

The New Generation of Advanced Particle Size Analyzers

Advanced instruments to improve R&D, process development and quality control.

- Digital Image Processing
- Laser Diffraction
- Dynamic Light Scattering
- Acoustic Spectroscopy

NEW
extreme depth of
sharpness,
double resolution



Particle size and shape analysis

- Results comparable to sieve analysis
- Very short measuring times
- Additional shape parameters
- Optimized software
- Measuring range 30 μm to 30 mm

NEW
now also for
dry measurements



The new benchmark in laser diffraction

- Extremely high resolution in the sub-micron range
- Sample throughput time of only 1 minute
- Very good reproducibility
- Dry and wet measurement possible
- Measuring range 10 nm to 3 mm

HORIBA

Explore the future

HORIBA INSTRUMENTS

World Leading Particle Characterization Analyzers

Horiba offers an entire product line of particle size analyzers covering a measurable range from 1 nanometer to 30 millimeters.



Best Value in Particle Size Analysis

- LA-300 Laser Scattering
- 0.1 micron to 600 microns
- Compact and Portable



The Ultimate in Nano Particle Sizing

- LB-550 Dynamic Light Scattering
- 1 nm to 6 microns
- True measurement of size distribution and multimodes 1 ppm to 40 vol %



Particle measurement with digital image processing

Digital image processing is increasingly becoming established in addition to sieve analysis and laser diffraction as a method for particle size analysis in the measuring range above 30 µm. This method is superior to the others in its resolution, precision and reproducibility and delivers additional detailed particle shape information.



In this segment, Horiba offers the optical particle measuring system CAMSIZER from Retsch Technology which covers a size range from 30 µm to 30 mm:

■ CAMSIZER	page 3 - 5
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Particle measurement with scattered laser light

The most important methods for the characterization of particles in the nanometer and micrometer range are dynamic and static laser scattering (laser diffraction). The static scattering can be used for the analysis of both emulsions and suspensions and dry samples.



For this range, Horiba offers the particle analyzers, covering the size range from 1 nm to 3 mm:

■ LA-950	page 6 - 8
■ LA-300	9
■ LB-550	10 - 11
■ DT-1200	12

The perfect solution for each measuring range

Particle size	1 nm	1 µm	1 mm	1 m
CAMSIZER			30 µm	30 mm
LA-300		0.1 µm	600 µm	
LA-950		10 nm	3 mm	
LB-550	1 nm	6 µm		
DT-1200		5 nm	100 µm	

30 µm

30 mm

The new CAMSIZER®

Particle size and shape analysis

The CCD cameras in the new CAMSIZER now operate with double resolution so that more than 45 megapixels can be measured per second. The intensity of the new LED strobe light source is 20 times higher than that of the light source of the previous model. Extremely short exposure times allow for very sharp images. The new CAMSIZER provides an excellent resolution across the entire measuring range of 30 µm to 30 mm. Thanks to the newly developed fitting algorithms, the measuring results are 100% compatible to those of sieve analysis.

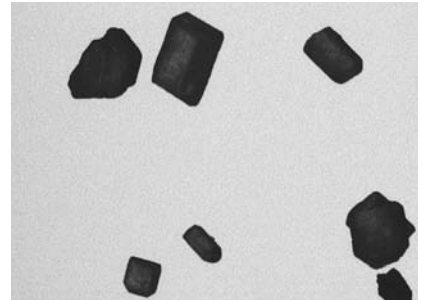


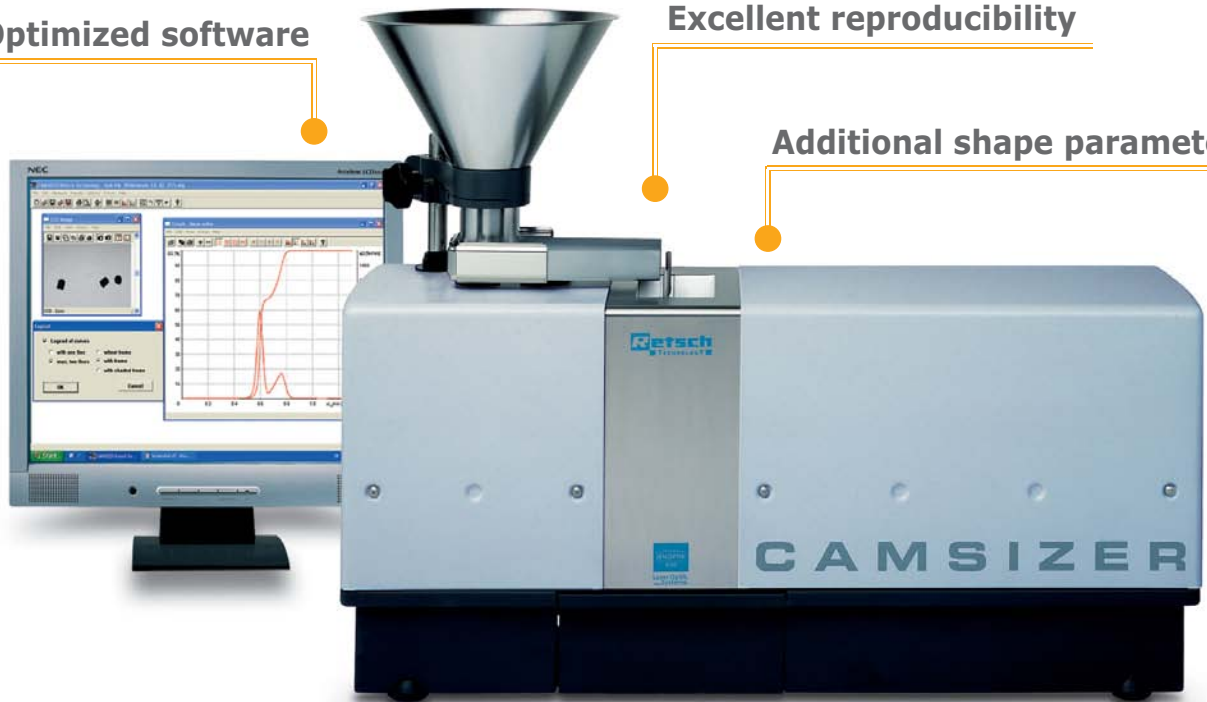
Image of sugar crystals made by the zoom camera

