The ultimate Microplate Reader
for research and life science

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POLARstar Omega

BMG LABTECH

The Microplate Reader Company

The POLARstar® Omega represents the best combination of performance and flexibility for all of your life science and R&D applications. Using BMG LABTECH's unique Tandem Technology, it provides the perfect instrument for a wide range of applications in basic research, life science studies, and assay development.

The high performance multi-mode reader for life science applications

Flexibility

Backed by German engineering and technology, the POLARstar Omega is a versatile, automated microplate reader offering the following main detection modes:
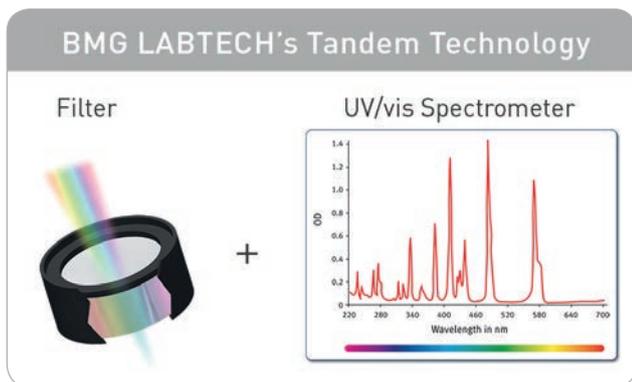
- Ultra-fast UV/vis absorbance spectra
- Fluorescence intensity (FI), including FRET
- Fluorescence polarization/Anisotropy (FP)
- Time-Resolved Fluorescence (TRF)
- Time-Resolved FRET (TR-FRET)
- Luminescence (flash & glow), including BRET
- AlphaScreen®/AlphaLISA®

With its ability to capture fast, full UV/vis absorbance spectra; to monitor rapid and slow kinetic reactions; and to perform FP, FRET, BRET, TR-FRET and AlphaScreen®/AlphaLISA® detection, the POLARstar Omega will confidently fulfill all assay needs.

Top and bottom plate reading, multi-color detection, Simultaneous Dual Emission detection, well scanning, precise temperature control, multi-mode shaking, and a gas vent all enhance the flexibility of the POLARstar Omega. The addition of onboard injectors provides the ability to dispense reagents and initiate kinetic reactions. The POLARstar Omega reads all plate formats from 6- to 1536-well in absorbance and up to 384-well in all other detection modes.

Tandem Technology

This is a combination of two technological concepts – an ultra-fast UV/vis full spectrum absorbance spectrometer, and extremely sensitive filter based detection incorporating advanced optics and photomultiplier tubes to provide superior sensitivity for all other detection modes. For the first time, spectrometer based absorbance with a resolution of 1 nm can now be performed in a multidetection microplate reader.

BMG LABTECH's Tandem Technology

Filter

UV/vis Spectrometer

Tandem Technology is a combination of an ultra-fast UV/vis spectrometer for absorbance measurements and filter-based optics for highest sensitivity in all other detection modes.

Spectrometer-based detection

The POLARstar Omega is the first multidetection plate reader to use a CCD spectrometer for absorbance measure-ments. This technology can capture a full UV/vis absorbance spectrum (220 to 1000 nm) at resolutions from 1 to 10 nm. Full absorbance spectrum can be measured as quickly as one second per well, significantly faster than any conventional method. Alternatively, up to eight wavelengths can be measured simultaneously in a single pass with no wavelength switching.
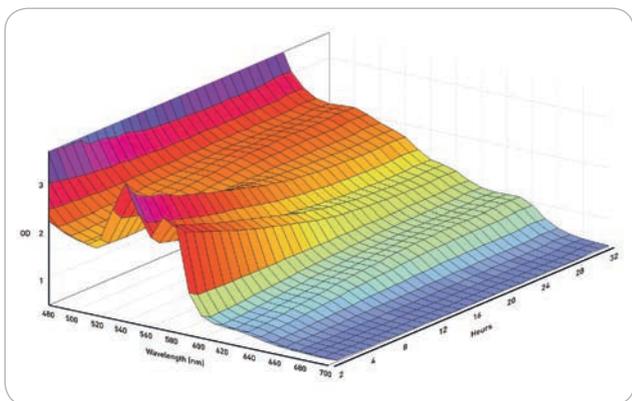
Time-dependent change in haemoglobin absorbance spectrum in the presence of N.nigricollis venom.

