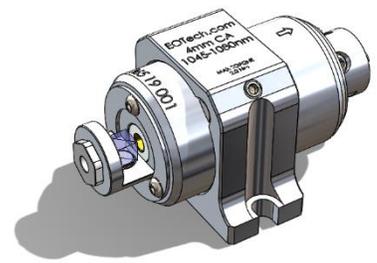
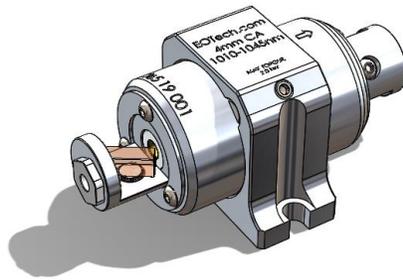
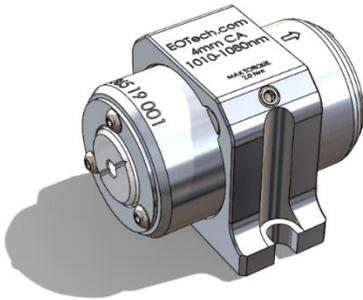


PAVOS+ ULTRA

User Guide



Faraday Rotators and Optical Isolators
1010 nm to 1080 nm



Thank you for purchasing your PAVOS+ Ultra Faraday Rotator or Optical Isolator from EOT. This user guide will help answer questions you may have regarding the safe use and optimal operation of your device.

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I. PAVOS+ Ultra Optical Isolator Overview

The PAVOS+ Ultra Faraday Rotators are optical assemblies that rotate the polarization of light 45° clockwise from input to output using the Faraday Effect. This is accomplished through the use of a proprietary optical material mounted inside a magnetic assembly.

The PAVOS+ Ultra Optical Isolators build on the technology found inside Faraday rotators by adding two high power polarizers creating an optical assembly that is polarization-dependent and allows transmission of light in only one direction with minimal losses.

The PAVOS+ Ultra Faraday rotators and optical isolators utilize a high-performance Faraday material which exhibits very low optical absorption. This material requires that the polarization of light propagates along a particular crystallographic orientation in order to maximize the device performance. It is recommended that minimal changes are made to the orientation of the product upon receipt as the proper orientation has been set at the factory.

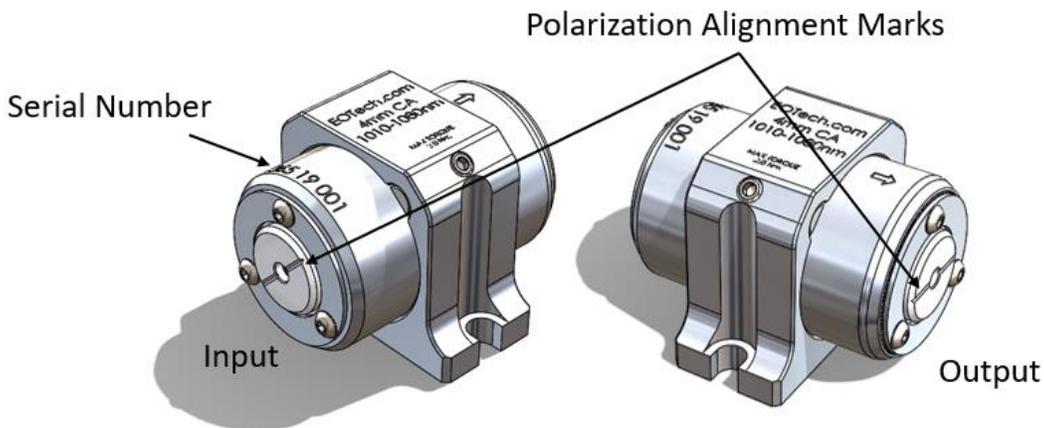
These products have been designed with several mounting options. These include a precision mounting option for customers who are interested in a drop-in alignment solution.

