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Light Analysis : Energy & Spectrum

TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

Light Analysis : Energy & Spectrum

Power Meters and PC Interfaces Overview

Ophir power meters and PC interfaces work on the smart plug principle. This means that almost any Ophir power meter or PC interface can work – plug and play – with almost any of the wide range of Ophir sensors. Ophir power meters are also the most sensitive, lowest noise, most precise calibration units on the market thus giving the untmost performance from our smart sensors.

As for ease of use, only Ophir power meters have smart keys to give the easiest and most convenient user interface. The units also come with a versatile range of software to use seamlessly either with the Ophir software or the user's own.

Photodiode Sensors
Powers pW to Watts

Thermal Sensors
Powers mW to kW and single shot energy

Pyroelectric Sensors
Energies pJ to Joules
Rep rates to 25kHz

Power Meters

with USB/RS232

Computer Interfaces

with USB/Bluetooth

StarBright
added features

Vega
color

Nova II
general

Juno
compact

Pulsar
1, 2, 4 channels

StarLite
basic

Nova
compact

Laserstar
2 channel

USB
Interface basic

Quasar
wireless

Software Solutions
StarLab, LabVIEW, StarCom ActiveX & COM Object Interfaces

StarLab software

LabVIEW

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Laser Power Meter

Model No : LP1

* Wide optical power measurement range
* Silicon photodiode
* Sensor can be all neatly contained and protected within the folding case
* Max / Min hold
* Auto power save (30min.)
* 500mm sensor cord

Wavelength customization

The standard LP1 is calibrated at 633 nm but can also read any other wavelength in the 400 ~ 1100 nm range using a chart inside the case cover. We can calibrate directly to any other 400 ~ 1100 nm wavelength for special orders. Pocket size meter but with high accuracy and wide ranges. Sensor / Probes can be all neatly contained and protected within the folding case. Easy to carry in a shirt pocket.

Specifications

Optical Sensor	Si Photodiode(Φ9mm)
Wavelength Range	400nm ~ 1100nm
Wavelength	633nm (He-Ne Laser) reference wavelength Convert by a table of spectral Sensitivity characteristic (representing value)
Display	Numeric: 3999 full scale,Bargraph : 42-segment
Sampling Rate	Approx. 2 times/sec. for numeral display. Approx. 20 times/sec. for bargraph.
Measuring Range	40.00u / 400.0u / 4.000m / 40.00mW
Accuracy	±5% (1mW : 4mW range , 633nm) 23°C±2°C
Battery	LR44 x 2
Power Consumption	Approx.6mW
Operating Temperature	0°C ~ 40°C max.80% RH no condensation
Storage Temperature	-10°C ~ 50°C max. 80% RH no condensation
Size/Mass	H117 x W76 x D18mm/approx. 120g Sensor probe: H84 x W16 x D10mm
Standard Accessories Included	Instruction manual

Handheld Laser Power Meter

*** 0.5μW to 1W * 400nm to 1064nm * ±5% Accuracy**

This laser power meter is truly a technological breakthrough for users of low power CW lasers. This is the most versatile, compact, and a ordable laser power meter available on the market today. Controls & indicators: power/ wavelength display select switch, wavelength select increment and decrement buttons, sample/hold button, 3 digit LCD with units indicator, attenuator position indicator, attenuator position control slide and over-range tone generator. Automatic functions: power range, wavelength correction, peak sample & hold, shut-o, over-range detect, and attenuator position detect. Additional features include an over-range indication, pocket clip, and storage case. Note: Battery is not replaceable.

Spectral Response	400 - 1064nm
Accuracy	8%
Max. CW Power*	10mW; 1W with built-in attenuator
Max. CW Power Density*	0.5W/cm^2, 30W/cm^2 with attenuator
Min. Full Scale Power	9.99 μW
Min. Power Resolution	0.01 μW
Min. Detectable Power	0.5 μW
Aperture Size	8.0mm
Measurement Display	3 digit LCD with power unit indicator
Built-in Range Step Attenuator	1mm thick; NG-10 Schott filter glass
Wavelength Selection Display	400 to 999 (for 400 to 999nm) 000 to 064 (for 1000 to 1064nm)
Peak Sample Time	2 sec.
Meas. Hold Display Time	10 sec.
Battery Life	180,000 samples at 12 sec/sample
Size (Max. Dimensions)	6.59"L x 0.92"W x 0.78"T
Weight	1.54oz.
Stock No.	UNI54018

Standard Photodiode Sensors

50pW to 3W

Features

* Very large dynamic range
* Swivel mount for hard to measure places
* Comes with filter in / filter out options
* Patented automatic background subtraction
* Fiber optic adapters available

PD300 with filter off

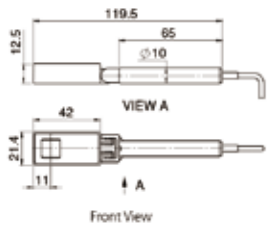
PD300 with filter installed

PD300-TP Mounted on stand

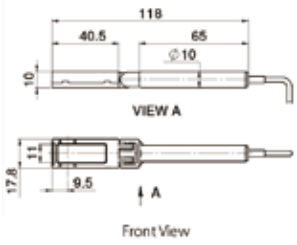
Model / Use	PD300 General			PD300-1W Powers to 1W			PD300-3W Powers to 3W			PD300-TP Thin profile for tight fit		
Detector Type	silicon			silicon			silicon			silicon		
Aperture	10x10mm			10x10mm			10x10mm			10x10mm		
Filter mode	Filter out		Filter in	Filter out		Filter in	Filter out		Filter in	Filter out		Filter in
Spectral Range nm	350-1100		430 - 1100	350 - 1100		430 - 1100	350 - 1100		430 - 1100	350 - 1100		400 - 1100
Power Range	30mW to 500pW		300mW to 200µW	30mW to 500pW		1W to 200µW	100mW to 5nW		3W to 200µW	3mW to 50pW		1W to 20µW
Power Scales	30mW to 30nW and dBm		300mW to 30mW and dBm	30mW to 30nW and dBm		1W to 30mW and dBm	100mW to 300nW and dBm		3W to 30mW and dBm	3mW to 3nW and dBm		1W to 3mW and dBm
Resolution nW	0.01		NA	0.01		NA	0.1		NA	0.001		1
	nm	mW	mW	nm	mW	mW	nm	mW	mW	nm	mW	mW
Maximum Power vs. Wavelength	<488	30	300	<488	30	1000	<488	100	3000	350-400	3	NA
	633	20	300	633	20	1000	633	100	3000	400-500	3	1000
	670	13	200	670	13	1000	670	100	2000	600	2.5	1000
	790	10	100	790	10	600	790	100	1200	700	2	500
	904	10	100	904	10	700	904	100	1200	800-950	1.5	300
	1064	25	250	1064	25	1000	1064	100	2200	1064	3	500
Accuracy (including errors due to temp. variations)% error vs Wavelength nm	±10 360 - 400 ±3 400 - 950 ±5 950 - 1100		NA ±5 430 - 950 ±7 950 - 1100	±10 360 - 400 ±3 400 - 950 ±5 950 - 1100		NA ±5 430 - 950 ±7 950 - 1100	±10 360-400 ±3 400 - 950 ±5 950 - 1100		NA ±5 430 - 950 ±7 950 - 1100	±7 350 - 400 ±3 400 - 950 ±5 950 - 1100		NA ±5 400-950 ±7 950-1100
Damage Threshold /cm²	10		50	10		10[(a)]	10		100	10		50
Max Pulse Energy µJ	2		20	2		100	20		500	1		100
Noise Level for filter out pW	20			20			200			±2		
Response Time with Meter s	0.2			0.2			0.2			0.2		
Beam Position Dependence	±2%			±2%			±2%		±3%	±2%		
Background Subtraction	95-98% of background is cancelled automatically under normal room						NA			NA		
Fiber Adapters Available	SMA, FC, ST, SC			SMA, FC, ST, SC			SMA, FC, ST, SC			NA		
Version							V1					
Part Number	7Z02410			7Z02411A			7Z02426			7Z02424		

Note: (a) Maximum power density above which sensor may not read correctly. There will be no permanent damage until 50W/cm²

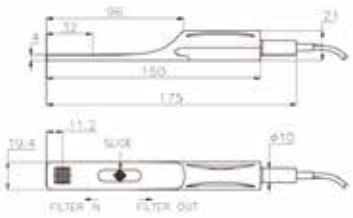
PD300/ PD300-1W filter installed



PD300/ PD300-1W filter off



PD300-TP



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Standard Photodiode Sensors

10pW to 300mW

Features

* Spectral range including UV and IR
* Very large dynamic range
* Swivel mount for hard to measure places
* Comes with filter in / filter out options
* Fiber optic adapters available

PD300 with filter off

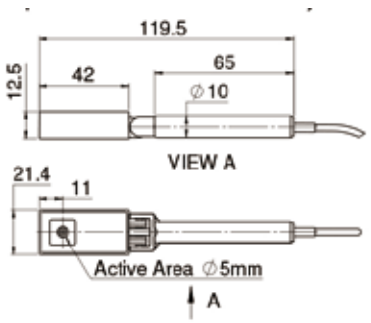
PD300 with filter installed

PD300-IRG with no fiber input

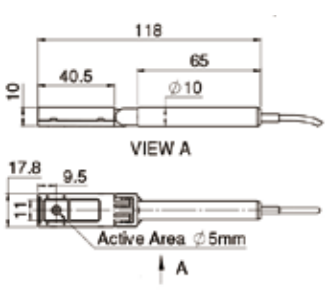
PD300-IRG with fiber input

Model Use	PD300-UV/ PD300-UV-193 Lowest powers from 200-1100nm			PD300-IR Low powers from 700-1800nm			PD300-IRG Telecom wavelength fiber and free space measurements		
Detector Type	silicon			germanium			InGaAs		
Aperture	10x10mm			φ5mm			φ5mm for free space beams		
Filter mode	Filter out		Filter in	Filter out		Filter in	Filter out		Filter in
Spectral Range nm	200 - 1100		220 - 1100	700 - 1800		700 - 1800	800 - 1700		950 - 1700
Power Range	3mW to 20pW		300mW to 2µW	30mW to 5nW		300mW to 200µW	800µW to 10pW		150mW to 20µW
Power Scales	3mW to 3nW and dBm		300mW to 300µW and dBm	30mW to 30nW and dBm		300mW to30mW and dBm	800 µW to 800pW and dBm		300mW to 3mW and dBm
Resolution nW	0.001		100	0.01		NA	0.0001		1
Maximum Power vs. Wavelength	nm	mW	mW	nm	mW	mW	nm	mW	mW
	250 – 350	3	300	800	12	120	<1000	0.8	100
	400	3	300	1000 - 1300	30	300	1100	0.8	30
	600	3	300	1400	30	250	1200	0.8	50
	800-950	2.5	150	1500	25	80	>1300	0.8	150
	1064	3	300	1600	30	100			
				1800	30	300			
Accuracy (including errors due to temp. variations) % error vs Wavelength nm	±6 200 - 270 ±3 270 - 950 ±5 950 - 1100		±10 220 - 400 ±5 400 - 950 ±7 950 - 1100	±5 700 - 900 ±4 900 - 1700 ±7 1700 - 1800		±7 700 - 900 ±6 900 - 1700 ±9 1700 - 1800	±3 1000 - 1650 ±5 <1000&> 1650		±6 1000 - 1650 ±8 <1000 &1650
Damage Threshold W/cm²	10		50	10		50	5		50
Max Pulse Energy µJ	0.4		15	0.3		3	1		100
Noise Level for filter out pW	±1			200			±300fW at 1550 nm and 1s average		
Response Time with Meter s	0.2			0.2			0.2		
Beam Position Dependence	±2%			±2%			±2%		
Fiber Adapters Available	SC, ST, FC, SMA			SC, ST, FC, SMA			FC, FC/APC, SMA		
Version							V1		
Part Number	PD300-UV: 7Z02413 PD300-UV-193: 7Z02413A (same as above with additionaly calibration point at 193nm accuracy ±6%)			7Z02412			7Z02402		

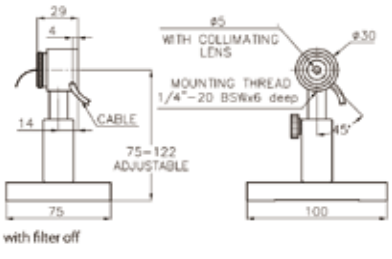
PD300-UV/PD300-IR filter installed (φ5mm for PD300-IR only)



PD300-UV/PD300-IR filter off (φ5mm for PD300-IR only)



PD300-IRG



Round Photodiode Sensors

20pW to 3W

Features

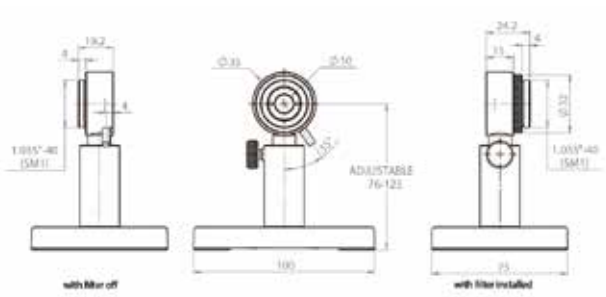
* Round geometry for easy centering
* Threaded to fit standard SM1 bench equipment
* Same performance as standard PD300 sensors
* Comes with removable filter as standard
* Fiber optic adapters available

PD300R Filter Off

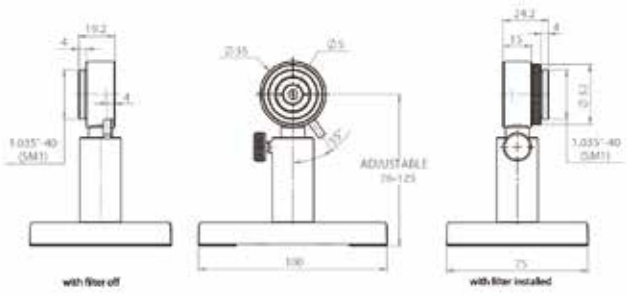
PD300R Filter installed

Model Use	PD300R General			PD300R-3W Powers to 3W			PD300R-UV Lowest powers from 200-1100nm			PD300R-IR IR wavelengths 700-1800nm		
Detector	silicon			silicon			silicon			germanium		
Aperture	φ10mm			φ10mm			φ10mm			φ5mm		
Filter mode	Filter out		Filter in	Filter out		Filter in	Filter out		Filter in	Filter out		Filter in
Spectral Range nm	350 - 1100		430 - 1100	350 - 1100		430 - 1100	200 - 1100		220 - 1100	700 - 1800		700 - 1800
Power Range	30mW to 500pW		300mW to 200µW	100mW to 5nW		3W to 200µW	3mW to 20pW		300mW to 2µW	30mW to 5nW		300mW to 200µW
Power Scales	30mW to 30nW and dBm		300mW to 30mW and dBm	100mW to 300nW and dBm		3W to 30mW and dBm	3mW to 3nW and dBm		300mW to 300µW and dBm	30mW to 30nW and dBm		300mW to 30mW and dBm
Resolution nW	0.01		NA	0.1		NA	0.001		100	0.01		NA
Maximum Power vs. Wavelength	nm	mW	mW	nm	mW	mW	nm	mW	mW	nm	mW	mW
	<488	30	300	<488	100	3000	250 - 350	3	300	800	12	120
	630	20	300	633	100	3000	400	3	300	1000 - 1300	30	300
	670	13	200	670	100	2000	600	3	300	1400	30	250
	790	10	100	790	100	1200	800 - 950	2.5	150	1500	25	80
	904	10	100	904	100	1200	1064	3	30	1600	30	100
	1064	25	250	1064	100	2200				1800	30	300
Accuracy (including errors	±10 360 - 400		NA	±10 360 - 400		NA	±6 200 - 270		±10 220 - 400	±5 700 - 900		±7 700 - 900
due to temp. variations)%	±3 400 - 950		±5 430 - 950	±3 400 - 950		±5 430 - 950	±3 270 - 950		±5 400 - 950	±4 900 - 1700		±6 900 - 1700
error vs Wavelength nm	±5 950 - 1100		±7 950 - 1100	±5 950 - 1100		±7 950 - 1100	±5 950 - 1100		±7 950 - 1100	±7 1700 - 1800		±9 1700 - 1800
Damage Threshold W/cm²	10		50	10		100	10		50	10		50
Max Pulse Energy µJ	2		20	20		500	0.4		15	0.3		3
Noise Level for filter out pW	20			200			±1			200		
Response Time with Meter s	0.2			0.2			0.2			0.2		
Beam Position Dependence	±2%			±3%			±2%			±2%		
Fiber Adapters Available	FC, ST, SC, SMA			FC, ST, SC, SMA			FC, ST, SC, SMA			FC, ST, SC, SMA		
Version												
Part Number	7Z02436			7Z02437			7Z02438			7Z02439		

PD300R/PD300R-3W/PD300R-UV



PD300R-IR



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Special Photodiode Sensors

Features

* PD300-BB for broadband light sources - radiometry(PD300-BB-50mW option up to 50mW)
* PD300-CIE for eye adjusted Lux measurements
* BC20 for measuring scanned beams such as bar code light sources

PD300-BB/ / PD300-BB-50mW

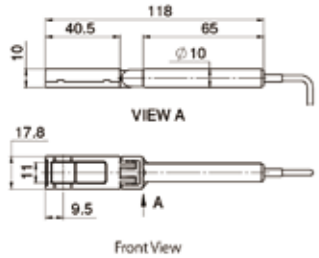
BC20

PD300-CIE

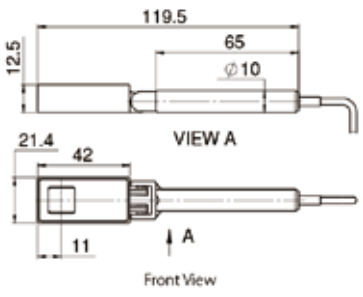
Model Use	PD300-BB Radiometry-broad spectrum	PD300-BB-50mW Same as PD300-BB with removable attenuator for use to 50mW		PD300-CIE [b] Eye adjusted measurement in Lux	BC20 [b] Scanned beams e.g. bar code
Detector Type	Silicon with special filter	Silicon with special filter		Silicon with special filter	Silicon with peak and hold circuit
Aperture	10 x 10mm	10 x 10mm		Active area 2.4 x 2.8mm	10 x 10mm
Spectral Range nm	430 - 1000	430 - 1000		400 - 700	400 - 1100 [c]
Filter Mode		Filter out	Filter in		
Power Range	4mW to 50pW	4mW to 50pW	50mW to 1nW	200kLux to 20 mLux	0.1mW to 20mW
Power Scales	4mW to 8nW and dBm	4mW to 8nW and dBm	50mW to 80nW and dBm	200kLux to 200 mLux	20mW to 2mW
Resolution nW	0.001	0.001	0.01	1 mLux	0.001
Accuracy	Maximum deviation from flat pectrum (See graph)	Maximum deviation from flat spectrum (See graph)		See graph	±3% for >10% of full scale. Deviation from calibration -3% at 30,000 inch/s scan rate on sensor
	±10%	±10%	±12%		
Damage Threshold W/cm²	10	10	100	10	50
Max Pulse Energy µJ	1	1	10	1	NA
Noise Level pW	2	2	30	±1mLux	5µW
Response Time with Meter s	0.2	0.2	0.2	0.2	Two modes of operation: Hold: holds highest reading for 5s then updates. No Hold: updates reading 3 times per second.
Beam Position Dependence	±2% for broadband light sources	±2% for broadband light sources	±3% for broadband light sources	NA – source overfills detector	±2%
Background Subtraction	NA	NA	NA	NA	Background is automatically subtracted from both scanned and static beams.
Fiber Adapters Available	NA	SC, ST, FC, SMA		NA	NA
Version					V1
Part Number	7Z02405	7Z02440		7Z02406	7Z02481 [a]

Notes: (a) Swivel stand for BC20 sensor P/N 1Z09004
(b) The PD300-CIE and BC20 sensors are not fully supported by Ophir PC Interfaces (Juno, USBI, Pulsar and Quasar) or by StarLite Meter.
(c) The User can select up to 5 wavelengths from the spectral range. When used with Nova or LaserStar meters, the sensor will only have the discrete wavelengths 405nm, 633nm, 650nm, 675nm and 780nm

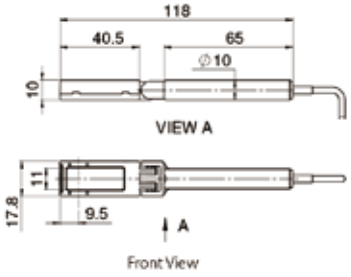
PD300-BB-CIE / PD300-BB / PD300-BB-50mW with filter off



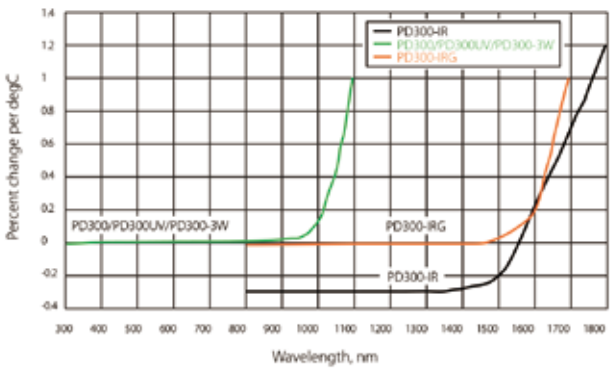
PD300-BB-50mW with filter installed



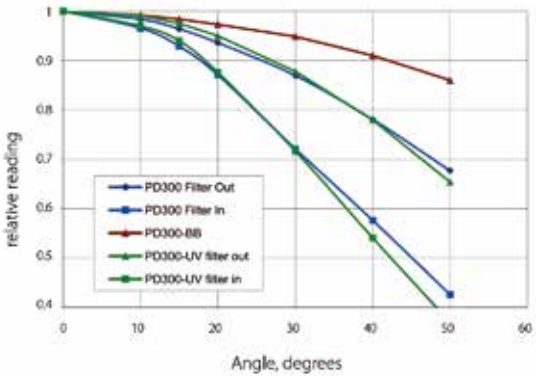
BC20



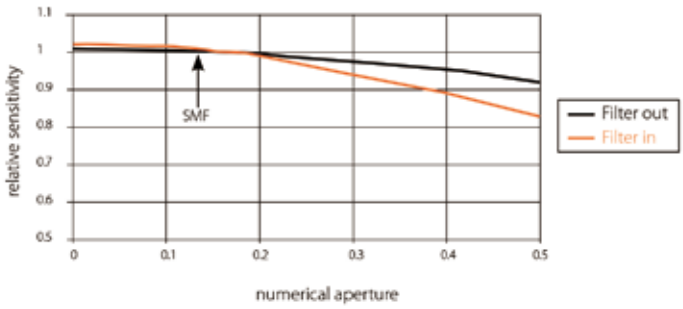
Temperature Coefficient of Sensitivity



PD300 Angle Dependence



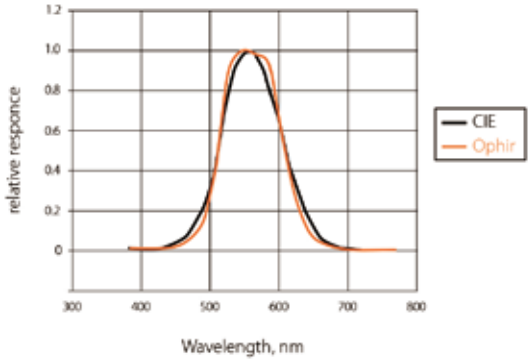
Dependence of Sensitivity on Numerical Aperture (PD300 - IRG)



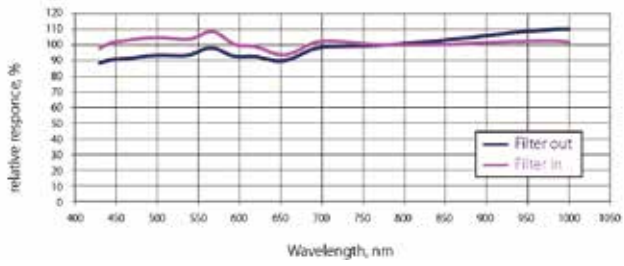
Note:

1. Graph assumes equal intensity into all angles up to maximum N.A.
2. Calibration is done with SMF, N.A. 0.13

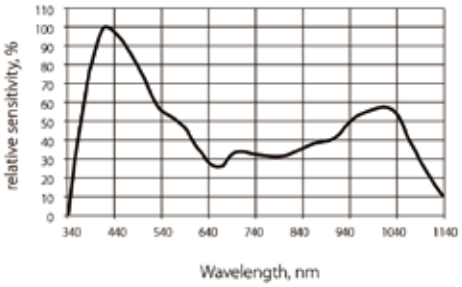
PD300-CIE spectral response vs. CIE curve



Typical Sensitivity Curve of PD300-BB Sensors



Relative Spectral Response of BC20



Graph of the approximate relative spectral response of the BC20 for purpose of interpolation, if the instrument is to be used at a wavelength other than the ones that are factory calibrated

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Fast Photodetector - Model FPS-1

Features

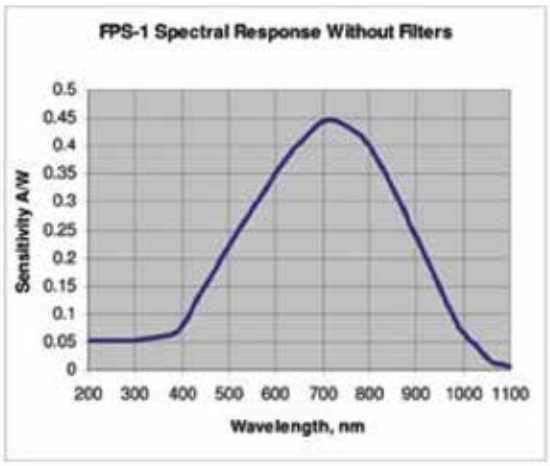
* Fast 1ns response time
* Measure temporal pulse shape of short or long pulses
* Wide spectral range 193 – 1100nm
* Optional attenuators and fiber adapters available
* Battery or wall cube operation

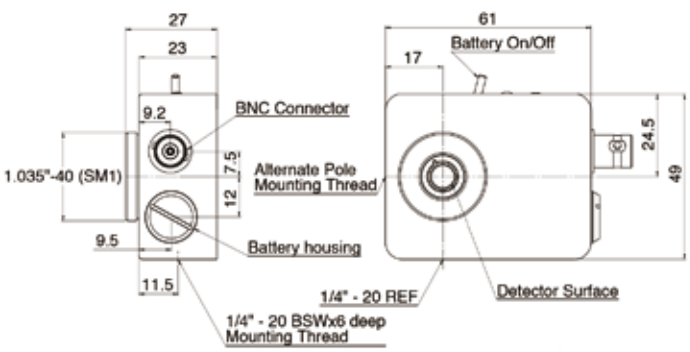
Description

The FPS-1 fast photodetector is a compact easy to use very fast photodetector with wide spectral response. It is used to measure the temporal pulse shape of laser pulses. It has two modes of operation: Into 50Ohm load for ns high peak power pulses and 10kOhm load for longer lower peak power pulses. In order to adjust the input intensity to the level appropriate for the detector, you may scatter the laser light off of a white matt surface and back off till the appropriate intensity is reached. Alternatively, or in addition, you may procure the ND attenuators listed below which may be stacked.

Specifications of the FPS-1 Fast Photodetector

Detector	Silicon PIN photodiode		
Spectral Range	193nm – 1100nm		
Detector Area	0.8mm^2		
Wavelength of Peak Sensitivity	720nm		
Spectral Response	See graph below		
Performance Specs	Into 50Ω load	Into 10kΩ load	
Sensitivity at Peak Wavelength	0.15V for 1W/cm^2 input	60V for 1W/cm^2 input	
Risetime 10 - 90%	1.5ns	3µs	
Maximum Output Voltage	10V		
Power Supply	12V A23 alkaline battery (40 hours lifetime). Also can be operated from 12VDC wall cube power supply. The power supply can be ordered from your local distributor		
Input	Direct beam or from fiber connection.		
Dimensions	See drawing		
Thread	Front flange is threaded with male SM1 thread.		
Sensor Part Number	FPS-1 fast photodiode	7Z02505	
Optional Accessories and P/N	ND1 nom. x10 attenuator	7Z08200	
	ND2 nom. x50 attenuator	7Z08201	
	Fiber adapters	SMA	1G01236
		FC	7Z08229
		SC	7Z08227
		ST	7Z08226
	SM1 to M20 adapter (1 necessary for above adapters and/or attenuators)	1G02259	





LED measurement – UV, VIS, NIR

20pW to 3W

Features

* 20pW to 3W
* 200nm to 1100nm
* Photodiode detectors - spectrally calibrated for LEDs and lasers
* Thermal sensors - power measurement is insensitive to Wavelength
* Fiber or free space input
* Compatible with all Ophir meters, acquisition devices and StarLab PC software

3A-IS

PD300 with filter off

PD300R with filter off

3A

Model Use	3A-IS Compact integrating sphere	PD300-UV Standard photodiode sensor for UV-NIR		PD300R-UV Round photodiode sensor for UV-NIR		3A spectrum response. Thermal sensor.Flat For fiber coupled source
Detector Type	Silicon	Silicon		Silicon		Thermal
Input Port Aperture mm	Φ12	10 x 10		Φ10		Φ 9.5
Filter Mode		Filter out	Filter in	Filter out	Filter in	
Spectral Range µm	0.35 - 1.1	0.2 - 1.1	0.22 - 1.1	0.2 - 1.1	0.22 - 1.1	0.19 - 20
Power Range	1µW - 3W	3mW - 20pW	300mW - 2µW	3mW - 20pW	300mW - 2µW	10µW - 3W
Power Scales	3W to 3µW and dBm	3mW to 3nW and dBm	300mW to 3µW and dBm	3mW to 3nW and dBm	300mW to 300µW and dBm	3W - 300µW
Resolution nW	1	0.001	100	0.001	100	100
Maximum Power	3W	3mW	300mW	3mW	300mW	3W
Accuracy(including error due to temp variations)%Error vs Wavelength nm	±5 350 - 1000 ±10 1000 - 1100	±6 200 - 270 ±3 270 - 950 ±5 950 - 1100	±10 220 - 400 ±5 400 - 950 ±7 950 - 1100	±6 200 - 270 ±3 270 - 950 ±5 950 - 1100	±10 200 - 400 ±5 400 - 950 ±7 950 - 1100	±3%
Damage Threshold W/cm^2	200	10	50	10	50	1000
Max Pulse Energy	5mJ	0.4µJ	15µJ	0.4µJ	15µJ	2J
Noise Level for Filter Out	20nW	1pW		1pW		2µW
Response Time with Meter s	0.2	0.2		0.2		1.8
Beam Position Dependence	N.A.	±2%		±2%		±2%
Linearity with Power +/- %	1	0.5		0.5		1.5
Fiber Adapters Available	SMA[(a)],FC,ST,SC	SMA,FC,ST,SC		SMA,FC,ST,SC		SMA,FC,ST,SC
Weight kg	0.6	0.07		0.11		0.2
Version	V1					
Part Number	7Z02404	7Z02413		7Z02438		7Z02621

Notes: (a)One fiber output port available with output = 2E-4 of input power / mm2 of fiber area.

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Integrating Spheres

Small Dimensions 1.5”

Features

* Integrating sphere for divergent beams
* φ12mm aperture
* For fiber or free space input

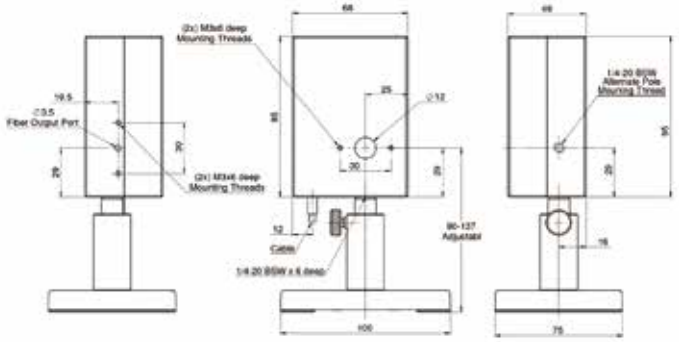
3A-IS

3A-IS-IRG

Model Use	3A-IS Divergent beams to 3W for visible NIR	3A-IS-IRG Divergent beams to 3W for IR
Absorber Type	Si	InGaAs
Input Port Aperture mm	φ 12mm	φ 12mm
Spectral Range µm	0.35 - 1.1	0.8 - 1.7
Power Range	1µW - 3W	1µW - 3W
Power Scales	3W to 3µW and dBm	3W to 3µW and dBm
%Error vs Wavelength nm	±5 350-1000,±10 1000-1100	±5
Linearity with Power +/-%	1	1
Damage Threshold kW/cm^2	0.2 on integrating sphere surface	0.2 on integrating sphere surface
Maximum Pulse Energy mJ	5	5
Power Noise Level nW	20	20
Response Time with Meter s	0.2	0.2
Maximum Beam Divergence	±40 degrees	±40 degrees
Sensitivity to Beam Size and Angle	±2%	±2%
Cooling	convection	convection
Fiber Adapters Available	SC, ST, FC, SMA[(a)]	SC, ST, FC, SMA[(a)]
Weight kg	0.6	0.6
Version	V1	
Part number	7Z02404	7Z02403

Notes: (a) One fiber output port available with output = 2E-4 of input power/mm2 of fiber area.

3A-IS/ 3A-IS-IRG



Integrating Spheres

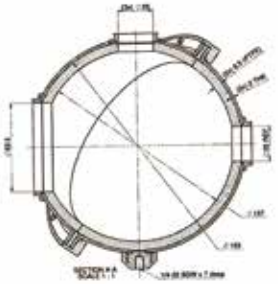
Large Dimensions 5.3”

Features

* 4 port Integrating spheres for collimated and divergent beams
* φ63.5mm (2.5”) aperture
* Fiber or free space input
* Uncalibrated – detectors for user installation

Model	IS6	
Detector	none – see below for detectors	
Spectral Range µm	0.2 – 2.2	
Source Geometry[(a)] (see introduction)	Divergent	Collimated
Input Port Aperture mm	φ63.5 (2.5”)	φ25.4 (1”)
Maximum Beam Divergence	±40deg	NA
Sensitivity to Beam Size and Angle	±2%	±2%
Power Range	Depends on detector – see below	
Damage Threshold kW/cm²	0.2 on integrating sphere surface	
Cooling	Convection	
Weight kg	1.3	
Version		
Part number		
IS6-C For collimated beams (large plug)	7Z02474	
IS6-D For divergent beams (small plug)	7Z02475	

Notes (a) In each configuration, the opposing port is closed with a port plug.



Detectors for IS6

These detectors are inserted into the 1” ports and are not calibrated but are linear and will give an approximate reading when used with Ophir meters and PC interfaces

Detector type Model Use	VIS IS-PD300R-VIS-NC High powers	UV IS-PD300R-UV-NC Low powers	IR IS-PD300R-IR-NC Near infrared	CIE IS-PD300R-CIE-NC Photometry
Type	Si with filters	Si	Ge	Si with CIE filter
Spectral Range µm	430-1100	220-1100	700-1800	400-700
Power range (approx.)	30W to 1µW	1W to 10nW	30W to 30nW	500lm to 100µlm
Noise level nW (approx.)	50	0.4	50	5µlm
Linearity with power ±%	1	1	1	1
Part number	7Z08310U	7Z08311U	7Z08312U	7Z08313U

Accessories for IS6

Accessory	Description	Part Number
Port plugs	Port plugs close ports with matte white reflective integrating sphere material. They eliminate the port from the sphere geometry.	
IS-1” Port plug	White reflectance coated φ25.4mm plug	7Z08280A
IS-2.5” Port plug	White reflectance coated φ63.5mm plug	7Z08283A
Port covers	Port Covers close ports with a black matt surface. They prevent extraneous light from entering the sphere without changing the sphere configuration. These covers can also be used as blanks for making specialized port adapters.	
IS-1” Port cover	Matt black coated φ25.4mm plug	7Z08282A
IS-2.5” Port cover	Matt black coated φ63.5mm plug	7Z08281A
Adapters and reducers	The adapters are black coated and the reducers white coated	
1” SMA fiber adapter	Attaches to the 1” port for SMA fiber input/output	7Z08285
1” FC fiber adapter	Attaches to the 1” port for FC fiber input/output	7Z08286
2.5” to 1” reducer	Attaches to the 2.5” port and turns it into a 1” port	7Z08287
1” to SM1 adapter	Attaches to the 1” port and has a female SM1 thread	7Z08289
1” to C mount adapter	Attaches to the 1” port and has a female C mount thread	7Z08290
1” to C mount reducer	Attaches to the 1” port. Has a male C mount thread and 11mm aperture	7Z08288

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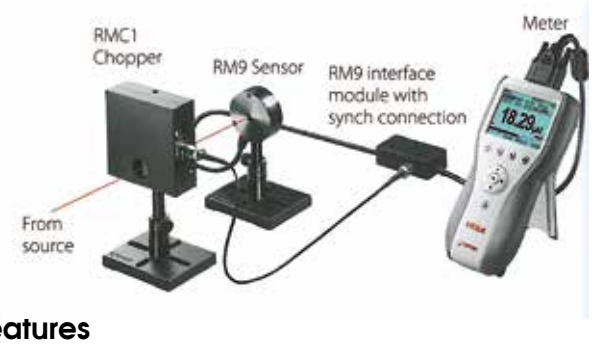
High Sensitivity Sensors – Radiometer

300fW to 100mW



Features

* Chopper and lock in amplifier for lowest noise and drift
* Wavelength range from UV to deep IR
* RM9 pyro is not sensitive to background radiation

Specifications

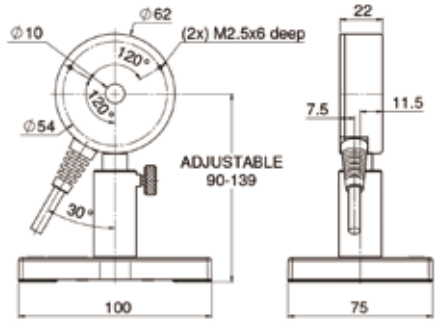
Model Use	RM9	RM9-PD
	Very low level signals	
Absorber Type	Pyroelectric	Si Photodiode
Spectral Range µm	0.15 - 12[a]	0.2 - 1.1[b]
Aperture mm	φ8mm	φ8mm
Surface Reflectivity % approx.	50	50
Power Range [c]	100nW – 100mW	300fW – 300nW
Power Scales	100mW to 3µW	300nW to 3pW
Power Noise Level [d]	~30nW	30fW
Minimum Frequency for Pulsed Sources	200Hz	200Hz
Thermal Drift (20min). [e]	~30nW	N.A.
Power Accuracy [a][b]	±5%	±5%
Maximum Average Power Density W/cm²	30	30
Response Time with Display (0-95%)	3.5s	3.6s
Linearity with Power	±2%	±2.5%
Connections		
1. 1.5 meter cable hard wired to interface module		
2. BNC connector on module for connection to chopper (2 meter BNC to BNCcable included). Perform zeroing with BNC cable removed		
3. 0.5 meter cable from module terminated in DB15 connector		
Cooling	convection	convection
Weight kg	0.37	0.37
Version		
Part Number for RM9 and RMC1 Chopper[f]	7Y70669	7Y70672
Part Number for RM9 Sensor	7Z02952	7Z02953

Notes:
(a) At calibrated wavelengths 500 – 1100nm. At other wavelengths, there is an additional error as follows: <500nm add ±8%, 1100 – 3000nm add ±5%, 10.6µm add ±15%
(b) At calibrated wavelengths 200 – 1100nm. For <700nm add ±2% additional error
(c) For LaserStar, Pulsar, USBI, Quasar and Nova/Orion, upper limit is ~1mW. Accuracy may also be less than values given above
(d) Averaged over 10s
(e) In a typical laboratory environment
(f) The RMC1 or another chopper unit that can be set to 18Hz is required for operation of the RM9 sensor

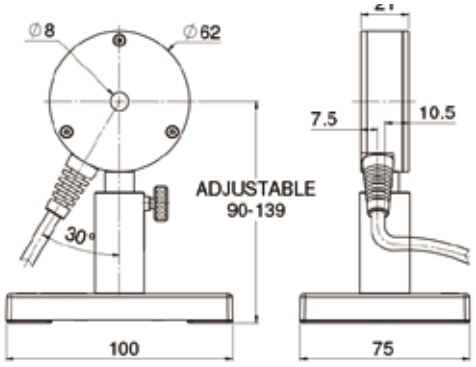
Model Use	RMC1 Chopper Chopper for RM9/RM9-PD
Aperture	φ22mm
Chopping frequency [a]	18Hz
Power consumption	85mA
Connections:	
1. BNC to interface module	
2. 12V power supply input (wall cube power supply included)	
3. Mini USB connector (factory use only)	

Notes: (a) not adjustable by user.

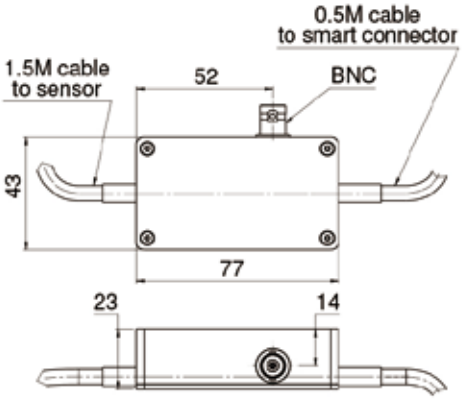
RM9-PD Sensor



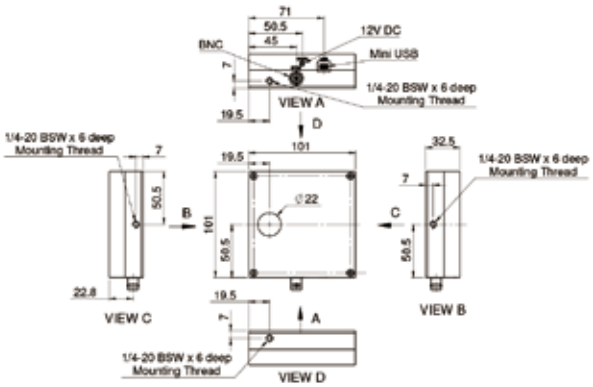
RM9 Sensor



Interface Module



Radiometer-Chopper



Thermal Power Sensors Table of contents

High Sensitivity Thermal Sensors - 8µW - 12W

3A / 3A-P / 3A-P-THz

3A-FS

3A-P-FS-12

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
3A	Very low powers	Ø9.5mm	0.19-20 µm	10µW-3W	20µJ-2J
3A-P	Low powers and energies	Ø12mm	0.15-8 µm	15µW-3W	20µJ-2J
3A-PF-12	As above with higher UV pulsed damage threshold	Ø12mm	0.15-20µm	15µW-3W	20µJ-2J
3A-P-THz	3A-P sensor calibrated for Terahertz	Ø12mm	0.3-10THz	15µW-3W	20µJ-2J
3A-FS	Lowest powers, Fused Silica window	Ø9.5mm	0.19-20µm	8µW-3W	15µJ-2J
3A-P-FS-12	For divergent beams, window blocks infrared	Ø12mm	0.22 - 2.1µm	15µW - 3W	20µJ-2J
12A	Wide dynamic range to 12W	Ø16mm	0.19-20 µm	2mW-12W	1mJ-30J
12A-P	Short pulse lasers to 12W	Ø16mm	0.15-8µm	2mW-12W	1mJ-30J

Low Power Thermal Sensors - 20mW-50mW (Continuous) / 150W (Intermittent)

10A

30A-BB-18

L30A-10MM

50(150)A-BB-26

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
10A	General purpose to 10W	Ø16mm	0.19-20µm	20mW-10W	6mJ-2J
30A-BB-18	General purpose to 30W	Ø17.5mm	0.19-20µm	20mW-30W	6mJ-30J
L30A-10MM	Thin Profile to 30W	Ø26mm	0.15-20µm	80mW-30W	20mJ-60J
50(150)A-BB-26	General purpose to 50W, 150W intermittent	Ø26mm	0.19-20µm	40mW-150W	20mJ-100J
10A-P	Pulsed lasers up to 10W	Ø16mm	0.15-8µm	40mW-10W	10mJ-10J
30A-P-17	Short pulse lasers to 30W	Ø17mm	0.15-8µm	60mW-30W	40mJ-30J
50A-PF-DIF-18	High energy density pulsed beams	Ø17.5mm	0.24 - 2.2µm	140mW-50W	60mJ-200J
15(50)A-PF-DIF-18	As above, compact for intermittent use	Ø17.5mm	0.24 - 2.2µm	140mW-50W	60mJ-200J
30A-N-18	High power density pulsed YAG	Ø17.5mm	0.532, 1.064µm	60mW-30W	30mJ-200J

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Low-Medium Power Thermal Sensors - Apertures 12mm to 35mm, 10mW - 150W

30(150)A-SV-17 / 30(150)A-HE-17

Diffuser installed

Diffuser off

L30-C-SH

100C-SH

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
30(150)A-BB-18	CW to 30W, intermittent to 150W	Ø17.5mm	0.19-20μm	30mW-150W	20mJ-100J
30(150)A-LP1-18	As above, high damage threshold for long pulses and CW	Ø17.5mm	0.25-2.2μm	30mW-150W	20mJ-300J
L50(150)A-BB-35	CW to 50W, intermittent to 150W	Ø35mm	0.19-20μm	100mW-150W	40mJ-300J
L50(150)A-LP1-35	CW to 50W, intermittent to 150W high damage threshold for long pulses	Ø35mm	0.25-2.2μm	100mW-150W	40mJ-300J
L50(150)A-PF-35	CW to 50W, intermittent to 150W for short pulse lasers	Ø35mm	0.15-20μm	100mW-150W	50mJ-300J
30(150)A-SV-17	Very high damage threshold, 30W continuous 150W intermittent	Ø17mm	0.19-12μm	100mW-150W	50mJ-300J
30(150)A-HE-17	High energy and average power YAGs and harmonics 30W continuous 150W intermittent	Ø17mm	0.19-0.625μm, 1.064 μm, 2.1μm, 2.94 μm	50mW-150W	60mJ-200J
30(150)A-HE-DIF-17	For highly concentrated Q switched pulses to 30W, intermittent to 150W	Ø17mm	0.19-3μm except for 625-900nm	50mW-150W	60mJ-200J
20C-SH	Compact smart sensor	Ø12mm	0.19-20μm	10mW-20W	6mJ-10J
L30C-SH	Medium aperture, smart sensor	Ø26mm	0.19-20μm	80mW-50W	30mJ-30J
L30C-LP1-26-SH	As above with LP1 absorber for high pulse energies	Ø26mm	0.25-2.2μm	80mW-100W	30mJ-2000J
100C-SH	Low profile, smart sensor	Ø18mm	0.19-20μm	60mW-100W	N.A
150C-SH	High power, smart sensor	Ø18mm	0.19-20μm	60mW-60W	20mJ-100J
150W-SH	High power, water cooled smart sensor	Ø18mm	0.19-20μm	60mW-150W	20mJ-100J

Medium Power Thermal Sensors - Apertures 50 to 65mm, 100mW - 300W

L40(150)A / L40(150)A -LP1

L40(150)A –EX

L50(150)A

L50(300)A-IPL

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
L40(150)A	CW to 35W, intermittent to 150W, large aperture	Ø50mm	0.19-20μm	100mW-150W	100mJ-200J
L40(150)A-LP1	As above, high damage threshold for long pulses	Ø50mm	0.25-2.2μm, 2.94μm	100mW-150W	100mJ-300J
L40(150)A-EX	As above for excimer lasers	Ø50mm	0.15-0.7μm, 10.6μm	100mW-150W	100mJ-200J
L50(150)A	CW to 50W, intermittent to 150W	Ø50mm	0.19-20μm	100mW-150W	100mJ-300J
L50(300)A	CW to 50W, intermittent to 300W, very large aperture	Ø65mm	0.19-20μm	400mW-300W	200mJ-300J
L50(300)A-LP1	As above, high damage threshold for CW and long pulses	Ø65mm	0.25-2.2μm	400mW-300W	200mJ-300J
L50(300)A-PF-65	CW to 50W, intermittent to 300W, large beam short pulses	Ø65mm	0.15-20μm	400mW-300W	200mJ-300J
L50(300)A-IPL	For gel coupled IPL sources	Ø65mm	0.5-1.1μm	400mW-300W	120mJ-300J

Medium-High Power Fan Cooled Thermal Sensors – 50mW – 500W

F100A-PF-DIF-33

FL250A-BB-35 / FL250A-LP1-35

FL250A-LP1-DIF-33

FL600A-BB-65/
FL600A-LP1-65/
FL1100A-BB-65

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
F100A-PF-DIF-33	High average power, short pulse lasers	Ø33mm	0.24-2.2μm	50mW-100W	60mJ-200J
F150A-BB-26	Fan cooled to 150W	Ø26mm	0.19-20μm	50mW-150W	20mJ-100J
FL250A-BB-35	Fan cooled to 250W	Ø35mm	0.19-20μm	150mW-250W	50mJ-300J
FL250A-LP1-35	As above, high damage threshold for long pulses and CW	Ø35mm	0.25-2.2μm	150mW-250W	50mJ-300J
FL250A-LP1-DIF-33	Fan cooled to 250W with diffuser for high power and energy density	Ø33mm	0.4-3μm	400mW-250W	400mJ-600J
FL250A-BB-50	Fan cooled to 250W, large aperture	Ø50mm	0.19-20μm	150mW-250W	80mJ-300J
FL400A-BB-50	Fan cooled to 400W	Ø50mm	0.19-20μm	300mW-400W	75mJ-600J
FL400A-LP1-50	Fan cooled to 400W, high power densities and long pulses	Ø50mm	0.35-2.2μm, 10.6μm	300mW-400W	75mJ-600J
FL600A-BB-65	Fan cooled to 600W	Ø65mm	0.19μm-20μm	500mW-600W	250mJ-600J
FL600A-LP1-65	Fan cooled to 600W for long pulsed lasers	Ø65mm	0.35μm-2.2μm	500mW-600W	250mJ-600J
FL1100A-BB-65	Fan cooled to 1100W	Ø65mm	0.19μm-20μm	1W-1100W	250mJ-600J

High Power Water Cooled Thermal Sensors - 1W – 10kW

1000W-BB-34 /
1000W-LP1-34

L2000W-BB-120

Protective Housing
Mounted on Sensor
(open shutter)

Protective Housing
Mounted on Sensor
(closed shutter)

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
L250W	Thin profile, 20mm thick, water cooled to 250W	Ø50mm	0.19-20μm	1W-250W	120mJ-200J
L300W-LP1-50	Thin profile, 20mm thick, water cooled to 300W	Ø50mm	0.35-2.2μm, 10.6μm	4W-300W	200mJ-300mJ
1000W-BB-34	Water cooled to 1000W	Ø34mm	0.19-20μm	5W-1000W	300mJ-300J
1000WP-BB-34	Water cooled to 1000W with non contaminating water circuit	Ø34mm	0.19μm-20μm	5W-1000W	400mJ-300J
1000W-LP1-34	Water cooled to 1000W, high power densities and long pulses	Ø34mm	0.35-2.2μm, 10.6μm	5W-1000W	400mJ-300J
L1500W-BB-50	Water cooled to 1500W	Ø50mm	0.19-20μm	15W-1500W	500mJ-200J
L1500W-LP1-50	As above, high power densities and long pulses	Ø50mm	0.35-2.2μm, 10.6μm	15W-1500W	500mJ-200J
L2000W-BB-120	Water cooled to 2000W. Very large aperture 120mm	Ø120mm	0.19-20μm	1W-2000W	2J-6000J
L100(500)A-PF-120	For short exposures, measure energies to 6000J	Ø120mm	0.15-20 μ m	1W-500W	2J-6000J
5000W-BB-50	Water cooled to 5000W	Ø50mm	0.19-20μm	20W-5000W	N.A.
5000W-LP1-50	As above, high power densities and long pulses	Ø50mm	0.35-3.2μm	20W-5000W	N.A.
6K-W-BB-200x200	Very large aperture 200x200mm to 6000W. Calorimetric measurement	198x198mm	0.19-20μm	200W-600W	N.A.

