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IEEE Guide for Protective Relay Applications to Transmission Lines

IEEE Power and Energy Society

Sponsored by the
Power System Relaying Committee

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Abstract: Information on the concepts of protection of ac transmission lines is presented in this guide. Applications of the concepts to accepted transmission line-protection schemes are also presented. Many important issues, such as coordination of settings, operating times, characteristics of relays, mutual coupling of lines, automatic reclosing, and use of communication channels, are examined. Special protection systems, protection of multi-terminal lines, and single-phase tripping and reclosing are also included. The impact of different electrical parameters and system performance considerations on the selection of relays and protection schemes is discussed.

The purpose of this guide is to provide a reference for the selection of relay schemes and to assist less experienced protective relaying engineers in applying protection schemes to transmission lines.

Keywords: distance protection, IEEE C37.113™, pilot protection, protective relaying, relay application, relaying, transmission line protection

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Introduction

This introduction is not part of IEEE Std C37.113-2015, IEEE Guide for Protective Relay Applications to Transmission Lines.

This document is a revision of IEEE Std C37.113-1999 [B65]. This guide is intended to assist protection engineers and technologists in effectively applying relays and protection systems to protect transmission lines.

Several areas have been improved in this revision, most notably the following:

- Several clauses revised for uniformity of style and ease of understanding the issues discussed in them
- Enhanced fundamental discussions
- Better defined technical discussion about length considerations
- Updated relay schemes with current technology
- Added Annex A that describes system studies

Contents

IEEE Guide for Protective Relay Applications to Transmission Lines

1. Overview

Each component on the electrical power system has protection problems unique to itself, but the concepts associated with transmission line protection are fundamental to all other electrical devices and provide an excellent starting point to examine and appreciate the implementation of protection of most components of power systems. A study of transmission line protection leads to a better appreciation of protection-related issues because transmission lines are links to substation buses and/or other equipment connected to the lines. Electrical engineers and technologists working with electric power utilities; consultants and manufacturers in general; and those working in designing, selecting, and maintaining protection systems in particular would benefit from the information provided in this guide.

General specifications of relays are given in IEEE Std 37.90™, IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus.[1] While protection of transmission lines is discussed in this guide, protection of distribution lines is addressed in IEEE Std C37.230™, IEEE Guide for Protective Relay Applications to Distribution Lines [B68].[2]

All interrupting devices are shown in the figures included in this guide. The isolators (disconnects) used in conjunction with the interrupting devices are not shown in all figures. If they are not shown, they are assumed to be provided for proper control and operation of the system.

1.1 Scope

Concepts of transmission line protection are discussed in this guide. Applications of these concepts to various system configurations and line termination arrangements are presented. Many important issues,

[1] Information on references can be found in Clause 2.
[2] The numbers in brackets correspond to those of the bibliography in Annex B.