

tML<sup>®</sup> 24- FO Dark Fiber Module 2x 24F MPO without Pins/6x 12F MPO with Pins 50/125µ OM3, SR4



## tML<sup>®</sup> - tde Modular Link

tML<sup>®</sup> is a patented, modular cabling system consisting of the three key components module, trunk cable and rack mount enclosure. The system components are 100 percent manufactured, pre-assembled and tested in Germany. They enable plug-and-play installation on site – especially in data centres, but also in industrial environments – within the shortest possible time. Heart of the system are the rear MPO/MTP<sup>®</sup> and Telco connectors, which can be used to connect at least six or twelve ports at a time. Depending on the module configuration, transfer rates of up to 200G are currently possible with SR4. The fibre optic and TP modules can be used together in a module carrier with a very high port density. The tde offers its tML<sup>®</sup> cabling system as a proven tML<sup>®</sup> standard system and in the highly innovative variants tML<sup>®</sup> Xtended, tML<sup>®</sup> 24 System and now tML<sup>®</sup> 32 System for extreme scalability and very easy migration to higher transmission rates such as 40G, 100G, 200G and 400G.

The tML<sup>®</sup> 24 - FO Dark Fiber Module MPO/MTP<sup>®</sup> is intended for the installation in the tML<sup>®</sup> Rack Mount Enclosure 1U (for 8 x Modules).



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## Technical Data

The end faces of the connectors are optimized by means of Lasercleaving and machine polish. The MPO/MTP<sup>®</sup>plug has a defined fiber height of 1 - 3.5 $\mu$ . The max. adjacent fiber height difference is 0.2 $\mu$ m and for all fibers 0.3 $\mu$ m. All system components (modules, trunk cables and patch cords) are co-ordinated for the reaching of the performance particularly. The module is marked with sequential serial number and article number. The modules are ROHS compliant.

Entry	2 x MPO/MTP <sup>®</sup> (24 Fibers) Female Adapter (red) back
Exit	6 x MPO/MTP <sup>®</sup> (12 Fibers) Male Adapter (aqua) front
Tests	Interferometer, Insertion Loss, Return Loss and Visual Final Inspection; all measured values are electronically archived
	QS-Managementsystem ISO 9001, ISO 14001 and TL 9000

Box	Galvanized steel sheet
Front Panel	Stainless steel
Dimensions	110 x 108 x 20 mm

## FO Adapters

Type	MPO/MTP <sup>®</sup>
Application	Singlemode / Multimode
Design	without Flange
Connector style	SC Simplex
Key Orientation	Type A, Key up/down
Color	Red
Material	Plastic
Sleeve	--
Shutter	--
Standards	IEC 61754-7 TIA 604-5
Manufacturer	US Conec

## FO Adapters

Type	MPO/MTP <sup>®</sup>
Application	Multimode OM3
Design	without Flange
Connector style	SC Simplex
Key Orientation	Type A, Key up/down
Color	Aqua
Material	Plastic
Sleeve	--
Shutter	--

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Standards	IEC 61754-7 TIA 604-5
Manufacturer	US Conec

### FO Connectors

The end faces of the connectors are optimized by means of Lasercleaving and machine polish. The MPO/MTP<sup>®</sup> plug has a defined fiber height of 1 - 3.5 $\mu$ m. The max. adjacent fiber height difference is 0.2 $\mu$ m and for all fibers 0.3 $\mu$ m.

#### Connector

Type	MPO/MTP <sup>®</sup> Female Push Pull Locking (aqua)
Ferrule	24 Fiber MM Elite <sup>®</sup> ferrule, PPS
Boot colour	Red
Temperature range	-40°C to +75°C
Manufacturer	tde/US Conec

#### Optical Performance

Fiber	Type	Wavelength	Insertion loss typ.	Insertion loss max.	Return loss min.
50/125 $\mu$ OM3	MPO/MTP <sup>®</sup>	850 nm	$\leq$ 0.20 dB	0.35 dB	25 dB

### FO Connectors

#### Connector

Type	MPO/MTP <sup>®</sup> Male Push Pull Locking (aqua)
Ferrule	12 Fiber MM Elite <sup>®</sup> ferrule, PPS
Boot colour	Black
Manufacturer	tde/US Conec

#### Optical Performance

Fiber	Type	Wavelength	Insertion loss typ.	Insertion loss max.	Return loss min.
50/125 $\mu$ OM3	MPO/MTP <sup>®</sup>	850 nm	$\leq$ 0.14 dB	0.25 dB	35 dB

