ABSTRACT

Many users in Northeast Utilities would like to use computer graphics. For many who could not be convinced to learn SAS in depth, the use of SAS/GRAPH was not possible. Through the development of fullscreen "menus", a non-SAS user may now produce SAS/GRAPHs with much the same capabilities as a SAS user.

This presentation focuses on a fullscreen development which guides a non-SAS user through a series of "menus" where they can define their data, choose graph types, colors, labels, titles or anything else they desire. The program builds the SAS/GRAPH statements and executes SAS. This package can speed the development of most SAS/GRAPHs even for the trained SAS user.

Using a PL/I assembler interface to handle the fullscreen I/O and to control PF keys, this product models itself after the IBM product--interactive chart utility. A user can quickly develop a SAS/GRAPH without any substantial training in SAS. A default table is provided and the user's input is combined with the table to produce the graph.

This presentation will include handouts of some examples and menu screens. A discussion about how to implement this product will be included.

PRESENTATION

A user wishing to use SAS/GRAPH must presently learn some SAS to utilize the SAS/GRAPH package. It was believed possible to develop a series of "screens" to guide a user through running a SAS/GRAPH session. What is special about these screens is that a user need not know SAS at all. Only a small introduction to SAS/GRAPH is necessary. With this in mind a prototype system was developed and tested.

This prototype system proved very successful. Not only could the untrained user produce SAS graphs but the experienced SAS user could create simple graphs and variations of these graphs in a very short period of time.

The system is made up of twenty-one different screens. One screen is an interface screen to the CLIST while the rest of the screens are selection panels that interface with the default table. The system is controlled by a TSO CLIST that allocates files and calls a PL/I assembler program. This program handles all screen displays and interfaces to the default table as well as building the SAS statements. SAS runs the statements to produce the graph. The default table and screen input are taken together to be used as input to a parser that builds the SAS statements. There are many checks to insure the statements are valid. There are, however, no safeguards if there are errors. The program will not work with some types of combinations.

The first screen (Appendix I) is the SAS GRAPH CLIST interface. This panel is a TSO CLIST controlled interface into the PL/I system that builds the SAS graph statements. The CLIST also runs SAS when the display PF key is keyed on the menu. The CLIST interface allows input of the data file that will become the points on the graph. A stored format that contains the specifications for a graph from a previous session can also be brought in if the default table is not used. The user also displays the hardware being used in the form of terminal and printer specifications.

Once this interface screen has been filled in the system will take over and display the first SAS/GRAPH panel.

The first SAS/GRAPH panel (0.0) is the SAS/GRAPH home panel. (See Appendix 2) This is a functional selection panel. There are nine functions that can be entered by selecting a number from the panel and hitting enter. Each of these display another menu that will allow some details to be specified. These are:

1. Data Specifications
2. Chart Type
3. Titles and Footnotes
4. X Axis
5. Y Axis
6. Legend
7. Symbols, Markers, Colors
8. Retrieve Stored Format
9. Save Inputted Formats

There are also six PF keys in this menu that can be keyed. They are:

1. Help
2. Exit
3. Print
4. Display
5. Back
6. Home
The Help key is an on-line tutorial of the menu being displayed. Exit will return to the CLIST interface panel. Print will display another menu that will guide the user through printing the graph. Display will check the panel table for valid input and run SAS to build the SAS/GRAPH statements and then run SAS/GRAPH. Back will return the user to the last panel displayed. Home will return the user to this panel.

The next SAS/GRAPH panel (1.0) is the data specification panel. (See Appendix 3) This is the most important panel and requires the most knowledge to operate. This panel handles the definition of the input record and more important defines the variables to be graphed. This panel can be used very simply or can be very complex but can provide many graphs from one set of data.

The panel allows a record size of 15 fields in free form input. The data must be massaged to put it in this order before it gets to the panel. The user fills in the type and length for each field. The types can be CHAR for character variables, ZD for standard numbers and PD for packed fields.

