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**A User's Guide to the CALVEC Software
Library: A Computer Program for Emulation
of CALCOMP Graphics on a
Versatec Printer/Plotter**

W. H. Gray

OAK RIDGE NATIONAL LABORATORY
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A USER'S GUIDE TO THE CALVEC SOFTWARE LIBRARY:
A COMPUTER PROGRAM FOR EMULATION OF CALCOMP
GRAPHICS ON A VERSATEC PRINTER/PLOTTER

W. H. Gray

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Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
DEPARTMENT OF ENERGY

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ABSTRACT

This document describes a set of FORTRAN subroutines collectively called the CALVEC subprogram library. The purpose of the CALVEC software library is the emulation of CALCOMP pen and ink graphics on a DECsystem 10. A user level interface with CALVEC software allows standard CALCOMP subprogram calls to produce a VECTOR file, SEGMNT.VEC. This vector file may subsequently be postprocessed into an image in a variety of ways.

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1. INTRODUCTION

This document describes a set of FORTRAN subroutines collectively called the CALVEC subprogram library. The purpose of the CALVEC software library is the emulation of CALCOMP [1] pen and ink graphics on a DECsystem 10. A user level interface with CALVEC software allows standard CALCOMP subprogram calls to produce a VECTOR file, SEGMNT.VEC. This vector file may subsequently be postprocessed into an image in a variety of ways.

To obtain instructions on how to acquire the most recent version of this documentation, type

```
.HELP CALVEC
```

This document has the following organization. Section 2 gives the user all the information necessary to execute a plotting program, produce a vector file, and have this vector file postprocessed into a line image. Section 3 reviews the CALCOMP emulation plotting software available at a user level in the CALVEC software library. Section 4 discusses the system software necessary to the implementation of CALVEC as well as the word structure of a vector file (this section is not intended for the casual user). A sample program is discussed in Sect. 5.

2. USING THE CALVEC SOFTWARE LIBRARY

The subroutines of the CALVEC software library exist in a .REL file format on the Fusion Energy Division's DECsystem 10 public disk structure. A user may invoke the CALVEC software library by loading this software with his code. For example,

```
.ASSIGN DSK 24  
      (This is an optional command. It is  
      necessary if the default specification  
      has been overridden in a previous job  
      step.)
```

```
.EXECUTE USERPG.FOR,PUB:CALVEC
```

Upon successful completion of this job step, a file called SEGMNT.VEC will have been created in the user's disk area. This file contains all the necessary information to produce a line image drawing on either the Versatec electrostatic printer/plotter or a Tektronix storage tube device. To postprocess the file onto the Versatec, the monitor level command PLOT may be used,

```
.PLOT VER:=SEGMNT.VEC
```

To postprocess this file onto a Tektronix device, the monitor level command PLOT may be used,

```
.PLOT TEK:=SEGMNT.VEC
```

Ask HELP for PLOT to review the available alternatives to these commands.

3. CALVEC USER SOFTWARE

This section describes the standard CALCOMP pen and ink subroutines available to the user of the CALVEC subprogram library. Each subsection discusses only one subroutine and gives an example argument list. Argument type specifications may be determined from the argument itself using standard FORTRAN conventions: arguments beginning with I, J, K, L, M, or N are integer; otherwise the argument is real. There are no double-precision or complex arguments within the CALVEC software library.

3.1 SUBROUTINE PLOTS

Subroutine PLOTS is used to initialize the CALVEC software library. It must be called prior to any calls to other subroutines within this library. The plotting origin or software origin is initially located by this subroutine at the hardware origin and the plotting limits are set to the maximum Versatec dimensions, 10.24 in. in the X direction and 7.8 in. in the Y direction. The plotting buffer is zeroed and a file called SEGMNT.VEC is opened. (The hardware origin is the lower left-hand corner of a Versatec page when the page is being viewed from the front of the Versatec device.)

There are at least three different argument lists to subroutine PLOTS used by the various CALCOMP plotting packages at Oak Ridge National Laboratory. In order to maintain compatibility, the CALVEC software library does not require any arguments to subroutine PLOTS. If any are supplied, they are ignored.

