Univesitatea Tehnică a Moldovei
Facultatea de Energetică
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Primii pasi in PSS/E

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« Programarea si Utilizarea Calculatoarelor II »

Hardware and Software Requirements

To install and run *PSS/E-30*, it is recommended that your **computer system** has the following:

- IBM PC or compatible with a PentiumIV-class **2 GHz** or faster CPU.
- **512 MB** or more of RAM is highly recommended.
- Approximately **90 MB** of free disk space (160 MB with documentation) is required for a full installation of PSS/E. Be sure to allow sufficient room for working files. You will need to allow additional disk space to support Windows' use of virtual memory.
- Windows 2000 or **WindowsXP**.
- PSS/E is written for an ideal SVGA display resolution of **1024x768** pixels. We highly recommend using 1024x768 resolution with the "small fonts" option enabled, and using a 17" or larger monitor. An AGP card with color palette at a minimum setting of 32 -bit (True Color) is highly recommended to improve graphics performance.
- Windows compatible **mouse**.
- You must have **administrative privileges** to install PSS/E; you do not need administrative privileges in order to run the program.

Memory Requirements

PSS/E requires a significant amount of computer memory in order to execute. This memory may be either **physical RAM** or virtual memory in the form of a **swap file** on your hard disk. For most efficient operation, however, your system should have sufficient physical memory to contain the PSS/E program plus those data arrays that are dynamically allocated while the program is running.

Because of these dynamic arrays, it is hard to determine the exact amount of memory that may be required in a particular case. However, here are some approximate memory requirements that can be used for planning purposes:

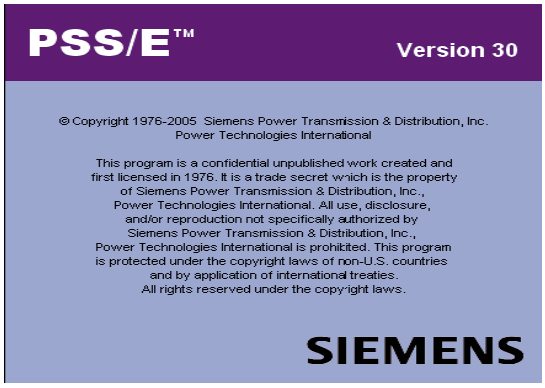
• 4,000 bus	load flow, 40MB.	dynamics, 20MB.
• 50,000 bus	load flow, 90MB.	dynamics, 70MB.
• 100,000 bus	load flow, 140MB.	dynamics, 120MB.
• 150,000 bus	load flow, 190MB.	dynamics, 170MB.

Keep in mind that the operating system itself, along with any other programs that may be running, can consume a great deal of memory. Here again, a monitoring tool such as Task Manager can be very helpful in determining the amount of memory that is really available for PSS/E.

It is possible to run PSS/E even if there is not sufficient physical memory on your system. Performance is sure to suffer in that case, but the program should still execute if enough virtual memory is available. Consult with your computer administrator if you need to increase the amount of virtual memory on your system.

Installation

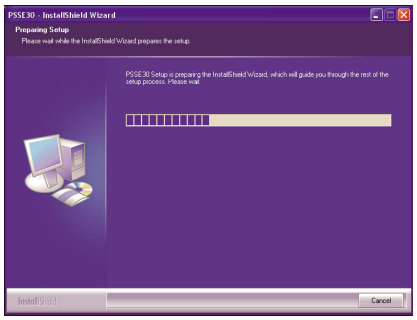
1. Insert the supplied PSS/E-30 installation CD in your CD reader.
2. The installer program should start running automatically.
3. When the installer first starts, it will display the initial screen:

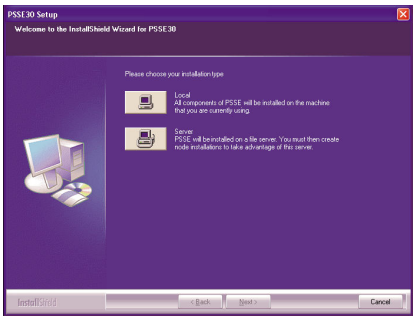


If you are running Windows 2000 or Windows XP, you must have administrative privileges on the target machine in order to install PSS/E. Setup will check for your privileges and will stop the installation process with a warning if you do not have the necessary privileges.

Installation

Once the installer has initialized itself, the Welcome screen will display:

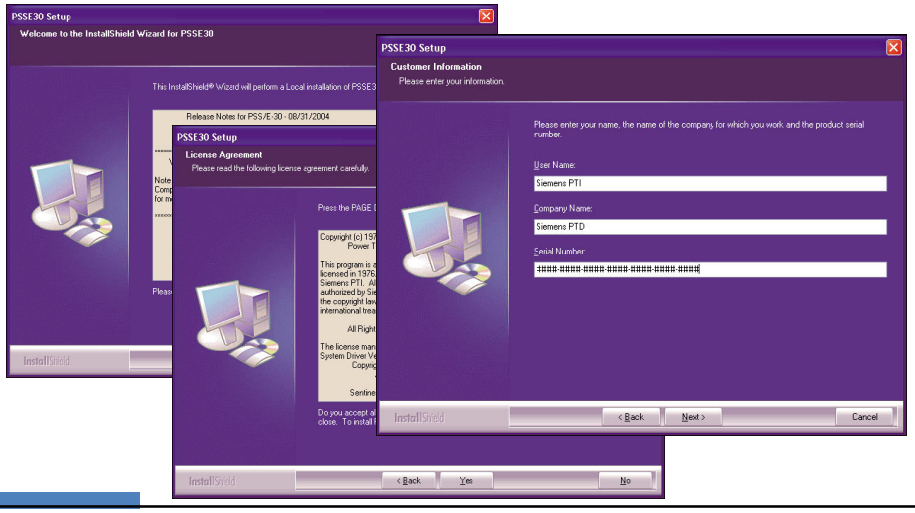




which will allow you to select the type of installation that is to be performed. The choices are ***Local*** and ***Server***. At any point during the installation where the ***Next*** and ***Back*** buttons are displayed, you can either accept the default response and move ahead by clicking ***Next***, or go backwards to a previous dialog box by clicking ***Back***.

