ORGANON

User Guide

Version 1.2

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Introduction

Organon is a software for power system analysis and security assessment. It can be used as standalone tool and integrated to an Energy Management Systems - EMS. Therefore, it is suitable for planning studies and real-time assessment.

SECURITY ASSESSMENT

Security assessment is a complex problem, as it demands a very high computational effort. Traditionally, security assessment is performed by planning engineers using conventional power system analysis tools, typically power flow and time domain calculations. The results are saved in operating orders in the form of tables, rules and graphics, which guide dispatchers in real time power system operation. The main disadvantage of this approach is that it is impossible to assess security for many possible real time operating conditions, as the combinatorial nature of the problem would require huge amount of simulations. Moreover, even the processing of a large number of operational conditions is impractical because it is a very slow process. The time required by an engineer to prepare data, process simulations, analyze results and write a report can take many hours or even days. Despite of that, the technology available until a few years ago would not allow the implementation of a different process. As a consequence the security assessment is done for a relatively small set of operating conditions. Usually worst scenario cases are evaluated, which tends to impose conservative constraints on security margins. These in turn may have undesirable economical effects, either because of the need for more investments (mainly in transmission lines) or the loss of opportunity to sell more power.

The limitation in the number of evaluated cases may also have serious consequences on system reliability because of the high probability of missing critical operating conditions and non-predicted emergency situations. To prevent such risk, it is necessary to adopt conservative reliability criteria. However, current environmental, economical and financial constraints do not allow much flexibility for that. The consequence may be risky operation of stressed networks.

In other words, the operation can be unnecessarily conservative for predictable situations, but unsafe for unpredictable ones.

For the last three decades, there have been many research efforts to develop methods for real time on line security assessment. The advantage of such facility would be that the complexity of the problem reduces significantly, as there is no uncertainty regarding the operating condition, which is known with good accuracy through SCADA system. Then the security assessment perfectly matches the current operating condition. The major difficulty to implementing an online security assessment was the insufficient computational power available for the complexity of the problem. Then the focus of the research concentrated in two main lines. One was the use of approximated algorithms and methods for power system simulation to speed up the computation. The other was the adoption of simplified power system models to reduce the size of the problem. Some very fast methods have been devised, but they have failed to reach production grade and being implemented commercially because they either fail to produce accurate results or fail to complete the calculations due to numerical problems.

This scenario has changed dramatically as low cost High Performance Computation - HPC became available in the last few years. For example, a power system simulation can be processed more effectively today in a personal computer than it used to be in a workstation some years ago.

ORGANON DESIGN CRITERIA

Organon was designed to take advantage of this technological evolution for improving power system planning and operation processes. It combines HPC, robustness and ability of detail modeling representation to provide reliable, accurate and fast security assessment. The system design is nurtured first by simulation fidelity, followed by robustness and then computational speed. This priority order distinguishes Organon from most of the similar tools.

Simulation fidelity implies the use of detail model representation, which is a characteristic of tools used in planning environment. Most of the tools developed for real time environment aim at fast computation in detriment of simulation accuracy. This is a major drawback as results are not accurate, i.e., it is hard to trust the assessment. Detail modeling presents no technical difficult, as it is a standard procedure in general purpose off-the-shelf power system analysis tools. Organon just recognizes this basic requirement for effective security assessment.

A security assessment tool is useless if it is not reliable. For example, if a load flow calculation fails to converge it is not possible to conclude the assessment. In this case dispatchers would be in the dark. So robustness is paramount for effective power system computation. The choice of numerical methods and algorithms has been guided by robustness criterion.

HPC is achieved in Organon with a scalable distributed processing architecture. Tasks in a security assessment process are concurrent. Thus they don't necessarily need to be processed sequentially. Contingency analysis, for example, is a typical functionality suitable for distributed processing. The various contingencies to be evaluated can be distributed among many processors, which process them in parallel. The results from all simulations are then combined to produce a global assessment.

ORGANON METHODOLOGY

Organon methodology is based on the automation of traditional planning procedures. It contains some built in functionalities, but in some cases customization may be necessary.

Automation usually arises suspicions about the ability of the system to deal with non-ordinary situations. In other words, the sometimes lack of flexibility or adaptability of an automated process is generally seen with skepticism. However, these feelings are generally unsubstantiated, as the industrialization history has shown. In the particular case of power system security assessment process the benefits of automation are overwhelming. An automated process can be 200 times faster than a manual one using a single processor. With 20 processors it can be 3000-4000 times faster. Such productivity gain cannot be disregarded in the planning environment and is sine qua non condition for real time security assessment. Moreover, the rules and methods can evolve as the system conditions change and/or more is learned about the system.

An automated process is also auditable and not ambiguous. It is well know in planning environment that given a calculation procedure, two analysts can reach different conclusions because of individual interpretations. In an automated process there is no such risk.

An automated process can help increase expertise and the knowledge base about the system, as much more system condition can be evaluated faster. Experts and specialists, usually spend most of their time with routine work (preparing data, inspecting results, etc). Usually a small percentage of their time is allocated to real analysis. Automation improves their working conditions and allows them to contribute more effectively and proactively with their expertise.

The essential components of Organon automated security assessment are the following:

Tools to perform simple tasks such as run a power flow, change the operating point to a new desired condition and run a time domain simulation.

- Procedures to evaluate the critical aspects of the system. These procedures are based on the practices adopted in planning environment.
- Reliability criteria, which are different for each system or coordination council.

- Methods of extracting diagnosis from simulations without human interpretation or visual inspection.

FUNCTIONALITIES

The main functionalities are the following.

Contingency analysis.

- Generation and load shedding calculations.
- Security margins in MW (e.g., distance to collapse).
- Security regions (nomograms).
- Long-term dynamic simulation.
- Alarms.
- Case-by-case processing or study mode.

OUTPUT AND USER INTERFACE

Various forms of output results are available depending on the implemented functionalities. Organon generates reports containing standard and user defined output channels, tables and plotting.

The use of the system has to be easy and intuitive particularly for real time environment where direct information about security state has to be readily available. Organon has its own graphical user interface, which is the standard for a standalone application, but it can also run in background mode at EMS if required.

TECHNOLOGY

Programming Languages - The system is written basically in Fortran-90/95 and C++ for Windows© platforms. Windows API is used for graphical user interface. Message Passing Interface - MPI is used for distributed processing.

Power Flow - The full Newton-Raphson method is used because of its better convergence properties. All the controls (tap, remote generation, shunts, HVDC, etc.) are solved simultaneously by Newton method. Newton step control is implemented to improve convergence of difficult cases. Initialization procedures and other non-published methods to improve convergence are also employed. Built-in sensitivity analysis is provided.

Continuation Power Flow - The tangent vector method is used. Facilities to fully control trajectories in parametric spaces are also used.

Time Domain simulation - ABM predictor corrector integration method is used for differential equations and BDF is used for algebraic equations. The solution of all equations is simultaneous and variable-step-variable-order approach is adopted, which provides both the highest computational efficiency and robustness. Simulations are automatically terminated either by detected instability or convergence to an equilibrium point.

Signal Processing - Prony analysis and energy function algorithms are used for automatic diagnosis of time domain simulations.

Hardware - The system can run either on a single personal computer under Windows NT, 2000 or XP© or on a network of personal computers (multi-processing). For multi-processing it is possible to use an existing network (e.g., standard offices computers), which is suitable for ‘overnight supercomputer’ configuration, or a dedicated cluster of computer for heavy-duty full-time processing system.

PERFORMANCE

Typically Organon can process around 500 time domain simulations and 2000 power flows in two minutes for a 2000-bus/100-generator system, using a cluster of twenty 3GHz processors. Of course, the performance depends on the number of processors used.

MANUALS

Volume I (this manual) is a guide for installation and program operation. Volume II shows details and data format for the dynamic models and simulation events. Volume III presents the theoretical methodology adopted.

Manual Conventions

This manual uses the following general conventions.

Typing	**Meaning**
expression	Words in italics indicate placeholders for information that users must supply. A file-name is an example of this kind of information. Italics are also used to introduce new terms.
[optional item]	Items inside single square brackets are optional. In some examples, square brackets are used to show arrays.
{*choice1* | *choice2*}	Braces and a vertical bar indicate a choice among two or more items. You must choose one of the items unless all of the items are also enclosed in square brackets.
Save	Words in bold indicate menu or dialog box itens.
Edit>**Drawing**>**Select All**	Bold words followed by > signal indicates the location of a sub-item. Example, Select All Sub-Item of Drawing Item in the Edit menu.
NEWTON	Bold capital letters indicate Script commands.

Installing and Configuring

Configuring a Distributed Processing Environment

It may be necessary to reinstall the process, MPD.exe, which manages computer clusters running ORGANON under Windows NT/2000/XP, due to problems in starting distributed processing.

The most common problems in starting distributed processing are:

Apparently nothing is working. The user cannot see Organon GUI but it is possible to see that slave processes have been started. Solution: Reinstall MPD with the -interact option on the master computer;

- Distributed processing cannot start because one computer has refused connection. Solution: Install MPD, once it is likely that it has not been installed yet. If MPD has been installed, reinstall it with Administrator Privileges;
- The user has not sufficient rights to start the distributed processing. Solution: Reinstall MPD with Administrator Privileges;
- Distributed processing fails to start without any special message. Solution: Check if all computers are on and all connections are OK (e.g., using ping command);

To reinstall MPD installation on each computer:

Open a command prompt DOS window;

- Change the current directory to the directory where Organon.exe has been installed;
- Uninstall process manager MPD, as follows: *MPD -remove*. If MPD has not been installed, an error message will be displayed;
- On the master computer, where the Organon GUI must show up, reinstall process manager MPD as follows:*MPD -install -interact*. On these computers the user must have Administrator Privileges;
- On the slave computers, where the Organon GUI need not show up, MPD installation should be done as follows:*MPD -install*. On these computers it is not mandatory that the user have Administrator Privileges;

Installing the Software

ORGANON installation is done as follows.

Copy the installation application **OrgInstall.exe** from the distribution CD or network folder into a temporary folder in your computer;

- Execute this application and follow the installation instructions.
- Do the same procedure for all computers in the network that will be running Organon in a distributed processing mode. For distribution processing mode, make sure that the user account has administrative privileges ;
- The user is encouraged to read the readme.txt file after installation to be aware of important release notes.

Data Input/Output

The user interface is based on menus, dialog boxes and output windows. Command line operations are not available in the current version.

The basic operations are loading data, editing them, if necessary, running simulations and saving data and reports.

There are specific file types for loading different data. A power flow data is necessary to load any other simulation data. Also**, it is important to note that every time a power flow data is loaded any other data in memory is erased**.

Printing

The **Print** command can be used to print the content of the Message, Drawing, Security Region, Report and Plotting windows. Its behavior depends on the type of the active window.

For Plotting, Security Region and Drawing windows, the content of the window's client area, as it appears on the screen, is printed to the selected paper size.

For the Message window users have the option in the Print Dialog Box of printing the selected or full content of the window.

For the Report window, the selected items of a report are printed. If there is no selected item, all items of the selected report are printed. If the size of the report text item exceeds the paper size, the text is cropped.

Conversion from Real Time Case into Planning Case

Real time cases usually are not suitable for planning studies, due to problems like different bus number and name, for example. Besides, EMS systems are likely to generate cases where generation buses are defined for each generation unit, instead of for the whole power plant, which is more common in planning studies. To overcome these difficulties, it has been implemented a facility in Organon to convert EMS cases into planning cases. The conversion can be enabled or disabled in the FTP function dialog box (File FTP) or in the Security Region Assessment dialog box (Running Security Assessment on Master Process). Besides, it is always prompted for the user when a SAGE data file is read (extension *.SGE).

The conversion steps are:

- Read the real time case;

- Read the planning case knowledge base;
- Read extra files, if present and necessary;
- Perform direct mapping;
- Perform mapping based on attributes match scoring.

In some EMS systems, the planning case bus number is defined in its database. When this is true, it is possible to perform direct mapping, which means that a bus in the real time case will be mapped into the same bus in the planning case. The information used for direct mapping must be defined in extra files.

In the particular case of the conversion from SAGE EMS base case to planning case, the conversion may use 2 extra data files:

- EMSKB.dat: contains a list of supervised stations with the station short name, the planning case bus number associated and the attributes voltage in kV and area number. In the conversion methodology, the bus in the real time case will be mapped into the bus in the planning case with the same number. Bus attributes will be checked, against planning knowledge base. If any attribute check fails, a warning message will be prompted, once they should be equal. This check is done in order to asses if the data base in EMS system has to be revised;
- EMSTable.dat: contains a list of supervised stations with the station short name and the planning case bus number associated. A bus in the real time case, whose name matches the station short name, will be mapped into the planning case bus straightforward.

Both files must be present in the same directory where Organon.exe is located and both are used to perform a direct mapping from real time case into planning case. Direct mapping do not use attributes match scoring heuristic.

The attributes match scoring heuristic consists of searching the best match for each bus from the real time case in the planning case knowledge base. The best match is the bus that has the highest scoring of attributes that match. Scoring considers the bus attributes itself, all its connections attributes and all its neighbors' attributes. Bus attributes are number, type (load and generation, including swing), area: number, voltage in kV and size of biggest unit of a power plant in MW. Branch attributes are type: (transmission line, series capacitor or transformer) and impedance value in pu. For generation buses, the generation in MW is an extra attribute that helps distinguishing real generators from synchronous condensers. These attributes are stored in a planning case knowledge base file called PlanningKB.dat, which is built from a planning case (Convertion from Real-Time Case into Planning Case). The scoring level threshold that allows for a bus mapping starts with high values and is progressively relaxed. Actually it starts with five, which means all five bus attributes match for the bus itself and all its neighbors. Besides, all connections are of the same type and the impedance values difference is lower than 5%.

Appendix V shows the template for EMSKB.DAT, EMSTABLE.DAT and PLANNINGKB.DAT.

The heuristics codes used in the conversion process are:

- Table: Direct mapping based on the EMSTABLE.DAT file;
- DirectM: Direct mapping based on the EMSKB.dat;
- MapGene: Map generator terminal bus after high voltage bus have been mapped;
- Relaxed: Map bus with highest attributes match scoring ;

- 2NgbXtf: Map bus with highest attributes match scoring. Neighbor buses where checked on the second neighborhood and all connections are transformers;
- 2NgSimp: Map bus with highest attributes match scoring. Neighbor buses where checked on the second neighborhood and, at least one connection have small impedance.

File conversion generates the following files:

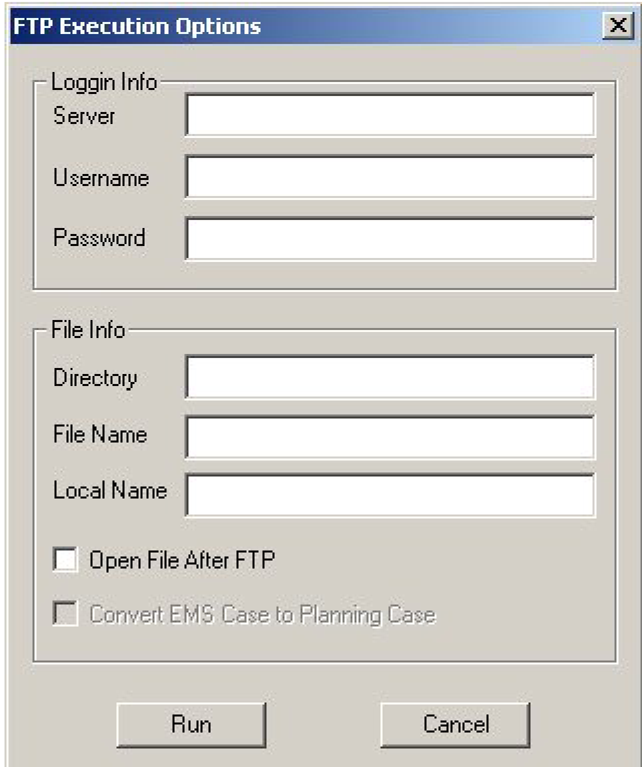
- Mapping.log: Contains the summary of conversion showing a numbered list with: heuristic responsible for the conversion, scoring level, number of trials at the same scoring level, counter, EMS bus number, EMS station Id (short name), EMS voltage in kV, EMS bus type and EMS area number, PlanningKB bus number, PlanningKB bus name, PlanningKB voltage in kV, PlanningKB bus type and PlanningKB area number;
- EMSMapping.log: Shows a list of all buses in EMS case file and its connections. Mapped bus in planning knowledge base appears in brackets. If brackets are empty, that EMS bus has not been mapped;
- PlanningMapping.log: Shows a list of buses in planning knowledge base file and its connections. Mapped bus(es) in EMS case appear(s) in brackets. It is possible that more than one bus in EMS case be mapped into the same planning bus. If no brackets appear, that planning bus has not been mapped;
- EMSTopology.log: Shows schematic diagrams for each bus in the EMS case, showing all the connections to that bus (|---| for transmission lines and |-x-| for transformers). Mapped bus in planning knowledge base appears in brackets. If brackets are empty, that EMS bus has not been mapped;
- PlanningTopology.log: Shows schematic diagrams for each bus in the planning knowledge base, showing all the connections to that bus (|---| for transmission lines and |-x-| for transformers). The number of mapped bus in EMS case and the name of the first bus appear in brackets. If no brackets appear, that planning bus has not been mapped;
- FailedEMSMapping.log: Shows a list of all buses in EMS case and its connections that have not been mapped;
- FailedPlanningMapping.log: Shows a list of all buses in planning knowledge base and its connections that have not been mapped.

When the conversion is finished, some messages may appear due to data update and checking. If several generation units are merged into one single bus, all transformers that connect those units to the same high voltage bus will end up in parallel. Thus, the conversion process redefines the circuit Id for these elements, automatically and some messages are generated.

File FTP

Organon uses FTP to download a file from a remote server and can be used in either real time applications or offline studies. Real time applications are related with security assessment. See Running Security Assessment on Master Process to learn more about this. For offline studies, the user must copy a remote file, usually generated by a state estimator, from a remote server to its own computer and then perform the studies.

To copy a file from a remote server, select **File>FTP** to activate the FTP Execution dialog box.



Fill the information regarding the remote file: Server IP address, user login and password, directory on the server where file is stored and file name. The file name may be a file template (Ex. *.dat). If more than one file, in the server directory, match the file template, the one with the latest date will be copied.

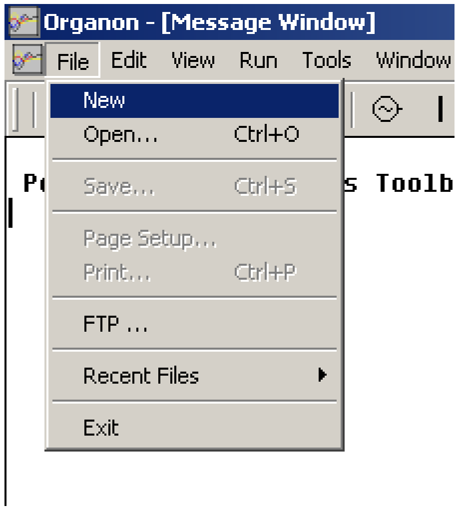
Give a local name for the file that will be copied. The name must include the path.

The FTP function may open the file after it has been copied. Just select the option **Open File After FTP**.

If the file has been copied from an EMS system and corresponds to a real time data file, it can be converted into a planning case, when the user selects the **Open File…** option. See Conversion from Real Time Case into Planning Case to learn more about real time to planning case conversion. To convert a real time data file that will be opened, just select the **Convert EMS Case to Planning Case** option. Finally press the button **Run**.

Creating a Power Flow Data Set

The user can create a new load flow case from scratch by choosing **File>New**. The program will create a system with just one swing bus. Then, the user can add new elements (bus, branch, etc.) through the editing dialog boxes (**Edit** > **Steady State Data** >**AC Components** or **DC Link**, - AC Network Data), or through the *Drawing Editor* (Single Line Diagram).



Saving a Data or Report File

To save a data file select **File>Save** or press the (Save) button on the toolbar. Type the name of the file and select the proper file extension and press Save.

To save report file select **File>Save** or press the (Save) button on the toolbar. Type the name of the file and select the *.rep file extension and press Save.

File Types and Requirements

There is a specific file extension for each data type file used in Organon. The table bellow shows the recognized input/output file extension and the related data.

Extension	File	Type of Data
*.SAV	Binary	Organon format. Network, continuation power flow, definitions and static contingency data
*.NTW	ASCII	Organon format. Network input data
*.PWF	ASCII	ANAREDE network data – (See details in Appendix III)
*.SGE	ASCII	SAGE data. Similar to ANAREDE data file
*.RAW	ASCII	PSS/E Release 26 raw data file (Refer to PSS/E Manual) – (See details in Appendix II)
*.DRW	Binary	Organon drawing data

*.CTG	ASCII	Static contingency data
*.CPF	ASCII	Continuation power flow data
*.DEF	ASCII	Generation groups, report filter by area and minimum voltage level, user defined variables and user defined table definition data
*.DYN	ASCII	Dynamic model data (See Manual - Vol. II for details)
*.EVT	ASCII	Time simulation contingency data (See Vol. II for details)
*.PLV	ASCII	Definition of variables and graphics for time domain simulation plotting
*.SEN	ASCII	Sensitivity analysis data
*.SPT	ASCII	Script commands and data
*.WFS	ASCII	Organon work file. This file can be used to enter a set of files
*.DSA	ASCII	Working file set and ftp input data for security assessment

Organon also generate the following output files

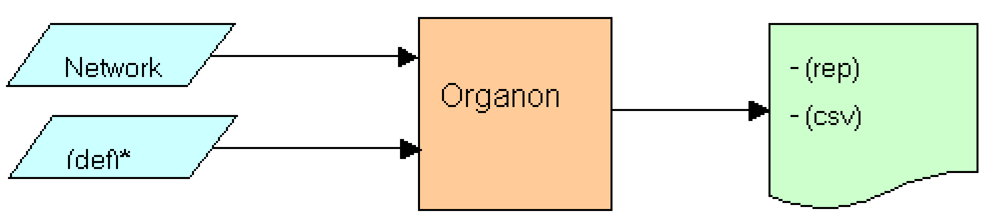
Extension	**File**	**Content**
*.REP	ASCII	Simulation report
*.PLT	ASCII	Plotting curves
*.CSV	ASCII	Comma separated values (for Excel import)

Data/File Requirements per Functionality and Respective Output Files

In the following diagrams Network means data/file-extension of types (sav, ntw, raw or pwf). Also, any data entered manually or by loading a file can be modified by users and saved into a file of corresponding format.

Important: Every time a new Network file is loaded, previous loaded data are erased from memory, except for User Defined Tables (UDT data defined in *.def file), that may be used for comparison of different load flow cases.

Power Flow

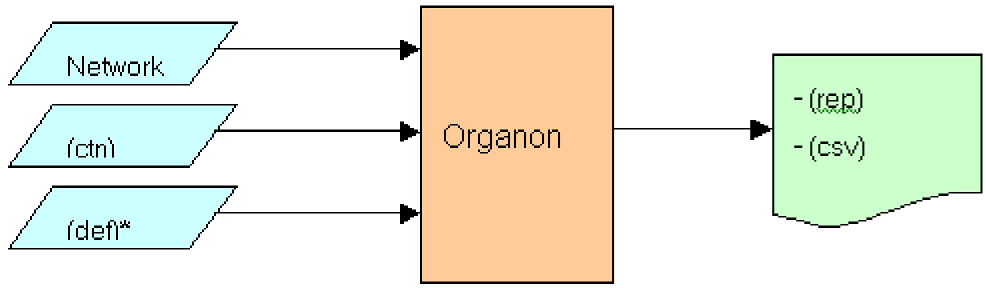


Note:

- Definition data (def) is optional. It may be used to define User Defined Variables, User Defined Tables and Report Filter.

