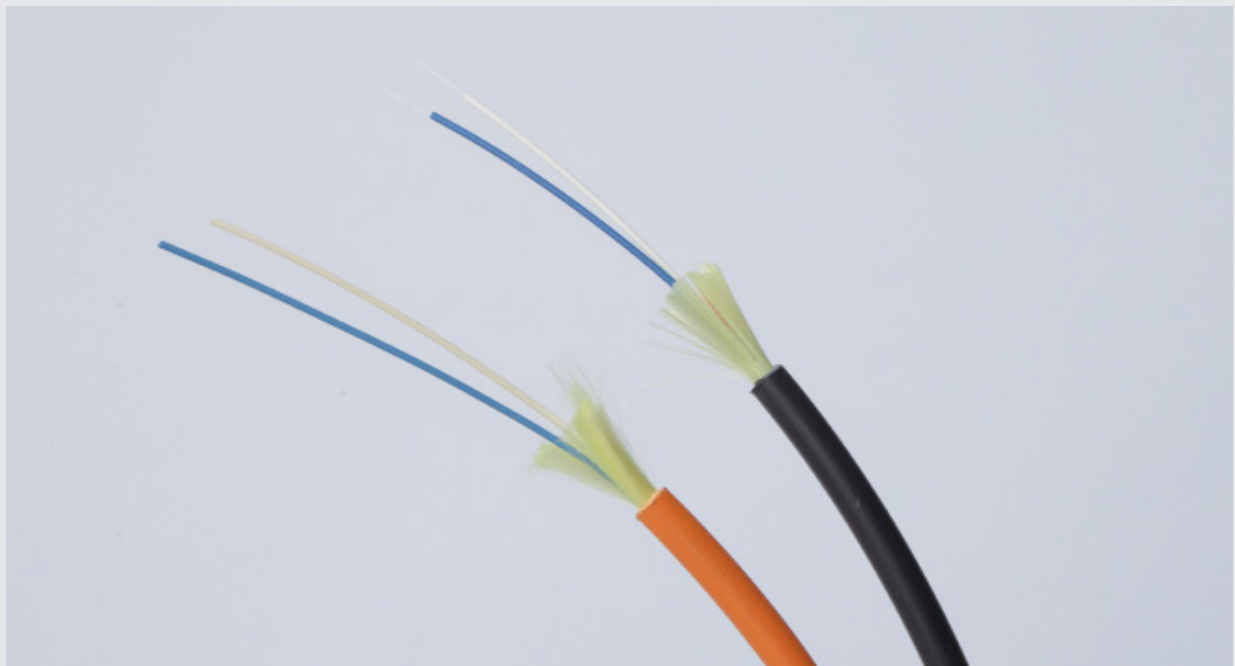


Understanding Fiber Optic

Advantages, System Design and Fiber Cable Selection



Fiber Optic Standards

The EIA/TIA 568 standard for premises cabling is used by most manufacturers and users of premises cabling systems in the United States.. Internationally, IEC/ISO 11801 is very similar, although there are differences in various countries. TIA-568 has been under continual revision since its inception. The current version is 568.C. It includes some major changes from earlier versions for fiber optics.

Work is already starting on TIA 568.D in late 2012. Several new issues are being addressed, including passive optical LANs based on FTTH PONs and the high component losses allowed, especially connector loss at 0.75db. But the biggest problem with TIA 568.C, organization, is also promised to be addressed. Since the work on various issues addressed in the C revision were completed at different times, the document was released in parts as they were completed. As a result, the C version has many issues with changes in one document affecting others, requiring amendments and cross references that are very confusing. There is widespread knowledge of this problem and it has been said that it will be addressed, hopefully by waiting to release all documents together.

Since its beginnings in early 1990s, additions and changes to TIA 568 included:

1. Add 50/125 micron fiber (OM2, OM3, OM4) as an alternative fiber type and specifies performance.
2. Allows alternate connectors to the SC, especially small form factor connectors.
3. Adds performance standards for all connectors.
4. Includes bend radius specifications for cables.
5. Specifies requirements for connecting hardware.

Fiber Type	Wavelength (nm)	Max Attenuation dB/KM	Bandwidth Mhz/KM
50/125 (OM2, OM3, OM4)	850	3.5	500 OM2- 2000 OM3 - 3500 OM4
	1300	1.5	500
62.5/125 (OM1)	850	3.5	160
	1300	1.5	500
Single-mode (OS1, OS2) (Premises)	1310	1.0	NA
	1550	1.0	NA
Single-mode (OS1, OS2) (OSP)	1310	0.5	NA
	1550	0.5	NA

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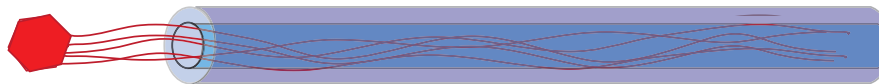
Fiber Optic Communication

Fiber optic links are the communications pathways between devices. A link is bidirectional, usually with signals transmitted in two directions on two different fibers. Using two fibers is usually the cheapest way, since the optical fiber itself is now about as cheap as kite string and fishing line! (FTTx PON systems use one fiber in two directions so it can use one PON coupler transmitting and receiving for lower system cost.) The link connects electronic signals from two devices that need to communicate, just like a copper cable. The link has a transmitter that converts electronic signals from communications equipment to optics and a receiver that converts the signal back to electronics at the other end.

