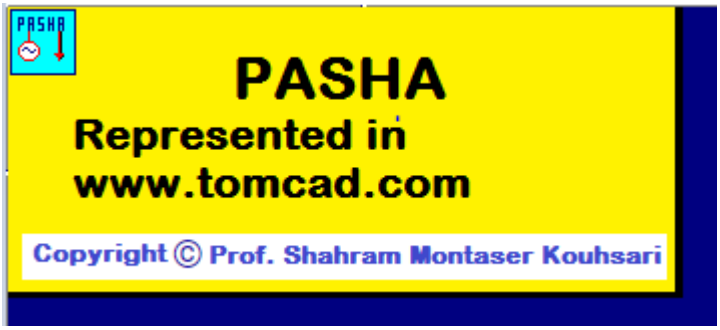


Chapter 4
The edit section

The edit section of PASHA is used to enter or change the numerical network parameters, i.e. line impedances, generator powers etc. It is termed the 'edit section' because the data entry process permits easy modification of the numerical data by allowing the user to overwrite any or all of it when desired. The network data in PASHA are split into separate groups; because the large amount of data required specifying a power system can best be presented in a number of sections. The data are organized using the conventional groupings, based on plant types:

Busbars (substations) (includes frequency relays)
Lines (includes circuit breakers, over current relays, and fuses)
Transformers
Synchronous generators (machines)
AVR's
Governors
Induction motors (machines)
DC machines
M-G sets
Batteries
Distance and unit protections
AC/DC Converters
Harmonic Sources

With two additional groups to control the study sections of PASHA:

Loadflow control data
General analysis parameters

4.1 Tables of data

To obtain a clear display of the data on the terminal, groups, which contain a large number of parameters, have been divided into an appropriate number of 'tables'. In most cases two tables exist per group of data and are identified as 'DATA 1' and DATA 2'. For some others there are more pages. For example, for generators, in addition to the three main data pages there are two extra pages of voltage regulator data and also one page of governor and turbine data, which are needed for transient stability studies only.

In broad terms, for data groups with parameters extending over two pages, the 'DATA 1' table contains all the essential data for the basic loadflow and fault studies. Also parameters generally are listed in the order in which they are needed to accommodate increasing detail in the modeling and to extend the possible studies, i.e. to enable parts of the fault level and transient stability studies. The on-line 'HELP' information associated with each data page gives details of the relevance of each data entry on that page. The HELP information can be accessed by selecting the [HELP] option (see 4.2.1). Tables are drawn automatically from the network data, i.e. when a network is constructed; the program will format the necessary data pages with the appropriate named entries for all the elements drawn in the network

4.2 Organization of the edit section of PASHA

When the [EDIT THE PRESENT NETWORK DATA] option is selected from the main menu the edit section of PASHA is entered. To allow access to the data tables for all the groups of data in the network diagram, a menu is constructed with all the tables as options. Figure 4.1 shows the main menu of the edit section. The options on this menu refer to the plant groups drawn in the diagram, and consequently some option lines will be blanked if no plant of that type exists in the network.
It is also possible to enter the data tables of each element by positioning the mouse cursor on the graphic symbol of the element and pressing keys <F1>, or <F2>, or <F3>, or.<F4>,.or.<F5>,.or.<F6> depending to the data page number relating to that element. The keys function anytime that the single-line diagram is on the screen. Please also refer to sections 2.2.4, and 3.4, for more option available to enter the edit section directly from drawings.
It is possible to regard the Loadflow and Fault studies as basic activities and on entry to PASHA the data options and displays are geared to the parameters needed for these studies. The additional generator and induction motor group data and the regulator and governor data options and data tables, are displayed until the user asks for these to be available. You may limit the data pages to Loadflow and fault data by pressing <L> instead of the <SP> key or click, or any other keys when selecting a 'main' option.
System data may be entered either directly, through the DATA 1, DATA 2, DATA 4 ,etc. sections of the tables or, alternatively, through the DATA 3 section which access the DATA BASE files. See chapter 9 for more details of this entry process.
Upon selection of an edit option the user will access the data table for that plant group. The tables of data are divided into what are termed 'edit pages'.
Note that there is a considerable modification on this page in PASHA to allow for protection device edit pages, reliability data pages. For more information on this please also refer to the relevant chapters.

4.3 The edit page

In the drawing section, whenever a network element is drawn a 'slot' is created into which the numerical data will be entered. The number of these slots, and their sizes, are of course governed by the number of elements in the diagram and their particular type. An edit page displays these slots in a tabular form, so that the user can easily select a specific data item for entry. Figure 4.2 shows a typical layout of the edit pages of PASHA.

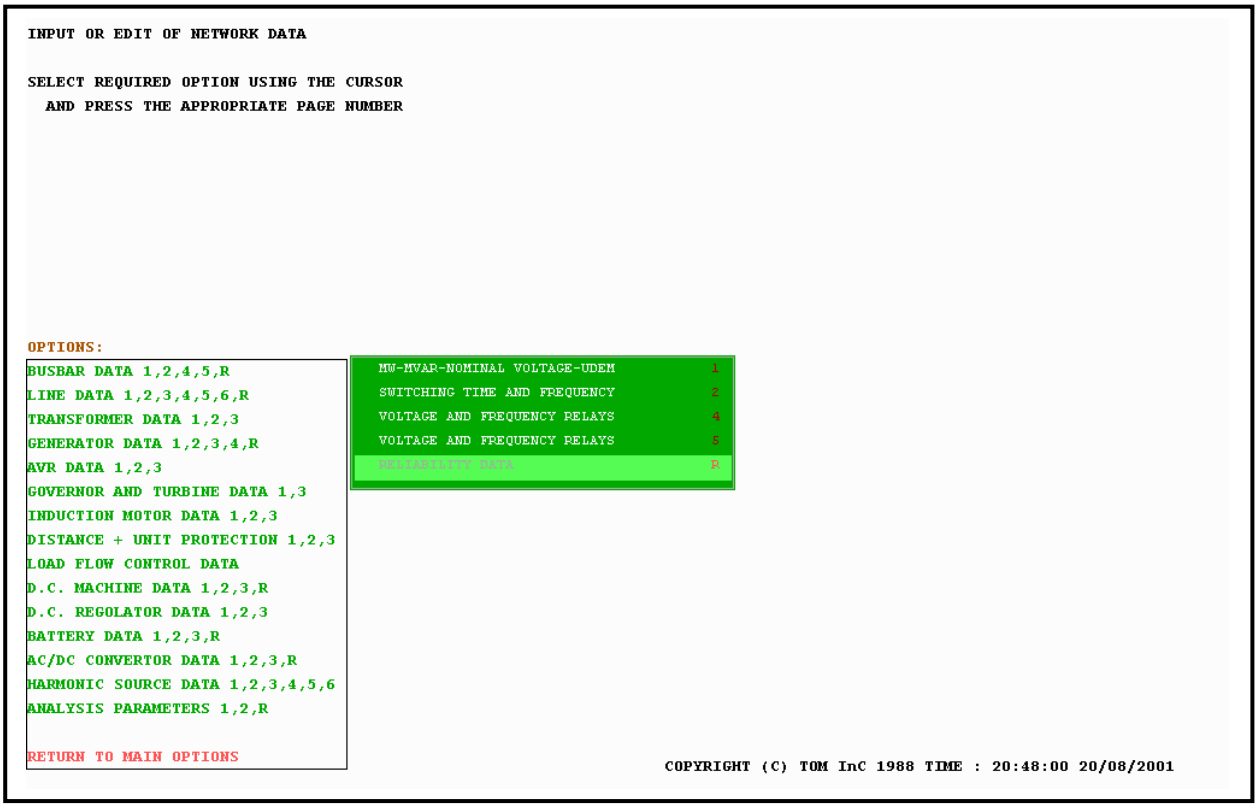


Figure 4.1

Figure 4.2

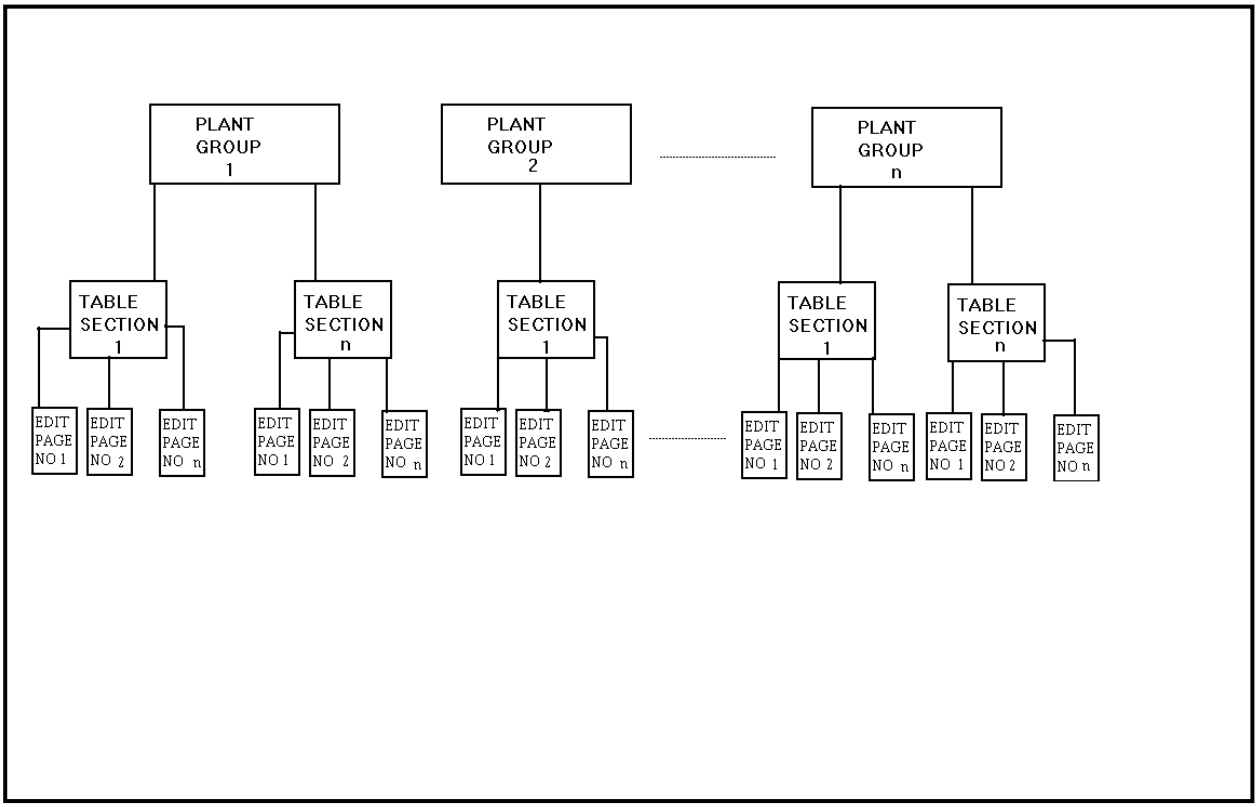

PLANT GROUP 1
PLANT GROUP 2
PLANT GROUP n
TABLE SECTION 1
TABLE SECTION n
TABLE SECTION 1
TABLE SECTION 1
TABLE SECTION n
EDIT PAGE NO 1
EDIT PAGE NO 2
EDIT PAGE NO n
EDIT PAGE NO 1
EDIT PAGE NO 2
EDIT PAGE NO n
EDIT PAGE NO 1
EDIT PAGE NO 2
EDIT PAGE NO n
EDIT PAGE NO 1
EDIT PAGE NO 2
EDIT PAGE NO n
EDIT PAGE NO 1
EDIT PAGE NO 2
EDIT PAGE NO n

Figure 4.3

At the top of the page is a heading of which plant group and table section the page refers to, along with a page number. Only a certain number of slots can be displayed on one page, if this is exceeded a further page is created to contain the extra slots. So for each section of the table of plant data a set of lined edit pages may exist. The relationship between plant groups, tables and edit pages is shown graphically in figure 4.3. It should be noted that most plant groups poses a section 3 of the table, which is used as an 'interface' to the database files. This table section is described fully in chapter 9.

Again referring to figure 4.2, the next line on the edit page contains the headings to identify both the plant item and the data parameters associated with the plant. In this case the plants are the lines. Directly below the headings the data slots are displayed inside the 'data entry box'. This is where the data are entered and displayed. To the left of the entry box are displayed the plant names to identify which slots refer to which piece of plant. In figure 4.2 the names of the sending and receiving busbars identify the lines.

At the bottom left hand corner of the screen a menu is displayed to permit paging functions and provide access to the on-line help information. Selection of these options is the same as with the other menus in PASHA.

4.3.1 Edit page options

The following options are available to all the edit pages, however two of them will only be displayed when more than one edit page exists on a particular table section. These are the [NEXT PAGE] and [PREVIOUS PAGE] options, which only appear when there is a next and/or previous page in the edit page set. If you want to go through the edit pages without using the following options, just press <Pg Up> or <Pg Dn> keys.

[HELP]
Displays the on-line HELP information on the terminal screen.

[NEXT PAGE]
Often, data entries, particularly for the common plant types, exceed the number which can be accommodated on the screen and are subdivided into a number of pages. The NEXT PAGE option is displayed only when a further page of data exists, and is blocked when the last page is reached. The standard selection of this option (using the graphics cursor and <SP>) displays the page immediately following the current one. If, however, a digit is typed (instead of the space bar), then that number of pages are skipped. If <S> key is typed the search facility is available.

[PREVIOUS PAGE]
As with [NEXT PAGE], but paging is backwards.

[REDISPLAY]
This option can be used to update the current display of a page of data after editing or entering data on that page, or to transfer from one table section to another and also from any EDIT page to the associated DATA BASE pages. Position the cursor on REDISPLAY and press:-
<1> to transfer from either DATA 2 or DATA 3 to the DATA 1 page.

<2> to transfer from either DATA 1 or DATA 3 to the DATA 2 page.
<3> to transfer from either DATA 2 or DATA 1 to the DATA 3 page.
<F> to transfer to the next data table in the sequence: busbar, line, transformer, generator, AVR, governor, induction motor, loadflow control, analysis parameters, busbar, line,..
<B> to transfer to the previous group of data i.e. in reverse order to <F>.
<T> to transfer from the 'system' data pages to the corresponding plant group in the 'database' section, and vice-versa.
<R> Reliability data edit pages. Please refer to chapter 12.

ANY KEY OTHER THAN THOSE ABOVE to display the current page.

NOTE: when a DATA 2, or a DATA 3 section does not exist, pressing <2> or <3> redisplays the current page.

Instead of pressing the above keys, you may select these options from an on line green boxes, where a brief description of each page is also described there. Just locate the cursor on 'redisplay' and the green box will be displayed. Click on the desired option of this green box.

4.3.2 An example of an PASHA edit page

In order to illustrate the actual construction of a PASHA edit page an example is given here. Figure 4.4 shows the edit page created for the busbar (substation) data by PASHA as a result of the network diagram constructed in the last chapter (figure 3.51).

The top line indicates that this is the busbar data table and that there is only one edit page for this section of data. Below this the titles of the data items are displayed.

By referring to figure 3.51, it can be seen that the network contains 5 substations and 6 junctions (totally 11 busbars):-

NETW, SUB 1, SUB 2, SUB 3, EMERG-G, MOT1, MOT2, MOT3, G1, G2, NETEQU

PASHA therefore creates 11 substation data slots, which are displayed in the data entry box, and enters their respective names.

The data entry box is displayed filled with blank spaces because, as yet, no data has been entered for the busbars, and consequently all the parameters default to zero.

In the edit section all zero entries are shown as blanks rather than '0.0. The menu box at the bottom of the screen only contains three of the five options, because there is only one page of data associated with the busbars.

Also included on the edit page is a message stating the base MVA of the system. This is purely for reference and is displayed on all the edit pages because the data is entered in a 'per unit' form. The base MVA can be changed in ANALYSIS PARAMETR 1 EDIT PAGE.
Area in each page refers to the three first characters of the name of WINDOW boxes, which the present element is located.

