

MICROPLATE READERS

for all your
assay needs



**BMG LABTECH**

The Microplate Reader Company



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A man with short brown hair, wearing a purple and white checkered button-down shirt, is looking down at a microplate reader he is holding. The device is a rectangular, clear plastic tray with a grid of small blue wells. The background is a plain, light grey color.

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A story of success

We are BMG LABTECH - your developer and global manufacturer of single- and multi-mode microplate readers.

Established in 1989 in Offenburg, Germany, our company has been successfully designing and producing high-quality instruments and microplate handling systems for more than 27 years!

The introduction of the first microplate fluorometer in 1993 brought us to the forefront of detection technology. Since then, we have been constantly improving the functionality and sensitivity of our plate readers to handle the increasingly challenging requirements of microplate-based assays.

The range of our products covers many types of bioanalytical measurement assays in various detection modes. For sure, you will find the instrument that fits your needs best on the following pages.

All of our microplate readers are developed, manufactured and tested at our facility in Germany. But no matter where and when you need us, we are just a phone call or a quick email away.

With our worldwide sales, service and support network, we provide you with the best scientific and technical support and bring the latest innovations in microplate reading technology directly to you and your laboratory. Always with the reliability and quality that you deserve.



www.bmglabtech.com

BMG LABTECH

The Microplate Reader Company

"We have four BMG LABTECH plate readers and they are all used heavily in our research. They are smart, reliable and help my company to achieve its strategic goals. The support team and servicing engineers are brilliant! Thank you BMG LABTECH!"

Hayley M. Saunders, LifeArt, Stevenage, UK

say needs

umption

Screen®

FP HDACs

larisation Ca²⁺

oLuo[®] BRET

P ADME/TOX

Kinetics Genomics

BMG LABTECH

BMG LABTECH

“The PHERAstar is a very **high-end instrument** which is very good for high-throughput screening and is the **most sensitive** instrument I have tested for BRET. We use it for ligand binding and protein-protein interactions.”

*Kevin Pflieger,
Harry Perkins Institute of Medical Research, Perth, Australia*



Bring your lab up to speed!

Are you looking for the microplate reader that leaves everyone else behind? One that is fast and sensitive? The PHERAstAr® FSX definitely is the best choice for the needs of high-throughput screeners. With its super fast read times, its precision and the highest sensitivity, this reader is the perfect tool to run your lab.

High-throughput screening

Up to 3456-well plates

M u l t i - m o d e

OPTIC MODULES

S e n s i t i v i t y

Speed

The gold standard for high-throughput screening

The PHERAstar FSX was specifically conceived for the highest sensitivity and the fastest speed required in screening campaigns. Its unique features make it superior to any other microplate reader on the market. This high-end instrument performs all the leading detection technologies:

- UV/vis absorbance
- Fluorescence intensity, including FRET
- Luminescence (flash and glow), including BRET
- Fluorescence polarization/anisotropy
- Time-resolved fluorescence, including TR-FRET
- AlphaScreen®, AlphaLISA® and AlphaPlex™

Whatever your application, the PHERAstar FSX will perform it with ease and speed in all plate formats up to 3456 wells. Dedicated light sources, Simultaneous Dual Emission, Decay Curve Monitoring and assay-dedicated Optic Modules are just some of the key features of this high-end reader.



Sensitivity, speed and precision

It is the combination of super fast read times, measurement precision, and the sensitivity to read small volumes that makes the PHERAstar FSX the gold standard for high throughput screening. Thanks to its capability to adjust the number of excitation flashes, the reader always provides the best combination of sensitivity and speed.

In single flash mode, it can read a 1536-well plate in 27 seconds - one of the fastest readers on the market. Even at low concentrations and small assay volumes, the unsurpassed sensitivity of its detection system always provides you with outstanding Signal-to-Noise, %CV, and Z' values.

Innovative technology

The outstanding sensitivity of this HTS-dedicated plate reader is based on an innovative optical design composed of a free air optical path, three independent light sources, dedicated detectors, and Optic Modules with high-transmission filters.



The optical system is based on a direct free air optical path from the light source to the sample and further to the detector. A series of software-controlled mirrors directs the light to the top or bottom of the plate. This way, the reader eliminates the need for fiber optic bundles or light guides and achieves higher transmission of light than conventional readers employing optic light fibres.

Depending on your application, you can choose between three different light sources:

- High energy xenon flash lamp
- Laser for TRF/TR-FRET
- Laser for AlphaScreen®, AlphaLISA® and AlphaPlex™

As detectors, four photomultiplier tubes (PMTs) are used. These are combined in two application-dedicated matched pairs. One PMT pair is dedicated to simultaneous dual luminescence and fluorescence detection, the second detects TRF-based signals.

Switch assays in seconds

Our application-specific Optic Modules make the PHERAstar FSX the easiest reader to optically configure on the market.

Optic Modules contain all the components required for a specific assay such as excitation and emission filters, dichroic mirrors, beam splitters and polarization filters. The modules are easy to use: they are automatically recognized via barcode and selected by the reader for the appropriate assay. Never worry which filters or dichroic mirrors are installed!

The reader accommodates up to six Optic Modules. You can easily add or replace them within seconds.



Our barcode-labelled Optic Modules are installed in seconds and automatically recognized by the reader.

Cut read times in half

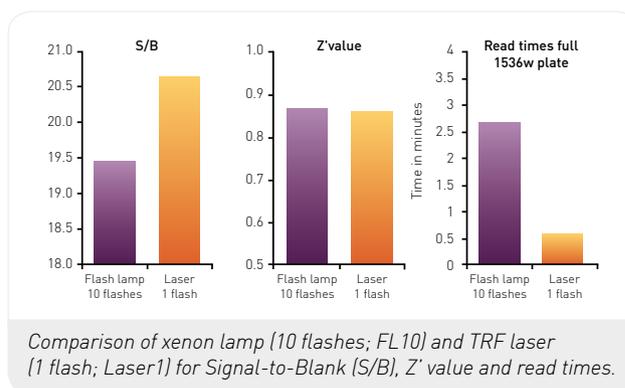
Several assays require the detection of two emission wavelengths. BMG LABTECH pioneered the technique of Simultaneous Dual Emission (SDE) detection by which two separate emission wavelengths are simultaneously detected in one single measurement. SDE detection can be used in any assay that measures two emission wavelengths or polarization vectors, including FP, FRET, TR-FRET, BRET and AlphaPlex™. It offers a significant speed advantage by cutting read times in half and eliminates the typical drawbacks of double sequential detection such as flash-to-flash variations,

photobleaching, decaying kinetic signals. SDE also reduces the variability caused by fluctuations in temperature or pH, and by evaporation.

Dedicated lasers make your assays shine

The PHERAstar FSX is equipped with two assay-dedicated lasers. Excitation lasers significantly improve performance and lower limits of detection. Compared to xenon lamps, they yield higher excitation energy at a specific wavelength.

The TRF laser specifically excites samples at 337 nm. With 60 laser flashes per second, it allows ultra-fast TR-FRET endpoint or kinetic measurements, and even “flying mode” detection. For several applications, a single laser flash provides enough energy to excite the donor molecules, measurements can therefore take place without stopping plate movement (flying mode), significantly reducing read times.



Comparison of xenon lamp (10 flashes; FL10) and TRF laser (1 flash; Laser1) for Signal-to-Blank (S/B), Z' value and read times.

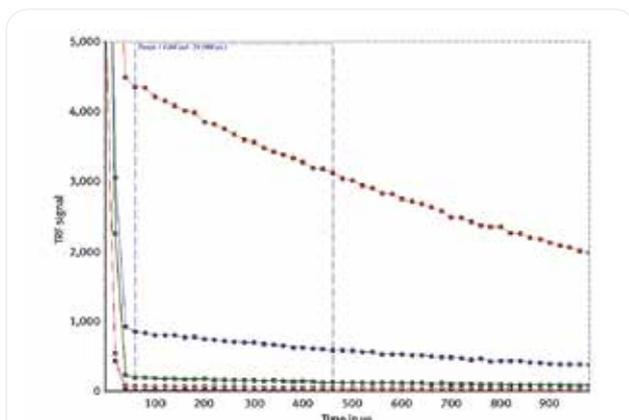
“The PHERAstar continues to provide us with reliable, reproducible data across a wide range of assay platforms including FI, FP, luminescence and absorbance. The LVis Plate allows us to accurately quantify concentrations of 2 µL protein and DNA samples which means less wastage of precious samples. Our lab wouldn't function without it!”

Helen Rapley
Assay Development and Screening Bicycle Therapeutics,
Cambridge, UK

Advanced Alpha Technology detection

The second laser is dedicated for Alpha Technology (AlphaScreen®, AlphaLISA® and AlphaPlex™) detection. It specifically excites donor beads at 680 nm, providing an increased Signal-to-Noise ratio and a broad dynamic range.

The combination of laser excitation and SDE detection gives the reader unsurpassed flexibility and sensitivity. In addition, the SDE detection system reduces read times and yields higher sensitivities in all multiplex Alpha Technology assays.



Unique TRF Decay Curve Monitoring feature for assay optimisation.

Optimize your signal detection

Decay Curve Monitoring (DCM) is a unique feature of the PHERAstar FSX and a fundamental tool for assay development and performance fine-tuning in TRF, TR-FRET and Alpha Technology. Enabled by a dedicated photon counting detection system, DCM measures and visualizes the time-resolved emission curve of the fluorophore. Together with the Integration Time Wizard, it helps to optimize timing parameters, thus improving signal detection and reducing background noise. The TR-FRET dedicated photon counting detection system enables simultaneous monitoring of both donor and acceptor decay curves with a time resolution of 2 µs.

Did you know ...

... Thanks to 5 different detectors - a spectrometer and 2 pairs of assay-dedicated matched PMTs - the PHERAstar FSX does not undergo compromises in assay detection.

From top to bottom

The optical system is able to adjust the detection focal height to ensure the highest possible sample signal and Signal-to-Noise ratio. The focal height adjustment eliminates the influence of microplate formats, sample volumes, surface tension and evaporation in all plates up to 3456 wells. The automated focal height adjustment is available for both top and bottom readings at a resolution of 0.1 mm. Top or bottom detection can be directly selected in the reader Control Software by a mouse click, requiring no hardware or Optic Module changes. Top reading provides the optimum sensitivity for biochemical assays and the ability to bottom focus is extremely advantageous in case of detection of adherent cell layers.

Automation

For HTS automation purposes, the PHERAstar FSX offers excellent robotic integration capabilities, multi-user control and MARS data analysis software with digital signature and FDA 21 CFR part 11 compliance included. Its standardized small reader footprint and robotic software interface make it easy to integrate it into all leading robotic platforms. The instrument comes with three integrated microplate barcode readers capable of reading the east, west and south side of a microplate and can be equipped with BMG LABTECH's Stacker.



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Detection modes	Fluorescence intensity - including FRET Fluorescence polarization/anisotropy AlphaScreen®, AlphaLISA®, AlphaPlex™ Luminescence (flash and glow) - including BRET Time-Resolved Fluorescence (TRF) - including TR-FRET UV/vis absorbance	
Measurement modes	Top and bottom reading Endpoint and kinetic Simultaneous Dual Emission Sequential multi-excitation Sequential multi-emission Real-time ratiometric Well scanning	
Microplate formats	Up to 3456-well plates, user-definable LVis Plate with 16 low volume microspots (2 µL)	
Microplate carrier	Robot compatible	
Light sources	High energy xenon flash lamp Dedicated laser for AlphaScreen®/AlphaLISA®/AlphaPlex™ Laser for TRF and TR-FRET	
Detectors	Two matched pairs of photomultiplier tubes (PMTs), optimized for different detection modes CCD spectrometer	
Wavelength selection	Optic Modules: Up to six application-specific modules (include all filters, dichroics, etc. for an application) Top or bottom reading is performed without module displacement UV/vis absorbance spectrometer: Full spectrum or up to 8 distinct wavelengths in < 1 sec/well	
Optical path guides	Top and bottom: enclosed, free air optical light path guided by motor-driven mirrors and dichroics	
Z-adjustment	Automatic focal height adjustment (0.1 mm resolution) for top and bottom	
Spectral range	Filters	230 - 750 nm or 230 - 900 nm for FI, FP 230 - 750 nm for LUM 230 - 900 nm for TRF
	Spectrometer	220 - 1000 nm for Abs
Sensitivity	FI (top)	< 0.15 pM fluorescein (black 384sv, 20 µL) < 5.0 pM fluorescein (black 1536, 8 µL)
	FI (bottom)	< 1.0 pM fluorescein (black 384 glass bottom, 50 µL)
	FP	< 0.5 mP SD at 1 nM fluorescein (black 384sv, 20 µL) < 1.5 mP SD at 1 nM fluorescein (black 1536, 8 µL)
	TRF	< 5 fM europium (white 384sv, 80 µL) < 15 fM europium (white 1536, 8 µL)
	HTRF® (black and white microplates)	Reader Control Kit (Eu) after 18h (384sv, 20 µL) Delta F > 1100 % (High Calibrator) Delta F > 25 % (Low Calibrator)
	LUM	< 0.4 pM ATP (white 384sv, 20 µL)
	AlphaScreen®	< 5 pM (< 100 amol/well P-Tyr-100, white 384sv, 20 µL)*
	Abs with spectrometer	Full spectrum captured in < 1 s/well Selectable spectral resolution: 1, 2, 5, and 10 nm OD range: 0 - 4 OD Accuracy: < 1 % at 2 OD Precision: < 0.5 % at 1 OD and < 0.8 % at 2 OD
Read times	Flying mode (1 flash)	14 s (384), 27 s (1536)
	10 flashes	38 s (384), 1 min 52 s (1536)
	50 flashes	1 min 29 s (384), 5 min 18 s (1536)
Reagent injection	Up to 2 built-in reagent injectors Injection at measurement position (6 to 384-well) Injection volumes for each well 3 to 500 µL (optional up to 2 mL) Variable injection speed up to 420 µL/s Reagent back flushing	
Shaking	Linear, orbital, and double-orbital with user-definable time and speed	
Integrated barcode reader	Up to three integrated barcode readers	
Incubation	+5 °C above ambient up to 45 °C	
Software	Multi-user reader Control and MARS data analysis software included FDA 21 CFR part 11 compliant	
Dimensions	Width: 45 cm, depth: 51 cm, height: 47 cm; weight: 49 kg	
	Optional accessories	
LVis Plate	Sixteen separate microdrop wells for 2 µL samples; standard cuvette position. Quality control internal standards (optional)	
Stacker	Magazines for up to 50 plates - continuous loading feature	
THERMOstar	Microplate incubator and shaker	
Optic Modules	Available for all applications	
Upgrades	Upgrades to include options such as additional detection modes, reagent injectors, etc. are available. Please contact your local representative for more information.	

