One-Line Diagram Module

Maintain your whole database graphically

SIEMENS

At a glance

The Advanced Protection Assessment One-Line Diagram module not only gives you an intuitive interface to the unequaled power of software's engineering functions, it almost certainly will be the tool you will choose to build your Advanced Protection Assessment Database. With it you can build and maintain your network and your protection system models at the same time. When we developed this latest generation One-Line Diagram module, our goal was to offer you a level of flexibility you will not find anywhere else.

The challenge

Preparing an integrated network and protection system model, with a single-line diagram that gives you ready access to them later can be a challenge with some less sophisticated tools.

Our solution

With Advanced Protection Assessment, building a new network could hardly be more intuitive. The primary objective of the One-Line Diagram module is to make it really easy to prepare the integrated network and protection system models, and the single-line diagram.

Build network data

The Network Toolbar has icons representing each type of component: buses, generators, motors, lines, power transformers, earthing transformers, series capacitors, capacitor and inductor banks, bus ties, and so on. To place one, click on its icon, move the cursor into the drawing area, and follow the instructions in the help box that floats with the cursor. Click the image below to see an example of placing a three-circuit transformer. The floating help tells you to click a bus of a particular voltage, then the second, then the third, and lastly you click where you want to place the transformer symbol. A data form pops up to let you set any 30-degree phase shifts and connect neutral points of wye-connected windings. You may ground them solidly, associate them with explicit neutral buses, or let them float. Want to change something after you have placed it?

Just double-click or right-click on the symbol.

Build protection data

Placing protective devices is just as easy and intuitive as building the network. Click any device in the Protection Toolbar. Breaker symbols will suddenly appear, if they were not already showing, because access to protection is through either these breakers or, in some cases, a bus. Move the cursor to a breaker where the instrument transformer is to be located or one that the protective device will control and click it. Fill out the standard data form and you are done. The Protection Toolbar supports the placement of VTs, CTs, Summation Points, relay panels which in Advanced Protection Assessment are known as Local Zones of Protection (LZOPs), relays, reclosers, fuses, and even the contact logic that tells Advanced Protection Assessment how device elements work together to cause breaker trips. We are sure you will be amazed at how simple it is to move up to the power of Advanced Protection Assessment models!

Operate breakers and apply faults

The One-Line Diagram supports all Advanced Protection Assessment modules, but when you are working in the Short Circuit environment, its real benefit becomes clear. If you have a diagram displayed, you can conduct your entire fault study from it. Click on a line, generator, or bus tie to apply one of SC's long list of interactive network changes: opening and closing breakers, outaging or grounding lines, placing off-line equipment back into service, inserting midline or close-in fault locations, etc. Then click the place you want to fault, select the fault type, and immediately read the results on your diagram. You control the quantities displayed and the format in which they appear by selecting a Text Style, as described below.

The Short Circuit window is split between text and graphics, and you can move the separator between text reports and the one-line diagram up and down like a window shade. You may display one or more text and graphics windows simultaneously. This unusual flexibility might be just what you need to examine different parts of a large network at the same time, or to conduct comparative studies when you have no diagram at all.

Build new data displays

Looking for flexibility in choosing the information to display on your network diagram? You won't find more than the Advanced Protection Assessment One-Line Diagram program offers today. Where most competing products limit you to a relatively small number of alternatives, Advanced Protection Assessment One-Line Diagram lets you select from any of a long list of predefined bus, branch, and shunt quantities. If that is not enough, you can display expressions involving any sensible combination of the predefined quantities. You will find that more than enough fields are available on buses, lines, transformers, generators, fault symbols, and so on for displaying not only the typical currents, voltages, line impedances, and other network data, but much more sophisticated quantities as well. For example, you can display apparent impedances seen by

