SPECTROstar® *Nano*

Ultra-fast absorbance spectrometer for

microplates and cuvettes

BMG LABTECH

The Microplate Reader Company

"One thing to point out is the wonderful ability to run a complete scan and then go in afterwards and select the peak areas and set wavelengths for analysis. We would not have seen the unique spectral shift in our dye-end point water hardness method using our older single wavelength instrument. The SPECTROstar *Nano* is making work and life easier, more unique and more interesting for us."

Gary Spedding, Ph.D.
BDAS, LLC , Lexington, KY, USA

The SPECTROstar® *Nano* represents the next evolution in absorbance microplate reader technology.
Equipped with BMG LABTECH's proprietary ultra-fast UV/vis spectrometer, it can measure full spectrum absorbance (220 - 1000 nm) in less than 1 second per well in microplates, cuvettes, and low-volume samples.

Unique technology and new features

Backed by German engineering and technology, the SPECTROstar *Nano* is a versatile, automated absorbance reader for microplates, cuvettes, and low-volume samples.
New and unique features include:

- Ultra-fast UV/vis spectrometer
- All microplate formats up to 1536-wells
- Standard cuvette port for individual samples
- Low-volume samples with BMG LABTECH's LVis Plate (2 µL)
- Multi-mode shaking: linear, orbital, and double orbital
- Incubation up to 45 °C
- Gas vent
- Robotic compliant software interface
- Powerful MARS data analysis software

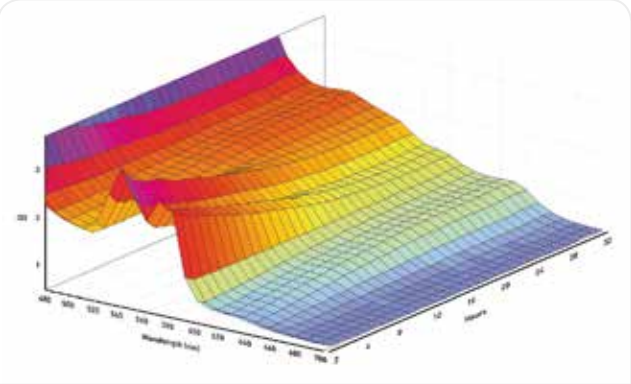
Other features include: automated path length correction, well scanning, kinetic readings, assay-specific buttons, and predefined calculation templates for data analysis.

Perfect for all absorbance assays

The SPECTROstar Nano is the ideal instrument to read all absorbance assays in a microplate or cuvette.
Its rapid full-spectrum analysis allows for absorbance assays never before possible on a microplate reader.
The most common absorbance assays such as ELISAs, DNA, RNA, protein (Bradford, BCA, Lowry), and beta-galactosidase have predefined quick run assay-specific protocols and buttons. More complex or user specific assays are programmable.

Assay-specific buttons

The Control and MARS data analysis software have predefined assay-specific protocols. This user-friendly feature enables researchers to carry out experiments with the SPECTROstar Nano quickly and easily. Measurement and analysis are performed with a single mouse click, and the user can assign a new test run or data analysis to a specific assay button.



Time-dependent change in haemoglobin absorbance spectrum in the presence of *N. nigricollis* venom.

UV/vis spectrometer

The SPECTROstar Nano is equipped with our proprietary UV/vis spectrometer. This spectrometer instantaneously captures full absorbance spectra from 220 - 1000 nm at resolutions of 1 - 10 nm.
Full absorbance spectra can be measured in less than one second per well - significantly faster than any conventional method. Alternatively, partial spectra or up to eight discrete wavelengths can be measured simultaneously.

The spectrometer incorporates a highly efficient optical grating and a solid state array detector. This allows the measurement of light intensity throughout the UV and visible parts of the spectrum.
Similar to a monochromator, but much faster, the spectrometer can capture the entire UV/vis spectrum of a sample within a second – no scanning needed.

Standard cuvette port

More than just a microplate reader, the SPECTROstar Nano has a standard cuvette port for single sample absorbance measurements. A range of sample sizes (0.3 µL to 5 mL) can be easily measured with several special cuvettes. The SPECTROstar Nano redefines cuvette-based kinetic assays. Full spectrum data can be collected in one second, allowing for polychromatic evaluation over the whole UV to visible spectrum. The cuvette port door can be kept open during measurements, which is ideal for a flow-through cell. This advantage also allows readings to be taken before, during, and after manual addition of reagents.

LVis Plate

When quantitating DNA or RNA, using the least amount of sample is always preferable. With the LVis Plate, our low-volume microplate, sixteen individual samples of 2 µL can be measured. The LVis Plate contains a tip rest for easy sample loading when using an eight channel pipettor.
The LVis Plate also contains NIST traceable optical density filters and a holmium oxide filter for instrument quality control and performance testing. In addition, a horizontal cuvette position can hold standard rectangular cuvettes for kinetic or endpoint studies.

