Anton Paar

# Dynamic Light Scattering Instruments

**Litesizer DLS Series**

# Litesizer DLS:
# **The Power to Explore**

**Best-in-class particle sizing**
Our instrument features automatic angle selection to ensure precise results every time, while our multi-angle particle sizing (MAPS) technology provides high-resolution particle sizing – even for multimodal samples. With continuous transmittance monitoring, the system detects sedimentation and agglomeration in real-time, giving you instant insights that measurements are reliable and of high quality.

**Market-leading zeta potential determination**
Unique to Litesizer DLS, the patented cmPALS technology and the Omega Cuvette enhance zeta potential measurement, ensuring stability and accuracy by minimizing electrical gradient interference.

**FIND OUT** MORE

**www.anton-paar.com/apb-litesizer**

**Even more benefits**

- ✓ Additional selection of measurement modes: including particle concentration, refractive index, molecular mass, and transmittance
- ✓ Capable fluorescence and polarization filters: applicable at all angles
- ✓ Ultra-low sample volumes for particle sizing, down to 1.5 µL
- ✓ Kalliope, the benchmark in software operation: No training required, results in three clicks

# The Future of **Zeta Potential Analysis**

**cmPALS innovation**
cmPALS is a significant advance on existing PALS technology because it allows the modulator to make large movements. This means you can use shorter measurements and apply lower electric fields, reducing the effects of electrode fouling and deterioration.

cmPALS technology, featured in Litesizer DLS 701 and 501, addresses these challenges with a groundbreaking, patented (European Patent 2 735 870) approach: It enhances sensitivity and stability, enabling precise zeta potential measurements even for delicate samples.


**How it works**
Zeta potential is determined by measuring the electrophoretic mobility of particles in an electric field. A laser beam passes through the sample, scattering off moving particles. The speed of this motion indicates the zeta potential's magnitude, while the direction reveals its sign. cmPALS refines this process, providing superior accuracy and repeatability.

**Omega cuvettes**
The specially designed cuvettes, with the unique Omega-shaped capillary ensure there are almost no gradients of the applied electric field at the measuring position. This delivers the highest possible repeatability because fluctuations of the results depending on the measurement position within the capillary are negligible.

**Next-level zeta potential analysis**
With cmPALS, Litesizer DLS 701 and 501 set a new benchmark in zeta potential measurement, efficiently delivering precise results. From formulation optimization to quality control, cmPALS ensures unparalleled performance for a wide range of applications.

**Key benefits of cmPALS and Omega cuvettes**

- ✓ Improved sensitivity: Detect even subtle changes in particle behavior
- ✓ Enhanced stability: Achieve consistent, reproducible results
- ✓ Faster measurements: Results in minutes without sacrificing accuracy
- ✓ Reduced sample damage: Safeguard sensitive samples during analysis

# Measuring Modes


**Particle size measurement by DLS**
Particles suspended in a liquid are constantly undergoing random motion, and the size of the particles directly affects their speed. Smaller particles move faster than larger ones. In dynamic light scattering (DLS), light passes through the sample, and the scattered light is detected and recorded at a certain angle. The time dependence of the scattered intensity reveals how fast the particles are moving. From this information, it's possible to calculate the average size of the particles as well as the size distribution.

Litesizer DLS particle analyzers give you accurate and precise size measurements. You can easily measure the effect of time, pH, temperature, and concentration on the particle size. With integrated measurement algorithms, you obtain the highest peak resolution when choosing the most suitable single-angle DLS or multi-angle dynamic light scattering (MAPS) measurement mode (DLS 701).

