Command Line Interface
PSS®E 34.8.2

February 2021

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Chapter 1
Overview of Line Mode Interface Introduction

This guide is an overview of the structure and general operation of PSS®E though the Line Mode. The Line Mode interface is available in the PSS®E GUI in a window that is normally located at the bottom of the GUI. The appearance of that window is controlled by using View > CLI Window. The PSS®E Console Mode program (pssecmd) provides a non-GUI method of using the Line Mode interface.

1.1. Modes of operation

There are 4 kinds of commands that can be used in the Line Mode interface, and two modes of operation. In Python Command mode only Python commands can be used. In Response command mode Line Mode commands, Batch commands, and Immediate commands can be used. In the GUI, under Edit > Preferences, the input mode can be selected. The default input type in the CLI window is the PSS®E Response language. In addition, two commands can be used to switch modes: Python, to switch from Response command mode to Python command mode, and Pyexit, to switch from Python command mode to Response command mode.

When using the Command Input window in the PSS®E GUI, commands are entered from the keyboard, and executed by using the [Return] or [Enter] key. Dialog prompts are displayed in the Progress tab. All user responses to the interactive dialog are entered in the Enter command: input field. No other input windows display.

The PSS®E Console Mode program operates as a console application. Input and prompts use the same window and the application used no other windows.

1.1.1. Python commands

PSS®E has a full embedded Python interpreter. Any valid Python command can be used. PSS®E can be operated through the use of the psspy extension module that provides access to the PSS®E API. The commands in the API are documented in the PSS®E Application Program Interface document. Unlike the stand-alone Python Line Mode interpreter, PSS®E does not echo the results of input automatically. The Python form of the PSS®E allows arguments to be omitted or entered by keyword in addition to the standard documented form.

1.1.2. Batch commands

The PSS®E API provides a data input syntax to execute any of the API routines. These are called Batch commands and are also documented in PSS®E Application Program Interface document. Note the Batch commands can be terminated with a semi-colon token (token, in the context, means that it must be separated from previous input on the same line) which will cause the remaining items to be defaulted. When an incomplete Batch Command is entered, a prompt of the form API-name: is presented.

1.1.3. Immediate commands

Immediate commands are so named because they are processed at input and before the PSS®E program itself receives the input. They have the form @command.

1.1.4. Line Mode commands

Before PSS®E had a GUI, the program was controlled by a dialog between the user and the program. The form of the responses required by the program is called the Line Mode. This capability has been retained in the modern program via an embedded processor called the Line Mode Interpreter (LMI). The remaining chapters of this document describe the Line Mode in detail.

When using the Line Mode, prompts are provided that direct the input that is required by the program. When an activity is completed the "Activity?" prompt is presented.

Chapter 2
Program Operation

2.1. Changing Program Settings

OPTN

Activity ID, Suffix	Suffix Function
OPTN,SAVE	Save option settings in PSS®E Options File (*psse.opt*) in current directory

When activity OPTN is run with the SAVE suffix, it preserves the current settings of most program settings in a PSS®E Options File (psse.opt, by default).

Otherwise activity OPTN displays the current settings of all options that may be modified and instructs the user to:

```
ENTER CODE OF OPTION TO BE CHANGED:
```

```
>>OPTN

 PRESENT OPTION SETTINGS ARE:
  1=BUS OUTPUT............NUMBERS        2=BUS INPUT.................NUMBERS
  3=POWER OUTPUT..........MVA            4=VOLTAGE OUTPUT............PER UNIT
  5=VOLTAGE INPUT.........PER UNIT       6=TRANSMISSION LINE UNITS....PER UNIT
  7=SHORT CIRCUIT UNITS...PER UNIT       8=SHORT CIRCUIT COORDINATES..RECTANG.
  9=SHORT CIRCUIT PHASE...3 PHASE       10=GRAPHICS OUTPUT DEVICE.....26
 11=BASE FREQUENCY........60.0          12=FILE OVERWRITE OPTION......YES
 13=DEFAULT RATING SET....RATEA         14=TAP ADJUSTMENT.............LOCKED
 15=AREA INTERCHANGE......OFF           16=PHASE SHIFT ADJUSTMENT.....OFF
 17=DC TAPS...............ADJUST        18=SWITCHED SHUNTS............ADJUST
 19=TREE BEFORE SOLVING...YES           20=LINE SHUNTS IN POUT/LOUT...NO
 21=NEWTON TOLERANCE......0.1           26=MULTI-SECTION REPORTING....ON
 27=RESQ/SEQD WARNINGS....YES           28=ALWAYS DO SEQD IN SCMU.....NO
 29=MATRIX GROWTH FACTOR..2.0           30=STARTUP BUS DIMENSION......12000
 31=NON-DIVERGENT NEWTON..DISABLED      32=TRANSFORMER % LOADINGS.....MVA
 33=NON-XFRMR % LOADINGS..CURRENT       34=PRINT 3 WINDING BUSES......NO
 35=PRINT OUTAGED LINES...NO
                         LINES PER PAGE:
 ENTER CODE OF OPTION TO BE CHANGED:
>>
```

Figure 2.1. Settings Available through Activity OPTN

Enter the numeric code for the option if you wish to change its current setting. The dialog requests the new option setting. Following the change, the option menu is re-displayed with the new setting, and another option may then be modified. This process is repeated until the user enters a zero or *[Enter]*.

Those options that must have one of only two possible settings are handled in the same manner. The user may either specify the setting to be used or use *[Enter]* to toggle the option from its present setting to its alternate setting.

```
 ENTER CODE OF OPTION TO BE CHANGED:
>>17
 ENTER <CR> TO TOGGLE, 0 FOR UNLOCKED, 1 FOR LOCKED:
>>

 PRESENT OPTION SETTINGS ARE:
  1=BUS OUTPUT............NUMBERS       2=BUS INPUT.................NUMBERS
  3=POWER OUTPUT..........MVA           4=VOLTAGE OUTPUT............PER UNIT
  5=VOLTAGE INPUT.........PER UNIT      6=TRANSMISSION LINE UNITS...PER UNIT
  7=SHORT CIRCUIT UNITS...PER UNIT      8=SHORT CIRCUIT COORDINATES..RECTANG.
  9=SHORT CIRCUIT PHASE...3 PHASE      10=GRAPHICS OUTPUT DEVICE.....26
 11=BASE FREQUENCY........60.0         12=FILE OVERWRITE OPTION......YES
 13=DEFAULT RATING SET....RATEA        14=TAP ADJUSTMENT.............LOCKED
 15=AREA INTERCHANGE......OFF          16=PHASE SHIFT ADJUSTMENT.....OFF
 17=DC TAPS...............LOCKED       18=SWITCHED SHUNTS............ADJUST
 19=TREE BEFORE SOLVING...YES          20=LINE SHUNTS IN POUT/LOUT...NO
 21=NEWTON TOLERANCE......0.1          26=MULTI-SECTION REPORTING....ON
 27=RESQ/SEQD WARNINGS....YES          28=ALWAYS DO SEQD IN SCMU.....NO
 29=MATRIX GROWTH FACTOR..2.0          30=STARTUP BUS DIMENSION......12000
 31=NON-DIVERGENT NEWTON..DISABLED     32=TRANSFORMER % LOADINGS.....MVA
 33=NON-XFRMR % LOADINGS..CURRENT      34=PRINT 3 WINDING BUSES......NO
 35=PRINT OUTAGED LINES...NO
                          LINES PER PAGE:
 ENTER CODE OF OPTION TO BE CHANGED:
>>
```

Figure 2.2. Toggled Setting in Activity OPTN

Additional Information
PSS®E Program Operation Manual, Changing PSS®E Program Settings

2.2. Terminating PSS®E

STOP

Activity ID, Suffix	Suffix Function
STOP	Exit PSS®E

Activity STOP is the normal exit from PSS®E when using the command line.

Entering STOP closes any active Response Files and any files that are active as a result of activities ODEV, PDEV, ECHO, or OPEN. It returns the computer to operating system level. Activity STOP does not affect the status of any command files or session logging files that might be open.

If the working case represents a system condition that may be needed in the future, the user should ensure that it is preserved in a Saved Case File prior to running activity STOP. If PSS®E was started up at its dynamic simulation entry point, a similar argument applies to preserving dynamics working memory in a Snapshot File. See Section 7.1, “Creating a Saved Case File” and Section 17.3, “Saving Dynamics Working Memory in a Binary File”, respectively.

Additional Information
PSS®E *Program Operation Manual*, Terminating PSS®E

2.3. Displaying Summary Help Information

HELP

Activity ID, Suffix	Suffix Function
HELP,activity name	Summary of specified activity
HELP,ALL	Summary of all activities by type of function
HELP,LF	Summary of activities used in power flow studies
HELP,EQ	Summary of activities used in equivalent construction
HELP,SC	Summary of activities used in short circuit studies
HELP,GR	Summary of activities producing graphical displays
HELP,DS	Summary of activities used in dynamic simulation studies
HELP,MS	Summary of activities accessible from either activity operating mode
HELP,NEW	Summary of program enhancements in current release
HELP,*,FULL	Single line activity description (except HELP,NEW)

When activity HELP is run with an activity name as a suffix (for example, HELP,POUT), a summary description of that activity is displayed.

When activity HELP is run with any of the other suffixes, except NEW, it lists the names of the appropriate PSS®E activities.

When activity HELP is run with the FULL suffix, the tabulation is expanded to include a single line description of each activity listed.

Activity HELP is sensitive to the option setting defining the number of lines on the terminal. It pauses at the end of each screen full, giving the user the opportunity to go on to the next page or to end the activity.

Note: This activity is currently non-functional.

Additional Information
PSS®E Program Operation Manual, Displaying Help Information

2.4. Running a User-Written Activity

USER

Activity ID, Suffix	Suffix Function
USER	Activity runs without a suffix.

The power flow activity operating mode provides for the incorporation of a user written activity USER into PSS®E.

```
 ACTIVITY? :
>>USER

 NO USER ACTIVITY LINKED INTO PSS/E.

 ACTIVITY? :
>>
```

Figure 2.3. Example: Running Activity USER, No User-Written Activity Available

Additional Information
PSS®E Program Operation Manual, Applying a User-Written Activity

Chapter 3
Power Flow Data Entry

3.1. Data Specification Using the CLI

3.1.1. File or Terminal Input

When initiated using the CLI, some activity dialogs request filename entry at the terminal:

```
ENTER INPUT FILE NAME (0 TO EXIT, 1 FOR TERMINAL):
```

Valid responses are:

- The name of the appropriate data input file. If the file does not exist or some other file system-related error occurs, an appropriate error message is generated and the request for input is repeated.
- Enter a 1 to enable the user to enter data directly from the dialog input device. This applies to both interactive and Response File operation of PSS®E.
- Enter a 0 to exit the activity without reading any data.

These options apply to the following activities: READ, RDCH, MCRE, BSNM, RETI, PSEB, RESQ, REMM, and PSAS. Observe that the various bulk data input API routines accept data records only from an input data file. If terminal input is selected, the CLI deposits the data records entered from the terminal into a temporary file. At the completion of input, the API routine is initiated, with this temporary file specified as its input data file.

3.2. Retrieving a Power Flow Saved Case File

CASE

Requirements / Prerequisites	
Saved Case File (*.sav) Section 7.1, “Creating a Saved Case File”	
Activity ID, Suffix	Suffix Function
CASE	CASE prompts for the name of the Saved Case File
CASE,filename	Retrieve Saved Case from the Saved Case File <file-name>
CASE,*	Retrieve Saved Case from the last accessed Saved Case File

The case retrieval activity CASE restores the contents of a previously saved power flow Saved Case file (*.sav) into the working case. The contents of the working case are overwritten while the contents of the specified Saved Case File are unchanged.

The name of the Saved Case File may be specified at the time activity CASE is initiated. If an asterisk (*) is entered instead of a filename, the last Saved Case File used by either activity CASE or activity SAVE during the current session of PSS®E is retrieved. If no file is specified, or if a file system error condition is encountered in opening the designated file, the dialog requests:

```
ENTER SAVED CASE FILENAME:
```

A response of zero followed by *[Enter]* (or simply *[Enter]*) ends activity CASE.

```
 ACTIVITY? :
>>CASE,*
 File not found: *.sav
 ENTER SAVED CASE FILENAME:
>>savnw.sav

 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 CASE savnw.sav WAS SAVED ON TUE, DEC 18 2007  11:29

 DEFAULT OPTIONS MODIFIED:
  GRAPHICS TERMINAL TYPE:    0
  [OPF] APPLY FUEL COST OBJECTIVE: YES
  [OPF] APPLY ADJUSTABLE BRANCH REACTANCE OBJECTIVE: YES
  [OPF] CONSTRAIN INTERFACE FLOWS: YES
  [OPF] AUTOMATIC SCALING: YES
  [OPF] DUAL VARIABLE CONVERGENCE CRITERIA: YES
  [OPF] NUMBER OF BAD ITERATIONS, COARSE LIMIT:   10
  [OPF] NUMBER OF BAD ITERATIONS, FINE LIMIT:   20
  [OPF] PRODUCE AN OPF LOG FILE: YES
  [OPF] PRODUCE A DETAILED OPF REPORT: YES

 ACTIVITY? :
>>
```

Figure 3.1. Example: Running Activity CASE

Additional Information
PSS®E Program Operation Manual, Retrieving a Power Flow Saved Case File *PSS ® E Application Program Interface (API)*,CASE See also: Section 7.1, "Creating a Saved Case File" Section 6.2.2, "Saved Case or Snapshot Filenames"

3.3. Reading Power Flow Raw Data into the Working Case

READ

Requirements / Prerequisites	
If reading change data, the working case must contain a validly specified power flow case. A Power Flow Raw Data File is available if input is to be taken from a file.	
Activity ID, Suffix	Suffix Function
READ	Standard READ with bus numbers on input records
READ,NAME	Standard READ with either extended bus names or bus numbers on input records for all data categories except bus data
READ,AREA	Subsystem READ for specified area(s) with bus numbers on input records
READ,ZONE	Subsystem READ for specified zone(s) with bus numbers on input records
READ,OWNER	Subsystem READ for specified owner(s) with bus numbers on input records
READ,KV	Subsystem READ for specified base voltage range with bus numbers on input records
READ,OPT	Subsystem READ for specified subsystem using multiple selection criteria with bus numbers on input records

The bulk power flow data input activity READ picks up hand-typed power flow source data and enters it into the power flow working case, rearranging it from its original format into a computationally oriented data structure in the process. The source data records are normally loaded from a Power Flow Raw Data file (*.raw). The format of the data records is taken from the REV data item on the first input record (see Case Identification Data and Reading Power Flow Raw Data Files Created by Previous Releases of PSS®E of the *PSS®E Program Operation Manual*).

When activity READ is run with the NAME suffix, data fields designating ac buses on load, generator, fixed shunt, branch, transformer, area, two-terminal dc line, VSC dc line, multi-terminal dc line, multi-section line, FACTS device, and switched shunt data records may be specified as either extended bus names enclosed in single quotes or as bus numbers (refer to *PSS®E Program Operation Manual*, Extended Bus Names). Otherwise, bus numbers *must* be used to designate ac buses.

Inputs to activity READ may be taken either from a Power Flow Raw Data file or from the dialog input device (the terminal keyboard, a Response file (*.idv), or an IPLAN program). When initiated, the dialog of activity READ requests specification of the input source. For details, see File or Terminal Input.

For a subsystem READ, the dialog of activity READ provides for selection of the options described in Subsystem READ of the PSS®E Program Operation Manual. Specification of the subsystem to be read is as described in Section 1.2.3, Subsystem Selection. When the subsystem to be processed is specified by voltage level (either through the use of the KV suffix or by selecting voltage levels when the OPT suffix is specified), it is not possible to process buses at two different voltage levels while omitting those buses at intervening levels.

Although the request for voltage levels will be issued more than once, only the *last* specification is recognized during activity READ's processing.

As data records are read, a message is displayed at the *Progress* device at the start of each new category of data. In addition, when records are being read from the dialog input device (rather than from a Power Flow Raw Data File), activity READ prompts the user regarding the order in which data items are to be entered. Except for the transformer and various dc line data categories, this prompt appears once for each category of data.

```
 ACTIVITY? :
>>READ,OPT
 ENTER INPUT FILE NAME (0 TO EXIT, 1 FOR TERMINAL):
>>savnw.raw

 ENTER OPTION CODE:
  0 = NO MORE        1 = BY AREA
  2 = BY ZONE        3 = BY BASE KV
  5 = BY OWNER:
>>1
 ENTER UP TO 20 AREA NUMBERS:

>>1

 ENTER OPTION CODE:
  0 = NO MORE        1 = BY AREA
  2 = BY ZONE        3 = BY BASE KV
  5 = BY OWNER:
>>

 DO YOU WANT MORE? :
>>0
 ENTER 1 TO APPEND DATA TO THE WORKING CASE:
>>1
 ENTER 1 TO CHANGE CODES OF BOUNDARY BUSES:
>>1

 ENTER: 1 FOR ALL DATA WITHIN SPECIFIED SUBSYSTEM
        2 FOR TIES FROM SPECIFIED SUBSYSTEM
        3 FOR ALL DATA PLUS TIES:
>>3
```

Figure 3.2. Example of Activity READ,OPT

Additional Information
PSS®E Program Operation Manual, Reading Power Flow Raw Data into the Working Case *PSS® E Application Program Interface (API)* READ READRAWVERSION READSUB READSUBRAWVERSION See also: Section 7.4, "Creating a Power Flow Raw Data File"

3.4. Reading Power Flow Data Additions from the Terminal

TREA

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
TREA	Bus numbers on input records
TREA,NAME	Either extended bus names or bus numbers on input records for all data categories except bus data

The terminal-oriented data input activity TREA is designed for those occasions when the user needs to add a limited amount of equipment to the system contained in the working case. Data records are read from the dialog input device (the terminal keyboard, a Response File, or an IPLAN program). All categories of data except Case Identification Data may be specified.

To run activity TREA, the CLI deposits the data records entered from the dialog input device into a temporary file, augmented with appropriate case identification data records. At the completion of input, the Read API routine is initiated, with this temporary file specified as its input data file.

When activity TREA is run with the NAME suffix, data fields designating ac buses on load, fixed shunt, generator, non-transformer branch, transformer, area, two-terminal dc line, VSC dc line, multi-terminal dc line, multi-section line, FACTS device, and switched shunt data records may be specified as either extended bus names enclosed in single quotes or as bus numbers. Otherwise, bus numbers *must* be used to designate ac buses on these records.

Use of the bus names input option of activity TREA requires that all buses be assigned unique extended bus names. Activity TREA checks for the presence of duplicate extended bus names in the working case *before* it starts to read bus data records. Any violations are logged at the *Progress* device and activity TREA is prohibited from executing.

While reading each bus data record with this option enabled, if a bus with the same extended bus name but a different bus number is present in the working case, an error message is printed, the record is ignored, and processing continues.

The format of the input records is normally in the format of the current release of PSS®E. However, input records in the format required in version 30 or 31 are expected when activity TREA is preceded by the CLI VERSION command to set the CLI dialog version to 30 or 31 (refer to *PSS®E Program Operation Manual*,Version). In practice, this is appropriate only when the input records are being supplied from an automation file.

At the start of each new category of data, a message is displayed at the *Progress* device giving the order in which data items are to be entered. Except for the transformer and various dc line data categories, this prompt appears once for each category of data. After all data records for a category of data have been specified, the end of the data category is indicated by a record specifying a value of zero; the end of the FACTS device and dc line data categories may alternatively be indicated with a record specifying a NAME value of blanks. Activity TREA then proceeds to the next data category.

Generally, specifying a data record with a Q in column one is used to indicate that no more data records are to be supplied to activity TREA. Refer to *PSS®E Program Operation Manual*, Q Record for details.

As in the change case mode of activity READ (refer to *PSS®E Program Operation Manual*, Change Case Data in a Standard READ), when entering data for an equipment item already modeled in the working case, omitted data items take on their default values rather than retaining their previous values. To modify data for existing equipment, either activity RDCH or activity CHNG should be used rather than activities TREA or READ.

When specifying a non-transformer branch between buses I and J with circuit identifier CKT, if a two-winding transformer between buses I and J with a circuit identifier of CKT is already present in the working case, it is replaced (i.e., the transformer is deleted from the working case and the newly specified branch is then added to the working case).

When specifying a two-winding transformer between buses I and J with circuit identifier CKT, if a non-transformer branch between buses I and J with a circuit identifier of CKT is already present in the working case, it is replaced (i.e., the non-transformer branch is deleted from the working case and the newly specified two-winding transformer is then added to the working case).

Activity TREA prints a warning message at the *Progress* device if generators have been converted (see Converting Generators). After generators are converted, machine impedance data (MBASE, ZSORCE, XTRAN, and GTAP) *must not* be changed.

Before it has completed reading its input data, activity TREA may be ended by entering the AB interrupt control code (refer to Interruption of PSS®E by the User). Activity TREA checks for an interrupt following processing of each group of data records corresponding to 50 equipment items.

Additional Information
PSS®E Program Operation Manual, Reading / Changing Power Flow Data *PSS®E Program Operation Manual* Power Flow Raw Data File Contents Program Automation *PSS ® E Application Program Interface (API)* READ

3.5. Reading or Changing Power Flow Data

RDCH

Requirements / Prerequisites	
The working case must contain a validly specified power flow case. A Power Flow Raw Data File is available if input is to be taken from a file.	
Activity ID, Suffix	Suffix Function
RDCH	Input from a file or the dialog input device, bus numbers on input records, records normally in the format of the current release
RDCH,NAME	Input from a file or the dialog input device, either extended bus names or bus numbers on input records for all data categories except bus data, records normally in the format of the current release
RDCH,OPT	Input from a file, either extended bus names or bus numbers on input records for all data categories except bus data, records in the format of the current or a prior release

The bulk power flow data input and modification activity RDCH picks up manually-entered power flow source data and enters it into the power flow working case. The source data records are in the form of a Power Flow Raw Data File *except* that the Case Identification Data records are omitted; that is, the first data record is expected to be a bus data record.

When activity RDCH is run with the NAME suffix, data fields designating ac buses on load, generator, fixed shunt, branch, transformer, area, two-terminal dc line, VSC dc line, multi-terminal dc line, multi-section line, FACTS device, and switched shunt data records may be specified as either extended bus names enclosed in single quotes or as bus numbers (refer to *PSS®E Program Operation Manual*, Extended Bus Names). Otherwise, bus numbers *must* be used to designate ac buses.

As data records are read, a message is displayed at the *Progress* device at the start of each new category of data. In addition, when records are being read from the dialog input device (rather than from a Power Flow Raw Data File), activity RDCH prompts the user regarding the order in which data items are to be entered. Except for the transformer and various dc line data categories, this prompt appears once for each category of data.

3.5.1. Operation of Activities RDCH and RDCH,NAME

Inputs to activities RDCH and RDCH,NAME may be taken either from a Power Flow Raw Data File or from the dialog input device (the terminal keyboard, a Response File, or an IPLAN program). When initiated, the dialog of activities RDCH and RDCH,NAME request specification of the input source (see File or Terminal Input).

The format of the input records is normally in the format of the current release of PSS®E. However, input records in the format required in version 30 or 31 are expected when both of the following are satisfied:

- Activity RDCH is preceded by the CLI VERSION command to set the CLI dialog version to 30 or 31. Refer to *PSS®E Program Operation Manual*,Version.
- Input from the dialog input device is specified.

In practice, this is appropriate only when the input records are being supplied from an automation file.

3.5.2. Operation of Activity RDCH,OPT

Activity RDCH,OPT requests:

```
VERSION (DEFAULT CURRENT), 1 FOR NAMES INPUT, FILENAME (BLANK TO EXIT)
```

The `VERSION` and `FILENAME` data values are specified as character strings, and an integer value is specified for the `NAMES INPUT` data value. These data items are passed as arguments to the RdchRawVersion API routine.

Additional Information
PSS®E Program Operation Manual, Reading / Changing Power Flow Data
PSS®E Program Operation Manual, Power Flow Raw Data File Contents Program Automation
PSS® E Application Program Interface (API) RAWD_2 RDCHRAWVERSION
See also: Section 7.4, “Creating a Power Flow Raw Data File”

3.6. Adding Machine Impedance Data

MCRE

Requirements / Prerequisites	
Validly specified power flow case. Machine Impedance Data file (*.rwm)	
Activity ID, Suffix	Suffix Function
MCRE	Set the status of machines to the STATUS value on their data records
MCRE,WSCC	Ignore status field on the input data records; determine status of machines added from those of existing machines at the bus

The machine impedance data input activity MCRE enters data from machine impedance data records into the power flow working case.

The presence or absence of the suffix WSCC in selecting activity MCRE determines the setting of the new machine status input data item of the MCRE API routine.

Inputs to activity MCRE may be taken either from a Machine Impedance Data File or from the dialog input device (the terminal keyboard, a Response File, or an IPLAN program). When initiated, the dialog of activity MCRE requests specification of the input source (see File or Terminal Input).

When terminal input is specified, activity MCRE prompts the user regarding the order in which data items are to be entered:

```
ENTER DATA RECORDS: IBUS, ID, P-FRAC, Q-FRAC, MBASE, ZSORCE(R,X), XTRAN(R,X),
GENTAP, STATUS
```

This prompt is displayed only once, and data records are read until a record containing a bus number of zero is entered.

After all records have been read, activity MCRE prompts the user:

```
AT BUSES WITH NO RECORD ENTERED FOR AN EXISTING MACHINE, BUT A RECORD ENTERED
FOR AT LEAST ONE OTHER MACHINE AT THE BUS, ENTER 0 TO PLACE OMITTED MACHINES
OUT OF SERVICE, 1 TO DELETE:
```

The response entered determines the setting of the treatment of machines with no record input data item of the MCRE API routine.

Additional Information
PSS®E Program Operation Manual, Adding Machine Impedance Data *PSS ® E Application Program Interface (API)* MCRE See also: Section 7.3, “Saving Machine Impedance Data”

3.7. Reading Sequence Data for Fault Analysis

RESQ

Requirements / Prerequisites	
Positive sequence network for which sequence data is to be read must be present in the working case. Sequence Data file (*.seq)	
Activity ID, Suffix	Suffix Function
RESQ	RESQ prompts for the name of the Sequence Data File
RESQ,filename	Read sequence data from Sequence Data File <filename>

Inputs to activity RESQ may be taken either from a Sequence Data File or from the dialog input device (the terminal keyboard, a Response File, or an IPLAN program). When file input is desired, the name of the Sequence Data File to be read may be specified at the time activity RESQ is initiated.

When activity RESQ is run without a filename specified as a suffix, or if some error occurs in attempting to open the specified file, the dialog of activity RESQ requests specification of the input source. For details, see File or Terminal Input.

As data records are read, a message is displayed at the *Progress* device at the start of each new category of data. In addition, when records are being read from the dialog input device (rather than from a Sequence Data File), activity RESQ prompts the user regarding the order in which data items are to be entered. This prompt appears once for each category of data.

Additional Information
PSS®E Program Operation Manual, Reading Sequence Data *PSS ® E Application Program Interface (API)* RESQ See also: Section 7.5, “Creating a Sequence Data File”

3.8. Reading Sequence Data Additions from the Terminal

TRSQ

Requirements / Prerequisites	
Positive sequence network for which sequence data is to be read must be present in the working case.	
Activity ID, Suffix	Suffix Function
TRSQ	Sequence data input from the dialog input device

The terminal oriented sequence data input activity TRSQ is designed for those occasions when the user needs to add a limited amount of sequence data to the system contained in the working case. Data records are read from the dialog input device (the terminal keyboard, a Response File, or an IPLAN program).

The user has the opportunity to enter all categories of data defined in Sequence Data File Contents with the exception of the Sequence Data Input Structurefirst record, IC; an IC value of 1 is assumed. As in activity RESQ (refer to *PSS®E Program Operation Manual*, Operation of Activity RESQ), if sequence data had not previously been read for the system in the working case, a message is printed at the *Progress* device and the data is processed in the same manner as in activity RESQ when it is executed with an IC value of zero.

To run activity TRSQ, the CLI deposits the data records entered from the dialog input device into a temporary file, augmented with the appropriate change code, IC. At the completion of input, the Resq API routine is initiated, with this temporary file specified as its input data file.

At the start of each new category of data, a message is displayed at the *Progress* device giving the order in which data items are to be entered. This prompt appears once for each category of data. When all data records for a category of data have been specified, the end of the data category is indicated by a record specifying a value of zero. Activity TRSQ then proceeds to the next data category.

Specifying a data record with a Q in column one is used to indicate that no more data records are to be supplied to activity TRSQ. Refer to *PSS®E Program Operation Manual*, Q Record for details.

As in the change case mode of activity RESQ, when entering data for an equipment item for which sequence data had previously been entered, omitted data items take on their default values rather than retaining their previous values.

Additional Information
PSS®E Program Operation Manual, Reading Sequence Data Additions from the Terminal *PSS ® E Application Program Interface (API)* RESQ See also: Section 3.7, “Reading Sequence Data for Fault Analysis”

3.9. Entering Transactions Raw Data

REMM

Requirements / Prerequisites	
The working case must contain a validly specified power flow case. Transactions Raw Data File (*.mwm)	
Activity ID, Suffix	Suffix Function
REMM	Clear transaction data arrays before adding transaction data
REMM,CH	Add and/or modify transaction data

Transaction data is introduced into working memory using activity REMM.

Inputs to activity REMM may be taken either from a Transactions Raw Data File or from the dialog input device (the terminal keyboard, a Response File, or an IPLAN program). When initiated, the dialog of activity REMM requests specification of the input source (see File or Terminal Input).

Activity REMM then processes data records from the specified source. A message is displayed at the start of each new category of data.

When activity REMM is run without a suffix, it removes all existing transaction events; and all null fields presented in data records results in default value assignments. Otherwise the existing data is retained and may be altered by reference in the data presentation.

To modify data for an existing transaction event (for example, to alter its service status), activity REMM should be run with the CH suffix. The qualified activity REMM,CH modifies data items for transaction events that have already been defined in the working memory, and adds new data to working memory when it encounters data records for transaction events that have not been previously defined. It begins processing with transaction event data records. The participation flag is not presented to nor can it be altered by the qualified activity.

Output of activity RWMM (refer to Section 7.6, “Creating a Transactions Raw Data File”) will include the initial record specifying the current state of the participation factor flag, IPF. It is the responsibility of the user to ensure that this record is removed when the file is to be used as the source of data for REMM,CH.

Additional Information
PSS®E Program Operation Manual, Reading Transactions Raw Data See also: Section 7.6, “Creating a Transactions Raw Data File”

3.10. Managing Case Titles

3.10.1. Importing a Long Title

RETI

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
RETI	Long title input

The long title data input activity RETI reads up to 16 lines of alphanumeric data and places them into the long title. The previous content of the long title is overwritten.

Inputs to activity RETI may be taken either from a data file or from the dialog input device (the terminal keyboard, a Response File, or an IPLAN program). When initiated, the dialog of activity RETI requests specification of the input source (see File or Terminal Input). Activity RETI then processes data records from the specified source.

When terminal input is specified, the CLI deposits the data records entered from the dialog input device into a temporary file. At the completion of input, the Reti API routine is initiated, with this temporary file specified as its input data file.

When terminal input is specified, title input is complete, and fewer than 16 input records have been specified, specify a data record containing the characters /E or /e in columns one and two.

Additional Information
PSS® E Program Operation Manual Section Activity, TREA *PSS® E Application Program Interface (API)* RETI

3.10.2. Changing the Long Title

CHTI

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
CHTI	Change individual lines of the long title

The long title data change activity CHTI enables the user to modify the contents of individual lines of the 16-line long title without having to reread the entire set of lines with activity RETI.

Activity CHTI prompts the user to:

```
ENTER LINE NUMBER (CARRIAGE RETURN FOR LINE n, 0 TO EXIT):
```

The user then responds with either:

- the number of the line to be changed (1 through 16) and *[Enter]*.
- *[Enter]* to proceed to the next line.
- 0 or the single character Q and *[Enter]* to exit activity CHTI.

If a valid line number is entered, the line is displayed and activity CHTI asks the question `CHANGE IT?`. Valid responses are:

- 0 or N for no change (this is followed by a prompt for a new line number).
- 1 or Y to enable a change to the line (this is followed by a prompt for the text of the line).
- -1 or Q to exit activity CHTI.

Additional Information
PSS®E Program Operation Manual, Changing the Long Title

3.10.3. Editing the Two-Line Case Title or the Long Title

EDTR

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
EDTR	Edit individual lines of the case title or the long title

The title editing activity EDTR allows the user to perform editing operations on the two line case title and on the sixteen line long title. It is accessible only as a Line Mode activity.

Operation of Activity EDTR

Activity EDTR prompts the user to specify which of the title blocks is to be edited:

```
EDITOR OPTIONS ARE: 0 - NO MORE 1 - TWO LINE CASE HEADING 2 - 16 LINE LONG
TITLE SELECT FUNCTION:
```

If the two-line case title is selected, the first title line is displayed followed by the editing prompt `EDTR:`. Any of the editing commands supported by activity EDTR may then be specified (see Editing Commands). The title line as edited is then displayed, followed by the `EDTR:` prompt. This editing cycle is repeated until ended by a line containing only *[Enter]*. Then the second title line is processed in the same manner.

If the code for the sixteen line long title is entered, activity EDTR instructs the user to:

```
ENTER LINE NUMBER (CARRIAGE RETURN FOR LINE n, 0 TO EXIT):
```

Valid responses to this prompt are:

- the number of the line to be edited (one through sixteen).
- *[Enter]* to proceed to the next line.
- zero to end editing of the long title.

If a valid line is specified, the line is displayed followed by the prompt `EDTR:`, and the user may specify editing commands as described for the two-line case title.

Editing Commands

The general form of each editing command is XnA where:

X	Is a single letter editing command as described below.
n	Is a number in the range of 1 through 32000 (default is 1) which specifies the number of times that the command is to be executed. Alternatively, n may be specified as an asterisk (*), indicating that the given command is to be executed as many times (perhaps zero times) as possible for the displayed line.
A	Are the argument(s), if any, required for a given command.

As an example, consider the command C2/WX/YZ/, where C specifies the change command, 2 specifies that the change is to be performed twice, and /WX/YZ/ is the argument to the change command. This command searches the displayed title line for the first two occurrences of WX and replaces them with YZ.

The / characters used in this example are delimiters and are used to separate the two strings required by the change command. Valid delimiters are: . / $ % ! : ' " and & . Any one of these delimiters may be used as long as it does not occur in either of the specified strings. (The starting, middle, and ending delimiter characters must, of course, all be the same.)

Several edit commands can be strung together in a single editing command input line. Prior to executing each editing command input line, an internal edit pointer is initialized to point to column one of the line being edited. As each edit command of the command input line is executed, this pointer moves toward the right end of line being edited. In other words, the editing proceeds from left to right, with each new editing command in the command input line starting where the previous one ended. For example, the command C/AB/CD/C/WX/TY/ would cause the first occurrence of AB to be replaced with CD and the first occurrence of WX *after* the original AB to be replaced with TY.

Whenever an error condition is encountered in performing the operations specified in an editing command input line, an appropriate error message is printed and the line is unchanged.

The editing commands are:

C or S	The change (or substitute) command. This command searches for one or more occurrences of a given string and substitutes a second string for the original string. The format of this command is one of the following: `Cn/string1/string2/ Sn/string1/string2/` where n and the / delimiters have been described above. Here, *string1* is the original string and *string2* is the string to be substituted. Note that *string2* can be the null string (//), so that the change command can be used to delete one or more occurrences of a given string. Normally, n is not specified and only the first occurrence of *string1* is changed.
F	The find command. This command moves the edit pointer to the position in the line being edited where a specific string is located. The format of this command is: `Fn/string/` where n and the / delimiters have been described above. This command moves the edit pointer to the first character of the nth occurrence (or last occurrence if an asterisk was specified) of *string*. Normally, n is not specified, so the find command moves the edit pointer to the first character of the first occurrence of *string*.
M	The move command. This command moves the edit pointer a specified number of character positions to the right. The format of this command is: `Mn` here n indicates the number of columns to move the edit pointer (relative to its current location). An asterisk is not allowed for n in this command.
D	The delete command. Starting at the current position, this command deletes a specified number of characters. The format of this command is: `Dn` where n indicates the number of characters to be deleted.
I	The insert command. This command inserts a given string of characters into the title line, starting just

	before the current position. The format of this command is: `I/string/` where the / delimiters have been described above and *string* is the string of characters to be inserted. The edit pointer is positioned to the first location following the inserted string. Characters that are pushed past the end of the title line by the insert command are lost, and no error message is generated.
O or R	The overlay command. Starting at the current location, this command overlays (replaces) characters in the title line. The format of this command is one of the following: `O/string/ or R/string/` where the / delimiters have been described above and *string* is the string of characters that are to overlay (replace) characters in the displayed title line. The edit pointer is positioned to the first location following *string*.
A	The append command. This command appends a specified string to the title line, starting immediately after the last non-blank character in the line. The format of this command is: `A/string/` where the / delimiters have been described above and *string* is the string of characters that is to be appended. The edit pointer is positioned to the first location following the appended string.

Examples

Following are several examples of using the editing commands.

Example 1: Simple C(hange) commands.

Assume that a title line originally contains ABCADEF. The edit command C/B/XY/ changes it to AXYCADEF, while the command C2/A/MN/ results in a line of MNBCMNDEF. Note that the second change command could have been written as C*:A:MN:, where an asterisk is used instead of an explicit count and a different delimiter is being used.

Two (or more) change commands can be specified as one EDTR command. For example, assume that the title line originally contains ABCABCABC and that the edit command C/B/X/C/A/Q/ is given. The resulting line is AXCQBCABC. Note that the first A *was not* changed, because the second C(hange) command started where the first C(hange) command left off (and *not* at the beginning of the line).

Example 2: The F(ind), I(nsert), and D(elete) commands.

Assume that a title line originally contains ABCDEF. The edit command F/C/I/NEW/ results in the title line containing ABNEWCDEF. Note that the string NEW is inserted directly *before* the character that was located with the F(ind) command. Starting with the same original line, the edit command F/C/D2I/NEW/ results in the title line containing ABNEWEF, where the D(elete) command has removed the original CD characters.

Example 3: The O(verlay), A(ppend), and M(ove) commands.

Assume once more that the line originally contains ABCDEF. The edit command F/C/O/xxx/A/stuff/ results in a line containing ABxxxFstuff. Starting with the original line, the edit command M3O/bigstuff/ results in the title line ABCbigstuff. Note that this command would have failed if there were not enough room in the title line to hold the additional characters.

Additional Information
PSS®E Program Operation Manual, Editing the Two-Line Case Title or the Long Title

Chapter 4
Power Flow Data Modification

4.1. Changing Service Status and Power Flow Parametric Data

CHNG

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
CHNG	Voltages specified in per unit or kV according to the voltage input option setting
CHNG,REV	Reverse the units for specifying ac voltages

Activity CHNG permits the user to change all service status, control mode, and other parametric data associated with equipment represented in the working case, as well as any of the solution parameters used by the various network solution activities and the two-line case title.

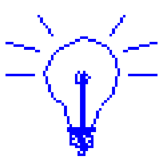
4.1.1. Operation of Activity CHNG

Activity CHNG maintains a comprehensive dialog so that any piece of data may be easily and quickly accessed, examined, and modified. New values assigned to data items are displayed, giving the engineer immediate verification that the intended value for the desired data item has been specified.

Following are possible responses to the dialog request `CHANGE IT?`:

0 or N or NO	No change for these data items; go on to next group of data for this equipment.
1 or Y or YES	Change desired; the dialog prompts the user to enter new values for these data items.
-1	Escape; no more changes for this equipment.
Q	Return to the data category selection menu.

In activity CHNG, ac voltages are specified in the units (per unit or kV) established by the voltage input program option setting (refer to Saved Case Specific Option Settings of the *PSS®E Program Operation Manual*) *unless* activity CHNG is selected with the suffix REV. When CHNG,REV is specified, activity CHNG reverses the units for specifying ac voltages from that specified by the voltage input program option setting to the alternate units.



Activity CHNG can only modify existing data; it cannot add equipment to the working case. To add equipment, use the change case option of activity READ (i.e., IC = 1 in the first data record), activities TREA or RDCH, or the *[Spreadsheet]*.

4.1.2. Example

Activity CHNG dialog and user response conventions are best illustrated by an example.

Suppose that you wish to change the generator reactive power upper limit for machine 1 at bus 206. Run activity CHNG and enter the generator data change code.

Enter the bus number; a line containing the plant data quantities for bus 206 is displayed. Because the desired quantity is a machine quantity, not a plant data item, enter a zero to leave the plant items unchanged.

Then the dialog requests specification of the machine identifier for which data is to be changed. Enter a 1; data values for machine 1 are displayed. (Note: a null response could have been made, because activity CHNG would cycle through the machines at bus 206 in ascending machine identifier order.)

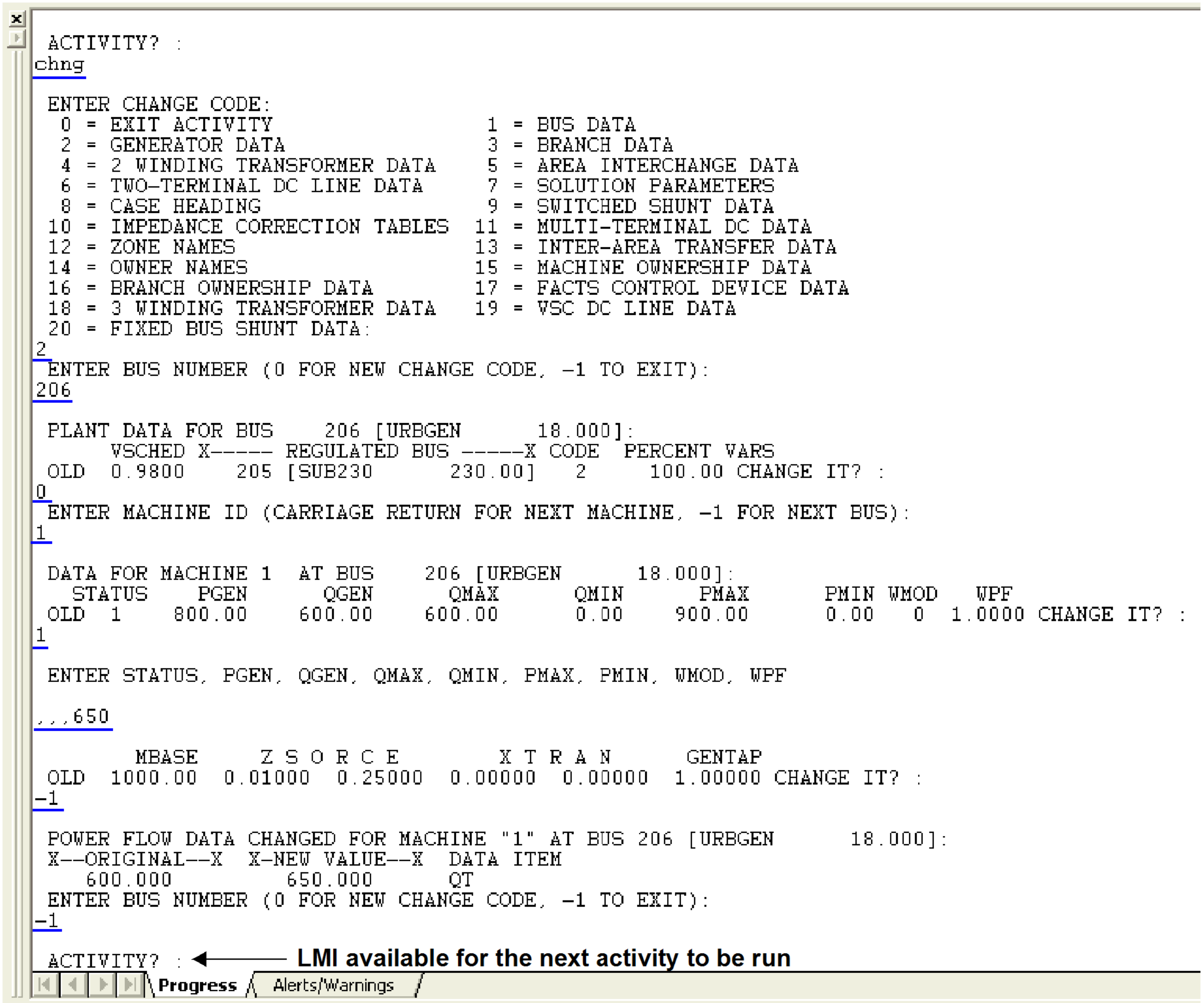
The quantity to be changed (QMAX) is contained in the line. Enter a 1 to indicate that a change is desired. Then the dialog requests specification of new values for the displayed parameters. Because the first three items are to retain their existing values, enter three commas, followed by the new value for QMAX.

No more changes to this machine's data are desired; enter -1.

Examine the display of the modified data items to verify that the desired value was entered.

No more changes are desired; enter -1 to end activity CHNG.

The dialog used in entering this data change is shown in Figure 4.1, "Example: Activity CHNG", with user responses and inputs underlined.



```
ACTIVITY? :
chng

ENTER CHANGE CODE:
 0 = EXIT ACTIVITY                  1 = BUS DATA
 2 = GENERATOR DATA                 3 = BRANCH DATA
 4 = 2 WINDING TRANSFORMER DATA     5 = AREA INTERCHANGE DATA
 6 = TWO-TERMINAL DC LINE DATA      7 = SOLUTION PARAMETERS
 8 = CASE HEADING                   9 = SWITCHED SHUNT DATA
10 = IMPEDANCE CORRECTION TABLES   11 = MULTI-TERMINAL DC DATA
12 = ZONE NAMES                    13 = INTER-AREA TRANSFER DATA
14 = OWNER NAMES                   15 = MACHINE OWNERSHIP DATA
16 = BRANCH OWNERSHIP DATA         17 = FACTS CONTROL DEVICE DATA
18 = 3 WINDING TRANSFORMER DATA    19 = VSC DC LINE DATA
20 = FIXED BUS SHUNT DATA:
2
ENTER BUS NUMBER (0 FOR NEW CHANGE CODE, -1 TO EXIT):
206

PLANT DATA FOR BUS     206 [URBGEN      18.000]:
     VSCHED X----- REGULATED BUS -----X CODE  PERCENT VARS
OLD  0.9800     205 [SUB230      230.00]   2     100.00 CHANGE IT? :
0
ENTER MACHINE ID (CARRIAGE RETURN FOR NEXT MACHINE, -1 FOR NEXT BUS):
1

DATA FOR MACHINE 1  AT BUS    206 [URBGEN      18.000]:
  STATUS    PGEN      QGEN      QMAX      QMIN      PMAX      PMIN WMOD   WPF
OLD  1    800.00    600.00    600.00    0.00    900.00      0.00   0  1.0000 CHANGE IT? :
1

ENTER STATUS, PGEN, QGEN, QMAX, QMIN, PMAX, PMIN, WMOD, WPF

,,,650

       MBASE     Z S O R C E        X T R A N      GENTAP
OLD  1000.00  0.01000  0.25000  0.00000  0.00000  1.00000 CHANGE IT? :
-1

POWER FLOW DATA CHANGED FOR MACHINE "1" AT BUS 206 [URBGEN      18.000]:
X--ORIGINAL--X  X-NEW VALUE--X  DATA ITEM
   600.000         650.000       QT
ENTER BUS NUMBER (0 FOR NEW CHANGE CODE, -1 TO EXIT):
-1

ACTIVITY? :  <------ LMI available for the next activity to be run
```


Figure 4.1. Example: Activity CHNG

4.1.3. Branch Data

The *branch data* category (change code 3) is intended to be used to change data assigned to non-transformer branches. When the branch data category is selected and the user indicates that changes are desired for a branch's series impedance, line charging or ratings, the following instruction is issued:

```
ENTER STATUS, R, X, CHARGING, RATE-A, RATE-B, RATE-C, # OF CIRCUITS, LENGTH
```

If a value of n greater than 1 is entered for the `# OF CIRCUITS`, the branch's R, X, charging, and its three ratings are *all* modified to represent the single circuit equivalent of n identical circuits. Following this calculation, the `# OF CIRCUITS` data item is discarded; it *is not* retained in the working case.

If a two-winding transformer is to be specified using the branch data change code, access to a limited subset of the transformer data is provided for backward compatibility purposes (see Figure 4.3, “Example: CHNG Branch Data for a Two-Winding Transformer”).

The *2 winding transformer data* category (change code 4) provides access to the complete set of impedance, rating, tapping, and control data associated with two-winding transformers. Similarly, the *3 winding transformer data* category (change code 18) is used to change the data associated with three-winding transformers.

Ownership data for non-transformer branches and for two-winding transformers is accessible using *branch ownership data* (change code 16). Ownership data for three-winding transformers is accessible using *3-winding transformer data* (change code 18).

```
>>CHNG

 ENTER CHANGE CODE:
  0 = EXIT ACTIVITY                     1 = BUS DATA
  2 = GENERATOR DATA                    3 = BRANCH DATA
  4 = 2 WINDING TRANSFORMER DATA        5 = AREA INTERCHANGE DATA
  6 = TWO-TERMINAL DC LINE DATA         7 = SOLUTION PARAMETERS
  8 = CASE HEADING                      9 = SWITCHED SHUNT DATA
 10 = IMPEDANCE CORRECTION TABLES      11 = MULTI-TERMINAL DC DATA
 12 = ZONE NAMES                       13 = INTER-AREA TRANSFER DATA
 14 = OWNER NAMES                      15 = MACHINE OWNERSHIP DATA
 16 = BRANCH OWNERSHIP DATA            17 = FACTS CONTROL DEVICE DATA
 18 = 3 WINDING TRANSFORMER DATA       19 = VSC DC LINE DATA
 20 = FIXED BUS SHUNT DATA:
>>3
 ENTER FROM BUS, TO BUS, CIRCUIT IDENTIFIER
  (FROM BUS = 0 FOR NEW CHANGE CODE, -1 TO EXIT):
>>154 153

 BRANCH DATA FOR CKT 1  FROM     154 [DOWNTN      230.00] TO    153 [MID230      230.00]:
  STATUS  LINE R    LINE X  CHARGING  RATE-A  RATE-B  RATE-C LENGTH
 OLD 1   0.00500   0.04500   0.10000   300.0   350.0     1.0    0.0 CHANGE IT? :
>>1
 ENTER STATUS, R, X, CHARGING, RATE-A, RATE-B, RATE-C, # OF CIRCUITS, LENGTH

>>,,,0.105
 LINE SHUNTS: BUS    154 [DOWNTN      230.00]  BUS    153 [MID230      230.00]
 OLD                    0.00000   0.00000                  0.00000   0.00000 CHANGE IT? :
>>
 METERED END IS BUS    153 [MID230      230.00]. ENTER 1 TO REVERSE:
>>

 POWER FLOW DATA CHANGED FOR NON-TRANSFORMER BRANCH CIRCUIT "1" FROM 154 [DOWNTN      230.00] TO 153 [MID230      230
 X--ORIGINAL--X  X-NEW VALUE--X  DATA ITEM
   0.100000        0.105000       B
 ENTER FROM BUS, TO BUS, CIRCUIT IDENTIFIER
  (FROM BUS = 0 FOR NEW CHANGE CODE, -1 TO EXIT):
>>-1

 ACTIVITY? :
>>
```

Figure 4.2. Example: CHNG Branch Data for a Non-Transformer Branch

```
 ACTIVITY? :
>>CHNG

 ENTER CHANGE CODE:
  0 = EXIT ACTIVITY                  1 = BUS DATA
  2 = GENERATOR DATA                 3 = BRANCH DATA
  4 = 2 WINDING TRANSFORMER DATA     5 = AREA INTERCHANGE DATA
  6 = TWO-TERMINAL DC LINE DATA      7 = SOLUTION PARAMETERS
  8 = CASE HEADING                   9 = SWITCHED SHUNT DATA
 10 = IMPEDANCE CORRECTION TABLES   11 = MULTI-TERMINAL DC DATA
 12 = ZONE NAMES                    13 = INTER-AREA TRANSFER DATA
 14 = OWNER NAMES                   15 = MACHINE OWNERSHIP DATA
 16 = BRANCH OWNERSHIP DATA         17 = FACTS CONTROL DEVICE DATA
 18 = 3 WINDING TRANSFORMER DATA    19 = VSC DC LINE DATA
 20 = FIXED BUS SHUNT DATA:
>>3
 ENTER FROM BUS, TO BUS, CIRCUIT IDENTIFIER
  (FROM BUS = 0 FOR NEW CHANGE CODE, -1 TO EXIT):
>>101 151
 THIS BRANCH IS A TRANSFORMER--USE CHANGE CODES 4 AND 16 TO ACCESS ITS DATA
 ACCESS TO SOME OF ITS DATA AVAILABLE HERE ONLY FOR BACKWARD COMPATIBILITY

 BRANCH DATA FOR CKT 1  FROM    101 [NUC-A       21.600]  TO     151 [NUCPANT     500.00]:
  STATUS  LINE R    LINE X    UNUSED  RATE-A  RATE-B  RATE-C
 OLD 1   0.00000   0.01000   0.00000  1250.0  1350.0     1.0 CHANGE IT? :
>>1
 ENTER STATUS, R, X, UNUSED, RATE-A, RATE-B, RATE-C, # OF CIRCUITS

>>0
 LINE SHUNTS: BUS    101 [NUC-A       21.600]  BUS    151 [NUCPANT     500.00]
 OLD                   0.00000   0.00000               0.00000   0.00000 CHANGE IT? :
>>Q

 POWER FLOW DATA CHANGED FOR TWO-WINDING TRANSFORMER CIRCUIT "1" FROM 101 [NUC-A       21.600] TO 151 [NUCPANT     500.00]:
 X--ORIGINAL--X  X-NEW VALUE--X  DATA ITEM
         1               0      STAT

 ENTER CHANGE CODE:
  0 = EXIT ACTIVITY                  1 = BUS DATA
  2 = GENERATOR DATA                 3 = BRANCH DATA
  4 = 2 WINDING TRANSFORMER DATA     5 = AREA INTERCHANGE DATA
  6 = TWO-TERMINAL DC LINE DATA      7 = SOLUTION PARAMETERS
  8 = CASE HEADING                   9 = SWITCHED SHUNT DATA
 10 = IMPEDANCE CORRECTION TABLES   11 = MULTI-TERMINAL DC DATA
 12 = ZONE NAMES                    13 = INTER-AREA TRANSFER DATA
 14 = OWNER NAMES                   15 = MACHINE OWNERSHIP DATA
 16 = BRANCH OWNERSHIP DATA         17 = FACTS CONTROL DEVICE DATA
 18 = 3 WINDING TRANSFORMER DATA    19 = VSC DC LINE DATA
 20 = FIXED BUS SHUNT DATA:
```

Figure 4.3. Example: CHNG Branch Data for a Two-Winding Transformer

4.1.4. Interarea Transfer Data

When *inter-area transfer data* (change code 13) is entered, activity CHNG first instructs the user to:

`ENTER 1 TO APPLY CHANGES IN TRANSFER MW TO FROM AND TO AREA PDES:`

If a 1 is entered in response to the above instruction, activity CHNG updates the desired area net interchange values of the from and to areas for each transfer that is subsequently modified (refer to Section 5.9.3, Inter-area Transfer Data Changes of the *PSS®E Program Operation Manual*).

If a 0 is entered in response to the above instruction, desired area net interchange values are not updated to reflect any interarea transfer changes.

Additional Information
PSS®E Program Operation Manual, Changing Service Status and Power Flow Parametric Data

4.2. Electrically Disconnecting a Bus

DSCN

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
DSCN	Disconnect a bus.

The bus disconnection activity DSCN automates the data changes required to electrically isolate a bus.

The dialog prompts the user to designate the bus to be disconnected. If the specified bus is not contained in the working case, activity DSCN generates an appropriate message and repeats the request for a bus. If the specified bus is Type 3 or greater, a message is generated and activity DSCN requests verification prior to isolating the bus:

```
ENTER 1 TO DISCONNECT IT:
```

If appropriate, the required data changes are implemented in the working case, and activity DSCN then requests the user to designate the next bus to be disconnected. This cycle is repeated until a zero is entered for the bus to be disconnected.

```
 ACTIVITY? :
>>DSCN
 ENTER BUS NUMBER:
>>101
 ENTER 1 TO DISCONNECT IT:
>>1

 TYPE CODE OF BUS     101 [NUC-A       21.600] SET TO  4
 AND STATUS OF FOLLOWING CONNECTED BRANCHES SET TO 0:
 ENTER BUS NUMBER:
>>

 ACTIVITY? :
>>
```

Figure 4.4. Example: Running Activity DSCN

Additional Information
PSS®E Program Operation Manual, Electrically Disconnecting a Bus *PSS ® E Application Program Interface (API)* DSCN

4.3. Electrically Reconnecting a Bus

RECN

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
RECN	Reconnect a bus.

The bus reconnection activity RECN automates the data changes required to electrically reconnect a disconnected (i.e., Type 4) bus. That is, activity RECN is the logical inverse of activity DSCN.

The dialog prompts the user to designate the bus to be reconnected. If the specified bus is not contained in the working case, activity RECN generates an appropriate message and repeats the request for a bus. If the specified bus is not Type 4, a message is generated and activity RECN requests verification prior to implementing the data changes:

```
ENTER 1 TO SET ALL CONNECTED BRANCHES IN SERVICE:
```

If appropriate, the required data changes are implemented in the working case, and activity RECN then requests the user to designate the next bus to be reconnected. This cycle is repeated until a zero is entered for the bus to be reconnected.

```
 ACTIVITY? :
>>RECN
 ENTER BUS NUMBER:
>>101

 TYPE CODE OF BUS    101 [NUC-A       21.600] SET TO  2
 AND STATUS OF FOLLOWING CONNECTED BRANCHES SET TO 1:
  CIRCUIT 1  TO BUS    151 [NUCPANT     500.00]
 ENTER BUS NUMBER:
>>

 ACTIVITY? :|
>>
```

Figure 4.5. Example: Running Activity RECN

Additional Information
PSS®E Program Operation Manual, Electrically Reconnecting a Bus *PSS ® E Application Program Interface (API)* RECN

4.4. Joining Buses

JOIN

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
JOIN	Join a pair of buses.

The bus joining activity JOIN enables the user to combine pairs of buses, retaining the identity of one of the two buses.

The dialog prompts the user to select the line shunt treatment option:

`ENTER 1 TO ADD LINE SHUNTS OF DELETED IN-SERVICE BRANCHES TO RETAINED BUS SHUNT:`

The user is then asked to:

`ENTER TWO BUSES TO JOIN (BUS WHOSE IDENTITY IS RETAINED FIRST):`

The user responds with the numbers (using the *numbers* input option) or extended names (using the *names* option) of the buses to be joined.

If both buses are accepted, activity JOIN applies the required changes to the working case. Then activity JOIN gives the user the opportunity to join another pair of buses. The request for buses to be joined is repeated until the user responds with a zero.

```
 ACTIVITY? :
>>JOIN
 ENTER 1 TO ADD LINE SHUNTS OF DELETED
 IN-SERVICE BRANCHES TO RETAINED BUS SHUNT:
>>1
 ENTER TWO BUSES TO JOIN (BUS WHOSE IDENTITY IS RETAINED FIRST):
>>3006 3007

 JOINING BUSES. RETAINING BUS 3006 [UPTOWN      230.00], ELIMINATING BUS 3007 [RURAL       230.00]

 DUPLICATE CIRCUIT IDENTIFIER "1 " TO BUS 3005 [WEST        230.00]
 CIRCUIT IDENTIFIER OF REROUTED BRANCH CHANGED TO "2 "
 MULTI-SECTION &1 FROM    3005 [WEST        230.00] TO    3008 [CATDOG      230.00] DELETED
 ENTER TWO BUSES TO JOIN (BUS WHOSE IDENTITY IS RETAINED FIRST):
>>

 ACTIVITY? :
>>
```

Figure 4.6. Example: Running Activity JOIN

Additional Information
PSS®E Program Operation Manual, Joining Buses *PSS® E Application Program Interface (API)* JOIN

4.5. Splitting Buses

SPLT

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
SPLT	Split a bus.

The bus sectionalizing activity SPLT enables the user to split a bus into two buses connected by a branch.

The dialog prompts the user to enter the number or extended bus name, as appropriate, of the bus to be split. If the bus is not contained in the working case, activity SPLT generates an appropriate message and repeats the request for a bus.

If the specified bus is in the working case, the dialog prompts the user:

```
SPLITTING BUS nnnnnn [bus name] ENTER NUMBER TO BE ASSIGNED TO NEW BUS (0 TO
SPECIFY NEW BUS TO SPLIT):
```

If the number specified for the new bus is already present in the working case, an error message is generated and the request for a new bus number is repeated.

Then the user is given the opportunity to assign a new name and base voltage to the new bus:

```
ENTER 1 TO ASSIGN A NEW NAME TO BUS nnnn:
```

If both specified buses are accepted, activity SPLT allows the user to move load from the original bus to the new bus. If any loads are present at the original bus, the dialog prompts the user to:

```
ENTER: 0 TO LEAVE LOAD ON ORIGINAL BUS 1 TO MOVE IT TO NEW BUS 2 TO HAVE
LOADS ON BOTH BUSES:
```

If multiple loads are modeled at the original bus, the last option above is included; otherwise, it is omitted.

If some of the loads are to be moved to the new bus, activity SPLT loops through all loads at the original bus. For each load the dialog requests the following user action:

```
ENTER: 1 TO MOVE LOAD id TO NEW BUS 0 TO LEAVE ON ORIGINAL BUS -1 TO LEAVE
REMAINING LOADS ON ORIGINAL BUS:
```

This gives the user the ability to specify which loads are to be moved to the new bus and which are to remain connected to the original bus. Upon completion of the load processing, a warning message is generated if at least one load is not present at each of the two buses.

Similarly, activity SPLT allows the user to move generation from the original bus to the new bus. If a plant entry is present at the original bus, the dialog prompts the user to:

```
ENTER: 0 TO LEAVE GENERATION ON ORIGINAL BUS 1 TO MOVE IT TO NEW BUS 2 TO HAVE
MACHINES ON BOTH BUSES:
```

If multiple machines are modeled at the original bus, the last option above is included; otherwise, it is omitted.

If some of the machines are to be moved to the new bus, activity SPLT loops through all machines at the original bus. For each machine the dialog requests the following user action:

```
ENTER: 1 TO MOVE MACHINE id TO NEW BUS 0 TO LEAVE ON ORIGINAL BUS -1 TO LEAVE
REMAINING MACHINES ON ORIGINAL BUS:
```

This gives the user the ability to specify which machines are to be moved to the new bus and which are to remain connected to the original bus. Using this option, the plant quantities are duplicated at the new bus, and an error message is generated if at least one machine is not present at each of the two buses.

Similarly, a switched shunt may be transferred from the original bus to the new bus:

```
ENTER 1 TO MOVE SWITCHED SHUNT TO NEW BUS:
```

Then activity SPLT loops through all branches connected to the bus being split. For each such branch the dialog requests the following user action:

```
ENTER: 1 TO ROUTE CIRCUIT id FROM nnnn [bus name] TO NEW BUS 0 TO LEAVE ON
ORIGINAL BUS -1 TO ROUTE NO MORE BRANCHES TO NEW BUS:
```

This gives the user the ability to specify which branches are to be rerouted to the new bus and which are to remain connected to the original bus.

Any fixed bus shunts on the original bus remain there.

The appropriate data changes are then implemented in the working case, and activity SPLT requests that the user specify the next bus to be split. This cycle is repeated until a zero is entered as the next bus to be split.

Figure 4.7, “Example: Running Activity SPLT” gives an example of running activity SPLT from line mode.

```
>>SPLT
 ENTER BUS NUMBER:
>>203
 ENTER NUMBER TO BE ASSIGNED TO NEW BUS (0 TO SPECIFY NEW BUS TO SPLIT):
>>212
 ENTER 1 TO ASSIGN A NEW NAME TO BUS    212:
>>1
 ENTER NEW BUS NAME: AAAAAAAAAAAAVVVVVV
>>EAST212

 SPLITTING BUS    203 [EAST230     230.00]
 ENTER: 0 TO LEAVE LOAD ON ORIGINAL BUS
        1 TO MOVE IT TO NEW BUS:
>>1

 ALL LOAD AT BUS 203 [EAST230     230.00] MOVED TO BUS 212 [EAST212           ]

 FOR CIRCUIT 1  FROM     154 [DOWNTN      230.00]
 ENTER: 1 TO ROUTE BRANCH TO NEW BUS
        0 TO LEAVE ON ORIGINAL BUS
       -1 TO ROUTE NO MORE BRANCHES TO NEW BUS:
>>1

 CIRCUIT "1 " FROM 154 [DOWNTN      230.00] TO 203 [EAST230     230.00] MOVED--IS NOW
 CIRCUIT "1 " FROM 154 [DOWNTN      230.00] TO 212 [EAST212           ]

 FOR CIRCUIT 1  FROM     202 [EAST500     500.00]
 ENTER: 1 TO ROUTE BRANCH TO NEW BUS
        0 TO LEAVE ON ORIGINAL BUS
       -1 TO ROUTE NO MORE BRANCHES TO NEW BUS:
>>0

 FOR CIRCUIT 1  FROM     205 [SUB230      230.00]
 ENTER: 1 TO ROUTE BRANCH TO NEW BUS
        0 TO LEAVE ON ORIGINAL BUS
       -1 TO ROUTE NO MORE BRANCHES TO NEW BUS:
>>1

 CIRCUIT "1 " FROM 205 [SUB230      230.00] TO 203 [EAST230     230.00] MOVED--IS NOW
 CIRCUIT "1 " FROM 205 [SUB230      230.00] TO 212 [EAST212           ]

 FOR CIRCUIT 2  FROM     205 [SUB230      230.00]
 ENTER: 1 TO ROUTE BRANCH TO NEW BUS
        0 TO LEAVE ON ORIGINAL BUS
       -1 TO ROUTE NO MORE BRANCHES TO NEW BUS:
>>1

 CIRCUIT "2 " FROM 205 [SUB230      230.00] TO 203 [EAST230     230.00] MOVED--IS NOW
 CIRCUIT "2 " FROM 205 [SUB230      230.00] TO 212 [EAST212           ]
 ENTER BUS NUMBER:
>>

 ACTIVITY? :
>>
```

Figure 4.7. Example: Running Activity SPLT

Additional Information
PSS®E Program Operation Manual Splitting Buses *PSS ® E Application Program Interface (API)* SPLT MOVE3WND MOVEBRN MOVELOAD MOVELOADS MOVEMAC MOVEPLNT MOVESWS

4.6. Tapping a Line

LTAP

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
LTAP	Tap a non-transformer branch.

The line tapping activity LTAP enables the user to introduce a new bus into the working case at a designated location along a specified ac branch. Any non-transformer branch may be tapped with activity LTAP.

The user is asked to specify the branch to be tapped. If the branch is not contained in the working case or if it is a transformer, an appropriate error message is generated and the request for a branch is repeated. Otherwise, the dialog described below occurs, the appropriate data changes are made to the working case, and another branch may then be specified for tapping. This cycle is repeated until a zero is entered as the from bus.

Following the designation of the branch to be tapped, the number to be assigned to the new bus is specified:

`ENTER NUMBER TO BE ASSIGNED TO NEW BUS (0 TO SPECIFY NEW BRANCH TO SPLIT):`

If the specified bus number is already assigned to a bus in the working case, an appropriate message is generated and the request for the bus number is repeated.

Then the user is asked to designate the extended name (name plus base voltage) to be assigned to the new bus:

`ENTER NAME FOR BUS nnnnn: AAAAAAAAAAAAVVVVVV`

The user then specifies the location of the new bus along the branch being tapped in per unit of total line length from the from bus:

`ENTER NEW BUS LOCATION AS FRACTION OF LINE FROM BUS nnnnn [bus name]:`

The data changes are implemented and then another branch may be specified for tapping.

```
 ACTIVITY? :
>>LTAP
 ENTER FROM BUS, TO BUS, CIRCUIT IDENTIFIER
  (FROM BUS = 0 TO EXIT):
>>203 154
 ENTER NUMBER TO BE ASSIGNED TO NEW BUS (0 TO SPECIFY NEW BRANCH TO SPLIT):
>>212
 ENTER NAME FOR BUS    212: AAAAAAAAAAAAVVVVVV
>>EAST212
 ENTER NEW BUS LOCATION AS FRACTION OF LINE FROM BUS    203 [EAST230     230.00]:
>>.75

 TAPPING CIRCUIT "1" FROM BUS 203 [EAST230     230.00] TO BUS 154 [DOWNTN      230.00]
 ENTER FROM BUS, TO BUS, CIRCUIT IDENTIFIER
  (FROM BUS = 0 TO EXIT):
>>

 ACTIVITY? :
>>
```

Figure 4.8. Example: Running Activity LTAP

Additional Information
PSS®E Program Operation Manual Tapping a Line *PSS® E Application Program Interface (API)* LTAP

4.7. Moving Equipment

MOVE

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
MOVE	Move equipment items.

The equipment transferal activity MOVE allows the user to move specified fixed shunts, switched shunts, loads, machines, and plants from one bus to another. It also provides for connecting the far end of specified branches and one winding of a three-winding transformer to different to buses.

Activity MOVE prompts the user to designate the type of data to be moved:

```
EQUIPMENT ITEMS WHICH MAY BE MOVED ARE: 1 = AC LINES 2 = SWITCHED SHUNTS 3 =
MACHINES 4 = PLANTS 5 = INDIVIDUAL LOADS 6 = ALL LOADS AT A BUS 7 = THREE-
WINDING TRANSFORMERS 8 = INDIVIDUAL FIXED SHUNTS 9 = ALL FIXED SHUNTS AT A BUS
ENTER EQUIPMENT CATEGORY CODE:
```

After the user enters the equipment change code, the dialog requests specification of the individual equipment to be moved. Then the user is asked to specify the bus to which the equipment item is to be transferred. This cycle is repeated until a zero is entered as the equipment code. The number of items that were moved is then tabulated and another equipment item code may be entered.

If both buses are plant buses and a machine with the same identifier as the machine being moved is already present at the destination bus, the machine previously at the destination bus keeps its original identifier and the user is asked to designate a new identifier for the moved machine:

```
MACHINE id AT BUS nnn [bus name] ALREADY EXISTS ENTER NEW MACHINE ID:
```

If both buses are load buses and a load with the same identifier as the load being moved is already present at the destination bus, the load previously at the destination bus keeps its original identifier and the user is asked to designate a new identifier for the moved load:

```
LOAD id AT BUS nnn [bus name] ALREADY EXISTS ENTER NEW LOAD ID:
```

If both buses are fixed shunt buses and a fixed shunt with the same identifier as the shunt being moved is already present at the destination bus, the shunt previously at the destination bus keeps its original identifier and the user is asked to designate a new identifier for the moved shunt:

```
SHUNT id AT BUS nnn [bus name] ALREADY EXISTS ENTER NEW SHUNT ID:
```

```
>>MOVE

 EQUIPMENT ITEMS WHICH MAY BE MOVED ARE:
  1 = AC LINES                        2 = SWITCHED SHUNTS
  3 = MACHINES                        4 = PLANTS
  5 = INDIVIDUAL LOADS                6 = ALL LOADS AT A BUS
  7 = THREE-WINDING TRANSFORMERS
 ENTER EQUIPMENT CATEGORY CODE:
>>2
 ENTER BUS WHOSE SWITCHED SHUNT IS TO BE MOVED (0 FOR NO MORE):
>>3005
 ENTER DESTINATION BUS (0 FOR NEXT SWITCHED SHUNT BUS):
>>3003

 WARNING: SWITCHED SHUNT CONTROLS VSC CONVERTER MVAR AT BUS 3005 [WEST        230.00] OF VSC DC LINE "VDCLINE1"

 SWITCHED SHUNT AT BUS 3005 [WEST        230.00] MOVED TO BUS 3003 [S. MINE     230.00]
 ENTER BUS WHOSE SWITCHED SHUNT IS TO BE MOVED (0 FOR NO MORE):
>>0

 EQUIPMENT ITEMS WHICH MAY BE MOVED ARE:
  1 = AC LINES                        2 = SWITCHED SHUNTS
  3 = MACHINES                        4 = PLANTS
  5 = INDIVIDUAL LOADS                6 = ALL LOADS AT A BUS
  7 = THREE-WINDING TRANSFORMERS
 ENTER EQUIPMENT CATEGORY CODE:
>>

 ACTIVITY? :
>>
```

Figure 4.9. Example: Running Activity MOVE

Additional Information
PSS®E Program Operation Manual Moving Equipment *PSS®E Application Program Interface (API)* MOVE3WND MOVEBRN MOVELOAD MOVELOADS MOVEMAC MOVEPLNT MOVESHUNT MOVESHUNTS MOVESWS

4.8. Removing Specified Buses and Connected Equipment

EXTR

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
EXTR	Remove specified buses
EXTR,AREA	Remove buses from specified area(s)
EXTR,ZONE	Remove buses from specified zone(s)
EXTR,OWNER	Remove buses for specified owner(s)
EXTR,KV	Remove buses for specified base voltage range
EXTR,OPT	Remove buses from specified subsystem using multiple selection criteria

The bus removal activity EXTR purges specified buses and all equipment connected to them from the working case.

When initiated, activity EXTR prompts the user:

```
WARNING: EXTR PURGES DATA FROM THE WORKING CASE DO YOU WANT TO CONTINUE?
```

To continue, the user must enter the response YES.

The dialog of activity EXTR allows the user to select the processing options of activity EXTR:

```
ENTER 1 TO ELIMINATE GENERATOR ENTRIES FOR OUT OF SERVICE PLANTS:
```

and:

```
ENTER 1 TO CHANGE CODES OF BOUNDARY BUSES:
```

To enable either option, enter 1; to bypass the option, enter 0.

Activity EXTR then generates the following message informing the user that all buses contained in the subsystem specified in the remaining dialog will be removed from the working case and all other buses will be retained:

```
USER SPECIFIES SUBSYSTEM TO BE DELETED
```

Specification of the subsystem to be deleted is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may then designate another subsystem for removal.

```
>>EXTR

 WARNING: EXTR PURGES DATA FROM THE WORKING CASE
 DO YOU WANT TO CONTINUE? :
>>yes
 ENTER 1 TO ELIMINATE GENERATOR ENTRIES FOR OUT OF SERVICE PLANTS:
>>1
 ENTER 1 TO CHANGE CODES OF BOUNDARY BUSES:
>>1
  USER SPECIFIES SUBSYSTEM TO BE DELETED
 ENTER UP TO 20 BUS NUMBERS

>>153
 ENTER UP TO 20 BUS NUMBERS

>>

      1 BUSES REMOVED

 ACTIVITY? :
>>
```

Figure 4.10. Example: Running Activity EXTR

Additional Information
PSS®E Program Operation Manual, Removing Specified Buses and Connected Equipment *PSS ® E Application Program Interface (API)* EXTR

4.9. Deleting Equipment

PURG

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
PURG	Remove outaged equipment at specfied buses
PURG,ALL	Remove outaged equipment at all buses
PURG,AREA	Remove outaged equipment in specified area(s)
PURG,ZONE	Remove outaged equipment in specified zone(s)
PURG,OWNER	Remove outaged equipment for specified owner(s)
PURG,KV	Remove outaged equipment for specified base voltage range
PURG,OPT	Remove outaged equipment in specified subsystem using multiple selection criteria
PURG,SINGLE or PURG,SI	Remove individual equipment items, regardless of their service status

The equipment removal activity PURG deletes designated equipment items from the working case. Activity PURG may be used to remove either individually specified equipment items or all outaged items of a specified equipment category that are contained in a specified subsystem of the working case.

4.9.1. Deleting Individual Equipment Items

In line mode, when activity PURG is run with the SINGLE suffix, the user is prompted to indicate the type of equipment to be deleted:

```
EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE: 1 = AC LINES 2 = SWITCHED SHUNTS 3
= MACHINES 4 = PLANTS 5 = 2-TERMINAL DC LINES 6 = MULTI-TERMINAL DC LINES 7
= MULTI-SECTION LINES 8 = ZERO SEQUENCE MUTUALS 9 = INTER-AREA TRANSFERS 10 =
LOADS 11 = FACTS DEVICES 12 = THREE-WINDING TRANSFORMERS 13 = VSC DC LINES 14
= FIXED BUS SHUNTS ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
```

The menu entry for zero sequence mutuals is omitted if sequence data is not contained in the working case.

