Sampling of relay protection devices



Overview

CN116643081A The application relates to the technical field of power system automation, in particular to a high-reliability relay protection device samplin.

Key Takeaways

Modern relay protection devices use high-resolution digital sampling, FPGA-based processing, and IEC 61850 Sampled Values to ensure accurate, reliable, and fast protection of power systems.

Digital Sampling and Sampled Values

Contemporary relay protection devices increasingly rely on digital sampling of voltage and current signals rather than traditional analog wiring. Using Sampled Value (SV) messages defined in IEC 61850, instantaneous voltage and current samples are transmitted over high-speed Ethernet networks from Merging Units (MUs) or Non-Conventional Instrument Transformers (NCITs) to Intelligent Electronic Devices (IEDs) for protection and monitoring functions. This approach replaces conventional copper wiring, providing greater flexibility, safety, and cost efficiency in substations.

S

V relays, such as the 87B23 series, have demonstrated the ability to detect faults in under 10 milliseconds while coordinating with conventional relays, showing comparable performance to traditional systems. These relays can restrain or trip breakers based on high-resolution sampled data, ensuring fast and reliable protection.

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High-

Resolution AD

C and Analog Front-End DesignsRelay protection devices use high-resolution analog-to-digital converters (ADCs), often 24-bit delta-sigma ADCs, to measure wide dynamic ranges of AC voltage and current.

Multiple AD

C channels are synchronized to ensure accurate sampling across all inputs, and signal conditioning circuits provide gain adjustment and DC level shifting to match the ADC input range. This allows relays to handle HV, MV, and LV applications with precise measurement of primary system parameters.

High-

Reliability Sampling Systems

To improve reliability, modern relay protection devices implement redundant sampling paths and error detection mechanisms. For example, a high-reliability sampling system may split analog signals into main and complex sampling signals, process them independently through separate ADC modules, and use an FPGA to perform interpolation, error detection, and message formatting.

The CP

U module then monitors the system, handles abnormal conditions, and ensures the integrity of the sampled data. This design mitigates risks from single-event upsets, component failures, or particle radiation, which could otherwise cause misoperation or refusal of the relay.

Standards and Compliance

Relay protection devices follow standards such as IEC 60255-1: 2022, which defines requirements for measuring relays and protection equipment, ensuring uniformity in testing, EMC, and safety. Compliance with IEC 61850-9-2LE for Sampled Values ensures interoperability and integration with digital substation architectures.

Summary

Modern relay protection devices combine high-resolution ADCs, FPGA-based processing, redundant sampling, and IEC 61850 Sampled Values to achieve fast, accurate, and reliable protection. These systems are capable of handling complex power system conditions, coordinating with conventional relays, and maintaining high reliability even under abnormal operating conditions or environmental disturbances.

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Article Content

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The application relates to the technical field of power system automation, in particular to a high-reliability relay protection device sampling system and a high-reliability relay...

Research on the analysis method of power system relay protection

The experimental results show that this method can effectively analyze the operation characteristics of power system relay protection, and can accurately check whether the relay

On the Assessment of Sampling Rate Impacts on Responses of Digital ...

This article assesses the performance of time-based, frequency-based, and time-frequency-based digital protective relays, when operated at different sampling rates.

Fault Tracing Method for Relay Protection System–Circuit ...

The adjacent device faults or communication faults in relay protection systems and CBs may cause adjacent devices to issue alarm messages. Based on Case 1, this paper simulates the

ANSI Standard Device Numbers & Common Acronyms

ANSI Standard Device Numbers & Common Acronyms ANSI Standard Device Numbers & Common Acronyms

Research on fault diagnosis method of substation relay protection ...

The sampling and control loops in the intelligent substation are set at the process layer, the sampling and A/D conversion are carried out based on the merging unit, and the digital quantities

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

Sampled Value IEC 61850

Conprove, recognized for its innovative role in developing tools for power system automation and protection, offers a complete line of universal testers compatible with the IEC 61850 standard, with

Performance of IEC 61850 Sampled Values Relays for a Real-World

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During this time, he performed system integration for protective relays in applications ranging from 230 kV utility substations and low-voltage distribution to electromechanical relays and modern digital relays.

Practical handbook for relay protection engineers | EEP

This handbook covers the code of practice in protection circuitry including standard lead and device numbers, mode of connections at terminal strips, colour codes in multicore cables, dos

The Role of Protection Relays in Power Systems and an

Protective relays are critical in power systems because they serve as decision-making devices that ensure the safe operation of power grid. They play a key role in power system protection.

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

Development and hardware implementation of a reliable protective relay ...

The converted digital information is given to relay''s algorithm for fault detection and decision making. However this information may not appropriate to reliable operation of protective

Research on the analysis method of power system relay protection

Abstract The action characteristics of power system relay protection devices can well analyze whether the relevant actions are correct. An analysis method of relay protection action

Operation, maintenance, and field test procedures for protective relays

The protection circuits include all low-voltage devices and wiring connected to: instrument transformer secondaries, telecommunication systems, auxiliary relays and devices, lockout relays,

Relay Maintenance and Testing

Ensure optimum system performance, efficiency, and safety with preventive relay maintenance and testing Today''s challenges in relay maintenance and testing are many. Due to rapid advancements

Protective Relay Testing and Maintenance Overview

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Protective relay testing may be divided into three categories: acceptance testing, commissioning, and maintenance testing. The selection of specific testing procedures depends on

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

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