

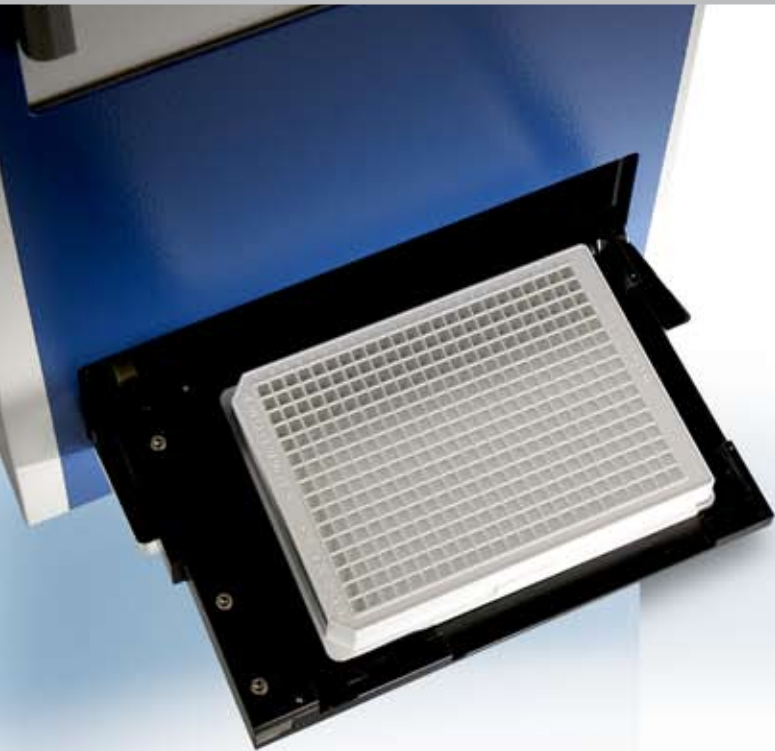
**PHERASTAR FS**

**The Gold Standard for  
High-Throughput Screening**



**BMG LABTECH**

*The Microplate Reader Company*



## The **Gold Standard** for High-Throughput Screening

Whether you need speed, sensitivity or flexibility, the PHERASTAR FS is the ultimate microplate reader for your research and HTS applications.

### Best Performance for all HTS Assays

The PHERASTAR FS is the next generation High-Throughput Screening microplate reader from BMG LABTECH. Built upon the successful PHERASTAR Plus platform, the PHERASTAR FS has new and unique features that make it superior to any other microplate reader currently on the market. German engineering with the latest technology makes the PHERASTAR FS the Gold Standard for HTS. It performs all the leading non-isotopic detection technologies such as:

- Ultra-fast UV/Vis Absorbance Spectra
- Fluorescence Intensity, including FRET
- Fluorescence Polarization
- Time-Resolved Fluorescence, including TR-FRET
- High-end AlphaScreen®
- Luminescence (flash and glow), including BRET

Sequential Dual Excitation, Simultaneous Dual Emission and ratiometric calculations are just some of the key features of the PHERASTAR FS for multichromatic applications such as FRET, TR-FRET, BRET and FP.

Application specific Optic Modules can be activated by a simple mouse click, and all the necessary components are selected automatically. Assay flexibility is enhanced by top/bottom reading, on-board reagent injectors, precise temperature control and multimode shaking capabilities. The PHERASTAR FS provides uncompromised sensitivity, speed and dynamic range in plate formats up to 3456.



... any plate format up to 3456

## Tandem Technology

The PHERAstar FS incorporates BMG LABTECH's unique Tandem Technology, which is based on two technological concepts: an ultra-fast UV/Vis spectrometer for absorbance and high-performance optical filters for all other detection modes.

