



## FARADAY ROTATORS AND MIRRORS – PIGTAIL STYLE

### Features

- Singlemode, multimode and polarization maintaining versions available
- Wide range of center wavelengths
- Low loss
- Low back reflection
- Compact housing

### Applications

- Fiber lasers
- Interferometers sensors
- Amplifiers
- Circulators

### Product Description

Faraday rotators change the polarization state of light traveling through it. The output polarization state is rotated by 45 degrees with respect to the input polarization.

When combined with a mirror, the reflected light is rotated by another 45 degrees, resulting in a 90 degree rotation. In addition, the polarization handedness is reversed by the mirror. This results in a reflected polarization that is orthogonal to the original polarization. This is useful when used in interferometers, because polarization changes through the fiber are cancelled out on the return journey.

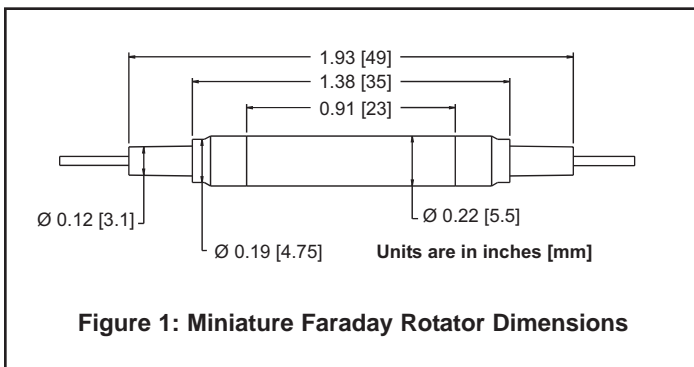


Figure 1: Miniature Faraday Rotator Dimensions

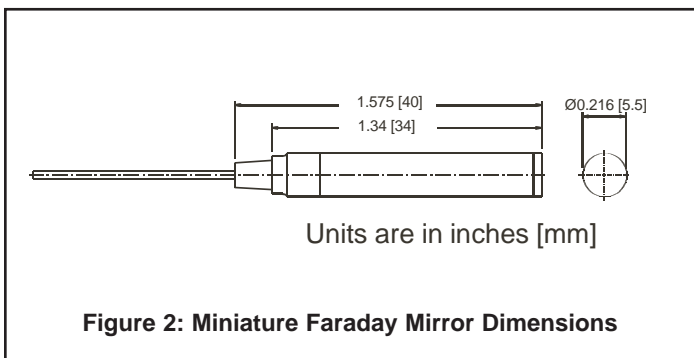


Figure 2: Miniature Faraday Mirror Dimensions



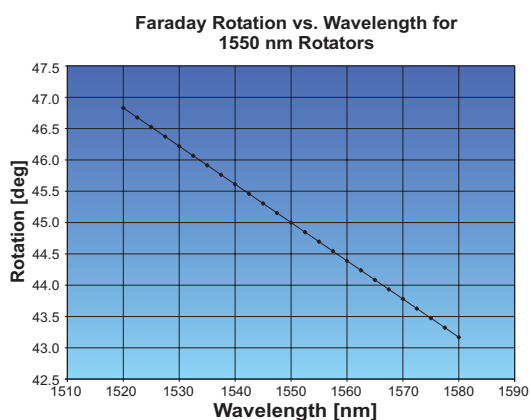
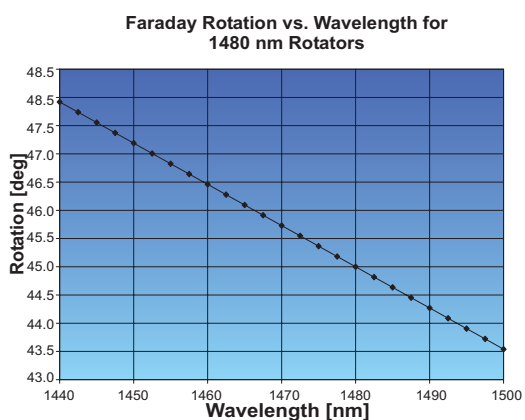
