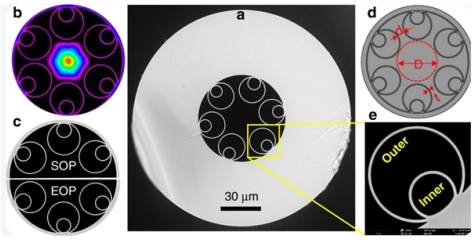
Standard for Relay Protection Action Time



Overview

Distribution Automation Handbook Because the protection areas of the interlocking-based protection concept are not overlapping and because they do not reac.

Key Takeaways

Relay protection action times are regulated to ensure selectivity, coordination, and system reliability, with standards defined by IEC, IEEE, and NERC specifying timing, grading, and operational criteria.

Principles of Relay Action Time

Relay protection systems are designed to operate selectively, meaning the relay closest to a fault should act first, while upstream relays operate only if the primary relay fails. This is achieved through time-graded protection, where relays are set with incremental operating times to maintain selectivity. Definite time relays operate after a fixed delay regardless of fault current, whereas inverse time relays operate faster for higher fault currents, making them suitable for radial networks with variable short-circuit currents (ABB, Distribution Automation Handbook).

The grading time is the time difference between consecutive protection stages. It must be carefully selected to avoid unnecessary delays while ensuring upstream relays do not trip prematurely. Inverse time relays generally require longer grading times due to measurement inaccuracies and current summation effects from downstream feeders.

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Regulatory StandardsNERC PRC-023-6NERC standards require that transmission line relays be set to avoid operation below defined load thresholds, ensuring system loadability is not limited while maintaining reliable protection. For example, relays must not operate at or below 150% of the highest seasonal facility rating for a 4-hour duration or 115% of the 15-minute facility rating. These criteria ensure that relay action times are coordinated with system ratings and fault conditions.

IEE

E GuidelinesIEEE provides guidance on relay coordination, operating times, and characteristics for transmission lines. It emphasizes the importance of coordinating relay settings with system parameters, including mutual line coupling, automatic reclosing, and communication-assisted protection schemes.

IEE

E standards also cover time-current characteristics and the use of numerical relays to calculate precise grading times.

IE

C 60255 SeriesThe IEC 60255-1xx series defines functional requirements for protection relays, including timing, measurement accuracy, and digital input/output handling. These standards ensure that relays meet internationally recognized performance criteria, supporting both analog and digital systems, and are compatible with modern smart grid implementations.

Practical Considerations

Inverse vs. Definite Time Relays: Inverse time relays are preferred for networks with variable fault currents, while definite time relays are simpler for radial systems. Numerical Relays: Modern digital relays allow precise calculation of grading times, improving selectivity and reducing unnecessary delays.

Coordination with System Ratings: Relay action times must consider thermal and short-circuit withstand limits of network components to prevent equipment damage. Compliance: Operators must ensure relay settings comply with NERC, IEEE, and IEC standards to maintain reliability and avoid regulatory violations. In summary, relay protection action times are governed by a combination of time grading principles and regulatory standards to ensure selective, reliable, and safe operation of power systems.

Proper coordination, adherence to NERC, IEEE, and IEC requirements, and consideration of system-specific parameters are essential for effective protection.

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Article Content

Distribution Automation Handbook

Because the protection areas of the interlocking-based protection concept are not overlapping and because they do not reach into the protection area of the next relays in the protection chain, a

IEEE Guide for Protective Relay Applications to Transmission Lines

The backup protection zone relays or elements are coordinated with the remote zone relays or elements and usually contain a coordination time delay. The backup zone may disconnect more power system

IEC 60255 Protection Relay Standards

It outlines the thermal ratings and operating ranges for protection relays. It also lists the standard protection functions for different relay codes like 50/51, 67, 27/59, 81 and their operating times and

Instantaneous and Time-overcurrent (50/51) Protection

In protective relay-based systems, the time overcurrent protection function is designated by the ANSI/IEEE number code 51. Time overcurrent protection allows for significant overcurrent

Power System Protective Relays: Principles & Practices

These curves can be used in conjunction with the motor time-current curve for a normal start to set protective relays and breakers for motor thermal protection during starting and running conditions.

PRC-005-6

Identify which maintenance method (time-based, performance-based per PRC-005 Attachment A, or a combination) is used to address each Protection System, Automatic Reclosing, and Sudden

Basic protection relay knowledge

Definite time delay means that the protection operate time dose not change or depend on the fault type or the fault current magnitude. Inverse time delay, on the other hand, depends on the current

IEC 60255-1:2022

This document covers the main technologies in use today; other emerging technologies present specific EMC and safety issues but the philosophy in this document will be applied. This second edition

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Protective Relaying Philosophy and Design Guidelines

In order to minimize the effect on customers and maintain system stability, fault clearing time should be kept to a minimum. This normally requires the application of a pilot relay scheme on transmission

Basic protection relay knowledge

Power system stability means also ability to maintain acceptable voltage. Stability may be lost due to too long clearing time of faults (too long operate times of protection) Problem with selectivity can also

PROTECTIVE RELAY TESTING

A comprehensive testing program should simulate fault and normal operating conditions of the relay. Acceptance testing, commissioning, and startup will include control power tests, current transformer

NOTICE OF NEW STANDARD PRODUCTS

IEEE Power Systems Relays Standards Collection: VuSpecTM This VuSpec includes 47 active IEEE standards, guides, recommended practices in the Power Systems Relays family. Power System

Distribution Automation Handbook

The operating time of definite time relays does not depend on the magnitude of the fault cur-rent, while the operating time of inverse time relays is shorter the higher the fault current magnitude is. The time

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Therefore, OR-2 must wait (certain time delay is applied) for the slowest relay protecting the lines and loads connected to the busbar 3 to operate. The ORs with fixed delay are called definite-time

What are the standard methods used to test Protection Relays?

The testing of protection relays is one of the most important activities in the power systems to guarantee the reliability and safety of the power systems. There are many ways of testing

Microsoft Word

The paper “Lessons Learned From Commissioning Protective Relaying Systems” describes best practices for commissioning protective relay systems . Observed field return data show that SEL

IEEE Std C37.90 -2005, IEEE Standard for Relays and Relay Systems ...

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Abstract: Service conditions, electrical ratings, thermal ratings, and testing requirements are defined for relays and relay systems used to protect and control power apparatus. This standard establishes a

IEEE Guide for Protective Relay Applications to Transmission Lines

IEEE-SA Standards Board 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

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