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THORLABS

RED-FIBER - May 8, 2020

Item # RED-FIBER was discontinued on May 8, 2020. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

2.05 MM FEMTOSECOND FIBER LASER

- Menlo Systems' figure 9® Technology
- Highly Stable and Easy to Use
- Custom Wavelengths Available on Request

RED-FIBER

Hide Overview

OVERVIEW

Features

- >100 mW, >10 nm Bandwidth, 10 MHz Repetition Rate
- Fiber-Based, Linearly Polarized Output
- High Stability
- Turnkey Operation
- All Polarization Maintaining
- Modular Internal Design
- Menlo Systems' figure 9® Technology
- Laser Output in Less Than 60 Seconds
- Air Cooling

Applications

- Seed for Ho:YAG-Based Regenerative Amplification
- Pump for Fiber-Based Mid-IR Supercontinuum Generation
- Silicon Semiconductor Processing
- Front End Laser for Mid-IR Based High Harmonic Generation
- Driving Dielectric Laser Acceleration of Electrons

Menlo Systems' RED-FIBER is a front-end laser with a 2.05 µm central wavelength and 10 MHz repetition rate. The compact laser is based on Menlo Systems' all-polarization-maintaining, figure 9 mode-locking technology. Intracavity dispersion compensation allows for spectral bandwidths supporting <500 fs pulse durations. An additional preamplifier module can be integrated to boost the output pulse energy to >10 nJ (>100 mW). The RED-FIBER is designed for reliable and long term stable operation in both scientific as well as industrial applications fields. The compact rack mount housing with integrated full remote control over RS232 or USB interface allows for easy integration into subsequent high power laser systems.

Item #	RED-FIBER
Central Wavelength	2.05 µm[a]

Average Power	>1 mW (Oscillator), >100 mW (Amplifier)
Repetition Rate	10 MHz
Bandwidth (3 dB)	>10 nm (20 nm Typical)
Pulse Duration	Compressible to <500 fs
Output Port	Fiber-Coupled, SC/APC
Monitor Ports (Optical, RF)	Optional
Polarization	Linear, PM Fiber

a. Custom Wavelengths Available Upon Request

Simon Kocur
Menlo Systems

Feedback? Questions? Need a Quote?

Contact Us

Please note that these femtosecond fiber lasers 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

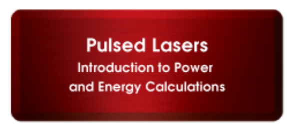
Outside United States
Phone: +49-89-189166-0
Email: sales@menlosystems.com

Hide Pulse Calculations

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:



Click above to download the full report.

- 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*****:** $P_{peak} \approx \frac{E}{\tau}$

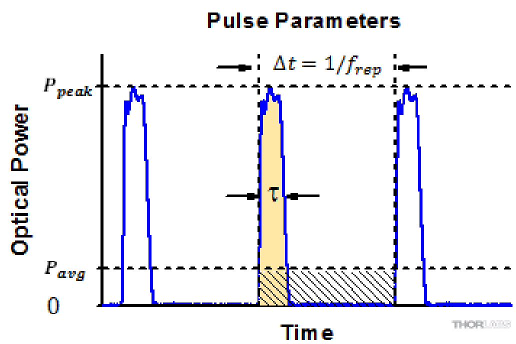
Peak power **and** ***average power*** **calculated from each other:**

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



Click to Enlarge

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.

Hide Part Numbers

Part Number	Description	Price	Availability
RED-FIBER	**Femtosecond Fiber Laser, 2.05 µm, >10 MHz**	**CALL**	**Menlo Lead Time**