MOS-500

SPECTROPOLARIMETER

Circular Dichroism Spectrometer

BioLogic Science Instruments

Everything you expect from a spectropolarimeter

- SPEED AND SENSITIVITY
- STABILITY
- MODULARITY
- LOW RUNNING COST
- USER-FRIENDLINESS

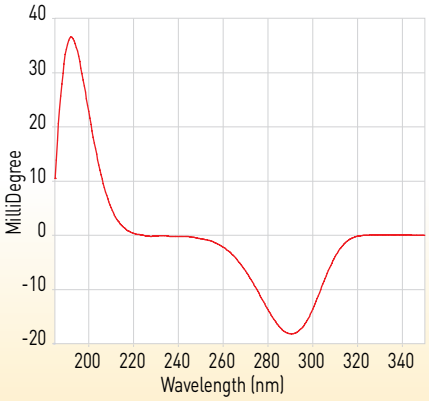
GENERAL SPECIFICATIONS

- 163-950 nm, and 0 nm (white light)
  (up to 1,250 nm optional)
- Dual light source (Xe and XeHg)
- ±0.1 nm wavelength accuracy over full wavelength range
- Peltier temperature control optional
- Unsurpassed baseline stability
- Fast and sensitive
- Standard detection modes: CD/Absorbance/HV, Fluorescence, FD/CD, Fluorescence anisotropy and polarization, LD, HPLC-CD
- Optional modes: NIR-CD, ORD, DR-CD, Stopped-flow and titration, Emission fluorescence

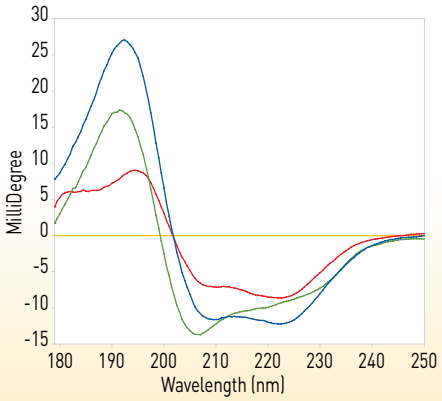
MOS-500 uses an innovative and patented three stage wavelength selection system to bypass the limitation of traditional prism-based monochromators. The design delivers outstanding performance in wavelength range, sensitivity, precision, speed, and modularity.

Operating cost is reduced as well, since the **MOS-500** requires purging of optics only when working below 195 nm. A standard dual lamp box adds to the convenience of the system, and an optional tungsten lamp enhances IR performance.

Thanks to its modular design the **MOS-500** is much more than a CD spectrophotometer. Multiple detection modes and a wide range of accessories from stopped-flow to ORD are available to allow you to adapt the system to your research.



0.06% Camphor sulfonic acid 0.2s/pt, 0.25 nm steps, and 1 nm bandwidth



CD spectra collected with 0.5s/pt, 0.25 nm steps, and 1 nm bandwidth lysozyme (green), cytochrome c (red) and myoglobine (blue)

UNSURPASSED STABILITY

The combination of super quiet light source with ultra stable optics and electronics make the **MOS-500** the most stable spectropolarimeter on the market by a full order of magnitude.

It is ideal for measurements and titrations that take hours to complete.

LOW NOISE

The optical components and design were carefully chosen for the best quality, longevity, and efficiency. The optical path is optimized so the maximum amount of light reaches the detector from far UV to NIR. The photomultiplier detector was chosen to offer the highest sensitivity from far UV to 950 nm. The wide range detector means the system can be used for no compromise fluorescence measurements, making **MOS-500** a more versatile and cost effective instrument. Optional PMTs can be installed for specific applications if needed, without upgrading hardware.

MULTIPLE SCANNING MODES

Scanning speed can be set by the user, or automatically controlled in software to optimize the quality of spectral data. Under software control the scanning speed is reduced for wavelengths where the level of light is low. The user can display raw data or apply post acquisition processing. Scans can be easily synchronized with temperature or titration steps through Biokine software.

