CORNING

Maximizing the Advantages of the MTP® Connector

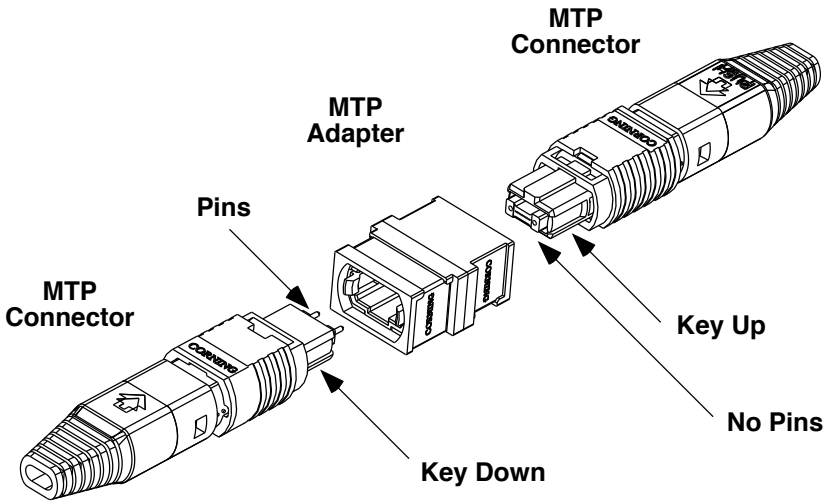
Multiple Fibers Mean More Challenges

At the heart of the MPO connector lies mechanical transfer (MT) ferrule technology, originated by a leading Japanese telecom company in the mid-1980s for use in its consumer telephone service. This MT ferrule technology became the basis for the first MPO connector, introduced in the early 1990s.

The timing couldn't have been better. Networks were being tasked with transmitting more data, more quickly. As the need for bandwidth increased, the industry began moving toward networks and cabling with higher fiber densities – the multilane highway of data transmission. This heralded the beginning of what is known today as parallel optics, or optical transmission using multiple fibers. Because of the increase in "lanes" used with parallel optics – the number of fibers moving data back and forth – an efficient, high-density interconnect was needed. The MPO connector format succeeded in establishing a compact means to efficiently couple and decouple the high-density MT ferrule format via a bulkhead-mounted coupler. More fibers, however, also meant more installation considerations.

Addressing the Challenge

To remedy the installation challenge presented by ever-increasing quantities of fibers, Corning, an innovator in materials science, joined forces with US Conec, a leading developer of interconnect components. In 1996, the MTP® connector brand — a family of advanced MPO connectors designed for 4-, 8-, and 12-fiber ribbon applications — was released to the US market. That same year, the MPO format was standardized by the International Electrotechnical Commission (IEC) and embraced by an industry thirsty for a better way to install, deploy, and manage high-density fiber networks.



Less Time. Less Space.

Before the MTP connector came to market, it typically took two installers a full day to terminate and test 144 fibers. With MTP connectors, suddenly installers had the ability to rapidly connect eight to 12 fibers at a time with the snap of a tool, or using a pre-terminated plug-and-play cable, trimming a daylong job to just a few hours. To ensure seamless connections, the MTP connector was the first MPO connector to be factory-verified and pre-engineered to proper lengths for the cable plant. This meant that less skill was required for installation, while future updates, additions, and changes to the structured cabling were dramatically simplified. Revolutionary at the time, these advancements introduced by the MTP connector eventually became the industry standard.

MTP connectors allowed installers to rapidly connect eight to 12 fibers at a time with the snap of a tool, reducing a day-long job to just a few hours.

Faster deployment was one thing. But installers also needed a way to fit more fibers into smaller spaces. MTP connectors addressed this challenge as well. Even before parallel optics gained popularity, installers were struggling to provision high-density applications. MTP connectors made it easier to do exactly that. In place of a 1U housing with duplex connections holding 144 fibers, the MTP housing was capable of holding 864 fibers — six times the capacity. This fiber density made MTP connectors especially well-suited for data centers with serious space constraints and/or massive amounts of cables.

