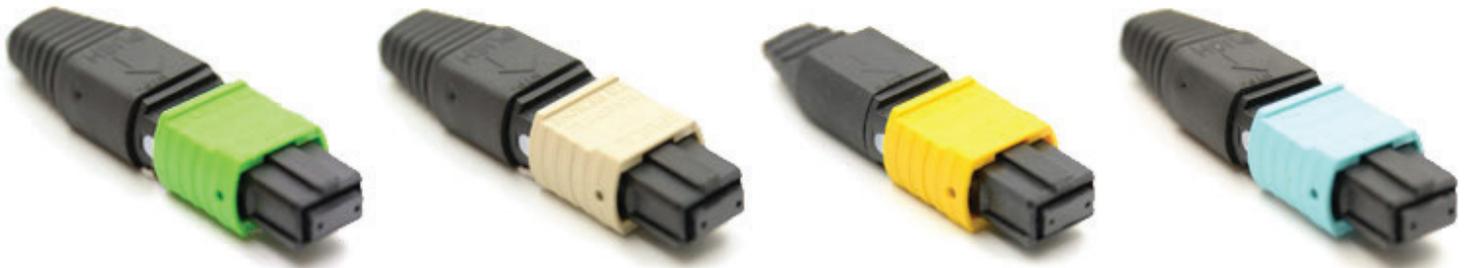


MTP® / MPO Solutions

FIBERTRONICS 



Multifiber Push-On (MPO) connectors have answered the call for more bandwidth and more space efficiency.

MPO connectors are able to provide up to 24 or more fibers in a single connector pushing up to and beyond 100Gbps data transmission. MTP® is a registered trademark of US Conec, marketed as a “high performance MPO connector when compared to generic MPO connectors.” The terms MTP and MPO are often used interchangeably and MTP is considered a generalized trademark. MTP and MPO are available with Standard or Elite® / Low Loss options.

General Applications & Loss Specifications

Ferrule Type	Typical Insertion Loss	Maximum Insertion Loss	Return Loss
Single-mode Standard:	< 0.25 dB	< 0.50 dB	> 60 dB
Single-mode Elite:	< 0.12 dB	< 0.25 dB	> 60 dB
Multimode Standard:	< 0.20 dB	< 0.45 dB	> 25 dB
Multimode Elite:	< 0.12 dB	< 0.25 dB	> 25 dB

Multimode Fiber Variants

While singlemode is optimized for long range data transfer, multimodes are designed with high-bandwidth short range optimization in mind.

- **OM1** is a 62.5/125µm fiber core, with the jacket usually cladded in orange. This is typically found in older applications where high bandwidth isn't a priority.
- **OM2** is the first variant of 50/125µm, usually also orange, but widely unused. OM2 offers modest improvement over OM1, however OM3 is leaps and bounds ahead with not much more cost.
- **OM3** is a laser optimized variant of 50/125µm multimode, and is the first fiber mode that supports 10Gb/40Gb/100Gb Ethernet.
- **OM4** is a recent addition to the lineup which offers a longer range than OM3. It should be noted that OM3 and OM4 are cross-compatible, and while OM4 is only needed for distances that exceed OM3 capabilities, it can still be used for shorter connections.

Multimode Variants	10 Gb	40 Gb	40 Gb (QSFP+ eSR4)	100 Gb (24 Fiber)
Optical Multimode 1 (OM1):	33m	N/A	N/A	N/A
Optical Multimode 2 (OM2):	82m	N/A	N/A	N/A
Optical Multimode 3 (OM3):	300m	100m	330m	100m
Optical Multimode 4 (OM4):	400m	150m	550m	150m

Fibertronics Standards

Fibertronics 12 Fiber, OM3, MPO cables use **Corning® ClearCurve®** laser optimized bend-insensitive fiber. This type of fiber allows for tighter bends in your cables, so you can route without worry.

The fiber comes in the form of 12 fiber 3mm micro-distribution cable with an aqua plenum jacket, which is rated for riser and plenum areas. The micro-distribution format uses 12 fibers in a loose tube jacket with protective aramid yarn, allowing for more flexibility and smaller footprint than traditional ribbon cable.

We can also build these to your custom specifications, including using a different brand of fiber, different type of jacket, or even customer-supplied cable.

Options such as OM4, LSZH jacket, ribbon cable, armored cable, indoor/outdoor cable, and more are available, so please call one of our sales representatives to discuss your needs. Please keep in mind that MPO cables work best with loose fibers, so tight-buffered fibers may not be suitable for this.