Following the selection of the equipment category, the user is instructed to designate the individual equipment items to be deleted. Except for multi-section line groupings, zero sequence mutuals, and interarea transfers, if the item is in-service, an appropriate message is printed and the user is instructed to confirm that it is to be deleted:

```
DELETE IT? (0=NO, 1=YES):
```

This check before deleting occurs as follows:

ac branches	The branch status flag is positive.
Switched shunts	The switched shunt status flag is 1.
Machines	Machine status flag is positive and the bus is Type 2 or Type 3.

Plants	The bus is Type 2 or Type 3.
Loads	The load status flag is positive.
Fixed bus shunts	The shunt status flag is positive.
dc lines	The control mode is non-zero.
FACTS devices	The control mode is non-zero.
Three-winding transformers	The status flag is non-zero.

Following an input that signifies that no more items of the category currently being processed are to be removed, the number of items of that category that were deleted is tabulated. Then another equipment category may be specified.

```
>>PURG,SI

 EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE:
  1 = AC LINES                        2 = SWITCHED SHUNTS
  3 = MACHINES                        4 = PLANTS
  5 = 2-TERMINAL DC LINES             6 = MULTI-TERMINAL DC LINES
  7 = MULTI-SECTION LINE GROUPINGS
  9 = INTER-AREA TRANSFERS           10 = LOADS
 11 = FACTS DEVICES                  12 = THREE-WINDING TRANSFORMERS
 13 = VSC DC LINES                   14 = FIXED BUS SHUNTS
 ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
>>10
 ENTER BUS NUMBER (0 FOR NO MORE):
>>203
 ENTER LOAD ID (CARRIAGE RETURN FOR NEW BUS):
>>1
 LOAD 1  IS IN-SERVICE AT BUS    203 [EAST230     230.00]
 DELETE IT? (0=NO, 1=YES):
>>1
 LOAD 1  AT BUS    203 [EAST230     230.00] DELETED
    203 [EAST230     230.00] ALL LOADS REMOVED
 ENTER BUS NUMBER (0 FOR NO MORE):
>>0

 EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE:
  1 = AC LINES                        2 = SWITCHED SHUNTS
  3 = MACHINES                        4 = PLANTS
  5 = 2-TERMINAL DC LINES             6 = MULTI-TERMINAL DC LINES
  7 = MULTI-SECTION LINE GROUPINGS
  9 = INTER-AREA TRANSFERS           10 = LOADS
 11 = FACTS DEVICES                  12 = THREE-WINDING TRANSFORMERS
 13 = VSC DC LINES                   14 = FIXED BUS SHUNTS
 ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
>>0

 ACTIVITY? :
>>
```

Figure 4.11. Example: Running Activity PURG,SI

4.9.2. Deleting Outaged Subsystem Equipment Items

Activity PURG may be used to remove all outaged equipment of a designated equipment category connected to buses in a specified subsystem from the working case.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection.

Following subsystem specification, the dialog prompts the user to:

```
EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE: 1 = AC LINES 2 = SWITCHED SHUNTS 3
= MACHINES 4 = PLANTS 5 = 2-TERMINAL DC LINES 6 = MULTI-TERMINAL DC LINES 7 =
LOADS 8 = FACTS DEVICES 9 = THREE-WINDING TRANSFORMERS 10 = VSC DC LINES 11 =
FIXED BUS SHUNTS ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
```

As the specified change code is being processed, each deleted item is reported at the Progress device. As the processing of each equipment category is completed, the number of items of that category that were deleted is tabulated. Then another equipment change code may be entered.

```
>>PURG,ALL

 EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE:
  1 = AC LINES                      2 = SWITCHED SHUNTS
  3 = MACHINES                      4 = PLANTS
  5 = 2-TERMINAL DC LINES           6 = MULTI-TERMINAL DC LINES
  7 = LOADS                         8 = FACTS DEVICES
  9 = THREE-WINDING TRANSFORMERS 10 = VSC DC LINES
 11 = FIXED BUS SHUNTS
 ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
>>7

 X---------- BUS ----------X ID
    154 [DOWNTN      230.00] 1
    154 [DOWNTN      230.00] 2
    154 [DOWNTN      230.00] ALL LOADS REMOVED

     2 LOADS DELETED

 EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE:
  1 = AC LINES                      2 = SWITCHED SHUNTS
  3 = MACHINES                      4 = PLANTS
  5 = 2-TERMINAL DC LINES           6 = MULTI-TERMINAL DC LINES
  7 = LOADS                         8 = FACTS DEVICES
  9 = THREE-WINDING TRANSFORMERS 10 = VSC DC LINES
 11 = FIXED BUS SHUNTS
 ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
>>0

 ACTIVITY? :
>>
```

Figure 4.12. Example: Running Activity PURG,ALL

Except when activity PURG is run with the suffix ALL, the user is given the choice to include or exclude outaged subsystem ties in the processing of ac branches, dc lines, FACTS devices, and three-winding transformers. Whenever categories 1, 5, 6, 8, 9 or 10 are entered, the dialog prompts the user to:

```
ENTER 1 TO REMOVE OUT-OF-SERVICE TIES TO OTHER SUBSYSTEMS:
```

When a 1 is entered, any outaged branch with at least one bus in the specified subsystem is deleted. Otherwise, all buses connected by the branch must be in the specified subsystem.

```
>>PURG
 ENTER UP TO 20 BUS NUMBERS

>>152 153 203
 ENTER UP TO 20 BUS NUMBERS

>>

 EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE:
  1 = AC LINES                        2 = SWITCHED SHUNTS
  3 = MACHINES                        4 = PLANTS
  5 = 2-TERMINAL DC LINES             6 = MULTI-TERMINAL DC LINES
  7 = LOADS                           8 = FACTS DEVICES
  9 = THREE-WINDING TRANSFORMERS 10 = VSC DC LINES
 11 = FIXED BUS SHUNTS
 ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
>>1
 ENTER 1 TO REMOVE OUT-OF-SERVICE TIES TO OTHER SUBSYSTEMS:
>>1

 X------- FROM BUS ---------X X--------- TO BUS ----------X CKT
    152 [MID500      500.00]    202 [EAST500      500.00]  1
    152 [MID500      500.00]   3004 [WEST         500.00]  1
    153 [MID230      230.00]    154 [DOWNTN       230.00]  1

     3 BRANCHES DELETED

 EQUIPMENT ITEMS WHICH MAY BE REMOVED ARE:
  1 = AC LINES                        2 = SWITCHED SHUNTS
  3 = MACHINES                        4 = PLANTS
  5 = 2-TERMINAL DC LINES             6 = MULTI-TERMINAL DC LINES
  7 = LOADS                           8 = FACTS DEVICES
  9 = THREE-WINDING TRANSFORMERS 10 = VSC DC LINES
 11 = FIXED BUS SHUNTS
 ENTER EQUIPMENT CATEGORY CODE (0 TO EXIT):
>>0

 ACTIVITY? :
>>
```

Figure 4.13. Example: Running Activity PURG (Out-of-Service Ties)

Additional Information
PSS®E Program Operation Manual, Deleting Equipment *PSS® E Application Program Interface (API)* PURG

4.10. Modifying Resistances of Non-Transformer Branches

MODR

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
MODR	Process branches at specified buses
MODR,ALL	Process branches at all buses
MODR,AREA	Process branches at buses in specified area(s)
MODR,ZONE	Process branches at buses in specified zone(s)
MODR,OWNER	Process branches with specified owner(s)
MODR,KV	Process branches at buses in specified base voltage range
MODR,OPT	Process branches in specified subsystem using multiple selection criteria

The branch resistance modification activity MODR enables the user to uniformly increase or decrease the line resistances of in-service non-transformer branches.

Activity MODR prompts the user to:

```
ENTER BASE LINE LOADING IN PERCENT:
```

The user should respond with the percentage loading on which branch resistances were initially entered; the default value for this response is 100%.

The user is then asked to designate the rating set on which the present values of branch resistances are based, with the default being the rating set established as the default rating set program option setting:

```
ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=n):
```

Activity MODR prompts the user to:

```
ENTER LINE RESISTANCE SCALING FACTOR IN pu:
```

where a response between 0.0 and 0.1 is permitted.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

```
>>MODR
 ENTER BASE LINE LOADING IN PERCENT:
>>
 ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=1):
>>2
 ENTER LINE RESISTANCE SCALING FACTOR IN P.U.:
>>.09

     13 BRANCH RESISTANCES CHANGED

 ACTIVITY? :
>>
```

Figure 4.14. Example: Running Activity MODR

Additional Information
PSS®E Program Operation Manual, Modifying Resistances of Non-Transformer Branches *PSS® E Application Program Interface (API)* MODR

4.11. Scaling Loads, Generators,and Shunts

SCAL

Requirements / Prerequisites	
The working case must contain a validly specified power flow case. If generation is to be scaled, and a Type 3 bus is in the subsystem being scaled, the working case must be solved to an acceptable mismatch level	
Activity ID, Suffix	Suffix Function
SCAL	Scale power flow data for specified buses
SCAL,ALL	Scale power flow data for entire working case
SCAL,AREA	Scale power flow data for specified area(s)
SCAL,ZONE	Scale power flow data for specified zone(s)
SCAL,OWNER	Scale power flow data for specified owner(s)
SCAL,KV	Scale power flow data in specified base voltage range
SCAL,OPT	Scale power flow data for specified subsystem using multiple selection criteria

The load, generation and shunt scaling activity SCAL enables the user to uniformly increase or decrease any or all of the following quantities for a specified grouping of loads, fixed shunts, and machines:

- Load active power.
- Load reactive power.
- Active component of fixed bus shunt admittance.
- Positive reactive component of fixed bus shunt admittance (capacitors).
- Negative reactive component of fixed bus shunt admittance (reactors).
- Generator active power output (positive generation).
- Motor active power output (negative generation).

Specification of the subsystem to be scaled is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may then select another subsystem for scaling.

Activity SCAL then tabulates totals as shown below and asks the user if any of the displayed quantities are to be modified:

```
LOAD-MW GENERATION SHUNT-MW REACTORS CAPACITORS MOTORS XXXX.X XXXX.X XXXX.X -
XXXX.X XXXX.X -XXXX.X ENTER 0 FOR NO CHANGE 1 TO SPECIFY NEW TOTAL POWERS 2
TO SPECIFY PERCENT CHANGES:
```

If the user chooses to scale any of these totals by entering a 1 in response to the above question, the dialog requests new totals for these quantities:

```
ENTER NEW TOTALS FOR LOAD, GENERATION, SHUNT-MW, REACTOR-MVAR (NEG), CAPACI-
TOR-MVAR, MOTOR MW (NEG):
```

When the user enters a 2 in response to the above question, the dialog requests the percentages by which the displayed quantities are to be scaled:

```
ENTER PERCENT TO CHANGE LOAD, GENERATION, SHUNT-MW, REACTOR-MVAR, CAPACI-
TOR-MVAR, MOTOR MW:
```

Consecutive commas may be used to skip over quantities that are not to be changed.

In either of these two cases, the user is given the option of having activity SCAL honor the active power limits of each machine for which output is to be changed:

```
TOTAL GENERATOR LIMITS: PMAX = XXXX.X PMIN = XXXX.X TOTAL MOTOR LIMITS: PMAX =
-XXXX.X PMIN = -XXXX.X ENTER 1 TO ENFORCE MACHINE POWER LIMITS:
```

Activity SCAL then enables the user to change the total reactive power load; the user is asked to specify the scaling rule to be enforced:

```
TOTAL LOAD MVAR = XXXXX.X. ENTER CHANGE CODE: 0 FOR NO CHANGE 1 FOR CONSTANT P/
Q RATIO 2 FOR NEW TOTAL Q LOAD 3 FOR PERCENT CHANGE 4 FOR NEW POWER FACTOR:
```

If a response of 2, 3, or 4 is entered, the user is instructed to enter the appropriate scaling parameter (i.e., either the new total, the percent change, or the new power factor).

Activity SCAL then modifies the appropriate data items to reflect the specified scaling.

```
 ACTIVITY? :
SCAL ALL

  LOAD-MW GENERATION   SHUNT-MW   REACTORS CAPACITORS
   3200.0      3248.9        0.0     -900.0      550.0

 ENTER 0 FOR NO CHANGE
       1 TO SPECIFY NEW TOTAL POWERS
       2 TO SPECIFY PERCENT CHANGES:
1
 ENTER NEW TOTALS FOR
 LOAD, GENERATION, SHUNT-MW, REACTOR-MVAR (NEG), CAPACITOR-MVAR [, MOTOR MW (NEG)]:
3000

 TOTAL GENERATOR LIMITS: PMAX =    59994.0  PMIN =        0.0
 ENTER 1 TO ENFORCE MACHINE POWER LIMITS:
1

 TOTAL LOAD MVAR =  1950.0

 ENTER CHANGE CODE:
  0 FOR NO CHANGE          1 FOR CONSTANT P/Q RATIO
  2 FOR NEW TOTAL Q LOAD  3 FOR PERCENT CHANGE
  4 FOR NEW POWER FACTOR:
1

 PRESENT TOTALS:
 LOAD-MW        3200.0  (     3200.0 SCALABLE,        0.0 FIXED)
 LOAD-MVAR      1950.0  (        0.0 SCALABLE,        0.0 FIXED)
 GENERATION     3248.9
 SHUNT-MW          0.0
 REACTORS       -900.0
 CAPACITORS      550.0

 NEW TOTALS:
 LOAD-MW        3000.0  (     3000.0 SCALABLE,        0.0 FIXED)
 LOAD-MVAR      1828.1  (     1828.1 SCALABLE,        0.0 FIXED)
 GENERATION     3248.9
 SHUNT-MW          0.0
 REACTORS       -900.0
 CAPACITORS      550.0

 ACTIVITY? :
```

Figure 4.15. Example: Running Activity SCAL (Total Power)

Additional Information
PSS®E ProgramProgram Operation Manual, Scaling Loads, Generators, and/or Shunts *PSS ® E Application Program Interface (API)* SCAL

4.12. Changing Adjustment Enable Flags of Transformers

TFLG

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
TFLG	Change adjustment enable flags of adjustable transformers connecting specified buses
TFLG,ALL	Change adjustment enable flags of all adjustable transformers
TFLG,AREA	Change adjustment enable flags of adjustable transformers in specified area(s)
TFLG,ZONE	Change adjustment enable flags of adjustable transformers in specified zone(s)
TFLG,OWNER	Change adjustment enable flags of adjustable transformers connecting buses of specified owner(s)
TFLG,KV	Change adjustment enable flags of adjustable transformers connecting buses in specified base voltage range
TFLG,OPT	Change adjustment enable flags of adjustable transformers in specified subsystem using multiple selection criteria

The transformer adjustment enable flag setting activity TFLG allows the user to either enable or disable the adjustment status of all automatically adjustable transformer windings contained in the subsystem specified by the user.

The user is first asked to enter the setting to be given to those transformer windings to be processed:

```
ENTER 0 TO DISABLE, 1 TO ENABLE:
```

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Additional Information
PSS®E Program Operation Manual,Changing Adjustment Enable Flags of Transformers *PSS ® E Application Program Interface (API)* TFLG

4.13. Running Unit Commitment and Economic Dispatch

ECDI

Requirements / Prerequisites	
The working case must contain a validly specified power flow case. Economic Dispatch Data File (*.ecd)	
Activity ID, Suffix	Suffix Function
ECDI	Calculate dispatch for machines at specified buses
ECDI,ALL	Calculate dispatch for all machines
ECDI,AREA	Calculate dispatch for machines in specified area(s)
ECDI,ZONE	Calculate dispatch for machines in specified zone(s)
ECDI,OWNER	Calculate dispatch for machines with specified owner(s)
ECDI,KV	Calculate dispatch for machines at buses in specified base voltage range
ECDI,OPT	Calculate dispatch for machines in specified subsystem using multiple selection criteria

The unit commitment/economic dispatch activity ECDI places machines in a specified subsystem in- or out-of-service to satisfy a given subsystem minimum capacity. The in-service machines in the subsystem are then dispatched on the basis of equal incremental cost to meet a specified total subsystem generation.

Activity ECDI prompts the user to:

```
ENTER ECONOMIC DISPATCH DATA FILE NAME:
```

The user then enters the name of the appropriate Economic Dispatch Data File, or a zero to end activity ECDI with the working case unchanged. If a filename is entered, and either the file does not exist or some other file system error occurs, an appropriate error message is displayed and the request for a data filename is repeated.

After the input file is successfully opened, activity ECDI processes the data records.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection.

Following the subsystem specification dialog, the user is asked to enter an initial commitment option.

```
ENTER 0 TO START FROM CURRENT COMMITMENT PROFILE 1 FOR NEW COMMITMENT PROFILE:
```

Activity ECDI then summarizes the predispatch condition and prompts the user to:

```
ENTER DESIRED LOAD, DESIRED MINIMUM CAPACITY OF UNITS BEING DISPATCHED:
```

After the dispatch parameters are specified, the unit commitment and economic dispatch calculation are run.

Additional Information
PSS®E Program Operation Manual, Performing Unit Commitment and Economic Dispatch

Additional Information
PSS® E Application Program Interface (API) ECDI

4.14. Changing Sequence Data

SQCH

Requirements / Prerequisites	
The working case must contain a validly specified power flow case. Sequence data must be present in the working case.	
Activity ID, Suffix	Suffix Function
SQCH	Change sequence data.

The sequence data modification activity SQCH allows the user to make changes to the various sequence data arrays in the working case. The interactive dialog of activity SQCH follows the same conventions as the power flow data changing activity, CHNG.

Activity SQCH prompts the user to specify the type of sequence data to be changed:

```
ENTER CHANGE CODE: 0 = EXIT ACTIVITY 1 = BUS SHUNT LOADS (ZERO & NEG SEQS) 2
= GENERATOR IMPEDANCES 3 = ZERO SEQ NONTRANSFORMER BRANCH DATA 4 = ZERO SEQ
SWITCHED SHUNTS 5 = ZERO SEQ 2 WINDING TRANSFORMER DATA 6 = ZERO SEQ 3 WINDING
TRANSFORMER DATA 7 = ZERO SEQ FIXED SHUNTS:
```

As with activity CHNG, activity SQCH only modifies existing sequence data. However, because the topology of the negative and zero sequence networks follows that of the positive sequence network, any bus, machine, branch, fixed shunt, and switched shunt data not entered in the sequence data input activity, RESQ, already exists with default values assigned. Thus, additional zero sequence mutual couplings are the only components that may not be added with activity SQCH. These must be introduced into the working case via the change case option of activity RESQ (i.e., with IC set to 1 on the first data record of the Sequence Data File), with activity TRSQ., or with the *[Spreadsheet]*.

In changing generator impedances, the user specifies the bus and activity SQCH then allows access to all machines at the bus.

Following the selection of a branch when changing non-transformer branch data, the user is given the opportunity to change the zero sequence impedance, charging and line connected shunts for that branch. Then, if the selected branch is coupled to any other branches, the user may modify the mutual impedance data for any of these mutual couplings.

Additional Information
PSS®E Program Operation Manual, Changing Sequence Data See also: *Section 4.1, "Changing Service Status and Power Flow Parametric Data"*

4.15. Changing Equipment Identifiers

MBID

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
MBID	Change equipment identifiers.

The equipment identifier modification activity MBID allows the user to change the alphanumeric identifiers assigned to specified machines, loads, fixed bus shunts, ac branches, multi-section line groupings, dc lines, FACTS devices, and interarea transfers in the working case.

Activity MBID prompts the user to:

```
ENTER 0 TO EXIT 1 FOR MACHINE ID'S 2 FOR CIRCUIT ID'S 3 FOR INTER-AREA TRANSFER
ID'S 4 FOR LOAD ID'S 5 FOR TWO-TERMINAL DC LINE NAMES 6 FOR MULTI-TERM DC LINE
NAMES 7 FOR FACTS DEVICE NAMES 8 FOR 3-WINDING TRANSFORMER ID'S 9 FOR VSC DC
LINE NAMES 10 FOR SHUNT ID'S:
```

The equipment code of 2 allows access to circiut identifiers of non-transformer branches (breakers, switches, and normal branches), two-winding transformers, and multi-section line groupings.

After entering the desired equipment code, the user is asked to specify the machine, load, shunt, branch, FACTS device, dc line, or interarea transfer for which the identifier is to be changed. If it is not in the working case, activity MBID generates an appropriate message and repeats the input request.

The user is then asked to designate the new identifier to be assigned to the specified equipment item by responding to one of the following prompts:

```
ENTER NEW ID:
```

```
ENTER NEW DC LINE NAME:
```

```
ENTER NEW FACTS DEVICE NAME:
```

The identifier is then updated, and the dialog prompts the user to specify the next element for which the identifier is to be changed. This cycle is repeated until a zero is entered in response to the element input request.

```
>>MBID

 ENTER 0 TO EXIT                              1 FOR MACHINE ID's
       2 FOR CIRCUIT ID's                     3 FOR INTER-AREA TRANSFER ID's
       4 FOR LOAD ID's                        5 FOR TWO-TERMINAL DC LINE NAMES
       6 FOR MULTI-TERM DC LINE NAMES         7 FOR FACTS DEVICE NAMES
       8 FOR 3-WINDING TRANSFORMER IDs        9 FOR VSC DC LINE NAMES
      10 FOR SHUNT ID's:
>>1
 ENTER BUS NUMBER, MACHINE ID:
>>401 1
 ENTER NEW ID:
>>2

 MACHINE IDENTIFIER "1" CHANGED TO "2" AT BUS 401 [COGEN-1     500.00]
 ENTER BUS NUMBER, MACHINE ID:
>>

 ENTER 0 TO EXIT                              1 FOR MACHINE ID's
       2 FOR CIRCUIT ID's                     3 FOR INTER-AREA TRANSFER ID's
       4 FOR LOAD ID's                        5 FOR TWO-TERMINAL DC LINE NAMES
       6 FOR MULTI-TERM DC LINE NAMES         7 FOR FACTS DEVICE NAMES
       8 FOR 3-WINDING TRANSFORMER IDs        9 FOR VSC DC LINE NAMES
      10 FOR SHUNT ID's:
>>0

 ACTIVITY? :
>>
```

Figure 4.16. Example: Running Activity MBID

Additional Information
PSS®E Program Operation Manual, Changing Equipment Identifiers *PSS® E Application Program Interface (API)* MBID2DC MBID3WND MBIDATRN MBID-BRN MBIDFACTS MBIDLOAD MBIDMAC MBIDMDC MBIDMSL MBIDSHUNT MBIDVSC

4.16. Changing Area Assignments of Buses

ARNM

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
ARNM	Reassign specified buses
ARNM,ALL	Reassign all buses
ARNM,AREA	Reassign buses in specified area(s)
ARNM,ZONE	Reassign buses in specified zone(s)
ARNM,OWNER	Reassign buses for specified owner(s)
ARNM,KV	Reassign buses in specified base voltage range
ARNM,OPT	Reassign buses in specified subsystem using multiple selection criteria

The area renumbering activity ARNM reassigns buses in the working case from their original areas to a designated area. All buses in the working case may be reassigned to a designated area; more typically, buses in a specified subsystem of the working case are assigned to a designated area.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Following any subsystem selection dialog, activity ARNM prompts the user to:

```
ENTER NEW AREA NUMBER, 0 TO EXIT (DEFAULT IS nn):
```

If the specified area is not empty, the number of buses, loads, and dc buses assigned to the area is listed, and activity ARNM prompts the user to:

```
ENTER 1 TO ADD SELECTED EQUIPMENT TO AREA:
```

A response of 0 causes activity ARNM to request another area number. Otherwise all buses in the specified subsystem are reassigned to that area.

Then, if activity ARNM was run with the ALL suffix, it ends. Otherwise, the user is given the opportunity to change the area assignments of buses in another subsystem:

```
DO YOU WANT MORE?
```

A response of 0 ends activity ARNM, and a response of 1 allows the user to select another subsystem for processing.

Additional Information
PSS®E Program Operation Manual Changing Owner Assignments *PSS ® E Application Program Interface (API)* ARNM

4.17. Changing Area Assignments of Loads

LDAR

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
LDAR	Reassign loads at specified buses
LDAR,ALL	Reassign all loads
LDAR,AREA	Reassign loads in specified area(s)
LDAR,ZONE	Reassign loads in specified zone(s)
LDAR,OWNER	Reassign loads for specified owner(s)
LDAR,KV	Reassign loads at buses in specified base voltage range
LDAR,OPT	Reassign loads in specified subsystem using multiple selection criteria

The area renumbering activity LDAR reassigns loads in the working case from their original areas to a designated area. All loads in the working case may be reassigned to a designated area; more typically, loads in a specified subsystem of the working case are assigned to a designated area.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Following any subsystem selection dialog, activity LDAR prompts the user to:

```
ENTER NEW AREA NUMBER, 0 TO EXIT (DEFAULT IS nn):
```

If the specified area is not empty, the number of buses, loads, and dc buses assigned to the area is listed, and activity LDAR prompts the user to:

```
ENTER 1 TO ADD SELECTED EQUIPMENT TO AREA:
```

A response of 0 causes activity LDAR to request another area number. Otherwise all loads in the specified subsystem are reassigned to that area.

Then, if activity LDAR was run with the ALL suffix, it ends. Otherwise, the user is given the opportunity to change the area assignments of loads in another subsystem:

```
DO YOU WANT MORE?
```

A response of 0 ends activity LDAR, and a response of 1 allows the user to select another subsystem for processing.

Additional Information
PSS®E Program Operation Manual Changing Owner Assignments *PSS® E Application Program Interface (API)* ARNM

4.18. Changing Owner Assignments

OWNM

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
OWNM	Reassign equipment at specified buses
OWNM,ALL	Reassign equipment at all buses
OWNM,AREA	Reassign equipment in specified area(s)
OWNM,ZONE	Reassign equipment in specified zone(s)
OWNM,OWNER	Reassign equipment for specified owner(s)
OWNM,KV	Reassign equipment at buses in specified base voltage range
OWNM,OPT	Reassign equipment in specified subsystem using multiple selection criteria

The owner renumbering activity OWNM reassigns buses, loads, machines, branches, FACTS devices and/or VSC dc lines in the working case from their original owners to a designated owner. All elements of the selected equipment types in the working case may be reassigned to a designated owner; more typically, all elements of the selected equipment types in a specified subsystem of the working case1 are assigned to a designated owner.

Activity OWNM prompts the user to designate the types of equipment for which the ownership assignments are to be changed, along with a series element renumbering option:

```
ENTER 1 TO CHANGE OWNERSHIP OF BUSES: ENTER 1 TO CHANGE OWNERSHIP OF LOADS: ENTER
1 TO CHANGE OWNERSHIP OF MACHINES: ENTER 1 TO CHANGE OWNERSHIP OF AC BRANCHES:
ENTER 1 TO CHANGE OWNERSHIP OF FACTS DEVICES: ENTER 1 TO CHANGE OWNERSHIP OF
VSC DC LINES: FOR BRANCH, SERIES FACTS DEVICE AND VSC DC LINE OWNERSHIP CHANGES
ENTER: 1 FOR BRANCHES WITHIN THE SPECIFIED SUBSYSTEM 2 FOR SUBSYSTEM TIE BRANCHES
3 FOR BOTH SUBSYSTEM BRANCHES AND TIES:
```

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Following any subsystem selection dialog, activity OWNM prompts the user to:

```
ENTER NEW OWNER NUMBER, 0 TO EXIT (DEFAULT IS nn):
```

If the specified owner has equipment assigned to it, the number of buses, loads, machines, branches, dc buses, FACTS devices, and VSC dc lines assigned to the owner is listed, and activity OWNM prompts the user to:

```
ENTER 1 TO ADD SELECTED EQUIPMENT TO OWNER:
```

A response of 0 causes activity OWNM to request another owner number. Otherwise all of the specified equipment in the specified subsystem are reassigned to that owner.

Then, if activity OWNM was run with the ALL suffix, it ends. Otherwise the user is given the opportunity to change the owner assignments of equipment in another subsystem:

```
DO YOU WANT MORE?
```

A response of 0 ends activity OWNM, and a response of 1 allows the user to select anothert subsystem for processing.

Additional Information
PSS®E Program Operation Manual Changing Owner Assignments *PSS® E Application Program Interface (API)* OWNM

4.19. Changing Zone Assignments of Buses

ZONM

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
ZONM	Reassign specified buses
ZONM,ALL	Reassign all buses
ZONM,AREA	Reassign buses in specified area(s)
ZONM,ZONE	Reassign buses in specified zone(s)
ZONM,OWNER	Reassign buses for specified owner(s)
ZONM,KV	Reassign buses in specified base voltage range
ZONM,OPT	Reassign buses in specified subsystem using multiple selection criteria

The zone renumbering activity ZONM reassigns buses in the working case from their original zones to a designated zone. All buses in the working case may be reassigned to a designated zone; more typically, buses in a specified subsystem of the working case are assigned to a designated zone.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Following any subsystem selection dialog, activity ZONM prompts the user to:

```
ENTER NEW ZONE NUMBER, 0 TO EXIT (DEFAULT IS nn):
```

If the specified zone is not empty, the number of buses, loads, and dc buses assigned to the zone is listed, and activity ZONM prompts the user to:

```
ENTER 1 TO ADD SELECTED EQUIPMENT TO ZONE:
```

A response of 0 causes activity ZONM to request another zone number. Otherwise all buses in the specified subsystem are reassigned to that zone.

Then, if activity ZONM was run with the ALL suffix, it ends. Otherwise, the user is given the opportunity to change the zone assignments of buses in another subsystem:

```
DO YOU WANT MORE?
```

A response of 0 ends activity ZONM, and a response of 1 allows the user to select another subsystem for processing.

Additional Information
PSS®E Program Operation Manual Changing Zone Assignments *PSS® E Application Program Interface (API)* ZONM

4.20. Changing Zone Assignments of Loads

LDZO

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
LDZO	Reassign loads at specified buses
LDZO,ALL	Reassign all loads
LDZO,AREA	Reassign loads in specified area(s)
LDZO,ZONE	Reassign loads in specified zone(s)
LDZO,OWNER	Reassign loads for specified owner(s)
LDZO,KV	Reassign loads at buses in specified base voltage range
LDZO,OPT	Reassign loads in specified subsystem using multiple selection criteria

The zone renumbering activity LDZO reassigns loads in the working case from their original zones to a designated zone. All loads in the working case may be reassigned to a designated zone; more typically, loads in a specified subsystem of the working case are assigned to a designated zone.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Following any subsystem selection dialog, activity LDZO prompts the user to:

```
ENTER NEW ZONE NUMBER, 0 TO EXIT (DEFAULT IS nn):
```

If the specified zone is not empty, the number of buses, loads, and dc buses assigned to the zone is listed, and activity LDZO prompts the user to:

```
ENTER 1 TO ADD SELECTED EQUIPMENT TO ZONE:
```

A response of 0 causes activity LDZO to request another zone number. Otherwise all loads in the specified subsystem are reassigned to that zone.

Then, if activity LDZO was run with the ALL suffix, it ends. Otherwise, the user is given the opportunity to change the zone assignments of loads in another subsystem:

```
DO YOU WANT MORE?
```

A response of 0 ends activity LDZO, and a response of 1 allows the user to select another subsystem for processing.

Additional Information
PSS®E Program Operation Manual Changing Zone Assignments *PSS® E Application Program Interface (API)* ZONM

4.21. Renumbering Buses

4.21.1. Saving Renumbered Bus Data to a File

BSNM

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
BSNM	Subsystem renumbering for specified buses (activity can be run without a suffix)
BSNM,ALL	All bus renumbering
BSNM,AREA	Subsystem renumbering for buses in specified area(s)
BSNM,ZONE	Subsystem renumbering for buses in specified zone(s)
BSNM,OWNER	Subsystem renumbering for buses with specified owner(s)
BSNM,KV	Subsystem renumbering for buses in specified base voltage range
BSNM,OPT	Subsystem renumbering for buses in a subsystem specified using multiple selection criteria
BSNM,TRAN	Bus number to bus number translation renumbering
BSNM,NAME	Bus name to bus number translation renumbering
BSNM,PACK	Bus number packing of all buses in specified bus number ranges

The bus renumbering activity BSNM enables the user to change the bus numbers of specified network buses in the working case and retain a tabulation, normally in file form, of the bus number changes made.

The destination for the Bus Renumbering Translation File records is handled as described in Section 1.5, Output Destination.

The remaining dialog of activity BSNM is dependent upon the suffix specified at the time the activity is run.

All Buses

When activity BSNM is run with the ALL suffix, it `renumbers the entire working case. Activity` BSNM prompts the user `to:`

```
ENTER 1 TO BLOCK BUS NUMBERS BY AREA:
```

`If zero is entered, the all buses without area blocking renumbering method is used. If 1 ie entered, the all buses with area blocking renumbering method is used.`

`For renumbering without area blocking, activity BSNM then asks the user to:`

```
ENTER STARTING BUS NUMBER (0 TO EXIT):
```

If zero is entered, activity BSNM ends. Otherwise, the renumbering is implemented and activity BSNM ends.

For renumbering with area blocking, activity BSNM initiates a dialog through which the user designates the bus number range for each area with at least one bus assigned to it. For each such area, activity BSNM requests:

```
nnn BUSES IN AREA mmm [area name] ENTER STARTING, ENDING BUS NUMBERS (0 TO EXIT):
```

No bus number changes are implemented until the new number range for each such area is specified. Thus, specifying a starting bus number of zero in response to the bus number range request for any area ends activity BSNM with the original numbering intact.

When valid ranges are entered for all areas with at least one bus, the renumbering is implemented and activity BSNM ends.

Subsystem

When activity BSNM is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it prompts the user to:

```
ENTER 0 TO SPECIFY NEW BUS NUMBER RANGES 1 TO SPECIFY BUS NUMBER OFFSETS:
```

Next, specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection.

If the bus number range method of renumbering was selected, the user then specifies the desired bus range:

```
ENTER NEW BUS RANGE (0 TO EXIT):
```

The user enters the starting and ending bus numbers for the range into which the subsystem is to be renumbered. If a valid range is specified the bus number changes are implemented; otherwise, an appropriate error message is printed. In either case, the user then has the opportunity to select another subsystem for renumbering.

If the bus number offset method of renumbering was selected, the user then specifies the desired offset:

```
ENTER BUS NUMBER OFFSET (0 TO EXIT):
```

If any error conditions are detected, an appropriate error message is printed; otherwise, the bus number changes are implemented. In either case, the user then has the opportunity to select another subsystem for renumbering.

Bus Number to Bus Number Translation

When activity BSNM is run with the TRAN suffix, it uses the bus number to bus number translation method to change bus numbers on a bus-by-bus basis. Activity BSNM prompts the user to:

```
ENTER INPUT FILE NAME (0 TO EXIT, 1 FOR TERMINAL):
```

If zero is specified, activity BSNM ends.

If the name of a file is specified, input is taken from the specified Bus Renumbering Translation File, the bus number changes implemented, and activity BSNM ends. Each record of the file must be of the form:

```
current bus number new bus number
```

If 1 is specified, activity BSNM prompts the user to:

```
ENTER OLD, NEW BUS NUMBERS:
```

If any errors are detected, an appropriate error message is printed. Otherwise, the bus number change is implemented.

The request for bus numbers is repeated until a zero is entered as the first bus number. Activity BSNM then tabulates the number of changes made and ends.

Bus Name to Bus Number Translation

When activity BSNM is run with the NAME suffix, it uses the bus name to bus number translation method to change bus numbers on a bus-by-bus basis. Activity BSNM prompts the user to:

```
ENTER INPUT FILE NAME (0 TO EXIT, 1 FOR TERMINAL):
```

If zero is specified, activity BSNM ends.

If the name of a file is specified, input is taken from the specified translation input file, the bus number changes implemented, and activity BSNM ends. Each record of the file must be of the form:

```
'extended bus name' new bus number
```

If 1 is specified, activity BSNM prompts the user to:

```
ENTER EXTENDED BUS NAME IN SINGLE QUOTES, NEW BUS NUMBER:
```

If any errors are detected, an appropriate error message is printed. Otherwise, the bus number change is implemented.

The request for bus name, number pairs is repeated until a zero is entered as the first bus. Activity BSNM then tabulates the number of changes made and ends.

Bus Number Packing

When activity BSNM is run with the PACK suffix, it uses the bus number packing method. Activity BSNM prompts the user to:

```
ENTER STARTING, ENDING BUS NUMBERS:
```

If any errors are detected, an appropriate error message is printed. Otherwise, the bus number change is implemented.

The request for a bus range is repeated until a zero is entered as the first bus. Activity BSNM then tabulates the number of changes made and ends.

Additional Information
PSS® E Program Operation Manual, Bus Renumbering *PSS® E Application Program Interface (API)*, BSNM

4.21.2. Renumbering Buses in Auxiliary Files

RNFI

Requirements / Prerequisites	
The working case must contain a validly specified power flow case. A Bus Renumbering Translation File must be available.	
Activity ID, Suffix	Suffix Function
RNFI	Reflect bus renumbering in an auxiliary data input file.

The auxiliary data input file bus renumbering activity RNFI reflects changes in bus numbering in auxiliary data input files. It is used primarily in conjunction with activity BSNM to coordinate bus renumbering implemented in a Saved Case with auxiliary data input files associated with the Saved Case and read by other PSS ®E activities.

Activity RNFI prompts the user to specify the Bus Renumbering Translation input file:

```
ENTER BUS TRANSLATION FILE NAME (FROM BSNM):
```

followed by the name of the data file to be modified:

```
ENTER INPUT FILE NAME:
```

and the name of an output file into which activity RNFI is to place data records from the input file with the new bus numbering scheme recognized (specifying no destination file results in the modified file being written to the *[Progress]* device):

```
ENTER DESTINATION FILE NAME:
```

The user is then asked to identify the type of data contained in the input file.

```
ENTER INPUT FILE TYPE: 0 = EXIT 1 = SEQUENCE DATA 2 = DRAWING COORDINATE DATA 3 = DYNAMICS DATA 4 = MCRE MACHINE DATA 5 = ECDI DISPATCH DATA 6 = INLF DISPATCH DATA 7 = BREAKER DUTY DATA 8 = BKDY FAULT SPEC. DATA 9 = ASCC FAULT CONTROL DATA 10 = GCAP CAPABILITY DATA 11 = ACCC LOAD THROWOVER DATA 12 = ANSI FAULT SPEC. DATA 13 = SUBSYSTEM DESCRIPTION DATA 14 = MONITORED ELEMENT DATA 15 = CONTINGENCY DESCRIPTION DATA 16 = TRIPPING ELEMENT DATA:
```

The new data file is then built with the bus number changes recognized and activity RNFI ends.

Additional Information
PSS®E Program Operation Manual, Renumbering Buses in Auxiliary Files Bus Renumbering *PSS® E Application Program Interface (API)* RNFI

Chapter 5
Power Flow Data Verification

PSS®E provides a variety of means by which data can be validated in order to identify suspect parameters, conflicting voltage controls, unacceptable tap controls, and isolated buses or inadvertent islands. The data checking is accompanied by the generation of reports at the *Report* device for examination.

Data checking does not validate the state of a power flow solution.

5.1. Checking or Changing Branch Parameters

BRCH

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
BRCH	Specified checks for branches connected to specified buses
BRCH,ALL	All checks for all branches
BRCH,AREA	Specified checks for branches connected to buses in specified area(s)
BRCH,ZONE	Specified checks for branches connected to buses in specified zone(s)
BRCH,OWNER	Specified checks for branches assigned to specified owner(s)
BRCH,KV	Specified checks for branches connected to buses in specified base voltage range
BRCH,OPT	Specified checks for branches in specified subsystem using multiple selection criteria

The branch parameter checking activity BRCH tabulates those branches where impedances or other characteristics are such that they may be detrimental to the rate of convergence of one or more of the power flow solution activities.

When activity BRCH is run with the ALL suffix, it cycles through all of its branch checks for the entire working case. Otherwise, activity BRCH prompts the user to enter the checks to be applied:

```
ENTER DESIRED BRANCH CHECK: 0 FOR NO MORE 1 FOR SMALL IMPEDANCE 2 FOR LARGE
IMPEDANCE 3 FOR R/X RATIO 4 FOR NEGATIVE REACTANCE 5 FOR XMAX/XMIN FOR EACH BUS
6 FOR CHARGING 7 FOR PARALLEL TRANSFORMERS 8 FOR HIGH TAP RATIOS 9 FOR LOW TAP
RATIOS 10 FOR MISSING ZERO SEQ. 11 FOR ALL CHECKS:
```

When the user enters the desired branch check code (1 - 11), the corresponding check(s) are enabled, and, except for the negative reactance, parallel transformer, and missing zero sequence data checks, the dialog prompts the user to designate a threshold tolerance as described below. The user may then apply another branch check. This cycle is repeated until a zero is entered as the branch check code.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select additional branch check codes and subsystems for processing; if no additional branch checks are specified, activity BRCH ends.

If the small impedance test is requested, activity BRCH prompts the user to enter the per unit reactance threshold:

```
ENTER REACTANCE LOWER LIMIT:
```

If the large impedance test is requested, activity BRCH prompts the user to enter the per unit reactance threshold:

```
ENTER REACTANCE UPPER LIMIT:
```

If the resistance to reactance ratio check is requested, activity BRCH prompts the user to enter the desired ratio threshold:

```
ENTER R/X THRESHOLD:
```

If the reactance ratio check is requested, activity BRCH prompts the user to:

```
ENTER XMAX/XMIN THRESHOLD:
```

If the line charging check is requested, activity BRCH prompts the user to:

```
ENTER CHARGING UPPER LIMIT:
```

In the high and low tap ratio checks, activity BRCH prompts the user to:

```
ENTER HIGH TAP RATIO LIMIT:
```

and:

```
ENTER LOW TAP RATIO LIMIT:
```

The output of activity BRCH may be ended by entering the AB interrupt control code. The interrupt is cleared, and the user may then request additional data checks and subsystems unless all checks were being performed.

```
 ACTIVITY? :
>>BRCH,ALL

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7
 ENTER REACTANCE LOWER LIMIT:
>>.008
 ENTER REACTANCE UPPER LIMIT:
>>.1
 ENTER R/X THRESHOLD:
>>.15
 ENTER XMAX/XMIN THRESHOLD:
>>
 ENTER CHARGING UPPER LIMIT:
>>2.5
 ENTER HIGH TAP RATIO LIMIT:
>>1.1
 ENTER LOW TAP RATIO LIMIT:
>>.99
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008  11:24
 PSS(TM)E SAMPLE CASE
 ALL DATA CATEGORIES WITH SEQUENCE DATA

 BRANCHES WITH [ /REACTANCE/ < 0.00800 ]:
 X--------- FROM BUS ---------X X---------- TO BUS ----------X
   BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT   LINE R   LINE X CHARGING STAT
    101 NUC-A        21.600    1    151 NUCPLNT      500.00    1  T1  0.00009  0.00758  0.00000   1
    102 NUC-B        21.600    1    151 NUCPLNT      500.00    1  T2  0.00012  0.00760  0.00000   1
    152 MID500       500.00    1    153 MID230       230.00    1  T3  0.00017  0.00775  0.00000   1
    152 MID500       500.00    1   3021 WDUM         18.000    3  T4  0.00008  0.00412  0.00000   1
    152 MID500       500.00    1   3022 EDUM         18.000    3  T5  0.00011  0.00490  0.00000   1
    153 MID230       230.00    1   3006 UPTOWN       230.00    5  1   ZERO IMPED. LINE  0.00000   1
    154 DOWNTN       230.00    1    205 SUB230       230.00    2  1   0.00033  0.00333  0.09000   1
    202 EAST500      500.00    2    203 EAST230      230.00    2  T7  0.00028  0.00721  0.00000   1
    204 SUB500       500.00    2    205 SUB230       230.00    2  T8  0.00046  0.00563  0.00000   1
    205 SUB230       230.00    2    206 URBGEN       18.000    2  T9  0.00018  0.00533  0.00000   1
   3001 MINE         230.00    5   3003 S. MINE      230.00    5  1   0.00000  0.00800  0.00000   1
   3011 MINE_G       19.400    5 3WNDTR 3WNDSTAT1    WND 3        1   0.00025 -0.00200            1

 BRANCHES WITH [ /REACTANCE/ >  0.1000 ]:
 X--------- FROM BUS ---------X X---------- TO BUS ----------X
   BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT   LINE R   LINE X CHARGING STAT
    154 DOWNTN       230.00    1   9154 WINDBUS1     4.1600    1  W1  0.00000  0.58333  0.00000   1
    204 SUB500       500.00    2   9204 WINDBUS2     0.5750    2  W2  0.08800  0.66171  0.00000   1
    216 URBANEAST1   230.00    2 3WNDTR 3WNDSTAT3    WND 3        3   0.00537  0.51667            0
    217 URBANEAST1   230.00    2 3WNDTR 3WNDSTAT4    WND 2        4   0.01701  0.23897            1
    218 URBANEAST1   230.00    2 3WNDTR 3WNDSTAT4    WND 3        4   0.01339  0.11975            1
   3002 E. MINE      500.00    5  93002 WINDBUS3     0.6900    5  W3  0.00000  2.02703  0.00000   1
   3009 URBANWEST1   230.00    5 3WNDTR 3WNDSTAT2    WND 2        2   0.00530  0.44166            0
   3010 URBANWEST2   21.600    5 3WNDTR 3WNDSTAT2    WND 3        2   0.00390  0.35834            1

 BRANCHES WITH [ /R/ > 0.15000 * /X/ ]:
 X--------- FROM BUS ---------X X---------- TO BUS ----------X
   BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT   LINE R   LINE X CHARGING STAT

                                        * NONE *
```

Figure 5.1. Example: Running Activity BRCH,ALL (1 of 2)

```
BRANCHES WITH [ REACTANCE < 0.0 ]:
X--------- FROM BUS ---------X X---------- TO BUS ----------X
  BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT   LINE R    LINE X CHARGING STAT
   205 SUB230       230.00     2 3WNDTR 3WNDSTAT3     WND 1         3  -0.00084 -0.01667               1
  3011 MINE_G       19.400     5 3WNDTR 3WNDSTAT1     WND 3        *1   0.00025 -0.00200               1

BUSES WITH BRANCHES HAVING [ (XMAX / XMIN) >  500.0 ]:
X--------- FROM BUS ---------X X---------- TO BUS ----------X
  BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT   LINE R    LINE X CHARGING STAT

                                  * NONE *

BRANCHES WITH [ CHARGING >  2.5000 ] OR NEGATIVE:
X--------- FROM BUS ---------X X---------- TO BUS ----------X
  BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT   LINE R    LINE X CHARGING STAT
   151 NUCPLNT      500.00     1    152 MID500       500.00     1  1   0.00260  0.04600  3.50000    1
   151 NUCPLNT      500.00     1    152 MID500       500.00     1  2   0.00261  0.04610  3.51000    1
   152 MID500       500.00     1   3004 WEST         500.00     5  1   0.00300  0.03000  2.50000    1

NON-IDENTICAL PARALLEL TRANSFORMERS:
X--------- FROM BUS ---------X X---------- TO BUS ----------X     W
  BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT 1     R        X      W1TAP    ANGLE   W2TAP   STAT

                                  * NONE *

TRANSFORMERS WITH [ RATIO > 1.10000 ]:
X--------- FROM BUS ---------X X---------- TO BUS ----------X     W
  BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT 1     R        X      W1TAP    ANGLE   W2TAP   STAT
   152 MID500       500.00     1   3021 WDUM         18.000     3  T4 F  0.00008  0.00412 1.10000     0.0 1.00000    1
   152 MID500       500.00     1   3022 EDUM         18.000     3  T5 F  0.00011  0.00490 1.10000     0.0 1.00000    1
   215 URBANEAST1   18.000     2 3WNDTR 3WNDSTAT3     WND 2         3  F  0.00153  0.08333 1.10000     0.0            1

TRANSFORMERS WITH [ RATIO < 0.99000 ]:
X--------- FROM BUS ---------X X---------- TO BUS ----------X     W
  BUS# X-- NAME --X BASKV AREA   BUS# X-- NAME --X BASKV AREA CKT 1     R        X      W1TAP    ANGLE   W2TAP   STAT
   152 MID500       500.00     1    153 MID230       230.00     1  T3 F  0.00017  0.00775 0.95000     0.0 1.00000    1
   202 EAST500      500.00     2    203 EAST230      230.00     2  T7 T  0.00028  0.00721 0.99000     0.1 1.00000    1

ACTIVITY? :
>>
```

Figure 5.2. Example: Running Activity BRCH,ALL (2 of 2)

Additional Information
PSS®E Program Operation Manual, Checking Branch Parameters *PSS ® E Application Program Interface (API)* BRCH

5.2. Checking or Changing Controlled Bus Scheduled Voltage

CNTB

Requirements / Prerequisites	
The working case must contain a validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
CNTB	Check/change scheduled voltage for all voltage-controlled buses from among specified buses
CNTB,ALL	Check/change scheduled voltage for all voltage-controlled buses
CNTB,AREA	Check/change scheduled voltage for all voltage-controlled buses in specified area(s)
CNTB,ZONE	Check/change scheduled voltage for all voltage-controlled buses in specified zone(s)
CNTB,OWNER	Check/change scheduled voltage for all voltage-controlled buses with specified owner(s)
CNTB,KV	Check/change scheduled voltage for all voltage-controlled buses in specified base voltage range
CNTB,OPT	Check/change scheduled voltage for all voltage-controlled buses in specified subsystem using multiple selection criteria

The bus scheduled voltage checking activity CNTB tabulates the voltage setpoints and desired voltage bands of voltage controlling equipment in the working case, and, optionally, allows the user to specify new scheduled voltages. It also performs certain checks on voltage controlling buses that are not themselves voltage controlled buses. It may be instructed to process all such buses, or only those with suspect or conflicting voltage schedules or other errors.

Activity CNTB may either include or omit Type 4 controlled buses and out-of-service or disabled controlling equipment in its checking and reporting. Activity CNTB prompts the user to:

```
ENTER 0 TO INCLUDE ALL ELEMENTS, 1 FOR IN-SERVICE ELEMENTS ONLY:
```

Activity CNTB then requests that the user specify processing of either all voltage controlled and controlling buses in the subsystem, or only those with apparent conflicting voltage objective data or other errors:

```
SELECT SUBSYSTEM CONTROLLED BUSES TO BE LISTED 0 FOR ONLY THOSE WITH CONFLICTS,
1 FOR ALL:
```

Then the user may elect to operate activity CNTB in an interactive mode, in which new voltage schedules may be specified, or in a reporting mode:

```
ENTER 0 TO REPORT ONLY, 1 TO PROMPT FOR VOLTAGE SCHEDULE CHANGES:
```

If a 0 is entered in response to the above instruction, the user is asked to specify the output destination.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

If the voltage schedule changing option was specified, as each voltage controlled bus is processed, the user has the option of entering a new scheduled voltage:

```
ENTER NEW SCHEDULED VOLTAGE (CR FOR NO CHANGE):
```

Any voltage controlling transformers with load drop compensation that are controlling voltage at the controlled bus being processed are listed. A new voltage band may be specified for any or all of such transformers:

```
ENTER NEW VMIN, VMAX (CR FOR NO CHANGE):
```

```
>>CNTB,ALL
 ENTER 0 TO INCLUDE ALL ELEMENTS, 1 FOR IN-SERVICE ELEMENTS ONLY:
>>1
 SELECT SUBSYSTEM CONTROLLED BUSES TO BE LISTED
  0 FOR ONLY THOSE WITH CONFLICTS, 1 FOR ALL:
>>0
 ENTER 0 TO REPORT ONLY, 1 TO PROMPT FOR VOLTAGE SCHEDULE CHANGES:
>>0

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW  :
>>1

 OUTPUT COMPLETED

 ACTIVITY? :
>>
```

Figure 5.3. Example: Running Activity CNTB,ALL

Additional Information
PSS®E Program Operation Manual, Checking/Changing Controlled Bus Scheduled Voltage *PSS® E Application Program Interface (API)* CNTB

5.3. Checking or Changing Transformer Adjustment Data

TPCH

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
TPCH	Check regulating transformer windings connected to specified buses
TPCH,ALL	Check all regulating transformer windings
TPCH,AREA	Check regulating transformer windings in specified area(s)
TPCH,ZONE	Check regulating transformer windings in specified zone(s)
TPCH,OWNER	Check regulating transformer windings with specified owner(s)
TPCH,KV	Check regulating transformer windings connected to buses in specified base voltage range
TPCH,OPT	Check regulating transformer windings in specified subsystem using multiple selection criteria

The controlling transformer parameter checking activity TPCH performs several checks on the adjustment data associated with voltage and flow controlling transformers.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Activity TPCH prompts the user to enter the code for the desired transformer data check:

```
ENTER DESIRED TRANSFORMER DATA CHECK: 0 TO EXIT 1 FOR TAP STEP = 0. (V AND MVAR) 2 FOR 0. < STEP < MINIMUM (V AND MVAR) 3 FOR TAP STEP > MAXIMUM (V AND MVAR) 4 FOR VOLTAGE BAND < 2*STEP (V) 5 FOR VOLTAGE BAND < MINIMUM (V) 6 FOR VOLTAGE BAND > MAXIMUM (V) 8 FOR FLOW BAND < MINIMUM (MW AND MVAR) 9 FOR FLOW BAND > MAXIMUM (MW AND MVAR):
```

After the user enters the desired code, an appropriate heading is displayed followed by a tabulation of any transformers failing the specified check. If any transformers have failed the check, the user has the option of modifying the data of all transformers tabulated. The user may then designate another data check. This cycle is repeated until a zero is entered as the desired check.

Tests two and three instruct the user to enter the step threshold against which tap steps are to be checked:

```
ENTER THRESHOLD (CR FOR 0.00625):
```

If any transformers are found failing the test, the user may elect to modify the steps, and therefore the number of tap positions, of these transformers:

```
ENTER 1 TO MODIFY:
```

If this option is enabled and there are both voltage and Mvar controlling transformers listed, the user may have both types changed, only the voltage controlling transformers changed, or only the Mvar controlling transformers changed:

```
WHICH TRANSFORMERS SHOULD BE CHANGED? ENTER 0 FOR BOTH TYPES, 1 FOR VOLTAGE
CONTROLLING, 2 FOR MVAR CONTROLLING:
```

The user is then asked to specify the new tap step to be assigned:

```
ENTER NEW TAP STEP (CR FOR x.xxxxx):
```

where x.xxxxx is the tap step threshold specified above.

The remaining checks of activity TPCH are handled in a similar manner.

While the tabulation of any check is being listed, entering the AB interrupt control code suppresses the remainder of the tabulation for that check. The user is still given the opportunity to modify the appropriate data of transformers failing that check and then proceed to another check.

Additional Information
PSS®E Program Operation Manual, Checking/Changing Transformer Adjustment Data *PSS® E Application Program Interface (API)* TPCH

5.4. Check for Islands Without a Swing Bus

TREE

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
TREE	Perform network continuity check.

The network continuity checking activity TREE enables the user to identify buses not connected back to a Type 3 (swing) bus through the in-service ac network. It also tabulates in-service branches connected to Type 4 (disconnected) buses. Each swingless island may optionally be disconnected.

Following the tabulation of each island, activity TREE prompts the user to select the next action:

```
ENTER -1 TO EXIT, 0 FOR NEXT ISLAND, 1 TO DISCONNECT THIS ISLAND:
```

This process is repeated for each island.

```
>>TREE

                                               SWING BUSES

   BUS# X-- NAME --X BASKV AREA     BUS# X-- NAME --X BASKV AREA     BUS# X-- NAME --X BASKV AREA
    301 NORTH         765.00    3     401 COGEN-1      500.00    4     402 COGEN-2      500.00    6
   3011 MINE_G        19.400    5

                                                 ISLAND

   BUS# X-- NAME --X BASKV AREA     BUS# X-- NAME --X BASKV AREA     BUS# X-- NAME --X BASKV AREA

                                               ** NONE **

 ACTIVITY? :
>>
```

Figure 5.4. Example: Running Activity TREE

Additional Information
PSS® E Program Operation Manual, Check for Islands Without a Swing Bus *PSS® E Application Program Interface (API)* TREE

Chapter 6
Data Reports

6.1. Working Case Data Reporting

PSS®E facilitates the listing of all data in the working case for viewing, problem checking, or case documentation. The following tabulations of working case data can be produced:

- Categories of power flow data in tabular form (activity LIST).
- Power flow data grouped together on a bus-by-bus basis (activity EXAM).
- Buses whose extended bus name matches the complete or partial extended name specified (activity FIND).
- Categories of sequence data (i.e., fault analysis data) in tabular form (activity SQLI).
- Sequence data grouped together on a bus-by-bus basis (activity SQEX).
- Outaged network elements (activity OUTS).
- Fixed and/or switched bus shunts (activity SHNT).
- Extended bus names in alphabetic order (activity ALPH).

The selection of the destination for these reports is handled as described in Section Output Destination.

6.1.1. Listing Power Flow Data

LIST

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
LIST	List selected categories of power flow data for the complete case (activity can be run without a suffix).
LIST,ALL	List all categories of power flow data for the complete case.
LIST,AREA	List selected categories of power flow data for specified area(s).
LIST,ZONE	List selected categories of power flow data for specified zone(s).
LIST,OWNER	List selected categories of power flow data for specified owner(s).
LIST,KV	List selected categories of power flow data for buses in specified base voltage range.
LIST,OPT	List selected categories of power flow data for a subsystem specified using multiple selection criteria.
LIST,REV	List selected categories of power flow data for the complete case with the voltage output option reversed.

The data listing activity LIST tabulates the power flow working case in a form suitable for problem data documentation. The report generated by activity LIST is separated into several categories of data.

The selection of the destination for the report of activity LIST is handled as described in Section 1.5, Output Destination. The remaining dialog of activity LIST is dependent upon the suffix specified when the activity is run.

When activity LIST is run with the AREA, ZONE, OWNER, KV, or OPT suffix, the user selects the subsystem of the working case to be processed. Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection, except that specification by bus is not allowed. Following the processing of the specified subsystem, the user may select another subsystem for processing.

When activity LIST is run with the ALL suffix, a full data listing is produced and activity LIST ends. The branch-related sections of the tabulation are in single entry format.

When activity LIST is run without a suffix, all buses for specified categories of data are processed. When activity LIST is run with the REV suffix, the behavior is the same as when no suffix is specified, except that the units for ac voltages in the report are changed from the units indicated by the voltage output program option setting to the alternate units.

Except when the suffix ALL had been specified, activity LIST prompts the user to enter a code for the category of data to be listed:

```
ENTER OUTPUT CATEGORY DESIRED: 0 = TO EXIT 1 = CASE SUMMARY 2 = BUS DATA 3 = SWITCHED SHUNT DATA 4 = PLANT DATA 5 = GEN. UNIT DATA 6 = BRANCH DATA (SINGLE ENTRY) 7 = BRANCH DATA (DOUBLE ENTRY) 9 = LINE SHUNT DATA 8 = 2W TRANSFORMER IMPEDANCE DATA 21 = 2W TRANSFORMER WINDING DATA 26 = 2W TRANSFORMER CONTROL DATA 25 = 3W TRANSFORMER GENERAL DATA 22 = 3W TRANSFORMER IMPEDANCE DATA 23 = 3W TRANSFORMER WINDING DATA 24 = 3W TRANSFORMER CONTROL DATA 10 = DC LINE DATA 11 = AREA INTERCHANGE DATA 12 = FULL LISTING (SINGLE ENTRY BRANCH) 13 = FULL LISTING (DOUBLE ENTRY BRANCH) 14 = IMPEDANCE CORRECTION DATA 15 = MULTI-SECTION LINE GROUPING DATA 16 = ZONE DATA 17 = INTER-AREA TRANSFER DATA 18 = LOAD DATA 19 = OWNER DATA 20 = FACTS SENDING END DATA 27 = FACTS TERMINAL END DATA 28 = FIXED SHUNT DATA:
```

The specified report is then generated. Unless the list code 12 or 13 (full listing) was specified, the dialog is repeated until the user enters a zero.

Additional Information
PSS® E Program Operation Manual, Displaying Power Flow Data *PSS® E Application Program Interface (API)*, LIST

6.1.2. Listing Buses in Alphabetical Order

ALPH

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
ALPH	List all buses (activity can be run without a suffix).

Activity ID, Suffix	Suffix Function
ALPH,ALL	List all buses.
ALPH,AREA	List buses in specified area(s).
ALPH,ZONE	List buses in specified zone(s).
ALPH,OWNER	List buses with specified owner(s).
ALPH,KV	List buses with specified base voltage range.
ALPH,OPT	List buses in a subsystem specified using multiple selection criteria.

The bus alphabetic listing activity ALPH prints an alphabetically sorted table of all buses in a specified subsystem of the working case.

The selection of the destination for the report of activity ALPH is handled as described in Section 1.5, Output Destination.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection, except that specification by bus is not allowed. Except when either no suffix or the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Additional Information
PSS® E Program Operation Manual, Listing Buses in Alphabetical Order *PSS® E Application Program Interface (API)*, ALPH

6.1.3. Listing Buses Matching a Partial Extended Bus Name

FIND

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
FIND	List buses matching specified extended bus name (activity can be run without a suffix).

The bus name to number translation activity FIND enables the user to determine the number of a bus with a specified extended bus name. In addition, through the use of a string matching character, activity FIND produces a listing of possible matching names even if the exact spelling of the bus name and/or its base voltage is not known.

Activity FIND prompts the user to:

```
ENTER DESIRED BUS NAME:
```

The user responds with the bus name component of the bus to be found. Activity FIND then asks the user to:

```
ENTER BUS BASE VOLTAGE:
```

The user then enters the desired base voltage.

The report is produced and then another bus name, base voltage pair may be specified.

```
>>FIND
 ENTER DESIRED BUS NAME:
>>*MINE
 ENTER BUS BASE VOLTAGE:
>>230
 ENTER DESIRED BUS NAME:
>>
 ENTER BUS BASE VOLTAGE:
>>

 ACTIVITY? :
--------------------------------------------------------------------------------

 POSSIBLE BUSES ARE:
 X-- NAME --X BASKV    BUS#   X-- NAME --X BASKV    BUS#   X-- NAME --X BASKV    BUS#
 MINE         230.00   3001   S. MINE      230.00   3003
```

Figure 6.1. Example: Running Activity FIND and Subsequent Report

Additional Information
PSS® E Program Operation Manual, Listing Buses using Partial Bus Name *PSS® E Application Program Interface (API)*, FIND

6.1.4. Listing Components of a Bus

EXAM

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
EXAM	List power flow data for specified buses (activity can be run without a suffix).
EXAM,ALL	List power flow data for all buses.
EXAM,AREA	List power flow data for buses in specified area(s).
EXAM,ZONE	List power flow data for buses in specified zone(s).
EXAM,OWNER	List power flow data for buses with specified owner(s).
EXAM,KV	List power flow data for buses in specified base voltage range.
EXAM,OPT	List power flow data for buses in a subsystem specified using multiple selection criteria.

The data examination activity EXAM produces a tabulation of power flow data organized by bus. For each bus tabulated, its bus data is followed by the data associated with each network element that is connected to the bus.

The selection of the destination for the report of activity EXAM is handled as described in Section 1.5, Output Destination.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Additional Information
PSS® E Program Operation Manual, Listing Components of a Bus *PSS® E Application Program Interface (API)*, EXAM

6.1.5. Sequence Data

SQLI

Requirements / Prerequisites	
The working case must contain a validly specified power flow case with sequence data appended to it. Reading Sequence Data for Fault Analysis	
Activity ID, Suffix	Suffix Function
SQLI	List selected categories of sequence data for the complete case (activity can be run without a suffix).
SQLI,ALL	List all categories of sequence data for the complete case.
SQLI,AREA	List selected categories of sequence data for specified area(s).
SQLI,ZONE	List selected categories of sequence data for specified zone(s).
SQLI,OWNER	List selected categories of sequence data for specified owner(s).
SQLI,KV	List selected categories of sequence data for buses in specified base voltage range.
SQLI,OPT	List selected categories of sequence data for buses in a subsystem specified using multiple selection criteria.

The sequence data listing activity SQLI tabulates the sequence data arrays in the working case in a form suitable for problem data documentation. The report generated by activity SQLI is separated into several categories of data.

The selection of the destination for the report of activity SQLI is handled as described in Section 1.5, Output Destination. The remaining dialog of activity SQLI is dependent upon the suffix specified when the activity is run.

When activity SQLI is run with the AREA, ZONE, OWNER, KV, or OPT suffix, the user selects the subsystem of the working case to be processed. Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection, except that specification by bus is not allowed. Following the processing of the specified subsystem, the user may select another subsystem for processing.

When activity SQLI is run with the ALL suffix, a full data listing is produced and activity SQLI ends.

When activity SQLI is run without a suffix, all buses for specified categories of data are processed.

Except when the suffix ALL had been specified, activity SQLI prompts the user to enter a code for the category of data to be listed:

```
ENTER OUTPUT CATEGORY DESIRED: 0 = EXIT ACTIVITY 1 = FULL LISTING 2 = BUS LOAD
DATA 3 = GENERATOR DATA 4 = BRANCH DATA 5 = 2-WINDING TRANSFORMER DATA 6 =
MUTUAL DATA 7 = SWITCHED SHUNT DATA 8 = 3-WINDING TRANSFORMER DATA 9 = LINE
SHUNT DATA 10 = FIXED SHUNT DATA:
```

The specified report is then generated. Unless code 1 (full listing) was specified, the dialog is repeated until the user enters a zero.

Additional Information
PSS® E Program Operation Manual, Listing Sequence Data *PSS® E Application Program Interface (API)*, SQLI

6.1.6. Listing Sequence Data for Buses and their Connected Equipment

SQEX

Requirements / Prerequisites	
The working case must contain a validly specified power flow case with sequence data appended to it. Reading Sequence Data for Fault Analysis	
Activity ID, Suffix	Suffix Function
SQEX	List sequence data for specified buses (activity can be run without a suffix).
SQEX,ALL	List sequence data for all buses.
SQEX,AREA	List sequence data for buses in specified area(s).
SQEX,ZONE	List sequence data for buses in specified zone(s).
SQEX,OWNER	List sequence data for buses with specified owner(s).
SQEX,KV	List sequence data for buses in specified base voltage range.
SQEX,OPT	List sequence data for buses in a subsystem specified using multiple selection criteria.

The sequence data examination activity SQEX produces a tabulation of fault analysis data organized by bus. For each bus tabulated, its shunt load data is followed by the data associated with each network element that is connected to the bus for which sequence data is applicable.

The selection of the destination for the report of activity EXAM is handled as described in Section 1.5, Output Destination.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Additional Information
PSS® E Program Operation Manual, Listing Sequence Data for a Bus

Additional Information
PSS® E Application Program Interface (API), SQEX

6.1.7. Listing Outaged Equipment

OUTS

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
OUTS	List outaged equipment for specified buses (activity can be run without a suffix).
OUTS,ALL	List all outaged equipment.
OUTS,AREA	List outaged equipment in specified area(s).
OUTS,ZONE	List outaged equipment in specified zone(s).
OUTS,OWNER	List outaged equipment for specified owner(s).
OUTS,KV	List outaged equipment at buses in specified base voltage range.
OUTS,OPT	List outaged equipment in a subsystem specified using multiple selection criteria.

The outaged equipment reporting activity OUTS tabulates those components in the working case that are removed from service.

The selection of the destination for the report of activity OUTS is handled as described in Section 1.5, Output Destination.

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Additional Information
PSS® E Program Operation Manual, Listing Outaged Equipment *PSS® E Application Program Interface (API)*, OUTS

6.1.8. Listing Bus Shunts

SHNT

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
SHNT	List shunts at specified buses (activity can be run without a suffix).
SHNT,ALL	List shunts at all buses.
SHNT,AREA	List bus shunts in specified area(s).
SHNT,ZONE	List bus shunts in specified zone(s).

Activity ID, Suffix	Suffix Function
SHNT,OWNER	List bus shunts at buses of specified owner(s).
SHNT,KV	List bus shunts at buses in specified base voltage range.
SHNT,OPT	List bus shunts at buses in a subsystem specified using multiple selection criteria.

The bus shunt summary activity SHNT tabulates fixed and/or switched bus shunts contained in the working case.

The selection of the destination for the report of activity SHNT is handled as described in Section 1.5, Output Destination.

Activity SHNT requests a code for the type(s) of bus shunts to be reported:

```
ENTER 1 FOR ALL SHUNTS 2 FOR FIXED SHUNTS 3 FOR SWITCHED SHUNTS:
```

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Except when the suffix ALL had been specified, following the processing of the specified subsystem, the user may select another subsystem for processing.

Additional Information
PSS® E Program Operation Manual, Listing Bus Shunts *PSS® E Application Program Interface (API)*,SHNT

6.2. Listing File Information

6.2.1. System Components

SIZE

Requirements / Prerequisites	
The working case must contain a non-null case.	
Activity ID, Suffix	Suffix Function
SIZE	Activity runs without a suffix.

The case size summary activity SIZE tabulates the number of components in the working case, along with the maximum number permitted at the current size level of PSS®E working memory.

Additional Information
PSS® E Program Operation Manual, Editing the Two-Line Case Title or the Long Title *PSS® E Application Program Interface (API)*, SIZE

6.2.2. Saved Case or Snapshot Filenames

SHOW

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
SHOW,*.SAV	List Saved Case Files
SHOW,*.SNP	List Snapshot Files
SHOW,filename	List specified Saved Case or Snapshot File

The Saved Case and Snapshot File summary activity SHOW lists the case headings of Saved Case and Snapshot Files contained in the current directory. This tabulation is displayed at the Progress tab.

When activity SHOW is run with the *.SAV suffix, all files with file extension .sav that are in the form of a PSS®E Saved Case File are tabulated.

When activity SHOW is run with the *.SNP suffix, it produces a report of all files with filenames ending with the file extension .snp that are in the form of a PSS®E Snapshot File.

When activity SHOW is run without a suffix, both Saved Case and Snapshot Files are tabulated.

When activity SHOW is run with a filename as a suffix, the case heading contained in the file is listed if it is either a Saved Case or Snapshot File. This is followed by the report of activity SIZE if the file is a Saved Case File, or a tabulation of the number of dynamics data array elements stored in the file if it is a Snapshot File.

```
--------------------------------------------------------------------------------

 C:\Program Files\PTI\PSSE31\EXAMPLE SAVED CASE FILES

 bench.sav WAS SAVED ON TUE, DEC 18 2007  11:29 WITH HEADING:
         ' POWER TECHNOLOGIES STANDARD BENCHMARK CASE                          '
         ' 1648 BUSES, 2602 BRANCHES                                           '

 bench2.sav WAS SAVED ON TUE, DEC 18 2007  11:29 WITH HEADING:
         ' POWER TECHNOLOGIES STANDARD LARGE BENCHMARK CASE                    '
         ' 7917 BUSES, 13014 BRANCHES                                          '

 iec60609_testnetwork.sav WAS SAVED ON TUE, DEC 18 2007  11:29 WITH HEADING:
         'IEC 60909 - 2001: SC CURRENTS IN THREE PHASE A.C. SYSTEMS            '
         'FIGURE 16 (PP 121, 60909-4): HIGH VOLTAGE A.C. TEST NETWORK          '

 sample.sav WAS SAVED ON TUE, DEC 18 2007  11:29 WITH HEADING:
         'PSS(TM)E SAMPLE CASE                                                 '
         'ALL DATA CATEGORIES WITH SEQUENCE DATA                               '

 savcnv.sav WAS SAVED ON TUE, DEC 18 2007  11:29 WITH HEADING:
         'PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                           '
         'BASE CASE INCLUDING SEQUENCE DATA                                    '

 savnw.sav WAS SAVED ON TUE, DEC 18 2007  11:29 WITH HEADING:
         'PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                           '
         'BASE CASE INCLUDING SEQUENCE DATA                                    '

--------------------------------------------------------------------------------

 C:\Program Files\PTI\PSSE31\EXAMPLE SNAPSHOT FILES

 savnw.snp WAS SAVED ON TUE, DEC 18 2007  11:29 WITH HEADING:
         'PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                           '
         'BASE CASE INCLUDING SEQUENCE DATA                                    '
```

Figure 6.2. Example: Running Activity SHOW

Additional Information
PSS® E Program Operation Manual, Listing Saved Case or Snapshot Files

6.2.3. Unused Bus Numbers

BUSN

Requirements / Prerequisites	
Validly specified specified power flow case.	
Activity ID, Suffix	Suffix Function
BUSN	Activity runs without a suffix.

The unused bus number summary activity BUSN tabulates those numbers, from within a user specified bus number range, which are not assigned to buses in the working case.

The destination for the report of activity BUSN is handled as described in Section 1.5, Output Destination.

Activity BUSN prompts the user to:

```
ENTER STARTING, ENDING BUS NUMBERS:
```

and the user enters the desired numeric range.

Activity BUSN lists the report for the designated range, and then prompts for another bus number range. This cycle is repeated until a starting bus number of zero or *[Enter]* ends activity BUSN.

Additional Information
PSS® E Program Operation Manual, Listing Unused Bus Numbers *PSS® E Application Program Interface (API)*, BUSN

6.2.4. Long Case Title

PRTI

Requirements / Prerequisites	
Validly specified specified power flow case.	
Activity ID, Suffix	Suffix Function
PRTI	Activity runs without a suffix.

The long title output activity PRTI prints the 16-line long title.

The destination of the long title output is handled as described in Section 1.5, Output Destination.

```
 ACTIVITY? :
>>PRTI

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 15 2008   14:17
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA















 ACTIVITY? :
>>
```

Figure 6.3. Example: Running Activity PRTI

Additional Information
PSS® E Program Operation Manual, Displaying the Long Case Title *PSS® E Application Program Interface (API)*,PRTI

6.2.5. Timing Statistics

TIME

Requirements / Prerequisites	
Validly specified specified power flow case.	
Activity ID, Suffix	Suffix Function
TIME,INIT	Initialize timers

The timing statistics activity TIME displays the data for a PSS®E work session.

When activity TIME is run with the INIT suffix, or the first time activity TIME is run following the launch of PSS®E, the timers are initialized and a message is generated at the Progress tab.

Thereafter, when activity TIME is run without a suffix, it generates a summary of elapsed time, in seconds, since the last time activity TIME was run, and cumulative times from the point at which the timers were last initialized. It also generates two additional system-dependent timing statistics, at least one of which indicates CPU utilization. This tabulation, which is displayed at the Progress tab, is of the form:

```
FRI, MAY 23 2003 15:21 ELAPSE heading2 heading3 SINCE LAST "TIME" XX.XXX XX.XXX
XX.XXX CUMULATIVE XX.XXX XX.XXX XX.XXX
```

```
 ACTIVITY? :
>>TIME,INIT

 THU, MAY 15 2008  14:20 - TIMER INITIALIZED

 ACTIVITY? :
>>
```

Figure 6.4. Example: Running Activity TIME,INIT

```
 ACTIVITY? :
>>TIME

 THU, MAY 15 2008  14:24   ELAPSE      USER     KERNEL
   SINCE LAST "TIME"      273.527     0.438     1.781
   CUMULATIVE             273.527     0.438     1.781

 ACTIVITY? :
>>
```

Figure 6.5. Example: Running Activity TIME

Additional Information
PSS® E Program Operation Manual, Displaying Timing Statistics

6.2.6. Directory Contents

CATA

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
CATA,string	List file(s) in the current directory with filename <*string*>

The directory listing activity CATA tabulates an alphabetical listing of the names of files contained in the current directory. Report content is dependent upon the suffix specified at the time activity CATA is run.

When activity CATA is run without a suffix, the names of all files in the current directory are listed.

Otherwise, the suffix is treated as a partial specification, and the names of all files in the current directory that contain this character string as a part of their name are listed. The suffix may contain embedded asterisks (*) which are treated as wild characters.

```
 ACTIVITY? :
>>CATA,*.sld

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7

 C:\Program Files\PTI\PSSE31\EXAMPLE

 11x17template.sld  8x11template.sld  NewYork.sld  sample.sld  savnw.sld

 TOTAL OF     5 FILES

 ACTIVITY? :
>>CATA,sa*

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7

 C:\Program Files\PTI\PSSE31\EXAMPLE

 savnw.bkd   savnw.con     savnw.drw   savnw.dyr   savnw.ecd   savnw.gcp
 savnw.grp   savnwchn.idv  sample.ltl  savnw.mon   savnw.mwm   savnw.pout
 sample.raw  savnw.raw     savnw.rop   savcnv.rwm  savnw.rwm   sample.sav
 savcnv.sav  savnw.sav     sample.seq  savnw.seq   sample.sld  savnw.sld
 savnw.snp   savnw.sub     savnw.trp

 TOTAL OF    27 FILES
```

Figure 6.6. Examples: Running Activity CATA

Additional Information
PSS® E Program Operation Manual, Listing Directory Contents

Chapter 7
Creating Power Flow Data Files

7.1. Creating a Saved Case File

SAVE

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
SAVE	Save the working case in the file that is specified in the dialog (activity can be run without a suffix).
SAVE,filename	Save the working case in the file <filename>.
SAVE,*	Save the working case in the last accessed Saved Case File.

