

# High-Speed Dual-Comb Lasers

Gigahertz repetition rate modelocked laser pairs

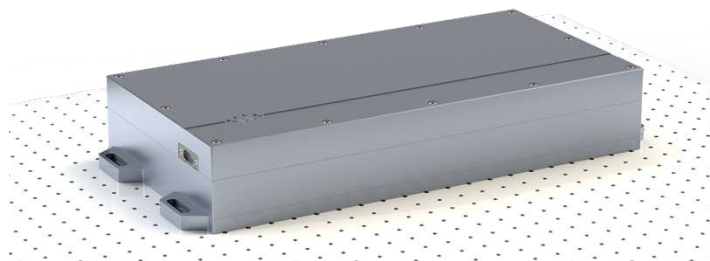


Ideal tool for spectroscopy,  
ranging, and optical  
sampling applications

**>100 mW** or **>2 W** per comb

**1 GHz** repetition rate

**<80 fs** pulse duration



1 nanosecond optical  
delay sweep

Measurement update  
rates up to 100 kHz

Ultra-low RIN  
and timing noise

The system produces a pair of modelocked femtosecond lasers (optical frequency combs) with a slightly different pulse repetition rate. In the time domain, the optical delay is rapidly swept through a range of 1 nanosecond at speeds of up to 100 kHz. In the frequency domain, beat notes between each pair of optical comb lines are generated via heterodyne detection. Due to the gigahertz repetition rate, high power per comb line is obtained. Through a novel shared-cavity

architecture, our system is able to achieve ultra-low noise simply in free-running operation. In particular, the laser pair is passively stable with highly correlated intensity, timing, and phase noise properties between the two combs. Since there is only one laser cavity and no high-speed locking electronics or optical amplification, most of the complexity of conventional dual-comb and ASOPS systems is removed, while providing a small footprint and superior performance.

## Options

- Second harmonic generation
- Spectral broadening
- Wavelength conversion to the IR / mid-IR
- High power 80 MHz version

## Applications

- THz time-domain spectroscopy
- Pump-probe measurements
- Dual-comb spectroscopy
- Absolute distance sensing / LIDAR



## Laser specifications

	Low power version (passively cooled)	High power version (actively cooled)
Power per comb	>100 mW	>2 W
Pulse duration	<100 fs	<100 fs
Repetition rate	1 GHz (inquire for options)	
Pulse energy	>100 pJ	>2 nJ
Center wavelength	1050 +/- 10 nm	
Beam quality factor $M^2$	<1.1	
Beam diameters, $1/e^2$	1.0 x 1.0 mm <sup>2</sup> (inquire for options)	
Individual comb RIN	<-160 dBc/Hz for frequencies >500 kHz	
Repetition rate difference range	+/- 100 kHz	

## Available outputs

Optical	Two spatially separated pulse trains
Pulse timing signals	$f_{rep,1}$ and $f_{rep,2}$ 5 GHz bandwidth electronic pulses
Analog cross-correlation signal	$\Delta f_{rep}$ signal pulse with >80 MHz analog bandwidth
Digital signals	Digital $\Delta f_{rep}$ values with better than $10^{-6}$ precision

## Controls

Pump power	Digital control (analog available upon request)
Repetition rate difference	
Repetition rate	

## Physical properties

	Low power version (passively cooled)	High power version (actively cooled)
Laser head (L x W x H)	500 x 250 x 90 mm <sup>3</sup>	500 x 250 x 90 mm <sup>3</sup>
Power supply (L x W x H)	483 x 343 x 150 mm <sup>3</sup> or smaller	483 x 343 x 150 mm <sup>3</sup> or smaller
Cooling	Passively cooled	Water cooled

## Requirements

Operating temperature	15 – 30 °C	
Relative humidity	<70 % (non-condensing)	
Electrical requirements	85 ~ 264 VAC, 47 ~ 63 Hz	
Rated power	25 W	150 W

We strive to excel in performance. Specifications can change – please inquire for the latest model