Calling sequence:

```
CALL PLOTS  
CALL PLOTS(IBUF,NBUF)  
CALL PLOTS(IBUF,NBUF,LDEV).
```

Argument list:

Not applicable.

Required subprograms: None

Language: FORTRAN

3.2 SUBROUTINE PLOT

Subroutine PLOT performs to conventional pen plotter descriptions and draws straight lines with the line being visible or invisible during the movement.

Calling sequence:

```
CALL PLOT (XPAGE,YPAGE,IPEN).
```

Argument list:

XPAGE,YPAGE	is a single coordinate, in inches, defining the terminal position of the line.
IPEN	is a signed integer value controlling line visibility or invisibility, plotting buffer, and paging requests.
=2	draws a visible line to XPAGE,YPAGE.
=3	moves invisibly to XPAGE,YPAGE.
=-2	establishes a new origin at XPAGE,YPAGE after a visible line is drawn to this coordinate.
=-3	moves invisibly to establish a new origin at XPAGE,YPAGE. Further, to maintain ORNL compatibility, the current plotting buffer is written to the vector file.
=999	updates the vector file with the current plotting buffer and then closes it to output. This type of call should be the last plotting call in a user program.

The particular model of Versatec which is available to the Fusion Energy Division is a page type device, as opposed to a scroll type device on which CALCOMP graphics are usually based. Therefore, it became necessary to define a new page facility in order that scrolling could be emulated. The paging is automatic and occurs every time the sum of the origin moves, either by IPEN=-2 or IPEN=-3, would move the origin past the X or Y extent of a Versatec page.

Required subprograms:

FFED
WHGDM
VECW

Language: FORTRAN

3.3 SUBROUTINE WHERE

Subroutine WHERE performs to standard pen plotter descriptions and returns in XNOW, YNOW the present pen position (as referenced from the current software origin) and in FNOW the current drawing factor ratio.

Calling sequence:

CALL WHERE (XNOW, YNOW, FNOW)

Argument list:

XNOW, YNOW are variables to be returned with the coordinate of the present pen position.
FNOW is a variable to be returned with the current drawing factor ratio.

Required subprograms: None

Language: FORTRAN

3.4 SUBROUTINE FACTOR

Subroutine FACTOR allows the programmer to enlarge or reduce the size of the entire plot by specifying the ratio of the desired plot size to the normal plot size (1 in. = 1 in.).

Calling sequence:

CALL FACTOR(XYFACT)

Argument list:

XYFACT is a plotting factor specification (e.g., XYFACT=2.0 doubles the normal plot size; XYFACT=0.5 halves the normal plot size).

Required subprograms: None

Language: FORTRAN

3.5 SUBROUTINE OFFSET

Subroutine OFFSET allows the user to independently set scale factors and offsets in horizontal and vertical directions.

Calling sequence:

```
CALL OFFSET(XO,XF,YO,YF)
```

Argument list:

XO,XF	defines the offset and scaling factor applied to the horizontal direction of the plot for all subsequent vectors.
YO,YF	defines the offset and scaling factor applied to the vertical direction of the plot for all subsequent vectors.

3.6 SUBROUTINE NEWPEN

Subroutine NEWPEN for conventional pen systems is used to select a different writing pen for plotters so equipped. In the CALVEC software library it is provided for compatibility only and no action is taken.

Calling sequence:

```
CALL NEWPEN (IPEN)
```

Argument list:

IPEN	specifies a new pen to be used for subsequent vectors.
------	--

Required subprograms: None

Language: FORTRAN

3.7 SUBROUTINE SYMBOL

Subroutine SYMBOL performs to conventional pen plotter descriptions and may be used to plot alphanumeric characters at various angles and sizes. Additionally, when NCHAR is negative, this subroutine performs symbol plotting for drawing centered symbols at specific pen positions.

