516-77
JES
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GLANCE PLOTTING ROUTINES

VERSION 2

ABSTRACT

Mini-computer users are often faced with the problem of finding a viable solution for the graphical display of data. A set of programs has been written to enable a HONEYWELL DCP-516 user to generate complete graphs.

The user has complete control over the presentation of his data. The program allows the user to control the size of the graph, the labelling, scaling and identification of his data. The program, GPLOT, is interfaced with FSNAP, the machine's high level processing language, to allow the user to generate displays internally from a program. There is also an interface to the HONEYWELL 6000 to allow the user to obtain a hard copy of his display.

An interpreter has also been written, which enables a user to create characters, which may be used to create pictures. This interpreter is interfaced with both GPLOT and FSNAP, to obtain maximum versatility.

In this manual, frequent reference is made to the "scope", which is the GLANCE display terminal on which the graphic displays are drawn.

The only limiting factor on the system is the size of the display memory in the scope.

This manual is intended as a users guide, to enable the user to fully take advantage of all the features of these programs.

TABLE OF CONTENTS

I. INTRODUCTION

This section of memorandum describes a program, GPLOT, which enables a 516 user to generate complete graphs on a "GLANCE G SCOPE". The user has considerable flexibility in the presentation of his data. Care has been taken to make the program easy to use. The program performs many of the small decisions necessary in generating a complete plot.

A short list of some of the features of the program include:

(1) Independent choice of linear or logarithmic scales for x and y.

(2) Automatic or specified selection of x and y scale factors.

(3) Automatic selection of grid lines, and the choice of grid lines or gric ticks.

(4) The ability to inhibit grid lines and specify your own.

(5) Automatic labeling of grid lines.

(6) The plotting of multiple curves with identification of each curve.

(7) Character or dashed-line drawing.

(8) Automatic centering of titles and labels.

(9) Controllable plot size in both horizontal and vertical directions.

(10) Ability to plot an arbitrary object at any data point.

(11) Choice of a rectangular frame or a polar graph frame.

(12) The ability to place a legend below the graph.

GPLOT takes its information in the form of an input file, and may be executed from either of the systems executives, or from an FSNAP program. Hard copy of the graphs is available through the interface to the HONEYWELL 6000.

II. CALLING THE PROGRAM

GPLOT may be called from either the system executive, the fsnap executive, or from an FSNAP program.

FROM THE SYSTEM EXECUTIVE:

SYS? GPLOT,DATAFILE,OUTPUTFILE(optional)

DATAFILE is an input file which complies with the standards set in the INPUT FILE FORMAT section of this manual. It contains all the necessary information for a plot.

An output file created from GPLOT contains all the necessary scope vectors for a plot. This is useful in the event that a user would like to look at his plots in rapid succession. This is possible through GLANCE(GLANCE is discussed later in this manual).

Another use of the output file option is that, providing the user specifies an output file, he may GPLOT from a terminal other than a scope, and later GLANCE at his plot on the scope. The output file contains all the necessary display information for a plot, so no calculation is involved in calling GLANCE.

In the event that the output file does not exist, GPLOT will create it. If the file already exists, GPLOT will append the new information to it.

FROM THE FSNAP EXECUTIVE:

FSNAP- GPLOT,DATAFILE,OUTPUTFILE(optional)

The rest is identical to the system call.

FROM AN FSNAP PROGRAM:

GPLOT may be called internally from an FSNAP program by means of DSPLAY.

The call format is:

CALL DSPLAY(filecode)

An example of this follows:

```
WRITE(5)"1 1 7 1 1.406 1 1 1 1 1 1 1 1 1 5 1"!
WRITE(5)"A CIRCLE"!
WRITE(5)"DEMONSTRATION OF THE FSNAP CALL"!
WRITE(5)"Y AXIS LABEL"!
WRITE(5)"X AXIS LABEL"!
WRITE(5)"1"!
WRITE(5)"361"!
FOR A=0,360
B=A/180*3.141592
X=COS(B)
Y=SIN(B)
WRITE(5)%8.6,X,Y!
NEXT A
CALL DSPLAY(5)
CALL DRSTOR
STOP
```

This program would produce a circle drawn with a cashed line.

At the end of the program, the user should CALL DRSTOR to restore the contents of the scope memories.

When a plot appears on the screen, five of the buttons below the screen will be labeled. These labels will be DEBUG, REWIND, NEXT, DONE, and STARE. These buttons perform the following functions:

DEBUG:

The DEBUG button will get the user into the plot debugger, which is discussed later in this manual. This is useful if a plot does not turn out as expected, and the user would like to find out why.

REWIND:

In the event that there is more than one plot in a data file, REWIND will bring the file back to the beginning and display the first plot.

NEXT:

In the event that there is more than one plot in a data file, NEXT will display the plot following the plot currently on the screen. If the NEXT button is depressed when there exist no successive plots, an INPUT FILE ERROR message will result.

DONE:

The DONE button will return the user to either the system executive, FSNAP executive, or the following statement in an FSNAP program depending on where GPLOT was called from.

STARE:

Depressing the STARE button will result in a copy of the currently displayed frame being sent to the HONEYWELL for hard copy. The user must have a HONEYWELL IDENT card in his directory, otherwise the job will be rejected. The SNUMB of the job will be given to the user after he exits from GPLOT by means of the DONE button.

INPUT FILE FORMAT

This section describes the format of the input file. All variables, files, and names used in the file are discussed in the the DESCRIPTION OF VARIABLES section of this manual.

The variables shown must be on the lines indicated. Some variables are omitted when other variables have certain values. When a variable is omitted, the variables below move up to fill in the vacated position.

LINE 1

LLX,LLY,NGL,ARX,ARY,YREF,LABOP,KO,XMIN,XMAX,YMIN,YMAX,KX,KY,ITYCUR,NTT,

LINE 1 (continued)

USEROPT,CFL,URSUBR,LFL

LINE 2

TTL

LINE 3

STL

LINE 4

YLB

LINE 5

XLB

LINE 6

NCURVE

LINE 7

CHAR (optional, should only be present when ITYCUR=3, 4, 6, 8, or 9)

LINE 8

NPTS

LINE 9 - LINE N

DATA

LINE N+1 (if NCURVE>1)

CHAR (optional, should only be present when ITYCUR=3, 4, 6, 8, or 9)

LINE N+2

NPTS

LINE N+3 - LINE N+X

DATA

USEROPT, CFL, URSUBR, and LFL may be omitted if not desired. NTT may be omitted if USEROPT, CFL, and URSUBR are omitted. CFL should not be present unless USEROPT is 1 or 3. URSUBR should not be present unless USEROPT is 2 or 3. If USEROPT is missing, it is given a default value of 0. CHAR should only be present when ITYCUR is equal to 3, 4, 6, 8, or 9.

The second, third,... sets of CHAR, NPTS, and DATA should only be present when NCURVE is greater than 1. CHAR(if ITYCUR = 3,4,6,8,9) and NPTS should be repeated before each subsequent data set.

Many data files can be concatenated into a single file. These files will be treated seperately, and may be viewed by pushing the NEXT button on the bottom of the screen.

IV. DESCRIPTION OF VARIABLES

This section describes the variables which make up the GPLOT input file. Several of these variables have redundant values to keep the file format compatible with GEPLOT(516-47). One of the major differences between GPLOT and GEPLOT is that GPLOT makes no distinction between floating-point numbers and integers, which is only important if the user wishes to GEPLOT his file after viewing it on the scope.

GPLOT also has several extra variables, and several of the variables have values which are not recognized by GEPLOT. It is important to remove these variables if the user desires to obtain a hard copy of his plot via GEPLOT. If the extra variables are missing, GPLOT will not complain, this is to keep input file formats compatible.

LLX:

LLX determines whether the x scale will be linear or logarithmic.

1 linear x scale

2 logarithmic x scale

3 linear x scale

LLY:

LLY determines whether the y scale will be linear or logarithmic.

1 linear y scale

2 logarithmic y scale

3 linear y scale

4 linear y scale

5 logarithmic y scale

6 linear y scale

When a linear grid is specified, GPLOT tries to give approximately 10 times the aspect ratio divisions. Linear divisions are 1, 2, 2.5, or 10 times some power of 10. If a zero line lies within the plotting area, it will be one of the grid lines. GPLOT rounds the minimums and maximums to an even multiple of a grid division.

With logarithmic scaling, the minimums and maximums are rounded to the number of whole decades which will encompass the data. The lines 1, 1.5, 2, 3, 4, 5, 6, 7, 8, and 9 will be labeled if the number of decades is 3 or less. If the number of decades is greater than 3, only the lines 1, 2, 4, 6, and 8 will be drawn. A value 10 raised to the exponent will be placed at every 1 line.

