 6: A TTL output for instrument status. A logical high indicates the detector is in standby.

Pin 7 and Pin 8: A contact closure input to reset baseline remotely. Maintain connectivity for a minimum of 500 ms. A subsequent toggle command within 2 seconds may be ignored.

Gas Connections

Connect a supply of clean, dry, inert gas regulated to 65 ± 5 psi to the GAS INLET port on the back of the unit. The internal gas regulator maintains the gas pressure at the factory set value displayed on the front panel.

Fluid Connections

Connect the outlet from your column to the LIQUID INLET on the front of the unit. The length and volume between the column outlet and the detector inlet should be kept as short as possible to avoid unnecessary band broadening. Use the supplied tubing for the best results.

Nebulization Chamber Drain

The instrument's internal "P" trap must be full during operation. Restricting the drain port with liquid is very important to ensure detection sensitivity. Introduce 10 ml of mobile phase into the drain using a squirt bottle or syringe.

☑ Note

If you use volatile solvents which are completely vaporized, you may not see solvents exiting the drain during operation. If this is true, you may need to periodically refill the "P" trap for optimal operation.

Place the ¼" stainless steel drain adapter provided in the accessory kit on the drain port located on the front of the instrument. Direct the outlet of the tube to a collection vessel located below the trap. Watch the liquid level in the vessel during operation and empty when full.

2.3 Installation Qualification Checklists

2.3.1 Overview

This qualification procedure will document that the SofTA ELSD is operating as designed. This documentation is important when working in a regulated environment to demonstrate to various auditors that the detector is working properly. This process is called qualification or validation. Qualification can be divided into the following steps:

- Installation Qualification (IQ) documents that the correct detector was received and installed properly.
- Operational Qualification (OQ) tests that the detector meets specifications in the user environment. OQ generally requires specialized test detectors that have been calibrated against NIST standards.
- Performance Qualification (PQ) tests that the system performs the selected application correctly. The original test report is shipped with each detector to certify that the detector passed the final test.

2.3.2 Installation Qualification (IQ) for SofTA ELSDs

Model Number:

Detector Serial Number:

Location of the Detector:

Step	Description	Yes	No	Installer Initials	Operator Initials
1	Is the detector the same as specified on the purchase order?				
2	Has the detector been inspected for damages and found unharmed?				
3	Has the required documentation identified by model number and date been supplied?				
4	Have details of all services and utilities required to operate the detector been provided?				
5	Have methods and instructions for user maintenance been provided along with a contact point for service and spare parts?				
6	Is the selected environment suitable for the detector (i.e. is adequate room provided for installation, operation, and servicing)? Have appropriate solvent services and utilities (electricity, Nitrogen gas, ventilation, solvent waste recovery, etc.) been provided?				
7	Has health, safety, and environmental information relating to the operation of this detector been provided?				

The undersigned individual, certified by the manufacturer, completed the manufacturer's procedure for the proper Installation Qualification of this detector.

Name:

Title/Affiliation:

Signature:

Date:

2.3.3 Operational Qualification (OQ) for SofTA ELSDs

Model Number:

Detector Serial Number:

Location of the Detector:

Set-up

Turn on the detector. Confirm the following settings are accurate:

Full Scale	1 V
Gain	Normal
Calibration	100%

Modify if necessary. Set the drift tube temperature to 60 °C and the spray chamber temperature to 30 °C. Wait until the temperature stabilizes (approx. 60 minutes).

Drift tube SET TEMPERATURE	
Drift tube DISPLAYED TEMPERATURE	

The display should read 60 °C ± 1 °C.

PASS☐ FAIL☐

Spray chamber SET TEMPERATURE	
Spray chamber DISPLAYED TEMPERATURE	

The display should read 30 °C ± 1 °C.

PASS☐ FAIL☐

Gas Sensor

Apply air or Nitrogen pressure monitored by a regulator and checked with a pressure gauge. Set the pressure to 65 psi. Record the gas pressure value displayed on the ELSD.

ELSD Value	

The display should read 50 ± 10psi.

PASS☐ FAIL☐

Baseline Noise

Connect a digital voltmeter calibrated with an NIST-traceable standard to the analog output of the ELSD. The meter must also be able to record a minimum and maximum voltage with a response time of at least 10 ms (Fluke 45 or equivalent).

Fill the ELSD drain tube with HPLC Grade Water.

Occasionally, liquid will be aspirated from the inlet line or drain which will result in a spike in the signal. The test should be restarted if this occurs.

Set the detector filter to RC 5. Reset the baseline. Monitor the output signal for 2 minutes. Record the lowest voltage and the highest voltage. Calculate the difference.

