



# OZ Optics

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## DIGITAL VARIABLE REFLECTOR

### Features:

- High speed
- Wide reflectance range
- Low insertion loss
- High resolution
- Rugged and compact design
- Can be calibrated for dual wavelengths
- Wide wavelength range
- Wide range of connectors
- Polarization insensitive
- USB communications interface
- Low cost

### Applications:

- Bit error rate testing
- Troubleshooting receivers and other active fiber optic components
- Design of fiber optic transmitter/receiver circuitry

### Product Description:

OZ Optics' Digital Variable Reflector enables the user to generate a known level of return loss to evaluate system response. The unit allows testing the return loss sensitivity of devices such as laser diodes, transmitters, isolators and so on. By generating a precise reflection level, system performance (bit error rate, noise levels, isolator performance) can be evaluated. Our built-in calibration table accurately defines intermediate degrees of reflection from 2dB to as high as 60dB for different wavelengths.

Digital reflectors are offered using either singlemode, multimode, or polarization maintaining (PM) fibers. In general, OZ Optics uses polarization maintaining fibers based on the PANDA fiber structure when building polarization maintaining components and patchcords. However OZ Optics can construct devices using other PM fiber structures. We do carry some alternative fiber types in stock, so please contact our sales department for availability. If necessary, we are willing to use customer supplied fibers to build devices.

For best results, the standard parts are designed to accept angled FC/PC connectors. Other connector types are possible with lower dynamic reflectance range.

The device can be controlled remotely via a USB interface. A universal AC/DC power supply is included with all units.

The Digital Variable Reflector can be provided with a custom built-in fused coupler which directs a fraction of the reflected light to a second optical connector on the unit. The user can use this signal for monitoring the reflected power, or determining the influence of reflected power on his device under test.

Contact OZ Optics for details.



Digital Variable Reflector

## Ordering Information For Standard Parts:

Bar Code	Part Number	Description
8154	DR-100-3A-1300/1550-9/125-S-60	Singlemode digital variable reflector with 60 dB dynamic range calibrated at 1300nm and 1550nm with angled FC receptacle.
9454	DR-100-3A-1550-9/125-S-60	Singlemode digital variable reflector with 60 dB dynamic range calibrated at 1550nm with angled FC receptacle.
9107	DR-100-3A-980-6/125-S-40	Singlemode digital variable reflector with 40B dynamic range calibrated at 980 nm with angled FC receptacle.
2118	SMJ-3S3A-1300/1550-9/125-3-2	Patchcord, Super FC/PC to angled FC/PC, 9/125um singlemode 1300/1550nm fiber, 3mm OD PVC jacketed, 2 meters long.
10283	SMJ-3S3A-980-6/125-3-2	Patchcord, Super FC/PC to angled FC/PC, 6/125um singlemode 980nm fiber, 3mm OD PVC jacketed, 2 meters long.

## Standard Product Specifications<sup>1</sup>:

Part number	DR-100-3A-1550-9/125-S-60	DR-100-3A-1310/1550-9/125-S-60	DR-100-3A-980-6/125-S-40
Bar Code number	9454	8154	9107
Calibrated Wavelength	1550nm $\pm$ 20nm	1310nm and 1550nm $\pm$ 20nm	980nm $\pm$ 20nm
Fiber Type	Singlemode Fiber (9/125 $\mu$ m)	Singlemode Fiber (9/125 $\mu$ m)	Singlemode Fiber (6/125 $\mu$ m)
Reflectance Range <sup>3</sup>	2.5dB to 60dB		3dB to 40dB
Reflectance Accuracy <sup>4</sup>	$\pm$ 0.3dB for 2.5dB up to 40dB		$\pm$ 0.3dB for 3 dB up to 25dB
	$\pm$ 0.5dB for 40dB to 50dB		$\pm$ 0.5dB for 25dB to 35dB
	$\pm$ 1dB for 50dB to 60dB		$\pm$ 1dB for 35dB to 40dB
PDL	0.05dB		0.08dB
Repeatability <sup>3</sup>	$\pm$ 0.03 dB for 2.5 dB to 10 dB		
	$\pm$ 0.15 dB for 10 dB to 40 dB		
Response Time 3dB change	0.1 sec (typical). Time depends on reflectance level		
Optical Power Level	500mW maximum continuous exposure – Singlemode fiber 50mW maximum continuous exposure – Multimode fiber For power levels above 50mW for multimode fiber or 500mW for singlemode fiber, please contact OZ Optics.		
Resolution	0.01 dB for 1 dB to 10 dB		
	0.1 dB for 10 dB to 40 dB		
Insertion Loss <sup>2</sup>	< 2.5 dB		< 3 dB
Connector Interface	FC/APC		
Communications Port	USB		
Input Voltage	Universal 110/220V AC/DC adapter		
Dimensions (with boot)	60 x 90 x 190 mm (2.4"x 3.5" x 7.5")		
Weight	450gr (1lb.)		
Operating Temperature	-10 to 55°C		
Storage Temperature	-30 to 70°C		
Relative Humidity	< 90% RH non condensing		
Safety	Complies with EMC (EN61326:1997 & A1:1998) and Safety Requirements (EN61010-1:1993, A2:1995)		

