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BP209-IR - November 22, 2021

Item # BP209-IR was discontinued on November 22, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

SCANNING-SLIT OPTICAL BEAM PROFILERS

- Wavelength Ranges from 200 to 2700 nm
- For Near-Gaussian Beams from Ø2.5 µm to Ø9 mm
- Scanning-Slit and Knife-Edge Operating Modes

BP209-VIS
Post and Post Holder
Sold Separately

Application Idea
For a complete beam quality measurement system, integrate a beam profiler with an M^2 measurement extension set. (Shown: BP209-IR and M2MS)

OVERVIEW

Features

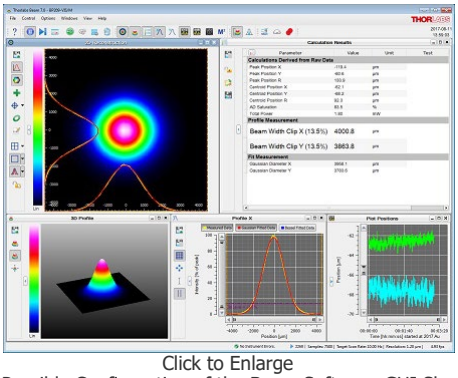
- High-Precision Analysis of Near-Gaussian Beam Quality
- Reconstructs 2D and Pseudo 3D Spatial Power Distribution
- Single Stand-Alone Measurement Head
- Characterizes Continuous Wave or >10 Hz Pulsed Laser Emission
- Scanning Speeds from 2 to 20 Hz
- Integrated Power Meter (See Manual for User-Calibration Procedure)
- Dynamic Range of 78 dB
- Low-Noise Amplifier
- High-Speed USB 2.0 Interface to PC

Key Specifications						
Item #[a]	**BP209-VIS**	**BP209-VIS/M**	**BP209-IR**	**BP209-IR/M**	**BP209-IR2**	**BP209-IR2/M**
Wavelength Range	200 - 1100 nm		900 - 1700 nm		900 - 2700 nm	
Detector Material	Si - UV Enhanced		InGaAs		Extended InGaAs	
Aperture Diameter	9 mm					
Scan Methods	Scanning Slits, Knife Edge					
Slit Sizes	5 µm and 25 µm					
Beam Diameter Range	2.5 µm - 9 mm					

a. Imperial and metric Item #s differ only in the threading of the tapped holes in the baseplate.

Software Features

- Multiple Beam Measurement and Analysis Options
  - Cross-Sectional X and Y Profiles at Adjustable Locations
  - 2D Power Density Diagram with Elliptical Beam Fit, Flexible 3D Graph
  - Plots of Total Beam Power as a Function of Time
  - Analysis of Centroid Position Drifts
  - Pass/Fail Analysis



Click to Enlarge
One Possible Configuration of the Beam Software GUI Showing

User-Configurable GUI with Multiple Display Options
    - Versatile Graphical Interface with Easy-to-Adjust Sub-Windows
    - Configurable Profile Colors
- Hotpixel and Ambient Light Corrections for Higher Accuracy
- Image and Text File Output with Sequential Saving Option
- Module for Automated M² Beam Quality Measurements (Requires M^2 Measurement Extension Set)

Thorlabs' Dual Scanning Slit Beam Profilers are ideal for analyzing cross sectional profiles of near-Gaussian laser beams. Measurements of the intensity profiles along the user-specified X and Y axes of the beam's cross section are acquired at scan rates between 2 Hz and 20 Hz, which can be set using the software. The fast 20 Hz scan rate enables real-time optical system alignment. Primarily intended for CW laser beams, >10 Hz pulsed beams can also be measured using an averaging technique (see the *Operation* tab for more information). These measurements can be used for beam quality evaluation, examination of the reconstructed beam profile, and monitoring long-term stability.

Reconstructed 2D View, Calculation Results, Plot Position vs. Time, X Profile, and Pseudo 3D View Windows Enabled

Programming References
Driver and File Locations
Application Note: Programming Functionality and Sample Code (LabVIEW and Visual C++, C#, and Basic)
Application Note: Operating with the TSP01[a] (LabVIEW and Visual Basic)

a. TSP01 Temperature and Humidity Sensor Available Separately

These scanning slit beam profilers are equipped with low-noise electronics, have a high dynamic range of 78 dB, and are capable of measuring beams with diameters between 2.5 µm and 9 mm. The beam diameter is measured in accordance with the ISO 11146 standard and can be displayed using a number of industry-standard clip levels, such as $1/e^2$ (13.5%), 50%, or an arbitrary clip level set by the user. When the beam of interest does not have a near-Gaussian beam shape, or when single-shot measurements of pulsed beams are required, we recommend our CMOS Camera Beam Profilers.

There are three Dual Scanning Slit Beam Profiler models available. The BP209-VIS(/M) is for use over the 200 nm - 1100 nm wavelength range, the BP209-IR(/M) operates over the 900 nm - 1700 nm range, and BP209-IR2(/M) has an extended near-IR wavelength range of 900 nm - 2700 nm. All models have a Ø9 mm physical input aperture and make measurements by sequentially scanning two slits with the same width and orthogonal orientations across the input laser beam. Use the software to switch between pairs of 5 µm or 25 µm width slits, select scanning-slit or knife-edge mode operation, and set a range of scan options. For information about the functionality and the usage of the different slit widths and operating modes, please see the *Operation* tab.