- File dependence: (def) => Network

Continuation Power Flow

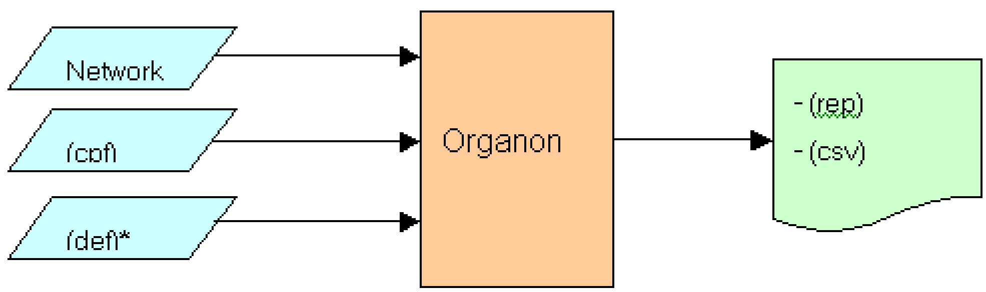


Note:

- Definition data (def) is optional. It may be used to define User Defined Variables, User Defined Tables and Report Filter.

- File Dependences: (def),(ctn) => Network

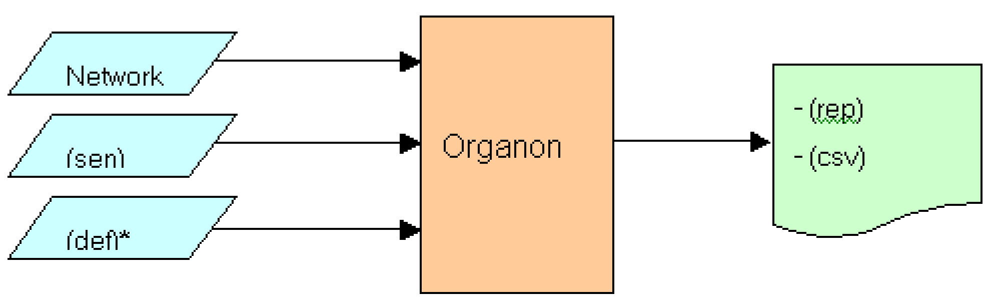
Contingency Analysis



Note:

- Definition data (def) is optional. It may be used to define User Defined Variables, User Defined Tables and Report Filter.
- File Dependences: (def),(ctg) = > Network
- Def files shall be loaded after ctg files so that UDT are allocated with enough space to store all contingencies results

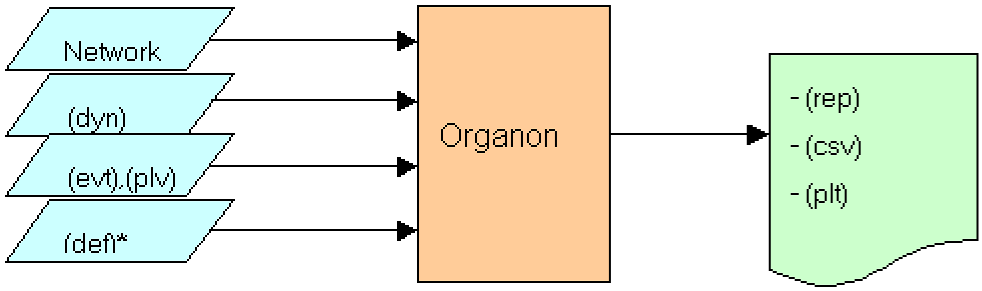
Sensitivity Analysis



Note:

- Definition data (def) is optional. It may be used to define User Defined Variables, User Defined Tables and Report Filter.
- File Dependences: (def),(sen) => Network

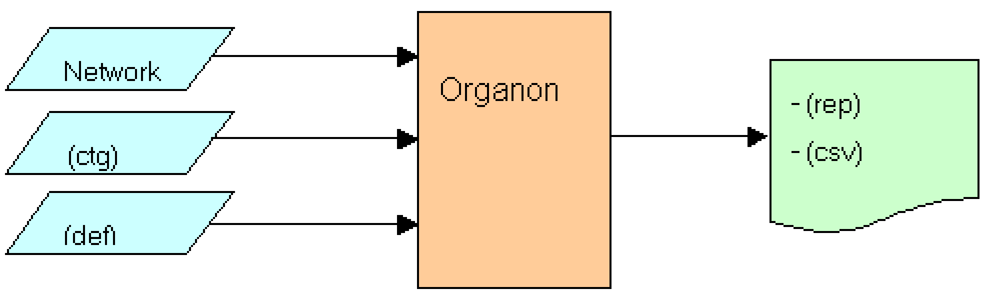
Time Domain (Single and Contingency) Simulation



Note:

- Definition data (def) is optional. It may be used to define User Defined Variables, User Defined Tables and Report Filter.
- Plotting data is optional, as summary results can be displayed in the Report Table Window.
- File Dependences: (evt),(plv) => (dyn) => Network; (def) = > Network
- Def files shall be loaded after evt files so that UDT are allocated with enough space to store all contingencies results

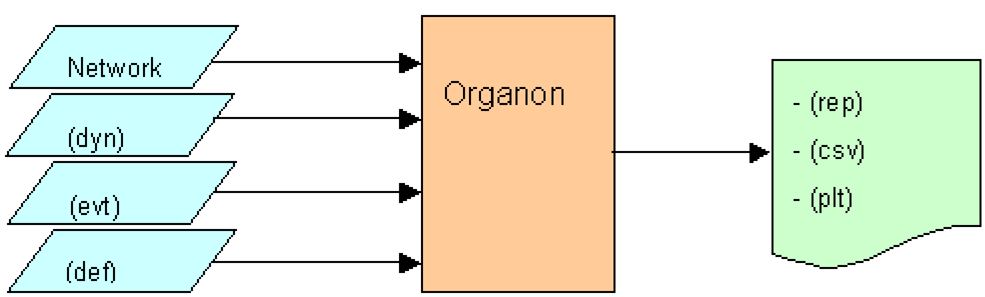
Voltage Security Assessment



Note:

- File Dependences: (def),(ctg) => Network

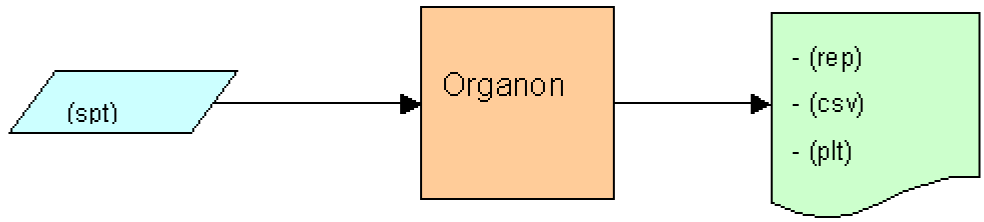
Dynamic Security Assessment



Note:

- File Dependences: (evt),(plv) => (dyn) => Network; (def) => Network

Script Run



Note: From within script text, it is possible to load any desired data from file.

File Set - WFS and DSA

It may be cumbersome sometimes to load many files one-at-a-time, especially if the user needs to do it recurrently.

The WFS file type allows you to load various files at once. The content of WFS is the name of the files to be loaded.

Example:

c:\mydir\powerflow.sav

c:\mydir\powerflow.drw

c:\work\dynamicdata.dyn

c:\work\dynamicdata.evt

c:\work\dynamicdata.plv

c:\mydir\case1\continuationdata.ctn

c:\mydir\case1\definition.def

Note: definition files should be loaded after all *.ctg (static contingency data file) and *.evt (dynamic contingency data file) are loaded, so that user defined tables (UDT) are are allocated with enough space to store all contingencies results.

It is also possible to save a WFS file. In this case, the program dumps the name of the loaded files in a .wfs file. The user provides the WFS file name in the Save Dialog Box (Menu File>Save).

Note: This save operation does not save the content of data in memory, just the name of loaded files, if any.

Loading a Data File

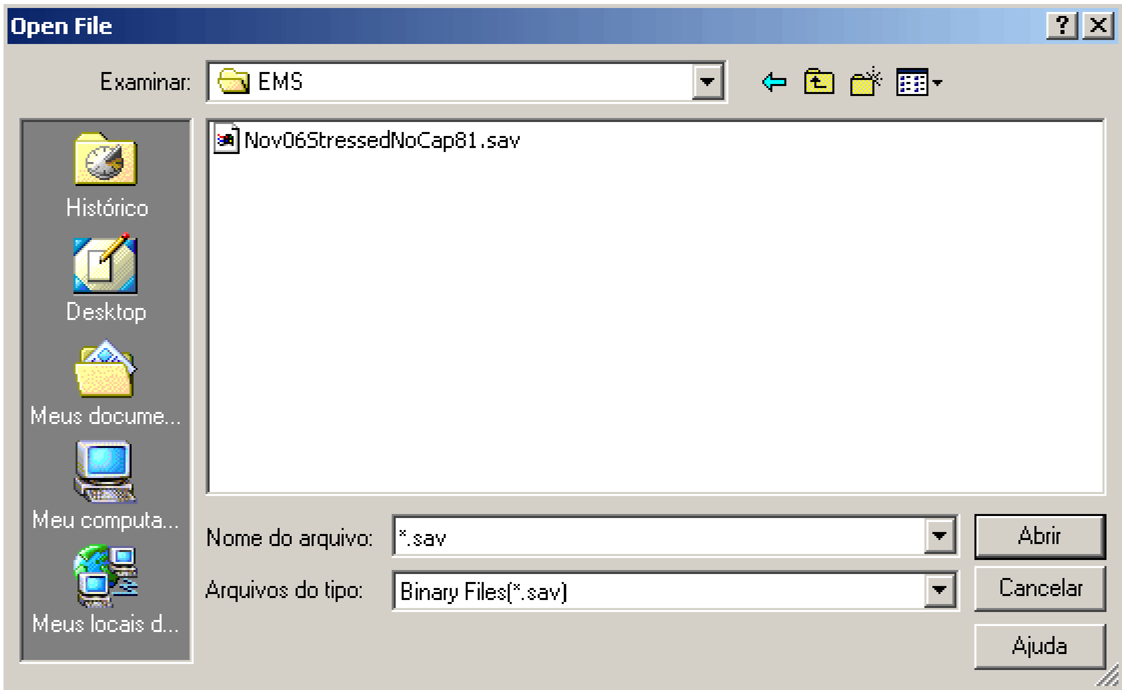
To load data from file, press the button (Open) on the toolbar, or select **File>Open** or use the hot key **Ctrl+S**. An **Open File** dialog box will pop up. Select the desired file and press Ok. You can use one of the available filters (*.ntw, *.sav, *.dyn, etc.) to help locating the file.

The last four loaded files can also be selected by choosing **Recent Files** in the **File** menu.

Notes:

1. The current data in memory is lost every time a new power flow file is opened.

2. Check for file dependences in File Types and Requirements.



Overview of Organon Menu Items

Organon menu has the following arrangement.

Menu Item Sub Item Shortcut General Description

File:

Item	**Subitem**	**Shortcut**	**Description**
New			Creates a 1 bus power flow case
Open		Ctrl+O	Opens and load a file
Save		Ctrl+S	Save a data or report file
Page Setup			Setup printing page
Print		Ctrl+P	Print active window content
FTP			FTP a remote (EMS) file
Recent Files:			
	List of Recent Files		
Exit			Exit Organon

Edit :

Item	Subitem	Shortcut	Description
Copy		Ctrl+C	Copy select content in a window
Stead State Data:			
	AC Components	Ctrl+A	Edit power flow ac data
	DC Links	Ctrl+D	Edit power flow dc data
	Continuation Power Flow		Edit CPF data
	Contingency		Edit contingency data
	Sensitivity		Edit sensitivity data
	Bus Split		Split bus
	Bus Merge		Merge bus
Dynamic Data			
	Events		Simulation events
	Plotting		Plotting trajectories/graphics
	Criteria		Security criteria
	Synchronous Machine		Synchronous machine parameters
	Infinite Bus		Inf. bus parameters
	Induction Motor		Ind. motor parameters
	DC Link		DC Link parameters
	Load		Load parameters
	SVC		SVC parameters
	OLTC		OLTC parameters
	AGC		AGC parameters
	TCSC		TCSC parameters
	Protection		Protection parameters
	CDU		User defined models
Definition Data:			

Groups		Security region groups
Report Filter		Area and voltage filters
User Defined Variables		User defined variables
User Defined Tables		User defined tables

Drawing:

Bus	Shft+B
Transmission Line	Shft+T
Transformer	Shft+R
Generator	Shft+G
Load	Shft+L
Fixed Shunt	Shft+F
Variable Shunt	Shft+V
Series Capacitor	Shft+S
DC Link	Shift+D
Output Variable	Shift+X
Delete	Del
Zoom In	Ctrl+I
Zoom Out	Ctrl+U
Select All	
Clear All	

Scenario

Load Curve	Load time series
Gen Schedule	Generation time series
Outage Schedule	Outage events time series

Script

Undo

Clear

Cut	Ctrl+X
Copy	Ctrl+C
Paste	Ctrl+V
Select All	

View

Item	Subitem	Shortcut	Description
Drawing Editor			Opens the drawing editor window
Script Editor			Opens the script editor window
Report Tables			Opens report table window
DC Link Report		Ctrl+R	Opens DC report dialog box
System Summary			Displays system summary
Area Summary			Displays area summary
Loaded Files			Displays loaded files

Run

Item	Subitem	Shortcut	Description
Steady State:			
	Newton Power Flow	Ctrl+N	
	Synthetic Dynamics P. Flow		
	Continuation Power Flow		
	Contingency Analysis		
	Sensitivity Analysis		
	Optimal Power Flow		
Dynamic:			
	Single Simulation	Ctrl+T	
	Contingency Analysis		
	Synch Machine Step Test		

Security Assessment

Script

Pause

Stop

Tools

Item	**Subitem**	**Shortcut**	**Description**
Text Font			Opens Font dialog box
Build Knowledge Base			Use a PF data to create KB
Build PF Contingency			
Build TDS Contingency			
Restore Initial Power Flow State		Ctrl+Z	Restore state as read from file
Options			Options dialog box
Preferences			
	Drawing Plots		Drawing colors dialog box
	Time Domain Plots		TD plotting colors dialog box

Window

Item	**Subitem**	**Shortcut**	**Description**
Cascade			
Title			
Arrange Icons			
Close All			
List of Opened Files			

Help

Item	**Subitem**	**Shortcut**	**Description**
Contents		Ctrl+H	

Search

Index

About

Data Editing

The following data editing facilities are available through the user interface.

Steady-State Data:

- AC Components;
- DC Links;
- Continuation Power Flow;
- Contingency List;
- Sensitivity Analysis;
- Bus Split;
- Bus Merge.

Dynamic Data:

- Simulation Programmed Events;
- Plotting Definitions;
- Synchronous Machine Parameters.

Definition Data:

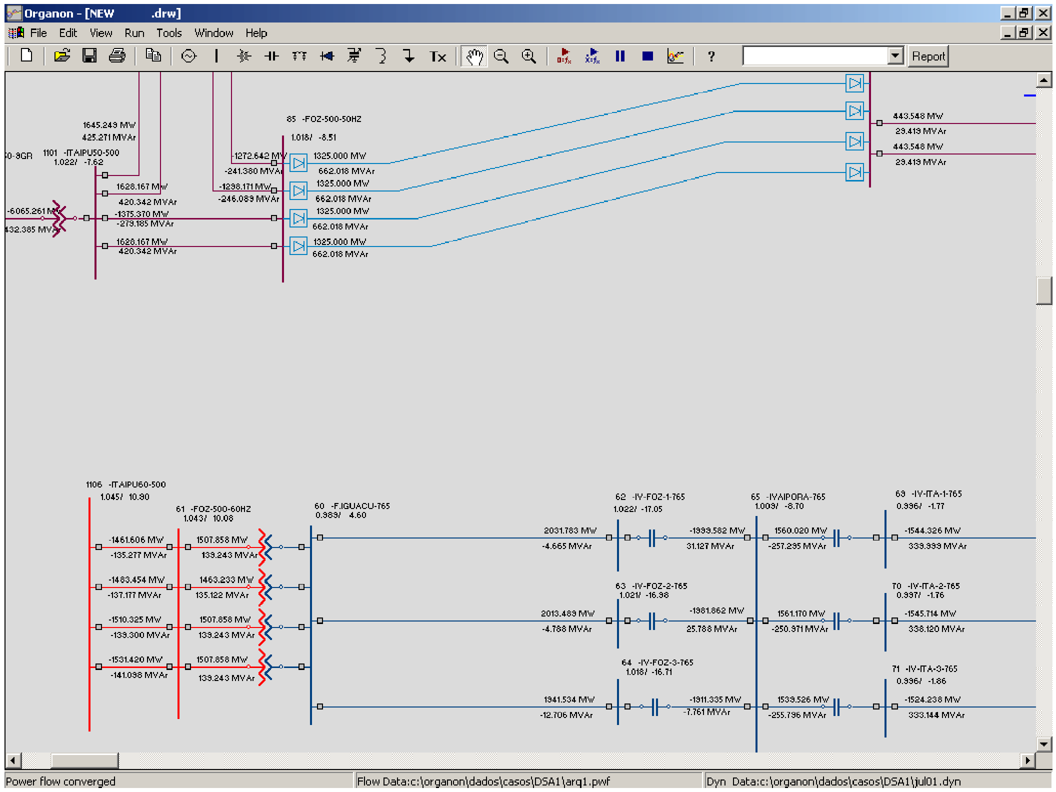
- Groups;
- Report Filter;
- User Defined Variables;
- User Defined Tables;

Drawing Elements.

Script.

Note: Regarding dynamic models, currently it is only possible to edit synchronous machine parameters. Parameters of all other dynamic models must be edited directly in the dynamic data file (*.dyn).

Single-Line Diagram



Organon offers a network unifilar diagram editor, which helps power flow visualization and data editing facilities. The editor can be displayed by selecting **View>Drawing Editor** or by loading a drawing file (*.drw).

The Drawing Window works in either Editing Mode or Visualization Mode. Click on the (Hand) button in the toolbar, to toggle between these two modes.

In the Editing Mode it is possible to draw the power system components and edit data.

The following power system components can be drawn: Bus, Generator, Shunt Capacitor/Reactor, Load, Transformer, Series Capacitor, Transmission Line and HVDC Link. It is possible, also, to draw Text Boxes that display data like bus name and number, MW, Mvar and MVA generation and load, voltage module and angle, etc.

In the Edition mode, it is also possible to edit the data of a drawing element by double-clicking the mouse left key on the drawing. The corresponding editing dialog box will pop up. Then it is possible to change attributes of the element or choose an element to be drawn. A useful feature to insert a neighbor bus drawing, for example, is to double-click on one bus drawing, selecting a neighbor bus in the Bus dialog box and press **Draw**. Then follow the procedure for drawing a bus, as described above. The advantage of doing this is that the drawing is automatically associated to the corresponding data.

Drag single or multiple elements is also possible. To select multiple elements, keep the Ctrl Key pressed while selecting the elements. Alternatively, drag a selection rectangle covering all the elements to be selected.

Right clicking on the editing area, a pop up menu is displayed to allow for copy, print, set preference colors, add node to an existing transmission line drawing.

It is possible to select all elements of the drawing through **Edit>Drawing>Select All**.

To delete elements from the drawing select them then press Delete.

In the Visualization mode, the drawing area can be dragged by pressing the mouse left key and dragging it to the desired position. In this mode it is possible, also, to Zoom-In by pressing and holding the mouse right button while dragging to select the desired zooming area.

Press the (Copy) button on the toolbar or use the hot key **Ctrl+C** to copy the image appearing on the Drawing Window to the clipboard area. Press the (Print) button on the toolbar or use the hot key **Ctrl+P** to print the same image.

If the mouse is left on a text box for two seconds the information about the quantity is displayed (e.g., flow from bus to bus # circuit).

Drawings can be saved selecting **File>Save** and entering file name and drawing extension (*.drw) on the file selection dialog box.

The drawing data is not lost if the drawing window is closed, but if a new load flow case is loaded the drawing data in memory is erased.

Drawing a Bus

To draw a bus in the network unifilar diagram, click on the (Bus) button in the toolbar, or select **Edit>Drawing> Bus** or use the hot key **Shift+B**, then click in the Drawing Window at the point you want to place the bus first vertices, hold the mouse left key down and drag the mouse to the point of the second vertices and release the left key. A Bus Edit dialog box will pop up to enter the bus data (new element) or associate the drawing with an existing bus data. If no data is associated, the bus drawing is deleted.

Drawing a Generator or Synchronous Condenser

To draw a generator in the network unifilar diagram, click on the (Generator) button in the toolbar, or select **Edit>Drawing>Generator** or use the hot key **Shift+G**, then click on the bus drawing where you want to draw the generator. A Gen Edit dialog box will pop up to enter the generator data (new element) or associate the drawing with an existing data. If no data is associated, the generator drawing is deleted. If you don’t click on a bus the operation is canceled.

Drawing a Load

To draw a load in the network unifilar diagram, click on the (Load) button in the toolbar, or select **Edit>Drawing>Load**, or use the hot key **Shift+L**, then click on the bus drawing where you want to draw the load. A Load Edit dialog box will pop up to enter the load data (new element) or associate the drawing with an existing data. If no data is associated, the load drawing is deleted. If you don’t click on a bus the operation is canceled.

Drawing a Fixed/Variable Shunt Capacitor/Reactor

To draw a shunt device in the network unifilar diagram, click on the (Fixed Shunt) or (Variable Shunt) buttons in the toolbar, or select **Edit>Drawing>Fixed Shunt** or **Edit>Drawing>Variable Shunt**, or use the hot keys **Shift+F** or **Shift+V**, accordingly, then click on the bus drawing where you want to draw the shunt. A Shunt Edit dialog box will pop up to enter the shunt data (new element) or associate the drawing with an existing data. If no data is associated, the shunt drawing is deleted. If you don't click on a bus the operation is canceled.

Drawing a Transmission Line

To draw a transmission line in the network unifilar diagram, click on the (Transmission Line) button in the toolbar, or select **Edit>Drawing>Transmission Line**, or use the hot key **Shift+T**, then click on the bus of one of the line terminals, release the mouse left button key and click on the bus of the second line terminal or click at intermediate points to break the line, by inserting line nodes, into new segment lines (up to four intermediate nodes are allowed). After clicking on the second bus, a Branch Edit dialog box will pop up to enter the line data (new element) or associate the drawing with an existing line data. If no data is associated, the line drawing is deleted. If you don't click on a bus the operation is canceled.

Drawing a Series Capacitor

To draw a series capacitor in the network unifilar diagram, click on the (Series Capacitor) button in the toolbar, or select **Edit>Drawing>Series Capacitor**, or use the hot key **Shift+S**, then click on the bus of one of the capacitor terminals, release the mouse left button key and click on the bus of the second capacitor terminal. A Branch Edit dialog box will pop up to enter the branch data (new element) or associate the drawing with an existing capacitor data. If no data is associated, the capacitor drawing is deleted. If you don't click on a bus the operation is canceled.

Drawing a Transformer

To draw a transformer in the network unifilar diagram, click on the (Transformer) button in the toolbar, or select **Edit>Drawing>Transformer**, or use the hot key **Shift+T**, then click on the bus of one of the transformer terminals, release the mouse left button key and click on the bus of the second transformer terminal. A Branch Edit dialog box will pop up to enter the branch data (new element) or associate the drawing with an existing transformer data. If no data is associated, the transformer drawing is deleted. If you don't click on a bus the operation is canceled.

Drawing a HVDC Link

To draw a HVDC link in the network unifilar diagram, click on the (HVDC Link) button in the toolbar, or select **Edit>Drawing>DC Link**, or use the hot key **Shift+D**, then click on the bus of one of the dc link terminals, release the mouse left button key and click on the bus of the second dc link terminal or click at intermediate points to break the line, by inserting line nodes, into new segment lines (up to four intermediate nodes are allowed). After clicking on the second bus, a DC Link Edit dialog box will pop up to enter the dc link data (new element) or associate the drawing with an existing link data. If no data is associated, the dc link drawing is deleted. If you don't click on a bus the operation is canceled.

Drawing a Text Box

To draw a text box in the network unifilar diagram, click on the (Text Box) button in the toolbar, then click in the Drawing Window at the point you want the upper left corner of the text box. Associate the text box with an element (bus, gen, load, etc) quantity (volt, angle, name, number, MW, Mvar, etc.).

Exporting a Network Unifilar Diagram

The network unifilar diagram can be exported in two different manners. The first is to copy it into the clipboard area, so that it could be pasted into a word processor document, for instance. The second is to print it. An important remark is that regardless the size of the diagram, only the visible part of it is copied or printed.

