RFL UTILITIES SOLUTIONS

HOW DO I USE PHASE COMPARISON TO SIMPLIFY ANTI-ISLANDING PROTECTION COMPARED WITH DIRECT TRANSFER TRIP?

THE SCENARIO

A utility has a looped transmission system including several interconnected substations all fed from a single-source station. In addition, a generating plant is interconnected with this loop system. **See Page 2: Figure 1**. The utility desires anti-islanding protection between the source station and the generator. Due to the level of generation with respect to the minimum circuit loads, local active or passive methods are not acceptable because of the inherent Non-Detection Zone (NDZ). As a result, Direct Transfer Trip (DTT) is being considered but becomes complex to implement when taking into account the overall system requirements. Due to the looped system, it requires more than one breaker to be open in order for the generator to be islanded. Because there are multiple substations in-between, there are numerous possible combinations of breakers opening needed to create an island. To accurately determine an island condition with DTT, all of the breaker positions must be known. As a result, a DTT transmitter will be required to send the breaker information from each interconnecting station to the generator station. At the generator station, each DTT signal must be received and logic used to determine if the combination of open breakers results in an islanded condition. **See Page 2: Figure 2**. In addition to this complexity, communication channels must be acquired and maintained between the various points of interconnection and the generator station. This can become costly even when using point-to-multipoint communications.

THE SOLUTION

Using Phase Comparison to determine the island condition simplifies the need for communications requirements compared with DTT. The principle of phase comparison islanding detection is to know when the source station voltage frequency no longer matches the generator frequency as a result of an island. When an island occurs and the source station and the generator are no longer electrically connected, the frequency at the generator will change. As a result of the change in frequency, the source station phase and the generator phase will begin to drift apart. Phase comparison can be used to detect this apparent phase angle difference. Once the two phase angles drift to a predetermined angle, a trip command is issued. Phase comparison only requires sending the source station voltage phase information to the generator and performing a comparison to the local generator voltage phase. Consequently, only one communications channel, one transmitter and one receiver are required regardless of the complexity of the interconnection and the number of islanding sources. **See Page 2: Figure 3**.

THE RESULT

With the implementation of the Phase Comparison islanding detection system, the utility is able to achieve a reliable islanding detection solution without the inherent NDZ as with local methods. In addition, what would have been a complex communications scheme with DTT is now a single point-to-point system. Communications costs are now kept to a minimum while maintaining a high level of protection.

HUBBELL

FIGURE 1: LOOPED SYSTEM WITH GENERATION

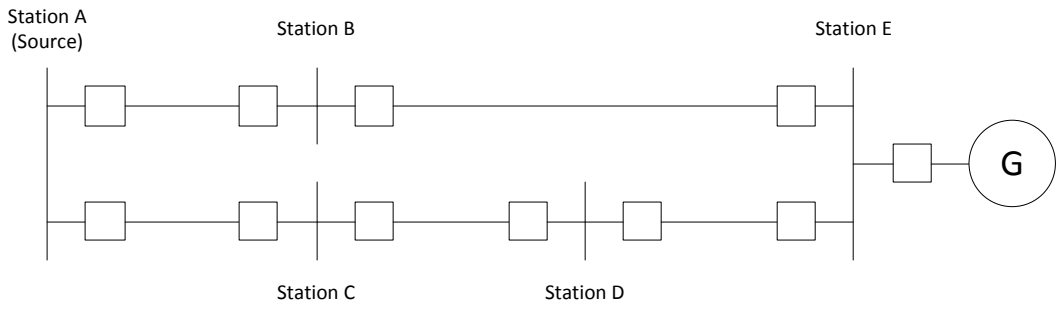

FIGURE 2: LOOPED SYSTEM ANTI-ISLANDING WITH DTT

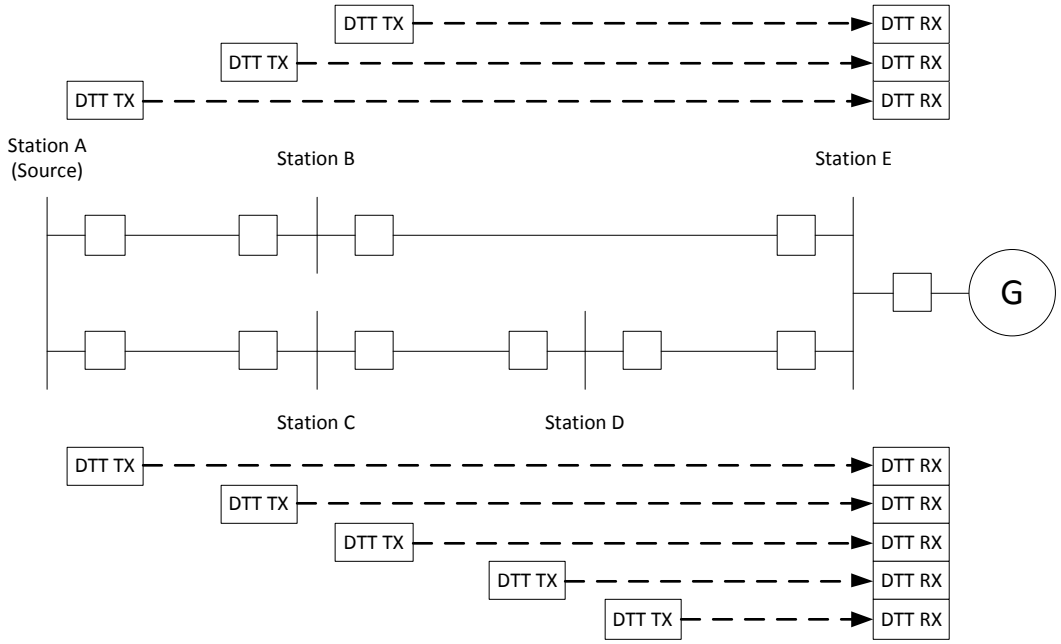

FIGURE 3: LOOPED SYSTEM ANTI-ISLANDING WITH PHASE COMPARISON