High Energy Flash Lamp Pumped Picosecond Amplifiers

PicoFlux HE SERIES

APPLICATIONS

- *Time resolved spectroscopy*
- *SFG/SHG spectroscopy*
- *Nonlinear spectroscopy*
- *OPCPA pumping*
- *OPG/OPA pumping*
- *Remote laser sensing*
- *Satellite ranging*
- *Other spectroscopic and nonlinear optics applications...*

FEATURES

- ***Flash lamp pumped picosecond amplifiers***
- *Pulse energies up to **2.2 J***
- ***20 – 300 ps** pulse duration*
- ***10 Hz** pulse repetition rate*
- *Diode pumped regenerative amplifier*
- *Internal or external seeding source*
- *Advanced beam shaping for high pulse energy*
- *Thermally induced birefringence compensated design*
- *Less than **10 ps RMS** jitter synchronization pulses for streak camera triggering*
- *Control through USB and LAN interfaces with supplied Windows control software (RS232 optional)*
- *Vacuum image relay system*
- *Optional temperature stabilized second, third and fourth harmonic generators*
- *Optional extremely precise synchronization to external RF signal with PLL option*
- *Optional Gaussian like spatial beam profile with Gaussian fit > 85% in near field*
- *Optional reduced pulse duration to 20 ps*

High energy PicoFlux series amplifiers are designed to produce high energy picosecond pulses at 1064 nm. High pulse energy, excellent pulse-to-pulse energy stability, superior beam quality makes these amplifiers well suited for applications like OPCPA pumping, non-linear optics and others.

Regenerative amplifier / Power amplifier design

PicoFlux series amplifiers are designed to be seeded by external seeding source. Diode pumped regenerative amplifier ensures amplification of seed signal to stable mJ level pulse for amplification in linear amplifiers. Advanced beam shaping ensures smooth, without hot spots beam spatial profile at the laser output. Low light depolarization level allows high efficiency generation of up to 4th harmonic with optional build-in harmonic generators.
Alternatively Ekspla can offer an internal seeder meeting customer's requirements.

Build-in harmonic generators

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

Simple and convenient laser control

For customer convenience the amplifier can be controlled through USB and LAN interfaces (RS232 as optional). The amplifier can be controlled from personal computer with supplied software for Windows operating system.

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SPECIFICATIONS

Model	P30010	P60010	P1k10	P2k10
MAIN SPECIFICATIONS [1]				
Output energy				
Fundamental	300 mJ	600 mJ	1 000 mJ	2 200 mJ [2] [3]
SH output [4] [5]	200 mJ	400 mJ	650 mJ	1 400 mJ
TH output [4]	90 mJ	180 mJ	300 mJ	660 mJ
FH output [4]	30 mJ	60 mJ	100 mJ	220 mJ
Pulse repetition rate	10 Hz	10 Hz	10 Hz	10 Hz
Pulse duration [6]	90 ± 10 ps	90 ± 10 ps	90 ± 10 ps	90 ± 10 ps
Pulse energy stability [7]				
Fundamental	≤ 0.6 %	≤ 0.6 %	≤ 0.6 %	≤ 0.6 %
SH output [4]	≤ 0.8 %	≤ 0.8 %	≤ 0.8 %	≤ 0.8 %
TH output [4]	≤ 2 %	≤ 2 %	≤ 2 %	≤ 2 %
FH output [4]	≤ 3 %	≤ 3 %	≤ 3 %	≤ 3 %
Long-term power drift [8]	± 2 %	± 2 %	± 2 %	± 2 %
Beam spatial profile	Super-Gaussian [9]	Super-Gaussian [9]	Super-Gaussian [9]	Super-Gaussian [9]
Beam diameter [10]	9 mm	~11 mm	~17 mm	~23 mm
Beam pointing stability [11]	≤ 30 µrad	≤ 30 µrad	≤ 30 µrad	≤ 30 µrad
Beam divergence	≤ 0.5 mrad	≤ 0.5 mrad	≤ 0.5 mrad	≤ 0.5 mrad
Pre-pulse contrast [12]	> 200:1	> 200:1	> 200:1	> 200:1
Optical pulse jitter [13]				
Trig out	≤ 100 ps	≤ 100 ps	≤ 100 ps	≤ 100 ps
Pre-Trig out	≤ 50 ps	≤ 50 ps	≤ 50 ps	≤ 50 ps
With –PLL option	≤ 2 ps	≤ 2 ps	≤ 2 ps	≤ 2 ps
Polarization	Linear	Linear	Linear	Linear
PHYSICAL CHARACTERISTICS [14]				
Laser head size (W×L×H mm)	600 × 1200 × 300	600 × 1500 × 300	600 × 1800 × 300	900 × 1800 × 300
Power supply size (W×L×H mm)	553 × 600 × 650	553 × 600 × 830	553 × 600 × 1230	553 × 600 × 1230
Umbilical length [15]	2.5 m	2.5 m	2.5 m	2.5 m
OPERATING REQUIREMENTS [16]				
Electrical power	200 – 240 V AC, single-phase, 47 – 63 Hz	200 – 240 V AC, single-phase, 47 – 63 Hz	208, 380 or 400 V AC, three-phase, 50/60 Hz [17]	208, 380 or 400 V AC, three-phase, 50/60 Hz [17]
Power consumption [18]	≤ 2 kVA	≤ 2.5 kVA	≤ 4.5 kVA	≤ 7 kVA
Water supply	≤ 3 l/min, 2 Bar, max 20 °C	≤ 6 l/min, 2 Bar, max 20 °C	≤ 12 l/min, 2 Bar, max 20 °C	≤ 14 l/min, 2 Bar, max 15 °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) 2 200 mJ energy is achieved with Super-Gaussian spatial beam profile of 11th or higher order (with steep edges). If lower order Super-Gaussian is required maximum pulse energy will be limited to 2 000 mJ.

