

How Do Fiber Optic Couplers Work And How Are They Made?

:: The need for fiber optic couplers

We use electronic couplers all the time: such as a telephone coupler which lets you connect both a telephone and a fax machine to the same telephone line. Or a CATV coupler which lets you connect several TV sets to a single cable from Comcast. Basically you can buy these couplers from Home Depot or other electronic retailers.

Optical couplers have the same functionality as electronic couplers: They split the signal to multiple points(devices). Fiber optic couplers are needed for tapping(monitors the signal quality) or more complex telecommunication systems which require more than simple point-to-point connections, such as ring architectures, bus architectures and star architectures.

:: Passive couplers and active couplers

Fiber optic couplers can be either active or passive devices. The difference between active and passive couplers is that a passive coupler redistributes the optical signal without optical-to-electrical conversion. Active couplers are electronic devices that split or combine the signal electrically and use fiber optic detectors and sources for input and output.

:: The difference between electronic couplers and fiber optic couplers

Electronic couplers are easy to make because electric current flows as long as you have physical contact between conductors. But optical signal is in a completely different domain. You have to align the tiny optical fiber cores precisely (9um for single mode and 50um or 62.5um for multimode fibers), so there won't be a huge power loss when you split the signal.

:: Understanding fiber optic coupler types

Fiber optic coupler types are often defined by their input and output port numbers. They are designed to fulfill different applications.

1. T couplers

T couplers are also called Y couplers which is based on their look. T couplers are three port device with one input and two output ports. One major application is tapping(power monitoring): the input power is split to 5% and 95% respectively on the two outputs. The 5% port is connected to system monitoring hardware to monitor the line quality. Another major application is to split the input to two equal outputs.

2. Tree couplers

Tree couplers usually take one input and split it into multiple (more than two) outputs. Tree couplers can also be used backward (bidirectional) as a combiner. Multiple output signals (now function as the input actually) are combined to a single input (now as the output actually).

3. Star couplers

Star couplers are different from tree couplers because they have multiple inputs and multiple outputs. The fibers radiate from the central point like a star. They often have same number of inputs and outputs (although not always the case).

4. wavelength selective couplers

Wavelength selective couplers are actually WDM (wavelength division multiplexer). They split the signal not based on their power but rather based on their wavelengths. The input signal has several wavelength channels(such as 1510nm, 1520nm, 1530nm, 1540nm and 1550nm, etc). The wavelength selective coupler then routes each wavelength to a different output port.

:: Fiber optic coupler manufacturing technologies

There are majorly three types of manufacturing technologies for fiber optic coupler: micro optics, fused-fiber and planar waveguide.

Micro optics technologies use individual optic elements such as prism, mirrors, lens etc to construct a optical route which functions as a coupler. This is a expensive approach and not as popular as the other two types.

Fuse-fiber couplers use the most basic material - optical fibers. Multiple fiber cores are melted together which let light transmit among them.

Planar waveguides are more like semiconductors. A planar wafer is used to make waveguide couplers. They are more often used for high port count couplers such as 12, 24, and 36 output ports.

About the Author

Colin Yao is an expert on fiber optic technologies and products. To learn even more about [fiber optic couplers](#), [fiber optic polishing](#) and [fiber optic cable](#), visit Fiber Optics For Sale Co. web site.

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