NGL:

NGL determines whether gric ticks or grid lines will be drawn.

1 draws frame plus x and y grid lines

2 draws frame, x grid ticks and y grid lines

3 draws frame, x grid lines and y grid ticks

4 draws frame plus grid ticks on both axes

5 draws frame, grid ticks on both axes, plus the lines X=0 and Y=0 if they lie within the plotting area

6 draws no frame, grid lines, or labels

7 draws x and y axes if they appear on the plotting area, and puts grid ticks and labels on the axes.

A grid line is a line which will be drawn across the entire frame. A grid tick is a short line placed at the edge of the frame to mark the division. When NGL=7, the grid ticks will be bisected by the axes. Due to the labels on the axes, the label for Y=0 will also be bisected.

ARX:

ARX determines the width of the plotting area.

ARX is a floating-point number bounded as 0.4 < | ARX | <1.0. The width of the grid is equal to the [| ARX x 1850 |].([] indicate the integer part of) The sign of ARX determines the direction of increasing x. A positive ARX gives an x scale which increases to the right, a negative ARX causes the x scale to increase to the left.

ARY:

ARY determines the height of the plotting area.

ARY is a floating-point number bounded as 0.25 < | ARY | < 1.407. The height of the grid area is equal to

the [| ARY x 1315.55 |]. The sign of ARY determines the direction of increasing y. A positive ARY gives a y scale increasing upward, a negative ARY causes the y scale to increase downward.

If the user desires a square grid, ARX should equal 1, and ARY should be equal to 1.406.

YREF:

YREF is not used by GPLOT. It fills the space to keep file formats compatable with that required by GEPLOT.

LABOP:

LABOP determines how the plot is to be labeled.

1 labels every other x grid line(linear scaling only)

2 labels every x grid line(linear scaling only)

3 labels x axis only. GPLOT looks for the file LFL to see if the user specified any y labels.

4 labels y axis only. GPLOT looks for the file LFL to see if the user specified any x labels.

5 labels neither axis. GPLOT looks for the file LFL for both x and y labels.

When GPLOT does not label an axis, it performs no scaling on that axis. Therefore, the minimums and maximums will be either the peaks of the curve, or exactly those that the user specifies by the variables KO, XMIN, XMAX, YMIN, and YMAX.

GPLOT will label the grid divisions with a signed number consisting of one digit to the left of the decimal point, and two digits to the right. If a scale factor is imposed on the labels, it will be appended to the label(XLB or YLB) corresponding to that axis. A label, when multiplied by the scale factor,

will give the correct value for that grid division.

KO:

KO determines how the minimums and maximums are to be chosen.

1	automatic x	automatic y
2	automatic x	specified y
3	specified x	automatic y
4	specified x	specified y

Automatic implies that GPLOT will scan the first set of data pairs and pick the minimum and maximum values for use as suggested scale extremes. Specified implies that GPLOT use the values in XMIN, XMAX, YMIN, and YMAX as a starting point for determining the final scale extremes.

If minimum and maximum values are specified which are less than those in the data, GPLOT will truncate those points outside of these values, and "blow up" the curve within the boundary. XMIN, XMAX, YMIN, and YMAX must be present even if they are not used.

XMIN:

XMIN is the minimum value desired in the x data. Used only when KO = 3 or 4.

XMAX:

XMAX is the maximum value desired in the x data. Used only when KO = 3 or 4.

If KX = 2, XMIN and XMAX apply to the absolute magnitudes of the x data.

YMIN:

YMIN is the minimum value desired in the y data. Used only when KO = 2 or 4.

YMAX:

YMAX is the maximum value desired in the y data. Used only when KO = 2 or 4.

If KY = 2, YMIN and YMAX apply to the absolute magnitudes of the y data.

KX:

KX determines how the x data is to be drawn

1 plots x

2 plots | x |

3 denotes that there are multiple sets of y data to be plotted for the same x data. Subsequent data sets should contain only y data.

4 same as 3

KY:

KY determines how the y data is to be drawn

1 plots y

2 plots | y |

3 denotes that there are multiple sets of x data to be plotted for the same y data. Subsequent data sets should contain only x data.

4 same as 3

ITYCUR:

ITYCUR determines how the curve is to be presented

1 data points connected consecutively by straight lines to form a continuous curve.

2 same as (1) except that an identifying letter is placed to the right of the last plotted point. The character will be A, B, C... corresponding to the

curve number.

3 same as (2) except that the curve is labeled with the character in CHAR.

4 no vectors drawn, instead the character in CHAR will be plotted at each point.

5 data connected by straight lines in pairs to give the dashed line effect.

6 fancy dashed line option. The connectivity pattern is specified by the first number in CHAR, and the number of points to be repeated in the pattern is specified by the second number.

The first number is put into a 16 bit word, where the pattern of adjacent bits specifies how the data points are to be connected. The second number should be the number of bits(must be > 0), starting at the right of the word, which will be examined before repeating. A 1 in any bit specifies that the segment will be visible, a 0 specifies invisible. If two zero's appear consecutively a dot will be placed at the data point.

Some examples are:			Data word:	Repeat pattern
1	1	continuous line	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1
0	1	dotted line	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0
5	4	dashed line	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0 1
2	3	-.-.-.-.-.-.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0
2	4	-..-..-..-..	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 1 0
26	5	-- - -- - --.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 1 0 1 0

7 no vectors drawn. This is useful only when USRCPT = 2 or 4.

8 no vectors drawn, but CHAR is read in. This is also useful when USERCPT = 2 or 4.

9 all vectors are crawn, and CHAR is also read in.

When drawing a dashed line, GPLOT connects adjacent data points together. Therefore, if the users data is not linearly spaced(for a linear scale), or logarithmically spaced(for a logarithmic scale), some segments of the dashed line will be longer than others, thus giving an uneven appearance.

NII:

NTT is not used by GPLOT, its only purpose is to keep file formats compatible with that required by GEPLOT.

USEROPI:

USEROPT determines whether the user will use a "User Subroutine" or the character generator CHRGEN, or both.

0 no character generator or user subroutine

1 character generator only

2 user subroutine only

3 character generator and user subroutine

If USEROPT is 1 or 3, the character generator CHRGEN will be called upon entering GPLOT. The file CFL must be present, otherwise the program will abort. This is exactly the same as calling CHRGEN from the executive. This option is designed to save the user some trouble. Interesting results may be obtained by using the character generator option in conjunction with character plotting(ITYCUR=4).

If USEROPT is 2 or 3, GPLOT will execute the program URSUBR at each data point. The segmented program URSUBR must be present, otherwise the program will abort. This is useful if

the user has some object he would like to draw at each data point such as bars or histograms.

CFL:

CFL is the name of a standard CHRGEN input file. This file should only be present when USEROPT is 1 or 3. CHRGEN is discussed later in this manual. Any characters written with the intention of using them in conjunction with CHAR plotting should be the same size as a standard GLANCE G character. Also, the following characters must not be overwritten: 21(DC1), 22(DC2), 23(DC3), and 24(DC4), 25(NAK), 26(SYN). Any characters which will be used by GPLOT(numbers, characters in the title and labels)should not be overwritten.

URSUBR:

URSUBR is the name of the subroutine that the user would like executed at each data point. This name should only be present when USEROPT is 2 or 3. A user may write his own user subroutine, or use a library routine. Writing a user subroutine is discussed later in this manual.

LFL:

LFL is the name of an optional file which contains data for x and y labels (LABOP =3, 4, or 5),a legend which will be drawn below the frame, positioning labels on the screen, or placing a legend anywhere within the plotting area. The user has a choice of a standard legend, or a positioned legend, but he may not use both on one plot. LFL allows the user to draw and label grid lines or ticks wherever he chooses. The choice of grid ticks or lines is made by NGL.

The LFL file format is as follows:

The LFL file is divided into 3 sections, x, y, and legend.

X LABELS

The x label section must be headed by an X:CR(character x, :,carraige- return). X labels then proceed one label per line. The format of a line is a rumber, which is the position of the tick or grid line, followed by one space, followed by 5 characters which will label that line or tick. The label is centered approximately between the second and third character. If less than 5 characters appear in the label field, the extra characters will be filled in with blanks. If more than 5 characters appear, the extra characters will be ignored. The x label section is terminated by either the end of the file, or something other than a number in the first column of a line.

Y LABELS

The y label section is identical to the x label section, except that it must be headed by a Y:CR, and the labels are positioned so that the fifth character is slightly to the left of the frame.

POSITIONED LABELS

The positioned label section must be headed by a P:CR. Subsequnt lines should contain the X and Y coordinates of the label, followed by a space, followed by the label to be placed at that point.