Great depth of sharpness

Optimized software

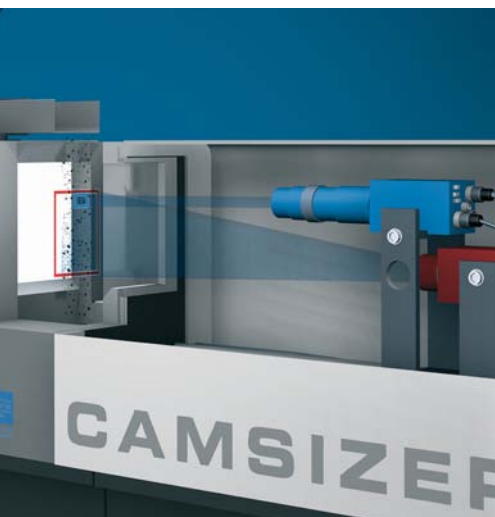
Excellent reproducibility

Additional shape parameters



Double resolution

100% compatible with sieve analysis



Measuring principle

The CAMSIZER uses the principle of digital image processing. The sample is transported to the measurement field via a vibratory feeder where the particles drop between an extended light source and two CCD cameras. The projected particle shadows are recorded at a rate of more than 60 images per second and analyzed. In this way every single particle in the bulk material flow is recorded and evaluated. Thanks to its extremely short exposure times, the novel **LED strobe light source** allows very sharp images to be produced and distortion-free determination of the projection areas. The sharp contrast allows, at the same time, details of the surface structure of the particles to be seen almost like through a microscope. The frequency of the light flashes is so high that the strobing is not visible to the naked eye.

With the unique, **patented two-camera system** a great depth of sharpness, and therefore **maximum precision across the entire measuring range**, is obtained. The zoom camera provides maximum resolution down to the fine range, while the basic camera also records larger particles and guarantees a high statistical certainty in the results. This ensures excellent reproducibility of the CAMSIZER measuring results, even with relatively small sample amounts. The results are saved in at least 1,000 size classes.

Applications.

The CAMSIZER is particularly suitable for the following applications:

- Abrasives
- Carbon black/coal
- Catalysts
- Coffee
- Fertilizers
- Foodstuffs
- Glass/ceramics
- Metal powder
- Pharmaceuticals
- Plastics
- Polystyrene
- Refractory products
- Salt/sugar
- Sand
- and many others



Camsizer with AutoSampler

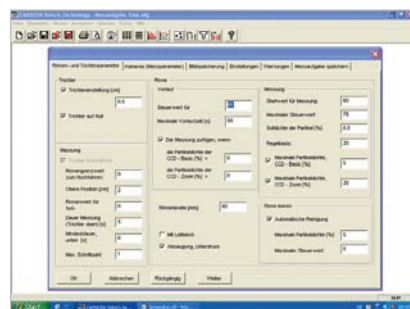
Technical data.

Measuring principle:	Digital image processing
Measuring range:	Recommended application range 30 µm to 30 mm
Measurements:	60 images with more than 780,000 measuring points (corresponds to more than 45 million measuring points per second)
Measuring time:	Approx. 2 – 3 min depending on the desired measuring statistics
W x H x D:	Approx. 850 x 650 x 350 mm
Weight:	Approx. 40 kg

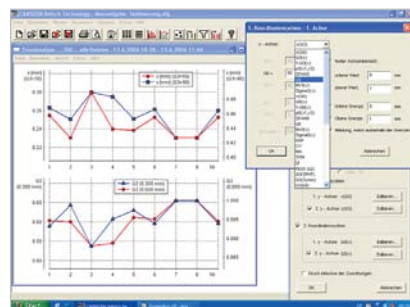
The CAMSIZER is CE-tested and complies with the relevant guidelines and standards such as 21 CFR Part 11.