The X, Y, and Z Var. and No. variables will determine the symbols, patterns and colors to be used for each line, bar, area, block or slice. The "X Var." and "X No." fields will determine the X variable for any type of chart. If there will be only one graph an "X" is placed in the "X Var." spot at the correct field number. The number "1" is placed in the "X No." input line. If two graphs are wanted with different X variables an "X" is placed in each "X Var." spot wanted and a "1" is placed in the first "X No." and a "2" in the second "X No.". Through the X Var. and X No. the user can select up to five graphs from one run of SAS.

The "Y Var." and "Y No." fields are used differently for different graphs. For a line graph, surface chart or 3D plot they choose the Y variable. For a chart of any type the X variable is used as the sumvar variable. The "sumvar" is the distinct amount of a variable not the frequency of occurrence. An "X" is placed for fields that will be Y variables. The first digit of the "Y No." for a field is used to denote which X it belongs to and the second to denote which line it is if more than one Y variable is specified. This variable may be omitted if there is no "sumvar" being used and a chart is wanted. It must be filled in for a plot.

The "Z Var." and "Z No." fields work similarly to the "Y" fields. For a equals sign. Example: Plot Y = X = Z. For a three dimensional plot it is the "Z" variable. For charts it is used for groups. As in the "Y Var." an "X" is placed in the fields designated for this status. The "Z No." field will contain the corresponding "X" graph numbers and Z line number.

The bar subgroups field is used to denote a chart will contain subgroups. The graph number of the variable and subgroup numbers are filled in to select the correct symbol or pattern statement.

With all of these filled in the parser can begin to produce SAS/GRAPH statements. There still is much further refinement a user can request.

The next panel is the SAS/GRAPH chart type (2.0). This panel allows specification of eight types of charts. (See Appendix 4) PROC GPLOT can be used to produce line graph and surface charts. PROC G3D is used for three dimensional plots. PROC CHART is used to produce vertical and horizontal bar charts, block charts, pie charts and star charts. Each graph or chart can be defined in further detail.

The line graph specification (2.1) panel is used to interface with the symbols, markers, colors panel to choose the line characteristics. (See Appendix 5) This panel allows a user to choose markers on the points and lines between the points. If either is answered affirmatively the symbols, markers, colors panels is checked for specifications.

The surface chart specifications (2.2) allows a user to choose the area to be filled on their graph either above the lines or below the lines. (See Appendix 6) The pattern comes from the symbols, markers, colors panel.

The three dimensional plot specification panel (2.3) allows the choosing of many items. (See Appendix 7) Axis labels may be omitted. The tilt and rotation angles may be specified. The pattern of the field may be specified.

The last special chart specifications allowed are the vertical and horizontal bar charts (2.4, 2.5). The type of chart may be specified here (Freq, Pct, Sum, Mean, etc.) (See Appendix 8 and 9)

After specifying the data and type of chart the user would go on to specify the titles and footnotes. This is done in Section 3.

The titles and footnotes selection panels allow the choice of manipulating titles and footnotes (3.0). (See Appendix 10)

The titles and footnotes (3.1, 3.2) panels allow the specification of a title or footnote. Up to ten titles or footnotes may be specified. (See Appendix 11 and 12)

After specifying the titles or footnotes the text may be further defined.

The SAS titles or footnotes size and color specification panels (3.1.1, 3.2.1) allows this further definition. The color of each title or footnote may be different. The panel has the list

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of seven different colors. (See Appendix 12, 14) There are also 20 fonts to choose from. A different font may be used for each title or footnote. The height of each from 1 to 5 can be chosen. The title or footnote may be left or right justified or centered. Finally the titles and footnotes can be moved or rotated 0 to 360 degrees. By doing this titles can be placed on the left running down or footnotes can be placed on top or any possible rotation. The title can also be angled -90 to 90 degrees so it may be vertical or diagonal. The angle and rotational specification must be used in conjunction with each other.

Both the X axis and Y axis may be defined. Presently labels and scaling is only valid for plots. Eventually SAS/GRAPH will support this for all charts. The X and Y axis panels (4.0, 5.0) are used to define the axis. (See Appendix 15, 16) The label can be defined for either axis. The color can be also specified. The scale and range can be specified along with a series of reference line specifications. Each axis can be specified separately. Though this is not fully supported by SAS/GRAPH it will be someday and the panels will be more compatible.