To copy the network unifilar diagram into the clipboard area, click on the (Copy) button in the toolbar, or select **Edit>Copy**, or use the hot key **Ctrl+C**.

To print the network unifilar diagram, click on the (Print) button in the toolbar, or select **File>Print**, or use the hot key **Ctrl+P**.

Using Script Commands

Organon allows the execution of a set of commands in a batch procedure. The commands must be loaded from a script file (*.spt) into the built-in script editor window or directly typed into this window.

To load a script file, select **File**>**Open**, then select the extension *.spt in the Open File dialog box. Finally, select the file and press OK.

To open the script editor select **View>Script Editor**. In the script editor it is possible to change commands read from the script file.

The script must end with an END record.

To execute the batch, select **Run**>**Script** from the main menu.

Commands are free formatted, except for some of the Anarede compatible ones. Comment lines start with '!' or '(' in the first column. Blank lines are allowed.

Bus Editing Script Command:

BUS *<busnumber>* [**parmeter-code** = *<parameter value>* ...]

Available parameter-codes:

V pu

ANG degree

GSHT pu

BSHT pu

SHTST logical (TRUE, T, 1, FALSE, F, 0)

DEL

Example:

Bus 150 V = 1.05 Ang = 10.

Gen Editing Script Command:

GEN <*busnumber*> [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

V pu

PG MW

MODE MIN, MAX or FIX

DEL

Example:

Gen 10 pg=780.

Gen Unit Editing Script Command:

GENUNIT < *busnumber* > [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

V pu

PG MW

PMAX MW

PMIN MW

QMAX MVAR

QMIN MVAR

STAT logical (TRUE, T, 1, FALSE, F, 0)

BLCK logical (TRUE, T, 1, FALSE, F, 0)

DEL

Example:

GenUnit 145 id = 2 stat = 1 pg = 94.

Load Editing Script Command:

LOAD < *busnumber* > [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

PL MW

QL MVAR

DEL

Load Unit Editing Script Command:

LOADUNIT < *busnumber* > [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

PL MW

QL MVAR

STAT logical (TRUE, T, 1, FALSE, F, 0)

DEL

Shunt Editing Script Command:

SHUNT < *busnumber* > [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

VMIN pu

VMAX pu

DEL

Branch Editing Script Command:

BRANCH <*bus1*> <*bus2*> <*circuit*> [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

TAP ratio (only for fixed tap transformer)

TAPMIN minimum tap ratio

TAPMAX maximum tap ratio

VMIN minimum limit of voltage control range

VMAX maximum limit of voltage control range

DEF degrees

SIDE controlled bus side (1 for bus from or 2 for bus to)

BRKF logical (TRUE, T, 1, FALSE, F, 0)

BRKT logical (TRUE, T, 1, FALSE, F, 0)

R resistance (pu)

X reactance (pu)

BSH line charge (pu)

BC controlled bus

NORMAL normal MVA rating

EMERG emergency MVA rating

BSHTFR susceptance of line shunt at bus from (pu)

GSHTFR condutance of line shunt at bus from (pu)

BSHTTO susceptance of line shunt at bus to (pu)

GSHTTO condutance of line shunt at bus to (pu)

SHTFST status of line shunt at bus from (TRUE, T, 1, FALSE, F, 0)

SHTTST status of line shunt at bus to (TRUE, T, 1, FALSE, F, 0)

DEL

HVDC Editing Script Command:

HVDC *<bus1>* *<bus2>* *<pole number>* [**parmeter-code** = *<parameter value>* ...]

Available parameter-codes:

MODE integer (1, 2, 3 or 4)

PD MW

ID Amperes

VD KV

ALFA degrees

ALFAMIN degrees

ALFAMAX degrees

GAMA degrees

GAMAMIN degrees

GAMAMAX degrees

TAPMINR pu

TAPMAXR pu

TAPMINI pu

TAPMAXI pu

IMARG pu

VCCMIN pu

NCONV number of converters in series

DEL

Growth Factor

GF *<Element>* *<ElementId(*)>* [**parmeter-code** = *<parameter value>* ...]

Available elements: SYSTEM, AREA, ZONE, BUS and RESET

RESET element does not require any other data, once it means all GF data will be erased.

(*) ElementId is required for elements AREA, ZONE and BUS only.

Available parameter-codes:

KPC %

KQC %

KPG %

RESET

Run Newton Power Flow Script Command:

NEWTON [**parmeter-code** = *<parameter value>* ...]

Available parameter-codes:

TAP logical (TRUE, T, 1, FALSE, F, 0)

TDSCR logical (TRUE, T, 1, FALSE, F, 0)

SHUNT logical (TRUE, T, 1, FALSE, F, 0)

INCHG logical (TRUE, T, 1, FALSE, F, 0)

SHIFT logical (TRUE, T, 1, FALSE, F, 0)

UDT name of case to be stored in UDT

Run Synthetic Dynamics Power Flow Script Command:

SDPF [**parmeter-code** = *<parameter value>* ...]

Available parameter-codes:

TAP logical (TRUE, T, 1, FALSE, F, 0)

TDSCR logical (TRUE, T, 1, FALSE, F, 0)

SHUNT logical (TRUE, T, 1, FALSE, F, 0)

INCHG logical (TRUE, T, 1, FALSE, F, 0)

SHIFT logical (TRUE, T, 1, FALSE, F, 0)

Run Newton Power Flow Contingency Script Command:

PFCTG [**parmeter-code** = *<parameter value>* ...]

Available parameter-codes:

TAP logical (TRUE, T, 1, FALSE, F, 0)

TDSCR logical (TRUE, T, 1, FALSE, F, 0)

SHUNT logical (TRUE, T, 1, FALSE, F, 0)

INCHG logical (TRUE, T, 1, FALSE, F, 0)

SHIFT logical (TRUE, T, 1, FALSE, F, 0)

UDT logical (TRUE, T, 1, FALSE, F, 0)

Run Continuation Power Flow Script Command:

CPF [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

TAP logical (TRUE, T, 1, FALSE, F, 0)

TDSCR logical (TRUE, T, 1, FALSE, F, 0)

SHUNT logical (TRUE, T, 1, FALSE, F, 0)

INCHG logical (TRUE, T, 1, FALSE, F, 0)

SHIFT logical (TRUE, T, 1, FALSE, F, 0)

Run Time Domain Simulation Script Command:

TDS [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

TIME seconds

CTG contingency number (integer)

UDT logical (TRUE, T, 1, FALSE, F, 0)

Run Time Domain Simulation Contingencies Script Command:

TDSCTG [**parmeter-code** = <*parameter value*> ...]

Available parameter-codes:

TIME seconds

UDT logical (TRUE, T, 1, FALSE, F, 0)

File and Directories Script Commands:

Open and Load a File:

OPEN *<filename>*

Save a File:

SAVE < *filename* >

Change Current Directory:

CHDIR *<directory name>*

Copy a File:

COPY *<existing file> <new file>*

Delete a File:

DEL *<file name>*

Script Commands in Anarede Format:

Anarede commands are entered in the script exactly as in Anarede batch files (See Anarede Manual). Currently Organon can interpret the following Anarede commands. **TITU**, **DBAR**, **DLIN**, **DHSL**, **DCAR**, **DANC**, **DINJ**, **DBTB**, **DFTB**, **DPGE**, **DQGE, DELO**, **DCCV**, **DCNV**, **DCBA**, **DCRE**, **DOPC**, **EXLF** and **FIM**.

These commands allow most of Anarede batch files (*.PWF) to be loaded in the script editor, after being renamed to *.SPF, and run with few changes. Manual changes are required for non-supported commands and base case files. Organon cannot read Anarede save case files (*.SAV) and consequently cannot retrieve base cases in it.

Script Commands in PSSE Format:

PSSE <object name> = <data record>

Note: Object names are BUS, GEN, LOAD, BRANCH, OLTC, HVDC, ...

Script Commands in Organon Format:

ORG < object name > = <data record>

Note: Object names are BUS, GEN, LOAD, BRANCH, OLTC, HVDC, ...

Definition Data

Group Definition

Report Filter

User Defined Variables

User Defined Reports

Group Definition Data

Group data is used in two different contexts and it is possible to define up to three groups.

The first context corresponds to the security region computation, where generation group is used to control the process of changing generation pattern in the continuation power flow method. The first two groups are the ones where the MW generation may either increase or decrease. The third one is just the slack group, which will balance any net increase or reduction of MW generation of the system. If the last group is not defined, the swing bus will cover this difference alone, what may cause problems to the solution of the new operating point, after the change in the generation pattern.

The second context corresponds to the computation of energy functions, where generators are grouped to define a cluster. It is possible to define up to three clusters.

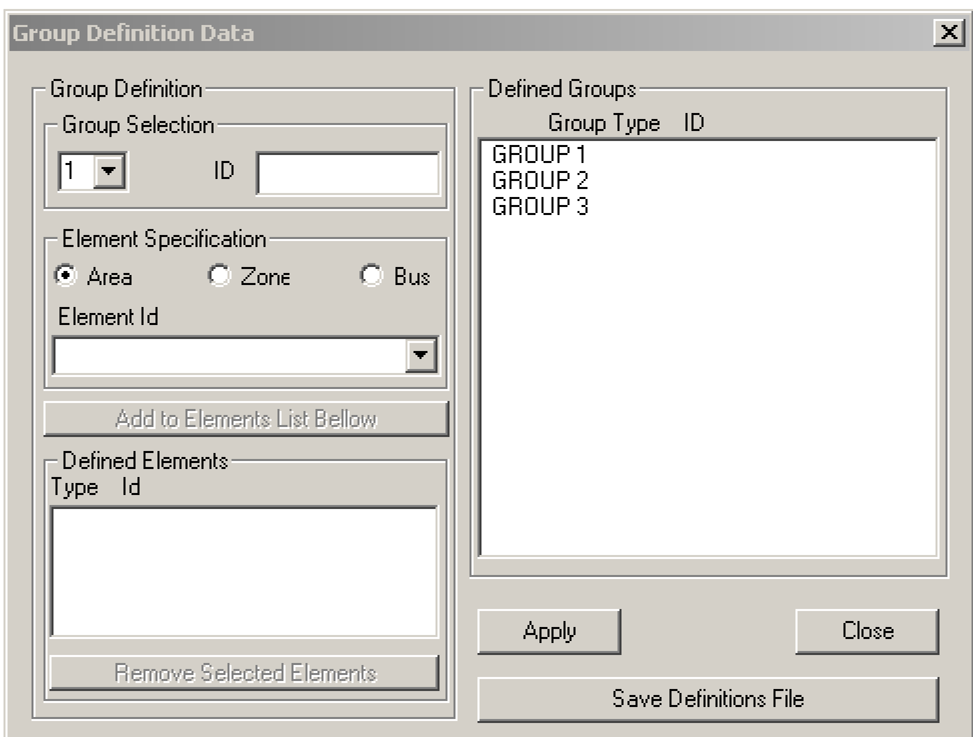
These groups may be defined as a set of areas, zones and/or buses.

Select **Edit>Definition Data>Groups** to open the **Group Definition Data** dialog box.

To add a new group, select the corresponding number in **Group Selection** frame, type in the group name in the **ID** edit box, select the element type (area, zone, bus), then select the element in the drop down list, and press the **Add to Elements List Bellow** button. Repeat this process for all elements of the group and press button **Apply**.

To remove an element, select it in the **Defined Elements** list and press the **Remove Selected Elements** button.

Press Save Definitions File to save group definition in *.def file.



Report Filter Data

By default all buses and branches are listed in reports such as overvoltage, undervoltage, overloading, etc. Organon allows users to filter those reports by location (system, area, zone and bus) and voltage level.

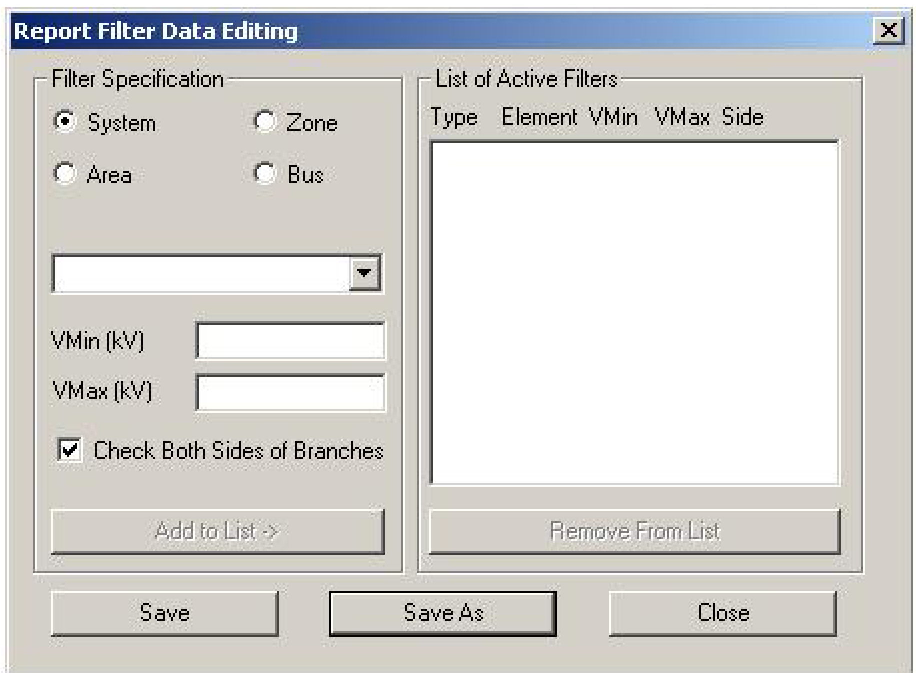
Select **Edit>Definition Data>Report Filter** to open the **Report Filter Editing** dialog box.

After selecting the location type, define the voltage level range associated. User may define also if a branch will be monitored only if both terminal buses are monitored or if it is enough that one terminal bus be monitored. It is possible to repeat the same location, in order to define different voltage level ranges.

To add a filter, select the location type (system, area, zone, bus), then select the location element in the drop down list, define voltage level range and Check both sides option, if necessary, and press the **Add to List** button. Repeat this procedure to add as many filters as needed.

To remove a filter from the list, select the specific filter in the list and press **Remove from List** button.

Press **Save** or **Save As** button to save report filter definition data in *.def file.



User Defined Variables Data Edition

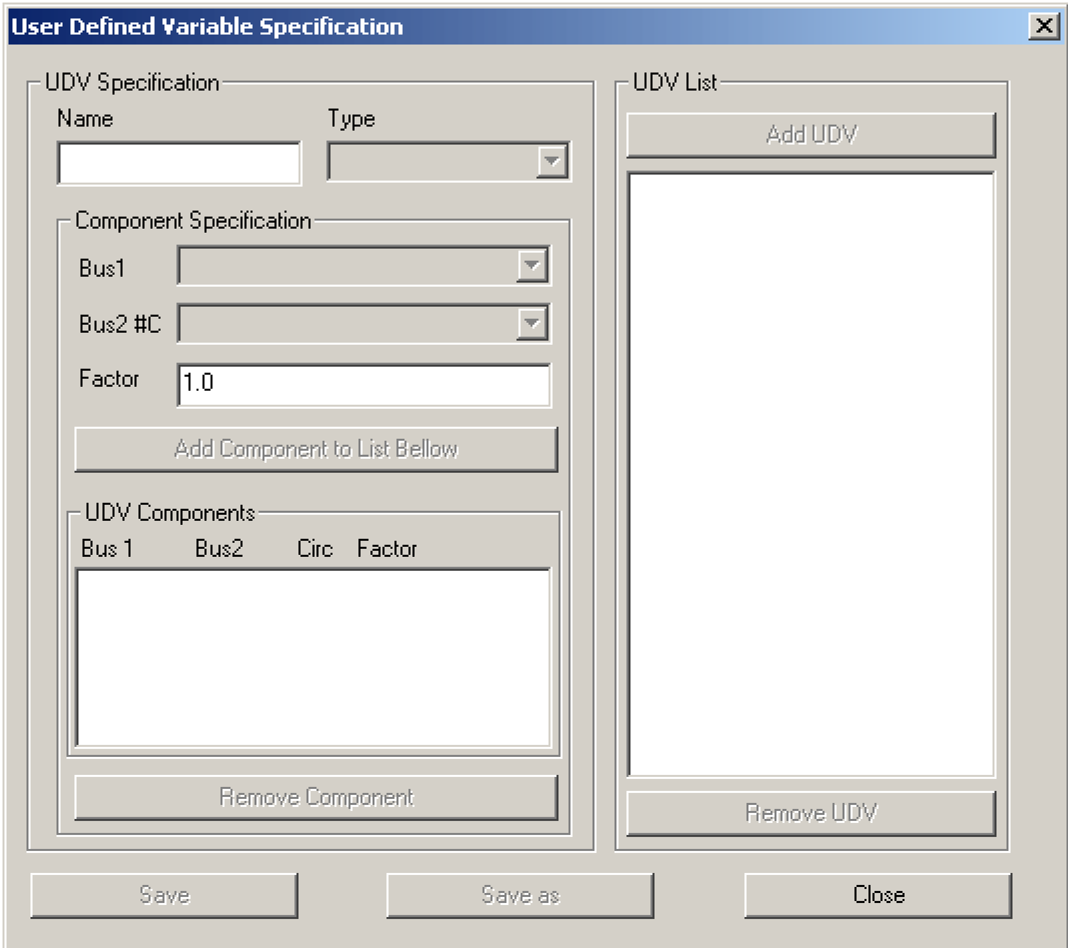
Users can define composite variables such as sum of load or sum of power flows. To do this, select **Edit>Definition Data>User Defined Variables** menu item to open the UDV dialog box.

To add a new variable, type in the variable name in the **Name** edit box, select the desired type of variable (generation, flow, load, current) in the **Type** list, select the component bus(es) and the multiplication factor (typically +1. or –1.), and press the **Add Component** button. Repeat this process for all components of the variable. Then press the button **Add UDV**.

To remove a component of a variable, select the component in the **UDV Component** list and press the **Remove Component** button.

To remove a user defined variable, select it in the **UDV List** and press the **Remove UDV** button.

Press **Save** or **Save As** buttons to save UDV definition data in *.def file.



User Defined Report Data

On the top of Organon default reports, users can include their own customized reports in the Report Tables window. These reports are useful for different load flow runs comparison (Ex. base case and static contingency analysis). They allow for load flow and time domain simulations comparison too, where time domain simulation results correspond to the values computed for the last time step.

Select **Edit>Definition Data> User Defined Reports** menu item to open the User Defined Report Data dialog box.

To include a new report, type in its name and select its type, add the Items of the report and press the **Add UDR** button. The report type indicates if the report is homogeneous (all Items are of same kind, e.g., voltage) or mixed (different kind of Items, e.g., voltage, flow, generation, etc).

To add an item to a homogeneous report, select the Bus 1 or User Defined Variable in the list and, if necessary, the Bus 2, type the multiplication factor and lower and upper limits, then press **Add**

Item button. The multiplication factor is typically used to convert from pu to physical values and vice-versa. The lower and upper limits are used for indicating any violation.

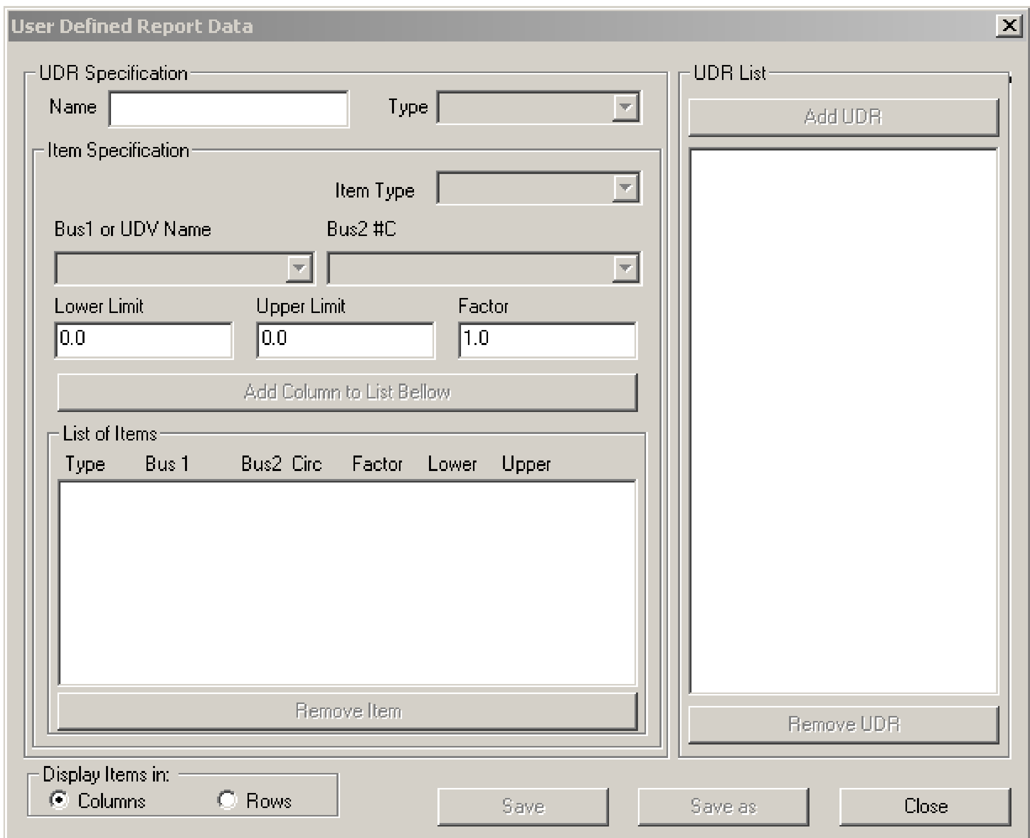
To add an item to a mixed report, first select the type of variable to be added, then proceed as for homogeneous report.

To remove an Item from the report, select it in the **List of Items** and press the **Remove Item** button.

To remove a report, select it in the **UDR List** and press the **Remove UDR** button.

Select report orientation in the **Display Items in** radio box. Items in columns means cases are displayed in rows and variables in columns. Items in rows means variables are displayed in rows and cases in columns.

Press **Save** or **Save As** buttons to save UDT definition data in *.def file.



Dynamic Data

Time Domain Simulation

Dynamic Models Data

Plotting Data

Time Domain Simulation Events

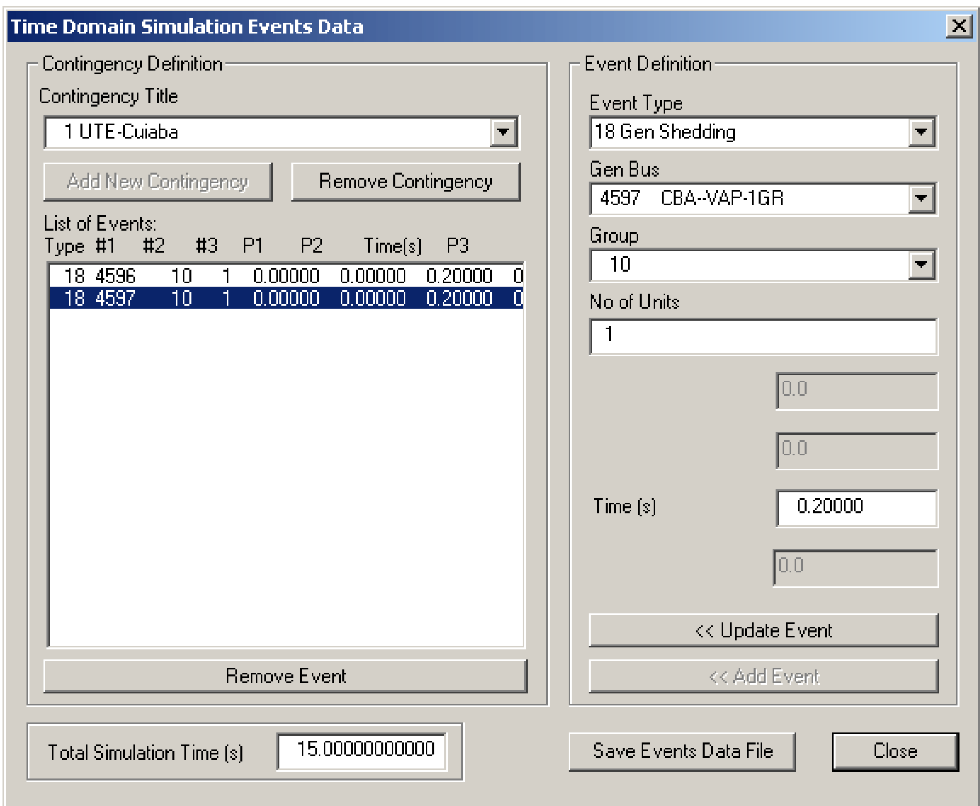
Contingencies in time domain simulations are defined as a set of events (e.g., branch switching, bus fault, etc). To open up the Dynamic Event dialog box, select **Edit>Dynamic Data>Events**.