MPO Gender Interface

MPO Genders can be counter-intuitive to newcomers to the technology. MPO cables are a plug, so they must be male, and transceivers have a port so they must be female, right? Unfortunately not!



MTP Male Female MPOs are classified by the guide pins on the end of the connector, and require 1 male and 1 female to mate properly. MPO connectors use a “barrel sleeve” adapter that simply holds one male and one female MPO “plug” together. The male guide pins fit into the female holes to ensure precise fiber alignment. It is never advised to mate two female connectors two male connectors due to both insertion loss and pin damage respectively.

Transceivers and cassettes come with the sleeve adapter built in and the industry standard is a male connection on the inside. Therefore, the standard for cables is female to female. This changes, however, when you need to extend a cable or connect two cables. You will then need a male to female cable plus adapter.

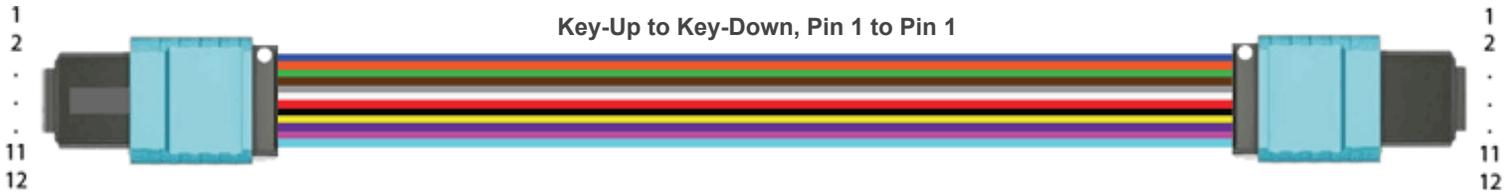
Gender Standards	
Cassettes:	Male Port
Transceivers:	Male Port
Patch Cables:	Female to Female
Extender Cables:	Male to Female
Trunk Cables:	Male to Male (Custom Mix)

Keys and Dots

MPO connectors have a key on one of the flat sides added by the body, and the orientation of this key determines the cable’s polarity. MPO and MTP connectors also have a white dot or square on one side of the connector to denote where fiber 1 is.

The key and gender are assigned near the end of manufacturing an MPO by adding the body kit. Fibertronics is able to take completed MPO cables and change gender or flip polarity from Method A to Method B and vice versa. Please note that flipping polarity will not be possible with a Single-mode MPO cable, as these ferrules have an 8° angle polish. For this same reason, Single-mode MPO cables cannot be used with aligned key “polarity flip” adapters. This process does carry the risk of breaking the delicate fibers inside the MPO body, even for trained professionals, so this service may come with a charge.

Method A: "Straight Cable"



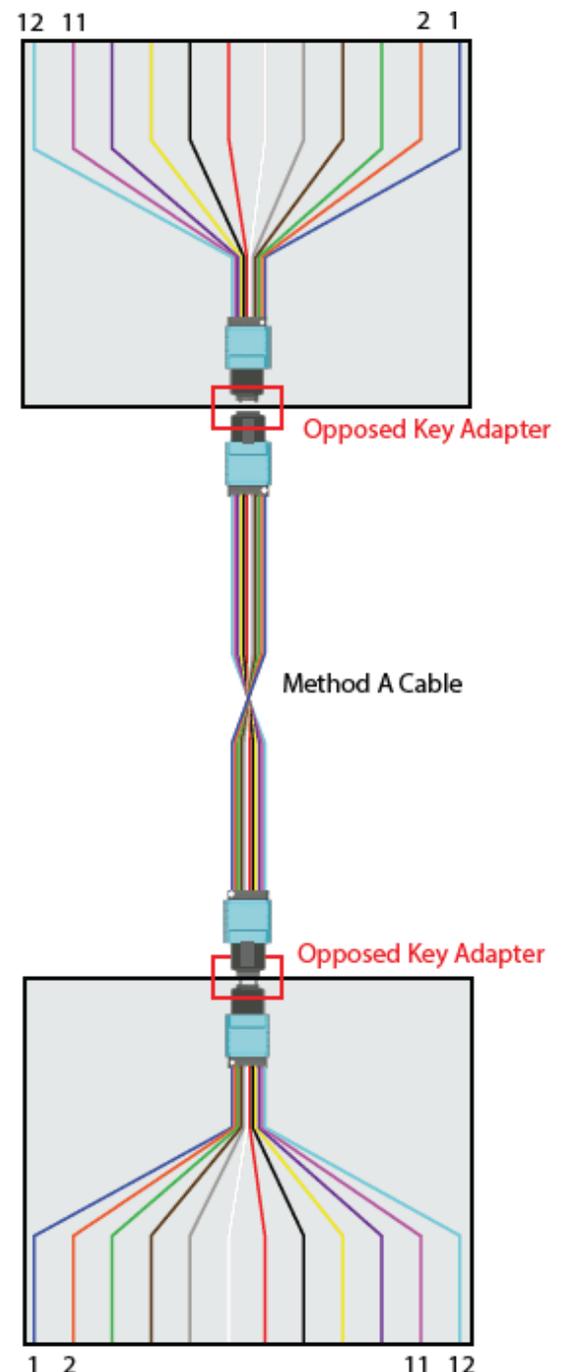
Sometimes referred to as a 10G MTP/MPO cable, the Method A cable is the first standard for polarity, and commonly used throughout the industry. The cable has a neutral polarity, so it is preferred for extending existing MTP patch and trunk cables, and can plug directly from a transceiver into an adapter patch panel, thus "moving" the transceiver port. As you can see in the diagram below, when plugged into standard fiber optic cassettes, it maintains a Pin 1 to Pin 1 relationship.

