# SEDEX LT-ELSD™

## THE RESULT OF 20 YEARS OF EVOLUTION


SEDEX LT-ELSD™

*Low Temperature*
*Evaporative Light Scattering Detectors*

SEDERE

SENSITIVITY
FLEXIBILITY
EXPERIENCE

SENSITIVITY

FLEXIBILITY

EXPERIENCE

# A BETTER WAY TO GET MORE FROM HPLC AND LC/MS ANALYSIS

## Introduction to SEDEX DETECTORS

SEDERE develops, manufactures, distributes and supports SEDEX detectors, the most complete product line dedicated to LT-ELSD™. As one of the originators of LT-ELSD, SEDERE remains exclusively focused on this technology as a core competency.

As the industry leader, SEDERE leverages decades of experience and customer knowledge to continually raise the bar for sensitive detector performance in chromatography laboratories.

To keep up with evolving user needs, SEDERE has added two new detectors, the SEDEX Models 80LT and 85LT. The unparalleled selection of LT-ELSD detection systems can match performance requirements and budgets for all chromatography applications.

## The challenges for sensitive, complete LT-ELSD™ require specialized design and knowledge of HPLC APPLICATIONS

### FEATURES

- Applicable to semi-volatile and thermo-sensitive compounds
- Lowest background noise to provide excellent S/N ratio
- Optimization of peak shape and peak width
- Consistency of operating protocols
- Compatibility of nebulization with any HPLC protocol
- Prevent contamination of critical detector components
- User friendly, low maintenance system
- Integrate readily with HPLC software

### SEDEX TECHNOLOGY

- The strength of the real Low Temperature technology
- An enhanced digital signal processing
- Nebulizer design and data rate up to 100Hz
- Complete, efficient and reliable information and SOPs
- Four nebulizers to cover a complete range of flow-rates
- Safety features, patented Gas Supported Focusing (GSF™)
- Plug-and-play detector, power-down methods
- RS 232

*Only SEDEX meets all the challenges.*

## POWER HPLC WITH ENRICHED DETECTION

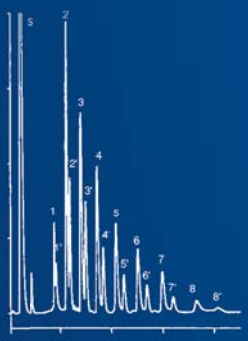
### The Reasons to Adopt LT-ELSD™

- Provides an essentially universal measurement ***not*** dependent on a compound's:
  - Absorbance
  - Electroactivity
  - Fluorescence
  - Radioactivity etc.
- Provides mass detector capability
- Minimizes volatilization of compounds through Low Temperature evaporation
- Allows gradient elution
- Permits a wide choice of volatile buffers
- Works with underivatized compounds
- Surpasses RI sensitivity by orders of magnitude

### Specifically, it is a Technology Solution

for detecting many compounds critical to pharmaceutical products[1]:

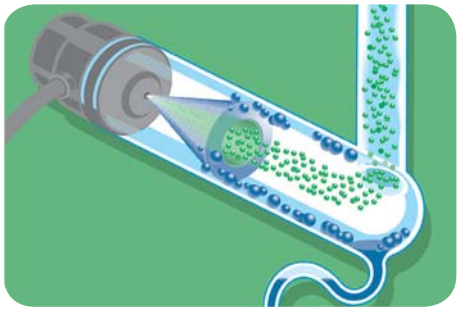
- Phospholipids, amino acids
- Polysorbates
- Polyethylene glycols (PEGs)
- Stearic, oleic, citric, tartaric acids
- Corn oil, castor oil, coconut oil
- Carbohydrates

