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Global Leader in Fiber Optic Products **SINCE 1985**



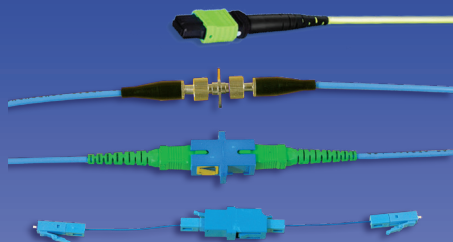
# Fiber Optic Components

## SHORT FORM CATALOG

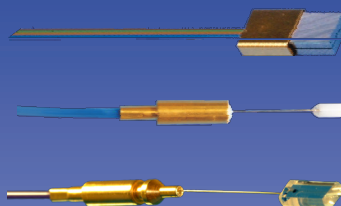


**Polarization Maintaining, High Power Fiber Optic Components, Laser & Laser Diode to Fiber Delivery Components, Fiber Optic Attenuators, Fiber Optic Components for Optoelectronic Packaging**

**Patent Numbers:** USA 7058275, 7067993, 7095931, 7295731, 7431513, 7499151, 7599047, 8090233, 8107782, 9568307, 9696141, 10329196  
EPO 10329196, 1527363 CANADA 2110651, 2494133, 2495223, 2496661, 2574702, 2590968, 2629446 CHINA ZL03818458.3



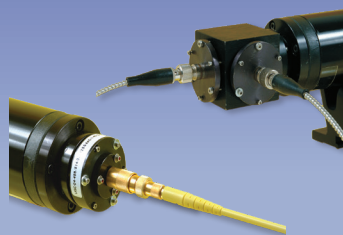
**Polarization Maintaining Patchcords**



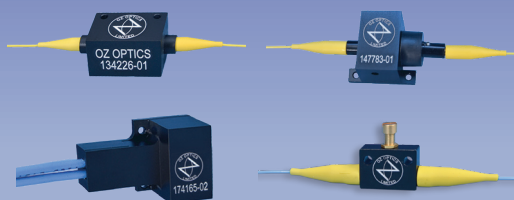
**Hermetically Sealable Patchcords**



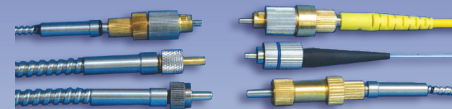
**Polarization Maintaining Splitters/Combiners**



**High Power Laser to Fiber Delivery Systems**



**Attenuators**



**High Power/Temperature Patchcords & Connectors**



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# Polarization Maintaining Fiber Optic Components



## Polarization Maintaining Patchcords

Up to 30 dB Polarization Extinction Ratios  
 <0.3 dB IL, Up to -60 dB Backreflection  
 FC/APC, FC/PC, SC, LC, MU, ST, E2000



## Polarization Measurement Systems

Includes Source, Meter and Master PM Patchcord  
 Measures up to 40 dB ER and Polarization  
 Angle Simultaneously  
 FC, SC, LC, E2000 or Custom  
 Connectors & Ferrules



## OEM High-Speed Polarization Controller-Scramblers

Continuous Control of Polarization  
 Negligible Insertion Losses and Return Losses  
 >30 kHz Response Speed at  
 Resonance Frequency



## Polarization Maintaining Fused Couplers

Low Cost, Miniature Size  
 50/50 to 99/1 Splitting Ratios  
 Ideal For Taps For Power Monitoring



## Planar Light Circuit Splitter (PLCS)

Polarization and Singlemode Fiber Versions  
 Broad Bandwidth  
 1x2, 1x4, 1x8, 1x16, 1x32 Available



