Understanding the PanMPO™

Purpose

The purpose of this document is to describe the usage and reason behind the development and characteristics of the PanMPO.

Overview

MPO connectivity has become widely used throughout the industry not only to reduce cable density, but also to prepare for the migration from 10GBASE-SR to 40GBASE-SR.

With the 10GBASE-SR transmission, there are two fibers associated with the channel - one fiber for transmit and one fiber for receive. This configuration is often referred to as a duplex channel. The polarity of these channels (TX to RX) is relatively easy to manage from end to end and if polarity correction is required, it is easy to accomplish in the field by re-arranging the fibers in the duplexing clip. Also, when two of these connectors need to be mated, an adapter with a split sleeve is used to align the ferrules of the two connectors. Shown below is a typical 10GBASE-SR Method A channel.

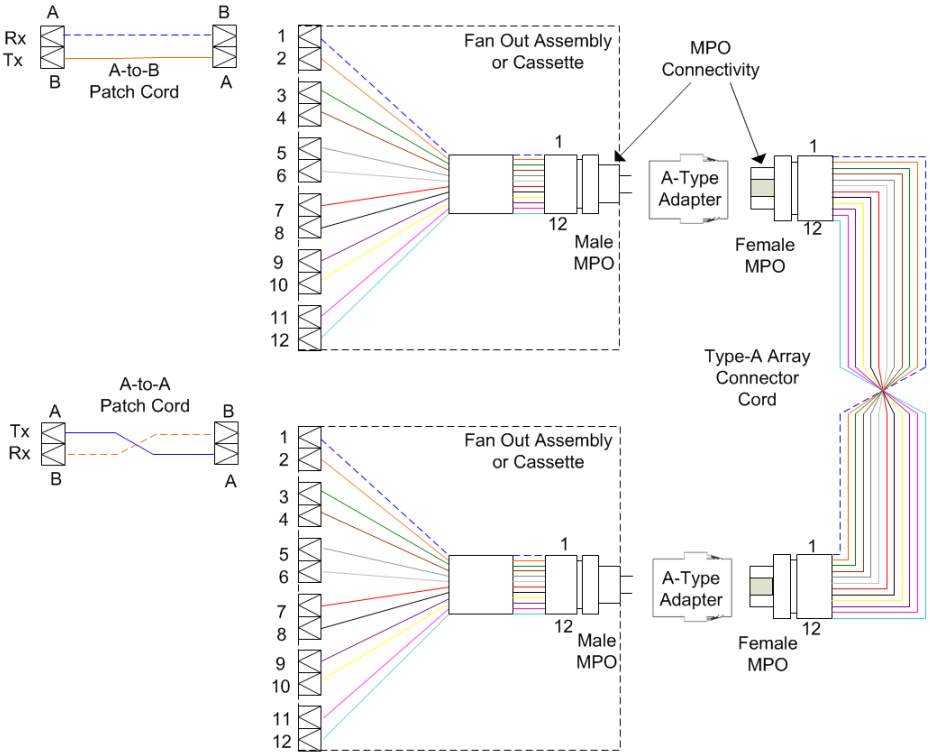


Figure 1. 10GBASE-SR Method A Channel

In the 40GBASE-SR transmission, there are eight fibers associated with the channel - four fibers for the TX signal and four fibers for the RX signal. With multiple fibers being utilized, the polarity of the channel becomes harder to manage from end to end. Additionally, mating of two MPO connectors is not completed with an adapter with a split sleeve but rather with alignment pins that are a fixture on the MPO connector. One MPO connector has alignment holes (this connector is referred to as a female MPO) and the other MPO connector has alignment pins (this connector is referred to as a male MPO).

These two connectors are mated together in a genderless MPO adapter. Figure 2 shows a typical 40GBASE-SR Method A channel.

