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PLOT-10

PREVIEW ROUTINES FOR CALCOMP PLOTTERS
USER'S MANUAL

INFORMATION DISPLAY PRODUCTS

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Please place all orders through your Tektronix Application Engineer.

PLOT-10/Preview Routines for CALCOMP Plotters (Release #1)

Paper Source Tape and Manual	062-1526-01
Source Card Deck and Manual	062-1526-02

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INTRODUCTION

Many good programs exist in the graphic world that produce graphic displays on a CALCOMP plotter. Usually the actual plotting is done "off line" or in "batch" mode, and the programmer or user needs some facility to preview the plots he has programmed prior to submitting the output to be plotted on the CALCOMP plotter. A Tektronix 4010 family terminal used with several replacement routines allows the CALCOMP user to "preview" displays of his CALCOMP programs on an "on line" display. Ideally, such a preview should be transparent to the program and not require a rewrite just in order to use the preview facility of the Tektronix terminal and the preview routines.

The Tektronix preview routines satisfy the above requirements by replacing the basic PLOT subroutine through which all the output to the terminal is passed. This plotting routine is called from the user FORTRAN program and has three arguments. The first two arguments are the X and Y coordinates in inches. The third argument, NPEN, defines the type of operation that is to be performed.

Since the CALCOMP software uses a multiple entry subroutine for its PLOT routine, certain other functions must also be supplied in order for the previewing routines to function properly.

DESCRIPTION OF ROUTINES REPLACED

The first of these routines is PLOTS, a three argument routine which initializes the CALCOMP routines. (In the Tektronix previewing routine

PLOTS, none of the arguments are used.) PLOTS sets the initial values of the COMMON used by the preview routines and initializes the Terminal Control System (Part Number 062-1464-xx) through which the previewing routines route all the plots to the Tektronix terminal.

A second routine, WHERE, tells the user where he is on the plotting surface, as well as the current scale factor. A call to this routine with its three arguments, XIN, YIN, and FACTOR, returns the X and Y coordinates of the last command to PLOT and the scale factor currently being used.

Also included in the previewing package is a FACTOR routine that enables the user to set or modify the scale factor. This one argument routine replaces the current scale factor in the COMMON table with the argument value passed in the call to FACTOR.

While not necessarily a standard CALCOMP subroutine, many systems also have an OFFSET routine. This routine allows special offsets and scale factors to be set and used by special calls to PLOT using NPEN of 12 or 13. Those users who have the offset routine in their CALCOMP software will want to include this preview routine in their system.

TEKTRONIX SUPPLIED PREVIEWING ROUTINES

Naturally, previewing programs that are ordinarily plotted on a large sheet of plotter paper will require some special consideration when plotted on a terminal screen. To handle these considerations, the

Tektronix software provides more than one option in previewing a CALCOMP plot. Subroutine PLOTS calls OPTION, allowing the user to select the manner of processing to be used in the preview and to direct the processing program through the preview if he chooses.

When the user is required to enter information into the terminal, a bell will ring. Entering a "?" will cause the options available to be listed on the terminal.

Initially, the user must select one of four options, indicating the type of processing he wishes to use. A bell prompts the user whenever an input is required. The options are:

"1" A "1" indicates that the user wishes to plot the plots from beginning to end without interruption. No plots outside the initial value of the plotting surface set by PLOTS will be drawn. For example, on an 8 by 11 inch plot, PLOTS to 9",14" would be drawn only to the window edge. That part which extends beyond the 8 x 11 boundary will be clipped.

"2" Option 2 is the same as the first option, except that, at the occurrence of a negative NPEN value in PLOT, the user will again be allowed to select options.

"3" Option 3 resets the origin of each new plot (determined by a negative NPEN) to the lower left corner of the screen window, and then allows the user to select options whenever a negative value is passed in the NPEN value of the call to PLOT.

"4" Option 4 is not supported, but is a software "hook" to allow the user to supply his own routines.

Additional immediate commands are available at any time that the option program is in control. They are:

"C" This means "CONTINUE" and allows the program to proceed. This command is necessary to notify the program that all the options the user wishes to select have been entered.

"E" This means "ERASE" which clears the Tektronix terminal screen.

"H" This means "HARDCOPY" which will cause a hard copy to be made of the image on the screen. (Note: A hard copy will be made only if a Tektronix Hard Copy Unit is attached to your terminal.)

"S" This means "SKIP". A question follows, asking how many -NPEN (negative NPEN's) the user wishes to skip. No vectors will be drawn until the specified number of -NPEN's are skipped.

