Air-Path Isolators

For Fiber-Optic Isolators

see FIBER-OPTIC PRODUCTS Section

Table of Contents

CONTENTS

OFR and Optical Isolators

OFR has been in optical isolators from the beginning. In fact, OFR introduced the optical isolator to the world's photonics market. Having designed more than 100 models in response to customers' requirements since the early 1980s, OFR now produces more isolator models than any other manufacturer.

Faraday Rotator crystal rods are optically ground and polished in the OFR optical shop using OFR-designed tooling. End faces of the rotator rods are ground and polished to <5 arc seconds parallel. Thus, end-face specifications are maintained under OFR control. This, along with internal inspection (for inclusions and strain-birefringence) of 100% of all Faraday Rotator crystal rods used, insures that all Isolators meet OFR's discriminating specifications.

OFR manufactures Optical Isolators for virtually all lasers from 193 nm to 10.6 µm and beyond. Most models are available with low-power or high-power polarizers. All are permanent magnet, single-pass type Isolators.

Among the many "firsts" introduced by OFR:

❑ Wideband Tunable Isolator for Visible	(1985)
❑ Wideband Tunable Isolator for Near-IR	(1985)
❑ Tunable, Pigtailed Isolator	(1986)
❑ “Aspirin Tablet" Micro Isolator	(1988)
❑ CO_2 Laser Isolator	(1991)
❑ Ti:Sapphire Isolator	(1991)
❑ “Grain-of-Rice" Micro-Isolator	(1991)
❑ HoYAG Isolator	(1991)
❑ Near-UV Isolator	(1991)
❑ 980 nm Isolator	(1993)
❑ Mini-package VIS, NIR designs	(1994)
❑ Utility Grade (economically-priced) designs	(1995)
❑ Tunable IR designs	(1995)
❑ Deep-UV Isolator	(1996)
❑ Faraday Rotators using a Movable Optical Element	US Patent 4,804,256
❑ Optical Isolator employing a Ge-As-Se Composition	US Patent 4,840,464
❑ Magnetic Configuration for Faraday Rotators	US Patent 4,856,878
❑ Optical Isolators employing Oppositely Signed Materials	US Patent 5,087,984
❑ Optical Isolators employing Wavelength Tuning	US Patent 5,111,330
❑ Optical Circulator having Simplified Construction	US Patent 5,212,586
❑ Optical Isolator employing Cd-Zn-Te Composition	US Patent 5,790,299
❑ Devices for holding optical components fixed positions	US Patent 6,061,190

Function of an Isolator

Purpose of an Isolator
OFR isolators are used to reduce or eliminate the effects of optical feedback...reflections of the laser's own energy back into itself. The effects of optical feedback are well known: amplitude fluctuation, frequency shift, limitation of modulation bandwidth, noise and even damage.

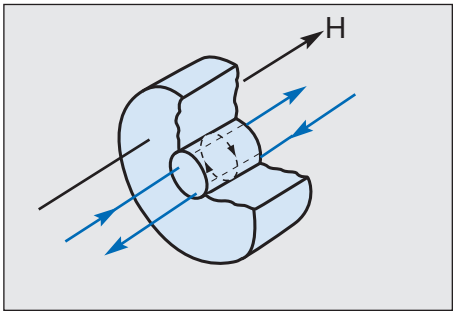
Much like a diode in an electrical circuit, the isolator transmits light in one direction only. An isolator consists of a Faraday rotator, two polarizers and a body to house the parts. The Faraday rotator consists of a magneto-optic material contained in a magnetic field.

The Faraday Effect
In 1842, Michael Faraday discovered that the plane of polarized light rotates while transmitting through glass (or other material) that is contained in a magnetic field. The direction of rotation is dependent on the direction of the magnetic field, and not on the direction of light propagation (non-reciprocal). The amount of rotation, Θ, equals VLH, where

V is the Verdet Constant, a property of the optical material, in minutes/Oersted-cm.

L is the path length through the optical material in cm.

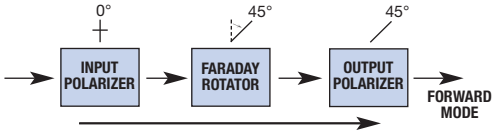
H is the magnetic field strength in Oersted.



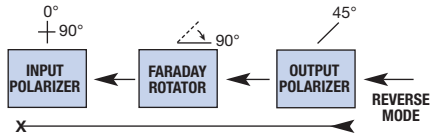
The Faraday Effect is non-reciprocal, meaning that the direction of rotation is independent of the direction of light propogation, and only dependent upon the direction of the magnetic field.

OPERATION OF AN ISOLATOR
The forward mode
Laser light, whether or not polarized, enters the Input Polarizer and becomes linearly polarized, say in the vertical plane (0°). It then enters the Faraday rotator rod, designed to rotate the plane of polarization (POP) by 45°, say in the ccw sense. It then exits through the Output Polarizer whose axis is at 45°.

The light leaves the Isolator, and reflections occur. This reflected light constitutes feedback.



The reverse mode
This feedback re-enters the Isolator, back through the Output Polarizer where it is repolarized at 45°. It then passes back through the rotator rod and is further rotated by another 45°, still in the ccw sense, making a total of 90° with respect to the Input Polarizer (0°). It is seen that the light is extinguished here. Thus, we have succeeded in isolating the laser from its own reflections.



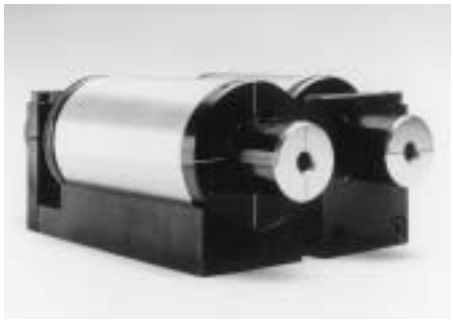
Horizontal or Vertical Polarization?

Unless otherwise specified at time of order, OFR Isolators are set for horizontal input polarization. However, most models can be easily reset for vertical input merely by rotating each polarizer 90°.

Whether horizontal or vertical input, the output plane of polarization will be at 45°, the specific quadrant depending upon the model.

An alternate means of rotating the output is the Polarization Rotator (1/2-Wave Retarder), mounted on the Output Poarizer. See page IO-14.

In a correctly adjusted isolator, maximum isolation and transmission occur together when the axis of the Input Polarizer is parallel to the plane of the polarized laser, and the Output Polarizer is at 45°. If the wavelength changes, then rotation is no longer 45°, and both isolation and transmission will decrease. Thus, it is desirable to readjust the isolator if the wavelength changes.



More Options with OFR Polarizers

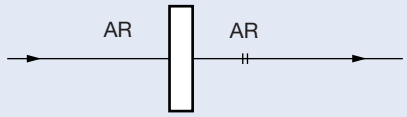
Of all isolators manufacturers in the world, OFR is the only one who manufactures all of the optical components used in its isolators. OFR manufactures calcite polarizers, and Brewster's Angle Plate Polarizers, and other types.

Types of Polarizers & Power Limits

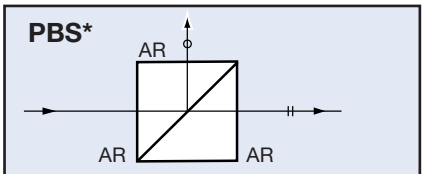
Number	Type of Polarizer	CW	Pulsed
VLP	Dichroic thin plate	25 W/cm²	300 kW/cm²
PBS	Polarizing B/S Cube	13 W/cm²	———
LP	Air-spaced Calcite	100 W/cm²	25 MW/cm²
HP	Air-spaced Calcite	500 W/cm²	150 MW/cm²
HP-YAG	Air-spaced Calcite	750 W/cm²	200 MW/cm²
VHP	Brewster's Angle Plate	20 kW/cm²	1 GW/cm²

Note: Pulsed measurements made at 1064 nm 20 ns pulse width, 20 Hz.