New, intuitive software

The CAMSIZER software is designed clearly and in a process-oriented way, the operation is simple and intuitive. All control and evaluation functions are available in one program. The measuring parameters are **saved in measuring tasks** so that similar sample materials can always be measured under identical conditions. A **wizard function** helps with the setting up of these measuring tasks to ensure that the feed rate, camera and evaluation settings can be made rapidly and reliably. Different password-protected user levels allow the advanced user to independently configure the software for routine operation. In this way, the CAMSIZER can also be used by untrained staff without risking a change or loss of settings. The measuring data can be saved and administered either locally in a PC or automatically in a network. Changes in the sample quality are identified and quantified using the functions "trend analysis" and "daily report".



Entry mask



Trend analysis

The new CAMSIZER software also offers:

- additional shape parameters (e.g. surface analysis)
- improved comparability to sieve analysis, also for multimodal distributions
- several language versions (German, English, Japanese, Russian and other languages)

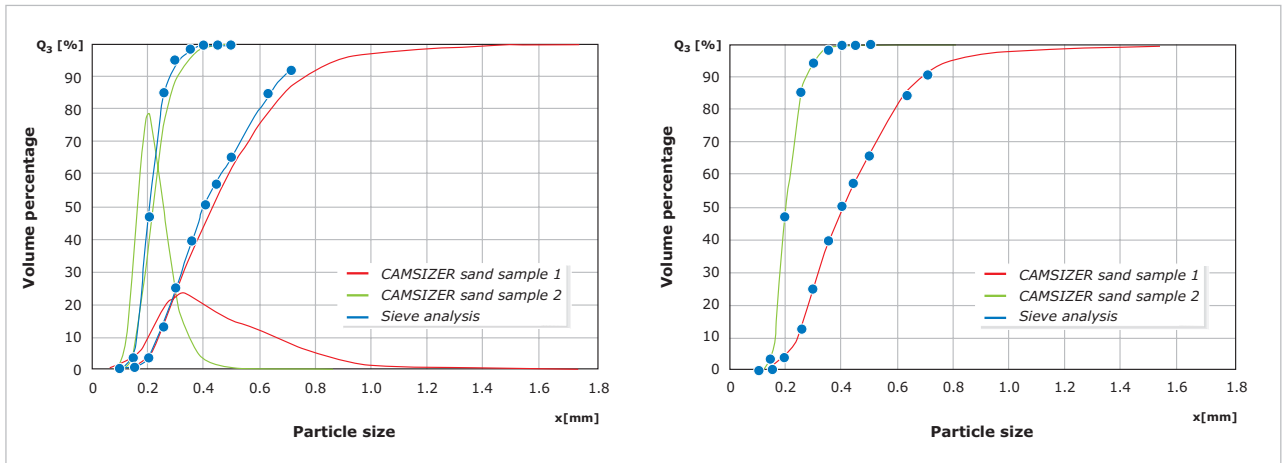
Maintenance free

Dust is removed from the measuring area and the glass panels by means of a **Venturi air flush**. In addition, inside the CAMSIZER a slight overpressure can be applied to prevent contamination within the device.

Application example: Sand

Sands with different particle size distributions are required for a range of applications. For construction materials, abrasives, as raw material for glass production, as moulding sand in foundries or as filter sand, sand types with different sizes and shapes are used. The CAMSIZER is the ideal instrument to measure sand routinely and to do this with an **improved resolution and with a higher throughput than is reached by sieving**. Thanks to the newly developed fitting algorithm, the CAMSIZER **measuring results are 100% compatible with the sieve analysis**. Irrespective of whether the distribution is narrow, wide or multimodal, only one fitting algorithm is needed.

Now small fractions of oversized grains can be quantified even more precisely than was possible with the previous model.