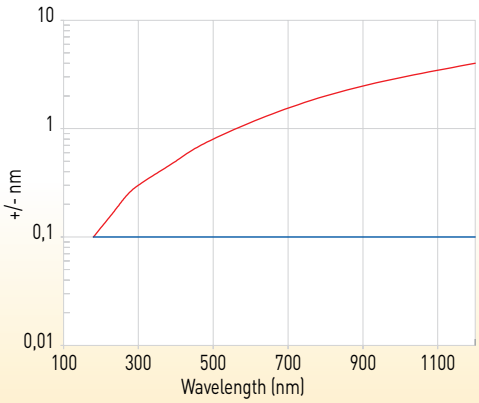
DOUBLE LIGHT SOURCE

The **MOS-500** includes a Xenon/Xenon (Hg) double light source. The xenon lamp is preferred for UV-Vis scans and XeHg for single wavelength applications.

The user can select either source in seconds without handling or re-aligning the lamp. This makes the system especially valuable in a multi-user lab.

The **MOS-500** can accommodate lamps from 75 W to 200 W, and tungsten lamps are available for different application needs.

UNIQUE TECHNOLOGY



Wavelength accuracy profile for — MOS-500
— prism based spectrometers

TUNABLE CHROMATIC LIGHT SOURCE COUPLED TO A DOUBLE GRATING MONOCHROMATOR

The **MOS-500** combines a patented chromatic illumination system with a new grating design to provide wavelength range, diffraction efficiency, and accuracy.

The **patented chromatic illumination** system provides the initial selection of the wavelength. Like a prism monochromator it uses the variation of the refractive index of quartz. This is followed by the latest design double grating monochromator to give constant and optimal resolution, and precision at all wavelengths.

The chromatic illumination of the double monochromator also reduces the energy received by the monochromator and extend lifetime of the optics. Monochromators are confined so level of stray light is minimum, allowing high performance spectra in the far-UV. The slit mechanism is software controlled, and bandwidth can be selected freely from 0 to 16 nm. The **MOS-500** also includes a software controlled shutter for photosensitive samples.

GRATING VS PRISM

Conventional CD spectrometers based on double prism monochromators use prisms to polarize light. Prisms provide good wavelength resolution in UV region, but in the visible and IR region however, wavelength precision can be reduced by a factor of 20. Precision is also reduced when compared to gratings in the same wavelength ranges. This makes it difficult to run well resolved spectra using small slits.

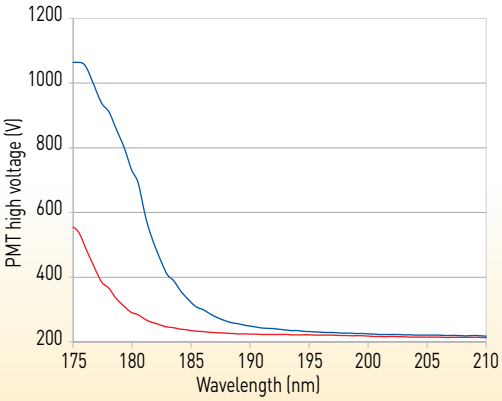
In addition, prism monochromators are not ideal for rapid kinetics studies even in UV region. Indeed for kinetics user wants to get as much light as possible and often wishes to open slits widely which is not always possible with prism monochromators.

The MOS-500 combination of a tunable chromatic light source with gratings offers the best performance over the full UV, visible and NIR range.

Instead of choosing between prism and grating monochromator the MOS-500 combines the best of both worlds

Low running cost - save more than 5,000 € a year

Calculation is based on a daily use at a 3l/ min N_2 flushing of optics (recommended by other manufacturers) and cost of one N_2 bottle in 2012. Instrument being used above 200 nm only.



HV spectra with and without N_2 flushing (no effect above 195 nm)

NO NEED FOR N_2 FLUSHING ABOVE 195 NM

Classical CD instrument manufacturers have made nitrogen flushing a requirement for CD measurements. The main reason is the need to remove oxygen and to reduce its light absorption in the far-UV range. This is important for wavelength shorter than 195 nm, but N_2 flushing is useless from 195 nm to NIR. Another reason is the need to protect refective coatings from ozone generated by UV reaction with oxygen in the lamp compartment.

The **MOS-500** design dramatically reduces the need for N_2 flushing. It is designed without focusing mirrors in the lamp compartment, so there is no risk to the optics. The gas purge space is divided into three areas: the light source, the optical bench and the sample compartment.

The instrument is sealed so the N_2 purge can be stopped in the lamp housing and optical bench after 20 minutes of operation, while keeping outstanding performances in the far UV range.

