

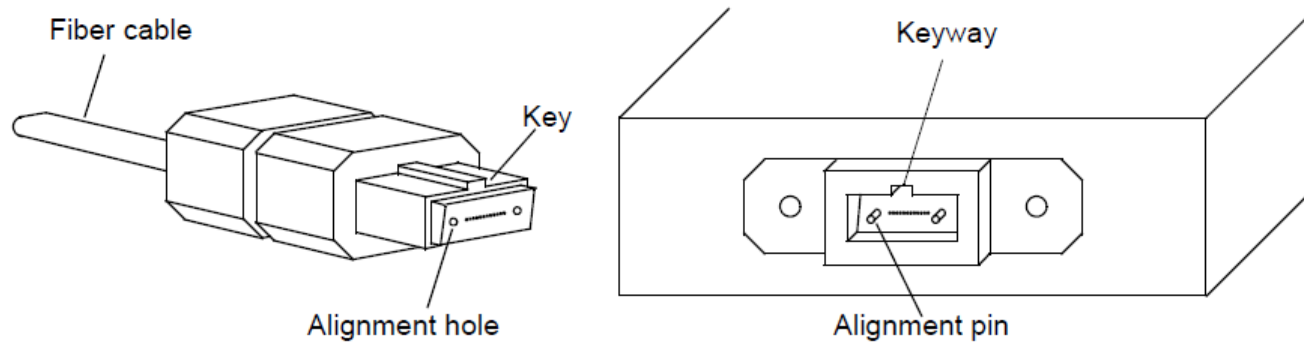
Optical Connection Specs for PSM4

Paul Kolesar
CommScope
April 30, 2013
IEEE P802.3bm SMF Ad Hoc

Purpose and Approach

- To define cable plant connection return loss and MDI connector physical and performance characteristics
 - for single-fiber-row MPO with angled (APC) interface
 - operating in environmental category appropriate for data centers
 - at performance level consistent with prior loss budget proposed in kolesar_02_0313
- Reference IEC specifications
 - IEC 61754-7 series for MPO physical characteristics
 - IEC 61753 series for performance characteristics

The PSM4 MDI



- Examining above diagram we see
 - Similarity to MDI of clause 86 used for 40GBASE-SR4
 - Single row of twelve fibers
 - Left side resembles MPO plug on cable
 - Alignment holes: unpinned “female” plug
 - Down-angled ferrule end-face
 - Long side of ferrule on same side as key
 - Right side resembles MPO device receptacle
 - Alignment pins: pinned “male” interface
 - Up-angled ferrule end-face
 - Short side of ferrule on same side as keyway

Relevant IEC Standards for Reference

- Physical characteristics
 - IEC 61754-7-1 ed.1 ...*MPO connector family – one fibre row*
 - Defines plugs, adapters and device receptacles; of relevance are:
 - Interface 7-1-1: MPO female plug connector, down-angled interface for 2 to 12 fibres
 - Interface 7-1-9: MPO active device receptacle, angled interface
 - Entering FDIS ballot stage, so will be published within needed time frame
- Performance
 - IEC 61753-1 ed.1 ...*General and guidance for performance standards*
 - Defines tests and severities that form performance categories
 - Examples: vibration, change of temperature, flexing, cable retention, durability
 - Relates performance categories to operating service environments
 - Examples: Cat. C = controlled, Cat. U = uncontrolled, Cat. E = Extreme
 - Defines performance grades for single-mode connections
 - Insertion loss Grades A, B, C, D – Return loss Grades 1, 2, 3, 4
 - IEC 61753-021-x series for single-mode connectors
 - Where x indicates environmental performance category:
 - Examples: 2 = Category C, 3 = Category U

IEC Performance Category / Service Environment for connectors and passive components

| Performance category | Description | Operating service environment |
|----------------------|------------------------|---|
| C | Controlled environment | Operating temperature: – 10 °C to +60 °C Relative humidity: 5 % to 93 % Typically within an office, equipment room, telecommunication centre or building. Not subjected to condensed water. |

Note: all other performance categories are for more severe service environments

IEC SM Connection Performance Grades

| Attenuation grade | Attenuation in random mate |
|-------------------|---|
| A | Not yet defined |
| B | ≤ 0.12 dB mean ≤ 0.25 dB max for $> 97\%$ of samples |
| C | ≤ 0.25 dB mean ≤ 0.50 dB max for $> 97\%$ of samples |
| D | ≤ 0.50 dB mean ≤ 1.0 dB max for $> 97\%$ of samples |