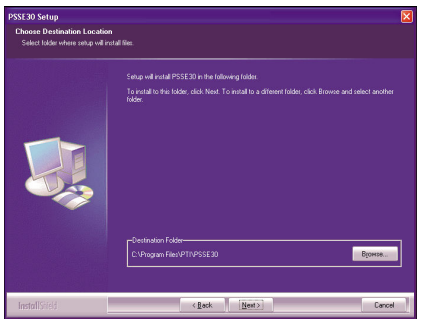
Installation

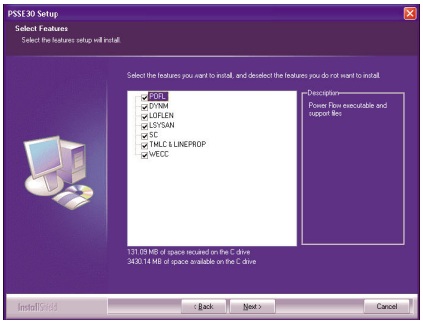
Clicking the ***Local*** button will generally start a full installation of PSS/E-30 on your machine.



Installation

Choose a destination directory for PSS/E. The default directory is **C:\Program Files\PTI\PSSE30**, which should be satisfactory in most cases. Once you are satisfied with the directory you have chosen, click ***Next*** to continue.

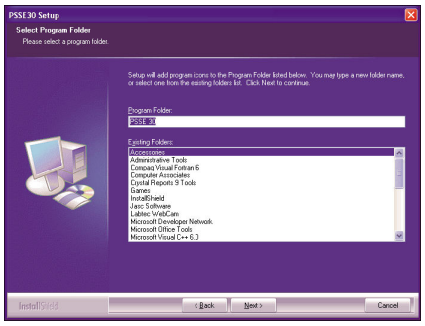


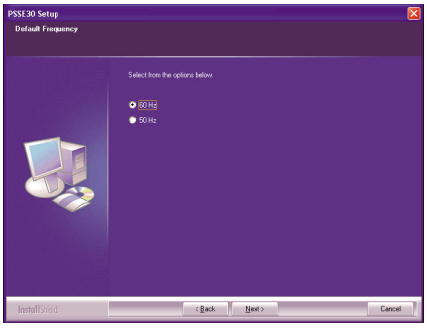


Setup now shows you a list of all of your licensed program sections and options which require files to be placed on the computer's disk. By default, Setup will install all of your licensed sections and options. If the machine to which you are installing PSS/E is short on disk space, you may wish to deselect one or more licensed sections or options. Make your selections and click ***Next*** to continue.

Installation

The following screen allows you to select or specify the Program Folder (i.e., the name of the folder under ***Start>Programs***) that will be used to contain all the PSS/E-30 programs that are being installed on the system. After selecting/specifying the Folder name, click ***Next*** to continue.

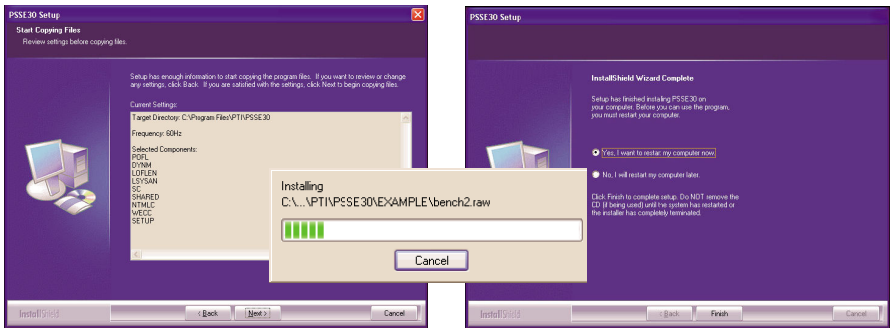




Select the appropriate operating frequency for your studies. By default, PSS/E is set for 60 Hz, but you may also select 50 Hz operation. When you are satisfied with your selection, click ***Next*** to continue.

Installation

Setup will now show you a summary of choices you have made in the course of the installation dialogs. If you are unsatisfied with any of these choices, you may use the ***Back*** button to move to the appropriate dialog and change your selections. When you are satisfied with your selections, click ***Next*** to allow Setup to copy files and install PSS/E.



Setup is now complete. If you do not need to run PSS/E right away, you can choose to restart your machine later.

Standard Maximum Capacities & Functionality

	I/E or S	1,000 Buses	4,000 Buses	12,000 Buses	50,000 Buses	150,000 Buses
TRANSMISSION NETWORK COMPONENTS						
Buses (including "star point" buses of three-winding transformers)	-	1,000	4,000	12,000	50,000	150,000
Loads	I/E	2,000	8,000	24,000	100,000	300,000
Plants	I/E	300	1,200	3,600	10,000	26,840
Machines	I/E	360	1,440	4,000	12,000	33,050
Switched shunts	I/E	126	500	1,500	4,000	10,580
Branches (including transformers and zero impedance lines)	I/E	2,500	10,000	24,000	100,000	300,000
Two-winding transformers (including three-winding transformer members)	I/E	400	1,600	4,800	20,000	60,000
Three-winding transformers	I/E	100	400	1,200	5,000	15,000
Transformer impedance correction tables	S	16	32	64	96	96
Zero impedance lines	I/E	50	200	500	2,000	5,950
Multisection line groupings	I/E	100	400	800	1,600	3,710
Multisection line sections	I/E	250	1,000	2,000	4,000	9,260

	I/E or S	1,000 Buses	4,000 Buses	12,000 Buses	50,000 Buses	150,000 Buses
TRANSMISSION NETWORK COMPONENTS						
Two-terminal dc transmission lines	S	20	30	40	50	50
Voltage source converter (VSC) dc lines	S	10	20	30	40	40
Multiterminal dc lines	S	5	5	5	20	20
Converters per multiterminal dc line	S	12	12	12	12	12
Dc buses per multiterminal dc line	S	20	20	20	20	20
Dc circuits per multiterminal dc line	S	20	20	20	20	20
FACTS control devices	S	20	20	20	50	50
Interchange control areas	S	100	250	500	1,200	1,200
Interarea transfers	S	300	500	1,000	2,000	2,000
Zones	S	999	999	999	2,000	2,000
Owners	S	999	999	999	1,200	1,200
Machine owner specifications	I/E	720	2,880	8,000	24,000	66,100
Branch owner specifications	I/E	5,000	20,000	48,000	200,000	600,000
Zero sequence mutual couplings	S	500	2,000	3,000	4,000	4,000

Through the PSS/E (Power Flow) interface the following functions and analyses are available:

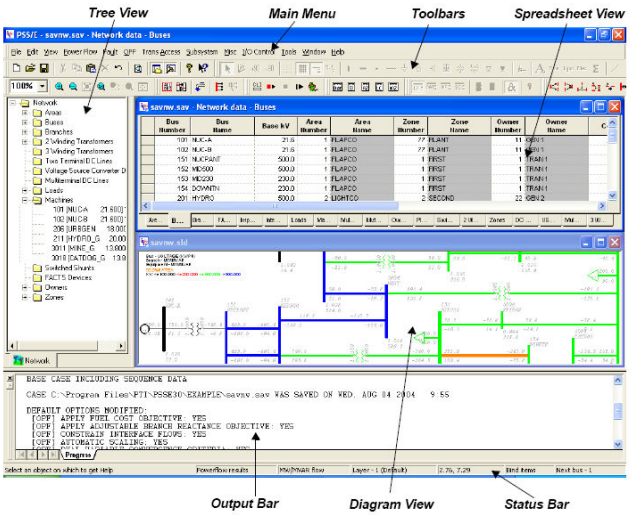
- Power flow and related network functions
- Optimal power flow
- Fault analysis
- Network equivalencing
- One-line diagrams
- Program automation

Overview: The PSS/E User Interface

The PSS/E (Power Flow) interface supports a variety of interactive facilities including:

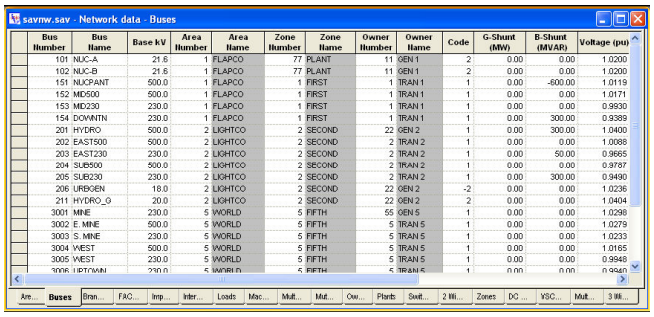
- Introduction, modification and deletion of network data using a spreadsheet.
- Creation of networks and one-line diagrams.
- Steady-state analyses (load flow, fault analysis, optimal power flow, etc.).
- Presentation of steady-state analysis results.

Overview: The PSS/E User Interface



Overview: The PSS/E User Interface

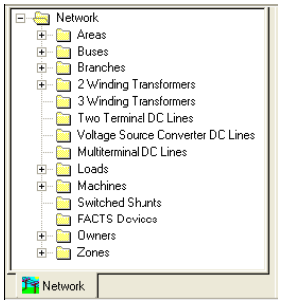
Spreadsheet View



All network data components (e.g., buses, lines, loads) are represented within worksheet style tabs on the spreadsheet. The spreadsheet, or workbook, is synchronized with the bus subsystem selector so that only a subset of the data may be viewed at any time. New network elements may be entered or modified directly in the appropriate worksheet, or existing ones deleted. In the Spreadsheet View, standard Windows commands such as copy and paste actions are supported. Sorting and filtering capabilities are provided to increase usability, especially with large systems.

Overview: The PSS/E User Interface

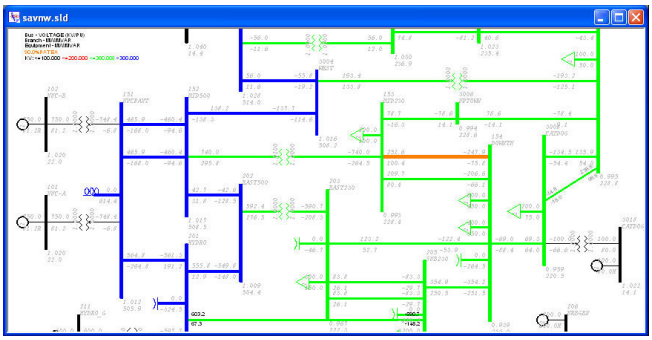
Tree View



The Tree View, as shown in Figure 1-3, provides a hierarchical, expandable and collapsible list view of the network data in the system. It is synchronized with the bus subsystem selector to enable the user to reduce the amount of data presented at any one time. The Tree View is also synchronized with the Spreadsheet and Diagram Views, reflecting their current content.

Overview: The PSS/E User Interface

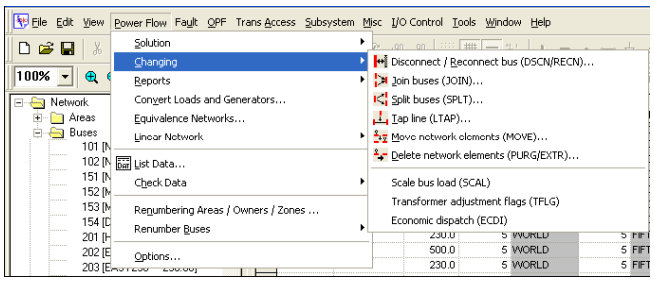
Diagram View



The Diagram View, as shown in Figure 1-4, is used to create, expand and display one-line diagrams of the electrical system. As new elements are added to the diagram, the Spreadsheet and Tree Views are automatically updated to reflect the addition. Additional diagram capabilities include the ability to view power flow and short-circuit analysis results. The Diagram View is not automatically opened. It is initiated by opening an existing one-line drawing file, or by starting a new diagram window.