Calling sequence:

```
CALL SYMBOL (XPAGE,YPAGE,HEIGHT,IASCII,ANGLE,NCHAR)
```

Argument list:

XPAGE,YPAGE is the starting coordinate defining the lower left-hand corner of the first character to be produced. If XPAGE and/or YPAGE are equal to 999.0, the annotation is continued from the current coordinate position. Note: when symbol plotting (negative NCHAR), XPAGE,YPAGE defines the centered position of the special symbol.

HEIGHT defines the character height in inches.

IASCII (for positive NCHAR) is an alphanumeric text string stored in standard system format (i.e. ASCII, left justified, contiguous); (for negative NCHAR) defines the integer symbol number of the special centered symbol to be plotted. The file DOC:CALVC1.VEC is an intermediate vector file which contains a drawing of all symbols and their corresponding numeric indexes. For a plotted image on the FED Versatec, give the command

```
.PLOT VER:=DOC:CALVC1.VEC/COMM:  
"SYMBOLS AVAILABLE IN CALVEC"
```

There are 125 symbols, including several from the Greek alphabet. The image shows each special symbol available in the right half of a box along with the necessary character code (IASCII) to produce it in the left half of the box.

ANGLE is the angle, in degrees measured from the horizontal axis, at which the alphanumeric annotation is plotted (i.e., the vector direction of the text string).

NCHAR positive NCHAR defines the number of characters to be plotted from the text string IASCII. Negative NCHAR indicates that IASCII is an integer symbol number designating the special centered symbol to be plotted at XPAGE,YPAGE. Additionally,

=-1 specifies that the pen is to be up during the initial move from the present pen position to XPAGE,YPAGE;

<-1 specifies that the pen is to be down during the initial move from the present pen position to XPAGE,YPAGE.

Required subprograms: None

Language: FORTRAN

3.8 SUBROUTINE NUMBER

Subroutine NUMBER performs to conventional pen plotter descriptions and may be used to convert a machine-formatted number to the appropriate ASCII equivalent which is then drawn on the user's plot. Since this routine seems to cause the most difficulty when programs are transported between the various computers in the Oak Ridge computation environment, it has been programmed to accept three "standard" argument lists.

Calling sequence ("CALCOMP standard"):

```
CALL NUMBER (X,Y,HEIGHT,FPN,ANGLE,NDEC)
```

Argument list:

X,Y is the starting coordinate defining the lower left-hand corner of the first character to be produced. If X and/or Y are equal to 999.0, annotation is continued from the current coordinate position.

HEIGHT defines the character height in inches.

FPN is the floating point number to be plotted.

ANGLE is the angle, in degrees measured from the horizontal axis, at which the numeric annotation is plotted (i.e., the vector direction of the text string).

NDEC the absolute value of NDEC specifies the number of decimal digits which are to be plotted. When positive, NDEC defines the number of digits to the right of the decimal point which are to be plotted, after rounding. Additionally,

=0 indicates that only the integer portion and decimal point are to be plotted after rounding.

=-1 indicates that only the integer portion is to be plotted after rounding (no decimal point).

<-1 specifies that ABS(NDEC)-1 digits to the right are to be truncated from the integer portion and plotted after rounding.

Restrictions:

ABS(NDEC) must be less than or equal to 20.

Calling sequence ("ORNL standard"):

CALL NUMBER (X,Y,HEIGHT,FPN,ANGLE,NFOR)

Argument list:

X,Y is the starting coordinate defining the lower left-hand corner of the first character to be produced. If X and/or Y are equal to 999.0, annotation is continued from the current coordinate position.

HEIGHT defines the character height in inches.

FPN is the machine-formatted number to be encoded with NFOR and plotted.

ANGLE is the angle, in degrees measured from the horizontal axis, at which the numeric annotation is plotted (i.e., the vector direction of the text string).

NFOR is a character string containing a format with which to encode FPN.

Calling sequence ("PDP-10 SYS:CALTEK.REL"):

CALL NUMBER (X,Y,HEIGHT,FPN,ANGLE,NFOR,ND)

Argument list:

X,Y is the starting coordinate defining the lower left-hand corner of the first character to be produced. If X and/or Y are equal to 999.0, annotation is continued from the current coordinate position.

HEIGHT defines the character height in inches.

