

Saturn DigiSizer 5205



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Description

Micromeritics The Saturn DigiSizer®II is the first commercially available particle sizing instrument to employ the [light scattering analysis technique](#) that utilizes advanced digital detection technology to deliver exceptionally high levels of resolution, accuracy, repeatability, and reproducibility. A state-of-the-art CCD detector containing over three million detector elements enables the completely automated Saturn DigiSizer II to capture a high resolution, digital representation of the pattern produced as a result of laser light scattered from a sample. The resulting information is then processed using data reduction based on [Mie theory](#).

The instrument produces fast, detailed results that are repeatable on and reproducible between every Saturn DigiSizer.

Features

Both organic and inorganic particles can be analyzed and measured over a range of 40 nanometers to 2500 micrometers. The Saturn DigiSizer includes a complete system for circulating the dispersing liquid/sample mixture through the cell and reservoir, as well as to an external waste container. Features such as fully automated sampling and low-volume sample

handling systems make the Saturn DigiSizer ideal for a wide range of production, research, and quality control applications.

The liquid sample handling unit (LSHU) is available in two configurations. The standard unit includes a reservoir that is adjustable between 590 to 690 mL of dispersed sample. This model is best suited for samples containing coarse or high-density particles. The low-volume unit includes a reservoir that is adjustable between 100 to 120 mL of dispersed sample and is best suited for analyses where the sample quantity or dispersion liquid is limited, or where the dispersion liquid may be hazardous or not easily disposable.

The Saturn DigiSizer II analysis program is designed to operate in the Windows® XP Professional or Windows Vista® Business or Ultimate environment and includes wizards and intuitive screens enabling you to perform system operations quickly and efficiently. For applications that fall under FDA's 21CFR11 rule, the Saturn DigiSizer II confirm™ software option provides the security features and audit trails required by this regulation.

- Measures particles ranging from 40 nm to 2500 µm equivalent spherical diameter
- CCD detector contains over 3 million detector elements producing extremely high-resolution data
- Liquid sample handler automatically disperses sample and is available in standard and low-volume configurations
- One computer can control up to two analyzers, each with a liquid sample handling unit, and two MasterTech 052 Autosamplers, each allowing unattended analysis of up to 18 samples
- Fast, detailed results that are repeatable on and reproducible between every Saturn DigiSizer

Automatic Sample Handler

The [MasterTech Autosampler](#) is designed to increase throughput by ensuring there is no lapse between the completion of one analysis and the beginning of the next. Reduced operator involvement not only limits the possibility of human error, but saves time and increases repeatability and reproducibility. You can queue up to 18 samples to run sequentially and completely unattended. Operation of the MasterTech is controlled by the Saturn DigiSizer's operating software with dispersion and redispersion information being automatically stored in the sample file for future reference.

The MasterTech features a powerful ultrasonic probe. Power to the probe tip is adjustable and the driving circuit is self-tuning for maintaining efficient and consistent sonic energy from the input power. A digital readout on the front panel assures that you reach the desired power for dispersing each sample and that the same power is applied each time the method is repeated.

The Saturn DigiSizer with fully equipped LSHU (Liquid Sample Handling Unit) and a MasterTech provides assurance that every sample is prepared and analyzed exactly the same way, every time. Combined with Saturn DigiSizer's automatic optical alignment, the contribution of instrument variance on analysis results is essentially eliminated and any difference in results can be attributed with confidence to sample variations. You can depend on the results being extremely reproducible. So, if instrument-to-instrument, site-to-site reproducibility or analysis-to-analysis repeatability are important factors in your particle sizing applications, Saturn DigiSizer is the solution.

Sample Handling Module

The Saturn DigiSizer is equipped with a state-of-the-art, patented liquid sample-handling unit (LSHU). The LSHU combined with the instrument software assures that the concentration of the liquid-solid suspension is sufficiently high to produce a strong scattering pattern while sufficiently dilute to negate multiple scattering effects.

The sample handling system maintains a homogeneous and representative suspension flowing through the sample cell while preventing settling of the larger particles due to insufficient transport velocity. Homogeneity is accomplished by maintaining controlled turbulent flow that provides a mixing action sufficient to keep the sample material suspended but gentle enough to do so without creating bubbles.

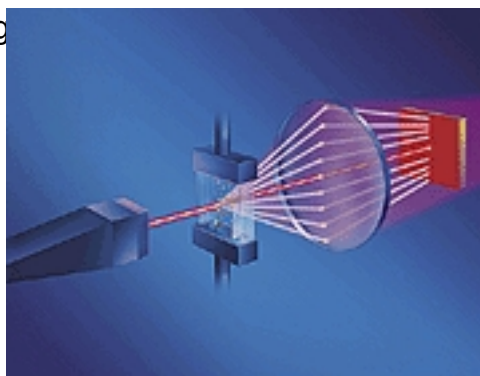
A centrifugal pump allows the flow-rate to be varied manually or automatically. The pump is integrated into the reservoir, as is an optional, system-controlled ultrasonic probe.

