

An MTP connector made by tde.  
The ferrule contains 72 fibers.

## MPO/MTP connectors – a flawed design?

### TIPS FOR CHOOSING HIGH QUALITY MULTI-FIBER CONNECTORS

Many users believe that MPO connectors have a flawed design due to their ferrules. However, since the new ›IEEE 802.3ba‹ standard was adopted in June 2010, it has been clear that future transmission speeds of 40 and 100GB using multimode fibers will be achieved exclusively through the use of MPO/MTP connectors.

#### WILFRIED SCHNEIDER

**M**PO and MTP connectors are standardized multi-fiber connectors with four, eight, twelve, 24 or even 72 fibers (see title picture) in a single housing. MPO stands for ›multi path push-on‹ and is a universal designation, while MTP is a patented connector made by US-Conec, – although the two connector types are fully compatible. The connectors are available in singlemode and multimode designs and have approximately the same dimensions as the commonly used ›RJ-45‹ connector. The fibers are fed into and bonded in ferrules with very small dimensions (2.5 x 6.4 mm<sup>2</sup>). Because they are so compact, MTP connectors provide extremely high packing density and out-

standing performance where limited space is available. MTP connectors can be used wherever stringent density and performance requirements coincide with limited space, whether that is in back plane, backbone or front-end applications. They can also be used for the higher transmission rates delivered by ›Fiber Channel‹ and ›Infiniband‹.

In many cases, critics base their dismissal of MTP connectors on negative experiences with ›MT-RJ‹ connectors in the past. These are multi-fiber connectors with two fibers in an MT ferrule. Large numbers of users previously used (on cost grounds) lower quality MT-RJ connectors and had bad experiences with the connectors. As a result, the MT-RJ was never a success and proved unable to establish itself in the

market. It is also important to remember that the production technology employed for this ferrule type was nowhere near today's level. In reality, there is actually no reason why the negative experiences with MT-RJ connectors in the past should be repeated with the latest MTP connectors.

Many users are also of the opinion that circular fibers are better off in a cylindri-

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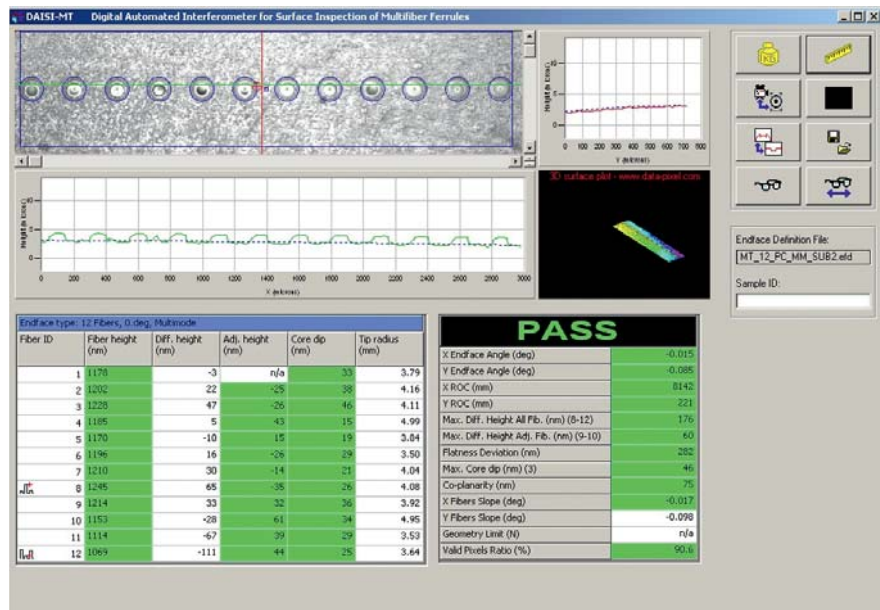
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cal ferrule, as this makes polishing processes easier. Some of them also assume that the plastic is stripped more quickly when polishing than the embedded fibers, which have greater hardness.

All of these criticisms actually relate to parameters that can be dealt with by optimizing the production process. Assuming the right choice of product is made, MTP connectors can bring huge advantages. But how does one go about doing this?