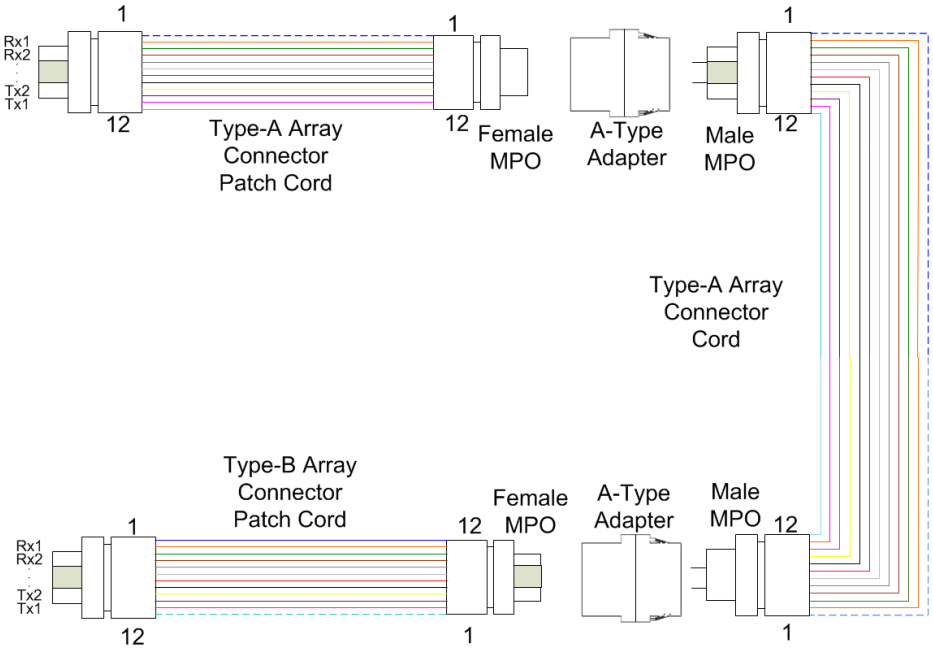


Figure 2. 40GBASE-SR4 Method A Channel

When using MPO based connectivity in the 10G channel, the standard, ANSI/TIA-568C.1-7, calls for a female MPO horizontal cabling infrastructure (as shown in Figure 1) and a male MPO cassette. The male MPO is located within the cassette to protect the fragile alignment pins from damage during installation. In a 40G channel configuration, cassettes are not used and therefore cannot serve to protect the pins. Consequently, in the 40G channel configuration the standard calls for male MPO horizontal cabling (as shown in Figure 2) to protect the alignment pins on the back side of the adapter module rather than have them exposed to possible damage on the end of a patch cord. Male connectors on patch cords pose an additional operational risk to QSFP+ ports should a male connector be inserted due to the QSFP+ ports being configured as male to protect the pins within the port.

Considering this discussion, in order to comply with the ANSI/TIA-568C.1-7 cabling guidelines and provide the optimal pin protection when migrating from a 10G to 40G cabling configuration, the MPO connectors associated with the horizontal cabling infrastructure must be changed from female to male. Given that existing MPO connectivity does not allow for this alteration in the field without significant risk of fiber or connector damage, it seems that the cabling in the horizontal cabling infrastructure would need to be changed out.

In the Method A configuration shown in Figure 2, there are also two different MPO patch cords necessary to complete the 40G channel. Not only does the horizontal cabling MPO change from female to male, but a Method A cord and Method B cord are needed at the ends to complete the channel to ensure proper polarity.

A Method B configuration holds the same gender issues as Method A when migrating from 10G to 40G, but does not need the two different MPO patch cords to complete the channel.

Testing is another challenge present with MPO horizontal solutions. Some testers have a fixed male MPO interface while others have a fixed female MPO interface. In both cases the preferred one jumper testing method, Method B, per TIA-568-C (TIA-526-14A and TIA-526-7) cannot be used for both the male horizontal and female horizontal cabling infrastructures. In the case where the MPO interface on the tester does not match the MPO in the horizontal infrastructure, a three jumper method would need to be utilized. The three jumper method introduces more variability and possibility for error in the testing.