**Zeta potential measured by ELS**
In electrophoretic light scattering (ELS), the speed of the particles is measured in the presence of an electric field. The faster the particles move, the higher the zeta potential of the particles. In general, a greater-magnitude zeta potential means that the particles will repel each other more strongly, giving a more stable suspension.

| PARTICLE SIZE SPECIFICATIONS | |
|---|---|
| **Particle analyzers** | - Litesizer DLS 701<br>- Litesizer DLS 501<br>- Litesizer DLS 101 |
| **Measuring range** | 0.3 nm to 12 µm* |
| **Sensitivity** | 0.1 mg/mL (lysozyme)<br>lower than 0.00001 % (0.1 ppm, Latex 100 nm) |
| **Max. sample concentration** | 50 % w/v (sample-dependent) |
| **Accuracy** | Better than ±2 % on NIST traceable standards |
| **Repeatability** | Better than ±2 % on NIST traceable standards |
| **Min. sample volume** | 12 µL (Litesizer DLS 101)<br>1.5 µL (Litesizer DLS 701 and 501) |
| **Measurement angles** | 175° (Litesizer DLS 101)<br>15°, 90°, 175° (Litesizer DLS 701 and 501) |
| **Multi-angle particle sizing (MAPS)** | Litesizer DLS 701 |

* Under laboratory conditions for Litesizer DLS 701 and 501. Litesizer DLS 101 0.3 nm to 10 µm.

| ZETA POTENTIAL SPECIFICATIONS | |
|---|---|
| **Particle analyzer** | - Litesizer DLS 701<br>- Litesizer DLS 501 |
| **Measuring range** | > ±1,000 mV |
| **Size range** | 1.3 nm to 100 µm |
| **Sensitivity** | 0.1 mg/mL (lysozyme) |
| **Repeatability** | ±3 % |
| **Max. sample concentration** | 70 % w/v (sample-dependent) |
| **Sample volume** | 50 µL* |
| **Max. sample conductivity** | 200 mS/cm |
| **Measurement angle** | 15° |
| **pH range** | 2 to 12 |

*Sample viscosity dependent

## Molecular mass measured by SLS

The intensity of the scattered light is directly related to molecular mass. If the scattering intensity is measured at several different concentrations, then a Debye plot can be generated, the intercept of which provides the molecular weight.

Static light scattering (SLS) measurements with Litesizer DLS 701 and 501 are simple, fast, and non-invasive. They also give you the second virial coefficient, which reflects protein solubility.

| MOLECULAR MASS SPECIFICATIONS | |
|---|---|
| **Particle analyzer** | - Litesizer DLS 701<br>- Litesizer DLS 501 |
| **Measuring range** | 300 Da to 20 MDa |
| **Sensitivity** | 0.1 mg/mL (lysozyme) |
| **Accuracy** | ±10 % |
| **Repeatability** | ±5 % |
| **Measurement angle** | 90° |

## Refractive Index

Performing DLS and ELS on particles in solution requires prior knowledge of the solvent's refractive index. With Litesizer DLS 701 and 501 you won't need to gather these indices from external sources anymore: They measure the solvent's refractive index for the exact wavelength and temperature of your experiment. Litesizer DLS 701 and 501 are the only DLS-based instruments able to determine the solvent refractive index within ±0.5 %, as defined by ISO 22412:2017 (accuracy of the refractive index required for DLS). All settings can be accessed via the dedicated Litesizer software Kalliope.

| REFRACTIVE INDEX SPECIFICATIONS | |
|---|---|
| **Particle analyzer** | - Litesizer DLS 701<br>- Litesizer DLS 501 |
| **Measuring range** | 1.28 to 1.50 |
| **Accuracy** | ±0.5 % |
| **Temperature range** | 0 °C to 90 °C |
| **Wavelength** | 658 nm |
| **Min. sample volume** | 1 mL |

## Particle concentration measurement

Litesizer DLS 701 determines the concentration of particles for monomodal and multimodal samples. Particle concentration measurements are performed without calibration, and you can determine the concentration of up to three different size populations within one sample. Since the measurement of the particle concentration can be based on single-angle DLS or multi-angle particle sizing (MAPS) measurements, this measurement mode is applicable to a broad range of different samples – giving you maximal flexibility.

| PARTICLE CONCENTRATION SPECIFICATIONS | |
|---|---|
| **Particle analyzer** | Litesizer DLS 701 |
| **Concentration range** | $10^8$ - $10^{13}$ particles/mL |
| **Size limit** | 1 µm |
| **Min. sample volume** | 12 µL |
| **Accuracy** | ±10 % (sample-dependent) |
| **Repeatability** | ±5 % (sample-dependent) |
| **Measurement angles** | 175°, 90°, 15°, MAPS |

