CORNELL UNIVERSITY

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USING THE OCS COMPLOT DP-1 PLOTTER

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by

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INTRODUCTION:

In using the plotter, I have found the plotting routines which were written at Cal Tech to be much more versatile and easier to use than the Cornell routines. In addition, several of the Cal Tech routines simply do not have any equivalent counterpart in the Cornell library. Since the Cal Tech routines are not part of the Cornell system library, they must be inserted (in object module form) in the link edit step of a FORTRAN job. At the present time these object decks are all stored as CF's under account ACX. In addition, the original source decks are in my office. In the future, Jay Goguen will be in charge of both the source decks and the CF's. The few Cornell routines which I recommend using are automatically link edited in when they are called and do not have to be inserted into the deck.

In using this manual, it is important to obtain a copy of OCS memo TN-39 which describes the "externals" of using the plotter (i.e. how to request pen type, pen color, type of paper, etc.). The other OCS manual "FORTRAN plotting routines for the COMPLOT DP-1 Plotter" is not necessary, however, as any necessary material from it is reproduced here.

General Description of the Plotting Routines

The various plotting subroutines perform the functions of creating a part of the finished picture, e.g., axes, labelling, curves, points, etc. and in so doing generate plotter word groups which the system considers as punched output (thereby allowing plotter output to be filed - see TN-39). The arguments of all the subroutines may be constants, subscripted variables, or nonsubscripted variables except where otherwise noted. The names assigned to variables throughout this description agree in mode with the modes (fixed or floating) which must be used when the subroutine is called. It should also be noted that all floating point variables must be in single precision.

The following plotter subroutines (described more fully later) are available:

PLOTS (A, B)

PLOTS must be the first routine called when these plot routines are used. PLOTS initializes certain variables used in the plotting routines and creates the (PLOTFILE header records.

SYMBOL (X, Y, HEIGHT, BCD, THETA, N)

SYMBOL draws titles and other identification or lettering on a graph.

PLOT (X, Y, KPEN)

PLOT is a general purpose routine used by both the programmer and the other plotter subroutines to draw points and the lines connecting points.

PLTEND

PLTEND must be called at the end of every plotting program.

These four routines are all Cornell system routines. The following routines are the Cal Tech routines (modified to work on the Cornell system).

LABEL (X, Y, XMN, XMX, SIZE, NI, TITLE, NCT, ND)

LABEL draws a horizontal or vertical axis with tick marks, labels at the tick marks and title. Its CF name is LABL.

LOGAXS (X, Y, FL, ID, NUMDEC, IHIGH, ILBL, TITLE, NCT, IROT, NTICK)

LOGAXS draws a logarithmic axis with tick marks, decade labels and title. Its CF name is LOGA.

PRTNUM (X, Y, SIZE, NUM, FMT, THETA)

PRTNUM plots numbers on the plot using a user provided format. Its CF name is PRTN.

PLOTXY (N, X, Y, XMN, XMX, YMN, YMX, LAB, IP, ISYS, ISP, DD)

PLOTXY plots the array (X, Y) as a continuous line, as points, or as a combination. Its CF name is XYPL.

EBPLOT (N, X, Y, XMIN, XMAX, YMIN, YMAX, LAB, ISYM)

EBPLOT plots an array of points and their associated error bars. Its CF name is EBPL.

INTPLT (NI, NO, KTYPE, N, XX, YY, XMIN, XMAX, YMIN, YMAX, LAB)

INTPLT interpolates points into an array of (XX, YY) points so that a smooth curve may be plotted. Its CF name is INTP.

Since each of the subroutines performs a unique function, the user needs to call only those routines necessary for the successful construction of his plot.

A more detailed description of each subroutine follows.

PLOTS

PLOTS must be called before any of the other plotting routines. PLOTS initializes some of the variables used in the rest of the routines and creates the) (PLOTFILE header records.

CALLING PROCEDURE:

The PLOTS subroutine is called by the statement

CALL PLOTS (A, B)

where

A and B are dummy variables, and can be any variable name the user chooses, as long as they have no meaning, i.e., do not correspond to the names of any actual variables used in the other plot routines.

SYMBOL

DESCRIPTION:

SYMBOL furnishes the capability of drawing letters, numbers, and certain special characters as identification or titles on graphs.

CALLING PROCEDURE:

The subroutine is called by the statement:

CALL SYMBOL (X, Y, HEIGHT, BCD, THETA, N)

where

X = X-coordinate in inches of the lower left-hand corner of the first character.

Y = Y-coordinate in inches of the lower left-hand corner of the first character.

HEIGHT = height in inches of the character to be drawn. Most symbols are drawn with their lower left-hand corner at the coordinates (X, Y) and are drawn on a 6 x 7 grid; the true plotted height will be an integer multiple of .07 inches. Special "centered" symbols (numbered 0-13) are drawn on a 4 x 4 grid with their center at coordinate (X, Y); the true plotted height will be a multiple of .04 inches.