To add a new contingency, write the name of the contingency in the **Contingency Title** edit box and press **Add Contingency** button. Then insert the events that will form the contingency. This is done by selecting one of the available events in the **Event Type** list. Depending on the selected event the other event definition fields will be enabled/disabled. Fill those fields as required (see Organon Manual Vol. II). After filling the **Time** edit box, the **Add Event** button will be enabled. Press this button to add the event to the contingency definition.

To edit an existing event, select the event in **List of Events** and change its parameters as desired. Then press the **Update Event** button to apply the changes.

To remove an event, select it in the **List of Events** list box and press the **Remove Event** button.

To remove a contingency, select the contingency in the **Contingency Tile** list and press the **Remove Contingency** button.



Contingency/Event data can be saved to file by pressing the **Save Event Data** button.

Dynamic Models Data

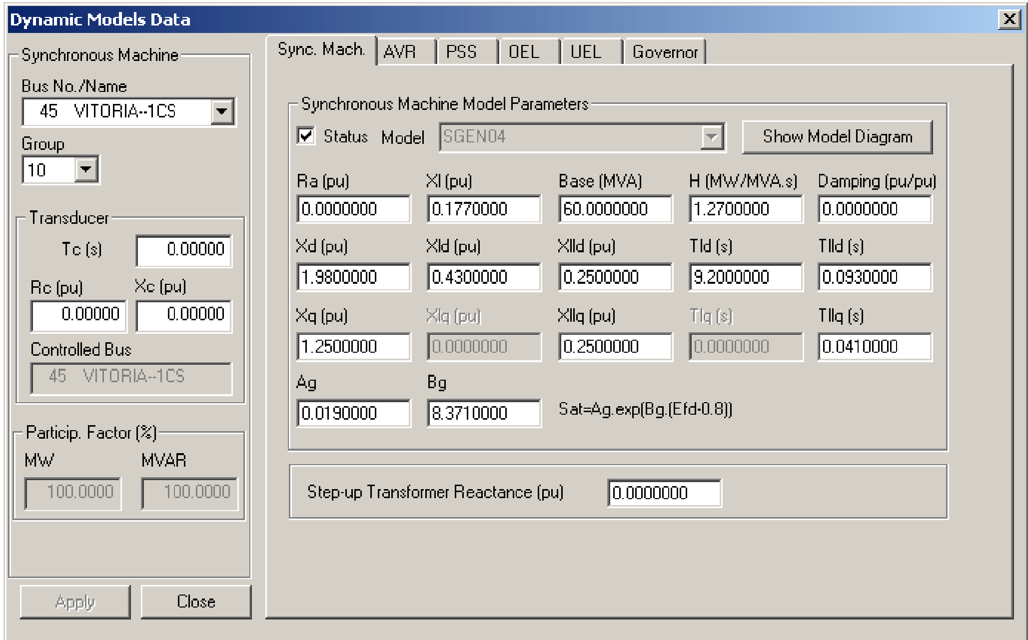
The current version allows you editing synchronous machine and respective control system parameters.

Synchronous Machines and Controls

Select **Edit>Dynamic Data>Synchronous Machine** to edit synchronous machine and respective control parameters.

To edit parameters of a specific synchronous machine, select the bus number from the **Bus No./Name** list and the machine group number in the **Group** list. Then edit the parameters as desired and press the **Apply** button to apply the changes.

The changes can be saved to a *.DYN through the **Save** item in the **File** menu.



Online help is available by pressing **Show Model Diagram**. A help window with the model block diagram and parameters definitions will pop up.

Plotting Data

Plotting of time domain simulations variables is done by first selecting the set of variables that will be stored during the simulation. These variables are called "Internal Variables". It is possible, also, to import the results from a previous simulation and plot them. These variables are called "External Variables". The users can define graphs, which will contain some or all of these variables. A variable can be added to more than one graph and a graph can contain more than one variable.

Select **Edit>Dynamic Data>Plotting** to open the Plotting dialog box.

To add variables to be stored during simulation, select the proper object in the **Source Object** list, and fill the required information (see Organon Manual Vol. II for more details) and press the **Add to Internal Variable List** button.

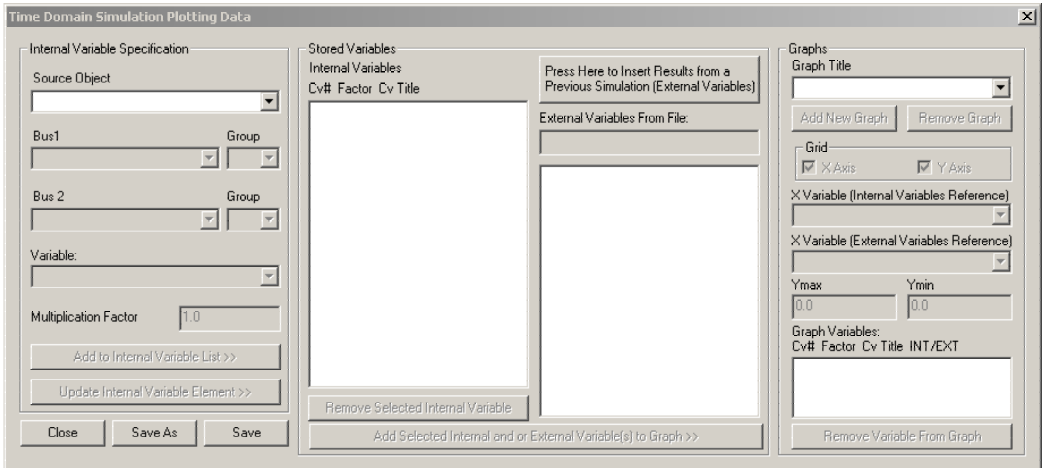
To remove a variable from the list, select the variable in the **Internal Variable** list and press the **Removable Selected Internal Variable** button.

To import results from a previous simulation, press the button **Press Here…,** located right above the external variables list, and select the desired *.PLT file in the file selection box that will pop up. The **External Variables List** will show all variables stored in the selected file.

To add a graph, type its name in the **Graphic Tile** edit box, fill the graphic parameters (grid, reference variable, etc.) as desired, add the variables to the graphic and press the **Add New Graph** button. To add variables to the graph, select them in the **Internal Variables** and/or **External Variables** lists, and press the **Add Selected Internal and or External Variable(s) to Graph** button. The X axis variable, or reference variable, may the time (default) or any other variable.

To remove a graph, select it in the **Graphic Title** list and press the **Remove Graph** button.

Press the **Save Plottings Data File** button to save plotting in a *.plv.



Power Flow Data

AC Network Data

DC Link Data

Continuation Power Flow

Static Contingencies

Bus Merge

Bus Split

Sensitivity Analysis Data

AC Network Data

The AC Data dialog box is used to edit Bus, Generation, Load, Shunt, Branch, Area and Case Identification data. This dialog box is activated by selecting **Edit> Steady-State Data>AC Components**. There is a specific Tab for each of these objects.

Except for Area and Case Identifications, all objects use a common Bus Selection list. The items in the Bus Selection list contains the number and name of the bus followed by characters indicating whether there is load(L), shunt(S) and/or generator(G) connected to that bus. For example, a Bus number 127, named MYBUS, with load and generation would be shown in the list as

127 MYBUS LG

The information about Area, Zone and Neighbors list are also common to those categories. The Neighbors list shows all buses that are connected to the selected Bus . The Neighbors list helps navigating through the network topology by selecting one of its elements.

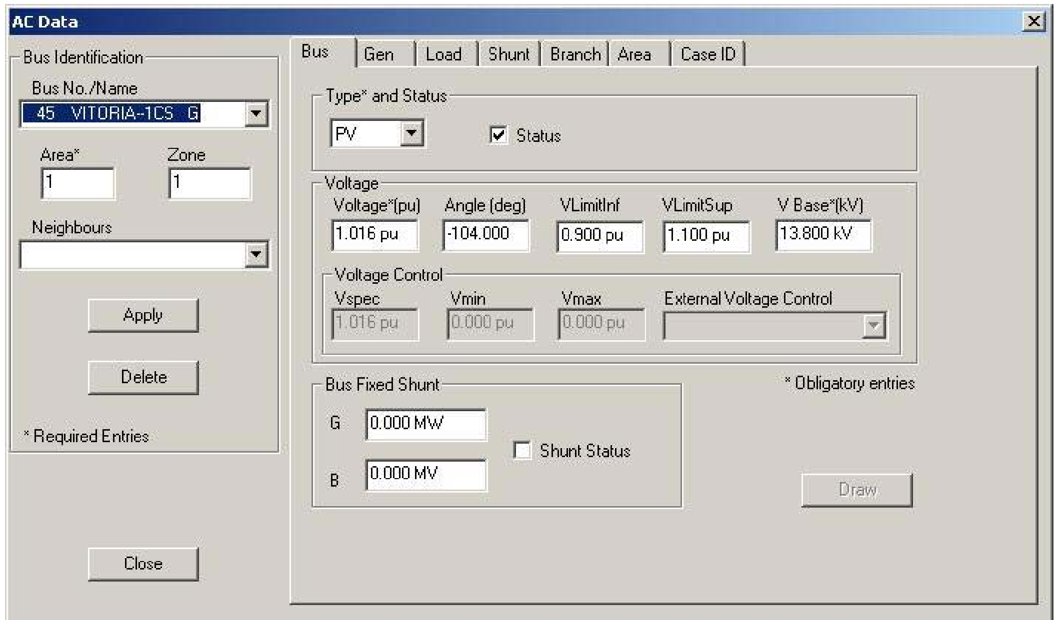
Organon Bus Numbering:

Bus numbers in Organon can be represented by an integer, as in most of power system programs, or by an integer (root) followed by dot (.) and an ID number (ex., 605.1). The ID is typically used for representing sections of a same bus. For example, lets assume that we want to split bus number 155 in three sections, if the users request default numbers, the program would assign the following numbers

- 155 (for original section)
- 155.1 (for the first split)
- 155.2 (for the second split)

Users can manually assign different new numbers (with or without ID). The advantage of using ID is to not loose the original root number, which helps to locate the bus and merge sections.

Bus Tab



The bus attributes Type, Voltage and V Base must be informed by the user. Organon can assume default values for the other attributes.

Bus Types:

- PQ is a load bus type.
- PV is the voltage control type. This type indicates that there is a source of voltage control (generator or synchronous condenser) connected to the bus. Note buses with controllable shunt devices must be modeled as load bus type (PQ1).
- SW is a swing bus type. This type indicates that there is a generator connected to the bus and this generator takes the difference between total MW generation and MW load + losses.

Note: Early Organon versions supported the bus type PQ2, which would keep the voltage within a control range by providing unlimited VAR support, if necessary. This type has been removed in the program version 1.2, but the same effect can be obtained by using a sufficient large capacity shunt element at the bus and specifying the required voltage control range.

Status: Bus status (on or off). If the bus status is unchecked, all branches connected to the bus will be removed from service by opening their breakers. If the bus status is checked, all branches connected to the bus will have their breakers closed (in service).

Voltage: Voltage magnitude is entered in p.u. Although this value is computed, most of the time it is used as initial condition for the Newton methods. Specified voltages are entered in the Tab relative to the controlling device (generator, shunt or OLTC).

Angle: Voltage angle is entered in degrees. Except for swing buses, this value is computed internally. It is also used as initial condition for the power flow calculation.

VlimitInf: Lower acceptable voltage level. This is used for diagnosis and under voltage classification.

VlimitSup: Upper acceptable voltage level. This is used for diagnosis and over voltage classification.

VBase: Nominal voltage level in kV.

Bus Fixed Shunt (G, B): Conductance and susceptance in p.u. of a shunt device connected to the bus.

Voltage Control Group:

Vspec: Specified control voltage for generators and continuous shunt control devices.

Vmin: Minimum limit of the voltage control range. It is used by PQ2 type buses, discrete shunt controlled devices and OLTC Transformers.

Vmax: Maximum limit of the voltage control range. It is used by PQ2 type buses, discrete shunt controlled devices and OLTC Transformers.

External Voltage Control: This dropdown list shows the elements, if any, that control the bus voltage. These elements can be generators, OLTCs and or shunt devices.

Notes:

- The purpose of the voltage control editing group is to facilitate visualization of all elements controlling the voltage at the selected bus through the External Voltage Control list and to allow changing the voltage control setting in all controlling elements (shunt, OLTC and generators) simultaneously. The change of a voltage control setting of a particular element can be done in the respective element edit Tab.
- The field Vspec is enabled if there is at least one continuous control element (generators or shunt in continuous mode) for the bus. The fields Vmin and Vmax are enabled if there is at least one discrete control element (OLTC or shunt in discrete mode) for the bus.
- Whenever there are continuous and shunt control for the same bus, it is recommended that the continuous control setting (Vspec) be in the range of the discrete control range (Vmin - Vmax).
- The priority order for elements controlling simultaneously the same bus is generators > shunts > OLTCs.

Adding a new bus to the system:

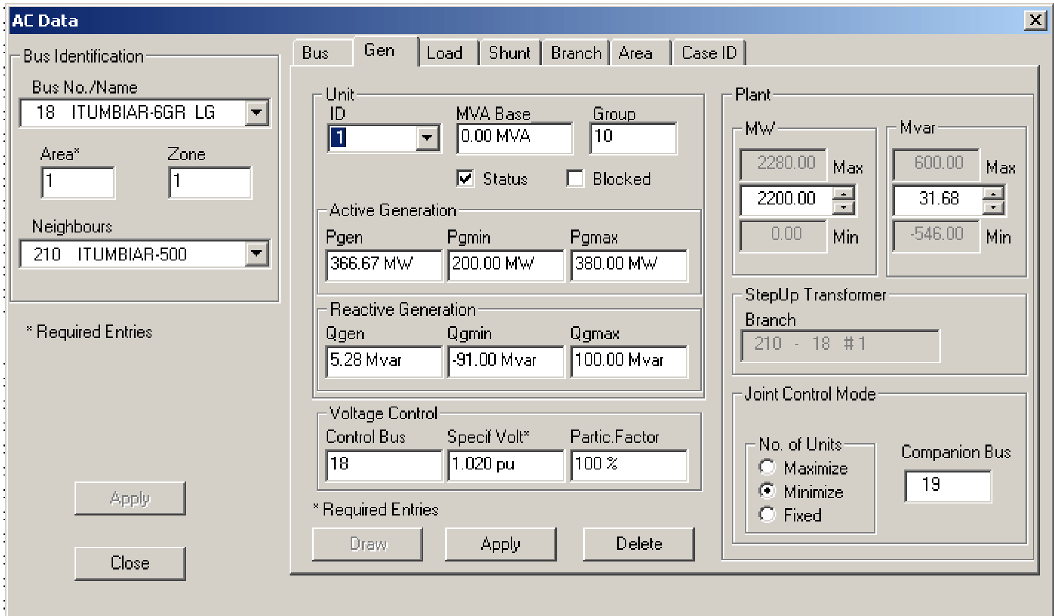
Fill the number and name of the bus in the **Bus No./Name** dropdown list, select a bus type, fill **Voltage** and **VBase** boxes, fill other fields if necessary and press **Save Bus**.

Deleting a bus:

Select the bus in the **Bus No./Name** dropdown list and press **Delete** in the Bus Tab.

Note: If a bus is deleted all the components (generators, branch, etc) connected to it are also deleted.

Gen Tab



To add a new generator unit, users must fill Unit ID attribute and optionally the other attributes.

MVA Base: Nominal generator power (MVA).

Status: On or Off.

Pgen: Active power generation (MW)

Pgmin: Minimum active power generation (MW).

Pgmax: Maximum active power generation (MW).

Qgen: Reactive power generation (Mvar).

Qgmin: Minimum reactive power generation (Mvar).

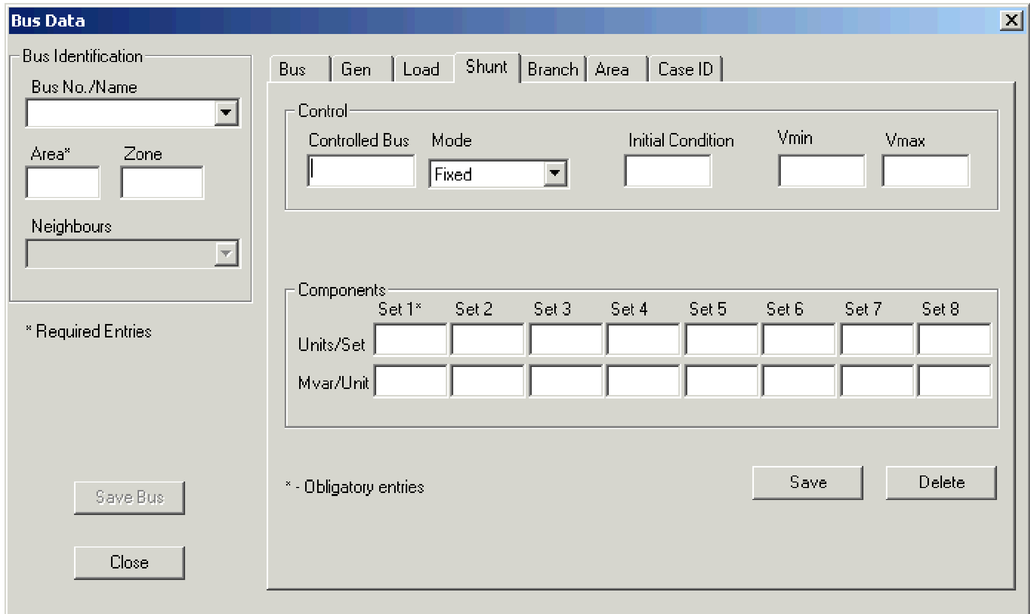
Qgmax: Maximum reactive power generation (Mvar).

Control Bus: Number of the controlled bus, i.e., the bus which voltage will be kept at the specified value as long as the generators controlling it have Mvar regulation margin.

Specified Voltage: Specified voltage value for the controlled bus (pu).

Participation Factor: Participation of the Mvar generation of the unit in the voltage control of the controlled bus (%). This is only useful when there are more than one generator unit controlling the voltage of the same bus. The percent value is relative to the sum of all participation factors. If the sum of participation factor of the units controlling the same bus is not 100%, then they are normalized.

Shunt Tab



To add a new load unit, users must fill the parameters of set1 attribute and optionally the other attributes.

Controlled Bus: Number of the bus whose voltage is controlled by the shunt device. The current version of Organon allows only one shunt controlling a bus. Shunts cannot control buses that are already controlled by a generator.

Mode:

None: Fixed shunt control.

Fixed: Fixed shunt value. No voltage control.

Discrete: Shunt elements are switched on and off at discrete values. The voltage must be controlled within a voltage range (Vmin, Vmax). If the range is too narrow, the control will not stabilise. In this case, after a few oscillations around the solution, the control will be blocked.

Continuous: Continuous shunt control. The shunt device can assume any value in the Mvar control range. This mode of can work well with a narrow control voltage range or no range at all (Vmin = Vmax).

Initial Condition: It tells the present shunt Mvar condition.

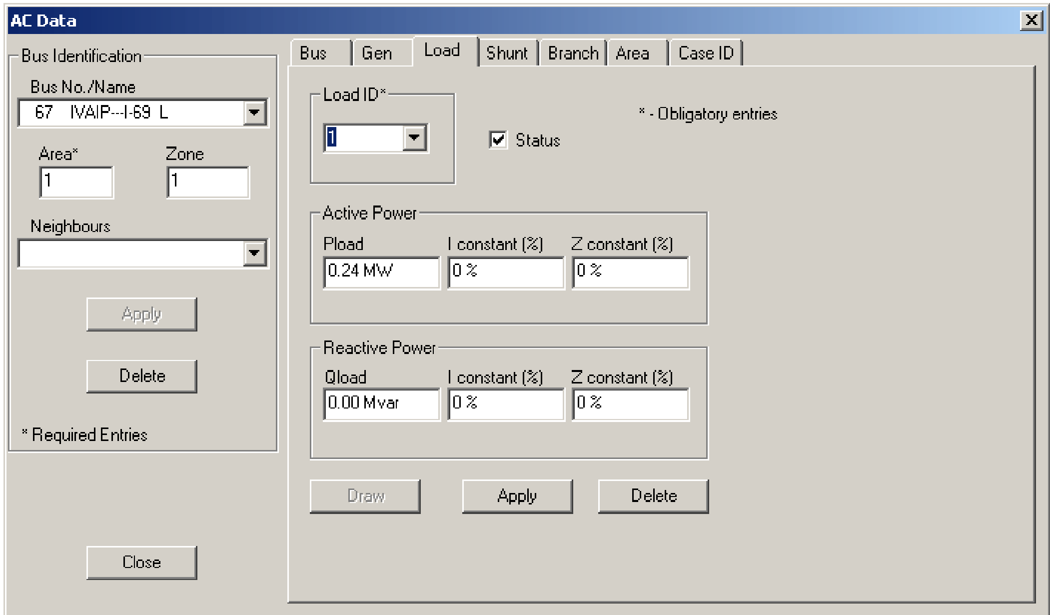
Vmin, Vmax: Voltage control range.

Components: The program allows the specification of 8 sets of shunt devices. Each set can contain any number of units with the same Mvar rate. The order of sets is related to the switching sequence. Reactor sets (if any) must be entered first, then the capacitor sets (if any) are entered. Consequently, reactors are only switched on if there is no capacitor in service and vice-versa. The switching sequence moves toward set 1 to decrease Mvar and toward set 8 to increase Mvar.

Units/Set: Number of units in the set.

Mvar/Unit: Mvar rating of each unit in the set.

Load Tab



To add a new load unit, users must fill Unit ID attribute and optionally the other attributes. Any number of load units can be connected to a bus.

Status: On or Off.

Active Power

Pload: Active power load (MW).

I(%): Percent of the active load to be modelled as constant current.

Z(%): Percent of the active load to be modelled as constant impendance.

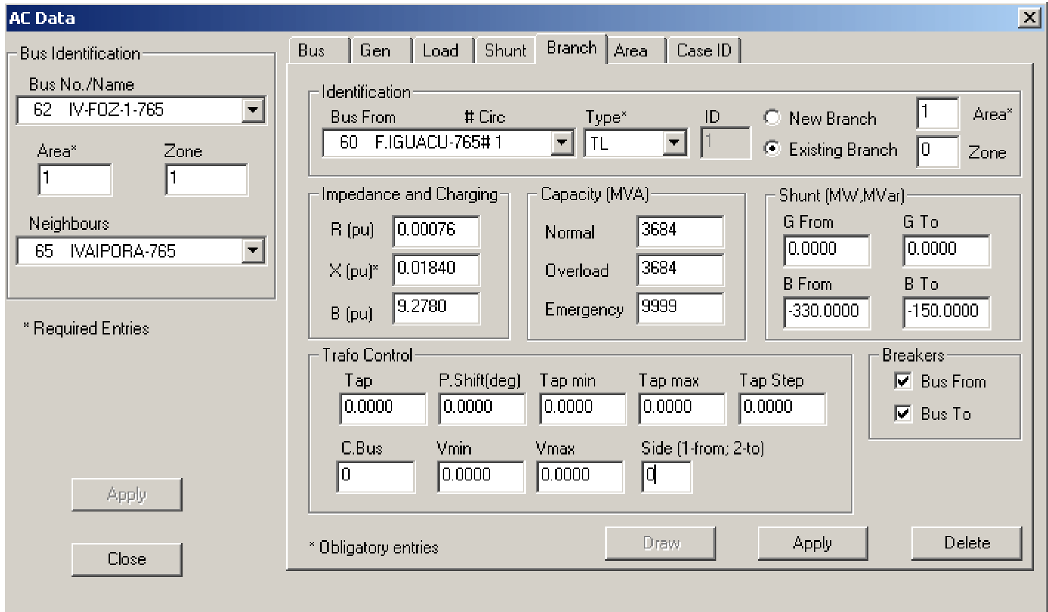
Reactive Power

Qload: Reactive power load (MW).