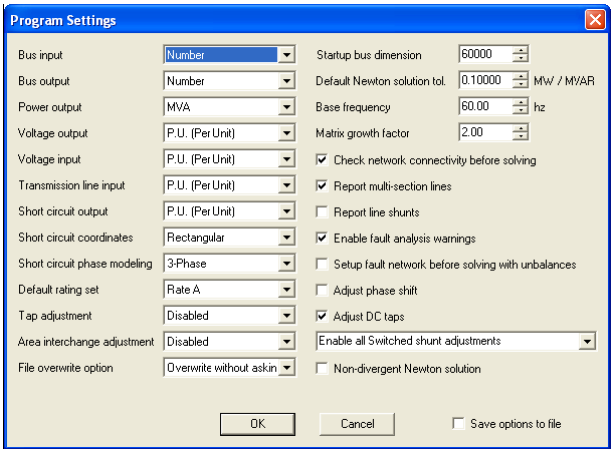
Using the PSS/E User Interface

Typical Interface Menu Showing Historic Activity Names



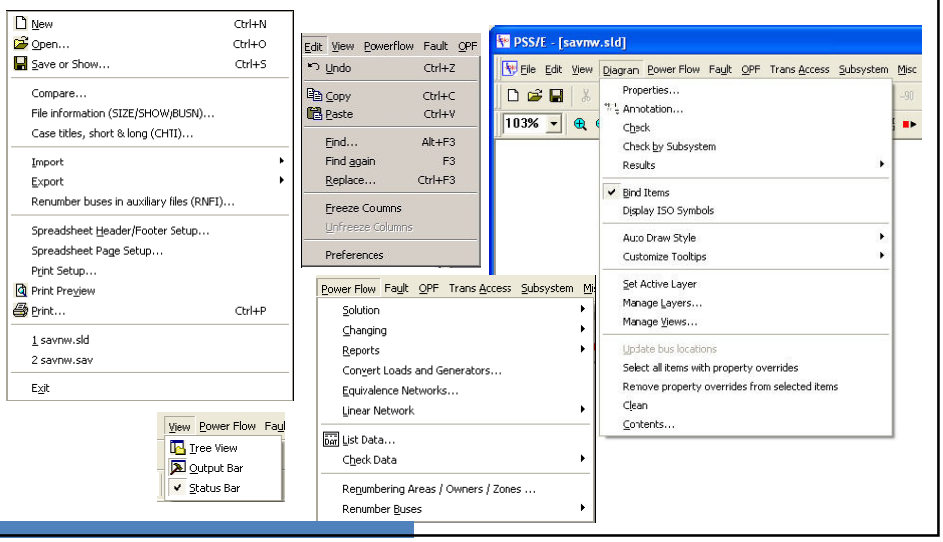
Each analytical function of PSS/E is available directly from pull-down menus and user customizable toolbars. With very few exceptions, the functional activities of the old PSS/E interface all exist in the new PSS/E interface. For convenience, the traditional activity names are shown on many of the menu items, as illustrated in Figure 1-6.

Setting Program Options



Most PSS/E calculation and reporting functions recognize one or more program settings. When PSS/E is installed on the system, default PSS/E program settings are established. You may modify a given program setting during a PSS/E work session by selecting the *Misc>Change program settings (OPTN)...* option.

Menu



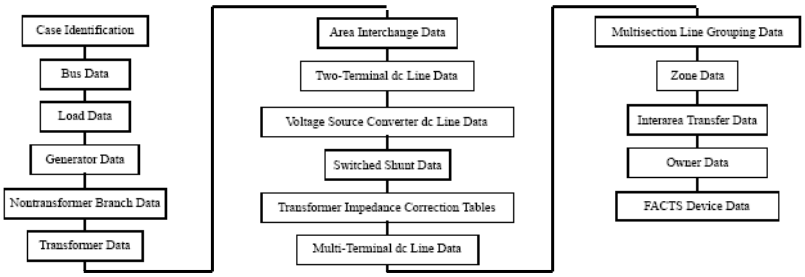
Toolbars

	Create a new case or diagram.
	Open an existing file.
	Save the active documents.
	Select a solution method and solve.
	Set interaction mode to automatically draw parts of the network.
	Split a bus into two buses. / Join two buses into one.
	Insert another bus into a line.
	Generate Bus based reports.
	Generate Area/Zone based reports.
	Generate Area/Owner/Zone total reports.

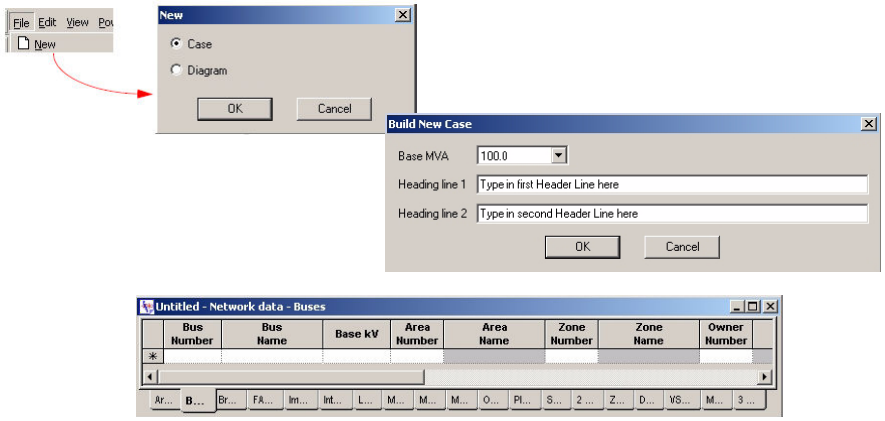
Toolbars

	The **Select** button is used to select diagram items in a Diagram View. Items can be selected using common selection techniques (e.g., dragging a rectangle around several objects, clicking on an item and then holding down the ***Ctrl*** key to add more selections to the selection list). The selected items can then be manipulated in many ways.
	The **Rotation** button is used to rotate diagram items. If the rotation item is selected, and then a diagram item is selected, the cursor changes to a circular arrow. Holding down the left mouse button while dragging the cursor will rotate the selected item around its center. The **+90** button is used to rotate a selected item positive 90 degrees.
	The **Show Grid** button is used to toggle on or off the display of a grid in the Diagram View.
	The **Bus** button is the basic building block of a PSS/E case and a Diagram View. Buses need to exist in a Diagram View before any lines or equipment can be drawn. Buses have a number of discrete "ports" arranged along both sides of the busbar. When connecting lines and equipment to a bus, the connection point will snap to the nearest port.
	The **Bus Node** button is used when busbar representation of the bus is not desired. The bus node has a number of "ports" "stacked" in the center of the node. When connecting lines or equipment to a bus node, the connection point will snap to the center.
	The **Branch** button is used to create a line between two buses. When the branch item is selected, the cursor changes to a crosshair. The branch is started by placing the cross-hair on the FROM bus and clicking. Any number of intermediate kneepoints may then be created by clicking on the way to the TO bus. Clicking on the TO bus will complete the creation of the branch. At any point during the creation of the branch, the branch may be canceled and removed by pressing the ***Esc*** key. The attachment point of a branch on a bus may be changed by ***Ctrl*** clicking on the attachment point of the link and then moving it to another port on the bus.
	The **Load** button is used to create a load on a bus. When the load item is selected, the cursor changes to a crosshair. The load is started by placing the crosshair on the bus and pressing the left mouse button. The mouse is then dragged to where the load symbol is to appear and released.
	The **Generator** button is used to create a generator on a bus. When the generator item is selected, the cursor changes to a crosshair. The generator is started by placing the crosshair on the bus and pressing the left mouse button. The mouse is then dragged to where the generator symbol is to appear and released.
	The **Two-winding Transformer** button is used to create a two-winding transformer between two buses. The two-winding transformer is started by placing the crosshair on the FROM bus and clicking. Any number of intermediate kneepoints may then be created by clicking on the way to the TO bus. Clicking on the TO bus will complete the creation of the two-winding transformer. At any point during the creation of the two-winding transformer, the two-winding transformer may be canceled and removed by pressing the ***Esc*** key. The attachment point of a two-winding transformer on a bus may be changed by ***Ctrl*** clicking on the attachment point of the twowinding transformer and then moving it to another port on the bus.
	The **Three-winding Transformer** button is used to create a three-winding transformer between three buses. The three-winding transformer is created by first selecting three buses. The three buses will be regarded as the FROM, TO, and last bus in the order they were initially selected. The three-winding transformer item is then selected, the cursor placed in the Diagram View at the desired location for the symbol to be placed, and the left mouse button clicked. Any number of intermediate kneepoints may be added to the links between the symbol and the three buses, or the attachment points modified in the manner described above.

