Fiber Optic Switches and Their Uses

Most of us are well aware of the use of fiber optics in local and wide area networks. These networks can be small, spanning relatively short distances (LANs) such as a group of buildings on a college campus or in an industrial complex or large (WANs), spanning long distances such as in cell phone tower interconnections, traffic control systems or even groups of LANs connected to each other.

Figure 1 shows a simplified example of a typical local area network. As you can see there are several (or many) nodes connected together in a ring or "loop" configuration. The loop connects all nodes so that any one node can communicate with any other node by means of the fiber. Fiber optic cable is used because it has the capability of handling very high data rates as well as being virtually interference free. At each node the signal is received from the network for use at the specific node, processed and then re-transmitted to the next node in the ring. If any node should fail due to a loss of operating power the entire network could suffer.

To prevent such a problem optical switches can be employed to actually steer the optical signals to and from the node when power is present and the node is operating properly or to completely bypass the node when there is a problem. There are two types of fiber optic switches commonly available. A so-called "moving fiber switch" and a switch that converts an incoming light signal to an electrical signal, performs its switching functions in the electrical domain and then coverts the processed electrical signal back into a light. Moving fiber switches of the type that ***Liteway, Inc.*** manufactures have a number of advantages compared to electrical ones.

A moving fiber optic switch physically moves the light beam within an optical fiber from one output to another by mechanical means. Since it is the actual light beam that is moved all of the information being carried by the light beam is maintained. There is no optical-to-electrical-to-optical circuitry. The bandwidth of such a switch is therefore essentially that of the bandwidth and modulation scheme used of the optical signal in the fiber itself and as a result extremely high data rates are possible. In addition since the light beam is never demodulated in any way any information being carried by the beam is totally secure. Figure 2 shows a simplified diagram of the operation of a typical 1X2 (SPDT) fiber optic switch.

Figure 3 is a diagram of the operation of a typical Liteway Inc. ***Luxlink***® brand fiber optic bypass switch and figure 4 is a photo of the actual switch itself.

This switch can be controlled by a front panel electrical slide switch or by an electrical signal as desired. If the switch is set to the "normal" mode of operation and power is applied the input light beam will be directed to the receive port and the output will be the light beam applied to the transmit port. Upon loss of operating power however the input light beam will then be directed to the output port and both the transmit and receive ports will be disconnected.

Liteway Inc. (www.luxlink.com) has a wide range of ready to use ***Luxlink*** optical switches from simple on/off versions to configurations that are similar to electrical switches in their function such as SPST, SPDT, DPDT etc. All are packaged in rugged mechanical housings and are totally adjustment free. Multimode as well as single-mode switches (with all standard optical connectors) are available and all that is necessary is to simply connect the appropriate fibers and the switch is "ready to go".

