

# Glossary

- Absorption:** Physical phenomenon that attenuates light traveling in fibers by converting it into heat, thereby raising the fiber's temperature. Absorption results from impurities and defects in the glass structure.
- Acceptance Angle:** The half-angle of the cone within which all incident light is totally internally reflected by the fiber core. For graded index fibers, acceptance angle is a function of position on the entrance face of the core.
- Adapter:** A mechanical media termination device designed to align and join fiber optic connectors. Often referred to as a coupling, bulkhead, or interconnect sleeve.
- Amplitude:** Height of a waveform that represents signal strength.
- Analog:** A format that uses continuous physical variables such as voltage amplitude or frequency variations to transmit information.
- Angle of Incidence:** The angle between an incident ray and the normal to a reflecting surface.
- Angle of Refraction:** Angle formed between a refracted ray and the normal to the surface. This angle lies in a common plane with the angle of incidence.
- Aramid Yarn:** Strength elements that provide tensile strength, support and additional protection of fiber bundles. It is commonly referred to as Kevlar (a DuPont trademark).
- Armor:** Protective covering, usually metal, used underneath plastic jackets to provide additional environmental protection in harsh environments.
- Attenuation:** Loss of signal strength between points. Usually measured in decibels per a unit length (e.g., dB/km).
- Backbone:** The main portion of network cabling connecting equipment rooms or communications closets. These cables often have the largest number of fibers and/or the longest continuous cable runs.
- Backscattering:** The scattering of light in a direction opposite to the original one.
- Bandwidth:** A characterization of the information-carrying capacity of a multimode optical fiber. It is expressed in terms of frequency and is often normalized to a unit length (e.g., MHz-km).
- Bend Loss:** A form of increased attenuation in a fiber that results from bending a fiber around a restrictive curvature (a macrobend) or from minute distortions in the fiber (microbends).
- Bend Radius:** Radius of curvature that a fiber can bend without breaking.
- Breakout:** Multifiber cable constructed in the tight buffered design with individually jacketed fibers. Designed for ease of connectorization and rugged applications for intra- or interbuilding requirements.
- Buffer:** Coating used to protect optical fiber from physical damage. Types include tight buffer (indoor) or loose tube (outdoor).
- Bundle:** Several individual fibers contained within a single jacket or buffer tube. Also a group of buffered fibers distinguished in some fashion from another group in the same cable core.
- Cable Assembly:** Optical fiber cable that has connectors installed on one or both ends.
- Cable Bend Radius:** The radius that a fiber can be bent before risking increased attenuation or fiber breaks.
- Central Member:** A material located in the middle of a cable that provides extra strength and anti-buckling properties.
- Chromatic Dispersion:** Spreading of a light pulse caused by the difference in refractive indices at different lengths.
- Cladding:** Dielectric material surrounding the core of an optical fiber.
- Coating:** Material put on a fiber during the drawing process for mechanical protection.
- Conduit:** Pipe or tubing through which cables can be pulled and housed.
- Connector:** A passive device attached at the end of a fiber to couple light from a transmitter to a receiver or between two fibers.
- Connector Return Loss:** Amount of power reflected from the connector to connector interface, typically expressed in decibels.
- Core:** Central region of an optical fiber through which light is transmitted.
- Core Eccentricity:** Measure of the displacement of the center of the core relative to the cladding center.
- Core Ellipticity:** Measure of the non-roundness of the core.
- Coupling Efficiency:** Efficiency of optical power transfer between two components.
- Coupling Loss:** Power loss suffered when coupling light from one optical device to another.
- Critical Angle:** Smallest angle at which a meridional ray may be totally reflected within a fiber at the core-cladding interface.
- Crosstalk:** Phenomenon of unwanted light transfer between fibers.
- CSA:** Abbreviation for Canadian Standards Association.
- Decibel (dB):** Standard unit used to express the magnitude of signal gain or loss.
- Dielectric:** Any non-metallic, non-conductive material.
- Diffraction:** Phenomenon that results when light passes by an opaque edge or through an opening, generating weaker secondary wavefronts. These secondary wavefronts interfere with the primary wavefronts, as well as with each other, to form various patterns.
- Digital:** Data format that uses two physical levels, ones and zeros, to transmit information.