"W" This means "WINDOW" and allows the user to adjust or modify the size in inches that he wants to be visible on the screen. The "W" command is followed by two prompts as to the type of input that is required. The first question asks for the coordinates of the origin. The second asks for the width and height of the plot.

"R" Means "RESET" which allows the user to select origins other than the lower left hand corner of the visible screen as specified with option "W". Prompting for input of the X and Y coordinates of the origin will follow the typing of "R". See Page 18 for use.

Three internal routines are provided with the system to allow maximum ease of information entry with minimal installation effort. Toward this end, there are no FORTRAN writes or reads in the software and no FORMAT statements which tend to be system dependent. The first internal routine is GETNUM which is called by OPTION to obtain information from the user. This routine calls two other routines--TBUFIL which inputs characters and places them in an array, and FCONVT which converts the items in the array into usable real values to be returned to the GETNUM routine.

A "?" on the terminal indicates that the input routines are ready for numeric input. Hitting the Rubout key will backspace the buffer one space at a time to delete errors detected before hitting the Carriage Return key. The entire line can be deleted by typing a "Control X". The character delete and the line delete characters can be altered by changing data statements in routine TBUFIL.

Note: It is assumed that the user has a buffered TINPUT on his system. See Appendix #2.

Subroutine PLOT

Calling Sequence:

CALL PLOT (XINCH,YINCH,NPEN)

Parameters:

XINCH is a real value of the X-coordinate in inches.

YINCH is a real value of the Y-coordinate in inches.

NPEN is the mode of operation

equal to	3	Dark vector or move to a location.
	2	Bright vector or draw to a location.
	-3	Dark vector (move) and redefine origin at the new position.
	-2	Bright vector (draw) and redefine origin at the new position.
	13	Dark vector (move) adding the offset to each coordinate given.
	12	Bright vector (draw) adding the offset to each coordinate given.
	-13	Dark vector (move) adding the offset to each coordinate given and redefining the origin at the new position.
	-12	Bright vector (draw) adding the offset to each coordinate given and redefining the origin at the new position.
	999	Terminate program.

Example:

```
CALL PLOT (.5,.5,3)
```

will move a half inch* up and a half inch* to the right from the present origin.

```
CALL PLOT (5.,10.,2)
```

will draw a line from the present location to a point that is 5 inches to the right and 10 inches up from the origin.

---

* Note: Inches in all references in this manual are scaled to fit the screen window and are NOT ACTUAL INCHES.

Subroutine PLOTS

Calling Sequence:

```
CALL PLOTS (IBUFF,NO,UNIT)
```

Parameters:

None of the arguments are used. They are included in order that no changes will be required to existing programs in order to use our package.

This routine asks the user for options for the first plot to be reviewed.

Subroutine OFFSET

Calling Sequence:

```
CALL OFFSET (XOFF,XFACT,YOFF,YFACT)
```

Parameters:

XOFF	is the value that is added to each X-coordinate just before plotting with calls to PLOT with an NPEN of ±12 or ±13.
XFACT	is the value that is multiplied by each X-coordinate for plot calls with NPEN of ±12 or ±13. Note: This multiplication takes place prior to the addition of XOFF.
YOFF	is the value that is added to each Y-coordinate just prior to plotting with calls to plot with an NPEN of ±12 or ±13.
YFACT	is the value that is multiplied by each Y-coordinate just prior to plotting with calls to plot with an NPEN of ±12 or ±13.

Note: Internal reprogramming of PLOT would permit offsets and scalings to be applied to calls with all values of NPEN rather than just ±12 or ±13.

Subroutine FACTOR

Calling Sequence:

```
CALL FACTOR (FACT)
```

Parameters:

FACT	is the scale factor that is multiplied to each given coordinate.

Example:

```
CALL FACTOR (2.)
```

will cause all subsequent plots to be double the number of inches specified in the call to PLOT.

```
CALL FACTOR (.5)
```

will cause all subsequent plots to be half the number of inches specified in the call to PLOT.

Subroutine WHERE

Calling Sequence:

```
CALL WHERE (X,Y,FACT)
```

Parameters:

X	is the X-coordinate in inches where the drawing mechanism is currently located.
Y	is the Y-coordinate in inches where the drawing mechanism is currently located, and
FACT	is the current scale factor that is being assumed by the system.

Example:

```
CALL WHERE (X,Y,FACT)
CALL PLOT (X/2,Y/2,3)
```

The above combination will move half the distance between the current pen location and Ø,Ø.