High-performance luminescence

The POLARstar Omega has been designed with a dedicated luminescence detection system for both flash and glow based assays. It offers exceptional performance that exceeds Promega's stringent Dual Luciferase® Reporter validation criteria for the DLReady™ certification in both 96- and 384-well plate formats.

Filter-based detection

For fluorescence and luminescence assays filters provide precise and superior performance for both sensitivity and selectivity. Filters offer high sensitivity, greater light transmission, precise control over transmitted peak shape, excellent blockage of undesired wavelengths, and fast wavelength switching. This is ideal for multi-excitation and multi-emission applications. Filters are also the technically preferred and most cost efficient technology in fluorescence- and luminescence-based detection. BMG LABTECH offers a wide range of assay specific filters from UV to NIR with various bandwidths.

Simultaneous Dual Emission

Simultaneous Dual Emission detection offers several advantages and halves read times. It corrects flash-to-flash variations, assay effects such as photobleaching, decaying kinetic signals, or fluctuating conditions like temperature, pH, and evaporation. Simultaneous Dual Emission in the POLARstar Omega is perfect for detecting applications that emit two wavelengths or polarization vectors at the same time without the need to switch filters. This includes FRET, BRET, FP, and anisotropy based assays.

Advanced Time-Resolved Fluorescence

The POLARstar Omega shows advanced TRF capability utilizing an advanced optic head for TRF and TR-FRET. Assays such as homogeneous TRF (e.g. HTRF®, LANCE®, LanthaScreen®) can now be performed with outstanding sensitivity. Combined with the high intensity xenon flash lamp, assay optimized filters and adjustable gain, the advanced TRF optic head allows the POLARstar Omega to outperform any microplate reader in its class.

AlphaScreen®/AlphaLISA®

BMG LABTECH's engineers have developed a specialized measurement mode and optical system for the POLARstar Omega to read AlphaScreen®/AlphaLISA® assays without using an expensive laser as a light source. For the first time users can experience fantastic AlphaScreen®/AlphaLISA® performance normally only available on more costly instruments.

Advanced reagent injection

Two precise onboard injectors with an exceptional low dead volume allow simultaneous reagent injection and assay monitoring. Users can adjust all parameters, such as plate shaking, injection speed, timing, and the number of injections per well. Delivery volumes are adjustable for each well, so dilution schemes and concentration gradients can be automatically produced across the microplate. The injectors are readily accessible and are housed within the instrument to safeguard any light sensitive reagents.

Endpoint, slow and fast kinetics

Kinetic data can be collected as fast as 50 reading points per second or as slow as one measurement every 2.5 hours. Users can capture e.g. a fast calcium signal that happens in a few seconds, or measure bacterial growth over a period of days. Data can also be collected at different rates within the same experiment, allowing users to collect more data when it is needed and less when it is not. Kinetic events can be conveniently initiated using the onboard reagent injectors.

Well scanning and orbital averaging

In well scanning mode, the POLARstar Omega can easily deal with nonhomogeneous samples such as adherent cells by taking multiple measurements in each well with up to 900 data points/well. The software displays each scan point graphically and creates a map for each well.

Another way to measure nonhomogeneous well content is BMG LABTECH's unique orbital averaging feature. This allows several measurements over a defined orbit, to collect data and calculate an average for each well.

