MTP® Polarity Management

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Technical Bulletin

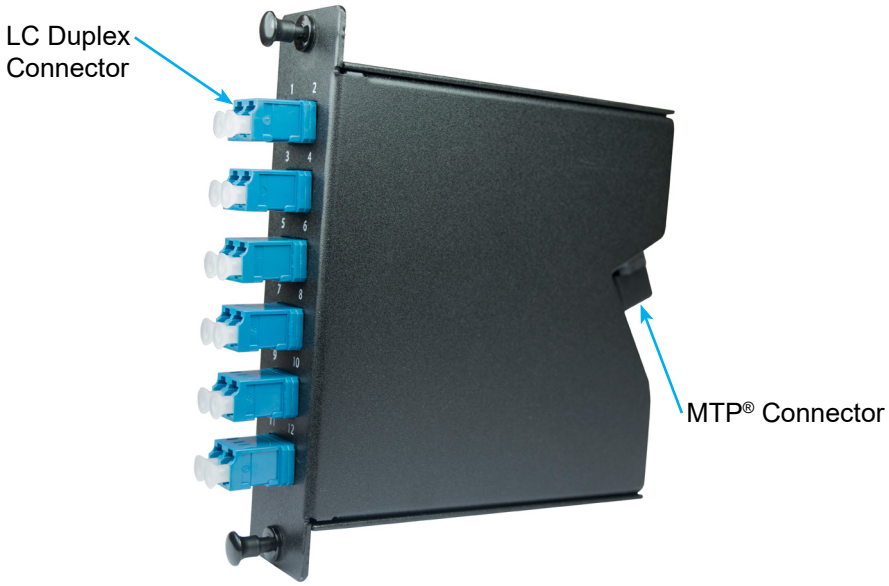
Local area network (LAN) campus and building backbones as well as data center backbones are migrating to higher cabled fiber counts in order to meet system bandwidth needs and provide the highest connectivity density relative to cable diameter to maximize utilization of pathway and spaces. Network designers are turning to MTP® connectorized optical fiber trunk cable designs for today's duplex fiber transmission and to provide an easy migration path for future data rates that will use parallel optics such as 40/100G Ethernet.

Optical cables require unique polarity design considerations to ensure reliable system performance as well as support ease of installation, maintenance and reconfiguration. These Guidelines for Maintaining Polarity Using Array Connectors have been incorporated into the TIA-568-C.0 standard to facilitate use of MTP® connectorized optical cables.

TIA MTP Polarity Guidance

The TIA-568-C.0 standard provides serial transmission fiber polarity guidance for systems using MTP® optical connectivity. Dense wiring requirements in the LAN and data center storage area network (SAN) facilitate the use of 12-fiber array style connectors like the MTP® Connector. Pre-assembled and field-terminated MTP®-to-MTP® connectorized optical cables called trunks are often used in these locations. Since there are MTP® Connectors on both ends of these trunks and the end equipment typically has standard duplex transceiver ports, the trunks are plugged into factory-made breakout furcations called modules that transition from the MTP® Connector to a duplex connector/adapter style (Figure 1).

Figure 1



102 Wright Brothers Ave
Livermore, CA 94551
www.ariatech.com
Phone (925) 447-7500
Fax (925) 447-7511
sales@ariatech.com

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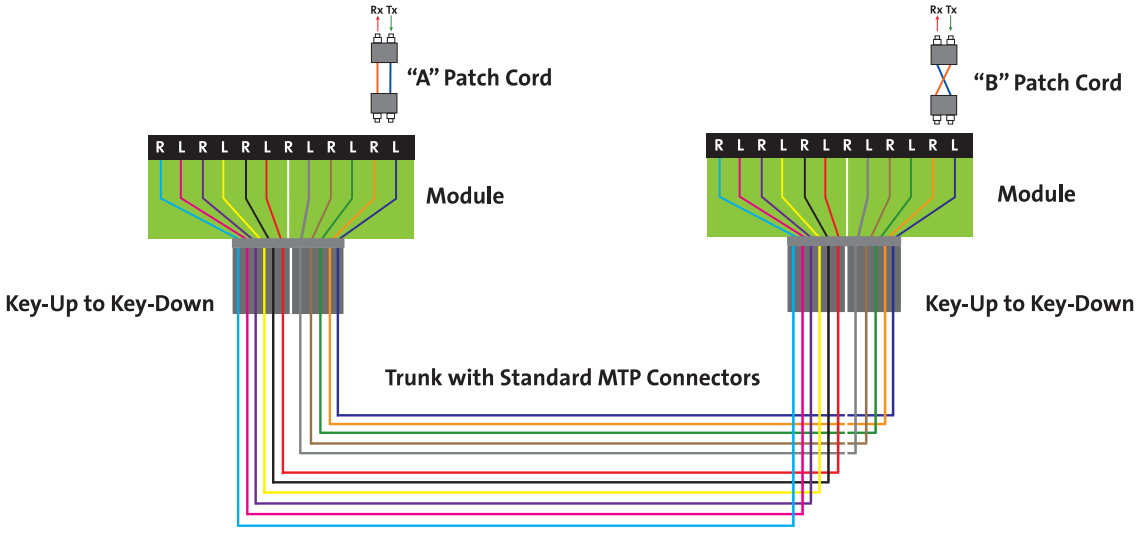
Each 12-fiber MTP® translates into six 2-fiber serial optical circuits that require polarity management that can be achieved using one of numerous methods. Like simplex and duplex connectors and adapters, the MTP® Connectors and adapters are also keyed to ensure the proper orientation is maintained when connectors are mated. With MTP® Connectors, this keying establishes the orientation of one fiber array in one connector relative to the array in the mating connector, but does not ensure that duplex fiber pair polarity is maintained.

