

# BeamMaster

## Knife-Edge Beam Profiler



### Features

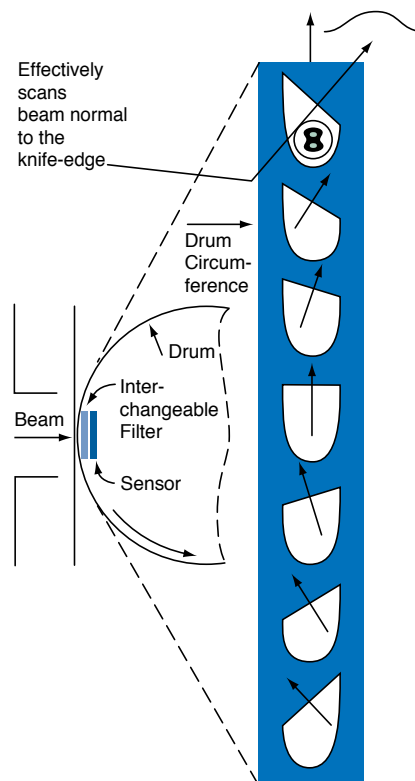
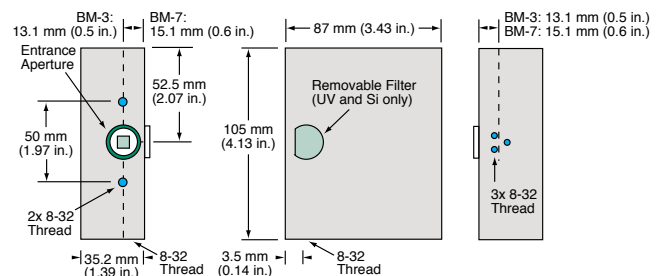
- CW laser beam shape, power and position measurements
- Beam sizes from 3  $\mu\text{m}$  to 9 mm with 0.1  $\mu\text{m}$  resolution and high dynamic range
- Real-time Windows display, analysis and data logging system
- Wavelengths from 190 nm to 1800 nm
- USB interface
- Windows XP, Vista 32-bit, Vista 64-bit, Windows 7 32-bit, Windows 7 64-bit

BeamMaster is a high-precision, multiple knife-edge scanning laser beam profiler which can be configured to sample, measure and display cross-sectional profiles and/or 2D and 3D image plots in real time up to 5 Hz. Selectable averaging of 1 to 20 samples provides noise reduction and maximizes measurement accuracy. Data can be collected, displayed, stored and continuously streamed via USB. All screen images can be captured and stored, or printed.

BeamMaster can measure focused beam spots as small as 3  $\mu\text{m}$  with 0.1  $\mu\text{m}$  resolution and has an aperture as large as 9 mm with 1  $\mu\text{m}$  resolution for larger beams. Measurements can be made from 190 nm to 1100 nm (Si-Enhanced) and from 800 nm to 1800 nm (InGaAs). Input powers can be as low as 10  $\mu\text{W}$ . There is automatic gain control and two internal distortion-free optical attenuation filters are included (Si-Enhanced models)

### Multiple Knife-Edges for Greater Resolution and Accuracy

BeamMaster is an advancement over the more common types of beam profilers, which use two orthogonal knife-edges or slits to scan the beam profile. The BeamMaster model BM-7 uses seven individual knife-edges on a rotating drum to scan the beam through seven different axes in a single rotation. This provides more accurate measurements of the true beam shape and dimensions by tomographically combining the data from all seven scans to reconstruct a profile of the beam. This technique also makes locating the angular orientation of elliptical beam major/minor axes much easier than searching by rotating the sensor head around the optical beam axis. For applications with circular or near-Gaussian beams, the lower-cost BM-3, with only three knife-edges, is also available.



