Laser Diffraction Particle Size Analyzer

LDPA-A100

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1. Introduction

Laser Diffraction Particle Size Analyzer LDPA-A100 functions for both wet and dry sample size detection. It measures particles ranging from 0.01μm to 3600μm in wet dispersion and from 0.1μm to 3600μm in dry dispersion. It comes with 103 detection channels that capture detailed scattering data. Our analyzer incorporates a high-precision aluminum alloy optical platform for stability and durability. Equipped with premium quality detector to ensure high sensitivity, low noise, and accurate detection.

2. Features

- Long focal length Fourier lens
- Offers automatic alignment system
- Three-dimensional detection system
- Testing reports are exportable to PDF, Word, and Excel format
- Enhanced software with SOP function
- Multiple Data analysis models
- Offers rapid and effective wet dispersion

3. Specifications

Model No.	LDPA-A100
Measurement Range	0.01 to 3600μm (wet dispersion) 0.1 to 3600μm (dry dispersion)
Principle	Laser diffraction technology
Dispersion Type	Wet and Dry
Repeatability	< 0.5%
Accuracy	< 0.6%
Detection Channels	103
Measurement Duration	Within 10 seconds
Wavelength Of Helium-Neon Laser	0.6328μm (Red light)
Wavelength Of Blue Light Source	0.466μm (Blue light)
Detection Angle Range of Red Light	0.016 to 140°
Max Dispersant Volume	600 ml
Dispersion Pressure	0.05 to 0.6 Mpa
Laser Safety	Class 1, IEC60825-1:2007 and CFR Chapter I
Operating Mode	Automated mode and manual mode
Optical Alignment	Automatic alignment system
Lens Arrangement	Single lens Reverse Fourier
Laser Power Level	2 mW
Dimensions (L×D×H)	330×266×380mm
Weight	60kg

4. Applications

Laser Diffraction Particle Size Analyzer are used for particle size analysis and characterization across various industries including pharmaceuticals, cosmetics, food, chemicals, paints, mining, environmental science, biotech, materials, and R&D.

5. Instrument Introduction

Advanced Optical Design

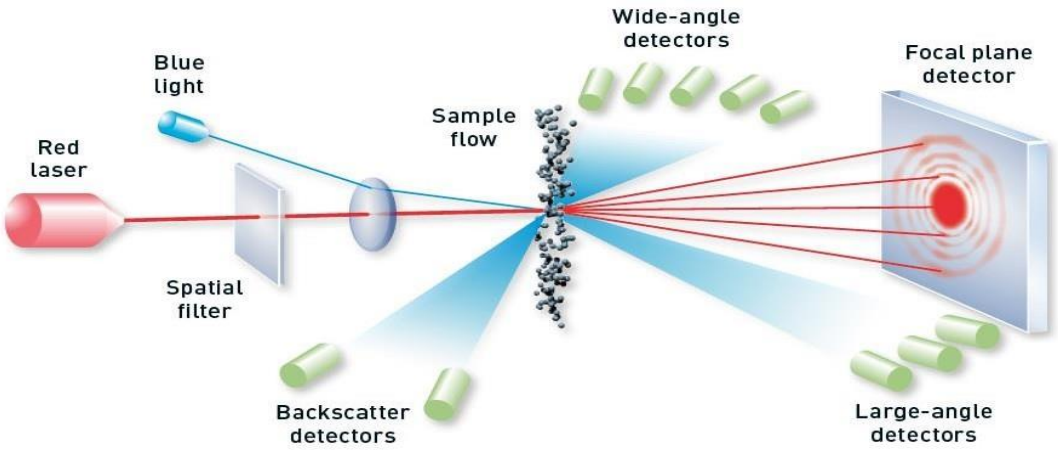

Figure 1

Dual Light Source Technology

- The Laser Diffraction Particle Size Analyzer utilizes red and blue dual-wavelength detection.
- The red-light source is a polarized He-Ne gas laser with a wavelength of 0.6328 μm, while the blue-light source is a solid-state device with a wavelength of 0.466 μm.
- This combination enhances sizing performance when used alongside forward and backscatter detectors.
- The dual-wavelength design addresses the weaknesses of other laser diffraction instruments, which often experience blind spots in the scattered light angles measured.
- This innovative approach significantly improves the accuracy and resolution of the Laser Diffraction Particle Size Analyzer, making it particularly effective for measuring submicron particles, wide or multi-distribution samples, and samples containing a small percentage of large particles.

