

Safe City-Level High-Speed Optical-Electro-Mechanical Connection DML Selection Guide



Overview

This application guide helps designers and installers select and deploy fiber optic media in plant environments.

Key Takeaways

For city-level high-speed optical connections, DMLs offer a cost-effective, low-power solution for short to medium distances (up to ~60 km), with careful selection based on wavelength, modulation speed, and application requirements. Key Considerations for DML Selection

1. Transmission Distance and Application DMLs are ideal for intracity or metro networks where distances are typically under 50-60 km. They perform well for 10G-25G speeds over standard single-mode fiber (SMF-28) without requiring optical amplifiers, making them suitable for drop-side, fronthaul, and data center interconnects. For longer distances or backbone networks, EMLs may be preferred due to DML's susceptibility to chirp-induced dispersion.

- 1310 nm: Preferred for short-reach city networks due to minimal fiber dispersion and cost-effectiveness. Supports high-speed direct modulation without complex dispersion compensation.

- 1550 nm: Typically used for long-haul WDM systems; less common for intracity DML applications due to higher cost and need for EDFAs.

- CWDM DMLs (1270–1330 nm) allow multiple channels in metro networks, supporting 10G, 25G, and 50G PAM4 operation . 3. Modulation Speed and Data Rate
 - 10G DMLs: Standard for traditional metro links and 10G PON applications .
 - 25G DMLs: Suitable for higher-capacity metro links; some models operate over wide temperature ranges (-40°C to 85°C) for reliability .
 - 50G PAM4 DMLs: Emerging for high-density metro and data center interconnects, requiring careful thermal management . 4. Cost, Power, and Integration DMLs are simpler and more cost-effective than EMLs, with lower power consumption and easier integration into optical modules . They are particularly advantageous for short-reach, high-volume deployments where budget and energy efficiency are critical. 5. Reliability and Environmental Tolerance Select DMLs with thermoelectric coolers, optical isolators, and rear-facet monitoring for stable operation and power control . Ensure the device supports the required temperature range for outdoor or urban cabinet installations . 6. Trade-offs vs. EMLs
 - DML Advantages: Low cost, low power, simple structure, suitable for short to medium distances.
 - DML Limitations: Chirp effect limits long-distance high-speed transmission; spectral width narrower than EMLs.
 - EML Advantages: High-speed, low-noise, suitable for long-reach metro and backbone networks.
 - EML Limitations: Higher cost, more complex integration .
- Practical Selection Steps
- Define network requirements: distance, data rate, number of channels, and environmental conditions.
 - Choose wavelength: 1310 nm for cost-effective metro links; CWDM for multi-channel deployment.
 - Select modulation speed: 10G for standard metro, 25G or 50G for higher capacity.
 - Verify thermal and power specifications: ensure stable operation across expected temperature ranges.
 - Evaluate cost-performance trade-offs: DML for short-reach, EML for long-reach or high-speed precision. By following these guidelines, network designers can safely deploy high-speed optical-electro-mechanical connections in city-level networks while optimizing cost, performance, and reliability .

Article Content

Safe City-Level High-Speed Optical-Electro-Mechanical Connection

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FTTH Selection Guide

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