FPN is the machine-formatted number to be encoded with NFOR and plotted.

ANGLE is the angle, in degrees measured from the horizontal axis, at which the numeric annotation is plotted (i.e., the vector direction of the text string).

NFOR is a character string containing a format with which to encode FPN.

ND is the number of ASCII characters which will be encoded by format NFOR.

Required subprograms:

SYMBOL
NUMBER

Language: FORTRAN

3.9 SUBROUTINE SCALE

Subroutine SCALE conforms to conventional pen plotter descriptions and may be used to compute scale factors for processing unscaled data with subroutines LINE and AXIS. The scaling factor DELTA, representing data units per inch, and the starting value FIRST, representing the starting unscaled data value (either minimum or maximum), are returned to the appropriate locations in ARRAY. FIRST is returned in ARRAY location NPTS*INC+1 and DELTA is returned in ARRAY location NPTS*INC+INC+1.

Calling sequence:

```
CALL SCALE (ARRAY,AXLEN,NPTS,INC)
```

Argument list:

ARRAY	is the array of unscaled data to be examined.
AXLEN	is the axis length to which the unscaled data in ARRAY are to be scaled. AXLEN must be greater than 1.0 in.
NPTS	defines the number of unscaled data points in ARRAY.
INC	the absolute value of INC is the increment used in gathering data from the unscaled array (e.g., INC=1 will index each data element, INC=2 will index every other data element, etc.) When INC is positive, the value of FIRST approximates a minimum with a positive DELTA. When INC is negative, the value of FIRST approximates a maximum with a negative DELTA.

Required subprograms: None

Language: FORTRAN

3.10 SUBROUTINE AXIS

Subroutine `AXIS` performs to conventional pen plotter descriptions and may be used to generate a positional axis line with labels, scale annotations, and tick marks.

Calling sequence:

```
CALL AXIS (XP,YP,LABEL,NCHAR,AXLEN,ANGLE,FIRST,DELTA)
```

Argument list:

<code>XP,YP</code>	defines the starting coordinate for the axis line.
<code>LABEL</code>	is an ASCII text string which will be centered and used to label the axis.
<code>NCHAR</code>	defines the number of contiguous, left justified characters in the ASCII text string <code>LABEL</code> . The sign of <code>NCHAR</code> determines the side of the axis upon which the annotation will appear. A positive value will produce annotation on the counterclockwise side. A negative value will produce annotation on the clockwise side. Tick marks are drawn on the side opposite the annotation. (This reflects the author's preference for tick marks and is exactly opposite to the conventional pen plotter definition.)
<code>AXLEN</code>	is the length of the axis line in inches.
<code>ANGLE</code>	is the angle, in degrees, at which the axis is to be drawn. Normally, 0.0 degrees is used for generating the X axis.
<code>FIRST</code>	is the first value (either minimum or maximum) which will be used for annotating the axis at unit (inch) intervals.
<code>DELTA</code>	represents the number of data units per axis inch. This delta value will be added to the <code>FIRST</code> starting value for generating scale annotations at each succeeding inch interval along the axis line.

Required subprograms:

SYMBOL
UMBER
PLOT

Language: FORTRAN

3.11 SUBROUTINE LINE

Subroutine LINE performs to conventional pen plotter descriptions and may be used to plot points from coordinate data arrays (X and Y). Data values may be represented by centered symbols, connecting lines, or both. Scaling parameters FIRST and DELTA must be stored in the data arrays.

Calling sequence:

CALL LINE (X,Y,NPTS,INC,LINTYP,INTSQ)

Argument list:

X	is a singularly dimensioned array containing the abscissa values with scaling parameters for the X-array. For this array, FIRSTX must be stored in the NPTS*INC+1 position and DELTAX must be stored in the NPTS*INC+INC+1 location
Y	is a singularly dimensioned array containing the ordinate values with scaling parameters for the Y-array. For this array, FIRSY must be stored in the NPTS*INC+1 position and DELTAY must be stored in the NPTS*INC+INC+1 location.
NPTS	is the number of data values in each of the two X,Y arrays. This number does not include the extra locations necessary for the scaling parameters.
INC	is the increment used in gathering data values from the two arrays (e.g., INC=1 will index each data element, INC=2 will index every other data element, etc.).