For example, Figure 3 shows a tester with fixed Male MPO interfaces on the source and meter units. When setting the reference, you will need to use a female-to-female MPO reference cord. After setting the reference, in order to test a female horizontal cabling infrastructure, a third reference cable with a male end would need to be introduced to properly test the horizontal cabling infrastructure.

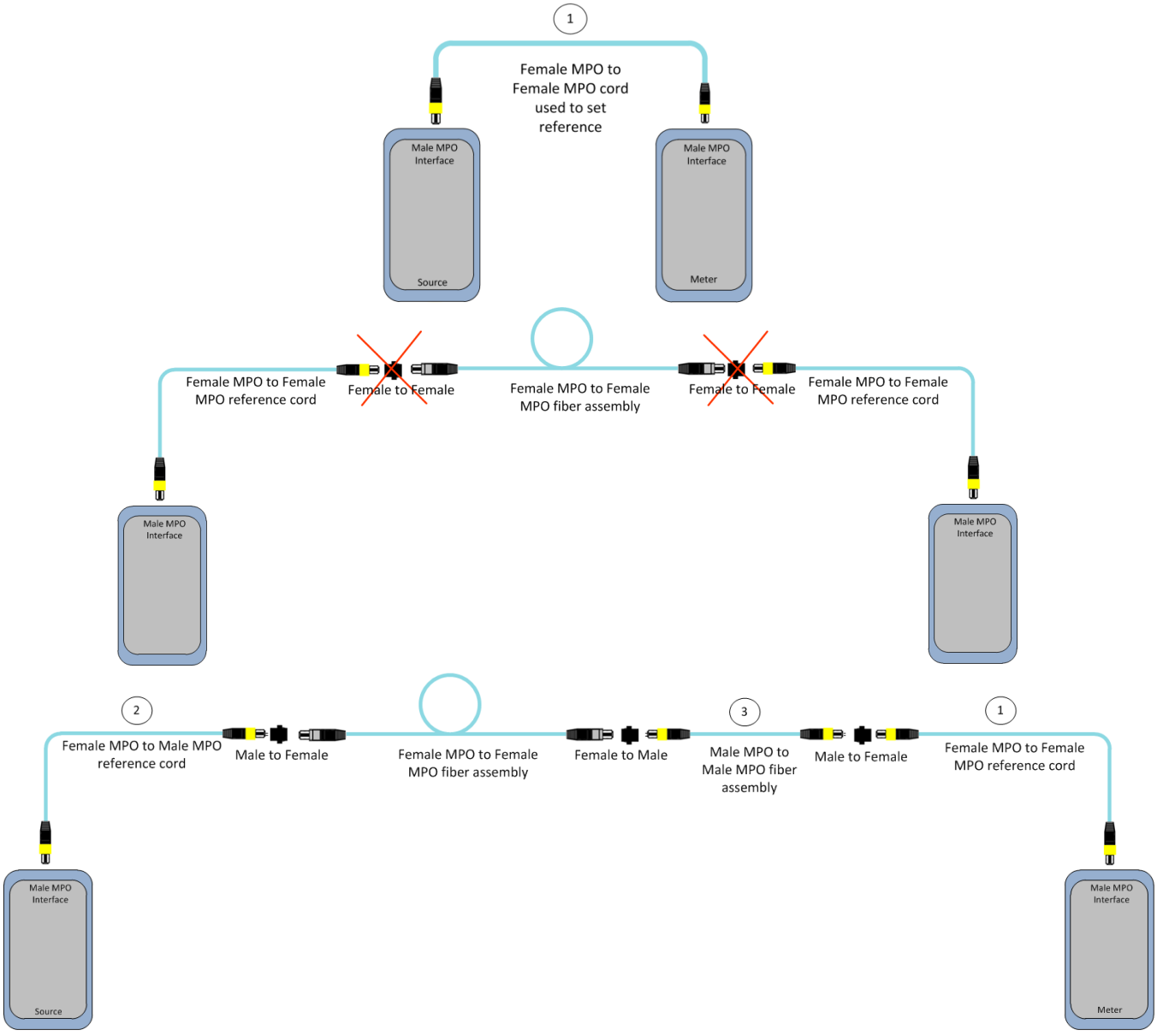


Figure 3. MPO Reference Setting and Link Test Setup if Gender of LUT does not match Gender of Tester Interface