The case saving activity SAVE stores the working case into a user-specified Saved Case File in a compressed format.

The Saved Case File to be used may be either:

- Specified on the activity Line Mode as a suffix to the SAVE activity command.
- Specified in the dialog of activity SAVE if no suffix is specified on the activity Line Mode.
- The last Saved Case File accessed by either activity SAVE or activity CASE in the current session of PSS®E if an asterisk (*) is specified as a suffix on the activity Line Mode.

If no file is specified, or if an error condition is encountered in opening the designated file, the user is prompted to:

```
ENTER SAVED CASE FILENAME:
```

The response of a zero followed by *[Enter]* (or simply *[Enter]*) ends activity SAVE.

Additional Information
PSS® E Program Operation Manual, Creating a Saved Case File *PSS® E Application Program Interface (API)*, SAVE

7.2. Saving the Working Case in an IEEE Common Format File

RWCM

Requirements / Prerequisites	
The working case must contain a validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
RWCM	Write IEEE Common Format data records (activity can be run without a suffix).

The IEEE Common Format output activity RWCM writes the working case as a file in IEEE common tape format data records.

The selection of the destination for the IEEE Common Format data records is handled as described in Section 1.5, Output Destination.

Then, if any unblocked dc lines or in-service FACTS devices are present in the working case, activity RWCM prompts the user:

```
ENTER 0 TO IGNORE DC LINES AND FACTS DEVICES, 1 TO ADD POWERS TO LOADS:
```

The data records are then written, and activity RWCM ends.

Additional Information
PSS® E Program Operation Manual, Saving the Working Case in an IEEE Common Format File
PSS® E Application Program Interface (API), RWCM

7.3. Saving Machine Impedance Data

RWMA

Requirements / Prerequisites	
Validly specified power flow case. If generator reactive powers are to be used in calculating the reactive power split fractions, the case must be solved to an acceptable mismatch level. Machine impedance data (MBASE, ZSORCE, XTRAN, and GENTAP) must be correctly specified for those machines to be processed.	
Activity ID, Suffix	Suffix Function
RWMA	Write machine parametric data records for machines at specified buses (activity can be run without a suffix).
RWMA,ALL	Write machine parametric data records for all machines.
RWMA,AREA	Write machine parametric data records for machines in specified area(s).
RWMA,ZONE	Write machine parametric data records for machines in specified zone(s).
RWMA,OWNER	Write machine parametric data records for machines with specified owner(s).
RWMA,KV	Write machine parametric data records for machines at buses in a specified base voltage range.
RWMA,OPT	Write machine parametric data records for machines in a subsystem specified using multiple selection criteria.

The machine impedance data output activity RWMA writes out machine parametric data from the working case in the form of a Machine Impedance Data File.

The selection of the destination for the Machine Impedance Data records is handled as described in Section 1.5, Output Destination.

Data records for out-of-service machines may be included or omitted. The default response to this request is 0.

```
ENTER 1 TO INCLUDE RECORDS FOR OUT OF SERVICE MACHINES:
```

Activity RWMA provides an option to calculate the power split fractions FP and FQ. The default response to these two requests is 0.

```
FOR CALCULATING P FRACTIONS, SELECT MACHINE QUANTITY ENTER 0 TO USE PGEN, 1 TO
USE MBASE, 2 TO USE PMAX: FOR CALCULATING Q FRACTIONS, SELECT MACHINE QUANTITY
ENTER 0 TO USE QGEN, 1 TO USE MBASE, 2 TO USE QMAX:
```

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection.

Following an input designating the completion of the subsystem selection process, the output tabulation is produced and activity RWMA ends.

Additional Information
PSS® E Program Operation Manual, Saving Machine Impedance Data *PSS® E Application Program Interface (API)*, RWMA

7.4. Creating a Power Flow Raw Data File

RAWD

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
RAWD	Write data records for equipment items at specified buses (activity can be run without a suffix).
RAWD,ALL	Write data records for the complete working case.
RAWD,AREA	Write data records for equipment items in specified area(s).
RAWD,ZONE	Write data records for equipment items in specified zone(s).
RAWD,OWNER	Write data records for equipment items of specified owner(s).
RAWD,KV	Write data records for equipment items at buses in a specified base voltage range.
RAWD,OPT	Write data records for equipment items in a subsystem specified using multiple selection criteria.
RAWD,NAME	Write data records for the complete working case using extended bus names as bus identifiers.
RAWD,TIES	Write data records only for branches whose terminal buses are in different areas.

The Raw Data File output activity RAWD writes the working case in the form of a Power Flow Raw Data File. That is, when directed to a file, the data records written by activity RAWD are in a format suitable for input to activity READ.

The selection of the destination for the Power Flow Raw Data records is handled as described in Section 1.5, Output Destination.

Activity RAWD prompts the user to indicate the options to include or omit disconnected (that is, Type 4) buses and out-of-service branches:

```
ENTER (1 TO OMIT ISOLATED BUSES),(1 TO OMIT OUT OF SERVICE BRANCHES):
```

with the default response in both cases being a zero (that is, include the outaged equipment).

When activity RAWD is run with the ALL suffix, the entire working case is processed. Bus identifiers are written as bus numbers on all data records except for bus data records where bus numbers are required, and bus names and base voltages are specified as data values.

When activity RAWD is run with the NAME suffix, the entire working case is processed. Bus identifiers are written as extended bus names on all data records except for bus data records where bus numbers are required, and bus names and base voltages are specified as data values.

When activity RAWD is run with the TIES suffix, it produces an output tabulation consisting only of branches between interchange areas. Thus, no bus, load, fixed shunt, generator, switched shunt, area, zone, owner, or interarea transfer data is processed, and the only branch, transformer, transformer impedance correction table, dc line, and FACTS device data included in the output is for branches with terminals connected to buses in different areas.

When activity RAWD is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it prompts the user to:

```
ENTER: 1 FOR ALL DATA WITHIN SPECIFIED SUBSYSTEM 2 FOR TIES FROM SPECIFIED
SUBSYSTEM 3 FOR ALL DATA PLUS TIES:
```

and:

```
ENTER: 1 FOR ALL LOADS AT SUBSYSTEM BUSES 2 FOR SUBSYSTEM LOADS AT ALL BUSES 3
FOR ALL LOADS AT SUBSYSTEM BUSES AND SUBSYSTEM LOADS AT NON-SUBSYSTEM BUSES:
```

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Following an input designating the completion of the subsystem selection process, the output tabulation is produced and activity RAWD ends.

Using the Line Mode Interface (CLI), the Power Flow Raw Data File written by activity RAWD always has the IC value on the first data record set to zero (refer to Case Identification Data). When using such a Power Flow Raw Data File, it is the responsibility of the user to ensure that this flag is set to the appropriate value for the application at hand. This data value may be changed with a text editor.

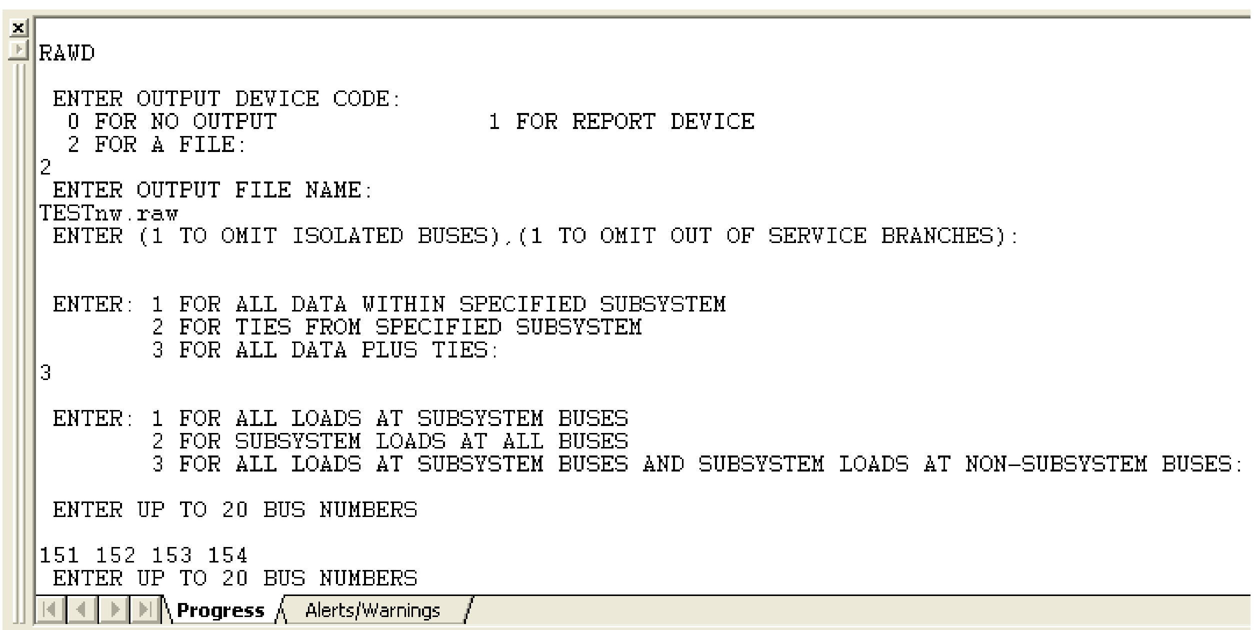


Figure 7.1. Example: Running Activity RAWD

Additional Information
PSS® E Program Operation Manual, Creating a Power Flow Raw Data File Power Flow Raw Data File Contents *PSS® E Application Program Interface (API)*,RAWD_2

7.5. Creating a Sequence Data File

RWSQ

Requirements / Prerequisites	
The working case must contain a validly specified power flow case with sequence data appended to it.	
Activity ID, Suffix	Suffix Function
RWSQ	Write data records for equipment items at specified buses (activity can be run without a suffix).
RWSQ,ALL	Write data records for the complete working case.
RWSQ,AREA	Write data records for equipment items in specified area(s).
RWSQ,ZONE	Write data records for equipment items in specified zone(s).
RWSQ,OWNER	Write data records for equipment items of specified owner(s).
RWSQ,KV	Write data records for equipment items at buses in a specified base voltage range.
RWSQ,OPT	Write data records for equipment items in a subsystem specified using multiple selection criteria.
RWSQ,TIES	Write data records only for branches whose terminal buses are in different areas.

The Sequence Data File output activity RWSQ writes the sequence data contained in the working case in the form of a Sequence Data File. That is, when directed to a file, the data records written by activity RWSQ are in a format suitable for input to activity RESQ.

The selection of the destination for the Sequence Data records is handled as described in Section 1.5, Output Destination.

Activity RWSQ prompts the user to indicate the options to include or omit disconnected (that is, Type 4) buses and out-of-service branches:

```
ENTER (1 TO OMIT ISOLATED BUSES),(1 TO OMIT OUT OF SERVICE BRANCHES):
```

with the default response in both cases being a zero (that is, include the outaged equipment).

When activity RWSQ is run with the ALL suffix, sequence data records for the entire working case are written.

When activity RWSQ is run with the TIES suffix, it produces an output tabulation consisting only of branches between interchange areas. Thus, no machine impedance, shunt load, fixed shunt, and switched shunt data is output, and the only branch, mutual impedance, and transformer data included in the output is for branches with terminals connected to buses in different areas.

When activity RWSQ is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it prompts the user to:

```
ENTER: 1 FOR ALL DATA WITHIN SPECIFIED SUBSYSTEM 2 FOR TIES FROM SPECIFIED
SUBSYSTEM 3 FOR ALL DATA PLUS TIES:
```

Specification of the subsystem to be processed is as described in Section 1.2.3, Subsystem Selection. Following an input designating the completion of the subsystem selection process, the output tabulation is produced and activity RWSQ ends.

Additional Information
PSS® E Program Operation Manual, Creating a Sequence Data File Sequence Data File Contents *PSS® E Application Program Interface (API)*, RWSQ

7.6. Creating a Transactions Raw Data File

RWMM

Requirements / Prerequisites	
The working case must contain a validly specified power flow case.	
Activity ID, Suffix	Suffix Function
RWMM	Write data records for all transactions data (activity can be run without a suffix).

The Transactions Raw Data File output activity RWMM writes the transactions data contained in working memory in the form of a Transactions Raw Data File. That is, when directed to a file, the data records written by activity RWMM are in a format suitable for input to activity REMM.

The selection of the destination for the Transactions Raw Data records is handled as described in Section 1.5, Output Destination.

Additional Information
PSS® E Program Operation Manual, Creating a Transactions Raw Data File Transactions Raw Data File Contents *PSS® E Application Program Interface (API)*,RWMM

Chapter 8
One-Line Diagrams

8.1. Drawing a One-Line Diagram from a Drawing Coordinate File

DRAW

Requirements / Prerequisites	
If bus voltages and/or line flows are to be printed, validly specified power flow case solved to an acceptable mismatch tolerance. Drawing Coordinate Data file (*.drw)	
Activity ID, Suffix	Suffix Function
DRAW,CHECK	Alarm any component (for example, load, branch, etc.) not specified in the Drawing Coordinate Data file for which a bus is included; then draw one-line diagram
DRAW,ACCEPT or DRAW,AC	Draw one-line diagram with default data (that is, ignore data in the working case)
DRAW,NCHECK	Suppress coordinate data checking error messages
DRAW,CLIP or DRAW,CL	Enable zooming to a specified portion of the diagram

Activity DRAW opens a dialog for specification of the Drawing Coordinate Data file (*.drw) and various options for drawing the one-line diagram. When activity DRAW instructs the user to enter an option from among a group of possible options, the default response is shown enclosed in square brackets. If the corresponding control record (VO, RA, VL, or AN) was contained in the Drawing Coordinate Data file, the default values are as specified on it. Otherwise, programmed defaults are used; for prompts where one of several options is to be specified, the first response code in the list of valid ones is the programmed default response. A response of a negative number to any question except the plotting device specification and the hard copy device name specification ends activity DRAW and without drawing the diagram.

Powers shown on the one-line diagram are in either MVA or kVA, according to the power output option currently in effect.

The dialog prompts the user to:

```
ENTER COORDINATE FILE NAME, BINARY OPTION (-1 TO EXIT):
```

The user enters the name of the desired Drawing Coordinate Data file(*.drw), and optionally a B if the file is a binary Drawing Save Data file (*.drb). If activity DRAW is unable to open the specified file, an appropriate message is printed and the user is asked to reenter a filename as described above.

After it is successfully initiated, activity DRAW reads the specified Drawing Coordinate Data file. Then, if the component checking option was enabled, the appropriate completeness checks are made.

If the S option is specified on the header record, activity DRAW requests the user to:

```
ENTER 1 TO SAVE DIAGRAM IN A BINARY FILE:
```

If the user responds with a 1, the next instruction is:

```
ENTER BINARY FILE NAME:
```

It is recommended that the user specify a file other than that of the original Drawing Coordinate Data file.

The user is then given the opportunity to change the diagram annotation options. The dialog prompts the user to:

```
TO CHANGE DEFAULT ANNOTATION ENTER: 0 FOR NO MORE 1 FOR LINE ANNOTATION 2 FOR
BUS ANNOTATION 3 FOR EQIP ANNOTATION [0] :
```

If no defaults are changed, either here or on any AN data records, the diagram is annotated as follows:

- Buses are identified with either their bus number or name according to the bus output option currently in effect.
- Bus voltages are tabulated in pu.
- Signed active and reactive power flows are printed on branches and FACTS devices.
- Active and reactive power loading is printed for generators, loads, shunts, and multi-terminal dc lines.

If a 1 is entered, the user specifies the branch annotation options to be used on the one-line diagram.

```
ENTER: 0 FOR LINE FLOWS 1 FOR IMPEDANCES 2 FOR NO LINE QUANTITIES [0] :
```

A response of 2 suppresses all branch and FACTS device quantities; transformer, series capacitor, and dc symbol quantities that would be drawn using the other branch annotation options are still drawn.

A response of 1 causes impedances, charging, and, optionally, a line rating to be printed for each ac transmission line and transformer, and dc line resistance and commutating reactances, in ohms, for each two-terminal dc line. Nominal values are printed for each shunt, and active power output along with reactive power limits are printed for each generator.

A response of 1 with a subsequent response of 1 (no line ratings) to the prompt below causes FACTS devices to be drawn without annotation. A response of 1 with a subsequent response of 0 (line ratings) to the prompt below causes FACTS devices to be drawn with transfer limit rating annotations.

If a 1 (impedances) is entered, the user specifies the line rating option to use:

```
ENTER: 0 FOR LINE RATINGS 1 FOR NONE [0] :
```

Following a response of 0, the user is then asked to specify which of the line rating sets are to be used.

Following a response of 0 to the line annotation specification request, the user is asked to designate the quantities to be displayed on ac transmission lines and transformers and the directional convention to be used:

```
ENTER LINE ANNOTATION, ARROW/SIGN ANNOTATION: 0 FOR MW/MVAR FLOW 1 FOR MVA 2
FOR MVA/% RATING 3 FOR AMPS/pu CURRENT 4 FOR MW/% RATING 5 FOR AMPS/% RATING
ENTER SELECTION [0,SIGN ] :
```

where the directional annotation option of SIGN or ARROW will display the standard PSS®E sign convention or arrows for indicating flow direction. Table 8.1, “Summary of Line Annotation Options ” summarizes the line annotation options available.

Table 8.1. Summary of Line Annotation Options

Line Option	Directional Option	First Item Displayed	Second Item Displayed
0	SIGN	Signed MW	Signed Mvar

Line Option	Directional Option	First Item Displayed	Second Item Displayed
0	ARROW	Arrow and unsigned MW	Arrow and unsigned Mvar
1	SIGN	Unsigned MVA	—
1	ARROW	Arrow and unsigned MVA	—
2	SIGN	Unsigned MVA	Unsigned % current loading
2	ARROW	Arrow and unsigned MVA	Unsigned % current loading
3	SIGN	Unsigned current in amps	Unsigned pu current
3	ARROW	Arrow and unsigned current in amps	Unsigned pu current
4	SIGN	Signed MW	Unsigned % current loading
4	ARROW	Arrow and unsigned MW	Unsigned % current loading
5	SIGN	Unsigned current in amps	Unsigned % current loading
5	ARROW	Arrow and unsigned current in amps	Unsigned % current loading

When the ARROW directional option is specified, the direction indicated by the arrow shown with the first item displayed is the direction of active power flow at the corresponding end of the line. For line annotation code zero (MW and Mvar flow), the arrow shown with the second item displayed indicates the direction of reactive power flow at the corresponding end of the line.

If branch currents are to be expressed in amps (that is, a response of 3 or 5 for the line annotation code), for any branch for which the corresponding bus base voltage is not contained in the working case, only the per unit current is printed.

If a response of 2, 4, or 5 is entered for the line annotation code, the current is calculated at the appropriate end(s) of the branch and is used in calculating the percentage current loading. The user is asked to specify the rating set to be used, with the default being the rating set established as the default rating set program option, or as replaced on an RA record in the Drawing Coordinate Data File:

```
ENTER: 1 FOR LINE RATEA 2 FOR LINE RATEB 3 FOR LINE RATEC [1] :
```

If the specified rating for a given branch had not previously been entered (that is, if it is zero), the percent loading field on the drawing is left blank.

The line annotation specification impacts FACTS devices, as shown in Table 8.2, “Summary of FACTS Device Annotation Options ” .

If the user elects to change the bus annotation options, the following dialog is entered:

```
ENTER: 0 FOR BUS NUMBERS 1 FOR NAMES 2 FOR BOTH 3 FOR NONE [0] :
```

If the code for bus names is entered and a bus has a blank name assigned to it, no identifier is printed for the bus. When the code for both bus numbers and names is entered, the name is printed above the number. The specification of bus names, which are up to twelve characters, may require adjustment of coordinates in the data file if the diagram was set up using the bus number option (bus numbers are at most six digits).

The user is then asked to specify the voltage annotation option:

```
ENTER: 0 FOR BUS VOLTAGE 1 FOR ANGLE 2 FOR BOTH 3 FOR NONE [0] :
```

Following a response of 0, the user is asked to specify the voltage units:

```
ENTER: 0 FOR pu VOLTAGE 1 FOR KV 2 FOR BOTH [0] :
```

If both voltage and angle are specification, voltage unit options are:

```
ENTER: 0 FOR pu VOLTAGE 1 FOR KV [0] :
```

If, in the above dialog, the kV option is specification, any bus for which no base voltage has been entered has its voltage printed in pu.

On a flow diagram, voltage and angle are printed as zero for any Type 4 bus (that is, for disconnected buses).

If an impedance diagram had been specified prior to selecting the bus annotation options, the voltage annotation options are restricted to either the bus base voltage, or no voltage annotation:

```
ENTER: 0 FOR BUS BASE KV 1 FOR NONE [0] :
```

This gives the user the ability to have base voltages printed for buses. The default base voltage of zero is printed at buses for which no base voltage has been entered.

If the user elects to change the equipment annotation options, responding to the following instruction will give the user the ability to designate the annotation of loads, generators, shunts, and multi-terminal dc lines.

```
ENTER: 0 FOR MW/MVAR 1 FOR MVA 2 FOR NONE [0] :
```

Table 8.2. Summary of FACTS Device Annotation Options

Line Option	Directional Option	First Item Displayed	Second Item Displayed
0	SIGN	• Series, shunt, and bridge elements: signed MW (P)	• Series and shunt elements: signed Mvar (Q)
0	ARROW	• Series, shunt, and bridge elements: arrow and unsigned MW (P)	• Series and shunt elements: arrow and unsigned Mvar (Q)
1	SIGN	• Series and shunt elements: signed S • Bridge element: signed MW (P)	—
1	ARROW	• Series and shunt elements: arrow and unsigned S • Bridge element: arrow and unsigned MW (P)	—
2	SIGN	• Series and shunt elements: signed S • Bridge element: signed MW (P)	• Series element: signed S/VM/FCIMX • Shunt element: signed S/VM/FCSHMX

Line Option	Directional Option	First Item Displayed	Second Item Displayed
			• Bridge element: signed P/TRSFMX
2	ARROW	• Series and shunt elements: arrow and unsigned S • Bridge element: arrow and unsigned MW (P)	• Series element: arrow and unsigned S/VM/FCIMX • Shunt element: arrow and unsigned S/VM/FCSHMX • Bridge element: arrow and unsigned P/TRSFMX
3	SIGN	• Series and shunt elements: signed (S*1000)/(VM*kV)	• Series and shunt elements: signed S/VM
3	ARROW	• Series and shunt elements: arrow and unsigned (S*1000)/(VM*kV)	• Series and shunt elements: arrow and unsigned S/VM
4	ARROW	• Series, shunt, and bridge elements: signed MW (P)	• Series element: signed S/VM/FCIMX • Shunt element: signed S/FCSHMX • Bridge element: signed P/TRSFMX
4	ARROW	• Series, shunt, and bridge elements: arrow and unsigned MW (P)	• Series element: arrow and unsigned S/VM/FCIMX • Shunt element: arrow and unsigned S/FCSHMX • Bridge element: arrow and unsigned P/TRSFMX
5	SIGN	• Series and shunt elements: signed (S*1000)/(VM*kV)	• Series element: signed S/VM/FCIMX • Shunt element: signed S/FCSHMX
5	ARROW	• Series and shunt elements: arrow and unsigned (S*1000)/(VM*kV)	• Series element: arrow and unsigned S/VM/FCIMX

Line Option	Directional Option	First Item Displayed	Second Item Displayed
			• Shunt element: arrow and unsigned SFCSH-MX

Legend:

P =	MW power flow at bus		FCIMX =	maximum series current (MVA at rated voltage)
Q =	Mvar flow at bus		FCSHMX =	sending end maximum shunt current (MVA at rated voltage)
VM =	voltage magnitude at bus		TRSFMX =	maximum MW bridge power transfer
kV =	voltage kV at bus			
S =	$\sqrt{P^2 + Q^2}$			

If an impedance diagram had been specified prior to specifying the equipment annotation options, the equipment annotation options are restricted to either active and reactive powers or no annotation:

```
ENTER: 0 FOR MW/MVAR 1 FOR NONE [0] :
```

Equipment powers are printed as zero for any Type 4 bus (that is, for disconnected buses).

Following the specification of diagram annotation options, unless the A or L option is specified on the header record, or the ACCEPT suffix is entered in running activity DRAW, the user may enable various range checking options. The dialog prompts the user to:

```
FOR RANGE CHECKING ENTER: 0 FOR NO MORE 1 FOR VOLTAGE LEVELS 2 FOR LINE RATINGS
3 FOR BUS VOLTAGE LIMITS [0] :
```

If voltage levels are specified, buses of different voltage levels are drawn as specified in the voltage level specification record. Activity DRAW displays the present voltage breakpoints and the user has the ability to replace the default values:

```
THE DEFAULT KV LEVELS ARE: XXXX.X, XXXX.X, XXXX.X (KV). ENTER: 0 IF ACCEPTABLE
1 TO CHANGE LEVELS [0] :
```

If the user elects to change the default values (either as contained on the VO data record or the program defaults if no VO record is present), the next instruction is:

```
ENTER: THREE KV LEVELS IN ASCENDING ORDER:
```

If line ratings are specified, branches for which loading exceeds a specified percentage of a specified rating are flagged as specified in the rating specification record. Unless a rating set was previously specified (that is, an RA record was included in the Drawing Coordinate Data File or one of the % RATING options for branches was chosen), the user is asked to specify which of the three branch rating sets is to be used, with the default being the rating set established as the default rating set program option:

```
ENTER: 1 FOR LINE RATEA 2 FOR LINE RATEB 3 FOR LINE RATEC [1] :
```

The user is then asked to specify the percentage of rating above which branches are to be flagged:

```
ENTER: PERCENT OF RATEn TO BE FLAGGED [XXX.X] :
```

All branches to be drawn that have a non-zero value for the specified rating are checked.

The PERCENT OF rating is used to determine whether the FACTS device loading exceeds the percent of maximum limit rating. Any FACTS device line overload is annotated by color or drawn with a dashed line.

If bus voltage limits are specified, each bus for which voltage is outside of a specified band are flagged, as specified in the bus voltage limits specification record. The user is given the opportunity to change the voltage limits:

```
THE DEFAULT BUS LIMITS ARE: X.XXX, X.XXX pu. ENTER: 0 IF ACCEPTABLE 1 TO CHANGE
LIMITS [0] :
```

If the user elects to change the default values (either as contained on the VL data record or the program defaults if no VL record is present), the next instruction is:

```
ENTER: VMIN,VMAX IN PER UNIT:
```

In a flow diagram, any combination of the above flagging options may be chosen in any order. Following the specification of and dialog describing any of these options, the user is invited to enter additional options until the NO MORE response of zero is entered.

In an impedance diagram, only the voltage level option is permitted. In place of the range checking specification instruction described above, the dialog prompts the user to:

```
ENTER 1 FOR VOLTAGE LEVEL OPTION [0] :
```

If a 1 is entered, the user is given the opportunity to modify the voltage breakpoints as described above.

If any of the range checking options described above are specified, a range checking symbol key is drawn in the title block of the diagram. The symbol key shows the range (or limits) and corresponding annotation used for any active options. If the x-coordinate drawing size is at least 10 in., a legend is printed in the title block noting the equipment quantities specified for output. A line is printed for buses, branches, and bus equipment.

Following specification of any range checking options, the dialog prompts the user to:

```
ENTER 30 CHARACTER DIAGRAM TITLE ************************************ :
```

The user may enter a diagram subtitle, which is printed below the two-line case title on the diagram along with the current date and time.

With the processing of the Drawing Coordinate Data File completed and annotation options specified, the diagram can now be drawn. The user is asked to specify the output device.

If a hardcopy device is specified and zooming is enabled (that is, a CL record had been read from the Drawing Coordinate Data File or the CLIP suffix was specified in running activity DRAW), the following instruction is repeated until a zero response is entered:

```
OPTIONS ARE: 0 = EXIT 1 = NEXT PAGE ( n) 2 = SELECT PAGE 3 = SELECT BUS 4 =
FULL ONE-LINE 5 = CHANGE CLIPPING SIZE SELECT OPTION:
```

By issuing a response of 1, activity DRAW may be used to page through the one-line diagram using the clipping window as specified by the CL record, as modified, or as rendered by the default, 6 × 4 in. When sent to a hard copy device, adjacent pages contain a slight overlap, easing the task of joining them together to form a large diagram. The n displayed in the option menu is the number of the next page to be drawn.

A response of 2 is similar to a response of 1 except that a specific page may be entered. Pages are numbered in ascending order starting at the lower left page as shown in the following example. For a diagram consisting of three pages along the x-axis and two pages along the y-axis, the page numbering is:

4	5	6
1	2	3

A response of 3 allows the user to zoom in on a specified bus. Normally the bus is centered in the resulting diagram; however, if it is near the border of the diagram, the picture is shifted to allow more of the diagram to be included in the drawing. The portion of the diagram displayed is as defined by the clipping window.

A response of 4 produces the complete one-line diagram on the specified device.

A response of 5 enables the user to change the definition of the clipping window for the duration of the current session.

If a hardcopy device is specified and zooming is not enabled, the full diagram is drawn.

In either case, any additional dialog by activity DRAW is dependent upon the specific hard copy device specified.

If a graphics CRT is specified as the output device, zooming is automatically enabled. Following a response of 1 through 4 to the zooming options menu described above, the diagram (or the appropriate portion thereof) is displayed and subsequent user input is entered using the keyboard and the graphics cursor.

When zooming is enabled, following the processing of a graphics display, the user is given the option of specifying another (or the same) graphics output device, where a response of zero ends activity DRAW. If a device is specified, the zooming options menu is again displayed. This cycle is repeated until a zero is specified for the output device specification.

Additional Information
PSS® E Program Operation Manual, DRAW

Chapter 9
Power Flow Solutions

9.1. Running Gauss-Seidel Power Flow Solution

SOLV

Requirements / Prerequisites	
Validly specified power flow case with voltages that are a reasonable estimate of a solution. No series capacitors.	
Activity ID, Suffix	Suffix Function
SOLV,FS	All voltages initialized to unity magnitude at zero phase; flat start
SOLV,OPT	User selects options manually using an interactive dialog or specifies flat start

The power flow solution activity SOLV uses a Gauss-Seidel iterative algorithm to solve for the bus voltages needed to satisfy the bus boundary conditions contained in the working case.

If the power flow solution network connectivity checking option is enabled, activity SOLV first checks that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity SOLV ends.

When activity SOLV is run with the FS suffix, Type 3 (swing) bus voltages are reset to scheduled voltage at zero phase angle and all other bus voltages to unity magnitude at zero phase angle for a flat start before applying the voltage adjustment formula of activity SOLV. Otherwise, the voltage vector at the time activity SOLV is run is used as the initial voltage estimate.

When activity SOLV is run with the OPT suffix, it may be instructed to replace the current automatic adjustment option settings.

The default responses corresponding to the adjustments for which a PSS®E option setting exists are the current values of these option settings; the default responses for the *flat start* and *var limits* items are zeros.

The PSS®E FACTS model will not attempt to solve for the state in which all three of the above quantities are simultaneously held at a limit. Such a state defines an over constrained problem. In such a system condition, the FACTS model will usually cycle among model states (5) through (7) above. Observing the FACTS device conditions monitor using the FD interrupt control code (see PSS®E Program Operation Manual,Interruption of PSS®E by the User) reveals such a situation. It is the user's responsibility to decide which of the three limits is to be relaxed, and then make the appropriate data change.

```
>>SOLV,OPT

 AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS

 ENTER: [1 FOR] , [AREA INT] , [1 TO FLAT] , [1 TO LOCK] , [1 TO LOCK ] , [1 TO IGNORE]
        [TAPS ]   [   CODE  ]   [   START  ]   [D.C. TAPS]   [SWCH SHNTS]   [VAR LIMITS ]

>>2

 ITER DELTAV/TOL X-------- AT BUS ---------X  REAL(DELTAV)  IMAG(DELTAV)
    1     0.259     211 [HYDRO_G     20.000]    0.2575E-04    0.2861E-05

 REACHED TOLERANCE IN   1 ITERATIONS

 LARGEST MISMATCH:     0.00 MW   -0.14 MVAR     0.14 MVA AT BUS    201 [HYDRO       500.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:                1.07 MVA

 SWING BUS SUMMARY:
   BUS# X-- NAME --X BASKV      PGEN     PMAX    PMIN      QGEN     QMAX    QMIN
   3011 MINE_G       13.800     258.7    900.0    0.0      104.0    600.0  -100.0

 ACTIVITY? :
>>
```

Figure 9.1. Example: Running Activity SOLV,OPT

Additional Information
PSS® E Program Operation Manual, Applying Gauss-Seidel Power Flow Solution

9.2. Running Modified Gauss-Seidel Power Flow Solution

MSLV

Requirements / Prerequisites	
Validly specified power flow case with voltages that are a reasonable estimate of a solution.	
Activity ID, Suffix	Suffix Function
MSLV,FS	All voltages initialized to unity magnitude at zero phase; flat start
MSLV,OPT	User selects options manually using an interactive dialog

The power flow solution activity MSLV uses a modified Gauss-Seidel iterative algorithm to solve for the bus voltages needed to satisfy the bus boundary conditions contained in the working case. A secondary adjustment applied, based on each primary voltage change, enables negative reactance branches to be represented between Type 1 buses.

```
 ACTIVITY? :
>>MSLV,OPT

 AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS

 ENTER: [1 FOR] , [AREA INT] , [1 TO FLAT] , [1 TO LOCK] , [1 TO LOCK ] , [1 TO IGNORE]
        [TAPS ]   [   CODE   ]   [  START  ]   [D.C. TAPS]   [SWCH SHNTS]   [VAR LIMITS ]

>>2

 ITER DELTAV/TOL X-------- AT BUS ---------X  REAL(DELTAV)  IMAG(DELTAV)
    1      0.200     211 [HYDRO_G     20.000]   -0.1919E-04   -0.5588E-05

 REACHED TOLERANCE IN   1 ITERATIONS

 LARGEST MISMATCH:     0.02 MW     0.12 MVAR      0.12 MVA AT BUS     201 [HYDRO       500.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:                  0.41 MVA

 SWING BUS SUMMARY:
   BUS# X-- NAME --X BASKV      PGEN      PMAX     PMIN      QGEN     QMAX    QMIN
   3011 MINE_G       13.800     258.7     900.0     0.0      104.0     600.0  -100.0

 ACTIVITY? :
>>
```

Figure 9.2. Example: Running Activity MSLV,OPT

Additional Information
PSS®E Program Operation Manual, Applying Modified Gauss-Seidel Power Flow Solution

9.3. Running Fully-Coupled Newton-Raphson Power Flow Solution

FNSL

Requirements / Prerequisites	
Validly specified power flow case with voltages that are a reasonable estimate of a solution.	
Activity ID, Suffix	Suffix Function
FNSL,FS	All voltages initialized to unity magnitude at zero phase; flat start
FNSL,OPT	User selects options manually using an interactive dialog

Activity FNSL uses a fully coupled Newton-Raphson iterative algorithm to solve for the bus voltages needed to satisfy the bus boundary conditions contained in the working case.

Activity FNSL requires activity ORDR to be run. If the need for a new bus ordering is detected, activity ORDR is automatically run before beginning the voltage change calculation.

Prior to starting its first iteration, activity FNSL requests that the user specify the number of the iteration during which generator reactive power limits will first be applied. A response of *[Enter]* returns the solution to its normal (default) mode in which reactive power limits are ignored until the largest reactive power mismatch has been reduced to a preset multiple of the mismatch convergence tolerance, TOLN. A response of -1 causes reactive power limits to be ignored at all Type 2 buses except those for which the upper and lower limits are equal. A response of zero causes reactive power limits to be recognized on the first mismatch calculation, preceding the first iteration. A response of a positive number n causes reactive power limits to be applied either on iteration number n or when the largest reactive power mismatch is within a preset multiple of the tolerance, whichever occurs first.

When activity FNSL is run with the OPT suffix, it may be instructed to replace the current automatic adjustment option settings. The default responses corresponding to the adjustments for which a PSS®E option setting exists are the current values of these option settings; the default response for the *flat start* item is a zero.

```
ACTIVITY? :
>>FNSL,OPT

TAP CODE IS 0 TO LOCK, 1 FOR STEPPING, 2 FOR DIRECT
AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS
```

Figure 9.3. Example: Running Activity FNSL,OPT

Additional Information
PSS® E Program Operation Manual, Applying Fully-Coupled Newton-Raphson Power Flow Solution

9.4. Running Decoupled Newton-Raphson Power Flow Solution

NSOL

Requirements / Prerequisites	
Validly specified power flow case with voltages that are a reasonable estimate of a solution.	
Activity ID, Suffix	Suffix Function
NSOL,FS	All voltages initialized to unity magnitude at zero phase; flat start
NSOL,OPT	User selects options manually using an interactive dialog

The power flow solution activity NSOL uses a decoupled Newton-Raphson iterative algorithm to solve for the bus voltages needed to satisfy the bus boundary conditions contained in the working case.

Activity NSOL handles the network connectivity checking option, flat start solution, treatment of generator reactive power limits, load, generator, switched shunt, FACTS device, and dc line boundary conditions, the blowup check, scaling of the voltage magnitude change vector, acceleration, and convergence criteria in the same way as activity FNSL. The specification and application of automatic adjustments is identical to that of activity FNSL except that the non-divergent solution option is not available in activity NSOL. The FACTS device monitor, dc transmission line monitors, largest mismatch tabulation, swing bus summary, and area interchange violation summary are identical to those of activity FNSL.

```
 ACTIVITY? :
>>NSOL,OPT

 TAP CODE IS 0 TO LOCK, 1 FOR STEPPING, 2 FOR DIRECT
 AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS

 ENTER:
  [TAP ] , [AREA INT] , [1 FOR PHASE] , [1 TO FLAT] , [1 TO LOCK] , [1 TO LOCK ]
  [CODE]   [  CODE  ]   [ SHIFTERS  ]   [  START  ]   [D.C. TAPS]   [SWCH SHNTS]

>>2,2,1,1
 ENTER ITERATION NUMBER FOR VAR LIMITS
  0 FOR IMMEDIATELY, -1 TO IGNORE COMPLETELY:
>>0

 ORDERING NETWORK
 DIAGONALS =     22  OFF-DIAGONALS =     40  MAX SIZE =     58

  ITER       DELTAP      BUS       DELTAQ     BUS       DELTA/V/      BUS      DELTAANG     BUS
   0.0      12.0000(     205   )   7.1856(     152   )
                                                          0.00000(            )  0.32209(    101   )
   0.5       0.1341(     152   )   6.0027(     154   )
                                                          0.08049(    3018    )  0.00000(           )
   1.0       0.4263(     201   )   2.3024(    3008   )
                                                          0.00000(            )  0.03797(    211   )
   1.5       0.0009(     204   )   2.3252(    3008   )
                                                          0.03584(    3008    )  0.00000(           )
   2.0       0.1347(     205   )   1.5635(     205   )
                                                          0.00000(            )  0.00583(   3018   )
   2.5       0.0000(    3008   )   1.5775(     205   )
                                                          0.03960(     205    )  0.00000(           )
   3.0       0.7023(     205   )   0.0710(     205   )
                                                          0.00000(            )  0.01275(    211   )
   3.5       0.0004(     205   )   0.1673(     205   )
                                                          0.01879(     211    )  0.00000(           )
   4.0       0.2165(     211   )   1.4254(     211   )
                                                          0.00000(            )  0.00842(    211   )
   4.5       0.0001(     204   )   1.3712(     211   )
                                                          0.02872(     211    )  0.00000(           )
   5.0       0.2197(     211   )   0.2222(     211   )
                                                          0.00000(            )  0.00448(    211   )

 TAP RATIOS ADJUSTED

 X---- ADJUSTABLE SIDE ----X  X---------- TO -----------X CKT   OLD      NEW       CHANGE
    152 [MID500      500.00]     153 [MID230      230.00]  1  1.01000  0.95000LO -0.06000
    204 [SUB500      500.00]     205 [SUB230      230.00]  1  1.00000  1.01520    0.01520

                                                          0.00000(            )  0.01313(    101   )
  14.5       0.0000(    3005   )   0.0380(     211   )
                                                          0.00077(     211    )  0.00000(           )
  15.0       0.0060(     201   )   0.0060(     211   )
                                                          0.00000(            )  0.00013(    211   )
  15.5       0.0000(     211   )   0.0069(     211   )
                                                          0.00014(     211    )  0.00000(           )
  16.0       0.0011(     211   )   0.0009(     211   )
                                                          0.00000(            )  0.00002(    211   )
  16.5       0.0000(     211   )   0.0008(     211   )
                                                          0.00002(     211    )  0.00000(           )
  17.0       0.0004(     206   )   0.0004(     211   )

 REACHED TOLERANCE IN  17 ITERATIONS

 LARGEST MISMATCH:    -0.01 MW     0.04 MVAR      0.04 MVA AT BUS     211 [HYDRO_G     20.000]
 SYSTEM TOTAL ABSOLUTE MISMATCH:                  0.19 MVA

 SWING BUS SUMMARY:
   BUS# X-- NAME --X BASKV     PGEN     PMAX     PMIN      QGEN     QMAX     QMIN
   3011 MINE_G       13.800    253.3    900.0     0.0      46.6    600.0   -100.0

 ACTIVITY? :
>>
```

Figure 9.4. Example: Running Activity NSOL,OPT

Additional Information
PSS®E Program Operation Manual, Applying Decoupled Newton-Raphson Power Flow Solution

9.5. Running Fixed Slope Decoupled Newton-Raphson Power Flow Solution

FDNS

Requirements / Prerequisites	
Validly specified power flow case with voltages that are a reasonable estimate of a solution.	
Activity ID, Suffix	Suffix Function
FDNS,FS	All voltages initialized to unity magnitude at zero phase; flat start
FDNS,OPT	User selects options manually using an interactive dialog or specifies flat start

The power flow solution activity FDNS uses a fixed-slope decoupled Newton-Raphson iterative algorithm to solve for the bus voltages needed to satisfy the bus boundary conditions contained in the working case.

Activity FDNS handles the network connectivity checking option, flat start solution, treatment of generator reactive power limits, load, generator, switched shunt, FACTS device, and dc line boundary conditions, specification and application of automatic adjustments, the blowup check, the scaling of the voltage magnitude change vector, acceleration, convergence criteria, and the non-divergent solution option in the same way as activity FNSL. The FACTS device monitor, dc transmission line monitors, largest mismatch tabulation, swing bus summary, and area interchange violation summary are identical to those of activity FNSL.

Activity FDNS ends if the voltage magnitude at a bus is driven to very nearly 0.0.

```
 ACTIVITY? :
>>FDNS,OPT

 TAP CODE IS 0 TO LOCK, 1 FOR STEPPING, 2 FOR DIRECT
 AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS

 ENTER:
  [TAP ] , [AREA INT] , [1 FOR PHASE] , [1 TO FLAT] , [1 TO LOCK] , [1 TO LOCK ]
  [CODE]   [  CODE  ]   [ SHIFTERS  ]   [   START  ]   [D.C. TAPS]   [SWCH SHNTS]

>>2,2,1,0
 ENTER ITERATION NUMBER FOR VAR LIMITS
  0 FOR IMMEDIATELY, -1 TO IGNORE COMPLETELY:
>>0

  ITER        DELTAP      BUS          DELTAQ      BUS        DELTA/V/      BUS        DELTAANG      BUS
   0.0        0.0000(     203    )     0.0006(      206    )
                                                               0.00000(             )   0.00000(      203    )
   0.5        0.0000(     153    )     0.0006(      206    )
                                                               0.00001(      206    )   0.00000(             )

 AREA SWINGS ADJUSTED

 X---- AREA -----X X------- SLACK BUS -------X   OLD P     NEW P    CHANGE    PMAX     PMIN
    1 FLAPCO           101 [NUC-A       21.600]  718.65  -278.41*  -997.06   810.0     0.0
    2 LIGHTCO          206 [URBGEN      18.000]  832.62  1829.42*   996.80   900.0     0.0
    5 WORLD           3011 [MINE_G      13.800]  255.70     SYSTEM SWING

    2 AREA SWING POWERS ADJUSTED

   1.0        9.9706(      101    )     0.0000(      206    )
                                                               0.00000(             )   0.28330(      101    )
   1.5        0.4010(      152    )     1.0218(      205    )
                                                               0.01345(      211    )   0.00000(             )
   2.0        0.5936(      206    )     0.9501(      201    )
                                                               0.00000(             )   0.03514(      206    )
   2.5        0.0293(      152    )     0.9308(      201    )
                                                               0.01745(      211    )   0.00000(             )
   3.0        0.1417(      206    )     0.0254(      206    )
                                                               0.00000(             )   0.00156(      211    )
   3.5        0.0071(      206    )     0.0428(      205    )
                                                               0.00114(      206    )   0.00000(             )

 AREA SWINGS ADJUSTED

 X---- AREA -----X X------- SLACK BUS -------X   OLD P     NEW P    CHANGE    PMAX     PMIN
    1 FLAPCO           101 [NUC-A       21.600] -278.41*  -293.67*   -15.25   810.0     0.0
    2 LIGHTCO          206 [URBGEN      18.000] 1829.42*  1823.76*    -5.67   900.0     0.0
    5 WORLD           3011 [MINE_G      13.800]  232.76     SYSTEM SWING

    2 AREA SWING POWERS ADJUSTED

 PHASE SHIFTERS ADJUSTED

 X---- ADJUSTABLE SIDE ----X  X----------- TO -----------X CKT     OLD       NEW       CHANGE
    202 [EAST500      500.00]     203 [EAST230      230.00]  1     0.472    -7.958     -8.4295

    1 PHASE SHIFTERS ADJUSTED

  12.5        0.0001(      206    )     0.0011(      211    )
                                                               0.00002(      211    )   0.00000(             )
  13.0        0.0005(      206    )     0.0006(      211    )

 REACHED TOLERANCE IN  13 ITERATIONS

 LARGEST MISMATCH:      0.02 MW    -0.06 MVAR      0.06 MVA AT BUS     211 [HYDRO_G      20.000]
 SYSTEM TOTAL ABSOLUTE MISMATCH:                   0.25 MVA

 SWING BUS SUMMARY:
   BUS# X-- NAME --X BASKV      PGEN      PMAX     PMIN       QGEN     QMAX     QMIN
   3011 MINE_G       13.800    255.4     900.0      0.0       45.9    600.0   -100.0

 ACTIVITY? :
>>
```

Figure 9.5. Example: Running Activity FDNS,OPT

Additional Information
PSS® E Program Operation Manual, Applying Fixed Slope Decoupled Newton-Raphson Power Flow Solution

9.6. Running Newton-Raphson Power Flow Solution with Inertial or Governor Dispatch

INLF

Requirements / Prerequisites	
Validly specified power flow case, solved in the pre-event condition. No prior power flow solution activities in working case. Unit Inertia and Governor Data File (*.inl) containing machine data for all in-service machines.	
Activity ID, Suffix	Suffix Function
INLF,OPT	User selects options manually using an interactive dialog

The inertial and governor response power flow solution activity INLF uses a Newton-Raphson iterative algorithm to solve for the bus voltages needed to satisfy the bus boundary conditions contained in the working case. Activity INLF provides for the redispatch of generator powers to allow proper load sharing in a power unbalance condition.

The working case is assumed to have appropriate data changes corresponding to some event imposed upon the solved pre-event power flow case; activity INLF then solves the network for conditions existing either at about half a second following the event (an inertial power flow) or at several seconds after the event (a governor response power flow).

When initiated, activity INLF generates the warning:

```
WARNING: INLF MODIFIES DATA IN WORKING CASE
```

Activity INLF then separates the working case into islands. An alarm message is generated and the activity ends if more than ten energized islands are detected. Otherwise, it reports the number of islands detected and instructs the user to specify the type of solution to be run:

```
nn ISLANDS FOUND ENTER 0 FOR INERTIAL SOLUTION 1 FOR GOVERNOR RESPONSE SOLUTION:
```

When activity INLF is run with the OPT suffix, it allows the user to specify the automatic adjustment options to be enabled. The default reflects the current automatic adjustment option settings, as in the standard power flow solution activities. Area interchange control is always disabled in activity INLF.

The dialog prompts the user to designate the data input file to be used:

```
ENTER UNIT INERTIA AND GOVERNOR DATA FILE NAME:
```

If no file is specified, default data is used for all machines. If a filename is entered, and the file does not exist or some other file system error occurs, an appropriate message is printed and the request for a data filename is repeated.

An alarm message is generated for gross data errors in the input file (for example, H = 0.0), and the corresponding record is ignored. An alarm message is also generated for data inconsistencies (for example, PMAX less than initial machine power), which are fixed and used in the analysis.

Finally, the user is asked to specify at which iteration generator reactive power limits are first applied.

9.6.1.

Inertial Power Flow Solution

The inertial power flow solution is intended to indicate system conditions that would exist half a second after the initiation of an event on a steady-state system condition. Generator scheduled voltages at those generator buses that are initially at a reactive power limit are set to their pre-disturbance (that is, initial working case) voltages.

The default response to the var limits specification is to ignore reactive power limits. By default, tap adjustment and phase shift angle adjustment are disabled, dc converter taps are locked, and switched shunts are active. These settings may be replaced by entering the OPT suffix. Area interchange control and the non-divergent solution option are always disabled.

```
>>INLF,OPT
 ENTER 0 FOR INERTIAL SOLUTION
       1 FOR GOVERNOR RESPONSE SOLUTION:
>>0
 ENTER UNIT INERTIA AND GOVERNOR DATA FILE NAME:
>>

 TAP CODE IS 0 TO LOCK, 1 FOR STEPPING, 2 FOR DIRECT
 AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS

 ENTER:
  [TAP ] , [AREA INT] , [1 FOR PHASE] , [1 TO FLAT] , [1 TO LOCK] , [1 TO LOCK ]
  [CODE]   [  CODE  ]   [ SHIFTERS  ]   [  START  ]   [D.C. TAPS]   [SWCH SHNTS]

>>0,1,1,0
 ENTER ITERATION NUMBER FOR VAR LIMITS
  0 FOR IMMEDIATELY, -1 TO IGNORE COMPLETELY:
>>0

 WARNING: INLF MODIFIES DATA IN WORKING CASE

  1 ISLANDS FOUND

  ITER        DELTAP      BUS         DELTAQ      BUS         DELTA/V/      BUS         DELTAANG      BUS
   0          0.0000(      201    )   0.0003(      205    )
                                                                0.00001(      205    )    0.00001(      206    )
   1          0.0000(      206    )   0.0006(      211    )

 REACHED TOLERANCE IN    1 ITERATIONS

 LARGEST MISMATCH:      0.00 MW     0.06 MVAR      0.06 MVA AT BUS     201 [HYDRO        500.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:                   0.11 MVA

 SWING BUS SUMMARY:
   BUS# X-- NAME --X BASKV       PGEN      PMAX     PMIN       QGEN      QMAX     QMIN
   3011 MINE_G       13.800      255.4     900.0     0.0       45.9     600.0   -100.0

 FREQUENCY FOR ISLAND  1 IS 60.000 HERTZ
   SWING BUS FOR THIS ISLAND IS    3011 [MINE_G       13.800]

 ACTIVITY? :
>>
```

Figure 9.6. Example: Running Activity INLF,OPT for Inertial Solution

9.6.2.

Governor Response Power Flow Solution

The governor response power flow solution is intended to indicate system conditions that would exist at least several seconds after the initiation of an event on a steady-state system condition. In this time frame, it is assumed that voltage regulator and turbine governor effects are influential in bringing the system to a new steady-state condition, and that changes in generator powers are determined by governor droop and damping characteristics.

In this solution, generator scheduled voltages are unchanged except as described below, and the default response to the var limit specification is to honor generator reactive power limits. By default, tap adjustment by the stepping method and phase shift angle adjustment are enabled, dc taps are unlocked, and switched shunts are active. These settings may be replaced by issuing the OPT suffix. Area interchange control and the non-divergent solution option are always disabled.

```
 ACTIVITY? :
>>INLF,OPT
 ENTER 0 FOR INERTIAL SOLUTION
       1 FOR GOVERNOR RESPONSE SOLUTION:
>>1
 ENTER UNIT INERTIA AND GOVERNOR DATA FILE NAME:
>>

 TAP CODE IS 0 TO LOCK, 1 FOR STEPPING, 2 FOR DIRECT
 AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS

 ENTER:
  [TAP ] , [AREA INT] , [1 FOR PHASE] , [1 TO FLAT] , [1 TO LOCK] , [1 TO LOCK ]
  [CODE]   [  CODE  ]   [ SHIFTERS  ]   [  START  ]   [D.C. TAPS]   [SWCH SHNTS]

>>0,1,1,0
 ENTER ITERATION NUMBER FOR VAR LIMITS
  0 FOR IMMEDIATELY, -1 TO IGNORE COMPLETELY:
>>0

 WARNING: INLF MODIFIES DATA IN WORKING CASE

  1 ISLANDS FOUND

  ITER       DELTAP      BUS        DELTAQ      BUS        DELTA/V/      BUS        DELTAANG      BUS
   0         0.0000(      206    )  0.0006(      211    )
                                                             0.00001(      211    )   0.00000(      206    )
   1         0.0000(      206    )  0.0004(      211    )

 REACHED TOLERANCE IN    1 ITERATIONS

 LARGEST MISMATCH:     0.00 MW     0.04 MVAR      0.04 MVA AT BUS     211 [HYDRO_G     20.000]
 SYSTEM TOTAL ABSOLUTE MISMATCH:                  0.10 MVA

 SWING BUS SUMMARY:
   BUS# X-- NAME --X BASKV      PGEN     PMAX    PMIN      QGEN     QMAX    QMIN
   3011 MINE_G       13.800     255.4    900.0    0.0      45.9    600.0   -100.0

 FREQUENCY FOR ISLAND   1 IS 60.000 HERTZ
   SWING BUS FOR THIS ISLAND IS    3011 [MINE_G      13.800]

 ACTIVITY? :
>>
```

Figure 9.7. Example: Running Activity INLF,OPT for Governor Response Solution

Additional Information
PSS®E Program Operation Manual, Applying Newton-Raphson Power Flow Solution with Inertial / Governor Dispatch

9.7. Running AC Contingency Analysis

ACCC

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. Distribution Factor Data File (*.dfx) corresponding to the network condition. Section 10.1, “Building the Distribution Factor Data File”	
Activity ID, Suffix	Suffix Function
ACCC,OPT	User selects options manually using an interactive dialog

The AC Contingency Solution functions calculate full ac power flow solutions for a specified set of contingency cases. Results are stored in a binary file, the AC Contingency Solution Output File. This file is subsequently processed to produce reports of non-converged contingencies, violations, loadings, and available capacity.

```
>>ACCC,OPT
 ENTER AC CONTINGENCY SOLUTION OUTPUT FILENAME:
>>TEST2savnw.acc

 SOLUTION PARAMETERS ARE:
  1:      0.5  MW MISMATCH TOLERANCE
  2:        0  SOLUTION METHOD (0=FDNS, 1=FNSL)
 ENTER PARAMETER CODE, NEW VALUE:
>>1, 0.6

 SOLUTION PARAMETERS ARE:
  1:      0.6  MW MISMATCH TOLERANCE
  2:        0  SOLUTION METHOD (0=FDNS, 1=FNSL)
 ENTER PARAMETER CODE, NEW VALUE:
>>
 ENTER DISTRIBUTION FACTOR FILENAME:
>>DFXtest.dfx

 TAP CODE IS 0 TO LOCK, 1 FOR STEPPING, 2 FOR DIRECT
 AREA INT CODE IS 0 TO DISABLE, 1 FOR TIE LINES ONLY, 2 FOR TIE LINES AND LOADS

 ENTER:
  [TAP ] , [AREA INT] , [1 FOR PHASE] , [1 TO FLAT] , [1 TO LOCK] , [1 TO LOCK ]
  [CODE]   [  CODE  ]   [ SHIFTERS  ]   [  START  ]   [D.C. TAPS]   [SWCH SHNTS]

>>1,2,1,0
 ENTER LOAD THROWOVER FILE NAME:
>>

 ORDERING NETWORK
 DIAGONALS =      22  OFF-DIAGONALS =      40  MAX SIZE =      58

 WORKING CASE HAS LARGEST MISMATCH OF       0.03  MW   AT BUS    151 [NUCPANT      500.00]
                                            0.26 MVAR AT BUS    205 [SUB230       230.00]

 PROCESSING CONTINGENCY 'TRIP1NUCLEAR' (#1 OF 9):
 REMOVE UNIT 1 FROM BUS 101 [NUC-A       21.600]

 PROCESSING CONTINGENCY 'TRIP2NUCLEAR' (#2 OF 9):
 REMOVE UNIT 1 FROM BUS 101 [NUC-A       21.600]
 REMOVE UNIT 1 FROM BUS 102 [NUC-B       21.600]
 *** SOLUTION NOT CONVERGED: BLOWN UP ***
 LARGEST MISMATCH IS      797.99 MW OR MVAR AT BUS 206 [URBGEN      18.000]
 TOTAL MISMATCH IS       3173.80 MVA

 PROCESSING CONTINGENCY 'ADDLARGELOAD' (#3 OF 9):
 INCREASE BUS 154 [DOWNTN      230.00] LOAD BY 50 PERCENT
 *** SOLUTION NOT CONVERGED: BLOWN UP ***
 LARGEST MISMATCH IS      795.39 MW OR MVAR AT BUS 206 [URBGEN      18.000]
 TOTAL MISMATCH IS       3657.24 MVA

 PROCESSING CONTINGENCY 'LOSEWESTGEN' (#4 OF 9):
 REMOVE UNIT 1 FROM BUS 3018 [CATDOG_G    13.800]
 *** SOLUTION NOT CONVERGED: ITERATION LIMIT EXCEEDED ***
 LARGEST MISMATCH IS        0.06 MW OR MVAR AT BUS 211 [HYDRO_G     20.000]
 TOTAL MISMATCH IS          0.29 MVA
```

Figure 9.8. Example: Running Activity ACCC,OPT

```
PROCESSING CONTINGENCY 'LOSEWESTBIGT' (#5 OF 9):
TRIP LINE FROM BUS 3004 [WEST        500.00] TO BUS 152 [MID500      500.00]
*** SOLUTION NOT CONVERGED: ITERATION LIMIT EXCEEDED ***
LARGEST MISMATCH IS       0.20 MW OR MVAR AT BUS 211 [HYDRO_G     20.000]
TOTAL MISMATCH IS         0.94 MVA

PROCESSING CONTINGENCY 'LOSEEASTBIGT' (#6 OF 9):
TRIP LINE FROM BUS 151 [NUCPANT     500.00] TO BUS 201 [HYDRO       500.00]

PROCESSING CONTINGENCY 'LOSEEASTLOAD' (#7 OF 9):
SET BUS 205 [SUB230      230.00] LOAD TO 0 MW
*** SOLUTION NOT CONVERGED: BLOWN UP ***
LARGEST MISMATCH IS    2496.23 MW OR MVAR AT BUS 154 [DOWNTN      230.00]
TOTAL MISMATCH IS     17063.89 MVA
  1 VOLTAGE CONTROLLED BUSES WITH CONTROLLING EQUIPMENT INCORRECTLY AT THEIR VAR
    LIMITS (VARS HIGH & VOLTAGE HIGH, OR VARS LOW & VOLTAGE LOW) AND VOLTAGE ERROR
    MORE THAN 0.000010--LARGEST ERROR IS 1.157226 AT BUS 205 [SUB230      230.00]

PROCESSING CONTINGENCY 'LOSE2LINESWE' (#8 OF 9):
TRIP LINE FROM BUS 3004 [WEST        500.00] TO BUS 152 [MID500      500.00]
TRIP LINE FROM BUS 3006 [UPTOWN      230.00] TO BUS 153 [MID230      230.00]
*** SOLUTION NOT CONVERGED: ITERATION LIMIT EXCEEDED ***
LARGEST MISMATCH IS       0.61 MW OR MVAR AT BUS 201 [HYDRO       500.00]
TOTAL MISMATCH IS         2.83 MVA

PROCESSING CONTINGENCY 'LOSE2LINEEA' (#9 OF 9):
TRIP LINE FROM BUS 151 [NUCPANT     500.00] TO BUS 201 [HYDRO       500.00]
TRIP LINE FROM BUS 152 [MID500      500.00] TO BUS 202 [EAST500     500.00]
*** SOLUTION NOT CONVERGED: ITERATION LIMIT EXCEEDED ***
LARGEST MISMATCH IS       0.38 MW OR MVAR AT BUS 206 [URBGEN      18.000]
TOTAL MISMATCH IS         1.85 MVA

ACTIVITY? :
>>
```

Figure 9.9. Example: Running Activity ACCC,OPT

Additional Information
PSS® E Program Operation Manual, Performing AC Contingency Analysis

Chapter 10

Linear Network Analysis

10.1. Building the Distribution Factor Data File

DFAX

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. Subsystem Description File (*.sub) Monitored Element Description File (*.mon) Contingency Output File (*.con)	
Activity ID, Suffix	Suffix Function
DFAX,AC	Ignore line outage distribution factors; for use by activities IMPC, LLRF and ACCC

The Distribution Factor File setup activity DFAX reads a set of Linear Network Analysis Data Files and reflects their contents in a Distribution Factor Data File in preparation for any of activities OTDF, DCCC, TLTG, SPIL, IMPC, LLRF, and ACCC. Activity DFAX also calculates line outage distribution factors and preserves them in the Distribution Factor Data File. Subsystems of the working case are specified in a Subsystem Description Data File, monitored elements are specified in a Monitored Element Data File, and contingencies are specified in a Contingency Description Data File.

Activity DFAX first checks that generators are not converted and that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity DFAX ends.

The dialog prompts the user to enter the name of the Distribution Factor Data File into which its results are to be deposited:

```
ENTER FILENAME FOR STORING DISTRIBUTION FACTORS RETURN TO EXIT:
```

Then the user may define subsystems of the working case:

```
FOR THE SUB-SYSTEM DESCRIPTION FILE, ENTER INPUT FILE NAME (RETURN FOR NONE,
1 FROM TERMINAL):
```

If specified, subsystem definitions are established, with input data records taken from either the designated Subsystem Description Data File or the dialog input device, as appropriate.

Subsystem definitions are required if the Distribution Factor Data File is to be used by activities TLTG, and/or SPIL. Activities OTDF, DCCC, IMPC, LLRF, and ACCC do not require subsystem definitions *unless* subsystems are referenced in the Monitored Element Data File and/or the Contingency Description Data File.

Next, the monitored elements are specified:

```
FOR THE MONITORED ELEMENT DESCRIPTION FILE, ENTER INPUT FILE NAME (RETURN TO
EXIT, 1 FROM TERMINAL):
```

The monitored element list is constructed, taking input data records from either the designated Monitored Element Data File or the dialog input device, as appropriate.

The user is then given the option of having the branches in the monitored element list sorted in the reports of activities OTDF, DCCC, IMPC, LLRF, and ACCC:

```
ENTER 1 TO SORT MONITORED BRANCH LIST 0 TO LEAVE IN MONITORED ELEMENT FILE ORDER:
```

If a one is entered, branches are sorted in ascending numerical or alphabetical order according to the bus output option currently in effect. Branches are sorted by from bus, and, for each from bus, by to bus and circuit identifier. If a zero is entered in response to the above instruction, monitored branches remain in the same order in which they were specified in the Monitored Element Data File. In either case, interfaces are reported after all monitored branches in the order in which they were specified in the Monitored Element Data File.

Finally, the dialog prompts the user to designate the input file describing the contingency cases to be calculated:

```
FOR THE CONTINGENCY DESCRIPTION FILE, ENTER INPUT FILE NAME (RETURN TO EXIT,
1 FROM TERMINAL):
```

Here again, contingencies may be specified from either the designated Contingency Description Data File or the dialog input device.

Activity DFAX reads the Contingency Description Data File, updating internal arrays and transferring the contingency definitions into the Distribution Factor Data File. An alarm message is generated for any contingency case specifications in which errors are detected. These are skipped.

When activity DFAX has been run with the AC suffix, it ends at this point. The Distribution Factor Data File constructed by activity DFAX,AC may be specified while running activities ACCC, IMPC, and LLRF; it may not be used by activities OTDF, DCCC, TLTG, and SPIL.

When activity DFAX is run without a suffix, it continues its processing. If a new ordering of network buses is required, an appropriate message is printed and activity ORDR is automatically run. The base case susceptance matrix is then constructed, followed by the calculation of vectors of line outage distribution factors corresponding to line outage contingency events contained in the Contingency Description Data File. Whenever a line outage contingency results in the presence of a swingless island, an appropriate message is printed prior to calculating the corresponding distribution factor vector.

```
>>DFAX
 ENTER FILENAME FOR STORING DISTRIBUTION FACTORS
 RETURN TO EXIT:
>>TESTdfx.dfx
 FOR THE SUBSYSTEM DESCRIPTION FILE,
 ENTER INPUT FILE NAME (RETURN FOR NONE, 1 FROM TERMINAL):
>>savnw.sub
 FOR THE MONITORED ELEMENT DESCRIPTION FILE,
 ENTER INPUT FILE NAME (RETURN TO EXIT, 1 FROM TERMINAL):
>>savnw.mon
 ENTER 1 TO SORT MONITORED BRANCH LIST
       0 TO LEAVE IN MONITORED ELEMENT FILE ORDER:
>>1
 FOR THE CONTINGENCY DESCRIPTION FILE,
 ENTER INPUT FILE NAME (RETURN TO EXIT, 1 FROM TERMINAL):
>>savnw.con

 PROCESSING THE SUB-SYSTEM DESCRIPTION FILE...

 PROCESSING THE MONITORED ELEMENT DESCRIPTION FILE...

 PROCESSING THE CONTINGENCY DESCRIPTION FILE...

 *** RECORD  32 -- MULTI-SECTION LINE REPORTING OPTION ENABLED
 DISCONNECT BRANCH FROM BUS 204 TO BUS 205

 CIRCUIT 1  FROM    204 [SUB500      500.00] TO    205 [SUB230      230.00] IS A MEMBER OF
   MULTI-SECTION LINE &1 FROM    201 [HYDRO       500.00] TO    205 [SUB230      230.00]

 ORDERING NETWORK
 DIAGONALS =     22  OFF-DIAGONALS =     40  MAX SIZE =     58

 ACTIVITY? :
>>
```

Figure 10.1. Example: Running Activity DFAX

Additional Information
PSS®E Program Operation Manual, Building the Distribution Factor Data File

10.2. Calculating Distribution Factors

OTDF

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. Distribution Factor Data File (*.dfx) corresponding to the network condition. Building the Distribution Factor Data File	
Activity ID, Suffix	Suffix Function
OTDF	Activity runs without a suffix.

The distribution factor reporting activity OTDF tabulates distribution factors for single event contingencies using a linearized network model. Distribution factors for line outage contingencies are retrieved from a Distribution Factor Data File constructed by activity DFAX. Distribution factors for other types of contingency events are calculated as needed by activity OTDF.

Activity OTDF first checks that generators are not converted and that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity OTDF ends.

If a new ordering of network buses is required, an appropriate message is printed and activity ORDR is automatically run. Next the largest active power mismatch corresponding to the present ac solution voltage vector in the working case is calculated and printed.

The dialog prompts the user to:

```
ENTER DISTRIBUTION FACTOR FILENAME:
```

The user must enter the name of a Distribution Factor Data File constructed by activity DFAX which corresponds to the network condition contained in the working case and to the desired Linear Network Analysis Data Files. The Distribution Factor Data File must specify at least one monitored branch or interface. The bus input option *must* have the same setting that was in effect when activity DFAX filled the specified file.

The Distribution Factor Data File is read, and the base case dc power flow solution is calculated followed by the processing of the designated contingency cases. Only single event contingencies are allowed in activity OTDF; changing the status of a three-winding transformer is considered a multiple event contingency; disconnecting a bus is often a multiple event contingency. An alarm message is generated for any multiple event contingencies, which are ignored.

```
>>OTDF

ENTER OUTPUT DEVICE CODE:
 0 FOR NO OUTPUT                   1 FOR REPORT WINDOW
 2 FOR A FILE                      3 FOR DEFAULT PRINTER
 6 FOR ALTERNATE SPOOL DEVICE      7 FOR PROGRESS WINDOW :
>>7
ENTER DISTRIBUTION FACTOR FILENAME:
>>TESTdfx.dfx

WORKING CASE HAS LARGEST MISMATCH OF      0.03 MW AT BUS 151 [NUCPANT     500.00]
    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008  10:49
PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                               PAGE 1
BASE CASE INCLUDING SEQUENCE DATA
                       *** OTDF CONTINGENCY SUMMARY ***

DISTRIBUTION FACTOR FILE:      TESTdfx.dfx
SUBSYSTEM DESCRIPTION FILE:    savnw.sub
MONITORED ELEMENT FILE:        savnw.mon
CONTINGENCY DESCRIPTION FILE:  savnw.con

<-CONTINGENCY-> <-MW SHIFT-> <----------------------------------------------CONTINGENCY DESCRIPTION-----------------------

  TRIP1NUCLEAR       750.0     REMOVE UNIT 1 FROM BUS 101 [NUC-A       21.600]

MULTIPLE EVENT CONTINGENCY 'TRIP2NUCLEAR' INVALID IN OTDF

  ADDLARGELOAD       500.0     INCREASE BUS 154 [DOWNTN      230.00] LOAD BY 50 PERCENT

  LOSEWESTGEN        100.0     REMOVE UNIT 1 FROM BUS 3018 [CATDOG_G     13.800]

  LOSEWESTBIGT      -138.2     TRIP LINE FROM BUS 3004 [WEST        500.00] TO BUS 152 [MID500       500.00]

  LOSEEASTBIGT       564.8     TRIP LINE FROM BUS 151 [NUCPANT     500.00] TO BUS 201 [HYDRO       500.00]

  LOSEEASTLOAD     -1200.0     SET BUS 205 [SUB230      230.00] LOAD TO 0 MW
    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008  10:49
PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                               PAGE 2
BASE CASE INCLUDING SEQUENCE DATA
                    *** OTDF DISTRIBUTION FACTOR TABLE ***

                                  CONTINGENCY LABEL--> BASE CASE MW TRIP1NUCLEAR ADDLARGELOAD  LOSEWESTGEN LOSEWESTBIGT I
                                   POWER SHIFT (MW)-->   AC     DC      750.0        500.0        100.0       -138.2
<-------- FROM ----------> <---------- TO ----------->CKT <----> <---><-----------> <-----------> <-----------> <-----------> <
   201 HYDRO        500.00    151 NUCPANT      500.00 1 -564.8 -558.7   0.41339     -0.07415     -0.04159      0.06946
   202 EAST500      500.00    152 MID500       500.00 1  -42.6  -50.7  -0.14785     -0.21055     -0.11808      0.19723
   203 EAST230      230.00    154 DOWNTN       230.00 1  122.4  122.4  -0.04237      0.07663      0.04298     -0.07178
   205 SUB230       230.00    154 DOWNTN       230.00 1  354.2  356.1  -0.22317      0.20808      0.11669     -0.19491
  3001 MINE         230.00   3002 E. MINE      500.00 1   56.0   57.3   0.34914      0.33780      0.32009     -0.13514
  3004 WEST         500.00    152 MID500       500.00 1 -138.2 -132.2   0.42977      0.34592      0.21485     -1.00000
  3004 WEST         500.00   3005 WEST         230.00 1  193.2  188.5  -0.08063     -0.00811      0.10524      0.86486
  3005 WEST         230.00   3008 CATDOG       230.00 1  135.9  133.0   0.13416      0.19828      0.33292      0.21377
  3006 UPTOWN       230.00    153 MID230       230.00 1  -78.6  -78.6   0.30190      0.25751      0.11931      0.57245
  3008 CATDOG       230.00    154 DOWNTN       230.00 1   69.0   62.9   0.26833      0.39657     -0.33416      0.42755
  3008 CATDOG       230.00   3018 CATDOG_G     13.800 1 -100.0 -100.0   0.00000      0.00000      1.00000      0.00000
       INTERFACE WEST                                   -147.9 -147.9   1.00000      1.00000      0.00000      0.00000
       INTERFACE EAST                                   -130.8 -130.8   0.00000      0.00000      0.00000      0.00000

   203 EAST230      230.00    154 DOWNTN       230.00 1  122.4  122.4   0.13140
   205 SUB230       230.00    154 DOWNTN       230.00 1  354.2  356.1  -0.66760
  3001 MINE         230.00   3002 E. MINE      500.00 1   56.0   57.3  -0.01351
  3004 WEST         500.00    152 MID500       500.00 1 -138.2 -132.2  -0.09997
  3004 WEST         500.00   3005 WEST         230.00 1  193.2  188.5   0.08646
  3005 WEST         230.00   3008 CATDOG       230.00 1  135.9  133.0   0.07644
  3006 UPTOWN       230.00    153 MID230       230.00 1  -78.6  -78.6  -0.05292
  3008 CATDOG       230.00    154 DOWNTN       230.00 1   69.0   62.9   0.15289
  3008 CATDOG       230.00   3018 CATDOG_G     13.800 1 -100.0 -100.0   0.00000
       INTERFACE WEST                                   -147.9 -147.9   0.00000
       INTERFACE EAST                                   -130.8 -130.8   0.00000

ACTIVITY? :
>>
```

Figure 10.2. Example: Running Activity OTDF (Partial Output)

Additional Information
PSS® E Program Operation Manual, Calculating Distribution Factors

10.3. Estimating Severity Rankings for Single Line Outage Contingencies

RANK

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. When ranking contingencies with respect to line overloading, Subsystem Description File (*.sub) AND Monitored Element Description File (*.mon)	
Activity ID, Suffix	Suffix Function
RANK,ALL	Consider all in-service branches in the working case as possible contingencies
RANK,AREA	Estimate severity rankings in specified area(s)
RANK,ZONE	Estimate severity rankings in specified zone(s)
RANK,OWNER	Estimate severity rankings for specified owner(s)
RANK,KV	Estimate severity rankings for specified base kV range
RANK,OPT	User selects options manually using an interactive dialog

The contingency ranking activity RANK estimates the severity of designated single branch outage contingencies and builds a Contingency Description Data File with contingencies specified in decreasing order of their estimated severities. Contingency rankings using two different performance criteria may be calculated by activity RANK. Activity RANK may also be instructed to include contingencies that create swingless islands. The group of branches that may be outaged are defined according to the suffix that is designated at the time activity RANK is run.

At the start, activity RANK displays its default solution and output control parameters and gives the user the opportunity to change any of these parameters:

```
SOLUTION PARAMETERS ARE: 1: 0.5 MW MISMATCH TOLERANCE 2: 0.0005 SMALL REACTANCE
THRESHOLD 3: 0 ALLOW TIES FROM SPECIFIED SUBSYSTEM AS CONTINGENCIES (0=NO,
1=YES) 4: 10 NUMBER OF OVERLOAD CONTINGENCIES TO INCLUDE IN CONTINGENCY FILE 5:
1 CONTINGENCY CASE RATING (1=RATEA, 2=RATEB, 3=RATEC) 6: 100.0 PERCENT OF RATING
7: 0 CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES) 8: 5 NUMBER OF VOLTAGE
CONTINGENCIES TO INCLUDE IN CONTINGENCY FILE 9: 0 LINES IN VOLTAGE RANKER PI
(0=ALL, 1=THOSE WITH NON-ZERO RATING) 10: 1 INCLUDE CONTINGENCIES WHICH CREATE
SWINGLESS ISLANDS (0=NO, 1=YES) 11: 100.0 MW THRESHOLD FOR INCLUDING ISLANDING
CONTINGENCIES ENTER PARAMETER CODE, NEW VALUE:
```

If the largest initial active power mismatch exceeds the specified MW mismatch tolerance, the user is given the opportunity to end activity RANK.

Following a response of zero or *[Enter]* to the parameter code input request, activity RANK checks that at least one of solution parameters 4, 8, and 10 is greater than zero, that generators are not converted, and that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity RANK ends.

If a new ordering of network buses is required, an appropriate message is printed and activity ORDR is automatically run. Next, activity RANK calculates and prints the largest active power mismatch corresponding to the present ac solution voltage vector in the working case. If this largest mismatch is greater than the MW mismatch tolerance solution parameter specified above, activity RANK gives the user the option of continuing or quitting:

```
ENTER 0 TO EXIT, 1 TO CONTINUE:
```

At this point, activity RANK constructs a contingency list which defines those single branch outages that are to be considered. The action taken by activity RANK is dependent upon the suffix specified when the activity is run.

When activity RANK is run without a suffix, the user is asked to select the buses for which the in-service connecting branches are to be included in the contingency list. When run with the ALL suffix, activity RANK places all in-service branches into the contingency list.