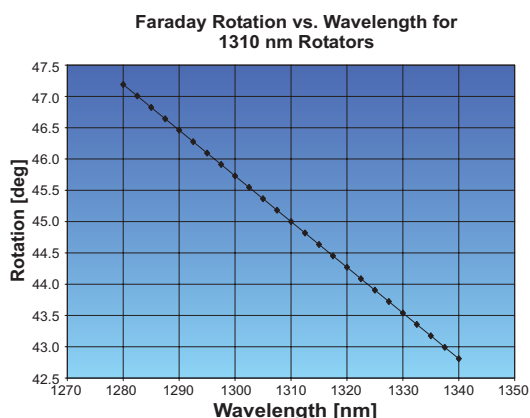
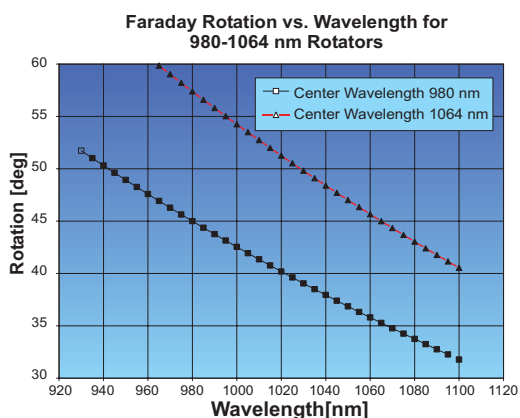
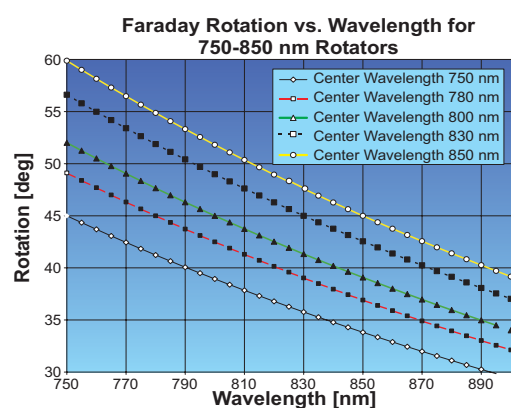
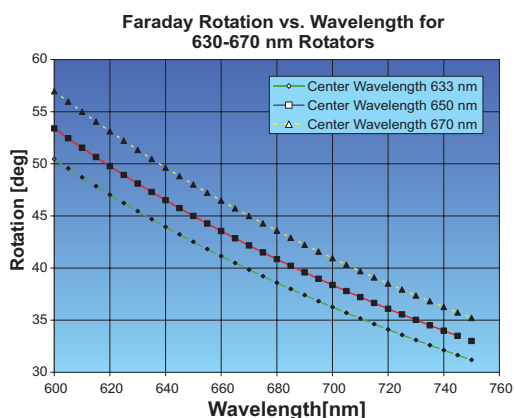
## Standard Product Specifications (Faraday Rotator-Mirror Standard Parts)

Parameter	Condition	Units	Value			
			633-850	980-1064	1310-1550 & 1064	1310-1550 Faraday Mirror & 1064
Center Wavelength		nm	633-850	980-1064	1310-1550 & 1064	1310-1550 Faraday Mirror & 1064
	Typical	dB	0.8	0.8	0.6	0.5
	Maximum	dB	1.0	1.0	0.8	0.75
Return Loss <sup>1</sup>	Low Loss (-60 Loss)	dB	N/A	N/A	0.6	0.5
Return Loss <sup>1</sup>		dB	40	40	40, 60	40, 60 <sup>2</sup>
Polarization Extinction Ratio <sup>3</sup>		dB	20	20	20, 25, 30	20
Rotation Angle	At center wavelength	degrees	45			
Rotation Tolerance	At center wavelength, 25°C	degrees	±3	±3	±3	±3 (±1)

<sup>1</sup> For 1310 - 1550 nm only. Does not include connector losses, return losses from connectors.

<sup>2</sup> For Faraday mirrors, return losses refers to reflections from points other than the mirror itself.

<sup>3</sup> When using polarization maintaining fibers.



## Standard Parts

The following items are all standard and are often in stock. Connectors can be added per customer specifications.