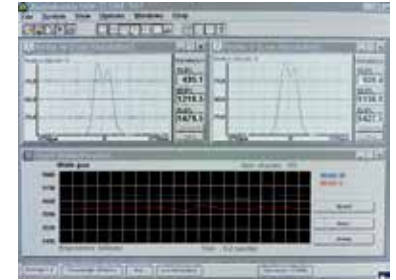
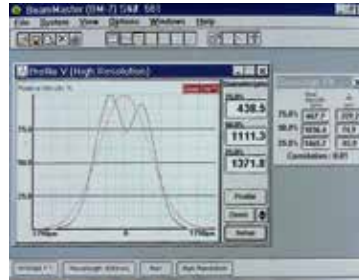
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# BeamMaster

## Knife-Edge Beam Profiler

### Beam Profiles and Widths

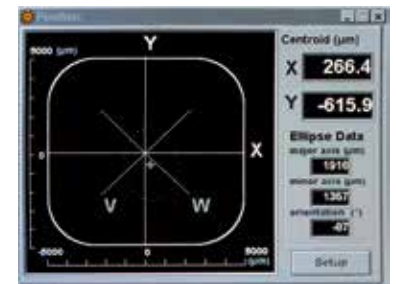
On each rotation of the drum, BeamMaster captures and processes the data from the passage of the seven knife edges across the beam (three knife edges with BM-3) as power, position and profile information. This information can be displayed every rotation, strip-charted, and sent to a file. Two orthogonal profiles can be displayed and the beam widths can be digitally displayed for any three user-chosen clip levels. A Gaussian-fit profile can be overlaid on any chosen measured profile and the fit and correlation parameters can be displayed.



To obtain the maximum profile detail, the system automatically centers the profile and zooms to display ~3 times the beam width, and the profile intensity data is autoscaled (optional) to fit the display height. Note: Unlike the PCI version, the USB model is always in high resolution mode for maximum detail.

### Beam Position and Ellipticity

The beam centroid position can be continuously monitored relative to the center of the sensor area, along with the beam shape, ellipticity (major and minor axes) and angular orientation. A zoom function is available and the user can choose the clip level and strip-chart the position (X and Y) data to monitor short-term or long-term, time-dependent stability or drift.



### Power Measurement

The beam power can be displayed either as a digital readout or in combination with an analog "needle." Units can be chosen as  $\mu\text{W}$ , mW or dBm, and the user can offset the zero and zoom in on any part of the power range. Attenuator (filter) files can be selected, and a test range can be selected and displayed to monitor beam power within specific limits, with optional audio alarms.



### Data Collecting and QA Testing

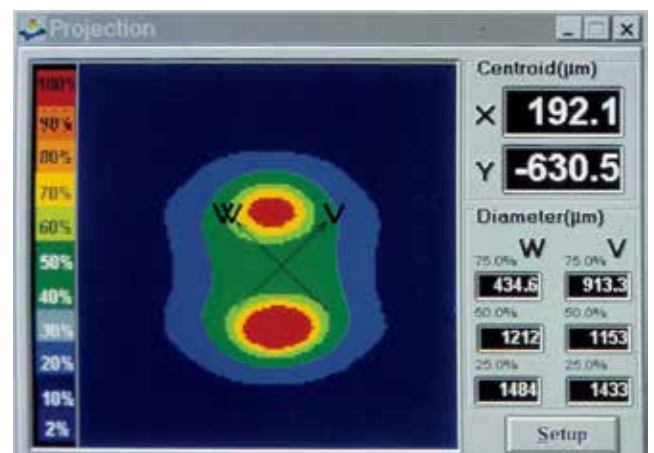
Data regarding beam size, position and power can be continuously displayed in analog, digital and strip chart forms on the computer screen. Data can also be logged to a data file in real time for later processing or test report generation. Pass/Fail testing can be performed on measured results for acceptance within specific tolerances. All screen images also can be captured and stored as BMP or JPG files.



### 2D and 3D Intensity Plots

The projection function provides either a 2D or 3D view of the beam intensity profile. The projection is created using reconstructive tomography. The same method is used to produce 3D images with X-ray systems. The more knife edges, the greater the level of detail that can be obtained. For a beam distribution that is significantly non-Gaussian, such as that from a diode laser, the standard seven-knife-edge system can reconstruct a plot that closely matches the real beam. When examining near-Gaussian beams, the three-knife-edge system gives an accurate intensity distribution.

The 2D contour maps and the 3D isometric plots can be displayed with or without scan axis and grids, and the isometric plots can be rotated for easier viewing of the detailed structure.



