

IEEE Guide for Interactions between Power System Disturbances and Surge-Protective Devices

IEEE Power and Energy Society

Developed by the
Surge Protective Devices Committee

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of the
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IEEE SA Standards Board

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Abstract: Information is provided to users and manufacturers of surge-protective devices (SPDs) about the interactions that can occur between SPDs and power system disturbances. This guide applies to SPDs manufactured to be connected to 50 Hz or 60 Hz ac power circuits rated at 100–1000 V rms. The effects of the presence and operation of SPDs on the quality of power available to the connected loads are described. The interaction between multiple SPDs on the same circuit is also described.

Keywords: harmonics, IEEE C62.41.3, noise, power system disturbance, SPD, surge-protective device, swell, voltage sag, voltage surge

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Introduction

This introduction is not part of IEEE Std C62.41.3-2020, IEEE Guide for Interactions between Power System Disturbances and Surge-Protective Devices.

The purpose of this guide is to provide users and manufacturers of surge-protective devices (SPDs) with an understanding of the nature of power system disturbances and variations outside of normal steady state operations, and of the interactions that can occur between SPD products and those power variations. Given this understanding, readers of this document can take steps to either prevent or mitigate adverse effects of such interactions.

The growth in the use of SPDs parallels the increasing number of applications of power electronic equipment that can be exposed and susceptible to the lightning and surge environment. Users of SPDs can sometimes be under the impression, or can be led to believe, that by installing SPDs in their facility or within their equipment, they will achieve total immunity to any and all power system disturbances. In reality, SPDs will respond to and protect localized downstream equipment only for very short duration power system disturbances such as lightning induced transients and power switching transients. The effects that SPDs will have on mitigating these power system disturbances are generally achieved only for transients of less than a few milliseconds in duration and not for cyclic, multi-cycle or steady state root mean square (rms) measurable events.

The SPDs discussed herein are those designed to limit transient voltages that can appear in low-voltage ac power systems having service voltages of 1000 V or less. The focus is generally considered to be points either at a building service entrance or on the electrical wiring somewhere downstream at main panels, sub-panels, or electrical receptacles.

The present document is a member of the IEEE C62 family of documents that deals with power system surges and surge protection. These standards include the following:

- IEEE Std C62.41.1™
- IEEE Std C62.41.2™
- IEEE Std C62.41.3 (this document)
- IEEE Std C62.45™
- IEEE Std C62.34™
- IEEE Std C62.44™
- IEEE Std C62.62™
- IEEE Std C62.77™

Overall this series characterizes and provides information on surge voltages in low-voltage ac power circuits, describes performance characteristics of SPDs, recommends standard test protocols for verifying SPD performance, and provides SPD applications guidance.

This is third publication in the document history; whereas, the prior version was published as IEEE Std C62.48 (or “dot 48”) which is now changed to IEEE Std C62.41.3 (or “dot 3”). The first version of this document with the “dot 48” title was approved in 1995 and revised in 2005.

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IEEE Guide for Interactions between Power System Disturbances and Surge-Protective Devices

1. Overview

1.1 Scope

This guide applies to surge-protective devices (SPDs) intended for connection to 50 Hz to 60 Hz ac power circuits rated 1000 V RMS or less.

This guide describes the effects on SPDs of power system disturbances occurring in these low-voltage ac power circuits. The disturbances are not limited to surges. The effects of the presence and operation of SPDs on the quality of power available to the connected loads are described. The interaction among multiple SPDs on the same circuit is also described.

This guide discusses both voltage and current surges. Current surges that are solely the result of load changes and do not result in voltage increases, such as a short circuit, are not discussed in this guide. An SPD's primary purpose is to provide surge protection. Devices discussed in this guide contain at least one nonlinear component for diverting surge current and/or dissipating surge energy, such as a metal oxide varistor (MOV), silicon avalanche diode (SAD), thyristor, or spark gap. Uninterruptible power supplies (UPSs), ferroresonators, motor-generators, and filters containing only inductive and/or capacitive components are not considered SPDs in this guide.

1.2 Purpose

The purpose of this document is to provide information on the interactions between power system disturbances and SPDs that is not readily available in other standards. This document provides summary information on power system disturbances that affect or can affect SPDs. The description of the interactions is intended to inform the potential user of such SPDs as to what can be expected from such devices.

NOTE—Data used for the preparation of this standard was obtained primarily from low-voltage ac power distribution systems used in North America.¹

¹Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.