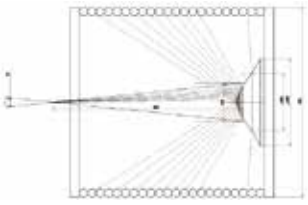
Very High Power Water Cooled Thermal Sensors - 100W – 120kW

10K-W-BB-45

30K-W-BB-74

Laser Beam Absorbing Chamber
and Power Measuring Unit

Laser Beam Path



Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
10K-W-BB-45	Water cooled to 10,000W, very high power densities	Ø45mm	0.8-2μm, 10.6μm	100W-11kW	N.A.
30K-W-BB-74	Water cooled to 30,000W, high power densities	Ø74mm	0.8-2μm, 10.6μm	100W-30kW	N.A.
120K-W	Water cooled to 100,000W. Highest powers	Ø200mm	0.8-1.1μm	10kW-120kW	N.A.

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Power Pucks 20W – 10kW

Comet 1K

Comet 10K

Comet 10K-HD

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
Comet 1K	Portable low-cost power probe with low powers	Ø50mm	0.2-20μm	20W-1000W	N.A.
Comet 10K	Portable low-cost power probe with high powers	Ø100mm	1.06μm and 10.6μm	200W-10,000W	N.A.
Comet 10K-HD	Portable low-cost power probe with high damage threshold	Ø55mm	1.06μm and 10.6μm	200W-10,000W	N.A.

Beam Dumps up to 10kW

BDFL500A-BB-50

BDFL1500A-BB-65

BD5000W-BB-50

Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
BDFL500A-BB-50	fan cooled beam dump up to 500W	Ø50mm	0.19-20μm	up to 500W	N.A.
BDFL1500A-BB-65	Water cooled beam dump up to 1500W	Ø65mm	0.19-20μm	up to 15000W	N.A.
BD5000W-BB-50	Water cooled beam dump up to 5000W	Ø50mm	0.8-20μm	up to 50,000W	N.A.

BeamTrack – Power / Position / Size Sensors

3A-QUAD / 3A-P-QUAD

10A-PPS

FL250A-BB-50-PPS

1000W-BB-34-QUAD

Track Screen on Nova II

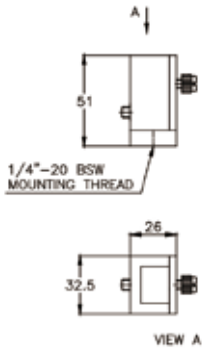
Sensor	Features	Aperture	Spectral Range	Power Range	Energy Range
3A-QUAD	Power & position, very low powers up to 3W	Ø9.5mm	0.19-20μm	100μW-3W	20μJ-2J
3A-P-QUAD	As above for short pulse lasers	Ø12mm	0.15-8μm	160μW-3W	30μJ-2J
10A - PPS	Power, position & size to 10W	Ø16mm	0.19-20μm	20mW-10W	6mJ-2J
50(150)A-BB-26-PPS	Power, position & size to 50W, 150W intermittent	Ø26mm	0.19-20μm	40mW-150W	20mJ-100J
50(150)A-BB-26-QUAD	As above, power and position only	Ø26mm	0.19-20μm	40mW-150W	20mJ-100J
F150A-BB-26-PPS	Power, position & size to 150W	Ø26mm	0.19-20μm	50mW-150W	20mJ-100J
FL250A-BB-50-PPS	Power, position & size to 250W, large aperture	Ø50mm	0.19-20μm	150mW-250W	80mJ-300J
1000W-BB-34-QUAD	Power & position, high powers up to 1000W	Ø34mm	0.19-20μm	5W-1000W	500mJ-300J

Power Sensors Accessories

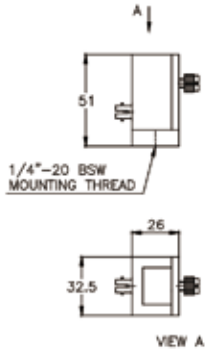
Accessories for PD300 Sensors

PD300 with F.O. Adapter Mounted

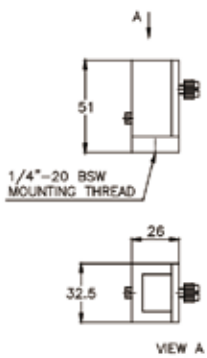
PD300-FO-SMA



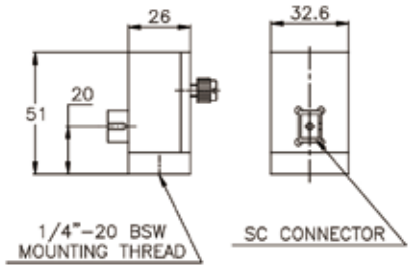
PD300-FO-ST



PD300-FO-FC



PD300-FO-SC



Accessories for Thermal Senors, PD300R, PD300-IRG, 3A-IS and FPS-1

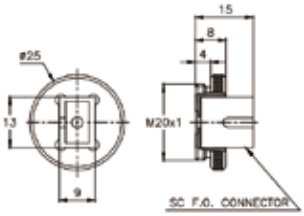
SC fiber adapter

ST fiber adapter

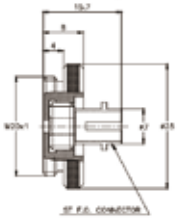
FC fiber adapter

SMA fiber adapter

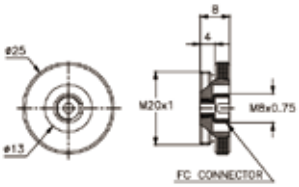
SC fiber adapter



ST fiber adapter

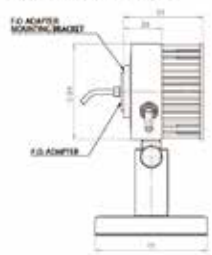


FC fiber adapter

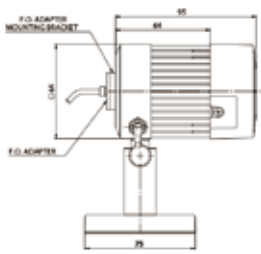


SM1 to M20 Adapter Mounting Bracket for PD300R Series and FPS-1, P/N 1G02259
Allows PD300R models to be used with above fiber adapters

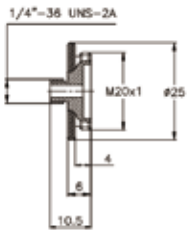
30A with F.O. input



FL250A with F.O. input



SMA fiber adapter



SH to BNC adapter
Allows raw voltage output from thermal sensors

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Photodiode and Pyroelectric Energy Sensors

Photodiode Energy Sensors - 10pJ - 20µJ

Features

* Silicon and Germanium detectors
* Very sensitive - down to 10pJ
* Repetition rates to 20kHz
* Wide spectral range

PD10-C / PD10-pJ-C / PD10-IR-pJ-C

Sensor	Features	Aperture	Spectral Range	Energy Range	Maximum Frequency
PD10-C	Very low energies down to nJ, Silicon photodiode	Ø10mm	0.19-1.1µm	1nJ-20µJ	20,000Hz
PD10-pJ-C	Lowest energies down to pJ, Silicon photodiode	Ø10mm	0.2-1.1µm	10pJ-200nJ	20,000Hz
PD10-IR-pJ-C	Lowest energies down to pJ, Germanium photodiode	Ø5mm	0.7-1.8µm	30pJ-20nJ	10,000Hz

Pyroelectric Energy Sensors - 0.2µJ - 10J

PE10-C

PE25BF-C

PE50-C

Energy Sensor with optional heat sink

Sensor	Features	Aperture	Spectral Range	Energy Range	Maximum Frequency
PE9-C	Pyroelectric for very low energies	Ø8mm	0.15-12µm	0.2µJ-1mJ	25,000Hz
PE9-ES-C	Pyroelectric for lowest energies	Ø8mm	0.15-12µm	0.05-200µJ	25,000Hz
PE10-C	Pyroelectric for low energies	Ø12mm	0.15-12µm	1µJ-10mJ	25,000Hz
PE10BF-C	As above, high damage threshold	Ø12mm	0.15-3µm, 10.6µm	7µJ-10mJ	250Hz
PE25-C	Medium aperture pyroelectric	Ø24mm	0.15-3µm	8µJ-10J	10,000Hz
PE25BF-C	As above, high damage threshold	Ø24mm	0.15-3µm, 10.6µm	60µJ-10J	250Hz
PE50-C	Large aperture pyroelectric	Ø46mm	0.15-3µm	10µJ-10J	10,000Hz
PE50BF-C	As above, high damage threshold	Ø46mm	0.15-3µm, 10.6µm	120µJ-10J	250Hz

High Energy Pyroelectric Sensors - 10µJ - 40J

PE50BF-DIF-C / PE50BF-DIFH-C

PE50BB-DIF-C

PE100BF-DIF-C

DIFFUSER IN

DIFFUSER OUT

DIFFUSER IN

DIFFUSER OUT

Sensor	Features	Aperture	Spectral Range	Energy Range	Maximum Frequency
PE50-DIF-C	Pyroelectric with diffuser, high repetition rate. Complete calibration	Ø35mm	0.19-2.2,2.94µm	20µJ-10J	10,000Hz
PE25BF-DIF-C	Pyroelectric with diffuser for high damage threshold. Complete	Ø20mm	0.24-2.2µm	100µJ-10J	250Hz
PE50BF-DIF-C	Pyroelectric with diffuser for highest damage threshold. Complete	Ø35mm	0.19-2.2µm,0.94µm	200µJ-10J	250Hz
PE50BF-DIFH-C	Similar to PE50BF-DIF-C but with higher damage threshold	Ø35mm	0.19-2.2µm, 2.94	200µJ-10J	250Hz
PE50BB-DIF-C	Pyroelectric with removable diffuser. Wide spectral range w/o diffuser	Ø46mm Ø33mm with diffuser	0.19-20µm, 0.4-2.5µm with diffuser	100µJ-40J	40Hz
PE50-DIF-ER-C	Pyroelectric with removable diffuser. Especially for Erbium laser	Ø46mm Ø33mm with diffuser	0.19-3µm, 0.4-3µm with diffuser	10µJ-30J	10,000Hz
PE100BF-DIF-C	Largest aperture pyroelectric with removable diffuser	Ø96mm Ø85mm with diffuser	0.15-3µm, 0.4-2.5µm with diffuser	400µJ-40J	200Hz
FPE80BF-DIF-C	Fan cooled pyroelectric for high ave powers to 200W	Ø 53mm	0.19-2.2µm, 2.94	1mJ-40J	250Hz

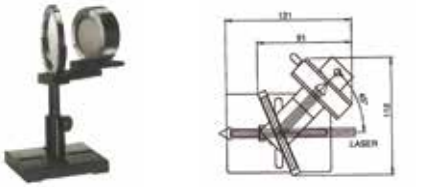
Energy Sensors Accessories

Accessories for Pyroelectric Sensors

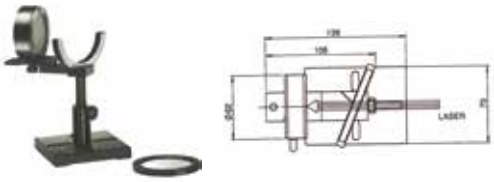
Fiberoptic Adapter for Pyroelectric Sensors

Oscilloscope Adapter for Pyroelectric Sensors

Heat Sink for PE-C Series Sensors



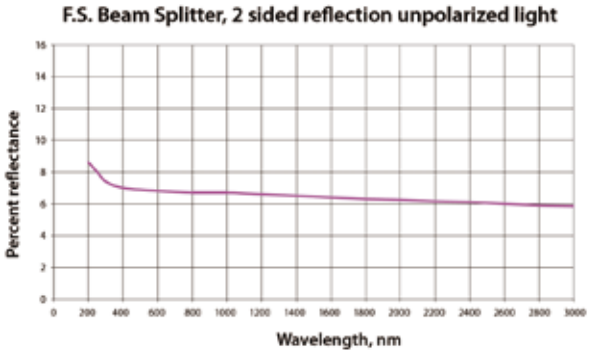
Beam splitter installed - reflected deam on-sensor



Beam splitter removed - direct deam on-sensor

Beam Splitter Specifications

Material	UV grade fused silica	
Spectral range	0.19 - 2.2µm	
Aperture	Ø60mm	
Damage threshold for pulses	< 10ns PW >300µs PW 5J/cm²	>300µs PW >200J/cm²
Fraction split off	See graph	



Damage Threshold Test Plates

Nova PE-C Adapter

PE-C to PE Size Adapter

Accessory	Description	Part Number
Heat Sink	Heat sink that screws onto rear of PE25 and PE50 series sensors and allows working at over 50% higher average powers.	7Z08267
Scope Adapter	Plugs in between the PE sensor and power meter. Provides BNC output to scope to see every pulse up to the maximum frequency of the sensor.	1Z11012 (non-RoHS)
PE Sensor Family Type	Distance from fiber to detector	
PD10-C / PD10-pJ-C / PD10-IR-pJ-C	10mm	7Z08275
PE50-C / PE50BF-C	15mm	7Z08270
PE9-C / PE9-ES-C / PE10-C / PE10BF-C / PE25-C / PE25BF-C	10mm	7Z08269
Fiber Adapters	Fiber adapters for mounting to above brackets	
	SC type	7Z08227
	ST type	7Z08226
	FC type	7Z08229
	SMA type	1G01236
Beam Splitter Assembly	Beam Splitter Assembly to measure pulsed laser sources too energetic for direct measurement. The reading with the Beam Splitter can be calibrated by setting the laser to a lower energy that will not damage the sensor and then taking a measurement with the beam splitter and without and taking the ratio.	7Z17001

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OEM Power and Energy Sensors

Standard OEM Thermal Sensors - 100pW - 300W

Sensor	Features	Aperture	Spectral Range	Power Range (a)	Size
20C-SH	Compact smart sensor	Ø12mm	0.19-20µm	10mW-20W	38x38x14mm
20C-UAS	compact, built in amplifier (RS232/analog)	Ø12mm	0.19-20µm	10mW-20W	34x38x34mm
20C-UAU	Compact, external amplifier (USB/analog)	Ø12mm	0.19-20µm	10mW-20W	38x38x14mm
3A-UA	Low power, built in amplifier (RS232/analog)	Ø9.5mm	0.19µm-20µm	100µW-3W	50x50x38mm
PD300-UAS	compact, photodiode, built in amplifier (RS232/analog)	10x10mm	0.2-1.1µm	100pW-50mW	38x38x32mm
L30C-SH	Medium aperture, smart sensor	Ø26mm	0.19-20µm	80mW-50W	60x60x38mm
L30C-LP1-26-SH	As above with LP1 absorber for high pulse energies	Ø26mm	0.25-2.5µm	80mW-100W	60x60x38mm
L30C-UA	Medium aperture, built-in amplifier (RS232/analog)	Ø26mm	0.19-20µm	80mW-50W	60x60x38mm
L30C-UAU	Medium aperture, built-in amplifier (USB)	Ø26mm	0.19-20µm	80mW-50W	60x60x38mm
100C-SH	Low profile, smart sensor	Ø18mm	0.19-20µm	60mW-100W	48x48x14.5mm
100C-UA	Low profile, separate amplifier (RS232/analog)	Ø18mm	0.19-20µm	60mW-100W	48x48x14.5mm
100C-UAU	Low profile, separate amplifier (USB)	Ø18mm	0.19-20µm	60mW-100W	48x48x14.5mm
100W-UAF	High power, very fast response (50ms) built in amplifier, water cooled (RS232/analog)	Ø26mm	0.19-20µm	40mW-100W	60x60x36mm
150C-SH	High power, smart sensor	Ø18mm	0.19-20µm	60mW-60W	50.8x50.8x33mm
150C-UA	High power, built-in amplifier (RS232/analog)	Ø18mm	0.19-20µm	60mW-60W	50x50x38mm
150C-UAU	High power, built-in amplifier (USB)	Ø18mm	0.19-20µm	60mW-60W	50x50x38mm
150W-UA	High power, built-in amplifier, water cooled(RS232/analog)	Ø18mm	0.19-20µm	100mW-150W	50x50x38mm
150W-UAU	High power, built-in amplifier, water cooled	Ø18mm	0.19-20µm	100mW-150W	50x50x38mm
L150C-UA	Large aperture, built-in amplifier (RS232/analog)	Ø50mm	0.19-20µm	0.2W-150W	80x80x45mm
L150C-UAU	Large aperture, built-in amplifier (USB)	Ø50mm	0.19-20µm	0.2W-150W	80x80x45mm
L250W-UA	Large aperture, built-in amplifier, water cooled (RS232/analog)	Ø50mm	0.19-20µm	0.3W-250W	80x80x58mm
L250W-UAU	Large aperture, built-in amplifier, water cooled (USB)	Ø50mm	0.19-20µm	0.3W-250W	80x80x58mm
L300W-UA	Large aperture, built-in amplefier, water cooled (RS232/analog)	Ø50mm	0.19-20µm	0.5W-300W	80x80x58mm
L300W-UAU	Large aperture, built-in amplifier, water cooled (USB connection)	Ø50mm	0.19-20µm	0.5W-300W	80x80x58mm

Note: (a) Effective Dynamic Range for a given sensor is ~ 30:1

Standard OEM Pyroelectric Energy Sensors - 1µJ - 10J

PE10-C-RE

PE XX-C-RS232

PE-C-RE

Sensor	Features	Aperture	Spectral Range	Energy Range	Max. Freq.	Size
PE10-C-RE	Non amplified compact sensor	Ø12mm	0.19-10.6µm	Depends on configuration	Depends on configuration	22 x 7.5mm
PE-C-RS232	PE smart sensors with built in output	choose from standard PE-C	choose from standard PE-C	same as equiv. PE-C	same as equiv. PE-C	same as std PE-C
PE-C-RE	Custom smart PE sensors	usually 10mm	0.19-10.6µm	same as equiv. PE-C	same as equiv. PE-C	Can be very small

EA-1 Ethernet Adapter for Customized Solutions (OEM) smart sensors

DB15 connection for smart sensor

Mini-USB connector for device configuration; Ethernet RJ45 connector; optional 12V power connector, required if "Power over Ethernet" (PoE) is not available from network

Accesspru	Description	Part Number
EA-1 Ethernet Adapter	Compact ethernet PC adapter for smart sensor	7Z08296

Power Meter Selection Guide

The table below lists the specs and features of Ophir Power Meters and PC Interfaces

						
Meters	**Vega**	**Nova II**	**StarBright**	**StarLite**	**LaserStar Single Channel**	**Nova**
Digital Display	Yes	Yes	Yes	Yes	Yes	Yes
Display Color	Color	Monochrome	Color	Monochrome	Monochrome	Monochrome
Analog Display	Yes	Yes	Yes	Yes	No	No
Rechargeable Battery	Yes	Yes	Yes	Yes	Yes	Yes
Detector Support (see compatibility table below)						
Thermal Sensors	Yes	Yes	Yes	Yes	Yes	Yes
Photodiode Sensors	Yes	Yes	Yes	Yes	Yes	Yes
Pyroelectric Sensors	Yes	Yes	Yes	Yes	Yes	Yes
BeamTrack Sensors	Yes	Yes	Yes	Yes	No	No
Measurement Options						
Average Power	Yes	Yes	Yes	Yes	Yes	Yes
Energy per Pulse (Pyro. Sensors)	Yes	Yes	Yes	Yes	Yes	Yes
Single Shot Energy (Thermal Sensors)	Yes	Yes	Yes	Yes	Yes	Yes
Statistics	Yes	Yes	Yes	No	Yes	Yes
Analog Out	1V,2V,5V,10V	1V,2V,5V,10V	1V,2V,5V,10V	1V	1V	1V
Trigger input & output	No	No	No	No	No	No
Real-Time Logging						
RS232	30Hz	30Hz	30Hz	N/A	30Hz	10Hz
GPIB	N/A	N/A	N/A	N/A	1500Hz	N/A
USB	2000Hz	2000Hz	5000Hz	20Hz*	N/A	N/A
Bluetooth	N/A	N/A	N/A	N/A	N/A	N/A
On-Board Data Storage	250K	50K	>10M**	No	50K	1K
Automation Interface	Yes for USB	Yes for USB	Yes for USB	YES*	No	No
Labview VI's	Yes	Yes	Yes	YES*	Yes	Yes
Part number	7Z01560	7Z01550	7Z01580	7Z01565	7Z01600/7Z01601	7Z01500

						
Meters	**Wireless Interface Quasar**	**PC Interfaces Juno**	**USBI**	**Pulsar-4**	**Pulsar-2**	**Pulsar-1**
Digital Display	N/A	N/A	N/A	N/A	N/A	N/A
Display Color	N/A	N/A	N/A	N/A	N/A	N/A
Analog Display	N/A	N/A	N/A	N/A	N/A	N/A
Rechargeable Battery	Yes	Powered from USB	Powered from USB	No	No	No
Detector Support (see compatibility table below)						
Thermal Sensors	Yes	Yes	Yes	Yes	Yes	Yes
Photodiode Sensors	Yes	Yes	Yes	Yes	Yes	Yes
Pyroelectric Sensors	Yes	Yes	Yes	Yes	Yes	Yes
BeamTrack Sensors	No	Yes	No	No	No	No
Measurement Options						
Average Power	Yes	Yes	Yes	Yes	Yes	Yes
Energy per Pulse (Pyro. Sensors)	Yes	Yes	Yes	Yes	Yes	Yes
Single Shot Energy (Thermal Sensors)	Yes	Yes	Yes	Yes	Yes	Yes
Statistics	Yes	Yes	Yes	Yes	Yes	Yes
Analog Out	No	No	1V	No	No	No
Trigger input & output	No	No	No	Yes	Yes	Yes
Real-Time Logging						
RS232	N/A	N/A	N/A	N/A	N/A	N/A
GPIB	N/A	N/A	N/A	N/A	N/A	N/A
USB	N/A	10,000Hz	2000Hz	25,000Hz	25,000Hz	25,000Hz
Bluetooth	500Hz	N/A	N/A	N/A	N/A	N/A
On-Board Data Storage	No	No	No	No	No	No
Automation Interface	No	Yes	Yes	Yes	Yes	Yes
Labview VI's	No	Yes	Yes	Yes	Yes	Yes
Part number	7Z01300	7Z01250	7Z01200	7Z01201	7Z01202	7Z01203

* With USB activation code

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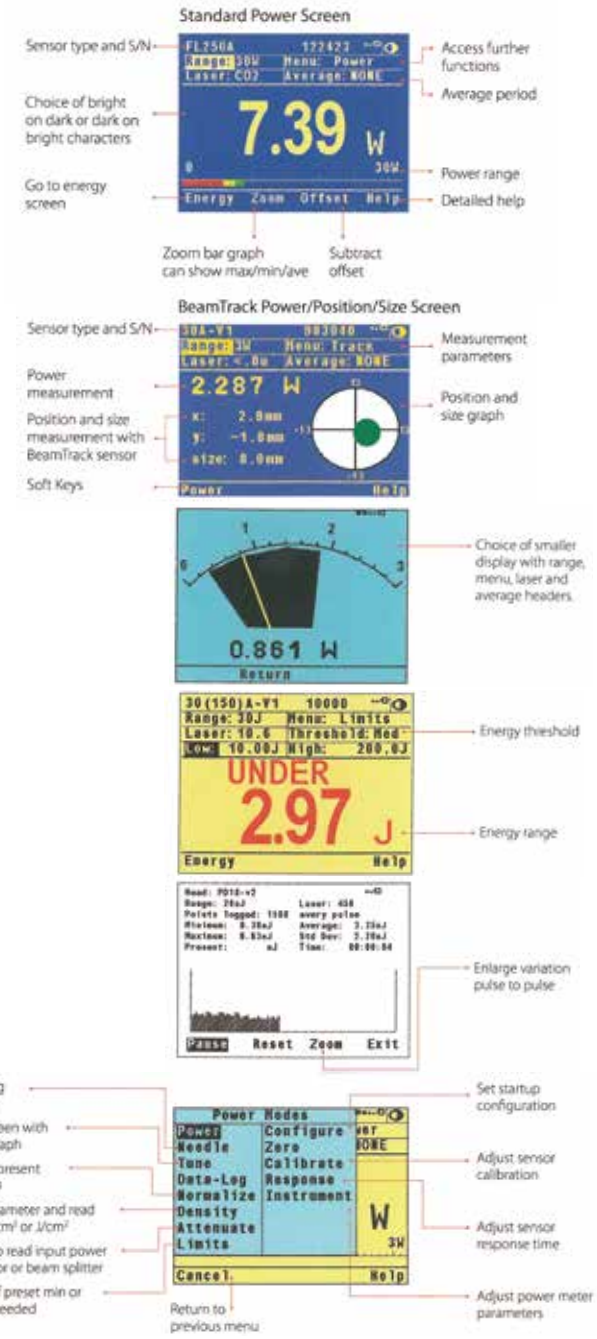
Compatibility Table

Sensor \ Meter / Interface	Vega/ Nova II	LaserStar	Nova/ Orion	StarLite	Quasar	Juno	USBI	Pulsar
Standard Thermal sensors*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LP1 type Thermal sensors	Yes	Has discrete wavelengths only	Has discrete wavelengths only	Yes	Yes	Yes	Yes	Yes
PF-DIF type Thermal sensors	Yes	Has discrete wavelengths only	Has discrete wavelengths only	Yes	Yes	Yes	Yes	Yes
Standard Photodiode sensors**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BC20 sensor	Yes	Yes	Yes	Measures static beams only	Measures static beams only	Measures static beams only	Measures static beams only	Measures static beams only
PD300-CIE sensor	Yes	Yes	Yes	No	No	No	No	No
BeamTrack Sensors	Yes	Power/energy only	Power/energy only	Yes	Power/energy only	Yes	Power/energy only	Power/energy only
PE-C Pyroelectric sensors	Yes	Somewhat limited functions. See catalog notes	Needs an adaptor (P/N 7Z08272) Somewhat limited functions. See catalog notes	Yes	Somewhat limited functions. See catalog notes	Yes	Somewhat limited functions. See catalog notes	Somewhat limited functions. See catalog notes
Previous generation Pyroelectric Sensors (non PE-C)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
RP sensors	No	Yes	No	No	No	No	Yes (with RP-USB s/w)	No

* Meaning all thermal sensors not listed as exceptions in above table.
** Meaning all photodiode sensors not listed as exceptions in above table.

Power Meters · Vega - Color Screen Laser Power/Energy Meter

* Compatible with all standard Ophir thermal, BeamTrack, pyroelectric and photodiode sensors
* Brilliant color large size TFT 320x240 display
* Compact handheld design with rubberized bumpers and optimized 2 position kickstand
* Choice of digital or analog needle display
* Illuminated keys for working in the dark
* Analog output
* Log every point at up to 4000Hz with pyro sensors
* Non volatile data storage up to 250,000 points
* Laser tuning screen and power and energy log
* USB and RS232 interfaces with StarLab and StarCom PC applications, LabVIEW driver, COM Object Interface and ActiveX control
* Soft keys and menu driven functions with on line help
* Many software features such as density, min/max, scaling etc.



Selected Screens

Digital Power Screen and Color Functions

* Choice of bright on dark or dark on bright characters
* Optimize colors for use with laser eye protection glasses
* Can average over selected period. Useful for unstable lasers
* Bar graph can show max / min / average in different colors

BeamTrack Power/Position/Size Screen

* Monitoring of laser beam size
* Accurate tracking of beam position to fractions of a mm
* Beam position and wander
* All the other features of standard power/energy meters

Analog Power Screen

* Perfect for adjusting and maximizing laser power
* Persistent graphical display allows tracking of minimum maximum values measured
* Large analog needle with small digital display as well

Energy/Limits Screen

* Pulsed energy sensors (single or repetitive) and thermal sensors (single shot only).
* Frequency measurement with pulsed energy sensors.
* Limits screen with bright colored warning

Energy Logging Screen

* Pyroelectric and thermal sensors
* Continuous scroll with up to 100 points on screen
* Full statistics
* Store data onboard and recall

Additional Functions

* Press the menu choice on the main screen and many more options pop up as shown

Ordering Information

Item	Description	Ophir P/N
Vega	Vega color universal power meter for standard thermal, BeamTrack, pyroelectric and photodiode sensors	7Z01560
Carrying Case	Carrying case 38 x 30 x 11 cm. For power meter and up to 3 sensors	1J02079
USB Cable for Vega	USB to mini DIN cable (1 unit supplied with Vega)	7E01205
RS232 Cable for Vega	D9 to mini DIN cable (1 unit supplied with Vega)	7E01206
Battery Pack for Vega	Replacement battery pack for the Vega	7E14007

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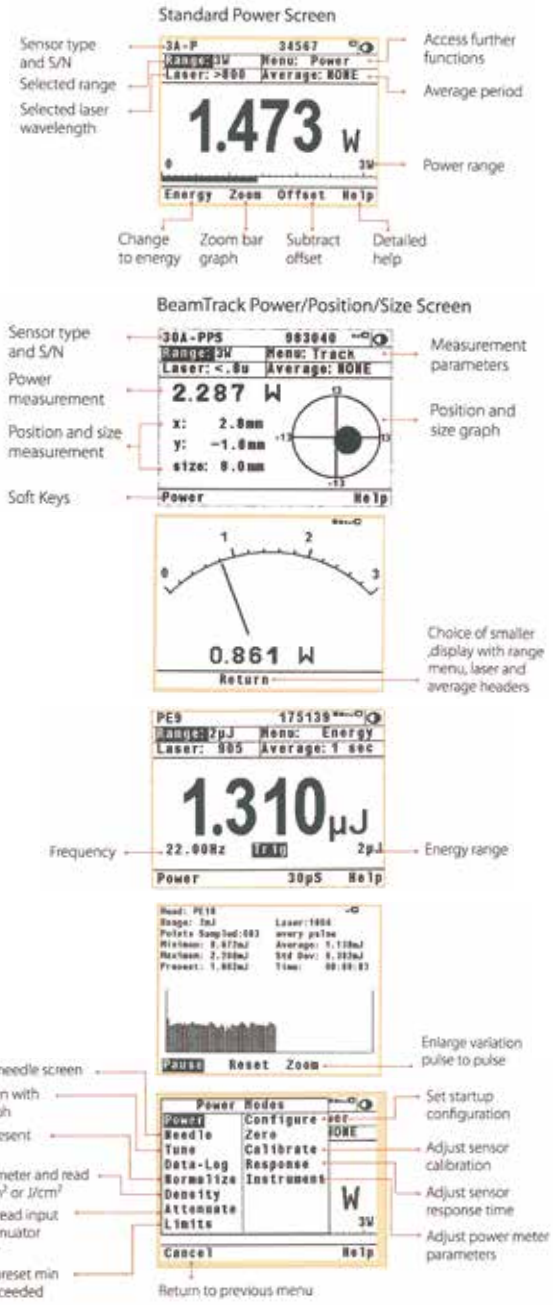
Nova II - Versatile Laser Power/Energy Meter

* Compatible with all standard Ophir thermal, BeamTrack, pyroelectric and photodiode sensors
* Large high definition LCD display
* Choice of digital or analog needle display
* 2 position kickstand
* Backlighting and rechargeable battery
* Analog output
* Log every point at up to 4000Hz with pyro sensors
* Non volatile data storage up to 59,400 points
* Laser tuning screen and power and energy log
* USB and RS232 interfaces with StarLab and StarCom PC applications, LabVIEW driver, COM Object Interface and ActiveX control Soft keys and menu driven functions with on-line help
* Many software features such and density, min/max, scaling etc.



Selected Screens

Digital Power Screen

* CW industrial, medical and scientific lasers
* pW to Multi kW with appropriate sensors
* Can average over selected period. Useful for unstable lasers
* Fast response bar graph

BeamTrack Power/Position/Size Screen

* Monitoring of laser beam size
* Accurate tracking of beam position to fractions of a mm
* Beam position and wander
* All the other features of standard power/energy meters

Analog Power Screen

* Perfect for adjusting and maximizing laser power
* Large analog needle with small digital display as well

Energy Screen

* Pulsed energy sensors (single or repetitive) and thermal sensors (single shot only)
* Frequency measurement with pulsed energy sensors

Energy Logging Screen

* Pyroelectric and thermal sensors
* Continuous scroll with up to 100 points on screen
* Full statistics
* Store data onboard and recall

Additional Functions

* Press the menu choice on the main screen and many more options pop up as shown

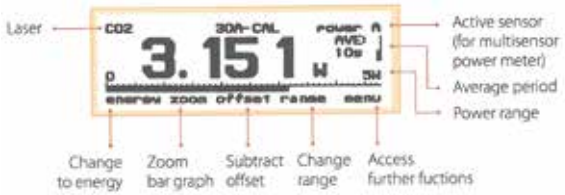
Ordering Information

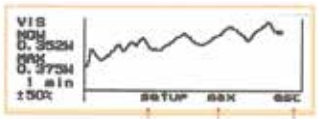
Item	Description	Ophir P/N
Nova II	Nova II universal power meter for standard thermal, BeamTrack, pyroelectric and photodiode sensors	7Z01550
Carrying Case	Carrying case 38 x 30 x 11 cm. For power meter and up to three sensors	1J02079
Nova II USB Cable	USB to mini DIN cable (1 unit supplied with Nova II)	7E01205
Nova II RS232 Cable	D9 to mini DIN cable (1 unit supplied with Nova II)	7E01206
Battery Pack	Replacement battery pack for the Nova II	7E14007

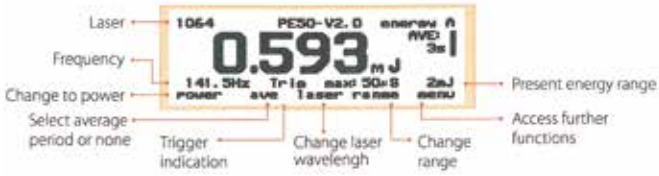
Laserstar - Versatile Laser Power/Energy Meter

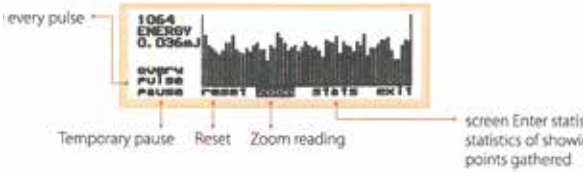
* Two models available: dual and single channel
* Single channel model can be upgraded to dual channel
* Compatible with all standard Ophir thermopile, pyroelectric, photodiode and RP sensors
* Large LCD display
* Backlighting and rechargeable battery
* Screen graphics and statistics (std dev. min, max)
* Analog output
* Built-in RS232 interface
* Log every data point at >1500Hz with pyroelectric sensors
* Non-volatile data storage up to 59,400 points
* Laser tuning screen and power log
* Audio sound for laser tuning and low battery
* RS232 interface with StarCom PC application software nd LabVIEW driver
* GPIB option (IEEE488.1)
* NIST traceable
* CE marked
* Soft keys, menu-driven

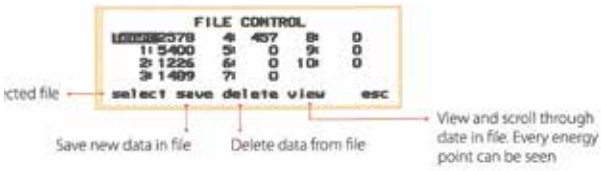
IEEE 488 GPIB Cable for LaserStar











Selected Screens

Digital Power Screen

* CW industrial, medical and scientific lasers
* pW to multi kW with appropriate sensors
* Can average over selected period. Useful for unstable lasers
* Fast response bar graph

Laser Tuning Screen or Power Log Screen (not shown)

* Maximizing laser power
* User selected time period and zoom
* Option of audio tune tone for maximizing laser power

Energy Measurement Screen

* Pyroelectric and thermal sensors - single pulse
* Pyroelectric frequency measurement

Energy Log Screen

* Pulsed energy sensors
* Thermal sensors - successive single pulses
* Continuous scroll
* Energy statistics

Ratio Screen

* Two independent sensors
* Measure ratio, sum, difference
* Normalize one sensor to the other

Data Storage and Transmission

* Non-volatile storage of power and energy logging data
* Store in up to 10 files and transmit to PC
* PC using StarCom Windows program provided

Ordering Information

Item	Description	Ophir P/N
Laserstar	Laserstar single channel universal power meter for thermal, pyroelectric, photodiode and RP sensors	7Z01600
Laserstar 2 Channel	Laserstar with dual channel capability including ratio and difference measurement	7Z01601
RS232 Cable for Laserstar	Cable RS232 D9 - D25 (1 unit supplied with Laserstar)	7E01121
Laserstar Battery Pack	Laserstar NiMH Battery update Kit	7Z14006A
Laserstar IEEE Option	IEEE GPIB adapter for Laserstar	7Y78300 [(a)]
Laserstar AN Adapter	Laserstar analog output adapter (1unit supplied with Laserstar)	7Z11004

Note: (a) P/N 7Y78300 replaces P/N 78300

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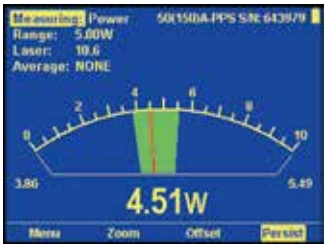
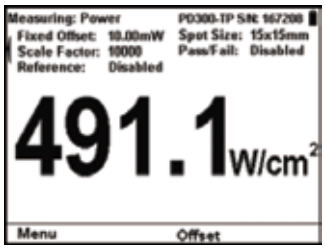
StarBright - Feature Rich Laser Power / Energy Meter

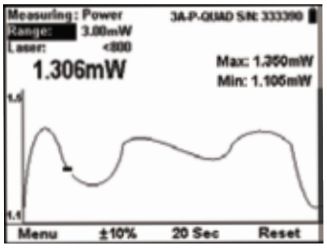
* Compatible with all standard Ophir thermal, BeamTrack, pyroelectric (PE-C series) and photodiode sensors
* Brilliant color large size TFT 320x240 display
* Compact handheld design with rubberized bumpers and optimized kickstand
* Choose between Digital with Bargraph, Analog Needle, Line Plot, Position, Stability and Real Time Statistics displays
* Scalable Analog Output
* Log every point at up to 5000Hz with Pyro sensors
* USB Flash Drive for nearly unlimited data storage
* Laser tuning screen as well as sophisticated power and energy logging
* USB and RS232 interfaces with StarLab and StarCom PC applications included
* LabVIEW driver and COM Object Interface (see page 129)
* Soft keys and menu driven functions with context sensitive help
* Math functions for advanced processing such as Density, Scale Factor, Pass/Fail inspection, etc
* Backlighting and rechargeable battery





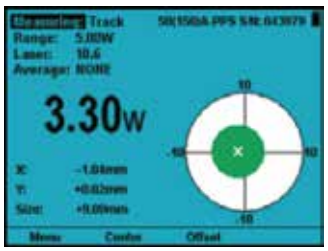
Selected Screens

* Power display in analog needle format.
* Persistence tracking of previous measurements including min/max display.
* Alternate color scheme selected.



Math functions applied to measure power density after rescaling the power measured by the sensor.

* Power measurement displayed as a line plot.
* Graph wraps back to start when end is reached.
* Min/Max displayed to help in tuning.



* Power, Position, and Size measured with a BeamTrack sensor.
* Also measures beam wander.

StarBright Screen Layout

StarBright screen ergonomics raise the user experience to new levels. The display is carefully designed to provide easy reading of the laser measurement, quick access to configuration parameters as well as the ability to set up for more advanced work.