Stable Laser Source

- The He-Ne laser used by the Laser Diffraction Particle Size Analyzer features a short warm-up time, a polarization ratio greater than 500:1, and a beam mode ratio of TEM00 > 95%.
- Its superior beam stability provides better power stability compared to alternative sources.
- Combined with a power fluctuation of less than 0.5%, the Laser Diffraction Particle Size Analyzer delivers a clean and stable background, ensuring high resolution and sensitivity.

Linear Optical path

- The Laser Diffraction Particle Size Analyzer features an optical design based on an enclosed linear light path, effectively minimizing stray light from external components and dust.
- Its high-precision aluminum alloy chassis ensures the optical system remains reliable and robust.

Single lens and Reverse Fourier design

- The combined single-lens and Reverse Fourier design effectively eliminates constraints imposed by the aperture of a Fourier lens, ensuring that the maximum detection angle of the scattered light is not limited by the aperture diameter.
- Compared to a multi-lens system, the single-lens optical design minimizes stray light caused by refraction and reflection.
- This significantly reduces background noise and improves the signal-to-noise ratio of the instrument.

Long focal length Fourier lens

- The Laser Diffraction Particle Size Analyzer features an optimized focal length-to-detector distance, enabling accurate detection of scattered light at smaller angles.
- This design allows seamless switching between wet and dry measurements without any loss of resolution.
- As a result, the instrument's capability to measure large particles is significantly enhanced, extending the upper size range of the Plus to 3600 μm.

Premium quality detectors

- The Laser Diffraction Particle Size Analyzer Plus utilizes premium-quality detectors that deliver both high resolution and sensitivity.
- Its optical design incorporates 103 detection channels optimally distributed in three-dimensional space, including the focal plane, side scattering, large-angle, and back-scattering detectors.
- This configuration provides a detection angle range from 0.016° to 140°. When combined with Dual Light Source technology, this wide detection angle range ensures maximum collection of raw and scattered light from the particles.

Intelligent auto-alignment

- The automatic alignment system is a key factor in the high reproducibility of the Laser Diffraction Particle Size Analyzer.
- Perfect optical alignment is achieved through an intelligent, software-controlled auto-alignment system, which adjusts the detector system to balance light intensity across an array of dedicated alignment pads.
- With the Laser Diffraction Particle Size Analyzer, optimized alignment is completed in seconds without user involvement.
- Alternatively, manual alignment can be performed easily via a simple user interface, if required.

6. Working Principle

The Laser Diffraction Particle Size Analyzer employs laser diffraction technology to measure particle size. As the laser beam passes through the dispersed particles, the analyzer records the intensity of the scattered light, analyzes the scattering pattern, and then calculates the particle size using Mie or Fraunhofer scattering theory.

7. Operations

7.1 Comprehensive and High-performance Sample Dispersion Units

1. **Wet Sample Dispersion Unit**
   - In the minerals, chemical, metal powder refining, and cement industries, larger sample volumes are often required for manufacturing quality control and processing finished products.
   - The high-performance LDPA-A100 uses a 1000 ml beaker as the sample container for rapid and simplified sampling.
   - A dip-in pump and stir head continuously agitate the sample and automatically circulate it through the measuring system.
   - An integrated 50W high-power ultrasonic probe ensures consistent control of the dispersion.
   - This design minimizes air bubbles and liquid splashes while providing effective dispersion, sample circulation, cleaning, and draining.