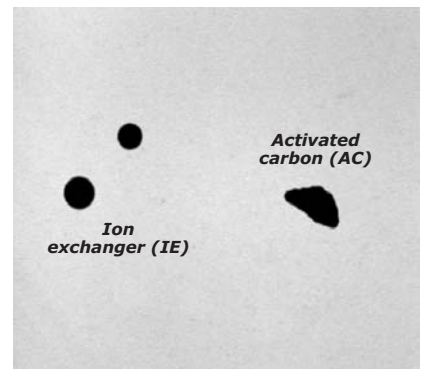
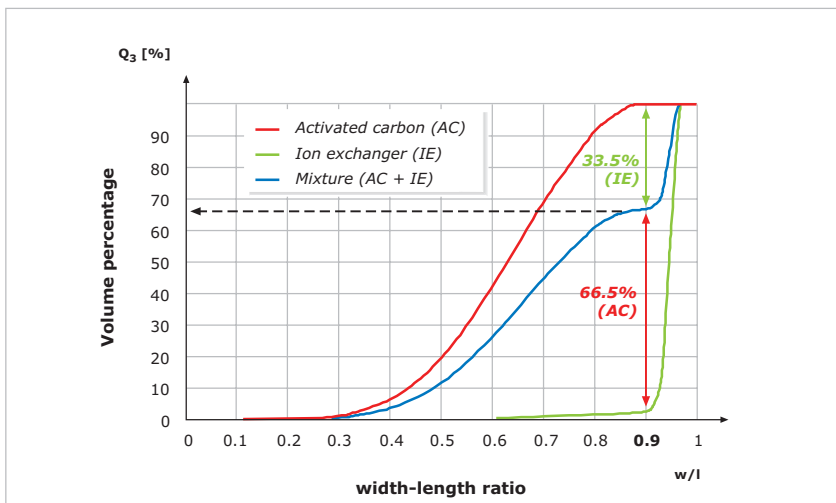


The diagram shows two different sand samples: wide distribution (red) and narrow distribution (green) with the corresponding measuring results of sieve analysis and Camsizer (without fitting).

The Camsizer provides excellent compatibility to the sieving results for both samples with only one fitting algorithm.

Application example: Analysis of mixtures by means of shape parameters

With the CAMSIZER it is possible to determine the mixing ratio of two components if they have the same particle size range but different shapes. In the example described here, it is a mixture of ion exchange granulate and activated carbon such as is used e.g. in water filters. The diagram shows that the shapes of the two components are markedly different from each other. Using the CAMSIZER, it is possible to determine the mixture ratio of these two components rapidly and easily.



Snapshot made during measurement

Comparison of the width-length ratio in a component mixture

10 nm

3 mm

Laser Diffraction Particle Size Analyzer LA-950

Higher – faster – further: The new particle size analyzer Horiba LA-950 sets a benchmark in particle size determination thanks to higher resolution, faster measurement and the extended measuring range of 10 nm to 3 mm.

with
PowderJet
for dry
measurements



Benefits at a glance.

- Very wide single measuring range of 10 nm to 3 mm
- Sample throughput time of only 1 minute
- Extremely high resolution in the sub-micron range
- Dry and wet measurement possible
- Exchange of the measuring cell within seconds
- Effective ultrasound and stirring dispersion
- 30 ml small volume recirculator
- All solvent compatible
- 10 ml small volume cuvette
- 21 CFR Part 11 compliant software

Particle analysis in the widest measuring range worldwide

In the previous two decades, static laser diffraction has gained in importance thanks to many advantages such as short analysis time, easy operation, high reproducibility and efficiency.

In numerous applications within the size range of 100 nm to 1,000 µm the advantages of laser diffraction are so eminent that the classical procedures do not represent a real alternative any longer.

With the **LA-950 laser diffraction particle size analyzer**, a device has been developed which can be used for many different applications.

The novel optical system provides an extremely wide **measuring range of 10 nm to 3 mm** and ensures that even in the submicron-range the resolution is optimum.

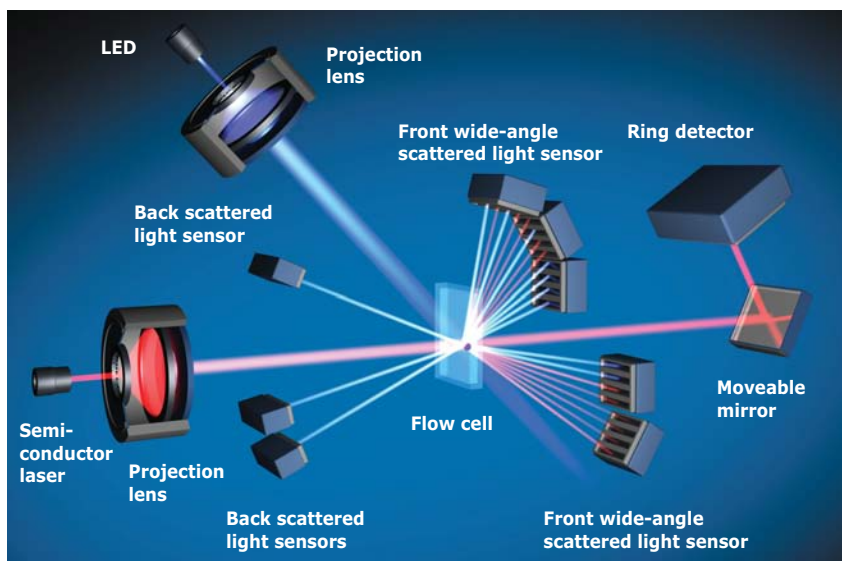
A big advantage of LA-950 is that the user will rapidly and easily receive correct and reliable measuring results.