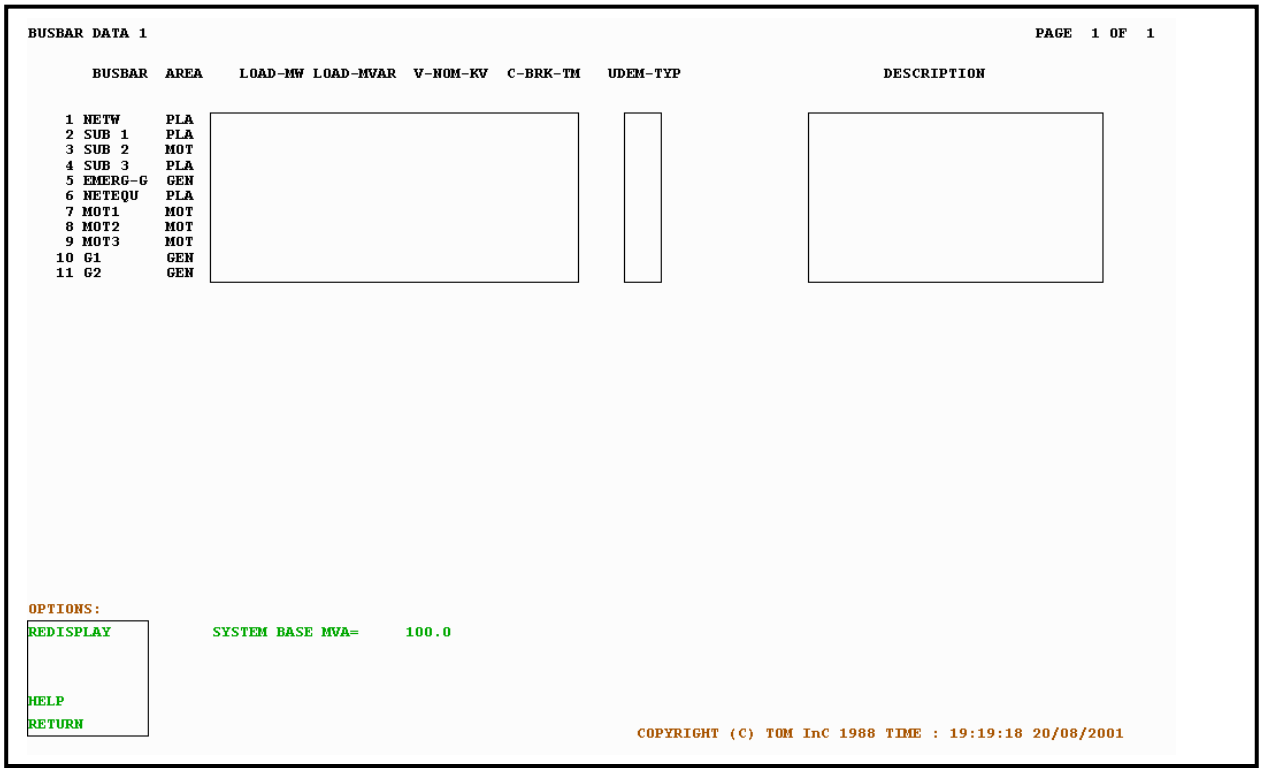


Figure 4.4

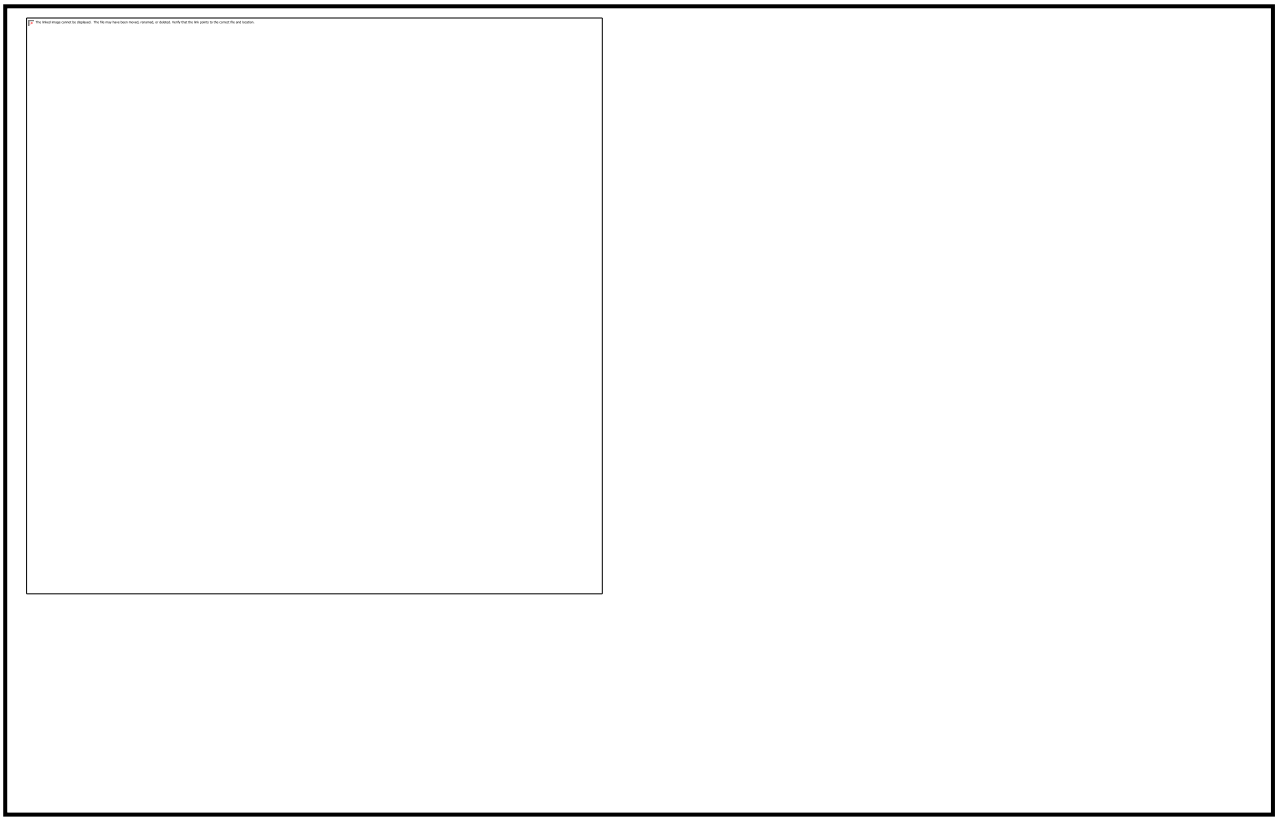


Figure 4.5

4.4 The data entry procedure

Throughout PASHA it has been our policy to use 'boxes', i.e. sets of lines arranged in a rectangular shape, to enclose user selectable areas, e.g. the menu boxes described in chapter 2. The data entry boxes are also therefore user-selectable areas, although the action taken after selection differs from that when a menu option is selected.

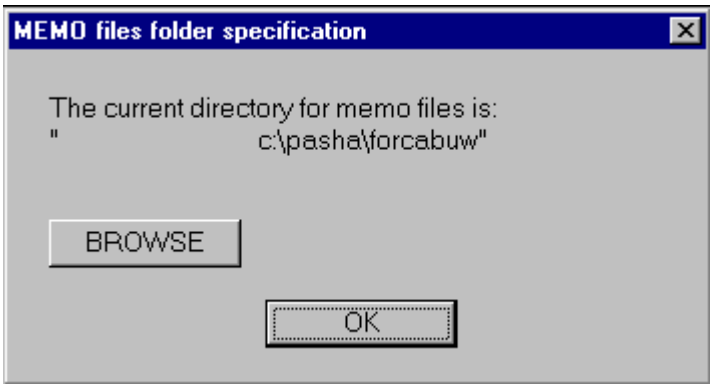
The data entry process is made up of two distinct steps:

(i) selection of the data item into which the data is to be entered.
(ii) typing in the data.

For the selection process, the data entry box can be thought of as being made up of a set of 'fields', one for each data item.

Note that whenever you place the cursor over these boxes, other available extra options may be displayed on a small green box as described in Chapter 2. There are two very useful extra keys. These are <G> and <E>. If you press <G> while the cursor is located over a data of an element, the single-line diagram will be displayed and a circle will indicate the location of the selected element.

If you would like to write any message as MEMO for an element, you must press <E> and your favorite editor will be appeared on the diagram. The memo files are quite general and you may keep the trace of the design, repair or maintenance of an element. The memo files will be arranged in default writable directory, unless you specify another directory. Please refer to chapter 2 in order to find out how you can change the MEMO folder. Next time you press this key on an element that has a memo, all you have written about this element will be appear to you on your favorite editor. Please make sure that you have specified you preferred editor in PASHASYM.FIL file otherwise the default editor will be used.



4.4.1 Data item fields

Associated with each data item in the data entry box is an area termed its 'field'. This is the area allocated to display the numeric parameter, and is used in the selection process.

Figure 4.5 shows the edit page for the busbar data for the network constructed in the last chapter. The data entry box has been split up with dotted lines to show all the fields defined in the data entry box. PASHA of course does not show these dotted lines.

4.4.2 Selection of the data item

In order to select the data item into which the system parameter is to be entered the cross hair cursor is positioned over the 'field' of the data item, and the <SP> key or a click is pressed. This will put the terminal into data input mode, which is signified by the appearance of the flashing alphanumeric cursor at the start of the selected field.

To illustrate this process, consider figure 4.6. The user wishes to enter data for the MW loading of the busbar SUB 1. In order to select this data item the mouse cursor must be positioned over the correct field. To do this the cursor, is positioned in the middle of the name 'SUB 1', as shown in the figure. The vertical position of the cursor must be positioned over the correct column for the data item, i.e. in the middle of the 'LOAD-MW' heading, as shown in the figure. The <SP> key or a click is then pressed to select this item and enter data input mode. The positioning of the cursor is not as critical as is suggested. The item can be selected by positioning the cursor anywhere in the field (the shaded area of figure 4.6 in this case).

As a rule it can be said that as long as the cursor is positioned over the names of the required row and column the data field will be selected.

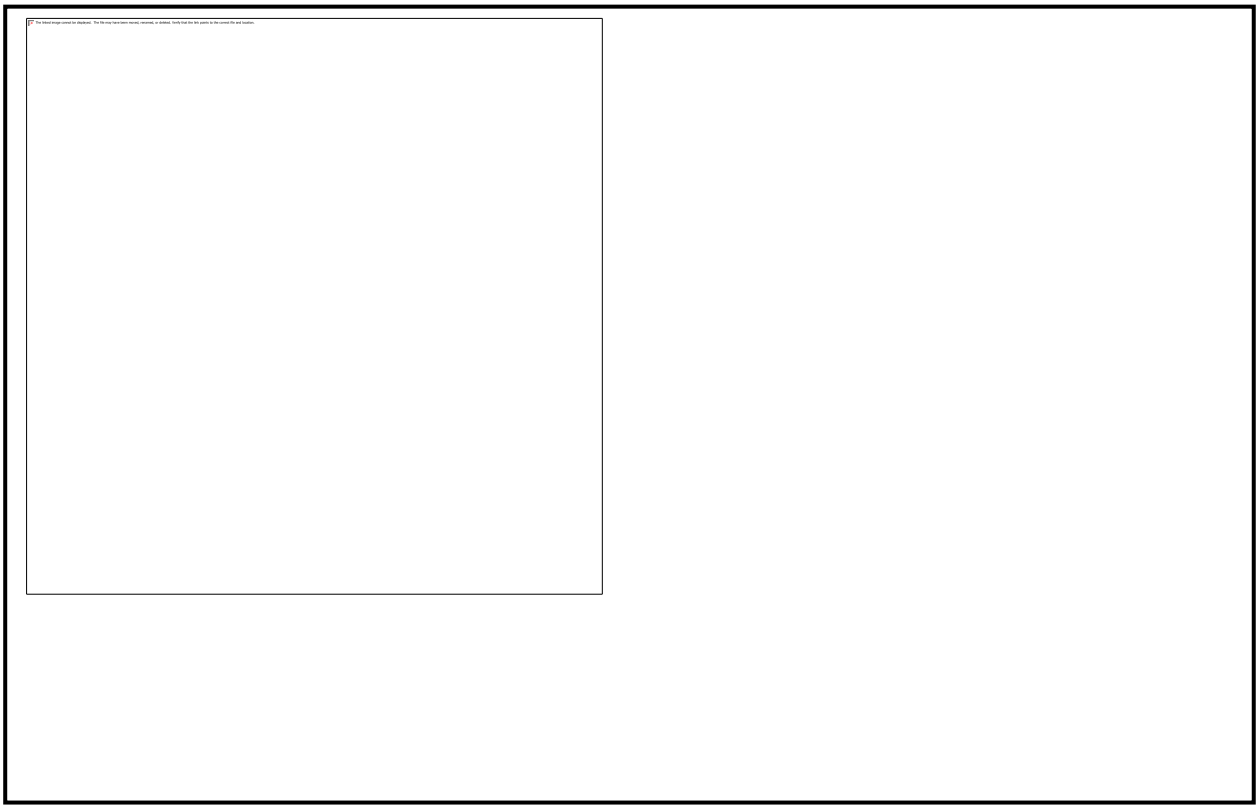


Figure 4.6

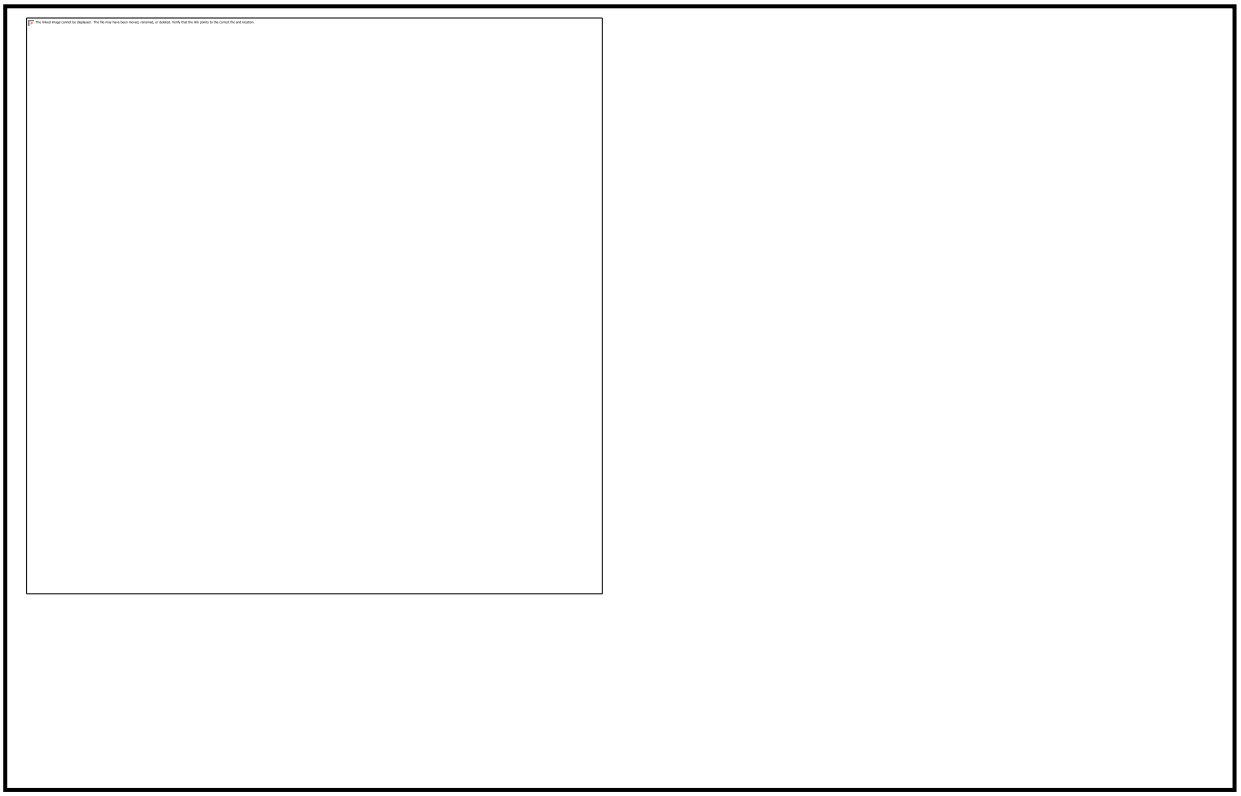


Figure 4.7

4.4.3 Data input mode

When the data item or field has been successfully selected (indicated by the appearance of the alphanumeric cursor), the parameters can be simply typed in. When the number has been typed in, it is terminated by pressing the <CR> key or just a click. The cursor will then reposition itself on the next line at the same column ready to receive the same parameter for the next piece of plant. If no other entries exist then the mouse cursor reappears, signifying that data input mode is terminated.

A simple example will make this clearer. Figure 4.7 continues the example given in section 4.4.2. The mouse cursor has been used to select the MW load item for SUB 1. The alphanumeric cursor is initially positioned to the start of field 1, position (a,b). The value of the load is typed in as 200, followed by the <CR> key, i.e. the users presses the keys:

<2><O><O><CR>

The alphanumeric cursor is then automatically repositioned to the next line, i.e. point (c,d) at the start of field 2. It is then possible to enter the load for SUB 2. However SUB 2 is not loaded, so a zero entry is required here. There are two ways of doing this:

(i) Type <CR> or Click - this will leave the data field unchanged, and since it was originally zero, it will remain as zero.

(ii) Type <O><CR> or click - this enters a zero value into the field.

The difference between the two procedures is that the first one also terminates data input mode, redisplaying the mouse cursor, whereas the second enables the load to specified for SUB 3, i.e. the alphanumeric cursor is repositioned at point (e,f).

Whenever the alphanumeric cursor is positioned by PASHA to the start of a field and the <CR> key or a click is pressed, the field is left unchanged, and data input mode is terminated.

4.4.4 Entering strings of data items

Although the above procedure for entering data is sufficient for entering columns of data, it would become rather tedious if each column has to be selected individually before data can be entered. This is not the case as it is possible to enter strings of numbers to PASHA by separating them with spaces. To show how this can be done let us continue by entering the data for the lines in the network constructed in chapter 2.

Figure 4.8 shows the edit page for section 1 of the line data table. To enter the data for the resistance, reactance and susceptance for the line between substations NETW and SUB 1 the cursor is positioned to point (a,b) and the <SP> key or a click is pressed. This selects the resistance column for the line and causes the alphanumeric cursor to appear and be positioned at the start of this field. The data to be entered for the line are:

PU resistance = 0.025
PU reactance = 0.04

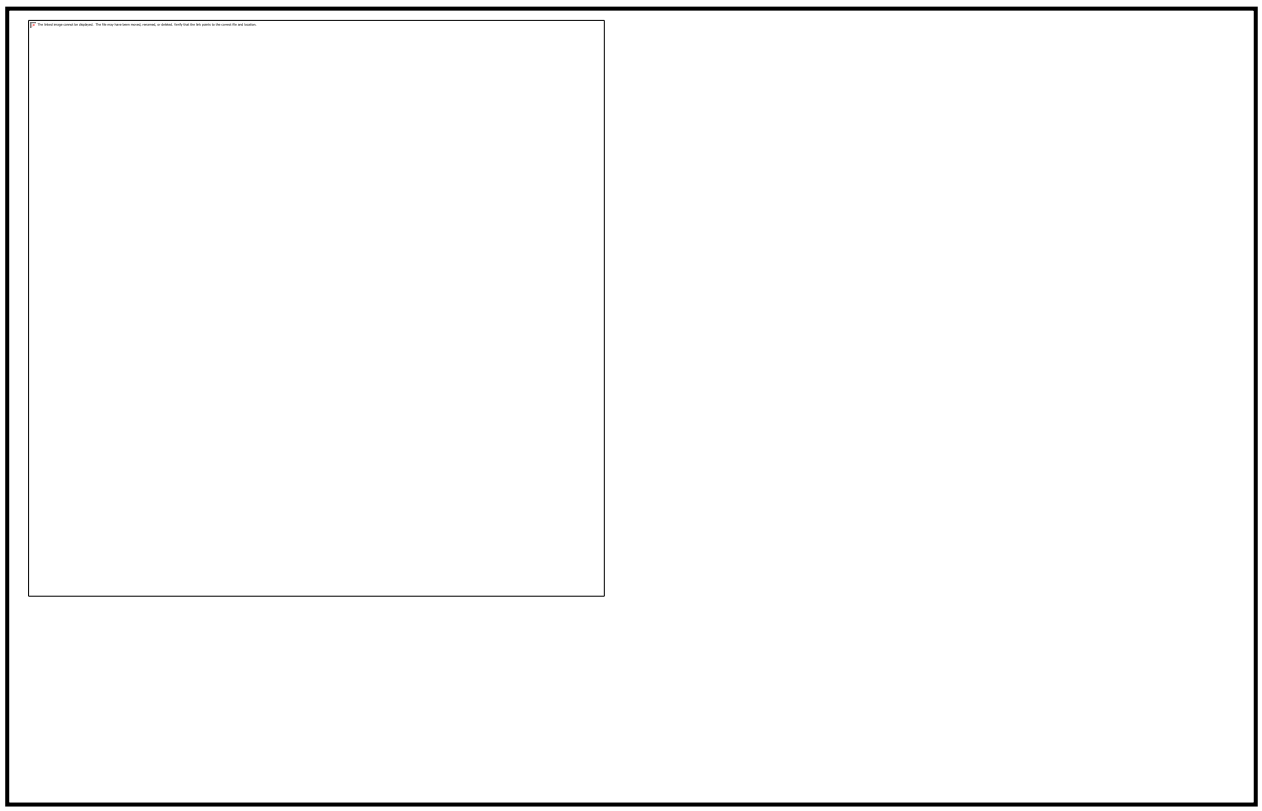


Figure 4.8

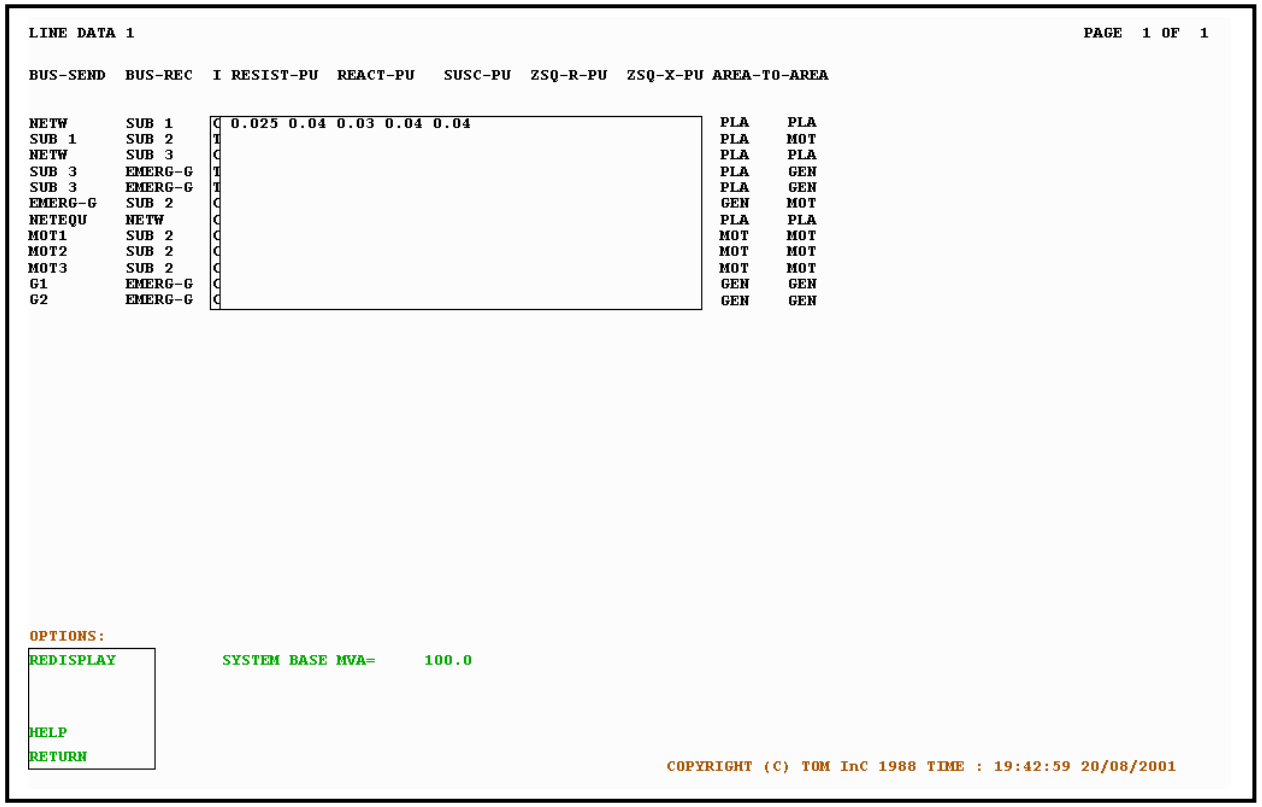


Figure 4.9

PU susceptance = 0.03
PU zero sequence resistance = 0.04
PU zero sequence reactance = 0.04

These data are entered by simply typing them in separating each number with a space and terminating the 'string' of numbers with a <CR>, as shown in figure 4.9. The following keys are pressed:

<O> <.> <O> <2> <5> <SP>
<O> <.> <O> <4> <SP>
<O> <.> <O> <3> <SP>
<O> <.> <O> <4> <SP>
<O> <.> <O> <4> <CR>

The alphanumeric cursor is then automatically positioned to the start of the RESIST-PU field on the next line ready for more data. The parameters for the line from SUB 1 to SUB 2 can then be input in exactly the same way. The parameters are:

PU resistance = 0.01
PU reactance = 0.1
PU susceptance = 0.0
PU zero sequence resistance = 0.01
PU zero sequence reactance = 0.1

These are entered by pressing the following keys:

<O> <.> <O> <1> <SP>
<O> <.> <1> <SP>
<O> <SP>
<O> <.> <O> <1> <SP>
<O> <.> <1> <CR>

The entry process can then proceed until all the data has been input, or an empty string is typed, i.e. a <CR> or a click is typed on its own.

4.4.5 Rules governing the entry of data

The following rules concerning the entry of the numerical parameters in data input mode

(i) Whenever an 'empty' string of parameters is entered, i.e. the <CR> key is not preceded by parameters, data input mode is terminated and the fields on the line on which the alphanumeric cursor was positioned are left unchanged.

(ii) If the number of parameters entered exceeds those defined on a particular line, the extra entries are ignored and not recorded.

(iii) If the number of parameters specified is less than those defined on particular line, the unspecified ones remain unchanged.

After the <CR> key is pressed the cursor will position itself according to the following rules:

(i) If the specified string is ‘empty’ data input mode is terminated and the mouse cursor reappears.

(ii) If the <CR> key was pressed on the last line of the data entry box, data input mode is terminated as no further fields exist.

(iii) If neither of the above conditions exist, the alphanumeric cursor is positioned to the start of the same field as initially selected, on the next line.

4.5 The edit pages of PASHA

This section describes each table section edit page that can be found in the edit section, with the exception of table section 3 pages which are described fully in chapter 9.

The system parameters for the example network drawn in section 3.3, have been included on the edit pages, both to show how the edit pages will appear when they contain system data and to develop the network example fully so that it can be used to illustrate the rest of this manual.

It should be remembered that not all of these pages would necessarily exist, as it depends on what plant has been drawn in the original diagram.

The following pages in this chapter give a detailed description of each edit page and the data items occurring on them. Appendix B gives a complete list of all the data items in the edit section arranged in alphabetic order for easy reference.

4.5.1 Busbar data 1

LOAD-MW : Busbar load power in MW.
LOAD-MVAR : Busbar load reactive power in MVAR.
V-NOM-KV : Nominal bus voltage in KV.
C-BRK-TM : Circuit breaker interrupting time in sec. Just in previous versions (before 2000) of PASHA. In new versions, use Line DATA 6 Circuit Breaker & Overload Protection. The circuit breaker interrupting time comes from Circuit Breaker database.
L-MODEL : Load models in transient and harmonics studies (New versions). Leave blank for impedance modeling. Enter 1 for constant power and 2 for constant current.
UDEM-TYP : User Defined Equipment Model of load

Notes:

1 Any fields left blank are treated as zero.

2 A load value may be entered for any busbar, irrespective of whether it has a load symbol associated with it, in the system diagram. However, the deletion of a load symbol from the diagram removes any existing load data entries from the busbar to which it was connected.

3 The titles "NEXT PAGE" and "PREVIOUS PAGE" appear in the options box, at the bottom of data pages, only when such additional pages of data exist.

4 Busbar names are entered whilst drawing the system diagram. The names of all substations and junctions drawn are listed automatically in the BUSBAR column, appearing in the order in which they were drawn except when the sorting option is in action (SET COLUR AND SYMBOLS).

The box within which load data entries are made, is also automatically adjusted to frame all possible entries in each page. Any discrepancy between the height of the box and the height of busbar name column, or any blank lines in this column, indicate that some busbars have not been named. Missing names can be entered by returning to the "MAIN" options, selecting MODIFY THE PRESENT SYSTEM DIAGRAM and then locating and naming the busbars in the usual way.

5 The nominal bus voltage is for information and is taken into account by setting the graphic color of the diagram. Also it is used for base conversion if it is provided.

6 The new version of the TRANSIENT STABILITY section of the program now supports UDEM modules, to use them simply enter the UDEM ID code in the UDEM-TYP box. Information on usage of the UDEM can be obtained by accessing the UDEM help pages. You may also type "F" to see the list of UDEM saved before and choose UDEM type you wish to use.

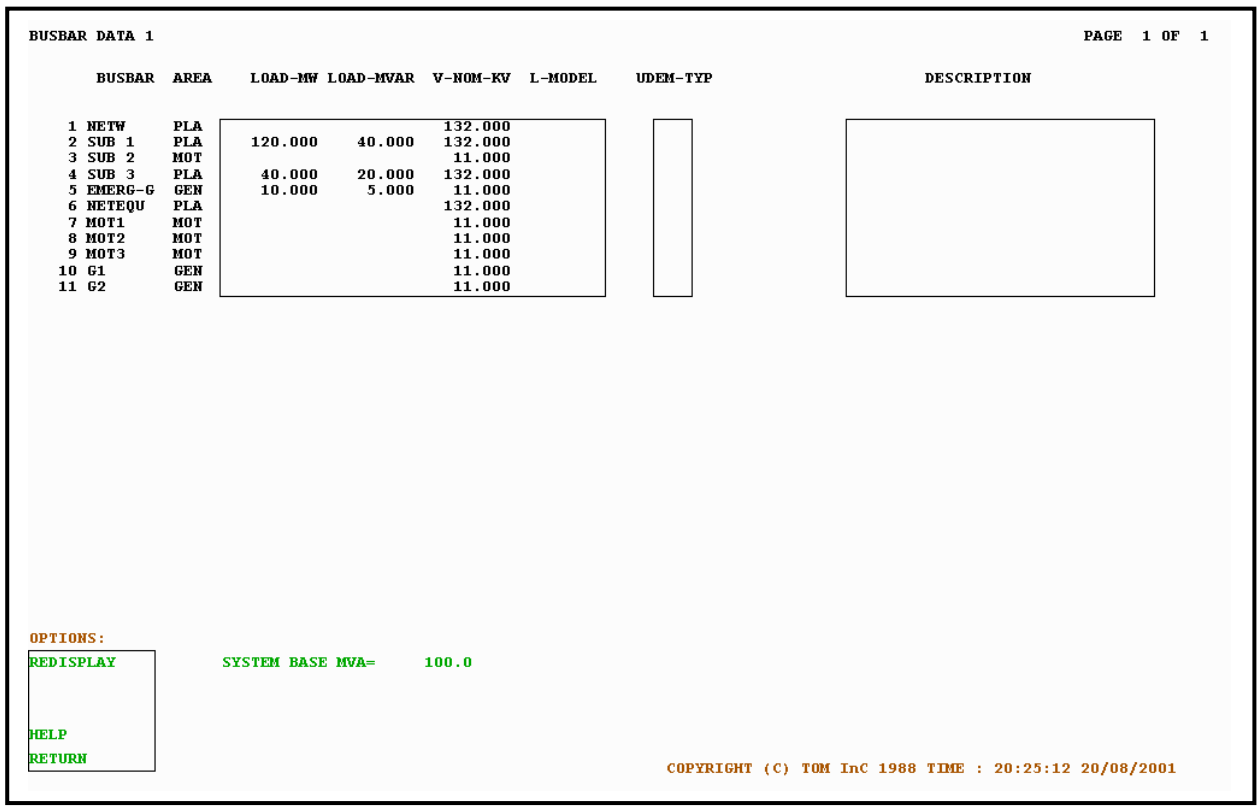

BUSBAR DATA 1
PAGE 1 OF 1
BUSBAR AREA LOAD-MW LOAD-MVAR V-NOM-KV L-MODEL UDEM-TYP DESCRIPTION
1 NETW PLA 132.000
2 SUB 1 PLA 120.000 40.000 132.000
3 SUB 2 MOT 11.000
4 SUB 3 PLA 40.000 20.000 132.000
5 EMERG-G GEN 10.000 5.000 11.000
6 NETEQU PLA 132.000
7 MOT1 MOT 11.000
8 MOT2 MOT 11.000
9 MOT3 MOT 11.000
10 G1 GEN 11.000
11 G2 GEN 11.000
OPTIONS:
REDISPLAY
HELP
RETURN
SYSTEM BASE MVA= 100.0
COPYRIGHT (C) TOM InC 1988 TIME : 20:25:12 20/08/2001

Figure 4.10

4.5.2 Busbar data 2

This page deals with load switching and divided to two separate switching, i.e. switch an amount of load in a specific time or shed the load by under frequency relays or both. The time switching consists of:

SW-TIM1 : Time of first switching operation, on the load, in sec.
SW-TIM2 : Time of second switching operation, on the load, in sec.
MW-SWITH : The amount of MW load to be switched in (+) or out (-).
MVAR-SWI : The amount of MVAR load to be switched in or out according to MW-SWITH sign.

The frequency switching consists of:

The following only taken into account in frequency dynamic analysis.

MONI : (monitor) Enter -1 if it is not desired to calculate and monitor frequency of that busbar.
UN-V-B :Undervoltage blocking value for under/over frequency relays (pu).
PE-UP Evaluation time for pickup of frequency relays (cycle).
RE-TIME : Actual reset time.
D-MW/HZ : D factor MW/HZ.
D-M/HZ : D' factor MVAR/HZ.
The last two items are only taken to the account if frequency dynamic calculation are selected.

NOTES:

1 Any suitable switching times can be specified as the stability program adjusts the step length automatically, to accommodate switching times.

2 Please take care that do not remove more MW power than it is available on the busbar, since the difference will act as a generation infeed to that busbar.

3 A switching action may be specified for any busbar, irrespective of whether it has a load symbol associated with it, in the system diagram.

The deletion of a load symbol from the diagram removes any existing load data entries from the busbar to which it was connected.

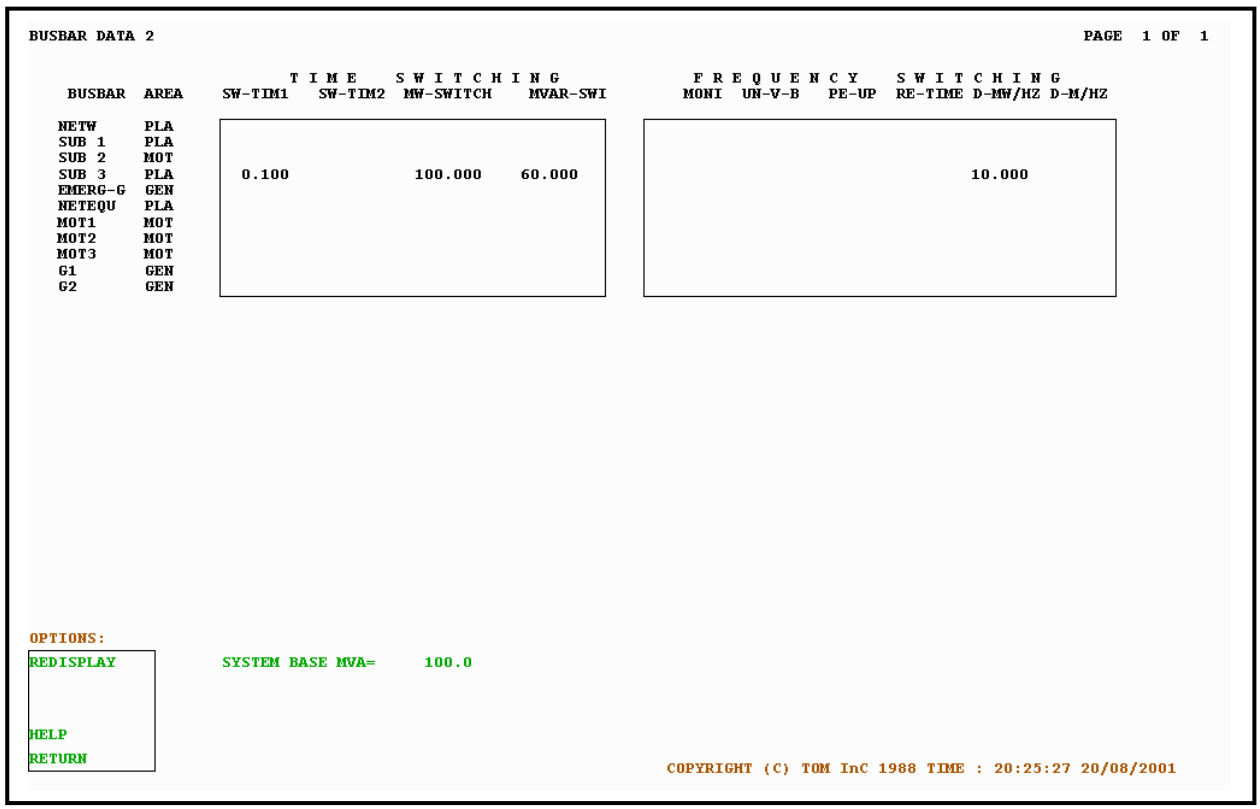

BUSBAR DATA 2
PAGE 1 OF 1
T I M E S W I T C H I N G
F R E Q U E N C Y S W I T C H I N G
BUSBAR AREA SW-TIM1 SW-TIM2 MW-SWITCH MVAR-SWI MONI UN-V-B PE-UP RE-TIME D-MW/HZ D-M/HZ
NETW PLA
SUB 1 PLA
SUB 2 MOT
SUB 3 PLA
EMERG-G GEN
NETEQU PLA
MOT1 MOT
MOT2 MOT
MOT3 MOT
G1 GEN
G2 GEN
0.100 100.000 60.000
10.000
OPTIONS:
REDISPLAY
HELP
RETURN
SYSTEM BASE MVA= 100.0
COPYRIGHT (C) TOM InC 1988 TIME : 20:25:27 20/08/2001

Figure 4.11

4.5.3 BUSBAR DATA 4 & 5

FIRST, SECOND, THIRD AND FOURTH STAGES

FRE : The magnitude of frequency in HZ for relay pick up. If this value is less than 3.0 the relay acts as under or over voltage relay depending to the initial magnitude of voltage.

FRE-GRA : The gradient of frequency in HZ/sec for relay pick up

MW-SW : The amount of MW load to be switched in (+) or out (-).

MVAR-S : The amount of MVAR load to be switched in or out according to MW-SWITH sign.

