

# FemtoLux 30



## INNOVATIVE “DRY” COOLING SYSTEM

The FemtoLux 30 laser employs an innovative cooling system and sets new reliability standards among industrial femtosecond lasers. No additional bulky and heavy water chiller is needed.

The chiller requires periodic maintenance – cooling system draining and rinsing and water and particle filter replacement. Moreover, water leakage can cause damage to the laser head and other equipment. Instead of using water for transferring heat from a laser head, the FemtoLux 30 laser uses an innovative Direct Refrigerant Cooling method.

The refrigerant agent circulates from a PSU-integrated compressor and condenser, to a cooling plate via armored flexible lines.

The entire cooling circuit is permanently hermetically sealed and requires no maintenance.

## SIMPLE & RELIABLE COOLING PLATE ATTACHMENT

The cooling plate is detachable from the laser head for more convenient laser installation.

The laser cooling equipment is integrated with the laser power supply unit into a single 4U rack-mounted housing with a total weight of 15 kg.

## PERFECT AND VERSATILE TOOL FOR MICROMACHINING

The FemtoLux 30 femtosecond laser has a tunable pulse duration from <350 fs to 1 ps and can operate in a broad AOM controlled range of pulse repetition rates from a single shot to 4 MHz.

The maximum pulse energy is more than 90  $\mu\text{J}$  operating with single pulses and can reach 250  $\mu\text{J}$  in burst mode, ensuring higher ablation rates and processing throughput for different materials.

The FemtoLux 30 beam parameters will meet the requirements of the most demanding materials and micro-machining applications.

Innovative laser control electronics ensure simple control of the FemtoLux 30 laser by external controllers that could run on different platforms, be it Windows, Linux or others using REST API commands.

This makes easy integration and reduces the time and human resources required to integrate this laser into any laser micromachining equipment.

## Femtosecond Industrial Lasers

### FEATURES

- ▶ 30 W typical max output power
- ▶ > 90  $\mu\text{J}$  max pulse energy
- ▶ > 250  $\mu\text{J}$  in a burst mode
- ▶ < 350 fs – 1 ps
- ▶ Single shot to 4 MHz (AOM controlled)
- ▶ <0.5% RMS power long term stability over 100 hours
- ▶  $M^2 < 1.2$
- ▶ Beam circularity > 0.85
- ▶ Zero maintenance
- ▶ Dry cooling (no water used)
- ▶ PSU and cooling unit integrated into single 4U rack housing
- ▶ Easy and quick installation
- ▶ Compatible with galvo and Polygon scanners as well as PSO controllers
- ▶ 2 years of total warranty

### APPLICATIONS

- ▶ LCD, LED, OLED drilling, cutting and repair
- ▶ Microelectronics manufacturing
- ▶ Glass, sapphire and ceramics micro processing
- ▶ Glass intra volume structuring
- ▶ Micro processing of different polymers and metals

SPECIFICATIONS <sup>1)</sup>

Model	FemtoLux 30
<b>MAIN SPECIFICATIONS</b>	
Wavelength	1030 nm
Pulse Repetition Rate (PRR) <sup>2)</sup>	200 kHz – 4 MHz
Pulse repetition frequency (PRF) after frequency divider	PRF = PRR / N, N=1, 2, 3, ... , 65000; single shot
Maximal average output power	> 27 W (typical 30 W)
Maximal pulse energy	> 90 µJ
Maximal total energy in a burst mode <sup>3)</sup>	> 250 µJ
Power long term stability (Std. dev.) <sup>4)</sup>	< 0.5 %
Pulse energy stability (Std. dev.) <sup>5)</sup>	< 1 %
Pulse duration (FWHM)	Tunable, < 350 fs <sup>6)</sup> – 1 ps
Beam quality	M <sup>2</sup> < 1.2 (typical < 1.1)
Beam circularity, far field	> 0.85
Beam divergence (full angle)	< 1 mrad
Beam pointing thermal stability	< 20 µrad/°C
Triggering mode	internal / external
Pulse output control	frequency divider, pulse picker, burst mode, packet triggering, power attenuation
Control interfaces	USB / RS232 / LAN
Length of the umbilical cord	3 m, detachable
Laser head cooling type	dry (direct refrigerant cooling through detachable cooling plate)
<b>PHYSICAL CHARACTERISTICS</b>	
Laser head (W × L × H)	429 × 569 × 130 mm
Power supply unit (W × L × H)	449 × 376 × 177 mm
<b>OPERATING REQUIREMENTS</b>	
Mains requirements	100 – 240 V AC, single phase, 50/60 Hz
Operating ambient temperature	18 – 27 °C
Relative humidity	10–80 % (non-condensing)
Air contamination level	ISO 9 (room air) or better

<sup>1)</sup> Due to continuous improvement, all specifications are subject to change without notice. Parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture. All parameters are specified for a shortest pulse duration.