LINTYP defines the line control to be used. If symbols are plotted, the absolute magnitude of LINTYP determines the symbol plot frequency. LINTYP=0 indicates that data points are to be connected by straight lines only; no symbols plotted. Positive LINTYP indicates that data points are to be connected by straight lines with a plotted symbol at every LINTYPth point. Negative LINTYP indicates that no lines are to be drawn; only the symbols plotted.

INTEQ is a positive integer representing the symbol character code.

Required subprograms:

WHERE
SYMBOL
PLOT

Language: FORTRAN

4. CALVEC SYSTEM SOFTWARE

Two commons are used by the CALVEC software for communication between the various subroutines. These are /WHGCPV/ and /WHGBUF/. The following is a description of the variables located within these two commons. All the variables occupy a single word of storage.

4.1 COMMON /WHGCPV/

Common /WHGCPV/ is 25 words long and contains the following information.

XOFST,YOFST	are the software offsets of the page in the X and Y directions, respectively.
XORG,YORG	are the coordinates of the software origin.
XNOW,YNOW	are the software coordinates of the current pen position.
XLAST,YLAST	are the software coordinates of the previous pen position.
PFACT	is the software-to-hardware coordinate conversion factor. Initially set to 1.0 by subroutine PLOTS.
FACTX,FACTY	are the software coordinate scaling factors. Initially set to 1.0 by subroutine PLOTS.
XLIMIT,YLIMIT	are the hardware page limits of the plotting device in inches. Initially set to 10.24 in. and 7.8 in. by subroutine PLOTS.
XPAGEZ,YPAGEZ	are the software page limits of the plotting device in inches. Initially set to 10.24 in. and 7.8 in. by subroutine PLOTS.
FNAME1,FNAME2	contains the name of the currently opened vector file. Left justified ASCII. Initialized to SEGMNT.VEC by subroutine PLOTS.
IPN	is the number of the pen specified by a call to subroutine NEWPEN.

IPLTU is the unit number of the output vector file. Initialized to 24 by subroutine PLOTS.

IOPLT is the number of vectors which have been output to the vector buffer.

IFPLT is the number of form feed control words which have been output to the vector buffer.

IASCII is a logical switch which determines the format of the vector file. If IASCII is false (a CALVEC default), then the vector buffer is written to the vector file in image (binary) mode. If IASCII is true, then the vector buffer is formatted on output to the vector file with a 4F8.4 unbuffered format.

ICALL is a logical switch which prevents multiple calls to subroutine PLOTS.

IAUTOF is a logical switch which determines the automatic paging feature of the CALVEC software. If IAUTOF is true (a CALVEC default), then whenever the sum of the origin moves positions the current pen origin out of a box defined at the top by Y=YPAGEZ and on the right side by X=XPAGEZ, a form feed will be written into the vector buffer and the coordinate of the origin which exceeded the page size will be reinitialized. If IAUTOF is false, then no action is taken when the page size is exceeded.

IPFMT is a logical switch which determines the position of the plotted image on the Versatec page. If IPFMT is true (a CALVEC default), then the plotted X direction will be horizontal.

4.2 COMMON /WHGBUF/

Common /WHGBUF/ is 128 words long and contains the following information.

IBUFFR is a singly dimensioned array of 126 words which contains the vector buffer.

NBUFFER is the number of locations in the vector buffer.

IPOINT is the next free location in the vector buffer.

The following six subroutines are used by CALVEC internally to properly pack vectors into the .VEC file. These subroutines should not be called from a user program unless the user has thoroughly familiarized himself with their purpose.

4.3 SUBROUTINE VECW

Subroutine VECW outputs vector coordinates to the vector buffer. If the vector buffer is filled up, subroutine VECW calls subroutine WHGDMP to write the vector buffer into the .VEC file.

