

Introduction to WaveSmart®

Optical Components



Clearfield® delivers unparalleled fiber performance with its WaveSmart optical components - custom built for the unique light requirements and interoperability needs of passive optical network splitting, fiber exhaust scenarios and coarse and dense wavelength division multiplexing. Key to the success of a fiber deployment is the performance and precision of the optical components deployed in the inside and outside plant environment. Clearfield leads the way with WaveSmart optical component technologies for PON splitting, wavelength division multiplexing and optical circulators. These products are custom built to your unique split ratios, wavelength requirements and interoperability needs.

Clearfield's expertise in the termination of fiber ensures these components are connectorized to optimize their performance potential. Teamed with Clearfield's experience in bend radius protection, the optimal packaging for these components is found within all Clearview® Cassettes. In addition, Clearfield provides modular optical components packaging within an LGX footprint as well as other space saving chassis enclosures and custom discrete packages.

Specializing in the manufacturing, termination and packaging of optical components for custom-built configurations, our rapid turn-around time consistently beats the lead time quoted by our competitors for standard and custom configuration. Clearfield's design experts can consult with you on your optical component needs and specify a solution to solve your application requirements.

By utilizing fiber optic splitters and wave division multiplexing, Clearfield's WaveSmart optical components will save money while increasing your network's capacity and bandwidth by creating virtual fiber without the expense of design, construction and deployment of more fiber optic cables. Splitting the light signal or separating multiple wavelengths over a single fiber allows you to increase the number of pathways within your existing fiber cable network reducing upgrade or new deployment costs. Combining Clearfield's WaveSmart products with the FieldSmart®, CraftSmart® and FieldShield® product lines, we can provide you a solution for all your applications.



WaveSmart Optical Components

Inspect and clean EVERY connector BEFORE inserting into adapter. See page 159 for Cleaning Kits.

WaveSmart®

HD Splitter



Application

High density splitter for the FieldSmart® Makwa Fiber Distribution Hub (FDH) and FieldSmart Fiber Deliver Point (FDP) 144 Port PON in Pedestal.

Description

The WaveSmart High Density (HD) Splitter is designed to work with the FieldSmart Makwa platform. Consistent with a simple yet innovative design methodology, the WaveSmart High Density (HD) Splitter utilizes a 75% smaller package over earlier designed splitter packages.

The WaveSmart High Density Splitter uses 900 μ m jacketed legs and offers superb fiber management. Clearfield® utilizes a special outdoor rated material that not only helps control thermal expansion and contraction, but goes one step further and remains flexible at extreme temperatures down to -40°F. By making it easier to handle, there is less chance that the fiber will be routed incorrectly or that damage will occur during this process.

The Optical Staging Plate, the industry's highest density product supporting ruggedized splitters in hardened environments, maximizes space for placing the optical fiber splitter legs of cabinet splitters where real estate is at a premium. Designed with performance in mind, the highly dense WaveSmart Optical Staging Plate allows for quick install and removal of splitter legs using adapters that support quick "Red Light" port testing or identification.



Features and Benefits

Integrity

- RUS listed
- Terminations are designed and tested to Telcordia GR-326
- 100% performance tested for insertion loss/return loss and final mechanical inspection
- Optical component configuration use devices that are compliant to Telcordia GR-1221/1209

Protection

- WaveSmart's High Density Splitter package protects the Planar Lightwave Circuit in all environments
- Inputs and outputs protected using high quality 900 μ m up-jacket

Access

- Individual splitters come preloaded in staging plate for easy access and turn-up
- Each leg is 27" (685.80 mm) to reach anywhere in the Makwa
- Each leg labeled for easy identification
- Red jacket on input leg

Investment

- Splitter package supports one 1 x 32, two 1 x 16 or four 1 x 8 configurations without penalty in real estate or port counts
- "Grow-as-you-go" - only buy splitters as customer take rates increase
- SC/UPC or SC/APC connectors

Technical Specifications

WaveSmart HD Splitters	
Dimensions	85 mm L x 35 mm W x 6 mm H
Core Size and Type	Singlemode (G.657.A)
Leg Length	27" (685.80 mm)
Jacket O.D.	900um
Connector Types	SC/UPC, SC/APC
Splitter Types	1 x 32, 1 x 16, 1 x 8, 1 x 4
Operating / Storage Temp	-40°C to 85 (-40°F to 185°F)

Performance Specifications

Splitter Type	1 x 32	1 x 16	1 x 8	1 x 4
Insertion Loss	< 16.8 dB	< 13.8 dB	< 10.8 dB	< 7.5 dB
Return Loss	> 50 dB	> 50 dB	> 50 dB	> 50 dB
PDL	< 0.3 dB	< 0.3 dB	< 0.3 dB	< 0.3 dB
Uniformity	< 1.7 dB	< 1.2 dB	< 0.8 dB	< 0.3 dB
Directivity	> 55 dB	> 55 dB	> 55 dB	> 55 dB
Wavelength Range (nm)	1260 – 1650	1260 - 1650	1260 - 1650	1260 - 1650

Configured Part Numbers

K E ____ - ____ A A

1

2

1

Select (qty)/Split Ratio

- | | |
|--------------|-------------|
| 1 = (1) 1x32 | 7 = (4) 1x8 |
| 2 = (2) 1x16 | 8 = (1) 1x4 |
| 3 = (2) 1x8 | 9 = (2) 1x4 |
| 4 = (1) 1x16 | A = (4) 1x4 |
| 5 = (1) 1x8 | G = (8) 1x4 |
| 6 = (3) 1x8 | |

2

Select Connector Style

- A = SC/UPC
C = SC/APC

WaveSmart®

Premium Ruggedized Splitter



Application

Ruggedized Splitter for outside plant cabinet environments.

Description

The Clearfield® WaveSmart Premium Ruggedized Splitter is the standard splitter component in its line of FieldSmart® FSC OSP Cabinets. The splitter addresses environmental and human handling issues that other standard splitters in the industry cannot combat. It provides improved fiber protection, management and maintenance in OSP FTTx deployments.

The Optical Staging Plate, the industry's highest density product supporting ruggedized splitters in hardened environments, maximizes space for placing the optical fiber splitter legs of cabinet splitters where real estate is at a premium. Designed with performance in mind, the highly dense WaveSmart Optical Staging Plate allows for quick install and removal of splitter legs using adapters that support quick "Red Light" port testing or identification.



