PHOTON Inc.
Precision Beam Profiling

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Real-Time M^2 Measurements

ModeScan Model 1780

The ModeScan Model 1780 is a laser beam profiling instrument that measures the M^2 Beam Propagation Ratio and all associated ISO 11146 parameters instantaneously in **real time** at video rates to over 20Hz. The measurement technique, patented by Photon Inc., uses 10 reflective surfaces to form simultaneous images of the propagating beam at 10 locations on a Model 2512 CCD array camera. With all 10 measurement positions acquired at once, the instrument is suitable for measurement of both CW and pulsed lasers down to single-shot rates. Beam diameters are obtained with NIST-traceable accuracy to better than 2% using the Photon Model 2512 12-bit FireWire BeamPro. This translates to M^2 measurements with accuracy to better than 4%. The FireWire system operates under Photon's renowned BeamPro Acquisition and Analysis Software in Microsoft Windows. The compactness of the system and the IEEE 1394 "FireWire" interface offers enhanced ease-of-use and portability. The ability to operate in any orientation allows for easy placement on any optical bench and saves valuable bench space.

Features

- IEEE 1394 (FireWire) connectivity
- 12-Bit Dynamic Range
- ½" Video Format
- External Asynchronous Trigger and Software Trigger
- Exposure and Gain Control
- Single shot, pulsed, or continuous wave operation
- Photon FireWire BeamPro Acquisition and Analysis Software stand-alone GUI with M^2 Analysis
- ActiveX Automation Interface
- Small form factor (62mm H × 140mm W × 210mm L) + Gimbal Mount
- Cover glass removed to eliminate fringes
- 2% Beam Diameter Accuracy
- 4% M^2 Accuracy

The CCD is sensitive from ~250nm to 1100nm wavelengths. The standard configuration is supplied with a glass OD 2.8 C-mount neutral density filter for wavelengths >380nm, and an OD 3.0 Fused Silica Inconel neutral density filter for wavelengths <380nm. Because of the limited usefulness of exposure control with pulsed lasers, the Photon Inc. Model ATP is recommended for use with pulsed lasers with repetition rate <~10kHz and wavelength >380nm. For pulsed lasers with wavelength <380nm, a variable UV filter or a combination of UV filters will generally be required.

ISO 11146 Standard M² Beam Parameters

- Beam Propagation Ratio M^2
- Divergence
- Beam Waist Diameter
- Beam Waist Location
- Rayleigh Length
- Major and Minor axes
- Astigmatism

FireWire BeamPro Acquisition and Analysis Software

The ModeScan 1780 operates under the FireWire BeamPro Acquisition and Analysis Software. The FireWire BeamPro Software was written specifically for Microsoft Windows XP Professional* or Microsoft Windows 2000 Professional* and takes full advantage of the menu driven, multi-windowing environment. The software provides quantitative measurement of numerous beam spatial characteristics in accordance with the ISO 13694 standard and M^2 parameters according to the ISO 11146 standard. The software operates in 2 modes: the M^2 Beam Propagation mode and the standard Beam Profiling mode. The M^2 Beam Propagation mode includes a live Video window for displaying the 10 beam spots, a Measurement view showing the beam caustics, and the Beam Statistics view, a tabular summary for the M^2 parameters and beam diameters with Pass/Fail analysis. Time Statistics views with strip chart time displays summary statistics—overlays are also available—and a Notes view for entering text. In the standard mode, all the features for beam analysis are available for closer inspection of a single beam. Additional window are the Profiles, 2D Topographic, 3D, and the Pointing Views.

For data display and visualization, the user can arrange and size these multiple windows as required. These may contain, for example as shown in figure 1, the Video, Measurement, and Beam Statistics views. Such custom-configured instrument screens with multiple views can be saved as configuration files for repeated use.

Data can be saved as program files, or exported to spreadsheets, math and statistical analysis programs and process/instrumentation control programs by logging to files or COM ports, or by sharing using ActiveX Automation.