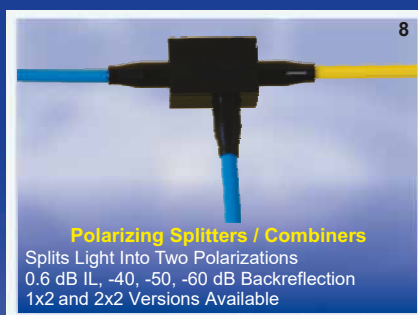
## Fiber Optic Coils

For tactical, navigation, and FOG applications  
 Different winding patterns; Wet or Dry,  
 Framed or Freestanding  
 High accuracy and low tension to minimize  
 coil stress



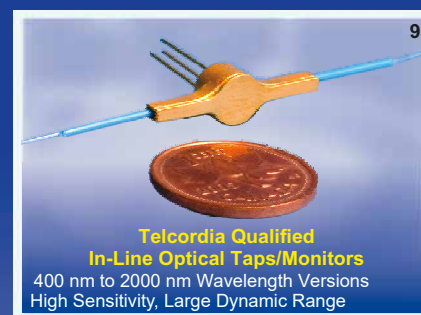
## Polarization Maintaining Splitters

Splits Polarized Light Into 2 PM or SM Fibers  
 0.6 dB IL, -40, -50, -60 dB Backreflection  
 1x2 and 2x2 Versions Available



## Polarizing Splitters / Combiners

Splits Light Into Two Polarizations  
 0.6 dB IL, -40, -50, -60 dB Backreflection  
 1x2 and 2x2 Versions Available



## Telcordia Qualified In-Line Optical Taps/Monitors

400 nm to 2000 nm Wavelength Versions  
 High Sensitivity, Large Dynamic Range



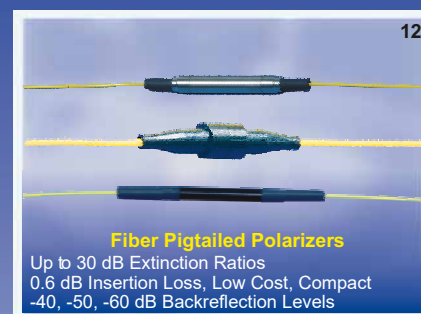
## Polarization Dependent Loss Emulators

0.05 dB to 1 dB Polarization Dependent Loss  
 Fixed or Manually Variable PDL Broad  
 Wavelength Range, Compact, and Low Cost



## PM Fiber Circulators

0.7 dB Typical Insertion Loss  
 532 nm to 2000 nm Wavelength Range  
 Up to 30 dB Extinction Ratios



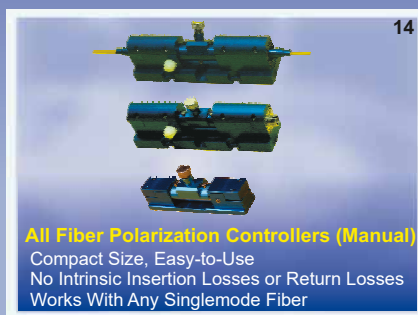
## Fiber Pigtailed Polarizers

Up to 30 dB Extinction Ratios  
 0.6 dB Insertion Loss, Low Cost, Compact  
 -40, -50, -60 dB Backreflection Levels



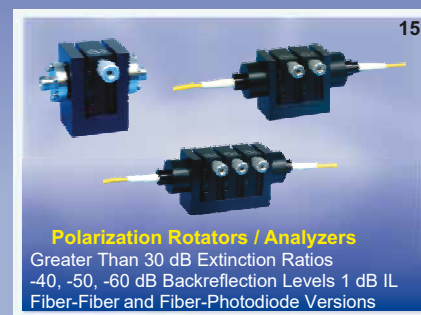
## Variable Optical Delay Lines

400–2000 nm Wavelength Range  
 Up to 600 ps Delay, 0.003 ps Resolution  
 < 1.2 dB Losses Over The Delay Range



## All Fiber Polarization Controllers (Manual)

Compact Size, Easy-to-Use  
 No Intrinsic Insertion Losses or Return Losses  
 Works With Any Singlemode Fiber