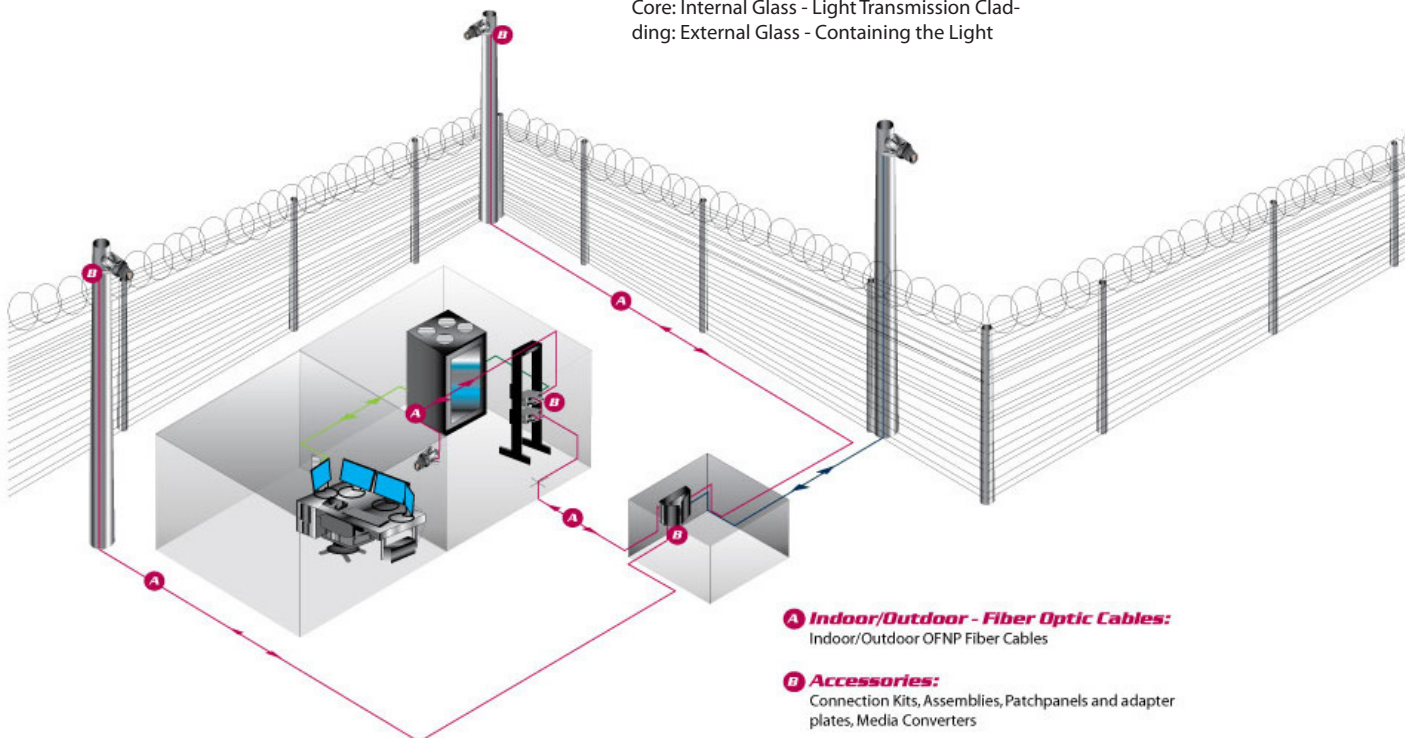
Fiber optic transmitters use LEDs or semiconductor lasers to convert electronic signals to optical signals. LEDs, similar to those used everywhere for indicators except transmitting in the infrared region beyond human perception, are used for slower links up to 100 million bits per second (Mb/s) for example fast Ethernet LANS. Faster links use infrared semiconductor lasers because they have more bandwidth, up to tens of billions of bits per second (Gb/s). Lasers have more power, so they can also go longer lengths, as in outside plant applications like long-distance telecom or CATV.

As noted, transmitters use infrared light. Infrared light has lower loss in the fiber, allowing longer cable runs. Typically multimode glass fibers use light at 850nm - 1300nm, referred to as "short wavelength" and single-mode fiber operates at 1310 or 1550nm, called "long wavelength."

Transmitter
 LED, VCSEL or LASER
 850nm, 1300nm, 1310nm or 1550nm



Optical Fiber
 In Communication: Pure Glass
 Two Parts:
 Core: Internal Glass - Light Transmission
 Cladding: External Glass - Containing the Light



Fiber Optic Installation General Guidelines

Conduct a Site Survey

The purpose of a site survey is to recognize circumstances or locations in need of special attention. For example, physical hazards such as high temperatures or operating machinery should be noted and the cable route planned accordingly. If the fiber optic cable has metallic components, it should be kept clear of power cables. Additionally, building code regulations, like the National Electric Code (NEC)***, must be considered. If there are questions regarding local building codes or regulations, they should be addressed to the authority having jurisdiction, such as the fire marshal or city building inspector.

Develop a Cable Pulling Plan

A cable pulling plan should communicate the considerations noted during the site survey to the installation team. This includes the logistics of cable let-off/pulling equipment, the location of intermediate access points, splice locations and the specific responsibilities of each member of the installation team.