## Innovative Optical Design

The outstanding sensitivity of the PHERAstar FS is based on a new, innovative lens-based optical design which is composed of three independent light sources, Simultaneous Dual Emission detection, and software-controlled top/bottom reading. Depending on the application, users can choose one of the following light sources:

- High energy xenon flashlamp
- Nitrogen Laser for TRF/TR-FRET
- Solid-state Laser for AlphaScreen®

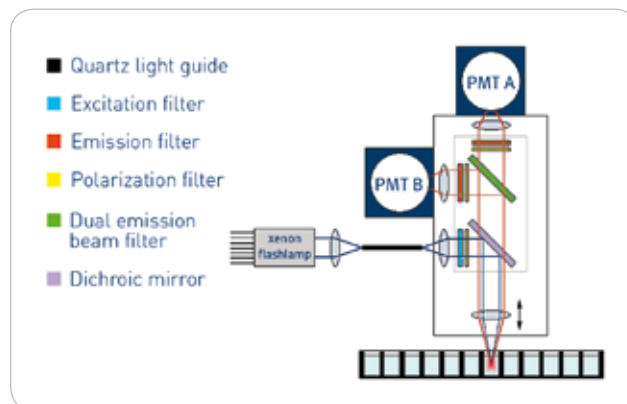
Two matched pairs of photomultiplier tubes (PMTs) are used in the PHERAstar FS. The first pair of PMTs is for simultaneous luminescence and fluorescence detection, and the second pair of PMTs detects time-resolved fluorescence based assays.

Distinct advantages of the nitrogen Laser include increased assay window and the "flying mode" measurement for TR-FRET based assays. A single Laser flash excites the donor molecule sufficiently so that measurement in a well takes places without stopping plate movement. Thus, reading time for an entire plate is significantly decreased.

## Simultaneous Dual Emission

BMG LABTECH pioneered the technique of Simultaneous Dual Emission detection for microplate readers. Because numerous assays require detection of two wavelengths, Simultaneous Dual Emission offers a significant advantage by cutting read times in half. It corrects flash-to-flash variations, assay effects such as photobleaching, decaying kinetic signals, or fluctuating conditions like temperature,

pH, and evaporation. Simultaneous Dual Emission detection can be used in any assay that measures two wavelengths or polarization vectors, including FP, FRET, and HTRF®.



*Schematic layout of the Simultaneous Dual Emission (SDE) optical pathway incorporated in the PHERAstar FS*

## Optic Modules

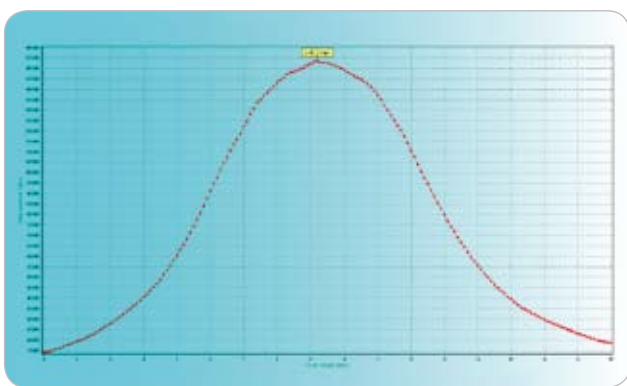
The assay specific Optic Modules are the core elements of the PHERAstar FS. They contain all the necessary optical components including excitation and emission filters, dichroic mirrors, beam splitters and polarization filters. The PHERAstar FS can accommodate up to six Optic Modules and the user can easily add or replace them within seconds. All Optic Modules are bar coded, and the PHERAstar FS then automatically selects the proper module for your assay.