2. **Dry Sample Dispersion Unit**
   - The LDPA-A100 is an automated dry powder feeder that supports SOPs, helping to minimize operator variability and ensuring consistent, reproducible results regardless of when or where the measurement is taken.
   - The LDPA-A100 features a sealed flow cell to prevent material loss to the environment while minimizing operator exposure to powder during measurements. It also includes a built-in protection mechanism that monitors and controls the vacuum level, safeguarding the measurement cell window and optical bench from potential contamination.
   - The LDPA-A100 provides dispersive air pressure in the range of 0.05–0.6 MPa, with precise monitoring and control of the air pressure. This ensures that the LDPA-A100 can be used for fragile materials, such as milk powders, without attrition, as well as for cohesive materials like pharmaceutical APIs.

7.2 Intelligent, User-friendly control and analysis software

- The software with Standard Operating Procedure (SOP) functionality standardizes the analysis and testing process, minimizing the impact of operator error.
- It supports automatic, manual, and one-key automatic alignment options.
- The software offers multiple data analysis models, including general reports, sieving reports, percentage reports, average reports, statistics reports, and fitting reports, as well as a user-defined report template.
- Testing reports can be exported directly to various file formats, including PDF, Word, and Excel, while data can be exported in CSV or Excel formats.
- Multiple reports can be viewed simultaneously for data comparison, statistics, and analysis. Reports can be classified and ranked by parameters such as date, characteristic particle size, and average result, and can be exported as Excel files.

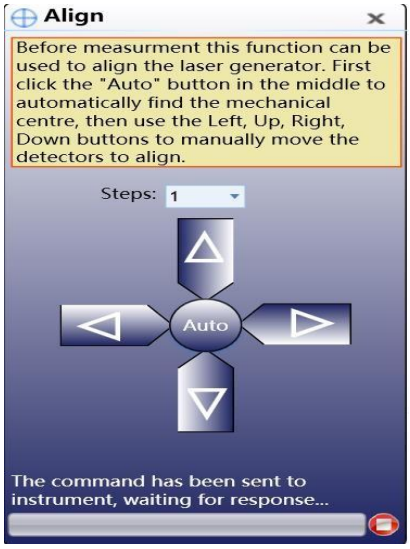

Figure 2

- The software includes a comprehensive refractive index database with optical parameters for over 200 common materials. Optical parameters for new materials can be added to the database as required by users.

7.3 Versatile Control and Analysis Software

User-friendly interface and modular design

- The software provides an intelligent and user-friendly framework that integrates sampling, measurement, data handling, and reporting.
- The sampling and measurement modules support full SOP measurements, instrument self-tests, autodetection of the sample dispersion unit, and the measurement and elimination of electrical background noise.
- The data handling and reporting modules include all essential features, such as filled frequency plots and frequency, and cumulative plots displayed on the screen.
- Additional features, like a zoom function, allow users to magnify selected parts of the graph for precise value readings. Graphs can also be copied and pasted into other applications.
- Customized reports to meet specific requirements can be easily created using the reporting module.
- Trend graphs can display information on dynamic processes, such as milling, and help analyze the effects of different milling times, machine settings, or unexplained product variability.
- Trend graph limits can be set so that values outside the limits are automatically highlighted.