II. Safe Use of your PAVOS+ Ultra Faraday Rotator and Isolator

Due to the powerful magnetic field that exists inside the products, care must be taken while working within their vicinity. Please carefully review the following warnings and recommendations. ***Failure to follow these recommendations may result in permanent damage to the product or serious injury to the user.***

1. Ferromagnetic tools and objects should not be used or placed in the proximity of the rotators and isolators. These items will be forcefully attracted to the internal magnets, causing damage or injury.
2. **Do not** pick up the isolator by its ends where the magnetic field and risk of attraction to other objects is the greatest.
3. Never attempt to disassemble your device. The internal magnets will be ejected outward possibly causing serious injury.
4. Due to the high-power capability of the PAVOS+ Ultra Products, port covers are not provided. It is the responsibility of the user to safely terminate all beams.
5. **Always** wear personal protective equipment that provides protection against the wavelengths and powers being used in your application.
6. **Never** sight through the products to align them with laser sources or other optical components.
7. Personnel with any magnetically-sensitive implants such as pacemakers should consult their medical doctor regarding any potential complications which could arise from the isolator's external magnetic fields.
8. Keep all magnetically-sensitive materials and devices such as watches, computer hard drives, and magnetic strips away from the products.

III. Using your PAVOS+ Ultra Faraday Rotator



1: PAVOS+ Ultra Faraday Rotator

Your rotator has been optimized at the factory to provide 45° clockwise, non-reciprocal rotation of linearly polarized light from the input to the output at the ordered wavelength and operating temperature.

EOT recommends that light is injected into the input side of the device (Figure 1) and that the customer carefully aligns the rotator to the beam path. For optimal performance, it is important that the sources polarization plane is well aligned to the polarization alignment marks inscribed onto the ceramic input and output apertures. These have been aligned at the factory and coincide with a particular crystallographic orientation.

Please see the product data sheet for typical performance curves and the product drawings for mounting options and physical dimensions. 3D CAD files are available upon request.

Please contact EOT with any additional questions regarding your Faraday Rotator.

IV. Using your PAVOS+ Ultra Optical Isolator

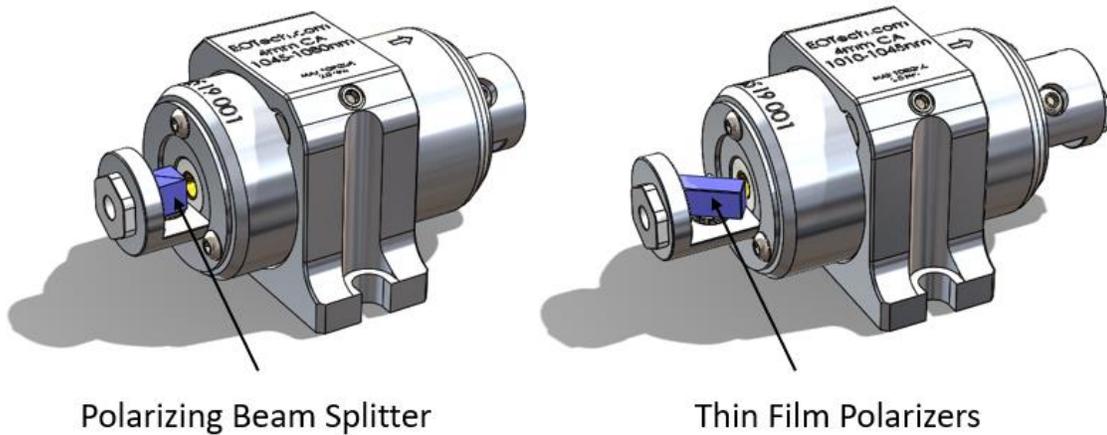


Figure 2: PAVOS+ Ultra Optical Isolator Polarizer Options

The PAVOS+ Ultra Optical Isolator can be ordered with either polarizing beam splitters or thin film polarizers. Your Optical Isolator has been optimized at the factory to provide optimal isolation and transmission at the ordered polarization orientations, operating temperature, and wavelength. In addition, the factory has aligned the polarizers to a particular crystallographic orientation in the Faraday crystal in order to optimize its high-power performance.

In a typical application, light traveling from the input to the output (forward light) will pass with minimal losses while reverse light will be highly attenuated. Due to the high-power capability of the PAVOS+ Ultra Products, port covers are not provided. It is the responsibility of the user to safely terminate all beams (see Figure 3 for reference).

EOT recommends that the customer carefully aligns the Optical Isolator to the beam path to insure optimal performance.

