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THORLABS

MID-IR-COMB - October 7, 2021

Item # MID-IR-COMB was discontinued October 7, 2021. For informational purposes this is a copy of the website content at that time and is valid only for the stated product.

OPTICAL FREQUENCY COMB, MID-IR

- **Fully Automated Turnkey Metrology System**
- **Easy Access to Molecular Fingerprint Region (3 - 13 µm)**
- **Repetition Rate: 100 MHz or 250 MHz**





MID-IR-COMB

OVERVIEW

Features

- High Output Power up to 120 mW at 3 µm
- Spectral Bandwidth >100 nm
- Carrier-Envelope Offset Free Frequency Comb
- Femtosecond Laser Pulses in the Mid-IR Range
- Repetition Rate Can Be Phase Locked to RF or Optical Reference
- Click Here to View Menlo Systems' Frequency Comb Brochure

Applications

- Fourier-Transform Spectroscopy in Mid-IR Range
- Calibration of Lasers
- High-Resolution Spectroscopy
- Trace Gas Detection, Atmospheric Chemistry
- Chemical and Biomolecular Sensing

Optional Package

EOM-Phase Electro-Optic Phase Modulator
Integrated into the laser cavity. Allows high-performance phase locking to an optical reference using a high bandwidth repetition rate actuator. With this EOM option, sub-Hz linewidths can be achieved.



Simon Kocur
Menlo Systems

Feedback?
Questions?
Need a Quote?

Please note that the MID-IR-COMB is 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

Frequency comb technology makes direct measurement of absolute optical frequencies possible. Menlo Systems' Optical Frequency Comb technology is now extended into the mid-IR spectral region. Taking advantage of Menlo Systems' proprietary figure 9® technology for the oscillator, the MID-IR-COMB is a robust and reliable optical synthesizer. The mode frequencies are completely defined by its repetition rate, as the carrier-envelope offset frequency vanishes in a difference-frequency generation process. The turnkey MIR comb enables high-accuracy spectroscopy in important molecular fingerprint regions. Configurations

for different wavelength ranges are available, including 3.0 - 3.4 µm, 3.8 - 4.8 µm, 4.8 - 8 µm, and 8 - 13 µm. Further output information is available on request.

Performance Specifications	
Comb Spacing	100 or 250 MHz
Accuracy	10^{-14} in 120 s[a]
Stability	5 x 10^{-13} in 1 s[a]
Laser Output	Free Space
Central Wavelength	3.2 µm or 7 µm
Spectral Range	>200 nm
Average Output Power	Up to 120 mW

a. Or same as reference, whichever applies first

Environmental Specifications	
Input Requirements	10 MHz Frequency Reference, Power Level +7 dBm
Operating Voltage	100/115/230 VAC
Frequency	50 to 60 Hz
Operating Temperature	22 ± 5 °C
Optical Unit Dimensions / Weight	706 mm x 976 mm x 175 mm / 105 kg (27.8" x 38.4" x 6.9" / 231 lbs)
Control Electronics Dimensions / Weight	448 mm x 437 mm x 484 mm / 50 kg (17.6" x 17.2" x 19.1" / 110 lbs)

LASER SAFETY

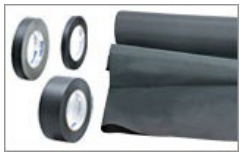
Laser Safety and Classification

Safe practices and proper usage of safety equipment should be taken into consideration when operating lasers. The eye is susceptible to injury, even from very low levels of laser light. Thorlabs offers a range of laser safety accessories that can be used to reduce the risk of accidents or injuries. Laser emission in the visible and near infrared spectral ranges has the greatest potentia for retinal injury, as the cornea and lens are transparent to those wavelengths, and the lens can focus the laser energy onto the retina.