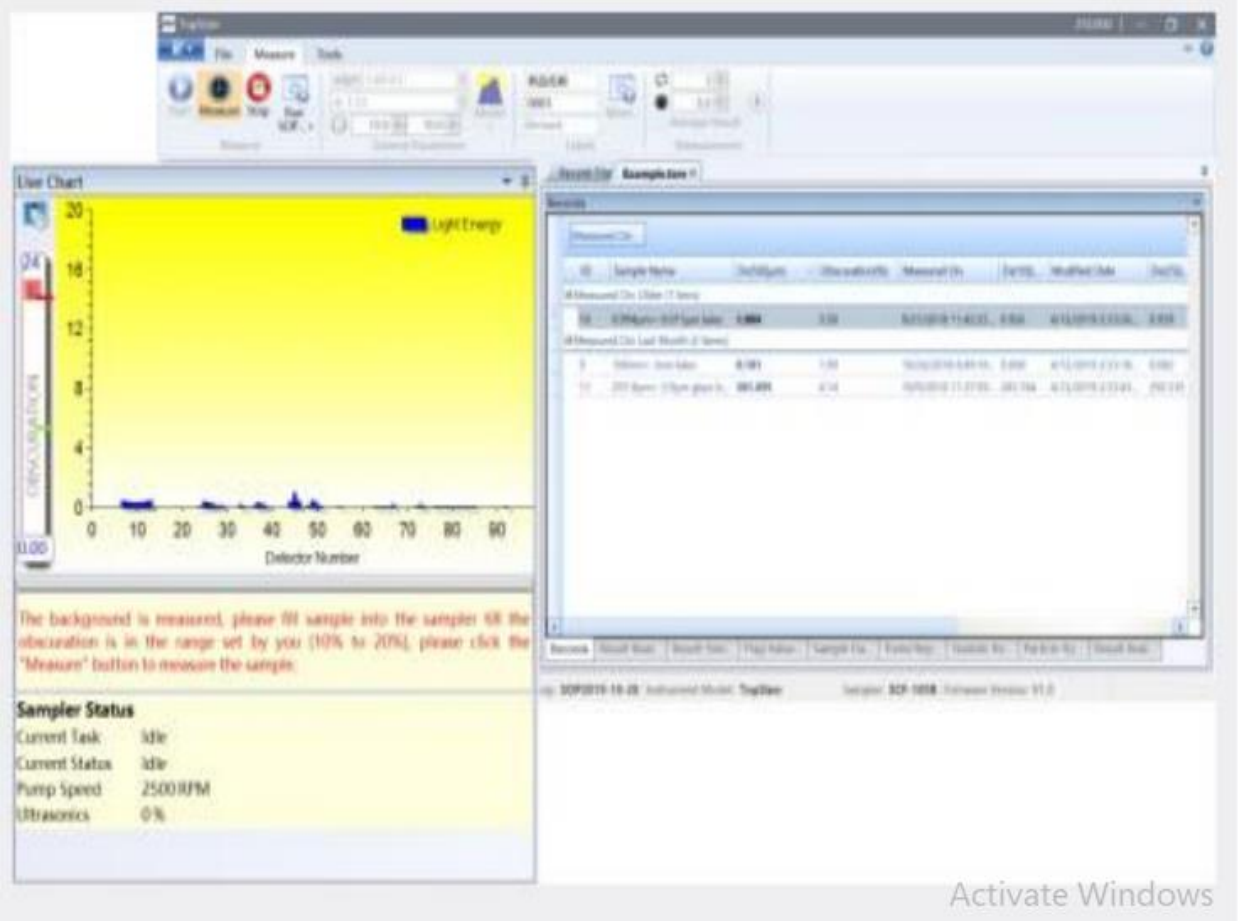

Figure 3

- The software also provides reporting templates for various industries and applications, including statistical reports, sieving reports, and templates for cement, hydrology, sand, and more.

Comprehensive Refractive Index database

- The calculations are based on the real refractive index and absorption values of the materials being measured.
- A comprehensive database holds refractive index and absorption values for a wide range of materials.
- Optical parameters for new materials can be added to the database as needed by users.

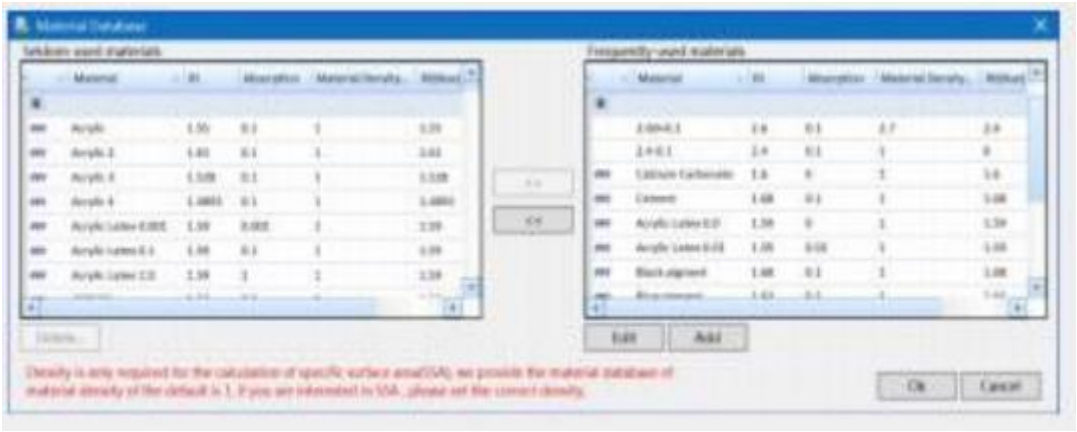

Figure 4

Support for Standard Operating Procedures (SOPs)

