CARBIDE

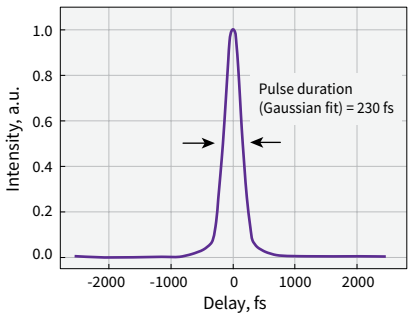
Femtosecond Lasers for Industry and Science

FEATURES

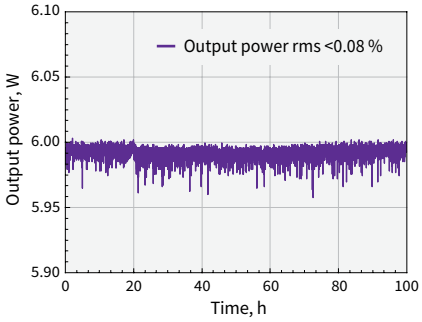
- < 290 fs – 10 ps tunable pulse duration
- > 800 µJ pulse energies
- > 80 W output power
- 60 – 2000 kHz tunable base repetition rate
- Includes pulse picker for pulse-on-demand operation
- Rugged, industrial-grade mechanical design
- Air or water cooling
- Automated harmonics generators (515 nm, 343 nm, 257 nm)
- Scientific interface enhancing system flexibility

CARBIDE-CB3

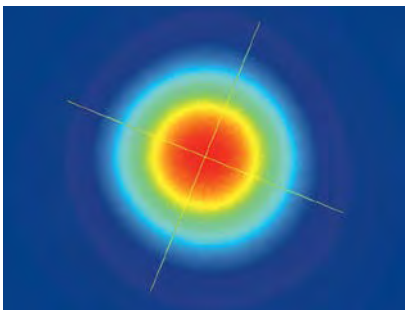
CARBIDE femtosecond lasers feature an output power of >80 W at 1030 nm wavelength. The laser emits pure pulses with ASE background of $<10^{-9}$ and recently updated maximum energy specifications without compromises to the beam quality, industrial grade reliability and beam stability regardless of environmental conditions. Continuously tunable repetition rate in a range of 60 kHz to 2 MHz is combined with an in-built Pulse Picker for output pulse timing and full-scale energy control with <10 microsecond response time, enabling arbitrary shaping of the emission. Pulse duration can be tuned in a range of 290 fs – 10 ps. Excellent power stability of <0.5 % RMS is standard. The laser output can be split into a burst of several pulses of pico- and nano- separation while having the ability to modify the burst envelope. Harmonic generator options permit femtosecond applications at different wavelengths. The parameters are entirely software adjustable.



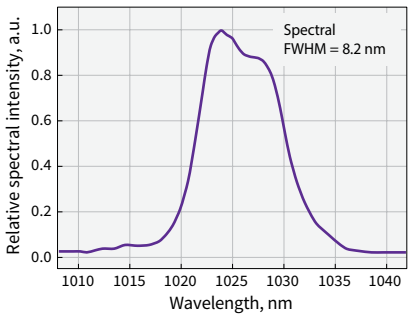
Typical pulse duration of CARBIDE laser



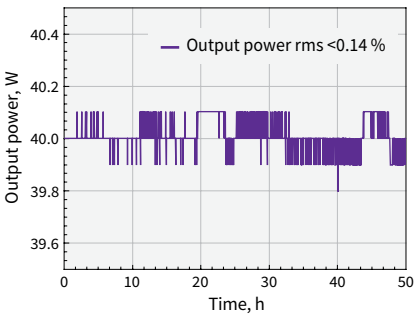
Long term power stability of CARBIDE-CB5



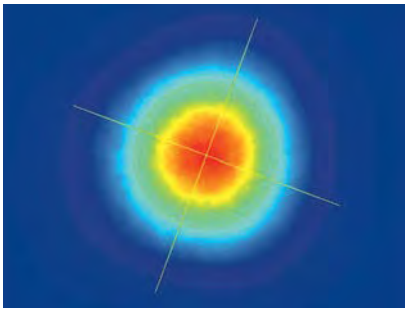
Typical beam profile of CARBIDE-CB5.
60 kHz, 5 W