Thorlabs' Beam software offers complete control over the operation of these beam profilers, providing a broad range of user-adjustable settings as well as display and data logging options. The software and can be downloaded from the *Software* tab and installed on a user-supplied PC. When the beam profiler is connected to a PC running the Beam software, no additional hardware or power supply is required. Thorlabs utilizes a high-speed USB 2.0 interface to connect the measurement head with the PC, and the required USB cable is included with the BP209 package. Flexible data export options as well as a data interface for National Instruments® software ease the integration of these profilers into customized data processing environments. Please see the *User Interface* tab above for more details on the functionality of the software.

M^2 Measurement Systems

A complete M^2 measurement system based on a BP209 beam profiler can be built by integrating the profiler with a wavelength-compatible extension set, available below. While a complete M^2 measurement system based on a BP209 series measurement head can be purchased from components offered on this page, information about all of Thorlabs' M^2 measurement systems, as well as the option to configure and purchase a system with the BP209 beam profiler of your choice, can be found on the M² Measurement System page.

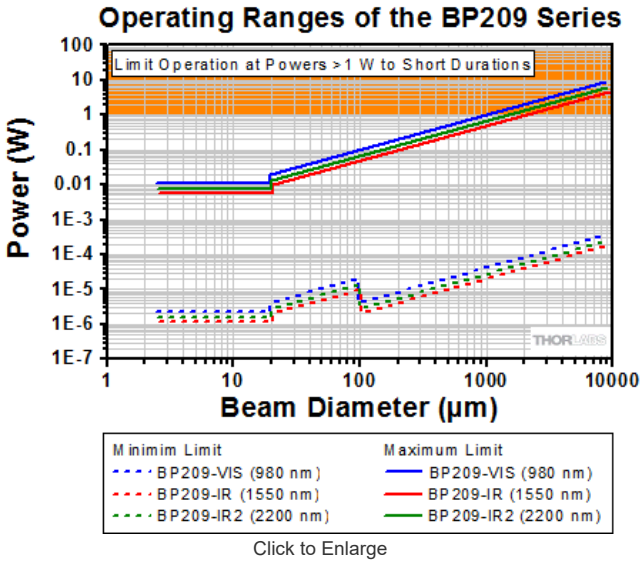
S P E C S

Item #	BP209-VIS	BP209-VIS/M	BP209-IR	BP209-IR/M	BP209-IR2	BP209-IR2/M
Sensor						
Wavelength Range	200 - 1100 nm		900 - 1700 nm		900 - 2700 nm	
Detector Material	Si - UV Enhanced		InGaAs		Extended InGaAs	
Aperture Diameter	9 mm					
Scan Methods	Scanning Slits, Knife Edge					
Slit Size	5 µm and 25 µm					
Minimum Beam Diameter	2.5 µm					
Maximum Beam Diameter	9 mm[a]					
Scan Rate	2.0 - 20.0 Hz (Continuously Variable)					
Sampling Resolution	0.12 - 1.24 µm (Depending on Scan Rate)					
Power Range	1 µW - 10 W (Depending on Beam Diameter and Model; See Plot Below Right)					
Amplifier Bandwidth	16 to 1000 kHz in 11 Steps (@ -1 dB)					
Sample Frequency	0.2872 - 2.0 MHz					

Dynamic Range	78 dB (Amplifier Switchable)	
PD Reverse Bias Voltage	0 / -1.5 V (Switchable)	0 V
Signal Digitization	15 Bit	
Head Size	Ø79.5 mm x 60.0 mm (Ø3.13" x 2.36") Including Rotation Mount	
Minimum Pulse Rate	10 Hz[b]	
Warm-Up Time for Rated Accuracy	15 min	
Software		
Displayed Parameters/Features	X-Y-Profile, Centroid Position, Peak Position, Pseudo 3D Profile, Beam Width Clip Level/Second Moment (4σ), Gaussian Fit Applicable, Pass/Fail Test with Color-Coded Results	
Compliant to Norm	ISO 11146 (Beam Widths, Divergence Angle and Beam Propagation Factor)	
Minimum System Requirements	Windows® 7 or Later, USB 2.0 High Speed Port, 4.0 GB RAM	
M² Analysis System (M^2 Extension Set Available Separately)		
Compatible M² Extension Set(s)[c]	M2MS or M2MS-AL	M2MS
Compliant to Norm	ISO 11146	
Measured Parameters[d]	M², Waist Width, Waist Position, Rayleigh Length, Divergence, Beam Pointing, Waist Asymmetry, Astigmatism	
Environmental		
Operating Temperature	5 °C to 35 °C	
Storage Temperature	-40 °C to 70 °C	

a. BP209-VIS(/M) and BP209-IR(/M) beam diameter errors are <10% for a Ø9 mm beam. BP209-IR2(/M) beam diameter error is <20% for a Ø9 mm beam with <5° divergence.
b. 300 kHz using M² Option
c. Combine a BP209 series measurement head with an M^2 extention set, available below, to give a complete M^2 measurement system.
d. Using M² Option

All technical data are valid at 23 °C ± 5 °C and 45 ± 15% relative humidity.



