

CARBIDE



Unibody-Design Industrial-Grade Femtosecond Lasers

FEATURES

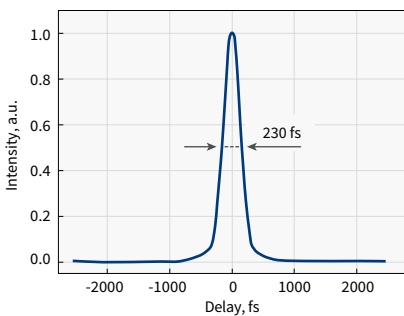
- 190 fs – 20 ps tunable pulse duration
- 800 μJ maximum pulse energy
- 80 W maximum output power
- Single-shot – 2 MHz repetition rate
- Pulse picker for pulse-on-demand mode
- Industrial-grade design
- Air- or water-cooled models
- Optional automated harmonic generator
- Optional scientific interface module



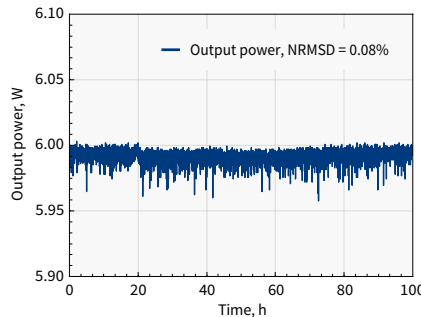
CARBIDE-CB3

CARBIDE is a series of femtosecond lasers combining high average power and excellent power stability. CARBIDE features market-leading output parameters without compromises to beam quality and stability. A compact and robust optomechanical CARBIDE design allows a variety of applications in top-class research centers, as well as display, automotive, LED, medical, and other industries. The reliability of CARBIDE has been proven by hundreds of systems operating 24/7 in the industrial environment.

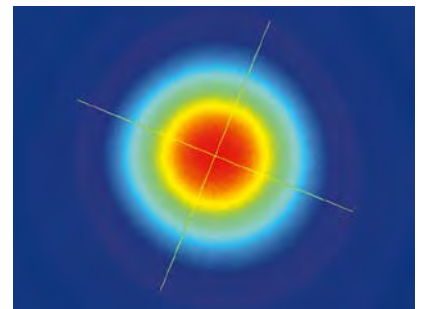
The tunability of CARBIDE lasers enables our customers to discover the most efficient manufacturing processes. Tunable parameters include pulse duration (190 fs – 20 ps), repetition rate (single-shot – 2 MHz), pulse energy (up to 0.8 mJ), and average power (up to 80 W). A pulse-on-demand mode is available using the built-in pulse picker. The CARBIDE lasers can be equipped with industrial-grade modules.



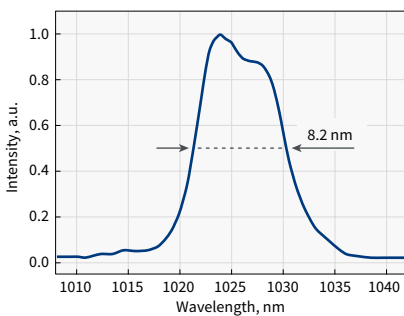
Typical pulse duration of CARBIDE laser



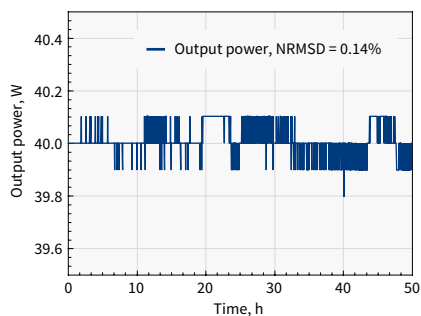
Long-term power stability of CARBIDE-CB5



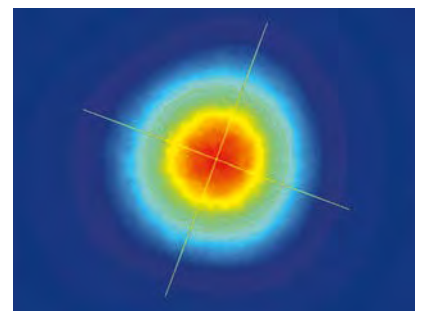
Typical beam profile of CARBIDE-CB5



Typical spectrum of CARBIDE laser



Long term power stability of CARBIDE-CB3



Typical beam profile of CARBIDE-CB3

SPECIFICATIONS

NEW

Model	CB3-20W	CB3-40W	CB3-80W	CB5	CB5-SP
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OUTPUT CHARACTERISTICS