LVis Plate for small volumes

Incubation, shaking, and gas vent

The SPECTROstar *Nano* has incubation, multi-mode shaking capabilities, and a gas vent. Since all cell-based assays require the correct environment to be properly measured, the gas vent can be used to purge the microplate chamber with different gases. For example a mixture of O_2/CO_2 can be used to measure mammalian cells. The built-in incubator uniformly heats the microplate chamber and the cuvette port up to 45 °C, thereby allowing the optimal temperature to be used for all cellular growth assays.

The built-in incubator can also be used for protein denaturation studies by incrementally increasing the temperature followed by full spectrum readings.
Multi-mode shaking - linear, orbital, and double orbital - increases flexibility when designing assays. Linear shaking allows for the fastest and most intense shaking conditions for cells that tend to clump. Double orbital shaking allows for the slowest and mildest conditions for sensitive cells. Orbital shaking is a cross in between the two.

Endpoint, kinetics, and well scanning

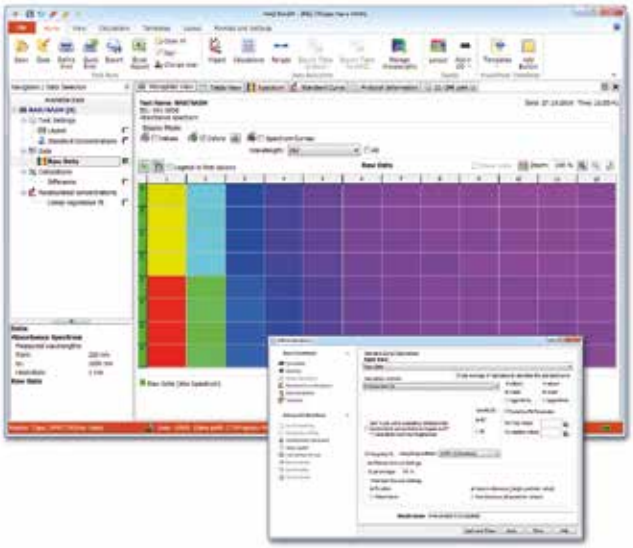
Users can capture an endpoint signal that happens in seconds, or measure the kinetics of bacterial growth over time. In well scanning mode, the SPECTROstar *Nano* can easily deal with non-homogeneous samples such as adherent cells by taking multiple measurements in each well with up to 900 data points/well. The MARS software displays each scan point graphically and creates a map for each well.
Alternatively, orbital or spiral averaging can be used. These perform several measurements over an orbit, collect the data and calculate an average for each well.

Automation

All BMG LABTECH microplate readers have similar dimensions and plate in/out locations. This minimizes the cost of automation solutions. Small footprint, automation-friendly plate carrier, and multiple robotic software interfaces allow for easy integration into all robotic platforms.
Furthermore, having 1536-well capability allows for high-throughput full spectrum analysis.

Control and MARS data analysis software

Our software package provides an extensive range of possibilities for both test protocol definitions and data analysis. It is fully compliant with FDA regulation 21 CFR part 11. The Control software defines instrument parameters and test protocols; the MARS software offers various tools for data analysis.
Well-organized, versatile, easy to use, and powerful are just a few of the ways the MARS data analysis software package is described by users. MARS provides several options to display data in a clear and concise format.



MARS data analysis software for automated data reduction.

Data can be processed with powerful predefined templates or by using an extensive range of data calculation features. Examples include the automatic calculation of enzyme kinetic parameters (V_{max} and K_m) with a variety of fits based on Michaelis-Menten or Lineweaver-Burk equations, or the generation of standard curves based on the following curve fitting algorithms to calculate e.g. EC_{50}, IC_{50}, and r^2 values:

- Linear regression fit
- 4 and 5 parameter fit
- Point to point fit
- Segmental regression fit
- Cubic spline fit
- 2^{nd} and 3^{rd} polynomial fit
- Enzyme kinetic (e.g. Michaelis-Menten)

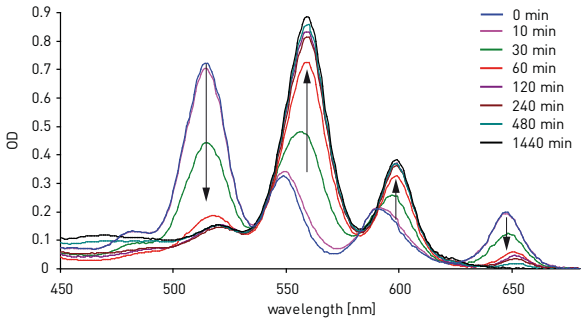
Applications center

Numerous publications for absorbance measurements such as application notes, posters, and scientific papers exemplify the versatility of the SPECTROstar *Nano*.
A wide range of possible applications include:

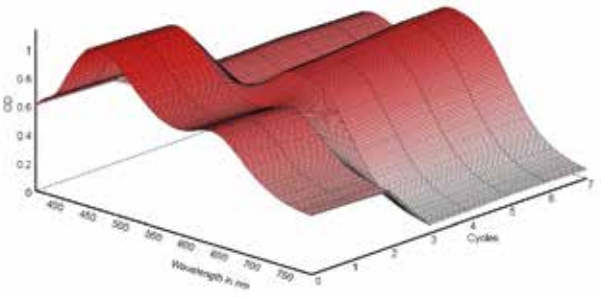
- 260/280 ratio for DNA and RNA
- Protein quantitation
- ELISA
- Cell-based assays
- Enzyme activity assays

The versatility and flexibility of the SPECTROstar *Nano* spectrometer are illustrated by the following examples:

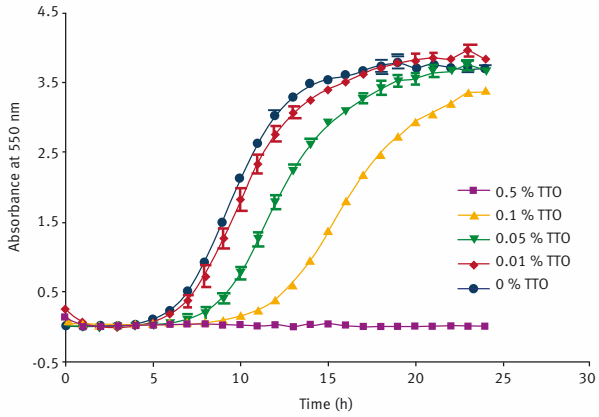
- Kinetic studies on the metallation of porphyrin
- Protein determination with the Bradford assay
- Monitoring of bacterial growth at elevated hydrostatic pressure



Changes in visible spectrum accompanying zinc metallation of TPP. Arrows indicate the evolution of the absorption bands with time.



3D well map of a Bradford absorbance spectrum taken over 60 seconds. The 475 nm peak decreases and the 595 nm peak increases.



Dose dependant growth curves of Candida albicans in Tree Tea Oil (TTO). The mean of the quadruplicate data was taken and standard error bars presented.

BMG LABTECH continuously works with all major reagent companies to develop protocols and to optimize instrument settings for their existing assays and their newest kits. Visit the online Applications Center to download all the leading applications, listed as:

- Application notes
- Application focus
- Peer-reviewed papers

The applications database reflects the expertise acquired by BMG LABTECH in more than 25 years. Over 4,000 published entries of peer-reviewed articles, application notes, and scientific posters demonstrate the flexibility and versatility of our readers, and their use in chemical and biological sciences.

Support and training

BMG LABTECH operates globally through an extensive network of subsidiaries and well-trained distributors. Customers can rely on PhD-level support and assistance with regard to software, assay development, or general enquiries related to the SPECTROstar *Nano* and all other BMG LABTECH microplate reading solutions.

The graphs were taken from BMG LABTECH's Application Notes

Due to the modularity of BMG LABTECH's instruments, all, or combinations of the features below can be installed at purchase or upgraded at any time. Please contact your local representative for more details or a quote.

Detection modes	UV/vis absorbance spectra
Measurement modes	Endpoint and kinetic Spectral scanning (absorbance) Well scanning
Microplate formats	6 to 1536-well plates, user-definable LVis Plate with 16 low-volume microspots (2 µL)
Microplate carrier	Robot compatible
Light sources	High energy xenon flash lamp
Detectors	CCD spectrometer
Wavelength selection	UV/vis absorbance spectrometer Full spectra or 8 discrete wavelengths in < 1 sec / well
Spectral range	220 - 1000 nm
Sensitivity	Full spectrum captured in < 1 s/well Selectable spectral resolution: 1, 2, 5, and 10 nm OD range: 0 to 4 OD Accuracy: < 1% at 2 OD Precision: < 0.5% at 1 OD and < 0.8% at 2 ODSelectable spectral resolution: 1 - 10 nm OD range: 0 to 4 OD Accuracy: < 1% at 2 OD Precision: < 0.5% at 1 OD and < 0.8% at 2 OD
Read times	Full spectrum from 220 to 1000 nm in less than 1 sec/well
Shaking	Linear, orbital, and double-orbital with user-definable time and speed
Purge gas vent	System to inject an atmosphere or to pull a vacuum into the reader
Incubation	+3°C above ambient up to 45 °C The upper heating plate of the incubation chamber operates at 0.5 °C more than the lower plate. This prevents condensation build-up on the lid or sealer.
Software	Multi-user Reader Control and MARS data analysis software included FDA 21 CFR Part 11 compliant
Dimensions	Width: 36 cm, depth: 50 cm, height: 16 cm; weight: 10 kg
	Optional accessories
THERMOstar	Microplate incubator and shaker
LVis Plate	Microplate designed to measure 16 low volume (2 µL) samples and standard cuvettes. Incorporating NIST-traceable filters and holmium oxide standards for instrument performance test. Sensitivity: 2 ng/µL dsDNA
Upgrades	Please contact your local representative for upgrades including options such as detection modes, reagent injectors, etc.

*Limit of detection (sensitivity) was calculated according to the IUPAC standard: $3x(SD_{blank})$ / slope
Specifications are subject to change without notice.

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