hypothetical distance relays or operating and polarizing quantities seen by directional elements. How about the display format? Here again, Advanced Protection Assessment demonstrates its near-trademark flexibility: engineering units or per-unit, polar or rectangular forms, arbitrary text labels, groupings of basic or derived quantities, user-selectable number of decimal places, and so on. Advanced Protection Assessment One-Line Diagram lets you assemble any number of predefined displays with just a few mouse clicks on its special Text Style form. With another click, you can store the setup in a file and then recall and apply it from your personal pop-up form whenever you wish. For example, you might set up one style template for use with single-line-to-ground and three-phase faults, another for line impedances, and yet another for indicating the response of a particular type of directional element.
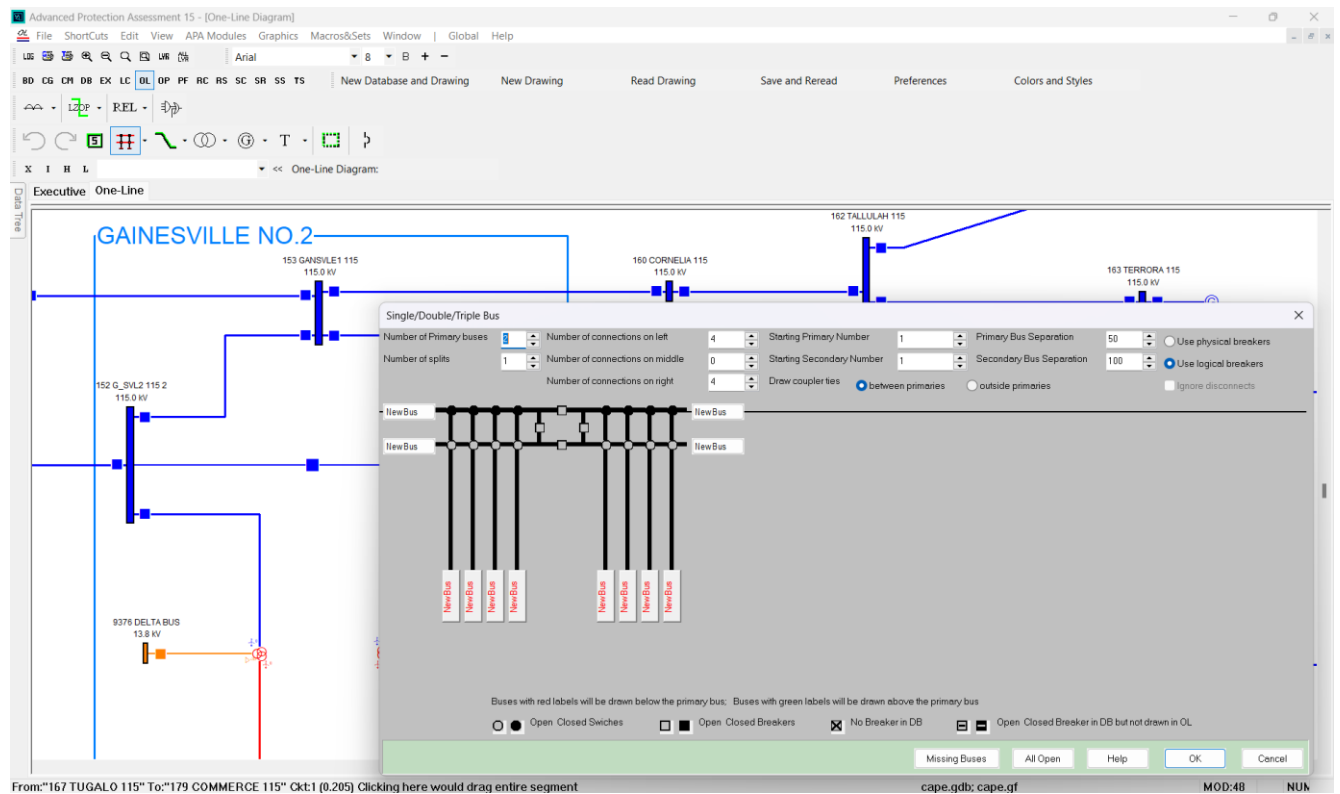

Figure 1: Three steps to add a transformer One-Line Diagram makes it easy to build integrated network and protection system models and the single-line diagram that gives you ready access to them later.

Access your database directly

The foundation of Advanced Protection Assessment is certainly its unifying, comprehensive database. It has always been easy to access through the Advanced Protection Assessment Database Editor, the relay data edit forms in Coordination Graphics, SQL queries, and any ODBC-compliant DBMS product, such as Microsoft Access and Oracle. However, the Advanced Protection Assessment One-Line Diagram gives you the fastest access to selected parts of your database. Just double click or right click a bus, line or transformer terminal, bus tie, generator, or reactor. For example, when you right click on a line end and click "Show protection," the Data Tree expands and displays the relay panel (Local Zone of Protection) for that location.

