

DSA Manager™

Product Features

Secure operation of power systems is of ultimate importance to the reliable supply of electricity and this is also the center element in the modern *smart grids*. The conventional off-line dynamic security assessment (DSA) of power systems often cannot meet the requirements of system operations in the new environment. The on-line DSA, which uses real-time system conditions obtained through SCADA/WAMS and state estimation in an Energy Management System (EMS), provides a viable solution to this problem.

DSA Manager™ offers a platform on which the security assessment software in Powertech's DSA Tools™ suite is applied in an on-line DSA system, providing system security monitoring, prediction, alarming, control, and other advanced functions required in the operation of smart grids.

Application Scope

An on-line DSA system based on solutions provided by DSA Manager™ can be used for the following applications:

- System security status and margin monitoring.
- Stability limit determination.
- Preventative and corrective control action recommendation.
- Special protection system lookup table update and operation verification.
- Settlement of power transactions in power markets.
- Active and reactive power reserve determination.
- Calibration and validation of power system models.
- Preparation of models for system studies.
- Post-mortem analysis of incidents.
- System restoration.

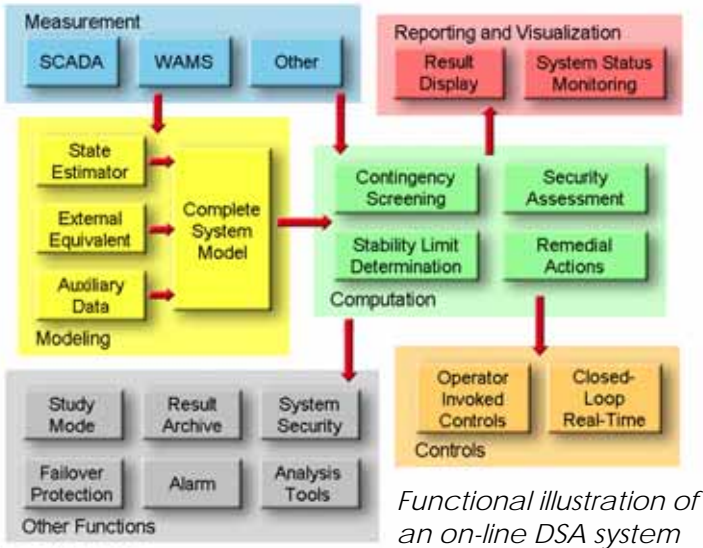


- **Common platform to integrate DSA Tools™ with Energy Management System (EMS)**
- **Static and dynamic security assessment including stability limit calculations**
- **Flexibilities in handling real-time and fixed data**
- **Comprehensive analysis scenario definition capabilities**
- **Security violations, stability limits, and alarms reported in simple colour-coded display**
- **Visualization of system security trends vs time**
- **Study mode for analysis of history and future cases**
- **Software/hardware failover and bad data detection/correction functions**
- **Parallel, distributed computations for scalable performance**

System Overview

DSA Manager™ acts as an interface module in an on-line DSA system with five main functions covering the management of,

- **security assessment modules:** computation clients and engines of each security assessment module (VSAT, TSAT, SSAT) are integrated and configured to perform the required analysis tasks.
- **computation hardware:** all computation servers, workstations, and data server deployed are set up and scheduled to function properly.
- **models, data, and analysis scenarios:** all models and data required are specified and maintained. In addition, analysis scenarios are defined for the target applications.



- **result archiving and visualization:** computation results are saved and analysis cases archived for future use. Various result visualization tools are available and direct access to more advanced output analysis via *DSATools™* DSAOA module is provided.
- **system operation:** this includes a set of functions for system configuration, operation monitoring, system security, failover, and maintenance of the on-line DSA system.

Security Assessment Options

DSA Manager™ can be configured to interface with any or all of the security assessment programs in Powertech's *DSATools™* suite:

- Voltage Security Assessment Tool (**VSAT**).
- Transient Security Assessment Tool (**TSAT**).
- Small Signal Analysis Tool (**SSAT**).

All supported security assessment options in these programs can be enabled for on-line DSA, including,

- Base case security analysis with various security criteria.
- Transfer analysis to determine stability limits.
- Remedial action analysis to recommend preventative and/or corrective control measures when required.

Such analyses are done for the specified contingencies, power transfers, and other models supported by *DSATools™* and defined in DSA Manager™.

In the **real-time mode**, analysis scenarios are set up in DSA Manager™ and an analysis cycle is triggered automatically when a real-time system snapshot (with other optional information) is passed from EMS.

In addition, all security assessment programs are also available through the **study mode** in DSA Manager™ for the what-if analysis of archived history cases or forecast future cases.

System Architecture

DSA Manager™ supports an on-line DSA system with an architecture comprised of the following components:

- A **DSA Client** on which all data and analysis tasks are managed. For improved reliability, dual Clients can be used and DSA Manager™ handles the Client failover.
- Multiple **Computation Servers** on which all calculations are done. Analysis scenarios are assigned to available servers by the built-in distributed computation feature.
- A **Data Server** on which input data, computation results, and analysis cases are stored.
- **User Workstations** on which current and history DSA results are displayed using the DSA Monitor software included in the DSA Manager™ package.