- SOPs are standard practice for particle size analysis in most industries and help minimize the impact of operator error.
- In this software, a detailed SOP can be created in less than ten minutes.
- Once established, the SOP can be saved on the system and transferred to other systems.
- The SOP is also automatically embedded in the measurement record, allowing users to extract it from existing records if needed.

Figure 5

Export of reports and data records

To facilitate data sharing and reporting between different users, the testing reports can be exported directly to various file formats, including PDF, Word, and Excel, while data can be exported as CSV or Excel files.

Multiple data analysis models

- The software provides multiple data analysis models to cover a wide range of applications, such as cement or those involving different particle shapes.
- The software reports volume distribution by default, but users can also select surface area distribution, length distribution, and number distribution.

Figure 6

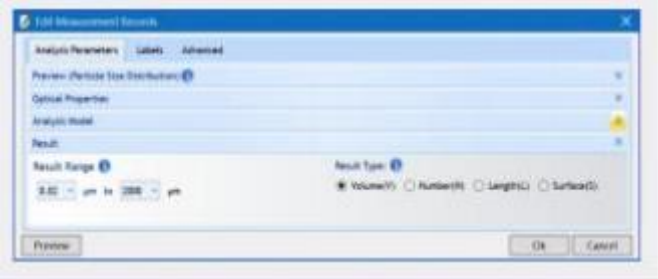

Figure 7

Example data: sample with very wide particle size distribution

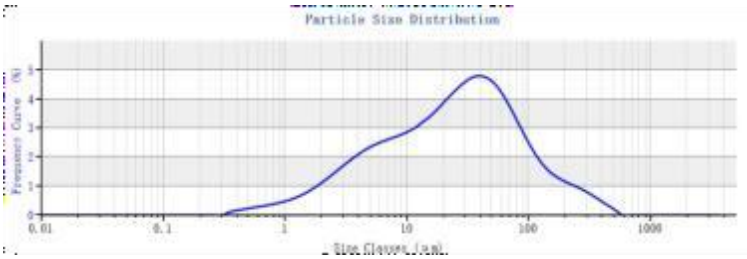

Figure 8

Accurate measurement of large particles

The presence of large particles has a significant impact on the quality of final products, such as powder coatings, battery materials, and pharmaceutical powders. The stable laser, long focal length Fourier lens, and high-quality detectors provide it with significant

advantages over other laser diffraction systems when measuring large particles or samples containing large particles.

Example data: Millimeter range glass beads (d50>1000 µm)

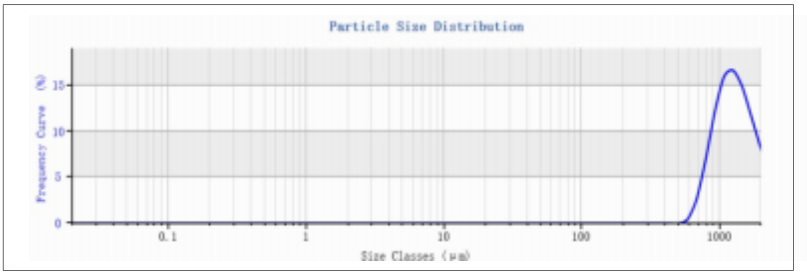

Figure 9

Accurate analysis for submicron and nanosized particles

With its optimized wide-angle detector array, use of two light wavelengths, and accurate modeling of backscatter and cell window reflections, it accurately measures complex particle size distributions down to 0.01 µm.

