ELSZ-2000 Series

Nano Particle, Zeta Potential & Molecular Weight Analyzer

Expert's Tool for Nanoparticle Characterization

Pioneering The Nanotechnology Frontier -
Advanced Optics Technologies Applied into Particle Size, Zeta Potential, Nano & Molecular Weight

Otsuka

A Faster Route to Great Insight, Achieve More with

Otsuka ELSZ-2000 Series Zeta Potential and Nano Particle Size Analyzer

Overcome the unknown or discover more about your product than ever before.

- High definition analysis with 70 mW of laser power finds small volume aggregates in mixtures.
- Discover true zeta potential with multi-point measurement scans for isoelectric point, formulation constancy and uniformity in colloidal systems. Know, predict and quantify the stability of your product.
- Learn more and save time with the ability to measure within the entire dynamic range of the ELSZ-2000 in a single analysis.

Reach deeper into acquired data to increase yield, optimize process, and find new capabilities.

- Improved sensitivity for increased raw data quality advances results accuracy.
- Avalanche Photodiode Detection (APD) permits high sensitivity detection of even small volume, diluted samples. Let user successfully acquire data in valuable and challenging low volume analyses.
- Generated customized 3D plots to track changes, compare lots or see pH effects. Use acquired data to positively impact your continual process improvement initiatives.

Protect data integrity, secure repeatability and accuracy for high confidence results.

- Exceptional multi-point electrophoretic mobility detection eliminates EOF effects.
- Utilize the intelligent SOP Designer and the preloaded liquid dispersion properties. Spend time understanding data and its impact instead of investing in method tuning and control.
- Broad range of temperature control secures sample integrity with protein and biological samples, keep sample bioactivity intact. Specially engineered analysis cells with parallel electrodes eliminate thermal damage to protein or biological materials.

Next Generation Zeta Potential and Particle Size Analyzer

- Particle and emulsion stability and food stuff
- Dispersion evaluation of nanocarbon material
- Colloidal solution stability in liposome and monoclonal antibody development
- Quantitative determination of oral and injectable suspension stability
- Evaluation of properties of electroconductive polymer (Pharmacokinetic drug delivery studies of nano-emulsion)
- Pigment and ink characterization
- Qualitative and quantitative assessment of nano-cosmetics
- Cosmetic slip casting evaluation and chemical dosing for colloidal stability
- And many more

Get the Most out of Your System with added capabilities

- Higher sensitivity and shorter measure time with new APD
- Melting point and phase transition point analysis enabled by auto-temperature gradient function
- Wide temperature range between 0 and 90°C
- Wide range molecular weight analysis
- Support concentrated sample measurement
- High precision zeta potential analysis thanks to electro-osmosis measurement and plot analysis.
- Supports zeta potential measurement of salt condensed samples.
- Surface zeta potential of smaller area sample.

ELSZ-2000 Series Particle Size & Zeta Potential Analyzer

The ELSZ-2000 series is a unique instrument that utilizes photon correlation spectroscopy and electrophoretic light scattering techniques to determine particle size, zeta potential, and molecular weight. The instrument is compact and easy to use with an extended analysis range, intuitive software, and multiple sample cells to fit the user's application.

The ELSZ-2000 series also features improved sensitivity and reduced analysis time through the upgraded HD-APD (avalanche photo diode).

The instrument is available in three model configurations:

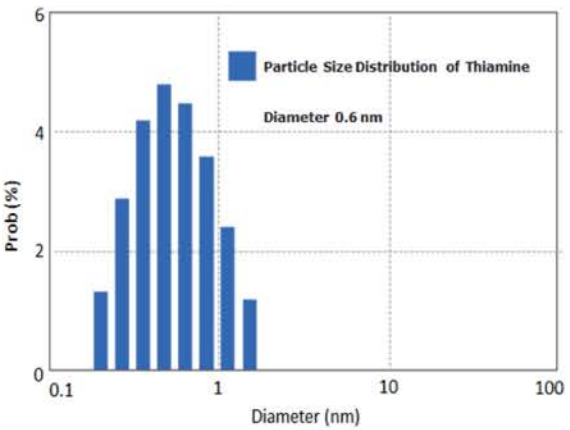
ELSZ-2000S
Nano Particle Sizing & Molecular Weight Measurement Instrument