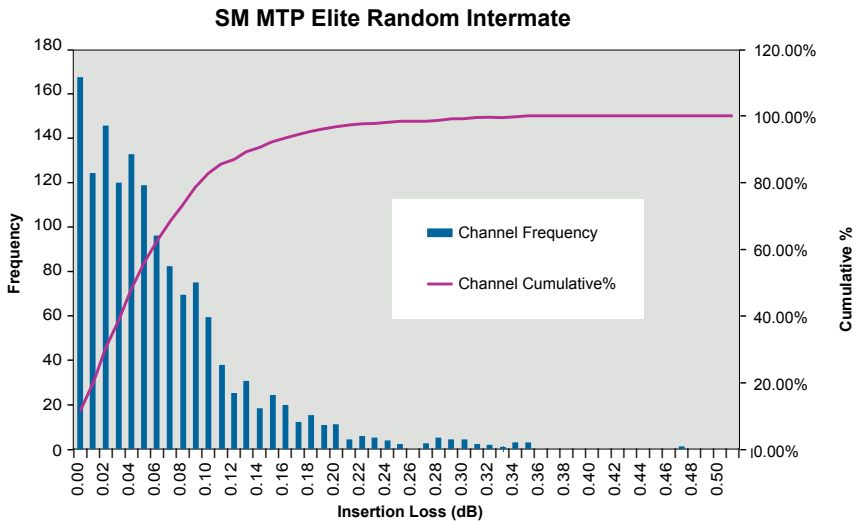
Good Technology Gets Even Better

With the increasing prevalence of plug-and-play solutions, MTP connectors quickly became the format of choice for data centers, offering an alternative to LC and SC connectors. But the MTP format is more than a niche connector, with advantages that translate across a wide range of technologies beyond parallel optics. Since their launch, MTP connectors have undergone continual improvements that make them the ideal multi-fiber connector choice for any data center, of any size.

Highly adaptable and flexible, MTP connectors have continued to evolve to meet the emerging needs of installers, data centers, and the organizations that rely on them. Let's take a brief tour of the key advancements we've seen in the MTP format over the past 20 years.

Lower Insertion Loss

In 1999, US Conec introduced low-insertion-loss MTP Elite® connector components. Corning was then able to build on this technology to introduce industry-leading, low-loss, high-density cabling solutions that delivered premier optical performance and reliable signal power. Since then, MTP insertion loss rates have continued to improve, now rivaling loss rates that single-fiber connectors saw just a few years ago.



Superior Stability

Simply put, installers need their connectors to work. The earliest versions of the MPO Connector format could plug in without problem, but accidental bumps to the cable could result in signal instability. Installers welcomed the introduction of the floating ferrule in the MTP connector. The innovative design allowed the ferrules to stay in contact while the connector housings rotated relative to each other. This major step in the MTP connector's evolution life allowed multi-fiber connectors to provide even more consistent, reliable performance. The floating ferrule feature was particularly important for applications where the cable plugs directly into an active Tx/Rx device, and was a primary reason the MTP became the connector of choice for emerging parallel optics Tx/Rx applications.

Between 2000 and 2002, additional improvements to the precision of MTP connector components resulted in increased stability and boosted durability performance while continuing to enhance the connectors' overall reliability. Through countless empirical studies, engineers optimized the lead-in on the precision alignment guide pins to an elliptical shape. This significantly reduced the wear and tear and debris generation from plugging and re-plugging the connector multiple times. In addition, the internal connector components were redesigned to ensure perfectly centered normal forces between the mating ferrules, ensuring physical contact of all polished fiber tips in the ferrule. Finally, installers had a connection that actually stayed connected.

The MTP reputation for performance continues. Used in a variety of applications, today's MTP connectors meet stringent Telcordia (formerly Bellcore) standards for carrier-grade demands and decades of use. Millions of MTP connectors installed in the field continue to perform as they did when they were first built in the cable assembly factory.

Simpler to Make — and Use

In 2002, US Conec migrated MTP's original thermosetting ferrule technology to polyphenylene sulfide (PPS) thermoplastic injection molding, which is much less susceptible to moisture absorption — a key culprit in degraded connector performance. The adoption of thermoplastic injection molding also made it possible to quickly scale up production to meet high-volume demand, while also improving control over ferrule end-face geometry during the polishing to improve connector performance.

Design improvements to the MTP Elite housing component also made it easier to install, take out, clean, and return to service. This set the stage for future innovations poised to simplify life for installers even more — but more on that later.

The new MTP connectors make it easy to change gender and polarity in the field, without requiring a specialized skill set.

Time Travel

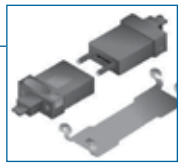
MTP continues to evolve and improve.

2004 – Engineers increase the MTP connector's fiber count, packing up to 72 fibers into one format.
2005 – The multimode MTP Elite connector is released, enabling fast installation of systems with lower-cost transceivers.
2007 – A lower-insertion-loss version of the multimode MTP Elite is released.
2010 – A multimode version is introduced, allowing for up to 24 fibers in one connector.
2012 – Standards bodies sanction the MTP format for use in data centers.
2013 – Industry standards bodies accept the MTP format for transceivers.
2015 – A new MTP 16 format is introduced, accommodating up to 16 fiber connections in a single row.
2016 – Soon, a new MTP 16 will be made available in a single-mode version.

