Saved Case Data Extraction Subroutines
PSS®E 34.8.2

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Siemens Industry, Inc.
Siemens Power Technologies International
400 State Street
Schenectady, NY 12301-1058 USA
+1 518-395-5000
www.siemens.com/power-technologies

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Chapter 1
General Information

1.1. Overview

The Saved Case Data Extraction Subroutines have been developed to allow the user to write programs that access data in PSSE saved cases directly. These subroutines are described individually later in this manual. Each subroutine retrieves data of a specific type, and a call would be made to each subroutine corresponding to a type of data which is desired by the user's program.

1.2. How to Use the Saved Case Data Extraction Subroutines

The first subroutine called must always be PSSOPN or PSSREV. All other subroutines in this package will not execute if the saved case file has not been opened. PSSCLS must be called before PSSOPN can be called a second time, i.e., only one saved case file may be accessed at a time. It is recommended that PSSSIZ be called next. This will return the number of the various components in the saved case, e.g., number of buses, branches, etc. More importantly, this will indicate the minimum dimensions of the arrays that must be used to contain the data retrieved by subsequent calls and the actual amount of data returned. Where the dimensions of the calling arguments exceed the necessary amount, the values of the additional array elements are unpredictable, and it is strongly recommended that user programs not be written in such a way as to depend on such values, e.g., bus number NBUS+1, where the case contains NBUS buses, will have an unpredictable value. The order in which the data is retrieved, i.e., whether PSSBUS, for example, is called before or after PSSBRN, is completely insignificant, with the exception of PSS3IX. PSSOPN and PSSCLS are the only subroutines that must be called, all others are optional (PSSSIZ and PSSMSC probably should always be called). There are no data arrays that are returned by more than one subroutine with the exception of PSS3IX; the user must call each subroutine that corresponds to a type of data which is desired. Only PSSOPN and PSS3IX require input values. All the usual rules for FORTRAN subroutine calls apply as well.

When the user has completed coding, and successfully compiled the application program, the next step will be to create an executable module which will include the Saved Case Data Extraction Subroutines. This process varies between different computer systems, and may be called link, load, bind, link edit, or some other name. In each case the process is to take object or relocatable code and create an executable program. Refer to Appendix A for details on how the Saved Case Data Extraction Subroutines can be made available to such a process on your computer.

1.3. Restrictions

There are no short integer or logical variables used. Nor are there any double precision variables used. All arguments are default size INTEGER, LOGICAL, REAL, or COMPLEX type, or default CHARACTER with the length indicated.

Only one (1) saved case may be accessed at a time.

Prior to release 4.0, these subroutines could only access saved cases created by the current release of PSSE. Beginning with release 4.0, saved cases created by PSSE-16 or later may be read.

Later releases of this package may require modification of existing user programs if the structure of the saved case file changes.

Note that these subroutines use two common blocks, PSSCMN and PSSCMC, five other internal subroutines, PSSDBG, PSSRWD, PSSIXX, PSSI24 and PSSL24, as well as many routines from the PTI Utilities package (PTIUtils - supplied with PSSE). Application programs may not have subroutines or common blocks with any of these names.

This package will be supplied compiled with the same release of the FORTRAN compiler as the concurrent release of PSSE. In general, all application programs will need to be compiled with that compiler.

Some arguments are used as temporary work space. It cannot be assumed, for instance, that an array can be used for more than one argument, a technique sometimes used to avoid declaring arrays for uninteresting values.

1.4. Bus Numbers

Buses specified for PSSE are restricted to have bus numbers less than HIBUS. PSSE can internally generate buses and those buses will have higher bus numbers. Star buses for 3-winding transformers will be higher than HIBUS and lower than HNDBS. Buses created by switching operations in substations will be in the range of HNDBS and higher, and the original buses from which they were split are in the array ORIGBUS

HIBUS and HNDBS can be retrieved by the routine PSSMISC.

ORIGBUS can be retrieved by the routine PSSBUS.

Chapter 2
Subroutine Definitions

2.1. PSSOPN – Open Case

PSSOPN(CASNAM,LU,IERR)

Where:

Character*260 CASNAM	Must contain the filename of the saved case to be opened (input; no default allowed).	
Integer LU	Must contain the unit number to be used to open the file whose name is contained in the argument CASNAM. See Section 2.1.1 About Unit Numbers for information about unit numbers (input/output).	
Integer IERR	Error code (output).	
	IERR = 0	No error; file opened and other subroutines in this package may now be used
	IERR = 1	Error opening file
	IERR = 2	I/O error reading file after open
	IERR = 3	File is not a PSSE saved case file
	IERR = 4	File is a PSSE saved case file, but of an older release. Use PSSE to read case and resave in the current format.
	IERR = 5	There is already a case open
	IERR = 6	Any other error
	IERR = 11	Assertion error: size parameter

See note below regarding negative values.

PSSOPN must be the first call made for each saved case file to be accessed. Only one case may be accessed at a time and a call to PSSCLS must be made before PSSOPN may be called again. Note that both CASNAM and LU are *input* to this routine. It is the user's responsibility that LU be a valid available unit number, and to verify the return code. The form of the filename contained in CASNAM must follow the same rules as saved case names for PSSE on that host computer system. Normally, when IERR is not zero, the file CASNAM will not be open. If an error was detected after the file was opened, and then PSSOPN was unable to close this file, the above error codes will be returned as negative numbers (e.g., -3 means the file was not a PSSE saved case and that an error occurred while attempting to close the file).

2.1.1. About Unit Numbers

Valid values for unit numbers vary for different computers, and in some cases for different compilers. In our experience, numbers in the range 10-40 tend to work well. If the application using these subroutines does not open any other files, a zero may be used and PSSOPN will select a valid unit number, and return the value used in LU. On some computers PSSOPN can determine which units are in use and therefore LU=0 can always be used. Refer to your FORTRAN documentation for more information about unit numbers.

2.2. PSSCLS – Close Case

PSSCLS(IERR)

Where:

Integer IERR	Error code (output).	
	IERR = 0	No error; file has been closed
	IERR = 1	Case not open
	IERR = 2	Error closing file

PSSCLS must be called after all processing of the saved case opened by PSSOPN has been completed. The PSSCLS can only close the file opened by the last execution of PSSOPN, so the only argument is the return code. It is the user's responsibility to verify the return code. Note that after PSSOPN has successfully opened a saved case, PSSCLS must be called before PSSOPN may be called again to open another case. After PSSCLS is called, all the other Case Data Extraction Subroutines will consider the saved case file to be closed, even if PSSCLS returns with IERR equal to 2.

2.3. PSSREV – Inquire Release Number

PSSREV(PNAME, MAJREL, MINREL, MODREL, DATE, IBUF)

Where:

Character*8 PNAME	Will return the string 'UserCase' (output).
Integer MAJREL	Will return the major release number (output).
Integer MINREL	Will return the minor release number (output).
Integer MODREL	Will return the modification level (output).
Character*23 DATE	Will return the release date (output).
Character*80 IBUF	Not in use; will return spaces (output).

2.4. PSSSIZ – Get Case Sizes

PSSSIZ(NBUS, NLOAD, NBUSHN, NGEN, NLIN, NSWD, NTRFMR, N3WNDT, NSHUNT, NDCL, NVSC, NMTDCL, NMSLIN, NSECTN, NTRNAC, NFACTS, NWNDMC, NAREAS, NZONES, NOWNRS, NINDMC, NGNES, NSTATS, MAXARE, MAXZNM, MAXTIC, MAX2DC, MAXMDC, MAXOWN, MAXFCT, ADJLOD, ADJBRN, IERR)

Where:

Integer NBUS	Number of buses (output).
Integer NLOAD	Number of loads (output).
Integer NBUSHN	Number of fixed bus shunts (output).
Integer NGEN	Number of generators (machines) (output).
Integer NLIN	Number of lines (branches system switching devices, and two-winding transformers) (output).
Integer NSWD	Number of system switching devices (output).
Integer NTRFMR	Number of two-winding transformers (output).
Integer N3WNDT	Number of three-winding transformers (output).
Integer NSHUNT	Number of switched shunts (output).
Integer NDCL	Number of two-terminal dc lines (output).
Integer NVSC	Number of Voltage Source Converter dc lines (output).
Integer NMTDCL	Number of multiterminal dc lines (output).
Integer NMSLIN	Number of multisection line groupings (output).
Integer NSECTN	Number of multisection line sections (total) (output).
Integer NTRNAC	Number of area transactions (output).
Integer NFACTS	Number of FACTS devices (output).
Integer NWNDMC	Number of wind machines (output).
Integer NAREAS	Number of areas (output).
Integer NZONES	Number of zones (output).
Integer NOWNRS	Number of owners (output).
Integer NINDMC	Number of induction machines (output).
Integer NGNES	Number of generic network elements (output).
Integer NSTATS	Number of substations (output).
Integer MAXARE	Maximum area number in the saved case (output).
Integer MAXZNM	Maximum zone number in the saved case (output).
Integer MAXTIC	Maximum transformer impedance correction table number in the saved case (output).
Integer MAX2DC	Maximum two-terminal dc line number in older saved cases (equal to NDCL in current saved cases) (output).
Integer MAXMDC	Maximum multi-terminal dc line number in older saved cases (equal to NDCL in current saved cases) (output).
Integer MAXOWN	Maximum owner number in the saved case (output).
Integer MAXFCT	Maximum FACTS device number in older saved cases (equal to NFACTS in current saved cases) (output).
Integer ADJLOD	Number of loads with a load adjustment table assigned (output).
Integer ADJBRN	Number of branches with a branch adjustment table assigned (output).
Integer IERR	Error code (output). IERR = 0 No error

IERR = 1	Case not open
IERR = 2	Error detected, values returned are undependable

Most of the above values correspond to the necessary dimensions for the arrays used by other Case Data Extraction Subroutines that can vary from case to case. Referring to data retrieval subroutines (other than PSSSIZ), some arrays have variable dimensions (e.g., NBUS), and some arrays have fixed dimensions. For those arrays that have variable length dimensions, only that many (the number returned by PSSSIZ) values will be returned. For those arrays that have fixed dimensions, that fixed number of values will be returned regardless of how many real data items were read into PSSE for that case.

Some of the above values are maximums, e.g. MAXARE. NAREAS will be the number of areas defined in the saved case (and the number of values returned in the arrays by PSSAIN) and MAXARE is the largest numeric value of any area number. In some cases a maximum value is used for dimensioning. The values above still indicate the number of data items to be returned.

