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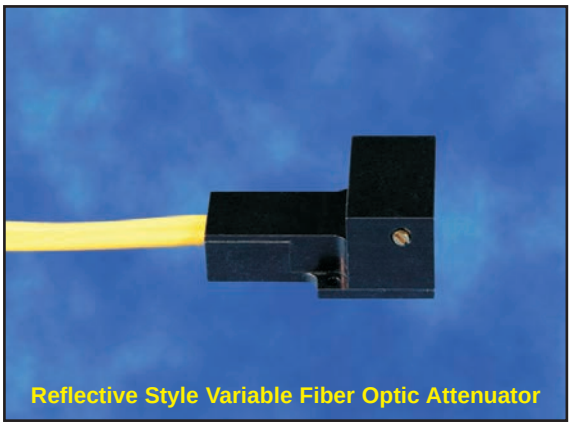
VARIABLE FIBER OPTIC ATTENUATOR – REFLECTIVE STYLE

Features:

- Neutral density filter or high power versions are available
- Rugged and compact
- Wide wavelength range
- Singlemode, and multimode fiber versions
- Low PDL and wavelength dependence
- Mode independent attenuation in multimode applications with neutral density filter version
- Wide attenuation range
- Low backreflection
- Low Cost


Reflective Style Variable Fiber Optic Attenuator

Applications:

- Optical power equalization and power control for WDMs and multi-channel optically amplified networks
- Telecommunications
- CATV
- LAN
- Test and measurement
- Receiver padding.

Product Description:

OZ Optics offers a complete line of low cost, compact PC board mountable reflective style variable attenuators with low backreflection. These attenuators can be used for C, L and S wavelength bands, with minimal changes in insertion loss. Reflector style housings are ideal for applications where the input and output fibers must be attached to the same side of the attenuator. Mounting holes provide easy attachment to PC boards and patch panels.

The reflector style attenuators contain either a variable neutral density filter or a blocking plate depending on the attenuator version selected. The blocking style is ideal for high power (over 50mW) applications, while the neutral density filter provides more uniform attenuation in multimode applications. The attenuation is controlled by a turn screw on the side of the attenuator, which controls the position of the filter or plate.

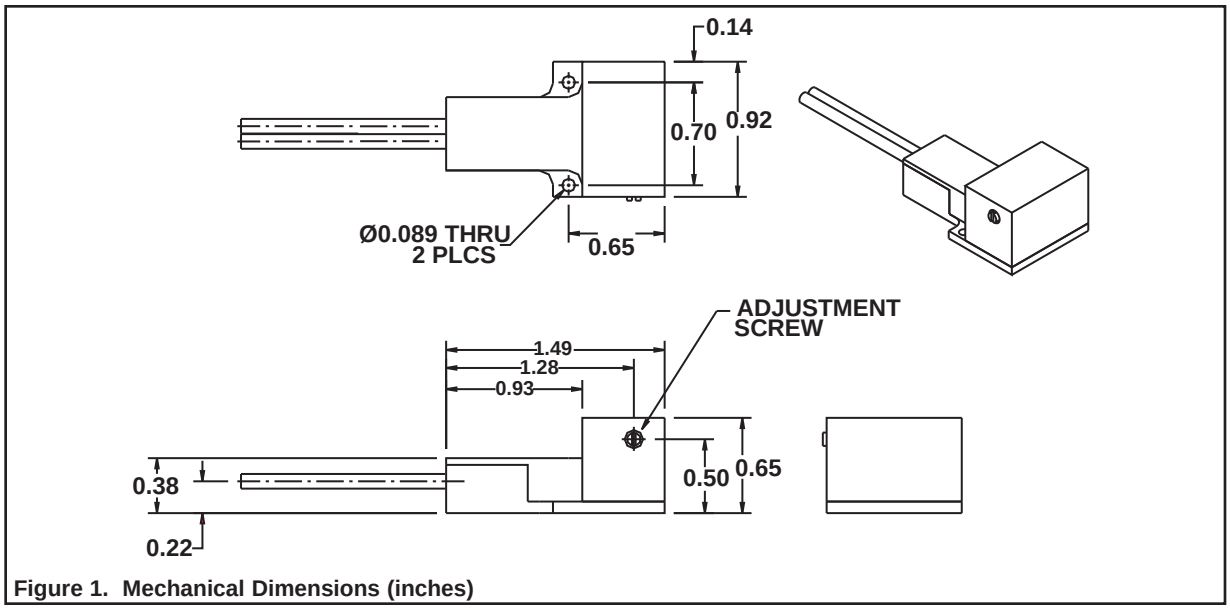


Figure 1. Mechanical Dimensions (inches)

