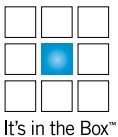


IceFyre™

VERSATILE GAME-CHANGING PICOSECOND LASER FOR PRECISION MICROMACHINING

The IceFyre Advantage

- Industry-leading cost-performance
- TimeShift ps technology
 - Adjustable number of pulses in burst
 - Programmable burst shape (envelope of burst)
 - Adjustable burst mode pulse separation
 - Full power available with burst mode adjustments
- Adjustable repetition rate, single shot to 10 MHz
- Lowest jitter
 - Pulse-on-demand (internal / external triggering)
 - Lowest variability in pulse timing
- Most compact, It's in the Box™ laser
- 24/7 industrial reliability



Applications

- Glass and sapphire cutting and drilling
- Semiconductor scribing and dicing
- PCB processing
- Ceramic cutting, drilling and scribing
- Solar cell scribing and drilling
- LED scribing, dicing and patterning
- Metal cutting, drilling and marking
- Medical device cutting, drilling and marking

IceFyre redefines picosecond micromachining lasers with a patent-pending design to achieve exceptional performance and unprecedented versatility at industry-leading cost performance. Based on Spectra-Physics' *It's in the Box™* design, IceFyre integrates laser and controller into the industry's smallest package.

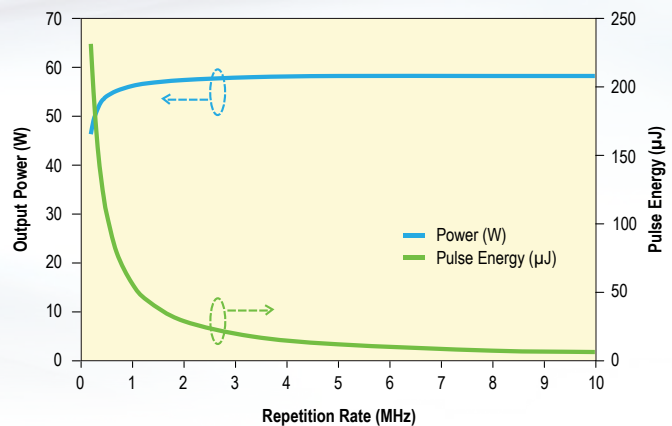
Unprecedented Versatility and Exceptional Performance

IceFyre's unique design exploits fiber laser flexibility and Spectra-Physics' exclusive power amplifier capability to enable TimeShift™ ps programmable burst-mode technology and wide adjustability of repetition rates. A standard set of waveforms is provided with each laser; an optional TimeShift ps GUI is available for creating custom waveforms. The laser provides pulse-on-demand triggering with the lowest jitter in its class for high quality processing at high scan speeds, e.g. when using a polygon scanner.

24/7 Industrial Reliability

IceFyre is designed, built, and tested to stringent quality standards for reliable continuous operation in demanding 24/7 manufacturing environments. IceFyre lasers' automatic data logging software monitors all key laser performance parameters over the life of the laser, providing a powerful service/preventative maintenance diagnostics feature and product reliability tool. A customer version of this software is also available.