In any of these cases changing either the polarity or gender of the standard MPO connector in the field is not recommended due to the complex construction of the connector. Trying to change either of these characteristics in the field is extremely difficult and may lead to damage to the fiber exposed when attempting to replace the connector housing.

PanMPO™ Connector

Panduit has introduced the PanMPO™ Connector, Figure 4, a universal MPO connector that can have the gender and polarity changed in the field with no risk of damage to the internal ribbon fiber or the connector's end face.

The PanMPO™ Connector is a multiple-fiber push-on/pull-off connector that is IEC-61754-7 and EIA/TIA-604-5 (FOCIS 5) compliant. It can be either male or female in gender or key up or key down in housing orientation.

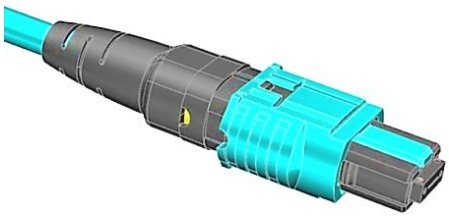


Figure 4. PanMPO™ Connector

What are the General Characteristics of PanMPO?

The PanMPO has an interchangeable housing that enables the user to change the key position on the connector between key up and key down. With this functionality and depending upon the orientation of the connector on the other end of the cable, this feature can make the cordage either a Method A or Method B MPO cord in accordance with ANSI/TIA-568-C.1-7. To identify which way the connector is keyed with respect to fiber one in the MPO ferrule, align the semicircles on the side of the connector (one on the inner housing and one on the connector housing). When the two are aligned the connector is key up with fiber one being on the side of the semicircles. When the two are on opposite sides of the connector, the connector is key down with fiber one remaining on the side of the semicircle located on the inner housing. These scenarios are shown in Figure 5.

Figure 5. Key position on PanMPO™ Connectors

The gender of the connector can be changed by removing the housing and using the gender changing tool to either extend or retract the pins. The tool shown in Figure 6 is used to easily slide the tab back (to retract the pins) or forward (to extend the pins). The tip of the tool inserts into the guide hole provided in the housing and is used to slide the aluminum pin housing forward or back.

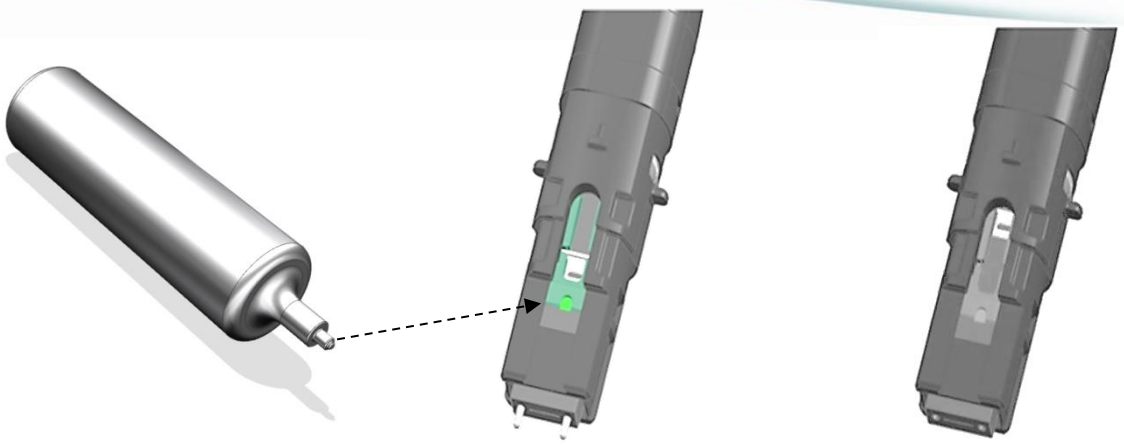


Figure 6. Changing gender on the PanMPO™ Connectors

What type of performance can I expect from the PanMPO?