BCD = normally a character string, i.e., 'abcd', etc., and represents the symbol to be printed. To plot a symbol by its code value, the value must be put into the first byte of 'BCD' by some means such as

```
INTEGER*2 BCD
BCD = L*256
```

where L is the value of the symbol.

THETA = the angle of rotation, counter-clockwise, in degrees between the X-axis and the line along which the characters are to be drawn.

N = the number of characters in the BCD character string. In addition, if N is made negative the pen will be put down rather than picked up before going to (X, Y) to draw the symbols specified in BCD.

EXAMPLES:

The following statement will draw the letters 'THIS IS A GRAPH' at an angle of 45 degrees across the paper in 1/2 inch letters, starting at (0.1, 3.1).

```
CALL SYMBOL (.1, 3.1, .5, 'THIS IS A GRAPH', 45., 15)
```

If instead the words 'THIS IS A GRAPH' have been read in A-format into an array TITLE, the following statement is used:

```
CALL SYMBOL (.1, 3.1, 15 TITLE, 45., 15)
```

The following statement will draw symbol number 52 with height of .5 inches at the point (5., 7.3). Note that the symbol number must be left-justified.

```
INTEGER*2 BCD
BCD = 52*256
CALL SYMBOL (5., 7.3, .5, BCD, 0., 1)
```

TABLE OF SYMBOLS

0	SQUARE-CENTERED	24	UNDERSCORE
1	OCTAGON-CENTERED	25	DOUBLE UNDERSCORE
2	TRIANGLE-CENTERED	26	OVERSCORE
3	PLUS-CENTERED	27	INTEGRAL
4	X-CENTERED	28	IMPLIES
5	DIAMOND-CENTERED	29	OR
6	UP ARROW-CENTERED	30	WAVE
7	BAR X-CENTERED	31	DOUBLE WAVE
8	Z-CENTERED	32	RIGHT BRACKET
9	Y-CENTERED	33	LEFT BRACKET
10	SQUARE X-CENTERED	34	MU
11	ASTERISK-CENTERED	35	PI
12	DOUBLE BAR X-CENTERED	36	PHI
13	VERTICAL-CENTERED	37	THETA
14	STAR	38	PSI
15	HORIZONTAL VECTOR	39	CHI
16	VERTICAL VECTOR	40	OMEGA
17	BACKSPACE	41	LAMBDA
18	CARAT	42	ALPHA
19	EQUIVALENCE	43	DELTA
20	RIGHT ARROW	44	EPSILON
21	CARRIAGE RETURN	45	ETA
22	NOT EQUAL	46	SUPERSCRIPT
23	PLUS MINUS	47	SUBSCRIPT

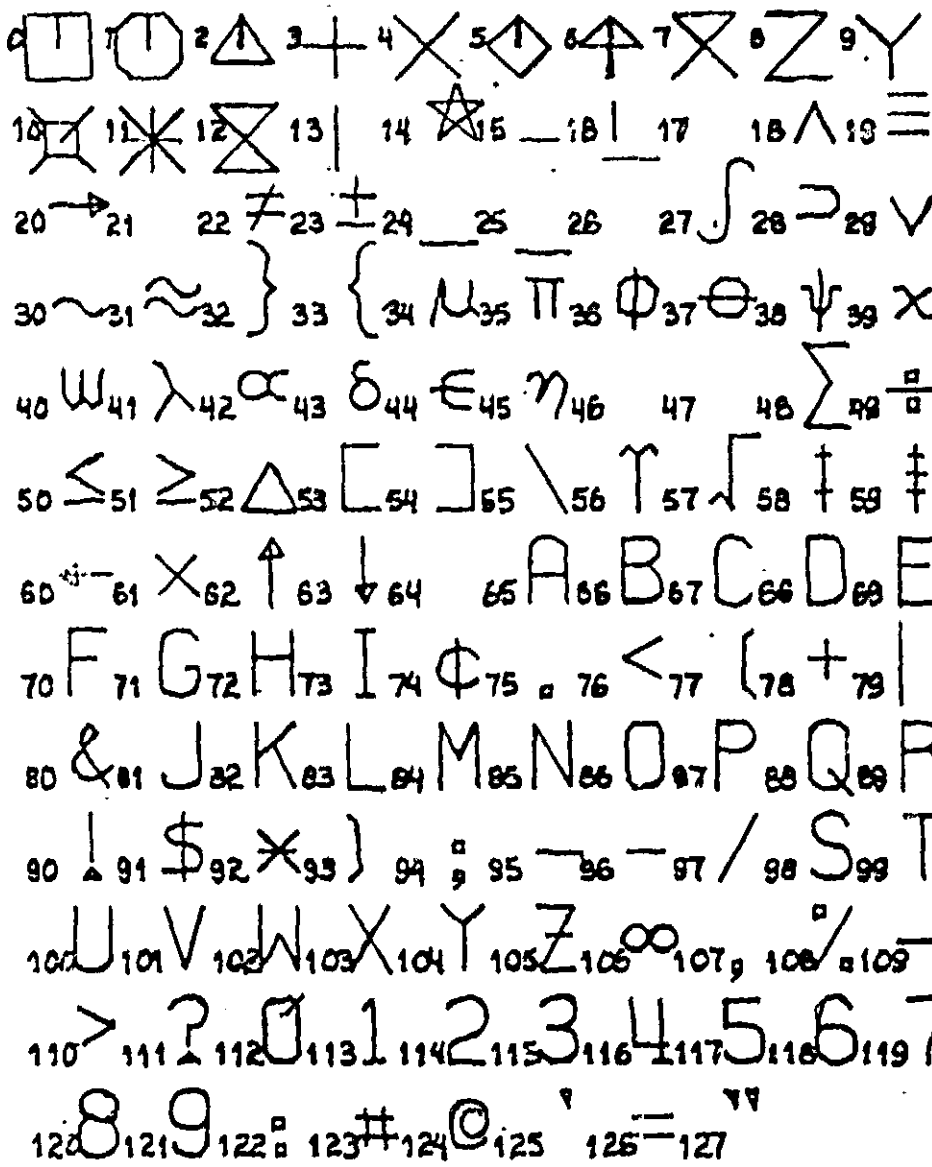
TABLE OF SYMBOLS (continued)

