

R&M GENERIC SPECIFICATION FOR NETSCALE™ SOLUTIONS

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1 Netscale™ Systems: General

Netscale systems include factory-terminated system components which can be quickly mated to form an end-to-end optical link between patching locations and/or equipment ports. Netscale is an ultra-high density system solution with rapid installation time that enables easy migration to parallel transmissions of 40G and 100G systems.

Netscale is a modular solution with fiber trunks terminated with either 2 fibers into each LC-duplex or 12 fibers into each MPO connector, which mate at each end to a harness, MPO-to-LC module or patch cords. Harnesses are cable assemblies which transition 12 fibers from an MPO connector to single-fiber connectors. MPO-to-LC modules have an identical configuration but they are protected in a modular case. Modular system solutions offer a greater degree of flexibility in managing equipment moves, additions, or changes. An example of this type of system is given in Figure 1.

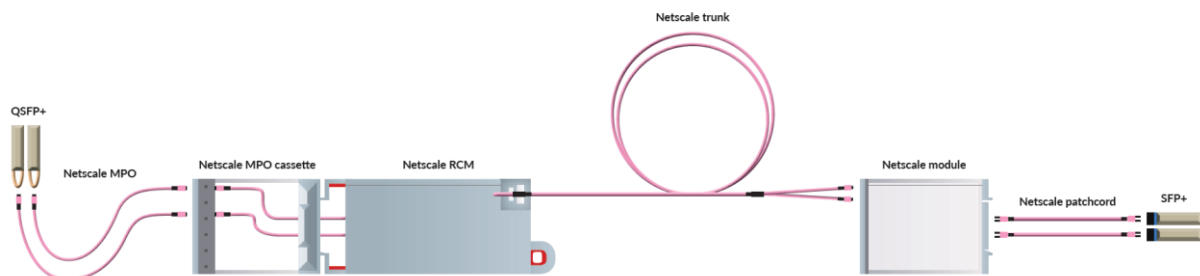


Figure 1: Modular Netscale™ System connecting QSFP+ to SFP+ Transceiver Ports with modules, LC and MPO patch cords.

- 1.1. To maintain proper fiber system polarity, components shall be specified to comply with Type S wiring as described in section 8.
- 1.2. Insertion loss specifications of individual components represent the expected performance when mated to other system components of like specification.

2. Trunk Specifications and Options

- 2.1. Trunk Function and Construction
 - 2.1.1. The operational temperature range for trunks shall be +15°C to +60°C.
 - 2.1.2. Trunks shall be all-dielectric construction.

- 2.1.3. Trunks shall be constructed with MPO connectors at both ends.
- 2.1.4. Trunk fiber count shall be specified as 12, 24, 36, 48, 72, 96 and 144.
- 2.1.5. Trunks shall be subdivided into 12-fiber legs. Standard leg length shall be 600 mm +50/-0mm.
- 2.1.6. Trunk length shall be specified as the distance between connector surfaces at each end of the cable and shall include the length of the legs at each end.
- 2.1.7. Trunk-cable dividers shall consist of a molded outer shell filled with an epoxy encapsulate.
- 2.1.8. The cable divider shall be round with an anti-rotation protection. This feature allows mounting the trunk into the hardware in any orientation and decouples torsional forces.
- 2.1.9. There shall be two cable divider sizes depending on the fiber count of the trunk. Trunks with 12 to 36 fibers shall be constructed with a size 1 divider. The size 1 divider dimension shall be 12.0 mm x 12.0 mm x 31.8 mm (65.1 mm inclusive boot). The divider shall have a notch area with dimensions of 7.9 mm x 11.9 mm x 1.8 mm in order to accommodate a field installable snap-on clip to secure the cable divider into or outside of the hardware. Trunks with 48 to 144 fibers shall be constructed with a size 2 divider. The size 2 cable divider dimension shall be 22.4 mm x 22.4 mm x 58.5 mm (127.6 mm inclusive boot). The divider shall have a notch area with dimensions of 18.4 mm x 22.4 mm x 2.2 mm in order to accommodate a field installable snap-on clip to secure the cable divider into or outside of the hardware. Trunks with 24 or 36 fiber can be constructed with either size 1 or size 2 dividers.
- 2.1.10. A tool-less snap-on clip shall be used to secure the trunk into the hardware. For low fiber count trunks (12 through 36 fibers), size 1 snap-on clips shall be offered. For higher fiber count trunks (24 to 144 fibers) size 2 snap-on clips shall be offered.
- 2.1.11. Trunk cable dividers shall incorporate mechanically designed features that allow securing the trunks inside or outside a patch panel or housing.
- 2.1.12. The trunk components shall be ROHS compliant.
- 2.1.13. Trunk cables shall be manufactured with bend-insensitive fiber and meet the fiber performance specifications mentioned in Table 2.
- 2.1.14. The trunk cable shall have a minimum bend radius of five times the outer cable diameter.
- 2.1.15. LSZH rated trunk cables shall meet the application requirements of Low Smoke (IEC 61034), Zero Halogen (IEC 60754-1), Flame Retardant (IEC 60332-3), Non-Corrosive (IEC 60754-2).
- 2.1.16. The trunk cable shall meet the outer diameters specified in Table 1.

