

BEAMAGE

CMOS beam profiling cameras



KEY FEATURES

- > **USB 3.0 FOR THE FASTEST TRANSFER RATES**
Up to 10X faster than regular USB 2.0 connections
- > **HIGH RESOLUTION**
4.2 Mpixels resolution gives accurate profile measurements of very small beams
- > **LARGE APERTURES**
 - 11.3 x 11.3 mm for the Beamage-4M
 - 20.5 x 20.5 mm for the Beamage-4M-FOCUS
- > **AVAILABLE WITH IR COATING**
Beamage 4M-IR cameras have a special phosphor coating for IR wavelengths (1495-1595 nm)
- > **ISO COMPLIANT**
D4 definition of diameter, centroid, ellipticity and orientation are ISO 11146:2004 and 11146:2005 compliant
- > **EXTERNAL TRIGGER**
To synchronize the camera with a pulsed laser

INTUITIVE SOFTWARE INTERFACE

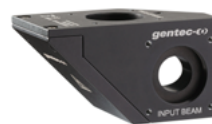
Easy to navigate interface, with many displays and control features:

- 2D, 3D and XY Displays
- Background Subtraction Function
- Unique "Animate" Function
- Gaussian Fit
- Semi-Log Graph

ACCESSORIES



Stand with delrin post



BA series optical attenuators



Stackable ND filters (0.5, 1.0, 2.0, 3.0, 4.0 & 5.0)



UV and IR filters



Pelican carrying case



Fiber adaptors & connectors (FC, ST and SMA)



UV converters & IR adaptors



	BEAMAGE-4M	BEAMAGE-4M-IR	BEAMAGE-4M-FOCUS
SENSOR TECHNOLOGY	CMOS	CMOS (with phosphor coating)	CMOS (with fiber optic taper)
EFFECTIVE APERTURE	11.3 x 11.3 mm	11.3 x 11.3 mm	20.5 X 20.5 mm ^a
MEASUREMENT CAPABILITY			
Wavelength range			
Camera only	350 - 1150 nm	1495 - 1595 nm	350 - 1150 nm
With UG11-UV filter	250 - 370 nm	---	---
With B3-IR-filter	1250 - 1350 nm	---	---
Pixel count	4.2 MPixels	4.2 MPixels	4.2 MPixels
H x V	2048 x 2048	2048 x 2048	2048 x 2048
Minimum measurable beam	55 μm	70 μm	120 μm
Frame rate		6.2 fps at 4.2 MPixels (Full Frame) 11.4 fps at 2.1 MPixels (2048 x 2048) 18.6 fps at 1.1 MPixels (2048 x 544) 32 fps at 0.066 MPixels (256 x 256)	
RMS noise	1000:1 (60 dB)	1000:1 (60 dB)	1000:1 (60 dB)
DAMAGE THRESHOLDS			
Maximum average power	1 W with ND filter	1 W with ND filter	1 W with ND filter
Maximum density (1064 nm)	10 W/cm ² 0.1 J/cm ²	10 W/cm ² 0.1 J/cm ²	10 W/cm ² 0.1 J/cm ²
SOFTWARE			
Displays	2D, 3D, XY and Beam Tracking		
Display Features	2D: Print Screen, Reset View, Show/Hide Beam Diameter 3D: Print Screen, Reset View, Top View XY: Save Data, Zoom, Gaussian Fit, Semi-Log, Show/Hide Cursor, Show/Hide FWHM, Show/Hide 1/e ² Beam Tracking: Save Data, Print Screen, Reset View, Zoom		
Beam Diameter Definitions	D4σ (ISO compliant), 1/e ² along crosshairs (13.5%) FWHM along crosshairs (50%) Custom (%)		
Buffer Controls	Open File, Save Current Data, Save All Data, Previous/Next Image, Clear Buffer, Animate		
Printing and Reports	Full Report in Print Ready Format (2D, 3D, XY, Measures, Parameters) Print Screen in BMP format (2D and 3D)		
PHYSICAL CHARACTERISTICS			
Sensor size	11.3 x 11.3 mm	11.3 x 11.3 mm	11.3 x 11.3 mm
Sensor area	1.28 cm ²	1.28 cm ²	1.28 cm ²
Effective aperture	Same as sensor	Same as sensor	20.5 x 20.5 mm
Dimensions (not including filter)	61H x 81.1W x 19.7D mm	61H x 81.1W x 19.7D mm	61H x 81.1W x 46.5D mm
Weight (head only)	138 g	138 g	235 g
ORDERING INFORMATION			
Compatible stand	STAND-D-233	STAND-D-233	STAND-D-233
Product page			

a. With a typical pixel multiplication factor (PMF) of 1.8.