Cooling method	Water-cooled			Air-cooled ¹⁾		
Maximum output power	20 W	40 W	80 W	6 W	5 W	
Pulse duration ²⁾	< 250 fs			< 290 fs	< 190 fs	
Pulse duration tuning range	250 fs – 10 ps			290 fs – 20 ps	190 fs – 20 ps	
Maximum pulse energy	0.4 mJ		0.8 mJ	100 µJ	83 µJ	
Repetition rate	Single-shot – 1 MHz	Single-shot – 1 MHz (2 MHz on request)	Single-shot – 2 MHz	Single-shot – 1 MHz		
Pulse selection	Single-shot, pulse-on-demand, any fundamental repetition rate division					
Center wavelength ³⁾	1030 ± 10 nm					
Polarization	Linear, vertical; 1 : 1000					
Beam quality	TEM ₀₀ ; M ² < 1.2					
Beam diameter ⁴⁾	2.5 mm		2.7 mm	1.4 mm		
Pulse-to-pulse energy stability ⁵⁾	RMS deviation ⁶⁾ < 0.5% over 24 h					
Long-term power stability	RMS deviation ⁶⁾ < 0.5% over 100 h					
Beam pointing stability	< 20 µrad/°C					
Pulse picker	FEC ⁷⁾			included	included ⁸⁾	included
Pulse picker leakage	< 0.5%			< 2%	< 0.1%	< 2%

OPTIONAL EXTENSIONS

Harmonic generators	Integrated, optional (see page 14)								
Output wavelength	515 nm, 343 nm, or 257 nm								
Optical parametric amplifier	Integrated, optional (see page 15)								
Tuning range	320 – 10000 nm								
BiBurst option	Tunable GHz and MHz burst with burst-in-burst capability, optional (see page 9)								
GHz-Burst	n/a								
Intra burst pulse period ⁹⁾						440 ± 40 ps			
Number of pulses, P ¹⁰⁾						1 ... 10			
MHz-Burst	n/a								
Intra burst pulse period						≈ 15 ns			
Number of pulses, N	1 ... 10								

PHYSICAL DIMENSIONS

Laser head (L × W × H)	632 × 305 × 173 mm			631 × 324 × 167 mm	
Chiller (L × W × H)	680 × 484 × 307 mm			Not required	
24 V DC power supply (L × W × H)	280 × 144 × 49 mm		320 × 200 × 75 mm	220 × 95 × 46 mm	

ENVIRONMENTAL & UTILITY REQUIREMENTS

Operating temperature	15 – 30 °C (59 – 86 °F)			17 – 27 °C (62 – 80 °F)	
Relative humidity	< 80% (non-condensing)				
Electrical requirements	100 V AC, 7 A – 240 V AC, 3 A; 50 – 60 Hz		100 V AC, 12 A – 240 V AC, 5 A; 50 – 60 Hz	100 V AC, 3 A – 240 V AC, 1.3 A; 50 – 60 Hz	
Rated power	600 W		1000 W	300 W	
Power consumption	500 W		700 W	150 W	
Electrical requirements (chiller)	100 – 230 V AC; 50 – 60 Hz		200 – 230 V AC; 50 – 60 Hz	Not required	
Rated power (chiller)	1400 W		2000 W		
Power consumption (chiller)	1000 W		1300 W		

¹⁾ Water-cooled version available on request.

²⁾ Assuming Gaussian pulse shape.

³⁾ Precise wavelengths for specific models available upon request.

⁴⁾ FWHM, measured at laser output, using maximum pulse energy.

⁵⁾ Under stable environmental conditions.

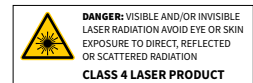
⁶⁾ Normalized to average pulse energy, NRMSD.

⁷⁾ Provides fast energy control; external analog control input available. Response time – next available RA pulse.

