



Fiber Optic Tutorial

What are Fiber Optic Cables?

Fiber optic cables consist of a glass core and cladding, buffer coating, Kevlar strength members and a protective outer jacket. Fiber optic cables use light pulses as opposed to electrical signals to send information.

How are Fiber Optic Cables used?

Fiber optic cables can be plugged into communications equipment and patch panels to provide a physical connection to a network or device.

Where are Fiber Optic Cables used?

Fiber optic cables are used by commercial business, governments, the military and many other industries for myriad applications involving the transmission of voice, video and data.

Fiber Optic Cabling Terms

Absorption: One cause of attenuation where light signal is absorbed into the glass during transmission.

Attenuation: Optical loss of power. Attenuation is measured in dB loss per length of cable. Attenuation is usually caused by absorption and scattering.

Attenuator: A device used to reduce the power of an optical signal.

Back Reflection: A measure of the light reflected off the polished end of a fiber connector. Measured in negative dB relative to incident power.

Bandwidth: The range of signal frequencies that a fiber optic cable will transmit.

Buffer: The protective coating over the fiber.

Insertion Loss: The attenuation caused by the insertion of a device (such as a splice or connection point) to a cable.

Loss Budget: The maximum amount of power that is allowed to be lost per optical link.

Multimode: A type of fiber optic cable where the core diameter is much larger than the wavelength of light transmitted. Two common multimode fiber types are 50/125 and 62.5/125.

Return Loss: The ratio of the power launched into a cable and the power of the light returned down the fiber. This measurement is expressed in positive decibel units (dB). A higher number is better. Return Loss = $10 \log \left(\frac{\text{incident power}}{\text{returned power}} \right)$.

Scattering: A second cause of attenuation. Scattering occurs when light collides with individual atoms in the glass.

Single mode: A type of fiber with a small core that allows only one mode of light to propagate. A common single mode type is 9/125.

Wavelength: A means of measuring light color. Expressed in nanometers (nm).

A Quick Lesson In Optical Transmission

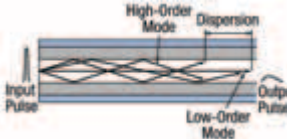
Where copper cabling uses electricity to transmit signals from one end to another, fiber optics use light pulses to accomplish the same purpose. The fiber cable is made of a transparent glass core surrounded by a mirror like covering called cladding. Light passes through the cable, bouncing off the cladding until it reaches the other end of the fiber channel - this is called total internal reflection.

In today's high speed networks, Graded Index Multimode fiber or Step Index Single mode fiber is used to improve light transmission over long distances. Multimode fiber has a larger core and is typically used in short runs within buildings. Single mode fiber has a smaller core and is used in long distance runs typically outside between buildings.

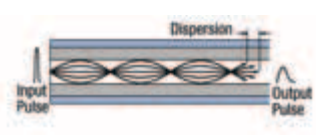
Fiber Glass Types

Stepped Index Fiber relies on the reflection of light whereas in Graded Index Fiber, the properties of the glass are changed in layers to "bend" the light as it travels down the cable. This reduces modal dispersion within the cable allowing for higher transmission rates.

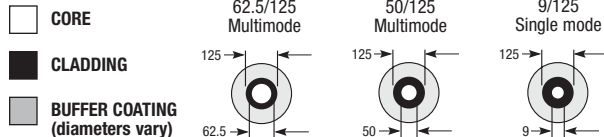
MULTIMODE, STEP-INDEX



MULTIMODE, GRADED-INDEX



SINGLE MODE, STEP-INDEX



Fiber Core Sizes

Fiber specifications list the core and cladding diameters as a ratio. The top example shows the ratio of core to cladding as 62.5/125 microns. Below, the ratio is 9/125 microns. Multimode fiber is commonly 62.5/125 or 50/125 micron, single mode fiber is commonly 9/125 micron.

How do fiber optics work?



Online Video

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Learn all about fiber connectors



Online Video

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	Connector Type	Coupling Type	Fiber Type	Polish	Number Fibers	Typical Applications	Comment
	ST	Twist On	Single mode/Multimode	PC, UPC	1	LANS	Keyed
	FC	Screw On	Single mode/Multimode	PC, UPC, APC	1	Datacom, Telecommunications	Keyed
	SC	Snap On	Single mode/Multimode	PC, UPC, APC	1	CATV, Test Equipment	Keyed
	LC	Snap On RJ45 Style	Single mode/Multimode	PC, UPC, APC	1	Gigabit Ethernet, Video Multimedia	Small Form Factor (SFF)
	MU	Push/Pull	Single mode/Multimode	PC, UPC, APC	1	Medical, Military	Small Form Factor (SFF)
	MT-RJ	Snap On RJ45 Style	Single mode/Multimode	N/A	2	Gigabit Ethernet, Asynchronous Transmission Mode (ATM)	One of Mating Connectors must have Alignment Pins
	MPO (MTP)	Push/Pull	Single mode/Multimode	N/A	4, 8, 12, 16, 24	Active Device Transceiver, Interconnections for O/E Modules	One of Mating Connectors must have Alignment Pins

