



## POLARIZATION EXTINCTION RATIO MEASUREMENT TEST SET FOR V-GROOVE ASSEMBLIES AND MPO/MTP® PATCHCORDS

### Features:

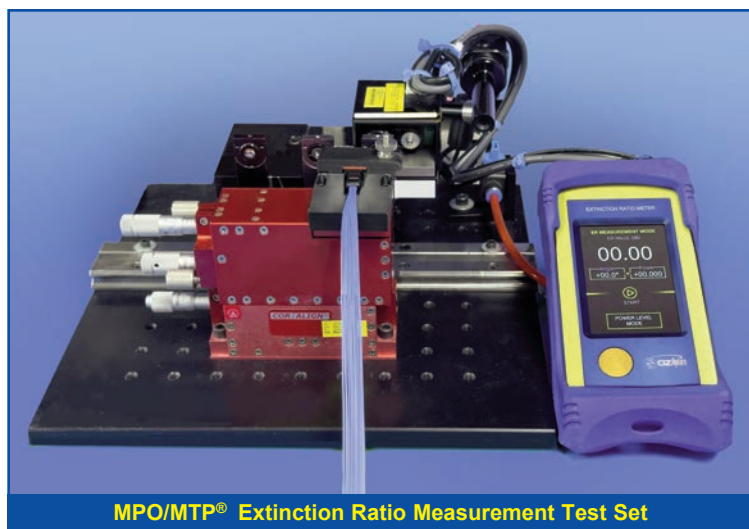
- Measures up to 40 dB extinction ratios
- Complete kit for extinction ratio measurement
- Simple operation

### Applications:

- Fiber optic component manufacturing
- Automated alignment
- Quality control and measurement
- Product development
- Component or system troubleshooting

### Product Description:

OZ Optics has bundled its polarized sources, polarization extinction ratio meters and master reference patchcords into one complete test set for rapid testing of the polarization maintaining properties of optical components. We offer systems for testing devices terminated with connectors, and now systems for testing the polarization properties of V-Groove arrays, MPO/MTP® patchcords and custom fiber arrays.



For standard components, the extinction ratio measurement system includes a polarized source with a rotatable polarizer, a polarization extinction ratio meter, a quick connect adaptor for the extinction ratio meter, and a reference polarization maintaining patchcord.

For V-Groove arrays and MPO/MTP® PM patchcords, OZ Optics offers an OEM version of the polarization measurement system. A manual operated type and semi-automated type. The test set includes the polarized source with rotatable polarizer, an OEM version of the extinction ratio meter with external optics, a V-Groove or connector mount with a three axis position system, with one axis motorized for semi-automated type, a reference V-Groove array or patchcord with a single PM fiber, and an application software package for semi-automated operation. The user only has to supply a Windows based computer to operate the system as a semi-automated test bed.

Although extinction ratio measurement test sets are supplied as complete units, one may later need to purchase additional accessories, such as receptacles or reference patchcords for other connector types. These products are readily available. For further information, please refer to the following data sheets:

Sources and Accessories	<i>Polarized Fiber Optic Source</i>
Meters and Accessories	<i>Fiber Optic Polarization Extinction Ratio Meter</i>
Reference Patchcords	<i>Fiber Optic Polarization Extinction Ratio Meter, Polarization Maintaining Patchcord, V-Groove Assemblies</i>



## Ordering Information For Standard Parts:

Bar Code	Part Number	Description
13619	PER-KIT-33-1550-1-ER=40	Polarization Extinction Ratio Measurement Test Set for testing 1550 nm polarization maintaining patchcords terminated with FC connectors with Super PC or Ultra PC Finishes. Kit contains the following items: Source: PFOSS-02-3-1550-1-ER=40 Meter: ER-100-1290/1650-ER=40 Receptacle: ER-23-1290/1650-ER=40 Patchcord: PMJ-3U3U-1550-8/125-1-1-1-ER=30-G
13620	PER-KIT-3VGA-1550-1-ER=40	Polarization Extinction Ratio Measurement Test Set for testing V-Groove Arrays using 1550 nm polarization maintaining patchcords terminated with FC connectors with Super PC or Ultra PC Finishes. Kit contains the following: Source: PFOSS-02-3-1550-1-ER=40 Meter: ER-11-1290/1650-ER=40 (Includes PC interface and software) Mount: ER-VGA-1290/1650-ER=40 (Includes positioning stage) Patchcord: VGA-1-250-0-X-10.3-3.8-2.03-P-1550-8/125-3S-0.25-1-0-ER=30-G