NBUS includes the hidden star buses created for three-winding transformers and "topological" buses created by switching operations in substations (NBUS = number of raw data buses + N3WNDT).

NTRMFR includes three two-winding transformer records representing each three-winding transformer (NTRMFR = number of raw data two-winding transformers + three times the number of three-winding transformers).

NLIN includes two-winding transformers as well as system switching devices and nontransformer branches (NLIN = number of raw nontransformer branches + NSWD + NTRMFR).

2.5. PSSMSC – Retrieve Miscellaneous Data

PSSMSC(THRSHZ, SBASE, XFRRAT, NXFRAT, BASFRQ, LCONV, GCONV, HIBUS, HDNBS, PSSVER, IERR)

Where:

Real THRSHZ	Will contain the threshold value for zero impedance lines. Nontransformer branches with zero resistance and whose magnitude of reactance falls below this threshold are treated as zero impedance lines in PSSE (output).
Real SBASE	Will contain the system base MVA (output).
Integer XFRRAT	Will contain the units of transformer ratings (output).
Integer NXFRAT	Will contain the units of non-transformer branch ratings (output).
Real BASFRQ	Will contain the system base frequency (output).
Logical LCONV	True if loads have been converted in the saved case, false otherwise; see Section 2.5.1 Converted Loads (output).
Logical GCONV	True if generators have been converted in the saved case, false otherwise (output).
Integer HIBUS	Highest bus number allowed for user input (output).
Integer HNDBS	Beginning of bus number range used for buses created by substation switching operations (output).
Real PSSVER	Version number of oldest PSSE release associated with this version of the Saved Case. Form is major.minor (output).

Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

PSSMSC must be used if the application needs to retrieve these values.

2.5.1. Converted Loads

The concept of converted loads is obsolete and only has meaning for saved cases prior to PSSE-24 (current cases will always return TRUE for this value); see PSSLOD.

2.6. PSSTIT – Retrieve Headings and Title Data

PSSTIT(HEDING, TITLE, IERR)

Where:

Character*60 HEDING (2)	Will return the two heading lines (output).	
Character*72 TITLE (16)	Will return the long case title (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

All this data (120 bytes for HEDING, 1152 bytes for TITLE) is returned, even if it is all or largely spaces.

2.7. PSSBUS – Retrieve Bus Data

PSSBUS(NUM, IDE, AREA, VM, VA, NAME, BASKV, ZONE, OWNER, NMAXV, NMINV, EMAXV, EMINV, ORIGBUS, IERR)

Where:

Integer NUM (NBUS)	Bus numbers (output).
Integer IDE (NBUS)	Bus type code (output).
Integer AREA (NBUS)	Area to which the bus is assigned (output).
Real VM (NBUS)	Bus voltage magnitude, in pu (output).
Real VA (NBUS)	Bus voltage angle, in degrees (output).
Character*12 NAME (NBUS)	Alphanumeric bus identifier (output).
Real BASKV (NBUS)	Bus base voltage, in kV (output).
Integer ZONE (NBUS)	Zone to which the bus is assigned (output).
Integer OWNER (NBUS)	Owner to which the bus is assigned (output).

Real NMAXV (NBUS)	Normal voltage magnitude high limit; entered in pu. NVHI=1.1 by default (output).
Real NMINV (NBUS)	Normal voltage magnitude low limit, entered in pu. NVLO=0.9 by default (output).
Real EMAXV (NBUS)	Emergency voltage magnitude high limit; entered in pu. EVHI=1.1 by default (output).
Real EMINV (NBUS)	Emergency voltage magnitude low limit; entered in pu. EVHI=0.9 by default (output).
Integer ORIGBUS (NBUS)	If this bus was created by substation switching operations, ORIGBUS will contain the bus number from which it was split. Otherwise it is the same as NUM (output).
Integer IERR	Error code (output).
	IERR = 0 No error occurred
	IERR = 1 Case not open
	IERR = 2 Other error; values returned are undependable.

The bus data is not retrieved in any particular order, i.e., there is no relationship between the buses that can be determined from their order or position in the above arrays. PSSBUS will attempt to place NBUS values in each data array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NBUS can be retrieved by PSSSIZ prior to calling PSSBUS. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.7.1. Older Cases

Cases prior to PSSE-20 could have zone values of zero. If the case contains zone values of zero, they are set to 9999.

For cases prior to PSSE-25, OWNER will be set to 1.

For cases prior to PSSE-31, bus data also contained fixed shunt data. They will be made part of a fixed shunt data type. Refer PSSFSH routine.

2.7.2. Usage Notes

Cases containing three-winding transformers will have bus records added for the hidden star bus. These buses are returned by PSSBUS (and included in the count of buses, NBUS, returned by PSSSIZ). They can be identified by having a bus number in excess of the value HIBUS and less than HDNBS, which can both be retrieved by PSSMSC.

Cases containing buses created by switching operations will have bus records added for those buses. Their bus numbers will be HDNBS or higher.

2.8. PSSLOD – Retrieve Load Data

PSSLOD(NUM, ID, STATUS, AREA, ZONE, LOAD, OWNER, LDSCALE, LDINT, IERR)

Where:

Integer NUM (NLOAD)	Bus numbers (output).
Character*2 ID (NLOAD)	Two character load identifier (output).
Integer STATUS (NLOAD)	Load in-service status. One for in-service; zero for out-of-service (output).
Integer AREA (NLOAD)	Area to which the load is assigned (output).
Complex LOAD (3, NLOAD)	Components of each load, in pu (output): 1. Constant MVA load. 2. Constant current load. 3. Constant admittance load.
Integer OWNER (NLOAD)	Owner to which the load is assigned (output).
Logical LDSCALE (NLOAD)	True if this load participates in scaling operations (output).
Logical LDINT (NBUS)	True if this load is interruptible in contingency analysis (output).
Integer IERR	Error code (output). IERR = 0 No error occurred IERR = 1 Case not open IERR = 2 Other error; values returned are undependable. IERR = 3 Allocation error

The load data is not retrieved in any particular order, i.e., there is no relationship between the loads that can be determined from their order or position in the above arrays. PSSLOD will attempt to place NLOAD values in each data array (or 6*NLOAD for LOAD); it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NLOAD can be retrieved by PSSSIZ prior to calling PSSLOD. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.8.1. Older Cases

For cases prior to PSSE-24, ID will be blank, STATUS will be one, and AREA and ZONE will be set to the values from the bus record for bus NUM. Normally these cases had unconverted loads, i.e., all loads were represented as constant MVA loads only. PSSLOD will place those values in the constant MVA elements of the LOAD array, setting the other elements to zero. Cases with converted loads will return values for all 6 elements of LOAD for each load.

For cases prior to PSSE-25, OWNER will be set to 1.

2.8.2. Usage Notes

The array LOAD contains the actual values used in the power flow solution, including any adjustments. For nominal values, see PSSALD.

2.9. PSSFSH – Retrieve Fixed Shunt Data

PSSFSH(NUM, ID, STATUS, SHUNT, IERR)

Where:

Integer NUM (NBUS)HN	Bus numbers (output).	
Character*2 ID (NBUS)HN	Two character shunt identifier (output).	
Integer STATUS (NBUS)HN	Shunt in-service status. One for in-service; zero for out-of-service (output).	
Complex SHUNT (NBUS)HN	Shunt admittance to ground, in pu (output):	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The fixed shunt data is not retrieved in any particular order, i.e., there is no relationship between the buses that can be determined from their order or position in the above arrays. PSSFSH will attempt to place NBUSHN values in each data array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NBUSHN can be retrieved by PSSSIZ prior to calling PSSFSH. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.9.1. Older Cases

For cases prior to PSSE-31, there isno data for the array's ID or STATUS. The ID is set to 1 (only one per bus was allowed) and STATUS is set according to defaults in PSSE activity CASE.

2.10. PSSGEN – Retrieve Generator Data

PSSGEN(NUM, IDE, PG, QG, QT, QB, VS, IREG, MBASE, ZSORCE, XTRAN, GTAP, STAT, RMPCT, PT, PB, OWNER, OWNPCT, WMOD, WPF, IERR)

Where:

Integer NUM (NGEN)	Bus numbers (output).
Character*2 ID (NGEN)	Two character machine identifier (output).
Real PG (NGEN)	Generator real power output, in pu (output).
Real QG (NGEN)	Generator reactive power output, in pu (output).
Real QT (NGEN)	Maximum generator reactive power output, in pu (output).
Real QB (NGEN)	Minimum generator reactive power output, in pu (output).
Real VS (NGEN)	Regulated voltage setpoint, in pu (output).
Integer IREG (NGEN)	Bus number of a remote bus whose voltage is regulated by this plant to the value specified by VS. IREG=0 indicates that the plant regulates its own voltage (output).
Real MBASE (NGEN)	Total base MVA of the units represented by this machine (output).
Complex ZSORCE (NGEN)	Machine impedance, in pu, on MBASE base (output).
Complex XTRAN (NGEN)	Step-up transformer impedance, in pu, on MBASE base (output).

Real GTAP (NGEN)	Step-up transformer off-nominal turns ratio, in pu (output).
Integer STAT (NGEN)	Machine status of one, for in-service, and zero for out-of-service (output).
Real RMPCT (NGEN)	Percent of total Mvar required to hold the voltage at bus IREG that are to be contributed by the generation at bus NUM. RMPCT=100 if there is no other generator bus controlling remote bus IREG (output).
Real PT (NGEN)	Maximum generator real power output, in pu (output).
Real PB (NGEN)	Minimum generator real power output, in pu (output).
Integer OWNER (4, NGEN)	Owner(s) to which the generator is assigned. There may be up to 4 such owners; OWNER(i)=0 means that there are only i-1 owners (output).
Real OWNPCT (4, NGEN)	Percentage of the generator owned by that owner (output).
Integer WMOD (NGEN)	Wind machine control mode, WMOD is used to indicate whether a machine is a wind machine, and, if it is, the type of reactive power limits to be imposed (output): 0 - for a machine which is not a wind machine. 1 - for a wind machine whose reactive power limits are specified by QT and QB 2 - for a wind machine whose reactive power limits are determined from the machine's active power output and WPF, limits are of equal magnitude and opposite sign 3 - for a wind machine with a fixed reactive power setting determined from the machine's active power output and WPF; when WPF is positive, the machine's reactive power has the same sign as its active power; when WPF is negative, the machine's reactive power has the opposite sign of its active power. 4 - infeed type machine. An infeed type machine reactive power (QG) is held constant. The QT and QB limits values are not used and are for information only. QG value has to be between QT and QB.
Real WPF (NGEN)	Power factor used in calculating reactive power limits or output when WMOD is 2 or 3 (output).
Integer IERR	Error code (output). IERR = 0 No error occurred IERR = 1 Case not open IERR = 2 Other error; values returned are undependable. IERR = 3 Allocation error IERR = 4 Deallocation error

The generator data is not retrieved in any particular order, i.e., there is no relationship between the generators that can be determined from their order or position in the above arrays. PSSGEN will attempt to place NGEN values in each data array (or 4*NGEN for OWNER, OWNPCT); it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NGEN can be retrieved by PSSSIZ prior to

calling PSSGEN. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.10.1. Older Cases

For cases prior to PSSE-25, OWNER(1,NGEN) will be set to 1 and OWNPCT(1,NGEN) will be set to 100%.