Data Input Structure



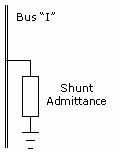
Creating a New Power Flow Case



A new data base can be created merely by typing data elements directly into a blank spreadsheet. This method would typically be limited to only small cases or to establish a small data base into which significantly more data could be pasted into or imported.

Bus Data

Each bus data record has the following format:
I, 'NAME', BASKV, IDE, GL, BL, AREA, ZONE, VM, VA, OWNER
where:



I Bus number (1 through 999997).

NAME Alphanumeric identifier assigned to bus "I". (The name may be up to twelve characters and **must** be enclosed in single quotes. NAME may contain any combination of blanks, uppercase letters, numbers and special characters, but the first character **must not** be a minus sign. NAME is twelve blanks by default.)

BASKV Bus base voltage; entered in kV. BASKV = 0.0 by default.

IDE Bus type code:
1 - load bus (no generator boundary condition)
2 - generator or plant bus (either voltage regulating or fixed Mvar)
3 - swing bus
4 - disconnected (isolated) bus IDE = 1 by default.

AREA Area number (1 through the maximum number of areas at the current size level). AREA = 1 by default.

ZONE Zone number (1 through the maximum number of zones at the current size level). ZONE = 1 by default.

VM Bus voltage magnitude; entered in pu. VM = 1.0 by default.

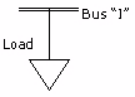
VA Bus voltage phase angle; entered in degrees. VA = 0.0 by default.

OWNER Owner number (1 through the maximum number of owners at the current size level). OWNER = 1 by default.

Each network bus to be represented in PSS/E is introduced through a bus data record. Each bus data record includes not only data for the basic bus properties but also includes information on an optionally connected shunt admittance to ground. That admittance can represent a shunt capacitor or a shunt reactor (both with or without a real component) or a shunt resistor. It *must not* represent line connected admittance, loads, line charging or transformer magnetizing impedance, all of which are entered in other data categories.

Load Data

Each load data record has the following format:
I, ID, STATUS, AREA, ZONE, PL, QL, IP, IQ, YP, YQ, OWNER
where:



I Bus number, or extended bus name enclosed in single quotes.

NAME One- or two-character uppercase nonblank alphanumeric load identifier used to distinguish among multiple loads at bus "I". (It is recommended that, at buses for which a single load is present, the load be designated as having the load identifier '1'. ID = '1' by default..)

STATUS Initial load status of one for in-service and zero for out-of-service. STATUS = 1 by default.

AREA Area to which the load is assigned (1 through the maximum number of areas at the current size level). By default, AREA is the area to which bus "I" is assigned.

ZONE Zone to which the load is assigned (1 through the maximum number of zones at the current size level). By default, ZONE is the zone to which bus "I" is assigned.

PL Active power component of constant MVA load; entered in MW.

QL Reactive power component of constant MVA load; entered in Mvar.

OWNER Owner to which the load is assigned (1 through the maximum number of owners at the current size level). By default, OWNER is the owner to which bus "I" is assigned.

Multiple loads may be represented at a bus by specifying more than one load data record for the bus, each with a different load identifier.

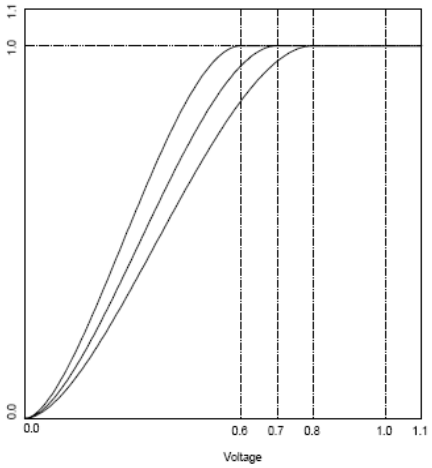
Each network bus at which a load is to be represented must be specified in at least one load data record. If multiple loads are to be represented at a bus, they must be individually identified in a load data record for the bus with a different load identifier. Each load at a bus can be a mixture of loads with different characteristics.

Load Characteristics

The constant power characteristic holds the load power constant as long as the bus voltage exceeds a value specified by the solution parameter PQBRAK. The constant power characteristic assumes an elliptical current-voltage characteristic of the corresponding load current for voltages below this threshold.

Figure depicts this characteristic for PQBRAK values of 0.6, 0.7, and 0.8 pu.

The user may modify the value of PQBRAK by selecting ***Power Flow>Solution>Parameters...*** and modifying the ***Constant power characteristic threshold (PQBRAK)*** located on the General tab.

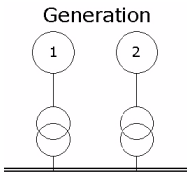


Generator Data

Each generator data record has the following format:

I,ID,PG,QG,QT,QB,VS,IREG,MBASE,ZR,ZX,RT,XT,GTAP,STAT,RMPCT, PT,PB,O1,F1,...,O4,F4

where:



I Bus number, or extended bus name enclosed in single quotes.

ID One- or two-character uppercase nonblank alphanumeric machine identifier used to distinguish among multiple machines at bus "I". (It is recommended that, at buses for which a single machine is present, the machine be designated as having the machine identifier '1'. ID = '1' by default.)

PG Generator active power output; entered in MW. PG = 0.0 by default.

PT Maximum generator active power output; entered in MW. PT = 9999.0 by default.

PB Minimum generator active power output; entered in MW. PB = -9999.0 by default.

QG Generator reactive power output; entered in Mvar. QG need be entered only if the case, as read in, is to be treated as a solved case. QG = 0.0 by default.

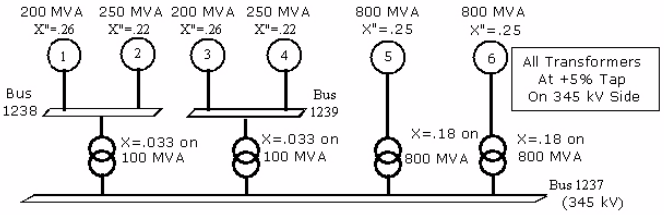
QT Maximum generator reactive power output; entered in Mvar. For fixed output generators (i.e., nonregulating), QT must be equal to the fixed Mvar output. QT = 9999.0 by default.

QB Minimum generator reactive power output; entered in Mvar. For fixed output generators, QB must be equal to the fixed Mvar output. QB = -9999.0 by default.