48	SUMMATION	73	I
49	DIVIDE	74	CENT
50	LESS THAN OR EQUAL	75	ARROW
51	GREATER THAN OR EQUAL	76	LESS
52	DELTA	77	LEFT PARENTHESIS
53	LEFT E JE	78	PLUS
54	RIGHT BRACE	79	VERTICAL
55	REVERSE SLASH	80	AMPERSAND
56	GAMMA	81	J
57	SQUARE ROOT	82	K
58	VERTICAL WITH 2 HORIZ	83	L
59	VERTICAL WITH 3 HORIZ	84	M
60	LEFT ARROW	85	N
61	TIMES	86	O
62	UP ARROW	87	P
63	DOWN ARROW	88	Q
64	BLANK	89	R
65	A	90	EXCLAMATION
66	B	91	DOLLAR SIGN
67	C	92	ASTERISK
68	D	93	RIGHT PARENTHESIS
69	E	94	SEMICOLON
70	F	95	NOT
71	G	96	MINUS
72	H	97	SLASH

TABLE OF SYMBOLS (continued)

98	S	121	9
99	T	122	COLON
100	U	123	POUND
101	V	124	AT
102	W	125	APOSTROPHE
103	X	126	EQUAL
104	Y	127	QUOTATIONS
105	Z		
106	INFINITY		
107	PER CENT		
108	COMMA		
109	DASH		
110	GREATER THAN		
111	QUESTION		
112	0		
113	1		
114	2		
115	3		
116	4		
117	5		
118	6		
119	7		
120	8		

TABLE OF VALID CHARACTERS
('SYMBOL' Output)



PLOT

DESCRIPTION:

PLOT subroutine is used to move the pen from its current location to a point specified by the user. The user must also specify whether the pen is on the paper (and will draw a line) or off the paper when it moves.

CALLING PROCEDURE:

The subroutine is called by the statement:

```
CALL PLOT (XCORD, YCORD, KPEN)
```

where

XCORD = X-coordinate in inches of the point to which the pen is to move from its present position.

YCORD = Y-coordinate in inches of the point to which the pen is to move from its present position.

KPEN = a signed control digit specifying whether the pen is to be on or off the paper while moving to the point defined by XCORD and YCORD. The following options are available: +1, -1, +2, -2, +3, -3, where:

+ = more points to be plotted in this picture

- = the point associated with this KPEN value is

the last to be drawn on this picture and will be considered the "zero" point of the next plot.

1 = the pen position (up or down) remains unchanged, i.e., the pen will remain as it was at the end of the previous operation.

2 = the pen will move in the down position (on the paper) and a line will be drawn.

3 = the pen will move in the up position (off the paper) and no line will be drawn.

NOTE :

PLOT can be used (with negative KPEN) to terminate a set of plots and reset the pen in a suitable position for a subsequent set of plots.

EXAMPLE :

```
CALL PLOT (9.3, 2.6, -3)
```

The pen will move to coordinates (9.3, 2.6) with the pen in up position. Since the sign associated with KPEN is negative, the coordinate system will be reset to zero when the pen reaches (9.3, 2.6), i.e., this point will be the new (0.0, 0.0) for the next picture.

