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**Signals and Communication Working
Group**

Processor-Based System Inspection, Testing and Configuration Control

Abstract: This document provides procedures for the inspection, testing and configuration control of rail transit agency processor-based train control systems.

Keywords: configuration control, firmware, inspection, interlocking, microprocessor, software, signal, test, testing, processor

Summary: This standard provides prerequisites, procedures and requirements for testing rail transit processor-based train control systems. Individual rail transit agencies may modify these requirements to accommodate their specific equipment and mode of operation.



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. 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-S-035-03, 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.
- Definitions for non-vital and vital systems was updated.



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Introduction

This introduction is not part of APTA RT-SC-S-035-03, “Processor-Based System Inspection, Testing and Configuration Control.”

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

The scope of this document is to establish standard requirements for the inspection, testing and configuration control of processor-based interlocking and signal control agencies. This document addresses both vital and non-vital processor system components.

The purpose of this standard is to verify that processor-based systems are operating safely and as designed through periodic inspection, testing and configuration control, thereby increasing reliability and reducing the risk of hazards and failures.

Note on alternate practices

Individual rail transit systems may modify the practices in this standard to accommodate their specific equipment and mode of operation. APTA recognizes that some rail transit systems may have unique operating environments that make strict compliance with every provision of this standard impossible. As a result, certain rail transit systems may need to implement the standards and practices herein in ways that are more or less restrictive than this document prescribes. A rail transit system may develop alternates to APTA standards so long as the alternates are based on a safe operating history and are described and documented in the system's safety program plan (or another document that is referenced in the system safety program plan).

Documentation of alternate practices shall:

- identify the specific APTA rail transit safety standard requirements that cannot be met;
- state why each of these requirements cannot be met;
- describe the alternate methods used; and
- describe and substantiate how the alternate methods do not compromise safety and provide a level of safety equivalent to the practices in the APTA safety standard (operating histories or hazard analysis findings may be used to substantiate this claim).

Processor-Based System Inspection, Testing and Configuration Control

1. Inspection, testing and configuration control requirements

1.1 Inspection, testing and configuration control frequency

The inspection and testing procedures in this standard shall be performed when processor-based systems are placed in service; when they are modified, repaired or disarranged; when application or executive software is modified; or as otherwise deemed necessary by the rail transit agency. Configuration control shall always be maintained.

The rail transit agency shall determine the need for additional inspection and testing frequencies for vital processor-based systems. 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
- applicable federal, state and local regulations

1.2 Training

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

1.3 Materials

No consumable materials are required for processor inspection, testing and configuration control unless otherwise specified by the OEM and/or rail transit agency.

1.4 Tools

The following test tools and apparatus shall be as required by the OEM and/or the rail transit agency. Applicable tools shall be calibrated in accordance with rail transit agency and/or OEM requirements.

- firmware extraction and insertion tool (as required)
- electrostatic discharge protection equipment
- rail transit agency–approved portable radio
- standard tools carried by maintenance personnel
- additional tools as required by the OEM and/or rail transit agency

1.5 Personal protective equipment

Personal protective equipment, as required by the rail transit agency, shall always be worn during testing.

1.6 Safety

Rail transit agency safety rules, procedures and practices shall always be followed during testing. No work of any type shall be performed until train movements have been protected. The normal functioning of any device shall not be interfered with, in testing or otherwise, without first taking measures to provide for the safety of train operation, which depends on the normal functioning of such device.

1.7 Inspection, testing and configuration control procedures

Processor system inspection, testing and configuration control procedures may be modified for each rail transit agency's requirements (see "Note on alternate practices") but shall contain the steps listed in sections 1.7.1 through 1.7.3 as a minimum.

1.7.1 Inspection

1. Notify the operations control center (OCC) and/or other authorities of the inspection activities to be performed.
2. Inspect area for debris, water or any other conditions that could adversely affect the safe operation of the equipment.
3. Follow rail transit agency electrostatic discharge protection procedures to prevent damage to the equipment.
4. Inspect equipment for physical damage, frayed or loose wiring, properly secured plugs and connectors, loose or missing hardware, and proper insertion of printed circuit cards and components.
5. Measure power supplies and power sources for proper values and tolerances.
6. Inspect equipment for active error codes and observe system status indications for proper system operation.
7. Verify that the in-service application and system/firmware software in the processor-based system is consistent with configuration control documentation.
8. Ensure that covers and locks (if available) are in place and secured.
9. Notify the OCC and/or other authorities when inspection is complete.