*Assay specific Optic Modules, all inclusive, installed in seconds*

## Focal Height Adjustment

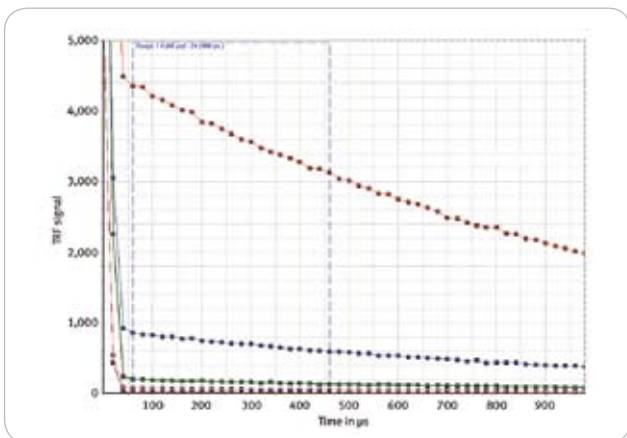
The PHERASTAR FS incorporates automated focal height adjustment for both top and bottom reading at a resolution of 0.1 mm. The optical system directs the excitation light to a small focal point in the center of the well, giving excellent sensitivity in all plate formats up to 3456. This feature eliminates the influence of microplate formats, sample volumes, surface tension and evaporation. The automated focal height adjustment ensures the best signal-to-noise ratio for every plate, application and volume.



The automated focal height adjustment ensures the best signal-to-noise ratio in all detection modes and all plate formats

## Decay Curve Monitoring

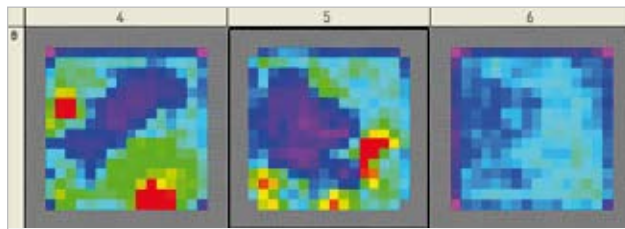
The PHERASTAR FS offers unique Decay Curve Monitoring in AlphaScreen® and TRF modes. This feature enables users to visualize the time-resolved emission curve and to optimize test parameters of their assays.



Unique TRF Decay Curve Monitoring feature for assay optimization

## Advanced Cell Layer Scanning

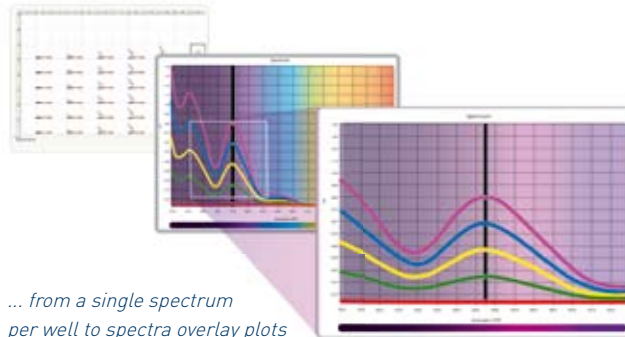
The PHERASTAR FS provides unmatched top and bottom reading performance. Switching between these modes is automatically carried out via software. Bottom reading for high resolution cell based scanning is achieved through innovative engineering using a series of lenses and mirrors. In well scanning mode, the PHERASTAR FS can take multiple measurements in each well with up to 30 x 30 data points. The software then displays each scan point graphically and creates a map for each well. BMG LABTECH's unique orbital averaging can be used to measure nonhomogeneous well content. Using this mode, the PHERASTAR FS takes several measurements on a defined orbit, collects the data, and calculates an average for each well.



Well Scanning for advanced cell based assays

## Ultra-fast Absorbance Spectrometer

The PHERASTAR FS is the first multidetection HTS microplate reader to integrate a spectrometer for absorbance measurements. This technology can capture a full UV/Vis absorbance spectrum (220 to 1000 nm) at selectable resolutions from 1 to 10 nm. A full absorbance spectrum can be measured as fast as one second per well, which is significantly faster than any conventional method. Furthermore, users can measure up to eight wavelengths simultaneously in a single pass with no wavelength switching.



... from a single spectrum per well to spectra overlay plots

## Sensitivity and Speed

The PHERAstar FS combines fast read times necessary for High-Throughput Screening and the sensitivity to read small volumes. The user can always find the best combination of sensitivity and speed by choosing the number of flashes. In single flash mode, the PHERAstar FS can read a 1536-well plate in 27 seconds, making the PHERAstar FS among the fastest in the microplate reader industry. The unsurpassed sensitivity of the PHERAstar FS detection system provides outstanding S/N, %CV, and Z' values, even at low concentrations and small assay volumes.