LABEL

USAGE:

CALLING SEQUENCE:

CALL LABEL (X, Y, XMN, XMX, SIZE, NI, TITLE, NCT, ND)

where:

X, Y = starting point of axis, in inches

XMN, XMX = range of axis (first and last values, printed at the beginning and end of axis)

SIZE = length of axis, in inches

NI = number of intervals along axis

If this value is too large to allow printed label, or is negative, only tick marks will be made.

TITLE = Hollerith title to be printed along axis

NCT = number of characters including blanks, of TITLE

NCT positive = Title will be printed below the X-axis or to the left of the Y-axis

NCT negative = Title will be printed above the X-axis or to the right of the Y-axis

NCT = 0 - no title will be printed

ND = 0 axis will be drawn horizontally

= 1 axis will be drawn vertically

or:

CALL VLABEL (X, Y, XMN, XMX, SIZE, NI, TITLE, NCT, ND, FMT, LF)

Normally, the magnitude of the numeric labels along the axis drawn is scaled to a value which lies between 0 and

9.999 and then the format F6.3 is used to plot the label. To some users, neither the scaling nor the format adopted may prove desirable. Two more arguments are therefore added to provide more flexibility in labeling:

FMT = a one-dimensional EBCDIC array where the format is stored. The format will be used in labeling. FMT is of the following form: (F n. m) FMT must be dimensioned, even if only for (1). Note: Be sure to include parentheses. where:

n - is the field length, which must include a position for the sign and a position for the decimal point (m may be zero).

m - is the number of decimal places after the decimal point (m may be zero).

LF = an integer specifying the field length of the format provided (LF = n). However, if the user wishes to print out an integer value, without the decimal point, LF should be set equal to n-1.

NOTE:

When FMT and LF are provided are provided in the calling sequence the numeric labels will not be scaled, therefore the user must provide a format with sufficient field length.

If the space between intervals is not large enough for the printing of the values, there may be overlapping of the first and second printings.

To avoid this, the following formula must be true:

Space > (n + I) * 0.12

where:

Space = value of the interval in inches

n = field length in the format statement (i.e. Fn.m)

I = number of digits to the left of the decimal point in the second value to be printed.

NOTE:

Letter sizes have been set as follows:

Numeric label along axis	= 0.12
Title	= 0.16
Scale factor	= 0.10

If the user wishes to alter any or all of the sizes, he may make use of the labeled common statement.

COMMON/LBLCOM/ITEST, SLBL, STTL, SSCL

where:

ITEST must be set = 1

SLBL = size of numeric label

STTL = size of title

SSCL = size of scale

These are real values in inches and must all be defined ever if only one or two values are to be altered.

User must be cautioned not to exceed boundaries of paper.

LOGAXS

USAGE

CALL LOGAXS(X, Y, FL, ID, NUMDEC, IHIGH, ILBL, TITLE, NCT, IROT, NTICK)

where

X,Y = Starting point of axis, in inches.

FL = Length of axis, in inches.

ID = Angle of axis in multiples of 90°, i.e. ID = 1,angle = 90°

NUMDEC = Number of decades along the axis. (number of intervals between cycles)
NUMDEC - positive - Scale increases from (X, Y) to other end of axis.
NUMDEC - negative - Scale decreases from (X, Y) to other end of axis.

IHIGH = Power of ten at opposite end of axis from (X, Y).

ILBL = 0 Labels printed for decades.
≠ 0 Labels not printed for decades.

TITLE = EBCDIC characters to be printed along the axis.

NCT = Number of characters in TITLE.
> 0 TITLE plotted parallel to axis
= 0 No TITLE plotted

IROT = Angle of numeric labels for decades with respect to angle of axis in multiples of 90° measured CCW

NTICK = Location of labels and tick marks with respect to axis

NTICK = +1 Labels plotted below or to right of axis; ticks above or to left of axis

NTICK = -1 Labels plotted above or to left of axis; ticks below or to right of axis

NOTE:

Letter sizes have been set as follows

Numeric label along axis = 0.12

Title = 0.16

Tick Marks = 0.20

If the user wishes to alter any or all of the sizes, he may make use of the labelled common statement

COMMON/LOGCOM/ITEST, SLBL, STTL, STICK

where

ITEST must be set = 1

SLBL = size of numeric label

STTL = size of title

SSCL = size of tick

SLBL, STTL, and SSCL are all real numbers in inches and must all be defined even if only one or two values are to be altered.

PRTNUM

USAGE:

Calling sequence

```
CALL PRTNUM (X, Y, SIZE, NUM, FMT, THETA)
```

where

X, Y = position, in inches, of the lower left corner of the first digit of NUM (including alphameric information if any).