HOW TO USE THE PREVIEW ROUTINES FOR CALCOMP PLOTTERS

The user may begin previewing without knowing anything about the application program and the plots it generates, but this procedure is not recommended for plots which take a long time, as several passes will be required to discover the correct parameters of size and location. For those who wish to try such a method, the "Simple But Slow Method" is included. Standard default is 8.5 inches high by 11.0 inches wide so the user should know the size of his plot in order to view it correctly. The lower left hand corner of the window is defined as 0,0. The user should move the pen in about .5 inches from each side before drawing his plot. This will insure that the labels for the X and Y axes will be viewable. If your installation has a different standard origin, then the call to VWINDO in PLOTS should be changed to define the origin as desired. In the above case, choosing an origin of -.5,-.5 would solve the labeling problem.

SIMPLE BUT SLOW METHOD

Run the program using Option 1 and setting the window to a size that should hold all the plots. If there are plots clipped from the viewable screen, rerun the program with a larger window screen. If the plots are so small that no detail can be seen, you may wish to rerun using a slightly smaller window. When you can see how the total plotting run is set up, you may then rerun the program with Option 2 or 3 for selective previewing or hard copying. This "simple but slow" method involves considerable trial and error effort that could be avoided with good operating instructions from the individual who wrote the CALCOMP program.

WHAT TO LOOK FOR IN APPLICATION PROGRAM

The most economical approach is to begin by examining the application program for the following items:

1. Size of each plot in inches.
2. Location of each plot.
3. Number of plots.
4. How negative NPEN arguments are used.
5. The number of negative NPEN's.

Items 1, 2, and 3 are relevant to choosing a window for the previewing. If only one plot is to be viewed at a time, the window should be large enough to accommodate the plot with some room to spare. Be aware that some plots move both left and right from the starting point, and simply looking for the largest X and Y values may not be sufficient. You will also be asked for the location of the window which is the lower left corner relative to the starting point of the pen. See note on aspect ratio below if distortion (stretching horizontally or vertically) is objectionable.

Item 4 is important to know when the options are selected. In general, there are two ways to use the negative NPEN argument. One way is to use one negative argument per plot to define both the location and the end of each plot. The other is to use a negative argument many times within one plot to locate multiple images at different locations without calculating all the unique points. These two situations will be described below in more detail to help you recognize the two variations. In general, using a negative argument at the end of each plot permits you to put each plot separately on the screen during a single pass, while using many negative calls per plot indicates that much more interaction

will be required in order to get different plots on separate displays. Item 5 is necessary if you wish to skip some of the negative NPEN's.

Note on Aspect Ratio: In order to preserve the ratio of height and width in your previewed plots, specifications for window size should be made at a ratio equal to the Ratio of width to height of the TEKTRONIX 4010 family terminal screen. The size of the screen is 1023 units wide by 780 high. The ratio of width to height is about 1.3 and height to width is about .76 therefore:

Actual X x .76 = Possible Y.

Actual Y x 1.3 = Possible X.

One of these two equations contains an X and Y that will show the entire plot while preserving the aspect ratio.

EXAMPLE:

We wish to preview a Plot 20 inches wide by 12 inches high

#1 ACTUAL X x .76 = Possible Y

20 x .76 = 15.2

#2 ACTUAL Y x 1.3 = Possible X

12 x 1.3 = 15.6

Since #1 is the calculation that has X and Y large enough for both axes, the window should be set at X=20 inches and Y=15.2 inches.

HOW TO RECOGNIZE SITUATION ONE AND DISPLAY IT

This situation is characterized by a single move (NPEN=-3) once for each plot. It normally occurs at the end of each plot. The sample program provided is such a situation. Statements 90 or 91 move to the origin of the next plot and terminate the previous plot. On the following page is a diagram of the output as it might appear on a CALCOMP plotter with the moves tagged with the statement number.

Sample Code for Figure 1

```
      DIMENSION IBUF(1000),XARRAY(8),YARRAY(8)
      INTEGER ITEM(6)
      DATA ITEM/'A','B','C','D','E','F'/
      LOGICAL UP
      DATA UP/.TRUE./
      DATA XARRAY/1.,2.,3.,4.,5.,6.,0.,0./
      DATA YARRAY/16.,8.,12.,6.,17.,4.,0.,0./
      CALL PLOTS(IBUF,1000,6)
30    CALL PLOT(.5,.5,-3)
      DO 105 I=1,6
40    CALL SCALE(XARRAY,8.5,6,1)
50    CALL SCALE(YARRAY,11.5,6,1)
80    CALL LINE(XARRAY,YARRAY,6,1,2,I)
      CALL PLOT(0.,0.,3)
      CALL PLOT(0.,11.5,2)
      CALL PLOT(8.5,11.5,2)
      CALL PLOT(8.5,0.,2)
      CALL PLOT(0.,0.,2)
      CALL SYMBOL(1.,9.,.75,ITEM(I),0.,1)
90    IF(UP) CALL PLOT(0.,12.0,-3)
91    IF(.NOT.UP) CALL PLOT(9.,-12.,-3)
      UP=.NOT.UP
105   CONTINUE
110   CALL PLOT(12.0,0.0,999)
120   STOP
      END
```

```
START OF TAPE
OPTIONS?1
W
WHERE WOULD YOU LIKE ORIGIN?(X,Y)
?0 0ENTER SIZE (WIDTH,HEIGHT)
?30 30
```

