

High Power Diode-Pumped Nanosecond Amplifier Systems

NanoFlux HP SERIES



Typical external view of NanoFlux DPSS series laser system (actual design might vary)

NanoFlux series electro-optically Q-switched nanosecond Nd:YAG amplifier systems produce high-energy pulses at high repetition rates. A diode-pumped Q-switched nanosecond laser, based on proven technology, serves as the system master oscillator. The pulses it produces are further amplified to the high-energy output pulses featuring a Super-Gaussian beam profile. The laser system master oscillator output pulses as short as several nanoseconds, featuring a uniform beam profile and low divergence. Alternatively, customers own seed source can be implemented as master oscillator and amplified to required energy level for further amplification in main power amplifiers. Power amplifiers are a chain of low-maintenance diode-pumped single and double pass amplifiers where pulses are amplified up to the required energy. During amplification, spatial beam shaping is employed in order to get a Super-Gaussian beam shape at the output.

Thermally stabilized angle-tuned harmonic generators assure stable second and third harmonic outputs. High spectral purity of harmonics output radiation is achieved using dichroic mirrors.

System control can be performed in several ways.

Using a laser system control pad, via USB and LAN ports (RS232 as optional), using a personal computer with supplied software for the Windows operating system. To tailor the laser for specific applications or requirements, a number of customization possibilities are available; e.g., an industrial-grade, portable laser housing with integrated power supplies and cooling units; customer's seed laser integration; multi-channel outputs; burst amplification, and others.

FEATURES

- ▶ Up to **5 J at 1064 nm** output pulse energy
- ▶ Up to **1 kHz** repetition rate
- ▶ **Multi-channel** version **2 J** per channel at 1064 nm
- ▶ Pulse durations **from 2 ns to 500 ns**
- ▶ Spatial Super-Gaussian beam profile
- ▶ Low maintenance cost and long diode lifetime
- ▶ Variable pulse duration and temporal pulse shape control (AWG) option available
- ▶ Various customization possibilities to tailor for specific application
- ▶ High efficiency diode pumping chambers
- ▶ Small laser head footprint and OEM integration upon request
- ▶ Internal system diagnostics
- ▶ Thermally induced birefringence compensation for high pulse repetition rates
- ▶ Integrated vacuum system for image translation for smooth Super-Gaussian beam profile
- ▶ **Burst** version available
- ▶ Optional thermally stabilized second and third harmonics generators
- ▶ Optional industrial grade, portable laser housing with integrated power supplies and cooling units

APPLICATIONS

- ▶ Thomson Scattering
- ▶ Multi-stage OPCPA pumping
- ▶ Non-linear optics
- ▶ Ti:S pumping

SPECIFICATIONS

Model	N400100	N5k100	N2001k	N2k100-Burst
MAIN SPECIFICATIONS ¹⁾				
Output energy				
at 1064 nm	400 mJ	5 000 mJ	200 mJ	2 000 mJ
at 532 nm ^{2) 3)}	260 mJ	3 000 mJ	130 mJ	1 300 mJ
at 355 nm ²⁾	120 mJ	Inquire	60 mJ	600 mJ
Pulse repetition rate	100 Hz	100 Hz	1 kHz	100 Hz
Pulse duration ⁴⁾	5 ± 1 ns	5 ± 1 ns	5 ± 1 ns	Adjustable bursts
Pulse energy stability ⁵⁾				
at 1064 nm	≤ 0.5 %	≤ 0.5 %	≤ 0.5 %	≤ 2 %
at 532 nm	≤ 0.8 %	≤ 0.8 %	≤ 0.8 %	≤ 4 %
at 355 nm	≤ 2 %	≤ 2 %	≤ 2 %	
Long-term power drift ⁶⁾	± 2 %	± 2 %	± 2 %	± 2 %
Beam spatial profile	Super-Gaussian ⁷⁾	Super-Gaussian ⁷⁾	Super-Gaussian ⁷⁾	Super-Gaussian ⁷⁾
Beam diameter ⁸⁾	7 mm	15 mm	7 mm	12 mm
Beam pointing stability ⁹⁾	≤ 30 µrad	≤ 30 µrad	≤ 30 µrad	≤ 30 µrad
Beam divergence	≤ 0.7 mrad	≤ 0.5 mrad	≤ 0.7 mrad	≤ 0.5 mrad
Optical pulse jitter ¹⁰⁾	≤ 0.2 ns	≤ 0.2 ns	≤ 0.2 ns	≤ 0.2 ns
Polarization	Linear	Linear	Linear	Linear
PHYSICAL CHARACTERISTICS ¹¹⁾				
Laser head size (W×L×H mm)	600×1200×300	900×2000×300	600×1200×300	900×1800×300
Power supply size (W×L×H mm)	553×600×830	553×600×1230	553×600×830	553×600×1800
Umbilical length ¹²⁾	2.5 m	2.5 m	2.5 m	2.5 m
OPERATING REQUIREMENTS ¹³⁾				
Power requirements ¹⁴⁾	208, 380 or 400 V AC, three phases, 50/60 Hz			
Power consumption ¹⁵⁾	≤ 6 kW	≤ 20 kW	≤ 10 kW	≤ 10 kW
Water supply ¹⁵⁾	≤ 8 l/min, 2 Bar, max 20 °C	≤ 20 l/min, 2 Bar, max 20 °C	≤ 12 l/min, 2 Bar, max 20 °C	≤ 12 l/min, 2 Bar, max 20 °C
Operating ambient temperature	22 ± 2 °C	22 ± 2 °C	22 ± 2 °C	22 ± 2 °C
Storage ambient temperature	15 – 35 °C	15 – 35 °C	15 – 35 °C	15 – 35 °C
Relative humidity (non-condensing)	≤ 80 %	≤ 80 %	≤ 80 %	≤ 80 %
Cleanness of the room	ISO Class 7	ISO Class 7	ISO Class 7	ISO Class 7