SIZE = size in inches of digits of NUM.

NUM = number (integer, real or EBCDIC) to be plotted.

FMT = dimensioned array containing the format (in EBCDIC form) with which NUM is plotted. FMT must be dimensioned, even if only for (1).

THETA = angle in degrees in which NUM is plotted, with respect to the horizontal direction, counter-clockwise

EXAMPLE:

```
CALL PRTNUM (13., 9.,.15, NP, '(9HPLOT_NO._13)',0.)
```

If NP = 15, the above statement would result in the plotting of:

PLOT_NO._ _ 15

in the upper right corner of the plotting paper.

The same result could be obtained by the following statements:

```
DIMENSION    FMT (4)
DATA         FMT/4H(9HP,4HLOT , 4HNO. , 3HI3)/
CALL         PRTNUM (13.,9.,.15, NP, FMT, 0.)
```

PLOTXY

USAGE:

Calling sequence

```
CALL PLOTXY(N, X, Y, XMN, XMX, YMN, YMX, LAB, IP,
ISYS, ISP, DD)
```

where

N = size of array to be plotted

X = array of abscissa coordinates

Y = corresponding array of ordinates

XMN, XMX = values of x at left and right edges of plotting area, respectively

YMN, YMX = values of y at bottom and top edges of plotting area, respectively

LAB = 0 plot on same sheet of paper

> this is last plot on current sheet of paper

IP = 0 point plot only (needs ISYS)

= 1 line plot only (ignores ISYS and ISP)

= 2 line point and line plot (needs ISYS and ISP)

ISYS = 0 through 13, determines which symbol is to be used in point plot. These correspond to the first 14 values of SYMBOL. If IP = 1, this argument is ignored.

ISP = spacing point plot for IP = 2. For example (in addition to line plot)

If ISP = 1, every point will be plotted

If ISP = 2, every second point will be plotted, etc.

DD = One-dimensional array of length 2. If DD (1) ≠ 0, DD (1) and DD (2) will be treated as 8 EBCDIC characters and plotted on the upper right corner of graph paper at the end of each plot (when LAB ≠ 0). If DD (1) = 0, such plotting will be suppressed.

NOTE:

1) All arguments must be present, even if they are not used.

Normally, PLOTXY plots on an area of 15 inches by 10 inches, where 15 inches is the length along the X-direction and 10 inches the width along the Y-direction. If the user wishes to alter these dimensions, he can enter the information through a labeled COMMON in the calling program, as follows:

```
COMMON/COMPXY/ITEST, XLNGTH, YLNGTH
```

where

ITEST must be set = 1

XLNGTH = altered X-length in inches

YLNGTH = altered Y-length in inches

NOTE: Both values must be provided even if only one is to be altered.

EBPLOT

USAGE:

Calling sequence

CALL EBPLOT (N, X, Y, DY, XMIN, XMAX, YMIN, YMAX, LAB, ISYM)

where N = Length of array of points

X, Y = Array coordinates of the center of the central symbol.

DY = Array distance from the center of the central symbol to the vertical extreme of either error bar, relative to YMIN and YMAX.

XMIN = X-value for left-hand edge of plotting area.

XMAX = X-value for right-hand edge of plotting area.

YMIN = Y-value for bottom edge of plotting area

YMAX = Y-value for top edge of plotting area

LAB = Page control

= 0, this plot is not the last plot on the graph sheet.

> 0, last plot on the graph sheet.

$0 \leq ISYM \leq 13$ designating symbol to be used for central symbol. If ISYM < 0, number 0 is used. These are SYMBOL symbols 0-13.

NOTES: 1. The subroutine normally plots on ar area of 15 inches by 10 inches.

2. The central symbol size is .08 inches.
3. If the center of the symbol lies outside the plotting area, the point is not plotted and the comment

   POINT OFF SCALE IN EBPLOT

   is printed on the user's output.
4. If an error bar extends beyond the plotting area, the portion lying outside the plotting area is omitted.
5. If the error bars are smaller than the central symbol, they are not plotted.
6. Plotting time is minimized if the user orders his points such that X increases monotonically.

If the user wishes to alter the plotting dimensions, he can enter the information through a labeled COMMON in the calling program as follows:

```
COMMON/COMEB/ITEST, XLNGTH, YLNGHT
```

where

ITEST must be set =1

XLNGHT = altered X-length in inches

YLNGTH = altered Y-length in inches

Note that all values must be provided even if only one is to be altered.