In preparation to placing the vector coordinates into the vector buffer, the vector coordinates are mapped from inches to raster coordinates using

$$IX(X) = (X*200. + 40.)$$

and

$$IY(Y) = -(Y*200.) + 1500$$

where X and Y are the hardware coordinates in inches referenced to the lower left-hand corner of a Versatec page. The X direction is horizontal and X is defined as increasing from left to right of the page. The Y direction is vertical and Y is defined as increasing from bottom to top of the page.

The following two equations define the linear mapping used to transform software coordinates (XS,YS) into hardware coordinates (X,Y).

$$X = ((XS*FACTX+XORG)+XOFST)*PFACT$$

$$Y = ((YS*FACTY+YORG)+YOFST)*PFACT$$

IX and IY are the .VEC file raster coordinates referenced to the upper left-hand corner of a Versatec page. The IX direction is horizontal and IX is defined as increasing from left to right of the page. The IY direction is vertical and IY is defined as increasing from top to bottom of the page.

To form a packed raster coordinate, the IX coordinate is shifted left 18 bits and ored to the IY coordinate. Finally, subroutine VECW takes a pair of packed vector coordinates, the necessary information to draw a visible line, and places them into the vector buffer (see Appendix A for a more complete description of the .VEC file format). If this fills the vector buffer, the buffer is output and reinitialized.

Calling sequence:

Call VECW

Argument list:

None

Required subprograms:

WHGDMP

Language: FORTRAN

4.4 SUBROUTINE FFEED

Subroutine FFEED places a form feed word into the vector buffer. The form feed word is octal 777777000001 or decimal -262143.

Calling sequence:

CALL FFEED

Argument list:

None

Required subprograms:

WHGDMP

Language: FORTRAN

4.5 SUBROUTINE WHGDMP

Subroutine WHGDMP writes the vector buffer contained in COMMON /WHGBUF/ into the SEGMNT.VEC file and then rezeroes the vector buffer.

Calling sequence:

CALL WHGDMP

Argument list:

None

Required subprograms: None

Language: FORTRAN

4.6 SUBROUTINE NEWFIL

Subroutine NEWFIL writes the vector buffer into the current vector file, closes this vector file, and then opens another with the appropriate switches.

Calling sequence:

CALL NEWFIL (FILNM)

Argument list:

FILNM is a five-character ASCII character string. The extension of .VEC will be supplied.

Required subprograms:

WHGDMP

Language: FORTRAN

4.7 SUBROUTINE FILUPP

Subroutine FILUPP may be called to calculate the best software page format possible, given an imaginary page size which a Versatec page is to represent.

Calling sequence:

CALL FILUPP (XPE,YPE)

Argument list:

XPE the physical extent, in inches, in the X-direction which a Versatec page is to represent.

YPE the physical extent, in inches, in the Y-direction which a Versatec page is to represent.

As an example, consider a user program which originally produced full-size (48.0 in. long by 30.0 in. high) pages on the CALCOMP plotters at ORNL. Instead of having to check all graphics subroutine calls in order to convert them to a 10.24 X 7.8-in. plotting surface, a single call to FILUPP,

```
CALL FILUPP (48.0,30.0),
```

immediately after the plotter initialization call will force the CALVEC software library to emulate a CALCOMP plotter with a 48 X 30-in. plotting surface.

Required subprograms: None

Language: FORTRAN

4.8 SUBROUTINE UMBER

Subroutine UMBER is the software which performs the number encoding necessitated by a call to subroutine NUMBER using the "CALCOMP standard" argument list in which the sixth argument in the list is the number of digits to the right or left of the decimal point which are to be plotted.

Calling sequence:

```
CALL UMBER (X,Y,HEIGHT,FPN,ANGLE,NDEC)
```

Argument list:

X,Y is the starting coordinate defining the lower left-hand corner of the first character to be produced. If X and/or Y are equal to 999.0, annotation is continued from the current coordinate position.

HEIGHT defines the character height in inches.

F2N is the floating point number to be plotted.

ANGLE is the angle, in degrees measured from the horizontal axis, at which the numeric annotation is plotted (i.e., the vector direction of the text string).