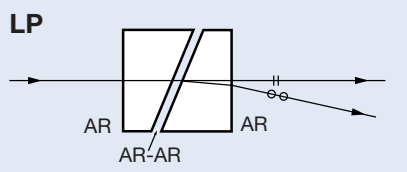
VLP



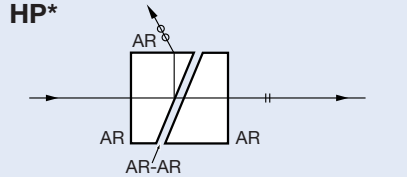
PBS*



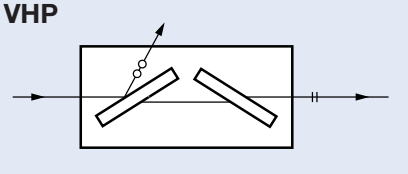
LP



HP*



VHP



VLP Polarizers (manufactured by OFR, see page OC-23)

- ❒ Thin glass plate
- ❒ AR coated
- ❒ Extinction ≥45 dB
- ❒ Dichroic polarizer
- ❒ Transmittance ≥98% (λ>1250µm)
- ❒ Absorbs unwanted polarization

*PBS Polarizers (manufactured by OFR, see page OC-20)

- ❒ Cemented prism beam-splitter
- ❒ AR coated
- ❒ Extinction >33 dB
- ❒ Energy injection at 90°*
- ❒ Transmittance/ reflectance ≥95%

LP Calcite Polarizers (manufactured by OFR, see page OC-23)

- ❒ Air-spaced design
- ❒ Extinction ≥53 dB
- ❒ Transmittance ≥98%
- ❒ AR coated

HP Calcite Polarizers (manufactured by OFR, see page OC-23)

- ❒ Air-spaced design
- ❒ Extinction ≥53 dB
- ❒ Transmittance ≥98%
- ❒ AR coated

VHP Polarizers (manufactured by OFR, see page OC-23)

- ❒ Double dielectric Brewster's Plates
- ❒ Highest power damage resistance
- ❒ AR coated
- ❒ Transmittance ≥96%
- ❒ Extinction ≥40 dB

***Access to Beam through Side Window**

The PBS and HP series allow access to the laser beam via the Side Window. This entry/exit face is used to sample the rejected energy, or to inject energy into the beam. The PBS is a cemented beamsplitter cube and therefore is power limited. All faces are AR coated.

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Outstanding Features & Other Information

Economically priced Utility Grade Isolators

Some applications do not require the typically superior performance of OFR Isolators. In order to meet these requirements, OFR has developed its new line of Utility Grade Isolators, whose performance and prices are more modest.

Look for "C" Models

Utility Grade Isolators contain the letter "C" in the part number. Where models are available, they are so listed throughout this catalog. For example, IO-5C-780-LP.

In some cases, "C" models might be somewhat larger than the standard models.

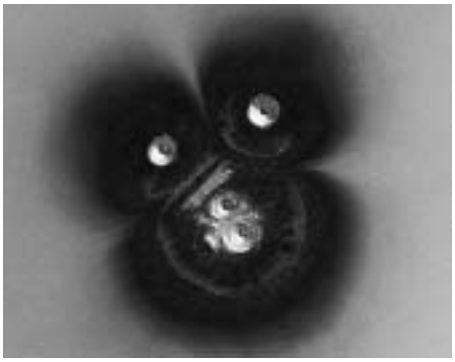
Faraday Rotators, without polarizers

Most OFR Isolators are available without Polarizers, in which case, terminate Part Number with "-I" (see Price List).

Highest transmission, highest isolation, and highest damage resistance

OFR Isolators typically have higher transmittance and Isolation than all other isolators on the market. Further, because of certain proprietary features (covered by 5 of OFR's US patents), OFR Isolators are smaller and have higher performance than any units of equivalent aperture available anywhere.

For visible to YAG laser Isolators, OFR's Faraday Rotator crystal of choice is TGG (terbium-gallium-garnet), which is unsurpassed in terms of optical quality, Verdet constant, and resistance to high laser power. OFR TGG Isolator rods have been damage tested to 22.5 J/cm^2 at 1064 nm in 15 ns pulses (1.5 GW/cm^2), and to 20 kW/cm^2 cw. However, OFR does not bear responsibility for laser power damage that is attributable to "hot spots" in the beam.



Certified laser damage testing assures guaranteed damage resistance. TGG with VHP AR coating for YAG, 440 µm spot size, 200 shots.

Other Faraday Rotator Materials

OFR produces more Isolator models covering more laser wavelengths than any other manufacturer. These models utilize numerous magneto-optic materials in addition to TGG, such as the thin film bismuth-iron-garnet (BIG) and others, depending upon wavelength, laser power, size requirement and other factors. Two materials are covered by OFR patents (4,840,464 and 5,790,299).

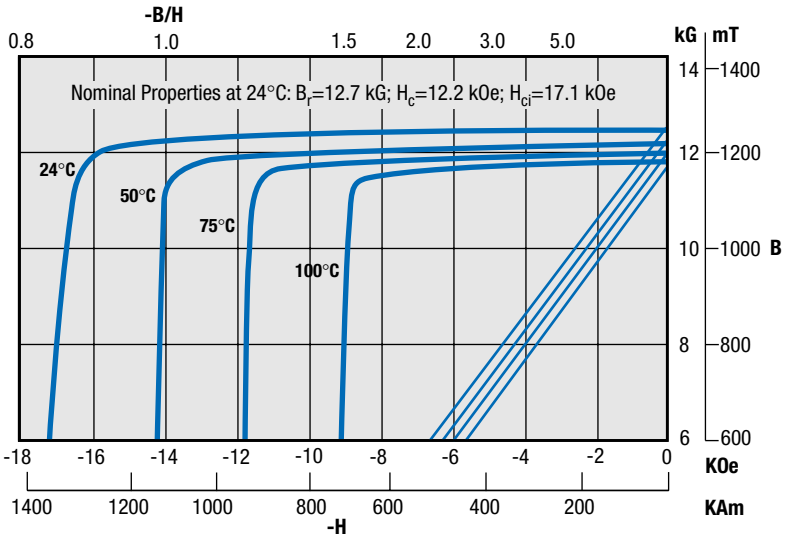
Magnets

The magnet is a major factor in determining the size of an Isolator. The ultimate size of the magnet is not simply determined by magnetic field strength, but is influenced by the mechanical design. Many OFR magnets are not simple (one piece), but are complex (more than one piece). OFR's computer modeling allows optimization of the many parameters that affect size, optical path length, total rotation, and field uniformity.

OFR's US Patent 4,856,878 describes one such design that is used in several of the larger aperture Isolators for YAG lasers.

OFR emphasizes that a powerful magnetic field exists around these Isolators. Do not bring steel or magnetic objects closer than 5 cm.

OFR will not be responsible for damage to any equipment, electronics, computer discs, etc., nor for injury to any persons, or damage to any peripheral equipment or property caused by use of OFR isolators. For information, contact OFR.



Magnet design is an important factor in determining minimum package size.

Double-dB Isolators

Most OFR Isolators are available as DOUBLE-dB Series yielding 60 dB to 75 dB isolation. See IOT models and Price List.

Custom Isolators

Custom micro isolators are based on two of OFR's patents (4,840,464 and 5,087,984), for example the IO-2D Series NIR Isolators.

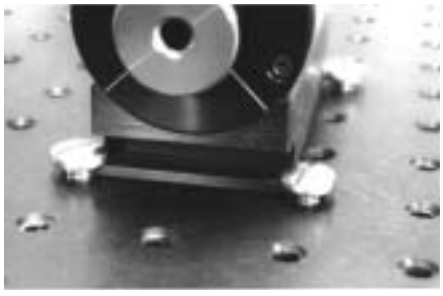
Epoxy-free optical path

This is a feature of all OFR Isolators.

Custom, mini and micro Isolators.

Mounting Feature For OFR Isolators

OFR Isolators can be post mounted via threaded holes (¼-20 & M6) on the underside of the base. In addition, a new method permits quick and easy clamping of the Isolator directly onto the surface of an optical table. The technique accommodates both 1" and 25 mm centers.



Narrowband Adjustable Isolators (IO-λ Series)

An Isolator is set for maximum isolation at a center wavelength. If the laser deviates from this wavelength, then the isolation will decrease. In order to regain maximum isolation, it is necessary to adjust the Isolator. Narrow Range Isolators are readjusted by rotating the Output Polarizer. At the extreme ends of this range of adjustment, transmission through the Isolator will decrease, but by no more than 3% from the peak wavelength value. It is possible to tune a small amount beyond the range and still retain maximum isolation; however, transmission will decrease by more than 3%.