Features and Benefits

Integrity

- RUS listed
- Terminations are designed and tested to Telcordia GR-326
- 100% performance tested for insertion loss, return loss and final mechanical inspection
- Optical component configuration uses devices that are compliant to Telcordia GR 1221/1209

Protection

- Ruggedized jacket material of input and output legs provide superior flexibility in temperatures ranging from -55°C to 85°C (-67°F to 185°F)
- Legs will not sag or wilt at extreme temperatures or during extreme temperature cycles
- 20 year warranty

Access

- Splitters legs come preloaded in staging plate for easy access and turn-up
- Fiber separators every 17" (431.80 mm) to easily recognize and prevent twisting of fiber legs
- Each leg is 51" (1295.40 mm) long and able to reach any port
- Each leg labeled for easy identification
- Red boot on input leg

Investment

- Splitter package supports one 1 x 32, two 1 x 16 or four 1 x 8 configurations without penalty in real estate or port counts
- Splitters can be used in:
 - FieldSmart 288, 432, 576 and 1,152 PON Cabinets
 - FieldSmart Wall Boxes
 - FieldSmart 96 port PON-in-Ped
 - FieldSmart Inside Plant PON Insert
- "Grow-as-you-go" - only buy splitters as customer take rates increase
- SC/UPC, SC/APC, LC/UPC or LC/APC connectors

WaveSmart®

Premium Ruggedized Splitter



Technical Specifications

WaveSmart Premium Ruggedized Splitters	
Dimensions	100 mm L x 80 mm W x 10 mm H
Core Size and Type	Singlemode (G.657.A)
Leg Length	51" (1295.40 mm)
Jacket O.D.	2.0mm
Connector Types	SC/UPC, SC/APC, LC/UPC, LC/APC
Splitter Types	1 x 32, 1 x 16, 1 x 8, 1 x 4
Operating / Storage Temp	-40°C to 85 (-40°F to 185°F)

Performance Specifications

Splitter Type	1 x 32	1 x 16	1 x 8	1 x 4
Insertion Loss	< 16.8 dB	< 13.8 dB	< 10.8 dB	< 7.5 dB
Return Loss	> 50 dB	> 50 dB	> 50 dB	> 50 dB
PDL	< 0.3 dB	< 0.3 dB	< 0.3 dB	< 0.3 dB
Uniformity	< 1.7 dB	< 1.2 dB	< 0.8 dB	< 0.3 dB
Directivity	> 55 dB	> 55 dB	> 55 dB	> 55 dB
Wavelength Range (nm)	1260 – 1650	1260 - 1650	1260 - 1650	1260 - 1650

Configured Part Numbers

K C - A A

Select (Qty) / Split Ratio

1 = (1) 1 x 32 6 = (3) 1 x 8
 2 = (2) 1 x 16 7 = (4) 1 x 8
 3 = (2) 1 x 8 8 = (1) 1 x 4
 4 = (1) 1 x 16 9 = (2) 1 x 4
 5 = (1) 1 x 8 A = (4) 1 x 4

Select Connector Style

A = SC/UPC
 C = SC/APC
 E = LC/UPC
 G = LC/APC

WaveSmart®

Industry Standard Splitter Module



Application

Upjacketed splitter for indoor and outdoor plant cabinet environments.

Description

Clearfield®'s WaveSmart Industry Standard Splitter is a proven component in Clearfield's line of optical components. The splitter addresses human handling issues that other splitters in the industry cannot combat. It provides improved fiber protection, management and maintenance in FTTx deployments.

The Optical Staging Plate maximizes space for placing the optical fiber splitter legs of cabinet splitters where real estate is at a premium. Designed with performance in mind, the highly dense WaveSmart Optical Staging Plate allows for quick install and removal of splitter legs using adapters that support "Red Light" port testing for quick identification.



Features and Benefits

Integrity

- RUS listed
- Terminations are designed to Telcordia GR-326
- 100% performance tested for insertion loss, return loss and final mechanical inspection
- Optical component configuration uses devices that are designed to Telcordia GR 1221/1209

Protection

- Splitter module package protects the discrete component while providing superior strain relief on the inputs and outputs
- 2mm jacket material of input and output legs provide protection in temperatures ranging from -40°C to 85°C (-40°F to 185°F)
- 5 year warranty

Access

- Splitters legs come preloaded in staging plate for easy access and turn-up
- Fiber separators every 17" (431.80 mm) to easily recognize and prevent twisting of fiber legs
- Each leg is 51" (1295.40 mm) long and able to reach any port
- Each leg labeled for easy identification
- Red boot on input leg

Investment

- Splitter package supports one 1 x 32, two 1 x 16 or four 1 x 8 configurations without penalty in real estate or port counts
- Splitters can be used in:
 - FieldSmart 288, 432, 576 and 1,152 PON Cabinets
 - FieldSmart Wall Boxes
 - FieldSmart 96 port PON-in-Ped
 - FieldSmart Inside Plant PON Insert
- "Grow-as-you-go" - only buy splitters as customer take rates increase
- SC/UPC, SC/APC, LC/UPC or LC/APC connectors

WaveSmart®

Industry Standard Splitter Module



Technical Specifications

WaveSmart Industry Standard Splitter	
Dimensions	100 mm L x 80 mm W x 10 mm H
Core Size and Type	Singlemode (G.657.A)
Leg Length	51" (1295.40 mm)
Jacket O.D.	2.0mm Yellow Riser Rated
Connector Types	SC/UPC, SC/APC, LC/UPC, LC/APC
Splitter Types	1 x 32, 1 x 16, 1 x 8, 1 x 4
Operating / Storage Temp	-40°C to 85°C (-40°F to 185°F)

Performance Specifications

Splitter Type	1 x 32	1 x 16	1 x 8	1 x 4
Insertion Loss	< 16.8 dB	< 13.8 dB	< 10.8 dB	< 7.5 dB
Return Loss	> 50 dB	> 50 dB	> 50 dB	> 50 dB
PDL	< 0.3 dB	< 0.3 dB	< 0.3 dB	< 0.3 dB
Uniformity	< 1.7 dB	< 1.2 dB	< 0.8 dB	< 0.3 dB
Directivity	> 55 dB	> 55 dB	> 55 dB	> 55 dB
Wavelength Range (nm)	1260 – 1650	1260 - 1650	1260 - 1650	1260 - 1650

