101 Fiber Documents: MPO Basics

As we started our previous OM4 Whitepaper, Bandwidth will never stop increasing.

Virtualization, new cloud services, SAN (Storage Area Networks) and of course, Netflix, Amazon among other streaming services and the huge rise in internet mobile access have been increasing our data consumption.

Data Consumption in 2018

Regarding the data to support the last comment and using data from GlobalWebIndex, GSMA Intelligence, Statista, Locowise and SimilarWeb we could summarize in this quick facts.

The number of internet users in 2018 is 4.021 billion, up 7 percent year-on-year.
The number of mobile phone users in 2018 is 5.135 billion, up 4 percent year-on-year.

Why is this huge update, well we could conclude that much of this year's growth in internet users has been driven by more affordable smartphones and mobile data plans. More than 200 million people got their first mobile device in 2017, and two-thirds of the world's 7.6 billion inhabitants now have a mobile phone.

This new ambition in global broadband will require more affordable, optimal and better internet connections, and to achieve this we require more and more fiber strands and also faster connections.

As stated in a Fluke Networks Document. Until recently, "10 Gbps was considered a top-end connection; now 40 Gbps is gaining traction, and some are even starting to look at 100 Gbps. In fact, according to a recent Cisco report (Cisco: "Market Need for 40 Gigabit Ethernet," 2012), shipments of servers with 40-Gbps Ethernet interfaces are expected to grow by more than 40% in the near term."

MPO®/MTP are on the way to become the default cabling solution to these ever- increasing data center bandwidth requirements. Why? We could establish some advantages:

- Compact (Small Form Factor)
- They arrive right out of the box (pre-terminated).
- Plug and Play Design.
- They can handle bandwidth all the way to 100 Gbps. (High Form Factor)
- Low insertion loss

MTP® or MPO, Why the are two names for the same?

They are not the same… But they are compatible.

MPO
The term MPO stands for (Multi-fibre Push On) and is a specific interface type.

The MPO interface was developed to enable multi-fibre connectivity for higher density and higher bandwidth based applications requiring parallel or channel based fiber optics. 12 and 24 fiber versions are currently used to direct connect into 40G and 100G transceivers and also used in high density fiber distribution areas.

Higher fibre versions are also available (48, 72 fibre).

MTP®
The MTP® connector is specifically a brand of MPO interface connector that is owned by the US based optical R&D company US Conec. Like MPO it is based on the MT (mechanical transfer) ferrule technology which was developed by Nippon Telephone and Telegraph (NTT) during the 1980s.

In the meantime, we would use the MPO connector as the main character of this document and we will discuss all the basic relevant information and performance of the Multi-fibre Push On.