It is possible to set up multiple DSA systems in one network for production, backup, studies, development, QA, testing, etc. These systems can be coordinated with the following available functions:

- Data sharing.
- Custom configuration of analysis tasks.
- Custom configuration of computation servers.
- System synchronization.

Model and Data Requirements

DSA Manager™ can be integrated with virtually any EMS system to exchange real-time and fixed data available in the following formats,

- *DSATools™* native format.
- Common third party formats.

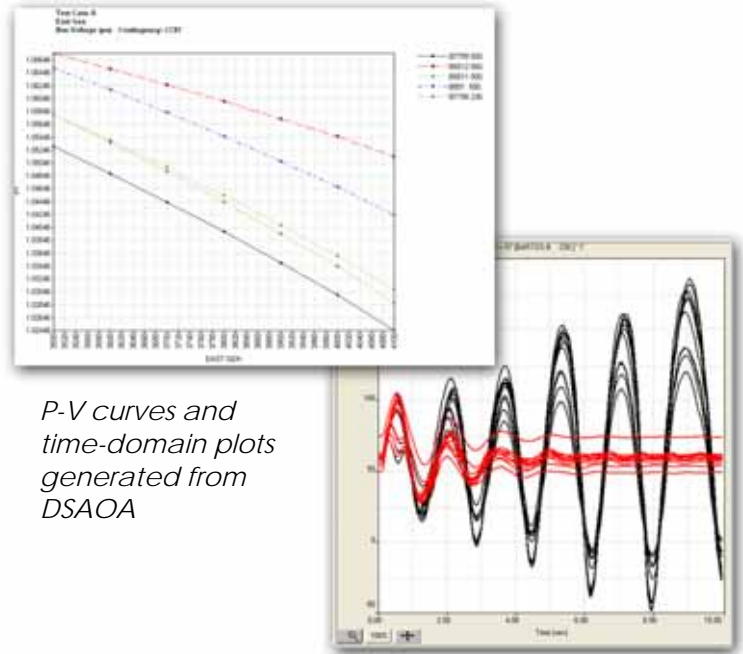
In addition, user can also define and maintain fixed data in DSA Manager™. All data can be prepared with the **equipment name** concept which ensures unique matching of real-time and fixed data for an analysis case.

For compatibility with off-line analysis, all models and data supported in the standard version of *DSATools™* are available for on-line DSA.



The following additional features are available in DSA Manager™ to handle models and data:

- Certain data can be defined in both EMS and DSA Manager™; user can specify the rules to merge data for the actual analysis.
- Certain data can be prepared in mixed formats. For example, if the base dynamic data is available in a third party format, it is still possible to add user-defined models in DSA Tools™ format.
- Multiple data sets can be defined independently and matched with different analysis scenarios.
- Identical data editing interfaces to the standard DSA Tools™ programs.



Result Archiving and Visualization

Each real-time case analyzed is archived in data server. Such cases can be loaded back in DSA Manager™ for examining full results and can also be loaded in DSA Tools™ programs easily with functions provided on DSA Manager™ interface.

Various types of results are displayed in DSA Manager™:

- Basecase security status and unstable contingencies.
- Security violation details with suggested remedial actions.
- One or two dimensional stability limits with limiting security violations and causes. Options are available in displaying stability limits.
- Interface flow, generator group output, and minimum voltage monitoring.
- Histogram showing time-tagged history security results.
- Security violation alarm.
- Custom P-V, time-domain, and other plots from DSAOA.
- Wherever possible, results displayed are consolidated from all installed security assessment modules.