### FO Fiber

Type	Corning ClearCurve <sup>®</sup> 50/125 $\mu$ OM3 multimode fiber
Optimized Data Rate over Distance	40/100 Gb/s über 140 m* 10 Gb/s over 300 m 1 Gb/s over 1000 m
Standard Compliance	ISO/IEC 11801: type OM3 fiber IEC 60793-2-10: type A1a.2 fiber TIA/EIA: 492AAAC-B ITU: ITU G651.1

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*	Distances specified in the 40G/100G per IEEE 802.3ba standard are 150m on OM4 and 100m on OM3; Corning fibers are manufactured to tighter dispersion specifications and thereby support the extended distances shown in the table (assuming cable attenuation $\leq 3.0$ dB/km and same 1.0 dB of connector loss for OM3 that the standard requires for OM4).
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### Optical Specifications

Bandwidth	High Performance EMB* (MHz.km): 2000 at 850 nm only Legacy Performance EMB* (MHz.km): 1500 at 850 nm / 500 at 1300 nm
Attenuation	At 850 nm max. $\leq 2.3$ dB/km At 1300 nm max. $\leq 0.6$ dB/km
Macrobend Loss	Mandrel Radius (mm): 37.5 / 15 / 7.5 Number of Turns: 100 / 2 / 2 Induced Attenuation (dB) at 850 nm: $\leq 0.05$ / $\leq 0.1$ / $\leq 0.2$ Induced Attenuation (dB) at 1300 nm: $\leq 0.15$ / $\leq 0.3$ / $\leq 0.5$
Numerical Aperture	0.200 $\pm$ 0.015
*	Ensured via miniEMBc, per TIA/EIA 455-220A and IEC 60793-1-49, for high performance laser-based systems (up to 10 Gb/s).
**	OFL BW, per TIA/EIA 455-204 and IEC 60793-1-41, for legacy and LED-based systems (typically up to 100 Mb/s).

### Dimensional Specifications

Core Diameter	50.0 $\pm$ 2.5 $\mu$ m
Cladding Diameter	125.0 $\pm$ 1.0 $\mu$ m
Core-Clad Concentricity	$\leq 1.5$ $\mu$ m
Cladding Non-Circularity	$\leq 1.0\%$
Core Non-Circularity	$\leq 5.0\%$
Coating Diameter	242 $\pm$ 5 $\mu$ m
Coating-Cladding Concentricity	$< 12$ $\mu$ m

### Environmental

Environmental Test	Test Condition	Induced Attenuation 850 nm & 1300 nm (dB/km)
Temperature Dependence	-60°C to +85°C	$\leq 0.10$
Temperature Humidity Cycling	-10°C to +85°C and 4% to 98% RH	$\leq 0.10$
Water Immersion	23°C $\pm$ 2°C	$\leq 0.20$
Heat Aging	85°C $\pm$ 2°C	$\leq 0.20$
Damp Heat	85°C at 85% RH	$\leq 0.20$
Operating Temperature Range	-60°C to +85°C	

### Mechanical Specifications

Proof Test	The entire fiber length is subjected to a tensile stress $\geq 100$ kpsi (0.7 GN/m <sup>2</sup> ).
Length	Fiber lengths available up to 17.6 km/spool.

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## Performance Characterizations

Refractive Index Difference	1%
Effective Group Index of Refraction	850 nm: 1.480 1300 nm: 1.479
Fatigue Resistance Parameter (nd)	20
Coating Strip Force	Dry: 0.6 lbs (2.7N) Wet: 14 days in 23°C water soak: 0.6 lbs (2.7N)
Chromatic Dispersion	Zero Dispersion Wavelength ( $\lambda_0$ ): 1295 nm $\leq \lambda_0 \leq$ 1315 nm Zero Dispersion Slope (S0): $\leq 0.101$ ps/(nm <sup>2</sup> *km)

## Product variants & accessories

Art.-No.	Description
TML-M06MPP/02M2-09E	tML <sup>®</sup> 24- FO Dark Fiber Module 2x 24F MPO without Pins/6x 12F MPO with Pins 09/125 $\mu$ OS2, LR4
TML-M06MPP/02M2-50G3	tML <sup>®</sup> 24- FO Dark Fiber Module 2x 24F MPO without Pins/6x 12F MPO with Pins 50/125 $\mu$ OM3, SR4
TML-M06MPP/02M2-50G4	tML <sup>®</sup> 24- FO Dark Fiber Module 2x 24F MPO without Pins/6x 12F MPO with Pins 50/125 $\mu$ OM4, SR4
TML-M06MPP/02M2-50G5	tML <sup>®</sup> 24- FO Dark Fiber Module 2x 24F MPO without Pins/6x 12F MPO with Pins 50/125 $\mu$ OM5, SR4