<sup>2)</sup> When frequency divider is set to transmit every pulse. Fully controllable by integrated AOM.

<sup>3)</sup> When number of pulses within a burst is set to 10 and PRR is set to a minimum value. Separation between pulses within a burst - ~20 ns.

<sup>4)</sup> Over 100 h after warm-up under constant environmental conditions.

<sup>5)</sup> Under constant environmental conditions.

<sup>6)</sup> At PRR > 500 kHz. At PRR < 500 kHz shortest pulse duration is < 400 fs.



## SEAMLESS USER EXPERIENCE

## ► Easy integration.

Remote control using REST API commands via USB, RS232 and LAN

## ► Reduced integration time.

Demo electronics is available for laser control programming in advance

## ► Easy and quick installation.

No water, fully disconnected laser head. Can be installed by the end-user.

## ► Easy troubleshooting.

Integrated detectors and constant system status logging.

## ► No periodic maintenance required

PERFORMANCE

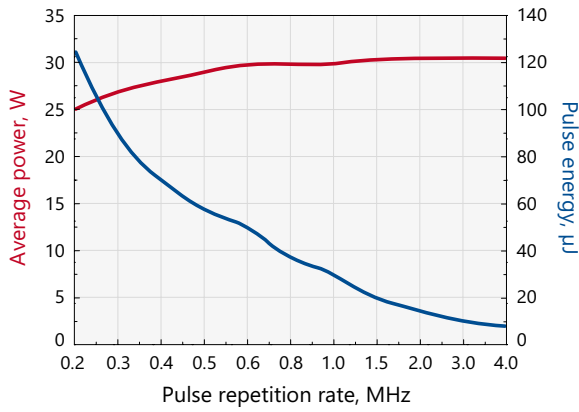


Fig 1. Typical dependence of output power and pulse energy of FemtoLux 30 laser on pulse repetition rate

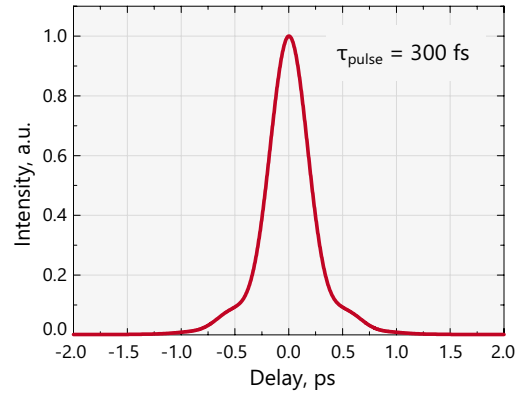


Fig 2. Typical FemtoLux 30 laser (at 1030 nm) output pulse autocorrelation function

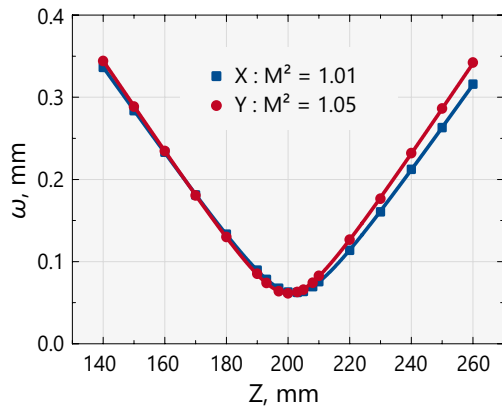


Fig 3. Typical  $M^2$  measurement of FemtoLux 30 laser at 1030 nm

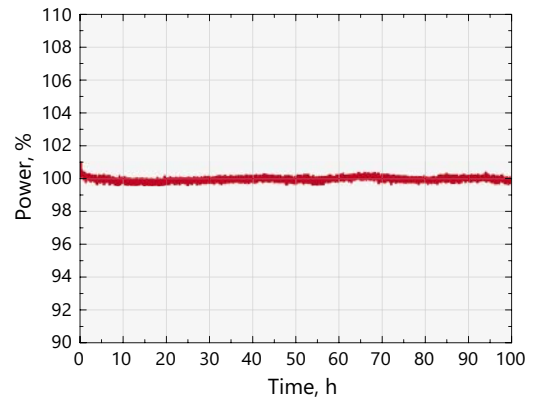


Fig 4. Typical long term average power stability of FemtoLux 30 laser at 1030 nm under constant environmental conditions

