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 deliver high energy pulses at high repetition rates.

A diode-pumped Q-switched nanosecond laser, based on industry-tested technology is used as a master oscillator of the system. It produces high-intensity, high-brightness pulses and is well suited for further amplification in linear amplifiers for high-energy Super-Gaussian output pulses. Employing electro-optical cavity dumping, the master oscillator can produce pulses which are as short as several ns with 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.

Angle-tuned non-linear crystals harmonic generators mounted in temperature stabilized heaters are used for second and third harmonic generation. Harmonic separation system is designed to ensure high spectral purity of radiation and direct it to the output ports.

System control is available through control pad, USB and LAN interfaces (RS232 as optional). The system can be controlled from personal computer with supplied software for Windows operating system.

To tailor the laser for specific applications or requirements, various customization possibilities are available such as industrial grade, portable laser housing with integrated power supplies and cooling units; customer's seed integration; multi-channel outputs; burst amplification and various other.

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*

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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 indications of typical performance and will vary with each unit we manufacture. Presented parameters can be customized to meet customer's requirements. All parameters measured at 1064 nm if not stated otherwise.

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

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

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

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

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

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

8) Beam diameter is measured at signal output at $1/e^2$ level for Gaussian beams and FWHM level for Super-Gaussian beams.

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

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

11) System sizes are preliminary and depend on customer lab layout and additional options purchased.

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

13) The laser and auxiliary units must be settled in such a place void of dust and aerosols. It is advisable to operate the laser in 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 nominal value.

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

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

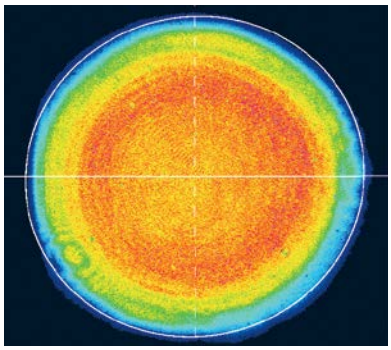

Fig 1. Typical NanoFlux DPSS system near field beam profile at 1064 nm

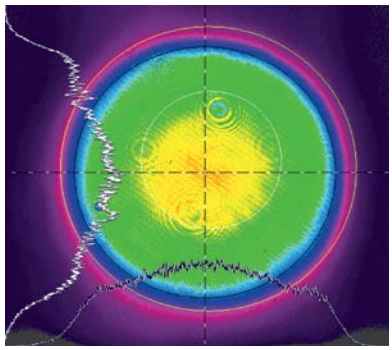

Fig 2. Typical NanoFlux DPSS system near field beam profile at 532 nm

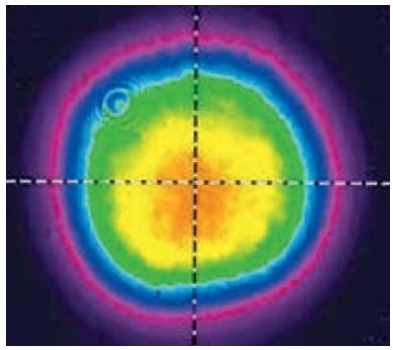

Fig 3. Typical NanoFlux DPSS system near field beam profile with Gaussian beam profile option purchased

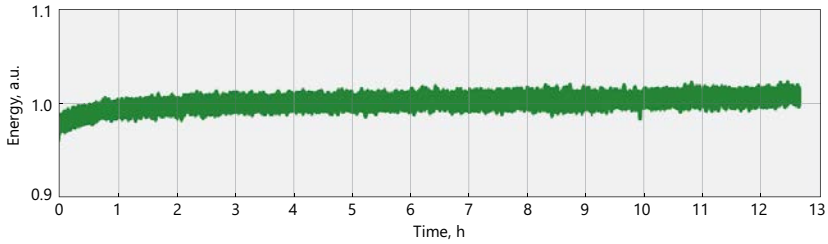

Fig 4. Typical long-term energy stability of High Power NanoFlux DPSS system

OUTLINE DRAWINGS

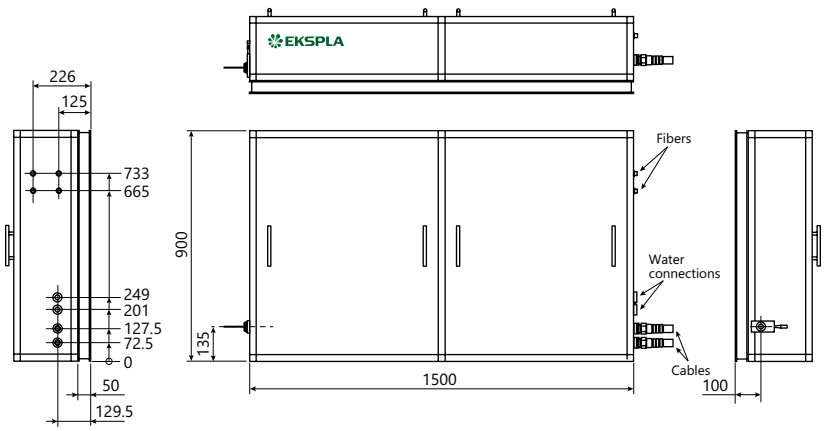

Fig 5. An example of NanoFlux DPSS system external dimensions

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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.

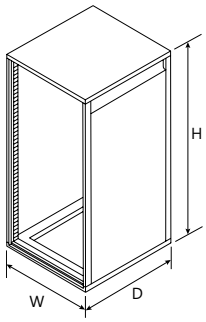

Fig 6. Typical NanoFlux laser system power supply dimensions (MR rack used depends on the laser model)

ORDERING INFORMATION

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

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

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

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

Any additional options:
See 'Options' table