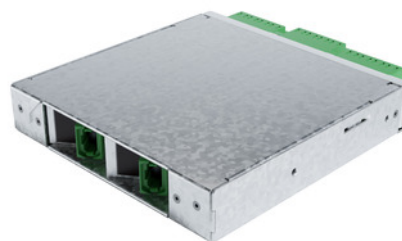


tML<sup>®</sup> HD - FO Module 5HP black 2x MPO/MTP<sup>®</sup> with Pins/12x LC Duplex 9/125µ OS2



## 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> HD - FO Module 5HP MPO/MTP<sup>®</sup> is intended for the installation in the tML<sup>®</sup> Rack Mount Enclosure 3U (for 17 x Modules). The tML<sup>®</sup> HD module can be used only in combination with the tML<sup>®</sup> HD patch cord.



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## tML® HD - FO Module 5HP black 2x MPO/MTP® with Pins/12x LC Duplex 9/125µ OS2

### 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 | 2 x MPO/MTP®Male Adapter (green) back  |
| Exit  | 6 x LC Quad 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 | black                  |

### 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<br>TIA 604-5 |
| Manufacturer    | US Conec                 |

### FO Adapters

|              |                         |
|--------------|-------------------------|
| Type         | LC Quad                 |
| Application  | Singlemode OS2 PC       |
| Design       | with flange             |
| Footprint    | SC Duplex               |
| Color        | Blue                    |
| Material     | Plastic                 |
| Sleeve       | Zirconia Straight Split |
| Shutter      | --                      |
| Manufacturer | tde                     |

## tML<sup>®</sup> HD - FO Module 5HP black 2x MPO/MTP<sup>®</sup> with Pins/12x LC Duplex 9/125μ OS2

### 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 - 3.5μ. The max. adjacent fiber height difference is 0.2μm and for all fibers 0.3μm.

#### Connector

|                   |   |
|-------------------|---|
| Type              | MPO/MTP <sup>®</sup> APC Male Push Pull Locking with Elite Pins (green) |
| Ferrule           | 12 Fiber SM Elite <sup>®</sup> 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 <sup>®</sup> APC | 1310 / 1550 nm | ≤ 0.10 dB           | 0.20 dB             | 75 dB            |

### FO Connectors

|                       |  |
|-----------------------|--|
| Connector Type        | LC UPC Unibody Simplex                         |
| Housing               | Plastic, Blue                                  |
| Ferrule               | Zirconia Straight Split, Spring-loaded Axially |
| Ferrul Hole           | 125.5 μ  |
| Ferrule Concentricity | ≤ 0.6 μ  |
| Mating Cycles         | 500  |
| Operating temperature | -40°C up to +75°C                              |
| Strain Relief to      | 100 N  |
| Manufacturer          | tde  |

#### Optical performance

| Fiber  | Type   | Wavelength     | Insertion loss typ. | Insertion loss max. | Return loss min. |
|--------|--------|----------------|---------------------|---------------------|------------------|
| 9/125μ | LC UPC | 1310 / 1550 nm | ≤ 0.10 dB           | 0.25 dB             | 55 dB            |

### FO Fiber

|                            |   |
|----------------------------|---|
| Type                       | Corning SMF-28e+ <sup>®</sup> 09/125μ OS2 G.652.D singlemode fiber  |
| Maximum Attenuation        | At 1310 nm max. 0.33 - 0.35 dB/km<br>At 1383 ± 3 nm max. 0.31 - 0.35 dB/km<br>At 1490 nm max. 0.21 - 0.24 dB/km<br>At 1550 nm max. 0.19 - 0.20 dB/km<br>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<br>Range: 1525 - 1575 nm; Ref. λ: 1550 nm; Max. Difference: 0.02 dB/km  |