For example, an isolator centered at 815 nm rotates exactly 45°. If its isolation and transmission are, say, 40 dB and 94%, what are these values when it is retuned for maximum isolation at a new wavelength, say 780 nm?

Over a small wavelength range, Faraday rotation is approximately proportional to λ^{-2}. Therefore, rotation at 780 nm is ~49°. In order to satisfy the condition for extinction (two planes of polarization are perpendicular), the output polarizer is set at 41° (90°- 49° = 41°), thus retaining 40 dB isolation.

Finally, the Law of Malus shows that transmittance through two polarizers is proportional to the $\cos^2$ of the angle between their axes of polarization. This angle is 8° (49°-41°) and the $\cos^2$ is 0.98. Thus, transmission is reduced by 2%, nominally from 94% to 92%.

Characteristics and Features

These Isolators are set at OFR for any center wavelength within the adjustment range specified at time of order. Adjustment range is a nominal 5% of the center wavelength.

Unless otherwise specified at time of order, these Isolators are set for horizontal input polarization. Output polarization is in the +/- 45° quadrant. The output polarization plane can be rotated to horizontal or vertical with an OFR ½-Wave Retarder. See IO-15

Double-dB Isolators, the IOT Series, have output polarization in the same plane as the input, available as indicated. These are two Isolators in tandem on a common base, sharing a common center Polarizer. Isolation is doubled and transmittance is reduced to approximately the squared value. Net rotation can be ordered to be 0° or 90°.

All surfaces are AR-coated for maximum transmittance.

Narrow Range Adjustable Isolators for VIS and NIR.

Center wavelength is adjusted by turning output polarizer.

Broadband Adjustable Isolators (IO-NIR Series)

For gas, dye, semiconductor and solid-state lasers, Broadband Adjustable Isolators can be tuned over the designated wavelength range. OFR's patented tuning technique (4,804,256) retains maximum transmission and isolation over the specified range, while total Faraday rotation is fixed at 45°.

The adjustment mechanism moves the Faraday rotator rod in the axial hole in the magnet, thus controlling the length of the Faraday rod that is exposed to the magnetic field. Faraday rotation is directly proportional to the product of length times field (LxH).

Unless otherwise specified at time of order, these Isolators are set for horizontal input polarization. Output polarization is in the +/- 45° quadrant. The output polarization plane can be rotated to the horizontal or vertical with an OFR Polarization Rotator. See Retarders on page IO-15

Double-dB Isolators, the IOT Series, have output polarization in the same plane as the input, or optionally at 90°. These are two Isolators in tandem on a common base, sharing a common center Polarizer. Isolation is doubled, transmittance is reduced to approximately the squared value.

All surfaces are AR-coated for maximum transmittance, and tilted to the optic axis.

Extended Range Isolators for Ti:Sapphire Lasers.

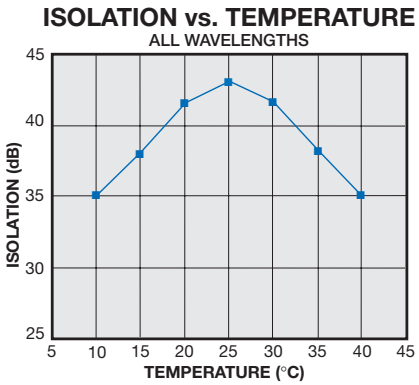
Fixed Narrowband "Aspirin Tablet" Isolators (IO-D Series)

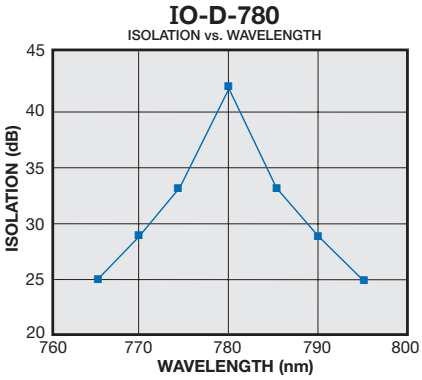
The IO-D Series "Aspirin Tablet" Isolators are designed for applications requiring a very small Isolator. These Isolators utilize BIG (bismuth-iron-garnet) film as the Faraday rotating material. To retain the very small size, dichroic Very Low Power Polarizers are used. VLP Polarizers absorb the unwanted polarization vector, and are therefore limited in laser power capability. See page IO-3 for polarizer information.

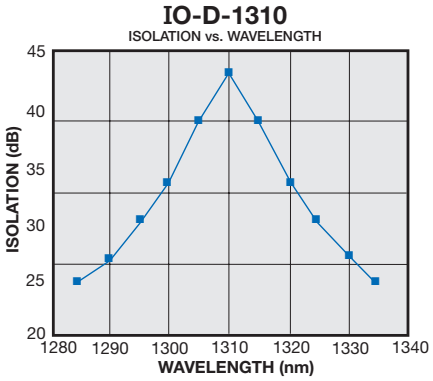
Aspirin Tablet Isolators are set at the OFR factory to the exact laser wavelength for maximum isolation and transmision, and cannot be readjusted thereafter. When ordering, specify the desired peak wavelength, for example, IO-D-780.

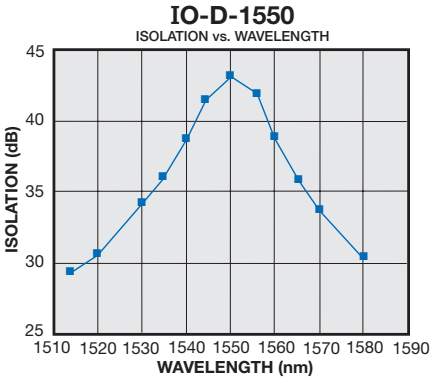
The small body size is made possible by the extremely high Verdet constant of the BIG film. For example, film thickness for 45° rotation at 1310 nm is only ~330 µm. In addition, BIG films are characterized by a low saturating magnetic field value, only a few hundred Gauss, thus enabling performance with a small magnet. The final result is an Isolator of small dimensions.

At 1310 nm and 1550 nm, transmission is ≥96%. However, in the NIR wavelengths, 760-850 nm, absorption is already increasing, and transmission is around 30-50%. This is the tradeoff for the small size, made possible because of the high Verdet constant of the BIG film.









Aspirin Tablet Isolator

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Fixed Broadband Isolators (IO-BB Series)

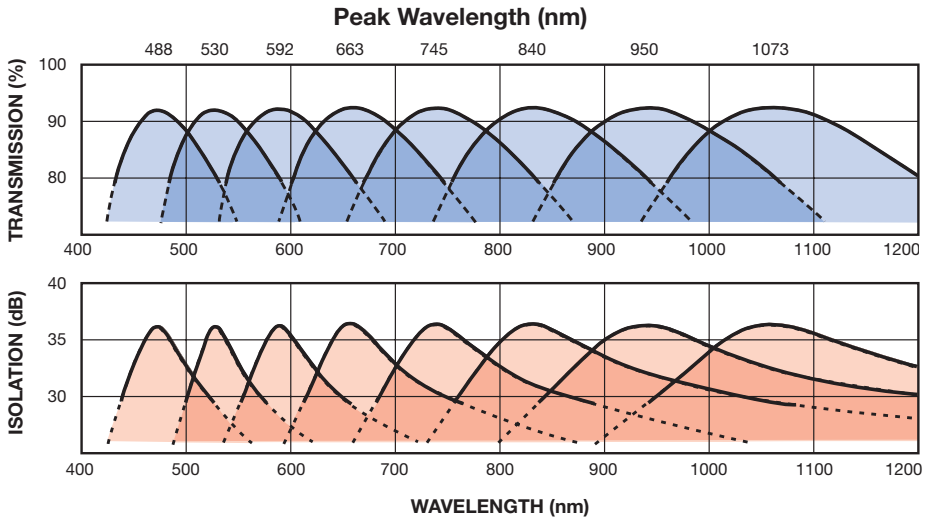
For "hands off" operation, OFR's no-moving-parts Broadband Fixed Isolators do not need to be readjusted when the wavelength changes.

These Isolators are equipped with the Polarizers indicated below. In addition, most Isolators can be ordered as Faraday Rotators without Polarizers, in which case terminate Isolator Part Number with -I.

See page IO-3 for a description of Polarizers and their safe power limitations.

Unless otherwise specified at time of order, these Isolators are set for horizontal input polarization. Output polarization is vertical, or can be rotated with an OFR Polarization Rotator. See Retarders on page IO-14 for specifications and ordering information.