## Smart Reagent Injection

The two on-board Reagent Injectors are skilfully positioned so reagents can be added to the well currently being read. Thus, concurrent reading and injection ensures that even the initial part of fast kinetic reactions can be monitored. Injectors are protected from light to preserve precious reagents which would otherwise suffer from bleaching effects.

An exceptionally small dead volume and back flushing ensure that precious reagents are conserved. Users can tune all parameters, such as injection speed, timing, shaking and the number of injections per well. Delivery volumes are adjustable for each well, allowing users to automatically produce dilution schemes and concentration gradients across the microplate.



*On-board Reagent Injectors with simultaneous injection and reading*

## Automation

Automation is a key feature in High-Throughput Screening. BMG LABTECH understands this and has designed all of its microplate readers to be automated. BMG LABTECH's small standardized reader footprint and robotic software interface make it easy to integrate the PHERAstar FS into all leading robotic systems.

In order to provide simple plate management, the PHERAstar FS comes with three integrated microplate barcode readers capable of reading the east, west and south sides of a microplate.

## Microplate Stacker

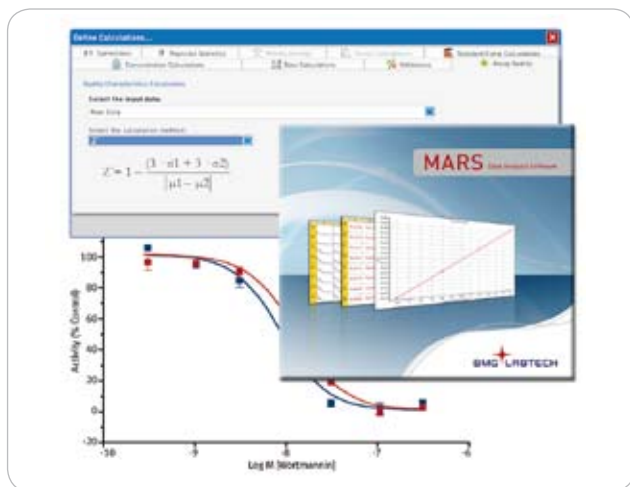
For medium level throughput, BMG LABTECH offers a 50 plate Stacker that can be used with the PHERAstar FS. The Stacker is an ideal solution for mid-throughput labs that wish to have the small footprint of an automated plate feeder along with the simplicity and reliability the Stacker offers.



*Automated plate handling with Stacker*

### Control and MARS Data Analysis Software

The PHERASTAR FS software package provides an extensive range of possibilities for both test protocol definitions and data analysis. It is fully compliant with FDA regulation 21 CFR Part 11. The control software allows users to define instrument parameters and test protocols. For assay development, kinetic measurements can be interrupted at any time in order to change reaction conditions.



The MARS Data Analysis Software for automated data reduction

MARS allows the user to display and process the data using predefined templates. One example is the automatic calculation of enzyme kinetic parameters ( $V_{max}$  and  $K_m$ ) with a variety of fits based on Michaelis-Menten or Lineweaver-Burk equations.

The software is also capable of creating standard curves based on curve fitting algorithms to calculate values such as  $EC_{50}$ ,  $IC_{50}$  and  $r^2$ :

- Linear regression fit
- Point-to-point fit
- Segmental regression fit
- Cubic spline fit
- 2<sup>nd</sup> and 3<sup>rd</sup> polynomial fit
- 4 parameter fit
- Enzyme kinetic (e.g. Michaelis-Menten; Lineweaver-Burk)

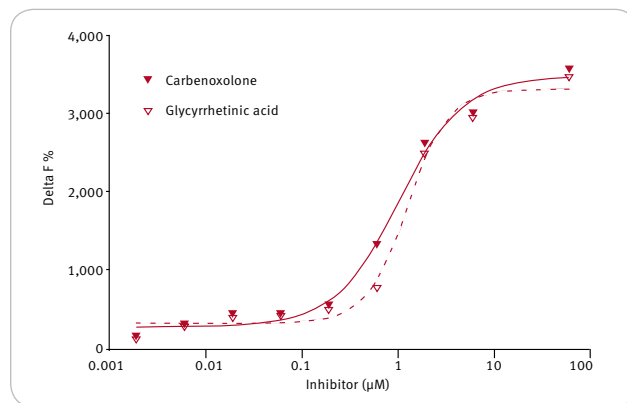
The MARS standard curve wizard creates a step-by-step calculation of a standard curve and important parameters such as S/N, Delta F % and  $Z'$  are easily obtained.