Ordering Information

Item	Description	Ophir P/N
StarBright	StarBright universal power meter for Thermal, BeamTrack, Pyroelectric and Photodiode sensors	7Z01580
Carrying Case	Carrying case 38x30x11 cm. For power meter and up to 3 sensors	1J02079
StarBright USB Cable	USB-A to MICRO-B cable for field upgrade support (1 unit supplied with StarLite)	7E01279
StarBright RS232 Cable	D9 to 3.5mm plug cable (1 unit supplied with StarBright)	7E01213
StarBright Battery Pack	Replacement battery pack for the StarBright	7E14008

StarLite - Low Cost Power / Energy Meter

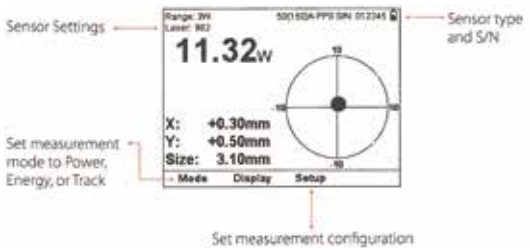
* Compatible with all standard Ophir Thermal, BeamTrack, PE-C Pyroelectric and Photodiode sensors (not compatible with non C pyroelectric sensors)
* Brilliant large size TFT 320x240 display
* Compact handheld design with rubberized bumpers and optimized kickstand
* Choice of digital or analog needle display
* Analog output
* Easy to use soft keys
* Easy measurement configuration with context sensitive help
* Backlighting and rechargeable battery
* Single shot energy measurement with thermal sensors
* Power averaging
* Resizable Screen graphics
* EMI rejection
* Optional software package for USB communication with our StarLab PC suite

Barchart Display of Power Measurement

Selected Screens

Digital Power Screen

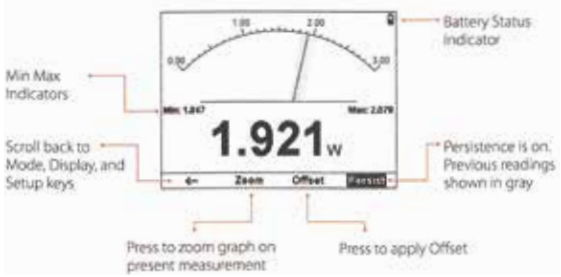
* CW industrial, medical and scientific lasers
* pW to Multi kW with appropriate sensors
* Can average over selected period. Useful for unstable lasers.
* Fast response bar chart



BeamTrack Position and Size Screen

BeamTrack Power/Position/Size Screen

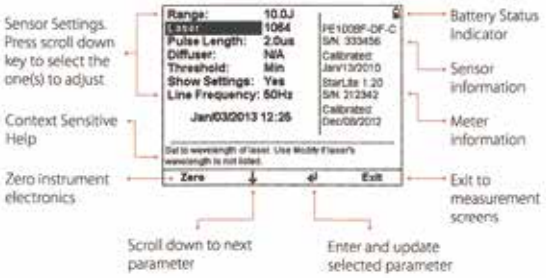
* Monitoring of laser beam size
* Accurate tracking of beam position to fractions of a mm
* Power measured at the same time



Large Analog Needle with Persistence

Analog Needle Screen

* Perfect for adjusting and maximizing laser power or energy
* Persistent graphical display allows tracking of minimum maximum values measured
* Large analog needle with small digital display as well



Configuration Screen

Configuration Screen

* Easy adjustment of all measurement configuration parameters
* Context sensitive help for selected parameter
* Sensor and meter information provided

Ordering Information

Item	Description	Ophir P/N
StarLite	StarLite universal power meter for Thermal, BeamTrack, Pyroelectric and Photodiode sensors	7Z01565
Carrying Case	Carrying case 38 x 30 x 11 cm. For power meter and up to 3 sensors	1J02079
StarLite USB Activation Code	Software Activation Code that enables the StarLite meter to communicate in USB with our StarLab software suite	7Z11049
USB Cable for StarLite	USB-A to MICRO-B cable for field upgrade support (1 unit supplied with StarLite)	7E01279
Battery Pack for StarLite	Replacement battery pack for the StarLite	7E14008

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PC Interfaces

PC Connectivity Options for Power/Energy Measurement

Ophir Pyroelectric, Thermal and Photodiode sensors measure at up to 25,000 points per second

Sample data with Ophir power meter at up to 4000 points per second

Ophir power meter capable of on board storage of data of up to 250,000 points and data storage rate of up to 4000 points per second

Ophir sensor to USB interfaces with up to 4 channel connectivity

Ophir Quasar interface with wireless connectivity

Transmit real time data to PC at 500 points per second via Bluetooth

Transmit real time data to PC at up to 25,000 points/s per channel (sensor limited) via USB

Transmit stored data or real time data to PC via USB or RS232

StarLab software (data transmitted via USB or Bluetooth)

StarCom software (data transmitted via RS232)

StarLab software

StarCom software

Compact Juno USB Interface

Convert your laptop or desktop PC into an Ophir sensor power/energy meter

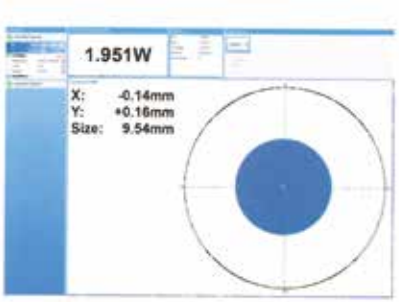
* From sensor to interface to PC - no power source needed
* Plug and play with all standard Ophir smart sensors
* Position & size measurement with BeamTrack sensors
* Record every energy pulse at up to 10kHz
* Log power and energy, average, statistics, histograms and more with included StarLab application
* LabVIEW VIs and COM Object interface
* Very compact - is just an extension of the smart plug

Smart Sensor to Juno to PC

Ophir's basic smart compact Juno module turns your PC or laptop into a full fledged Ophir laser power/energy meter. Just install the software, plug the sensor into the Juno module and connect the Juno with a standard USB cable to the PC USB port. Using the Juno, you can connect several sensors to the PC by using one Juno module for each sensor and, if necessary, a USB hub.

LabVIEW

Juno operating with StarLab software



Juno with BeamTrack sensor and StarLab showing beam power, position and size

Specifications

Power Measurement	
Power log period	5s to 500hr.
Energy Measurement	
Max real time data logging to PC	10,000Hz [(a)]
Trigger input and output	N.A.
Timing	Supports time stamp for each pulse - resolution 10µs
General	
Number of sensors supported	One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC
Compatible sensors	Supports all standard Ophir pyroelectric, thermal, BeamTrack and photodiode sensors [(b)]
Power supply	Powered from USB
Dimensions	76 x 55 x 22mm

Notes:
(a) This is the data logging rate for every single point in turbo mode. Above that rate, the instrument will sample points but not log every single point
(b) Not including RP, PD300-CIE and BC20

Ordering Information

Item	Description	Ophir P/N
Juno	Compact module to operate one Ophir sensor from your PC USB port. Comes with software. Max repetition rate for every pulse 10kHz. Powered from PC USB port	7Z01250
Juno USB cable	USB-A to MINI-B Cable (1 unit supplied with Juno)	7E01217

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Pulsar Multichannel and Triggered USB Interfaces

Convert your laptop or desktop PC into a multichannel power/energy meter

* From sensor to interface to PC
* 1,2 and 4 channel models
* Plug and play with most Ophir sensors
* Record every energy pulse at up to 25kHz
* Measure missing pulses & trigger output with external trigger
* Log power and energy, average, statistics, histograms and more with included StarLab application
* LabVIEW VIs, COM Object Interface and ActiveX software included

Smart Sensor to Pulsar to PC

Ophir's 1-4 channel Pulsar interface turns your PC or laptop into a full fledged Ophir multi-channel laser power/energy meter. Just install the software, plug the sensor into the Pulsar and the USB cable from the Pulsar to the PC USB port. With the Pulsar series, you can connect up to 4 sensors to each module, monitor each pulse at up to 25kHz and utilize external trigger.

LabVIEW

Pulsar-4 operating with StarLab software

Specifications

Power Measurement	
Power log period	5s to 500hr.
Energy Measurement	
Max real time data logging to PC	25,000Hz [a]
Trigger input and output	BNC trigger input to enable measurement of missing pulses or to select specific pulses. Can also be configured to give trigger output
Timing	Supports time stamp for each pulse - resolution 1µs
General	
Number of sensors supported	4 / 2 / 1 sensors per unit. Can combine several units with software for display of up to 8 sensors on one PC
Compatible sensors	Supports all standard Ophir pyroelectric, thermal and photodiode sensors [b]
Power supply	12V wall cube power supply plugs into jack on rear. The power supply can be ordered from your local distributor.
Dimensions	189 x 103 x 33mm

Notes :
(a) Limited by the maximum repetition rate of the sensor. At present only the PE9-F can operate up to 25000Hz
(b) Not including RP, PD300-CIE and BC20 sensors

Ordering Information

Item	Description	Ophir P/N
Pulsar-4	Module to operate up to 4 Ophir sensors from your PC USB port. Comes with software. Max repetition rate for every pulse 25kHz. Has external trigger capability. Powered from wall cube power supply (can be ordered from your local distributor).	7Z01201
Pulsar-2	Same as above but for 2 channels only	7Z01202
Pulsar-1	Same as above but for 1 channel only	7Z01203
Pulsar USB	Cable USB-A to B cable (1 unit supplied with Pulsar)	7E01202
USB Interface (USBI) legacy	Legacy smart sensor to USB interface with similar performance to Juno but larger size. Has analog output. See summary page 102 for specifications	7Z01200

Quasar Wireless Bluetooth Interface

Straight from your measuring sensor to your laptop or PC with no cables

* Quasar wireless interface connects to any Ophir sensor and broadcasts to your PC
* Wireless range of 10-30 meters depending on surroundings
* Operates from rechargeable battery with typically >40 hours lifetime
* Powerful USB interface with StarLab PC application software included
* Converts your PC into a complete laser power/energy meter
* Log power and energy, average, statistics, histograms and more
* Monitor up to 7 Quasars simultaneously on one PC

Quasar Bluetooth Wireless Sensor to PC Interface

Quasar module connects to any Ophir sensor, thermal, pyroelectric or photodiode

Any PC or laptop connects to Quasar module via Bluetooth adapter and operates as a power/energy meter/data logger

Specification

Sensor Compatibility	All Ophir standard sensors, thermal, photodiode and pyroelectric [(a)]
Number of Sensors on One PC	Up to 7 Quasars can operate simultaneously and be displayed at the same time on one PC
Operating Range	10-30 meters depending on surroundings when used with built in laptop Bluetooth or Ophir recommended adapter
Power	Powered by rechargeable NiMH battery. Battery life typical 40 hours, 20 hours for pyro sensors. Automatically goes into sleep mode when not connected to PC. Low batt indication. Charges from 12VDC either polarity. The charger can be ordered from your local distributor.
LED Indicator	LED indicator indicates whether connected, in standby or off
Bluetooth Standard	Bluetooth class 1. Connection to PC is transparent to user. Will work with built in laptop Bluetooth and most add on USB to Bluetooth adapters. Ophir recommended USB to Bluetooth adapter Ophir P/N 7E10039 (see table below)
Data Transfer Rate for Pyro Sensors	500Hz
Dimensions	96mm (W) x 95mm (D) x 36mm (H) not including antenna
Connections	15 pin D type sensor connector standard Ophir 12V charger input

Notes : (a) Not including RP, PD300-CIE and BC20 sensors

Ordering Information

Item	Description	Ophir P/N
Quasar Bluetooth Interface	Module to operate one Ophir sensor from your PC via Bluetooth wireless interface. Comes with software. Max repetition rate for every pulse 500Hz. Powered from built in rechargeable battery. Comes with power supply. Bluetooth adapter required when not available on PC. See next line	7Z01300
USB to Bluetooth adapter	Adapter for PC or Laptop not equipped with built in Bluetooth. This adapter is tested and recommended by Ophir. Quasar is not guaranteed to work with all other adapters on the market	7E10039
Battery Pack for Quasar	Replacement battery pack for Quasar	7E14007

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Summary of Computer Options for Ophir Meters and Interfaces

Communications

With Ophir RS232, USB, Bluetooth and GPIB communication options you can transfer data from the sensor to the PC in real time or offline. You can also control your Ophir power meter from the PC.

* USB standard on Nova II, Vega power meters and Juno, Pulsar and USBI PC interfaces
* Bluetooth wireless on the Quasar interface
* RS232 standard with the Laserstar, Nova II and Vega, optional on the Nova
* GPIB optional with the Laserstar

Ophir Power Meter and Interface Specifications

Model	Nova	Laserstar	Nova II / Vega	StarBright	StarLite	Pulsar-1, 2 or 4	Juno	USB interface	Quasar Bluetooth
Communication Method	RS232	RS232 / GPIB	USB / RS232	USB / RS232	USB (c)	USB	USB	USB	Bluetooth
Power Measurement									
Power log period	5s to 24hr.	12s to 600hr.	12s to 600hr.	1s to 1000hr.	N.A	5s to 500hr.	5s to 500hr.	5s to 500hr.	5s to 500hr.
Max points stored onboard	300	5400	Nova II 5400 Vega 27000	unlimited	N.A	N.A	N.A	N.A	N.A
Max points direct on PC	unlimited	unlimited	unlimited	unlimited	N.A	unlimited	unlimited	unlimited	unlimited
Analog output	1V F.S.	1V F.S.	1V, 2V. 5V, 10V F.S.	1V, 2V. 5V, 10V F.S.	1V F.S.	N.A	N.A	1V F.S.	N.A
Energy Measurement									
Max real time data logging to PC	>10Hz	>30Hz RS232 >1500Hz GPIB(a)	>2000Hz USB(a) >30Hz RS232	>5000Hz USB >30Hz RS232	20Hz (c)	25,000Hz (a)	10,000Hz (a)	2000Hz (a)	500Hz
Max onboard data logging rate	>10Hz	>1500Hz (a)	4000Hz (a)	5000Hz	N.A	N.A	N.A	N.A	N.A
Data transfer rate of a data file from instrument to PC	~50 points/s	~500 points/s	~500 points/s	~500 points/s	N.A	N.A	N.A	N.A	N.A
Max points stored onboard	1000	59,400	Nova II 59,400 Vega 250,000	unlimited	N.A	N.A	N.A	N.A	N.A
Trigger input and output	N.A	N.A	N.A	N.A	N.A	BNC trigger input to enable measurement of missing pulses. Can also be configured to give trigger output.	N.A	N.A	N.A
Timing - time stamp for each pulse	N.A	N.A	N.A	resolution 1µs	N.A	resolution 1µs	resolution 10µs	resolution 50ms	resolution 10ms
General									
Automation Interface	no	no	yes	yes	yes (c)	yes	yes	yes	no
LabVIEW VIs	yes	yes	yes	yes	yes (c)	yes	yes	yes	no
Maximum baud rate	19200 (b)	38400	38400	115200	N.A	N.A.	N.A.	N.A.	N.A.
PC file format	Text files, spreadsheet compatible ASCII								
Number of sensors supported	One sensor per unit.	One sensor per unit for single channel mode. Two sensors per unit for dual channel mode.	One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC	One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC	One sensor per unit	4 / 2 / 1 sensors per unit. Can combine several units with software for display of up to 8 sensors on one PC	One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC	One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC	One sensor per unit. Can combine several units with software for display of up to 7 Quasars on one PC
Compatible sensors	Supports most Ophir pyroelectric, thermal and photodiode sensors								
Power supply	Powered from internal rechargeable battery power supply	Powered from internal rechargeable battery power supply	Powered from internal rechargeable battery power supply	Powered from internal rechargeable battery power supply	Powered from internal rechargeable battery power supply	12V wall cube plugs into jack on rear	Powered from USB	Powered from USB	Powered from internal rechargeable battery power supply
Dimensions	205 x 95 x 39mm	228 x 195 x 54mm	208 x 117 x 40mm	208 x 117 x 40mm	213 x 113 x 40mm	189 x 103 x 33mm	76 x 55 x 22mm	155 x 90 x 34mm	96 x 95 x 36mm

Notes :

(a) The above refers to the rate for logging every single point in turbo mode. Above that rate, the instrument will sample points but not log every single point.

(b) For pyroelectric sensors, maximum guaranteed baud rate is 9600.

(c) StarLite must be USB enabled in order to work with StarLab. If your StarLite has not been USB enabled, please contact your Ophir distributor in order to obtain a USB Activation Code.

Beam Profiling System

Laser Wavelength	Power			Minimum Beam Size				
	<100mW	100mW-100W	>100W	<20µm	>20 <50µm	>50µm	>500µm	<1mm
UV-Vis	NS-Si	NS-Pyro	HP-NS	NS-Si/3.5/1.8	NS-Si/9/5	NS-Si/9/5	NS-Si/9/5	NS-Si/9/5
	SP928	SP928	NS-Pyro		NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5
	LT665	LT665	SP928			SP928	SP928	SP928
NIR 1000-1100n			LT665			LT665	LT665	LT665
	NS-Ge	NS-Pyro		NS-Ge/3.5/1.8	NS-Ge/9/5	NS-Ge/9/5	NS-Ge/9/5	NS-Ge/9/5
	SP928	SP928	NS-Pyro		NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5
	LT665	LT665	SP928			SP928	SP928/SP907	
Telecom and Eye-Safe 1100-1800nm	NS-Ge	NS-Pyro	HP-NS	NS-Ge/3.5/1.8	NS-Ge/9/9	NS-Ge/9/9	NS-Ge/9/9	NS-Ge/9/9
			NS-Pyro		NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5
						XEVA	XEVA	XEVA
	Pyrocam	Pyrocam	Pyrocam				Pyrocam	Pyrocam
1500-1600nm	NS-Ge	NS-Ge	NS-Ge	NS-Ge/3.5/1.8	NS-Ge/9/5	NS-Ge/9/5	Pyrocam	NS-Ge/9/5
	SP620-1550	SP928-1550	SP928-1550			SP928-1550	XEVA	SP928-1550
	LT665-1550	LT665-1550	LT665-1550			LT665-1550	SP928-1550	XEVA
							LT665-1550	LT665-1550
MIR&FIR	Pyrocam	NS-Pyro	HP-NS	Pyrocam w/ Beam Expansion	NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5
		Pyrocam	NS-Pyro				Pyrocam	Pyrocam
			Pyrocam					
			ModeCheck					

Abbreviations:

FIR	Far Infrared	NIR	Near Infrared
Ge	Germanium	Si	Silicon
HP	High Power	SP	Indicates camera profiler
MIR	Mid-Infrared	NS	NanoScan
UV-Vis	Ultraviolet - Visible		

Laser Wavelength	Minimum Beam Size		CW or Pulsed			Customer Priority				
	>5mm	>10mm	CW	Pulsed <1kHz	Pulsed >1kHz	Price	2D/3D	No optics	Speed	Ease of use
UV-Vis	Pyrocam	NS-Pyro	HP-NS	Pyrocam w/ Beam Expansion	NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5	NS-Pyro/9/5	NS	NS
		Pyrocam	NS-Pyro				Pyrocam	Pyrocam		
			Pyrocam							
			ModeCheck							
NIR 1000-1100nm	NS-Ge/12/25		NS	SP928	SP928	SP928	SP928	NS	NS	NS
	NS-Pyro/20/25	NS-Pyro/20/25	SP928	LT665	NS		LT665			
	LT665	L11059	LT665		LT665					
		LT665								
Telecom and Eye-Safe 1100-1800nm	NS-Ge/12/25		NS	XEVA	XEVA	NS	XEVA	NS	NS	NS
	NS-Pyro/20/25	NS-Pyro/20/25			NS		Pyrocam			
	Pyrocam									
	NS-G/12/25	NS-Pyro/20/25			NS					
1500-1600nm	SP928-1550	LT665-1550	XEVA	XEVA	XEVA	SP928-1550	SP928-15550	NS	NS	NS
	LT665-1550			LT665-1550	LT665-1550		LT665-1150			
MIR & FIR	NS-Pyro/20/25	NS-Pyro/20/25	NS	Pyrocam	NS	NS	Pyrocam	NS	NS	NS
	Pyrocam		Pyrocam		Pyrocam					

Abbreviations:

FIR	Far Infrared	NIR	Near Infrared
Ge	Germanium	Si	Silicon
HP	High Power	SP	Indicates camera profiler
MIR	Mid-Infrared	NS	NanoScan
UV-Vis	Ultraviolet - Visible		

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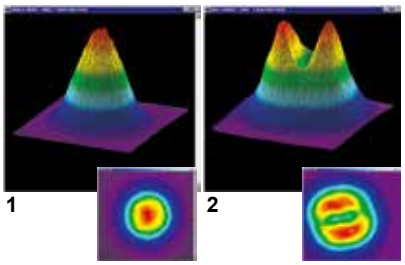
Benefits of Beam Profiling

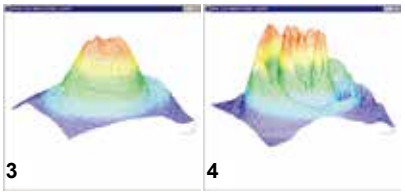
You can get more out of your laser

Figure 1 shows an industrial Nd: YAG laser, near Gaussian beam, with 100 Watts output power and 1.5kW/cm^2 power density. Figure 2 is the same Nd: YAG beam at greater power, 170 Watts, but it split into 2 peaks producing only 1.3kW/cm^2 power density. The power density of the beam decreased 13% instead of increasing by the 70% expected.
Without measuring the beam profile and beam width, you would not know what happened to your power density, and why the performance did not improve.



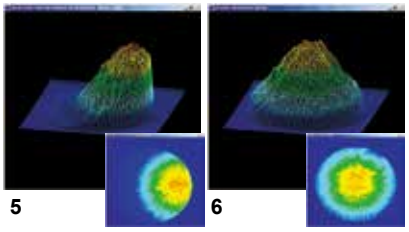
Laser cavities become misaligned

Figures 3 & 4 are beam profiles of CO_2 lasers used for ceramic wafer scribing in the same shop. The second laser with the highly structured beam produced mostly scrap parts, until the laser cavity was aligned.



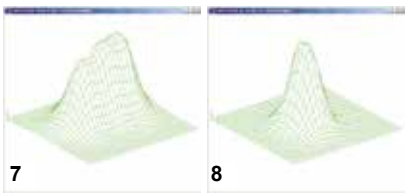
Off axis delivery optics

Figures 5 & 6 show an industrial Nd:YAG laser with misaligned turning mirror, before and after adjustment.



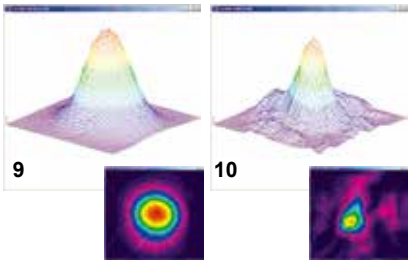
Alignment of devices to lenses

Figures 7 & 8 show beam profiles during alignment of a collimating lens to a laser diode. The first profile shows poor alignment of the lens to the diode, which can easily be improved when seeing the profile in real time.



Laser amplifier tuning

Figures 9 & 10 show a Cr: LiSAF femtosecond laser oscillator beam with a near Gaussian output, and what happens to the oscillator beam with poor input alignment.



All these examples illustrate the need for beam monitoring

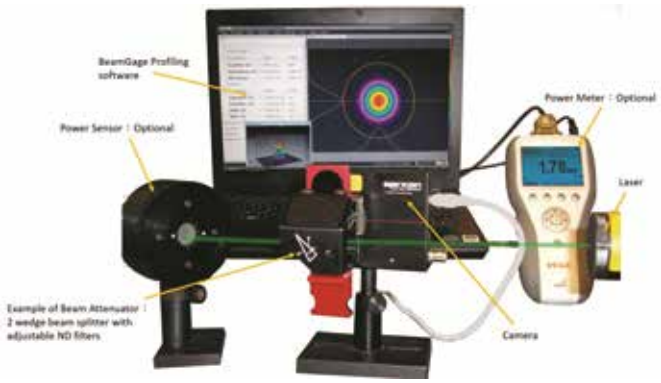
* Measurement of the beam profile is needed to know if problems exist, and the profile must be seen to make corrections
* Most laser processes can be improved
* Scientific experiments can be more accurate
* Commercial instruments can be better aligned
* Military devices can have greater effectiveness
* Industrial processing produces less scrap
* Medical applications are more precise

Just knowing the beam profile can make the difference between success and failure of a process.

Introduction to Camera-Based Profilers

Beam Attenuating Accessories

A camera-based beam profiler system consists of a camera, profiler software and a beam attenuation accessory. Spiricon offers the broadest range of cameras in the market to cope with wavelengths from 13nm, extreme UV, to 3000 µm, in the long infrared. Both USB and FireWire interfaces are available for most wavelength ranges providing flexibility for either laptop or desktop computers.



BeamGage®, the profiling software, comes in two versions: Standard and Professional. Each builds off of the next adding additional capability and flexibility needed for adapting to almost any configuration requirement.
Spiricon also has the most extensive array of accessories for beam profiling. There are components for attenuating, filtering, beamsplitting,magnifying, reducing and wavelength conversion. There are components for wavelengths from the deep UV to CO_2 wavelengths. Most of the components are modular so they can be mixed and matched with each other to solve almost any beam profiling requirement needed.

Acquisition and Analysis Software

The BeamGage software is written specifically for Microsoft Windows operating systems and takes full advantage of the ribbon-base, multi-window environment. The software performs rigorous data analyses on the same parameters, in accordance with the ISO standards, providing quantitative measurement of numerous beam spatial characteristics. Pass/Fail limit analysis for each of these parameters can bealso applied.

* ISO Standard Beam Parameters
* Dslit, Denergy, D4σ
* Centroid and Peak location
* Major and Minor axes
* Ellipticity, Eccentricity
* Beam Rotation
* Gaussian Fit
* Flat-top analysis/Uniformity
* Divergence
* Pointing stability

For data display and visualization, the user can arrange and size multiple windows as required. These may contain, for example, live video, 2D Topographic and 3D views, calculated beam parameters and summary statistics in tabular form with Pass/Fail limit analysis, and graphical strip chart time displays with summary statistics and overlays. Custom configured instrument screens with multiple views can be saved as configuration files for repeated use. Data can be exported to spreadsheets, math, process/ instrumentation and statistical analysis programs, and control programs by logging to files or COM ports, or by sharing using LabView or ActiveX Automation.

* Video Dual Aperture Profiles
* Bam Statistics
* 3D Profile View
* 2D Topographic View
* Time Statistics Charts
* Pointing / Targeting
* Hide measurements and features not in use for user simplicity
* Notes

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BeamGage®-Standard Version

* Extensive set of ISO quantitative measurements
* Patented Ultracal™ algorithm for highest accuracy measurements in the industry
* Customizable user interface for 'ease of use'
* Auto-setup and Auto-exposure capabilities for fast set-up and optimized accuracy
* Statistical analysis on all calculated results displayed in real time
* New BeamMaker® beam simulator for algorithm self-validation

The performance of today's laser systems can strongly affect the success of demanding, modern laser applications.

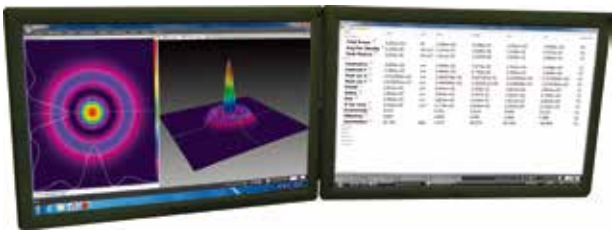
The beam's size, shape, uniformity or approximation to the expected power distribution, as well as its divergence and mode content can make or break an application. Accurate knowledge of these parameters is essential to the success of any laser-based endeavor. As laser applications push the boundaries of laser performance it is becoming more critical to understand the operating criteria.

For over thirty years Ophir-Spiricon has developed instruments to accurately measure critical laser parameters. Our LBA and BeamStar software have led the way. Now with the introduction of BeamGage, Ophir-Spiricon offers the first "new from the ground up" beam profile analysis instrument the industry has experienced in over 10 years.

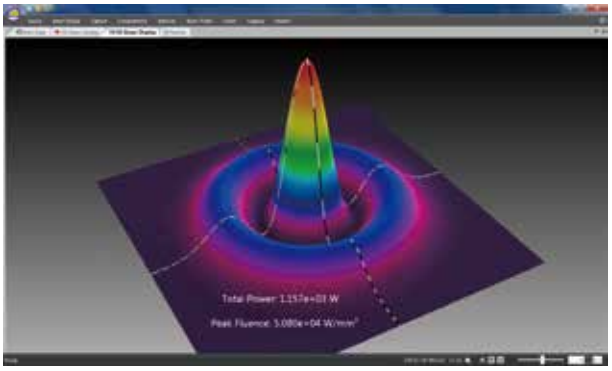
BeamGage includes all of the accuracy and ISO approved quantitative results that made our LBA software so successful. BeamGage also brings the ease-of-use that has made our BeamStar software so popular. Our patented UltraCal algorithm, guarantees the data baseline or "zero-reference point" is accurate to 1/10 of a digital count on a pixel-by-pixel basis. ISO 11146 requires that a baseline correction algorithm be used to improve the accuracy of beam width measurements. UltraCal has been enhanced in BeamGage to assure that accurate spatial measurements are now more quickly available.

See Your Beam As Never Before:

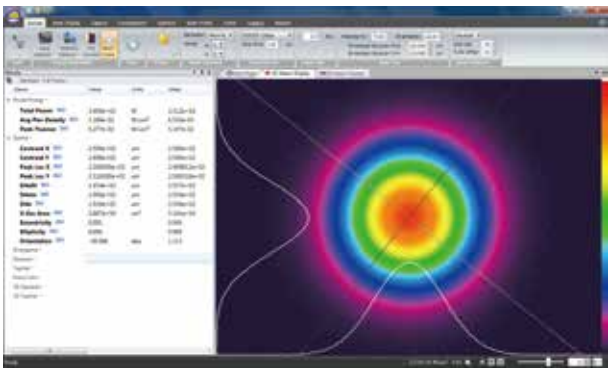
The Graphical User Interface (GUI) of BeamGage is new. Dockable and floatable windows plus concealable ribbon tool bars empowers the BeamGage user to make the most of a small laptop display or a large, multi-monitor desktop PC.



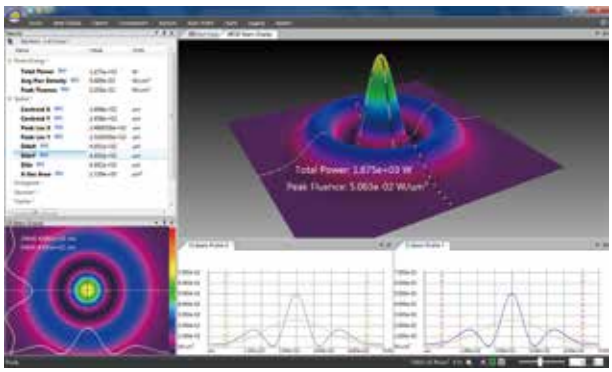
Dual or single monitor setup with beam displays on one and results on the other.(Note that results can be magnified large enough to see across the room).



Beam only (Note results overlaid on beam profile).



Beam plus results



Multiple beam and results windows.
(Note quantified profile results on 3D display & quantified 2D slices).

*3D displays Rotate & Tilt. All displays Pan, Zoom, Translate & Z axis Zoom.

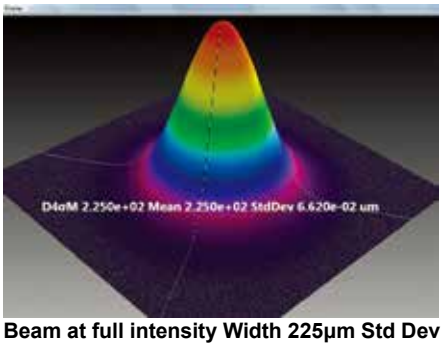
Measure Your Beam As Never Before:

Ultracal: Essential, or no big deal?
If you want accurate beam measurements, you want Ultracal.

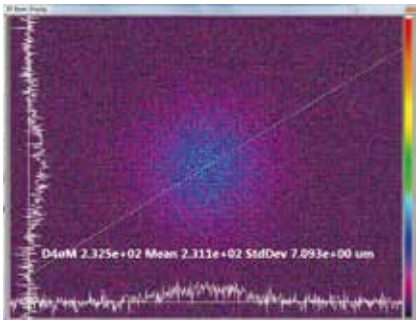
What is Ultracal?
Our patented, baseline correction algorithm helped establish the ISO 11146-3 standard for beam measurement accuracy. The problems with cameras used in beam profile measurements are: a) baseline, or zero, of the cameras drift with time temperature, and b) include random noise. Ultracal is the only beam profiler algorithm that sets the baseline to “zero”, and, in the center of the noise. (Competitive products use other less sophisticated algorithms that perform a baseline subtraction, but truncate the noise below the “zero” of the baseline. This leaves only a “positive” component, which adds a net value to all beam measurements).

Try the following on any other beam profiler product to see the inherent error if you don’t use Ultracal.

1. Measure a beam with full intensity on the profiler camera.
2. Insert a ND2 filter (100X attenuation) into the beam and measure it again.
3. Compare the results.
4. The Standard Deviation below is about 3%, which is phenomenal compared to the 100% or more of any beam profiler without Ultracal.



Beam at full intensity Width 225µm Std Dev 0.06µm



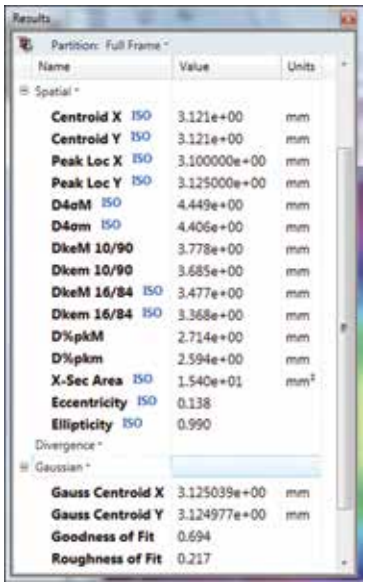
Beam attenuated 100X (displayed here in 2D at 16X magnitude zoom), Width 231µm, Std Dev 7µm

Adding the use of Automatic Aperture improves the accuracy to 1%. (The conditions of this measurement is a camera with a 50dB SNR).

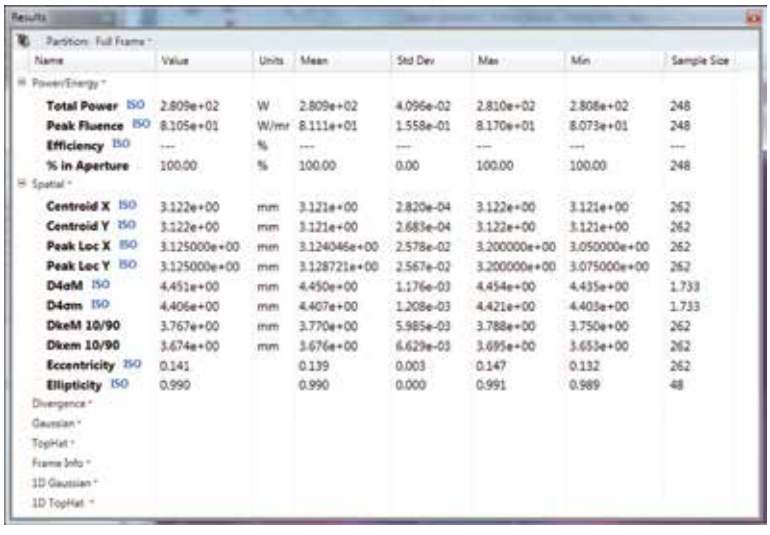
5. You normally don’t make measurements at such a low intensity. But occasionally you may have a drop in intensity of your beam and don’t want to have to adjust the attenuation. Or, you may occasionally have a very small beam of only a few tens of pixels. In both of these cases, Ultracal becomes essential in obtaining accurate measurements.

Beam Measurements and Statistics

BeamGage allows you to configure as many measurements as needed to support your work, and comes standard with over 55 separate measurement choices. To distinguish between calculations that are based on ISO standards and those that are not, a graphical ISO logo isb displayed next to appropriate measurements. You can also choose to perform statistical calculations on any parameter in the list.



Small sample of possible measurements out of a list of 55



Sample of calculation results with statistics applied

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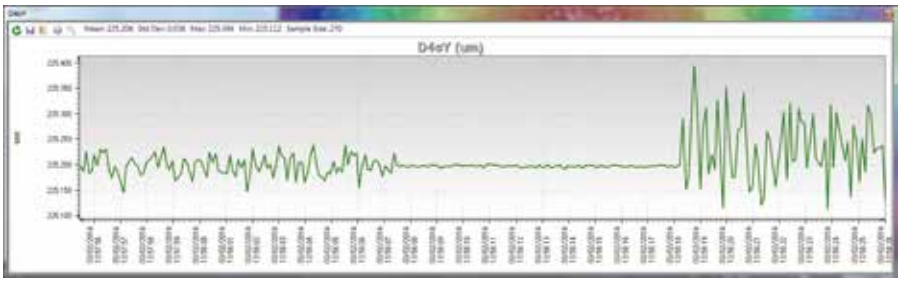
Multiple Charting Options

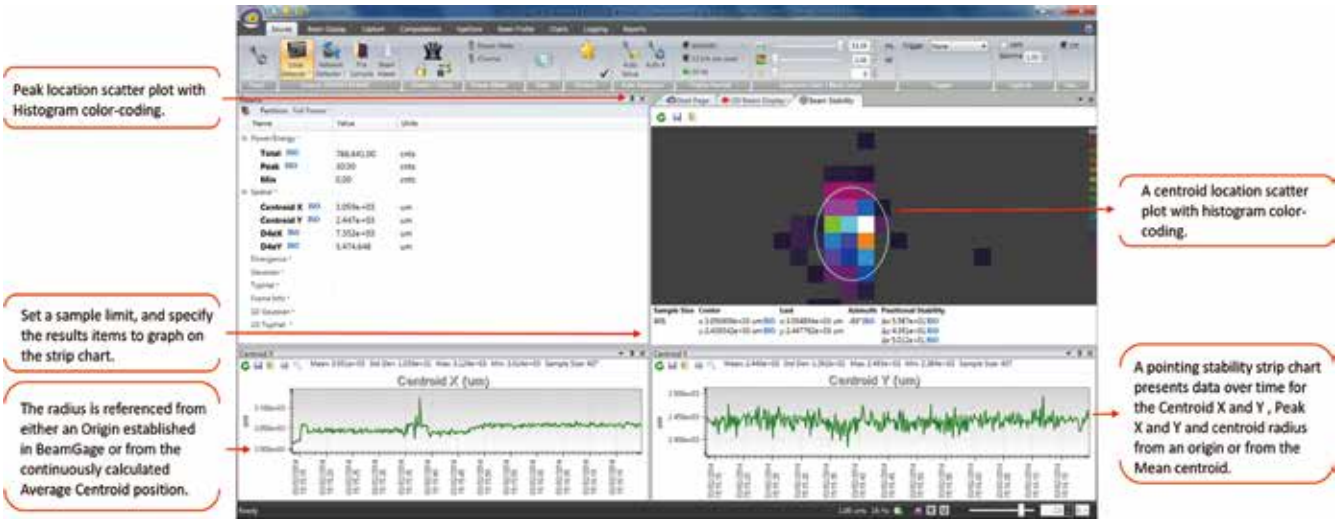
You can create strip charts for stability observations on practically any of the calculations options available. Charts enable tracking of short or long term stability of your laser.



Strip chart of beam D4sigma width. Note how changing conditions affects the width repeatability. Beam intensity changed over 10db, making noise a significant factor in measurement stability.

Beam Pointing Stability

Open the Pointing Stability Window to collect centroid and peak data from the core system and display it graphically.View a chart recorder and statistical functions in one interface:



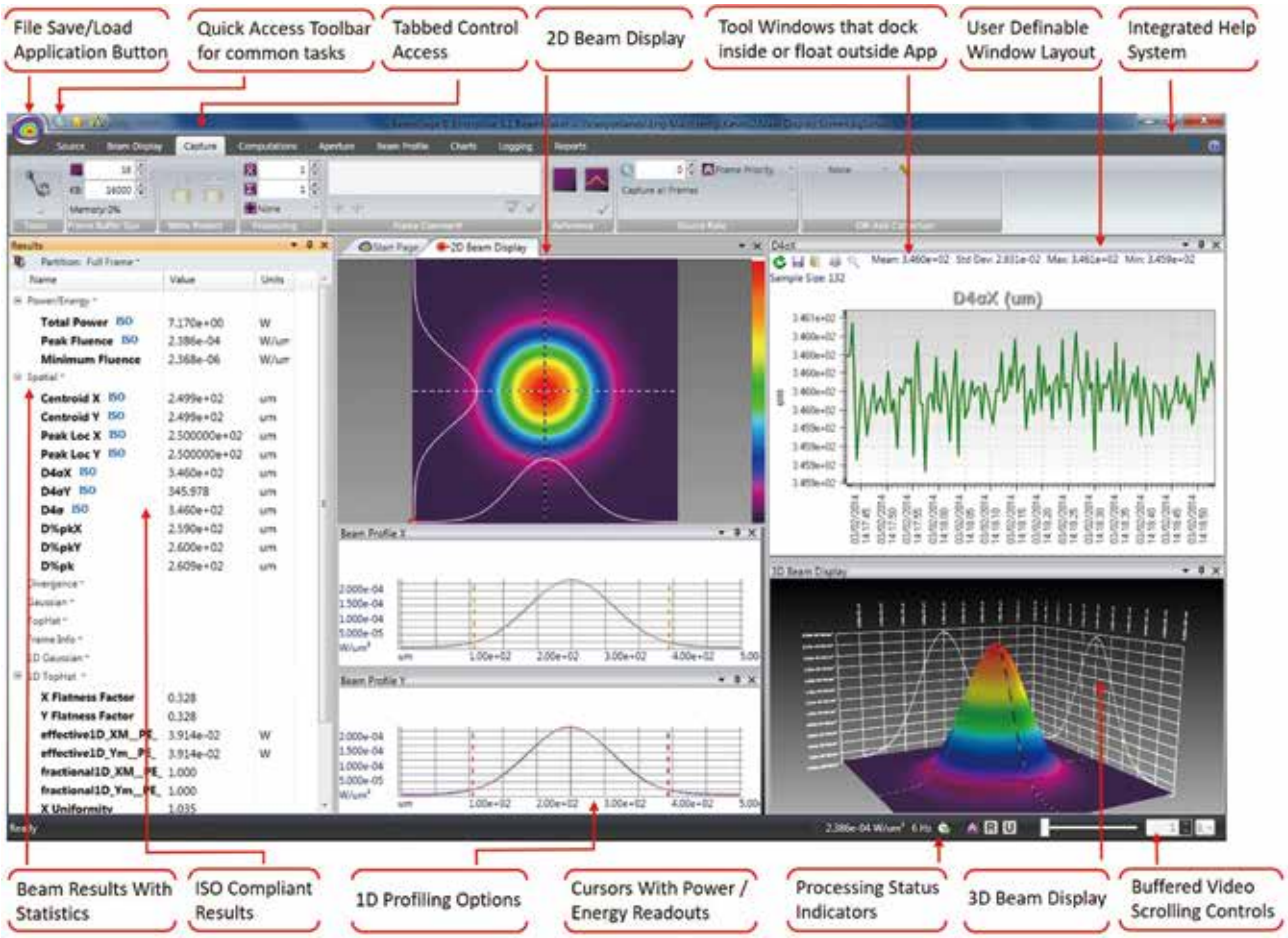
Easy to Use and Powerful

BeamGage is the only beam profiler on the market using modern Windows 7 navigation tools. The menu system of BeamGage is easy tolearn and easy to use with most controls only one mouse click away. Some ribbon toolbar examples:

Some of the Beam Display options (Display access options under the Tools tab on the left).

Some of the Beam Capture options.

BeamGage Main Display Screen



Pass / Fail with Password Protection for Production Testing

BeamGage allows the user to configure the displayed calculations; set-up the screen layout and password protect the configuration from any changes. This permits secure product testing as well as data collection for Statistical Process Control (SPC), all while assuring the validity of the data.

Name	Value	Mean	Std Dev	Max	Min	Units
Power/Energy						
Spatial						
Centroid X ISO	7.831e+01	7.831e+01	2.849e-03	7.832e+01	7.830e+01	um
Centroid Y ISO	7.965e+01	7.965e+01	3.047e-03	7.966e+01	7.964e+01	um
Peak Loc X ISO	7.000000e+01	7.073199e+01	1.340173e+0	7.500000e+01	6.700000e+01	um
Peak Loc Y ISO	7.100000e+01	7.183659e+01	1.333245e+0	7.500000e+01	6.800000e+01	um
D4σX ISO	1.238e+02	1.238e+02	8.334e-03	1.239e+02	1.238e+02	um
D4σY ISO	124.041	124.053	0.008	124.079	124.027	um
D4σ ISO	1.239e+02	1.239e+02	6.395e-03	1.240e+02	1.239e+02	um

Failures (or successes) can be the impetus for additional actions including a TTL output signal or PC beep and the termination of further data acquisition.

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Unique Features of BeamGage - Standard

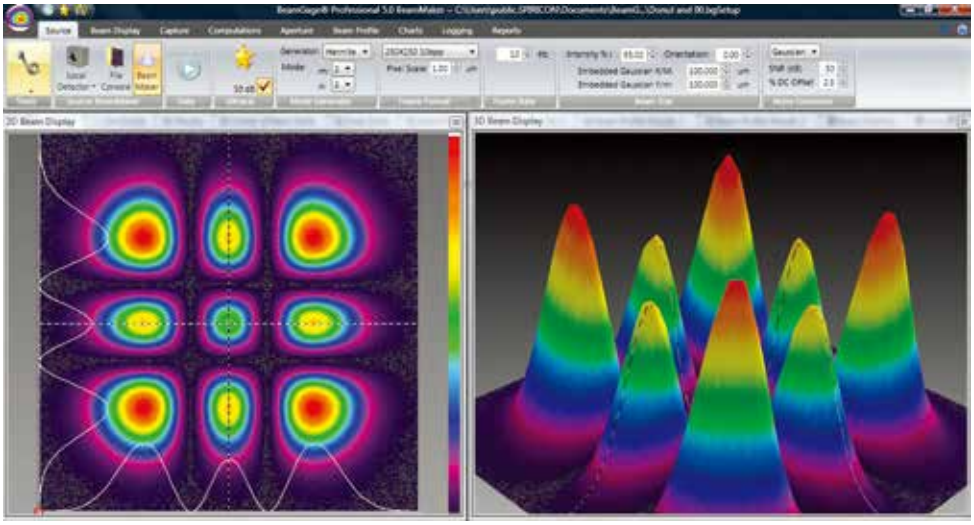
Power/Energy Calibration

Using the USB output from select Ophir power/energy meters, the BeamGage application will display measured power/energy values from the full range of Ophir thermopile, photodiode and pyroelectric sensors. Pulsed lasers can be synced up to 100Hz, or the frame rate of the triggered camera, whichever is less. This is the first time in the industry a laser power meter has been married to a laser beam profile system.

BeamGage is the only product to integrate profiling and power meter measurements

BeamMaker®; Numerical Beam Profile Generator

BeamGage contains a utility, BeamMaker, that can synthetically generate beam profile data by modeling either Laguerre, Hermite or donut laser beams in various modal configurations. BeamMaker permits the user to model a beam profile by specifying the mode, size,width, height, intensity, angle, and noise content.Once generated the user can then compare the theoretically derived measurements to measurements including experimental inaccuracies produced by the various measurement instruments and environmental test conditions. Users can now analyze expected results and confirm if measurement algorithms will accurately measure the beam even before the experiment is constructed. BeamMaker can help laser engineers, technicians and researchers understand a beam's modal content by calculating results on modeled beams for a better understanding of real laser beam profiles. BeamMaker is to laser beam analysis as a function generator is to an oscilloscope.



BeamMaker producing a synthetically generated Hermite TEM_{22} beam and displayed in both 2D and 3D

Integrated automatic Help linked into the Users Guide

Touch sensitive Tool tips are available on most all controls, and "What's This" help can provide additional details. Confused about what something is or forgot how it works, just go to the top right corner and touch the "What's This" help icon, then click on the control or menu item that you want more info about and you are taken to the explanation within the BeamGage Users Guide.

Multilingual

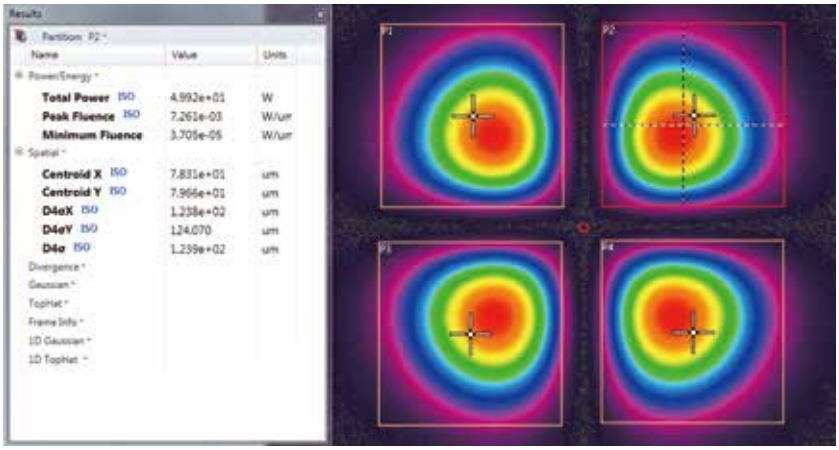
BeamGage comes with both Japanese and Chinese user interface. Country specific manuals can be downloaded from the ophiropt.com/photonics web site.

BeamGage®-Professional Version

Professional is an upgrade version of BeamGage-Standard that has all of the BeamGage-Standard features plus additional functionality.

Image Partitioning

Partitioning allows the user to subdivide the camera image into separate regions, called partitions, and compute separate beam results within each partition. When using partitioning special results items can be displayed that relate to delta values between the computed centroids or peaks of each partition. Partitioning is useful to enable separate analysis of individual beams when multiple beams impinge on the camera simultaneously. This feature is particularly useful when analyzing multiple fibers in a single bundle.