T-DLY-ms : Time delay set on the frequency relay (msec).

LINE : Press D in this column to select the required line to be disconnected by frequency relay action. You may also specify a remote line not connected to the busbar. For lines connected to the busbar just click on the other end busbar. Otherwise click on the line.

NOTES:

1 Any suitable switching times can be specified as the stability program adjusts the step length automatically, to accommodate switching times.

2 Please take care that do not remove more MW power than it is available on the busbar, since the difference will act as a generation infeed to that busbar.

3 A switching action may be specified for any busbar, irrespective of whether it has a load symbol associated with it, in the system diagram.

The deletion of a load symbol from the diagram removes any existing load data entries from the busbar to which it was connected.

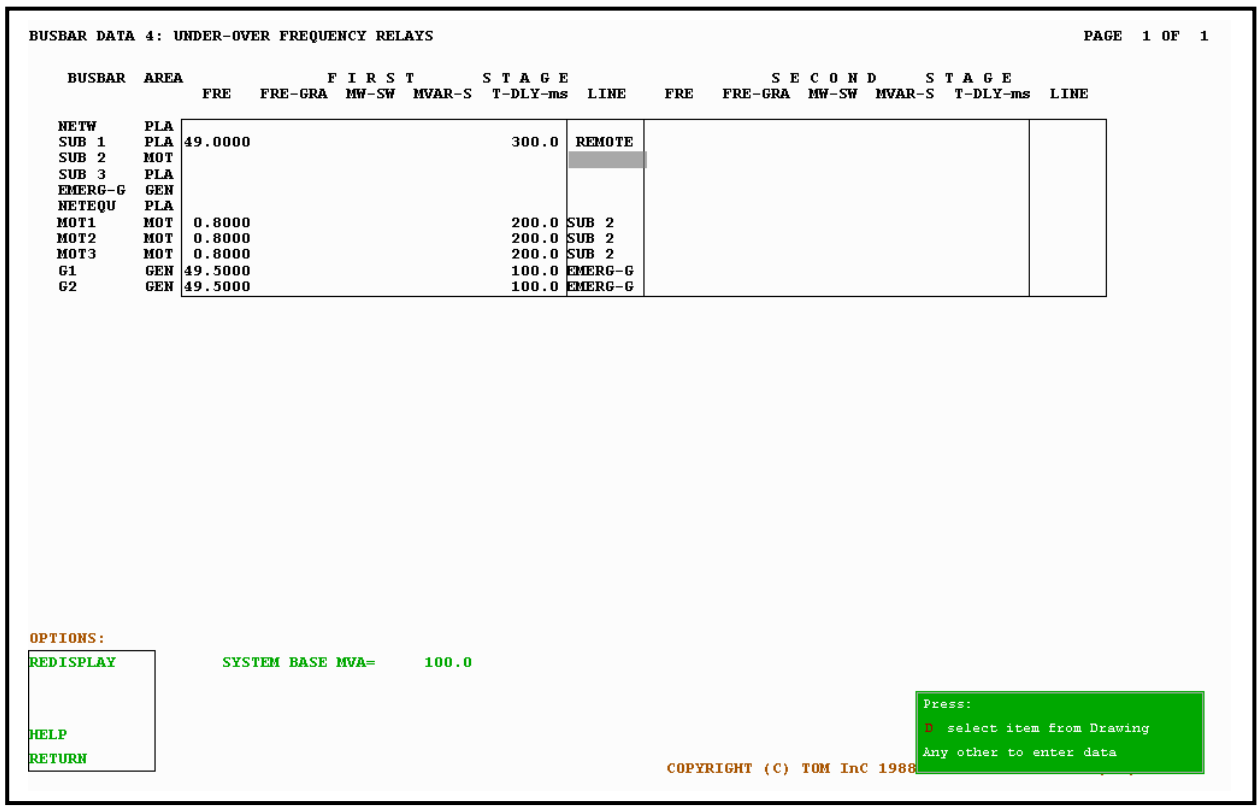

BUSBAR DATA 4: UNDER-OVER FREQUENCY RELAYS
PAGE 1 OF 1
BUSBAR AREA FIRST STAGE SECOND STAGE
FRE FRE-GRA MW-SW MVAR-S T-DLY-ms LINE FRE FRE-GRA MW-SW MVAR-S T-DLY-ms LINE
NETW PLA
SUB 1 PLA 49.0000 300.0 REMOTE
SUB 2 MOT
SUB 3 PLA
EMERG-G GEN
NETEQU PLA
MOT1 MOT 0.8000 200.0 SUB 2
MOT2 MOT 0.8000 200.0 SUB 2
MOT3 MOT 0.8000 200.0 SUB 2
G1 GEN 49.5000 100.0 EMERG-G
G2 GEN 49.5000 100.0 EMERG-G
OPTIONS:
REDISPLAY
HELP
RETURN
SYSTEM BASE MVA= 100.0
Press:
D select item from Drawing
Any other to enter data
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Figure 4.12

4.5.4 LINE DATA 1

RESIST-PU : Positive sequence resistance of circuit in pu.

REACT-PU : Positive sequence reactance of circuit in pu.

SUSC-PU : Positive sequence shunt susceptance of line circuit in pu.

ZSQ-R-PU : Zero sequence resistance of circuit in pu.

ZSQ-X-PU : Zero sequence reactance of circuit in pu.

NOTES:

1 Per-unit values must be based on the chosen system MVA base. This can be specified in the ANALYSIS PARAMETERS. The default value is 1OO MVA.Altering the value of the system base does not change any impedance figures, which may have already been entered.

2 Negative sequence values are assumed to be equal to the positive sequence values.

3 Zero sequence values are used only in earth fault calculations.

4 A susceptance value is not accepted for shunt connections.

5 Shunt connections are indicated by sending and receiving busbar names being the same. Following rules applies:

If REACT PU is bigger than 0.2 pu reactor will be assumed
If REACT PU is -minus capacitor will be assumed
If RESIST PU is positive and REACT PU is zero resistance will be assumed
If RESIST.PU is negative surge arrestor will be assumed
If REACT.PU is very big and ZSQ-X-PU is small zigzag grounding will be assumed

6 Any values left blank are assumed to be zero, but if both R and X are blank (i.e zero), in either sequence network, then it is assumed that there is no connection in that sequence network (ie the line impedance is infinite). If both R and X are blank in both sequence networks then an error will be indicated if any calculation is attempted.

7 Where an in-line transformer (or reactor etc) and its feeder are drawn in series, without drawing an intermediate busbar or junction, a single combined entry is provided in "LINE DATA 1" and, therefore, the combined impedance values must be entered.

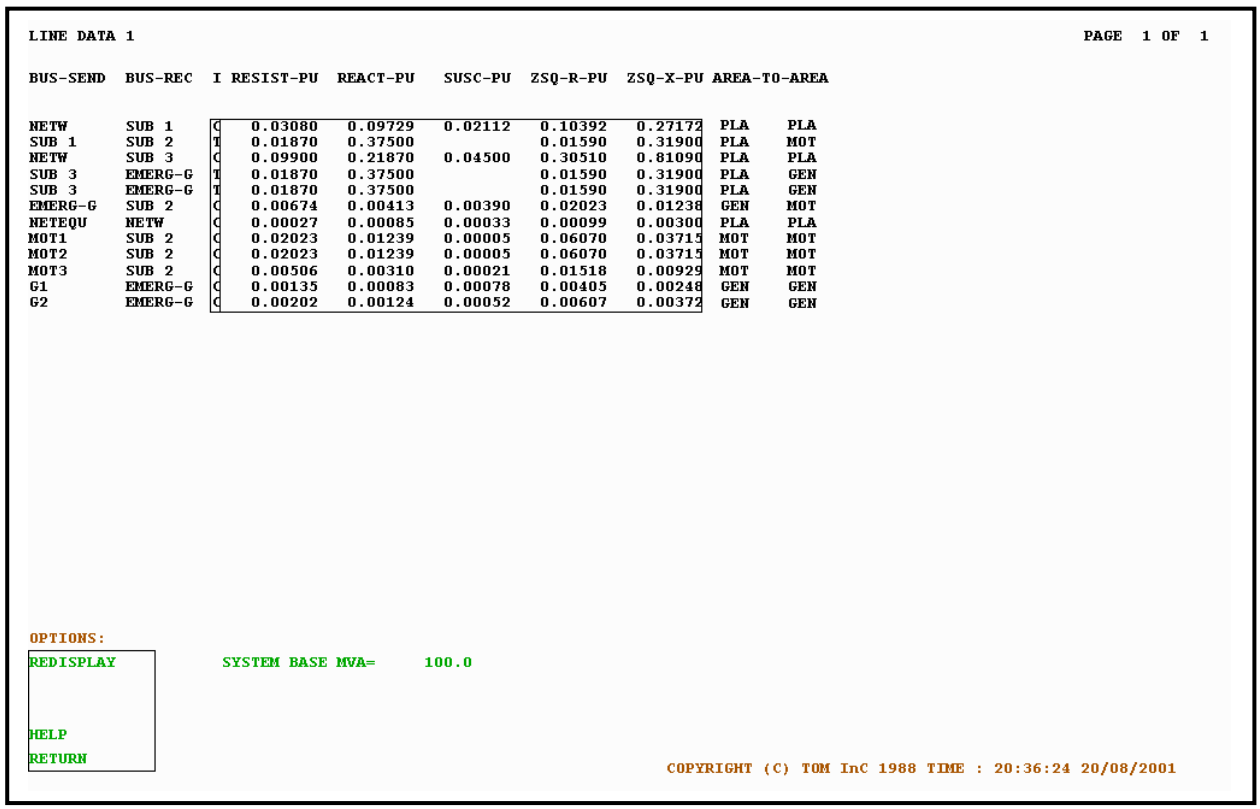
LINE DATA 1
PAGE 1 OF 1
BUS-SEND BUS-REC I RESIST-PU REACT-PU SUSC-PU ZSQ-R-PU ZSQ-X-PU AREA-TO-AREA
NETW SUB 1 0 0.03080 0.09729 0.02112 0.10392 0.27172 PLA PLA
SUB 1 SUB 2 1 0.01870 0.37500 0.01590 0.31900 PLA MOT
NETW SUB 3 0 0.09900 0.21870 0.04500 0.30510 0.81090 PLA PLA
SUB 3 EMERG-G 1 0.01870 0.37500 0.01590 0.31900 PLA GEN
SUB 3 EMERG-G 1 0.01870 0.37500 0.01590 0.31900 PLA GEN
EMERG-G SUB 2 0 0.00674 0.00413 0.00390 0.02023 0.01238 GEN MOT
NETEQU NETW 0 0.00027 0.00085 0.00033 0.00099 0.00300 PLA PLA
MOT1 SUB 2 0 0.02023 0.01239 0.00005 0.06070 0.03715 MOT MOT
MOT2 SUB 2 0 0.02023 0.01239 0.00005 0.06070 0.03715 MOT MOT
MOT3 SUB 2 0 0.00506 0.00310 0.00021 0.01518 0.00929 MOT MOT
G1 EMERG-G 0 0.00135 0.00083 0.00078 0.00405 0.00248 GEN GEN
G2 EMERG-G 0 0.00202 0.00124 0.00052 0.00607 0.00372 GEN GEN
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
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Figure 4.13

4.5.6 LINE DATA 2

RAT-MVA : Circuit rating in MVA. Enter ratings for circuits on which overload checks are required. An infinite capacity is assumed where a zero entry or no entry is made. Circuits found to be on overload have their power flow indicated by a triple arrowhead in the loadflow displays and are listed separately in the FULL LIST output.

STATUS : Circuit status, used to introduce any switching operations, particularly for transient stability studies. Enter a zero (or leave blank), +1 or -1 to specify one of the following three switching modes:-

O : normal circuit operation, no switching required.

+1 : circuit initially switched in, to be disconnected at time SW-TIM1 and reconnected at time SW-TIM2.

-1 : circuit initially disconnected, to be switched in at time SW-TIM1 and disconnected again at time SW-TIM2.

SW-TIM1 : Time of first switching operation, on this circuit, in sec.

SW-TIM2 : Time of second switching operation, on this circuit, in sec.

MONIT.? : Enter a +1 to specify this line for monitoring in the transient stability result files and plotting. The lines containing relays significant action automatically will be monitored.

NOTES:

1 Any suitable switching times can be specified as the stability program adjusts the step length automatically, to accommodate switching times.

2 Short circuit faults can be initiated during a transient stability study by introducing one or more shunts, at the appropriate busbar(s), in the system diagram, and then entering the fault impedance value as the positive sequence impedance, a -1 STATUS and the appropriate fault incidence and clearance times in SW-TIM1 and SW-TIM2, in the line entries created by the insertion of the shunt(s).

3 Arc furnaces switching will be done automatically by setting the associated control box in drawing in or out.

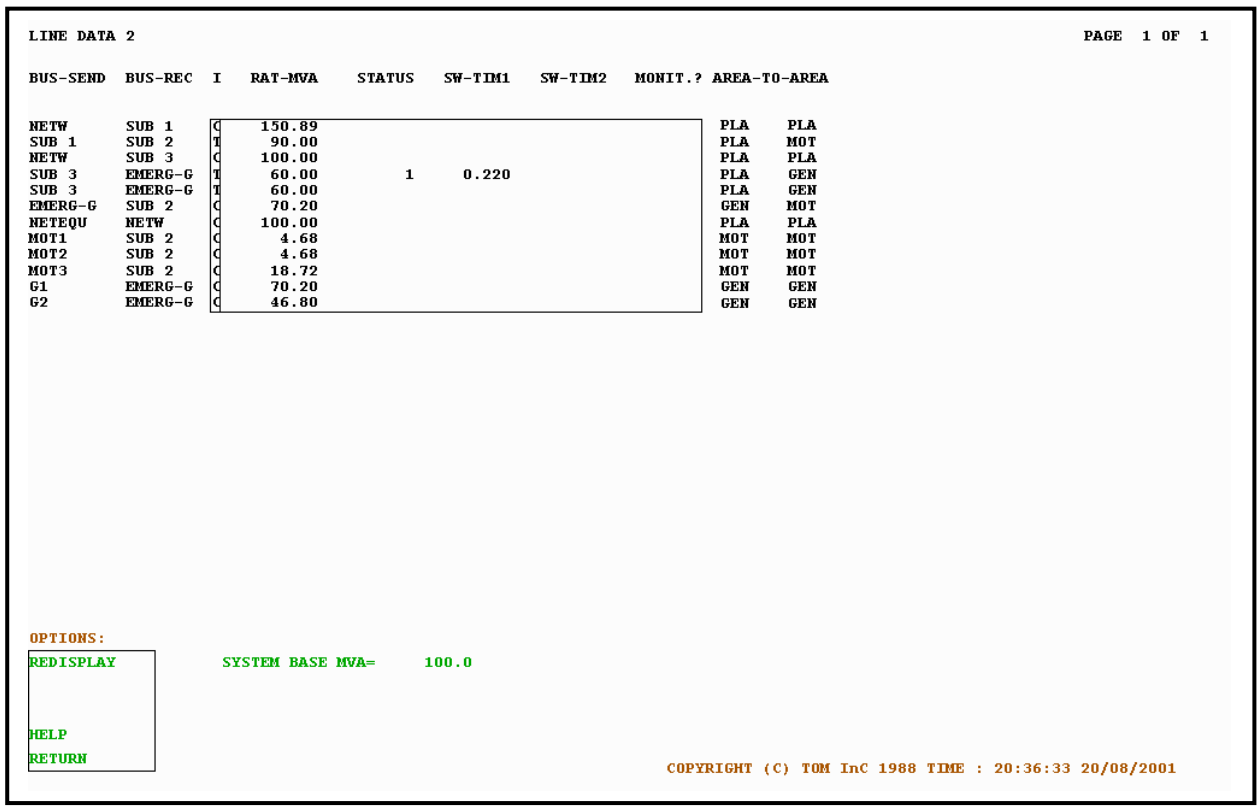
LINE DATA 2
PAGE 1 OF 1
BUS-SEND BUS-REC I RAT-MVA STATUS SW-TIM1 SW-TIM2 MONIT.? AREA-TO-AREA
NETW SUB 1 C 150.89 PLA PLA
SUB 1 SUB 2 T 90.00 PLA MOT
NETW SUB 3 C 100.00 PLA PLA
SUB 3 EMERG-G T 60.00 1 0.220 PLA GEN
SUB 3 EMERG-G T 60.00 PLA GEN
EMERG-G SUB 2 C 70.20 GEN MOT
NETEQU NETW C 100.00 PLA PLA
MOT1 SUB 2 C 4.68 MOT MOT
MOT2 SUB 2 C 4.68 MOT MOT
MOT3 SUB 2 C 18.72 MOT MOT
G1 EMERG-G C 70.20 GEN GEN
G2 EMERG-G C 46.80 GEN GEN
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
COPYRIGHT (C) TOM InC 1988 TIME : 20:36:33 20/08/2001

Figure 4.14

4.5.7 LINE DATA 4,5 phase and earth overcurrent relays

Please refer to Chapter 11.

4.5.8 LINE DATA 6 circuit breakers and overload protection

Please refer to chapter 15.

4.5.9 TRANSFORMER DATA 1

TAP-START : Initial tap position in percent off nominal. Value can be positive, negative or zero (blank).
MIN- TAP : Minimum tap position in percent off nominal. Will normally have a negative value (or zero if left blank).
TAP-STEP : Tap changer increments in percent of nominal. Will be assigned the minimum value of O.01 percent if left blank.
MAX-TAP : Maximum tap position in percent off nominal. Will normally have a positive value (or zero if left blank).
V-SPEC : The absolute value specifies the target voltage in pu. The sign determines which busbar will be controlled:-

- A positive value applies control on the receiving busbar.
- A negative value applies control on the sending busbar.

NOTES:

1 Taps are always assumed to be at the sending end.
2 For fixed tap operation specify TAP-START only.
3 For voltage control by automatic tap changing specify voltage, with appropriate sign, and the tapping range details. The TAP-START value is optional but if a value is entered which is outside the tapping range, the TAP-START entry is used as the limit.
4 If the absolute value of V-SPEC is less than 0.5 pu voltage control is abandoned and fixed tap operation is assumed.
5 The transformer positive sequence and, where appropriate, zero sequence impedance values must be entered in the "LINE DATA 1" pages.
6 When the zero sequence data is omitted it is assumed that no path exists.