## Polarization Rotators / Analyzers

Greater Than 30 dB Extinction Ratios  
 -40, -50, -60 dB Backreflection Levels 1 dB IL  
 Fiber-Fiber and Fiber-Photodiode Versions



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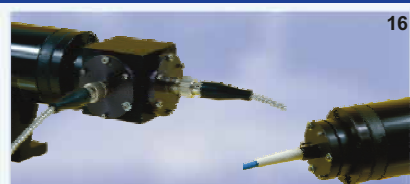


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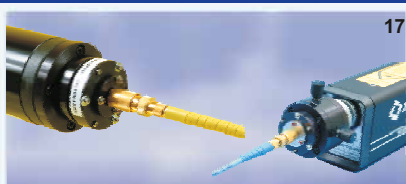
# Laser & Laser Diode to Fiber Delivery Components



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## Laser to Fiber Couplers

> 60% Coupling Efficiency For SMF & PMF Low / High Power Versions up to 100 W 180 nm to 2000 nm Wavelengths



17

## Laser to Fiber Couplers with Adjustable Focus

Up to 95% Coupling Efficiency for SMF & PMF SMF, MMF & PMF Versions 0.1 Micron Resolution in Focus Adjustment



18

## Adjustable Fiber Collimators/Focusers/Connectors

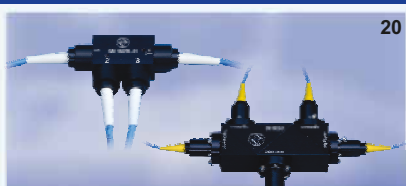
Use for Adjustable Focusers and Couplers Super & Angled FC/PC, And SMA905 Connectors SMF, MMF & PMF Versions



19

## Delivery Systems for Flow Visualization

Uniform Intensity Along the Line < 1 mm Linewidths, 10° To 60° Fan Angles Cross Targets Also Available



20

## Red/Green/Blue WDM Combiners

Combine Red, Green and Blue Sources with Low Loss Singlemode, Multimode and PM Fiber Versions High Power Handling. 2 to 6 Wavelength Versions



21

## Receptacle Style Collimators/Focusers

0.2 mm to > 15 mm Beam Diameters 180 nm to 2000 nm Wavelengths Achromatic Collimators Available



22

## Pigtail Style Collimators/Focusers

As Small as 2µm Spot Sizes, up to 5 W Power Up to -60 dB Backreflection SMF, PMF & MMF 1.6 mm, 2.5 mm, 4 mm and 8 mm OD Housing High Power Versions Available, up to 300 W



23

## Fused Fiber Collimators

Low Insertion Loss Low Backreflection Over 1 kW Power Handling



24

## Precision Fiber Collimator/Focuser Arrays

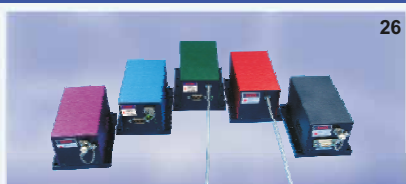
High Density, Small Footprint Low Insertion and Backreflection Loss High Polarization



25

## OEM Laser Diode to Fiber Couplers

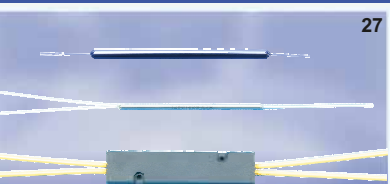
375 nm to 1625 nm Wavelengths Up to 80% Coupling Efficiency into SMF & PMF PC Board Mountable, Reusable Optics



26

## Turnkey OEM Laser Diode Sources

Wavelength Range: 375 nm to 2000 nm Externally Modulatable Red, Green, Blue Combiner Versions Available



27

## Fused Fiber Optic Couplers

1x2, 2x2 and 1xN Couplers Available SM, MM, and PM Fibers 400 nm to 1550 nm Wavelengths



