



Two vs. Three Overcurrent Elements for Phase Fault Protection in Feeder Relays

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SCHEME DESCRIPTION

Digital feeder protection relays (for example, GE Power Management F35, F60, and 750/760 relays) typically provide overcurrent protection elements for all three phases. However, it is often desirable to save the expense of one CT and to use only two elements for feeder protection. This is possible with some specific considerations.

METERING AND ACTUAL VALUES

The first consideration regards relay metering and the displayed actual values. When current is supplied to the relay in only two phases, the metering is altered and only the currents in the phases equipped with CTs are measured correctly. The sequence currents will be altered and should be disregarded, as well as power, energy, demand, and power factor metering.

NON-DIRECTIONAL PROTECTION

Non-directional overcurrent phase fault protection can be provided by two phase overcurrent elements energized from CTs in two of the three phases, provided the CTs in all circuits are located in the same phases. If the CTs on different circuits are located on different phases, protection will not necessarily be provided (as illustrated in Figure 1). The example system in Figure 1 is assumed to be ungrounded. Simultaneous ground faults on different phases of two different circuits constitute a phase-to-phase fault on the system, and yet neither overcurrent element will operate.

If a wye-delta or delta-wye power transformer bank is interposed between the relays and a phase-to-phase fault, the current magnitude in one of the phases at the relay location will be twice as great as either of the other two phases. If only two overcurrent elements are used, neither element will see this larger current for a fault between one pair (of the three possible pairs) of phases that may be faulted on the other side of the bank. This should be taken into account in choosing the pickup and time settings.

If the fault current magnitude for a phase-to-phase fault is of the same order as the load current, the effect of load current adding to fault current in one phase and subtracting from it in another phase should be considered. This affects the pickup and time settings in a manner similar to that of an intervening power transformer bank.

In a non-grounded system, two single-phase overcurrent elements may generally be used provided the relays of all circuits are energized by currents from the same phases. Otherwise, grounds could occur on different phases of two different circuits, as seen in the figure below, imposing a phase-to-phase fault on the system, and no protection will be provided.

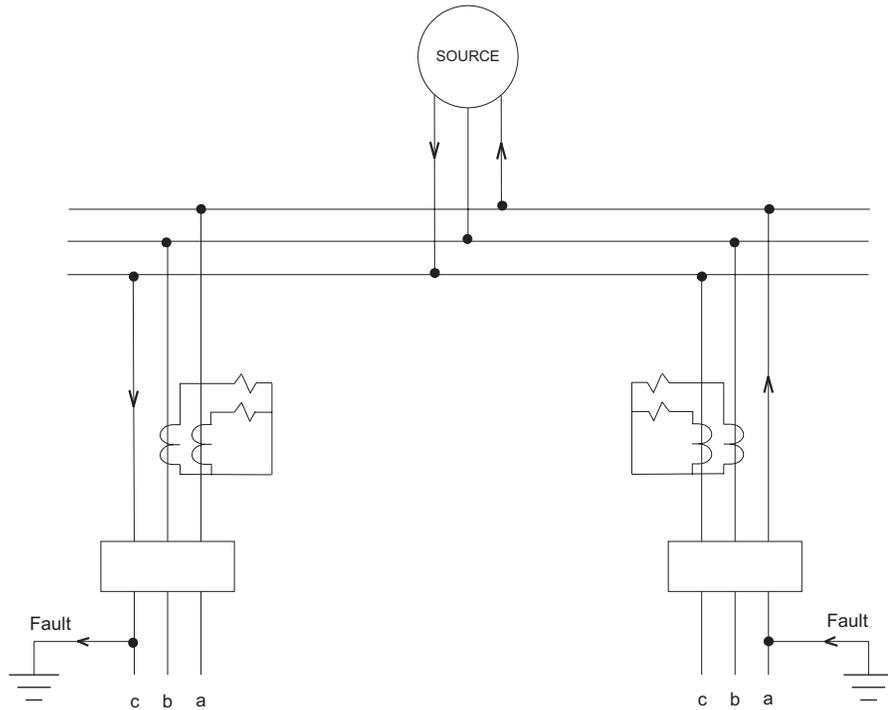


FIGURE 1. Lack of Protection with Two Overcurrent Elements

Directional overcurrent relays for ground fault protection are not usable on non grounded systems.