Maximum Value	mV
Minimum Value	mV
Difference	mV

The difference should be less than 2.5 mV.

PASS☐ FAIL☐

Baseline Drift

Set the detector filter to RC 5. Autozero the detector to change the signal to about 20 mV, and monitor the signal for 30 minutes.

Initial Signal Value	mV
Final Signal Value	mV
Difference	mV

The baseline drift should be less than 2.5 mV.

PASS☐ FAIL☐

The undersigned individual, certified by the manufacturer, completed the manufacturer's procedure for the proper Operational Qualification of this detector.

Name:

Title/Affiliation:

Signature:

Date:

2.3.4 Performance Qualification (PQ) for SofTA ELSDs

Model Number:

Detector Serial Number:

Location of the Detector:

> **☑ Note**
>
> Before this procedure is performed, it is necessary to complete the Installation Qualification and the Operational Qualification.

Sensitivity

Set the HPLC System and ELSD conditions to: 1 ml/min of 50/50 Water/Methanol.

Add a backpressure regulator or a length of small ID tubing between the pump outlet and the injector inlet. Ideally, this will maintain 1000 psi pressure on the pump check valves enough to minimize baseline pulsation on the ELSD.

Full Scale	1 V
Gain	Normal
Calibration	100%
Spray chamber	30 °C
Drift tube	60 °C
Filter	5
Injection Standard	100 ng Sodium Benzoate

The injection standard (Sodium Benzoate) should be delivered in 20 µl (10 ng/µl) or smaller loop.

Enter the conditions into the detector. Start the HPLC pump and the gas flow and wait for temperatures to reach the set points.

When the temperatures reach equilibrium, reset the baseline to about 20 mV. Monitor the ELSD signal for stability. The signal should be stable within 2 mV.

Connect a digital voltmeter calibrated with an NIST traceable standard to the analog output of the ELSD. (Alternatively, a calibrated Chromatography Data System can be used.) When the signal is stable, inject the 100 ng sample three times. Record the maximum signal for each peak.

Peak 1 Height	mV
Peak 2 Height	mV
Peak 3 Height	mV
Average Peak Height	mV

The Average Peak Height should be at least 3 mV.

PASS☐ FAIL☐

Reproducibility

Without changing conditions, make six 20 µl (max) injections of a 1000 ng standard. (100 ng/µl or appropriate for loop.) Deliver 5x the loop volume for manual injections.

Peak Area 1		Peak Height 1	
Peak Area 2		Peak Height 2	
Peak Area 3		Peak Height 3	
Peak Area 4		Peak Height 4	
Peak Area 5		Peak Height 5	
Peak Area 6		Peak Height 6	
Peak Area% RSD		Peak Height % RSD	

The reproducibility of six injections should be no greater than 4.0% RSD (area) or 5.0% RSD (height).

PASS☐ FAIL☐

The undersigned individual, certified by the manufacturer, completed the manufacturer's procedure for the proper Performance Qualification of this detector.

Name:

Title/Affiliation:

Signature:

Date:

2.3.5 Overall Detector Performance for SofTA ELSDs

After the Installation Qualification, Operational Qualification, and Performance Qualification procedures have been completed, the Overall Detector Performance document should be completed to verify the completion of all tests.

Model Number:

Detector Serial Number:

Location of the Detector:

Procedure	Date	Pass	Fail
Installation Qualification (IQ) Date			
Operational Qualification (OQ) Date			
Performance Qualification (PQ) Date			

The undersigned individual, certified by the manufacturer, completed the certification for this detector.

Name:

Title/Affiliation:

Signature:

Date:

Customer Name/LC Operator:

Signature:

Date:

SofTA 1300 ELSD

Section 3 Operation

3.1 Instrument Controls

The 1300 ELSD is controlled via six multi-function keys on the front panel labeled PWR (power), A/Z (autozero), ESC (escape), ▲ (up), ▼(down) and ENT (enter) found behind the front panel of the Model 1300 ELSD. The touch-sensitive keys are activated by lightly placing a finger over the light representing the key. An audible beep is heard when the key is activated. The 1300 ELSD features a 2-line vacuum florescent display.

3.1.1 Power Key

- When the instrument is OFF, touch the POWER key to turn the 1300 ELSD ON. The LED changes from red (OFF) to green (ON).
- To turn the power OFF, touch and hold the ENT key for 5 seconds. After it has been turned off, wait at least 10 seconds before turning the instrument ON.

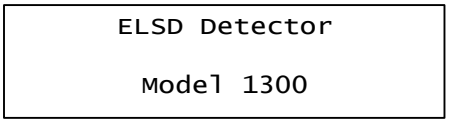
3.1.2 A/Z Key

When the A/Z key is touched, the ELS Detection signal will reset to about 20 mV.