# Glossary

**Dispersion:** Spread of the signal delay in an optical waveguide. It consists of various components: modal dispersion, material dispersion and waveguide dispersion. As a result of the dispersion, an optical waveguide acts as a low-pass filter for the transmitted signals.

**Duplex:** Referring to a type of data transmission, either half or full. Half duplex permits only one-way communication. Full duplex allows simultaneous two-way transmission.

**Electromagnetic Interference (EMI):** Flowing currents generate magnetic fields. Depending on the strength and proximity, these magnetic fields can induce unwanted current in nearby conductive media, negatively affecting signal transfer.

**End Finish:** Quality of the surface at an optical fiber's end, commonly described as mirror, mist, hackle, chipped, cracked or specified by final grit size used in polishing.

**FDDI (Fiber Distributed Data Interface):** A standard for a 100 Mbs fiber optic area network.

**Fiber:** Any filament or fiber made of dielectric materials that guides light.

**Fiber Channel:** A high speed point-to-point, ANSI Optical Communications Standard that supports data transfer rates up to 1,062.5 Mbs (1 Gps).

**Fiber Cleaving:** Controlled fracture of an optical fiber along a crystalline plane which results in a smooth surface.

**Fiber Optics:** Branch of optical technology dealing with the transmission of radiant power through fibers made of transparent materials such as glass, fused silica or plastic.

**FOTP:** Abbreviation for fiber optic test procedures, which are defined in TIA/EIA Publication Series 455.

**Frequency:** Number of cycles per unit of time, measured in Hertz (Hz).

**Fusion Splice:** Splice accomplished by the application of localized heat sufficient to fuse or melt the ends of two lengths of optical fiber, forming a continuous single fiber.

**Gigabit:** One billion bits of information.

**Gigahertz (GHz):** One billion Hertz.

**Graded-Index Fiber:** An optical fiber core that has a nonuniform index of refraction. The core is composed of concentric rings of glass, which have refractive indices that decrease from the center axis. The refractive index is changed in a systematic way from the center to the edges in order to decrease modal dispersion.

**Hertz:** Measurement unit of frequency.

**Hybrid Cable:** A fiber optic cable containing two or more different types of fiber (e.g., multimode and singlemode).

**Index of Refraction:** The ratio of light velocity in a vacuum to its velocity in a given transmission medium.

**Infrared (IR):** The range of electromagnetic wavelengths between the visible part of the spectrum (750nm) and microwaves (30µm).

**Insertion Loss:** The attenuation caused by insertion of an optical component such as a connector, splice or coupler.

**Intensity:** Irradiance.

**Interbuilding:** Between buildings.

**Intrabuilding:** Within a building.

**Jumper:** Fiber optic cable that has connectors terminated on both ends.

**KPSI:** Abbreviation used to denote a measurement unit of thousands of pounds per square inch. Commonly used in the fiber proof test tensile strength measurement.

**Kevlar:** DuPont trade name for aramid material (see *Aramid Yarn*).

**Kilometer:** Unit of measure for length equal to 1000 meters and about 3,281 feet.

**Laser:** A device which produces a narrow band of light and is used as a transmitting device for light signals traveling along optical fibers. Laser is an acronym for Light Amplification by Stimulated Emission of Radiation.

**Launch Angle:** Angle between the propagation direction of the incident light and the optical axis of an optical waveguide.

**LED:** Acronym for Light Emitting Diode. It is a semiconductor device that emits incoherent light from a p-n junction (when biased with an electrical current).

**Light:** In the laser and optical communications fields, the portion of the electromagnetic spectrum that can be handled by the basic optical techniques used for the visible spectrum extending from the near ultraviolet region of approximately 0.3 micron, through the visible region and into the mid-infrared region of about 30 microns.