LEGEND

The legend section must be headed by a L:CR. All text appearing between this header and the end of the file will appear in the lower left hand corner of the viewing area.

POSITIONED LEGEND

This section must be headed by a T:CR. The next line should contain the X and Y coordinates of the point at which the legend will be placed. All text between these coordinates and the end of the file will be placed on the viewing area starting at the specified point.

If any of the sections of this file, or the whole file is missing, it will be ignored. For speed in plotting, the sections should appear in the order x, y, p, l or t in the file.

The following four variables form labels for the plot. In centering these labels, GPLOT assumes that the users data contains no leading spaces. The number of characters which can be fit horizontally over the frame is [ARX x 77]. The number of characters which can fit vertically next to the frame is [ARY x 36].

TTL:

TTL is a string of up to 80 characters which will be centered over the frame to form the title.

STL:

STL is a string of up to 80 characters which will be centered over the frame to form the subtitle. The subtitle is positioned between the title and the top of the frame.

YLB:

YLB is a string of up to 80 characters which will be vertically centered to the left of the frame to form the y axis label. If GPLOT imposes any scaling upon the y data, the scale factor will be appended to the label.

XLB:

XLB is a string of up to 80 characters which will be

centered beneath the frame to form the x axis label. If GPLOT imposes any scaling upon the x data, the scale factor will be appended to the label.

NCURVE:

NCURVE is an integer which specifies the number of different data sets.

CHAR:

CHAR contains either a single character if ITYCUR is 3,4,8 or 9 or two integers if ITYCUR is 6. CHAR should not be present if ITYCUR is 1, 2, 5, or 7.

NPTS:

NPTS is the number of points in the data set which immediatly follows it.

DATA:

The format of the data is very liberal. Numbers may be floating-point or integer, and may be separated by spaces, carraige-returns, line-feecs, commas, and/or semi-colons.

If there is more than one set of data(NCURVE>1), CHAR (if applicable) and NPTS should appear before each data set.

More than one separate data file may be concatenated and viewed as separate plots by GPLOT. This will also produce an output file which will contain several separate plots. This may be viewed in the same manner in both GPLOT and GLANCE.

V. THE USER SUBROUTINE

The user subroutine is a program written in the 516 SEGMENT ASSEMBLER(516-41), which GPLOT will call at each data point. This is useful in drawing objects at each data point, such as bars. The only constraints placed on the writer of such a subroutine, are as follows:

1. The pointer to the data string(.T5) must be in the same position as it was upon entering the subroutine.
2. The subroutine may only have one return.
3. The program must be entered via a CALL, and terminated by a RET1.
4. T5-11,.T14-15, and .TST13-16 must not be changed, nor may any of the already defined values in the block pointed to by .RP6
5. The scope must be left in scale 2.
6. The beam must be in the same position as it started out at.
7. The scope will be in short vector mode upon entering, and must be in short vector mode upon return to GPLOT.
8. Any variable labeled DO NOT USE must naturally not be used, otherwise strange results will occur.

Any double word values are floating point numbers. The following values will be set up in the .RP6 block upon entering the subroutine:

.RP6+.RZERO+

0. Do not use.
1. Do not use.
2. Do not use.
3. Do not use.

4. Do not use.

5. LLX-this is equal to the value of LLX read in from the data file.

6. LLY-this is equal to the value of LLY read in from the data file, unless LLY was 4, 5, or 6, in which case it is equal to LLY-3.

7. NGL-this is the value of NGL read in from the users data.

8. NOTHING-may be used.

9. NOTHING-may be used.

10. NOTHING-may be used.

11. Do not use.

12. LABOP-the value of LABCP read in from the data file.

13. KO-the value of KO read in.

14. XMIN-the high order word of XMIN.

15. XMIN+1-the low order word of XMIN.

16. XMAX-the high order word of XMAX.

17. XMAX+1-the low order word of XMAX.

18. YMIN-the high order word of YMIN.

19. YMIN+1-the low order word of YMIN.

20. YMAX-the high order word of YMAX.

21. YMAX+1-the low order word of YMAX.

22. KX-the value of KX from the data.

23. KY-the value of KY from the data.

24. ITYCUR-as read in.

25. XSRT-the x distance in bits from the origin to the lower left corner of the frame.

26. XSDT-the scope coorcinate of the x lower left corner of the frame.

27. YSRT-the y distance in bits from the origin to the lower left corner of the frame.

28. YSDT-the scope coordinate of the y lower left corner of the frame.

29. NCURVE-the number of curves. NCURVE will be decremented by one after each curve is drawn.

30. Do not use.

31. Do not use.

32. ARXX-the width of the screen in bits.

33. ARXX+1-low order ARXX

34. ARYY-the height of the screen in bits.

35. ARYY+1-low order ARYY

36. ARX-as read in from the users data.

37. ARX+1-low order ARX.

38. ARY-as read in from the users data.

39. ARY+1-low order ARY.

40. NPOINT-two's complement of NPTS as read in.

41. XPOW-10 raised to the XEXP.

42. XPOW+1-low order XPOW.

43. XEXP-the integer part of the log base ten of the absolute value of XMIN or XMAX, whichever is greater, plus 0.05575872.

44.XEXP+1-low order XEXP.

45. YPOW-10 raised to the YEXP.

46. YPOW+1-low order YPOW.

47. YEXP-the integer part of the log base ten of the absolute value of YMIN or YMAX, whichever is greater, plus 0.05575872.

48. YEXP+1-low order YEXP.

49. NXTICK-the number of x grid divisions if the x scale is

linear. If the x scale is logarithmic, NXTICK will be the number of the first log division.

50. NXTICK+1-low order NXTICK, unless the x scale is logarithmic, in which case NXTICK is a single-precision integer in NXTICK.

51. NYTICK-the number of y grid divisions if the y scale is linear. If the y scale is logarithmic, NYTICK will be the number of the first log division.

52. NYTICK+1-low order NYTICK, unless the y scale is logarithmic, in which case it will contain garbage.

53. Do not use.

54. OPATRN-the connectivity word as read in if ITYCUR=6.

55. REPEAT-the repeat word as read in if ITYCUR=6.

56. Do not use.

57. XLBSAV-the number of characters in the x axis label(XLB).

58. YLBSAV-the number of characters in the y axis label(YLB).

59. TTLSAV-the number of characters in the title(TTL).

60. Do not use.

61. STLSAV-the number of characters in the subtitle(STL).

62. CHAR-the char as read in from the input file shifted into the first character position with an octal 21 in the second if ITYCUR=3, 4, 8, or 9. If ITYCUR=2, CHAR will be the same as when ITYCUR is 3, 4, 8, or 9 except that the first character position will be filled with an A, B, C... corresponding to the current value of NCURVE.

63. Do not use.

64. XLST-same as XSRT unless NGL=7, in which case it is equal to the distance to the y axis if it exists.

65. XLDT-same as XSDT unless NGL=7, in which case it is the scope coordinate of the x position of the y axis if it exists.

66. YLST-same as YSRT unless NGL=7, in which case it is equal to the distance to the x axis if it exists.

67. YLDT-same as YSDT unless NGL=7, in which case it is the scope coordinate of the y position of the x axis if it exists.

68. PAGCTR-the first character is the current plot number, the second is an octal 21.

69. NOTHING-may be used.

70. PCOUNT-used only when ITYCUR=6, it is the repeat counter for the dashed line.

71. PATTRN-used only when ITYCUR=6, it is the connectivity word as it is rotated.

72. CONTIN-used only when ITYCUR=6, it keeps track of whether the beam is visible or invisible.

73. NOTHING-may be used.

74. NOTHING-may be used.

75. FIRSTT-this value is set to zero when GPLOTD starts drawing a curve. This is only used to let the user know it is the first time through in case he has any initialization to do in his subroutine. May be used.

76-127 NOTHING-may be usec.

