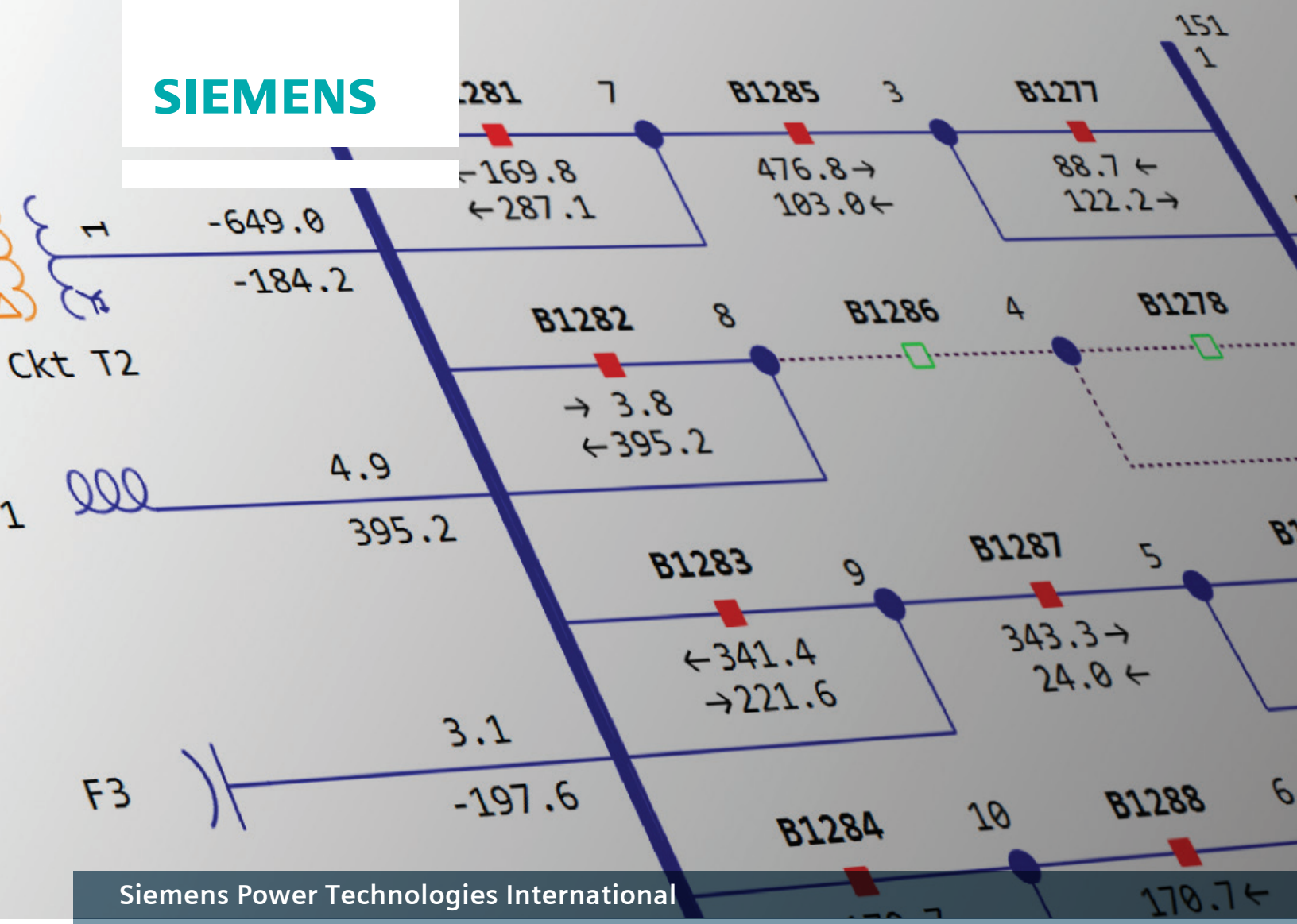
SIEMENS



Siemens Power Technologies International

Breaking down barriers between planning and operations

Using PSS®E 34

At a glance

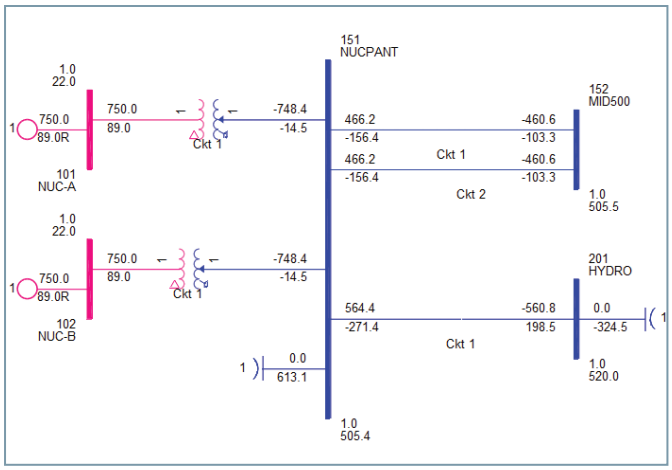
Traditionally, detailed substation modeling only took place in system operations. With today's complex systems and industry requirements, it is just as important for transmission planners to interact with their models in the same way. At Siemens PTI, our engineering team has implemented an innovative solution to this problem. With the addition of integrated node-breaker modeling in PSS®E 34, detailed substation topology provides planners with even more powerful and accurate study capabilities.

- Auto-generate substation layouts to easily create complex topologies with the ability to graphically manipulate details and fine tune the design
- Simulate complex contingencies at the breaker level to accurately portray protection behavior
- Readily compare planning and operation models at the substation level, which can aid in power flow base case validation and NERC MOD 33 compliance
- Visualize substation topology at the device level with PSS®E single-line diagrams, allowing the user to view power flow results at individual buses, breakers, and switches.

Automatic substation creation

Although node-breaker modeling is a very powerful tool, creating substation topology can be a very tedious exercise. Therefore, PSS®E 34 provides an easy-to-use node-breaker tool for automatically generating substation layouts, based on several common substation designs (such as ring bus, breaker-and-a-half, etc.). The user simply makes their selection from a dropdown menu, and the network and graphical engines take care of the rest. Once the network and graphical representations are auto-generated, the diagram can be manually tweaked for proper placement of terminals, and to approximate the actual general arrangement of the substation. Additionally, there is almost no limit to the amount of substation detail that can be created. The topology processor supports the addition of tens of thousands of additional nodes without any loss in efficiency or accuracy.

PSS®E 34.0 will save you hours by auto-generating node-breaker topology for standard substation layouts, such as breaker-and-a-half, double-breaker, and ring bus.



Traditional Bus-Branch Single-line Diagram

Node-breaker contingency analysis

One of the most important advantages of node-breaker detail is the powerful new way of defining and simulating contingencies. With node-breaker modeling, complex protection system behavior can be simulated easily and accurately. For users, this means significantly less work and better results when verifying compliance with NERC TPL standards and other regional Grid Codes.

There are new contingency commands available for simulating complex protection behavior; this behavior was previously difficult or impossible to properly simulate using bus-branch data only.

Examples:

- A branch contingency can still be defined as:

  ```
  open line from bus 101 to bus 102 circuit 1
  ```