The complete processing time from one sample to the next is only 1 minute, this is only a quarter of the usual time up to now. An integrated system and software automation dispenses with time-consuming activities such as filling with the dispersion liquid, selection of the measuring parameters and starting of the individual process steps of the analysis sequence; external sample preparation before the measurement is in most cases not necessary. In addition, LA-950 works with high precision. With NIST standard particles (US National Institute of Standards and Technology), it has a **measuring accuracy of ± 0.6%** and a **reproducibility of ± 0.1%**.

The unique optical system of LA-950

The good results for measurements in the sub-micron range are mainly based on the fact that with very fine particles the **strong, blue LED light source** ensures a clear signal with large scatter angles. These signals are recorded by the innovative **4-channel detectors** with increased sensitivity and an extremely high reading frequency of 5,000 values per second. This makes it possible to measure many new materials in the nanometer range which up to now required other methods such as photon correlation spectroscopy (PCS). This is a clear advantage for the user because the analytical performance in combination with a wide measuring range can, in certain cases, save the expenditure for an additional particle analyzer.

The optical layout of LA-950 uses a light path that is about 4 times the length of that of conventional devices. By extending the light path, the signal/noise ratio was considerably improved. Thanks to the reverse Fourier optics and the light path folded by mirrors, a very compact design size was realized. A newly developed **segmented multi-element detector** with special arrangement and increased sensitivity of the individual detectors allows the light diffracted at a small angle by large particles to be accurately recorded. The effectiveness of these new developments is exemplified by the **very high resolution** of LA-950. For example, it is possible when measuring a multi-modal distribution to resolve five separate modes. Three of these modes can be within a single decade.



Quick and easy switch between measuring cells

In order to obtain optimum measuring results for a range of applications, alternative sample dispersing systems are required. This will usually mean that the measuring cell has to be exchanged, which requires several working steps. With the LA-950, the manual effort has been reduced to a minimum.

In the optical bench of the instrument the optical components are mounted vertically and the measuring cell is located on a slide which is freely accessible by opening the appliance door. **Three different cells can be mounted onto the slide at the same time.**

The changeover between the measuring methods is achieved simply by shifting the slide into the required position. The measuring cell is automatically recognized, causing the software to change automatically.

This means that a single device can be used for a very wide range of analyses without the user having to carry out time-consuming changes to the settings.



Applications.

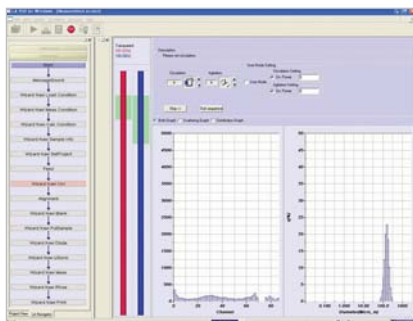
The LA-950 is particularly suitable for the following applications:



- Research & development for nano-particles
- Catalysts
- Ceramics
- Chemical-mechanical polishing
- Cosmetics
- Foodstuffs
- Metal powders
- Nano-coatings
- Pharmaceuticals
- Pigments

Technical data.

Measuring principle:	Mie scattering theory
Measuring range:	0.01 µm to 3,000 µm
Measuring time:	1 minute (from dispersion liquid filling to measurement and rinse)
Measuring methods:	Manual measurement with flow cell Manual fraction cell measurement (fraction cell and holder are required) Dry measurement (PowderJet Dry Feeder required)
Required sample quantity:	Approx. 10 mg – 5 g
Dispersion medium:	Approx. 180-250 ml (flow cell), Approx. 30 ml (small volume recirculator) Approx. 15 ml (fraction cell),
Dispersion liquid:	Water and organic solvents
Interface:	USB 2.0
Light source:	650 nm laser diode 405 nm LED
Detectors:	Multi-element detectors
Circulation system:	Circulation pump / agitator: max. 10 l/min (water), 15-level selections Circulation system with ultrasonic probe Flow cell: Tempax glass
Operating environment:	15 – 35 °C, below 85% rel. air humidity
W x H x D:	704 x 450 x 530 mm
Weight:	Approx 80 kg
Operating system:	Windows 2000, XP; 2 GHz



On the left-hand side the SOP routine is displayed, on the right-hand side the measuring result in real time.

Intuitive software with navigation function

One important component of the new LA-950 is the software. The user interface is set-up in such a way that the entire measuring process is as simple and uncomplicated as possible. The setting of the measuring conditions and work processes can be carried out with the help of the new navigation function. This navigation guides the user through the analysis and indicates what measuring conditions have to be selected without the need for intensive training. The user simply has to follow

the input prompts. The navigation function can be used for the rapid creation of SOPs. Then the subsequent measurements can be carried out at the push of a button. **With this function measuring methods can be developed rapidly and safely, saved permanently and then repeated at any time.**

For experienced users, the manual operation offers higher software flexibility and the numerous features allow comprehensive processing and the display of the measured data.