ELSZ-2000Z
Zeta Potential Measurement Instrument

ELSZ-2000ZS
Nano Particle Sizing, Zeta Potential & Molecular Weight Measurement Instrument

Particle Size

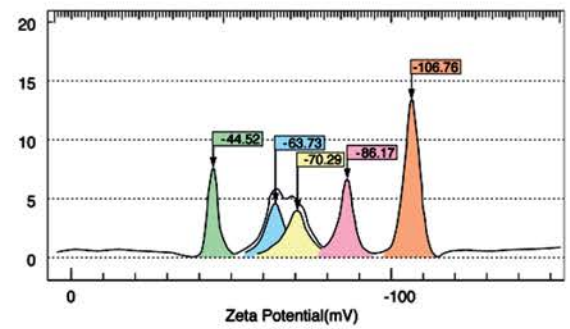
- Measure particle size of samples suspended in liquids in the range of 0.1 nm to 12.3 µm with sample suspension concentrations from 0.00001% to 40%.
- Well-established photon correlation spectroscopy technique conforms to ISO 13321 and ISO 22412.
- Combination of linear and log-scale correlators covers diverse sample characteristics
- Variety of sample cells available



Zeta Potential

- Measures zeta potential of a sample suspension in the range of -1000 mV to +1000 mV (*no practical limit) with concentrations from 0.001% to 40%.
- Reliable measurements based on electrophoretic light scattering technology conforms to ISO 13099-2.
- Accurately characterizes both dilute and concentrated suspensions.
- Capable of measuring the surface charge on solid surfaces, film, etc based on probing particles.

The ELSZ-2000 is capable of obtaining high resolution zeta potential analyses even with multi-component samples. In the example, a mixture of five polystyrene latexes of different particle sizes were measured. Five spectrums corresponding to each latex component was detected. The zeta potential of these components was in the range of -45 mV to -107 mV.



Evaluation of Dispersion Stability by Zeta Potential/Particle Size

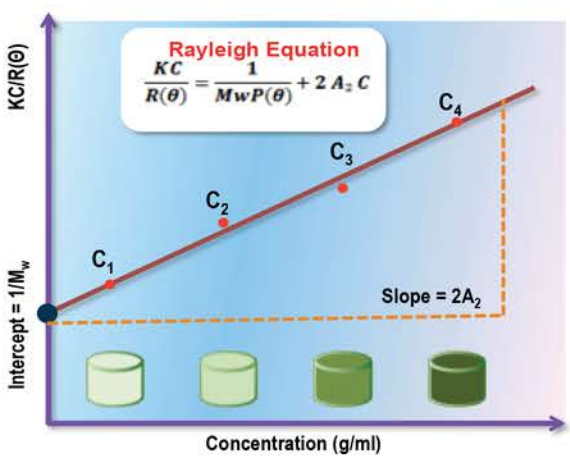
As the absolute value of zeta potential increases, colloidal systems give generally stable dispersion due to electrostatic repulsion between particles. However, as the zeta potential approaches zero, the stability of the dispersion reduces and aggregation becomes likely.

Molecular Weight Determination of Macromolecules with ELSZ-2000:

There are two modes of MW determination of macromolecules provided by the ELSZ2000. The first method is by using dynamic light scattering (DLS) size information with the use of Mark Houwink Sakurada equation and the second method is by using Static Light Scattering techniques (SLS)

The first method uses the diffusion constant obtained from the DLS analysis and by providing two empirical constants associated with the macromolecules–solution under analysis; the molecular weight can be calculated from the Mark Houwink Sakurada equation.

The second method is using Static Light Scattering information in the determination of the molecular weight of any macromolecules in solution. The scattering intensity is a function of the molecular weight and the concentration of the macromolecule solution as described by Rayleigh equation.