INTPLT

PURPOSE:

To take a one dimensional array which is to be plotted and interpolate enough values to produce a smooth curve on the XY plotter. Produces linear scale, semi-log, or log-log plots as desired

METHOD:

The program takes logarithms of the input X and Y arrays and the maximum and minimum values of X and Y if requested in the calling sequence. If there are more than (NO -1)/2 values of X-Y given, the curve is immediately plotted. If not, the program produces NO values of X, putting $(\frac{NO-1}{NI-1})$ new points between each pair of the NI values of X in the original array. N^{th} order interpolation by the Aitken method is performed to give Y at each new X value. The resulting curve is plotted

USAGE:

Calling sequence

```
CALL INTPLT (NI, NO, KTYPE, N, XX, YY, XMINI,
XMAXI, YMINI, YMAXI, LAB)
```

where

NI = integer giving the number of values in the XX array which are to be included in the interpolation routine. NI must be less than 1501.

NO = integer giving total number of output points desired. NO must be less than 1501.

KTYPE = integer, specifies type of graph desired

1 for plot of Y vs. X

2 for plot of $\log_{10}$Y vs. X

3 for plot of Y vs. $\log_{10}$X

4 for plot of $\log_{10}$ Y vs. $\log_{10}$X

N = order of the interpolation done on the input points.

XX = one dimensional, real array containing values of X-coordinate which increase monotonically.

YY = one dimensional, real array containing values of Y-coordinate, where YY(I) corresponds to point XX(I).

XMINI = real number, X-value for left-hand edge of graph paper.

YMAXI = real number, X-value for right-hand edge of graph paper.

YMINI = real number, Y=value for bottom edge of graph paper

YMAXI = real number, Y-value for top edge of graph paper

LAB = integer, page control

= 0 if this is not last plot on page

> 0 if it is last plot on page

NOTE:

1. Any points with X values greater than XMAXI will not be plotted.

2. Normally XYPLOT plots on an area of 15 inches by 10 inches, where 15 inches is the length along the X-direction and 10 inches the width along the Y-direction. If the user wishes to alter these dimensions, he can enter the information through a labeled COMMON in the calling program as follows:

```
COMMON/COMPLO/ITEST, XLNGTH, YLNGTH
```

where

ITEST must be set = 1

XLNGTH = altered X-length in inches

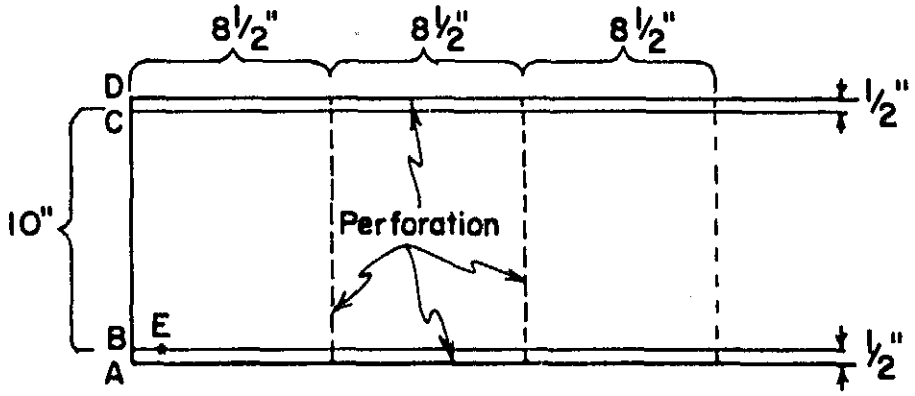
YLNGTH = altered Y-length in inches

Both values must be provided even if only one is to be altered.

NOTES, COMMENTS AND SUGGESTIONS

1) The programs PRTNUM, LABEL, and LOGAXS all use a subprogram, OUTCOR which is stored in CF OUTC. If any one of these three routines is used, OUTCOR must be included also.

2) The plotting paper is fan-folded, each page being 11" high and 8½" long



Grid paper has a 10 x 10 to the inch grid printed along it between B and C

3) When a plot is started, the pen is initially placed by the operator at point A for plain paper and at point B for grid paper. This defines the initial (0, 0) point. If a call is made to LABEL or LOGAXS for a horizontal axis with point A as the origin, the label will not be printed correctly as part of the label is below the axis and hence off scale on the paper (see comment #5 below). Similarly, if a vertical axis is drawn with either point A

or B as its origin, part of the axis label will be on one sheet of paper and part on the preceeding page. If the origin is at point E, however, both axes will plot correctly. Therefore, is axes are to be put on the plot, one should CALL PLOT (1., 0., -3) before drawing labels or plotting on grid paper or CALL PLOT (1., 0.5, -3) before drawing labels or plotting on plain paper. In both cases the origin will then be reset at point E (see writeup for PLOT). This call also will center a standard 10" x 15" plot on two sheets of 11" x 8½" paper.