(Results do not include terminations)

Configured Part Numbers

K Y - A A

1

2

1 Select (Qty) / Split Ratio

1 = (1) 1 x 32 6 = (3) 1 x 8
 2 = (2) 1 x 16 7 = (4) 1 x 8
 3 = (2) 1 x 8 8 = (1) 1 x 4
 4 = (1) 1 x 16 9 = (2) 1 x 4
 5 = (1) 1 x 8 A = (4) 1 x 4

2 Select Connector Style

A = SC/UPC
 C = SC/APC
 E = LC/UPC
 G = LC/APC

Application

These products are needed when an optical splitter or combiner is required in a central office environment. They are used in CATV headends and telephone company central offices.

Description

Clearfield® provides Planar Lightwave Circuit (PLC) and Fused Biconic Taper (FBT) Splitters in a variety of optical component packages for the network and application need allowing carriers the ability to provide uniform fully passive signal splitting to multiple premises.

Planar Lightwave Circuit (PLC or Planar)

A light circuit on an 'optical chip' is mounted on a carrier and fibers, usually in ribbon form, are bonded to the edges of the chip. The assembly is encapsulated in a protective enclosure. PLC devices support direct split counts up to 32. In planar fabrication technology, devices are made using ion-exchange or photo-lithography techniques that replicate solid-state circuit methods. Ultimately, the per-unit cost for the expected high volumes will become advantageous for planar technology, especially for higher port devices. A difficult manufacturing problem involves a low-loss method for attaching the optical fibers to the chip and then passing the market's qualification and reliability requirements.

Fused Biconic Taper (FBT)

Two or more fibers are twisted together, heated and drawn to bring the optical cores into near contact. The combined fibers are mounted on a low-expansion carrier and encapsulated in a low expansion tube. FBT devices allow direct splitting up to 4 ways. Higher split counts are achieved by splicing multiple devices to form multi-stage, concatenated splitters. Concatenated splitters are also called tree splitters. The fused biconic tapered technology directly bonds or melts the fibers together so that the final splitter can be mounted in small diameter (approximately 3-millimeter) stainless-steel tubes. This technology produces small, low-cost, high-performance devices. A tough fabrication obstacle involves the small and delicate final coupling region. However, when properly mounted and packaged, these devices meet long-term stability and reliability requirements.



1RU Splitter/Pizza Box

Packaging Options

- Clearview® Cassette
- Clearview xPAK
- Discrete (unpackaged solution)
- 1 RU Splitter/Pizza Box
- LGX

Features and Benefits

Integrity

- RUS listed
- Terminations are designed and tested to Telcordia GR-326
- Supports industry standard SC and LC singlemode and multimode connectors
- 100% performance tested for insertion loss, return loss and final mechanical inspect

Protection

- Ruggedized, secure packaging
- Non-removable adapter plates

Access

- Front and rear access to panel

Investment

- FieldSmart® Optical Components offer an economical, dense and user-friendly solution for deploying splitters or WDMs in a central office design
- Virtually any combination of split ratios and number of components can be achieved in one of the four Clearview Cassette sizes
- Clearfield supports legacy splitter deployments by offering optical components in LGX footprint
- 1 RU optical components available for smaller, limited deployments
- Environmentally stable, high isolation, low insertion loss
- Compliant to Telcordia GR-1221 and GR-1209

Technical Specifications

Planar Lightwave Circuit Splitters

Type	Insertion Loss	Return Loss	PDL	Uniformity	Directivity	Operating/ Storage Temperature	Wavelength Range
1 x 32	< 16.8 dB	> 50 dB	< 0.3 dB	< 1.7 dB	> 55 dB	-40°C to 85°C	1260 to 1650nm
1 x 16	< 13.8 dB	> 50 dB	< 0.3 dB	< 1.2 dB	> 55 dB	-40°C to 85°C	1260 to 1650nm
1 x 8	< 10.8 dB	> 50 dB	< 0.3 dB	< 0.8 dB	> 55 dB	-40°C to 85°C	1260 to 1650nm
1 x 4	< 7.5 dB	> 50 dB	< 0.3 dB	< 0.6 dB	> 55 dB	-40°C to 85°C	1260 to 1650nm

Fused Biconic Taper Splitters

Dual Window - Wavelength Flattened (Terminated Specs)	1 x 2	1 x 4	1 x 8	1 x 16	1 x 32
Maximum Insertion Loss	3.6 dB	7.2 dB	10.7 dB	14 dB	17.6 dB
Maximum Uniformity	0.8 dB	1 dB	1.3 dB	1.6 dB	1.9 dB
Maximum PDL	0.2 dB	0.3 dB	0.4 dB	0.5 dB	0.6 dB

Packaging Dimensions

Optical Component Type	Dimensions
One High Clearview Blue Cassette	0.8" H x 8.6" W x 7.06" D (20.32 mm x 218.44 mm x 179.32 mm)
Two High Clearview Blue Cassette	1.6" H x 8.6" W x 7.06" D (40.64 mm x 218.44 mm x 179.32 mm)
Three High Clearview Blue Cassette	2.41" H x 8.6" W x 7.06" D (61.21 mm x 218.44 mm x 179.32 mm)
Six High Clearview Blue Cassette	4.84" H x 8.6" W x 7.06" D (122.94 mm x 218.44 mm x 179.32 mm)
LGX One Wide Box	1.15" H x 5.12" W x 6.25" D (29.21 mm x 130.05 mm x 158.75 mm)
LGX Two Wide Box	2.27" H x 5.12" W x 6.25" D (57.66 mm x 130.05 mm x 158.75 mm)
LGX Four Wide Box	4.55" H x 5.12" W x 6.25" D (115.57 mm x 130.05 mm x 158.75 mm)
One Rack Unit (19")	1.75" H x 19" W x 15.02" D (44.45 mm x 482.60 mm x 381.50 mm)
One Rack Unit (23")	1.75" H x 23" W x 15.02" D (44.45 mm x 584.20 mm x 381.51 mm)