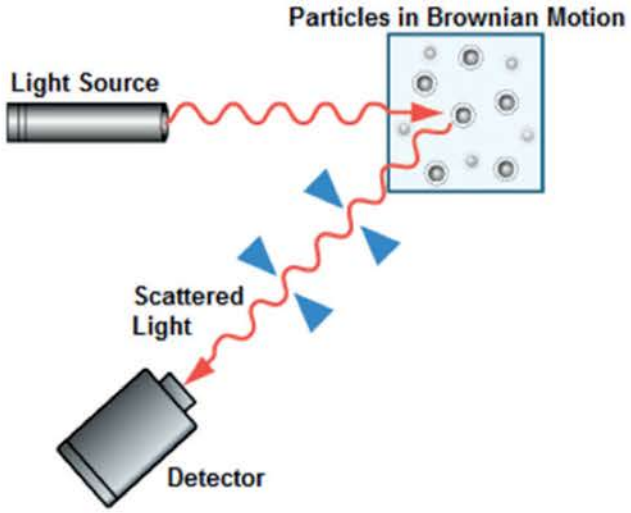
The Scattering intensity of a series of macromolecules solution with known concentrations is being measured. Using a Debye plot, Molecular weight can be calculated by a linear extrapolation line from the Debye Plot.

*Under lab conditions & sample dependent

ELSZ-2000 Series Particle Size & Zeta Potential Analyzer

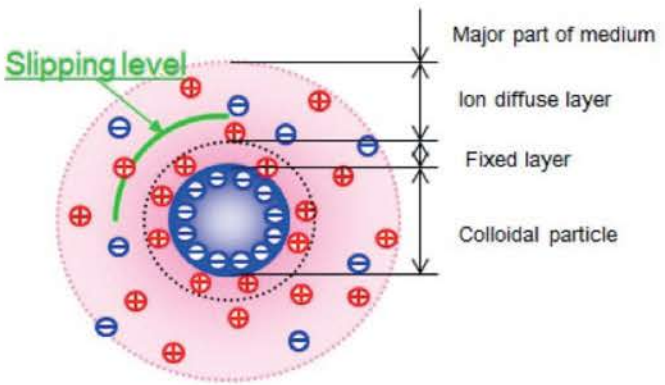
Principle of Particle Sizing

Particulates dispersed in a solution are normally subject to Brownian motion. The motion is slower with larger particles and faster with smaller particles. When laser light illuminates particles under the influence of Brownian motion, scattered light from the particles shows fluctuation corresponding to individual particles. The fluctuation is observed according to the pinhole type photon detection method so that particle size and particle size distributions are calculated.



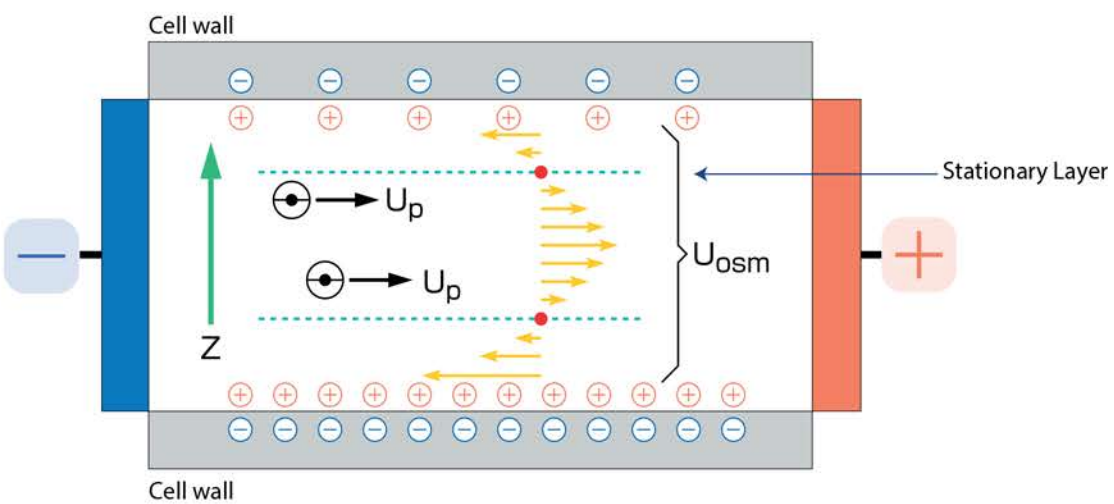
Principle of Zeta Potential

In most cases, colloidal particles possess a positive or negative electrostatic charge. As electrical fields are applied to the particle dispersion, the particles migrate in oppositely charged directions. As particles are irradiated in migration, scattering light causes Doppler shift dependiong on electrophoretic mobility. ELSZ-2000 software calculates the amount of Doppler shift followed by electrophoretic mobility and zeta potential by combining a heterodyne system and photon correlation method to perform Fourier transform of obtained correlation function.