Specifications are subject to change without notice
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BEAMAGE

Software features

Capture Controls:

Start/Stop,
Subtract Background

Buffer Controls:

View Data Offline

Data:

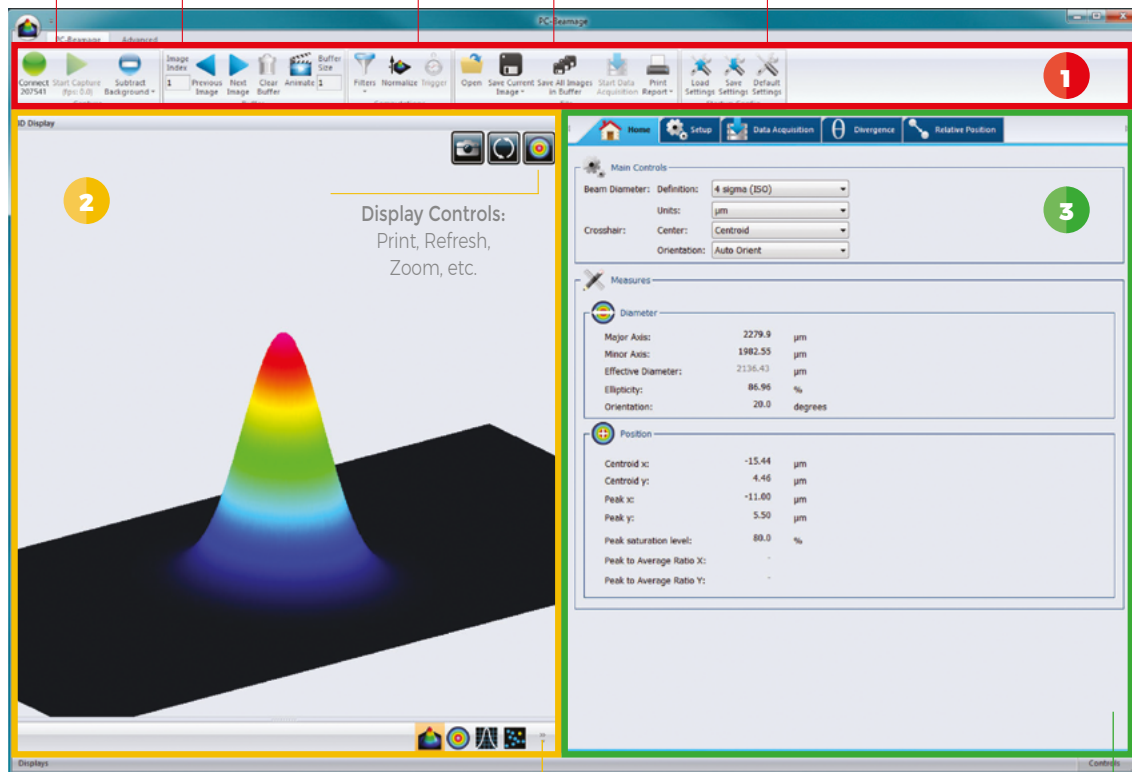
Computation

File Controls:

Save and Open Data

Startup Configuration:

Save and Load Settings



Displays:
3D, 2D, XY Graphs and Beam Tracking

Home, Setup and Acquisition Tabs:
Set your capture parameters and get the resulting measurements

1

MAIN CONTROLS

The upper part of the software includes all the main controls in a ribbon format. These controls are grouped by family: Capture Controls, File Controls, Buffer Controls, M2 Controls and Data Computations. The last includes very useful filters and a normalization function.

2

DISPLAYS

The left-hand side of the software is the display panel. Four displays are available: 3D, 2D, XY (cross-sectional graphs along the crosshairs) and Beam Tracking. The desired display is selected by clicking on the corresponding icon at the bottom of the panel. Print screen controls are available for the 3D, 2D and Beam Tracking displays. They allow the user to save an image of the current view in BMP format.