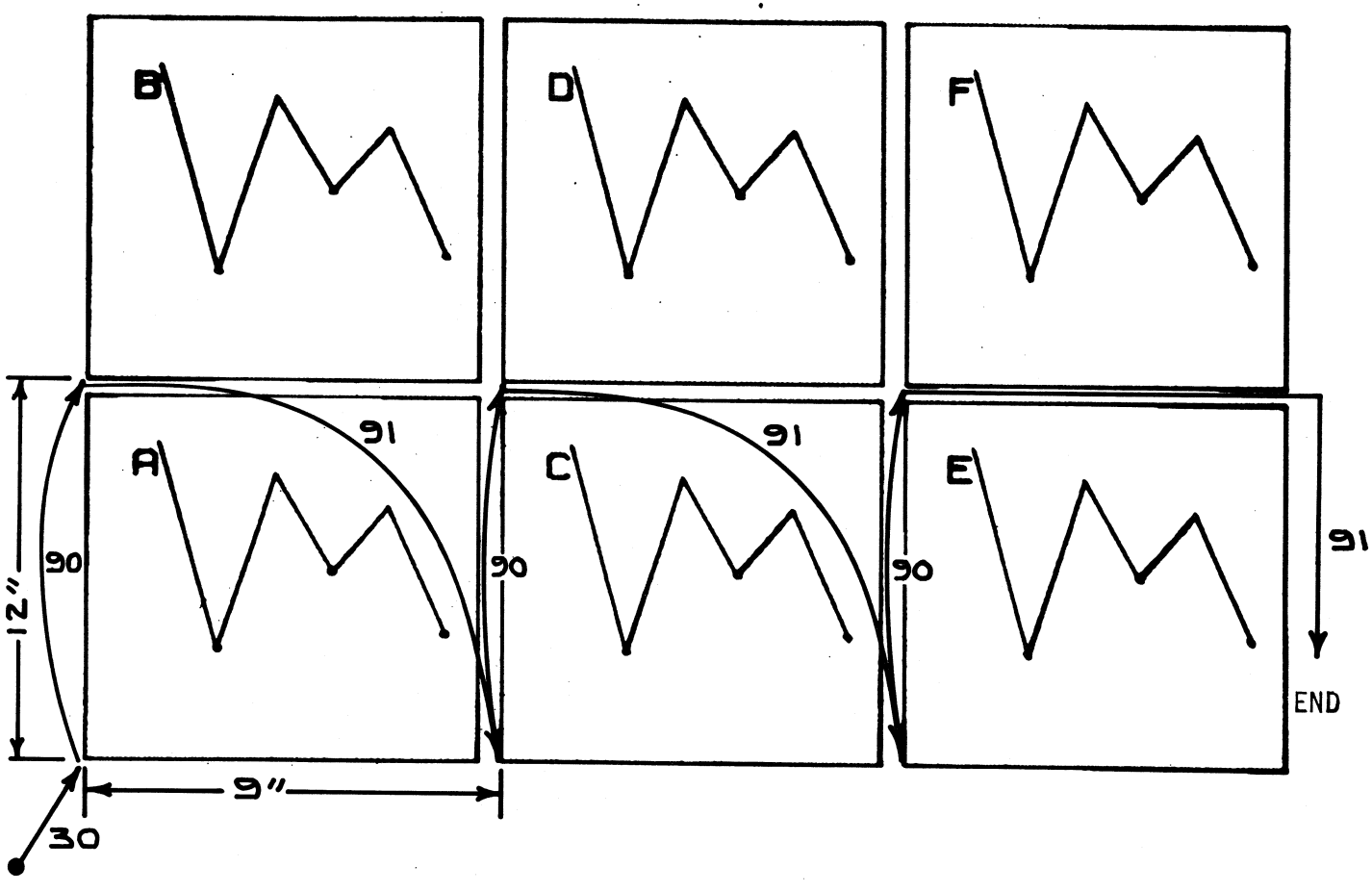


Figure 1

The origin of the second plot is located 12 inches above the first plot and the third is located 9 inches to the right of the first.