IceFyre Typical Average Power¹



1. Typically measured performance without optional AOM, not a guaranteed or warranted specification.

Specifications^{1, 2, 6}

IceFyre 1064-50	
Output Characteristics	
Wavelength	1064 nm
Power ^{2, 3}	>50 W
Maximum Pulse Energy, typical	>200 μ J single pulse at 200 kHz (greater pulse energy per burst possible with TimeShift ps)
Repetition Rate Range	Single shot to 10 MHz
Pulse Width, FWHM ²	<20 ps
TimeShift™ ps	yes
Pulse-to-Pulse Energy Stability ²	<1.5% rms
Power Stability (after warm-up) ²	<1%, 1 σ over 8 hours
Beam Characteristics	
Spatial Mode ²	TEM ₀₀ (M ² <1.3)
Polarization	>100:1, vertical
Beam Diameter (D4 σ) ²	3.0 \pm 0.3 mm
Beam Divergence, full angle ²	<0.75 mrad
Beam Asymmetry ²	<1.0 \pm 10%
Boresight Tolerance ²	\pm 0.5 mm, \pm 5 mrad
Beam Pointing Stability ²	< \pm 25 μ rad / °C
Operating Conditions	
Warm-up Time, typical	<20 min from standby mode, <60 min from cold start
Temperature Range	15–30°C
Altitude	0–3000 m
Humidity	10–80% non-condensing
Storage Conditions	
Temperature Range	0–50°C
Altitude	0–10,000 m
Humidity	10–80% non-condensing
Electrical and Chiller Requirements	
Water Temperature (laser inlet)	20 \pm 1°C, stable to \pm 0.5 °C
Water Flow Rate (at laser head)	1.8 GPM (6.8 LPM)
AC Input	100–240 VAC, 12 A 50/60 Hz, single phase
Heat Load (at laser head)	<800 W (600 W typical)
Heat Load (at power supply)	<200 W
Total Power Consumption	<1000 W
Physical Characteristics⁵	
Laser Dimensions (L x W x H) ⁴	29.50 x 12.13 x 7.50 in (749.5 x 308.0 x 190.6 mm)
Laser Weight	95 lbs (43 kg)
Features	
RoHS 2 Compliant	Product compliance with restriction of hazardous substances
Internal Power Monitor	May be calibrated against an external power meter
IR Alignment Beam Mode	Lower power IR beam for installation and alignment in a tool (requires optional AOM)
Sacrificial Output Window	Customer replaceable to maintain power in harsh environments
Data Log (includes customer version as well)	Long and short term recording for diagnostics and equipment maintenance
Optional Safety Shutter	Externally mounted for easy field service and customer replaceable
Optional AOM	Provides power attenuation at constant power, used with trigger, gate and pulse on demand, use as a process shutter
Optional Timeshift ps GUI	Enables waveform customization

1. Due to our continuous product improvement program, specifications may change without notice.

2. Specifications are at 400 kHz with the diode current set to achieve >50 W, unless otherwise noted.

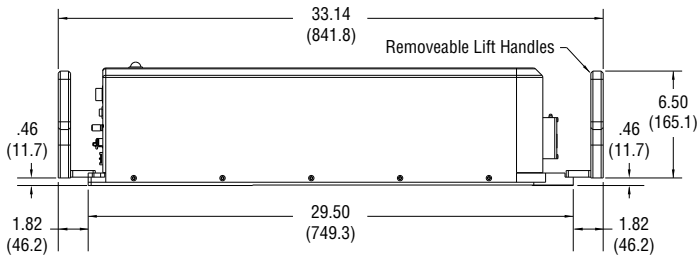
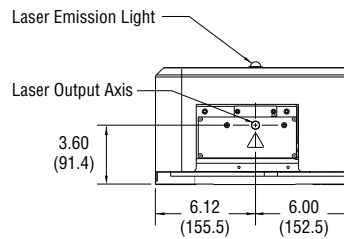
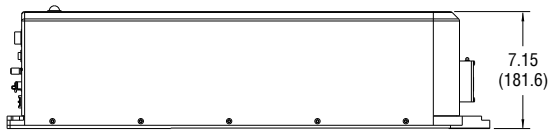
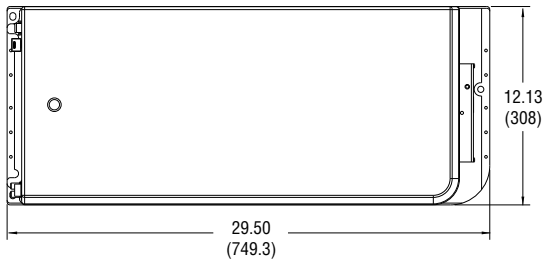
3. Power shown is without AOM.

4. Dimensions noted do not include the removable lift handles.

5. AC to DC converter module included with standard system.

6. IceFyre is a Class IV – High-Power Laser, whose beam is, by definition, a safety and fire hazard. Take precautions to prevent exposure to direct and reflected beams. Diffuse as well as specular reflections can cause severe skin or eye damage.

IceFyre Laser Dimensions¹



Side view with removable service handles

Dimensions in inch (mm)

1. AC to DC converter module not shown.