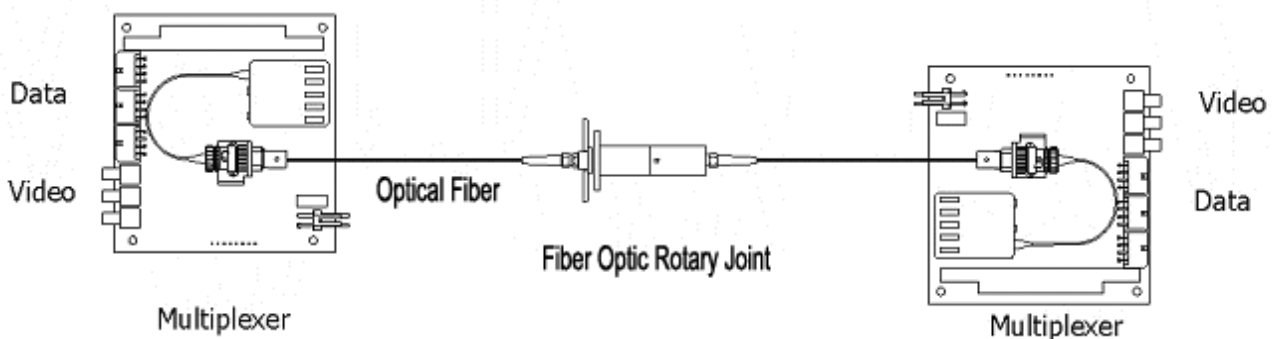
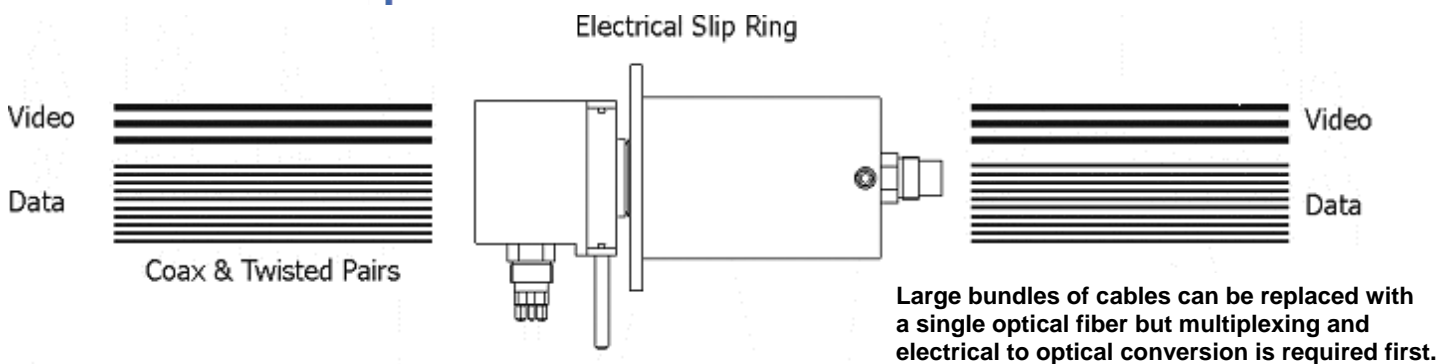
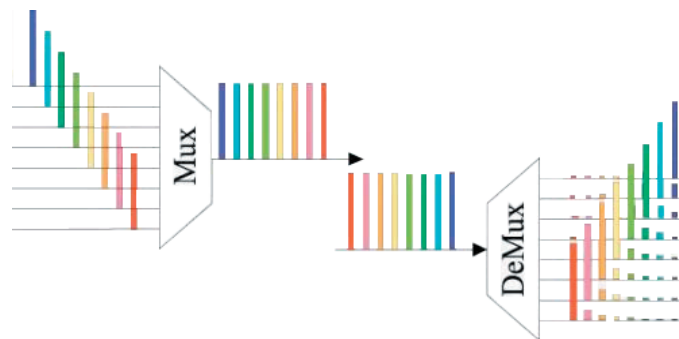


Introduction to Multiplexing in Fiber Optics

Halifax Operation

The bandwidth properties of optical fiber are well known and make it the media of choice for high-speed data and video applications. However, various forms of multiplexing are required to take advantage of this bandwidth. Time division and wavelength division multiplexing are the two most commonly used.