Determination of True Electrophoretic Mobility

When the measurement of electrophoresis is actually taken, an electroosmotic current is generated in the cell due to an electric charge on the cell wall. With a negatively charged on cell wall, the electroosmotic flow phenomenon causes the positively charged ions and particles to gather together by the cell walls. The solution located by the cell walls migrates toward the negative electrode during electrophoresis. The solution located in the cell centre moves in the opposite direction (toward the positive electrode) to compensate for the flow by the cell walls. Therefore, an electroosmotic flow is created during the electrophoresis. The ELSZ-2000 is designed to measure electrophoretic mobility at several points in the cell to obtain a position (i.e. stationary point) not influenced by electroosmotic flow. As a result, the instrument can calculate and accurately measure electrophoretic mobility, even if the electroosmotic profile of the system is asymmetrical due to adsorption or sedimentation of the sample on the cell walls. The Multi-point determination allows for exceptional repeatability and reproducibility.

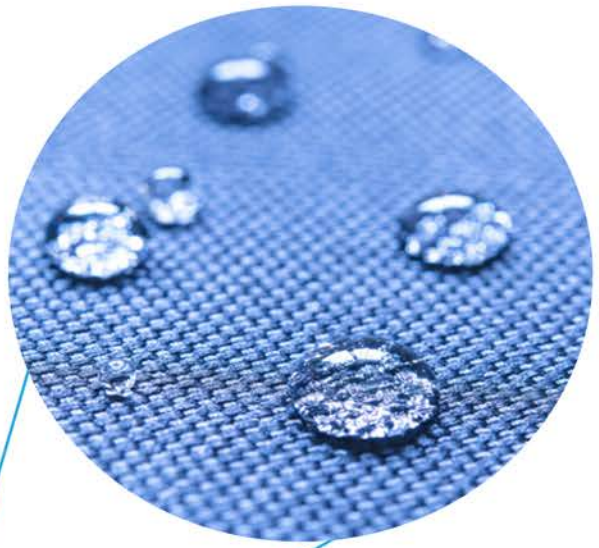


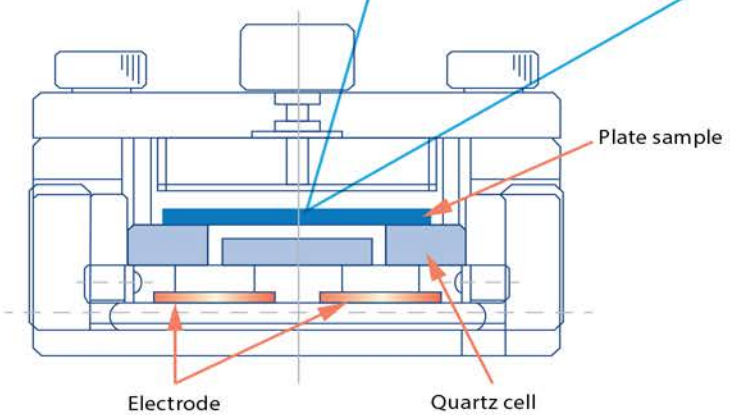
Method to Measure Zeta Potential of Solid Surfaces and FST Method

Evaluation of the Surface Charge of a Solid Sample by Zeta Potential

Novel method to measure the zeta potential of solid surfaces using probing particles.

- Surface charge of solid sample can be evaluated. Determination of electrostatic interactions between particles and flat surfaces
- Easy to use. Large sample size, min: 14 x 33 mm, max: 16 x 37 mm up to 5 mm thickness
- Solid surface modification analysis. Additive effect and particle adhesion. Zeta potential vs. pH/additive volume also available
- Wide sample application. Soft sample-like fibres can be measured





Applications:

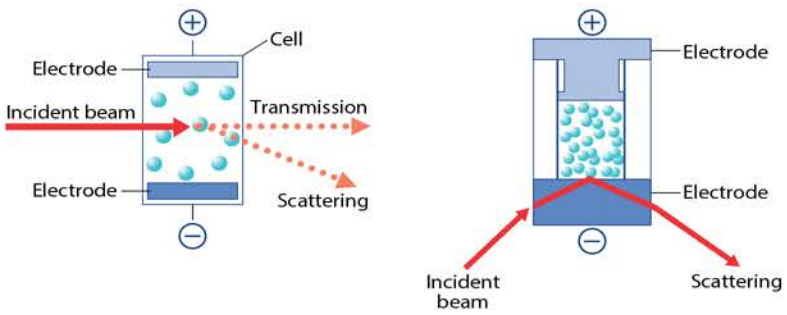
- Fibres and textiles
- Thin films
- Shampoo and conditioner
- Membranes and filters
- Biomedical surfaces
- Semiconductor industry
- Polymer surfaces and coatings
- Optical glass polishing
- Protein adsorptive studies
- Paper and pulp industry
- Antimicrobial surfaces
- Packaging materials
- Recording media
- Printing and paint

Concept of FST Method

By conventional methods, scattered light from a concentrated suspension cannot be measured correctly due to multiple scattering (A) or in very concentrated solutions due to its ability to transmit light. The FST method detects the scattered light from particles through a transparent electrode.

The optical path length is minimized to reduce the effects of multiple scattering. Thus, the ELSZ-2000 can perform a zeta potential measurement of a concentrated suspension with a high degree of accuracy (B).

FST: Electrophoretic mobility measurement of concentrated suspension using Forward Scattering Transparent electrode.



(A) Standard cell

(B) High concentration cell (Patented technology)

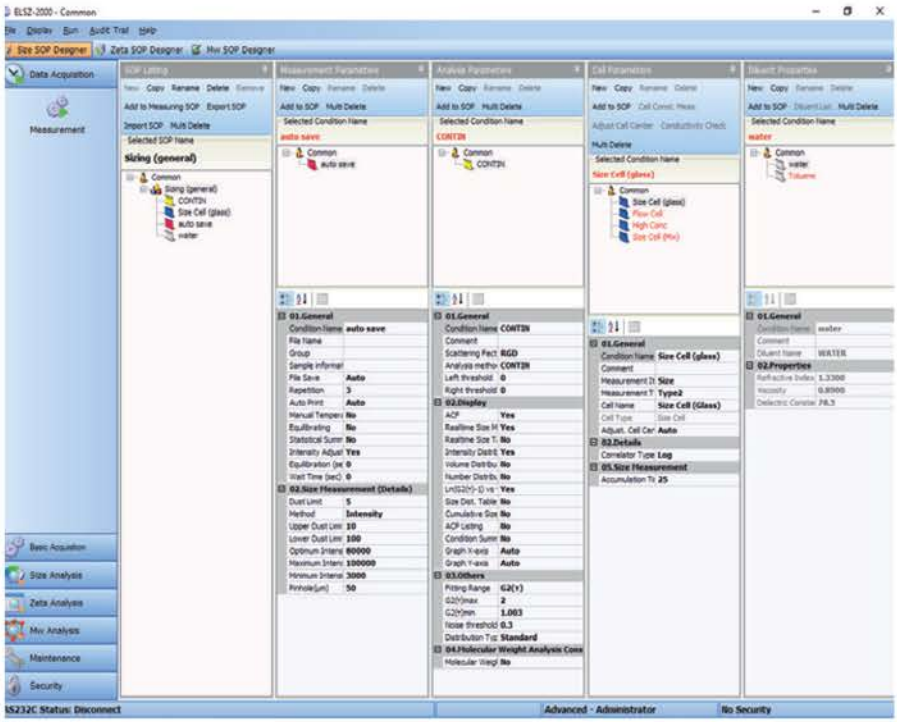
Easy to use Instrument Control, Data Acquisition, and Superior Analysis Results

The ELSZ-2000 Software provides intuitive and powerful instrument control, data acquisition, and data analysis. Our software is designed to enable the user to easily understand instrument control and method development to ensure that your lab productivity is always fully optimized.

SOP Designer

Intelligent and automatic creation of standard operating procedures.

Ensure that you get the best results, regardless of the operator or instrument utilized in an analysis. Our intelligent SOP designer permits you to establish fixed SOPs that generate reproducible and repeatable results time after time. Simply input in the color-coded conditions for measurement, analysis, cell, and diluent conditions. Name and save your SOP, load your sample, and start your analysis.