Example data: 100nm latex reference materials

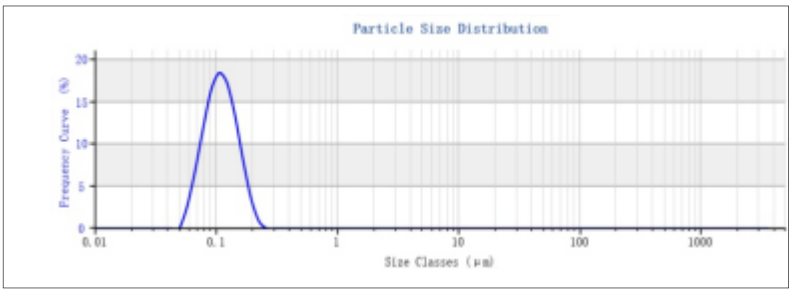

Figure 10

Good repeatability and reproducibility

The advanced optical system calibration, optics auto-alignment, and robust alloy chassis provide consistent, accurate, and stable optics. This ensures high measurement repeatability and reproducibility between different instruments, ensuring compliance with the ISO 13320:2009 standard.

Sample	D10/μm	D50/μm	D90/μm
1	13.49	36.97	71.64
2	13.46	36.94	71.73
3	13.51	37.06	71.76
Average	13.49	36.99	71.71
SD	0.03	0.06	0.06
Repeata bility RSD (%)	0.19	0.17	0.08

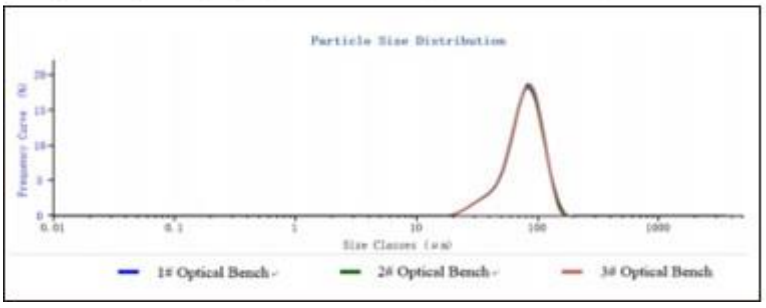

Figure 11

High resolution and sensitivity

High resolution in particle size distribution is a crucial requirement in both R&D and quality control. With its advanced and robust optical design, it can detect small variations in the particle size distribution of a sample. This allows it to accurately quantify differences between powder materials or changes within the same material, whether measuring a monodisperse or a polydisperse sample.

Example data: A mixture of 5.1 μm, 14 μm, and 37.8 μm – three latex reference materials.

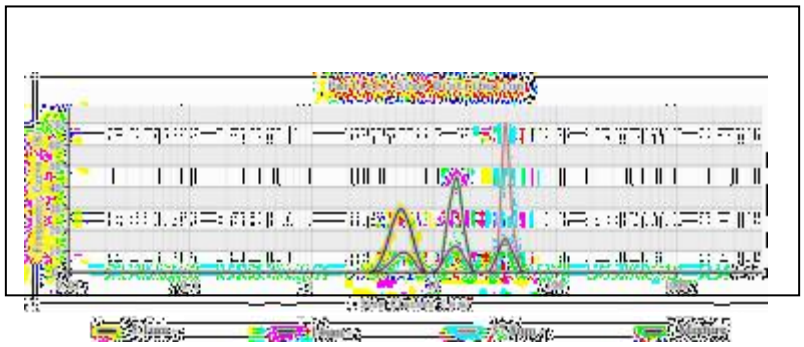

Figure 12

Fast measurement

With the support of its effective sample dispersion units, it can complete a routine test in as little as 10 seconds, a key requirement for quality control users.

Strong dispersion capability

With the exceptional suspension and circulation capability of the LDPA-A100 sample dispersion unit, it can accurately measure a wide range of powder materials, particularly those containing large or dense metal particles, without generating sampling bias caused by particle sedimentation during measurements.

8. Accessories

Standard Accessories

Accessories Name	Quantity
Optical bench	1ps
Circulating sample feeding system	1ps
Dry-dispersion sample feeding system	1ps
Special test software	1ps
Singal line	1ps
Power line	1ps
Polyethylene tube	1ps
Rubber suction bulb	1ps
Sampling spoon	1ps
Lens paper	1ps
User manual	1ps
Transport package	1ps

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