

Single Mode Fiber and Multimode Fiber

Fiber optic cables are specified using the mode, composition (glass/plastic), and core/cladding size; for example, 8.3 micron core/125 microcladding single mode glass or 62.5 micron core/125 microcladding multimode plastic. Fiber optic cables fall into two broad categories: single mode and multimode.

- **Single Mode Fiber (SMF)** has a small core (8 to 10 microns) and a long wavelength, near infrared (1310 nm or 1550 nm) light signal, generated by a laser. Single mode cables support data rates up to 100 Gbps and cable runs of many kilometers, depending on the quality of the cable and optics. There are two grades of SMF cable; OS1 is designed for indoor use, while OS2 is for outdoor deployment.
- **Multimode Fiber (MMF)** has a larger core (62.5 or 50 microns) and shorter wavelength light (850 nm or 1300 nm) transmitted in multiple waves of varying length. MMF uses less expensive optics and consequently is less expensive to deploy than SMF. However, it does not support such high signaling speeds or long distances as single mode and so is more suitable for LANs than WANs.



Optical transceivers for SMF are now only slightly more expensive than ones for MMF. Consequently, SMF is often used for short range applications in datacenters, as well as for long distance links. SMF still comes at a slight price premium, but it provides better support for 40 Gbps and 100 Gbps Ethernet standards.

MMF is graded by **Optical Multimode (OM)** categories, defined in the ISO/IEC 11801 standard:

- **OM1/OM2**—62.5-micron cable is OM1, while early 50-micron cable is OM2. OM1 and OM2 are mainly rated for applications up to 1 Gbps and use LED transmitters.
- **OM3/OM4**—these are also 50-micron cable, but manufactured differently, designed for use with 850 nm Vertical-Cavity Surface-Emitting Lasers (VCSEL), also referred to as laser optimized MMF (LOMMF). A VCSEL is not as powerful as the solid-state lasers used for SMF, but it supports higher modulation (transmitting light pulses rapidly) than LED-based optics.

Fiber Ethernet Standards

Ethernet standards over fiber set out the use of different types of cable for 100 Mbps, 1 Gbps, and 10 Gbps operation. There are variants for long wavelength optics, required for long distance transmission, and short wavelength optics.

Specification	Optics	Cable	Maximum Distance	Connectors
100BASE-FX	1300 nm	MMF (OM1) MMF (OM2)	2 km (1.2 miles)	ST, SC, MT-RJ
100BASE-SX	850 nm	MMF (OM1) MMF (OM2)	550 m (1804 feet)	ST, SC, LC
1000BASE-SX	850 nm	MMF (OM1) MMF (OM2) MMF (OM3)	275 m (902 feet) 550 m (1804 feet)	ST, SC, LC, MT-RJ
1000BASE-LX	1300 nm 1310 nm	MMF (OM1/ OM2/OM3) SMF (OS1/OS2)	550 m (1804 feet) 5 km (3.1 miles)	SC, LC
10GBASE-SR	850 nm	MMF (OM1) MMF (OM2) MMF (OM3) MMF (OM4)	33 m (108 feet) 82 m (269 feet) 300 m (984 feet) 400 m (1312 feet)	SC, LC
10GBASE-LR	1310 nm	SMF (OS1/OS2)	10 km (6.2 miles)	SC, LC