28

## Fiber to Photodiode Couplers

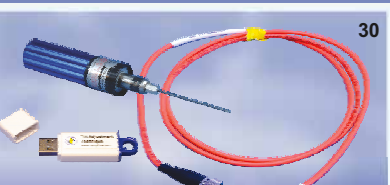
>70% Coupling Efficiency, SMF, MMF & PMF -40 dB, -50 dB, -60 dB Backreflection Low Cost, Rugged and Compact Size



29

## U-Bracket with Removable Optics

As Good as 0.6 dB Insertion Loss -40, -50, -60 dB Backreflection Use with A/O Modulators, Bulk Optics



30

## Alignment Kits & Tools

Polarization Tool Aligns Polarization in Seconds Alignment Kit Simplifies Laser to Fiber Coupling Video/USB Demonstrates the Coupling Process



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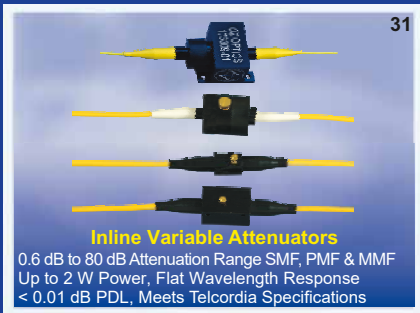


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# Fiber Optic Attenuators



**Inline Variable Attenuators**

0.6 dB to 80 dB Attenuation Range SMF, PMF & MMF  
Up to 2 W Power, Flat Wavelength Response  
< 0.01 dB PDL, Meets Telcordia Specifications



**Reflective Style Variable Attenuators**

0.8 dB to 60 dB Attenuation Range  
0.01 dB Resolution, SMF & MMF Versions  
-40 dB, -50 dB, -60 dB Backreflection



**Miniature Single/Multi-Channel Variable Attenuators**

Less Than 5 mm Thick per Channel  
Ideal for High Density Fiber Networks  
High Power Handling, Low Loss, PDL And WDL



**Electrically Controlled Attenuators**

0.6 dB to 60 dB Attenuation Range SMF, PMF & MMF  
Maintains Attenuation with Power Off, up to 2 W Power  
Low Cost, High Speed, Rugged and Compact Size



**Reflective Style Motor Driven Attenuators**

0.8 dB - 60 dB Attenuation Range  
Up to 2 W Power Handling SMF, PMF & MMF  
High Speed, Rugged and Compact Size



**MEMS Variable Attenuators**

Compact and Inexpensive  
Single Channel up to 40 Channel Versions  
Low Loss, Large Attenuation Range



**Digital Variable Attenuators**

0.01 dB Resolution, Fast Response Time  
0.6 dB to 60 dB Attenuation Range  
Computer / USB Port / Battery Option



**Benchtop Digital Multichannel Attenuators**

High Power Up to 2 Watts  
Up to 60 dB Attenuation Range  
350-2050 nm Wide Wavelength Range



**Rack Mount Electrically Controlled Variable Attenuators**

High Power up to 2 Watts  
Up to 60 dB Attenuation Range  
350-2050 nm Wide Wavelength Range



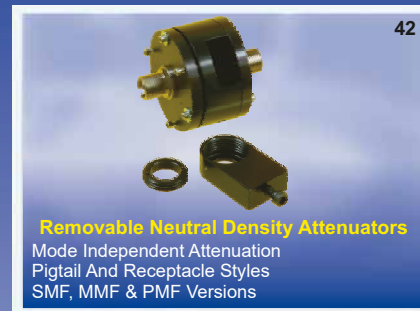
**Loopback Style Fixed Attenuators**

Mode Independent Attenuation  
Rugged, Compact Housing  
SMF & MMF Versions



**Attenuating Fiber Patchcords**

Up to 2 Watts Power Handling, Low PDL  
SM, PM Fiber Versions  
Very Low Cost, Small Size