Control and MARS data analysis software

The POLARstar Omega multi-user 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 part of the software allows users to define instrument parameters and test protocols. 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.
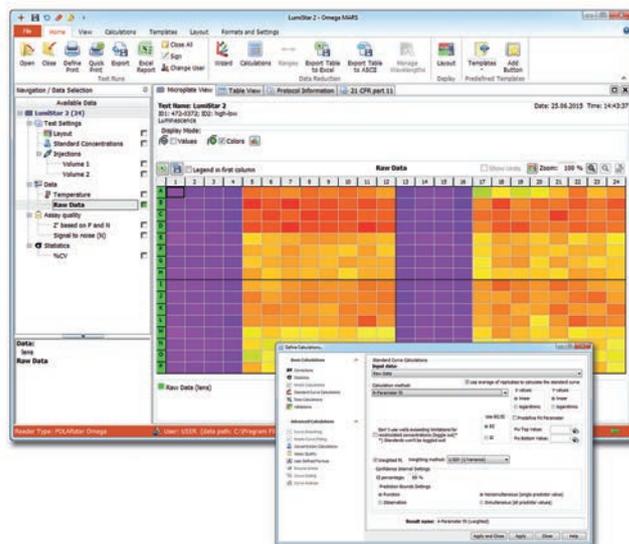
MARS data analysis software for automated data reduction.

Data can be processed with powerful predefined templates or by using an extensive range of data calculation features: for example 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:

- ☐ Hyperbola fit
- ☐ Linear regression fit
- ☐ 4 and 5 parameter fit
- ☐ Segmental regression fit
- ☐ Cubic spline fit
- ☐ 2nd and 3rd polynomial fit
- ☐ User-defined fit

Stacker and robot compatibility

BMG LABTECH's standardized reader footprint and robotic software interface allow for easy integration into all robotic platforms. For medium level throughput, the 50-plate Stacker with an integrated barcode reader is also available.

Applications center

The POLARstar Omega has been cited in numerous publications such as application notes, scientific posters, and peer-reviewed papers exemplifying the versatility of the POLARstar Omega. The following main categories are amongst a wide range of possible applications:

- Biomolecular interaction assays
- Cell-based assays
- Enzyme activity assays
- Quantification assays
- ELISA

The versatility and flexibility of the POLARstar Omega are illustrated by the following examples for:
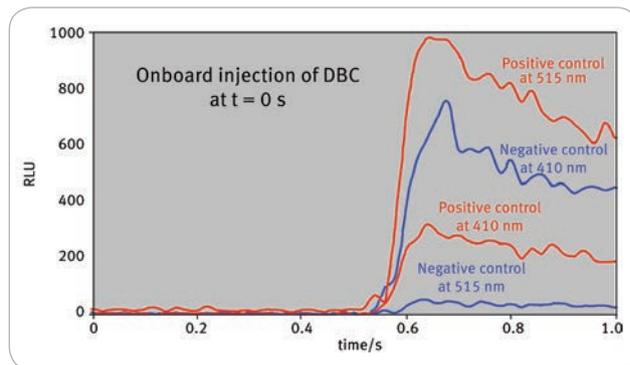
- SPARCL® Assay using flash luminescence
- Antioxidant analysis of foods in cells (FI)
- Cell-based biomolecular interaction assay (BRET)
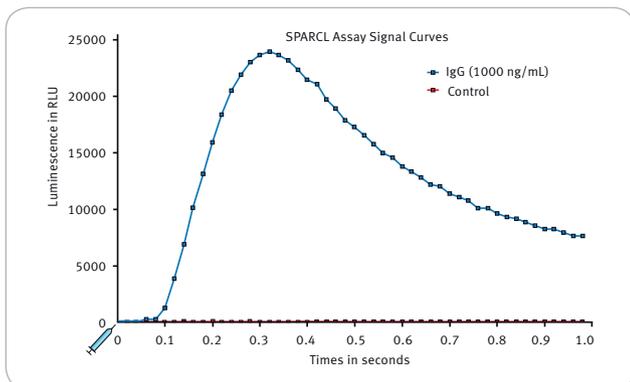
Typical SPARCL assay pattern. Light energy was captured every 0.02 seconds for 1 second.[1]
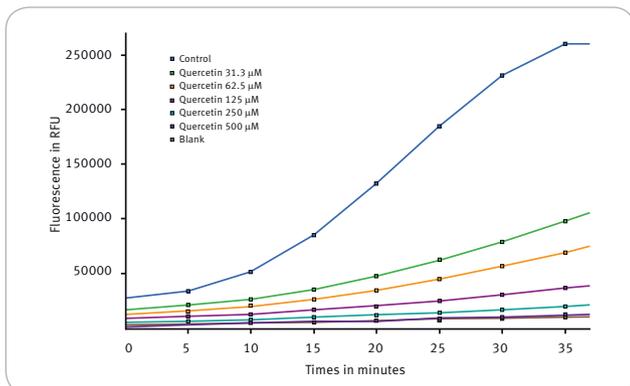
Plant flavonoid quercetin used as standard substance in the OxiSelect Cellular Antioxidant Assay.[2]