For cases prior to PSSE-31, WMOD is set to 0 and WPF is set to 1.0.

2.11. PSSBRN – Retrieve Branch Data

PSSBRN(SLIN, FRMBUS, TOBUS, METBUS, CKT, RX, B, BRNAME, RATINGS, GBI, GBJ, STAT, LINLEN, INDXSWD, INDXSW, DOWNER, OWNPCT, IERR)

Where:

Integer SLIN	SLIN is the declared size of the first dimension of RATINGS, below. Must be >= NLIN (input).
Integer FRMBUS (NLIN)	Bus number of from bus; for a transformer this is the winding one bus (output).
Integer TOBUS (NLIN)	Bus number of to bus; for a transformer this is the winding one bus (output).
Integer METBUS (NLIN)	Bus number which has been designated as the metered end for area interchange and loss zone calculations (output).
Character*2 CKT (NLIN)	Two character circuit identifier (output).
Complex RX (NLIN)	Branch resistance and reactance, in pu (output).
Real B (NLIN)	Total branch charging susceptance, in pu, will be zero for transformers (output).
Character*40 BRNAME (NLIN)	An alphanumeric identifier assigned to the branch (output).
Real RATINGS (SLIN,12)	Current ratings for each branch, in MVA (output).
Complex GBI (NLIN)	Complex admittance of the line shunt at the from bus end of the branch, in pu. A negative reactive component indicates a line-connected reactor (output).
Complex GBJ (NLIN)	Complex admittance of the line shunt at the to bus end of the branch, in pu. A negative reactive component indicates a line-connected reactor will be zero for transformers (output).
Integer STAT (NLIN)	Branch in-service status. One for in-service, and zero for out-of-service (output).
Real LINLEN (NLIN)	Length of line will be zero for transformers (output).
Integer INDX2W (NLIN)	Index to the two-winding transformer data. If INDX2W is zero, the branch is not a transformer. If INDX2W is not zero, it provides an index to the arrays returned by PSSTRN (output).
Integer INDXSWD (NLIN)	Index to the system switching device data. If INDXSWD is zero, the branch is not a system switching device. If INDXSWD is not zero, it provides an index to the arrays returned by PSSSWD (output).

Integer OWNER (NLIN)	Owner(s) to which the line is assigned. There may be up to four such owners; OWNER(i)=0 means that there are only i-1 owners (output).	
Real OWNPCT (4, NLIN)	Percentage of line owned by that owner (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.
	IERR = 3	Allocation error
	IERR = 4	Deallocation error

The branch data is not retrieved in any particular order, i.e., there is no relationship between the branches that can be determined from their order or position in the above arrays. PSSBRN will attempt to place NLIN values in each data array or (or 4*NLIN for OWNER, OWNPCT and 12*NLIN for RATINGS); it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NLIN can be retrieved by PSSSIZ prior to calling PSSBRN. Refer to*PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.11.1. Older Cases

For saved cases produced by versions earlier than PSSE-24, there is no data for the array LINLEN and PSSBRN will return values of zero. For cases prior to PSSE-25, OWNER(1,NGEN) will be set to 1 and OWNPCT(1,NGEN) will be set to 100%.

2.11.2. Usage Notes

For cases containing transformers with nonzero values for the arrays B and LINLEN, those entries will be set to zero. For cases containing transformers with nonzero values for the array GBJ, those values will be added to the corresponding GBI entry, and the GBJ entry will be set to zero.

Branch data includes branches that are transformers. Cases containing three-winding transformers will have three branch records added for each three-winding transformer. These branches are returned by PSSBRN (and included in the count of branches, NLIN, returned by PSSSIZ). They connect each of the buses identified for the three-winding transformer to the hidden star bus. The hidden star bus can be identified by having a bus number in excess of the value HIBUS and less than HDNBS, which can both be retrieved by PSSMSC.

RX will contain the actual values used in the power flow solutions. For nominal values see array RXTRAN of PSSTRN for transformer adjustments, and PSSABX for branch adjustments.

2.12. PSSSWD - Retrieve System Switching Device Data

PSSSWD(NSTATUS, STYPE, IERR)

Where:

Integer NSTATUS (NSWD)	Normal service status. 1 for normally open and 0 for normally closed (output).

Integer STYPE (NSWD)	Switching device type (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The system switching device data is not retrieved in any particular order, i.e., there is no relationship between the system switching device that can be determined from their order or position in the above arrays. PSSSWD will attempt to place NSWD values in each data array; it is the users' responsibility to ensure that each array used forany argument is properly dimensioned. NSWD can be retrieved by PSSSIZ prior to calling PSSSWD. Refer to PSSE Program Operation Manual, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.12.1. Older Cases

For saved cases produced by versions earlier than PSSE-34, there is no system switching device data.

2.12.2. Usage Notes

The array INDXSWD, retrieved by PSSBRN, provides a correspondence between the branch data arrays and these system switching device data arrays, i.e., if, for a branch I, the value of INDXSWD(I) is J, then the Jth element of all the arrays returned by PSSSWD pertain to the branch I.

2.13. PSSTRN – Retrieve Two-Winding Transformer Data

PSSTRN(WIND1, WIND2, NOMV1, NOMV2, ANG1, SBASE1, CONBUS, RASW, RMAX, RMIN, VMAX, VMIN, NTAPS, RXTRAN, TABLE, CNTL, XFRCMP, ANGW, INDX3W, VECGRP, IERR)

Where:

Real WIND1(NTRFMR)	The winding 1 off-nominal turns ratio, in pu, of the *from* bus (output).
Real WIND2(NTRFMR)	The winding 2 off-nominal turns ratio, in pu, of the *to* bus (output).
Real NOMV1(NTRFMR)	The nominal (rated) winding 1 voltage, in kV (output).
Real NOMV2(NTRFMR)	The nominal (rated) winding 2 voltage, in kV (output).
Real ANG1(NTRFMR)	The winding 1 phase shift angle, in degrees (output).
Real SBASE1(NTRFMR)	The winding 1 base MVA of the transformer (output).
Integer CONBUS(NTRFMR)	Bus number of the bus whose voltage is controlled by this transformer (output).
Logical RASW(NTRFMR)	RASW will be true if and only if CONBUS is not the from or the to bus of the branch, and ratio adjustment should be performed as if the bus were on the tapped side of the transformer, rather than the impedance side (output).
Real RMAX(NTRFMR)	Upper limit of (a) off-nominal ratio for voltage- or Mvar-controlling transformers (when /CNTL/ is 1 or 2), in pu; or (b) phase shift angle

	for MW controlling transformers (when /CNTL/ is 3), in degrees (output).
Real RMIN(NTRFMR)	Lower limit, corresponding to RMAX (output).
Real VMAX(NTRFMR)	Upper limit of (a) controlled bus voltage (when |CNTL| is 1), in pu; or (b) real power through phase shifter (at tapped side) (when |CNTL| is 3), in MW; or (c) reactive power flow through the transformer (at tapped side) (when |CNTL| is 2), in Mvar (output).
Real Vin(NTRFMR)	Lower limit, corresponding to VMAX (output).
Integer NTAPS(NTRFMR)	Number of tap positions available (output).
Complex RXTRAN(NTRFMR)	Initial branch resistance and reactance before transformer impedance correction (see TABLE), in pu (output).
Integer TABLE(NTRFMR)	Zero, or number of transformer impedance correction table (output).
Integer CNTL(NTRFMR)	The transformer control mode for automatic adjustments of the first winding tap or phase shift angle during power flow solutions: 0 - for no control (fixed tap and phase shift) 1 - for voltage control 2 - for reactive power flow control 3 - for active power flow control 4 - for control of a dc line quantity. A positive control mode enables automatic adjustment of this transformer when the corresponding adjustment is activated during power flow solutions; a negative control mode suppresses the automatic adjustment of this transformer (output).
Complex XFRCMP(NTRFMR)	Load drop compensation impedance for voltage controlling transformers, in pu (output).
Complex XFRCMP(NTRFMR)	Load drop compensation impedance for voltage controlling transformers, in pu (output).
Real ANGW(NTRFMR)	Winding connection angle, in degrees (output).
Integer INDX3W(NTRFMR)	Index to the three-winding transformer data. If INDX3W is zero, the transformer is not part of a three-winding transformer. If INDX3W is not zero, it provides an index to the arrays returned by PSS3WT (output).
Character*12 VECGRP(NTRFMR)	Vector Group identifier (output).
Integer IERR	Error code (output). IERR = 0 No error occurred IERR = 1 Case not open IERR = 2 Other error; values returned are undependable.

The transformer data is not retrieved in any particular order, i.e., there is no relationship between the transformers that can be determined from their order or position in the above arrays. PSSTRN will attempt to place NTRFMR values in each data array; it is the users' responsibility to ensure that each array used for any

argument is properly dimensioned. NTRFMR can be retrieved by PSSSIZ prior to calling PSSTRN. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.13.1. Older Cases

For saved cases produced by versions earlier than PSSE-17, there is no data for the array CNTL. Values will be assigned according to defaults in PSSE activity CASE.

For saved cases produced by versions earlier than PSSE, there is no data for the array XFRCMP. Values will be assigned according to defaults in PSSE activity CASE.

For saved cases produced by versions earlier than PSSE-27, there is no data for WIND1, WIND2, NOMV1, NOMV2, ANG1, SBASE1, and TRNAME. Values will be assigned according to defaults in PSSE activity CASE.

