

3.8 High-Power Applications

3.8.1 High-Power NanoScan

Photon's High-Power NanoScan can measure focused CO₂ laser beams up to 5 kilowatts. The High-Power NanoScan is equipped with a pyroelectric detector with copper slits and drum. A cooling fan mounted on the scan head body provides additional heat management. With the new "peak connect" algorithm and the software controlled variable scan speed, the High-Power NanoScan is ideal for measuring lasers operating with pulse width modulation (PWM) power control. Measurement of Q-switched lasers and other higher frequency pulsed lasers is also possible using this feature.

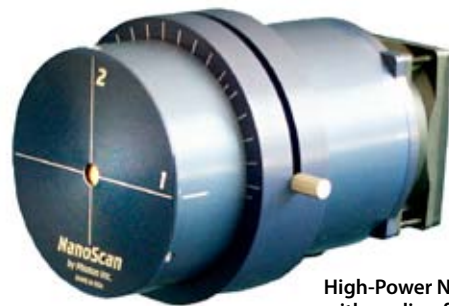
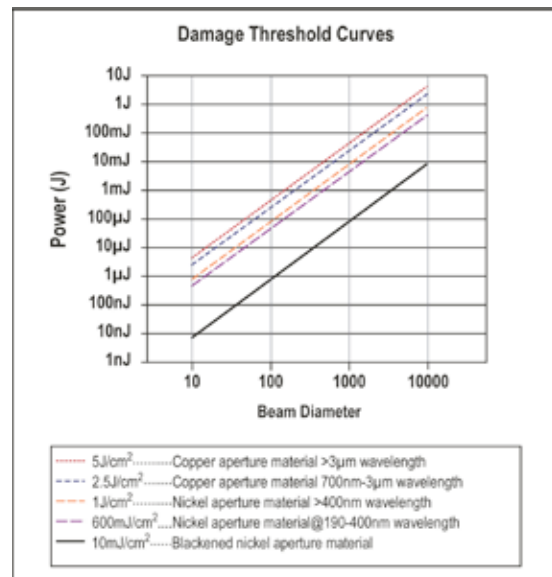
What Can be Measured?

Measuring high-power beams can be tricky. The lasers have the potential to damage the scan head, and any reflected light can be dangerous to both the operator and the surroundings. The High-Power NanoScan can measure these beams because it uses a combination of highly reflective components with high thermal dissipation capability. It is important to manage the reflected beam so that it neither reenters the laser cavity nor sends stray beams into the surrounding area. The scan head is designed to make short duration measurements to avoid excessive heating of components. The head should be only in the incident beam for 10 to 60 seconds depending on the power levels to prevent excessive heating of the components. The High-Power NanoScan scan head has been shown to be able to handle power densities of 3.2MW/cm² at 10.6μm, the power density of a 200μm beam at 1kW. At the shorter wavelengths of the other common industrial lasers, Nd:YAG and DPSS, the upper limits are a little less, due to the slightly lower reflectivity of the components at wavelengths around 1000nm. Visible and UV lasers can also be measured, but these will have lower limits yet.

The chart below shows the damage thresholds for pulsed beam energies for the three wavelength regimes. The lines represent the maximum energies per pulse for various spot sizes that correspond to 5J/cm² for the 3μm to 100μm wavelengths, 2.5J/cm² for the 700nm to 3μm range, and 250mJ/cm² for the UV-Visible range from 190nm to 700nm. When operating with pulsed lasers, calculate the energy per pulse to ensure that the values fall below these lines for the wavelength of the laser. Operation above these values will likely cause damage to the scan head apertures.

Minimum Beam Size per Pulse Frequency

NanoScan	Large Drum (HP)			
Rotation Rate (Hz)	1.25	2.50	5.00	10.00
Slit Speed (μm/msec)	233.25	466.50	933.01	1866.01
Data Points per Profile	15	15	15	15
Pulse Frequency (kHz)	Minimum Beam Diameter in μm			
0.5	6998	13995	N/A	N/A
1	3499	6998	13995	N/A
2	1749	3499	6998	13995
3	1166	2333	4665	9330
4	875	1749	3499	6998
5	700	1400	2799	5598
6	583	1166	2333	4665
7	500	1000	1999	3999
8	437	875	1749	3499
9	389	778	1555	3110
10	350	700	1400	2799
11	318	636	1272	2545
12	292	583	1166	2333
13	269	538	1077	2153
14	250	500	1000	1999
15	233	467	933	1866
16	219	437	875	1749
17	206	412	823	1646
18	194	389	778	1555
19	184	368	737	1473
20	175	350	700	1400
21	167	333	666	1333
22	159	318	636	1272
23	152	304	608	1217
24	146	292	583	1166
25	140	280	560	1120
50	70	140	280	560
100	35	70	140	280
150	23	47	93	187