The PanMPO is both IEC-61754-7 and EIA/TIA-604-5 (FOCIS 5) compliant. It is offered with a standard maximum insertion loss (0.50dB maximum) or optimized maximum insertion loss (0.35dB maximum) with a minimum return loss of 26dB for the multimode fiber solution and standard insertion loss (0.75dB) with a minimum return loss of 55dB for the singlemode solution.

Where can I use PanMPO?

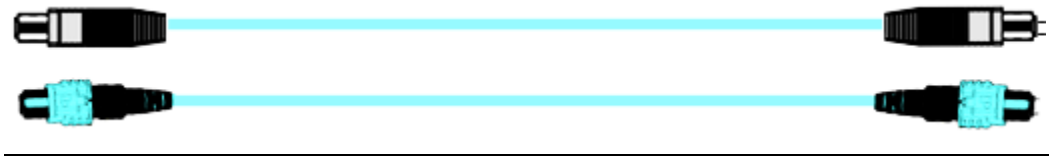
The PanMPO can be utilized in any MPO-based infrastructure containing trunk assemblies, interconnect cords, and MPO patch cords. It will minimize MPO cord configurations to keep in stock and to keep track of during operations. It will also prevent installation, adds/move/changes or new turn up delays if an MPO cord, harness or cassette is ordered with the incorrect gender or polarity.

Figure 7 shows how the PanMPO can be configured into any gender and any key orientation taking the place of six different MPO cord or trunk configurations.

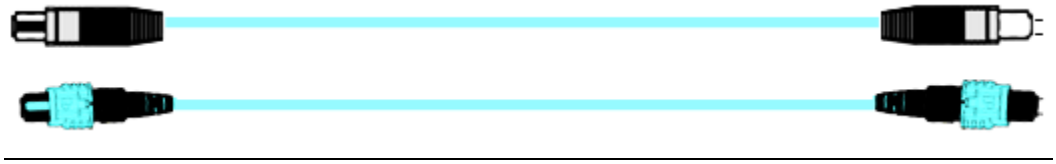
Male Key Up to Male Key Up

Male Key Up to Male Key Down

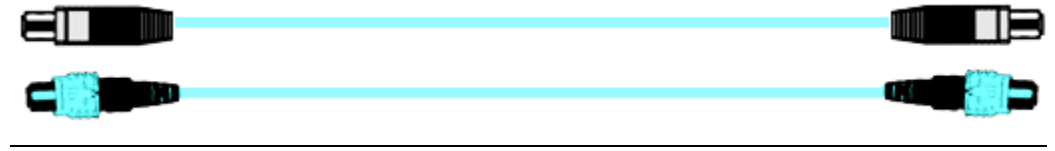
Female Key Up to Male Key Up



Female Key Up to Male Key Down



Female Key Up to Female Key Up



Female Key Up to Female Key Down

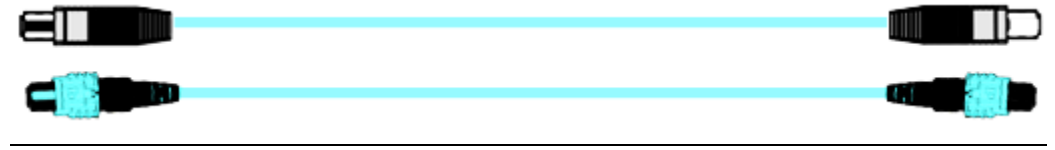


Figure 7. Patch cord configurations using PanMPO™

As discussed earlier, testing the MPO can be a difficult task due to the fixed gender of the MPO interface on the tester. If the test heads do not match the tester interface, a third test cord would need to be introduced into the test method to complete the testing per TIA/EIA One Jumper – Method B. As seen in Figure 8 the PanMPO can configure to any test configuration necessary, enabling Method B to always be used.