P H A S E S H I F T I N G

TAP-START : Initial tap position in degree off nominal. Value can be positive, negative (or zero if left blank).
MIN- TAP : Minimum tap position in degree off nominal. Will normally have a negative value (or zero if left blank).
TAP-STEP : Tap changer increments in degree of nominal. Will be assigned the minimum value of O.0001 degree if left blank. If less than -0.00001 Target will be receiving end. See P-SPEC
MAX-TAP : Maximum tap position in degree off nominal. Will normally have a positive value (or zero if left blank).
P-SPEC : The absolute value specifies the target active power in MW. The sign determines the direction of power. The TAP-STEP sign determines which busbar will be controlled:-

- A positive value applies control on the sending busbar.
- A negative value applies control on the receiving busbar.

NOTES:

1 Taps are always assumed to be at the sending end.
2 For fixed tap operation specify TAP-START only.
3 For voltage control by automatic tap changing specify voltage, with appropriate sign, and the tapping range details. The TAP-START value is optional but if a value is entered which is outside the tapping range, the TAP-START entry is used as the limit.
4 If absolute value of P-SPEC is less than 0.5 MW active power control is abandoned and fixed tap operation is assumed.

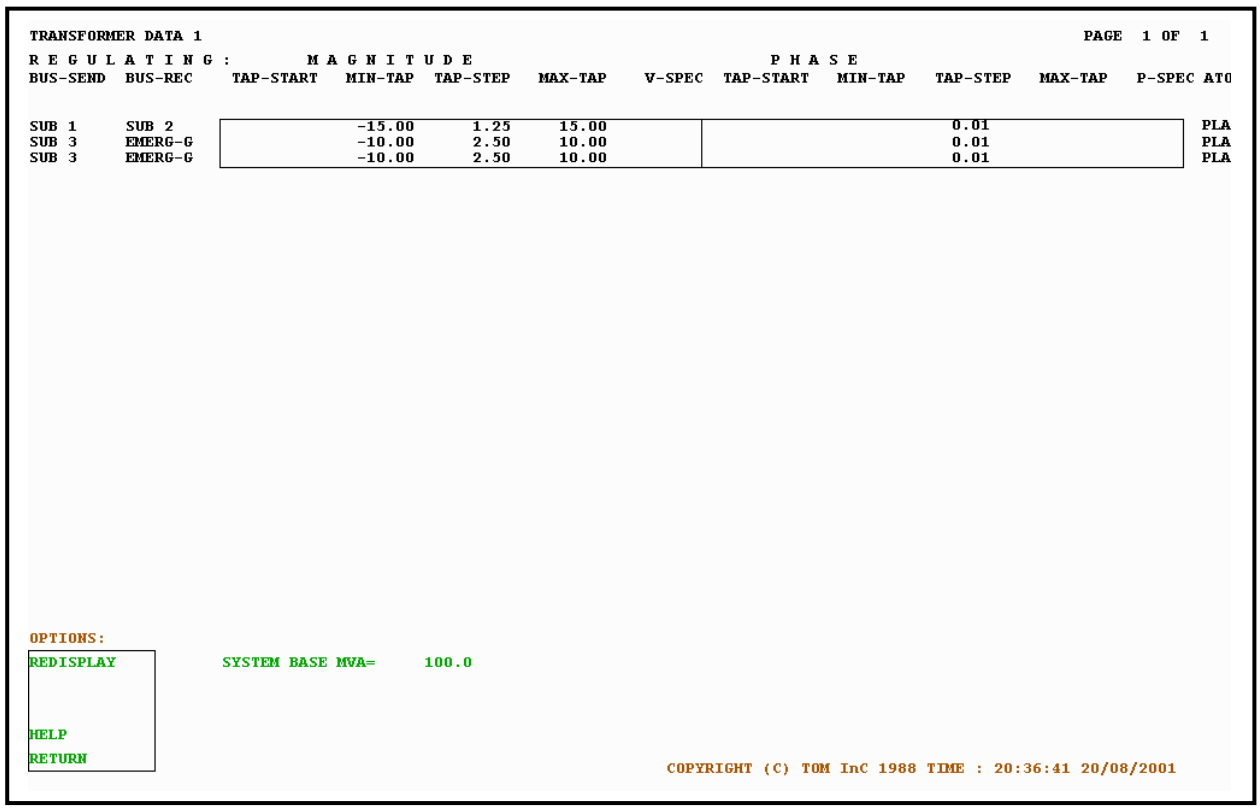
TRANSFORMER DATA 1
PAGE 1 OF 1
REGULATING: MAGNITUDE PHASE
BUS-SEND BUS-REC TAP-START MIN-TAP TAP-STEP MAX-TAP V-SPEC TAP-START MIN-TAP TAP-STEP MAX-TAP P-SPEC ATC
SUB 1 SUB 2 -15.00 1.25 15.00 0.01 PLA
SUB 3 EMERG-G -10.00 2.50 10.00 0.01 PLA
SUB 3 EMERG-G -10.00 2.50 10.00 0.01 PLA
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
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Figure 4.15

4.5.10TRANSFORMER DATA 2

WNDG-CON: Transformer winding connections entered by specifying: sending winding connection - receiving winding connection phase shift. Enter D for a delta, Y for a star or X for an earthed star winding and 0-11 to specify the phase shift. The following combinations are acceptable: XX0,YY0, DD0, XY0, YX0, DX1, DY1, XD1, YD1, DX11,DY11,XD11,YD11

RLY-BW : Bandwidth of the voltage sensing relay in percent. Defaults to the tap-step, if no entry is made, or if a value lower than the tap-step is entered.

COMP-R : Resistance value of line drop compensation, in percent.

COMP-X : Reactance value of line drop compensation, in percent value if negative reactance compounding is required.

VARTIO : Ratio of change of the voltage of transformer to the base voltage selected for the terminals of that transformer. Please refer to the PASHA manual.

DX/DTAP : Ratio of change in transformer reactance to change in tap e.g. if the transformer reactance decrease by 1% for each 2% increase in tap value then DX/DTAP = - 0.5.

Notes:

1 The winding connections are used in the fault level calculations to determine the phase values of the fault currents. Phase shifts are neglected in the loadflow calculations.

2 If no winding connection is entered, a star-star connected transformer is assumed with the question of earthing determined by the presence or absence of a zero sequence impedance value for the circuit.

3 The phase angle is specified in terms of the clock position, i.e. O=no shift, 1=30ø, 2=60ø etc. i.e: for YD11 voltage on D side leads voltage on Y side 30ø for positive sequence networks.

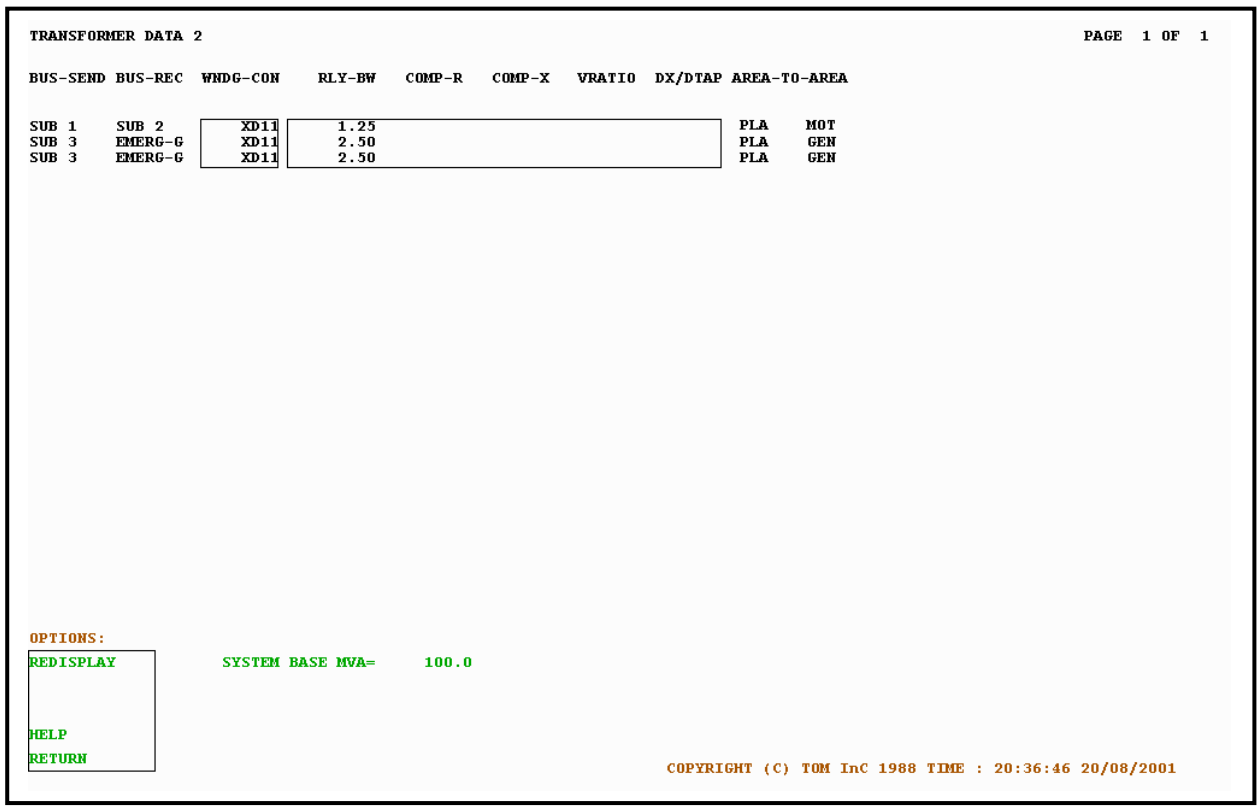
TRANSFORMER DATA 2
PAGE 1 OF 1
BUS-SEND BUS-REC WNDG-CON RLY-BW COMP-R COMP-X VRATIO DX/DTAP AREA-TO-AREA
SUB 1 SUB 2 XD11 1.25 PLA MOT
SUB 3 EMERG-G XD11 2.50 PLA GEN
SUB 3 EMERG-G XD11 2.50 PLA GEN
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
COPYRIGHT (C) TOM InC 1988 TIME : 20:36:46 20/08/2001

Figure 4.16

4.5.11 GENERATOR DATA 1

ID : Machine identifier. Any keyboard character may be entered, when required, and is subsequently displayed on the diagrams.

VOLT-PU : Machine busbar voltage magnitude in pu. See note 2.

GEN-MW : Generated MW. Use negative values for synchronous motors.

GEN-MVAR : Generated MVAR. Use negative values for consumed MVAR.

RES-PU : Positive sequence or armature resistance in pu.

REAC-PU : Positive sequence or d-axis synchronous reactance in pu. See notes 3 and 4.

ZSQ-R-PU : Zero sequence resistance in pu.

ZSQ-X-PU : Zero sequence reactance in pu. See note 3.

INERT-C : Inertia constant in KWs/KVA. Defaults to infinity.

DAMP-FAC : Damping factor in pu.

POTIER-X : Potier reactance in pu. Required only if SAT-FAC is entered Defaults to 0.8 x transient reactance value.

SAT-FAC : Saturation factor (the pu value of field current required to generate 1.2 pu V on OC). Defaults to no saturation.

NOTES:

1 Per-unit impedances must be based on the chosen system MVA base.

2 GEN-MW and either VOLT-PU or GEN-MVAR entries are required for loadflow studies. Further details in LOADFLOW HELP.

3 For basic fault level calculations enter the appropriate positive sequence impedance. For faults involving ground, zero sequence impedance values must also be entered wherever zero sequence paths exist.

4 To calculate time varying fault currents and for transient stability enter armature resistance and synchronous reactance in RES-PU and REAC-PU and additional data in GENERATOR DATA 2.

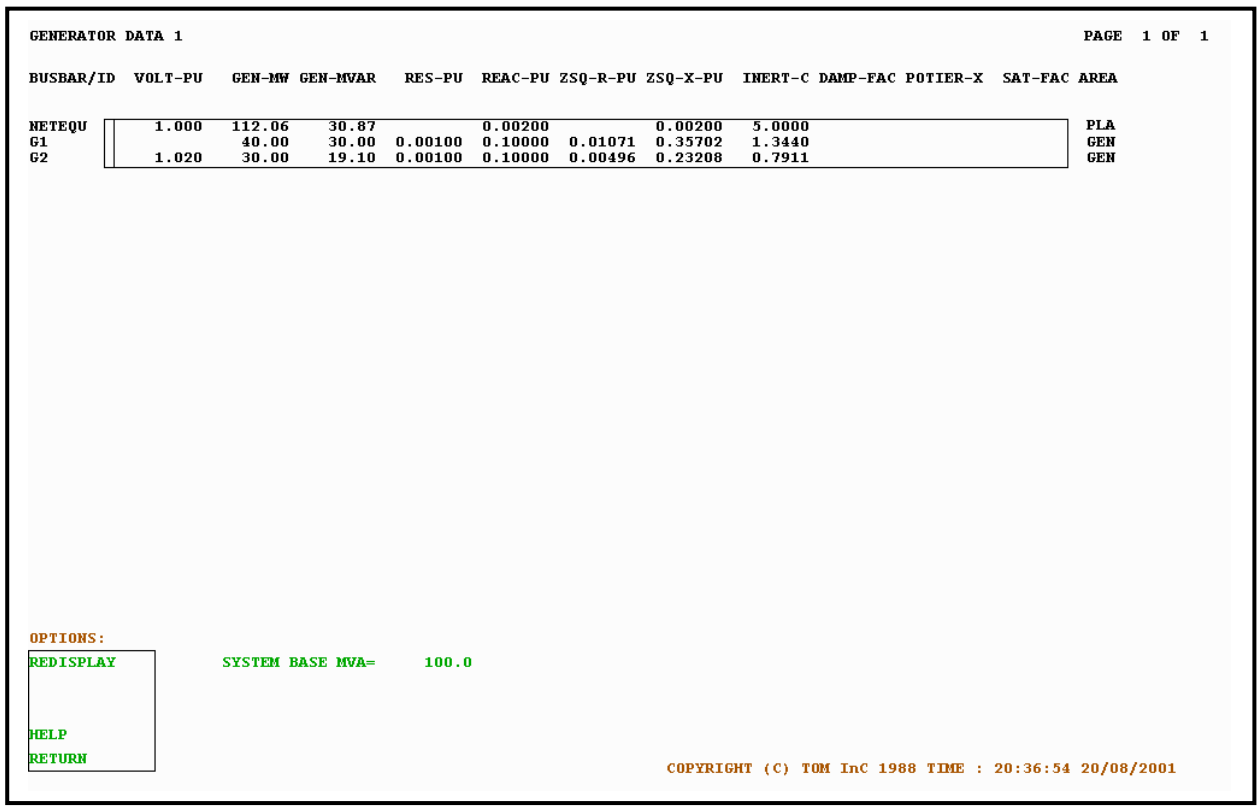
GENERATOR DATA 1
PAGE 1 OF 1
BUSBAR/ID VOLT-PU GEN-MW GEN-MVAR RES-PU REAC-PU ZSQ-R-PU ZSQ-X-PU INERT-C DAMP-FAC POTIER-X SAT-FAC AREA
METEQU 1.000 112.06 30.87 0.00200 0.00200 5.0000 PLA
G1 40.00 30.00 0.00100 0.10000 0.01071 0.35702 1.3440 GEN
G2 1.020 30.00 19.10 0.00100 0.10000 0.00496 0.23208 0.7911 GEN
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
COPYRIGHT (C) TOM InC 1988 TIME : 20:36:54 20/08/2001

Figure 4.17

4.5.12 GENERATOR DATA 2

ID : Machine identifier. Any keyboard character may be entered. when required, and is subsequently displayed on the diagrams.

STATE : Machine status. Enter -1 to exclude machine from studies but retains the machine data on file.

DA-TR-X : d-axis transient reactance in pu.

DA-TR-TC : d-axis transient open-circuit time constant in sec.

DA-ST-X : d-axis subtransient reactance in pu.

DA-ST-TC : d-axis subtransient open-circuit time constant in sec.

QA-SYN-X : q-axis synchronous reactance in pu.

QA-TR-X : q-axis transient reactance in pu.

QA-TR-TC : q-axis transient open-circuit time constant in sec.

QA-ST-X : q-axis subtransient reactance in pu.

QA-ST-TC : q-axis subtransient open-circuit time constant in sec.

NOTES:

1 All four d-axis parameters and the q-axis subtransient reactance values are required to permit fault currents to be calculated using a double exponential ac component decay and a single exponential dc component. If the q-axis parameter is omitted it is assumed to be equal to the d-axis value. A single exponential ac decay is used if subtransient values are omitted. Further details in FAULT LEVEL HELP.

2 For transient stability studies the basic E behind X model is used if the d-axis transient reactance only is entered. Three stages of improved representation are reached when the d-axis transient, q-axis transient and, finally, the subtransient parameters are entered. Further details in TRANSIENT STABILITY HELP.

