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Six Logic Circuits for Relay Protection



Overview

The schematic diagrams for relay logic circuits are often called line diagrams, because the inputs and outputs are essentially drawn in a series of lines. A relay logic circuit is an electrical network consisting of lines, or rungs, in which each line or rung must have continuity to enable the output device. A typical circuit consists of a number of rungs, with each rung controlling an output.

Key Takeaways

Relay protection systems commonly use six fundamental logic circuits: AND, OR, NOT, AND-OR, time-delay, and interlocking circuits to ensure safe and selective fault isolation.1. AND Logic Circuit

The AND logic is implemented by connecting normally open (NO) contacts of relays in series. The output activates only when all input conditions are met, making it ideal for schemes where multiple conditions must be satisfied before tripping a breaker, such as differential protection requiring current detection from both ends of a line .

2. OR Logic Circuit

OR logic uses parallel-connected NO contacts. The output energizes if any one of the input relays is activated, suitable for backup protection or alarm circuits where a fault at any monitored point should trigger a response .

3. NOT Logic Circuit

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NOT logic is realized using normally closed (NC) contacts. It inverts the input signal, allowing a relay to operate when a specific condition is absent. This is often used in permissive schemes or to prevent unwanted tripping under certain conditions .

4. AND-OR Logic Circuit

AND-OR logic combines series and parallel contacts to create more complex conditions. For example, a relay may trip if either of two sets of conditions is met, each set requiring multiple inputs. This is common in directional or restricted earth fault protection .

5. Time-Delay Logic Circuit

Time-delay circuits introduce a deliberate delay before relay operation. They are implemented using relays with built-in timers or external timing relays. This logic ensures coordination between upstream and downstream protection, preventing unnecessary tripping of main feeders when a fault occurs on a lateral line .

6. Interlocking Logic Circuit

Interlocking circuits prevent conflicting operations by using NC contacts to block certain relay actions. For example, breaker interlocks ensure that two breakers cannot close simultaneously on the same bus, enhancing safety and preventing short circuits .

Implementation and Documentation

These logic circuits are typically represented in ladder diagrams, where vertical rails represent power supply and horizontal rungs show relay contacts, coils, and outputs. Ladder diagrams allow engineers to visualize and test relay logic before physical implementation, ensuring reliability and selectivity in protection schemes .

Summary

The six logic circuits—AND, OR, NOT, AND-OR, time-delay, and interlocking—form the backbone of relay protection systems. They enable selective fault detection, coordination, and safe operation of power system equipment, and are essential for designing reliable industrial and substation protection schemes .

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Article Content

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Logic Circuit in Static Relay: The concept of Logic Circuit in Static Relay can be better understood by considering the logic operations

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Basic protection relay knowledge

The components used in the power system are usually dimensioned to withstand a short circuit current for one or three seconds but

Relay logic

On this page several relay based circuits are given: basic logic functions, but also multiplexing, coding/decoding, flipflop/registers and

(PDF) Relay logic programming explained

For a reliable switching application, the protection fault identification and protection coordination programs and circuit

Combinational Logic Design Using Six-Terminal NEM Relays

Abstract—This paper presents techniques for designing na-noelectromechanical relay-based logic circuits using six-terminal relays

Power System Protection: Protective Relay Logic from Udemy

The course may be useful by providing a deeper understanding of the logic behind protective relays, which are essential components

CHAPTER-3

3.1.1 Reliability of Protection Factors affecting reliability are as follows; Quality of relays Component and circuits involved in fault

Microsoft PowerPoint

A primary motor protective element of the motor protection relay is the thermal overload element and this is accomplished through

Relay-to-Relay Digital Logic Communication for Line Protection ...

INTRODUCTION Protection engineers, in concert with protective relay and communication product manufacturers, strive to achieve

2015-49(3)-2.vp

One of the most promising forms of developing the apparatus part of relay protection and automation devices is considered. The

Distribution Automation Handbook

The principle of inverse time protection is especially suited for radial networks where the variations of short-circuit power due to

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Six tools you MUST learn before programming numerical protection relays ...

A basic understanding of Boolean expressions and methodologies is helpful in developing the required programing to

Power System Protection: Protective Relay Logic Course Outline

He obtained his bachelor''s and master''s degrees in Electrical Engineering from The University of North Carolina at Charlotte, where

Protective Relay : Working, Types, Circuit & Its Applications

The protective relay diagram is shown below. Protection Relay Protective Relay Working Principle A protective relay is used to

Operation analysis of fuzzy logic-based relay protection devices

The study analysed the performance of relay protection devices based on the application of fuzzy logic. Relay

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