High-Power NanoScan with cooling fan

High-Power NanoScan Configurations

Detector Type	Power Range	Wavelength	Aperture	Slits	Scan Head Size
Pyroelectric	~1W - ~5W upper limit dependent on wavelength	190nm - > 100μm	9mm	5μm	100mm
Pyroelectric Large Aperture	~1W - ~5W upper limit dependent on wavelength	190nm - > 100μm	20mm	10μm	100mm



High-Power NanoScan

Ordering Information - High-Power NanoScan

All High-Power NanoScan Systems Include: Fan cooled scanhead. For use at wavelengths from 200nm to greater than 20μm. Maximum power capacity is dependent on wavelength and spot size. Refer to operating space charts for more information. Slits and scan drum are highly reflective and user must send reflected energy into appropriate dump. A direct back reflection may cause laser cavity to oscillate or if not properly directed may cause damage. User must handle all back-reflected energy from laser. NanoScan Integrated Software package. Software for use with NanoScan under Windows 7 (32/64) Laptop or Desktop. Measurements include: spot size, position and position difference information and laser profiles. Includes "peak connect" and software control of scan speed for measurement of pulsed and pulse width modulated (PWM). Software includes ability to capture and record bursts of data and ActiveX automation. USB 2.0 controller replaces the PCI bus card and allows NanoScan to interface to USB 2.0 port of laptop or desktop PC. Performance of Certificate of Calibration traceable to National Institute of Standards and Testing (NIST) to better than ±3%.

Pyroelectric Detectors

Item	Description	P/N
USB NS-PYRO/9/5	NanoScan Pyroelectric Detector 9mm aperture 5micron slits. High-resolution head featuring pyroelectric detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 5μm wide slits. Use for wavelengths from 190nm to >20μm. This model does not include a cooling fan USB	PH00025
USB NS-PYRO/9/25	NanoScan Pyroelectric Detector 9mm aperture 25micron slits. High-resolution head featuring pyroelectric detector, 63.5mm diameter head with rotation mount, 9mm entrance aperture, and matched pair of 25μm wide slits. Use for wavelengths from 190nm to >20μm. This model does not include a cooling fan.	PH00228
USB NS-PYRO/20/25	NanoScan Large Area Pyroelectric Detector 20mm aperture 25micron slits. High-resolution head featuring pyroelectric detector, 100mm diameter head with rotation mount, 20mm entrance aperture, and matched pair of 25micron wide slits. Use for wavelengths from 190nm to >20micron. This model does not include a cooling fan. USB	PH00026
USB NS-PYRO HP/20/10	High-Power NanoScan scanhead with 20mm Pyroelectric Detector 10μm slits for use with higher power beams. High-resolution profiler featuring pyroelectric detector, 100mm diameter scanhead with rotation mount, 20 mm entrance aperture, and matched pair of 10-μm wide slits. Can measure spots 50 μm and larger (1/e ² diameter) directly. Works with CW and pulsed beams with rates greater than 2kHz. Actual minimum pulse rate is dependent on beam size and scan rate. USB	PH00027
USB NS-PYRO HP/9/5	High-Power NanoScan scanhead with 9mm Pyroelectric Detector 5μm slits for use with higher power beams. High-resolution profiler featuring pyroelectric detector, 100mm diameter scanhead with rotation mount and matched pair of 5-μm wide slits. Use to measure spots 20μm and larger (1/e ² diameter) directly. Works with CW and pulsed beams with rates greater than 2kHz. Actual minimum pulse rate is dependent on beam size and scan rate. USB	PH00028
NH-PYRO/9/5	Head only NanoScan-Pyro 9mm aperture 5μm slits	PH00041
NH-PYRO/9/25	Head only NanoScan-Pyro 9mm aperture 25μm slits	PH00243
NH-PYRO/20/25	Head only NanoScan-Pyro 20mm aperture 25μm slits	PH00042
NH-HP-NS/20/10	Head only High-Power NanoScan 20mm aperture 10μm slits	PH00043
NH-HP-NS/9/5	Head only High-Power NanoScan 9mm aperture 5μm slits	PH00044