2.13.2. Usage Notes

The array INDX2W, retrieved by PSSBRN, provides a correspondence between the branch data arrays and these transformer data arrays, i.e., if, for a branch I, the value of INDX2W(I) is J, then the Jth element of all the arrays returned by PSSTRN pertain to the branch I.

Cases containing three-winding transformers will have three two-winding transformer records added for each three-winding transformer. These transformers are returned by PSSTRN (and included in the count of two-winding transformers, NTRFMR, returned by PSSSIZ). They connect each of the buses identified for the three-winding transformer to the hidden star bus. The hidden star bus can be identified by having a bus number in excess of the value HIBUS and less than HDNBS, which can both be retrieved by PSSMSC.

2.14. PSS3WT - Retrieve Three-Winding Transformer Data

PSS3WT(BUS1ST, BUS2ND, BUS3RD, BUSSTAR, STATUS, NMETER, CKT, TRNAME, VECGRP, IERR)

Where:

Integer BUS1ST(N3WNDT)	Bus number of the bus to which the first winding is connected (output).
Integer BUS2ND(N3WNDT)	Bus number of the bus to which the second winding is connected (output).
Integer BUS3RD(N3WNDT)	Bus number of the bus to which the third winding is connected (output).
Integer BUSSTAR(N3WNDT)	Bus number of the hidden star bus (output).
Integer STATUS(N3WNDT)	Branch in-service status. Zero for out-of-service, one for in-service, two for only winding two out-of-service, three for only winding three out-of-service, and four for only winding one out-of-service (output).
Integer NMETER(N3WNDT)	Bus number of the nonmetered end of the three-winding transformer (output).
Character*2 CKT(N3WNDT)	Two-character circuit identifier (output).

Character*40 TRNAME(N3WNDT)	An alphanumeric identifier assigned to the transformer (output).	
Character*12 VECGRP(N3WNDT)	Vector Group identifier (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The transformer data is not retrieved in any particular order, i.e., there is no relationship between the transformers that can be determined from their order or position in the above arrays. PSS3WT will attempt to place N3WNDT values in each array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. N3WNDT can be retrieved by PSSSIZ, prior to calling PSS3WT. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.14.1. Usage Notes

The Ith entry in each array corresponds to a separate three-winding transformer. Each three-winding transformer, when entered into PSSE, generates the creation of a bus record (for the hidden star bus), as well as three two-winding transformer records (returned by these routines as three branch entries and three corresponding two-winding transformer entries).

There is no power flow data returned by this routine that is not available from the routines PSSBRN and PSSTRN. The three branch/transformers indicated by these routines (BUS1ST(I)-BUSSTAR(I), BUS2ND(I)-BUSSTAR(I), and BUS3RD(I)-BUSSTAR(I)) will all have the same status (STATUS(I)), circuit-identifier (CKT(I)), and transformer name (TRNAME(I)), and the branch metered end will be consistent with NMETER(I).

2.15. PSS3IX – Build Indices to Three-Winding Transformer Data

PSS3IX(FRMBUS, TOBUS, INDX2W, INDX3W, BUS1ST, BUS2ND, BUS3RD, BUSSTAR, IDX1BR, IDX2BR, IDX3BR, IDXBUS, IERR)

Where:

Integer FRMBUS (see PSSBRN for description)	The FRMBUS array retrieved by using PSSBRN (input).
Integer TOBUS (see PSSBRN for description)	The TOBUS array retrieved by using PSSBRN (input).
Integer INDX2W (see PSSBRN for description)	The INDX2W array retrieved by using PSSBRN (input).
Integer INDX3W (see PSSTRN for description)	The INDX3W array retrieved by using PSSTRN (input).
Integer BUS1ST (see PSSTRN for description)	The BUS1ST array retrieved by using PSS3WT (input).
Integer BUS2ND (see PSSTRN for description)	The BUS2ND array retrieved by using PSS3WT (input).

Integer BUS3RD (see PSSTRN for description)	The BUS3RD array retrieved by using PSS3WT (input).
Integer BUSSTAR (see PSSTRN for description)	The BUSSTAR array retrieved by using PSS3WT (input).
Integer IDX1BR(N3WNDT)	An index to the branch arrays for the two-winding transformer placed between the first winding bus and the hidden star bus of the three-winding transformer (output).
Integer IDX2BR(N3WNDT)	An index to the branch arrays for the two-winding transformer placed between the second winding bus and the hidden star bus of the three-winding transformer (output).
Integer IDX3BR(N3WNDT)	An index to the branch arrays for the two-winding transformer placed between the third winding bus and the hidden star bus of the three-winding transformer (output).
Integer IDXBUS(N3WNDT)	An index to the bus arrays for the hidden star bus of the three-winding transformer (output).
Integer IERR	Error code (output). IERR = 0 No error occurred IERR = 1 Case not open IERR = 2 Other error; values returned are undependable.

In order to use this routine, PSSBRN and PSS3WT must be called first, as they will supply the source for the first eight arrays, which are input to this routine.

PSS3IX will attempt to place N3WNDT values in each returned array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. N3WNDT can be retrieved using PSSSIZ, prior to calling PSS3IX.

2.15.1. Usage Notes

The purpose of this routine is to allow easy reference to the data corresponding to a given three-winding transformer. The Ith entry in the IDX1BR, IDX2BR, and IDX3BR arrays each indicates the branch array entries that contain the data for the Ith three-winding transformer. Transformer data can then be accessed using the INDX2W array for that branch. The Ith entry in the IDXBUS array indicates the bus array entries that contain the data for the hidden star bus for the Ith three-winding transformer.

2.16. PSSAIN – Retrieve Area Interchange Data

PSSAIN(ARNUM, ISW, PDES, PTOL, ARNAM, IERR)

Where:

Integer ARNUM(MAXARE)	Area number (output).
Integer ISW(MAXARE)	Number of area slack bus for area interchange control (output).
Real PDES(MAXARE)	Desired net interchange leaving the area, in pu (output).
Real PTOL(MAXARE)	Interchange tolerance band width, in pu (output).

Character*12 ARNAM(MAXARE)	Alphanumeric identifier for the area (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The area interchange data is not retrieved in any particular order, i.e., there is no relationship between the areas that can be determined from their order or position in the above arrays. PSSAIN will attempt to use MAXARE elements and return NAREAS values in each array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NAREAS and MAXARE can be retrieved using PSSSIZ prior to calling PSSAIN. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.16.1. Older Cases

For cases written by versions of PSSE prior to version 25, only areas where the value of at least one array besides ARNUM is not the default value are returned. For later saved case versions areas that contain any equipment in the case are also returned.

2.17. PSS2DC – Retrieve Two-Terminal Transmission Line Data

PSS2DC(NAME, MDC, RDC,SETVL, VSCHD, VCMOD, RCOMP, DELTI, METER, DCVMIN, CITMX, CACC, IP, NB, MX, MN, RC, XC, EBAS, TR, TAP, TPMX, TPMN, TSTP, IC, IFR, ITO, ID, XCAP, PAC, QAC, IERR)

Where:

Character*12 NAME(MAX2DC)	The non-blank alphanumeric identifier assigned to the dc line (output).
Integer MDC(MAX2DC)	Control mode: 0 for blocked, 1 for power, 2 for current (output).
Real REAL(MAX2DC)	dc line resistance, in ohms (output).
Real SETVL(MAX2DC)	Current (amps) or power (MW) demand. When MDC is one, a positive value of SETVL specifies desired power at the rectifier and a negative value specifies inverter power (output).
Real VSCHD(MAX2DC)	Scheduled compounded dc voltage, in kV (output).
Real VCMOD(MAX2DC)	Mode switch dc voltage, in kV. When MDC=1, if dc voltage falls below this value indicates control should switch to current mode (MDC=2) (output).
Real RCOMP(MAX2DC)	Compounding resistance, in ohms. Used to calculate compound voltage (output).
Real DELTI(MAX2DC)	Margin in per unit of desired dc power or current (fraction by which order is reduced when ALPHA is at its minimum and the inverter is controlling the line current) (output).
Character*1 METER(MAX2DC)	Indicates metered end. 'R' for rectifier, 'I' for inverter (output).

Real DCVMIN(MAX2DC)	Minimum compounded dc voltage, in kV, used in constant gamma operation (output).
Integer CITMX(MAX2DC)	Iteration limit for CCC Newton solution procedure (output).
Real CACC(MAX2DC)	Acceleration factor for CCC Newton solution procedure (output).

For arrays dimensioned (2, MAX2DC), entry (1,I) and (2,I) pertain to the rectifier end and the inverter end of dc line number I, respectively.

Integer IP (2, MAX2DC)	Bus number (output).
Integer NB (2, MAX2DC)	Number of bridges in series (output).
Real MX (2, MAX2DC)	Nominal maximum firing angle, in degrees (output).
Real MN (2, MAX2DC)	Minimum steady state firing angle, in degrees (output).
Real RC (2, MAX2DC)	Commutating transformer resistance per bridge, in ohms (output).
Real XC (2, MAX2DC)	Commutating transformer reactance per bridge, in ohms (output).
Real EBAS (2, MAX2DC)	Primary base ac voltage, in kV (output).
Real TR (2, MAX2DC)	Transformer ratio (output).
Real TAP (2, MAX2DC)	Tap setting (output).
Real TPMX (2, MAX2DC)	Maximum tap setting (output).
Real TPMN (2, MAX2DC)	Minimum tap setting (output).
Real TSTP (2, MAX2DC)	Tap step (output).
Integer IC (2, MAX2DC)	Firing angle measuring bus. If 0 (zero), firing angle measured at converter bus (output).
Integer IFR (2, MAX2DC)	Tapped side from bus number of ac transformer branch. If 0 (zero) then dc tap is adjusted to control quantities inside the dc line, and the next two arrays should be ignored (output).
Integer ITO (2, MAX2DC)	Untapped side to bus number of ac transformer branch (output).
Character*2 ID (2, MAX2DC)	Circuit identifier for ac transformer branch (output).
Real XCAP (2, MAX2DC)	Commutating capacitor reactance magnitude per bridge, in ohms (output).
Real PAC (2, MAX2DC)	Real power flowing into the dc line at converter bus, in pu (output).
Real QAC (2, MAX2DC)	Reactive power flowing into the dc line at converter bus, in pu (output).
Integer IERR	Error code (output).
	IERR = 0 — No error occurred
	IERR = 1 — Case not open
	IERR = 2 — Other error; values returned are undependable.
	IERR = 3 — Allocation error
	IERR = 4 — Deallocation error

The two-terminal transmission line data is not retrieved in any particular order, i.e., there is no relationship between the lines that can be determined from their order or position in the above arrays. PSS2DC will at-

tempt to use MAX2DC elements and return NDCL values in each data array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NDCL and MAX2DC can be retrieved by PSSSIZ prior to calling PSS2DC. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.17.1. Older Cases

For saved cases produced by versions earlier than PSSE-18, there is no data for the arrays IC, IFR, ITO, DCVMIN and ID, and for cases prior to PSSE-26, there is no data for arrays CITMX, CACC, and XCAP. Values are assigned according to defaults in PSSE activity CASE.