Ordering Information For Standard Parts:

Bar Code	PART NUMBER	DESCRIPTION
3345	BB-600-11-1300/1550-9/125-S-40-3S3S-3-1-HP	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed singlemode fiber with FC/Super PC connectors on both ends, 40dB return loss. HP: High power, up to 2 Watts.
3346	BB-600-11-1300/1550-9/125-S-40-3S3S-3-1-ND	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed singlemode fiber with FC/Super PC connectors on both ends, 40dB return loss. ND: Neutral density filter version
10140	BB-600-11-1300/1550-9/125-S-40-SCSC-3-1-HP	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed singlemode fiber with SC/Super PC connectors on both ends, 40dB return loss. HP: High power, up to 2 Watts.
12460	BB-600-11-1300/1550-9/125-S-40-SCSC-3-1-ND	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed singlemode fiber with SC/Super PC connectors on both ends, 40dB return loss. ND: Neutral density filter version
10104	BB-600-11-1300/1550-9/125-S-50-3U3U-3-1-HP	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed singlemode fiber with FC/Ultra PC connectors on both ends, 50dB return loss. HP: High power, up to 2 Watts.
12394	BB-600-11-1300/1550-9/125-S-50-SCUSCU-3-1-HP	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed singlemode fiber with SC/Ultra PC connectors on both ends, 50dB return loss. HP: High power, up to 2 Watts.
10062	BB-600-11-1300/1550-9/125-S-50-XX-1-0.5-ND	Reflector style variable attenuator at 1300/1550nm with 0.5m long, 900micron OD jacketed unterminated single mode fiber on both ends, 50dB return loss. ND: Neutral density filter version
13173	BB-600-11-1300/1550-9/125-S-50-XX-1-1-HP-LL	Reflector style variable attenuator at 1300/1550nm with 1m long, 900micron OD jacketed unterminated single mode fiber on both ends, 50dB return loss. HP: High power, up to 2 Watts. IL < 1dB.

Standard Product Specifications:

Model		**Beam Blocking Version (HP)**	**Neutral Density Version (ND)**
Insertion loss:	Standard	< 1.5dB	< 1.5dB
	Low Loss Versions	< 0.8dB	< 0.8dB
Backreflection:	Singlemode	40, 50 or 60dB	40, 50 or 60dB
	Multimode		
Power handling	40dB or 50dB backreflection	Up to 2 Watts	Up to 50mW
	60dB Backreflection	Up to 200mW	Up to 50mW
Attenuation range		Up to 60dB	Up to 40dB
Wavelength dependence[1]			
at min.I.L.:		Max 0.15dB	Max 0.15dB
Up to 10dB:		Max 0.30dB	Max 0.25dB
Up to 20dB:		Max 0.30dB	Max 0.30dB
Up to 35dB:		Max 0.60dB	Max 0.40dB
Peak to Peak ripple over all attenuation range		Max 0.30dB	
Available wavelengths		400 -1625nm	800-1620nm
Storage Temperature		-40 C to +85 C	-40 C to +85 C
Polarization sensitivity		<0.2dB	<0.2dB
Notes:			
[1] Measured between 1520 and 1570nm at 23 °C			

Ordering Examples For Standard Parts:

1. A customer needs a reflective style attenuator with neutral density filter for 1300/1550nm with 40dB backreflection or better. He wants the fibers to be standard 9/125 micron, 3mm OD cabled, single mode fiber. The fibers should be 1 meter long and terminated with Super polished FC connectors, on both ends. Our standard part number will be:

Bar Code	Part Number	Description
3346	BB-600-11-1300/1550-9/125-S-40-3S3S-3-1-ND	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed single mode fiber with FC/Super PC connectors on both ends, 40dB return loss. ND: Neutral density

2. A customer needs a high power version reflective style attenuator for 1550nm with 50dB backreflection or better. He wants the fibers to be standard 9/125 micron, 3mm OD cabled, single mode fiber. The fibers should be 1 meter long and terminated with Ultra polished SC connectors, on both ends. Our standard part number will be:

Bar Code	Part Number	Description
12394	BB-600-11-1300/1550-9/125-S-50-SCUSCU-3-1-HP	Reflector style variable attenuator at 1300/1550nm with 1m long, 3mm OD jacketed single mode fiber with SC/Ultra PC connectors on both ends, 50dB return loss. HP: High power, up to 2 watts.