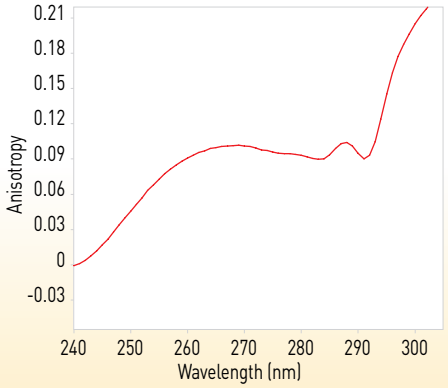
AUTOMATIC VARIABLE FOCALIZATION

The sample compartment is large and accessible to accommodate many options. The focal point is automatically adjusted to accommodate the detection mode and accessory installed.

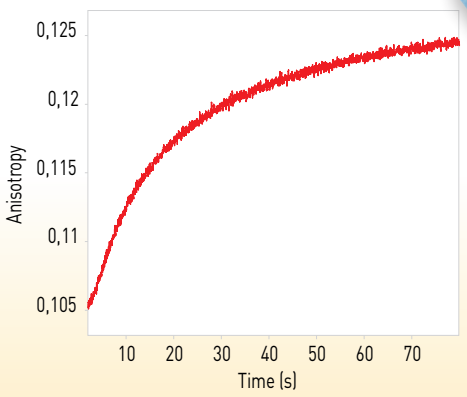
The light beam can be parallel, or be focused on the cell, or on the detector to offer the best signal to noise for each experimental condition. The detector position can also be as close as possible to the cell.

These automatic adjustments are unique and a key to delivering the best performance in the most demanding applications.

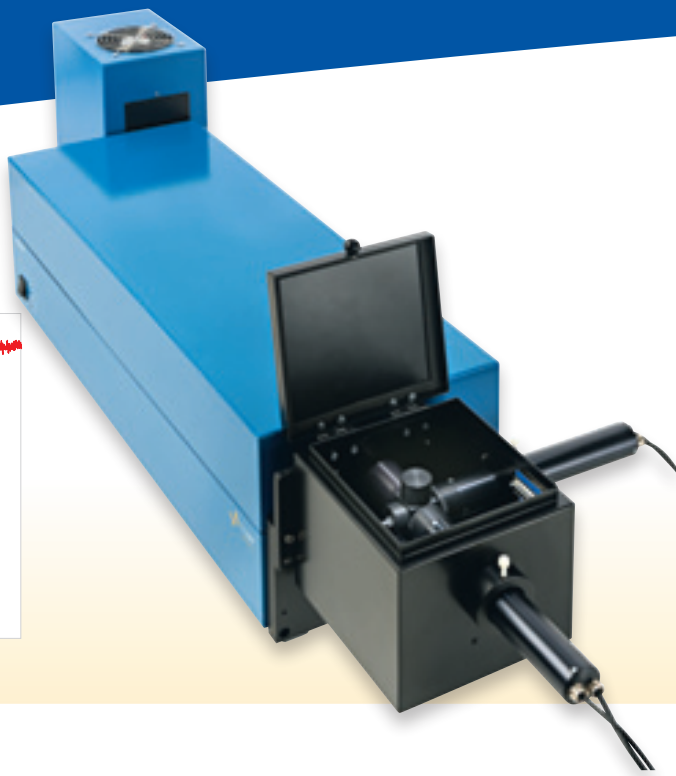
MORE THAN JUST A CD SPECTROMETER



Lysozyme fluorescence anisotropy spectrum



BSA /Phloxine reaction followed in anisotropy mode



POLARIZATION AND FLUORESCENCE ANISOTROPY

The **MOS-500 includes** a unique fluorescence **anisotropy measurement** mode. The EMFA® method uses fast modulation of the polarized excitation light and synchronous detection of the fluorescence signal to achieve a very sensitive and fast measurement of sample anisotropy.

Fluorescence anisotropy is a useful technique in a wide range of application: binding, denaturation, aggregation and crystallization, or any reaction inducing a total or a partial change of flexibility of the molecule holding the chromophore.

Data can be displayed in anisotropy units, or as the two polarized signals. Total Fluorescence is also measured simultaneously.