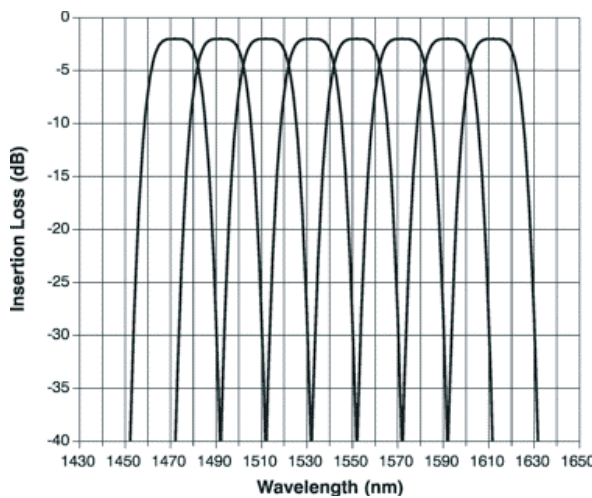
As fiber is best suited to digital transmission, many low-rate digital signals can be time division multiplexed (TDM) using electronic parallel-to-serial converters like the Agilent G-Link or the Cypress Hotlink. Several low rate signals are combined into a single high-speed channel for transmission and then reconstructed or broken out at the receiving end. Although high-speed TDM devices are available for aggregate data rates of 10-40 Gbps for telecommunications applications, affordable components, e.g. TDM ICs, fiber optic transceivers and test equipment, are currently limited to 2.5 Gbps. TDM can also be done in several stages, e.g. programmable logic devices (PLDs) can be used to combine many low-rate signals. Over-sampling using a common clock is required when the signals are asynchronous. Wavelength division multiplexing (WDM) is used to transmit more than one high-speed digital data stream on a single optical fiber. Different wavelengths of light, i.e. different colors, propagate in a single fiber without interfering as shown below. The devices that do the optical combining and separation are referred to as WDMs. These are passive optical devices that typically employ optical filters or gratings.



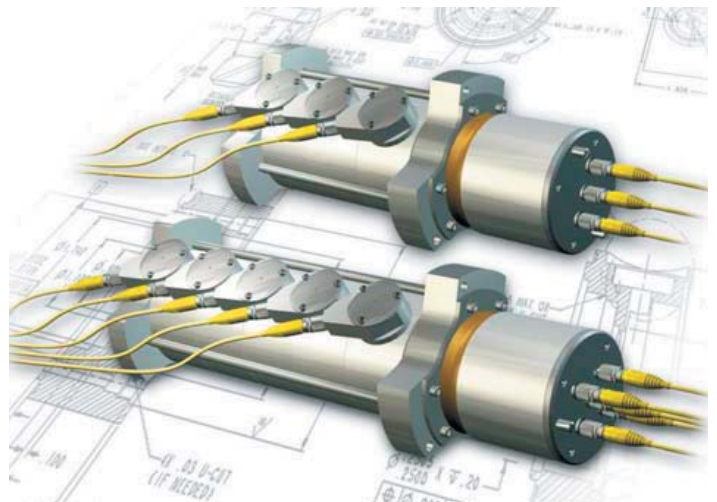
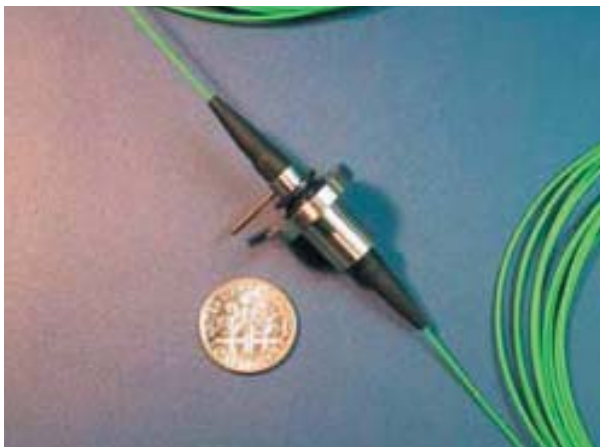
WDMs for 1310 and 1550 nm are common and often used to provide bi-directional transmission in a single fiber. These are compact (2 mm x 50 mm) inexpensive devices. Dense or DWDM using precision filters and lasers with tight temperature control are available that allow 80 or more channels, i.e. wavelengths, on a single fiber with 0.4 nm spacing. However costs are 3 - 5 times higher.

In the past few years, Coarse or CWDM technology has become commercially available which provides 8 or more channels with a broader 20 nm wavelength spacing that, coupled with a new laser diode technology (VCSEL), obviates the need for extensive laser screening and precise temperature control resulting in greater cost effectiveness. High reliability commercial transceivers and WDMs of this type are available.

Coarse WDM offers 8 - 10 channels at 20 nm optical spacing in a single fiber. An add / drop CWDM module is shown (right) that permits a specific wavelength to be extracted or inserted from a fiber.



Moog Components Group also produces related devices from simple single pass fiber optic rotary joints (Model 286, below left) to multichannel designs like the (Model 242, below right) for both multimode and singlemode optical fiber. These are often used to replace many circuits in electrical slip rings with a high bandwidth, low crosstalk, EMI immune alternative that can be more readily upgraded.



Specifications and information are subject to change without prior notice.

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