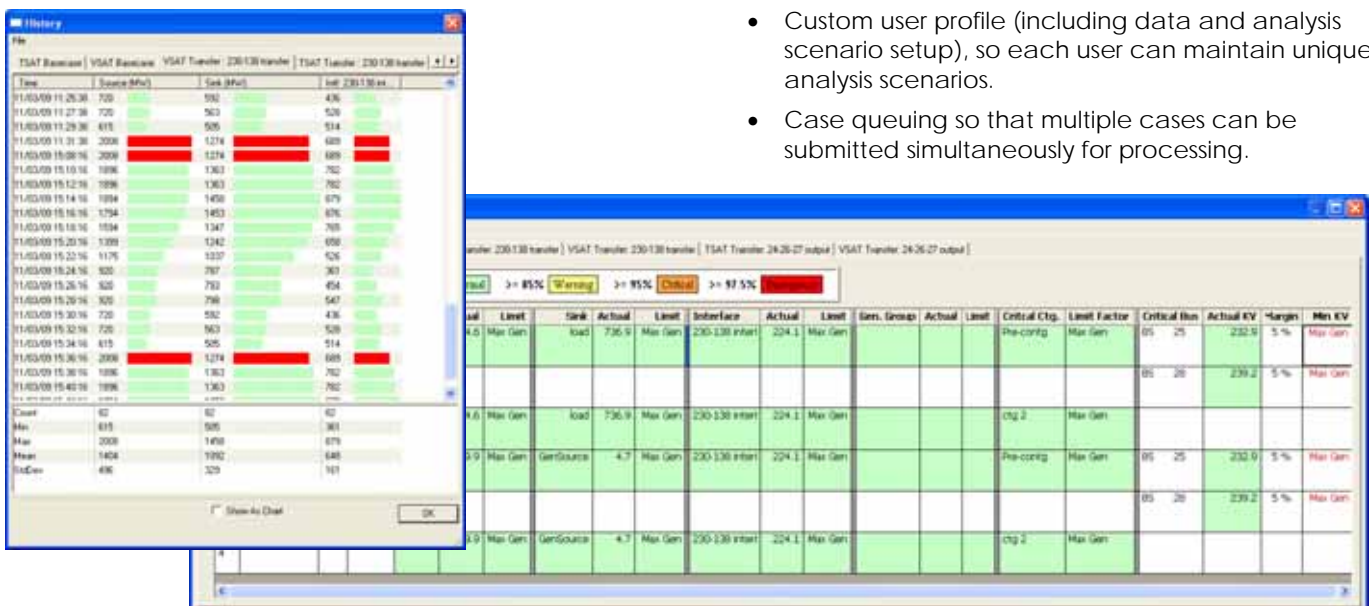
Study Mode

DSA Manager™ supports two study modes:

- **Study mode for history cases:** all real-time cases analyzed and archived can be loaded into off-line version of DSA Tools™ programs with the interface provided in DSA Manager™. User is free to make modifications on models, data, and analysis scenarios in the studies. All features, including GUI, of the off-line version of the programs are supported.
- **Study mode for future cases:** this is supported with a special version of DSA Manager™ (referred to as ST DSA Manager™). Under this mode, future study cases (next hour, next day, etc.) can be submitted and processed in batch.

In addition to the features available in DSA Manager™, ST DSA Manager™ supports:

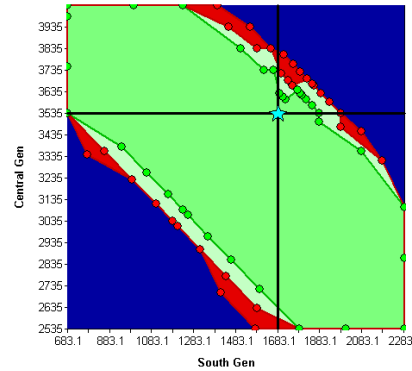
- Custom user profile (including data and analysis scenario setup), so each user can maintain unique analysis scenarios.
- Case queuing so that multiple cases can be submitted simultaneously for processing.



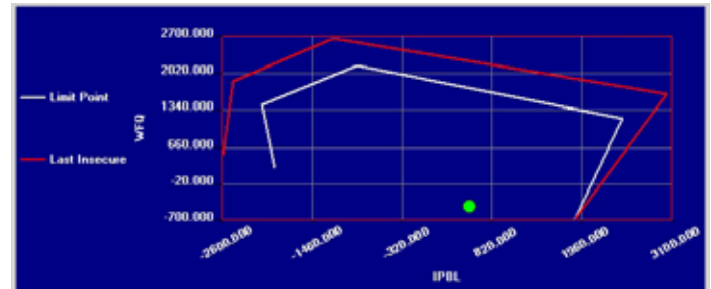
Other Features

DSA Manager™ includes other features:

- Detection and correction of deficient real-time data and system condition during computations.
- Handling of high priority real-time cases.
- Batch modifications to real-time powerflows.
- Lookup table for fault clearance time.
- Rule-based conversion of VSAT contingencies to TSAT format.
- Contingency grouping for specific transfers.
- Ability to process forecast cases, in addition to real-time cases, in real-time mode.
- Comprehensive configuration options available to set up an on-line DSA system.
- DSA client, server, and computation cycle monitoring.
- Daily message logs.
- Runs on Microsoft Windows Server 2003/2008.



Two methods of showing limits for a two-dimensional transfer: source and sink with indication of various types of violations (left) and specified interfaces (below)



Other Powertech Services

- Evaluation of transfer capability and security limits
 - Powerflow analysis
 - Transient Stability analysis
 - Small-Signal Stability analysis
 - Voltage Stability analysis
- Post-mortem analysis of system disturbances
- Frequency control assessment
 - Islanding studies
 - AGC & governor performance
 - Design and evaluation of under-frequency load-shedding schemes
- Increasing transfer capability
 - Control-tuning and design
 - Load shedding schemes
 - Reactive compensation planning
 - Special protection system design and verification
- Assessment of planning alternatives
- Custom modelling & dynamic model reduction
- Reliability Assessment of power systems
- Generator field testing, model development & validation
- Load characteristic measurement and model development
- Custom software and model development
- Training

In addition to extensive power system analysis software and study capabilities, Powertech has a \$50 million lab and test facility which includes high voltage, high current, and high power labs, as well as capabilities in hydrogen technologies, chemistry, metallurgy, and materials engineering.

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