I(%): Percent of the active load to be modelled as constant current.

Z(%): Percent of the active load to be modelled as constant impendance.

Branch Tab



To add a new branch the user must selec **New Branch**, select **Bus No/Name** (bus from) and **Bus 2** (bus to), branch **Type**, enter circuit **ID**, **Area** number and branch reactance – **X(pu)**, and optionally enter other attributes.

Bus 2: If the New Branch option is selected, this list will contain all buses in the system. If Existing Branch is selected, this list will contain only the buses that are directly connected to the bus selected in Bus No/Name list. Once a branch is selected the name of the list (Bus 2) will change to either Bus From or Bus To, depending on the original input data.

Type: Type of the branch. The following types are currently supported.

TL: Transmission line.

Trafo: Fixed tap/phase shift transformer.

OLTC: On load tap change transformer.

PShft: MW control phase shift transformer.

ID: Circuit identification (up to six alphanumeric characters).

Area: Area number to which the branch belongs.

Zone: Zone number to which the branch belongs.

R(pu): Branch longitudinal resistance (pu).

X(pu): Branch longitudinal reactance (pu).

B(pu): Branch total charging (pu).

Capacity:

Normal: Regular circuit rating.

Overload: Acceptable overload circuit rating.

Emergency: Emergency circuit rating.

Shunt: Shunt reactors connected to the branch at buses ‘from’ and ‘to’. These shunts are automatically removed from the network if the branch is opened.

G From, G To: Mw contribution of the shunts.

B From, B To: Mvar contribution of the shunts.

Tap: Current tap value.

P.Shift: Current phase shift (degree).

Tap max: Maximum tap value or maximum phase shifting, depending on the transformer type. This has no meaning for transmission lines.

Tap max: Maximum tap value or maximum phase shifting, depending on the transformer type. This has no meaning for transmission lines.

Tap step: Discrete tap or phase angle step.

C.Bus: Number of voltage controlled bus (OLTCs only).

Vmin, Vmax: Voltage range for the controlled bus (OLTCs only).

Side: Side of controlled bus. If side=1, the controlled bus is on bus 'from' side. If side=2, the controlled bus in on bus 'to' side. If the controlled bus is one of the terminal buses of the transformer the program will automatically set the side attribute. Otherwise, it will rely on the user information. The consequence of entering the wrong side number may be an unsatisfactory voltage level or lack of convergence.

Breakers:

Bus From, Bus To: The status of the breakers are used to open the branch or just one of its terminals.

Area Tab

Area Number/Name: List of area number, code and names.

Code:

Name: Name of the area.

Swing: Area swing bus for MW Interchange control.

Interchange: MW interchange value.

Define Area load model: If checked, allows user definition of the area load model.

ZIP Model: Constant current and impedance percent for the area. The constant power percent is calculated.

Case Identification

Date: Date for the case preparation.

Source: Source of the data.

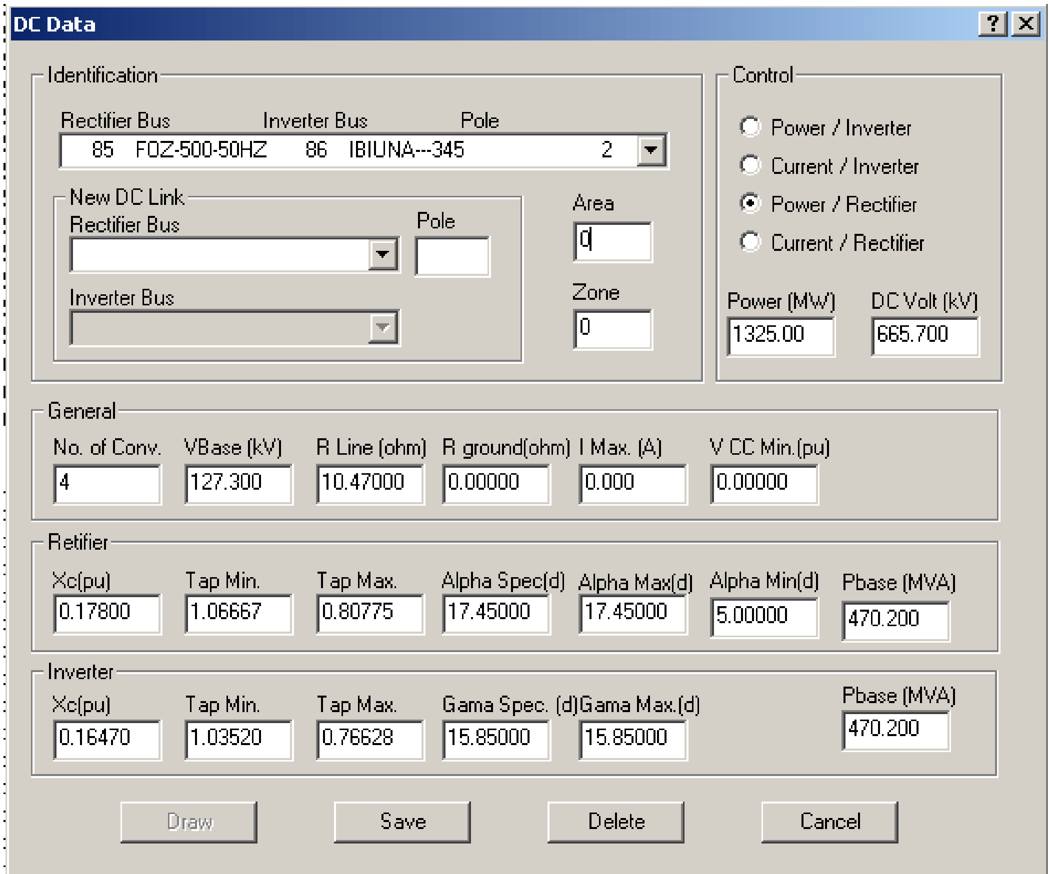
Base: MVA Base.

Year: Year related to the system condition in the case.

Season: Season related to the system condition in the case.

Identification: Other information related to the case.

DC Link Data



To add a new DC Link, select the terminal buses in the New DC Link group and enter a pole number. The pole number is the identification number for links with the same terminal buses. Therefore, it is not possible to use the same pole number for links connected to the same buses.

Rectifier/Inverter/Pole: This is a selecting list for existing DC Links.

Area: To which the link belongs.

Zone: To which the link belongs.

Control: It is possible to select four control modes, which are current or power control at rectifier or inverter side.

Value: Control setting point (MW or A).

DC Volt: Specified voltage for the controlled side (rectifier or inverter).

No.of Conv: Number of converters in series.

VBase: AC Base Voltage at the secondary side of the converter transformer.

R Line: Resistance of the DC transmission line (ohms).

R ground: Resistance of ground return (if any) (ohms).

I Max: DC Line Current rating (A).

VCC Min: DC voltage threshold to change from constant power control mode to constant current control mode.

Xc: Commutation reactance of the converter transformer (pu).

Tap Mim: Minimum allowed tap value of the converter transformer.

Tap Max: Maximum allowed tap value of the converter transformer.

Alpha,Gama Spec: Specified values for Alpha and Gama (degree).

Alpha,Gama Max: Maximum allowed angles allowed (degree).

Alpha Min: Minimum allowed Alpha (degree).

P Base: Converter transformer MVA rating.

Continuation Power Flow Data

Continuation power flow consists in moving from one converged power flow solution to another through a self-controlled method. It is useful for load level purposes and to determine the maximum loadability point. It can be used, also, for generation pattern changes. Each continuation power flow control is, basically, a set of load and generation multiplication factors. These factors may be defined at system, area, zone or bus level. For load level they mean the total change, in percent of original load (Ex: Pload rate = 10, means that after the load-level, the active load will be 10% greater). They also mean the different rates of change for generations and/or loads in the search of the maximum loadability point (saddle node point).

Select **Edit>Steady State Data>Continuation Power Flow** to open the **Continuation Power Flow Data** dialog box.

To add a continuation power flow control, select the **Data Entering Mode**, which can be based on conventional network data or based on group definition. The latter one is available only if group data has been defined.

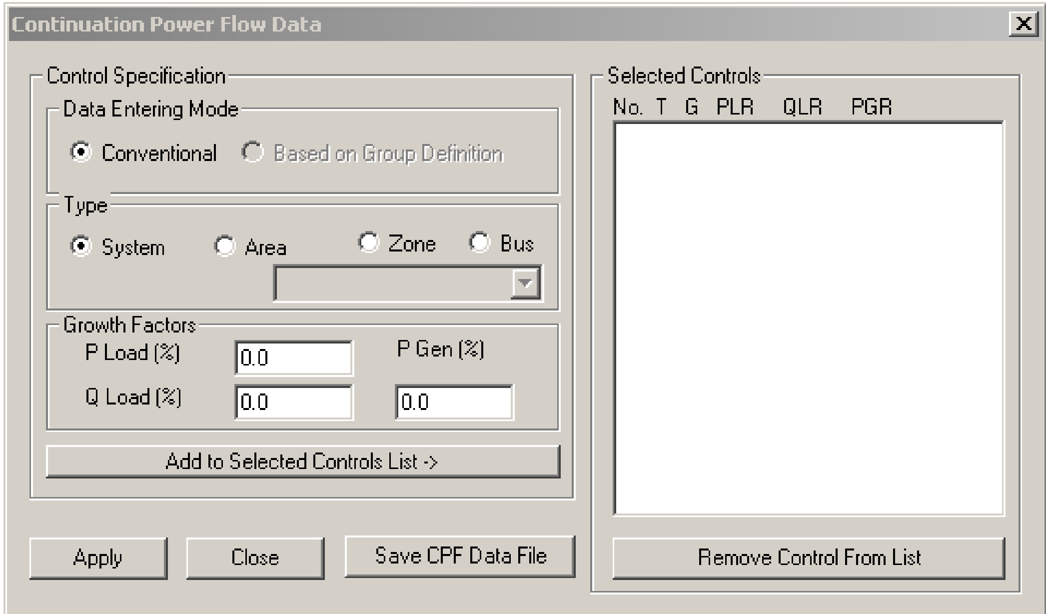
To define a continuation power flow control in the conventional mode, select the location type (system, area, zone, bus), select the location element in the drop down list, define the multiplication factors and press the **Add to Selected Controls List** button. Repeat this procedure to add more controls, if necessary, and press button **Apply**.

To add a continuation power flow control based on the group definition data, select the group from the drop down list, define the multiplication factors and press the **Add to Selected Controls List** button. It is possible to define up to three different controls in this mode.

Note: Each new continuation power flow control that is added to the Selected Controls list, overwrites any previous information.

To remove a control from the list, select it and press the **Remove Control from List** button.

Press **Save CPF data File** to save continuation power flow data in *.cpf file.



Static Contingencies

A static contingency can be defined by the loss of one or more circuits and/or the change in MW generation and/or the change in MW/Mvar load and/or the change in Mvar of shunt elements.

Select **Edit>Steady State Data>Contingency List** to open the **Static Contingency Data** dialog box.

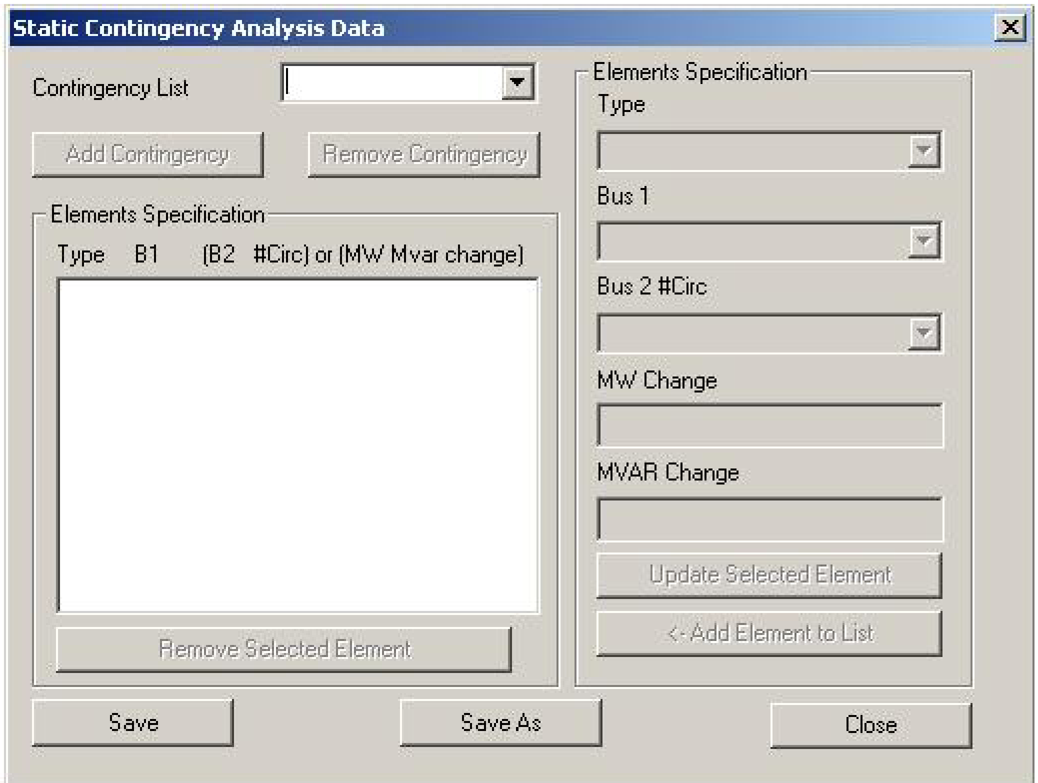
To add a new contingency, write the name of the contingency in the **Contingency List** edit box and press **Add Contingency** button. Then insert the elements that will form the contingency. This is done by selecting one of the available elements in the **Element Type** list. Depending on the selected element the other fields will be enabled/disabled accordingly. Fill those fields and press the **Add Element** button to add the element to the contingency definition.

To edit an existing element, select it in the **Elements Specification** list and change its parameters as desired. Then press the **Update Selected Element** button to apply the changes.

To remove an element, select it in the **Elements Specification** list box and press the **Remove Selected Element** button.

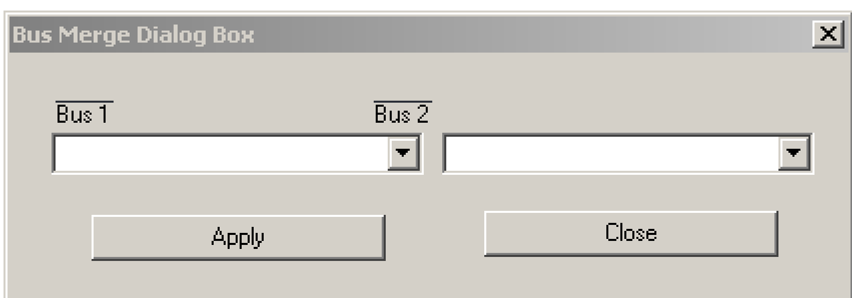
To remove a contingency, select the contingency in the **Contingency List** and press the **Remove Contingency** button.

Press the **Save** or **Save As** button to save the contingency data in a *.ctg file.



Bus Merge

Bus merging is a very simple operation. Open the merge dialog box (**Edit>Load Flow Data>Bus Merge**), select the two buses in Bus1 and Bus 2 lists, and press **Apply** button. The bus selected in Bus 2 list is deleted and all elements in this bus move to the bus selected in Bus 1 list.



Bus Split

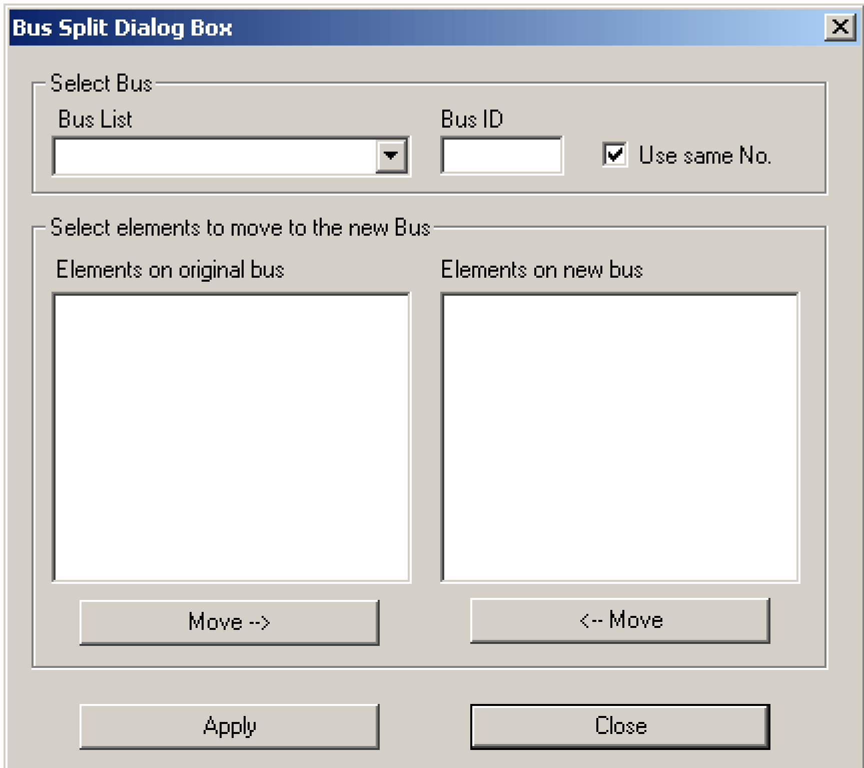
Select **Edid>Load Flow Data>Bus Split** to open the Bus split dialog box. Select the bus to be split in Bus List. All elements connected to the selected bus will be listed in **Elements on original bus**. Select the elements on this list you want to move to the new section and move them to the **Elements on new bus** list, by pressing the move (**Move**) button below the list.

Three options are available for numbering of the new bus.

1. Check **Use same No** and leave **Bus ID** edit box blank. In this case, Organon will assign same bus root number and an ID to the new bus.

2. Check **Use same No** and enter new ID in **Bus ID** edit box. In this case, Organon will assign same bus root number and the specified ID to the new bus.

3. Uncheck **Use same No** and enter new bus number in **Bus ID** edit box. In this case, Organon will assign the specified bus number to the new bus.



If the bus to be split contains generation units and one or more unites are moved to the new bus, the program will check if the step-up transformer is an *aggregated transformer* . If it is, and there is no branch move to the new bus, the program automatically adds a new aggregated step-up transformer for this (these) unit(s).

An aggregated transformer is recognized if the generation units contains not null step-up transformer impedance information (See Organon data format), the impedance is the same for all units and there is only one transformer branch connecting the units to the rest of the system.

Sensitivity Analysis Data

Sensitivity analysis consists in the computation of indexes that show the influence of one or more controlled variables over one or more dependent variables.

Select **Edit>Steady-State Data>Sensitivity** to open the Sensitivity Analysis Data dialog box. Choose the type of sensitivity analysis and then define the control and dependent variables sets. The sensitivity analysis types are:

- Branch MW flow variation per generator MW change (dPF/dPg);

- Load bus voltage variation per MW load change (dV/dPL);
- Load bus voltage variation per controlled bus voltage change (dV/dV);
- Load bus voltage variation per shunt MVAR change (dV/dQsh);
- Load bus voltage variation per tap change (dV/dTap);
- Branch MW flow variation due to branch opening (dPF/dPF).

The following table shows the control dependent variables required for each sensitivity analysis type.

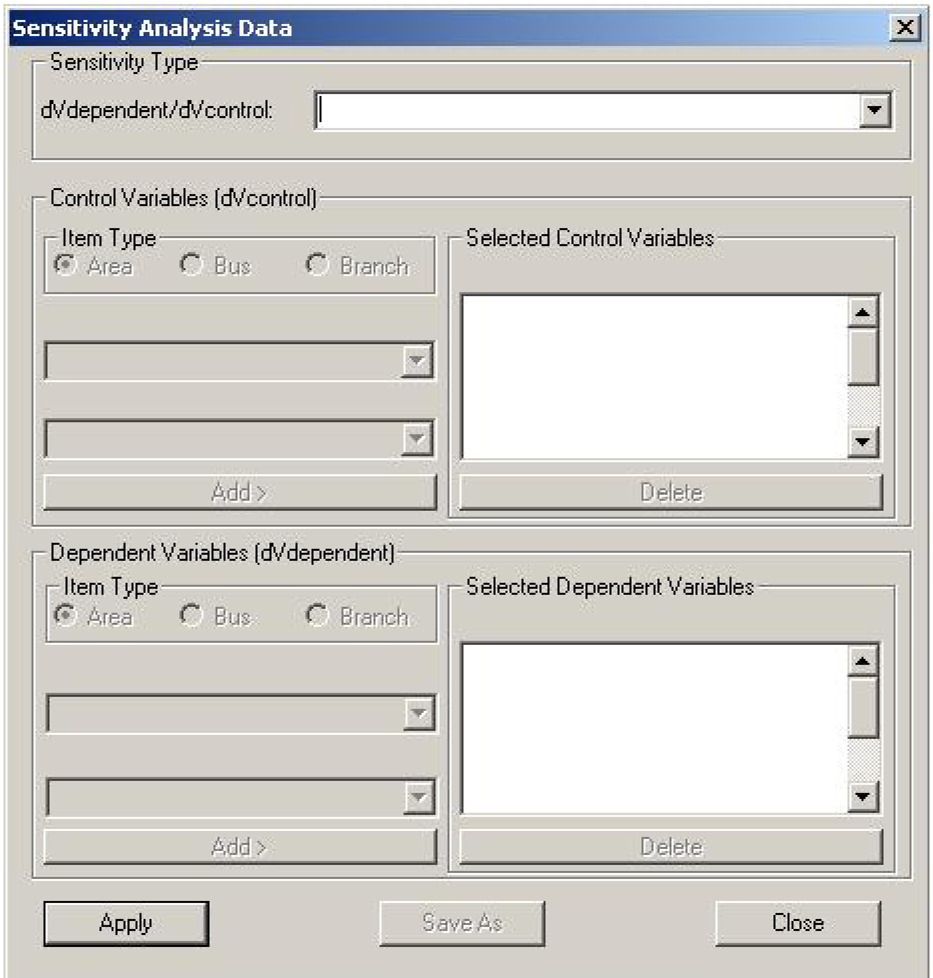
Sensitivity Analysis	**Control Variable**	**Dependent Variable**
dPF/dPg	MW Generation	MW flow in branch
dV/dPL	MW Load	Load bus voltage
dV/dV	Controlled voltage bus	Load bus voltage
dV/dQsh	Shunt MVAR in non controlled voltage bus	Load bus voltage
dV/dTap	Tap	Load bus voltage
dPF/dPF	Branch to be opened	MW flow in branch

Define each element of the control variable set and add it to the **Selected Control Variables** list pressing the **Add >** button. Repeat the same procedure for the dependent variables set.

To remove a control or a dependent variable from the set, select it in the corresponding list and press the **Delete** button.

Finally press the **Apply** button.

Press **Save As** to save sensitivity definition data in *.sen file.


Sensitivity Analysis Data
Sensitivity Type
dVdependent/dVcontrol:
Control Variables (dVcontrol)
Item Type
Area
Bus
Branch
Selected Control Variables
Add >
Delete
Dependent Variables (dVdependent)
Item Type
Area
Bus
Branch
Selected Dependent Variables
Add >
Delete
Apply
Save As
Close

Report

Report File

A report file containing printed reports of bus, branch, generation, etc can be saved to a file. This is done by choosing **File>Save** and naming a file with extension *.REP.

The options for report can be selected in **Tools>Options**.

Reports on Message Window

Several reports are presented on the Message Window. Some of them are automatically printed, like data checking results, when a file is read, convergence report for conventional power flow, continuation power flow and static contingency simulation and time domain simulation initialization and solution. Others are printed upon users request, like bus report and HVDC, area and system summary reports. The reports printed on the Message Window can be copied to the clipboard area.

