

High Power Faraday Optical Isolator User Guide



Faraday Optical Isolators
1010 nm to 1080 nm
Small Aperture (≤ 5 mm)



Thank you for purchasing your Optical Isolator from Newport. This user guide will help answer questions you may have regarding the safe use and optimal operation of your device.

TABLE OF CONTENTS

I. Optical Isolator Overview	2
II. Safe Use of your Optical Isolator	2
III. Using your Optical Isolator.....	3
IV. Installation of your device	6
V. Warranty Statement.....	6

I. Optical Isolator Overview

The 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.

As an additional benefit, Optical Isolators have been designed to reject any isolated light orthogonally to the input beam with a pointing accuracy of < 5 mrad. This allows for efficient optical isolation of subsystems or for passing high power beams to beam traps.

Finally, the 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 Optical 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 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. The port covers should be opened if any of the following conditions are met:
 - a. Forward propagating beam >25 W average power
 - b. Reverse propagating beam >1 W average power
 - c. Reverse pulsed energy density > 0.15 J/cm² @ 10 ns pulse width

Once opened, it is the responsibility of the user to properly terminate all beams in a safe manner.

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 Optical Isolator

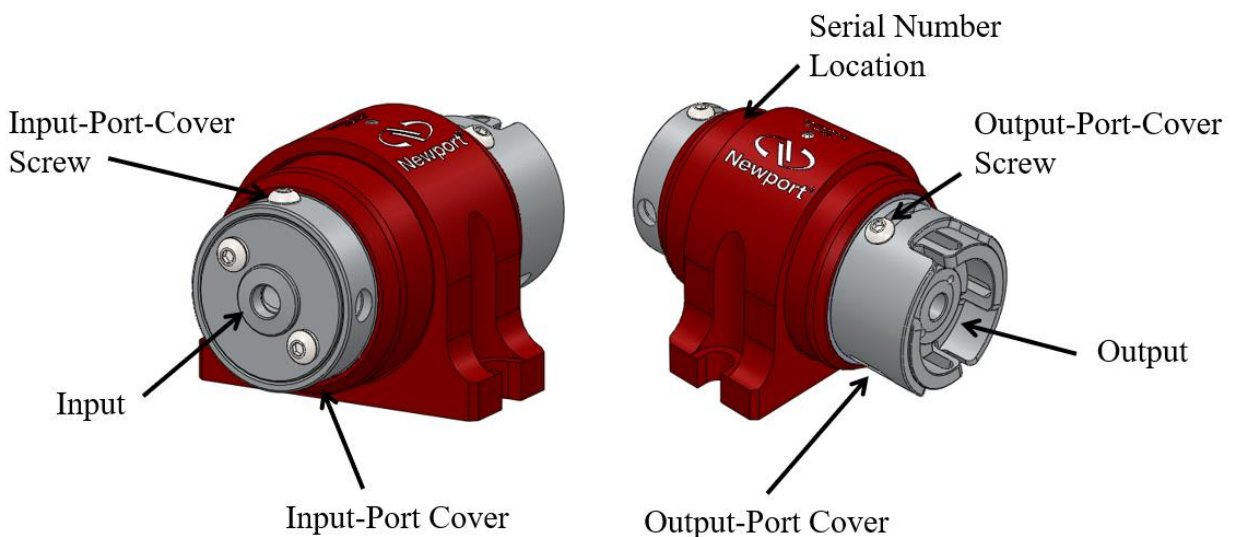


Figure 2: Optical Isolator

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 input polarizer to provide precision pointing of the isolated light (Figure 3), providing a drop-in solution for OEM customers needing to pass light to subsystems or beam traps.

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. If the port covers are opened, this attenuated or isolated light will be rejected as shown in Figure 3.

