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IEEE Standard for Inverse-Time Characteristics Equations for Overcurrent Relays

IEEE Power and Energy Society

Sponsored by the
Power System Relaying Committee

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3 Park Avenue
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USA

IEEE Std C37.112™-2018
(Revision of IEEE Std C37.112-1996)

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Abstract: The inverse-time characteristics of overcurrent relays are defined in this standard. Operating equations and allowances are provided in the standard. The standard defines an integral equation for microprocessor relays that ensures coordination not only in the case of constant current input but for any current condition of varying magnitude. Electromechanical inverse-time overcurrent relay reset characteristics are defined in the event that designers of microprocessor based relays and computer relays want to match the reset characteristics of the electromechanical relays.

Keywords: IEEE C37.112™, inverse-time characteristics, overcurrent relays

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Introduction

This introduction is not part of IEEE Std C37.112–2018, IEEE Standard for Inverse-Time Characteristics Equations for Overcurrent Relays.

Induction overcurrent relay characteristics have been in continuous use for over 50 years and are a de facto standard in North America. When an overcurrent relay is installed in North America, it often must coordinate with existing induction relays and fuses. Induction characteristics appear in the form of stored data tables, polynomials, or spline curves in most relay coordination programs. There has been no previous defining standard and all the relay curve data was obtained from characteristics plotted from experimental data. Conversely, microprocessor relays execute algorithms that are mathematical procedures. They produce analytic characteristics that can be described accurately by an equation. This standard bridges the gap between the previous graphical practices and the present analytical practices. This is done by defining equations that ensure that microprocessor overcurrent relays will coordinate with induction overcurrent relays. The standard defines equations for the reset region as well as for the trip region of the time-current characteristic that are derived from the basic differential equation for input-dependent time delay as it applies to the induction relay.

Contents

IEEE Standard for Inverse-Time Characteristics Equations for Overcurrent Relays

1. Overview

1.1 Scope

The scope of this standard includes the review of various existing analytic techniques used to represent relay operating characteristic curve shapes and proposes analytical (formula) representation of typical operating characteristic curve shapes to foster some standardization of available inverse-time relay characteristics provided in microprocessor or computer relay applications.

1.2 Purpose

The purpose of this standard is to provide an analytic (formula) representation of typical relay operating characteristic curve shapes of various inverse-time relays to facilitate representation by microprocessor-type relays and promote a degree of standardization in the inverse shape of a selected curve.

2. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[1]

inverse-time overcurrent relay: A current sensing relay that produces an inverse time-current characteristic by integrating a function of current *F(I)* with respect to time. The function *F(I)* is positive above and negative below a predetermined input current called the pickup current. Pickup current is therefore the current at which integration starts positively and the relay produces an output when the integral reaches a predetermined positive set value.

For the induction relay, it is the disk velocity that is the function of current *F(I)* that is integrated to produce the inverse time characteristic. The velocity is positive for current above and negative for current below a predetermined pickup current. The predetermined set value of the integral represents the disk travel, required to actuate the trip output.

reset characteristics: The time versus current curve that defines the time required for the integral of the function of current *F(I)* to reach zero for values below current pickup.

[1] *IEEE Standards Dictionary Online* is available at: http://dictionary.ieee.org.