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

*Limit of detection: < 100 amol of biotinylated and phosphorylated polypeptide [P-Tyr-100 assay kit, PerkinElmer, #6760620C].

Sensitivity was calculated according to the IUPAC standard: $3 \times SD_{blank} / \text{slope}$
Specifications are subject to change without notice.

384sv = 384-well small volume microplates

IT'S TIME FOR
SOMETHING
NEW



The next addition to your lab!

Are you looking for a reader that is flexible, sensitive and on top easy to use?

Then the CLARIOstar[®] Plus is perfect for you! Equipped with our patented LVF Monochromators[™] and EDR technology, it is the ideal tool for getting better data, more easily.

Assay development

Up to 1536-well plates

M u l t i - m o d e

MONOCHROMATOR

S e n s i t i v i t y

Flexibility

Monochromator. Perfected!

The CLARIOstar^{Plus} is a high-performance, multi-mode microplate reader that combines the flexibility of monochromators with the sensitivity of filters. Thanks to our in-house developed and patented revolutionary LVF Monochromators™, filters and a spectrometer, it runs any application you need with ease.

Additionally, the reader introduces new features like the Enhanced Dynamic Range technology, microplate autofocus and dedicated detectors that simplify detection optimization and help to streamline your workflow in the lab.

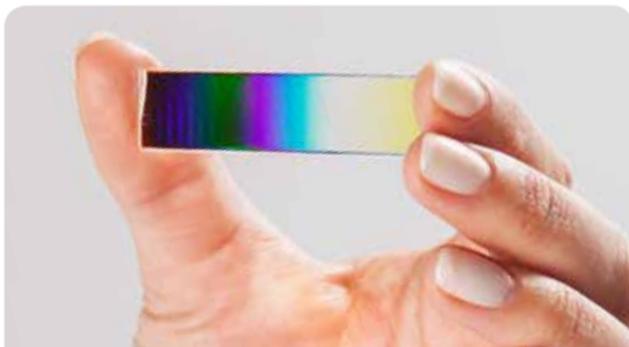
Three different detection technologies guarantee no compromise on sensitivity or flexibility:

- **LVF Monochromators** for fluorescence intensity including FRET, and luminescence (flash/glow) including BRET
- **Spectrometer** for UV/vis absorbance
- **Filters** for AlphaScreen®/AlphaLISA®/AlphaPlex™, TRF, including TR-FRET, fluorescence polarization

Game-changing technology

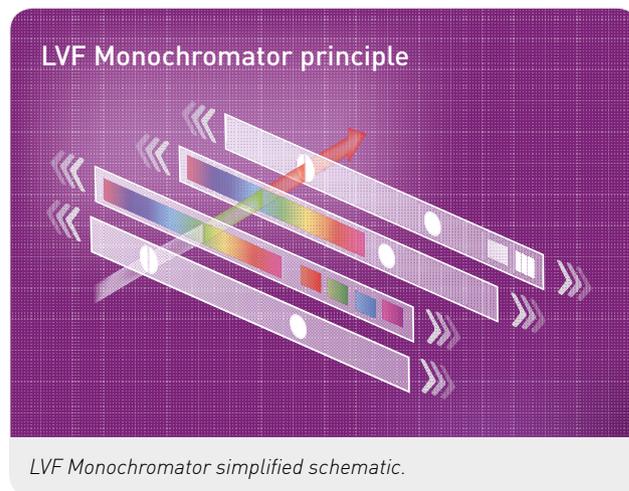
The CLARIOstar^{Plus} is equipped with an innovative wavelength-selecting technology: LVF Monochromators. These eliminate the need for concave gratings employed in conventional monochromators to separate and mechanically select coloured light.

Our monochromators are based on Linear Variable Filters (LVF). These vary spectral properties over their length, transmitting or blocking specific wavelengths in different positions. An LVF Monochromator consists of



Linear Variable Filters have spectral properties that vary linearly across their length.

two aligned filter slides that separate light into distinct wavelengths and continuously adjustable bandwidths. The reader is equipped with two LVF Monochromators, one for excitation and one for emission. A unique Linear Variable Dichroic mirror separates excitation and emission light. Spectral scanning is possible both in fluorescence intensity and luminescence detection.



LVF Monochromator simplified schematic.

No compromise

Several features of the CLARIOstar^{Plus} and its LVF Monochromator ensure significantly higher sensitivity and flexibility compared to conventional grating-based monochromator readers.

- **Filter-like performance**
LVF slides have the same light transmitting properties as optical filters. Hence LVF Monochromators benefit from a higher light transmission over conventional monochromators. Moreover, they eliminate the light dissipation typically associated to conventional grating-based monochromators.
- **Free air optical path**
A direct free air optical path from the light source to the sample and further to the detector makes optical light bundles or light guides superfluous. A series of software controlled mirrors directs the light to the top or bottom of the plate, ensuring the reader achieves higher light transmission compared to conventional monochromators.

□ **No stray light**

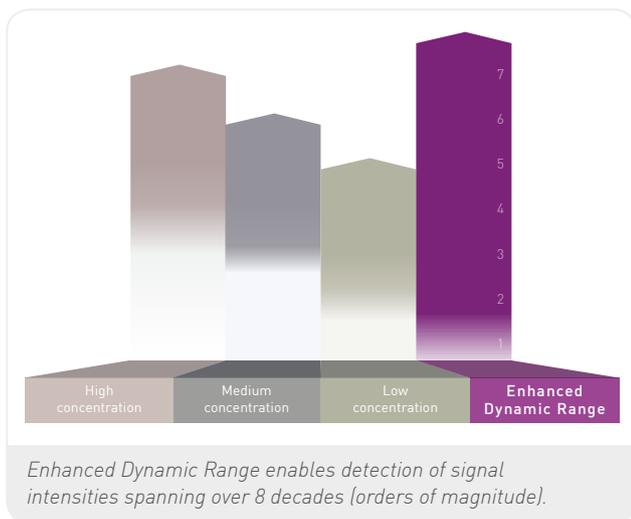
The LVF Monochromator design avoids the stray light associated with conventional grating-based monochromators. Avoidance of undesired wavelengths that leak through the system decreases the background signal and significantly increases sensitivity.

□ **Adjustable bandwidths up to 100 nm**

Continuously adjustable bandwidth from 8 to 100 nm is a unique feature of LVF Monochromators. Larger bandwidths yield more light for excitation and emission, and hence increase sensitivity.

□ **Less background signal**

The CLARIOstar^{Plus} is the only monochromator-based plate reader with a Linear Variable Dichroic. This mirror separates the excitation from the emission light, significantly reducing the background signal.



Simplify your assay setup

Thanks to the Enhanced Dynamic Range (EDR) technology and rapid, full-plate autofocus, every sample on your plate is automatically measured with the ideal settings without any action prior to the start of measurement.

New users will be able to easily get started, while experienced ones will get better data, more quickly.

When running experiments, sample signal intensities are usually hard to predict. From dim to very bright, different samples on a microplate may display a large variability of signal intensities. Usually, kinetic assays are quite

problematic as well, as the signal intensities can highly diverge over time.

EDR technology grants a dynamic range spanning over 8 concentration decades in a single measurement. It ensures reliable detection of samples at a large range of signal intensities with no manual intervention, providing better sensitivity, flexibility, and more accurate results. As it acquires both very high and low signals in a single detection run, EDR significantly simplifies measurement setup and provides an easier solution for assay development.

EDR can be applied to any wavelength in fluorescence intensity and luminescence, both with filters and LVF Monochromators.

Focus on your samples

The new full-plate autofocus makes detection easier and improves data quality for both top and bottom reading in all plate formats up to 1536 wells. It automatically ensures the best signal-to-noise ratio for every application, eliminating the influence of microplate formats, sample volumes, surface tension, and evaporation.

Combined with EDR, it automatically selects the best detection settings for each well.

Combine filters and monochromators

The LVF Monochromator optic design allows monochromators and fixed filters to share the same optical path such that you can combine both in one measurement. It is possible to excite with a filter and scan the emission spectrum, or vice versa. This gives the CLARIOstar^{Plus} unmatched flexibility for your research.

Did you know ...

...For luminescence assays such as flash, glow, dual glow, and BRET, LVF Monochromators or filters can be used. However, the LVF Monochromators with adjustable bandwidths up to 100 nm are sensitive enough to read dual-colour luminescence including BRET signals, without the need of fixed filters.

Dedicated detectors

The CLARIOstar^{Plus} reader can be equipped with up to three different detectors. A CCD spectrometer guarantees the best performance in all colourimetric assays, as well as the ability to acquire absorbance spectra.

A low-noise detector (PMT) is available for fluorescence- and luminescence-based modes. Additionally, for the very best performance in far-red fluorescence intensity, fluorescence polarization as well as TRF and TR-FRET, you can benefit from a red-sensitive PMT. A dedicated detector for luminescence and AlphaScreen provides the option to measure with the most sensitive PMT without compromise.

High-flyer in advanced detection modes

For fluorescence polarization, time-resolved fluorescence (incl. TR-FRET), and AlphaScreen®/AlphaLISA®/AlphaPlex™ assays, the reader uses specialized components that guarantee exceptional performance without any compromise.

□ Exceptional fluorescence polarization

The CLARIOstar^{Plus} is the best fluorescence polarization plate reader on the market. Its unique optical path and instant polarizer switching provides the smallest mP standard deviation in any reader.

□ High-end TRF and TR-FRET/HTRF® detection

Certified to measure HTRF® assays in both black or white plates, the reader guarantees no compromises on any HTRF assay. The ability to measure HTRF in black plates is only prerogative of the most sensitive readers.

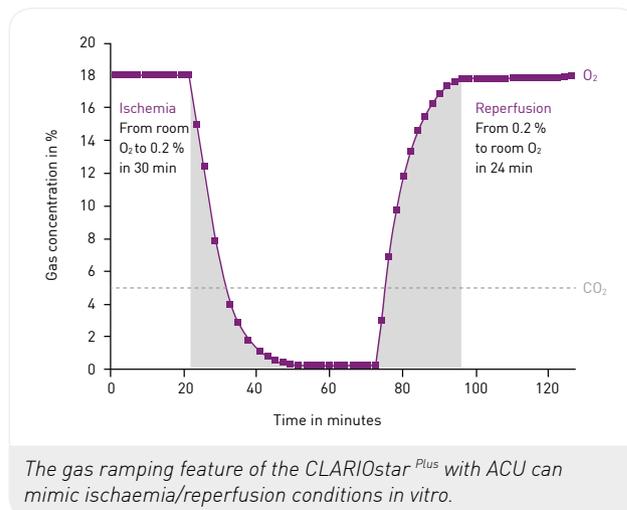
□ Dedicated laser for AlphaScreen® excitation

A dedicated laser and specialized optics ensure the best performance for AlphaScreen®/AlphaLISA®/AlphaPlex™ assays with respect to speed, assay window, and sensitivity.

Keep your cells happy

The CLARIOstar^{Plus} has several key features that improve cell-based applications, including temperature control and three shaking modes for microbial and cellular growth assays. The Atmospheric Control Unit (ACU) independently regulates O₂ and CO₂, providing the perfect environment for cell growth. As a unique

feature, the CLARIOstar^{Plus} can run gas ramps. Useful for hypoxic and ischemia/reperfusion assays, as well as for metabolic and redox experiments, the gas ramping feature allows O₂ to be rapidly reduced from ambient to hypoxic and return to ambient whilst maintaining a constant CO₂ concentration.



Automation

The reader offers improved robotic integration capabilities, multi-user control and MARS data analysis software with included digital signature and FDA 21 CFR part 11 compliance.

With a standardized small reader footprint and robotic software interface, you can easily integrate it into all leading robotic platforms.