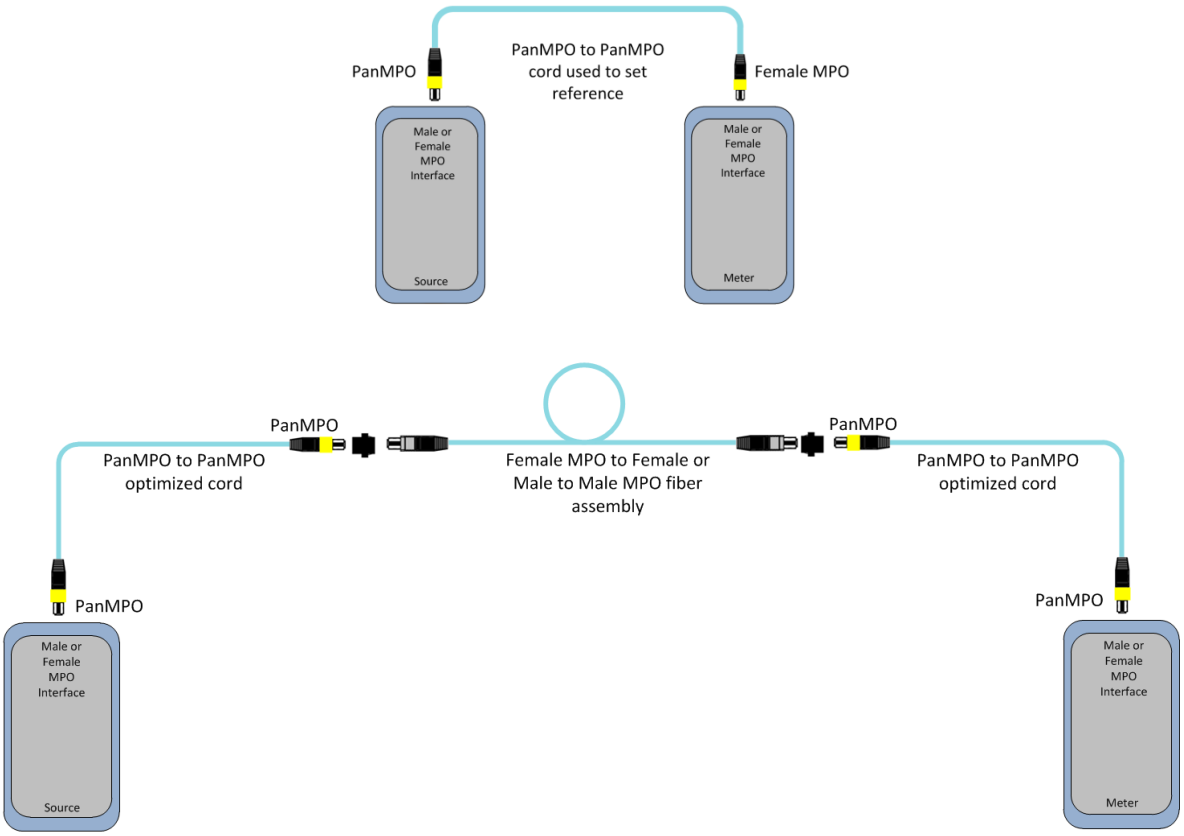


Figure 8. Test Cord Configuration with MPO

Summary

Polarity and gender have always been an issue when designing, testing or troubleshooting an MPO-based infrastructure in a 10G or 40G environment. To add further complications, the 10G standards call for a female horizontal cabling infrastructure while the 40G standards call for a male horizontal cabling infrastructure. Panduit has developed the PanMPO™ Connector to easily solve the gender, polarity, testing and standards compliancy questions that surround the MPO cabling infrastructure by removing the operational risks involved with changing the gender or polarity of the existing MPO connectivity solution.