When activity RANK is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which the in-service branches are to be placed into the contingency list.

Unless the ALL suffix is specified, activity RANK honors the user's specification of solution parameter 3 to either include or omit tie branches from the specified subsystem in the contingency list.

If overload ranking is enabled, the Subsystem and Monitored Element Description Data Files are defined:

```
FOR THE SUBSYSTEM DESCRIPTION FILE, ENTER INPUT FILE NAME (RETURN FOR NONE,
1 FROM TERMINAL):
```

Subsystem definitions are required only if subsystems are referenced in the Monitored Element Data File.

```
FOR THE MONITORED ELEMENT DESCRIPTION FILE, ENTER INPUT FILE NAME (RETURN TO
EXIT, 1 FROM TERMINAL):
```

A monitored branch list is constructed, taking input data records from either the designated Monitored Element Data File or the dialog input device, as appropriate.

Next, the base case dc power flow is calculated and then the dialog prompts the user to:

```
ENTER CONTINGENCY OUTPUT FILE NAME:
```

The user responds with either the name of a file into which contingency specification records are to be deposited or *[Enter]* to enable the output of the contingency records to the user's terminal.

When RANK ends, the working case is restored to its content prior to activity RANK.

```
>>RANK,AREA

 SOLUTION PARAMETERS ARE:
  1:      0.5   MW MISMATCH TOLERANCE
  2:   0.0005   SMALL REACTANCE THRESHOLD
  3:        0   ALLOW TIES FROM SPECIFIED SUBSYSTEM AS CONTINGENCIES (0=NO, 1=YES)
  4:       10   NUMBER OF OVERLOAD CONTINGENCIES TO INCLUDE IN CONTINGENCY FILE
  5: %5   CONTINGENCY CASE RATING (1=RATEA, 2=RATEB, 3=RATEC)
  6:        1   PERCENT OF RATING
  7:    100.0   CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES)
  8:        0   NUMBER OF VOLTAGE CONTINGENCIES TO INCLUDE IN CONTINGENCY FILE
  9:        5   LINES IN VOLTAGE RANKER PI (0=ALL, 1=THOSE WITH NON-ZERO RATING)
 10:        0   INCLUDE CONTINGENCIES WHICH CREATE SWINGLESS ISLANDS (0=NO, 1=YES)
 11:        1   MW THRESHOLD FOR INCLUDING ISLANDING CONTINGENCIES
 ENTER PARAMETER CODE, NEW VALUE:
>>
 ENTER UP TO 20 AREA NUMBERS:

>>5
 ENTER UP TO 20 AREA NUMBERS:

>>
 FOR THE SUBSYSTEM DESCRIPTION FILE,
 ENTER INPUT FILE NAME (RETURN FOR NONE, 1 FROM TERMINAL):
>>savnw.sub
 FOR THE MONITORED ELEMENT DESCRIPTION FILE,
 ENTER INPUT FILE NAME (RETURN TO EXIT, 1 FROM TERMINAL):
>>savnw.mon
 ENTER CONTINGENCY OUTPUT FILE NAME:
>>savnw.con

 WORKING CASE HAS LARGEST MISMATCH OF      0.03 MW AT BUS 151 [NUCPANT     500.00]

 PROCESSING THE SUBSYSTEM DESCRIPTION FILE...

 PROCESSING THE MONITORED ELEMENT DESCRIPTION FILE...

 ACTIVITY? :
>>
```

Figure 10.3. Example: Running Activity RANK,AREA

Additional Information
PSS®E Program Operation Manual, Estimating Severity Rankings for Single Line Outage Contingencies

10.4. Running the DC Linearized Network Solution

DCLF

Requirements / Prerequisites	
Validly specified power flow case, normally solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
DCLF,ALL	List results for buses in entire system
DCLF,AREA	List results for buses in specified area(s)
DCLF,ZONE	List results for buses in specified zone(s)
DCLF,OWNER	List results for buses for specified owner(s)
DCLF,KV	List results for buses for specified base kV range
DCLF,OPT	User selects options manually using an interactive dialog

The linearized network solution activity DCLF applies the dc analogy network solution algorithm to the network modeled in the working case. Optionally, the solution method may also be applied to that network with the status of a specified ac branch changed. The base case and change case solutions are then tabulated in a single report:

Activity DCLF checks that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity DCLF ends.

If a new ordering of network buses is required, an appropriate message is printed and activity ORDR is automatically run. Next the largest active power mismatch corresponding to the present ac solution voltage vector in the working case is calculated and printed. If this largest mismatch is greater than 0.5 MW, activity DCLF gives the user the option of continuing or quitting:

```
ENTER 0 TO EXIT, 1 TO CONTINUE:
```

Then the user is asked to designate which of the three ratings are to be used in tabulating line loading percentages in the report, with the default being the rating set established as the default rating set program option:

```
ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=n):
```

The base case solution is then calculated and activity DCLF invites the user to designate a branch for which the status is to be changed for the change case solution. A non-transformer branch or a two-winding transformer is specified by using the default value or entering a zero as the third bus identifier; a three-winding transformer is designated by specifying the three buses it connects. If the user responds with a zero or *[Enter]*, only the base case dc power flow solution is calculated and reported. If a branch is specified, its present status is listed and the user is asked to verify that the specified branch is to have its status changed:

```
CHANGE ITS STATUS?
```

If a zero is entered, the request for a branch is repeated. Otherwise, the new status of the branch is listed as in the following example:

```
NEW STATUS OF CKT aa FROM nnnnnn [bus name] TO nnnnnn [bus name] IS OUT
```

If a branch outage separates the system such that an island with no Type 3 (swing) bus remains, an appropriate message is printed.

The change case solution is then calculated.

At this point, the action taken by activity DCLF is dependent upon the suffix specified when the activity is run.

When activity DCLF is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated.

When activity DCLF is run with the ALL suffix, a report for all buses in the working case is produced in the requested order.

When activity DCLF is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. Following bus selection, the output is generated with buses ordered. The user is then given the opportunity to select an additional group of buses.

Following completion of output, activity DCLF gives the user the option of modifying the voltage vector to incorporate the phase angle vector calculated for either the base case or change case dc power flow solution. The user is asked:

```
WHICH VOLTAGES SHOULD BE SAVED? 0 = ORIGINAL VOLTAGES 1 = BASE CASE DC LOAD FLOW
VOLTAGES 2 = CHANGE CASE DC LOAD FLOW VOLTAGES:
```

If a zero is entered, the voltage vector remains the same as it was prior to entering activity DCLF and the following message is printed:

```
ORIGINAL VOLTAGES RETAINED
```

If a one or two is entered, activity DCLF sets the voltage at each bus to its voltage magnitude as contained in the working case at a phase angle corresponding to its phase angle in the specified dc solution. An appropriate message is printed:

```
BASE CASE DC LOAD FLOW VOLTAGES SAVED
```

or:

```
CHANGE CASE DC LOAD FLOW VOLTAGES SAVED
```

If no change case solution was calculated, entering either a one or two has the effect of using the phase angles as determined by the base case dc solution.

Finally, if the change case solution option was enabled, the branch or multi-section line grouping for which the status was changed for that solution may be either returned to its original status or left with its modified status. The following example illustrates the dialog:

```
CKT 1 FROM 153 [MID230 230.00] TO 154 [DOWNTN 230.00] FOR CHANGE CASE SOLUTION
STATUS WAS SET TO OUT ENTER 1 TO SAVE NEW STATUS:
```

If a one is entered, the new status is saved, and the message:

```
NEW BRANCH STATUS SAVED
```

is printed prior to ending activity DCLF. Otherwise, the original status is restored, the following message is printed, and activity DCLF ends:

```
ORIGINAL BRANCH STATUS RESTORED
```

```
>>DCLF,AREA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                  1 FOR REPORT WINDOW
  2 FOR A FILE                     3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE     7 FOR PROGRESS WINDOW :
>>7

 ENTER 1 FOR RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=1):
>>2

 FOR CHANGE CASE SOLUTION
 ENTER FROM BUS, TO BUS, CIRCUIT IDENTIFIER, THIRD BUS
  (FROM BUS = 0 FOR NO CHANGE CASE):
>>0
 ENTER UP TO 20 AREA NUMBERS:

>>5
 ENTER UP TO 20 AREA NUMBERS:

>>

 WHICH VOLTAGES SHOULD BE SAVED?
   0 = ORIGINAL VOLTAGES
   1 = BASE CASE DC LOAD FLOW VOLTAGES
   2 = CHANGE CASE DC LOAD FLOW VOLTAGES:
>>1

 ORDERING NETWORK
 DIAGONALS =      22  OFF-DIAGONALS =      40  MAX SIZE =      58
```

Figure 10.4. Example: Running Activity DCLF,AREA (1 of 2)

```
 WORKING CASE HAS LARGEST MISMATCH OF      0.03 MW AT BUS 151 [NUCPANT     500.00]
                                 PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008  11:54
                                        PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
                                        BASE CASE INCLUDING SEQUENCE DATA
                                                    OUTPUT FOR AREA 5 [WORLD        ]

 X--------- FROM BUS ---------X  BASE CHANGE    GEN.    LOAD X---------- TO BUS ----------X       BASE CASE      RATE    CHANGE CASE    DELTA
   BUS# X-- NAME --X BASKV AREA ANGLE  ANGLE     MW       MW    BUS# X-- NAME --X BASKV AREA CKT     MW       %      MVA      MW       %        MW
   3001 MINE          230.00    5   -1.5           0.0     0.0 ------------------------------------------------------------------------------------
                                                                3002 E. MINE      500.00    5  1     57.3     5.5  1040.0
                                                                3003 S. MINE      230.00    5  1    201.2
                                                                3011 MINE_G       13.800    5  1   -258.5    16.6  1560.0
   3002 E. MINE       500.00    5   -2.0           0.0     0.0 ------------------------------------------------------------------------------------
                                                                3001 MINE         230.00    5  1    -57.3     5.5  1040.0
                                                                3004 WEST         500.00    5  1     57.3
   3003 S. MINE       230.00    5   -2.4           0.0     0.0 ------------------------------------------------------------------------------------
                                                                3001 MINE         230.00    5  1   -201.2
                                                                3005 WEST         230.00    5  1    100.6
                                                                3005 WEST         230.00    5  2    100.6
   3004 WEST          500.00    5   -3.7           0.0     0.0 ------------------------------------------------------------------------------------
                                                                 152 MID500       500.00    1  1   -131.6
                                                                3002 E. MINE      500.00    5  1    -57.1
                                                                3005 WEST         230.00    5  1    188.7    18.1  1040.0
   3005 WEST          230.00    5   -5.5           0.0   100.0 ------------------------------------------------------------------------------------
                                                                3003 S. MINE      230.00    5  1    -99.9
                                                                3003 S. MINE      230.00    5  2    -99.9
                                                                3004 WEST         500.00    5  1   -188.5    18.1  1040.0
                                                                3006 UPTOWN       230.00    5  1    -78.3
                                                                3008 CATDOG       230.00    5 &1    233.7
                                                                3008 CATDOG       230.00    5  1    133.0
   3006 UPTOWN        230.00    5   -4.1           0.0     0.0 ------------------------------------------------------------------------------------
                                                                 153 MID230       230.00    1  1    -78.5
                                                                3005 WEST         230.00    5  1     78.5
   3008 CATDOG        230.00    5   -9.3           0.0   200.0 ------------------------------------------------------------------------------------
                                                                 154 DOWNTN       230.00    1  1     63.2    14.4   440.0
                                                                3005 WEST         230.00    5 &1    -31.6
                                                                3005 WEST         230.00    5  1   -131.6
                                                                3018 CATDOG_G     13.800    5  1   -100.0    50.0   200.0
   3011 MINE_G        13.800    5    0.0         258.7     0.0 ------------------------------------------------------------------------------------
                                                                3001 MINE         230.00    5  1    258.7    16.6  1560.0
   3018 CATDOG_G      13.800    5   -4.4         100.0     0.0 ------------------------------------------------------------------------------------
                                                                3008 CATDOG       230.00    5  1    100.0    50.0   200.0

 BASE CASE DC LOAD FLOW VOLTAGES SAVED

 ACTIVITY? :
>>
```

Figure 10.5. Example: Running Activity DCLF,AREA (2 of 2)

Additional Information
PSS® E Program Operation Manual, Applying the DC Linearized Network Solution

10.5. Calculating Linearized Network Contingency

DCCC

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. Distribution Factor Data File (*.dfx) corresponding to the network condition.	
Activity ID, Suffix	Suffix Function
DCCC	Activity runs without a suffix.

The linearized network contingency calculation activity DCCC estimates the flows on a set of monitored elements for the base case and for a specified set of contingency cases. Either an overload report or a loading table giving results of each case may be tabulated.

At the start, activity DCCC displays its default solution and output control parameters and gives the user the opportunity to change any of these parameters:

```
SOLUTION PARAMETERS ARE: 1: 0.5 MW MISMATCH TOLERANCE 2: 1 CONTINGENCY CASE RATING (1=RATEA, 2=RATEB, 3=RATEC) 3: 100.0 PERCENT OF RATING 4: 0 LINE FLOW CODE (0=DC BASE CASE, 1=AC BASE CASE) 5: 0 OUTPUT CODE (0=SUMMARY, 1=FULL) 6: 0.0 MINIMUM CONTINGENCY CASE FLOW CHANGE IN OVERLOAD REPORT 7: 0 EXCLUDE CASES WITH NO OVERLOADS FROM SUMMARY REPORT (0=NO, 1=YES) 8: 0 CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES) ENTER PARAMETER CODE, NEW VALUE:
```

Following a response of zero or *[Enter]* to the parameter code input request, activity DCCC checks that generators are not converted and that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity DCCC ends.

If a new ordering of network buses is required, an appropriate message is printed and activity ORDR is automatically run. Next, activity DCCC calculates and prints the largest active power mismatch corresponding to the present ac solution voltage vector in the working case. If this largest mismatch is greater than the MW mismatch tolerance, activity DCCC gives the user the option of continuing or quitting:

```
ENTER 0 TO EXIT, 1 TO CONTINUE:
```

The dialog prompts the user to:

```
ENTER DISTRIBUTION FACTOR FILENAME:
```

The user must enter the name of a Distribution Factor Data File constructed by activity DFAX which corresponds to the network condition contained in the working case and to the desired Linear Network Analysis Data Files. The Distribution Factor Data File must specify at least one monitored branch or interface. The bus input option *must* have the same setting that was in effect when activity DFAX filled the specified file.

```
>>DCCC

 SOLUTION PARAMETERS ARE:
  1:      0.5   MW MISMATCH TOLERANCE
  2:        1   CONTINGENCY CASE RATING (1=RATEA, 2=RATEB, 3=RATEC)
  3:    100.0   PERCENT OF RATING
  4:        0   LINE FLOW CODE (0=DC BASE CASE, 1=AC BASE CASE)
  5:        0   OUTPUT CODE (0=SUMMARY, 1=FULL)
  6:      0.0   MINIMUM CONTINGENCY CASE FLOW CHANGE IN OVERLOAD REPORT
  7:        0   EXCLUDE CASES WITH NO OVERLOADS FROM SUMMARY REPORT (0=NO, 1=YES)
  8:        0   CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES)
 ENTER PARAMETER CODE, NEW VALUE:
>>

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                  1 FOR REPORT WINDOW
  2 FOR A FILE                     3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE     7 FOR PROGRESS WINDOW  :
>>7

 ENTER DISTRIBUTION FACTOR FILENAME:
>>TESTdfx.dfx

 ORDERING NETWORK
 DIAGONALS =      22   OFF-DIAGONALS =      40   MAX SIZE =      58

 WORKING CASE HAS LARGEST MISMATCH OF      0.03 MW AT BUS 151 [NUCPANT     500.00]
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008  11:39
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                                PAGE 1
 BASE CASE INCLUDING SEQUENCE DATA
 DCCC OVERLOAD REPORT: MONITORED ELEMENTS LOADED ABOVE 100.0 % OF RATING SET A

 DISTRIBUTION FACTOR FILE:      TESTdfx.dfx
 SUBSYSTEM DESCRIPTION FILE:    savnw.sub
 MONITORED ELEMENT FILE:        savnw.mon
 CONTINGENCY DESCRIPTION FILE:  savnw.con
```

Figure 10.6. Example: Running Activity DCCC (1 of 2)

```
                                                                  <--------- O V E R L O A D E D   L I N E S ----------->  <--- MW FLOW --->
<----------- C O N T I N G E N C Y   E V E N T S ----------->< ------- F R O M -------> <---------- T O ---------->CKT  PRE-CNT  POST-CNT  RATING  PERCENT
BASE CASE                                                         ------------------------------------------------------------------------------- BASE CASE
                                                                                            *** NONE ***
REMOVE UNIT 1 FROM BUS 101 [NUC-A        21.600]                  ------------------------------------------------------------ CONTINGENCY TRIP1NUCLEAR
                                                                       INTERFACE WEST                                -147.9    602.1    200.0    301.0
REMOVE UNIT 1 FROM BUS 101 [NUC-A        21.600]                  ------------------------------------------------------------ CONTINGENCY TRIP2NUCLEAR
REMOVE UNIT 1 FROM BUS 102 [NUC-B        21.600]
                                                                    3008 CATDOG       230.00    154 DOWNTN       230.00 1    62.9    465.4    400.0    116.3
                                                                       INTERFACE WEST                                -147.9   1352.1    200.0    676.0
INCREASE BUS 154 [DOWNTN      230.00] LOAD BY 50 PERCENT          ------------------------------------------------------------ CONTINGENCY ADDLARGELOAD
                                                                       INTERFACE WEST                                -147.9    352.1    200.0    176.0
REMOVE UNIT 1 FROM BUS 3018 [CATDOG_G    13.800]                  ------------------------------------------------------------- CONTINGENCY LOSEWESTGEN
                                                                                            *** NONE ***
TRIP LINE FROM BUS 3004 [WEST        500.00] TO BUS 152 [MID500      500.00] -------------------------------------------------- CONTINGENCY LOSEWESTBIGT
                                                                                            *** NONE ***
TRIP LINE FROM BUS 151 [NUCPANT     500.00] TO BUS 201 [HYDRO       500.00] --------------------------------------------------- CONTINGENCY LOSEEASTBIGT
                                                                                            *** NONE ***
SET BUS 205 [SUB230      230.00] LOAD TO 0 MW                     ------------------------------------------------------------ CONTINGENCY LOSEEASTLOAD
                                                                     205 SUB230       230.00    154 DOWNTN       230.00 1   356.1   1198.2    600.0    199.7
                                                                       INTERFACE WEST                                -147.9  -1347.9    200.0    674.0
                                                                       INTERFACE EAST                                -130.8   1069.2    350.0    305.5
TRIP LINE FROM BUS 3004 [WEST        500.00] TO BUS 152 [MID500      500.00] -------------------------------------------------- CONTINGENCY LOSE2LINESWE
TRIP LINE FROM BUS 3006 [UPTOWN      230.00] TO BUS 153 [MID230      230.00]
                                                                                            *** NONE ***
TRIP LINE FROM BUS 151 [NUCPANT     500.00] TO BUS 201 [HYDRO       500.00] --------------------------------------------------- CONTINGENCY LOSE2LINEEA
TRIP LINE FROM BUS 152 [MID500      500.00] TO BUS 202 [EAST500     500.00]
                                                                                            *** NONE ***
DISCONNECT BRANCH FROM BUS 201 [HYDRO       500.00] TO BUS 205 [SUB230      230.00] CKT &1 -------------------------------- CONTINGENCY XFMR204-205
                                                                     203 EAST230      230.00    154 DOWNTN       230.00 1   122.4    202.2    200.0    101.1

ACTIVITY? :
>>
```

Figure 10.7. Example: Running Activity DCCC (2 of 2)

Additional Information
PSS® E Program Operation Manual, Calculating Linearized Network Contingency

10.6. Calculating Transmission Interchange Limits

TLTG

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. Distribution Factor Data File (*.dfx) corresponding to the network condition in the working case.	
Activity ID, Suffix	Suffix Function
TLTG	Activity runs without a suffix.

The transmission interchange limit analysis activity TLTG estimates the import or export limits of a specified subsystem of the working case using a linearized network model. The user designates this study system in which the total power injection is to be increased (for export limits) or decreased (for import limits). An opposite change in the total power injection is made in a designated opposing system.

Power transfer distribution factors relating changes in branch and interface flows to a change in study system interchange are determined. The maximum study system export or import is then derived by extrapolation subject to the constraint that no monitored elements exceed a specified percentage of a specified rating.

This process may then be repeated for a designated set of user specified contingency cases.

At the start, activity TLTG displays its default solution and output control parameters and gives the user the opportunity to change any of these parameters:

```
SOLUTION PARAMETERS ARE: 1: 0.5 MW MISMATCH TOLERANCE 2: 1 BASE CASE RATING (1=RATEA, 2=RATEB, 3=RATEC) 3: 1 CONTINGENCY CASE RATING (1=RATEA, 2=RATEB, 3=RATEC) 4: 100.0 PERCENT OF RATING 5: 0 LINE FLOW CODE (0=DC BASE CASE, 1=AC BASE CASE) 6: 0 PHASE SHIFTER CODE (0=LOCKED, 1=REGULATING IN BASE CASES) 7: 0 (0=IGNORE BASE CASE CONSTRAINTS IN CONTINGENCY CASES, 1=INCLUDE) 8: 0 LIST STUDY SYSTEM BUSES (0=NO, 1=YES) 9: 0 LIST OPPOSING SYSTEM BUSES (0=NO, 1=YES) 10: 0 LIST STUDY SYSTEM TIE LINES (0=NO, 1=YES) 11: 0 ADD STUDY SYSTEM TIES TO MONITORED LINE LIST (0=NO, 1=YES) 12: 0 OUTPUT CODE (0=SUMMARY, 1=FULL) 13: 0 INTERCHANGE LIMIT OUTPUT CODE (0=INCREMENTAL, 1=TOTAL) 14: 10000 NUMBER OF ELEMENTS TO INCLUDE IN FLOW TABLES 15: 99999. SUMMARY TABLE MAXIMUM IMPORT OR EXPORT (>0.) 16: 0.0000 SUMMARY TABLE MINIMUM DISTRIBUTION FACTOR MAGNITUDE 17: 5 SUMMARY TABLE MAXIMUM TIMES FOR REPORTING THE SAME ELEMENT 18: 0 APPLY SUMMARY MIN. DISTR. FACTOR TO SOLUTION REPORTS (0=NO, 1=YES) 19: 0.0 MINIMUM CONTINGENCY CASE PRE-SHIFT FLOW CHANGE 20: 0.0000 MINIMUM CONTINGENCY CASE DISTRIBUTION FACTOR CHANGE 21: 0 CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES) 22: 1 SUMMARY TABLE CONTINGENCY DESCRIPTIONS (0=LABELS, 1=EVENTS, 2=BOTH) ENTER PARAMETER CODE, NEW VALUE:
```

Following a response of 0 or *[Enter]* to the parameter code input request, activity TLTG checks that generators are not converted and that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity TLTG ends.

If a new ordering of network buses is required, an appropriate message is printed and activity ORDR is automatically run. Next, activity TLTG calculates and prints the largest active power mismatch corresponding to the present ac solution voltage vector in the working case. If this largest mismatch is greater than the MW mismatch tolerance, activity TLTG gives the user the option of continuing or quitting:

```
ENTER 0 TO EXIT, 1 TO CONTINUE:
```

The dialog prompts the user to:

```
ENTER DISTRIBUTION FACTOR FILENAME:
```

The user must enter the name of a Distribution Factor Data File constructed by activity DFAX which corresponds to the network condition contained in the working case and to the desired Linear Network Analysis Data Files. The Distribution Factor Data File must specify at least one monitored branch or interface. The bus input option *must* have the same setting that was in effect when activity DFAX filled the specified file.

The Distribution Factor Data File is read, and if no subsystems are defined an appropriate error message is printed and activity TLTG ends. If only one subsystem is defined, a second subsystem (WORLD) is assumed containing those buses in the working case that are not assigned to the specified subsystem.

The subsystems entered are summarized and the dialog prompts the user to designate the study and opposing systems:

```
THESE SUBSYSTEMS WERE SPECIFIED: # <-- NAME --> BUSES # <-- NAME --> BUSES #
<-- NAME --> BUSES

1 label nnn 2 label nnn 3 label nnn

.

.

ENTER STUDY SYSTEM NUMBER:

ENTER OPPOSING SYSTEM NUMBER:
```

If only one subsystem was specified, these two instructions are skipped, and the specified subsystem is taken as the study system while the remainder of the working case is treated as the opposing system. If exactly two subsystems were specified, the second instruction is bypassed.

Activity TLTG then checks to ensure that there are no buses that are members of both of the selected subsystems. An alarm message is generated if any such buses are found, and activity TLTG ends.

If the convert ratings option was enabled at the start of activity TLTG, ratings from the specified rating set(s) of those monitored branches having non-zero rating(s) are modified. For each such branch, the reactive power loading is calculated and MW rating(s) are determined with the assumption that the reactive power loading is unchanged under power transfer and contingency conditions.

The base case dc network solution is then calculated and the solution summarized as in the following example:

```
STUDY SYSTEM GENERATION IS 1500.0 MW

OPPOSING SYSTEM GENERATION IS 1748.9 MW
```

```
STUDY SYSTEM NET INTERCHANGE IS 282.8 MW
```

The dialog prompts the user to:

```
ENTER STUDY SYSTEM GENERATION SHIFT:
```

If the value entered is positive, export limits are to be determined; otherwise, import limits are to be calculated.

The base case solution is then reported, followed by processing of the designated contingency cases with contingency case flow estimates. Prior to ending, an ordered summary report from among all the cases calculated is tabulated.

The user is given the option of having the summary report repeated with interface transfer limits and distribution factors for a specified interface listed rather than study system transfer limits and distribution factors:

```
ENTER INTERFACE LABEL FOR INTERFACE LIMITS SUMMARY TABLE:
```

The summary report is printed and the above instruction is repeated. This process continues until the user presses *[Enter]*. The interface distribution factors listed on the interface summary report are measures of the changes in monitored element flows to a change in base case interface flow.

```
ACTIVITY? :
>>TLTG

SOLUTION PARAMETERS ARE:
 1:      0.5  MW MISMATCH TOLERANCE
 2:        1  BASE CASE RATING (1=RATEA, 2=RATEB, 3=RATEC)
 3:        1  CONTINGENCY CASE RATING (1=RATEA, 2=RATEB, 3=RATEC)
 4:    100.0  PERCENT OF RATING
 5:        0  LINE FLOW CODE (0=DC BASE CASE, 1=AC BASE CASE)
 6:        0  PHASE SHIFTER CODE (0=LOCKED, 1=REGULATING IN BASE CASES)
 7:        0  (0=IGNORE BASE CASE CONSTRAINTS IN CONTINGENCY CASES, 1=INCLUDE)
 8:        0  LIST STUDY SYSTEM BUSES (0=NO, 1=YES)
 9:        0  LIST OPPOSING SYSTEM BUSES (0=NO, 1=YES)
10:        0  LIST STUDY SYSTEM TIE LINES (0=NO, 1=YES)
11:        0  ADD STUDY SYSTEM TIES TO MONITORED LINE LIST (0=NO, 1=YES)
12:        0  OUTPUT CODE (0=SUMMARY, 1=FULL)
13:        0  INTERCHANGE LIMIT OUTPUT CODE (0=INCREMENTAL, 1=TOTAL)
14:    24000  NUMBER OF ELEMENTS TO INCLUDE IN FLOW TABLES
15:   99999.  SUMMARY TABLE MAXIMUM IMPORT OR EXPORT (>0.)
16:      0.0  SUMMARY TABLE MINIMUM DISTRIBUTION FACTOR MAGNITUDE
17:        5  SUMMARY TABLE MAXIMUM TIMES FOR REPORTING THE SAME ELEMENT
18:        0  APPLY SUMMARY MIN. DISTR. FACTOR TO SOLUTION REPORTS (0=NO, 1=YES)
19:      0.0  MINIMUM CONTINGENCY CASE PRE-SHIFT FLOW CHANGE
20:   0.0000  MINIMUM CONTINGENCY CASE DISTRIBUTION FACTOR CHANGE
21:        0  CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES)
22:        1  SUMMARY TABLE CONTINGENCY DESCRIPTIONS (0=LABELS, 1=EVENTS, 2=BOTH)
ENTER PARAMETER CODE, NEW VALUE:
>>

ENTER OUTPUT DEVICE CODE:
 0 FOR NO OUTPUT               1 FOR REPORT WINDOW
 2 FOR A FILE                  3 FOR DEFAULT PRINTER
 6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

ENTER DISTRIBUTION FACTOR FILENAME:
>>TESTdfx.dfx
Enter Study System Label:
>>EAST
Enter Opposing System Label:
>>WEST
ENTER STUDY SYSTEM GENERATION SHIFT:
>>10
ENTER INTERFACE LABEL FOR INTERFACE LIMITS SUMMARY TABLE:
>>

WORKING CASE HAS LARGEST MISMATCH OF      0.03 MW AT BUS 151 [NUCPANT     500.00]

THESE SUBSYSTEMS WERE SPECIFIED:
  # <-- NAME -->   BUSES    # <-- NAME -->   BUSES    # <-- NAME -->   BUSES
  1 STUDY              6    2 EAST               7    3 WEST              10

STUDY SYSTEM GENERATION IS        1400.0 MW
OPPOSING SYSTEM GENERATION IS      358.7 MW
STUDY SYSTEM NET INTERCHANGE IS   -130.8 MW
```

Figure 10.8. Example: Running Activity TLTG (Partial Output)

Additional Information
PSS® E Program Operation Manual, Calculating Transmission Interchange Limits

10.7. Calculating Sequential Participation Interchange Limits

SPIL

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. Distribution Factor Data File (*.dfx) corresponding to the network condition in the working case. Subsystem Participation Data File (*.prt) corresponding to the subsystem definitions in the Distribution Factor Data File.	
Activity ID, Suffix	Suffix Function
SPIL	Activity runs without a suffix.

The sequential participation transmission interchange limit analysis activity SPIL estimates the import or export limits of a specified subsystem of the working case using a linearized network model. The user designates this study system in which the total power injection is to be increased (for export limits) or decreased (for import limits). An opposite change in the total power injection is made in a designated opposing system.

Activity SPIL accesses a Distribution Factor Data File (*.dfx) to pick up subsystem, monitored element and contingency definitions. It also accesses a Subsystem Participation Data File (*.prt) in which alternative participation data may be provided for the study and/or opposing systems.

Power transfer distribution factors relating changes in branch and interface flows to a change in study system interchange are determined. The maximum study system export or import is then derived by interpolation and extrapolation subject to the constraint that no monitored elements exceed a specified percentage of a specified rating. This process may then be repeated for a designated set of user specified contingency cases.

At the start, activity SPIL displays its default solution and output control parameters and gives the user the opportunity to change any of these parameters:

```
SOLUTION PARAMETERS ARE: 1: 0.5 MW MISMATCH TOLERANCE 2: 1 BASE CASE RATING
(1=RATEA, 2=RATEB, 3=RATEC) 3: 1 CONTINGENCY CASE RATING (1=RATEA, 2=RATEB,
3=RATEC) 4: 100.0 PERCENT OF RATING 5: 0 LINE FLOW CODE (0=DC BASE CASE, 1=AC
BASE CASE) 6: 0 PHASE SHIFTER CODE (0=LOCKED, 1=REGULATING IN BASE CASES) 7: 1
SUMMARY TABLE CONTINGENCY DESCRIPTIONS (0=LABELS, 1=EVENTS, 2=BOTH) 8: 0 LIST
STUDY SYSTEM BUSES (0=NO, 1=YES) 9: 0 LIST OPPOSING SYSTEM BUSES (0=NO, 1=YES)
10: 0 LIST STUDY SYSTEM TIE LINES (0=NO, 1=YES) 11: 0 ADD STUDY SYSTEM TIES
TO MONITORED LINE LIST (0=NO, 1=YES) 12: 0 OUTPUT CODE (0=SUMMARY, 1=FULL) 13:
0 INTERCHANGE LIMIT OUTPUT CODE (0=INCREMENTAL, 1=TOTAL) 14: 10000 NUMBER OF
ELEMENTS TO INCLUDE IN FLOW TABLES 15: 99999. SUMMARY TABLE MAXIMUM IMPORT OR
EXPORT (>0.) 16: 0.0000 SUMMARY TABLE MINIMUM DISTRIBUTION FACTOR MAGNITUDE 17:
5 SUMMARY TABLE MAXIMUM TIMES FOR REPORTING THE SAME ELEMENT 18: 0 APPLY SUMMARY
MIN. DISTR. FACTOR TO SOLUTION REPORTS (0=NO, 1=YES) 19: 0.0 MINIMUM CONTINGENCY
CASE PRE-SHIFT FLOW CHANGE 20: 0.0000 MINIMUM CONTINGENCY CASE DISTRIBUTION
FACTOR CHANGE 21: 0 CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES) ENTER
PARAMETER CODE, NEW VALUE:
```

If the largest initial active power mismatch exceeds the specified MW mismatch tolerance, the user is given the opportunity to end activity SPIL.

Following a response of 0 or *[Enter]* to the parameter code input request, activity SPIL checks that generators are not converted and that each non-Type 4 bus is connected back to a Type 3 (swing) bus through the in-service ac network. If any violations are detected, an appropriate message is printed and activity SPIL ends.

If a new ordering of network buses is required, an appropriate message is printed and activity ORDR is automatically run. Next, activity SPIL calculates and prints the largest active power mismatch corresponding to the present ac solution voltage vector in the working case. If this largest mismatch is greater than the MW mismatch tolerance, activity SPIL gives the user the option of continuing or quitting:

```
ENTER 0 TO EXIT, 1 TO CONTINUE:
```

The dialog prompts the user to:

```
ENTER DISTRIBUTION FACTOR FILENAME:
```

The user must enter the name of a Distribution Factor Data File constructed by activity DFAX which corresponds to the network condition contained in the working case and to the desired Linear Network Analysis Data Files. The Distribution Factor Data File must specify at least one monitored branch or interface. The bus input option *must* have the same setting that was in effect when activity DFAX filled the specified file.

The Distribution Factor Data File is read, and if no subsystems are defined an appropriate error message is printed and activity SPIL ends. If only one subsystem is defined, a second subsystem (WORLD) is assumed containing those buses in the working case that are not assigned to the specified subsystem.

The subsystems entered are summarized and the dialog prompts the user to designate the study and opposing systems:

```
THESE SUBSYSTEMS WERE SPECIFIED: # <-- NAME --> BUSES # <-- NAME --> BUSES #
<-- NAME --> BUSES

1 label nnn 2 label nnn 3 label nnn

.

.

ENTER STUDY SYSTEM NUMBER:

ENTER OPPOSING SYSTEM NUMBER:
```

If only one subsystem was specified, these two instructions are skipped, and the specified subsystem is taken as the study system while the remainder of the working case is treated as the opposing system. If exactly two subsystems were specified, the second instruction is bypassed.

Activity SPIL then checks to ensure that there are no buses that are members of both of the selected subsystems. An alarm message is generated if any such buses are found, and activity SPIL ends.

The dialog prompts the user to:

```
ENTER SUBSYSTEM PARTICIPATION DATA FILE NAME:
```

The user may enter the name of a Subsystem Participation Data File that contains subsystem sequential participation data. If no Subsystem Participation Data File is specified, activity SPIL uses the participation data contained in the Distribution Factor Data File and produces results identical to those of activity TLTG.

The base case dc network solution is then calculated and the solution summarized as in the following example:

```
STUDY SYSTEM GENERATION IS 1500.0 MW

OPPOSING SYSTEM GENERATION IS 1748.9 MW

STUDY SYSTEM NET INTERCHANGE IS 282.8 MW
```

The user is then instructed to:

```
ENTER STUDY SYSTEM GENERATION SHIFT:
```

If the value entered is positive, export limits are to be determined; otherwise, import limits are to be calculated.

The base case solution is then reported, followed by processing of the designated contingency cases with contingency case flow estimates. Prior to ending, an ordered summary report from among all the cases calculated is tabulated.

The user is given the option of having the summary report repeated with interface transfer limits and distribution factors for a specified interface listed rather than study system transfer limits and distribution factors:

```
ENTER INTERFACE LABEL FOR INTERFACE LIMITS SUMMARY TABLE:
```

The summary report is printed and the above instruction is repeated. This process continues until the user presses *[Enter]*. The interface distribution factors listed on the interface summary report are measures of the changes in monitored element flows to a change in base case interface flow.

```
>>SPIL

 SOLUTION PARAMETERS ARE:
  1:      0.5  MW MISMATCH TOLERANCE
  2:        1  BASE CASE RATING (1=RATEA, 2=RATEB, 3=RATEC)
  3:        1  CONTINGENCY CASE RATING (1=RATEA, 2=RATEB, 3=RATEC)
  4:    100.0  PERCENT OF RATING
  5:        0  LINE FLOW CODE (0=DC BASE CASE, 1=AC BASE CASE)
  6:        0  PHASE SHIFTER CODE (0=LOCKED, 1=REGULATING IN BASE CASES)
  7:        1  SUMMARY TABLE CONTINGENCY DESCRIPTIONS (0=LABELS, 1=EVENTS, 2=BOTH)
  8:        0  LIST STUDY SYSTEM BUSES (0=NO, 1=YES)
  9:        0  LIST OPPOSING SYSTEM BUSES (0=NO, 1=YES)
 10:        0  LIST STUDY SYSTEM TIE LINES (0=NO, 1=YES)
 11:        0  ADD STUDY SYSTEM TIES TO MONITORED LINE LIST (0=NO, 1=YES)
 12:        0  OUTPUT CODE (0=SUMMARY, 1=FULL)
 13:        0  INTERCHANGE LIMIT OUTPUT CODE (0=INCREMENTAL, 1=TOTAL)
 14:    24000  NUMBER OF ELEMENTS TO INCLUDE IN FLOW TABLES
 15:   99999.  SUMMARY TABLE MAXIMUM IMPORT OR EXPORT (>0.)
 16:      0.0  SUMMARY TABLE MINIMUM DISTRIBUTION FACTOR MAGNITUDE
 17:        5  SUMMARY TABLE MAXIMUM TIMES FOR REPORTING THE SAME ELEMENT
 18:        0  APPLY SUMMARY MIN. DISTR. FACTOR TO SOLUTION REPORTS (0=NO, 1=YES)
 19:      0.0  MINIMUM CONTINGENCY CASE PRE-SHIFT FLOW CHANGE
 20:   0.0000  MINIMUM CONTINGENCY CASE DISTRIBUTION FACTOR CHANGE
 21:        0  CONVERT RATINGS TO ESTIMATED MW RATINGS (0=NO, 1=YES)
 ENTER PARAMETER CODE, NEW VALUE:
>>

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                  1 FOR REPORT WINDOW
  2 FOR A FILE                     3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE     7 FOR PROGRESS WINDOW :
>>7

 ENTER DISTRIBUTION FACTOR FILENAME:
>>TESTdfx.dfx
 Enter Study System Label:
>>EAST
 Enter Opposing System Label:
>>WEST
 FOR THE SUBSYSTEM PARTICIPATION DATA FILE,
>>
 ENTER STUDY SYSTEM GENERATION SHIFT:
>>10
 ENTER INTERFACE LABEL FOR INTERFACE LIMITS SUMMARY TABLE:
>>

 ORDERING NETWORK
 DIAGONALS =      22   OFF-DIAGONALS =      40   MAX SIZE =      58

 WORKING CASE HAS LARGEST MISMATCH OF       0.03 MW AT BUS 151 [NUCPANT     500.00]

 THESE SUBSYSTEMS WERE SPECIFIED:
   # <-- NAME -->   BUSES     # <-- NAME -->   BUSES     # <-- NAME -->   BUSES
   1 STUDY              6     2 EAST               7     3 WEST              10

 STUDY SYSTEM GENERATION IS          1400.0 MW
 OPPOSING SYSTEM GENERATION IS        358.7 MW
 STUDY SYSTEM NET INTERCHANGE IS     -130.8 MW

     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008   13:42
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                                 PAGE 1
 BASE CASE INCLUDING SEQUENCE DATA
         *** SPIL EXPORT LIMIT OUTPUT FOR BASE CASE                ***

 DISTRIBUTION FACTOR FILE:      TESTdfx.dfx
 SUBSYSTEM DESCRIPTION FILE:    savnw.sub
 MONITORED ELEMENT FILE:        savnw.mon
 CONTINGENCY DESCRIPTION FILE:  savnw.con

                                  PRE-SHIFT     DELTA   POST-SHIFT
 STUDY SYSTEM MW GENERATION:        1400.0       10.0     1410.0
 OPPOSING SYSTEM MW GENERATION:      358.7      -10.0      348.7
 STUDY SYSTEM NET INTERCHANGE:      -130.8       10.0     -120.8
```

Figure 10.9. Example: Running Activity SPIL (Partial Output)

Additional Information
PSS® E Program Operation Manual, Calculating Sequential Participation Interchange Limits

10.8. Running Midwest MW-mile Calculation

MWMI

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
MWMI	Activity runs without a suffix.

This activity was incorporated into PSS®E for the convenience of customers who use Midwest ISO (http://www.midwestiso.org/home) planning algorithms. Please contact MISO for current updates, as Siemens PTI does not provide warranty or support for Midwest Independent Transmission System Operator solutions.

Additional Information
PSS® E Program Operation Manual, Midwest MW-Mile Calculation

Chapter 11

Network Reduction

11.1. Building a Network Equivalent

11.1.1. Electrical Equivalent

EEQV

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
EEQV,ALL	All Type 1 buses
EEQV,AREA	Type 1 buses in specified area(s)
EEQV,ZONE	Type 1 buses in specified zone(s)
EEQV,OWNER	Type 1 buses for specified owner(s)
EEQV,KV	Type 1 buses for specified base kV range
EEQV,OPT	User selects options manually using an interactive dialog

The power flow equivalent construction activity EEQV constructs an electrical equivalent of a subsystem of the network contained in the working case, building an electrical equivalent of all radial and, optionally, two-point Type 1 buses from among the buses specified.

Activity EEQV processes the positive sequence network only. If sequence data is present in the working case, activity EEQV generates the following message, and processing continues:

```
WARNING: SEQUENCE DATA WILL NOT BE EQUIVALENCED
```

Activity EEQV requires that the working case be solved to an acceptable mismatch level. The output of activity EEQV is a working case with part or all of the original network model replaced by an equivalent representation.

External systems are defined according to the suffix specified when running activity EEQV.

When activity EEQV is run with the ALL suffix, an equivalent of the entire working case is constructed. Otherwise, activity EEQV prints the message:

```
USER SPECIFIES SUBSYSTEM TO BE EQUIVALENCED
```

When activity EEQV is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed.

Following the specification of the subsystem to be processed, the user may elect to keep area and/or zone boundaries intact:

```
ENTER 1 TO RETAIN AREA BOUNDARY BUSES: ENTER 1 TO RETAIN ZONE BOUNDARY BUSES:
```

If any two-winding transformers with a non-zero phase shift angle are present in the subsystem to be processed, activity EEQV requests the user to:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF PHASE SHIFTERS:
```

If the user elects to retain two-winding transformer phase shifters, activity EEQV forces the retention of the buses involved by changing their type codes from 1, 2, or 3 to 5, 6, or 7, respectively. Thus, the phase shifter and the buses it connects are all explicitly retained in the equivalent.

If the user chooses to build an electrical equivalent of two-winding transformer phase shifters, activity EEQV resets the phase shift angle to zero degrees and introduces equivalent MVA load at the buses connected by the phase shifter such that an electrical balance is retained. The phase shifter is then treated like any other transformer.

Next, building an electrical equivalent of buses for which voltage or reactive power output is controlled by remote generation, switched shunt, VSC dc line converter, and/or FACTS device shunt element may be suppressed:

```
ENTER 1 TO RETAIN BUSES CONTROLLED BY REMOTE GENERATION, SWITCHED SHUNT, FACTS
SHUNT ELEMENT, OR VSC CONVERTER:
```

The user may instruct activity EEQV to net small plants at Type 2 buses:

```
ENTER MINIMUM GENERATION FOR RETAINING GENERATOR BUSES (CARRIAGE RETURN TO KEEP
ALL ON-LINE GENERATOR BUSES):
```

If the threshold specified is zero, all Type 2 generator buses in the subsystem being processed are retained. When a positive threshold value is specified, any nonboundary Type 2 bus that is not an area swing bus and for which active and reactive power generation magnitudes are both below the threshold has its generation netted with the bus load and its type code changed to Type 1.

Finally, activity EEQV instructs the user to:

```
ENTER 1 TO RETAIN EXISTING BRANCHES BETWEEN RETAINED BUSES:
```

The default response for the specification of each of the above options is a zero.

An alarm message is generated if either none or all buses are to be retained, and activity EEQV ends. Otherwise, the equivalencing calculation is initiated.

The dialog prompts the user to:

```
ENTER BRANCH THRESHOLD TOLERANCE:
```

Any equivalent branch for which the magnitude of impedance is greater than this tolerance is not retained in the equivalent. The default value is 10 per unit.

Then the standard output of activity ORDR is tabulated, the construction of the equivalent is completed, and the dialog prompts the user to:

```
ENTER 1 TO NET LOAD AND SHUNT AT RETAINED BUSES:
```

If a one is entered in response to the above instruction, activity EEQV nets the total equivalent load and shunt at retained buses such that occurrences of load and shunt that cancel out at a bus (for example, positive load and negative shunts) are eliminated. The component of smaller magnitude is set to zero with the other component set to the netted quantity. Active and reactive components at each retained bus are processed independently.

If a zero is entered in response to the above instruction, the equivalent load and shunt components at retained buses remain as calculated by the equivalent construction matrix reduction process.

The equivalent and detailed system sections are then combined, and activity EEQV ends.

```
>>EEQV,AREA
 USER SPECIFIES SUBSYSTEM TO BE EQUIVALENCED
 ENTER UP TO 20 AREA NUMBERS:

>>5
 ENTER UP TO 20 AREA NUMBERS:

>>
 ENTER 1 TO RETAIN AREA BOUNDARY BUSES:
>>1
 ENTER 1 TO RETAIN ZONE BOUNDARY BUSES:
>>1
 ENTER 1 TO RETAIN BUSES CONTROLLED BY REMOTE
   GENERATION, SWITCHED SHUNT OR VSC CONVERTER:
>>1
 ENTER MINIMUM GENERATION FOR RETAINING GENERATOR BUSES
   (CARRIAGE RETURN TO KEEP ALL ON-LINE GENERATOR BUSES):
>>
 ENTER 1 TO RETAIN EXISTING BRANCHES BETWEEN RETAINED BUSES:
>>1
 ENTER BRANCH THRESHOLD TOLERANCE:
>>
 ENTER 1 TO NET LOAD AND SHUNT AT RETAINED BUSES:
>>0
      3 RADIAL AND TWO POINT BUSES EQUIVALENCED
 DIAGONALS =      6  OFF-DIAGONALS =      13  MAX SIZE =      19

 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 ACTIVITY? :
>>
```

Figure 11.1. Example: Running Activity EEQV,AREA

Additional Information
PSS® E Program Operation Manual, Building an Electrical Equivalent

11.1.2. Net Generation with Load at All Non-Boundary Buses

GNET

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
GNET,ALL	All Type 2 and 3 buses
GNET,AREA	Type 2 and 3 buses in specified area(s)
GNET,ZONE	Type 2 and 3 buses in specified zone(s)
GNET,OWNER	Type 2 and 3 buses for specified owner(s)
GNET,KV	Type 2 and 3 buses for specified base kV range
GNET,OPT	User selects options manually using an interactive dialog

The generation netting activity GNET changes the in-service generation to negative MVA load at all Type 2 and 3 buses in the subsystem specified by the user. The user specifies the portion of the working case to be processed by entering the appropriate suffix when running activity GNET.

When activity GNET is run with the ALL suffix, it nets the generation of all Type 2 and 3 buses in the working case.

Otherwise, activity GNET prints the message: `USER SPECIFIES THOSE TO BE NETTED`

When activity GNET is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be netted.

Prior to ending, activity GNET summarizes its processing by printing the message:

```
GENERATION AT nnnnn BUSES NETTED WITH THEIR LOAD
```

```
>>GNET
 USER SPECIFIES THOSE TO BE NETTED
 ENTER UP TO 20 BUS NUMBERS

>>101 102
 ENTER UP TO 20 BUS NUMBERS

>>

 GENERATION AT      2 BUSES NETTED WITH THEIR LOAD

 ACTIVITY? :
>>
```

Figure 11.2. Example: Running Activity GNET

Additional Information
PSS® E Program Operation Manual, Net Generation with Load In a Subsystem

11.1.3. Net Generation with Load at All Buses Except Boundary Buses

NETG

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
NETG,ALL	Netting at all Type 2 and 3 buses
NETG,AREA	Netting at all Type 2 and 3 buses except for specified area(s)
NETG,ZONE	Netting at all Type 2 and 3 buses except for specified zone(s)
NETG,OWNER	Netting at all Type 2 and 3 buses except for specified owner(s)
NETG,KV	Netting at all Type 2 and 3 buses except for specified base kV range
NETG,OPT	User selects options manually using an interactive dialog

The generation netting activity NETG changes the in-service generation to negative MVA load at all Type 2 and 3 buses *except* those in the subsystem specified by the user.The user specifies the portion of the working case to be processed by entering the appropriate suffix when running activity NETG.

When activity NETG is run with the ALL suffix, it nets the generation of all Type 2 and 3 buses in the working case.

Otherwise, activity NETG prints the message: `USER SPECIFIES EXCEPTIONS (that is, THOSE NOT TO BE NETTED)`

When activity NETG is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be exempted from netting. Prior to ending, activity NETG summarizes its processing by printing the message:

`GENERATION AT nnnnn BUSES NETTED WITH THEIR LOAD`

```
>>NETG
 USER SPECIFIES EXCEPTIONS (I.E., THOSE NOT TO BE NETTED)
 ENTER UP TO 20 BUS NUMBERS

>>151 154
 ENTER UP TO 20 BUS NUMBERS

>>

 GENERATION AT      6 BUSES NETTED WITH THEIR LOAD

 ACTIVITY? :
>>
```

Figure 11.3. Example: Running Activity NETG

Additional Information
PSS®E Program Operation Manual, Net Generation with Load Outside of a Subsystem

11.1.4. Radial Bus and 2-Point Buses, with Exception

RDEQ

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level	
Activity ID, Suffix	Suffix Function
RDEQ,ALL	Build an electrical equivalent at all Type 1 buses
RDEQ,AREA	Build an electrical equivalent at Type 1 buses in specified area(s)
RDEQ,ZONE	Build an electrical equivalent at Type 1 buses in specified zone(s)
RDEQ,OWNER	Build an electrical equivalent at Type 1 buses for specified owner(s)
RDEQ,KV	Build an electrical equivalent at Type 1 buses for specified base kV range

Activity ID, Suffix	Suffix Function
RDEQ,OPT	User selects options manually using an interactive dialog

The radial bus equivalencing activity RDEQ builds an electrical equivalent at radial and, optionally, two point Type 1 buses *except* specified subsystems of the working case.

The dialog requests the user to indicate whether only radial buses are to be processed, or if both radial buses and those buses connected to only two other buses are to be eliminated:

```
ENTER 1 TO EQUIVALENCE RADIAL BUSES ONLY:
```

The user may then elect to exclude transformer branches from the equivalencing process:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF TRANSFORMERS:
```

If the working case contains any branches that are treated as zero impedance lines, buses connected by such lines may be exempted from the equivalencing process:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF ZERO IMPEDANCE LINES:
```

Next, building an electrical equivalent of buses for which voltage or reactive power output is controlled by remote generation, switched shunt, VSC dc line converter, and/or FACTS device shunt element may be suppressed:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF BUSES CONTROLLED BY REMOTE GENERATION,
SWITCHED SHUNT, FACTS SHUNT ELEMENT, OR VSC CONVERTER:
```

If sequence data is contained in the working case and zero sequence mutual couplings have been specified, the user may elect to exempt from the process any branch (and the buses it connects) involved in such a coupling:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF MUTUALLY COUPLED BRANCHES:
```

Finally, the user may elect to keep area and/or zone boundaries intact:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF AREA BOUNDARY BUSES: ENTER 1 TO SUPPRESS
EQUIVALENCING OF ZONE BOUNDARY BUSES:
```

The default response for the specification of each of the above options is a zero.

The action taken next is dependent upon the suffix specified when starting activity RDEQ.

When activity RDEQ is run with the ALL suffix, it builds an electrical equivalent at all buses and branches in the working case meeting the criteria specified above.

When activity RDEQ is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it prints the message:

```
USER SPECIFIES EXCEPTIONS (that is, THOSE NOT TO BE EQUIVALENCED)
```

It then opens a dialog through which the user selects the subsystem of the working case to be *exempted* from the equivalencing process.

Activity RDEQ then builds the electrical equivalent using the same algorithm as activity EEQV.

If the actual positive sequence impedance of any transformer being processed differs from its nominal value, the dialog prompts the user to specify the treatment of the zero sequence impedance of all such transformers:

```
ENTER 1 TO APPLY TRANSFORMER IMPEDANCE CORRECTION TO ZERO SEQUENCE:
```

If a response of one is entered, the zero sequence impedance of each such transformer is scaled by the same factor as is its positive sequence impedance. Otherwise, all zero sequence transformer impedances are left at their nominal values. The same treatment applies to *all* transformers to be processed that are not at nominal impedance.

```
>>RDEQ,ALL
 ENTER 1 TO EQUIVALENCE RADIAL BUSES ONLY:
>>1
 ENTER 1 TO SUPPRESS EQUIVALENCING OF TRANSFORMERS:
>>
 ENTER 1 TO SUPPRESS EQUIVALENCING OF ZERO IMPEDANCE LINES:
>>
 ENTER 1 TO SUPPRESS EQUIVALENCING OF BUSES CONTROLLED
   BY REMOTE GENERATION, SWITCHED SHUNT OR VSC CONVERTER:
>>
 ENTER 1 TO SUPPRESS EQUIVALENCING OF AREA BOUNDARY BUSES:
>>
 ENTER 1 TO SUPPRESS EQUIVALENCING OF ZONE BOUNDARY BUSES:
>>

      69 BUSES EQUIVALENCED

 ACTIVITY? :
>>
```

Figure 11.4. Example: Running Activity RDEQ,ALL

Additional Information
PSS® E Program Operation Manual, Equivalencing Radial Buses, with Exception

11.1.5. Radial and 2-Point Buses

EQRD

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level	
Activity ID, Suffix	Suffix Function
EQRD,ALL	All Type 1 buses
EQRD,AREA	Type 1 buses in specified area(s)
EQRD,ZONE	Type 1 buses in specified zone(s)
EQRD,OWNER	Type 1 buses for specified owner(s)
EQRD,KV	Type 1 buses for specified base kV range
EQRD,OPT	User selects options manually using an interactive dialog

The radial bus equivalencing activity EQRD builds an electrical equivalent at radial, and optionally, two point Type 1 buses in specified subsystems of the working case.

The dialog requests the user to indicate whether only radial buses are to be processed, or if both radial buses and those buses connected to only two other buses are to be eliminated:

```
ENTER 1 TO EQUIVALENCE RADIAL BUSES ONLY:
```

Then the user may elect to exclude transformer branches from the equivalencing process:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF TRANSFORMERS:
```

If the working case contains any branches that are treated as zero impedance lines, buses connected by such lines may be exempted from the equivalencing process:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF ZERO IMPEDANCE LINES:
```

Next, building an electrical equivalent of buses for which voltage or reactive power output is controlled by remote generation, switched shunt, VSC dc line converter, and/or FACTS device shunt element may be suppressed:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF BUSES CONTROLLED BY REMOTE GENERATION,
SWITCHED SHUNT, FACTS SHUNT ELEMENT, OR VSC CONVERTER:
```

If sequence data is contained in the working case and zero sequence mutual couplings have been specified, the user may elect to exempt from the equivalent any branch (and the buses it connects) involved in such a coupling:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF MUTUALLY COUPLED BRANCHES:
```

Finally, the user may elect to keep area and/or zone boundaries intact:

```
ENTER 1 TO SUPPRESS EQUIVALENCING OF AREA BOUNDARY BUSES: ENTER 1 TO SUPPRESS
EQUIVALENCING OF ZONE BOUNDARY BUSES:
```

The default response for the specification of each of the above options is a zero.

The action taken next is dependent upon the suffix specified when starting activity EQRD.

When activity EQRD is run with the ALL suffix, it builds an electrical equivalent at all buses and branches in the working case meeting the criteria specified above.

When activity EQRD is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it prints the message:

```
USER SPECIFIES THOSE TO BE EQUIVALENCED
```

It then opens a dialog through which the user selects the subsystem of the working case to be processed.

Activity EQRD then builds the electrical equivalent using the same algorithm as activity EEQV.

If the actual positive sequence impedance of any transformer being processed differs from its nominal value, the dialog prompts the user to specify the treatment of the zero sequence impedance of all such transformers:

```
ENTER 1 TO APPLY TRANSFORMER IMPEDANCE CORRECTION TO ZERO SEQUENCE:
```

If a response of one is entered, the zero sequence impedance of each such transformer is scaled by the same factor as is its positive sequence impedance. Otherwise, all zero sequence transformer impedances are left at their nominal values. The same treatment applies to *all* transformers to be processed that are not at nominal impedance.

```
>>EQRD,ALL
 ENTER 1 TO EQUIVALENCE RADIAL BUSES ONLY:
>>0
 ENTER 1 TO SUPPRESS EQUIVALENCING OF TRANSFORMERS:
>>0
 ENTER 1 TO SUPPRESS EQUIVALENCING OF ZERO IMPEDANCE LINES:
>>0
 ENTER 1 TO SUPPRESS EQUIVALENCING OF BUSES CONTROLLED
   BY REMOTE GENERATION, SWITCHED SHUNT OR VSC CONVERTER:
>>0
 ENTER 1 TO SUPPRESS EQUIVALENCING OF AREA BOUNDARY BUSES:
>>0
 ENTER 1 TO SUPPRESS EQUIVALENCING OF ZONE BOUNDARY BUSES:
>>0
 ENTER 1 TO APPLY TRANSFORMER IMPEDANCE CORRECTION TO ZERO SEQUENCE:
>>0

       5 BUSES EQUIVALENCED

 ACTIVITY? :
>>
```

Figure 11.5. Example: Running Activity EQRD,ALL

Additional Information
PSS® E Program Operation Manual, Equivalencing Radial Buses

11.1.6. Net Boundary Bus Mismatch

BGEN

Requirements / Prerequisites	
Validly specified subsystem of a solved power flow case.	
Activity ID, Suffix	Suffix Function
BGEN,ALL	Net boundary buses for all buses
BGEN,AREA	Net boundary buses in specified area(s)
BGEN,ZONE	Net boundary buses in specified zone(s)
BGEN,OWNER	Net boundary buses for specified owner(s)
BGEN,KV	Net boundary buses for specified base kV range
BGEN,OPT	User selects options manually using an interactive dialog

The boundary bus balance activity BGEN converts the mismatch at boundary buses to equivalent load and/or generation. It is intended to be used following the removal of a subsystem from a solved working case, with the flows to the deleted subsystem replaced by load and/or generation at those retained buses that were directly connected to the removed subsystem.

The user is asked to specify the type of boundary condition modifications to be used:

```
ENTER 0 IF GENERATOR FOR INFLOW, LOAD FOR OUTFLOW

1 FOR ALL EQUIVALENT GENERATORS
```

`2 FOR ALL EQUIVALENT LOADS:`

With a response of 0, a new machine is introduced at any boundary bus at which there was a net inflow of active power from the removed subsystem into the retained subsystem; at boundary buses where there was a net outflow of active power, a new load is introduced.

When a 1 is entered in response to the above request, a new machine is introduced at each boundary bus regardless of the direction of power flow, and when a 2 is entered, each flow to the deleted subsystem is replaced by a new load.

Following this specification, the action taken by activity BGEN is dependent upon the suffix specified when the activity is run.

When activity BGEN is run without a suffix, the user is asked to select the buses to be processed. Following each response to the bus specification request, the specified buses are checked in the order specified by user input. When a bus has a mismatch in excess of 0.5 MVA, it is assumed to be a boundary bus and a new load or machine, as specified above, is introduced. The bus specification request is then repeated.

When activity BGEN is run with the ALL suffix, all buses in the working case are checked as described above. Boundary buses are reported in ascending bus number order (using the *numbers* output option) or alphabetical order (using the *names* output option).

When activity BGEN is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case that is to be processed. Following bus selection,activity BGEN checks and reports boundary buses. Then the user is given the opportunity to select an additional group of buses.

```
>>BGEN

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW  :
>>7

 ENTER 0 IF GENERATOR FOR INFLOW, LOAD FOR OUTFLOW
       1 FOR ALL EQUIVALENT GENERATORS
       2 FOR ALL EQUIVALENT LOADS:
>>2
 ENTER UP TO 20 BUS NUMBERS

>>101 102 151 152 153 154 155
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008   15:33
 PSS(TM)E SAMPLE CASE
 ALL DATA CATEGORIES WITH SEQUENCE DATA
                          X--- MISMATCH ---X
   BUS# X-- NAME --X BASKV       MW       MVAR
    153 MID230      230.00      10.8     342.3 CREATED LOAD 99
    155 FACTS TE    230.00    -350.0     -40.0 CREATED LOAD 99
 ENTER UP TO 20 BUS NUMBERS

>>

 ACTIVITY? :
>>
```

Figure 11.6. Example: Running Activity BGEN

Additional Information
PSS® E Program Operation Manual, Converting Net Boundary Bus Mismatch

11.2. Building a Three-Sequence Electrical Equivalent

SCEQ

Requirements / Prerequisites	
Validly specified power flow case reflecting classical fault analysis assumptions. Sequence data included in the case. Reading Sequence Data for Fault Analysis Using Classical Fault Analysis Assumptions	
Activity ID, Suffix	Suffix Function
SCEQ,ALL	Build an electrical equivalent at all buses and their connected branches except those with type codes of 5, 6, or 7
SCEQ,AREA	Build an electrical equivalent of power flow for specified area(s)
SCEQ,ZONE	Build an electrical equivalent of power flow for specified zone(s)
SCEQ,OWNER	Build an electrical equivalent of power flow for specified owner(s)
SCEQ,KV	Build an electrical equivalent of power flow for specified base kV range
SCEQ,OPT	User selects options manually using an interactive dialog

The three sequence equivalencing activity SCEQ constructs network equivalents of the positive and zero sequence networks and calculates source impedances at equivalent source nodes for all three sequences in preparation for the unbalanced fault analysis activities of PSS®E.

Activity SCEQ works on the basis of classical fault analysis assumptions. External systems are defined according to the suffix specified when running activity SCEQ, and activity SCEQ handles the data processing tasks automatically. Activity SCEQ requires that the working case be in the following format:

1. The network must reflect classical fault analysis assumptions:

    a. a uniform voltage profile must be specified

    b. no non-zero in-service loads may be present

    c. all transformers must be at zero phase shift angle

    d. The set up of these conditions is automated by running activity FLAT,CL.

2. The generator source currents must be determined on the basis of the positive sequence generator impedances and the flat generator conditions described above. This initialization is accomplished by running activity CONG,SQ.

An alarm message is generated if these conditions are not satisfied when activity SCEQ is run, and activity SCEQ ends.

If sequence data is not contained in the working case (that is, activity RESQ has not been run), an appropriate message is printed, the equivalent is constructed in the normal manner, but only the positive sequence equivalent is valid.

When activity SCEQ is run with the ALL suffix, an equivalent of the entire working case is constructed, with Type 5 and 6 buses retained as Type 1 and 2 buses, respectively. Otherwise, activity SCEQ prints the message:

```
USER SPECIFIES SUBSYSTEM TO BE EQUIVALENCED
```

When activity SCEQ is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed.

Following the specification of the subsystem to be processed, an alarm message is generated if either none or all buses are to be retained, and activity SCEQ ends. Otherwise, the equivalencing calculation is initiated.

First, the portion of the working case to be exempted from the electrical equivalent is (temporarily) removed from the working case, and all radial and two point Type 1 buses are processed. Then the standard output of activity ORDR is tabulated as the processing of the positive sequence network commences. The dialog prompts the user to:

```
ENTER BRANCH THRESHOLD TOLERANCE:
```

Any equivalent branch for which the magnitude of impedance is greater than this tolerance is not retained in the equivalent. The default value is 10 per unit.

If the actual positive sequence impedance of any transformer in the subsystem to be processed differs from its nominal value, the dialog prompts the user to specify the treatment of the zero sequence impedance of all such transformers:

```
ENTER 1 TO APPLY TRANSFORMER IMPEDANCE CORRECTION TO ZERO SEQUENCE:
```

If a response of 1 is entered, the zero sequence impedance of each such transformer is scaled by the same factor as is its positive sequence impedance. Otherwise, all zero sequence transformers are left at their nominal values. The same treatment applies to *all* transformers in the subsystem to be processed that are not at nominal impedance.

The user is given the option of saving the equivalents in the form of a Power Flow Raw Data File and a Sequence Data File:

```
ENTER RAW DATA OUTPUT FILE NAME: ENTER SEQUENCE DATA OUTPUT FILE NAME:
```

Processing is completed and activity SCEQ ends.

Additional Information
PSS®E Program Operation Manual, Building a Three-Sequence Electrical Equivalent

Chapter 12
Unbalanced Fault Analysis (Short Circuit)

12.1. Preparing Sequence Network for Unbalanced Network Solution

SEQD

Requirements / Prerequisites	
Validly specified power flow case, with sequence data appended, solved to an acceptable mismatch level with bus voltages corresponding to prefault network condition. Reading Sequence Data for Fault Analysis	
Activity ID, Suffix	Suffix Function
SEQD	Activity runs without a suffix.

The sequence network set up activity SEQD prepares the working case for the unbalanced network solution activity SCMU or the separate pole circuit breaker duty activity SPCB. This process involves taking the positive sequence network (that is, the power flow case) and the various sequence data arrays defining the negative and zero sequence networks, and setting up the SEQD temporary file in the form required by activities SCMU and SPCB. Activity SEQD does not modify the contents of the working case itself.

If sequence data has not been read into the working case by running activity RESQ, an appropriate error message is printed and activity SEQD ends.

If any unblocked dc lines or in-service FACTS devices are present in the working case, the user is asked to specify their treatment in the fault analysis solution:

```
ENTER DC LINE AND FACTS DEVICE OPTION: 0 FOR BLOCKED 1 FOR LOADING REPRESENTED:
```

Only one of these options may be entered while running activity SEQD and the unbalanced network solutions that follow. The specified option applies to *all* dc lines and FACTS devices in the working case. The default handling of these devices is to block.

If the actual positive sequence impedance of any transformer in the working case differs from its nominal value, the dialog prompts the user to specify the treatment of the zero sequence impedance of all such transformers:

```
ENTER 1 TO APPLY TRANSFORMER IMPEDANCE CORRECTION TO ZERO SEQUENCE:
```

If a response of one is entered, the zero sequence impedance of each such transformer is scaled by the same factor as is its positive sequence impedance. Otherwise, all zero sequence transformer impedances are left at their nominal values (that is, the values entered in activities RESQ, TRSQ, or SQCH). The same treatment applies to *all* transformers in the system that are not at nominal impedance.

```
>>SEQD
 DIAGONALS =      23  OFF-DIAGONALS =      41  MAX SIZE =      60
 POS. SEQUENCE: DIAGONALS =      23  OFF-DIAGONALS =      41
 DIAGONALS =      23  OFF-DIAGONALS =      35  MAX SIZE =      48
 BUS    101 [NUC-A       21.600] ISOLATED IN ZERO SEQUENCE
 BUS    102 [NUC-B       21.600] ISOLATED IN ZERO SEQUENCE
 BUS    206 [URBGEN      18.000] ISOLATED IN ZERO SEQUENCE
 BUS    211 [HYDRO_G     20.000] ISOLATED IN ZERO SEQUENCE
 BUS   3011 [MINE_G      13.800] ISOLATED IN ZERO SEQUENCE
 BUS   3018 [CATDOG_G    13.800] ISOLATED IN ZERO SEQUENCE
      6 BUSES ISOLATED IN ZERO SEQUENCE
 ZERO SEQUENCE: DIAGONALS =      23  OFF-DIAGONALS =      35

 ACTIVITY? :
>>
```

Figure 12.1. Example: Running Activity SEQD

Additional Information
PSS® E Program Operation Manual, Preparing Sequence Network for Unbalanced Network Solution

12.2. Running Fault Analysis under Unbalance Condition

SCMU

Requirements / Prerequisites	
Validly specified power flow case with sequence data appended to it. Reading Sequence Data for Fault Analysis Preparing Sequence Network for Unbalanced Network Solution.	
Activity ID, Suffix	Suffix Function
SCMU,SING or SCMU,SI	Solve network in the presence of a single unbalance

The multiply unbalanced network solution activity SCMU allows the user to apply simultaneously, at any bus, on any phase, any or all of the following unbalances or faults:

1. Two single-line-to-ground faults (L-G) with specified fault impedances.

2. Two line-to-line (L-L) or double-line-to-ground (L-L-G) faults with specified fault impedances.

3. Single phase, with specified impedance, closed between a pair of buses.

4. Two phases, with equal specified impedance, closed between a pair of buses.

The network is solved in the presence of the specified unbalances, and summary output is printed. Activity SCMU does not modify the contents of the working case or the SEQD temporary file set up by activity SEQD. If sequence data has not been read into the working case by running activity RESQ, an error message displays and activity SCMU ends.

When the sequence network setup option is enabled, activity SEQD is automatically run. Otherwise, activity SCMU assumes that activity SEQD has been run for the network conditions contained in the working case. The user specifies the types of unbalances and specifying faulted buses and phases, and fault impedances. Note that all fault impedances are complex numbers and are entered in per unit. The dialog prompts the user to:

```
ENTER UNBALANCE CODE: 0 FOR NO MORE 1 FOR FIRST L-G 2 FOR SECOND L-G 3 FOR FIRST
L-L-G 4 FOR SECOND L-L-G 5 FOR 1 PHASE CLOSED 6 FOR 2 PHASES CLOSED 7 FOR THREE
PHASE FAULT 8 FOR ONE END OPENED 9 FOR IN LINE SLIDER:
```

Upon specification of the type of unbalance, a dialog is entered in which the user describes the unbalance. The request for an unbalance is then repeated.

When activity SCMU is run with the SING suffix, the user is given the ability to specify only a single unbalance. This mode is intended for the case of an engineer using PSS®E from a remote location over a low speed telephone line. This reduces the volume of dialog required to specify an unbalanced condition consisting of only one unbalance.

Following the end of the unbalance specification process, the unbalances applied are tabulated and the user is asked to verify that they are as intended:

```
ENTER 1 IF OK, 0 TO RE-SPECIFY UNBALANCES, -1 TO EXIT ACTIVITY:
```

```
>>SCMU

 ENTER UNBALANCE CODE:
  0 FOR NO MORE           1 FOR FIRST L-G
  2 FOR SECOND L-G        3 FOR FIRST L-L-G
  4 FOR SECOND L-L-G      5 FOR 1 PHASE CLOSED
  6 FOR 2 PHASES CLOSED   7 FOR THREE PHASE FAULT
  8 FOR ONE END OPENED    9 FOR IN LINE SLIDER:
>>1
 ENTER BUS NUMBER (0 FOR NEW FAULT CODE, -1 FOR NO MORE):
>>101
 ENTER PHASE (1, 2 OR 3):
>>1
 ENTER FAULT IMPEDANCE (R,X):
>>

 ENTER UNBALANCE CODE:
  0 FOR NO MORE           1 FOR FIRST L-G
  2 FOR SECOND L-G        3 FOR FIRST L-L-G
  4 FOR SECOND L-L-G      5 FOR 1 PHASE CLOSED
  6 FOR 2 PHASES CLOSED   7 FOR THREE PHASE FAULT
  8 FOR ONE END OPENED    9 FOR IN LINE SLIDER:
>>0
 UNBALANCES TO BE APPLIED:

 ENTER 1 IF OK, 0 TO RE-SPECIFY UNBALANCES, -1 TO EXIT ACTIVITY:
>>1

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                 1 FOR REPORT WINDOW
  2 FOR A FILE                    3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE    7 FOR PROGRESS WINDOW :
>>7

 ENTER BUS NUMBER:
>>101
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008  16:02
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                                BRANCH
 BASE CASE INCLUDING SEQUENCE DATA                                        CURRENTS

 SEQUENCE                 RE(V0)    IM(V0)    RE(V+)    IM(V+)    RE(V-)    IM(V-)   RE(3V0)   IM(3V0)
 PHASE                    RE(VA)    IM(VA)    RE(VB)    IM(VB)    RE(VC)    IM(VC)

    101 (P.U.)            0.0000    0.0000    0.9778    0.2905    0.0000    0.0000    0.0000    0.0000
 NUC-A         21.600     0.9778    0.2905   -0.2373   -0.9920   -0.7405    0.7015

 SEQUENCE                 RE(I0)    IM(I0)    RE(I+)    IM(I+)    RE(I-)    IM(I-)   RE(3I0)   IM(3I0)
 PHASE                    RE(IA)    IM(IA)    RE(IB)    IM(IB)    RE(IC)    IM(IC)

 MACHINE 1                0.0000    0.0000   -7.2751   -1.3310    0.0000    0.0000    0.0000    0.0000
                         -7.2751   -1.3310    2.4849    6.9659    4.7902   -5.6349

 TO     151 CKT 1         0.0000    0.0000    7.2751    1.3310    0.0000    0.0000    0.0000    0.0000
 NUCPANT      500.00      7.2751    1.3310   -2.4849   -6.9659   -4.7902    5.6349

 SUM OF                   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 CONTRIBUTIONS            0.0000    0.0000    0.0000    0.0000    0.0000    0.0000


 ENTER BUS NUMBER:
>>102
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008  16:02
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                                BRANCH
 BASE CASE INCLUDING SEQUENCE DATA                                        CURRENTS

 SEQUENCE                 RE(V0)    IM(V0)    RE(V+)    IM(V+)    RE(V-)    IM(V-)   RE(3V0)   IM(3V0)
 PHASE                    RE(VA)    IM(VA)    RE(VB)    IM(VB)    RE(VC)    IM(VC)

    102 (P.U.)            0.0000    0.0000    0.9778    0.2905    0.0000    0.0000    0.0000    0.0000
 NUC-B         21.600     0.9778    0.2905   -0.2373   -0.9920   -0.7405    0.7015

 SEQUENCE                 RE(I0)    IM(I0)    RE(I+)    IM(I+)    RE(I-)    IM(I-)   RE(3I0)   IM(3I0)
 PHASE                    RE(IA)    IM(IA)    RE(IB)    IM(IB)    RE(IC)    IM(IC)

 MACHINE 1                0.0000    0.0000   -7.2751   -1.3310    0.0000    0.0000    0.0000    0.0000
                         -7.2751   -1.3310    2.4849    6.9659    4.7902   -5.6349

 TO     151 CKT 1         0.0000    0.0000    7.2751    1.3310    0.0000    0.0000    0.0000    0.0000
 NUCPANT      500.00      7.2751    1.3310   -2.4849   -6.9659   -4.7902    5.6349

 SUM OF                   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
 CONTRIBUTIONS            0.0000    0.0000    0.0000    0.0000    0.0000    0.0000

 ENTER BUS NUMBER:
>>
```

Figure 12.2. Example: Running Activity SCMU

Additional Information
PSS® E Program Operation Manual, Performing Fault Analysis with Multiple Unbalances

12.3. Running Detailed Fault Analysis under Unbalance Condition

SCOP

Requirements / Prerequisites	
Validly specified power flow case with sequence data appended to it. Reading Sequence Data for Fault Analysis Preparing Sequence Network for Unbalanced Network Solution	
Activity ID, Suffix	Suffix Function
SCOP,ALL	Report fault analysis for entire working case
SCOP,AREA	Report fault analysis for specified area(s)
SCOP,ZONE	Report fault analysis for specified zone(s)
SCOP,OWNER	Report fault analysis for specified owner(s)
SCOP,KV	Report fault analysis for specified base kV range
SCOP,OPT	User selects options manually using an interactive dialog

The unbalanced network solution output activity SCOP tabulates the results of activity SCMU. It allows the user to obtain output of all bus voltages and either branch currents, apparent impedances or apparent admittances.

The user is asked to specify the branch quantity to be tabulated:

```
ENTER BRANCH QUANTITY DESIRED: 0 TO EXIT ACTIVITY 1 FOR CURRENTS 2 FOR APPARENT
IMPEDANCES 3 FOR APPARENT ADMITTANCES:
```

Following this specification, the action taken by activity SCOP is dependent upon the suffix specified when the activity is run.

When activity SCOP is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated.

