NASA TM X-1419

A SET OF FORTRAN IV SUBROUTINES FOR GENERATING PRINTED PLOTS

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SUMMARY

A set of subroutines, written in FORTRAN IV, easy for the FORTRAN programmer to use, provides printed plots as part of normal output. These subroutines are simplified so that no choices must be made and generalized so that choices may be made by the programmer of the plotting characters, the scales, the appearance of the grid, and other options. The FORTRAN routines generate ordinary output records (up to 132 BCD characters) suitable for on- or off-line printing.

INTRODUCTION

Various versions (refs. 1 to 3) of this plotting system have been in use at Lewis Research Center since April 1962. The current version is a set of FORTRAN IV subroutines which generates ordinary FORTRAN output records (up to 132 BCD characters) suitable for printing on- or off-line.

The system permits, but does not require, the programmer to choose the plotting characters, the scales, the grid-line spacing, etc. It handles single or multiple curves, prints true scales, and permits titles above or below the plot. The next section is a manual for users.

The routines are presently in use at Lewis on a 7094 Model II - 7044 direct-coupled system. All output is under the control of the 7044 supervisory system. The programs, however, are almost entirely machine independent, and the information provided in the section SYSTEM MANUAL is intended to make it very simple for the systems programmer to make the changes required to adapt the plotting system to other machine configurations. The final section contains examples of plots obtainable with these subroutines (see pp. 61 to 65).

This system offers printed plots as part of normal output with a minimum of programming effort. The programmer writes CALL PLOTXY (for a single curve) or CALL PLOTMY (for multiple curves). The arguments, or call list, include the names of the arrays to be plotted and specify the number of points per curve and the number of curves. He may precede the call by writing a title to be printed above the plot. He may follow the call by writing a legend to be printed at the bottom of the plot.

The plot or plots are printed as part of the regular output listing with no delay. No changes in his card-handling procedures nor special instructions for the operators are required.

If he is using PLOTXY, the values of the variable to be plotted in the x-direction must be in sequence. If they are not, the subroutine SORTXY (which makes the necessary rearrangements) is supplied to be used before calling PLOTXY. For either PLOTXY or PLOTMY, if the size of the elements in (or the total range of) any array is not known to be within certain limits, the programmer calls the subroutine SCALE for each array before calling the plotting subroutine. SCALE will transform the array to suit PLOTXY and PLOTMY only if it is necessary.

In addition to the minimum-effort use just described, the programmer may choose to use one or more of several options that permit him to control, for example, the appearance of the grid (by specifying the frequency of the grid-lines in either direction), the scale for either variable (by specifying the scale factor and a starting value), the plotting character, etc.

This section contains detailed instructions for the use of PLOTXY and PLOTMY and brief descriptions of SCALE and SORTXY. Some assistance in debugging users programs completes this section.

I. PLOTXY

To get plotted output using PLOTXY, the corresponding pairs of ordinates to be plotted must be in two arrays. For an example, let us name the arrays XDOWN and YACROS and assume each is NPTS elements long. These names are chosen specifically to call the user's attention to the fact that the x-direction is down the page.

A. Call

Write CALL PLOTXY (XDOWN, YACROS, KODE, P)

XDOWN is the name of the array containing the values of the variable to be plotted on the x scale (down the page). The elements in the array are restricted as follows:

(1) They must be in floating point.

(2) The absolute value of each element must[1] be within permissible limits (approximately $10^{-6} \leq e \leq 10^{6}$).

(3) They must[2] be in order, either increasing or decreasing.

YACROS is the name of the variable to be plotted on the y scale (across the page). The elements of the array are restricted exactly as in (1) and (2) above.

KODE is the name of an integer. Many options are provided for the user of PLOTXY. Each has a number associated with it. The sum of the numbers representing the options being used is KODE ($0 \leq$ KODE ≤ 127). For your first plot, use KODE = 0. When KODE = 0, the starting-values and scale-factors in both directions are computed by PLOTXY. The other effects of KODE = 0 are shown in the example plot:

(1) The plotting character is an asterisk.

(2) The grid-line frequency is 10×10.

(3) Nothing is printed to the left of the plot.

P is an array.

P(1) must contain NPTS (the number of points to be plotted) in floating point.

If KODE = 0 or 64, there are no other requirements for P.

For all other values of KODE, the requirements for the P array are displayed (see section D. Using the Options, p. 6).

---

[1]If the element size of any array is unknown or out of range, write CALL SCALE (NPTS, A, KA) before calling PLOTXY (see III, p. 13).

[2]If the array to be plotted on the x scale is not in order, write CALL SORTXY (XDOWN, YACROS, NPTS) before calling PLOTXY (see IV, p. 13).

B. Title

The call for PLOTXY may be preceded by writing at least one TITLE (PT) record. A representative example is:

```
      WRITE (6, 500)
  500 FORMAT (2HPT, 71X, 14HSAMPLE EXAMPLE/2HPT, 69X,
      17H JOLO SYSTEM PLOT)
```

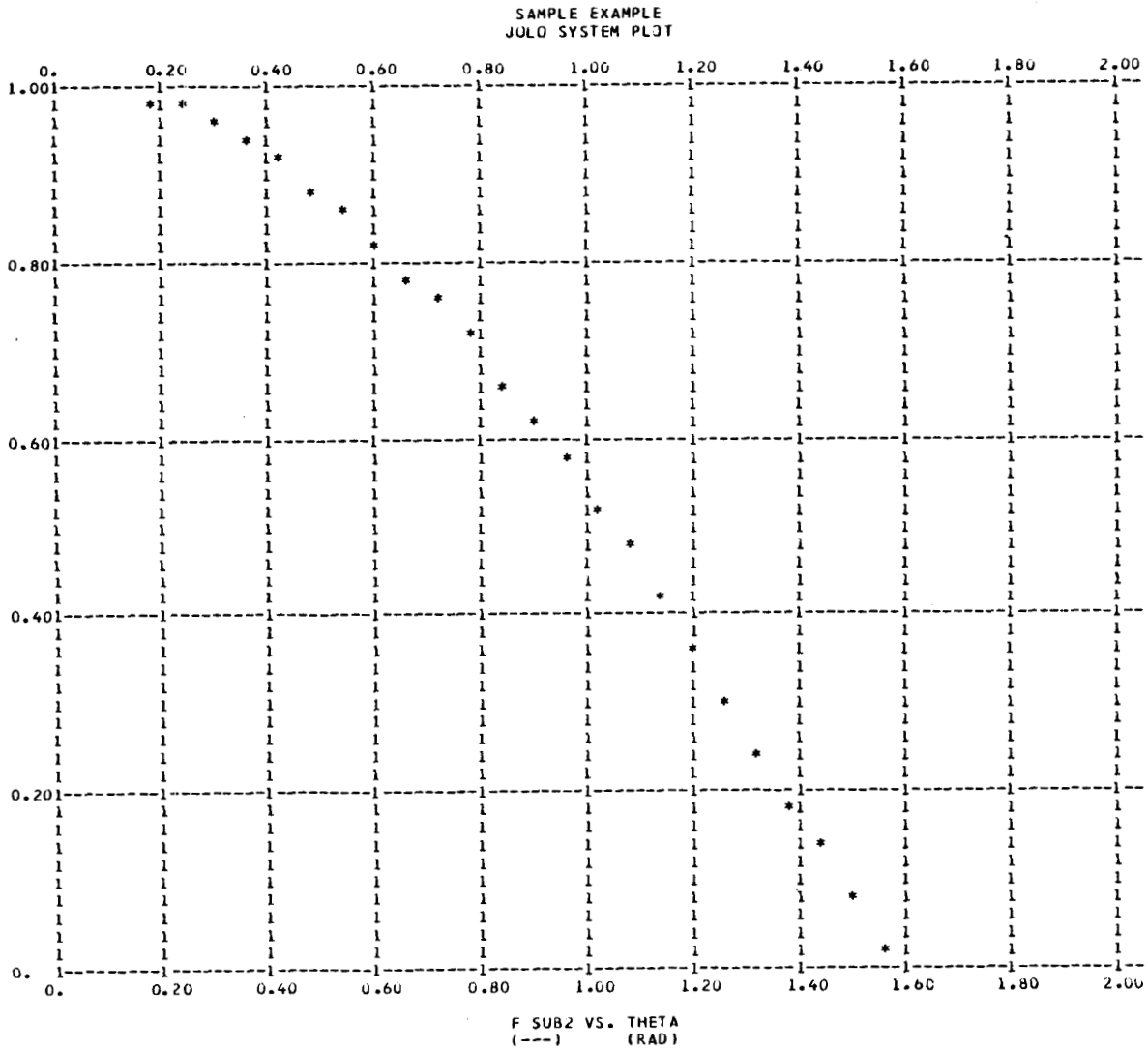
The result is shown on the plot on the facing page.

C. Legend

The call for PLOTXY may be followed by writing at least one LEGEND (PL) record. A representative example is:

```
      WRITE (6, 502)
  502 FORMAT (2HPL, 70X, 16HF SUB2 VS. THETA/2HPL, 70X,
      16H(---)          (RAD))
```

The result is shown on the plot on the facing page.


SAMPLE EXAMPLE
JOLO SYSTEM PLOT
0.
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
1.00
0.80
0.60
0.40
0.20
0.
F SUB2 VS. THETA
(---) (RAD)

D. Using the Options

Each option has a number associated with it. The sum of the numbers representing options chosen is KODE, the third argument in the call.

TO CHOOSE:	TO KODE ADD	AND SUPPLY	IN	(FORMAT)	KODE 0 USES
The plotting character. θ represents any acceptable FORTRAN character except the minus sign.	1	Desired character	P(2)	1Hθ	*
The frequency of x grid-lines. They are printed every m line-spaces below the first. If m = 0, only two will be printed, one above and one below the plot.	2	m	P(3)	Floating point	10
The frequency of y grid-lines. They are printed every n positions to the right of the first. If n = 0, only one is printed, at the left of the plot.	4	n	P(4)	Floating point	10
The x scale.[a] The scaling parameters FX, representing the starting-value, and DX, representing the scale-factor for one line space, must be whole numbers of magnitude less than 10^6. ($0 \leq KSX \leq 6$) See I.-E. Scaling.	16	Three scaling parameters, KSX, FX, and DX	P(6), P(7), P(8)	Floating point	Scale computed by plotting routine
The y scale.[a] The scaling parameters FY, representing the starting-value, and DY, representing the scale-factor for one print position, must be whole numbers of magnitude less than 10^6. ($0 \leq KSY \leq 6$) See I.-E. Scaling.	32	Three scaling parameters, KSY, FY, and DY	P(9), P(10), P(11)	Floating point	Scale computed by plotting routine
To print P array. The 6 BCD characters in P(I + 11) will be printed at the left of the plot on the line on which the point (x_i, y_i) is plotted. (If desired material is numeric, write it out using format F6.n, and read it back into P array using A6)	8	Array to be printed	P(I + 11) through P(NPTS + 11)	BCD	No printout
To print coordinates. The coordinates of each point will be printed on the line on which the point is plotted.	64	No requirements			No printout

[a] To specify only FX, omit DX in P(8) and place 1. in P(5).
To specify only FY, omit DY in P(11) and place 2. in P(5).
To specify FX and FY only, omit DX and DY and place 3. in P(5).

E. Scaling

When the user wishes to specify his own scale in either direction, in addition to increasing KODE by 16 or 32, he must:

(1) Choose his desired starting-value F.

(2) Choose his desired scale-factor D - for one line-space if he is specifying the x scale, for one print position if he is specifying the y scale.

(3) Determine a value of N such that:

(a) $F \times 10^N$ is a whole number.

(b) $D \times 10^N$ is a whole number.

(c) $0 \leq N \leq 6$.

(4) Compute 6 - N.

The integer calculated in step (4) is the first of three scaling parameters that must be available in the P array (in P(6) if scaling x, P(9) if scaling y) when the plotting subroutine is called. $F \times 10^N$ is the second scaling parameter, and is placed in P(7) or P(10). F may be zero. $D \times 10^N$ is the third, and is placed in P(8) or P(11). Note that D may never be zero, and when scaling x for PLOTMY, D must be positive.

If the user wishes to supply only the starting value and leave the choice of scale-factor to the plotting system, he must do steps (1), (3)(a), (3)(c), and (4) above, and

(a) Supply 1. in P(5) if option 16.

(b) Supply 2. in P(5) if option 32.

(c) Supply 3. in P(5) if both 16 and 32 are being used.

II. PLOTMY

Although more than one curve can be plotted on the same grid with PLOTXY, only one plotting character will be used for all curves. PLOTMY provides a different plotting character for each curve. Options, similar to those in PLOTXY, are available but not required, except that option 1 must be used if there are more than six curves. However, a selection must be made from three Variations: DUPX - when more than one set of y values corresponds to the same set of x values; DUPY - when more than one set of x values corresponds to the same set of y values (this offers complete control of which variable is to be plotted in which direction); and NO DUP - when each set of x values has a corresponding set of y values.

A. Call

Write CALL PLOTMY (XDOWN, YACROS, KKK, P)

XDOWN is the name of the array containing the values of the variable to be plotted on the x scale (down the page). The minimum DIMENSION of this array depends on the Variation selected. (See E. Variation Layout, pp. 10 to 12). The elements of this array are destroyed by PLOTMY. The elements are restricted as follows:

(1) They must be in floating point.

(2) They must be within permissible range. (See I. PLOTXY, p. 3.)

YACROS is the name of the array containing the values of the variable to be plotted on the y scale (across the page). The minimum DIMENSION of this array depends on the Variation selected. (See E. Variation Layout.) The elements of this array are restricted exactly as in (1) and (2) above.

KKK is the name of an array. The first element must be KODE (as in PLOTXY, this is the sum of the option numbers), and the second element must be KN (the number of curves). The third element must be:

(1) The number of points in one curve for DUPX and DUPY.

(2) The number of points in the first curve for NO DUP.

