GRIDSCALE X ADVANCED PROTECTION ASSESSMENT

Relay Setting Module

Supporting engineering insight

SIEMENS

At a glance

Relay Setting is a practical tool, with realistic objectives and capabilities, for developing relay settings.

The challenge

Relaying is an imprecise "science" at best, one that demands a lot of human judgment despite the routine, repetitive tasks that it also entails. It is virtually impossible to create the ideal settings without human intervention, yet it is possible to reduce the initial calculations and allow for appropriate adjustments from a basic settings point.

Our solution

Our approach was not to program the human judgment facet of relay setting, but rather the repetitive, time-consuming calculations of initial tap settings. We let the computer perform number crunching and routine logical decisions and the engineer resolve conflicts and "impossible" situations.

Briefly, the method is this. Relay Setting provides an environment in which any number of a utility's standard setting procedures can be described in a high-level language tailored to power engineers. RS enables these procedures to be recorded and applied. Typically, the first step is a comprehensive fault analysis from which key fault currents and apparent impedances are derived. The next step is usually to develop what we call "raw settings," the currents or impedances that must be translated into actual settings. Then the taps to achieve the desired settings are computed. In some cases, additional tests may be performed to verify the correctness of the recommended taps. If your setting philosophy for a particular type of relay can be described in words, an engineer can embody that philosophy in an Advanced Protection Assessment Relay Setting algorithm.

Advanced Protection Assessment Relay Setting:

- Helps to ensure the consistent application of company standards.
- Provides (perhaps for the first time) a written record of the initial steps an engineer is to follow when setting a relay of a given type and function. It may therefore be a valuable reference for the new engineer.
- Provides, at the user's option, a written record of intermediate and "final" results of the setting calculations.
- Promotes "better" settings. In order for RS to carry out the protection group's procedures, those procedures must be stated in words. The very act of articulating them often leads to a review of previously vague aspects of the procedure. The review, in turn, leads to a more precise statement of policy and better settings.

Custom setting procedures

An objective of Relay Setting is to enable the user to model any and all of his company's setting procedures. This is not possible with "hardwired" source code or with expert system technologies. For this purpose, we developed the Advanced Protection Assessment User's Programming Language. With CUPL, one can "program" any number of setting procedures. In practice, it is more common to either use directly or modify slightly one of the ready-to-run setting algorithms we supply with RS.

Quick relay search and computation

Using a mouse and the Advanced Protection Assessment Data Tree, you can quickly select a relay from a database with tens of thousands of relays. Drag it to the text area and choose the setting procedure. Supply the run-time parameters requested and then watch a few seconds as Advanced Protection Assessment computes the settings. Choose between standard and detailed report options. And if you want a printed copy of the report for your records, you can have it in two mouse clicks.

User interaction and control

Even "standard" setting procedures need to be flexible. Generally, a well-written setting algorithm prompts the user for key numbers and directives or obtains them from a small text file. That way the standard setting method is versatile enough to apply under many conditions. Consider a setting procedure for traditional directional-ground-overcurrent relays. Your algorithm might prompt for a factor to multiply the maximum expected fault current at the relay so that the reach of the instantaneous overcurrent element can be pulled back from the remote bus. Perhaps you would like to prohibit the selection of time-overcurrent pickup taps less than some value, in accordance with company policy. This number can be prompted for as well. The Advanced Protection Assessment

User Programming Language offers the algorithm developer several custom forms to give the setting procedure a clean, professional appearance.

Automated fault analysis

The heart of a reliable setting algorithm is a thorough fault analysis. The full computational capabilities of Advanced Protection Assessment's Short Circuit program are directly available within Relay Setting. It is not a difficult task to prepare this part of a setting algorithm. Keep in mind that we have already written many common studies in CUPL and you are free to "borrow" these. If you prefer, you may write your own. With CUPL commands such as DO LINES and DO MUTUALS tailored to the power engineer, it is easy to conduct sophisticated fault studies.