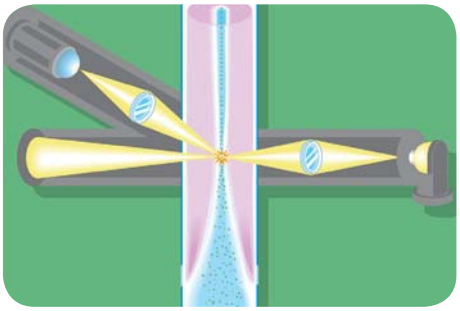


*Carrageenan Analysis by LT-ELSD™*

**LT-ELSD™ PREVENTS YOU FROM MISSING COMPOUNDS "INVISIBLE" TO UV/VIS DETECTORS.**

# THREE STAGES OF SEDEX LT-ELSD EACH OPTIMIZED FOR HIGH PERFORMANCE DETECTION





## 1 Nebulize Eluent and Select Small Droplets to minimize background noise

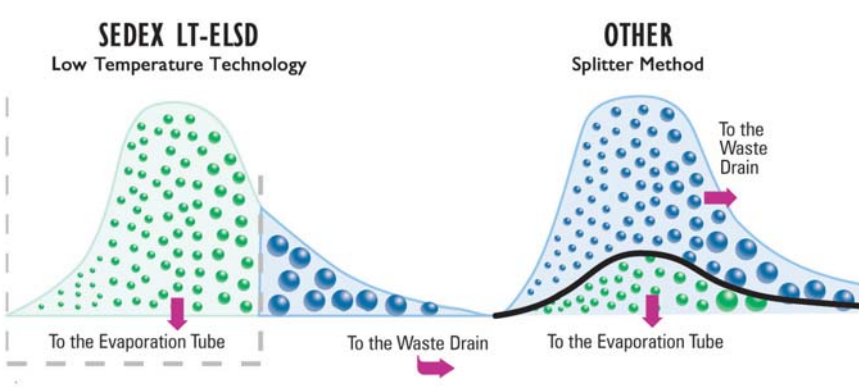
The eluent from the HPLC column is transformed into a fine mist of droplets, using the nebulizer. The SEDEX LT technology allows the selection of droplets as a function of their size in order to prevent larger droplets from entering the evaporation (drift) tube. Large droplets are responsible for increased background noise, as they are more difficult to evaporate. This selection of droplets enables detection using a very low evaporation temperature, with resulting low baseline noise and excellent sensitivity to solutes, even those which are semi-volatile.

## 2 Evaporate at Low Temperature every time so you won't miss any compound

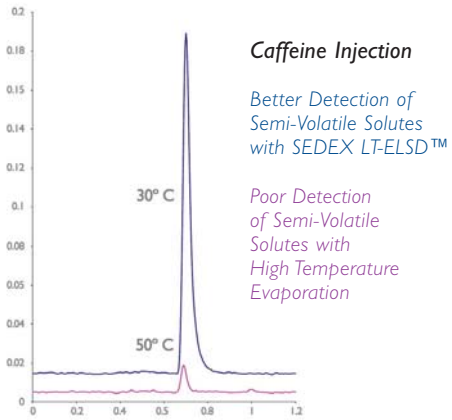
Solute molecules are obtained from the mist using a heated evaporation (drift) tube, using the Low Temperature technology. All SEDEX detectors are designed to evaporate high boiling mobile phases (e.g. those with high aqueous concentration) at very low temperatures. This unique low temperature provided in the standard operating mode minimizes the potential for thermal decomposition of the compound of interest, and makes the SEDEX method a more reliable way to detect everything in the sample.

## 3 Detect Light Scattering using Patented Gas Supported Focusing (GSF™) for less maintenance and better data

The solute molecules from the mist, assisted by Gas Supported Focusing (GSF), pass through an optical head designed to measure light scattering. Gas supported focusing (GSF) involves the addition of gas to focus the solute particles within the optical head for enhanced detection. The magnitude of resulting scattered light is related to the concentration of the compounds in the sample (i.e. mass). The optical head is also protected from contamination by the gas surrounding the solute particles.




- *SEDEX LT-ELSD™ eliminates large droplets to significantly lower baseline noise.*
- *The quantity of droplets evaporated is greater with LT-ELSD than with other detectors using splitter methods, providing enhanced sensitivity.*




*The SEDEX Low Temperature technology is the key to significantly better sensitivity than other ELSD systems that may use splitters or require high temperature to reduce noise.*

SENSITIVITY

FLEXIBILITY

EXPERIENCE

# SEDEX: MORE QUALITY, MORE OPTIONS

*SEDEX 80LT*

## Introducing the Visually Enhanced series with SEDEX 80 LT-ELSD™, the New Standard

SEDEX 80 LT-ELSD™ combines high sensitivity, reliability and accuracy for your analyses, using the thanks to unrivalled SEDEX Low Temperature technology. This detector presents a new **Visually Enhanced** design and a number of outstanding innovations providing the best optical and electronic benefits at a **very competitive price**.

Two different nebulizers are available to optimize sensitvity and resolution at HPLC flow rates from 100µL/min to 5mL/min.