The remaining odd-numbered elements are only required for NO DUP, and the remaining even-numbered elements are only required for option 1. (See E. Variation Layout.) The minimum DIMENSION of KKK must be 2 * KN + 2 or 14, whichever is greater.

P is the name of an array. The first element must specify the Variation selected:

P(1) = 1. for DUPX

P(1) = 3. for DUPY

P(1) = 5. for NO DUP

The remaining elements and the minimum DIMENSION of P are functions only of the options being used. (See E. Variation Layout.)

B. Title

A TITLE record may be written before calling PLOTMY, exactly as for PLOTXY (p. 4).

C. Legend

A LEGEND record may be written after calling PLOTMY, exactly as for PLOTXY (p. 4).

D. Using the Options

The use of the options is exactly the same as for PLOTXY (see I.-D. Using the Options, p. 6) with the following exceptions:

(1) If option 16 is used, DX must be positive.

(2) When option 64 is used, only the ordinate in the x-direction will be printed.

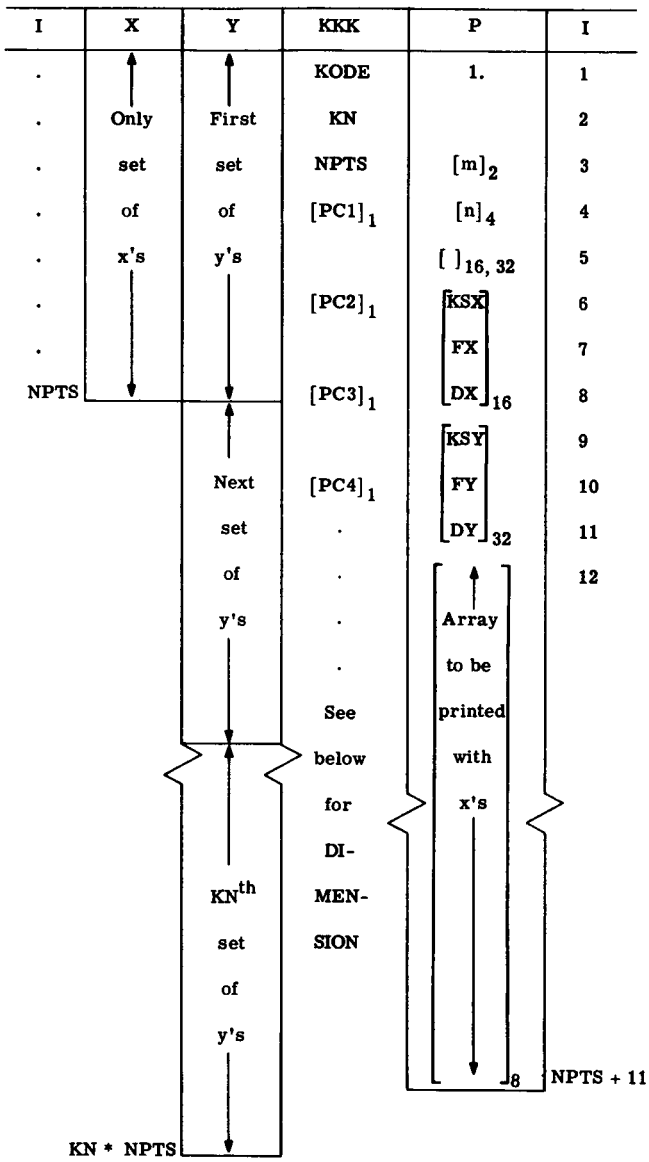
(3) Unless option 1 is chosen, the plotting characters *, +, 0, X, =, □ will be used for the first six curves. To use others, use option 1 and supply the desired plotting character for the first curve in KKK(4), for the second curve in KKK(6), ... If more than six curves are to be plotted, option 1 must be used, and all plotting characters supplied. To put a plotting character, for example, $, in KKK(4), write

DATA KKK(4)/1H$/

E. Variation Layout

DUPX

$[\ ]_N$ means supply item in brackets if option N is being used.



DIMENSIONS

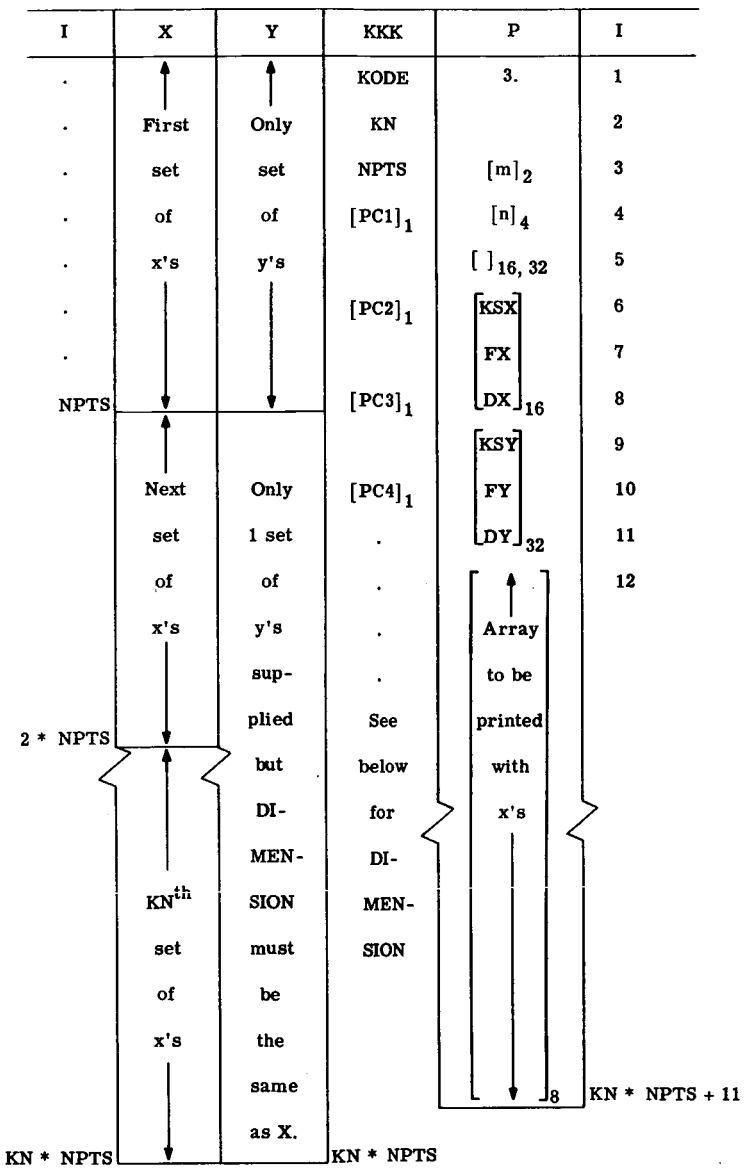
X(NPTS)
Y(KN * NPTS)
KKK = (2 * KN + 2) or (14), whichever is greater

If option 8 is not used, P($\leq$11), depending on use of options 2, 4, 16, and 32.
If option 8 is used,

P(NPTS + 11)

DUPY

$[\ ]_N$ means supply item in brackets if option N is being used.



DIMENSIONS

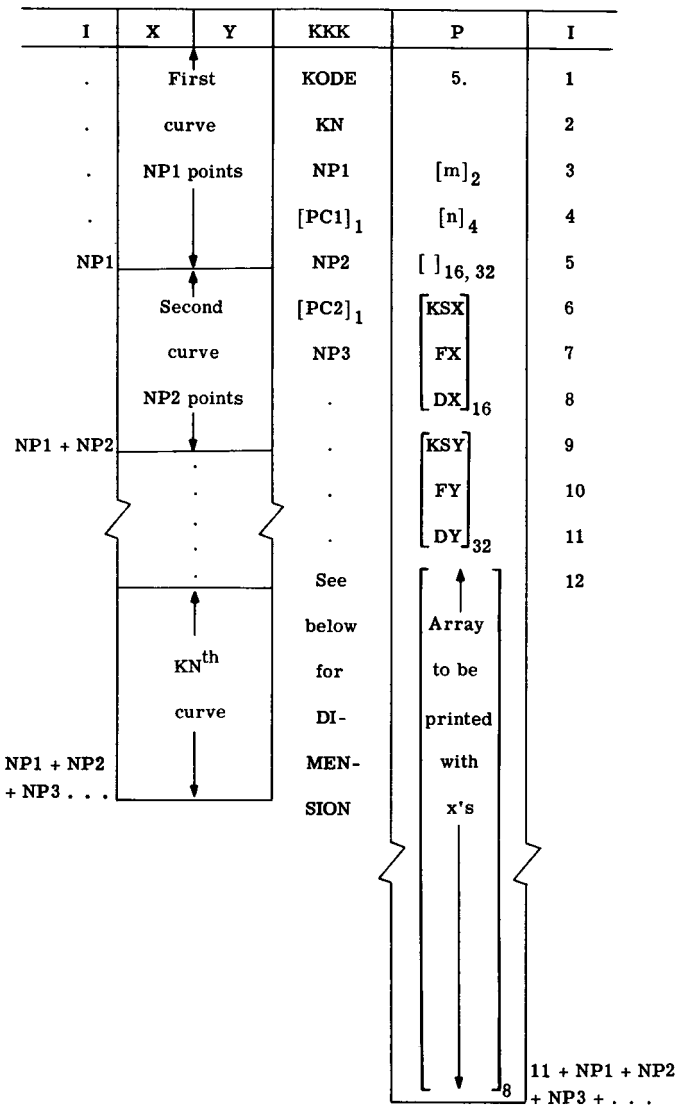
X(KN * NPTS)
Y(KN * NPTS)
KKK = (2 * KN + 2) or (14), whichever is greater.

If option 8 is not used, P($\leq$11), depending on use of options 2, 4, 16, and 32.
If option 8 is used,

P(KN * NPTS + 11)

NO DUP

$[\ ]_N$ means supply item in brackets if option N is being used.



DIMENSIONS

X(NP1 + NP2 + NP3 + . . .)
Y(NP1 + NP2 + NP3 + . . .)
KKK = (2 * KN + 2) or (14), whichever is greater

If option 8 is not used, P($\leq$11), depending on use of options 2, 4, 16, and 32.
If option 8 is used,

P(11 + NP1 + NP2 + NP3 + . . .)

III. SCALE

CALL SCALE (NPTS, A, KRSTR)

This subroutine finds the largest absolute value of the NPTS elements of A and computes the characteristic of its $\log_{10}$ using a function subprogram KHAR (described under PISTUG, p. 46). If the characteristic K is $-2 \leq K \leq 4$, KRSTR is set to zero and control returns to the calling program. If $K > 4$ or < -2, each element of A is multiplied by a power (KRSTR) of 10 to transform the array to suit PLOTXY and PLOTMY. KRSTR is returned to enable the user to ReSToRe the array or to record how it has been altered.

IV. SORTXY

CALL SORTXY (V, W, NPTS)

This subroutine rearranges the NPTS elements of the V array in order of increasing size. The elements of the W array are moved to maintain the original pair-relation; that is, if the fifth element of the V array is moved to the first position of V, the fifth element of W is moved to the first position of W.

V. ERROR MESSAGES

A. The message BAD LABELS printed below and to the left of the plot indicates that one or more of the x or y grid-labels may be incorrect. This can be caused by DX or DY too large or too small or by a label requiring more than the allotted nine print positions.

B. When the system computes the scale factor for either array and finds the range is zero, calculations are stopped. For either PLOTXY or PLOTMY the plot terminates with a message:

(1) For PLOTXY - N.G. followed by the contents of X(1), Y(1), X(2), Y(2), KODE, and P(1)

or

(2) For PLOTMY - N.G. followed by the contents of X(1), Y(1), X(2), Y(2), K(1), K(2), and K(3).

C. If the values in the X array are not in order when PLOTXY is called, or if you use option 16 and a value of X lies outside your specified starting value, the message

X OUT OF ORDER. I=NNNNN

will be printed followed by the message described in (2) on the previous page, and the plot is terminated.

D. In PLOTMY if the plotting character search fails, the message ERROR in K ARRAY is printed. This usually means DIMENSION of KKK is incorrect.

SYSTEM MANUAL

The objective of this section is to simplify the work of the systems programmer who implements and may have to modify this plotting system. To such a programmer the system consists of a set of FORTRAN IV subroutines (PLOTXY, PLOTMY, PISTUG, SORTXY, SCALE) which are executed in a machine configuration that controls all input-output. A brief description and a complete listing are included for all routines. For PLOTXY, PLOTMY, and PISTUG, comprehensive block diagrams and dictionaries of the FORTRAN variable names are supplied. These are intended as systems debugging aids. Each dictionary is designed for use primarily as a cross-reference with the corresponding FORTRAN listing and block diagram. Within each dictionary, each variable name is identified in terms of its contribution to the program. Throughout this section, the subroutine name is printed at the bottom of each page for assistance in rapid cross-referencing.

The final discussion in this section is of the input-output structure within which the system operates at Lewis.

I. PLOTXY

A. Description

To plot one curve, the programmer will usually use PLOTXY. His call statement lists the names of the arrays to be plotted, the number KODE (an indicator of which options are being used), and finally, an array whose first element is the number of points to be plotted and whose other elements are any additional data required by the choice of option.

PLOTXY writes a blank line (FORMAT 2HPT; see VI, p. 58) to initiate the plot, and calls the auxiliary subrouting PISTUG (p. 46) to compute scaling parameters for either or both scales and check label sizes. Communication with PISTUG is through

COMMON/JOLO/N, F, DX, XYX, FORY, STUG, LABOUT, TONLY, KSW64, KPWR, KFD, TLINX

Records are then written for the plot beginning with a line of 11 y grid-labels. For each line of the plot any required horizontal and vertical grid-line characters as well as correctly positioned plotting characters for all points in that line are written. An x grid-label is printed every tenth line using space suppress. When all points have been plotted, the plot is terminated (with an x grid-line at the next x grid-label, followed by a line of y-labels and a final blank line (FORMAT 2HPL; see VI, p. 58)).