The TIA-568-C.0 standard includes guidance on three sample methods identified as Method A, Method B and Method C. It is important to note that the standard states that “While many methods are available to establish polarity, this standard outlines sample methods that may be employed for array cabling systems where the connectors have one row of fibers only.” The word “may” implies that alternate polarity methods, which are not discussed or included in the standard, are available to accomplish the same results. Thus, the standard shows three examples and recognizes that other valid methods also exist, including the Plug & Play™ Universal Systems polarity management method.

Method A

Method A (Figure 2) uses a single module type wired in a “straight-through” configuration and two different patch cords in an optical circuit. One patch cord is straight wired and the other has a pair-wise flip. All components in the channel are mated key-up to key-down. No guidance is included in the standard to differentiate where the patch cord with pair-wise flips should be used and how it should be made so that it is easily recognizable from the regular duplex patch cord “straight-wired.” Because polarity is addressed in the patch cords, the end-user is ultimately responsible for managing it.

Figure 2



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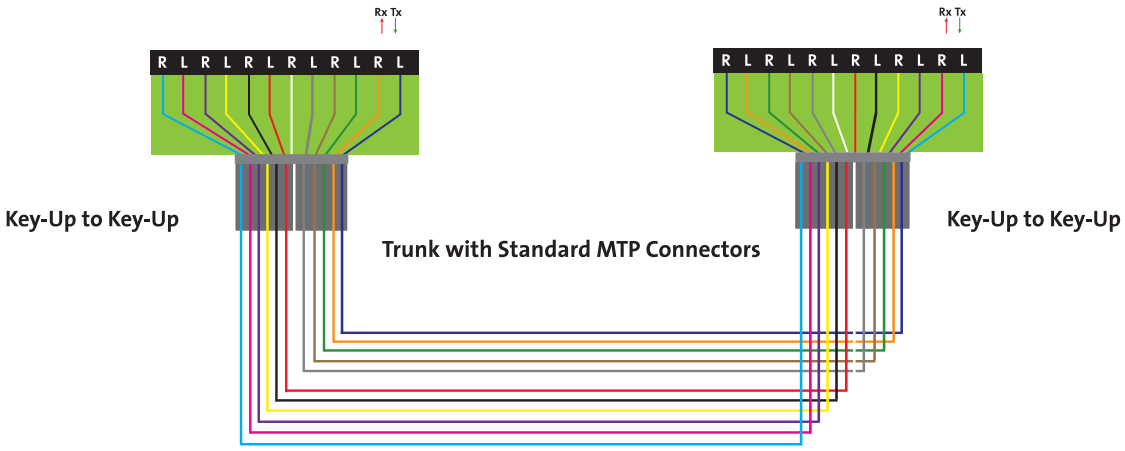
Method B

Method B (Figure 3) uses a single module type wired in a straight-through configuration and standard patch cords on both ends. The differences are that all components in the system are mated key-up to key-up. When the link is configured in this fashion, physical position #1 goes to physical position #12 on the other end. A module on one end is inverted so logically (label-wise) position #1 goes to position #1. This method requires advanced planning for module locations in order to identify the module types and location of the inverted module in the optical link. This adds complexity to the polarity management. Using an MTP® Connector key-up to key-up configuration does not easily accommodate angled polished (APC) single-mode connectors.

