

YOU MAY THINK EVERYTHING'S OK WITH YOUR POWER SYSTEM, BUT ARE YOU REALLY SURE?



THE IMPORTANCE OF UP-TO-DATE RELAY SETTING COORDINATION

Part 3 in a 4-part Series on Protection Engineering

How long has it been since you had your relay settings checked? If you have simply been replicating the same settings year after year, in spite of the fact that your system has been changing over the years, you risk some serious and potentially very costly power system issues.

Another consideration: Do you know if your downstream reclosers are properly coordinated? In other words, if you keep adding reclosers to a distribution line and do not coordinate them with the rest of the system, you are at risk of facing significant problems in the event of a fault.

When a new feeder is installed, some co-ops and municipals simply duplicate the same settings they've always used before, regardless of what else is on might be down the line. Certainly, standardization can be good in certain circumstances, but "standardizing" when it comes to relay settings and downstream reclosers is frequently not a good idea. When you duplicate the same relay settings from your existing feeders on your new feeder, you are essentially regarding the new feeder as a "clone" of the old feeder. That is, you are assuming that the new feeder has the exact same type of load and the exact same amount of load as your old feeder. While this may be the case, it is more likely that something has changed.

Updated and accurate relay settings are vital to safely protecting your system, your

employees, and your customers. Failing to keep your relay settings current can occur in one of four ways.

1 - You may not have been provided the proper relay setting recommendations in the first place. Finley Engineering was working with one utility and discovered that the system was seriously mis-coordinated, yet, utility personnel were unaware of it. Fortunately, no problems had yet occurred, and Finley was able to recommend updates that would ensure proper relay operation.

2 - You may have been given recommendations to update your relay settings at some point in the past, but had never gotten around to implementing them. On a past incident, Finley Engineering was contacted by a utility to investigate a fault that occurred on a transmission line between two substations. In this case, only the line between these two substations should have been de-energized. However, because of outdated relay settings, relaying at a third substation responded, resulting in the complete de-energization of an entire substation. A nearby school lost power and needed to be closed until power could be restored. As it turned out, the utility had received relay setting recommendations two years prior to this, but had never made the recommended updates. This situation could have been avoided entirely. Frequently, a utility isn't aware that their settings are out-of-date, until those relays are called upon to operate. At this point, it is already too late.

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3 - Perhaps you were given recommendations for relay settings in the past, and, as a result of reading this paper, have made the decision to now implement those recommendations. Keep in mind that as the system changes, the relay settings may also change. The original updates could become inaccurate. Therefore, it is a good idea to verify that the recommended relay settings are still applicable to the system in its current state. Implementing outdated recommendations to an updated system, without due diligence, could lead to a system that encounters adverse operations down the road.

4 - Fourth, upon further investigation, you may find that some of your relays are not working at all. Another utility working with Finley Engineering arranged to have a service firm perform functional tests on their relays. Many of these relays were of an old electromechanical type. When the utility sent us the testing service firm's report, many of the functional test results simply stated, "No Operation." Obviously, that is a serious problem.

Other than the substation example above, what other types of problems can occur with inaccurate relay settings, mis-coordinated downstream reclosers, and faulty relays? It is important to remember that when a fault occurs, the only thing worse than tripping off more of your system than you need to, is to not trip at all. When a recloser should trip but does not, the resultant problems quickly escalate. For example, if you experience a fault and the protection relay has "No Operation", a significant amount of

additional damage can occur. The additional damage can be extreme, including, but not limited to property damage or fires. This not only affects the cost of the additional equipment and labor needed to restore service, but more importantly impacts the safety of your personnel and the safety of the general public.

In sum, the earlier you address these issues, the better: Not only does attention to these matters reduce your risk of widespread outages due to "over-tripping", but it also saves additional time and labor while reducing the chance of widespread damage to your system.

Finley Engineering can help you with these challenges. We provide a range of services tailored to your specific situation and specific needs. Some of the services we provide include:

- Reclosing studies
- Review of existing relay settings and recommended updates
- Review of existing relays to determine if replacement is recommended or required
- Reviews of microprocessor relays and setting
- Conducting sectionalizing studies to coordinate lines with your substations

Not ready to take the next step? We can work with you to determine which solution makes the most sense for your specific utility - based on your needs, your risk exposure, and your cost considerations.

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How much time will it take to help you get to where you need to be in this area? Much of what may need to be done depends upon the type of relays you currently have:

- If you have mostly electromechanical relays, it can be difficult, especially without up-to-date documentation, to ascertain what the settings actually are and to identify the source of any problems that your system has experienced. We need information on all the relay settings, the instrument transformer ratios connected to those relays, plus all the drawings you have, including schematic and connection diagrams. Once we have this information, we can recommend the best solution to reduce your risk.
- If your relays are microprocessor based, it is usually much easier to determine the settings, and easier to determine the source of problems that may have already occurred. This is accomplished by retrieving the relay event records. Most modern microprocessor relays create oscillography records during their fault events, and often they embed the relay's settings.

In summary, a lack of either updated relay settings or relay coordination can negatively impact several areas, including:

- Damaging your electrical system, or a neighboring electrical system
- Public Safety
- Both your property and the public's property
- The possibility of unnecessary outages
- The revenues of your organization and of other businesses
- Other institutions, such as schools, hospitals, etc.

Instead of hoping that everything will work properly, it's well worth the time and expense to have your protective systems reviewed. This will help give you the peace of mind that you've done all you can to ensure that, when faults happen, your system will respond as intended.

About the Author

Mark Thatcher, a Senior Protection Engineer for Finley's Energy Division, has over 30 years of engineering experience in the energy industry. His experience and responsibilities include performing fault studies and calculating protective relay settings for new or existing transmission, substation, and distribution facilities, and in addition he is responsible for analyzing fault occurrences and determining appropriate setting modifications to enable proper operation. Mark is also responsible for specifying and implementing relaying schemes, involving microprocessor based relays as well as electromechanical relays as needed or required. He is responsible for project coordination for individual projects and supervises the testing of new electrical distribution facilities

If you have any questions about these solutions or want to discuss this topic further, please contact Mark Thatcher, 913-601-3518 .

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