PowderJet for dry measurement

When dry powders are to be measured in their original state, the use of the **PowderJet Dry Feeder** is recommended for many different sample types within a measuring range of 0.1 µm – 3,000 µm. The material is fed into the measuring chamber via an automatic feeder, which ensures a constant and uniform supply. The path length between feeder and the measuring chamber is extremely short. This prevents blockages, re-agglomeration and contamination, in contrast to systems with a hose connection. A controllable dispersing nozzle breaks up agglomerates before the material flow is measured. The high measuring speed also allows very small sections within the entire particle size distribution to be recorded.

Application example: Cement

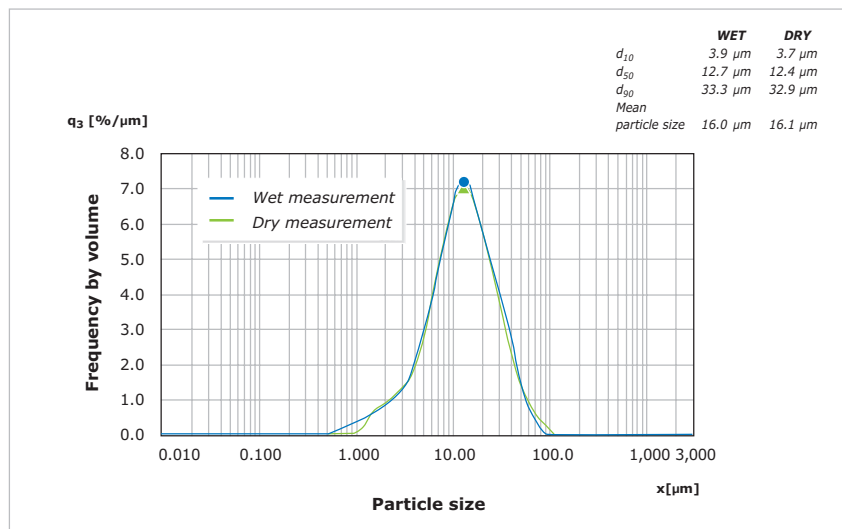
Cement types can be routinely measured both wet and dry with the LA-950. Because a wet measurement has to be carried out with alcohol the **dry measurement is less costly** and requires **less effort**.

The diagram shows the difference between a wet measurement (blue) and a dry measurement (green) on the same cement sample. The particle size is recorded identically in both measuring modes.

In general, **larger sample quantities** can be measured by means of dry measurements, which leads to a higher statistical certainty in the results. This particularly applies to coarse-grained samples and those with a wide distribution of particle sizes.



LA-950 with PowderJet Dry Feeder



Results of dry measurement and wet measurement of a cement sample.

Accessory options for optimized applications

In order to cover many applications, the LA-950 has been equipped with versatile accessory options. They include:

- Small volume measuring cell with a total volume of only 15 ml
- "MiniFlow" circulation system (30 ml)
- Large volume circulation system for sample amounts up to approx. 1,000 ml
- Cells for organic solvents
- Autosampler for maximum sample throughput

0.1 μm

600 μm

Laser Diffraction Particle Size Analyzer LA-300



The compact particle analyzer LA-300 is the ideal combination of high functionality, easy operation, low maintenance and high cost efficiency. It covers a measuring range of 0.1 to 600 μm .

Application example: Chocolate

The production of chocolate involves the repeated mixing, pressing and grinding of various components such as milk powder, cocoa butter and sugar. In the course of this, the particle size is reduced step by step from, on average, 100 μm to 10-20 μm . This is of decisive importance for the quality of the product - too fine particles lead to a powdery-dry taste, too coarse chocolate is less aromatic and creamy.

Benefits at a glance.

- Suitable for a large number of sample materials and suspension media
- High resolution
- Very short measuring times
- High reproducibility thanks to auto-calibration function
- Very compact size allows mobile application
- Very simple operation
- Various layouts available for the evaluations
- Individualized access authorization
- Flexible data processing options

Applications.

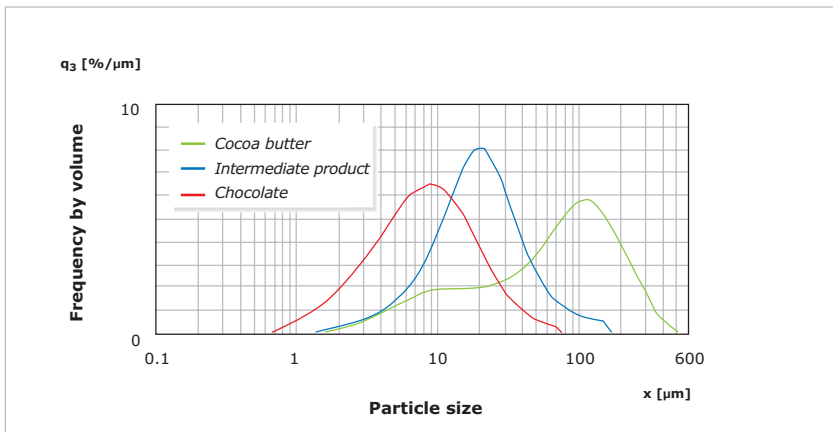
The LA-300 is particularly suitable for the following applications:



- Adhesives
- Catalysts
- Fine ceramics
- Foodstuffs
- Metal powders
- Minerals
- Paints
- Paper
- Pharmaceuticals
- Pigments
- Plastics
- and many others

Technical data.