The following values will be in the .T's upon entering the subroutine:

0. XSCALE-the high order word of the x scale factor

1. XSCALE+1-low order XSCALE

2. NPTS-the number of points. This is incremented after each point is connected.

3. NOTHING-may be used.

4. SVECTR-the short vector which was just sent to the scope. May be used.

5. DTPTR-the pointer to the data string based in .RP3

6. YSCALE-the high order word of the y scale factor.

7. YSCALE+1-low order YSCALE.

10. XCORD1-the high order word of the x distance between the preceding data point and the current data point.

11. XCORD1+1-low order XCORD1.

12. DX-the x distance of the last vector shipped to the scope, shifted over 7 bits. May be used.

13. GARBAGE-not a variable, may be used.

14. YCORD1-the high order word of the y distance between the preceding data point and the current data point.

15. YCORD1+1-low order YCORD1.

16. DY-the y distance of the last vector shipped to the scope, may be used.

17 DY+1-low order DY. May be used.

The following values will be in the .TST's:

0. HOPND-the high order word of the last y point read in from the data string, may be used.

1. LOPND-the low order word of the last y point read in from the data string, may be used.

11. GARBAGE-may be used.

12. GARBAGE+1-low order GARBAGE, treat accordingly(may be used).

13. XS-the x data point which started the section of curve currently being drawn.

14. XS+1-low order XS

15. YS-the y data point which started the section of curve currently being drawn.

16. YS+1-low order YS.

The following pointers will be set up in the .RP*s:

0. Pointer to the input file.

1. Pointer to the output file.

2. Not used.(used by FSNAP)

3. Pointer to the data string.

4. Pointer to the legend file(LFL). May be used.

5. Pointer to the GE skeleton deck.

6. Pointer to main variable storage.

7. Pointer to the GE buffer.

The character NAK(octal 25) is the plotting dot used by the dashed line routine. It may be used in user subroutines. A SYN(octal 26) is the o usec by PHIPLT. It may also be used.

VI-A. BARPLT

A user subroutine, BARPLT, has been written to enable a GPLOT user to construct bar graphs. The subroutine is called as described in the DESCRIPTION OF VARIABLES section of this manual. Since the subroutine, like all user subroutines is globally available to all users, it is not necessary for a user to have a copy in his directory.

BARPLT expects the x data to be increasing from left to right. Bars will be drawn vertically from the y position of the data point to either the line Y=0 if it lies within the plotting area, YMIN if all the data is positive, or YMAX if all the data is negative.

The width of the bar is the sum of the width of the left side and the right side. The width of the left side is equal to one-third of the x distance between the data point and the preceding data point. The width of the right side is equal to one-third of the distance between the data point and the following data point.

BARPLT is normally used with ITYCUR=7. However, interesting results may be obtained by setting ITYCUR equal to 4, and plotting a character, such as an "X" at each data point.

VI-B. HISPLT

A user subroutine, HISPLT, has been written to enable a GPLOT user to construct histograms. The subroutine is called as described in the DESCRIPTICN OF VARIABLES section of this manual. Since the subroutine, like all user subroutines, is globally available to all users, it is not necessary for a user to have a copy in his directory.

HISPLT expects the x cata to be increasing from left to right. Bars will be drawn vertically from the y position of the data point to either the line Y=0 if it lies within the plotting area, YMIN if all the data is positive, or YMAX if all the data is negative.

A horizontal bar is then drawn from the data point to the x position of the next data point. HISPLT will display both positive and negative data, however, the user must note that since the program will draw the vertical line to the axis, there must be a data point on the axis otherwise there will be a break in the curve at the transition.

HISPLT is normally used with ITYCUR=7. However, interesting results may be obtained by setting ITYCUR equal to 4, and plotting a character, such as an "X" at each data point.

VI-C. MIXCHR

A user subroutine, MIXCHR, has been written to enable a GPLOT user to draw mixed character plots. The subroutine is called as described in the DESCRIPTION OF VARIABLES section of this manual. Since the subroutine, like all user subroutines, is globally available to all users, it is not necessary for a user to have a copy in his directory.

MIXCHR will place a label below each data point consisting of the character currently in CHAR, and a number(1 through 99) corresponding to the number of the data point. If CHAR is not read in from the users data, its default value will be drawn.

MIXCHR may be used in a variety of ways. If ITYCUR = 4, MIXCHR can be used to subscript the character at each data point. With ITYCUR = 6, and CHAR being "0 1", a dot will be placed at each data point labeled by the character - number combination. Since the label is placed below the data point, it may be used to label parts of a curve. The character pattern is especially useful in distinguishing separate curves when only the points are plotted (CHAR plotting or dot plotting).

VI-D. PHIPLT

A user subroutine, PHIPLT, has been written to enable a GPLOT user to generate phi (Φ) symbols at his data points. This is useful in statistical plotting. The subroutine is called as described in the DESCRIPTION OF VARIABLES section of this manual. Since the subroutine, like all user subroutines is globally available to all users, it is not necessary for a user to have a copy in his directory.

PHIPLT expects the data to appear in three seperate curves. The first curve should have the largest y values, the third should contain the smallest, and the second should be somewhere in between. The top of the PHI will be drawn at each data point in the first curve. The o will be drawn at the points in the second curve, and the bottom of the PHI will be drawn at the points contained in the third curve. A vertical bar will connect the centers of the top and bottom bars.

PHIPLT is normally used with ITYCUR=7.

VI-E. SHDBAR

A user subroutine, SHDBAR, has been written to enable a GPLOT user to generate shaded bar graphs. This is useful in statistical plotting. The subroutine is called as described in the DESCRIPTION OF VARIABLES section of this manual. Since the subroutine, like all user subroutines is globally available to all users, it is not necessary for a user to have a copy in his directory.

SHDBAR expects the data to appear in the following manner: The first curve must contain only one data pair. The x value is ignored, and the y value is the width of the bars. The second curve must contain y values equal to YMIN, and the x values of the center of each bar. The following curves must contain x values corresponding to the center of each bar to be shaded, and y values of the dividing point in the bar. The bars will be shaded with eight different patterns before repeating.

SHDBAR is normally used with ITYCUR=7.

VI-E. AROPLT

A user subroutine, AROPLT, has been written to enable a GPLOT user to place directional arrows at his data points. This is useful if the user has many data points occuring in tight closed loops, or in vector diagrams.

The subroutine is called as described in the DESCRIPTION OF VARIABLES section of this manual. Since the subroutine, like all user subroutines is globally available to all users, it is not necessary for a user to have a copy in his directory.

AROPLT expects CHAR to be read in. CHAR should be a single digit corresponding to the repeat pattern of the arrows. If CHAR=1, an arrow will appear at every data point, if CHAR=2, an arrow will appear at every other data point.

The arrow will appear with its tip at the data point. The size of the arrow will vary depending on the distance between data points. There is, however, a maximum size arrow which will be drawn.

AROPLT is normally used with ITYCUR=8 or 9.

VI-G. LINPLT

A user subroutine, LINPLT, has been written to enable a GPLOT user to construct veritical bars from his data points to the minimum y value present in the data. The subroutine is called as described in the DESCRIPTION OF VARIABLES section of this manual. Since the subroutine, like all user subroutines is globally available to all users, it is not necessary for a user to have a copy in his directory.

LINPLT will always draw its bar to the minimum y value. Therefore, if the user reverses the direction of positive y(negative ARY), the bars will be drawn to the top of the frame.

LINPLT is normally used with ITYCUR=7. However, interesting results may be obtained by setting ITYCUR equal to 4, and plotting a character, such as an "o" at each data point.

VI-H. VARCHR

A user subroutine, VARCHR, has been written to enable a GPLOT user to plot different characters at his data points in a single curve. The subroutine is called as described in the DESCRIPTION OF VARIABLES section of this manual. Since the subroutine, like all user subroutines is globally available to all users, it is not necessary for a user to have a copy in his directory.

VARCHR obtains its data from the legend file (variable LFL). The data is placec under the header C:CR (C-colon-carraige return). Immediately underneath the header should be the number of characters tc be used. Following this should be a list of the characters to be plotted. The SPACE, CARRAIGE-RETURN, and LINE-FEED are not recognized as plottable characters, thus allowing the list to be nicely formatted. If the number of characters is less than the number of points, VARCHR will repeat the characters after it runs out.

VARCHR is normally used with ITYCUR=7.

VII. DIAGNOSTICS AND DEBUGGING

In this section, the various error messages returned by GPLOT are discussed, along with suggestions to aid in debugging a plot. If a plot does not turn out as the user expects, he may get into the debugging package by depressing the DEBUG button.

In the debugger, GPLOT will list all the main user controlled variables in their present state. If a variable other than those listed specially below fails to appear, the user may assume that GPLOT did not progress to the point where that variable is read in. The variables which will be listed are LLX, LLY, NGL, ARX, ARY, LABOF, KO, XMIN, XMAX, YMIN, YMAX, KX, KY, ITYCUR, NCURVE, CHAR, AND NPTS. All variables will have the same values as appear in the user's input file, with the following exceptions:

LLY:

If LLY>3, LLY will be equal to LLY-3.

XMIN, XMAX, YMIN, YMAX:

Depending on when the program enters the debugger, these values may contain the GPLOT rounced off version.

NPTS:

NPTS will be the value from the curve currently being drawn.

CHAR:

Char will be the CHAR from the current curve.

NCURVE:

NCURVE will be decremented by 1 each time a curve is drawn.

The values YREF, NTT, and USEROPT are not shown. Also, the files CFL and LFL, and the name URSUBR are not shown.