For cases prior to PSSE-31, NAME is set to the character value of the dc line number (names were not used), e.g., the name for dc line #3 will be 3.

2.18. PSSVSC - Retrieve Voltage Source Converter dc Line Data

PSSVSC(VNAME, CNTL, RDC, OWNER, OWNPCT, CNVBUS, ITYPE, MODE, DCSET, ACSET, ALOSS, BLOSS, MN-LOSS, SMAX, IMAX, PWF, MAXQ, MINQ, REMBUS, REMPCT, PAC, QAC, IERR)

Where:

Character*12 VNAME (NVSC)	An alphanumeric identifier assigned to the dc line (output).
Integer CNTL (NVSC)	Control mode: 0 for out-of-service, 1 for in-service (output).
Real RDC (NVSC)	Dc line resistance, in ohms (output).
Integer OWNER (4,NVSC)	Owner(s) to which the dc line is assigned. There may be up to 4 such owners; OWNER(i)=0 mean that there are only i-1 owners (output).
Real OWNPCT (4,NVSC)	Percentage of the dc line owned by that owner (output).

For arrays dimensioned (2, NVSC), entry (1,I) and (2,I) pertain to data for converter bus 1 and converter bus 2, respectively.

Integer CNVBUS (2,NVSC)	Converter bus number (output).
Integer ITYPE (2,NVSC)	Type of converter dc control: 1 for dc voltage control or 2 for MW control (output).
Integer MODE (2,NVSC)	Converter ac control mode: 1 for ac voltage control or 2 for fixed ac power factor (output).
Real DCSET (2,NVSC)	Converter dc setpoint. For TYPE=1 it is the scheduled dc voltage on the dc side of the converter bus, in kV. For TYPE=2 it is the power demand at CNVBUS, in MW (positive value indicates feeding power to the ac network at CNVBUS, negative value indicates withdrawing power from the ac network at CNVBUS) (output).
Real ACSET (2,NVSC)	Converter ac setpoint. For MODE=1 it is the regulated ac voltage setpoint, in pu. For MODE=2 it is the power factor setpoint (output).
Real ALOSS (2,NVSC)	

Real BLOSS (2,NVSC)	Coefficients of the linear equation used to calculate converter losses: $KW_{conv\ loss}$ = ALOSS + I_{dc} * BLOSS (output).
Real MNLOSS (2,NVSC)	Minimum converter losses, in kW (output).
Real SMAX (2,NVSC)	Converter MVA rating, in MVA (zero indicates unlimited converter MVA loading) (output).
Real IMAX (2,NVSC)	Converter ac rating, in amps (zero indicates unlimited converter current loading) (output).
Real PWF (2,NVSC)	Power weighting factor fraction (0.0 = PWF = 1.0) used in reducing the active power order and either the reactive power order (when MODE=2) or the reactive power limits (when MODE=1) when the converter MVA or current rating is violated. When PWF is 0.0, only the active power is reduced; when PWF is 1.0, only the reactive power is reduced; otherwise a weighted reduction of both active and reactive power is applied (output).
Real MAXQ (2,NVSC) Real MINQ (2,NVSC)	Reactive power upper limit, and reactive power lower limit (positive value of reactive power indicates reactive power flowing into the ac network from the converter; negative value of reactive power indicates reactive power withdrawn from the ac network). Not used if MODE=2 (output).
Integer REMBUS (2,NVSC)	Bus number of remote bus whose voltage is to be regulated by this converter to the value specified by ACSET. Not used if MODE=2 (output).
Real RMPCT (2,NVSC)	Percent of total Mvar required to hold the voltage at the bus controlled by bus CNVBUS that are to be contributed by this VSC. Only needed if REMBUS specifies a bus controlled by more than one VSC. Not used if MODE=2 (output).
Real PAC (2,NVSC)	Real power flowing into the dc line at CNVBUS, in pu (output).
Real QAC (2,NVSC)	Reactive power flowing into the dc line at CNVBUS, in pu (output).
Integer IERR	Error code (output). IERR = 0 — No error occurred IERR = 1 — Case not open IERR = 2 — Other error; values returned are undependable.

The VSC dc line data is not retrieved in any particular order, i.e., there is no relationship between the VSC dc lines that can be determined from their order or position in the above arrays. PSSVSC will attempt to place NVSC values in each data array (or 2*NVSC if the array is dimensioned (2,NVSC), or 4*NVSC if the array is dimensioned (4,NVSC)); it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NVSC can be retrieved using PSSSIZ, prior to calling PSSVSC. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.19. PSSWSH – Retrieve Switched Shunt Data

PSSWSH(NUM, MODSW, ADJM, STAT, VSWHI, VSWLO, SWREM, RMPCT, BINIT, RMINDX, NI, BI, IERR)

Where:

Integer NUM (NSHUNT)	Bus numbers (output).
Integer MODSW (NSHUNT)	Control mode: 0 - locked 1 - discrete adjustment, controlling voltage locally or at bus SWREM 2 - continuous adjustment, controlling voltage locally or at bus SWREM 3 - discrete adjustment, controlling reactive power output of the plant at bus SWREM 4 - discrete adjustment, controlling reactive power output of the VSC dc line converter at bus SWREM of the VSC dc line whose name is specified as RMINDX 5 - discrete adjustment, controlling admittance setting of the switched shunt at bus SWREM 6 - discrete adjustment, controlling reactive power output of the shunt element of the FACTS device whose name is specified as RMINDX (output).
Integer ADJM (NSHUNT)	Adjustment method: 0 - steps and blocks are switched on in input order, and off in reverse input order; this adjustment method was the only method available prior to PSSE-32.0. 1 - steps and blocks are switched on and off such that the next highest (or lowest, as appropriate) total admittance is achieved.(output).
Integer STAT (NSHUNT)	Initial switched shunt status of one for in-service and zero for out-of-service (output).
Real VSWHI (NSHUNT)	Controlled voltage upper limit, in pu (output).
Real VSWLO (NSHUNT)	Controlled voltage lower limit, in pu (output).
Integer SWREM (NSHUNT)	Bus number of remote bus whose voltage is controlled by this switched shunt. Zero indicates device controls its own voltage (output).
Real RMPCT (NSHUNT)	Percent of total Mvar required to hold the voltage at the bus NUM that are to be contributed by this switched shunt. Only needed if SWREM specifies a bus controlled by more than one voltage controlling device. Only used if MODSW = 1 or 2 (output).
Real BINIT (NSHUNT)	Actual switched shunt admittance, in pu (output).
Integer RMINDX (NSHUNT)	Index to VSC dc line data when MODSW is 4, indicates the VSC dc line whose converter bus is specified in SWREM (output).
Integer NI (8, NSHUNT)	Number of steps per block, up to 8 blocks (output).
Real BI (8, NSHUNT)	Admittance increment per step per block, up to 8 blocks (output).

Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The switched shunt data is not retrieved in any particular order, i.e., there is no relationship between the switched shunts that can be determined from their order or position in the above arrays. PSSWSH will attempt to place NSHUNT values in each data array (or 8*NSHUNT for NI, BI); it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NSHUNT can be retrieved by PSSSIZ prior to calling PSSWSH. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.19.1. Older Cases

For cases prior to PSSE-29, there is no data for array RMINDX. For cases prior to PSSE-30, there is no data for array RMPCT. These values are assigned according to defaults in PSSE activity CASE.

2.20. PSSTIC – Retrieve Transformer Impedance Correction Tables

PSSTIC(TBLCNT, TI, FI, PHTR, IERR)

Where:

Integer TBLCNT (MAXTIC)	Number of entries in each table (output).	
Real TI (99, MAXTIC)	Either winding one off-nominal turns ratio in pu or phase shift angle in degrees (output).	
Complex FI (99, MAXTIC)	Scaling factor by which transformer nominal impedance is to be multiplied to obtain the actual transformer impedance for the corresponding TI (output).	
Logical PHTR (MAXTIC)	If true then TI is a phase shift angle, else TI is a turns ratio (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The Ith row (e.g., TI(x,I) or TBLCNT(I)) in each array corresponds to table number I. When no data for table number I has been entered into PSSE and saved in the saved case, TBLCNT(I) will be zero. PSSTIC will attempt to place 99*MAXTIC values in arrays TI and FI, and MAXTIC values in arrays PHTR and TBLCNT; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. MAXTIC can be retrieved by PSSSIZ prior to calling PSSTIC. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.21. PSSMDC – Retrieve Multiterminal dc Transmission Line Data

PSSMDC(NAME, NCONV, NDCBS, NDCLN, MDC, VCONVP, VCONVN, VCMOD, IB, N, ANGMX, ANGMN, RC, XC, EBAS, TR, TAP, TPMX, TPMN, TSTP, SETVL, DCPF, MARG, CNVCOD, AC, IA, ZONE, DCNAM, IDC2, RGRND, OWNER, FROM, TO, DCCKT, RDC, LDC, METEND, PAC, QAC, IERR)

This group of arrays is dimensioned by the number of multi-terminal dc lines.