Additional information

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Detection modes	UV/vis absorbance Fluorescence intensity - including FRET Luminescence (flash and glow) - including BRET Fluorescence polarization Time-resolved fluorescence - including TR-FRET AlphaScreen®, AlphaLISA®, AlphaPlex™	
Measurement modes	Top and bottom reading Endpoint and kinetic Sequential multi-excitation Sequential multi-emission Spectral scanning (fluorescence, luminescence, absorbance) Ratiometric measurements 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 Dedicated laser for AlphaScreen®/AlphaLISA®/AlphaPlex™	
Detectors	Low-noise photomultiplier tube Red-sensitive photomultiplier tube CCD spectrometer	
Wavelength selection	Dual Linear Variable Filter (LVF) Monochromators™ Linear Variable Dichroic Mirror: separates ex & em LVF Monochromators Optical filters: excitation and emission slides hold 4 filters each LVF Monochromators + optical filters: use one for excitation and the other for emission UV/vis absorbance spectrometer: full spectrum or 8 distinct wavelengths in < 1 sec/well	
Optical filters	Excitation and emission slides for 4 filters each	
Optical path guides	Top and bottom: free air optical light path guided by motor-driven mirrors and dichroics	
Z-Adjustment	Automatic focal height adjustment (0.1 mm resolution)	
Spectral range	Filters	Fl, FP, TRF: 240 - 740 nm or 240 - 900 nm (red-shifted PMT) LUM: 240 - 740 nm
	LVF Monochromators™	Fl: 320 - 740 nm or 320 - 840 nm (red-shifted PMT) LUM: 320 - 740 nm
	Linear Variable Dichroic	340 - 740 nm or 340 - 760 nm (red-shifted PMT)
	Spectrometer	ABS: 220 - 1000 nm
Sensitivity	FI Filters (top)	< 0.15 pM fluorescein (< 3 amol/well, 384sv, 20 µL)
	FI Filters (bottom)	< 1.0 pM fluorescein (< 50 amol/well, 384g, 50 µL)
	FI Monochromator (top)	< 0.35 pM fluorescein (< 7 amol/well, 384sv, 20 µL)
	FI Monochromator (bottom)	< 3.0 pM fluorescein (< 150 amol/well, 384g, 50 µL)
	FI dynamic range	8 decades in a single measurement
	FP	< 0.5 mP SD at 1 nM fluorescein (384sv, 20 µL)
	TRF	< 20 fM europium, 384, 80 µL
	HTRF® (black and white microplates)	Reader Control Kit (Eu) after 18h (384sv, 20 µL) Delta F > 880 % (High Calibrator) Delta F > 30 % (Low Calibrator)
	LUM	< 0.4 pM ATP (< 8 amol/well, 384sv, 20 µL)
	LUM dynamic range	8 decades in a single measurement
	AlphaScreen® with laser	< 5 pM (< 100 amol/well P-Tyr-100, 384sv, 20 µL)*
	Abs with spectrometer	Selectable spectral resolution: 1, 2, 5, and 10 nm OD range: 0 - 4 OD Accuracy: < 1 % at 2 OD Precision: < 0.5 % at 1 OD and < 0.8 % at 2 OD
Read times	Flying mode (1 flash)	8 s (96), 15 s (384), 28 s (1536)
	10 flashes	19 s (96), 57 s (384), 3 min 4 s (1536)
Reagent injection	Up to 2 built-in reagent injectors - Variable injection speed up to 420 µL/s Individual injection volumes for each well: 3 to 500 µL (optionally up to 2 mL) Reagent back flushing	
Shaking	Linear, orbital, and double-orbital with user-definable time and speed	
Integrated barcode reader	Up to two integrated barcode readers	
Incubation	+3 °C above ambient up to 45 °C or 65 °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 - Integrated fluorophore library FDA 21 CFR part 11 compliant	
Dimensions	Width: 45 cm, depth: 51 cm, height: 40 cm; weight: 32 kg	
	Optional accessories	
LVIS Plate	Sixteen separate microdrop wells for 2 µL samples; standard cuvette position Quality control internal standards (optional)	
Atmospheric Control Unit	Actively regulates O ₂ and CO ₂ - 0.1-20 %. Gas ramping function	
Stacker	Magazines for up to 50 plates - continuous loading feature	
THERMOstar	Microplate incubator and shaker	
Optical filters	Excitation and emission slides for 4 filters each	
Upgrades	Upgrades to include options such as additional detection modes, reagent injectors, etc. are available. Please contact your local representative for more information	

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

*Limit of detection: < 100 amol of biotinylated and phosphorylated polypeptide [P-Tyr-100 assay kit, PerkinElmer, #6760620C].

Sensitivity was calculated according to the IUPAC standard: $3 \times \text{SD}_{\text{blank}} / \text{slope}$
Specifications are subject to change without notice.

Microplates: white for LUM, AlphaScreen®, TRF; black for FI, FP.
384sv = 384-well small volume microplates
384g = 384-well glass bottom microplates

“Our laboratory has used the FLUOstar Omega microplate reader for several years. We find that even weak fluorescence signals can be measured with **high accuracy.**”

*Prof. Stefan Rensing
Department of Plant Cell Biology, University of Marburg, Germany*



Omega series

Only one option is not an option.

Omega plate readers are equipped with exactly what you need for your life science applications. The true modular flexibility perfectly fulfills your requirements: from an absorbance-only SPECTROstar® to a fully equipped multi-mode POLARstar®. The choice is yours!

Life science

Up to 384-well plates

Single- to multi-mode

FILTER-BASED

Value for money

Upgradable

The Omega series is certified for:



Flexibility and modularity for life science research

The Omega series offers a combination of performance, flexibility, and value for money for all of your applications. It provides the perfect platform for a wide range of applications in basic research, life science studies, and assay development. Backed by German engineering and technology, the Omega series encompasses single to multi-mode microplate readers:

Single-mode readers:

- SPECTROstar®: dedicated absorbance reader
- LUMIstar®: dedicated luminescence reader

Multi-mode readers:

- FLUOstar®: fluorescence intensity, luminescence, absorbance, TRF and AlphaScreen®
- POLARstar®: multi-mode reader including fluorescence polarization and Simultaneous Dual Emission

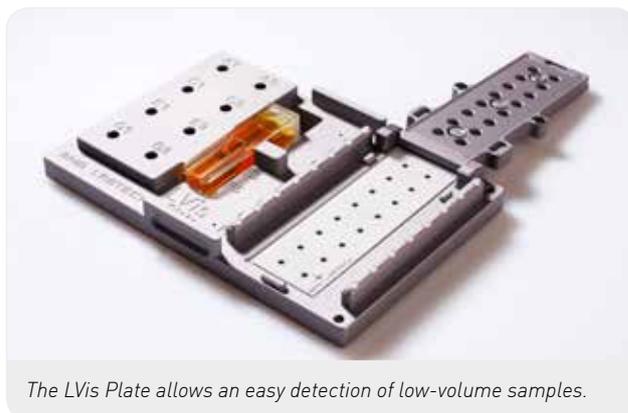
Thanks to its modular design, the Omega series not only meets the needs you have today but can be upgraded to fulfill your future requirements. If additional features or detection modes are necessary in the future, you can upgrade your Omega at any time - from an absorbance-only SPECTROstar or luminescence-only LUMIstar to a FLUOstar or even a fully-equipped POLARstar Omega with up to six detection modes.

What is included

Readers belonging to this series read all plate formats from 6- to 1536-wells in absorbance and up to 384-wells in all other detection modes. Precise temperature control up to 45 °C or 65 °C, different shaking modes and well scanning all enhance the flexibility of the Omega series. Additionally, up to two onboard injectors provide the ability to dispense reagents and initiate kinetic reactions, and the Atmospheric Control Unit (ACU) regulates the concentration of CO₂ and O₂ in the reader. Alternatively, a gas venting system allows to either pump in inert gases (e.g. CO₂ or N₂) or to pull a vacuum into the reader.

All spectrometer-based readers are compatible with the LVis Plate, allowing quick and easy low-volume concentration measurements of DNA, RNA, protein

samples, etc. For mid-throughput purposes, the instruments can be equipped with our Stacker, allowing automated plate handling for up to 50 microplates.



The LVis Plate allows an easy detection of low-volume samples.

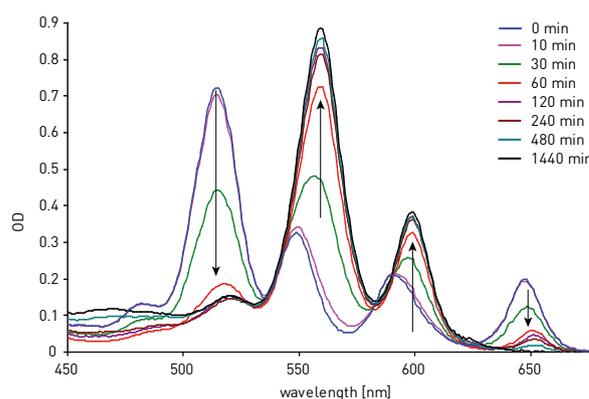
SINGLE-MODE READERS

SPECTROstar Omega

BMG LABTECH was the first plate reader manufacturer to equip its instruments with a spectrometer for absorbance detection.

The SPECTROstar Omega is a dedicated absorbance microplate reader equipped with a spectrometer, capable of either a full-absorbance spectrum capture or the detection of up to eight discrete wavelengths simultaneously.

Spectrometers allow a much faster measurement of the complete UV and visible absorbance spectrum



Spectra acquisition over time.

compared to monochromators. Sensitivity and resolution is also improved with no requirement for mechanical scanning.

The SPECTROstar Omega was the first upgradeable microplate reader equipped with a spectrometer for absorbance detection. Our proprietary technology can capture a full UV/vis absorbance spectrum from 220 to 1000 nm at resolutions of 1, 2, 5 or 10 nm in less than one second per well, and is up to five times faster than any monochromator.

Alternatively, up to eight distinct wavelengths can be measured simultaneously with no mechanical wavelength switching. Obtain 96 full-spectra in less than 60 seconds or 96 single wavelength reads in less than 40 seconds. No need to select or guess the optimal wavelengths, they are all given!

LUMIstar Omega

This powerful luminescence-only microplate reader was designed with a dedicated luminescence detection system for both flash and glow assays. It offers exceptional luminescence performance in both 96- and 384-well plate formats and is certified by Promega for Dual Luciferase® Ready (DLR) assays.

The built-in filter wheel and the optional Simultaneous Dual Emission detection make detection of multiple luminescence wavelengths possible, as well as measurement of BRET (Bioluminescence Resonance Emission Transfer) assays.

The LUMIstar can be upgraded to include injectors, ideal for flash kinetics, a gas vent for cell-based assays or even upgrade read modes to the FLUOstar or POLARstar.



Filter wheels with 8 filter positions.

MULTI-MODE READERS

FLUOstar Omega

The best combination of performance and value-for-money for all of your life science and R&D applications is the FLUOstar Omega, a versatile multi-mode microplate reader with up to five detection modes:

- UV/vis absorbance
- Fluorescence intensity, including FRET
- Time-Resolved Fluorescence (TRF), including TR-FRET
- Luminescence (flash and glow), including BRET
- AlphaScreen® and AlphaLISA®

Top and bottom plate reading, multi-color detection, well scanning, precise temperature control, multi-option shaking, and a gas vent all enhance the flexibility of this instrument. The addition of onboard “smart” injectors provides you with the ability to dispense reagents and initiate kinetic reactions.

The FLUOstar Omega reads all plate formats from 6- to 1536-well in absorbance and up to 384-well in all other detection modes.

□ Filter-based detection

For fluorescence and luminescence assays, filters provide precise and superior performance. The fast filter switching capability allows the detection of multi-excitation and multi-emission applications, such as FRET, BRET, FURA-2 and other ratiometric methods. Filters enable superb light transmission and excellent blocking of undesired wavelengths.

We offer a wide range of assay-specific filters from UV to NIR with various bandwidths.

□ Spectrometer-based absorbance detection

The FLUOstar Omega is equipped with a spectrometer for absorbance detection as the SPECTROstar. The full absorbance spectrum from 220 to 1000 nm at 1 - 10 nm resolution is measured in less than one second/well or, alternatively up to eight wavelengths are measured simultaneously in a single pass with no wavelength switching. Alternatively, for simple applications or where a small number of specific absorbance wavelengths are required, filter based absorbance is available. This reader- has no spectral scanning capabilities and is not compatible with the LVis Plate.

□ AlphaScreen® and AlphaLISA®

Our engineers have developed a specialized optical system for the FLUOstar Omega to read AlphaScreen®/AlphaLISA® assays using the standard xenon excitation lamp as light source. This technology provides excellent AlphaScreen®/AlphaLISA® performance normally only available on higher specification readers.

□ Advanced time-resolved fluorescence

The reader comes with standard TRF detection capabilities. Up to 10-fold increased performance can be achieved thanks to the advanced optic head for TRF and TR-FRET detection. This option incorporates an assay specific dichroic mirror combined with manual Z-height adjustment.

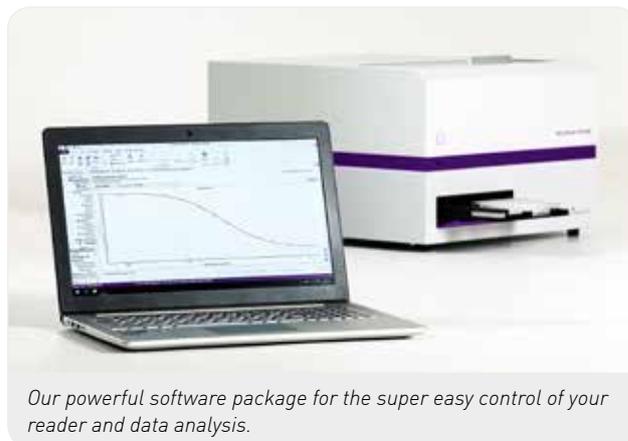
Assays such as HTRF®, LANCE®, Delfia®, and LanthaScreen® can now be performed with outstanding sensitivity. Combined with the high intensity xenon flash lamp, assay-optimized filters and adjustable gain, the advanced TRF optic head allows to outperform any microplate reader in its class.



□ Robustness for extended shaking assays

The FLUOstar Omega is the most durable reader for extensive shaking-based, long-term kinetic measurements. Its robustness and ability to withstand

harsh shaking conditions even for long kinetics, made it the reader of choice for protein aggregation assays and microbial growth. Thanks to its robustness and precision, it was chosen by Rocky Mountain Labs, Montana, USA, as the reference reader for the development of the prion seeding RT-QulC assay (Wilham et al., 2010).



The FLUOstar Omega is the most used platform for the detection of the following assays in microplate format:

- Protein aggregation
- Prion seeding (RT-QulC)
- β -amyloid fibril formation
- α -synuclein aggregation
- Microbial growth

This instruments offers the following dedicated features for extensive shaking-based assays:

- High-quality German engineering and manufacturing for higher robustness and functionality
- Dedicated plate carrier for highest microplate stability even in thorough shaking conditions
- Shaking and incubation over long periods of time (20-68 hours)
- Ability to withstand prolonged and continuous high-speed shaking
- Data collection without interruption and output to MARS data analysis software and/or Excel®

POLARstar Omega

This multi-mode microplate reader extends the capabilities of the FLUOstar Omega thanks to further dedicated features. This versatile, automated instrument offers the following detection modes:

- UV/vis absorbance
- Fluorescence intensity, including FRET
- Time-Resolved Fluorescence (TRF), including TR-FRET
- Fluorescence polarization/anisotropy (FP)
- Luminescence (flash and glow), including BRET
- AlphaScreen® and AlphaLISA®

In addition to the features already available on the FLUOstar, the POLARstar Omega is equipped with fluorescence polarization as a further detection mode, an additional photomultiplier tube (PMT) detector, and Simultaneous Dual Emission detection.