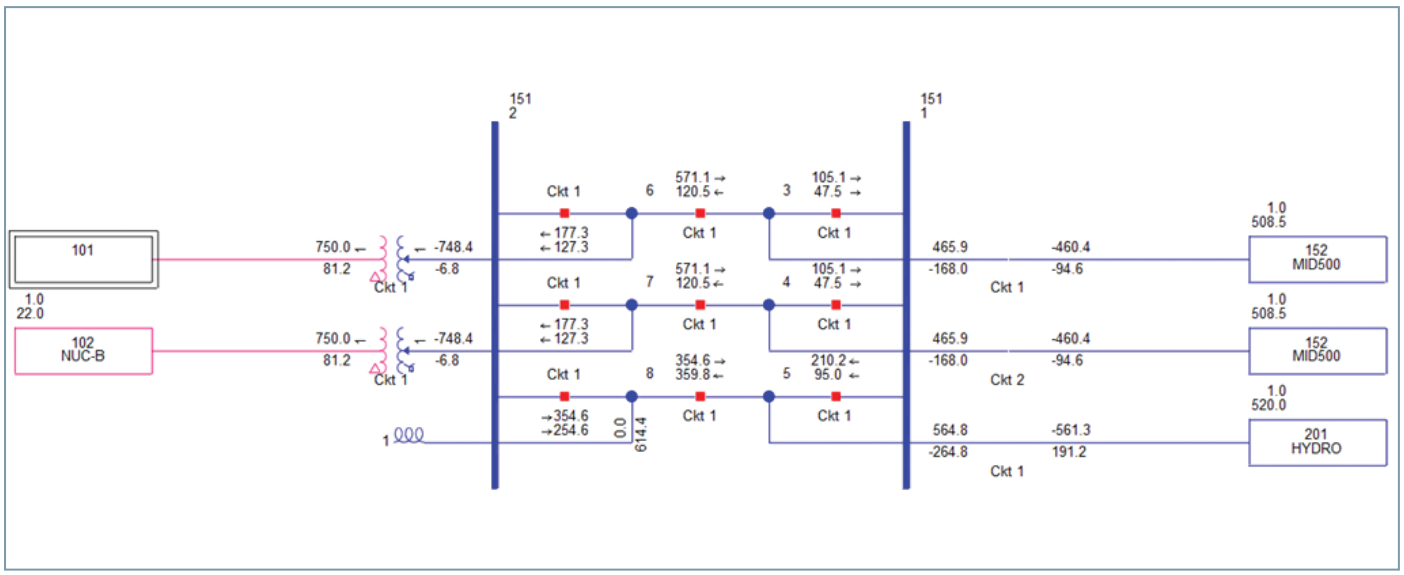
  But, in the presence of node-breaker data, the contingency engine will actually implement this contingency by isolating this branch using the appropriate breakers.

- The definition of a stuck-breaker contingency is simply:

  ```
  stuck breaker from bus 101 to bus 102 circuit 1
  ```

  This new command, will outage the branch and automatically determine which breakers need to open.

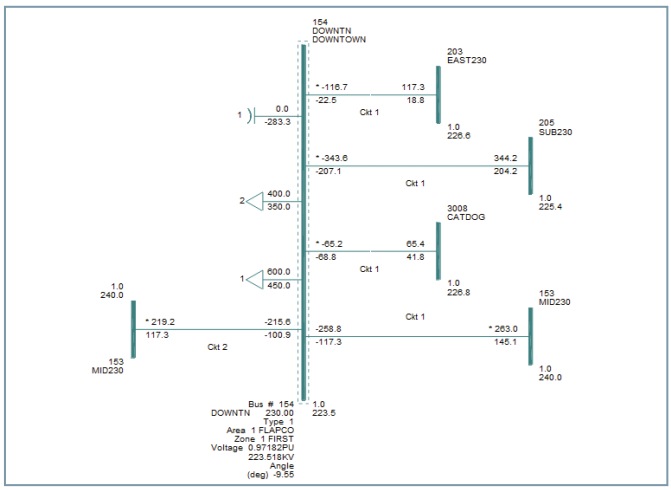
Node-Breaker is there when you need it, and out of the way when you don't!



