Fiber Optic Multiplexer Inspection, Testing and Maintenance

Abstract: This recommended practice provides guidelines for inspecting, testing and maintaining rail transit communication system fiber optic multiplexer systems.

Keywords: communication, communication system, fiber optic multiplexer (FOM), inspection, maintenance

Summary: FOM inspection, testing and maintenance may be modified for each rail transit agency's requirements but should include general inspection; electrical inspection; cleaning, coating and lubrication; and an operational check. Deficiencies identified during FOM inspection, testing and maintenance should be corrected and documented in accordance with OEM and/or rail transit agency requirements.

Foreword

The American Public Transportation Association is a standards development organization in North America. The process of developing standards is managed by the APTA Standards Program's Standards Development Oversight Council (SDOC). These activities are carried out through several standards policy and planning committees that have been established to address specific transportation modes, safety and security requirements, interoperability, and other topics.

APTA used a consensus-based process to develop this document and its continued maintenance, which is detailed in the manual for the APTA Standards Program. This document was drafted in accordance with the approval criteria and editorial policy as described. Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

This document was prepared by the Signals and Communication Working Group as directed by the Rail Standards Policy and Planning Committee.

This document represents a common viewpoint of those parties concerned with its provisions, namely transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any recommended practices or guidelines contained herein is voluntary. APTA standards are mandatory to the extent incorporated by an applicable statute or regulation. In some cases, federal and/or state regulations govern portions of a transit agency's operations. In cases where there is a conflict or contradiction between an applicable law or regulation and this document, consult with a legal adviser to determine which document takes precedence.

This document supersedes APTA RT-SC-RP-014-03, which has been revised. Below is a summary of changes from the previous document version:

- Migration to the new 2025 APTA document template which standardizes and reorganizes the document's content; a document summary and foreword were added; the scope and purpose have been combined and updated to be more specific.
- Updated list of participants.
- Updated definitions, abbreviations and acronyms to be consistent with standard definitions; specifically, RTS has been replaced with rail transit system throughout the document.
- Document sections renumber to simplify organization and referencing of content

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Introduction

This introduction is not part of APTA RT-SC-RP-014-03, "Fiber Optic Multiplexer Inspection, Testing and Maintenance."

APTA recommends the use of this document by:

- individuals or organizations that operate rail transit systems;
- individuals or organizations that contract with others for the operation of rail transit systems; and

- individuals or organizations that influence how rail transit systems are operated (including but not limited to consultants, designers and contractors).

Scope and purpose

This document establishes recommended guidelines for inspecting, testing and maintaining rail transit fiber optic multiplexers. The purpose of this recommended practice is to verify that fiber optic multiplexers are operating safely and as designed through periodic inspection, testing and maintenance, thereby increasing reliability and reducing the risk of hazards and failures.

Fiber Optic Multiplexer Inspection, Testing and Maintenance

1. Inspection, testing and maintenance provisions

1.1 Inspection, testing and maintenance frequency

The inspection, testing and maintenance procedures in this recommended practice should be performed:

- when FOM equipment is placed in service;
- when FOM equipment is modified, repaired or disarranged;
- at the frequencies recommended in **Table 1**; or
- as otherwise deemed necessary by the rail transit agency.

TABLE 1
Frequency of FOM Inspection, Testing and Maintenance

Action	Recommended Frequency (Minimum)
Operational inspection	Biweekly
Mechanical inspection	Monthly
Electrical inspection	Monthly
Cleaning/coating	As specified by the OEM and/or rail transit agency
Lubrication	As specified by the OEM and/or rail transit agency

The rail transit agency should determine the need for additional inspection, testing and maintenance frequencies for fiber optic multiplexers. A review of the following factors may be useful in making this assessment:

- OEM-recommended intervals
- industry experience
- operating environment/conditions
- historical data
- reliability-centered maintenance program development
- failure analysis
- rail transit agency testing and experience
- regulatory requirements

The frequency of tasks should comply with applicable federal, state and local regulations.

1.2 Training

The rail transit agency and/or its maintenance contractors should develop and execute training programs that provide employees with the knowledge and skills necessary to safely and effectively perform the tasks outlined in this recommended practice.

1.3 Materials

The following materials are recommended for inspecting, testing and maintaining fiber optic multiplexers:

- rail transit agency–approved nonconducting cleaning solvents
- additional materials as required by the OEM and/or rail transit agency

1.4 Tools

The following tools are recommended for inspecting, testing and maintaining fiber optic multiplexers:

- multimeter*
- bit error rate tester
- fiber optic power level meter*
- electrostatic discharge protection equipment
- laptop computer with network management software
- rail transit agency–approved portable radio
- standard tools carried by maintenance personnel
- additional tools as required by the OEM and/or rail transit agency

  NOTE: Items marked with an asterisk (*) should be calibrated in accordance with OEM and/or rail transit agency requirements.