□ Fluorescence polarization

Depending on their mobility in a solution, molecules emit polarized or depolarized light. Detection of fluorescence polarization/anisotropy provides information about molecule mobility and orientation. Low levels of polarization indicate that the fluorescent molecules move freely in the solution. Higher levels of polarization indicate the presence of a larger molecular complex that is less mobile.

Fluorescence polarization is utilized to study protein-protein interaction events such as receptor-ligand or protein-antibody binding, as well as protein-DNA binding, etc.

A pair of carefully matched photomultiplier tubes and assay-optimized filters ensure the POLARstar Omega detects polarization events with low variability and low mP standard deviations.

□ Simultaneous Dual Emission

In Simultaneous Dual Emission (SDE) detection two separate emission wavelengths are detected at the same time in one single measurement without the need to switch filters or to excite a second time. Compared to the sequential measurement of two single channels, SDE halves detection times as both emission wavelengths are detected simultaneously. Moreover, it corrects flash-to flash variations, assay effects such as photobleaching, decaying kinetic signals, or fluctuating

conditions like temperature, pH, and evaporation. SDE is a helpful tool for FP, FRET, and TR-FRET assays.

Much more to choose from

The Omega series has additional features that enhance the functionality of the reader and allow to perform many different types of assays. We highlighted several of these features here below.

You can also find more information in the Features and Technology section.

The readers of the Omega series all share the same platform. The following features can be upgraded at any time:

Fluorescence intensity detection
Fluorescence polarization detection (requires 2 PMTs)
Luminescence detection
UV/vis absorbance detection
AlphaScreen® detection
Time-resolved fluorescence, including TR-FRET
High-end TRF optic head
Simultaneous Dual Emission (requires 2 PMTs)



Additional information

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Omega series microplate reader comparison

	SPECTROstar	LUMIstar	FLUOstar	POLARstar
Absorbance, spectrometer-based	✓		✓	✓
Absorbance, filter-based			✓	
Luminescence		✓	✓	✓
Fluorescence intensity			✓	✓
Fluorescence polarization				✓
TRF			✓	✓
AlphaScreen			✓	✓
Microplate format (up to)	1536-w	384-w	1536-w for Abs, 384-w all	1536-w for Abs, 384-w all
Incubation 45 °C / 65 °C	✓	✓	✓	✓
Detector	Spectrometer	1 PMT	Spectrometer and 1 PMT	Spectrometer and 2 PMTs
Simultaneous Dual Emission				✓
Bottom read		✓	✓	✓
Injectors	✓	✓	✓	✓
Atmospheric Control Unit	✓	✓	✓	✓
Gas vent	✓	✓	✓	✓
Multiple shaking	✓	✓	✓	✓
Matrix scan	✓	✓	✓	✓
LVis plate	✓		✓	✓
Stacker	✓	✓	✓	✓
Automation	✓	✓	✓	✓

Due to the modularity of BMG LABTECH's instruments, all or combinations of the features above can be installed at purchase or upgraded at any time.

Detection modes	Fluorescence intensity - including FRET UV/vis absorbance Luminescence (flash and glow) - including BRET Time-Resolved Fluorescence - including TR-FRET AlphaScreen®, AlphaLISA® Fluorescence polarization/Anisotropy	
Measurement modes	Top and bottom reading Endpoint and kinetic Sequential multi-excitation Sequential multi-emission Simultaneous Dual Emission Spectral scanning (absorbance) Ratiometric measurements 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	Up to two low-noise photomultiplier tubes CCD spectrometer	
Wavelength selection	Optical filters: excitation and emission wheels for 8 filters each UV/vis absorbance spectrometer: full spectra or 8 distinct wavelengths in < 1 sec/well	
Optical filters	Excitation and emission filter wheels for 8 filters each	
Optical path guides	Top: liquid filled light guides Bottom: fiber optics	
Spectral range	Filters	240 - 750 nm or 240 - 900 nm for FI, FP, TRF, filter Abs 240 - 750 nm for LUM
	Spectrometer	220 - 1000 nm for Abs
Sensitivity	FI	< 10 pM (< 0.2 fmol/well fluorescein, 384sv, 20 µL)
	FP	< 5 mP SD at 1 nM fluorescein
	TRF	< 30 amol/well europium
	High-end TRF	< 3 amol/well europium
	LUM	< 20 amol/well ATP
	AlphaScreen®	< 5 pM (< 100 amol/well P-Tyr-100, 384sv, 20 µL)*
	Abs with spectrometer	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 OD
	Abs with filters	OD range: 0 to 4 OD Reproducibility: ±0.010 OD for 0-2 OD range
Read times	Flying mode (1 flash) 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	
Purge 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 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: 44 cm, depth: 48 cm, height: 30 cm; weight: 28 kg	
	Optional accessories	
LVis Plate	Sixteen separate microdrop wells for 2 µL samples One standard cuvette position for up to 1 mL samples Quality control internal standards (optional): four NIST-traceable optical density filters (approximate values of 0.1, 0.3, 0.6 and 1.0 OD); one holmium oxide filter for wavelength accuracy Conforms to SBS standards for microplates.	
Atmospheric Control Unit	Actively regulates O ₂ and CO ₂ - 0.1-20 %	
Stacker	Magazines for up to 50 plates - continuous loading feature	
THERMOstar	Microplate incubator and shaker	
Optical filters	Assay-optimized filters	
Upgrades	Please contact your local representative for upgrades including options such as detection modes, reagent injectors, etc.	

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.

* Limit of detection: < 100 amol of biotinylated and phosphorylated polypeptide (P-Tyr-100 assay kit, PerkinElmer, #6760620C).

Sensitivity was calculated according to the IUPAC standard: $3 \times (SD_{blank}) / \text{slope}$
Specifications are subject to change without notice.

Microplates: white for LUM, AlphaScreen®, TRF; black for FI, FP.
384sv = 384-well small volume microplates

“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*



Small but mighty.

If you are looking for an absorbance-only plate reader that performs assays quickly and easily in both microplates and cuvettes, the smallest of our instruments is the one for you. It acquires the complete UV/vis absorbance spectrum in less than one second per well. In the blink of an eye the work is done!

Absorbance-only

Up to 1536-well plates

C u v e t t e s

SINGLE-MODE

S p e c t r o m e t e r

Spectral scan

Ultra-fast determination of DNA, RNA, ELISA and so much more

The SPECTROstar^{® Nano} is a spectrometer-based absorbance reader for microplates and cuvettes. Its rapid full-spectrum analysis allows for absorbance assays never possible before on a microplate reader. Its unique features include:

- Ultra-fast UV/vis spectrometer
- Microplate formats up to 1536-wells
- Standard cuvette port for single samples
- Multi-mode shaking
- Incubation up to 45 °C
- Gas Vent

Other features include: automated path length correction, well scanning and kinetic readings. The reader is compatible with the LVis Plate for low-volume absorbance detection.

A full spectrum in the blink of an eye

Spectrometers allow faster measurements of the UV and visible absorbance spectrum than monochromators, with no need for a mechanical scanning. Moreover, they provide better sensitivity and resolution.

The SPECTROstar^{Nano} is equipped with BMG LABTECH's proprietary spectrometer and can capture the entire UV/vis spectrum of a sample (220 - 1000 nm) at resolutions of 1 - 10 nm in less than one second per well. Alternatively, up to eight discrete wavelengths can be measured simultaneously.



Top view of the SPECTROstar^{Nano} touch pad and cuvette port.

Plates and cuvettes

More than just a plate reader, this instrument has a standard cuvette port for single sample absorbance measurements. With different cuvettes you can easily measure a range of sample sizes (0.7 µL to 5 mL). Full spectrum data are collected within one second, allowing for multi-chromatic evaluation over the whole UV to visible spectrum. By keeping the lid open during measurements, the cuvette port works well as a flow-through cell. This also allows readings to be taken before, during, and after manual addition of reagents.



Place cuvettes into the reader easily.

Incubation, shaking, and gas vent

Several other features such as incubation, multi-mode microplate shaking capabilities, and a gas venting port are included on the SPECTROstar^{Nano}.

Purge different gases into the microplate chamber by using the Gas Vent. For example, a mixture of O₂/CO₂ can be used when running live cell-based assays.

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 incubator can also be used for protein denaturation studies by incrementally increasing the temperature upon full spectrum detection.

Multi-mode plate shaking - linear, orbital, and double orbital - assures flexibility when designing assays.

Save benchspace in your lab

Small footprint, automation friendly plate carrier, and multiple robotic software interfaces allow for an easy integration of the SPECTROstar^{Nano} into all robotic platforms.

Furthermore, the optional capability to read 1536-well plates allows for high-throughput full spectrum analysis.



Additional information

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SPECTROstar^{Nano} - Technical specifications

Detection modes	UV/vis absorbance spectrum
Measurement modes	Endpoint and kinetic Well scanning
Microplate formats	6 to 1536-well plates, user-definable
Microplate carrier	Robot compatible
Cuvette port	Cuvette port for cuvettes with 10 mm path length Micro cuvettes, Traycell compatible Beam height 8.5 mm
Light source	High energy xenon flash lamp
Detector	CCD spectrometer
Wavelength selection	UV/vis absorbance spectrometer Full spectra or 8 distinct wavelengths in < 1 sec/well
Spectral range	220 - 1000 nm
Sensitivity	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 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
Gas vent	System to inject an atmosphere or to pull a vacuum into the reader
Integrated barcode reader	External manual barcode 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
LVis Plate	Sixteen separate microdrop wells for 2 µL samples; standard cuvette position. Quality control internal standards [optional].
THERMOstar	Microplate incubator and shaker
Upgrades	Please contact your local representative for upgrades including options such as detection modes, reagent injectors, etc.

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.

Specifications are subject to change without notice.

“We have four BMG LABTECH plate readers and they are all used heavily. They are **smart, reliable** and help my company to achieve its strategic goals. More than this, **the support team and servicing engineers are brilliant!** Thank you BMG!”

*Hayley Jones
Scientist, MRC Technology, London, UK*

NEPHELOstar *Plus*

 **BMG LABTECH**

One of a kind.

Do you need a solution for fast compound solubility screens? We have developed the NEPHELOstar^{Plus} to meet exactly the demands of high-throughput laboratories. By detecting insoluble particles in liquid samples through the measurement of forward scattered light, it is one of its kind.

Nephelometry

Up to 384-well plates

Single-mode

LIGHT SCATTERING

L a s e r - b a s e d

High-throughput

Laser-based microplate nephelometer for light-scattering and turbidity measurements

The NEPHELOstar^{Plus} is a microplate nephelometer that detects insoluble particles in liquid samples by measuring forward scattered light. Thanks to its speed, flexibility and performance, this instrument enables you to adapt more applications to microplate-based laser nephelometry than ever before.

Up to two onboard reagent injectors, precise temperature control, multi-mode shaking capabilities, automatic gain adjustment, Stacker plate handler, and compatibility with robotic systems further enhance instrument flexibility.

Thirty times more sensitive

The world's first laser-based microplate nephelometer is equipped with a self-monitoring laser diode with adjustable intensity and beam diameter. These features optimize sensitivity and allow for measurements to be performed in plate formats up to 384-well.

The laser beam passes through the sample well and reaches a scattered light collector, the Ulbricht sphere. In the absence of particles, light is not deflected and passes straight through the sphere, generating no signal. If insoluble particles are present in the sample, light is scattered, reflected and directed by the interior of the sphere to the detector. Scattered light is detected

at incident angles up to 80 degrees. This capability makes the NEPHELOstar^{Plus} approximately thirty times more sensitive than traditional transmission readers that measure the reduction in direct light passing through a sample well.

Run your assay in any plate

With this reader and its exclusive features you have the ability to adjust laser intensity and beam width. Narrow beam widths minimize liquid surface effects such as strong meniscus. Wider widths improve measurements in 24-, 48-, and 96-well microplate formats.

Adjust the laser intensity to adapt to the requirement of different samples. For instance, in opaque liquids such as petroleum samples, a higher laser intensity is usually beneficial to stabilize the light scattering signal.

Fast and simple

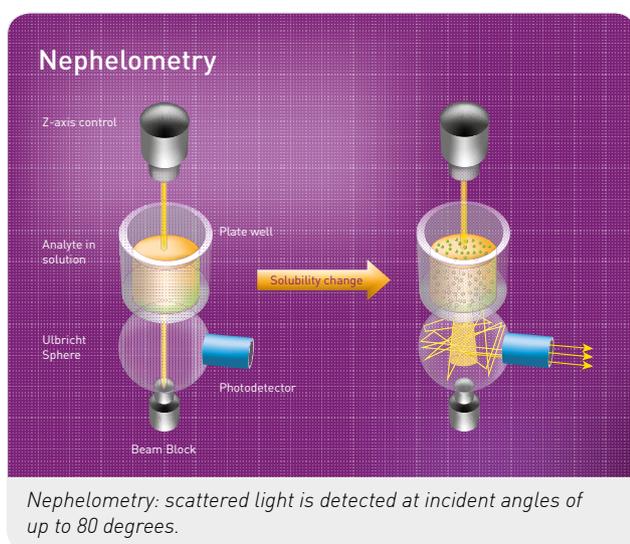
Thanks to the flexibility and performance of the NEPHELOstar^{Plus}, several applications can be adapted to microplate-based laser nephelometry. Developed to meet high-throughput demands, it offers drug screening laboratories a fast, simple and automatable method for checking compound solubility.

Applications include: flocculation assays, drug solubility determination, bacterial and fungal growth kinetics, and determination of precipitation of particles in solution.

Data analysis made easy

Our software package provides an extensive range of possibilities for both test protocol definitions and data analysis.

The Reader Control part of the software allows you to define instrument parameters and test protocols. The MARS data analysis software offers various tools to easily determine compound solubility or microbial growth kinetics. With MARS, data can be processed with powerful predefined templates or by using an extensive range of data calculation features. For example,



compound solubility by a segmental regression fit can automatically be determined, or a standard curve could be generated based on different curve fitting algorithms to calculate EC₅₀, IC₅₀, and r² values.