Where:

Character*12 NAME (MAXMDC)	The non-blank alphanumeric identifier assigned to the multiterminal dc line (output).
Integer NCONV (MAXMDC)	Number of ac converter station buses in multiterminal dc line; will range from 3 to 12. This will also be the number of elements returned in those arrays below dimensioned by (NCONV, dc line #) that contain actual data for each line (output).
Integer NDCBS (MAXMDC)	Number of dc buses in multiterminal dc line; will range from NCONV to 20. This will also be the number of elements returned in those arrays below dimensioned by (NDCBS, dc line #) that contain actual data for each line (output).
Integer NDCLN (MAXMDC)	Number of dc links in multiterminal dc line; will range from 2 to 20. This will also be the number of elements returned in those arrays below dimensioned by (NDCLN, dc line #) that contain actual data for each line (output).
Integer MDC (MAXMDC)	Control mode: 0 for blocked, 1 for power, 2 for current (output).
Integer VCONVP (MAXMDC)	Bus number of the ac converter station bus which controls dc voltage on the positive pole of the multiterminal dc line (will be a positive pole inverter) (output).
Integer VCONVN (MAXMDC)	Bus number of the ac converter station bus which controls dc voltage on the negative pole of the multiterminal dc line. Will be zero if negative pole not modeled (output).
Real VCMOD (MAXMDC)	Mode switch dc voltage, in kV. When MDC=1, if dc voltage falls below this value indicates control should switch to current mode (MDC=2) (output).

This group of arrays is dimensioned by the maximum number of ac converter station buses, and the number of multi-terminal dc lines (NCONV, dc line #)

Integer IB (12,MAXMDC)	The ac converter bus number (output).
Integer N (12,MAXMDC)	Number of bridges in series (output).
Real ANGMX (12,MAXMDC)	Nominal maximum ALPHA or GAMMA angle, in degrees (output).
Real ANGMN (12,MAXMDC)	Minimum steady state ALPHA or GAMMA angle, in degrees (output).
Real RC (12,MAXMDC)	Commutating resistance per bridge, in ohms (output).
Real XC (12,MAXMDC)	Commutating reactance per bridge, in ohms (output).

Real EBAS (12,MAXMDC)	Primary base ac voltage, in kV (output).
Real TR (12,MAXMDC)	Actual transformer ratio (output).
Real TAP (12,MAXMDC)	Tap setting (output).
Real TPMX (12,MAXMDC)	Maximum tap setting (output).
Real TPMN (12,MAXMDC)	Minimum tap setting (output).
Real TSTP (12,MAXMDC)	Tap step (output).
Real SETVL (12,MAXMDC)	Converter setpoint. When IB equals VCONVP or VCONVN above, then SETVL specifies the scheduled dc voltage magnitude, in kV, across the converter. Otherwise, SETVL contains the converter current, in amps, or the power demand, in MW; a positive value of SETVL indicates that IB is a rectifier and a negative value indicates an inverter (output).
Real DCPF (12,MAXMDC)	Converter participation factor. When the order at any rectifier in the multiterminal dc line is reduced, the orders at the remaining converters on the same pole are modified according to their DCPF's (output).
Real MARG (12,MAXMDC)	Rectifier margin, in per unit of desired dc power or current. The converter order reduced by this fraction, (1.-MARG)*SETVL, defines the minimum order for this rectifier. MARG is used only at rectifiers (output).
Integer CNVCOD (12,MAXMDC)	Converter code (output).

This group of arrays is dimensioned by the maximum number of dc buses, and the number of multi-terminal dc lines (NDCBS, dc line #).

Integer AC (20,MAXMDC)	The ac converter bus number, or zero. Each converter station bus specified in IB above must occur as a value of ac for that multiterminal dc line; ac is zero otherwise and indicates a dc bus connected only to other dc buses by dc links (output).
Integer IA (20,MAXMDC)	Area number, range from 1 to 100 (output).
Integer ZONE (20,MAXMDC)	Loss zone, range from 1 to 999 (output).
Character*12 DCNAM (20,MAXMDC)	Alphanumeric identifier for this dc bus (output).
Integer IDC2 (20,MAXMDC)	Second dc bus to which converter ac is connected. Zero if connected directly to ground (output).
Real RGRND (20,MAXMDC)	Resistance to ground. Used during solutions only for those dc buses that were specified as IDC2 on other dc bus records (output).
Integer OWNER (20,MAXMDC)	Owner to which dc bus is assigned (output).

This group of arrays is dimensioned by the maximum number of dc links, and the number of multi-terminal dc lines (NDCLN, dc line #)

Integer FROM (20,MAXMDC)	Branch from bus dc bus number (output).
Integer TO (20,MAXMDC)	Branch to bus dc bus number (output).

Character*1 TO (20,MAXMDC)	Branch circuit identifier (output).
Real RDC (20,MAXMDC)	The dc link resistance, in ohms (output).
Real LDC (20,MAXMDC)	The dc link inductance, in mH (output).
Integer METEND (20,MAXMDC)	Metered end of branch for area interchange and loss zone calculations, must be FROM or TO (output).

This group of arrays is dimensioned by the maximum number of dc buses, and the number of multi-terminal dc lines (NDCBS, dc line #)

Real PAC (12,MAXMDC)	Real power flowing into the dc line at the converter bus, in pu (output).	
Real QAC (12,MAXMDC)	Reactive power flowing into the dc line at the converter bus, in pu (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The multi-terminal dc transmission line data is not retrieved in any particular order, i.e., there is no relationship between the lines that can be determined from their order or position in the above arrays. PSSMDC will attempt to use MAXMDC elements and return NMTDCL values in each data array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NMTDCL and MAXMDC can be retrieved by PSSSIZ prior to calling PSSMDC. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.21.1. Older Cases

For saved cases produced by versions earlier than PSSE-19, there is no data for the arrays VCONVN, IDC2, RGRND and LDC. Values are set according to defaults in PSSE activity CASE.

For cases prior to PSSE-25, OWNER value will be set 1.

For cases prior to PSSE-31, NAME is set to MDCLINE#, where # is a sequence number (see PSS2DC, Section 2.17 PSS2DC – Retrieve Two-Terminal Transmission Line Data).

2.21.2. Usage Notes

There are four groups of data returned by PSSMDC: firstly the arrays indexed solely by multiterminal dc line number (i.e., (NMTDCL)), secondly, those indexed by converter and dc line number (i.e., (12,NMTDCL)), thirdly, those indexed by dc bus number and dc line number (i.e., (20,NMTDCL), AC through RGRND), and fourthly, those indexed by dc link index and dc line number (i.e., (20,NMTDCL), FROM through METEND). NCONV(I) contains the actual number of converter stations for that dc line, even though the arrays must be dimensioned to allow for the maximum, which is 12. NDCBS, for dc buses, and NDCLN, for dc link indices, apply similarly to the other arrays.

2.22. PSSMSL – Retrieve Multisection Line Data

PSSMSL(FRMBUS, TOBUS, LINEID, CKT, DUMBUS, METBUS, IERR)

Where:

Integer FRMBUS (NMSLIN)	From bus number of multisection line grouping (output).
Integer TOBUS (NMSLIN)	To bus number of multisection line grouping (output).
Character*2 LINEID (NMSLIN)	Multisection line grouping identifier. Only NMSLIN values are returned; the additional dimensional requirement is to provide work space for PSSMSL (output).
Character*2 CKT (NMSLIN)	Branch circuit identifiers of branches which are members of this multisection line grouping. Unused values are unchanged. One plus the number of non-zero values in DUMBUS will be set (output).
Integer DUMBUS (9, NMSLIN)	Bus numbers of the dummy buses connected by the branches which comprise this multisection line grouping. If there are less than 9 dummy buses (i.e., less than 10 sections), the unused DUMBUS values for that multisection line grouping are set to zero (output).
Integer METBUS (NMSLIN)	Bus number which has been designated as the metered end (output).
Integer IERR	Error code (output).
	IERR = 0 — No error occurred
	IERR = 1 — Case not open
	IERR = 2 — Other error; values returned are undependable.

The multisection line data is not retrieved in any particular order, i.e., there is no relationship between the multisection lines that can be determined from their order or position in the above arrays. PSSMSL will attempt to place NMSLIN values in each data array (9*NMSLIN for array DUMBUS, 10*NMSLIN for array CKT, NSECTN for array LINEID). It is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NMSLIN and NSECTN can be retrieved by PSSSIZ prior to calling PSSMSL. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.22.1. Older Cases

For saved cases produced by PSSE-19 there is no data for the array METBUS. Values will set according to the defaults in PSSE activity CASE.

2.22.2. Usage Notes

There is no significance to the *from bus* and *to bus* designations.

2.23. PSSZNM – Retrieve Zone Names

PSSZNM(ZONUM, ZONAME, IERR)

Where:

Integer ZONUM (MAXZNM)	Zone number (output).

Character*12 ZONAME (MAXZNM)	Zone names (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The zone name data is not retrieved in any particular order, i.e., there is no relationship between the zones that can be determined from their order or position in the above arrays. PSSZNM will attempt to use MAXZNM elements and return NZONES values in each array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NZONES and MAXZNM can be retrieved using PSSSIZ prior to calling PSSZNM. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.23.1. Older Cases

For cases written by versions of PSSE prior to version 25 only zones where the value of at least one array besides ZONUM is not the default value are returned. For later saved case versions zones that contain any equipment in the case are also returned.

2.24. PSSATR – Retrieve Area Transaction Data

PSSATR(ARFROM, ARTO, PTRAN, TRANID, IERR)

Where:

Integer ARFROM (NTRNAC)	Seller's area number (output).	
Integer ARTO (NTRNAC)	Buyer's area number (output).	
Real PTRAN (NTRNAC)	Amount of transaction, in MW (output).	
Character*1 TRANID (NTRNAC)	Alphanumeric identifier for the transaction (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The transaction data is not retrieved in any particular order, i.e., there is no relationship between the transactions that can be determined from their order or position in the above arrays. PSSATR will attempt to place NTRNAC values in each data array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NTRNAC can be retrieved by PSSSIZ prior to calling PSSATR. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays

2.25. PSSOWN – Retrieve Owner Names

PSSOWN(OWNUM,OWNAME,IERR)

Where:

Integer OWNUM (MAXOWN)	Owner number (output).	
Character*12 OWNAME (MAXOWN)	Owner names (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The owner name data is not retrieved in any particular order, i.e., there is no relationship between the owners that can be determined from their order or position in the above arrays. PSSZNM will attempt to use MAXOWN and return NOWNRS values in each array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NOWNRS and MAXOWN can be retrieved using PSSSIZ prior to calling PSSOWN. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.25.1. Older Cases

For cases written by versions of PSSE prior to version 25 only owners where the value of at least one array besides OWNUM is not the default value are returned. For later saved case versions owners that contain any equipment in the case are also returned.