Table 1: Trunk cable outer diameter

| Fiber count | LSZH trunk cable outer diameter (mm) |
|-------------|--------------------------------------|
| 12 | 3.0 |
| 24 | 3.5 |
| 36 | 6.8 |
| 48 | 6.8 |
| 72 | 7.5 |
| 96 | 8.5 |
| 144 | 9.0 |

- 2.1.17. The trunk legs shall be round and have a 2.2 mm outer diameter with no preferential bend for easy routing.
- 2.1.18. Trunks shall meet the connector performance specifications of TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard, (normative) Annex A, or EN

2.2. Trunk Fiber Types, Optical Specifications, and Jacket Color

2.2.1. Available fiber types and their optical performance specifications shall be as indicated in Table 2.

2.2.2. Trunk jacket color shall be as indicated in Table 2.

Table 2: Trunk - Available Fiber Types, Optical Specifications, Jacket Colors

| Property | Multimode | | Singlemode |
|---|---|---|---|
| | OM3 Bend-insensitive 50µm (850/1300nm) | OM4 Bend-insensitive 50µm (850/1300nm) | OS2 Bend-insensitive 9µm (1310/1550nm) |
| Cabled Fiber Attenuation, max (dB/km) | 3.0/1.0 | 3.0/1.0 | 0.35/0.2 |
| Minimum Over Filled Launch (OFL) Bandwidth (MHz*km) | 1500/500 | 3500/500 | -/- |
| Minimum Effective Modal Bandwidth (EMB) (MHz*km) | 2000/- | 4700/- | -/- |
| Jacket Color | Aqua | Heather violet | Yellow |

2.3. Trunk Connectivity

2.3.1. Where modular trunks are specified, connectors shall be MPO having 12 fibers per ferrule.

2.3.2. MPO terminated primary trunks shall have pinned MPO connectors on both ends.

2.3.3. MPO terminated primary trunks shall comply with TIA/EIA 568 Type B array cable.

2.4. Trunk Protective Pulling Tubes

2.4.1. Both ends of a trunk shall have a protective packaging over the cable divider, legs, and connectors. Customer may specify a protective pulling tube on one end, both ends, or neither end.

2.4.2. Pulling tubes shall withstand a maximum pulling force of 100 N.

2.5. Trunk Packaging

2.5.1. Depending on length, the trunk shall either be packaged on in cardboard box or a cardboard reel.

3. Harness Specifications and Options

3.1. Harness Function and Construction

3.1.1. Harnesses shall be 12-fiber cable assemblies used as a transition between MPO terminated trunk legs and end equipment ports or patch panels.

3.1.2. The harness shall provide a means to transition from MPO connectors to LC duplex connectors. The break-out legs shall be 2 mm and use a single two-fiber non-preferential bend cable terminated with quick-release LC Uniboot connectors and share a single boot.

- 3.1.3. The harness break-out point shall be a molded epoxy plug.
- 3.1.4. Harness shall be color coded according to Table 3.

3.2. Harness Fiber Types and Optical Specifications

- 3.2.1. Available fiber types and their optical performance specifications shall be as indicated in Table 3.

3.3. Harness Connectivity

- 3.3.1. Harnesses shall be terminated with a non-pinned MPO connector and legs shall be terminated with LC Uniboot style connectors.

Table 3: Trunk - Available Fiber Types, Optical Specifications, Jacket Colors

| Property | Multimode | | Singlemode |
|---|--|--|--|
| | OM3 Bend-insensitive 50µm (850/1300nm) | OM4 Bend-insensitive 50µm (850/1300nm) | OS2 Bend-insensitive 9µm (1310/1550nm) |
| Cabled Fiber Attenuation, max (dB/km) | 3.0/1.0 | 3.0/1.0 | 0.35/0.2 |
| Minimum Over Filled Launch (OFL) Bandwidth (MHz*km) | 1500/500 | 3500/500 | -/- |
| Minimum Effective Modal Bandwidth (EMB) (MHz*km) | 2000/- | 4700/- | -/- |
| Jacket and leg color | Aqua | Heather violet | Yellow |