Shown is an example of the results for partition P2 and its related display frame. Observe that the selected partition is highlighted in RED. The crosshair in each partition is user controlled. The crosshair can be moved to a new position with the mouse or can be numerically positioned using the expanded controls that appear when a partition is created.

Automation Interface

BeamGage Professional provides an automation interface via .NET components to allow customers the ability to build custom applications' that incorporate the laser beam analysis and processing power of BeamGage. The BeamGage automation interface allows developers to control BeamGage programmatically via a set of "puppet strings" known as the automation interface. The automation interface was developed to provide the ability to base control decisions for a second application on results and behaviors recognized by BeamGage. With this ability users can quickly and efficiently meet their manufacturing/analysis goals with minimum human interaction.

The automation interface was designed to achieve two main goals. First, to allow the BeamGage user to programmatically do what they could otherwise do via the graphical user interface (GUI). Second, to expose stable interfaces to the user that will not change, causing breaks to their dependant code. Interface examples for LabVIEW, Excel and .NET VB are included.

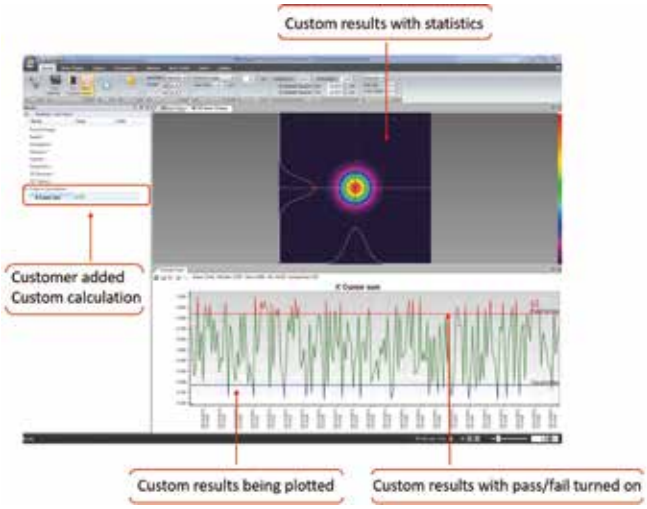
Custom Calculations

If BeamGage-Standard does not have the measurement you need the Professional and Enterprise versions permit the user to program-in their own set of calculations. User defined computations are treated the same as other BeamGage standard calculations.

These custom results are displayed on the monitor, logged with results, and included on hard copy print-outs as if they were part of the original application.

An example of a customer generated custom equation.

$$S=\frac{1}{\Pi^2}\left|\int_0^{2\pi}\int_0^1 \exp(\pi i\,\Delta W(p,\Theta)pdpd\Theta\right|^2$$



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Camera Compatibility

For lasers between 190-1100nm wavelenghts, BeamGage interfaces to silicon CCD USB and GigE cameras. For applications between 1440-1605nm, BeamGage supports cost effective phosphor coated CCD cameras. For demanding applications between 900-1700nm, BeamGage supports an InGaAs camera. And for applications in the ultraviolet, 13-355nm, or far infrared or Terahertz range, 1.06-3000nm, BeamGage supports Spiricon's Pyrocam, pyroelectric array cameras.

190-1100nm*



Model	SP907	SP928	SP300	Gevicam
Spectral Response nm	190 - 1100nm*	190 - 1100nm*	190 - 1100nm*	190 - 1100nm*
Application	1/1.8" format, slim profile, wide dynamic range, CW & pulsed lasers, adjustable ROI	1/1.8" format, high resolution, wide dynamic range, CW & pulsed lasers, adjustable ROI	1/1.8" format, high resolution, CW & pulsed lasers, adjustable ROI	1/1.8" format, high resolution, networkable, long cable distances, adjustable ROI
Number of Elements	964 x 724	1928 x 1448	1928 x 1448	1600 x 1200
Interface Style	USB 3.0	USB 3.0	USB 3.0	GigE
Windows OS support	Windows 7 (32/64)			

190-1100nm*


Model	LT665	L11059
Spectral Response nm	190 - 1100nm*	190 - 1100nm*
Application	12.5mm x 10mm, 1" format for large beams,CW & pulsed lasers, adjustable ROI	36mm x 24mm, 35mm format for large beams, CW & pulsed lasers, adjustable ROI
Number of Elements	2752 x 2192	4008 x 2672
Interface Style	USB 3.0, USB 2.0	USB 2.0
Windows OS support	Windows 7 (32/64)	

*Although our silicon cameras have shown response out to 1320mn it can cause significant blooming which could lead to significant errors of beam width measurements. We would suggest our XC13 InGaAs camera for these wavelengths to give you the best measurements.

1440-1605nm


Model	SP907-1550	SP928-1550	LT665-1550
Spectral Response nm	1440 - 1605nm	1440 - 1605nm	1440 - 1605nm
Application	NIR wavelengths, 1/1.8" format, low resolution, adjustable ROI and binning	NIR wavelengths, 1/1.8" format, adjustable ROI and binning	12.5mm x 10mm, 1" format for large beams, CW & pulsed lasers, adjustable ROI
Number of Elements	964 x 724	1928 x 1448	2752 x 2195
Interface Style	USB 3.0	USB 3.0	USB 3.0
Windows OS support	Windows 7 (32/64)		

900-1700nm

Model	XEVA 100Hz
Spectral Response nm	900 - 1700nm
Application	High resolution InGaAS performance, NIR wavelengths
Number of Elements	320 x 256
Interface Style	USB 2.0
Windows OS support	Windows 7 (32)

13-355nm & 1.06-3000µm


Model	Pyrocam IIIHR	Pyrocam IV
Spectral Response nm	13 - 355nm & 1.06 - 3000µm	13 - 355nm & 1.06 - 3000µm
Application	UV & Far IR Only commercial array to view Terahertz	UV & Far IR Only commercial array to view Terahertz
Number of Elements	160 x 160	320 x 320
Interface Style	GigE	GigE
Windows OS support	Windows 7 (32/64)	

Ordering Information

Item	Description	P/N
190 - 1100nm BeamGage **Standard** : Beam Profiler Systems (camera and software)		
BGS-USB-SP907-OSI	BeamGage Standard software, software license, 1/1.8" format 964x724 pixel camera with 17.5mm C mount CCD recess. Comes with USB cable and 3 ND filters	SP90417
BGS-USB-SP928-OSI	BeamGage Standard software, software license, 1/1.8" format 1928x1448 pixel camera with 17.5mm C mount CCD recess. Comes with USB cable and 3 ND filters	SP90421
BGS-USB3-SP300	BeamGage Standard software, software license, 1/1.8" format 1928x1448 pixel camera with 17.5mm C mount CCD recess. Comes with USB 3.0 cable and 3 ND filters	SP90375
BGS-GigE-OSI182000	BeamGage Standard software, software license, 1/1.8" format 1600x1200 pixel Gevicam camera with 17.5mm C mount CCD recess. Comes with Cat5e cable, power supply with ext trigger adapter and 3 ND filters	SP90267
BGS-USB3-LT665	BeamGage Standard Edition software, software license, 1 inch format 2752x2192 pixel camera with 17.5mm C mount CCD recess. Comes with USB 3.0 cable and 3 ND filters	SP90377
190 - 1100nm BeamGage **Professional** : Beam Profiler Systems (camera and software)		
BGP-USB-SP907-OSI	BeamGage Professional software, software license, 1/1.8" format 964x724 pixel camera with 17.5mm C mount CCD recess. Comes with USB cable and 3 ND filters	SP90418
BGP-USB-SP928-OSI	BeamGage Professional software, software license, 1/1.8" format 1928x1448 pixel camera with 17.5mm C mount CCD recess. Comes with USB cable and 3 ND filters	SP90422
BGP-USB3-SP300	BeamGage Professional software, software license, 1/1.8" format 1928x1448 pixel camera with 17.5mm C mount CCD recess. Comes with USB 3.0 cable and 3 ND filters	SP90376
BGP-GigE-OSI182000	BeamGage Professional software, software license, 1/1.8" format 1600x1200 pixel Gevicam camera with 17.5mm C mount CCD recess. Comes with Cat5e cable, power supply with ext trigger adapter and 3 ND filters	SP90268
BGP-USB3-LT665	BeamGage Professional Edition software, software license, 1 inch format 2752x2192 pixel camera with 17.5mm C mount CCD recess. Comes with USB 3.0 cable and 3 ND filters	SP90378
BGP-USB-L11059	BeamGage Professional software, software license, 35mm format 4008x2672 pixel camera. Comes with universal power supply, 5 meter USB A-B cable and 3 ND filters (1.0, 2.0 & 3.0, optimized for use in the region of 400-700nm; ND 3.0 filter is installed in the input aperture of the camera)	SP90320
1440 - 1605nm BeamGage **Standard** : Beam Profiler Systems (camera and software)		
BGS-USB-SP907-1550-OSI	BeamGage Standard software, software license, 1/1.8" format 964x724 pixel camera with 17.5mm C mount CCD recess. Phosphor coated to 1550 nm. Comes with USB cable and 3 ND filters	SP90419
BGS-USB-SP928-1550-OSI	BeamGage Standard software, software license, 1/1.8" format 1928x1448 pixel camera with 17.5mm C mount CCD recess. Phosphor coated to 1550 nm. Comes with USB cable and 3 ND filters	SP90423
BGS-USB3-LT665-1550	BeamGage Standard Edition software, software license, 1 inch format 2752x2192 pixel camera with 17.5mm C mount CCD recess. Phosphor coated 1550nm sensor. Comes with USB 3.0 cable and 3 ND filters	SP90384
1440 - 1605nm BeamGage **Professional** : Beam Profiler Systems (camera and software)		
BGP-USB-SP907-1550-OSI	BeamGage Professional software, software license, 1/1.8" format 964x724 pixel camera with 17.5mm C mount CCD recess. Phosphor coated to 1550 nm. Comes with USB cable and 3 ND filters	SP90420
BGP-USB-SP928-1550-OSI	BeamGage Professional software, software license, 1/1.8" format 1928X1448 pixel camera with 17.5mm C mount CCD recess. Phosphor coated to 1550 nm. Comes with USB cable and 3 ND filters	SP90424
BGP-USB3-LT665-1550	BeamGage Professional Edition software, software license, 1 inch format 2752x2192 pixel camera with 17.5mm C mount CCD recess. Phosphor coated 1550nm sensor. Comes with USB 3.0 cable and 3 ND filters	SP90385
900 - 1700nm BeamGage **Professional** : Beam Profiler Systems (camera and software)		
BGP-USB-XC130	BeamGage Professional software, software license, 320x256 pixel InGaAs camera with C mount recess. .9 to 1.7um spectral band. Comes with universal power supply, USB cable, external trigger cable and 3 ND filters (consult factory for other camera options)	SP90241
13 - 355nm & 1.06 - 3000µm BeamGage **Professional** and one window is included		
PY-III-HR-C-A-PRO	Pyroelectric array detector, chopped, Grade A, one Gigabit Ethernet port, BeamGage Professional GigE to USB3 adaptor, hard shipping case, 3 meter GigE cable, and power supply w/locking connector included. To complete this order you must add an interchangeable window part number to accompany this system (see below)	SP90405
PY-IV-C-A-PRO	Pyroelectric array detector, chopped, Grade A, one Gigabit Ethernet port, BeamGage Professional GigE to USB3 adaptor, hard shipping case, 3 meter GigE cable, and power supply w/locking connector included. To complete this order you must add an interchangeable window part number to accompany this system (see below)	SP90404
Windows for Pyrocam IIIHR		
PY-III-HR-W-BK7-1.064	Pyrocam III-HR window assembly, BK7, A/R coated for 1.064µm	SP90365
PY-III-HR-W-SI-1.05-2.5	Pyrocam III-HR window assembly, Si, A/R coated for 1.05 to 2.5µm	SP90366
PY-III-HR-W-SI-2.5-4	Pyrocam III-HR window assembly, Si, A/R coated for 2.5 to 4µm	SP90367
PY-III-HR-W-GE-3-5.5	Pyrocam III-HR window assembly, Ge, A/R coated for 3 to 5.5µm	SP90368
PY-III-HR-W-GE-10.6	Pyrocam III-HR window assembly, Ge, A/R coated for 10.6µm	SP90369
PY-III-HR-W-GE-8-12	Pyrocam III-HR window assembly, Ge, A/R coated for 8 to 12µm	SP90370
PY-III-HR-W-ZNSE-10.6	Pyrocam III-HR window assembly, ZnSe, A/R coated for 10.6µm	SP90371
PY-III-HR-W-ZNSE-2-5	Pyrocam III-HR window assembly, ZnSe, A/R coated for 2 to 5µm	SP90372
PY-III-HR-W-BaF2-Uncoated	Pyrocam III-HR window assembly,BaF2 uncoated for 193 to 10µm	SP90373
PY-III-HR-W-POLY-THZ	Pyrocam III-HR window assembly, LDPE, uncoated for Terahertz wavelengths	SP90374
Windows for Pyrocam IV		
PY-IV-W-BK7-1.064	Pyrocam IV window assembly, BK7, A/R coated for 1.064µm	SP90301
PY-IV-W-SI-1.05-2.5	Pyrocam IV window assembly, Si, A/R coated for 1.05 to 2.5µm	SP90302
PY-IV-W-SI-2.5-4	Pyrocam IV window assembly, Si, A/R coated for 2.5 to 4µm	SP90303
PY-IV-W-GE-3-5.5	Pyrocam IV window assembly, Ge, A/R coated for 3 to 5.5µm	SP90304
PY-IV-W-GE-10.6	Pyrocam IV window assembly, Ge, A/R coated for 10.6µm	SP90305
PY-IV-W-GE-8-12	Pyrocam IV window assembly, Ge, A/R coated for 8 to 12µm	SP90306
PY-IV-W-ZNSE-10.6	Pyrocam IV window assembly, ZnSe, A/R coated for 10.6µm	SP90307
PY-IV-W-ZNSE-2-5	Pyrocam IV window assembly, ZnSe, A/R coated for 2 to 5µm	SP90308
PY-IV-W-ZNSE-UNCOATED	Pyrocam IV window assembly, ZnSe, uncoated	SP90336
PY-IV-W-POLY-THZ	Pyrocam IV window assembly, LDPE, uncoated for Terahertz wavelengths	SP90309

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Accessories for Beam Profiling

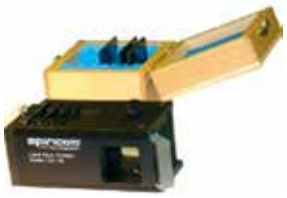
Neutral Density Attenuators/Filters




Model	Stackable ND Filters ND1/ND2/ND3	LBF-50	ATP-K Variable Attenuator	UV ND Filters	Speciality Filter for 355nm	Speciality Filter for 1300nm
Nominal ND value	1, 2, 3	0.3, 0.7, 1, 2, 3, 4	ND=1.7 - 4.6 Max. ND: 7.4 (with fixed 2.8 grayglass attenuator)	0.3, 0.7, 1.0,1.3,1.7, 2.0, 2.3,2.7, 3.0, 3.3, 3.7,4.0, 4.3, 4.7, 5.0, 6.0	Pass 355nm, blocks 532nm & 1064nm	Pass 1300nm, blocks <1100nm
Clear aperture	φ19mm	φ12mm	φ15mm	φ20mm	φ19mm	φ19mm
Damage threshold	5W/cm² no distortion	5W/cm² no distortion	100mW/mm no thermal lensing	100W/ cm² CW, 10ns pulses, no distortion	5W/ cm² no distortion	5W/ cm² no distortion
Mounting	C-Mount Threads	C-Mount Threads	C-Mount Threads	C-Mount Threads	C-Mount Threads	C-Mount Threads

Beam Splitter + Neutral Density Filters Combo





Model	LBS-300	LBS -400	LBS-100
Wavelength	multiple versions from 190 to 1550nm	UV or 10.6μm	multiple versions; 400 - 700nm, 1064nm, 10.6 μm
Reflection	0.01% of incident beam	0.01%	4% @ 400-900nm, 1% @1064nm, 0.5% or 5% @10.6μm
Nominal ND value (vis)	0.3, 0.7, 1, 2, 3, 4	0.5, 1.0 in both filters	0.3, 0.7, 1, 2, 3, 4 for 300 - 700nm & 1064nm, 30% & 60% for 10.6μm
Clear aperature	φ17.5mm	φ31.75mm	φ19mm
Damage threshold	see spec sheet	see spec sheet	5W/cm² no distortion
Mounting	C-Mount Threads	Custom thread	C-Mount and Lab post mounted

LBS-300 Beam Splitters Ordering Information

Model	LBS-300-UV	LBS-300-VIS	LBS-300-NIR	LBS-300-BB
Part No.	SP90183	SP90184	SP90185	SP90186
Wavelength	266-355nm	400-700nm	1064nm	190-1550nm
Wedge Material	UVFS	BK7	BK7	UVFS
Wedge Coating	A/R ≤1%	A/R ≤1%	A/R ≤1%	No coating, 4% reflection
Clear aperture	17.5mm	17.5mm	17.5mm	17.5mm
Reflection	0.01%	0.01%	0.01%	0.16%
Wedge ND value, each	ND ≥2	ND ≥2	ND ≥2	ND ~1.3
ND Filters	Inconel	Bulk ND	Bulk ND	One each of the UV, VIS & NIR sets
ND Values, nominal	0.3, 0.7, 1.0, 2.0, 3.0, 4.0 (Blue holders)	0.3, 0.7, 1.0, 2.0, 3.0, 4.0 (Green holders)	0.3, 0.7, 1.0, 2.0, 3.0, 4.0 (Red holders)	See UV, VIS and NIR descriptions
Filter Slides	3	3	3	9
Maximum allowable input to filter (1)	100 W/cm² CW 20mJ/cm², 10ns pulse	50 W/cm² CW 1J/cm², 10ns pulse	50 W/cm² CW 1J/cm², 10ns pulse	See adjacent specifications

(1) ND bulk absorbing filters damage threshold is 50W/cm² but should be used at <5W/cm² to avoid thermal lensing effects.

LBS-400 Beam Splitters Ordering Information

Model	LBS-400-IR	LBS-400-UV	LBS-400-NIR
Part No.	SP90349	SP90351	SP90354
Wavelength	10.6μm	193-355nm	1064nm
Wedge Material	ZnSe	UVFS	BK7
Wedge Coating	A/R ≤1%	A/R ≤1%	A/R ≤1%
Clear Aperture	1.25 inch (31.75mm)	1.25 inch (31.75mm)	1.25 inch (31.75mm)
Reflection	0.01%	0.01%	0.01%
Wedge ND value (each)	ND ≥2	ND ≥2	ND ≥2
Filter Material	CaF2	Inconel	Bulk ND
Filter ND Values nominal	0.5, 1.0 in both filters	0.5, 1.0 in both filters	0.5, 1.0 in both filters
Adjustable Filter Slides	2	2	2
Filter Damage (1)	5W/cm^2 300 J/cm^2, 1ms pulse	100W/cm^2 20mJ/cm^2, 10ns pulse	50W/cm^2 1J/cm^2, 10ns pulse

(1) ND bulk absorbing filters damage threshold is 50W/cm^2 but should be used at <5W/cm^2 to avoid thermal lensing effects.

Beam Splitter




Model	Beam Tap I & II	Beam Tap I & II YAG	Stackable Beam Splitter	Single & Dual Front-Surface Beam Samplers
Wavelength	400 - 700nm	1064nm	190 - 2000nm	200nm - 2.5μm
Reflection	4% & 0.16% of incident beam	0.5% & 0.0025% of incident	5% & 0.25% of incident beam	0.057% @ 532nm
Clear aperture	φ17.5mm	φ17.5mm	φ15mm	14mm x 14mm
Damage threshold	5W/cm^2 no distortion	5W/cm^2 no distortion	>5J/cm^2	100mW/cm^2
Mounting	C-Mount Threads	C-Mount Threads	C-Mount Threads	C-Mount Threads

Beam Expanders Microscope Objectives


Model	Beam Expander	4X Beam Expander with UV Converter
Wavelength	400 - 1800nm	193nm - 360nm
Beam Size Change	4X, 6X, 12X, 22X	4X Expansion
Clear aperture	1/4 the size of the CCD imager	
Mounting	C or CS Mount Threads	

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Beam Reducers

4X beam reducer

Specifications	4X Beam Reducer
Spectral Range	360nm to 1100nm
Antireflection Coating	Antireflection coating optimized for 1064nm and 532nm
Beam reduction Accuracy	± 3%
Size	Ø60 mm dia x 94mm length
Aperture	50mm
Maximum Beam Size	SP 503: 25x19mm, FX 33: 18x14mm, SP 620 or GRAS20: 28x21.2mm
Distortion of Beam	Less than 1% over 80% of diameter
Damage Threshold	30mJ per pulse for nanosecond pulses

CCTV Lens for Front Imaging Through Glass or Reflected Surface

Item	Description
25mm focal length CCTV lens kit	25mm focal length lens assembly with locking iris and focus adjustment. Includes 8mm spacer x 1pc and 5mm spacers x 2pcs
50mm focal length CCTV lens kit	50mm focal length lens assembly with locking iris and focus adjustment. Includes 8mm spacer x 1pc and 5mm spacers x 2pcs

Imaging UV lasers

4X beam reducing UV Image Converter as mounted on Camera

1X UV Image Converter with Optional Beam Splitter

4X beam expander with UV converter

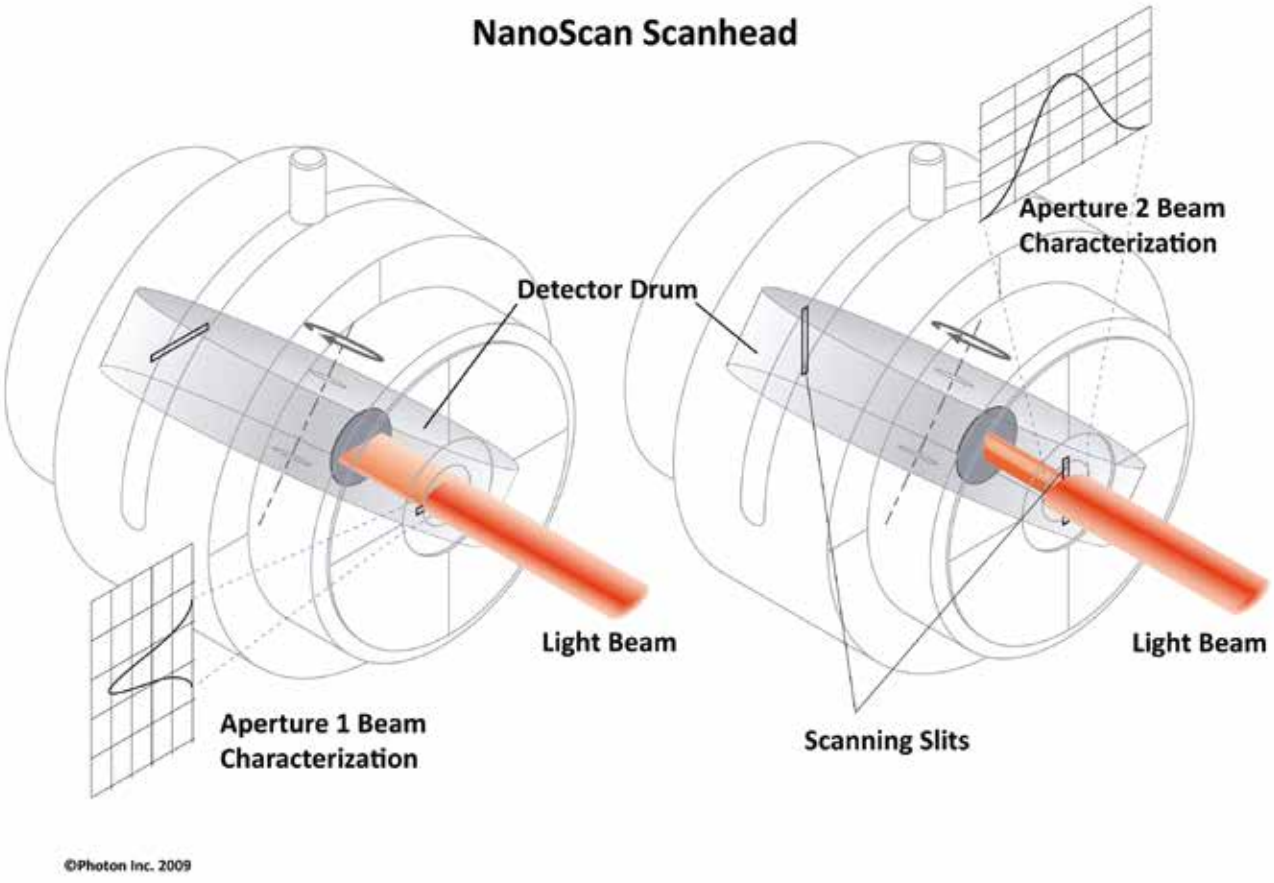
Specifications	4X UV Image Reducing Converter	1X UV Image Converter	4X Beam Expander with UV converter
Beam Reduction	4X reduction ±2% with included correction factor	1:1 imaging ±2% with included correction factor	4X expansion ±2% with included correction factor
Resolution	50µm x 50µm	35µm x 35µm	15µm x 15µm
Spectral range	193 to 360nm		
Minimum signal	~1µJ/cm2 with blank filter		
Saturation intensity	~30mJ/cm² at 193nm, ~15mJ/cm² at 248nm with included filter 20 times above values with optional beam splitter	~15mJ/cm² at 193nm, ~20mJ/cm² at 248nm with included filter, 20 times greater with optional beam splitter	~30mJ/cm² at 193nm, ~15mJ/cm² at 248nm 20 times above values with optional beam splitter
Effective Aperture	φ30mm but effective beam size is limited to 4X CCD dimensions	φ18mm but effective beam size is limited to CCD dimensions	1/4 the size of the CCD dimensions
Damage threshold	100W/cm² or 2J/ cm² with beam splitter		
Dimensions	Ø50mm dia x 185mm length	Ø31mm dia x 120mm length	Ø29mm dia x 69mm length

Introduction to Scanning-Slit Profilers

The scanning slit beam profiler moves two narrow orthogonal slits in front of a linear photo-detector through the beam under analysis. Light passing through the slit induces a current in the detector. Thus, as the slit scans through the beam, the detector signal is linearly proportional to the spatial beam irradiance profile integrated along the slit. A digital encoder provides accurate slit position. The photo-induced current signal is digitized and analyzed to obtain the beam profile in both X and Y from the two orthogonal slits.

The slit apertures act as physical attenuators, preventing detector saturation for most beam applications. High dynamic range amplification allows operation over many orders of magnitude in beam power.
From these profiles, important spatial information such as beam width, beam position, beam quality, and other characteristics are determined. This technique can accommodate a wide variety of test conditions. Because slit scanners measure beams at high powers with little or no attenuation, they are ideal to profile beams used in material processing.

Carbon dioxide (CO_2) lasers are widely used in materials processing, and have a 10.6 micron wavelength that cannot be profiled with most cameras. Slit scanners, therefore, provide an convenient means of measuring high-resolution CO_2 lasers with powers up to and exceeding 1000 watts.



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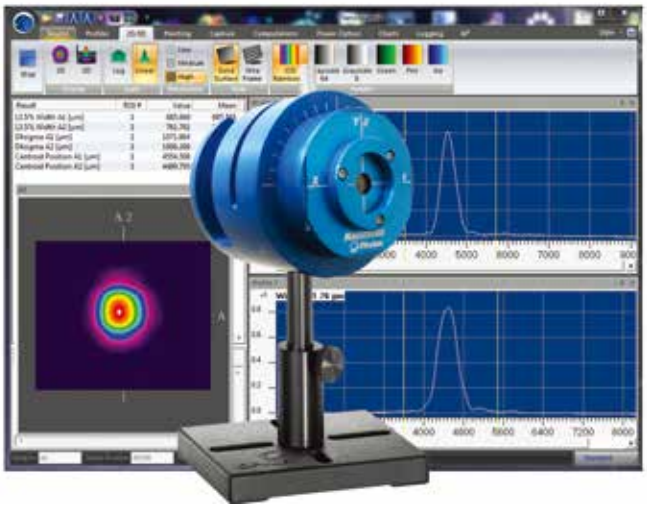
NanoScan 2s

Scanning Slit Beam Profiler For High Accuracy Dimensional Measurement

NanoScan 2s combines the convenience and portability of direct USB connectivity with the speed, accuracy, and dynamic range that users have come to expect from the Photon NanoScan slit based profilers. The NanoScan 2s is available with a silicon, germanium or pyroelectric detector, which allows it to profile lasers of any wavelength from UV to far infrared, out to 100µm and beyond. With the new NanoScan 2s software package, the user can configure the display interface however it is desired; displaying those results of most interest on one easy-to-read screen, or on multiple screens.

The NanoScan slit profiler is the most versatile laser beam profiling instrument available today: providing instantaneous feedback of beam parameters for CW and kilohertz pulsed lasers, with measurement update rates to 20Hz. The natural attenuation provided by the slit allows the measurement of many beams with little or no additional attenuation. The high dynamic range makes it possible to measure beams while adjustments to focus are made without having to adjust the profiler. Just aim the laser into the aperture and the system does the rest!



Capabilities

NanoScan 2s is a PC-based instrument for the measurement and analysis of laser beam spatial irradiance profiles in accordance with the ISO standard 11146. The scan heads also measure power in accordance with ISO 13694.

NanoScan uses the scanning slit, one of the ISO Standard scanning aperture techniques. It can measure beam sizes from microns to centimeters at beam powers from microwatts to over kilowatts, often without attenuation. Detector options allow measurement at wavelengths from the ultraviolet to the infrared.

The NanoScan 2s digital controller has 16-bit digitization of the signal for enhanced dynamic range up to 35dB power optical. With the accuracy and stability of the beam profile measurement you can measure beam size and beam pointing with a 3-sigma precision of several hundred nanometers. The software controllable scan speed and a “peak-connect” algorithm allows the measurement of pulsed and pulse width modulated lasers with frequencies of 10kHz and higher[(a)]. The NanoScan is also able to measure up to 16 beams, or regions of interest, in the aperture simultaneously.

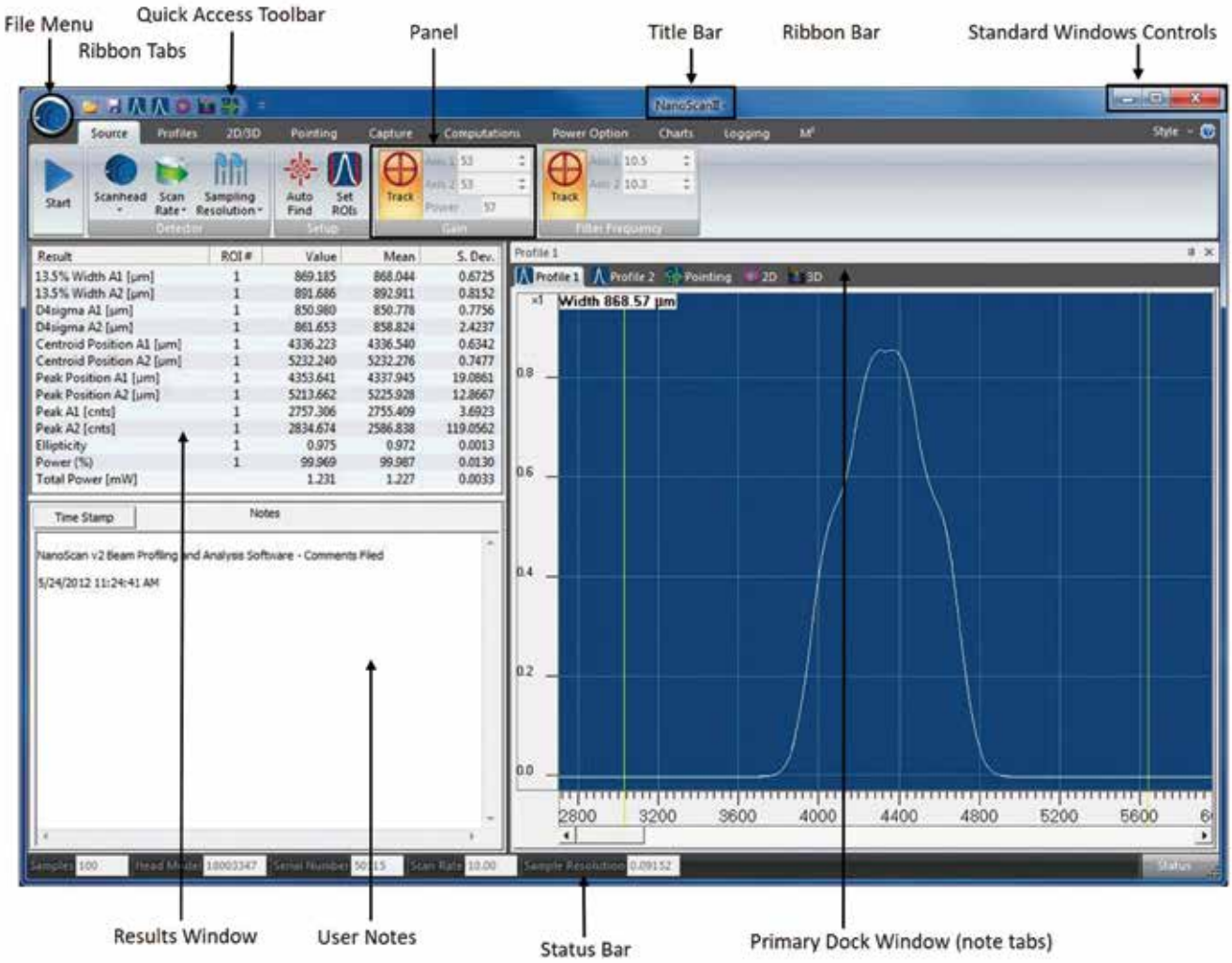
Benefits

* Absolute measurement accuracy is guaranteed by NIST traceable calibration of every NanoScan
* Measure any wavelength from UV to very far infrared (190nm to >100µm)
* Instantaneous real time display of results; beam found in less than 300ms and updated at up to 20Hz
* Waist location can be determined to within ±25µm due to the well-defined Z-axis datum plane of the NanoScan
* Measure pulsed and CW lasers
* For pulsed beams the pulse rate is measured and reported
* From as small as 7µm beams, can be measured directly with guaranteed accuracy and precision
* Additional high signal to noise ratio can be achieved with averaging
* Z-axis caustic measurements are available with built-in mechanical linear stage control
* M^2 propagation ratio values available with simple M^2 Wizard included with the software.
* Any beam result can be charted and monitored over time
* Power levels can be monitored along with spatial measurements to determine if losses are introduced by beam adjustments
* Log results to text files for independent analysis
* Automate the system using optional ActiveX Automation commands, available with the PRO version software and scan heads Samples of automation programs included for Excel,VBA, LabView and Visual Basic.net

[(a)] The minimum frequency is a function of the beam size and the scan speed. This is a simple arithmetic relationship; there must be a sufficient number of pulses during the time that the slits sweep through the beam to generate a meaningful profile. Please refer to Photon's Application Note, Measuring Pulsed Beams with a Slit-Based Profiler.

NanoScan 2s Configurable User Interface

In addition to new hardware, the NanoScan 2s has an updated integrated software package for the Microsoft Windows Platform, which allows the user to display any of the results windows on one screen. The NanoScan 2s software comes in two versions, STD and PRO. The NanoScan 2s Pro version includes ActiveX automation for users who want to integrate the NanoScan into OEM systems or create their own user interface screens with C++, LabView, Excel or other OEM software packages.



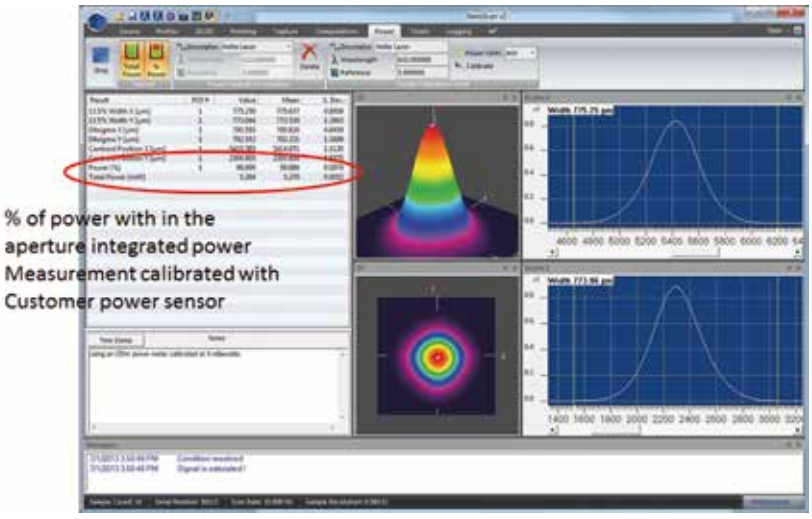
Example of display configuration window

Integrated Power Meter

The silicon and germanium detector equipped NanoScan 2s systems include an integrated 200mW power meter. The scanhead comes with a quartz attenuator window that provides a uniform response across a broad wavelength range.

This is a relative power meter that has better than 1.5% correspondence when calibrated with a user-supplied power meter and used in the same configuration as calibrated.

The power meter screen in the software shows both the total power and the individual power in each of the beams being measured.



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Available Detectors

The NanoScan 2s is available with silicon, germanium or pyroelectric detectors to cover the light spectrum from UV to very far infrared.

Apertures and Slits

The NanoScan 2s is available with a variety of apertures and slit sizes to allow for the accurate measurement of varying beam sizes. The slit width defines the minimum beam width that can be measured; due to convolution error, the slit should be no larger than 1/4 the beam diameter to provide a ±3% accurate measurement. For this reason the minimum beam diameter measureable with the standard 5µm slit is 20µm. To measure beams smaller than 20µm it is necessary to use the small aperture 1.8µm slit instrument, providing a minimum beam diameter of ~8µm. Because these slits are so narrow, the maximum length limits the aperture to 3.5mm. Contrary to many people's beliefs, these smaller slits do not improve the resolution of the measurement, only the minimum size of the beam. Therefore, unless it is necessary to measure beams less than 20µm, one would be advised to stick with the 9mm/5µm configurations.
For very large beams, NanoScan is available with a large 20 or 25mm aperture with 25µm slits. These sensor are larger than the standard scan heads (100mm diameter)

NanoScan 2s Scanhead Model	Si/3.5/1.8µm	Si/9/5µm	Si/9/25µm
Wavelength	190nm - 950nm	190nm - 950nm	190nm - 950nm
Slit Size	1.8µm	5µm	25µm
Aperture Size	3.5mm	9mm	9mm
$1/e^2$ Beam Diameter Range	7µm - 2.3mm	20µm - 6mm	100µm - 6mm
Spatial Sampling Resolution	5.3nm - 18.3µm		
Profile Digitization	16-bit		
Scan Frequency	1.25, 2.5, 5, 10, 20Hz		
Power Reading	User calibrated		
Power Aperture Window	Metalized Quartz (200mW upper limit)		
Laser Type	CW or Pulsed		
Operating Range	See Operating Space Charts		
Damage Threshold	See Operating Space Charts		
Rotation Mount	Standard		
Scanhead Dimension	63.4mm diameter x 102.6mm long		

NanoScan 2s Scanhead Model	Ge/3.5/1.8µm	Ge/9/5µm	Ge/9/25µm
Wavelength	700nm - 1800nm	700nm - 1800nm	700nm - 1800nm
Slit Size	1.8µm	5µm	25µm
Aperture Size	3.5mm	9mm	9mm
$1/e^2$ Beam Diameter Range	7µm - 2.3mm	20µm - 6mm	100µm - 6mm
Spatial Sampling Resolution	5.3nm - 18.3µm		
Profile Digitization	16-bit		
Scan Frequency	1.25, 2.5, 5, 10, 20Hz		
Power Reading	User calibrated		
Power Aperture Window	Metalized Quartz (200mW upper limit)		
Laser Type	CW or Pulsed		
Operating Range	See Operating Space Charts		
Damage Threshold	See Operating Space Charts		
Rotation Mount	Standard		
Scanhead Dimension	63.4mm diameter x 102.6mm long		

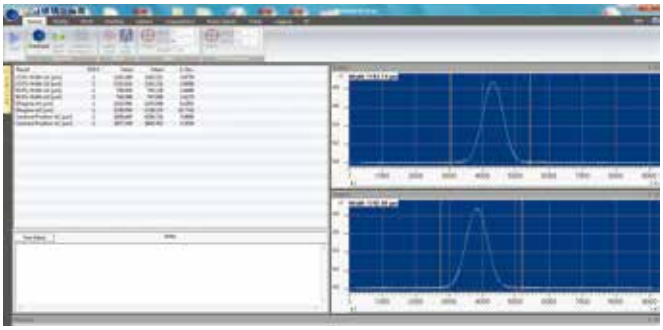
NanoScan 2s Scanhead Model	Pyro/9/5µm	Pyro/9/25µm
Wavelength	190nm - >100µm	190nm - >100µm
Slit Size	5µm	25µm
Aperture Size	9mm	9mm
$1/e^2$ Beam Diameter Range	20µm - 6mm	100µm - 6mm
Spatial Sampling Resolution	5.3nm - 18.3µm	
Profile Digitization	16-bit	
Scan Frequency	1.25, 2.5, 5, 10, 20Hz	
Power Reading	Not Availble	
Power Aperture Window	N A	
Laser Type	CW or Pulsed	
Operating Range	See Operating Space Charts	
Damage Threshold	See Operating Space Charts	
Rotation Mount	Standard	
Scanhead Dimension	63.4mm diameter x 102.6mm long	

The Most Versatile and Flexible Beam Profiling System Available

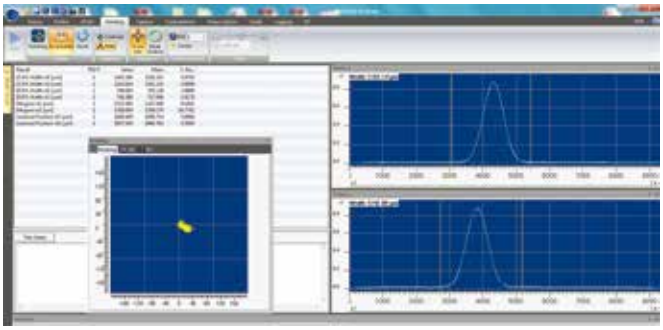
With the available range of detectors, slit sizes and apertures the NanoScan 2s provides the maximum versatility in laser beam profiling. NanoScan 2s adds the convenience and portability of direct USB connectivity: no external controllers or power supplies required to operate the profiler. In addition the rotation mount has been redesigned to provide a stand for vertical operation, if desired. The mount can be positioned in one of two places. If vertical operation is desired the mount is positioned toward the back of the scanhead to expose the stand, which can be affixed to the optical table or stage. If standard horizontal operation is desired, then the rotation mount can be positioned in the forward configuration, maintaining the original length and size of the scanhead.

See Your Beam As Never Before

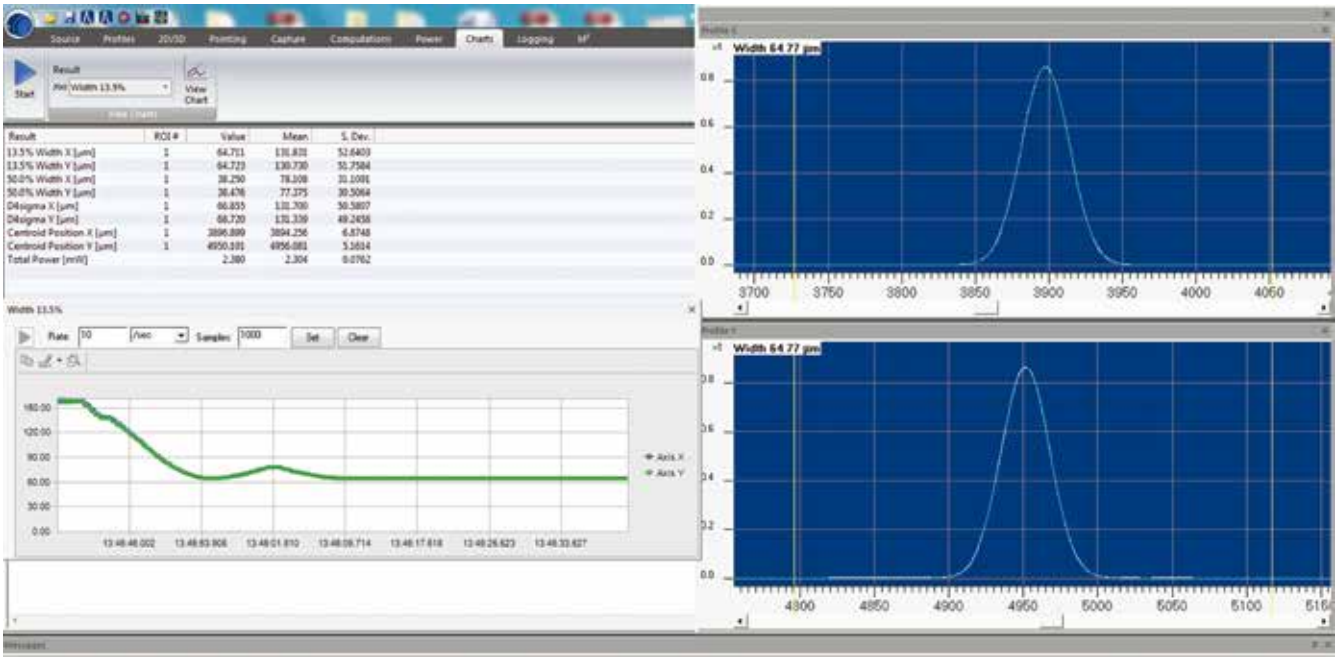
The new NanoScan 2s graphical user interface (GUI) allows the user to set the display screens to any appropriate configuration, displaying those that are of interest and hiding what is not. This means that you can have the information that you want to see, uncluttered by extraneous output, and you can have all the features you need, visible at once. The screens can be docked or floating with ribbon bars for the controls that can be visible or hidden as desired. This allows you to take advantage of a large, multi-monitor desk top or maximize the useful information on a small laptop display.