Reader automation

Designed from the outset for standalone use or robotic integration the small foot print, robotic software interface and robot compatible plate carrier make integration to all leading robotic platforms simple. For compliance requirements the multi-user software includes digital signature and FDA 21 CFR part 11 compliance.



Additional information

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NEPHELOstar^{Plus} - Technical specifications

Detection modes	Nephelometry Light scattering
Measurement modes	Endpoint and kinetic measurements
Microplate formats	Up to 384-well plates
Microplate carrier	Robot compatible
Light sources	Self-monitoring laser diode Wavelength 635±10 nm Stability <0.2 % deviation Lifetime 20,000 hours Output: 1 mW Selectable beam width: 1.5 to 3.5 mm Selectable intensity 0-100 % Scattering angle: detects up to 80° full cone angle
Detectors	Side window photodiode detector
Wavelength selection	Photodiode: wavelength 635±10 nm
Sensitivity	Depends on particle size and liquid properties Silica detection (particle size 0.5 to 10 µm) 800 nM Dynamic range: 5 decades Maximum count rate (2,000,000 Relative Nephelometry Units (RNUs) per second)
Read times	Depend on assay conditions and liquid surface stability 16 s (96), 47 s (384) (shortest possible times)
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 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: 44 cm, depth: 48 cm, height: 32 cm; weight: 25 kg
	Optional accessories
Stacker	Magazines for up to 50 plates - continuous loading feature
Atmospheric Control Unit	Actively regulates O ₂ and CO ₂ - 0.1-20 %
THERMOstar	Microplate incubator and shaker
Upgrades	Please contact your local representative for upgrades including options such as detection modes, reagent injectors, etc.

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. Specifications are subject to change without notice.

Optic modules & filters

Gas Vent

LVF Monochromator™

SOFTWARE

Atmospheric Control Unit

Reagent injectors



Accessories & technical details

It's the inside that counts!

Since BMG LABTECH's inception, it has been our mission to produce microplate readers of highest quality for all research areas. Their simple external design belies what lies within. All instruments are fully equipped with high-end technology, user-friendly software and compatible with the latest in accessories and upgrades.



Atmospheric Control Unit (ACU) and Gas Vent

The Atmospheric Control Unit (ACU) is an add-on module for independent and simultaneous regulation of O₂ and CO₂. It provides the optimal environment for any live cell-based assay on the CLARIOstar^{Plus}, Omega series and NEPHELOstar^{Plus}. Its features include:

- O₂ and CO₂ control range: 0.1 - 20 %
- O₂ and CO₂ gas ramps (CLARIOstar^{Plus} only)
- Gas level trackability in MARS (CLARIOstar^{Plus} only)
- LCD touchscreen with intuitive user interface
- Gas concentration curve display
- Up to 10 user-definable presets
- Altitude correction for accurate gas regulation

Used in combination with temperature control, shaking, bottom reading detection, and Z-height focus adjustment, it reproduces physiological conditions, and provides an ideal 'walk-away' solution for any long-term cell-based assay.

Both O₂ and CO₂ can be independently regulated between 0.1 % and 20 %, making the ACU one of the most flexible gas control systems available on plate readers today. Any gas combination is easily programmed with no need to change cylinders or piped gas supplies.



On the CLARIOstar^{Plus}, the ACU is directly connected to the MARS data analysis software, allowing to track O₂ and CO₂ values, and to display and analyse gas curves.

Applications include:

- Proliferation and cell viability assays - Microbial growth
- Migration and invasion assays - Hypoxia studies
- Angiogenesis - Cytotoxicity studies - Viral uptake - Intracellular pH

Unique gas ramping function

With the CLARIOstar^{Plus} with ACU, gas ramping is now possible for the first time on a microplate reader. For instance, O₂ can be programmed to reduce from ambient to hypoxic and return to ambient whilst maintaining a constant CO₂ concentration. Duration times for each step are set independently. The ramping function is extremely useful for ischemia/reperfusion, hypoxic, metabolic and redox assays.

Gas Vent

Alternatively, the Gas Vent offers a combination of performance and value for money by which the internal atmosphere of the microplate reader can be modified with an inert gas (such as CO₂ or N₂) or a defined gas mix. The quick connect system provides a simple and easy connection for different gas supplies to the instrument. It is also possible to connect vacuum to the reader to remove any volatile gases that may be present. The Gas Vent is available for the Omega series and the SPECTROstar^{Nano}.

Atmospheric Control Unit specifications

O ₂ Control	Range: 0.1 - 20 % Control: ± 0.1 % Sensor: Low drift, long lifetime
CO ₂ Control	Range: 0.1 - 20 % Control: ± 0.1 % Sensor: Low drift, long lifetime

LVis Plate

BMG LABTECH's proprietary LVis Plate is a low-volume microplate that incorporates a cuvette slot and optional performance testing filters. It has the following features:

- Sixteen microdrop well sites for 2 μ L samples
- Horizontal position for a standard cuvette
- Optional NIST-traceable optical density filters for quality control assessment
- Optional holmium oxide filter for wavelength accuracy assessment
- Compatible with all UV/vis absorbance spectrometer-based BMG LABTECH microplate readers

The LVis Plate adheres to the SBS standardized 96-well microplate format definition. The microdrop well sites are easily accessible to wipe clean for further measurements.

Low-volume measurements

With sixteen micro-drop wells, the LVis Plate is ideal for quick and easy low-volume concentration measurements of DNA, RNA, protein samples, or spectral scanning. Its left- and right-handed physical support for an 8 channel pipette makes pipetting multiple samples simple and easy.

Cuvette and optional quality control

A built-in horizontal cuvette position allows measurement of standard (1 cm pathlength) rectangular cuvettes for rapid, full spectrum analysis of individual samples, for kinetic studies or for quick experiments.

The LVis Plate can also be equipped with NIST-traceable optical density (OD) and holmium oxide filters for quality control checks and wavelength assessment of all spectrometer-based instruments. These filters ensure correct instrument functionality, thus improving process reliability in laboratories.

Specifications for LVis Plate

Sample capacity	Sixteen separate microdrop wells for 2 μ L samples. One standard cuvette position for up to 1 mL samples.
Quality control internal standards	Four NIST-traceable density filters (approximate values of 0.1, 0.3, 0.6 and 1.0 OD). One holmium oxide filter for wavelength accuracy.
Dimensions	Conforms to SBS standards for microplates.
Instrument compatibility	All readers with spectrometer-based absorbance detection

Applications include:

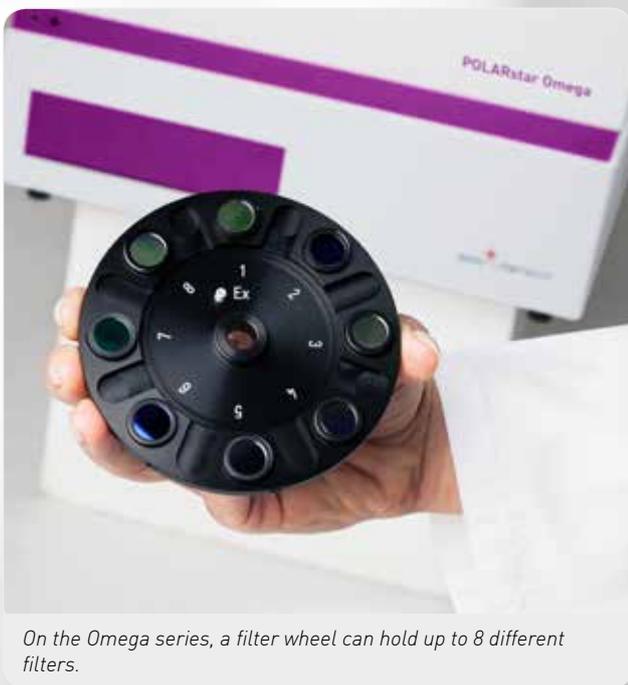
- Low volume DNA/RNA quantification
- Low volume protein quantification
- Endpoint and kinetic assays
- Spectral scanning of low volume samples



Filters

Filters are coated substrates that use light-interference principles and allow only specific wavelengths of light to be transmitted.

Our interference filters are designed using multilayer substrates with thin film coatings of various refractive indices applied to a surface. Up to forty coatings may be applied to produce a filter with the desired transmission characteristics.



On the Omega series, a filter wheel can hold up to 8 different filters.

Filters can be produced with almost any kind of transmission profile – short pass, long pass, broad peaks, narrow peaks and even multiple peak transmission bands – whatever you need to precisely fit the application.

Superior optical performance

Our fluorescence filters have a typical blocking power of 999,999 parts in one million, or six optical density (OD) units. This means a filter is capable of rejecting unwanted stray light down to 0.0001 %.

A solution for every need

We offer a wide array of general filters that range from 240 nm to 850 nm in 10 nm increments. Special filters with smaller (2 or 3 nm) or larger (50 or 100 nm) bandwidths, as well as assay optimized filters (e.g. GFP, HTRF®, and LANCE®) are available.

Custom filters of any wavelength and bandpass can be manufactured to meet your needs. We will work closely with you to ensure proper filter selection for your particular assay.



Optic Modules

The PHERAstar FSX microplate reader is the easiest-to-optically-configure microplate reader you can get. The unique optical design of the PHERAstar FSX and the Optic Modules ensures simple, hassle-free configuration of filters and dichroics for all assays.

Ensure assay-specific filters and dichroics

Optic Modules incorporate an integrated design which allows you to concentrate on running assays instead of instrumentation. Just place a module into one of the five module bays and read the assay. It is that simple and takes only a few seconds.

Optic Modules incorporate all the components necessary to read the assay of your choice in a convenient and easy-to-use package. Each module contains all the filters, dichroics, beam splitters and polarizers needed to run a specific assay. The components are matched and optimized by our scientists and engineers. Each Optic Module is labelled with a barcode and recognized by a barcode reader integrated into the PHERAstar FSX, eliminating the possibility of using the wrong assay filter set.



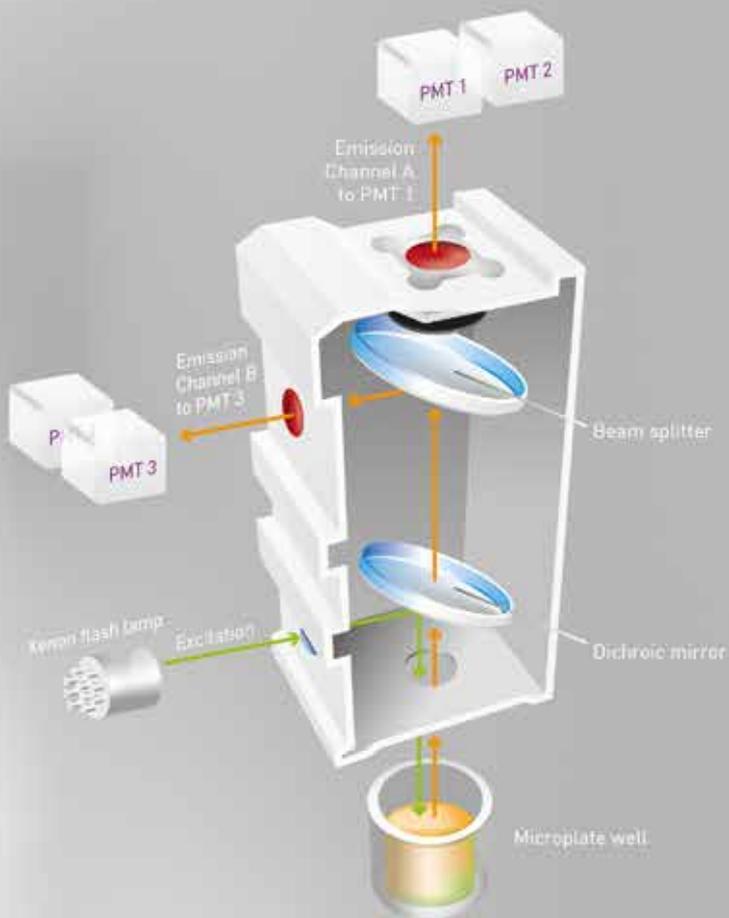
Changing Optic Modules is easy.

Tailor-made solutions

We have already produced countless Optic Modules for various assays.

Modules are available for all assays and our team of scientists is able to assist you in providing custom modules for your specific needs.

We value the partnership with our customers by giving them the freedom to run any assay they choose. With BMG LABTECH's Optic Module system, you are in control!



A sample of common Optic Modules includes:

- CFP/YFP FRET
- HTRF
- AlphaLISA
- NanoBRET
- LanthaScreen
- Transcreener FP
- Cy-5
- ...and many more!

THERMOstar

The THERMOstar is a high-performance microplate incubator and orbital shaker that can accommodate up to four microplates. It can be used for any enzyme or cell-based assay that requires strictly controlled, uniform incubation up to 56 °C with effective mixing.

Microprocessor-controlled heating plates above and below the microplates ensure outstanding temperature accuracy and uniformity across the plate, providing constant temperature up to 56 °C with < 0.6 °C variation.

Temperature, shaking speed, and incubation time are fully programmable via keypad, while the system parameters are displayed on the LCD in real-time.

Features:

- Incubation up to 56 °C
- High temperature accuracy and uniformity across the plate
- Microprocessor-controlled heating
- Variable shaking parameters
- Up to four microplates
- Small footprint

Incubation	Range: +8 °C ambient to 45 °C (56 °C optional) in 1 °C steps Temperature stability: ± 0.2 °C Temperature gradient: < 1.0 °C across the plate
Set point time	< 20 min from 25 °C to 37 °C
Shaking	Orbit radius: 0.7 mm Range: 120 to 700 rpm Time range: 0 to 18 hours (1 s steps) Continuous shaking
Capacity	Up to 4 microplates Max. microplate dimensions: W: 8.9 cm, L: 13.3 cm, H: 2.3 cm
Dimensions	W: 33.5 cm, D: 40.5 cm, H: 17 cm Weight: 9 kg



Stacker III

Designed to optimize microplate handling and increase workflow and throughput, the Stacker III is the best choice for medium-throughput screening operations. It allows you to concentrate on running assays, not managing plates. Its features include:

- 35 and 50 microplate capacity magazines
- Compatible with all microplate formats
- Rapid plate loading, unloading and restacking
- Continuous load feature
- Barcode reader for left and front side of microplate
- User-definable advanced protocols
- Compatible with: PHERAstar FSX, CLARIOstar^{Plus}, Omega series and NEPHELOstar^{Plus}.