VS Regulated voltage setpoint; entered in pu. VS = 1.0 by default.

Each network bus to be represented as a generator or plant bus in PSS/E must be specified in a generator data record. In particular, each bus specified in the bus data input with a type code of two (2) or three (3) *must* have a generator data record entered for it.

Generator Data



Generator Data Records:

```
1238  1  200 , ,  120  0  1.03  0  200  0  .26  0  0   1.    1   50  200  60
1238  2  250 , ,  150  0  1.03  0  250  0  .22  0  0   1.    1   50  250  75
1239  3  200 , ,  120  0  1.03  0  200  0  .26  0  0   1.    0   50  200  60
1239  4  250 , ,  150  0  1.03  0  250  0  .22  0  0   1.    0   50  250  75
1237  5  750 , ,  500  0  1.06  0  800  0  .25  0  .18  1.05  1   50  760  240
1237  6  750 , ,  500  0  1.06  0  800  0  .25  0  .18  1.05  1   50  760  240
```

I ID PG QG QT QB VS IREG MBASE ZR,ZX RT,XT GTAP STAT RMPCT PT PB
(not specified)

Nontransformer Branch Data

Each nontransformer branch data record has the following format:
I,J,CKT,R,X,B,RATEA,RATEB,RATEC,GI,BI,GJ,BJ,ST,LEN,O1,F1,...,O4,F4
where:

I Branch *"from bus"* number, or extended bus name enclosed in single quotes.

J Branch *"to bus"* number, or extended bus name enclosed in single quotes.

CKT One- or two-character uppercase nonblank alphanumeric branch circuit identifier. It is recommended that single circuit branches be designated as having the circuit identifier '1'. CKT = '1' by default.

R Branch resistance; entered in pu. A value of R must be entered for each branch.

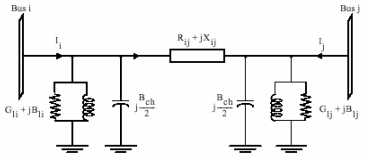
X Branch reactance; entered in pu. A nonzero value of X must be entered for each branch.

B Total branch charging susceptance; entered in pu. B = 0.0 by default.

RATEA \ RATEB \ RATEC First \ Second \ Third current rating; entered in MVA.

LEN Line length; entered in user-selected units. LEN = 0.0 by default.

Oi Owner number (1 through the maximum number of owners at the current size level). Each branch may have up to four owners. By default, O1 is the owner to which bus "I" is assigned (see Section 4.1.1.2) and O2, O3, and O4 are zero.



Each ac network branch to be represented in PSS/E as a nontransformer branch is introduced by reading a nontransformer branch data record

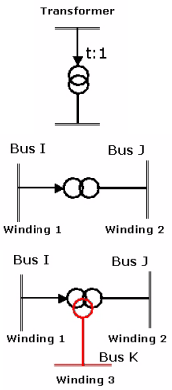
Transformer Data

The five record transformer data block for three-winding transformers has the following format:

I,J,K,CKT,CW,CZ,CM,MAG1,MAG2,NMETR,'NAME',STAT,O1,F1,...,O4,F4
R1-2,X1-2,SBASE1-2,R2-3,X2-3,SBASE2-3,R3-1,X3-1,SBASE3-1,
VMSTAR,ANSTAR,WINDV1,NOMV1,ANG1,RATA1,RATB1,RATC1,COD1,
CONT1,RMA1,RMI1,VMA1,VMI1,NTP1,TAB1,CR1,CX1,WINDV2,NOMV2,
ANG2,RATA2,RATB2,RATC2,COD2,CONT2,RMA2,RMI2,VMA2,VMI2,NTP2,
TAB2,CR2,CX2,WINDV3,NOMV3,ANG3,RATA3,RATB3,RATC3,COD3,
CONT3,RMA3,RMI3,VMA3,VMI3,NTP3,TAB3,CR3,CX3

The four-record transformer data block for two-winding transformers is a subset of the data required for three-winding transformers and has the following format:

I,J,K,CKT,CW,CZ,CM,MAG1,MAG2,NMETR,'NAME',STAT,O1,F1,...,O4,F4
R1-2,X1-2,SBASE1-2,WINDV1,NOMV1,ANG1,RATA1,RATB1,RATC1,COD1,
CONT1,RMA1,RMI1,VMA1,VMI1,NTP1,TAB1,CR1,CX,WINDV2,NOMV2



Each ac transformer to be represented in PSS/E is introduced through transformer data record blocks that specify all the data required to model transformers in power flow calculations, with one exception. That exception is a set of ancillary data, comprising transformer impedance correction tables, which define the manner in which transformer impedance changes as off-nominal turns ratio or phase shift angle is adjusted. Both two-winding and three-winding transformers are specified in transformer data record blocks. Two-winding transformers require a block of four data records. Three-winding transformers require five data records.

Transformer Data

All data items on the first record are specified for both two- and three-winding transformers:

I The bus number, or extended bus name enclosed in single quotes, of the bus to which the first winding is connected. The transformer's magnetizing admittance is modeled on winding one. The first winding is the only winding of a two-winding transformer whose tap ratio or phase shift angle may be adjusted by the power flow solution activities; any winding(s) of a three-winding transformer may be adjusted. No default is allowed.

J The bus number, or extended bus name enclosed in single quotes, of the bus to which the second winding is connected. No default is allowed.

K The bus number, or extended bus name enclosed in single quotes, of the bus to which the third winding is connected. Zero is used to indicate that no third winding is present (i.e., that a two-winding rather than a three-winding transformer is being specified). K = 0 by default.

CKT One- or two-character uppercase nonblank alphanumeric transformer circuit identifier; the first character of CKT **must not** be an ampersand ("&"). CKT = '1' by default.

R1-2, X1-2 The measured impedance of the transformer between the buses to which its first and second windings are connected.

R2-3, X2-3 The measured impedance of a three-winding transformer between the buses to which its second and third windings are connected; ignored for a two-winding transformer.

R3-1, X3-1 The measured impedance of a three-winding transformer between the buses to which its third and first windings are connected; ignored for a two-winding transformer.

