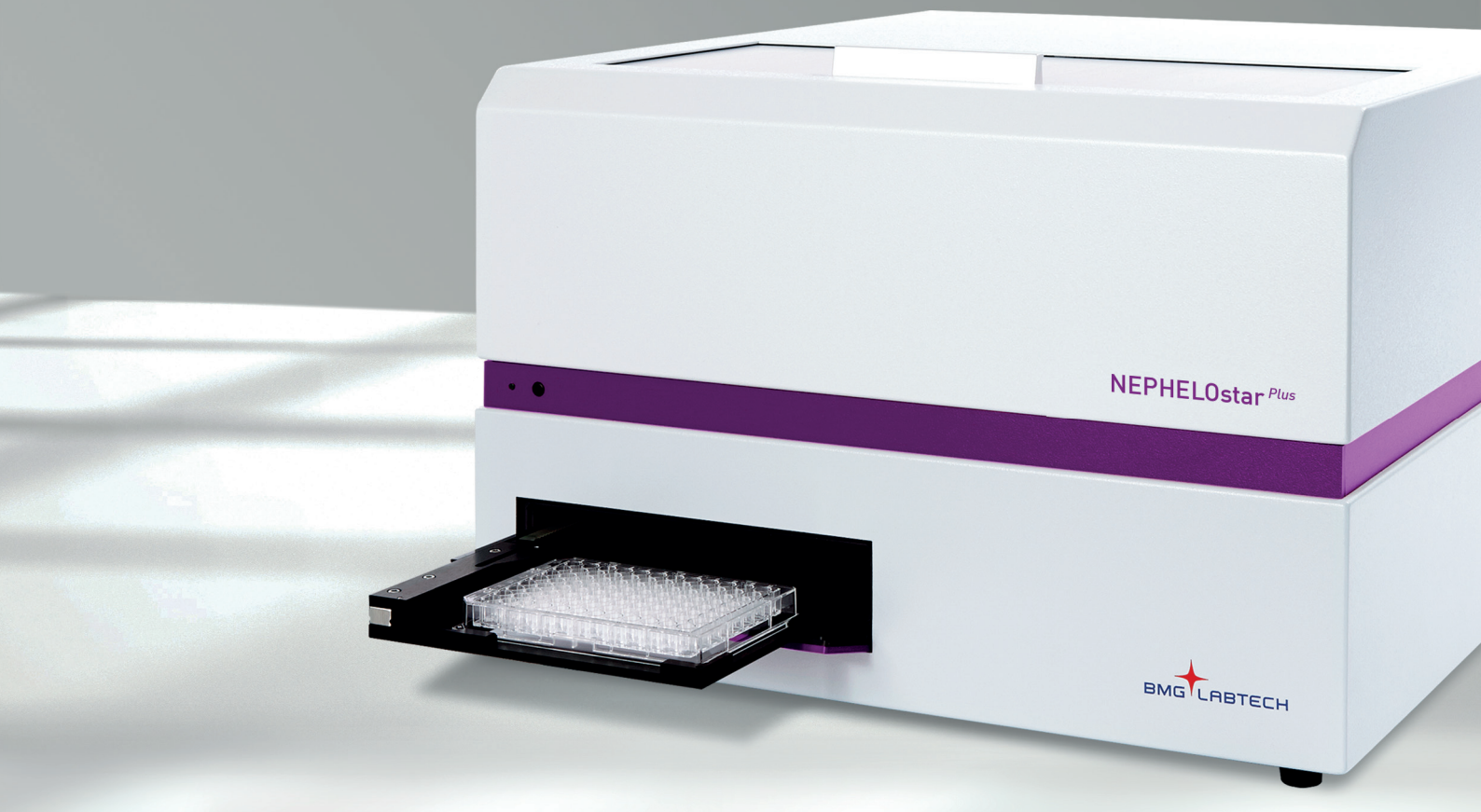
NEPHELOstar®

Microplate nephelometer for light scattering assays



BMG LABTECH

The Microplate Reader Company

www.bmglabtech.com

Your benefits at a glance:

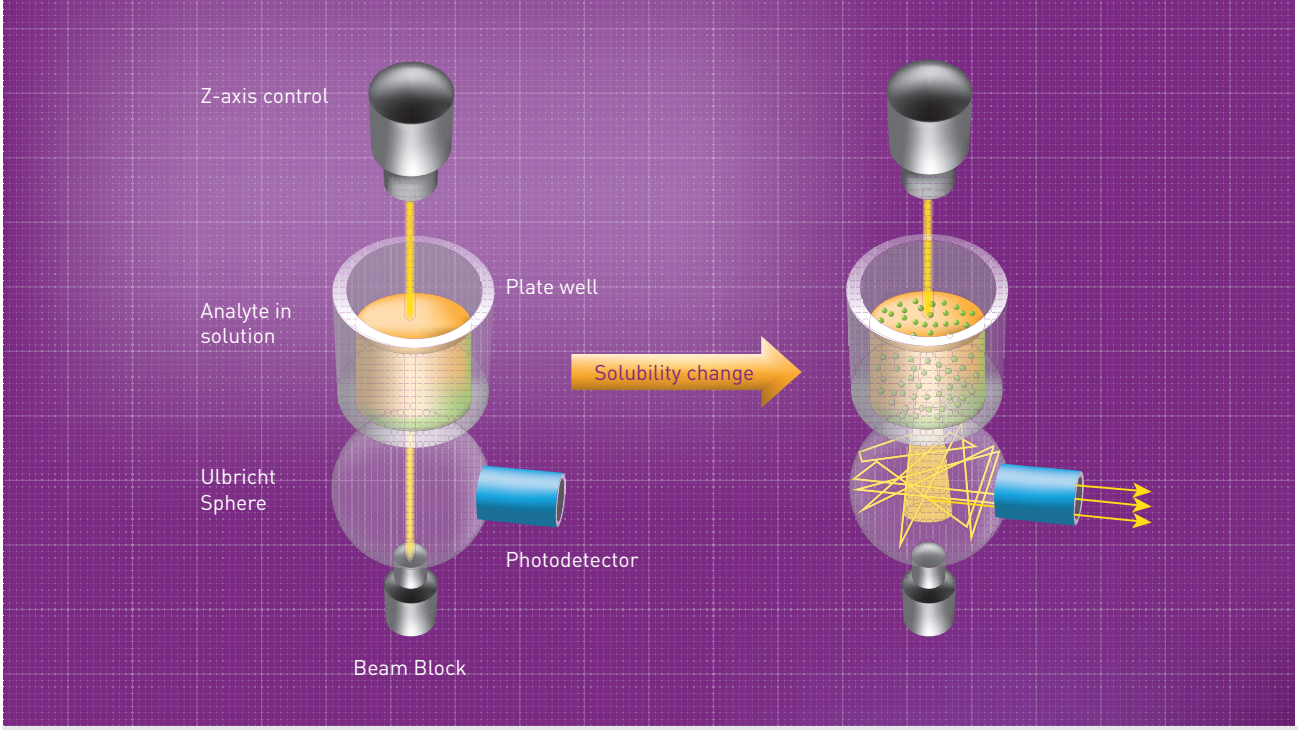
- Only laser-based microplate nephelometer
- More sensitive scattering detection than with light transmission readers
- Optimisable laser intensity and width for highest flexibility
- Walk-away solution with injectors, temperature and gas control, and multi-shaking

Flexibility

The NEPHELOstar® Plus is a microplate nephelometer that detects unsoluble particles in liquid samples by measuring forward scattered light.
Light scattered by insoluble samples is detected at incident angles up to 80 degrees, making the reader approximately thirty times more sensitive than traditional transmission readers that measure the reduction in direct light passing through a sample well.
The key feature of the NEPHELOstar Plus is its robust optical system employing a self-monitoring laser diode that offers adjustable intensity and beam diameter. These features allow to reduce the influence of meniscus effects, to optimise sensitivity, and to perform measurements in up to 384-well plate formats.
Up to two on-board reagent injectors, precise temperature and gas control, multi-mode shaking capabilities, Stacker plate handler, and compatibility with robotic systems further enhance instrument flexibility.

Optical design

The high-intensity light source of the NEPHELOstar Plus is a laser diode (at 635 nm) with a highly collimated beam. The laser beam passes through the sample well into a scattered light detector (Ulbricht sphere). If the light is not deflected by particles, it passes straight through the sphere and no signal is generated. If particles are present in the sample, the light is scattered and reflected around the interior of the sphere and ultimately detected by a photodiode. In liquid solutions, the relationship between the concentration of scattering particles and scattered light intensity is linear over a wide range of concentrations.



Scattered light is detected at incident angles of up to 80 degrees, making the NEPHELOstar *Plus* more sensitive than traditional transmission readers.

An exclusive feature of the NEPHELOstar *Plus* is the ability to adjust the laser intensity and the beam width for best performance. With a narrow beam width, liquid surface effects such as a strong meniscus are reduced.

Liquid handling

Two precise on-board injectors allow simultaneous reagent injection and detection. This ensures no data point is lost, even in extremely fast reactions. Kinetic data can be collected as fast as 50 reading points per second or as slow as one measurement every 2.5 h. The exceptionally small dead volume and back flushing ensure precious reagents are used sparingly and can be recovered.
Users can adjust injection speed, timing, shaking and the number of injections per well. Delivery volumes are adjustable for each well, so dilution schemes and concentration gradients can be automatically produced. The injectors are housed within the instrument to safeguard any light sensitive reagents.