Software Window Views for Data Display and Visualization

- M^2 Beam Measurement Caustics
- Video
- Dual Aperture Profiles
- Beam Statistics
- 3D Profile View
- 2D Topographic View
- Up to 15 Time Statistics Charts
- Pointing
- Notes

PC Specifications

- 1.8GHz or faster Pentium IV Processor
- Windows XP Professional SP1 or Windows 2000 Professional SP3 Operating System
- OHCI compliant IEEE 1394a (FireWire Port): Powered port required
- 512 MB of RAM
- CD-ROM Drive
- 30MB free space on hard disk
- SVGA display monitor
- 64MB Color SVGA graphics card
- Mouse or other pointing device
- Keyboard
- Writeable CD recommended for data archiving

*Vista Operating System not supported

ModeScan Model 1780 System Specifications

Specification	Model 1780
Sensor:	Si CCD 1/2" Format
Wavelength:	380nm–1100nm (Standard configuration with OD 2.8 filter) 190nm–1100nm (Sensor only)
Pixel Array:	780 (H) × 580 (V)
Pixel Size:	8.3µm × 8.3µm
Array Dimension:	6.49mm × 4.83mm
Scanning Mode:	Progressive
A / D Conversion:	12 Bit
Signal to Noise Ratio (maximum)	58.4dB
Maximum Frame Rate:	35.8fps (full frame @ full resolution)
Exposure range:	20µs–27.64ms (Software selectable via 1394 bus)
Gain:	0 – 12dB (Software selectable via 1394 bus)
Trigger:	Internal or External (Software selectable)
External Trigger Specifications:	5V ± 1V @ 10mA ± 5mA (Positive transition)
Trigger Connector:	10 pin RJ-45 Jack
Trigger Cable:	10 pin RJ-45 to BNC
Interface:	IEEE 1394a (FireWire)
Cable Length:	1.8m (standard)
Supply Voltage:	+8V - +36V DC (+12V DC nominal), <1% ripple (supplied via IEEE 1394 cable); requires external powered hub with laptop PCs
Supply Power:	3.5W max @ 12V DC (typical)
Filter/Lens Mount:	C-mount (1"-32 tpi)
Operating temp:	O° - +50°C (+32°-112F)
Humidity:	20%-80%, relative, non-condensing
Conformity:	CE; FCC; RoHS and WEEE
Mounting:	Gimbal Mount on ½" post; 12mm Metric post optional
Dimensions:	62mm H × 140mm W × 210mm L + Gimbal Mount
Weight	~ 1.4kg
CCD Cover Glass	Removed to eliminate interference fringes
Beam Splitters	Fused Silica: <20/10 Scratch Dig, l/10 Flatness
Test Lenses	
UV 250-450nm	200mm fl Fused Silica/250-450nm AR coated standard; other fl's optional
Visible 450-650nm	200mm fl BK7/450-650nm AR coated standard; other fl's optional
VIS-NIR 650-950nm	200mm fl BK7/650-950nm AR coated standard; other fl's optional
NIR 950-1100nm	200mm fl BK7/950-1600nm AR coated standard; other fl's optional
Fixed Attenuator	
Visible-NIR	OD 2.8 Absorbing Glass >380nm
UV	OD 3.0 Fused Silica Inconel 250-450nm

All Specifications are subject to change without notice.

