

IceFyre® FS

Breakthrough High-Power UV and IR Femtosecond Lasers for 24/7 Micromachining of Critical Materials

 mks | Spectra-Physics

The IceFyre FS family is an extraordinary leap forward in industrial femtosecond laser technology, delivering industry-leading performance, versatility, reliability, and cost-of-ownership. The IceFyre FS femtosecond lasers are ideal for high throughput, highest-quality micromachining of critical materials, including glass, polymers, metals, semiconductors, thin films, and composites for demanding consumer electronics, clean energy, medical device, and industrial applications. Based on Spectra-Physics' *It's in the Box™* design, IceFyre FS integrates laser and control electronics in a single, easy-to-install package.

IceFyre FS UV50 is the highest-performing UV femtosecond laser on the market, providing >50 W of UV output power, >50 μ J pulse energy, and pulse widths of <500 fs at high repetition rates up to 3 MHz. IceFyre FS IR200 delivers high average power (>200 W) and high pulse energy (>200 μ J) with a wide repetition-rate range from a single shot to 50 MHz in the infrared. High average power (>200 W) and high pulse energy (>200 μ J)

combined with high repetition rates up to 50 MHz push femtosecond micromachining applications to the highest levels of throughput at the lowest cost-of-ownership.

The IceFyre FS platform delivers exceptional versatility for optimal process performance. It offers flexible burst-mode operation with adjustable repetition rates, pulse-on-demand (POD) and position-synchronized output (PSO) triggering, and TimeShift™ programmable pulse capability for flexible burst-mode operation.

Building on MKS' deep experience and technology, the patent-pending IceFyre FS lasers pass extensive environmental qualification testing to ensure high reliability and a low cost-of-ownership. Fully automated and computer controlled, the laser exhibits exceptional stability in power, beam parameters, and beam pointing during 24/7 operation to deliver high precision and reproducibility for demanding applications.

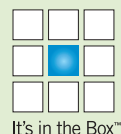
The IceFyre FS Advantage

- Highest average power of up to >50 W UV and >200 W IR
- Ultrashort femtosecond pulses for highest quality micromachining
- TimeShift programmable burst-mode capability for highest ablation efficiency
- Wide repetition-rate range
- POD and PSO triggering for precise pulse control
- Identical form-factor for IceFyre FS family
- Industry-leading cost-performance
- Compact *It's in the Box* laser
- 24/7 industrial reliability



Applications

- Glass Processing
- OLED, AR/VR and micro LED Displays Processing
- Solar/PV Scribing and Drilling
- 5G PCB Cutting and Drilling
- Medical Device Processing
- Wafer Scribing and Dicing
- Ceramics Processing
- Fine Metal Processing
- Polymer Cutting



IceFyre FS UV50 and IR200 Specifications^{1,2}

	IceFyre FS UV50	IceFyre FS IR200
Output Characteristics		
Wavelength	343 ±2 nm	1030 ± 6 nm
Power	>50 W @ 1 MHz and 1.25 MHz	>200 W @ 1-50 MHz
Maximum Pulse Energy	>50 µJ @ 1 MHz	>200 µJ @ 1 MHz
Repetition Rate Range	Single shot to 3 MHz	Single shot to 50 MHz
Pulse Width, FWHM	<500 fs	
Pulse-to-Pulse Energy Stability	<2% rms	
Power Stability (after warm-up)	<1% rms over 8 hours	
Spatial Mode	TEM ₀₀ (M ² <1.3)	
Polarization	>100:1, vertical	
Beam Diameter at Exit	5.0 mm ±0.5 mm	4.0 mm ±0.5 mm
Beam Divergence, full angle	<0.20 mrad	<1.0 mrad
Beam Pointing Stability	<±25 µrad/°C	
PSO Capability (Position Synchronized Output)	Yes	
Pulse-on-Demand Triggering (internal and external)	Yes	
TimeShift Programmable Burst Mode	Yes	
Operating Conditions³		
Warm-up Time, typical	<30 min from warm start mode, <60 min from cold start	
Temperature Range	18 to 35°C	
Altitude	0–2000 m	
Relative Humidity, non-condensing	0–65% non-condensing, dew point <19°C	
Non-Operating Storage Conditions³		
Temperature Range	0–50°C	
Altitude	0–2,000 m	
Relative Humidity, non-condensing	0–90% non-condensing, dew point <22°C	
Physical Characteristics⁴		
Dimensions (Laser) (L x W x H) ⁵	35.67 x 17.05 x 6.89 in (906 x 433 x 175 mm)	
Weight (Laser)	150 lbs (68 kg)	
Dimensions (Utility Module) (L x W x H)	17.99 x 18.98 x 3.96 in (457.1 x 482.1 x 100.7 mm)	
Weight (Utility Module)	24.25 lbs. (11 kg)	
Features		
EU RoHS 2 Compliant, China RoHS 2, CE Compliant	Product compliant with restriction of hazardous substances	
Internal Power Monitor	Yes	
Replaceable Output Window	Yes, customer and field replaceable	
Optional Safety Shutter	Externally mounted for easy field service	
Replaceable Active Laser Purge System (ALPS)	Yes	
Replaceable Head Desiccant	Yes	
Data Log	Long and short term recording for diagnostics and equipment maintenance	