Configured Part Numbers

M _____ - _____ E S - _____ Z - Z Z Z

1 2 3 4 5

1 Select Packaging

A = LGX – vertical - 1 wide
 B = LGX – vertical - 2 wide
 D = LGX – vertical - 4 wide
 E = FieldSmart FxMP – 6 high
 G = 1.75" (44.45 mm)(1 RU) - 19" brackets
 (482.60 mm)
 H = 3.50" (88.90 mm)(2 RU) - 23" brackets
 (584.20 mm)
 S = Clearview Blue – 1 high
 T = Clearview Blue – 2 high
 U = Clearview Blue – 3 high
 Y = Clearview Blue – 6 high
 7 = FieldSmart FxMP – 1 high
 8 = FieldSmart FxMP – 2 high
 9 = FieldSmart FxMP – 3 high

2 Select Input / Output

A = 1 x 2 H = 1 x 16
 B = 1 x 3 J = 1 x 24
 C = 1 x 4 K = 1 x 32
 D = 1 x 5 L = 2 x 2
 E = 1 x 6 M = 2 x 16
 F = 1 x 8 N = 2 x 32
 G = 1 x 12 P = 1 x 64

3 Select Optical Type

P = Planar splitter
 F = FBT splitter

4 Select Connector

A = SC/UPC G = LC/APC
 B = SC/UPC DX J = FC/UPC
 C = SC/APC K = FC/APC
 D = SC/APC DX M = ST/UPC
 E = LC/UPC

5 # of Components Per Package

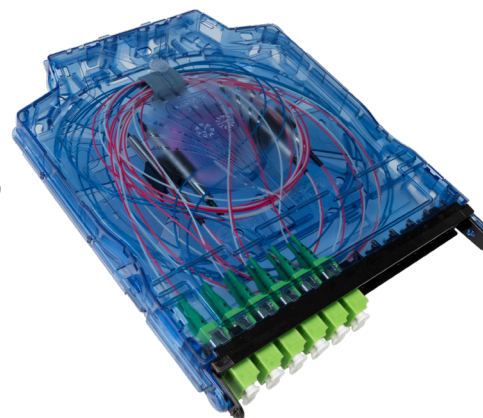
A = 1 G = 7
 B = 2 H = 8
 C = 3 J = 9
 D = 4 K = 10
 E = 5 M = 11
 F = 6

Application

Provides fiber relief for applications that currently utilize a unidirectional dual fiber transmit/receive configuration, using either 1310nm or 1550nm wide band optics or Sonet/Ethernet optics (discrete, SFP, XFP). Note: SFP or XFP systems may be better served using a WDM solution.

Description

The WaveSmart Circulator allows the user to reroute the traffic that traditionally required two fibers (one for each direction of travel) onto a single fiber with bidirectional traffic. This in turn allows the user to reduce the number of required fibers from two to one (four to two for working/protect systems).



Features and Benefits

Integrity

- RUS Listed
- Compliant to Telcordia GR-1221 and GR-1209
- Supports Industry standard SC/APC and LC/APC connectors and adapters in standard and custom platforms

Protection

- Offered in the wide variety of Clearview® Cassettes and discrete packages
- Ruggedized fiber up-jacket and packages available
- Angled Polished connectors recommended throughout the network to minimize errors due to back reflection
- Not recommended for Multi-longitudinal Mode (MLM) Laser based systems

Access

- Compact tube style discrete component offered for direct splice in options
- Available in either wideband 1310nm or 1550nm
- Clearview Cassettes hold four Circulators when using SC/APC and eight when using LC/APC

Investment

- WaveSmart Optical Components offer an economical, dense and user-friendly solution for deploying Circulators in a fiber network
- Environmentally stable, high-isolation, low-insertion loss
- “Grow-as-you-go” – only buy circulators as customer take rates increase

Technical Specifications

WaveSmart Circulators	
Insertion Loss	< 1.0 dB (2.0 for matched pair)
Return Loss	> 50 dB
Maximum Power	500 mW
Minimum Isolation	> 40 dB
Channel Peak Isolation	> 50 dB
Fiber Type	SMF - 28e
Operating/Storage Temperature	-40°C ~ 85°C
PDL	< 0.15 dB
PMD	< 0.05 ps
Industry Standards	ROHS Compliant

Packaging Options

- Clearview® Cassette
- Clearview xPAK
- Discrete (unpackaged solution)
- LGX

Pre-Configured Part Numbers

Clearview Blue Cassettes - Terminated with SC/APC Connectors

Part Number	Description
LYG-CA01-ZZZ-31	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 1 x 1310nm optical circulators, component is terminated with SC/APC connectors
LYG-CA01-ZZZ-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 1 x 1550nm optical circulators, component is terminated with SC/APC connectors
LYG-CB01-ZZZ-31	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 2 x 1310nm optical circulators, component is terminated with SC/APC connectors
LYG-CB01-ZZZ-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 2 x 1550nm optical circulators, component is terminated with SC/APC connectors
LYG-CD01-ZZZ-31	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 4 x 1310nm optical circulators, component is terminated with SC/APC connectors
LYG-CD01-ZZZ-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 4 x 1550nm optical circulators, component is terminated with SC/APC connectors
LYG-CD01-ZZZ-31-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 2 x 1310nm and 2 x 1550nm optical circulators, component is terminated with SC/APC connectors

Clearview Blue Cassettes - Terminated with LC/APC Connectors

Part Number	Description
LYG-GA01-ZZZ-31	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 1 x 1310nm optical circulators, component is terminated with LC/APC connectors
LYG-GA01-ZZZ-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 1 x 1550nm optical circulators, component is terminated with LC/APC connectors
LYG-GB01-ZZZ-31	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 2 x 1310nm optical circulators, component is terminated with LC/APC connectors
LYG-GB01-ZZZ-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 2 x 1550nm optical circulators, component is terminated with LC/APC connectors
LYG-GD01-ZZZ-31	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 4 x 1310nm optical circulators, component is terminated with LC/APC connectors
LYG-GD01-ZZZ-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 4 x 1550nm optical circulators, component is terminated with LC/APC connectors
LYG-GD01-ZZZ-31-55	Circulator, loaded into Clearview Blue Cassette, one high cassette, contains 2 x 1310nm and 2 x 1550nm optical circulators, component is terminated with LC/APC connectors

WaveSmart®

Wave Division Multiplexing (WDM)



Application

These products are needed when a passive multiplexing or demultiplexing unit is required in a central office environment. They are used in CATV headends and telephone company central offices.