To guard against sample carryover between analyses, the LSHU has a patented reservoir rinse design. While other manufacturers' designs simply fill and empty the reservoir to perform a rinse, the DigiSizer's LSHU has a feature that sprays the reservoir walls as the fluid level recedes. This removes residue that otherwise would cling to the surface.

Analysis Technique

Static Light Scattering

There are two primary light



emented in particle sizing instruments, s

Digital Detection Technology

Typical light scattering particle size analyzers prior to the Saturn DigiSizer had detector arrays consisting of between 15 to 130 detector elements to cover the angular measurement range of the instrument. Saturn DigiSizer's CCD array utilizes more than 1.3 million detector elements, or pixels, for each of several five-degree band segments of scattering angle. The result of using such a dense array of light detectors is that the resulting light measurements represent a very detailed, digitized replica of the light scattering pattern to which the detector array was exposed.

The charge collected by the individual detector elements is proportional to light intensity at the position of the element, and the position of the element relates to the scattering angle.

Optical Design Features

A light beam from a solid state laser is coupled to a beam splitter which directs a portion of the light onto a reference photodiode. The remainder of the light is directed by fiber optics to a collimator and then to the sample cell where some of it is scattered by suspended particles. A Fourier lens intercepts the scattered light, projecting a segment of the scattering pattern onto the CCD array.

The physical size of the scattering pattern projected by the Fourier lens is considerably larger than the physical dimensions of the CCD array, which spans a little more than five degrees of the scattering pattern at any one position. The first relative position of the scattering pattern and detector array places the unscattered portion of the light beam somewhere on the detector near the edge; the initial physical position does not matter. The operating software scans the detector array and determines which CCD element contains the center of the incident beam and, therefore, intersects the optical axis. This pixel defines the location of zero degrees in polar coordinates. The software then maps all other pixels in the CCD array according to the angular position they occupy in the scattering pattern.

The range of light intensity in a scattering pattern can span more than ten orders of magnitude which is much greater than the dynamic range of any light detector. Therefore, Saturn DigiSizer takes multiple exposures at each CCD position in the scattering pattern by varying the number and duration of laser pulses. This assures that each CCD element will be on scale in at least one exposure and eliminates the loss of data due to pixel saturation or under-exposure. The reference measurement for each exposure is used to calculate a normalized exposure value for each element position in the CCD array and this data set represents one five degree segment of the scattering pattern.

After the first set of measurements is collected, the scattering pattern is shifted by increasing the angle of incident light relative to the sample cell thereby exposing the CCD to a new range of angles. The software re-maps the CCD array accordingly. Another series of exposures is taken, the series is normalized, and the angle of incident light again increases. This process continues until the required range of the scattering pattern has been measured. The 1.3 million element CCD may be employed in as many as 10 different angular positions, and multiple exposures

may be required in each position. The result is that initially millions of light intensity measurements are taken over thousands of unique angle bands.

Technical Specifications

General Power Requirements

Analyzer

Sample Handling Unit

450 VA

100 Voltage

100/115/220/240 VAC

85 to 264 VAC

Frequency

47 to 63 Hz

47 to 63 Hz

Physical

Analyzer

Sample Weight Handling Unit (kg)

45

29 Width (mm)

470

27 Height (mm)

500

50 Depth (mm)

650

650

Temp Ambient +10 to 35 °C

Humidity Up to 90% (non-condensing)

Laser Type Solid State; Diode

Wavelength 658 nm

Power 5 Output 5 mw

Beam Parallel Type

Beam 16 Width in sample

Certified under IEC825 as a class 1 laser product/Class 1 laser Product (CDRH).

Sample Circuit Liquid 6 Recirculation Rate

*Sonic 60 watts max

Recirc 600 ³ m System Volume

Material Borosilicate in Contact with Sample Glass, Stainless Steel, Fuel Grade Tygon Tubing, Titanium,

Lens Focal 200mm Length fixed

Detector Numb 1,310,720 of Elements
 Geom Rectangular Array with 1280x1024 pixels used at 10 different angles
 Alignn Automatic

Measurement Typical: less Time Between Measurements 5 min

Computer Requirements Pentium 333MHz or Equivalent
 . 64 MB RAM
 . Windows NT
 . Ethernet Card
 . CD Rom drive
 . 1 gigabyte hard drive

Deconvolution Type Mie of the Theory for Code applied 1000µm (Fraunhofer is available)

Output Meas: 0.1 to 100µm Range Equivalent Spherical Diameter
 Size 40 Class Range for 4 Decades

Performance Accur: **Diameter** (µm)
 0.1 to 1
 1 to 100
 100 Spec
 10%
 3%
 3%
 Resol: The Saturn DigiSizer can resolve peaks to baseline for Monosized particles
 Repe: **Diameter** (µm) (mean diameter for multiple analyses on the same instrument)
 0.1 to 1
 1 to 100
 100 Spec
 5%
 2%
 5%