All surfaces are AR coated for maximum transmittance, and tilted to the optic axis.



Adjustable Broadband or Fixed Broadband?

Frequently asked question: which do we recommend, **Broadband Adjustable** or **Fixed Broadband?**

Broadband Adjustable (IO-5-NIR, for example)
- Most wavelength flexibility
- As much as 200 nm adjustable range
- Very useful with different lasers
- Lower Cost
- Higher isolation by 3-5 dB
- Better transmittance by 1-2%

Broadband (IO-5BB-800-LP, for example)
- "Hands off", no adjustment required
- As much as 80 nm passband
- Useful with different simultaneous λ's
- Operation where adjustment is not practical
- Especially useful with tunable lasers

244 to 505 nm

Narrowband Adjustable Isolators (IO-λ Series)

Catalog Number & Polarizer	Aperture	Select λ between	Use/tune between	Transmittance	Isolation	Body Type
IO-5-λ-HP	5.0 mm	244-380 nm	±~5% of λ	~80%	32-42 dB	Inquire
IO-5-λ-HP	5.0 mm	395-415 nm	±~5% of λ	~82%	32-42 dB	IX
IO-5-λ-HP*	5.0 mm	415-450 nm	±~5% of λ	82-89%	32-42 dB	IX
*Transmittance varies with wavelength. Discuss with OFR.						
IO-3-λ-LP	3.0 mm	450-505 nm	±~5% of λ	~93%	36-39 dB	V
IO-5-λ-LP	5.0 mm	450-505 nm	±~5% of λ	~93%	36-39 dB	IX
IO-3-λ-HP	3.0 mm	450-505 nm	±~5% of λ	~89%	35-42 dB	V
IO-5-λ-HP	5.0 mm	450-505 nm	±~5% of λ	~89%	38-42 dB	IX
IO-3-488-VHP	3.0 mm	488 nm	±~1 nm	~91%	36-42 dB	V
IO-5-488-VHP	5.0 mm	488 nm	±~1 nm	~91%	36-42 dB	IX
IOT-any of above Isolation is ~60 dB. Transmittance is required.						

Broadband Adjustable Isolators (IO-UVS Series)

Catalog Number & Polarizer	Aperture	Use/tune between	Transmittance	Isolation	Body Type
IO-5-UVS-LP	4.7 mm	380-420 nm	75-80%	33-40 dB	VIII
IO-5-BLG-LP	4.7 mm	420-515 nm	78-90%	36-40 dB	VIII
IO-5-UVS-HP	4.7 mm	380-420 nm	75-80%	33-40 dB	VIII
IO-5-BLG-HP	4.7 mm	420-520 nm	76-87%	36-40 dB	VIII
Note: Transmittance varies with wavelength. Discuss with OFR.					

Types of Polarizers and Power Limits

Model	Type of Polarizer	CW	Pulsed*	Comments
LP	Air-spaced Calcite	100 W/cm²	25 MW/cm²	Broadband
HP	Air-spaced Calcite	500 W/cm²	150 MW/cm²	Broadband
VHP	Brewster's Angle Plate	20 kW/cm²	1 GW/cm²	532 nm
*Pulsed measurements made at 1064 nm, 20 ns pulse width, 20 Hz				

Isolator Types

IO-λ Series	IO-UVS Series
• Extremely large λ selection • "Tweekable" • Best for single λ	• Wide operation bands • Fixed Polarizers • Best for tunable lasers

Narrowband Adjustable Isolators (IO-λ Series)

Catalog Number & Polarizer	Aperture	Select λ between	Use/tune between	Transmittance	Isolation	Body Type
IO-3D-λ-PHE*	3.0 mm	514, 532, 633 nm	±~2% of λ	75-78%	35-40 dB	II
*PHE is similar to VLP						
IO-2D-633-VLP	2.0 mm	633 nm	±~2% of λ	67%	35-40 dB	II
IO-3D-λ-VLP*	3.0 mm	650, 670, 690 nm	±~2% of λ	75-83%	34-40 dB	II
Notes: Transmittance varies with wavelength, (ii) Proper alignment of polarizers is required because of absorption concerns. Discuss with OFR.						
IO-3-λ-LP	3.0 mm	505-700 nm	±~5% of λ	~93%	35-40 dB	V
IO-5-λ-LP	5.0 mm	505-700 nm	±~5% of λ	~93%	36-40 dB	IX
IO-8-λ-LP	8.0 mm	505-700 nm	±~5% of λ	~92%	33-38 dB	IX
IO-10-λ-LP	9.8 mm	505-700 nm	±~5% of λ	~92%	33-38 dB	IX
IO-5-λ-PBS	5.0 mm	505-690 nm	±~5% of λ	86-90%	33-38 dB	IX
IO-3-λ-HP	3.0 mm	505-700 nm	±~5% of λ	~89%	38-44 dB	V
IO-5-λ-HP	5.0 mm	505-700 nm	±~5% of λ	~89%	38-44 dB	IX
IO-8-λ-HP	8.0 mm	505-700 nm	±~5% of λ	~89%	33-44 dB	IX
IO-10-λ-HP	9.8 mm	505-700 nm	±~5% of λ	~89%	33-40 dB	IX
IO-3-532-VHP	3.0 mm	532 nm	±~1 nm	~91%	36-42 dB	V
IO-3-532-VHP	5.0 mm	532 nm	±~1 nm	~91%	36-42 dB	IX
IOT-any of above Isolation is ~60 dB. Transmittance is squared.						

Broadband Adjustable Isolators (IO-BLG Series)

Catalog Number & Polarizer	Aperture	Use/tune between	Transmittance	Isolation	Body Type
IO-5-BLG-LP	4.7 mm	420-515 nm	78-90%*	36-40 dB	VIII
IO-5-VIS-LP	4.7 mm	510-650 nm	~93%	36-40 dB	VIII
IO-5-VNR-LP	4.7 mm	610-800 nm	~93%	36-40 dB	VIII
*Note: Transmittance varies with wavelength. Discuss with OFR.					
IO-5-BLG-HP	4.7 mm	420-520 nm	78-90%*	36-40 dB	VIII
IO-5-VIS-HP	4.7 mm	510-650 nm	~88%	38-42 dB	VIII
IO-5-VNR-HP	4.7 mm	610-790 nm	~90%	38-42 dB	VIII
*Note: Transmittance varies with wavelength. Discuss with OFR.					

Fixed Broadband Isolators (IO-BB Series)

Catalog Number & Polarizer	Aperture	Peak Wavelength	Use Between	Transmittance	Isolation	Body Type
IO-5BB-530-LP	4.7 mm	530 nm	505-563 nm	≥ 88%	≥ 33 dB	IX
IO-5BB-592-LP	4.7 mm	592 nm	562-629 nm	≥ 88%	≥ 33 dB	IX
IO-5BB-633-LP	4.7 mm	633 nm	599-675 nm	≥ 88%	≥ 33 dB	IX
IO-5BB-530-HP	4.7 mm	530 nm	505-563 nm	≥ 88%	≥ 33 dB	IX
IO-5BB-633-HP	4.7 mm	633 nm	599-675 nm	≥ 88%	≥ 33 dB	IX

Types of Polarizers and Power Limits

Model	Type of Polarizer	CW	Pulsed*	Comments
VLP	Thin Plate	25 W/cm²	300 kW/cm²	Narrowband
PBS	Polarizing B/S Cube	13 W/cm²	—	Broadband
LP	Air-spaced Calcite	100 W/cm²	25 MW/cm²	Broadband
HP	Air-spaced Calcite	500 W/cm²	150 MW/cm²	Broadband
VHP	Brewster's Angle Plate	20 kW/cm²	1 GW/cm²	532 nm

*Pulsed measurements made at 1064 nm, 20 ns pulse width, 20 Hz

Isolator Type

IO-λ Series
- Extremely large λ selection
- Tweekable
- Best for λ

IO-BLG, etc. Series
- Wide operating bands
- Fixed Polarizers
- Best for tunable laser

IO-BB Series
- Hands-off operation
- Wide operating bands

Fixed Narrowband Series (IO-D "Aspirin Tablet" Series)

Catalog Number & Polarizer	Aperture	Select λ Wavelength	Use Between	Transmittance	Isolation	Max Power (cw)
IO-D-λ	1.75 mm	760-810 nm	± 2 nm	48-55%	≥ 40 dB	80 mW
IO-D-830	1.75 mm	830 nm	± 2 nm	~35%	≥ 40 dB	60 mW
IO-D-855	1.75 mm	855 nm	± 2 nm	~25%	≥ 40 dB	50 mW

Notes: (i) Proper alignment of polarizers is required because of absorption concerns, (ii) Other wavelengths available, (iii) IO-D Isolators have VLP Polarizers. Discuss with OFR.

