Fiber Polarity Rules

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Question: In the design of our data center, it was an easy decision to choose a modular pre-terminated fiber system for our fiber plant and backbone cables. However, selecting a connectivity method and all the corresponding components is very confusing.

Answer: Good choice with selecting fiber cassettes, which are the heart of a modular fiber system and perfect for the data center environment. One of the main concerns in today's data centers is space efficiency and especially as it relates to airflow, which is critical for the equipment. Therefore, selecting smaller diameter cables and high-density, pre-terminated fiber cassettes is preferred when designing your data center's cabling infrastructure.

As you have probably already realized, modular pre-terminated fiber optic cabling systems increase optical port density, reduce congestion in cable pathways and spaces, save on installation time and offer superior optical performance and reliability. They are also supposed to offer system interoperability, but that's where it is confusing – the connectivity method. How do you choose?

The key issue is maintaining polarity. The term "polarity" conjures up meaning of having two oppositely charged "poles," one positive and one negative. In fiber optics, which is a duplex (two-way) or bi-directional transmission method using separate fibers in each direction, the cabling system is based on the same polarity principle as in electricity. The cabling system must provide proper signal "polarity" which means that the transmitter on one end of the channel will connect to the receiver on the other end. Without correct transmit-to-receive polarity from point to point, the channel simply won't work.

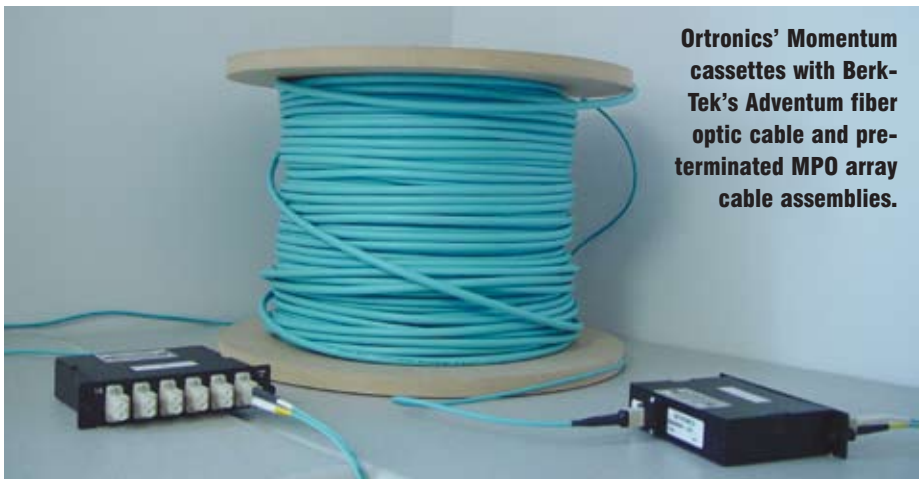
Prior to 2002, there were proprietary connectivity methods to achieve proper polarity using a myriad of connectors, cables and patch cords. Basically, you had to select one manufacturer and stick with it. So, TIA stepped in to put some "rhyme and reason" to the selection, so that end users and installers, like yourself, can follow these termination guidelines to properly select the method and interoperable components that works best for each scenario.

Specifically, the TIA/EIA-568-B.1-7-2006 (Commercial Building Telecommunications Cabling Standard) addresses the polarity issues associated with multi-terminated fibers (also known as "array") connections. In doing so, they suggest three connectivity scenarios, or "methods" with the same goals – to maintain polarity. The confusion stems from the components within each method – three different cable types (A, B, & C) and two different patch cords (A-to-A and A-to-B) and connector and cassette keying. Let's take a closer look at these components to figure out how to build a fiber link in each of the three methods.

PATCH CORDS

The two patch duplex (two-fiber) patch cords used to connect to the fiber cassettes in the cabinets to the transmission equipment are either A-to-A, which cross over or A-to-B, known as "straight-through." You would think it would be the other way around, but you need to see the diagram of the connection from point to point.