**Light Diffusion:** Scattering of light by reflection or transmission. Diffuse reflection results when light strikes an irregular surface such as a frosted window or coated light bulb.

**Light Emitting Diode:** See *LED*.

**Lightwaves:** Electromagnetic waves in the region of optical frequencies. The term "light" was originally restricted to radiation visible to the human eye, with wavelengths between 400 and 700nm. However, it has become customary to refer to radiation in the speed regions adjacent to visible light as "light" to emphasize the physical and technical characteristics they have in common with visible light.

**Loose Tube:** Type of cable design in which coated fibers are encased in buffer tubes offering excellent fiber protection and segregation. Mainly used in outdoor cable types.

**MDPE:** Acronym for Medium Density Polyethylene. MDPE is a form of polyethylene commonly used as a jacketing material for outdoor fiber optic cables (see *PE*).

**Macrobending:** Macroscopic axial deviations of a fiber from a straight line.

**MegaHertz:** One million Hertz.

# Glossary

**Microbending:** Curvatures of the fiber which involve axial displacements a few micrometers and spatial wavelengths of a few millimeters. Microbends cause loss of light and consequently increase the attenuation of the fiber.

**Micrometer ( $\mu\text{m}$ ):** One millionth of a meter or a micron. Conventional unit of measurement for optical fibers.

**Micron:** See *Micrometer*.

**Modal Dispersion:** Pulse spreading due to multiple light rays traveling different distances and speeds through an optical fiber.

**Mode:** A term used to describe an independent light path through a fiber, as in multimode or singlemode.

**Mode Field Diameter (MFD):** The diameter of optical energy in a singlemode fiber. Because the MFD is greater than the core diameter, MFD replaces core diameter as a practical parameter.

**Monochromatic:** Consisting of a single wavelength. In practice, radiation is never perfectly monochromatic but, at best, displays a narrow band of wavelengths.

**Multimode Fiber:** An optical waveguide in which light travels in several modes. Typical core and cladding sizes are 62.5 and 125  $\mu\text{m}$ , respectively.

**Multiplex:** Combining two or more signals into a single bit stream that can be individually recovered.

**Nanometer:** One billionth of a meter (nm).

**National Electric Code (NEC):** Defines building flammability requirements for indoor cables.

**Numerical Aperture (NA):** Measure of the range of angles of incident light transmitted through a fiber. Depends on the differences in index of refraction between the core and the cladding. (The number that expresses the light-gathering ability of a fiber.)

**Optical Return Loss (ORL):** The ratio, expressed in decibels, of optical power reflected by a component or an assembly to the optical power incident on a component or assembly that is induced into a link or system.

**Optical Time Domain Reflectometer (OTDR):** An instrument used to measure the transmission performance of optical fibers.

**Optical Transmitter:** See *Transmitter*.

**Optical Waveguide:** Dielectric waveguide with a core consisting of optically transparent material of low attenuation (usually silica glass) and with cladding consisting of optically transparent material of lower refractive index than that of the core. It is used for the transmission of signals with lightwaves and is frequently referred to as a fiber. In addition, there are some optical components, such as laser diodes, which are referred to as optical waveguides.

**PE:** Abbreviation used for polyethylene. Polyethylene is a type of plastic, commonly used as a jacketing material for outside plant cables, that possesses good mechanical properties including good moisture resistance. However, it is very flammable and not suitable for indoor jacketing applications.

**PVC:** Abbreviation used for polyvinyl chloride. Polyvinyl chloride is a plastic material that is widely used as a jacketing material in indoor cables.

**PVDF:** Abbreviation denoting polyvinylidene fluoride, a fluoropolymer plastic material often used as a jacket in plenum cables, especially in larger fiber count cables.

**Pigtail:** A fiber optic connector that is terminated to one end of an optical fiber cable. A short length of optical fiber, permanently fixed to a component, used to couple power between the component and a transmission fiber.

**Plenum:** The air handling space such as that found above drop-ceiling tiles or in raised floors. It is also the most stringent fire code rating for indoor cables.