Since the values in the X array are required to be in order (up or down), no sorting is required and the user's arrays are undisturbed.

B. Program Listing

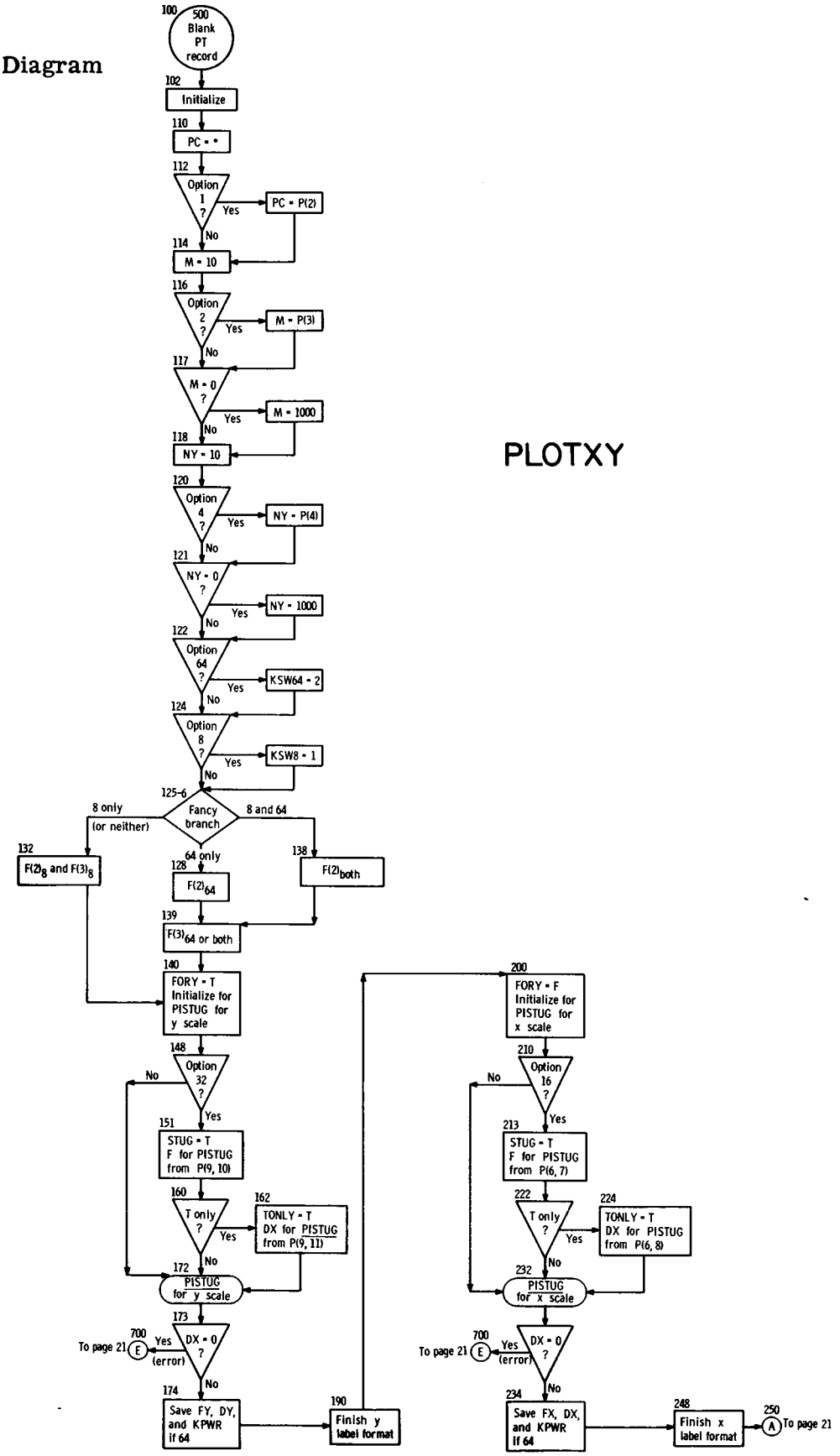
```
      SUBROUTINE PLOTXY(X,Y,K,P)
C
      COMMON/JOLO/N,F,DX,XYX,FORY,STUG,LABOUT,TONLY,KSW64,KPWR,KFD,TLINX
       LOGICAL XYX,FORY, STUG,TONLY,XGL,LS
      DIMENSION X(1),Y(1),P(1)
      DIMENSION FLS(3),FLAB(4),FYLAB(4),YLABEL(11),A(104),ELS(3)
      EQUIVALENCE (FLAB(3),IFLAB3),(FYLAB(3),IYLAB)
      DATA MASK1, MASK2,MASK4,MASK8,MASK16,MASK32,MASK64    /
     1         01,    02,    04,   010,    020,    040,   0100    /
      DATA FYLAB(1),FYLAB(2),FYLAB3,FYLAB(4)    /
     1    6H(2HP ,,6H20X,11   ,6H F10.0,1H)   /
      DATA BLANK,XGRID,YGRID /1H ,1H-,1H1 /
       DATA PCSTD/1H*/
       DATA RMARK/0726060606060/
      DATA  FLS(1),FLS28,FLS264,FLS2B,FLS38,FLS3B /
     1    6H(2HP+,,4H12X,, 3H6X,,3HA6,,3HA6),6H2F6.3) /
      DATA FLAB(1),FLAB(2),FLAB3,FLAB(4) /
     1   6H(2HP+,,4H18X,,6H  F9.0,1H)     /
C
  100 WRITE (6,500)
  500 FORMAT(2HPT)
  102 KODE=K
       N=P(1)
       LABOUT=1
       FLAB(3) = FLAB3
       LS = .FALSE.
      FYLAB(3)=FYLAB3
      KSW8=0
      KSW64=0
  110 PC=PCSTD
C
  112 IF((AND(KODE,MASK1)).GT.0.)PC = P(2)
  114 M=10
  116 IF((AND(KODE,MASK2)).GT.0.)M=P(3)
  117 IF (M.EQ.0)M=1000
  118 NY=10
  120 IF((AND(KODE,MASK4)).GT.0.)NY = P(4)
  121 IF(NY.EQ.0) NY=1000
  122 IF((AND(KODE,MASK64)).GT.0.)KSW64=2
  124 IF((AND(KODE,MASK8)).GT.0.)KSW8=1
C
  125 K864=KSW8+KSW64
  126 IF(K864-2) 132,128,138
  128 FLS(2)=FLS264
  130 GO TO 139
  132 FLS(2)=FLS28
  134 FLS(3)=FLS38
  136 GO TO 140
  138 FLS(2)=FLS2B
  139 FLS(3)=FLS3B
C
```

```
  140 XYX=.FALSE.
  142 FORY=.TRUE.
  144  STUG=.FALSE.
  146 TONLY=.FALSE.
C
  148 IF((AND(KODE,MASK32).LE.0.))  GO TO 172
  151 STUG=.TRUE.
  152 KSY=P(9)
  154 PWR10Y=10.**(KSY-6)
  156 FY =P(10)*PWR10Y
  158 F = FY
C
  160 IF(P(5).GE.2.) GO TO 172
  162 TONLY=.TRUE.
  164 DY= P(11)*PWR10Y
  166 DX= DY
  172 CALL PISTUG(Y)
  173 IF(DX.EQ.0.) GO TO 700
  174 FY=F
  176 DY=DX
  180 IF(KSW64.EQ.2) KPWRY=KPWR
  190 IYLAB=IYLAB-KFD
C
  200 XYX =.TRUE.
  202 FORY=.FALSE.
  204 STUG=.FALSE.
  206 TONLY=.FALSE.
  208 TLINX=55*(1+N/35)
C
  210 IF((AND(KODE,MASK16).LE.0.)) GO TO 232
  213 STUG=.TRUE.
  214 KSX = P(6)
  216 PWR10X=010.**(KSX-6)
  218 FX= P(7)*PWR10X
  220 F=FX
C
  222 IF(MOD(IFIX(P(5)),2).EQ.1) GO TO 232
  224 TONLY=.TRUE.
  226 DX =P(8)*PWR10X
  232 CALL PISTUG(X)
      IF(DX.EQ.0.) GO TO 700
  234 FX=F
  240 IF(KSW64.EQ.2) KPWRX=KPWR
  248 IFLAB3=IFLAB3-KFD
C
  250 IF(KSW64.EQ.0)GO TO 264
  252 KOUTX=-KPWRX
  254 KOUTY=-KPWRY
  256 F10X=10.**KPWRX
  258 F10Y=10.**KPWRY
  260 WRITE (6,502) KOUTX,KOUTY
  502 FORMAT(2HPT,7X, 3HX*E,I2,4H Y*E,I2)
C
  264 DO 278 I=1,11
  266 TEMP = FY+FLOAT(I-1)*DY*10.
  268 ATEMP= ABS(TEMP)
```

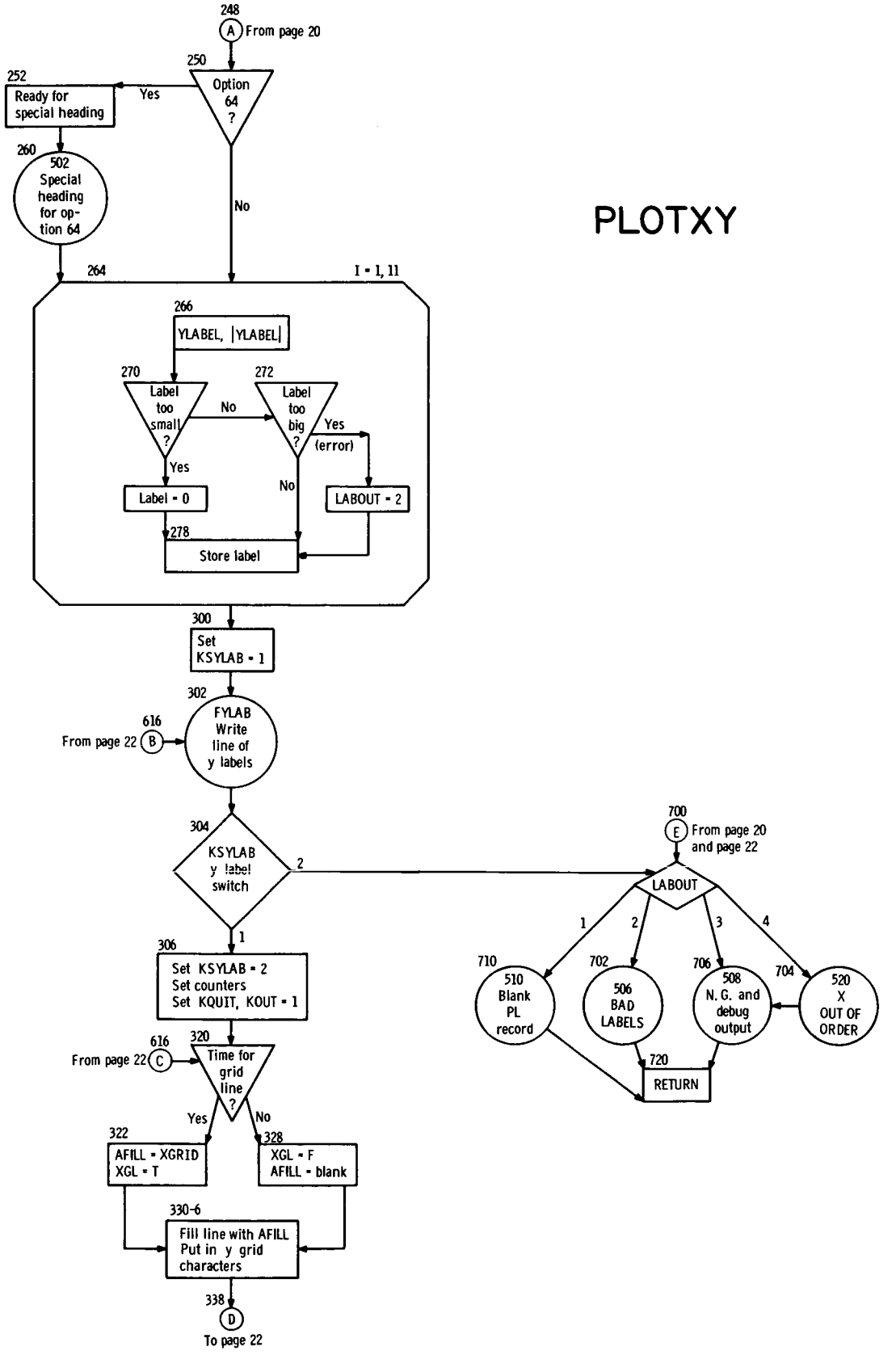
```
  270 IF (ATEMP.LT.1.E-7) TEMP = 0.
  272 IF (ATEMP.GE.1.E+7)LABOUT=2
  278 YLABEL(I)=TEMP
  300 KSYLAB =1
  302 WRITE (6,FYLAB) (YLABEL(I),I=1,11)
  304 GO TO (306,700),KSYLAB
C
  306 KSYLAB =2
  310 LCTR=0
      NCTR=1
      KOUT=1
      KQUIT= 1
C
  320 IF(MOD(LCTR,M))328,322,328
  322 AFILL= XGRID
  324 XGL =.TRUE.
      GO TO 330
  328 XGL =.FALSE.
      AFILL=BLANK
  330 DO 332 I=2,104
  332 A(I) = AFILL
  334 DO 336  I=2,104,NY
  336 A(I)= YGRID
      A(1) =BLANK
  338 GO TO (340,400),KOUT
C
  340 KX =(X(NCTR)-FX)/DX +.5
  342 IF(KX-LCTR)630,350,600
  350 KY= (Y(NCTR)-FY)/DY+.5
  351 LS= .TRUE.
  352 TPC = PC
  353 KYL = KY+2
  354 IF(KY.LT.0) GO TO 360
  356 IF(KY.GT.101)GO TO 364
  358 GO TO 370
  360 KYL=1
  362 GO TO 366
  364 KYL=104
  366 TPC=RMARK
C
  370 A(KYL) =TPC
  372 J=1
  374 IF(KSW8.EQ.0) GO TO 380
  376 ELS(J)=P(NCTR+11)
  378 J= J+1
  380 IF(KSW64.EQ.0) GO TO 386
  382 ELS(J)=X(NCTR)/F10X
  384 ELS(J+1) = Y(NCTR)/F10Y
C
  386 IF(NCTR.GE.N)GO TO 392
  388 NCTR=NCTR+1
  390 GO TO 340
C
  392 KOUT = 2
  394 M= 10
C
```

```
  400 IF(XGL.AND.(MOD(LCTR,10).EQ.0))KQUIT=2
C
  600 WRITE (6,504)(A(I),I=1,104)
  504 FORMAT(2HP ,26X,104A1)
  602 IF(K864.NE.0) GO TO 620
C
  604 IF(MOD(LCTR,10))614,606,614
  606 XLABEL =FX+FLOAT(LCTR)*DX
  608 TEMP =ABS(XLABEL)
  610 IF(TEMP.GE.1.E+7)LABOUT=2
  612 IF(TEMP.LT.1.E-7)XLABEL=0.
  613 WRITE(6,FLAB) XLABEL
C
  614 LCTR = LCTR+1
  616 GO TO (320,302),KQUIT
C
  620 IF(.NOT.LS) GO TO 604
  622 LS = .FALSE.
  624 WRITE (6,FLS)(ELS(I),I=1,K864)
  626 GO TO 604
  630 LABOUT= 4
C
  700 GO TO (710,702,706,704),LABOUT
  702 WRITE (6,506)
  506 FORMAT(2HPL,3X,10HBAD LABELS
      GO TO 720
C
  704 WRITE(6,520) NCTR
  520 FORMAT(2HPL,18HX OUT OF ORDER. I=,I5)
  706 WRITE(6,508)(X(I),Y(I),I=1,2),K,P(1)
  508 FORMAT(2HPL,5H N.G.,4G20.8,I6,F8.2)
  708 GO TO 720
  710 WRITE(6,510)
  510 FORMAT(2HPL)
  720 RETURN
      END
```

