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POLARIZERS – FIBER OPTIC

Features

- Rugged and compact housing
- SM, MM, PM and fiber combinations available
- Miniature sizes available
- High extinction ratio up to 30 dB
- Low loss
- Low back reflection
- Wide range of available wavelengths: 400–2050 nm
- Low cost

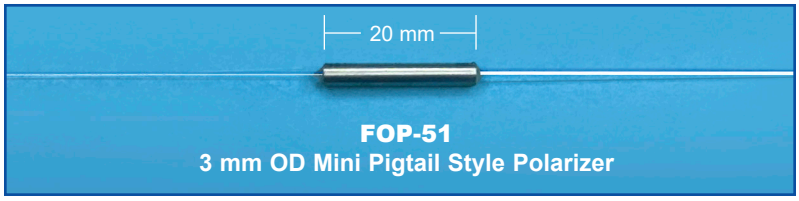
Applications

- Fiber optic gyroscope
- Fiber amplifiers
- System polarization extinction ratio conditioning
- Measuring polarization extinction ratio
- Sensors
- Integrated optics
- Interferometric sensors
- OCT systems

Product Description

Fiber Optic Polarizers are designed to polarize the output from a light source or fiber and launch it into an output fiber. These polarizers typically consist of input and output collimators with a plate polarizer in between. Broadband polarizers are used, so the power extinction ratio is maintained for up to several hundreds of nanometers. The same polarizer, for example, may be used for 1300 nm to 1600 nm. The power extinction ratio is the ratio between maximum and minimum output power as the input polarization state is changed. This is different from the output polarization extinction ratio, which is a measure of the ratio between the power in the two axes of polarization maintaining fiber. This value is dependent upon the extinction ratio of the polarizer, the alignment of the output fiber axes to the polarizer and the extinction ratio of the output fiber. When an output extinction ratio is specified, it is the polarization extinction ratio. This value is only applicable when the output fiber is polarization maintaining fiber. The power extinction ratio will always equal exceed the polarization extinction ratio.

OZ Optics offers fiber optic polarizers in six sizes. Our original 12.5 mm and 20 mm diameter sizes are best suited for non-telecom wavelengths and for custom designs. The larger size is also well suited for high power applications. Polarizers capable of transmitting several Watts of power have been made with this technique. The 5.5 mm diameter size and smaller are well suited for telecom wavelengths, such as 1310 nm and/or 1550 nm. We now offer a new version only 3 mm in diameter, ideal for applications where space is critical.



FOP-51
3 mm OD Mini Pigtail Style Polarizer



FOP-21
5.5 mm OD Inline Miniature Pigtail Polarizer



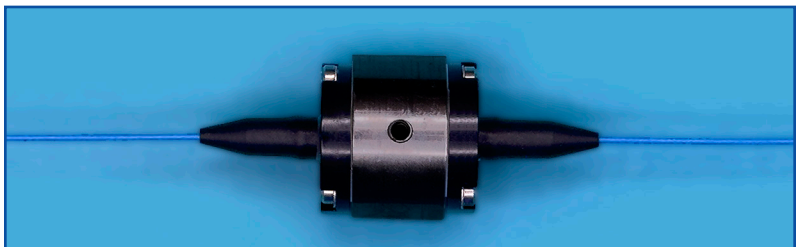
FOP-31
4 mm OD Miniature Polarizer



FOP-41
3 mm OD Inline Miniature Pigtail Polarizer



FOP-11 - **Pigtail Style Polarizer**
for Non-Telecom Wavelenghts ≥ 650 nm



FOP-11 - **20 mm OD Pigtail Style Polarizer**
for Non-Telecom Wavelenghts < 650 nm

OZ Optics reserves the right to change any specifications without prior notice.