Excitation Modulated Fluorescence Anisotropy

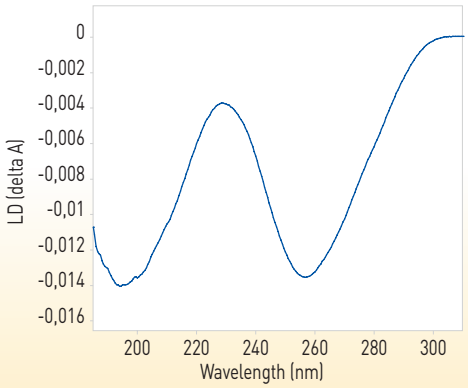
EMFA method was developed and patented by Bio-logic in 1999.
Refer to World Intellectual Property Organization website for details.

FLUORESCENCE AND FD-CD

The standard photomultiplier tube covers a wavelength range from 160 nm to 950 nm. It is ideal for fluorescence application. The PMT housing can be easily relocated at 90° to the beam for fluorescence or FD-CD measurements. The PMT housing accepts 1 inch diameter filters to select emission light.

When doing Fluorescence Detected Circular Dichroism (FD-CD), the photo elastic modulator alternatively generates left and right circularly polarized light. The difference between the two polarization signals is measured with the PMT installed at 90° to the beam.

If the user wants to simultaneously record CD and fluorescence signals, or dual fluorescence, second PMT is required.



28 µg/ml DNA spectra using 1 second sampling

LINEAR DICHROISM

Linear dichroism is the difference in absorption of parallel and perpendicular linearly polarized light. These two polarizations are generated by using half wave retardation with a photo elastic modulator. LD gives information on the orientation of bio-macromolecule.

The **MOS-500** includes hardware and software to measure LD signals in steady state and kinetics mode. To collect LD spectra the user can use commercial flow through cells or an optional couette cell to orient the sample in the cell.

A MULTI-CHANNEL APPROACH

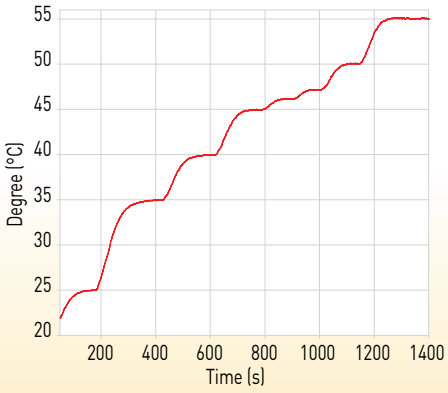
The **MOS-500** was designed to provide a multi-modal approach. CD, absorbance and HV can be recorded simultaneously, and the user can add temperature and fluorescence signals with additional accessories. When temperature is controlled through a Peltier element, dynamic multimode spectroscopy measurements are possible.

The **MOS-500** is by far the most modular and highest performing system on the market, with outstanding specifications in every detection modes.

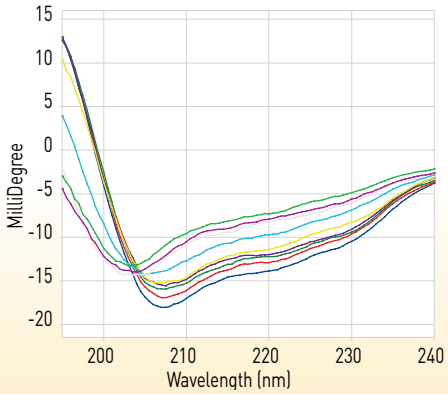
HPLC-CD

The **MOS-500** can be coupled to HPLC instruments using a commercial flow cell fitted into the sample compartment. Biokine software can be triggered from the HPLC to record the chromatogram. The CD signal can also be fed back into the HPLC for data comparison and analysis. The **HPLC-CD** signal can be recorded over the full wavelength range of the **MOS-500**.