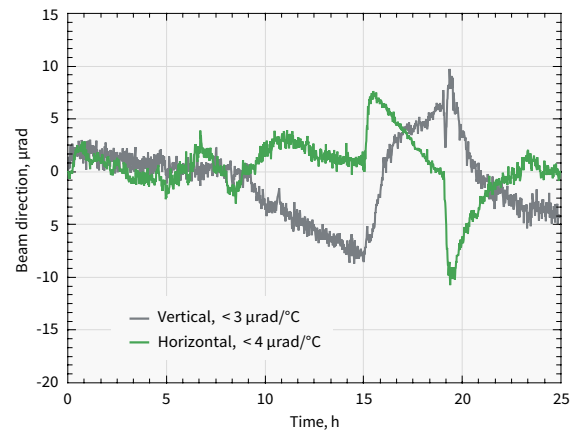
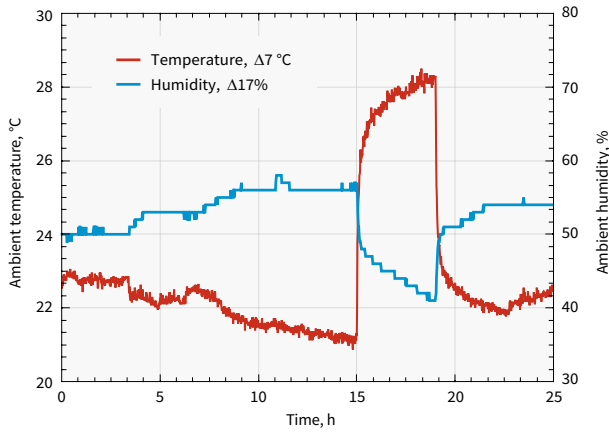
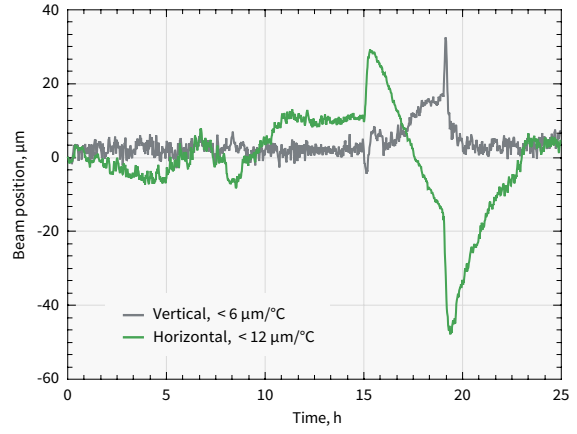
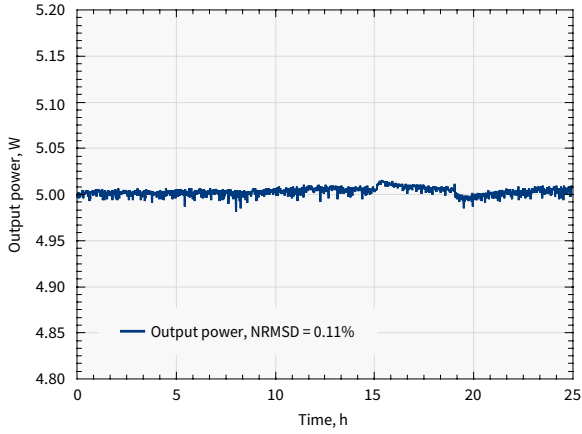
⁸⁾ Enhanced contrast AOM. Provides fast amplitude control of output pulse train.

⁹⁾ Custom spacing is available on request.

¹⁰⁾ Maximum number of pulses in a burst depends on the laser repetition rate. Custom number of pulses is available on request.