Description

Wavelength Division Multiplexing increases fiber capacity by combining (mux) and separating (demux) multiple input channels over a single fiber output. Wavelength division multiplexers let you expand the bandwidth of optical communication networks and can be used at several locations within each network. Clearfield® provides WDMs for singlemode fiber applications.

Coarse Wavelength Division Multiplexing

CWDMs combine or multiplex more than one wavelength over one fiber. This is done by using fiber pigtail collimators and wavelength/light filters that are aligned and mounted in a glass tube and typically packaged in a stainless steel tube for more protection. The wavelength/light filters used only allow specific wavelengths of light to pass through the filter and the remainder of the wavelengths to be reflected back. CWDMs can also be used to separate or demultiplex more than one signal using the same device and transmitting the signal in the opposite direction. CWDMs have channel spacing of 20nm with a working channel passband of ± 6.5 nm from the wavelengths center. This allows you to add multiple wavelengths on to one fiber while keeping within the operating wavelengths of 1260nm to 1620nm. The wavelengths used are defined by the International Telecommunications Union; reference ITU G.694.2 for the ITU CWDM Wavelength Grid. Note: as of June 2002, 18 center wavelengths, from 1270nm to 1610nm, were listed.

Dense Wavelength Division Multiplexing

Dense Wavelength Division Multiplexing or DWDM is a technology which multiplexes or demultiplexes a number of optical carrier signals onto a single optical fiber by using different wavelengths (i.e. colors) of laser light. This technique enables bidirectional communications over one strand of fiber, as well as multiplication of capacity. DWDM signals within the 1550nm band which are wavelengths between approximately 1530–1565nm (C band) and/or 1570–1625nm (L band) adhering to the DWDM ITU-T G.694.1 frequency grid. DWDMs allow you to increase your wavelength capacity. DWDM products can offer multiplexing of multiple channels using 200 GHz and 100 GHz spacing with the option to have an added Expansion port and/or Monitor port. All of the Clearfield Passive Products are Telcordia GR-1209 and GR-1221 certified.

Packaging Options

- Clearview® Cassette
- Clearview xPAK
- Discrete (unpackaged solution)
- Pizza Box
- LGX

Features and Benefits

Integrity

- Compliant to Telcordia GR-1221
- Consistent performance

Protection

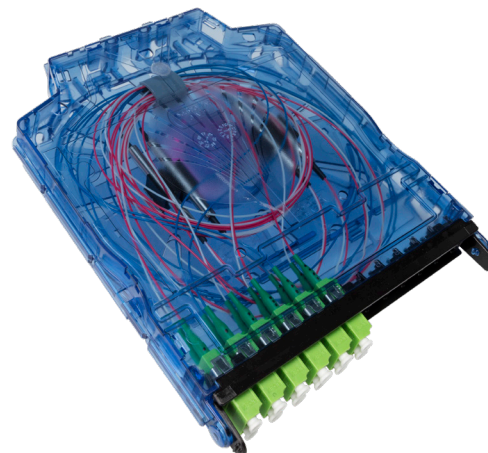
- Wide operating temperature range
- Low polarization sensitivity
- No epoxy in optical path

Access

- Transport protocol independent
- Low insertion loss
- Minimal optical loss

Investment

- Wide bandwidth (CWDM/DWDM)
- Mux, demux and universal options available
- PDL = < 0.2 dB
- Return Loss = > 45 dB



WaveSmart®

Wave Division Multiplexing (WDM)



Technical Specifications

WaveSmart Wave Division Multiplexing	Channel Spacing	Wavelength Range	ITU Starting Wavelength	Start Channel
CWDM	20nm	1260 – 1650	1471nm 1491nm 1611nm	N/A
DWDM	100 GHz	1520 to 1560	N/A	ITU – T GRID
DWDM	200 GHz	1520 to 1560	N/A	ITU – T GRID

FSAN WDM Specifications

Parameter	Ports	Specifications
Pass Channel Wavelength	P1 to P3	1260nm to 1360nm
		1480nm to 1500nm
Reflect Channel Wavelength	P1 to P2	1540 dB to 1565 dB
Insertion Loss	P1 to P3	< 0.8 dB
	P1 to P2	< 0.5 dB
Isolation	N/A	> 25 dB
		> 18 dB/ °C
PDL	N/A	< 0.1 dB
Ripple	N/A	< 0.3 dB
Return Loss	N/A	> 45 dB
Operating Temperature Range	N/A	-40°C to 85°C
Storage Temperature Range	N/A	-40°C to 85°C
Maximum Input Power	N/A	500 mW
Mechanical Dimension	N/A	5 mm x 34 mm

WaveSmart®

Wave Division Multiplexing (WDM)



200 GHz DWDM

Parameter	Value				
	Add/Drop	4 CH	8 CH	16 CH	20 CH
Wavelength Range	1520 to 1560nm	1520 to 1560nm	1520 to 1560nm	1520 to 1560nm	1520 to 1560nm
Central Wavelength	ITU-T G.694.1	ITU-T G.694.1	ITU-T G.694.1	ITU-T G.694.1	ITU-T G.694.1
Bandwidth	$C \pm 0.25\text{nm}$	$C \pm 0.25\text{nm}$	$C \pm 0.25\text{nm}$	$C \pm 0.25\text{nm}$	$C \pm 0.25\text{nm}$
Insertion Loss	< 0.8 dB	< 2.4 dB	< 3.4 dB	< 5.8 dB	< 6.5 dB
Insertion Loss - Reflection	< 0.4 dB	N/A	N/A	N/A	N/A
Isolation	> 30 dB	> 30 dB	> 30 dB	> 30 dB	> 30 dB
Isolation - Reflection	> 12 dB	N/A	N/A	N/A	N/A
PDL	< 0.2 dB	< 0.2 dB	< 0.2 dB	< 0.2 dB	< 0.2 dB
Return Loss	> 45 dB	> 45 dB	> 45 dB	> 45 dB	> 45 dB
Operation Temperature	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Storage Temperature	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Maximum Input Power	500 mW	500 mW	500 mW	500 mW	500 mW
Mechanical Dimensions	5 mm x 34 mm	100 mm x 80 mm x 10 mm	100 mm x 80 mm x 10 mm	100 mm x 80 mm x 10 mm	100 mm x 80 mm x 10 mm