<sup>1</sup> All specifications are tested at 23°C  $\pm$  2°C.

<sup>2</sup> Includes the connector loss.

<sup>3</sup> The minimum reflectance depends on the connector end being used.

<sup>4</sup> Measured with FP laser diode source after 30 minutes warm-up using a singlemode jumper with angled connector.

### Ordering Examples For Standard Parts:

A European laser diode manufacturer wants to automate a test system via a USB interface. He wants to test the effect of backreflection on the output spectrum of his 1550nm laser diodes. He needs to order these following parts:

Bar Code	Part Number	Description
8154	DR-100-3A-1300/1550-9/125-S-60	Singlemode Digital Variable Reflector with 60 dB dynamic range calibrated at 1300nm and 1550nm with angled FC receptacle
11303	FUSED-12-1300/1550-9/125-50/50-3A3A3A-3-0.5	Fused Fiber Coupler, 50/50 split 1x2, 9/125um singlemode 1300/1550nm fiber, 0.5 meter long 3mm OD PVC jacketed leads with angled FC/PC connectors

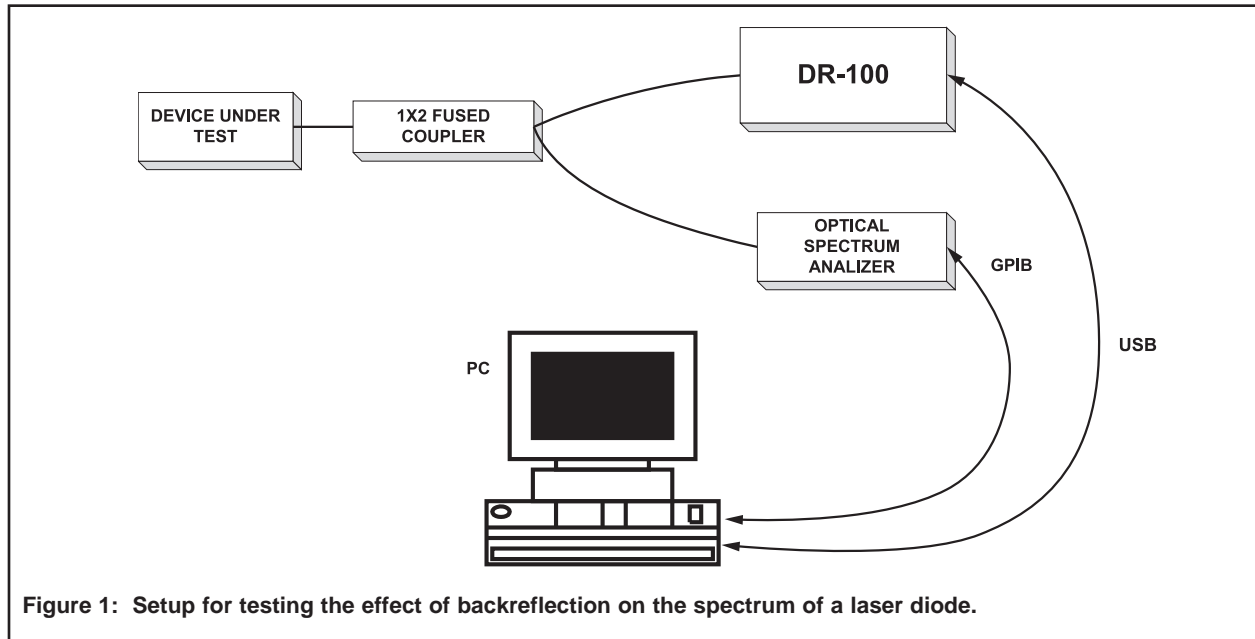


Figure 1: Setup for testing the effect of backreflection on the spectrum of a laser diode.