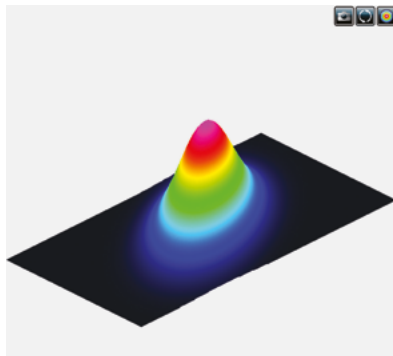
3

HOME AND SETUP TABS

The right-hand side of the software contains the Home, Setup and Data Acquisition tabs. The Home tab allows the user to select the main controls for his measurements (Beam Diameter Definition, Crosshair Center and Orientation) and displays the resulting measurements below. The Setup tab allows the user to set the measurement parameters (Exposure Time, Image Orientation and Averaging, Active Area, etc.) and the Data Acquisition tab allows the user to save measurements with or without full images, to enter the Sampling Rates and a Total Duration for the Acquisition. More tabs with advanced controls are available when clicking on the Show/Hide Options button in the Computations panel.

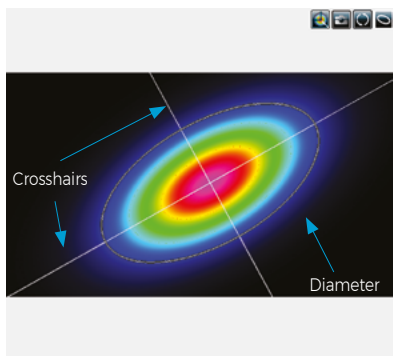
BEAMAGE

Software features



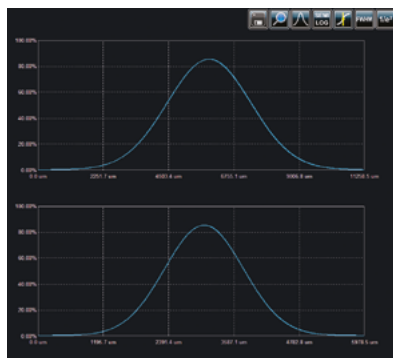
3D DISPLAY

The 3D display shows the actual shape of the beam. It is possible to easily zoom, pan and rotate the image. The Reset button puts the data back in its original configuration. This display also features a Print Screen button to save the latest image in BMP format.



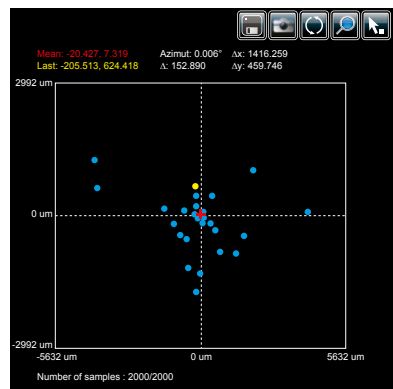
2D DISPLAY

The 2D display features the crosshairs (set to the major and minor axis or along a specific angle) and the measured diameters of the beam. These diameters vary with the chosen definition (4-sigma, FWHM, 1/e², etc.) and the display can be turned ON or OFF. The Print Screen button allows to save a picture of the current screen in BMP format.



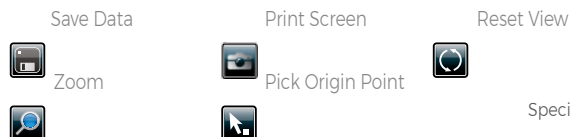
XY DISPLAY

The XY display plots cross-sectional graphs of the beam along the crosshairs. This display features many useful tools like zoom, cursor, and FWHM and 1/e² level bars. It is also possible to display the graphs in semi-log format to enhance the details in the low intensity parts of the beam.



BEAM TRACKING DISPLAY

The Beam Tracking Display allows the user to visualize the variation of the beam's centroid position on the sensor. This display shows the latest calculated position as well as the previous ones, until the user resets the view. The display also shows the mean position of all computed values and gives information regarding position stability for both X and Y axes. This tool is great to monitor the beam pointing stability over time.



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BEAM PROFILING

Overview of the different models



BEAM PROFILING CAMERAS

Profiling a laser beam is a convenient complement to the measurement of its power or energy because it provides very useful additional information, like spatial energy or intensity distribution, beam widths, centroid, ellipticity and orientation, that may help you determine if your laser-based systems are operating optimally.

The Beamage is the most cost-effective USB3.0 Beam Profiling Camera on the market. It is available for UV to IR wavelengths and in 2 sizes. It comes with an intuitive and complete software that features an array of useful tools and functions. Its calculations are ISO compliant.