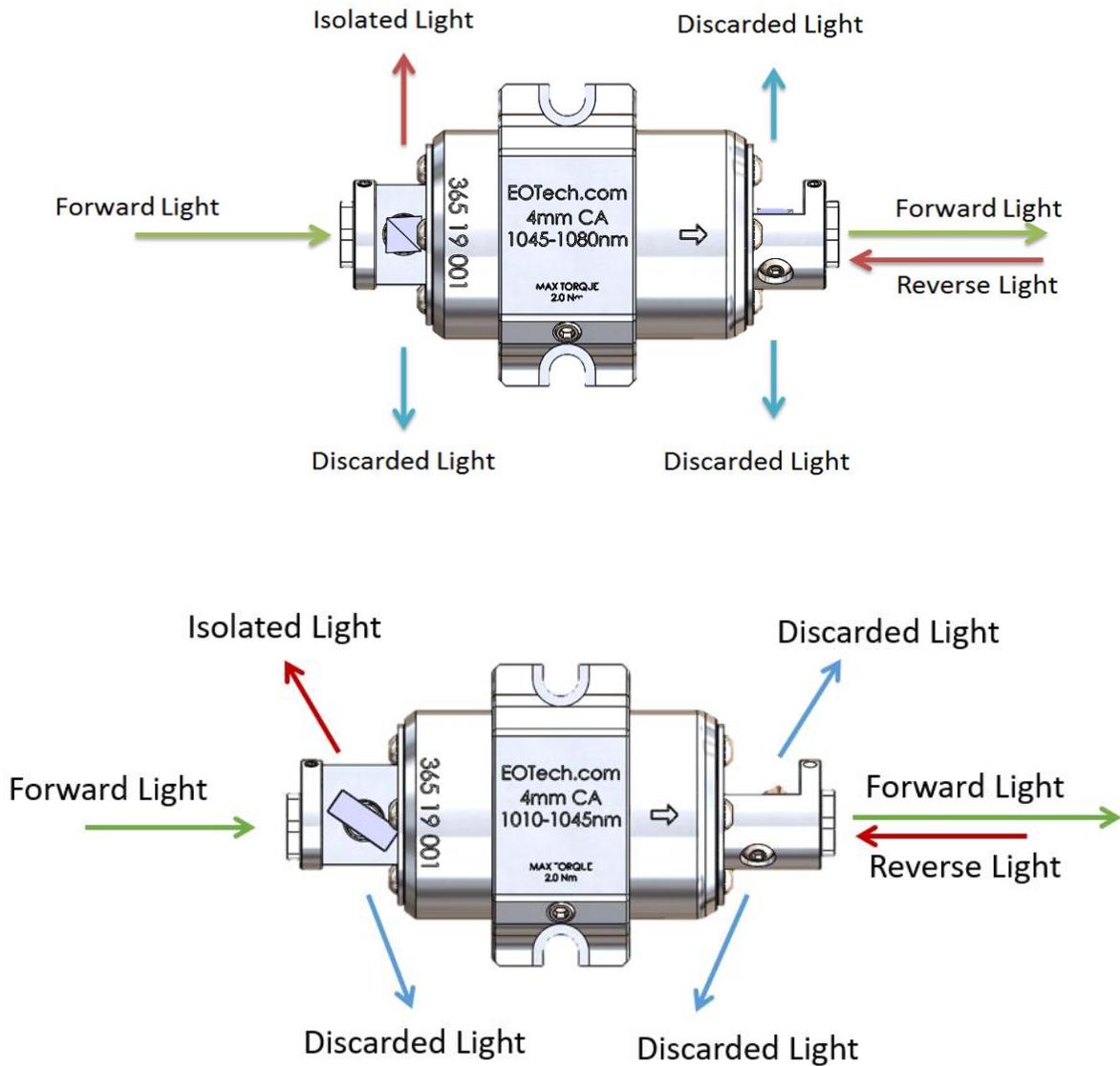


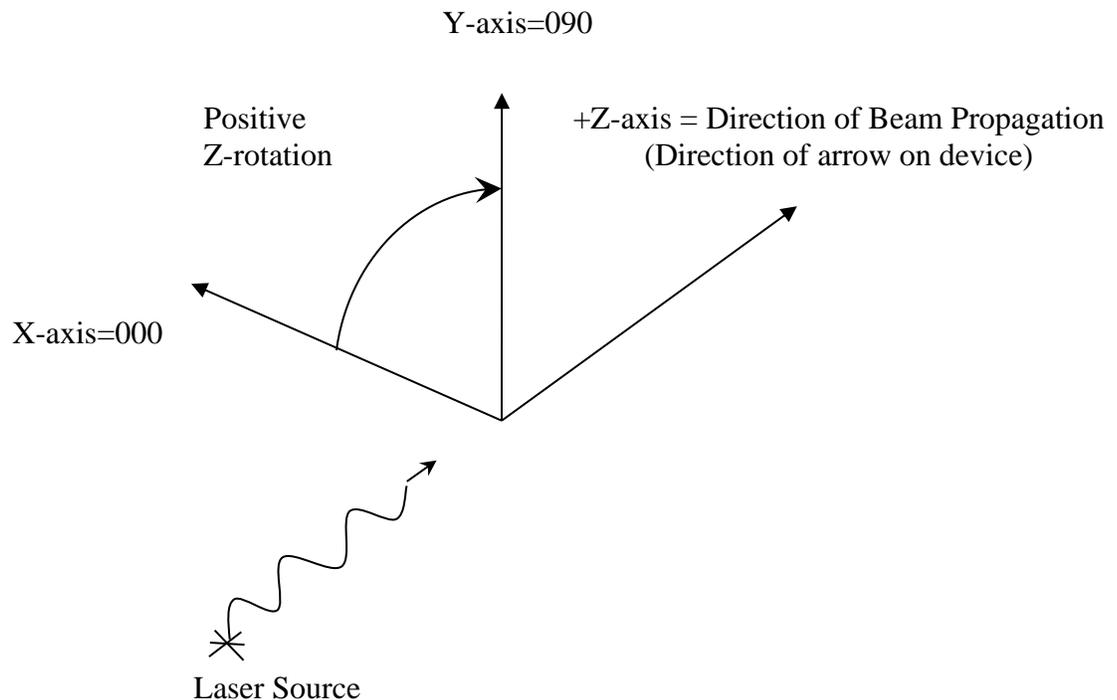
Figure 3: Light Propagation through Optical Isolators

Numbering Fields & Coordinate System for PAVOS+ Faraday Rotators & Optical Isolators

General Format for Numbering Field: AA-B-CCCC-DDD-EEE

Field Description:

1. “AA” is the aperture size, e.g. 04=4 mm.
2. “B” is the device type. I=isolator; R=rotator.
3. “CCCC” is the operating wavelength in nm.
4. “DDD” is the input polarization axis angle. A right hand X, Y, Z Cartesian coordinate system is used, in which the direction of beam propagation away from the laser source is along the positive Z axis. The X axis is in the plane of the baseplate. The Y axis is vertical, normal to the plane of the baseplate. The XY plane forms the plane of polarization. The XZ plane forms the plane of the baseplate. As an example, a horizontal input polarization is 000 or 0 degrees. A vertical polarization is 090, or 90 degrees. If no polarization is selected by the customer, 000 will be assigned. For rotators, this field does not apply.
5. “EEE” is the output polarization, which is 45 degrees from the input polarization if no waveplate is used. If a waveplate is used and no output polarization is specified, the default setting is the input polarization plus 90 degrees. The angle convention is the same as described for “DDD”. For rotators, this field does not apply.



Waveplate Tuning:

If your device was ordered with a $\lambda/2$ waveplate, it was factory adjusted to provide the input and output polarization orientations as ordered. $\lambda/2$ waveplates can be installed, as requested, on the input or output of the isolator.

If additional tuning of the output polarization is desired:

- Determine if the waveplate has been installed onto the input or output of the device.
- Loosen the set screw of the associated waveplate holder with an M1.5 hex wrench (Figure 4).
- Adjust the waveplate holder to the desired output polarization.
- Tighten the set screw with an M1.5 hex wrench. *Care must be taken to not crack the ceramic waveplate holder.*
 - Recommended torque: **1.5 in-lbs Max**