Transformer Data

Example of 2-Winding Transformer:

Data Formats

I, J, K, CKT, CW, CZ, CM, MAG1, MAG2, NMETR, 'NAME', STAT, O1, F1, ..., O4, F4

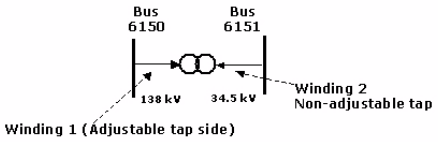
R1-2, X1-2, SBASE1

WINDV1,NOMV1,ANG1,RATA1,RATB1,RATC1,COD,CONT,RMA,RMI,VMA,VMI,NTP,TAB,CR,CX

WINDV2, NOMV2

Data

6150, 6151, 0, '1 ', 1, 1, 1, 0.0, 0.0, 2, 'TWO-WINDINGS', 1, 5, 1.0
0.0, 0.30, 100.0
1.01, 0.0, 0.0, 50.0, 60.0, 75.0, 1, 6151, 1.1, 0.9, 1.025, 1.0, 33, 0, 0.0, 0.0
1.0, 0.0



Transformer Data

Example of 3-Winding Transformer:

Data Formats

I, J, K, CKT, CW, CZ, CM, MAG1, MAG2, NMETR, 'NAME', STAT, O1, F1, ..., O4, F4

R1-2, X1-2, SBASE1, R2-3, X2-3, SBASE2, R3-1, X3-1, SBASE3, VMSTAR, ANSTAR

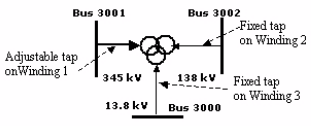
WINDV1,NOMV1,ANG1,RATA1,RATB1,RATC1,COD,CONT,RMA,RMI,VMA,VMI,NTP,TAB,CR,CX

WINDV2, NOMV2, ANG2, RATA2,RATB2,RATC2

WINDV3, NOMV3, ANG3, RATA3,RATB3,RATC3

Data

3001, 3002, 3000, '1', 1, 1, 1, 0.0, 0.0, 2, 'THREEWINDING', 1, 5, 1.0
0.003, 0.03, 100.0, 0.001, 0.03, 100.0, 0.001, 0.035, 100.0, 1.025, 0.0
1.00, 0.0, 0.0, 300, 400, 600, 0, 3001, 1.1, 0.9, 1.04, 1.0 , 33, 0, 0.0, 0.0
1.02, 0.0, 0.0, 300, 400, 600
1.00, 0.0, 0.0, 50, 60, 75



Areas and Zones

Areas are commonly used to designate sections of the network which represent control areas between which there are scheduled flows. PSS/E facilitates the identification of both areas and schedules. Alternatively, the network can be subdivided between utility companies or other subdivisions useful for specific analyses.
Designating buses to specific zones allows additional subdivision of the network to facilitate analyses and documentation but PSS/E provides no analytical facility to schedule interchange between zones. Although areas cannot overlap other areas and zones cannot overlap other zones, areas and zones can overlap each other.

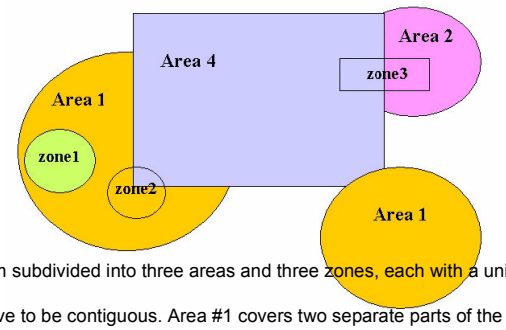
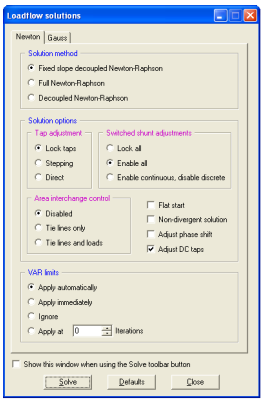
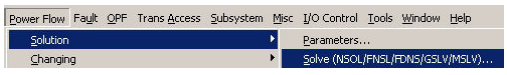


Figure shows a system subdivided into three areas and three zones, each with a unique name.
Notice the following:
• An area does not have to be contiguous. Area #1 covers two separate parts of the network.
• Zone #1 lies entirely in Area #1.
• Zone #2 lies partly in Area #1 and partly in Area #4.
• Zone #3 lies partly in Area 4 and Area 2.

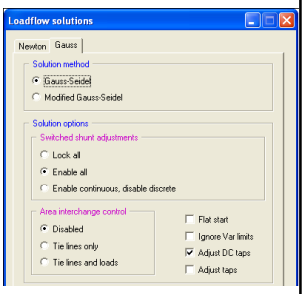
Obtaining a Power Flow Solution

If the imported data were from a Power Flow Raw Data File, it will be necessary to obtain a power flow solution. If the data were in the form of a Saved Case, it is probably already solved. In either case, for the purpose of this exercise, a power flow solution can be run. To run a power flow case, use the Power Flow>Solution>Solve... option (see Figure 4-3) or the Solve button.





There are three Newton solutions and two Gauss solutions. The user should select the appropriate solution as a function of the network conditions and solution starting point (Section 4.3). Other controls are available for use during the iteration process. These include, depending on the type of solution selected:
• Area interchange control (both Newton and Gauss).
• Control of Transformer taps (both Newton and Gauss.)
• A variety of other solution options (vary by type of solution).
• Control of Var limits (only Newton).
These options and controls are discussed in more detail in the subsequent sections of this chapter. A quick note of value is that the Gauss-Seidel solution cannot handle negative series reactances (series capacitors) but the Newton and Modified Gauss-Seidel can. When the solution type and control options have been selected, the user needs to click the Solve button. The solution will proceed and a printout of the convergence monitor and power flow conditions will appear in the Output Bar.



Convergence Monitor

When the non-divergent solution option is enabled, the standard FNSL convergence monitor is augmented by two additional columns containing SUMSQM and ACCFAC. In addition, each "inner loop" mismatch calculation is reported. Figure shows the convergence monitors for the attempted FNSL solutions of a difficult case, first with the non-divergent solution option disabled, and then with the non-divergent solution option enabled.