Injection of DeepBlueC™ (DBC) results in resonance energy transfer in the positive control. No BRET occurs for negative control.[3]

BMG LABTECH continuously works with all the leading reagent companies to optimize instrument settings for their existing assays and their newest chemistries.

Visit BMG LABTECH's Applications Center online to find references to all applications, listed as:

- Application notes
- Scientific posters
- Peer-reviewed papers

BMG LABTECH's comprehensive searchable applications database reflects more than 25 years of expertise and innovations in microplate reading technology. Over 4.000 references exemplify the flexibility and versatility of our readers, as well as their use in the chemical and biological sciences.

Support and training

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

[1,2,3] The graphs were taken from BMG LABTECH's Application Notes AN 282, AN 280 and AN 120.

POLARstar® Omega - Technical specifications

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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	Fluorescence intensity - including FRET Fluorescence polarization/Anisotropy AlphaScreen®/AlphaLISA® Luminescence (flash and glow) - including BRET Time-Resolved Fluorescence - including TR-FRET UV/vis absorbance
Measurement modes	Top and bottom reading Endpoint and kinetic Sequential multi-excitation Sequential multi-emission Simultaneous Dual Emission Ratiometric measurements Well scanning
Microplate formats	Up to 384-well plates, 1536-well plates in absorbance, user-definable
Light source	High energy xenon flash lamp
Detectors	Two matched side window photomultiplier tubes
Optical filters	Excitation and emission filter wheels for 8 filters each
Spectral range	240 - 750 nm or 240 - 900 nm Absorbance spectrometer: 220 - 1000 nm

Sensitivity		
	FI	< 0.2 fmol/well fluorescein
	FP	< 5 mP SD at 1 nmol/L fluorescein
	TRF	< 30 amol/well europium
	High-End TRF for Omega	< 3 amol/well europium
	LUM	20 amol/well ATP DLReady™ certified
	AlphaScreen®	< 100 amol* (384)
	Abs with spectrometer	Spectral range: 220 - 1000 nm Full spectrum captured in < 1 s/well Selectable 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	Flying mode: 9 s (96), 16 s (384)
Reagent injection	Up to 2 built-in reagent injectors Injection at measurement position (6 to 384-well) Individual injection volumes for each well (3 to 500 µL) Variable injection speed up to 420 µL/s Up to four injection events per well Reagent back flushing
Shaking	Linear, orbital, and double-orbital with user-definable time and speed
Gas vent	System to inject an atmosphere or to pull a vacuum into the reader
Incubation	+4°C above ambient up to 45°C or 65°C
Software	Multi-user software package including Reader Control and MARS data analysis software, FDA 21 CFR part 11 compliant
Dimensions	Width: 44 cm, depth: 48 cm, height: 30 cm, weight: 28 kg

Accessories	
Stacker	Plate handler for up to 50 microplates - continuous loading feature
THERMOstar	Microplate incubator and shaker
Filters	Optimized for dyes, fluorophores and specific assays Filters for all applications from UV to NIR Customized filters available upon request
Upgrades	Upgrades to include options such as additional detection modes, reagent injectors, extended temperature control, etc. are available. Please contact your local representative for more information.

* Limit of detection: < 100 amol of biotinylated and phosphorylated polypeptide (P-Tyr-100 assay kit, PerkinElmer, #6760620C), measured in white 384-well small volume microplates (17 µL/well)

Limit of detection (sensitivity) was calculated according to the IUPAC standard: 3 x (SD$_{blank}$)/slope

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Transcreener is a registered trademark of Bellbrook Labs.
SPARCL is a trademark of Lumigen, Inc. and registered in the USPTO. Lumigen is a Beckman Coulter company.
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