Directional Overcurrent and Directional Power Relays

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From time to time we experience some confusion about the difference between directional overcurrent relays, ANSI device 67, and directional power relays, ANSI device 32. Although there are some similarities between these two types of relays, they are really very different in both construction and application.

Directional overcurrent relays (67) respond to excessive current flow in a particular direction in the power system. The relay typically consists of two elements. One is a directional element, which determines the direction of current flow with respect to a voltage reference. When this current flow is in the predetermined trip direction, this directional element enables (“turns on”) the other element, which is a standard overcurrent relay, complete with taps and time dial, as found on a normal non-directional overcurrent relay. Because these relays are designed to operate on fault currents, the directional unit is made so that it operates best on a highly lagging current, which is typical of faults in power systems. Directional overcurrent relays are normally used on incoming line circuit breakers on buses which have two or more sources. They are connected to trip an incoming line breaker for fault current flow back into the source, so that a fault on one source is not fed by the other sources. In complex distribution or sub-transmission networks, these relays may be used to improve coordination of the system.

Directional power relays (32) measure real power \( (E_1 \cos \theta) \), so they operate best at a high power factor. Various degrees of sensitivity and speed of operation are available in various models of directional power relays. There are three typical uses of these relays:

- Connected to measure power flow into a generator, the relay will operate to trip the generator breaker if the generator begins to draw power from the system and act as a motor. This is usually due to loss of prime mover power.

- Connected to measure power flow into a transformer from the secondary side, a very sensitive directional power relay can measure core loss power input to the transformer, detecting loss of the primary source to the transformer. The transformer can then be disconnected from the system.

- A directional power relay can be used to limit power flow in a circuit. The relay may trip a breaker or initiate control action to change the system configuration. By using quadrature potential connections or a phase shifting transformer, these relays can be made to measure vars \( (E_1 \sin \theta) \). A typical use would be to limit the real or reactive power drawn from a utility source to a contractual level.
Neither the functions (67 and 32) nor the actual relays are interchangeable. Be sure to use the function and the hardware which fit the application.

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