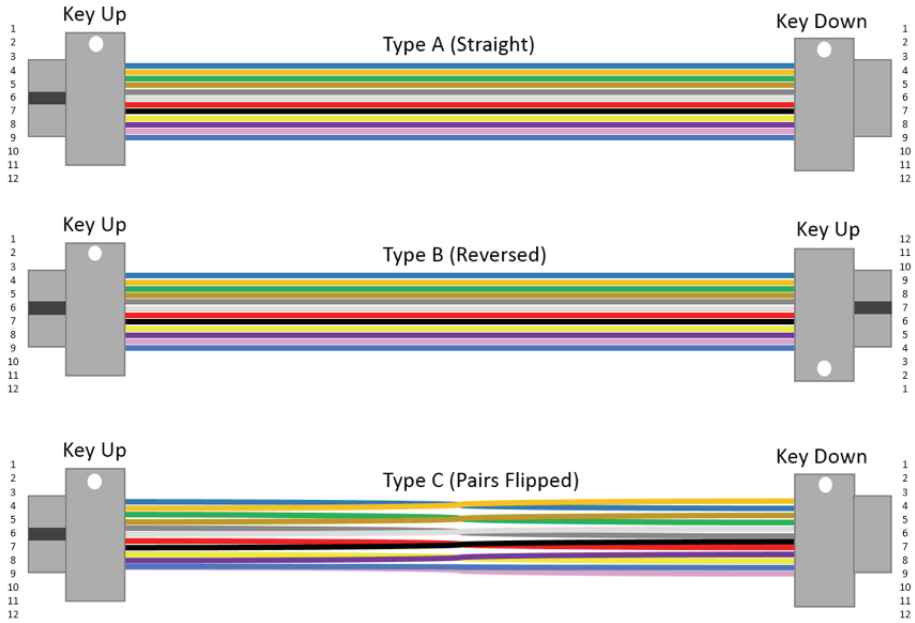
MPO Polarity

We have discussed the main advantages, we don't want to brag about this technology to be perfect, we would discuss the disadvantages in a couple of pages, nevertheless, we always hear the same question, What about the polarity?

Polarity defines direction of flow, In fiber optics, it defines the direction that light signals travels through an optical fiber tube. In this case we require two ends, one of them Transmit the signal (Tx) and the other one should Recieve the light (Rx).

While this seems obvious, polarity is one area that seems to cause the most confusion among technicians, Nevertheless, this is not a Duplex Cable (Witch, could be easier to manage) so handling multi fibers could get more complicated.

MPO connectors also include a white dot on the top side of the connector that white dot represents the 1 position of the multi fiber connectors, if you put the MPO cable in a flat surface you could find out with the attached representation what kind of polarity your cable has.



Source: Fluke Networks / 101 Series: 12-Fiber MPO Polarity

MPO Connector include a white dot that represents the #1 position of the fibers.

With that in mind you can know find out what polarity you MPO patch cable has. Nevertheless, what are the uses of different arrange of the fibers?

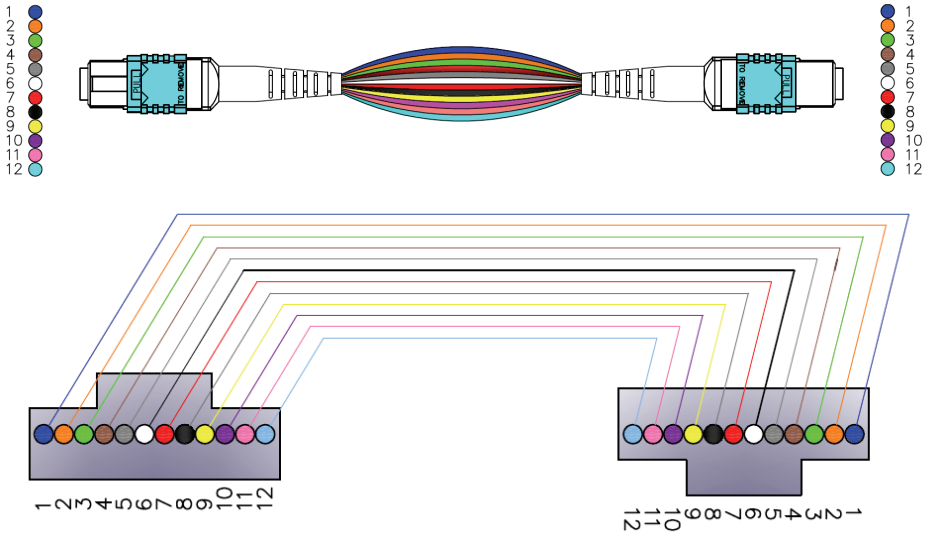
First, lets state the three different kinds.

• Type A (Straight)

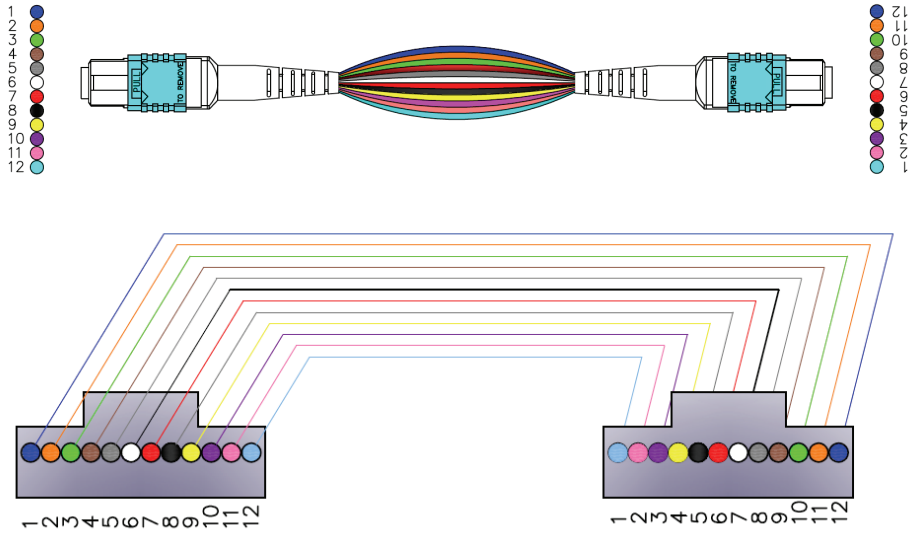
• Type B (Reversed)