MAIN SPECIFICATIONS

	BEAMAGE-4M	BEAMAGE-4M-IR	BEAMAGE-4M-FOCUS
Wavelength range			
Camera only	350 - 1150 nm	1495 - 1595 nm	350 - 1150 nm
With UG11-UV filter	250 - 370 nm	---	---
With B3-IR-Filter	1250 - 1350 nm	---	---
Pixel count	4.2 MPixels	4.2 MPixels	4.2 MPixels
H x V	2048 x 2048	2048 x 2048	2048 x 2048
Sensor size	11.3 x 11.3 mm	11.3 x 11.3 mm	20.5 x 20.5 mm
Frame rate (full frame)	6.2 fps	6.2 fps	6.2 fps

BEAM QUALITY MEASUREMENT

The performance of a laser in practical applications is critical in the design of optical systems and focusing applications, and it can be quantified by measuring M2, the laser beam quality factor, which indicates how close a laser is to being an ideal Gaussian beam.

The Beamage-M2 acquires a sequence of beam profile measurements to automatically perform beam quality measurements within a few seconds. It is equipped with the largest optics on the market for easy alignment and fast measurements that you can trust. Its software is both intuitive and ISO compliant.



ACCESSORIES

Specifications



IF YOUR **LASER SPECIFICATIONS EXCEED THE LIMITS** IN TERMS OF

YOU CAN MANAGE THEM WITH THE ACCESSORIES PRESENTED BELOW

> **WAVELENGTH**

> **BEAM SIZE**

> **LASER POWER**

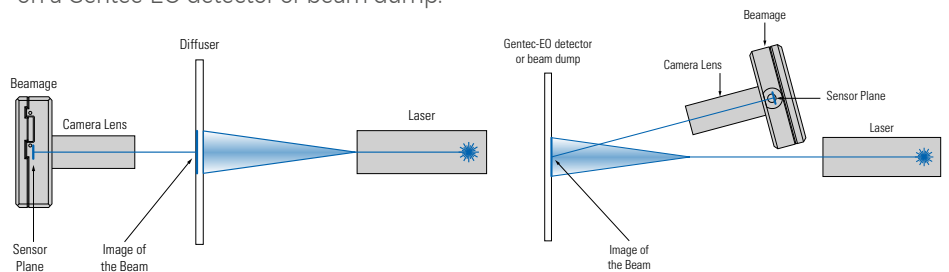
MANAGE THE WAVELENGTH

Since CMOS sensors are not sensitive to every frequency of the electromagnetic spectrum, we offer several wavelength management solutions to enhance the capabilities of the Beamage beam profiling cameras.



MANAGE THE BEAM SIZE

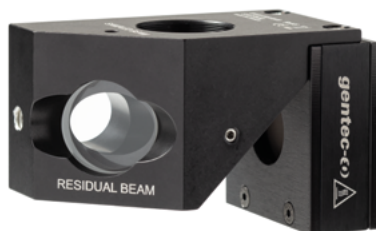
A simple solution is offered to those who need to profile beams that are larger than the CMOS sensor (> 11.3 mm x 11.3 mm). This solution is a beam reducing optical component called camera lens. It works either by indirectly imaging the transmission of the beam after it has passed through a diffusing element or by directly imaging the beam that is incident on a Gentec-EO detector or beam dump.



MANAGE THE LASER POWER

CMOS sensors have low saturation levels as well as low damage thresholds. It is thus very important that you control your laser power to get the best measurement possible and avoid damaging the Beamage camera.

- For laser power under 1 W, you can attenuate the beam with ND filters
- For laser power up to 1000 W, you can sample a small fraction of the beam with a BA optical sampler



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ND

Neutral density (ND) filters - up to 1 W



KEY FEATURES

> FOR ALL BEAMAGE MODELS

We offer various SM1-threaded absorptive ND filters that can be fixed directly on the aperture of the Beamage camera via a SM1 to C-mount adaptor. We also offer SM2-threaded filters that can be fixed on the Beamage-4M-FOCUS via a SM2 to T-Mount adaptor.

> HIGH-QUALITY OPTICS

These filters reduce the intensity of all wavelengths without affecting the wavefront of the beam or distorting the image.

> STACKABLE ATTENUATION

Subsequent filters can be stacked directly on each other. Sets of 3 filters or 6 filters as well as individual filters are available.