Follow Proper Procedures

Because fibers are sensitive to moisture, the cable end should be covered with an end cap, heavy tape or equivalent at all times. The let-off reel must never be left unattended during a pull because excess or difficult pulls, center-pull or backfeeding techniques may be employed.

Do Not Exceed Cable Minimum Bend Radius

Every West Penn Wire cable has an installation minimum bend radius value. During cable placement, it is important that the cable not be bent to a smaller radius. After the cable has been installed, and the pulling tension removed, the cable may be bent to a radius no smaller than the long-term application bend radius specification.

The minimum bend radius values still apply if the cable is bent more than 90 degrees. It is permissible for fiber optic cable to be wrapped or coiled as long as the minimum bend radius constraints are not violated.

Do Not Exceed Cable Maximum Recommended Load

While fiber optic cables are typically stronger than copper cables, it is still important that the cable maximum pulling tension not be exceeded during any phase of cable installation. In general, most cables designed for outdoor use have a strength rating of at least 600 lbs. West Penn Wire fiber optic cables also have a maximum recommended load value for long term application. After cable placement is complete, the residual tension on the cable should be less than this value. For vertical installations, it is recommended that the cable be clamped at frequent intervals to prevent the cable weight from exceeding the maximum recommended long-term load. The clamping intervals should be sufficient to prevent cable movement as well as to provide weight support.

Leave Extra Cable

A common practice is to leave extra cable at the beginning and at the end of the cable run. Also, extra cable should be placed at strategic points such as junction boxes, splice cases and cable vaults. Extra cable is useful should cable repair or mid-span entry be required.

Document the Installation

Good record keeping is essential. This will help to ensure that the cable plant is installed correctly and that future troubleshooting and upgrading will be simplified. All West Penn Wire fiber optic cables have a unique lot number shown on the shipping spool. It is important that this number be recorded. Cable pre- and post- installation test data should be recorded in an orderly and logical fashion.

Fiber Optics: Fiber Cables

Fiber Optics

Fiber optic use started in the early 1970s. Corning Glass Works developed a fiber optic cable with a loss of 20dB/km, today many fiber optics have extremely low loss- .5dB/km for single-mode. During the 1980s, telephone companies began to deploy fiber throughout their networks. By implementing a fiber network, telecom companies could future-proof their systems backbone.

Fiber optics is used in many applications such as: telecommunication, high bandwidth data, video signaling, long distant CCTV, communication between fire alarm panels, and much more.

Fiber Optics - Advantages

- Maintaining signal integrity in high EMI/RFI applications
- Long distance installations
- Security issues
- Future-proofing
- Greater amount of information carrying capacity (bandwidth)
- Easy installation - lightweight, simplified termination

Fiber Optics - Disadvantages

- Expensive overall installation cost
- Can not carry electrical power



Fiber Optics: Fiber Cables

Optical Fibers

A glass optical fiber is made of three components:

1. Core - Light Carrier of the optical fiber. It is made from a doped glass (silica). The silica material of the core allows the light signals to be carried efficiently and effectively across the fiber.

Sizes of the Core:

- 8µm (8.3 or 9µm) single-mode
- 50µm - multi-mode
- 62.5µm - multi-mode µm - microns - 1000microns = 1mm

2. Cladding - Surrounds the cladding, it is also made from a different type of silica. The glass of the cladding is made to contain the light within the core.

Sizes of the Cladding:

- 125µm

3. Plastic Coating - surrounds the cladding and acts as a protector for the glass. The coating is implemented to protect the glass while it is shipped to the fiber optic cable manufacturers. The coating is normally clear (color), but for all outdoor cables the coating is color coded to help identify the individual fibers. The coating has to be removed to connect the fiber to a connector or splice.

Sizes of the Coating

- 250µm

Single-Mode Fibers

8/125µm single-mode or path of light from a laser source.

Long haul installations

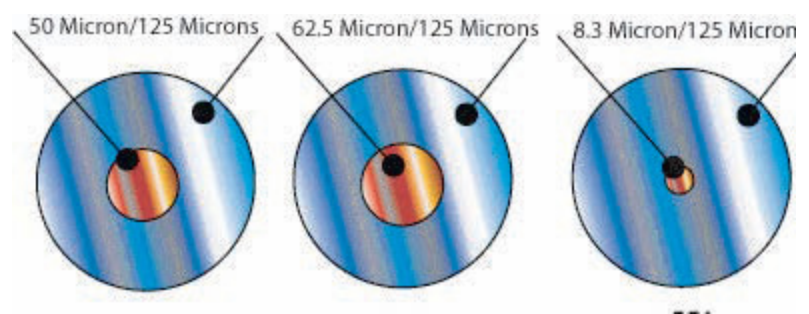
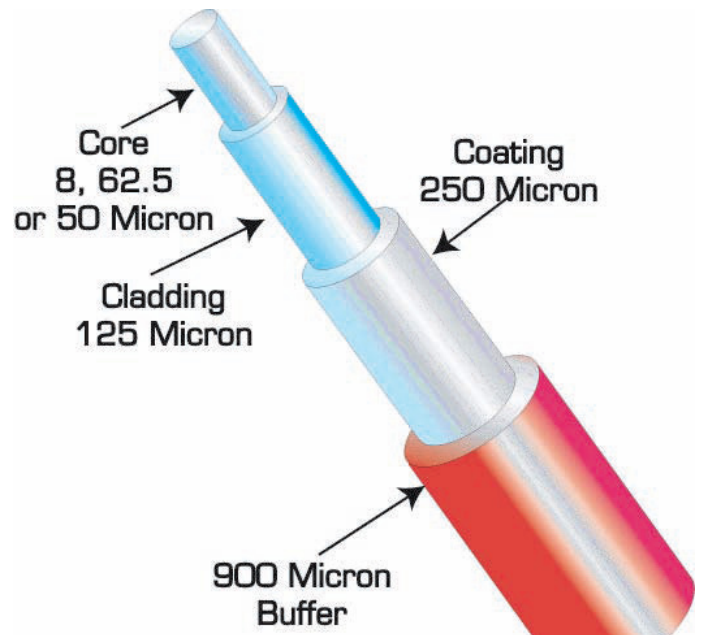
Multi-Mode Fibers