Simple docked view of profiles and numerical results



Both docked and undocked windows : profiles , results , and pointing



Example of time charts used to monitor focusing process

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Measured Beam Results

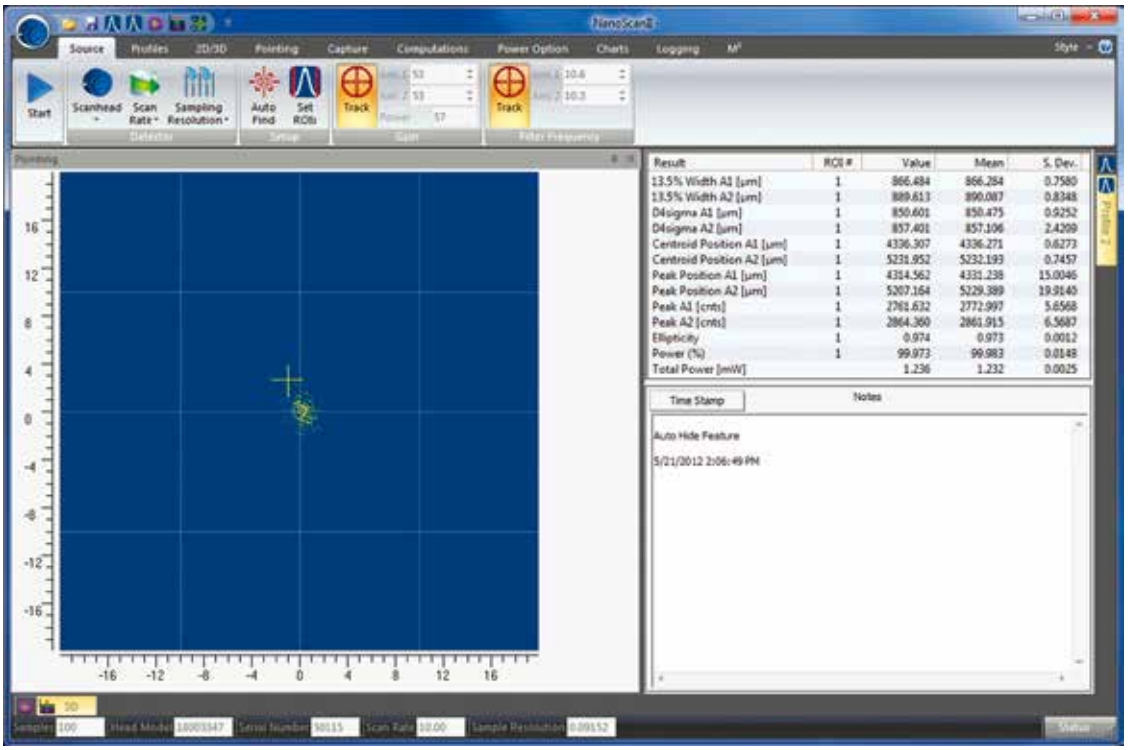
From 1989 through 1996, John Fleischer, founder and past President of Photon Inc., chaired the working laser beam width ISO/DIN committee that resulted in the ISO/DIN 11146 standard. The final approved standard, available in 13 languages. The standard governs profile measurements and analysis using scanning apertures, variable apertures, area sensors and detector arrays. NanoScan 2s measures spatial beam irradiance profiles using scanning slit techniques.

Results measured include:

* Beam Width at standard and user-definable clip levels, including $1/e^2$ and 4σ
* Centroid Position
* Peak Position
* Ellipticity
* Gaussian Fit
* Beam Divergence
* Beam Separation
* Pointing Stability
* ROI Power
* Total Power
* Pulsed Laser Repetition Rate

Result	ROI #	Value	Mean	S. Dev.
13.5% Width A1 [µm]	1	863.328	864.612	0.7082
13.5% Width A2 [µm]	1	876.317	875.622	0.9432
D4sigma A1 [µm]	1	849.062	849.700	1.5084
D4sigma A2 [µm]	1	842.054	840.924	2.3751
Centroid Position A1 [µm]	1	1.111	-0.133	0.5622
Centroid Position A2 [µm]	1	-1.730	0.275	1.2221
Peak Position A1 [µm]	1	-11.521	-19.890	5.6014
Peak Position A2 [µm]	1	4.156	8.732	6.9860
Peak A1 [cnts]	1	2812.438	2810.688	4.0486
Peak A2 [cnts]	1	2687.898	2678.320	5.5879
Ellipticity	1	0.806	0.807	0.0023
Power [%]	1	99.994	99.979	0.0273
Total Power [mW]		1.202	1.203	0.0002

Example of the many measurements that can be made and the precision you can expect



Knowing pointing stability is a critical factor in laser performance

NanoScan 2s Acquisition and Analysis Software

Feature		NanoScan Standard	NanoScan Professional (all features in standard plus)
Controls			
Source	ScanHead Select, Gain, Filter, Sampling Resolution, AutoFind, Rotation Frequency, Record Mode	●	
Capture	Averaging, Rotation, Magnification, CW or Pulse Modes, Divergence, Gaussian Fit, Reference Position, Recompute	●	
Regions of Interest (ROI)	Single or Multiple, Automatic or Manual, Colors	●	
Profiles	Vertical Scale (1´, 10´, 100´), Logarithmic Scale, Z & PAN(Automatic or Manual)	●	
Computation:ISO 13694, ISO11146	Dslit, (13.5%, 50% 2 User Selectable Clip Levels), D4O, Width ratios, Centroid Position, Peak Position, Centroid Separation,Peak Separation, Irradiance, Gaussian Fit, Ellipticity,Divergence, Total Power, Pulse Frequency, % power	●	
	Continuous, Rolling, Finite	●	
Pointing	Centroid or Peak, Accumulate Mode, Beam Indicator, Graph Center, Colors	●	
2D/3D	2D or 3D Mode, Linear or Logarithmic Scale, Resolution, Fill Contours, Solid Surface, or Wireframe, Clip Level Colors	●	
Charts	Chart Select, Parameter Select, Aperture Select, Update Rate, Start and Clear	●	
Logging	File Path/Name, Delimiter, Update Rate	●	
M^2	Rail Setup: Com Port and Length, Connect/Disconnect, Rail Control	●	
Views			
Profiles	Displays Beam Profiles for each axis, with optional Gaussian Overlays	●	
Results	Displays Values and Statistics for Selected results	●	
Pointing	Displays the XY position of the Centroid or Peak for each ROI , with optional overlays and Accumulate Mode	●	
Charts	Displays Time Charts for User-selected results	●	
2D/3D	Displays pseudo 2D/3D Beam Profile	●	
M^2 Wizard	An interactive procedure for measuring M^2 by the Rayleigh Method	●	
File Saving			
NanoScan Data Files		●	
Text Files		●	
Data Logging			
Log to File		●	
Reports			
NanoScan Report		●	
Automation Interface			
ActiveX Automation Server			●
Minimum System Requirements			
PC computer running windows 7 (32/64) Laptop or Desktop[a]			
A dual core processor CPU, 2GHz or better			
2GB of RAM[b]			
1-USB 2.0 port available			
At least 250MB of free HDD space			
1400 x 900 display resolution or better			
Graphics card w/hardware accelerator			
DVD-ROM drive			
Microsoft compatible pointing devices (e.g., mouse, trackball, etc)			

a. A business/professional version of windows is recommended. The NanoScan v2 software has not been tested with home versions of Windows. Both 64-bit and 32-bit versions of Windows 7 are supported. NanoScan v2 is no longer tested on Windows XP 32-bit operating systems.

b. The computer memory (RAM) will affect the performance of the software in the Data Recorder.

Model	General Specification
Bus interface	USB 2.0
Signal digitization	16bit
Maximum digitization clock	21.4MHz
Maximum update rate	20Hz
Data transfer	Bulk Transfer Mode
On-board memory	64MB mDDR SDRAM
Weight	434g (15.3 ounces)
Operating temperature	0-50oC
Humidity	90%, non-condensing
Scanhead Dimensions	3.03"(7.68cm) L X 2.5"(6.35cm) Ø
Power	USB 2.0 Bus Powered
CPU Clock	300MHz
Memory Clock	264MHz
Scanning Motor	Brushed DC, 4W max

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Typical NanoScan Operating Space Charts

Operating range is at peak sensitivity of detector. Operating space is NOT absolute.

THESE CHARTS TO BE USED AS A GUIDE ONLY.

Silicon Detector

Silicon Detector: Responsivity varies with wavelength. Detects between 400-1100nm. Peak responsivity is 0.7 amps/watt at 980nm. Detector to detector responsivity variation can be as great as ±20%.

Power: Average power in the laser beam.

Beam Diameter: Assumes a round beam. The operating point for an elliptic beam can be approximated by using the average diameter. For extremely elliptic beams (ratio >4:1), contact Spiricon.

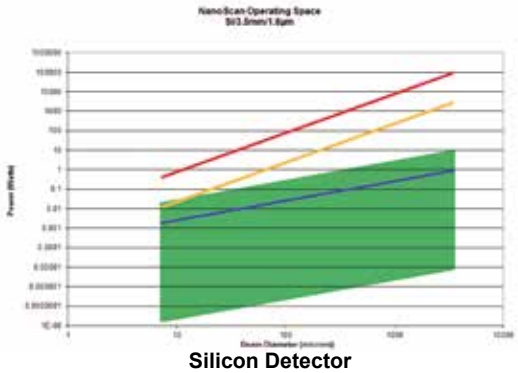
Pulsed Operation (——): Upper limit of the operating space for pulsed laser measurements.

Black Coating Removed (——): Slits are blackened to reduce back reflections; blackening begins to vaporize near this line. Slits in pyro detectors are not blackened.

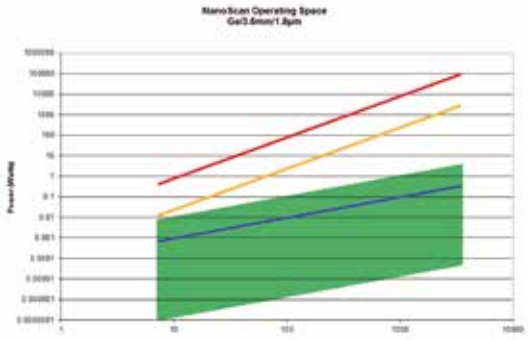
Slit Damage (——): Power density (watts/cm^2) where one can begin to ablate and cut the slits.
Refer to Spiricon's Damage Threshold with High Power Laser Measurements document.

Left Boundary: The left boundary is 4 times the slit width, where slit convolution error becomes significant to the 5% level for reported 1/e^2 diameter of a TEM$_{00}$ Gaussian beam.

Right Boundary: The right boundary is the instrument entrance aperture diameter, which determines the largest beam profile and diameter that can be measured. For a TEM$_{00}$ Gaussian beam the 1/e^2 diameter needs to be ≤1/2 the aperture diameter to measure and see the entire profile out to the tails. Similarly for a Flat-top distribution the 1/e^2 diameter needs to be ≤~95% of the aperture diameter. To obtain any given clip level diameter for any beam (but not the full profile) ~95% of the aperture is useable.



Silicon Detector



Germanium Detector

Germanium Detector

Responsivity: Detector converts constant, incident photons to a current.

Detector: Responsivity varies with wavelength. Detects between 800-1800nm. Peak responsivity is 1.05 amps/watt at 1550nm. Detector to detector responsivity variation can be as great as ±20%.

Power: Average power in the laser beam.

Beam Diameter: Assumes a round beam. The operating point for an elliptic beam can be approximated by using the average diameter. For extremely elliptic beams (ratio >4:1), contact Spiricon.

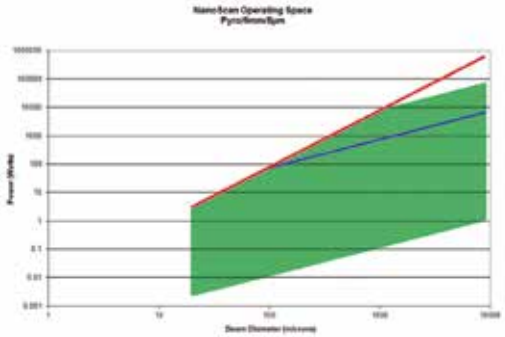
Pulsed Operation (——): Upper limit of the operating space for pulsed laser measurements.

Black Coating Removed (——): Slits are blackened to reduce back reflections; blackening begins to vaporize near this line. Slits in pyro detectors are not blackened.

Slit Damage (——): Power density (watts/cm^2) where one can begin to ablate and cut the slits. Refer to Spiricon's Damage Threshold with High Power Laser Measurements document.

Left Boundary: The left boundary is 4 times the slit width, where slit convolution error becomes significant to the 5% level for reported 1/e^2 diameter of a TEM$_{00}$ Gaussian beam.

Right Boundary: The right boundary is the instrument entrance aperture diameter, which determines the largest beam profile and diameter that can be measured. For a TEM$_{00}$ Gaussian beam the 1/e^2 diameter needs to be ≤1/2 the aperture diameter to measure and see the entire profile out to the tails. Similarly for a Flat-top distribution the 1/e^2 diameter needs to be ≤~95% of the aperture diameter. To obtain any given clip level diameter for any beam (but not the full profile) ~95% of the aperture is useable.



Pyroelectric Detector

Pyroelectric Detector

Pyroelectric Detector: Uniform in response between 0.2 and 20 microns wavelength.

Power: Average power in the laser beam.

Beam Diameter: Assumes a round beam. The operating point for an elliptic beam can be approximated by using the average diameter. For extremely elliptic beams (ratio >4:1), contact Spiricon.

Slit Damage (——): Power density (watts/cm^2) where one can begin to ablate and cut the slits. Refer to Spiricon's Damage Threshold with High Power Laser Measurements document.

Left Boundary: The left boundary is 4 times the slit width, where slit convolution error becomes significant to the 5% level for reported 1/e^2 diameter of a TEM$_{00}$ Gaussian beam.

Right Boundary: The right boundary is the instrument entrance aperture diameter, which determines the largest beam profile and diameter that can be measured. For a TEM$_{00}$ Gaussian beam the1/e^2 diameter needs to be ≤1/2 the aperture diameter to measure and see the entire
profile out to the tails. Similarly for a Flat-top distribution the 1/e^2 diameter needs to be ≤~95% of the aperture diameter. To obtain any given clip level diameter for any beam (but not the full profile) ~95% of the aperture is useable.

Ordering Information

Item	Description	P/N
NS2s-SI/3.5/1.8-STD	NanoScan 2s Silicon Detector 3.5mm aperture 1.8 µm slits. High-resolution head featuring Silicon detector, 63.5mm diameter head with rotation mount, 3.5mm entrance aperture, and matched pair of 1.8 µm wide slits. Use from 190nm to wavelengths <1 µm. Not for 1.06 µm wavelength	PH00421
NS2s-SI/9/5-STD	NanoScan 2s Si Detector 9mm aperture 5 µm slits. High-resolution head featuring Si detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 190nm to wavelengths <1 µm. Not for 1.06 µm wavelength	PH00422
NS2s-SI/9/25-STD	NanoScan 2s Si Detector 9mm aperture 25 µm slits. High-resolution head featuring Si detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 25 µm wide slits. Use from 190nm to wavelengths <1 µm. Not for 1.06 µm wavelength	PH00423
NS2s-Ge/3.5/1.8-STD	NanoScan 2s Ge Detector 3.5mm aperture 1.8 µm slits. High-resolution head featuring Germanium detector, 63.5mm diameter head with rotation mount, 3.5mm entrance aperture, and matched pair of 1.8 µm wide slits. Use from 700nm to 1.8 µm wavelength	PH00424
NS2s-Ge/9/5-STD	NanoScan 2s Ge Detector 9mm Aperture 5 µm slits. High-resolution head featuring Germanium detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 700nm to 1.8µ m wavelength	PH00425
NS2s-Ge/9/25-STD	NanoScan 2s Ge Detector 9mm Aperture 25 µm slits. High-resolution head featuring Germanium detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 25 µm wide slits. Use from 700nm to 1.8 µm wavelength	PH00426
NS2s-PYRO/9/5-STD	NanoScan 2s Pyro Detector 9mm Aperture 5.0 µm slits. High-resolution head featuring pyroelectric detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 190nm to >100 µm wavelength	PH00427
NS2s-PYRO/9/25-STD	NanoScan 2s Pyro Detector 9mm Aperture 25.0 µm slits. High-resolution head featuring pyroelectric detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 190nm to >100 µm wavelength	PH00428
NS2s-Si/3.5/1.8-PRO	NanoScan 2s Silicon Detector 3.5mm aperture 1.8 µm slits. High-resolution head featuring Silicon detector, 63.5mm diameter head with rotation mount, 3.5mm entrance aperture, and matched pair of 1.8 µm wide slits. Use from 190nm to wavelengths <1 µm. Not for 1.06 µm wavelength Software includes ActiveX automation feature	PH00429
NS2s-Si/9/5-PRO	NanoScan 2s Si Detector 9mm aperture 5 µm slits. High-resolution head featuring Si detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 190nm to wavelengths <1 µm. Not for 1.06 µm wavelength Software includes ActiveX automation feature	PH00430

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Item	Description	P/N
NS2s-Si/9/25-PRO	NanoScan 2s Si Detector 9mm aperture 25 µm slits. High-resolution head featuring Si detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 25 µm wide slits. Use from 190nm to wavelengths <1 µm. Not for 1.06 µm wavelength Software includes ActiveX automation feature	PH00431
NS2s-Ge/3.5/1.8-PRO	NanoScan 2s Ge Detector 3.5mm aperture 1.8 µm slits. High-resolution head featuring Germanium detector, 63.5mm diameter head with rotation mount, 3.5mm entrance aperture, and matched pair of 1.8 µm wide slits. Use from 700nm to 1.8 µm wavelength Software includes ActiveX automation feature	PH00432
NS2s-Ge/9/5-PRO	NanoScan 2s Ge Detector 9mm Aperture 5 µm slits. High-resolution head featuring Germanium detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 700nm to 1.8 µm wavelength Software includes ActiveX automation feature	PH00433
NS2s-Ge/9/25-PRO	NanoScan 2s Ge Detector 9mm Aperture 25 µm slits. High-resolution head featuring Germanium detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 25 µm wide slits. Use from 700nm to 1.8 µm wavelength Software includes ActiveX automation feature	PH00434
NS2s-Pyro/9/5-PRO	NanoScan 2s Pyro Detector 9mm Aperture 5.0 µm slits. High-resolution head featuring pyroelectric detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 190nm to >100 µm wavelength Software includes ActiveX automation feature	PH00435
NS2s-Pyro/9/25-PRO	NanoScan 2s Pyro Detector 9mm Aperture 25.0 µm slits. High-resolution head featuring pyroelectric detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5 µm wide slits. Use from 190nm to >100 µm wavelength Software includes ActiveX automation feature	PH00436
Software Upgrades		
NSv2 STD to NSv2 PRO Upgrade	Upgrade NanoScan v2 Standard version software to the PRO version. This upgrade opens the NanoScan automation feature for those users wanting to integrate or develop their own interface using Visual Basic for Applications to embed into such applications as LabView. Return scanhead to factory	PH00417
Accessories		
RAL-FXT	Rayleigh fixture for manual M2	PH00073
COL-FXT 250	250 mm FL collimation fixture	PH00070
COL-FXT 500	500 mm FL collimation fixture	PH00227

Beam Watch

BeamWatch® Non-Contact, Focus Spot Size and Position Monitor for High Power YAG, Diode and Fiber Lasers

* Instantly measure focus spot size
* Dynamically measure focal plane location during start-up
* From 1kW and up – no upper limit (So far we have measured up to 100kW)
* Non-contact, laser beam is completely pass-through
* Automation Control Interface for System Integration
* GigE camera interface for local network installation
* Patent

BeamWatch utilizes disruptive technology for very high power lasers. By not intercepting the beam yet providing instantaneous measurements, you can now monitor the beam at frequent intervals without having to shut down the process or remove tooling and fixtures to get access. In addition, you can now measure focal spot location several times per second and know if there is any focal spot shift during those critical start-up moments.

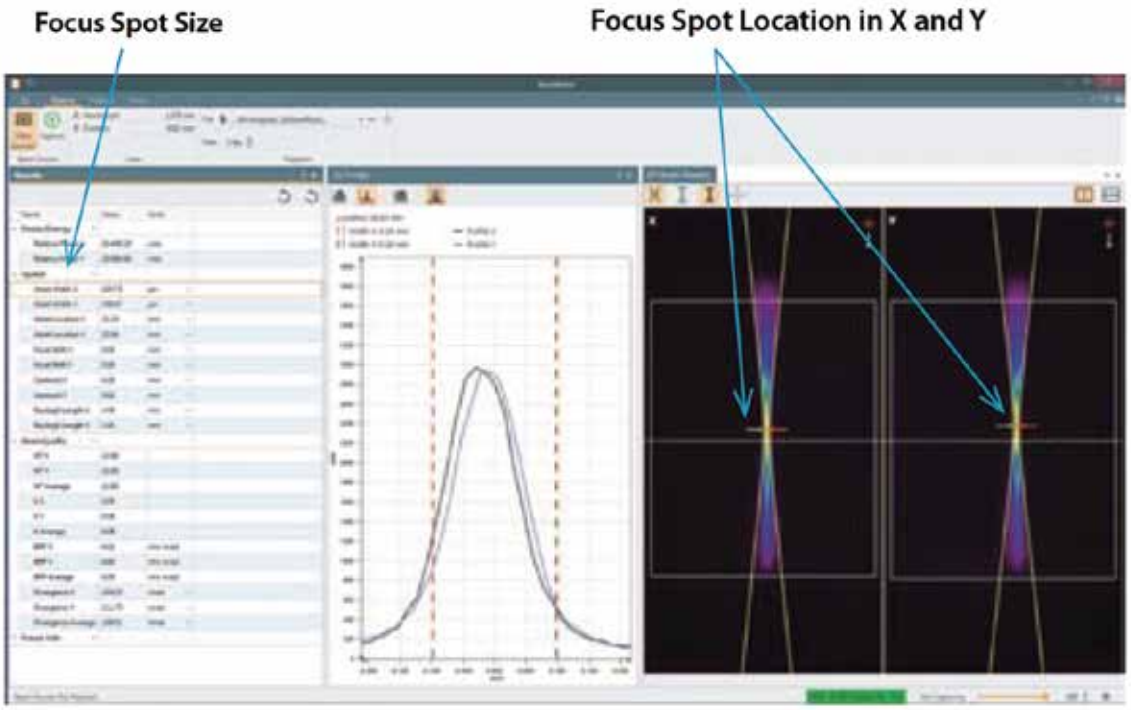
Disruptive Technology

BeamWatch is the first device to measure a laser without coming in contact with its beam which allows it to be the first laser quality measurement product in history to have no upper limit on the lasers which it can measure. BeamWatch provides high-power industrial laser users with data never before seen such as the dynamic measurement of focus shift caused by thermal effects on the laser system. BeamWatch also provides the industrial laser user with measurement of other key laser operating parameters in real-time.

The system measures the signal generated from Rayleigh scattering around the laser's beam waist, where the power density is the highest. Rayleigh scattering is a physical property of light caused by light scattering off of air molecules. Unlike traditional beam measurement systems, the beam passes directly through BeamWatch and is not disrupted, mechanically or optically. In addition, BeamWatch has no moving parts so there is no need for cooling of any components. Specialized system software dynamically measures the signal multiple times per second, allowing the laser user to key in on critical operational laser attributes, such as beam waist size and position with respect to the material being processed.

BeamWatch Technician User Interface

* Technician Mode: The technician has access to those tools needed for start-up and advanced beam diagnostics.



Technician mode for dual axis set-up and beam diagnostics

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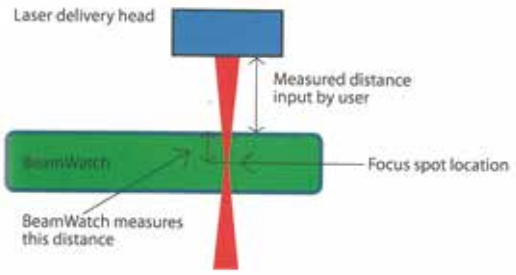
Focus Spot Size

BeamWatch images the full beam caustic measuring the waist at its smallest point, many times per second.

Focus Spot Location

Now you can precisely know the dynamic behavior of focal spot shift throughout the laser duty cycle. By inputting the known distance from the laser delivery head to a precise datum on BeamWatch the focal spot distance is constantly measured and tracked with millisecond updates.

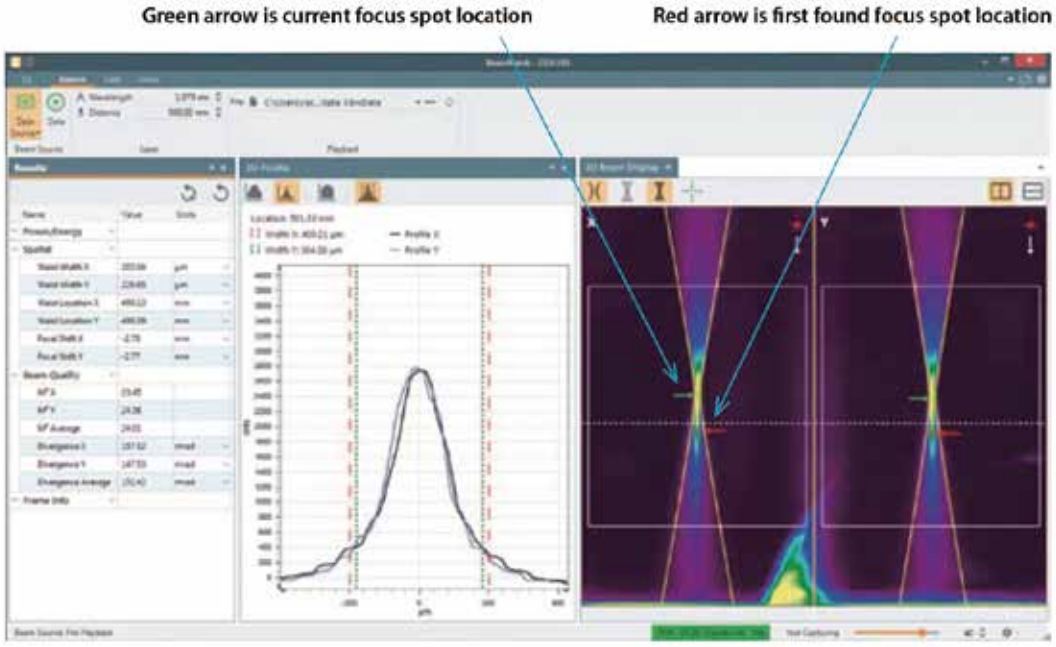


Assured Process Consistency

Measure as often as needed to assure repeatable and consistent process uniformity. Mount BeamWatch into the process or manually insert BeamWatch and make periodic measurements. You can also automatically compare to initial process validation measurements and utilize automated pass/fail.

Automation Interface

BeamWatch includes the tools to support Automation Clients written in Visual Basic for Applications (VBA), C++ CLI, or any .Net compliant environment, such as Microsoft Excel or National Instruments' LabVIEW.



Example using dual axis technician screen

Specifications

Model		BeamWatch
Wavelength		980-1080nm
Minimum Power Density		2 Megawatts/cm^2
Minimum Spot Size		
SP90335	Single axis	155 microns
SP90389	Single axis	55 microns
SP90390	Dual axis	155 microns
SP90391	Dual axis	55 microns
Maximum Beam diameter at entrance/exit		12.5mm
Communication to PC		GigE Ethernet
Power		110 – 220 Volts AC
Particulate Purge		Clean Dry Gas, approximately 10 LPM
Accuracy		
Waist Width (Spot Size)		±5%
Waist Location		±125 micrometers within the BeamWatch window
Focal Shift		±50 microns
Beam Parameter Product		±3.5% RMS
Divergence		±3.5% RMS
M^2		±3.5% RMS

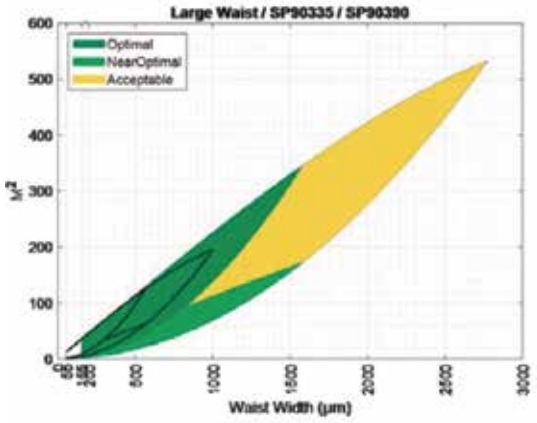
Specification subject to change

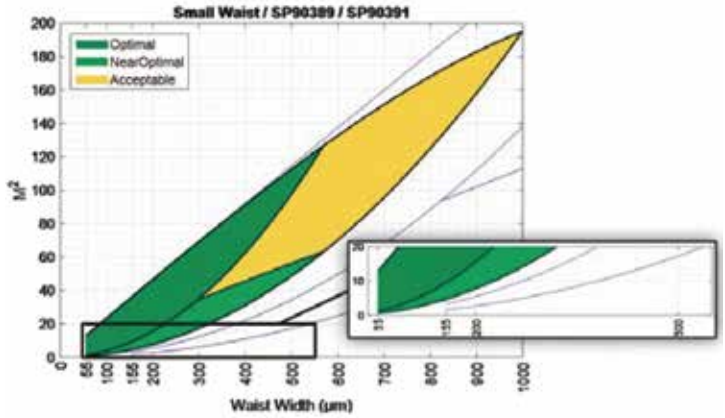
Operating Space Charts

The plots are intended to give a visual indication of the recommended operating space for BeamWatch. If BeamWatch is operated outside of this space, it may be more difficult to see the curvature of the caustic or the beam may be large enough at the edges of the image that it is out of focus. The maximum waist is dependent on the power density and M^2 of the beam. Specified is a minimum power density of 2 megawatts/cm^2 and the M^2 vs waist width is shown in the corn-looking graphs. Following these charts also covers the 12.5mm max beam size as it enters and exits the unit.

The 12.5mm maximum beam size at entrance and exit is the physical clear aperture of unit, and is the same for all models.

* Optimal has at least 3 Rayleigh lengths on both sides of the waist, with the waist at the center of the image
* Near Optimal has at least 3 Rayleigh lengths on 1 side of the waist, with the waist at the end of the image
* Acceptable has at least 1.5 Rayleigh lengths on both sides of the waist, with the waist at the center of the image





Ordering Information

Item	Description	P/N
BW-NIR-1-155	Single axis - BeamWatch non-contact, focus spot size and position monitor for focus spots from 155 µm and larger (see operating space charts) larger (see operating space charts)	SP90335
BW-NIR-1-55	Single axis - BeamWatch non-contact, focus spot size and position monitor for focus spots from 55 µm and larger (see operating space charts)	SP90389
BW-NIR-2-155	Dual axis - BeamWatch non-contact, focus spot size and position monitor for focus spots from 155 µm and larger (see operating space charts)	SP90390
BW-NIR-2-155	Dual axis - BeamWatch non-contact, focus spot size and position monitor for focus spots from 55 µm and larger (see operating space charts)	SP90391
Suggested Add-Ons		
Rotation Mount	Add-on 180° manual rotation mount to bottom of BeamWatch	SP90346
Locking Ethernet Cable	Replace standard Ethernet cable with one that locks into place, IP67 rated	SP90394
5000W-BB-50	5kW water cooled power sensor	7Z02754
10K-W-BB-43	10kW water cooled power sensor	7Z02756
30K-W-BB-74	30kW water cooled power sensor	7Z02757
120K-W	100kW water circulated power sensor for laser with an approximately Gaussian beam and fiber output	7702691
Juno	Compact module to operate one Ophir sensor from your PC USB port	7Z01250
Vega	Hand held color universal power meter	7Z01560

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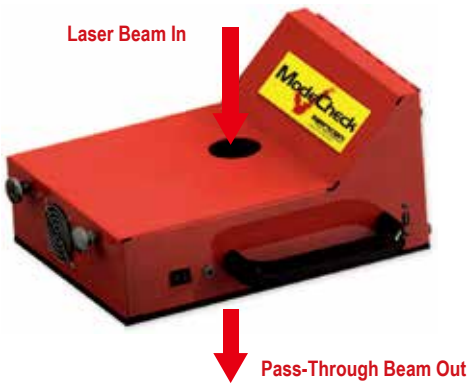
ModeCheck

High Power - ModeCheck® - A New Method to Assure the Performance of High Power CO_2 Lasers

* Beam Profiler for collimated CO_2, 10.6um wavelength, beam width up to 30mm.
* Quality Cutting, Marking, Drilling & Ablating Require More Than Consistent Laser Power
* Instantaneously "see" and measure the beam - reduce set-up time between jobs
* Real-time "mode burns" - eliminate hazardous acrylic vapors
* Optimize laser efficiency - reduce cost per part
* Predict laser preventative maintenance - increase manufacturing efficiency



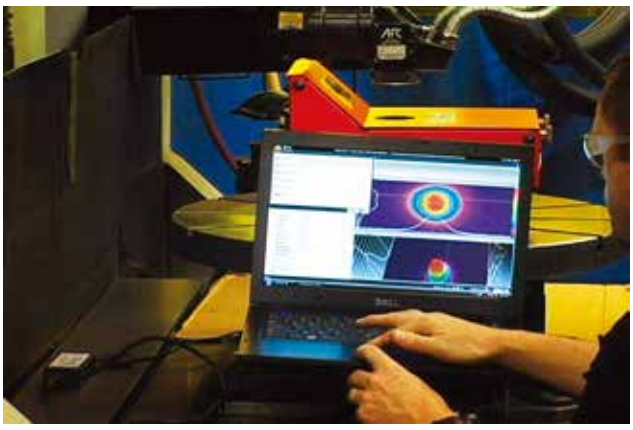
ModeCheck is designed for the industrial parts manufacturer to reduce the time it takes to change over between different jobs. The user can quickly place the ModeCheck in front of the laser and see and measure, in real-time, the laser beam profile to confirm optimal laser performance. In addition, and when used periodically, the user can compare measurement changes from the same set-up and make necessary laser adjustments, keeping the laser output constant for the same job from day-to-day. Over time the user will be able to see and measure aser degradation to predict and advance schedule downtime needed for periodic maintenance.

ModeCheck eliminates operator exposure to acrylic mode burn hazards while improving product quality and manufacturing efficiency.

Measurements:

In addition to both 2D and 3D graphical image display and save, the following measurements are made from each image:

* Beam Widths and Diameters
* Beam Position Stability
* Power Density Peak
* Beam Centroid Location
* Elliptical Analysis with Major Axis Orientation



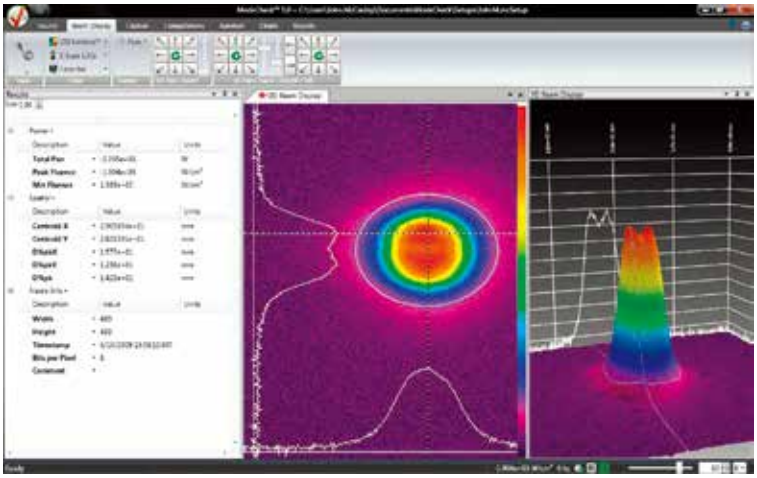
It's just this easy.

1. Remove Focusing optic or attach the optional MLA
2. Locate the beam center with pointing beam or similar device
3. Place ModeCheck in beam center
4. Turn on Laser
5. Instantly see, measure and electronically store the beam characteristics

Optional Accessories

One must manage the pass-through laser beam by collecting the beam using either a power meter or beam dump. We recommend using a power meter as the additional measurement information will assist in managing laser optimization. Note that any beam dump or power meter large enough to handle 5-10kW will require water cooling. There are holes on the bottom of ModeCheck for mounting the Power Meter Head or Beam Dump.

A ruggedized storage/carrying case is highly recommended for safe and efficient handling.



ModeCheck makes instantaneous beam measurements along with graphically displaying both the 2D and 3D power density distribution

The ModeCheck Lens Adapter (MLA) is an option that will enable a ModeCheck to recollimate a focused CO_2 laser beam. The advantage of using this adapter is that the focusing head of the machine does not have to be removed, which is the normal case for a ModeCheck without this adapter.

The disadvantage is that the ModeCheck must be positioned further from the output head in order to properly recreate the collimated beam profile. The recollimating lens must be supplied by the user and must be the same lens that is used on the lasers cutting head. (See application note: SP90329).

A PC is required to run the ModeCheck imaging software. The camera is powered over the USB cable that connects the computer to ModeCheck.

ModeCheck with optional MLA, profiling a CO2 cutting laser with its processing head installed

Specifications

Model	ModeCheck
Laser Input Power	100 - 5000 Watts (or more depending on Beam size)
Input Clear Aperture	50mm (~2")
Laser Type	CW, Pulsed >100 KHz
Beam Width	5mm - 30mm
Pick-off Percent	0.5%, 1%, 2%, 4%, 10% sampling wands; user replaceable
Damage Threshold	27 - 36 W/cm^2; See graph
Camera	1/3" format CMOS, 480x480, 6µm pixel, 8bit, CS-mount, USB2
Lens	12mm C-mount
Cooling	Built in Fan (water required for the optional beam dump or optional power meter sensor)
UV Light Source	LED array
Software	ModeCheck
Power Requirements	Input: 100 - 240 Vac, 50 - 60Hz, 1.5A Output: 12Vdc, 5.0A, w/power jack, UL listed and CE compliant universal power supply included Camera is powered over the USB port
Dimensions	9.5" x 13" x 6.7" 242mm x 330mm x 171mm Not including handle and cabling or any options
Weight	~8 lbs 3.6kg
Beam Dump (optional)	Water cooled and rated for 5kW total power
Power Meter (optional)	5000W-SH; up to 5kW total power 10kW-SH-V2; up to 10kW total power
Laptop Computer	Provided by user; Windows 7 (32/64)
Compliance	Unit meets CE and RoHS requirements

The optional rugged case is recommended for safe storage in an industrial facility

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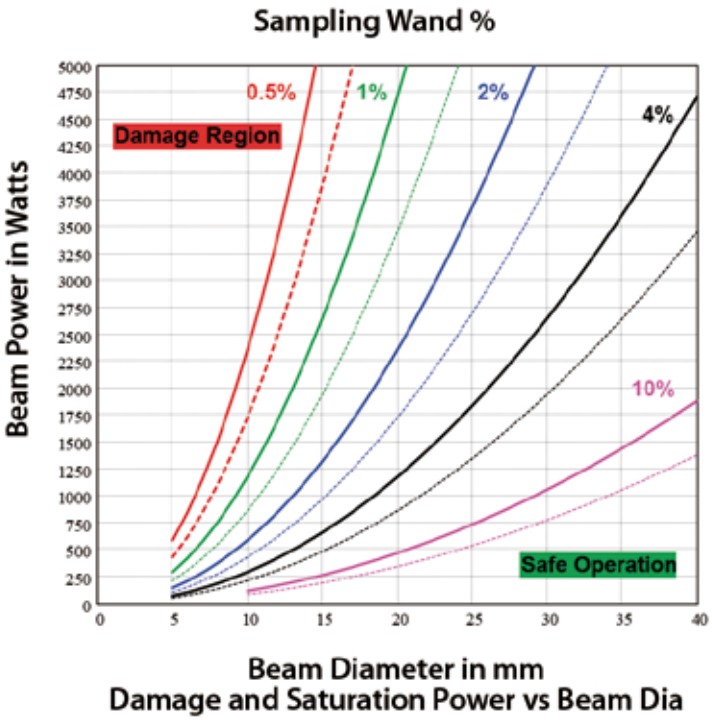


Safe Operation is to the Right of the Solid line. Image Saturation is approximately the Dashed line. Chose a sampling Wand that contains your beams maximum power and minimum diameter to be near but below the dashed line for safe and best beam viewing

Ordering Information

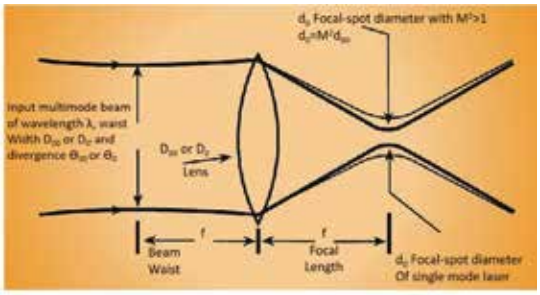
Item	Description	P/N
MODECHECK CO_2 - 5kW	ModeCheck, CO_2 sampler for 10.6µm beams up to 5kW, beam width up to 30mm; includes 2 user selectable wands from selection below	SP90211
0.5% wand	0.5% beam wand sampler, see damage and saturation chart	SP90324
1% wand	1% beam wand sampler, see damage and saturation chart	SP90325
2% wand	2% beam wand sampler, see damage and saturation chart	SP90326
4% wand	4% beam wand sampler, see damage and saturation chart	SP90327
10% wand	10% beam wand sampler, see damage and saturation chart	SP90283
Beam Dump; 5kW	Beam dump for up to 5kW continuous, includes mounting bracket, requires continuous water flow.	SP90224
5000W-SH	Power sensor, measure CO_2 power up to 5000W; water cooling needed	7Z02119
Mounting Hardware, 5000W detector	Mounting hardware for 5kW power sensor. Required when ordering the 5000W-SH sensor	SP90212
10kW-SH-V2	Power sensor, measure CO_2 power up to 10,000W; water cooling needed	7Z02645
Mounting Hardware, 10,000W detector	Mounting hardware for 10KW power sensor. Required when ordering the 10kW-SH-V2 sensor	SP90213
ModeCheck storage/carrying case	Ruggedized ModeCheck storage/carrying case	SP90227
Collimating 2" Lens Adapter	ModeCheck Lens Adapter (MLA) enables a ModeCheck to recollimate a focused CO_2 laser beam. MLA should be ordered with the ModeCheck so that it can be factory installed.	SP90329

M²

What is M² ?

M², or Beam Propagation Ratio, is a value that indicates how close a laser is to being a single mode TEM_{00} beam, which in turn determines how small a beam waist can be focused. For the perfect Gaussian TEM_{00} condition the M² equals 1.

For a laser beam propagating through space, the equation for the divergence, θ, of an unfocused beam is given by:



Characteristics of a laser beam as it passes through a focusing lens.

$$\theta_0 = M^2 4\lambda / \pi D0$$

For a pure Gaussian TEM00 beam M² equals 1, and thus has no impacton the calculation. The calculation of the minimal beam spot is then

$$d_0 = 4\lambda / \pi\theta$$

Again with M² equal to 1, the focused spot is diffraction limited. For real beams, M²will be greater than 1, and thus the minimum beam waist will be larger by the M² factor

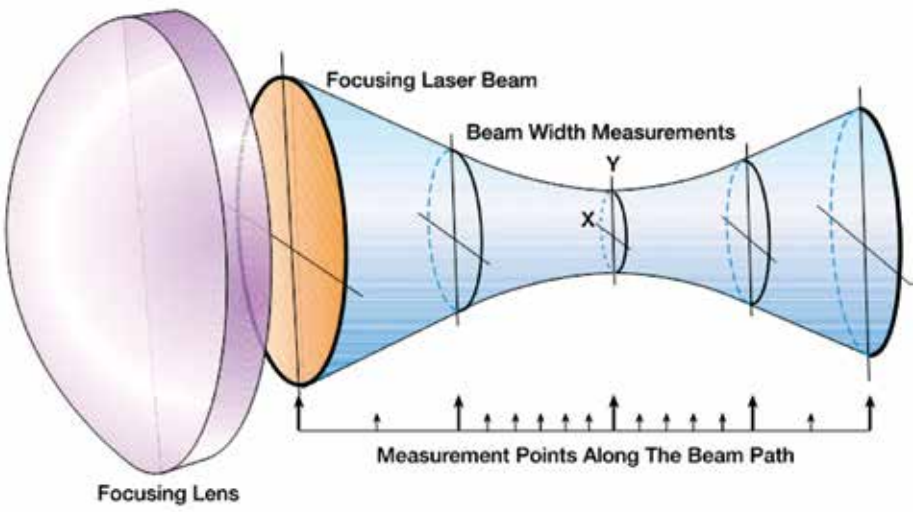
How is M² measured?

M² cannot be determined from a single beam profile measurement. The ISO/DIS 11146 requires that M² be calculated from a series of measurements as shown in the figure above. M² is measured on real beams by focusing the beam with a fixed position lens of known focal length, and then measuring the characteristics of the artificially created beam waist and divergence.

To provide an accurate calculation of M², it is essential to make at least 5 measurements in the focused beam waist region, and at least 5 measurements in the far field, two Rayleigh ranges away from the waist area. The multiple measurements ensure that the minimum beam width is found. In addition, the multiple measurements enable a “curve fit” that improves the accuracy of the calculation by minimizing measurement error at any single point. An accurate calculation of M² is made by using the data from the multiple beam width measurements at known distances from a lens, coupled with the known characteristics of the focusing lens.

M² Measurement Solutions

Ophir-Spiricon and Photon have a number of solutions for the measurement of M² ranging from simple manual processes to fully automated dedicated instruments, depending on the frequency of the need to measure M² of lasers and laser systems. We have a system that will meet most needs, whether for research and development of new laser systems, manufacturing quality assurance, or maintenance and service of existing systems.



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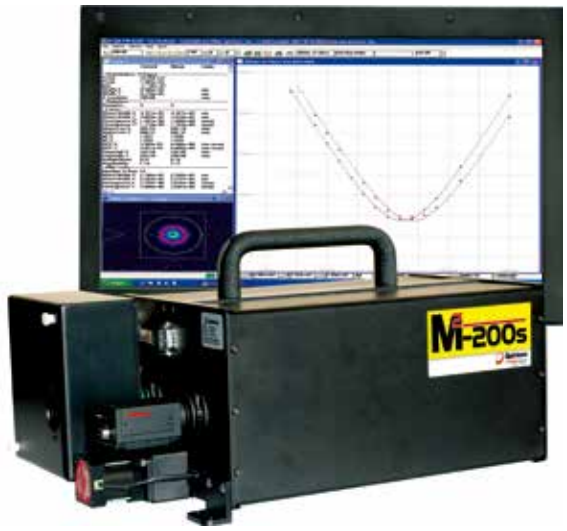
M^2 - 200s

Camera Based Beam Propagation Analyzer: M^2

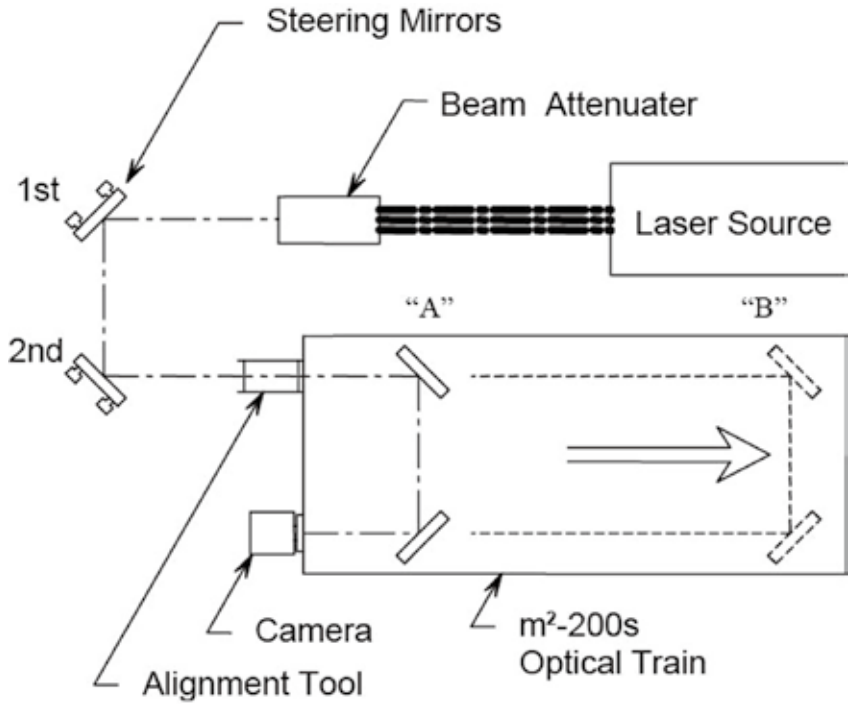
* Automatically measure your beam quality in under 2 minutes
* Tune your laser for best operation
* ISO compliant
* Specifically developed for continuous usage
* Unequaled accuracy using patented Ultracal™ Calibration
* Automatic attenuation adjustment
* Pulsed and CW for most beam diameters and powers
* Compact and portable



Not all commercial M^2 measuring instruments conform to the ISO 11146 method of employing a fixed position lens and moving detector. Instead, some manufacturers use a fixed position detector and a moving lens. If the laser beam is diverging or converging within the travel range of a moving lens, the reported M^2 value and other results can be significantly compromised. Spiricon's M^2-200s Beam Propagation Analyzer is fully ISO 11146 compliant.