The compact design minimizes the additional bench space required. Magazines are easily accessible, plates can be loaded *in-situ* on the stacker or on the bench and safely transported to the stacker. Without the magazines in place the reader can be used in single plate mode.

A microplate barcode reader can be installed in three different positions depending on the label location. When automatically entered into the test run information or ASCII data stream, the barcode ensures an accurate and organized data collection.

The Stacker III is built with quality materials that withstand the rigors of a working laboratory. The magazines are chemical resistant and easily removed for cleaning and maintenance. Electromagnets minimize the number of moving parts needed, and the precision control software accurately delivers plates to the reader.

Software package

The Stacker III is operated through the Reader Control software, ensuring a seamless integration. The BMG LABTECH Control Software directly runs and coordinates both the Stacker and the reader and controls both the definition of the measurement protocol and the configuration of the plate reader.

Additionally, the script mode gives you unlimited flexibility. It can be used to select different test definitions for different plates in one batch run or to perform multiple measurements on one plate.

Power requirements	85 to 240 V AC, 50 to 60 Hz, 100 VA
Dimensions	W: 45 cm, D: 68 cm, H: 13 cm
Weight	15 kg
Barcode reader	Complies with Code 128, Code 39, Codabar, Code 11UPC/EAN and 2/5 Interleaved and further barcodes



Microplate reader software package

German engineered hardware is only one part of a great microplate reader - the software that runs the instrument and analyses the data is the other. BMG LABTECH's comprehensive, multi-user software package includes Reader Control and MARS data analysis software and provides all of the requirements needed to both effectively run the microplate reader and extensively analyse the data.

Compliant with FDA regulation 21 CFR part 11, this software package is included with every reader and can be installed on as many computers you need, without the need to purchase additional licenses.

Reader Control Software

A simple and intuitive interface, the Reader Control software allows you to effortlessly acquire measurement data by defining instrument parameters and protocols. An extremely versatile software, it can run multi-step assays including multiple reagent injections and shaking, and takes advantage of advanced timing

for kinetic assays. Predefined protocols are already installed and assay-specific buttons on the main control screen enable quick and easy access to the most commonly used applications.

For more complex tasks, a built-in script wizard integrates different assay measurements into one.

Key features include:

- Real-time data display during measurement
- Quick-start button for quick measurements
- Software-controlled top and bottom reading
- Matrix scan with 900 points/well resolution
- Orbital and spiral averaging for heterogeneous samples
- Data export to Excel, dBase, or ASCII format
- Compliant with FDA regulation 21 CFR part 11
- ActiveX, DDE and SiLA interfaces for easy integration
- Easy integration into LIMS systems



Powerful control software and MARS data analysis software for all BMG LABTECH microplate readers.

MARS

The MARS software allows the intuitive analysis and processing of the measured values with a broad range of calculation features. All wells of the microplate can be displayed in either the numerical form or as a graphical representation, if applicable (e.g. kinetic curves or display data in colours).

The MARS Wizard creates a step-by-step calculation of standard curves, and other important parameters such as Signal-to-Noise or -Blank, Delta F% and Z' are easily obtained.

Instant analysis and calculation of enzymatic constants such as K_m and V_{max} and fast analysis of enzyme kinetic data using standard fit equations complete the MARS software package.

To simplify data reduction after measurement, complex and assays-specific analysis and calculations can be created and saved as calculation templates.

Templates can be linked to specific test protocols, enabling measurement and data analysis of an assay with just two mouse clicks.

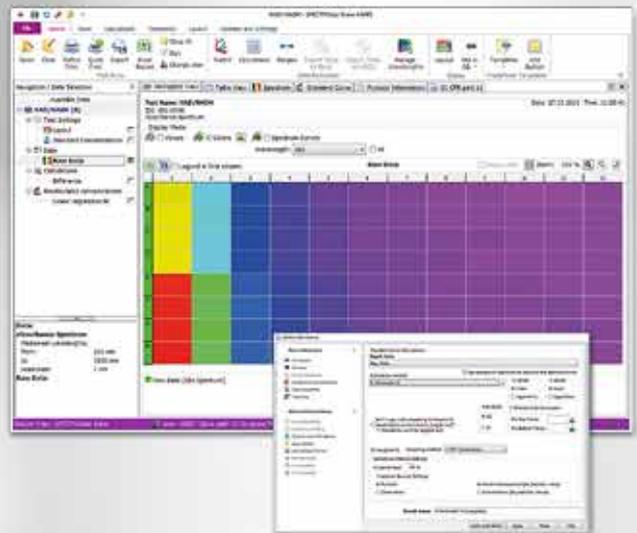


Bar chart representation of MitoXpress Intra data

Based on the powerful MATLAB numerical computing environment, MARS offers several calculation possibilities:

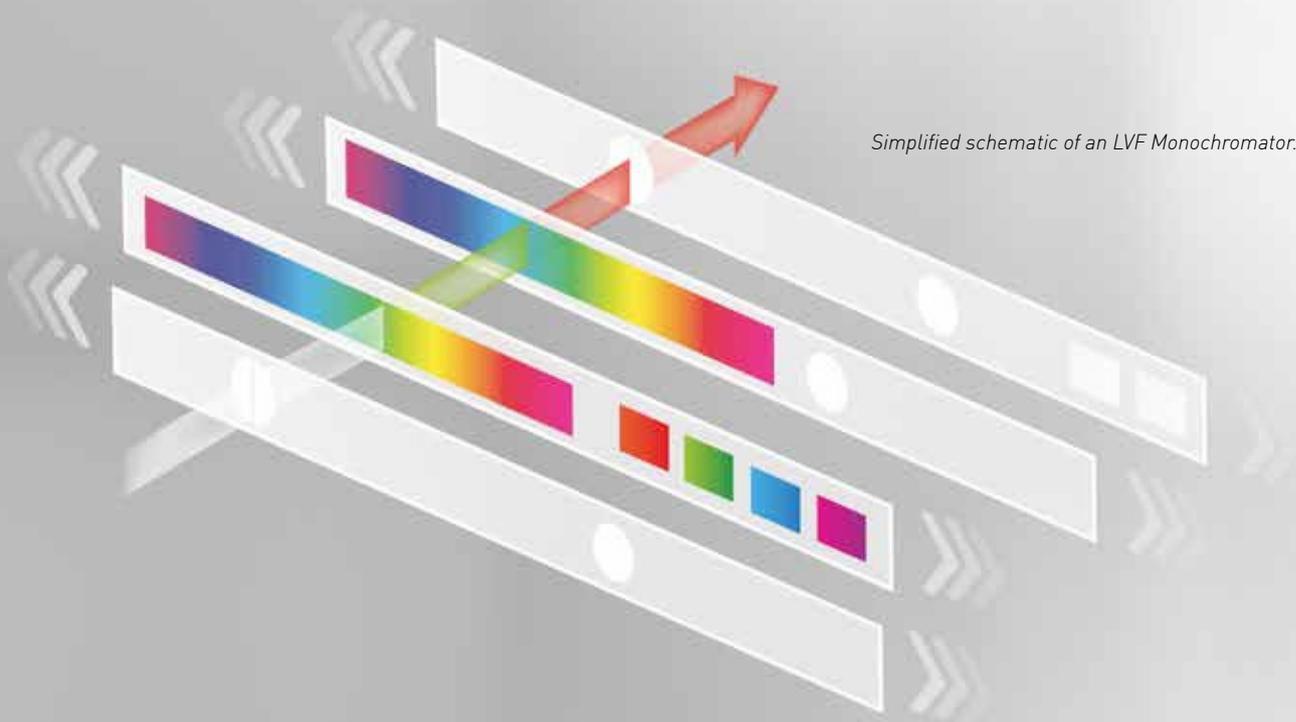
- One-click assay calculation templates
- Automatic DNA/RNA concentration determination
- Delta F calculation for HTRF®
- Excel and ASCII export

- FDA 21 CFR part 11 compliant
- First order rate kinetics
- K_d , K_m , V_{max} calculations
- Moving (boxcar) averages
- Automatic background/baseline correction
- Standard curve calculation wizard
- Signal-to-Noise and Signal-to-Blank calculations
- User-defined formula generator
- Michaelis-Menten, Lineweaver-Burk, Scatchard, etc.
- Z' value calculation
- UV/vis spectral view
- Standard curve fits for linear, 4- and 5-parameter, hyperbola, 2nd and 3rd polynomial, cubic-spline, segmental, user-defined, etc.



General system requirements:

- Pentium CPU (Intel Pentium 4 or higher with at least 2 GHz clock rate recommended)
- At least 256 MB RAM (1 GB or more recommended)
- 400 MB free hard disk memory for software installation
- Microsoft Windows Vista/7/8/10
- One free USB port



Simplified schematic of an LVF Monochromator.

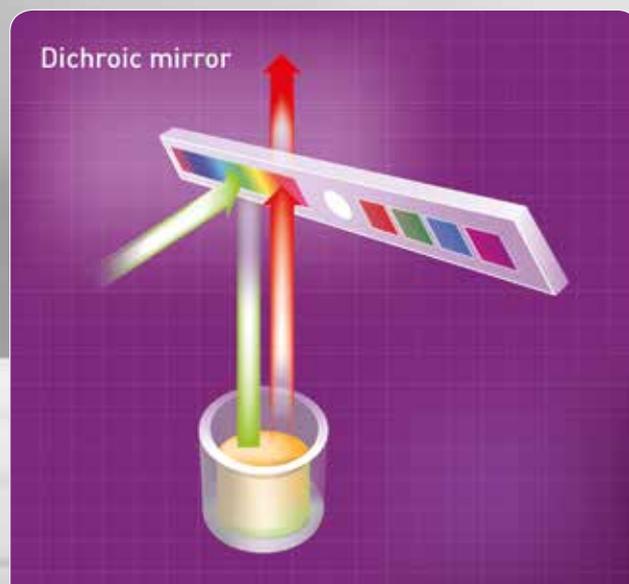
LVF Monochromator™

The monochromator is an optical device that selects a specific wavelength of light by mechanical movement of a light filtering stage. So far, there have been two generations of monochromators on the market:

- **The “classic” monochromator** selects a wavelength by passing broadband light through a slit, a concave grating, and another slit. This is needed in order to split up the light and block unwanted wavelengths. Due to light diffraction, only a limited amount of the light is transmitted to the sample, and from the sample to the detector. Another consequence of internal light reflections is high stray light (undesired wavelengths leaking through the slit).
- **The dual or double monochromator** has two classical monochromators in series (one after the other). It is also referred to as a quad/quadruple monochromator as a reader bears four monochromators, two for excitation and two for emission. In order to decrease stray light, a second monochromator is positioned after the first one, with a second series of grating and slits. This double diffraction and light filtering design significantly limits the amount of excitation and emission light with a consequential reduction in signal/sensitivity.

The next generation

We introduced Linear Variable Filter (LVF) monochromators specifically for the CLARIOstar^{Plus}. The revolutionary design of the LVF Monochromator does not employ concave gratings or other means to mechanically select wavelengths. Instead, it utilizes special tunable filters.



The Linear Variable Dichroic Mirror slide separates excitation and emission light further reduce undesired wavelengths.

LVBs are defined as filters whose spectral properties vary linearly from one end of the filter to the other. The LVB Monochromators consist of two LVB slides that form the rising and falling edge of a filter. By moving the LVB slides relative to each other, the system separates light into distinct wavelengths (320 to 850 nm) and continuously adjustable bandwidths (8 to 100 nm). The CLARIOstar^{Plus} reader consists of two LVB Monochromators, one for excitation and one for emission. In addition, a Linear Variable Dichroic Mirror slide is used to separate the excitation from the emission light and further reduce undesired wavelengths. LVB Monochromators transmit more light than grating-based monochromators since, like filters, LVB slides allow for more than 80 % light transmission. This results in filter-like sensitivity. In addition, the absence of a grating eliminates internal light reflection and the stray light associated with conventional monochromators.

In grating-based monochromators, bandwidths are limited. The special design of BMG LABTECH's LVB Monochromators allows continuously adjustable bandwidths up to 100 nm, four times broader than conventional monochromators. Depending on the specific spectrum of a fluorophore, the use of the broadest possible bandwidth is beneficial to the sensitivity of the system: the broader the bandwidth, the more light, the higher the sensitivity.

Although some microplate readers include both filters and monochromators, these cannot be combined since monochromators and filters use separate light paths that are not compatible with each other. For the first time, in the CLARIOstar^{Plus} LVB Monochromators and filters share the same light path as the slides holding the LVBs also incorporate slots for fixed filters. LVB Monochromators and filters can hence be combined in one measurement since LVBs or filters can simply be selected by sliding a filter slide.

Reagent injectors

BMG LABTECH was the first plate reader company to introduce injectors on its readers. Readers can be equipped with up to two reagent injectors that are fully integrated into the instrument, protecting reagents from light. Injectors enable reagent delivery into any plate format up to 384-wells. Through the software you can control injection timing and speed, delivery volume, and the ability to inject different volumes into any well. Multiple injections from the same injector into a single well are possible as well.

An important feature is the ability to inject reagents and simultaneously detect a signal in the same well. This ensures no loss of data in very fast kinetics. Many popular assays such as enzyme kinetics or calcium flux require the ability to monitor a signal before, during and after the addition of a reagent. In some assays, the signal has to be read within a few seconds after injection.

The injectors have an extremely low dead volume and the ability to back flush precious reagents. Moreover, they are easily accessed for cleaning, and chemically inert.



Our injectors are housed within the reader, protecting reagents from light.