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

Part Number	PFOSS-02-3-1550-1-ER=40	PFOSS-02-3-1310-1-ER=40
Bar Code #	11378	13507
Laser Type <sup>2</sup>	Fabry-Perot Laser	
Central Wavelength <sup>3</sup>	1550 nm ± 20 nm	1310 nm ± 20 nm
Extinction Ratio	40 dB	
Output Power <sup>4</sup>	1 mW	
Polarizer Type	Rotatable	
Spectral Bandwidth <sup>5</sup>	< 5 nm	
Short Term Stability <sup>6</sup>	±0.05 dB	
Long Term Stability <sup>7</sup>	±0.1 dB	
Connector Type	Standard, Super, Ultra NTT-FC/PC receptacle	
Power Variation induced by rotatable polarizer <sup>8</sup>	< 0.25 dB	
Input Voltage	Universal 110/220 Volt AC to DC adapter	
Dimensions (LXWXH)	76 x 63 x 70 mm	
Weight	500 gr	
Operating Temperature	0 to 40°C	
Storage Temperature	-20 to 60°C	
Relative Humidity	< 90% RH non condensing	

<sup>1</sup> Reference condition: 23°C ambient temperature after 30 minutes warm-up period

<sup>2</sup> DFB and SLED lasers are also available as a custom order.

<sup>3</sup> Depends on laser diode manufacturer and temperature operation.

<sup>4</sup> For higher output power we recommend ordering a HIPFOSS to improve wavelength and power stability.

<sup>5</sup> Measured at Full Width Half Maximum

<sup>6</sup> 15 minutes at constant temperature and after 30 minutes warm-up period

<sup>7</sup> 6 hours at constant temperature and after 30 minutes warm-up period

<sup>8</sup> Power variation induced by rotatable polarizer applied only to 1310 nm and 1550 nm wavelength. At shorter wavelength, the power variation induced by rotatable polarizer can be up to 1.2 dB, due to the smaller core diameter.

## Standard Product Specifications For Extinction Ratio Meters<sup>1</sup>:

<b>Part Number</b>	<b>ER-100-1290/1650-ER=40</b>
Bar Code Number	11998
Wavelength Range	1290 nm to 1650 nm
Extinction Ratio Range	40 dB for 1290 nm to 1650 nm
Dynamic Range	47 dB
Extinction Ratio Accuracy	±1 dB
Extinction Ratio Resolution	0.01 dB
Angular Accuracy <sup>2</sup>	± 0.5 degrees
Angular Resolution	0.3 degrees
Update Rate (Extinction Ratio)	2.7 Hz
Update Rate (Relative Power)	650 Hz
Input Optical Power <sup>3</sup>	50 µW to 1.0 mW
Communication Interface	RS232
Input Supply Voltage <sup>4</sup>	Universal 50/60 Hz 110/220V AC/DC adapter
Dimensions	60x90x190 mm
Weight	0.5 kg (5 kg for V-Groove Array Measurement Test Set)
Operating Temperature	10° to 50°C
Storage Temperature	-30° to +60°C
Storage Humidity	<90% RH non condensing
Regulatory Compliance	Complies with EMC (EN61326:1997 & A1:1998) and Safety Requirements (EN61010-1:1993, A2:1995)

<sup>1</sup> Tested at 23°C ± 2°C with a 1550 nm linearly polarized source plus a master 1550 nm polarization maintaining patchcord, after a 30 minute warm-up period.

<sup>2</sup> For FC style connectors with high tolerance keyway.

<sup>3</sup> Without attenuator. Higher powers can be measured with an attenuator. When ordering an attenuator with >20 dB attenuation, the wavelength should be specified. Note: Exposing the detector to power higher than +17 dBm (50 mW) without attenuator for a short period of time (3 minutes) can damage the detector.

<sup>4</sup> North American power cord provided as standard equipment. Power cords for Europe and the United Kingdom can be ordered separately.

### Additional Information For V-Groove Array and MPO/MTP® PM Measurement Test Set:

Standard Travel Range <sup>1</sup>	12 mm
Travel Resolution	0.1 µm
Motion Control Interface (For semi-automated only)	RS-232 (no additional driver/controller required)

<sup>1</sup> Longer travel ranges are available upon request. This might require a longer lead time.