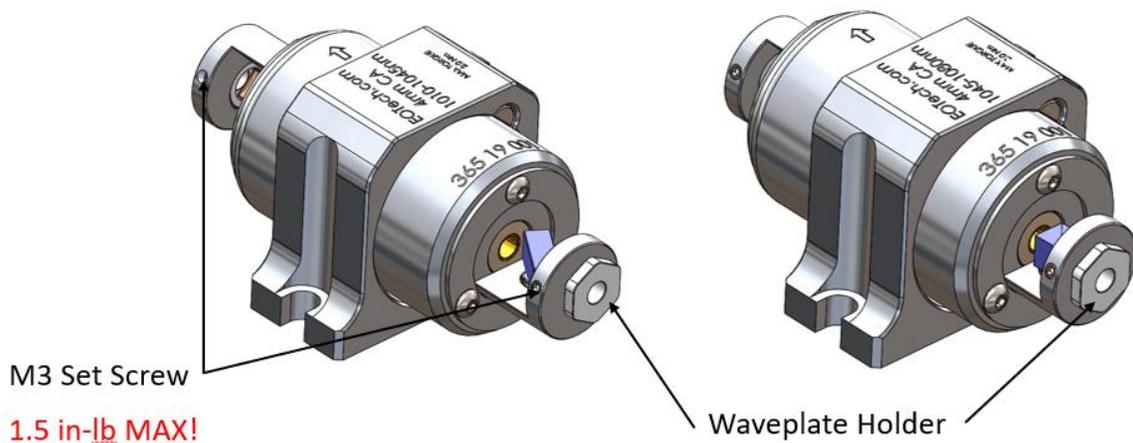


Figure 4: Waveplate Tuning

V. Installation of your device

The products are fully compatible with both metric and English breadboards. For OEM customers, EOT recommends installing the products using the precision dowel pin holes provided on the bottom of the clamp. EOT uses these features during final testing and use of this mounting option will provide drop-in precision.

For more information, please see the drawing.



VI. Warranty Statement and Repair

EOT warrants its products to be free from defects in material and workmanship and complies with all specifications. EOT will at its option, repair or replace any product or component found to be defective during the warranty period. This warranty applies only to the original purchaser and is not transferrable for a period of one year after date of original shipment. The foregoing warranties shall not apply, and EOT reserves the right to refuse warranty service, should malfunction or failure result from:

- a. Damage caused by improper installation, handling or use.
- b. Unauthorized product modification or repair.
- c. Operation outside the environmental or damage specifications of the product.
- d. Contamination not reported to EOT within 30 days of the original ship date.
- e. EOT's output isolators contain a "spacer" at the end of the isolator. Under certain conditions, an off-axis back-reflection from the workpiece could focus down onto the output displacer or polarizer inside the isolator. The purpose of the spacer is to eliminate the conditions under which this could happen. Should EOT's output isolators be purchased without the spacer, or should the spacer be removed, damage to the output displacer or polarizer will not be covered under warranty and the customer will be responsible for all costs associated with such an occurrence.

This warranty is exclusive in lieu of all other warranties whether written, oral, or implied. EOT specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. In no event shall EOT be liable for an indirect, incidental, or consequential damages in connection with its products.

If the customer believes there is a problem with the rotator/isolator, they should immediately contact EOT's Sales/Customer department at 231-935-4044 or customerservice@eotech.com. EOT's Customer Service department will either issue an RMA for the device, or provide the customer with a procedure and authorize the customer to modify the device. All returns should reference the RMA number on the outside of the shipping container and should be sent to:

Electro-Optics Technology, Inc.
Attn: Sales/Customer Service
3340 Parkland Ct.
Traverse City, MI 49866 USA

EOT reserves the right to inspect rotators/isolators returned under warranty to assess if the problem was caused by a manufacturer defect. If EOT determines the problem is not due to a manufacturer defect (an example would be damage to an optical element caused by impact from a loose ball driver or exceeding the damage threshold of the device), repairs will be done at the customer's expense. EOT will always provide a written quote for repair prior to performing repairs at the customer's expense. **Never attempt to disassemble the magnetic housing of your Faraday Rotator/Isolator. Injury could result.** Any indications that an attempt to disassemble the magnetic housing was made will render the warranty null and void.



Electro-Optics Technology, Inc.

Notes:

1. **Operating Temperature:** Performance of EOT's Faraday Rotators/Isolators is related to operating temperature. For information on the effect of operating temperature on EOT's Faraday Rotators/Isolators, please review our application note, *Thermal Lensing Analysis of TGG*.
2. **For higher incident powers or aperture sizes other than those specified, or other custom requirements, please consult EOT.** You may either contact EOT's sales department at sales@eotech.com or view our *Custom Solutions* page on our website, eotech.com. EOT has a designated Custom Solutions department with the expertise and capability of manufacturing custom Faraday Rotators and Isolators.
3. **Pulsed Damage Threshold:** The pulsed damage threshold of your free space Faraday Rotator or Isolator can be determined at pulsewidths other than 10 ns by using the "Root T" scaling method.