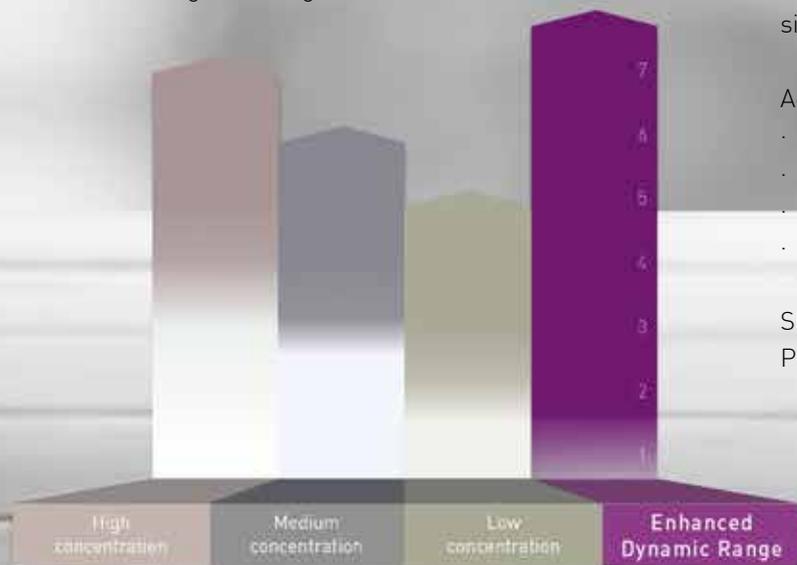
Enhanced Dynamic Range

The signal of samples can span over a wide range of intensities – from dim to very bright. In enzymatic or cell-based kinetic assays, the signal intensity is as well hard to predict, as usually intensities increase over time during the kinetic. In conventional signal detection, the incoming light signal measured by a detector is usually amplified by an amplification factor: the gain.

Changing the gain moves the dynamic range of detection along the concentration curve of an analyte. However, the width of the dynamic range does not change and ensures that only a limited range of signal intensities (usually 5-6 decades) can be reliably detected. Samples outside of the dynamic range (because much brighter or dimmer) cannot be consistently detected and require further measurements with different gain settings.

The Enhanced Dynamic Range (EDR) technology was specifically developed to eliminate this inconvenience. EDR allows the measurement of both very bright and dim signals in one single measurement, ensuring reliable detection of samples at the largest range of concentrations and signal intensities with no manual intervention or gain setting required.

By providing the capability to detect highly reliable results over 8 decades of signal intensities, it significantly simplifies measurement setup and provides an easier solution for assay development. EDR saves time and money as well, as it eliminates the need for repeated detection runs to acquire highly divergent samples at different gain settings.



Advantages of EDR include:

- Simplified endpoint and kinetic detection
- No gain guessing or adjustment required
- Extended dynamic range keeping best sensitivity
- No need for multiple measurements
- Comparison of data acquired at different times

Available on the CLARIOstar^{Plus}, EDR can be applied to any wavelength in fluorescence intensity and luminescence, both with filters and LVF Monochromators.

Simultaneous Dual Emission

The perfect tool for double emission assays such as FRET, TR-FRET, and BRET, or fluorescence polarization assays, Simultaneous Dual Emission (SDE) detection allows the measurement of two emitted wavelengths at the same time. In fluorescence polarization, this technology can be used to read parallel and perpendicular emission signals with only a single excitation event. Taking advantage of two matched PMTs for the measurement of the two emission wavelengths, SDE substantially reduces plate read times and increases throughput. It also corrects any signal variation due to differences in well volumes, concentrations, or fluctuations in excitation energy. This ensures improved sensitivity and lower %CVs compared with other readers. The PHERAstar FSX can also simultaneously measure AlphaPlex™ assays using SDE.

Advantages of SDE detection are:

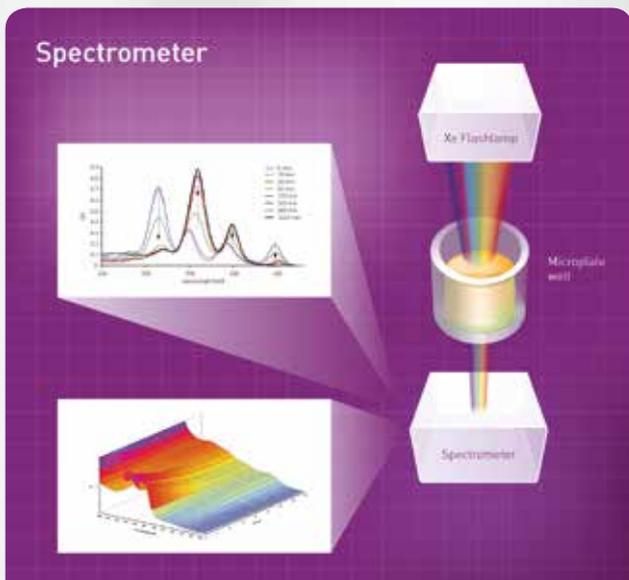
- 50 % faster read times
- Increased sensitivity
- Lower %CV values
- Higher Z'-factors

SDE comes as standard on the PHERAstar FSX and POLARstar, and is an option on the LUMIstar Omega.

Spectrometer

BMG LABTECH was the first company to include a spectrometer for absorbance detection. This cutting-edge technology is available on all our plate readers.

The spectrometer incorporates a highly-efficient optical grating and a solid state array detector that allow immediate absorbance measurements with no mechanical parts moving. Similar to a monochromator, but much faster, a spectrometer can capture the entire UV/vis spectrum of a sample in less than 1 second/well – no scanning needed. Alternatively, up to 8 discrete wavelengths can be acquired at the same time. By capturing absorbance values from wavelengths 220 - 1000 nm at a 1, 2, 5 or 10 nm resolution, the spectrometer gives you peace of mind in absorbance assays. Never again worry about using the wrong filter or missing the peak wavelength.



Spectra from 220 - 1000 nm in less than 1 second.

The ultra-fast speed of the spectrometer makes it possible to perform time courses of spectral capture at 0.2 second intervals. This ability will allow spectral or wavelength shift measurement in real time. With the spectrometer technology you can focus on developing assays and expand capabilities without worrying about running instrumentation.

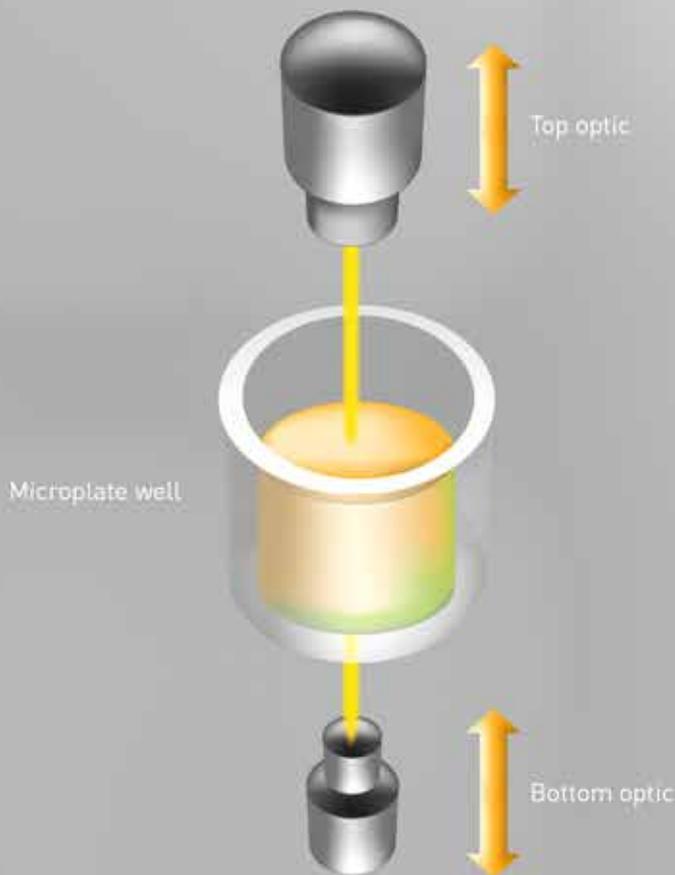
Incubation and shaking

Incubation and shaking allows you to mix reagents and measure samples at elevated temperatures.

- **The incubator** controls the temperature in the measurement chamber from ambient up to 45 °C or 65 °C. You can increase the temperature at regular time intervals so that temperature-sensitive reactions can be carried out entirely within the reader with no measurement interruption. A large heating area provides uniform temperature and a more stable buffered area when microtiter plates are inserted or when reagents are added. The upper heating plate of the incubation chamber is 0.5 °C warmer than the lower plate. This helps to prevent condensation build-up on the lid or sealer.
- **Shaking** can vary in intensity, duration and the direction of motion. There are different shaking options: linear, orbital and double-orbital, with additional control of the shaking radius. Shaking can be programmed to occur before or after kinetic measurement intervals or only after an injection cycle has been completed. For assays that require high uniformity, shaking can take place in each well immediately following injection. Thanks to the ability to withstand prolonged, high speed shaking, the FLUOstar Omega and CLARIOstar^{Plus} set the standard for the implementation of protein aggregation and microbial growth assays. Their robustness and ability to withstand extensive shaking conditions even for long kinetics, made them the reference readers for amyloid seeding assays such as RT-QuIC.

"Our BMG LABTECH FLUOstar plate-reader is the work-horse of the laboratory. We use it for real-time absorbance and fluorescence measurements, often at 60 °C, with shaking, for up to 10 hrs at a time. It has never skipped a beat!"

*Dr. Heath Ecroyd,
NHMRC Peter Doherty Fellow, University of Adelaide, Australia*



Direct optic bottom reading

We engineered the CLARIOstar^{Plus} and PHERAstar FSX with the most sophisticated bottom reading optical system available in plate readers. A direct free air optical path to the bottom of the microplate eliminates the need for fibre optic bundles or light guides. A series of software-controlled, motor-driven mirrors are used to direct the light to the bottom or top of the plate. Unlike conventional readers, top or bottom detection can be directly selected in the reader Control Software by a mouse click, requiring no hardware or Optic Module changes.

Features that enhance bottom reading are:

- Well scanning for cell layer detection
- Automatic Z-height focus with 0.1 mm resolution
- Simultaneous Dual Emission detection (only on the PHERAstar FSX).

Automatic focus adjustment

When measuring, adjusting for the Z-height is extremely important to obtain the best possible signal in any assay. Even a focus positioning error as small as 0.2 mm can lead to signal decrease of up to 25 %.

BMG LABTECH's automatic focus adjustment optimally focuses the internal optic system onto the sample to obtain the highest possible signal.

A key aspect of the detection system is the automatic and software-controlled Z-height scan and adjustment. This feature automatically scans the Z-axis of a sample both in top and bottom reading mode, and identifies the focus height at which the signal is at its highest.

While most readers adjust the focus height to "low, medium, high" or in 1 mm increments, the PHERAstar FSX and CLARIOstar^{Plus} give precise control in 0.1 mm increments.

Focal height adjustment eliminates the influence of microplate formats, sample volumes, surface tension and evaporation. Moreover, the ability to focus is extremely advantageous when detecting adherent cell layers.

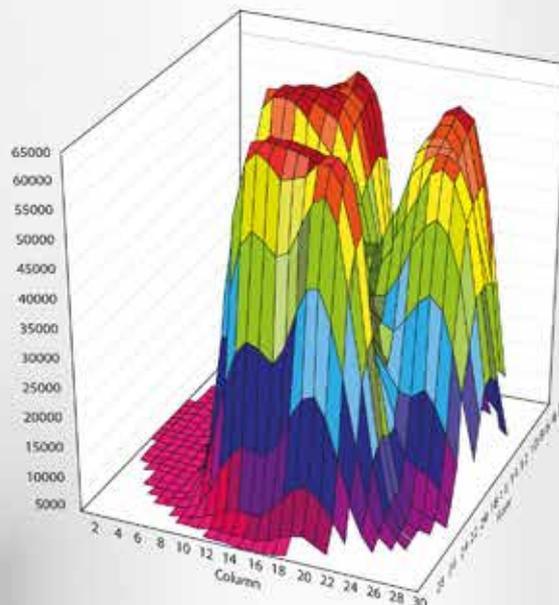
"Our laboratories have used several generations and models of BMG LABTECH plate reading fluorescence spectrophotometers. We have found them to be of the highest quality, extremely reliable, and very intelligently designed. Technical/assay support has been consistently excellent. We strongly recommend BMG LABTECH as the instrument of choice for the use of our products."

*Donald L. Melchior, Ph.D.
The Fluorosome Company, Worcester, MA, USA*

Advanced measurement modes

As standard setting, plate readers measure in the centre of the well. For non-homogeneous samples such as cells, bacteria or insoluble particles, a single centre well measurement may not be sufficient though. Cell clumping, pocket concentrations and particulates falling out of solution can cause inconsistent readings and may not account for heterogeneities within a sample. In some cases, a single centre point reading may completely miss the sample of interest, especially in a large well format. In order to help compensate for these issues, there are a selection of advanced measurement modes available for plate formats up to 384 well:

- **Matrix scan:** the reader takes multiple measurements of each well in a matrix format, with a resolution of up to 900 points/well (30 x 30 data point matrix). Upon scan, the software displays each point graphically and creates a well map for each well. You have the option to remove individual data points or entire sections and perform statistics such as averages or %CVs only on the chosen data points. The graphical interface uses multiple colour options to display data quickly and a 3D coloured heat map corresponding to intensity variations within the well can be displayed.
- **Orbital/spiral averaging:** a faster alternative to matrix scans, also useful when measuring non-homogeneous samples. With these modes, the plate reader takes multiple measurements for each well on either a user-defined circular or spiral orbit, collects the data and calculates an average.



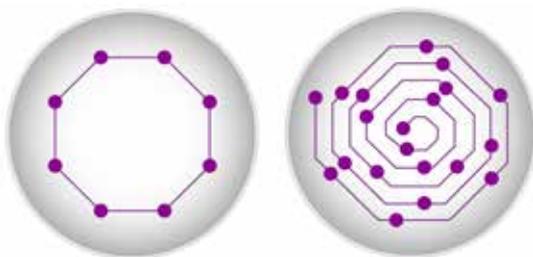
3D matrix scan representation.

