

Protection Element Consistency

In an earlier article, we explored the advantages inherent in the consistent application of user and integration interfaces and in relay input/output assignment. There is a fourth consistency that protection engineers can benefit from: Protection Element/Scheme Application Consistency.

This consistency is reasonably clear and most commonly practiced. Most utilities have either formal or de facto standard element sets for the protection of various apparatus. Perhaps you almost always use phase distance and ground directional overcurrent-based directional comparison blocking schemes on transmission lines. A collection of non-directional phase and residual instantaneous and time-overcurrent elements can be found protecting nearly every radial distribution feeder in North America.

One area of possible inconsistency is in the selection of ground directional polarization method. For a great many years, the directional polarization method of ground elements was limited to three mutually exclusive options: current polarized, zero-sequence voltage polarized, and negative-sequence voltage polarized. The selection depended on the electrical characteristics of the line terminal, the signal sources available, and the method employed on the remote end of the line.

In the last fifteen years, additional polarization methods have been developed. More recently it has become possible to configure certain relays to make a real-time decision of which polarization method to use. We prefer this approach since it allows a single relay type and configuration to be applied in nearly every case.

By standardizing our protection element selection and protection scheme implementation for a particular class of protection, we achieve a number of benefits:

- An improved understanding of the protection scheme operation
- An improved understanding of the relay performance in the scheme
- A repeatable relay setting and control logic definition
- A consistent bill of materials for protection, communication, and control equipment used in the protection scheme
- More refined processes for the selection of properly coordinated relay settings to support the protection scheme on your system
- More efficient methods of constructing, commissioning, and maintaining the equipment used in the protection scheme

In the past, single-function relays, hard-wired scheme logic, and labor intensive design practices made standardized protection schemes the rule rather than the exception. Lately, computer-aided design tools and highly-flexible, multi-function protective relays have allowed the freedom to implement highly customized schemes in nearly any application. While we applaud the flexibility of the multi-function relays, the undisciplined use of that flexibility can isolate you from the benefits described above.

Faced with the competing realities of a shrinking technical workforce and an aging fleet of protective relays, today's protection engineers are more than ever required to do more with less. Standardization is one of the tools we can use to meet that requirement.