Opsytec Dr. Gröbel

Collimated Beam Device BSH-03

BSH-03 collimaed beam device

dose controller UV-MAT Touch

The BSH-03CBD is a precisely engineered collimated beam irradiation chamber for reproducible and dose-accurate UV irradiation of liquid samples. With three 150 W UVC amalgam lamps, it ensures a homogeneous, **high-intensity 254 nm radiation source**. The system was developed based on the standard methods for fluence and dose determination described in the technical literature according to Bolton & Linden, Standardization of Methods for Fluence "UV Dose Determination in Bench-Scale UV Experiments" (2003) – the methodology that is considered the reference in scientific UV disinfection research.

The procedure was adopted in DIN 19294-1:2020-08, so that the BSH-03CBD can be used to determine the average fluence rate in the spore suspension.

The inactivation must be carried out in a BSH-03CBD in accordance with Annex D of DIN 19294-1:2020-08.

The chamber can also be opened safely during active operation to load and unload samples. The internal shutter is controlled by the UV-MAT to ensure precise dosing. Safety monitoring ensures that no UV radiation escapes outside the chamber.

The BSH-03CBD irradiation chamber is therefore a reliable and precise solution for scientific research and industrial applications of UV disinfection. Its robust construction, safety, and user-friendly operation make it an indispensable tool in water treatment and chemical analysis.

Key features:

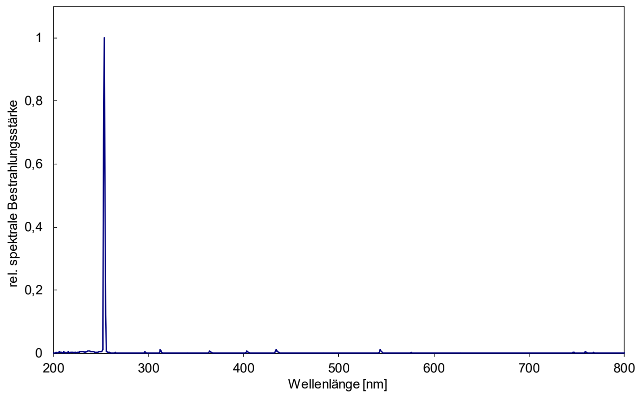
- The BSM-03CBD is equipped with three ozone-free 50 W UVC amalgam lamps. These lamps ensure uniform and high UV irradiation.
- A robust and secure protective housing ensures safe operation and protection from UV radiation.
- The large irradiation area is suitable for customer-supplied Petri dishes and magnetic stirrers for continuous mixing of the liquid.
- A UV reference sensor for dose-controlled operation is built in.
- A second UVC sensor allows for easy setup of the system.
- The UV-MAT Touch allows for easy handling and monitoring of the irradiation process.
- Monitored & interlocking door: Safety mechanisms prevent the emission of UV radiation when the door is open.

BESCHREIBUNG

- A base plate with screw threads allows easy measurement of the irradiation field and adjustment of the sample position.
- Pneumatic, automated plate shutter: For precise control of the irradiation duration
- Operating hours counter for monitoring lamp life and planning maintenance.
- PC software for storing raw data and short reports (PDF), including user management and password protection (2 user levels).

TECHNICAL DATA

Interior chamber	60 x 40 x 25 cm
Dimensions	130 x 62 x 76 cm
Weight	ca. 65 kg
Power consumption	550 W
Mains	230 V_{AC}, 6 A
	3 x110/208 V_{AC}, 8 A, optional
Operation temperature	15 to 30 °C
Humidity	< 80% non-condensing
Lamp lifetime	3.000 h to 5.000 h, typical
Number of lamps	3
Lamp type	150 W UVC amalgam lamps
ozone free	yes
Sample temperature	Room temperature + ~ 1-2°C
Shutter control	Pneumatic, 4-6 bar
Cooling	1 x DN 100



Spectrum of mercury amalgam lamps, typical

The dose can be precisely controlled by means of integrated shutter. The UV lamp remains on.

INCLUDED ACCESSORIES

The following functions are always included:

SENSORS

Calibrated radiometric sensors are available for each spectral range. The integrated diffuser ensures the required cosine correction. Excellent long-term stability is achieved through the use of appropriate materials. The sensors are calibrated with traceability to PTB (the German national test authority); after being calibrated, they are supplied with a factory calibration certificate.

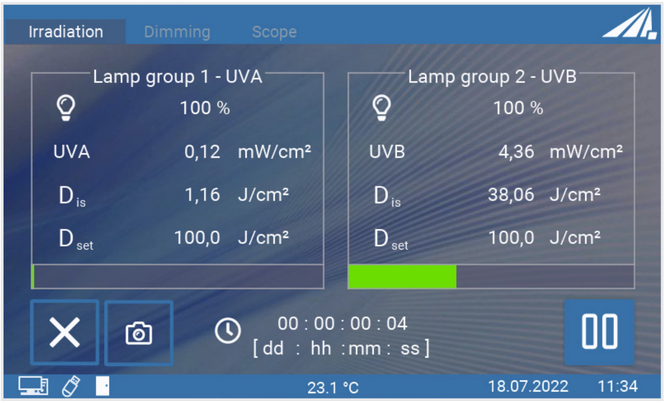
DOSE CONTROLLER

The dose control UV-MAT Touch offers alternatively all functions of the UV-MAT, but simplifies the operation and documentation of the irradiations.

