GRIDSCALE X ADVANCED PROTECTION ASSESSMENT

Database Editor Module

Enter data once and use it everywhere

SIEMENS

At a glance

The Advanced Protection Assessment database was designed to meet Advanced Protection Assessment data needs and yours, too. Use it as a general repository of technical and recordkeeping data and access it with other commercial programs like Access or Oracle. Or use it with programs that you have written yourself. The database design is open and you can extend it to suit your needs.

The challenge

Managing and maintaining the massive amounts of data required to perform protective relay simulations can be a daunting task. A single digital relay settings file may contain thousands of settings. Keeping track of this information and making sure that it is kept up-to-date requires not only detailed planning by engineers but also a database where all the required data may be stored and easily accessed by the entire protection team, eliminating the need to manually enter and maintain data in multiple places.

Our solution

The Advanced Protection Assessment Database Editor offers a superbly designed interface for quick, intuitive searching, well-organized forms for data entry, built-in data reports, and a host of data manipulation tools to streamline the work of maintaining “industrial strength” databases. For example,

- Only Advanced Protection Assessment lets you model any number of future construction scenarios in one database with its unique Equipment Category feature.
- Only Advanced Protection Assessment offers a general-purpose facility for merging your network and protection data from one database to another.
- Only Advanced Protection Assessment offers an import facility to keep your library of relay models up to date.
- Only Advanced Protection Assessment gives you the Database Doctor to point out data likely to be in error.

At a higher level, the protective device and transformer models in the Advanced Protection Assessment database are unmatched by any other protection product. Modern digital relays may have fifty to one hundred elements with rather complex supervisory relationships among them and may have literally hundreds and hundreds of settings. Advanced Protection Assessment models them in detail. Any relay may have any number of alternative settings and any setting group can be made active by the click of a button. Transformers with any number of windings, explicit neutral buses, and complex neutral circuits with protective devices are supported by the Advanced Protection Assessment database and simulated in the software.

Quick data access

The Advanced Protection Assessment Database Editor makes matter how large your database. To move about the database, you need only make choices in a single, dynamic search form. The Database Editor guides every step, showing your data in a clear, logical order. Even though the database has a tabular (relational) structure, searches are always done in a natural, top-down way. For example, most searches involving system data begin at a substation. Once you see the data you want, just highlight it, and click the “View Data” button. You’ll be impressed with the crisp, easy-to-understand edit form that you see next. You enter data from the keyboard or from simple pop-up lists. Industry standard buttons and symbols are used consistently throughout the Database Editor.

When you are working with functions like Short Circuit and Coordination Graphics, the Advanced Protection Assessment Data Tree puts all your data at your fingertips without getting in the way. The Data Tree gets you quickly and naturally to any piece of network and protection data in your system. For example, begin by expanding a substation, then a Local Zone of Protection (a relay panel), and right-click on one of its relays to see what you can do with that relay. One choice is always to pop up the Database Editor form for that relay. Another is to set the relay! Or choose any bus in the substation and apply a fault or have the one-line diagram center itself on that bus. In truth, there is so much you can do from the Data Tree that you may sometimes forget to use your one-line diagram.