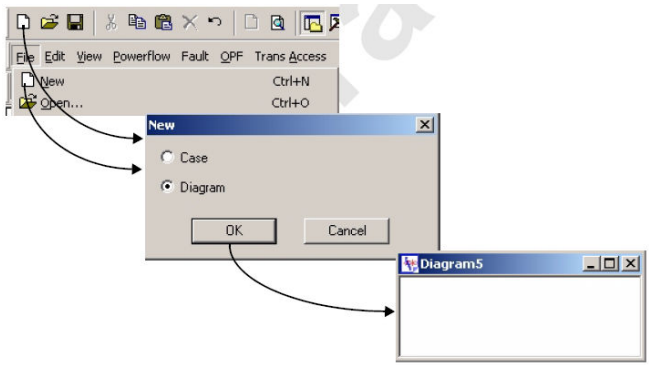
```
 ITER       DELTAP      BUS         DELTAQ      BUS        DELTA/V/      BUS       DELTAANG      BUS
  0        5.6995(      151   )    1.2217(      151   )    0.07177(     3008   )    0.14024(      101   )
  1        0.5073(      201   )    0.6370(      205   )    0.00591(      206   )    0.00490(      201   )
  2        0.0028(      152   )    0.4046(      206   )    0.00379(      206   )    0.00034(      206   )
  3        0.0001(      205   )    2.4734(     3008   )    0.03639(     3008   )    0.00266(      206   )
  4        0.0065(      154   )    1.6332(      205   )    0.03136(      205   )    0.00779(      101   )
  5        0.0253(      205   )    0.8006(      201   )    0.08905(      205   )    0.03293(      101   )
  6        0.2468(      205   )    0.0599(      205   )    0.17461(      205   )    0.06537(      101   )
  7        0.9226(      205   )    0.2194(      205   )    0.13294(      154   )    0.04131(      101   )
  8        0.3062(      205   )    0.0904(      154   )    0.13959(      205   )    0.04873(      101   )
  9        0.5686(      205   )    0.1260(      205   )    0.08090(      154   )    0.03244(      101   )
 10        0.2733(      205   )    0.0589(      205   )    0.82297(      205   )    0.30216(      101   )
 11        7.0235(      206   )    7.6130(      102   )    0.99000(      152   )    4.91214(      206   )


 BLOWN UP AFTER  12 ITERATIONS

 LARGEST MISMATCH:  495.60 MW 1025.72 MVAR  1139.18 MVA AT BUS    205 [SUB230      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:            7280.84 MVA

 SWING BUS SUMMARY:
   BUS# X-- NAME --X BASKV      PGEN     PMAX    PMIN      QGEN     QMAX    QMIN
   3001 MINE                -1500.9   9999.0 -9999.0    2959.5*   600.0  -100.0
```

Opening a New Diagram



A new one-line diagram may be created or existing diagram files may be opened within the Diagram View. To open a new diagram select File>New, click on the Diagram option and click OK, as shown in Figure 2-28. Alternatively the "new file" toolbar icon can be selected. In either case a new blank diagram will be displayed within which a small portion or an entire one-line network can be created. Multiple diagrams may be created for a network case and multiple views may be opened simultaneously.

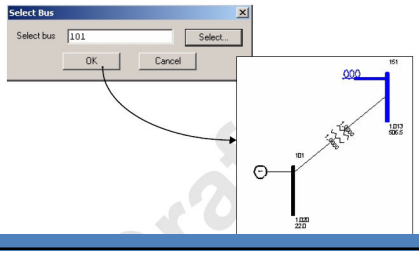
Creating a Diagram for an Existing Power Flow Case

The initiation of the creation of a one-line diagram is done using the Auto Draw button found in the Diagram Toolbar, 

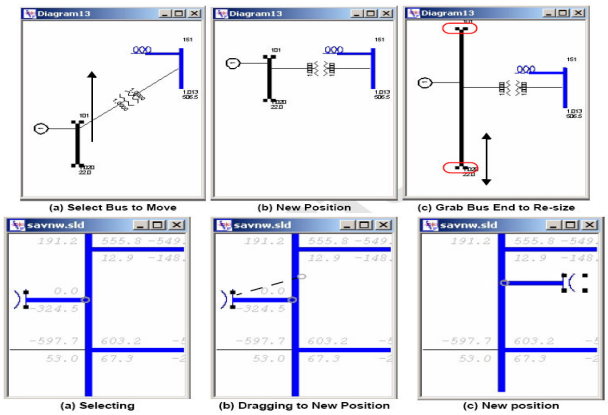
The user has two options to quickly draw a diagram. The first approach involves the following steps:

1. Open a Diagram View.
2. Select the Auto Draw button and click on the Diagram View to set the bus position.
3. A Bus Selector window will appear in which to select or specify the bus to grow. See Figure 2-32 where, using the savnw.sav power flow case, bus 101 has been selected and "grown".

The bus, all it's equipment, all lines, transformers, and attached buses are then laid out in the Diagram View. Figure 2-32 shows the result of selecting to grow bus 101. The bus along and its one neighboring bus is drawn, along with their attached equipment and connecting transformer branch.



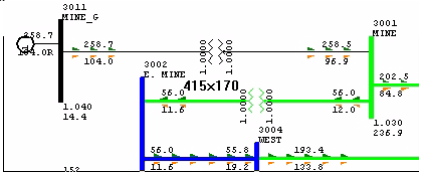
Moving Diagram Elements



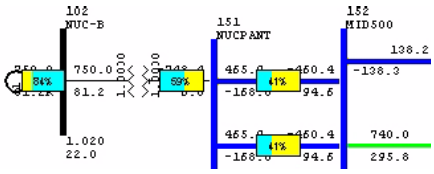
Existing diagram items can easily be manipulated within the Diagram View. Buses can be moved and their length changed. Equipment and lines can be repositioned on a bus as well as be moved to another bus. If the Bind Items option is selected, then moving equipment and lines to another bus in the Diagram View will also move the equipment and lines within the network data.

Additional Diagram Display Capabilities

The **Animate flows** button is used to animate branch flows on the active Diagram View. The branch flows are animated using the flows from the last load flow solution.

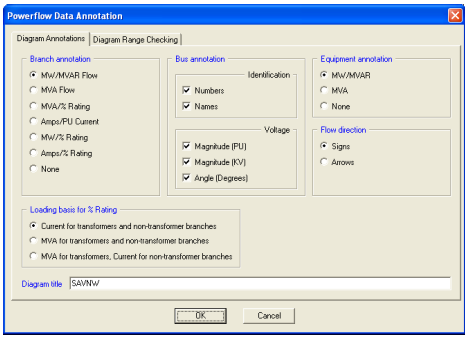


The **Current loadings** button is used to display line loading graphs.
The graph values are set using values from the last load flow solution.



The **Multisection line reporting** button is used to expose or hide the dummy buses that constitute the terminals of multiple sections that make up a single line between buses.

Annotating the Diagram



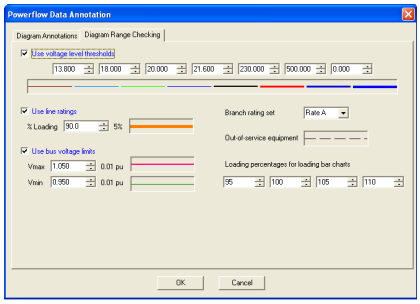


Diagram annotations can easily be adjusted by changing options in the Diagram Annotation tab. Choices include the type of results annotation information to be displayed for Branches, Buses and Equipment. Additionally, the user can elect to represent flows on the branches with either signs or arrows, as shown in Figure 2-91. The real power, in each case is shown above the branch.

(a) Signs

(b) Arrows