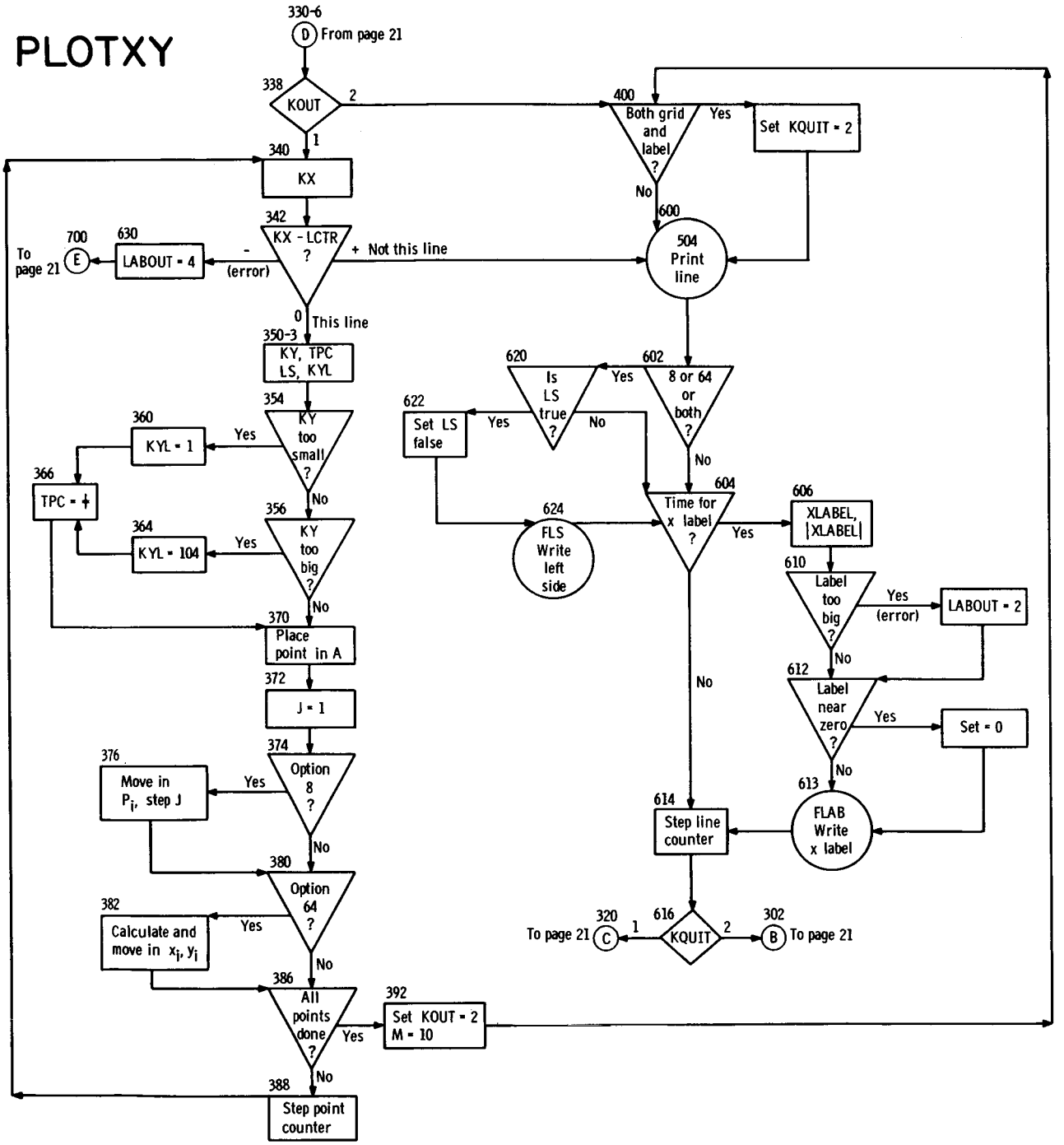
C. Block Diagram



PLOTXY


248
A From page 20
250
Option 64 ?
252
Yes
Ready for special heading
260
502 Special heading for option 64
No
264
I = 1, 11
266
YLABEL, |YLABEL|
270
Label too small ?
No
272
Label too big ?
Yes (error)
Yes
No
Label = 0
LABOUT = 2
278
Store label
300
Set KSYLAB = 1
302
FYLAB Write line of y labels
616
From page 22 B
304
KSYLAB y label switch
2
1
306
Set KSYLAB = 2
Set counters
Set KQUIT, KOUT = 1
616
From page 22 C
320
Time for grid line ?
Yes
No
322
AFILL = XGRID
XGL = T
328
XGL = F
AFILL = blank
330-6
Fill line with AFILL
Put in y grid characters
338
D To page 22
700
E From page 20 and page 22
LABOUT
1
2
3
4
710
510 Blank PL record
702
506 BAD LABELS
706
508 N. G. and debug output
704
520 X OUT OF ORDER
720
RETURN

PLOTXY


330-6
D
From page 21
338
KOUT
2
1
400
Both grid and label ?
Yes
No
Set KQUIT = 2
340
KX
342
KX - LCTR ?
-
(error)
+ Not this line
700
To page 21
E
630
LABOUT = 4
600
504 Print line
0
This line
350-3
KY, TPC LS, KYL
620
Is LS true ?
Yes
No
602
8 or 64 or both ?
622
Set LS false
354
KY too small ?
360
KYL = 1
366
TPC = +
356
KY too big ?
364
KYL = 104
624
FLS Write left side
604
Time for x label ?
606
XLABEL, |XLABEL|
610
Label too big ?
LABOUT = 2
612
Label near zero ?
Set = 0
613
FLAB Write x label
370
Place point in A
372
J = 1
374
Option 8 ?
376
Move in P_i, step J
380
Option 64 ?
382
Calculate and move in x_i, y_i
386
All points done ?
392
Set KOUT = 2 M = 10
388
Step point counter
614
Step line counter
320
To page 21
C
616
KQUIT
302
B
To page 21

D. PLOTXY Dictionary

A	Array in which each line of the plot proper is constructed. It is initialized to 104 blanks or 104 minuses (the horizontal grid-line character). The vertical grid-line characters (1's) are placed in position 2 and every NY^{th} position thereafter. Finally, the plotting characters (if any) are positioned.
AFILL	Temporary storage for the character (1 or -) with which the A array is initialized.
ATEMP	Temporary storage for the absolute value of each y grid-label.
BLANK	BCD representation for a blank printing character. It is used to initialize the A array for lines that are not x grid-lines.
DX	Vertical scale factor (per printing line). It is either calculated by PISTUG based on the range and length of the X array or it is calculated from values supplied by the user of option 16 in P(6) and P(8) as $DX = P(8) \cdot 10^{P(6)-6}$. Also see DX, COMMON/JOLO/ - Dictionary, page 53.
DY	Horizontal scale factor (per print position). It is either calculated by PISTUG based on the range and length of the Y array, or it is calculated from values supplied by the user of option 32 in P(9) and P(11) as $DY = P(11) \cdot 10^{P(9)-6}$. Also see DX, COMMON/JOLO/ - Dictionary, page 53.
ELS	Array in which the information (the first 18 characters of each line) to be printed at the left of the plot is assembled. See FLS, page 24.
F	See COMMON/JOLO/ - Dictionary, page 53.
F10X	10^{KPWRX}. It is the divisor of all values in the X array before they are printed at the left of the plot when option 64 is used.
F10Y	10^{KPWRY}. It is the divisor of all values in the Y array before they are printed at the left of the plot when option 64 is used.

FLAB — Variable FORMAT array with which each x grid-label is written. It is of the form

(2HP+, 18X, F9.d)

where $0 \leq d \leq 6$. A value of d is inserted by the program (as KFD) after the call to PISTUG to process the X array. See KFD, page 53.

FLAB3 — Initial value for FLAB(3).

FLS — Variable FORMAT array with which the output to the left of the x grid-labels is written out if option 8 or option 64 is used. It is constructed during execution and becomes one of three different statements:

		Used to write:
If 8 only	(2HP+, 12X, A6)	One word of P array
If 64 only	(2HP+, 6X, 2F6.3)	The modified coordinates
If 8 and 64	(2HP+, A6, 2F6.3)	One word of P array and the modified coordinates

FLS264 — Used to fill FLS(2) if option 64.

FLS28 — Used to fill FLS(2) if option 8.

FLS2B — Used to fill FLS(2) if both option 8 and option 64 are used.

FLS38 — Used to fill FLS(3) if option 8.

FLS3B — Used to fill FLS(3) if option 64 or both 8 and 64 are used.

FORY — See COMMON/JOLO/ - Dictionary, page 53.

FX — Starting value for the vertical scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 52) of the X array, or it is calculated from values supplied by the user of option 16 in P(6) and P(7) as $FX = P(7) \cdot 10^{P(6)-6}$.

FY — Starting value for the horizontal scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 52) of the Y array, or it is calculated from values supplied by the user of option 32 in P(9) and P(10) as $FY = P(10) \cdot 10^{P(9)-6}$.

FYLAB — Variable FORMAT array with which the line of y grid-labels is written. It is of the form

(2HP , 20X, 11F10.d)

where $0 \leq d \leq 6$. A value of d is inserted by the program (as KFD) after the call PISTUG to process the Y array. See KFD, page 53.

FYLAB3 — Initial value for FYLAB(3).

I — Index of loop forming y grid-labels.

IFLAB3 — Equivalent to FLAB(3).

IYLAB — Equivalent to FYLAB(3).

J — Subscript used when filling ELS array.

K864 — Sum of KSW8 and KSW64. It has the possible values 0, 1, 2, 3.

KFD — See COMMON/JOLO/ - Dictionary, page 53.

KHAR — Function subprogram described under PISTUG, page 46.

KODE — Sum of the option numbers. It is supplied by the programmer in the third argument of the call. Branching on single bit positions using MASK1, MASK2, MASK4, MASK8, MASK16, MASK32, and MASK64 serves to identify the options being used.

KOUT — Switch initialized to 1 and set to 2 after all points have been processed.

KOUTX — Value in the special heading of option 64 for the x coordinates. It is the negative of KPWRX.

KOUTY — Value in the special heading of option 64 for the y coordinates. It is the negative of KPWRY.

KPWR — See COMMON/JOLO/ - Dictionary, page 53.

KPWRX — KPWR for the X array.

KPWRY — KPWR for the Y array.

KQUIT — Switch initialized to 1. It is set to 2 just before the last line (a labeled x grid-line) of the plot is printed.

KSW8 Switch initialized to zero and set to 1 if option 8 is used.

KSW64 See COMMON/JOLO/ - Dictionary, page 53.

KSX Fixed point form of the value supplied in P(6) by the programmer using option 16. P(7) and P(8) are multiplied by 10^{KSX-6} to get FX and DX.

KSY Fixed point form of the value supplied in P(9) by the programmer using option 32. P(10) and P(11) are multiplied by 10^{KSY-6} to get FY and DY.

KSYLAB Switch initialized to 1 and set to 2 after the first line of y grid-labels has been written.

KX Line number of a particular point. It is computed from $\lceil (x_i - FX)/DX \rceil$ rounded. The first x grid-line is line number zero.

KY "Printing position" of a particular point. It is computed from $\lceil (y_i - FY)/DY \rceil$ rounded. The first y grid-line is in "printing position" zero - actually the second element of the A array.

KYL Value of KY + 2 if the y-coordinate falls on the plot; 1 if KY is negative; 104 if KY > 101.

LABOUT See COMMON/JOLO/ - Dictionary, page 53.

LCTR Line counter. It is set to zero for the first x grid-line and is stepped by 1 after each line is printed.

LS Logical variable set to TRUE whenever a point has been found for the current line. If option 8 or 64 are in effect, LS is used to control a branch (to print on the left side of the plot) and is set to FALSE immediately after the branch.