Bus Report on Message Window

The bus report contains a header with Bus ID, generation, load and shunt injection, followed by the flow report, which contains the list of elements connected to the bus, showing the MW and Mvar flow, transformer tap, OLTC status, breakers statuses and line shunt injection.

The Bus Report can be generated either from the Bus Report List or from the Report Tables.

To print the Bus Report on the Message Window using the Bus Report List, select a bus in the list or type the number of the bus and press Enter or type a string that is part of the bus name and press Enter. In this last case, all buses whose name contains the typed string will be presented in the report.

From the Report Tables it is possible to print a Bus Report on the Message Window, by double-clicking on the Bus ID cells. For HVDC or branch like reports, it is possible to print the report for any of the terminal buses.

DC Link Report on Message Window

The DC Link Report shows the summary report for a selected HVDC link. The report contains the terminal buses ID, power flow (MW and Mvar), DC voltage and current, firing and extinction angles and converter transformer tap.

To print the DC Link Report on the Message Window select **View>DC Link Report** then select the HVDC link on the "DC Link Report Selection List" dialog box and press Ok.

Area Summary Report on Message Window

The area summary report shows, for each area, a header with Area ID, generation, load, shunt injection and losses followed by the interchange report, which contains the list of areas connected to that area, showing the MW and Mvar interchanges. This interchange list ends with the net interchange for the area. The whole report ends with the system totals (generation, load, shunt injection and losses).

To print the Area Summary Report on the Message Window select **View>Area Summary**.

System Summary Report on Message Window

The system summary report shows the number of areas, buses, generators and circuits, as well as system totals for generation, load, shunt injection and losses.

To print the System Summary Report on the Message Window select **View>System Summary**.

Loaded Files Report on Message Window

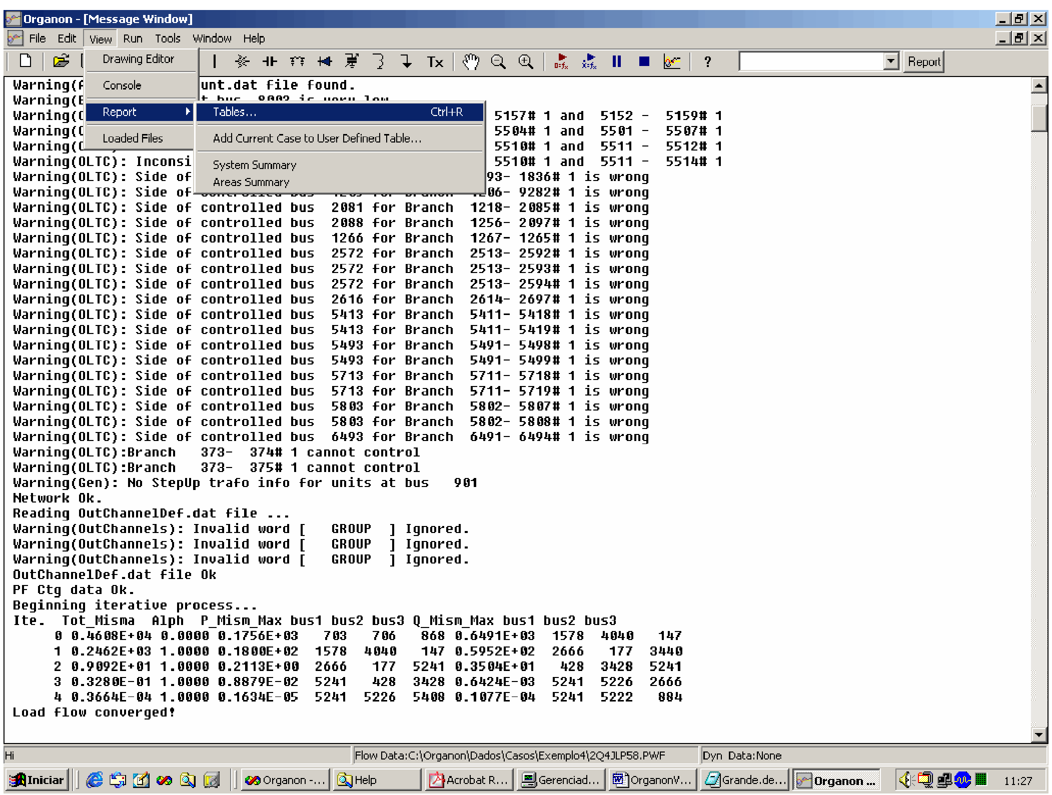
The loaded files report shows all files that have been read since the last time network data file has been read.

To print the Loaded Files Report on the Message Window select **View>Loaded Files**.

Report Tables

The reports presented in the Report Tables window provide several functionalities like sorting, copying data into the clipboard area, data edition, etc. Copying data to the clipboard area enables data migration to Excel spreadsheets or Word documents. Some tables allow calling the data edition dialog box using the right-button or generating a "bus report" in the "Message Window" with a double-click.

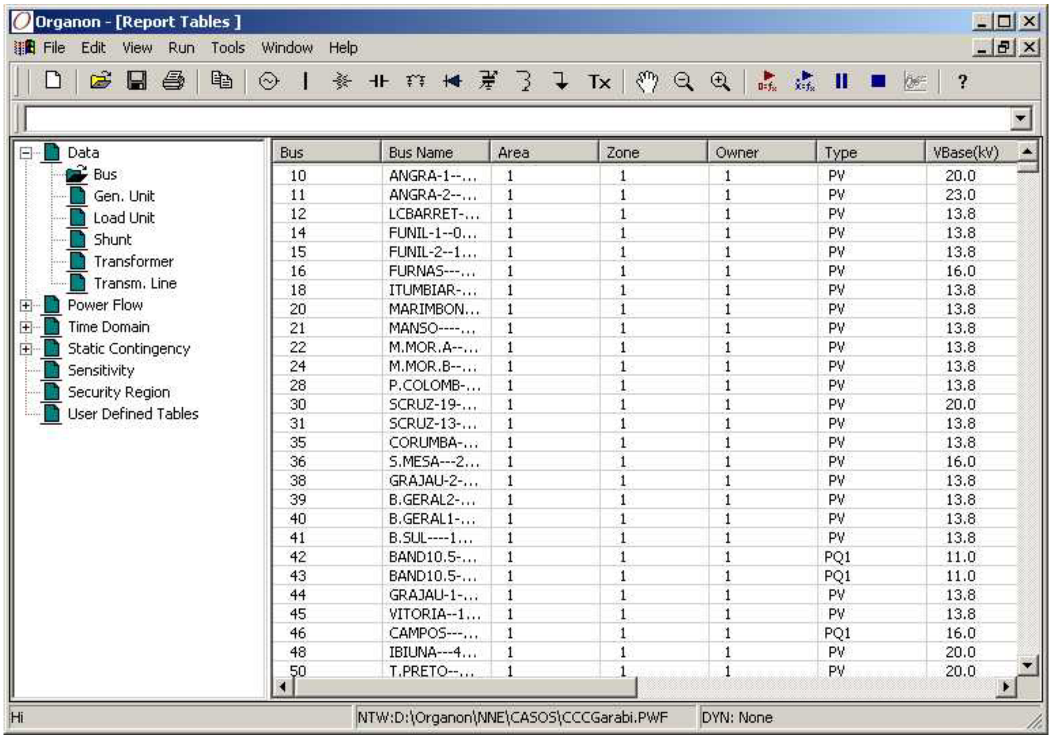
To display Report Tables window select **View>Report Tables**.



The Report Window displays folders for "Power Flow" solution, "Time Domain" simulation, "Static Contingency" analysis and "User Defined Tables".

Data Tables

Input data are presented in the following tables: "Bus", "Gen. Unit", "Load Unit", "Shunt", "Line Shunt", "Transformer" and "Transm. Line" (Fig. bellow).

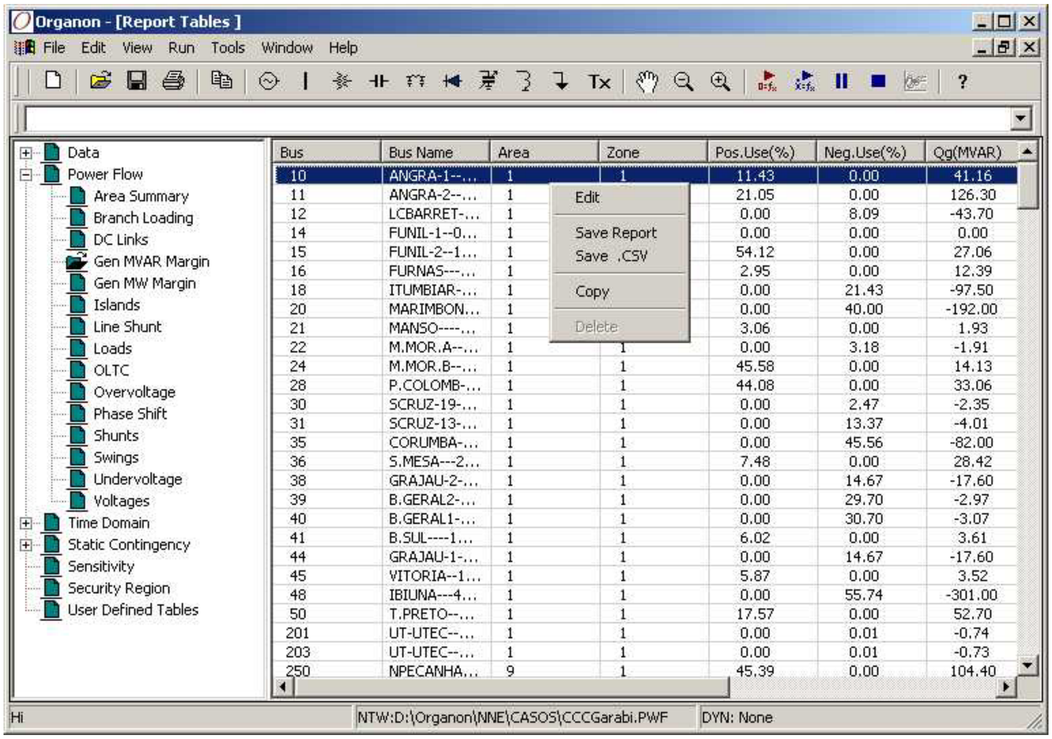


A double-click on an element of the first column of these tables, generates a "Bus Report", in the "Message Window", for that specific bus. The same happens for a double click in the "Bus To" column for the tables: "Transformer" and "Transm. Line".

The right-button activates a pop-up menu that allows data edition or copying selected rows into the clipboard area. Data edition is possible if only one row is selected. The "AC Dialog" box is displayed for all tables.

Power Flow Tables

Power flow results are presented in the following tables: "Area Summary", "Branch Loading", "DC Links", "Gen. Mvar Margin", "Gen. MW Margin", "Islands", "Line Shunt", "Loads", "OLTC", "Overvoltage", "Phase Shift", "Shunts", "Swings", "Undervoltage" and "Voltages" (Fig. bellow).



A double-click on an element of the first column of these tables, generates a "Bus Report", in the "Message Window", for that specific bus. The same happens for a double click in the "Bus To" column for the tables: "Branch Loading", "Line Shunt", "OLTC" and "Phase Shift"

The right-button activates a pop-up menu that allows for:

- Edit data. The "AC Data" dialog box is displayed for all tables, except for the "DC Links" table that opens the "DC Data" dialog box;
- Save the table in a report output file (*.rep) or in a comma separated value file (*.csv). This last one is usefull for manipulation with Excel program;
- Copy selected rows into the clipboard area (may be pasted in an Excel sheet, for example);
- Delete row. This feature is enable in UDT only and for one row at a time.

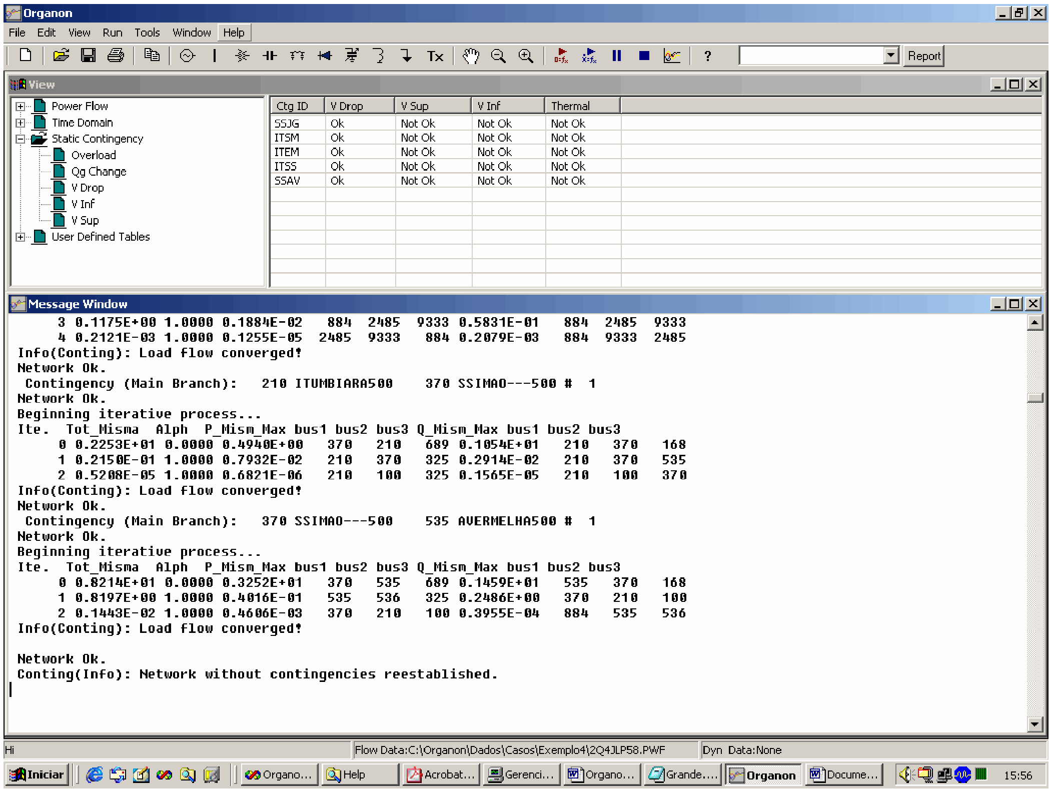
The symbols "+" or "-", on the right side of a table cell, indicate violation of upper limit or lower limit respectively. This can be seen in tables: "Shunts", "Voltages" and "Line Shunt".

Static Contingency Tables

The initial table (Fig. bellow) contains a summary of the static contingency analysis, in which is possible to see if the contingency violates (Not Ok) or not (Ok) the criteria. The criteria are:

- Vdrop: the post-contingency bus voltage cannot drop more than a threshold compared to the pre-contingency value;
- V Sup: indicates if there is any overvoltage in the post-contingency solution;
- V Inf: the same for undervoltages;
- Thermal: indicates if there is any overloaded circuit in the post-contingency solution.

The codes "Not Checked" and "Not Converged" indicate problems in the static contingency power flow solution.



The tables "Overload", "V Drop", "V Inf" and "Thermal" show the list of elements, if they exist, that violates the criteria for each contingency. Due to memory allocation issues, this list is limited to 10 elements per contingency.

The table "Qg Change" shows the difference of Mvar generation between the post and pre-contingency solutions.

Sensitivity Analysis Table

Sensitivity indexes show the influence of one or more controlled variables over one or more dependent variables. Each sensitivity analysis type results in different sensitivity indexes which are explained in the following table:

Sensitivity Analysis	Sensitivity Index
dPF/dPg	MW flow variation per +100 MW change in Pg
dV/dPL	Load bus V variation in pu per +100 MW change in Load
dV/dV	Load bus V variation in pu per +1pu change in controlled V
dV/dQsh	Load bus V variation in pu per +100MVAR change in Qshunt
dV/dTap	Load bus V variation in pu per +1pu change in tap
dPF/dPF	MW flow variation due to branch opening

The sensitivity index may be positive, which means a positive change in the control variable causes an increase in the dependent variable value, or negative, which means a positive change in the control variable causes a reduction in the dependent variable value.

The sensitivity report table can be displayed with control variables in rows and dependent variables in columns or vice-versa. This flexibility is important, once the report can be sorted and, thus, it is possible to see in the dV/dPL report, for instance, which Load variation will affect most one given voltage, or, on the other hand, which voltage will be most affected by one given Load variation. The first information will be obtained if the dV/dPL report has control variables (Loads) in rows and dependent variables (voltages) in columns, while the second, if the Loads are in columns and voltages in rows. The table orientation is defined in the sensitivity analysis execution control dialog box.

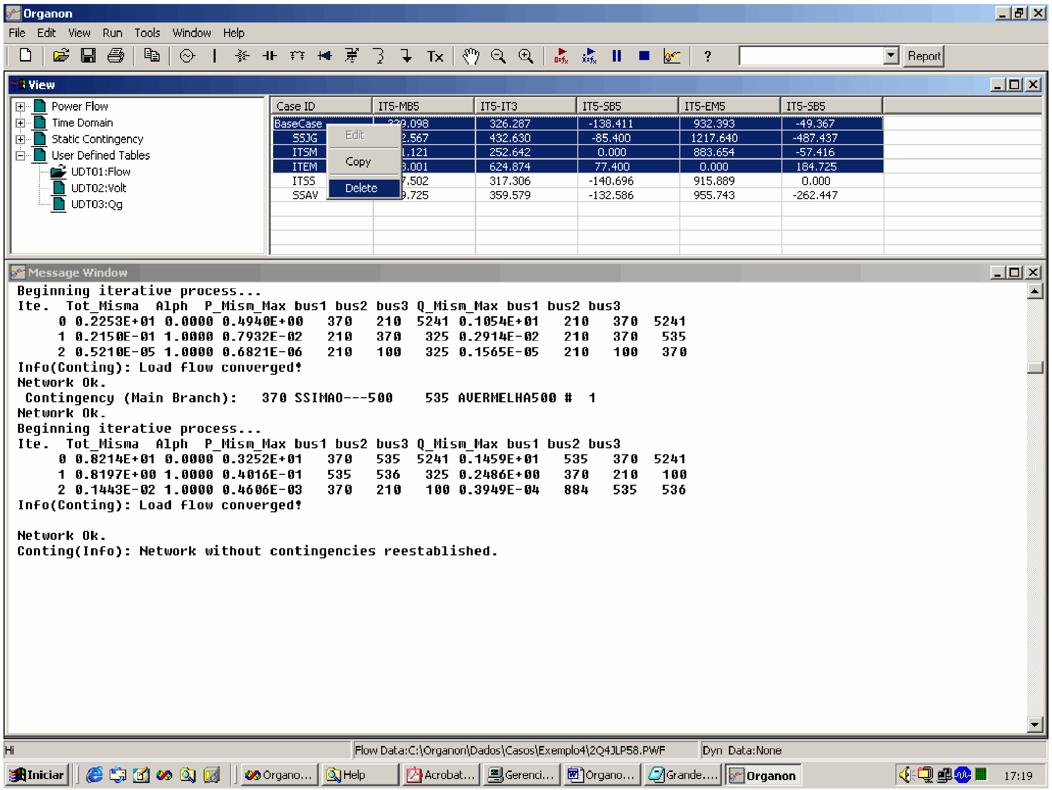
User Defined Reports (UDT)

User defined reports are customized reports, created in the UDT definition data dialog box or read from definition files (*.def).

Each row in these tables corresponds to a power flow solution, associated with a "Base Case" name and the user may add as many "Base Cases" as needed. After a new base case is added, it is considered the current "Base Case", and any change in the power flow solution is updated only in this row. All previous cases remain unchanged. It is possible to add new rows with static contingency analysis and/or time domain simulation results, including dynamic contingency analysis. Each static contingency and/or time domain simulation corresponds to a row in the UDT.

The symbols "+" or "-", on the right side of a table cell, indicate violation of upper limit or lower limit respectively. These limits are given in the UDT definition data. It is possible to define, for example, new voltage limits for a bus, different from those given in bus data.

The right-button activates a pop-up menu that allows row deletion or copying selected rows into the clipboard area. If a row containing the results for a static contingency has been deleted and a new static contingency analysis is run, the results for all contingencies are displayed, including those for the contingency that had been removed. The same is valid for time domain simulation.



Time Domain Tables

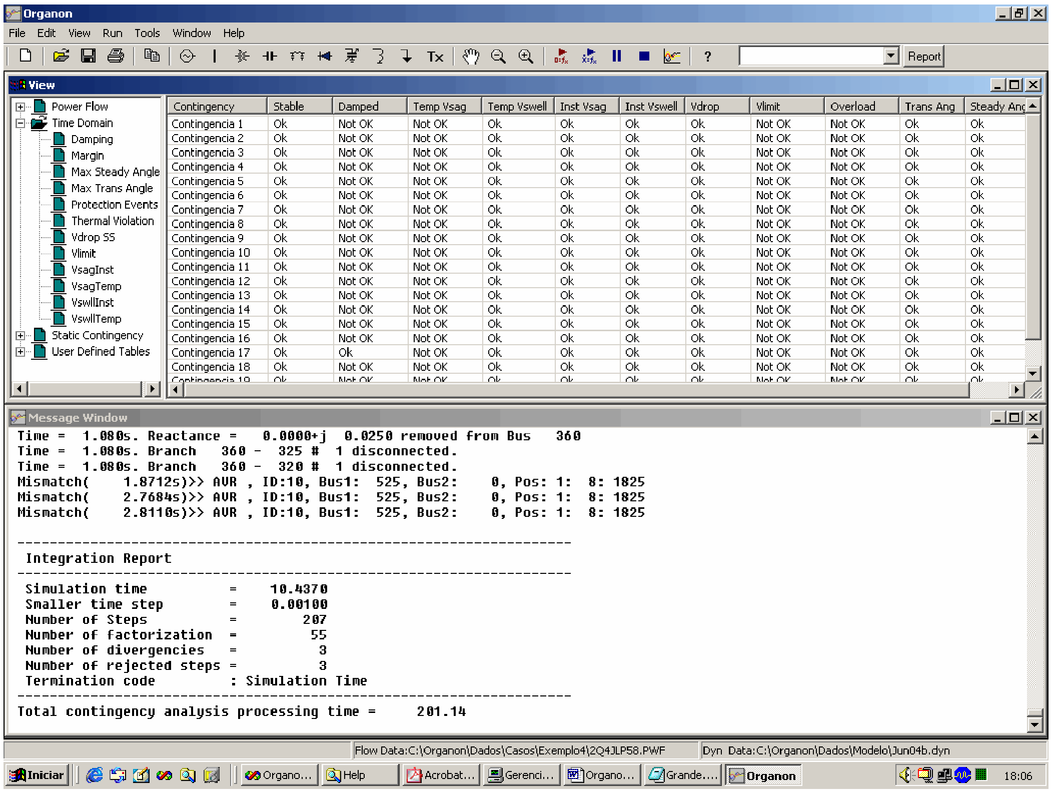
The initial table (Fig. bellow) contains a summary of the time domain simulation analysis, in which is possible to see if a contingency violates (Not Ok) or not (Ok) the criteria. The criteria are:

- Stable: indicates if the system is stable or unstable;
- Damped: indicates if the damping is acceptable;
- Temp Vsag: indicates if there is any voltage sag (transient undervoltage) that lasts more than an acceptable period;
- Temp Vswell: indicates if there is any voltage swell (transient overvoltage) that lasts more than an acceptable period;
- Inst Vsag: indicates if there is any voltage sag (transient undervoltage) that goes bellow an acceptable threshold;
- Inst Vswell: indicates if there is any voltage swell (transient overvoltage) that goes above an acceptable threshold;
- V Drop: indicates if there is any voltage drop greater than a threshold, in the post-contingency steady-state solution.
- Thermal: indicates if there is any overloaded circuit in the post-contingency steady-state solution.
- VLimit: indicates if there is any overvoltage or undervoltage in the post-contingency steady-state solution.

- Trans.Ang: indicates if there is any angle difference greater than a threshold during the transient.

- Steady.Ang: indicates if there is any angle difference greater than a threshold in the post-contingency steady-state solution.