NDEC the absolute value of NDEC specifies the number of decimal digits which are to be plotted. When positive, NDEC defines the number of digits to the right of the decimal point which are to be plotted after rounding. Additionally,

=0 indicates that only the integer portion and decimal point are to be plotted after rounding.

=1 indicates that only the integer portion is to be plotted after rounding (no decimal point).

<-1 specifies that ABS(NDEC)-1 digits to the right are to be truncated from the integer portion and plotted after rounding.

Restrictions:

ABS(NDEC) must be less than or equal to 20.

Required subprograms:

SYMBOL

Language: FORTRAN

5. EXAMPLE OF USE

The following computer program, called TSTCAL, has been included in this document to demonstrate how the CALVEC software library may be used to produce line images on the FED Versatec printer/plotter. A listing of this program follows:

```
PROGRAM TSTCAL
C
C PURPOSE:
C
C TO TEST THE CALVEC SOFTWARE LIBRARY
C
C DIMENSION XA(363),YA(363)
C
C INITIALIZE THE PROGRAM
C CALL PLOTS
C
C TEST SCALE,AXIS AND LINE
C DEGRAD=3.1415926/180.
C DO 2 I=0,360
C AI=FLOAT(I)
C XA(I+1)=AI
C YA(I+1)=COS(AI*DEGRAD)
2 CONTINUE
C
C SCALE THE DATA
C CALL SCALE(XA,6.0,361,1)
C CALL SCALE(YA,6.0,361,1)
C
C MOVE THE ORIGIN SO THAT THE AXES WILL HAVE ROOM TO PLOT
C CALL PLOT(.5,.5,-3)
C
C DRAW THE AXES AND DATA LINE
C CALL AXIS(0.,0.,'X',-1,6.,0.,XA(362),XA(363))
C CALL AXIS(0.,0.,'COS(X)',6,6.0,90.,YA(362),YA(363))
C CALL LINE(XA,YA,361,1,10,0)
C
C TERMINATE THE SESSION
C CALL PLOT(0.,0.,999)
C STOP
C END
```

This program may be executed by typing:

```
.EXECUTE TSTCAL,PUB:CALVEC
```

It will create a SEGMNT.VEC file which may be postprocessed using the PLOT command. This file has been copied to DOC:CALVC2.VEC. To obtain a copy, type

```
.PLOT VER:=DOC:CALVC2.VEC/COMM:"TEST OF CALVEC"
```

APPENDIX A

VEC File Format

This appendix describes the format of the standard vector or .VEC file used on the FED PDP-10 computer at Y-12. This .VEC file consists of two types of information, paging control and the coordinates of a visible straight line segment. It is a binary file written in the image mode which is divided into 18 bits per byte.

Paging control is stored in the .VEC file as a control byte, octal 777777, followed by a form feed byte, octal 000001. At present, any other byte sequence will be interpreted by the postprocessors as raster coordinate information and will be decoded accordingly.

A visible line segment is stored in the .VEC file as a set of four 18-bit bytes. The first byte contains the beginning IX raster coordinate, the second byte contains the beginning IY raster coordinate, the third byte contains the ending IX raster coordinate, and the fourth byte contains the ending IY raster coordinate. The raster coordinates, IX and IY, are referenced to the upper left-hand corner of the Versatec page (when the page is viewed from the front of the Versatec device). The IX direction is horizontal and IX is defined as increasing from left to right on the page. The IY direction is vertical and IY is defined as increasing from top to bottom.

For example, the following byte sequence within a .VEC file will be interpreted by the VECVER and VECTEK postprocessors to draw a diagonal line on the first page from the lower left-hand corner (1600,0) to the upper right-hand corner (0,2048), form feed, and then draw a diagonal line from the upper left-hand corner (0,0) to the lower right-hand corner (1600,2048)

003100000000

000000004000

777777000001

000000000000

003100004000

As the .VEC file format is intended for postprocessing onto the Versatec printer/plotter, no provision has been made to include color or intensity information within this file.

REFERENCE

1. "Programming CALCOMP Pen Plotters," California Computer Products, Inc., Anaheim, California, September 1969.

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