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BI-200SM

Research Goniometer and Laser Light Scattering System

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Features at a glance

- Stepping motor controlled, multiangle measurements
- Particle size and size distributions
- M_w , R_g , A_2 for dilute polymer solutions
- Cross-correlation detector option
- Avalanche photodiode detector option
- CONTIN, Zimm, Guinier, Fractal, and more

The Brookhaven Approach to Light Scattering

Light Scattering occurs when polarizable particles in a sample are bathed in the oscillating electric field of a beam of light. The varying field induces oscillating dipoles in the particles and these radiate light in all directions. This important and universal phenomena is the basis for explaining why the sky is blue, why fog and emulsions are opaque and other observations. It has been utilized in many areas of science to determine particle size, molecular weight, shape, diffusion coefficients etc. Brookhaven Instruments' scientists have extensive experience in the development of instruments and methods for light scattering and this experience has been incorporated into the BI-200SM to make it the finest instrument available for research applications of light scattering.

With a Brookhaven Instruments BI-200SM system this rich field of exploration is open to you for studies of both Static Light Scattering (**SLS**) and Dynamic Light Scattering (**DLS**).

The BI-200SM Research Goniometer System provides access to all of these studies with an **automatic, modular and versatile** system. It is a precision instrument designed for exacting scattering measurements. Based on a special turntable with precision ball bearings and stepping motor, the BI-200SM's modern design and quality construction guarantee precise measurements due to the wobble-free movement of the detector. It is field proven in hundreds of laboratories. It is ideal for macro-molecular studies and submicron particle sizing.

NEW! By taking advantage of the multiple inputs available on the [TurboCorr](#) correlator a **new** capability of the 200SM system is created. By adding an optical signal splitter to the beam of scattered light and a second detector

it is possible to eliminate the effects of very high speed interference from the detector(s). This **Cross Correlation System** provides remarkably clean information as seen in [the article we have presented](#).

The BI-200SM's modularity simplifies system expansion. Featuring a standard optical rail, the BI-200SM can be used with neutral density filters, a polarizer, an analyzer, and a reference detector. Special sample requirements can often be met by changing the cell holder design or size.

Special Features of the BI-200SM Research Goniometer System

Both DLS and SLS modes: Correlation & Intensity Measurements

Large angular Range: 8° to 155° with 25mm cells: 15° to 155° with 12mm cells.

Fine Adjustment Control: Read angle to 0.01° directly on large, fine-control adjustment knob.

Open Design/Standard Optical Rails: Facilitates user customizations for special purposes.

Temperature Control: Heating and cooling via any standard external circulator Separate temperature and filtration plumbing.

Special Design Glass Vats: Specially polished and flat entrance window ensures minimum flare.

Alignment Cell: Fine-screw vertical adjustment makes finding the center of rotation easier.

Multiple Laser Line Filters: Filter wheel with 632.8 (HeNe), 514.5/488.0 nm (Ar+), one open position for weak scatterers, and 2 blank (shutter) positions. Also available with 532 nm bandpass filter

Enhanced Viewing Optics: Coated, precision achromats coupled with behind-the-slit viewing and high-quality eyepiece make alignment easier.

Additional Alignment Aperture: Alignment of laser much simpler and faster.

Variety of Cell Holders: High precision cell holders standard, low-priced round cells available: 27.5 mm dilution vials fit cell holder sleeve. Special small-volume cell available.