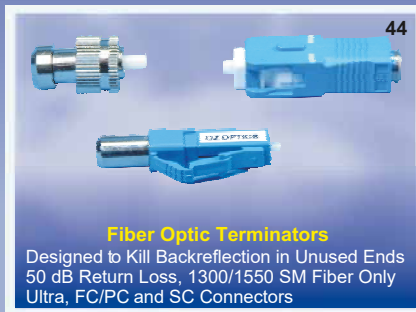
**Removable Neutral Density Attenuators**

Mode Independent Attenuation  
Pigtail And Receptacle Styles  
SMF, MMF & PMF Versions



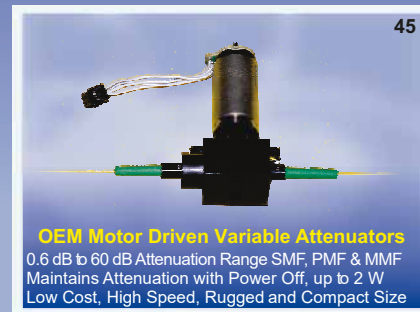
**Plug Type Fixed Attenuators**

< -50 dB Backreflection, SMF & MMF  
-1 dB to -25 dB Attenuation, 1300 & 1550 nm Only  
Low Cost, Rugged and Compact Size



**Fiber Optic Terminators**

Designed to Kill Backreflection in Unused Ends  
50 dB Return Loss, 1300/1550 SM Fiber Only  
Ultra, FC/PC and SC Connectors



**OEM Motor Driven Variable Attenuators**

0.6 dB to 60 dB Attenuation Range SMF, PMF & MMF  
Maintains Attenuation with Power Off, up to 2 W  
Low Cost, High Speed, Rugged and Compact Size



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# Fiber Optic Connectors, Patchcords and Components for Optoelectronic Packaging

**46**

**Hermetically Sealable Patchcords with Metal Solder (Single/Multi Channel)**  
Meets Telcordia Specifications, up to 16 Channels  
SMF, MMF & PMF Versions  
Customer Specific OEM Designs

**47**

**Hermetically Sealable Patchcords with Glass Solder (Single/Multi Channel)**  
No Metalization Required, up to 16 Channels  
Meets Telcordia Specifications SMF, MMF & PMF  
Customer Specific OEM Designs

**48**

**12 and 16 Channels MPO/MTP Polarization Maintaining Fiber Assemblies**  
High precision polarization axis alignment to the Base of the MPO connector to  $\pm 3^\circ$  Min. Extinction Ratio (PER) of  $\geq 20\text{dB}$  and a Typical PER of  $\geq 25\text{dB}$  Ferrules and Connectors with PC or APC Termination

**49**

**Tapered/Lensed Fibers**  
As Small as 2.0 Micron Spot Sizes  
Circular and Oval Spot Profiles  
Custom OEM Designs, Metalized Versions

**50**

**Metalized Fibers**  
SMF, MMF & PMF Versions  
Ideal for Hermetic Component Packaging  
Cleaved Fiber Endfaces, Masked Regions

**51**

**V-Groove Substrates**  
Up to 96 Fiber Substrates  
Better than 0.5 Micron Accuracy  
Use with Either UV or Thermal Epoxies

**52**

**Glass Solder Preforms**  
Solders Glass Directly to Metal  
Ideal for Hermetic Sealing, Device Packaging  
Circular and Oval Preform Shapes

**53**

**Hermetic Patchcords with Built-in Optical Taps**  
Allows In-Line Monitoring Inside Devices  
Wide Wavelength Range, Automatable  
SM, PM Fiber Versions

**54**

**Fiber Optic Ferrules**  
Glass, Zirconia, and Kovar Metal Ferrules  
Cylindrical and Rectangular Shapes Custom Shapes and Hole Sizes

**55**

**PM Fiber Pigtailed V-Groove Assemblies**  
Up to 48 Fibers in Single Array  
High Extinction Ratio  
127, 250, 400, 500 Micron Spacings

