

## Description

tML® 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® 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 400G 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® cabling system as a proven tML® standard system and in the highly innovative variants tML® 12, tML® 24, tML® 32 and now tML® 24+ System for extreme scalability and very easy migration to higher transmission rates such as 40G, 100G, 200G, 400G and 800G and more.

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

## Technical Data

The end faces of the connectors are optimized by means of Lasercleaving and machine polish. The MPO/MTP® plug has a defined fiber height of 1 - 3.5µ. The max. adjacent fiber height difference is 0.2µm and for all fibers 0.3µm. 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	1 x MPO/MTP® Male Adapter (green) back
Exit	6 x E2000 Compact Adapter (blue) 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®
Application	Singlemode OS2 APC
Design	without Flange
Connector style	SC Simplex
Key Orientation	Type A, Key up/down
Color	Green
Material	Plastic

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

### FO Adapters

Standardisation	acc. to IEC61754-15, DIN EN 186270
Mating cycles	min. 1000
Pull-out force	min. 70 N
Number of connectors (A)	1
Connector type (A)	E2000™ Compact
Protection class (IP) connector (A)	20
Polishing connector (A)	PC
Attenuation grade IL - connector (A)	≤ 0.2 dB, testing method acc. to IEC 61300-3-4
Connector color (A)	blue
Lever- frame-coding connector (A)	color
Frame color connector (A)	blue-blue
Sleeve material	Zirkonia Staight Split
Holder for connector / module	support plate
Fiber type	Singlemode (SM)
Dimensions	74.7 / 42 x 14.7 / 22.95 x 13 / 16.6 mm
Material	steel: X10CrNi18-8 (1.4310) / plastic: PBT, fiber-glass reinforced (halogen-free)
Manufacturer	R&M

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

### FO Connectors

Type	MPO/MTP® APC Male Push Pull Locking with Elite Pins (green)
Ferrule	12 Fiber SM Elite® ferrule, PPS
Boot colour	Black
Temperature range	-40°C bis +75°C

Manufacturer	tde/US Conec
--------------	--------------

**Optical Performance**

Fiber	Type	Wavelength	Insertion loss typ.	Insertion loss max.	Return loss min.
9/125µ OS2	MPO/MTP®APC	1310 / 1550 nm	≤ 0.10 dB	0.20 dB	75 dB

**FO Connectors**

Type	E2000 UPC
Ferrule	Ceramic
Ferrule Hole	125.5 µ
Ferrule Concentricity	≤ 0.6 µ
Connector colour	Blue
Lever Colour	Blue
Boot colour	Blue
Manufacturer	RDM

**Optical performance**

Fiber	Type	Wavelength	Insertion loss typ.	Insertion loss max.	Return loss min.
9/125µ	E2000 UPC	1550 nm	≤ 0.10 dB	0.25 dB	55 dB

**FO Fiber**

Type	Corning SMF-28e+® 09/125µ OS2 G.652.D singlemode fiber
Maximum Attenuation	At 1310 nm max. 0.33 - 0.35 dB/km At 1383 ± 3 nm max. 0.31 - 0.35 dB/km At 1490 nm max. 0.21 - 0.24 dB/km At 1550 nm max. 0.19 - 0.20 dB/km At 1625 nm max. 0.20 - 0.23 dB/km
Attenuation vs. Wavelength	Range: 1285 - 1330 nm; Ref. λ: 1310 nm; Max. Difference: 0.03 dB/km Range: 1525 - 1575 nm; Ref. λ: 1550 nm; Max. Difference: 0.02 dB/km
Macrobend Loss	Mandrel Diameter:32mm; Number of Turns: 1; Wavelength: 1550nm; Induced Attenuation: ≤0.03 dB Mandrel Diameter:50mm; Number of Turns: 100; Wavelength: 1310nm; Induced Attenuation: ≤0.03 dB Mandrel Diameter:50mm; Number of Turns: 100; Wavelength: 1550nm; Induced Attenuation: ≤0.03 dB Mandrel Diameter:60mm; Number of Turns: 100; Wavelength: 1625nm; Induced Attenuation: ≤0.03 dB