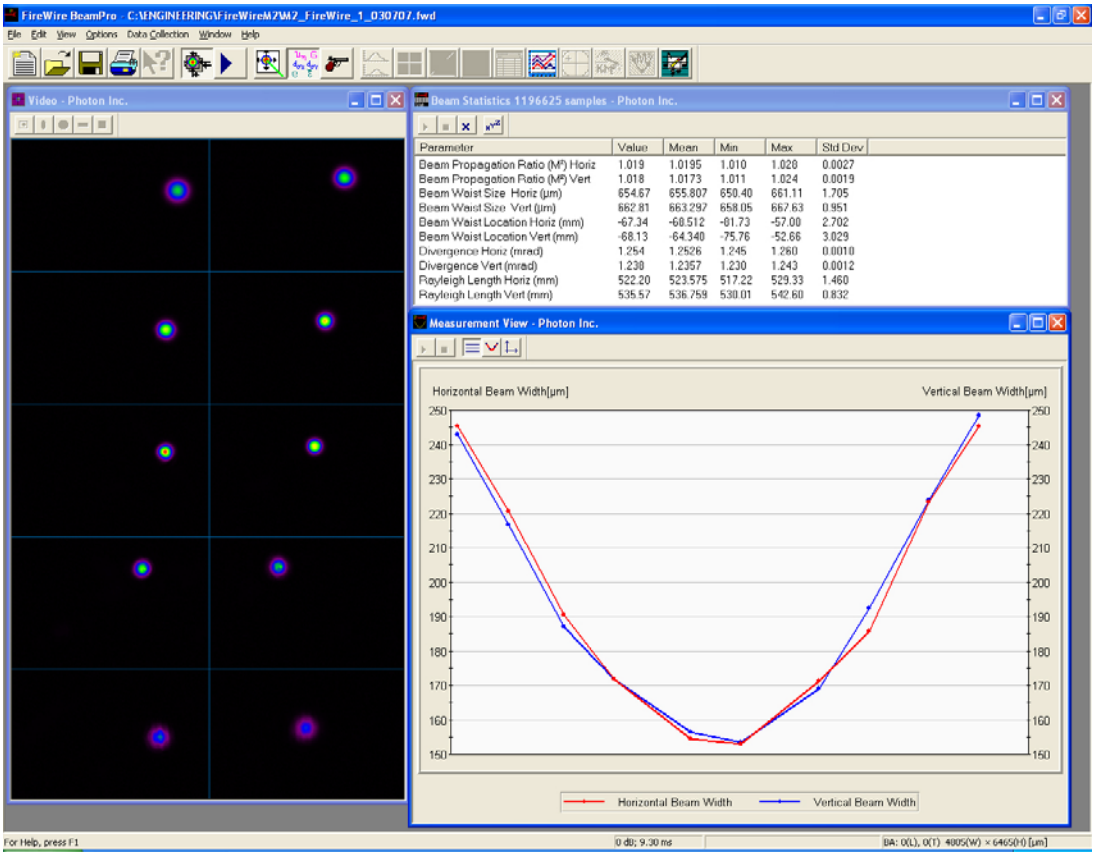

Figure 1. Sample software GUI showing 10 beam spots in the Video view, ISO Standard Beam Propagation parameters in the Beam Statistics view, and the beam caustic in the Measurement View

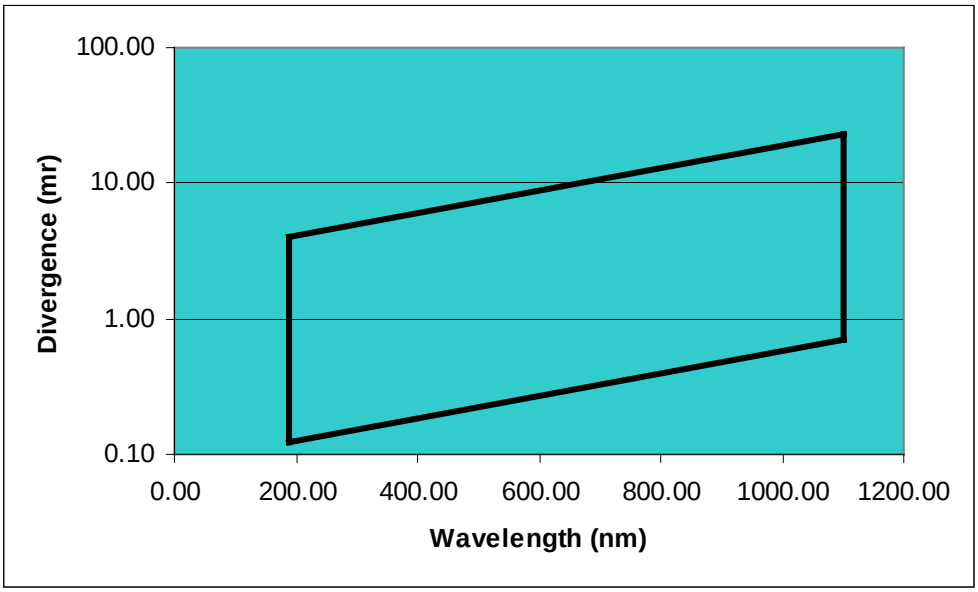

Figure 2. Measurement Range for ModeScan 1780