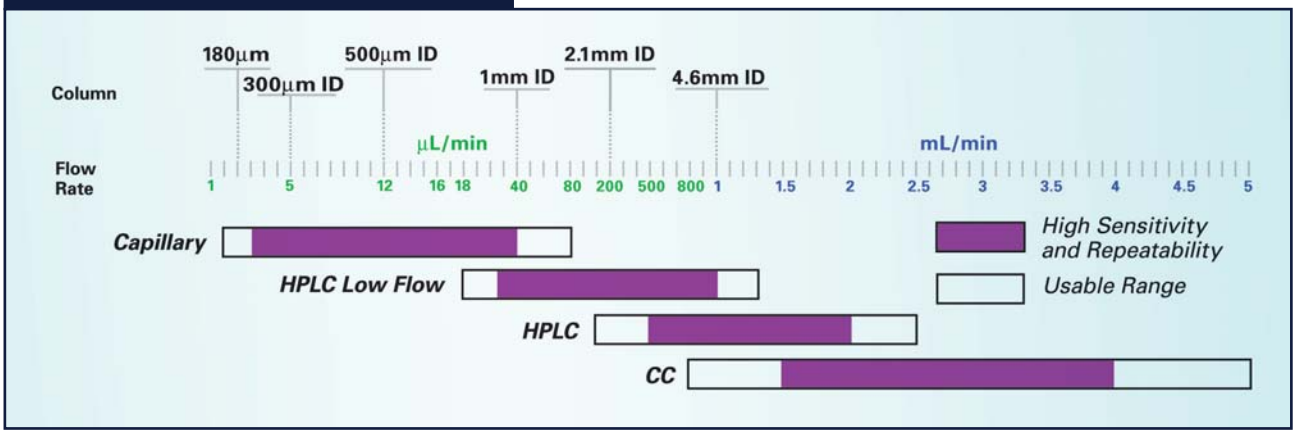
The SEDEX 80 LT-ELSD™ is user-friendly and meets the requirements of any HPLC system and application. In addition, the detector features programmable power-down methods and optimized controls.


*SEDEX 75LT*

## SEDEX 75 LT-ELSD™, the Reference Detector

- More than 2000 Sedex 75 are employed in the field today.
- Includes Low Temperature technology and patented GSF™ (Gas Supported Focusing).
- Four specific nebulizers are available to optimize sensitivity and resolution at HPLC flow rates from 5µL/min to 5mL/min.
- Easy to use and compatible with all HPLC systems.

## SEDEX NEBULIZER OPTIONS



# FLEXIBILITY

## Introducing the Visually Enhanced series with SEDEX 85 LT-ELSD™, the State-of-the-Art

The new **Visually Enhanced** SEDEX 85 LT-ELSD™ employs the most advanced technology to provide the highest sensitivity, efficiency and reproducibility of all ELS detectors in the market. This powerful and versatile instrument can be used with any conventional HPLC, from micro to preparative, due to the use of four specific nebulisers. In addition, it is optimized to meet the requirements of ultra fast liquid chromatography including Ultra High Performance Liquid Chromatography **(U-HPLC)**, High Temperature Liquid Chromatography **(HTLC)** and **µ-HTLC**. For µ-HTLC, a patented cell has been designed to provide the lowest dispersion and the best peak shape. As an example of the power of the system, the SEDEX 85 can measure **sub-one second** peak widths with data rate up to 100Hz.

As a true mass detector, calibration using SEDEX 85 LT-ELSD™ is straightforward and consistent in responses with variations below 10% between compounds having identical concentrations and belonging to the same chemical class. In addition, linearity over 3 orders of magnitude can be easily achieved using the log-log coordinates of the general equation $A=a.m^b$. Other equations such as second-order or third-order polynomial equations can also provide excellent quantitative results with correlation coefficients nearly equal to 1.