4. Patch Cord Specification

4.1. Patch cord function and construction

- 4.1.1. The LC patch cord shall be a 2-fiber cable assembly useful as a transition between the LC side of a harness or module and end equipment ports.
- 4.1.2. The patch cord shall have a LC Uniboot connector with quick release mechanism.
- 4.1.3. The bending directionality shall not be impaired by connector features triggering the quick-release mechanism.
- 4.1.4. The patch cord shall have the option to add an RFID tag for cable tracking purposes.
- 4.1.5. The boot shall have an overall length of 37.2 mm measured from the connector to the end of the boot.
- 4.1.6. The connector should have a mechanism that allows for reversing the polarity in the field. An identifier shall be incorporated on the connector to determine if polarity has been reversed.
- 4.1.7. The patch cord shall be constructed with a single 1.4 mm round cable with no preferential bend that allows easy routing and reduces patch cord congestion in the housings and vertical managers.
- 4.1.8. MPO patch cords shall be constructed with 2.2 mm round cable.
- 4.1.9. MPO patch cords shall be available in TIA/EIA 568 Type A and Type B.

- 4.2. Patch Cord Fiber types and Optical Specifications.
 - 4.2.1. Available fiber types and their optical performance specifications shall be as indicated in Table 3.

5. Cassette Specification

- 5.1. Cassette function and construction
 - 5.1.1. Cassettes shall meet the following dimensions 119.3 mm x 82.7 mm x 29.9 mm (L x W x H).
 - 5.1.2. MPO Cassettes shall provide a means for joining MPO terminated trunks entering the back of an MPO cassette to a MPO terminated harness or MPO patch cord entering at the front of the cassette.
 - 5.1.3. LC Cassettes shall provide a means for joining LC-duplex terminated trunks entering the back of an LC cassette to an LC terminated harness or LC patch cord entering at the front of the cassette.
 - 5.1.4. Cassettes shall be dimensionally compatible with Netscale™ rackmountable connector housings.
 - 5.1.5. Cassette design shall permit front and rear installation into the Netscale™ housings.
 - 5.1.6. Cassettes shall be available with up to 12 (optionally with RFID-based sensor system) or 18 MPO adapters.

6. Module Specifications and Options

- 6.1. Module Function and Construction
 - 6.1.1. Modules shall provide a means for joining MPO terminated trunks entering the back of an appropriately designed connector housing to LC patch cords or cables entering the front of the housing.
 - 6.1.2. Modules shall contain at least two 12-fiber cable assemblies within a protective housing.
 - 6.1.3. Modules shall have shutter LC adapters at the front.
 - 6.1.4. Modules shall be dimensionally compatible with Netscale™ rackmountable connector housings.
 - 6.1.5. The module shall meet the following dimensions 119.3 mm x 82.7 mm x 29.9 mm (L x W x H). It shall provide a high density solution when loaded into the 1U and 3U Netscale™ housings.
 - 6.1.6. Modules shall permit front and rear installation into the Netscale™ housings.
 - 6.1.7. Modules shall be available with up to 12 (optionally with RFID-based sensor system) or 18 MPO adapters.
- 6.2. Module Connectivity
 - 6.2.1. Cable assemblies within modules shall be terminated with non-pinned MPO connector at the back and LC connector at the front.
 - 6.2.2. Each module shall contain 12 fiber terminations.
 - 6.2.3. All connectors shall be inside the module but shall be accessible for mating through adapters mounted through the wall of the module.
 - 6.2.4. The adapters shall be color coded as indicated in Table 4.
- 6.3. Module Fiber Types and Optical Specifications

6.3.1. Available fiber types and their optical performance specifications shall be as indicated in Table 4. Module insertion loss performance shall be as indicated in Table 5.

Table 4: Modules - Available Fiber Types, Optical Specifications, Adapter Colors

| Property | Multimode | Singlemode |
|---|--|--|
| | OM4 bend-insensitive 50µm (850/1300nm) | OS2 Bend-insensitive 9µm (1310/1550nm) |
| Fiber Attenuation, max (dB/km) | 3.0/1.0 | 0.35/0.2 |
| Minimum Over Filled Launch (OFL) Bandwidth (MHz*km) | 3500/500 | -/- |
| Minimum Effective Modal Bandwidth (EMB) (MHz*km) | 4700/- | -/- |
| Adapter color | | |
| LC | black | blue |
| MPO | black | black |

7. Components Insertion Loss Specifications

All components shall meet the maximum insertion loss values indicated in Table 5.