50/125µm or 62.5/125µm

Multiple-modes or paths of light from the LED source

Shorter installation

Both single-mode and multi-mode will simultaneously handle audio, video and data.



Fiber Optics: Fiber Cables

Optical Fibers

Single-Mode Fiber Cables

The single-mode core is 10th the size of a human hair. This fiber type uses a LASER to transmit the signals. The fiber is designed as a step index, meaning that the core has only one refractive index to carry the light signal. There is some dispersion over long distances. Chromatic dispersion is caused by the intense LASER filtering into the cladding, causing pulse overlap and distorted signals.

Multi-Mode Fiber Cables

The multi-mode core is larger and can gather more light. This fiber uses an LED or VCSEL to transmit the light signals. A multi-mode core has a broader aperture over single-mode fibers. A multi-mode fiber also has dispersors over longer distances. This dispersion is all modal dispersion. A multi-mode core is set up with multiple rings with different refractive index characteristics. These rings allow the light to travel over longer distances without loss of continuity of light, but these signals can become compromised if the distance is increased too much.

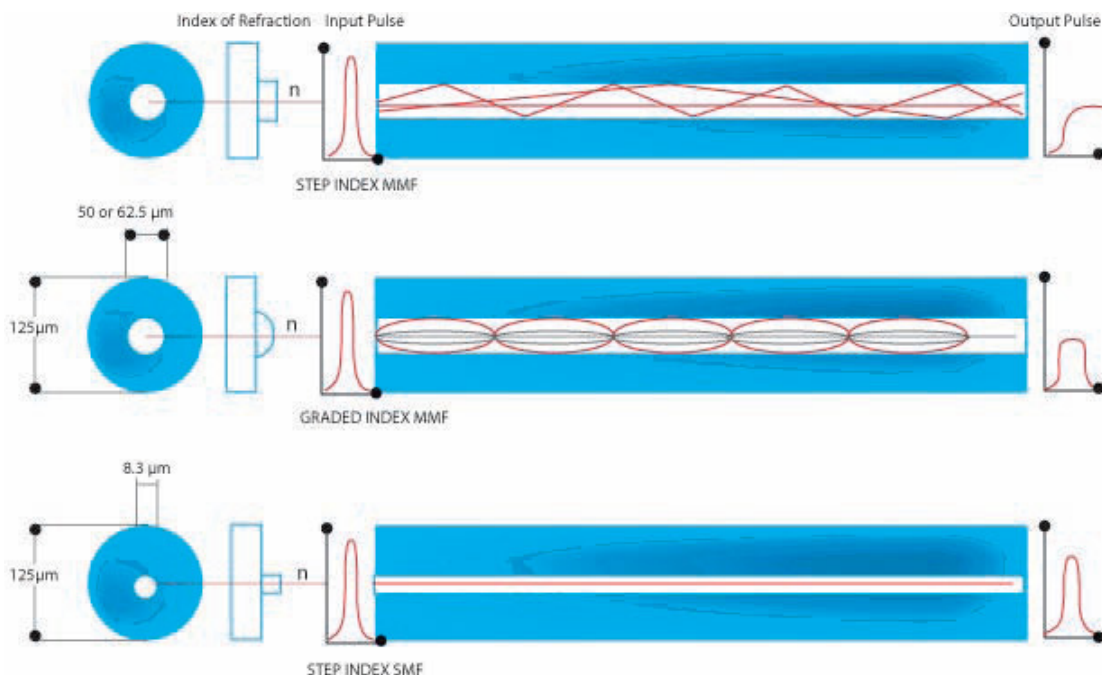
Refractive Index:

Air = 1 meaning light travels 186,000 miles/second

Normal Glass = 1.5

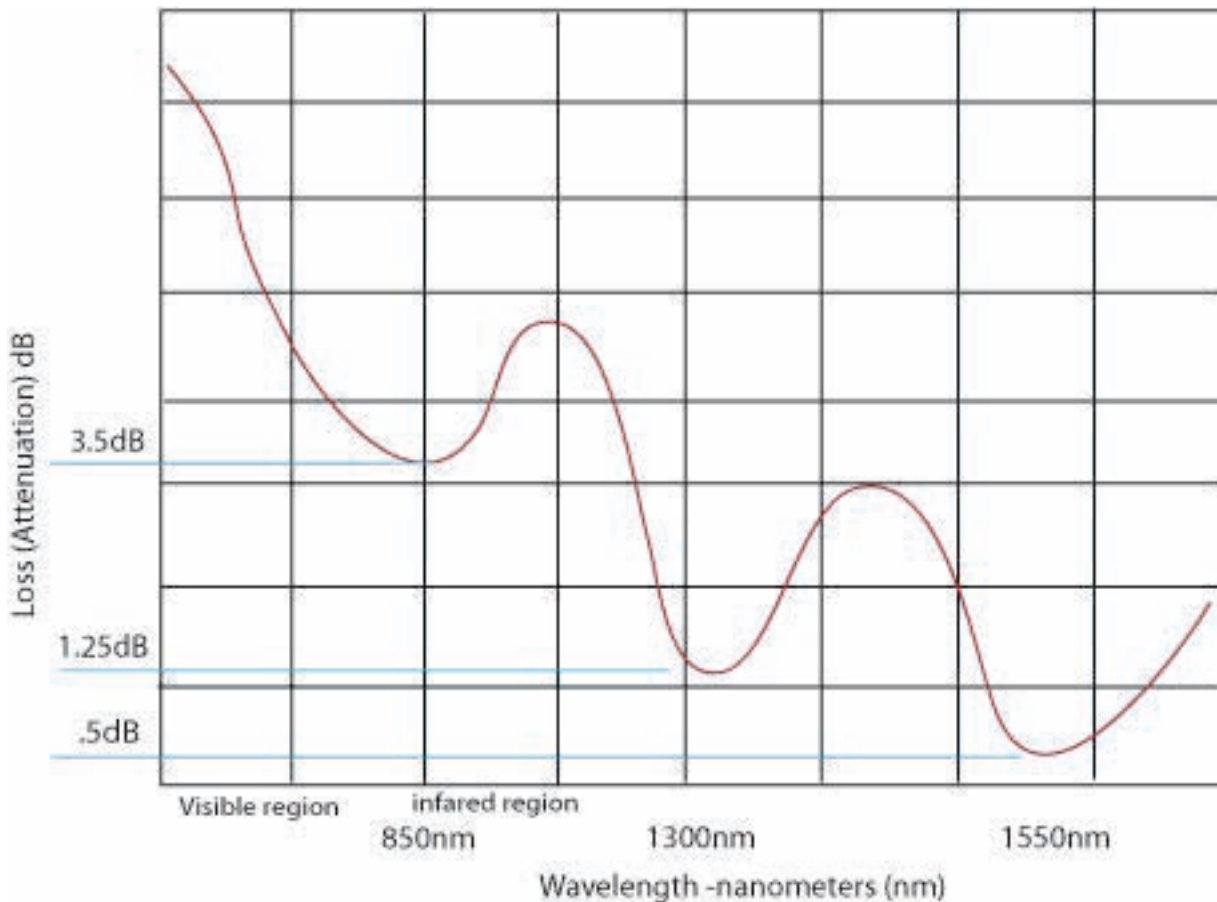
Cladding = 1.46 doped to contain the light

Core = 1.48 single-mode - 1.47 to 1.48 different layers multi-mode



Operating Wavelengths

There are Primarily three windows of opportunity to transmit light effectively through an optical fiber. These specific wavelenths are in the infared region. Visible light starts with blue - approx. 400nm to red 700nm. nm=nanometers.



850nm - 3-4dB of loss/km. The least expensive transmitting device. Found on lower speed, shorter distant applications such as CCTV, fire alarm communication devices. (LED) Used with multi-mode fibers.

1300nm (1310nm) - 1-1.5dB of loss/km. The second window of opportunity. Used for speed, longer distance multi-mode applications. 1310nm is used for single-mode shorter distance applications. LED or VCSEL.

1550nm - .5dB of loss/km. This is the second window of opportunity for single-mode transmission. This wavelength is used for extremely long distance high bandwidth applications.

Fiber Optic Cable Types

Indoor Fiber Optic Cables

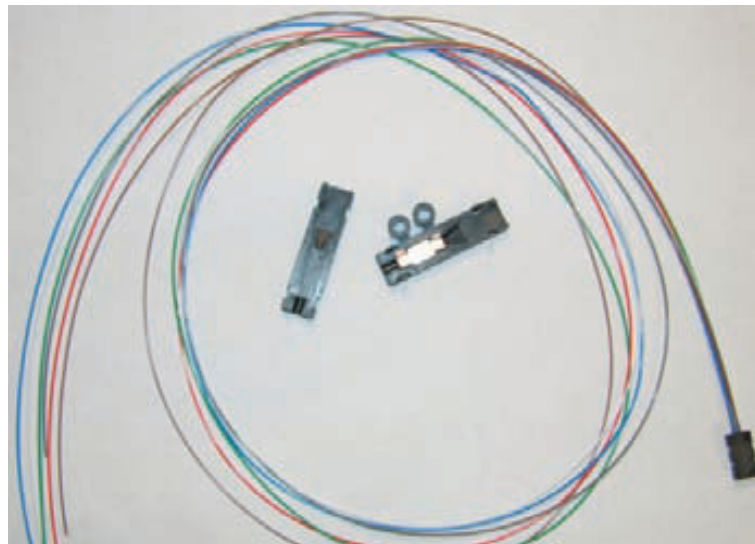
Indoor fiber optic cables are designed to either limit smoke vertically (riser), or limit smoke and flame vertically and horizontally (plenum). The cables are constructed with 900µm bufer over the 250µm coating to help facilitate a connector.