Automation

We designed all our microplate readers to be easily integrated into automated systems. All multi-mode readers have the same x-y dimensions and plate out/in locations. Hence, once automation hardware has been designed for one, the solution will work for all BMG LABTECH instruments, minimizing the cost of automation solutions for customers.

All readers can be controlled through ActiveX, DDE and SiLA interfaces. All interfaces are fully documented and manuals are included with our software. Our reader control language for basic commands has remained consistent and early drivers can execute basic functions even on the most advanced readers.

For more complex tasks, our experienced software team will work with you to help design any automation solution. There are many automation software features that give flexibility without any programming – the ASCII data output is the most versatile in the industry and works with most LIMS and automation platforms.



Orbital and spiral averaging.





Which reader fits best?



Find here an overview that helps you to find out which BMG LABTECH microplate reader is the right one for you - sorted by detection modes or technical features.

Which reader fits best?

DETECTION MODES		UV/vis absorbance filters	UV/vis absorbance spectrum	Fluorescence intensity	FRET	Fluorescence polarization	TRF	TR- FRET	AlphaScreen®/ AlphaLISA®
HTS readers	PHERASTAR FSX		✓	✓	✓	✓	✓	✓	✓
	NEPHELOSTAR Plus								
Life science readers	CLARIOSTAR Plus		✓	✓	✓	✓	✓	✓	✓
	POLARSTAR Omega		✓	✓	✓	✓	✓	✓	✓
	FLUOSTAR Omega	✓	✓	✓	✓		✓	✓	✓
	LUMISTAR Omega								
	SPECTROSTAR Omega		✓						
	SPECTROSTAR Nano		✓						

DETECTION MODES

AlphaPlex™

Luminescence

BRET

Sequential
dual emission
detection

Simultaneous
Dual Emission
detection

Multichromatic

Nephelometry
(scattered light)

	AlphaPlex™	Luminescence	BRET	Sequential dual emission detection	Simultaneous Dual Emission detection	Multichromatic	Nephelometry (scattered light)
HTS readers	<p>PHERASTAR FSX</p> 						
	<p>NEPHELOSTAR Plus</p>						
Life science readers	<p>CLARIOSTAR Plus</p> 						
	<p>POLARSTAR Omega</p>						
	<p>FLUOSTAR Omega</p>						
	<p>LUMIstar Omega</p>						
	<p>SPECTROstar Omega</p>						
	<p>SPECTROstar Nano</p>						

Which reader fits best?

	TECHNICAL FEATURES	LVF Mono-chromators	Enhanced Dynamic Range	Injectors	45 °C incubation	65 °C incubation	Cuvette port (on board)	LVis plate (ABS)	Cuvette measurements (LVis plate)
HTS readers	PHERASTAR FSX			✓	✓			✓	✓
	NEPHELOstar Plus			✓	✓				
Life science readers	CLARIOstar Plus	✓	✓	✓	✓	✓		✓	✓
	POLARstar Omega			✓	✓	✓		✓	✓
	FLUOstar Omega			✓	✓	✓		✓	✓
	LUMIstar Omega			✓	✓	✓			
	SPECTROstar Omega			✓	✓	✓		✓	✓
	SPECTROstar Nano					✓	✓	✓	✓

TECHNICAL FEATURES

Gas Vent Atmospheric Control Unit Spectral fluorescence scanning Spectral luminescence scanning Spectral absorbance scanning (spectrometer) 6 - 384 well 1536 well 3456 well

	Gas Vent	Atmospheric Control Unit	Spectral fluorescence scanning	Spectral luminescence scanning	Spectral absorbance scanning (spectrometer)	6 - 384 well	1536 well	3456 well
HTS readers	PHERASTAR FSX				✓	✓	✓	✓
	NEPHELOSTAR Plus	✓	✓			✓		
Life science readers	CLARIOSTAR Plus		✓	✓	✓	✓	✓	
	POLARSTAR Omega	✓	✓		✓	✓	✓ Only ABS	
	FLUOSTAR Omega	✓	✓		✓	✓	✓ Only ABS	
	LUMIstar Omega	✓	✓			✓		
	SPECTROstar Omega	✓	✓			✓	✓	✓
	SPECTROstar Nano	✓				✓	✓	✓

Reader qualification packages

Many modern laboratories are subject to regulations such as GxP, ISO 9001 or ISO 13485. A part of these regulations is a procedure which ensures a correct start of operation of the equipment. It consists of two main parts – Installation Qualification (IQ) and Operational Qualification (OQ). The IQ is dedicated to demonstrating that the equipment arrived undamaged and was installed according to the manufacturer's recommendations. The OQ procedure demonstrates that the main parameters of the performance are within manufacturer's specifications at the time point of the installation.

To meet the requirements of each laboratory, BMG LABTECH provides different testing packages.



Evaluation Plate

In combination with the IQ/OQ protocols, this product enables the conduction of the OQ procedure in a widely automated manner. It is fully integrated into the BMG LABTECH Reader Control and MARS data analysis software. The procedure covers the operational testing of fluorescence intensity, absorbance and luminescence detection with only few clicks and few manual operations. The result of the testing is automatically created, analyzed and validated.

At the end of the procedure the user only needs to print and sign the test reports.

Fluorescence intensity, absorbance and luminescence are tested in terms of accuracy (linearity) and precision (repeatability). Additionally, in luminescence detection intensity evaluation (sensitivity of detector) is tested as well. For the validation of absorbance detection, NIST-traceable solid standards are used.

NIST-traceable OQ procedure

In laboratories subject to stricter regulations, an OQ procedure with NIST-traceable standards is often required. For these cases, BMG LABTECH provides a document package which defines a testing procedure for absorbance, fluorescence intensity, fluorescence polarization (if required) and luminescence with NIST-traceable standards.

This package enables an integration of the reader even in laboratories with strict regulatory requirements. Should your QA guidelines require additional procedures or an extension of our standard IQ/OQ/PQ procedures, please contact our in-house specialists.

BMG LABTECH can not be held liable for any mistakes or errors in this catalog pertaining to product descriptions or specifications.

HTRF is a registered trademark of Cisbio Bioassays.

Transcreener is a registered trademark of BellBrook Labs.

AlphaScreen, AlphaLISA, AlphaPlex, LANCE and DELFIA are registered trademarks of PerkinElmer.

LanthaScreen is a trademark of Life Technologies.

Dual Luciferase Reporter (DLR) is a registered trademark of Promega Corp.

MycAlert is a registered trademark of Lonza.

Customer care and technical service

At BMG LABTECH our mission is simple – To deliver the best microplate reader and to ensure the best product, application, software and technical assistance.

Our customer care begins at headquarters in Germany with the development and construction of microplate readers from the highest quality components. German engineers test each instrument according to the strictest of standards before shipment. Customer care continues with direct support from the scientists and engineers at our offices worldwide. All sales and customer support employees are highly trained professionals and experts in new product training, technical troubleshooting and assay support. We offer both on-site and factory service.

At BMG LABTECH we strive to provide you with the very best customer service. If you need customer support, we are only a phone call or email away. During business hours, you immediately speak live to a person who is happy to assist. There is no automated phone system or waiting in a queue, our scientists, engineers and technicians are always there to help.

Technical and applications support

Our commitment to customer satisfaction and support is paramount. Through our global network of subsidiaries and product distributors, we provide product, applications, technical and software support. Application and technical support is provided for the lifetime of the instrument.

The customer support centre is available during regular business hours. All technical and applications queries are responded to promptly and professionally either from the office-based technical support center or by one of our field-based support teams. Our applications specialists are highly experienced scientists who are ready to help optimising your instrument and software settings. We have also developed a wide range of application notes to further support your work.

Instrument service

We guarantee availability of spare parts for at least 10 years after a product is discontinued. That's how long we keep components in stock for your plate reader! BMG LABTECH offers several different service plans to meet the needs of all research laboratories, including both on-site and factory service:

□ Maintenance

We support and service all products that we sell. If a reader's warranty or service contract is expired, our technicians will quote all work and get approval before beginning any repair. On-site service is available on a per visit basis and may include travel costs, labour and part replacement.

□ Warranty

Every BMG LABTECH reader purchased is covered by our standard one-year warranty. This guarantees the repair of the unit by qualified service personnel at our facility. This warranty covers all related costs of repair including parts and labour.

□ Service contract

We offer service packages for those customers requiring on-site service. With this plan, a qualified service engineer will repair the unit on-site or BMG LABTECH will provide a loaner unit during the maintenance period. The goal of the service plan is to minimize downtime and to get the unit repaired as quickly as possible.

Quality Control and Preventative Maintenance

A regularly maintained instrument ensures accurate results. We offer a comprehensive Quality Control and Preventative Maintenance (QC/PM) package that can be performed on-site or at our office. This service realigns the reader, QCs for potential problems and tests the reader in all modes.

Availability of specific services and maintenance plans may depend on product and country. For assistance please contact your local representative or BMG LABTECH headquarters.

Applications center

At BMG LABTECH we recognize that a perfectly engineered instrument is only part of the solution. It needs to effectively perform all applications. Therefore, we continuously collaborate with our customers and all the leading reagent companies to optimize reader settings for every assay.

Our wide range of microplate readers offers unique combinations of features to support all major existing applications as well as your future needs.

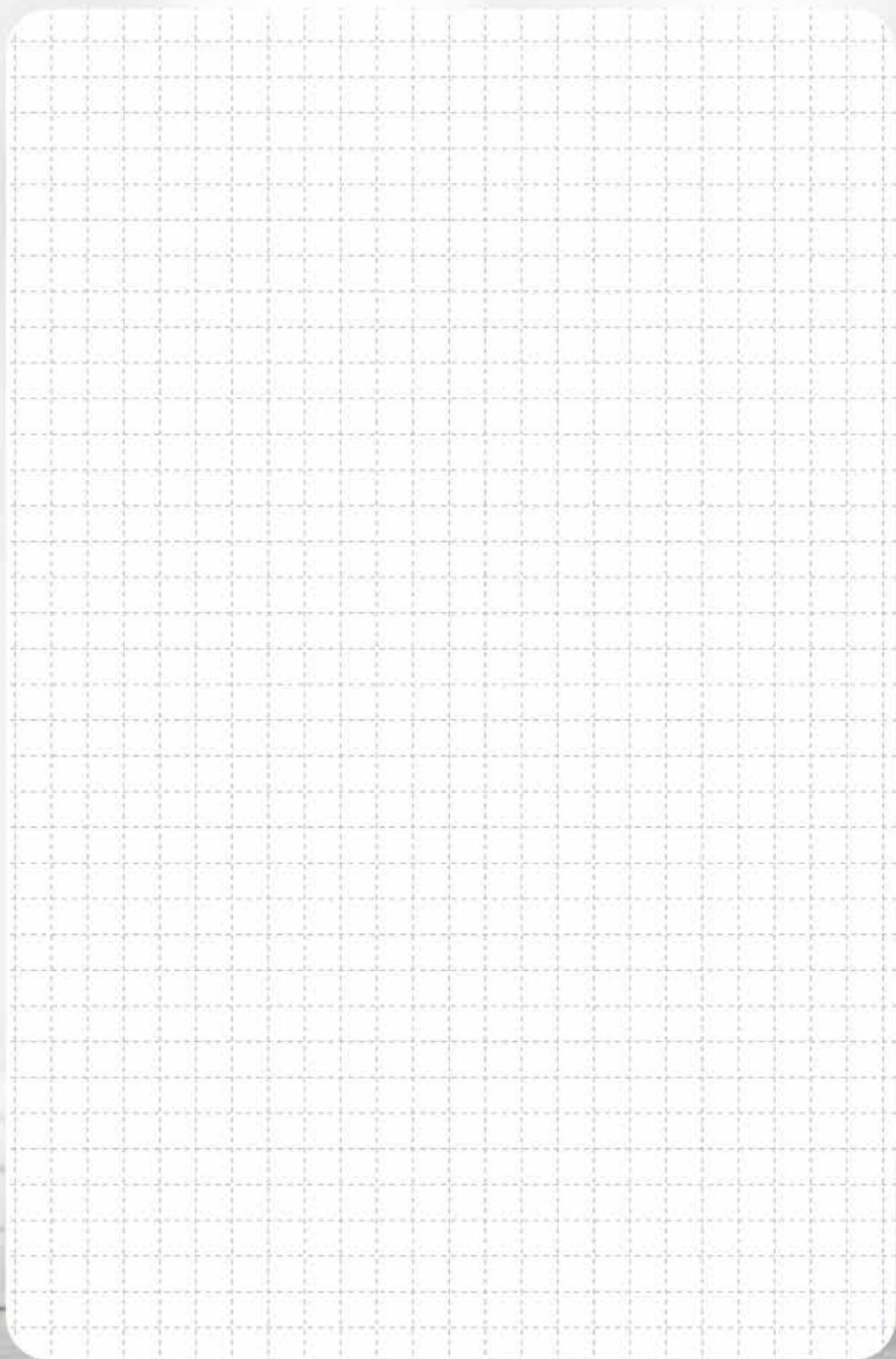
Our expertise, represented by over 4,000 published entries of peer-reviewed articles and application notes can be found in our comprehensive online application center:

www.bmglabtech.com/en/applications/

The application notes detailed therein have been performed by our customers on BMG LABTECH readers and outline a variety of experiments and methods.

A word cloud of various assay and application types. The words are arranged in a roughly circular pattern, with some larger and more prominent than others. The colors are primarily purple and grey. The words include:

- HTRF[®]
- Reporter Genes
- HDACs
- LANCE[®]
- DELFI[®]
- Genomics
- AlphaLISA[®]
- ROS
- Transcreener[®]
- Fluorescence
- TRF
- BRET
- Fluorescence Polarization
- Kinetics
- GPCRs
- AlphaScreen[®]
- SPARCL
- Luminescence
- GFP
- ELISAs
- GeneBLAzer[®]
- Ca²⁺ Signaling
- RT-QuIC
- MitoXpress[®]
- HTS
- NanoLuc[®]
- Epigenetics
- Cell Assays
- Compound Solubility
- Assay Development
- Spectrometry
- Kinases
- ADME/TOX
- SNP
- AlphaPlex[™]
- mCherry
- LanthaScreen[®]



A world of MICROPLATE READERS



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