Narrowband Adjustable Series (IO-λ Series)

Catalog Number & Polarizer	Aperture	Select λ between	Use/tune between	Transmittance	Isolation	Body Type
IO-3C-λ-VLP	3.0 mm	760-890 nm	±~5% of λ	86-89%	37-42 dB	III
IO-3D-λ-VLP	3.0 mm	760-860 nm	±~5% of λ	86-90%	34-40 dB	II
IO-4-λ-VLP	4.0 mm	780-830 nm	discuss	35-48%	40-45 dB	VIIa
IO-5-λ-VLP	5.0 mm	760-860 nm	±~5% of λ	86-90%	38-44 dB	IX

Notes: (i) IO-4 transmittance varies with wavelength, (ii) Proper alignment of polarizers is required because of absorption concerns. Discuss with OFR.

IO-3-λ-LP	3.0 mm	760-860 nm	±~5% of λ	>93%	34-40 dB	V
IO-3C-λ-LP	3.0 mm	760-890 nm	±~5% of λ	>90%	36-40 dB	V
IO-5-λ-LP	5.0 mm	760-925 nm	±~5% of λ	>93%	36-40 dB	IX
IO-5C-λ-LP	5.0 mm	760-890 nm	±~5% of λ	>90%	36-40 dB	IX
IO-8-λ-LP	8.0 mm	760-925 nm	±~5% of λ	>92%	33-38 dB	IX
IO-10-λ-LP	9.0 mm	760-925 nm	±~5% of λ	>92%	33-38 dB	IX
IO-5-λ-PBS	5.0 mm	760-852 nm	±~5% of λ	86-91%	34-38 dB	IX
IO-3-λ-HP	2.7 mm	760-860 nm	±~5% of λ	>92%	34-40 dB	V
IO-3C-λ-HP	3.0 mm	760-890 nm	±~5% of λ	>92%	36-40 dB	V
IO-5-λ-HP	5.0 mm	760-925 nm	±~5% of λ	>92%	38-44 dB	IX
IO-5C-λ-HP	5.0 mm	760-890 nm	±~5% of λ	>90%	37-44 dB	IX
IO-8-λ-HP	8.0 mm	760-925 nm	±~5% of λ	>92%	33-44 dB	IX
IO-10-λ-HP	9.8 mm	760-925 nm	±~5% of λ	>92%	33-40 dB	IX

IOT-any of above Isolation is ~60 dB. Transmittance is squared.

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Broadband Adjustable Isolators (IO-NIR, etc. Series)

Catalog Number & Polarizer	Aperture	Use/tune between	Transmittance	Isolation	Body Type
IO-5-VNR-LP	4.7 mm	610-800 nm	~93%	36-40 dB	VIII
IO-5-NIR-LP	4.7 mm	700-925 nm	~93%	36-40 dB	VIII
IO-8-NIR-LP	7.8 mm	700-925 nm	~93%	33-38 dB	VIII
IO-5-VNR-HP	4.7 mm	610-790 nm	~92%	38-42 dB	VIII
IO-5-NIR-HP	4.7 mm	750-900 nm	~92%	38-42 dB	VIII
IO-8-NIR-HP	7.8 mm	750-900 nm	≥91%	33-42 dB	VIII
IO-10-NIR-HP	9.5 mm	750-900 nm	≥91%	33-39 dB	VIII
IO-5-TIS2-HP	4.7 mm	780-980 nm	≥91%	33-39 dB	VIII
IO-5-TIS3-HP	4.7 mm	910-1080 nm	≥91%	33-39 dB	VIII

IO-BB Isolators (Fixed Broadband Series)

Catalog Number & Polarizer	Aperture	Peak Wavelength	Use Between	Transmittance	Isolation	Body Type
IO-5BB-800-LP	4.7 mm	800 nm	748-851 nm	≥ 88%	≥ 33 dB	VIII
IO-5BB-800-HP	4.7 mm	800 nm	748-851 nm	≥ 88%	≥ 33 dB	VIII

Types of Polarizers and Power Limits

Model	Type of Polarizer	CW	Pulsed*	Comments
VLP	Thin Plate	25 W/cm²	300 kW/cm²	Narrowband
PBS	Polarizing B/S Cube	13 W/cm²	—	Broadband
LP	Air-spaced Calcite	100 W/cm²	25 MW/cm²	Broadband
HP	Air-spaced Calcite	500 W/cm²	150 MW/cm²	Broadband

*Pulsed measurements made at 1064 nm, 20 ns pulse width, 20 Hz

Isolator Types

IO-D Series	IO-λ Series	IO-NIR etc. Series	IO-BB Series
• Very small • Single λ • Not adjustable	• Extremely large λ selection • "Tweakable" • Best for single λ	• Wide operation bands • Fixed Polarizers • Best for tunable laser	• Hands-off operation • Wide operation bands

925 to 1100 nm

Fixed Narrowband "Aspirin Tablet" Isolators (IO-D Series)

Catalog Number & Polarizer	Aperture	Select λ Wavelength	Use Between	Transmittance	Isolation	Max Power (cw)
IO-D-1053	1.75 mm	1053 nm	± 2 nm	≥ 74%	≥ 42 dB	150 mW
IO-D-1064	1.75 mm	1064 nm	± 2 nm	≥ 80%	≥ 42 dB	250 mW
IO-D-1083	1.75 mm	1083 nm	± 2 nm	≥ 85%	≥ 42 dB	400 mW

Notes: (i) Proper alignment of polarizers is required because of absorption concerns, (ii) Other wavelengths available, (iii) IO-D Isolators have VLP Polarizers. Discuss with OFR.

Narrowband Adjustable Isolators (IO-λ Series)

Catalog Number & Polarizer	Aperture	Select λ between	Use/tune between	Transmittance	Isolation	Body Type
IO-3C-λ-VLP	3.0 mm	925-1020 nm	±~5% of λ	> 88%	36-42 dB	III
IO-3D-λ-VLP	3.0 mm	950-1010 nm	±~5% of λ	> 86%	28-36 dB	II
IO-5-λ-VLP	5.0 mm	925-1020 nm	±~5% of λ	88-90%	38-42dB	IX
IO-3-λ-HP	3.0 mm	950-1010 nm	±~5% of λ	>92%	38-43 dB	V
IO-5-λ-HP	5.0 mm	925-1020 nm	±~5% of λ	>92%	37-42 dB	IX
IO-1x2-λ-VLP	1.0 x 2.0 mm	1047-1064 nm	±~2% of λ	90-92%	34-40 dB	inquire
IO-2.5-λ-VLP*	2.5 mm	1064 or 1083 nm	discuss	≥ 78%	≥ 42 dB	I
IO-2.5E-λ-VLP	2.5 mm	1020-1100 nm	±~5% of λ	≥ 86%	28-33 dB	II
IO-3D-λ-VLP	3.0 mm	1020-1100 nm	±~5% of λ	90-92%	38-44 dB	III
IO-5-λ-VLP	4.8 mm	1020-1100 nm	±~5% of λ	90-92%	38-44 dB	IX
*Max power 250 mW cw, proper alignment of polarizers is required due to absorption concerns. Discuss with OFR.						
IO-3-λ-HP	2.8 mm	1020-1100 nm	±~5% of λ	≥ 93%	38-44 dB	V
IO-5-λ-HP	4.8 mm	1020-1100 nm	±~5% of λ	≥ 93%	38-44 dB	IX
IO-8-λ-HP	7.8 mm	1020-1100 nm	±~5% of λ	≥ 93%	33-40 dB	IX
IO-10-λ-HP	9.8 mm	1020-1100 nm	±~5% of λ	≥ 92%	32-40 dB	IX
IO-3-λ-VHP	2.8 mm	1053 or 1064 nm	±1 nm	≥ 91%	35-44 dB	V
IO-5-λ-VHP	4.8 mm	1053 or 1064 nm	±1 nm	≥ 91%	35-44 dB	IX
IO-8-λ-VHP	8.0 mm	1053 or 1064 nm	±1 nm	≥ 91%	33-40 dB	IX
IO-10-λ-VHP	9.8 mm	1053 or 1064 nm	±1 nm	90-92%	30-38 dB	IX
IO-12-λ-VHP	12.0 mm	1053 or 1064 nm	±1 nm	89-92%	30-38 dB	IX
IO-15-λ-VHP	15.0 mm	1053 or 1064 nm	±1 nm	88-92%	30-38 dB	IX

IOT-any HP units above: Isolation is ~60 dB. Transmittance is squared.