**Plenum Cable:** A cable that meets the most stringent flammability and smoke-generating test and is suitable for installation in a plenum area without a conduit.

**Power:** The rate at which energy is transferred.

**Preform:** A glass structure from which an optical fiber waveguide can be drawn.

**Primary Coating:** The plastic coating applied directly to the cladding surface of the fiber during manufacture to preserve the integrity of the surface.

**Receiver:** A detector and electronic circuitry to change optical signals into electrical signals.

**Reflection:** The abrupt change in direction of a light beam at an interface between two dissimilar media so that the light beam returns into the media from which it originated.

**Refraction:** The bending of a beam of light at an interface between two dissimilar media or in a medium whose refractive index is a continuous function of position (graded index medium).

**Refractive Index:** The ratio of the velocity of light in a vacuum to that in an optically dense medium.

**Repeater:** In an optical-fiber communication system, an optoelectronic device or module that receives an optical signal, converts it to electrical form, amplifies it (or in the case of a digital signal, reshapes, retimes or otherwise reconstructs it) and retransmits it in optical form.

**Riser:** Pathways for indoor cables that pass between floors. It is normally a vertical shaft or space. A riser cable rating indicates good flammability characteristics, but not necessarily low smoke as in a plenum type.

# Glossary

**Scattering:** Property of glass that causes light to deflect from the fiber and contributes to optical attenuation.

**Simplex:** Transmission in only one direction. Generally a communications system or device capable of transmission in one direction only.

**Singlemode Fiber:** Optical fiber with a small core diameter (typically 9  $\mu\text{m}$ ) in which only a singlemode, the fundamental mode, is capable of propagation. This type of fiber is particularly suitable for wideband transmission over large distances, since its bandwidth is limited only by chromatic dispersion.

**Source:** A light emitter, either an LED or laser diode, in a fiber optic link; a device that when properly driven will produce information-carrying optical signals.

**Spectral Bandwidth:** The difference between wavelengths at which the radiant intensity of illumination is half its peak intensity.

**Speed of Light:** 186,000 miles per second.

**Splice:** A permanent joint between two optical waveguides.

**ST® Connector:** Type of connector used on fiber optic cable utilizing a spring-loaded twist-and-lock coupling similar to the BNC connectors used with coaxial cabling.

**Step Index Fiber:** A fiber having a uniform refractive index within the core and a sharp decrease in refractive index at the core/cladding interface.

**Strength Member:** Part of a fiber optic cable composed of aramid yarn, steel strands or fiberglass filaments that increase the tensile strength of the cable.

**Tight Buffer:** Type of cable construction whereby each glass fiber is tightly buffered by a protective thermoplastic coating to a diameter of 900  $\mu\text{m}$ . Increased buffering provides ease of handling and connectorization.

**Time-Division Multiplex (TDM):** The process or device by which more than one signal can be sent over a single channel by using different time intervals for the different signals. This may be done by varying the pulse duration, pulse amplitude and pulse position.

**Total Internal Reflection:** The total reflection that occurs when light strikes an interface at angles of incidence greater than the critical angle.

**Transmitter:** A driver and a source used to change electrical signals into optical signals.

**UL:** Abbreviation for Underwriters Laboratories, Inc., a non-profit organization that rates fiber optic cables according to their flammability characteristics. (See *Plenum* and *Riser*.)

**VCSEL (Vertical Cavity Surface Emitting Laser):** A specialized laser diode used in fiber optic communications to improve efficiency and increase data speeds. These devices emit energy at 850 nm and 1300 nm. The VCSEL emits a narrow, more nearly circular beam than traditional light emitting diodes (LEDs) or laser diodes, which makes it easier to get the energy from the device into an optical fiber.

**Wavelength:** The distance, measured in the direction of propagation, of a repetitive electrical pulse or waveform between two successive points that are characterized by the same phase of vibration.

**Zero-Dispersion Wavelength:** Wavelength at which the chromatic dispersion of an optical fiber is zero. Occurs when waveguide dispersion cancels out material dispersion.