Indoor/Outdoor Fiber Optic Cables

Indoor/outdoor fiber optic cables are designed together to limit smoke vertically (riser), or limit smoke and flame vertically and horizontally (plenum). The cables are constructed with 900µm buffer to help facilitate a connector. They also provide water-blocking material. West Penn Wire offers indoor/outdoor plenum-rated fiber optic cables.

Individual Fiber Color Code

- | | |
|-----------|------------|
| 1. Blue | 2. Orange |
| 3. Green | 4. Brown |
| 5. Slate | 6. White |
| 7. Red | 8. Black |
| 9. Yellow | 10. Violet |
| 11. Rose | 12. Aqua |



Fiber Optic Cable Types

West Penn Wire Bulk Fiber Optic Cables

West Penn Wire offers indoor/outdoor plenum-rated cables to reduce the amount of inventory and SKU numbers.

Part Number Structure:

WP9X043T - The X in the PN has to be with B, C or W to get to the appropriate OM size (fiber optic size).

Fiber Type	Code Replace (X)	Wavelength (nm)	Max Attenuation dB/KM	Bandwidth Mhz/KM
62.5/125 OM1	B	850	3.5	200
		1300	1.25	500
50/125 OM3	C	850	3.5	1500
		1300	1.25	500
50/125 OM4	E	850	3.5	3500
		1300	1.25	4700
8/125 Single-mode	W	1310	.8	NA
		1550	.5	NA

Environment	2 Fiber	6 Fiber	12 Fiber	24 Fiber
Indoor/Outdoor Plenum OFNP	WP9X043T	WP9X045T	WP9X048T	WP9X611T
Indoor/Outdoor Armoured OFCP		WP9X240T	WP9X241T	WP9X242T

Myth Busting

Installers are worried about pulling and terminating fiber optics. **DO NOT WORRY!!**

Pull Tension

6 Fiber Optic Cable	300lbf.
Cat 5E	25lbf.
RG59/U	45lbf.

Optical fiber has the same tensile strength of a piece of steel the same size.

Bend Radius:

Fiber Optic	10 x Cable OD
Category Cable	4 x Cable OD
Coaxial Cable	10 x Cable OD
Audio Cable	10 x Cable OD

Fiber optic cables have the same bend radius of coaxial cables.

Fiber Optic Termination Time	1 Min. (brilliance field kit)
Category 5E Plug	2 Min.
Crimp BNC	3 Min.

Fiber Optic Connector and Splice Types

90% of the market consists of ST, SC and LC connector types

ST - Straight Tip

- Used mostly in security applications (CCTV) because of the design is similar to a BNC coaxial connector
- Keyed locking bayonet style
- Loss- .5-1dB per connection
- Offered in the brilliance kit.



SC - Square or Subscriber

- Used mostly in data applications because of the design is similar to a RJ45 modular plug.
- Push/Pull with floating ferrule - no disconnect
- Loss- .5-1dB per connection Offered in the brilliance kit.



LC - Lucent or Little

- Used mostly in data applications because of the design is similar to a RJ45 modular plug
- SFF - Small form factor connector
- Push/Pull with clipping hood
- Loss- .5-1dB per connection Offered in the brilliance kit.



Mechanical Splice

Mechanical Splices are used in low-voltage shorter distance fiber optic applications. The mechanical splice has a loss of approx. 1 - 1.5 dB/ Splice.

A mechanical splice can be used for a transition from an outdoor cable to an indoor cable, or for any fiber cable that is damaged.

Once a splice is terminated, a splice tray may be used to protect each splice.

Other splices such as fusion splice offer lower loss (.05 to 1dB) depending on the type of fusion splicer.

Catalog PN	Description
3M-2501	3M Mechanical Splice Tool
3M-2529	3M Mechanical Splice
SPL-MSPL6	Metal Splice Tray 6 Fibers
SPL-MSPL12	Metal Splice Tray 12 Fibers
SPL-WS12A	Plastic Splice Tray 12 Fibers



Fiber Optic Connector Installation Kits

Brilliance field kit - **FI-4270**

The brilliance field kit will connect SC, ST and LC Connector Types.

The brilliance field kit is a unique design that incorporates factor polished fiber stub in a splice mechanism which provides a fast, secure and reliable termination of fiber optic cables.

The brilliance field kit connectors offer premium quality ceramic ferrule. The patent-pending design offers the quickest termination in the industry (less than 30 seconds). The brilliance connectors can be used up to 5-6 times.

The Optimax installation consists of:

1. Cleave the fiber
2. Open connector cavity - activation tab
3. Insert the fiber into the connector
4. Release activation tab on the connector body

Specifications: brilliance connector interconnection interconnection compatibility LC/SC/ST

Field Assembly Time 900µm	30 sec. with setup 1 min.
Insertion Loss dB	.3dB
Storage Temp.	-40°F - 140°F
Operating Temp.	-40°F -167°F
Tensile Strength 900µm	1.12lbs.

Connectors are reusable up to 6 times.