Measuring principle:	Mie scattering theory
Measuring range:	0.1 μm to 600 μm
Measuring time:	Approx. 20 seconds (from start of measurement to display of results)
Required sample quantity:	Approx. 10 mg - 5 g
Optical system:	650 nm laser diode, 5 mW Detector: 36-segment ring-shaped photodiode detector, 6 wide-angle photodiode detectors
Sample circulation system:	Ultrasonic bath 15 W, 28 Hz
Discharge volume:	5.5 l/min (distilled water), 15 speed levels
Flow cell:	Tempax glass
Interface:	RS232
Operating environment:	15 °C - 30 °C, < 85% rel. air humidity
W x H x D:	289 x 320 x 420 mm
Weight:	Approx. 25 kg
Operating system:	Windows 98, NT, 2000, XP



The diagram shows the particle size distribution of three chocolate samples which have been drawn from the production process at three different stages.

■ Green curve: Cocoa butter at the beginning of the chocolate manufacturing process.

■ Blue curve: Intermediate step – mixing and grinding of the ingredients.

■ Red curve: the final product.

With the LA-300, the particle size distribution can be rapidly and reliably monitored so that, if necessary, the production process can be promptly adjusted.

1 nm

6.000 nm

Dynamic laser scattering with the LB-550

Benefits at a glance.

- Precision and robustness combined with compact size
- Short measuring time thanks to fast Fourier transformation
- High concentration range of up to 40 vol%
- Disposable plastic, glass, small volume and flow cells
- Integrated viscosimeter (optional)
- High degree of automation
- Low maintenance and cleaning effort
- Database for material parameters
- SOP method, validation of the results
- Access authorization with password protection
- 21 CFR Part 11 compliant software

The LB-550 laser scattering particle analyzer is used for the reliable measuring of nano-particles in a measuring range of 1 nm to 6,000 nm. A very effective detector with a photomultiplier ensures the reliable measurement even of particles which scatter light only weakly such as proteins and polymers. At the same time it is possible to measure strongly colored solutions such as pigments, emulsions or toners without dilution and therefore without affecting their formulation. Thanks to the temperature-controlled cell holder and an optional viscosimeter, the LB-550 allows optimum control of the measurement conditions.

Depending on the task, a **wide range of cells** (disposable plastic, glass, small volume and flow cells) are available. The concentration range for polystyrene standard particles of 100 nm diameter is between **1 ppm and 40 vol%**. Many material systems can therefore be measured in their **original concentration**.

Carrying out the measurements with the LB-550 is very simple and programmable in SOP routines. The samples are poured into a cell and can be maintained at a constant temperature by means of a Peltier element within the range of 5°C to 70°C. The viscosity can be determined by means of an **optionally integrated viscosimeter**.



Applications.

The LB-550 is particularly suitable for the following applications:

- Chemical-mechanical polishing
- Cosmetics
- Pharmaceuticals
- Polymers

Nano-technologies:

- Coatings
- Biotechnology
- Emulsions
- Pigments



LB-550V – Version with integrated viscosimeter

Technical data.

Measuring principle:	Dynamic light scattering (Brownian motion)
Calculation of the result:	Fast Fourier transformation
Light source:	650 nm diode laser
Measuring range:	1 nm - 6.000 nm
Measuring time:	60 - 90 s
Concentration:	1 ppm - 40 vol%
Measuring volume:	100 µl - 30 ml
Temperature range:	5 - 70°C, with integrated Peltier temperature control
Interface:	SCSI interface
Operating system:	Windows 98, NT, 2000, XP
W x H x D:	340 x 510 x 565 mm
Weight:	Approx. 28 kg or 36 kg (LB-550S or LB-550V)
Accessories:	Dilution unit, Autosampler, flow cell and micro cells