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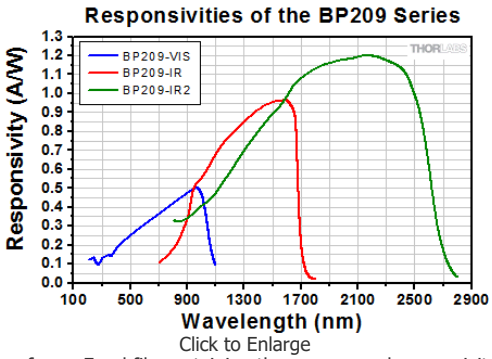
These maximum and minimum beam power limits are provided as functions of $1/e^2$ beam diameter for knife-edge and scanning-slit measurements and may not apply to measurements of total power. Please see the *Operation* tab for more information. To prevent thermal damage to the measurement head, do not operate for longer than 5 s with input powers exceeding 1 W.



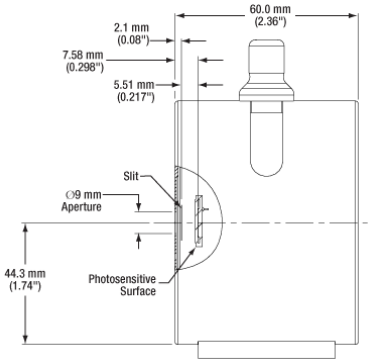
Click to Enlarge

Cick here for an Excel file containing these measured responsivity data.

Slit and Photodiode Position

Accurate measurements require a ≤Ø9 mm beam to be centered in the entrance aperture, the slits to scan the entire beam, and all transmitted power to be incident on the photosensitive surface of the photodetector. Please consult the drawing for the BP209 model of interest, shown below and included in the manuals, for information about the distances separating the front face of the entrance aperture, the slit location, and the position of the photosensitive surface of the photodiode. These dimensions are provided to help the user ensure that the optical input, especially in the case of a highly diverent beam, is not clipped by the entrance pupil and does not overfill the photosensitive surface of the photodetector.

BP209-VIS(/M)



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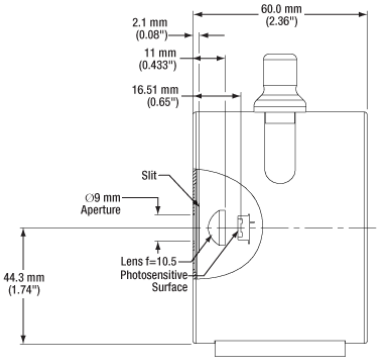
BP209-IR(/M) and BP209-IR2(/M)



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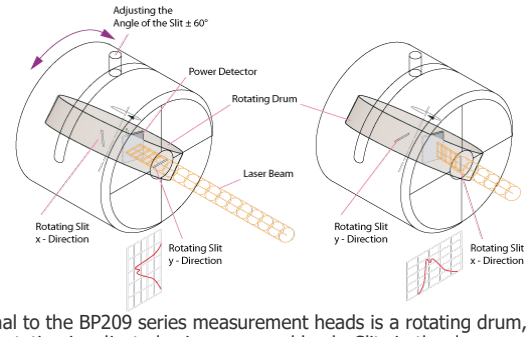
OPERATION

Scanning-Slits and Knife-Edge Techniques

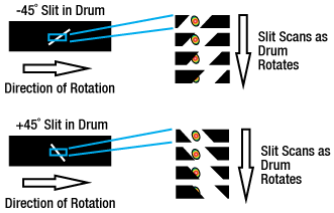
The BP209 series of Slit Beam Profilers analyze near-Gaussian, elliptical (or circular) free-space optical beams using either the scanning-slits or the knife-edge technique, depending on the diameter of the beam. These approaches scan two slits, one after the other, across the full cross section of the beam. One slit is scanned along the X axis of the beam, and the other slit is scanned along the Y axis, where the X and Y axes are defined by the user and frequently correspond to the major and minor axes of the ellipse. The light transmitted by the slit is incident on a photodetector. Optical intensity measurements, which are referenced to the position of the slit, are acquired as the slit scans across the beam.

The scanning-slit mode is appropriate for beams whose diameters are at least four times the width of the slits. In this mode, when the beam overlaps with the slit, a sliver of the beam with a width equal to that of the slit is transmitted. As the slit scans across the beam, the optical intensity of the sampled beam segments is measured by the photodetector. Knife-edge mode should be used when the beam diameter is smaller than the slit width. In knife-edge mode, the scanning slit transmits fractions of the beam, from zero to 100%. The scanning slit first overlaps with and transmits little of, then more of, and eventually all of the beam. The amount of overlap between the slit and the beam, and therefore the transmitted optical intensity, decreases and becomes zero again as the slit continues to scan across the beam.

These measurements are used to determine the beam intensity profiles along the X and Y axes of the beam. Using these data, peak power and beam centroid locations with respect to each axis are found, as well as beam diameter and ellipticity. By assuming the beam has a near-Gaussian profile, the measured X and Y beam profiles can also be used to reconstruct the intensity profile of the full beam cross section and plot the results in either 2D or 3D formats.