Assays

The flexibility and performance of the NEPHELOstar *Plus* allows more applications to be adapted to microplate-based laser nephelometry than ever before. Flocculation assays, drug solubility determination, bacterial and fungal growth kinetics, and determination of precipitation of particles in solution are amongst a variety of possible studies. Four examples are outlined below:

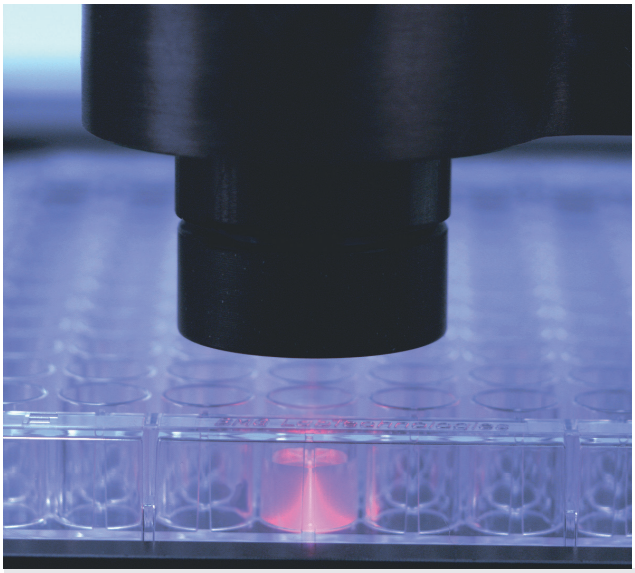
- **Automated drug solubility screening**
  Determining aqueous compound solubility has become an essential early measurement in the drug discovery process to avoid time-consuming and costly ADME screens of low solubility compounds. Developed to meet high-throughput demands, the NEPHELOstar *Plus* offers HTS/drug screening laboratories a fast and simple method for checking compound solubility, which can be fully automated. The nephelometric method has been shown to produce results equivalent to those produced by an HPLC method and to be largely unaffected by coloured solutions.

- **Microbial growth kinetics**
  Continuous nephelometric monitoring of changes in the turbidity can be used to test antimicrobial drugs and their effects on microbial growth kinetics. Among various parameters of the growth curves, the duration of the lag phase is strongly affected by the presence of antimicrobial drugs. Using the NEPHELOstar *Plus* instead of a traditional photometer, this early part of the growth curve can be monitored more exactly. Featuring additional precise temperature and gas control, and multi-mode shaking capabilities, the instrument is a perfect tool to study microbial growth.

- **Quantification of proteins**
  In clinical chemistry, immunonephelometric assays are used to determine the concentration of serum immunoglobulin (IgA, IgG, IgM) , complement components (C3, C4), acute phase reactant proteins (CRP, transferrin), albumin, and α-1-antitrypsin. Protein precipitation of globular proteins refers to the formation of protein aggregates by adding e.g. salt or organic solvent. In contrast, immunoprecipitation allows a given protein to be precipitated selectively via an antibody-antigen reaction.

- **Monitoring of polymerization**
  In organic chemistry, nephelometry is used to quantify macromolecules, e.g. by monitoring of a polymerization reaction.

The NEPHELOstar *Plus*' unique combination of features is ideal for all four application areas.



Insoluble particles in solution in a microplate well scatter laser light.

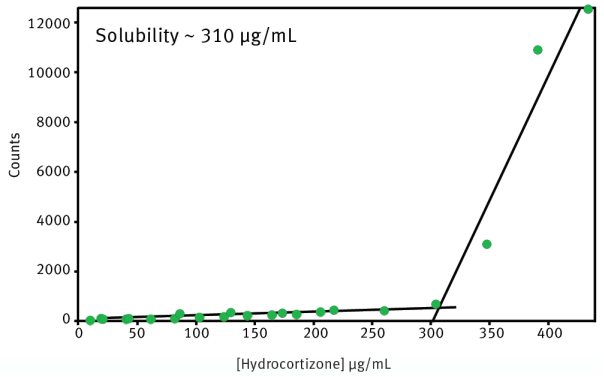
Stacker and robot compatibility

For medium level throughput, BMG LABTECH offers a Stacker that can be used with the NEPHELOstar *Plus*.
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. It provides loading, unloading, restacking and a continuous load feature of up to 50 microplates. The script mode of the Stacker software gives the user unlimited flexibility to run diverse assays. This function can be used to choose different test definitions for different plates in one batch run, or to perform more than one measurement on one plate.