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Typical Applications

In the **SLS** mode, time-averaged intensity measurements are made - at either fixed or variable angles - in the range from 8° to 155° and analyzed with software provided for the methods of Zimm, Berry, Debye, Guinier, Kratky etc. Such evaluations using measured angular or concentration dependencies of the intensity of the scattered light provide key information for those interested in the such topics as:

- M_w Molecular weight determinations
- R_g Radius of gyration
- A_2 Determination of second virial coefficient
- Micro-emulsion technology
- Colloid behavior
- Complex fluid characterization
- Emulsion polymerization
- Particle size growth

- Nucleation processes

The field of **DLS** measurements is at least as rich as that of **SLS**. In this method the dynamics of the scattered light are determined and analyzed. The short-term intensity fluctuations (dynamics) of the scattered light arise from the fact that the scattering particles are undergoing rapid thermal motions. These movements are called Brownian motion and they cause short term fluctuations in the intensity of the scattered light. Various terms have been used for this phenomenon. These are Dynamic Light Scattering (**DLS**), Photon Correlation Spectroscopy (**PCS**) and Quasi-elastic Light Scattering (**QELS**), We will adhere to **DLS**. To uncover the key parameters which describe the diffusive motions a digital autocorrelator is used to determine the autocorrelation function (**ACF**).

From these **DLS** measurement many interesting subjects may be explored, among them:

- Particle size distributions
- Particle aggregation phenomena
- Micellar systems
- Micro-emulsion technology
- Colloid behavior
- Vesicles & liposomes
- Plasmid DNA's
- Particle size growth
- Nucleation processes & protein crystallization

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Specifications

Beam Focus and Steering: Includes mounts, adjustments, and apertures.

Turntable: 200 mm O.D. turntable, worm gear and ball bearings; manual or automatic selection of angles in 0.01° steps; precision machined base with mounting holes; positioning table with micrometer adjustments. (Power supply and controller for stepping motor is optional)

Specimen Cell Assembly: Including thermal enclosure, centering adjustments, separate plumbing for temperature control and index matching liquids, round cell holders, square cell holder and alignment cell.

Index Matching Vat: With optically flat and specially polished entrance window; precision machined and annealed to minimize stray light.

Periscopic Beam Stop: Located inside vat to prevent flare from exit window; provided with coupling for use with optional, zero-angle reference detector.

Main Detector Optics:

- Entrance aperture of 3 mm.
- Coated, adjustable achromat for focusing scattered light onto 200 micron slit. Slit position adjustable.
- Reflex mirror and high quality eyepiece for viewing scattering region through slit.
- Filter turret with 632.8, 514.5, 488.0 nm, 2 closed positions, and 1 open position. other filters available.
- Secondary pinhole turret: 100, 200 and 400 micron pinholes for DLS measurements; 1, 2 and 3 mm pinholes

for SLS measurements.

A policy of continual improvement may lead to specification changes.

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Options and Accessories

BI-DNDC: Differential Refractometer. **New**

BI-CrossCorr: Eliminate detector artifacts by cross correlation.

BI-SFS: The new BI-SFS sample filtration system provides a fast and convenient way to clean your light scattering samples, a necessity for samples smaller than 20nm. Utilizing Teflon® tubing and nonreactive components, the BI-SFS is compatible with most sample filtration needs. Its modular design allows users to change pump heads and speeds to encompass virtually any possible application.

BI-APD: Avalanche photo diode, up to 10 times the sensitivity.

BI-HV: High voltage power supply.

BI-LRM: Laser rail and mounts for most lasers. Lasers are frequently supplied by the user. Contact the factory for recommendations.

BI-TCA: Temperature controller, external circulator type, -20 to 100° C, analog setting and readout, ± 0.2° stability.

BI-TCD: Temperature controller, external circulator type, -20 to 100° C, alphanumeric setting and readout, ± 0.1° stability.

BI-FC: Filtration/circulation system for index matching liquid. New gear pump and rigid Teflon tubing.

BI-RC12: Nominal 12 mm O.D. Round Glass Cell, polyethylene cap.

BI-SC: 10mm path length Glass Square Cell & PTFE cap.

BI-RC25: Nominal 25 mm O.D. Round Quartz Cell, dual Teflon tops, mounting ring.