1.5 Personal protective equipment

Personal protective equipment, as required by the rail transit agency, should be worn at all times during inspection, testing and maintenance.

1.6 Safety

Rail transit agency safety rules, procedures and practices should be followed at all times during inspection, testing and maintenance.

1.7 Inspection, testing and maintenance procedures

FOM inspection, testing and maintenance may be modified for each rail transit agency's requirements but should contain the steps listed in sections 1.7.1 and 1.7.2 as a minimum.

Field maintenance personnel should make no changes to the internal software configuration or add, change, alter or modify the interconnected input or serial connected wiring without proper engineering permission or authorized revision documentation.

1.7.1 Inspection
1.7.1.1 General inspection

1. Notify the operations control center (OCC) and/or other authorities of the inspection activities to be performed.
2. Follow rail transit agency electrostatic discharge protection procedures to prevent damage to the equipment.

3. Inspect each FOM system for proper condition and operation.
4. Check external alarms.
5. Check internal logged errors, warnings and/or failure messages.
6. Inspect channel banks and associated equipment.
7. Inspect equipment for physical damage; signs of rust or corrosion; frayed or loose wiring; and loose, missing or damaged hardware.
8. Ensure that plugs and connectors are properly secured.
9. Inspect interconnected cabling and connectors, and ensure that they are tight and secure.
10. Notify the OCC and/or other authorities when inspection is complete.

1.7.1.2 Electrical inspection

1. Notify the OCC and/or other authorities of the inspection activities to be performed.
2. Inspect cabling and wiring to ensure that it is not frayed, burned, broken, cut or otherwise defective.
3. Inspect cables to ensure that they do not exceed their normal bending radius and are positioned to prevent chafing or cutting.
4. Measure and record the values for optic light levels.
5. Measure and record the values for appropriate electrical voltages.
6. Inspect ribbon or cartridge type fuses and other electrical protection equipment for burned, separated or otherwise damaged elements, and replace as required.
7. Notify the OCC and/or other authorities when inspection is complete.

1.7.2 Maintenance
1.7.2.1 Cleaning, coating and lubrication

1. Perform cleaning procedures as required by the OEM and/or rail transit agency.
2. Perform cleaning and/or filter replacement as required by the OEM and/or rail transit agency.
3. Lubricate moving parts as required by the OEM and/or rail transit agency.

1.7.2.2 Operational check

1. Check for proper operation of cooling fans.
2. Simulate failure of primary system and verify operation of backup systems.
3. Return system to normal mode of operation.
4. Notify the OCC and/or other authorities when maintenance activities are complete.

1.8 Correction of deficiencies

Deficiencies identified during FOM inspection, testing and maintenance should be corrected and documented in accordance with OEM and/or rail transit agency requirements.

1.9 Documentation

Inspection, testing and maintenance activities should be documented, reviewed and filed in accordance with rail transit agency procedures.

References

This document should be used in conjunction with OEM specifications and rail transit agency procedures for FOM system inspection, testing and maintenance.

Definitions

cartridge fuse: A device used to protect an electrical circuit from the effect of excessive current draw enclosed in an insulating cartridge. See also *fuse*.

electrostatic discharge: The release of stored electrical energy.

external alarm: A visual message, light or audible tone produced by an electrical system that is either seen or heard when the system has failed or has generated an error.

failure message: A visual or audible indication produced by a system to report failure.

fiber optic multiplexer (FOM): A system used in the process of combining a number of individual channels into a common bit stream for transmission over fiber optic cable.

fuse: A device used to protect an electric circuit from the effect of excessive current draw. See also *cartridge fuse*.

hazard: Any real or potential condition that can cause injury, death or damage or loss of equipment or property.

internal logged error: An abnormal condition or communications error generated within a device, circuit or system that is displayed and stored in memory.

operations control center (OCC): A location or locations designed, equipped and staffed for the purposes of monitoring and controlling rail transit agency activities from one or more a central locations. Also called *rail control center*, *rail operations center*, *rail service control center*.

original equipment manufacturer (OEM): The enterprise that initially designed and built a piece of equipment.

personal protective equipment: All clothing and other work accessories designed to create a barrier against workplace hazards. Examples include safety goggles, blast shields, hard hats, hearing protectors, gloves, respirators, aprons and work boots.

rail transit agency: The organization or portion of an organization that operates rail transit service and related activities. Also called *operating agency*, *operating authority*, *transit agency*, *transit authority*, *transit system*.

warning message: A visual or audible message produced by a system to warn maintainers or monitors of the status of a device, circuit or system.

Abbreviations and acronyms

FOM	fiber optic multiplexer
OCC	operations control center
OEM	original equipment manufacturer

Document history

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First published	—	—	—	—	June 8, 2003
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