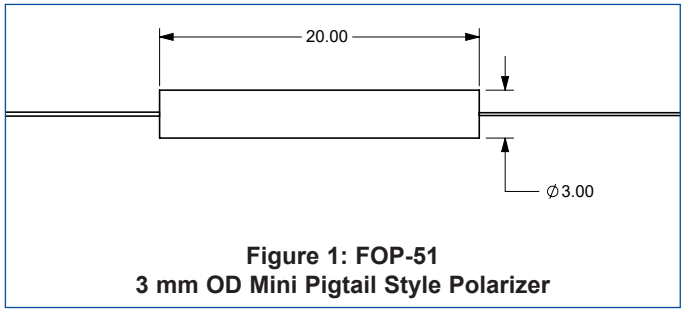


Figure 1: FOP-51
3 mm OD Mini Pigtail Style Polarizer

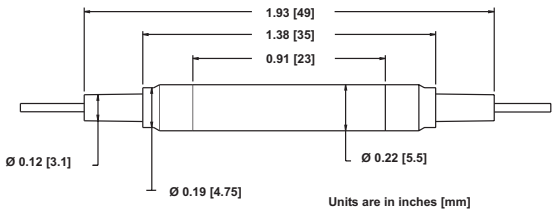


Figure 2: FOP-21
5.5 mm OD Inline Miniature Pigtail Polarizer

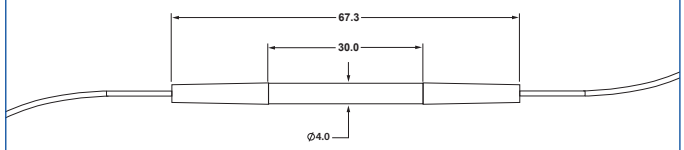


Figure 3: FOP-31
4 mm OD Miniature Polarizer

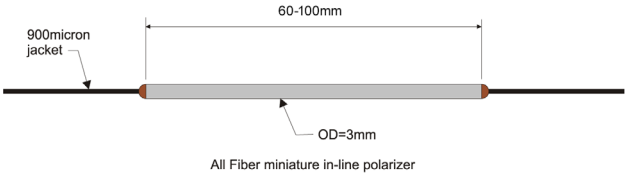


Figure 4: FOP-41
3 mm OD Inline Miniature Pigtail Polarizer

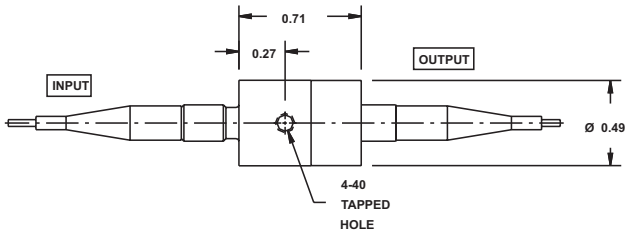


Figure 5: FOP-11 - Pigtail Style Polarizer
for Non-Telecom Wavelenghts ≥ 650 nm

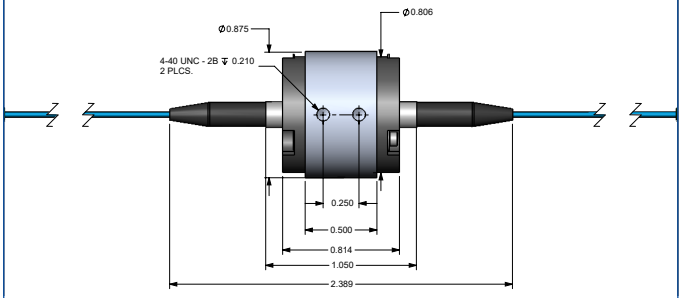


Figure 6: FOP-11 - 20 mm OD Pigtail Style Polarizer
for Non-Telecom Wavelenghts < 650 nm

Standard Product Specifications

Parameter	Units	Condition	Value				
Polarizer Model			**FOP-11***	**FOP-21**	**FOP-31**	**FOP-41**	**FOP-51**
Available Wavelengths	nm		400-2050	1280-2050			600-1650
Polarization Extinction Ratio	dB	600-1064 nm[1]	20	Not Available			20
		1300-1550 nm[1]	20 or 30	20 or 30	20	30	30
Return Losses	dB	600-1064 nm[1]	40	Not Available			
		1300-1550 nm[1]	40 or 60	40 or 60	40	70	40
Insertion Losses (Typical)	dB	600-1064 nm[1]	0.8	Not Available			
		1300-1550 nm[1]	0.7	0.8	1.0	0.5	0.7
Insertion Losses (Maximum)	dB	600-1064 nm[1]	1.2	Not Available			
		1300-1550 nm[1]	1.0	0.9	1.5	1.0	1.0
Insertion Losses (60 dB return loss Option)	dB	1300-1550 nm[1]	0.7 max	0.6 max	Not Available	0.6 max	0.8 max

[1] Specificatons are for a specific operating wavelength, to be identified when ordering.

*For shorter wavelenghts < 650 mm which will come in large 20 mm OD housing.

Questionnaire

1. What is your operating wavelength?
2. What type of fiber do you have for your input?
3. What type of fiber do you need on the output?
4. What is the maximum acceptable return loss for your setup?
5. What is the mimimum acceptable output extinction ratio?
6. Is size a critical concern?
7. Is cost a critical concern?
8. How long should the fibers be, and what type of cabling do you prefer?
9. Do you require connectors on the fiber ends? If yes, what type?
10. How much optical power is being transmitted through your system?

