

**American Railway Engineering and Maintenance of Way Association
Letter Ballot 38 21-11**

1. Committee and Subcommittee:

AREMA C&S Committee 38

2. Letter Ballot Number: 38 21-11

3. Assignment:

MP's revised at Fall 2021 meeting.

4. Ballot Item:

Ballot 38 21-11: This ballot contains the MP approved at the Fall 2021 meeting:

11.2.1 - Recommended General Practices for Electrical Surge Protection of Signal Systems

Rationale:

Revised Manual Parts

Draft Not Yet Approved

Recommended General Practices for Electrical Surge Protection of Signal Systems

~~Revised 2018~~ Revised/affirmed 2023 (4 Pages)

A. Purpose

This Manual Part recommends guidelines for the design and installation of electrical surge protection for track circuits, line circuits, and ac or dc power circuits for railroad signal systems.

B. General

1. Railroad signal systems operate in a severe EMI environment with both atmospheric and man-made surges prevalent. Tracks, power lines, and line wires provide a low impedance path to bring electrical surges into the signal equipment housing. These surges can be damaging to both electromechanical and electronic equipment. Electrical potentials can exist, which can be hazardous to personnel.
2. Staged or multiple levels of protection for line-to-line surges are recommended for electronic equipment in signal enclosures, train control rooms, etc. Staged protection consists of primary, secondary, and tertiary levels.
3. Primary (first level) protection is to be provided closest to the entrance point and should be rated to withstand the brunt of the exposure. Secondary (second level) protection is to be provided close to or within the protected equipment. Tertiary (third level) protection is normally within the equipment itself.
4. Coordination of the clamping voltage levels is very important in order to assure that each level of protection does its intended job, and not the job of the preceding level. Protective devices shall be coordinated with signal equipment so as not to interfere with normal operation of such equipment, nor introduce additional any hazard.
5. For line-to-ground protection, primary protection when line to ground may be the only requirement only is required if and the dielectric withstand level of the electronic and relay equipment should be designed to be higher than the level of the primary protection level.
6. Electromechanical vital relay systems normally require only primary protection. For systems consisting only of electromechanical vital electromechanical relays, primary protection should suffice.

7. Surge protection for railroad signal systems shall conform to the following Manual Parts:
- 11.2.2 (Recommended Guidelines for Signal Enclosure Layout, Component Placement, and General Wiring Strategies for Surge Damage Prevention).
 - 11.3.1 (Recommended Design Criteria and Functional/Operating Guidelines for Primary Surge Protectors for Electrical Surge Protection of Signal Systems).
 - 11.3.2 (Recommended Design Criteria and Functional/Operating Guidelines for Secondary Surge Protectors for Electrical Surge Protection of Signal Systems).
 - 11.3.3 (Recommended Design Criteria for Surge Withstand Capability of Electronic Signal Equipment for Signal Systems).
 - 11.3.4 (Recommended Design Criteria for Copper Clad Steel Ground Rods and Connections for Signal Systems).
 - 11.3.5 (Recommended Design Criteria for Chemically Enhanced Ground Electrode Systems for Signal Systems).
 - 11.3.6 (Recommended Design Criteria and Function of Solid State AC Primary Surge Protective Devices (SPDs) for Communication and Signal Systems).
 - 11.4.1 (Recommended Instructions for Made Grounds for Signal Systems Utilizing Earth Electrodes).
 - 11.4.2 (Recommended Instructions for Application of Electrical Surge Protection for Signal Systems).
 - 11.5.1 (Recommended Environmental Requirements for Electrical and Electronic Railroad Signal System Equipment), Class C, Wayside Signal Enclosures.

C. Design Categories

- 1. General
 - a. Primary protection should be located close to the entrance point to protect equipment within the signal enclosure from external surges. Primary protection shall conform to Manual Part 11.3.1 and/or Manual Part 11.3.6.

- b. Secondary protection should be provided near or within the equipment that is being protected. Effective secondary protection requires isolation impedance between the primary and secondary protectors. Secondary protection shall conform to Manual Part 11.3.2.
 - c. Tertiary protection normally is designed into the equipment by the equipment manufacturer. Effective tertiary protection requires isolation impedance between the secondary and tertiary circuit protectors. Tertiary protection shall conform to Manual Part 11.3.3.
2. AC Power Protection
 - a. Line-to-line and line-to-ground primary protection should be provided within the signal enclosure on the load side of the disconnect, or on individual branch circuits.
 - b. Where AC power circuits leave the signal enclosure for power distribution to other facilities, line-to-line and line-to-ground primary protection should be provided close to the entrance point in the signal enclosure.
3. Track Circuits and Line Circuits
 - a. Primary line-to-ground and line-to-line protectors should be provided on each circuit close to the entrance point in the signal enclosure.
4. DC Power Protection
 - a. Primary protection should be provided where DC power circuits leave the signal enclosure. Line-to-ground and line-to-line protectors should be provided on each circuit close to the entrance point in the signal enclosure.
5. Grounding

Grounding shall conform to Manual Part 11.3.4, Manual Part 11.3.5, and Manual Part 11.4.1.
6. Application

The best engineered surge protection plan will be defeated if the installation and wiring methods are not implemented with surge protection in mind. In particular, it is critical that ~~surge-surge~~-protected wiring be kept separate from non-protected wiring. ~~Application~~—The application shall conform to Manual Part 11.4.2.

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