The variable CHAR is given a default value if ITYCUR does

not equal 3, 4, or 6. This value will be A, B, C... corresponding to the number of the curve that was being drawn at the time the debugger was called.

If the picture on the scope appears to be garbage, but the buttons underneath the screen still function, it is reasonable to assume that the number of vectors generated by the users data was greater than the capacity of the scope memory.

The following is a list of the error messages, and some probable causes:

FILE?

GPLOT can not access the input file. The file does not exist, or is currently attached to some other program.

WHAT OUTPUT FILE?

GPLOT has been called from a terminal other than a GLANCE G scope, and an output file has not been specified. This comment will also appear if DSPLAY has been called from an incorrect terminal.

INPUT FILE ERROR

GPLOT will return this message if it finds an error which can not specifically be attributed to one segment of the program. The most common cause for this error is when the input file is not a file intendec for GPLOT. It may be noticed from the DUMP OF VARIABLES received in the debugger, that if none or very few variables appear, this is probably the cause.

ASPECT RATIO ERROR

This message will result from either ARX or ARY being too big or too small. If ARY appears in the variable dump, it can

be assumed that it was the culprit. If only ARX is printed, it would be the cause.

LOG ERROR

This comment will result if the user has specified logarithmic scaling, but was careless enough to have data which contained values less than or equal to zero.

KO OPTION TOO LARGE

As might be expected, this message will appear when KO is too large.

ITYCUR ERROR. CHAR CARD MISSING

This will result if the ITYCUR is 3, 4, or 6 and GPLOT can not find CHAR. The user should not depend on this message, since anything is a valid CHAR, the message may not appear.

DIFFERENCE BETWEEN XMIN AND XMAX TOO SMALL

This message will result if GPLOT cannot determine a meaningfull x scale factor on the basis of the difference between XMIN and XMAX.

DIFFERENCE BETWEEN YMIN AND YMAX TOO SMALL

This message will result if GPLOT cannot determine a meaningfull y scale factor on the basis of the difference between YMIN and YMAX.

XMIN GREATER THAN XMAX

If the user specifies a minimum x value that is greater than the maximum value, this message will appear to warn him of his treachery.

YMIN GREATER THAN YMAX

The same basic meaning as the previous message, but on a different scale.

NUMBER OF POINTS MISSING

If GPLOT is unable to locate NPTS, this message will result.

UNDEFINED USER SUBROUTINE

If USEROPT is 2 or 3, and GPLOT cannot find the name of URSUBR either in the data file or the system's symbol table, it will communicate that fact.

OUT OF DATA

If NPTS is greater than the actual number of data points in the file, this message will be displayed. Some hidden causes of this error result if the user forgot NCURVE, a CHAR, or an NPTS. In this case, GPLOT may pick up the first or second piece of data and use it for NPTS, which often causes either this error or an incomplete curve.

*****PLOTTING SUPPRESSED*****

When this message appears, it will be preceded by a CHRGEN error message. This occurs when CHRGEN is called from GPLOT(USEROPT= 1 or 3), and an error is detected in the CHRGEN input file.

A "*****DUMP OF VARIAELES*****" will follow most error messages. Most of the errors which occur in the input data can be found by examining the variables for discrepencies between the values given and the values that the user expected. These values are by no means the answer to the users problem, but are intended to give the user a clue as far as where to look for his error.

VIII. GLANCE

A program, GLANCE, has been written to enable a GPLOT user to look through his plots in rapid succession. GLANCE may be called from either the system or FSNAP executive.

FROM THE SYSTEM EXECUTIVE:

SYS? GLANCE,INPUTFILE

FROM THE FSNAP EXECUTIVE:

FSNAP- GLANCE,INPUTFILE

Inputfile is a file which was created by using the output file option in GPLOT.

GLANCE may only be called from a GLANCE G scope.

When a GLANCE plot appears on the screen, four of the buttons below the screen will be labeled. These labels will be REWIND, NEXT, DONE, and STARE. They will perform the following functions:

REWIND:

In the event there is more than one plot in a data file, REWIND will bring the file back to the beginning and display the first plot.

NEXT:

In the event there is more than one plot in a data file, next will display the next plot in the input file. If the NEXT button is depressed when there exists no successive plots, an INPUT FILE ERROR message will result.

DONE:

The done button will return the user to either the system executive, or the FSNAP executive depending on where GLANCE was called from.

STARE:

Depressing the STARE button will result in a copy of the currently displayed frame being sent to the HONEYWELL 6000 for hard copy. The user must have a HONEYWELL IDENT card in his directory, otherwise the job will be rejected. The SNUMB of the job will be given to the user after he exits from GLANCE by means of the DONE button.

DIAGNOSTICS:

FILE?

If GLANCE can not access the input file.

INPUT FILE ERROR

If GLANCE determines that the input file was not created by GPLOT, or if it has incurred some damage.

WRONG TERMINAL

If GLANCE is called from a terminal other than a GLANCE G scope.

IX. THE CHARACTER GENERATOR

A versatile interpreter, CHRGEN, has been written to enable a 516 user to write characters for a GLANCE "G" scope. The program converts simple strings of alpha-numeric commands to scope vectors and packs them into scope memory 2. Provisions have been made to allow writing either a few supplemental characters, or a whole character set. This allows the user to have some flexibility in the output from his programs. CHRGEN has been interfaced with FSNAP to allow the user's programs to generate characters internally. One of the highlights of this interpreter is that it gives the 516 user the power to create pictures by means of an FSNAP "TYPE" statement.

The user must call DTRSTR from either executive in order to restore the normal character set.

X. CALLING THE CHARACTER GENERATOR

CHRGEN may be called from either the system or FSNAP executives:

SYS? CHRGEN,INPUTFILE,ADDRESS(optional)

FSNAP- CHRGEN,INPUTFILE,ADDRESS(optional)

INPUTFILE is a file containing a list of the commands as described below. ADDRESS is the location in memory where the characters will be stored. If left out, a default of 1330(octal) will be taken. CHRGEN will respond by typing out the LAST ADDRESS it used in storing the characters. All of the characters not directly overwritten by the user will remain intact.

CHRGEN may also be called from an FSNAP program as follows:

CALL CHARAC(FILECODE)

FILECODE is the code corresponding to a file containing a list of commands as described below.

XI. DESCRIPTION OF COMMANDS

The following commands should be placed in the INPUTFILE to create the characters.

CHARACTER DEFINITION

A character is defined by a C octalnumber, where C is an ascii "C", and octalnumber is the octal equivalent of the ascii character, taken from an ASCII conversion chart(see section XV). Following the definition, the user should place the appropriate commands as described below. Up to 256 characters may be defined in any given file.

There are two character modes, incremental and control. The user may switch from control to incremental in the middle of a character, but he may not switch back.

INCREMENTAL MODE COMMANDS

In incremental mode, there are three basic directions, x, y, and diagonal. the user may also turn the beam on and off(visible and invisible). The only quirk is that if the user wants a point illuminated, he must turn the beam on before he moves to it. At the start of the increments, the beam is always set to invisible. The commands which make up the incremental set follow:

X NUMBER

The X specifies that the beam moves in the x direction. The number is a signed integer corresponcing to the number of increments to be moved. The sign of the number determines whether the beam will move left or right: positive specifies moving to the right, negative to the left.

Y NUMBER

The Y specifies that the beam moves in the y direction. The number is a signed integer corresponding to the number of increments to be moved. The sign of the number determines whether the beam will move up or down: positive specifies moving up, negative specifies moving down.

D SIGN SIGN NUMBER

The D specifies a diagonal. The two signs are the x and y direction respectively, of the diagonal. The signs correspond to those in the Cartesian coordinate system. The number specifies the number of increments to be moved in the diagonal direction.

V

V turns the beam on, that is, the following increments will be visible.

I

I turns the beam off, the following increments will be invisible.

CONTROL MODE COMMANDS

In the control mode, the user may move in the x or y directions, visibly or invisibly, specify absolute positions on the screen, or change the scale, brightness, and blink of the characters. He may also use 'short vectors', which allow him to move in any direction. The commands for the control set follow:

XV NUMBER

The XV specifies a visible X vector, and the number is a signed integer less than 2048 which specifies the length and direction of the line.

XI NUMBER

XI is an invisible x vector, otherwise similar to the XV.

XS NUMBER

XS specifies an absolute x position on the screen, and number is a positive integer less than 4096 which specifies the position.

YV NUMBER

YV is the same as XV except it moves in the y direction.

YI NUMBER

YI is the same as XI except that it moves in the y direction.

YS NUMBER

YS is the same as XS except that it specifies the Y position.

SV XNUMBER YNUMBER

SV specifies a visible short vector. XNUMBER and YNUMBER are signed integers less than 500, which specify the number of units to be moved in the X and Y directions respectively.