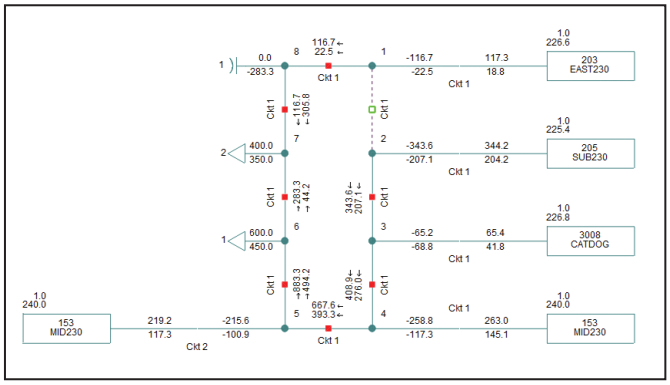
New Node-Breaker Substation Diagram showing Breaker-and-a-Half Topology

Bringing planning and operations closer together

Replication of similar substation topologies to those found in typical Energy Management Systems (EMS) is also possible. Planning and Operations can now manage and analyze the system models in more common ways with PSS®E 34. Similar to EMS systems, PSS®E 34 allows the planner to view voltages and currents at the breaker and switch level, and individual breakers and switches can be opened independently with just the click of a button.



Traditional Bus-Branch Single-line Diagram with No Breaker Outages



Node-breaker Ring-Bus Substation Diagram with a Breaker Outage

Additional enhancements to PSS®E 34

PSS®E 34 is not just about node-breaker capabilities. Siemens PTI has also enhanced the user experience through data organization improvements, new power flow models, customizable ratings groups, new Geomagnetic Induced Current (GIC) features, and new Dynamics models. With these enhancements, users gain increased analysis capabilities while saving time and meeting industry requirements.

Interface, diagram and plotter improvements

- The network data grids have been reorganized to group common spreadsheets into tabs, allowing for quick selection between spreadsheets.
- Management of large sets of study files is made simple with the new Study Management System built upon the existing scenario management concept.
- Single-line diagram properties have been reorganized, and can be saved and loaded from external files.
- PSS®E Plotter now supports the popular PSSPLT functions RANG, SLCT and FUNC.

Improved power flow models

Individual loads can now be designated as distributed generation loads to properly model renewable generation. Machines may now be modeled as in-feeder devices with the proper management of machine parameters. Also, transformer impedance tables have been updated to allow 99 defined points, as well as real and imaginary pairs, allowing higher-fidelity modeling of transformers.

Customizable ratings groups

The number of available thermal ratings for branches has increased from 3 to 12. These rating groups are customizable with names and descriptions to easily denote the intended purpose of the ratings. For example, long and short-term seasonal rating groups can be added and populated.

Geomagnetic Induced Current (GIC) analysis improvements

The GIC engine supports additional functions to meet and surpass regional GIC modeling requirements. Location-based field scaling and non-uniform field calculations are now available.

New dynamics models

Many new dynamics models have been added including twelve of the latest IEEE 421 models, as well as new governor and Volts/Hz models. Additionally, improvements have been made to existing dynamics models. For example, wind machines now expose internal three-phase quantities for complex control logic and post-processing.

Summary

PSS®E 34 brings an unparalleled work experience to the transmission planning arena, replacing tedious guesswork with easy-to-use real-world functionality. Our engineering team has gone beyond a basic implementation of node-breaker modeling by providing tools to auto-generate topology, and graphically interact with node-breaker data. A powerful tool, node-breaker will take previously unheard of planning detail, and make this detail a seamless part of the user's daily routine. With the new node-breaker capability and other enhancements, Siemens PTI continues to build upon PSS®E's strong foundation as a leader in power systems analysis.

How to get started

For further information or to purchase PSS®E 34, please contact Siemens PTI software sales at pti-software-sales.ptd@siemens.com or +1 518 395 5000.

Siemens Industry, Inc.
Siemens Power Technologies International
400 State Street
P.O. Box 1058
Schenectady, NY 12301-1058

usa.siemens.com/psse