UV-MAT TOUCH

The UV-MAT Touch user interface is a high-resolution capacitive touchscreen. A powerful Cortex ARM processor ensures durability and updateability. This means that new functions can be installed directly on site. The UV-MAT Touch and the PC software are Windows 10 / 11 compatible.

Numerical and graphical single and multi-channel irradiations, oscillograms and the settings are clearly displayed. The parameterization is done intuitively directly on the UV-MAT Touch and is password protected.



TECHNICAL DATA UV-MAT TOUCH

Display	Capacitive touch display
	5“ WVGA
Display output	Irradiance + dose
	Oscilloscope view
Data recording rate	adjustable: 1 s - 1 h
Recording duration	> 24000 h
Memory interface	1 USB flash drive (up to 32 GB)

PART NUMBERS

BSH-03CBD	860915
UV-MAT Touch	820930CH
Radiometric sensors	814412
Calibration	CAL254
spare lamps HG	860814H
ISO 17025 calibration	17025

Our calibrations are available as factory and ISO 17025 calibrations and are traceable to PTB standards. IP65 sensors, further measuring and spectral ranges available. Just ask us!

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FEATURES IN DETAIL

	UV-MAT Touch
Display	Capacitive touch display
Memory	USB flash drive
Number of channels	2
Irradiance, dose and temperature measurement	✓
Time and dose controlled irradiations	✓
Recordings of measurements	✓
Oscilloscope view	✓
Screenshots can be saved on USB flash drive	✓
Pause and restart of irradiations	✓
Add notes and comments to the irradiation	✓
Remote control from PC	✓
Irradiation logs	USB flash drive
User control & admin mode	✓
Easy firmware upgrades	✓

BACKGROUND & INFORMATION

The paper "**Standardization of Methods for Fluence (UV Dose) Determination in Bench-Scale UV Experiments**" by James R. Bolton and Karl G. Linden (2003) presents a basic standard procedure for determining UV fluence (UV dose) in laboratory experiments. The aim of the paper is to standardize experimental methods for UV disinfection and to ensure the comparability of scientific results in water treatment.

Ultraviolet light has established itself as an efficient method for inactivating pathogenic microorganisms in drinking water and wastewater. The mechanism is based on the absorption of UV radiation by nucleic acids, which leads to dimerization of pyrimidine bases and thus prevents the replication of DNA or RNA. Wavelengths around 254 nm, as emitted by low-pressure mercury lamps, are particularly effective.

There are major differences in the literature regarding the design, calibration, and implementation of UV experiments. Among other things, the type of lamp, distance to the sample, homogeneity of the radiation, and calculation of the dose varied. This variability made it difficult to compare dose-response curves and led to uncertainties in regulatory applications and the technical implementation of UV disinfection systems.

Bolton and Linden developed a uniform methodology for determining fluence that is applicable to both monochromatic (low-pressure) and polychromatic (medium-pressure) UV light sources (BSM-03CBD) and proposes an irradiation chamber. The aim of the irradiation chamber is to achieve homogeneous, quasi-parallel irradiation of the water surface in order to ensure uniform fluence distribution.

The protocol includes:

- the mechanical construction of the irradiation chamber,
- the calibration of the measuring instruments,
- the mathematical correction of the radiation parameters,
- as well as guidelines for microbiological and safety aspects

Description of the standard protocol

The fluence is defined as the product of the fluence rate (E) and the irradiation time (t):

The measurement is performed with a radiometer whose sensor is positioned at the height of the water surface. To increase the measurement accuracy, several correction factors are taken into account:

- Reflection factor: loss due to reflection at the water surface (~2.5%)
- Petri factor: correction for inhomogeneity across the sample area (should be > 0.9)
- Water factor: consideration of UV absorption in water according to Beer–Lambert's law
- Divergence factor: Correction for the non-completely parallel beam path

For medium-pressure lamps, the sensor factor (spectral sensitivity of the detector) and the germicidal factor (weighting of the wavelengths) are also taken into account.

Microbiological test procedure

- Stirring: Homogeneous mixing of the suspension without vortex formation.
- Irradiation with different dose values
- Replicates: At least three repetitions per dose value; perform dose-response curves at least twice.
- Randomization: Random order of irradiation to minimize systematic errors.
- Evaluation: Calculation of the log10 reduction of microorganisms as a function of dose and linear regression to determine UV sensitivity.

The paper defines a complete, internationally recognized protocol for standardizing UV disinfection tests on a laboratory scale.

Through precise correction methods, defined design requirements, and microbiological guidelines, it provides the basis for reproducible and comparable results in determining UV fluence-effect relationships.

The Bolton & Linden (2003) method remains the reference standard for laboratory testing with collimated beam systems and is central to regulatory applications such as DIN 19294, validation testing, and the development of industrial UV disinfection technologies.

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