

AN-033 – Are two FO cables better than one ?

Traditional FO technology uses a single wavelength of light for data transmission in a single cable.

WDM (Wavelength Division Multiplexing) is a technology that transmits more than one wavelength of light on a single FO cable, thereby enabling full-duplex communications on a single cable. It is getting more and more common these days as it offers the following benefits:

1. Halving the amount of FO cable
2. More foolproof as there is no chance of mixing up TX and RX which exists in standard duplex cables
3. Better reliability as compared to duplex cables

This application note attempts to address point 3.

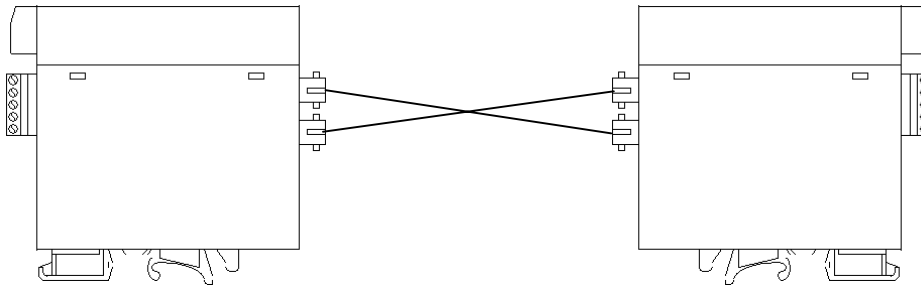


Figure 1 : Standard connection for non-WDM fiber

As shown in figure 1 above, standard fiber optic connections (dual cables) are crossed (i.e. TX to RX etc). We define a case of total communication failure if both, or any one of the fiber optic cable fails.

Let PTF = Probability of Total Communication Failure
P1F = Probability of Cable 1 failing
P2F = Probability of Cable 2 failing

Therefore,

$$PTF(\text{Dual Cable Connection}) = P1F(1 - P2F) + P2F(1 - P1F) + P1F * P2F$$

Or

$$PTF = 1 - (1 - P1F)(1 - P2F)$$

If $P1F = P2F = 5\%$, i.e. 0.05, then $PTF(\text{Dual Cable Connection}) = 0.0975$ or 9.75 %

With WDM, there is only one connection.

This implies that $P2F = 0$ (i.e. no chance of failing since it does not exist)

And the equation for $PTF(\text{Dual Cable Connection})$ reduces to

$$PTF(\text{Single Cable Connection}) = P1F$$

Hence, the $PTF(\text{Single Cable Connection})$ is simply 0.05 or 5 %.

In conclusion, the probability for total communication failure is higher for dual cables as compared to single cables.