## Production calls for know-how

When selecting an MTP connector, users need to focus on quality and avoid making false economies. Producing a high quality MTP connector calls for the utmost precision and a wealth of knowledge. Distributing multiple fibers packed together in a 0.25 mm grid in a single ferrule results in very high demands, for both production of high precision ferrules with narrow tolerances, and for assembly of high performance connectors. Subsequent tuning or alignment of ferrules in the actual connector – common practice on other connector types to offset tolerances in the ferrules and achieve improved performance – is simply impossible with multi-fiber connectors. Quality and performance losses often occur with cylindrical ceramic ferrules due to excessive squint angle mismatch and a lack of concentricity of the holes. Modern production methods enable the holes in plastic ferrules to be produced with far greater precision than is the case with zirconium ferrules. MTP ferrules from USConec, for example, are produced with optimum precision and deliver performance that would be the envy of all manufacturers of conventional ferrules.



1 The interferometer image provides information about the quality of the connector.

On the component side, this means that the holes for fibers and guide pins have to be produced with maximum precision. The plastic material used requires high quality and specific properties. On the production side, high MTP connector performance can only be achieved by continuous monitoring and optimization of the polishing processes. The only way to guarantee constant quality and minimal attenuation losses is by implementing more stringent geometric specifications for the connector surface and one hundred percent testing of these specifications.

The key factor behind the performance of the connectors is to achieve a uniform fiber facet offset, so that when coupling two connectors, the air gap between all fibers is as small as possible, thus minimizing losses. With meticulous production processes, the lowest fiber height differ-

ences that can be achieved with state-of-the-art production technology and high quality components is in the nanometer range, way below the intended standard. This is the only way to obtain maximum attenuation values of 0.20 dB.

## What parameters do users need to consider?

Stable results can only be achieved with high quality components. Narrow tolerances for guide holes and pins is of critical importance in producing good attenuation values, and using premium quality ferrules definitely makes sense.

The high quality MTP connectors also feature optimized oval springs, which ensure optimum pressure on the ferrules while simultaneously preventing stress on the fibers at the end of the connector. The ferrule is mounted to move freely in the body of the connector to make the connection process easier. Meanwhile, the guide pins do not have any sharp edges, preventing any unwanted abrasion in the holes on the opposite side. This has a significant impact on the connection cycle and performance.

To ensure that all fibers achieve the same high level of performance, the fiber height should be as uniform as possible. Practical experience shows that the limits specified by the IEC of 500 nm as the maximum height difference between all fibers and 300 nm as the maximum height



2 The use of idle fibers in a 40 GbE network means that the four rear MTP connectors feed into six front MTP connectors.

▶ difference between two adjacent fibers (see ›IEC 61755-3-3‹ and ›EN 50377-15-1‹) are much too high.

Specialist manufacturers measure these quality parameters with an interferometer on every multi-fiber connector, and provide their customers with the measured values (Figure 1).

## Multi-fiber connectors in 40/100GbE networks

Both 40 and 100GbE networks involving multimode fibers are created exclusively using MTP connectors (Figure 3). Using conventional single-fiber connection technology alone is not possible, as conventional single-fiber connectors would require far too much space for each link. Signal delay time differences (skew) caused by varying fiber lengths could also lead to faults. The IEEE 802.3ba standard stipulates the use of a single-row 12 fiber MTP connector for 40GbE. A total of eight fibers are required, with four fibers used for transmission, four central fibers unused and four fibers used to receive signals (Figure 2). A 24 fiber MTP connector is used for a 100 GbE network. A 24 fiber MPO connector has two rows of twelve fibers, with only 20 fibers used and the outer fibers remaining unused. To ensure effective migration to 100GbE with exist-

**3** A fully installed tML module mounting made by tde. The rear MTP and Telco connectors allow on-site plug & play installation. The modules are available with all standard connectors on the front.

ing 12 fiber MPO/MTP connections, the use of two adjacent 12 fiber MTPs is possible as an option. One connector is used for transmission and the other to receive data.

## Summary

**In the coming decade, 40/100GbE networks will bring about a four- to tenfold increase in the number of fibers used in data centers. The optimum solution for next generation networks is to use high quality ›OM3‹ and ›OM4‹ fibers combined with equally high quality MPO/MTP connectors in pre-assembled**

**systems. In the future, using MPO/MTO connectors will be unavoidable, so it is vital to focus on quality when choosing a connector, and the best way to do this is by relying on system solutions ›made in Germany‹ by a single supplier.**

## AUTHOR

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