Internal to the BP209 series measurement heads is a rotating drum, whose axis of rotation is adjusted using a manual knob. Slits in the drum are scanned across the X and the Y axes of the beam as the drum rotates, and transmitted intensity is detected by an integrated photodetector.



Click to Enlarge
Operate in Knife-Edge Mode when the beam diameter is less than the slit width, as shown above. Choose Scanning-Slit Mode when the beam diameter is at least four times greater than the slit width.

Operational Overview of the BP209 Series Beam Profilers

Thorlabs' Beam Software

Thorlabs' Beam software, which was developed to control and acquire measurements using our beam profilers and related M^2 measurement systems, can be downloaded from the *Software* tab. The software includes a GUI and enables detailed control over the scan and measurement settings, including selecting the active slit pair, scanning mode, gain, averaging mode, and scan rate. The configuration and appearance of the displayed windows, which include X Profile, Y Profile, 2D Reconstruction, 3D Profile, Position vs. Time, Power vs. Time, and Calculation Results, can be adjusted as desired. The software also enables M^2 beam quality and convergence/divergence measurements to be made, as well as including tools to assist with the task of overlapping two different laser beams and tuning an optical beam parameter. Select which measurement and calculation results to save to a file, and take advantage of the option to sequentially save data acquired during long term measurements. For an introduction to the software and to see some representative screen images, please see the *User Interface* tab. For detailed information describing the software's functionality, please see the manual.

Programming References
Driver and File Locations
Application Note: Programming Functionality and Sample Code (LabVIEW and Visual C++, C#, and Basic)
Application Note: Operating with the TSP01[a] (LabVIEW and Visual Basic)

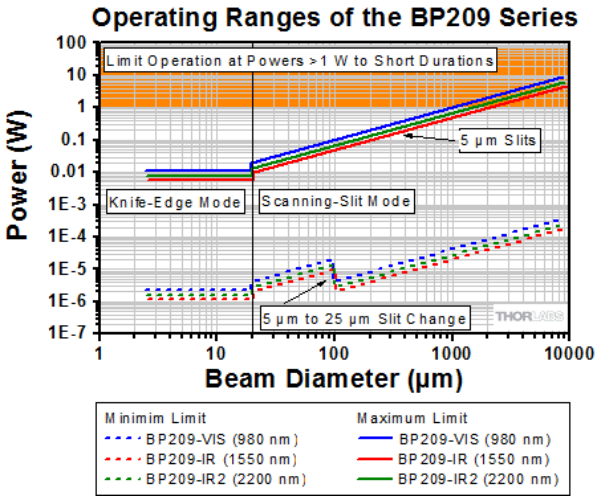
a. TSP01 Temperature and Humidity Sensor Available Separately

Perform Measurements with 5 µm or 25 µm Slits

Shown above are diagrams illustrating the configuration of the measurement head, which includes an input aperture and a rotating drum with slits in it. The beam enters the Ø9 mm input aperture perpendicular to the front plane of the measurement head and is incident on the rotating drum. The slits in the drum are spaced at intervals, and each slit spans the full width of the input aperture. There are two pairs of slits in the drum, and each pair includes one oriented at +45° with respect to the axis of rotation and the other oriented at -45°. Both slits in one pair are 5 µm wide, while those in the other pair are 25 µm wide. Including two slit width options in each measurement head and offering two operating modes enables beams with an extended range of diameters and powers to be profiled.

If the beam diameter is equal to or less than 20 µm, use the 25 µm slits and operate in Knife-Edge mode. Beams with diameters as small as 2.5 µm can be measured using this approach.

The Scanning-Slit mode can be used to measure beams with diameters between 20 µm and 9 mm. As a general rule, choose slits with widths at least four times smaller than the beam diameter to make the measurement. When this condition is met by both slit widths, the choice of scanning slit pair is influenced by the beam power and application requirements.



Click to Enlarge

These maximum and minimum beam power limits are provided as functions of $1/e^2$ beam diameter for knife-edge and scanning-slit measurements and may not apply to measurements of total power. To prevent thermal damage to the measurement head, do not operate for longer than 5 s with input powers exceeding 1 W.

Measure Beams with a Wide Range of Powers

The maximum and minimum beam powers accommodated by the scanning-slit beam profilers are plotted as functions of the $1/e^2$ beam diameter in the plot at the right. The vertical black line at 20 µm marks the beam diameter at which it is necessary to switch between knife-edge and scanning-slit operating modes. In scanning-slit mode, the maximum beam power limits correspond to operation with the 5 µm slits. By transmitting a smaller portion of the beam than the 25 µm slits, using the 5 µm slits allows beams with higher power to be measured. The minimum beam power limits were determined in scanning-slit mode using the 5 µm slits for beams with diameters between approximately 20 µm and 100 µm, while the 25 µm slits were used for beams with larger diameters. Switching between the slits when the beam diameter exceeds 100 µm maximizes the amount of beam power reaching the photodetector while also

Click to Enlarge
The laser-engravings on the front face show the orientation of the X and Y

maintaining an adequate ratio between slit width and beam size.

axes when the knob is vertical and can be used to estimate the axes' orientation when the knob is rotated.

As discussed below, reduced maximum and/or increased minimum beam power limits may apply when the beam profiler is used to measure total power (see below). If the Total Power measurement falls outside of the applicable limits, an error message will be displayed in the status box. However, beam shape measurements using the slits can still be made, assuming the power transmitted by the slits falls within the limits plotted in the diagram.