The code "Not Checked" indicates problems in the time domain simulation.



The tables "Damping", "Margin", "Max.Steady Angle", "Max.Trans.Angle", "Protection Events", "Thermal violation", "V Drop SS", "V Limit", "V Sag.Inst" ", "V Sag Temp.", "V Swell Inst" and "V Swell Templ" show the list of elements, if they exist, that violates the criteria for each contingency. Due to memory allocation issues, this list is limited to 10 elements per contingency.

In the "Margin" table, the negative margins indicate the generators that lost synchronism. Small values for the margin indicate generators that are close to instability.

The "Damping" table shows the generators with worst damped oscillations. The original signal is decomposed into a sum of sin curves, and the 2 most dominant signals are listed. The formula **t(s) = 4/(Damp),** gives the time necessary for the amplitude of one signal reduces to 2% of its initial value.

Security Region Table

This table contains the summary of the security region analysis. It shows the limits detected in each direction, with a brief explanation about them. For each direction it is possible to have more than one row associated with it. It is possible, to have, for instance, one row for the first edge and one for the second edge of the security region, in the case the operating point is outside the security region. It is possible to have, also, one or two edges for the thermal limit.

Each row of VSA2 and DSA2 tables has the following results:

- Direction number;

- Direction angle;
- Limit type:
  - VS-In or DS-In: first edge of security region;
  - VS-Out or DS-Out: second edge of security region;
  - TL-In: first edge of thermal limit region;
  - TL-Out: second edge of thermal limit region;
- Contingency: Id of contingency responsible for the security region limit;
- G1 Limit: Generation group #1 limit coordinate in MW;
- G2 Limit: Generation group #2 limit coordinate in MW;
- G3 Limit: Generation group #3 limit coordinate in MW;
- Distance: Distance from operating point in MW, considering G1 and G2 coordinates;
- VS or DS Code:
  - Generation limit: maximum or minimum generation reached;
  - Security region limit: Nose point reached, lack of convergence for static contingency or time domain simulation becomes unstable;
  - For thermal limits this column shows the circuit where violation has been detected;
- G1 OP: Generation group #1 coordinate in MW for operating point;
- G2 OP: Generation group #2 coordinate in MW for operating point;
- G3 OP: Generation group #3 coordinate in MW for operating point;
- G1 PgMax: Generation group #1 maximum MW generation;
- G2 PgMax: Generation group #2 maximum MW generation;
- G3 PgMax: Generation group #3 maximum MW generation.

Simulating

Pause and Stop

To interrupt temporarily a power flow solution or a time domain simulation, select **Run>Pause**. Select **Run>Resume** to resume the power flow solution or time domain simulation.

To stop a power flow solution or a time domain simulation, select **Run>Stop**.

Running Script

Organon allows the execution of a set of commands in a batch procedure. The commands must be loaded from a script file (*.spt) into the built-in script editor window or directly typed into this window.

To load a script file, select **File**>**Open**, then select the extension *.spt in the Open File dialog box. Finally, select the file and press OK.

To open the script editor select **View>Script Editor**. In the script editor it is possible to change commands read from the script file.

The script must end with an END record.

To execute the batch, select **Run**>**Script** from the main menu or press Ctrl+B.

Commands are free formatted, except for some of the Anarede compatible ones. Comment lines start with '!' or '(' in the first column. Blank lines are allowed.

Security Assessment

Running Security Assessment on Master Process

Lauching Organon on a Distributed Processing Environment

Running Security Assessment on Master Process

Organon has to be launched on a distributed processing environment (see also Lauching Organon in a Distributed Processing Environment) in order to perform Security Assessment.

Prior to running the security assessment, the user must open a *.DSA input file containing the name of files to be used and FTP information, if the base case is to be transferred over Internet.

For now it is possible to perform four different types of system security assessment:

- Static security assessment for current operating point only;
- Static security region for current operating point;
- Dynamic security assessment for current operating point only;
- Dynamic security region for current operating point.

To run a security assessment, select **Run>Security Assessment**. A dialog box will pop up to allow setting up execution parameters. The parameters in the dialog box are:

- **Dynamic security assessment type:** One of the four mentioned above;
- **Data type:** From files or from memory (disabled for now);
- **Number of directions:** Number of radial directions that will be scanned in security region assessment;
- **Refresh plot at intervals:** Enables periodic (cyclic) assessment;
- **Interval:** Time interval between two consecutive assessments;
- **Get base case using FTP:** Enables getting base case over internet;
- **Convert EMS case to Planning:** Convert base case generated by EMS tools into base case normally used for planning studies. Basically changes bus numbers and aggregate independent generation unit buses into a single one. See Conversion from Real-Time Case into Planning Case to learn more about this conversion;
- **1st trial:** Host IP address, user login and password and remote file address and template that will be checked first. If this file cannot be reached, the second trial file will be checked;
- **2nd trial:** Host IP address, user login and password and remote file address and template that will be checked, if first trial file cannot be reached;
- **Local name file:** Base case file name.

Launching Organon on a Distributed Processing Environment

The distributed process can use one or more computers.

To launch Organon on a distributed processing environment, in only one computer use the following command.

MPIRUN -np 2 -localonly organon.exe

This will launch a Master and a Slave process on the same computer.

To implement a distributed processing environment over a LAN, MPD has to be installed. MPD is the process manager for clusters of computers running Windows NT/2000/XP. See Configuring a Distributed Processing Environment to learn more about MPD installation.

Use the following command to launch Organon on a distributed processing environment based on a multi-computer LAN:

MPIRUN -hosts n host1 2 host2 1 host3 1 ... hostN 1 organon.exe

Where n is the number of computers in the LAN that will be used for the distributed processing, hostx means the computer network ID. This command prompts for user account and password. If incorrect account or password is entered, it will be necessary to reboot the Master computer to try again.

Dynamic Analysis

The dynamic analysis tools available in Organon are:

1. Single time domain simulation;
2. Dynamic contingency analysis;
3. Synchronous generator step tests.

The dynamic algorithms available in Organon are the numerical integration method, transient energy function methods and Prony analysis. These algorithms are used for simulation and diagnosis of system stability margins.

To display Dynamic Analysis menu, select **Run>Dynamic**.

Single Time Domain Simulation

Prior to running the time domain simulation, the user must define the list of contingencies, where each contingency corresponds to a list of events and obtain a converged power flow solution.

To run a single time domain simulation, select **Run>Dynamic>Single Simulation,** or use the hot key Ctrl+T. A dialog box will pop up to allow setting up execution parameters. The parameters in the dialog box are:

- **Simulation Time**: Total simulation time.
- **Termination due to angular instability**: This option enables automatic termination due to angular instability.
- **Block Governor Control**: Blocks Governor action.
- **Block AVR Control**: Blocks AVR action.

- **Block PSS Control**: Blocks PSS action.
- **Block OEL Control**: Blocks OEL action.
- **Block UEL Control**: Blocks UEL action.

Select, then, a contingency to be simulated. The events for the selected contingency are displayed in the list box below the selection drop-down list. To interpret the events parameters refer to ???.

Alternatively, click on the (Run Time Domain Simulation) button in the toolbar. No dialog box is prompted and the time domain simulation starts right away, using the current parameters and selected contingency.

The time domain simulation initialization and solution report is printed on the Message Window. All plotting graphs are displayed at the end of the simulation. Each graph is displayed on a separated window. These windows may be tiled, cascaded, maximized or minimized. To zoom-in a graph, select a rectangle area (click on the upper left corner and drag to the lower right corner). To zoom-out, select a rectangle area in the region outside the plotting area or, alternatively, click the right mouse button and chose **Zoom Out** in the pop up menu. Other options are:

- **Copy:** Copy the graph to the clipboard area;
- **Print:** Print the graph;
- **Export Data:** Dump all trajectories in an ASCII file, with *.plt extension, defined by the user in the File Selection Box that will pop-up;
- **Preferences**: Select Preferences to change the colors in the plotting area.

Time domain simulation results may be put in user-defined tables (UDT), if they are defined. Each simulation corresponds to a different case

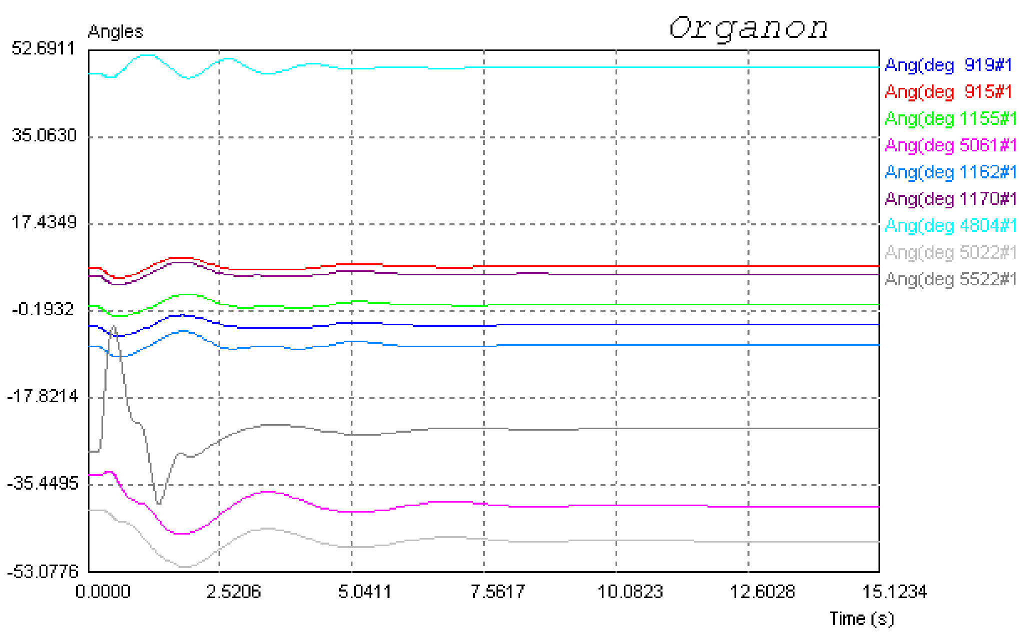


Figure – Example of time simulation plotting

Dynamic Contingency Analysis

Prior to running the dynamic contingency analysis, the user must define the list of contingencies, where each contingency corresponds to a list of events and obtain a converged power flow solution.

To run a dynamic contingency analysis, select **Run>Dynamic>Contingency Analysis**. A dialog box will pop up to allow setting up execution parameters. The parameters in the dialog box are:

- **Simulation Time**: Total simulation time.
- **Termination due to angular instability**: This option enables automatic termination due to angular instability.
- **Block Governor Control**: Blocks Governor action.
- **Block AVR Control**: Blocks AVR action.
- **Block PSS Control**: Blocks PSS action.
- **Block OEL Control**: Blocks OEL action.
- **Block UEL Control**: Blocks UEL action.

The dynamic contingency analysis report shows the initialization and solution results, for each contingency, on the Message Window. All plotting graphs are displayed at the end of the simulation. Each graph is displayed on a separated window. These windows may be tiled, cascaded, maximized or minimized. To zoom-in a graph, select a rectangle area (click on the upper left corner and drag to the lower right corner). To zoom-out, select a rectangle area in the region outside the plotting area or, alternatively, click the right mouse button and chose **Zoom Out** in the pop up menu. Other options are:

- **Copy:** Copy the graph to the clipboard area;
- **Print:** Print the graph;
- **Export Data:** Dump all trajectories in an ASCII file, with *.plt extension, defined by the user in the File Selection Box that will pop-up;
- **Preferences**: Select Preferences to change the colors in the plotting area.

Dynamic contingency analysis results may be put in user-defined tables (UDT), if they are defined. Each contingency corresponds to a different case

Synchronous Generator Step Tests

This is an automatic procedure to apply a step test to all synchronous generators in the system simultaneously. To run a synchronous generator step test, select **Run>Dynamic>Sync Machine Step Test**. A dialog box will pop up to allow setting up execution parameters. The parameters in the dialog box are:

- **Speed No Load AVR** step test. A step change is applied to the reference of the AVR. The machines operate at speed-no-load condition. Initial terminal voltage is the same as in the loaded case.

- **One Machine Infinite Bus AVR** step test. A step change is applied to the reference of the AVR. Each machine operates connected to an infinite bus. The external reactance is the machine's transient reactance. The initial conditions (voltage, angle, generation) are the same as in the loaded case.
- **One Machine Isolated Load Governor** step test. A step change is applied to the reference of the Governor. Each machine operates supplying an isolated load. The initial conditions (volt and generation) are the same as in the loaded case. The generator is connected to the load through an external impedance equal to 0.001 pu in the system MVA base.
- **Mode**: Per unit or percent of reference value.
- **Simulation Time**: Total simulation time (s).
- **Step Value**: Step change in the reference value (depends on the Mode).
- **Event Time**: Time when the step will be applied (s).

The synchronous generator step test initialization and solution report is printed on the Message Window.

The time response signals are stored in a file named 'Dump.PLT', located in the same directory Organon.exe is. The trajectories saved in this file can be plotted by the Organon plotting facility. Alternatively, the file can be opened by the 'Plot.exe' program from CEPEL.

Note: These tests can generate very large data files if the simulation time is too long and one or more machines are unstable. This can be monitored by the time step size. If the integration process cannot increase time step, it is possible that there are unstable units in the system. In this case, it is suggested to run a short simulation to identify the unstable machines. Then, it is possible to either retune their controls or remove them from the simulation.

Steady State Analysis

The steady state analysis tools available in Organon are:

1. Newton power flow;
2. Synthetic dynamic power flow;
3. Continuation power flow;
4. Static contingency analysis;
5. Sensitivity analysis.

Static contingency analysis is assembled repeating a regular power flow calculation for different contingencies.

To display Steady State Analysis menu, select **Run>Steady State**.

Newton Power Flow

To run a Newton power flow, select **Run>Steady State>Newton Power Flow**, or use the hot key Ctrl+N. A dialog box will pop up to allow setting up execution parameters. The available parameters are:

- **Flat Start**: This option forces initialization of all buses with angle set to zero and uncontrolled voltages set to 1.0 pu. Usually this option is not selected because the voltages and angles in memory loaded are better guesses for convergence. These values are often results of previously converged cases. Flat start is also not robust for stressed load flow conditions.
- **Reset Voltages to the Specified Values**: This option forces the algorithm to use the specified voltage for generation-controlled buses. If this value is not selected, the algorithm uses the current terminal voltage, which can be different from the specified voltage. It is recommended to enable this option always.
- **Block Tap Control**: Selecting this option blocks the OLTC type control. This is typically used when there is no interest in changing a previously converged case.
- **Discrete Tap Control**: This option forces the tap position to a realistic discrete step.
- **Apply Tap Control at Iteration**: Specifies the iteration at which the OLTCs will start acting to hold controlled voltages at specified values.
- **Block P.Shifters**: Selecting this option blocks the phase shift type control.
- **Apply Mvar limits at Iteration**: Specifies the iteration at which the generators Mvar limits will be reinforced.
- **Interchange Control**: This option selects power interchange control between areas. This option is only enabled if there is at least one area with swing bus defined. Note that selecting this option requires special care in setting the specified MW interchange values.
- **Block Shunt Control**: This allows for blocking shunt voltage control.

Alternatively, click on the (Run Newton Power Flow) button in the toolbar. No dialog box is prompted and the power flow computation starts right away, using the current options.

The convergence report is printed on the Message Window.

Power flow results may be put in user-defined tables (UDT), if they are defined. These results may be added as a new base case result or update existing values.

Synthetic Dynamic Power Flow

To run a synthetic dynamic power flow, select **Run>Steady State>Synthetic Dynamic Power Flow**. A dialog box will pop up to allow setting up execution parameters. The available parameters are:

- **Flat Start**: This option forces initialization of all buses with angle set to zero and uncontrolled voltages set to 1.0 pu. Usually this option is not selected because the voltages and angles in memory loaded are better guesses for convergence. These values are often results of previously converged cases. Flat start is also not robust for stressed load flow conditions.

- **Reset Voltages to the Specified Values**: This option forces the algorithm to use the specified voltage for generation-controlled buses. If this value is not selected, the algorithm uses the current terminal voltage, which can be different from the specified voltage. It is recommended to enable this option always.

- **Block Tap Control**: Selecting this option blocks the OLTC type control. This is typically used when there is no interest in changing a previously converged case.

- **Discrete Tap Control**: This option forces the tap position to a realistic discrete step.

- **Apply Tap Control at Iteration**: Specifies the iteration at which the OLTCs will start acting to hold controlled voltages at specified values.

- **Block P.Shifters**: Selecting this option blocks the phase shift type control.

- **Apply Mvar limits at Iteration**: Specifies the iteration at which the generators Mvar limits will be reinforced.

- **Interchange Control**: This option selects power interchange control between areas. This option is only enabled if there is at least one area with swing bus defined. Note that selecting this option requires special care in setting the specified MW interchange values.

- **Block Shunt Control**: This allows for blocking shunt voltage control.

The convergence report is printed on the Message Window.

Power flow results may be put in user-defined tables (UDT), if they are defined. These results may be added as a new base case result or update existing values.

Continuation Power Flow

Prior to running the continuation power flow, the user must define the continuation power flow data, which are, basically, the load and generation growth rates and obtain a converged power flow solution.

This method can be used for three different purposes: perform a load level; find the maximum loadability point (saddle node point) and plot the PxV curve (nose curve).

1. **Load Level**: The load will change according to percentage defined by the user. The generation change will be scaled to balance the load. If no generation change is defined, the swing bus will balance all load changes and system losses.

2. **Maximum Loadability**: The load will increase, according to percentage defined by the user, until the system reaches the maximum loadability point. The generation change will be scaled to balance the load. If no generation change is defined, the swing bus will balance all load changes and system losses.

3. **Nose Curves**: The load will increase, according to percentage defined by the user, until the system reaches the maximum loadability point, then it will be reduced to the original value, following the lower part of the PxV curve. The generation change will be scaled to balance the load. If no generation change is defined, the swing bus will balance all load changes and system losses. This method is useful for educational purposes, having very limited practical use.

To run a continuation power flow, select **Run>Steady State>Continuation Power Flow**. A dialog box will pop up to allow setting up execution parameters. The available parameters are:

- **Losses Shared among Generators**: Losses increase due to load increase is absorbed either by the swing bus or by all generators that are changing.

- **Under/Overvoltage Stop Criterion**: Maximum loadability point search stops if any bus violates its voltage limits.

- **Horizontal Axis**: PxV plot shows total MW change or λ factor

.

- **Block Shunt Control**: This allows for blocking shunt voltage control.

- **Block Tap Control**: Selecting this option blocks the OLTC type control.

- **Block P.Shifters**: Selecting this option blocks the phase shift type control.

The continuation solution report is printed on the Message Window. A PxV curve will be displayed for the buses selected by the user (up to five buses).

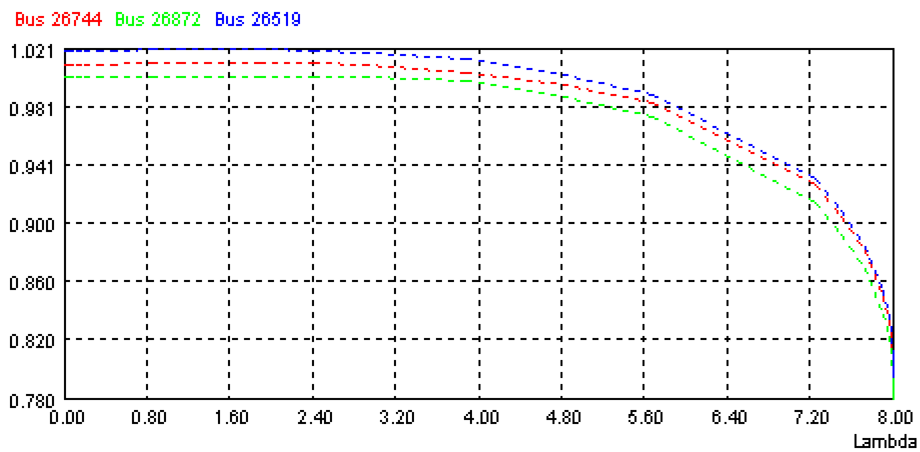


Figure – Example of Voltage x Power or Lambda plot

Continuation power flow results may be put in user-defined tables (UDT), if they are defined. These results may be added as a new base case result or update existing values.

Static Contingency Analysis

Prior to running the static contingency analysis, the user must define the contingency list, which is, for now, the list of circuits to be removed, and obtain a converged power flow solution.

To run a static contingency analysis, select **Run>Steady-State>Contingency Analysis**. A dialog box will pop up to allow setting up execution parameters.

On the contingency selection frame, on the left side of this dialog box, it is possible to select which contingencies to run. The user must double-click on the contingency list item to select or undo the selection. It is possible to select all or clean all items clicking on the radio buttons at the bottom of the list. With a single click on a contingency list item, the elements for that contingency are shown in the Element List.

It is possible to enable the admittance (Y) reduction method, to try to solve a contingency that does not converge when the circuit(s) is (are) switched off. In this method the admittance is reduced until the MVA flow falls bellow 1 MVA. At this point the breakers are opened and a final load-flow is run.

The user may also choose whether to restore the pre-contingency case or keep the post-contingency case at the end of the contingency analysis.

Static contingency results may be put in user-defined tables (UDT), if they are defined. Each contingency corresponds to a different case

The Newton power flow execution parameters available are:

- **Flat Start**: Initializes all buses with angle=0 deg and uncontrolled V=1.0 pu.
- **Reset Voltages to the Specified Values**: This option initializes voltage for generation-controlled buses with specified values
- **Block Tap Control**: This option blocks the OLTC type control.
- **Discrete Tap Control**: Forces the tap position to a realistic discrete step.
- **Apply Tap Control at Iteration**: Specifies the iteration at which the OLTCs will start acting to hold controlled voltages at specified values.
- **Block P.Shifters**: This option blocks the phase shift type control.
- **Apply Mvar limits at Iteration**: Specifies the iteration at which the generators Mvar limits will be reinforced.
- **Interchange Control**: This option enables power interchange control between areas.
- **Block Shunt Control**: This option blocks shunt voltage control.

The convergence report for all contingencies is printed on the Message Window.

Sensitivity Analysis

The sensitivity report table can be displayed with control variables in rows and dependent variables in columns or vice-versa. This flexibility is important, once the report can be sorted and, thus, it is possible to see, in the dV/dPL report, for instance, which Load variation will affect most one given voltage, or, on the other hand, which voltage will be most affected by one given Load variation. The first information will be obtained if the dV/dPL report has control variables (Loads) in rows and dependent variables (voltages) in columns, while the second, if the Loads are in columns and voltages in rows.

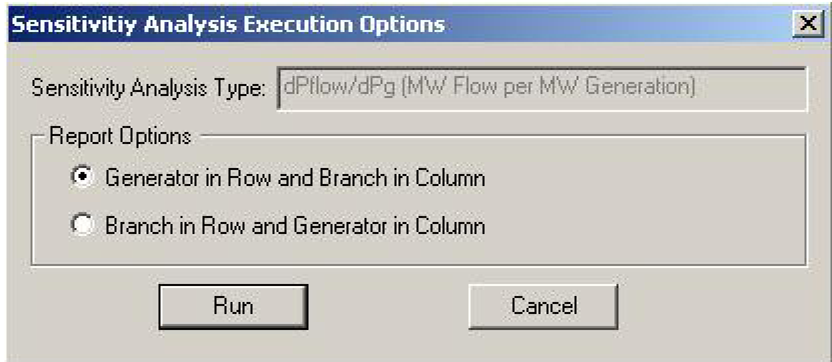
Prior to running the sensitivity analysis, the user must define the sensitivity analysis data and obtain a converged power flow solution.

To run a sensitivity analysis, simply select **Run>Steady-State>Sensitivity Analysis** .

Select the table orientation by clicking in the proper radio button in the **Report Options** frame and press button **Run** .

The analysis is performed right away and the results are put in the sensitivity folder in the report tables.

OBS: It is important to note that for any injection Δ P in the system, there is a corresponding change -Δ P in slack bus. Thus, the sensitivity analysis results are dependent on the slack bus location.


