34. Standard for Supervisory Control and Data Acquisition (SCADA) System Inspection, Testing and Maintenance

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Abstract: This standard provides procedures for inspecting, testing, and maintaining rail transit supervisory control and data acquisition (SCADA) systems.

Keywords: communication, communication system, inspection, maintenance, remote terminal unit, RTU, SCADA, supervisory control and data acquisition, tape head cleaning, tape head testing, test, testing
Introduction

(This introduction is not a part of APTA RT-SC-S-034-03, Standard for Supervisory Control and Data Acquisition (SCADA) System Inspection, Testing and Maintenance.)

APTA rail transit safety standards represent an industry consensus on safety practices for rail transit systems to help achieve a high level of safety for passengers, employees, and the general public. This document was created by and for those parties concerned with its provisions; namely, rail transit systems (operating agencies), manufacturers, consultants, engineers, and general interest groups. This standard provides procedures for inspecting, testing, and maintaining rail transit SCADA systems.

APTA recommends this standard for:

- Individuals or organizations that inspect, maintain, and/or operate rail transit systems
- Individuals or organizations that contract with others for the inspection, maintenance, and/or operation of rail transit systems
- Individuals or organizations that influence how rail transit systems are inspected, maintained, and/or operated (including but not limited to consultants, designers, and contractors)

This standard intends to meet the following objectives:

- To ensure special life/safety equipment is operational and reliable
- To help rail transit systems incorporate safety considerations during the inspection and maintenance process
- To identify inspection criteria and maintenance standards that provide a high level of passenger and personnel safety

The application of any standards, practices, or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of how a rail transit system operates. In such cases, the government regulations override any conflicting practices this document requires or recommends.
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Standard for Supervisory Control and Data Acquisition (SCADA) System Inspection, Testing and Maintenance

1. Overview

1.1 Scope

This document establishes standard requirements for inspecting, testing, and maintaining rail transit supervisory control and data acquisition (SCADA) systems.

1.2 Purpose

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

1.3 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 (RTS) may develop alternates to the 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:

a) Identify the specific APTA rail transit safety standard requirements that cannot be met

b) State why each of these requirements cannot be met

c) Describe the alternate methods used

d) 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).
2. Definitions and acronyms

For the purposes of this standard, the following definitions and acronyms apply:

2.1 Definitions

2.1.1 battery: A device that converts chemical energy to electrical energy.

2.1.2 electro-static discharge (ESD): The release of stored electrical energy.

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

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

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

2.1.6 personal protective equipment (PPE): 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.

2.1.7 power supply: A unit that supplies electrical energy and maintains constant voltage and/or current output within in specific limits.

2.1.8 rail transit system (RTS): The organization or portion of an organization that operates rail transit service and related activities. Syn: operating agency, operating authority, transit agency, transit authority, transit system.

2.2 Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>OCC</td>
<td>operations control center</td>
</tr>
<tr>
<td>OEM</td>
<td>original equipment manufacturer</td>
</tr>
<tr>
<td>PPE</td>
<td>personal protective equipment</td>
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<tr>
<td>RTS</td>
<td>rail transit system</td>
</tr>
<tr>
<td>RTU</td>
<td>remote terminal unit</td>
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<tr>
<td>SCADA</td>
<td>supervisory control and data acquisition</td>
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</tbody>
</table>
3. Inspection, testing, and maintenance requirements

3.1 Inspection, testing, and maintenance frequency

The inspection, testing, and maintenance procedures in this standard shall be performed

a) when SCADA systems are placed in service

b) when SCADA systems modified, repaired, or disarranged

c) at the frequencies recommended in Table 1 below

d) as otherwise deemed necessary by the RTS

Refer to the corresponding sections of the document for specific procedures.