1.7.2 Testing

1. Notify the OCC and/or other authorities of the testing activities to be performed.
2. Test all revised application software and/or wiring changes.
3. Perform testing using a rail transit agency-approved procedure that ensures safe operation of all interlocking and signal system functions.
4. If applicable, perform the following transfer operations:
 - a. Simulate failure of the primary system and confirm that the system transfers to the backup/standby system.
 - b. Verify operation of backup/standby system.
 - c. Repeat steps a and b by performing the same operation for transfer from backup/standby to primary system (if applicable).
5. Return system to normal mode of operation.
6. Perform configuration control procedures. See Section 1.7.3.
7. Notify the OCC and/or other authorities when testing is complete.

1.7.3 Configuration control

All rail transit agencies must have configuration control procedures requiring recorded information to be documented and archived for future reference and retrieval.

1. Notify the OCC and/or other authorities of the configuration control activities to be performed.
2. Follow the manufacturer's software configuration data log sheet as provided in its O&M manual. Identify the in-service application and system firmware/software version for each processor-based system, including the following minimum requirements:
 - a. name of person recording data
 - b. location of the system
 - c. system description (e.g., "System 1," "Main System" or application name)
 - d. in-service date
 - e. site ID, revision ID and system ID
 - f. application and system firmware/software information (revision, build time, etc.)
3. In-service application and system firmware/software shall be archived and placed in configuration control.
4. If applicable, EPROMs shall be labeled with name, revision level, revision date, checksum value and socket location on printed circuit card (e.g., U32).
5. Hardware configuration on the processor-based system such as the position of field settable switches (if applicable), jumpers, board address assignments, keying, and proper revision levels (e.g., site ID, revision ID and system ID) shall be archived and placed in configuration control.
6. Notify the OCC and/or other authorities when configuration control activities are complete.

2. Correction of deficiencies

Deficiencies identified during processor-based system inspection, testing and configuration control shall be corrected, retested and documented in accordance with OEM and/or rail transit agency requirements.

3. Documentation

Inspection, testing and configuration control activities shall be documented, reviewed and filed in accordance with rail transit agency procedures.

References

In addition to the most recent edition of OEM processor-based system inspection, testing and configuration control specifications for the signals under test, this document shall be used in conjunction with the following:

American Railway Engineering and Maintenance-of-Way Association, “Communications & Signals Manual,” 2018:

Part 2.2.12, Recommended Functional/Operating Guidelines for Vital Software-based Interlocking Systems.

Part 17.7.2, Recommended Guidelines for Verification and Validation Testing of Revised Application Software for Electronic/Software Based Products Used in Vital Signal Applications.

Federal Railroad Administration, Office of Safety, “Rules and Regulations Governing Railroad and Train Control Systems,” Section 236, Subpart H. Standards for Processor-Based Signal and Train Control Systems.

Rail transit agency procedures for processor-based system inspection, testing, and configuration control.

Definitions

application software: Software that defines the site-specific functions of a system, e.g., route locking.

checksum/signature: A number derived from a cyclic redundancy check used to verify accuracy of data.

disarrangement: Includes, but is not limited to, situations in which a relay, circuit board, termination shunt, joint bypass coupler or other electronic device is replaced with another; two or more conductors in a cable are severed; a cable or conductor in a warning system is replaced with another; or wires are removed at the same time from more than one terminal of a relay, electronic device, terminal board or other vital component of a warning system.

system firmware/software: Software that performs the basic operations of a system (memory mapping, addressing, self-diagnostics, etc.). Typically of standard format that does not change from installation to installation.

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

interlocking: An arrangement of signals and signal appliances so interconnected that their movements must succeed one another in proper sequence and for which interlocking rules are in effect. It may be operated manually or automatically.

non-vital system: Any system in which all functions are demonstrated to not affect the safety of train operations.

operations control center (OCC): That facility from which train control, train dispatching and/or train supervision takes place for the entire rail transit agency or for specific segments of a system if there is more than one control center. Also called *rail control center*, *rail operations center*, *rail service control center*, *train command center*.

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

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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 workboots.

processor-based: A system dependent upon a digital processor for proper functioning.

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*.

signal: An appliance that conveys information governing train movement.

vital system: Any system that has at least one function that is vital, with a function that affects the safety of train operations.

Abbreviations and acronyms

EPROM	erasable programmable read-only memory
ID	identification
O&M	operations and maintenance
OCC	operations control center
OEM	original equipment manufacturer

Document history

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