

# Concept of Instantaneous Overcurrent Relay Protection

## Article Overview

Instantaneous overcurrent protection is a relay function that trips a circuit breaker immediately when the current exceeds a preset threshold, without intentional time delay.

## Definition and Principle

Instantaneous overcurrent protection (IOCP), designated as ANSI/IEEE device number 50, is a protective scheme used to rapidly isolate faults in power systems when the current exceeds a predetermined pickup value for any duration. The relay continuously monitors the line current through current transformers (CTs), and when the measured current surpasses the instantaneous pickup setting ( $I_{inst}$ ), the relay sends a trip signal to the circuit breaker immediately. This ensures fast fault clearance, minimizing equipment damage and maintaining system stability.

## Operating Mechanism

The basic components of an instantaneous overcurrent relay include a coil, armature, and contact assembly. Under normal conditions, the magnetic field generated by the relay coil is insufficient to overcome the spring tension holding the trip contacts open. When the current exceeds the set threshold, the magnetic force energizes the relay, closing the contacts and triggering the breaker. In digital relays, the current is sampled and filtered to remove harmonics and transients before comparison with the pickup value.

## Characteristics

- o Zero intentional time delay: The relay operates almost immediately, typically within 10-50 milliseconds, depending on relay type (electromechanical or digital), .
- o Definite-time operation: The relay trips as soon as the current exceeds the set value, unlike time-overcurrent relays (ANSI 51) which consider both magnitude and duration .
- o Limited coverage: Usually protects 50-80% of the line length from the relay location .
- o Coordination: Often used in combination with time-delayed overcurrent relays to form a graded protection scheme, ensuring selectivity and backup protection .

## Applications

Instantaneous overcurrent protection is widely used for:

- o Phase-to-phase and phase-to-ground fault protection in distribution lines (11-35 kV), .
- o Backup protection for motors, transformers, and power plant auxiliary systems .

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o Rapid fault isolation to prevent equipment damage and maintain system stability .

## Setting Considerations

The instantaneous pickup setting ( $I_{inst}$ ) is typically set at 1.2-1.3 times the maximum short-circuit current at the line end, accounting for CT errors and system tolerances . For transformer-connected lines, higher multiples of rated current are used to avoid nuisance tripping due to inrush currents. Proper coordination with time-delayed overcurrent relays ensures selective tripping and system reliability. In summary, instantaneous overcurrent protection provides fast, reliable fault clearance by tripping the breaker immediately when excessive current is detected, forming a critical part of modern power system protection schemes .

Such relays are used for restricted earth-fault and other forms of circulating current protection. With so fast an operation it is likely

This article introduces the working principle of Instantaneous Overcurrent Protection, explains its function, and

As the name suggests, an instantaneous overcurrent relay trips off the circuit as soon as a

It specifies minimum requirements for over/under current relays. This standard includes a specification of the protection function,

This paper focuses on using the threshold current and voltage to reduce the time of delay and trip time of the

Module 4 : Overcurrent Protection Lecture 15 : Fundamentals of Overcurrent Protection Objectives In this lecture we will Discuss the

Instantaneous overcurrent relays (IOCRs) are fundamental components of power system protection schemes. They are designed to

OVERCURRENT PROTECTION FUNDAMENTALS Relay protection against high current was the earliest relay protection

While, when the impedance of feeder is high, the instantaneous protection has advantages of reducing the relay's

In an instantaneous overcurrent relay, a magnetic core is wrapped with a current coil. An

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A protective relay which operates when the current flowing in the circuit reaches a predetermined value is called

When a fault occurs on the transmission line, the relay should send the faulty signal to the circuit breaker to trip or

Learn about the most common types of overcurrent relays used in power systems, their pros and cons, and how they are coordinated

How Does Instantaneous and Time-Overcurrent Protection Work? Overcurrent protection prevents

The instantaneous overcurrent (IOC) relay sits on the incomer -- between the transformer and the low-side busbar.

Relay protection against the high current was the earliest relay protection mechanism to develop. From this basic method, the

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