

## High Power 780 nm Fiber Based Femtosecond Laser (CFL)



### Applications

- Multiphoton microscopy
- Optical metrology
- Materials characterization
- Terahertz radiation
- 3D-microprinting
- Nonlinear spectroscopy
- Ophthalmology
- Replacement of a Ti:sapphire laser

### Features

- High power stability (up to 1W)
- < 90 fs pulse widths
- Outstanding beam quality ( $M^2 < 1.2$ )
- Exceptional beam pointing stability
- All air-cooled, no chiller required
- Optional 1550 nm output
- Full computer control and data logging capability
- Remote system diagnostics
- Expected lifetime > 10,000 hours

The Carmel X-series is a range of high power, air-cooled, fiber-based femtosecond lasers with output powers from 0.2 to greater than 2.5 W and pulse widths of less than 90 fs in the industry's most compact, user-friendly package. The Carmel X-780 provides the perfect 780 nm source for a wide range of ultrafast laser applications, including bio-imaging, multiphoton microscopy, optical metrology, 3D-microprinting, terahertz imaging and ophthalmology.

The system features a rack mountable controller with a robust armored cable interface to the compact laser head, which facilitates its incorporation into OEM designs. It is over 100 times smaller than many Ti:sapphire lasers with a similar output power level. A simple key switch interface provides for manual operation with full remote access through computer control. The X-series includes the capability of remote data logging, power monitoring, system diagnostics, and automated adjustment of the second harmonic crystal for prolonged lifetime and OEM service support. The rugged design supports 24/7 operation with an expected lifetime of > 10,000 hours.

The Carmel X-780 can be configured for dual wavelength output to enable alternating between 780 and 1550 nm outputs. The repetition rate can be specified from 10 to 80 MHz with a clean pulse width of < 90 fs, and outstanding beam quality ( $M^2 < 1.2$ ). Excellent long term pulse-to-pulse stability (<1% rms) over a wide operating temperature range (17-30°C) ensures superior results for both tissue imaging and ablation in biomedical applications. An RF synchronization output is also provided as a trigger signal.

For multiphoton microscopy applications, the Carmel provides an ideal ultrafast laser solution for optimum cellular tissue imaging with minimal scatter and reduced risk of photodamage. The compact laser head and associated armored fiber cable make for straight forward integration into existing microscopes with minimal delivery optics.

# FIBER BASED FEMTOSECOND LASER

## Technical Specifications<sup>1</sup>

Model Number	CFL-		
	04RFF	05RFF	10RFF
Suffix			
<b>OPTICAL</b>			
Average Power (W)	0.25	0.5	1.0
Repetition Rate <sup>2</sup> (MHz)	50 or 80	50 or 80	80
Central Wavelength <sup>3</sup> (nm)	780		
Minimum Pulse Width <sup>4</sup> (fs)	< 90		
Spectra Width (nm)	~ 10		
Pulse Energy <sup>5</sup> (nJ)	> 12.5		
Beam Quality, M <sup>2</sup>	< 1.2		
Beam Diameter at Exit (mm)	1.2 (typical)		
Beam Roundness (%)	> 90		
Polarization Extinction Ratio (dB)	> 20		
Power Stability in Operating Temperature Range (% rms, 8 hours) <sup>6</sup>	< 1		
Termination / Output	Free space, collimated beam		
<b>ELECTRICAL</b>			
Supply Voltage (VAC)	85 - 264 autoranging		
Supply Frequency (Hz)	47 - 63 autoranging		
Power Consumption (VA)	200		
RF Synchronization Output (V)	0.5 with SMA connector		
<b>MECHANICAL</b>			
Warm up time (min)	10 (typical)		
Operating Temperature (°C)	17 - 30		
Storage Temperature (°C)	0 - 50		
Connection between Controller and Head <sup>7</sup>	1 m fixed armored fiber cable		
Laser Head Dimensions (cm)	9.0(w) x 18(d) x 3.5(h)		
Laser Controller Dimensions (cm)	48(w) x 44(d) x 9.8(h); 19" 2U		
Laser Head Weight (kg)	0.8 (typical)		
Laser Controller Weight (kg)	13.6 (typical)		
Cooling	Air-cooled by low noise fan		
<b>I/O CONTROL</b>			
Communication Interface Type	RS232, Monitor Ports		
Laser Status Indicators on Controller Front Panel	Electrical Power On/Off, Laser On and Operational, Emergency Stop		