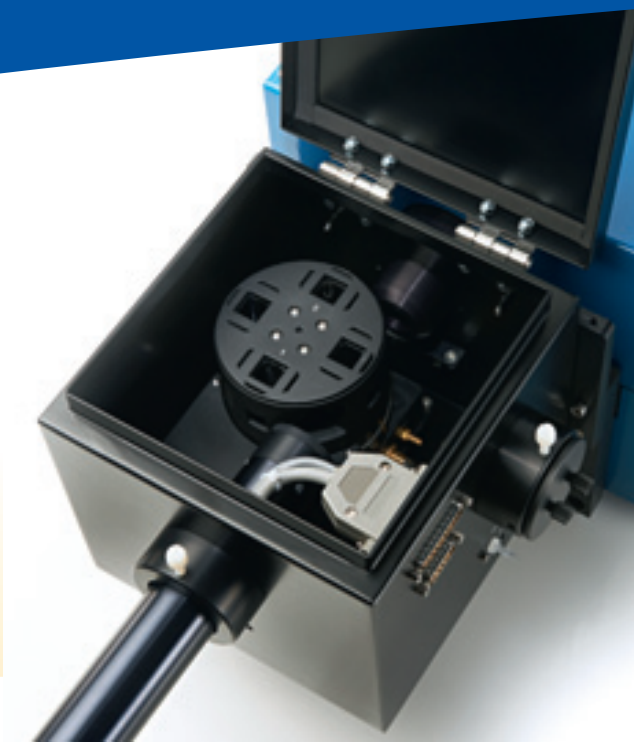
TEMPERATURE CONTROL



Precision of sample temperature recording without overshoot (10°C, 5°C and 1°C temperature steps)



Thermal denaturation of lysozyme (from 30°C to 85°C in a 1 cm cuvette)



SINGLE CELL PELTIER TEMPERATURE CONTROLLER

The **MOS-500** can be equipped with an optional Peltier temperature controller for precise and rapid temperature control of the cell. The temperature of the Peltier element is regulated according to the real temperature of the cell for smooth control without overshoot. The measured temperature corresponds exactly to the target temperature without any gradient due to the distance between the Peltier and the cell.

Temperature ramping is easily programmable from Biokine software. At each temperature step a CD spectrum can be measured automatically. For single wavelength thermal stability studies it is also possible to directly measure the CD signal versus temperature to determine thermodynamic properties of a protein (Tm, ΔCp, ΔS).

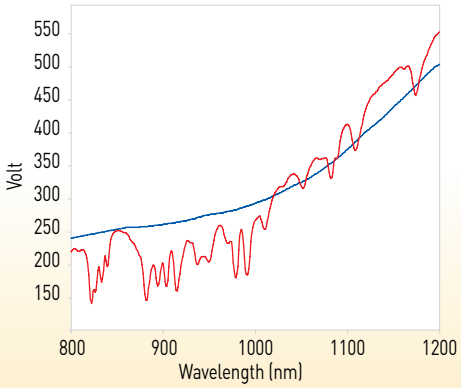
Specifications

- Full software control
- 0.01°C precision
- Magnetic stirring standard
- Temperature range: -10°C to 110°C
- Temperature of the cell and Peltier can both be measured
- Easy programming

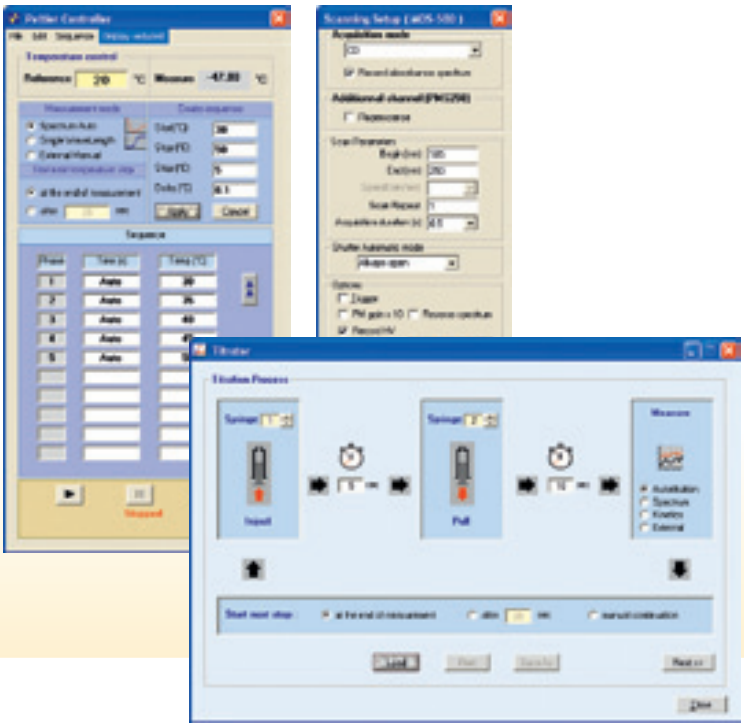
MULTI-CELL PELTIER TEMPERATURE CONTROLLER

The **MOS-500** can be fitted with a 4-cell Peltier temperature controller for precise temperature regulation of up to four samples. Each cell has its own magnetic stirrer. The operating range is -40°C to 105°C using a circulating chiller unit.