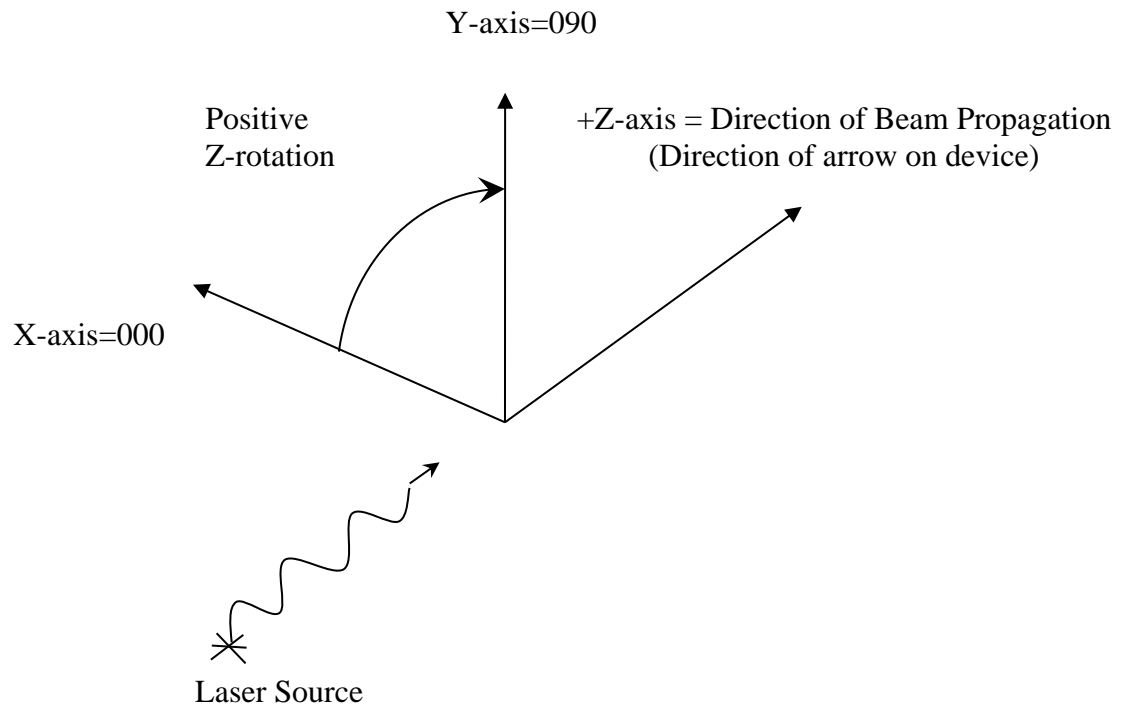
Newport recommends that the customer carefully aligns the Optical Isolator to the beam path to insure optimal performance.

Numbering Fields & Coordinate System for Faraday Optical Isolators

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

Field Description:

1. “AA” is the aperture size, e.g. 05=5 mm.
2. “B” is the device type. I=isolator;
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.
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”.



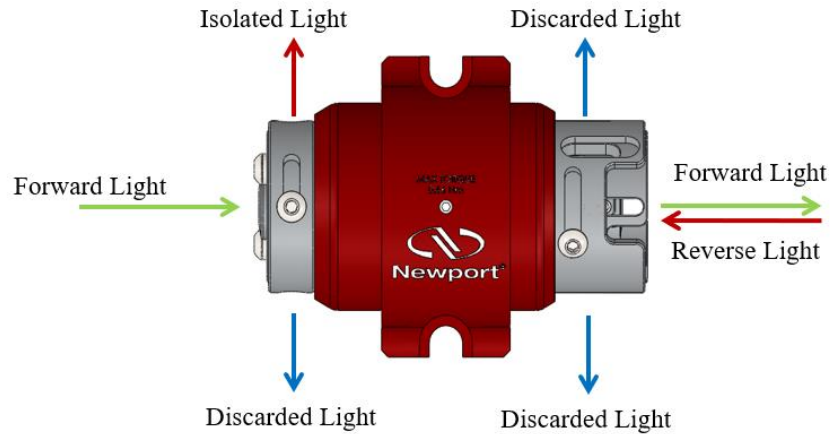


Figure 3: Light Propagation through Optical Isolators

Port Covers:

Newport recommends opening the port covers on your Optical Isolator if any of the following conditions exist in your application. Failure to open the ports when recommended may result in either poor performance or product failure.

