

Distribution Single-Phase Tripping and Reclosing: Overcoming Obstacles With Programmable Recloser Controls

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Abstract

Ever since the first ground fault detection device was incorporated into a fault interrupting mechanism, limitations have existed as to how much sustained load unbalance could be tolerated for a given three-phase distribution feeder. All single-phase fault interruption will introduce some incremental unbalance if load is dropped as a result. Therefore, projected peak load levels beyond the location of fault interrupting and sectionalizing devices have always been a determining factor as to whether the protection device would isolate all phases or only the faulted ones. For example, fuses, as independent phase interrupting devices, can only be used at locations where the load interruption will not cause unbalance above the pickup level of upstream ground fault detection equipment. Single-phase reclosers and sectionalizers must also be applied with similar consideration. Traditionally, if high load levels will be interrupted, three-phase circuit reclosers with gang-operated interrupters are used.

With no choice but to use three-phase interruption on more heavily loaded feeder sections, utilities long ago accepted the fact that possibly two-thirds of the customers beyond these protection devices would have to endure unnecessary outages each time a single-phase fault occurred. However, the quest for improved reliability through minimizing customer outages has brought about a renewed interest in single-phase fault interruption on three-phase distribution lines. With the availability of microprocessor-based recloser controls designed to operate with three-phase, independent-pole operated reclosers, utilities are taking a closer look at using single-phase fault interruption in non-traditional locations.

This paper will explore the possibilities opened when a programmable recloser control, monitoring current on all phases, is used to make independent trip and close decisions for each phase. Various challenges introduced with single-phase interrupting will be addressed and solutions offered.

Discussion Points

2. As dependency on reliable power grows, utilities are expected to increase feeder reliability through minimizing the number of customers interrupted by any single fault event.
3. Single-phase fault interruption, when possible, offers an economical method of greatly reducing the number of customers interrupted for single-phase faults.
4. The challenge presented to ground relaying by single-phase load interruption and the resulting unbalance has not changed. However, with intelligent user-programmable recloser controls, utilities can implement adaptable protection schemes based on loading and recloser interrupter status.