When activity SCOP is run with the ALL suffix, a report for all buses in the working case is produced in the requested order.

When activity SCOP is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which the results are to be printed. Following bus selection, the output is generated with buses ordered. Then the user is given the opportunity to select an additional group of buses.

```
 ACTIVITY? :
>>SCOP

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

 ENTER BRANCH QUANTITY DESIRED:
  0 TO EXIT ACTIVITY          1 FOR CURRENTS
  2 FOR APPARENT IMPEDANCES   3 FOR APPARENT ADMITTANCES:
>>2
 ENTER UP TO 20 BUS NUMBERS

>>101 102
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    FRI, MAY 16 2008  16:08
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                          APPARENT
 BASE CASE INCLUDING SEQUENCE DATA                                  IMPEDANCES

 SEQUENCE                 RE(V0)    IM(V0)    RE(V+)    IM(V+)    RE(V-)    IM(V-)   RE(3V0)   IM(3V0)
 PHASE                    RE(VA)    IM(VA)    RE(VB)    IM(VB)    RE(VC)    IM(VC)

    101 (P.U.)            0.0000    0.0000    0.9778    0.2905    0.0000    0.0000    0.0000    0.0000
 NUC-A         21.600     0.9778    0.2905   -0.2373   -0.9920   -0.7405    0.7015

 SEQUENCE                 RE(Z0)    IM(Z0)    RE(Z+)    IM(Z+)    RE(Z-)    IM(Z-)
 PHASE                    RE(ZA)    IM(ZA)    RE(ZB)    IM(ZB)    RE(ZC)    IM(ZC)

 MACHINE 1                0.0000    0.0000   -0.1371   -0.0148    0.0000    0.0000
                         -0.1371   -0.0148   -0.1371   -0.0148   -0.1371   -0.0148

 TO    151 CKT 1          0.0000    0.0000    0.1371    0.0148    0.0000    0.0000
 NUCPANT      500.00      0.1371    0.0148    0.1371    0.0148    0.1371    0.0148


 SEQUENCE                 RE(V0)    IM(V0)    RE(V+)    IM(V+)    RE(V-)    IM(V-)   RE(3V0)   IM(3V0)
 PHASE                    RE(VA)    IM(VA)    RE(VB)    IM(VB)    RE(VC)    IM(VC)

    102 (P.U.)            0.0000    0.0000    0.9778    0.2905    0.0000    0.0000    0.0000    0.0000
 NUC-B         21.600     0.9778    0.2905   -0.2373   -0.9920   -0.7405    0.7015

 SEQUENCE                 RE(Z0)    IM(Z0)    RE(Z+)    IM(Z+)    RE(Z-)    IM(Z-)
 PHASE                    RE(ZA)    IM(ZA)    RE(ZB)    IM(ZB)    RE(ZC)    IM(ZC)

 MACHINE 1                0.0000    0.0000   -0.1371   -0.0148    0.0000    0.0000
                         -0.1371   -0.0148   -0.1371   -0.0148   -0.1371   -0.0148

 TO    151 CKT 1          0.0000    0.0000    0.1371    0.0148    0.0000    0.0000
 NUCPANT      500.00      0.1371    0.0148    0.1371    0.0148    0.1371    0.0148
 ENTER UP TO 20 BUS NUMBERS

>>

 ENTER BRANCH QUANTITY DESIRED:
  0 TO EXIT ACTIVITY          1 FOR CURRENTS
  2 FOR APPARENT IMPEDANCES   3 FOR APPARENT ADMITTANCES:
>>0

 ACTIVITY? :
>>
```

Figure 12.3. Example: Running Activity SCOP

Additional Information
PSS® E Program Operation Manual, Multiple Unbalanced Fault Report

12.4. Calculating Automatic Sequencing Fault

ASCC

Requirements / Prerequisites	
Validly specified power flow case with sequence data appended to it. Reading Sequence Data for Fault Analysis	
Activity ID, Suffix	Suffix Function
ASCC,ALL	All buses
ASCC,AREA	Buses in specified area(s)
ASCC,ZONE	Buses in specified zone(s)
ASCC,OWNER	Buses for specified owner(s)
ASCC,KV	Buses for specified base kV range
ASCC,OPT	User selects options manually using an interactive dialog

The automatic sequencing short circuit calculation activity ASCC allows the user to apply a series of single faults at various locations in the working case. If sequence data has not been read into the working case by running activity RESQ, an appropriate error message is printed and activity ASCC ends.

The first data request for activity ASCC includes the following four data items, for which the default values are zeros:

```
ENTER : [1 FOR] , [ 1 FOR ] , [ 1 FOR ] , [1 FOR FLAT] [L - G] [LINE OUT]
[LINE END] [CONDITIONS]
```

If a 1 is entered for the first data item (1 FOR L - G), both a three phase fault and a phase A to ground fault are applied at each fault location. Otherwise, only three phase faults are applied.

If a 1 is entered for the second data item (1 FOR LINE OUT), the applied fault calculations are repeated at each home bus n additional times: once with each of its n connected branches placed out-of-service. In addition, if any branches have been designated in the Fault Control Data File as branches to be outaged for the current home bus, these fault cases are also calculated.

If a one is entered for the third data item (1 FOR LINE END), the applied fault calculations are repeated for each home bus at least n additional times: once (twice for any three-winding transformer that has all its windings in-service) with each of its n connected branches opened at the far end, with the fault located at the line end position. As in activity SCMU, a dummy bus, numbered 999999, is introduced at the opened end of the branch for each line end fault.

If a response of one is entered for the final data item (1 FOR FLAT CONDITIONS), classical fault analysis conditions are assumed for the network in the working case.

The original values of all data items in the working case are not modified by activity ASCC.

If the flat conditions option is not enabled, the level of network modeling and the bus boundary conditions used by activity ASCC as the pre-fault network condition are as specified in the working case at the time activity ASCC is run.

The user is then asked to specify the output format option:

```
ENTER OUTPUT OPTION CODE: 1 = FULL OUTPUT AT HOME BUS AND 'N' LEVELS AWAY 2 =
FULL OUTPUT AT HOME BUS, SUMMARY 'N' LEVELS AWAY 3 = FAULT CURRENT SUMMARY TABLE:
```

If an option code of 1 or 2 is entered, the user is asked to indicate the portion of the working case for which output is to be generated for each fault calculation:

```
ENTER NUMBER OF LEVELS BACK FOR CONTRIBUTIONS OUTPUT (0 FOR OUTPUT AT HOME
BUS ONLY):
```

A response of 0 restricts the output to the home bus for each fault. A response of 1 causes output for the home bus to be printed followed by the output for all buses connected to it for each fault case solution.

```
DO YOU REALLY WANT nn LEVELS?
```

Activity ASCC then asks the user to:

```
ENTER FILENAME FOR RELAY OUTPUT:
```

The user then enters either the name of an output file into which activity ASCC is to write a one-line summary of each fault applied, or *[Enter]* to suppress the summary output.

If the single-line-to-ground fault and one of the full output at the home bus options have been specified above, activity ASCC instructs the user to:

```
ENTER BRANCH QUANTITY OUTPUT CODE FOR LINE TO GROUND FAULTS (0 FOR A PHASE,
1 FOR 3*I0, 2 FOR BOTH):
```

This gives the user the option of specifying either A phase currents and apparent impedances, three times the zero sequence currents and zero sequence apparent impedances, or both sets of currents and impedances for reporting in the detailed report for the line to ground faults.

If the flat conditions option is not specified and unblocked dc lines or in-service FACTS devices are present in the working case, the user is asked to specify their treatment in the fault analysis solution:

```
ENTER DC LINE AND FACTS DEVICE OPTION: 0 FOR BLOCKED 1 FOR LOADING REPRESENTED:
```

If dc lines and FACTS devices are to be represented as load, the apparent ac system complex loads are converted to positive sequence constant admittance load at the buses at which these quantities are injected into the ac system during normal power flow work. In the negative and zero sequence networks, dc lines and FACTS devices are represented as open circuits. The specified option applies to *all* dc lines and FACTS devices in the working case. The default handling of these devices is to block.

Activity ASCC then builds and factorizes the sequence admittance matrices, reporting its progress in the same manner as activity SEQD.

If the line-to-ground fault option had been specified and the actual positive sequence impedance of any transformer in the working case differs from its nominal value, the dialog prompts the user to specify the treatment of the zero sequence impedance of all such transformers:

```
ENTER 1 TO APPLY TRANSFORMER IMPEDANCE CORRECTION TO ZERO SEQUENCE:
```

If a response of one is entered, the zero sequence impedance of each such transformer is scaled by the same factor as is its positive sequence impedance. Otherwise, all zero sequence transformer impedances are left at their nominal values. The same treatment applies to *all* transformers in the system that are not at nominal impedance.

Following the setup of the sequence matrices, activity ASCC instructs the user to:

```
ENTER FAULT CONTROL INPUT FILE NAME:
```

Through the use of the Fault Control Data File, various faulting and reporting options may be specified.

The action taken next by activity ASCC is dependent upon the suffix specified when the activity is run.

When activity ASCC is run without a suffix, the user is asked to select the buses that are to be home buses. Following each response to the bus specification request, the fault calculations for the designated home buses are calculated and reported in the order specified by the user input. The request for buses is then repeated.

When activity ASCC is run with the ALL suffix, fault calculations are calculated and reported for all buses in the working case in ascending numerical (using the *numbers* output option) or alphabetical (using the *names* option) order.

When activity ASCC is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed. Following bus selection, the fault solutions are calculated and reported. Then the user is given the opportunity to select an additional group of buses.

When full output (that is, an output option code of one is entered during the dialog of activity ASCC) at least one level away from the home bus is specified and output is directed to the user's terminal, the user is given a set of choices for the next display at the end of each screenfull of output. Specification from among two or more of the following, as appropriate, is provided:

- Go on to the next page at the current level.
- Skip to the next level.
- Skip to the next fault.
- End activity ASCC.

```
>>ASCC,ZONE

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

 ENTER :
 [1 FOR] , [ 1  FOR ] , [ 1  FOR ] , [1 FOR FLAT]
 [L - G]   [LINE OUT]   [LINE END]   [CONDITIONS]

>>1,1,1,0

 ENTER OUTPUT OPTION CODE:
  1 = FULL OUTPUT AT HOME BUS AND 'N' LEVELS AWAY
  2 = FULL OUTPUT AT HOME BUS, SUMMARY 'N' LEVELS AWAY
  3 = FAULT CURRENT SUMMARY TABLE:
>>2

 ENTER NUMBER OF LEVELS BACK FOR CONTRIBUTIONS OUTPUT
  (0 FOR OUTPUT AT HOME BUS ONLY):
>>0
 ENTER FILENAME FOR RELAY OUTPUT:
>>
 ENTER BRANCH QUANTITY OUTPUT CODE FOR LINE TO GROUND FAULTS
  (0 FOR A PHASE, 1 FOR 3*I0, 2 FOR BOTH):
>>2
 ENTER FAULT CONTROL INPUT FILE NAME:
>>
 ENTER UP TO 20 ZONE NUMBERS:

>>1
 DIAGONALS =      24  OFF-DIAGONALS =      41  MAX SIZE =      60
 BUS 999999 [DUMMY BUS          ] ISOLATED IN POS. SEQUENCE
      1 BUSES ISOLATED IN POS. SEQUENCE
 POS. SEQUENCE: DIAGONALS =      24  OFF-DIAGONALS =      41
 DIAGONALS =      24  OFF-DIAGONALS =      35  MAX SIZE =      48
 BUS     101 [NUC-A        21.600] ISOLATED IN ZERO SEQUENCE
 BUS     102 [NUC-B        21.600] ISOLATED IN ZERO SEQUENCE
 BUS     206 [URBGEN       18.000] ISOLATED IN ZERO SEQUENCE
 BUS     211 [HYDRO_G      20.000] ISOLATED IN ZERO SEQUENCE
 BUS    3011 [MINE_G       13.800] ISOLATED IN ZERO SEQUENCE
 BUS    3018 [CATDOG_G     13.800] ISOLATED IN ZERO SEQUENCE
 BUS 999999 [DUMMY BUS          ] ISOLATED IN ZERO SEQUENCE
      7 BUSES ISOLATED IN ZERO SEQUENCE
 ZERO SEQUENCE: DIAGONALS =      24  OFF-DIAGONALS =      35
 .                 PSS/E  SHORT  CIRCUIT  OUTPUT                     FRI, MAY 16 2008  16:35 .      HOME  BUS  IS  :       .
 .           PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                                      .    151 [NUCPANT      500.00] .
 .           BASE CASE INCLUDING SEQUENCE DATA                                               .   ZONE    1 [FIRST         ] .
 .                 ***  FAULTED  BUS  IS :     151 [NUCPANT     500.00]  ***                 .        0  LEVELS  AWAY     .
 .                          OUTPUT FOR ZONE 1 [FIRST       ]                                 .                            .

 AT BUS     151 [NUCPANT      500.00] AREA     1       (PU) V+:    0.0000+J 0.0000         (PU) VA:    0.0000+J 0.0000     V0:  -0.1349-J 0.0509
                                                                                                V+:    0.5643+J 0.1210     V-:  -0.4294-J 0.0701

 THEV. R, X, X/R: POSITIVE  0.00409  0.01765    4.318          NEGATIVE  0.00409  0.01765    4.318          ZERO  0.00017  0.00600   34.823

                                             T H R E E   P H A S E   F A U L T                  O N E   P H A S E   F A U L T
 X--------- FROM ----------X AREA CKT  I/Z      RE(I+)   IM(I+)   RE(Z+)   IM(Z+)  APP X/R      RE(IA)   IM(IA)   RE(ZA)   IM(ZA)  APP X/R
                                                                                                RE(3I0)  IM(3I0)  RE(Z0)   IM(Z0)  APP X/R
    101 [NUC-A        21.600]    1 1    PU/PU    9.8734 -11.0030   0.0003   0.0136   45.333     13.1694 -19.1672   0.0048   0.0237    4.964
                                                                                                11.8784 -29.5003   0.0000   0.0000    0.000

                 TOTAL  FAULT  CURRENT  (P.U.)  19.0391 -47.5461                                11.5851 -51.5335
 .                 PSS/E  SHORT  CIRCUIT  OUTPUT                     FRI, MAY 16 2008  16:35 .      HOME  BUS  IS  :       .
 .           PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                                      .    154 [DOWNTN       230.00] .
 .           BASE CASE INCLUDING SEQUENCE DATA                                               .   ZONE    1 [FIRST         ] .
 .                 ***  FAULTED  BUS  IS :     154 [DOWNTN      230.00]  ***                 .        0  LEVELS  AWAY     .
 .     ***  LINE  END :    154 [DOWNTN       230.00]  TO    3008 [CATDOG       230.00]  CIRCUIT 1    ***   .           LINE  END    .
 .                          OUTPUT FOR ZONE 1 [FIRST       ]                                 .                            .

 AT BUS     154 [DOWNTN       230.00] AREA     1       (PU) V+:    0.5230+J 0.0102         (PU) VA:    0.6312-J 0.0556     V0:  -0.1039+J 0.0035
                                                                                                V+:    0.8259-J 0.1116     V-:  -0.0909+J 0.0525

 THEV. R, X, X/R: POSITIVE  0.01242  0.03759    3.026          NEGATIVE  0.01242  0.03759    3.026          ZERO  0.00937  0.08361    8.920

                                             T H R E E   P H A S E   F A U L T                  O N E   P H A S E   F A U L T
 X--------- FROM ----------X AREA CKT  I/Z      RE(I+)   IM(I+)   RE(Z+)   IM(Z+)  APP X/R      RE(IA)   IM(IA)   RE(ZA)   IM(ZA)  APP X/R
                                                                                                RE(3I0)  IM(3I0)  RE(Z0)   IM(Z0)  APP X/R
    153 [MID230       230.00]    1 1    PU/PU    2.2734  -3.8731   0.0635   0.1478    2.328      2.3267  -2.9825   0.1301   0.1764    1.356
                                                                                                 0.0789  -1.1414  -0.0100  -0.1191   11.914
    153 [MID230       230.00]    1 2    PU/PU    1.8948  -3.2450   0.0771   0.1783    2.312      1.9347  -2.4857   0.1601   0.2131    1.331
                                                                                                 0.0589  -0.8784  -0.0122  -0.1523   12.438
    203 [EAST230      230.00]    2 1    PU/PU    1.2222  -2.6652   0.0780   0.2065    2.649      1.1569  -2.2340   0.1521   0.2666    1.753
                                                                                                 0.0595  -1.4735  -0.0055  -0.1089   19.823
    205 [SUB230       230.00]    2 1    PU/PU    3.9353 -16.5651   0.0069   0.0334    4.858      3.1696 -14.5622   0.0137   0.0461    3.368
                                                                                                 0.3888 -13.9471  -0.0004  -0.0123   33.210
   3008 [CATDOG       230.00]    5 1    PU/PU    0.0000   0.0000   0.0000   0.0000    0.000      0.0000   0.0000   0.0000   0.0000    0.000
                                                                                                 0.0000   0.0000   0.0000   0.0000    0.000
 999999 [DUMMY BUS    230.00]    0 1    PU/PU   -3.3307  23.2870   0.0000   0.0000    0.000     -0.6094  17.1287   0.0000   0.0000    0.000
                                                                                                -0.5860  17.4404   0.0094   0.0836    8.920
                           TO SHUNT   (P.U.)    5.9951  -3.0614                                  7.9785  -5.1357
                                                                                                 0.0000   0.0000
                 TOTAL  FAULT  CURRENT  (P.U.)   3.3322 -23.3655                                 0.5994 -17.2469
 ENTER UP TO 20 ZONE NUMBERS:

>>

 ACTIVITY? :
>>
```

Figure 12.4. Example: Running Activity ASCC, Partial Output

Additional Information
PSS® E Program Operation Manual, Calculating Automatic Sequencing Fault

12.5. Using Classical Fault Analysis Assumptions

FLAT

Requirements / Prerequisites	
Validly specified specified power flow case.	
Activity ID, Suffix	Suffix Function
FLAT,CL	Set up classical fault analysis network conditions
FLAT,IEC	Set up fault analysis network conditions for IEC 60909 short circuit current calculations by activity BKDY

The classical conditions network activity FLAT is used primarily to set up network conditions corresponding to classical fault analysis assumptions:

When activity FLAT is run without a suffix, it sets *all* bus voltages to one per unit at zero phase angle (1. +j0.). This *is not* identical in function to the flat start option that may be specified for the network solution activities of PSS®E, which causes swing (Type 3) bus voltage magnitudes to be set to their scheduled values, and all other bus voltage magnitudes to unity.

When activity FLAT is run with the CL suffix, the following data changes are implemented in the working case:

1. All bus voltages are set to one per unit at zero phase angle.
2. Constant power, current, and admittance loads are set to zero.
3. Generator power outputs are set to zero.
4. FACTS devices and dc lines are removed.
5. Transformer phase shift angles are set to zero. Any transformer impedance, which is a function of phase shift angle, is set to its nominal value.

Optional data changes are specified in response to the following instructions from activity FLAT:

```
ENTER 1 TO SET TAP RATIOS TO UNITY: ENTER 1 TO SET CHARGING TO ZERO: ENTER
1 TO SET SHUNTS TO ZERO IN POSITIVE SEQUENCE 2 TO SET SHUNT LOADS TO ZERO IN
ALL SEQUENCES:
```

When activity FLAT is run with the IEC suffix, the following data changes are implemented in the working case:

1. Voltage magnitudes are either left at their present values or are all set to a specified magnitude; phase angles are all set to zero.
2. Constant power, current, and admittance loads are set to zero.
3. Any machine for which active power is zero or negative has its active and reactive power outputs set to zero. All machines for which active power outputs are positive have their reactive power outputs either left unchanged or set such that a specified power factor is maintained.
4. FACTS devices and dc lines are removed.

5. Transformer phase shift angles are set to zero. Any transformer impedance, which is a function of phase shift angle, is set to its nominal value.

The optional data changes are specified in response to the following instructions from activity FLAT:

```
ENTER DESIRED VOLTAGE MAGNITUDE OR ZERO FOR PRESENT MAGNITUDES: ENTER 1 TO SET
TAP RATIOS TO UNITY: ENTER 1 TO SET CHARGING TO ZERO: ENTER 1 TO SET SHUNTS TO
ZERO IN POSITIVE SEQUENCE 2 TO SET SHUNT LOADS TO ZERO IN ALL SEQUENCES: ENTER
GENERATOR POWER FACTOR OR 0 TO LEAVE GENERATOR MVAR UNCHANGED:
```

When activity FLAT,IEC is followed by activity BKDY, short circuit currents in conformance with IEC standard 909 are calculated.

```
>>FLAT,CL
 ENTER 1 TO SET TAP RATIOS TO UNITY:
>>1
 ENTER 1 TO SET CHARGING TO ZERO:
>>1
 ENTER 1 TO SET SHUNTS TO ZERO IN POSITIVE SEQUENCE
       2 TO SET SHUNTS TO ZERO IN ALL SEQUENCES:
>>2

 SELECTED FLAT CHANGES IMPOSED

 ACTIVITY? :
>>
```

Figure 12.5. Example: Running Activity FLAT,CL

```
>>FLAT,IEC
 ENTER DESIRED VOLTAGE MAGNITUDE OR ZERO FOR PRESENT MAGNITUDES:
>>0
 ENTER 1 TO SET TAP RATIOS TO UNITY:
>>1
 ENTER 1 TO SET CHARGING TO ZERO:
>>1
 ENTER 1 TO SET SHUNTS TO ZERO IN POSITIVE SEQUENCE
       2 TO SET SHUNTS TO ZERO IN ALL SEQUENCES:
>>2
 ENTER GENERATOR POWER FACTOR OR 0 TO LEAVE GENERATOR MVAR UNCHANGED:
>>0

 SELECTED FLAT CHANGES IMPOSED

 ACTIVITY? :
>>
```

Figure 12.6. Example: Running Activity FLAT,IEC

Additional Information
PSS® E Program Operation Manual, Setting up Classical Fault Analysis Conditions

12.6. Calculating Circuit Breaker Interrupting Duty

BKDY

Requirements / Prerequisites	
Validly specified power flow case must reflect the pre-fault network condition. Converting Load Characteristics	
Activity ID, Suffix	Suffix Function
BKDY,ALL	All buses
BKDY,AREA	Buses in specified area(s)
BKDY,ZONE	Buses in specified zone(s)
BDKY,OWNER	Buses for specified owner(s)
BKDY,KV	Buses for specified base kV range
BKDY,OPT	User selects options manually using an interactive dialog
BKDY,FILE or BKDY,FI	Calculate using Fault Specification Data File

The circuit breaker duty analysis activity BKDY calculates and reports circuit breaker interrupting duty for three phase faults at all buses in a specified subsystem of the working case.

Fault locations and corresponding breaker operating times may be specified in a Fault Specification Data File. Machine parametric data required by activity BKDY is specified in a Breaker Duty Data File.

If activity CONG has not been run, activity BKDY prints an appropriate message and ends. Otherwise, if activity BKDY detects that activity ORDR is required to be run, a message is printed and activity ORDR is automatically run.

The dialog prompts the user to specify the time after fault application at which the decremented fault current is to be calculated:

```
ENTER DEFAULT FAULT DUTY TIME:
```

The user may then specify output options:

```
ENTER NUMBER OF LEVELS BACK FOR CONTRIBUTIONS OUTPUT 0 FOR CONTRIBUTIONS AT
FAULTED BUS ONLY -1 FOR FAULT CURRENTS ONLY:
```

Finally, the user is asked to designate the data input file to be used:

```
ENTER BREAKER DUTY DATA FILE NAME:
```

If no file is specified, activity BKDY ends. If a filename is entered, and the file does not exist or some other file system error occurs, an appropriate message is printed and the request for a data filename is repeated. Following the processing of the Breaker Duty Data File, the action taken by activity BKDY is dependent upon the suffix specified when the activity is run.

When activity BKDY is run without a suffix, the user is asked to select the buses that are to be faulted. Following each response to the bus specification request, the fault calculations for the designated buses are calculated and reported in the order specified by the user input. The request for buses is then repeated.

When activity BKDY is run with the ALL suffix, fault calculations are processed and reported for all buses in the working case in ascending numerical (using the *numbers* output option) or alphabetical (using the *names* option) order.

When activity BKDY is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed. Following bus selection, the fault solutions are calculated, and reported with buses ordered. Then the user is given the opportunity to select an additional group of buses.

In all of the above modes of operation, the fault duty time specified in the above dialog is used for calculating the decremented currents for each fault calculation.

When activity BKDY is run with the FILE suffix, fault specifications are specified using a Fault Specification Data File. Activity BKDY instructs the user to:

```
ENTER FAULT SPECIFICATION INPUT FILE NAME:
```

If no file is specified, activity BKDY ends. If a filename is entered, and the file does not exist or some other file system error occurs, an appropriate message is printed and the request for a data filename is repeated.

```
>>CONG

 GENERATOR CONVERSION COMPLETED

 ACTIVITY? :
>>BKDY,ALL

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                  1 FOR REPORT WINDOW
  2 FOR A FILE                     3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE     7 FOR PROGRESS WINDOW :
>>1

 ENTER DEFAULT FAULT DUTY TIME:
>>

 ENTER NUMBER OF LEVELS BACK FOR CONTRIBUTIONS OUTPUT
        0 FOR CONTRIBUTIONS AT FAULTED BUS ONLY
       -1 FOR FAULT CURRENTS ONLY:
>>-1
 ENTER BREAKER DUTY DATA FILE NAME:
>>savnw.bkd
 ORDERING NETWORK
 DIAGONALS =      23   OFF-DIAGONALS =      41   MAX SIZE =      60

     23 DIAGONAL AND      41 OFF-DIAGONAL ELEMENTS

 TERMINATED AFTER  20 ITERATIONS

 LARGEST MISMATCH:  141.91 MW 1767.56 MVAR  1773.25 MVA AT BUS    154 [DOWNTN      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:            4397.29 MVA

 TERMINATED AFTER  20 ITERATIONS

 LARGEST MISMATCH: -161.81 MW 2799.31 MVAR  2803.98 MVA AT BUS    154 [DOWNTN      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:            7368.81 MVA

 TERMINATED AFTER  20 ITERATIONS

 LARGEST MISMATCH:  141.91 MW 1767.56 MVAR  1773.25 MVA AT BUS    154 [DOWNTN      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:            4397.29 MVA

 TERMINATED AFTER  20 ITERATIONS

 LARGEST MISMATCH: -161.81 MW 2799.31 MVAR  2803.98 MVA AT BUS    154 [DOWNTN      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:            7368.81 MVA

 TERMINATED AFTER  20 ITERATIONS

 LARGEST MISMATCH:  -26.34 MW  655.84 MVAR   656.37 MVA AT BUS    205 [SUB230      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:            1716.10 MVA

 LARGEST MISMATCH:   -0.89 MW   10.41 MVAR    10.45 MVA AT BUS    205 [SUB230      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:              29.08 MVA

 TERMINATED AFTER  20 ITERATIONS

 LARGEST MISMATCH:   -0.30 MW    0.81 MVAR     0.87 MVA AT BUS    205 [SUB230      230.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:               2.29 MVA

 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 OUTPUT COMPLETED

 ACTIVITY? :
>>
```

Figure 12.7. Example: Running Activity BKDY, Partial Output

Additional Information
PSS® E Program Operation Manual, Calculating Circuit Breaker Interrupting Duty

12.7. Calculating pi-Equivalent, Single Transmission Line Unbalance

SPCB

Requirements / Prerequisites	
Validly specified power flow case with sequence data appended to it. It must be solved to an acceptable mismatch level with bus voltages corresponding to the pre-unbalance condition. The branch to have the unbalance must be removed from service. Reading Sequence Data for Fault Analysis	
Activity ID, Suffix	Suffix Function
SPCB	Activity runs without a suffix.

The separate pole circuit breaker activity SPCB calculates the positive sequence pi-equivalent corresponding to a single *transmission line* unbalance. This equivalent may subsequently be used in dynamic simulations to model the branch unbalance.

Prior to entering activity SPCB, the PSS®E working case and the SEQD temporary file must be set up in the form required by activity SPCB. The procedure is as follows:

1. Solve the working case in the pre-unbalance condition.
2. Place the transmission line, that is to be subjected to the unbalance, out-of-service by running activity CHNG.
3. Ensure that the fault analysis modeling option setting is placed in the normal three phase mode.
4. Apply activity SEQD.
5. Then apply activity SPCB.

At the start, if sequence data has not been read into the working case by running activity RESQ, or if activity SEQD had last been run with the fault analysis option setting at the two phase option, an appropriate error message is printed and activity SPCB ends.

The dialog prompts the user to specify the buses connected by the branch on which unbalances are to be applied.

Activity SPCB then calculates the columns of the three sequence impedance matrices corresponding to the specified buses. These are then tabulated in submatrix form.

The user is next asked to designate the circuit identifier of the branch on which the unbalance is to be imposed:

```
ENTER CIRCUIT ID OR -1 TO EXIT ACTIVITY:
```

where a response of -1 ends activity SPCB. An alarm message is generated for any error conditions (for example, no such branch in the working case), and the request for a circuit identifier is repeated.

The user then specifies the desired unbalance from the following menu of unbalances:

```
ENTER UNBALANCE CODE: 0 TO EXIT 1 FOR ONE PHASE OPEN 2 FOR TWO PHASES OPEN 3
FOR IN-LINE FAULT 4 FOR ONE BREAKER OPEN 5 FOR NO UNBALANCE:
```

Upon specification of the type of unbalance, a dialog is entered in which the user describes the unbalance. The positive sequence pi-equivalent of the branch unbalance is calculated, the results printed, and the request for an unbalance code is repeated.

```
ACTIVITY? spcb ENTER OUTPUT DEVICE CODE: 0 FOR NO OUTPUT 1 FOR REPORT WINDOW,
WITH PAGE BREAKS 2 FOR A FILE 3 FOR \\swcschfps01\SCH-3S-ps 4 FOR PRINTER-2
5 FOR REPORT WINDOW, WITH NO PAGE BREAKS 6 FOR ALTERNATE SPOOL DEVICE 7 FOR
PROGRESS WINDOW (WITH PAGE BREAKS): 7 ENTER FROM BUS, TO BUS NUMBERS OF BRANCH
WITH UNBALANCE: 153 154 ZERO SEQUENCE THEVENIN IMPEDANCE SUBMATRIX: BUS 153
[MID230 230.00] 154 [DOWNTN 230.00] 153 ( 0.00393, 0.03925) ( 0.00061, 0.00947)
154 ( 0.00061, 0.00947) ( 0.00103, 0.01658) POS. SEQUENCE THEVENIN IMPEDANCE
SUBMATRIX: BUS 153 [MID230 230.00] 154 [DOWNTN 230.00] 153 ( 0.00623, 0.01951)
( 0.00604, 0.00938) 154 ( 0.00604, 0.00938) ( 0.00761, 0.01364) NEG. SEQUENCE
THEVENIN IMPEDANCE SUBMATRIX: BUS 153 [MID230 230.00] 154 [DOWNTN 230.00] 153
( 0.00623, 0.01951) ( 0.00604, 0.00938) 154 ( 0.00604, 0.00938) ( 0.00761,
0.01364) FROM BUS 153 [MID230 230.00] TO BUS 154 [DOWNTN 230.00] ENTER CIRCUIT
ID OR -1 TO EXIT ACTIVITY: 1 ENTER UNBALANCE CODE: 0 TO EXIT 1 FOR ONE PHASE
OPEN 2 FOR TWO PHASES OPEN 3 FOR IN-LINE FAULT 4 FOR ONE BREAKER OPEN 5 FOR NO
UNBALANCE: 3 ENTER TYPE OF FAULT: 1 FOR LINE-GROUND 2 FOR LINE-LINE-GROUND 3
FOR THREE PHASE: 1 ENTER IMPEDANCE TO GROUND (R,X): 0 0 ENTER FAULT LOCATION
AS FRACTION OF LINE FROM BUS 153 [MID230 230.00]: .4
```

Sample Terminal Session of Activity SPCB

```
PI EQUIVALENT Y MATRIX IS: ( 3.1070, -25.9629) ( -1.9937, 19.2435) ( -1.9937,
19.2435) ( 2.7359, -23.7064) TO SIMULATE: ONE PHASE GROUNDED WITH IMPEDANCE=
0.0000 +J 0.0000 40.0 PERCENT OF WAY DOWN LINE FROM 153 [MID230 230.00] FOR
BRANCH FROM BUS 153 [MID230 230.00] TO BUS 154 [DOWNTN 230.00] CIRCUIT 1 USE
EQUIVALENT R+JX= ( 0.00533, 0.05141) B= 0.0 AT BUS 153 [MID230 230.00] USE
LINE CONNECTED SHUNT= ( 1.11328, -6.71941) AT BUS 154 [DOWNTN 230.00] USE LINE
CONNECTED SHUNT= ( 0.74219, -4.46294) ENTER UNBALANCE CODE: 0 TO EXIT 1 FOR
ONE PHASE OPEN 2 FOR TWO PHASES OPEN 3 FOR IN-LINE FAULT 4 FOR ONE BREAKER
OPEN 5 FOR NO UNBALANCE: 0 ACTIVITY?
```

Sample Terminal Session of Activity SPCB

Additional Information
PSS®E Program Operation Manual, Calculating pi-Equivalent, Single Transmission Line Unbalance

Chapter 13
Power Flow Reports

13.1. Area and Zone-Based Summaries

13.1.1. Area-to-Area Interchange

INTA

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
INTA,AREA	Interchange between specified areas and all other areas

The area interchange summary activity INTA summarizes tie flows between an interchange area and all other areas in the working case.

When activity INTA is run without a suffix, the report is generated and activity INTA ends.

When activity INTA is run with the AREA suffix, the user is given the ability to restrict the report to interchange from specified areas. The user designates the areas to be reported. Following the specification of one or more areas, tie flow totals from the specified areas to all other areas are printed in ascending from area number order. The user may then designate additional areas for reporting; a response of zero to this request ends activity INTA.

```
>>INTA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008  10:16
 PSS(TM)E SAMPLE CASE                                                   AREA
 ALL DATA CATEGORIES WITH SEQUENCE DATA                            INTERCHANGE

       TO AREA:     1     2     3     4     5     6
 FROM AREA     *------------------------------------
         1    *        1207 -2858        -894
 CENTRAL      *        -147 -2007         298
              *------------------------------------
         2    * -1207                 0
 EAST         *   147                 0
              *------------------------------------
         3    *  2858
 CENTRAL_DC   *  2007
              *------------------------------------
         4    *           0                       0
 EAST_COGEN1  *           0                       0
              *------------------------------------
         5    *   894
 WEST         *  -298
              *------------------------------------
         6    *                       0
 EAST_COGEN2  *                       0
              *------------------------------------

 ACTIVITY? :
>>
```

Figure 13.1. Example: Running Activity INTA

Additional Information
PSS® E Program Operation Manual, Summarizing Area-to-Area Interchange

13.1.2. Zone-to-Zone Interchange

INTZ

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
INTZ,ZONE	Interchange between specified zones and all other zones

The zone interchange summary activity INTZ summarizes tie flows between each zone and all other zones in the working case.

When activity INTZ is run without a suffix, the report is generated and activity INTZ ends.

When activity INTZ is run with the ZONE suffix, the user is given the ability to restrict the report to interchange from specified zones. Following the specification of one or more zones, tie flow totals from the specified zones to all other zones are printed in ascending from zone number order. The user may then designate additional zones for reporting; a response of zero to this request ends activity INTZ.

```
 ACTIVITY? :
>>INTZ

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008  10:17
 PSS(TM)E SAMPLE CASE                                                   ZONE
 ALL DATA CATEGORIES WITH SEQUENCE DATA                             INTERCHANGE

       TO ZONE:     1     2     3     4     5     6     7     8     9
 FROM ZONE     *-------------------------------------------------------
         1     *          760                            594
 NORTH_A1      *           64                            -25
               *-------------------------------------------------------
         2     *  -760          471   634 -2858 -1260  -474   904
 MID_A1_A2_A5  *   -64          585  -195 -2007   258    90   149
               *-------------------------------------------------------
         3     *         -471        -929                     182
 DISCNT_IN_A1  *         -585          60                    -280
               *-------------------------------------------------------
         4     *         -634   929                                   0
 SOUTH_A1_A5   *          195   -60                                   0
               *-------------------------------------------------------
         5     *         2858
 ALL_A3        *         2007
               *-------------------------------------------------------
         6     *         1260
 NORTH_A5      *         -258
               *-------------------------------------------------------
         7     *  -594    474                                 782
 NORTH_A2      *    25    -90                                 353
               *-------------------------------------------------------
         8     *         -904  -182                    -782
 SOUTH_A2      *         -149   280                    -353
               *-------------------------------------------------------
         9     *                        0
 ALL_A4_A6     *                        0
               *-------------------------------------------------------

 ACTIVITY? :
>>
```

Figure 13.2. Example: Running Activity INTZ

Additional Information
PSS® E Program Operation Manual, Summarizing Zone-to-Zone Interchange

13.1.3. Loadings on Ties from Interchange Areas

TIES

Requirements / Prerequisites
Validly specified power flow case solved to an acceptable mismatch tolerance.

Activity ID, Suffix	Suffix Function
TIES,AREA	List tie summary for specified area(s)

The tie line summary activity TIES tabulates the flows on all area ties, with tie flows grouped by area. Interchange between pairs of areas and net interchange from each area are also listed.

When activity TIES is run without a suffix, the report is generated.

When activity TIES is run with the AREA suffix, the user is given the ability to restrict the report to tie flows from specified areas. Following the specification of one or more areas, tie flows from the specified areas to all other areas are printed in ascending from area number order. The user may then designate additional areas for reporting; a response of zero to this request ends activity TIES.

```
>>TIES,AREA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7
 ENTER UP TO 20 AREA NUMBERS:

>>5
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008   8:48
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                          AREA TIE LINE
 BASE CASE INCLUDING SEQUENCE DATA                                     INTERCHANGE

 FROM AREA    5   WORLD

   TO AREA    1   FLAPCO
   X---- FROM AREA BUS -----X   X----- TO AREA BUS -----X
     BUS# X-- NAME --X BASKV     BUS# X-- NAME --X BASKV  CKT      MW      MVAR
     3004 WEST         500.00     152 MID500       500.00*  1    -138.2    138.3
     3006 UPTOWN       230.00     153 MID230       230.00*  1     -78.6     16.3
     3008 CATDOG       230.00     154 DOWNTN       230.00*  1      69.0     88.4
   TOTAL FROM AREA    5 TO AREA    1                                             -147.9     242.9
                                                                                ---------  ---------
 TOTAL FROM AREA    5   WORLD                                                    -147.9     242.9
 ENTER UP TO 20 AREA NUMBERS:

>>
```

Figure 13.3. Example: Running Activity TIES,AREA

Additional Information
PSS® E Program Operation Manual, Summarizing Loadings on Ties from Interchange Areas

13.1.4. Loadings on Ties from Zones

TIEZ

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
TIEZ,ZONE	List tie summary for specified zone(s)

The zone tie line summary activity TIEZ tabulates the flows on all zone ties, with tie flows grouped by zone. Interchange between pairs of zones and net interchange from each zone are also listed.

When activity TIEZ is run without a suffix, the report is generated.

When activity TIEZ is run with the ZONE suffix, the user is given the ability to restrict the report to tie flows from specified zones. Following the specification of one or more zones, tie flows from the specified zones to all other zones are printed in ascending from zone number order. The user may then designate additional zones for reporting; a response of zero to this request ends activity TIEZ.

```
>>TIEZ,ZONE
 ENTER UP TO 20 ZONE NUMBERS:

>>77
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008   8:54
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                         ZONE TIE LINE
 BASE CASE INCLUDING SEQUENCE DATA                                    INTERCHANGE

 FROM ZONE   77   PLANT

   TO ZONE    1   FIRST
   X---- FROM ZONE BUS ----X   X----- TO ZONE BUS -----X
     BUS# X-- NAME --X BASKV     BUS# X-- NAME --X BASKV  CKT      MW       MVAR
      101 NUC-A        21.600      151 NUCPANT     500.00*  1     748.3      6.8
      102 NUC-B        21.600      151 NUCPANT     500.00*  1     748.3      6.8
   TOTAL FROM ZONE    77 TO ZONE    1                                          1496.7      13.6
                                                                            ---------  ---------
 TOTAL FROM ZONE    77   PLANT                                                 1496.7      13.6
 ENTER UP TO 20 ZONE NUMBERS:

>>

 ACTIVITY? :
>>
```

Figure 13.4. Example: Running Activity TIEZ,ZONE

Additional Information
PSS® E Program Operation Manual, Summarizing Loadings on Ties from Zones

13.2. Area,Owner and Zone Totals

13.2.1. Area Totals

AREA

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
AREA,AREA	Totals for specified area(s)

The area summary activity AREA provides a tabulation by interchange area of the desired area net interchange, along with area totals of:

- Generation
- Load
- Bus connected shunt elements, including fixed shunts, switched shunts and shunt elements of FACTS devices
- Line connected shunt elements, including magnetizing admittance of transformers
- Line charging
- Net interchange
- Losses

When activity AREA is run without a suffix, the report is generated.

When activity AREA is run with the AREA suffix, the user is given the ability to restrict the report to specified areas. Following the specification of one or more areas, totals for the specified areas are printed in ascending area number order, followed by the sums of the totals of those areas. The user may then designate additional areas for reporting; a response of zero to this request ends activity AREA.

An individual in-service bus load is included in the load totals of the area to which the load is assigned; this area need not be the same area in which the bus at which the load is connected exists.

```
 ACTIVITY? :
>>AREA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE 7 FOR PROGRESS WINDOW :
>>7
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008   9:54
 PSS(TM)E SAMPLE CASE                                            AREA TOTALS
 ALL DATA CATEGORIES WITH SEQUENCE DATA                           IN MW/MVAR

                   FROM       TO    TO BUS  TO LINE      FROM       TO             DESIRED
 X-- AREA --X GENERATION    LOAD     SHUNT    SHUNT  CHARGING  NET INT    LOSSES   NET INT

    1              1410.8   4219.1     15.4     22.8       0.0  -2545.1      37.8   -2800.0
 CENTRAL            240.3   1799.0    483.3    180.5    1192.1  -1855.4     522.2

    2              1406.1   3160.0     18.1      0.6       0.0  -1207.0      33.7   -1600.0
 EAST               372.6   1106.0   -771.7      2.2     807.7    146.7     511.7

    3              2990.6      0.0      0.0      0.7       0.0   2858.5       6.7    2900.0
 CENTRAL_DC         898.6      0.0  -3493.9      4.6       0.0   2007.0     305.3

    4               321.0      0.0      0.0      0.0       0.0      0.0       0.0     300.0
 EAST_COGEN1        142.3      0.0      0.0      0.0       0.0      0.0       0.0

    5              1798.4    513.1      0.0      0.4       0.0    893.6      48.2     900.0
 WEST               138.9    205.9     -1.4      3.7      52.7   -298.3     535.3

    6               321.0      0.0      0.0      0.0       0.0      0.0       0.0     300.0
 EAST_COGEN2        142.3      0.0      0.0      0.0       0.0      0.0       0.0

 TOTALS            8247.9   7892.2     33.4     24.4       0.0      0.0     126.4       0.0
                   1935.1   3110.9  -3783.8    191.0    2052.5      0.0    1874.6

 ACTIVITY? :
>>
```

Figure 13.5. Example: Running Activity AREA

Additional Information
PSS® E Program Operation Manual, Summarizing Area Totals

13.2.2. Owner Totals

OWNR

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
OWNR,OWNER	Report restricted to specified owners

The owner summary activity OWNR provides a tabulation by owner of the following owner totals:

- Generation
- Load

- Bus connected shunt elements, including fixed shunts, switched shunts and shunt elements of FACTS devices
- Line connected shunt elements, including magnetizing admittance of transformers
- Line charging
- Losses

When activity OWNR is run without a suffix, the report is generated. The output block for each owner and for system totals consists of two lines: the first contains active power totals and the second the reactive power totals. The owner number and name is printed for each owner block.

When activity OWNR is run with the OWNER suffix, the user is given the ability to restrict the report to specified owners. Following the specification of one or more owners, totals for the specified owners are printed in ascending owner number order, followed by the sums of the totals of those owners. The user may then designate additional owners for reporting; a response of zero to this request ends activity OWNR.

An individual in-service bus load is included in the load totals of the owner to which the load is assigned; this owner need not be the same owner in which the bus at which the load is connected exists. Similarly, generation, ac branch, VSC dc line, and FACTS device quantities are assigned to the designated machine, branch, VSC dc line, and FACTS device owners, respectively.

```
ACTIVITY? :
>>OWNR

ENTER OUTPUT DEVICE CODE:
 0 FOR NO OUTPUT                 1 FOR REPORT WINDOW
 2 FOR A FILE                    3 FOR DEFAULT PRINTER
 6 FOR ALTERNATE SPOOL DEVICE    7 FOR PROGRESS WINDOW :
>>7
    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008   9:03
PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                         OWNER TOTALS
BASE CASE INCLUDING SEQUENCE DATA                                    IN MW/MVAR

                FROM      TO    TO BUS  TO LINE    FROM
X- OWNER --X GENERATION  LOAD    SHUNT    SHUNT CHARGING   LOSSES

   1            499.9   800.0     0.0      0.0      0.0     26.3
TRAN 1           54.1   550.0   349.9      0.0   1270.8    506.5

   2            560.0  1500.0     0.0      0.0      0.0      6.2
TRAN 2          247.1   850.0  -316.9      0.0     14.7    264.9

   5            124.0   500.0     0.0      0.0      0.0      5.4
TRAN 5           67.6   200.0     0.0      0.0     57.4     53.4

  11           1019.9     0.0     0.0      0.0      0.0      0.0
GEN 1           116.3     0.0     0.0      0.0      0.0      0.0

  22            899.7     0.0     0.0      0.0      0.0     19.5
GEN 2           394.7     0.0  -324.5      0.0    464.9    257.8

  55            155.0     0.0     0.0      0.0      0.0      0.2
GEN 5            84.5     0.0     0.0      0.0      0.0     24.6

 100              0.0   400.0     0.0      0.0      0.0      0.9
NO BUSES          0.0   350.0     0.0      0.0      2.3      8.5

TOTALS         3258.7  3200.0     0.0      0.0      0.0     58.7
                964.2  1950.0  -291.5      0.0   1810.1   1115.7

ACTIVITY? :
>>
```

Figure 13.6. Example: Running Activity OWNR

Additional Information
PSS® E Program Operation Manual, Summarizing Owner Totals

13.2.3. Zone Totals

ZONE

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
ZONE,ZONE	Tabulate specified zone(s)

The zone summary activity ZONE provides a tabulation by zones of the following zone totals:

- Generation
- Load
- Bus connected shunt elements, including fixed shunts, switched shunts and shunt elements of FACTS devices
- Line connected shunt elements, including magnetizing admittance of transformers
- Line charging
- Net interchange
- Losses

When activity ZONE is run without a suffix, the report is generated.

When activity ZONE is run with the ZONE suffix, the user is given the ability to restrict the report to specified zones. Following the specification of one or more zones, totals for the specified zones are printed in ascending zone number order, followed by the sums of the totals of those zones. The user may then designate additional zones for reporting; a response of zero to this request ends activity ZONE.

An individual in-service bus load is included in the load totals of the zone to which the load is assigned; this zone need not be the same zone in which the bus at which the load is connected exists.

```
 ACTIVITY? :
>>ZONE

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE 7 FOR PROGRESS WINDOW :
>>7
      PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008   9:55
 PSS(TM)E SAMPLE CASE                                                ZONE TOTALS
 ALL DATA CATEGORIES WITH SEQUENCE DATA                               IN MW/MVAR

                   FROM      TO     TO BUS  TO LINE     FROM      TO
 X-- ZONE --X GENERATION  LOAD     SHUNT    SHUNT CHARGING  NET INT    LOSSES

    1             1400.0   4219.1     11.2     22.8      0.0   1353.4     12.6
 NORTH_A1          238.1   1799.0    602.6    180.5    853.0     39.0    268.8

    2                0.0   3160.0      1.8      0.2      0.0  -3343.3     13.1
 MID_A1_A2_A5        0.0    935.0    199.4      1.9    379.6  -1185.4    125.8

    3               10.8      0.0      2.4      0.0      0.0  -1218.4     16.1
 DISCNT_IN_A1        2.2      0.0   -318.7      0.0     64.1   -805.1    167.8

    4              500.0     13.1      0.0      0.2      0.0    295.3      7.5
 SOUTH_A1_A5        -0.8    176.9      0.0      1.8     21.8    135.6     90.4

    5             2990.6    500.0      0.0      0.7      0.0   2858.5      6.7
 ALL_A3            898.6    200.0  -3493.9      4.6      0.0   2007.0    305.3

    6             1298.4      0.0      0.0      0.0      0.0   1259.8     38.5
 NORTH_A5          139.7      0.0     -1.4      0.0     27.6   -257.7    426.0

    7              600.0      0.0     15.3      0.3      0.0    662.9     21.7
 NORTH_A2           86.7      0.0   -421.7      2.0    458.4    287.9    301.4

    8              806.0      0.0      2.8      0.3      0.0  -1868.1     10.2
 SOUTH_A2          285.9      0.0   -350.0      0.2    248.0   -221.4    189.2

    9              642.0      0.0      0.0      0.0      0.0      0.0      0.0
 ALL_A4_A6         284.6      0.0      0.0      0.0      0.0      0.0      0.0

 TOTALS           8247.9   7892.2     33.4     24.4      0.0      0.0    126.4
                  1935.1   3110.9  -3783.8    191.0   2052.5      0.0   1874.6

 ACTIVITY? :
>>
```

Figure 13.7. Example: Running Activity ZONE

Additional Information
PSS® E Program Operation Manual, Summarizing Zone Totals

13.3. Bus-Based Reports

13.3.1. Standard Power Flow Solution Report

POUT

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
POUT,ALL	Power flow output for all buses in working case
POUT,AREA	Power flow output for all buses in specified area(s)
POUT,ZONE	Power flow output for all buses in specified zone(s)
POUT,OWNER	Power flow output for all buses of specified owner(s)
POUT,KV	Power flow output for all buses of specified base kV range
POUT,OPT	User selects options manually using an interactive dialog

The power flow output activity POUT prints power flow solution output for the working case. The data tabulated for each bus printed includes bus voltage and phase angle, generator power output, constant power, current and admittance loads, bus shunts, and flows into all connected branches and FACTS devices. Bus mismatch is printed for any bus where it exceeds 0.5 MVA or kVA, according to the power output option in effect. For buses where voltage magnitude is less than 10% (such as faulted buses), the quantity FAULT MVA is printed.

The action taken by activity POUT is dependent upon the suffix specified when the activity is run.

When activity POUT is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated.

When activity POUT is run with the ALL suffix, a report for all buses in the working case is produced in the requested order.

When activity POUT is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. The user is then given the opportunity to select an additional group of buses.

The star point buses of three-winding transformers are not reported. When the multi-section line reporting option is enabled, the interior dummy buses of multi-section line groupings are not reported.

```
 ACTIVITY? :
>>POUT

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7
 ENTER UP TO 20 BUS NUMBERS

>>151
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008   9:44
 PSS(TM)E SAMPLE CASE                                                     RATING   %MVA FOR TRANSFORMERS
 ALL DATA CATEGORIES WITH SEQUENCE DATA                                    SET A   % I  FOR NON-TRANSFORMER BRANCHES

 BUS     151 NUCPLNT      500.00 CKT      MW     MVAR     MVA   % 1.0022PU  -13.57  X--- LOSSES ---X X---- AREA -----X X---- ZONE -----X    151
                                                                  501.10KV               MW     MVAR    1 CENTRAL          1 NORTH_A1
  TO SHUNT                               11.2    602.6    602.7
  TO     101 NUC-A        21.600  T1  -732.0    -74.3    735.8  61 1.0000UN               0.49   40.87    1 CENTRAL          1 NORTH_A1
  TO     102 NUC-B        21.600  T2  -649.0    -77.0    653.6  54 1.0000UN               0.51   32.32    1 CENTRAL          1 NORTH_A1
  TO     152 MID500       500.00  1     386.4  -229.4    449.4  37                        4.01   70.88    1 CENTRAL          2 MID_A1_A2_A5
  TO     152 MID500       500.00  2     385.9  -229.6    449.0  37                        4.00   70.72    1 CENTRAL          2 MID_A1_A2_A5
  TO     201 HYDRO        500.00  1     597.5     7.5    597.6  49                        3.60   54.01    2 EAST             7 NORTH_A2
 ENTER UP TO 20 BUS NUMBERS

>>

 ACTIVITY? :
>>
```

Figure 13.8. Example: Running Activity POUT

Additional Information
PSS® E Program Operation Manual, Producing a Standard Power Flow Solution Report

13.3.2. Wide-Format Power Flow Solution Report

LOUT

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
LOUT,ALL	Power flow output for all buses in entire working case
LOUT,AREA	Power flow output for all buses in specified area(s)
LOUT,ZONE	Power flow output for all buses in specified zone(s)
LOUT,OWNER	Power flow output for all buses for specified owner(s)
LOUT,KV	Power flow output for all buses in specified base kV range
LOUT,OPT	User selects options manually using an interactive dialog

The power flow output activity LOUT prints power flow solution output for the working case. The data tabulated for each bus printed includes bus voltage and phase angle, generator power output, loads, bus shunt elements, and flows into all connected branches and FACTS devices. Bus mismatch is printed for any bus where it exceeds 0.5 MVA or kVA, according to the power output option in effect. For buses where the voltage magnitude is less than 10% (such as faulted buses), the quantity FAULT MVA is printed.

The action taken by activity LOUT is dependent upon the suffix specified when the activity is run.

When activity LOUT is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated.

When activity LOUT is run with the ALL suffix, a report for all buses in the working case is produced in the requested order.

When activity LOUT is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. Following bus selection, the output is generated. The user is then given the opportunity to select an additional group of buses.

The star point buses of three-winding transformers are not reported. When the multi-section line reporting option is enabled, the interior dummy buses of multi-section line groupings are not reported.

Activity LOUT formats its report in traditional power flow output style, with bus quantities on the left side of the page and branch information shown on the right side.

Example: Running Activity LOUT

Additional Information
PSS® E Program Operation Manual, Producing a Wide-Format Power Flow Solution Report

13.3.3. Producing a Wide Format Power Flow Solution Report with Branch Current Loadings

LAMP

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
LAMP,ALL	Power flow output, entire working case
LAMP,AREA	Power flow output, specified area(s)
LAMP,ZONE	Power flow output, specified zone(s)
LAMP,OWNER	Power flow output, specified owner(s)
LAMP,KV	Power flow output, specified base kV range
LAMP,OPT	User selects options manually using an interactive dialog

The power flow output activity LAMP prints power flow solution output for the working case. The data tabulated for each bus printed includes bus voltage and phase angle, generator power output, loads, bus shunt elements, flows into all connected branches and FACTS devices, and branch current loadings in amps. Bus mismatch is printed for any bus where it exceeds 0.5 MVA or kVA, according to the power output option in effect. For buses where voltage magnitude is less than 10% (such as faulted buses), the quantity FAULT MVA is printed.

The action taken by activity LAMP is dependent upon the suffix specified when the activity is run.

When activity LAMP is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated.

When activity LAMP is run with the ALL suffix, a report for all buses in the working case is produced in the requested order.

When activity LAMP is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. The user is then given the opportunity to select an additional group of buses.

The star point buses of three-winding transformers are not reported. When the multi-section line reporting option is enabled, the interior dummy buses of multi-section line groupings are not reported.

Activity LAMP formats its report in traditional power flow output style, with bus quantities on the left side of the page and branch data shown on the right side.

```
 ACTIVITY? :
>>LAMP

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7
 ENTER UP TO 20 BUS NUMBERS

>>152
                         PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008  10:35
              PSS(TM)E SAMPLE CASE                                            %MVA FOR TRANSFORMERS
              ALL DATA CATEGORIES WITH SEQUENCE DATA                          % I  FOR NON-TRANSFORMER BRANCHES

 X------- FROM BUS ------X AREA  VOLT          GEN    LOAD    SHUNT  X---------- TO BUS ----------X                         TRANSFORMER          RATING
   BUS# X-- NAME --X BASKV ZONE  PU/KV   ANGLE  MW/MVAR MW/MVAR MW/MVAR   BUS# X-- NAME --X BASKV AREA CKT    MW     MVAR   RATIO    ANGLE   AMPS   %  SET A

    152 MID500       500.00    1 1.0438  -23.4     0.0  3019.1     1.8 ---------------------------------------------------------------------------------
                               2 521.88            0.0  1119.0   199.4    151 NUCPLNT      500.00    1  1  -380.2  -24.7                        422   30  1386A
                                                                         151 NUCPLNT      500.00    1  2  -379.3  -39.7                        422   30  1391A
                                                                         153 MID230       230.00    1  T3   470.9  585.0 0.950LO               831   94   800M
                                                                         202 EAST500      500.00    2  1   431.5  158.6                        509   36  1394A
                                                                        3004 WEST         500.00    5  1  -305.4    9.2                        338
                                                                        3021 WDUM         18.000    3  T4-1426.2-1101.7 1.100HI               1994 120  1500M
                                                                        3022 EDUM         18.000    3  T5-1432.3 -905.3 1.100HI               1874 112  1510M
 ENTER UP TO 20 BUS NUMBERS

>>

 ACTIVITY? :
>>
```

Figure 13.9. Example: Running Activity LAMP

Additional Information
PSS®E Program Operation Manual, Producing a Wide-Format Power Flow Solution Report in Amps

13.3.4. Summary of Subsystem Conditions

SUBS

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
SUBS,ALL	Summarize data for entire working case
SUBS,AREA	Summarize data for specified area(s)
SUBS,ZONE	Summarize data for specified zone(s)
SUBS,OWNER	Summarize data for specified owner(s)
SUBS,KV	Summarize data for specified base kV range
SUBS,OPT	User selects options manually using an interactive dialog

The subsystem reporting activity SUBS summarizes conditions in the working case by tabulating the following for a specified subsystem:

- Conditions at each system swing (Type 3) bus.
- Conditions at each area slack generator bus.

- The number of components.
- Generation, load, shunt and charging totals.
- Loss, line shunt, and charging totals by voltage level.

The action taken by activity SUBS is dependent upon the suffix specified when the activity is run.

When activity SUBS is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated.

When activity SUBS is run with the ALL suffix, the entire working case is summarized. Losses on a dc link of a multi-terminal line are included in the loss totals. Similarly, losses through the grounding resistance of the second dc bus of the converters of a multi-terminal line are included in the loss totals.

When activity SUBS is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. The output is generated and the user is given the opportunity to select an additional group of buses.

```
>>SUBS

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7
 ENTER UP TO 20 BUS NUMBERS

>>152
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008  10:25
 PSS(TM)E SAMPLE CASE
 ALL DATA CATEGORIES WITH SEQUENCE DATA

 ******************  SUMMARY FOR THE SUBSYSTEM SPECIFIED BY  ******************

 BUSES:
    152 [MID500      500.00]

 ******************************************************************************

      1 BUSES        0 PLANTS        0 MACHINES         1 FIXED SHUNTS      1 SWITCHED SHUNTS
      1 LOADS        1 BRANCHES      0 TRANSFORMERS     0 DC LINES          0 FACTS DEVICES

                       X------ ACTUAL ------X X----- NOMINAL ------X
                              MW        MVAR        MW        MVAR
 FROM GENERATION              0.0        0.0        0.0        0.0
 TO CONSTANT POWER LOAD    1200.0      360.0     1200.0      360.0
 TO CONSTANT CURRENT        906.3      376.3      868.3      360.5
 TO CONSTANT ADMITTANCE     912.7      382.8      837.8      351.3
 TO BUS SHUNT                 1.8      199.4        1.6      183.0
 TO FACTS DEVICE SHUNT        0.0        0.0        0.0        0.0
 TO LINE SHUNT                0.0        0.0        0.0        0.0
 FROM LINE CHARGING           0.0      264.9        0.0      250.0

  VOLTAGE      X----- LOSSES -----X   X-- LINE SHUNTS --X   CHARGING
  LEVEL BRANCHES     MW       MVAR        MW        MVAR       MVAR
  500.0       1     3.15     31.50       0.0        0.0      264.9
  TOTAL       1     3.15     31.50       0.0        0.0      264.9
 ENTER UP TO 20 BUS NUMBERS

>>

 ACTIVITY? :
>>
```

Figure 13.10. Example: Running Activity SUBS

Additional Information
PSS® E Program Operation Manual, Summarizing Subsystem Conditions

13.4. Limit-Checking Reports

13.4.1. Machine Reactive Capability

GCAP

Requirements / Prerequisites	
Validly specified power flow case. Machine Capability Data File (*.gcp)	
Activity ID, Suffix	Suffix Function
GCAP,ALL	All buses
GCAP,AREA	Buses in specified area(s)
GCAP,ZONE	Buses in specified zone(s)
GCAP,OWNER	Buses for specified owner(s)
GCAP,KV	Buses for specified base kV range
GCAP,OPT	User selects options manually using an interactive dialog

The machine capability curve checking activity GCAP reads a data file containing capability curve data and prints a report of machine loading and limit data. Optionally, machine reactive power limits in the working case may be updated.

Activity GCAP instructs the user to:

```
ENTER CAPABILITY CURVE DATA FILE NAME:
```

The user then enters the name of the appropriate Machine Capability Curve Data File or a zero to end activity GCAP with the working case unchanged. If a filename is entered, and either the file does not exist or some other file system error occurs, an appropriate message is printed and the request for a data filename is repeated.

When the input file is successfully opened, activity GCAP processes the data records. An alarm message is generated for any inconsistencies detected during data input, and the corresponding record is ignored. Activity GCAP processes only the valid data records.

Following the processing of the Machine Capability Curve Data File, the action taken by activity GCAP is dependent upon the suffix specified when the activity is run.

When activity GCAP is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated.

When activity GCAP is run with the ALL suffix, a report for all buses in the working case is produced in the requested order.

When activity GCAP is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. Output is generated with buses ordered according to the user option. Then the user is given the opportunity to select an additional group of buses.

When activity GCAP is run with the OWNER suffix, each machine wholly or partly owned by any of the owners specified, and for which a data record was successfully read, is processed. The owner assignment of the bus to which the machine is connected is not considered.

The dialog prompts the user to:

```
ENTER 1 TO UPDATE VAR LIMITS IN WORKING CASE:
```

If a 1 is entered, activity GCAP updates the reactive power limits of all machines that were reported.

```
>>GCAP

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7

 ENTER CAPABILITY CURVE DATA FILE NAME:
>>savnw.gcp
 ENTER UP TO 20 BUS NUMBERS

>>101 102
 ENTER UP TO 20 BUS NUMBERS

>>
 ENTER 1 TO UPDATE VAR LIMITS IN WORKING CASE:
>>1
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008    9:16
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 CAPABILITY CURVE CHECK:
                                                    X-- CAPABILITY CURVE --X X------- WORKING  CASE -------X
   BUS# X-- NAME --X BASKV ID    PGEN    QGEN     QMAX    QMIN  PLIMIT     QMAX    QMIN    PMAX     PMIN
    101 NUC-A       21.600 1    750.0    81.2    243.8   -37.5   900.0    600.0  -100.0   810.0      0.0
    102 NUC-B       21.600 1    750.0    81.2    243.8   -37.5   900.0    600.0  -100.0   810.0      0.0

 VAR LIMITS AT    2 MACHINES UPDATED

 ACTIVITY? :
>>
```

Figure 13.11. Example: Running Activity GCAP

Additional Information
PSS® E Program Operation Manual, Producing a Machine Reactive Capability Report

13.4.2. Generator Bus Limits

GENS

Requirements / Prerequisites	
Validly specified power flow case. Plant outputs and voltages are valid only if the working case is solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
GENS,ALL	All plants
GENS,AREA	Plants in specified area(s)
GENS,ZONE	Plants in specified zone(s)
GENS,OWNER	Plants for specified owner(s)
GENS,KV	Plants for specified base kV range
GENS,OPT	User selects options manually using an interactive dialog

Activity ID, Suffix	Suffix Function
GENS,REV	All plants tabulated with voltages printed in alternate units (per unit or kV)

Activity GENS prints a summary of plant loading data, including power output, reactive power limits, and scheduled and actual voltage at generator buses. Activity GENS asks the user to:

```
ENTER: 1 FOR VAR LIMITED PLANTS WITH UNEQUAL VAR LIMITS 2 FOR ALL VAR LIMITED
PLANTS 3 FOR ON-LINE PLANTS 4 FOR ALL PLANTS:
```

Following a response of 1, the report is restricted to those plants that are at a reactive power limit and for which var limits are unequal; with a response of 2, all var-limited plants are listed. Following a response of 3, all generator buses that are in-service are listed, while with a response of 4, both in-service and out-of-service plants are included in the report.

Following this specification, the action taken by activity GENS is dependent upon the suffix specified when the activity is run.

When activity GENS is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated. If any bus specified is not a generator bus, or does not fit into the subset of generator buses designated above, it is omitted from the report.

When activity GENS is run with the ALL suffix, a report for all generator buses in the working case is produced in the requested order. When activity GENS is run with the REV suffix, the voltage output units are changed from the default units to the alternate units, and the dialog and report run as if the ALL suffix was specified.

When activity GENS is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. Following bus selection, output for the appropriate grouping of generator buses is produced with buses ordered as in the user option. The user is then given the opportunity to select another subsystem.

```
 ACTIVITY? :
>>GENS,ALL

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                  1 FOR REPORT WINDOW
  2 FOR A FILE                     3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE     7 FOR PROGRESS WINDOW :
>>7

 ENTER: 1 FOR VAR LIMITED PLANTS WITH UNEQUAL VAR LIMITS
        2 FOR ALL VAR LIMITED PLANTS
        3 FOR ON-LINE PLANTS
        4 FOR ALL PLANTS:
>>4
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008  10:43
 PSS(TM)E SAMPLE CASE
 ALL DATA CATEGORIES WITH SEQUENCE DATA
 GENERATOR SUMMARY:
                          # MACH                                                               X----- REMOTE BUS ------X
   BUS# X-- NAME --X BASKV ON/OFF TYP     MW      MVAR     QMAX     QMIN   VSCHED VACTUAL   BUS# X-- NAME --X BASKV  MVABASE ZONE AREA SWING
    101 NUC-A       21.600  1   0   2   750.0    125.6    400.0   -100.0  1.0100  1.0100                              900.0    1    1  AREA
    102 NUC-B       21.600  1   0   2   650.0    112.4    410.0   -110.0  1.0100  1.0100                              950.0    1    1
    206 URBGEN      18.000  1   0   2   800.0    283.9    500.0   -400.0  1.0000  1.0000                             1000.0    8    2  AREA
    211 HYDRO_G     20.000  1   0   2   600.0     86.7    510.0   -100.0  1.0000  1.0000                              725.0    7    2
    301 NORTH       765.00  3   0   3  2990.6    898.6   2130.0  -1850.0  1.0000  1.0000                             3212.0    5    3  SYST
    401 COGEN-1     500.00  1   0   3   321.0    142.3    600.0   -100.0  1.0000  1.0000                              600.0    9    4  SYST
    402 COGEN-2     500.00  1   0   3   321.0    142.3    610.0   -110.0  1.0000  1.0000                              610.0    9    6  SYST
   3011 MINE_G      19.400  1   0   3  1295.1    141.2    620.0   -120.0  1.0000  1.0000                             1050.0    6    5  SYST
   3018 CATDOG_G    13.800  2   0   2   500.0     -0.8    375.0   -225.0  0.9900  0.9900                              650.0    4    5
   9154 WINDBUS1    4.1600  1   0   2    10.8      2.2      2.2     -2.2  1.0500  0.9919    154 DOWNTN       230.00    12.0    3    1
   9204 WINDBUS2    0.5750  1   0   2     6.1      2.0      2.0      2.0  1.0000  1.0474                                8.3    8    2
  93002 WINDBUS3    0.6900  1   0   2     3.2     -1.5     -1.5     -1.5  1.0000  0.9962                                4.0    6    5
 SUBSYSTEM TOTALS                      8247.9   1935.1   6157.7  -3116.7                                             9721.3

 ACTIVITY? :
>>
```

Figure 13.12. Example: Running Activity GENS,ALL

Additional Information
PSS® E Program Operation Manual, Producing a Generator Bus Limits Report

13.4.3. Machine Terminal Limits

GEOL

Requirements / Prerequisites	
Validly specified power flow case. Machine outputs and voltages are valid only if the working case is solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
GEOL,ALL	All online machines (or all overloaded machines if specified)
GEOL,AREA	Online machines in specified area(s)
GEOL,ZONE	Online machines in specified zone(s)
GEOL,OWNER	Online machines for specified owner(s)
GEOL,KV	Online machines for specified base kV range
GEOL,OPT	User selects options manually using an interactive dialog

The machine terminal conditions summary activity GEOL tabulates the loading and voltage conditions at the generator terminals of in-service machines at Type 2 and 3 buses in the working case. It prints a summary of in-service machines (or all overloaded machines if specified), including power output, terminal voltage, and current. Activity GEOL asks the user to:

```
ENTER 1 FOR OVERLOADED MACHINES ONLY 2 FOR ALL:
```

A response of 1 restricts the report to those machines for which loading is outside an assumed capability curve. Following a response of 2, conditions for all in-service machines at plants that are in-service (that is, at buses with a type code of ± 2 or 3) are listed. Following this specification, the action taken by activity GEOL is dependent upon the suffix specified when activity GEOL is run.

When activity GEOL is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated. If any bus specified is not a generator bus, it is omitted from the report.

When activity GEOL is run with the ALL suffix, a report for all in-service machines, or all overloaded machines, as appropriate, is produced, with buses in the requested order.

When activity GEOL is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. Output for the appropriate grouping of generator buses is produced with buses ordered as directed by the user. The user is then given the opportunity to select another subsystem.

When activity GEOL is run with the OWNER suffix, each machine wholly or partly owned by any of the owners specified is processed. The owner assignment of the bus to which the machine is connected is not considered.

When activity GEOL is run with the OPT suffix, multiple selection criteria are enabled. The area, zone, base voltage, and/or bus selection criteria, if enabled, dictate those buses for which the machines are candidates for processing; otherwise, all buses are candidate buses. The owner selection criterion, if enabled, dictates which machines at candidate buses are to be processed; otherwise, all machines at candidate buses are processed.

Example: Running Activity GEOL,ALL

Additional Information
PSS® E Program Operation Manual, Producing a Machine Terminal Limits Report

13.4.4. Branch Overloads

RAT3

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
RAT3,AREA	Overload checking restricted to specified area(s)
RAT3,ZONE	Overload checking restricted to specified zone(s)
RAT3,OWNER	Overload checking restricted to specified owner(s)
RAT3,KV	Overload checking restricted to specified base kV range
RAT3,OPT	User selects options manually using an interactive dialog

The branch overload checking activity RAT3 checks ac branch loadings against designated branch ratings. For non-transformer branches, loadings are calculated as either current loadings or MVA loadings, according to the non-transformer branch percent loading units program option setting. Similarly, for transformer branches, loadings are calculated as either current loadings or MVA loadings, according to the transformer percent loading units program option setting. When percent MVA loadings are calculated, ratings are assumed to have been entered as MVA ratings.

The percentage loading threshold is specified by the user:

```
ENTER LINE LOADING LIMIT IN PERCENT:
```

Any checked branch for which loading, including line charging, line connected shunt, and transformer magnetizing admittance components, exceeds the specified percentage of rating is reported. The default limit is 100%.

When activity RAT3 is run without a suffix, the report is generated, with all branches having a non-zero value for at least one rating being checked.

When activity RAT3 is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which the overload check is to be made. The output is generated, with all branches having at least one endpoint bus in the specified subsystem and at least one non-zero rating being checked. Then the user is given the opportunity to select another subsystem.

When subsystem selection by owner is in effect, branch ownership rather than bus ownership is used in determining which branches are contained in the specified subsystem; any other selection criteria apply to the branch's endpoint buses.

Example: Running Activity RAT3,AREA

Additional Information
PSS® E Program Operation Manual, Producing a Branch Overload Checking Report

13.4.5. Transmission Line Overloads

OLTL

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
OLTL,AREA	Overload checking restricted to nontransformer branches in specified area(s)
OLTL,ZONE	Overload checking restricted to nontransformer branches in specified zone(s)
OLTL,OWNER	Overload checking restricted to nontransformer branches for specified owner(s)
OLTL,KV	Overload checking restricted to nontransformer branches for specified base kV range
OLTL,OPT	User selects options manually using an interactive dialog

The transmission line overload checking activity OLTL checks non-transformer branch loadings against designated branch ratings. Loadings are calculated as either current loadings or MVA loadings, according to the non-transformer branch percent loading units program option setting. When percent MVA loadings are calculated, ratings are assumed to have been entered as MVA ratings. Activity OLTL functions in exactly the same manner as activity RATE, except that transformer branches are omitted from the overload checking.

The percentage loading threshold is specified by the user:

```
ENTER LINE LOADING LIMIT IN PERCENT:
```

Any checked branch for which loading, including line charging and line connected shunt components, exceeds the specified percentage of rating is reported. The default limit is 100%.

The user is then asked to specify which of the three ratings is to be used, with the default being the rating set established as the default rating set program option setting:

```
ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=n):
```

When activity OLTL is run without a suffix, the report is generated, with all non-transformer branches having a non-zero value for the specified rating being checked.

When activity OLTL is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which the overload check is to be made. Output is generated, with all non-transformer branches having at least one endpoint bus in the specified subsystem being checked. Then the user is given the opportunity to select another subsystem.

```
 ACTIVITY? :
>>OLTL

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                 1 FOR REPORT WINDOW
  2 FOR A FILE                    3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE    7 FOR PROGRESS WINDOW :
>>7

 ENTER LINE LOADING LIMIT IN PERCENT:
>>90
 ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=1):
>>1
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  11:51
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 NON-TRANSFORMER BRANCH CURRENT LOADINGS ABOVE  90.0 % OF RATING SET A:

 X--------- FROM BUS ----------X X---------- TO BUS -----------X
   BUS# X-- NAME --X BASKV  AREA    BUS# X-- NAME --X BASKV  AREA CKT LOADING  RATING PERCENT
    153 MID230      230.00     1     154 DOWNTN      230.00*    1  1    276.0   300.0    92.0

 ACTIVITY? :
>>
```

Figure 13.13. Example: Running Activity OLTL

Additional Information
PSS® E Program Operation Manual, Producing a Transmission Line Overload Checking Report

13.4.6. Transformer Overloads

OLTR

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
OLTR,AREA	Overload checking restricted to nontransformer branches in specified area(s)
OLTR,ZONE	Overload checking restricted to nontransformer branches in specified zone(s)
OLTR,OWNER	Overload checking restricted to nontransformer branches for specified owner(s)
OLTR,KV	Overload checking restricted to nontransformer branches for specified base kV range
OLTR,OPT	User selects options manually using an interactive dialog

The transformer overload checking activity OLTR checks transformer branch loadings against designated branch ratings. Loadings are calculated as either current loadings or MVA loadings, according to the transformer percent loading units program option setting. When percent MVA loadings are calculated, ratings are assumed to have been entered as MVA ratings. Activity OLTR functions in exactly the same manner as activity RATE, except that non-transformer branches are omitted from the overload checking.

The percentage loading threshold is specified by the user:

```
ENTER LINE LOADING LIMIT IN PERCENT:
```

Any checked transformer branch for which loading, including magnetizing admittance, exceeds the specified percentage of rating is reported. The default limit is 100%.

The user is then asked to specify which of the three ratings is to be used, with the default being the rating set established as the default rating set program option setting:

```
ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=n):
```

When activity OLTR is run without a suffix, the report is generated, with all transformer branches having a non-zero value for the specified rating being checked.

When activity OLTR is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which the overload check is to be made. Output is generated, with all transformer branches having at least one endpoint bus in the specified subsystem being checked. The user is then given the opportunity to select another subsystem.

```
 ACTIVITY? :
>>OLTR

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT               1 FOR REPORT WINDOW
  2 FOR A FILE                  3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

 ENTER LINE LOADING LIMIT IN PERCENT:
>>90
 ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=1):
>>2
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008   11:43
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 TRANSFORMER MVA LOADINGS ABOVE  90.0 % OF RATING SET B:

 X--------- FROM BUS ----------X X---------- TO BUS -----------X
   BUS# X-- NAME --X BASKV  AREA    BUS# X-- NAME --X BASKV  AREA CKT LOADING  RATING PERCENT
    205 SUB230      230.00     2     206 URBGEN      18.000*    2  1   1000.0  1080.0    92.6

 ACTIVITY? :
>>
```

Figure 13.14. Example: Running Activity OLTR

Additional Information
PSS® E Program Operation Manual, Producing a Transformer Overload Checking Report

13.4.7. Branch Current Ratings

RATE

Requirements / Prerequisites
Validly specified power flow case solved to an acceptable mismatch tolerance.