M Frequency of the x grid-lines. It is either supplied in P(3) by the programmer if option 2 is used or set equal to 10. If the programmer specifies zero, M is set to 1000 and only the first and last x grid-lines will be printed.

MASK1
MASK2
MASK4
MASK8
MASK16
MASK32
MASK64

See KODE, page 25.

N — See COMMON/JOLO/ - Dictionary, page 54.

NCTR — Counter for the number of points that have been processed. It is initialized to 1 and tested for equality to N. It is increased by 1 each time the test fails.

NY — Frequency of the y grid-lines. It is either set to 10 or supplied in P(4) by the programmer using option 4. If it is supplied as zero, it is replaced by 1000 and only the left-most y grid-line will be printed.

P — Array name, the fourth argument in the call list of this subroutine. P(1) contains number of points to be plotted. Further contents are prescribed by the options being used.

PC — Plotting character. It is either supplied by the programmer using option 1 in P(2) or by the program as PCSTD.

PCSTD — Standard plotting character *.

PWR10X — Value of 10^{KSX-6}.

PWR10Y — Value of 10^{KSY-6}.

RMARK — Record mark character (≠).

STUG — See COMMON/JOLO/ - Dictionary, page 54.

TEMP — Temporary storage.

TLINX See COMMON/JOLO/ - Dictionary, page 55.

TONLY See COMMON/JOLO/ - Dictionary, page 55.

TPC Current plotting character.

X Array name, the first argument in the call list of this subroutine, containing the values of the variable to be plotted on the vertical scale (down the page). They must be in sequence either increasing or decreasing.

XGL Logical variable set to TRUE whenever the value of LCTR is evenly divisible by M.

XGRID x grid-line character, a minus sign.

XLABEL Current value of the x label. It is computed only for every tenth line from FX + LCTR·DX.

XYX See COMMON/JOLO/ - Dictionary, page 55.

Y Array name, the second argument in the call list of this subroutine, containing the values of the variable to be plotted on the horizontal scale (across the page).

YGRID y grid-line character - the digit 1.

YLABEL Array holding the 11 labels for the y axis.

II. PLOTMY

A. Description

Although more than one curve can be plotted on the same grid using PLOTXY, they will all use the same plotting character. When a different plotting character for each curve is desired, the programmer uses PLOTMY. The CALL statement lists the names of the arrays to be plotted; an array containing the number KODE, the number of curves, and possibly other information - depending on the options used and the Variation chosen; and finally an array whose first element indicates the Variation chosen and whose other elements are any additional data required for the options being used.

The records written by PLOTMY are identical to those written by PLOTXY (p. 14), and the auxiliary subroutine PISTUG is used in the same way.

Because the X array is not required to be in order, a search for the next point to be plotted occurs for every point. The search technique used avoids the use of additional storage by using the X array itself in such a fashion that the values in the array are destroyed. The Y, KKK, and P arrays are undisturbed.

B. Program Listing

```
      SUBROUTINE PLOTMY(X,Y,K,P)
C
      COMMON/JOLO/N,F,DX,XYX,FORY,STUG,LABOUT,TONLY,KSW64,KPWR,KFD,TLINX
       LOGICAL XYX,FORY, STUG,TONLY,XGL,LS
      DIMENSION X(1),Y(1),P(1),K(1)
      DIMENSION FLS(3),FLAB(4),FYLAB(4),YLABEL(11),A(104),ELS(3)
       DIMENSION KPCSTD(6)
      EQUIVALENCE (FLAB(3),IFLAB3),(FYLAB(3),IYLAB)
       EQUIVALENCE (KPC,TPC)
      DATA MASK1, MASK2,MASK4,MASK8,MASK16,MASK32,MASK64    /
     1         01,    02,   04,  010,   020,   040,  0100    /
       DATA FYLAB(1),FYLAB(2),FYLAB3,FYLAB(4)    /
     1    6H(2HP ,,6H20X,11  ,6H F10.0,1H)   /
       DATA BLANK,XGRID,YGRID /1H ,1H-,1H1 /
        DATA RMARK/0726060606060/
        DATA(KPCSTD(I),I=1,6)/1H*,1H+,1HO,1HX,1H=,1HO/
       DATA  FLS(1),FLS28,FLS264,FLS2B,FLS38,FLS3B /
     1  6H(2HP+,,4H12X,,4H12X,,4HA12,,3HA6),6H F6.3)   /
       DATA FLAB(1),FLAB(2),FLAB3,FLAB(4) /
     1   6H(2HP+,,4H18X,,6H  F9.0,1H)     /
C
  100 WRITE (6,500)
  102 KODE=K(1)
       KN=K(2)
       NPTS=K(3)
       LABOUT=1
       FLAB(3) = FLAB3
       LS = .FALSE.
      FYLAB(3)=FYLAB3
      KSW8=0
      KSW64=0
       KTL=1
       KSWI=1
       KSWII=1
11000 IF(P(1)-2.5) 11002,11002,11010
11002 KSWI=2
11004 KTL=KN
11006 GO TO 11034
11010 IF(P(1)-4.0)11020,11020,11012
11012 NPTST=0
11014 DO 11016 I=1,KN
11016 NPTST=NPTST+K(2*I+1)
11017 TLINX=55*(1+NPTST/(35*KN))
11018 GO TO112
11020 KSWII=2
11021 KTIMES=KN-1
11022 DO 11032 I=1,KTIMES
11024 MM=I*NPTS
11026 K(2*I+3)=NPTS
11028 DO 11032 II=1,NPTS
```

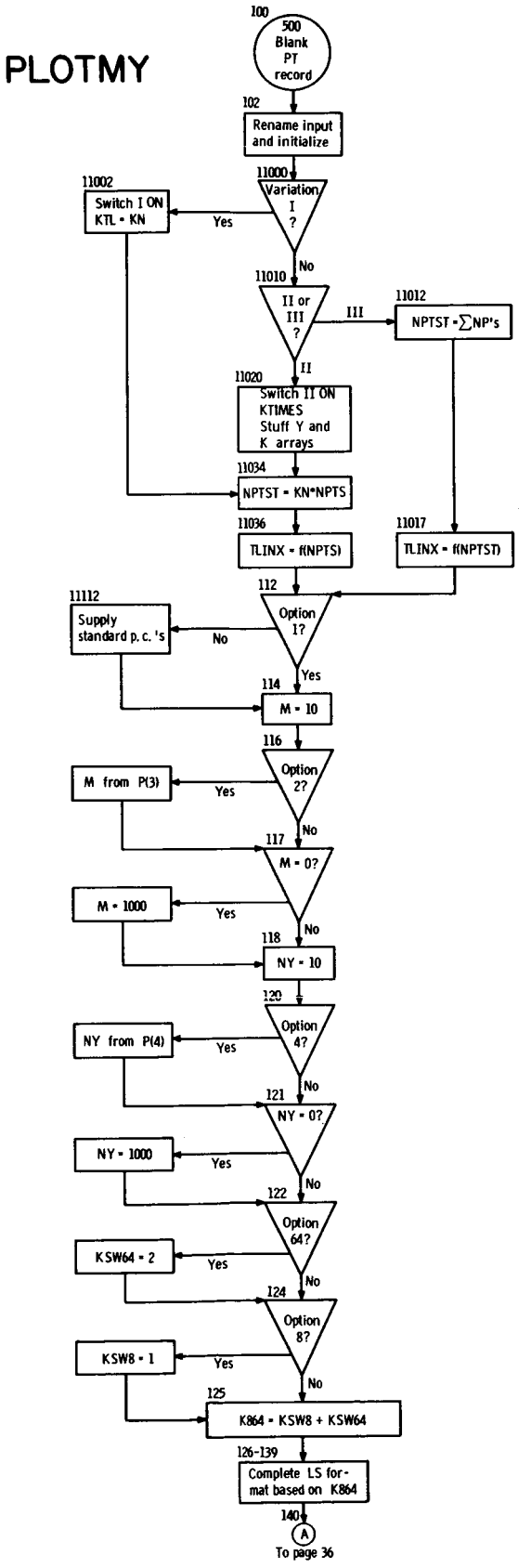
```
11030 L=MM+II
11032 Y(L)=Y(II)
11034 NPTST=KN*NPTS
11036 TLINX=55*(1+NPTS/35)
  112 IF((AND(KODE,MASK1)).GT.0.)GO TO 114
11112 DO 11113 I=1,KN
11113 K(2*I+2)=KPCSTD(I)
  114 M=10
  116 IF((AND(KODE,MASK2)).GT.0.)M=P(3)
  117 IF (M.EQ.0)M=1000
  118 NY=10
  120 IF((AND(KODE,MASK4)).GT.0.)NY = P(4)
  121 IF(NY.EQ.0) NY=1000
  122 IF((AND(KODE,MASK64)).GT.0.)KSW64=2
  124 IF((AND(KODE,MASK8)).GT.0.)KSW8=1
C
  125 K864=KSW8+KSW64
  126 IF(K864-2) 132,128,138
  128 FLS(2)=FLS264
  130 GO TO 139
  132 FLS(2)=FLS28
  134 FLS(3)=FLS38
  136 GO TO 140
  138 FLS(2)=FLS2B
  139 FLS(3)=FLS3B
C
  140 XYX=.FALSE.
  142 FORY=.TRUE.
  144  STUG=.FALSE.
  146 TONLY=.FALSE.
C
  148 IF((AND(KODE,MASK32).LE.0.))  GO TO 172
  151 STUG=.TRUE.
  152 KSY=P(9)
  154 PWR10Y=10.** (KSY-6)
  156 FY =P(10)*PWR10Y
  158 F = FY
C
  160 IF(P(5).GE.2.) GO TO 172
  162 TONLY=.TRUE.
  164 DY= P(11)*PWR10Y
  166 DX= DY
C
  172 N=NPTST
11172 CALL PISTUG(Y)
  173 IF(DX.EQ.0.) GO TO 700
  174 FY=F
  176 DY=DX
  190 IYLAB=IYLAB-KFD
C
  200 XYX=.FALSE.
  202 FORY=.FALSE.
  204 STUG=.FALSE.
  206 TONLY=.FALSE.
C
  210 IF((AND(KODE,MASK16).LE.0.)) GO TO 232
```

