Automatic Test of Relay Protection Inputs



Overview

Today, many important devices are tested on RTS before it is installed in the real power system. One popular application is to use RTS for closed-loop testing protective relays.

Key Takeaways

Automatic testing of relay protection inputs ensures accurate, efficient, and standardized verification of protection relays using specialized hardware and software systems.

Overview of Automatic Relay Testing

Automatic testing of protection relays involves using dedicated test systems to simulate electrical inputs (current, voltage, and digital signals) and verify relay responses under controlled conditions. These tests are essential to ensure relays operate correctly during faults, abnormal conditions, or auxiliary supply disturbances, and to detect hidden defects before they affect the power system.

Key Components

Test Hardware: Modern systems like ARTES or Megger FREJA/SMRT provide multiple voltage and current outputs, allowing three-phase testing of static, digital, and self-powered relays. High output power ensures accurate simulation of real-world conditions. Software and Automation: Automated test software can: Parse relay configuration files (e.g., IEC 61850 SCD files) to extract substation topology and relay settings.

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Generate test templates and unit test cases based on authoritative standards. Dynamically calculate output parameters for current, voltage, and digital channels. Compare measured relay responses with expected results and generate structured reports with pass/fail indicators.

Test Templates and Rule Libraries: Automated systems use predefined templates and rule libraries derived from standards and technical manuals to ensure consistent testing across different relay types and protection schemes.

Testing Process

Input Simulation: The system applies controlled AC/DC voltages, currents, and digital signals to the relay inputs, including auxiliary supply variations, frequency changes, and communication signals. Functional Verification: The relay's response is measured against expected behavior, including trip commands, logic operations, and timing accuracy. Reporting: Automated systems generate detailed reports documenting compliance with specifications, including pass/fail results, waveform captures, and parameter deviations.

Advantages of Automatic Testing

Efficiency: Reduces manual effort and testing time, especially for complex relay schemes. Accuracy: Minimizes human error and ensures repeatable, standardized testing. Integration: Supports modern digital relays and IEC 61850 communication protocols without requiring a PC connection, enhancing cybersecurity.

Versatility: Suitable for lab and field testing, including outdoor environments and renewable energy installations.

Applications

Automatic relay testing is used for: Commissioning new protection relays and schemes. Routine maintenance and verification of relay performance. Type testing of digital and numerical relays during manufacturing.

Ensuring compliance with standards such as IEC 60255 and IEC 61850. By leveraging automatic test systems, utilities and engineers can ensure reliable protection operation, reduce downtime, and maintain high safety standards in power networks.

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Article Content

Protection Relay Testing

Testing protection relays with sensor inputs As the protection relay and the primary equipment in the medium-voltage substations are close to one another, digital

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Today, many important devices are tested on RTS before it is installed in the real power system. One popular application is to use RTS for closed-loop testing protective relays. These

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Protection Relay Testing and Commissioning

These tests are done to show that protection relays are free from defects during manufacturing process. Testing will be done at several stages during manufacture, to make sure problems are discovered at

The advancement of automated testing in protection relay systems ...

The field of automated testing in protection relay systems has advanced significantly, offering more efficient, accurate, and reliable testing procedures compared to traditional manual

Testing SEL relays with sensor inputs

This application note explains the steps required for configuring a test for protection devices with inputs for Rogowski current sensors and voltage sensors using the Test Universe software.

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The Relay Testing Handbook: Principles and Practice

This online protective relay testing seminar follows Chris Werstiuk (author of The Relay Testing Handbook) as he tests a relay from start to finish. You''ll learn the basic skills needed to test any

Power System Protective Relays: Principles & Practices

Abstract: Protective relays and devices have been developed over 100 years ago to provide “last line” of defense for the electrical systems. They are intended to quickly identify a fault and isolate it so the

Research on Automatic Test System of Relay Protection Device in

The relay protection device in intelligent substation is of great significance to the stable operation of the power system. The key technology of automatic test system for relay protection device in digital

Research on the remote automatic test technology of the full link of ...

There are still problems such as low automation, long test time and low point-to-point debugging efficiency of the relay protection fault information system. This article proposes the full-link

Preparation of Papers in a Two-Column Format

This article illustrates two different techniques namely standalone testing and real-time hardware-in-the-loop testing used for protection relays performance verification. Both techniques are evaluated for

The Relay Testing Handbook: Principles and Practice

The complete handbook combines basic electrical fundamentals, detailed descriptions of protective elements, and generic test plans with examples of real-world applications, enabling you to confidently

Commissioning tests of protection relays at site

Installation of protection relays Installation of protection relays at site creates a number of possibilities for errors in the implementation of the scheme

Protection Relay Testing and Commissioning R

PROTECTION RELAY TESTING AND COMMISSIONING The testing and verification of protection devices and arrangements introduces a number of issues. This happens because the main function

Relay testing procedure | PDF

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- Commissioning tests to prove correct installation of a protection scheme before use.
- Periodic maintenance tests to identify equipment failures or degradation over time.
Electrical type tests are

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