COMPATIBLE PRODUCTS



BEAMAGE-4M



BEAMAGE-4M-FOCUS
(for BA32-1KW only)




PH series

OVERVIEW OF THE MODELS

MODEL NAME		EQUIVALENT ATTENUATION	TRANSMITTANCE AT 633 NM
SM1 FILTERS	SM2 FILTERS		
ND0.5	ND0.5-FOCUS	(1/3.16)	~32%
ND1.0	ND1.0-FOCUS	(1/10)	~10%
ND2.0	ND2.0-FOCUS	(1/100)	~1%
ND3.0	ND3.0-FOCUS	(1/1000)	~0.1%
ND4.0	ND4.0-FOCUS	(1/10 000)	~0.01%
ND5.0	ND5.0-FOCUS	(1/100 000)	~0.001%
NDSET-6 (Set of 6 filters)			
NDSET-3 (Set of 3 filters: ND1, ND2, ND3)			
ND-H (ND filter holder)			

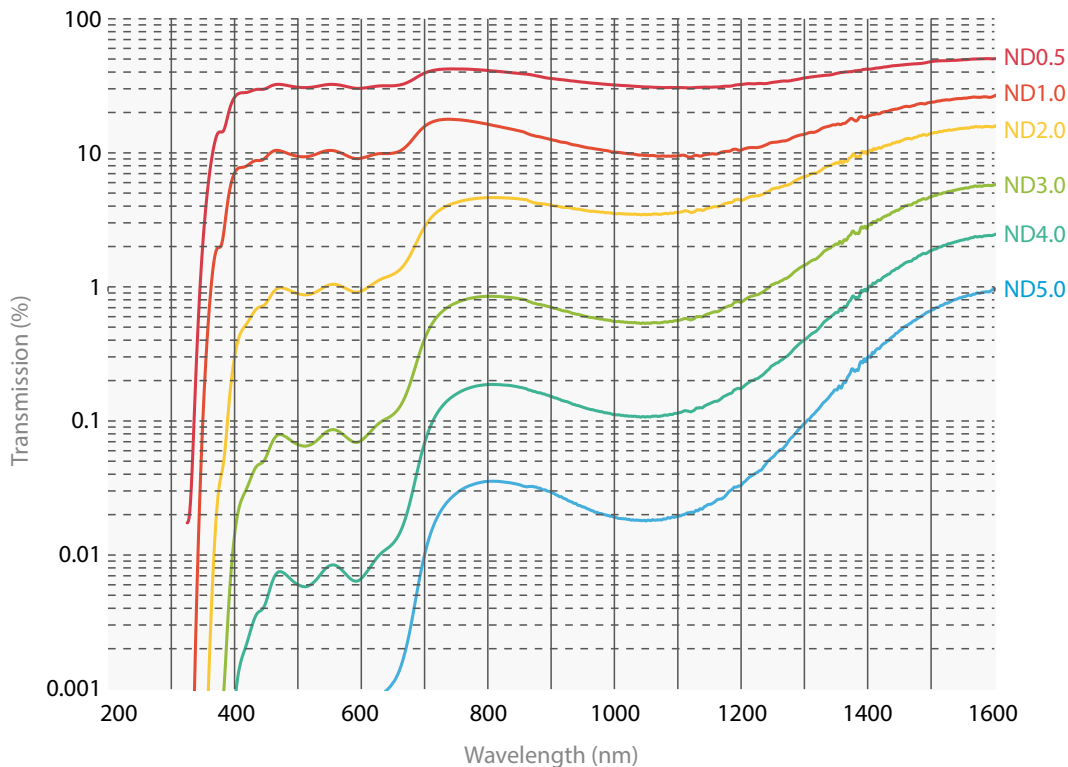


ND0.5 TO ND5.0

Spectral range	400 nm ^a - 1595 nm
Filter diameter	25 mm Ø
Clear aperture	22.5 mm Ø (90% of diameter)
Dimensional tolerance	+0.0/-0.25 mm
Optical density tolerance	± 5%
Parallelism	< 10 arcsec
Transmitted wavefront error	< $\lambda/10$ at 633 nm
Surface flatness	< $\lambda/4$
Surface quality	40 - 20 Scratch-Dig
Maximum power	1 W
Damage thresholds	100 W/cm ² or 3 J/cm ²
Product page	

* Data specified at 633 nm
 a. For ND4.0 filter, lower limit with other models.