Table 5: Components Optical Specifications - Available Fiber Types

| Property | Multimode | Singlemode |
|---------------------------------------|---|--|
| | OM4 Bend-insensitive 50µm (850/1300 nm) | OS2 Bend-insensitive 9 µm (1310/1550 nm) |
| Insertion Loss, max (dB) ¹ | | |
| MPO mated pair loss | 0.30 | 0.30 |
| LC mated pair loss | 0.25 | 0.25 |
| Module Loss | 0.35 | 0.40 |

Note ¹: Insertion loss specifications when mated to other system components of a like performance.

8. Type S Polarity Management System

8.1. Netscale™ systems shall be constructed with Type S Polarity management for proper system polarity and ease of deployment.

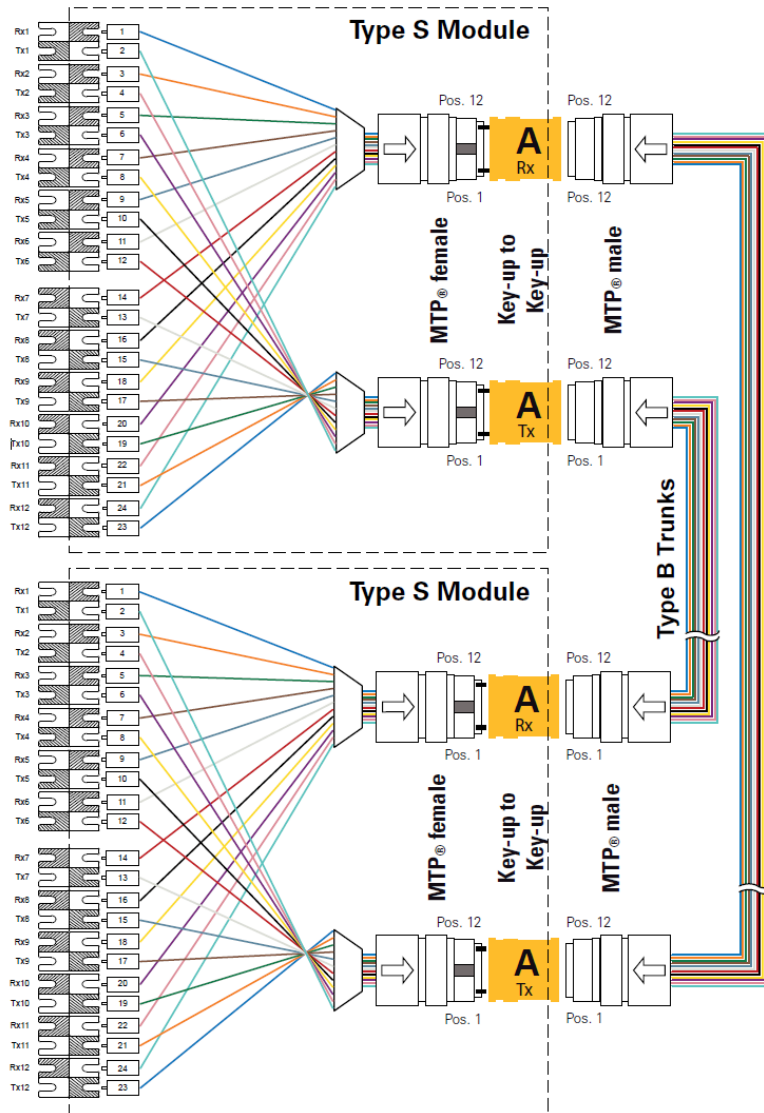


Figure 2: Type S Wiring Scheme – Module on Both Ends

9. Rear-Cabling Manager

The rear-cabling manager for MPO and LC trunk cables is specially designed to address both slack management and documentation of trunk cables in the back-side of the Netscale™ housing. It accepts incoming trunk cables from the back to improve installation times.

9.1. The rear-cabling manager comprises up to two size 1 or one size 2 divider snap-on clips at the rear which enable fast and easy installation and strain-relief of trunk cables.

- 9.2. It shall allow for the slack management of trunk legs and ensure a minimum bend radius of 20.0 mm.
- 9.3. It shall be modular in installation and operation to address not more than one individual insert.
- 9.4. It shall provide for a separate slack management for an optional bus cable coming from the RFID-sensor system.
- 9.5. Insertion from the back of the Netscale™ housing and withdrawal from there shall be tool-less.
- 9.6. The rear-cabling manager shall meet the following dimensions 302.0 mm x 83.0 mm x 30.3 mm (L x W x H).
- 9.7. The rear-cabling manager shall have a documentation area with dimensions of 29.8 mm x 13.2 mm at the rear-facing end.