Standard Parts For more standard parts, please see our Online Catalog http://shop.ozoptics.com/

Polarizers for 600 nm to 1064 nm wavelengths		
Bar Code	**Part Number**	**Description**
23241	FOP-11-11-633-4/125-P-P-40-XX-3-1	Fiber optic polarizer for 633 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 4/125 PM fiber pigtails, with no connectors.
23242	FOP-11-11-633-4/125-S-P-40-XX-3-1	Fiber optic polarizer for 633 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 4/125 singlemode fiber on the input, 4/125 PM fiber on the output, with no connectors.
23243	FOP-11-11-633-4/125-S-S-40-XX-3-1	Fiber optic polarizer for 633 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 4/125 singlemode fiber pigtails, with no connectors.
23244	FOP-11-11-800-5/125-P-P-40-XX-3-1	Fiber optic polarizer for 800 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 5/125 PM fiber pigtails, with no connectors.
23245	FOP-11-11-800-5/125-S-P-40-XX-3-1	Fiber optic polarizer for 800 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 5/125 singlemode fiber on the input, 5/125 PM fiber on the output, with no connectors.
23246	FOP-11-11-800-5/125-S-S-40-XX-3-1	Fiber optic polarizer for 800 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 5/125 singlemode fiber pigtails, with no connectors.
14321	FOP-11-11-980-6/125-P-P-40-XX-3-1	Fiber optic polarizer for 980 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 6/125 PM fiber pigtails, with no connectors.
23247	FOP-11-11-980-6/125-S-P-40-XX-3-1	Fiber optic polarizer for 980 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 6/125 singlemode fiber on the input, 6/125 PM fiber on the output, with no connectors.
23248	FOP-11-11-980-6/125-S-S-40-XX-3-1	Fiber optic polarizer for 980 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 6/125 singlemode fiber pigtails, with no connectors.
23249	FOP-11-11-1064-6/125-P-P-40-XX-3-1	Fiber optic polarizer for 1064 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 6/125 PM fiber pigtails, with no connectors.
23250	FOP-11-11-1064-6/125-S-P-40-XX-3-1	Fiber optic polarizer for 1064 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 6/125 singlemode fiber on the input, 6/125 PM fiber on the output, with no connectors.
23251	FOP-11-11-1064-6/125-S-S-40-XX-3-1	Fiber optic polarizer for 1064 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 6/125 singlemode fiber pigtails, with no connectors.

Standard Parts (continued)

Miniature Polarizers

Bar Code	Part Number	Description
23262	FOP-21-11-1550-8/125-P-P-60-XX-1-1	Miniature fiber optic polarizer for 1550 nm with 60 dB return loss, and with 1 meter long, 0.9 mm OD loose tube cabled 8/125 PM fiber pigtails, with no connectors.
23263	FOP-21-11-1550-9/125-S-P-60-XX-1-1	Miniature fiber optic polarizer for 1550 nm with 60 dB return loss, and with 1 meter long, 0.9 mm OD jacketed Corning SMF-28 singlemode fiber on the input, 8/125 PM fiber on the output, with no connectors.
23264	FOP-21-11-1550-9/125-S-S-60-XX-1-1	Miniature fiber optic polarizer for 1550 nm with 60 dB return loss, and with 1 meter long, 0.9 mm jacketed Corning SMF-28 fiber pigtails, with no connectors.

Low Cost Polarizers

Bar Code	Part Number	Description
23265	FOP-31-11-1550-8/125-P-P-40-XX-1-1	Low cost fiber optic polarizer for 1550 nm with 40 dB return loss, and with 1 meter long, 0.9 mm OD loose tube cabled 8/125 PM fiber pigtails, with no connectors.
23266	FOP-31-11-1550-9/125-S-P-40-XX-1-1	Low cost fiber optic polarizer for 1550 nm with 40 dB return loss, and with 1 meter long, 0.9 mm OD jacketed Corning SMF-28 singlemode fiber on the input, 8/125 PM fiber on the output, with no connectors.
23267	FOP-31-11-1550-9/125-S-S-40-XX-1-1	Low cost fiber optic polarizer for 1550 nm with 40 dB return loss, and with 1 meter long, 0.9 mm jacketed Corning SMF-28 fiber pigtails, with no connectors.

