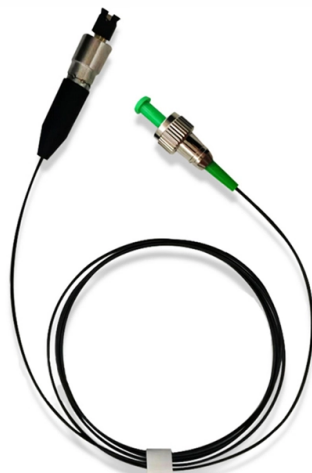


Hollow optical cable and copper cable



Overview

An optical fiber, or optical fibre, is a flexible glass or plastic fiber that can transmit light from one end to the other.

Key Takeaways

Fiber optic cables transmit data using light through a glass or plastic core, offering higher speed, bandwidth, and longer distance capabilities than copper cables, which use electrical signals. Construction and Transmission

Fiber optic cables consist of a thin glass or plastic core, about the width of a human hair, surrounded by cladding that keeps light signals contained. Data is transmitted as light pulses, allowing photons to travel at nearly the speed of light. The cable is further protected with layers of plastic, gel-filled sleeving, or Kevlar for strength and fire resistance, making it immune to electrical interference and safe in high-voltage environments . Copper cables use electrical currents to transmit data. They come in types such as twisted pair cables (with insulated copper wire pairs twisted together) and coaxial cables (a central conductor with insulation and shielding). Copper is an excellent conductor of electricity, cost-effective, and widely compatible with existing hardware, but it is susceptible to electromagnetic interference and signal degradation over longer distances .



Performance Comparison

- **Bandwidth and Speed:** Fiber optics support extremely high bandwidth and data rates, with commercial deployments achieving 400–800 Gbps and advanced systems reaching up to 1.6 Tbps over kilometers. Copper cables are limited to shorter distances (typically up to 100 meters) and lower speeds due to signal attenuation and crosstalk .
 - **Distance and Signal Loss:** Fiber experiences minimal signal loss (low attenuation) over long distances, while copper loses a significant portion of signal strength over the same distance, often requiring repeaters or boosters .
 - **Interference:** Fiber is immune to electromagnetic interference (EMI) and electrostatic discharge (ESD), whereas copper is prone to interference from nearby electrical devices .
 - **Durability and Size:** Fiber cables are lighter, thinner, and more durable than copper, making installation easier and reducing space requirements in conduits and racks .
- Cost and Installation

Copper cables are generally cheaper to purchase and install, especially for short-distance connections. Fiber optic cables have a higher initial cost, particularly if retrofitting existing infrastructure, but offer long-term savings through reduced maintenance, lower cooling requirements, and scalability for future high-bandwidth needs .

Applications

- Fiber optic cables are ideal for long-distance communication, high-speed internet, data centers, and environments requiring high reliability and minimal interference .
- Copper cables remain suitable for short-distance connections, legacy systems, and applications where cost is a primary concern, such as office networks or Power over Ethernet (PoE) setups .

Key Takeaway

While copper cables are cost-effective and widely compatible, fiber optic cables provide superior speed, bandwidth, distance, and immunity to interference, making them the preferred choice for modern high-performance networks, data centers, and long-distance communication infrastructure .

Article Content

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