SI XNUMBER YNUMBER

SI is the same as SV except that the vectors are drawn invisibly.

PR NUMBER NUMBER NUMBER

PR is a set parameter command. The first number is a positive integer less than 8, which specifies the brightness of the beam, 0 being the brightest. The second number is a positive integer less than 16 which specifies the scale. 15 is the greatest, 1 is the smallest, and 0 blanks the beam. The third number is a positive integer less than 8 which specifies the blink, 0 being no blink.

WT NUMBER

WT is a wait command. If the beam is moved invisibly, a wait must be placed after the move, the value being approximately 1 wait for every 16 invisible moves.

The format of the input file is very liberal. The data may be delineated by spaces, commas, colons, semi-colons, carraige-returns, or line-feeds. No spaces are required between a command and a number. A comment may be placed on a line providing it is preceeded by a backslash.

XII. DIAGNOSTICS

If CHRGEN encounters an error in the input file, it will return an educated guess as to the cause of the trouble, followed by the line on which the error occurred, and the character on that line. The number returned for the character is often slightly too large. This is caused by CHRGEN's attempts to locate the data correctly.

The following is a list of the error messages and their respective causes:

FILE?

This will result if CHRGEN cannot locate the input file, either because it is nonexistant, or is currently attached to another program. No line or character numbers will be printed with this error.

WRONG TERMINAL

If the user dares to call CHRGEN from a terminal other than a GLANCE G scope, this will remind him of his foolishness. This error will not return line or character numbers.

NO CHARACTER DEFINITION

If CHRGEN can not find a C in the input file, it will return this message. Chances are that the input file was chosen incorrectly.

NO CHARACTER ADDRESS

If CHRGEN is unable to locate the address of the new character in the users data, this message will return.

NO COMMAND

As might be expected, this error will result if CHRGEN is unable to locate any commands(XV,D,..etc.).

BAD COMMAND

This message will appear if there is a command which is not among CHRGEN'S repetoire.

NO PARAMETER

This message will result from giving a command without a number following it.

NO DIRECTION SIGN

When in the diagonal mode(D), if one of the two signs is missing, this error will result.

BAD DIRECTION

If an illegal character is occupying one of the slots for the signs in the diagonal mode(D), CHRGEN will notify the user with this message.

ILLEGAL NEGATIVE NUMBER

If a negative number is found in a position which was described to be a positive integer in the DESCRIPTION OF COMMANDS section, this comment will be returned to remind the user to read more carefully.

NUMBER TOO LARGE

If CHRGEN detects a number that is larger than it is willing to accept, it will convey that fact by means of this comment.

BAD ARGUMENT

This message will result from something other than a number appearing as an argument.

ILLEGAL RETURN FROM INCREMENTAL MODE

If the user tries to switch from incremental mode to control mode this message will be printed.

MISSING ARGUMENT

This message is causec by a command with no argument.

MISSING X ARGUMENT

If XNUMBER is missing on an SV or SI command, this message will result.

MISSING Y ARGUMENT

If YNUMBER is missing on an SV os SI command, this message will result.

XIII. GLOSSARY OF TERMS

This section is devoted to explaining some of the terms used in this manual. Its purpose is to give a user who is not familiar with GPLOT and its associated programs a little help in interpreting the language.

CHARACTER-any standard ASCII character, or a user written character.

CURVE-the pattern of one set of data.

FILE-any file on the 516.

FRAME-the frame is a rectangular boundary drawn around the plotting area.

GRID DIVISION-the distance between two grid ticks or lines.

GRID LINE-a line spanning the frame which designates a particular value in the data.

GRID TICK-a short grid line. Its purpose is to leave the plotting area clear.

HEIGHT-the height of the plotting area is the vertical distance from the top of the frame to the bottom.

LABEL-a set of characters to designate the value of various parts of a plot.

LEGEND-text appearing below the plot.

LINE-a string of characters terminated by a carraige return line-feed pair.

LOG-GPLOT uses common logarithms for the logarithmic scaling.

NAME-the name of a 516 file or segment.

SEGMENTED PROGRAM-a program written in the 516 SEGMENT ASSEMBLER(516-41) format.

STARE-the hard copy generated by the GE 635 at Murray Hill.

VARIABLE-any value which is subject to change, either by the user or the program

XIV. ACKNOWLEDGEMENT

I am deeply indebted to all the users who took the effort to express their preferences and difficulties in using the routine. Their concern prompted the writing of a more powerful routine, and a comprehensive users guide.

The assistance of Carl Christensen and Heinz Lycklama is gratefully acknowledged.

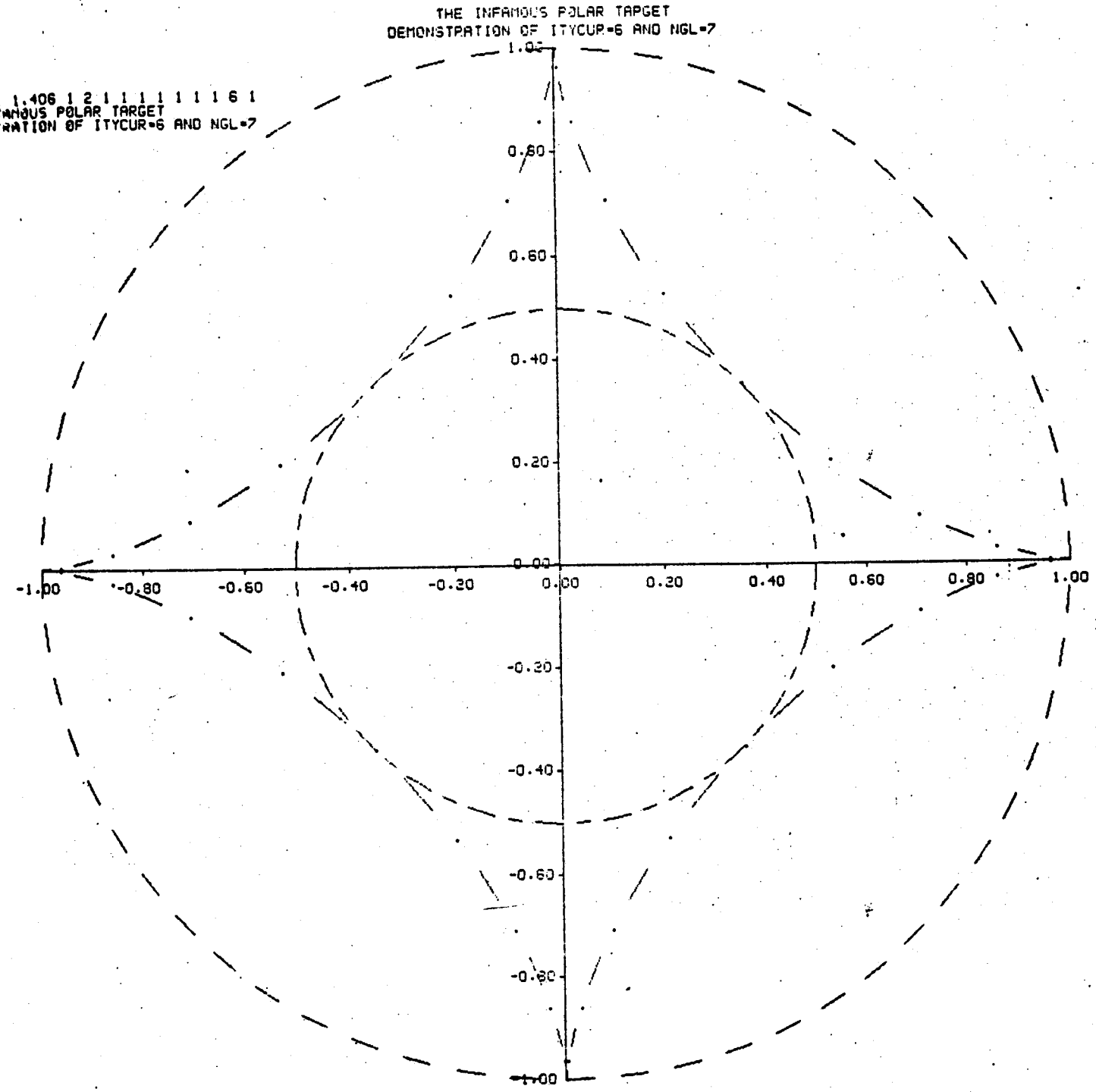
516-32
CC-ADH
6/12/69

ASCII CHARACTER MNEMONICS

Octal	0	1	2	3	4	5	6	7
000	NUL	SØH	STX	ETX	EØT	ENQ	ACK	BEL
010	BS	HT	LF NL	VT	FF NP	CR	SØ RRS	SI BRS
020	DLE	DC1	DC2 HLF	DC3 VA	DC4 HLR	NAK	SYN	ETB
030	CAN	EM	SUB SS	ESC MC	FS	GS	RS MS	US MR
040	(space) SP	! EXC	" DQ	# NS	$ DS	% PC	& AMP	' AA
050	(ØP	) CP	* AST	+ PLS	, CØM	- MIN	(period) .	/ SL
060	0	1	2	3	4	5	6	7
070	8	9	: CØL	; SC	< LT	= EQ	> GT	? QM
100	@ AT	A	B	C	D	E	F	G
110	H	I	J	K	L	M	N	Ø
120	P	Q	R	S	T	U	V	W
130	X	Y	Z	[ØSB	\ LS	] CSB	^ CIR	_ UL
140	` GA	a .A	b .B	c .C	d .D	e .E	f .F	g .G
150	h .H	i .I	j .J	k .K	l .L	m .M	n .N	o .Ø
160	p .P	q .Q	r .R	s .S	t .T	u .U	v .V	w .W
170	x .X	y .Y	z .Z	{ ØCB	| VL	} CCB	~ TIL	/// DEL