Typical spectrum of CARBIDE laser



Long term power stability of CARBIDE-CB3

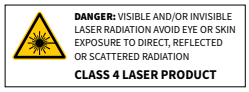


Typical beam profile of CARBIDE-CB3

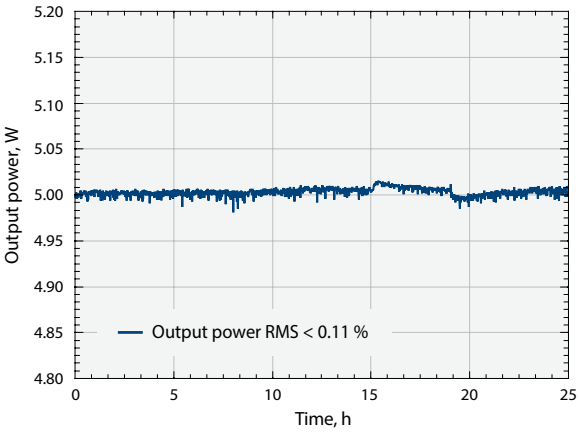
SPECIFICATIONS

Model	CB3-40W	CB3-80W NEW	CB5	
OUTPUT CHARACTERISTICS				
Cooling method	Water-cooled		Air-cooled [1]	
Max. average power	> 40 W	> 80 W	> 6 W	> 5 W
Pulse duration (assuming Gaussian pulse shape)	< 290 fs			
Pulse duration adjustment range	290 fs – 10 ps			
Max. pulse energy	> 0.4 mJ	> 0.8 mJ	> 100 µJ	> 83 µJ
Base repetition rate [2]	100 – 2000 kHz		60 – 1000 kHz	
Pulse selection	Single-shot, Pulse-on-Demand, any base repetition rate division			
Centre wavelength [3]	1029 ± 5 nm			
Polarization	Linear, vertical			
Beam quality	TEM_{00}; M^2 < 1.2			
Output pulse-to-pulse stability [4]	< 0.5 % rms over 24 hours			
Output power stability	< 0.5 % rms over 100 hours			
Beam pointing stability	< 20 µrad/°C			
Pulse picker	FEC [6]		included	included, enhanced contrast AOM [5]
Pulse picker leakage	< 0.5 %		< 2 %	< 0.1 %
OPTIONAL EXTENSIONS				
Harmonics generator	Integrated, optional *(see page 14)*			
Output wavelength	515 nm, 343 nm, 257 nm			
Optical parametric amplifier	Integrated, optional *(see page 15)*			
Tuning range	640 – 4500 nm			
BiBurst mode	Tunable GHz and MHz burst with burst-in-burst capability, optional *(see page 9)*		n/a	
GHz-mode (P)				
Intra burst pulse separation	~ 440 ± 40 ps [7]			
Max no. of pulses	1 . . 10 [8]			
MHz-mode (N)				
Intra burst pulse separation	~ 16 ns			
Max no. of pulses	1 . . 10			
PHYSICAL DIMENSIONS				
Laser head	632 (L) × 305 (W) × 173 (H) mm		631 (L) × 324 (W) × 167 (H) mm	
Power supply	280 (L) × 144 (W) × 49 (H) mm		220 (L) × 95 (W) × 45 (H) mm	
Chiller	590 (L) × 484 (W) × 267 (H) mm		Not required	
ENVIRONMENTAL & UTILITY REQUIREMENTS				
Operating temperature	15 – 30 °C (59 – 86 °F)		17 – 27 °C (62 – 80 °F)	
Relative humidity	< 80 % (non condensing)			
Electric	110 – 220 VAC, 50 – 60 Hz			
Rated power	600 W	1000 W	300 W	
Power consumption	500 W	700 W	150 W	

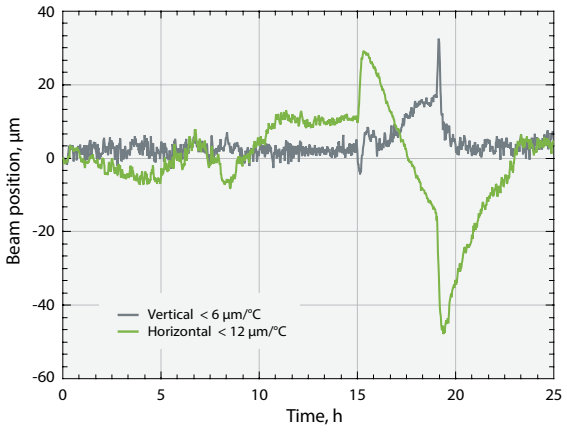
[1] Water-cooled version available on request.
[2] Lower repetition rates are available by controlling pulse picker.
[3] 2nd (515 nm) and 3rd (343 nm) harmonic output also available.
[4] Under stable environmental conditions.
[5] Provides fast amplitude control of output pulse train.
[6] Provides fast energy control; external analog control input available. Response time – next available RA pulse.
[7] Custom spacing on request.
[8] Maximum number of pulses in a burst is dependent on the laser repetition rate. Custom number of pulses on request.