• Type C (Pairs Flipped)

For Type A, the transmit-receive flip must happen in the patch cords, and the trunk cable is a straight through transmission, with the key up on one end, and the key down on the opposite end. This means that the blue fiber (F1) located in Position 1 (P1) of the connector on the left will arrive at P1 at the other connector

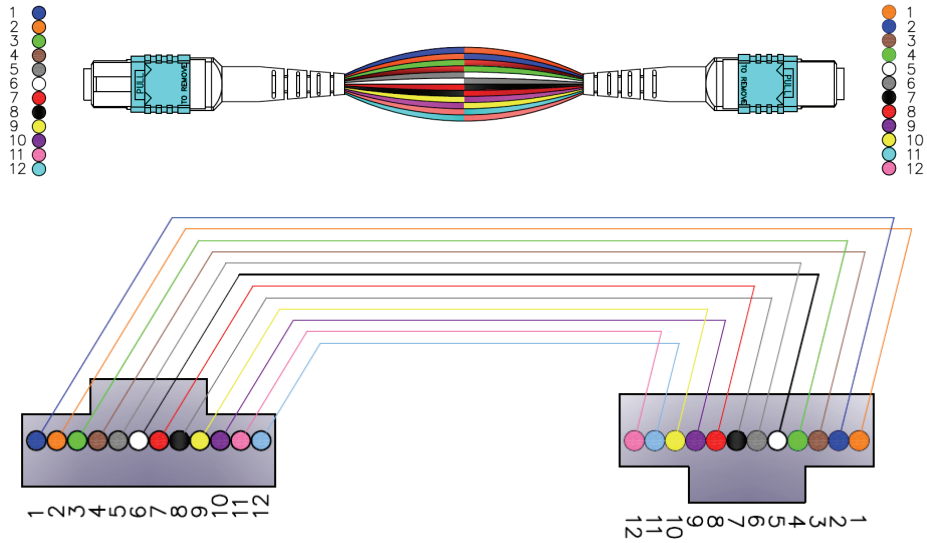


For Type B, The keys are in an up position at both ends (remember to imagine yourself facing the front of the connector) of the trunk cable, but the fiber that is at position 1 in one connector end is in position twelve at the opposite end, and the fiber that is in position 12 at the originating end is in position 1 at the opposing end.



According to the three methods: Type B (Reversed) is often the most recommended.

For Type C, each adjacent pair of fibers at one end are flipped at the other end. Notice the swapping of the color positions in the diagram.



Which Configuration Do You Need To Use?

According to the FOA (The Fiber Optics Association) The type of MPO components you choose depends on your network components needs - that is how you need to connect appropriate trasmitters and receivers in your network. Unfortunately manufacturers of these components and cable assemblies do not agree on exactly how to make those connections, so we have all this choice and 23 pages in TIA 568 on the official options, although many more exists.

One thing to remember is that adding Type B components (cables or mating adapters) swaps the fibers while Type A components (cables or mating adapters)does not affect the positions of the fibers. **Thus if you need to reverse fibers, use Type B components.** If you do not want to reverse fibers, use Type A components. And if you have a cable plant with an odd number of Type B components, it will have the fibers reversed, and even number will have the fibers in the original configuration.

Beyondtech PureOptics MPO - Method B Patch Cable

Adding Type B components swaps the fibers while Type A components does not affect the positions of the fibers.