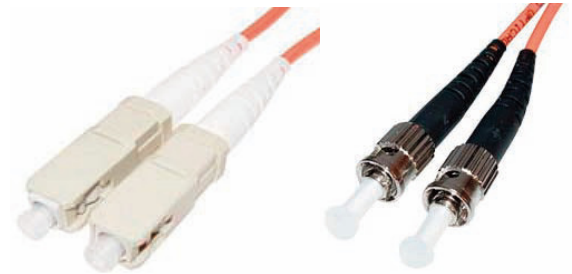
Catalog PN	Description
FI-4270	Fiber Optic Brilliance Field Kit
LC Connectors	
FI-4240	LC - 900µm, Multi-mode Beige Connector, 62.5um
FI-4241	LC - 900µm, Multi-mode Black Connector, 50um
FI-4242	LC - 900µm, Multi-mode Aqua Connector, 50um
FI-4243	LC - 900µm, Single-mode Blue Connector, 8um
SC Connectors	
FI-4244	SC - 900µm, Multi-mode Beige Connector, 62.5um
FI-4245	SC - 900µm, Multi-mode Black Connector, 50um
FI-4246	SC - 900µm, Multi-mode Aqua Connector, 50um
FI-4247	SC - 900µm, Single-mode Blue Connector, 8um
ST Connectors	
FI-4248	ST - 900µm, Multi-mode Beige Connector, 62.5um
FI-4249	ST - 900µm, Multi-mode Black Connector, 50um
FI-4250	ST - 900µm, Multi-mode Aqua Connector, 50um
FI-4251	ST- 900µm, Single-mode Blue Connector, 8um

Fiber Optic Assemblies and Pigtails

Types: ST, SC, LC

Glass Types: single-mode and multi-mode

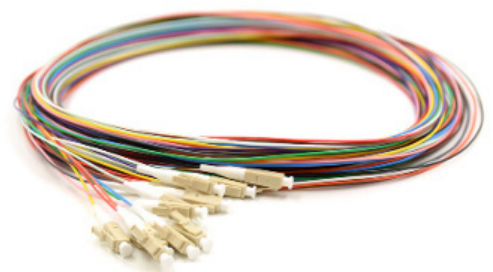
Simplex or Duplex Designs



Catalog PN	Description
ST Assemblies	
FI-X002-xx	Duplex ST to ST Replace xx with: 3,6,10,15,30
SC Assemblies	
FI-X002-xxSC	Duplex SC to SC Replace xx with: 3,6,10,15,30
LC Assemblies	
FI-X002-xxLC	Duplex LC to LC Replace xx with: 3,6,10,15,30
SC to LC Assemblies	
FI-X002-xxLC/SC	Duplex LC to SC Replace xx with: 3,6,10,15,30

REPLACE (X)
 2 - 62.5/125 OM1
 3 - 8/125 SINGLEMODE
 4 - 50/125 OM3
 5 - 50/125 OM4

Catalog PN	Description
FP12-51-9-003M	LC 12 Fiber OM3 3M
FP12-6-2-003M	ST 12 Fiber OM1 3M
FP12-9-2-003M	ST 12 Fiber Single-mode 3M
FP12-9-9-003M	LC 12 Fiber Single-mode 3M
FP1-51-4-003M	SC Single OM3 3M
FP1-51-9-003M	LC Single OM3 3M
FP1-6-4-003M	SC Single OM1 3M
FP1-9-4-003M	SC Single-mode 3M
FP1-9-9-003M	LC Single-mode 3M
FP6-51-4-003M	SC 6 Fiber OM3 3M
FP6-51-9-003M	LC 6 Fiber OM3 3M
FP6-6-4003M	SC 6 Fiber OM1 3M
FP6-9-4-003M	SC 6 Fiber Single-mode 3M
FP6-9-9-003M	LC 6 Fiber Single-mode 3M



OFNP Pre-Terminated Fiber Optic Assemblies

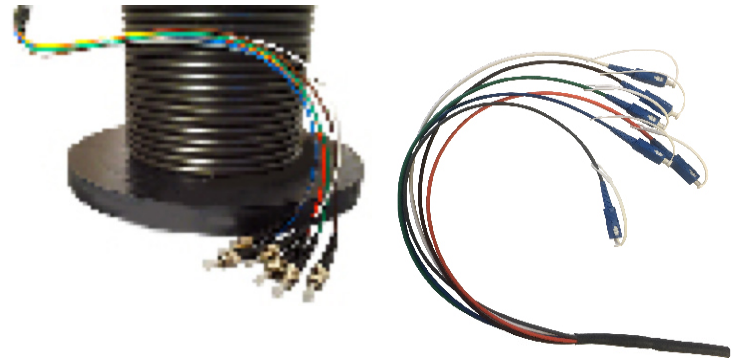
West Penn Wire's indoor/outdoor OFNP pre-terminated fiber optic assemblies are perfect for fiber optic installations within a building or between two buildings.

West Penn Wire can provide fully tested long length assemblies to allow plug and play fiber optic installation.

West Penn Wire pre-terminated long-length fiber assemblies are built to your specifications using the best materials with highly skilled technicians in an environmentally controlled workspace. All terminations are fully tested and ready for immediate installation.

We provide either 2 or 6 fiber indoor/outdoor OFNP OM1, OM3, OM4 and OS2 (single-mode) long-length assemblies. The assemblies are terminated at each end with ST, SC, LC connectors. We can provide a pulling eye on one end or pulling eye with staggered connectors. Provide the part number with A, B or no designation.

The length of fiber cable can range from 50ft up to 1000ft. or more.