## Transmittance

The Litesizer DLS particle analyzers continuously measure the transmittance for every sample. The value is reported in real-time and is displayed during operation. You obtain instant insight into the sample's behavior during the measurement and learn if, e.g., sedimentation or aggregation has taken place. In addition, this measurement allows Litesizer DLS to select the best parameters for your sample (focus position, measuring angle, measurement duration).

| TRANSMITTANCE SPECIFICATIONS | |
|---|---|
| **Particle analyzers** | - Litesizer DLS 701<br>- Litesizer DLS 501<br>- Litesizer DLS 101 |
| **Measuring time** | 10 s |
| **Min. sample volume** | 15 µL (Litesizer DLS 101)<br>1.5 µL (Litesizer DLS 701 and 501) |

# Cuvettes

Litesizer DLS analyzers are compatible with a number of different cuvette types for measuring size, particle concentration, zeta potential, molecular mass and transmittance of particles dispersed in liquids and the refractive index of the liquid. The table below lists all the available cuvettes and their major measurement applications.

| | Disposable cuvette | Glass cuvette | Quartz cuvette | Quartz low-volume cuvette | Uvette® low-volume cuvette | C-vette | Omega cuvette | Univette |
|---|---|---|---|---|---|---|---|---|
| | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| |  |  |  |  |  |  |  |  |
| **APPLICATION (MEASURING PARAMETER)** | | | | | | | | |
| | - Particle size, MAPS<br>- Transmittance<br>- Particle concentration | - Particle size, MAPS<br>- Molecular mass<br>- Transmittance<br>- Particle concentration | - Particle size, MAPS<br>- Molecular mass<br>- Transmittance<br>- Refractive index<br>- Particle concentration | - Particle size, MAPS<br>- Molecular mass<br>- Transmittance<br>- Particle concentration | - Particle size<br>- Transmittance | - Particle size<br>- Transmittance | - Zeta potential<br>- Particle size<br>- Transmittance | - Zeta potential<br>- Particle size<br>- Transmittance<br>- Particle concentration |
| **DETAILS** | | | | | | | | |
| | - For aqueous solvents<br>- Ideal sample volume: 1 mL (not less than 0.85 mL) | - For aqueous and organic solvents<br>- Ideal sample volume: 1 mL (not less than 0.85 mL) | - For aqueous and organic solvents<br>- Ideal sample volume: 1 mL (not less than 0.85 mL) | - For aqueous and organic solvents<br>- Maximum volume: 45 µL<br>- Minimum sample volume: 12 µL (when inserting a supporting plate into the module) | - For aqueous solutions and organic solvents<br>- Minimum sample volume: 50 µL<br>- Maximum sample volume: 2 mL | - For aqueous solutions only<br>- Minimum sample volume: 1.5 µL | - Disposable cell<br>- For aqueous solutions only<br>- Minimum sample volume: 650 µL | - For aqueous solutions and organic solvents*<br>- Minimum sample volume: 50 µL<br>- Chemical resistance<br>- Reusable<br>- For highly concentrated samples |
| **Cuvette compatibility with Litesizer DLS 701** | | | | | | | | |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Cuvette compatibility with Litesizer DLS 501** | | | | | | | | |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Cuvette compatibility with Litesizer DLS 101** | | | | | | | | |
| | ✓ | ✓ | ✓ | ✓ | ✓ | × | × | ✓ |

**Legend:** ✓ Compatible × Not compatible

*Refer to the supplier material data sheet for the list of compatible solvents.

# **Kalliope Software** for Particle Analysis

The Kalliope software is a highlight of Litesizer DLS. It enables particle analysis at the touch of a button.


**Become an expert in minutes**
Perform expert-level measurements with minimal-to-no experience. Kalliope supports you every step of the way – for DLS and ELS measurements it automatically optimizes attenuation, focus position, and detection angle. The Expert Advice function ensures your results are always top-class. With Kalliope, everyone's an expert.