01/10/74
PC-217 X4441

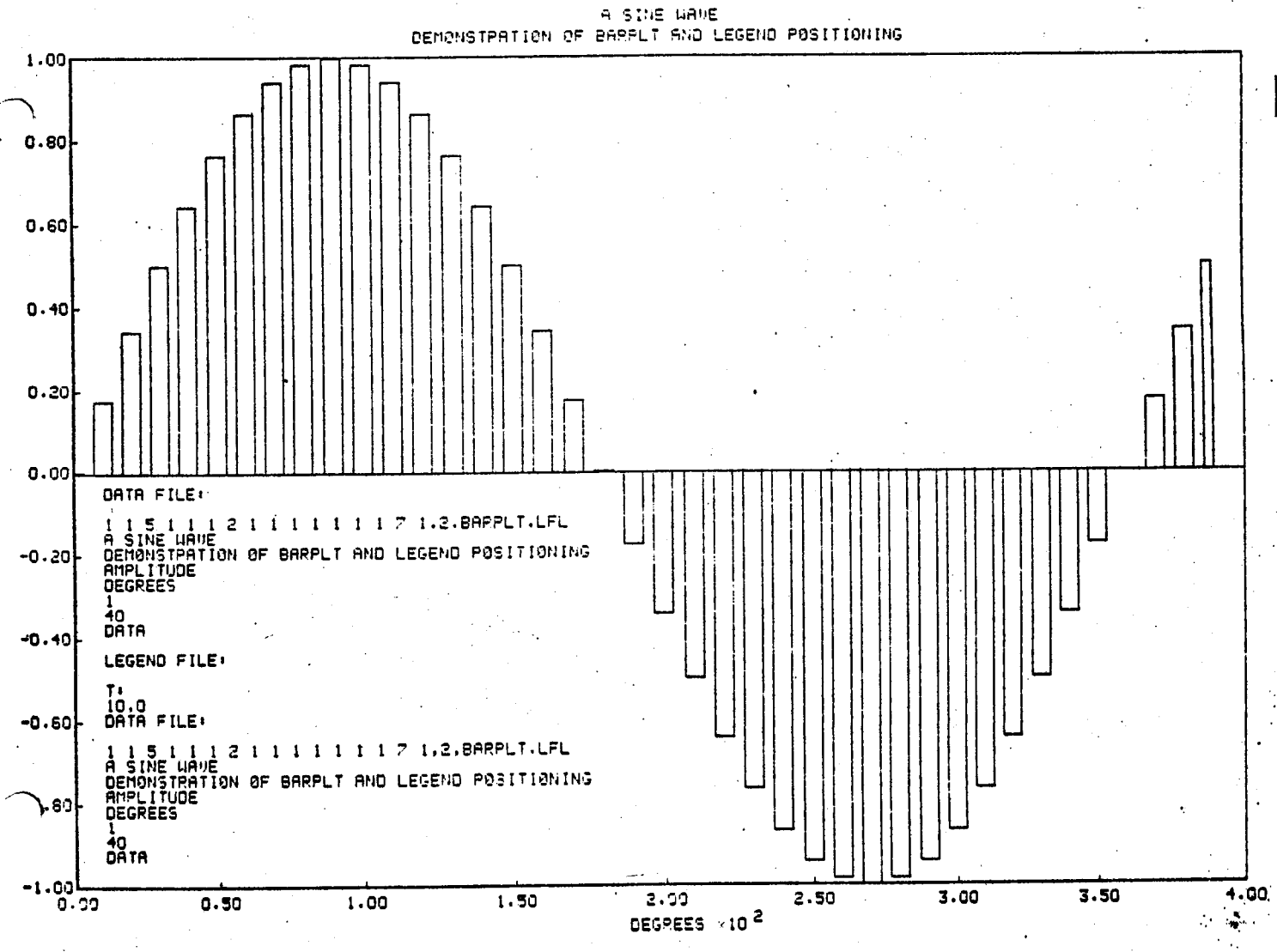
1 1.406 1 2 1 1 1 1 1 1 1 6 1
FAMOUS POLAR TARGET
STRATION OF ITYCUR=6 AND NGL=7