# FIBER BASED FEMTOSECOND LASER

<sup>1</sup> Due to our continuous improvement philosophy, all product specifications are subject to change without prior notice. Please contact sales@calmarlaser.com for customized specifications.

<sup>2</sup> For the -04 and -05 models, the repetition rate needs to be specified at the time of purchase. For other repetition rates, please contact sales@calmarlaser.com.

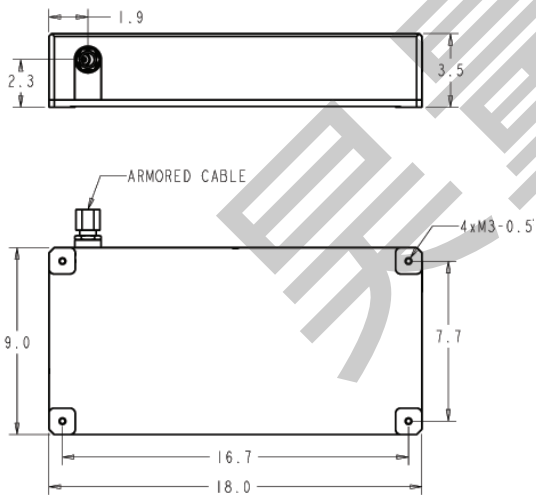
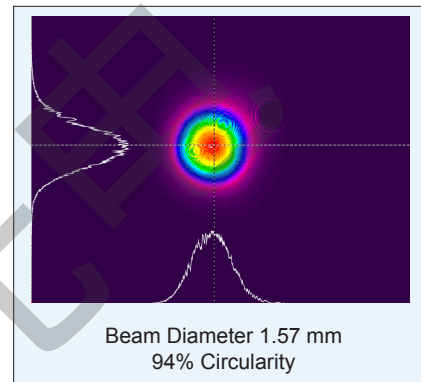
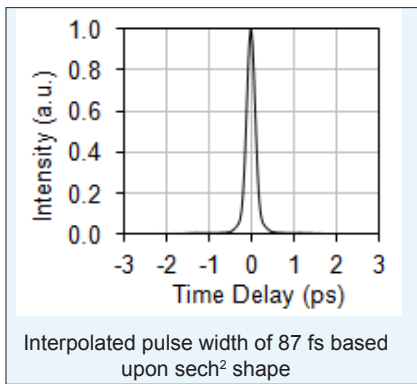
<sup>3</sup> 1550 nm output is also available from a separate port (switchable with the 780 nm output). This option should be specified at the time of purchase, please contact sales@calmarlaser.com for more details.

<sup>4</sup> A  $\text{sech}^2$  pulse shape (deconvolution factor of 0.65) is used to determine the pulse width from the second harmonic autocorrelation trace.

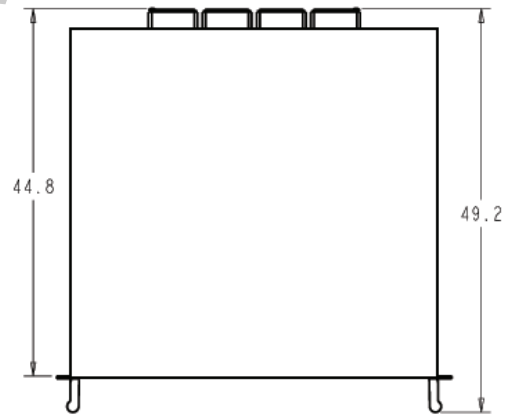
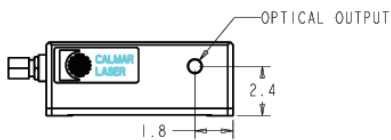
<sup>5</sup> The absolute pulse energy will depend on the version and specified repetition rate.

