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Find the *Brookhaven BI-9000AT* at our website: *Click HERE*

Brookhaven BI-9000AT

Digital Correlator and Photon Counter
Now with Windows™ Software

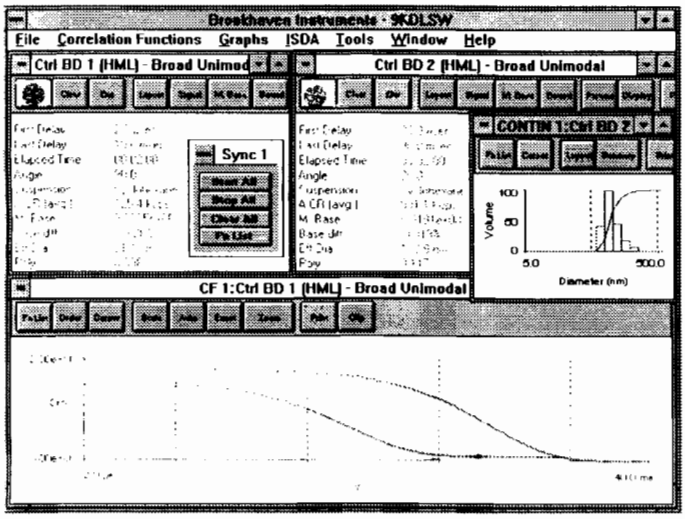
Hardware

The *new* **BI-9000AT** is an advanced and extremely versatile digital photon correlator and counter designed for use in static (SLS) and dynamic (DLS) light scattering applications. It is supplied in the form of a single ISA-compatible card with control software for installation in a PC (or pre-installed in a PC).

Multiple Signal Sources. The **BI-9000AT** is capable of accepting two signal sources, one for the middle and one for the low speed circuits. An on-board microprocessor on each correlator card controls the circuits and collects the correlation function(s). This relieves the host computer CPU of many tasks and allows concurrent running of up to eight correlator cards in a single computer. The new **BI-DLSW** Windows™ software can display and control the simultaneous accumulation of up to 16 functions at once.

The middle and low speed circuits can be operated as independent correlators, simultaneously processing different input signals. This can be used, for example, to correlate two light scattering signals from different detector angles simultaneously or for cross correlating two signals originating from two different positions in a liquid.

Two functions are shown in the window below. The data are from the same sample at different angles: 30° and 90°. Note the use of the **Sync Tool** which allows simultaneous data collection. The functions are here shown overlayed to demonstrate the obvious difference in the correlation functions collected at two different angles.



Features at a Glance

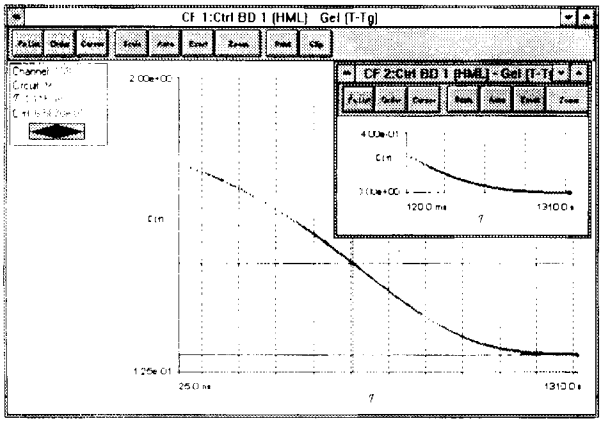
- Auto- & cross correlation modes
- Up to 522 software selected channels
- Sampling times 25 ns to 40 ms
- Delay range 25 ns to 1,310 s
- 100% efficient, real-time operation over the entire delay time range
- Single, ISA-format, PC card
- Up to eight cards can be addressed simultaneously
- Includes Count Rate History
- Optional analog input
- Power saver feature
- **Now with Windows™ Software**

Operating modes. The **BI-9000AT** digital correlator permits real-time operation in both auto- and cross correlation modes. It is 100% efficient in either mode over the entire delay time range. Unlike other correlators, the **BI-9000AT** requires no prescaling.