Formulate new construction scenarios

With this program, you can assemble a one-line diagram with surprising speed and convenience. There is no need to prepare a complete, all-purpose system diagram unless you want to. You can have as many different diagrams as your work dictates, and each may have as many or as few buses as you wish. Of course, every diagram can be used repeatedly. Normally, you begin by dragging a bus from the Data Tree onto a blank screen. Then you use the mouse to select neighbors of the bus and place them, vertically or horizontally, on the screen. Advanced Protection Assessment One-Line Diagram finds the interconnecting lines and transformers in the database and shows them automatically.

Despite its human origins, Advanced Protection Assessment One-Line Diagram does not possess the same aesthetic sense that you do. So, the remaining task is to arrange everything for a pleasing appearance and to accommodate the display of numbers and other data. Advanced Protection Assessment One-Line Diagram's point-and-drag edit facility makes this easy. Then all you need to do is apply the finishing touches: color, special texts and titles, and perhaps frames surrounding various groups of buses.

You can assemble a One-Line Diagram with surprising speed and convenience. There is no need to prepare a "one-size-fits-all" diagram, unless you prefer to.

Control colors, line styles, and displayed kV levels

In Advanced Protection Assessment, every graphical entity is an object, and every object may have its own color, line thickness, and style.

The software offers a number of menus to simplify this aspect of diagram building, but the most important one is the Colors and Styles menu. Default selections are made separately in this menu for buses, lines, highlighted mutual couplings, symbols, texts, global frames, and the background; your decisions on color are assisted by the mock-up graphics area on the right that shows how your colors will look together. The thickness and color of buses and lines can easily be made dependent on their nominal voltage levels; you choose the voltage thresholds, colors, and thicknesses of course. Again, these are only default selections. Other commands let you make exceptions to the default colors and line styles so that you can make your point more effectively or just exercise a little creativity. When using the one-line diagram for practical studies, you may turn any combination of voltage levels on or off, a very useful feature if your drawing is layered like your physical network.

Highlight mutually-coupled lines

If you want to see what lines are coupled to a chosen line, all lines in a coupled group, or simply all coupled lines, One-Line Diagram can highlight them for you instantly. Partial coupling is shown accurately. Right click on a line, or in an open area, and choose the kind of mutual coupling display you want. The Data Tree will lead you to the mutual impedance values. The Colors and Styles pop-up lets you choose the highlight color.

One-Line Diagram can highlight lines in a coupled group for you instantly and accurately, down to partial couplings.

Use special features to make your work easier

Siemens has been developing and offering one-line diagram software for over twenty years. In that time, we have gained a great deal of experience and feedback concerning the little things that become important when you work with the one-line diagram function a lot. As a result, you will find much attention to detail in Advanced Protection Assessment One-Line Diagram. For example, you can detach and reattach line, transformer, generator, and bus tie terminals from one bus to another. You can duplicate any existing bus, transformer, line, generator, etc., and place it wherever you want. To make it

easy to line things up when building a diagram, Advanced Protection Assessment One-Line Diagram provides an optional grid to help you place objects more precisely. When small kinks appear in lines despite your careful efforts to the contrary, Advanced Protection Assessment has an option that will remove them automatically. You can always find the right style and size text for your drawing; a standard text tool lets you select any available font and size. You can add a legend with the drawing title, location, author, and date. In the software, buses such as load taps, multiterminal line junction points, and mutual coupling points have a different status from those in recognized substations. You have the option of displaying such buses as points. An entire group of buses can be enclosed and dragged together. Any text can be made invisible. Fault locations are shown symbolically and can be dragged. Outaged lines and generators are highlighted graphically. The list goes on.

Features

- Build your network and protectiondata graphically
- Operate breakers and apply faultsgraphically
- Build new data displays with the StyleTemplate Menu
- Access your database directly
- Formulate new constructionscenarios easily
- Control colors, line styles, anddisplayed kV levels
- Highlight mutually-coupled lines
- Use special reterminate and duplicatefeatures to simplify maintenance of your network model

Advanced Protection Assessment's standard set of advanced features includes:

- Multiple graphics panes
- Macro facility
- Set facility
- Advanced Protection Assessment User's Programming Language
- One-click pop-up help
- On-line documentation