MTP® Connector Timeline

1985

Thermoset Epoxy based Singlemode MT ferrule technology established by NTT Laboratories



NTT releases MT Ferrules as pre-engineered splice into commercial subscriber lines

1990

MPO Connector format established by NTT Laboratories

MTP® brand connector family for 4, 8 and 12 Fiber ribbon applications is introduced as the premier MPO

1995

IEC MPO Intermateability Standard published: IEC 61754-7

Low-loss single-mode MT ferrule and MTP™ Elite solution released

Enhanced MTP® design optimized for direct coupling to parallel Tx/Rx modules. Other enhancements during 2000-2003 include ellipitcal pin tip, removeable housing, improved spring force centering

2000

Major advance to termoplastic injection molded MT ferrules

QSFP MSA for MPO based Tx/Rx

72F and 24F MT ferrules and MTP® hardware introduced

Round cable MTP® solutions and termination methodologies introduced

2005

Low-loss multimode MT ferrule and MTP® Elite solution released

2010

24F MTP® Elite: Introduced higher spring force format optimized for low-loss 24 fiber applications

TIA sanctions MPO for Data Center use in TIA-942

2015

MTP®-16 1x16 and 2x16 Multi-mode solutions introduced. TIA 604-18 Intermatebility standard published

MTP® 1x16 and 2x16 SM APC Introduced

Any Technology. Any Data Center. Any Size.

We've come a long way since that initial MT ferrule technology used in Japanese telecom networks. But the MTP format is just getting started. Today, the challenge we face is hyperscale, big data, and cloud data centers: How do we provision, add, and support high-density, bandwidth-greedy applications that require massive space to accommodate a massive number of cables? With its ever-improving insertion loss, fiber density, and ease of installation, and its time-tested stability, the MTP Connector is ready to meet those demands.

But it's important to note that the MTP brand isn't built just for the mega-cloud, big data, and hyperscale computing. The latest versions of MTP connectors are designed to work not only with true fiber-to-fiber connections, but with a host of other technology and electronics across all vertical industries – financial, medical, educational, co-location, and more.

So whether you're working with duplex, 8-, or 16-fiber transmissions, the MTP connector scales to whatever technology you're using – including new parallel applications such as 400 Gb Ethernet capable of running across 32, 16, and eight fibers. With their robust engineering, MTP connectors also perform in a wide range of operating environments, including those with high humidity, extreme heat and cold, and fluctuating temperatures.

The latest versions of MTP connectors are designed to work not only with true fiber-to-fiber connections, but also with a host of other technology and electronics our industry has adopted.

Ethernet Optical Transceiver Roadmap

Solution	# of Fibers	Con Type	Reach	40G	100G	400G
Duplex OM3/4	2F	LC Dup	Short	BiDi SWDM4	BiDi SWDM4	??
Parallel OM3/4	32F	MTP				Gen1: SR16 16x25G
	20F	MTP			Gen1: SR10 10x10G*	
	16F	MTP				Gen2: SR8 8x50G
	8F	MTP		SR4*/eSR4 4x10G	Gen2: SR4 4x25G*	Gen3: SR4 4x100G
Duplex SM	2F	LC Dup	Long	LR4 (10km)* LRL4 (2km)	LR4 (10km)* CWDM4 (2km)	WDM (10km) WDM (2km)
Parallel SM	8F	MTP	Mid	PLR4	PSM4	PSM4 4x100G* (100G via WDM, symbol rate, encoding)

Meet the Next-Generation MTP

With its usefulness in so many different applications with so many different technologies, the MTP connector offers versatility that is definitely an advantage for installers. But this versatility has also presented some challenges. Installers struggle with not knowing whether they need a male or a female end, or with managing polarity when they're dealing with thousands of fibers that not only have to transmit but also receive. These issues can delay deployment and rack up hours on the job.

The latest generation of the MTP connector brings novel features and functionality that simplify field configurability. Don't have the right male or female end on hand? Not a problem. These new MTP connectors make it easy to change gender and polarity in the field, without requiring a specialized skill set or a connector engineer. Along with optimized field configurability, the connectors also feature environmentally friendly performance enhancements that improve the feel of plugging and unplugging.

Make Your Move to MTP Connectors

Since 1996, installers have relied on MTP connectors to speed deployment of data center installations. Now we've seen that the advantages of MTP go much further. With their 20-plus-year history of performance, ongoing improvements, and the next generation of advancements soon to come, MTP connectors still deliver exceptional value for a vast range of network technologies. Regardless of the technology you're working with, make MTP connectors part of your data center build-out. And take full advantage of the time savings, space efficiencies, and simplicity synonymous with the MTP brand.

Capable of holding 864 fibers, the MTP format proved well-suited for data centers with serious space constraints.

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