## tML<sup>®</sup> HD - FO Module 5HP black 2x MPO/MTP<sup>®</sup> with Pins/12x LC Duplex 9/125μ OS2

|   |  |
|---|--|
| Macrobend Loss                              | Mandrel Diameter:32mm; Number of Turns: 1; Wavelength: 1550nm; Induced Attenuation: ≤0.03 dB<br>Mandrel Diameter:50mm; Number of Turns: 100; Wavelength: 1310nm; Induced Attenuation: ≤0.03 dB<br>Mandrel Diameter:50mm; Number of Turns: 100; Wavelength: 1550nm; Induced Attenuation: ≤0.03 dB<br>Mandrel Diameter:60mm; Number of Turns: 100; Wavelength: 1625nm; Induced Attenuation: ≤0.03 dB |
| Point Discontinuity                         | Wavelength: 1310 nm; Point Discontinuity: ≤ 0.05 dB<br>Wavelength: 1550 nm; Point Discontinuity: ≤ 0.05 dB   |
| Cable Cutoff Wavelength ( $\lambda_{ccf}$ ) | $\lambda_{ccf} \leq 1260$ nm   |
| Mode-Field Diameter                         | At 1310 nm = $9.2 \pm 0.4$ μm<br>At 1550 nm = $10.4 \pm 0.5$ μm  |
| Dispersion                                  | At 1550 nm = ≤ 18.0 [ps/(nm*km)]<br>At 1625 nm = ≤ 22.0 [ps/(nm*km)]   |
|   | Zero Dispersion Wavelength ( $\lambda_0$ ): 1310 nm ≤ $\lambda_0$ ≤ 1324 nm<br>Zero Dispersion Slope ( $S_0$ ): ≤ 0.092 ps/(nm <sup>2</sup> *km)   |
| Polarization Mode Dispersion (PMD)          | PMD Link Design Value = ≤ 0.06 ps/√km<br>Maximum Individual Fiber = ≤ 0.1 ps/√km   |
| Norm  | ITU-T Recommendation G.652 (Tables A, B, C, and D)<br>IEC Specifications 60793-2-50 Type B1.3<br>TIA/EIA 492-CAAB<br>Telcordia Generic Requirements GR-20-CORE<br>ISO 11801 OS2  |

### Dimensional Specifications

|                                |                             |
|--------------------------------|-----------------------------|
| Fiber Curl                     | ≥ 4.0 m radius of curvature |
| Cladding Diameter              | 125.0 ± 0.7 μm              |
| Core-Clad Concentricity        | ≤ 0.5 μm                    |
| Cladding Non-Circularity       | ≤ 0.7%                      |
| Coating Diameter               | 242 ± 5 μm                  |
| Coating-Cladding Concentricity | < 12 μm                     |

### Environmental Specifications

| Environmental Test           | Test Condition              | Induced Attenuation 1310 nm, 1550 nm & 1625 nm |
|------------------------------|-----------------------------|--|
| Temperature Dependence       | -60°C to +85°C              | ≤ 0.05   |
| Temperature Humidity Cycling | -10°C to +85°C up to 98% RH | ≤ 0.05   |
| Water Immersion              | 23°C ± 2°C                  | ≤ 0.05   |
| Heat Aging                   | 85°C ± 2°C                  | ≤ 0.05   |
| Operating Temperature Range  | -60°C to +85°C              |  |

### Mechanical Specifications

|            |  |
|------------|--|
| Proof Test | The entire fiber length is subjected to a tensile stress ≥ 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   |

## tML<sup>®</sup> HD - FO Module 5HP black 2x MPO/MTP<sup>®</sup> with Pins/12x LC Duplex 9/125 $\mu$ OS2

|   |  |
|---|--|
| 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<br>1550 nm: 1.4682                               |
| Fatigue Resistance Parameter (nd)                       | 20   |
| Coating Strip Force                                     | Dry: 0.6 lbs (3N)<br>Wet: 14 days room temperature: 0.6 lbs (3N) |
| Rayleigh Backscatter Coefficient (for 1 ns Pulse Width) | 1310 nm: -77 dB<br>1550 nm: -82 dB                               |

## Product variants & accessories

| Art.-No.             | Description  |
|----------------------|--|
| TML-T12LCADK/MPP09ES | tML <sup>®</sup> HD - FO Module 5HP black MPO/MTP <sup>®</sup> with Pins/12x LC APC Duplex 9/125 $\mu$ OS2 |
| TML-T12LCDK/MPP09ES  | tML <sup>®</sup> HD - FO Module 5HP black 2x MPO/MTP <sup>®</sup> with Pins/12x LC Duplex 9/125 $\mu$ OS2  |
| TML-T12LCDK/MPP50G3S | tML <sup>®</sup> HD - FO Module 5HP black 2x MPO/MTP <sup>®</sup> with Pins/12x LC Duplex 50/125 $\mu$ OM3 |
| TML-T12LCDK/MPP50G4S | tML <sup>®</sup> HD - FO Module 5HP black 2x MPO/MTP <sup>®</sup> with Pins/12x LC Duplex 50/125 $\mu$ OM4 |