### Applications Center

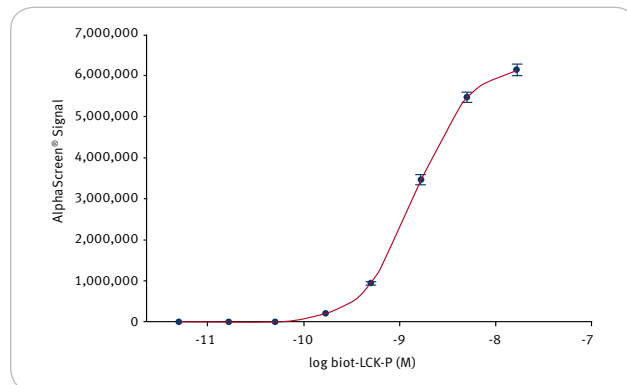
A perfectly engineered microplate reader is only part of the solution. The reader's ability to effectively perform all of the leading applications is the final piece of the puzzle. With the PHERASTAR FS, BMG LABTECH offers a unique combination of features to support all major existing applications as well as future needs. Applications include:

- Protein-protein interactions
- Genotyping
- Molecular binding assays
- Receptor-ligand binding
- DNA and protein quantification
- Enzyme activity and kinetic assays
- Cell based assays
- Reporter gene assays

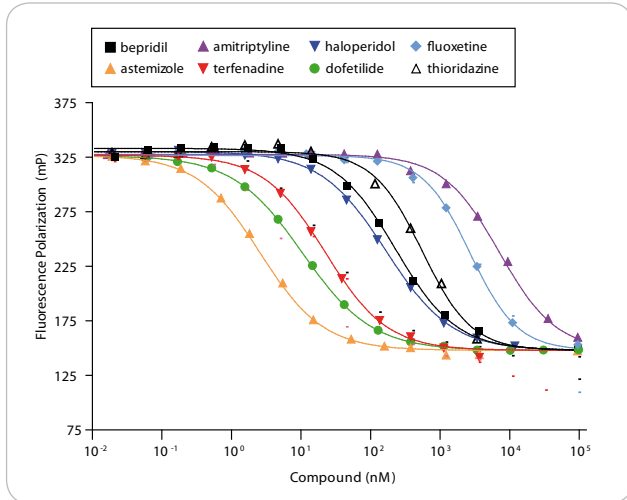
The PHERASTAR FS provides excellent performance in all HTS applications, including HTRF®, AlphaScreen® and FP assays.



HTRF® assay showing response curves of cortisol inhibitors



Biot-LCK-P titration curve measured in AlphaScreen® mode



Competitive binding of known hERG blockers using the Predictor™ hERG FP assay

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

Visit BMG LABTECH's Applications Center online to download all the leading applications, listed as:

- Application Notes
- Scientific Posters
- Scientific Papers

BMG LABTECH's searchable applications database provides the expertise expected from a dedicated microplate reader company. With more than 1,700 entries of peer reviewed articles, application notes and scientific posters, there is information on how to perform countless applications on our microplate readers.