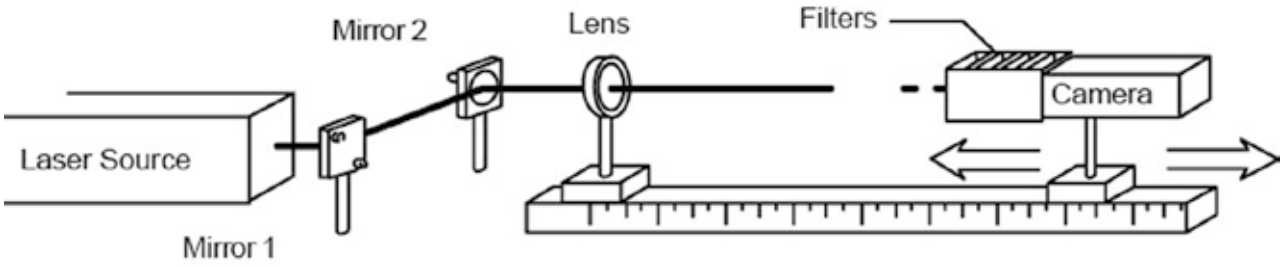
Automatic M^2 - at Production Speeds

The M^2-200s optical train uses a fixed position lens and camera. The mirrors that direct the focused beam into the camera are moved to precise locations, translating the beam through both the waist region and the far field regions. All these measurements and translations, as well as incremental beam attenuation, are automatically controlled by the M^2-200s software. Software improvements in the M^2-200s, including more efficient algorithm execution, has decreased the measurement reporting time by 2-3 times, making it possible to report M^2 in under two minutes.



Manual M²

Manual mode is available for beams that are too large or too small or at wavelengths outside the standard optical train



Accuracy by Design

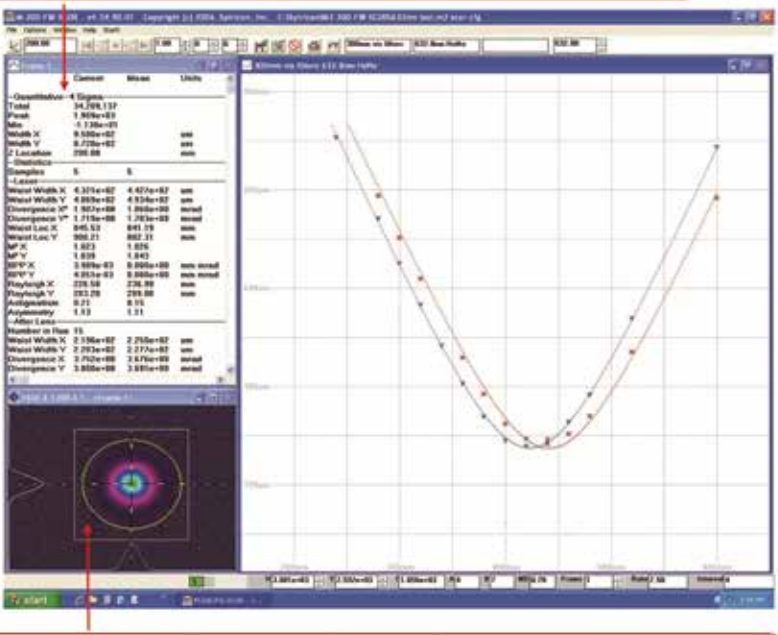
Spiricon products are known for accuracy. Using our patented Ultracal™ calibration method and auto aperturing to exclude noise beyond the wings of the laser beam, assures the user of the most accurate measurements in the industry.

Designed by Our Customers

Spiricon has redesigned the M²-200, the world's top selling beam propagation system to include customer input, increased attention to durability, and operational robustness for continuous use applications - three shifts a day, seven days a week. Novice and seasoned users will appreciate these new features along with the time-tested excellence that the Spiricon M²-200 measurement system has provided overthe years.

Main Screen Functions

This window displays quantitative measurements of the laser parameters. These include the X and Y Beam widths, M^2 or K, the divergence angles, the Rayleigh range, and other parameters shown.



This window presents measurements of Beam width vs. position for a given run. After measuring a few points, the software extrapolates a curve fit. The Xs and Ys represent individual measurement points. The solid lines present the best fit hyperbola of the beam propagation equation to the measured points. The M^2 and other laser parameter are computed from the best fit hyperbola since it provides a smoothing of the data points.

This 2D or 3D beam profile of the currently measured point in the beam propagation curve. This image enables visual intuitive verification of the beam profile behavior through focus. After each run the user can click any individual measured point and observe the beam profile. Outlying or anomalous points can be automatically or manually excluded from the curve fit calculations for more accurate results.

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Specifications for the M²-200s

General	
Accuracy	±5% typical, ±12% waist location and Rayleigh length typical (Note: Accuracy can be degraded by a variety of situations)
Measurement Cycle Time	2-3 minutes typical, depending on setup conditions and operating mode
Camera Attachment	Std C-mount, 90° camera on axis rotation
Translation System	Step motor-driven lead screw
Translation Pitch	4 mm/rev optical pitch
Step Angle	1.8° (200 steps/rev)
Sample Range	190 - 600 mm, typical
Camera Specifications (for SP300 camera)	
Imager	1/1.8" CCD, 1928 x 1448 pixels
Dynamic Range	12 bit A to D
Frame Rates	26 FPS (at full resolution)
Pixel size	3.69µm x 3.69µm
Gain	0 to 24 dB
Shutter Control	Programmable from 110µs to 70ms
S/N Ratio	56dB at min gain
Trigger Input	Edge sensitive 3.3 / 5Vdc LVTTL / TTL (positive or negative, user programmable)Minimum pulse width 10us. External Trigger cable provided
Trigger Out	3.3Vdc LVTTL, Programmable
Voltage Requirement	Powered through USB 3.0, USB 2.0
Power Consumption	<3.5watts
Environmental	
Storage Temperature	-30°C to 65°C
Storage Humidity	95% maximum (non-condensing)
Operating Temperature	10°C to 40°C
Operating Humidity	95% maximum (non-condensing)
Power Requirements*	
Line Voltage	95V AC to 250V AC
Line Frequency	47Hz to 63Hz
Maximum Power	4.5 Watts
* For the Optical Train only. The PC computer supplies the power for the system components, such as the CCD camera. An external power supply is forrequired for Laptop computer use.	
Physical	
Weight	15lbs, 6.8 kg (without camera)
Measurements	M^2x, M^2y, Kx, Ky, BPPx, BPPy
Statistical results	Width at waist Wx, Wy
are available on	Divergence angle qx, qy
all measurements	Waist location Zx, Zy
	Rayleigh X, Y
	Astigmatism
	Asymmetry ratio
Wavelength Range	
Different lenses are needed for different wavelength regions	
The M^2-200s model include 3 standard lenses with nominal 300mm focal lengths. See below	
M^2-200s-USB	266 - 587nm (included)
	400 - 750nm (included)
	650 - 1125nm (included)
	1000 - 1300nm (optional)
Attenuation Range Nominally from ND 0 to ND 4.8. Actual values vary with wavelength	
Beam Size	0.5mm - 10mm
	Varies with wavelength, waist size and location, and M^2
Damage Limits [1]	
Camera	0.15 µW/cm² CW mode for a 10 mm input beam diameter
	1.0 µJ/cm² pulse mode for a 10 mm input beam diameter
	Both of the above for an M^2=1 @ 1064nm

[1] CCD cameras can be damaged by power in excess of 0.1 mW/cm² or energy in excess of 1 mJ/cm². The M^2-200s employs a focusing optic. While it may be that the laser input power or energy measures well below this damage threshold, it can easily exceed these levels when focused onto the camera sensor. Use caution and error on the side of safety. CCD cameras can be costly to repair or replace.

Ordering Information

Item	Description	P/N
M^2-200s-USB	M^2-200s software, software license, SP300 USB 3.0 camera, short optical train, automatic and manual operation, recommended for 266nm - 1300nm wavelengths.	SP90144
M^2-200s-USB-A	M^2-200 software, software license, short optical train, automatic and manual operation, recommended for 266nm - 1064nm wavelengths (SP300 camera not included)	SP90145
M^2-200sM-USB	Manual mode M^2-200s software, software license, SP300 USB 3.0 camera, manual operation with a SP300 camera (optical train not included)	SP90146
Accessories		
1000 - 1300nm	Lens assy telecom, 300mn fl	11402-001

Instantly measure M² Model 1780

The ModeScan Model 1780 is a laser beam profiling instrument that measures the M² 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 ten 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 BeamPro. This translates to M² measurements with accuracy to ~5%. The FireWire system operates under Photon's BeamPro in Microsoft Windows. The compactness of the system and the IEEE 1394a 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.

ModeScan 1780

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 >360nm, and an OD 3.0 Fused Silica Inconel neutral density filter for wavelengths <360nm. 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 >360nm. For pulsed lasers with wavelength <360nm, a variable UV filter or a combination of UV filters will generally be required.

ModeScan Model 1780 System Specifications

Optical/Sensor/Detector	
Sensor	Si CCD 1/2" Format
Wavelength	~360nm – 1100nm (Standard with OD 2.8 filter) ~250nm – 1100nm with UV optics
Pixel Array	780 (H) × 580 (V)
Pixel Size	8.3µm × 8.3µm
Array Dimension	6.49mm × 4.83mm
Scanning Mode	Progressive
CCD Cover Glass	Removed
Beam Splitters	Fused Silica: <20/10 Scratch Dig, I/10 Flatness
Test Lenses UV: ~250 – 460nm Visible: 425 – 720nm VIS – NIR: 620 – 1080n	 200mm fl Fused Silica/250 – 460nm AR coated standard 200mm fl BK7/425 – 720nm AR coated standard 200mm fl BK7/620 – 1080nm AR coated standard
Fixed Attenuator: Visible – NIR UV	OD 2.8 Absorbing Glass >360nm OD 3.0 Fused Silica Inconel 250 – 450nm
Computer/Electrical	
A / D Conversion	12 Bit
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 1.8m
Interface	IEEE 1394a (FireWire)
IEEE 1394 Cabl	1.8m
Supply Voltage	+8V – +36V DC (+12V DC nominal), <1% ripple (supplied via IEEE 1394 cable); requires externalpowered hub with laptop PCs
Supply Power	3.5W max @ 12V DC (typical)
Mechanical	
Filter/Lens Mount	C-mount (1" – 32 tpi)
Mounting	Gimbal Mount on ." post; 12mm Metric post optional
Dimensions in mm	62 H × 140 W × 210 L , + Gimbal Mount
Weight	~1.4kg
Environmental	
Operating Temperature	0˚ – +50˚C (+32˚ – 112F)
Humidity	20% – 80%, relative, non-condensing
Conformity	CE; FCC; RoHS and WEEE

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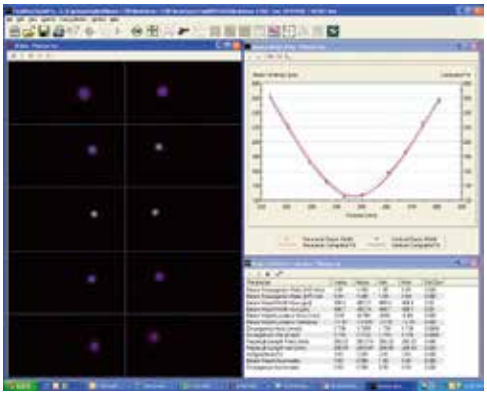

Arrangement of Measurement Windows: VideoWindow Beam Propagation Mode; Beam Statistics Window; Horizontal and Vertical Caustics Window

Ordering Information

Item	Description	P/N
ModeScan 1780 M2 System with Fire Wire BeamPro		
MS-1780	ModeScan Model 1780, dedicated M^2 measurement system, with 12-bit FireWire (IEEE 1394a) CCD detector for single-shot, pulsed and CW lasers. System includes: ModeScan with gimbaled mount for alignment; FireWire CCD camera; Photon FireWire BeamPro Acquisition and Analysis Software standalone GUI with M^2 Analysis; Active X automation interface; 200mm lens coated for Visible range (400– 700nm); OD 2.8 glass filter for operation >360nm; Dimensions: 62mm x 140mm x 210mm; For use from 250–1100nm wavelengths - UV and NIR operation will require additional specifically coated optics.	PH00096
ModeScan 1780 Accessories		
UV Lens Kit (MS-UV kit)	UV lenses are all fused silica plano-convex and coated for UV wavelengths 250-400nm All lens kits contain 200mm, 250mm, 400mm, 500mm, 750mm and 1m focal length coated lens with mounting hardware and MS-Tube Kit.	PH00097
UV200	200mm focal length lens	PH00098
UV250	250mm focal length lens	PH00099
UV350	350mm focal length lens	PH00100
UV500	500mm focal length lens	PH00101
UV750	750mm focal length lens	PH00102
UV1000	1000mm focal length lens	PH00103
MS-VIS Lens Kit (MS-VIS kit)	Visible (VIS) lenses are all BK 7 plano-convex and coated for visible wavelengths 450–650nm All lens kits contain 200mm, 250mm, 400mm, 500mm, 750mm and 1m focal length coated lens with mounting hardware and MS-Tube Kit.	PH00104
VIS200	200mm focal length lens	PH00105
VIS250	250mm focal length lens	PH00106
VIS400	400mm focal length lens	PH00107
VIS500	500mm focal length lens	PH00108
VIS750	750mm focal length lens	PH00109
VIS1000	1000mm focal length lens	PH00110
MS-NIR Lens Kit (MS-NIR kit)	NIR lenses are all BK-7 Plano-convex and coated for NIR wavelengths 700-1100nm All lens kits contain 200mm, 250mm, 400mm, 500mm, 750mm and 1m focal length coated lens with mounting hardware and MS-Tube Kit.	PH00111
NIR200	200mm focal length lens	PH00112
NIR250	250mm focal length lens	PH00113
NIR400	400mm focal length lens	PH00114
NIR500	500mm focal length lens	PH00115
NIR750	750mm focal length lens	PH00116
NIR1000	1000mm focal length lens	PH00117
Extension and Focusing Tubes		
CM-EXT100	100mm long C-Mount extension tube for mounting lenses outside ModeScan 1780 Box	PH00119
CM-EXT50	50mm long C-Mount extension tube for mounting lenses outside ModeScan 1780 Box	PH00120
CM-EXT40	40mm long C-Mount extension tube for mounting lenses outside ModeScan 1780 Box	PH00121
CM-EXT25	25mm long C-Mount extension tube for mounting lenses outside ModeScan 1780 Box	PH00122
CM-EXT10	10mm long C-Mount extension tube for mounting lenses outside ModeScan 1780 Box	PH00123
FOCTUBE20-30	C-Mount fine thread focus tube with 20–30mm adjustable length for focus of lenses mounted to extension tubes	PH00124
FOCTUBE30-50	C-Mount fine thread focus tube with 30–50mm adjustable length for focus of lenses mounted to extension tubes	PH00125
FOCTUBE50-90	C-Mount fine thread focus tube with 50–90mm adjustable length for focus of lenses mounted to extension tubes	PH00126
MS-TUBE Kit	Tube Kit for MS-1780	PH00127

NanoModeScan

Slit - Based Beam Propagation Analyzer M^2

The NanoModeScan combines the flexibility and speed of the NanoScan with dedicated M^2 measurement hardware and software. The NanoModeScan provides an automated measurement of M^2 using either the ISO 11146 or the Rayleigh method.

The ISO Method software and hardware report the ISO 11146 parameters:

* Times diffraction limit: M^2
* Beam propagation factor: K
* Beam waist size: d_0
* Beam waist location: Z_0
* Divergence: θ
* Rayleigh range: Z_r

NanoModeScan

By adding the capabilities of the NanoScan to the ModeScan, the range of possible measurable lasers is greatly expanded and the speed of the measurements dramatically improved. The NanoScan's software controlled variable scan speed allows the measurement of both CW and kHz pulsed lasers with any NanoScan scan head, covering the entire wavelength range from UV to FIR. The NanoScan's rapid beam finding and autoranging speed up the total M^2 measurement to ~20 seconds for CW lasers. Both 200mm and 400mm lenses are available to generate the proper artificial waist for the laser source under test. For ease of alignment, there is an entrance iris on the optical axis of the NanoModeScan and a precision alignment stage for horizontal and vertical positioning.

The ISO 11146 Method

The ISO 11146 method for measuring the propagation of a laser source calls for the measurement of the beam diameter for at least 10 positions through the waist created by a test lens inserted in the beam path. Five locations should be within ±1 Rayleigh range of the artificial waist and at least five more points beyond two Rayleigh ranges from this waist. These measurements are then used to compute the laser propagation parameters. Once points are selected properly, the ISO Method is the fastest measurement method and best for volume testing of lasers.

The Rayleigh Method

The ISO method requires the user to manually select the measurement points, and changing one or two of the selected points can yield different M^2 values. The Rayleigh method is completely automated, selecting its own measurement points based on mapping the Rayleigh range of the beam waist. This method is fully discussed in Application Note 230, Fast M^2(k-factor) Measures with Photon Beam Profilers. In addition, the Rayleigh method can yield more consistent results for M^2 values for lasers that are not exactly like those for which the ISO standard was written, such as fiber lasers, lensed diode lasers, and VCSELs.

The NanoScan Difference

With the NanoScan-equipped NanoModeScan, all scan heads can measure pulsed beams with repetition frequencies down to 10kHz.Measuring pulsed beams in discussed in the application note Measuring Pulsed Beams with a Slit-Based Profiler. The silicon and germanium detectors will measure less than a milliwatt of power. The pyroelectric detector-equipped NanoScan head can analyze higher power lasers at all wavelengths. The increased dynamic range of the NanoScan enhances the signal to noise ratio of the system and allows a much broader range of laser powers to be analyzed with one instrument setup.

Real-Time Divergence Measurement

By monitoring the divergence angle θ, it is possible to make a measurement that will be directly proportional to M^2. This enables the adjustment of the laser performance in real time at the NanoScan's rapid update rate (up to 20Hz). To use this feature, the scan head is moved to a position one geometric focal length from the test lens. Divergence is the beam diameter divided by the focal length, and the measured divergence is equal to M times the embedded divergence.

Therefore when the beam diameter at this location is minimized, the divergence is at its minimum and the M^2 of the laser should then be optimized. After this real-time adjustment, the full M^2 measurement can be done to generate the required parameter values. This method makes the NanoModeScan an even more valuable tool for the final setup of lasers on the manufacturing floor by decreasing the time it takes both to adjust the laser system and to make the measurements required for quality control documentation.

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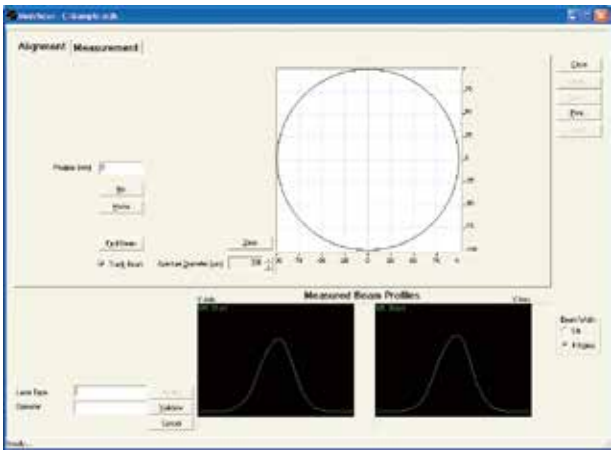
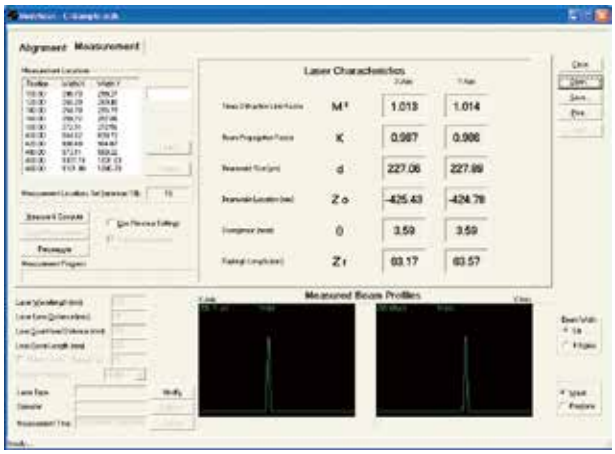
NanoModeScan Specifications

Sensor/Detector	
Scan head Travel	500mm
Optical Axis Height	140-170mm
Standard Lenses	200mm EFL, BK-7 plano-convex, Broadband AR Coated 400mm EFL, BK-7 plano-convex, Broadband AR Coated; UV through long IR lenses available
Optional Lens	200mm FL fused silica for UV coated for wavelength of use 350mm FL fused silica for UV coated for wavelength of use 190mm FL IR lens for 10.6µm wavelength
Minimum Spot Size	See scan head specifications
Computer/Electrical	
Source Power	See scan head specifications
File Saving and	Data Logging Data files, ASCII Files
AC Power	110V, 60Hz standard 220V, 50Hz optional
Communication	RS-232 Interface or USB to RS-232 adapter required
Mechanical	
NanoModeScan Linear Stage	812 x 102 x 78 mm
Photon Motion Controller	273 x 89 x 57 mm
Weight	
NanoModeScan Linear Stage	8.4kg
Photon Motion Controller	1.5kg



Alignment screen in ModeScan software



Measurement results screen in ModeScan software

Ordering Information - NanoModeScan M² Systems

All NanoModeScan Systems include (unless otherwise noted):

* High-resolution scanhead with rotation mount.
* Two BK 7 lenses and mounts. Standard are 200 and 400mm focal length.
* Lens coating Choices:
  - VIS Visible: 430–700nm (not for use with Germanium detector)
  - NIR Near IR: 650–1000nm
  - LIR Long IR: 1000–1550nm (not for use with Silicon detector)
* VLIR: Very long infrared >1550nm. The two glass lenses will not be included but instead credited toward the very long wavelength IR lens or lenses that will require an optional charge (for use with NMS-NS2-Pyro/9/5 only).
* OPTIONAL UV: If ultraviolet application, the two glass lenses will not be included; instead we will send one 200 mm focal length lens coated for wavelength of use.

Be sure to specify XXX wavelength when ordering.

Item	Description	P/N
NanoModeScan M² Systems		
NMS-NS2-Si/9/5	Model 1740 ModeScan with NanoScan 2s Silicon (Si) Detector 9mm aperture 5µm slits Si detector, 63.5mm diameter head, 9mm entrance aperture, and matched pair of 5.0 µm wide slits. Use from 190 to 1000nm wavelengths.	PH00448
NMS-NS2-GE/9/5	Model 1740 ModeScan with NanoScan 2s Germanium (GE) Detector 9mm aperture 5.0 µm slits. Germanium detector, 63.5mm diameter head, 9mm entrance aperture, and matched pair of 5.0µm wide slits. Use from 700nm to 1.8µm wavelength.	PH00449
NMS-NS2-Pyro/9/5	Model 1740 ModeScan with NanoScan 2s Pyroelectric Detector 9.0mm aperture 5µm slits. Pyroelectric detector, 63.5mm diameter head, 9mm entrance aperture, and matched pair of 5µm wide slits.	PH00450

Flame Spectrometer

High Thermal Stability, Interchangeable Slits

The Next Generation of Miniature Spectrometers

The Flame spectrometer is built using industry-leading manufacturing techniques that help deliver high thermal stability and low unit to unit variation — without compromising the flexibility and configurability that are the hallmark of Ocean Optics miniature spectrometers. New features such as interchangeable slits, indicator LEDs and simple device connectors deliver more freedom and less frustration.
Whether you are an educator looking for an instrument to teach students the basic principles of spectroscopy, a research lab looking to make a breakthrough, or an engineer working to integrate a spectrometer into an OEM system, the Flame will provide you with the performance and features you need to make your UV-Vis spectroscopy application successful.

Features

* **Modular** — configurable to your application and needs within the wavelength range 190-1100 nm
* **Compatible** — works with Ocean Optics light sources, accessories and software
* **Easy to use** — plug and play via the micro USB connection
* **User interchangeable slit** — allows you to vary the resolution and throughput of the spectrometer on demand
* **Indicator LEDs** — indicator of power and data transfer status at all times
* **Compact and lightweight** – 89.1 mm x 63.3 mm x 34.4 mm and just 265 g

Specifications

	FLAME-S	FLAME-T
Spectroscopic		
Optical resolution	~0.1 - 10.0 nm FWHM (configuration dependent)	
Signal-to-noise ratio	250:1 (full signal)	300:1 (at full signal)
Dark noise	50 RMS counts	
Dynamic range	1300:1 for a single acquisition, 8.5 x 10^7 (system)	
Integration time	1 ms – 65 seconds	3.8 ms – 10 seconds
Stray light	<0.05% at 600 nm; <0.10% at 435 nm	
Corrected linearity	>99%	
Electronics		
A/D resolution	16 bit	
Power consumption	250 mA @ 5 VDC	
Inputs/Outputs	8 x user programmable GPIOs	
Trigger modes	4 modes	
Strobe functions	Yes	
Gated delay feature	Yes	
Connectors	USB, high density 40 pin JAE DD4 connector	
Detector		
Detector	Sony ILX511B linear silicon CCD array	Toshiba TCD1304AP linear silicon CCD array
Detector range	190 - 1100 nm	190 - 1100 nm
Pixels	2048 pixels	3648
Physical		
Dimensions	88.9 x 63.5 x 31.9 mm (34.4 mm with feet)	
Weight	265 g	

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USB2000+ Spectrometer

User-configured for Maximum Flexibility

The USB2000+ Spectrometer is a clever combination of technologies: a powerful 2-MHz A/D converter, programmable electronics, a 2048-element CCD-array detector and a high-speed USB 2.0 port.

This innovative design produces our fastest spectrometer and provides resolution to 0.35 nm (FWHM). The USB2000+ allows you to capture and store a full spectrum into memory up to once per millisecond (nearly 1,000 full spectra every second) when the spectrometer is interfaced to a computer via a USB 2.0 port (performance may vary depending on computer and process loading). The USB2000+ is perfect for chemical, biochemical and other applications where fast reactions need to be monitored.

Features

* Up to 1,000 full spectra/second
* Programmable microcontroller
* Modular design – hundreds of configurations possible
* Built-to-suit wavelength range and resolution
* Automatically reads the wavelength calibration coefficients of the spectrometer and configures operating software
* USB-to-PC interface; no external power requirements
* RoHS and CE compliance

Specifications

Physical	
Dimensions	89.1 x 63.3 x 34.4 mm
Weight	190 g
Detector	
Detector	Sony ILX511B linear silicon CCD array
Detector range	200 -1100 nm
Pixels	2048 pixels
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500 electrons
Sensitivity	75 photons/count at 400 nm; 41 photons/count at 600 nm
Optical Bench	
Design	f/4, Symmetrical crossed Czerny-Turner
Focal length	42 mm input; 68 mm output
Entrance aperture	5, 10, 25, 50, 100 or 200 µm wide slits or fiber (no slit)
Grating options	14 different gratings, UV through Shortwave NIR
XR grating option	Yes
Detector collection lens option	Yes, L2
OFLV filter options	OFLV - 200 - 850; OFLV - 350 - 1000
Other bench filter options	Longpass OF-1 filters
Collimating and focusing mirrors	Standard or SAG
UV enhanced window	Yes, UV2 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	Grating-dependent
Optical resolution	~0.3 - 10.0 nm FWHM
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	16 bit
Dark noise	50 RMS counts
Dynamic range	8.5×10^2 (system); 1300:1 for a single acquisition
Integration time	1 ms to 65 seconds (20 seconds typical)
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	250 mA @ 5 VDC
Data transfer speed	Full scans to memory every 1 ms with USB 2.0 or 1.1 port, 300 ms with serial port
Inputs/Outputs	Yes, onboard digital user-progammable GPIOs
Analog channels	No
Auto nulling	No
Breakout box compatibility	No
Trigger modes	4 modes
Strobe functions	Yes
Gated delay feature	Yes
Connector	22-pin connector

USB4000 Spectrometer

User-Configured to be Flexible

If you're looking for an economical, versatile spectrometer, you'll find the USB4000 to be an exceptional solution. This compact, modular unit packs a 3648-element Toshiba linear CCD-array detector to provide increased signal-to-noise and enhanced electronics for control of the spectrometer as well as its accessories.

The USB4000 Spectrometer is distinguished by its enhanced electronics: 16-bit A/D resolution with auto nulling feature (an enhanced electrical dark-signal correction); EEPROM storage of calibration coefficients for simple spectrometer start-up; 8 programmable GPIO signals for controlling peripheral devices; and an electronic shutter – a handy feature to prevent detector saturation.

Features

* Programmable microcontroller
* Modular design
* Automatically reads wavelength calibration coefficients of the spectrometer and configures operating software
* RoHS and CE compliant

Specifications

Physical	
Dimensions	89.1 x 63.3 x 34.4 mm
Weight	190 g
Detector	
Detector	Toshiba TCD1304AP linear CCD array
Detector range	200- 1100 nm
Pixels	3648 pixels
Pixel size	8 µm x 200 µm
Pixel well depth	100,000 electrons
Sensitivity	130 photons/count at 400 nm; 60 photons/count at 600 nm
Optical Bench	
Design	f/4, Asymmetrical crossed Czerny-Turner
Focal length	42 mm (input); 68 mm (output)
Entrance aperture	5, 10, 25, 50, 100 or 200 µm wide slits or fiber (no slit)
Grating	Multiple gratings, UV through Shortwave NIR
OFLV filter	OFLV - 200 - 850, OFLV - 350 -1000
UV enhanced window	Yes, UV4 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	Grating dependent
Optical resolution	~0.1-10 nm FWHM
Signal-to-noise ratio	300:1 (at full signal)
A/D resolution	16 bit
Dark noise	50 RMS counts
Integration time	3.8 ms - 10 seconds
Dynamic range	3.4×10^6 (system), 1300:1 for a single acquisition
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	250 mA @ 5 VDC
Data transfer speed	Full spectrum to memory every 5 ms with USB 2.0 port
Inputs/Outputs	Yes, 8 onboard digital user-programmable GPIOs
Breakout box compatible	Yes, with the USB-ADP-BB adapter
Trigger modes	4 modes
Strobe functions	Yes
Connector	22-pin connector

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USB2000+UV-VIS and USB2000+VIS-NIR

Application-ready Spectrometers for the UV-VIS and VIS-NIR

We offer general-purpose UV-VIS and VIS-NIR spectrometers – where all of the optical bench accessories are already selected – for basic spectroscopy applications such as measuring absorbance in solutions and reflectance of solids.

Features

* Each of the four models has an order-sorting filter and 25 µm slit for optical resolution of ~1.5 nm (FWHM)
* The USB2000+UV-VIS covers the 200-850 nm range and the USB2000+VIS-NIR covers 350-1000 nm
* Enhanced sensitivity models (ES) have an installed detector collection lens for increased light collection efficiency
* Software is priced separately and operates on Windows, OS X and Linux operating system

Specifications

	USB2000+UV-VIS	USB2000+VIS-NIR	USB2000+UV-VIS-ES	USB2000+VIS-NIR-ES
Dimensions	89.1 x 63.3 x 34.4 mm	89.1 x 63.3 x 34.4 mm	89.1 x 63.3 x 34.4 mm	89.1 x 63.3 x 34.4 mm
Weight	190 g	190 g	190 g	190 g
Detector	2048-element linear silicon CCD array	2048-element linear silicon CCD array	2048-element linear silicon CCD array	2048-element linear silicon CCD array
Integration time	1 ms - 65 seconds	1 ms - 65 seconds	1 ms - 65 seconds	1 ms - 65 seconds
Dynamic range	8.5 x 10^7 (system), 1300:1 (single acquisition)	8.5 x 10^7 (system), 1300:1 (single acquisition)	8.5 x 10^7 (system), 1300:1 (single acquisition)	8.5 x 10^7(system), 1300:1 (single acquisition)
Sensitivity	75 photons/count;also, 2.9 x 10^{-17} joule/count 2.9 x 10^{-17}watts/count (for1-second integration)	75 photons/count; also, 2.9 x 10^{-17} joule/count 2.9 x 10^{-17}watts/count (for 1-second integration)	75 photons/count; also, 2.9 x 10^{-17} joule/count 2.9 x 10^{-17}watts/count (for 1-second integration)	75 photons/count; also, 2.9 x 10^{-17} joule/count 2.9 x 10^{-17}watts/count (for 1-second integration)
Signal-to-noise ratio	250:1 (at full signal)	250:1 (at full signal)	250:1 (at full signal)	250:1 (at full signal)
Dark noise	50 (RMS)	50 (RMS)	50 (RMS)	50 (RMS)
Grating	600 lines/mm, set to 200-850 nm (blazed at 300 nm)	600 lines/mm, set to 350-1000 nm (blazed at 500 nm)	600 lines/mm, set to 200-850 nm (blazed at 300 nm)	600 lines/mm, set to 350-1000 nm (blazed at 500 nm)
Slit	25 µm width (height is 1000 µm)	25 µm width (height is 1000 µm)	25 µm width (height is 1000 µm)	25 µm width (height is 1000 µm)
Detector collection lens	No	No	Yes	Yes
Focal length	42 mm (input); 68 mm (output)	42 mm (input); 68 mm (output)	42 mm (input); 68 mm (output)	42 mm (input); 68 mm (output)
Order-sorting	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 200-850 nm	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 350-1000 nm	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 200-850 nm	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 350-1000 nm
Resolution	1.5 nm (FWHM)	1.5 nm (FWHM)	1.5 nm (FWHM)	1.5 nm (FWHM)
Stray light	< 0.05% at 600 nm < 0.10% at 435 nm < 0.10% at 250 nm	< 0.05% at 600 nm < 0.10% at 435 nm	< 0.05% at 600 nm < 0.10% at 435 nm < 0.10% at 250 nm	< 0.05% at 600 nm < 0.10% at 435 nm
Fiber optic connector	SMA 905 to single-strand optical fiber (0.22 NA)	SMA 905 to single-strand optical fiber (0.22 NA)	SMA 905 to single-strand optical fiber (0.22 NA)	SMA 905 to single-strand optical fiber (0.22 NA)

USB4000-UV-VIS and USB4000-VIS-NIR

Application-ready Spectrometers for the UV-VIS and VIS-NIR

The USB4000-UV-VIS and USB4000-VIS-NIR are reliable, robust spectrometers that have a 3648-element linear CCD array detector for good signal-to-noise performance as well as enhanced electronics for controlling the spectrometer and accessories.

Each spectrometer has a 3648-element Toshiba TCD1304AP detector with a multibandpass order-sorting filter and 25 µm slit for optical resolution to ~1.5 nm (FWHM). We also offer enhanced-sensitivity (ES) models – distinguished by more efficient light collection optics. The USB4000-UV-VIS covers the 200-850 nm wavelength range and the USB4000-VIS-NIR covers 350-1000 nm. Software is priced separately and operates on Windows, OS X and Linux.

Specifications

	USB4000-UV-VIS	USB4000-VIS-NIR	USB4000-UV-VIS-ES	USB4000-VIS-NIR-ES
Dimensions	89.1 x 63.3 x 34.4 mm	89.1x 63.3 x 34.4 mm	89.1 x 63.3 x 34.4 mm	89.1 x 63.3 x 34.4 mm
Weight	190 g	190 g	190 g	190 g
Detector	Toshiba TCD1304AP Linear CCD array	Toshiba TCD1304AP Linear CCD array	Toshiba TCD1304AP Linear CCD array	Toshiba TCD1304AP Linear CCD array
Integration time	3.8 ms-10 seconds	3.8 ms-10 seconds	3.8 ms-10 seconds	3.8 ms-10 seconds
Dynamic range	3.4 x 10^6(system), 1300:1 for a single acquisition	3.4 x 10^6(system), 1300:1 for a single acquisition	3.4 x 10^6(system), 1300:1 for a single acquisition	3.4 x 10^6(system), 1300:1 for a single acquisition
Sensitivity	130 photons/count at 400 nm; 60 photons/count at 600 nm	130 photons/count at 400 nm; 60 photons/count at 600 nm	130 photons/count at 400 nm; 60 photons/count at 600 nm	130 photons/count at 400 nm; 60 photons/count at 600 nm
Signal-to-noise ratio	300:1 (at full signal)	300:1 (at full signal)	300:1 (at full signal)	300:1 (at full signal)
Dark noise	50 (RMS)	50 (RMS)	50 (RMS)	50 (RMS)
Grating	600 l/mm, set to 200-850 mm (blazed at 300 nm)	600 l/mm, set to 350-1000 nm (blazed at 500 nm)	600 l/mm, set to 200-850 mm (blazed at 300 nm)	600 l/mm, set to 350-1000 nm (blazed at 500 nm)
Slit	1000 µm x 25 µm	1000 µm x 25 µm	1000 µm x 25 µm	1000 µm x 25 µm
Detector collection	No	No	Yes	Yes
Focal length	42 mm (input); 68 mm (output)	42 mm (input); 68 mm (output)	42 mm (input); 68 mm (output)	42 mm (input); 68 mm (output)
Order-sorting	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 200-850 nm	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 350-1000 nm	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 200-850 nm	Single-piece, multi-bandpass detector coating to eliminate second-order effects from 350-1000 nm
Optical resolution	1.5-2.3 nm (FWHM)	1.5-2.3 nm (FWHM)	1.5-2.3 nm (FWHM)	1.5-2.3 nm (FWHM)
Stray light	<0.05% at 600 nm; 0.10% at 435 nm	<0.05% at 600 nm; 0.10% at 435 nm	<0.05% at 600 nm; 0.10% at 435 nm	<0.05% at 600 nm; 0.10% at 435 nm
Fiber optic connector	SMA 905 to single-strand optical fiber (0.22 NA)	SMA 905 to single-strand optical fiber (0.22 NA)	SMA 905 to single-strand optical fiber (0.22 NA)	SMA 905 to single-strand optical fiber (0.22 NA)

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USB Series - XR Spectrometers

Extended Range XR Spectrometers

Our XR-Series USB Spectrometers are responsive across a wide spectral range and provide you optical resolution of ~2.0 nm (FWHM) with the convenience of a single, monolithic unit that covers wavelengths from ~200-1025 nm.

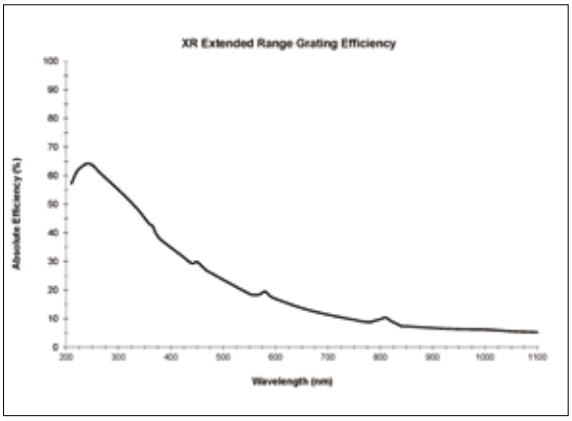
With the XR Series, there's no need to daisy-chain multiple spectrometers to enable UV-NIR coverage. Thanks to the XR's 500 lines/mm groove density grating, you have the advantages of broader spectral coverage as well as good optical resolution.

This grating delivers 825 nm of spectral range and is blazed at 250 nm. And, because their optical bench designs are not affected, the USB2000+ and USB4000 experience no trade-off in performance with the new grating.

Specifications

	USB2000+XR1	USB4000-XR1	USB2000+XR1-ES	USB4000-XR1-ES
Spectrometer type	USB2000+ advanced electronics spectrometer	USB4000 general-purpose spectrometer	USB2000+ enhancedsensitivity spectrometer	USB4000 enhancedsensitivity spectrometer
Grating	Grating #31, 500 l/mm, blazed at 250 nm	Grating #31, 500 l/mm, blazed at 250 nm	Grating #31, 500 l/mm, blazed at 250 nm	Grating #31, 500 l/mm, blazed at 250 nm
Spectral range	200-1025 nm	200-1025 nm	200-1025 nm	200-1025 nm
Entrance slit	25 µm	25 µm	25 µm	25 µm
Detector collection lens	No	No	Yes	Yes
Optical resolution (FWHM)	~1.7-2.1 nm	~1.7-2.0 nm	~1.7-2.1 nm	~1.7-2.0 nm
Order-sorting filter	Yes	Yes	Yes	Yes

Note: Dimensions, detector and electronics specifications are comparable to the specifications for the USB2000+ and USB4000 Spectrometers and their application-ready versions.



Technical Tip: XR-Series Applications

XR-series spectrometers are especially useful for solar irradiance measurements, atomic emission line analysis, plasma monitoring, process applications and more.

Those applications benefit from the XR's unique optical characteristics. The diffraction grating provides coverage from 200-1025 nm, but that's only part of the story. The broad range doesn't do you much good if you are unable to manage higher-order spectral sorting. So we developed a proprietary order-sorting filter that is applied directly to the detector to eliminate second- and third-order effects.

USB4000-FL Fluorescence Spectrometers

Preconfigured Spectrometers for Fluorescence

The USB4000-FL, USB4000-FL-450 and USB4000-FL-395 Spectrometers are preconfigured for fluorescence measurements from 360-1100 nm. Each spectrometer comes with a 200 µm slit and detector collection lens for increased light throughput and features plug-and-play operation, a high-performance 3648-element CCD-array detector and fast USB 2.0 connectivity.

There are three USB4000-FL options:

∗ **USB4000-FL**

Our basic fluorescence spectrometer can be combined.With various excitation sources and accessories for probe- and cuvettebased setups. We offer an extensive range of separate LEDs for excitation.

∗ **USB4000-FL-450 and USB4000-FL-395**

These models offer all the advantages of our USB4000-FL, but with a direct-attach 470 nm LED (pictured) or 395 nm LED for excitation. The LED connects to the spectrometer via a 10-pin connector.

The spectrometer powers and controls (through software) the LED. The direct-attach LED option provides you with a convenient, small-footprint package for your single-wavelength excitation needs.

∗ **Filtering Options**

USB4000-FLs can be used with our LVF-series Linear Variable Filters for simple yet effective separation of excitation and fluorescence energy. Use our LVF-L Linear Variable Low-pass Filter to fine-tune your excitation source for maximum signal with minimum overlap. Our LVF-H Linear Variable High-pass Filter can be effective on the detection side. Additional blocking filter options are also available.

Specifications

Physical	
Dimensions	89.1 x 63.3 x 34. 4 mm (spectrometer only) 89.1 x 120.3 x 34.4 mm (spectrometer w/LED)
Weight	190 g (spectrometer only) 310 g (spectrometer w/LED)
Detector Specifications	
Detector	Toshiba TCD1304AP Linear CCD array
Detector range	200 - 1100 nm
Pixels	3648 pixels
Pixel size	8 µm x 200 µm
Pixel well depth	100,000 electrons
Sensitivity	130 photons/count at 400 nm; 60 photons/count at 600 nm
Optical Bench	
Design	f/4, Asymmetrical crossed Czerny-Turner
Focal length	42 mm (input); 68 mm (output)
Entrance aperture	200 µm wide slit
Grating	Grating #3 -- groove density 600 l/mm, set to 360 - 1000 nm, 500 nm blaze
Detector collection lens	Yes, L4
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	360 - 1000 nm
Optical resolution	~10.0 nm FWHM
Signal-to-noise ratio	300:1 (at full signal)
A/D resolution	16 bit
Dark noise	50 RMS counts
Dynamic range	3.4 x 106 (system), 1300:1 for a single acquisition
Integration time	3.8 ms-10 seconds
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
LED Specifications for USB4000-FL-450 and USB4000-FL-395	
Wavelength	460-490 nm (USB4000-FL-450) and 380 - 410nm (USB4000-FL-395)
Power consumption	60 mA @ 5 VDC
Power output	60 µW (minimum) into a 600 µm fiber
Stability	+/-1.0% drift after 2-minute warm-up period
Electronics	
Power consumption	250 mA @ 5 VDC
Data transfer speed	Full scans to memory every 5 ms with USB 2.0 port
Inputs/Outputs	Yes, 8 onboard digital user-programmable GPIOs
Analog channels	No
Auto nulling	Yes
Trigger modes	4 modes
Strobe functions	Yes
Connector	22-pin connector

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USB2000+RAD Spectrometer

Preconfigured for Irradiance Measurements

The USB2000+RAD Spectroradiometer is a preconfigured combination of a powerful 2-MHz analog-to-digital (A/D) converter, programmable electronics, a 2048-element CCD-array detector, a high-speed USB 2.0 port and cosine corrector. This innovative combination produces our fastest spectrometer yet and provides resolution to 0.35 nm (FWHM). The USB2000+RAD allows you to capture and store a full spectrum into memory up to once per millisecond when the spectrometer is interfaced to a computer via a USB 2.0 port.

This spectroradiometer system features a USB2000+ Spectrometer and attached CC-3-DA cosine corrector. It does not require in-field NIST-traceable UV-VIS calibration as it is precalibrated by Ocean Optics with our SPEC-CAL-UV radiometric calibration service for UV spectrometers. The USB2000+RAD is preconfigured and ready for measurement "out of the box" so that installation and measurement is fast, accurate and convenient.