*SEDEX 85LT*

## THE OPTIMIZED PERFORMANCE OF SEDEX 85

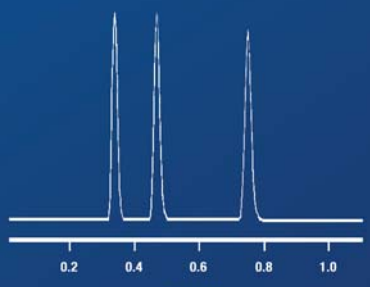
### FEATURES

- Improved optical head design
- Digital signal processing
- Data rate 100Hz
- Software controlled
- Option of four interchangeable nebulizers
- Visual enhancement

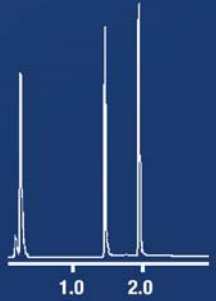
### BENEFITS

- Lowest limits of detection: **100pg** level sensitivity
- Contamination free
- Minimizes peak broadening, improves Signal/Noise ratio
- Allows **sub-one second** peak width
- Provides full remote control including gain programming
- Integrable in any HPLC software method, GLP compliant
- Assures synergy with HPLC methods improves sensitivity, peak efficiency and peak symmetry
- Controls visually nebulization

**U-HPLC: Paraben Analysis**




**HTLC: Acetamidophenol, Hydroxydibenzofuran, tert-Butylphenoxybenzaldehyde**




**Minutes**

**Column oven temperature:** 80°C

SENSITIVITY

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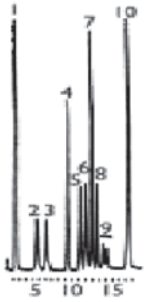
# CASE STUDIES:

## CASE 1
### PHOSPHOLIPIDS[2]

LT-ELSD™ solves the major problems common to other HPLC detectors: lack of sensitivity, incompatibility with multi-solvent gradients… This state-of-the-art technique is ideally suited to non-chromophoric compounds, such as lipids and phospholipids, which have a low extinction coefficient.

LT-ELSD™ is also highly useful where the mobile phase contains a chromophore, which blanks out the UV detector.

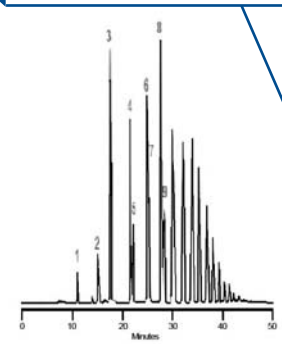
**Column:** Lichrospher™ Si 60, 5µm
**Injected Sample:** 3µg quantity, Phospholipids
**Eluent:** $CHCl_3$/MeOH/$H_2O$/30%$NH_3$
**Gradient:** 60/34/5.5/0.5 to 80/19.5/0.5/0.0 in 14 min then hold for 10 min
**Flow Rate:** 1mL/min




| | |
|---|---|
| 1. Apolar lipids | |
| 2. CR Cerebroside - Not hydroxylated | |
| 3. CROH Cerebroside - Hydroxylated | |
| 4. PE Phosphatidyl ethanolamine | |
| 5. PI Phosphatidyl inositol | |
| 6. PS Phosphatidyl serine | |
| 7. PC Phosphatidyl choline | |
| 8. PA Phosphatidic acid | |
| 9. Sph Sphingomyeline | |
| 10. LPC Lysophosphatidyl choline | |

## CASE 2
### MONO AND OLIGOSACCHARIDES

Unlike RI Detection, LT-ELSD™ allows gradient elution. Gradient elution provides increased resolution of sugars in minimal time, impossible with RI and isocratic elution. Moreover, lower detectable limits (sensitivity) can improve by orders of magnitude. Nanomole and picomole detectability are obtained with the improved sensitivity of LT-ELSD™. In spite of a complex matrix, these mono and oligosaccharides are easily and rapidly characterized by gradient HPLC with LT-ELSD™. Previously, RI detection entailed slow and tedious programmed flow, often up to several hours. LT-ELSD™ also enables analysis of high "DPs" which is an important advantage.

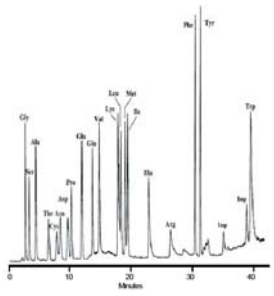



**Column:** Premier Carbohydrate, 5µm, 250x4.6mm
**Injected Sample:** Extract from minced onions
**Eluent:** - A: MeCN
- B: Water + 0.0004N $NH_4OH$
**Gradient:** From 60 to 65% B in 15 min
**Flow Rate:** 1mL/min

| | |
|---|---|
| 1. Fructose | 6. Nystose |
| 2. Glucose | 7. DP4 |
| 3. Sucrose | 8. Fructofuranosyl-D-nystose |
| 4. DP3 | 9. DP5 |
| 5. Kestose | |

## CASE 3
### UNDERIVATIZED AMINO ACIDS[3]

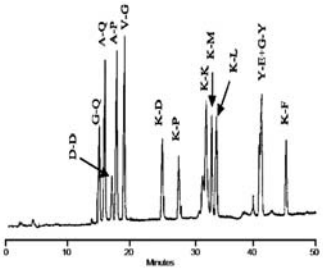
Analysis of amino acids has typically been complicated by the absence of adequate visible or ultraviolet chromophores in naturally occurring amino acids. Using LT-ELSD™, sensitivity is excellent with detection limits as low as 200 picomoles. In this study, twenty protein amino acids have been separated and quantified within 40min without any sample preparation step for derivatization.