100 GHz DWDM

Parameter	Value				
	Add/Drop	4 CH	8 CH	16 CH	40 CH
Wavelength Range	1520 to 1560nm	1520 to 1560nm	1520 to 1560nm	1520 to 1560nm	1520 to 1560nm
Central Wavelength	ITU-T G.694.1	ITU-T G.694.1	ITU-T G.694.1	ITU-T G.694.1	ITU-T G.694.1
Bandwidth	$C \pm 0.11\text{nm}$	$C \pm 0.11\text{nm}$	$C \pm 0.11\text{nm}$	$C \pm 0.11\text{nm}$	$C \pm 0.11\text{nm}$
Insertion Loss	< 0.8 dB	< 2.4 dB	< 3.4 dB	< 5.8 dB	< 6.5 dB
Insertion Loss - Reflection	< 0.4 dB	N/A	N/A	N/A	N/A
Isolation	> 30 dB	> 30 dB	> 30 dB	> 30 dB	> 30 dB
Isolation - Reflection	> 12 dB	N/A	N/A	N/A	N/A
PDL	< 0.2 dB	< 0.2 dB	< 0.2 dB	< 0.2 dB	< 0.2 dB
Return Loss	> 45 dB	> 45 dB	> 45 dB	> 45 dB	> 45 dB
Operation Temperature	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Storage Temperature	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Maximum Input Power	500 mW	500 mW	500 mW	500 mW	500 mW
Mechanical Dimensions	5 mm x 34 mm	100 mm x 80 mm x 10 mm	100 mm x 80 mm x 10 mm	100 mm x 80 mm x 10 mm	120 mm x 75 mm x 13.5 mm

WaveSmart®

Wave Division Multiplexing (WDM)



CWDM

Parameter	Value		
	Add/Drop	4 CH	8 CH
Wavelength Range	1260 to 1650nm	1260 to 1650nm	1260 to 1650nm
Central Wavelength	ITU-T G.694.2	ITU-T G.694.2	ITU-T G.694.2
Bandwidth	C ± 6.5nm	C ± 6.5nm	C ± 6.5nm
Insertion Loss	< 0.8 dB	< 2.0 dB	< 3.0 dB
Insertion Loss - Reflection	< 0.4 dB	N/A	N/A
Isolation	> 30 dB	> 30 dB	> 30 dB
Isolation - Reflection	> 12 dB	N/A	N/A
PDL	< 0.2 dB	< 0.2 dB	< 0.2 dB
Return Loss	> 45 dB	> 45 dB	> 45 dB
Operation Temperature	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Storage Temperature	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Maximum Input Power	500 mW	500 mW	500 mW
Mechanical Dimensions	5 mm x 34 mm	100 mm x 80 mm x 10 mm	100 mm x 80 mm x 10 mm

Coarse Wavelength Division Multiplexing (CWDM)

ITU Channel/Wavelength Chart

ITU Channel (xx or yy)	Wavelength	ITU Channel (xx or yy)	Wavelength	ITU Channel (xx or yy)	Wavelength
27	1270nm	41	1410nm	55	1550nm
29	1290nm	43	1430nm	57	1570nm
31	1310nm	45	1450nm	59	1590nm
33	1330nm	47	1470nm	61	1610nm
35	1350nm	49	1490nm	63	1630nm
37	1370nm	51	1510nm	65	1650nm
39	1390nm	53	1530nm		

WaveSmart®

Wave Division Multiplexing (WDM)



Dense Wavelength Division Multiplexing (DWDM)

ITU Grid: C-Band, 100 GHz Spacing

Channel (#)	Frequency (GHz)	Wavelength (NM)
1	190100	1577.03
2	190200	1576.20
3	190300	1575.37
4	190400	1574.54
5	190500	1573.71
6	190600	1572.89
7	190700	1572.06
8	190800	1571.24
9	190900	1570.42
10	191000	1569.59
11	191100	1568.11
12	191200	1567.95
13	191300	1567.13
14	191400	1566.31
15	191500	1565.50
16	191600	1564.68
17	191700	1563.86
18	191800	1563.05
19	191900	1562.23
20	192000	1561.42
21	192100	1560.61
22	192200	1559.79
23	192300	1558.98
24	192400	1558.17
25	192500	1557.36
26	192600	1556.56
27	192700	1555.75
28	192800	1554.94
29	192900	1554.13
30	193000	1553.33
31	193100	1552.52
32	193200	1551.72
33	193300	1550.92
34	193400	1550.12
35	193500	1549.32
36	193600	1548.52

Channel (#)	Frequency (GHz)	Wavelength (NM)
37	193700	1547.72
38	193800	1546.92
39	193900	1546.12
40	194000	1545.32
41	194100	1544.53
42	194200	1543.73
43	194300	1542.94
44	194400	1542.14
45	194500	1541.35
46	194600	1540.56
47	194700	1539.77
48	194800	1538.98
49	194900	1538.19
50	195000	1537.40
51	195100	1536.61
52	195200	1535.82
53	195300	1535.04
54	195400	1534.25
55	195500	1533.47
56	195600	1532.68
57	195700	1531.90
58	195800	1531.12
59	195900	1530.33
60	196000	1529.55
61	196100	1528.77
62	196200	1527.99
63	196300	1527.22
64	196400	1526.44
65	196500	1525.66
66	196600	1524.89
67	196700	1524.11
68	196800	1523.34
69	196900	1522.56
70	197000	1521.79
71	197100	1521.02
72	197200	1520.25

WaveSmart®

Wave Division Multiplexing (WDM)