### Support and Training

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

**Transcreener®**  
DNA / RNA quantifications

**HTRF®** Protein quantifications  
**Ca<sup>2+</sup> assays**  
*Reporter gene assays*

Kinase activity  
**DLR™** **AlphaScreen®**  
Protease activity

**LanthaScreen®** **ORAC**  
**HTS** Immunoprecipitation  
Dual luciferase assays

**BRET assays** **Apoptosis**  
**ROS detection** *Enzyme kinetics*  
**PCR product quantifications**

**NADH / NADPH assays** **ELISA**  
Cell Viability ATP and ADP detection  
**LANCE®** Binding studies

**Enzyme activity** Gene expression  
Solubility tests **DELFI A®**  
**FRET assays**  
SNP Genotyping



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DLR is a trademark of Promega Corp.

## PHERASTAR FS - Technical Specifications



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.

<b>Detection Modes</b>	Fluorescence Intensity - including FRET Fluorescence Polarization High-End AlphaScreen® Luminescence (flash and glow) - including BRET Time-Resolved Fluorescence - including TR-FRET UV/Vis Absorbance Spectra	
<b>Measurement Modes</b>	Top and bottom reading Endpoint and Kinetic measurements Sequential Multi Excitation measurements Sequential Multi Emission measurements Simultaneous Dual Emission measurements Real-time ratiometric measurements Well Scanning	
<b>Microplate Formats</b>	Up to 3456-well plates, user-definable	
<b>Light Sources</b>	High energy xenon flashlamp Nitrogen Laser for TRF and TR-FRET Solid state Laser for AlphaScreen®	
<b>Detectors</b>	Four photomultiplier tubes, optimized for different detection modes	
<b>Optic Modules Capacity</b>	Up to six application specific Optic Modules built in	
<b>Z-Adjustment</b>	Automatic focal height adjustment (0.1 mm resolution)	
<b>Spectral Range</b>	230 - 750 nm or 230 - 900 nm for FI, FP 230 - 750 nm for LUM 230 - 900 nm for TRF 220 - 1000 nm for ABS	
<b>Sensitivity</b>	FI (top)	0.4 pmol/L sodium fluorescein (8 amol/well) (384) 2.0 pmol/L sodium fluorescein (16 amol/well) (1536)
	FI (bottom)	5.0 pmol/L sodium fluorescein (0.2 fmol/well) (384)
	FP	1.0 mP SD at 1 nM sodium fluorescein (384) 3.0 mP SD at 1 nM sodium fluorescein (1536)
	TRF	25 fmol/L europium (0.5 amol/well) (384) 100 fmol/L europium (0.8 amol/well) (1536)
	HTRF®	Reader Control Kit (Eu / Tb) Delta F 1050 % (Eu) and 1150 % (Tb) (high calibrator) Delta F 95 % (Eu) and 110 % (Tb) (low calibrator)
	LUM	10 amol / well ATP (384)
	AlphaScreen®	< 100 amol / well* (384)
	ABS with spectrometer	Spectral range: 220 - 1000 nm Full spectrum captured in < 1 s / well Selectable spectral resolution: 1 nm, 2 nm, 5 nm, 10 nm OD range: 0 - 4 OD Accuracy: < 1% at 2 OD Precision: < 0.5% at 1 OD and < 0.8% at 2 OD
<b>Read Times</b>	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)
<b>Reagent Injection</b>	Up to 2 built-in reagent injectors Injection at measurement position (6 to 384-well) Individual injection volumes for each well (3 to 350 µL) Variable injection speed up to 420 µL / s Up to four injection events per well Reagent back flushing	
<b>Shaking</b>	Linear, orbital, and double-orbital with user-definable time and speed	
<b>Barcode Reader</b>	Up to three integrated barcode readers	
<b>Incubation</b>	+5°C above ambient up to 45°C	
<b>Software</b>	License-free software package including Reader Control and MARS Data Analysis Software	
<b>Dimensions</b>	Width: 45 cm, depth: 51 cm, height: 47 cm; weight: 49 kg	
<b>Accessories</b>		
<b>Stacker</b>	Magazines for up to 50 plates - continuous loading feature	
<b>THERMOstar</b>	Microplate Incubator and Shaker	
<b>Optic Modules</b>	Available for all applications	
<b>Upgrades</b>	Upgrades to include options such as additional detection modes, reagent injectors, etc. are available. Please contact your local representative for more information.	

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

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