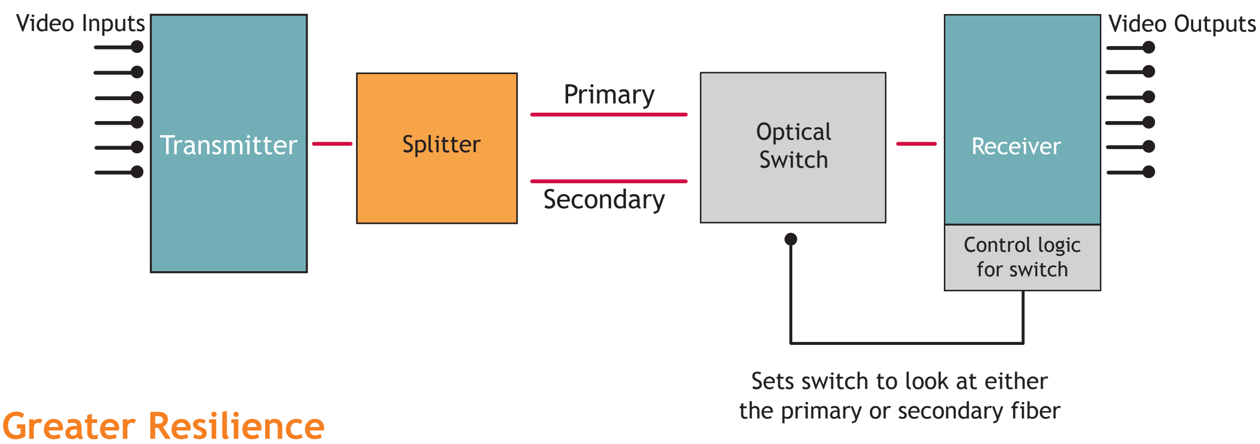
KBC Networks ASFOM
Redundant Systems Information Guide

When redundancy is required in a communication system, the KBC Networks ASFOM range can be configured to provide back up links on fiber for both point-to-point and bus systems. Redundancy is created by offering two independent paths for the optical signal – the primary and the secondary path. Under normal operation, the primary path is used; in the event of a failure, the system switches to the secondary path.

Most of KBC's competitors' solutions will transmit the signals along both paths by splitting the optical signals using some form of optical switch at the receive end to select between the primary and secondary rather than switching the transmit end. The system will switch to the secondary side when an issue is detected in the primary and remain in this position until the primary issue is rectified, at which point it will switch back to the primary.

Optical Splitting Redundant System



Greater Resilience

Rather than using optical splitting to create the redundant path, the KBC solution splits the signals electrically before transmitting the signal through dual transmit and receive optics. This means that an optical component failure will not cause a system failure. In the alternative system that uses optical splitting, an optical failure in the transmitter or receiver will result in a system failure as there is only one set of optics.

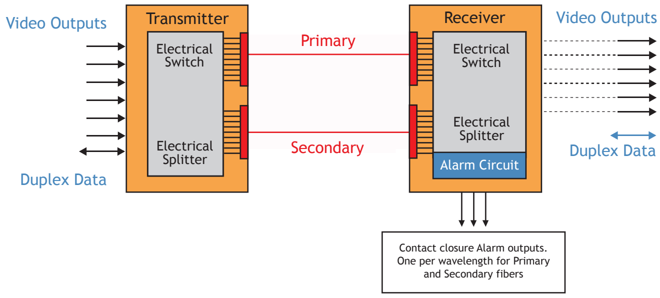
Electrical splitting also removes the need for passive splitters / couplers at each remote position and an optical switch at the receiver end, removing single points of failure and increasing the usable optical budget in the system. By using electrical splitting, KBC offers a much greater level of resilience.

Point-to-Point Systems

Each electrical input - be that video, audio, data, contact closure, telephone or Ethernet - is split and passed to two sets of identical optics. Each set of optics then connects to either the primary or secondary fiber. Depending on the number of signals to be transmitted, the optics may be single wavelength WDM or CWDM. During operation, identical signals are transmitted through both the primary and secondary fibers. The electrical interface requirement will dictate how many optical wavelengths are needed and in what direction each wavelength will travel. Regardless of the number of wavelengths required for the particular application, the unit will provide two optical connections - primary and secondary fiber.

To monitor the link integrity effectively, it's not enough just to look at one optical wavelength; all the individual wavelengths must be monitored. To do this, the KBC solution monitors the electrical signal that corresponds to each optical wavelength. As soon as an electrical signal is lost in the primary path, its corresponding data stream signal in the secondary path is made available and is immediately switched in, maintaining the link integrity. As most systems will have bi-directional signals in them, optical wavelengths are monitored at their receiving end, therefore both ends of the link have monitoring and switching capability.

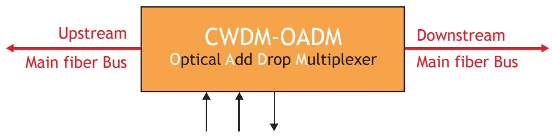
KBC Electrical Splitting Redundant Point-to-Point System



Contact closure alarm outputs at the central location (ASFOM receiver position) indicate the integrity of every optical wavelength transmission link in both the primary and the secondary paths. Where monitoring happens at the remote location, the alarm contact closure is mapped to the central / receiver location. The secondary alarm outputs are required as the system runs in 'hot standby' mode. When there is a failure in the primary side, the system immediately pulls the lost signal automatically from the secondary link. It continues to do this until the issue in the primary link is rectified, at which time the system switches back to taking the information from the primary. As soon as the problem is resolved, the alarm condition is cleared. The contact closure alarm outputs at the central position will be equal to twice the number of optical wavelengths used in the system as there will be one for each primary and secondary fiber.

Bus Systems

CWDM-Optical Add Drop Multiplexer



The remote end nodes on the bus system will have three optical connections - one each for the primary and secondary buses, and then a second or primary connection depending on the node's position in the bus. A CWDM device behind the single optical connections breaks the multiplexed link into the individual wavelengths used at that node.

A redundant ASFOM bus system is essentially the same as a point-to-point system, apart from the bus system always being based on CWDM-OADM technology (Coarse Wave Division Multiplexing Optical Add Drop Multiplexer - see ASFOM Optics guide) to enable a number of remote nodes to link together on a common optical fiber. Like the point-to-point system, every remote bus node features electrical splitting and dual optics to provide the primary and secondary connections.

The remote end nodes on the bus system will have three optical connections - one each for the primary and secondary buses, and then a second primary or secondary connection depending on the node's position in the bus. A CWDM device behind the single optical connections breaks the multiplexed link into the individual wavelengths used at that node.

At each intermediary node there will be four optical connections provided on the equipment - two for the primary ring, upstream and downstream connections, and likewise for the secondary bus. The CWDM-OADM devices at these locations can be thought of as 'T' junctions on a road network. As shown in the diagram, the 'upstream' and 'downstream' connections form e the top section of the 'T', and the wavelengths required at that location are the bottom connections. All these connections ar internal to the KBC devices.

At the central point, the primary and secondary fibers (one connection each) are passed through CWDMs to break out the s individual optical wavelengths. From here the system is identical to the point-to-point in that each electrical signal stream ded monitored and if it is lost, its sister stream is pulled from the secondary fiber bus. Contact closure alarm outputs are provi for every wavelength used in both the primary and secondary fibers. By knowing the wavelengths used at each location, a fiber break can be pin-pointed to between two node positions based on the fact that the wavelengths received in the primary would not be received in the secondary and vice versa. From this matrix, a cable break could be located very easily.

Redundant Bus System