# Relay Protection CT Configuration

Article Overview

Proper CT configuration ensures accurate relay operation, prevents false tripping, and maintains system protection during faults and transients.

CT Selection and Accuracy

CTs must be selected based on the accuracy class and accuracy limit factor (ALF or Fa) to ensure reliable relay operation under fault conditions. For protection purposes, IEC 60044-1 recommends using CTs with a protection class (e.g., 5P10), where the number indicates the maximum permissible composite error at the rated accuracy limit current, and the letter "P" denotes protection use. The accuracy limit factor should typically exceed 20 to accommodate high fault currents without significant saturation . ANSI standards commonly use 5A or 1A secondary ratings, with the CT ratio chosen to limit the secondary current under maximum fault conditions to around 100A .

CT Sizing and Burden Considerations

CT sizing depends on the primary current, relay burden, and expected fault currents. The CT must remain in its linear region during internal faults to ensure correct tripping while avoiding false operation during external faults. The burden includes the relay input impedance and connecting leads; excessive burden can increase CT secondary voltage and risk saturation . Modern numerical relays have low input impedance, so the CT internal resistance and lead resistance are the primary contributors to burden .

Saturation and Transient Response

CT saturation occurs when the CT core cannot accurately reproduce the primary current, often due to high DC offset, high X/R ratio, or remanence. Saturation can distort the secondary current, causing delayed or false relay operation. Differential relays use percentage-slope characteristics to maintain security during CT saturation, ensuring that external faults do not cause false tripping . CTs should be selected to minimize saturation during expected system transients, including generator black starts or transformer energization .

Relay-Specific Configuration

o Differential Protection (87G/87T): CTs must be matched in ratio and polarity across all phases to ensure accurate current summation. Any mismatch can produce false differential currents. CTs should be sized to handle maximum fault currents without exceeding the relay's input limits .
o Overcurrent Protection: CTs must provide sufficient secondary current to operate the relay within its time-current characteristic. The start current setting is typically 70% of the CT nominal current to account for relay inaccuracies and CT errors .

o Generator and Transformer Applications: CTs must accommodate high inrush currents and transient conditions. Using CT models validated against physical tests helps determine the required CT ratio, class, and burden for secure relay operation .

Practical Guidelines

o Match CT ratios and polarity across all elements in a differential zone.
o Select CTs with adequate accuracy class and limit factor to handle maximum fault currents.
o Consider CT burden including relay input and lead resistance to prevent saturation.
o Account for transient conditions such as DC offset, remanence, and inrush currents.
o Verify relay settings against CT performance to ensure correct operation under internal faults and security during external faults.
o Use separate CT cores for metering and protection if high accuracy is required for both functions . By following these requirements, protective relays can operate reliably, minimizing false trips and ensuring fast, selective fault clearing.

This technical article explains seven applications of CTs in protection schemes for generators, generator-transformers,

the CT star point towards the line or protected object. The currents used in the relay elements and oscillographic records follow the

Calculate thermal overload, overcurrent, ground fault, and differential relay settings with

In the "good old days" Transformer Differential protection and Winding Restricted Earth fault protection "had" to use

The purpose of this study is to learn more about CT operation in association with protection relays and to lay down a few rules for

The SEL-751 Feeder Protection Relay is ideal for directional overcurrent, fault location, arc-flash detection, and high-impedance fault

Typical Relay and Circuit Breaker Connections Protective relays using electrical quantities are connected to the power

We consider CT models and compare the various models commonly available to laboratory test data to provide insight into the

This document provides guidelines for setting restricted earth fault (REF) protection for transformer windings using a high impedance

The derived equation provides the CT rating criterion for line protection in new installations and can identify the threshold of CT

In this article, CT connection for transformer differential protection will be discussed. The analysis of different CT connections will be

A differential protection monitors an area limited by CTs which measure incoming and outgoing currents. Now, let''s

NGR ground fault relay coordination with 50/5 zero-sequence CTs. Covers pickup calculation, time dial settings, and

Analysis of different CT connection for transformer differential protection and derivation of matrix equations used in modern numerical

The relay is low impedance with a biased differential characteristic and includes means to detect CT saturation. The

The selection of a CT depends not only on the CT specifications, but also on the network fault current magnitudes, desired protection

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