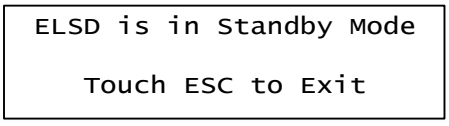
3.2 Display Screens

The 1300 ELSD uses one of four screens to aid in the operation of the detector.

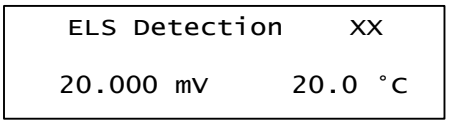
Startup Screen



- The text moves from left to the right while the program is loaded.
- When the 1300 ELSD finishes the start-up process, it enters the stand-by mode.
- Touch the ESC key to exit and enter the HOME screen.



Home Screen



Touching the ▲ or ▼ keys will circulate XX section to review operation condition. SC, DT, and OC sections display their set points to the degree for 5 seconds when selected. Then, they display the actual temperatures to the tenth of a degree.

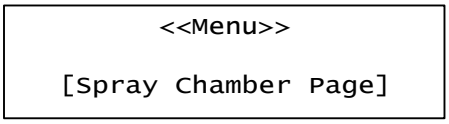
Touch the ENT key will bring up the MENU screen.

If there is a * at the upper right corner, pushing the ENT key will bring up a screen to explain what is wrong.

XX = SC, DT, OC, RST, BLN, GAS, FLT or BFT, FS, GAIN, CAL

- SC = Spray chamber (Setpoint: 10 °C to 70 °C; readout range: -10.0 °C to 120.0 °C)
- DT = Drift tube (Setpoint: 22 °C to 120 °C; readout range: -10.0 °C to 120.0 °C)
- OC = Optical Cell (Setpoint: 22 °C to 70 °C; readout range: -10.0 °C to 120.0 °C)
- RST= Reset baseline to about 20 mV
- BLN = Baseline reading (5000.000 – 0.000 mV)
- GAS = Gas (0.0 to 130.0 psi)
- FLT or BFT = Baseline Filter (OFF, weight 1 to 10)
- FS = Full Scale (1 V or 10 mV)
- GAIN = Gain (Normal or Low)
- CAL = Calibration (50% to 200%)

Menu Screens



Pressing the ENT key once displays the menu screen.

- Touch the ▲ or ▼ keys to select the menus.
- Touch the ENT key to open the desired page.
- Touch the ESC key to return to the HOME screen.

Available Menus:

- Drift Tube Page: Sets drift tube, optical cell and exhaust tube temperatures.
- Spray Chamber Page: Sets spray chamber temperature.
- Op Status Page: Displays the operational status of the detector.
- Hardware Stat Page: Displays the status of the voltages used on the hardware for diagnostic purposes.

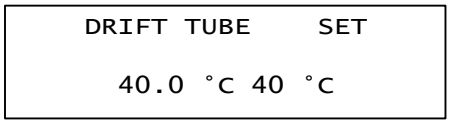
- Output Page: Selects the signal sent to the output for diagnostic purposes.
- Laser Page: Provides diagnostic reading from the laser.

⚠ WARNING

Do not adjust the POT#.

- Control Page: Sets RUN/STANDBY mode, ON/OFF Laser, ON/OFF Alarm.
- Calibration Page: Attenuates or amplifies the detector output.
- Detector Gain Page: Changes Gain.
- Full Scale Page: Changes Full Scale.
- Filter Page: Sets the type and weight of filter for noise filtration.

Drift Tube Page



- The reading under DRIFT TUBE is the current temperature.
- The reading under SET is the setpoint. The temperatures of the optical cell and the exhaust tube are controlled at the same temperature as that of DRIFT TUBE, but their maximum temperature is limited.
- Touch the ▲ or ▼ keys to change a set point at 1 °C increment.
- Touch the ENT key to accept the change and go back to HOME screen.
- Touch the ESC key to abandon the change and go back to the HOME screen.

Spray Chamber

```
SPRAY CHAMBER SET

10.0 °C     10 °C
```

- The reading under SPRAY CHAMBER is the current temperature.
- The reading under SET is the setpoint.
- Touch the ▲ or ▼ keys to change a setpoint at 1 °C increment.
- Touch the ENT key to accept the change and go back to HOME screen.
- Touch the ESC key to abandon the change and go back to the HOME screen.

Op Status Page

```
Op Status

[Ready]
```

- [Ready], [SC not Ready], [SC/DT/OC/Gas are not Ready]
- Use the ▲ or ▼ keys to select an action.
- Touch the ENT key to take an action and go back to HOME screen.
- Touch the ESC key to keep current state and go back to HOME screen.