3) 2 500 mJ output energy is available upon request with longer pulse duration.

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

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

6) Standard pulse duration is 90 ps. Other pulse durations can be ordered within range of 20 ps – 300 ps. Shortening the pulse duration below 90 ps will reduce the output energy proportionally.

7) Under stable environmental conditions, normalized to average pulse energy (RMS, averaged from 60 s).

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

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

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

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

[12] 1000:1 contrast available upon request.

[13] Optical pulse jitter with respect to electrical outputs:
– Trig out > 3.5 V @ 50 Ω
– Pre-Trig out > 1 V @ 50 Ω
– PLL option > 1 V @ 50 Ω

[14] System sizes are preliminary and depend on customer lab layout and additional options purchased.

[15] Longer umbilical with up to 10 m available upon request.

[16] 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.

[17] Voltage fluctuations allowed are +10 % / -15 % from nominal value.

[18] Required current rating can be calculated by dividing power rating by mains voltage. Power rating is given in apparent power (kVA) for systems with flash lamp power supplies and in real power (kW) for systems without flash lamp power supplies where reactive power is neglectable.

OPTIONS

Option	Description	Comment
-P20...300	Custom pulse duration between 20 ps and 300 ps	Available with internal and external seeder. Shortening the pulse duration below 90 ps will reduce the output energy proportionally
-G	Gaussian like spatial beam profile	Reduces the output energy of fundamental by ~80 %
-FS	External seeder input via motorized spectral broadening stage	Requires > 1.5 nJ per pulse @ 800 nm, ≤ 100 fs
-PLL	Phase Lock Loop option for precise lock to external RF signal	Electrical to optical signal jitter ≤ 3 ps
-SH/TH/FH	Second, third and fourth harmonic outputs	Conversion efficiency from fundamental respectively ~50 %, ~30 % and ~10 %. Harmonic outputs not simultaneous with fundamental output
-AW	Water-to-Air cooling	Replaces or supplements Water-to-Water cooling unit. Heat dissipation equals total power consumption

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.