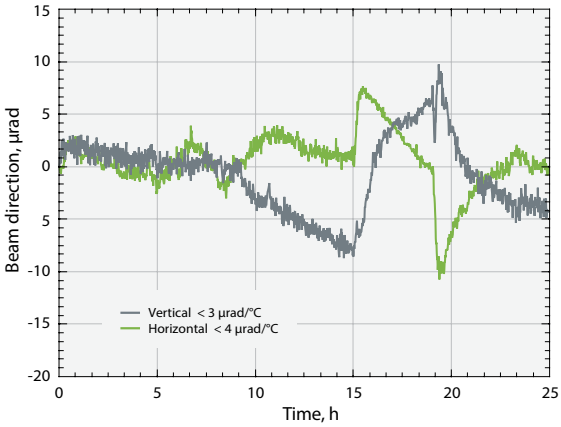
STABILITY MEASUREMENTS



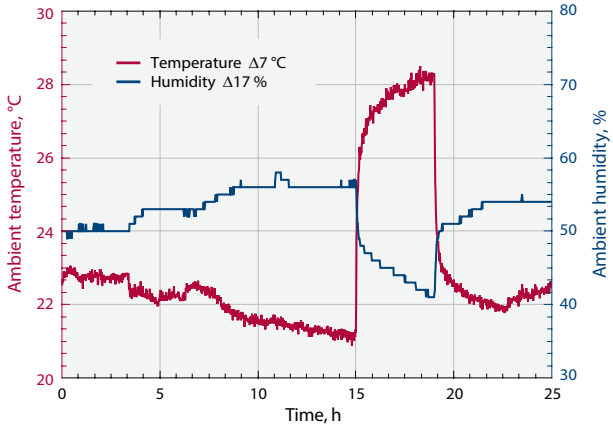
Output power under harsh environment conditions of CARBIDE-CB5



