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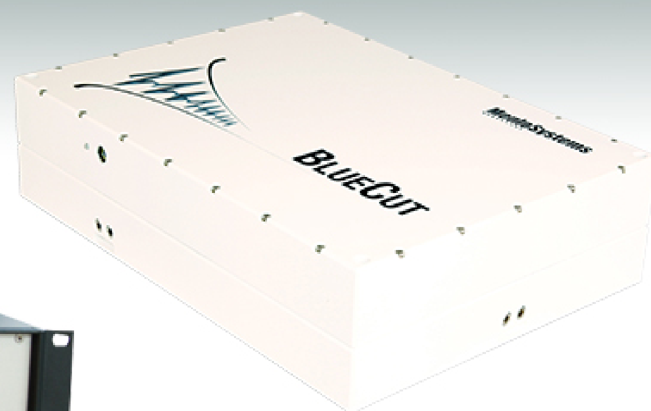
THORLABS

BLUECUT - MAY 3, 2021

Item # BLUECUT was discontinued on MAY 3, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

HIGH-ENERGY FEMTOSECOND FIBER LASER SYSTEM

- ► Microjoule Fiber Laser System
- ► Highly Stable and Easy to Use
- ► Ideal for OEM Integration



BLUECUT

BLUECUT-OEM-SEED

OVERVIEW

Features

- Single Shot up to 10 MHz
- Programmable Burst Mode
- >10 µJ up to 1 MHz
- Modular and Compact Design for OEM Integration
- Active Air Cooling
- High Beam Quality
- Optional Fiber Delivery of Pulses

OEM Seed Laser Features

- figure 9® Mode Locking
- Selectable Repetition Rate
- Modular Internal Design
- Active Air Cooling
- Single Mode Linear Polarized Fiber Output
- Remote Controllable

The BLUECUT is an industrial-grade, microjoule femtosecond fiber laser system. Based on all-fiber integrated technology, this is an inherently robust and stable system which comes in a sealed package designed for OEM integration. The system is maintenance free and easily field serviceable, ensuring maximum up-time demanded by both industrial and scientific applications. The high repetition rates available from the laser combined with its high average power and beam quality allow for high throughput and increased efficiency. The BLUECUT laser operates at 1030 nm; a 515 nm version (item # BLUECUT-515) is also available.

BLUECUT and BLUECUT-515 Applications

- Micro Material Processing
  - Waveguide Writing
  - Micro-Cutting
  - Micro-Structuring
  - Marking of Transparent Materials
- Biomedical
  - Life Science
  - Lab-on-a-Chip
  - Ophthalmology
  - Multiphoton Microscopy
  - 2-Photon Polymerization
- Industrial
  - Semiconductors
  - Organic Materials
  - Solar Cells
- Scientific
  - Seeding of Solid State Amplifiers
  - Nonlinear Frequency Conversion

The OEM seed laser (item # BLUECUT-OEM-SEED) is a high repetition rate, ultrashort pulsed laser in a compact turnkey design based on Menlo Systems' figure 9® mode-locking technology. It is designed as a seed source for ultrafast chirped pulsed laser amplifiers. Center wavelengths from 1025 nm to 1070 nm are available, allowing for seeding of active solid state and fiber laser materials. It is suitable for generating high-power pulses shorter than 300 fs. The laser covers a wide range of repetition rates with constant pulse energy. The BLUECUT-OEM-SEED is designed for industrial application with full remote control over its RS232 or USB interface. The compact rack mount housing allows for easy integration into high-power laser systems.

Simon Kocur
Menlo
Systems

Feedback? Questions? Need a Quote?

Contact Us

Please note that these products are available directly from Menlo Systems, Inc. within the United States and from Menlo Systems GmbH outside the United States.

United States
Phone: +1-973-300-4490
Email: ussales@menlosystems.com

Outside United States
Phone: +49-89-189166-0
Email: sales@menlosystems.com

BLUECUT-OEM-SEED Applications

- Seed for Solid State or Fiber Amplifiers
- 2-Photon Microscopy
- Ophthalmology
- Material Processing
- Cold Ablation
- Thin Film Processing

SPECS

Item #	BLUECUT	BLUECUT-515
Center Wavelength	1030 nm	515 nm[a]
Average Output Power	>10 W[b]	>3.5 W[b]
Pulse Energy	>10 µJ[b]	>3.5 µJ[b]
Pulse Duration	<400 fs	
Repetition Rate	Single Pulse up to 10 MHz	
Output Port	Free Space	
Beam Quality	$M^2 < 1.25$	
Warm-Up Time	<30 minutes	
Long-Term Stability	<1% RMS (over 12 hours, for constant ambient temperature)	
Operating Voltage	100 - 240 VAC (50 - 60 Hz)	
Power Consumption	<500 W	

a. Secondary Output at 1030 nm, Power Ratio Adjustable
b. Whatever Applies First for a Given Repetition Rate; See Typical Performance Table for Examples

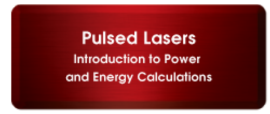
BLUECUT Typical Performance		
Repetition Rate	Average Power	Pulse Energy
250 kHz	2.5 W	10 µJ
1 MHz	10 W	10 µJ
10 MHz	10 W	1 µJ

Item #	BLUECUT-OEM-SEED
Central Wavelength	1025 - 1070 nm
Pulse Energy	2 nJ
Spectral Bandwidth	7 - 12 nm
Repetition Rate	100 kHz - 10 MHz
Output Port	SM Fiber, SC/APC Connector

PULSE CALCULATIONS

Pulsed Laser Emission: Power and Energy Calculations

Determining whether emission from a pulsed laser is compatible with a device or application can require referencing parameters that are not supplied by the laser's manufacturer. When this is the case, the necessary parameters can typically be calculated from the available information. Calculating peak pulse power, average power, pulse energy, and related parameters can be necessary to achieve desired outcomes including:



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- Protecting biological samples from harm.
- Measuring the pulsed laser emission without damaging photodetectors and other sensors.
- Exciting fluorescence and non-linear effects in materials.