<sup>6</sup> With a temperature control of  $\pm 0.5^\circ\text{C}$ .

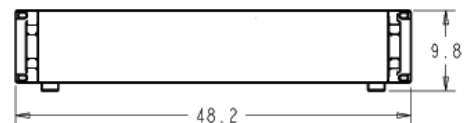
<sup>7</sup> Please contact sales@calmarlaser.com for other cable length options.



Dimensions of Laser Head  
Unit: cm



Dimensions of Laser Controller  
Unit: cm



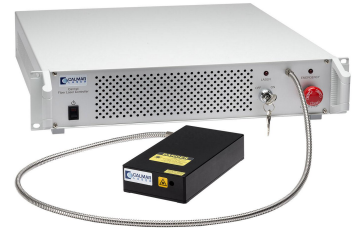
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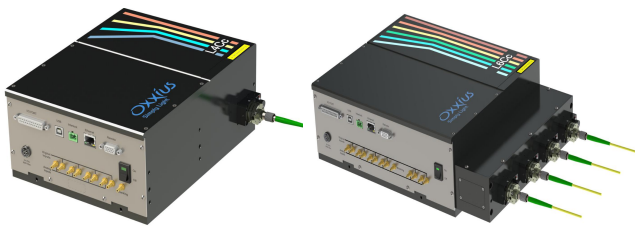
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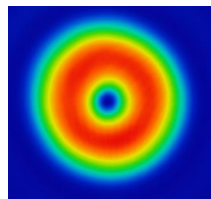
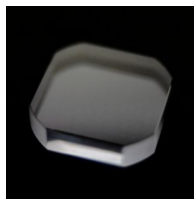
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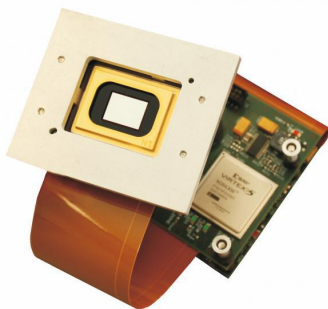
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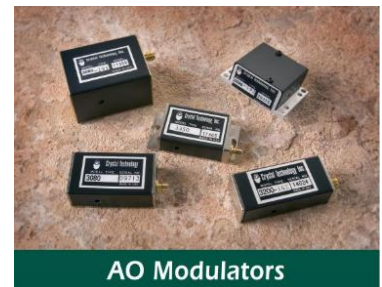
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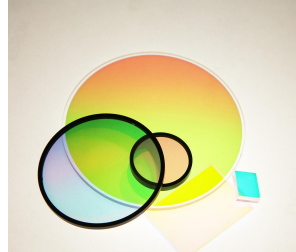
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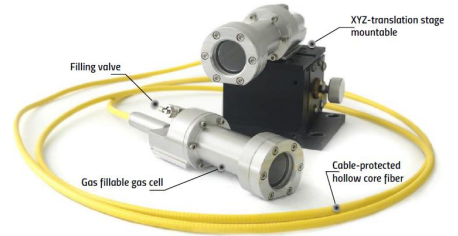
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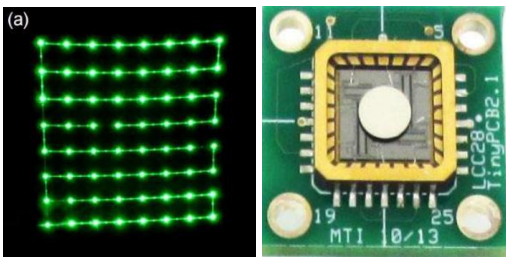
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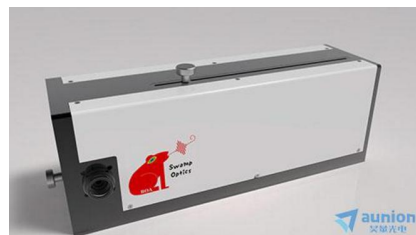
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