Beam position under harsh environment conditions of CARBIDE-CB5

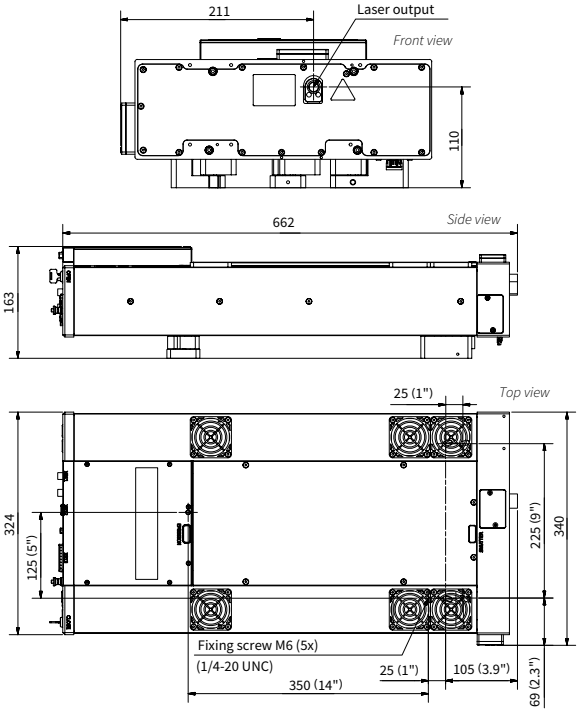


Beam direction under harsh environment conditions of CARBIDE CB5

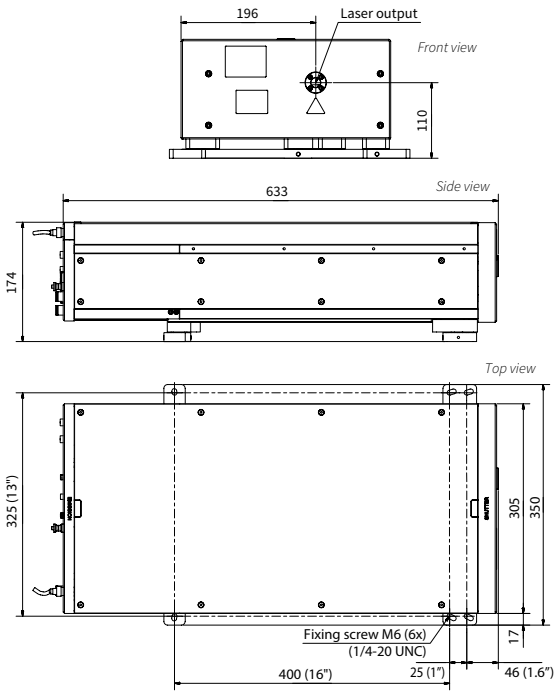


Harsh environment conditions of CARBIDE-CB5

OUTLINE DRAWINGS



Outline drawing of air-cooled CARBIDE-CB5 with attenuator



Outline drawing of CARBIDE-CB3

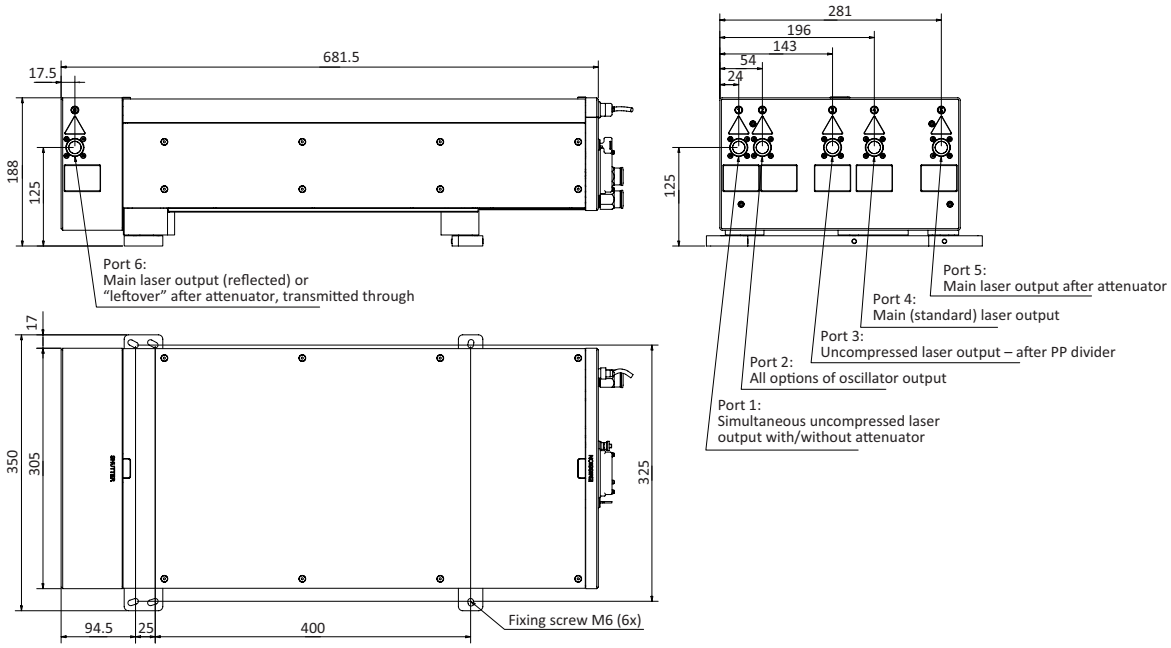
SCI-M | CARBIDE

Scientific Interface Module for CARBIDE

FEATURES

- Laser seeding via external OSC (FLINT)
- Uncompressed laser output access
- Provides simultaneous OSC output (~65 Mhz, <100 fs, >100 mW output power)
- Beam-splitting options

The CARBIDE scientific interface module is an optional laser add-on which extends the flexibility of industrial-grade laser configurations and makes it particularly attractive to scientific applications. This module incorporates multiple options which include a simultaneous or separate oscillator output, a second compressed or uncompressed main amplifier output and seeding by an external oscillator. For example, it can be seeded by another CARBIDE laser with its own oscillator, thus ensuring precise optical synchronization between two lasers. All the mentioned amplifier outputs can be equipped with motorized power attenuators and all options are compatible in-between.