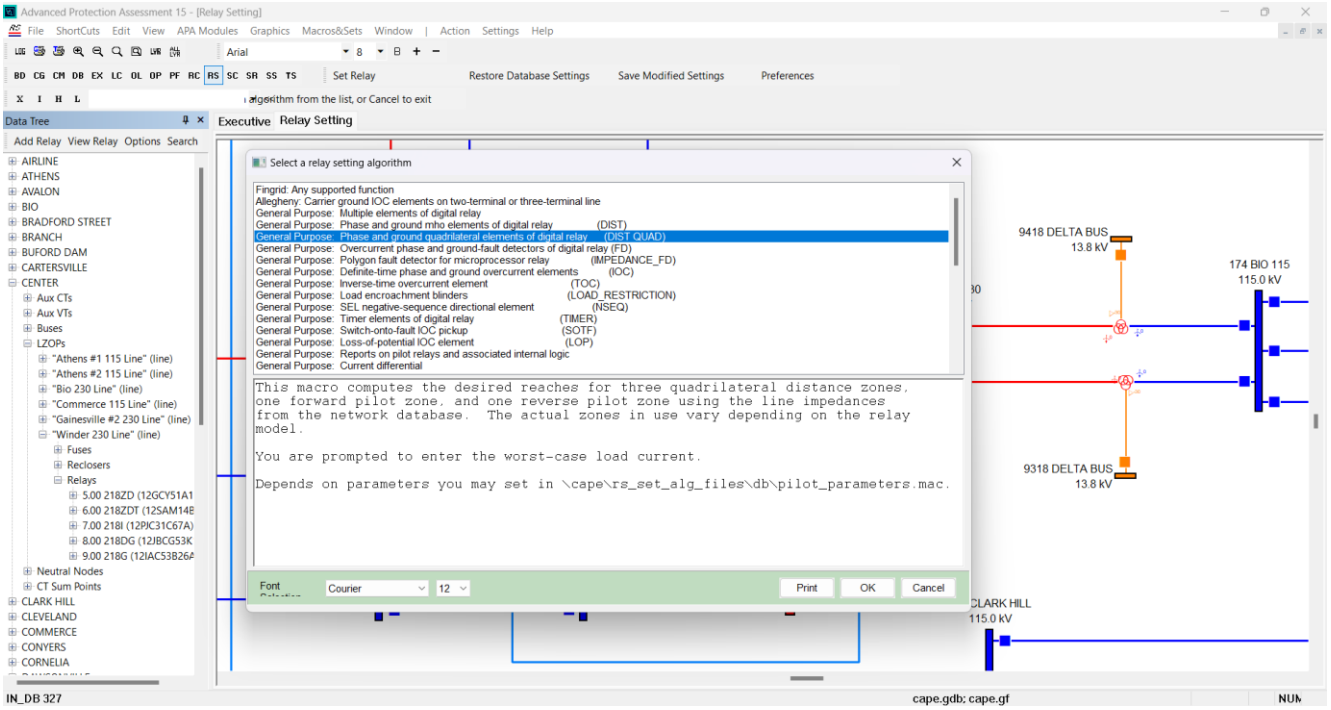

Figure 1: Quickly select one relay from tens of thousands, supply run-time parameters, and then see Advanced Protection Assessment compute the settings in seconds.

Ready-to-use setting algorithms and building-block functions

RS comes with many setting algorithms that may actually be suitable as is or with minor adaptation. There are algorithms for directional-ground-overcurrent relays and for ground- and phase-distance relays with one or several distance elements. You'll also find an example for computing settings for a negative sequence
directional element.

Computing the actual reach of a distance element along a line any number of buses away is done too. Advanced Protection Assessment provides many smaller functions you can use as building blocks to write your own setting algorithms. There are predefined functions for computing the time dial given a test point, for rounding a raw setting to the nearest available tap, or for computing a zero-sequence compensated apparent impedance.

Features

- Custom setting procedures
- Quick relay search
- User interaction and control
- Automated fault analysis
- Free library of ready-to-use setting algorithms and building-block functions

Published by
Siemens AG
Smart Infrastructure
Grid Software

Siemens Technopark
Humboldtstr. 64
90459 Nuremberg, Germany

For the U.S. published by
Siemens Industry Inc.

3617 Parkway Lane
Peachtree Corners, GA 30092
United States

For more information, please contact: Gridscale-X-APA-Contact.si@siemens.com

Article No. SIDG-T10010-00-7600 – Advanced Protection Assessment – Relay Setting Module