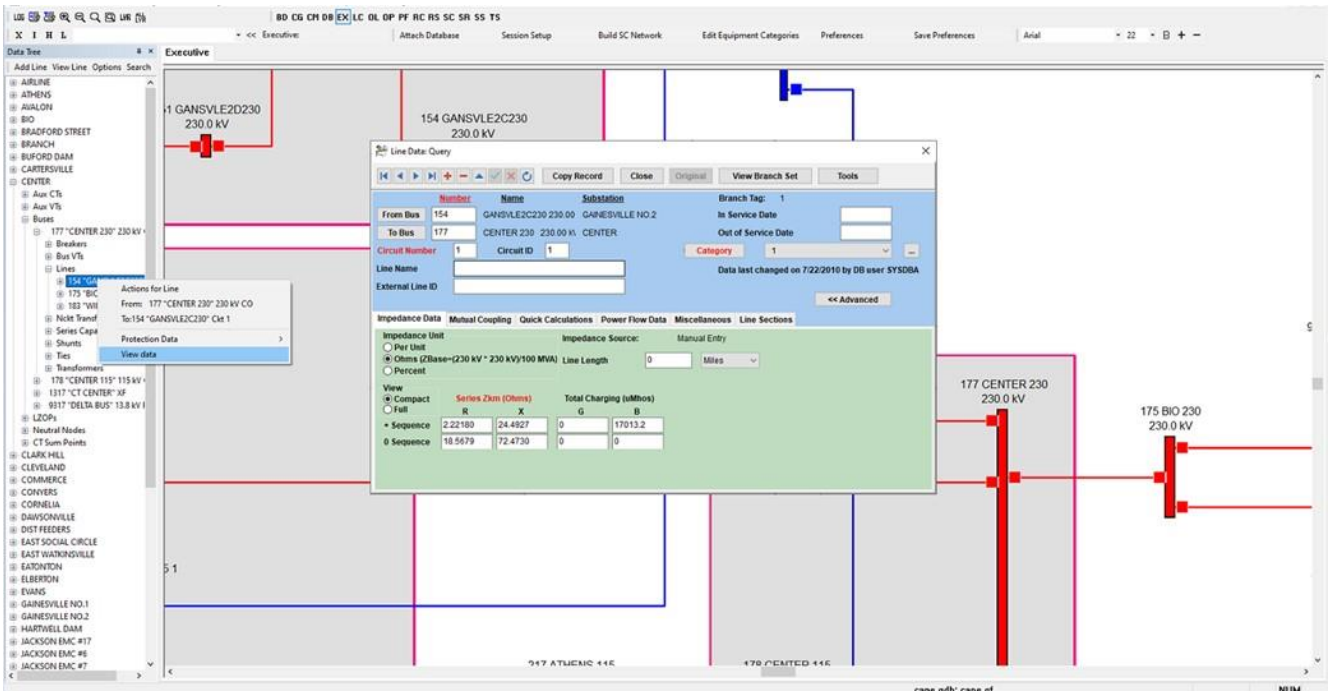

Figure 1: Database Editor offers multiple ways to access your data and is easily accessible throughout all the Advanced Protection Assessment modules.

Want to look at network data really quickly? Then click on a bus or line in your one-line diagram to bring up the edit form you need. When you are done, close the form and continue with your previous task. In Advanced Protection Assessment, your data is easy to find and easy to change.

Quick data entry forms

All data are presented in carefully organized pop-up forms called Data Windows. Each is designed to let you do all your editing there in one place. When more room is needed, we have used the simpler “index card” technique instead of multiple windows. The data window for a relay, for example, has separate “tabs” for its element lists, common taps, and memo fields for operating history, failure information, etc. When you want to select related data, such as an operating or polarizing CT, you simply click a button on the form.

Data entered from the keyboard undergoes various checks for validity before being accepted. Error messages will inform you of any problems. Key information is compared carefully with existing data to prevent the accidental entry of duplicate data. Pop-up lists are used extensively both to simplify your data entry effort and
to prohibit inconsistent data (such as nonexistent
tap settings).

Commercial Database Management System (DBMS)

Some of the features and benefits Advanced Protection Assessment’s underlying DBMS are:

- No limit on database size or scope
- Supports SQL (Structured Query Language) and dynamic SQL.
- Provides independent backup and recovery features.
- You may extend the Advanced Protection Assessment database design (schema) with new fields and tables.
- You may connect your own programs to the Advanced Protection Assessment database.
- Supports multiple, simultaneous use of the same database.
- Forms and report packages are available independently of Advanced Protection Assessment, for example, from Crystal Reports™.
- Database is accessible from PCs using Access, Oracle, and other ODBC- compliant products.

You benefit from new DBMS technological advancements, while Advanced Protection Assessment concentrates on developing a power system-specific software.