**56**

**Dual Fiber Pigtails**  
SM, MM, and PM Fiber Versions  
PM Stress Rods Aligned to  $\pm 0.5$  Degrees  
Miniature Size Ideal for Packaging

**57**

**2D Fiber Arrays**  
Up to 12x12 channels  
Available in SM, MM, and PM Configurations  
Available with a range of Termination Options

**58**

**Fiber Pigtailed V-Groove Arrays**  
Up to 96 Fibers in a Single Array  
127, 250, 400 and 500 Micron Spacings  
SM, MM, and PM Fibers

**59**

**Bulkhead Receptacles**  
Available for FC, LC, ST, SMA, SC, FC/APC, Angled AT&T-ST and Angled SC  
Designed for Free Space Use, Compact Size

**60**

**Bare Fiber Adaptors with Magnetic Clip**  
Very Easy to Hold Bare Fibers  
FC, ST, LC, SC, SMA, E2000, MU Available  
80 Micron – 1000 Micron Hole Sizes

# High Power Fiber Optic Components



## High Power Patchcords and Connectors

Able to Transmit over 100 W of Optical Power  
Operating Wavelengths from 180 nm to 2000 nm  
PMF, SMF, and MMF High Power AR Coatings



## High Power Collimators/Focusers

Up to 100 Watts CW Power Handling  
Available for 180 nm to 2000 nm Wavelengths  
Receptacle and Pigtailed Versions



## High Power Fiber Pigtailed Isolators

Low Insertion Loss, up to 100 Watts  
1064 nm Fiber-to-Fiber and Fiber-to-Air Versions  
Polarization Independent, High Isolation



## High Power Directional Taps/Power Monitors

Up to 10 Watts Power Handling SM,  
PM and Specialty Fiber Versions  
Available for 320 nm to 2000 nm



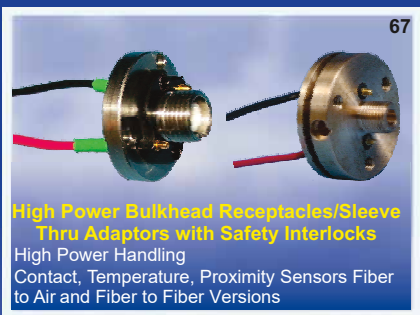
## High Power Fiber Optic Shutters with Safety Interlocks

Up to 100 Watts Power Handling  
Fiber-Fiber and Source-Fiber Versions  
Available for 180 nm to 2000 nm Wavelengths



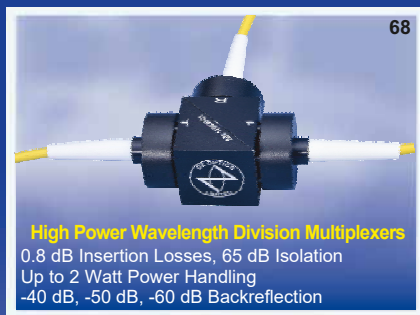
## High Power Mode Field Adapters

High Power Handling  
Adapts and Conserves Modal Content  
Custom Designs Available



## High Power Bulkhead Receptacles/Sleeve Thru Adapters with Safety Interlocks

High Power Handling  
Contact, Temperature, Proximity Sensors Fiber  
to Air and Fiber to Fiber Versions



## High Power Wavelength Division Multiplexers

0.8 dB Insertion Losses, 65 dB Isolation  
Up to 2 Watt Power Handling  
-40 dB, -50 dB, -60 dB Backreflection



## High Power Free Space Splitters Fiber to Fiber Version

Up to 100 Watts Power Handling  
Available Wavelengths from 400 nm to 2000 nm  
MM, SM, PM Fiber Versions



## High Power Free Space Splitters Source to Fiber Type

Up to 100 Watts Power Handling  
Available Wavelengths from 400 nm to 2000 nm  
MM, SM, PM Fiber Versions