**Column:** Hypercarb™ S, 5µm, 100x2.1mm
**Injected Sample:** Mixture of 20 underivatized amino acids
**Eluent:** - A: Water + NFPA 20mM
- B: MeCN
**Gradient:** 0 to 15% B in 10 min, 15 to 26% B in 10 min, 26 to 50% B in 10 min
**Flow Rate:** 0.2mL/min

## CASE 4
### UNDERIVATIZED PEPTIDES[4]

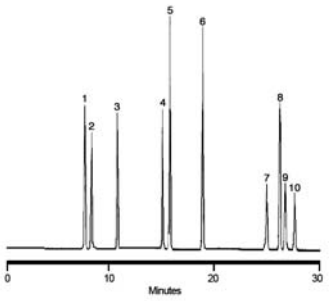
In peptide "mapping", where gradient elution is required, LT-ELSD™ has a key advantage over UV detection: its baseline is unperturbed by the mobile phase change during the gradient, and remains flat. As a mass detector, LT-ELSD™ can also provide a material balance purity analysis. Degradation products are often lacking of the chromophores that were initially present in the original compounds, and do not allow purity evaluation using a UV detector.




**Column:** Hypercarb™ S, 5µm, 100x2.1mm
**Injected Sample:** Mixture of 13 peptides
**Eluent:** - A: Water + NFPA 20mM
- B: MeCN
**Gradient:** 0 to 50% B in 60 min
**Flow Rate:** 0.2mL/min

## CASE 5
### NATURAL PRODUCTS[5]

Many natural products such as herbal drugs are gaining more and more interest in the pharmaceutical and nutraceutical industry because they contain bioactive compounds. Some of these compounds such as saponins and terpenes do not possess any chromophore and therefore cannot be analyzed in HPLC using a UV detector. LT-ELSD™ can detect chromophoric and non-chromophoric molecules in a single gradient HPLC analysis with an excellent sensitivity, thanks to the true Low Temperature technology. This example shows a validated method for a simultaneous determination of isoflavones and saponins in soybean.

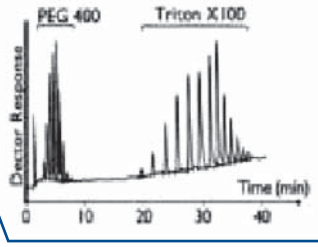



**Column:** Hypersil C18, 5 µm, 150x4.6mm
**Injected Sample:** Soybean extract
**Eluent:** - A: H2O + 0.025% TFA
- B: MeCN + 0.025% TFA
**Gradient:** 85:15 to 60:40 in 15 min
and 60:40 to 45:55 in 20 min
**Flow Rate:** 1.0mL/min

| |
|---|
| 1 to 6. Isoflavones |
| 7 to 10. Saponins |

## CASE 6
### POLYETHYLENE GLYCOL AND TRITON

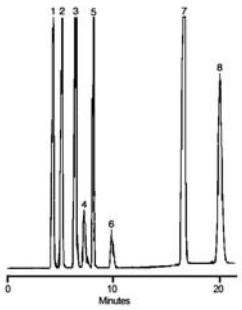
The high sensitivity and time saving potential of LT-ELSD™ are evident in the HPLC/LT-ELSD™ analysis of two polymer mixtures in a single run; this is not feasible with competing detections such as RI, UV and MS.




**Column:** Hypercarb™ S, 7 µm, 100x4.6mm
**Injected Sample:** Mixture containing PEG400 and Triton X100
**Eluent:** $H_2O$ / MeCN / $CH_2Cl_2$
**Gradient:** From 80:20:0 to 0:100:0 in 15 min
From 0:100:0 to 0:20:80 in 25 min
**Flow Rate:** 1mL/min

## CASE 7
### INORGANIC IONS

LT-ELSD™ can dramatically simplify the analysis of ions in aqueous samples. A broad range of volatile buffers can be used to separate the ions[6]. Since the mobile phase and buffers are vaporized before the ions are detected, the need for ion suppression is eliminated. This example shows an outstanding patented method[7] to determine immediately and simultaneously cations and anions in a mineral water.