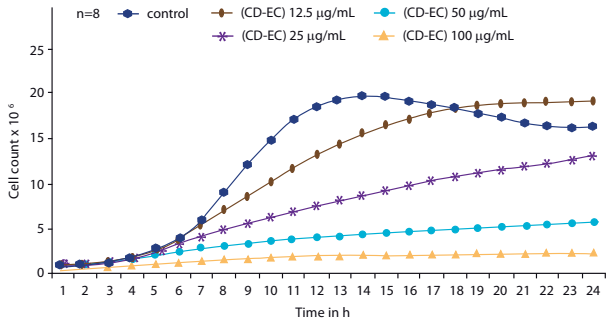
The Stacker simplifies the handling of up 50 microplates for mid-throughput applications.

Automation friendly

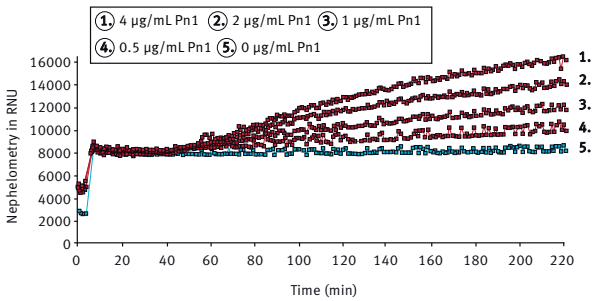
Small footprint, multiple robotic software interfaces and an automation-friendly plate carrier guarantee an easy integration into all leading robotic platforms. For GxP requirements, the multi-user software includes digital signature and FDA 21 CFR Part 11 compliance.



Solubility screen of hydrocortizone. The intersection at 310 µg/L indicates the point of precipitation.



The antifungal econazole nitrate complex (CD-EC) inhibits growth of Candida albicans.



Kinetic determination of antigen-antibody binding at different concentrations.

Easy data analysis

The NEPHELOstar *Plus* software package includes the Reader Control and MARS data analysis interfaces. This multi-user software can be installed on as many computers as you require, without the need to purchase additional licenses. The Reader Control software allows to define measurement protocols and acquire data. It is an extremely versatile interface for the straightforward execution of routine tasks, as well as the optimisation of complex operations. MARS is designed to make data analysis simple and effective, and offers multiple data reduction possibilities such as the automatic determination of compound solubility by segmental regression fit, or a standard curve based on different curve fitting algorithms to calculate EC_{50}, IC_{50}, and r^2 values.

Applications hub

The NEPHELOstar *Plus* has been cited in numerous publications. Automated drug solubility screening, microbial growth kinetics and quantification of proteins are amongst a wide range of possible applications.
The versatility and flexibility of the NEPHELOstar *Plus* are illustrated by the following examples for:

- Solubility screen of the corticosteroid hydrocortizone
- Monitoring of antifungal agents
- Antigen-antibody binding

Our comprehensive online application database reflects more than 30 years of expertise and innovations. Over 8,000 published entries of peer-reviewed articles and application notes demonstrate the flexibility and versatility of our readers, and their use in chemical and biological sciences.

Support and training

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

The NEPHELOstar Plus can include all or any combination of features/options/accessories listed below at purchase. Upgrading with additional features/options/accessories may be possible after purchase. Contact your local representative for more details or a quote.

Detection modes	Nephelometry (light scattering)
Measurement modes	Endpoint and kinetic
Microplate formats	Up to 384-well plates
Microplate carrier	Robot compatible
Light source	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 Shortest times possible: 16 s (96), 47 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 60°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
	Accessories
Stacker	Plate handler for up to 50 microplates - continuous loading feature
THERMOstar	Microplate incubator and shaker
Atmospheric Control Unit (ACU)	Actively regulates O_2 and CO_2 - 0.1-20%
Upgrades	Please contact your local representative for upgrades including options such as detection modes, reagent injectors, etc.

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

BMG LABTECH

The Microplate Reader Company

Headquarters Germany
BMG LABTECH GmbH
Allmendgrün 8
77799 Ortenberg
Tel. +49 781 96968 -0
germany@bmglabtech.com

Australia
BMG LABTECH Pty. Ltd.
2/24 Carbine Way
Mornington, Victoria, 3931
Tel. +61 3 5973 4744
australia@bmglabtech.com

France
BMG LABTECH SARL
7, Rue Roland Martin
94500 Champigny s/Marne
Tel. +33 1 48 86 20 20
france@bmglabtech.com

Japan
BMG LABTECH JAPAN Ltd.
1-6-2, Shimo-cho
Omiya-ku
330-0844 Saitama City
Tel. +81 48 647 7217
japan@bmglabtech.com

UK
BMG LABTECH Ltd.
8 Bell Business Park
Smeaton Close
Aylesbury
Bucks
HP19 8JR
Tel. +44 1296 336650
uksales@bmglabtech.com

USA
BMG LABTECH Inc.
13000 Weston Parkway
Suite 109
Cary, NC 27513
Tel. +1 877 264 5227
usa@bmglabtech.com

www.bmglabtech.com

Made in Germany

09/2022