Configurable Security Levels

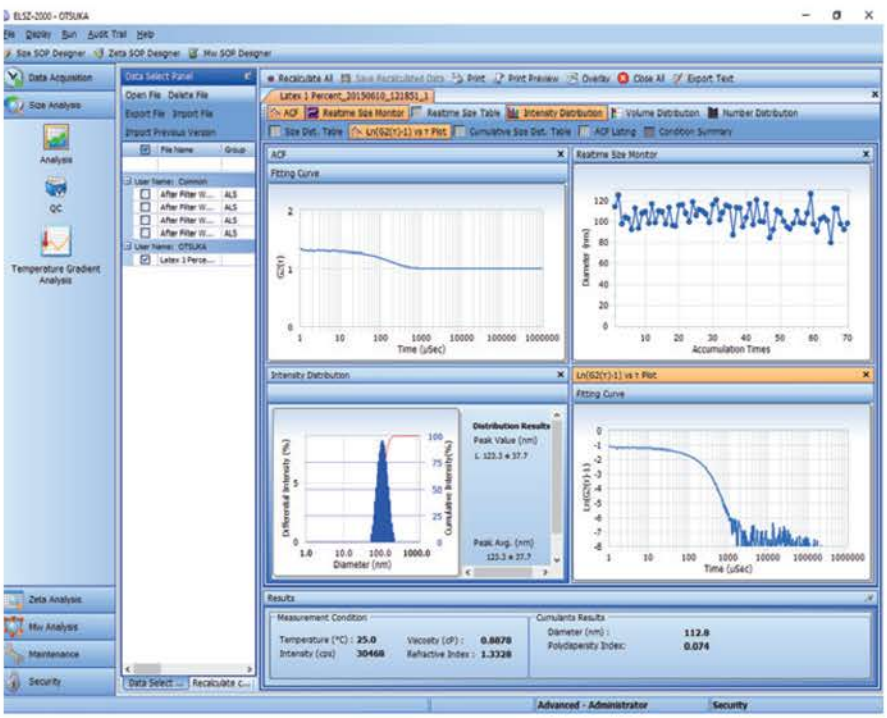
Easily and quickly set up four levels of security for accessing software, data collection, and report generation. Complies with 21 CFR Part 11 requirements.

Easy Data File Back-up

Data back-up is automated. Simply choose the directory, network drive, or wireless data storage device directly from the ELSZ-2000 software. A copy of all data files and SOP parameter files will automatically be backed up at the selected location as soon as it is generated, giving the researcher peace of mind.

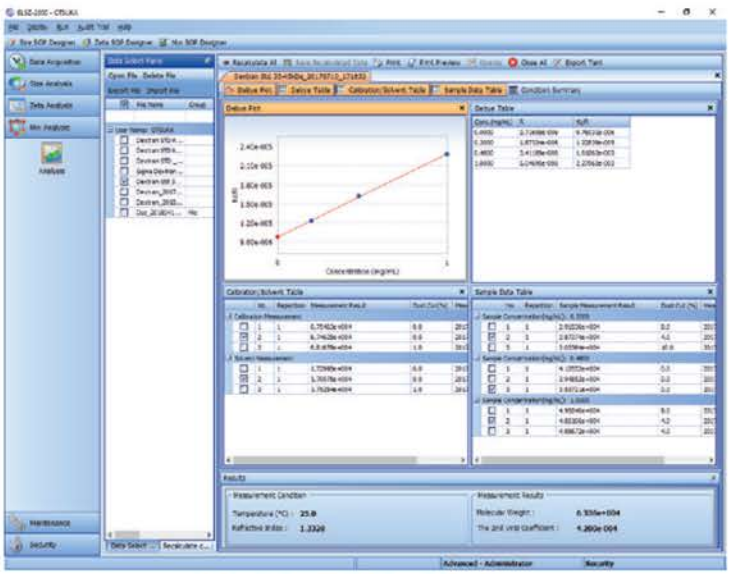
Real-Time Analysis Monitoring

Data is presented in real time during analysis. The screen can be customized to present as many graphs and tables as needed to fully characterize the material in real time. Post analysis data files are easy to find, organize and review.