Acquire Total Power Measurements (Power Meter Readings)
In addition to the two pairs of slits, the rotating drum contains an aperture fitted with a neutral density (ND) filter. Once per rotation, the full beam passes through this aperture, and its attenuated total intensity is measured by the photodetector. This Total Power measurement is used as a reference value for the beam profile measurements, and it can also be measured and plotted with respect to time in a GUI window. The Total Power measurement is corrected using the typical wavelength-dependent responsivity, but it is not a calibrated value. To obtain absolute optical power measurements, the user can use the software to record a calibration measurement at the wavelength of interest.

The ranges of maximum and minimum beam powers for which Total Power measurements can be acquired may not reach the limits plotted above. The limits in the graph were determined for knife-edge and scanning-slit mode operation. Scanning-slit mode transmits a fraction of the beam power to the photodetector, and during knife-edge mode the un-attenuated, ≤Ø20 µm, full beam is transmitted to the photodetector. The power in the attenuated full beam that reaches the photodetector during Total Power measurements may need to fall within reduced maximum and/or increased minimum limits than the beam powers accommodated when operating with the slits.

Choose the X and Y Scan Axes' Orientation
The knob at the top of the measurement head, which is shown in the image at right, is used to manually adjust the drum's axis of rotation by ±60°. Adjusting the drum's axis of rotation changes the orientation of the X and Y scan axes with respect to the beam cross section. This allows the beam profile to be measured with the scan axes defined as desired, and it enables a series of measurements to be acquired in which the orientation of the scan axes are different in each. The drum is located internally to the measurement head, and rotating the knob does not rotate the measurement head.

This functionality is of particular importance when the input beam has an elliptical cross section, as the scan axes must be aligned with the major and minor axes of a given beam in order to measure the real ellipticity. To achieve the most accurate alignment for an ellipticity measurement, rotate the knob while observing the X and Y intensity profiles plotted in the software. When the profile width in one axis is a minimum and the other is a maximum, the rotation angle is optimum.

Measure the Beam Profile of Pulsed Laser Beams
The BP209 series can be used to measure the beam profiles of pulsed laser beams with repetition rates greater than 10 Hz; however, Thorlabs' camera beam profilers are a better choice for applications that require single-shot measurements.

There is no difference between analyzing a CW signal and a pulsed signal when the pulse repetition rate is high and the duration is short, as is the case with a femtosecond laser with 100 MHz repetition rates and pulse durations lower than 100 fs. This is due to the limited bandwidth of the photodiode's current amplifier, which cannot resolve the individual pulses and instead effectively averages the input pulse train to produce a CW signal.

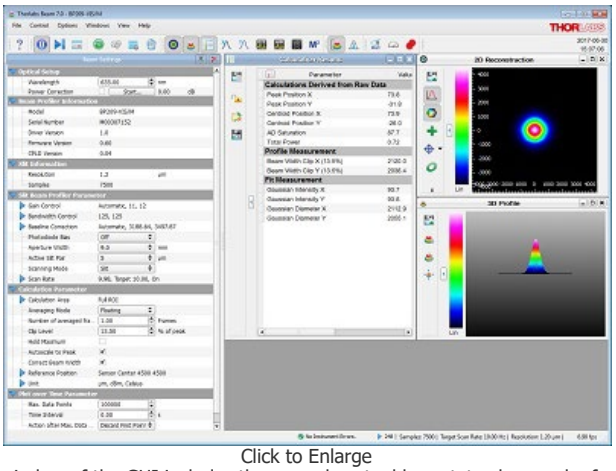
When pulse rates are lower, on the order of 50 kHz and less, configure the Scan Rate setting in the software to achieve optimal measurements. As the scan rate can be set between 1.5 Hz and 20 Hz, it is frequently not possible to set the scan rate to be as fast as the pulse rate. Set the scan rate so that an integer multiple of the scan rate is slightly different than the pulse rate. Then, perform the measurement with the Hold Maximum function enabled. A set of scans are performed, and the software accumulates and averages the measured peak intensities in the scan set. When the pulse rate is fast enough for more than one pulse to be measured during a single scan, the software will accumulate and average the peak intensities of all the measured pulse segments. The reported beam profile is the final average of the set of measurements. Setting the integer multiple of the scan rate to differ slightly from the pulse rate ensures that each scan measures a different portion of the beam profile; the set of scans should include measurements of all segments of the beam profile.