**Ingenious simplicity**
Kalliope's one-page workflow displays all relevant data in a straightforward overview. Input parameters, a live view of the measurement, and all results in one place consolidate measurement transparency. Additionally, measurements can be recalculated using different input parameter sets.

**Real-time monitoring**
Kalliope tracks and monitors zeta potential and particle size change, along with time, temperature, pH, and concentration. Data analysis and trend identification are easy because of very clear results presentation. The most important numeric data are tabulated under the graph to further simplify analysis.

**US FDA 21 CFR Part 11**
A pharma option with built-in data security functions, user management, and audit trails makes Kalliope fully compliant with the US FDA's 21 CFR Part 11. Comprehensive analytical instrument and system qualification (AISQ) is also available.

**Application-specific modes**
Single-click, application-specific measurement modes transform Kalliope into a completely new tool. Whether it's proteins that have to be measured or a parameter screened over the pH range, Kalliope automatically optimizes the measurement configuration and delivers watertight results.

**One software – all instruments**
Kalliope is compatible with Anton Paar particle-sizing instruments. From laser diffraction and dynamic image analysis, to DLS and ELS, it's all performable with the same software. Forward planning delivers continuous updates and improvements. New functions and features are frequently added as per user requirements

# Accessories

For automation, the Litesizer DLS series can be equipped with a dosing system and a flow module.

**Flow Module FM11:**
FM11 enables the automatic size and zeta potential measurements of dispersed samples under varying pH conditions. It can be installed on Litesizer DLS 701 and Litesizer DLS 501 instead of the general batch module BM11, which accommodates cuvettes for single measurements. The flow module can also be used for single measurements in standard cuvettes, so it's a versatile solution for a wide variety of applications.


**Optical filters:**
The Litesizer DLS 701 and 501 can be equipped with fluorescence, horizontal or vertical polarization filters in any of the three measurement angles. This allows for maximum flexibility and covers not only single angle DLS measurements, but also multi-angle particle sizing and concentration measurements.

**Dosing system:**
The Dosing System is an optional accessory for Litesizer DLS 701 and 501 that automates the adjustment of the sample's pH and enables the determination of the isoelectric point directly in the measurement cuvette. Fast and accurate characterization of zeta potential and particle size changes in response to pH are now possible, and the tedious process of adjusting the pH manually between every measurement can now be avoided. Automating this process not only saves time and effort but, most importantly, also reduces human error.

| | **Litesizer DLS Series** ↓ |
|---|---|
| **Product compliance** | Laser class 1, EN 60825-1:2014 and CDRH, LVD, EMC, RoHS |
| **Light source** | Semiconductor laser / 40 mW, 658 nm |
| **Detector** | Avalanche photodiode (APD) |
| **Temp. control range** | 0 °C to 120 °C |
| **Operating temp.** | 10 °C to 35 °C |
| **Humidity** | 35 % to 80 % non-condensing |
| **Dimensions (WxDxH)** | 450 mm x 505 mm x 135 mm |
| **Weight** | Approx. 18 kg (40 lbs) |
| **Power consumption** | 50 W |

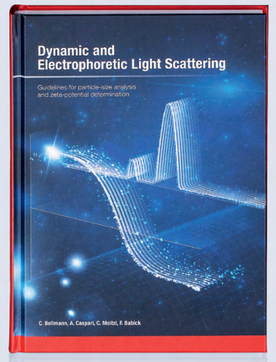
**Trademarks** **Kalliope (EU: 012709391), (UK: UK00912709391) Litesizer (EU: 011695491), (UK: UK00911695491)**

# Background Knowledge and Support

**Your guide to particle size and zeta potential determination**
Your guide to dynamic and electrophoretic light scattering introduces particle size and zeta potential analysis theory. It includes useful information for properly preparing suspensions and emulsions, choosing measurements, and interpreting results.

**Access our knowledge collection**
Learn more about Litesizer DLS in application reports and on the Anton Paar wiki. Join our live webinars or listen to recordings.

**Contact our experts**
Anton Paar has more than 30 subsidiaries and numerous partners worldwide. An expert is always close by and happy to help, in your language, free of charge. Call us for advice on sample preparation and measurement or to discuss specific particle characterization challenges.





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