This sample can be displayed in its entirety by using Option 1 and using a window located at Ø,Ø and 27 inches wide by 24 inches high. The program will proceed to completion without stopping.

Normally, displaying this many plots on the screen will cause each plot to be so small as to obscure fine details. Fine details will be more easily readable if a window is chosen such that one plot appears at a time and fills the screen. This can most easily be accomplished by using Option 3 and defining a window of location -1",-1", width 10 inches, and height 13 inches. At each -NPEN, the program will stop and ring the bell. At this time the user can make a hard copy, erase the screen and continue. If successive plots were different sizes, the window size could be altered. Using Option 3, each plot's origin will be located on the same place on the screen. Consequently, the window will not have to be shifted in order to frame succeeding plots.

Whenever Option 3 is used, the origin will be reset to a specified point in the window. (The user may wish to use Option "R" to set this point in the same way as an operating instruction to a plotter operator.) Note: This feature is provided only for convenience and is never absolutely necessary.

Example: If the original program was designed to work within a 6-1/2 inch wide by 9 inch high box and the origin is in the lower

left corner of this box, then specifying a window of location Ø,Ø and 8-1/2 inches wide by 11 inches high, and a restart point of 1 inch by 1 inch will yield a plot with a 1 inch border around the plotting area. Note: Reset values entered are not invoked immediately, but at the encounter of a -NPEN. To use the above example, a CALL PLOT with a -NPEN must follow the Reset and precede the actual plot. See Figure 2.

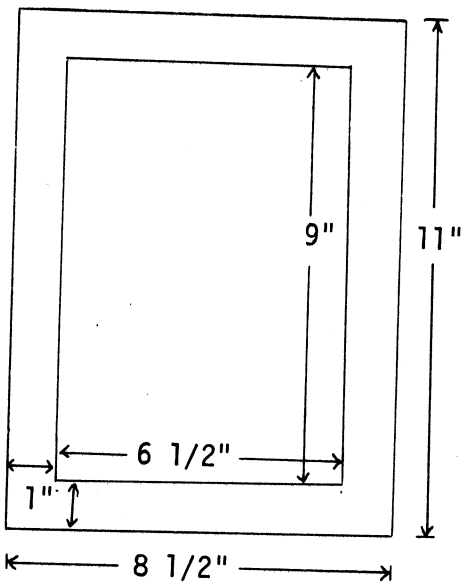


Figure 2

RECOGNIZING AND DISPLAYING SITUATION TWO

The second sample included will draw the display on a CALCOMP plotter as shown in Figure 3.

Sample Code for Figure 3

```
      CALL PLOTS(I,N,U)
      CALL PLOT(0.,0.,3)
      DO 100 I=1,2
      CALL PLOT(0.,11.,2)
      CALL PLOT(8.5,11.,2)
      CALL PLOT(8.5,0.,2)
      CALL PLOT(0.,0.,2)
025   CALL PLOT(2.,2.,-3)
      CALL TRIANG
050   CALL PLOT(0.,5.,-3)
      CALL TRIANG
075   CALL PLOT(4.,-1.,-3)
      CALL TRIANG
100   CALL PLOT(3.,-6.,-3)
      CALL PLOT(0.,0.,999)
      END
      SUBROUTINE TRIANG
      CALL PLOT(2.,0.,2)
      CALL PLOT(0.,2.,2)
      CALL PLOT(0.,0.,2)
      RETURN
      END
```

```
START OF TAPE
OPTIONS?1
W
WHERE WOULD YOU LIKE ORIGIN?(X,Y)
?0 0ENTER SIZE (WIDTH,HEIGHT)
?20 15
```

