Incorrect sampling value of relay protection device

Overview

Fault Tracing Method for Relay Protection System–Circuit. To promptly detect the faults of the relay protection system and the circuit breakers in time.

Key Takeaways

Incorrect sampling values in relay protection devices can cause misoperation or failure, and are typically addressed through redundant sampling, error detection, and high-reliability sampling systems.

Causes of Incorrect Sampling Values

Incorrect sampling values in relay protection devices can arise from several factors: Component failures or abnormal states: Integrated circuits and microprocessor components in modern relays may experience unstable performance, single-event upsets, or particle-induced errors, leading to incorrect sampling data. Single-particle inversion effects: High-energy particles (protons, electrons, heavy ions) can flip the state of critical processing chips, causing misoperation or refusal of the relay. Communication or merging unit errors: In IEC 61850 digital substations, Sampled Values (SV) streams transmitted from merging units may be corrupted or delayed, affecting relay operation.

Detection and Mitigation Methods

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To prevent incorrect operation due to faulty sampling values, several strategies are employed: Redundant sampling detection: By acquiring multiple sampled values of the same voltage or current and comparing instantaneous differences and sums, relays can quickly detect abnormal sampling and block incorrect operations. High-reliability sampling systems: These systems use multiple analog-to-digital conversion modules, operational amplifiers, and FPGA-based error detection logic to generate main and complex sampling signals. The central processing unit monitors these signals and implements abnormal processing mechanisms in real time.

Fault tracing and machine learning: Advanced methods, such as improved Random Forest models, analyze alarm messages and operational data to identify incorrect relay operations and locate faults in the protection system. Testing with Sampled Values: Test sets can simulate SV streams according to IEC 61850-9-2 and IEC 61869-9 standards, allowing verification of relay performance and detection of potential sampling errors before deployment.

Practical Implications

Incorrect sampling values can lead to false tripping, failure to trip, or delayed operation, which compromises power system stability and safety. Implementing redundant sampling, high-reliability hardware, and rigorous testing ensures that protective relays operate correctly even under abnormal conditions, maintaining grid reliability and minimizing the risk of outages or equipment damage. By combining hardware redundancy, real-time error detection, and simulation-based testing, utilities can significantly reduce the impact of incorrect sampling values on relay protection devices.

Article Content

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

To promptly detect the faults of the relay protection system and the circuit breakers in time and to ensure the operational reliability of these protective devices, this paper proposes a fault

WO/2020/253301 METHOD FOR REDUNDANT SAMPLING AND

The present application can quickly determine the redundant sampling abnormality, so as to quickly block the quick-action section protection without delay and prevent incorrect operation of a relay

Protection Testing with Sampled Values

Simply re-use test plans created for conventional protection relays in Digital Substations by replacing hard wiring with Sampled Values configurations. This saves you precious time on site.

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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

Protection Relay Testing and Commissioning R

Because a protection configuration only works under fault conditions, defects may not be discovered for a substantial period of time, until a fault happens. Regular testing assists in discovering faults that

Evaluation of Single Event Upset on a Relay Protection Device

This research represents a preliminary assessment of single event effects on relay protection devices and is expected to provide valuable insights for evaluating the reliability of

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

Using digital data from the unfiltered event report, which are not sampled at the protection and control processing rate of the relay, can produce a small timing error in Relay Word bits'' assertion time.

Automatic Checking Method of Setting Value for Relay Protection

Abstract: In order to improve the efficiency and accuracy of fixed value checking of relay protection device, this paper proposes an automatic fixed value check method based on image

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.

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PROTECTIVE DEVICES COORDINATION 4-1. General of seri es devices from the e Where there are two or more located series on protective a composite t graph de- fro vices between int the and fault

Microsoft Word

Microprocessor relays offer a range of recording lengths, from 9 to 72 cycles for first generation relays, and from 8 to 630 cycles for newer relays. The sampling rates of these fault records range from four

How to calculate relay settings for IEC 61850–9–2 Sampled Values ...

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How to calculate relay settings for IEC 61850–9–2 Sampled Values Channel Latency Network latency is a measurement of delay in a system. Latency accounts for processing delays,

Relay Protection Device Reliability Assessment Through Radiation

Relay protection devices must operate continuously throughout the year without anomalies. With the integration of advanced technology and process chips in secondary equipment,

Effects of Sampled-Values Data Quality on Responses of Time

Power systems utilize the IEC 61850 standard to implement data communication between measurement, control, and protection devices. This article assesses the impacts of the IEC

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

Power systems (including industrial and commercial power systems) widely utilize digital protective relays for component and system protection. These protective devices have shown

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

Article Tracking for Relay Protection Devices

Abstract: A method of fault tracking for relay protection devices is presented in this paper. Fault tracking means that after the failure of relay protection devices, the anomalies and warning ...

Research on Setting Value Detection of Relay Protection Device

Analyzing the feasibility of modifying setting values on the condition of the running line without exiting the protection function is of great importance for 110 kV substations.

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