USER INTERFACE

Thorlabs Beam Software for the BP209 Beam Profilers

- GUI with Adjustable Layout: Windows with Different Measurement Results can be Rearranged and Resized within the Workspace
- 2D and 3D Views of the Beam Profile
  - Selectable Overlays such as Peak, Centroid, and Cut Profiles
  - 3D View is Fully Rotatable
- M^2 and Divergence Measurements Compliant with ISO 11146
- Data Export:

Main Window



Click to Enlarge

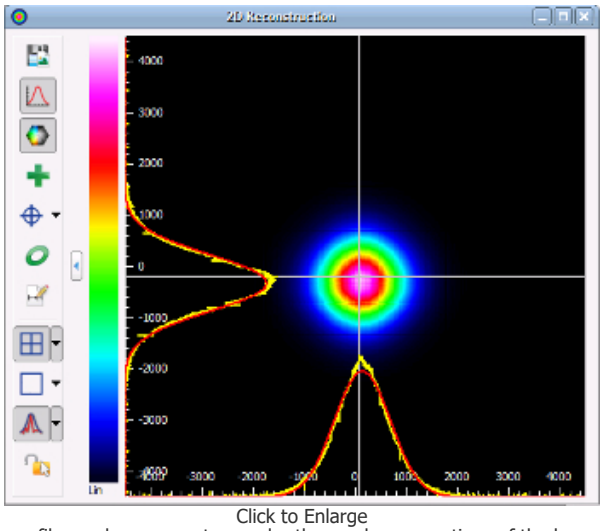
The main window of the GUI includes the menu bar, tool bar, status bar, and a frame where several windows can be displayed. This version of the Main Window includes several panels: Beam Settings, Calculation Results, 2D Reconstruction, and 3D Profile. The Beam Settings Panel displays all important information in a single location; this panel can be unpinned from the main window and moved to a second location, such as another monitor.

    - Results can be Exported from Windows in Different Formats
    - Sequential Saving of Long Term Test Data
- Pass/Fail Tests with Customizable, Lockable and Saveable Pass/Fail Parameters
- Power Correction Available for Absolute Power Measurements
- Supports TSP01 for Temperature Logging During Long-Term Measurements

Thorlabs' Scanning Slit Beam Profilers, Camera Beam Profilers, and M² Measurement Systems all use the Thorlabs Beam software package. The screenshots below highlight key features and measurement modes that can be used with our scanning slit beam profilers, including 2D reconstructions of the beam profile and measurements of the beam stability and position. If an M² Extension Set (available below) is added to the system, the software also enables M² and beam divergence measurements.

The latest version of the Beam software package can be downloaded from the *Software* tab.

2D Reconstruction of the Beam Profile



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Slit beam profilers only measure two real orthogonal cross sections of the beam (i.e., the beam profile in X and Y). Assuming a Gaussian-like beam profile, the Beam software package can create a 2D reconstruction of the beam profile from the two cross sections, seen in the screenshot above. Buttons along the side allow users to save the image, show or hide the x and y scales, mark the centroid or peak position, and display an approximated Beam Ellipse superimposed on the image.

Calculation Results

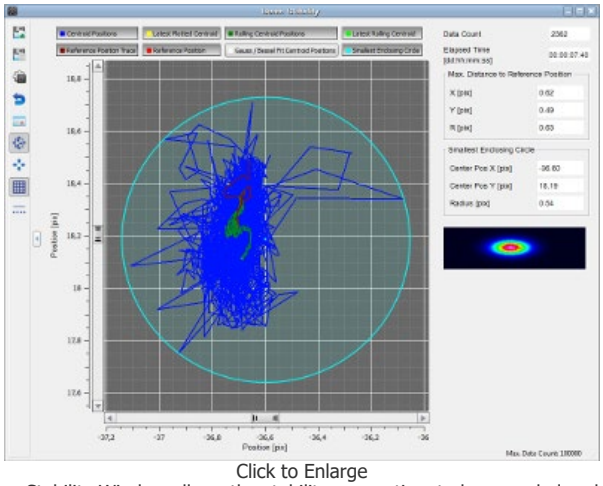
Click to Enlarge

Click to Enlarge

The Calculation Results window (left) displays the results of calculations performed by the software, including beam width, centroid and peak positions, power, ellipticity, and fits of the beam profile. This

panel also includes a Pass/Fail test. For each parameter, a minimum or maximum can be set as criteria. After the calculations are complete, the user can save them in .txt, csv, or .xls format (screenshot to the right). In addition to saving single measurement results, diagrams, and device data, the software can automatically sequentially save this information for a series of measurements.

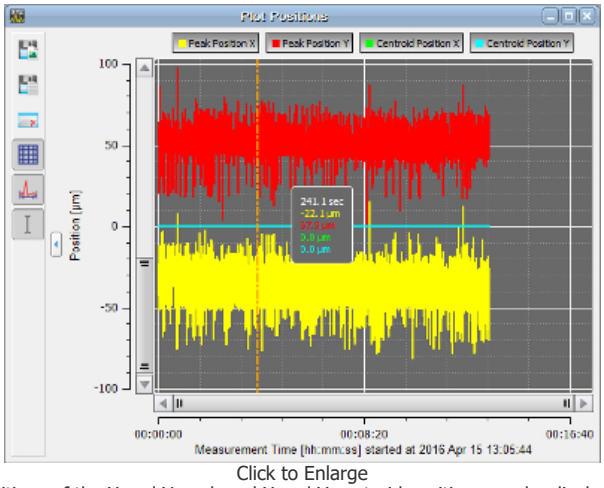
Beam Stability



Click to Enlarge

The Beam Stability Window allows the stability versus time to be recorded and viewed. Display options include the Centroid Positions, Latest Plotted Centroid, Rolling Centroid Positions, Reference Positions, and Smallest Enclosing Circle.