ST to ST		Glass Size (X)				Pulling Eye (P)	Length xxx
Part Number	Cable Description	OM1	OM3	OM4	OS2	Replace p with A,B or No Letter	Replace xxx:
FI-9X043-pxxxST FI-9X045-pxxxST FI-9X048-pxxxST	Indoor/Outdoor OFNP 2 Fiber - 4 ST Connections Indoor/Outdoor OFNP 6 Fiber - 12 ST Connections Indoor/Outdoor OFNP 12 Fiber - 24 ST Connections	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
FI-9X240-pxxxST FI-9X241-pxxxST	Armored Indoor/Outdoor OFNP 6 Fiber - 12 ST Conn Armored Indoor/Outdoor OFNP 12 Fiber - 24 ST Conn	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
LC to LC		Glass Size (X)					Replace xxx:
FI-9X043-pxxxLC FI-9X045-pxxxLC FI-9X048-pxxxLC	Indoor/Outdoor OFNP 2 Fiber - 4 LC Connections Indoor/Outdoor OFNP 6 Fiber - 12 LC Connections Indoor/Outdoor OFNP 12 Fiber - 24 LC Connections	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
FI-9X240-pxxxLC FI-9X241-pxxxLC	Armored Indoor/Outdoor OFNP 6 Fiber - 12 LC Conn Armored Indoor/Outdoor OFNP 12 Fiber - 24 LC Conn	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
SC to SC		Glass Size (X)					Replace xxx:
FI-9X043-pxxxSC FI-9X045-pxxxSC FI-9X048-pxxxSC	Indoor/Outdoor OFNP 2 Fiber - 4 SC Connections Indoor/Outdoor OFNP 6 Fiber - 12 SC Connections Indoor/Outdoor OFNP 12 Fiber - 24 SC Connections	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
FI-9X240-pxxxSC FI-9X241-pxxxSC	Armored Indoor/Outdoor OFNP 6 Fiber - 12 SC Conn Armored Indoor/Outdoor OFNP 12 Fiber - 24 SC Conn	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
SC to LC		Glass Size (X)					Replace xxx:
FI-9X043-pxxxCL FI-9X045-pxxxCL FI-9X048-pxxxCL	Indoor/Outdoor OFNP 2 Fiber - 2 LC /2SC Connections Indoor/Outdoor OFNP 6 Fiber - 6 LC/6SC Connections Indoor/Outdoor OFNP 12 Fiber - 12 LC /12SC Connections	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
FI-9X240-pxxxCL FI-9X241-pxxxCL	Armored Indoor/Outdoor OFNP 6 Fiber - 6SC/6LC Armored Indoor/Outdoor OFNP 12 Fiber - 12SC/12LC	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
SC to ST		Glass Size (X)					Replace xxx:
FI-9X043-pxxxCT FI-9X045-pxxxCT FI-9X048-pxxxCT	Indoor/Outdoor OFNP 2 Fiber - 2 ST/2SC Connections Indoor/Outdoor OFNP 6 Fiber - 6 ST/6SC Connections Indoor/Outdoor OFNP 12 Fiber - 12 ST /12SC Connections	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet
FI-9X240-pxxxCT FI-9X241-pxxxCT	Armored Indoor/Outdoor OFNP 6 Fiber - 6SC/6ST Armored Indoor/Outdoor OFNP 12 Fiber - 12SC/12ST	B	C	E	W	A: Pulling Eye B: Pulling Eye-Connectors staggered	50-1000 feet

Fiber Optic Enclosures, Panels, and Adapter Plates

Rack Mount Panels

Catalog PN	Description
PP-W1U1	1 RU Rack Mount Holds 3 plates
PP-W2U1	2 RU Rack Mount Holds 6 plates
PP-W4U1	4 RU Rack Mount Holds 12 plates



Wall Mount Panels

Catalog PN	Description
PP-WM1S	1 Adapter Plate - Wall Mount 7"x6"x1.5"
PP-WM2S	2 Adapter Plate - Wall Mount 15.625"x13"x 2.125"
PP-WM4S	4 Adapter Plate - Wall Mount 15.625"x15"x 3.5"



Adapter Plates

Catalog PN	Description
AS-WC06M	SC Simplex Multi-mode - 6 Fiber
AS-WC06G	SC Simplex 10G Multi-mode - 6 Fiber
AS-WC06S	SC Simplex Single-mode - 6 Fiber
AS-WC12M	SC Simplex Multi-mode - 12 Fiber
AS-WC12G	SC Duplex 10G Multi-mode - 12 Fiber
AS-WC12S	SC Duplex Single-mode - 12 Fiber
AS-WT06M	ST Simplex Multi-mode - 6 Fiber
AS-WT06S	ST Simplex Single-mode - 6 Fiber
AS-WT12M	ST Simplex Multi-mode - 12 Fiber
AS-WT12S	ST Simplex Single-mode - 12 Fiber
AS-WL12M	LC Duplex Multi-mode - 12 Fiber
AS-WL12G	LC Duplex 10G Multi-mode - 12 Fiber
AS-WL12S	LC Duplex Single-mode - 12 Fiber
AS-WL24M	LC Quad Multi-mode - 24 Fiber
AS-WL24G	LC Quad 10G Multi-mode - 24 Fiber
AS-WL24S	LC Quad Single-mode - 24 Fiber



Cassette Plates

Catalog PN	Description
DM-1MLCB24	24 LC Single-mode
DM-1MSCB12	12 SC Single-mode
DM-4MLCC12	12 LC OM3
DM-4MLCC24	24 LC OM3
DM-4MSCC12	12 SC OM3



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