Broadband Adjustable Isolators (IO-TIS Series)

Catalog Number & Polarizer	Aperture	Use/tune between	Transmittance	Isolators	Body Type
IO-5-TIS2-HP	4.7 mm	780-1000 nm	≥ 91%	≥39 dB	VIII
IO-5-TIS3-HP	4.7 mm	910-1080 nm	≥ 91%	≥39 dB	VIII

Types of Polarizers and Power Limits

Model	Type of Polarizer	CW	Pulsed*	Comments
VLP	Thin Plate	25 W/cm²	300 kW/cm²	Narrowband
HP	Air-spaced Calcite	500 W/cm²	150 MW/cm²	Broadband
HP-YAG	Air-spaced Calcite	750 W/cm²	200 MW/cm²	Narrowband 1064 nm only
VHP	Brewster's Angle Plate	20 kW/cm²	1 GW/cm²	488, 532, 1053, 1064 only

*Pulsed measurements made at 1064 nm, 20 ns pulse width, 20 Hz

Isolator Type

IO-D Series
- Very small
- Single λ
- Not adjustable

IO-λ Series
- Extremely large λ selection
- Tweekable
- Best for single λ

IO-TIS, etc. Series
- Wide operating bands
- Fixed Polarizers
- Best for tunable lasers

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1260 to 1650 nm

Fixed Narrowband "Aspirin Tablet" Isolators (IO-D Series)

Catalog Number & Polarizer	Aperture	Select λ Wavelength	Use Between	Transmittance	Isolation	Max Power (cw)
IO-D-λ	1.75 mm	1290-1325 nm	± 2 nm	~ 96%	≥ 40 dB	1W
IO-D-λ	1.75 mm	1450-1660 nm	± 2 nm	~ 96%	≥ 40 dB	1W

Notes: (i) Proper alignment of polarizers is required because of absorption concerns, (ii) Other wavelengths available, (iii) IO-D Isolators have VLP Polarizers. Discuss with OFR.

Narrowband Adjustable Isolators (IO-λ Series)

Catalog Number & Polarizer	Aperture	Select λ between	Use/tune between	Transmittance	Isolation	Body Type
IO-2.5-λ-VLP	2.5 mm	1260-1650 nm	±~5% of λ	> 95%	> 40 dB	I
IO-4-λ-VLP	4.0 mm	1260-1650 nm	±~5% of λ	> 95%	> 40 dB	VIIa

Note: Proper alignment of polarizers is required because of absorption concerns. Discuss with OFR.

IO-2.5-λ-HP*	2.5 mm	1260-1650 nm	±~5% of λ	>92%	> 36 dB	IV
IO-4-λ-HP*	4.0 mm	1260-1650 nm	±~5% of λ	>92%	> 36 dB	VI

*Rated Power 20 W cw max recommended for 2-3 mm beams Discuss with OFR.

1950 to 2200 nm

Narrowband Adjustable Isolators (IO-λ Series)

Catalog Number & Polarizer	Aperture	Select λ between	Use/tune between	Transmittance	Isolation	Body Type
IO-2.5-λ-HP	2.5 mm	1950-2200 nm	±~5% of λ	91-93%	> 33 dB	IV
IO-4-λ-VLP	4.0 mm	1950-2200 nm	±~5% of λ	91-93%	> 33 dB	VI

Notes: Maximum recommended power 20 W/cm^2 for 2-3 mm beams. Discuss with OFR.

Types of Polarizers and Power Limits

Model	Type of Polarizer	CW	Pulsed*	Comments
VLP	Thin Plate	25 W/cm^2	300 kW/cm^2	Narrowband
HP	Air-spaced Calcite	500 W/cm^2	150 MW/cm^2	Broadband

*Pulsed measurements made at 1064 nm, 20 ns pulse width, 20 Hz

Polarization Independent Isolators

All of the previous Isolators in this catalog are polarization dependent, meaning that the plane of polarization of the input laser beam must be aligned with the Input Polarizer. However, if the polarization state of the laser is indeterminate or variable, then a Polarization Independent Isolator is required.

Borrowing design principles from Fiber-Optic Isolators, OFR has designed Polarization Independent Air-Path Isolators. Transmittance through these Isolators does not vary, regardless of the state of polarization of the input laser beam.

These Isolators are equipped with the Polarizers indicated below.

All surfaces are AR-coated for maximum transmittance, and tilted to the optic axis.

Catalog Number & Polarizer	Aperture	Select λ	Transmittance	Isolation	Body Length
IO-1PI-λ-PBB	1.0 mm	1310 or 1550 nm	> 93%	28-36 dB	113 mm
IO-2PI-λ-PBB	2.0 mm	1310 or 1550 nm	> 93%	28-38 dB	148 mm

Note: (i) Rated power for PBB polarizers is similar to HP polarizers: 500 W/cw^2 max cw, 150 MW/cw^2 max pulsed, (ii) Transmittance for beam ≤ 0.5 of Aperture, (iii) Mounted on OFR FiberTables.

1/2 Wave Retarders (Polarization Rotators)

½-Wave Retarders will rotate the plane of polarization to any orientation desired. ½-Wave Retarders are multilayer AR-coated, with transmission ~99%, and mounted in a Snap-On Cell on the Output Polarizer.

These are used to rotate the output plane of polarization.

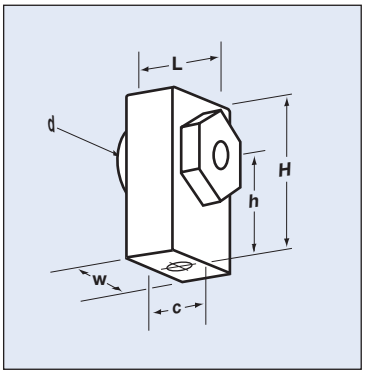
Catalog Number	Discription	Bandwidth	Laser Power
RZ-1/2-λ-IO*	Zero-order, Narrowband	± 6 nm	VHP
RMA-1/2-NIR-IO	Zero-order, Broadband	700-900 nm	HP
RMA-1/2-IR-IO	Zero-order, Broadband	1200-1600 nm	HP

*Specify wavelength when ordering. For example, RZ-1/2-810-IO

Note: Retarder Mounting Cell is available for isolator body types IV, V, VI, VIII, and IX. For other isolators, discuss with OFR.

Isolator Body Types

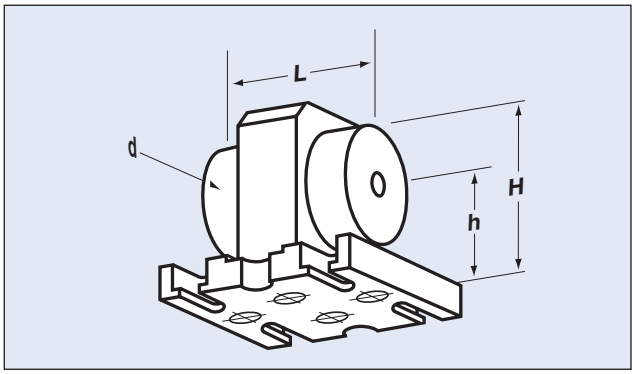
Body Type I



8-32 post-mounted

IO-2.5-λ-VLP
L 0.49" 12.4 mm
d 0.50" 12.7 mm
H 1.00" 25.4 mm
h 0.62" 15.7 mm
c 0.34" 8.7 mm
w 1.62" 15.7 mm

Body Type II



1/4-20 post-mounted

IO-2D-633-VLP
L 0.48" 12.2 mm
d 0.87" 22.1 mm
H 1.12" 28.6 mm
h 0.56" 14.2 mm

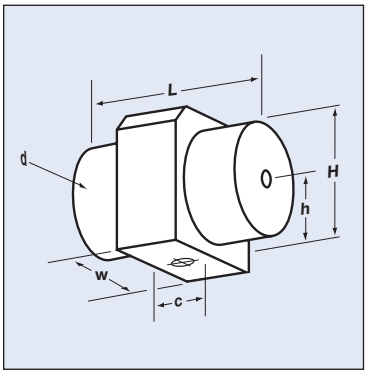
IO-3D-λ-VLP
(λ=650-690)
L 0.82" 20.8 mm
d 0.87" 22.1 mm
H 1.12" 28.6 mm