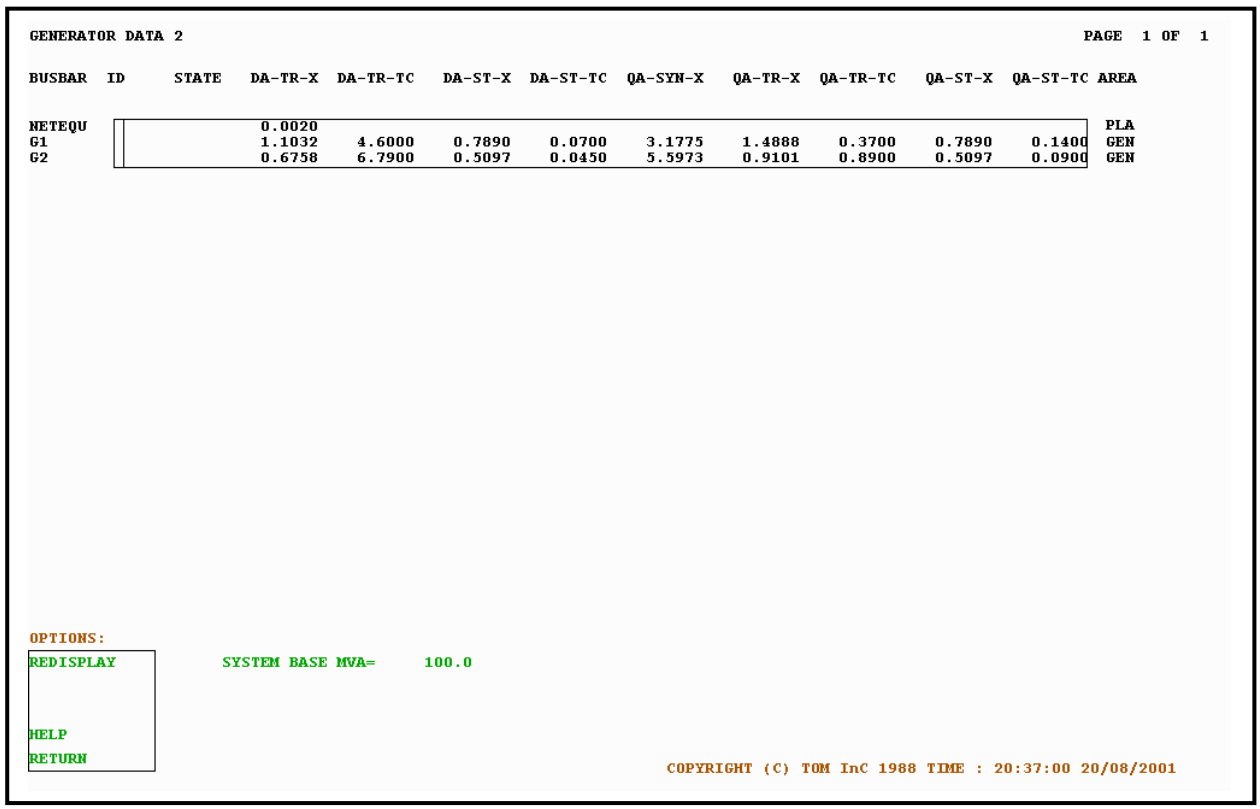
GENERATOR DATA 2
PAGE 1 OF 1
BUSBAR ID STATE DA-TR-X DA-TR-TC DA-ST-X DA-ST-TC QA-SYN-X QA-TR-X QA-TR-TC QA-ST-X QA-ST-TC AREA
METEQU 0.0020 PLA
G1 1.1032 4.6000 0.7890 0.0700 3.1775 1.4888 0.3700 0.7890 0.1400 GEN
G2 0.6758 6.7900 0.5097 0.0450 5.5973 0.9101 0.8900 0.5097 0.0900 GEN
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
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Figure 4.18

4.5.13 GENERATOR DATA 4 -Optimal Power Flow limits

ID : Machine identifier. Any keyboard character may be entered when required, and is subsequently displayed on the diagrams.

MW-MIN : Minimum active power output.

MW-MAX : Maximum active power output.

COST $: The cost function is represented as a quadratic function:

$$A*P^2 +B*P+C$$

This is the value of C. If you want to increase the order please call us. The OPF routines accept functions up to order 6.

COST $/MW : The value of B

COST $/MW2: The value of A

MIN-IF : Minimum field current (at present time not used in studies)

MAX-IF : Maximum field current

SPARE : Spare (not used)

SPARE : Spare (not used)

NOTES:

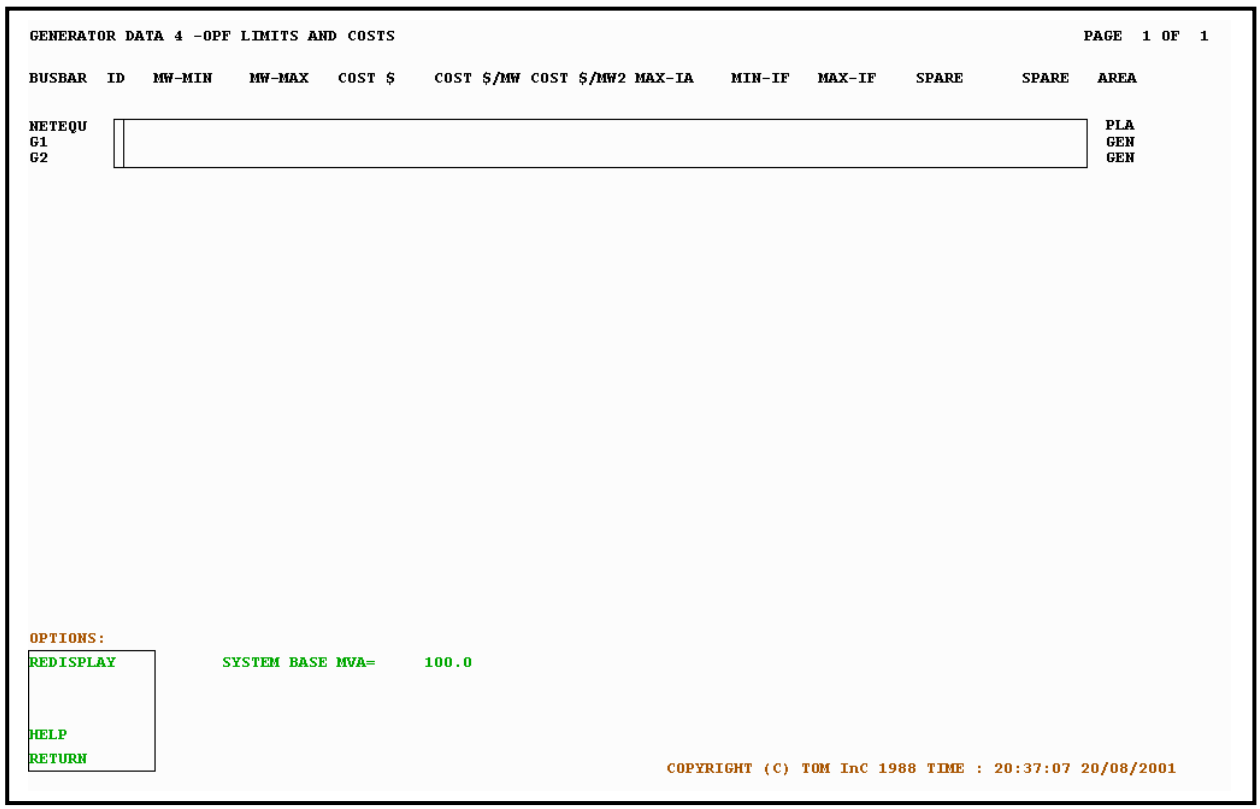
GENERATOR DATA 4 -OPF LIMITS AND COSTS
PAGE 1 OF 1
BUSBAR ID MW-MIN MW-MAX COST $ COST $/MW COST $/MW2 MAX-IA MIN-IF MAX-IF SPARE SPARE AREA
METEQU
G1
G2
PLA
GEN
GEN
OPTIONS:
REDISPLAY
HELP
RETURN
SYSTEM BASE MVA= 100.0
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Figure 4.19

4.5.14 AVR DATA 1

ID : Machine identifier. Any keyboard character may be entered, when required, and is subsequently displayed on the diagrams.

UDEM-TYP : ID code of UDEM AVR, if zero or blank the old version is used instead.

CTRL-BAR : Name of busbar controlled by AVR.

FW-GAIN ; Forward gain Ka in pu.

FW-TC : Forward time constant Ta in sec.

FB-GAIN : Feedback gain Kf in pu.

FB-TC : Feedback time constant Tf in sec.

V-MAX : Maximum regulator voltage limit Vmax in pu.

V-MIN : Minimum regulator voltage limit Vmin in pu.

V-RATE : Rate of change of regulator voltage in pu V/sec

IP-F-TC : Input filter time constant Tr in sec.

NOTES:

1 The new version of the TRANSIENT STABILITY section of the program now supports UDEM controllers, to use them simply enter the UDEM ID code in the UDEM-TYP box. Information on usage of the UDEM can be obtained by accessing the UDEM help pages. You may also type "F" to see the list of UDEM saved before and choose UDEM type you wish to use.

2 The gains, forward and feedback time constants, and voltage limits in the AVR DATA 1 pages refer to the regulator amplifier and stabilizing loop of the full model. However, if no data is entered in AVR DATA 2 the model reduces to a single loop and values entered must represent the combined regulator/exciter characteristics.

3 Entries of "AVR DATA 1" parameters only, results in a simplified IEEE type 1 model with a combined regulator/exciter and no saturation.

AVR DATA 1 PAGE 1 OF 1

BUSBAR	ID	UDEM-TYP	CTRL-BAR	FW-GAIN	FW-TC	FB-GAIN	FB-TC	V-MAX	V-MIN	V-RATE	IP-F-TC
METEQU				400.0000	0.0200	0.0300	1.0000	8.2000	-8.2000		
G1				180.0000	1.0000	0.1500	1.0000	3.0000	-3.0000		
G2				180.0000	1.0000	0.1500	1.0000	3.0000	-3.0000		

OPTIONS:
REDISPLAY
HELP
RETURN
SYSTEM BASE MVA= 100.0
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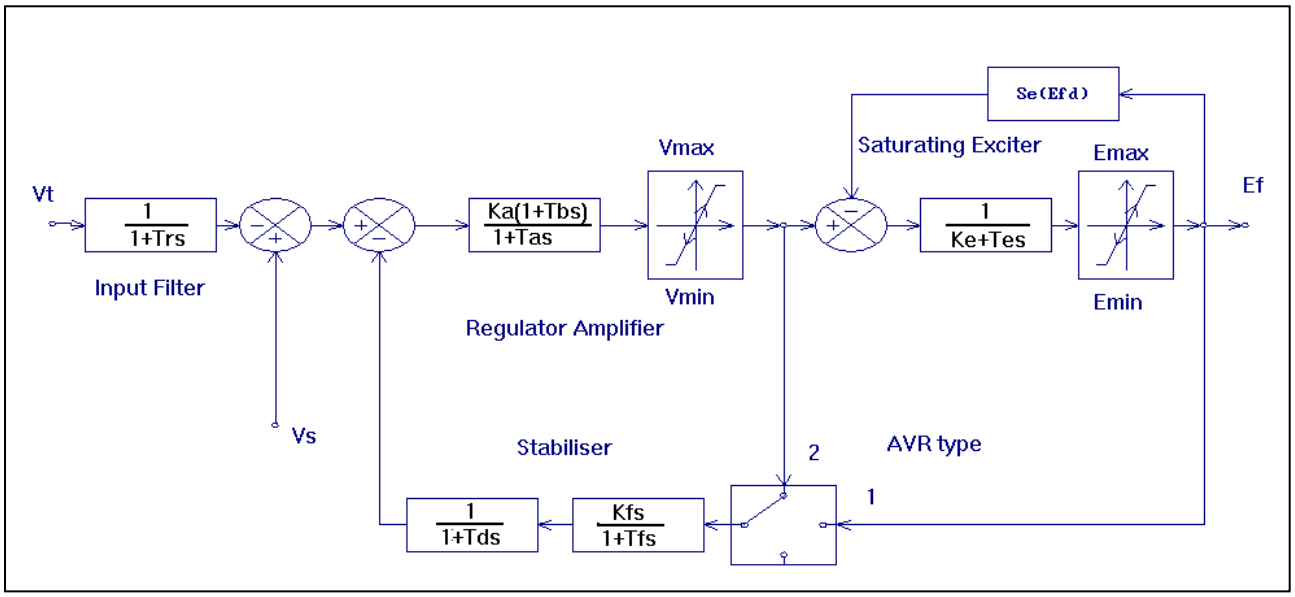
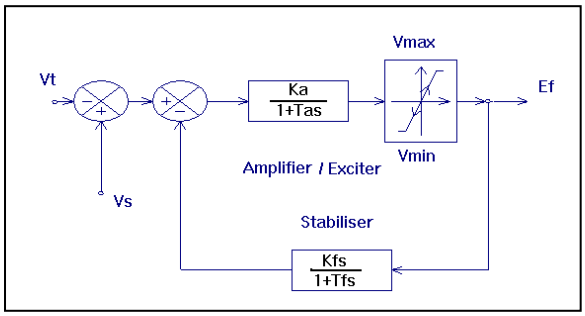
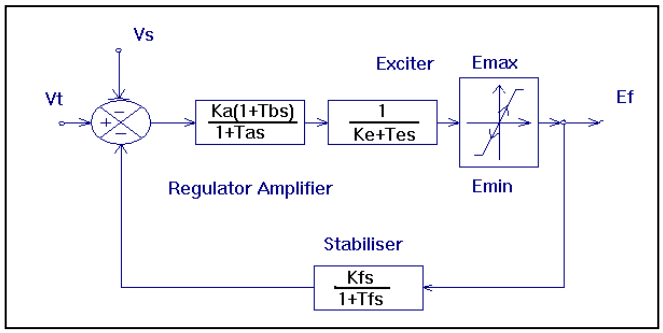
Figure 4.20

Composite, Stage 1, and Stage 2 IEEE AVR model







4.5.15 AVR DATA 2

ID : Machine identifier. Any keyboard character may be entered, when required, and is subsequently displayed on the diagrams.

IEEE-MOD : IEEE model. Enter a blank, 1 or 2.

EX-GAIN : Exciter gain Ke in pu.

EX-TC : Exciter time constant Te in sec.

EX-E-MAX : Exciter ceiling voltage Emax in pu.

EX-E-MIN : Exciter minimum voltage Emin in pu.

REG-TC : Regulator amplifier time constant Tb in sec.

FB-AMP-TC: Feedback amplifier time constant Td in sec.

EX-SAT1 : Exciter saturation function Se at 75% of ceiling voltage.

EX-SAT2 : Exciter saturation function Se at ceiling voltage.

NOTES:

1 The "AVR DATA 1" set of parameters must be complete before the model can be improved further by making AVR DATA 2 entries. Check that any forward and feedback parameter values and voltage limits previously entered in AVR DATA 1 are for the regulator loop.

2 Enter 1 for the model type and the six exciter parameters to obtain the full IEEE type 1 model.

3 To change from the IEEE type 1 to the type 2 model, change the type number to 2 and enter the feedback amplifier time constant.

4 Enter the final time constant Tb to obtain the full model.

AVR DATA 2 PAGE 1 OF 1

BUSBAR	ID	IEEE-MOD	EX-GAIN	EX-TC	EX-E-MAX	EX-E-MIN	REG-TC FB-AMP-TC	EX-SAT1	EX-SAT2
METEQU		1	1.0000	1.3000	3.9000			0.5000	1.1000
G1		1	-.1500	2.0000	2.5500	-2.5500		0.6230	1.3270
G2		1	-.1500	2.0000	2.5500	-2.5500		0.6230	1.3270

OPTIONS:
REDISPLAY
HELP
RETURN

SYSTEM BASE MVA= 100.0

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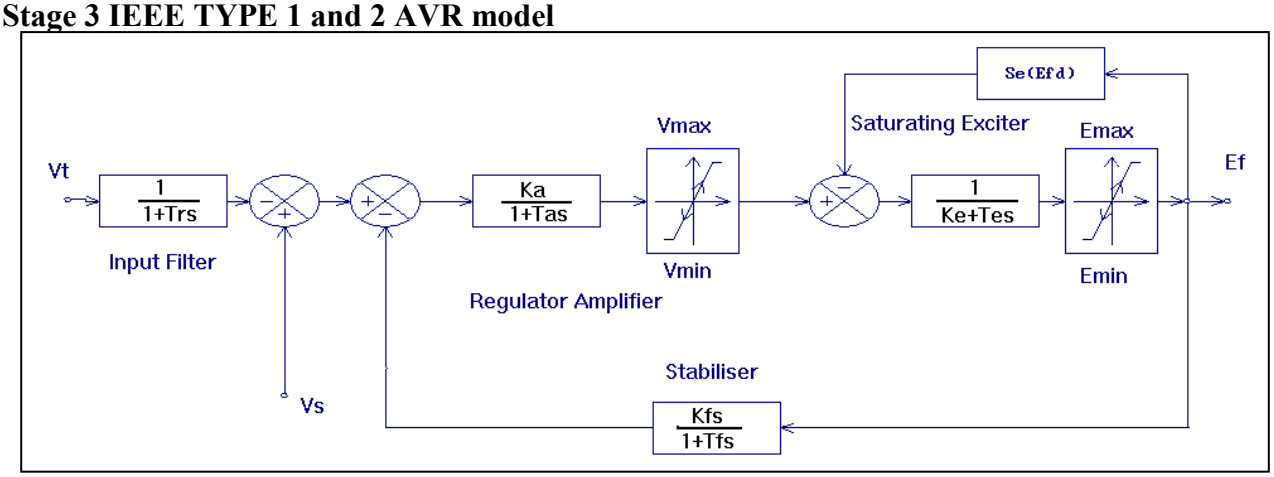
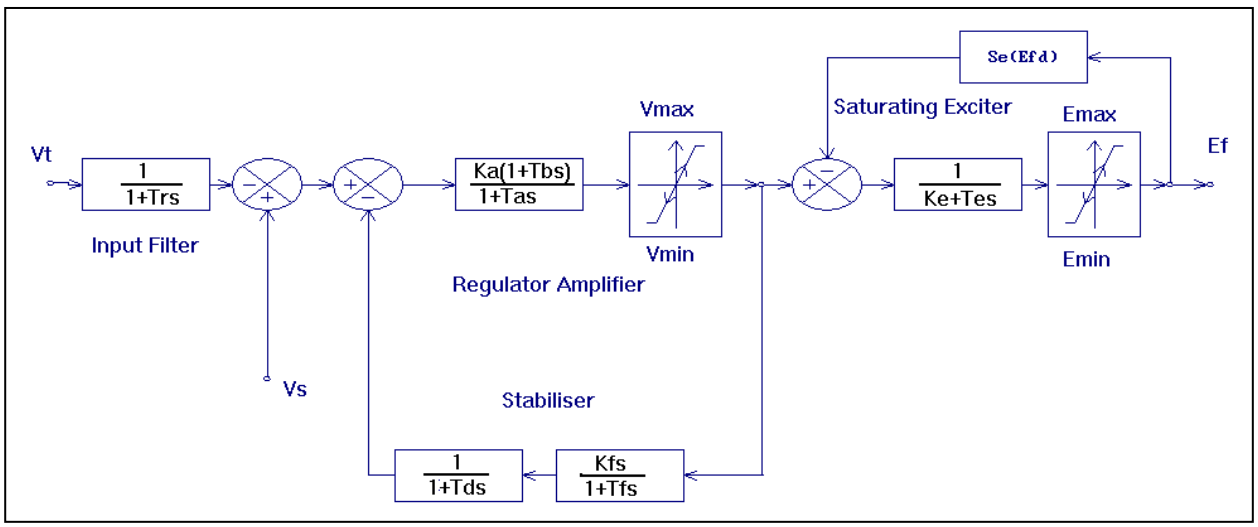
Figure 4.21

Stage 3 IEEE TYPE 1 and 2 AVR model





4.5.16 GOVERNOR AND TURBINE DATA 1

ID : Machine identifier. Any keyboard character may be entered, when required, and is subsequently displayed in the diagrams.

UDEM-TYP : Enter the UDEM ID of your governor if using UDEM governors.

G-REG : Governor regulation R. Enter as a positive number in per-unit or per-cent.

G-FLY-TC : Governor flyball time constant Tb in sec.

G-TC1 : Governor control system time constant T1 in sec.