- Forward propagating beam >25 W average power
- Reverse propagating beam >0.5 W average power
- Reverse pulsed energy density > 0.15 J/cm² @ 10 ns pulse width

Once opened, the port covers reveal four ports as shown in Figure 3. If incorrectly aligned with the source or if the reverse light has been depolarized, the discarded light ports may contain a significant amount of power. It is the customer's responsibility to analyze their specific application and to properly manage the light from all ports on the product.

To open or close the port covers:

- Loosen the port-cover screw using an M2 hex wrench.
- Rotate the port cover until the optical ports are open or closed.
- Retighten the port-cover screw using an M2 hex wrench.
 - Recommended torque: 2.5 in-lbs.

Waveplate Tuning:

If your device was ordered with a $\lambda/2$ waveplate, it was factory adjusted to provide the output polarization as ordered.

If additional tuning of the output polarization is desired:

- Close the output-port cover per the instructions.
 - This reveals an M3 set screw which secures the waveplate holder (Figure 4).
- Loosen the set screw with an M1.5 hex wrench.
- Adjust the waveplate holder to the desired output polarization (Figure 4).

- Tighten the set screw with an M1.5 hex wrench.
 - Recommended torque: 2.5 in-lbs.

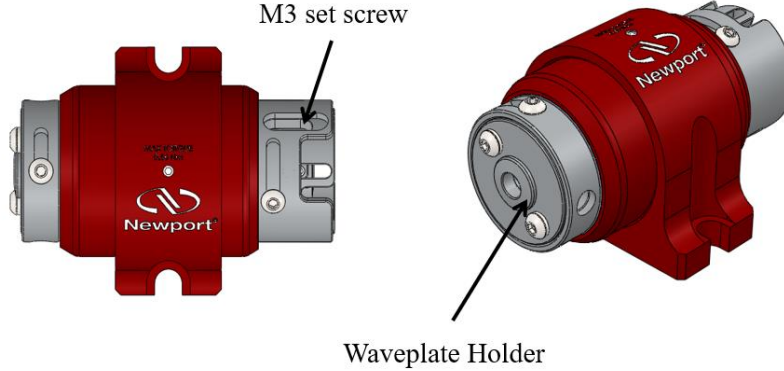


Figure 4: Waveplate Tuning

IV. Installation of your device

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

For more information, please see the drawing.

V. Warranty Statement

Warranty

Newport Corporation warrants that this product will be free from defects in material and workmanship and will comply with Newport's published specifications at the time of sale for a period of one year from date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport office or representative. You will be given prompt assistance and return instructions. Send the product, freight prepaid, to the indicated service facility. Repairs will be made, and the instrument returned freight prepaid. Repaired products are warranted for the remainder of the original warranty period or 90 days, whichever first occurs.

Limitation of Warranty

The above warranties do not apply to products which have been repaired or modified without Newport's written approval, or products subjected to unusual physical, thermal or electrical stress, improper installation, misuse,

abuse, accident or negligence in use, storage, transportation or handling. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE. NEWPORT CORPORATION SHALL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM THE PURCHASE OR USE OF ITS PRODUCTS.

Notes:

1. **Operating Temperature:** Performance of Newport's Isolators is related to operating temperature.
2. **For higher incident powers or aperture sizes other than those specified, or other custom requirements, please consult Newport.** You may either contact Newport's sales department at sales@newport.com.
3. **Pulsed Damage Threshold:** The pulsed damage threshold of your free space Faraday Isolator can be determined at pulsewidths other than 10 ns by using the "Root T" scaling method.