Our standard cassettes utilize opposed key adapters, which also have a neutral polarity. Therefore, to plug the cable into the identical cassettes, the Method A cable must be rotated a half-turn, shown in the diagram as "key up to key up." This keeps fiber 1 interfacing with fiber 1, shown as a blue line throughout.

However this can be problematic for a very common application. When plugging in your duplex cables to the front of the cassette, your transmit lane is on the right, fiber 2 in orange. Plugging in standard duplex cables will result in a clash, as both sides attempt to transmit down the same lane. To resolve this, you would need to use "crossover" duplex cables on one side.

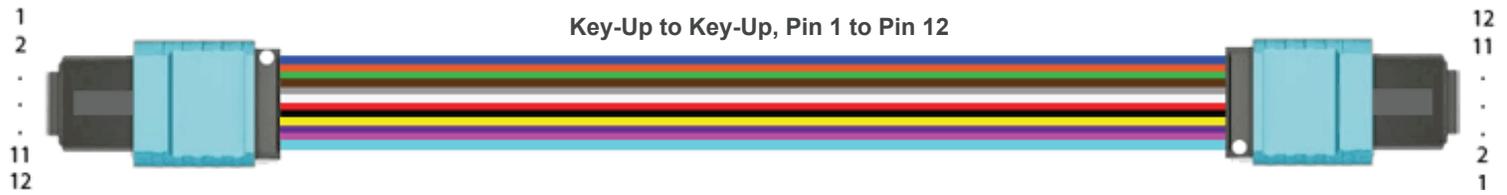
Fibertronics duplex cables can be disassembled and flipped for a cross-over variety, however depending on your application, this may not be the best use of your technician's time. Therefore we recommend Method A cables for trunk extension and optics patch extension, and only for cassette / duplex applications if you keep in mind that this will maintain 1 to 1 pinouts and plan accordingly.

For the above reasons, with OM3 applications we find that many of our customers prefer Method B cables.



Beware of Tx to Tx clash! Method A maintains Pin 1 to Pin 1 polarity, so utilize crossover duplex cables if you are working with duplex transceiver fiber optics applications.

Method B: "Crossover Cable"