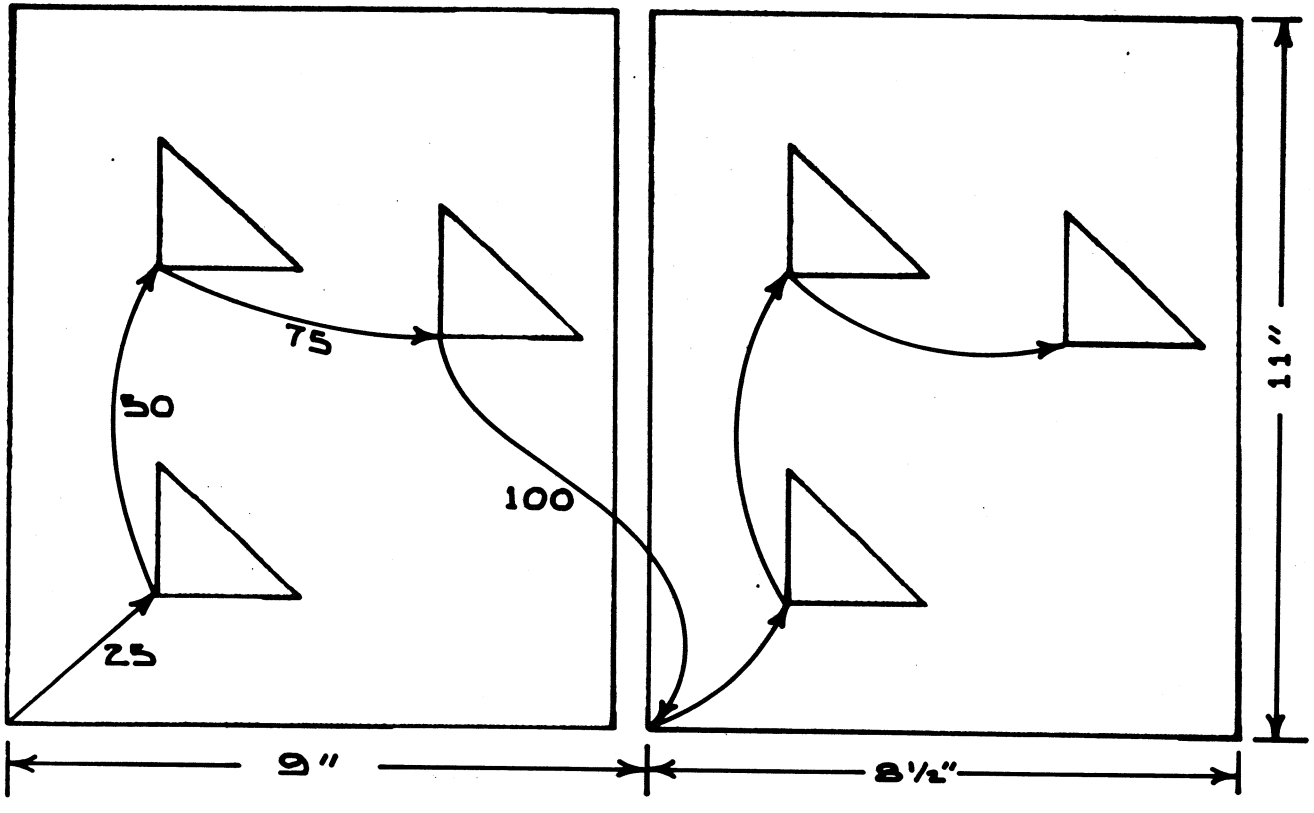


Figure 3

This situation can most easily be handled with Option 2 and a starting window of -1,-1, width 10 inches, and height 13 inches. After the third triangle is drawn, take a hard copy if desired and set the window to location 8,-1, width 9 inches, height 13 inches, erase the screen and continue. The second plot will be drawn as the first was drawn.

APPENDIX # 1

File or Tape Creation

The Tektronix Previewing Routines for CALCOMP Plotters are designed to plot on a Tektronix terminal instead of creating a plot tape. To preview several times from a single run, the user may wish to create a tape or other file for succesive runs. To assist the user in making this usage available on his system, we have provided three sample routines. The INPUT/OUTPUT subroutines (PIN and POUT) are very machine dependent and will handle reading in and writing out the file. The other sample is the main line program that one would use to preview the tape created. To attach the file creating routine, several lines of code in the PLOT routine which are currently comments must be included in that routine.

A list of statements and their approximate location in code follows.

```
LINE 22          LOGICAL SAVE
     23          DATA SAVE/.TRUE./
     27          IF (N.EQ.995) GO TO 995
     41          IF (SAVE) CALL POUT (X-ACCUM,Y-ACCUM,NPEN)
     73  995     SAVE=.NOT.SAVE
     74          GO TO 900
     76  999     IF (SAVE) CALL POUT (X,Y,N)
```

and remove the statement #999 from the CALL FINITT (Ø.Ø) in line 77.