Faraday Rotators Using Polarization Maintaining Fiber		
Bar Code	Part Number	Description
23218	FOR-11P-633-4/125-P-P-40-XX-3-1	Faraday Rotator for 633 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 633 nm 4/125 polarization maintaining fiber pigtails with no connectors.
23219	FOR-11P-830-5/125-P-P-40-XX-3-1	Faraday Rotator for 830 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 830 nm 5/125 polarization maintaining fiber pigtails with no connectors.
23220	FOR-11P-1064-6/125-P-P-40-XX-3-1	Faraday Rotator for 1064 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1064 nm 6/125 polarization maintaining fiber pigtails with no connectors.
23221	FOR-11P-1300-7/125-P-P-40-XX-3-1	Faraday Rotator for 1300 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1300 nm 7/125 polarization maintaining fiber pigtails with no connectors.
23222	FOR-11P-1550-8/125-P-P-40-XX-3-1	Faraday Rotator for 1550 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1550 nm 8/125 polarization maintaining fiber pigtails with no connectors.
23223	FOR-11P-1550-8/125-P-P-60-XX-3-1	Faraday Rotator for 1550 nm with 60dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1550 nm 8/125 polarization maintaining fiber pigtails with no connectors.
23224	FOR-21P-1550-8/125-P-P-60-XX-1-1	Miniature Faraday Rotator for 1550 nm with 60dB return loss, and with 1 meter long 900 micron OD loose tube cabled 1550 nm 8/125 polarization maintaining fiber pigtails with no connectors.

Faraday Rotators Using Singlemode Fiber		
Bar Code	Part Number	Description
23225	FOR-11P-633-4/125-S-S-40-XX-3-1	Faraday Rotator for 633 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 633 nm 4/125 singlemode fiber pigtails with no connectors.
23226	FOR-11P-830-5/125-S-S-40-XX-3-1	Faraday Rotator for 830 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 830 nm 5/125 singlemode fiber pigtails with no connectors.
23227	FOR-11P-1064-6/125-S-S-40-XX-3-1	Faraday Rotator for 1064 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1064 nm 6/125 singlemode fiber pigtails with no connectors.
23228	FOR-11P-1300-9/125-S-S-40-XX-3-1	Faraday Rotator for 1300 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1300-1550 nm 9/125 singlemode fiber pigtails with no connectors.
23229	FOR-11P-1550-9/125-S-S-40-XX-3-1	Faraday Rotator for 1550 nm with 40dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1300-1550 nm 9/125 singlemode fiber pigtails with no connectors.
23230	FOR-11P-1550-9/125-S-S-60-XX-3-1	Faraday Rotator for 1550 nm with 60dB return loss, and with 1 meter long 3 mm OD kevar reinforced PVC cabled 1300-1550 nm 9/125 singlemode fiber pigtails with no connectors.
23231	FOR-21P-1550-9/125-S-S-60-XX-1-1	Miniature Faraday Rotator for 1550 nm with 60dB return loss, and with 1 meter long 900 micron OD jacketed 1300-1550 nm 9/125 singlemode fiber pigtails with no connectors.

Faraday Mirrors Using Polarization Maintaining Fiber		
Bar Code	Part Number	Description
23232	FOFM-11P-1300-7/125-P-40-XX-3-1	Faraday Mirror for 1300 nm with 40dB return loss, and with a 1 meter long 3 mm OD kevar reinforced PVC cabled 1300 nm 7/125 polarization maintaining fiber pigtail with no connector.
23233	FOFM-11P-1550-8/125-P-40-XX-3-1	Faraday Mirror for 1550 nm with 40dB return loss, and with a 1 meter long 3 mm OD kevar reinforced PVC cabled 1550 nm 8/125 polarization maintaining fiber pigtail with no connector.
23234	FOFM-11P-1550-8/125-P-60-XX-3-1	Faraday Mirror for 1550 nm with 60dB return loss, and with a 1 meter long 3 mm OD kevar reinforced PVC cabled 1550 nm 8/125 polarization maintaining fiber pigtail with no connector.
23235	FOFM-21P-1550-8/125-P-60-XX-1-1	Faraday Mirror for 1550 nm with 60dB return loss, and with a 1 meter long 900 micron loose tube cabled 1550 nm 8/125 polarization maintaining fiber pigtail with no connector.