4) If the LAB parameter is greater than zero in calls to PLOTXY, EBPLOT, and INTPLT, the plotter will finish the current plot and then move to a new origin on a clean sheet of paper in preparation for the next plot. If the old origin was at point E, it will move to point E on a new page. Therefore the call to PLOT does not have to be repeated. Similarly, if the old origin was at point A, B, or any point Q on the page, it will rezero at the corresponding point on a clean page.

5) If a point on the plot goes offscale in the +Y or -Y directions, all sucessive points will be plotted incorrectly. For example, assume that the Y coordinate runs from 0.0 to 1.0 unit and is 10" long. We wish to plot points with Y coordinates of 0.5, 1.0, 1.5, and 0.5 units. The

first two points will plot correctly, but the third will go up against the limit of travel at the upper perforation. When the pen then moves from the third to the fourth point, it will attempt to move down one unit (i.e., 10"). However, since it is not really 0.5 unit (5") above the perforation, it will move down 10" from its current position (on the upper perforation) and plot the last point near the bottom of the paper. All succeeding points will also be in error.

6) Point plots take considerably more time than line plots

7) The length of an EBCDIC character string is 6/7 x N x SIZE since each letter is 6/7 · SIZE in width.

8) Since the system thinks that it is punching cards when it plots, it is recommended that the CARDS parameter on the limits card be raised from its default value of 500.

9) When using the plotting routines and the labelling routines, make sure the minimum and the maximum values passed to both routines are the same. Also, be sure the lengths are the same. Otherwise, the plotted points and their labels will not correspond.

10) The plotting surface in the Y direction is not quite 11" long, so that using grid paper, for example, one can only

plot approximately 0."4 above and below the grid. If this is not wide enough, there is a 20" plotter in Upson which may be used.

11) In addition to the routines which have been discussed, there exist programs for drawing countours and three dimensional surfaces. Dale Pleticha has copies of the contour plotters and I have a copy of the 3D plotting routine.

12) The plotting routines take only modest amounts of core (LABEL $\approx$ 7K, LOGAXS $\approx$ 5K, PLOTXY $\approx$ 2K. All the others take less than 2K) and add only a few seconds compute time to a job (see example).

13) Even though a program has the plot routines written into it, the plotter may be "turned off" by the following substitution:

```
Replace    //GO.FT98F001 DD SYSOUT=P
with       //GO.FT98F001 DD  DUMMY,DCB=BLKSIZE=80
```

The program will run exactly as before, except than no plotter output will be produced.