## High Power Optical Coatings

High Power AR, Beamsplitter, Dichroic Coatings on  
Fibers, Micro Optics, Lenses, Plates, Prisms etc.  
Low Temperature High Abrasion Resistant Coatings



## OZPEN CO, Cleaning Unit for High Power Components

Designed to Clean Small Surfaces  
Superior to Other Cleaning Methods  
Quick Dry and Solvent-Free Cleaning Process



## Fused Fiber Collimators

Low Insertion Loss  
Low Backreflection  
Over 1 kW Power Handling



## Bulkhead Receptacles

Available for FC, LC, ST, SMA, SC, FC/APC,  
Angled AT&T-ST and Angled SC  
Designed for Free Space Use, Compact Size



## High Power Antireflection (AR) and Highly Reflective (HR) Coated Fiber Ends

HR, R > 98%, AR < 0.3%  
350 nm to 2000 nm Wavelength Coatings SMF,  
MMF & PMF Versions



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# Miscellaneous Fiber Optic Components

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**OCT Module/Components**  
Complete Module or Separate Component  
Such as Broadband Isolators, Sources, Attenuators,  
Collimators, Fused Splitters, Delay Lines

77



**2000 nm Components**  
Fiber Pigtailed Sources  
Isolators, Attenuators  
Fused Splitters, Collimators

78



**Fiber Optic Termination Kits**  
For FC, LC, ST, SMA or SC Connectors  
Contains All the Necessary Polishing Films,  
Tools, Epoxies and Accessories

79



**Fiber Optic Educational Kits**  
Teaches Basics of Fiber Optics  
Easy-to-Use, Affordable  
Wide Range of Labs Available

80



**Faraday Mirrors and Rotators**  
Used in EDFA, Tunable Lasers, Etc. 0.7  
dB Typical Insertion Loss  
-40, -50, -60 dB Backreflection

81



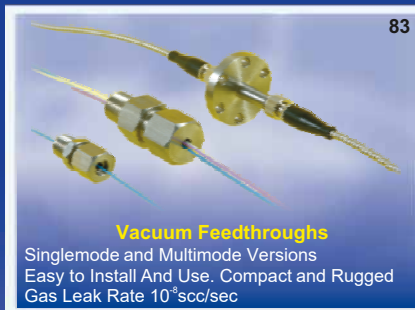
**Fiber Optic Shutters**  
Up to 100 W Optical Power SMF, PMF & MMF  
Fast Response Time  
Ideal for Safety Interlocks

82



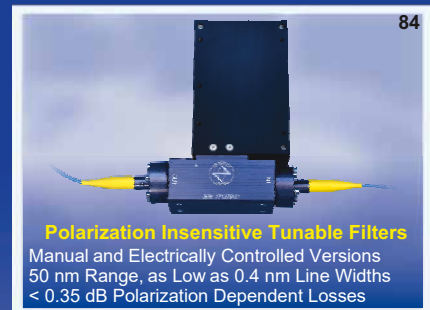
**Pin Gauges for Fiber OD Measurements**  
Easy-to-Use, Low Cost  
124-128 Micron Gauges Available  
Individual or 5-In-One Gauges

83



**Vacuum Feedthroughs**  
Singlemode and Multimode Versions  
Easy to Install And Use. Compact and Rugged  
Gas Leak Rate 10<sup>-6</sup> scc/sec

84



**Polarization Insensitive Tunable Filters**  
Manual and Electrically Controlled Versions  
50 nm Range, as Low as 0.4 nm Line Widths  
< 0.35 dB Polarization Dependent Losses

85



**Compact RGB Engine/Combiner**  
Combine up to 5 Visible Wavelengths in One Fiber  
Compact Size  
High Power Handling

86



**Bare Fiber Adaptors with Magnetic Clip**  
Very Easy to Hold Bare Fibers  
FC, ST, LC, SC, SMA, E2000, MU Available  
80 Micron - 1000 Micron Hole Sizes