Features

* Programmable microcontroller
* Up to 1,000 full spectra per second
* Modular design
* Automatically reads wavelength calibration coefficients of the spectrometer and configures operating software
* RoHS and CE compliant

Specifications

Physical	
Dimensions	89.1 x 63.3 x 34.4 mm
Weight	190 g
Detector	
Detector	Sony ILX511B linear silicon CCD array
Detector range	200 - 1100 nm
Pixels	2048 pixels
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500 electrons
Sensitivity	75 photons/count at 400 nm; 41 photons/count at 600 nm
Optical Bench	
Design	f/4, Symmetrical crossed Czerny-Turner
Focal length	42 mm input; 68 mm output
Entrance aperture	50 µm wide slit
Grating	Grating # 2 groove density 600 l/mm, set to 250-800 nm(400 nm blaze)
Detector collection lens	Yes, L2
Collimating and focusing mirror	Standard
UV enhanced window	UV2 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	200 - 850 nm
Optical resolution	~2.0 FWHM
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	16 bit
Dark noise	50 RMS counts
Dynamic range	8.5×10^7 (system); 1300:1 for a single acquisition
Integration time	1 ms to 65 seconds (20 s typical)
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	250 mA @ 5 VDC
Data transfer speed	Full scans to memory every 1 ms with USB 2.0 or 1.1 port, 300 ms with serial port
Trigger modes	4 modes
Strobe functions	Yes
Gated delay feature	Yes
Connector	22-pin connector

USB User-Configured Spectrometers

Optical Bench Accessories

UV2 and UV4 Detector Window Upgrades

Detector	Description	Spectrometer
DET2B-200-850	Sony ILX511B detector, installed, w/200-850 nm variable longpass filter and UV2 quartz window; best for UV-VIS systems configured with Grating #1 or #2	USB2000+
DET2B-200-1100	Sony ILX511B detector, installed, w/200-850 nm variable longpass filter and UV2 quartz window; best for UV-VIS systems configured with XR-1 Grating	USB2000+
DET2B-350-1000	Sony ILX511B detector, installed, with 350-1000 nm variable longpass filter; best for VIS system configured with Grating #2 or #3	USB2000+
DET2B-UV	Sony ILX511B detector, installed, with UV2 quartz window; best for systems configured for <360 nm	USB2000+
DET2B-VIS	Sony ILX511B detector, installed, with VIS BK7 window; best for systems configured for >400 nm	USB2000+, Torus
DET2B-TORUS-OSF	Sony ILX511B detector, installed, with Torus Order-Sorting Filter	Torus
DET4-200-850	Toshiba TCD1304AP detector, installed, w/200-850 nm variable longpass filter and UV2 quartz window; best for UV-VIS systems configured with Grating #1 or #2	USB4000
DET4-200-1100	Toshiba TCD1304AP detector, installed, with 200-850 nm variable longpass filter and UV4 quartz window; best for systems configured with XR-1 grating	USB4000
DET4-350-1000	Toshiba TCD1304AP detector, installed, with 350-1000 nm variable longpass filter; best for VIS systems configured with Grating #2 or #3	USB4000
DET4-UV	Toshiba TCD1304AP detector, installed, with UV4 quartz window; best for systems configured for <360 nm	USB4000
DET4-VIS	Toshiba TCD1304AP detector, installed, with VIS BK7 window; best for systems configured for >400 nm	USB4000

Fixed Entrance Slits

Our entrance slits are rectangular apertures that are 1 mm tall and come in varying widths from 5 µm to 200 µm. Smaller slit sizes achieve the best optical resolution.

Slit	Description	USB2000+ Pixel Resolution	USB4000 Pixel Resolution
SLIT-5	5-µm wide x 1-mm high	~3.0 pixels	~5.3 pixels
SLIT-10	10-µm wide x 1-mm high	~3.2 pixels	~5.7 pixels
SLIT-25	25-µm wide x 1-mm high	~4.2 pixels	~7.5 pixels
SLIT-50	50-µm wide x 1-mm high	~6.5 pixels	~11.6 pixels
SLIT-100	100-µm wide x 1-mm high	~12 pixels	~21 pixels
SLIT-200	200-µm wide x 1-mm high	~24 pixels	~42 pixels

Note: Torus uses INTSMA-Series slits. See Jaz section for options

Longpass Absorbing Filters

Whether you select a Longpass Absorbing or Blocking Filter, each has a transmission band and a blocking band to restrict radiation to a certain wavelength region. This helps eliminate second- and third-order effects. Filters are installed permanently.

Item	Description
OF1-WG305	Longpass filter; transmits light >305 nm
OF1-GG375	Longpass filter; transmits light >375 nm
OF1-GG395	Longpass filter; installed, transmits light >395 nm
OF1-GG475	Longpass filter; transmits light >475 nm
OF1-OG515	Longpass filter; transmits light >515 nm
OF1-OG550	Longpass filter; transmits light >550 nm
OF1-OG590	Longpass filter; transmits light >590 nm

Grating and Wavelength Range

Grating Number	Intended Use	Groove Density	Spectral Range	Blaze Wavelength	Best Efficiency (>30%)
1	UV	600	650 nm	300 nm	200-575 nm
2	UV-VIS	600	650 nm	400 nm	250-800 nm
3	VIS-Color	600	650 nm	500 nm	350-850 nm
4	NIR	600	625 nm	750 nm	530-1100 nm
5	UV-VIS	1200	300 nm	Holographic UV	200-400 nm
6	NIR	1200	200-270 nm	750 nm	500-1100 nm
7	UV-VIS	2400	100-140 nm	Holographic UV	200-500 nm
9	VIS-NIR	1200	200-270 nm	Holographic VIS	400-800 nm
10	UV-VIS	1800	100-190 nm	Holographic UV	200-635 nm
11	UV-VIS	1800	120-160 nm	Holographic VIS	320-720 nm
12	UV-VIS	2400	50-120 nm	Holographic VIS	260-780 nm
14	NIR	600	625 nm	1000 nm	650-1100 nm
31	UV-NIR	500	200-1025 nm	250 nm	200-450 nm

* For applications >720 nm, please consult an Application Sales Engineer.

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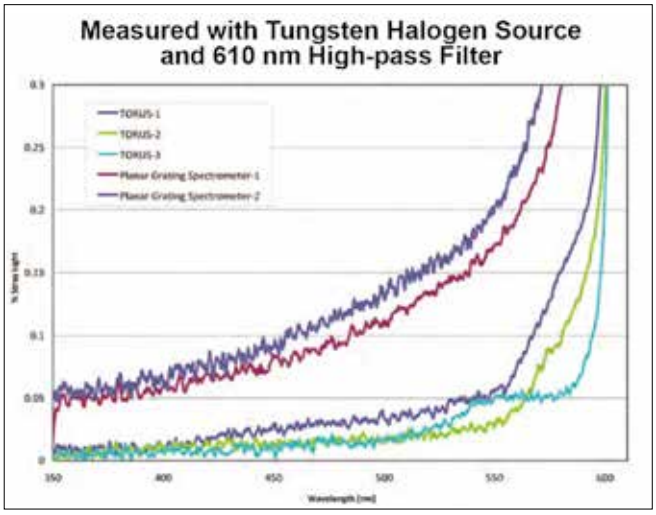
Torus - Concave Grating Spectrometer

High Throughput Compact Spectrometer for Color Measurements and Light Metrology

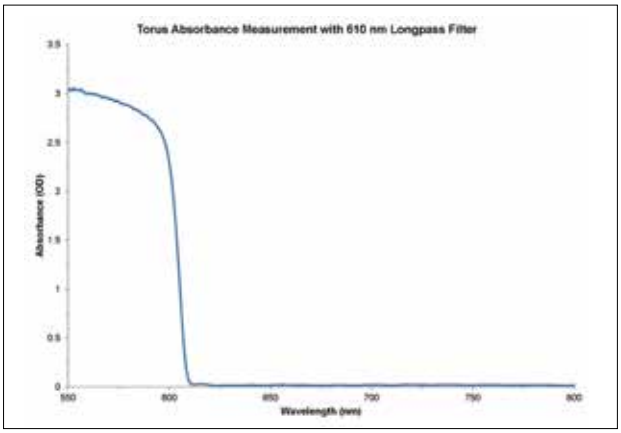
Torus uses a Sony ILX511B linear CCD-array detector. However, the Torus debuts a unique flat field optical bench design. The Torus has the same robust, high-speed electronics made popular by our USB2000+, but with improved throughput and less stray light due to the aberration-corrected toroidal grating. Its interchangeable slit design adds on-the-fly flexibility.

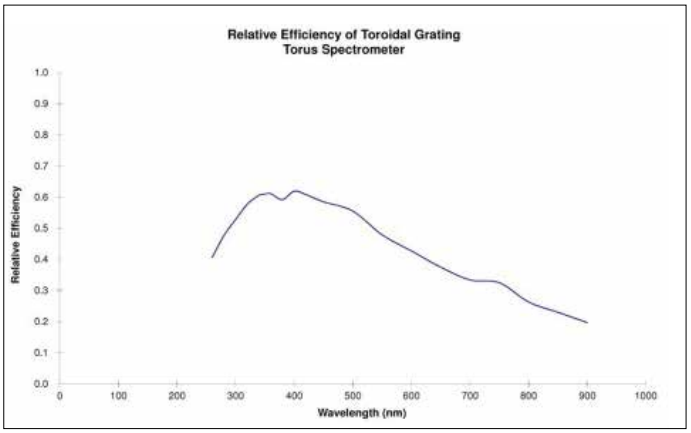


% Stray Light Torus vs. Planar Grating Spectrometers Measured with Tungsten Halogen Source and 610 nm High-pass Filter

Specifications

Physical	
Dimensions	149.9 mm (L) x 119.4 mm (W) x 63.5 mm (H)
Weight	0.954 kg (2.1 lb)
Detector	
Type	Sony ILX511B
Range	200 - 1100nm
Pixels	2048
Spectroscopic	
Wavelength range	360-825nm
Integration time	1 ms – 65 sec
Dynamic range	8.5 x 10^7 (system) ; 1300:1 (single acquisition)
Signaltonoise ratio	250:1 at full signal
Grating	Toriodal concave holographic grating blazed at 400 nm
Slit	5, 10, 25, 50 or 100 μm wide slit or fiber with userselectable aperture (tested at F3 and F4)
Optical resolution	≤ 1.6 nm FWHM over the spectral range
Stray light	<0.015% at 400 nm
Fiber optic connector	SMA





HR2000+ Spectrometer

High Resolution User-Configured for Flexibility

HR2000+

One of our most popular items, the HR2000+ Spectrometer features a high-resolution optical bench, a powerful 2-MHz analog-to-digital (A/D) converter, programmable electronics, a 2048-element CCD-array detector and a high-speed USB 2.0 port.

This innovative combination produces an extremely fast spectrometer and provides resolution to 0.035 nm (FWHM).

Features

* Up to 1,000 full spectra per second
* Programmable microcontroller
* High-resolution performance
* Multiple bench and interface options

Specifications

Physical	
Dimensions	148.6 x 104.8 x 45.1 mm
Weight	570 g
Detector	
Detector	Sony ILX511B linear silicon CCD-array
Detector range	200 - 1100 nm
Pixels	2048 pixels
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500 electrons
Sensitivity	75 photons/count at 400 nm; 41 photons/count at 600 nm
Optical Bench	
Design	f/4, Symmetrical crossed Czerny-Turner
Focal length	101.6 mm input and output
Entrance aperture	5, 10, 25, 50, 100 or 200 µm wide slits or fiber (no slit)
Grating options	Multiple gratings, UV through Shortwave NIR
HC-1 grating option	Provides 200 - 1050 nm range
Detector collection lens option	Yes, L2
OFLV filter options	OFLV 200-1100 nm
Other bench filter options	Longpass OF-1 filters
Collimating and focusing mirrors	Standard or SAG+UPG-HR
UV enhanced window	Yes, UV2 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	Grating dependent
Optical resolution	~0.035 - 6.8 nm FWHM
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	14 bit
Dark noise	12 RMS counts
Dynamic range	8.5×10^7 (system); 1300:1 for a single acquisition
Integration time	1 ms-65 seconds (20 s typical)
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	220 mA @ 5 VDC
Data transfer speed	Full scans to memory every 2 ms with USB 2.0 port, 15 ms with USB 1.1 port
Inputs/Outputs	Yes, 10 onboard digital user-programmable GPIOs
Analog channels	One 13-bit analog input; one 9-bit analog output
Auto nulling	No
Breakout box compatibility	Yes, HR4-BREAKOUT
Trigger modes	4 modes
Strobe functions	Yes
Gated delay feature	No
Connector	30-pin connector

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HR4000 Spectrometer

High Resolution User-Configured for Flexibility

HR4000

Inside the HR4000 Spectrometer is a 3648-element CCD-array Toshiba detector that enables optical resolution as precise as 0.02 nm (FWHM). Responsive from 200-1100 nm, the HR4000 can be customized for your setup needs through a choice of gratings, slits and other optical bench options.

The HR4000 gives you the freedom to set integration time and features an electronic shutter that helps minimize saturation – even with 3.8 ms integration.

Features

* Onboard microcontroller and electronic shutter
* 0.02 nm optical resolution (FWHM) possible
* Choice of configurations and accessories

Specifications

Physical	
Dimensions	148.6 x 104.8 x 45.1 mm
Weight	570 g
Detector	
Detector	Toshiba TCD1304AP linear CCD array
Detector range	200 - 1100 nm
Pixels	3648 pixels
Pixel size	8 µm x 200 µm
Pixel well depth	~100,000 electrons
Sensitivity	130 photons/count at 400 nm; 60 photons/count at 600 nm
Optical Bench	
Design	f/4, Symmetrical crossed Czerny-Turner
Focal length	101.6 mm input and output
Entrance aperture	5, 10, 25, 50, 100 or 200 µm wide slits or fiber (no slit)
Grating options	Multiple gratings, UV through Shortwave NIR
HC-1 grating option	Provides 200 - 1050 nm range (best efficiency)
Detector collection lens option	Yes, L4
OFLV filter options	OFLV - 200 - 1100
Other bench filter options	Longpass OF-1 filters
Collimating and focusing mirrors	Standard or SAG+UPG-HR
UV enhanced window	Yes, UV4 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	Grating dependent
Optical resolution	~0.02-8.4 nm FWHM
Signal-to-noise ratio	300:1 (at full signal)
A/D resolution	14 bit
Dark noise	12 RMS counts
Dynamic range	3.4 x 10^6(system); 1300:1 for a single acquisition
Integration time	3.8 ms-10 seconds
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	450 mA @ 5 VDC
Data transfer speed	Full scans to memory every 4 ms with USB 2.0 port
Inputs/Outputs	Yes, 10 onboard digital user-programmable GPIOs
Analog channels	One 13-bit analog input; one 9-bit analog output
Auto nulling	No
Breakout box compatibility	Yes, HR4-BREAKOUT
Trigger modes	4 modes
Strobe functions	Yes
Gated delay feature	No
Connector	30-pin connector

HR2000+CG Application-Ready Spectrometer

Preconfigured for High Resolution over Extended Range

HR2000+CG

The HR2000+CG Composite Grating Spectrometer is preconfigured with our HC-1 Grating. This proprietary variable-blazed grating was specifically designed to provide full spectral output throughout the 200-1050 nm range.

Also, the HR2000+CG optical bench is preconfigured with a 5 µm slit for excellent optical resolution and our OFLV-200-1100 Variable Longpass Order-sorting Filter to eliminate second- and third-order effects.

The HR2000+CG is ideal for biological and chemical applications where fast measurements and high resolution are needed.

Features

* Broad UV-NIR response
* High resolution (1.0 nm FWHM) over entire available range
* Captures up to 1,000 full scans per second
* Programmable microcontroller

Specifications

Physical	
Dimensions	148.6 x 104.8 x 45.1 mm
Weight	570 g
Detector	
Detector	Sony ILX511B linear silicon CCD array
Detector range	200 - 1100 nm
Pixels	2048 pixels
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500 electrons
Sensitivity	75 photons/count at 400 nm; 41 photons/count at 600 nm
Optical Bench	
Design	f/4, Symmetrical crossed Czerny-Turner
Focal length	101.6 mm input and output
Entrance aperture	5 µm wide slit
Grating	HC-1
OFLV filter	OFLV - 200 - 1100
UV enhanced window	Yes, UV2 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand fiber
Spectroscopic	
Wavelength range	200-1100 nm (best response 200 - 1050 nm)
Optical resolution	<1.0 nm FWHM
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	14 bit
Dark noise	12 RMS counts
Dynamic range	8.5 x 10^7 (system); 1300:1 for a single acquisition
Integration time	1 ms to 65 seconds
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	220 mA @ 5 VDC
Data transfer speed	Full scans into memory every 2 ms with USB 2.0 port;every 15 ms with USB 1.1 port
Inputs/outputs	10 onboard digital user-programmable GPIOs
Analog channels	One 13-bit analog input and one 9-bit analog output
Trigger modes	4 modes
Strobe functions	Yes
Connector	30-pin connector

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HR2000+ES Application-Ready Spectrometer

Preconfigured for High Resolution and Sensitivity

HR2000+ES

The HR2000+ES Spectrometer is a preconfigured system for enhanced sensitivity. This system integrates a high-resolution optical bench with a powerful 2-MHz A/D converter, programmable electronics and a 2048-element CCD-array detector for optical resolution to ~1.33 nm (FWHM).

The HR2000+ES has a slightly larger entrance slit (10 µm) and an L2 detector collection lens for additional sensitivity in extended-range applications. We also include a UV2 quartz window for UV transmission and the OFLV-200-1100 Variable Longpass Order-sorting Filter to eliminate second- and third-order effects.

Features

* Up to 1,000 full spectra per second
* Programmable microcontroller
* High-resolution bench
* Plug and play operation

Sample Applications for HR2000+CG/HR2000+ES

* Thin film measurements of various substrates
* Plasma monitoring
* Reflectance of nanoparticles
* Analysis of phosphors
* Characterization of lasers
* Solar irradiance
* Spectral output of light sources

Specifications

Physical	
Dimensions	148.6 x 104.8 x 45.1 mm
Weight	570 g
Detector	
Detector	Sony ILX511B linear silicon CCD-array
Detector range	200 - 1100 nm
Pixels	2048 pixels
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500 electrons
Sensitivity	75 photons/count at 400 nm; 41 photons/count at 600 nm
Optical Bench	
Design	f/4, Symmetrical crossed Czerny-Turner
Focal length	101.6 mm input and output
Entrance aperture	10 µm wide slit
Grating	HC-1 provides 200 - 1100 nm range
Detector collection lens	Yes, L2
OFLV filter	OFLV 200 - 1100 nm
UV enhanced window	Yes, UV2 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	200 - 1100 nm (best response 200 - 1050 nm)
Optical resolution	~1.33 nm FWHM
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	14 bit
Dark noise	12 RMS counts
Dynamic range	8.5 x 10^7 (system); 1300:1 for a single acquisition
Integration time	1 ms-65 seconds (20 s typical)
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	220 mA @ 5 VDC
Data transfer speed	Full scans to memory every 1 ms with USB 2.0 port, 15 ms with USB 1.1 port
Inputs/Outputs	Yes, 10 onboard digital user-programmable GPIOs
Analog channels	One 13-bit analog input; one 9-bit analog output
Auto nulling	No
Breakout box compatibility	Yes, HR4-BREAKOUT
Trigger modes	4 modes
Strobe functions	Yes
Gated delay feature	No
Connector	30-pin connector

HR4000CG-UV-NIR Spectrometer

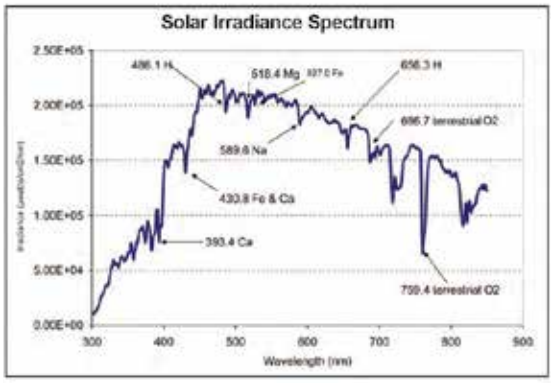
Preconfigured for High Resolution and Extended Range

Our HR4000CG-UV-NIR Composite Grating Spectrometer uses our HC-1 Grating and provides full spectral output from 200-1100 nm with best efficiency at 200-1050 nm.

This preconfigured system has an OFLV variable Longpass Order-sorting filter that eliminates second- and third-order effects and utilizes a 5 µm entrance slit for improved optical resolution performance.

Features

* Up to 1,000 full spectra per second
* Programmable microcontroller
* High-resolution performance
* Multiple bench and interface options



Specifications

Physical	
Dimensions	148.6 x 104.8 x 45.1 mm
Weight	570 g
Detector	
Detector	Sony ILX511B linear silicon CCD-array
Detector range	200 - 1100 nm
Pixels	2048 pixels
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500 electrons
Sensitivity	75 photons/count at 400 nm; 41 photons/count at 600 nm
Optical Bench	
Design	f/4, Symmetrical crossed Czerny-Turner
Focal length	101.6 mm input and output
Entrance aperture	5, 10, 25, 50, 100 or 200 µm wide slits or fiber (no slit)
Grating options	Multiple gratings, UV through Shortwave NIR
HC-1 grating option	Provides 200 - 1050 nm range
Detector collection lens option	Yes, L2
OFLV filter options	OFLV 200 - 1100 nm
Other bench filter options	Longpass OF-1 filters
Collimating and focusing mirrors	Standard or SAG+UPG-HR
UV enhanced window	Yes, UV2 quartz window
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic	
Wavelength range	Grating dependent
Optical resolution	~0.035 - 6.8 nm FWHM
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	14 bit
Dark noise	12 RMS counts
Dynamic range	8.5×10^7 (system); 1300:1 for a single acquisition
Integration time	1 ms-65 seconds (20 s typical)
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm
Corrected linearity	> 99%
Electronics	
Power consumption	220 mA @ 5 VDC
Data transfer speed	Full scans to memory every 2 ms with USB 2.0 port, 15 ms with USB 1.1 port
Inputs/Outputs	Yes, 10 onboard digital user-programmable GPIOs
Analog channels	One 13-bit analog input; one 9-bit analog output
Auto nulling	No
Breakout box compatibility	Yes, HR4-BREAKOUT
Trigger modes	4 modes
Strobe functions	Yes
Gated delay feature	No
Connector	30-pin connector

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HR User-Configured Spectrometers

Optical Bench Accessories

UV2 and UV4 Detector Window Upgrades

For any application <360 nm, we replace the detector's standard BK7 glass window with a quartz window. Quartz transmits in the UV and provides better UV performance.

Detector	Description	Spectrometer
DET2B-200-1100	Sony ILX511B detector, installed, w/200-1100 nm variable longpass filter and UV2 quartz window; best for UV-NIR systems configured with Grating # HC-1	HR2000+
DET2B-UV	Sony ILX511B detector, installed, with UV2 quartz window; best for systems configured for <360 nm	HR2000+
DET2B-VIS	Sony ILX511B detector, installed, with VIS BK7 window; best for systems configured for >400 nm	HR2000+
DET4-200-1100	Toshiba TCD1304AP detector, installed, w/200-1100 nm variable longpass filter and UV2 quartz window;best for UV-NIR systems configured with Grating # HC-1	HR4000
DET4-UV	Toshiba TCD1304AP detector, installed, with UV4 quartz window; best for systems configured for <360 nm	HR4000
DET4-VIS	Toshiba TCD1304AP detector, installed, with VIS BK7 window; best for systems configured for >400 nm	HR4000

Fixed Entrance Slits

Our entrance slits are rectangular apertures that are 1 mm tall and come in varying widths from 5 µm to 200 µm. Smaller slit sizes achieve the best optical resolution.

Slit	Description	HR2000+ Pixel Resolution	HR4000 Pixel Resolution
SLIT-5	5µm wide x 1mm high	~1.5 pixels	~2.0 pixels
SLIT-10	10µm wide x 1mm high	~2.0 pixels	~3.7 pixels
SLIT-25	25µm wide x 1mm high	~2.5 pixels	~4.4 pixels
SLIT-50	50µm wide x 1mm high	~4.2 pixels	~7.4 pixels
SLIT-100	100µm wide x 1mm high	~8.0 pixels	~14.0 pixels
SLIT-200	200µm wide x 1mm high	~15.3 pixels	~26.8 pixels

Longpass Absorbing Filter

Whether you select a Longpass Absorbing or Blocking Filter, each has a transmission band and a blocking band to restrict radiation to a certain wavelength region. This helps eliminate second- and third-order effects. Filters are installed permanently.

Item	Description
OF1-WG305	Longpass filter; transmits light >305
OF1-GG375	Longpass filter; transmits light >375
OF1-GG395	Longpass filter; transmits light >395
OF1-GG475	Longpass filter; transmits light >475
OF1-OG515	Longpass filter; transmits light >515
OF1-OG550	Longpass filter; transmits light >550
OF1-OG590	Longpass filter; transmits light >590

Grating and Wavelength Range

Grating Number	Intended Use	Groove Density	Spectral Range	Blaze Wavelength	Best Efficiency (>30%)
HC-1	UV-NIR	300/600 variable	900 nm	Variable	200-1050 nm
H1	UV	600	425-445 nm	300 nm	200-575 nm
H2	UV-VIS	600	415-445 nm	400 nm	250-800 nm
H3	VIS-Color	600	410-440 nm	500 nm	350-850 nm
H4	NIR	600	410-430 nm	750 nm	530-1100 nm
H5	UV-VIS	1200	205-220nm	Holographic UV	200-400 nm
H6	NIR	1200	140-195 nm	750 nm	500-1100 nm
H7	UV-VIS	2400	72-102 nm	Holographic UV	200-500 nm
H9	VIS-NIR	1200	165-205 nm	Holographic VIS	400-800 nm
H10	UV-VIS	1800	95-140 nm	Holographic UV	200-635 nm
H11	UV-VIS	1800	75-135 nm	Holographic VIS	320-720 nm
H12	UV-VIS	2400	60-100 nm	Holographic	VIS 260-780 nm*
H13	UV-NIR	300	800-900 nm	500 nm	300-1100 nm
H14	NIR	600	410-420 nm	1000 nm	650-1100 nm

Maya2000 Pro

High Sensitivity Spectrometers

Maya2000 Pro Spectrometers offer high sensitivity in configurations that cover a range of ~165-1100 nm. They are perfect for deep-UV (vacuum UV), UV-VIS and VIS-NIR measurements.

At the heart of each Maya2000 Pro spectrometer is a back-thinned 2D FFT-CCD detector in a robust, configurable optical bench with lownoise electronics. Choose from a wide range of accessories and bench options to optimize your system. Our Application Sales Engineers will help you select the correct configuration for your measurement.

Specifications

Physical	
Dimensions	182 x 110 x 47 mm
Weight	1.18 kg (2.6 lb.)
Detector	
Type	Back-thinned, 2D
Options	Hamamatsu S10420 (best option for UV-VIS applications)
	Hamamatsu S11510 (best option for VIS-NIR applications)
Quantum efficiency	75% peak @ 600 nm (S10420)
	85% peak @ 700 nm (S11510)
Spectroscopic	
Spectral range (detector response)	~165 - 1100 nm (S10420)
	~400 - 1180 nm (S11510)
Optical resolution(FWHM)	Depends on grating groove density and slit size (multiple options available)
Signal-to-noise ratio at full signal	~450:1
Dynamic range	15000:1 (typical)
Integration time	7.2 ms-5 seconds
Electronics	
Power requirement	500 mA @ +5 VDC
Trigger modes	4 modes
Strobe functions	Yes
Interfaces	USB 2.0, RS232
Environmental Conditions	
Temperature	0 °C to +50 °C (operation)
Humidity	0 - 90% non-condensing

Maya2000 Pro-NIR

High Sensitivity Spectrometer for Raman and NIR Applications

Maya2000 Pro-NIR is an application-ready, high-sensitivity spectrometer ideal for Raman and low light level shortwave NIR applications. The Maya2000 Pro-NIR is optimized for the 780-1180 nm region and includes a 760 nm longpass filter, 50 µm slit and gold mirrors for enhanced NIR reflectivity.

Specifications

Physical	
Dimensions	182 x 110 x 47 mm
Weight	1.18 kg (2.6 lb.)
Detector	
Type	Back-thinned, 2D
Detector	Hamamatsu S11510 (uncooled)
Quantum efficiency	~85% peak QE @ 700 nm; 40% QE @ 1000 nm
Spectroscopic	
Spectral range(preset)	780 - 1180 nm
Optical resolution(FWHM)	~0.82 nm
Signal-to-noise ratio at full signal	~450:1
Dynamic range	15000:1 (typical)
Integration time	7.2 ms5 seconds
Fiber optic connector	SMA 905 to 0.22 numerical aperture singlestrand optical fiber
Electronics	
Power requirement	500 mA @ +5 VDC
Trigger modes	4 modes
Strobe functions	Yes
Interfaces	USB 2.0, RS232
Environmental Conditions	
Temperature	0 °C to +50 °C (operation)
Humidity	0 - 90% noncondensing

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Maya LSL Spectrometer

Low Stray Light with High Sensitivity

The Ocean Optics Maya LSL (Low Stray Light) includes the linear CCD-array optical bench, plus all the circuits necessary for spectrometer operation. The result is a compact, flexible system, with no moving parts, that's easily integrated as an OEM component.

The Maya LSL is a unique combination of technologies providing users with high sensitivity and low stray light performance for low light-level, UV-sensitive and other scientific applications. The electronics have been designed for considerable flexibility in connecting to various modules as well as external interfaces. The Maya LSL spectrometer interfaces to PCs, PLCs and other embedded controllers through USB 2.0 or RS-232 communications.

Specifications

Physical	
Dimensions	151 x 151 x 65 mm (5.94" x 5.94" x 2.56")
Weight	1.9 kg (4.21 lb.)
Detector	
Type	Hamamatsu S10420
Pixels (active)	2048 x 64
Pixel size	14 µm x 14 µm
Quantum efficiency	75% peak @ 600 nm
Spectroscopic	
Integration time	7.2 ms - 5 seconds
Wavelength range	360 – 825 nm
Optical resolution	<1.6 nm (FWHM)
Dynamic range (typical)	15000:1
Signal to Noise	450:01:00
Stray light	<0.015% @ 400 nm
Linearity (corrected)	>99.7%
Fiber connector	SMA 905 to single-strand optical fiber (0.22 NA)
Electronics	
Power requirement	500 mA @ +5 VDC
Onboard pulse generator	2 programmable strobe signals
Onboard GPIO	8 user-programmable digital I/O
Interfaces	USB 2.0, 480 Mbps; 3-wire RS-232; SPI

Model	Detector and Bench Characteristics	Sample Applications
Maya2000 Pro (custom)	Hamamatsu S10420: configurable from VUV to NIR, with excellent response <190 nm	• VUV and UV-Vis analysis of plasmas, gases and emission sources • Emission of gases in semiconductor processing
	Hamamatsu S11510: optimum configuration from ~700-1100 nm	• Low light Vis-NIR measurements • Modular Raman and fluorescence • Biological absorbance measurements
Maya2000 Pro-NIR	Hamamatsu S11510: preconfigured for 780-1180 nm with 50 µm slit and 760 nm longpass filter	• Modular Raman analysis • Low light Vis-NIR measurements
Maya LSL	Hamamatsu S10420: preconfigured for 360-825 nm	• Low stray light applications • Life sciences measurements • Process environments

QE Pro Spectrometer

High-sensitivity Spectrometer for Low Light Level Applications

Advantages

* Buffering full spectrum kinetics measurements
* Higher sensitivity
* Replaceable slit design
* Thermal stability
* High quantum efficiency detector
* TE-cooled detector

Specification

Physical	QE Pro	QE Pro-ABS	QE Pro-FL
Dimensions: (L x W x H) mm and inches	182 x 110 x 47 mm (7.17" x 4.33" x 1.85")	182 x 110 x 47 mm (7.17" x 4.33" x 1.85")	182 x 110 x 47 mm (7.17" x 4.33" x 1.85")
Weight: kg and lb	Spectrometer: 1.15 kg (2.6 lbs.) Power supply: 0.45 kg (1 lb.)	Spectrometer:1.15 kg (2.6 lbs.) Power Supply:0.45 kg (1 lb.)	Spectrometer:1.15 kg (2.6 lbs.) Power Supply:0.45 kg (1 lb.)
Detector			
Type	Hamamatsu S7031-1006 scientific grade, back-thinned, TE Cooled, CCD array	Hamamatsu scientific grade, back-thinned, TE Cooled, 1044 x 64 element CCD array	Hamamatsu scientific grade, back-thinned, TE Cooled, 1044 x 64 element CCD array
Range	185 - 1100 nm	185 - 1100nm	185 - 1100nm
Quantum efficiency	90% (peak)	90% (peak)	90% (peak)
Spectroscopic			
Wavelength range	200 - 1100 nm, grating dependent	200 - 950nm	350 - 1100nm
Integration time	8 ms to 60 minutes	8 ms to 60 minutes	8 ms to 60 minutes
Dynamic range	~85,000:1	~85,000:1	~85,000:1
Signal-to-noise ratio	System: 1000:1 (single acquisition)	1000:1 (single acquisition)	1000:1 (single acquisition)
Grating	multiple gratings available (H1–H14), HC1 grating	14 gratings available (H1–H14), HC1 grating	14 gratings available (H1–H14), HC1 grating
Slit	5, 10, 25, 50, 100 or 200 µm wide slits (or SMA/FC bulkhead with no slit)	5, 10, 25, 50, 100 or 200 µm wide slits (or SMA/FC bulkhead with no slit)	5, 10, 25, 50, 100 or 200 µm wide slits (or SMA/FC bulkhead with no slit)
Optical resolution	0.14 - 7.7 nm (Depends on grating and size of entrance aperture)	0.14 - 7.7 nm (Depends on grating and size of entrance aperture)	0.14 - 7.7 nm (Depends on grating and size of entrance aperture)
Stray light	<0.08% at 600 nm; 0.4% at 435 nm	<0.08% at 600 nm; 0.4% at 435 nm	<0.08% at 600 nm; 0.4% at 435 nm
Buffering	15,000 spectra	15,000 spectra	15,000 spectra
Fiber optic connector	SMA 905 and Ocean Optics FC	SMA 905 and Ocean Optics FC	SMA 905 and Ocean Optics FC
Electronics			
Power requirement	Supply voltage: 4.5 - 5.5 V	Supply voltage: 4.5 - 5.5 V	Supply voltage: 4.5 - 5.5 V
Strobe functions	continuous and single strobe	continuous and single strobe	continuous and single strobe
Interfaces	USB 2.0, 480 Mbps (USB 1.1 compatible); RS-232 (5-wire)	USB 2.0, 480 Mbps (USB 1.1 compatible); RS-232 (5-wire)	USB 2.0, 480 Mbps (USB 1.1 compatible); RS-232 (5-wire)
Temperature	TE Cooler can only cool 40 ˚C below ambient temperature; Operation: -40 ˚C to +50 ˚C	TE Cooler can only cool 40 ˚C below ambient temperature; Operation: -40 ˚C to +50 ˚C	TE Cooler can only cool 40 ˚C below ambient temperature; Operation: -40 ˚C to +50 ˚C
Humidity	≤ 90% noncondensing	≤ 90% noncondensing	≤ 90% noncondensing

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Maya2000 / QE Pro User-Configured Spectrometers

Optical Bench Accessories

Detector Options

Item	Description	Spectrometer
DET-MAYAPRO	Hamamatsu S10420 detector, installed, w/no variable longpass filter	Maya2000 Pro
DET-MAYAPRO-OFLV-200	Hamamatsu S10420 detector, installed, w/OFLV-200 variable longpass filter	Maya2000 Pro
DET-MAYAPRO-UV	Hamamatsu S10420 detector, installed, w/UV window	Maya2000 Pro
DET-MAYAPRO-VIS	Hamamatsu S10420 detector, installed, w/VIS window	Maya2000 Pro
DET-MAYAPRO-WINDOWLESS	Hamamatsu S10420 detector, installed, with no window options; required for VUV applications	Maya2000 Pro
MAYA-DEEP-UV	DET-MAYAPRO-UV, installed, w/MgF2 window in place of standard UV window	Maya2000 Pro
DET-QE	Hamamatsu S7031 detector, installed, w/no variable longpass filter	QE Pro
DET-QE-OFLV-200	Hamamatsu S7031 detector, installed, w/OFLV-QE-200 variable longpass filter	QE Pro
DET-QE-OFLV-250	Hamamatsu S7031 detector, installed, w/OFLV-QE-250 variable longpass filter	QE Pro
DET-QE-OFLV-300	Hamamatsu S7031 detector, installed, w/OFLV-QE-300 variable longpass filter	QE Pro
DET-QE-OFLV-350	Hamamatsu S7031 detector, installed, w/OFLV-QE-350 variable longpass filter	QE Pro
DET-QE-OFLV-400	Hamamatsu S7031 detector, installed, w/OFLV-QE-400 variable longpass filter	QE Pro
DET-QE-WINDOWLESS	Hamamatsu S7031 detector, installed, with no window options; required for VUV applications	QE Pro

Fixed Entrance Slits

Light passes through the installed slit, which acts as the entrance aperture. Slits come in various widths from 5 µm to 200 µm.

Slit	Description	Maya2000Pro Pixel Resolution	QE Pro Pixel Resolution
SLIT-5	5µm wide x 1mm high	~1.5 pixels	~2.0 pixels
SLIT-10	10µm wide x 1mm high	~2.0 pixels	~2.2 pixels
SLIT-25	25µm wide x 1mm high	~2.5 pixels	~2.6 pixels
SLIT-50	50µm wide x 1mm high	~4.2 pixels	~3.3 pixels
SLIT-100	100µm wide x 1mm high	~8 pixels	~4.7 pixels
SLIT-200	200µm wide x 1mm high	~15.3 pixels	~8.9 pixels

Longpass Absorbing Filter (Options)

If selected, an absorbance filter is installed between the slit and the clad mode aperture in the SMA 905 bulkhead. The filter is used to limit bandwidth of light entering the spectrometer. Filters are installed permanently.

Item	Description
OF1WG305	Longpass filter; transmits light >305 nm
OF1GG375	Longpass filter; transmits light >375 nm
OF1GG395	Longpass filter; transmits light >395 nm
OF1GG475	Longpass filter; transmits light >475 nm transmits light >515 nm
OF1OG550	Longpass filter; transmits light >550 nm
OF1OG590	Longpass filter: transmits light >590 nm

Gratings and Wavelength Range

Grating Number	Intended Use	Groove Density	Spectral Range	Blaze Wavelength	Best Efficiency (>30%)
HC-1 (Maya2000 Pro)	UVNIR	300/600(variable)	850 nm	variable	200-1050 nm
HC-1 (QE Pro)	UV-NIR	300/600(variable)	750nm	variable	200-950nm
H1	UV	600	373-390 nm	300 nm	200-575 nm
H2	UV-VIS	600	365-390 nm	400 nm	250-800 nm
H3	VIS-Color	600	360-386 nm	500 nm	350-850 nm
H4	NIR	600	360-377 nm	750 nm	530-1100 nm
H5	UV-VIS	1200	180-193 nm	Holographic UV	200-400 nm
H6	NIR	1200	123-170nm	750 nm	500-1100 nm
H7	UV-VIS	2400	63-90 nm	Holographic UV	200-500 nm
H9	VIS-NIR	1200	145-180 nm	Holographic VIS	400-800 nm
H10	UV-VIS	1800	83-123 nm	Holographic UV	200-635 nm
H11	UV-VIS	1800	66-120 nm	Holographic VIS	320-800 nm
H12	UV-VIS	2400	52-88 nm	Holographic VIS	250-575 nm
H13	UV-NIR	300	750-800 nm	500 nm	300-1100 nm
H14	NIR	600	360-370 nm	1000 nm	650-1100 nm
Options					
H33	Absorbance	300		200 nm	200-450 nm
H35	NIR Raman	1200		1000 nm	525-1625 nm
H36	VIS Raman	900		500 nm	325-1225 nm
H5U	Absorbance	1200		250 nm	225-450 nm
H7U	Absorbance	2400		240 nm	200-800 nm
H10U	Absorbance	1800		250 nm	210-475 nm

NIRQuest Series Spectrometers

Small-Footprint Spectrometer for Near-Infrared Measurements

A high-performance optical bench, low-noise electronics and various grating options make NIRQuest Spectrometers the best choice for modular NIR spectroscopy. This small footprint spectrometer is available in several different models that cover various wavelength ranges between 900 nm and 2500 nm. As with most Ocean Optics designs, the NIRQuest can be customized for your specific application with various grating, slit and mirror options.

Applications

* On-line absorbance measurement of moisture and protein content in grain.
* Component analysis of soils in a portable laboratory.
* Laser beam characterization.
* QA/QC inspection of pharmaceutical powders.
* Through tissue blood oxygenation measurements.
* Photoluminescence measurements of coated silicon wafers.
* Monitoring of CO, CO2, NO2 and other emissions gases.
* Octane measurements of hydrocarbons.

Specifications

	NIRQuest512-1.7	NIRQuest512-1.9	NIRQuest512-2.2	NIRQuest512-2.5
Physical				
Dimensions	182 x 110 x 47mm	182 x 110 x 47mm	182 x 110 x 47mm	182 x 110 x 47mm
Weight	1.18 kg (w/o power supply)	1.18 kg (w/o power supply)	1.18 kg (w/o power supply)	1.18 kg (w/o power supply)
Detector				
Detector	Hamamatsu G9204-512 InGaAs linear array	Hamamatsu G9205-512 InGaAs linear array	Hamamatsu G9206-512 InGaAs linear array	Hamamatsu G9208-512W InGaAs linear array
Pixels	512	512	512	512
Pisel size	25µm x 500µm	25µm x 250µm	25µm x 250µm	25µm x 250µm
Optical Bench				
Design	f/4, symmetrical crossed Czerny-Turner	f/4, symmetrical crossed Czerny-Turner	f/4, symmetrical crossed Czerny-Turner	f/4, symmetrical crossed Czerny-Turner
Entrance aperture (standard)	25µm	25µm	25µm	25µm
Entrance aperture (custom options)	10µm, 50µm, 100µm and 200µm (or no slit)	10µm, 50µm, 100µm and 200µm (or no slit)	10µm, 50µm, 100µm and 200µm (or no slit)	10µm, 50µm, 100µm and 200µm (or no slit)
Grating options (standard)	Grating NIR3, 150 l/mm, 900 - 1700nm	Grating NIR3, 100 l/mm, 150 l/mm, 900 - 1700nm	Grating NIR2, 100 l/mm, 900 - 2050nm	Grating NIR1, 75 l/mm, 1075 - 2500nm
Grating options (custom)	NIR10, NIR11, NIR12, NIR13 and NIR14	NIR10, NIR11, NIR12, NIR13 and NIR14	NIR2, NIR3, NIR10, NIR11, NIR12 and NIR13	NIR10, NIR11, NIR12, NIR13 and NIR14
Longpass filter	OF1-RG830 longpass NIR filter (optional)	OF1-CGA1000 longpass NIR filter (standard)	OF1-RG830 longpass NIR filter (optional)	OF1-RG830 longpass NIR filter (optional)
2nd Order filter	N/A	Standard	Standard	Standard
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber	SMA 905 to 0.22 numerical aperture single-strand optical fiber	SMA 905 to 0.22 numerical aperture single-strand optical fiber	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic				
Wavelength range	900 - 1700 nm w/Grating NIR3	1100 - 1900nm w/Grating NIR3	900 - 2200nm w/Grating NIR2	900 - 2500nm w/Grating NIR1
Optical resolution (FWHM)	~3.1 nm w/25µm slit	~3.1 nm w/25µm slit	~5 nm w/25µm slit	~6.3 nm w/25µm slit
Signal-to-noise ratio at full signal	>15000:1 @100ms integration >13000:1 @1000ms integration	>15000:1 @100ms integration >13000:1 @1000ms integration	10000:1 @100ms integration	10000:1 @100ms integration
A/D resolution	16-bit	16-bit	16-bit	16-bit
Dark noise	6 RMS counts @100ms 12 RMS counts @1000ms	6 RMS counts @100ms 12 RMS counts @250ms	6 RMS counts @100ms 12 RMS counts @250ms	16 RMS counts @10ms 24 RMS counts @30ms
Dynamic range	150 x 10^6 (system); 15K:1 for a single acquisition	7.5M (system); 10K:1 for a single acquisition	7.5M (system); 10K:1 for a single acquisition	100K (system); 7.5K:1 for a single acquisition
Integration time	1 ms – 120 s	1 ms – 1 s	1 ms – 1 s	1 ms – 30 ms
Electronics				
Power consumption	DC input jack +5V, 3 A maximum			
Data transfer speed	Full scan to memory every 5 ms with USB 2.0 port			
Inputs/ Outputs	External trigger input + single strobe output			
Breakout box compatibility	Yes			
Gated delay	Yes, with external hardware trigger delay			
Connector	30-pin connector			
Temperature & Thermoelectric Cooling				
Temperature limits (environmental)	10-35 °C (0-90% non-condensing)			
TEC range: Guaranteed range is 20 °C	21 -- 37°C below ambient	33.5 -- 48°C below ambient	33.5 -- 48°C below ambient	33.5 -- 48°C below ambient
TEC stability	+/-0.5 °C of set temperature in <1 minute; typical long-term stability +/-0.1 °C			

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NIRQuest Series Spectrometers

Small-Footprint Spectrometer for Near-Infrared Measurements

	NIRQuest256-2.1	NIRQuest256-2.5
Physical		
Dimensions	182 x 110 x 47 mm	182 x 110 x 47 mm
Weight	1.18 kg (w/o power supply)	1.18 kg (w/o power supply)
Detector		
Detector	Hamamatsu G9206-256 InGaAs linear array	Hamamatsu G9208-256 InGaAs linear array
Pixels	256	256
Pixel size	50µm x 250µm	50µm x 250µm
Optical Bench		
Design	f/4, symmetrical crossed Czerny-Turner	f/4, symmetrical crossed Czerny-Turner
Entrance aperture (standard)	25µm	25µm
Entrance aperture (custom options)	10µm, 50µm, 100µm and 200µm (or no slit)	10µm, 50µm, 100µm and 200µm (or no slit)
Grating options (standard)	Grating NIR2, 100 l/mm, 900 - 2050nm	Grating NIR1, 75 l/mm, 1075 - 2500nm
Grating options (custom)	NIR2, NIR3, NIR10, NIR11, NIR12 and NIR13	NIR2, NIR3, NIR10, NIR11, NIR12 and NIR13
Longpass filter	OF1-RG830 longpass NIR filter (optional)	OF1-RG830 longpass NIR filter (optional)
2nd Order filter	Standard	Standard
Fiber optic connector	SMA 905 to 0.22 numerical aperture single-strand optical fiber	SMA 905 to 0.22 numerical aperture single-strand optical fiber
Spectroscopic		
Wavelength range	900 - 2050nm w/Grating NIR2	900 - 2500nm w/Grating NIR1
Optical resolution (FWHM)	~7.6nm w/25µm slit	~ 9.5nm w/25µm slit
Signal-to-noise ratio at full signal	10000:1 @100ms integration	7500:1 @10ms integration
A/D resolution	16-bit	16-bit
Dark noise	6 RMS counts @100ms 12 RMS counts @250ms	8 RMS counts @10ms 12 counts RMS @30ms
Dynamic range	15M (system); 10K:1 for a single acquisition	500K (system); 7.5K:1 for a single acquisition
Integration time	1 ms – 2 s	1 ms – 400 ms
Electronics		
Power consumption	DC input jack +5V, 3 A maximum	
Data transfer speed	Full scan to memory every 5 ms with USB 2.0 port	
Inputs/ Outputs	External trigger input + single strobe output	
Breakout box compatibility	Yes	
Gated delay	Yes, with external hardware trigger delay	
Connector	30-pin connector	
Temperature & Thermoelectric Cooling		
Temperature limits (environmental)	10-35 ˚C (0-90% non-condensing)	
TEC range: Guaranteed range is 20˚C	33.5 -- 48˚C below ambient	
TEC stability	+/-0.5 ˚C of set temperature in <1 minute; typical long-term stability +/-0.1 ˚C	

NIRQuest Series Spectrometers

Optical Bench Accessories

NIRQuest Detectors

	Pixels	Wavelength Range	Integration Time
NIRquest-512-1.7	512	900 – 1700nm	1 ms – 120 s
NIRquest-512-1.9	512	900 – 1900nm	1 ms – 1s
NIRquest-512-2.2	512	900 – 2200nm	1ms – 1s
NIRquest-512-2.5	512	900 – 2500 nm	1ms – 200ms
NIRquest-256-2.1	256	900 – 2100nm	1ms – 2s
NIRquest-256-2.5	256	900 – 2500nm	1ms – 400 ms

Fixed Entrance Slits

Slit	NIRQuest512	NIRQuest512-2.2	NIRQuest512-2.5	NIRQuest256-2.1	NIRQuest256-2.5
SLIT-10	~2.0 nm	~3.0 nm	~4.1 nm	~6.7 nm	~9.4 nm
SLIT-25	~3.1 nm	~4.7 nm	~6.3 nm	~7.6 nm	~10.6 nm
SLIT-50	~3.6 nm	~5.4 nm	~7.2 nm	~8.9 nm	~12.5 nm
SLIT-100	~6.6 nm	~9.8 nm	~13.1 nm	~11.2 nm	~15.6 nm
SLIT-200	~12.3 nm	~18.5 nm	~25 nm	~17.9 nm	~25.0 nm

NIRQuest Gratings for Preconfigured Setups

Spectrometer	Standard Grating	Groove Density (lines/mm)	Spectral Range	Blaze Wavelength	Best Efficiency (>30%)
NIRQuest512-1.7	NIR3	150	~800 nm	1100 nm	900-1700 nm
NIRQuest512-1.9	NIR3	150	~800 nm	1100 nm	1100-1900 nm
NIRQuest512-2.2	NIR2	100	1150 nm	1600 nm	900-2200 nm
NIRQuest512-2.5	NIR1	75	1425 nm	1700 nm	1075-2500 nm
NIRQuest256-2.1	NIR2	100	1150 nm	1600 nm	900-2050 nm
NIRQuest256-2.5	NIR1	75	1425 nm	1700 nm	1075-2500 nm

NIRQuest Gratings – All Options

Grating	Intended Use	Groove Density (lines/mm)	Spectral Range*	Blaze Wavelength	Best Efficiency (>30%)
NIR1	NIRQuest 512-2.5 NIRQuest 256-2.5	75	1600 nm	1700 nm	1075-2500 nm
NIR2	NIRQuest 512-2.2 NIRQuest 512-2.5 NIRQuest 256-2.1 NIRQuest 256-2.5	100	1200 nm	1600 nm	900-2050 nm
NIR3	NIRQuest 512-1.7 NIRQuest 512-1.9 NIRQuest 512-2.2 NIRQuest 512-2.5 NIRQuest 256-2.1 NIRQuest 256-2.5	150	~800 nm	1100 nm	900-1700 nm
NIR10	NIRQuest 512-1.7 NIRQuest 512-2.2 NIRQuest 512-2.5 NIRQuest 256-2.1 NIRQuest 256-2.5	300	350-380 nm	1200 nm	750-2200 nm
NIR11	NIRQuest 512-1.7 NIRQuest 512-2.2 NIRQuest 512-2.5 NIRQuest 256-2.1 NIRQuest 256-2.5	400	240-290 nm	1600 nm	980-2500 nm
NIR12	NIRQuest 512-1.7 NIRQuest 512-2.2 NIRQuest 512-2.5 NIRQuest 256-2.1 NIRQuest 256-2.5	500	160-220 nm	1370 nm	900-2500 nm
NIR13	NIRQuest 512-1.7 NIRQuest 512-2.2 NIRQuest 512-2.5 NIRQuest 256-2.1 NIRQuest 256-2.5	600	100-180 nm	1200 nm	800-2500 nm
NIR14	NIRQuest512-1.7	1000	50-90 nm	1310 nm	900-1700 nm

* The spectral range is a function of the starting wavelength; the longer (i.e., the farther out in the NIR) the starting wavelength, the smaller the spectral range possible.