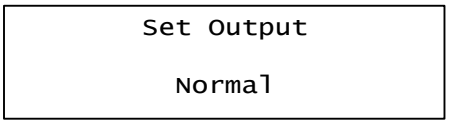
Hardware Status Page

```
TP: +5 V-5 V

X.XVX.XV
```

- The set and actual voltages from the electronics are displayed on the HARDWARE STATUS page for diagnostic purposes.
- Touch the ENT key to take an action and go back to HOME screen.
- Touch the ESC key to keep current state and go back to the HOME screen.

Outage Page

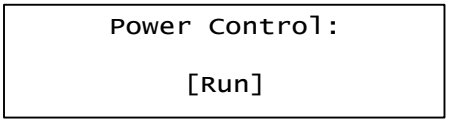


- [Normal], [Fixed at 20 mV], [Baseline], [Pre-Amp].
- The output sent to the analog output connections can be changed for diagnostic purposes.
- Touch the ENT key to take an action and go back to the HOME screen.
- Touch the ESC key to keep current state and go back to the HOME screen.

Laser Page

- The New# can be changed using the ▲ or ▼keys for diagnostic purposes. Do not change unless instructed to do so by a certified technician.
- Touch the ENT key to take an action and go back to the HOME screen.
- Touch the ESC key to keep current state and go back to the Home screen.

Control Page

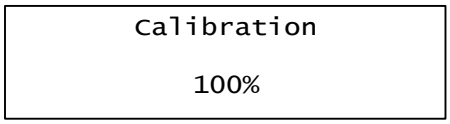


- [Enter Standby], [Turn Off Laser] or [Turn On Laser], [Disable Beeper] or [Enable Beeper].
- Use the ▲ or ▼keys to select an action.
- Touch the ENT key to take an action and go back to the HOME screen.
- Touch the ESC key to keep current state and go back to the HOME screen.

⚠ CAUTION

If the display reads Laser Off or Laser On, touching ENT key will turn the laser off or on. The laser may take up to 30 minutes to stabilize when it has been turned off and on again.

Calibration Page



- 20% to 200% in 1% increments.
- Use the ▲ or ▼ keys to select an action.
- Touch the ENT key to take an action and go back to the HOME screen.
- Touch the A/Z key to keep the current state and go back to the HOME screen.

This feature scales the detector output. This feature is useful to match individual detectors to each other for standardization within a lab or to set the full scale output to a value other than 1 V or 10 mV. At 100%, the signal is neither amplified nor attenuated.

Detector Gain Page

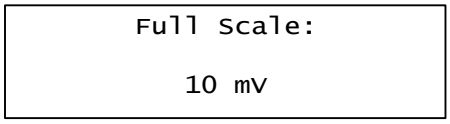
Normal and Low

- Use the ▲ or ▼ keys to select an action.
- Touch the ENT key to take an action and go back to the HOME screen.
- Touch the A/Z key to keep the current state and go back to the HOME screen.

There are two gain settings, **Norm** and **Low**:

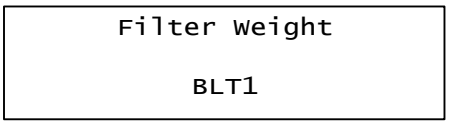
- Use **Norm** (Normal) setting for all analytical scale analysis.

Full Scale Page



- 10 mV or 1 V.
- Use whichever setting is appropriate for your data collection system. Using the calibration parameter can also modify the full scale. See *Calibration Page* for details.

Filter Page



- FLT or BFT OFF, 1 to 10.
- Use the ▲ or ▼ keys to select an action.
- Push the MENU|POWER key to take an action and go back the HOME screen.
- Push the AUTOZERO key to keep the current state and go back the HOME screen.

There are two filter types to choose from: FLT and BFT.

- Filter weight is the level of baseline noise filtration.
- OFF indicates no filtration. 10 is maximum filtration.

In most cases, select BFT for baseline filtering. The FLT setting applies a RC filter to the entire signal.

For high-speed chromatography (less than a 5 sec peak width), select BFT and turn the weight OFF. If the peak widths are 5 to 30 seconds, use the BFT filter with a weight of 1 to 10. For peak widths greater than 30 seconds, select the FLT setting with a weight of 1 to 10.

When the baseline filter is on, a dramatic operation condition change (e.g. turning on/off the HPLC pump) may upset the filter and cause baseline drifting. The baseline will stabilize again in a few minutes.

Error Condition Screen

If any of the detector parameters are not met, the READY status indicator will not illuminate and the * will appear in the upper right corner of the home screen. Touch the ESC key for more information about the affected parameter.

