NEPHELOstar

Laser-based Microplate Nephelometer

Sensitivity is calculated according to the IUPAC standard: \(3(SD_{\text{blank}})/\text{slope}\)

Specifications are subject to change without notice

Detection Mode

Nephelometry

Measurement Modes

Endpoint and Kinetic measurements

Microplate Formats

Up to 384-well plates

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 photomultiplier tube

Sensitivity

Depends on particle size and liquid properties

Silica detection (particle size 0.5 to 10 µm) 800 nM

Dynamic Range: 5 decades

Maximum measurement value (1s= 500,000 Relative Nephelometry Units)

Read Times

Depend on assay conditions and liquid surface stability

23 s (96), 66 s (384)

Reagent Injection

Up to 3 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

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

+5°C above ambient up to 38°C

Software

License-free software package including Reader Control and MARS Data Analysis Software

Dimensions

Width: 44 cm, depth: 48 cm, height: 33 cm; weight: 25 kg

Accessories

Stacker

Magazines for up to 50 plates - continuous loading feature

THERMOstar

Microplate Incubator and Shaker

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.
NEPHELOstar - the unique laser-based microplate nephelometer

The NEPHELOstar is the world’s first and only laser-based microplate nephelometer for measuring turbidity or solubility of a sample in native microplate based environments, even up to 384-well formats.

Flexibility
The NEPHELOstar microplate nephelometer detects particles in liquid samples by measuring forward scattered light when a laser beam is directed through the solution. This scattered light is detected at angles up to 80 degrees, making it 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 is the robust optical system employing a self-monitoring laser diode that offers adjustable intensity and beam diameter. These features permit the user to reduce meniscus effects and optimize sensitivity, even allowing for measurements to be performed in 384-well plate format.

Optical Design
The high-intensity light source of the NEPHELOstar is a laser diode (at 635 nm) with a highly collimated beam. The laser beam passes through the sample well into an Ulbricht sphere scattered light detector. 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 the photomultiplier tube (PMT) and the signal measured.

Furthermore, the NEPHELOstar samples are measured directly in the microplate well meaning there is no need to transfer samples to a measurement cell as in other systems. 96-well plates can be read in as little as 23 seconds, while 384-well plates can be read in approximately 66 seconds.

Up to three optional on-board reagent injectors, precise temperature control, multi-mode shaking capabilities, automatic gain adjustment, Stacker plate handler, and a robotic plate carrier further enhance instrument flexibility.

In liquid solutions, the relationship between the concentration of scattering particles and scattered light intensity is linear over a wide range of concentrations. An exclusive feature of the NEPHELOstar 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 can be reduced.
Liquid Handling
All three precision syringe injectors have direct access to the measurement position, allowing injection of reagents and plate reading simultaneously. The software gives complete control over injection timing and pump speed.

The three injectors have a delivery volume of 3 to 350 µL (in 96-well plates), adjustable in 1 µL increments, and can be used for injecting up to three different reagents.

Stacker and Robot Compatibility
If you have medium level throughput needs for your NEPHELOstar, BMG LABTECH offers the 50 plate Stacker that can be equipped with a barcode reader. For even higher throughput, BMG LABTECH microplate readers can be integrated into many types of robotic systems.

Control and Evaluation Software
Windows™ based PC software provides an extensive range of options for assay design and data evaluation. During plate measurement, the Current State feature can be used to observe kinetics in any well. The evaluation part of the software is based on powerful Excel™ macros with built-in solubility point determination. Worksheets are provided for raw data display, calculations, signal plots, and standard curves. In addition, you can create your own workbooks for specific assays and evaluation methods.

Applications
The flexibility and performance of the NEPHELOstar allows more applications to be adapted to microplate-based laser nephelometry than ever before:

- **Drug solubility determinations**
- **Bacterial and fungal growth kinetics**
- **Determination of precipitation of particles in solution** (e.g. immunoprecipitation, protein precipitation)
- **Quantification of macromolecules** (e.g. polymerization)
- **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 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 colored solutions.
- **Microbial Growth Kinetics**
  Continuous nephelometric monitoring of changes in the optical density can be used to test antimicrobial drugs and their effects on turbidimetric growth curves. 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 instead of a traditional photometer this early part of the growth curve can be monitored much more exactly. Featuring additional precise temperature 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. monitoring of a polymerization reaction.

The NEPHELOstar’s unique combination of features is ideal for all four application areas.
**NEPHELOstar - Technical Specifications**

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