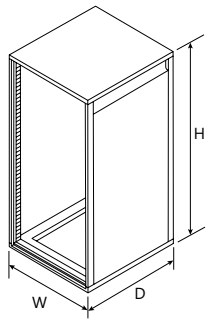

Fig 1. Typical PicoFlux laser system power supply dimensions (MR rack used depends on the laser model)

Fig 2. Integrated multi-channel high energy PicoFlux pump lasers into OPCPA

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PERFORMANCE

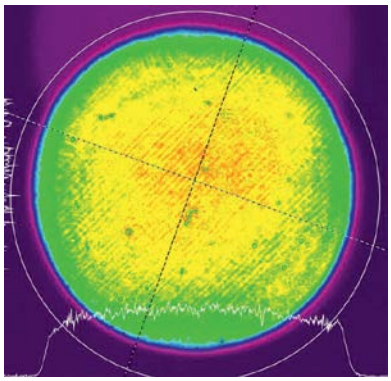

Fig 3. Typical High Energy PicoFlux amplifier system near field beam profile at 1064 nm (imaged from laser output)

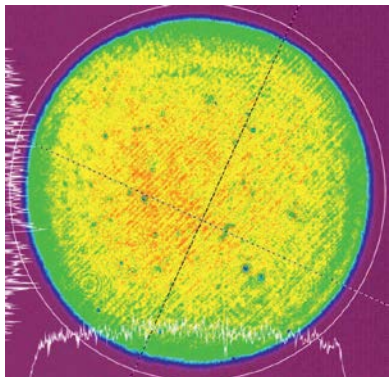

Fig 4. Typical High Energy PicoFlux amplifier system near field beam profile at 532 nm (imaged from SH crystal)

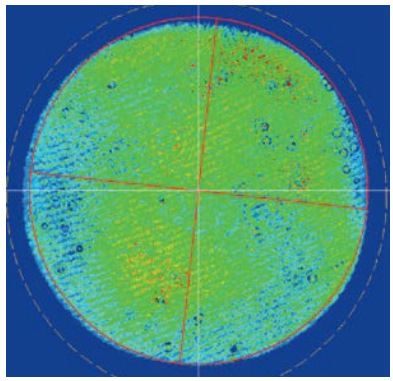

Fig 5. Typical High Energy PicoFlux amplifier system near field beam profile at 355 nm (imaged from TH crystal)

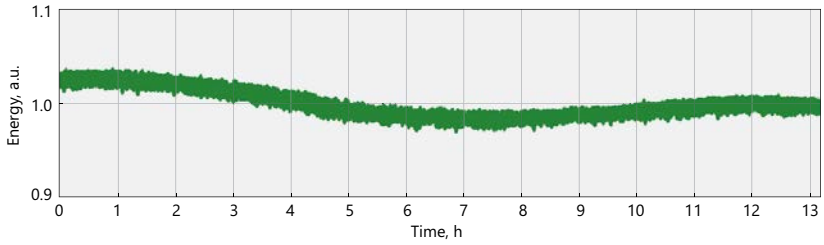

Fig 6. Typical long-term energy stability of High Energy PicoFlux system

OUTLINE DRAWINGS

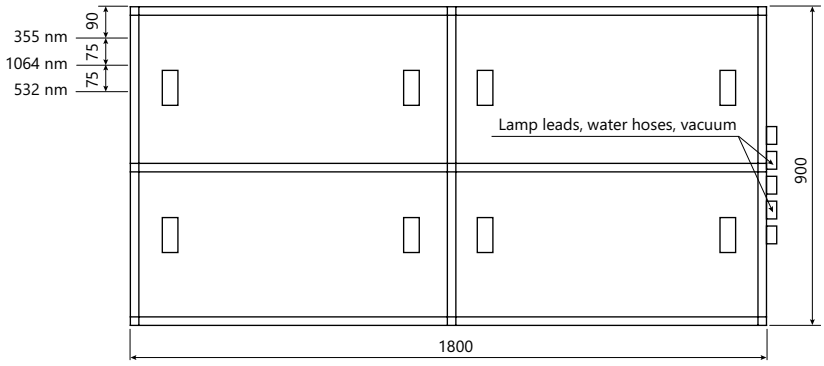

Fig 7. Typical PicoFlux P2k10 laser system external dimensions

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.

PicoFlux P(1)(2)-(3)

Energy level:
300 → 300 mJ
600 → 600 mJ
1k → 1000 mJ
2k → 2200 mJ

Pulse repetition rate:
SS → Single Shot
5 → 5 Hz
10 → 10 Hz

Any additional options:
See 'Options' table