SPECTRAL TRANSMISSION OF ALL FILTERS



BA

Optical attenuators - up to 1 kW

New product



KEY FEATURES

- > **MANAGE THE LASER POWER**
CMOS sensors have low saturation levels as well as low damage thresholds. It is thus very important that you control your laser power to get the best measurement possible and avoid damaging the BEAMAGE camera.
- > **SAMPLE YOUR LASER BEAM**
The BA series optical attenuators use Fresnel reflections on two orthogonal wedges to pick off a small fraction of the input beam. The incoming beam polarization state and irradiance are preserved.

MULTIPLES USES

- > Monitor power and beam profile simultaneously
- > Polarization insensitive beam-splitter with no back-reflections
- > Optical pick-off for use with our energy or power detectors
- > Attenuator for our high sensitivity detectors like M6 series and PH series

COMPATIBLE PRODUCTS



BEAMAGE-4M



BEAMAGE-4M-FOCUS
(for BA32-1KW only)



UP55N-40S-H9
(for BA32-1KW only)



PH series



M6 series

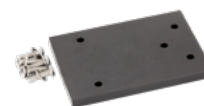
ACCESSORIES



BA32 mounting kit for
BEAMAGE-4M



BA32 mounting kit for
BEAMAGE-4M-FOCUS



BA32 mounting kit for
UP55N-40S-H9



	BA16-60S	BA16K-150S-H5-D0	BA16K-500F-H9-D0	BA32-1KW
MAXIMUM POWER	60 W	150 W	500 W	1000 W
EFFECTIVE APERTURE	16 mm ϕ	16 mm ϕ	16 mm ϕ	32 mm ϕ
COOLING METHOD	Convection	Convection	Fan	Water

MEASUREMENT CAPABILITY

Spectral range	200 - 2100 nm	200 - 2100 nm	200 - 2100 nm	200 - 2100 nm
Integrated power detector	N/A	UP19K-15S-H5-D0	UP19K-110F-H5-D0	Compatible with UP55 series (not included)
Fan input voltage	N/A	N/A	12 VDC	N/A
Equivalent attenuation	1/1700 @ 1064 nm	1/1700 @ 1064 nm	1/1700 @ 1064 nm	1/1900 @ 1064 nm
Optical wedges material	UV fused silica (uncoated)	UV fused silica (uncoated)	UV fused silica (uncoated)	UV fused silica (uncoated)
Residual beam deviation	5.6°	5.6°	5.6°	3.6° @ 1064 nm
Polarization correction	Yes (pair of orthogonal wedges)	Yes (pair of orthogonal wedges)	Yes (pair of orthogonal wedges)	Yes (pair of orthogonal wedges)

DAMAGE THRESHOLDS

Maximum power	60 W	150 W	500 W	1000 W
Maximum average power density	10 MW/cm ²	10 MW/cm ²	10 MW/cm ²	10 MW/cm ²
Maximum energy density	10 J/cm ²	10 J/cm ²	10 J/cm ²	10 J/cm ²

PHYSICAL CHARACTERISTICS

Aperture diameter	16 mm ϕ	16 mm ϕ	16 mm ϕ	32 mm ϕ
Dimensions	45H x 47W x 81D mm	54H x 50W x 91D mm	54H x 54H x 126D mm	145H x 250W x 132D mm
Weight	0.26 kg	0.37 kg	0.46 kg	5.5 kg
Mounting thread	SM1	SM1	SM1	SM2
Included adaptor	SM1 external threaded tube	SM1 external threaded tube	SM1 external threaded tube	N/A

ORDERING INFORMATION

Compatible Stand	STAND-S-233	STAND-S-233	STAND-S-233	2x STAND-S-443-C-M
Product Page				

BEAMAGE-M2

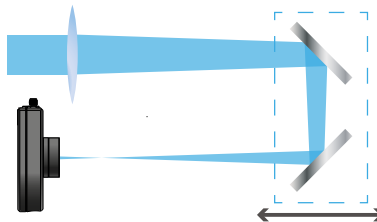
Automated M² measurement system



KEY FEATURES

- **LARGE APERTURES**
The only M² system on the market equipped with a complete set of 50mm (2") optics. Also, the sensor is 11.3 x 11.3mm
- **SIMPLE ALIGNMENT**
Two beam-steering mirrors are included for quick and easy alignment of your laser into the system.
- **COMPACT**
The low-profile ingenious mechanics make it easy to fit the device on any optical table
- **ISO COMPLIANT**
The calculations are fully compliant to the ISO 11146 and 13694 standards
- **FAST ACQUISITION**
Make a complete, ISO-compliant measurement in only 20 seconds with the ROI feature and in less than a minute with full-frame acquisition
- **FLEXIBLE & INTUITIVE SOFTWARE**

AUTOMATED MEASUREMENTS



Inside the BEAMAGE-M2, a computer-controlled motorized rail allows precise positioning of two mirrors, which in turn allow a 400 mm beam path difference. At each position of the translation stage, a beam profile is acquired and the beam diameter is measured. The automation of the translation stage allowed by the software is the key to a fast measurement.