PLOT 1

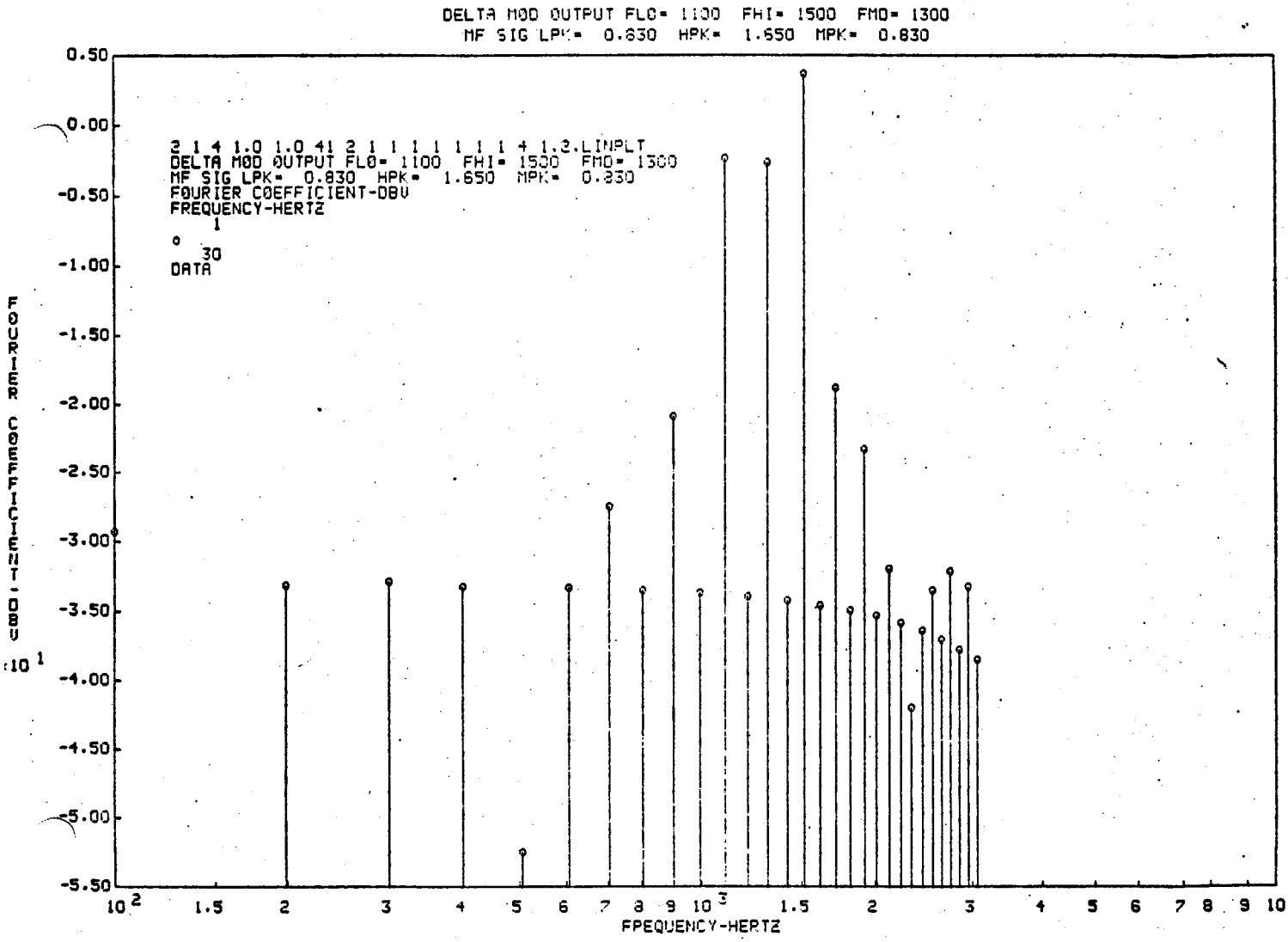
DEBUG REWIND NEXT DONE STAPE

16.807 01/10/74
19 JES 7C•217 X4441



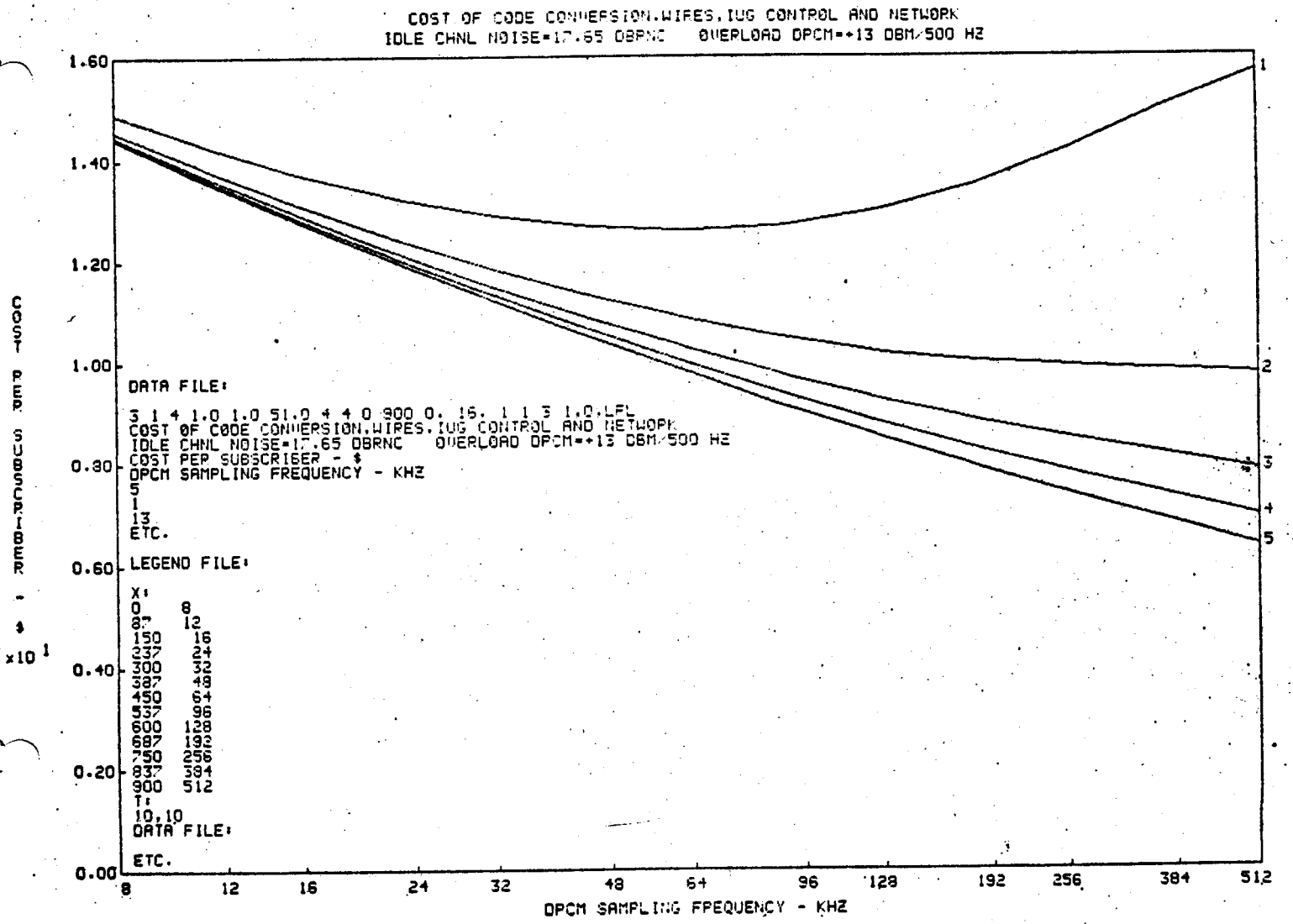
PLOT 1

DEBUG REWIND NEXT DONE STARE



PLOT 1

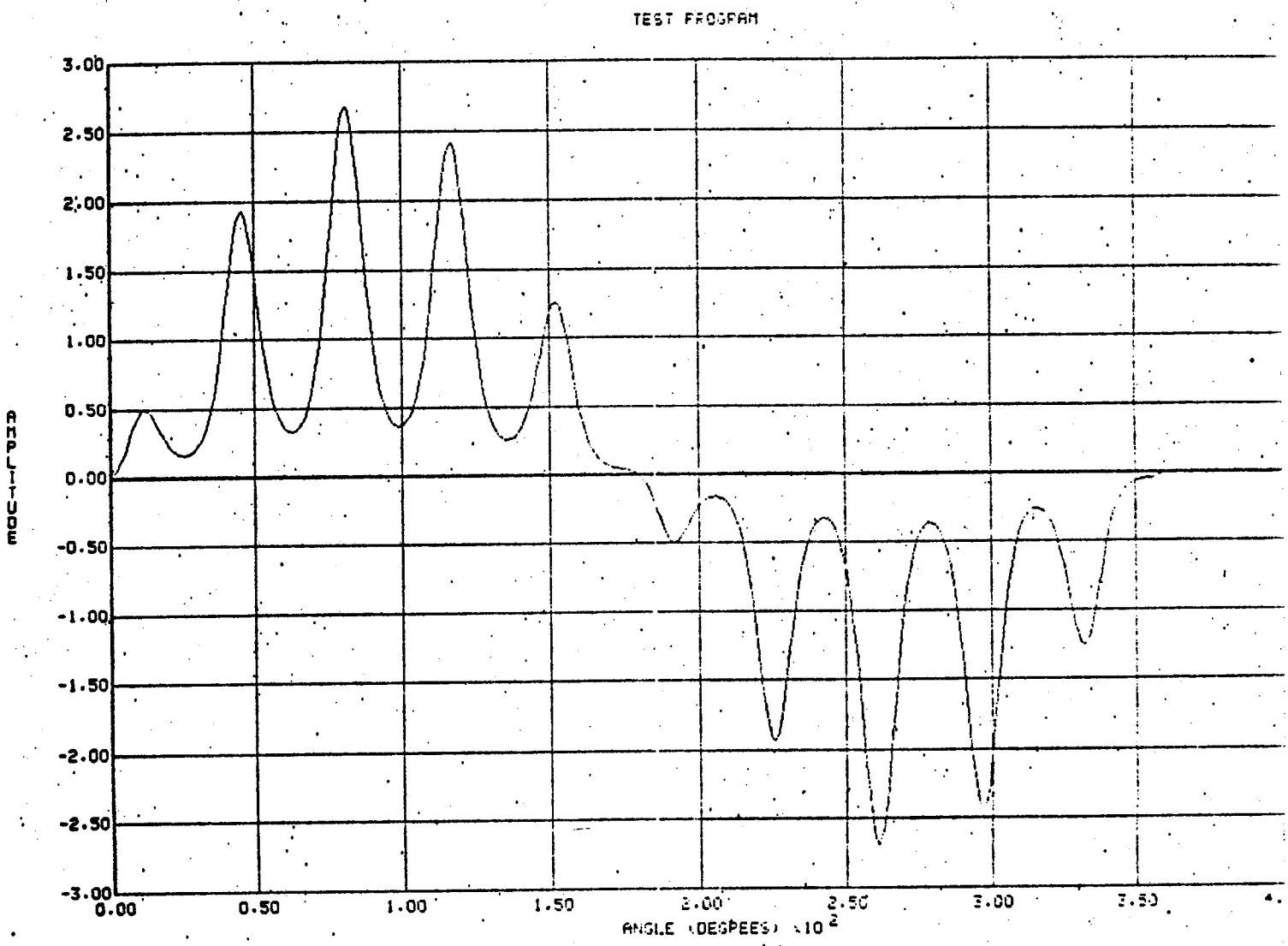
DEBUG REWIND NEXT DONE STARE



PLOT 1

DEBUG REWIND NEXT DONE STARE

78273 14.329 01/11/74
80XM119 JES 7C•217 X4441



1 1 1 1 1 2 1 1 1 1 1 1 1 1 1
TEST PROGRAM

AMPLITUDE
ANGLE (DEGREES)
1
361
DATA

DEBUG REWIND NEXT DONE STAPE