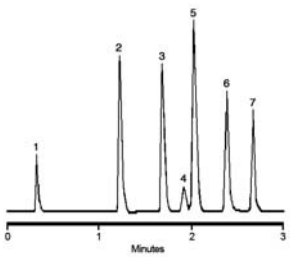



**Column:** Hypercarb™ , 7 µm, 100x4.6mm,
+ Lichrosil IC CA, 5 µm, 100x4.6mm
**Injected Sample:** Mineral water
**Eluent:** - A: $H_2O$
- B: HCOOH 100mM / $NH_4OH$ 60mM, pH : 3.71
**Gradient:** 25%B during 7 min,
from 25 to 100%B in 8 min
**Flow Rate:** 0.8mL/min

| | |
|---|---|
| 1. unknown | 5. $K^+$ |
| 2. $Cl^-$ | 6. $NO_3^-$ |
| 3. $Na^+$ | 7. $Mg^{2+}$ |
| 4. $SO_4^{2-}$ | 8. $Ca^{2+}$ |

## CASE 8
### U-HPLC/ELSD[8]

The pharmaceutical discovery environment requires an increasing number of rapid high throughput methods such as U-HPLC to determine the identity, purity and quantity of small molecules. In this regard, the powerful and versatile LT-ELSD™ is the detector of choice because of its universality, highest sensitivity and optimized technology which provides the smallest peak widths, the best symmetry and the highest data rate. This example shows an application which combines an ultra fast liquid chromatography system with LT-ELSD™, to determine the non-chromophoric artemisinine and derivatives used as antimalaric drugs.




**Column:** Acquity C18, 1.7 µm, 30x2.1mm
**Injected Sample:** Artemisinine and derivatives
**Eluent:** $H_2O$ / MeCN / TFA 38:60:2
**Flow Rate:** 0.4mL/min

| |
|---|
| 1. unknown |
| 2 to 7. Artemisinine (6) and derivatives |

| SPECIFICATIONS | SEDEX 75LT | SEDEX 80LT | SEDEX 85LT |
|---|---|---|---|
| **COMPONENTS** | | | |
| Detection | Photomultiplier (PMT) | Photomultiplier (PMT) | Photomultiplier (PMT) |
| Light Source | Halogen Lamp | LED (470nm)<br>Elapsed Time Counter | LED (470nm)<br>Elapsed Time Counter<br>Normalization |
| Temperature Range | Ambient - 100°C | Ambient - 100°C | Ambient - 100°C |
| Nebulizer | 4 options: Capillary,<br>Low Flow, HPLC, CC | 2 options: HPLC, CC | 4 options: Capillary,<br>Low Flow, HPLC, CC |
| Eluent Flow Rate | 5µL/min - 5mL/min | 100µL/min - 5mL/min | 5µL/min - 5mL/min |
| **DATA** | | | |
| Analog Output | 0 - 1V | 0 - 1V | 0 - 1V |
| Gain Settings | $2^{11}$ (2048) | $2^{11}$ (2048) | $2^{11}$ (2048) |
| Filter | Time Constant<br>(None, Medium, High) | Moving Average (0 - 10s) | Moving Average (0 - 10s) |
| Data Rate | N/A | 40Hz | 100Hz |
| **COMMUNICATION** | | | |
| Selection & Display | Liquid Cristal Display and Keypad<br>Windows based PC control | Liquid Cristal Display and Keypad | Liquid Cristal Display and Keypad<br>Windows based PC control |
| Event | Contact closure for auto-zero | Contact closure for ready, auto-zero | Contact closure for ready, auto-zero |
| Power-down Methods | N/A | Shut-off: Gas, LED, Heating and/or PMT<br>Cleaning Mode | Shut-off: Gas, LED, Heating and/or PMT<br>Cleaning Mode |
| Computer Interface | RS232 | RS232 | RS232 |
| Software | Option | Option | Bundled - Control of all the parameters<br>(Windows 9x, NT, 2000, XP) |
| GLP Compliance | - | - | Audit trail - Password - Admin. mode |
| **EXTERNAL REQUIREMENTS** | | | |
| Power | 115V/60Hz, 1.5A<br>230V/50Hz, 1.7A | 115V/60Hz, 1.8A<br>230V/50Hz, 1.7A | 115V/60Hz, 1.8A<br>230V/50Hz, 1.7A |
| Gas Pressure (Nitrogen or Air) | 3.5 bars (51psi) | 3.5 bars (51psi) | 3.5 bars (51psi) |
| Dimensions | 360mm (14.1") W<br>504mm (19.8") H<br>500mm (19.7") D | 250mm (10") W<br>480mm (18") H<br>550mm (22") D | 250mm (10") W<br>480mm (18") H<br>550mm (22") D |
| Weight | 20Kg (44lbs) | 18.5Kg (40lbs) | 18.5Kg (40lbs) |