3.3 Operating Conditions

3.3.1 Start Up Procedure

If this is the first time you have operated the detector, it is very important that you reproduce the QC tests found in *Installation Qualification Checklists* (2.3) before beginning your analysis.

1. Make all connections (gas, liquid, power, communications, exhaust, and drain) as described in *Connections* on page 2-1.
2. Turn on the power to the 1300 ELSD. Allow the system to run through the start-up sequence and then touch the ENT key to exit standby and enter the Home screen.
3. Confirm that the detector conditions are set according to the test parameters. Adjust if necessary. Allow the drift tube and spray chamber temperatures to reach thermal equilibrium as indicated by the blinking of the corresponding status lights.

4. While waiting for the temperatures to reach the setpoints, fill the drain with HPLC grade water using a syringe or squeeze bottle.

> **Note**
>
> When using very volatile solvents such as used for normal phase chromatography, fluid may not be present. In this case, manually fill the "P" trap several times a week with a less volatile solvent such as isopropanol.

5. When temperatures reach setpoints, turn on the regulated gas flow and gradually increase the gas pressure to 65 ± 5 psi. If you use an on-off valve to turn on the gas, make sure the upstream gas pressure is below 70 psi before you turn on the valve. Gas pressure higher than 70 psi may permanently damage the detector. Start the pump.
6. A * may be blinking at the upper right corner indicating the detector is not ready yet. You can touch the ESC key to check what is not ready.
7. When the detector is ready, begin data collection system and monitor the baseline.
8. Touch the A/Z key to rest the baseline to approx. 20 mV. Repeated A/Z may be necessary until the baseline stabilizes.
9. When the baseline is stable (variation is less than 1.0 mV when FS is set as 1 V) and the "*" has disappeared, the detector is ready.
10. Inject your standard or sample and begin analysis.

3.3.2 Shut Down Procedure

1. Stop the flow of mobile phase to the system.
2. Allow the gas to flow through the detector for 5 minutes without mobile phase flowing to clear all vapor from the system.
3. Enter the CONTROL page and select ENTER STANDBY. When the detector enters standby, the gas solenoid is closed (shutting off the flow of the nebulization gas), the laser is turned off, and the heaters are disabled.
4. If there are no leaks between your gas source and the 1300 ELSD, you do not have to turn the gas off at the source.

3.4 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. Some experimentation will be required to optimize the Model 1300 ELSD.

When setting the 1300 ELSD temperatures for a new method, select 30 °C for spray chamber temperature and 60 °C for drift tube temperature. These temperatures should then be adjusted for the best signal-to-noise ratio during method optimization. For

the best performance, a mobile phase that is highly organic and volatile requires an ambient or elevated spray chamber temperature and moderately high drift tube temperature. When highly aqueous or high boiling point organic mobile phases are used with the detector, the best performance will be at sub-ambient spray chamber temperatures and moderate drift tube temperatures.

3.4.1 Thermo-Split Spray Chamber Temperature

The Thermo-Split spray chamber can operate from 10 °C to 60 °C. The spray chamber temperature controls the vapor phase split ratio. For an easily evaporated mobile phase, the split ratio can be set low. To achieve this, the Thermo-Split chamber is heated. As the aerosol traverses the chamber, it partially evaporates and shifts the particle size distribution low enough for essentially all the particles to negotiate the bend. So 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.

For difficult to evaporate mobile phases or high flow rates, the split ratio needs be high so the Thermo-Split chamber is 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.

As an example, the following data was collected with 90% water and 10% methanol at 1 ml/min, a more difficult to evaporate mobile phase. The recommended conditions for this mobile phase are 15 °C spray chamber and 45 °C drift tube. Figure 3-1 shows the effect of spray chamber temperature on the resulting peaks when the drift tube temperature is held constant.