### 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 5 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 is the application?
2. What wavelengths do you plan on using?
3. What are the return loss requirements?
4. What fiber type are you using?
5. What connector receptacle type do you need?
6. What power level do you need to handle?
7. Do you need to control the unit by a computer? If so, what type of interface?

## Digital Variable Reflector:

### ***DR-100-X-W-a/b-F-LB***

#### **XY** = Connector Code:

3S= Super NTT-FC/PC  
 3U= Ultra NTT-FC/PC receptacle  
 3A= Angled NTT-FC/PC  
 SC= SC  
 SCA= Angled SC  
 8= AT&T-ST

#### **W** = Wavelength in nm:

980, 1310, 1480, 1550 and 1625

#### **a/b** = Fiber core/cladding size, in microns.

#### **LB** = Backreflection range:

40, 50 or 60dB for singlemode or PM fibers  
 60dB backreflection is available for 1310nm and 1550nm singlemode only with FC/APC connectors  
 35dB for multimode fibers

#### **F** = Fiber type:

M= Multimode  
 S= Singlemode  
 P= Polarization maintaining (PM) fiber

## Ordering Examples For Custom Parts:

A customer would like to emulate the anticipated backreflection from different types of devices by using a variable reflector. If his system is operating at a wavelength of 980 nm and he is using an SCA connector, then he could order the following part to perform the required testing:

Bar Code	Part Number	Description
N/A	DR-100-SCA-980-6/125-S-40	Singlemode Digital Variable Reflector with 40dB dynamic range calibrated at 980nm with angled SC connector.

## Frequently Asked Questions (FAQs):

**Q:** What is a variable reflector used for?

**A:** A variable reflector is useful for emulating the reflectance that normally occurs from all optical interfaces within fiber optic systems. This allows a designer to test a prototype quickly and easily to determine if its operation will be adversely affected by unexpected backreflection.

**Q:** Can it be used at wavelengths for which it is not calibrated?

**A:** Sometimes. Since the wavelength response of the Digital Variable Reflector is fairly flat, it can be used at other wavelengths without noticeable degradation, if the wavelength is within a few tens of nanometers of the calibrated values. If the wavelength is significantly different than the calibrated value, then the insertion losses will increase and the overall backreflection will deviate somewhat from the displayed value.

**Q:** How do I get the unit calibrated?

**A:** OZ Optics recommends that the unit be returned to the factory annually for calibration.

**Q:** Why is the power rating for a multimode unit different than that of a singlemode unit?

**A:** Singlemode units use a beam blocking technique that can handle significant power levels. Multimode units use a variable neutral density filter. The power handling of the multimode unit is limited by the power handling capabilities of the filter.

**Q:** Why do singlemode devices use a different technique than multimode units?

**A:** With singlemode units, the beam blocking technique is simple, repeatable, and cost effective. With multimode units, the fiber can support many different modes. These mode patterns tend to be susceptible to any changes in the fiber due to applied stresses or temperature variations. The beam blocking technique does not work well in such situations because it will not block all possible modes equally. Hence, a variable filter is used instead.

## Application Notes:

If a coherent light source is used in an application where a variable reflector will also be used, then the user may observe the effects of constructive or destructive interference as the reflected light returns to the source. This may cause instabilities in the source or measurements that might or might not be a problem in a "real" application. There are a couple of ways of getting around this problem:

1. If possible, replace the source with a non-coherent source. LED sources are relatively non-coherent and may be used successfully in some situations, although their power output is generally less than that of a laser.
2. By inserting a spool of fiber between the system under test and the variable reflector, the coherence of the light will be greatly diminished.
3. Use a source with a built-in isolator to block any reflections before they reach the source.