PRACTICAL ALIGNMENT TOOL



Each BEAMAGE-M2 system includes an alignment tube that helps you set up the system faster. Simply use the two alignment mirrors to center your laser beam onto both irises, and you will be ready to start measuring in no time!


The fluorescent material around the pinholes also helps to align beams that are in the NIR range without having to use an IR viewer.

BEAMAGE-M2

Specifications



BEAMAGE-M2

SENSOR TECHNOLOGY	Beamage-4M included
EFFECTIVE APERTURE	Ø 48 mm optics - 11.3 x 11.3 mm sensor
MEASUREMENT CAPABILITY	
System wavelength range	350 - 1100 nm
Attenuation range	3 Flip-mount attenuators for 8 levels of attenuation: no attenuation, ND0.5, ND1, ND2, ND1.5, ND2.5, ND3, ND3.5
Beam diameter range ^a	55 µm to 11.3/3 mm
Translation stage	
Mechanical travel range	200 mm
Effective optical path range	400 mm
Lens focal length	5 AR-coated lenses included: 200 mm, 250 mm, 300 mm, 400 mm and 500 mm
Typical M ² accuracy ^b	± 5%
Typical M ² repeatability ^b	± 2%
Applicable light sources	CW and quasi-CW
Typical measurement time	45 s with full-frame acquisition
DAMAGE THRESHOLDS ^c	
Maximum average power	1 W with ND filter
Maximum density (1064 nm)	CW: 10 W/cm ² ; Pulsed: 0.1 J/cm ²
PHYSICAL CHARACTERISTICS	
Dimensions	
Main enclosure	357 mm (L) x 165 mm (W) x 135 mm (H)
Total (including external mirrors)	602 mm (L) x 193 mm (W) x 172 mm (H)
Optical axis height	86 mm
Weight	6.6 kg
Power supply	48 VDC, 1.25A out
SOFTWARE	
Displays	2D, 3D, XY, Beam Tracking and M ²
Beam diameter definitions	D4σ 1/e ² along crosshairs (13.5%) FWHM along crosshairs (50%) Custom (%)
Beam quality definitions	Laser beam quality M ² : M ² _x , M ² _y (ISO compliant) Beam Propagation Factor: BPP _x , BPP _y Width at waist: W _x , W _y Waist location and offset: Z _x , Z _y , ΔZ Divergence angle: θ _x , θ _y Rayleigh length: Z _{Rx} , Z _{Ry} Astigmatism
Printing and reports	Full report in print-ready format
ORDERING INFORMATION	
Product page	

Specifications in the table above are for the use with a Beamage-4M beam profiler (included in the Beamage-M2 kit)

- a. At the Beamage sensor
- b. Depending on the beam quality and optical configuration
- c. With ND4 filter at the Beamage