¹⁾ Due to continuous improvement, all specifications are subject to change without notice. The parameters marked 'typical' are typical performance and vary with each unit we manufacture. These parameters can be customized to meet customers' requirements. All parameters measured at 1064 nm if not stated otherwise.

²⁾ Harmonic outputs are optional. Specifications are valid with the respective harmonic module purchased. Outputs are not simultaneous.

³⁾ Second harmonic specification is valid when only the SH option is ordered. If TH/FH options are ordered, second harmonic efficiency is reduced to ~50 %.

⁴⁾ Standard pulse duration is 5 ns. Other pulse durations can be ordered within the range of 0.2 – 500 ns. Output energy differs depending on duration.

⁵⁾ Under stable environmental conditions, normalized to average pulse energy (RMS, averaged from 60 s). Energy stability in burst mode depends on the temporal burst shape

⁶⁾ Measured after 30 min warm-up when the ambient temperature variation is less than ±2 °C during 8 hours.

⁷⁾ Super-Gaussian spatial mode of 6–11th order in near field.

⁸⁾ Beam diameter is measured at the laser output at the 1/e² level for Gaussian beams and the FWHM level for Super-Gaussian beams.

⁹⁾ Beam pointing stability is measured as the beam centroid movement in the focal plane of a focusing lens (RMS, averaged from 60 s).

¹⁰⁾ Optical pulse jitter with respect to electrical synchronization pulse outputs:
Trig out > 3.5 V @ 50 Ω.

¹¹⁾ System sizes are preliminary and depend on the customer's lab layout and options ordered.

¹²⁾ Longer umbilical with up to 5 m available upon request.

¹³⁾ The laser and auxiliary units must be settled in a place void of dust and aerosols. It is advisable to operate the laser in an air-conditioned room, provided that the laser is placed at a distance from air conditioning outlets. The laser should be positioned on a solid worktable. Access from one side should be ensured.

¹⁴⁾ Voltage fluctuations allowed are +10 % / -15 % from the nominal value.

¹⁵⁾ Power consumption and water supply requirements deviate depending on system configuration.



Note: The laser must be connected to the mains electricity at all times. If there will be no mains electricity for longer than 1 hour, then the laser (system) needs warm up for a few hours before switching on.

OPTIONS

Option	Description	Comment
- AWG	Arbitrary waveform generator	Temporal pulse shape control in 1 – 50 ns range by 125 ps step
- AW	Water-air cooling option	Replaces or supplements Water-to-Water cooling unit. Heat dissipation equals total power consumption
- External vacuum supply	External vacuum pump and tubing	
- Multiple channel option	Multiple outputs of same or different wavelength/energy	Up to 8 channels
- G	Gaussian like spatial beam profile	Reduces the output energy of fundamental by ~80 %