Pulsed laser radiation parameters are illustrated in Figure 1 and described in the table. For quick reference, a list of equations are provided below. The document available for download provides this information, as well as an introduction to pulsed laser emission, an overview of relationships among the different parameters, and guidance for applying the calculations.

Equations:

Period **and** ***repetition rate*** **are reciprocal:** $\Delta t = \frac{1}{f_{rep}}$ and $f_{rep} = \frac{1}{\Delta t}$

Pulse energy **calculated from** ***average power*****:** $E = \frac{P_{avg}}{f_{rep}} = P_{avg} \cdot \Delta t$

Average power **calculated from** ***pulse energy*****:** $P_{avg} = \frac{E}{\Delta t} = E \cdot f_{rep}$

Peak pulse power **estimated from** ***pulse energy*****:** $P_{peak} \approx \frac{E}{\tau}$

Peak power **and** ***average power*** **calculated from each other:**

$$P_{peak} = \frac{P_{avg}}{f_{rep} \cdot \tau} = \frac{P_{avg} \cdot \Delta t}{\tau}$$ and $$P_{avg} = P_{peak} \cdot f_{rep} \cdot \tau = \frac{P_{peak} \cdot \tau}{\Delta t}$$

Peak power **calculated from** ***average power*** **and** ***duty cycle******:**

$$P_{peak} = \frac{P_{avg}}{\tau/\Delta t} = \frac{P_{avg}}{duty\ cycle}$$

*Duty cycle ($\tau/\Delta t$) is the fraction of time during which there is laser pulse emission.

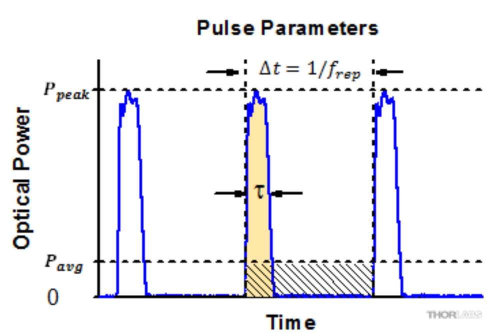

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Figure 1: Parameters used to describe pulsed laser emission are indicated in the plot (above) and described in the table (below). **Pulse energy** (**E**) is the shaded area under the pulse curve. Pulse energy is, equivalently, the area of the diagonally hashed region.

Parameter	Symbol	Units	Description
Pulse Energy	**E**	Joules [J]	A measure of one pulse's total emission, which is the only light emitted by the laser over the entire period. The pulse energy equals the shaded area, which is equivalent to the area covered by diagonal hash marks.
Period	**Δt**	Seconds [s]	The amount of time between the start of one pulse and the start of the next.
Average Power	P_{avg}	Watts [W]	The height on the optical power axis, if the energy emitted by the pulse were uniformly spread over the entire period.
Instantaneous Power	**P**	Watts [W]	The optical power at a single, specific point in time.
Peak Power	P_{peak}	Watts [W]	The maximum instantaneous optical power output by the laser.
Pulse Width	τ	Seconds [s]	A measure of the time between the beginning and end of the pulse, typically based on the full width half maximum (FWHM) of the pulse shape. Also called **pulse duration**.
Repetition Rate	f_{rep}	Hertz [Hz]	The frequency with which pulses are emitted. Equal to the reciprocal of the period.

Example Calculation:

Is it safe to use a detector with a specified maximum peak optical input power of **75 mW** to measure the following pulsed laser emission?

- Average Power: 1 mW
- Repetition Rate: 85 MHz
- Pulse Width: 10 fs

The energy per pulse:

$$E = \frac{P_{avg}}{f_{rep}} = \frac{1\ mW}{85\ MHz} = \frac{1\ x\ 10^{-3} W}{85\ x\ 10^{6} Hz} = 1.18\ x\ 10^{-11} J = 11.8\ pJ$$

seems low, but the peak pulse power is:

$$P_{peak} = \frac{P_{avg}}{f_{rep} \cdot \tau} = \frac{1\ mW}{85\ MHz\ \cdot 10\ fs} = 1.18\ x\ 10^{3}\ W = \mathbf{1.18\ kW}$$

It is ***not safe*** to use the detector to measure this pulsed laser emission, since the peak power of the pulses is >5 orders of magnitude higher than the detector's maximum peak optical input power.

Part Number	Description	Price	Availability
BLUECUT	**High-Energy Femtosecond Fiber Laser, 1030 nm, >10 µJ**	**$0.00**	**Menlo Lead Time**
BLUECUT-515	**High-Energy Femtosecond Fiber Laser, 515 nm, >3.5 µJ**	**$0.00**	**Menlo Lead Time**
BLUECUT-OEM-SEED	**Femtosecond Fiber Seed Laser, 1025 - 1070 nm, >1 mW, OEM Package**	**$0.00**	**Menlo Lead Time**

Visit the *High-Energy Femtosecond Fiber Laser System* page for pricing and availability information:
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=7941


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