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 a 50 piece 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 For Custom Parts:

1. What wavelengths are you operating at?
2. How much power will be transmitted through the attenuator?
3. What type of fiber do you wish to use?
4. What is fiber length and jacket OD?
5. What is the worst acceptable return loss?
6. Do you need a variable or fixed attenuation?
7. What connectors do you need at each end of fiber?
8. What environmental requirements do you need to meet?
9. Are there any special performance requirements that you need to meet?

Reflector Style Attenuator:

BB-600-11-*W*-*a/b*-*F*-*LB*-*XY*-*JD*-*L*-*V*

W = Wavelength: Specify in nanometers: Example: 1300/1550 for 1300 to 1550nm wavelength range

a/b = Fiber core/cladding sizes, in microns 9/125 for 1300/1550nm SM fiber, See the OZ Standard Tables data sheet for other standard fiber sizes.

F = Fiber type:
M=Multimode
S=Singlemode
P=Polarization Maintaining (PM)

LB = Backreflection level:
40, 50 or 60dB for singlemode fibers,
35dB for MM fibers

Note 1: For low insertion loss add "-LL" to the end of the part number. LL = 0.8dB with units that have 60dB return loss, LL = 1dB for other attenuators.

V = Version
ND = Neutral Density Version
HP = Beam Blocking Style

L = Fiber length in meters, on each side of the device. If they are different, specify the input and output lengths separated by a comma.
Example: To order 1 meter of the fiber at the input and 7 meters at the output, replace the L with 1,7. Total fiber length is input fiber length plus output fiber length

JD = Fiber jacket type:
1 = 900 micron OD hytrel jacket
3 = 3mm OD Kevlar reinforced PVC cable

X,Y = Connector code:
X = No connector
3S = Super NTT-FC/PC
3U = Ultra NTT-FC/PC
3A = Angled NTT-FC/PC
8 = AT & T-ST
SC = SC
SCA = Angled SC
LC = LC/PC
LCA = Angled LC/PC
See the OZ Standard Tables data sheet for other connectors.

Ordering Example For Custom Parts:

Example 1: A customer wants to order a reflective style, beam blocker version, single mode attenuator at 1300nm, with 2m and 900 micron cabled fiber on both sides with FC super PC polished connectors and 40dB back reflection with low loss. The part number should be:
BB-600-11-1300/1550-9/125-S-40-3S3S-1-2-HP-LL

Example 2: A customer wants to order reflective style, neutral density version attenuator at 850nm with 62.5/125µ multimode fiber, 3m at input, 2m at output, 3mm OD cabled with SC/PC connector on input end, Super FC connector on output end, 35dB back reflection. The part number should be:
BB-600-11-850-62.5/125-M-35-SC3S-3-3,2-ND

Frequently Asked Questions (FAQs):

Q: What advantages or disadvantages does the beam blocking version have over the neutral density version?
A: The beam blocking technique is naturally suited for high power applications, and can achieve greater attenuation levels. The neutral density version shows less mode dependence or modal noise in multimode applications.

Q: What do you mean by mode dependence and modal noise?
A: The term multimode means there is more than one path for light to travel inside a single fiber. These paths are known as modes. It does not mean the unit consists of multiple fibers in a bundle. When coherent laser light is coupled into multimode fiber, the output shows speckles. Bending the fiber causes the speckle pattern to change. If the losses in a system depend on which modes are excited, then changing the modes excited in the fiber changes the output power. This is known as modal noise. If the source being used is an LED, then one does not see speckles, and modal noise is not an issue. However, for laser sources, modal noise is an issue.

When blocking style attenuators are used with multimode fiber, some modes are blocked, while others are transmitted. This can produce 1dB or greater modal noise fluctuations with coherent sources. A variable attenuator using a neutral density filter is not as strongly affected by modal noise. However, neutral density filter attenuators offer lower attenuation range (around 40dB) and can only handle about 50mW of power.