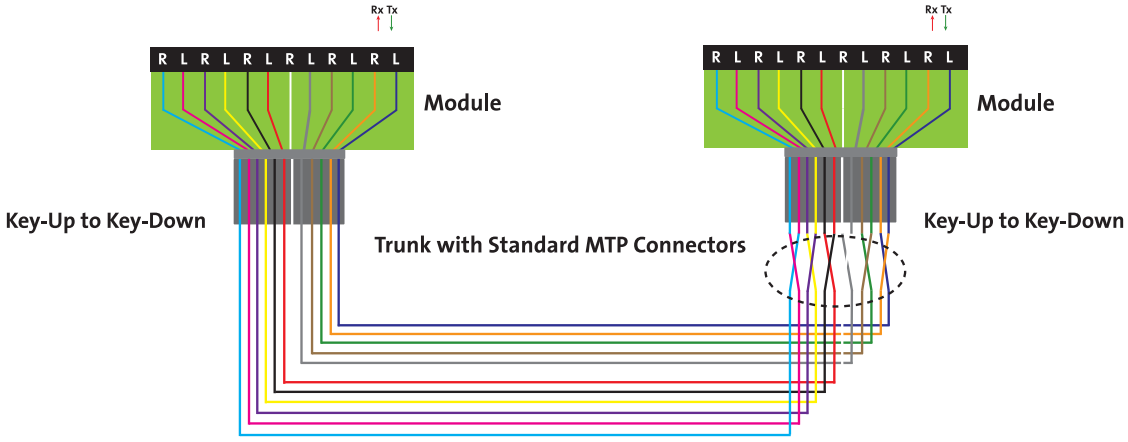
Figure 3



Method C

Method C (Figure 4) uses a pair-wise fiber flip in the trunk cable to correct for polarity. This enables the use of the same module type on both ends of the channel and standard patch cords. Because polarity is managed in the trunk, extending the links requires planning of the number of trunks in order to maintain polarity. The TIA standard does not include text regarding the ability to migrate to parallel optics for Method C, but parallel optic capability can easily be achieved with a special patch cord to reverse the pair-wise fiber flips in the trunk.

Figure 4



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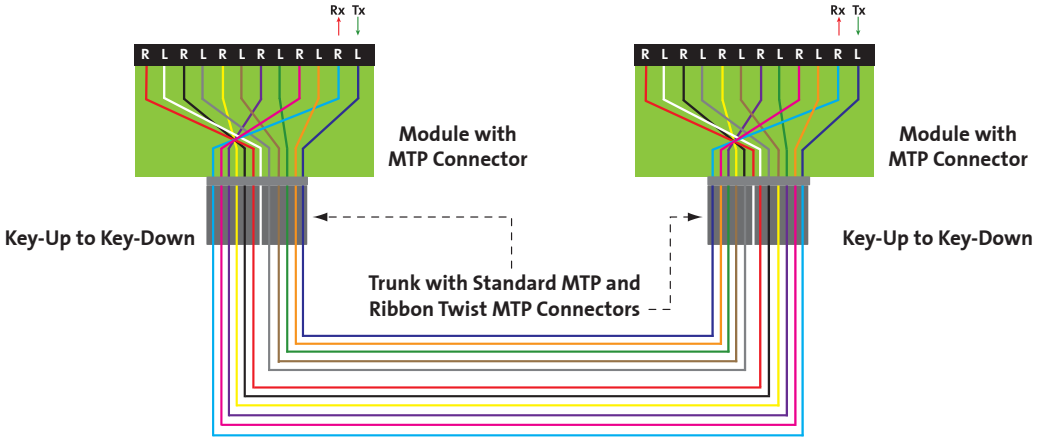
Universal Polarity Management Method

The Plug & Play™ Universal Systems polarity management method (Figure 5) is an enhanced polarity management method that is not included but meets the intent of the TIA standard. The method uses the same module and patch cord type at both ends with no inversion or reconfiguration needed to maintain polarity. Polarity is easily accomplished and managed with the modules internal fiber wiring scheme.

The system is mated key-up to key-down. The method supports simple concatenation of multiple trunks without effecting polarity. The method easily accommodates all simplex/duplex connector types as well as single-mode fiber APC MTP® Connectors. Similar to Methods A, B and C, the universal polarity management method easily facilitates migration to parallel optics. The wired modular system components enable fast and simple networking moves, adds and changes without polarity concerns associated with special polarity-compensating components used in Methods A, B and C.

Figure 5



Conclusion

Each of the methods works when the rules of that method are followed. The user is cautioned, however, not to mix and mate component parts from the various methods. This will not necessarily work. The TIA-568-C.0 standard states “it is recommended that a method be selected in advance and maintained consistently throughout an installation.”

In summary, numerous MTP® polarity methods are available to consider. It is essential that end-users and system designers evaluate each method before implementing to ensure that criteria such as reliability, ease of installation, maintenance and reconfiguration, as well as the ability to easily migrate to higher-data-rate solutions that may require parallel optics, are addressed and satisfied.