Sensitivitiy Analysis Execution Options
Sensitivity Analysis Type:
dPflow/dPg (MW Flow per MW Generation)
Report Options
Generator in Row and Branch in Column
Branch in Row and Generator in Column
Run
Cancel

Tools, Options and Preferences

The **Tools** menu contains options for building the knowledge base file, bulk contingency data files for either static contingency or time domain simulation, based on area number and voltage level, setting default options for load-flow, time domain simulation, reports, etc. and defining color preferences for single-line diagram and plottings.

Preferences

Select **Tools>Preferences>Drawing Plots** to define color preferences for single-line diagrams drawings.

Select **Tools>Preferences>Time Domain Plots** to define color preferences for curves, background, text titles and grid for all graphs.

Time Domain Simulation Options

Parameters:

Minimum Step: Minimum value the time step can assume.

Maximum Step: Maximum value the time step can assume.

Relative Tolerance: Relative tolerance measures the error relative to the size of each state. The relative tolerance represents a percentage of the state's value. The default, 1e-3,means that the computed state will be accurate to within 0.1%.

Absolute Tolerance: Absolute tolerance is a threshold error value. This tolerance represents the acceptable error as the value of the measured state approaches zero.

Note: Error tolerances - The integration method uses standard local error control techniques to monitor the error at each time step. During each time step, the solvers compute the state values at the end of the step and also determine the local error, the estimated error of these state values. They then compare the local error to the acceptable error, which is a function of the relative tolerance (*rtol*) and absolute tolerance (*atol*). If the error is greater than the acceptable error for any state, the solver reduces the step size and tries again:

The error for the i_{th} state, e_i, is required to satisfy $e_i<(rtol*|x_i|+atol)$

By default Organon sets the absolute tolerance for each state to 1e-4.

Synchronous Machine Parameters Changing with Frequency: This option allows for synchronous machine parameters changing with frequency.

Automatic Termination for Angular Instability: This options allows for simulation termination when angular instability is detected. This is useful when the system model is not suitable for simulations of unstable system (e.g., lack of required protection models). Also it saves lots of computation time because unstable systems develop high frequency transients, which forces time step to small values).

Power Flow Options

Organon allows changing the following program execution parameters and controls:

Flat Start: This option forces initialization of all buses with angle set to zero and uncontrolled voltages set to 1.0 pu. Usually this option is not selected because the voltages and angles in memory loaded are better guesses for convergence. These values are often results of previously converged cases. Flat start is also not robust for stressed load flow conditions.

Reset Voltages to the Specified Values: This option forces the algorithm to use the specified voltage for generation controlled buses. If this value is not selected, the algorithm uses the current terminal voltage, which can be different from the specified voltage. It is recommended the this option is always selected.

Block Tap Control: Selecting this option blocks the OLTC type control. This is tipically used when there is no interesting in changing a previously converged case.

Discrete Tap Control: This option forces the tap position to a realistic discrete step.

Apply Tap Control at Iteration: Specifies the iteration at which the OLTCs will start acting to hold controlled voltages at specified values.

Apply Mvar limits at Iteration: Specifies the iteration at which the generators Mvar limits will be reinforced.

Interchange Control: This option selects power interchange control between areas. This option is only enabled if there is at least one area with swing bus defined. Note that selecting this option requires special care in setting the specified MW interchange values.

Block Shunt Control: This allows for blocking shunt voltage control.

Choose Swing: This option allows for the program to automatically choose a swing bus for electrical islands in the system, if none swing bus is specified for those islands. This is useful for contingency analysis in which may happen that a branch opening can cause part of the network to be island.

Maximum Number of Iterations: Maximum allowed number of iterations. If the power flow does not converge after that number of iterations, the iterative process is terminated.

Power Tolerance: Individual bus tolerance threshold for considering the power flow equations converged.

Default Voltage Threshold: Default values for classifying a bus voltage as either an overvoltage or undervoltage.

Report Options

Report Items: This list of options defines all possible reports that can be printed in report files (*.rep), which are text (ASCII) files. Select

Options

Select **Tools>Options** to open the Options dialog box. There are options available for defining the contents of report file and setting power flow and time simulation solution parameters.

Note: Changing these parameters only affects the current Organon Session. To make them permanently, one has to edit the Organon.prm file.

Restore Initial PF State

If a load-flow does not converge, it is possible to restore initial voltage modules and angles, and taps values by selecting **Tools>Restore Initial PF State**.

Build TDS Contingency

Organon has the facility of defining time domain simulation data, based on area number and voltage level. This automated process creates the file **TDCTGBuild.evt**, in the same directory Organon.exe is, which contains a list of contingencies corresponding to all circuits that match the voltage range and area number defined by the user. Each contingency consists of a fault followed by the circuit removal. The user can define the fault impedance and duration, which will be used for all contingencies.

To build the PF contingency data file, select **Tools>Build PF Contingency**. Then define the voltage level range, the area number and the fault impedance and duration.

Build PF Contingency

Organon has the facility of defining static contingency data based on the monitored region (region defined by report filters), or based on area number and voltage level. This automated process creates the file **CTGBuild.ctg** , in the same directory Organon.exe is located. This file contains a list of single contingencies corresponding to all circuits that match the selection defined by the user.

To build the PF contingency data file, select **Tools>Build PF Contingency** . On the dialog box, select wheter to use the monitored region or the voltage range and area number. If the monitored region has been selected, press button Ok. If not, define the voltage level range and the area number and then press button Ok.

Build Knowledge Base

EMS cases usually are not suitable for planning studies, due to problems like different bus numbering, for example. Organon has the EMS case to planning case conversion facility (Conversion from Real-Time Case into Planning Case). This conversion is based on rules that use attributes match scoring and topological search. These attributes are stored in a planning case knowledge base, which is built from a planning base case.

To build the planning case knowledge base file, select **Tools>Build Knowledge Base**. Then select a planning case in the Open File dialog box. The knowledge base file is called **PlanningKB.dat** and is generated in the same directory Organon.exe is.

Formats

Required Files for EMS CASE to PLANNING CASE Conversion

Bellow you will find an example of each of the three files needed for file conversion (Conversion from Real-Time Case into Planning Case):

EMSKB.DAT:

RJUSAN0A 10 19.00 01

RJUSAN0D 11 25.00 01

RJUSFL0A 14 13.80 01

RJUSFL0B 15 13.80 01

EMSTABLE.DAT:

RJUSAN0A 10

RJUSAN0D 11

SPUSLB0D 12

SPUSLB0E 12

PLANNINGKB.DAT:

57 "IVAIPOR-R540" 0 1 69.0 0.0 0.0 1

58 "IVAIPORA--T2" 1 1 3.6200

58 "IVAIPORA--T2" 0 1 765.0 0.0 0.0 3

57 "IVAIPOR-R540" 1 1 3.6200

65 "IVAIPORA-765" 1 1 0.8220

66 "IVAIPORA-525" 1 2 0.1700

Parameter File

The default parameters and options for Organon are stored in the file **Organon.prm**. The user can open and edit this file using a text editor. Some of those parameters can be changed using dialog box. However, these changes are ignored after exiting the program. Editing Organon.prm is currently the only way of changing the parameters permanently.

If Organon.prm is not found or it is corrupted Organon assumes the following default values.

NUMERICAL PARAMETERS FOR DATA CHECKING	**VALUE**
Minimum impedance value (pu)	0.0001
Maximum impedance value (pu)	100.
Tap default value	1.0
Minimum value for minimum tap	0.001
Maximum value for minimum tap	1.1
Minimum value for maximum tap	0.9
Maximum value for maximum tap	1000.0
Minimum value for phase shifter angle (deg)	-60.0
Maximum value for phase shifter angle (deg)	60.0
Minimum value for DC line resistance (pu)	0.00001
Maximum value for DC ground resistance (pu)	0.0
Maximum value for DC line reactance (pu)	0.00001
Minimum value for firing (alpha) angle (deg)	0.0
Maximum value for firing (alpha) angle (deg)	30.0
Minimum value for extinction (gamma) angle (deg)	0.0
Maximum value for extinction (gamma) angle (deg)	30.0
Undervoltage threshold	0.9
Overvoltage threshold	1.1
Merge shunt data specified to the same bus	Y
NUMERICAL PARAMETERS FOR POWER FLOW SOLUTION	**VALUE**
Maximum active power mismatch (converg.&interch.) (pu)	0.001
Minimum voltage value (input check&overvoltage) (pu)	0.8
Maximum voltage value (input check&overvoltage) (pu)	1.3
PF Voltage level to change loads from P or I to Z model	0.7
CTG Voltage level to change loads from P or I to Z model	0.8

CPF Voltage level to change loads from P or I to Z model	0.01
Gen units dispatch mode (0-maxixum,1-mininum,2-fixed)	1
PF Number of times allowed for control limit bouncing	5
CTG Number of times allowed for control limit bouncing	5
CPF Number of times allowed for control limit bouncing	3
PF Maximum number of iterations (convergence)	30
CTG Maximum number of iterations (convergence)	20
CPF Maximum number of iterations (convergence)	16
PF Number of iterations with Gen MVAr controls off	0
CTG Number of iterations with Gen MVAr controls off	0
CPF Number of iterations with Gen MVAr controls off	0
PF Number of iterations with Shunt MVAr controls off	0
CTG Number of iterations with Shunt MVAr controls off	0
CPF Number of iterations with Shunt MVAr controls off	0
PF Number of iterations with Tap controls off	0
CTG Number of iterations with Tap controls off	0
CPF Number of iterations with Tap controls off	0
PF Load Model: 0 as in input data, 1 CZ, 2 CI, 3 CP	0
CTG Load Model: 0 as in input data, 1 CZ, 2 CI, 3 CP	0
CPF Load Model: 0 as in input data, 1 CZ, 2 CI, 3 CP	3
PF Overload Level: 1-Normal, 2-Alert, 3-Emergency	1
CTG Overload Level: 1-Normal, 2-Alert, 3-Emergency	1
CPF Overload Level: 1-Normal, 2-Alert, 3-Emergency	1
NUMERICAL PARAMETERS FOR TIME DOMAIN SIMULATION	**VALUE**
Minimum Time Step (s)	0.0001
Maximum Time Step (s)	40.
Relative Tolerance	0.001
Absolute Tolerance	0.001
Maximum number of curves for TDS plotting	500

Maximum number of graphs for TDS plotting	50
OPTIONS FOR POWER FLOW SOLUTION	**Y->YES or N->NO**
PF Reset controlled voltages to specified values	Y
CTG Reset controlled voltages to specified values	N
CPF Reset controlled voltages to specified values	N
PF Use Flat Start	N
CTG Use Flat Start	N
CPF Use Flat Start	N
PF Block Shunt Control	N
CTG Block Shunt Control	Y
CPF Block Shunt Control	Y
PF Block Tap Control	N
CTG Block Tap Control	Y
CPF Block Tap Control	N
PF Enable discrete tap	N
CTG Enable discrete tap	N
CPF Enable discrete tap	N
PF Block Phase Shift control	N
CTG Block Phase Shift control	Y
CPF Block Phase Shift control	N
PF Enable area interchange control	N
CTG Enable area interchange control	N
CPF Enable area interchange control	N
PF Enable auto-selection of Swing Bus for islands	Y
CTG Enable auto-selection of Swing Bus for islands	Y
CPF Enable auto-selection of Swing Bus for islands	Y
PF Voltage dependent MVA thermal limit (current)	Y
CTG Voltage dependent MVA thermal limit (current)	Y
CPF Voltage dependent MVA thermal limit (current)	Y
Use only diagonal pivoting in Newton Solution	Y

Display control limit messages	N
OPTIONS FOR TIME DOMAIN SIMULATION	**Y->YES or N->NO**
Termination of Simulation if instability detected	Y
Variation of Synchr. Machine parameters with frequency	N
OPTIONS FOR REPORTS	**Y->YES or N->NO**
Bus report	Y
Flow report	Y
HVDC report	N
Area report	N
MVAr generation report	N
Line/Trafo loading report	N
Undervoltage report	N
Overvoltage report	N
Contingencies ranking report	N
Voltage differences report	N
MVAr generation differences report	N
MVA branch flows differences report	N
NUMERICAL PARAMETERS FOR REPORTS	**VALUE**
Number of areas for report (0 means all areas)	0
Number of 1st area for report only if # areas for rep.>0	-
Number of 2nd area for report only if # areas for rep.>0	-
Number of 3rd area for report only if # areas for rep.>0	-
Number of 4th area for report only if # areas for rep.>0	-

Anarede Data Format

O filtro do Organon para leitura do formato Anarede (*.PWF) tem o objetivo de importar dados no formato Anarede para o Organon e exportar dados do Organon para o Anarede. Entretanto, nem todos os dados podem ser importados e/ou exportados. Isso acontece porque nem todas as informações contidas nas estruturas de dados de entrada desses códigos são armazenadas internamente no Organon, há modelos no Anarede que não são suportados pelo Organon e vice-versa, e nem todos os códigos do Anarede podem ser lidos pelo Organon. O objetivo da leitura é preencher as estruturas de dados do Organon. A princípio, o que é lido e entendido pelo Organon pode ser reescrito por este em formato de cartão do Anarede.

Quando o Organon abre um arquivo *.PWF para leitura, ele procura no mesmo diretório deste arquivo um arquivo de nome Bnt1.DAT (o mesmo que é utilizado pelo programa Anate0 do CEPEL) e um arquivo de nome Shunt.DAT. Do arquivo Bnt1.DAT, o Organon retira informação sobre o número mínimo e máximo de geradores por barra, impedância do transformador elevador, etc. Com isso, o Organon pode determinar o número de unidades por barra de geração e automaticamente fazer o ajuste da impedância do transformador elevador, caso exista um, estabelecer limites de geração, ajustar modelos dinâmicos equivalentes, se estes forem carregados na memória, etc. Portanto, é altamente recomendado que se tenha o Bnt1 no mesmo diretório do arquivo PWF. *É importante observar que se forem realizadas simulações dinâmicas com base nos dados de rede lidos de um arquivo do Anarede, é* ***imperativo*** *que o arquivo Bnt1.DAT seja colocado no mesmo diretório do arquivo *.PWF. Sem isso certamente ocorrerão erros severos de inicialização dos modelos dinâmicos*.

Do arquivo Shunt.DAT, o Organon retira os dados de elementos shunt discretos por barra, podendo então fazer o ajuste automático de tensões através a inserção/remoção de elementos shunt do sistema quando realiza um cálculo de fluxo de potência. O formato de dados no arquivo Shunt.DAT é o mesmo do formato Organon (*.NTW, Ver Appendix I) e PSS/E (*.RAW). Todavia, os campos ‘Voltage Upper Limit’, ‘Voltage Lower Limit’ e ‘Current MVAR Generation’ não são utilizados na leitura do arquivo Shunt.DAT. Ou seja, a geração de MVAR inicial é retirada dos dados de fluxo de potência (arquivo. *.pwf) e os limites para controle de tensão são estabelecidos como sendo a tensão especificada (ou convergida) para a barra controlada $\pm$ 0.01 pu.

A seguinte lista contém os códigos de leitura atualmente suportados pelo filtro.

- DBAR
- DLIN
- DARE
- DGLT
- DGBT
- DGER
- DSHL
- TITU
- DCAR
- DELO
- DCLI
- DCBA
- DCNV
- DCCV
- DINJ
- DOPC

- DCTE
- DCSC - O organon não suporta modelo de capacitor série controlado. Esses dados são transformados em dados de ramo.
- DCER - O modelo de compensação shunt controlada do Organon é diferente da do Anatem e não requer dados de inclinação da regulação. Os dados de grupo também são perdidos.

PSS/E Format

Organon is able to read PSS/E (Release 26) raw data. However, the following objects are not used in or not modeled in Organon.

Transformer Impedance Correction Tables

Multi-Terminal DC Line Data.

Multi Section Line Grouping Data.

Owner Data.

FACTS Control Device Data.

For details on this format refer to PSS/E manuals.

Organon Format

Organon format was developed in order to enable entering network data without the need of any "fictitious" element to represent equipments in real power systems. So far, the only limitation is found in the representation of three winding transformers, whose data is entered in the form of three two winding transformers, connected to the same "fictitious" node.

Follows the sequence of elements to be read and a description of the data required for each of these elements:

VERSION NUMBER

DAY, YEAR AND MVA BASE

CASE HEADER

BUS DATA

LOAD DATA

GENERATOR DATA

SHUNT DATA

TRANSMISSION LINE DATA

TRANSFORMER DATA

SERIES COMPENSATION DATA

HVDC DATA

AREA DATA

AREA INTERCHANGE DATA

ZONE DATA

OWNER DATA

OBS:

All DATA sets end with a null record (0 /);

All DATA sets require one record per element, except HVDC data, where there are 3 records for each HVDC (HVDC Control, Rectifier and Inverter).

The following table summarizes all required data, per record:

Set	Required Data
BUS	Bus identification in the form Number.Id
	Bus name (up to 12 characters)
	Base voltage in kV
	Bus type (0=load bus; 1=load bus withvoltage limits; 2= generation bus; 3=swing bus and 4=Isolated bus)
	Bus shunt (Gsht+jBsht) status (0 = off, 1 = on)
	Gsht (real part of shunt element in p.u.)
	Bsht (imaginary part of shunt element in p.u.)
	Bus area number
	Bus zone number
	Bus voltage module in p.u.
	Bus voltage angle in degrees
	Voltage threshold for overvoltage detection in p.u.
	Voltage threshold for undervoltage detection in p.u.
	Bus owner number

Set	Required Data
LOAD	Bus identification in the form Number.Id
	Load identifier
	Load status (0=off; 1=on)
	Load area number
	Load zone number
	MW to be considered as constant power in the ZIP model
	MVAR to be considered as constant power in the ZIP model

MW to be considered as constant current in the ZIP model

MVAR to be considered as constant current in the ZIP model

MW to be considered as constant impedance in the ZIP model

MVAR to be considered as constant impedance in the ZIP model

Load owner number

Set	Required Data
GENERATOR	Bus identification in the form Number.Id
	Generator identifier
	Generation in MW
	Generation in MVAR
	Maximum generation in MVAR
	Minumum generation in MVAR
	Specified controlled voltage in p.u.
	Controlled bus identification in the form Number.Id
	Generator power base in MVA
	Step-up transformer resistance in p.u.
	Step-up transformer reactance in p.u.
	Step-up transformer tap
	Generator status (0=off; 1=on)
	Participation factor for remote bus voltage control in %
	Maximum generation in MW
	Minimum generation in MW
	Group number (identify similar machines in the same power plant)

Set	Required Data
SHUNT	Bus identification in the form Number.Id
	Control mode (0=fixed; 1=discrete; 2=continuous or SVC)
	Voltage control range upper bound (for discrete mode) or specified voltage (for continuous mode) in p.u.
	Voltage control range lower bound (for discrete mode) in p.u. Not used for continuous control mode.

	Controlled bus identification in the form Number.Id
	Initial shunt admittance MVAR
	Number of elements of first MVAR bank
	Size of the elements of the first bank in MVAR
	Number of elements of second MVAR bank
	Size of the elements of the second bank in MVAR
	Number of elements of third MVAR bank
	Size of the elements of the third bank in MVAR
	Number of elements of fourth MVAR bank
	Size of the elements of the fourth bank in MVAR
	Number of elements of fifth MVAR bank
	Size of the elements of the fifth bank in MVAR
	Number of elements of sixth MVAR bank
	Size of the elements of the sixth bank in MVAR
	Number of elements of seventh MVAR bank
	Size of the elements of the seventh bank in MVAR
	Number of elements of eighth MVAR bank
	Size of the elements of the eighth bank in MVAR

Set	Required Data
TRANSMISSION LINE	Bus From identification in the form Number.Id
	Bus To identification in the form Number.Id
	Circuit identifier
	Series resistance in p.u.
	Series reactance in p.u.
	Total line charging in MVAR
	Limit 1 in MVA
	Limit 2 in MVA
	Limit 3 in MVA
	Bus From line shunt status (0 or 1)

	GshtF (real part of shunt element connected to Bus From in p.u.)
	BshtF (imaginary part of shunt element connected to Bus From in p.u.)
	Bus To line shunt status (0 or 1)
	GshtT (real part of shunt element connected to Bus To in p.u.)
	BshtT (imaginary part of shunt element connected to Bus To in p.u.)
	"Bus From" Line breaker status (0=off; 1=on)
	"Bus To" Line breaker status (0=off; 1=on)
	Line length (not used)
	Area
	Zone
	Line owner

Set	Required Data
TRANSFORMER	Bus From identification in the form Number.Id
	Bus To identification in the form Number.Id
	Circuit identifier
	Transformer type (1=fixed tap; 2=OLTC; 3=SOLTC)
	Resistance in p.u.
	Reactance in p.u.
	Limit 1 in MVA
	Limit 2 in MVA
	Limit 3 in MVA
	Tap in p.u.
	Phase shift in degrees
	Controlled bus identification in the form Number.Id
	Remote controlled bus side (1=Bus From side; 2=Bus To side)
	Upper limit of tap range
	Lower limit of tap range

Upper limit of controlled voltage range in p.u.

Lower limit of controlled voltage range in p.u.

Tap step in p.u.

Bus From shunt status (0 or 1)

GshtF (real part of shunt element connected to Bus From in p.u.)

BshtF (imaginary part of shunt element connected to Bus From in p.u.)

Bus To shunt status (0 or 1)

GshtT (real part of shunt element connected to Bus To in p.u.)

BshtT (imaginary part of shunt element connected to Bus To in p.u.)

Transformer "Bus From" breaker status (0=off; 1=on)

Transformer "Bus To" breaker status (0=off; 1=on)

Control status (0=off; 1=on)

Area

Zone

Owner

Set	Required Data
SERIES CAPACITOR	Bus From identification in the form Number.Id
	Bus To identification in the form Number.Id
	Circuit identifier
	Resistance in p.u.
	Reactance in p.u.
	Limit 1 in MVA
	Limit 2 in MVA
	Limit 3 in MVA
	Bus From shunt status (0 or 1)
	GshtF (real part of shunt element connected to Bus From in p.u.)
	BshtF (imaginary part of shunt element connected to Bus From in p.u.)

Bus To shunt status (0 or 1)

GshtT (real part of shunt element connected to Bus To in p.u.)

BshtT (imaginary part of shunt element connected to Bus To in p.u.)

"Bus From" breaker status (0=off; 1=on)

"Bus To" breaker status (0=off; 1=on)

Area

Zone

Owner

Set	Required Data
HVDC CONTROL	Bipole Number
	Area
	Zone
	Control mode (1=Power at inverter; 2=Current at inverter; 3=Power at rectifier; 4=Current at rectifier)
	DC line resistance in ohms
	DC control set value (power in MW or current in A)
	Scheduled voltage (kV)
	Voltage threshold to convert control mode from power to current in kV
	Current margin for inverter control in p.u.
	Compounding resistance
	Minimum compounded DC voltage (kV) (not used)
	Iteration limit for capacitor commutated DC line (not used)

Set	Required Data
RECTIFIER	Bus identification in the form Number.Id
	Number of converters in series connection
	Maximum firing angle in degrees
	Minimum firing angle in degrees
	Commutation transformer resistance in ohms
	Commutation transformer reactance in ohms

	Base voltage phase-phase of converter transformer secondary side in kV
	Transformer turns ratio
	Transformer Tap
	Upper limit of transformer tap range
	Lower limit of transformer tap range
	Transformer tap step (positive)
	Commutating capacitor reactance per bridge in ohms

Set	Required Data
INVERTER	Bus identification in the form Number.Id
	Number of converters in series connection
	Maximum extinction angle in degrees
	Minimum extinction angle in degrees
	Commutation transformer resistance in ohms
	Commutation transformer reactance in ohms
	Base voltage phase-phase of converter transformer secondary side in kV
	Transformer turns ratio
	Transformer Tap
	Upper limit of inverter transformer tap range
	Lower limit of inverter transformer tap range
	Transformer tap step (positive)
	Commutating capacitor reactance per bridge in ohms

Set	Required Data
AREA	Area Number
	Area swing bus identification in the form Number.Id
	Net interchange in MW
	Interchange mismatch in MW
	Area name (up to 30 characters)

Set	Required Data
ZONE	Zone number

	Zone name (up to 8 characters)
Set	Required Data
OWNER	Owner number
	Owner name (up to 8 characters)

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