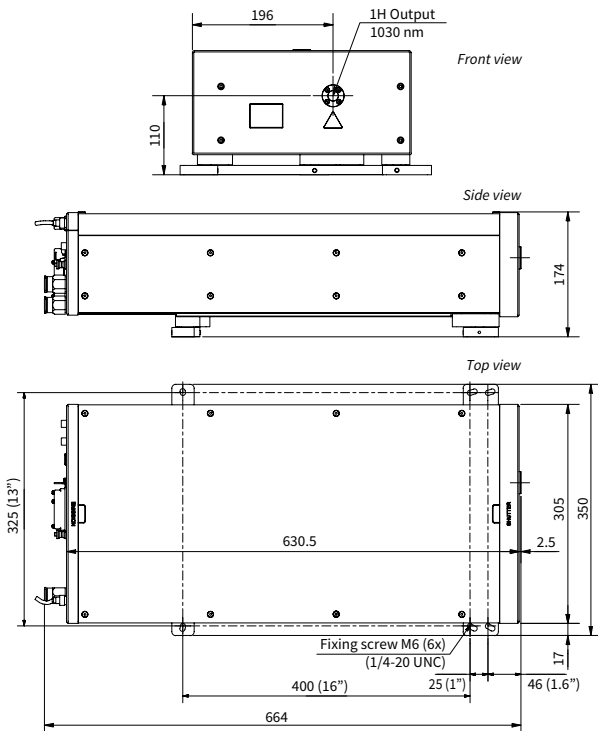


STABILITY MEASUREMENTS

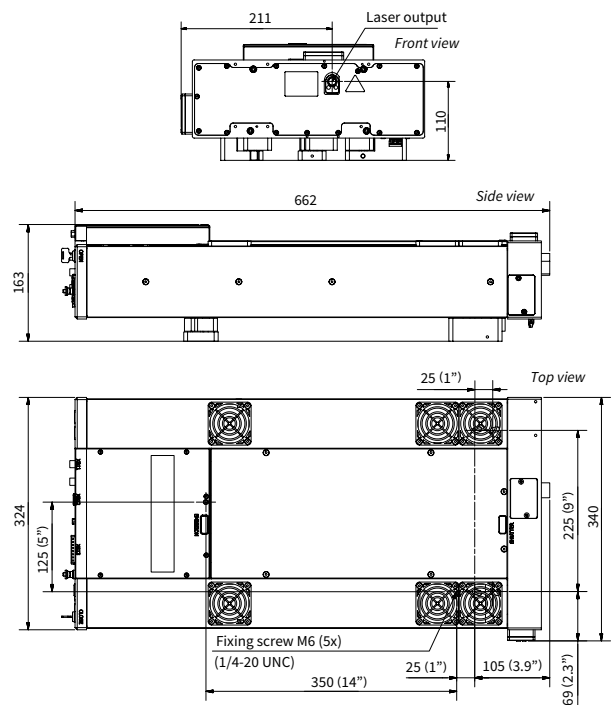


Output power, beam direction, and beam position of CARBIDE-CB5 under harsh environmental conditions

DRAWINGS



Drawing of CARBIDE-CB3



Drawing of air-cooled CARBIDE-CB5 with attenuator

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Automated Harmonic Generators

FEATURES

- 515 nm, 343 nm, or 257 nm output
- Automated harmonic selection
- Mounted directly on the laser head
- Industrial-grade design
- 30 W UV model option

CARBIDE lasers equipped with automated harmonic generators (HGs) provide a selection of fundamental (1030 nm), second (515 nm), third (343 nm), or fourth (257 nm) harmonic outputs using software control.



Harmonics generator attached to air-cooled CARBIDE-CB5

HGs are perfect for industrial applications that require a single-wavelength output. Modules, mounted directly at the output of the laser, are fully integrated into the system.

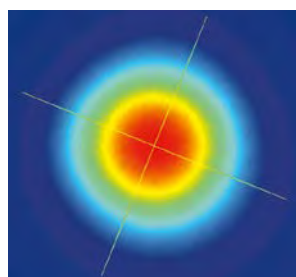
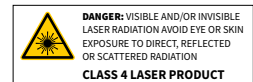
SPECIFICATIONS

Model	2H	2H-3H	2H-4H	CBM03-30W ²⁾ NEW
Output wavelength ²⁾ (automated selection)	1030 nm 515 nm	1030 nm 515 nm 343 nm	1030 nm 515 nm 257 nm	1030 nm 515 nm 343 nm
Pump pulse energy	20 – 800 μJ	50 – 800 μJ	20 – 800 μJ	< 270 μJ
Pump pulse duration		< 300 fs		≈ 500 fs
Conversion efficiency / Output power	> 50% (2H)	> 50% (2H) > 25% (3H)	> 50% (2H) > 10% (4H) ³⁾	40 W (2H) 30 W (3H)
Beam quality (M ²)	≤ 400 μJ pump	< 1.3 (2H), typical < 1.15	< 1.3 (2H), typical < 1.15 < 1.4 (3H), typical < 1.2	< 1.3 (2H, 3H)
	> 400 μJ pump	< 1.4 (2H)	< 1.4 (2H) < 1.5 (3H)	n/a

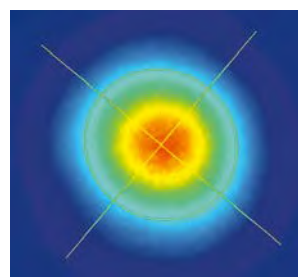
¹⁾ Available only for CARBIDE-CB3-80W with maximum output power; has 1 year lifetime.

²⁾ Depends on pump laser model.

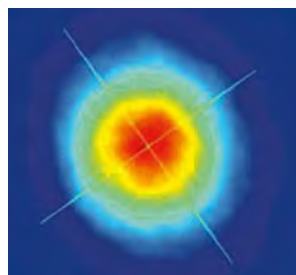
³⁾ Maximum output power of 1 W.



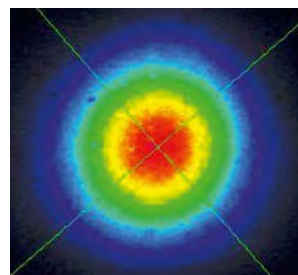
Typical 1H beam profile of CARBIDE-CB5 (60 kHz, 5 W)



Typical 2H beam profile of CARBIDE-CB5 (100 kHz, 3.4 W)



Typical 3H beam profile of CARBIDE-CB5 (100 kHz, 2.2 W)



Typical 4H beam profile of CARBIDE-CB5 (100 kHz, 100 mW)