Some procedures support a legend being turned off. The legend panel allows the specification of a legend or no legend (6.0). Presently this only works for PROC GPLOT. (See Appendix 17)

The SAS symbols, markers, colors, patterns panel (7.0) allows the unique specification of line and pattern characteristics for up to nine lines. Defaults are provided for all. This panel produces SAS symbol and pattern statements. (See Appendix 18) Symbol definition includes color, marker, line connection, and line type. Patterns include pattern or crosshatching angle, and density for surface charts. A list of the possible entries are provided. The user will have to be somewhat familiar with the SAS/GRAPH definitions of line connections and types or patterns. The user, however, will not have to know the SAS symbol or pattern statements; this is done for him.

The changed default table may be saved on a preallocated dataset from the CLIST. It may also be later retrieved and brought in. This way the same data can be displayed many different ways and the format for each can be stored.

The retrieval panel (8.0) simply has an input line for the member name of the dataset. (See Appendix 19) The format is retrieved and a message printed out.

To save a format the stored format panel is used (9.0). This panel allows the user to specify a member name to store the format under and if the file exists an override to replace the old format. (See Appendix 20)

The final panel is the print panel. Here the number of copies and printer identification can be input. The graph does not have to be displayed to print it. This panel generates the correct options statement for printed output. (See Appendix 21)

APPENDICIES

(APPENDIX 1)

SAS GRAPHIC CLIST INTERFACE

SAS DATA FILE:
PROJECT ==>
LIBRARY ==>
TYPE ==>
MEMBER ==>

OTHER PAGENTED OR SEQUEIIAL DATASET:
DATASET NAME ==>

SAS GRAPH FILE MEMEDR ==>

GRAPHICS TERMINAL SECD ==> IBM3279
GRAPHICS PRINTER USERNAME, VERSATEC, CALCOMP) ==>

(SESSION 2)

0.0 --------------- SAS GRAPH HOME PANEL ---------------

SELECT NEXT PANEL ENTRY ==>

1 - DATA SPECIFICATION
2 - CHART TYPE
3 - TITLES AND FOOTNOTES
4 - X AXIS
5 - Y AXIS
6 - LEGEND
7 - SYMBOLS, MARKERS, COLORS
8 - RETRIEVE STORED FORMAT
9 - SAVE INPUTTED FORMAT

ON OTHER PANELS, USE THE HOME KEY TO RETURN TO THIS PANEL.

PF 1/15 = HELP PF1/16 = PRINT
PF 9/21 = EXIT PF15/17 = DISPLAY

(SESSION 3)

1.0 --------------- SAS GRAPH DATA SPECIFICATION PANEL ---------------

FIELD # TYPE LENGTH X VAR. X NO. Y VAR. Y NO. Z VAR. Z NO. SUBGROUPS

PF 1/15 = HELP PF15/16 = PRINT
PF 9/21 = BACK PF15/17 = DISPLAY PF12/24 = HOME
2.0 ----------------- SAS GRAPH CHART TYPE -----------------------------

SELECT CHART TYPE ==>
1 - LINE GRAPH
2 - SURFACE CHART
3 - 3 DIMENSIONAL PLOT
4 - HORIZONTAL BAR CHART
5 - BLOCK CHART
6 - STAR CHART

WOULD YOU LIKE TO DEFINE THE TYPE IN FURTHER DETAIL?
ENTER Y/N ===> N

(WHAT TYPE OF PATTERN DO YOU WANT (1,2,3))

(A EXAMPLE)
THE FOLLOWING CODE WILL BE GENERATED:
PROC GPLOT; PLOT X/Y = "..." / AREA OPT; TITLE "..."; PRINT

(APENDIX 5)
2.1 ----------------- SAS GRAPH LINE GRAPh SPECIFICATION --------------------

USE SYMBOLS, MARKERS, COLORS PANEL TO DEFINE LINE CHARACTERISTICS

(WHAT TYPE OF PATTERN DO YOU WANT (1,2,3))

(A EXAMPLE)
THE FOLLOWING CODE WILL BE GENERATED:
MARKERS WILL USE - SYMBOl "..." L = "..." I = "..."

