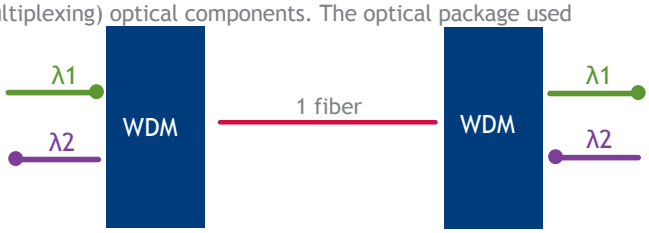
data delivered

ASFOM Optical Configurations Information Guide

ASFOM can be configured to provide either optical point-to-point or bus architecture solutions.

Point-to-Point Systems

Depending on the solution required, ASFOM point-to-point systems will use single wavelength, WDM (Wavelength Division Multiplexing) or CWDM (Coarse Wavelength Division Multiplexing) optical components. The optical package used depends on the quantity and mix of electrical interfaces. The analog video interface, for example, requires more bandwidth than the other interfaces, and if video is required in the ASFOM, it will also dictate the optics used. Up to eight video signals can be transported on one wavelength, therefore; a system requiring four video signals only, would use a single wavelength LASER transmitter. An eight-channel multiplexer would also use a single wavelength and require optics with a data rate of 1.2 Gbps. This data rate (bandwidth) will limit the multimode transmission distance due to modal dispersion, to approximately 2km.

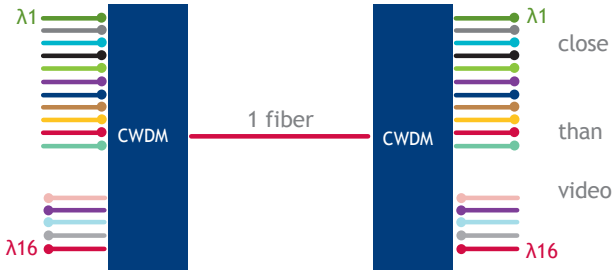


Direction of signal flow is not controlled by the WDM device but by the transmit and receive optics

If the system requires twelve video signals only, a WDM optic would be used to combine two wavelengths together in one fiber. This would be configured by putting eight video signals on one wavelength and the other four video signals on the second wavelength. The two wavelengths would then be multiplexed together. This can be thought of as two different colours of light in the same fiber that do not interfere with each other.

The WDM would also be used in situations where duplex signals are required on a single fiber. In this case, the wavelengths travel in opposite directions. This could be a solution for say four video signals with a duplex data channel, where, as shown in Fig.1, λ1 (wavelength 1) would carry the four video and one half of the data channel, and λ2 would carry the other half of the data channel.

When the system becomes more complex, a CWDM is used. This device is able to multiplex up to sixteen different wavelengths together, enabling them to pass through a single fiber. Each wavelength is spaced 20nm apart and unique optical transmitters and receivers are used to generate and see each particular wavelength. As each wavelength is spaced together, the optical components are more expensive than standard optics. As a result, CWDM-based system costs are much greater standard optic system costs. For example, rather than being twice the cost of a sixteen channel multiplexer, a thirtytwo channel only multiplexer could be up to three times the price simply because of the optics required.



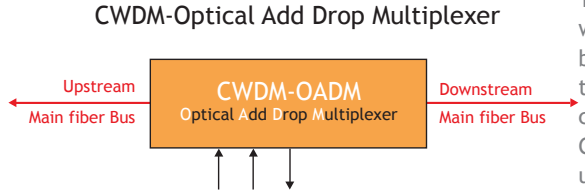
Direction of signal flow is not controlled by the CWDM device but by the transmit and receive optics

The direction of information flow at a particular wavelength dictated by the location of the transmitter optic, associated with the particular wavelength.

Another reason for using a CWDM device in a point-to-point system could be for expansion. If a CWDM system is specified data delivered at day one, future expansion can be accommodated by putting signals on unused CWDM wavelengths and then passing them across the already-installed fiber. As all KBC's products are serial numbered, this is simply a process of checking records and identifying the available wavelengths.

Bus Systems

By utilizing the features of CWDM and CWDM OADM (Optical Add Drop Multiplexer) technology, ASFOM products can be configured as a bus network on a single optical fiber. Due to the CWDM technology, KBC would advise that bus systems are configured on singlemode fiber only.



Local wavelengths are dropped off or inserted via the CDWM-OADM. The CWDM-OADM is configured to meet the system requirements. This example shows two wavelengths inserted and one wavelength being removed from the main optical bus.

The CWDM module combines up to sixteen different optical wavelengths (colors of light) onto one fiber, allowing the bandwidth potential of the fiber to be realized and minimizing the requirements on the installed infrastructure. The system is configured by having a CWDM at the head-end and then using CWDM-OADM units at the remote points. The CWDM-OADM allows unused wavelengths to be added in and used wavelengths to be dropped off where required. The number of wavelengths added in or dropped off will depend on the system requirements at a particular location. The system cannot use more than sixteen wavelengths due to the CWDM.

Expanding a Bus System

Bus systems can also be added to in the future, expanding as the system requirement does. This will have major benefits for the end user as the existing infrastructure can be used and no additional fiber is required. As long as there are unused CWDM wavelengths, additional modules can be added that utilize those wavelengths.

Designing a Bus System

As with point-to-point systems, the maximum number of video signals that can be transmitted at one wavelength is eight. Therefore if ten videos are required at a certain location, two wavelengths are required. If return signals, such as audio or data, are required at the same location, they will also need an optical wavelength.

For example, imagine a railway line with five stations, all monitored from a control room at one end of the line. At each station there are ten PTZ (pan-tilt-zoom) cameras that need to viewed and controlled from the control room. The control room also needs a telephone connection to each remote station. This system will require four ASFOM systems that have ten video, one data and one telephone circuit. Each system will require three optical wavelengths, which equates to twelve out of the sixteen available wavelengths being used. All the ASFOM systems that are at the stations will be classified as transmitter units and their corresponding receivers will be located at the control room.

The example below shows four remote stations (nodes) where each station has four video input signals; a bi-directional data channel and a single Ethernet channel. Due to the electrical signals, each location will require two optical wavelengths to carry the information. At the head-end, all signals are presented to the user.