Integrated network and protection system models

Half of the Advanced Protection Assessment database is devoted to a detailed model of your network and protection system. (The other half is the Advanced Protection Assessment library of relays, instrument transformers, conductors, towers, etc.) We call this your system data. System data include the substations, buses, transmission lines with associated mutual coupling, transformers, generators, and loads that are needed for power flow and short circuit computations. System data also encompass the breakers, zones of protection, CTs, aux CTs, summation points, VTs, aux VTs, relays, fuses, and reclosers needed for coordination analysis and recordkeeping.

The network data often already exists in machine-readable form and may be transferred to an Advanced Protection Assessment database automatically by conversion programs included with Advanced Protection Assessment. Examples are data in PSS®E, ASPEN, and ANAFAS formats.

Equipment category feature for multiple network scenarios

There is one data management problem real companies face that no other protection system software has solved. Your network can easily have fifty to a few hundred configurations that must be studied repeatedly. If that sounds excessive, think of the demands the competing plans of Independent Power Producers, or your own present and future construction scenarios place on your engineering staff. Think of the need to study variations of your present system topology, perhaps at various generation levels. If you have a staff of more than one engineer, wouldn't it be great if all of them could use the same database at the same time, each one studying a different view of the network, without stepping on each other's toes? Advanced Protection Assessment lets you do all of that without even breathing hard. With our unique Equipment Category feature, you can call up the configuration you want after clicking a few buttons.

Carefully designed and field-proven forms make it easy for you to assign components of your network to one or more categories you have named, even if your network has thousands of buses. This feature really works! Take a closer look at Advanced Protection Assessment and we will show you how.

Transformer modeling utility

Sometimes it is not enough for the Database Editor to support merely the entry of data. Transformers have traditionally been one of the most difficult and frustrating network components for the engineer to model. Advanced Protection Assessment does not leave you on your own to figure out how to model your transformers.

A full modeling utility program is working for you "behind the scenes". All you need to do is enter the terminal and tap kVs, implicit and explicit phase shifts, winding configurations, and manufacturer's test or tee model information. The edit form adapts itself to the number of windings and to whatever form your raw data requires. Advanced Protection Assessment Database Editor computes the internal mathematical model for you, even if every terminal is operated with off-nominal taps. The internal model is computed automatically when Advanced Protection Assessment reads the system data. Neutral buses may be ungrounded, solidly grounded, or named explicitly and interconnected later with various neutral network components such as neutral branches, shunts, and switches; CTs and relays can be attached to neutral branches.

Transformers with up to five windings are modeled with data found right on the test reports. Advanced Protection Assessment does all the arithmetic for you.

Realistic relay models

A significant characteristic of the Advanced Protection Assessment database design is the modular structure that generalizes the modeling of relays. With this approach, a relay is modeled as a combination of instantaneous-overcurrent, time-overcurrent, directional, distance, voltage, timer, differential, and auxiliary elements (voltage restrained and product elements are modeled too, although part of those models is in code provided by us). The supervisory (or torque control) relationship between relay elements is easily specified either as part of the relay definition or as part of the system data when the relay is placed. A simple concept in Advanced Protection Assessment known as "common taps" supports the modeling of all settings of a digital relay. Some affect more than one relay element simultaneously. Common taps also provide a place in Advanced Protection Assessment for special relay information such as binary "masks" and configuration logic.

Modular modeling allows Advanced Protection Assessment to analyze everything from relatively simple electromechanical relays to complicated microprocessor-based relays. It also helps ensure that Advanced Protection Assessment will be able to model relays not yet commercially available.

Every relay engineer knows that the elements and taps available in a relay cannot be specified correctly unless the relay is modeled by manufacturer's style number. Advanced Protection Assessment does this. There is a level of modularity in the design of the Advanced Protection Assessment relay library that makes it easy for you to add new relay styles. Tap ranges are modeled like the proverbial "little black box" (by you or by us). You build a new style by simply clicking buttons to add elements or to select a predefined tap range. The Database Editor copy feature simplifies even this task because it lets you start with an existing style.

Advanced Protection Assessment comes with a library of over 7,300 manufacturer-specific relay styles that model the devices you bought; they are not generic over-simplifications.