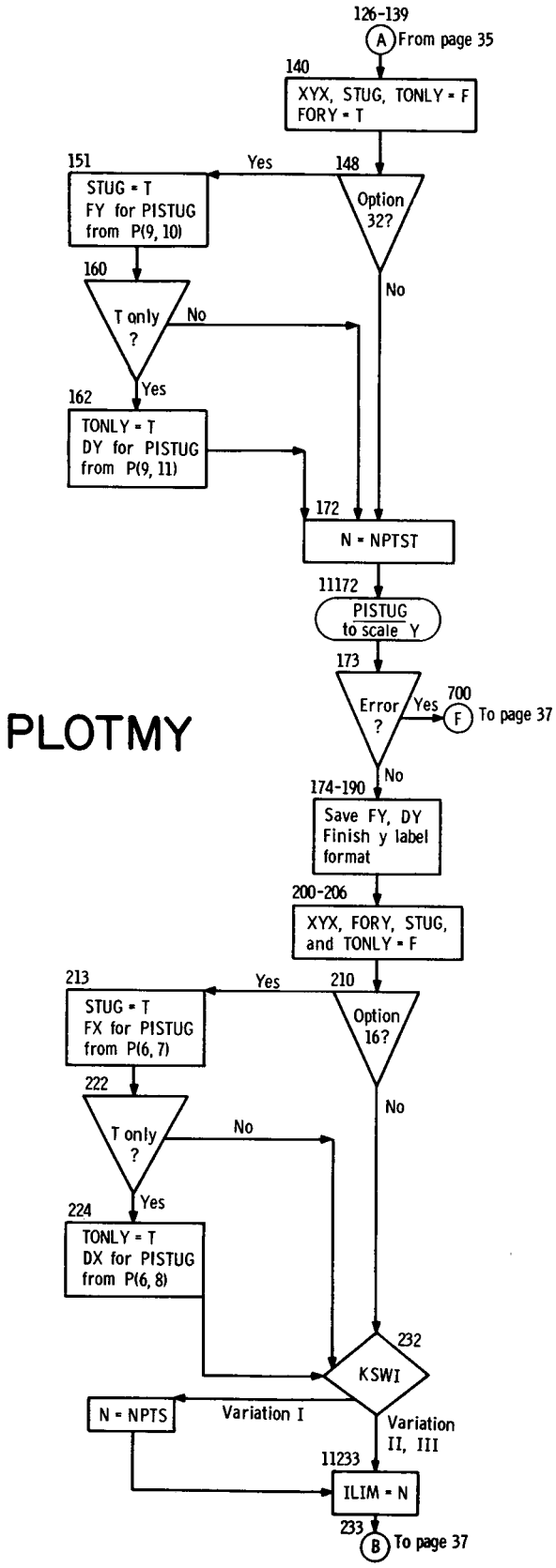
```
  213 STUG=.TRUE.
  214 KSX = P(6)
  216 PWR10X=10.**(KSX-6)
  218 FX= P(7)*PWR10X
  220 F=FX
C
  222 IF(MOD(IFIX(P(5)),2).EQ.1) GO TO 232
  224 TONLY=.TRUE.
  226 DX =P(8)*PWR10X
  232 IF(KSWI.EQ.2)N=NPTS
11233 ILIM=N
  233 CALL PISTUG(X)
      IF(DX.EQ.0.) GO TO 700
  234 FX=F
  248 IFLAB3=IFLAB3-KFD
C
  250 IF(KSW64.EQ.0)GO TO 264
  252 KOUTX=-KPWR
  256 F10X=10.**KPWR
  260 WRITE (6,502) KOUTX
C
  264 DO 278 I=1,11
  266 TEMP = FY+FLOAT(I-1)*DY*10.
  268 ATEMP= ABS(TEMP)
  270 IF (ATEMP.LT.1.E-7) TEMP = 0.
  272 IF (ATEMP.GE.1.E+7)LABOUT=2
  278 YLABEL(I)=TEMP
  300 KSYLAB =1
  302 WRITE (6,FYLAB) (YLABEL(I),I=1,11)
  304 GO TO (306,700),KSYLAB
C
  306 KSYLAB =2
  310 LCTR=0
      NCTR=1
      KOUT=1
      KQUIT= 1
C
  320 IF(MOD(LCTR,M))328,322,328
  322 AFILL= XGRID
  324 XGL =.TRUE.
      GO TO 330
  328 XGL =.FALSE.
      AFILL=BLANK
  330 DO 332 I=2,104
  332 A(I) = AFILL
  334 DO 336  I=2,104,NY
  336 A(I)= YGRID
      A(1) =BLANK
  338 GO TO (340,400),KOUT
C
  340 XMIN=1.E15
11340 IMIN=1
11342 DO 11350 I=1,ILIM
11344 IF(XMIN-X(I))11350,11350,11346
11346 XMIN=X(I)
11348 IMIN=I
```

```
11350 CONTINUE
  341 KX =(X(IMIN)-FX)/DX +.5
  342 IF(KX-LCTR)630,350,600
  350 LS=.TRUE.
11352 X(IMIN)=1.E15
  372 J=1
  374 IF(KSW8.EQ.0) GO TO 380
  376  ELS(J)=P(IMIN+11)
  378 J= J+1
  380 IF(KSW64.EQ.0) GO TO 11400
00382 ELS(J)=XMIN/F10X
11400 DO 370 IM=1,KTL
11402 LL=IMIN+(IM  -1)*NPTS
11404 KY=(Y(LL)-FY)/DY+.5
11420 IF(KSWI.EQ.2) GO TO 11440
11422 IK=0
       KLAST=2*KN+1
11424 DO 11430 IL=3,KLAST,2
11426 IK=IK+K(IL)
11428 IF(IK-IMIN) 11430,11436,11436
11430 CONTINUE
11432 LABOUT=5
11434 GO TO 700
11436 KPC=K(IL+1)
11438 GO TO 353
11440 KPC=K(2*IM+2)
  353 KYL = KY+2
  354 IF(KY.LT.0) GO TO 360
  356 IF(KY.GT.101)GO TO 364
  358 GO TO 370
  360 KYL=1
  362 GO TO 366
  364 KYL=104
  366 TPC=RMARK
  370 A(KYL) =TPC
  386 IF(NCTR.GE.ILIM) GO TO 392
  388 NCTR=NCTR+1
  390 GO TO 340
C
  392 KOUT = 2
  394 M= 10
C
  400 IF(XGL.AND.(MOD(LCTR,10).EQ.0))KQUIT=2
C
  600 WRITE (6,504)(A(I),I=1,104)
  602 IF(K864.NE.0) GO TO 620
C
  604 IF(MOD(LCTR,10))614,606,614
  606 XLABEL =FX+FLOAT(LCTR)*DX
  608 TEMP =ABS(XLABEL)
  610 IF(TEMP.GE.1.E+7)LABOUT=2
  612 IF(TEMP.LT.1.E-7)XLABEL=0.
  613 WRITE(6,FLAB) XLABEL
C
  614 LCTR = LCTR+1
  616 GO TO (320,302),KQUIT
```

```
C
  620 IF(.NOT.LS) GO TO 604
  622 LS = .FALSE.
  623 KT=K864-1
  624 WRITE (6,FLS)(ELS(I),I=1,KT)
  626 GO TO 604
  630 LABOUT= 4
C
  700 GO TO (710,702,706,704,712),LABOUT
  702 WRITE (6,506)
      GO TO 720
C
  704 WRITE(6,520) NCTR
  706 WRITE(6,508)(X(I),Y(I),I=1,2),K(1),K(2),K(3)
  708 GO TO 720
  712 WRITE(6,512)
  710 WRITE(6,510)
  720 RETURN
  500 FORMAT(2HPT)
  502 FORMAT(2HPT,13X,3HX*E,I2)
  504 FORMAT(2HP ,26X,104A1)
  506 FORMAT(2HPL,3X,10HBAD LABELS  )
  508 FORMAT(2HPL,5H N.G.,4G20.8,3I7)
  510 FORMAT(2HPL)
  512 FORMAT(2HPL,16HERROR IN K ARRAY      )
  520 FORMAT(2HPL,18HX OUT OF ORDER. I=,I5)
      END
```

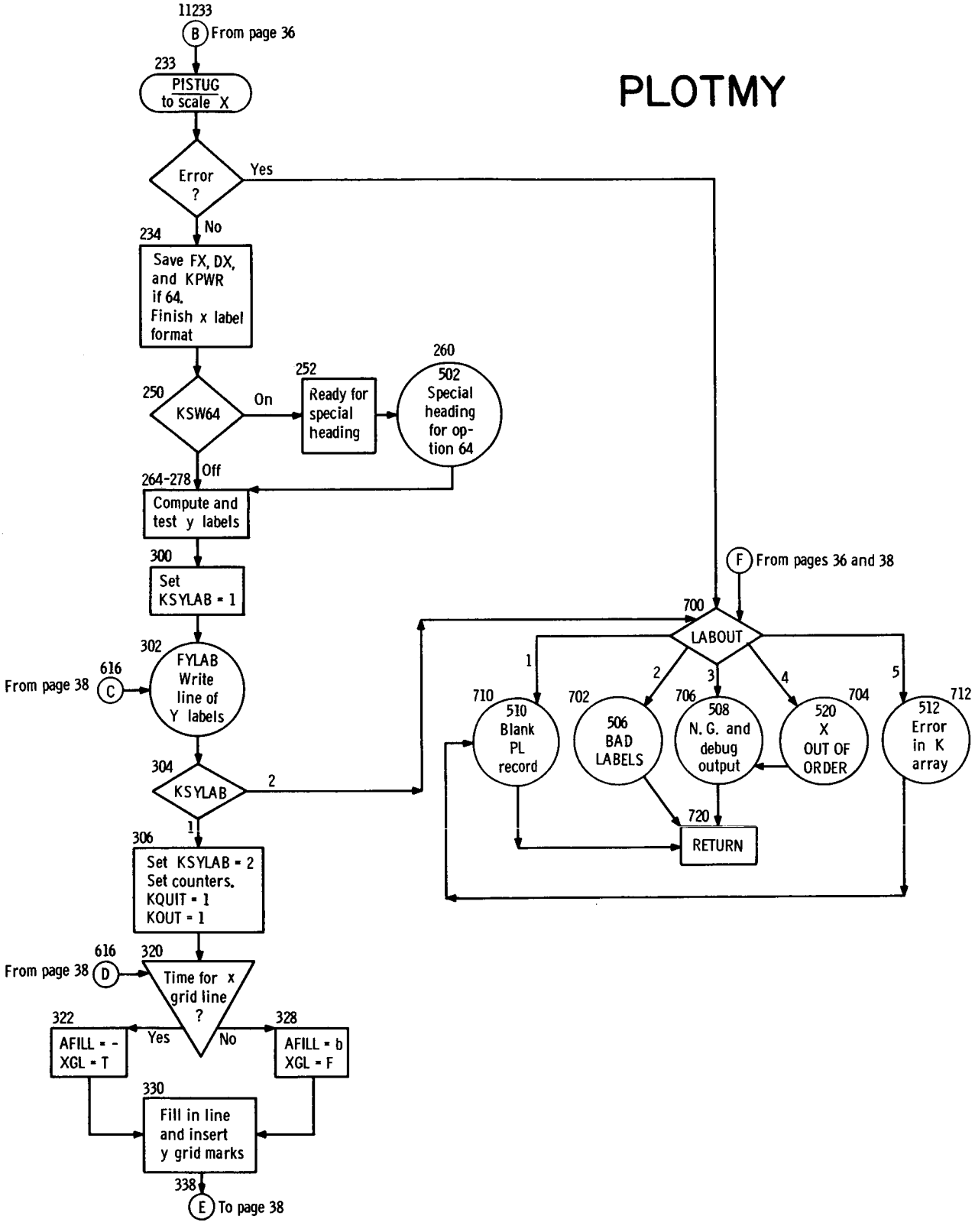
C. Block Diagram



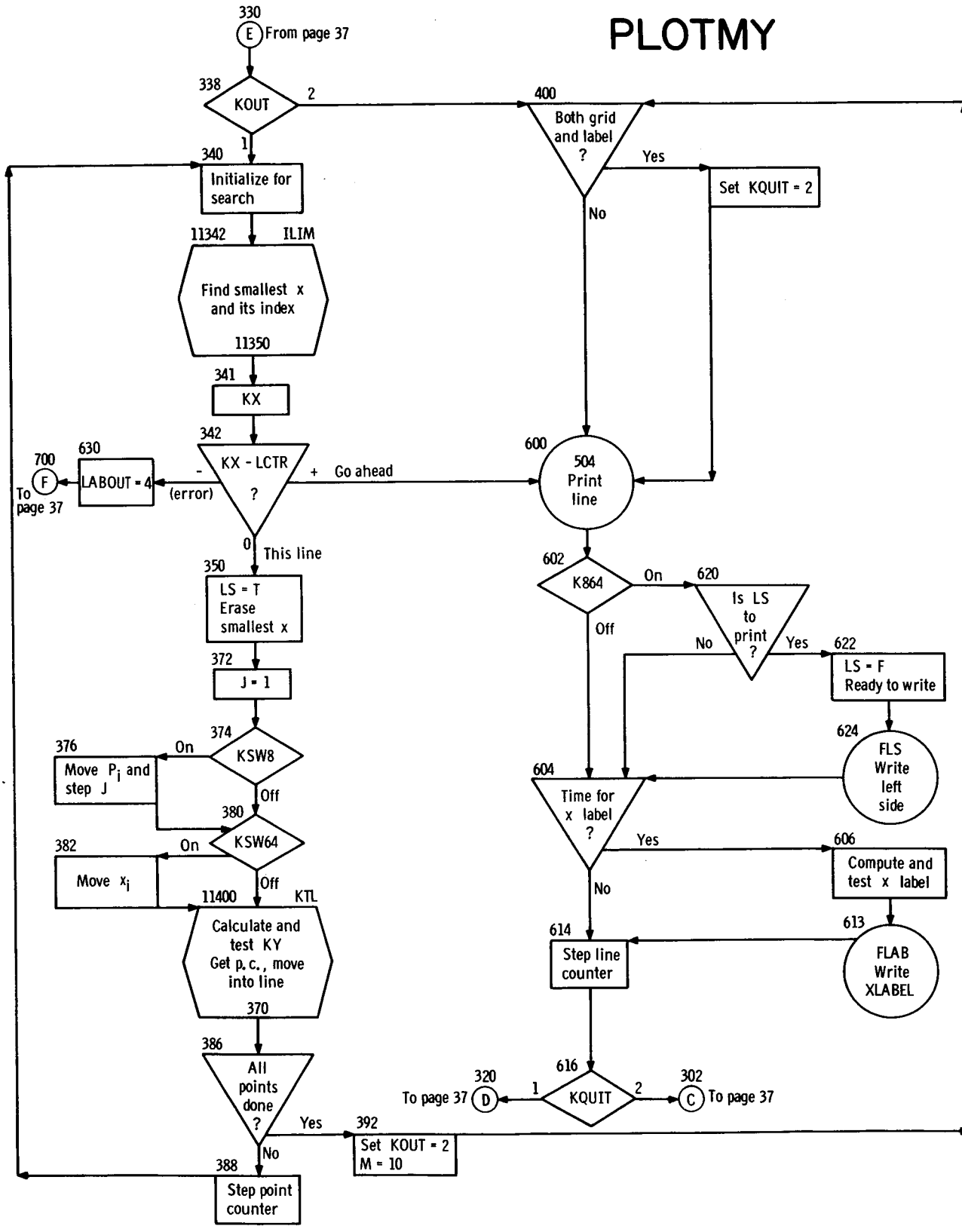

126-139
A From page 35
140
XYX, STUG, TONLY = F
FORY = T
151
Yes
148
STUG = T
FY for PISTUG
from P(9, 10)
Option
32?
160
No
T only
?
No
Yes
162
TONLY = T
DY for PISTUG
from P(9, 11)
172
N = NPTST
11172
PISTUG
to scale Y
173
Error
?
Yes
700
F To page 37
No
174-190
Save FY, DY
Finish y label
format
200-206
XYX, FORY, STUG,
and TONLY = F
213
Yes
210
STUG = T
FX for PISTUG
from P(6, 7)
Option
16?
222
No
T only
?
No
Yes
224
TONLY = T
DX for PISTUG
from P(6, 8)
232
KSWI
N = NPTS
Variation I
Variation
II, III
11233
ILIM = N
233
B To page 37

PLOTMY

PLOTMY


11233
B From page 36
233
PISTUG to scale X
Error ?
Yes
No
234
Save FX, DX, and KPWR if 64. Finish x label format
250
KSW64
On
252
Ready for special heading
260
502 Special heading for option 64
Off
264-278
Compute and test y labels
300
Set KSYLAB = 1
302
FYLAB Write line of Y labels
From page 38 616 C
304
KSYLAB
2
1
306
Set KSYLAB = 2 Set counters. KQUIT = 1 KOUT = 1
From page 38 616 D
320
Time for x grid line ?
322
AFILL = - XGL = T
Yes
No
328
AFILL = b XGL = F
330
Fill in line and insert y grid marks
338
E To page 38
F From pages 36 and 38
700
LABOUT
1
2
3
4
5
710
510 Blank PL record
702
506 BAD LABELS
706
508 N. G. and debug output
704
520 X OUT OF ORDER
712
512 Error in K array
720
RETURN

PLOTMY


330
E
From page 37
338
KOUT
2
1
400
Both grid and label ?
Yes
No
Set KQUIT = 2
340
Initialize for search
11342
ILIM
Find smallest x and its index
11350
341
KX
342
KX - LCTR ?
-
(error)
+
Go ahead
700
F
To page 37
630
LABOUT = 4
600
504 Print line
0
This line
350
LS = T
Erase smallest x
372
J = 1
602
K864
On
Off
620
Is LS to print ?
No
Yes
622
LS = F
Ready to write
624
FLS
Write left side
374
KSW8
On
Off
376
Move P_j and step J
380
KSW64
On
Off
382
Move x_j
604
Time for x label ?
Yes
No
606
Compute and test x label
613
FLAB
Write XLABEL
614
Step line counter
11400
KTL
Calculate and test KY
Get p. c., move into line
370
386
All points done ?
Yes
No
392
Set KOUT = 2
M = 10
388
Step point counter
616
KQUIT
1
2
320
To page 37
D
302
C
To page 37

D. PLOTMY Dictionary

A — Array in which each line of the plot proper is constructed. It is initialized to 104 blanks or 104 minuses (the horizontal grid-line character). The vertical grid-line characters (1's) are then placed in position 2 and every NY^{th} position thereafter. Finally, the plotting characters (if any) are positioned.