G-TC2 : Governor control system time constant T2 in sec.

G-TC3 : Governor control system time constant T3 in sec.

T-TC1 : Turbine time constant T4 in sec.

T-TC2 : Turbine time constant T5 in sec.

MAX-T-POW: Maximum turbine power in MW.

NOTES:

1 The new version of the TRANSIENT STABILITY section of the program now supports UDEM controllers, to use them simply enter the UDEM ID code in the UDEM-TYP box. Information on usage of the UDEM can be obtained by accessing the UDEM help pages.

2 Entry of the governor regulation value is mandatory.

3 For a simple lag model of the governor enter a value for time constant T3.

4 Thermal turbine characteristics are obtained if no entry is made for the turbine time constant T4. Hydro turbine characteristics are modeled if a value is entered for the turbine time constant T4.

GOVERNOR AND TURBINE DATA 1 PAGE 1 OF 1

BUSBAR	ID	UDEM-TYP	G-REG	G-FLY-TC	G-TC1	G-TC2	G-TC3	T-TC1	T-TC2	MAX-T-POW
METEQU										
G1			7.2464		0.0900		0.2000		0.3000	55.00
G2			7.2464		0.0900		0.2000		0.3000	55.00

OPTIONS:
REDISPLAY
HELP
RETURN

SYSTEM BASE MVA= 100.0

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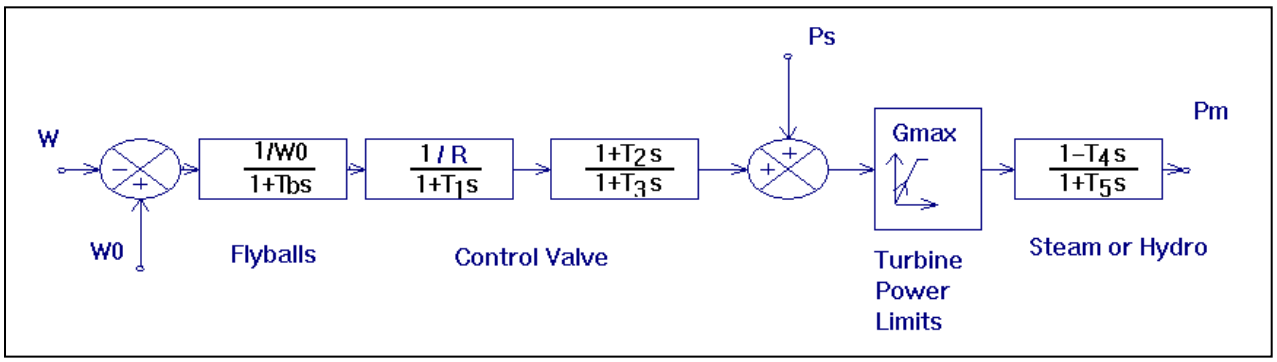
Figure 4.22

Composite steam hydro speed governor model



4.5.17 INDUCTION MOTOR DATA 1

ID : Motor identifier. Any keyboard character may be entered, when required, and is subsequently displayed on the diagrams.

PMECH-MW : Mechanical power output of motor in MW.

SLIP-PC : Normal slip for the motor in per cent. No need to enter a value as this will be calculated within the loadflow.

MAG-X : Magnetizing reactance in pu.

ST-R-PU : Stator resistance in pu.

ST-X-PU : Stator reactance in pu.

ROT-R-PU : Inner cage or running rotor resistance in pu.

ROT-X-PU : Inner cage or running rotor reactance in pu.

S-OUT-T1 : Motor switch-out time SO1 in sec.

S-IN-T1 : Motor switch-in time SI1 in sec.

S-OUT-T2 : Motor switch-out time SO2 in sec.

S-IN-T2 : Motor switch-in time SI2 in sec.

NOTES:

1 A single cage equivalent circuit is used for motors, which have no entries for ST-ROT-R and X in INDUCTION MOTOR DATA 2.

2 When two sets of rotor impedances are entered these are treated either as running - standstill, or as inner - outer cage impedances, depending on the value of PAR-IDX, and a double cage model is used.

3 Switching times should be entered only for motors which are to be switched at pre-specified times during a transient stability study.

4 Any switching times left blank, or set to zero, are disregarded. To switch a motor at time t=0+, i.e. the start of the transient stability run, enter any negative value in S-OUT-T1 or S-IN-T1.

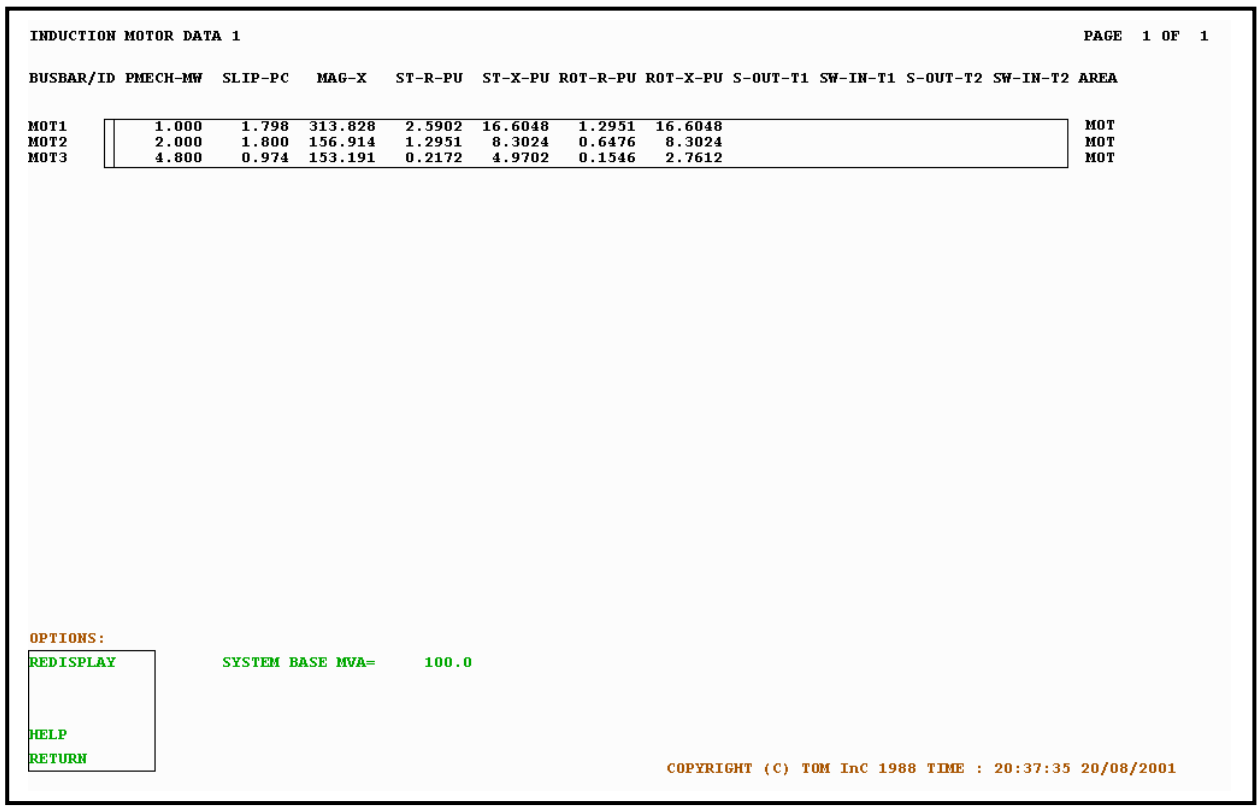

INDUCTION MOTOR DATA 1
PAGE 1 OF 1
BUSBAR/ID PMECH-MW SLIP-PC MAG-X ST-R-PU ST-X-PU ROT-R-PU ROT-X-PU S-OUT-T1 SW-IN-T1 S-OUT-T2 SW-IN-T2 AREA
MOT1 1.000 1.798 313.828 2.5902 16.6048 1.2951 16.6048 MOT
MOT2 2.000 1.800 156.914 1.2951 8.3024 0.6476 8.3024 MOT
MOT3 4.800 0.974 153.191 0.2172 4.9702 0.1546 2.7612 MOT
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
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Figure 4.23

4.5.18 INDUCTION MOTOR DATA 2

ID : Motor identifier. Any keyboard character may be entered, when necessary, and is subsequently displayed in the diagram.

STATE : Motor status. Leave blank or enter 0 for normal operation. Enter -1 to disconnect motor, and allow starting in a TS run.

PAR-IDX : The parameter index gives the type of rotor impedances used:-
- leave blank if running-standstill values are entered
- Enter 1 if inner-outer cage impedances are entered

ST-ROT-R : Outer cage or standstill rotor resistance in pu.

ST-ROT-X : Outer cage or standstill rotor reactance in pu.

TQ-SP-B : Load torque-speed coefficient B.

TQ-SP-C : Load torque-speed squared coefficient C.

INERT-C : Inertia constant in kWs/kVA.
D-OFF-V : Motor contactor drop-off voltage in pu.
DO/PU-T : Contactor drop-off to pick-up time delay in sec.
L-OUT-T : Lock-out time in sec.
UN-SPED : Underspeed setting in pu.

NOTES:

1 The following switching operations can be carried out within the transient stability section:-
- Motor(s) will be initially disconnected if a -1 is entered in STATE.
- Motor(s) will be switched out or in at any pre-specified times entered in SO1, SI1, SO2 and SI2.
- Motor(s) will be switched out when their speed drops below the value entered in UN-SPED.
- Motors will be switched out when the voltage drops below D-OFF-V and, if the voltage recovers, will be switched back in, subject to a minimum delay of DO/PU-T and a maximum recovery period L-OUT-T. Pick-up is at 0.8 pu V or at 2x(drop-off-voltage), if this is lower.

2 The load torque-speed (T-N) relationship is:- T = To.(A+B.N+C.N**2) where A =1.0 -B -C and, therefore, only B and C need be specified.

3 If ST-ROT-R is negative, starting motor will be assumed single cage and it starts with a switching resistor of this amount. In this case the magnitude of ST-ROT-X in the form AAAA.BBB becomes switching time, where AAAA is the time in sec that the resistor short circuited and BBBB is the initial elapsed time in sec.

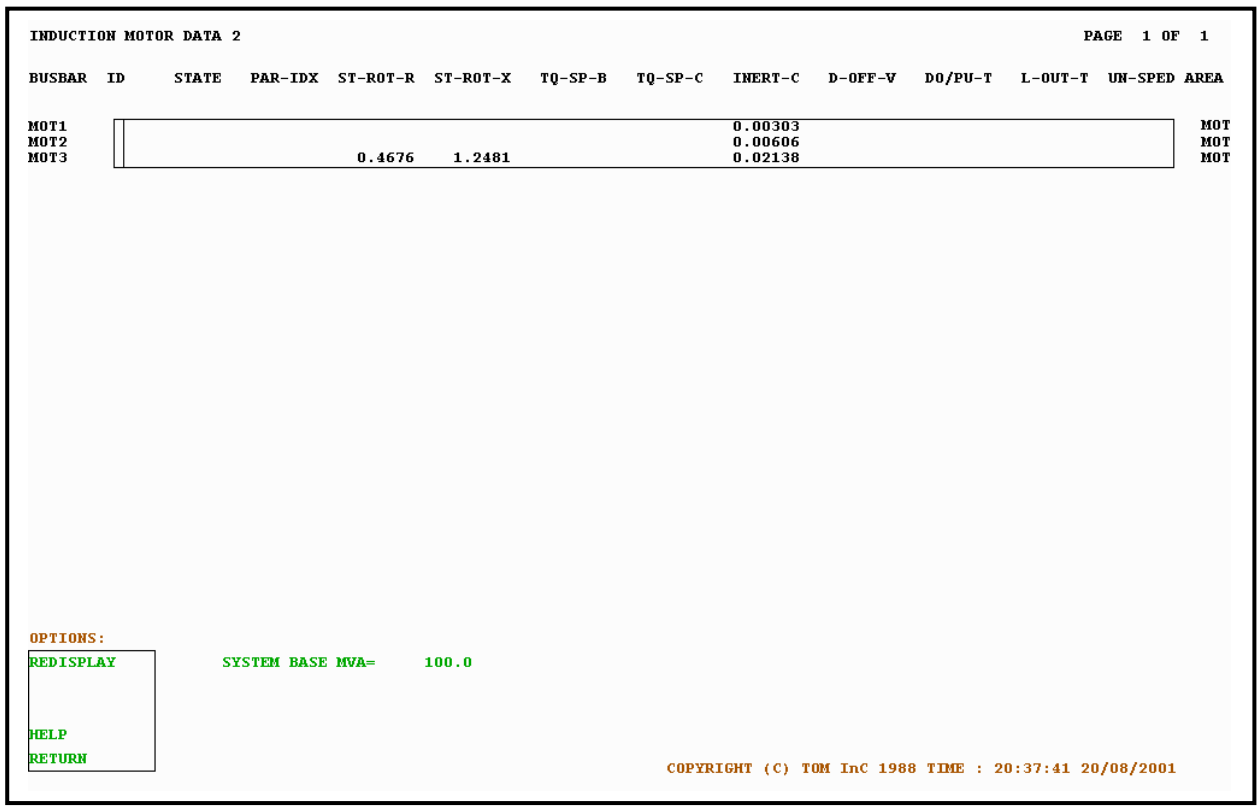
INDUCTION MOTOR DATA 2
PAGE 1 OF 1
BUSBAR ID STATE PAR-IDX ST-ROT-R ST-ROT-X TQ-SP-B TQ-SP-C INERT-C D-OFF-V DO/PU-T L-OUT-T UN-SPED AREA
MOT1 0.00303 MOT
MOT2 0.00606 MOT
MOT3 0.4676 1.2481 0.02138 MOT
OPTIONS:
REDISPLAY
SYSTEM BASE MVA= 100.0
HELP
RETURN
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Figure 4.24

4.5.19 LOAD FLOW CONTROL DATA

Entry of data on this page introduces busbar voltage and reactive power controls on the loadflow solutions. See LOADFLOW HELP and NOTES below.

CTRL-BAR : Controlling busbar name.

MIN-V-PU : Minimum busbar voltage limit in pu.

MAX-V-PU : Maximum busbar voltage limit in pu.

MIN-MVAR : Minimum reactive power limit in MVAR.

MAX-MVAR : Maximum reactive power limit in MVAR.

NOTES:

1 Enter voltage limits to impose local voltage control on a "PQ" busbar. MVAR limits may also be entered to specify the permissible variation in Q. Voltage control is abandoned when a Q limit is reached.

2 Enter a controlling busbar name and voltage limits to impose remote voltage control on a PQ busbar. Voltage is controlled by varying Q on the controlling busbar which must, therefore, be a PV busbar. The reactive power of the controlling busbar can be kept within limits by making a separate entry of Q limits to that busbar and, in that case, voltage control is abandoned when a Q limit is reached.

3 Enter MVAR limits to control Q on a PV busbar.

4 When only one limit value is entered, the other is taken to be zero.

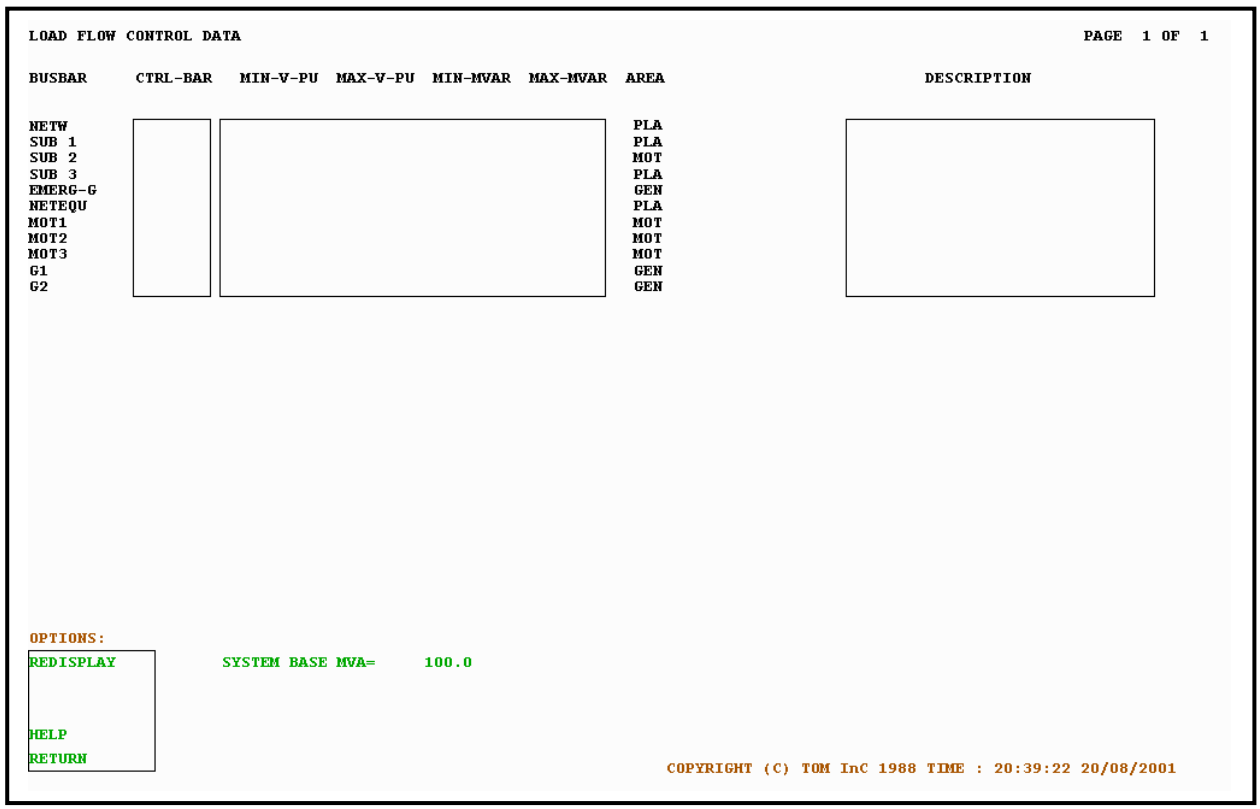
LOAD FLOW CONTROL DATA
PAGE 1 OF 1
BUSBAR
CTRL-BAR
MIN-V-PU
MAX-V-PU
MIN-MVAR
MAX-MVAR
AREA
DESCRIPTION
NETW PLA
SUB 1 PLA
SUB 2 MOT
SUB 3 PLA
EMERG-G GEN
NETEQU PLA
MOT1 MOT
MOT2 MOT
MOT3 MOT
G1 GEN
G2 GEN
OPTIONS:
REDISPLAY
HELP
RETURN
SYSTEM BASE MVA= 100.0
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Figure 4.25

4.5.20 DISTANCE & UNIT PROTECTION 1

Please refer to chapter 11.