IO-3D-λ-VLP
(λ=760-860)
L 1.25" 31.8 mm
d 0.87" 22.1 mm
H 1.12" 28.6 mm
h 0.56" 14.2 mm

IO-2.5E-λ-VLP
IO-3D-λ-VLP
(λ=950-1010)
IO-3D-633-PHE
L 1.15" 29.2 mm
d 0.87" 22.1 mm
H 1.12" 28.6 mm

IO-3D-514, 532-PHE
(λ=650-690)
L 0.59" 15.0 mm
d 0.87" 22.1 mm
H 1.12" 28.6 mm
h 0.56" 14.2 mm

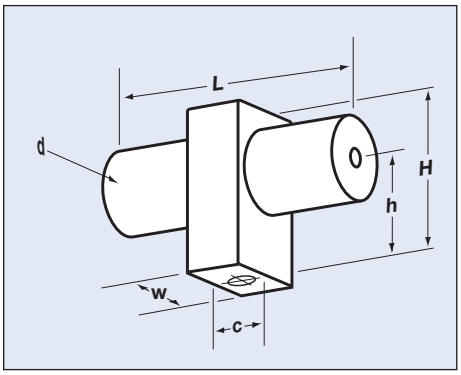
Body Type III



8-32 post-mounted

IO-3C-λ-VLP
IO-3D-λ-VLP
(λ=1020-1100)
L 2.00" 50.8 mm
d 1.23" 31.2 mm
H 1.50" 38.1 mm
h 0.75" 19.1 mm
c 0.75" 19.1 mm
w 1.50" 38.1 mm

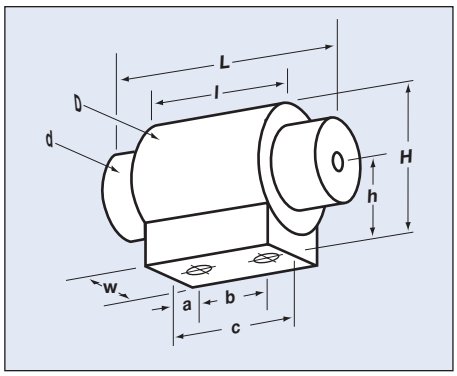
Body Type IV



4-40, 8-32 post-mounted

IO-2.5-λ-HP
IO-2.5-HoYAG-HP
L 1.54" 39.1 mm
d 0.50" 12.7 mm
H 1.00" 25.4 mm
h 0.62" 15.7 mm
c 0.70" 17.8 mm
w 0.62" 15.7 mm

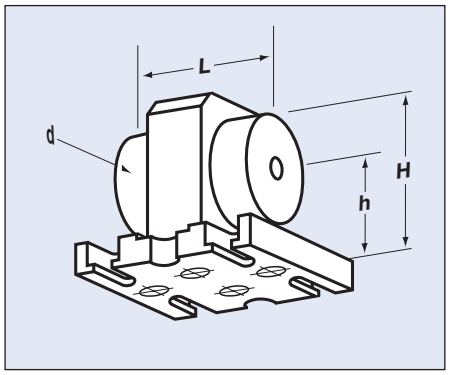
Body Type VI



8-32 post-mounted

IO-4-λ-HP
IO-4-HoYAG-HP
L 2.74" 69.9 mm
d 1.00" 25.4 mm
H 1.50" 38.1 mm
a 0.25" 6.4 mm
b 0.30" 7.6 mm
h 0.75" 19.1 mm
c 0.75" 19.1 mm
w 1.50" 38.1 mm
l 1.20" 30.5 mm
D 1.23" 31.2 mm

Body Type VIIa

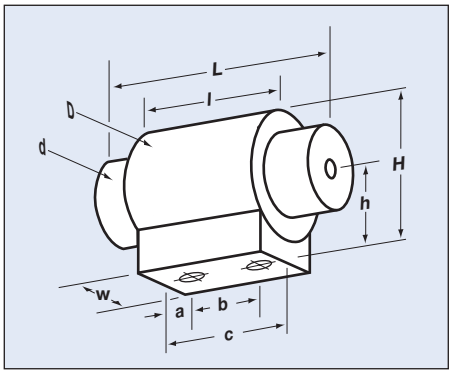


1/4-20 post-mounted

IO-4-λ-VLP
L 0.60" 15.2 mm
d 0.87" 22.1 mm
H 1.12" 28.6 mm
h 0.56" 14.2 mm

*Check website **http://www.ofr.com/air-path/bodytypes.html** for latest dimensions, as changes are sometimes made.*

Isolator Body Types



1/4-20, M6 post-mounted

Body Type V (LP & VHP)

IO-3-λ-LP (λ=505-700)
IO-3-532-VHP

L	2.77"	70.4 mm
l	1.64"	41.7 mm
D	1.50"	38.1 mm
d	1.00"	25.4 mm
H	1.87"	47.5 mm
h	1.12"	28.6 mm
a	0.37"	9.4 mm
b	0.82"	20.8 mm
c	1.55"	39.4 mm
w	1.12"	28.6 mm

IO-3-λ-LP (λ=760-860)

L	3.31"	84.1 mm
l	2.17"	55.1 mm
D	1.50"	38.1 mm
d	1.00"	25.4 mm
H	1.87"	47.5 mm
h	1.12"	28.6 mm
a	0.37"	9.4 mm
b	0.82"	20.8 mm
c	1.55"	39.4 mm
w	1.12"	28.6 mm

IO-3-λ-LP (λ=450-505)
IO-3C-λ-LP
IO-3-488, 1064-VHP

L	4.01"	101.9 mm
l	2.87"	72.9 mm
D	1.50"	38.1 mm
d	1.00"	25.4 mm
H	1.87"	47.5 mm
h	1.12"	28.6 mm
a	1.06"	26.9 mm
b	0.38"	9.7 mm
c	2.50"	63.5 mm
w	1.12"	28.6 mm

Body Type V (HP)

IO-3-λ-HP (λ=505-700)

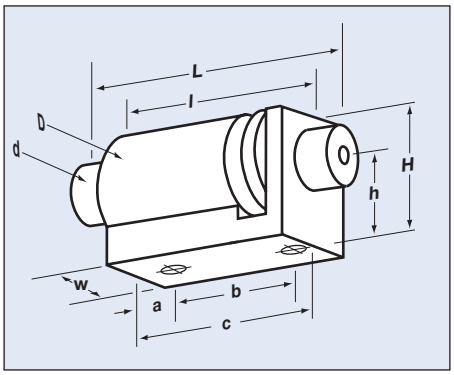
L	3.26"	82.8 mm
l	1.64"	41.7 mm
D	1.50"	38.1 mm
d	1.00"	25.4 mm
H	1.87"	47.5 mm
h	1.12"	28.6 mm
a	0.37"	9.4 mm
b	0.82"	20.8 mm
c	1.55"	39.4 mm
w	1.12"	28.6 mm

IO-3-λ-HP (λ=760-860)

L	3.80"	96.5 mm
l	2.17"	55.1 mm
D	1.50"	38.1 mm
d	1.00"	25.4 mm
H	1.87"	47.5 mm
h	1.12"	28.6 mm
a	0.37"	9.4 mm
b	0.82"	20.8 mm
c	1.55"	39.4 mm
w	1.12"	28.6 mm

IO-3-λ-HP (λ=450-505)
IO-3-λ-HP (λ=950-1100)
IO-3C-λ-HP

L	4.50"	114.3 mm
l	2.87"	72.9 mm
D	1.50"	38.1 mm
d	1.00"	25.4 mm
H	1.87"	47.5 mm
h	1.12"	28.6 mm
a	1.06"	26.9 mm
b	0.38"	9.7 mm
c	2.50"	63.5 mm
w	1.12"	28.6 mm



1/4-20, M6 post-mounted

Body Type VIII (LP)

IO-5-VIS-LP
IO-5-VNR-LP

L	4.08"	103.6 mm
l	3.17"	80.5 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.59"	40.4 mm
b	0.32"	8.1 mm
c	3.15"	80.0 mm
w	1.75"	44.5 mm