AFILL — Temporary storage for the character (1 or -) with which the A array is initialized.

ATEMP — Temporary storage for the absolute value of each y grid-label.

BLANK — BCD representation for a blank printing character. It is used to initialize the A array for lines that are not x grid-lines.

DX — Vertical scale factor (per printing line). It is either calculated by PISTUG based on the range and length of the X array or it is calculated from values supplied by the user of option 16 in P(6) and P(8) as $DX = P(8) \cdot 10^{P(6)-6}$. It must be positive. Also see DX, COMMON /JOLO/ - Dictionary, page 53.

DY — Horizontal scale factor (per print position). It is either calculated by PISTUG based on the range and length of the Y array, or it is calculated from values supplied by the user of option 32 in P(9) and P(11) as $DY = P(11) \cdot 10^{P(9)-6}$. Also see DX, COMMON/JOLO - Dictionary, page 53.

ELS — Array in which the information (the first 18 characters of each line) to be printed at the left of the plot is assembled. See FLS on the following page.

F — See COMMON/JOLO/ - Dictionary, page 53.

F10X — 10^{KPWRX}. F10X is the divisor of all values in the X array before they are printed on the left of the plot when option 64 is used.

FLAB — Variable FORMAT array with which each x grid-label is written. It is of the form

(2HP+, 18X, F9.d)

where $0 \leq d \leq 6$. A value of d is inserted by the program (as KFD) after the call to PISTUG to process the X array. See KFD, page 53.

FLAB3 Initial value for FLAB(3).

FLS Variable FORMAT array with which the output to the left of the x grid-labels is written out if option 8 or option 64 is used. It is constructed during execution and becomes one of three different statements.

	Used to write:
If 8 only (2HP+, 12X, A6)	One word of P array
If 64 only (2HP+, 12X, F6.3)	The modified x coordinate
If 8 and 64 (2HP+, A12, F6.3)	One word of P array and the modified x coordinate

FLS264 Used to fill FLS(2) if option 64.

FLS28 Used to fill FLS(2) if option 8.

FLS2B Used to fill FLS(2) if both option 8 and option 64 are used.

FLS38 Used to fill FLS(3) if option 8.

FLS3B Used to fill FLS(3) if option 64 or both 8 and 64 are used.

FORY See COMMON/JOLO/ - Dictionary, page 53.

FX Starting value for the vertical scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 52) of the X array, or it is calculated from values supplied by the user of option 16 in P(6) and P(7) as $FX = P(7) \cdot 10^{P(6)-6}$.

FY Starting value for the horizontal scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 52) of the Y array, or it is calculated from values supplied by the user of option 32 in P(9) and P(10) as $FY = P(10) \cdot 10^{P(9)-6}$.

FYLAB Variable FORMAT array with which the line of y grid-labels is written. It is of the form

(2HP , 20X, 11F10.d)

where $0 \leq d \leq 6$. A value of d is inserted by the program (as KFD) after the call to PISTUG to process the Y array. See KFD, page 53.

FYLAB3 Initial value for FYLAB(3).

I	Index of many loops.
IFLAB3	Equivalent to FLAB(3).
II	Inner index of double DO loop that initializes the Y and K arrays for DUPY.
IK	Counter used as a subscript in the loop that associates the correct plotting character with the current value of IMIN for DUPY and NO DUP.
IL	Index of the loop that finds the correct plotting character for DUPY and NO DUP.
ILIM	Number of executions of the loop that finds XMIN and IMIN.
IM	Index of the loop that calculates KY, finds the associated plotting character, and positions it in the A array.
IMIN	Value of I for the X(I) that is the smallest value in the X array at any particular time.
IYLAB	Equivalent to FYLAB(3).
J	Subscript used when filling ELS array.
K	Array name, the third argument in the call list of this subroutine. The first element is the sum of the option numbers being used; the second is the number of curves. The remaining elements of the array are prescribed by the Variation and the options being used.
K864	Sum of KSW8 and KSW64. It has the possible values 0, 1, 2, 3.
KFD	See COMMON/JOLO/ - Dictionary, page 53.
KLAST	Limit of the loop that finds the correct plotting character for DUPY and NO DUP.
KN	Number of curves to be plotted. It is supplied by the programmer in K(2).
KODE	Sum of the option numbers. It is supplied by the programmer in K(1). Branching on single bit positions using MASK1, MASK2, MASK4, MASK8, MASK16, MASK32, and MASK64 serves to identify the options being used.

KOUT Switch initialized to 1 and set to 2 after all points have been processed.

KOUTX Value in the special heading of option 64 for the x coordinates. It is the negative of KPWR of the X array.

KPC Equivalent to TPC. Temporary storage for a plotting character before it is positioned in the A array.

KPCSTD Array containing the six standard plotting characters (* + 0 X = □).

KPWR See COMMON/JOLO/ - Dictionary, page 53.

KQUIT Switch initialized to 1. It is set to 2 just before the last line (a labeled x grid-line) of the plot is printed.

KSW8 Switch initialized to zero and set to 1 if option 8 is used.

KSW64 See COMMON/JOLO/ - Dictionary, page 53.

KSWI Switch initialized to 1 and set to 2 if Variation I (DUPX) is used.

KSWII Switch initialized to 1 and set to 2 if Variation II (DUPY) is used.

KSX Fixed point form of the value supplied in P(6) by the programmer using option 16. P(7) and P(8) are multiplied by 10^{KSX-6} to get FX and DX.

KSY Fixed point form of the value supplied in P(9) by the programmer using option 32. P(10) and P(11) are multiplied by 10^{KSY-6} to get FY and DY.

KSYLAB Switch initialized to 1 and set to 2 after the first line of y grid-labels has been written.

KT Value of K864 - 1. It is the number of words written to the left of the plot; 1 if option 8 or option 64, 2 if both option 8 and option 64.

KTIMES Value of KN - 1. The number of executions of the loop that stuffs the Y and K arrays for DUPY.

KTL Number of executions of the loop whose index is IM. It is 1 for DUPY and NO DUP and KN for DUPX.

KX "Line number" of a particular point. It is computed from $\left[(x_i - FX)/DX\right]$ rounded. The first x grid-line is "line number" zero.

KY — "Printing position" of a particular point. It is computed from $[(y_i - FY)/DY]$ rounded. The first y grid-line is in "printing position" zero - actually the second element of the A array.

KYL — Value of KY + 2 if the y-coordinate falls on the plot; -1, if KY is negative; 104, if KY > 101.

L — Subscript computed and used in the loop that stuffs the Y and K arrays for DUPY.

LABOUT — See COMMON/JOLO/ - Dictionary, page 53.

LCTR — Line counter. It is set to zero for the first x grid-line and is stepped by 1 after each line is printed.

LL — Subscript computed and used in the loop that computes each KY and finds its associated plotting character.

LS — Logical variable set to TRUE whenever a point has been found for the current line. If option 8 or 64 is in effect, LS is used to control a branch (to print on the left side of the plot) and is set to FALSE immediately after the branch.

M — Frequency of the x grid-lines. It is either set equal to 10 or supplied in P(3) by the programmer if option 2 is being used. If the programmer specifies zero, M is set to 1000, and only the first and last x grid-lines will be printed.

MASK1, MASK2, MASK4, MASK8, MASK16, MASK32, MASK64 — See KODE, page 41.

MM — Subscript computed and used in the loop that stuffs the Y and K arrays if DUPY is used.

N — See COMMON/JOLO/ - Dictionary, page 54.

NCTR — Counter of the number of points that have been processed. It is initialized to 1 and tested for equality to ILIM. It is increased by 1 each time the test fails.

NPTS — Number of points in the X array (or Y array) supplied by the programmer using DUPX (or DUPY) in K(3).

NPTST — Sum of the numbers of points in all the curves (supplied by the programmer in K(3), K(5), . . . K(2 * KN + 1)) for NO DUP. It is KN multiplied by NPTS for DUPY.

NY — Frequency of the y grid-lines. It is either set to 10 or supplied in P(4) by the programmer using option 4. If it is supplied as zero, it is replaced by 1000 and only the left-most y grid-line will be printed.

P — Array name, the fourth argument in the call list of this subroutine. Its contents are prescribed by the Variation and the options being used.

PWR10X — Value of 10^{KSX-6}.

PWR10Y — Value of 10^{KSY-6}.

RMARK — Record mark character (≠).

STUG — See COMMON/JOLO/ - Dictionary, page 54.

TEMP — Temporary storage.

TLINX — See COMMON/JOLO/ - Dictionary, page 55.

TONLY — See COMMON/JOLO/ - Dictionary, page 55.

TPC — Current plotting character. Equivalent to KPC.

X — Array name, the first argument in the call list of this subroutine, containing the values of the variable to be plotted on the vertical scale (down the page). The contents are destroyed during execution.

XGL — Logical variable set to TRUE whenever the value of LCTR is evenly divisible by M.

XGRID — x grid-line character - a minus sign.

XLABEL Current value of the x label. It is computed only for every tenth line from XLABEL = FX + LCTR·DX.

XMIN Smallest value in the X array at any particular time.

XYX See COMMON/JOLO/ - Dictionary, page 55.

Y Array name, the second argument in the call list of this subroutine, containing the values of the variable to be plotted on the horizontal scale (across the page).

YGRID y grid-line character, the digit 1.

YLABEL Array holding the 11 labels for the y axis.

III. PISTUG

A. Description

This routine is internal to the plotting system and is used by PLOTXY and PLOTMY. The calling statement is CALL PISTUG (ARRAY). ARRAY is an array in any order. All other information is transmitted through

COMMON/JOLO/N, F, DX, XYX, FORY, STUG, LABOUT, TONLY, KSW64, KPWR, KFD, TLINX

PISTUG uses the minimum and maximum values of the array to compute the total range. When scaling parameters are being computed for the y scale, 101 print positions are available to cover the range. For the x scale, an arbitrarily chosen number of lines is assigned. In either case, the scale factor computed is always a value of $D \times 10^n$, where D is a member of the set [2, 2.5, 5, 10].

PISTUG uses a function subprogram KHAR(V) which finds the integer that is the characteristic of the logarithm to the base 10 of the floating point variable V.