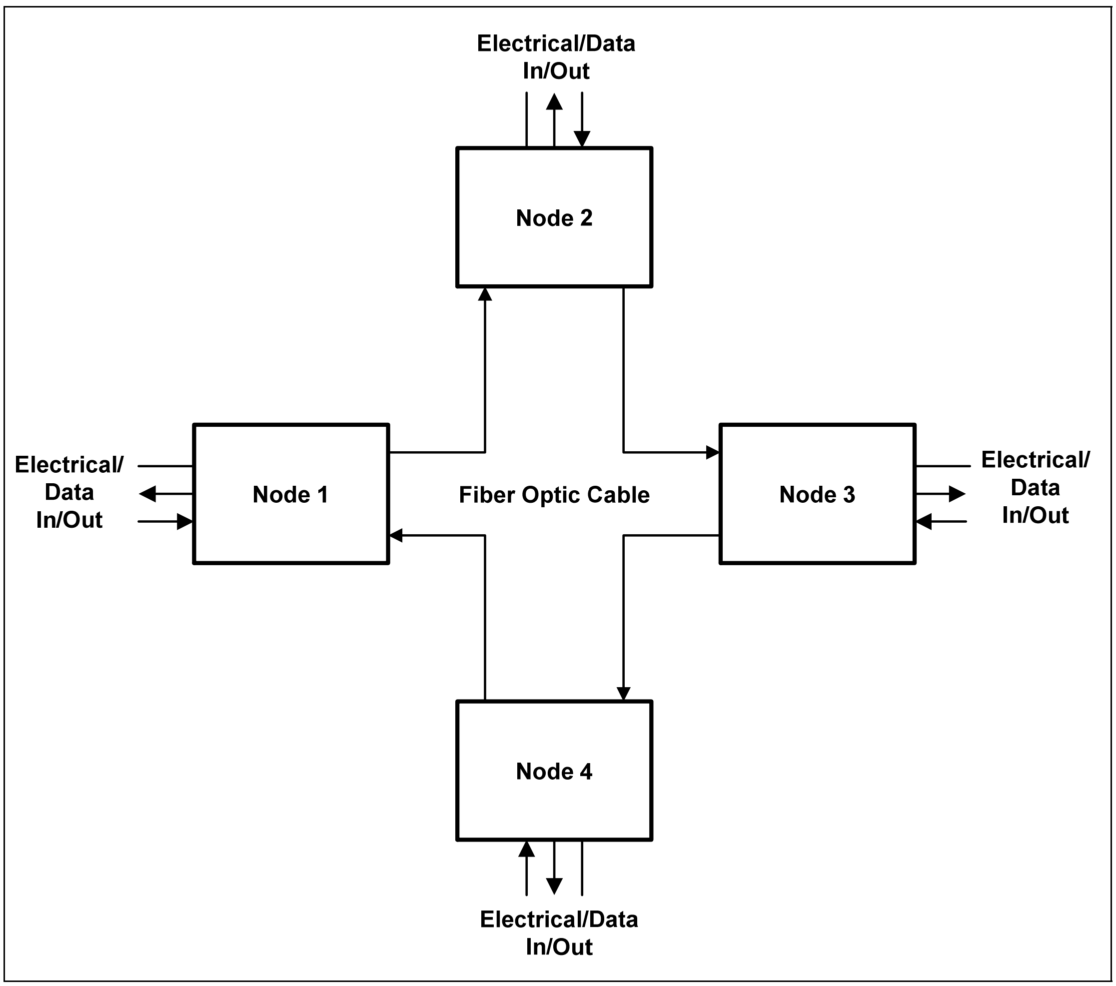

Figure 1, Simplified Fiber Optic Local Area Network

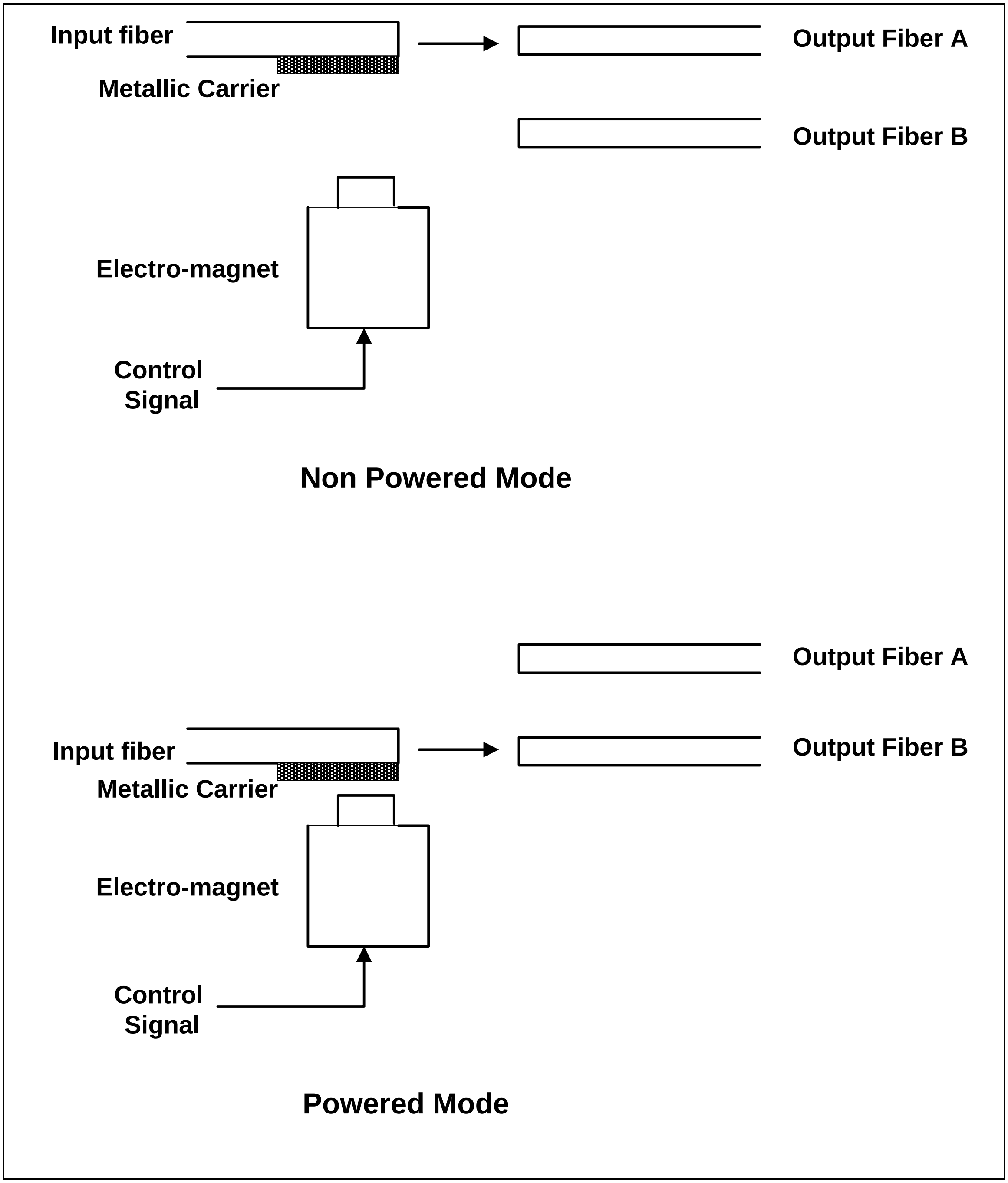

Figure 2, Basic operation of a 1X2 Fiber Optic Switch

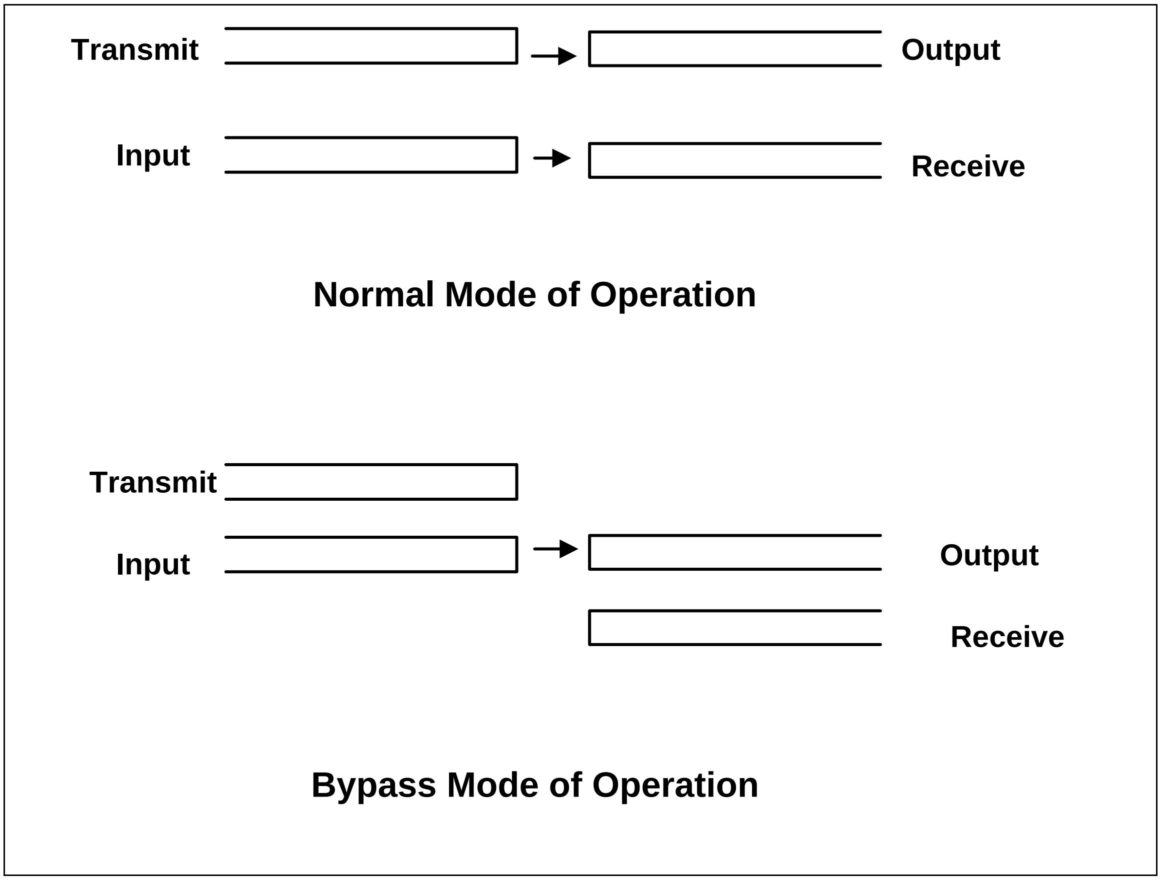

Figure 3, Basic Operation of a Fiber Optic Bypass Switch

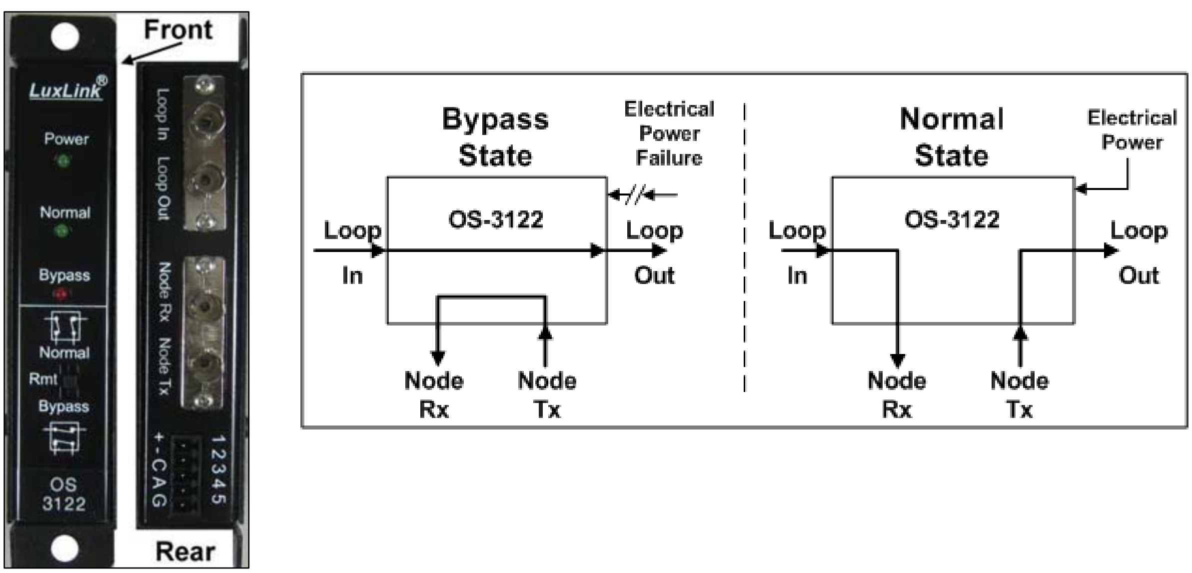

Figure 4, Photo and Block Diagram of an Actual Fiber Optic Bypass Switch

As a result of the fact that all ***Liteway*** fiber optic switches use a moving fiber design as described above, the optical bandwidth that can be conducted by the switch is based on the optical bandwidth of the actual fiber used. For losses of less than 0.1dB the following wavelengths can be conducted:

Multimode optical switches will pass all wavelengths from 850nm to 1550nm.

Single-mode optical switches will pass all wavelengths from 1290nm to 1625nm.

Other wavelengths may pass but total attenuation through the switch can not be guaranteed outside the ranges specified above

While the above primarily discusses the use of fiber optic switches in data networks they are also ideal for such diverse applications as switching fibers for testing purposes, emergency communications systems and signal routing in various media production applications without concern for interference or bandwidth limitations. Again, since the only parameter actually switched is the light within the fiber, all of the parameters of the originally optically encoded signals are preserved.

*For more information contact **Liteway Inc.** at 516-931-2800 or at sales2@liteway.com*