### Master Reference Patchcords

Available Wavelengths	488 nm, 633 nm, 830 nm, 980 nm, 1300 nm, 1550 nm
Available Connectors	Ultra FC/PC, Angled FC, SC, Angled SC, ST, LC, and MU
Minimum Extinction Ratio	30 dB for 1300 and 1550 25 dB for 830 and 980 20 dB for 488 and 633
Stress Rod Alignment With Respect To The Key	±1.5 degrees
Polarization Transmission Axis Alignment With Respect To The Key	±1.5 degrees

### Ordering Example For Standard Parts:

A customer in the United Kingdom wants a measurement test set for testing polarization maintaining patchcords for 1550nm. His patchcords use FC connectors with Super PC and Ultra PC finishes. He should order the following parts:

Bar Code	Part Number	Description
13619	PER-KIT-33-1550-1-ER=40	Polarization Extinction Ratio Measurement Test Set for testing 1550nm polarization maintaining patchcords terminated with FC connectors with Super PC or Ultra PC Finishes. Kit contains the following items: Source: PFOSS-02-3-1550-1-ER=40 Meter: ER-100-1290/1650-ER=40 Receptacle: ER-23-1290/1650-ER=40 Patchcord: PMJ-3U3U-1550-8/125-1-1-1-ER=30-G
2736	POWER CORD – UK	Power Cord for United Kingdom AC receptacles (Order two, one for the source, one for the Polarization Extinction Ratio Meter).

## 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 1 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 wavelength are you using?
2. What is the minimum acceptable polarization extinction ratio for the source?
3. What should be the minimum extinction ratio rating of the polarization extinction ratio meter?
4. What type of connector are you using on the source side?
5. What type of connector are you using on the detector side?
6. Do you need a custom mount?
7. Do you need a manual system or semi-automated system?

## Polarization Extinction Ratio Measurement System:

**PER-KIT-XY-W-1(-ER=ZZ)<sup>1</sup>**

### X = Source Connector Code:

3 = Standard Flat, Super or Ultra NTT-FC/PC receptacle  
 3A = Angled NTT-FC/PC  
 8 = AT&T-ST  
 SC = SC  
 SCA = Angled SC  
 LC = LC  
 MU = MU  
 Consult factory for special connector and ferrule adaptors.

### Y = Meter Connector Code:

3 = Standard Flat, Super or Ultra NTT-FC/PC receptacle  
 3A = Angled NTT-FC/PC  
 8 = AT&T-ST  
 SC = SC  
 SCA = Angled SC  
 LC = LC  
 MU = MU  
 VGA = V-Groove array  
 MPO/MTP® = MPO/MTP® adaptor mount  
 Consult factory for special connector and ferrule adaptors.

<sup>1</sup> ZZ: Extinction Ratio: None if 30 dB is required.  
 If an ER > 30 dB is required, enter ER=35 or ER=40 respectively for ER=35 dB or ER=40 dB.

W = Wavelength Range (in nm)  
 Example: (1550 for 1550 nm, 1310 for 1310 nm, 980 for 980 nm)

MAN: = Add to part number for manual type V-Groove measurement system



**MPO/MTP®  
Adaptor Mount**

**ER-Measurement Test System  
for V-Groove (Manual Type)**

## Application Notes:

### PM V-Groove Array ER Measurements

OZ Optics' ER Meters for PM V-Groove arrays provide fast and accurate extinction ratio measurements of V-Groove assemblies manufactured with PM fiber. The semi-automated system is computer controlled for hassle free control and measurements. The system consists of a polarized light source, 3 axis measurement micro-stage with one axis motorized, an extinction ratio display set and PC software to control the system. The stage and meter display are connected to a PC using RS-232 cables. The system is capable of measuring extinction ratios up to 40 dB with an accuracy of 1.5°.

### Operating The PM V-Groove Array ER Measurement Test Set

The system works by first setting the software configurations for the appropriate V-Groove size and spacing. The V-Groove chip is then attached to the mounting stage and the opposite end of the fiber is attached to the polarized source. After adjusting the stage to roughly align the fiber to the meter, the software is started to take the ER measurement and automatically move the array to the next fiber position. Manual recording of the measured ER and angle is required at this point; optional software is available to log the measurements for later use. At the software prompt, the user must change the fiber on the polarized source so the next measurement can be taken.

## Application Notes:

### Comparison of the OZ ER measurement system with results from a polarimeter

A common alternate technique used in polarization analysis is through the use of a polarimeter. These devices work by mathematically mapping the output polarization from a source onto what is known as a Poincaré sphere. By monitoring the variation of the polarization over time on this Poincaré sphere, one can calculate the variation in the polarization and presumably the degree of polarization itself.