Particle Size Analysis Results

Easy to use Instrument Control, Data Acquisition, and Superior Analysis Results

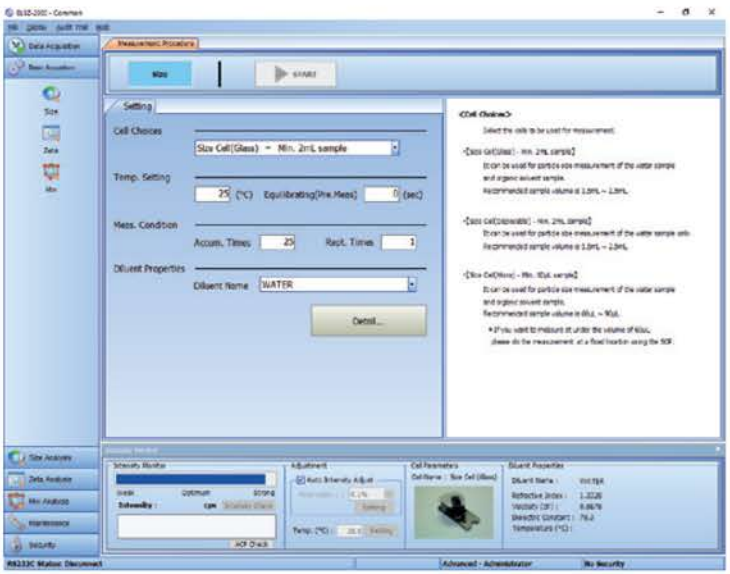


Molecular Weight Analysis Result

Zeta Potential Analysis Result

Pre-loaded, Dispersion Liquid Properties

There is no need to research dispersion liquid properties such as refractive index, viscosity and dielectric constants. The ELSZ-2000 Software comes pre-loaded with all common dispersion liquids and required properties for size and zeta potential analysis, including different temperature variations.



Easy to Use Mode

Accessories

The ELSZ-PT is used to titrate sample suspension in a pH range from 1 to 13. The instrument automatically controls the pH of these suspensions and conducts titrations during both zeta potential or nano particle size analysis measurements.

Features

- Automatic unattended operation
- Automatic determination of isoelectric point
- Software control of the titration and measurement provides automatic control through standard operating procedures
- Automatically generated reports and graphs; plot size and zeta potential versus pH value and additive volume

Optional Sample Cells

Particle Size Sample Cells

Technique	Cell Description	Cell Volume	Scattering Angle	Sample Medium		Sample Concentration
	Standard Cell (in cell holder)	0.90 mL	165° Back Scattering	Aqueous	Some Organic	Dilute/ Concentrated
	Disposable	0.90 mL	165° Back Scattering	Aqueous	Organic	Dilute/ Concentrated
	Glass-Micro Volume	20 µL	165° Back Scattering	Aqueous	Some Organic	Dilute/ Concentrated
	Disposable-Micro Volume	20 µL	165° Back Scattering	Aqueous	Some Organic	Dilute/ Concentrated
	Flow Cell (titration studies)	N/A	165° Back Scattering	Aqueous	Some Organic	Dilute/ Concentrated

Particle Size Sample Cells

Technique	Cell Description	Cell Volume	Scattering Angle	Sample Medium		Sample Concentration
	Standard Flow Cell (zeta, size and titration studies)	0.70 mL	15° Forward Scattering	Aqueous	Organic	Dilute/ Concentrated
	Disposable-Micro Volume	130 µL	15° Forward Scattering	Aqueous	Some Organic	Dilute/ Concentrated
	High Concentration	0.70 mL	15° Forward Scattering	Aqueous	Organic	Dilute/ Concentrated
	Low Conductivity Cell (organicdispersions)	1.5 mL	15° Forward Scattering	Aqueous	N/A	Dilute
	Solid Sample Cell (solid surface studies)	Min: 14 x 33 mm Max: 16 x 37 mm Up to 5 mm thickness	15° Forward Scattering	Aqueous	Some Organic	N/A