Through the software, the user can select the number of channels, in either linear or constant ratio spacing, up to a maximum of 522 channels.

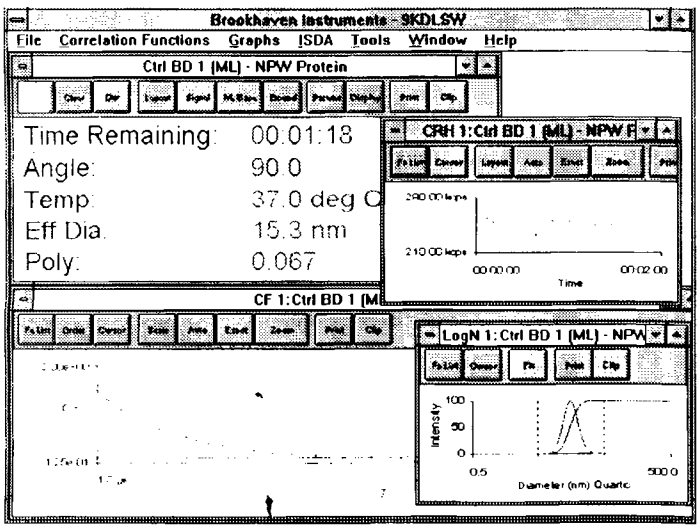
User written macro commands can be saved and reloaded to provide an unlimited number of predetermined automatic sequences, each initiated by a single mouse click.

The **BI-9000AT** spans over 10 decades in delay time range from 25 ns to 1,310 s. This is very useful when studying gels, glass transitions, concentrated polymer solutions and colloidal suspensions. The function shown below was generated using the Williams-Watts equation in the built-in simulator. It is difficult to tell if the function has reached the baseline. In such a case one can use the cursor to draw a box around any group of channels **(Bound Box)** and then use the **Zoom In/Out** feature. Alternatively, as shown below, a second graph window was created and the x and y axes were scaled for greater clarity.



Software

Versatility. Using Windows™ a variety of different and customized screen layouts are possible. The window below shows a typical layout useful in particle sizing. Here the emphasis is on measurement of a small protein. For such applications dust might have been a problem, but the flat count rate history shows that, in this case, it was not. The windows do not fill all the space in order to emphasize the great versatility the user has in designing their own layout.



The numerical information displayed in the control window was selected to show just time remaining, angle, temperature, average diameter and polydispersity. But, by clicking the **Display** command button, the user can choose to display any or all of the following items:

STOPPED		Ant	5.4294e+06
Signal	Auto A	A CR (avg)	252.2 kcps
Run	2	Btot	5.4294e+06
First Delay	25.0 nsec	B CR (avg)	252.2 kcps
Last Delay	1310.0 sec	MS 0 Chan	Undefined
Elapsed Time	00:00:22	Normalization	M. Base
Wavelength	632.8 nm	M. Base	5.731e+06
Angle	15.0	C. Base	5.6458e+06
Temp	29.6 deg C	Base diff	-1.663%
Suspension	Heptane	Dust Cutoff	Undefined
Viscosity	0.867 cP	Data Ref	Undefined
Ref Index	1.331	Eff Dia	17.2.8 nm
Samples	4.3060e+06	Poly	0.208

Windows™ Interface. Allows text and graphical displays such as:

- Large numerical **Count Rate Meter**, useful during alignment
- **Fourier Transform**
- **Count Rate Distribution** and **History**
- Simultaneous **multiple results** windows for comparison of different fitting algorithms

This versatility extends to a variety of **BI-DLSW** software features including:

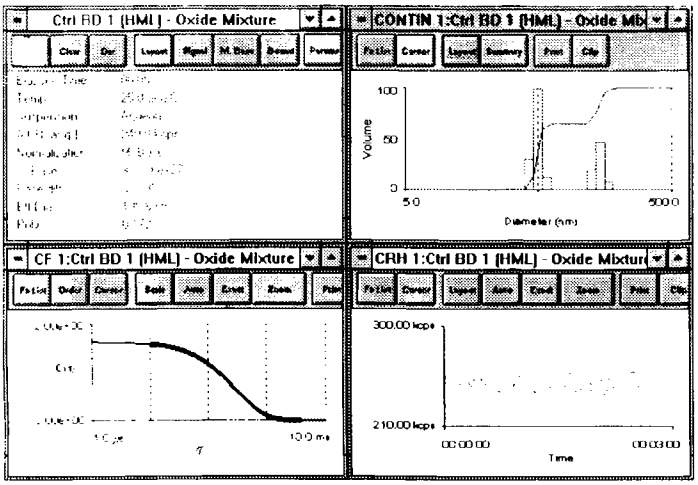
- Resizable Windows & groups of Windows, save/reload favorite configurations by name
- Database management using folders and files
- Data logging for spreadsheet applications
- Print preview
- Distribution information as particle size, relaxation time τ_{rel}, or linewidth Γ
- Automatic update of distribution and residual plots during measurement
- Automatic calculation of common liquid viscosities and refractive indices as a function of temperature and wavelength
- Overlay of up to 6 correlation functions, measured or simulated, color differentiated
- Simulate data, up to 3 exponentials, with variable intensities or a Williams-Watts function
- Lin/Log display and/or scaling
- Zero to 8 extended channels, 2 to 10 times the last contiguous channel
- Zoom in/out on any portion of the function
- Standard clipboard and print window functions

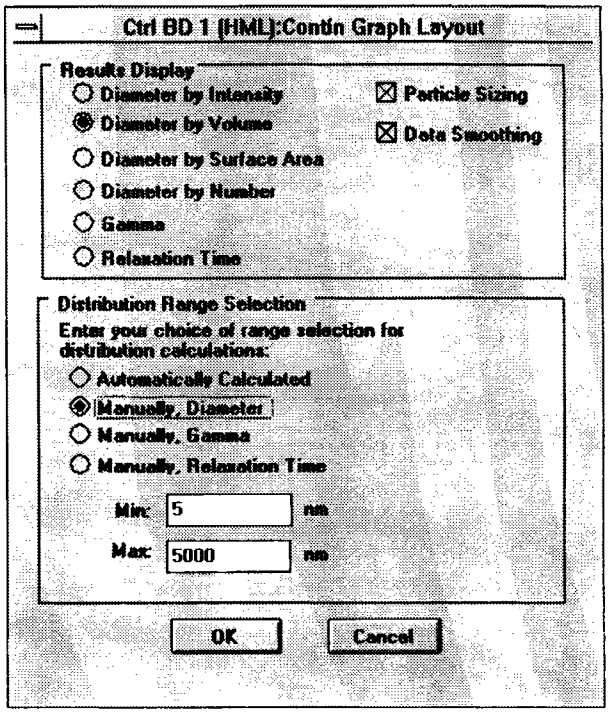
Application Software. The **BI-9000AT** allows a wide variety of applications including static and dynamic light scattering measurements.

Brookhaven offers a number of Windows-based programs suitable for use with the **BI-9000AT** and the **BI-200SM** laser light scattering goniometer system including:

- **BI-DLSW**, Correlator control algorithm, DLS
- **BI-PCSW**, Simple particle sizing algorithm, DLS
- **BI-ISDAW**, Advanced DLS distribution algorithms including cumulants, NNLS, CONTIN, exponential sampling, double exponential, and Williams-Watts
- **BI-SLSW**, SLS algorithms including Guinier, Kratky, Fractal, R_g, and $\ln(I_{ex})$ vs. q for structure and size determination in colloids and polymers
- **BI-ZPW**, Zimm, Berry, Debye plots for molecular weight determination in dilute polymer solutions
- **BI-ISTW**, Alignment and goniometer stability testing

The optional **BI-ISDAW** particle size analysis routines now include fitting by volume, surface area and number as well as intensity for particle sizing, with and without smoothing. For polymer and complex fluid applications, the distributions can be presented in Γ and τ space as well. Users can select the automatic range calculation or enter maximum and minimum values for finer control. Fitted data can be displayed as well as the overlay of measured and calculated correlation functions. For even more sensitivity, the residuals can be displayed.