There are two principle drawbacks with this technique. The first is that to map the polarization onto the Poincaré sphere, polarimeters subtract any randomly polarized light from the signal. Thus any calculation of the polarization extinction ratio using a polarimeter ignores this signal. This results in reported values that are more optimistic than that given by the OZ Extinction Ratio Meter. The Extinction Ratio Meter gives a more conservative and more reliable result.

The second drawback is that most fiber optic polarimeters utilize singlemode fiber to transmit light to its internal sensors. The singlemode fiber itself changes the polarization to an arbitrary polarization. Therefore fiber optic polarimeters are only suitable for measuring relative changes. This makes them unsuitable for alignment of polarization maintaining connectors.

### General Considerations

OZ Optics Polarization Extinction Ratio Meters, together with OZ Optics Highly Stable Polarized Sources, provide a quick, reliable, and effective means to align, characterize, and QA polarization maintaining components. To ensure that your measurements are as accurate as possible, the following precautions should be taken.

#### 1. Check your reference angle:

The OZ Optics Extinction Ratio Meter provides a reading of the polarization axis orientation compared to the keyway on the receptacle. However, if the receptacle is exchanged or replaced, the orientation might be changed by a few degrees.

To ensure that the angle reading is accurate, OZ Optics supplies master reference patchcords. These patchcords maintain polarization to better than 30dB, and are aligned to within  $\pm 1.5$  degrees of the connector keyway. A menu option allows one to adjust the angle reference to any desired value, allowing one to compensate for any offset. Note that a misalignment of  $\theta$  degrees between the source and the fiber will degrade the extinction ratio and the maximum ER that can be achieved will be given by:

$$ER \leq 10 \log (\tan^2 \theta)$$

#### 2. Stress the fiber:

When working with a highly coherent source, such as a DFB laser, it is possible to get readings that initially meet specifications, but degrade over time. This degradation of the extinction ratio can take several minutes to occur. This behavior occurs because part of the light within the fiber is traveling along the wrong axis. At the output end of the fiber the light traveling along the slow and fast axes combine to form a unique polarization state. If the two signals are in phase with one another, they will form linearly polarized light. However, as the fiber is stressed, the phase relation will change and so will the output polarization.

To check for this behavior, one should stress the fiber while measuring the polarization. The meter has a data logging mode for this function. To use it, activate the logging mode through the menu, then apply stress to the device under test. One common method is to simply wrap the fiber several turns around a mandrel, 40 or 50mm in diameter. Such a mandrel is available from OZ Optics. A second technique is to heat the fiber with a warming plate. After stressing the fiber, stop the logging mode. The meter will then display the worst case extinction ratio, and the variation in the polarization angle. Use these readings as the performance specification. Refer to the manual for further details.

#### 3. Look both ways:

If a device is being used to transmit light in either direction, then it should be inspected in both directions. The performance of a device will depend on the direction in which it is used. This is because stresses and microbends usually occur near the fiber ends. If the microbend is at the output end of the fiber, then the output polarization may be rotated, but otherwise remain static. However if the microbend is at the input end, then the polarization is perturbed before travelling through the fiber, so the polarization will vary.

#### 4. Autoalign components using the computer interface.

The meter can report both power and extinction ratios to a computer control system via an RS232 interface. This can be used to develop an auto-alignment system. The power level can be reported at over 650 samples per second, which is sufficient for rapid alignment. A complete set of application notes, one on polarization measurements (POLARIZATION MAINTAINING MEASUREMENT SYSTEMS), the other on how to use the meter for alignment applications (AUTOMATED POLARIZATION ALIGNMENT) are available from our website ([www.ozoptics.com](http://www.ozoptics.com)).

#### 5. Measurement limits

The detection circuitry for the ER meter has an overall dynamic range of about 60 dB. When the input signal has a power level within the range of 50  $\mu$ W to 1 mW (a 13 dB range), this leaves at least a 47 dB range for the ER measurement itself.

Since the extinction ratio is based on the ratio of two values, a minimum and a maximum, the minimum value may approach the noise floor of the instrument if the extinction ratio is really good or the input power is close to 50  $\mu$ W or below. In such a case, the minimum value may default to the noise floor of the instrument. Under these conditions, the instrument may not be able to provide an accurate reading. However, it will be able to determine a worst case value, which will be indicated to the user as such. By using a higher-powered source, the instrument will be able to provide an improved reading. For example, with a low power signal, the ER meter may indicate that an extinction ratio is  $>27$  dB. If the user needs to know whether the actual value is over 30 dB, then a more powerful source should be used. If the ER meter has an optional attenuator installed, the user could simply remove the attenuator.