Configured Part Numbers

L - - - - -

1 2 3 4 5 6 7 8 9 10

1 Component Package

A = Discrete – 250 μ m (0.5 meter legs)
 B = Discrete – 250 μ m (1 meter legs)
 C = Discrete – 900 μ m (0.5 meter legs)
 D = Discrete – 900 μ m (1 meter legs)
 E = Discrete – 2 mm rugged (0.5 meter legs)
 F = Discrete – 2 mm rugged (1 meter legs)
 G = xPAK (no longer used, see N or O)
 H = LGX
 M = Pizza box/1 rack unit
 N = xPAK LGX front panel
 O = xPAK standard panel
 P = LGX Blade
 Q = Module 100x80x10 mm – 900 μ m
 (0.5 meter legs)
 R = Module 100x80x10 mm – 900 μ m
 (1 meter legs)
 S = Module 100x80x10 mm – 2 mm
 (0.5 meter legs)
 T = Module 100x80x10 mm – 2 mm
 (1 meter legs)
 U = Module 100x80x10 mm – 2 mm
 (51 inch legs)
 V = Module 100x80x13 mm – 2 mm
 (51 inch legs)
 W = Clearview Blue 1 high – no mounting ears
 Y = Clearview Blue 1 high – mounting ears
 1 = 80x60x7 mm – 900 μ m – 0.5 meter legs
 2 = 80x60x7 mm – 900 μ m – 1 meter legs

2 Device Type

A = Add / drop CWDM
 B = CWDM
 C = DWDM (50 or 100 Ghz)
 D = DWDM (200 Ghz)
 E = 1310 / 1550 WDM
 F = 1310 / 1490 / 1550 FSAN WDM
 G = Circulator
 H = Drop only CWDM

3 Select Connector Style

A = SC/UPC E = LC/UPC
 C = SC/APC G = LC/APC
 Z = N/A

4 Number of Components

A = 1 E = 5
 B = 2 (Quad) F = 6
 C = 3 G = 7
 D = 4 (Quad) H = 8

5 Number of Channels

XX = # of channels

6 1310 Port

A = Included
 Z = N/A

7 Expansion Port

A = Included
 Z = N/A

8 Test Port

A = 1% incoming
 B = 2% incoming
 C = 3% incoming
 D = 5% incoming
 E = 7% incoming
 F = 10% incoming
 G = 1% out going
 H = 2% out going
 J = 3% out going
 K = 5% out going
 L = 7% out going
 M = 10% out going
 Z = N/A

9 Start Channel

XX = Channel
 Z = N/A

10 Application

M = Channel
 D = N/A
 M/D = Mux & demux
 M/M = Mux & mux
 D/D = Demux & demux
 U = Universal

WaveSmart®

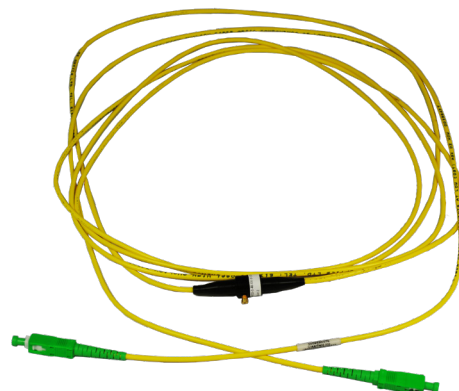
VOA and Patch Cord Splitter



Application

A variable optical attenuator (VOA) is a device designed to attenuate an intensity or power level of an input optical beam in a controlled manner to produce an output optical beam with different attenuated intensities. Variable optical attenuators play an important role in the implementation of modern information networks having optical interconnects. In fiber optic communication systems, variable optical attenuators are broadly employed to regulate the optical power levels to prevent damages to the optical receivers caused by irregular optical power variations.

Fiber optic patch cord splitters are optical devices that connect three or more fiber ends, dividing one input between two or more outputs or combining two or more inputs into one output



Description

Clearfield® VOA and Patch Cord Splitters are optical components that are up-jacketed to 3 mm and terminated with any industry standard connectors.

Features and Benefits

Integrity

- RUS Listed
- Compliant to Telcordia GR-1221 and GR-1209
- Supports Industry standard Singlemode and Multimode fibers and connectors
- Outside plant hardened components

Protection

- Ruggedized fiber up-jacket and packages available for superior protection
- Multi-component custom packages available

Access

- Compact tube style and discrete components offered for direct splice in options
- VOA input available with up to one meter and output leg up to 30 meters
- Up to 80 dB attenuation on VOA
- Patch Cord Splitters available with up to one meter for input and nine meters on the outputs

Investment

- WaveSmart VOA and Patch Cord Splitters offer an economical, dense and user-friendly solution for deploying fiber in any optical network
- Environmentally stable, high-isolation, low-insertion loss
- All components tested 100% and include test documentation

Technical Specifications

WaveSmart VOA and Patch Cord Splitter	
VOA	12 mm round x 15 mm L
Patch Cord Splitter	90 mm L x 20 mm D x 10 mm H

Environmental Reliability Tests

- Complies with Telcordia requirement TR-NWT-0012 21 and TR-NW T-00 1209
 - Optical characteristics
 - Thermal Cycling
 - Vibration Test
 - Salt Spray Erosion
 - Thermal Aging
 - Humidity Resistance

WaveSmart®

VOA and Patch Cord Splitter



VOA and Patch Cord Splitter - Environmental Reliability Tests

High Temperature Storage Test	85°C for 2,500 hours
Low Temperature Storage Test	-40°C for 2,500 hours
Thermal Cycling Test	-40°C/ 75°C for 500 cycles
Fiber Pulling Test	0.25 Kg for 250 µm fiber and 900 µm loose tube
Water Immersion Test	43°C, PH=5.5, for 340 hours
Vibration Test	10~2,000 Hz Random, 20 g, three axes
Impact Test	8 Drops, 1.8 meters high
Thermal Shock Test	100°C

Variable Optical Attenuator Specifications

These attenuators are designed to meet Telcordia standards. These attenuators can be used for 1300nm and 1550nm, as well as for C (1520-1570nm), L (1570-1620nm) and S (1470-1520nm) bands, with minimal changes in the insertion loss. Mounting holes provide easy attachment to PC boards and patch panels.