Activity ID, Suffix	Suffix Function
RATE,AREA	Overload checking restricted to specified area(s)
RATE,ZONE	Overload checking restricted to specified zone(s)
RATE,OWNER	Overload checking restricted to specified owner(s)
RATE,KV	Overload checking restricted to specified base kV range
RATE,OPT	User selects options manually using an interactive dialog

The branch overload checking activity RATE checks ac branch loadings against designated branch ratings. For non-transformer branches, loadings are calculated as either current loadings or MVA loadings, according to the non-transformer branch percent loading units program option setting. Similarly, for transformer branches, loadings are calculated as either current loadings or MVA loadings, according to the transformer percent loading units program option setting. When percent MVA loadings are calculated, ratings are assumed to have been entered as MVA ratings.

The percentage loading threshold is specified by the user:

```
ENTER LINE LOADING LIMIT IN PERCENT:
```

Any checked branch for which loading, including line charging, line connected shunt, and transformer magnetizing admittance components, exceeds the specified percentage of rating is reported. The default limit is 100%.

The user is then asked to specify which of the three ratings is to be used, with the default being the rating set established as the default rating set program option setting:

```
ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=n):
```

When activity RATE is run without a suffix, the report is generated, with all branches having a non-zero value for the specified rating being checked.

When activity RATE is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which the overload check is to be made. Following the user specification of the subsystem to be tabulated, the output is generated, with all branches having at least one endpoint bus in the specified subsystem being checked. Then the user is given the opportunity to select another subsystem.

When subsystem selection by owner is in effect, branch ownership rather than bus ownership is used in determining which branches are contained in the specified subsystem; any other selection criteria apply to the branch's endpoint buses.

```
>>RATE,OWNER

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                 1 FOR REPORT WINDOW
  2 FOR A FILE                    3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE    7 FOR PROGRESS WINDOW :
>>7

 ENTER LINE LOADING LIMIT IN PERCENT:
>>90
 ENTER 1 TO USE RATEA, 2 FOR RATEB, 3 FOR RATEC (DEFAULT=1):
>>1
 ENTER UP TO 20 OWNER NUMBERS:

>>1
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  13:02
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA
                       OUTPUT FOR OWNER 1 [TRAN 1       ]
 BRANCH LOADINGS ABOVE  90.0 % OF RATING SET A (MVA FOR TRANSFORMERS, CURRENT FOR NON-TRANSFORMER BRANCHES):

 X--------- FROM BUS ----------X X---------- TO BUS -----------X
   BUS# X-- NAME --X BASKV  AREA   BUS# X-- NAME --X BASKV  AREA CKT LOADING  RATING PERCENT
    153 MID230      230.00    1     154 DOWNTN      230.00*    1  1    276.0   300.0    92.0
 ENTER UP TO 20 OWNER NUMBERS:

>>

 ACTIVITY? :
>>
```

Figure 13.15. Example: Running Activity RATE,OWNER

Additional Information
PSS® E Program Operation Manual, Producing a Branch Current Ratings Report

13.4.8. Voltage-Controlled Buses

REGB

Requirements / Prerequisites	
Validly specified power flow case. Bus voltages are valid only if the working case is solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
REGB,ALL	List all in-service voltage controlled buses
REGB,AREA	List in-service voltage controlled buses in specified area(s)
REGB,ZONE	List in-service voltage controlled buses in specified zone(s)
REGB,OWNER	List in-service voltage controlled buses for specified owner(s)
REGB,KV	List in-service voltage controlled buses for specified base kV range
REGB,OPT	User selects options manually using an interactive dialog

The regulated bus reporting activity REGB tabulates those buses for which voltages are controlled by generation, switched shunts, voltage controlling transformers, FACTS devices, and/or VSC dc line converters. Data presented includes the bus number, name, and base voltage of each regulated bus along with its present voltage magnitude. For each controlling equipment item, the desired voltage setpoint or voltage band, as appropriate, is listed along with any deviation between actual and scheduled voltages. The action taken by activity REGB is dependent upon the suffix specified when the activity is run.

When activity REGB is run without a suffix, the user is asked to select the buses. Following each response to the bus specification request, the report is generated with buses in the requested order (see Section 1.2.2). The bus specification request is then repeated. If any bus specified is not a voltage controlled bus, it is omitted from the report.

When activity REGB is run with the ALL suffix, a report for all voltage controlled buses in the working case is produced in the requested order.

When activity REGB is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. Output for the voltage controlled buses contained in the specified subsystem is produced with buses ordered as directed by the user. Then the user is given the opportunity to select an additional group of buses.

Example: Running Activity REGB,AREA

Additional Information
PSS®E Program Operation Manual, Producing a Regulated Bus Report

13.4.9. Controlling Transformers

TLST

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance.	
Activity ID, Suffix	Suffix Function
TLST,ALL	List all controlling transformers
TLST,AREA	List controlling transformer data for specified area(s)
TLST,ZONE	List controlling transformer data for specified zone(s)
TLST,OWNER	List controlling transformer data for specified owner(s)
TLST,KV	List controlling transformer data for specified base kV range
TLST,OPT	User selects options manually using an interactive dialog
TLST,REV	List controlling transformer summary with voltages printed in alternate units (per unit or kV)

The controlling transformer summary activity TLST tabulates those transformers in the working case for which the off-nominal turns ratio or phase shift angle may be adjusted by the power flow solution activities. Actions taken by activity TLST is dependent upon the suffix specified when the activity is run.

The user is first asked to specify the output destination. Activity TLST then instructs the user to:

```
ENTER 0 FOR ALL, 1 FOR VIOLATIONS ONLY:
```

This gives the user the option of listing all adjustable transformers or of restricting the report to those for which controlled quantity is outside of its specified band.

When activity TLST is run with the ALL suffix, all controlling transformers (or those in violation, as appropriate) in the working case are listed. When activity TLST is run with the REV suffix, the entire case is processed as with the ALL suffix, but voltages and desired voltage bands of voltage controlling transformers are printed in the alternate units for voltage output rather than in the default units.

When activity TLST is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem for which output is to be printed. Output is generated, with all controlling transformers having at least one endpoint bus in the specified subsystem being processed. The user is then given the opportunity to select another subsystem.

When subsystem selection by owner is in effect, branch ownership rather than bus ownership is used in determining which transformers are contained in the specified subsystem; any other selection criteria apply to the transformer's endpoint buses.

When subsystems are selected by area, zone, and/or owner, the output of activity TLST is grouped as described in Section 1.2.4.

Example: Running Activity TLST

Additional Information
PSS® E Program Operation Manual, Producing a Controlling Transformer Report

13.4.10. Out-of-Limits Bus Voltage

VCHK

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance	
Activity ID, Suffix	Suffix Function
VCHK,AREA	Buses in specified area(s)
VCHK,ZONE	Buses in specified zone(s)
VCHK,OWNER	Buses for specified owner(s)
VCHK,KV	Buses for specified base kV range
VCHK,OPT	User selects options manually using an interactive dialog

The voltage checking activity VCHK tabulates those buses where per unit voltage magnitude is outside a specified range. The star point buses of three-winding transformers are neither checked nor reported by activity VCHK.

The voltage band is specified by the user:

```
ENTER VMAX, VMIN:
```

The user responds with the desired setpoints. The default settings result in a tabulation of buses where voltage is above 1.05 pu or below 0.95 pu.

When activity VCHK is run without a suffix, all buses except Type 4 buses are checked and the corresponding report produced.

When activity VCHK is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which the voltage check is to be made. All non-Type 4 buses in the subsystem are checked, the report is generated, and the user is given the opportunity to select an additional grouping of buses and a new voltage band:

```
ENTER 1 TO CHANGE VOLTAGE LIMITS:
```

Activity VCHK produces a listing of those buses for which the voltage magnitude is greater than VMAX, followed by a listing of buses for which voltage is less than VMIN. Both listings are in ascending numerical (using the *numbers* output option) or alphabetical (using the *names* output option) order.

```
>>VCHK

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

 ENTER VMAX, VMIN:
>>1.005 .95
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  13:08
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 BUSES WITH VOLTAGE GREATER THAN 1.0050:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
    101 NUC-A        21.600    1 1.0200 22.032      102 NUC-B        21.600    1 1.0200 22.032
    151 NUCPANT      500.00    1 1.0119 505.95      152 MID500       500.00    1 1.0171 508.54
    201 HYDRO        500.00    2 1.0400 520.00      202 EAST500      500.00    2 1.0088 504.40
    206 URBGEN       18.000    2 1.0236 18.425      211 HYDRO_G      20.000    2 1.0404 20.808
   3001 MINE         230.00    5 1.0298 236.85     3002 E. MINE      500.00    5 1.0279 513.96
   3003 S. MINE      230.00    5 1.0233 235.37     3004 WEST         500.00    5 1.0165 508.23
   3011 MINE_G       13.800    5 1.0400 14.352     3018 CATDOG_G     13.800    5 1.0218 14.100

 BUSES WITH VOLTAGE LESS THAN 0.9500:

   BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)      BUS# X-- NAME --X BASKV AREA  V(PU)  V(KV)
    154 DOWNTN       230.00    1 0.9389 215.95      205 SUB230       230.00    2 0.9490 218.27

 ACTIVITY? :
>>
```

Figure 13.16. Example: Running Activity VCHK

Additional Information
PSS® E Program Operation Manual, Producing Out-of-Limits Bus Voltage Reports

13.5. Case Comparison

13.5.1. Power Flow Case Totals

CMPR

Requirements / Prerequisites	
Validly specified power flow case. If losses, mismatches, or interchange are to be compared, both cases should be solved to an acceptable mismatch level. Saved Case file (*.sav).	
Activity ID, Suffix	Suffix Function
CMPR,AREA	Compare specified area power flow data with Saved Case
CMPR,ZONE	Compare specified zone power flow data with Saved Case
CMPR,OWNER	Compare specified owner power flow data with Saved Case

The case comparison activity CMPR provides a tabulation comparing certain case totals, as contained in the working case, with those of a designated Saved Case. Either system totals, area totals, zone totals, or owner totals may be compared. The actions taken by activity CMPR are dependent upon the suffix specified when the activity is run.

Prior to running activity CMPR, one of the two cases to be compared must exist in the working case. When initiated activity CMPR instructs the user to designate the Saved Case to be compared against the working case:

```
ENTER SAVED CASE FILENAME:
```

Any errors encountered in accessing the designated Saved Case File are handled as in activity CASE.

When activity CMPR is run without a suffix, system totals of generation, load, losses, and mismatch are tabulated for the working case and the designated Saved Case. Differences between the two cases (Saved Case value minus working case value) are also printed, both in engineering units and as percentages of the working case totals.

When activity CMPR is run with the AREA, ZONE, or OWNER suffix, it calculates area, zone, or owner totals for selected areas, zones, or owners. In tabulating these subsystem totals, if the difference between any subsystem total in the two cases is within a threshold tolerance, it is omitted from the report. The dialog prompts the user to:

```
FOR SPECIFYING DIFFERENCE THRESHOLDS ENTER 0 FOR ENGINEERING UNITS, 1 FOR
PERCENT:
```

These tolerances are allowed to be specified either in engineering units (for example, MW) or as a percentage of the subsystem totals in the working case.

Activity CMPR then opens a dialog through which the user selects the areas, zones, or owners for which totals are to be compared.

Following the subsystem specification dialog, the user may specify the quantity for which area, zone, or owner totals are to be compared:

```
QUANTITIES WHICH MAY BE COMPARED ARE: 1 = GENERATION 2 = LOAD 3 = LOSSES 4 =
MISMATCH 5 = INTERCHANGE ENTER CATEGORY NUMBER (0 FOR NEW AREAS): (or ZONES
or OWNERS)
```

The specification of interchange is disabled when totals by owner are being compared.

If the *percent* option was specified above, the dialog prompts the user to:

```
ENTER DIFFERENCE THRESHOLD IN PERCENT:
```

Otherwise, the dialog prompts the user to specify this tolerance value in engineering units appropriate to the data category specified. A zero is the default response to these requests.

At the completion of activity CMPR, the user designates which of the two cases is to be left as the PSS®E working case:

```
SELECT CASE TO LEAVE IN THE WORKING CASE ENTER 0 FOR ORIGINAL WORKING CASE,
1 FOR filename:
```

```
>>CMPR,AREA
 ENTER SAVED CASE FILENAME:
>>savnw.sav

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT               1 FOR REPORT WINDOW
  2 FOR A FILE                  3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

 FOR SPECIFYING DIFFERENCE THRESHOLDS
 ENTER 0 FOR ENGINEERING UNITS, 1 FOR PERCENT:
>>0
 ENTER UP TO 20 AREA NUMBERS:

>>5

 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 CASE savnw.sav WAS SAVED ON TUE, DEC 18 2007  11:29

 QUANTITIES WHICH MAY BE COMPARED ARE:
  1 = GENERATION     2 = LOAD
  3 = LOSSES         4 = MISMATCH
  5 = INTERCHANGE
 ENTER CATEGORY NUMBER (0 FOR NEW AREAS):
>>1
 ENTER DIFFERENCE THRESHOLD IN MW or MVAR:
>>
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  13:57
 COMPARISON OF THE WORKING CASE AND THE SAVED CASE savnw.sav

 WORKING CASE:
          PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
          BASE CASE INCLUDING SEQUENCE DATA

 SAVED CASE savnw.sav:
          PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
          BASE CASE INCLUDING SEQUENCE DATA

 AREA GENERATION TOTALS DIFFERING BY AT LEAST   0.0 MW OR MVAR:
                     IN WORKING CASE   IN savnw.sav
 AREA  X-- NAME --X     MW      MVAR      MW      MVAR  DELTA MW    %  DELTA MVAR   %
    5  WORLD          358.7    184.0    358.7    184.0       0.0   0.0        0.0   0.0

 QUANTITIES WHICH MAY BE COMPARED ARE:
  1 = GENERATION     2 = LOAD
  3 = LOSSES         4 = MISMATCH
  5 = INTERCHANGE
 ENTER CATEGORY NUMBER (0 FOR NEW AREAS):
>>


 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA
 ENTER UP TO 20 AREA NUMBERS:

>>
 SELECT CASE TO LEAVE IN THE WORKING CASE
 ENTER 0 FOR ORIGINAL WORKING CASE, 1 FOR savnw.sav:
>>0

 ACTIVITY? :
>>
```

Figure 13.17. Example: Running Activity CMPR,AREA

Additional Information
PSS®E Program Operation Manual, Comparing Power Flow Case Totals

13.5.2. Power Flow Cases

DIFF

Requirements / Prerequisites	
Validly specified power flow case. If bus voltages, line flows, or line losses are to be compared, both cases should be solved to an acceptable mismatch level. Saved Case file (*.sav)	
Activity ID, Suffix	Suffix Function
DIFF,ALL	All buses
DIFF,AREA	Buses in specified area(s)
DIFF,ZONE	Buses in specified zone(s)
DIFF,OWNER	Buses for specified owner(s)
DIFF,KV	Buses for specified base kV range
DIFF,OPT	User selects options manually using an interactive dialog

Activity DIFF compares certain power flow data, fault analysis data, and solution results, as contained in the working case, with those of a designated Saved Case. All buses and ac branches may be subjected to the comparison, or the checks may be restricted to a designated subsystem.

Prior to running activity DIFF, one of the two cases to be compared must exist in the working case. When initiated, activity DIFF instructs the user to designate the Saved Case to be compared against the working case:

```
ENTER SAVED CASE FILENAME:
```

Any errors encountered in accessing the designated Saved Case File are handled as in activity CASE.

Following the successful pickup of the comparison case, the action taken by activity DIFF is dependent upon the suffix specified when the activity is run.

When activity DIFF is run without a suffix, the user is asked to select the buses for which data are to be compared. Buses are specified by number or extended bus name, according to the bus input option setting at the time activity DIFF is run (that is, according to its setting in the working case).

When activity DIFF is run with the ALL suffix, all buses are candidates for comparison.

When activity DIFF is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem for which the buses are candidates for comparison.

Activity DIFF instructs the user:

TO BE CONSIDERED THE SAME BUS, IN EACH CASE IT MUST HAVE THE SAME: 0=BUS NUMBER 1=BUS NAME 2=BUS NUMBER AND NAME ENTER SELECTION CODE:

If buses in the two cases are matched using only their extended bus names (that is, a 1 is entered), each bus in the specified subsystem must have a unique extended bus name. An alarm message is generated if there are duplicate extended bus names in the specified subsystem of either the working case or the designated Saved Case. Any `buses generating an alarm` are treated as being outside of the specified subsystem, and processing continues using the remaining subsystem buses in the two cases.

For several of the data categories that may be compared (see below), the user is asked to specify a threshold tolerance. If the difference between data items in the two cases is within this tolerance, the item is omitted from the report.

The dialog prompts the user to:

FOR SPECIFYING DIFFERENCE THRESHOLDS ENTER 0 FOR ENGINEERING UNITS, 1 FOR PERCENT:

Tolerances are allowed to be specified either in engineering units (for example, MW), or as a percentage of the data item values in the working case.

The user may then enter a code for the type of data to be compared:

QUANTITIES WHICH MAY BE COMPARED ARE: 1 = BUS IDENTIFIERS 2 = BUS TYPE CODES 3 = MACHINE STATUS 4 = GENERATOR MW 5 = GENERATOR MW OR MVAR 34 = GENERATOR MVAR 32 = BUS LOAD STATUS 6 = BUS LOADS 41 = BUS SHUNT STATUS 7 = BUS SHUNTS 8 = SWITCHED SHUNTS 9 = VOLTAGE 10 = VOLTAGE AND ANGLE 11 = MBASE & ZSORCE 12 = MBASE & ZPOS 13 = MBASE & ZNEG 14 = MBASE & ZZERO 15 = NEG SEQ BUS SHUNTS 16 = ZERO SEQ BUS SHUNTS 17 = BRANCH STATUS 18 = LINE R, X, B 19 = LINE SHUNTS 20 = LINE RATINGS 21 = METERED END 33 = LINE LENGTHS 22 = TRANSFORMERS 23 = FLOW MW OR MVAR (FROM BUS) 24 = FLOW MW OR MVAR (FROM TO) 35 = FLOW MW (FROM BUS) 37 = FLOW MW (FROM TO) 36 = FLOW MVAR (FROM BUS) 38 = FLOW MVAR (FROM TO) 25 = LINE MW OR MVAR LOSSES 39 = LINE MW LOSSES 40 = LINE MVAR LOSSES 26 = ZERO SEQ. R, X, B 27 = ZERO SEQ LINE SHUNTS 28 = CONNECTION CODES 29 = ZERO SEQ MUTUALS 30 = MULTI-SECTION LINES 31 = MULTI-SECTION LINE METERED END ENTER CATEGORY NUMBER (0 TO EXIT):

The specified check is made and exceptions are listed. The user is then invited to enter the code for the next data category to be checked.

Categories 4 through 8, 15, 16, 23 through 25, and 34 through 40 allow the user to specify a threshold tolerance. An alarm message is generated for those buses or branches for which the designated data item(s) in the two cases differ by more than the specified tolerance. If the *percent* option was entered, the dialog prompts the user to:

ENTER DIFFERENCE THRESHOLD IN PERCENT:

Otherwise, the dialog prompts the user to specify this tolerance value in engineering units appropriate to the data category specified. A zero is the default response to these requests.

Similarly, categories 9, 10 and 22 provide for user-specified threshold tolerances:

ENTER VOLTAGE THRESHOLD: (category 9) ENTER VOLTAGE THRESHOLD, ANGLE THRESHOLD: (category 10) ENTER RATIO THRESHOLD, ANGLE THRESHOLD: (category 22) where the default responses are 0.01 per unit and 5 degrees.

```
SELECT CASE TO LEAVE IN THE WORKING CASE ENTER 0 FOR ORIGINAL WORKING CASE,
1 FOR filename:
```

Category 6 allows the user to compare either the total in-service constant MVA, constant current, or constant admittance load, or the total in-service nominal load, at each bus in the bus comparison list. The dialog prompts the user to:

```
ENTER CODE OF LOAD CHARACTERISTIC TO BE COMPARED: 0=TOTAL NOMINAL LOAD 1=CONSTANT
MVA 2=CONSTANT CURRENT 3=CONSTANT ADMITTANCE:
```

An alarm message is generated only if the in-service load exceeds the threshold tolerance where one case contains in-service load while in the other either no load elements are modeled at the bus or they are all out-of-service.

Category 20 checks line ratings. The dialog prompts the user to designate the rating sets to be compared:

```
ENTER CODE FOR RATINGS TO COMPARE 0 FOR ALL RATINGS 1 FOR RATEA 2 FOR RATEB
3 FOR RATEC:
```

For branches for which the specified rating(s) differ, all three ratings from both cases are tabulated. If a branch exists in only one of the cases, it is excluded from the report.

For categories comparing fault analysis data, this data must be present in both cases. At the completion of activity DIFF, the user designates which of the two cases is to remain as the PSS®E working case:

```
>>DIFF,AREA
 ENTER SAVED CASE FILENAME:
>>savcnv.sav
 ENTER UP TO 20 AREA NUMBERS:

>>2
 ENTER UP TO 20 AREA NUMBERS:

>>

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7

 TO BE CONSIDERED THE SAME BUS, IN EACH CASE IT MUST HAVE THE SAME:
  0=BUS NUMBER   1=BUS NAME   2=BUS NUMBER AND NAME
 ENTER SELECTION CODE:
>>0

 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 CASE savcnv.sav WAS SAVED ON TUE, DEC 18 2007  11:29
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  14:31
 COMPARISON OF THE WORKING CASE AND THE SAVED CASE savcnv.sav

 WORKING CASE:
          PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
          BASE CASE INCLUDING SEQUENCE DATA

 SAVED CASE savcnv.sav:
          PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
          BASE CASE INCLUDING SEQUENCE DATA

 BUSES FROM THE TWO CASES ARE CONSIDERED TO BE THE
 SAME BUS WHEN THEY HAVE THE SAME BUS NUMBER

 WORKING CASE SUBSYSTEM BUSES OMITTED FROM BUS COMPARISON LIST:
  BUS # X-- NAME --X  BASE KV

                      * NONE *


 savcnv.sav SUBSYSTEM BUSES OMITTED FROM BUS COMPARISON LIST:
  BUS # X-- NAME --X  BASE KV

                      * NONE *

 WORKING CASE CONTAINS      23 BUSES AND      34 BRANCHES
      7 BUSES IN SELECTED SUBSYSTEM

 savcnv.sav CONTAINS      23 BUSES AND      34 BRANCHES
      7 BUSES IN SELECTED SUBSYSTEM

      7 BUSES TO BE COMPARED

      8 BRANCHES IN COMPARE LIST

      1 MULTI-SECTION LINES IN COMPARE LIST

 FOR SPECIFYING DIFFERENCE THRESHOLDS
 ENTER 0 FOR ENGINEERING UNITS, 1 FOR PERCENT:
>>
```

Figure 13.18. Example: Running Activity DIFF,AREA (1 of 3)

```
 QUANTITIES WHICH MAY BE COMPARED ARE:
  1 = BUS IDENTIFIERS                2 = BUS TYPE CODES
  3 = MACHINE STATUS                 4 = GENERATOR MW
  5 = GENERATOR MW OR MVAR          34 = GENERATOR MVAR
 32 = BUS LOAD STATUS                6 = BUS LOADS
 41 = BUS SHUNT STATUS               7 = BUS SHUNTS
  8 = SWITCHED SHUNTS                9 = VOLTAGE
 10 = VOLTAGE AND ANGLE             11 = MBASE & ZSORCE
 12 = MBASE & ZPOS                  13 = MBASE & ZNEG
 14 = MBASE & ZZERO                 15 = NEG SEQ BUS SHUNTS
 16 = ZERO SEQ BUS SHUNTS           17 = BRANCH STATUS
 18 = LINE R, X, B                  19 = LINE SHUNTS
 20 = LINE RATINGS                  21 = METERED END
 33 = LINE LENGTHS                  22 = TRANSFORMERS
 23 = FLOW MW OR MVAR (FROM BUS)    24 = FLOW MW OR MVAR (FROM & TO)
 35 = FLOW MW (FROM BUS)            37 = FLOW MW (FROM & TO)
 36 = FLOW MVAR (FROM BUS)          38 = FLOW MVAR (FROM & TO)
 25 = LINE MW OR MVAR LOSSES
 39 = LINE MW LOSSES                40 = LINE MVAR LOSSES
 26 = ZERO SEQ. R, X, B             27 = ZERO SEQ LINE SHUNTS
 28 = GROUNDING CODES               29 = ZERO SEQ MUTUALS
 30 = MULTI-SECTION LINES           31 = MULTI-SECTION LINE METERED END
 ENTER CATEGORY NUMBER (0 TO EXIT):
>>6

 ENTER CODE OF LOAD CHARACTERISTIC TO BE COMPARED:
  0=TOTAL NOMINAL LOAD  1=CONSTANT MVA
  2=CONSTANT CURRENT    3=CONSTANT ADMITTANCE:
>>0
 ENTER DIFFERENCE THRESHOLD IN PERCENT:
>>2
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  14:35
 COMPARISON OF THE WORKING CASE AND THE SAVED CASE savcnv.sav

 BUSES WITH TOTAL NOMINAL LOAD DIFFERING BY MORE THAN   2.0 PERCENT:
                                IN WORKING CASE    IN savcnv.sav
 X---------- BUS ----------X      MW      MVAR       MW      MVAR    DELTA MW    %     MVAR     %
    203 [EAST230      230.00]   300.0    150.0     310.4    160.6       10.4    3.5    10.6    7.0
    205 [SUB230       230.00]  1200.0    700.0    1264.5    777.2       64.5    5.4    77.2   11.0
```

Figure 13.19. Example: Running Activity DIFF,AREA (2 of 3)

```
 ENTER CATEGORY NUMBER (0 TO EXIT):
>>20

 ENTER CODE FOR RATINGS TO COMPARE
       0 FOR ALL RATINGS    1 FOR RATEA
       2 FOR RATEB          3 FOR RATEC:
>>0
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  14:35
 COMPARISON OF THE WORKING CASE AND THE SAVED CASE savcnv.sav

 BRANCHES WITH DIFFERENT LINE RATINGS:
                                                                          IN WORKING CASE       IN savcnv.sav
 X------- FROM BUS --------X X-------- TO BUS ---------X CKT      RATEA   RATEB   RATEC      RATEA   RATEB   RATEC

                                     * NONE *

 QUANTITIES WHICH MAY BE COMPARED ARE:
  1 = BUS IDENTIFIERS                2 = BUS TYPE CODES
  3 = MACHINE STATUS                 4 = GENERATOR MW
  5 = GENERATOR MW OR MVAR          34 = GENERATOR MVAR
 32 = BUS LOAD STATUS                6 = BUS LOADS
 41 = BUS SHUNT STATUS               7 = BUS SHUNTS
  8 = SWITCHED SHUNTS                9 = VOLTAGE
 10 = VOLTAGE AND ANGLE             11 = MBASE & ZSORCE
 12 = MBASE & ZPOS                  13 = MBASE & ZNEG
 14 = MBASE & ZZERO                 15 = NEG SEQ BUS SHUNTS
 16 = ZERO SEQ BUS SHUNTS           17 = BRANCH STATUS
 18 = LINE R, X, B                  19 = LINE SHUNTS
 20 = LINE RATINGS                  21 = METERED END
 33 = LINE LENGTHS                  22 = TRANSFORMERS
 23 = FLOW MW OR MVAR (FROM BUS)    24 = FLOW MW OR MVAR (FROM & TO)
 35 = FLOW MW (FROM BUS)            37 = FLOW MW (FROM & TO)
 36 = FLOW MVAR (FROM BUS)          38 = FLOW MVAR (FROM & TO)
 25 = LINE MW OR MVAR LOSSES
 39 = LINE MW LOSSES                40 = LINE MVAR LOSSES
 26 = ZERO SEQ. R, X, B             27 = ZERO SEQ LINE SHUNTS
 28 = GROUNDING CODES               29 = ZERO SEQ MUTUALS
 30 = MULTI-SECTION LINES           31 = MULTI-SECTION LINE METERED END
 ENTER CATEGORY NUMBER (0 TO EXIT):
>>
 SELECT CASE TO LEAVE IN THE WORKING CASE
 ENTER 0 FOR ORIGINAL WORKING CASE, 1 FOR DIFFERENCE CASE:
>>0

 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 ACTIVITY? :
>>
```

Figure 13.20. Example: Running Activity DIFF,AREA (3 of 3)

13.5.3. Displaying Power Flow Solution Differences on a Diagram

GDIF

Requirements / Prerequisites	
Validly specified power flow case. Saved Case file (*.sav) Both cases solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
GDIF	Activity runs without a suffix.

The graphical case comparison activity GDIF calculates differences in power flow solution results and certain power flow boundary condition data contained in the working case with those of a designated Saved Case. Results are displayed in the Diagram View in a form similar to the display of power flow output.

```
>>GDIF
 ENTER COORDINATE FILE NAME, BINARY OPTION (-1 TO EXIT):
>>sample.sld
 ENTER SAVED CASE FILENAME:
>>sample.sav

 TO BE CONSIDERED THE SAME BUS, IN EACH CASE IT MUST HAVE THE SAME:
  0=BUS NUMBER   1=BUS NAME   2=BUS NUMBER AND NAME
 ENTER SELECTION CODE:
>>0

 ENTER: 0 FOR BUS NUMBERS      1 FOR NAMES
        2 FOR BOTH             3 FOR NONE [2] :
>>0

 Enter  0 to exit
       26 for interactive display
       30 for default printer:
>>26

 OPTIONS ARE:
   0 = EXIT              1 = NEXT PAGE ( 1)
   2 = SELECT PAGE       3 = SELECT BUS
   4 = FULL ONE-LINE     5 = CHANGE CLIPPING SIZE
 SELECT OPTION:
>>0

 Enter  0 to exit
       26 for interactive display
       30 for default printer:
>>0

 ACTIVITY? :
>>
```

Figure 13.21. Examples: Running Activity GDIF

Additional Information
PSS® E Program Operation Manual, Displaying Power Flow Solution Differences on a Diagram

13.6. Reporting DC Network Conditions

MTDC

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch tolerance. Unblocked multi-terminal dc lines must be present in the working case	
Activity ID, Suffix	Suffix Function
MTDC	Activity runs without a suffix.

The multi-terminal dc line power flow output activity MTDC prints power flow solution results at all dc buses of all unblocked multi-terminal dc lines in the working case.

An alarm message is generated if there are no unblocked multi-terminal dc lines in the working case, and activity MTDC ends. The report is then produced in multi-terminal dc line name alphabetical order. Within each multi-terminal dc line, the block of results for each of its dc buses is printed in ascending dc bus number order.

```
--------------------------------------------------------------------------------

    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 01 2008  10:54
PSS(TM)E SAMPLE CASE                                          MULTI-TERMINAL DC
ALL DATA CATEGORIES WITH SEQUENCE DATA                          "1           "

       BUS# X-- NAME --X BASKV AREA ZONE CKT     MW      AMPS      KV
FROM      1 DC1           (DC)     4    4                          0.00
  TO    401 COGEN-1     500.00     4    9        0.0      0.0
  TO      5 DC5           (DC)     4    4   1    0.0      0.0

       BUS# X-- NAME --X BASKV AREA ZONE CKT     MW      AMPS      KV
FROM      2 DC2           (DC)     2    2                          0.00
  TO    212 INVERT1     230.00     2    7        0.0      0.0
  TO      5 DC5           (DC)     4    4   1    0.0      0.0

       BUS# X-- NAME --X BASKV AREA ZONE CKT     MW      AMPS      KV
FROM      3 DC3           (DC)     4    4                          0.00
  TO    402 COGEN-2     500.00     6    9        0.0      0.0
  TO      5 DC5           (DC)     4    4   1    0.0      0.0

       BUS# X-- NAME --X BASKV AREA ZONE CKT     MW      AMPS      KV
FROM      4 DC4           (DC)     2    2                          0.00
  TO    213 INVERT2     230.00     2    7        0.0      0.0
  TO      5 DC5           (DC)     4    4   1    0.0      0.0

       BUS# X-- NAME --X BASKV AREA ZONE CKT     MW      AMPS      KV
FROM      5 DC5           (DC)     4    4                          0.00
  TO      1 DC1           (DC)     4    4   1    0.0      0.0
  TO      2 DC2           (DC)     2    2   1    0.0      0.0
  TO      3 DC3           (DC)     4    4   1    0.0      0.0
  TO      4 DC4           (DC)     2    2   1    0.0      0.0
```

Figure 13.22. Example: Output for Activity MTDC

13.7. Graphical Reports

13.7.1. Generating a Graphical Report

GRPG

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
GRPG	Activity runs without a suffix.

The graphic report generating activity GRPG allows the user to generate arbitrary diagrams on a customer-supported graphics output device.

The dialog prompts the user to:

```
ENTER INPUT FILE NAME, FILE TYPE OPTION (0=EXIT, 1=TERMINAL):
```

The user will respond with either:

- The name of the appropriate GRED Library file (*.sgf) created by activity GRED of PSS®E-21 or later and containing one or more binary GRPG diagrams, optionally followed by ,L.
- The name of the appropriate Graphical Report Definition Data file (*.grp) containing source records, optionally followed by ,S.
- The name of the appropriate binary Graphical Report Definition Data file (*.grb) created by activity GRED of PSS®E-19 or earlier containing a single GRPG diagram, followed by ,B.
- 1 to enable the user to enter data directly from the dialog input device. This applies to both interactive and Response File operation of PSS®E. Subsequent inputs are treated as GRPG commands until the END or ABORT command is entered.
- 0 to exit activity GRPG without reading any data or generating any graphical display.

If activity GRPG is unable to open the specified file, an appropriate message is printed and the user is asked to reenter a filename as described above.

A dialog opens, requesting specification from among the customer-supported graphics output devices.

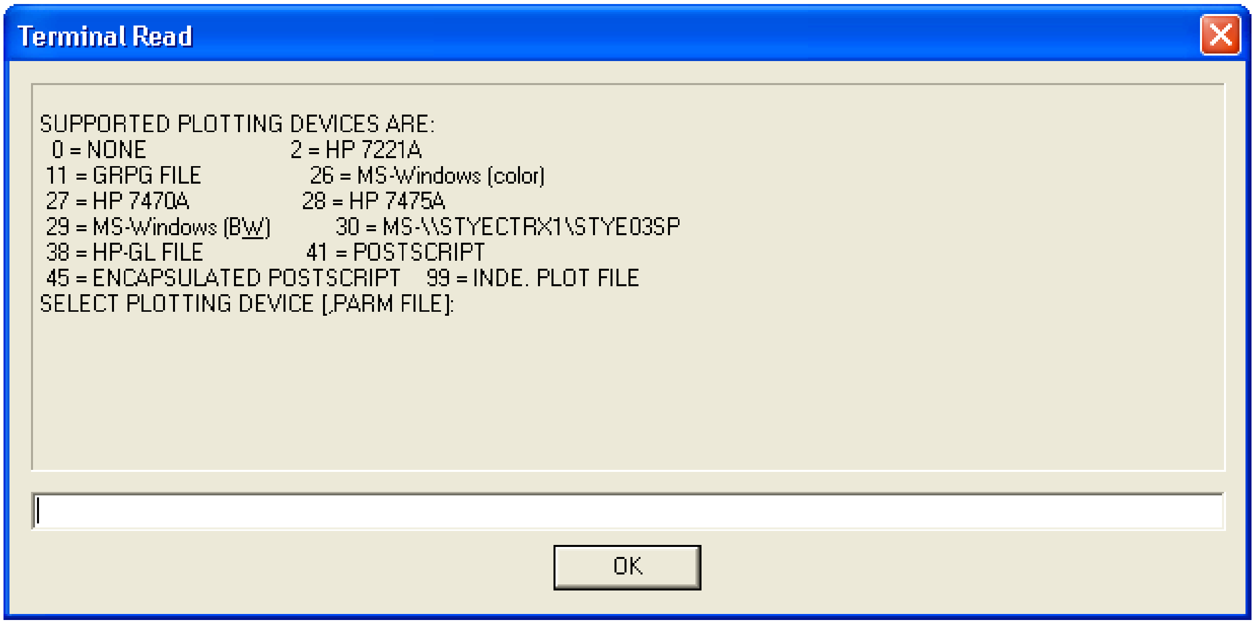


Figure 13.23. Plotting Device Popup Dialog

For terminal display, enter the device number for MS-Windows (color) or MS-Windows (BW). To close the graphic display and return to the *[Terminal Read]* dialog, use *[Enter]*.

After terminal input is specified, activity GRPG issues the prompt **GRPG:** each time it is ready to accept a new GRPG command. GRPG command input ends by entering either an END or ABORT command.

When input is taken from a Graphical Report Definition Data File, no prompts are issued. If the input file is not terminated with either the END or ABORT command, additional GRPG commands are taken from the dialog input device.

If an error occurs in processing an input record, an appropriate error message is printed, the offending record is ignored, and processing continues.

When all input defining a diagram has been processed (that is, an END or START NEW PLOT command is encountered), the user is requested to specify the graphical output device where the diagram is to be plotted. When graphical output is directed to a graphic CRT, the display remains on the screen until the user presses *[Enter]*. The list of valid plotting devices is again displayed, giving the user the ability to repeat the drawing on another graphics output device. This is repeated until zero is entered. The above process is repeated for each drawing defined in the data input file. Following the processing of the final drawing, activity GRPG ends.

Activity GRPG may be run without a valid working case in memory. However, if any of the commands that access the working case are to be used, a working case solved to an acceptable mismatch tolerance must be present.

Activity GRPG is not able to access GRED Library Files created in PSS®E-20. Such files must be picked up by activity GRED and converted to the current GRED Library File format.

```
>>GRPG
 ENTER INPUT FILE NAME, FILE TYPE OPTION (0=EXIT):
>>savnw.grp

 Drawing currently being imported is:

      ID #      Creation date               Plot #     Drawing Source
 *      48      THU, MAY 29 2008   10:59         1     savnw.grp
 COMMENT          ...SAMPLE GRPG DATA FILE...
 COMMENT         DISPLAYS AREA INTERCHANGE PLUS
 COMMENT       AREA GENERATION AND LOAD SUMMARIES
 SAVING MACRO--> AREANAME
 SAVING MACRO--> ANNOTATE

 *** INVALID FILENAME
    INCLUDE intchgu WITH OFFSET 3.3,5.7 AND SCALE 1.0

 *** INVALID FILENAME
    INCLUDE intchgd WITH OFFSET 3.7,6.8 AND SCALE 1.0

 *** INVALID FILENAME
    INCLUDE intchgd WITH OFFSET 3.7,3.0 AND SCALE 1.0

 *** INVALID FILENAME
    INCLUDE intchgu WITH OFFSET 3.3,2.0 AND SCALE 1.0

 Drawing currently loaded in GRPG002.SGF for plotting is:

      ID #      Creation date               Plot #     Drawing Source
 *      48      THU, MAY 29 2008   10:59         1     savnw.grp

 ***WARNING, Should close previous graphics device.
```

Figure 13.24. Example: Running Activity GRPG

Additional Information
PSS® E Program Operation Manual, Generating a Graphical Report

13.7.2. Displaying Power Flow Solution on the Diagram

GOUT

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
GOUT	Activity runs without a suffix.

The graphical power flow output activity GOUT results in the execution of the GUI diagram view graphical power flow bus display function.

The dialog prompts the user to:

```
SELECT DISPLAY TYPE: 0 = EXIT 1 = DISPLAY BUS 2 = DISPLAY BRANCH:
```

where a response of 0 ends activity GOUT. Following a response of 1 or 2, the dialog prompts the user to specify the bus or branch to be displayed. The drawing is then generated. Then the dialog prompts the user to:

```
ENTER: 0 = RETURN 1 = SELECT NEW PLOTTING DEVICE 2 = NEW PLOT ON THE device
name 3 = REPEAT PLOT ON NEW DEVICE:
```

If appropriate, the user is asked to designate a new device code, and ultimately the user may specify another bus or branch, as appropriate, for display.

```
>>GOUT

 Enter  0 to exit
       26 for interactive display
       30 for default printer:
>>26

 SELECT DISPLAY TYPE:
   0 = EXIT             1 = DISPLAY BUS
   2 = DISPLAY BRANCH:
>>1
 ENTER BUS NUMBER (0 FOR NO MORE):
>>151

 ENTER:
   0 = RETURN
   1 = SELECT NEW PLOTTING DEVICE
   2 = NEW PLOT ON THE CURRENT DEVICE
   3 = REPEAT PLOT ON NEW DEVICE:
>>0
 ENTER BUS NUMBER (0 FOR NO MORE):
>>0

 SELECT DISPLAY TYPE:
   0 = EXIT             1 = DISPLAY BUS
   2 = DISPLAY BRANCH:
>>0

 ACTIVITY? :
>>
```

Figure 13.25. Example: Running Activity GOUT

Additional Information
PSS® E Program Operation Manual, Displaying Power Flow Solution on the Diagram

13.7.3. Displaying Power Flow Data on the Diagram

GEXM

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
GEXM	Activity runs without a suffix.

The graphical power flow data examination activity GEXM results in the execution of the GUI diagram view GEXM function.

The dialog prompts the user to:

```
SELECT DISPLAY TYPE: 0 = EXIT 1 = DISPLAY BUS 2 = DISPLAY BRANCH:
```

where a response of 0 ends activity GEXM. Following a response of 1 or 2, the dialog prompts the user to specify the bus or branch to be displayed. The drawing is then generated.

The dialog prompts the user to:

```
ENTER: 0 = RETURN 1 = SELECT NEW PLOTTING DEVICE 2 = NEW PLOT ON THE device
name 3 = REPEAT PLOT ON NEW DEVICE:
```

If appropriate, the user is asked to designate a new device code, and ultimately the user may specify another bus or branch, as appropriate, for display.

```
>>GEXM

 Enter  0 to exit
       26 for interactive display
       30 for default printer:
>>26

 SELECT DISPLAY TYPE:
   0 = EXIT              1 = DISPLAY BUS
   2 = DISPLAY BRANCH:
>>1
 ENTER BUS NUMBER (0 FOR NO MORE):
>>152

 ENTER:
   0 = RETURN
   1 = SELECT NEW PLOTTING DEVICE
   2 = NEW PLOT ON THE CURRENT DEVICE
   3 = REPEAT PLOT ON NEW DEVICE:
>>0
 ENTER BUS NUMBER (0 FOR NO MORE):
>>0

 SELECT DISPLAY TYPE:
   0 = EXIT              1 = DISPLAY BUS
   2 = DISPLAY BRANCH:
>>0

 ACTIVITY? :
>>
```

Figure 13.26. Example: Running Activity GEXM

Additional Information
PSS® E Program Operation Manual, Displaying Power Flow Data on the Diagram

Chapter 14
Switching

14.1. Converting Generators

CONG

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level. Machine impedance data must be correctly specified for all online machines	
Activity ID, Suffix	Suffix Function
CONG,SQ	Convert using fault analysis positive sequence machine impedance ZPOS instead of default machine impedance ZSORCE

The generator conversion activity CONG initializes the generators in the working case in preparation for dynamic simulation calculations, network solutions used in switching studies (activity TYSL), and the three sequence equivalencing activity SCEQ. It also remembers the conditions at each FACTS device and VSC dc line for use in their modeling in switching studies:

Activity CONG calculates the Norton source current for all Type 2 and 3 buses on the basis of the network conditions at the bus (voltage and power output) and the values specified for MBASE, ZSORCE, XTRAN, and GTAP. In addition, the type codes of system swing buses are changed from 3 to 2, and of var-limited generator buses from -2 to 2.

The working case must be solved to an acceptable mismatch level and appropriate values of MBASE, ZSORCE, XTRAN, and GTAP must have been specified for all in-service generators prior to running activity CONG.

When activity CONG is run with the SQ suffix, the positive sequence generator impedances as specified in sequence data input are used in place of ZSORCE in determining the Norton source currents. If sequence data had not previously been read into the working case, activity CONG prints the following message and proceeds with the generator conversion using ZSORCE:

```
SEQUENCE DATA NOT IN CASE--USING ZSORCE
```

Activity CONG is neither reversible nor repeatable. Therefore, it is *strongly* recommended that the power flow case be saved prior to running activity CONG. Furthermore, the only network solution permitted following activity CONG is activity TYSL.

An alarm message is generated for any bus with a machine where an impedance of zero is detected during the Norton current calculation. An alarm message is also generated for any Type 2 or Type 3 bus that does not have a plant sequence number assigned to it.

```
>>CONG

 GENERATOR CONVERSION COMPLETED

 ACTIVITY? :
>>
```

Figure 14.1. Example: Running Activity CONG

Additional Information
PSS® E Program Operation Manual, Converting Generators

14.2. Converting Load Characteristics

CONL

Requirements / Prerequisites	
Validly specified power flow case solved to an acceptable mismatch level.	
Activity ID, Suffix	Suffix Function
CONL,ALL	Apply load mix to entire system
CONL,AREA	Apply load mix to specified area(s)
CONL,ZONE	Apply load mix to specified zone(s)
CONL,OWNER	Apply load mix to specified owner(s)
CONL,KV	Apply load mix to specified base kV range
CONL,OPT	User selects options manually using an interactive dialog

The load conversion activity CONL converts the constant MVA load for a specified grouping of network loads to a specified mixture of the constant MVA, constant current, and constant admittance load characteristics. The user specifies the portion of the working case to be processed by entering the appropriate suffix when running activity CONL.

When activity CONL is run without a suffix, the user is asked to select the buses for which loads are to be converted.

When activity CONL is run with the ALL suffix, all loads at all buses in the working case are processed.

When activity CONL is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed. In this mode, or when bus selection is specified, the user specifies the subsystem to be processed, the dialog described below is entered, and the specified grouping of loads is processed. The user may then specify another group of loads to be processed.

When activity CONL is run with the KV suffix, it processes all loads at each bus where base voltage falls within the specified base voltage band.

When activity CONL is run with the AREA, ZONE, OWNER suffix, each load assigned to one of the areas, zones, or owners specified is converted. The area, zone, or owner assignments of buses are not considered in these subsystem selection modes.

When activity CONL is run with the OPT suffix, multiple selection criteria are enabled. The base voltage and/or bus selection criteria, if enabled, dictate those buses for which loads are candidates for processing; otherwise, all buses are candidates for processing. The area, zone, and/or owner selection criteria, if enabled, dictate which loads at candidate buses are to be converted; otherwise, all loads are candidate buses are converted.

For each grouping of loads to be processed, activity CONL invites the user to specify the manner in which the existing constant MVA load is to be apportioned. This is done by specifying the percentages of the constant current and constant admittance load characteristics in response to the following instructions:

```
ENTER % CONSTANT I, % CONSTANT G FOR ACTIVE POWER: ENTER % CONSTANT I, % CONSTANT
B FOR REACTIVE POWER:
```

Activity CONL then summarizes the mixture of load characteristics and requests verification that this is the desired load split as in the following example:

```
LOAD TO BE REPRESENTED AS: ACTIVE REACTIVE 30.00% 0.00% CONSTANT POWER 30.00%
50.00% CONSTANT CURRENT 40.00% 50.00% CONSTANT ADMITTANCE ENTER 1 IF O.K., 0
OTHERWISE:
```

A response of zero provides the user with the opportunity to respecify the split of load as described above. If a one is entered in response to the dialog, the appropriate load conversion is applied.

Prior to ending, activity CONL prints the message:

```
n OF m LOADS CONVERTED
```

where m is the total number of loads and n is the number of loads processed while activity CONL is being run. If all loads have not been processed (that is, n < m), the dialog prompts the user to:

```
ENTER 1 TO CONVERT REMAINING m-n LOADS:
```

When a 1 is entered in response to the above request, the dialog described above is entered, the remaining loads are converted as specified, and the `LOADS CONVERTED` summary message is again printed.

```
>>CONL,OPT

 ENTER OPTION CODE:
  0 = NO MORE        1 = BY AREA
  2 = BY ZONE        3 = BY BASE KV
  4 = BY BUS         5 = BY OWNER:
>>4
 ENTER UP TO 20 BUS NUMBERS

>>152 153 154

 ENTER OPTION CODE:
  0 = NO MORE        1 = BY AREA
  2 = BY ZONE        3 = BY BASE KV
  4 = BY BUS         5 = BY OWNER:
>>0
 ENTER % CONSTANT I, % CONSTANT G FOR ACTIVE POWER:
>>
 ENTER % CONSTANT I, % CONSTANT B FOR REACTIVE POWER:
>>92,98

 LOAD TO BE REPRESENTED AS:
     ACTIVE REACTIVE
    100.00%  -90.00% CONSTANT POWER
      0.00%   92.00% CONSTANT CURRENT
      0.00%   98.00% CONSTANT ADMITTANCE
 ENTER 1 IF O.K., 0 OTHERWISE:
>>1

      3 LOADS CONVERTED DURING THIS STEP

 DO YOU WANT MORE? :
>>no
 ENTER 1 TO CONVERT REMAINING      5 LOADS:
>>0

      3 OF      8 LOADS CONVERTED

 ACTIVITY? :
>>
```

Figure 14.2. Example: Running Activity CONL,OPT

Additional Information
PSS®E Program Operation Manual, Converting Load Characteristics

14.3. Reconverting Load Characteristics

RCNL

Requirements / Prerequisites	
Validly specified power flow case. If the existing voltage vector is used in the load reconstruction, the working case must be solved to an acceptable mismatch.	
Activity ID, Suffix	Suffix Function
RCNL,ALL	Apply load mix to entire system
RCNL,AREA	Apply load mix to specified area(s)
RCNL,ZONE	Apply load mix to specified zone(s)
RCNL,OWNER	Apply load mix to specified owner(s)
RCNL,KV	Apply load mix to specified base kV range
RCNL,OPT	User selects options manually using an interactive dialog

The load reconstruction and conversion activity RCNL reconstructs the constant MVA load from the three load characteristics for specified network loads. It then converts the reconstructed MVA load to a specified mixture of the constant MVA, constant current, and constant admittance load characteristics.

Upon initiation, activity RCNL instructs the user to designate the option to be used in reconstructing the MVA load:

```
ENTER LOAD RECONSTRUCTION OPTION: 1 FOR PRESENT VOLTAGE 2 OR 3 FOR UNITY VOLTAGE:
```

The user specifies the portion of the working case to be processed by entering the appropriate suffix when running activity RCNL.

When activity RCNL is run without a suffix, the user is asked to select the buses for which loads are to be processed.

When activity RCNL is run with the ALL suffix, all loads at all buses in the working case are processed.

When activity RCNL is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed. In this mode, or when bus selection is specified, the user specifies the subsystem to be processed, the load conversion specification dialog is entered, and the specified grouping of loads is processed. The user may then specify another group of loads to be processed.

When activity RCNL is run with the KV suffix, it processes all loads at each bus where base voltage falls within the specified base voltage band.

When activity RCNL is run with the AREA, ZONE, or OWNER suffix, each load assigned to one of the areas, zones, or owners specified is processed. The area, zone, or owner assignments of buses are not considered in these subsystem selection modes.

When activity RCNL is run with the OPT suffix, multiple selection criteria are enabled. The base voltage and/or bus selection criteria, if enabled, dictate those buses for which loads are candidates for processing; otherwise, all buses are candidates for processing. The area, zone, and/or owner selection criteria, if enabled, dictate which loads at candidate buses are to be processed; otherwise, all loads are candidate buses are processed.

For each grouping of loads to be processed, activity RCNL enters an identical dialog to that of activity CONL.

```
 ACTIVITY? :
>>RCNL,ALL
 ENTER LOAD RECONSTRUCTION OPTION:
  1 FOR PRESENT VOLTAGE  2 OR 3 FOR UNITY VOLTAGE:
>>2
 ENTER % CONSTANT I, % CONSTANT G FOR ACTIVE POWER:
>>
 ENTER % CONSTANT I, % CONSTANT B FOR REACTIVE POWER:
>>

 LOAD TO BE REPRESENTED AS:
     ACTIVE REACTIVE
    100.00%  100.00% CONSTANT POWER
      0.00%    0.00% CONSTANT CURRENT
      0.00%    0.00% CONSTANT ADMITTANCE
 ENTER 1 IF O.K., 0 OTHERWISE:
>>1

      8 LOADS CONVERTED DURING THIS STEP

      8 OF      8 LOADS CONVERTED

 ACTIVITY? :
>>
```

Figure 14.3. Example: Running Activity RCNL,ALL

Additional Information
PSS® E Program Operation Manual, Reconverting Load Characteristics

14.4. Ordering Network Buses for Matrix Manipulation

ORDR

Requirements / Prerequisites	
Validly specified specified power flow case.	
Activity ID, Suffix	Suffix Function
ORDR,OPT	Ignore out-of-service branches

The optimal ordering activity ORDR determines an ordering of the network buses such that sparsity is maintained as the Jacobian matrix is triangularized in activities FNSL, NSOL, FDNS, INLF, and ACCC, or the system admittance matrix is decomposed into its triangular factors in activities FACT and BKDY and the linearized network analysis activities DCLF, DFAX, DCCC, OTDF, TLTG, and SPIL:

When activity ORDR is run without a suffix, it ignores the service status of all branches and assumes all branches connected to Type 1, 2, or 3 buses are in-service. Thus, following the ordering, simple branch status changes do not require activity ORDR to be rerun.

When activity ORDR is run with the OPT suffix, it recognizes the status of network branches and ignores out-of-service branches in determining the bus ordering. Thus, when the network has been ordered using the OPT suffix and an out-of-service branch out-of-service is returned to service, activity ORDR should be re-run. The advantage in not using the OPT suffix is that branch status changes that do not isolate a bus do not require activity ORDR to be rerun repeatedly. However, when a large number of branches are out-of-service, the specification of the OPT suffix *may* result in a more efficient matrix storage, thereby decreasing both the time and memory required to apply calculations using the network matrices.

Activities FNSL, FDNS, NSOL, INLF, ACCC, FACT, BKDY, and the linearized network activities automatically apply activity ORDR if the user has not explicitly done so prior to their being run.

```
 ACTIVITY? :
>>ORDR
 DIAGONALS =      22   OFF-DIAGONALS =      40   MAX SIZE =      58

 ACTIVITY? :
>>
```

Figure 14.4. Example: Running Activity ORDR

Additional Information
PSS® E Program Operation Manual, Ordering Network Buses for Matrix Manipulation

14.5. Factorizing the Network Admittance Matrix

FACT

Requirements / Prerequisites	
Validly specified power flow case. Normally, the load characteristics are modified. Converting Generators Converting Load Characteristics.	
Activity ID, Suffix	Suffix Function
FACT	Activity runs without a suffix.

The triangular factorization activity FACT decomposes the network admittance matrix (Y matrix) into its upper and lower triangular factors for use in the triangularized Y matrix network solution (activity TYSL) or in the network balance of dynamic simulations.

Activity FACT tabulates the number of non-zero diagonal and off-diagonal terms in each factor of the matrix.

Activity CONG, usually activity CONL, and activity ORDR are required to be run before running activity FACT. Activity FACT prints an appropriate error message and ends if generators have not been converted (that is, activity CONG has not been run).

If activity FACT detects that activity ORDR is required, a message is printed and activity ORDR is automatically run prior to the factorization.

```
 ACTIVITY? :
>>FACT
 ORDERING NETWORK
 DIAGONALS =      45  OFF-DIAGONALS =      65  MAX SIZE =     106
 BUS     301 [NORTH        765.00] ISOLATED
 BUS     401 [COGEN-1      500.00] ISOLATED
 BUS     402 [COGEN-2      500.00] ISOLATED

     45 DIAGONAL AND     63 OFF-DIAGONAL ELEMENTS

 ACTIVITY? :
>>
```

Figure 14.5. Example: Running Activity FACT

Additional Information
PSS® E Program Operation Manual, Factorizing the Network Admittance Matrix

14.6. Solving the Converted Case

TYSL

<table>
<tr><th colspan="2">Requirements / Prerequisites</th></tr>
<tr><td colspan="2">Validly specified power flow case with voltages corresponding to the preswitching network condition, and with impedance data specified for all machines.

Converting Generators

Converting Load Characteristics

Ordering Network Buses for Matrix Manipulation

Factorizing the Network Admittance Matrix</td></tr>
<tr><td>Activity ID, Suffix</td><td>Suffix Function</td></tr>
<tr><td>TYSL,FS</td><td>All voltages initialized to unity magnitude at zero phase; flat start</td></tr>
</table>

The triangularized Y matrix network solution activity TYSL is designed for those situations where the internal flux linkages of generators are assumed to remain unchanged as a load or fault is switched onto the system, as a line is opened or closed, or as a load is removed. It determines the instantaneous change in network voltages as the switching operation takes place. This activity is used for balanced short circuit, motor starting, voltage dip, and initial load rejection overvoltage studies; this class of studies is termed switching studies:

When activity TYSL is run with the FS suffix, all bus voltages are reset to unity magnitude at zero phase angle for a flat start. Otherwise, the existing voltage vector in the working case is used as the initial voltage estimate.

Activity TYSL requires that the factors of the network admittance matrix exist in the admittance matrix temporary file (that is, activity FACT must be run before activity TYSL).

```
 ACTIVITY? :
>>TYSL,FS

 ITER DELTAV/TOL X--------- AT BUS ----------X  REAL(DELTAV)  IMAG(DELTAV)
    1 **********      213 [INVERT2     230.00]    0.4633E-01   -0.1365E+01
    2 **********      213 [INVERT2     230.00]    0.1932E+00    0.1312E+01
    3 **********     3022 [EDUM        18.000]   -0.6849E+00   -0.1116E+01
    4 **********     3022 [EDUM        18.000]    0.9340E+00    0.1065E+01
    5 **********     3022 [EDUM        18.000]   -0.9608E+00   -0.1020E+01
    6 **********     3022 [EDUM        18.000]    0.9646E+00    0.9442E+00
    7 **********     3022 [EDUM        18.000]   -0.9647E+00   -0.8694E+00
    8 **********     3022 [EDUM        18.000]    0.9538E+00    0.7759E+00
    9 **********     3022 [EDUM        18.000]   -0.9058E+00   -0.7564E+00
   10 **********     3022 [EDUM        18.000]    0.8572E+00    0.7675E+00
   11 **********     3022 [EDUM        18.000]   -0.8359E+00   -0.8189E+00
   12 **********     3022 [EDUM        18.000]    0.8147E+00    0.9063E+00
   13 **********     3022 [EDUM        18.000]   -0.8111E+00   -0.1003E+01
   14 **********     3022 [EDUM        18.000]    0.8320E+00    0.1091E+01
   15 **********     3022 [EDUM        18.000]   -0.8224E+00   -0.1175E+01
   16 **********     3022 [EDUM        18.000]    0.8403E+00    0.1226E+01
   17 **********     3022 [EDUM        18.000]   -0.8308E+00   -0.1268E+01
   18 **********     3022 [EDUM        18.000]    0.8367E+00    0.1288E+01
   19 **********     3022 [EDUM        18.000]   -0.8325E+00   -0.1303E+01
   20 **********     3022 [EDUM        18.000]    0.8339E+00    0.1309E+01

 TERMINATED AFTER  20 ITERATIONS

 LARGEST MISMATCH: 2129.67 MW-1875.04 MVAR  2837.48 MVA AT BUS    152 [MID500      500.00]
 SYSTEM TOTAL ABSOLUTE MISMATCH:            14279.40 MVA

 ACTIVITY? :
>>
```

Figure 14.6. Example: Running Activity TYSL,FS

Additional Information
PSS® E Program Operation Manual, Solving the Converted Case

Chapter 15

Transmission Pricing and Open Access Activities

15.1. Calculating Transaction Event Impact on Monitored Elements

IMPC

Requirements / Prerequisites	
Validly specified power flow case. Entering Transactions Raw Data Distribution Factor Data File (*.dfx) corresponding to the network condition. Building the Distribution Factor Data File	
Activity ID, Suffix	Suffix Function
IMPC	Activity runs without a suffix.

Activity IMPC computes and reports the incremental monitored element MW flow impacts due to transaction events. The user is asked to provide the following:

```
ENTER DISTRIBUTION FACTOR FILENAME:
```

The user must enter the name of a Distribution Factor Data File constructed by activity DFAX that corresponds to the network condition contained in the working case and to the desired Linear Network Analysis Data Files. The Distribution Factor Data File must specify at least one monitored branch or interface. The bus input option *must* have the same setting that was in effect when activity DFAX filled the specified file.

The dialog prompts the user to:

```
ENTER ATC UPDATE FILENAME:
```

The user may provide the name of the ATC update file (optional).

The user is then prompted to choose one transaction from a list of transaction events.

```
>>IMPC

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT               1 FOR REPORT WINDOW
  2 FOR A FILE                  3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

 ENTER DISTRIBUTION FACTOR FILENAME:
>>dfxTEST.dfx
 ENTER ATC UPDATE FILENAME:
>>

 X---- TRANSACTION EVENT -----X
 ID    LABEL
 ----- ------------------------
     6 UPSTART
     5 WORLD
     2 LIGHTCO
     1 FLAPCO
 SELECT THE TRANSACTION EVENT (0 TO EXIT):
>>2

 ORDERING NETWORK
 DIAGONALS =      22  OFF-DIAGONALS =      40  MAX SIZE =      58
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    MON, MAY 19 2008  16:42
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                             PAGE 1
 BASE CASE INCLUDING SEQUENCE DATA
                       ** TRANSACTION IMPACT SUMMARY **

 DISTRIBUTION FACTOR FILE:      dfxTEST.dfx
 SUBSYSTEM DESCRIPTION FILE:    C:\Program Files\PTI\PSSE31\EXAMPLE\savnw.sub
 MONITORED ELEMENT FILE:        C:\Program Files\PTI\PSSE31\EXAMPLE\savnw.mon
 CONTINGENCY DESCRIPTION FILE:  C:\Program Files\PTI\PSSE31\EXAMPLE\savnw.con

 TRANSACTION:            2 LIGHTCO                  , FOR      1522.00 MW
 <------- F R O M -------> <--------- T O --------->CKT  <INT ATC MW> <IMPACT MW-> <FIN ATC MW>
    201 HYDRO       500.00    151 NUCPANT     500.00 1      1200.00        17.85      1182.15
    202 EAST500     500.00    152 MID500      500.00 1      1200.00       218.37       981.63
    203 EAST230     230.00    154 DOWNTN      230.00 1       200.00      -102.21       302.21
    205 SUB230      230.00    154 DOWNTN      230.00 1       600.00      -167.09       767.09
   3004 WEST        500.00    152 MID500      500.00 1         0.00       -50.21        50.21
    154 DOWNTN      230.00    153 MID230      230.00 2       300.00       -87.51       387.51
   3008 CATDOG      230.00    154 DOWNTN      230.00 1       400.00        76.79       323.21

 TRANSACTION:            2 LIGHTCO                  , FOR      1522.00 MW
 <-INTERFACE-> <INT ATC MW> <IMPACT  MW> <FIN ATC MW> <MAX TRN MW>
 WEST               200.00        -60.93       260.93
 EAST               350.00        -33.08       383.08

 ACTIVITY? :
>>
```

Figure 15.1. Example: Running Activity IMPC

Additional Information
PSS® E Program Operation Manual, Calculating Transaction Event Impact on Monitored Elements

15.2. Calculating Line Loading Relief

LLRF

Requirements / Prerequisites	
Validly specified power flow case. Entering Transactions Raw Data Distribution Factor Data File (*.dfx) corresponding to the network condition. Building the Distribution Factor Data File	
Activity ID, Suffix	Suffix Function
LLRF	Activity runs without a suffix.

Activity LLRF runs various analyses related to identifying the active power flow on monitored elements as a function of transaction events. LLRF is used to determine the following:

- transfer distribution factors on all monitored elements due to all transaction events;
- incremental curtailment of transaction events required to achieve an incremental flow change on a target monitored element; and
- incremental restoration of previously curtailed transaction events needed to achieve an incremental flow change on a target monitored element.

The user is asked to provide the following:

```
ENTER DISTRIBUTION FACTOR FILENAME:
```

The user must enter the name of a Distribution Factor Data File constructed by activity DFAX that corresponds to the network condition contained in the working case and to the desired Linear Network Analysis Data Files. The Distribution Factor Data File must specify at least one monitored branch or interface. The bus input option *must* have the same setting that was in effect when activity DFAX filled the specified file.

The dialog requests the user to enter a code for a line loading relief function:

```
>>LLRF

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                  1 FOR REPORT WINDOW
  2 FOR A FILE                     3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE     7 FOR PROGRESS WINDOW :
>>7

 ENTER DISTRIBUTION FACTOR FILENAME:
>>dfxTEST.dfx

 SELECT THE LINE LOADING RELIEF FUNCTION,
 (0 CURTAIL TRANSACTIONS [DEFAULT],
  1 RESTORE TRANSACTIONS,
  2 REPORT DISTRIBUTION FACTOR MATRIX,
  3 RESET DISTRIBUTION FACTOR TOLERANCE [0.05],
 -1 TO EXIT):
>>
```

Figure 15.2. Example: Running Activity LLRF

15.2.1.

Curtail or Restore Transactions

When continuing with specification of either curtail transactions or restore transactions, the user is next presented with a list of monitored elements and asked to specify the target element from this list and to define the target adjustment value in MW. The conventions for positive and negative element flow are defined when presenting the monitored element list to activity DFAX. Exiting from this monitored element list with no element specification returns the user to the prior level of dialog.

```
 SELECT THE LINE LOADING RELIEF FUNCTION,
 (0 CURTAIL TRANSACTIONS [DEFAULT],
  1 RESTORE TRANSACTIONS,
  2 REPORT DISTRIBUTION FACTOR MATRIX,
  3 RESET DISTRIBUTION FACTOR TOLERANCE [0.05],
 -1 TO EXIT):
>>0

 ORDERING NETWORK
 DIAGONALS =      22  OFF-DIAGONALS =     40  MAX SIZE =     58

 ASSIGN THE TRANSACTION ADJUSTMENT TARGET ELEMENT AND MW
 SEQ#   MONITORED ELEMENT
 ------ ----------------------------------------
      1     201 HYDRO       500.00    151 NUCPANT     500.00 1
      2     202 EAST500     500.00    152 MID500      500.00 1
      3     203 EAST230     230.00    154 DOWNTN      230.00 1
      4     205 SUB230      230.00    154 DOWNTN      230.00 1
      5    3004 WEST        500.00    152 MID500      500.00 1
      6     154 DOWNTN      230.00    153 MID230      230.00 2
      7    3008 CATDOG      230.00    154 DOWNTN      230.00 1
      8  INTERFACE: WEST
      9  INTERFACE: EAST
 ENTER SEQ# (0 TO EXIT), MW:
>>2,450

 PRIORITY AND ADJUSTMENT METHOD ASSOCIATION

 ADJUSTMENT  TRANSACTION
 METHOD      PRIORITY
 ----------- -----------
 FILO             1
 FILO             2
 FILO             5
 ENTER METHOD [<CR>TO EXIT, 0=FILO, 1=DF-ORDER, 2=DF-PRO RATA, 3=DF-SCHED-PRO RATA], PRIORITY:
>>
```

Figure 15.3. LLRF Curtail/Restore Transactions Dialog

By specifying a target element and defining the incremental flow target the program proceeds with a request for association of adjustment method. Four transaction event adjustment methods are available: first in last out (`FILO`), decreasing order of distribution factor magnitude (`DF-ORDER`), distribution factor pro rata (`DF-PRO RATA`), and a pro rata base on the product of distribution factor with transaction schedule (`DF-SCHED-PRO RATA`). A transaction's schedule is the transaction magnitude less curtailment. The user is presented with a list of transaction event priorities and associated adjustment method. The user may alter the adjustment method associated with each priority. Individual events, for which distribution factors exceed a tolerance, are grouped by priority. The curtail transactions function proceeds to investigate the priorities from lowest to highest priority number until the incremental flow target is satisfied or all transaction priority groups are exhausted. The restore transactions function proceeds to investigate the priorities from highest to lowest priority number until the incremental flow target is satisfied or all transaction priority groups are exhausted.

Having updated the adjustment method associations the activity proceeds by producing a report of transaction adjustments and the effect of each on the target monitored element. The transaction event curtailment values are updated by the reported adjustments.

15.2.2.

Distribution Factor Matrix

When continuing with a *report distribution factor matrix* specification, the activity produces a report of transfer distribution factors for all monitored elements due to all transactions events. Out-of-service transaction events will have distribution factors of zero.

15.2.3.

Reset Distribution Factor Tolerance

When continuing with a *reset distribution factor tolerance* specification, the activity prompts for a new value of distribution factor tolerance. This tolerance is employed to preclude those transaction events with negligible effect on the target monitored element from the transaction adjustment functions.

Additional Information
PSS® E Program Operation Manual, Calculating Line Loading Relief

15.3. Making Allocations

ALOC

Requirements / Prerequisites	
Validly specified power flow case. Entering Transactions Raw Data Building the Distribution Factor Data File	
Activity ID, Suffix	Suffix Function
ALOC,SS	Format for spreadsheet input

Activity ALOC runs various analyses related to identifying the MW-mile impact of transaction events on transmission facility owners. ALOC is used to:

- determine the MW-mile impacts of all transaction events on all transmission facility owners
- determine the active power generation on MW-mile shift factors of an individual event on all transmission facility owners
- determine the MW-ohm impacts of all transaction events on all control areas
- determine the active power generation on MW-ohm shift factors of a individual event on all control areas
- report the total branch mileage of each transmission facility owner.

The dialog requests the user to enter a code for the report:

```
SELECT THE ALLOCATION TYPE,

(0 FOR VECTOR ABSOLUTE MW-MILE [DEFAULT]

1 FOR GENERATION ON MW-MILE SHIFT FACTORS

2 FOR VECTOR ABSOLUTE MW-OHM

3 FOR GENERATION ON MW-OHM SHIFT FACTORS

4 FOR VECTOR MW-OHM

5 FOR MILEAGE SUMMARY

-1 TO EXIT):
```

If `GENERATION ON MW-MILE SHIFT FACTORS` or `GENERATION ON MW-OHM SHIFT FACTORS` is specified, the user is asked to specify an item from a list of transaction events. The report for that event is produced and the program will prompt for an activity.

When activity ALOC is run with the SS suffix, MW-mile or MW-ohm impact reports are formatted for import to a spreadsheet program. Data fields are delimited by semicolons.

```
 ACTIVITY? :
>>ALOC

 SELECT THE ALLOCATION TYPE,
 (0 FOR VECTOR ABSOLUTE MW-MILE [DEFAULT]
  1 FOR GENERATION ON MW-MILE SHIFT FACTORS
  2 FOR VECTOR ABSOLUTE MW-OHM
  3 FOR GENERATION ON MW-OHM SHIFT FACTORS
  4 FOR VECTOR MW-OHM
  5 FOR MILEAGE SUMMARY
 -1 TO EXIT):
>>1

  X---- TRANSACTION EVENT -----X
  ID    LABEL
  ----- ------------------------
     6 UPSTART
     5 WORLD
     2 LIGHTCO
     1 FLAPCO
 SELECT THE TRANSACTION EVENT (0 TO EXIT):
>>5

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7
BUS NO.; NAME; MW; TRAN 1       ; TRAN 2       ; TRAN 5       ; GEN 1        ; GEN 2        ; GEN 5        ; NO BUSES
        3011 ; MINE_G      ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000
        3002 ; E. MINE     ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000
        3003 ; S. MINE     ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000
        3004 ; WEST        ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000
        3005 ; WEST        ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000
        3006 ; UPTOWN      ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000
        3007 ; RURAL       ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000
        3018 ; CATDOG_G    ;    100.0000    ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000     ;     0.000000

 ACTIVITY? :
>>
```

Figure 15.4. Example: Running Activity ALOC

Additional Information
PSS® E Program Operation Manual, Making Allocations

Chapter 16
Optimal Power Flow

16.1. Reading Optimal Power Flow Data

ROPF

Requirements / Prerequisites	
Validly specified power flow case. Optimal Power Flow Data File (*.rop) Creating an Optimal Power Flow Raw Data File	
Activity ID, Suffix	Suffix Function
ROPF,filename	Read optimal power flow data from an Optimal Power Flow Raw Data File

Optimal power flow data may be introduced or appended through an OPF Raw Data File. Doing so requires that the base power flow data model be read in first, and that the additional OPF solution options be manually set.

```
>>ROPF
 ENTER OPF INPUT FILE NAME (0 TO EXIT, 1 FOR TERMINAL):
>>1
 ENTER IC

>>
 ENTER BUS ATTRIBUTE DATA:
 I    VMX    VMN    EVMX    EVMN    LIM    WGT

>>
 ENTER ADJUSTABLE BUS SHUNT DATA:
 I   VID   VADD   VRMX   VRMN   CST   TYP   STS   TBL

>>
 ENTER BUS LOAD DATA:
 I   LDID   TBL

>>
 ENTER ADJUSTABLE BUS LOAD TABLE DATA:
 TBL   MLT   MXL   MNL   RATIO   MXRT   MNRT CST TYP STS CTBL

>>
 ENTER GENERATOR DISPATCH DATA:
 IBUS   GID   FRAC   TBL

>>
 ENTER ACTIVE POWER DISPATCH DATA:
 TBL   MXPG   MNPG   FUEL TYP   STAT   CSTB

>>
 ENTER GENERATION RESERVE DATA:
 IBUS   GID   RAMP   GCAP

>>
 ENTER GENERATION REACTIVE CAPABILITY DATA:
 IBUS   GID   XD   ISMX   PFLG   PFLD   QMAX   STAT

>>
 ENTER ADJUSTABLE BRANCH REACTANCE DATA:
 IBUS   JBUS   CKT   XMLT   XMX   XMN   CST   TYP   STAT   CSTB

>>
 ENTER PIECE-WISE LINEAR COST TABLE DATA:
 ITBL    LABEL    NUMPRS

>>
 ENTER PIECE-WISE QUADRATIC COST TABLE DATA:
 ITBL    LABEL    COST    NUMPRS

>>
 ENTER POLYNOMIAL AND EXPONENTIAL COST TABLE DATA:
 ITBL    LABEL    COST    LINCOST   QUADCOST   EXPCOST   EXP

>>
 ENTER PERIOD RESERVE CONSTRAINT DATA:
 ENTER    ID   LIM   PER   STS

>>
 ENTER BRANCH FLOW CONSTRAINT DATA:
 IBUS   JBUS   CKT   BRID   MXFL   MNFL   EMXFL   EMNFL   TYP   LIM   WGT   KBUS

>>
 ENTER INTERFACE FLOW CONSTRAINT DATA:
 ENTER    ID   LBL   MXFL   MNFL   TYP   LIM   WGT
```

Figure 16.1. Example: Running Activity ROPF (1 of 2)

```
>>
ENTER PIECE-WISE QUADRATIC COST TABLE DATA:
ITBL   LABEL   COST   NUMPRS

>>
ENTER POLYNOMIAL AND EXPONENTIAL COST TABLE DATA:
ITBL   LABEL   COST   LINCOST   QUADCOST   EXPCOST   EXP

>>
ENTER PERIOD RESERVE CONSTRAINT DATA:
ENTER    ID   LIM   PER   STS

>>
ENTER BRANCH FLOW CONSTRAINT DATA:
IBUS  JBUS  CKT  BRID  MXFL  MNFL  EMXFL  EMNFL  TYP  LIM  WGT  KBUS

>>
ENTER INTERFACE FLOW CONSTRAINT DATA:
ENTER    ID   LBL   MXFL  MNFL  TYP  LIM  WGT

>>
ENTER LINEAR CONSTRAINT DEPENDENCY DATA:
EQID   EQLBL   SLKMX   SLKMN

>>
ENTER 2-TERMINAL DC LINE CONSTRAINT DATA:
ENTER  IDC    FLMX  FLMN   VMX  VMN

>>

ENTER IC

ENTER BUS ATTRIBUTE DATA:

ENTER ADJUSTABLE BUS SHUNT DATA:

ENTER BUS LOAD DATA:

ENTER ADJUSTABLE BUS LOAD TABLE DATA:

ENTER GENERATOR DISPATCH DATA:

ENTER ACTIVE POWER DISPATCH DATA:

ENTER GENERATION RESERVE DATA:

ENTER GENERATION REACTIVE CAPABILITY DATA:

ENTER ADJUSTABLE BRANCH REACTANCE DATA:

ENTER PIECE-WISE LINEAR COST TABLE DATA:

ENTER PIECE-WISE QUADRATIC COST TABLE DATA:

ENTER POLYNOMIAL AND EXPONENTIAL COST TABLE DATA:

ENTER PERIOD RESERVE CONSTRAINT DATA:

ENTER BRANCH FLOW CONSTRAINT DATA:

ENTER INTERFACE FLOW CONSTRAINT DATA:

ENTER LINEAR CONSTRAINT DEPENDENCY DATA:

ENTER 2-TERMINAL DC LINE CONSTRAINT DATA:
```

Figure 16.2. Example: Running Activity ROPF (2 of 2)

Additional Information
PSS®E Program Operation Manual, *Optimal Power Flow Raw Data File*

16.2. Listing Optimal Power Flow Data

LSTO

Requirements / Prerequisites	
Validly specified power flow case with optimal power flow data appended to it. Reading Optimal Power Flow Data	
Activity ID, Suffix	Suffix Function
LSTO,ALL	List all categories of optimal power flow data for all buses
LSTO,AREA	List data categories for all buses in specified area(s)
LSTO,ZONE	List data categories for all buses in specified zone(s)
LSTO,OWNER	List data categories for all buses for specified owner(s)
LSTO,KV	List data categories for all buses for specified base kV range
LSTO,OPT	User selects options manually using an interactive dialog
LSTO,REV	List specified categories of optimal power flow data for all buses with the voltage output option reversed (per unit or kV)

The data listing activity LSTO tabulates optimal power flow data in the working case. Activity LSTO is dependent upon the suffix specified when the activity is run.