New software features include the ability to automatically set the *total experiment duration* according to the following choices:

- Total time in seconds
- Total samples
- Difference between the first channel and the selected baseline
- Percent difference between calculated and measured baselines

Another **new feature** is a greater variety of measured baselines including:

- Up to 8 extended channels, extended by 2 to 10 times the last contiguous channel
- Up to 32 channels using a **Bound Box**
- Up to 32 channels using **Autoslope**
- Infinite time, calculated from monitor channels

A **Bound Box** can be drawn around any group of channels using the mouse. Once bound the channels can be used for **Zooming** in or out, for a measured baseline, or to reset the delay time range.

With the **Autoslope** feature enabled, the measured baseline is automatically set as the average of up to 32 user-designated channels when the slope of the first eight channels is less than - 0.07%.

Specifications

Section	Channels	Sampling Time Range	Maximum Delay Time	Multiplier Bits
Low Speed	1 to 240	50 µs to 40 ms	1,310 s (40 ms)	16 x 16
Mid Speed	1 to 256	500 ns to 100 µs	1.6 s (100 µs)	8 x 8
High Speed	*See Below*			

High Speed Section:
14 Standard Channels at: 100, 200, 300, 400, 500, 600, 800 ns, 1.0, 1.2, 1.4, 1.6, 20, and 2.4 µs
Plus 12 optional channels at: 25, 50, 75, 125, 150, 175, 225, 250, 275, 325, 350, and 375 ns

Maximum Number of Channels:
240 + 256 + 14 + 12 = 522
Delay Time Axis: User selected (except fixed, high speed channels) from linear, constant ratio, or as individual time points recalled from user files
Dynamic Range: Over 10 decades (25 ns to 1,310 seconds)
Operation Modes: Automatic and Manual. User definable macro commands to write, save, and reload unlimited number of sequences enabled by single mouse click
Maximum Count Rate: 4×10^7 per second
Standard Input Levels: TTL, 50 Ω input impedance, 5 ns minimum pulse width. Other levels available via optional, external converter

Power Requirements:
ISA-compatible Bus, 22 Watts/card, 12 W with Power Saver feature
Power Saver: Automatically removes power from unneeded high speed channels
Dimensions: Full ISA-compatible Bus Card
Weight: 100 g, without computer
Environmental Characteristics:
Temperature 10^0 to 75^0 C
Humidity 0% to 95%, non-condensing

CE Marked

Options

BI-25NS: Twelve, 25 ns channels
BI-ANIN: Analogue input
BI-CON: Stepping motor controller, for use with **BI-200SM** goniometer and accessories
BI-ISTW: Alignment/Stability Software for use with BI-200SM goniomete
BI-PCSW: Simple particle sizing algorithm: cumulants
BI-ISDAW: Advanced particle sizing algorithms: CONTIN, NNLS, Exp. Sampling, Double Exponential
BI-ZPW: Molecular weight algorithms: Zimm, Debye, Berry
BI-SLSW: Particle and fluid structure algorithms: Guinier, Kratky, Fractal, R_g, ln (I_{ex}) vs. q
BI-NT: Special drivers for Win™ NT, contact factory

Please inquire about our complete line of light scattering equipment for colloid and polymer characterization. The **BI-9000AT** may be used with our **FOQELS** instrument for particle sizing in concentrates using single mode fiber optic technology, or with our **BI-200SM** goniometer for laser light scattering at multiple angles for the characterization of polymers and colloids. Brookhaven also offers sedimentation devices for high resolution particle sizing and zeta potential devices for stability studies.

For more information on Brookhaven products, please visit our Home Page www.bic.com.

A policy of continual improvement may lead to specification changes.

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