Acknowledgements

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EXAMPLE

The following program is an example of the use of several of the plotting routines. The program took 3.5 seconds to execute and 4 minutes to plot (at a cost of $10.00 per plot-hour).

```
C     IN ORDER TO RUN THIS PROGRAM (SEE TN-39):
C
C    // HASP JOB CARD
C    /*LIMITS CARDS=5K,CLASS=K
C    /*FORMAT P,DDNAME=FT98F001,FORMS=1201,PEN=FELT
C    // EXEC FORTGCLG,REGION.FORT=100K,REGION.LKED=100K,REGION.GO=60K
C          FORTRAN SOURCE DECK
C    //LKED.SYSIN DD *
C    /*I ACX.OUTC
C    /*I ACX.LABL
C    /*I ACX.LOGA
C    /*I ACX.PRTN
C    /*I ACX.XYPL
C    //GO.FT98F001 DD SYSOUT=P
C    //
```

```
                C     THE FOLLOWING PROGRAM IS AN EXAMPLE OF THE USE OF THE PLOTTER,
                C     IN PARTICULAR, THE ROUTINES PLOT, PLOTS, PLTEND, SYMBOL, LOGAXS,
                C     LABEL (AND VLABEL), AND PLOTXY.
                C
0001                  DIMENSION X(51),Y(51),Z(51),DD(2),FMT(2)
                C
                C     INITIALIZE THE ARRAY DD TO ZERO FOR PLOTXY.
                C
0002                  DATA DD/0.,0./
                C
                C     THE INPUT FORMAT TO VLABEL IS F3.1
                C
0003                  DATA FMT/'(F3.' , '1)  '/
0004                  INTEGER*2 L2
                C
                C     SET X LENGTH IN PLOTXY TO 6.5 INCHES SO THAT ONE PLOT WILL FIT ON A
                C     8.5 INCH SHEET.
                C
0005                  COMMON/COMPXY/ITEST,XLN,YLN
0006                  ITEST=1
0007                  XLN=6.5
0008                  YLN=10.
                C
                C     INITIALIZE PLOT FILE
                C
0009                  CALL PLOTS(XXX,YYY)
                C
                C     RESET THE ZERO FOR PLAIN PAPER SO AS TO LEAVE ROOM FOR AXES.
                C
0010                  CALL PLOT(1.,0.5,-3)
                C
                C     COMPUTE THE INPUT DATA FOR THE FIRST PLOT.
                C
0011                  DO 100 I=1,51
0012                  X(I)=(I-1)/50.
0013                  Y(I)=X(I)*X(I)
0014                100 Z(I)=X(I)*X(I)*X(I)+3.*Y(I)
                C
                C     THE NEXT STATEMENT DEFINES THE X AXIS LABEL.  IT IS 6.5 INCHES LONG
                C     AND RUNS FROM 0 TO 1 IN 5 INTERVALS.
                C
0015                  CALL LABEL(0.,0.,0.,1.,6.5,5,'X VALUES',8,0)
                C
                C     THE Y AXIS ON THE LEFT CORRESPONDS TO THE Y ARRAY.  IT IS 10 INCHES
                C     LONG AND RUNS FROM 0 TO 1 IN 10 INTERVALS.
                C
0016                  CALL LABEL(0.,0.,0.,1.,10.,10,'Y VALUES',8,1)
                C
                C     THE Y AXIS ON THE RIGHT CORRESPONDS TO THE Z ARRAY.  IT IS 10 INCHES
                C     LONG AND RUNS FROM 0 TO 4 IN 10 INTERVALS, PRINTED WITH A F3.1 FORMAT.
                C
0017                  CALL VLABEL(6.5,0.,0.,4.,10.,10,'Z VALUES',-8,1,FMT,3)
                C
                C     EXAMPLE OF THE USE OF SYMBOL WITH AN EBCDIC STRING.
                C
0018                  CALL SYMBOL(1.0,9.0,0.15,'PLOTTING-EXAMPLE',0.,16)
                C
                C     EXAMPLE OF THE USE OF PRTNUM
```

```
      C
0019      CALL PRTNUM(1.0,8.5,0.15,XLN,'(11HTHE PLOT = ,F4.1,4H IN.)',0.)
      C
      C     PLOT X VS Y AS A LINE PLOT.
      C
0020      CALL PLOTXY(51,X,Y,0.,1.,0.,1.,0,1,0,0,DD)
      C
      C     PLOT X VS Z AS A POINT PLOT WITH SYMBOL #3.  SINCE LAB>0, THE NEXT
      C     PLOT WILL BE ON A NEW PAGE.
      C
0021      CALL PLOTXY(51,X,Z,0.,1.,0.,4.,2,0,3,0,DD)
      C
      C     COMPUTE INPUT DATA FOR SECOND PLOT.
      C
0022      NCT=0
0023      DO 77 I=2,51
0024      NCT=NCT+1
0025      X(NCT)=X(I)
0026      Y(NCT)=ALOG10(Y(I))
0027   77 Z(NCT)=ALOG10(1./Z(I))
      C
      C     NOTE THE USE OF IROT AND ITICK IN THE TWO CALLS TO LOGAXS.
      C     THE LEFT SIDE Y AXIS IS FOUR DECADES LONG WITH AN INCREASING SCALE
      C     WHICH RUNS FROM  LOG(Y)=-4. TO LOG(Y)=0 AND CORRESPONDS TO THE Y ARRAY.
      C
0028      CALL LOGAXS(0.,0.,10.,1,4,0,0,'LOG (Y)',7,3,-1)
      C
      C      THE RIGHT SIDE Y AXIS IS FOUR DECADES LONG WITH A DECREASING SCALE
      C     WHICH RUNS FROM LOG(Z)=3. TO LOG(Z)=-1.
      C
0029      CALL LOGAXS(8.5,0.,10.,1,-4,-1,0,'LOG (Z)',7,0,1)
      C
      C     THE X AXIS LABEL IS THE SAME AS IN THE FIRST PLOT.
      C
0030      CALL LABEL(0.,0.,0.,1.,8.5,5,'X VALUES',8,0)
      C
      C     THE NEXT THREE CARDS USE SYMBOL TO LABEL THE TYPE OF POINT THAT WILL BE
      C     USED BY PLOTXY
      C
0031      L2=256*3
0032      CALL SYMBOL(1.,1.,0.08,L2,0.,1)
0033      CALL SYMBOL(1.2,0.93,0.15,'Z VALUES',0.,8)
      C
      C     NOTE IN THE NEXT TWO CALLS TO PLOTXY THAT YMN AND YMX HAVE BEEN CHANGED
      C     TO AGREE WITH THE NEW DATA AND WITH THE AXIS LABELS.
      C
0034      CALL PLOTXY(50,X,Y,0.,1.,-4.,0.,0,1,0,0,DD)
0035      CALL PLOTXY(50,X,Z,0.,1.,3.,-1.,2,0,3,0,DD)
      C
      C     EVERY PLOT MUST END WITH A CALL TO PLTEND.
      C
0036      CALL PLTEND
0037      STOP
0038      END
```