When activity LSTO is run with the ALL suffix, a full data listing is produced.

When activity LSTO is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be listed.

When activity LSTO is run without a suffix, all categories of data are displayed.

```
 ACTIVITY? :
>>LSTO,AREA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7
 ENTER UP TO 20 AREA NUMBERS:

>>5

 ENTER OUTPUT CATEGORY DESIRED:
  0 = TO EXIT                         1 = CASE SUMMARY
  2 = BUS ATTRIBUTE DATA              3 = ADJUSTABLE BUS SHUNT DATA
  4 = BUS LOAD DATA                   5 = ADJUSTABLE BUS LOAD DATA
  6 = GEN. DISPATCH DATA              7 = ACTIVE POWER DISPATCH DATA
  8 = GENERATION RESERVE DATA         9 = GEN. REACTIVE CAPABILITY DATA
 10 = ADJ. BRANCH REACTANCE DATA     11 = LINEAR COST TABLE DATA
 12 = QUADRATIC COST TABLE DATA      13 = POLY. & EXP. COST TABLE DATA
 14 = PERIOD RES. CONSTRAINT DATA    15 = BRANCH FLOW CONSTRAINT DATA
 16 = INT. FLOW CONSTRAINT DATA      17 = LINEAR CONSTRAINT DATA
 18 = TWO-TERMINAL DC LINE DATA      21 = FULL LISTING:
>>9
 GENERATION REACTIVE CAPABILITY DATA   PTI OPTIMAL POWER FLOW -- PSS/OPF                                   Page   1
                                       PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE                    THU, MAY 15 2008  13:20
                                       BASE CASE INCLUDING SEQUENCE DATA
                                   GENERATOR  SYNCHRONOUS      STATOR CURRENT    LAGGING  LEADING  ABSORPTION            LIMIT
   BUS #    BUS NAME      BASE KV      ID      REACTANCE (PU)    LIMIT (PU)        PF       PF        (PU)       MBASE   STATUS
 ------------------------------------------------------------------------------------------------------------------------------
    3011    MINE_G        13.800       1          1.470           1.000          0.900    0.850     0.544     1000.000    1
    3018    CATDOG_G      13.800       1          1.760           1.000          0.950    0.900     0.454      130.000    4
 ENTER 0 TO EXIT, 1 FOR NEW DATA CATEGORY, 2 FOR NEW SUBSYSTEM:
>>0

 ACTIVITY? :
>>
```

Figure 16.3. Example: Running Activity LSTO,AREA

Additional Information
PSS®E Program Operation Manual, Listing Control and Constraint Data

16.3. Running the Optimal Power Flow Solution

NOPF

Requirements / Prerequisites	
Validly specified power flow case with optimal power flow data appended to it.	
Activity ID, Suffix	Suffix Function
NOPF,OPT	User selects options manually using an interactive dialog

Activity NOPF allows the user to define and then solve and analyze optimal power flow problems. In order to solve the case, that is, to apply an interior point solution to a nonlinear power flow network, the working case must contain data from either a PSS®E Saved Case (*.sav) (Section 3.1, “Data Specification Using the CLI”) or PSS®E Power Flow Raw Data File (*.raw) (Section 3.3, “Reading Power Flow Raw Data into the Working Case”) and an Optimal Power Flow Raw Data File (*.opt) (Section 16.1, “Reading Optimal Power Flow Data”), containing definitions for the constraints and controls of the OPF problem statement.

Specific objectives and solution parameter settings may be stored in in the optimal power flow options file, PSSOPF.OPT. When activity NOPF is run with the OPT suffix, the user enters the settings interactively. Default values for each objective are displayed in the middle column, as follows:

```
OBJECTIVE FUNCTIONS ARE: 1: NO MINIMIZE FUEL COST 2: NO MINIMIZE ACTIVE POWER SLACK GENERATION 3: NO MINIMIZE REACTIVE POWER SLACK GENERATION 4: NO MINIMIZE ACTIVE POWER LOSS 5: NO MINIMIZE REACTIVE POWER LOSS 6: NO MINIMIZE ADJUSTABLE BRANCH REACTANCE 7: NO MINIMIZE ADJUSTABLE BUS SHUNTS 8: NO MINIMIZE ADJUSTABLE BUS LOADS

9: NO MINIMIZE INTERFACE FLOWS 10: 1.00 ACTIVE POWER LOSS COST COEFFICIENT ($/pu MW) 11: 1.00 REACTIVE POWER LOSS COST COEFFICIENT ($/pu MVAR) 12: 1.00 INTERFACE FLOW COST COEFFICIENT ($/pu FLOW) ENTER PARAMETER CODE, NEW VALUE: >>
```

Responding with a value change is reflected immediately for the working case, as in the following example:

```
>> 5,YES   OBJECTIVE FUNCTIONS ARE: 1: NO MINIMIZE FUEL COST 2: NO MINIMIZE ACTIVE POWER SLACK GENERATION 3: NO MINIMIZE REACTIVE POWER SLACK GENERATION 4: NO MINIMIZE ACTIVE POWER LOSS 5: YES MINIMIZE REACTIVE POWER LOSS 6: NO MINIMIZE ADJUSTABLE BRANCH REACTANCE 7: NO MINIMIZE ADJUSTABLE BUS SHUNTS 8: NO MINIMIZE ADJUSTABLE BUS LOADS 9: NO MINIMIZE INTERFACE FLOWS 10: 1.00 ACTIVE POWER LOSS COST COEFFICIENT ($/pu MW) 11: 1.00 REACTIVE POWER LOSS COST COEFFICIENT ($/pu MVAR) 12: 1.00 INTERFACE FLOW COST COEFFICIENT ($/pu FLOW) ENTER PARAMETER CODE, NEW VALUE: >>
```

After all desired objectives are added from the first list, entering a zero or *[Enter]* opens another specification dialog.

```
>>0   SOLUTION OPTIONS ARE: 1: NO REGULATE AREA INTERCHANGE 2: NO CONSTRAIN INTERFACE FLOWS 3: NO USE AUTOMATIC SCALING 4: NO USE DUAL VARIABLE CONVERGENCE CRITERIA 5: NO FIX TRANSFORMER TAP RATIOS 6: NO FIX TRANSFORMER PHASE SHIFT ANGLES 7: NO FIX SWITCHED SHUNTS 8: NO ROUND TRANSFORMER TAP RATIOS AFTER
```

```
SOLUTION 9: NO ROUND SWITCHED SHUNT VARS AFTER SOLUTION 10: 0.00 QUADRATIC PENALTY COEFFICIENT ($/pu) 11: 1.000 INITIAL BARRIER COEFFICIENT 12: 0.00010 FINAL BARRIER COEFFICIENT 13: 0.99000 MINIMUM BARRIER STEP LENGTH TOLERANCE 14: 3 BAD ITERATION COARSE LIMIT 15: 10 BAD ITERATION FINE LIMIT ENTER PARAMETER CODE, NEW VALUE: >>
```

After all desired objectives are added from the second list, a zero or *[Enter]* accesses an interactive dialog with default specifications in brackets.

```
CLAMP NON-OPTIMIZED GENERATORS [ NO] ? : >> CLAMP NON-OPTIMIZED TRANSFORMERS [ NO] ? : >> ENTER PENALTY FOR FIXED VOLTAGES [ 100.00]: >> FIX GENERATOR VOLTAGES [ NO] ? : >> USE GENERATOR SCHEDULED VOLTAGE [ NO] ? : >> PRODUCE A LOG FILE OF THE SOLUTION [ NO] ? : >> ENTER OPTIMIZATION LOG FILE NAME (0 FOR NONE): >> 0   OUTPUT SOLUTION DETAILS IN REPORT [ NO] ? : >> YES   PRODUCE A PSS(tm)E RAW DATA CHANGE (RDCH) FILE [ NO] ? : >>
```

Activity NOPF then displays a list of avdanced solution options that may be modified in the same manner as the objectives.

```
ADVANCED SOLUTION OPTIONS: 1: NO APPLY STEP SIZE LIMIT 2: 100000.0 LAGRANGE MULTIPLIER BLOW-UP TOLERANCE 3: 0.0000 INTERIOR SHIFT PARAMETER 4: 0.9900 STEP LENGTH FOR BARRIER FUNCTION 5: 0.0000 STEP VALUE TO OPENUP MINIMUM TAP RATIO SETTING 6: 0.0000 STEP VALUE TO OPENUP MAXIMUM TAP RATIO SETTING ENTER PARAMETER CODE, NEW VALUE: >>
```

Responding with a zero or *[Enter]* ends the specification of advanced solution options.

Finally, the user must specify the output device for solution results.

```
ENTER OUTPUT DEVICE CODE: 0 FOR NO OUTPUT 1 FOR REPORT WINDOW 2 FOR A FILE 3 FOR DEFAULT PRINTER 6 FOR ALTERNATE SPOOL DEVICE 7 FOR PROGRESS WINDOW : >>
```

```
     Matrix Size                         Problem      Size
     -----------                         -----------------
  CM Rows:                    72         Angles         28
  CM Columns:                 90         Voltages       28
  Jacobian elements:         558         Xformers       11
  KTM elements:              860         MW gens         1
                                         MV gens         6
                                         Bus Shunts      0
                                         Sw. Shunts      0
                                         Load Shed       0
                                         Flows           3
                                         Interfaces      0
                                         S. Compen.      0
                                         R-cap.          5
                                         Res. Units      0
                                         Reserves        0
                                         Area Int.       3
                                         Lin. Dep.       0
                                         Segments        0

All data appears to be okay.

Note:  There were    3 infeasible variables found.
       The sum of the violations is    0.2055,
       The  largest   violation  is Efd       206        0.1934.

----------------------------------------------------------------------------------------------------
Iter  Mu NL Objective  Norm RHS  Mismatch(pu)  Row Equation       Nearest Variable     Step size  NE
----  -- ------------ ---------- ------------------------------  ------------------------------ ---
  1    0  1.08838E+01  1.82E+02   6.34E+00   RC-Q       206       AI           1    u   3.36E-01
  2    0  1.08422E+01  9.36E+02   4.17E+00   RC-Q       206       AI           1    u   8.70E-03
  3x   0  1.08592E+01  5.53E+04*  4.13E+00   RC-Q       206       AI           2         2.79E-03   2
  4x   0  1.08753E+01  7.22E+05*  4.12E+00   RC-Q       206       Volt      3011    u   3.07E-04   1

Error: Problem seems infeasible.
  5x   0  1.08798E+01  1.66E+07*  4.12E+00   RC-Q       206


    Minimum  X   loss  objective:     10.879782

Elapsed time:   0 minutes,  0.1 seconds.
    CPU time:   0 minutes,  0.0 seconds.

Producing OPF output report ...
Output report complete.

OUTPUT COMPLETED

LARGEST MISMATCH:    17.55 MW  315.60 MVAR   316.08 MVA AT BUS    154 [DOWNTN      230.00]
SYSTEM TOTAL ABSOLUTE MISMATCH:              651.77 MVA

SWING BUS SUMMARY:
  BUS# X-- NAME --X BASKV      PGEN     PMAX    PMIN      QGEN     QMAX    QMIN
  3011 MINE_G       13.800     257.9    900.0    0.0      118.5    600.0  -100.0

AREAS NOT MEETING DESIRED INTERCHANGE TOLERANCE
X---- AREA -----X X-- INTERCHANGE --X
   # X-- NAME --X    ACTUAL   DESIRED   TOLERANCE
   1 FLAPCO          297.1     250.0       10.0
   2 LIGHTCO        -142.7    -100.0       10.0

ACTIVITY? :
>>|
```

Figure 16.4. Example: Running Activity NOPF, Results

Additional Information
PSS® E Program Operation Manual, Optimal Power Flow

16.4. Creating an Optimal Power Flow Raw Data File

RWOP

Requirements / Prerequisites	
Validly specified power flow case with optimal power flow data appended to it.	
Activity ID, Suffix	Suffix Function
RWOP,ALL	Write data records for the entire working case
RWOP,AREA	Write data records for specified area(s)
RWOP,ZONE	Write data records for specified zone(s)
RWOP,OWNER	Write data records for specified owner(s)
RWOP,KV	Write data records for specified base kV range
RWOP,OPT	User selects options manually using an interactive dialog

Activity RWOP writes optimal power flow data contained in the working case in a format suitable for input to activity ROPF.

The dialog prompts the user to manage disconnected buses (that is, Type 4 buses) and out-of-service branches:

```
ENTER (1 TO OMIT ISOLATED BUSES),(1 TO OMIT OUT OF SERVICE BRANCHES):
```

with the default response in both cases being a zero (that is, include the outaged equipment).

When activity RWOP is run with the ALL suffix, optimal power flow data data for the entire working case is processed.

When activity RWOP is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, the dialog prompts the user to:

```
ENTER: 1 FOR ALL DATA WITHIN SPECIFIED SUBSYSTEM 2 FOR TIES FROM SPECIFIED
SUBSYSTEM 3 FOR ALL DATA PLUS TIES:
```

Following an input designating the completion of the subsystem selection process, the output tabulation is produced and activity RWOP ends.

```
>>RWOP

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE
>>2
 ENTER OUTPUT FILE NAME:
>>TESTnw.rop
 ENTER (1 TO OMIT ISOLATED BUSES),(1 TO OMIT OUT OF SERVICE BRANCHES):
>>

 ENTER: 1 FOR ALL DATA WITHIN SPECIFIED SUBSYSTEM
        2 FOR TIES FROM SPECIFIED SUBSYSTEM
        3 FOR ALL DATA PLUS TIES:
>>3
 ENTER UP TO 20 BUS NUMBERS

>>151 152 153 154
 ENTER UP TO 20 BUS NUMBERS

>>

 OUTPUT COMPLETED

 ACTIVITY? :
>>
```

Figure 16.5. Example: Running Activity RWOP

Additional Information
PSS®E Program Operation Manual, OPF Raw Data File Format

Chapter 17
Dynamic Simulation Setup

17.1. Reading Dynamics Model Data

DYRE

Requirements / Prerequisites	
Validly specified power flow case, solved to an acceptable mismatch level. Converting Generators	
Activity ID, Suffix	Suffix Function
DYRE,ADD	Add models to existing system model from a Dynamics Data File

If activity DYRE is run without the ADD suffix, and simulation data already exists in dynamics working memory, an appropriate message is generated and the dialog prompts the user to:

```
ENTER 0 TO INITIALIZE TABLES, 1 TO SWITCH TO ADD MODELS MODE:
```

The dialog instructs the user to:

```
ENTER DYNAMICS DATA SOURCE FILENAME:
```

After the name of the Dynamics Data Input File is entered, the dialog then requests additional filenames:

```
ENTER FILENAME FOR SUBROUTINE CONEC:
```

and:

```
ENTER FILENAME FOR SUBROUTINE CONET:
```

Activity DYRE places the connection subroutines into these files. If the user enters a blank line for either request, an image of the corresponding subroutine's CALL statements is written to the user's terminal rather than to a file.

Then activity DYRE generates the message:

```
NEXT AVAILABLE ADDRESSES ARE: CON STATE VAR ICON nnn nnn nnn nnn ENTER STARTING
CON, STATE, VAR, ICON OR CARRIAGE RETURN
```

The values <nnn> indicate the next available locations in the corresponding dynamics data arrays. When PSS®E is started, these indices are set to one and are subsequently updated by activities DYRE, CHAN, and CHSB. They may be changed by running activity ALTR using the category for solution parameter changes. These indices are preserved with dynamics working memory as it is saved and retrieved with activities SNAP and RSTR, respectively.

When constructing a new dynamics setup, the normal response to the above instruction is a one for each of the starting indices. When activity DYRE is used in its *add models* mode, the usual procedure is to let activity DYRE assign locations in the dynamics data arrays for the models being added beginning at the next unused slots.

A response of *[Enter]* to the request retains the displayed values in the working case.

An alarm message is generated for any model data record for which either too many, or not enough, data items have been specified. Upon completing its pass through the Dynamics Data Input File, activity DYRE generates the following message and then continues its processing, building the connection subroutines and depositing values in locations in the dynamics data constant arrays:

```
OUT OF FILE DATA--SWITCH TO TERMINAL INPUT MODE
```

The Progress tab then displays a summary of storage locations, a summary of the number of model references, and the status of the connection subroutines.

If the case has user models for which compilation is required, and if no model calls were generated in the connection routines CONEC and CONET, the following message is generated:

```
COMPILE USER MODELS, & CREATE USER DLL
```

If there are user models in the case, and if model calls were generated only in CONEC, the following message is generated:

```
COMPILE CONEC, USER MODELS, & CREATE USER DLL
```

If there are user models in the case, and if model calls were generated only in CONET, the following message is generated:

```
COMPILE CONET, USER MODELS, & CREATE USER DLL
```

If there are user models in the case, and if model calls were generated both in CONEC and in CONET, the following message is generated:

```
COMPILE CONEC, CONET, AND USER MODELS, & CREATE USER DLL
```

If the case does not have any user models for which compilation is required, the following message is generated:

```
NO USER WRITTEN MODELS IN CASE. COMPILATION NOT REQUIRED
```

Finally, activity DYRE instructs the user to:

```
ENTER FILENAME FOR COMPILING FILE (0 TO EXIT):
```

This instruction is skipped if no filenames were entered for both the CONEC and CONET filename specification requests above.

When a filename is specified in response to this request, activity DYRE creates a file that, when executed at operating system level, compiles the connection subroutines just constructed. A response of zero to the above instruction suppresses the generation of the compiling file.

17.1.1. Adding Models

Running activity DYRE with the ADD suffix initiates an *add models* mode. The usual procedure in adding models to an existing (or partially completed) system model is as follows:

1. Initiate PSS®E.

2. Use activity RSTR to restore the Snapshot containing the dynamics data of the existing system model (refer to Section 17.4, “Restoring Dynamics Working Memory from a Binary Snapshot File”).

3. Pick up the network model corresponding to the Snapshot accessed in (2).

4. Apply activity DYRE,ADD.

5. Apply activity SNAP (refer to Section 17.3, “Saving Dynamics Working Memory in a Binary File”).

6. Exit PSS®E with activity STOP (refer to Section 2.2, “Terminating PSS®E ”).

7. If there are model calls in the connection routines CONEC and/or CONET, merge the model calls generated in (4) with the original versions of these connection subroutines.

8. Compile the resulting subroutines and link the connection subroutines into PSS®E in the standard manner (see Extended Modeling in Dynamics Simulation and Program Set-Up in *PSS®E Program Operation Manual*).

If no additional model calls are generated in the connection subroutine additions files, steps 6 through 8 are not required (see below).

After specifying the appropriate Dynamics Model Raw Data File to activity DYRE in (4) above, the user enters the names of the files into which activity DYRE is to place any new connection subroutine model calls.

The user *should not* specify the pair of files containing the versions of these subroutines corresponding to the existing system model; activity DYRE does not append to the specified files but *overwrites* the previous contents of existing files. Refer to File Usage in the *PSS®E Program Operation Manual* for the file specification conventions used by activity DYRE.

The normal response to the request for starting data array indices is *[Enter]* to retain the displayed values, after which activity DYRE uses the *next available* locations as contained in the Snapshot restored in Step 2.

In the *add models* mode, activity DYRE summarizes the status of the connection subroutines by generating an appropriate message (refer to *PSS®E Program Operation Manual*, Section 17.1.1, “Adding Models”.

Additional Information
PSS®E Program Operation Manual, Reading Dynamics Model Data

17.2. Assigning Output Channels

17.2.1. Simulation Variables

CHAN

Requirements / Prerequisites	
Validly specified power flow case, solved to an acceptable mismatch level. Dynamics data must exist in dynamics working memory. Converting Generators	
Activity ID, Suffix	Suffix Function
CHAN	Activity runs without a suffix.

The output channel specification activity CHAN enables the user to specify simulation variables that are to be monitored during dynamic simulation runs. These quantities may be tabulated and/or placed into a Simulation Channel Output File at regular intervals during a simulation run. The simulation results, as contained in the Channel Output File, are able to be processed by the PSS®E plot package following completion of the simulation.

The user identifies quantities to be placed into output channels and activity CHAN places their memory addresses and alphanumeric identifiers into the PSS®E dynamics data arrays IPRINT and IDENT respectively.

When initiated, activity CHAN instructs the user:

```
NEXT AVAILABLE ADDRESSES ARE: CHANNEL VAR ICON nnn nnn nnn ENTER STARTING
CHANNEL, VAR, ICON INDICES OR CARRIAGE RETURN:
```

The values <nnn> are the next available location pointers for the corresponding dynamics data arrays. Responding with *[Enter]* assigns the next available locations in these arrays.

Activity CHAN then opens a dialog in which the user specifies the quantities to be placed into output channels and assigns identifiers to them. The dialog prompts the user to:

```
ENTER OUTPUT CATEGORY: 0 = EXIT 1 = ANGLE 2 = PELEC 3 = QELEC 4 = ETERM 5 = EFD
6 = PMECH 7 = SPEED 8 = XADIFD 9 = ECOMP 10 = VOTHSG 11 = VREF 12 = BSFREQ 13
= VOLTAGE 14 = VOLT & ANG 15 = FLOW (P) 16 = FLOW (P & Q) 17 = FLOW (MVA) 18 =
RELAY2 (R & X) 19 = VAR 20 = STATE 21 = MACH ITERM 22 = MACH APP IMP 23 = VUEL
24 = VOEL 25 = PLOAD 26 = QLOAD 27 = GREF 28 = LCREF 29 = WIND VEL. 30 = WIND
TUR. SPD 31 = WIND PITCH 32 = WIND AERO TOR 33 = WIND ROT VOL. 34 = WIND ROT
CUR. 35 = WIND P COMMAND 36 = WIND P COMMAND 37 = WIND AUX CON:
```

The user specifies the type of data to be placed in output channels and activity CHAN then asks the user to enter the element to be monitored and an optional thirty-two character identifier to be assigned to the output channel. For example, in specifying rotor angles (category one) with the numbers input option in effect, activity CHAN instructs the user to:

```
ENTER BUS NUMBER, MACHINE ID, 'IDENTIFIER':
```

The user responds with the desired bus number and machine identifier followed by the alphanumeric channel identifier that, if supplied, *must* be enclosed in single quotes. If no identifier is specified, activity CHAN supplies a default identifier.

When specifying branches for monitoring (categories 15 through 18), up to three buses may be specified, as shown in the following example:

```
ENTER FROM BUS, TO BUS, CIRCUIT ID, 'IDENTIFIER', THIRD BUS:
```

Nontransformer branches and two-winding transformers are specified by making no entry in the third bus field. For three-winding transformers, all three buses must be specified. Branch quantities are calculated at the end of the branch corresponding to the first bus specified.

Note that categories 14, 16, 18 and 22 generate two output channel assignments for each element specified for monitoring.

The specification process ends for a given category of data by entering a zero in response to the input request. The user is then given the opportunity to specify another category of data. Except when specifying a bus name, a response of -1 to an input request ends activity CHAN.

Following an input designating the completion of the channel specification process, a summary of the next available positions in the pertinent arrays are displayed:

```
NEXT AVAILABLE ADDRESSES ARE: CHANNEL VAR ICON iii jjj kkk
```

The value of the solution parameter NCHAN, which indicates the highest numbered channel being monitored during simulations, is set to iii-1.

Error Messages

Alarm messages are generated during the dialog for errors generated by the following conditions:

1. A bus, machine, load or branch specified by the user is not in the working case. An appropriate error message is printed and the user is asked to respecify the equipment identifier(s).

2. In allocating an output channel, the preceding channel specification used the highest numbered output channel for which PSS®E is currently dimensioned. The following error message is printed and activity CHAN ends:

   ```
   ALL CHANNELS USED
   ```

3. In specifying an output quantity requiring a network monitoring model call, there are not enough ICONs remaining to accommodate those required by the model call. The following message is printed and the user is asked to specify the next output category:

   ```
   nnnn IS END OF ICON ARRAY
   ```

4. In specifying an output quantity requiring a network monitoring model call, there are not enough VARs remaining to accommodate those required by the model call. The following message is printed and the user is asked to specify the next output category:

   ```
   nnnn IS END OF VAR ARRAY
   ```

5. In specifying an output quantity requiring a network monitoring model call, the table accommodating the CHAN monitoring model references is full. The following message is printed and the user is asked to specify the next output category:

```
nnnn MONITORING MODELS SPECIFIED--POINTER TABLE FULL
```

6. In placing a VAR or STATE in an output channel, a VAR or STATE number greater than the largest for which PSS®E is currently dimensioned is specified. The following message is printed and the user is asked to specify the next VAR or STATE index:

```
nnnn IS END OF aaaaa ARRAY
```

```
>>CONG

 GENERATOR CONVERSION COMPLETED

 ACTIVITY? :
>>CHAN
 NEXT AVAILABLE ADDRESSES ARE:
   CHANNEL    VAR    ICON
        3       9       1
 ENTER STARTING CHANNEL, VAR, ICON INDICES OR CARRIAGE RETURN:
>>

 ENTER OUTPUT CATEGORY:
  0 = EXIT            1 = ANGLE            2 = PELEC
  3 = QELEC           4 = ETERM            5 = EFD
  6 = PMECH           7 = SPEED            8 = XADIFD
  9 = ECOMP          10 = VOTHSG          11 = VREF
 12 = BSFREQ         13 = VOLTAGE         14 = VOLT & ANG
 15 = FLOW (P)       16 = FLOW (P&Q)      17 = FLOW (MVA)
 18 = RELAY2 (R&X)   19 = VAR             20 = STATE
 21 = MACH ITERM     22 = MACH APP IMP    23 = VUEL
 24 = VOEL           25 = PLOAD           26 = QLOAD
 27 = GREF           28 = LCREF           29 = WIND VEL.
 30 = WIND TUR. SPD  31 = WIND PITCH      32 = WIND AERO TOR
 33 = WIND ROT VOL.  34 = WIND ROT CUR.   35 = WIND P COMAND
 36 = WIND Q COMAND  37 = WIND AUX.CON:
>>11
 ENTER BUS NUMBER, MACHINE ID, 'IDENTIFIER':
>>101 1

 CHANNEL    3 WITH IDENTIFIER "VREF   101[NUC-A       21.600]1" ADDED
 ENTER BUS NUMBER, MACHINE ID, 'IDENTIFIER':
>>102 1

 CHANNEL    4 WITH IDENTIFIER "VREF   102[NUC-B       21.600]1" ADDED
 ENTER BUS NUMBER, MACHINE ID, 'IDENTIFIER':
>>0

 ENTER OUTPUT CATEGORY:
  0 = EXIT            1 = ANGLE            2 = PELEC
  3 = QELEC           4 = ETERM            5 = EFD
  6 = PMECH           7 = SPEED            8 = XADIFD
  9 = ECOMP          10 = VOTHSG          11 = VREF
 12 = BSFREQ         13 = VOLTAGE         14 = VOLT & ANG
 15 = FLOW (P)       16 = FLOW (P&Q)      17 = FLOW (MVA)
 18 = RELAY2 (R&X)   19 = VAR             20 = STATE
 21 = MACH ITERM     22 = MACH APP IMP    23 = VUEL
 24 = VOEL           25 = PLOAD           26 = QLOAD
 27 = GREF           28 = LCREF           29 = WIND VEL.
 30 = WIND TUR. SPD  31 = WIND PITCH      32 = WIND AERO TOR
 33 = WIND ROT VOL.  34 = WIND ROT CUR.   35 = WIND P COMAND
 36 = WIND Q COMAND  37 = WIND AUX.CON:
>>
      2 OUTPUT CHANNELS HAVE BEEN ADDED

 ACTIVITY? :
>>
```

Figure 17.1. Example: Running Activity CHAN

Additional Information
PSS® E Program Operation Manual, Assigning Output Channels

17.2.2. Subsystem Simulation Data

CHSB

Requirements / Prerequisites	
Validly specified power flow case, solved to an acceptable mismatch level. Dynamics data must exist in dynamics working memory. Converting Generators	
Activity ID, Suffix	Suffix Function
CHSB,ALL	Add monitored quantities as output channels for entire working case
CHSB,AREA	Add monitored quantities as output channels for specified area
CHSB,ZONE	Add monitored quantities as output channels for specified zone
CHSB,OWNER	Add monitored quantities as output channels for specified owner
CHSB,KV	Add monitored quantities as output channels for specified base kV range
CHSB,OPT	User selects options manually using an interactive dialog
CHSB,TIES	Add monitored quantities involving branches between specified areas or zones as output channels
CHSB,SUBS	Add subsystem totals of certain power quantities as simulation output quantities for individual areas, zones or owners, or as the complete system
CHSB,ANGLES	Add machine angle statistics as simulation output quantities

The output channel specification activity CHSB enables the user to specify either simulation variables that are to be monitored during dynamic simulation runs on a subsystem basis, or certain machine angle-related quantities. These quantities may be tabulated, placed into a Simulation Channel Output File and/or plotted at the terminal at regular intervals during a simulation run. The simulation results, as contained in the Channel Output File, are able to be processed by the plotting package provided with PSS®E.

The user identifies quantities to be placed into output channels and activity CHSB places their memory addresses and alphanumeric identifiers into the PSS®E dynamics data arrays IPRINT and IDENT respectively.

When initiated, activity CHSB instructs the user:

```
NEXT AVAILABLE ADDRESSES ARE: CHANNEL VAR ICON nnn nnn nnn ENTER STARTING
CHANNEL, VAR, ICON INDICES OR CARRIAGE RETURN:
```

The values <nnn> are the next available location pointers for the corresponding dynamics data arrays. Responding with *[Enter]* assigns the next available locations in these arrays.

Subsequent operation of activity CHSB is dependent upon the suffix specified at the time the activity is run.

When activity CHSB is run without a suffix or with the ALL, AREA, ZONE, OWNER, KV or OPT suffix, it opens a dialog in which the user designates output channel quantities for machines, loads, buses and/or branches in a subset of the working case. The dialog prompts the user to:

```
ENTER OUTPUT CATEGORY: 0 = EXIT 1 = ANGLE 2 = PELEC 3 = QELEC 4 = ETERM 5 = EFD
6 = PMECH 7 = SPEED 8 = XADIFD 9 = ECOMP 10 = VOTHSG 11 = VREF 12 = BSFREQ 13
= VOLTAGE 14 = VOLT & ANG 15 = FLOW (P) 16 = FLOW (P & Q) 17 = FLOW (MVA) 18
= RELAY2 (R & X) 19 = VAR (CHAN only) 20 = STATE (CHAN only) 21 = MACH ITERM
22 = MACH APP IMP 23 = VUEL 24 = VOEL 25 = PLOAD 26 = QLOAD 27 = GREF 28 =
LCREF 29 = WPCMND 30 = WTRBSP 31 = WPITCH 32 = WAEROT 33 = WROTRV 34 = WROTRI
35 = WPCMND 36 = WQCMND 37 = WAUXSG:
```

Activity CHSB then instructs the user:

```
ENTER 1 TO INCLUDE OUT OF SERVICE EQUIPMENT:
```

If a one is specified, output channels are generated for all machines, loads, buses or branches, as appropriate, in the subsystem that is specified next in the dialog of activity CHSB. Otherwise, output channels are generated only for in-service machines, loads, buses or branches, as appropriate. The default response to the above instruction is a zero.

When activity CHSB is run with the ALL suffix, specified quantities are added as output channels for the entire working case.

When activity CHSB is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output channels are to be added.

For load and generating-plant quantities, activity CHSB processes all elements in the selected subsystem. For bus quantities, activity CHSB processes all buses in the specified subsystem. For branch quantities, activity CHSB processes all branches for which endpoint buses are in the specified subsystem. Output channels are generated, and then the user may specify another type of quantity, service status option, and, if appropriate, subsystem. Activity CHSB ends by entering a zero in response to the output category input request.

Note that categories 14, 16, 18 and 22 generate two output channel assignments for each element specified for monitoring.

When activity CHSB is run with the TIES suffix, it opens a dialog in which the user designates output channel quantities involving branches between areas or zones. The dialog prompts the user to:

```
ENTER OUTPUT CATEGORY: 0 = EXIT 1 = FLOW (P) 2 = FLOW (P & Q) 3 = FLOW (MVA)
4 = RELAY2 (R & X):
```

The dialog prompts the user to specify either area ties or zone ties:

```
ENTER 0 FOR TIES FROM AREAS 1 FOR TIES FROM ZONES:
```

Activity CHSB then instructs the user:

```
ENTER 1 TO INCLUDE OUT OF SERVICE EQUIPMENT:
```

If a one is specified, output channels are generated for all tie branches from the areas or zones, as appropriate, that are specified next in the dialog of activity CHSB. Otherwise, output channels are generated only for in-service tie branches. The default response to the above instruction is a zero.

Activity CHSB then opens a dialog through which the user selects area or zones, as appropriate. The specified branch quantity or quantities for all tie branches from each specified area or zone are placed into output channels. Then the user may specify another type of quantity, area or zone tie branch option, service status option, and area or zone selections. Activity CHSB ends by entering a zero in response to the output category input request.

When activity CHSB is run with the SU suffix, it opens a dialog in which the user designates output channel quantities involving summations by subsystem of: machine electrical power, machine mechanical power, accelerating power, and load demand. The dialog prompts the user to specify from among output categories:

```
ENTER OUTPUT CATEGORY: 0 = EXIT 1 = SUBSYSTEM TOTALS: 1
```

If a one is specified, the dialog prompts the user to:

```
ENTER: 0 FOR TOTALS BY AREA 1 FOR TOTALS BY ZONE 2 FOR TOTALS BY OWNER 3 FOR
TOTALS BY ALL BUSES:
```

Activity CHSB then instructs the user:

```
ENTER 1 TO INCLUDE OUT OF SERVICE EQUIPMENT:
```

For a subsystem designation of area, zone or owner, activity CHSB instructs the user to designate the desired subsystem. The power totals for the selected subsystem are then assigned to output channels. Activity CHSB ends by entering a zero in response to the output category input request.

When activity CHSB is run with the AN suffix, quantities with the following identities are specified for monitoring (no other dialog ensues):

```
AVERAGE ANGLE LARGEST ANGLE BUS WITH LARGEST ANGLE SMALLEST ANGLE BUS WITH
SMALLEST ANGLE ANGLE SPREAD
```

Activity CHSB supplies a channel identifier for each output channel that it generates. These identifiers are of the same forms as the default identifiers generated by activity CHAN.

Following an input designating the completion of the channel specification process, a summary of the next available positions in the pertinent arrays are displayed:

```
NEXT AVAILABLE ADDRESSES ARE: CHANNEL VAR ICON iii jjj kkk
```

The value of the solution parameter NCHAN, which indicates the highest numbered channel being monitored during simulations, is set to iii-1.

Error Messages

Alarm messages are generated during the dialog for errors generated by the following conditions:

1. In allocating an output channel, the preceding channel specification used the highest numbered output channel for which PSS®E is currently dimensioned. The following error message is printed and activity CHSB ends:

```
ALL CHANNELS USED
```

2. In specifying an output quantity requiring a network monitoring model call, there are not enough ICONs remaining to accommodate those required by the model call. The following message is printed and the user is asked to specify the next output category:

```
nnnn IS END OF ICON ARRAY
```

3. In specifying an output quantity requiring a network monitoring model call, there are not enough VARs remaining to accommodate those required by the model call. The following message is printed and the user is asked to specify the next output category:

```
nnnn IS END OF VAR ARRAY
```

4. In specifying an output quantity requiring a network monitoring model call, the table accommodating the CHAN monitoring model references is full. The following message is printed and the user is asked to specify the next output category:

```
nnnn MONITORING MODELS SPECIFIED--POINTER TABLE FULL
```

5. In specifying angle statistics, the following message is printed if the function was previously applied:

```
ANGLE STATISTICS STARTING AT VAR nnnn ALREADY IN CHANNELS
```

```
 ACTIVITY? :
>>CHSB

 NEXT AVAILABLE ADDRESSES ARE:
   CHANNEL    VAR    ICON
        5      9      1
 ENTER STARTING CHANNEL, VAR, ICON INDICES OR CARRIAGE RETURN:
>>8 11 2

 ENTER OUTPUT CATEGORY:
  0 = EXIT              1 = ANGLE              2 = PELEC
  3 = QELEC             4 = ETERM              5 = EFD
  6 = PMECH             7 = SPEED              8 = XADIFD
  9 = ECOMP            10 = VOTHSG            11 = VREF
 12 = BSFREQ           13 = VOLTAGE           14 = VOLT & ANG
 15 = FLOW (P)         16 = FLOW (P&Q)        17 = FLOW (MVA)
 18 = RELAY2 (R&X)     19 = VAR (CHAN only)   20 = STATE (CHAN only)
 21 = MACH ITERM       22 = MACH APP IMP      23 = VUEL
 24 = VOEL             25 = PLOAD             26 = QLOAD
 27 = GREF             28 = LCREF             29 = WVLCTY
 30 = WTRBSP           31 = WPITCH            32 = WAEROT
 33 = WROTRV           34 = WROTRI            35 = WPCMND
 36 = WQCMND           37 = WAUXSG:
>>7
 ENTER 1 TO INCLUDE OUT-OF-SERVICE EQUIPMENT:
>>1
 ENTER UP TO 20 BUS NUMBERS

>>101 102 206 211

      4 OUTPUT CHANNELS HAVE BEEN ADDED
```

Figure 17.2. Example: Running Activity CHSB

```
>>CHSB,TIES

 NEXT AVAILABLE ADDRESSES ARE:
   CHANNEL    VAR   ICON
       12       9      1
 ENTER STARTING CHANNEL, VAR, ICON INDICES OR CARRIAGE RETURN:
>>15 10 2

 ENTER OUTPUT CATEGORY:
  0 = EXIT              1 = FLOW (P)          2 = FLOW (P&Q)
  3 = FLOW (MVA)        4 = RELAY2 (R&X):
>>3

 ENTER: 0 FOR TIES FROM AREAS
        1 FOR TIES FROM ZONES:
>>0
 ENTER 1 TO INCLUDE OUT-OF-SERVICE EQUIPMENT:
>>1

 ENTER OUTPUT CATEGORY:
  0 = EXIT              1 = ANGLE             2 = PELEC
  3 = QELEC             4 = ETERM             5 = EFD
  6 = PMECH             7 = SPEED             8 = XADIFD
  9 = ECOMP            10 = VOTHSG           11 = VREF
 12 = BSFREQ           13 = VOLTAGE          14 = VOLT & ANG
 15 = FLOW (P)         16 = FLOW (P&Q)       17 = FLOW (MVA)
 18 = RELAY2 (R&X)     19 = VAR (CHAN only)  20 = STATE (CHAN only)
 21 = MACH ITERM       22 = MACH APP IMP     23 = VUEL
 24 = VOEL             25 = PLOAD            26 = QLOAD
 27 = GREF             28 = LCREF            29 = WVLCTY
 30 = WTRBSP           31 = WPITCH           32 = WAEROT
 33 = WROTRV           34 = WROTRI           35 = WPCMND
 36 = WQCMND           37 = WAUXSG:
>>1
 ENTER 1 TO INCLUDE OUT-OF-SERVICE EQUIPMENT:
>>1
 ENTER UP TO 20 BUS NUMBERS

>>101 102 206 211
 CHANNEL     5: BUS      0 NOT FOUND
 CHANNEL     6: BUS      0 NOT FOUND
 CHANNEL     7: BUS      0 NOT FOUND

      4 OUTPUT CHANNELS HAVE BEEN ADDED
```

Figure 17.3. Example: Running Activity CHSB,TIES

Additional Information
PSS®E Program Operation Manual, Section Activity, CHSB

17.3. Saving Dynamics Working Memory in a Binary File

SNAP

Requirements / Prerequisites	
Dynamics working memory must contain the appropriate dynamics data.	
Activity ID, Suffix	Suffix Function
SNAP,filename	Write to specified Snapshot File filename
SNAP,*	Overwrite last accessed binary Snapshot File

The snapshot activity SNAP preserves the contents of dynamics working memory in a user specified Snapshot File. PSS®E can also create a Snapshot file at the completion of activity STRT.

The name of the file in which the Snapshot is to exist may be specified at the time activity SNAP is run.

When an asterisk (*) is specified in running activity SNAP, the last Snapshot File accessed by either activity SNAP or activity RSTR in the current session of PSS®E is used.

If no file is specified, or if an error condition is encountered in opening the designated file, the user is asked to:

```
ENTER SNAPSHOT FILENAME:
```

The response of a zero or *[Enter]* ends activity SNAP.

At the start of activity SNAP the following message is displayed:

```
NUMBER OF ELEMENTS IN USE ARE: CONS STATES VARS ICONS CHANNELS nnn nnn nnn nnn
nnn ENTER NUMBER TO BE SAVED OR CARRIAGE RETURN FOR ABOVE VALUES
```

and the user responds with the number of elements in the CON, STATE, VAR and ICON arrays to be saved, along with the number of output channels to be written to the Snapshot File. The values <nnn> reflect the next available position indices as maintained by activities DYRE, CHAN, and CHSB. When specifying other than the default values (that is, the indices displayed), the number specified for each of the above quantities should be at least as large as the number of elements in use in the corresponding data arrays.

The contents of dynamics working memory are then written to the file, along with the current date and time. The following message is generated at the user's terminal and activity SNAP ends:

```
SNAPSHOT AT TIME = X.XXX
```

Additional Information
PSS®E Program Operation Manual,   Saving Dynamics Working Memory in a Binary File

17.4. Restoring Dynamics Working Memory from a Binary Snapshot File

RSTR

Requirements / Prerequisites	
Dynamics Snapshot Data File (*.snp) Saving Dynamics Working Memory in a Binary File Saved Case or Snapshot Filenames	
Activity ID, Suffix	Suffix Function
RSTR,filename	Replace dynamics working memory from specified Snapshot File
RSTR,*	Replace dynamics working memory from the last accessed binary Snapshot File

The filename of the Snapshot file may be specified at the time activity RSTR is initiated. When an asterisk (*) is entered, the last Snapshot File used by either activity RSTR or activity SNAP in the current session of PSS®E is retrieved. If no file is specified, or if a file system error condition is encountered in opening the designated file, the user is asked to:

```
ENTER SNAPSHOT FILENAME:
```

The response of a zero or *[Enter]* ends activity RSTR.

If the specified file is not in a Snapshot File format recognized by this release of PSS®E, the following error message is generated:

```
FILE filename NOT IN SNAPSHOT FILE FORMAT
```

To recover, re-apply activity RSTR, entering the correct Snapshot filename.

If the Snapshot exceeds the capacity limits of the size level of PSS®E currently installed in the system, the following message is generated:

```
SNAPSHOT filename TOO BIG FOR WORKING MEMORY
```

Generally, activity RSTR is able to access Snapshot Files filled by activity SNAP of the current and previous releases of PSS®E.

In restoring output channel specification data, activity RSTR automatically updates the channel addresses if the Snapshot was taken in a version of PSS®E of different dimensional capacity than the one currently installed on the system.

Finally, the case heading as read from the file is displayed at the user's terminal, along with the time and date at which the Snapshot was written, and the number of elements in the dynamics data arrays that were restored. Activity RSTR is then ended.

Additional Information
PSS®E Program Operation Manual,

Additional Information
Restoring Dynamics Working Memory from a Binary Snapshot File

17.5. Restoring Dynamics Working Memory from a Snapshot File Created in PSS®E-26 or Earlier

SRRS

Requirements / Prerequisites	
Validly specified power flow case, solved to an acceptable mismatch level. Converting Generators Creating a Dynamics Model Raw Data File	
Activity ID, Suffix	Suffix Function
SRRS,filename	Restore dynamics working memory with specified Source Form Snapshot File (Dynamics Snapshot Raw Data File)

The name of the file in which the Snapshot exists may be specified at the time activity SRRS is initiated. If no file is specified, or if a file system error condition is encountered in opening the designated file, the user is asked to:

```
ENTER SOURCE FORM SNAPSHOT FILENAME:
```

The response of a zero or *[Enter]* ends activity SRRS.

If the specified file is not in Source Form Snapshot File format, the following error message is generated:

```
FILE filename NOT IN SOURCE FORM SNAPSHOT FILE FORMAT
```

To recover, re-apply activity SRRS, entering a valid Source Form Snapshot File name.

If the number of CONs, ICONs, or output channels contained in the Snapshot File exceeds the capacity limits of the size level of PSS®E currently installed in the system, the following message is generated along with sizing information, and activity SRRS ends:

```
SNAPSHOT filename TOO BIG FOR WORKING MEMORY
```

Similarly, if any of the next available position pointers specified in the Snapshot File exceed the capacity limits of the size level of PSS®E currently installed, the following message is generated along with sizing information, and activity SRRS ends:

```
NEXT AVAILABLE POINTERS IN SNAPSHOT filename TOO BIG FOR WORKING MEMORY
```

Following the reading of the dynamics data from the Snapshot File, the case heading is displayed in the Progress tab, along with the time and date at which the Snapshot was written and the number of elements in the dynamics data arrays that were restored.

Prior to completion, activity SRRS gives the user the option of generating a file to compile the connection subroutines, CONEC and CONET. These were presumably obtained from the same party as the Source Form Snapshot that was just read by activity SRRS. The dialog prompts the user to:

```
TO BUILD COMPILING FILE ENTER CONEC FILE NAME: ENTER CONET FILE NAME: ENTER
FILENAME FOR COMPILING FILE (0 TO EXIT):
```

When a filename is specified in response to the third request, activity SRRS creates a file that, when executed at operating system level, compiles the CONEC and/or CONET subroutines that are contained in the files specified. A response of *[Enter]* to both the CONEC and CONET filename requests, or a zero or *[Enter]* to the final instruction above, suppresses the generation of the compiling file.

Additional Information
PSS®E Program Operation Manual,   Restoring Dynamics Working Memory from a Snapshot File Created in PSS®E-26 or Earlier

17.6. Modifying Data in Dynamics Working Memory

ALTR

Requirements / Prerequisites	
Dynamics data must exist in dynamics working memory.	
Activity ID, Suffix	Suffix Function
ALTR	Activity runs without a suffix.

The dynamics data change activity ALTR allows the user to examine and make changes to the values of data items contained in dynamics data working memory. It also provides for the specification of network data changes through an automatic link to the power flow activities CASE, CHNG, ORDR, and FACT.

Activity ALTR is organized in the same manner as activity CHNG and follows the same dialog conventions. The dialog displays the case heading and the current value of simulation TIME and then invites the user to specify the type of dynamics data to be changed:

```
ENTER CHANGE CODE: 0 = NO MORE CHANGES 1 = OUTPUT CHANNEL DATA 2 = CONS 3 = VARS 4
= CRT PLOT CHANNELS 5 = ICONS 6 = SOLUTION PARAMETERS 7 = STATES 8 = CASE HEADING:
```

Change Code 1 and 4: The user is specifying changes for simulation outputs. Refer to *PSS®E Program Operation Manual*,Simulation Outputs.

Change Code 5: The user may designate any ICON entry to be either an integer quantity (such as a bus number) or a one- or two-character quantity (such as a machine or circuit identifier).

If the ICON is to be interpreted as a numeric quantity, the user simply enters the desired value; if it is to be interpreted as a character quantity, the value is entered enclosed in single quotes (for example, '1A'), and either one or two alphanumeric characters may be specified. If a character ICON consists only of numeric characters (for example, a machine identifier of '1'), it may be entered either with or without the quotes; those PSS®E models that expect a machine, load or circuit identifier in an ICON interpret such an entry correctly.

Following a response of one to the question CHANGE IT?, activity ALTR instructs the user to:

```
ENTER NEW VALUE (IN SINGLE QUOTES IF CHARACTER VALUE):
```

Change Code 6: The user may change:

1. The network solution parameters defining the maximum number of iterations, acceleration factor and convergence tolerance.

2. The island frequency acceleration factor and convergence tolerance. These are used in the *large time step mode* of extended term dynamic simulations (refer to *PSS®E Program Operation Manual*, MRUN and Extended Term Simulations).

3. The number of output channels being monitored. This number must be less than or equal to the number of output channels assigned by running activities CHAN, CHSB, ALTR, and PSAS (refer to Section 17.2.1, “Simulation Variables”, Section 17.2.2, “Subsystem Simulation Data”, Section 17.6, “Modifying Data in Dynamics Working Memory”, and Section 19.4, “Building a Response File, Power Flow Calculation”).

4. The number of state variables or integrators in use. This number is set by activities DYRE, STRT, MSTR, ESTR, GSTR, or ASTR and should not normally be changed by the user (refer to Section 17.1, “Read-

ing Dynamics Model Data", Section 18.1, "Initializing Models for State-Space Simulation",Section 18.3, "Initializing Models for Extended Term Simulation",Section 18.5, "Initializing Excitation System Models",Section 18.7, "Initializing Turbine Governor Models" and Section 18.9, "Building a State Variable Matrix for Linear Dynamic Analysis (LSYSAN)" respectively).

5. The simulation time step. This is set to half a cycle on program start-up and may be changed prior to simulation initialization (that is, before running activities STRT, MSTR, ESTR, or GSTR). It may be changed during simulations *only* when running extended term simulations (that is, when using activities MSTR and MRUN (refer to Section 18.4, "Running Extended Term Simulation in Time Steps"); it *must not* be changed during state-space and response test simulations (refer to *PSS®E Program Operation Manual*, STRT, RUN, ESTR, ERUN , GSTR, and GRUN).

6. The filter time constant used in calculating bus frequency deviations. This is set to four time steps on program start-up and may be changed prior to simulation initialization (that is, before running activities STRT or MSTR). It *must not* be changed during a simulation.

7. The time step thresholds used in setting the extended term simulation mode to either *small*, *intermediate* or *large* (island frequency) *time step mode* (refer to *PSS®E Program Operation Manual*,Extended Term Simulations).

8. The name of the simulation channel output file.

9. The position pointers to the next available locations in the dynamics data storage arrays. These indices are used to set the default responses in activities SNAP, DYRE, CHAN, CHSB, and SRSN, and are updated by activities DYRE, CHAN, and CHSB (refer to Section 17.3, "Saving Dynamics Working Memory in a Binary File", Section 17.1, "Reading Dynamics Model Data", Section 17.2.1, "Simulation Variables", Section 17.2.2, "Subsystem Simulation Data", and *PSS®E Program Operation Manual*,Application Notes.)

Change Code 7: The value of the state variable used in state-space and response test simulations (refer to *PSS®E Program Operation Manual*, STRT, RUN, ESTR, ERUN , GSTR, and GRUN) is displayed, along with the present values of its time derivative (DSTATE) and the associated memory cell used in the integration algorithm (STORE). Although activity ALTR permits modification of all of these quantities, it is rare that any of them are changed. Unless some very special purpose is being served, the values of the DSTATE and STORE should *never* be modified.

When running extended term simulations with activities MSTR and MRUN (Section 18.3, "Initializing Models for Extended Term Simulation" and Section 18.4, "Running Extended Term Simulation in Time Steps"), an implicit integration method is used; it utilizes the STORE array with its standard indexing. However, the memory locations occupied by the STATE and DSTATE arrays during state-space simulations are used for different purposes with a different indexing scheme during extended term simulations; the values displayed during ALTR are unrelated to the STATE index specified. These arrays *must not* be modified during extended term simulations.

Following an input signifying that all dynamics data changes have been made, activity ALTR asks the user:

```
NETWORK DATA CHANGES (1=YES, 0=NO)?
```

This gives the user the opportunity to apply disturbances or switchings to the network. A response of zero ends activity ALTR with the network data unchanged. If the user responds with a one, the user is asked:

```
PICK UP NEW SAVED CASE (1=YES, 0=NO)?
```

Entering zero initiates the standard network modification dialog of activity CHNG.

Entering one gives the user the ability to bring into the working case a previously set up network configuration (for example, to clear a complicated switching operation previously imposed). The dialog prompts the user to:

```
ENTER SAVED CASE FILENAME:
```

Activity CASE is then run; and the specified Saved Case File, with the exception of the voltage vector that is retained from the present system condition, is brought into the working case.

Activity CHNG is then run; and, following the specification of network data changes, activity FACT is run. If activity FACT detects that activity ORDR is required, a message is generated and activity ORDR is automatically run. The network admittance matrix is then factorized, the standard summary of activity FACT is displayed, and activity ALTR ends.

Additional Information
PSS® E Program Operation Manual, Modifying Data in Dynamics Working Memory *PSS® E Program Operation Manual*, Simulation Outputs

17.7. Modifying Dynamics Model Pointer Tables

DYCH

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Converting Generators	
Activity ID, Suffix	Suffix Function
DYCH	Activity runs without a suffix.

The table driven data table maintenance activity DYCH allows the user to examine and modify the data array entries used in associating plant related equipment models with machines represented in the working case.

When initiated, activity DYCH summarizes table utilization; following is an example:

```
ENTRIES MAXIMUM MODEL CONNECTION TABLE 6 1440 ARRAY ALLOCATION TABLE 16 10080
USER MODEL DEF'N TABLE 0 100 ACTIVITY CHAN MODELS 2 2000
```

The dialog prompts the user to specify the function of activity DYCH to be run:

```
FUNCTIONS ARE: 0 = EXIT ACTIVITY 1 = CHECK CONSISTENCY 2 = LIST PLANT MODELS
3 = CHANGE MODEL STATUS 4 = REMOVE PLANT MODELS 5 = LIST UNCONNECTED MODELS 6
= REMOVE UNCONNECTED MODELS 7 = PACK TABLES 8 = LIST CHAN MODELS 9 = REMOVE
UNUSED CHAN MODELS 10 = LIST USRMDL DEFINITIONS 11 = REMOVE UNUSED USRMDL DEFS
SELECT FUNCTION:
```

Some of the above functions carry on a dialog with the user. The default response to all instructions in activity DYCH that require a numeric response is a zero. Following completion of a given function, the list of functions is again displayed.

A full description of these functions may be found in *PSS ® E Program Operation Manual*, Activity DYCH.

```
>>DYCH

                                    ENTRIES MAXIMUM
 MODEL CONNECTION TABLE                  6     4000
 ARRAY ALLOCATION TABLE                 16    32000
 USER MODEL DEF'N TABLE                  0      100
 ACTIVITY CHAN MODELS                    0     2000

 FUNCTIONS ARE:
   0 = EXIT ACTIVITY              1 = CHECK CONSISTENCY
   2 = LIST PLANT MODELS          3 = CHANGE MODEL STATUS
   4 = REMOVE PLANT MODELS        5 = LIST UNCONNECTED MODELS
   6 = REMOVE UNCONNECTED MODELS  7 = PACK TABLES
   8 = LIST CHAN MODELS           9 = REMOVE UNUSED CHAN MODELS
  10 = LIST USRMDL DEFINITIONS   11 = REMOVE UNUSED USRMDL DEFS
 SELECT FUNCTION:
>>2
 ENTER BUS NUMBER:
>>206 211

 PLANT RELATED MODELS AT BUS    206 [URBGEN      18.000]:
 MACH     GEN.       COMP.     STAB.     MINEXL     MAXEXL     EXC.      GOV.      TLC
  1      GENROU       --        --         --         --      IEEET1    TGOV1       --
 ENTER BUS NUMBER:
>>

 FUNCTIONS ARE:
   0 = EXIT ACTIVITY              1 = CHECK CONSISTENCY
   2 = LIST PLANT MODELS          3 = CHANGE MODEL STATUS
   4 = REMOVE PLANT MODELS        5 = LIST UNCONNECTED MODELS
   6 = REMOVE UNCONNECTED MODELS  7 = PACK TABLES
   8 = LIST CHAN MODELS           9 = REMOVE UNUSED CHAN MODELS
  10 = LIST USRMDL DEFINITIONS   11 = REMOVE UNUSED USRMDL DEFS
 SELECT FUNCTION:
>>5

 ALL PLANT MODELS ARE CONNECTED TO POWER FLOW MACHINES

 FUNCTIONS ARE:
   0 = EXIT ACTIVITY              1 = CHECK CONSISTENCY
   2 = LIST PLANT MODELS          3 = CHANGE MODEL STATUS
   4 = REMOVE PLANT MODELS        5 = LIST UNCONNECTED MODELS
   6 = REMOVE UNCONNECTED MODELS  7 = PACK TABLES
   8 = LIST CHAN MODELS           9 = REMOVE UNUSED CHAN MODELS
  10 = LIST USRMDL DEFINITIONS   11 = REMOVE UNUSED USRMDL DEFS
 SELECT FUNCTION:
>>

                                    ENTRIES MAXIMUM
 MODEL CONNECTION TABLE                  6     4000
 ARRAY ALLOCATION TABLE                 16    32000
 USER MODEL DEF'N TABLE                  0      100
 ACTIVITY CHAN MODELS                    0     2000

 ACTIVITY? :
>>
```

Table Utilization Summary repeats for validation of table changes

Figure 17.4. Example: Running Activity DYCH

Additional Information
PSS®E Program Operation Manual, Section Activity, DYCH

17.8. Changing Dynamics Model Constants

CCON

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory.	
Activity ID, Suffix	Suffix Function
CCON	Activity runs without a suffix.

The dynamics data modification activity CCON allows the user to display and modify the constant data values being used by plant-related models contained in the simulation setup.

Activity CCON uses the CRT terminal lines per page option setting to group data items into pages. After a model is specified, any CONs that it uses are processed first, followed by its ICONs. If the model uses both CONs and ICONs, the ICON display always starts on a new page.

The dialog prompts the user to designate the bus and machine identifier of the machine for which plant-related model data is to be examined.

```
ENTER BUS NUMBER, MACHINE ID (0 TO EXIT):
```

The user enters the desired code for the equipment being modeled at the machine, as in the following example:

```
MODEL CODES FOR MACHINE 1 AT BUS 101 [NUC-A 21.600] ARE: ( 1) GENROU ( 6) IEEET1
( 7) TGOV1 ENTER CODE OF MODEL TO BE CHANGED (0 FOR NO MORE):
```

Following the entry of a valid model code, the constant data associated with the specified model is displayed, as in the following example:

```
CON DATA FOR MODEL GENROU: CON VALUE DESCRIPTION 1: 6.500 J T'DO (> 0) 2:
0.6000E-01 J+1 T''DO (> 0) 3: 0.2000 J+2 T'QO (> 0) 4: 0.5000E-01 J+3 T''QO (>
0) 5: 4.000 J+4 INERTIA H 6: 0.0000 J+5 SPEED DAMPING D 7: 1.800 J+6 XD 8: 1.750
J+7 XQ 9: 0.6000 J+8 X'D 10: 0.8000 J+9 X'Q 11: 0.3000 J+10 X''D = X''Q 12:
0.1500 J+11 XL 13: 0.9000E-01 J+12 S(1.0) 14: 0.3800 J+13 S(1.2)
```

followed by one of the following instructions:

```
ENTER CODE, VALUE (0 FOR NO MORE): ENTER CODE, VALUE (0 FOR NO MORE, RETURN FOR
NEXT PAGE): ENTER CODE, VALUE (0 FOR NO MORE, RETURN FOR NEXT PAGE, -1 FOR ICONS):
```

The user may change the value of any of the displayed data items by entering its code as shown on the display along with the new value. The data display is repeated with the new data value, and the user may then change another displayed data item. This process is repeated until one of the other responses listed in the prompt is entered. Except for a response of -1 when the -1 FOR ICONS response is valid, any negative response is treated the same as a response of zero.

After the list of models at the specified machine is redisplayed, another (or the same) model may be changed. This process is repeated until a zero is entered for the model code, at which time another bus and machine identifier may be specified. A response of a zero or *[Enter]* to the bus selection request ends activity CCON.

Additional Information
PSS® E Program Operation Manual, Section Activity, CCON

17.9. Creating a Dynamics Model Raw Data File

DYDA

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Converting Generators	
Activity ID, Suffix	Suffix Function
DYDA,AREA	Replicate specified categories of model data for all models in specified area(s)
DYDA,ZONE	Replicate specified categories of model data for all models in specified zone(s)
DYDA,OWNER	Replicate specified categories of model data for all models of specified owner(s)
DYDA,KV	Replicate specified categories of model data for all models of specified base kV range
DYDA,OPT	User selects options manually using an interactive dialog
DYDA,ALL	Record models in dynamic sequence; report simulation option settings
DYDA,CN	Replicate model data for all models called from subroutine CONEC
DYDA,CT	Replicate model data for all models called from subroutine CONET

Activity DYDA replicates dynamics model data in the form suitable for input to activity DYRE. It may be viewed as the logical inverse of activity DYRE.

The output of activity DYDA is dependent upon the suffix specified at the time the activity is run. When activity DYDA is run with the CN suffix, it replicates only those models called from subroutine CONEC. \When activity DYDA is run with the CT suffix, it replicates only those models called from subroutine CONET. When activity DYDA is run with the ALL suffix, it replicates the model specification records for all models contained in the current simulation setup.

The dialog prompts the user to enter a code for the model type to be processed:

```
SELECT MODELS TO BE PROCESSED (-1 TO EXIT): 1 = ALL 2 = ALL PLANT 3 = GENERATOR
4 = COMPENSATOR 5 = STABILIZER 6 = MIN. EXC. LIMITER 7 = MAX. EXC. LIMITER 8
= EXCITATION SYSTEM 9 = TURBINE GOVERNOR 10 = LOAD CHAR. 11 = LOAD RELAY 12 =
LINE RELAY 13 = AUX SIGNAL 14 = 2-TERM DC LINE 15 = N-TERM DC LINE 16 = VSC DC
LINE 17 = FACTS DEVICE 18 = CONEC 19 = CONET 20 = TURBINE LOAD CONTROLLER 21
= SWITCHED SHUNT 22 = WIND MODELS 23 = WIND GENERATOR 24 = WIND ELEC. CONTROL
25 = WIND MECHANICAL 26 = WIND PITCH 27 = WIND AERODYNAMIC 28 = WIND GUST 29
= WIND AUX. CONTROL
```

When activity DYDA is run without a suffix, the user is asked to select the buses for which output is desired. Following each response to the bus selection and model type requests, the output is generated with buses ordered as specified by the user input. The request for buses is then repeated. If any bus specified has no models of the specified type(s), it is omitted from the output.

When activity DYDA is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed. Following specification of the buses and types of models to be tabulated, output for the appropriate grouping of buses is produced. Then the user is given the opportunity to select another subsystem.

```
>>DYDA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE
>>2
 ENTER OUTPUT FILE NAME:
>>TESTnw.dyr
 ENTER UP TO 20 BUS NUMBERS

>>151 152 153 154

 SELECT MODELS TO BE PROCESSED (-1 TO EXIT):
   1 = ALL                  2 = ALL PLANT
   3 = GENERATOR            4 = COMPENSATOR
   5 = STABILIZER           6 = MIN. EXC. LIMITER
   7 = MAX. EXC. LIMITER    8 = EXCITATION SYSTEM
   9 = TURBINE GOVERNOR    10 = LOAD CHAR.
  11 = LOAD RELAY          12 = LINE RELAY
  13 = AUX. SIGNAL         14 = 2-TERM DC LINE
  15 = N-TERM DC LINE      16 = VSC DC LINE
  17 = FACTS DEVICE        20 = TURBINE LOAD CONTROLLER
  21 = SWITCHED SHUNT
  22 = WIND MODELS         23 = WIND GENERATOR
  24 = WIND ELEC. CONTROL  25 = WIND MECHANICAL
  26 = WIND PITCH          27 = WIND AERODYNAMIC
  28 = WIND GUST           29 = WIND AUX. CONTROL
  18 = CONEC               19 = CONET:
>>2

 OUTPUT COMPLETED
 ENTER UP TO 20 BUS NUMBERS

>>

 ACTIVITY? :
>>
```

Figure 17.5. Example: Running Activity DYDA

Additional Information
PSS® E Program Operation Manual, Section Activity, DYDA

17.10. Creating Dynamic Data Records for Use by Other Activities

RWDY

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. All equipment models used in the system dynamic model must have been upgraded for use in the extended term simulation mode Converting Generators Factorizing the Network Admittance Matrix Running State-Space Simulation in Time Steps OR Running Extended Term Simulation in Time Steps	
Activity ID, Suffix	Suffix Function
RWDY	Activity runs without a suffix.

The auxiliary dynamics data output activity RWDY writes machine parametric data from dynamics working memory in the following formats:

- Inertia and Governor Response Data File for input to activity INLF
- Breaker Duty Data File for input to activity BKDY
- Lline relay data and branch impedances in the form required by the PSSPLT activity RELY

The dialog prompts the user to enter a data file code for the type of data records to be generated:

```
ENTER 1 FOR BREAKER DUTY DATA FILE 2 FOR INERTIA AND GOVERNOR RESPONSE DATA FILE
3 FOR RELAY CHARACTERISTIC DATA FILE ENTER DATA FILE CODE (0 TO EXIT):
```

If a two is entered in response to the above instruction, the user is given the option of including machine power limits as defined in the turbine governor models or of using the default value for these fields on the data records output by activity RWDY:

```
ENTER 1 TO SUPPRESS MACHINE LIMITS OUTPUT:
```

If a one is entered, when the resulting file is used by activity INLF the machine active power limits from the working case are used rather than those from the turbine governor models.

For the Inertia and Governor Response Data File, the user is also instructed to:

```
SELECT INLF TREATMENT OF MACHINES WITHOUT GOVERNOR MODELS: 0 TO USE THE WORKING
CASE LIMITS 1 TO TREAT THEM AS NON-DISPATCHABLE:
```

If a zero is entered, PMAX and PMIN are processed as default values for such machines so that activity INLF will assign active power limits. If a one is entered, PMAX and PMIN are both processed as zero so that activity

INLF will treat such machines as fixed MW output machines and will exclude them from participating in any swing bus power change dispatches.

The appropriate output tabulation is then produced and activity RWDY ends.

```
 ACTIVITY? :
>>RWDY

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT               1 FOR REPORT WINDOW
  2 FOR A FILE
>>2
 ENTER OUTPUT FILE NAME:
>>OutTEST.inl

 ENTER 1 FOR BREAKER DUTY DATA FILE
       2 FOR INERTIA AND GOVERNOR RESPONSE DATA FILE
       3 FOR RELAY CHARACTERISTIC DATA FILE
 ENTER DATA FILE CODE (0 TO EXIT):
>>2

 ENTER 1 TO SUPPRESS MACHINE LIMITS OUTPUT:
>>

 SELECT INLF TREATMENT OF MACHINES WITHOUT GOVERNOR MODELS:
   0 TO USE THE WORKING CASE LIMITS
   1 TO TREAT THEM AS NON-DISPATCHABLE:
>>0

 ACTIVITY? :
>>
```

Figure 17.6. Example: Running Activity RWDY

Additional Information
PSS®E Program Operation Manual, Section Activity, RWDY

17.11. Listing Dynamics Data

17.11.1. Listing Dynamics Model Data

DOCU

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Converting Generators	
Activity ID, Suffix	Suffix Function
DOCU,AREA	List dynamic models and data in specified area(s)
DOCU,ZONE	List dynamic models and data in specified zone(s)
DOCU,OWNER	List dynamic models and data for specified owner(s)
DOCU,KV	List dynamic models and data for specified base kV range
DOCU,OPT	User selects options manually using an interactive dialog
DOCU,ALL	List dynamic models and data in dynamic sequence; report simulation option settings
DOCU,CN	List dynamic models and data for all models called from subroutine CONEC
DOCU,CT	List dynamic models and data for all models called from subroutine CONET
DOCU,CH	List dynamic models and data for all output channel monitoring model references

The model documenting activity DOCU produces a tabulation of the data associated with equipment models referenced in the user's simulation setup. The tabulation for each model includes a listing of the locations in the various dynamics data arrays used by the model, and a listing of the values of the constant data parameters used by the model.

The dialog prompts the user to:

```
ENTER 0 FOR REPORTING MODE, 1 FOR DATA CHECKING MODE:
```

In reporting mode, all model references being processed are tabulated. In its data checking mode, activity DOCU compares the data of each model reference being processed to typical parameter ranges and applies relational checks. For any model for which data is found to be suspect, the data item(s) in question are tabulated followed by the standard model data tabulation for that model.

Operation of activity DOCU is dependent upon the suffix specified at the time the activity is run.

When activity DOCU is run with the CN suffix, the tabulation is restricted to those models called from subroutine CONEC. When activity DOCU is run with the CT suffix, the tabulation includes only those models called from subroutine CONET. When activity DOCU is run with the CH suffix, the tabulation includes only the CHAN and CHSB monitoring models being used, listed in the order in which the output channel assignments were made.

When activity DOCU is run with the ALL suffix, it produces output for all plant-related equipment models referenced in the simulation setup, followed by all load-related models referenced in the simulation setup, followed by all line relay models referenced in the simulation setup, followed by all auxiliary signal models (all auxiliary signals associated with two-terminal dc line, followed by those associated with multi-terminal dc line models, followed by those associated with VSC dc line models, followed by all auxiliary signals associated with FACTS device models), followed by all dc line models (all two-terminal dc line models, followed by all multi-terminal dc line models, followed by all VSC dc line models), followed by all FACTS device models referenced in the simulation setup, followed by all models called from subroutines, CONEC and CONET. The various dynamic simulation options are also reported.

In each of the subsystem selection modes, following the subsystem selection dialog, the dialog prompts the user to specify the type or types of models to be processed.

When activity DOCU is run without a suffix, the user is asked to select the buses. Following each response to the bus selection and model type requests, the report is generated with buses in the requested order (see Section 1.2.2). The bus selection request is then repeated. If any bus specified has no models of the specified type(s), it is omitted from the report.

When activity DOCU is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case to be processed. Following specification of the buses and types of models to be tabulated, a report for the appropriate grouping of buses is produced. Then the user is given the opportunity to select another subsystem.

```
 ACTIVITY? :
>>DOCU,AREA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW :
>>7

 ENTER 0 FOR REPORTING MODE, 1 FOR DATA CHECKING MODE:
>>0
 ENTER UP TO 20 AREA NUMBERS:

>>1

 SELECT MODELS TO BE PROCESSED (-1 TO EXIT):
   1 = ALL                     2 = ALL PLANT
   3 = GENERATOR               4 = COMPENSATOR
   5 = STABILIZER              6 = MIN. EXC. LIMITER
   7 = MAX. EXC. LIMITER       8 = EXCITATION SYSTEM
   9 = TURBINE GOVERNOR       10 = LOAD CHAR.
  11 = LOAD RELAY             12 = LINE RELAY
  13 = AUX. SIGNAL            14 = 2-TERM DC LINE
  15 = N-TERM DC LINE         16 = VSC DC LINE
  17 = FACTS DEVICE           21 = TURBINE LOAD CONTROLLER
  22 = SWITCHED SHUNT
  23 = WIND MODELS            24 = WIND GENERATOR
  25 = WIND ELEC. CONTROL     26 = WIND MECHANICAL
  27 = WIND PITCH             28 = WIND AERODYNAMIC
  29 = WIND GUST              30 = WIND AUX. CONTROL
  18 = CONEC                  19 = CONET
  20 = CHAN:
>>9
1     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 15 2008   14:59
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 PLANT MODELS
                                            BUS 101 [NUC-A        21.600] MODELS
 REPORT FOR GOVERNOR MODELS IN AREA 1 [FLAPCO       ]


 ** TGOV1 **     BUS X-- NAME --X BASEKV MC     C O N S      S T A T E S      VAR
                 101 NUC-A        21.600 1      322-328       117-118          12

       R          T1         VMAX       VMIN        T2         T3         DT
     0.050      0.050       1.050      0.300      1.000      1.000      0.000


 ** TGOV1 **     BUS X-- NAME --X BASEKV MC     C O N S      S T A T E S      VAR
                 102 NUC-B        21.600 1      329-335       119-120          13

       R          T1         VMAX       VMIN        T2         T3         DT
     0.050      0.050       1.050      0.300      1.000      1.000      0.000

 OUTPUT COMPLETED
 ENTER UP TO 20 AREA NUMBERS:

>>0

 ACTIVITY? :
>>
```

Figure 17.7. Examples: Running Activity DOCU,AREA

Additional Information
PSS® E Program Operation Manual, Section Activity, DOCU

17.11.2. Listing Dynamics Data Arrays

DLST

Requirements / Prerequisites	
Dynamics data must exist in dynamics working memory.	
Activity ID, Suffix	Suffix Function
DLST	Activity runs without a suffix.

The dynamics data array listing activity DLST provides a tabulation of user specified portions of data arrays, output channels, and plot channels. Activity DLST instructs the user to enter the desired starting and ending indices for each of the arrays.

```
 ACTIVITY? :
>>DLST

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                 1 FOR REPORT WINDOW
  2 FOR A FILE                    3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE    7 FOR PROGRESS WINDOW :
>>7
 ENTER CON RANGE:
>>1,25
 ENTER VAR RANGE:
>>1,10
 ENTER STATE RANGE:
>>1,10
 ENTER ICON RANGE:
>>1,25
 ENTER OUTPUT CHANNEL RANGE:
>>1,10
 ENTER CRT PLOT CHANNEL RANGE:
>>1,10
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 15 2008  15:06
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA


 CONS:

     1:   6.500          2: 0.6000E-01       3: 0.2000          4: 0.5000E-01
     5:   4.000          6:   0.000          7:   1.800         8:   1.750
     9: 0.6000          10: 0.8000          11: 0.3000         12: 0.1500
    13: 0.9000E-01      14: 0.3800          15:   6.500        16: 0.6000E-01
    17: 0.2000          18: 0.5000E-01      19:   4.000        20:   0.000
    21:   1.800         22:   1.750         23: 0.6000         24: 0.8000
    25: 0.3000


 VARS:

     1: 0.3380E-36       2: 0.3380E-36       3:   0.000         4:   0.000
     5:   0.000          6:   0.000          7:   0.000         8:   0.000
     9:   0.000         10:   0.000


 STATES:

     1: 0.3380E-36       2: 0.3380E-36       3:   0.000         4:   0.000
     5:   0.000          6:   0.000          7:   0.000         8:   0.000
     9:   0.000         10:   0.000


 ICONS:

     1:******            2:******            3:      0          4:      0
```

etc.

Figure 17.8. Examples: Running Activity DLST (Partial Output)

Additional Information
PSS® *E Program Operation Manual*, Section Activity, DLST

17.11.3. Listing Dynamics Model Storage Locations

MLST

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Converting Generators	
Activity ID, Suffix	Suffix Function
MLST,AREA	List all plant models in specified area(s)
MLST,ZONE	List all plant models in specified zone(s)
MLST,OWNER	List all plant models for specified owner(s)
MLST,KV	List all plant models for specified base kV range
MLST,OPT	User selects options manually using an interactive dialog
MLST,ALL	List all plant models at all machines
MLST,UNCN	List all bypassed plant-related models

The model listing activity MLST produces a tabulation of plant-related equipment models referenced in the user's simulation setup. The tabulation for each model includes a listing of the locations in the various dynamics data arrays used by the model and a flag for models that are bypassed. Operation of activity MLST is dependent upon the suffix specified at the time the activity is run.

When activity MLST is run with the UNCN suffix, the tabulation is restricted to unconnected models (that is, to those plant-related models for which data is in dynamics memory but the corresponding machine is not contained in the working case).

When activity MLST is run with the ALL suffix, all plant-related models at all machines in the working case are tabulated.