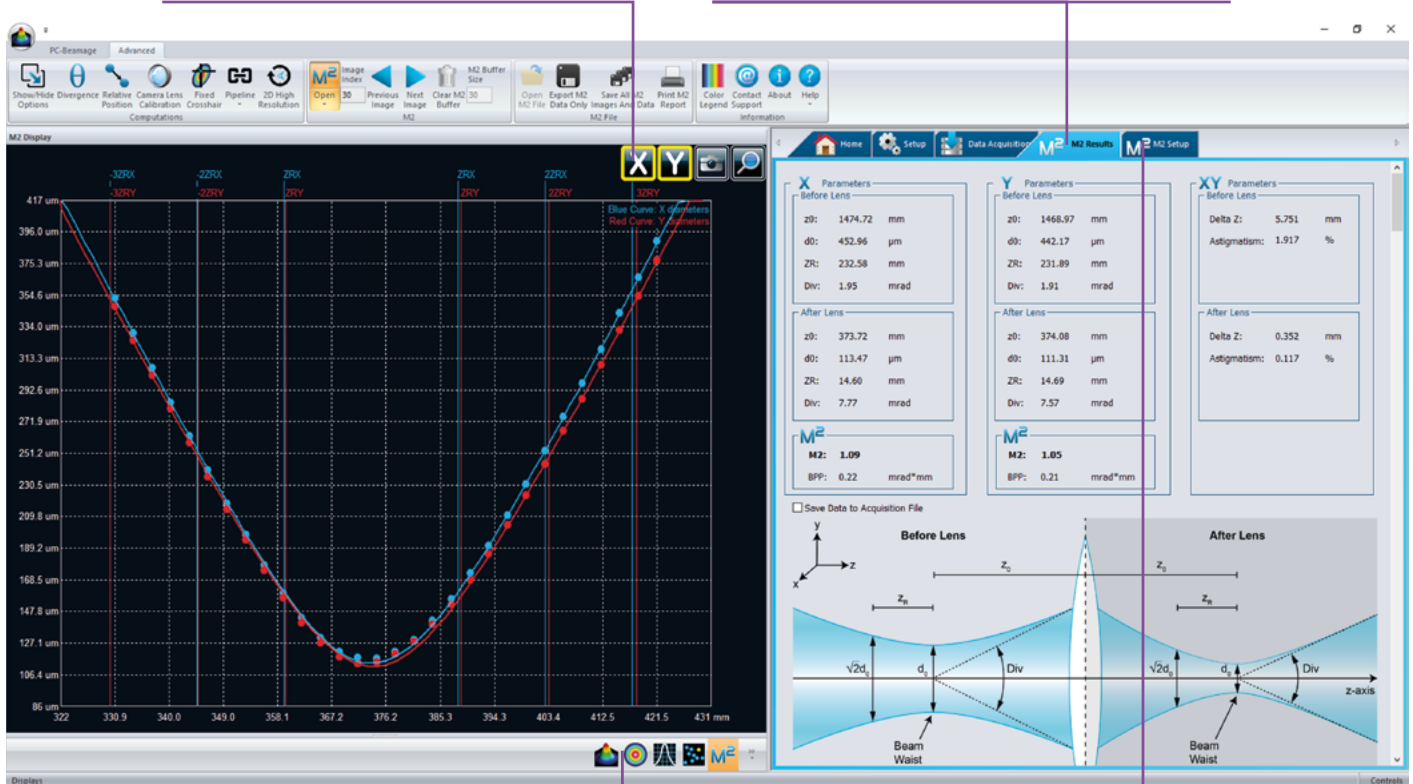
Specifications are subject to change without notice
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BEAMAGE-M2

Software features

Select which set of Rayleigh range boundaries to display on the graph: X, Y or both

M2 Results tab:
View and understand all the measured parameters quickly, for both the initial laser beam and the beam inside the BEAMAGE-M2 system

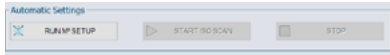


Switch to 3D or 2D displays to see each of the measured profiles

M2 Setup tab:
Control your acquisition parameters

BEAMAGE-M2

Software features

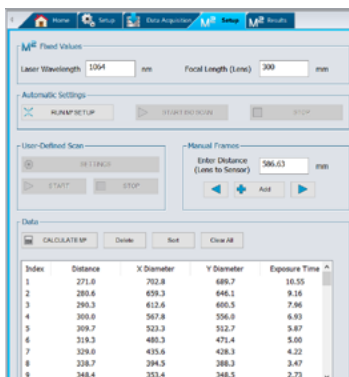


ISO COMPLIANCE MADE SIMPLE

With the "RUN M2 SETUP" button, the software automatically defines new parameters for a more precise M² measurement. The "ISO SCAN" data set complies with the ISO-11146 M² measurement standard, being spread between $-3Z_R$ and $+3Z_R$.

The automatic settings are updated after each calculation, considering the values of Z_0 and Z_R from the latest measurement.

By default, the results graph always shows the calculated positions of the first three Rayleigh distances on each side of the waist.



FULL CONTROL ON YOUR DATA

During an M² scan, each of the measured profiles is saved and the flexible software gives you complete control on your acquired data.

- View each acquired profile in 2D display or 3D display.
- Add measurement points to a data set at the position of your choice with the "ADD" button.
- Remove unwanted profiles from your data set & recalculate the measurements.



FAST ATTENUATION

Add or remove attenuation with the flick of a finger. The software adjusts the exposure time at each frame during an acquisition, and advises the user on the required attenuation.

PHOTO
TECHNICA

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