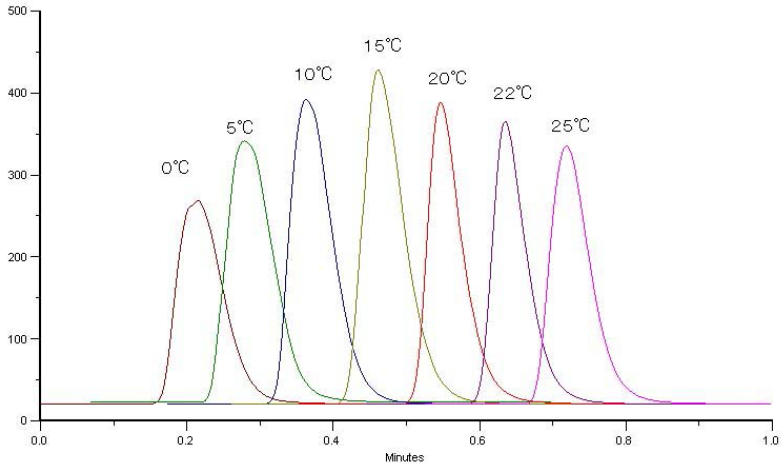


Figure 3-1 Spray chamber temperature effects: sub-ambient

As the spray chamber temperature increases from 0 ° to 15 °C, more of the vapor phase goes to drift tube and not to the drain, and the signal becomes larger. When the spray chamber is heated from 15 °C to 25 °C, the signal decreases because the vapor is partially evaporated in the spray chamber. When the SC temperature is higher than 30 °C, more of the vapor is sent to the drift tube. A drift tube temperature of 45 °C is not sufficient to evaporate the larger volume of vapor and results in more baseline noise.

When the mobile phase is changed to 90% Methanol and 10% water at 1 ml/min, the recommended conditions are spray chamber 50 °C and drift tube 70 °C. In Figure 3-2, the drift tube was held constant at 70 °C, and the spray chamber temperature was lowered. The signal height decreased as the spray chamber temperature decreased because more of the vapor was diverted from the drift tube and sent to the drain.

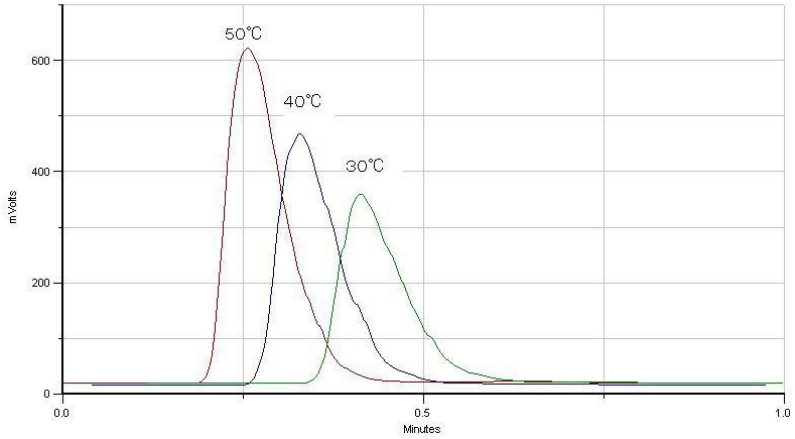


Figure 3-2 Spray chamber temperature effects: elevate

3.4.2 Drift Tube Temperature

The drift tube temperature can be set from ambient to 120 °C. The drift tube temperature is set at a temperature high enough to evaporate the mobile phase and not vaporize the analyte. A higher drift tube temperature may give result in a quieter baseline but a smaller peak. The drift tube temperature should always be higher than the spray chamber temperature but only as high as needed to achieve a quite baseline.

In this example (Figure 3-3), the mobile phase was 90% water and 10% methanol at 1 ml/min and the spray chamber was held constant at 10 °C. Figure 3-3 shows the effect of drift tube temperature on the signal.

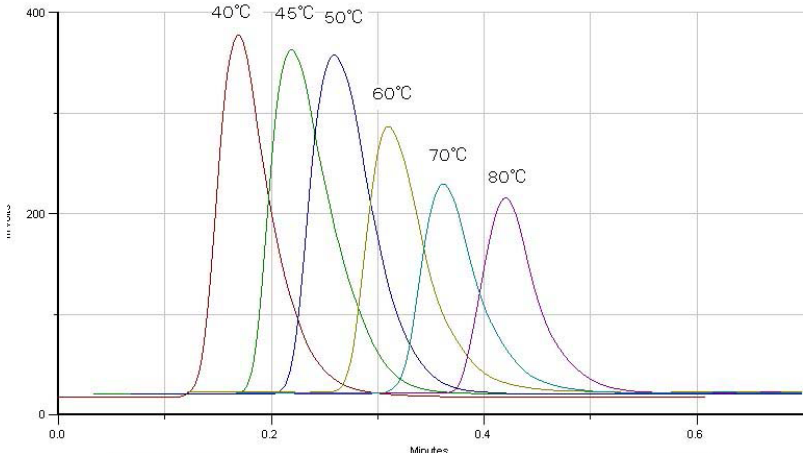


Figure 3-3 Drift tube temperature effects

The effect of temperature on signal between 45 °C and 50 °C is small, but as the drift tube temperature increased above 60 °C, the signal height decreased.