MPO Cable Solutions: Various Options for Differents Needs

There is a broad array of MPO cabling solutions to fit different application demands, we're going to explore each in the following.

According to FS.COM, MPO cable comes in various types and configurations, which plays a prominent role in different cabling scenarios. Here we introduce three of the common MTP/MPO cable types: MTP/MPO trunk cable, MTP/MPO breakout cable and MTP/MPO conversion cable.

• MPO Trunk Cable

MPO trunk cable works to connect modules together as a permanent link. The trunk cables are available with 12, 24, 48 and 72 fibers. They are often used to interconnect cassettes, panels or ruggedized MPO fan-outs, and to facilitate rapid deployment of high-density backbone cabling in data centers and other high fiber environments. The MPO trunk cables are constructed from loose tube, gel-filled indoor/outdoor rated cables and are used for interconnect spanning MDA, HAD and EDA zones.

• MPO Harness Cable

MPO harness cable, known as MPO breakout cable or MPO fan-out cable, offers a transition from multi-fiber cables to individual fibers or duplex connectors. MPO harness cable has a single MTP connector on one end that breaks out into 6 or 12 connectors, and these connector types can be LC, SC, ST, etc. MPO harness is available in 4, 6, 8, or 12

Fiber ribbon configurations with lengths about 10, 20, 30 meters and other customized lengths. Harness cable provides a reliable, cost-effective cabling option for 10G-40G migration.

• MTP/MPO-LC Cassette

MTP/MPO cassette modules are fitted with 12 or 24 fibers and have LC, SC or E2000 adapters on the front side and MTP/MPO connector at the rear. Thus enables users to take the fibers brought by a trunk cable and distribute them to a duplex LC cable. MTP/MPO cassette allows for rapid deployment of high-density data center infrastructure and supports improved troubleshooting and reconfiguration during MACs.

• MTP-LC Breakout Patch Panel

Data traffic keeps accelerating and legacy 10/25G systems are hardly enough for it, making migration to higher-speed 40/100G imperative. The 96-fiber MTP-LC breakout patch panel can assist in making the transition: use MTP cables to connect your 40/100Gb switches to the rear ports of the panel, then add duplex LC cables to connect your 10 Gb devices to the breakout panel's front ports. This MTP-LC breakout patch panel is designed with a removable cable management plate at the back, it effectively simplifies trunk cable organization, facilitates installation and reduces cable clutter.

Disadvantages of the MPO Connector.

To understand the challenges of MPO cable we quoted some of the difficulties David Luk says in its MPO Whitepaper publicated in Lightwave, it's necessary to understand MPO cables and how they're tested in the work-field. An MPO connection is about the size of a fingernail and contains 12 optical fibers, each less than the diameter of a human hair – and each one needs to be tested separately. That traditionally means the use of a fan-out cord to isolate each fiber, **followed by tedious manual testing**, tracing, and error-prone calculations.

This calculation is very important, Luk stated that the actual fiber test is quick enough typically under 10 seconds per fiber once you're in process. : While one of their enterprise customers has data centers with as little as 48 MPO fiber trunks (x12 fibers each), that same customer also has a 30,000-MPO data center installation. That's 30,000 connections with 12 fibers each, or roughly **3,120 hours in labor** (and $343,200 in cost) if you had to test them all individually.

And at some point, you better have tested them. There were two primary drivers behind development of MPO fiber trunks. The first was the ever-increasing need for cabling density in the data center. Cabling blocks airflow, so the denser the cable, the better the thermal management. And, as data center bandwidth steadily climbs to 10, 40, and 100Gbps, a dense multi-fiber cable becomes the only option you could do.

But the most important disadvantage, is the difficult and highly technical nature of field termination for fiber. We're talking curing ovens, adhesives, microscopic fibers, etc. Given that expensive and time-consuming "craft" process, modular factory-terminated MPO cables promise simplicity, lower cost, and true plug-and-play fiber connectivity, but you have to take into consideration that pre-terminated fiber is only guaranteed "good" as it exists in the manufacturer's factory or local inventory.