Extremely wide concentration range from highly diluted to highly concentrated



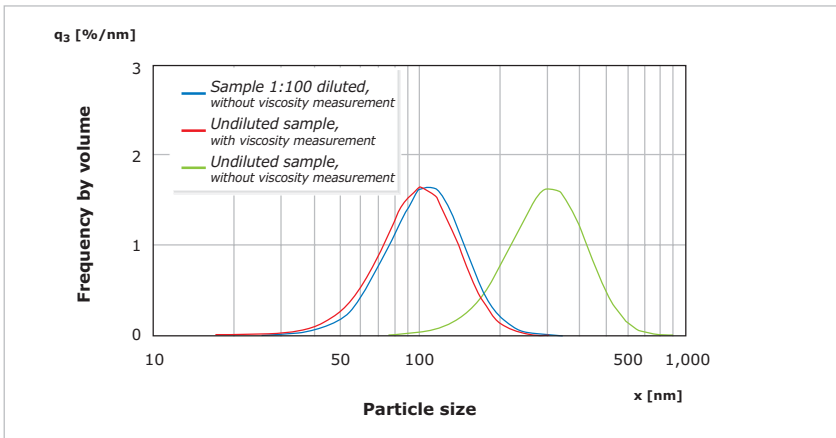
Application examples of the LB-550V with viscosity measurement

The viscosity and temperature of the measuring solution have a major influence on the measuring result. Both parameters can be monitored during measurement using the LB-550V, which includes an integrated viscosimeter. This leads to more accurate and reproducible results in the case of varying concentrations, which is illustrated by the example of printer ink.

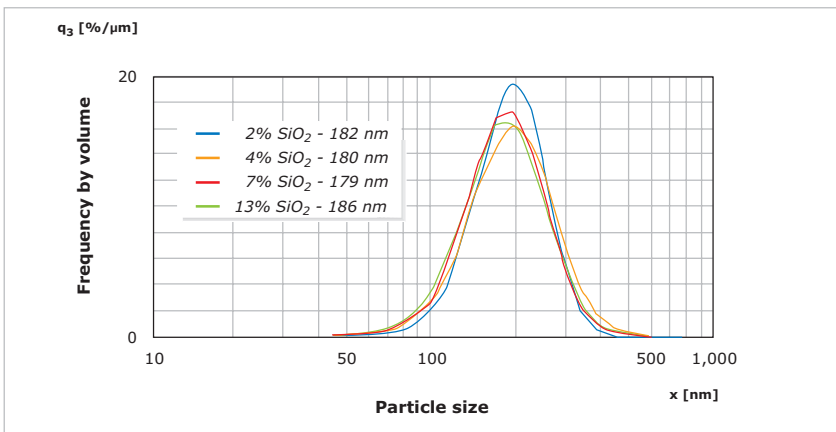
The blue curve shows the particle size distribution of a sample which has been diluted in the ratio 1:100.

If the same sample is measured undiluted by viscosity monitoring, nearly the identical size distribution is found (red curve). This shows that for many materials dilution is no longer required when using the LB-550V.

If the sample is measured undiluted and without the viscosimeter, the particle distribution will not be shown correctly (green curve).



The diagram below shows a further example of the good reproducibility of measurements with the LB-550V at a range of different concentrations. The particle size distribution and the average particle size of a SiO₂ suspension are shown. Such suspensions are used, among other things, for the manufacture of thin coatings.



Acoustic / Electroacoustic Spectrometer for Particle Sizing and Zeta Potential DT-1200

Particle size and zeta potential can now be measured at process concentrations with the DT series of instruments. Acoustic attenuation and electroacoustic spectroscopy are used to characterize a wide range of concentrated materials without dilution, thus providing meaningful results for samples that are sensitive to dilution. This may change the sample properties such that the measured results may give a different picture of the particle size and zeta potential of the final product.



Flexible Measurement Technique for Full System Characterization

This instrument measures sound attenuation and velocity of any fluid-like material, from water to toothpaste. No sample information is required to measure the attenuation and sound speed. A variable gap technique eliminates any need for calibration. A pulse technique, which automatically adjusts the accumulated number of pulses to reach a target signal-to-noise ratio, provides the extremely large dynamic range needed to characterize samples over a wide range of particle size and concentrations. Operation is completely automatic.

Wide Range of Applicability

Able to measure samples up to 50 volume %, the DT analyzers are able to measure most industrial products. The system also lends itself to on-line applications with the appropriate connections. Various options can add the titration capability of the DT-400 titrator, as well as adding sensors such as pH/temperature measurement, conductivity for aqueous as well as non aqueous media, and dielectric constant. A number of sample handling options are available depending on the nature of the sample, including magnetic stirrer or peristaltic pump for more viscous samples.

In cooperation with our partners JENOPTIK AG, Retsch Technology, and Dispersion Technology, we offer high quality optical systems for the determination of the particle size distribution in colloidal substances, emulsions, suspensions, dispersions, powders and granulates. For powders and granulates a shape analysis is also possible. The product program of Horiba Instruments covers the particle size range of 1 nm to 30 mm.

Suitability for industrial applications, compact construction size and ease of operation are the characteristic features of instruments offered by Horiba Instruments. In addition, the systems can be automated and used online, thus fulfilling the increasing demands in analysis and process technology. The qualified and motivated Horiba Instruments team aims to deal with all customer requirements rapidly and competently and to develop simple standard solutions for the user groups.

Contact us to find out how Horiba can improve your particle characterization capabilities:

HORIBA

Explore the future

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