PERFORMANCE

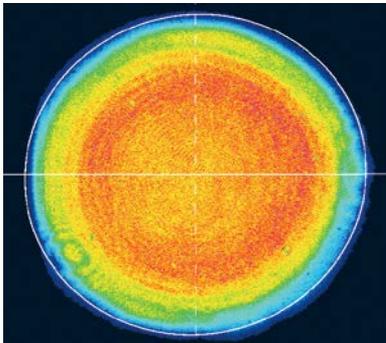


Fig 1. Typical NanoFlux DPSS system near field beam profile at 1064 nm

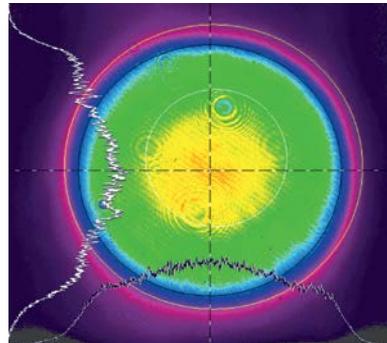


Fig 2. Typical NanoFlux DPSS system near field beam profile at 532 nm

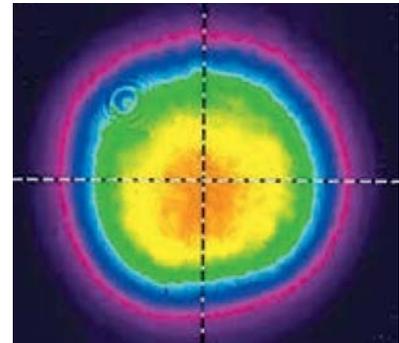


Fig 3. Typical NanoFlux DPSS system near field beam profile with Gaussian beam profile option purchased

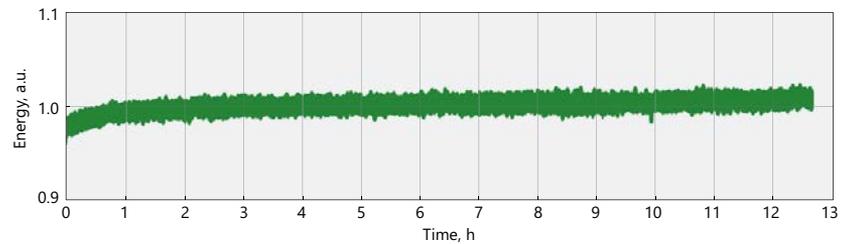


Fig 4. Typical long-term energy stability of High Power NanoFlux DPSS system

OUTLINE DRAWINGS

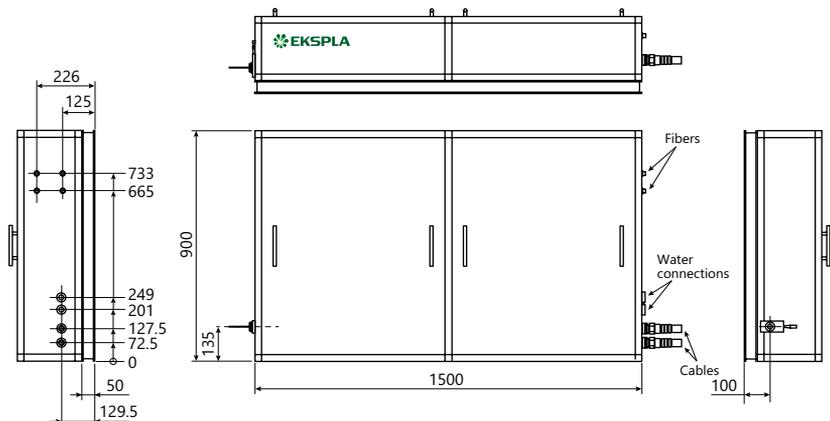


Fig 5. An example of NanoFlux DPSS system external dimensions

POWER SUPPLY

Cabinet	Usable height	Height H, mm	Width W, mm	Depth D, mm
MR-9	9 U	455.5 (519 ¹⁾)	553	600
MR-12	12 U	589 (653 ¹⁾)	553	600
MR-16	16 U	768 (832 ¹⁾)	553	600
MR-20	20 U	889 (952 ¹⁾)	553	600
MR-25	25 U	1167 (1231 ¹⁾)	553	600

¹⁾ Full height with wheels.

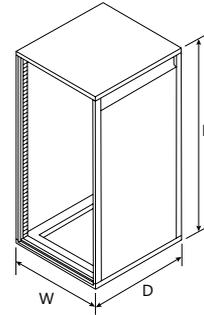


Fig 6. Typical NanoFlux laser system power supply dimensions (MR rack used depends on the laser model)

ORDERING INFORMATION

NanoFlux N(1)(2)-(3)

Energy level:
 200 → 200 mJ
 200 → 200 mJ
 2k → 2000 mJ
 5k → 5000 mJ

Any additional options:
 See 'Options' table

Pulse repetition rate:
 SS → Single Shot
 100 → 100 Hz
 1k → 1000 Hz