When activity MLST is run without a suffix or with the AREA, ZONE, OWNER, KV, or OPT suffix, it tabulates specified model types connected to machines in a selected subsystem of the working case. The user is able to restrict the tabulation to active models, bypassed models, or both:

```
ENTER 0 TO LIST ACTIVE AND BYPASSED MODELS 1 TO LIST ONLY ACTIVE MODELS 2 TO
LIST ONLY BYPASSED MODELS ENTER SELECTION CODE (-1 TO EXIT):
```

In each of the subsystem selection modes, following the subsystem selection dialog, the dialog prompts the user to enter a code for the type or types of models to be processed:

```
SELECT MODELS TO BE PROCESSED (-1 TO EXIT): 1 = ALL PLANT 2 = GENERATOR 3 =
COMPENSATOR 4 = STABILIZER 5 = MIN. EXC. LIMITER 6 = MAX. EXC. LIMITER 7 =
EXCITATION SYSTEM 8 = TURBINE GOVERNOR 8 = TURBINE LOAD CONTROLLER:
```

When activity MLST is run without a suffix, the user is asked to select the buses. Following each response to the bus selection request, the report is generated with buses in the requested order (see Section 1.2.2). The bus selection request is then repeated. If any bus specified has no models of the specified type(s), it is omitted from the report.

When activity MLST is run with the AREA, ZONE, OWNER, KV, or OPT suffix, it opens a dialog through which the user selects the subsystem of the working case for which output is to be printed. Following specification of the buses and types of models to be tabulated, a report for the appropriate grouping of buses is produced. Then the user is given the opportunity to select another subsystem.

```
>>MLST,AREA

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>7

 ENTER 0 TO LIST ACTIVE AND BYPASSED MODELS
       1 TO LIST ONLY ACTIVE MODELS
       2 TO LIST ONLY BYPASSED MODELS
 ENTER SELECTION CODE (-1 TO EXIT):
>>0
 ENTER UP TO 20 AREA NUMBERS:

>>1

 SELECT MODELS TO BE PROCESSED (-1 TO EXIT):
   1 = ALL PLANT                  2 = GENERATOR
   3 = COMPENSATOR                4 = STABILIZER
   5 = MIN. EXC. LIMITER          6 = MAX. EXC. LIMITER
   7 = EXCITATION SYSTEM          8 = TURBINE GOVERNOR
   9 = TURBINE LOAD CONTROLLER:
>>1
     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    THU, MAY 15 2008  15:46
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

                      AREA 1 [FLAPCO      ] PLANT MODELS

   BUS# X-- NAME --X BASKV ID  MODEL  X----CONS---X  X---STATES--X  X----VARS---X  X---ICONS---X
    101 NUC-A        21.600 1  GENROU    178-    191      64-    69
                               IEEET1    260-    273      99-   102        9
                               TGOV1     322-    328     117-   118       12

    102 NUC-B        21.600 1  GENROU    192-    205      70-    75
                               IEEET1    274-    287     103-   106       10
                               TGOV1     329-    335     119-   120       13
 ENTER UP TO 20 AREA NUMBERS:

>>0

 ACTIVITY? :
>>
```

Figure 17.9. Examples: Running Activity MLST

Additional Information
PSS® E Program Operation Manual Listing Dynamics Model Storage Locations

17.12. Dumping Dynamic Simulation Output Channels into a Response File

DMPC

Requirements / Prerequisites	
Dynamics data must exist in dynamics working memory.	
Activity ID, Suffix	Suffix Function
DMPC	Activity runs without a suffix.

The output channel dumping activity DMPC replicates dynamic simulation output channels contained in dynamics working memory in a PSS®E Response File suitable for driving activities CHAN and/or CHSB. Thus, activity DMPC may be viewed as the logical inverse of the channel specification activities.

The dialog requests the user to specify channel preference:

```
ENTER 0 TO SKIP CHANNELS CONTAINING STATES AND VARS 1 TO INCLUDE ALL CHANNELS:
```

If a zero is entered in response to the request, all channels containing STATEs, as well as those containing VARs not associated with activity CHAN and CHSB monitoring models, are omitted from the set of responses produced by activity DMPC. Otherwise, responses for all channels are generated. Activity DMPC then opens the dialog required to specify channels one through NCHAN by running activities CHAN and/or CHSB.

An alarm message is generated for one of the following conditions:

- An invalid channel address is assigned to the channel.
- The channel quantity is a VAR not associated with a CHAN monitoring model or a STATE, and the option to include these was not enabled.

Under these conditions, the channel generation dialog is skipped.

```
 ACTIVITY? :
>>DMPC

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE
>>2
 ENTER OUTPUT FILE NAME:
>>TESTnw.idv
 ENTER 0 TO SKIP CHANNELS CONTAINING STATES AND VARS
       1 TO INCLUDE ALL CHANNELS:
>>1

 ACTIVITY? :
>>
```

Figure 17.10. Example: Running Activity DMPC

Additional Information
PSS®E Program Operation Manual, Section Activity, DMPC

Chapter 18

Dynamic Simulation

18.1. Initializing Models for State-Space Simulation

STRT

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Factorized network admittance matrix in the admittance matrix temporary file. Section 14.1, “Converting Generators” Section 14.5, “Factorizing the Network Admittance Matrix”	
Activity ID, Suffix	Suffix Function
STRT,CM	Automatically print network solution convergence monitor

The state-space dynamic simulation initialization activity STRT calculates the initial values of all variables for each equipment model as a function of the model’s constant data and the boundary condition at the bus in the working case at which it is referenced. The normal activity sequence that precedes activity STRT is:

```
rstr,file1 lofl case,file2 rtrn
```

where < file1 > is the Snapshot File containing the appropriate dynamics model data and output channel specifications, and < file2 > is the Saved Case File containing the converted power flow case.

An alarm message is generated if generators are not converted, and activity STRT ends.

Activity STRT then ensures that the machine power arrays in the power flow working case are set to their original initial condition values, as they may have been changed by previously running activity STRT or MSTR. Activity STRT completes its setup phase by checking for the presence of the factorized network admittance matrix. If necessary, run activity FACT (or activities ORDR and FACT).

Activity STRT initializes the dynamic simulation by first doing a network solution and then, based on the bus boundary conditions, initializing the state variables (STATEs) and algebraic variables (VARs) of each equipment model. If, in setting up for the initial network solution, any CIMTR5, CIMWSC, CIM5xx, CIMWxx, CLODxx, or IEELxx model removes constant admittance load from the load at which it is called, an appropriate message is printed and the network admittance matrix is automatically refactorized prior to commencing the network solution.

An alarm message is generated for any machine that is online in the working case but which does not have a generator model assigned to it. The source current (ISORCE) of any such machine is set to zero. The presence of any such machines renders the initial condition invalid, and activity RUN cannot be run.

Similarly, an alarm message is generated for any two-terminal, multi-terminal, or VSC dc line, any FACTS device, or any switched shunt device that is under continuous control that is in-service in the working case but which does not have a dynamic table model assigned to it.

Activity STRT then prints, at the Progress tab, the case heading followed by the message:

```
INITIAL CONDITION LOAD FLOW USED n ITERATIONS
```

A value of n greater than one usually (but not always) indicates some sort of modeling error.

Activity STRT then summarizes the conditions at each online machine by tabulating the following quantities:

- Terminal voltage (ETERM).
- Exciter output voltage (EFD).
- Active and reactive power output (PELEC and QELEC).
- Power factor.
- Machine angle in degrees (ANGLE).
- d and q axis currents on machine base.

This report is in ascending bus number order when the *numbers* output option is in effect, and in alphabetical bus name order using the *names* option. Note that for wind machines, because the quantity EFD is not of any relevance, this is set to zero.

Following the calculation of the system initial condition, a dummy step calculation is made and the time derivatives (DSTATEs) of all STATE variables are checked for a steady state. If no nonzero STATEs are found, the following message is printed:

```
INITIAL CONDITIONS CHECK O.K.
```

Upon completion of its processing, activity STRT instructs the user to:

```
ENTER CHANNEL OUTPUT FILENAME:
```

The user responds with the name of the Simulation Channel Output File to be used in the subsequent dynamic simulation run. If no filename is specified in response to the above instruction, the writing of the output channel variable values to a file is suppressed during the simulation run.

Then the user is asked to:

```
ENTER SNAPSHOT FILENAME:
```

This gives the user the opportunity to preserve the initial system condition, as contained in the dynamics data arrays, in a Snapshot. If no filename is specified in response to the above instruction, activity STRT ends. If a Snapshot filename is specified, a Snapshot is taken prior to ending activity STRT.

When activity STRT is run with the CM suffix, the network solution convergence monitor is automatically printed. This is particularly useful when PSS®E is being executed as a batch job.

```
 ACTIVITY? :
>>STRT
 ENTER CHANNEL OUTPUT FILENAME:
>>ChOutTEST.out

     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    WED, MAY 21 2008  10:20
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 INITIAL CONDITION LOAD FLOW USED   1 ITERATIONS

 ----------------------------- MACHINE INITIAL CONDITIONS -----------------------------
   BUS# X-- NAME --X BASKV ID  ETERM   EFD    POWER    VARS   P.F.   ANGLE   ID     IQ
    101 NUC-A        21.600 1  1.0200 2.0564  749.99    81.21 0.9942  63.47 0.6571 0.4934
    102 NUC-B        21.600 1  1.0200 2.0564  749.99    81.21 0.9942  63.47 0.6571 0.4934
    206 URBGEN       18.000 1  1.0236 2.5618  800.00   600.01 0.8000  23.53 0.8733 0.4380
    211 HYDRO_G      20.000 1  1.0404 1.6150  600.00    17.74 0.9996  42.14 0.4089 0.6827
   3011 MINE_G       13.800 1  1.0400 1.4655  258.66   104.05 0.9277  16.02 0.1648 0.2114
   3018 CATDOG_G     13.800 1  1.0218 2.9374  100.00    80.00 0.7809  22.53 0.8757 0.4033

 INITIAL CONDITIONS CHECK O.K.

 CHANNEL OUTPUT FILE IS ChOutTEST.out
 ENTER SNAPSHOT FILENAME:
>>OutTEST.snp

 NUMBER OF ELEMENTS IN USE ARE:
   CONS STATES   VARS  ICONS CHANNELS
    177      63       8      0       8
 ENTER NUMBER TO BE SAVED OR CARRIAGE RETURN FOR ABOVE VALUES
>>

 SNAPSHOT STORED IN FILE OutTEST.snp AT TIME =  -0.017

 ACTIVITY? :
>>
```

Figure 18.1. Example: Running Activity STRT

Additional Information
PSS®E Program Operation Manual, Initializing Models for State-Space Simulation

18.2. Running State-Space Simulation in Time Steps

RUN

<table>
<tr><th colspan="2">Requirements / Prerequisites</th></tr>
<tr><td colspan="2">Validly specified power flow case.

Dynamics data must exist in dynamics working memory.

Factorized network admittance matrix in the admittance matrix temporary file.

Section 14.1, “Converting Generators”

Section 14.5, “Factorizing the Network Admittance Matrix”

Initializing Models for State-Space Simulation</td></tr>
<tr><th>Activity ID, Suffix</th><th>Suffix Function</th></tr>
<tr><td>RUN,CM</td><td>Automatically print network solution convergence monitor</td></tr>
</table>

The state-space time simulation activity RUN sequences through time solving the system’s differential equations and the electrical network at each time step.

An alarm message is generated if activity STRT had not been previously run successfully or if generators are not converted, and activity RUN ends. Otherwise, the dialog prompts the user to:

```
AT TIME = X.XXX ENTER TPAUSE, NPRT, NPLT, CRTPLT:
```

The user specifies the following simulation options:

- TPAUSE: Run to n.nnnn secs
- NPRT: Print every <n> time steps
- NPLT: Write every <n> time steps
- CRTPLT: Plot every <n> time steps

If the value specified for TPAUSE is less than the current value of simulation TIME, activity RUN ends.

If a Simulation Channel Output File has been opened (during the initialization activity STRT or by running activity ALTR), the following message is printed at the dialog output device:

```
CHANNEL OUTPUT FILE IS aaaaaa
```

Activity RUN then checks for islands that contain no in-service machines. An alarm message is generated for buses in such islands, and they are disconnected. Activity RUN completes its setup phase by checking for the presence of the factorized network admittance matrix. If necessary, activity FACT (or activities ORDR and FACT) is run.

The simulation, starting at the present value of simulation TIME, then begins.

When activity RUN is run with the CM suffix, the network solution convergence monitor is automatically printed. This is particularly useful when PSS®E is being executed as a batch job.

The form of the network convergence monitor is identical to that of activities STRT, TYSL, and SOLV. The induction motor convergence monitor is identical to that of activity STRT.

```
 ACTIVITY? :
>>RUN
 AT TIME =  -0.017 ENTER TPAUSE, NPRT, NPLT, CRTPLT:
>>.01,1,1,0

 CHANNEL OUTPUT FILE IS ChOutTEST.out

    TIME X- VALUE --X X--------- IDENTIFIER ---------X X- VALUE --X X--------- IDENTIFIER ---------X
 -0.0167   16.019     ANGL  3011[MINE_G      13.800]1    22.533     ANGL  3018[CATDOG_G    13.800]1
       3   1.0200     ETRM   101[NUC-A       21.600]1    1.0200     ETRM   102[NUC-B       21.600]1
       5   1.0236     ETRM   206[URBGEN      18.000]1    1.0404     ETRM   211[HYDRO_G     20.000]1
       7   1.0400     ETRM  3011[MINE_G      13.800]1    1.0218     ETRM  3018[CATDOG_G    13.800]1

 -0.0083   16.019       22.533       1.0200       1.0200       1.0236       1.0404
       7   1.0400       1.0218

  0.0000   16.019       22.533       1.0200       1.0200       1.0236       1.0404
       7   1.0400       1.0218

  0.0083   16.019       22.533       1.0200       1.0200       1.0236       1.0404
       7   1.0400       1.0218

  0.0167   16.019       22.533       1.0200       1.0200       1.0236       1.0404
       7   1.0400       1.0218

 ACTIVITY? :
>>
```

Figure 18.2. Example: Running Activity RUN

Additional Information
PSS® E Program Operation Manual,   Performing State-Space Simulation in Time Steps

18.3. Initializing Models for Extended Term Simulation

MSTR

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. All equipment models used in the system dynamic model must have been upgraded for use in the extended term simulation mode Section 14.1, “Converting Generators” Section 14.5, “Factorizing the Network Admittance Matrix”	
Activity ID, Suffix	Suffix Function
MSTR,CM	Automatically print network solution convergence monitor

The extended term dynamic simulation initialization activity MSTR initializes the dynamic models in preparation for extended term simulation calculations. Activity MSTR is used in conjunction with activity MRUN in running these simulations.

Activities MSTR and MRUN are special versions of the state-space simulation activities STRT and RUN respectively which are used to run extended term simulations. As such, their dialog and operating characteristics are similar to those of activities STRT and RUN.

When initiated, activity MSTR first checks that:

1. The simulation time step is less than the *intermediate time step* mode threshold.

2. The *long time step* mode threshold is greater than the *intermediate time step* mode threshold.

If either of these requirements is violated, an appropriate error message is printed and activity MSTR ends.

An alarm message is generated if generators are not converted, and activity MSTR ends.

Activity MSTR then ensures that the machine power arrays in the power flow working case are set to their original initial condition values, as they may have been changed by previously running activity STRT or MSTR). Activity MSTR completes its setup phase by checking for the presence of the factorized network admittance matrix. If necessary, activity FACT (or activities ORDR and FACT) is run.

An alarm message is generated for any machine that is online in the working case but which does not have a generator model assigned to it. The source current (ISORCE) of any such machine is set to zero. The presence of any such machines renders the initial condition invalid, and activity MRUN cannot be run.

Similarly, an alarm message is generated for any two-terminal, multi-terminal, or VSC dc line, any FACTS device, or any switched shunt device that is under continuous control that is in-service in the working case but which does not have a dynamic table model assigned to it.

During the model initialization process, an alarm message is generated for any model variable that is initialized beyond its prescribed limits (for example, the voltage regulator output of the IEEE type one excitation system model, IEEET1).

Activity MSTR then prints, at the Progress tab, the case heading followed by the number of iterations used to calculate the initial power flow. More than one iteration usually (but not always) indicates some sort of modeling error.

Activity MSTR then summarizes the conditions at each online machine. Note that for wind machines, because the quantity EFD is not of any relevance, this is set to zero.

Upon completion of its processing, activity MSTR instructs the user to:

```
ENTER CHANNEL OUTPUT FILENAME:
```

The user responds with the name of the Simulation Channel Output File to be used in the subsequent dynamic simulation run. If no filename is specified in response to the above instruction, the writing of the output channel variable values to a file is suppressed during the simulation run.

The default time step in PSS®E is half a cycle (that is, 0.008333 of a second when base frequency is sixty cycles and 0.01 of a second for fifty cycle systems). Activity MSTR sets the value of simulation TIME to minus two time steps. This provides for a period of simulation under steady-state conditions prior to initiating a disturbance.

When activity MSTR is run with the CM suffix, the network solution convergence monitor is automatically printed. This is particularly useful when PSS®E is being executed as a batch job.

```
>>MSTR,CM
 ENTER CHANNEL OUTPUT FILENAME:
>>ChOutTEST.out

     23 DIAGONAL AND      41 OFF-DIAGONAL ELEMENTS
   1      0.080     205 [SUB230       230.00]     -0.7751E-05     0.1858E-05

     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    WED, MAY 21 2008   11:05
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 INITIAL CONDITION LOAD FLOW USED  1 ITERATIONS

 ----------------------------- MACHINE INITIAL CONDITIONS -----------------------------
   BUS# X-- NAME --X BASKV ID  ETERM  EFD    POWER    VARS   P.F.   ANGLE   ID     IQ
    101 NUC-A        21.600 1  1.0200 2.0563  749.99    81.20 0.9942  63.47 0.6571 0.4934
    102 NUC-B        21.600 1  1.0200 2.0563  749.99    81.20 0.9942  63.47 0.6571 0.4934
    206 URBGEN       18.000 1  1.0236 2.5618  800.00   600.00 0.8000  23.53 0.8733 0.4380
    211 HYDRO_G      20.000 1  1.0404 1.6150  600.00    17.74 0.9996  42.14 0.4089 0.6827
   3011 MINE_G       13.800 1  1.0400 1.4655  258.66   104.05 0.9278  16.02 0.1648 0.2114
   3018 CATDOG_G     13.800 1  1.0218 2.9374  100.00    80.00 0.7809  22.53 0.8757 0.4033

 CHANNEL OUTPUT FILE IS ChOutTEST.out

 ACTIVITY? :
>>
```

Figure 18.3. Example: Running Activity MSTR,CM

Additional Information
PSS® E Program Operation Manual, Initializing Models for Extended Term Simulation

18.4. Running Extended Term Simulation in Time Steps

MRUN

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. All equipment models used in the system dynamic model must have been upgraded for use in the extended term simulation mode Section 14.1, "Converting Generators" Section 14.5, "Factorizing the Network Admittance Matrix" Initializing Models for Extended Term Simulation	
Activity ID, Suffix	Suffix Function
MRUN,CM	Automatically print network solution convergence monitor

The extended term time simulation activity MRUN sequences through time solving the system's differential equations and the electrical network at each time step.

In addition to successful initialization by activity MSTR, activity MRUN requires that the *long time step* mode threshold be greater than the *intermediate time step* mode threshold and that generators be converted. If any of these requirements is violated, an appropriate error message is printed and activity MRUN ends. Otherwise, activity MRUN instructs the user:

```
AT TIME = X.XXX ENTER TPAUSE, NPRT, NPLT, CRTPLT:
```

and the user responds with four data items having the same significance as in activity RUN. Following the specification of these parameters, if the value specified for TPAUSE is less than the current value of simulation TIME, activity MRUN ends. Otherwise, if a Simulation Channel Output File has been opened (during the initialization activity MSTR or by running activity ALTR), the following message is printed at the dialog output device:

```
CHANNEL OUTPUT FILE IS aaaaaa
```

If the simulation time step has changed since the last time activity MRUN was run, both the old and new time steps are listed along with the simulation mode to be used.

Activity MRUN then checks for islands that contain no in-service machines. An alarm message is generated for buses in such islands, and they are disconnected.

If activity MRUN is operating in the *uniform island frequency* mode, the number of energized islands in the system is determined and each non-Type 4 bus is assigned to an island. Up to ten such islands are permitted.

Activity MRUN completes its setup phase by checking for the presence of the factorized network admittance matrix. If necessary, activity FACT (or activities ORDR and FACT) is run.

The simulation, starting at the present value of simulation TIME, then commences.

When activity MRUN is run with the CM suffix, the network solution convergence monitor is automatically printed. This is particularly useful when PSS®E is being executed as a batch job.

```
 ACTIVITY? :
>>MRUN
 AT TIME =  -0.017 ENTER TPAUSE, NPRT, NPLT, CRTPLT:
>>.01,1,1,0

 CHANNEL OUTPUT FILE IS ChOutTEST.out

    TIME X- VALUE --X X--------- IDENTIFIER ---------X X- VALUE --X X--------- IDENTIFIER ---------X
 -0.0167 -7.13702E-10 SPD  BUS 101      MACHINE '1 '    0.84008     PMEC BUS 101      MACHINE '1 '
       3 -7.13702E-10 SPD  BUS 102      MACHINE '1 '    0.84008     PMEC BUS 102      MACHINE '1 '
       5 -6.00608E-09 SPD  BUS 206      MACHINE '1 '    0.80954     PMEC BUS 206      MACHINE '1 '
       7 -5.43703E-09 SPD  BUS 211      MACHINE '1 '    0.83391     PMEC BUS 211      MACHINE '1 '

 -0.0083 -1.24060E-09  0.84008     -1.24060E-09  0.84008     -1.62232E-08  0.80954
       7 -1.55625E-08  0.83391

  0.0000 -1.02230E-09  0.84008     -1.02230E-09  0.84008     -2.71711E-08  0.80954
       7 -2.50355E-08  0.83391

  0.0083 -4.93885E-10  0.84008     -4.93885E-10  0.84008     -4.06358E-08  0.80954
       7 -3.42536E-08  0.83391

  0.0167  7.16737E-10  0.84008      7.16737E-10  0.84008     -5.38341E-08  0.80954
       7 -4.30681E-08  0.83391

 ACTIVITY? :
>>
```

Figure 18.4. Example: Running Activity MRUN

Additional Information
PSS® E Program Operation Manual, Performing Extended Term Simulation in Time Steps

18.5. Initializing Excitation System Models

ESTR

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Section 14.1, “Converting Generators”	
Activity ID, Suffix	Suffix Function
ESTR,SINGLE or ESTR,SI	All machines with connected exciter models at specified bus

The excitation system performance initialization activity ESTR initializes the dynamic models in preparation for excitation system performance checking. Activity ESTR is used in conjunction with activity ERUN to verify excitation system data by simulating the step response of excitation systems in isolation.

When activity ESTR is run with the SINGLE suffix, it instructs the user to designate a bus. Activity ESTR then tests the excitation system response of all machines at the specified bus having a connected excitation system model. Otherwise, all machines with connected exciter models are tested.

Two distinct step response tests may be simulated: a response ratio test, and an open circuit test with a step of the voltage regulator setpoint. Activity ESTR instructs the user to:

```
ENTER 0 FOR RESPONSE RATIO TEST 1 FOR OPEN CIRCUIT SETPOINT STEP TEST:
```

The dialog prompts the user to specify the test to be run.

Following the initialization calculation, activity ESTR prints the case heading and the message:

```
INITIAL CONDITION LOAD FLOW USED 0 ITERATIONS
```

This is followed by the machine initial conditions summary for all machines being tested in a form identical to that of activity STRT. The dialog prompts the user to:

```
ENTER CHANNEL OUTPUT FILENAME:
```

The user responds with the name of the Simulation Channel Output File to be used in the subsequent exciter test simulation. If no filename is specified in response to the above instruction, the writing of the output channel variable values to a file is suppressed during the simulation.

Activity ESTR replaces the user-specified set of main output channel assignments with a set of channels suitable for excitation system testing and sets all CRT plot channel specifications to zero. Therefore, activity ESTR does not enable the user to take an optional Snapshot as activity STRT does. In fact, the user should *never* overwrite the main simulation Snapshot File following activity ESTR, because running it destroys the user-specified output channel assignments.

18.5.1.

Response Ratio Test

In this test, activity ESTR initializes each generator to rated MVA (that is, to MBASE as contained in the power flow generator data) at a user specified power factor. Following specification of the response ratio test, activity ESTR instructs the user to:

```
ENTER DEFAULT POWER FACTOR:
```

where 0.95 is the default response. Then activity ESTR allows the user to specify those machines that are to be initialized at a power factor other than the one specified (for example, synchronous condensers). For example, when the numbers input option is in effect, activity ESTR asks the user to:

```
ENTER BUS NUMBER, MACHINE ID, POWER FACTOR:
```

Activity ESTR repeats the request for exceptions to the default power factor until a zero is entered as the exceptional bus. Activity ESTR then initializes all machines to rated MVA at their specified power factor.

```
 ACTIVITY? :
>>ESTR
 ENTER 0 FOR RESPONSE RATIO TEST
       1 FOR OPEN CIRCUIT SETPOINT STEP TEST:
>>0
 ENTER DEFAULT POWER FACTOR:
>>
 ENTER BUS NUMBER, MACHINE ID, POWER FACTOR:
>>101 1 .98
 ENTER BUS NUMBER, MACHINE ID, POWER FACTOR:
>>102 1 .98
 ENTER BUS NUMBER, MACHINE ID, POWER FACTOR:
>>
 ENTER CHANNEL OUTPUT FILENAME:
>>ChOutTEST.out

     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    WED, MAY 21 2008  10:28
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 INITIAL CONDITION LOAD FLOW USED   0 ITERATIONS

 ----------------------------- MACHINE INITIAL CONDITIONS ------------------------------
   BUS# X-- NAME --X BASKV ID  ETERM   EFD    POWER    VARS   P.F.   ANGLE    ID     IQ
    101 NUC-A       21.600 1  1.0000 2.4384  882.00  179.10 0.9800  48.09 0.8623 0.5065
    102 NUC-B       21.600 1  1.0000 2.4384  882.00  179.10 0.9800  48.09 0.8623 0.5065
    206 URBGEN      18.000 1  1.0000 2.1923  950.00  312.25 0.9500  38.47 0.8355 0.5495
    211 HYDRO_G     20.000 1  1.0000 2.2390  688.75  226.38 0.9500  29.70 0.7419 0.6705
   3011 MINE_G      13.800 1  1.0000 2.4745  950.00  312.25 0.9500  40.50 0.8544 0.5196
   3018 CATDOG_G    13.800 1  1.0000 2.4745  123.50   40.59 0.9500  40.50 0.8544 0.5196

 CHANNEL OUTPUT FILE IS ChOutTEST.out

 ACTIVITY? :
>>
```

Figure 18.5. Example: Running Activity ESTR (Response Ratio Test)

18.5.2.

Open Circuit Setpoint Step Test

Activity ESTR initializes each generator to unity terminal voltage on open circuit. The user-specified output channels are bypassed, and the exciter output voltage, EFD, and machine terminal voltage, ETERM, for each of the n online machines being tested are placed in channels one through 2n.

```
 ACTIVITY? :
>>ESTR
 ENTER 0 FOR RESPONSE RATIO TEST
       1 FOR OPEN CIRCUIT SETPOINT STEP TEST:
>>1
 ENTER CHANNEL OUTPUT FILENAME:
>>ChOutTEST.out

     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    WED, MAY 21 2008   10:32
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 INITIAL CONDITION LOAD FLOW USED  0 ITERATIONS

 ----------------------------- MACHINE INITIAL CONDITIONS -----------------------------
   BUS# X-- NAME --X BASKV ID  ETERM    EFD    POWER     VARS   P.F.   ANGLE    ID      IQ
    101 NUC-A        21.600 1  1.0000 1.0900    0.00     0.00 0.0000    0.00 0.0000 0.0000
    102 NUC-B        21.600 1  1.0000 1.0900    0.00     0.00 0.0000    0.00 0.0000 0.0000
    206 URBGEN       18.000 1  1.0000 1.0900    0.00     0.00 0.0000    0.00 0.0000 0.0000
    211 HYDRO_G      20.000 1  1.0000 1.1100    0.00     0.00 0.0000    0.00 0.0000 0.0000
   3011 MINE_G       13.800 1  1.0000 1.0900    0.00     0.00 0.0000    0.00 0.0000 0.0000
   3018 CATDOG_G     13.800 1  1.0000 1.0900    0.00     0.00 0.0000    0.00 0.0000 0.0000

 CHANNEL OUTPUT FILE IS ChOutTEST.out

 ACTIVITY? :
>>
```

Figure 18.6. Example: Running Activity ESTR (Open Circuit Setpoint Step Test)

Additional Information
PSS® E Program Operation Manual, Initializing Excitation System Models

18.6. Running Exciter Simulation in Time Steps

ERUN

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Section 14.1, “Converting Generators” Initializing Excitation System Models	
Activity ID, Suffix	Suffix Function
ERUN	Activity runs without a suffix.

The excitation system performance checking activity ERUN simulates the step response of excitation systems in isolation. Activity ERUN runs the test specified during the initialization activity ESTR; activity ERUN must, therefore, be preceded by activity ESTR.

The dialog prompts the user to enter the following data:

```
AT TIME = X.XXX ENTER TPAUSE, NPRT, NPLT, CRTPLT:
```

and the user responds with four data items having the same significance as in activity RUN. Re-entering these parameters is necessary because the required activity ESTR has overridden channel assignments.

If the value specified for TPAUSE is less than the current value of simulation TIME, activity ERUN ends. Otherwise, if a Simulation Channel Output File has been opened (during the initialization activity ESTR or running activity ALTR), the following message is printed at the dialog output device:

```
CHANNEL OUTPUT FILE IS aaaaaa
```

The simulation starts at the present value of simulation TIME.

18.6.1.

Response Ratio Test

Activity ERUN automatically raises the voltage regulator reference settings by a large amount at TIME equals zero seconds. This will drive all excitation systems being tested to their ceilings as rapidly as possible.

18.6.2.

Open Circuit Step Response Test

The open circuit response test is intended to check correctness of the voltage regulator gains and time constants. A simple step change of about five percent is applied to the voltage regulator references and the resulting responses of field voltage and generator terminal voltage are observed. At TIME equals zero seconds, the user is asked to:

```
ENTER STEP CHANGE TO VREFS:
```

The user responds with the step to be applied to all voltage regulator setpoints, typically 0.02 to 0.1. The step magnitude should not exceed about ten percent (0.1) because the object of this test is to reveal small disturbance behavior.

```
 ACTIVITY? :
>>ERUN
 AT TIME =  -0.017 ENTER TPAUSE, NPRT, NPLT, CRTPLT:
>>.01,1,1,0

 CHANNEL OUTPUT FILE IS ChOutTEST.out

    TIME X- VALUE --X X--------- IDENTIFIER ---------X X- VALUE --X X--------- IDENTIFIER ---------X
 -0.0167   1.0900     EFD  BUS 101      MACHINE '1 '     1.0000     ETRM BUS 101      MACHINE '1 '
       3   1.0900     EFD  BUS 102      MACHINE '1 '     1.0000     ETRM BUS 102      MACHINE '1 '
       5   1.0900     EFD  BUS 206      MACHINE '1 '     1.0000     ETRM BUS 206      MACHINE '1 '
       7   1.1100     EFD  BUS 211      MACHINE '1 '     1.0000     ETRM BUS 211      MACHINE '1 '
       9   1.0900     EFD  BUS 3011     MACHINE '1 '     1.0000     ETRM BUS 3011     MACHINE '1 '
      11   1.0900     EFD  BUS 3018     MACHINE '1 '     1.0000     ETRM BUS 3018     MACHINE '1 '

 -0.0083   1.0900       1.0000       1.0900       1.0000       1.0900       1.0000
       7   1.1100       1.0000       1.0900       1.0000       1.0900       1.0000

  0.0000   1.0900       1.0000       1.0900       1.0000       1.0900       1.0000
       7   1.1100       1.0000       1.0900       1.0000       1.0900       1.0000

  0.0083   1.0900       1.0000       1.0900       1.0000       1.0900       1.0000
       7   1.1100       1.0000       1.0900       1.0000       1.0900       1.0000

  0.0167   1.0900       1.0000       1.0900       1.0000       1.0900       1.0000
       7   1.1100       1.0000       1.0900       1.0000       1.0900       1.0000

 ACTIVITY? :
>>
```

Figure 18.7. Example: Running Activity ERUN

Additional Information
PSS® E Program Operation Manual, Section Activity, ERUN

18.7. Initializing Turbine Governor Models

GSTR

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Section 14.1, “Converting Generators”	
Activity ID, Suffix	Suffix Function
GSTR,SINGLE or GSTR,SI	All machines with connected governor models at a specified bus

The governor performance initialization activity GSTR initializes the dynamic models in preparation for governor performance checking. Activity GSTR is used in conjunction with activity GRUN to verify turbine governor data by simulating the response of individual units in isolation.

When activity GSTR is run with the SINGLE suffix, it instructs the user to designate a bus. Activity GSTR then tests the governor response of all machines at the specified bus having a connected governor model. Otherwise, all machines with connected governor models are tested.

Activity GSTR instructs the user to:

```
ENTER INITIAL LOADING, STEP (P.U.):
```

The user responds with a value of initial machine loading in per unit of machine base, MBASE, and the load step change to be run at TIME equals zero by activity GRUN. Because the machine initialization to a specified fraction of rated MVA is based on the value specified as MBASE for each machine, this test assumes that generator and governor model parameters are entered on actual machine base.

Following the initialization calculation, activity GSTR prints the case heading and the message:

```
INITIAL CONDITION LOAD FLOW USED 0 ITERATIONS
```

This is followed by the machine initial conditions summary for all machines being tested in a form identical to that of activity STRT. The dialog prompts the user to:

```
ENTER CHANNEL OUTPUT FILENAME:
```

The user responds with the name of the Simulation Channel Output File to be used in the subsequent governor test simulation. If no filename is specified in response to the above instruction, the writing of the output channel variable values to a file is suppressed during the simulation.

Activity GSTR replaces the user-specified set of output channel assignments; the user should *never* overwrite the main simulation Snapshot File following activity GSTR.

```
 ACTIVITY? :
>>GSTR
 ENTER INITIAL LOADING, STEP (P.U.):
>>1
 ENTER CHANNEL OUTPUT FILENAME:
>>ChOutTEST.out
 TGOV1 AT BUS    206 MACHINE 1  INITIALIZED OUT OF LIMITS

     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    WED, MAY 21 2008  10:38
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 INITIAL CONDITION LOAD FLOW USED  0 ITERATIONS

 ----------------------------- MACHINE INITIAL CONDITIONS -----------------------------
   BUS# X-- NAME --X BASKV ID  ETERM   EFD    POWER    VARS   P.F.  ANGLE   ID     IQ
    101 NUC-A       21.600 1  1.0000 2.1819  900.00    0.00 1.0000  57.14 0.8400 0.5426
    102 NUC-B       21.600 1  1.0000 2.1819  900.00    0.00 1.0000  57.14 0.8400 0.5426
    206 URBGEN      18.000 1  1.0000 1.8362 1000.00    0.00 1.0000  50.45 0.7710 0.6368
    211 HYDRO_G     20.000 1  1.0000 1.6211  725.00    0.00 1.0000  36.60 0.5962 0.8029

 CHANNEL OUTPUT FILE IS ChOutTEST.out

 ACTIVITY? :
>>
```

Figure 18.8. Example: Running Activity GSTR

Additional Information
PSS® E Program Operation Manual, Section Activity, GSTR

18.8. Running Governor Response Simulation in Time Steps

GRUN

Requirements / Prerequisites	
Validly specified power flow case. Dynamics data must exist in dynamics working memory. Converting Generators Initializing Turbine Governor Models	
Activity ID, Suffix	Suffix Function
GRUN	Activity runs without a suffix.

The governor performance checking activity GRUN simulates the response of the governing loops of units in isolation to a step change in load. Activity GRUN uses the step specified during the initiation activity GSTR. The dialog prompts the user to enter the following data:

```
AT TIME = X.XXX ENTER TPAUSE, NPRT, NPLT, CRTPLT:
```

and the user responds with four data items having the same significance as in activity RUN. Re-entering these parameters is necessary because the required activity GSTR has overridden channel assignments. If the value specified for TPAUSE is less than the current value of simulation TIME, activity GRUN ends. Otherwise, if a Simulation Channel Output File has been opened (during the initiation activity GSTR or running activity ALTR), the following message is printed at the dialog output device:

```
CHANNEL OUTPUT FILE IS aaaaaa
```

The simulation, starting at the present value of simulation TIME, then commences.

Activity GRUN automatically applies the load increment (typically 0.05 to 0.1) specified in activity GSTR to each unit at TIME equals zero seconds.

This simulation should normally be carried out until at least ten seconds; the simulation may have to be extended to as long as twenty seconds if hydro units are present.

```
>>GRUN
 AT TIME =  -0.017 ENTER TPAUSE, NPRT, NPLT, CRTPLT:
>>.01,1,1,0

 CHANNEL OUTPUT FILE IS ChOutTEST.out

    TIME X- VALUE --X X--------- IDENTIFIER ---------X X- VALUE --X X--------- IDENTIFIER ---------X
 -0.0167   0.0000     SPD  BUS 101      MACHINE '1 '     1.0100     PMEC BUS 101      MACHINE '1 '
     3     0.0000     SPD  BUS 102      MACHINE '1 '     1.0100     PMEC BUS 102      MACHINE '1 '
     5     0.0000     SPD  BUS 206      MACHINE '1 '    0.97333     PMEC BUS 206      MACHINE '1 '
     7     0.0000     SPD  BUS 211      MACHINE '1 '     1.0100     PMEC BUS 211      MACHINE '1 '

 -0.0083   0.0000       1.0100       0.0000       1.0100     -9.16667E-05  0.97323
     7     0.0000       1.0100

  0.0000   0.0000       1.0100       0.0000       1.0100     -1.52809E-04  0.97316
     7     0.0000       1.0100

  0.0083 -1.59550E-04   1.0100     -1.59550E-04   1.0100     -4.69235E-04  0.97310
     7   -1.27637E-04   1.0101

  0.0167 -2.65663E-04   1.0108     -2.65663E-04   1.0108     -6.99951E-04  0.97303
     7   -2.12497E-04   1.0101

 ACTIVITY? :
>>
```

Figure 18.9. Example: Running Activity GRUN

Additional Information
PSS® E Program Operation Manual, Section Activity, GRUN

18.9. Building a State Variable Matrix for Linear Dynamic Analysis (LSYSAN)

ASTR

Requirements / Prerequisites	
Validly specified power flow case, solved to an acceptable mismatch level. Dynamics data exists in dynamics working memory. Section 14.1, "Converting Generators" Section 14.5, "Factorizing the Network Admittance Matrix"	
Activity ID, Suffix	Suffix Function
ASTR,CM	Automatically print network solution convergence monitor

The state variable matrix construction activity ASTR calculates the initial values of all variables for each equipment model as a function of the model's constant data and the boundary condition at the bus in the working case at which it is referenced. It then infers the state variable system matrices and processes them for input into the Linear Dynamic Analysis program, LSYSAN.

An alarm message is generated if generators are not converted, and activity ASTR ends.

Activity ASTR ensures that the machine power arrays in the power flow working case are set to their original initial condition values, as they may have been changed by previously running activity STRT or MSTR. Activity ASTR completes its setup phase by checking for the presence of the factorized network admittance matrix. If necessary, activity FACT (or activities ORDR and FACT) is run.

Activity ASTR runs a network solution and then, based on the bus boundary conditions, initializes the state variables (STATEs) and algebraic variables (VARs) of each equipment model. If, in setting up for the initial network solution, any CIMTR5, CIMWSC, CIM5xx, CLODxx, or IEELxx model removes constant admittance load from the load at which it is called, an appropriate message is printed and the network admittance matrix is automatically refactorized prior to commencing the network solution.

An alarm message is generated for any machine that is online in the working case but which does not have a generator model assigned to it. The source current (ISORCE) of any such machine is set to zero. The presence of any such machines renders the initial condition invalid.

Similarly, an alarm message is generated for any two-terminal, multi-terminal, or VSC dc line, any FACTS device, or any switched shunt device that is under continuous control that is in-service in the working case but which does not have a dynamic table model assigned to it. The presence of any dc line or FACTS device for which there is no dynamic model renders the initial condition invalid.

During the model initialization process, an alarm message is generated for any model variable that is initialized beyond its prescribed limits.

Activity ASTR then prints the case heading followed by the number of iterations used to calculate the initial power flow. A value of n greater than one usually (but not always) indicates some sort of modeling error.

Activity ASTR then summarizes the conditions at each online machine.

This report is in ascending bus number order when the *numbers* output option is in effect, and in alphabetical bus name order using the *names* option. Note that for wind machines, because the quantity EFD is not of any relevance, this is set to zero.

Following the calculation of the system initial condition, the time derivatives (DSTATEs) of all STATE variables are calculated and then checked for a steady state. The dialog prompts the user to:

```
ENTER LARGEST DERIVATIVE CHANGE ALLOWED (DEFAULT IS 0.01):
```

An alarm message is generated for any STATE for which time derivative exceeds the specified threshold. Its index is printed along with the values of its time derivative and the STATE variable itself. If machine or load STATE variable errors are detected, activity ASTR ends.

Activity ASTR then instructs the user to:

```
ENTER MATRIX OUTPUT FILE NAME (0 TO EXIT):
```

The user responds with the name of the Matrix Output File into which the system matrices and related information are to be written (*.lsa). If no filename is specified in response to the above instruction, activity ASTR ends.

The user is asked to designate those STATE variables to be included in the linear system matrices:

```
nnnn STATES IN USE. ENTER SINGLE STATES OR STARTING AND ENDING STATES TO BE
INCLUDED IN MATRICES (CR FOR ALL) ENTER STARTING AND ENDING STATES:
```

All system model STATEs are used if *[Enter]* is the response. Otherwise, the user may designate a single STATE or range of STATEs in response to this request. Activity ASTR repeats the request for starting and ending STATE indices until the user responds with a zero or *[Enter]*.

Following the STATE variable specification, the dialog prompts the user to specify the perturbation factor:

```
ENTER AMOUNT TO PERTURB SELECTED STATES (DEFAULT IS 0.01):
```

The LSYSAN program provides for up to fifty elements in the system output vector and related matrices. Activity ASTR treats the output channel specifications in dynamics working memory as potential output quantities. If no output channel specifications have been introduced into the simulation setup, an appropriate message is printed and the H and F matrices are not constructed. Otherwise, the user is asked to designate those output channels to be included as linear system outputs:

```
nnnn OUTPUT CHANNELS IN USE. ENTER SINGLE CHANNELS OR STARTING AND ENDING
CHANNELS TO BE INCLUDED AS LINEAR SYSTEM OUTPUTS (CR FOR FIRST nn) ENTER STARTING
AND ENDING OUTPUT CHANNELS:
```

The first nn (or 50, whichever is smaller) output channels are used if the user responds *[Enter]*. Otherwise, the user may designate a single channel or range of channels in response to this request. Activity ASTR repeats the request for starting and ending channel indices until the user responds with a zero or *[Enter]*, or until a total of fifty channels have been specified.

The user may then designate input variables to be perturbed. The LSYSAN program provides for up to twenty input variables. Each input variable is designated in response to the instruction:

```
ENTER INPUT QUANTITY CATEGORY AND AMOUNT OF PERTURBATION: 0 = EXIT 1 = EFD 2
= PMECH 3 = VOTHSG 4 = VREF 5 = VAR:
```

where the user enters one of the numeric category codes listed, and a perturbation factor by which the initial condition value of the specified quantity is modified. The user is then asked to designate the machine for which quantity is to be perturbed (categories one through four) or the VAR index (category five). A thirty-two character identifier may also be entered, which is included in the matrix output file. If no identifier is specified, activity ASTR assigns an identifier as described in activity CHAN. This process is repeated until either a zero category code is entered or twenty input quantities have been specified. The corresponding columns of the B and F matrices are then calculated and written to the matrix output file, and activity ASTR ends.

When activity ASTR is run with the CM suffix, the network solution convergence monitor is automatically printed. This is particularly useful when PSS®E is being executed as a batch job.

```
 ACTIVITY? :
>>ASTR
 ENTER LARGEST DERIVATIVE CHANGE ALLOWED (DEFAULT IS 0.01):
>>.15
 ENTER MATRIX OUTPUT FILE NAME (0 TO EXIT):
>>TEST.lsa

     63 STATES IN USE.  ENTER SINGLE STATES OR STARTING AND
 ENDING STATES TO BE INCLUDED IN MATRICES (CR FOR ALL)

 ENTER STARTING AND ENDING STATES:
>>
 ENTER AMOUNT TO PERTURB SELECTED STATES (DEFAULT IS 0.01):
>>
 NO OUTPUT CHANNELS AVAILABLE--H AND F MATRICES NOT BUILT

 ENTER INPUT QUANTITY CATEGORY AND AMOUNT OF PERTURBATION:
 0 = EXIT      1 = EFD       2 = PMECH
 3 = VOTHSG    4 = VREF      5 = VAR:
>>4
 ENTER BUS NUMBER, MACHINE ID, 'IDENTIFIER':
>>206 1

 ENTER INPUT QUANTITY CATEGORY AND AMOUNT OF PERTURBATION:
 0 = EXIT      1 = EFD       2 = PMECH
 3 = VOTHSG    4 = VREF      5 = VAR:
>>4
 ENTER BUS NUMBER, MACHINE ID, 'IDENTIFIER':
>>211 1

 ENTER INPUT QUANTITY CATEGORY AND AMOUNT OF PERTURBATION:
 0 = EXIT      1 = EFD       2 = PMECH
 3 = VOTHSG    4 = VREF      5 = VAR:
>>

     PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(tm)E    WED, MAY 21 2008   13:20
 PSS(TM)E PROGRAM APPLICATION GUIDE EXAMPLE
 BASE CASE INCLUDING SEQUENCE DATA

 INITIAL CONDITION LOAD FLOW USED   1 ITERATIONS

 ----------------------------- MACHINE INITIAL CONDITIONS -----------------------------
   BUS# X-- NAME --X BASKV ID  ETERM   EFD    POWER     VARS   P.F.   ANGLE   ID     IQ
    101 NUC-A        21.600 1  1.0200 2.0564  749.99    81.21 0.9942  63.47 0.6571 0.4934
    102 NUC-B        21.600 1  1.0200 2.0564  749.99    81.21 0.9942  63.47 0.6571 0.4934
    206 URBGEN       18.000 1  1.0236 2.5618  800.00   600.01 0.8000  23.53 0.8733 0.4380
    211 HYDRO_G      20.000 1  1.0404 1.6150  600.00    17.74 0.9996  42.14 0.4089 0.6827
   3011 MINE_G       13.800 1  1.0400 1.4655  258.66   104.05 0.9277  16.02 0.1648 0.2114
   3018 CATDOG_G     13.800 1  1.0218 2.9374  100.00    80.00 0.7809  22.53 0.8757 0.4033

 INITIAL CONDITIONS CHECK O.K.

 NO OUTPUT CHANNELS AVAILABLE--H AND F MATRICES NOT BUILT

 ACTIVITY? :
>>
```

Figure 18.10. Example: Running Activity ASTR

Additional Information
PSS® E Program Operation Manual, Section Activity, ASTR

Chapter 19
Program Automation

19.1. Handling Response Files

The following @ commands are recognized by PSS®E:

`@PAUSE`	Temporarily suspend Response File operation.
`@CONTINUE`	Resume PAUSEd Response File operation.
`@INPUT filename`	Open the specified file as a nested Response File.
`@CHAIN filename`	Open the specified file as a chained Response File.
`@END`	Close the current Response File.
`@SYSTEM command`	Issue the designated system command; this command has restrictions on some host computer systems.
`@!text`	Treat the line as a comment line; comment lines may be included in Response Files and data input files to clarify their contents when they are being read by people.

These commands are detected and executed by the input processor rather than being passed to PSS®E itself. The following rules and characteristics apply to these commands:

1. @ commands are not case sensitive.
2. @ commands may be abbreviated to as short a character sequence as is required to uniquely identify the command. @CONTINUE and @CHAIN may be abbreviated @CO and @CH respectively, while the remaining commands may be as short as one character following the @.
3. The @ character may be anywhere in the first 10 columns of the input line as long as it is the first nonblank character.
4. @ commands may only be issued from Response Files, IPLAN programs and the `ACTIVITY?` input field of the CLI.

The @SYSTEM and @! commands may be used in all of PSS®E's auxiliary programs (see Chapter 1, PSS®E Applications and Utilities in Additional Resources for *PSS® E*). The @INPUT, @CHAIN, @CONTINUE, @PAUSE, and @END commands are meaningful only for programs that support Response File operation; therefore, PSSPLT and LSYSAN are the only auxiliary programs in which they may be used.

19.1.1. Version

The CLI provides the ability to change versions. As releases of PSS®E become available, sometimes changes are necessary in the sequence of Line Mode commands. This creates maintenance work for existing Response Files. The CLI provides a command, VERSION, which displays or sets the version of the Line Mode language being processed. Introduced at rev 31 of PSS®E, it recognizes versions from rev 30 and newer and resets the version as directed, for example:

`VERSION 30` - sets the version to rev 30

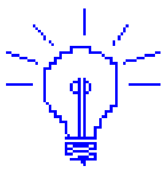
`VERSION 31` - sets the version to rev 31

`VERSION` - displays the current version

19.2. Assigning Interactive Input to a Response File

IDEV

Requirements / Prerequisites	
Response File (*.idv)	
Activity ID, Suffix	Suffix Function
IDEV,filename	Assign interactive input to the specified Response File
IDEV,filename, arg1,arg2,...,arg9	Pass up to 9 arguments to specified Response File



Activity IDEV is considered an obsolete activity which is retained for backward compatibility with prior versions of PSS®E.

The dialog input device specification activity IDEV is used to change the source from which PSS®E accepts the user's portion of the dialog for a Response File. The generalized Response File capability, initiated by the @INPUT and @CHAIN commands, is the recommended method of using Response Files.

When activity IDEV is run with the filename suffix, the current Response File is closed and PSS®E accepts subsequent command input from the specified Response File. Optionally, up to nine arguments may be passed to the designated Response File. Running activity `IDEV,<filename>` is equivalent to entering an @CHAIN,< filename > command at `ACTIVITY?`.

Activity IDEV supports the argument passing capability of the generalized Response File operation. This form of the IDEV activity command is:

```
IDEV , filename , 'argument 1' , 'argument 2' ... 'argument 15'
```

When no filename is appended to the IDEV activity command, the current Response File is closed and subsequent user input is taken from its prior source (either the user's terminal or, if the current Response File was initiated from another Response File using an @INPUT command, the initiating Response File). This form of the IDEV activity command is retained for backward compatibility purposes; the recommended method of terminating a Response File is with the @END command.

Additional Information
PSS®E Program Operation Manual, Running a Response File

19.3. Recording User Actions

ECHO

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
ECHO,filename	Append user dialog input to designated Response File

The dialog echoing activity ECHO enables the writing of all subsequent user dialog input to a designated file, which may subsequently be used as a Response File.

If a file for capturing responses is open because activity ECHO had been run during the current work session, it is closed and the following message is printed when activity ECHO is initiated:

```
CLOSING ECHO FILE old-echo-filename
```

When activity ECHO is run without a suffix, it ends and the echoing of subsequent user responses is disabled.

When activity ECHO is run with the filename suffix, the specified file is opened and the following message is displayed:

```
OPENED ECHO FILE filename
```

All subsequent dialog input is then written to the file. If a file system related error occurs in opening the file, an appropriate error message is printed and activity ECHO ends with the echoing of subsequent user responses disabled.

Additional Information
PSS® E Program Operation Manual, Recording User Actions

19.4. Building a Response File, Power Flow Calculation

PSEB

Requirements / Prerequisites	
PSEB Command file (*.pse)	
Activity ID, Suffix	Suffix Function
PSEB,CHECK	Suppress automatic execution of the Response File

The power flow run assembler activity PSEB allows the user to specify routine power flow runs in an English-like language. Input to activity PSEB is taken either from a PSEB Command File or from the dialog input device (normally the user's terminal). The output from activity PSEB is in the form of a Response File.

The activity PSEB dialog requests filename entry at the terminal:

```
ENTER INPUT FILE NAME (0 TO EXIT, 1 FOR TERMINAL):
```

For details, see Section 3.1.1, “File or Terminal Input”.

The dialog prompts the user to:

```
ENTER OUTPUT FILE NAME (BLANK FOR DEFAULT):
```

If a file system error occurs while opening the specified file, an appropriate error message is printed and the request for a filename is repeated. If no filename is specified, activity PSEB writes its output into a file for which the name is of the form PSEBnnn.IDV, where <nnn> is a number that is set such that the resulting filename is a new file in the user's directory.

When terminal input had been specified, activity PSEB issues the prompt `PSEB:` each time it is ready to accept a new PSEB command. PSEB command input ends by entering either the END or ABORT command.

When input is taken from a PSEB Command File, no prompts are issued. If the input file is not terminated with either the END or ABORT command, the following message is printed:

```
OUT OF FILE DATA--SWITCH TO TERMINAL INPUT MODE
```

Additional PSEB command input records may then be entered from the user's terminal.

If an error occurs in processing an input record, an appropriate error message is printed, the offending record is ignored, and processing continues.

Upon entry of either the END or ABORT command, activity PSEB ends and, except as described below, an @INPUT command is automatically issued to execute the Response File constructed by activity PSEB. If PSS®E is already being operated in Response File mode (that is, activity PSEB was initiated from a Response File), any remaining commands contained in the original Response File are executed following the execution of the Response File created by activity PSEB.

The execution of the PSEB Response File is bypassed if any one of the following has occurred:

1. Activity PSEB was run with the CHECK suffix.

2. The PSEB command CHECK was entered during PSEB command input.

3. PSEB command input was terminated with the command ABORT rather than END.

4. *Any* errors were encountered during the processing of PSEB command input. In this case, if PSS®E is being operated in its Response File mode, all active Response Files are closed and additional user inputs to PSS®E are taken from the user's terminal.

When automatic Response File execution is bypassed, activity PSEB prints the message:

```
YOUR RESPONSE FILE IS filename
```

where < filename > is the name of the Response File corresponding to the run described by the PSEB commands that were specified.

While activity PSEB may be used with response echoing enabled, care must be exercised if the automatic execution of the Response File built by activity PSEB occurs. In this case, the Response File built by activity ECHO will contain the commands used to apply activity PSEB as well as the Response File commands generated by activity PSEB. That is, if subsequently executed, the Response File built by activity ECHO will run the sequence defined by the PSEB commands twice.

Additional Information
PSS®E Program Operation Manual, Building a Response File, Power Flow Calculation

19.5. Building a Response File, Dynamic Simulation

PSAS

Requirements / Prerequisites	
PSAS Command file (*.psa)	
Activity ID, Suffix	Suffix Function
PSAS,CHECK	Suppress automatic execution of the Response File

The simulation run assembler activity PSAS allows the user to specify dynamic simulation runs in an English-like language. Input to activity PSAS is taken either from a PSAS Command File or from the dialog input device (normally the user's terminal). The output from activity PSAS is in the form of a Response File.

The activity PSAS dialog requests filename entry at the terminal:

```
ENTER INPUT FILE NAME (0 TO EXIT, 1 FOR TERMINAL):
```

For details, see Section 3.1.1, "File or Terminal Input".

The dialog prompts the user to:

```
ENTER OUTPUT FILE NAME (BLANK FOR DEFAULT):
```

If a file system error occurs while opening the specified file, an appropriate error message is printed and the request for a filename is repeated. If no filename is specified, activity PSAS writes its output into a file for which the name is of the form PSASnnn.IDV, where <nnn> is a number that is set such that the resulting filename is a new file in the user's directory.

When terminal input had been specified, activity PSAS issues the prompt `PSAS:` each time it is ready to accept a new PSAS command. PSAS command input ends by entering either the END or ABORT command.

When input is taken from a PSAS Command File, no prompts are issued. If the input file is not terminated with either the END or ABORT command, the following message is printed:

```
OUT OF FILE DATA--SWITCH TO TERMINAL INPUT MODE
```

Additional PSAS command input records may then be entered from the user's terminal.

If an error occurs in processing an input record, an appropriate error message is printed, the offending record is ignored, and processing continues.

Upon entry of either the END or ABORT command, activity PSAS ends and, except as described below, an @INPUT command is automatically issued to execute the Response File constructed by activity PSAS. If PSS®E is already being operated in Response File mode (that is, activity PSAS was initiated from a Response File), any remaining commands contained in the original Response File are executed following the execution of the Response File created by activity PSAS.

Execution of the PSAS Response File is bypassed if any one of the following has occurred:

1. Activity PSAS was run with the CHECK suffix.

2. The PSAS command CHECK was entered during PSAS command input.

3. PSAS command input was terminated with the command ABORT rather than END.

4. *Any* errors were encountered during the processing of PSAS command input. In this case, if PSS ®E is being operated in its Response File mode, all active Response Files are closed and additional user inputs to PSS®E are taken from the user's terminal.

When automatic Response File execution is bypassed, activity PSAS prints the message:

```
YOUR RESPONSE FILE IS filename
```

where < filename > is the name of the Response File corresponding to the run described by the PSAS commands that were specified.

While activity PSAS may be used with an ECHO file enabled, care must be exercised if the automatic execution of the Response File built by activity PSAS occurs. In this case, the ECHO file will contain the commands used to apply activity PSAS as well as the Response File commands generated by activity PSAS. That is, if subsequently executed as a Response File, the ECHO file will run the sequence defined by the PSAS commands twice.

Additional Information
PSS ® E Program Operation Manual, Building a Response File, Dynamic Simulation

19.6. Inserting Comments into the Progress Output

TEXT

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
TEXT,message	Echo message at ODEV and PDEV if different than IDEV

The null activity TEXT doesn't really do anything. However, it does provide a mechanism by which the user may insert descriptive comments in a Response File at any point at which the next activity to be run is specified. In addition, it enables the user to insert comments in the progress output and into the PDEV, ODEV or session logging output if any of these features have been used to preserve hard copy records of the PSS®E work session.

In response to the question `ACTIVITY?`, the user may enter the activity name TEXT followed by any descriptive text that is suitable; for example:

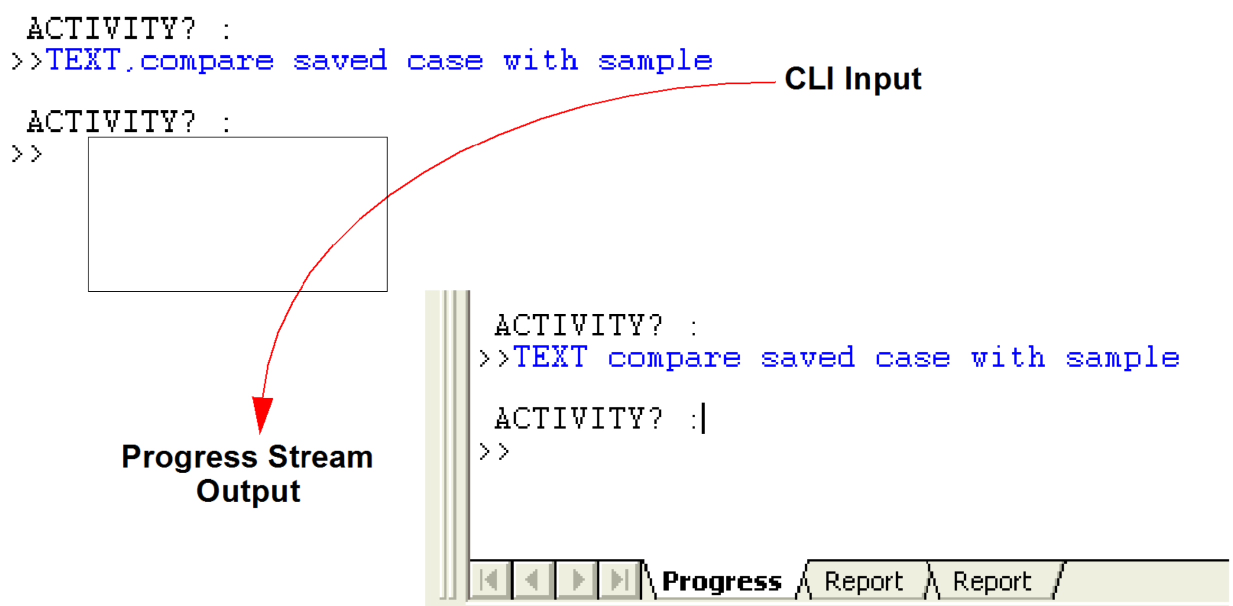


Figure 19.1. Example: Output for Activity TEXT

Additional Information
PSS® E Program Operation Manual, Inserting Comments into the Progress Output

19.7. Launching an IPLAN Program File

EXEC

Requirements / Prerequisites	
IPLAN File (*.irf)	
Activity ID, Suffix	Suffix Function
EXEC,filename	Execute the IPLAN program contained in the specified file
EXEC,filename,argument list	Execute the IPLAN program with the specified argument list
EXEC,filename, -ARG	Prompt the user for an argument list and then execute the IPLAN program

The programmable PSS®E execution activity EXEC retrieves an IPLAN executable program and starts its execution. The IPLAN program must have been compiled by the IPLAN compiler from its source form into an IPLAN Executable Program File, and the name of the IPLAN Executable Program File must be specified as a suffix when activity EXEC is run. For example, to execute the IPLAN program contained in the IPLAN Executable Program File job1.irf, activity EXEC could be run with the activity command:

```
exec,job1.irf
```

If no file is specified, or if a file system error condition is encountered in opening the designated file, an error message is printed and activity EXEC ends. If the file is not found, an appropriate message is printed and activity EXEC ends. If the IPLAN program requires run-time arguments, it may be initiated with either of the activity commands:

```
exec,job1, argument_list exec,job1, -arg
```

When the token -arg is specified, activity EXEC instructs the user to specify the argument list that is to be passed to the IPLAN program.

After the IPLAN program is loaded into PSS®E's working memory, activity EXEC ends and PSS®E operation continues. PSS®E's next request for input (that is, for the user's specification of the next function or activity to be run) triggers the execution of the IPLAN program.

While the redirection of input to PSS®E provided by activity EXEC is similar in concept to the use of Response Files, an IPLAN program is much more flexible than a Response File; it may receive information from PSS®E and make decisions based upon PSS®E execution results.

Additional Information
PSS® E Program Operation Manual, Launching an IPLAN Program File *IPLAN Program Manual*

Chapter 20
Controls

20.1. Output Controls

20.1.1. Specifying Global Report Destination

OPEN

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
OPEN	Activity runs without a suffix.

The report output device specification activity OPEN allows the user to preselect the destination for reports generated by PSS®E activities. When initiated, activity OPEN first CLOSes the previously OPENed output device if any and then instructs the user to specify the device to be used for reports.

Specifying zero requires the user to direct output manually when running the activity. If a device or window is specified, the `ENTER OUTPUT DEVICE` instruction is suppressed, and the report is automatically sent to that device. If a file or high speed printing device is specified, reports are stacked in the order in which they are generated. If a hard copy device is specified, the output is not printed until activity OPEN, CLOS, or STOP is run.

The device specified in activity OPEN applies to all reporting activities. However, it does not affect those activities for which output is a data file intended to be read by PSS®E or some other program.

```
>>OPEN

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT                1 FOR REPORT WINDOW
  2 FOR A FILE                   3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE   7 FOR PROGRESS WINDOW  :
>>1

 ACTIVITY? :
>>
```

Figure 20.1. Example: Running Activity OPEN

Additional Information
PSS® E Program Operation Manual, Selecting Report Output Destination

20.1.2. Closing Report Destination

CLOS

Requirements / Prerequisites	
Specifying Global Report Destination	
Activity ID, Suffix	Suffix Function
CLOS	Activity runs without a suffix.

The report output device closing activity CLOS ends output to the previously OPENed output device, and returns to the operating mode in which each reporting activity requests the user to specify the destination for its report, and each reporting activity prints its report in the Progress tab.

```
 ACTIVITY? :
>>OPEN

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR REPORT WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE  7 FOR PROGRESS WINDOW :
>>3
 ENTER NUMBER OF COPIES (UP TO 6):
>>2

 Opened queue for \\STYECTRX1\STYE03SP

 ACTIVITY? :
>>CLOS
 Sent 2 copies of file C:\DOCUME~1\stywima1\LOCALS~1\Temp\PSStmOUT001.SPL
 to Windows printer \\STYECTRX1\STYE03SP

 ACTIVITY? :
>>
```

Figure 20.2. Example: Running Activity CLOS

Additional Information
PSS®E Program Operation Manual, Closing Report Destination

20.1.3. Specifying Progress Report Destination

PDEV

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
PDEV	Activity runs without a suffix.

The progress report output device specification activity PDEV is used to change the destination of a progress report to the user's terminal, a file, or a hard copy printing device. A progress report consists of those portions of standard PSS®E output that are not a part of the activity dialog, such as network solution convergence monitors, machine initial conditions summaries, and output channel tabulations. The dialog prompts the user to specify the device to be used for these tabulations.

Entering either zero or one to the dialog assigns progress report output to the user's terminal.

When a hard copy device is specified by activity PDEV, the output is not printed until either the progress report output is reassigned elsewhere by running activity PDEV again, or PSS®E ends by running activity STOP.

The destination specified in activity PDEV may be the same as that specified in activities ODEV and OPEN. The progress report output destination is totally independent of the output device specified to report generating activities such as LIST and POUT.

```
 ACTIVITY? :
>>PDEV

 ENTER OUTPUT DEVICE CODE:
  0 FOR NO OUTPUT              1 FOR PROGRESS WINDOW
  2 FOR A FILE                 3 FOR DEFAULT PRINTER
  6 FOR ALTERNATE SPOOL DEVICE:
>>1

 ACTIVITY? :
>>
```

Figure 20.3. Example: Running Activity PDEV

Additional Information
PSS® E Program Operation Manual, Selecting Progress Output Destination *PSS® E Program Operation Manual*, Virtual Output Devices

20.1.4. Specifying Alert and Prompt Destination

ODEV

Requirements / Prerequisites	
None, although in practice, activity ODEV would be executed only from a Response File or an IPLAN program. Response File (*.idv)	
Activity ID, Suffix	Suffix Function
ODEV	Activity runs without a suffix.

The dialog output device specification activity ODEV is used to change the destination to which PSS®E writes its portion of the dialog to either the user's terminal, a file, or a hard copy printing device.

The dialog prompts the user to specify the new device to be used for PSS®E instructions to the user. Entering either zero or one to the dialog assigns dialog output to the user's terminal.

After the new dialog output device is specified and activity ODEV ends, all subsequent instructions and requests for input from PSS®E will be written to this device. It follows, then, that activity ODEV should not be used to direct PSS®E's dialog output to a device other than the user's terminal when dialog input is taken from the user's terminal (that is, dialog output should be assigned to the terminal except when operating with a Response File or the IPLAN program). Otherwise, the user will be unable to respond to activity requests. Therefore, activity ODEV, if used, should only be run from a Response File or IPLAN program: once at the beginning to direct PSS®E's questions to a permanent storage medium, and once prior to exiting the Response File or IPLAN program to direct the dialog output back to the user's terminal.

When a hard copy device is specified to activity ODEV, the output is not printed until either dialog output is reassigned elsewhere by running activity ODEV again, or PSS®E ends by running activity STOP.

The destination specified in activity ODEV may be the same as that specified in activities PDEV and OPEN.

Additional Information
PSS® E Program Operation Manual, Selecting Prompt Output Destination

Additional Information
PSS® E Program Operation Manual,Virtual Output Devices

20.1.5. Setting the Path for Use with & Filenames

PATH

Requirements / Prerequisites	
none	
Activity ID, Suffix	Suffix Function
PATH	Activity runs without a suffix.

The directory path specification activity PATH allows the user to specify a directory name. Then, whenever a simple filename preceded by an ampersand (for example, *& myfile*) is specified to a PSS®E activity file request, the file is opened in the directory specified rather than in the user's current directory.

```
 ACTIVITY? :
>>PATH
 ENTER PATHNAME PREFIX FOR USE WITH '&' FILE NAMES
>>C:\Program Files\PTI\PSSE31\Example

 ACTIVITY? :
>>
```

Figure 20.4. Example: Running Activity PATH

Additional Information
PSS® E Program Operation Manual, Setting the Path for Use with & Filenames

20.2. Interfaces

20.2.1. Returning Analytical Output to Dynamic Simulation

RTRN

Requirements / Prerequisites	
PSSDS4 Linking to Power Flow Activities from Dynamic Simulation	
Activity ID, Suffix	Suffix Function
RTRN	Activity runs without a suffix.

The return to dynamics activity RTRN transfers PSS®E control from the power flow activity operating mode to the dynamic simulation activity operating mode. Activity RTRN is not valid when PSS®E was initiated at its power flow entry point, PSSLF4; it is only valid when PSS®E is entered at its dynamics entry point, PSSDS4, and the power flow activity operating mode was subsequently entered by running activity LOFL.

If run while in dynamic simulation mode, activity RTRN displays the following message:

```
 ACTIVITY? :
>>RTRN

 Messages for api DYNAMICSMODE
 Already operating in dynamics mode

 ACTIVITY? :
>>
```

Figure 20.5. Example: Running Activity RTRN in Dynamics Mode

Additional Information
PSS®E Program Operation Manual, Returning Activity Selection to Dynamic Simulation

20.2.2. Linking to Power Flow Activities from Dynamic Simulation

LOFL

Requirements / Prerequisites	
PSSDS4	
Activity ID, Suffix	Suffix Function
LOLF	Activity runs without a suffix.

The power flow link activity LOFL allows the user to apply any activity accessible from the power flow activity operating mode after having initiated PSS®E at its dynamic simulation entry point, PSSDS4.

At the start activity LOFL links directly to the power flow activity operating mode, giving the user the ability to run any activities available using the power flow activity operating mode. While the power flow linkage is in effect, rather than the familiar `ACTIVITY?` prompt, the user is invited to specify the next activity to be run with the prompt:

ACTIVITY RTRN TO RETURN TO DYNAMICS--ACTIVITY?

The user may return to the dynamic simulation activity operating mode by specifying activity RTRN.

If run while in power flow mode, activity LOFL displays the following message:

```
 ACTIVITY? :
>>LOFL

 Messages for api POWERFLOWMODE
 Already operating in power flow mode

 ACTIVITY? :
```

Figure 20.6. Example: Running Activity LOFL in Power Flow Mode

Additional Information
PSS® E Program Operation Manual,Linking to Power Flow Activities from Dynamic Simulation

Chapter 21
Appendix A - Behavior of the Line Mode Interface

The historic Line Mode interface to PSS®E has been replaced with a modern, event-driven GUI. There exist many response files, representing many man-hours of development effort that use the Line Mode language, as well as IPLAN programs that also utilize it using the PUSH set of commands. A Line Mode Interface (LMI) has been developed to support these usages that read in sequences of the Line Mode language and calls the appropriate PSS®E API routine - the same API routines that are called by the PSS ®E GUI. This is desirable for recording and translation purposes, consistency of behavior, and quality of maintenance. Given this mode of operation the imitation cannot be perfect. This section attempts to capture and summarize the differences.

21.1. General

1. Activities that are not permitted (that is, optional purchase, required data, etc.) will absorb all inputs, and produce errors only afterwards.

2. Some prompts are reorganized (very few).

3. Many warning or informative messages that would have appeared during the dialog will no longer be displayed, or will be displayed at the end of the dialog. In general, if a message presented information needed to respond to a prompt it was maintained; if it was strictly informational, it was not (although most are later produced by the API routines).

4. Many data errors that depended on values from the case that could short-circuit the activity dialog will no longer occur (the errors will still occur, but later in the dialog) (see some omitted activity data checks, below). In general, if data values could generate additional prompts, or modify the sequence of prompts, those checks are maintained; if the data values produced errors that simply aborted the activity, they were not (for exceptions, see differences in behavior: by activity, below).

5. Bus subsystems with multiple base kV ranges not supported (actually, this is a limitation of the entire interface).

6. Activities that output data files will have report or printer specifications directed to the Progress tab instead (actually, this is a limitation of the API design). Only file and terminal choices are presented. The LMI dialog will still absorb printer/copies/etc. inputs, even though those choices will not be presented in the initial menu.

7. Device specification menus no longer present the with or without page breaks alternative; use lines-per-page to control.

8. Next page dialog for report output is ignored. It compares to running the old interface with the CRT lines per page (OPTN option 23) set to the maximum.

9. Terminal input of data will not verify any values until all data is entered. Some prompts may then be repeated (as progress information).

10. Inputs that could accept certain characters or numeric input will not produce data type errors for other character inputs, but will be treated as zero (for example, CHNG allows 'Q' for data change lines. Entering, say, 'x' will be treated as zero.)

11. Integer responses other than 0 and 1 to `DO YOU WANT MORE?` will be treated as No. The Line Mode either treated them as Yes or as an invalid response and repeated the question, depending on the activity.

12. Names input is allowed, but all APIs are called with bus numbers (means that if you record your input, you will see bus numbers, not names) (this is true of the entire interface). Quoted strings are allowed for bus names, which is a new feature, but within that string the length of the name portion of the extended name is still fixed.

13. Names input mode would generate extra input lines (that is, the bus names would always be requested on a separate line from everything else). The interpreter simply accepts bus names instead of bus numbers when in names input mode.

14. Yes/No questions treat invalid responses as No. This was mostly true using the Line Mode, but there were some exceptions.

21.2. By Activity

Other than the general differences cited above.

1. HELP, DRED, and GRED will be ignored, except for HELP, NEW.
2. IDEV works like @input; Line Mode IDEV had worked like @chain if a filename was supplied, and like @end if the filename was omitted.
3. ECHO works as always, but this is misleading. What ECHO does and always did was to make a copy of all inputs received from the terminal, or standard input device. In the LMI implementation, the only such inputs are responses to prompts generated from IPLAN INPUT and INPUTLN calls, and the equivalent Python API calls.
4. PSAS and PSEB run only in CHECK mode when entered interactively; when used from a response file or an IPLAN program they can automatically apply the created response file.
5. PSAS and PSEB HELP commands will not process until command input ends.
6. OPTN option for graphics device will not record.
7. EXEC can no longer be abbreviated EXE.
8. SIZE and CATA output to the Report tab, not the Progress tab.
9. CATA and EDTR will not be recorded.
10. ODEV does not show its menu when redirected.
11. GOUT/GEXM will use Line Mode dialog for CRT display.
12. There is no support for binary coordinate data files (DRAW).
13. DRAW options to plot by page (or Cycle Through All Pages option) or by bus are not supported (dialog will be absorbed).
14. All DRAW dialog subsequent to plot, other than device and options specifications, are ignored (but absorbed). Line Mode commands generated from the diagram are not recognized.
15. DRAW options are ignored, except for CHECK. However, the one-line drawing functions are philosophically different. In DRAW, drawing elements were required to match network elements, unless DRAW was run in ACCEPT mode, in which case the entire drawing was simply considered a picture, with no correspondence to the network case. The new one-line diagram allows for bound and unbound items on the diagram, and the coordinate data file input process attempts to bind what it can, and draws all remaining items as unbound.

16. DCLF/DCCC/RANK/TLTG/SPIL/MWMI will not ask the question `ENTER 0 TO EXIT, 1 TO CONTINUE` when the largest mismatch is greater than the MW mismatch tolerance on startup.

17. The SS option is assumed for ALOC.

18. CHNG will not print new line (changed data) immediately. The APIs will display changed data at the Progress tab.

19. TLTG/SPIL will ask for the study and opposing systems by label rather than by number; also it will always ask for these labels, even if the DFAX file has only 1 or 2 subsystems specified.

20. RDEQ/EQRD/SCEQ will ask whether to 'APPLY TRANSFORMER IMPEDANCE CORRECTION TO ZERO SEQUENCE' if any appropriate transformer exists in case, and prior to the subsystem selection dialog (Line Mode dialog asked only after the first such transformer was specified for the subsystem).

21. EEQV will ask whether to SUPPRESS EQUIVALENCING OF PHASE SHIFTER if any appropriate transformer exists in case, and prior to the subsystem selection dialog (Line Mode dialog asked only after the first such transformer was specified for the subsystem).

22. LIST/SQLI by subsystem, the interpreter strictly presents the prompt:

    ```
    ENTER 0 TO EXIT, 1 FOR NEW DATA CATEGORY, 2 FOR NEW SUBSYSTEM:
    ```

    after each data category is listed.

23. MCRE permits 'Q' to end terminal data input.

24. SPLT presents loads, machines, and branches at a bus in ID order rather than in load order.

25. Block data records in terminal input mode will always generate prompts.

26. STRT always asks for an OUTPUT file, and skips asking for a snapshot file if errors are returned from the STRT API.

27. ALTR will reject an IPRINT value of zero.

28. ALTR will recognize Q responses, like CHNG and SQCH.

29. SNAP and STRT will use the next available value for number of elements to save when -1 is entered; Line Mode used the maximum values.

30. ASTR cannot display the initial value for # of states in use unless all user models strictly adhere to coding guidelines.