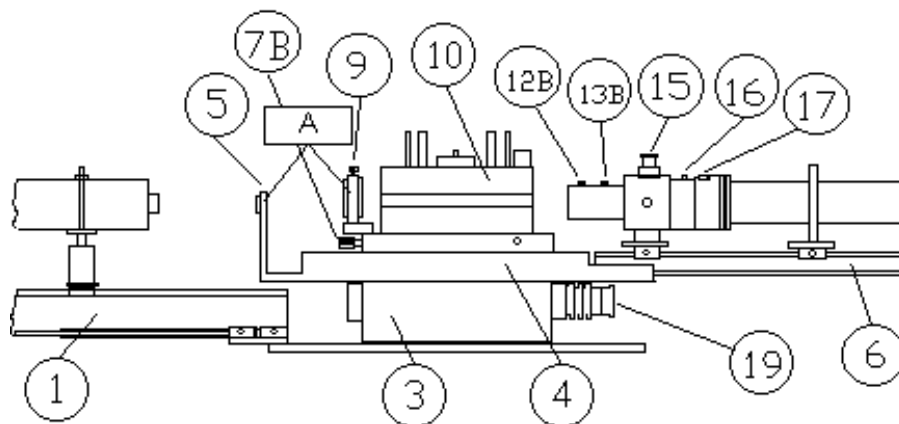
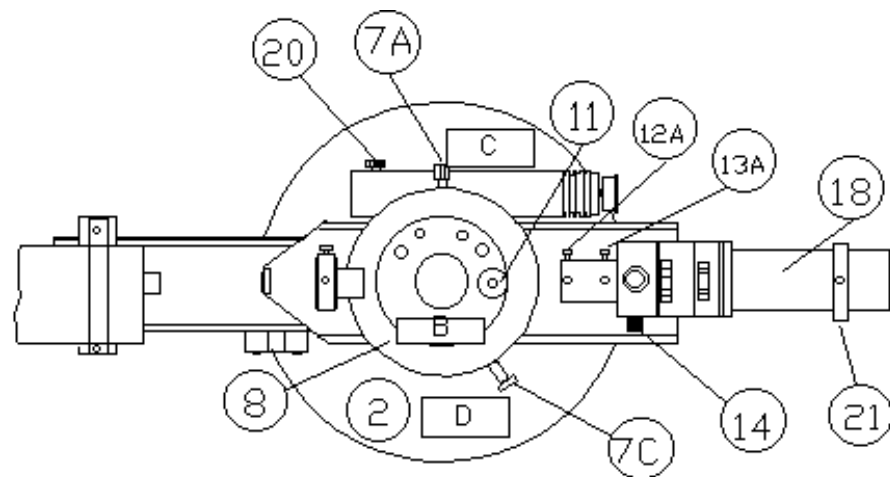
BI-RC27: Nominal 27.5mm O.D. Dilution Vials, package of 100 with HDPE screw caps.

BI-SVC: Small-volume cell for precious samples

BI-2DS: Reference detector including mount. Is recommended for use with BI-ZP software when laser drift is greater than 1% and/or when measuring samples that absorb strongly

BI-PA: Polarization Analyzer, Glan-Thompson prism, 5x10⁻⁶ extinction, 2-position mount.

BI-Spec/Adap Inquire about adapting parts of your existing light scattering system.



Legend

- 1. Laser rail and mounts, optional
- 2. Precision-machined base
- 3. Turntable
- 4. Rigid rotating arm
- 5. Upright for 2 mm alignment aperture
- 6. Detector rail
- 7A,B. Center of rotation adjustment screws
- 7C. Center of rotation locking screw
- 8. Center of rotation adjustment table
- 9. Beam focusing and steering lens assembly
- 10. Sample cell assembly
- 11. Beam Stop
- 12A. Lens adjustment, horizontal

- 12B. Lens adjustment, vertical
- 13A. Slit adjustment, horizontal
- 13B. Slit adjustment, vertical
- 14. Mirror adjustment
- 15. Eyepiece
- 16. Pinhole wheel
- 17. Filter wheel
- 18. Photomultiplier housing
- 19. Angle adjustment
- 20. Clutch release
- 21. Support ring