87



**Mechanical Bare Fiber Adaptors**  
Use to Hold Bare Fibers  
FC, ST Versions Available  
80-1000 Micron

88



**Universal Connectors/Hybrid Patchcords**  
Less than 0.5 dB Insertion Loss  
Ultra, Super, Angled FC/PC, LC, SC, ST & SMA  
Low Cost, Rugged And Compact Size

89



**Sleeve Thru Adaptors**  
Available For FC, ST, SMA, SC And LC, MM  
Less Than 0.3 dB Insertion Losses  
Patch Panel Mountable, Duplex Styles

90



**Air Gap Variable Attenuators**  
Very Compact Size  
Patch Panel Mountable  
FC/PC And ST Connector Styles



# Miscellaneous Fiber Optic Components

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**Benchtop High Speed Polarization Controller Scramblers**  
Continuous Control of Polarization  
Negligible Insertion and Return Losses  
Up to 2 kHz Response Speed

92



**600 ps Reflector Style Manual Variable Delay Lines**  
400–200 nm Wavelength Range  
Up to 600 ps Variable Delay Line  
Low Insertion Loss

93



**600 ps Reflector Style Delay Lines with Servo Motor**  
400–200 nm Wavelength Range  
Up to 600 ps Variable Delay Line  
Low Insertion Loss

94




**Fiber Reflectors**  
Low Loss, Compact Design  
400–2000 nm Wavelengths Available  
Partial Reflectors are Available

95



**Benchtop Polarization Extinction Ratio Meters**  
Measures up to 50 dB  
450–2400 nm Wide Wavelength Range  
0.5° Angle Accuracy

96



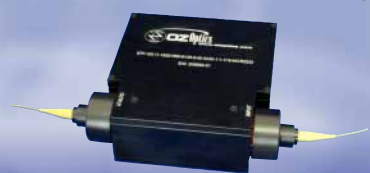
**PM Fiber Optic Switches**  
Repeatability < ±0.05 dB  
1x2 Miniature Reliable Switching Mechanism  
Low Loss < 0.6 dB, High ER > 20 dB

97



**Electrically Controlled Fabry-Perot Tunable Filters**  
Tuning Rate up to 25 kHz  
Narrow Bandwidth  
Low Insertion Loss

98



**Motor Driven Variable Bandwidth Tunable Filters**  
45 nm Tunable Range  
Flat Top Filter Shape  
Polarization Insensitive

99



**Manually Tunable Variable Bandwidth Filters**  
45 nm Tunable Range  
Flat Top Filter Shape  
Polarization Insensitive

100



**Polarization Measurement System for V-Grooves**  
Measures Polarization Angle to ± 0.5 Degrees  
Measures Extinction Ratios up to 40 dB  
Measures Relative Power (650 Hz Sample Rate)

101



**Connector Video Microscopes**  
Easy-to-Use  
Up to 400x Magnification  
LC, FC, SC, E2000 or Other Custom Connectors

102




**Connector Cleaning Units**  
Easy-to-Use  
Low Cost  
2.5 mm, 1.25 mm, Custom Design Connectors

103



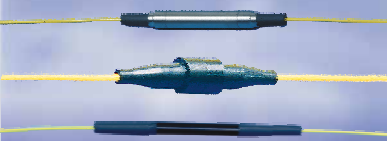
**Laser Diode Power Combiners**  
Up to 45% Coupling from Each Diode  
-40, -50, -60 dB Backreflection SMF, PMF & MMF  
Can Combine Equal / Different Wavelengths

104



**Fiber Optic Fixed Filters**  
400 nm to 1600 nm Wavelengths, SMF & PMF  
-40 dB, -50 dB, -60 dB Backreflection  
Filters Can Be Fixed or Removable

105



**Low Power Isolators**  
Compact Size  
440–2000 nm Wavelengths Available  
Low Insertion Loss



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