

Relay Protection Curve



Overview

The selectivity diagram is a set of specific time/current curves which shows all the time/current curves, that is, the operating characteristics of the relays of the concerned chain of protection relays.

Key Takeaways

A relay protection curve graphically represents the operating time of a protective relay versus the magnitude of current, allowing coordination and selective tripping in electrical networks.

Overview of Relay Protection Curves

Relay protection curves, also known as time-current characteristic (TCC) curves, define how quickly a relay will operate in response to overcurrent or fault conditions. The curve plots operating time on the vertical axis against fault current magnitude on the horizontal axis. These curves are essential for ensuring selective protection, where only the relay closest to the fault operates first, while upstream relays act as backup.

Types of Curves IEC standards define several common curves for overcurrent and earth fault relays (): Normal Inverse (NI): Slower at low fault currents, faster at high currents; commonly used in distribution feeders. Very Inverse (VI): More responsive to higher fault currents; suitable for overhead lines with widely varying fault currents. Extremely Inverse (EI): Very fast operation for high fault currents; often used for transformer feeders.

Long Time Inverse (LTI): Allows longer delays, useful for backup protection or ignoring transformer inrush currents.

Key Settings Affecting the Curve

Plug Setting Multiplier (PSM): Indicates how many times the actual current exceeds the relay pickup current.

Higher PS

M results in faster tripping. Time Setting Multiplier (TSM): Scales the base operating time from the relay's characteristic curve.

Lower TS

M produces faster tripping, while higher TSM provides coordination with upstream relays. Overload (OL) and Earth Leakage (EL) Settings: Define thermal and earth fault thresholds for relay operation.

Coordination and Grading

Relay curves are coordinated to maintain a grading margin between downstream and upstream relays. This ensures that the relay nearest the fault trips first, while upstream relays provide backup if the primary relay fails. Inverse time relays are particularly useful in radial networks, as their operating time decreases with increasing fault current, allowing faster clearance for severe faults while maintaining selectivity for lower currents.

Practical Application

Radial networks: Time-graded or inverse-time relays are preferred for selective protection. Transformer feeders: Extremely inverse curves allow rapid fault clearance to protect sensitive equipment. Backup protection: Long time inverse curves or upstream relays with higher TSM ensure reliability if downstream relays fail.

Relay protection curves are fundamental for safe, reliable, and selective operation of electrical systems, balancing speed of fault clearance with coordination across the network.

Article Content

Distribution Automation Handbook

The selectivity diagram is a set of specific time/current curves which shows all the time/current curves, that is, the operating characteristics of the relays of the concerned chain of protection relays.

Relay Coordination & Protection Grading Tool

Free relay coordination and protection grading tool for power systems engineers. Visualize Time-Current Characteristic (TCC) curves on a log

IEC Curves: The Language of Protection Coordination

In protection engineering, it is not only important to know when a relay should operate, but also how fast it should act compared with other relays in the system.

Inverse Time Overcurrent Relays and Curves Explained

Electromechanical overcurrent relays are often constructed to a specific curve shape, such as the ABB CO-6, CO-7, CO-8, etc. Changing the

Relay Coordination Study Online | TCC Curves, Protection Settings

Online relay coordination study tool for TCC curves, overcurrent and earth fault settings, transformer and fuse coordination, selectivity checks and reports.

Protective Relay Basics Part 2

Relay curves show only the time for the relay itself to operate and do not include additional time required to trip and clear the fault. The relay curve is shown as the dark blue line.

IDMT and DMT Characteristics: Working Principle, Curve, Settings..

In this technical guide, we will discuss everything you need to know about IDMT and DMT characteristics, including their working principles, types, curve equations, applications, relay

Free Protection Coordination Calculator | ELEK Software

Free Protection Coordination Calculator with Time-Current Curves, Manufacturers Database, Adjustable Device Settings, and Interactive Single-line Diagram.

Protective Relay Fundamentals

Protection System Elements Protective relays Circuit breakers CTs and VTs (instrument transformers) Communications channels

Fundamentals of Modern Protective Relaying

Coordination – Between Fuses & Relays The time overcurrent relay should back up the fuse over full current range. The time overcurrent relay characteristic curve best suited for coordination with fuses

Circuit Breaker Trip Curves (B, C, D): 2025 Guide

Circuit Breaker Trip Curves (B, C, D): 2025 Guide Selecting the right breaker trip curves is one of the fastest ways to eliminate nuisance tripping without compromising protection. In this

Overcurrent Relay Curve Standards | PDF

The document outlines various standard curves used in overcurrent protection relays, including U.S. curves, IEC curves, and ANSI curves, detailing their equations and parameters. It highlights the

Protection Basics

Protection System Elements Protective relays Circuit breakers CTs and VTs (instrument transformers) Communications channels

Overcurrent Protection Fundamentals R

OVERCURRENT PROTECTION FUNDAMENTALS Relay protection against high current was the earliest relay protection mechanism to develop. From this basic method, the graded overcurrent relay

Phasor Diagram & Time Current Curve Tools | Relay Protection

Interactive phasor diagram and time current curve tools for protection engineers. Visualize phasors, draw TCC curves, run fault calculations, and analyze COMTRADE records in your browser.

The fundamentals of protection relay co-ordination and time ...

Among the various possible methods used to achieve correct relay co-ordination are those using either time or overcurrent, or a combination of both.

Power System Protection & Relay Coordination Studies

3. Review existing relay settings and coordination rules. Note current time-overcurrent curves, instantaneous settings, and zone definitions for distance relays.
4. Develop or update protection

Technical Explanation for Motor Protective Relay

The better choice would be to use activation time characteristics, or the so-called inverse time-delay characteristics, selected to operate the Motor Protective Relay quickly for large currents and take

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This video was associated with the source search result. Verify technical details against current product documentation and project requirements.

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This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