The Multi-cell temperature controller is fully controlled from Biokine software, including cell position in the beam, temperature ramping, or single temperature scans.



Comparative HV spectra of Xenon and Tungsten lamp in NIR region (xenon peaks are clearly observed)



NIR UPGRADE

The NIR option extends wavelength range to 1,250 nm. It includes a photomultiplier tube optimized for NIR range, and a tungsten lamp.

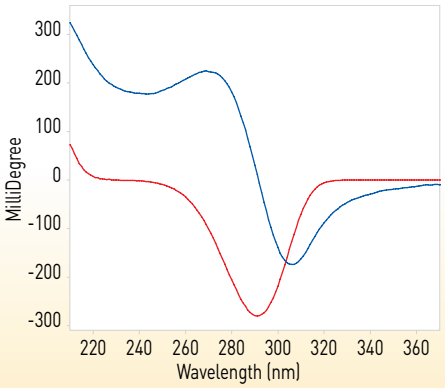
Conventional CD spectrometers based on prism monochromators are optimized to separate light in the far UV. However, the longer the wavelength, the worse the wavelength resolution, and it is impossible to work with small slits and to detect narrow CD peaks. Bio-Logic's new wavelength focusing system with grating monochromators gives the user the same wavelength resolution over the full wavelength range. In the NIR region the **MOS-500** offers 20 times better accuracy compared to a prism based system.

A tungsten lamp adds to the better performance, since tungsten bulbs do not have sharp intensity peaks which makes lamp regulation difficult.

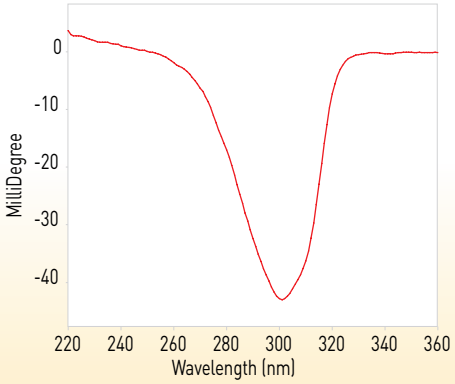
INTUITIVE SOFTWARE

The **MOS-500** and all accessories are fully controlled from Biokine software. Acquisition parameters are selected from a single window for easy experiment design. Data files can be saved in different formats for internal analysis, or easily exported to secondary structure analysis software for example.

OPTIONS



CD and ORD spectra of camphor sulfonic acid showing positive cotton effects



DR-CD spectra of camphor sulfonic acid

ORD ACCESSORY

ORD (Optical Rotary Dispersion) and CD are closely related techniques. **ORD** is used to study the chirality of a biomolecule by passing a beam of linearly polarized light through the sample. If the sample is chiral, then the light will be rotated as a function of wavelength. From this rotation, the user can determine the left- or right-handed chirality of the molecule. No physical rotation of the polarizer is required during acquisition so an ORD spectrum can be collected over tens of seconds with a outstanding sensitivity. The **ORD** accessory is mounted on a standard photomultiplier tube. It includes one polarizer and a special PMT holder equipped with a micrometric screw, allowing fine adjustment of the polarizer position before measurements. Electronics in the **MOS-500** do not need to be upgraded when adding the **ORD** accessory.

The **ORD** accessory can also be used for steady state measurements.

Specifications

- 210-900 nm (1,200 nm when combined with IR accessory)
- ±10 degrees
- Detection limit: 0.01 mdeg