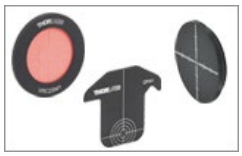
Safe Practices and Light Safety Accessories

- Laser safety eyewear must be worn whenever working with Class 3 or 4 lasers.
- Regardless of laser class, Thorlabs recommends the use of laser safety eyewear whenever working with laser beams with non-negligible powers, since metallic tools such as screwdrivers can accidentally redirect a beam.
- Laser goggles designed for specific wavelengths should be clearly available near laser setups to protect the wearer from unintentional laser reflections.
- Goggles are marked with the wavelength range over which protection is afforded and the minimum optical density within that range.
- Laser Safety Curtains and Laser Safety Fabric shield other parts of the lab from high energy lasers.
- Blackout Materials can prevent direct or reflected light from leaving the experimental













setup area.
- Thorlabs' Enclosure Systems can be used to contain optical setups to isolate or minimize laser hazards.
- A fiber-pigtailed laser should always be turned off before connecting it to or disconnecting it from another fiber, especially when the laser is at power levels above 10 mW.
- All beams should be terminated at the edge of the table, and laboratory doors should be closed whenever a laser is in use.
- Do not place laser beams at eye level.
- Carry out experiments on an optical table such that all laser beams travel horizontally.
- Remove unnecessary reflective items such as reflective jewelry (e.g., rings, watches, etc.) while working near the beam path.
- Be aware that lenses and other optical devices may reflect a portion of the incident beam from the front or rear surface.
- Operate a laser at the minimum power necessary for any operation.
- If possible, reduce the output power of a laser during alignment procedures.
- Use beam shutters and filters to reduce the beam power.
- Post appropriate warning signs or labels near laser setups or rooms.
- Use a laser sign with a lightbox if operating Class 3R or 4 lasers (i.e., lasers requiring the use of a safety interlock).
- Do not use Laser Viewing Cards in place of a proper Beam Trap.

Laser Classification

Lasers are categorized into different classes according to their ability to cause eye and other damage. The International Electrotechnical Commission (IEC) is a global organization that prepares and publishes international standards for all electrical, electronic, and related technologies. The IEC document 60825-1 outlines the safety of laser products. A description of each class of laser is given below:

Class	Description	Warning Label
1	This class of laser is safe under all conditions of normal use, including use with optical instruments for intrabeam viewing. Lasers in this class do not emit radiation at levels that may cause injury during normal operation, and therefore the maximum permissible exposure (MPE) cannot be exceeded. Class 1 lasers can also include enclosed, high-power lasers where exposure to the radiation is not possible without opening or shutting down the laser.	
1M	Class 1M lasers are safe except when used in conjunction with optical components such as telescopes and microscopes. Lasers belonging to this class emit large-diameter or divergent beams, and the MPE cannot normally be exceeded unless focusing or imaging optics are used to narrow the beam. However, if the beam is refocused, the hazard may be increased and the class may be changed accordingly.	
2	Class 2 lasers, which are limited to 1 mW of visible continuous-wave radiation, are safe because the blink reflex will limit the exposure in the eye to 0.25 seconds. This category only applies to visible radiation (400 - 700 nm).	
2M	Because of the blink reflex, this class of laser is classified as safe as long as the beam is not viewed through optical instruments. This laser class also applies to larger-diameter or diverging laser beams.	
3R	Class 3R lasers produce visible and invisible light that is hazardous under direct and specular-reflection viewing conditions. Eye injuries may occur if you directly view the beam, especially when using optical instruments. Lasers in this class are considered safe as long as they are handled with restricted beam viewing. The MPE can be exceeded with this class of laser; however, this presents a low risk level to injury. Visible, continuous-wave lasers in this class are limited to 5 mW of output power.	
3B	Class 3B lasers are hazardous to the eye if exposed directly. Diffuse reflections are usually not harmful, but may be when using higher-power Class 3B lasers. Safe handling of devices in this class includes wearing protective eyewear where direct viewing of the laser beam may occur. Lasers of this class must be equipped with a key switch and a safety interlock; moreover, laser safety signs should be used, such that the laser cannot be used without the safety light turning on. Laser products with power output near the upper range of Class 3B may also cause skin burns.	
4	This class of laser may cause damage to the skin, and also to the eye, even from the viewing of diffuse reflections. These hazards may also apply to indirect or non-specular reflections of the beam, even from apparently matte surfaces. Great care must be taken when handling these lasers. They also represent a fire risk, because they may ignite combustible material. Class 4 lasers must be equipped with a key switch and a safety interlock.	
All class 2 lasers (and higher) must display, in addition to the corresponding sign above, this triangular warning sign.		

Part Number	Description	Price	Availability
MID-IR-COMB	Mid-IR Optical Frequency Comb	$0.00	Menlo Lead Time