## SEDERE is committed to user satisfaction with every SEDEX Detector, and supports you with :

- On-site installation and user training
- Full SOPs (Standard Operating Procedures) including IQ, OQ, PQ
- Formal Operational Qualification
- Technical and applications support
- Web-access to applications in many fields
- User seminars, on and off-site
- Flexible service contract options
- Easy-to-order spare parts and accessories
- Nebulizer options for a wide range of applications
- Web-based software upgrades

SENSITIVITY
FLEXIBILITY
SEDERE EXPERIENCE

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# EXPERIENCE

*"ArQule has been using SEDEX LT-ELSD™ for over five years to fully characterize automated parallel synthesis products. We have worked closely with the manufacturer, SEDERE, to adapt the instruments to the changing needs of high-speed analysis. In our laboratory, each SEDEX detector analyzes tens of thousands of samples every year in a 24/7 operation.*

*The instruments have proven to be robust and reliable in our high throughput environment."*

*– Wolfgang K. Goetzinger, Ph.D.*
*Director of Analytical Chemistry*
*ArQule, Inc.*

## Ordering information

| **SEDEX 85 LT-ELSD™** | Part # |
|---|---|
| HPLC Version 230 V | 85000 |
| HPLC Version 115V | 85001 |
| LF Version 230V | 85300 |
| LF Version 115V | 85301 |
| CC Version 230 V | 85400 |
| CC Version 115 V | 85401 |
| Capillary Version 230 V | 85600 |
| Capillary Version 115 V | 85601 |

| **SEDEX 80 LT-ELSD™** | Part # |
|---|---|
| HPLC Version 230V | 80000 |
| HPLC Version 115V | 80001 |
| CC Version 230V | 80400 |
| CC Version 115V | 80401 |

| **ACCESSORIES** | Part # |
|---|---|
| Gas regulator with 0.01µm filter and manometer | 45100 |
| TTL to CC converter | 85080 |
| Nitrogen generator | 30100 |

| **SEDEX 75 LT-ELSD™** | Part # |
|---|---|
| HPLC Version 230 V | 75000 |
| HPLC Version 115V | 75001 |
| LF Version 230V | 75300 |
| LF Version 115V | 75301 |
| CC Version 230 V | 75400 |
| CC Version 115 V | 75401 |
| Capillary Version 230 V | 75600 |
| Capillary Version 115 V | 75601 |
| HPLC/SFC Version 230 V | 75200 |
| HPLC/SFC Version 115 V | 75201 |

| **SEDEX 754 LT-ELSD** | Part # |
|---|---|
| Multichannel Version 230 V | 754000-220 |
| Multichannel Version 115 V | 754000-115 |

# EXPERIENCE

## SEDEX LT-ELSD™

### An Industry Standard for Low Temperature Evaporative Light Scattering Detection

The arrival of the Ultra Fast HPLC has fueled the demand for technology capable of both qualitative and quantitative analysis of complex mixtures at high speed. SEDEX LT-ELSD™ technology has been validated by extensive applications within the drug discovery, pharmaceutical and nutraceutical industries. SEDEX detectors are used in every major pharmaceutical company and in hundreds of biotechnology laboratories in industry and universities.

For many research and process requirements, complementary detection by SEDEX LT-ELSD™ has proven indispensable to high quality LC/MS and other HPLC procedures. SEDEX LT-ELSD™ is particularly valuable for effective compound library screening, where sample characterization may be incomplete. With other ELSD detectors, volatilization could limit the detection capability of the platform, resulting in loss of vital data.

By combining reliability and sensitivity, SEDEX detectors have taken their place in the armamentarium of excellent techniques for medicinal chemistry.


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