DR-CD: CD-POWDER

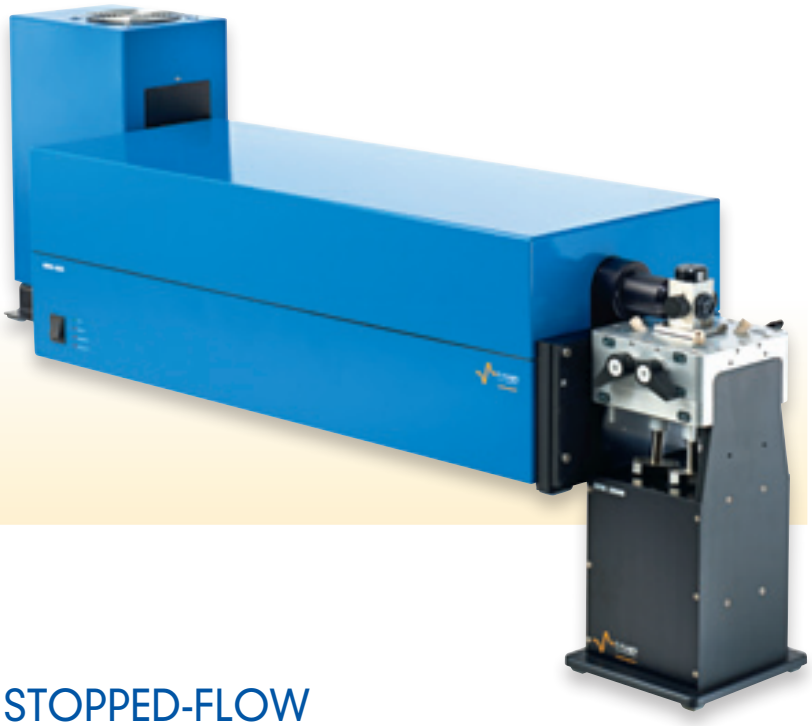
Measuring CD spectra on powder has long been desired as a way to eliminate solvent contribution. A Pellet technique can be used, but the quality of results is very dependent upon quality of sample preparation.

Bio-Logic has designed a Diffuse Reflectance CD accessory based on an integration sphere using an internal coating specially chosen for its high reflectance. The **DR-CD** accessory can be installed in seconds in the sample compartment. The powder holder is designed to minimize linear dichroism artifacts, and is installed directly into the integration sphere.

High quality spectra can be obtained in minutes on solid samples like powders and other samples like leaves.

Specifications

- 240-900 nm (1,200 nm when combined with IR accessory)



STOPPED-FLOW

All stopped-flow mixing systems manufactured by Bio-logic can be attached to the **MOS-500** in minutes. The latest generation **SFM-2000/3000/4000** mixers deliver outstanding kinetics specification. Our **SFM** models are based on independent stepping motor technology and Berger Ball mixers which provide the best kinetics performance on the market. A series of experiments such as concentration dependence studies can be done quickly and automatically, without changing syringes or doing manual dilution. This saves time for the user.

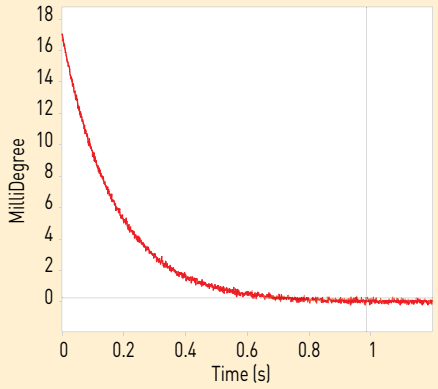
Stopped-flow kinetics can be measured in all detection modes. A dead time of 0.2 ms can be obtained in all detection modes with the optional micro-cuvette.

Nitrogen flushing of optics is not necessary when the **MOS-500** is operated in stopped-flow configuration. To get an optimum signal to noise ratio in kinetics mode it could be essential to use a XeHg lamp (222 nm alpha helix, Trp fluorescence...). The dual light source of **MOS-500** allows switching from Xe to XeHg lamp in seconds without handling or realigning the bulb. It is the easiest to use lamp system available.

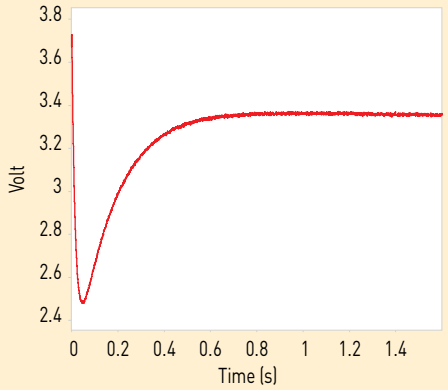
Specifications

- 0.2 ms dead time (with optional microcuvette)
- Mixing ratio fully controllable form 1:1 to 1:100
- Single, double, and triple mixing
- Automatic concentration dependence studies
- Choice of 10 cuvettes
- Low sample volume requirement
- For absorbance, fluorescence, CD, anisotropy, LD, chemiluminescence, 90° light scattering