Q: What are the standard numerical apertures (NA) for the fibers used in your attenuators? Should I specify the NA of the fiber when I'm ordering an pigtail style attenuator?
A: Please see our standard tables for detailed information on our fibers. If the fiber that you want to use is not specified in the standard tables, then you should specify it when ordering.

Q: I ordered an attenuator with 60dB return loss but when I measured it my return losses are higher. Why?
A: If you ordered an attenuator with 60dB return loss with connectors, the back reflection will depend on what grade of connector you selected for your fibers. Typically only angle polished (APC) style connectors will give the desired return losses. The device itself has 60dB return loss (i.e. if you cut off the connectors and measured the return loss you will see it above 60dB) but if you picked only ultra PC finish connec tors you may only see from 50 to 55dB return losses.

Q: Do 1300/1550nm attenuators work at other wavelengths?
A: Yes, they do. They can also be used for the S (1470-1520nm), C (1250-1570nm) and L (1570-1620nm) bands, with little variation in performance.

Q: How many turns of the adjustment screw are needed to obtain 0 to 40 dB attenuation?
A: Five turns for the beam blocking model and 7 to 8 turns for the neutral density model.

Application Notes:

One of the important applications of attenuators is channel balancing in DWDMs. Attenuators can be adjusted to different attenuation levels so that at the receiver end all signals produce similar power levels. Each channel may have different output levels. By adjusting the power level of each channel by using the attenuators, one can balance the power.

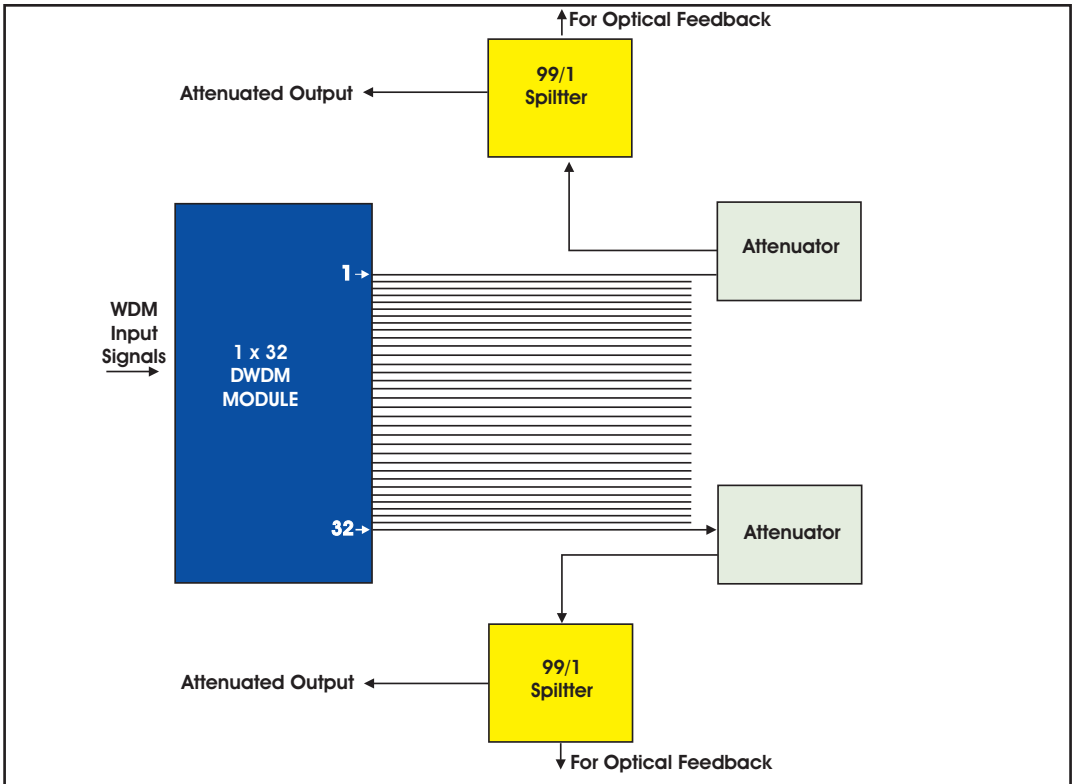


Figure 2: Use of variable attenuators in DWDM systems for power equalization