Point Discontinuity	Wavelength: 1310 nm; Point Discontinuity: $\leq 0.05$ dB Wavelength: 1550 nm; Point Discontinuity: $\leq 0.05$ dB
Cable Cutoff Wavelength ( $\lambda_{ccf}$ )	$\lambda_{ccf} \leq 1260$ nm
Mode-Field Diameter	At 1310 nm = $9.2 \pm 0.4$ $\mu$ m At 1550 nm = $10.4 \pm 0.5$ $\mu$ m
Dispersion	At 1550 nm = $\leq 18.0$ [ps/(nm*km)] At 1625 nm = $\leq 22.0$ [ps/(nm*km)]
	Zero Dispersion Wavelength ( $\lambda_0$ ): 1310 nm $\leq \lambda_0 \leq$ 1324 nm Zero Dispersion Slope ( $S_0$ ): $\leq 0.092$ ps/(nm <sup>2</sup> *km)
Polarization Mode Dispersion (PMD)	PMD Link Design Value = $\leq 0.06$ ps/ $\sqrt$ km Maximum Individual Fiber = $\leq 0.1$ ps/ $\sqrt$ km
Norm	ITU-T Recommendation G.652 (Tables A, B, C, and D) IEC Specifications 60793-2-50 Type B1.3 TIA/EIA 492-CAAB Telcordia Generic Requirements GR-20-CORE ISO 11801 OS2

#### Dimensional Specifications

Fiber Curl	$\geq 4.0$ m radius of curvature
Cladding Diameter	$125.0 \pm 0.7$ $\mu$ m
Core-Clad Concentricity	$\leq 0.5$ $\mu$ m
Cladding Non-Circularity	$\leq 0.7\%$
Coating Diameter	$242 \pm 5$ $\mu$ m
Coating-Cladding Concentricity	$< 12$ $\mu$ m

#### Environmental Specifications

Environmental Test	Test Condition	Induced Attenuation 1310 nm, 1550 nm & 1625 nm
Temperature Dependence	-60°C to +85°C	$\leq 0.05$
Temperature Humidity Cycling	-10°C to +85°C up to 98% RH	$\leq 0.05$
Water Immersion	23°C $\pm$ 2°C	$\leq 0.05$
Heat Aging	85°C $\pm$ 2°C	$\leq 0.05$
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 GPa).
Length	Fiber lengths available up to 63.0 km/spool.

Performance Characterizations

Core Diameter	8.2 µm
Numerical Aperture	0.14
Zero Dispersion Wavelength ( $\lambda_0$ )	1317 nm
Zero Dispersion Slope ( $S_0$ )	0.088 ps/(nm <sup>2</sup> *km)
Effective Group Index of Refraction	1310 nm: 1.4676 1550 nm: 1.4682
Fatigue Resistance Parameter (nd)	20
Coating Strip Force	Dry: 0.6 lbs (3N) Wet: 14 days room temperature: 0.6 lbs (3N)
Rayleigh Backscatter Coefficient (for 1 ns Pulse Width)	1310 nm: -77 dB 1550 nm: -82 dB

Art.-No.	Description
TML-M06E2AC/MPP09E	tML® - FO Module MPO/MTP® with Pins/6x E2000 APC Compact 9/125µ OS2
TML-M06E2C/MPP09E	tML® - FO Module MPO/MTP® with Pins/6x E2000 Compact 9/125µ OS2
TML-M06E2C/MPP50G	tML® - FO Module MPO/MTP® with Pins/6x E2000 Compact 50/125µ OM2
TML-M06E2C/MPP50G3	tML® - FO Module MPO/MTP® with Pins/6x E2000 Compact 50/125µ OM3
TML-M06E2C/MPP50G4	tML® - FO Module MPO/MTP® with Pins/6x E2000 Compact 50/125µ OM4
TML-M06E2C/MPP62G	tML® - FO Module MPO/MTP® with Pins/6x E2000 Compact 62,5/125µ OM1