2.26. PSSFCT – Retrieve FACTS Device Data

PSSFCT(NAME, SBUS, TBUS, MODE, PDES, QDES, VSET, SHMX, TRMX, VTMN, VTMX, VSMX, IMX, LINX, RMPCT, OWNER, SET1, SET2, VSREF, REMOT, MNAME, PBRDG, QSHNT, PSEND, QSEND, PTERM, QTERM, IERR)

Where:

Character*12 NAME (MAXFCT)	The non-blank alphanumeric identifier assigned to the FACTS device (output).
Integer SBUS (MAXFCT)	Sending end bus number (output).
Integer TBUS (MAXFCT)	Terminal end bus number; 0 for STATCON (output).
Integer MODE (MAXFCT)	For a STATCON (i.e., a FACTS devices with a shunt element but no series element), J must be 0 and MODE must be either 0 or 1): 0 - out-of-service (i.e., shunt link open) 1 - shunt link operating For a FACTS device with a series element (i.e., J is not 0), MODE may be: 0 - out-of-service (i.e., series and shunt links open) 1 - series and shunt links operating

	2 - series link bypassed (i.e., like a zero impedance line) and shunt link operating as a STATCON 3 - series and shunt links operating with series link at constant series impedance 4 - series and shunt links operating with series link at constant series voltage 5 - master device of an IPFC with P and Q setpoints specified; another FACTS device must be designated as the slave device (i.e., its MODE is 6 or 8) of this IPFC 6 - slave device of an IPFC with P and Q setpoints specified; the FACTS device specified in MNAME must be the master device (i.e., its MODE is 5 or 7) of this IPFC. The Q setpoint is ignored as the master device dictates the active power exchanged between the two devices. 7 - master device of an IPFC with constant series voltage setpoints specified; another FACTS device must be designated as the slave device (i.e., its MODE is 6 or 8) of this IPFC 8 - slave device of an IPFC with constant series voltage setpoints specified; the FACTS device specified in MNAME must be the master device (i.e., its MODE is 5 or 7) of this IPFC. The complex $V_d + jV_q$ setpoint is modified during power flow solutions to reflect the active power exchange determined by the master device (output).
Real PDES (MAXFCT)	Desired real power flow arriving at the terminal end bus, in MW (output).
Real QDES (MAXFCT)	Desired reactive power flow arriving at the terminal end bus, in Mvar (output).
Real VSET (MAXFCT)	Voltage setpoint at the sending end bus, in pu (output).
Real SHMX (MAXFCT)	Maximum shunt current at the sending bus end, in MVA at unity voltage (output).
Real TRMX (MAXFCT)	Maximum bridge real power transfer, in MW (output).
Real VTMN (MAXFCT)	Minimum voltage at the terminal end bus, in pu (output).
Real VTMX (MAXFCT)	Maximum voltage at the terminal end bus, in pu (output).
Real IMX (MAXFCT)	Maximum series current, or zero for no current limit, in MVA at unity voltage (output).
Real LINX (MAXFCT)	Reactance of the dummy series element used in certain model solution states, in pu (output).
Real RMPCT (MAXFCT)	Percent of total Mvar required to hold the voltage at the bus SBUS that are to be contributed by the shunt element of this FACTS device. Only needed if more than one voltage controlling devices are controlling SBUS voltage (output).
Integer OWNER (MAXFCT)	OWNER to which the FACTS device is assigned (output).
Real SET1 (MAXFCT)	If MODE = 3, resistance component of constant series impedance, in pu. If MODE = 4, magnitude of constant series voltage, in pu. If

	MODE = 7 or 8, real component of the constant series voltage with respect to the quantity referred to VSREF (output).
Real SET2 (MAXFCT)	Reactive/imaginary component; see SET1 (output).
Integer VSREF (MAXFCT)	When MODE = 4 or 7 or 8, series voltage reference of SET1 and SET2. 0 for sending end voltage, 1 for series current (output).
Integer REMOT (MAXFCT)	Bus number of a remote type 1 or 2 bus whose voltage is to be regulated by the shunt element of this FACTS device to the value specified by VSET. If bus REMOT is other than a type 1 or 2 bus, the shunt element regulates voltage at the sending end bus to the value specified by VSET. REMOT is entered as zero if the shunt element is to regulate voltage at the sending end bus and must be zero if the sending end bus is a type three (swing) bus (output).
Character*12 MNAME (MAXFCT)	The name of the FACTS device which is the IPFC master device when this FACTS device is the slave device of an IPFC (i.e., its MODE is specified as 6 or 8). MNAME must be enclosed in single or double quotes if it contains any blanks or special characters (output).
Real PBRDG (MAXFCT)	Real power demand to the shunt at the sending bus, in MW (output).
Real QSHNT (MAXFCT)	Reactive power demand to the shunt at the sending bus, in Mvar (output).
Real PSEND (MAXFCT)	Real power demand to the series element at the sending bus in MW (output).
Real QSEND (MAXFCT)	Reactive power demand to the series element at the sending bus in MW (output).
Real PTERM (MAXFCT)	Real power demand at the terminal bus in MW (output).
Real QTERM (MAXFCT)	Reactive power demand at the terminal bus in Mvar (output).
Integer IERR	Error code (output).
	IERR = 0 — No error occurred
	IERR = 1 — Case not open
	IERR = 2 — Other error; values returned are undependable.

The FACTS device data is not retrieved in any particular order, i.e., there is no relationship between the FACTS devices that can be determined from their order or position in the above arrays. PSSFCT will attempt to use MAXFCT elements and return NFACTS values in each data array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NFACTS and MAXFCT can be retrieved by PSSSIZ prior to calling PSSFCT. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.26.1. Older Cases

For cases prior to PSSE-30, there is no data for array RMPCT. Values are assigned according to defaults in PSSE activity CASE.

For cases prior to PSSE-31, NAME is set to FACTS #, where # is a sequence number, REMOT is set to 0 and MNAME is set to blank (see PSS2DC, Section 2.17 PSS2DC – Retrieve Two-Terminal Transmission Line Data).

2.27. PSSALD – Retrieve Nominal Values of Adjusted Load Data

PSSALD(NUM, ID, ADJFAC, NOMLOD, IERR)

Where:

Integer NUM (ADJLOD)	Bus number (output).	
Character*2 ID (ADJLOD)	Two character load identifier (output).	
Real ADJFAC (ADJLOD)	Adjustment factor (output).	
Real NOMLOD (2, ADJLOD)	Nominal constant MVA load (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The data for these loads is not retrieved in any particular order, i.e., there is no relationship between the loads that can be determined from their order or position in the above arrays. PSSALD will attempt to place ADJLOD values in each array (or 2*ADJLOD for array NOMLOD); it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. ADJLOD can be retrieved using PSSSIZ, prior to calling PSSALD. The *PSSE Program Operation Manual*, Sections 14.6.3, 14.9.4 and 14.9.5 contain more details on the data contained in these arrays.

2.27.1. Usage Notes

Only the loads with adjustments are returned by PSSALD. The data returned by PSSALD and PSSLOD refer to the same load if, and only if, the arrays NUM, and ID are equal.

2.28. PSSABX – Retrieve Nominal Values of Adjusted Branch Data

PSSABX(FRMBUS, TOBUS, CKT, RCTMLT, NMREAC, IERR)

Where:

Integer FRMBUS (ADJBRN)	From bus number (output).	
Integer TOMBUS (ADJBRN)	To bus number (output).	
Character*2 CKT (ADJBRN)	Two character circuit identifier (output).	
Real RCTMLT (ADJBRN)	Adjustment factor (output).	
Real NMREAC (ADJBRN)	Nominal reactance, in pu (output).	
Integer IERR	Error code (output).	
	IERR = 0	No error occurred
	IERR = 1	Case not open
	IERR = 2	Other error; values returned are undependable.

The data for these branches is not retrieved in any particular order, i.e., there is no relationship between the branches that can be determined from their order or position in the above arrays. PSSABX will attempt to place ADJBRN values in each array; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. ADJBRN can be retrieved by PSSSIZ, prior to calling PSSABX. The *PSSE Program Operation Manual*, Sections 14.6.4 and 14.9.10 contains more details on the data contained in these arrays.

2.28.1. Usage Notes

Only the branches with adjustments are returned by PSSABX. The data returned by PSSABX and PSSBRN refer to the same branch if, and only if, the arrays FRMBUS, TOBUS, and CKT are equal.

2.29. PSSIND - Retrieve Induction Machine Data

PSSIND(NUM, ID, STATUS, SCODE, DCODE, AREA, ZONE, OWNER, TCODE, BCODE, MBASE, RATEKV, PCODE, PSET, H, A, B, D, E, RA, XA, XM, R1, X1, R2, X2, X3, E1, SE1, E2, SE2, IA1, IA2, IAM, IERR)

Where:

Integer NUM (NINDMC)	Bus number (output).
Character*2 ID (NINDMC)	Two character machine identifier (output).
Integer STATUS (NINDMC)	Machine in-service status. One for in-service; zero for out-of-service (output).
Integer SCODE (NINDMC)	Machine standard code (output): 1 - NEMA 2 - IEC
Integer DCODE (NINDMC)	Machine design code. Following are allowed machine design codes (output): 0 - Custom design with equivalent circuit reactances specified 1 - NEMA Design A 2 - NEMA Design B / IEC Design N 3 - NEMA Design C / IEC Design H 4 - NEMA Design D 5 - NEMA Design E
Integer AREA (NINDMC)	Area to which the induction machine is assigned (output).
Integer ZONE (NINDMC)	Zone to which the induction machine is assigned (output).
Integer OWNER (NINDMC)	Owner to which the induction machine is assigned (output).
Integer TCODE (NINDMC)	Type of mechanical load torque variation (output): 1 - simple power law 2 - WECC model

Integer BCODE (NINDMC)	Machine base power code (output): 1 - mechanical power (MW) output of the machine 2 - apparent electrical power (MVA) drawn by the machine BCODE = 1 by default
Real MBASE (NINDMC)	Machine base power; entered in MW or MVA. This value is specified according to BCODE, and could be either the mechanical rating of the machine or the electrical input. It is necessary only that the per unit values entered for the equivalent circuit parameters match the base power (output).
Real RATEKV (NINDMC)	Machine rated voltage; entered in kV line-to-line, or zero to indicate that machine rated voltage is assumed to be identical to the base voltage of bus I. RATEKV = 0.0 by default (output).
Integer PCODE (NINDMC)	Scheduled power code (output): 1 - mechanical power (MW) output of the machine 2 - apparent electrical power (MW) drawn by the machine PCODE = 1 by default
Real PSET (NINDMC)	Scheduled active power for a terminal voltage at the machine of 1.0 pu of the machine rated voltage; entered in MW. This value is specified according to PCODE, and is either the mechanical power output of the machine or the real electrical power drawn by the machine. The sign convention used is that PSET specifies power supplied to the machine. A positive value of electrical power means that the machine is operating as a motor; similarly, a positive value of mechanical power output means that the machine is driving a mechanical load and operating as a motor. No default allowed. (output):
Real H (NINDMC)	Machine inertia; in per unit on MBASE base (output).
Real A, B, D, E (NINDMC)	Constants that describe the variation of the torque of the mechanical load with speed. If TCODE is 1 (simple power law model), only D is used; if TCODE is 2 (WECC model), all of these constants are used (output).
Real RA (NINDMC)	Armature resistance, ra (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).
Real XA (NINDMC)	Armature leakage reactance, Xa (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).
Real XM (NINDMC)	Unsaturated magnetizing reactance, Xm (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).
Real R1 (NINDMC)	Resistance of the first rotor winding ("cage"), r1 (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).
Real X1 (NINDMC)	Reactance of the first rotor winding ("cage"), X1 (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).