Outline drawing of CARBIDE-CB3-40-200 with scientific interface

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フォトテクニカ株式会社
〒336-0017 埼玉県さいたま市南区南浦和 1-2-17
TEL:048-871-0067 FAX:048-871-0068
e-mail:voc@phototechnica.co.jp

HG | CARBIDE

Automated Harmonics Generators

FEATURES

- 515 nm, 343 nm and 257 nm
- Output selection by software
- Mounted directly on a laser head and integrated into the system
- Rugged, industrial-grade mechanical design

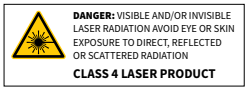
Harmonics generator module attached to air-cooled CARBIDE-CB5

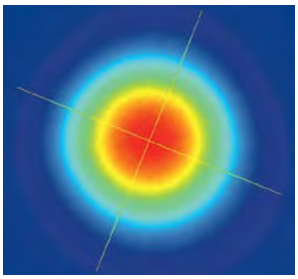
CARBIDE laser can be equipped with automated harmonics modules. Selection of fundamental (1030 nm), second (515 nm), third (343 nm) or fourth (257 nm) harmonics outputs are available by software control. Harmonics generators are designed to be used in industrial applications where a single output wavelength is desired.

SPECIFICATIONS

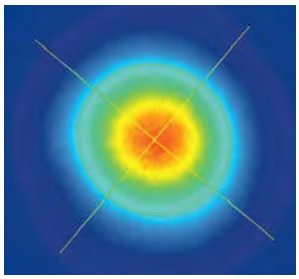
Model	2H	2H-3H	2H-4H
Output wavelength [1] **(automated selection)**	1030 nm 515 nm	1030 nm 515 nm 343 nm	1030 nm 515 nm 257 nm
Input pulse energy	20 – 800 µJ	50 – 800 µJ	20 – 800 µJ
Pump pulse duration	< 300 fs		
Conversion efficiency	> 50 % (2H)	> 50 % (2H) > 25 % (3H)	> 50 % (2H) > 10% (4H) [2]
Beam 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), typical < 1.15 n/a (4H)
Beam quality (M^2) > 400 µJ pump	<1.4 (2H)	<1.4 (2H) <1.5 (3H)	<1.4 (2H) n/a (4H)

[1] *Depends on pump laser model.*
[2] *Maximum output power 1 W.*

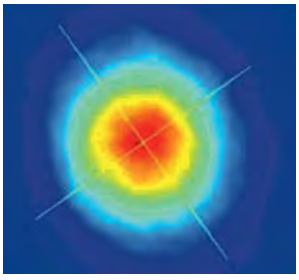




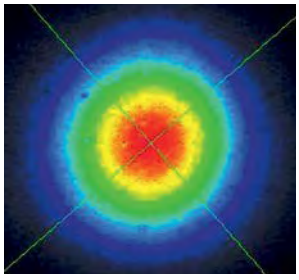
Typical 1H beam profile of CARBIDE-CB5, 60 kHz, 5 W



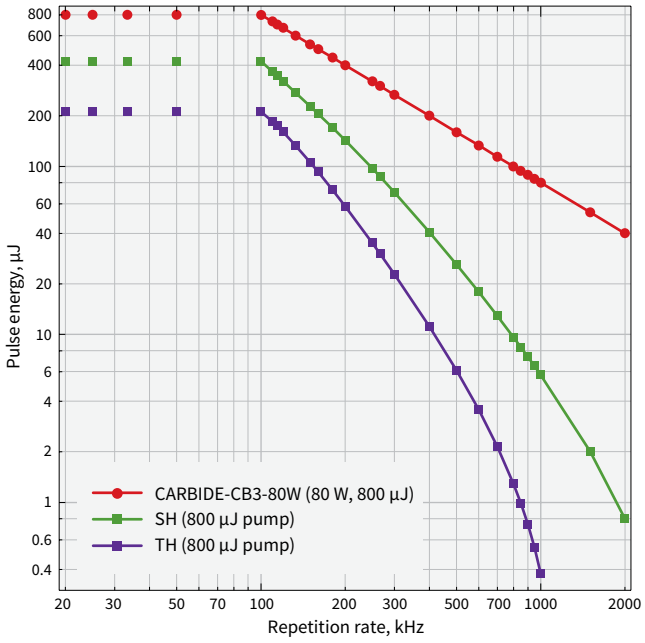
Typical 2H beam profile of CARBIDE-CB5, 100 kHz, 3.4 W



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



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



Harmonics energy vs pulse repetition rate for CARBIDE-CB3-80W

LIGHT CONVERSION