It must then be transported, stored, and later bent and pulled during installation in the data center. All kinds of performance uncertainties are introduced before fiber cables are deployed. Proper testing of pre-terminated cables after installation is the only way to guarantee performance in a live application. In conclusion, investing in factory-terminated fiber trunks to save time and decrease labor costs doesn't really offer an advantage if the testing becomes an expensive bottleneck.

Testing and determining fiber polarity is another challenge. The simple purpose of any polarity scheme is to provide a continuous connection from the link's transmitter to the link's receiver. For array connectors, TIA-568-C.0 defines three methods to accomplish this: which we discussed earlier. Deployment mistakes are common because these methods require a combination of patch cords with different polarity types.

An MPO Connector is about the size of a fingernail and it contains 12 optical fibers.

More bandwidth means more testing

The use of MPO cables for trunking 10-Gbps connections in the data center has steadily risen over the past 12 years. That trunking requires use of a cassette at the end of the MPO cable designed to accommodate legacy equipment connections. Now that 40-Gbps and 100-Gbps connections are coming on the market, a migration path has emerged: Remove the 10-Gbps cassette from the MPO cable and replace it with a bulkhead accommodating a 40-Gbps connection. Then it might be possible to remove that bulkhead and do a direct MPO connection for 100 Gbps at a later date.

The problem is that while this migration strategy is an efficient way to leverage the existing cabling, in comparison to 10-Gbps connections, the 40-Gbps and 100-Gbps standards call for different optical technology (parallel optics) and tighter loss parameters.

In conclusion, each time you migrate you need to verify the links to ensure the performance delivery the company or data-center requires.

Proper MPO testing

So what would a proper MPO test look like? The answer is simple: **Test all 12 fibers** – the whole cable – simultaneously and comprehensively (including loss, polarity, etc.). That sort of test capability changes the fiber landscape, enabling installers and technicians to efficiently validate and troubleshoot fiber – flying through the process by tackling an entire 12-fiber cable trunk with the push of a button.

Demand for fast and reliable delivery of critical applications is driving data center technology to evolve at an ever-increasing pace. And that insatiable need for bandwidth ensures that the integrity of the data center has become inextricably linked to the strength of the fiber cabling infrastructure. The growing use of MPO fiber trunks – and the migration from 10-Gbps to 40/100-Gbps connections – means that it's time to stop the cumbersome verification of individual fibers. *After all, it's a single MPO connection. You should be able to test it as one.*

Bandwidth demand is going to keep growing and OM4 MPO based connectivity is the most efficient solution.

Conclusions

It is clear that this MPO connector is the most versatile on the market and will undoubtedly enable end users unlimited flexibility when installed on fiber optic jumpers and trunks in an infrastructure network. Ease of use, particularly when employed in a high density patch panel is unsurpassed due to the short boot and optional installation tool. And, since the connector meets both the requirement and the objective of GR1435, the only MPO connector to do so, the end user can be absolutely confident in the performance and mechanical reliability of the connector.

In short, a MPO connector of this type will allow data center operators the best possible solution to their infrastructure installation design needs. Its leading edge technology and capabilities are not matched by any other MPO connector on the market.

References

1. https://wearesocial.com/ (2018). DIGITAL IN 2018: WORLD'S INTERNET USERS PASS THE 4 BILLION MARK [online] Available at: https://wearesocial.com/blog/2018/01/global-digital-report-2018

2. https://www.completeconnect.co.uk (2016). MTP vs MPO Connectors [online] Available at: https://www.completeconnect.co.uk/mtp-vs-mpo-connectors-2/

3. www.flukenetworks.com, (2018). 101 Series: 12-Fiber MPO Polarity [online] Available at: http://es.flukenetworks.com/blog/cabling-chronicles/101-series-12-fiber-mpo-polarity

4. Fluke Netwokrs (2017). The A-B-C's of Fiber Polarity [online] Available at: http://www.flukenetworks.com/blog/cabling-chronicles/b-c-s-fiber-polarity

5. Light Wave (2012). What MPO cabling means for fiber testing in the data center [online] Available at: http://www.lightwaveonline.com/articles/2012/07/what-mpo-cabling-means-for-fiber-testing-in-the-data-center.html

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