Numerical Relay

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Overview

A protection relay is a device that senses any change in the signal it is receiving, usually from a current and/or voltage source. If the magnitude of the incoming signal is outside a pre-set value, the relay will carry out a specific operation, generally to close or open electrical contacts to initiate some further operation, for example the tripping of a circuit breaker.
Two ball-shaped floats and two glass-enclosed reed switches are visible inside this cutaway view of a **Buchholz relay**


**Centrifugal switch**

[https://www.witmermotorservice.com/](https://www.witmermotorservice.com/)

**Bimetallic thermostat**

[www.explainthatstuff.com](http://www.explainthatstuff.com)
Attraction: [Image of a relay diagram]

Induction: [Image of a relay diagram]

Based on Technology (Construction):
- Non-electric (thermal, pressure, etc.)
- Electromechanical
- Solid state
- Microprocessor
- Numerical

Classification of Protective Relays

https://circuitglobe.com/electromagnetic-relay.html
The Solid Static relays use analogue electronic devices instead of magnetic coils and mechanical components to create the relay characteristics. The measurement is carried out by static circuits consisting of comparators, level detectors, filter etc while in a conventional electromagnetic relay it is done by comparing operating torque (or force) with restraining torque (or force).
Measuring principles:
✓ A2D
✓ Microprocessor: counting technique, use the Discrete Fourier Transform (DFT), limited processing capacity and memory compared to that provided in numerical relays.

Function:
✓ wider range of settings, and greater accuracy. A communications link to a remote computer may also be provided

Operation of Relay:
Digital relay consists of:
(1) Analogue input subsystem
(2) Digital input subsystem
(3) Digital output subsystem
(4) A processor along with RAM (data scratch pad), main memory (historical data file) and Power supply

Limitations of Digital Relay:
Short lifetime due to the continuous development of new technologies. The devices become obsolete rapidly. Susceptibility to power system transients. As digital systems become increasingly more complex they require specially trained staff for Operation.
Typical numerical relay hardware architecture
Commissioning Numerical Protection and Procedure For Carrying Out Performance Tests

Set-up system configuration of a numerical protection system (Beckwith M-3425)
Conventional electromechanical and static relays are hard wired relays. Their wiring is fixed, only their setting can be manually changed. Numeric relays are programmable relays. The characteristics and behaviour of the relay are can be programmed.

**Advantages of Numerical relays:**
- Compact Size
- Flexibility
- Multi Function Capability
- Different types of relay characteristics
- Digital communication capabilities
- Modular frame
- Sensitivity
- Speed
- Fast Resetting
- Data History

**Limitations of Numerical Relay:**
- potential risk of hacking
- shares common functions

(1) Nature of fault, (2) Magnitude of fault level, (3) Breaker problem, (4) C.T. saturation, (5) Duration of fault

Auto Resetting & Self Diagnosis
Thanks!