(APENDIX 6)
2.2 ----------------- SAS GRAPH SURFACE CHART SPECIFICATION -----------------

USE SYMBOLS, MARKERS, COLORS PANEL TO DEFINE CHART CHARACTERISTICS

(A EXAMPLE)
THE FOLLOWING CODE WILL BE GENERATED:
MARKERS WILL USE - SYMBOl "..." L = "..." I = "..."

(APENDIX 7)
2.3 ----------------- SAS GRAPH 3 DIMENSIONAL PLOT SPECIFICATION -----------------

USE SYMBOLS, MARKERS, COLORS PANEL TO DEFINE CHART CHARACTERISTICS

(A EXAMPLE)
THE FOLLOWING CODE WILL BE GENERATED:
PROC GPLOT; PLOT X/Y = "..." / AREA OPT; TITLE "..."; PRINT

(APENDIX 8)
2.4 ----------------- SAS GRAPH VERTICAL BAR CHART SPECIFICATION -----------------

USE SYMBOLS, MARKERS, COLORS PANEL TO DEFINE CHART CHARACTERISTICS

(A EXAMPLE)
THE FOLLOWING CODE WILL BE GENERATED:
PROC GCHART; VBAR X/TYPE="..."
(APPENDIX 16)

5.0 ------------------ SAS GRAPH Y AXIS PANEL -----------------------

| LABEL ==> | WHAT COLOR DO YOU WANT THE AXIS LINE ==> |
| SCALE AND RANGE ==> | * TO * BY * |
| REFERENCE LINES ==> |

PF 1/13 = HELP PFV/16 = PRINT
PF 3/15 = BACK PF5/17 = DISPLAY PF12/24 HOME

(AN EXAMPLE)

THE FOLLOWING CODE WILL BE GENERATED:

LABEL Y = LABEL;
PLOT Y * X/COLN=1...
VAXIS = TO BY ... VREF = ...;

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(APPENDIX 17)

5.0 ------------------ SAS GRAPH LEGEND PANEL -----------------------

DO YOU WANT A LEGEND PRODUCED ==> 

PF 1/13 = HELP PFV/16 = PRINT
PF 3/15 = BACK PF5/17 = DISPLAY PF12/24 HOME

(APPENDIX 18)

7.0 ------------------ SAS SYMBOL MARKERS (CHORE PATTERNS) ---------------

<table>
<thead>
<tr>
<th>COLOR</th>
<th>MARKER</th>
<th>DOT SIZE</th>
<th>LINE STYLE</th>
<th>PATTERN</th>
<th>INVERSE</th>
</tr>
</thead>
</table>

COLORS:
- BLUE, RED, PINK, ORANGE, YELLOW, WHITE
MARKERS:
- X, ., +, *, _, __, ---, -.

PF 1/13 = HELP PFV/16 = PRINT
PF 3/15 = BACK PF5/17 = DISPLAY PF12/24 HOME

(AN EXAMPLE)

THE FOLLOWING CODE WILL BE GENERATED:

SYMBOLS = X, ., +, *...;
PATTERM = 1, 2, 3...;

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(APPENDIX 19)

8.0 ------------------ RETRIEVE STORED FORMAT ------------------------

MEMBER NAME OF YOUR FORMAT DATASET ==> 

PF 1/13 = HELP PFV/16 = PRINT
PF 3/15 = BACK PF5/17 = DISPLAY PF12/24 HOME

(APPENDIX 20)

9.0 ------------------ SAVE STORED FORMAT ----------------------------

MEMBER NAME OF YOUR FORMAT DATASET ==> 

DOES FILE EXIST ==> 

PF 1/13 = HELP PFV/16 = PRINT
PF 3/15 = BACK PF5/17 = DISPLAY PF12/24 HOME

(APPENDIX 21)

---------- SAS GRAPH PRINT INTERFACE -----------------------------

NUMBER OF COPIES ==> 

PRINTER IDENTIFICATION ==> 

PF 1/13 = HELP PFV/16 = PRINT
PF 3/15 = BACK PF5/17 = DISPLAY PF12/24 HOME

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