A drift tube temperature setting that is too high could vaporize the analyte and cause a loss of sensitivity. If the analyte is thermally labile, use a lower temperature to improve sensitivity. However, there will be a point where the temperature is not high enough to evaporate the mobile phase, and the increase in noise will negate the increase in signal. Optimize for the best signal-to-noise ratio.

3.4.3 Mobile Phase Flowrate

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 1300 ELSD may perform best at sub-ambient spray chamber temperatures if the flowrate is extremely high even for volatile mobile phases. If these solvents are used, the "P" trap should be manually filled with a less volatile solvent such as isopropanol.

3.4.4 Gradient Separations

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

Table 3-1 Suggested Operating Temperatures

Solvent @ 1.0 ml/min	Drift Tube Temperature, °C	Spray Chamber Temperature, °C
90/10 Water/METHANOL	45	15
90/10 Methanol/WATER	65	50
50/50 Methanol/Water	60	30
Acetonitrile	60	50

Table 3-1 Suggested Operating Temperatures		
Methanol	60	50
Water	45	10

3.5 Mobile Phase Considerations

3.5.1 Selecting a Solvent

High purity mobile phase solvents with low boiling points are recommended for use with the 1300 ELSD. Solvents should be spectral or HPLC grade. Dirty or contaminated solvents will cause baseline noise and drift, blocked fluid paths, and a build up in the detector. All solvents used should have less than 1 ppm of residue after evaporation and be filtered to less than 0.45 µm. Solvents can be evaluated by pumping them directly into the detector and comparing the noise to other known solvents. We have found that not all HPLC grade solvents are acceptable for use with an 1300 ELSD. Preservatives commonly used in Tetrahydrofuran (THF) will increase the noise level. Ensure that unstabilized THF is fresh as THF can contain peroxides that can increase noise and are potentially explosive if taken to dryness.

3.5.2 Mobile Phase Flowrate and Composition

The recommended flowrate for the 1300 ELSD is 0.25 ml/min to 3 ml/min. The mobile phase flowrate will affect baseline noise. In general, more baseline noise will be generated by the higher flowrate of a mobile phase.

The 1300 ELSD will operate with common HPLC solvents that are volatile enough to form a vapor under the operating conditions. This includes common HPLC solvents such as water, methanol, acetonitrile, acetone, isopropyl alcohol, and THF. Normal phase solvents such as dichloromethane and hexane may also be used.

> ☑ ***Note***
>
> Solvents with higher boiling points will generally result in more baseline noise. These should be used in limited percentages or at a lower flowrate.

3.5.3 Buffer Compatibility

The 1300 ELSD is not compatible with mobile phase modifiers that are not volatile, such as salts. Some modifiers are volatile and can be used. These include, but are not limited to, acetic acid, trifluoroacetic aid (TFA), formic acid, triethylamine, and ammonia. The concentration of buffer in the mobile phase should be as low as possible.

3.5.4 Column Pre-Treatment

Chromatographic columns may introduce particles into the mobile phase which may lead to increased noise and blocked fluid paths. It is recommended that the chromatographic column be flushed with at least 10 column volumes before it is connected to the 1300 ELSD.

3.5.5 QC Test Conditions

Please refer to the QC report in *Installation Qualification Checklists* on page 2-3 for the exact conditions used to test your 1300 ELSD. The general conditions are:

- 1.0 ml/min of 50/50 Water/Methanol
- Spray chamber 30 °C
- Drift tube 60 °C
- Filter 0
- Injected Standard: 1000 ng Sodium Benzoate in water

SofTA 1300 ELSD

Appendix A Speciations

A.1 Specifications

Dimensions	13.8” W x 17.2” D x 6.3” H
Weight	46 lbs
Display	2 Line x 20 Character per line VFD
User Interface	Six multi-function keys or Computer control via Agilent ChemStation or DataApex Clarity
Evaporative Zone Temperature	Ambient to 120 °C
Thermo-Split™ Chamber Temperature	10 °C to 60 °C
Liquid Flow Rate	0.2 ml/min to 5 ml/min
Gas Requirements	65 ± 5 psi Nitrogen or other inert gas
Gas Consumption	~ 3 SLPM
Operating Conditions	Intended for indoor use only, 15 °C to 29 °C and <90% R.H. non condensing
Electrical Requirements	Nominal 120 VAC, 50/60 Hz or Nominal 240 VAC, 50/60 Hz; 600 watts
Wetted Materials	Stainless steel, glass, anodized aluminum, PTFE
Light Source	670 nm Laser Diode, <5 mW
Detector	Hermetically sealed photo-diode/ operational amplifier
Output Signal	0 - 1 VDC
Interface	RS232, Contact Closure, Software Driver