ELSZ-2000 Particle Size Specifications

Features

Principle	Photon Correlation Spectroscopy (PCS) Dynamic Light Scattering (DLS)
Scattering Angle	165° Back-scattering
Minimum Sample Volume	Standard Cell: 0.9 mL Micro Volume Cell: 20 µL
Concentration	0.00001% to 40%
Accuracy	± 2%, measured using standard reference material
Repeatability	± 2%, measured using standard reference material
Measurement Range	0.1 nm to 12,300 nm Size Range* ; 0.6 nm - 10,000 nm Size Distribution Range
Light Source	Semiconductor Laser Diode
Detector	HD Avalanche Photodiode
Laser Wavelength	660 nm
Laser Power	70 mW
Correlator	Includes both Time-Domain and Time-Interval correlators. Maximum of 1,000,000 equivalent channels
FDA 21 CFR Part 11	Compliant

Temperature

Temperature Control	Peltier
Temperature Range	0°C to 90°C (Temperature Gradient function available)
Temperature Accuracy	Within ± 0.2°C

Accessories

Optical Band Pass Filter	Optional accessory available for use with fluorescent materials
Autotitrator	Optional accessory with bubble elimination system available for automated pH and quantitative addition studies, such as surfactant or flocculating agent activity
Organic Solvent Compatible	Standard glass cell

Molecular Weight

Principle	Dual Method: Dynamic Light Scattering (DLS) using Diffusion Coefficient and Static Light Scattering (SLS) using Debye Plot
Scattering Angle	165° Back-scattering
Minimum Sample Volume	Standard Glass Cell: 0.9 mL
Concentration	Sample dependent
Accuracy	± 20%, measured using standard polystyrene
Measurement Range (Mass)	360 Da to 20 MDa
Light Source	Semiconductor Laser Diode
Detector	HD Avalanche Photodiode

**Under lab conditions & sample dependent*

**Due to continuous improvements, specifications are subject to change without notice.*

ELSZ-2000 Zeta Potential Specifications

Features

Principle	Electrophoretic Light Scattering (ELS)
Scattering Angle	15° Forward-scattering (dilute) 30° Forward-scattering (concentrated)
Minimum Sample Volume	Standard Glass Cell: 0.7 mL Disposable Cell: 130 µL
Concentration	0.001% to 40%
Sensitivity	1mg/mL – 18 kDa Protein, for reference
Measurement Range	Zeta: -1000 to +1000 mV (no practical limit)*
Laser Power	30 mW
Light Source	Semiconductor Laser Diode
Detector	HD Avalanche Photodiode
Laser Wavelength	660 nm
Correlator	Includes both Time-Domain and Time-Interval correlators. Maximum of 1,000,000 equivalent channels
FDA 21 CFR Part 11	Compliant

Temperature

Temperature Control	Peltier
Temperature Range	0°C to 90°C (Temperature Gradient function available)
Temperature Accuracy	Within ± 0.2°C

Accessories

Optical Band Pass Filter	Optional accessory available for use with fluorescent materials
Autotitrator	Optional accessory with bubble elimination system available for automated adjustment of pH and quantitative addition studies, such as surfactant or flocculating agent activity
Organic Solvent Compatible	Optional accessory available for use with Low Conductivity solvents i.e. Toluene, Benzene, Hexanes, etc
Surface Zeta Potential Capable	Optional accessory available for determining zeta potential of flat surfaces, including Catalytic Plates, Fibres, Wafers, Membranes, etc

**Under lab conditions & sample dependent*
**Due to continuous improvements, specifications are subject to change without notice.*

ELSZ-PT Specifications

Auto Titrator Specifications

Function	Automatically performs liquid titration for zeta potential and particle size measurements
Principle	Automatic pH and additive control of suspension
Operating Temperature	15°C to 35°C
Dimensions	250 (W) x 310 (D) x 290 (H) mm
Number of titrants	Maximum of three

Volume

Titrant volume	Standard glass vial: 50 mL Plastic vial: 50 mL
Sample volume	Minimum: 30 mL Maximum: less than 50 mL for standard vial
Titrant dispense volume	Minimum: 0.1 µL
Circulation flow rate	10 – 40 mL/min

pH

Maximum number of pH settings	100
pH probe	1 to 13
pH range	User definable up to pH calibration
pH calibration	Up to three points
Sample stirrer	Magnetic
pH tolerance increment	Minimum: 0.05 Maximum: 2

**Under lab conditions & sample dependent*
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Auto Titrator ELSZ-PT

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