Real R2 (NINDMC)	Resistance of the second rotor winding ("cage"), r2 (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).
Real X2 (NINDMC)	Reactance of the second rotor winding ("cage"), X2 (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).
Real X3 (NINDMC)	Third rotor reactance, X3 (> 0.0); in per unit on the power base MBASE and voltage base RATEKV (output).
Real E1 (NINDMC)	First terminal voltage point from the open circuit saturation curve, E1 (> 0.0); entered in per unit on RATEKV base (output).
Real SE1 (NINDMC)	Saturation factor at terminal voltage E1, S(E1) (output).
Real E2 (NINDMC)	Second terminal voltage point from the open circuit saturation curve, E2 (> 0.0); entered in per unit on RATEKV base (output).
Real SE2 (NINDMC)	Saturation factor at terminal voltage E2, S(E2) (output).
Real IA1, IA2 (NINDMC)	Stator currents in PU specifying saturation of the stator leakage reactance, XA (output).
Real IAM (NINDMC)	Multiplier for the saturated value. Allowed value 0 to 1.0 (output).
Integer IERR	Error code (output). IERR = 0 No error occurred IERR = 1 Case not open IERR = 2 Other error; values returned are undependable.

The induction machine data is not retrieved in any particular order, i.e., there is no relationship between the induction machines that can be determined from their order or position in the above arrays. PSSIND will attermpt to place NINDMC values in each data arraay; it is the user's responsibility to ensure that each array used for any argument is properly dimensioned. NINDMC can be retrieved by PSSSIZ prior to calling PSSIND. Refer to the PSSE Program Operation Manual, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

2.30. PSSGNE – Retrieve GNE Device Data

PSSGNE(TRMS, STAT, OWNR, NMTR, NAME, MODL, CNTREL, CNTINT, CNTCHR, DIMDAT, RELDAT, INTDAT, CHRDAT, IERR)

Where:

Integer TRMS (6,NGNES)	Bus numbers of the buses connected to the GNE device. While storage for up to six buses is provided, at this time, 1 or 2 buses are permitted for a variable admittance device, and 1 bus is permitted for a variable power and a variable current device (output).
Integer STAT (NGNES)	Device status of 1 for in-service and 0 for out-of-service (output).
Integer OWNR (NGNES)	Number of the owner to which the device is assigned (output).
Integer NMTR (NGNES)	Bus number of the non-metered end bus (output).
Character*12 NAME (NGNES)	The non-blank alphanumeric identifier assigned to the GNE device (output).
Character*16 MODL (NGNES)	The root name of the ".mac" or "*.xmac" file containing the BOSL model (output).

Integer CNTREL (NGNES)	The number of real (i.e., floating point) data items required by the model (output).
Integer CNTINT (NGNES)	The number of buses used in calculating the inputs required by the model (output).
Integer CNTCHR (NGNES)	The number of two-character equipment identifiers (e.g., machine identifiers, circuit identifiers, etc.) used in calculating the inputs required by the model (output).
Integer DIMDAT (NGNES)	Number of elements in the first dimension of the arrays RELDAT, INTDAT and CHRDAT. DIMDAT should be at least as large as the maximum number of any of these elements used by any of the BOSL models in the case (output).
Real RELDAT (DIMDAT, NGNES)	Real data items required by the model. For the Nth GNE device, RELDAT(1:CNTREL(N),N) contains its real data items (output).
Integer INTDAT (DIMDAT, NGNES)	Bus numbers used in calculating the inputs required by the model. For the Nth GNE device, INTDAT(1:CNTINT(N),N) contains these bus numbers (output).
Character*2 CHRDAT (DIMDAT, NGNES)	Two-character equipment identifiers used in calculating the inputs required by the model. For the Nth GNE device, CHRDAT(1:CNTCHR(N),N) contains these identifiers (output).
Integer IERR	Error code (output). IERR = 0 No error occurred IERR = 1 Case not open IERR = 2 Other error; values returned are undependable.

The GNE device data is not retrieved in any particular order; i.e., there is no relationship between the GNE devices that can be determined from their order or position in the above arrays. PSSGNE will attempt to return NGNES values (or columns of values for TRMS, RELDAT, INTDAT and CHRDAT) in each data array.It is the users' responsibility to ensure that each array argument is properly dimensioned. NGNES can be retrieved by PSSSIZ prior to calling PSSGNE. Refer to *PSSE Program Operation Manual*, Section 5.2, Reading Power Flow Raw Data into the Working Case, for more details on the data contained in these arrays.

Chapter 3
Appendix A - Access to the USRCAS Library

3.1. Microsoft Windows 7 / Windows 10

The PSSE saved case data extraction subroutines are installed with PSSE and are located in the PSSBIN directory in a dynamic link library named USRCAS.DLL.

Users may access the USRCAS routines by linking USRCAS.LIB, which is located in the PSSLIB directory, with their executables. At run time, the executable program will need access to the CRUTCH.DLL, FILEINFO.DLL, PROTECMDF.DLL, PTIUTILS.DLL, USRCAS.DLL, ZIPARCHIVE.DLL files. These files are located in the PSSBIN directory. The executable will also need access to the Fortran runtime libraries.

Chapter 4
Appendix B - Extracting Saved Case Data in Python

4.1. Introduction

Module Name: caspy

Purpose: Extract PSSE save case data in Python

The module defines the class Savecase. Creating an instance of this class opens, reads, and closes a PSSE saved case. That instance object can then be used as follows:

- All retrievable data is stored as dictionary attributes of the instance object
- The attribute names are the documented subroutine names
- The dictionary keys are the documented subroutine arguments
- Arrays are returned as tuples
- The dictionary values can also be referenced as attributes (see example below)
- Case sensitivity has been overridden for the dictionary keys and corresponding attributes (see example below)

4.2. Access Procedure

The process is described in the following examples, using a local saved case file named *sample.sav*.

1. Import the caspy module:

   ```
   >>> import caspy
   ```

   

   This is only done once per execution.

2. Create the Python object for the PSSEsaved case:

   ```
   >>> sample = caspy.Savecase('sample')
   ```

   Alternatively:

   ```
   >>> sample = caspy.Savecase(casnam='sample')
   OR
   ```

```
>>> sample = caspy.Savecase(casnam='sample.sav', LU=11)
```

The Python class name Savecase is case-sensitive. The casnam and LU arguments are defined for the PSSOPN subroutine, and are also case-sensitive.

3. Once the Savecase object is created, all Saved Case Data Extraction subroutines and their respective argument data can be extracted either as attributes or dictionary items.

   All data of a specific Saved Case Data Extraction subroutine can be extracted as an attribute of the Savecase Python object created in Step 1. The attribute name should be in lowercase. Example:

   ```
   >>> sample.pssopn {'LU': 11, 'IERR': 0}

   >>> sample.pssznm {'IERR': 0, 'ZONAME': ('NORTH_A1 ', 'MID_A1_A2_A5',
   'DISCNT_IN_A1', 'SOUTH_A1_A5 ', 'ALL_A3 ', 'NORTH_A5 ', 'NORTH_A2 ',
   'SOUTH_A2 ', 'ALL_A4_A6 ')}

   >>> sample.pss3ix {'IDX2BR': (41, 44, 47, 52), 'IDXBUS': (40, 41, 42, 43),
   'IDX1BR': (40, 43, 46, 51), 'IERR': 0, 'IDX3BR': (42, 45, 48, 53)}
   ```

   Data for a particular argument of a specific subroutine can be extracted as an attribute or as a dictionary item. If the returned data is tuple, it can be further accessed with a tuple index. The attributes or dictionary keys are case-insensitive. For example, any one of the following four lines:

   ```
   >>> sample.pssznm.zoname
   >>> sample.pssznm.ZONAME
   >>> sample.pssznm[‘zoname’]
   >>> sample.pssznm[‘ZONAME’]
   ```

will produce return this tuple:

```
('NORTH_A1 ', 'MID_A1_A2_A5', 'DISCNT_IN_A1', 'SOUTH_A1_A5 ', 'ALL_A3 ',
'NORTH_A5 ', 'NORTH_A2 ', 'SOUTH_A2 ', 'ALL_A4_A6 ')
```

Either of the following two lines:

```
>>> sample.pssznm.zoname[0]
>>> sample.pssznm[‘ZONAME’][0]
```

will produce this value:

```
'NORTH_A1 '
```

4.3. Usage Notes

Input Arguments

Input arguments will not appear in the dictionaries. Returned values of input/output arguments will.

Multiple Cases

The data for a given case is part of the Savecase instance object, and the saved case file is closed once the object is created. Any number of Savecase instance objects may exist at one time.

Data Order

The user should not depend on the order of the elements in a Python dictionary. The order of elements in a particular tuple will be the same as the order of the corresponding array as documented.

Object Lifetime

As long as a reference to the Savecase instance object exists, the data will remain in memory. Reusing the name (i.e., binding the name to a new object) may result in the data being removed from memory. PSSE saved cases may be quite large; use the del command to remove references to objects (or delattr for specific object attributes) if you are concerned about the performance impact of retaining the data in memory longer than needed.