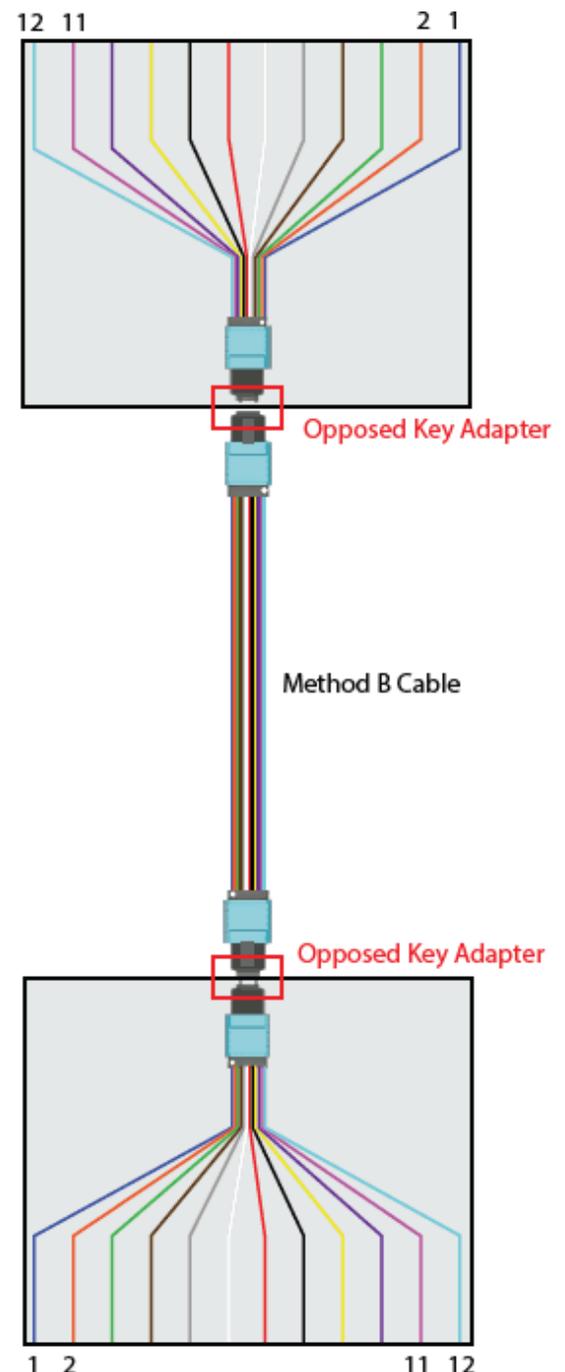
Often referred to as a 40G MTP/MPO cable, the Method B cable is the second standard for polarity, and extremely versatile. The cable has a "flipped" polarity, so it is not recommended for extending existing MTP patch and trunk cables, as this can make it difficult to maintain polarity and keep track of how many flips are in your assembly. However, this cable assembly can be used to plug directly between your 40G optic transceivers, so it is commonly referred to as a QSFP/QSFP+ cable or Direct Attach 40GBASE-SR4.

As you can see in the diagram, this cable will result in a Pin 1 to Pin 12 relationship. This is extremely useful because 40G optics utilize parallel optics.

Most 40G optics do not require perfect port symmetry: any Tx can go to any Rx and it will sort it out in the end. This means fiber 12 can interface with fiber 1 because one is Tx and the other is Rx.

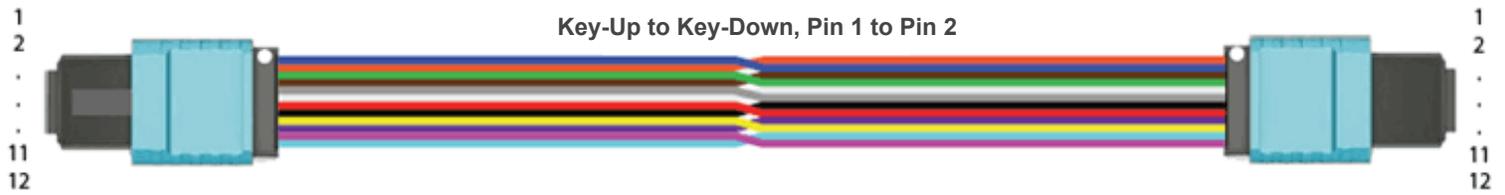
This cable is ideal for 40G optics use, however if you are using this in a duplex or cassette application, please keep in mind the 1-to-12 relationship. This can be circumvented by using our universal cassette, diagram shown on the next page. This will result in a Pin 1 to Pin 2 relationship, keeping your duplex pairs together.

Both Method B cables and Aligned Key adapters will invert, or "flip" the polarity each time they are used. One way to think about this is to go back to grade-school math classes. Remember that each negative inverted the number, and that two negatives multiplied to give you a positive. It can still be challenging to keep track of this, so for this reason it is not recommended you use Method B cables as trunk or patch cable extenders.



Don't get flip-flopped! Each Method B cable or aligned key adapter will flip the polarity! Use Method B cables for your 40G optics applications and stick to Method A for your patching needs.

Method C: "Pairwise Flip Cable"



One of the more recent standards, Method C remains a relatively uncommon custom cable type. This cable functions in the same way as Method A, except it sends Pin 1 to Pin 2 with a pairwise flip.

This is useful to maintain duplex integrity while still using standard cassettes. Unlike Method A and Method B, this cable cannot be built with ribbon cable. It can only be built with microdistribution.

Custom Pinouts

In addition to Methods A, B and C, we can create any custom pinout configuration you need. We can build cables, cassettes, loopbacks and more with custom fiber counts, different ferrule sizes, fanouts, fiber modes, and more.

The possibilities are virtually limitless, so please give one of our experienced sales representatives a call today and we will work with you to design the exact cable you need. Also be sure to check out our singlemode and 24 fiber varieties, as well as our multi-connector trunk cables.