Alternative setting groups

A major new feature of the Database Editor is a clever facility for representing any number of user-named groups of alternative settings. Groups are easily created and deleted or renamed. They may represent alternative settings supported physically in the relay or they may serve an administrative function, e.g. "Pending," "Approved," "In Service," and so on. Any relay may have any number of such groups, and the currently active group is quickly changed with a mouse click. A setting group may even involve an entirely different style of relay! Some modern digital relays have several thousand settings. Today, you need a tool like Advanced Protection Assessment just to manage your data.

User-expandable library of relays, CTs, VTs, and line construction data

The second half of an Advanced Protection Assessment database is the portion known as the library (and you'll be happy to know that it comes free with Advanced Protection Assessment). The Advanced Protection Assessment library is a collection of data that are more-or-less common to all users. The largest part of the library is its set of detailed models of relays. Directional elements may be voltage or current polarized (or both) by zero-, positive-, or negative-sequence quantities. Distance elements may have more than one unit, typically phase-to-phase and three-phase. Taps for any type of element may be continuous, stepped, or discrete. Manufacturers' catalog data for fuses, reclosers, CTs, and VTs are also stored in the library. Conductor and tower configuration data are stored in the library for use by the Line Constants module.

While library data other than tower designs generally will not require modification, you can edit it just as easily as your system data. From time to time you will want to add new protective devices, for example. The Database Editor Import command simplifies the transfer of new relay models from Advanced Protection Assessment's master library to your own database.

Relay models can be assembled from previously-defined components such as the time- current curve family.

"Modified/Original" data recall buttons

The Database Editor and the edit windows of the Coordination Graphics module can display alternately two versions of a data window: the newly entered data and the (original) data stored in the database. A "Modified"/ "Original" button is provided on each data window. Clicking the button toggles the display back and forth between the new and original data. This is a very helpful feature. If you are interrupted and forget what you have entered so far, the Database Editor lets you review the present value of a field before you replace it with a new value.

Data merge

Every utility is faced with the daunting task of keeping a database up to date. One common situation occurs when the protection group invests the effort to develop its protection system model while faced with having to accept updated network models periodically from the planning department or from the reliability council. Another very common situation occurs when there is more than one engineer in the protection group, they have chosen to work with separate copies of their database rather than use the Equipment Category feature described above, and each engineer is assigned to study different scenarios of future construction. The group needs to maintain a master database and no one wants to enter data twice, of course. The Advanced Protection Assessment Merge feature within the Database Editor makes it practical to perform these important data maintenance tasks. In fact, just about any type of data movement or merge between databases is readily managed. Even databases having different systems of bus numbering/identification can be merged. Better yet,
if the operation will be done more than once, as in the case of an annual network model update, the entire setup of the merge form can be saved for future recall.
No other protection software has faced up to this real-life challenge.

"Before Advanced Protection Assessment, a coordination study on one subsystem required about a month of an engineer's time. Using Advanced Protection Assessment, the time has been reduced to less than a week".

– Ron Oñate, Arizona Public Service Company

Features

- Quick data access within the Database Editor, the Advanced Protection Assessment Data Tree, or from the Advanced Protection Assessment One-Line Diagram
- Convenient edit forms let you do everything in one place
- Commercial database engine that supports unlimited database size, user-designed extensions, SQL access from other programs, and ODBC access from any modern DBMS
- Integrated network and protection system data for an accurate model of your system. Equipment Category feature represents any number of past, present, and future network scenarios in one database
- Integrated transformer modeling utility program
- Realistic models of electromechanical and digital relays having any combination of overcurrent, directional, distance, voltage, differential, timer, and auxiliary elements
- Settings are correctly limited to physically available taps
- Any number of alternative setting groups for any relay
- User-expandable library of relays, reclosers, power transformers, instrument transformers, conductors, and tower designs
- "Modified"/"Original" data recall buttons for instant comparison of newly entered and existing data
- Practical database merge feature for transferring data between databases
- Replace an entire network model without losing the protection model or update a master database with a model of new construction that was studied separately

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
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Article No. SIGSW-B90093-00-76 – Advanced Protection Assessment – Database Editor Module