4.5.21 Dc radial components

Please refer to chapter 17.

4.5.22 AC/DC CONVERTER DATA 1

DC-P-PMW : Active power of the static converter. A positive value indicates rectifier operation.

DC-V-PU : DC converter busbar voltage, in p.u.

AC-P-MW : Active power of the static converter considering the convention of a generator. The value displayed is the negative value of input described in DC-P-PMW.

AC-Q-MW : Reactive power generated by static converter at its terminal busbar. A positive value means that the converter is supplying that particular amount of reactive power to the AC system.

C-X-PU : Commutation reactance of the static converter. For natural or line commutated only.

OP-TAP : Converter transformer operating ratio. A pu value of 1.0 is the default value. The load flow algorithm may change this input, however, the user input is displayed.

MIN-TAP : pu minimum transformer operating ratio.

TAP-STEP : pu tap step.

MAX-TAP : pu maximum transformer operating ratio.

F-A-DG : Minimum firing angle.

DC-I-PU : Maximum DC current of the static converter.

NOTES:

1 The related values are used in harmonic studies too.

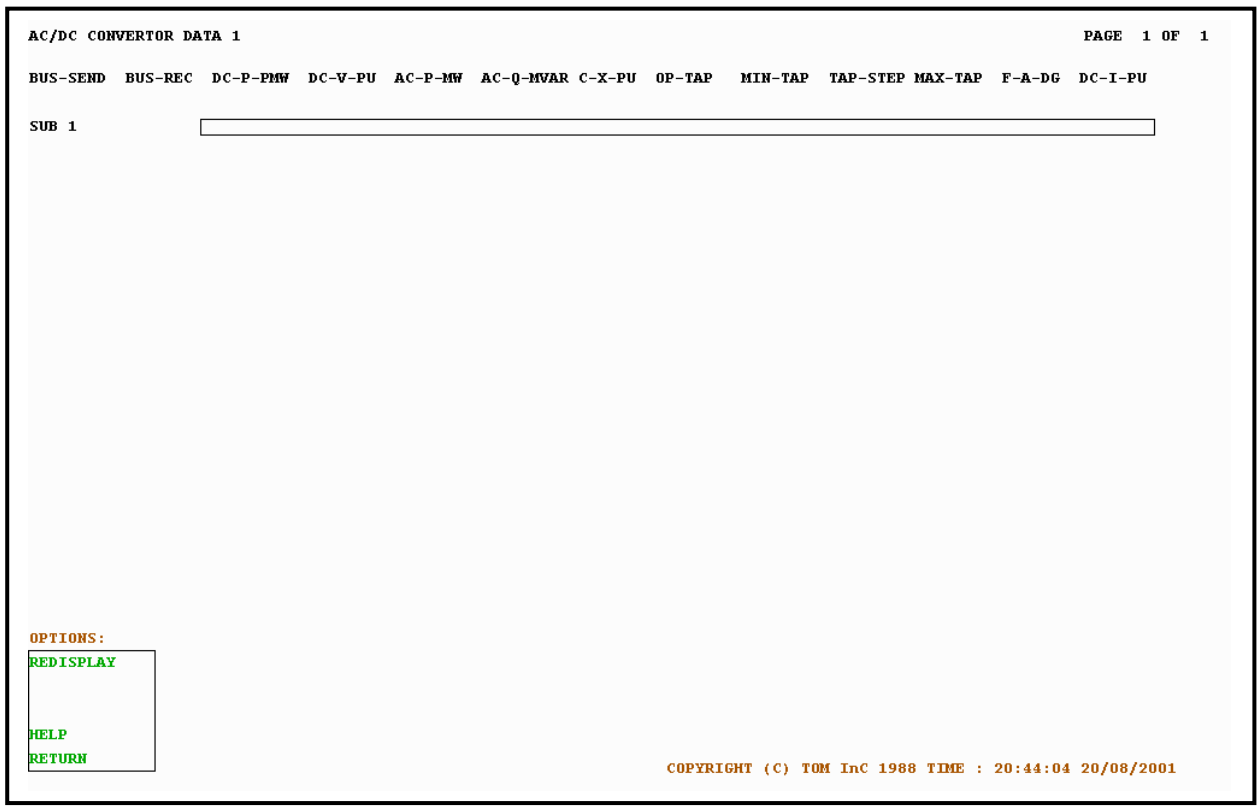
AC/DC CONVERTOR DATA 1
PAGE 1 OF 1
BUS-SEND BUS-REC DC-P-PMW DC-V-PU AC-P-MW AC-Q-MVAR C-X-PU OP-TAP MIN-TAP TAP-STEP MAX-TAP F-A-DG DC-I-PU
SUB 1
OPTIONS:
REDISPLAY
HELP
RETURN
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Figure 4.26

4.5.23 HARMONIC DATA pages 1,2,3,4,5,6

HO-i : Harmonic Order 1 to 24.

HM-i : Harmonic current magnitude, in p.u.

ANG-i : Harmonic current angle in degree.

NOTES:

1 The values are used in harmonic studies.

2 If left blank the default values for the harmonic production of the device will be used.

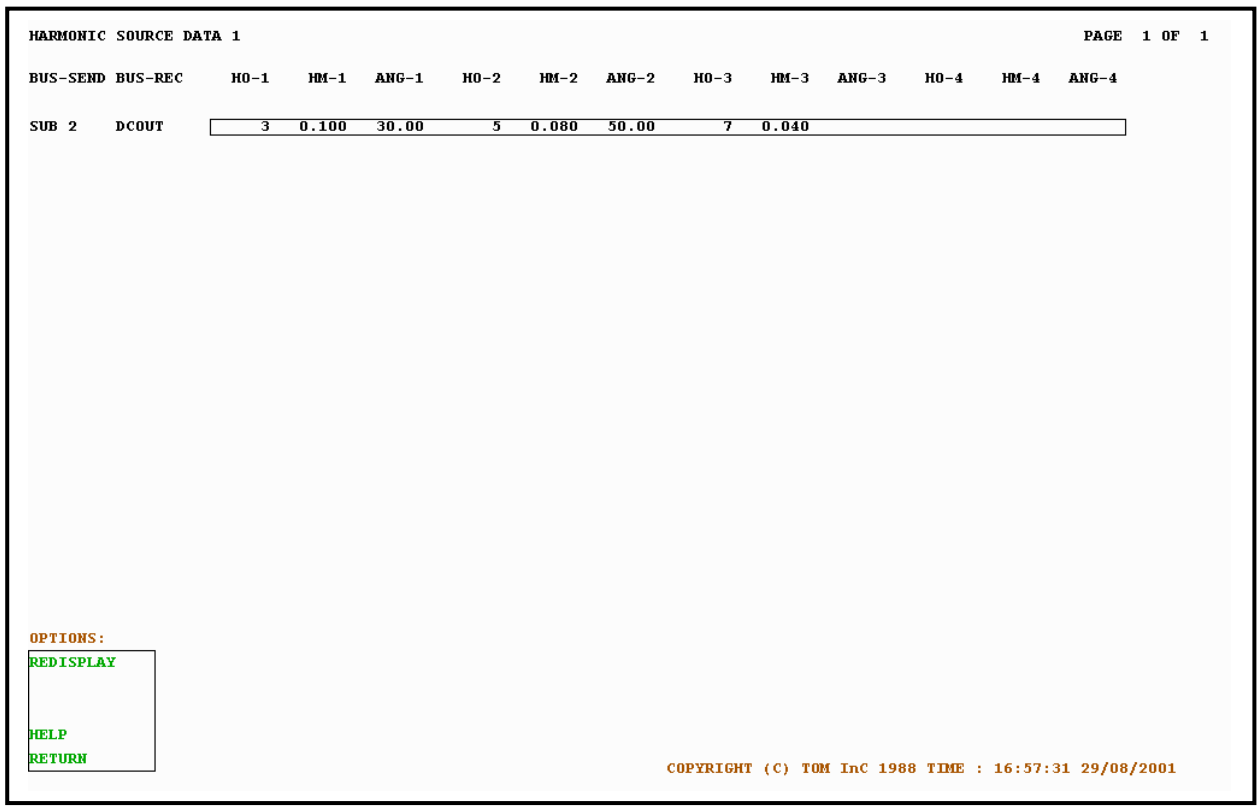
HARMONIC SOURCE DATA 1
PAGE 1 OF 1
BUS-SEND BUS-REC HO-1 HM-1 ANG-1 HO-2 HM-2 ANG-2 HO-3 HM-3 ANG-3 HO-4 HM-4 ANG-4
SUB 2 DCOUT 3 0.100 30.00 5 0.080 50.00 7 0.040
OPTIONS:
REDISPLAY
HELP
RETURN
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Figure 4.27

4.5.24 General Analysis parameters

The ANALYSIS PARAMETERS page contains all the necessary system and program control parameters and, initially, displays the default value for each parameter. These values may be changed using the normal edit procedure. It must be clear, however, that changes made in the system base MVA and frequency, do not apply any conversion to impedance values which may have been entered previously in the other data pages.

Analysis parameters are stored along with all other system data when a system is filed. The data page is shown in figure 4.29. The following information is reproduced from the on-line help file.

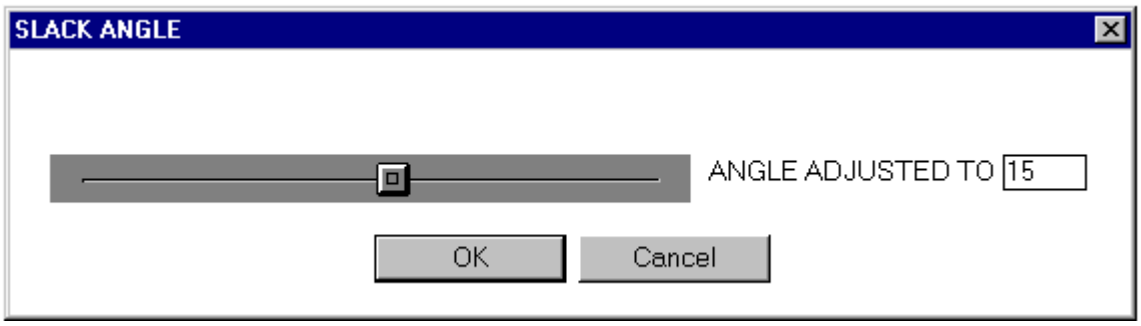
ANALYSIS PARAMETERS 1

SYSTEM BASE MVA:
May be edited to have any appropriate value but users must ensure that adjustments are also made to any impedance values previously entered in the data and based on a different system base MVA. The default value is 100 MVA.

LOADFLOW CONVERGENCE ACCURACY:
The loadflow solution converges very rapidly and, therefore, small values can be used. The default value is 0.001 MVA.

MAXIMUM LOADFLOW ITERATIONS:
Usually set to 25, but this is not critical as additional rounds of iterations can be initiated, within the loadflow section, if convergence is not achieved.

SLACK BUSBAR NO1 NO2 NO3 NO4 NO5 :
Any one of the busbars drawn in the network can be specified as the slack by entering its name here. The default selection of the slack is made as described in the LOADFLOW HELP.



For split networks slack No 2,3,4,5 can also be identified. If you have split networks there will be a warning in fault study and the study would not proceed. To do fault analysis for split networks just connect them with a fictitious line while the status of line is set to -1 i.e. the line is out. Note also that whenever you enter a slack name, the computer asks for its angle.

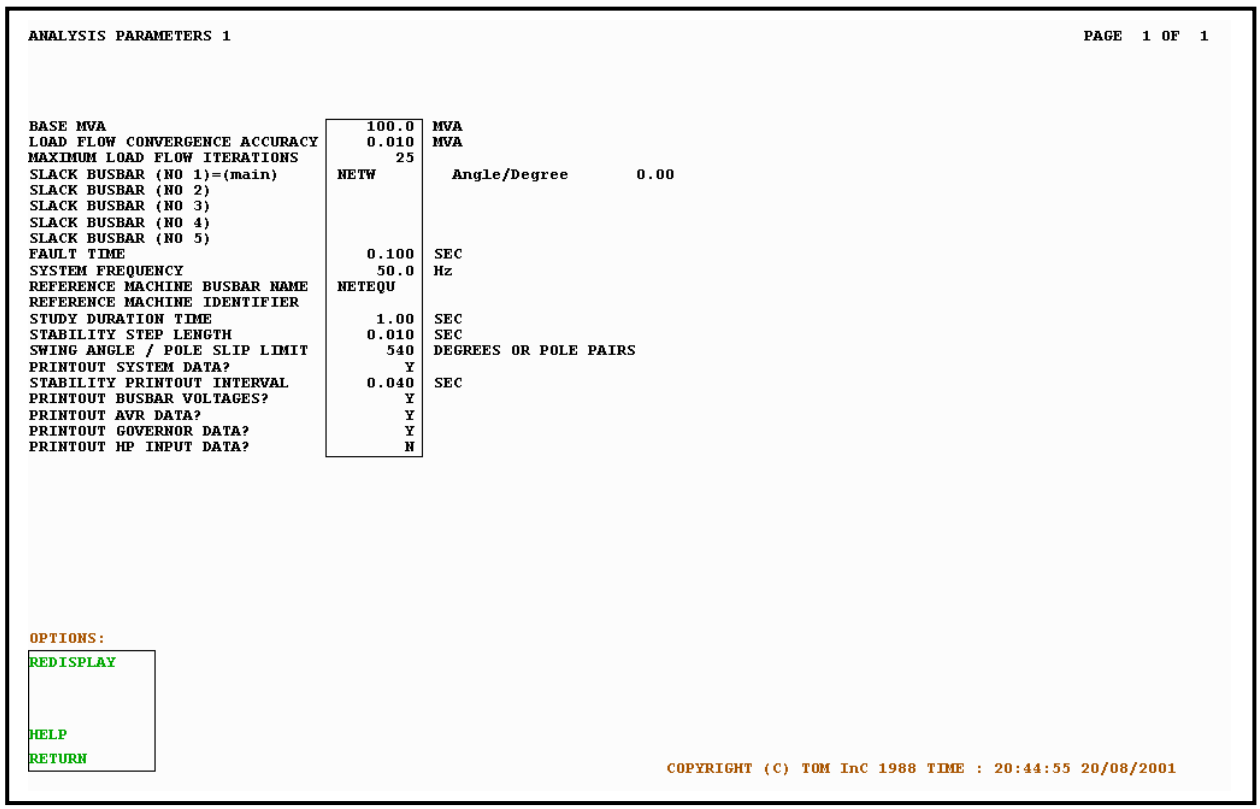

ANALYSIS PARAMETERS 1
PAGE 1 OF 1
BASE MVA 100.0 MVA
LOAD FLOW CONVERGENCE ACCURACY 0.010 MVA
MAXIMUM LOAD FLOW ITERATIONS 25
SLACK BUSBAR (NO 1)=(main) NETW Angle/Degree 0.00
SLACK BUSBAR (NO 2)
SLACK BUSBAR (NO 3)
SLACK BUSBAR (NO 4)
SLACK BUSBAR (NO 5)
FAULT TIME 0.100 SEC
SYSTEM FREQUENCY 50.0 Hz
REFERENCE MACHINE BUSBAR NAME NETEQU
REFERENCE MACHINE IDENTIFIER
STUDY DURATION TIME 1.00 SEC
STABILITY STEP LENGTH 0.010 SEC
SWING ANGLE / POLE SLIP LIMIT 540 DEGREES OR POLE PAIRS
PRINTOUT SYSTEM DATA? Y
STABILITY PRINTOUT INTERVAL 0.040 SEC
PRINTOUT BUSBAR VOLTAGES? Y
PRINTOUT AVR DATA? Y
PRINTOUT GOVERNOR DATA? Y
PRINTOUT HP INPUT DATA? N
OPTIONS:
REDISPLAY
HELP
RETURN
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Figure 4.28

Just adjust the angle in the desired setting. This can be used in out of phase switching of two split networks or can also be set for Automatic Generation Control (AGC) actions.

FAULT TIME:

Time at which fault currents and MVA are to be calculated. Applicable only when AC and DC decrements are considered. The default value is 100 msec. This may be edited here or varied through the FLT TIME option within the faults section.

The following additional parameters are needed for program and output control in transient stability studies:-

SYSTEM FREQUENCY:

This is used to define radial frequency. It does not modify the impedance values entered. The default value is 50 Hz.

REFERENCE MACHINE BUSBAR NAME:

Enter the name of the busbar to which the machine used as reference for angular changes is connected. The default is the slack busbar.

REFERENCE MACHINE IDENTIFIER:

Enter the identifier number of the machine which will be used as the reference for angles. Defaults to the first machine drawn on the reference machine busbar.

STUDY DURATION TIME:

Enter the overall study time. The default is 1 second.

STABILITY STEP LENGTH:

Steps of the order of 0.005 to 0.05 sec will yield acceptable results. The default value is 0.01 sec. The step is adjusted (halved, doubled etc), depending on the rates of change in the system.

NOTE: As the Printout interval is fixed, the step is constrained by:
Printout interval = (2**N).(step length)

SWING ANGLE LIMIT:

Study is automatically terminated when the specified swing angle limit is exceeded. The default is 540 degrees. If this is less than 10 then the study will be proceeded until the number of swings. Put zero value to do not terminate the study.

PRINTOUT SYSTEM DATA?

Enter N to exclude system data from the display (FULL LIST) and printer (PRINT) listings of the results. The default is Y and data are included in the listings.

STABILITY PRINTOUT INTERVAL:

Enter the time interval at which the machine and system details are to be recorded into the file used for the subsequent display or printer listings of results. Defaults to 40ms.

NOTE: max stability step length = printout interval

PRINTOUT BUSBAR VOLTAGES?:
Enter N to exclude busbar voltages from the information recorded at each print interval during the study. The default is Y and busbar voltages are included.

PRINTOUT AVR DATA?:
As above but for AVR details.

PRINTOUT GOVERNOR DATA?:
As above but for Governor details.

4.6 Summary

The edit section of PASHA is used to enter the numerical network parameters, and to enable the modification of these parameters. It can be accessed both through menu options and directly from graphic single-line diagram.

The network data is divided into separate plant groups, which are then organized in multi-section tables, which are displayed by PASHA as sets of 'edit pages'.

Entry of data on these edit pages is by selection of the required data 'field', followed by simply typing in the numerical data.

Most of the current pages of data are described in this chapter while those related to the specific calculations are described in their respective chapters. The data pages related to database are described in chapter 9.