Plot Centroid and Peak Positions



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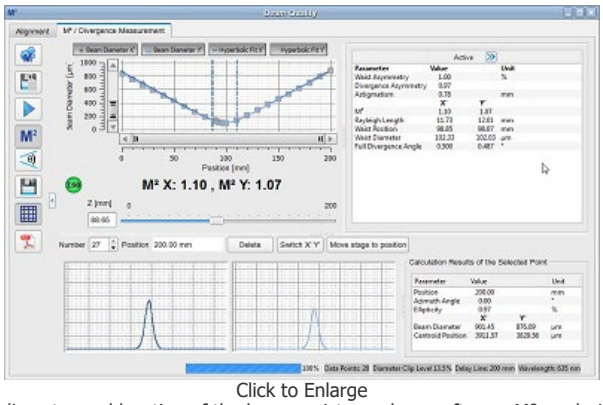
The positions of the X and Y peak and X and Y centroid positions can be displayed as a function of time in this window.

M^2 Measurements



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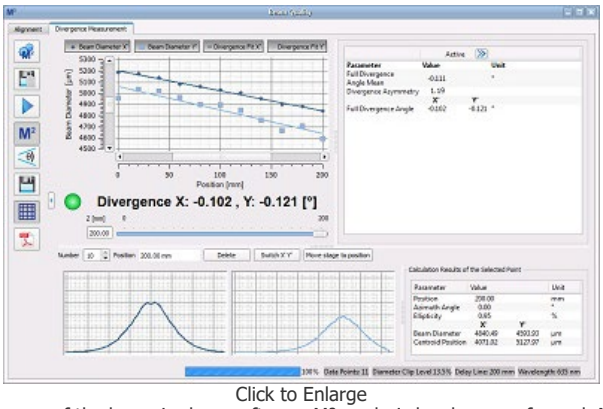
The beam diameter and location of the beam waist are shown after an M^2 analysis has been performed. Note: This functionality is only enabled when one of the M^2 analysis systems is connected to the PC.

Convergence / Divergence Measurements



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The divergence of the beam is shown after an M² analysis has been performed. Note: This functionality is only enabled when one of the M² analysis systems is connected to the PC.

S O F T W A R E

Software Packages for Thorlabs' Beam Profilers

The Beam software package can be downloaded by clicking on the Software button below. The software download page also offers programming reference notes for interfacing with our beam profilers using LabVIEW™, Visual C++, Visual C#, and Visual Basic. Please see the *Programming Reference* tab on the software download page for more information and download links.

Features

- Settings Panel Displays All Important Parameters in a Central Location
- Customizable Calculation Results
  - Measured Parameters can be Individually Hidden
  - Adjustable Row Heights
  - Enhanced Beam Stability Window Measures and Displays the Smallest Enclosing Circle Around the Centroid Point Cloud
- Alignment Wizard to Aid in Correctly Aligning the M2MS M^2 Measurement Systems
- Language Settings of English, German, or Chinese

System Requirements		
Operating System		Windows® 7 (32 Bit), 7 x64 Edition (64 Bit) 8.1 (32 Bit), 8.1 x64 Edition (64 Bit), 10 (32 Bit), or 10 x64 Edition (64 Bit)
Connectivity		USB 2.0 High Speed Port
Monitor Resolution		1024 x 758 Pixel (Min), ≥16 Bit Color Depth
Processor (CPU)	Minimum	Pentium 4 (2.6 GHz Min), Intel or A64 3000+ AMD (3.0 GHz Min)
	Recommended	Intel Core 2 i5 or AMD Ryzen 5 (3.0 GHz Min)
Memory (RAM)	Minimum	4.0 GB RAM
	Recommended	8.0 GB RAM
Graphics Adapter	Required	OpenGL (Specification GLX 1.3 Up)
	Minimum	Radeon: X100 Series ≥X850, X1000 Series ≥X1600, HD Series ≥2400; Geforce: 7 Series ≥7600, 8 Series ≥ 8500, 9 Series ≥9600; Quadro: FX Series ≥FX770M
	Recommended	Radeon: HD Series ≥7000; Geforce: GTX Series ≥500;

Software

Version 8.0.5157.366 (October 14, 2021)

Standard full version of software package for 32-bit and 64-bit Windows with driver and graphical user interface for operating the device in standard applications.

Software

Firmware Update for Scanning Slit Beam Profilers

Below is a link to a firmware update for Thorlabs scanning slit beam profilers to correct an error regarding hardware and firmware compatibility.

Firmware Update

Version 1.3 (September 29, 2020)

Click on the link below to download the latest firmware. The link includes instructions for installing the firmware update and necessary drivers.