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

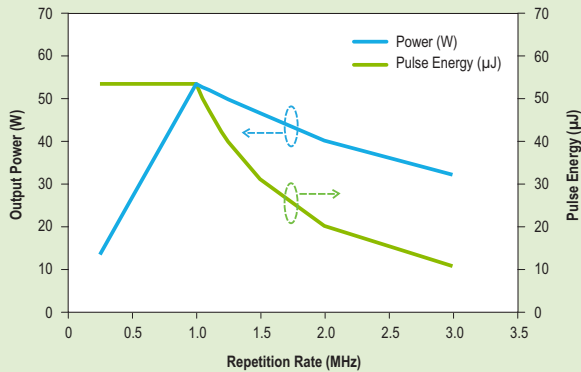
2. IceFyre FS is a Class IV - High-Power Laser, whose beam is, by definition, a safety and fire hazard. Take precautions to prevent exposure to the direct and reflected beams. Diffuse as well as specular reflections can cause severe skin or eye damage.

3. High temperature, high humidity operation limited to dew point <19°C; high temperature, high humidity storage limited to dew point <22°C.

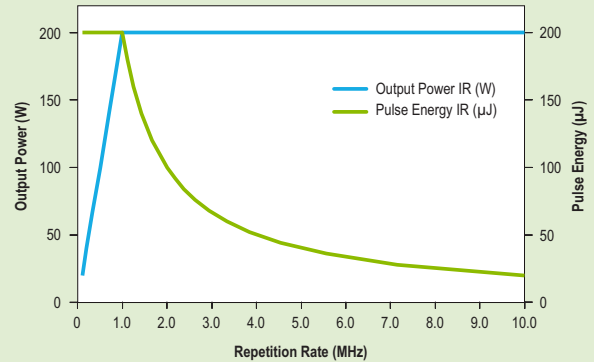
4. AC to DC converter module included with standard system.

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

IceFyre FS UV50 Typical Power and Pulse Energy¹

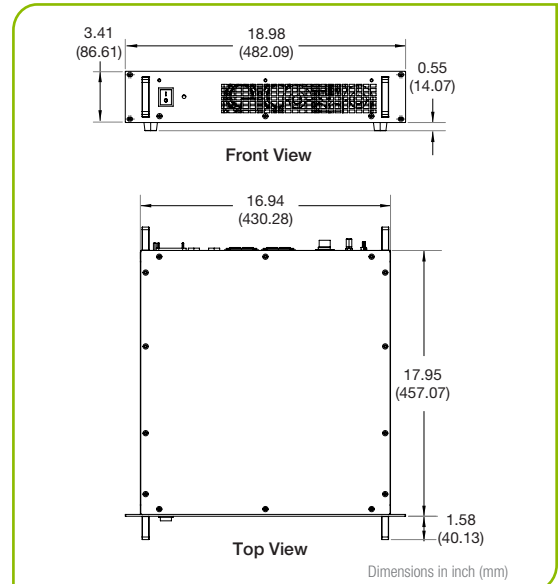
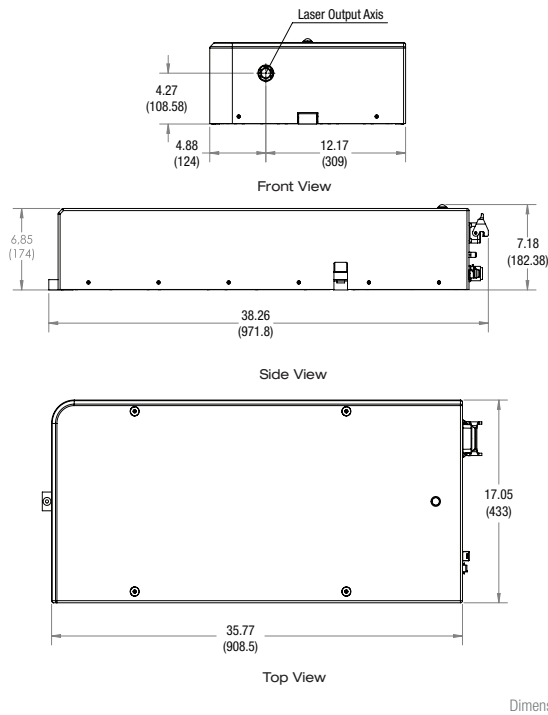


IceFyre FS IR200 Typical Power and Pulse Energy^{1,2}



1. Typically measured performance, not a guaranteed or warranted specification.
 2. IceFyre FS IR200 provides >200 W at repetition rates between 1 and 50 MHz

IceFyre FS Dimensional Drawing



Utility Module Dimensions

IceFyre FS Laser Dimensions



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