Faraday Mirrors Using Singlemode Fiber		
Bar Code	Part Number	Description
23237	FOFM-11P-1300-9/125-S-40-X-3-1	Faraday Mirror for 1300 nm with 40dB return loss, and with a 1 meter long 3 mm OD kevar reinforced PVC cabled 1300-1550 nm 9/125 singlemode fiber pigtail with no connector.
23238	FOFM-11P-1550-9/125-S-40-X-3-1	Faraday Mirror for 1550 nm with 40dB return loss, and with a 1 meter long 3 mm OD kevar reinforced PVC cabled 1300-1550 nm 9/125 singlemode fiber pigtail with no connector.
23239	FOFM-11P-1550-9/125-S-60-X-3-1	Faraday Mirror for 1550 nm with 60dB return loss, and with a 1 meter long 3 mm OD kevar reinforced PVC cabled 1300-1550 nm 9/125 singlemode fiber pigtail with no connector.
21014	FOFM-21P-1550-9/125-S-60-X-1-1	Faraday Mirror for 1550 nm with 60dB return loss, and with a 1 meter long 900 micron jacketed 1300-1550 nm 9/125 singlemode fiber pigtail with no connector.

## Ordering Example For Standard Parts

A researcher is building a fiber interferometer wants a Faraday mirror for 1550 nm. She is using standard singlemode fiber with 3 mm cabling. To minimize losses and unwanted reflections, she requires the lowest loss units available. She will fusion splice the unit in her system so no connectors are required.

Bar Code	Part Number	Description
23234	FOFM-11P-1550-8/125-P-60-XX-3-1	Faraday Mirror for 1550 nm with 60dB return loss, and with a one meter long 3 mm OD kevlar reinforced PVC cabled 1550 nm 8/125 polarization maintaining fiber pigtail with no connector.

## Ordering Information For Custom Parts

OZ Optics welcomes the opportunity to provide custom designed products to meet your application needs. As with most manufacturers, customized products do take additional effort so please expect some differences in the pricing compared to our standard parts list. In particular, we will need additional time to prepare a comprehensive quotation, and lead times will be longer than normal. In most cases non-recurring engineering (NRE) charges, lot charges, and minimum order will be necessary. These points will be carefully explained in your quotation, so your decision will be as well informed as possible. We strongly recommend buying our standard products.

## Questionnaire

1. Are you looking for a rotator or a Faraday mirror?
2. What is the operating wavelength?
3. Do you need single mode or polarization maintaining fiber?
4. What is the minimum acceptable return loss?
5. What is the maximum acceptable insertion loss?
6. Do you need connectors on the fibers? If yes, what type?
7. What type of fiber cabling do you prefer?
8. How long should the fibers be?

### Description

#### Pigtail Style

#### Faraday Rotator :

Body sizes: 1 for standard size  
2 for miniature size (1300-1550 nm)

Wavelength: Specify in nanometers  
(Example: 1550 for 1550 nm)

Fiber core/cladding sizes, in microns  
9/125 for 1300/1550 nm SMF  
See Tables 1 to 5 of the Standard Tables data sheet for other standard fiber sizes.

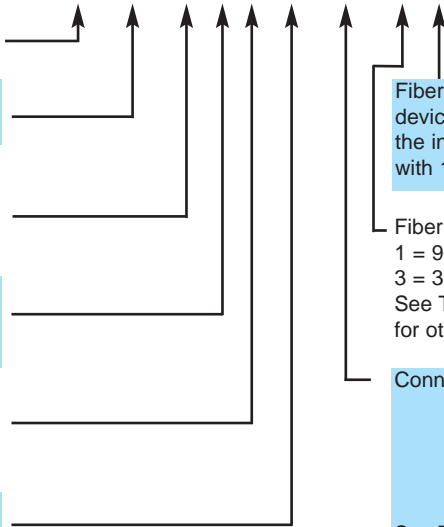
Input Fiber: M = Multimode  
S = Singlemode  
P = Polarization maintaining

Output Fiber: M = Multimode  
S = Singlemode  
P = Polarization maintaining

Backreflection Level: 25, 40, 50, or 60dB  
60dB is available for 1300 nm and 1550 nm wavelengths only. Special charges apply for other wavelengths.

### Part Number

**FOR-11P-W-a/b-I-O-LB-XY-JD-L**



Fiber length, in meters, on each side of the device. Example: to order 1 meter of fiber at the input and 7 meters at the output, replace L with 1,7.

Fiber Jacket Type:  
1 = 900 Micron OD hytel jacket  
3 = 3 mm OD Kevlar reinforced PVC cable  
See Table 7 of the Standard Tables data sheet for other jacket sizes.

Connector Code: 3S = Super NTT-FC/PC  
3U = Ultra NTT-FC/PC  
3A = Angled NTT-FC/PC  
8 = AT&T-ST  
SC = SC  
SCA = Angled SC  
See Table 6 of the Standard Tables data sheet for other connectors.