<table>
<thead>
<tr>
<th>Inspection, maintenance, and tests</th>
<th>Recommended frequency (not to exceed)</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>System status backup/synchronization</td>
<td>Test upon receiving an alarm indication or daily if not performed automatically via maintenance diagnostics.</td>
<td>3.7.2.2.a</td>
</tr>
<tr>
<td>Communication link status</td>
<td>Test upon receiving an alarm indication or daily if not performed automatically via maintenance diagnostics.</td>
<td>3.7.2.2.b</td>
</tr>
<tr>
<td>Alarm blocks</td>
<td>Weekly. View or run report to indicate status or control points that have been blocked.</td>
<td>3.7.2.2.c</td>
</tr>
<tr>
<td>Event logging/data storage</td>
<td>Monthly, if not performed automatically through programming.</td>
<td>3.7.1.5</td>
</tr>
<tr>
<td>Tape head cleaning (where applicable)</td>
<td>Quarterly (every 3 months).</td>
<td>3.7.1.4</td>
</tr>
<tr>
<td>Power supplies and backup systems</td>
<td>Bi-annually.</td>
<td>3.7.1.6 and 3.7.2.3</td>
</tr>
</tbody>
</table>

The RTS shall determine the need for additional inspection, testing, and maintenance frequencies for SCADA 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
- RTS testing and experience
- Regulatory requirements

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

### 3.2 Training

The RTS and/or their 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.

### 3.3 Materials

No consumable materials are required for inspecting, testing, and maintaining SCADA systems unless otherwise specified by the OEM and/or RTS.

### 3.4 Tools

The following tools are required for inspecting, testing, and maintaining SCADA systems:

- Data communication diagnostic test set
- Tape head cleaner (where applicable)
- Multi-meter*
- Electrostatic discharge protection equipment
- RTS-approved portable radio
- Standard tools carried by maintenance personnel
- Additional tools as recommend by the OEM and/or RTS

* Calibrate in accordance with OEM and/or RTS requirements.

### 3.5 Personal protective equipment

Personal protective equipment, as required by the RTS, shall be worn at all times during inspection, testing, and maintenance.
3.6 Safety

RTS safety rules, procedures, and practices shall be followed at all times during inspection, testing, and maintenance.

3.7 Inspection, testing, and maintenance procedures

SCADA system inspection, testing, and maintenance procedures may be modified for each rail transit system’s requirements (see Section 1.3) but shall contain the steps listed in Sections 3.7.1-3.7.2 as a minimum.

3.7.1 Inspection and maintenance

3.7.1.1 Notify the operations control center (OCC) and/or other authorities of the inspection and maintenance activities to be performed.

3.7.1.2 Follow RTS electro-static discharge protection procedures to prevent damage to the equipment.

3.7.1.3 Inspect diagnostic cards for alarms.

3.7.1.4 Clean server tape head using RTS/OEM approved materials.

3.7.1.5 Ensure that event logging/data storage does not exceed the time period specified. If RTS and/or OEM recommendations have been exceeded, then initiate data storage.

3.7.1.6 Ensure that the power supply voltage levels are appropriate and battery backup is functioning as intended.

3.7.1.7 Ensure that programming configuration and data records are accurate.

3.7.1.8 Notify the OCC and/or other authorities when inspection and maintenance activities are complete.

3.7.2 Testing

3.7.2.1 Notify the operations control center (OCC) and/or other authorities of the test activities to be performed.

3.7.2.2 Test SCADA equipment in accordance with RTS and/or OEM requirements to ensure that:

   a) System status backup/synchronization is functioning correctly. Test this system by reviewing data log and/or appropriate screen. If the system is not synchronized, force the system into synchronization;

   b) Communication link status levels at the RTU and OCC are acceptable. Test this system by reviewing the data log and/or appropriate screen;
c) Alarm blocking scheme is correct. Test this system by reviewing data log and/or appropriate screen to verify blocking scheme of status or control points is correct;

3.7.2.3 If applicable, simulate failure of primary systems and verify operation of back up system.

3.7.2.4 Return system to normal mode of operation.

3.7.2.5 Notify the OCC and/or other authorities when testing is complete.

3.8 Correction of deficiencies

Deficiencies identified during SCADA systems inspection, testing, and maintenance shall be corrected and documented in accordance with OEM and/or RTS requirements.

3.9 Documentation

Inspection, maintenance, and testing shall be documented, reviewed, and filed in accordance with RTS procedures.
Annex A

(informative)

Bibliography

[B1] Original equipment manufacturer (OEM) specifications for SCADA inspection, testing, and maintenance.

[B2] Rail transit system (RTS) procedures for SCADA inspection, testing, and maintenance.