BeamMaster 2D Intensity Plot

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# BeamMaster

## BeamMaster Accessories

### BeamMaster System Components

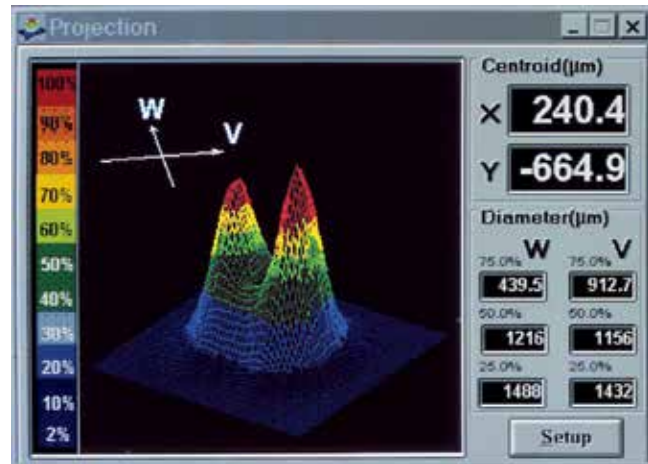
Each BeamMaster system consists of a sensor head, complete with a 1.8 m cable, USB interface module to plug into a PC computer, complete Windows software on a CD-ROM disk, a 0.5" mounting post (threaded 8-32) and stand, and optical filters (for Si-Enhanced).

### Optical Filters

The BM-7 and BM-3 Si-Enhanced heads come with two neutral density filters. NG4 and NG9 filters (complete with transmission curves) are provided to extend the power range of the heads from 5 mW to 1W in the 400 nm to 1100 nm range. The NG4 filter comes pre-installed and provides ~10% transmission at 633 nm. The NG9 filter is in a protective filter case and provides ~0.5% transmission at 633 nm. There is no filter in the BeamMaster InGaAs head configurations.

### BeamMaster Accessories

An optional mount is available to enable rotation of the BeamMaster sensor head about the optical axis. This mount has a 360-degree calibrated scale with a locking screw. An optional C-Mount Adapter Plate allows the attachment of any C-Mount, threaded optical accessory, such as a BCUBE high power attenuator pickoff optic (see the Beam Diagnostics Accessories section on pages 113-114).



BeamMaster 2D Intensity Plot

Device Specifications	Model	BeamMaster
Measurement Rate (Hz)		5
Wavelength Range (nm)		190 to 1100 [BM-7 Si-Enhanced, BM-3 Si-Enhanced] 800 to 1800 [BM-7 InGaAs (3 or 5 mm), BM-3 InGaAs (3 mm)]
Sensor Aperture		9 mm square [BM-7 (Si-Enhanced)] 5 mm circular [BM-3 (Si-Enhanced)] 3 mm circular [BM-3 and BM-7 (InGaAs)] (optional BM-7 InGaAs 5 mm available)
Minimum Beam Size (µm)		15 (BM-7 all models) 3 (BM-3 all models)
Beam Size Resolution		1 µm for beams >100 µm in size (0.1 µm for beams <100 µm in size)
Position Measurement Resolution (µm)		1
Position Measurement Accuracy (µm)		±15
Beam Width Measurement Accuracy (%)		±2
Beam Power Range		10 µW to 1 W (with supplied internal filters), saturation 0.1 W/cm <sup>2</sup> without filter, 20W/cm <sup>2</sup> with NG9 filter [BM-7, BM-3 (Si-Enhanced)] 10 µW to 5 mW (no filters provided), saturation 0.1 W/cm <sup>2</sup> [BM-3 InGaAs, BM-7 InGaAs]
Relative Power Measurement		0.1 µW resolution
Sensor Head Weight (g)		56 g
Part Number		
	1224014	BeamMaster BM-7 Si-Enhanced - USB interface
	1224012	BeamMaster BM-3 Si-Enhanced - USB interface
	1224018	BeamMaster BM-7 InGaAs (3 mm) - USB interface
	1224020	BeamMaster BM-7 InGaAs (5 mm) - USB interface
	1224016	BeamMaster BM-3 InGaAs (3 mm) - USB interface
	1038024	BeamMaster Rotation Mount
	33-7147-000	BeamMaster C-Mount Adapter Plate

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