### Pigtail Style

#### Faraday Mirror:

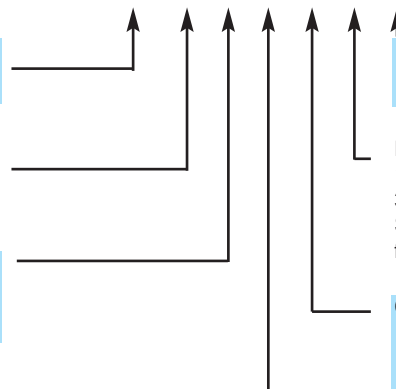
**FOFM-11P-W-a/b-F-LB-X-JD-L**

Wavelength: Specify in nanometers  
(Example: 1550 for 1550 nm)

Fiber core/cladding sizes, in microns  
9/125 for 1300/1550 nm SMF  
See Tables 1 to 5 of the Standard Tables data sheet for other standard fiber sizes.

Input Fiber: M = Multimode  
S = Singlemode  
P = Polarization maintaining

Backreflection Level: 25, 40, 50, or 60dB  
60dB is available for 1300 nm and 1550 nm wavelengths only. Special charges apply for other wavelengths.



Fiber length in meters

Fiber Jacket Type:  
1 = 900 Micron OD hytel jacket  
3 = 3 mm OD Kevlar reinforced PVC cable  
See Table 7 of the Standard Tables data sheet for other jacket sizes.

Connector Code: 3S = Super NTT-FC/PC  
3U = Ultra NTT-FC/PC  
3A = Angled NTT-FC/PC  
8 = AT&T-ST  
SC = SC  
SCA = Angled SC  
See Table 6 of the Standard Tables data sheet for other connectors.

## Ordering Example For Custom Parts

A customer requires a Faraday Rotator for 980 nm wavelengths, using polarization maintaining fiber. The fibers have to be 1.5 meters long, and terminated on both ends with FC connectors with Super PC Finish.

Part Number	Description
FOR-11P-980-6/125-P-P-40-3S3S-3-1.5	Faraday Rotator for 980nm with 40dB return loss, and with 1.5 meter long 3 mm OD kevlar reinforced PVC cabled 6/125 polarization maintaining fiber pigtailed with Super FC connectors.

### Application Notes

Different Faraday rotator materials are applicable to different wavelengths. At 1300-1600 nm, small powerful rotators allow for very compact packages. From 633 to 1064 nm, less powerful rotators materials requiring much longer lengths and larger magnets are used. This accounts for the wide range of package sizes for different wavelength regions. Rotation accuracy is very tightly controlled at 1300-1625 nm (standard  $\pm 3$  degrees single pass — with  $\pm 1$  degree available) but less controllable at lower wavelengths ( $\pm 3$  degrees standard).

Faraday Rotator Mirrors are readily available at telecom wavelengths (1300-1550 nm). For shorter wavelength applications where an Faraday mirror is required, it can be constructed using a Faraday rotator with a polarization maintaining fiber output pigtail and a polarization maintaining fiber pigtailed fixed reflector.

### Frequently Asked Questions (FAQs)

- Q.** Why are the Faraday rotators offered in different sizes?
- A.** Different rotator materials are used for each wavelength. These materials have different magnetic field requirements and different rotation values per unit length. Please see the Fiber Optic Isolator data sheet for a detailed description of the materials used and the design issues involved. For telecom wavelengths we have the miniature devices to fit into tight OEM system packages.
- Q.** Can you build Faraday mirrors for wavelengths shorter than 1300 nm?
- A.** The Faraday Rotator is typically too long to allow low loss coupling in a mirror configuration. OZ Optics can supply these devices on a custom order, but with higher losses. We can also combine PM fiber pigtailed Faraday rotators with fiber reflectors to achieve the same result.
- Q.** I want a Faraday rotator/Faraday mirror at a non-standard wavelength; what are my options?
- A.** Check the provided rotation curves to see if the rotation level is close enough to use a standard design. Large rotators (633-1064 nm) are easier to adjust for non-standard wavelengths than small rotators (1310-1550 nm)
- Q.** I just want to reflect light, not rotate it.
- A.** Use a Fiber Optic Reflector (FORF) instead. See the data sheet titled *Fiber Optic Reflector (Fixed or Variable)* for details.