The three TIA connectivity methods (A, B or C) specify particular patch cord types for each scenario. Method A utilizes both types (one on each end of the channel). Methods B & C utilize only the straight-through. The advantage of the latter is that you only need to stock one type of patch cord for B & C, but other issues arise with



Ortronics' Momentum cassettes with Berk-Tek's Adventum fiber optic cable and pre-terminated MPO array cable assemblies.

matching cable assembly and cassette selection.

CABLE ASSEMBLIES

Where there are two types of patch cords, there are three general types of array (multi-fiber) cable assemblies. The big differentiator is the alignment pins on the connectors, which are factory installed. You will need to know the difference when ordering the cable type to make sure of proper pin position.

Type A keeps the same fiber position on both ends, except the key on one side is up and on the opposing side it is down. The term "key" refers to a bumped notch on the housing, which is manufactured to assure proper alignment of the MPO (or similar) connector.

Type B reverses the fiber positions at each end (1 to 12 and 12 to 1) and the connector keys are both oriented face up.

Type C looks like Type A with one key side up and one down, but the cable is actually designed so that the adjacent pairs of fibers are crossed from one end to the other (1 to 2, 2 to 1, etc.)

MODULAR CASSETTES

The selection of the modular cassette will also determine the interface needed for plugging into the transceiver terminal equipment on one end and active equipment on the other. Alignment pins are pre-installed on the cassettes to allow near-perfect mating of the connectors at ether end of the array cables.

As with the cables and patch cords, you must select a cassette that has the proper factory-installed adapter for the connectorization method that you are specifying. The rear of the adapter mounted on the cassette defines it as either Method A or Method B to correspond with the TIA standard. The difference in the two is the orientation of the internal MPO connector with respect to mating with the specific type of array connector. Method A cassettes are also used for Method C since the key positions are the same in the two methods.

TIA CONNECTIVITY METHODS

So, at this point, you need to make sure that you have selected the proper patch cords and cable types to mate to your cassettes to build the full fiber link for methods A, B or C, as defined by TIA to maintain optimal polarity and fiber performance in your data center.

The chart, on page 31, provides a guideline to make it easier to choose the components for your end-to-end link, depending on the method that best suits your environment. It's important to note that fiber pair-flipping occurs in the shaded areas. You will need to be aware of this to properly select the correct patch cord and corresponding cable.

UNFURLING THE CONFUSION

There are explicit white papers available written on the importance of polarity and mapping out the different connector methods to help you decide. (Go to www.netclear-channel.com to download "Maintaining Proper Polarity for Modular Pre-terminated Fiber Systems," by Rudolph Montgelas of Ortronics/Legrand) But, the most important consideration is to select one of the recommended methods by the TIA standard, as it will significantly increase reliability and life of your fiber plant within your data center, especially when adding more fiber channels in the future. Standards are important or you may find yourself locked in with one proprietary design and one manufacturer. Consistency is key. ■

"Reel Time" addresses cable topics including both copper and fiber constructions, applications, installation practices and standards updates. If you have a particular cable issue, please send an E-mail to: carol.oliver@nexans.com and we will feature the solution in an upcoming issue.

COMPONENTS REQUIRED FOR TIA CONNECTIVITY METHODS

TIA Connectivity	Patch cord type (one end)	Array adapter type at one end	Array cable-to-cassette keying	Array cable type	Array adapter type at other end	Array cable-to-cassette-keying	Patch cord type at other end
Method A	A-to-B	A	Key Up to Key Down	A	A	Key Up to Key Down	A-to-A
Method B	A-to-B	B	Key Down to Key Down	B	B	Key Up to Key Up	A-to-B
Method C	A-to-B	A	Key Up to Key Down	C	A	Key Up to Key Down	A-to-B

Note: Pair-wise flipping (A-to-B swap) occurs in the shaded component boxes.