产品中有毒有害物质或元素的名称及含量

Name and amount of Hazardous Substances or Elements in the product

部件名称 Component Name	有毒有害物质或元素 Hazardous Substances or Elements					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二联苯 (PBDE)
液晶显示 LCD Display (none on RF4X)	O	O	O	O	O	O
线路板 Circuit boards	X	O	O	O	O	O
接线 Wiring	O	O	O	O	X	O
内部电缆 Internal Cables	O	O	O	O	X	O
主电源线 Line Cord	O	O	O	O	X	O
步进电机 Stepper Motor	X	O	O	O	X	O
氘气灯 Deuterium lamp	O	O	X	O	O	O
阀体 Valve Body	O	O	O	O	X	O

产品中有毒有害物质或元素的名称及含量：Name and amount of Hazardous Substances or Elements in the product

O: 表示该有毒有害物质在该部件所有均质材料中的含量均在ST/ 标准规定的限量要求以下。

O: Represent the concentration of the hazardous substance in this component's any homogeneous pieces is lower than the ST/ standard limitation.

X：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出ST/ 标准规定的限量要求。

(企业可在此处，根据实际情况对上表中打"X" 的技术原因进行进一步说明。)

X: Represent the concentration of the hazardous substance in this component's at least one homogeneous piece is higher than the ST/ standard limitation.

(Manufacturer may give technical reasons to the "X"marks)

环保使用期由经验确定。

The Environmentally Friendly Use Period (EFUP) was determined through experience.

生产日期被编码在系列号码中。前三位数字为生产年(207 代表2007年) 。随后的一个字母代表月份：A为一月，B为二月，等等。

The date of Manufacture is in code within the serial number. The first three numbers are the year of manufacture (207 is year 2007) followed by a letter for the month. "A" is January, "B" is February and so on.

Teledyne Isco One Year Limited Factory Service Warranty*

This warranty exclusively covers Teledyne Isco instruments, providing a one-year limited warranty covering parts and labor.

Any instrument that fails during the warranty period due to faulty parts or workmanship will be repaired at the factory at no charge to the customer. Teledyne Isco's exclusive liability is limited to repair or replacement of defective instruments. Teledyne Isco is not liable for consequential damages.

Teledyne Isco will pay surface transportation charges both ways within the 48 contiguous United States if the instrument proves to be defective within 30 days of shipment. Throughout the remainder of the warranty period, the customer will pay to return the instrument to Teledyne Isco, and Teledyne Isco will pay surface transportation to return the repaired instrument to the customer. Teledyne Isco will not pay air freight or customer's packing and crating charges. This warranty does not cover loss, damage, or defects resulting from transportation between the customer's facility and the repair facility.

The warranty for any instrument is the one in effect on date of shipment. The warranty period begins on the shipping date, unless Teledyne Isco agrees in writing to a different date.

Excluded from this warranty are normal wear; expendable items such as charts, ribbon, lamps, tubing, and glassware; fittings and wetted parts of valves; and damage due to corrosion, misuse, accident, or lack of proper maintenance. This warranty does not cover products not sold under the Teledyne Isco trademark or for which any other warranty is specifically stated.

No item may be returned for warranty service without a return authorization number issued by Teledyne Isco.

This warranty is expressly in lieu of all other warranties and obligations and Teledyne Isco specifically disclaims any warranty of merchantability or fitness for a particular purpose.

The warrantor is Teledyne Isco, 4700 Superior, Lincoln, NE 68504, U.S.A.

*** This warranty applies to the USA and countries where Teledyne Isco does not have an authorized dealer. Customers in countries outside the USA, where Teledyne Isco has an authorized dealer, should contact their Teledyne Isco dealer for warranty service.**

Before returning any instrument for repair, please call, fax, or e-mail the Teledyne Isco Service Department for instructions. Many problems can often be diagnosed and corrected over the phone, or by e-mail, without returning the instrument to the factory.

Instruments needing factory repair should be packed carefully, and shipped to the attention of the service department. Small, non-fragile items can be sent by insured parcel post. **PLEASE BE SURE TO ENCLOSE A NOTE EXPLAINING THE PROBLEM.**

Shipping Address:	Teledyne Isco - Attention Repair Service 4700 Superior Street Lincoln, NE 68504 USA
Mailing Address:	Teledyne Isco PO Box 82531 Lincoln, NE 68501 USA
Phone:	Repair service: (800) 775-2965 (lab instruments) (866) 298-6174 (samplers & flow meters) Sales & General Information: (800) 228-4373 (USA & Canada)
Fax:	(402) 465-3001
Email:	IscoService@teledyne.com

February 28, 2012 P/N 60-1002-040 Rev G

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