IO-5-UVS-LP
IO-5-BLG-LP
IO-5-NIR-LP
IO-5BB-800-LP

L	4.44"	112.8 mm
l	3.70"	94.0 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.41"	38.8 mm
b	0.66"	16.8 mm
c	3.68"	93.5 mm
w	1.75"	44.5 mm

IO-8-NIR-LP

L	5.60"	142.2 mm
l	4.79"	121.7 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.77"	45.0 mm
b	1.00"	25.4 mm
c	4.77"	121.2 mm
w	1.75"	44.5 mm

Body Type VIII (HP)

IO-5-VIS-HP
IO-5-VNR-HP

L	4.79"	121.7 mm
l	3.17"	80.5 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.59"	40.4 mm
b	0.32"	8.1 mm
c	3.15"	80.0 mm
w	1.75"	44.5 mm

IO-5-UVS-HP
IO-5-BLG-HP
IO-5-NIR-HP
IO-5-TIS 2, 3-HP
IO-5BB-800-HP

L	5.27"	133.9 mm
l	3.70"	94.0 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.41"	38.8 mm
b	0.66"	16.8 mm
c	3.68"	93.5 mm
w	1.75"	44.5 mm

IO-8-NIR-HP
IO-10-NIR-HP

L	6.60"	167.6 mm
l	4.79"	121.7 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.77"	45.0 mm
b	1.00"	25.4 mm
c	4.77"	121.2 mm
w	1.75"	44.5 mm

*Check website **http://www.ofr.com/air-path/bodytypes.html** for latest dimensions, as changes are sometimes made.*

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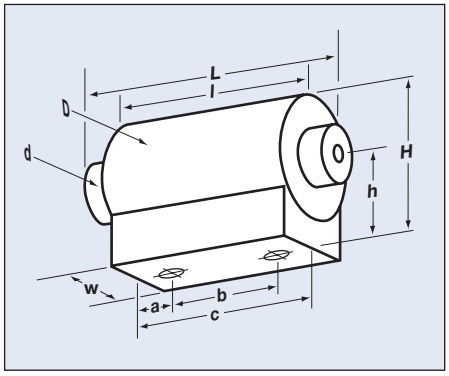
Isolator Body Types



1/4-20, M6 post-mounted

Body Type IX (VLP* & LP)

IO-5-λ-LP (λ=505-650)
IO-5BB-530, 592, 633-LP

L	2.51"	63.8 mm
l	1.42"	36.1 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.36"	9.1 mm
b	0.53"	13.5 mm
c	1.25"	31.8 mm
w	1.75"	44.5 mm

IO-5-λ-LP (λ=650-700)
IO-5C-λ-LP (λ=760-790)

L	2.51"	63.8 mm
l	1.64"	41.7 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.36"	9.1 mm
b	0.53"	13.5 mm
c	1.25"	31.8 mm
w	1.75"	44.5 mm

IO-5-λ-LP (λ=760-830)
IO-5C-λ-LP (λ=790-890)

L	3.58"	90.9 mm
l	2.49"	63.2 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.98"	24.9 mm
b	0.30"	7.6 mm
c	2.25"	57.2 mm
w	1.75"	44.5 mm

IO-5-λ-LP (λ=450-505)
IO-5-λ-LP (λ=830-925)

L	4.11"	104.4 mm
l	3.02"	76.7 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

IO-8-λ-LP
IO-10-λ-LP (λ=760-925)

L	4.51"	114.6 mm
l	3.64"	92.5 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

IO-10-λ-LP (λ=505-700)

L	3.07"	78.0 mm
l	2.20"	55.9 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.36"	9.1 mm
b	0.53"	13.5 mm
c	1.25"	31.8 mm
w	1.75"	44.5 mm

*Note: VLP models have same dimensions as LP models.

Body Type IX (PBS* & HP)

IO-5-λ-HP (λ=505-650)
IO-5BB-530, 633-HP

L	3.16"	80.3 mm
l	1.42"	36.1 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.36"	9.1 mm
b	0.53"	13.5 mm
c	1.25"	31.8 mm
w	1.75"	44.5 mm

IO-5-λ-HP (λ=650-700)
IO-5C-λ-HP (λ=760-790)

L	3.16"	80.3 mm
l	1.64"	41.7 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.36"	9.1 mm
b	0.53"	13.5 mm
c	1.25"	31.8 mm
w	1.75"	44.5 mm

IO-5-λ-HP (λ=760-830)
IO-5C-λ-HP (λ=790-890)

L	4.23"	107.4 mm
l	2.49"	63.2 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.98"	24.9 mm
b	0.30"	7.6 mm
c	2.25"	57.2 mm
w	1.75"	44.5 mm

IO-5-λ-HP (λ=395-505)
IO-5-λ-HP (λ=830-1100)

L	4.76"	120.9 mm
l	3.02"	76.7 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

IO-8-λ-HP
IO-10-λ-HP (λ=760-1100)

L	5.76"	146.3 mm
l	3.64"	92.5 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

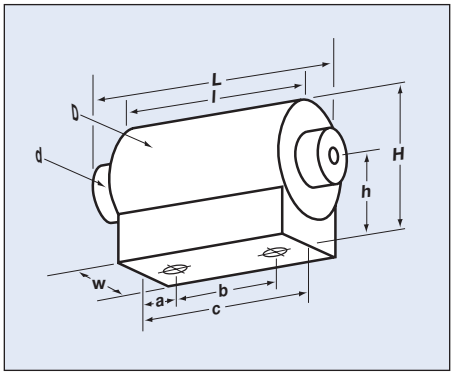
IO-10-λ-HP (λ=505-700)

L	4.32"	109.7 mm
l	2.20"	55.9 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.36"	9.1 mm
b	0.53"	13.5 mm
c	1.25"	31.8 mm
w	1.75"	44.5 mm

*Note: PBS models have same dimensions as HP models.

*Check website **http://www.ofr.com/air-path/bodytypes.html** for latest dimensions, as changes are sometimes made.*

Isolator Body Types



1/4-20, M6 post-mounted

Body Type IX (VHP)

IO-5-532-λ-VHP

L	3.45"	87.6 mm
l	1.42"	36.1 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	0.36"	9.1 mm
b	0.53"	13.5 mm
c	1.25"	31.8 mm
w	1.75"	44.5 mm

IO-8-1053,1064-VHP

L	6.76"	171.7 mm
l	3.64"	92.5 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

IO-12-1053,1064-VHP

L	9.30"	236.2 mm
l	3.64"	92.5 mm
D	2.00"	50.8 mm
d	1.37"	34.8 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

IO-5-488,1053,1064-VHP

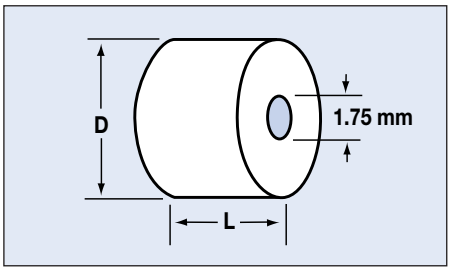
L	5.05"	128.3 mm
l	3.02"	76.7 mm
D	2.00"	50.8 mm
d	1.00"	25.4 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

IO-10-1053,1064-VHP

L	8.70"	221.0 mm
l	3.64"	92.5 mm
D	2.00"	50.8 mm
d	1.12"	28.6 mm
H	2.50"	63.5 mm
h	1.50"	38.1 mm
a	1.37"	34.8 mm
b	0.30"	7.6 mm
c	3.03"	77.0 mm
w	1.75"	44.5 mm

IO-15-1053,1064-VHP

L	10.29"	261.1 mm
l	3.67"	93.2 mm
D	3.50"	88.9 mm
d	1.37"	34.8 mm
H	3.66"	93.0 mm
h	1.91"	48.5 mm
a	1.45"	36.8 mm
b	0.40"	10.2 mm
c	3.30"	83.8 mm
w	2.50"	63.5 mm



Body Type D

IO-D-λ (λ=760-855)

IO-D-λ (λ=1290-1660)

L	0.16"	4.0 mm
D	0.22"	5.5 mm

IO-D-λ (λ=1053-1660)

L	0.19"	4.9 mm
D	0.22"	5.5 mm

IO-D series available in body type I, not post-mounted otherwise.

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