Note that when you are creating a tape with this system, only those items previewed will be on the tape. The proper method for using these

routines would be to create the file using Option 1 and a window large enough to preview the whole plot at once. Once created, the file can be read by the main line routine using PIN, and a more detailed review of the plot is possible. All calculations are preserved from the first run of the program.

```
C*************************************************************
C* PLOT-10/PREVIEW ROUTINES FOR  C A L C O M P  PLOTTERS
C*      -----     -----     -----     -----     -----
C*                      COPYRIGHT
C*                        TEKTRONIX, INC.
C*                        P.O. BOX 500
C*                        BEAVERTON, OREGON 97005
C*-----------------------------------------------------------
C*
C*            ROUTINE: POUT
C*
C*************************************************************
      SUBROUTINE POUT(X,Y,N)
      REAL A(100)
      DATA IFIRST,NBMAX/989893,100/
      IF(IFIRST)100,200,100
C *FIRST PASS---OPEN FILE
100   IFIRST=0
      CALL OFILE(22,'CTMP1')
200   IF(NB .GE. NBMAX-3) GO TO 300
      A(NB+1)=X
      A(NB+2)=Y
      A(NB+3)=N
      NB=NB+3
      IF(N .EQ. 999) GO TO 400
      GO TO 500
C *DUMP BUFFER
300   WRITE(22)A
      NB=0
      GO TO 200
400   WRITE(22)A
      ENDFILE(22)
500   RETURN
      END
```

```
C*************************************************************
C* PLOT-10/PREVIEW ROUTINES FOR  C A L C O M P  PLOTTERS
C*      -----     -----     -----     -----     -----
C*                      COPYRIGHT
C*                        TEKTRONIX, INC.
C*                        P.O. BOX 500
C*                        BEAVERTON, OREGON 97005
C*-----------------------------------------------------------
C*
C*            ROUTINE: MAINLINE RETRIEVAL SYSTEM
C*
C*************************************************************
C * MAINLINE RETRIEVAL PROGRAM
      CALL INITT(30)
      CALL PLOT(0.,0.,995)
100   CALL PLOTS(0,0,0)
200   CALL PIN(X,Y,N)
      IF(N .EQ. 999) GO TO 999
      CALL PLOT(X,Y,N)
      GO TO 200
C * END OF PASS
999   CALL TOUTPT(7)
      CALL TOUTPT(7)
      CALL TINPUT(K)
C * A 'Q' WILL STOP THE JOB
      IF (K .NE. 81) GO TO 100
      CALL FINITT(0,0)
      END
```

```
C*****************************************************************
C* PLOT-10/PREVIEW ROUTINES FOR  C A L C O M P  PLOTTERS
C*      -----     -----     -----     -----     -----
C*                      COPYRIGHT
C*                        TEKTRONIX, INC.
C*                        P.O. BOX 500
C*                        BEAVERTON, OREGON 97005
C*---------------------------------------------------------------
C*
C*           ROUTINE: PIN
C*
C*****************************************************************
      SUBROUTINE PIN(X,Y,N)
      REAL A(100)
      DATA IFIRST,NBMAX/989893,100/
      IF(IFIRST)100,300,100
C *FIRST PASS---OPEN FILE
100   IFIRST=0
      CALL IFILE(23,'CTMP1')
C *FILL BUFFER
200   READ(23,END=400)A
      NB=0
300   IF(NB .GT. NBMAX-3) GO TO 200
      X=A(NB+1)
      Y=A(NB+2)
      N=A(NB+3)
      NB=NB+3
      IF(N .NE. 999) GO TO 500
400   N=999
      IFIRST=989893
      ENDFILE(23)
500   RETURN
      END
```

APPENDIX #2

Buffered TINPUT Consideration

The programs supplied with this package assume that the user has a buffered TINPUT routine on his system and that the system is capable of sending carriage returns. If your system does not have such a TINPUT routine, either the calls to GETNUM in OPTION must be replaced with FORTRAN reads, or the TINPUT will have to be buffered. An example of buffered TINPUT is shown below.

```
C*************************************************************
C * BUFFERED INPUT
      SUBROUTINE TINPUT(ICHAR)
      INTEGER ICHS(80)
      DATA I,IEND/81,80/
      IF(I .GT. IEND) GO TO 200
100   ICHAR=ICHS(I)
      IF(ICHAR .EQ. 13)I=IEND
      I=I+1
      RETURN
C * FILL THE BUFFER
200   READ(5,300)ICHS
C*************************************************************
C * NOTE NOTE NOTE NOTE NOTE NOTE NOTE NOTE NOTE NOTE NOTE   *
C * THE 'R' IN THE FORMAT STATEMENT IS FOR -RIGHT JUSTIFIED *
C * ASCII- IF YOUR SYSTEM DOES NOT SUPPORT THIS YOU WILL
C * NEED TO USE 'A' FORMAT AND ADD THE CODE SUFFICIENT TO
C * MAKE IT RIGHT JUSTIFIED ASCII.....
C*************************************************************
300   FORMAT(80R1)
C*************************************************************
C * FORCE CARRIAGE RETURN AFTER SIGNIFICANT CHAR
      DO 400 J=1,IEND
400   IF(ICHS(IEND+1-J) .NE. 32) GO TO 500
500   ICHS(IEND+2-J)=13
      I=1
      GO TO 100
      END
*
```