The attenuators consist of two base plates. Each base plate contains a fiber followed by a collimating lens. The attenuator is pre-aligned for optimum coupling efficiency using a patented tilt alignment technique. A threaded radial screw is used to block the collimated beam between the two lenses. Because the attenuator works by directly blocking the beam, it is polarization insensitive. A seal cap is used to seal the junction against temperature and humidity effects. The attenuator can even withstand immersion in water for extended periods of time. Attenuators are offered with singlemode, multimode or polarization maintaining fibers.

Configured Part Numbers

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1 Select Attenuator Type

A = Splitter (50/50 split)
B = Variable optical attenuator

2 Select Input Connector

A = SC/UPC J = FC/UPC
C = SC/APC K = FC/APC
E = LC/UPC M = ST/UPC
G = LC/APC

3 Select Output Connector # 1

A = SC/UPC J = FC/UPC
C = SC/APC K = FC/APC
E = LC/UPC M = ST/UPC
G = LC/APC

4 Select Output Connector # 2

A = SC/UPC J = FC/UPC
C = SC/APC K = FC/APC
E = LC/UPC M = ST/UPC
G = LC/APC Z = N/A

5 Select Length of Input Leg *

XXX = Length required from end of input connector to the attenuator / splitter

6 **8** **10** Select Unit of Measure for Length Specified in Options # 5, # 7 and # 9

I = Inches
F = Feet
M = Meters

7 Select Length of Output Leg # 1 **

XXX = Length required from end of output connector # 1 to the attenuator / splitter

9 Select Length of Output Leg # 2 **

XXX = Length required from end of output connector # 2 to the attenuator / splitter

VOA

* The maximum length from the input connector to the VOA cannot exceed 1 meter.

** The maximum length from the output connectors to the VOA cannot exceed 29 meters.

Overall length of a VOA patchcord cannot exceed 30 meters.

Splitter

* The maximum length from the input connector to the splitter cannot exceed 1 meter.

** The maximum length from the output connectors to the splitter cannot exceed 9 meters.

Overall length of a splitter patchcord cannot exceed 10 meters.

WaveSmart®

1/2 Wide LGX Modular Optical Components

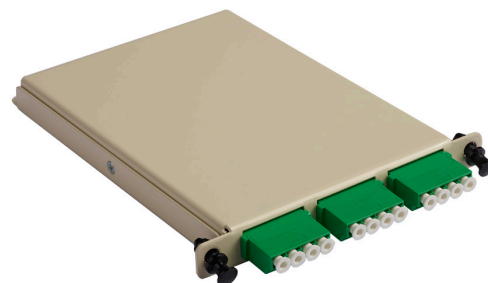


Application

This product is needed when an optical splitter or WDM is required in a central office environment. They are used in CATV headends and telephone company central offices.

Description

Modular optical components are splitters or WDMs that are packaged inside this metal housing with three duplex SC adapters or three quad LC female adapters for a total of 12 ports. The LGX modules utilize a 6" (152.40 mm) high Optical Component Chassis to house the modules in a frame and can hold up to 29, 1/2 wide LGX.



Features and Benefits

Integrity

- RUS listed
- Compliant to Telcordia GR-449
- Supports industry standard LC adapters

Protection

- Ruggedized, secure packaging

Access

- Front inputs and outputs

Investment

- FieldSmart® Optical Components offer an economical, dense and user-friendly solution for deploying splitters or WDMs in a central office design
- Any combination of split ratios and number of components up to 12 ports
- Clearfield® supports legacy splitter deployments by offering optical components in LGX footprint
- Environmentally stable, high-isolation, low-insertion loss
- Compliant to Telcordia GR-1221 and GR-1209

Technical Specifications

WaveSmart 1/2 Wide LGX Modular Optical Components	
Dimensions	0.56" H x 5.12" W x 6.72" D (14.22 mm x 130.04 mm x 170.69 mm)
Port Density	SC: 6 (3 dual SC adapters); LC: 12 (3 quad LC adapters)
Connector Types	SC/UPC, SC/APC, LC/UPC, LC/APC
Optical Component Types	WDMs, FSAN-WDMs, CWDMs, Splitters
Splitter Types	1 x 8, 1 x 4
Panel Type	6" (152.40 mm) LGX Optical Component Chassis
Material	16 gauge cold rolled steel with almond powder coating

WaveSmart®

Build-Out Attenuators

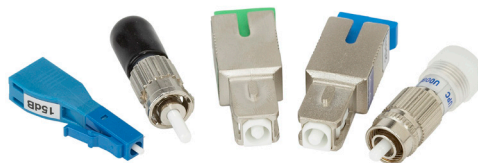


Application

Fiber optic attenuators are designed to introduce a specific amount of signal loss into an optical circuit. These products provide attenuation at a mated pair connection and are used for signal budgeting and power equalization.

Description

Clearfield® provides both build-out and in-line attenuators in all industry standard interface and attenuation values.



Features and Benefits

Integrity

- Compliant to Telcordia GR-910 and GR-1221
- Supports Industry standard Singlemode connectors
- Outside Plant hardened components

Protection

- Male and female ends all have protective dust cap
- Individually packaged for protection and to eliminate product mix up

Access

- Compact style fits in most cabinets and panels
- Connector interface includes ST, SC, SC/APC, FC, FC/APC, LC, LC/APC
- 1 dB through 20 dB, 25 dB and 30 dB attenuation
- Dual Bandwidth 1310/1550nm Supported
- Attenuation levels clearly marked for easy identification

Investment

- WaveSmart Attenuators offer an economical, dense and user-friendly solution for deploying fiber in any optical network
- Environmentally stable, high-isolation, low-insertion loss
- All components are tested 100%

Technical Specifications

WaveSmart Build-Out-Attenuators	
Return Loss	UPC: 55 dB; APC: 65 dB
Attenuation Tolerance	1 to 10 db: ± 0.5 dB 11 to 30 dB: $\pm 5\%$
Operational Wavelength	1260nm to 1650nm
Operating Temperature	-40°C to 85°C (-40°F to 185°F)
Max Power	500mW

Configured Part Numbers

A	-	
1	2	3
1	2	3
Select Attenuator Style	Select Connector Style	Select Attenuation Value
B = Buildout (male / female)	A = SC/UPC C = SC/APC E = LC/UPC G = LC/APC	J = FC/UPC K = FC/APC M = ST/UPC XXX = Attenuation value up to 30 dB