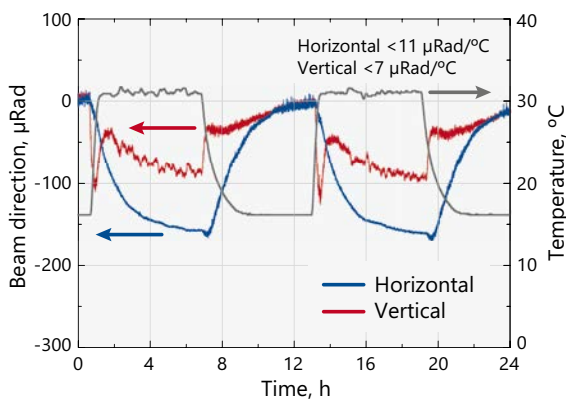


Fig 5. Typical beam direction stability of FemtoLux 30 laser under harsh environmental conditions

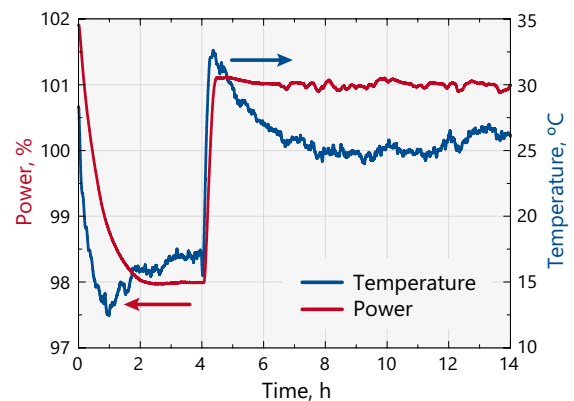
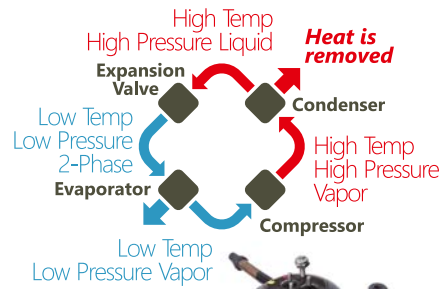


Fig 6. Average output power dependence of FemtoLux 30 laser on ambient temperature at 1030 nm

DIRECT REFRIGERANT COOLING SYSTEM

FEATURES

- ▶ Military-grade reliability
- ▶ Permanently hermetically sealed system >90,000 hour MTBF
- ▶ No maintenance
- ▶ High cooling efficiency
- ▶ >45% lower power consumption compared to water cooling equipment
- ▶ Compact and light



Compressor picture courtesy of Aspen Systems Inc.



Simple and reliable cooling plate attachment

DRAWINGS

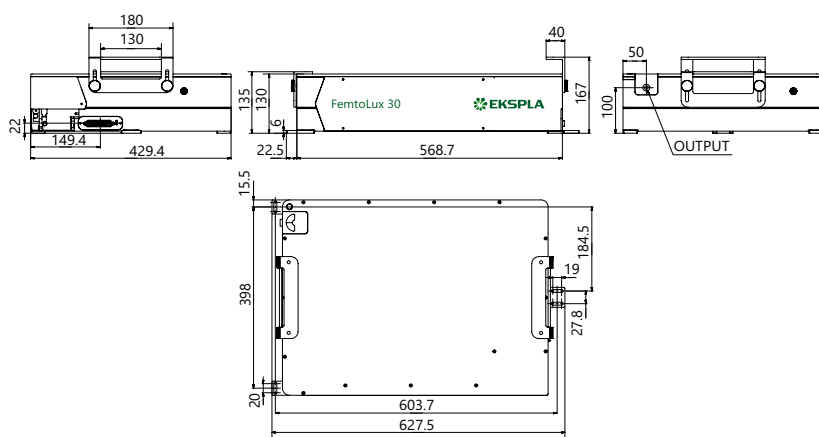


Fig 7. FemtoLux 30 laser head outline drawing

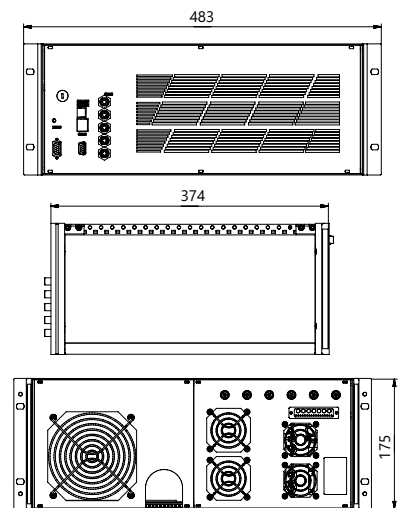


Fig 8. Power supply outline drawing