← Appropriate for
“un-tuned” LC

← Appropriate for MPO

| Return loss grade | Return loss in random mate |
|-------------------|--|
| 1 | ≥ 60 dB mated, ≥ 55 dB unmated |
| 2 | ≥ 45 dB |
| 3 | ≥ 35 dB |
| 4 | ≥ 26 dB |

← Appropriate for APC

← Aligned with present
IEEE 802.3 specs

Referencing IEC Standards (1 of 2)

- IEC explicitly details a few grade combinations (called performance levels) in the 61753-021-x series
 - Performance Levels B/1, B/2, C/1, C/2, C/3
- Defined grade combinations form 12 performance levels
 - IEEE 802.3 expects or specifies the equivalent of C/4 or D/4
 - D/1 is appropriate for SM APC MPO
- General & Guidance document defines everything needed to insert any grade combination into the connector specification established for the chosen environmental category
 - Category C (controlled environment) is appropriate for data centers
- Complete reference includes performance level
 - Example: IEC 61753-021-2 for performance level D/1



Referencing IEC Standards (2 of 2)

- IEC 61754-7-1 defines a dozen different MPO interfaces
 - Plugs, adapters, backplane & board housings, device receptacles
- Complete reference includes interface
 - Examples:
 - IEC 61754-7-1 interface 7-1-1: MPO female plug connector, down-angled interface for 2 to 12 fibers
 - IEC 61754-7-1 interface 7-1-9: MPO active device receptacle, angled interface

Putting It All Together (1 of 2)

- Proposed content for Clause 96, underlined texts contain references

96.11.3.2 Medium Dependent Interface (MDI) requirements

The MDI shall meet the dimensional specifications of IEC 61754-7-1 interface 7-1-9: MPO device receptacle, angled interface. The plug terminating the optical fiber cabling shall meet the dimensional specifications of IEC 61754-7-1 interface 7-1-1: MPO female plug connector, down-angled interface for 2 to 12 fibres. The MDI shall optically mate with the plug on the optical fiber cabling. Figure 96-7 shows an MPO female plug connector with down-angled interface, and an MDI as an active device receptacle with angled interface.

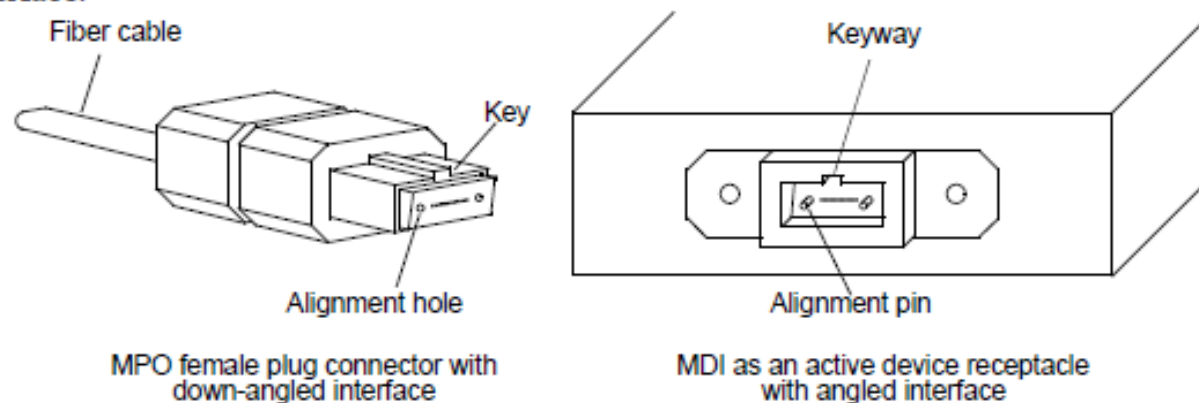


Figure 96-7—MPO female plug with down-angled interface and MDI active device receptacle with angled interface

The MDI shall meet the interface performance specifications of IEC 61793-021-2 for performance level D/1.

NOTE—Transmitter compliance testing is performed at TP2 as defined in 96.5.1, not at the MDI.

Putting It All Together (2 of 2)

- Proposed content for Clause 96

96.11.2.2 Maximum discrete reflectance

The maximum discrete reflectance shall be less than -55 dB.

Summary and Closing Perspectives

- IEC specifications can be used to specify performance and physical characteristics of connections
 - No need for 802.3 to reinvent these specifications
- Specifying APC end-faces for single-mode MPO has several benefits
 - Matches the default SM MPO/MTP end-face commonly deployed in pre-terminated structured cabling environments
 - 55 dB return loss performance greatly mitigates (virtually eliminates) reflection-related impairments
 - Opens the door to a greater variety of transmission technologies
 - Example: Enables advanced encoding technologies like PAM
 - We will likely require combinations of technologies to enable practical solutions at rates higher than 100G

Q & A