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STS Series Spectrometer

UV-NIR Spectral Analysis in a Tiny Footprint

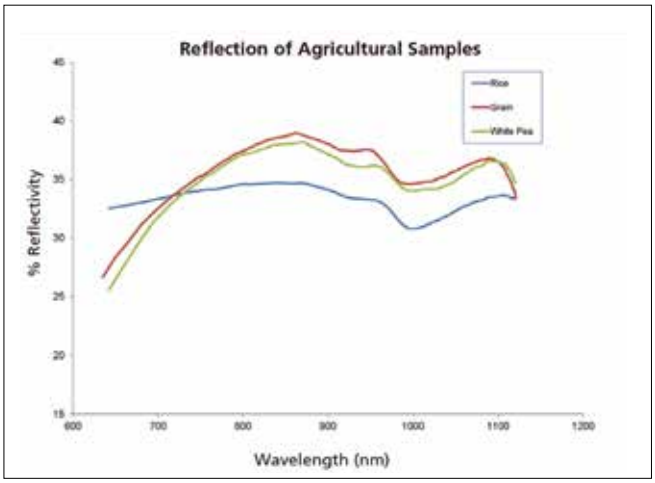
The STS series is a family of compact, high performance, cost-effective spectrometers ideal for embedding into OEM devices. The STS models are attractive option for applications such as LED characterization, absorbance and transmission measurements. Life sciences, materials identification, environmental monitoring, quality control and process monitoring are among some of the applications where the STS has played its role of a powerful performer in a small footprint. The STS delivers optical resolution, sensitivity and stability associated with larger, more expensive spectrometers.

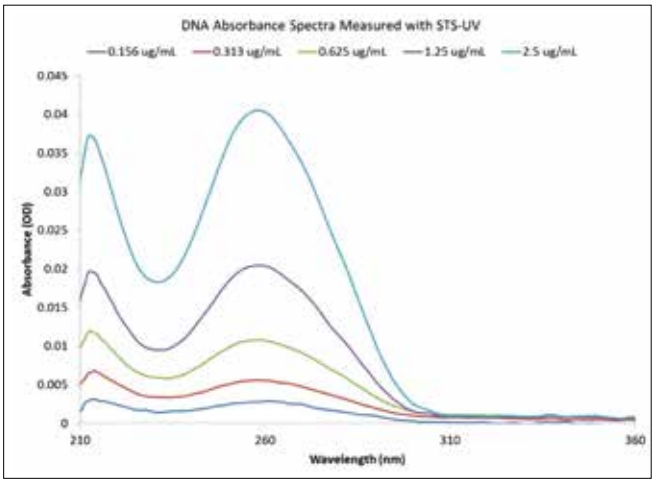
STS-UV

STS-VIS

STS-NIR

Engineering Specifications	STS-UV	STS-VIS	STS-NIR
Dimensions	40 mm x 42 mm x 24 mm	40 mm x 42 mm x 24 mm	40 mm x 42 mm x 24 mm
Weight	68 g	68 g	68 g
Detector	ELIS1024	ELIS1024	ELIS1024
Wavelength range	190 - 650 nm	350 - 800 nm	650 - 1100 nm
Integration time	10 µs – 10 s	10 µs – 10 s	10 µs – 10 s
Dynamic range	5 x 10^9(system, 10 s max integration), ~4600 single acquisition	5 x 10^9(system, 10 s max integration), ~4600 single acquisition	5 x 10^9(system, 10 s max integration), ~4600 single acquisition
Signal-to-noise ratio	> 1500:1 (maximum signal)	> 1500:1 (maximum signal)	> 1500:1 (maximum signal)
Dark noise	≤ 3 counts rms	≤ 3 counts rms	≤ 3 counts rms
Grating	600 g/mm	600 g/mm	600 g/mm
Slit	10, 25, 50, 100 or 200 µm	10, 25, 50, 100 or 200 µm	10, 25, 50, 100 or 200 µm
Detector collection	no	no	no
Order-sorting	yes	no	no
Optical resolution	● 1.0 nm (10 µm slit) ● 1.5 nm (25 µm slit) ● 3.0 nm (50 µm slit) ● 6.0 nm (100 µm slit) ● 12.0 nm (200 µm slit)	● 1.0 nm (10 µm slit) ● 1.5 nm (25 µm slit) ● 3.0 nm (50 µm slit) ● 6.0 nm (100 µm slit) ● 12.0 nm (200 µm slit)	● 1.0 nm (10 µm slit) ● 1.5 nm (25 µm slit) ● 3.0 nm (50 µm slit) ● 6.0 nm (100 µm slit) ● 12.0 nm (200 µm slit)
Stray light	≤ 0.25% at 450 nm	≤ 0.25% at 590 nm	≤ 0.25% at 850 nm
Fiber optic connector	SMA 905	SMA 905	SMA 905





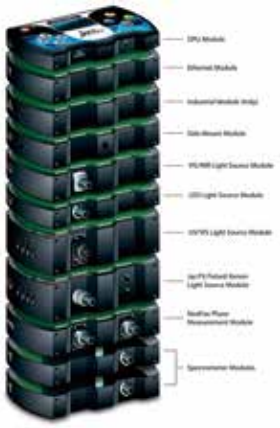
Jaz Modular Spectroscopy

Multi-purpose Spectrometer

The Jaz spectrometer is a handheld analytical instrument that combines low-power optical sensing and onboard computing power for custom applications ranging from chlorophyll analysis in plants to process stream monitoring in industrial environments. Thanks to its modular design, replaceable slits and multichannel capabilities, Jaz delivers a great deal of flexibility in a monolithic instrument.

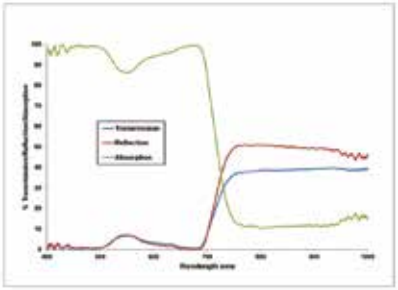
Features

* Powerful microprocessor and onboard display allow you to process and store data without a computer
* Full spectral analysis in a convenient, handheld unit
* Replaceable slit design provides extra level of configuration flexibility
* Ethernet connectivity plus SD card data storage capability make remote operation a snap
* Expansion up to 8 channels allows simultaneous, multi-point measurement
* Changeable display orientation makes operation convenient in both lab and field
* Up to 8 hours of battery life — ideal for field work



Make Jaz Your Own

Imagine having all the gear needed for optical sensing in one, convenient form. That's what we've done with Jaz while blending the functionality of all its parts into a single, seamless instrument. A basic Jaz includes the spectrometer module and onboard DPU. All other modules are optional so you can mix and match for the configuration that best handles your application. Jaz has a home in the lab, the field, the process line and anywhere you need reliable, accurate optical sensing.



Spectrometer	
Physical	L109 x W64 x H57 mm ; 352 g (JAZ-COMBO only)
Detector	Sony ILX511B linear silicon CCD array (200-1100 nm)
Wavelength range	Grating dependent (extended-range grating available for 200-1025 nm coverage)
Optical resolution	~0.3 - 10.0 nm FWHM
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	16 bit
Dark noise	50 RMS counts
Dynamic range	8.5 x 10^7 (system); 1300:1 for a single acquisition
Integration time	870 µs to 65 seconds (20 s typical maximum)
Stray light	<0.05% at 600 nm; <0.10% at 435 nm
Sensitivity	75 photons/count at 400 nm; 41 photons/count at 600 nm
Fiber optic connector	SMA 905 to 0.22 numerical aperture optical fiber
Electronics connector	19-pin MHDMI connector; use ADP-MHDMI-RS232 adapter to interface to RS-232
Channels supported	Up to 8 spectrometers
OEM integration supported	Yes
Power options	Wall transformer (+5VDC); Power over Ethernet (Class III PoE provides 12 Watts); USB; integrated battery module (JAZ-B); Solar charger and external batteries
Inputs/Outputs	Yes, 4 onboard digital user-programmable GPIOs
Communications and Software	
Computer interface	Onboard Blackfin® microprocessor
Operating systems	Windows XP, Vista (32/64 bit), Windows 7 (32/64 bit); OS X and Linux when using the USB interface on PCs
Ethernet Module (optional)	IEEE 802.3-compliant 10/100; includes 2 GB SD card
Industrial Communications Module (optional)	Interfaces (RS-232, RS-485); 4 analog I/O, 8 digital I/O
Trigger modes	Normal (free-running), Software, Synchronization and External Hardware
Strobe functions	Continuous, Single, Lamp Enable
Operating software	Basic Jaz software (included) operates from DPU interface; SpectraSuite (separate purchase) acquires data from USB or Ethernet connection; Overture software also available
Applications software	Irradiance measurement and other options available; application is loaded to an SD card and operates from DPU interface
Development software	Scripting program and API option for writing your own applications
Light Source Options	
JAZ-UV-VIS (optional module)	Deuterium-Tungsten Halogen (210-1100 nm); lifetime is ~1,500 hours (recommended for UV absorbance)
JAZ-PX (optional module)	Pulsed Xenon (190-1100 nm); lifetime is 4 x 108 flashes to 50% of initial intensity
JAZ-VIS-NIR (optional module)	Tungsten Halogen (360-1100 nm); lifetime is 500-10,000 hours depending on power setting
LEDs (optional module w/replaceable bulbs)	365 nm, 405 nm, 470 nm, 590 nm, 640 nm and White wavelength options
Compliance	
CE mark	Yes (all modules)
RoHs	Yes (all modules)

TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

Red Tide Spectrometers

Flexible, Low-Cost, Ideal for Education

USB-650 Red Tide spectrometers are ideal for teaching about UV and visible absorbance, reflectance and emission applications. They are preconfigured, ready-to-use spectrometers that come in several different options.

Physical	
Dimensions	89.1 x 63.3 x 34.4mm
Weight	190 g
Detector	
Type	Linear silicon CCD array
Pixels	650 enabled pixels
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500
Sensitivity	75 photons/count @ 400 nm
Optical Bench	
Design	f/4, asymmetrical crossed Czerny-Turner
Focal length	42 mm input; 68 mm output
Entrance aperture	25 µm wide slit
Fiber optic connector	SMA 905
Spectroscopic	
Wavelength range USB-650 USB-650-UV USB-650-VIS-NIR USB-650-UV-VIS	 350 - 1000 nm 200 - 880 nm 350 - 1000 nm 200 - 880 nm
Optical resolution	Model dependent
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	12 bit
Dark noise	3.2 RMS counts
Dynamic range	8.5 x 10^7 (system) 1300:1 for a single acquisition
Integration time	3 ms to 65 s (15 s typical max)
Stray light	< 0.05% @ 600 nm < 0.10% @ 435 nm
Corrected linearity	> 99%
Computer	
Operating systems	Windows XP/7, Mac OS X and Linux w/USB port
Operating software (required)	SpectraSuite Spectroscopy Software Overture Spectroscopy Software

Order Information

Model	Wavelength Range	Light Source	Sample Holder	Flexibility to Select Accessories
USB-650	350 - 1000 nm			●
USB-650-UV	200 - 880 nm			●
USB-650-UV-VIS	200 - 880 nm	●	●	
USB-650-VIS-NIR	350 - 1000 nm	●	●	

ChemUSB Spectrometer

Smart Systems for Education

Our CHEMUSB4 Spectrometer Systems are the ideal combination of our USB-interface spectrometer technology and modular accessories. This system is made up of our popular USB4000 spectrometer, a deuterium tungsten halogen or tungsten halogen and LED light source and 1-cm cuvette holder.

Physical	CHEMUSB4-UV-VIS	CHEMUSB4-VIS-NIR
Spectrometer dimensions	89.1 x 63.3 x 34.4mm	89.1 x 63.3 x 34.4mm
Spectrometer weight	190 g	190 g
Light source dimensions	89.1 x 77.79 x 34.4 mm	40.7 x 88.8 x 34.1 mm
Light source weight	200 g	130 g
Detector		
Type	Toshiba TCD1304AP Linear CCD array	Toshiba TCD1304AP Linear CCD array
Pixels	3648 pixels	3648 pixels
Pixel size	8 µm x 200 µm	8 µm x 200 µm
Pixel well depth	100,000 electrons	100,000 electrons
Sensitivity	130 photons/count at 400 nm; 60 photons/count at 600 nm	130 photons/count at 400 nm; 60 photons/count at 600 nm
Optical Bench		
Design	f/4, Asymmetrical crossed Czerny-Turner	f/4, Asymmetrical crossed Czerny-Turner
Focal length	42 mm input; 68 mm output	42 mm input; 68 mm output
Entrance aperture	25 µm wide slit	25 µm wide slit
Spectroscopic		
Wavelength range	210 - 880 nm	370 - 985 nm
Optical resolution	1.0 nm FWHM	1.0 nm FWHM
Signal-to-noise ratio	300:1 (at full signal)	300:1 (at full signal)
A/D resolution	16 bit	16 bit
Dark noise	50 RMS counts	50 RMS counts
Dynamic range	3.4 x 10^6 (system), 1300:1 for a single acquisition	3.4 x 10^6 (system), 1300:1 for a single acquisition
Integration time	3.8 ms to 10 seconds	3.8 ms to 10 seconds
Stray light	< 0.05% at 600 nm; < 0.10% at 435 nm	< 0.05% at 600 nm; < 0.10% at 435 nm
Light Source/Sample Holder		
Light source	Deuterium tungsten	Tungsten halogen and violet LED
Bulb life (hours)	800 deuterium; 2,000 tungsten	2,000 (tungsten); 45,000 (LED)

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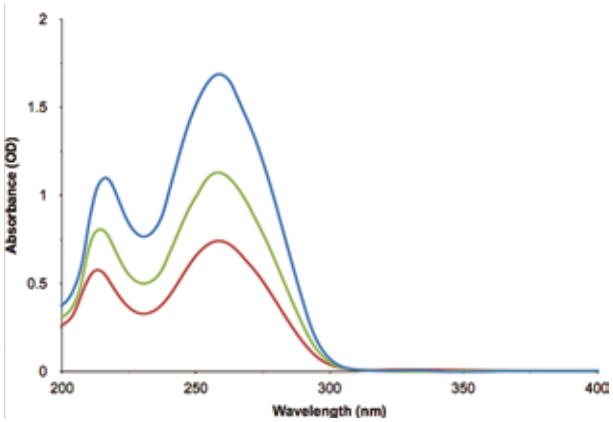
EMBED Spectrometer for OEM Applications



DNA Absorbance spectra using the EMBED spectrometer

EMBED's onboard electronics provide fundamental spectral preprocessing and multi-channel capability, as well as native SPI communication support that establishes a direct, stable and fast interface with microcontrollers and industrial control systems. EMBED's design allows for extensive optical component customization to support a variety of applications, while maintaining excellent quality in high volume production.

Configuration and Integration

The standard EMBED configuration has selectable optical bench components – including entrance apertures, gratings, order sorting filters and more – that make it possible to support low-light and high-throughput measurements. Its design provides the EMBED exceptional thermal and environmental stability – attractive features for process and other applications where temperature and environmental factors can affect measurements. In addition, the EMBED design supports multichannel functionality, which enables users to make simultaneous or timed-gated measurements from multiple EMBED spectrometers within a single system.

Engineering Specifications	EMBED Spectrometer
Spectrometer	
Detector	Sony ILX511B
Detector range	200 - 1100 nm
Focal length (input)	42 mm
Focal length (output)	68 mm (75 mm, 83 mm and 90 mm also available)
Gratings	Multiple options within 200 - 1100 nm
Entrance slit	5 µm, 10 µm, 25 µm, 50 µm, 100 µm or 200 µm
Fiber connector	SMA 905
Spectroscopic	
Integration time	1 ms - 60 seconds
Optical resolution	~0.3 - 10.0 nm (FWHM) (grating and slit dependent)
Dynamic range (typical)	1300:1 (per pixel)
Signal to Noise	250:1 (single acquisition)
Stray light	< 0.05% @ 600 nm; < 0.10% @ 435 nm
Electronics	
Power requirement	100 mA @ 3.3 VDC
Supply voltage	2.63-3.3 VDC
A/D converter	16 bit, 3.3 MHz

N.I.S.T. Certified UV Radiometer

Edmund

* **Designed to Detect UV Wavelengths from 250 – 380nm**
* **NIST Certified Sensors**
* **9V Battery Provides up to 120 Hours of Operation**

The NIST Certified UV Radiometer is ideal for inspecting ultraviolet light sources in a variety of quality control applications.
The NIST Certified UV Radiometer is powered by a standard 9V battery for up to 120 hours of operation. Three NIST certified interchangeable sensors are available to detect a wide range of ultraviolet wavelengths from 250 – 380nm. The NIST Certified UV Radiometer's range switch allows the selection of three intensity ranges.

Conversion Rate	2.8 readings/sec	**Intensity Ranges (switchable)**	0 – 200mW/cm² 0 – 2000µW/cm² 0 – 200µW/cm²
Display	3.5 digit LCD	**Dimensions**	157 x 51 x 91mm
Accuracy	±2%	**Weight**	0.3kg
		Power Requirements	9V Battery (not included)

Sensor Specifications

Description	Calibration Wavelength	Wavelength Range	Accuracy
Shortwave Sensor	254nm	250-290nm	±5%
Midrange Sensor	310nm	280-340nm	±5%
Longwave Sensor	365nm	335-380nm	±5%

N.I.S.T. UV Radiometer

	Description	Stock No.
Required	UV Radiometer Unit	UNI88136
One Required	NIST Traceable Shortwave Sensor	UNI88137
	NIST Traceable Midrange Senso	UNI88138
	NIST Traceable Longwave Sensor	UNI88139

N.I.S.T. Certified & Calibrated Light Meters

Edmund

* **Certified and Traceable to N.I.S.T. and NRC National Standards**
* **0 – 400,000 Lux and 0 – 40,000 FC Switchable**
* **Portable with 9V Battery Included**

The front light sensor contains a silicon photodiode with photopic and cosine correction. It has a diameter of 10mm and is angled 70˚ away from the display face. Unit features one-button operation with auto-ranging and autopower off after approximately 1 minute of downtime. User selectable switch located in battery compartment. Comes complete with soft protective carrying case for safe storage and transport. Backlit version available for taking measurements in dark environments. Calibrations are performed by the manufacturer and are traceable to N.I.S.T. and NRC National Standards. The photopic response of the calibrated sensor matches the CIE standard observer curve response to within 1% of the reading when using a standard tungsten source at 2856K. Calibration certificate included.

Measuring Range	Lux: 0-400,000 Lux; Footcandle: 0-40,000 FC			**Accuracy**	Overall: ±5% of displayed value Photopic: better than 1.0% of CIE curve
Resolution	Range: 0-375	Resolution: 0.1		**Battery Life**	300 hours continuous use
	Range: 375-4,000	Resolution: 1		**Dimensions**	141mmL x 59mmW x 25mmT
	Range: 4,000-400,000	Resolution: 10		**Weight**	150g
Display	10mm high digital LCD				

Description	Stock No.
Lux/Footcandle Meter	UNI55593
Backlit Lux/Footcandle Meter	UNI57476

TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

N.I.S.T Certified Handheld Photometer

Edmund optics | singapore

* **Portable, Easy to Use and Accurate**
* **9V Battery Powered**
* **0.05-7000 Lumens Measurement Sensitivity**
* **4-Digit LCD Display Accuracy**

This compact, lightweight instrument features a 2 inch diameter integrating sphere that collects the total light entering the sphere measurement port. The sphere interior is fabricated from a nearly-Lambertian (perfectly diffuse) reflectance material. Portable and easy to operate, this compact system is designed for use in the field, laboratory, or production floor. The instrument measures luminous flux from sources such as LEDs, small lamps, and fiber illuminators. The instruments' photopic filtered silicon detector provides maximum sensitivity at low light levels. A calibration certificate traceable to N.I.S.T is included. Housing has an M6 tapped hole for post mounting. The LED Adapter Kit, sold separately, includes entrance port adapters for standard LED package sizes including 2mm, 3mm (T1), 4mm, 5mm (T1-3/4), 8mm and 10mm.

Ststem Properties And Performance

Range Selection	Auto Range	**Readout**	4 digit, 2 x 8 LCD
Sphere Diameter	2.0-inch (50.8 mm)	**Temperature Range**	0°C to 50°C
Entrance Port Diameter	0.5-inch (12.7 mm)	**Size**	3.5 W x 3 H x 8.5 L inches (8.9 W x 7.6 H x 21.6 L cm)
Sphere Interior	Spectralon®	**Weight**	1.25 lbs. (0.57 kg.)
Detector	Photopic Filtered Silicon		

N.I.S.T Certified Handheld Photometer

Description	Stock No.
Handheld Photometer	UNI64817
LED Adapter Kit	UNI64818

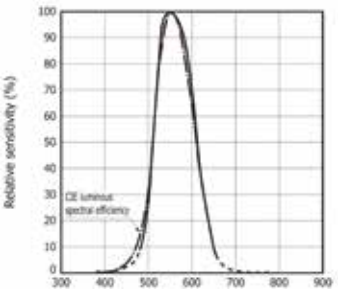
Asteria Series - Compact, Fast Industrial Light Meter

High-Speed Robust Luminance, Illuminance & Flicker Meter

Asteria is a high-speed measurement device suited for Luminance, Illuminance and Flicker measurements. Based on the popular Admesy platform the Asteria is designed for in-line use with integrated calculating power for easy implementation and high speed measurement results in production settings. The Asteria is available in two configurations: the lens based system is capable of measuring luminance (cd/m^2) and flicker, its cosine corrector configuration allows illuminance (lux) and flicker measurements.

Highlights

* Absolute luminance or illuminance measurement according to the human eye: CIE1931 luminosity function
* All flicker measurement standards supported for LCD: Contrast, JEITA, VESA and Lighting: percentage, index
* Measure high and low frequencies at the same time through a high sample rate and large memory size
* Trigger input and output for in line applications
* Windows, Linux, OSX and embedded systems compatible
* SCPI command interface for easy integration in other applications
* Supported in all major programming languages Labview / Labwindows / Visual Studio (C++, C#, VB)/ etc.
* USBTMC standard compliant
* Integrating- or sampling mode available
* 3 gain stages for every mode
* Autorange function
* User calibration function and pre-programmed calibration values



Specifications

Interfaces				
USB 2.0	USBMTC compliant, SCPI command set, full speed device			
RS 232	For PC and embedded purposes, using same command set as USB			
Trigger in & out	5V compliant			
Power ratings				
USB powered	**Min voltage**	**Typical voltage**	**Max voltage**	**Max current**
	4.75V	5.00V	5.25V	220mA
System information				
Photo detector	Silicon photo diode			
Spectral response	Approximates CIE 1931 spectral luminous efficiency curve, fs value 8% typical			
Measurement parameters	Luminance, illuminance, flicker (contrast, JEITA, VESA, Percentage, Index), Response time.			
Optical systems	10mm lens system & cosine corrector			
Measurement speed in sample mode	180,000 samples/second. Memory for 250,000 samples. For samples/delay versus total time see table below.			
Operating Temperature	10 - 35°C			
Mechanical dimensions				
Size (H x W x D)	69 x 31 x 93 mm			
Weight	320g			
Mounting	12 M3 threat holes spread over four sides of Asteria			

Asteria Cosine Corrector Specifications

Optical system					
Optics	1 cm^2 cosine corrector				
Consine response	Lambertian				
Sample mode signal frequency response					
Parameter	f_{3db}				
Gain 1	DC – 20 kHz				
Gain 2	DC – 50 kHz				
Gain 3	DC – 120 kHz				
Measurement Specification					
Parameter	**Range**	**Accuracy**	**Light level (lx)**	**Repeatability**	**Speed (samples/sec)**
Luminance (Y) (integrating mode)	0.005 – 15,000lx integration time between 1ms and 5 seconds	±4% of measured value. Measured on halogen light source with illuminance level ~1800 lx	1	± 0.20%	4-10
			10	± 0.10%	10-20
			50	± 0.05%	20-100
			>1500	± 0.03%	20-100
Luminance (Y) (sampling mode)	1 - 150,000 cd/m^2	±4% of measured value. Measured on halogen light source with illuminance level ~1800 lx	10	± 0.20%	4-10
			50	± 0.10%	10-20
			200	± 0.05%	20-100
			>1500	± 0.03%	20-100
Percentage Flicker	1 - 150,000cd/m^2	±1% Flicker frequency: 100Hz AC/DC 10% sine wave @100 lux			
Flicker Index	1 - 150,000 cd/m^2	± 0.01 Flicker frequency: 100Hz AC/DC 10% sine wave @ 100 lux			

TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

Accessories · 視效函數偵測器 / Photometric

基本原理

利用偵測器與濾光片結合後的響應度曲線，來模擬人眼在週遭環境亮度大於 2cd/m^2 時，對各別波長的入射光的反應曲線，也就是 CIE 配色函數 (Color Matching Function)，又稱為視效函數曲線 (V-Lambda Curve)，可用於量測照度 (lx)、光強度 (cd)、光通量 (lm) 等。

型號 : HPD001W

產品特色

＊研發過程中均以國家標準實驗室的原級標準為依據。
＊與知名國外市售產品比較，在藍光部份的曲線誤差明顯降低。

應用範圍

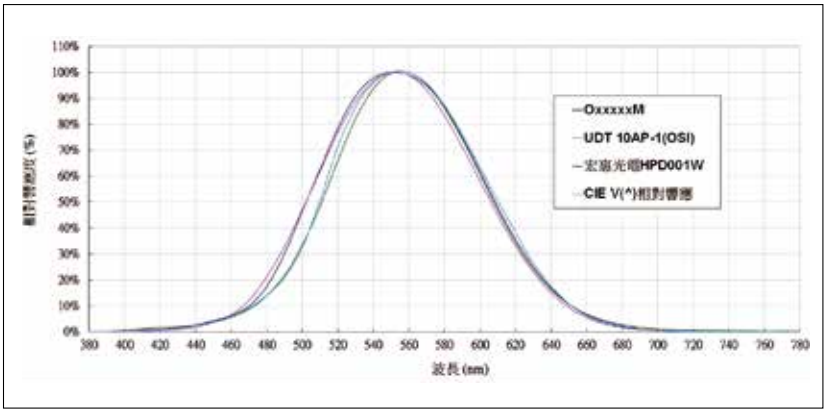
＊ LED 輝度測量
＊積分球輸出光源輝度監控

產品規格

＊與 CIE 配色函數的曲線誤差：
F1′ ≦ 4% (Typical)
＊絕對響應：≧ 33nA/1x (Typical)
＊Window Φ 12mm, BNC type Connector

廠牌	F1′: 與CIE曲線的差異
0xxxxxM	6.84%
UDT 10AP-1(OSI)	8.92%
宏惠光電-HPD001W	3.72%

相對響應度比較圖



輻射功率偵測器 / Power Sensor

產品特色

＊研發過程中均以國家標準實驗室的原級標準為依據
＊與知名國外市售產品比較，曲線平坦範圍 410nm ~ 970nm
優於 10DF 的 500nm ~ 970nm

型號 : PPD001W

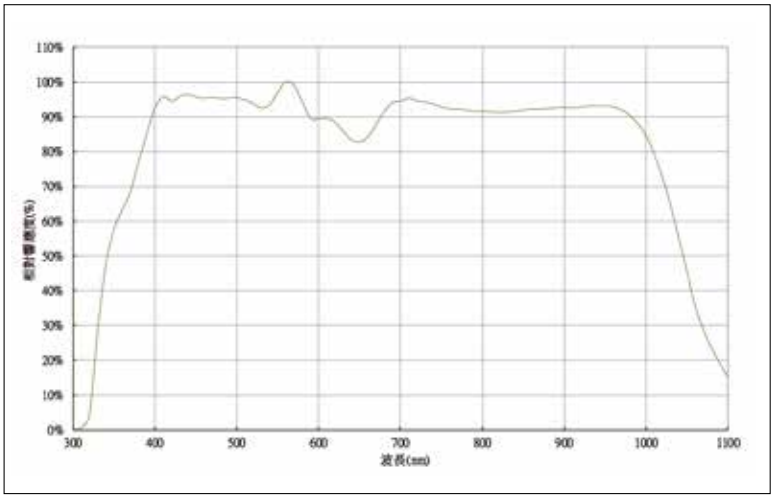
產品規格

＊ Electrical characteristics Typ. T=25℃
＊ Optical characteristics Typ. T=23±1.5℃
＊ Area:10*10mm^2

應用範圍

＊光源在 700~1000nm 輸出功率量測

相對響應度



OVAL 光纖連續式可調光衰減器 / Fiber Optic Linear Variable Attenuator

漸進式

＊兩條光纖間控制光的穿透率。
＊ SMA905 接頭和光纖連接。
＊輸入 / 輸出端各有一準直透鏡 (CL-UV-R) 結合，增加光強度。
＊準直透鏡適合波長範圍紫外光到近紅外 (200nm~2000nm)。
＊用手轉動輪盤可獲得 0% ~ 100% 不同穿透率。
＊內部螺旋式的設計，確保大多數平行輸入的光都能通過。
＊當轉動到定位時，背面有一小螺絲旋鈕，具有固定功能。
＊側邊和底部附有磁鐵，適合吸附在具有磁性基座上如光學桌。
＊底部有 M6 (1/4-20) 螺紋牙孔可固定在支撐棒或其他元件上。
＊選擇配件 OVAS-B 滑動底板 (另售)，使用更具彈性。

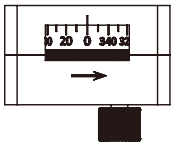
＊ Control the ligh transmission between two fibers.
＊ An opto-mechanical device couples to fibers via SMA905 connectors.
＊ Collimating lens (CL-UV-R) on input/output both ports to collect light source.
＊ Attenuation wavelength range 200nm to 2000nm.
＊ Manual adjustment on mechanical wheel for different attenuation performance.
＊ Gyroidal design on the wheel allows most of the light source having a collimating lens at its aperture.
＊ A thumbscrew on the out port for locking purpose when wheel is positioned.
＊ Magnets on the side and bottom can attach to magnetism optical table.
＊ M6 (1/4-20) thread on the bottom for posts or components mounting.
＊ Accessory OVAS-B slide base (not including) provides more flexible for mounting.

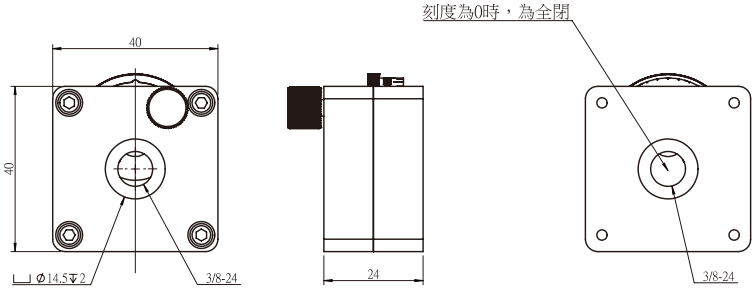
OVAS-B 滑動底板

OVAL+OVAS-B
示意圖

產品規格

型號	OVAL
尺寸	L40 x H40 x D24mm
重量	110 g
操作波長	350 ~ 800nm，公差 ±1.5% 800 ~ 2000nm，公差 ±4.0%
接頭	SMA905





TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

OVAS 光纖階梯式可調光衰減器 / Fiber Optic Step Circular Attenuator

步進式

＊兩條光纖間控制光的穿透率。
＊ SMA905 接頭和光纖連接。
＊輸入 / 輸出端各有一準直透鏡 (CL-UV-R) 結合，增加光強度。
＊準直透鏡適合波長範圍可見光到近紅外 (350nm~2000nm)。
＊指撥式手動調整不同衰減片可準確達到定位。
＊內部配有八個 12.5mm 孔徑，除全開和全關外，客戶可依需求配置六個不同穿透率的衰減片。
＊提供九種不同穿透率的衰減片予客戶選擇。
＊當轉動到定位時，背面有一小螺絲旋鈕，具有固定功能。
＊轉盤上數字刻字方便記錄各位置衰減片的穿透率。
＊側邊和底部附有磁鐵，適合吸附在具有磁性基座上如光學桌。
＊底部有 1/4(M6) 螺紋牙孔可固定在支撐棒或其他元件上。
＊選擇配件 OVAS-B 滑動底板 (另售)，使用更具彈性。

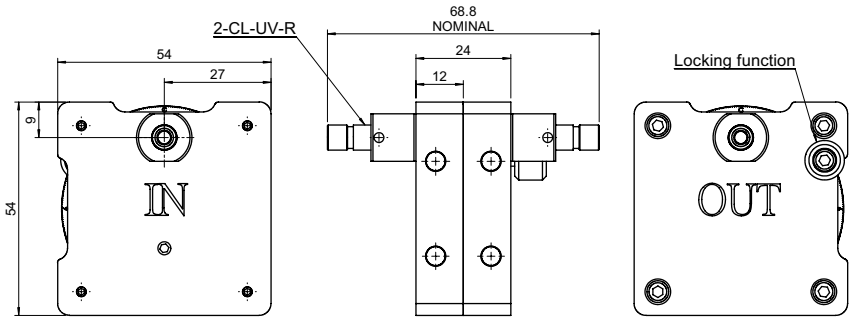
＊ Control the ligh transmission between two fibers.
＊ An opto-mechanical device couples to fibers via SMA905 connectors.
＊ Collimating lens (CL-UV-R) on input/output both ports to collect light source.
＊ Attenuation wavelength range 350nm to 2000nm.
＊ Manual adjustment on mechanical wheel for different attenuator filter.
＊ 8-diameter 12.5mm aperture on the internal wheel. User depends on his own demand to fit 6-different neutral density filters except always open and close.
＊ Offering 9-different neutral density filters for selection.
＊ A thumbscrew on the out port for locking purpose when wheel is positioned.
＊ Numbers engraved on the wheel to indicate the norminal transmission.
＊ Magnets on the side and bottom can attach to magnetism optical table.
＊ 1/4-20(M6) thread on the bottom for posts or components mounting.
＊ Accessory OVAS-B slide base (not including) provides more flexible for mounting.

OVAS-B 滑動底板

OVAS+OVAS-B
示意圖

產品規格

尺寸	L54 x H54 x D24mm
重量	200 g
操作波長	350 ~ 800nm，公差 ±1.5% 800 ~ 2000nm，公差 ±4.0%
接頭	SMA905



產品型號

OVAS - □□□□□□

平均穿透率 (%)		
1 = 0.1%	4 = 10%	7 = 50%
2 = 1%	5 = 25%	8 = 60%
3 = 5%	6 = 40%	9 = 70%

* 提供九種不同平均穿透率，可挑選六種
** 可接受其他平均穿透率

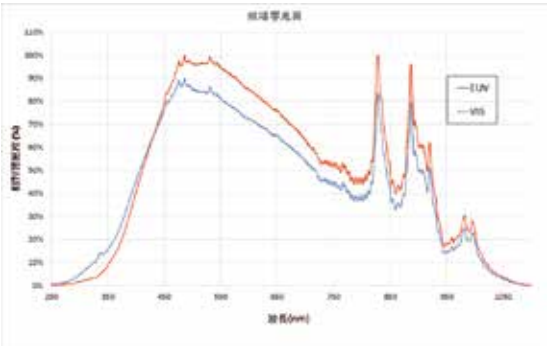
Ex: 型號：OVAS-135678-M
描述：步進式
平均穿透率分別為 0.1%,5%,25%,40%,50%,60%
兩側具有磁鐵

積分球 / Integrating Sphere

UIS-ADP-SMA

產品介紹

使用積分球 (Integrating Sphere) 來量測光源的輻射功率或是光通量等，是在光學量測領域中十分常見的技術與應用。積分球本身為一空心球體，球體內壁表面塗布有高漫射特性的材料。入射光在球體內經過多次的反射與漫射之後，會形成均勻的光線散佈在球體內。然後藉由在球體上的偵測器孔或射出孔，即可進行光源特性的量測。本公司提供一系列的積分球產品，可針對應用或產品選擇合適之積分球形式與尺寸大小。並提供客製化的服務，以滿足任何光的量測應用。

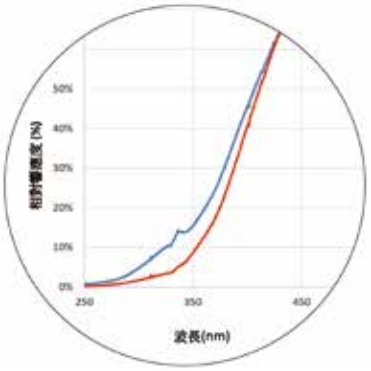


產品應用

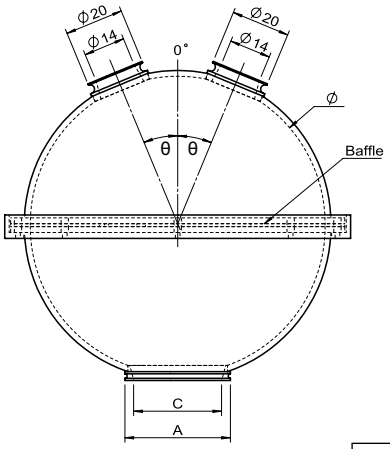
＊光源特性量測：光譜、色座標、色温、主波長、峰波長、CRI、流明值、飽和度、光通量
＊材料特性量測：散射、反射、穿透、折射
＊濾光片的穿透率反射率量測
＊均勻光源
＊光收集器

產品特色

＊提供多種尺寸 (0.15m ~ 2m)
＊校正燈可以追溯美國國家標準實驗室 (NIST)
＊搭配光譜儀，可以量測：CIE 的座標如 (x, y, u′, v′)、流明值、色温、主波長、峰波長、飽和度、CRI … 等
＊可搭配 SMA 輸出孔蓋板 UIS-ADP-SMA 使用 (選配)
＊模組化設計，可依顧客需求更改



3 孔積分球之結構及尺寸



訂購資訊

Outside Dia. (mm) (Ø)	Input Port Dia. (mm)		Available Angle (θ)			
	Cap Ring (C)	Apeature (A)				
50	14	C+6mm	X	45	56	X
100	14, 20, 30, 45	C+6mm	30	45	X	60
150	14, 20, 30, 45, 50	C+6mm	30	45	X	60
200	14, 20, 30, 45, 50, 80	C+6mm	30	45	X	60
300	14, 20, 30, 45, 50, 80	C+6mm	30	45	X	60
500	14, 20, 30, 45, 50, 80, 150	C+6mm	30	45	X	60

產品型號 UIS- □□□ - □□□ - □ - □□ - □□□

Diameter
050 = 50mm
100 = 100mm
150 = 150mm
200 = 200mm
250 = 250mm
300 = 300mm
500 = 500mm

Input Port
014 = 14mm
020 = 20mm
030 = 30mm
045 = 45mm
050 = 50mm
080 = 80mm
150 = 150mm

Cap Ring
R = Ring
N = None

Angle
30 = 30° / 30°
45 = 45° / 45°
56 = 0° / 56°
60 = 60° / 60°

Wavelength
EUV = 260 - 1100nm
VIS = 380 - 1100nm

Ex: 型號：Example: UIS - 050 - 014 - N - 30- VIS
描述：積分球外徑尺寸為 50mm, 入光口尺寸為 14mm 且不含固定環，輸出端為 Y 型各 30 度夾角，兩輸出端夾角為 60 度，波長範圍為 380-1100nm.

TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

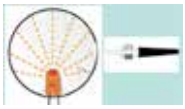
Collimating Lenses

The Widest Range of Accessories

Ocean Optics modular spectrometers and accessories can be configured for absorbance, transmission, reflectance, fluorescence, emission or scattering applications. We offer nearly 500 sampling accessories for free space measurements, solid sampling and liquid sampling. Probes and accessories for Raman analysis are also available. In many setups, sampling accessories collect light or excitation energy that interacts with the sample and is transmitted to the spectrometer. Sampling accessories also include fixtures such as collimating lenses that provide specific sampling geometries.

Field of View (FOV)

Four of our sampling accessories allow users to control FOV and aperture.

Item	Image	FOV	Aperture
Optical Fiber		25˚	Same as fiber diameter
Collimating Lens		up to 45˚	3.0 mm
Cosine Corrector		180˚	3.9 mm
Integrating Sphere		360˚	25 mm

What's Your Field of View?

Four of our devices are used to control field of view (FOV) and aperture:

1. Optical Fiber (25˚ FOV, aperture = fiber diameter)
2. Collimating Lens (0˚ - 45˚ FOV, aperture = 3 mm)
3. Cosine Corrector (180˚ FOV, aperture = 3.9 mm)
4. Integrating Sphere (360˚ FOV, aperture = 25 mm)

Ordering Information

	Item	Diameter	Focul Length	Lens Material	Range	Connector
	CL-UV-R	5 mm	12.5mm	Fused Silica Dynasil	200-2000 nm	SMA 905, 6.35-mm ferrule, 3/8-24 external thread
	CL-VIS-ACR (Achromatic Doublet Lens)	5 mm	12.5mm	N-SSK8 / N-SF56	350-2000 nm Coating:400-700nm	SMA 905, 6.35-mm ferrule, 3/8-24 external thread
	CL-UV-DA	6 mm	12mm	Fused Silica Dynasil	200-2000 nm	SMA 905, 1/4-36 internal thread
	74-90-UV	5 mm	10mm	Fused Silica Dynasil	200-2000 nm	SMA 905, 6.35-mm ferrule, 3/8-24 external thread
	COL-UV-30	30mm	30mm	Fused Silica Suprasil	200-2000 nm	SMA 905, 6.35-mm ferrule, 3/8-24 external thread
	84-UV-25	25.4mm	100mm	Fused Silica Dynasil	200-2000 nm	SMA 905, 6.35-mm ferrule, 3/8-24 external thread

Sampling Accessories

Cosine Correctors
Opticl diffusers collect light from 180° fov

WS-1
Reflectance Standards

STAN Series
Reflectance Standards

FOIS-1
Integrating Sphere

ISP-REF
Integrating Sphere

ISP-R Series
Integrating Spheres

ISP-I
Integrating Spheres

CUV-UV
Cuvette Holder

CUV-FL-DA
Cuvette Holder

CUV-ALL-UV
Cuvette Holder

FHS-UV
In-Line Filter Holder

FHSA-TTL
Filter and Cuvette Holder

ACH-CUV-VAR Lens Holder
Adjustable Collimating Lens and cuvette Holder

In-Line Filter Holders for Fibers

74-ACH Lens Holder
Adjustable Collimating Lens Holder

LED-PS
Power Supply-Controller

CUV-QPOD
Temperature Controlled Cuvette Holders

STAGE
Single-Point Reflection Stage

STAGE-RTL-T
Reflection-Transmission Stage

FIA Series Fluorescence Flow Cells
Chemically Resistant Cells for Fluorescence Applications

FIA Series Microvolume Flow Cells
Z-Type Flow Cells for Absorbance Measurements

Longpass Flow Cells
Low-Concentration Absorbance Measurements

Process Cross Flow Cells
Process Monitoring Industrial Environments

CVD Series
Plastic Cuvettes

USB-ISS Series
Illuminated Cuvette Holders

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MEMO