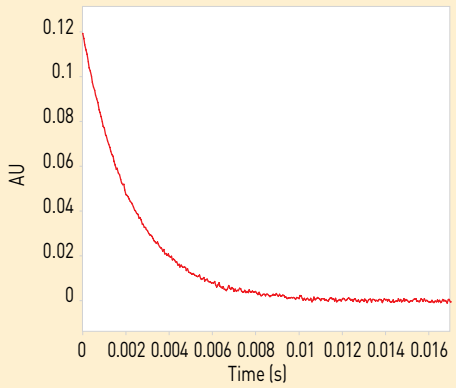
Circular dichroism



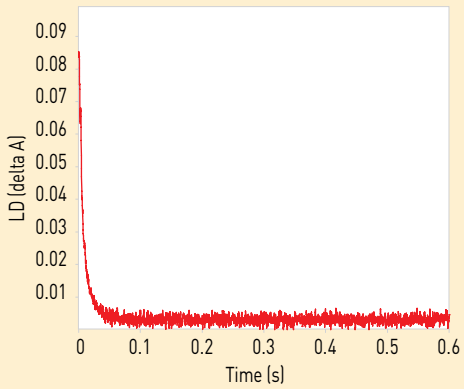
Fluorescence



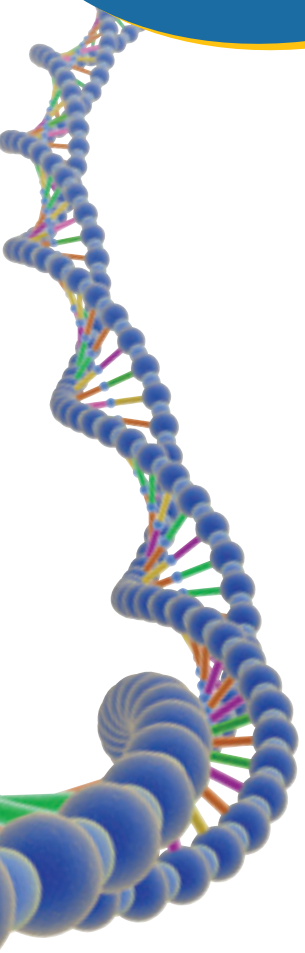
Absorbance



Linear dichroism



SPECIFICATIONS



SPECIFICATIONS

Light source	super quiet 150 W Xe and Xe (Hg) air-cooled, tungsten available in option (air-cooled)
Monochromator	tunable chromatic light source coupled to double grating (patented)
Wavelength range	163-950 nm (standard), 163-1250 nm (with optional detector)
Nitrogen gas purge	only for scans < 195 nm (no risk of damaging optics), high efficiency N_2 purge optimized for light source, optical bench and sample compartment
Wavelength accuracy	±0.1 nm from 163 to 1,250 nm
Wavelength precision	±0.05 nm from 163 to 1,250 nm
Bandwidth	0 to 16 nm on full wavelength range
Stray light	< 2 ppm at 200 nm
CD resolution	0.0001 mdeg
CD range	±7,500 mdeg
Baseline stability	±0.007 mdeg/hour
Scanning speed	0.1 ms to 20 s per data point
Data interval	0.1 nm to 10 nm in scanning mode, 10 µs to 20 s in kinetics mode
Scanning modes	step scan, adaptive scan, temperature scan, kinetics (slow or using stopped-flow)
Rms noise	0.015 mdeg at 185 nm using 1 nm BW, 16 s sampling 0.01 mdeg at 200 nm using 1 nm BW, 16 s sampling 0.007 mdeg at 500 nm using 1 nm BW, 16 s sampling
Standard detection modes	CD, Absorbance, HV (standard all simultaneous) Fluorescence, FD/CD, Fluorescence anisotropy, HPLC-CD, LD
Optional detection mode	NIR-CD, ORD, DR-CD
UV measurement	accuracy ±0.001 AU (built-in filters to remove second order)
Shutter	built-in, software control
External input/output	4 in, 3 out (for external connections)
PC interface	Windows 7, 32 or 64 bits
Other options	titrator (concentration and pH), emission monochromator
Dimensions	139 x 32 x 39 (cm, W x D x H)
Weight	35 kg

Specifications are subject to change

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