Ordering Example For Standard Parts:

A customer needs a polarizer to improve the polarization extinction ratio of the light coming out of his 980 nm laser diode, which is pigtailed with polarization maintaining fiber. Connectors are not needed.

Bar Code	Part Number	Description
14321	FOP-11-11-980-6/125-P-P-40-XX-3-1	Fiber optic polarizer for 980 nm with 40 dB return loss, and with 1 meter long, 3 mm OD kevlar reinforced PVC cabled 6/125 PM fiber pigtails, with no connectors.

Ordering Information

For standard parts, please see our Online Catalog http://shop.ozoptics.com/

Pigtail Style: **FOP-A1-11-W-a/b-I-O-LB-XY-JD-L**

A1= Polarizer size:
1 for 12.5 mm size
2 for miniature 5.5 mm OD size
3 for low cost 4 mm OD size
4 for all inline polarizer
5 for 3 mm OD and 20 mm length

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

a/b = Fiber core/cladding sizes, in microns
9/125 for 1300/1550 nm SM fiber
See Tables 1 to 5 in the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other standard fiber sizes

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

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

LB= Backreflection level: 25, 40, 50, or 60 dB version available for 1300, 1550, 2000 nm wavelengths only

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

JD = Fiber Jacket Type: 1 = 900 Micron OD hytrel jacket
3 = 3 mm OD Kevlar reinforced PVC cable
See Table 7 in the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other jacket sizes

XY = 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 in the *Standard Tables*
http://www.ozoptics.com/ALLNEW_PDF/DTS0079.pdf
for other connectors

NOTE: For extinction ratios greater than 25 dB or 30 dB, add the term "-ER=25" or "-ER=30" to the end of the part number.

Ordering Example For Custom Parts

A customer has a tunable laser for 1520-1570 nm, pigtailed with singlemode fiber with a Super PC finish FC connector on it. She wants to polarize the signal as much as possible, and transmit it through a polarization maintaining fiber, achieving over 30 dB extinction ratios. The output fiber also needs to have a Super PC finish FC connector on the end. Return losses and insertion losses are not critical.

Part Number	Description
FOP-11-11-1520/1570-9/125-S-P-40-3S3S-3-1-ER=30	Fiber optic polarizer for 1520 nm to 1570 nm, with 60 dB return loss, 30 dB extinction ratio, and with 1 meter long, 3 mm OD Kevlar reinforced PVC cabled Corning SMF-28 singlemode fiber on the input, 8/125 PM fiber on the output, with Super FC/PC connectors on both ends.

Application Notes

Upgrading System Output Extinction Ratio

When several PM fiber pigtailed components are connected, there is the possibility that the accumulated extinction ratio will degrade. Each time two PM fibers are joined, any offset of their stress axes can cause the extinction ratio to get a little lower. For example, two 30 dB fibers offset by 3 degrees can have a net extinction ratio of only 25 dB. Add a couple more interfaces with similar angles and the value gets even worse. In order to have the final output extinction ratio be high, one can insert a pigtailed polarizer as the least component. This can drastically improve the output extinction ratio of the system with only a minor impact on system loss. For example, upgrading from a 15 dB ER signal to a 25 dB ER signal would only incur 0.125 dB loss (plus device loss). A small price to pay for a 10 dB ER gain.

Basic equation is Log
(1 - (inv log original ER - inv log new ER))

Ex 15 dB upgraded to 25 dB is 0.125 dB loss (plus device loss)

Frequently Asked Questions (FAQs)

Q. Why are there so many versions? Which version should I choose?
A. Each version of the fiber polarizer has its strengths and weaknesses. The original FOP-11 design is our original version, and is still the best suited for non-telecom wavelengths and high-power applications. The FOP-21 is our standard form factor for telecom applications, while the new FOP-51 provides the same performance in a smaller size, ideal for high density applications where space is at a premium. The FOP-31 style is a cost-effective telecom option when power levels are only around a few milliwatts, and high extinction ratios are not required. Finally, the FOP-41 all-fiber construction is your best choice for harsh environments.

Q. Why is my output power so low?
A. Check orientation and/or state of input polarization. If input fiber is PM, check to make sure light is launched along the correct axis.

Q. Why is output extinction ratio low?
A. Check you are using it in correct direction. Polarizer alignment is optimized to the output fiber for best output extinction ratio. The input fiber is oriented for transmission. These two placements are very similar, but may be slightly different.

Q. Why is my output power fluctuating?
A. Check stability of input fiber and polarization states. If there are large backreflections coming from further down the fiber optic system, an isolator may be required to protect the source or defeat an etalon effect.