Firmware Updates

SHIPPING LIST

Each Beam Profiler Comes with the Following Parts:

- BP209 Series Beam Profiler Head with Dust Cover
- High-Speed USB 2.0 A to Mini-B Connection Cable, 3.0 m
- Quick Start Guide

Scanning Slit Optical Beam Profilers

Part Number	Description	Price	Availability
BP209-VIS/M	Dual Scanning Slit Beam Profiler, 200 - 1100 nm, Ø2.5 µm - Ø9 mm, Metric	$4,482.14	Today
BP209-IR/M	Dual Scanning Slit Beam Profiler, 900 - 1700 nm, Ø2.5 µm - Ø9 mm, Metric	$5,090.28	Lead Time
BP209-IR2/M	Dual Scanning Slit Beam Profiler, 900 - 2700 nm, Ø2.5 µm - Ø9 mm, Metric	$6,895.85	Lead Time
BP209-VIS	Dual Scanning Slit Beam Profiler, 200 - 1100 nm, Ø2.5 µm - Ø9 mm	$4,482.14	Today
BP209-IR	Dual Scanning Slit Beam Profiler, 900 - 1700 nm, Ø2.5 µm - Ø9 mm	$5,090.28	Lead Time
BP209-IR2	Dual Scanning Slit Beam Profiler, 900 - 2700 nm, Ø2.5 µm - Ø9 mm	$6,895.85	Today

M² Measurement Extension Sets

- Combine with BP209 Scanning Slit Beam Profilers to Build Complete M^2 Measurement System
- Mirrors for the 250 - 600 nm or 400 - 2700 nm Range
- Mounting Adapters for BC207 Camera and BP209 Scanning Slit Beam Profilers
- Includes an Alignment Laser

These extension sets are designed to convert Thorlabs' Camera or Scanning Slit Beam Profilers into a fully automated, motorized M² measurement system. The M2MS-AL has internal mirrors for wavelengths between 250 - 600 nm and the M2MS has internal mirrors for wavelengths between 400 - 2700 nm. A magnetic mount at the input port allows the included AR-coated lenses (see boxes below) to be easily switched out to optimize the system for your laser source.

The beam profiler and focusing lens remain in a fixed position. For M^2 measurements, the beam path length is varied using a movable retroreflector mounted on a translation stage, which has a translation range of 200 mm and a maximum velocity of 500 mm/s.

Each extension kit ships with a Class 1 alignment laser.

The side of the M² measurement system features an integrated USB 2.0 hub, which has ports for the slit beam profiler, one other device such as the TSP01 USB temperature and humidity controller, and a mini USB output connection to a PC. The translation stage inside of the system also communicates with the computer through this hub. The system is controlled via the Thorlabs Beam software package, which is also use to control our beam profilers (see the *Software* tab), which enables accurate measurements of a variety

Item #		M2MS-AL	M2MS
Wavelength Range		250 - 600 nm[a]	400 - 2700 nm[a]
Beam Profiler Compatibility[b]		BC207UV(/M) BP209-VIS(/M)	BC207VIS(/M) BP209-VIS(/M) BP209-IR(/M) BP209-IR2(/M)
Internal Translation Stage	Travel Range	100 mm	
	Velocity (Max)	500 mm/s	
	Effective Translation Range	200 mm (Total) ±100 mm (from Focal Point)	
Lens Focal Length		250 mm	
Optical Axis Height		70 mm (Without Additional Feet)	
M² Measurement Range		>1.0 (No Upper Limit)	
Typical M² Accuracy		±5% (Depends on Optics and Alignment)	
Minimum Detectable Divergence Angle		<0.1 mrad	
Applicable Light Sources		CW, Pulsed[a]	
Typical Measurement Time		15 - 30 s (Depends on Beam Shape and Settings)	
General Specifications			

of beam-related parameters.

The housing of the M^2 measurement rests on four feet at the corners created by a 0.5 mm deep relief cut in the base. A set of RDF1 rubber damping feet are included. Five M6 taps allow for the installion of four damping feet with one near each corner or in a configuration using three damping feet.

More information about these complete M² measurement systems can be found here.

Size	300 mm x 175 mm x 109 mm (Without Beam Profiler)
Weight	4.2 kg (Without Beam Profiler)

a. Depending on the beam profiler used with the system.
b. The previous-generation BC106x and BP10x beam profilers are also compatible with the M2MS systems. Contact Tech Support to purchase the appropriate mounting adapter for the BC106 profilers.

Lenses Included with M2MS-AL*

Lenses with f = 250 mm Mounted in CXY1QF Quick Release Plate:

- LA4158-UV (AR Coated for 245 - 400 nm)
- LA1461-A (AR Coated for 350 - 700 nm)

*Additional lenses for shorter UV wavelengths and the CXY1QF quick release front plate are available separately to enable further customization of the M^2 measurement system.

Lenses Included with M2MS*

Lenses with f = 250 mm Mounted in CXY1QF Quick Release Plate:

- LA1461-A (AR Coated for 350 - 700 nm)
- LA1461-B (AR Coated for 650 - 1050 nm)
- LA1461-C (AR Coated for 1050 - 1700 nm)
- LA5255-D (AR Coated for 1650 - 3000 nm)

*Additional lenses for longer IR wavelengths and the CXY1QF quick release front plate are available separately to enable further customization of the M2 measurement system.

Accessories Included with M2MS-AL and M2MS

- Alignment Laser
- USB 2.0 to Mini B Cable, 3 m
- USB 2.0 to Mini B (Angled), 0.5 m
- 15 V, 3.0 A Power Supply
- 0.05" Hex Key
- 3 mm Balldriver
- 4 Rail Clamps
- 6 M4 Cap Screws

Part Number	Description	Price	Availability
M2MS-AL	**M² Measurement System Extension Set, 250 - 600 nm**	**$6,211.35**	**Lead Time**
M2MS	**M² Measurement System Extension Set, 400 - 2700 nm**	**$6,211.35**	**Lead Time**