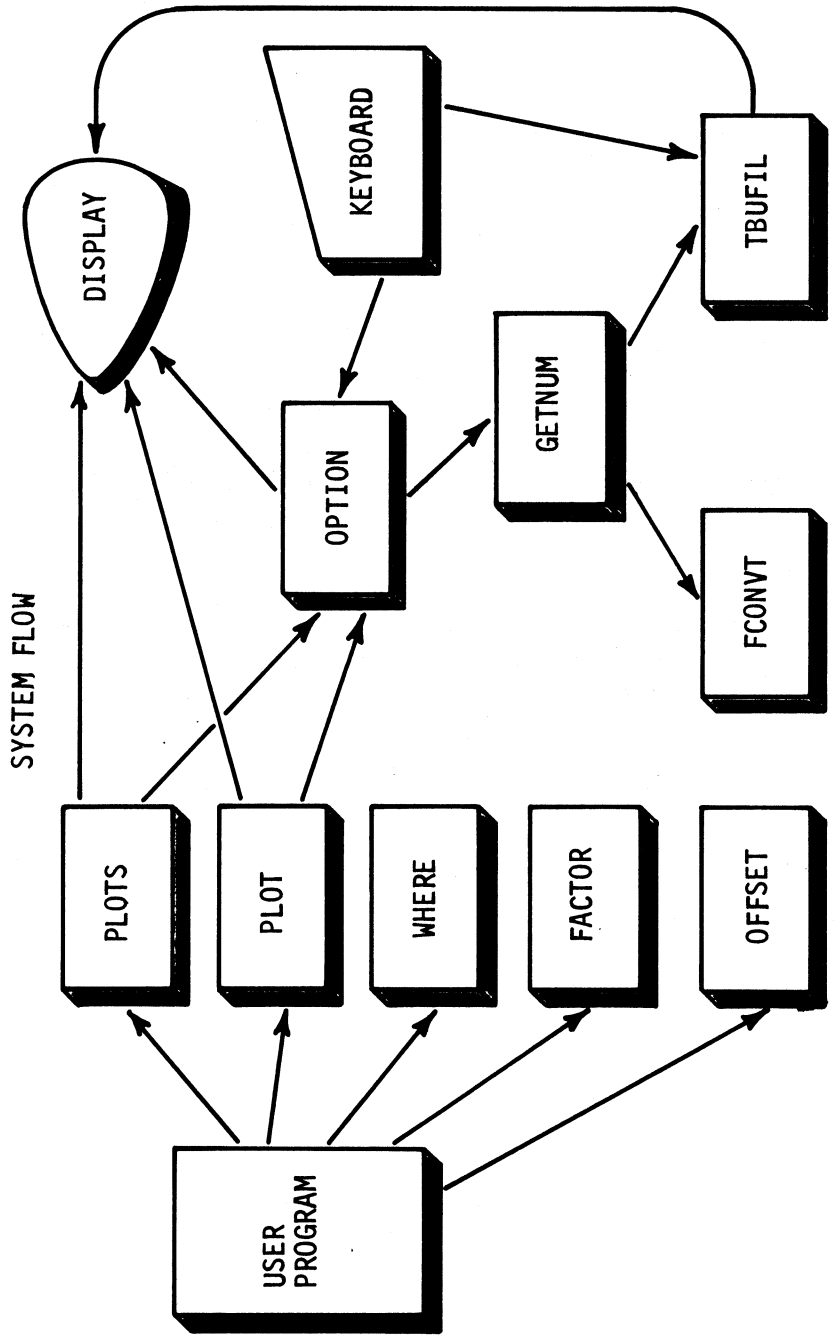
If you wish to change GETNUM so that it uses FORTRAN reads, the code may look like the sample below.

Note: With this method, the user will have to enter one floating point number at a time followed by a carriage return. User operating instructions must be altered to reflect this restriction.

```
C*************************************************************
C* PLOT-10/PREVIEW ROUTINES FOR  C A L C O M P  PLOTTERS
C*
C*                      COPYRIGHT
C*                        TEKTRONIX, INC.
C*                        P.O. BOX 500
C*                        BEAVERTON, OREGON 97005
C*-----------------------------------------------------------
C*
C*            ROUTINE: GETNUM
C*
C*************************************************************
      SUBROUTINE GETNUM(X)
      CALL BELL
      READ(5,100)X
100   FORMAT(E8.0)
      RETURN
      END
```

APPENDIX #3

System Flow Chart



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