B. Program Listing

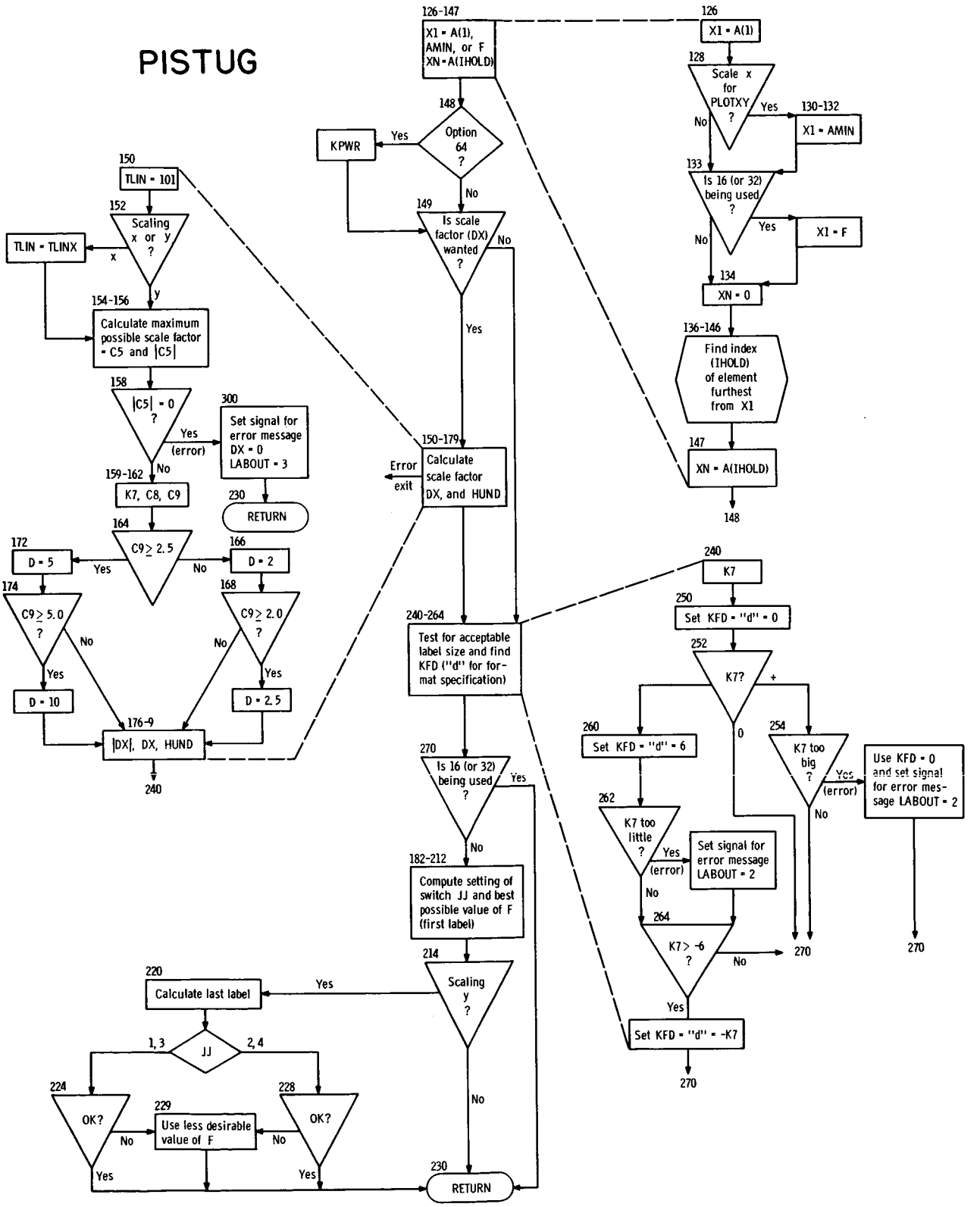
```
      SUBROUTINE PISTUG(ARRAY)
      DIMENSION ARRAY(1)
     COMMON/JOLO/N,F,DX,XYX,FORY,STUG,LABOUT,TONLY,KSW64,KPWR,KFD,TLINX
      LOGICAL XYX,FORY, STUG,TONLY
  126 X1 = ARRAY(1)
  128 IF(XYX) GO TO 133
  130 DO 132 J = 2,N
  132 X1 = AMIN1(X1,ARRAY(J))
C
  133 IF(STUG) X1=F
  134 XN = 0.0
  136 DO 146 J = 1,N
  138 DIF = ABS(X1-ARRAY(J))
  140 IF(DIF.LE.XN)GO TO 146
  142 XN=DIF
  144 IHOLD=J
  146 CONTINUE
  147 XN = ARRAY(IHOLD)
C
  148 IF(KSW64.EQ.2) KPWR = KHAR(AMAX1(ABS(X1),ABS(XN)))
  149 IF(TONLY) GO TO 240
C
  150 TLIN=101.
  152 IF(.NOT.FORY) TLIN = TLINX
  154 C5 = (XN-X1)/TLIN
  156 C6 = ABS(C5)
  158 IF(C6.EQ.0.) GO TO 300
  159 K7 = KHAR(C6)
  160 C8 = 10.**K7
  162 C9 = C6/C8
  164 IF((2.5-C9).LE.0.0) GO TO 172
  166 D=2.
  168 IF((2.0-C9).LE.0.) D=2.5
  170 GO TO 176
  172 D=5.
  174 IF((5.-C9).LE.0.0) D=10.
  176 C11 = D*C8
  178 DX = SIGN(C11,C5)
  179 HUND = 100.*DX
C
  240 K7 = KHAR(ABS(DX))
  250 KFD = 0
  252 IF(K7) 260,270,254
  254 IF(K7.GE.5) LABOUT=2
  256 GO TO 270
  260 KFD = 6
  262 IF(K7.LT.(-7)) LABOUT = 2
  264 IF(K7.GT.(-6)) KFD = -K7
```

```
C
  270 IF(STUG) GO TO 230
  182 KC12 = INT(ABS(X1)/C11)
  184 JJ = 1
  186 IF(X1) 188,192,190
  188 JJ = 3
  190 IF(DX.LT.0.) JJ = JJ+1
  192 GO TO (193,194,195,196),JJ
  193 KC14 = KC12
      GO TO 198
  194 KC14 = KC12+1
      GO TO 198
  195 KC14 = -KC12-1
      GO TO 198
  196 KC14 = -KC12
  198 KC13 = MOD(KC12,10)
      KC15 = KC12-KC13
  199 KC18 = KC15
  200 GO TO (212,202,202,210),JJ
  202 KC18 = KC18+10
  204 IF(KC13.NE.9) GO TO 210
  206 KC18 = KC14
  208 GO TO 212
  210 IF(X1.LT.0.)KC18 = -KC18
  212 F=C11*FLOAT(KC18)
  214 IF(.NOT.FORY) GO TO 230
  220 TEMP = F+HUND
  222 GO TO (224,228,224,228),JJ
  224 IF(TEMP.GE.XN) GO TO 230
  226 GO TO 229
  228 IF(TEMP.LE.XN) GO TO 230
  229 F=C11*FLOAT(KC14)
  230 CONTINUE
      RETURN
  300 DX=0.
      LABOUT=3
      GO TO 230
      END



      FUNCTION KHAR(XMAX)
      KHAR = INT(ALOG(XMAX)/2.302585+40.0)-40
      RETURN
      END
```

C. Block Diagram



D. PISTUG Dictionary

C5	Value of the maximum possible scale-factor. It is found by dividing the range XN - X1 by TLIN.
C6	Absolute value of C5. It may not be zero. If it is, the error switch LABOUT is set to 3 and the plot is terminated. It is used to determine C9.
C8	Intermediate storage used in the calculation of C9 and DX.
C9	When the maximum possible scale-factor C5 is expressed as x.xxxx multiplied by 10^n, C9 is the absolute value of the x.xxxx factor. It is used to select D, the next larger value from the set of permissible values [2, 2.5, 5, 10].
C11	Intermediate storage used in the calculation of DX and of F.
D	Smallest member of the set [2, 2.5, 5, 10] that is larger than C9. It is used when PISTUG is calculating the scaling parameter DX.
DIF	Absolute value of the distance between X1 and the element furthest from X1.
DX	See COMMON/JOLO/ - Dictionary, page 53.
F	See COMMON/JOLO/ - Dictionary, page 53.
FORY	See COMMON/JOLO/ - Dictionary, page 53.
HUND	One hundred times the scaling parameter DX.
IHOLD	Index of the element in the array which is furthest from X1.
J	Index of the search loop in which DIF and IHOLD are found.
JJ	Switch used to control the calculation of the starting value, F, according to the algebraic signs of X1 and DX.
K7	Characteristic of the $\log_{10}$ of the absolute value of the scale-factor DX. It controls the value of KFD, the number of decimal places in the grid-label, as follows:

KFD = 0 if K7 is + or zero.

KFD = -K7 if K7 is negative and greater than -6.

KFD = +6 if K7 is negative and equal to or less than -6.

If K7 is greater than 4 or less than -7, the error switch LABOUT is set to 2 to cause an error message to be printed below the plot.

The symbol K7 was inadvertently also used for intermediate storage of the characteristic of $\log_{10}$ C5 during the calculation of C9.

KC12, KC13, KC14, KC15, KC18 — Intermediate storage used in the calculation of the "best possible" value of F.

KFD — See COMMON/JOLO/ - Dictionary, page 53.

KHAR — Function subprogram (see p. 46).

KPWR — See COMMON/JOLO/ - Dictionary, page 53.

KSW64 — See COMMON/JOLO/ - Dictionary, page 53.

LABOUT — See COMMON/JOLO/ - Dictionary, page 53.

N — See COMMON/JOLO/ - Dictionary, page 54.

STUG — See COMMON/JOLO/ - Dictionary, page 54.

TEMP — Temporary storage.

TLIN — When PISTUG is scaling a Y array, TLIN is set equal to 101. When an X array is being scaled, TLIN is supplied by the calling routine as TLINX. TLIN is used to compute C5.

TLINX — See COMMON/JOLO/ - Dictionary, page 55.

TONLY — See COMMON/JOLO/ - Dictionary, page 55.

X1 Minimum or maximum value of the array being scaled. It is set equal to the first element of the array when PISTUG is scaling an X array for PLOTXY, otherwise it contains the minimum value of the array after a search. If STUG is TRUE, X1 is set equal to the scaling-parameter F supplied by the calling routine. X1 is used to compute C5 and KPWR, and several times in the calculation of F.

XN Minimum or maximum value of the array being scaled. It is set equal to zero and replaced by the element furthest away from X1. It is used to compute C5 and in the calculation of KPWR.

XYX See COMMON/JOLO/ - Dictionary, page 55.

E. COMMON/JOLO/ - Dictionary

DX — Scaling parameter for the scale factor for either scale. It may be calculated by PISTUG or supplied indirectly by the user. For PLOTMY, DX for the x scale must be positive.

F — Scaling parameter for the starting-value for either scale. It may be calculated by PISTUG or supplied indirectly by the user.

FORY — Logical switch set to TRUE by PLOTXY or PLOTMY only if the call to PISTUG is for the y scale.

KFD — Number of decimal places required in the grid-label for the array being processed by PISTUG. It is used in PLOTXY and PLOTMY to modify the variable FORMATS (FLAB, FYLAB) used to write the grid-labels. This modification is made by subtracting KFD from a word in the FORMAT array containing blank, blank, F9.0 . Subtraction rather than addition is necessary because the representation of a blank character in the 7094 is 110000, which is negative.

KPWR — Characteristic of the $\log_{10}$ of the maximum of the absolute values of X1 and XN. (The minimum and maximum of the array being processed by PISTUG.) It is calculated by PISTUG only if option 64 is being used. It is used by PLOTXY and PLOTMY to prepare the coordinates being printed at the left of the plot so they will fit a F6.3 FORMAT specification. A special heading is written displaying the conversion factors.

KSW64 — Variable initialized to zero by PLOTXY and PLOTMY and set to 2 if option 64 is used. It is used in PISTUG to control calculation of KPWR and in PLOTXY and PLOTMY to control printing of coordinates at the left of the plot.

LABOUT — This is a computed-go-to index used to control branching to normal termination or to various error terminations.

1 — Normal ending of a plot; a blank PL record.

2 Error message BAD LABELS is written below the plot. This is an indication that one or more x or y grid-labels are either too large or too small to be printed correctly in the assigned label field (F9.d - where $0 \leq d \leq 6$). This is checked by PISTUG for F and by PLOTXY and PLOTMY for successive labels. The relative positions of the plotted points are always correct; the labels may or may not be.

3 The plot is terminated immediately if:

(a) The range of an array being scaled by PISTUG is found to be zero. The error output is

PLOTXY N.G. followed by X(1), Y(1), X(2), Y(2), K(1), P(1)

PLOTMY N.G. followed by X(1), Y(1), X(2), Y(2), K(1), K(2), K(3)

(b) The values in the X array are not in monotonic order when PLOTXY is used. The error output is X OUT OF ORDER followed by the message in (a).

4 The plot is terminated immediately if option 16 is used in PLOTXY or PLOTMY and a value of x is found outside the user-specified starting-value (Rewind Carriage Error). The error output is the same as in (b).

5 If the search in PLOTMY for the plotting character fails, the plot is terminated and the error message ERROR IN K ARRAY is written.

N Number of points in the array sent to PISTUG to be scaled. If the call is from PLOTXY, N has been supplied by the user in P(1). If the call is from PLOTMY:

Variation I - N is the number of points in the X array (supplied by the user in K(3)).

Variation II - N is the number of points in the X array. It is calculated by multiplying the number of points in the Y array (supplied by the user in K(3)) by the number of curves, KN (supplied by the user in K(2)).

Variation III - N is the total number of points to be plotted and is calculated by adding the number of points for each curve (supplied by the user in K(3), K(5), K(7), etc).

STUG Logical switch set to TRUE by PLOTXY or PLOTMY when PISTUG is not required to calculate F.

TLINX If PISTUG is scaling an X array, the calling routine must supply the number of lines into which the plot must be fitted. The empirically chosen function of N, TLINX = $55\left(\frac{N}{35}+1\right)$, fits most plots of less than 35 points onto one page.

TONLY Logical switch set to TRUE by PLOTXY or PLOTMY if PISTUG is not required to calculate F or D.

XYX Logical switch set to TRUE only if the call to PISTUG is for the x scale from PLOTXY.

IV. SORTXY

A. Description

CALL SORTXY (V, W, NPTS)

This subroutine rearranges the NPTS elements of the V array in order of increasing size. The elements of the W array are moved to maintain the original pair-relation; that is, if the fifth element of the V array is moved to the first position of V, the fifth element of W is moved to the first position of W.

B. Program Listing

```
      SUBROUTINE SORTXY(X,Y,NPTS)
      DIMENSION X(1),Y(1)
100   N=NPTS
102   NN=N-1
104   DO 140 KT=1,NN
      XMIN=X(KT)
      JAD=KT
      JKL=KT+1
112   DO 120 JK=JKL,N
114   IF (XMIN-X(JK)) 120,120,116
116   XMIN=X(JK)
118   JAD=JK
120   CONTINUE
122   YMIN=Y(JAD)
      X(JAD)=X(KT)
      Y(JAD)=Y(KT)
      X(KT)=XMIN
      Y(KT)=YMIN
140   CONTINUE
      RETURN
      END
```

V. SCALE

A. Description

CALL SCALE (NPTS, A, KRSTR)

This subroutine finds the largest absolute value of the NPTS elements of A, and computes the characteristic of its $\log_{10}$. If the characteristic K is $-2 \leq K \leq 4$, KRSTR is set to zero and control returns to the calling program. If $K > 4$ or < -2, each element of A is multiplied by a power (KRSTR) of 10 to transform the array to suit PLOTXY and PLOTMY.

KRSTR is returned to enable the user to ReSToRe the array or record how it has been altered.

B. Program Listing

```
      SUBROUTINE SCALE(NPTS,X,KRSTR)
      DIMENSION X(1)
  100 N=NPTS
  102 XMAX=X(1)
  104 DO 106 J=1,N
  106 XMAX=AMAX1(ABS(XMAX),ABS(X(J)))
  108 KHAR = INT(ALOG(XMAX)/2.302585+40.)-40
  116 IF((4-KHAR)*(KHAR+2))120,118,118
  118 KPWR=0
  119 GO TO 130
  120 KPWR=3-KHAR
  122 FACT=10.**KPWR
  126 DO 128 J=1,N
  128 X(J)=X(J)*FACT
  130 KRSTR=KPWR
  140 RETURN
      END
```

VI. INPUT-OUTPUT CONSIDERATIONS

A. Discussion

The printer plotting system used at Lewis operates under a supervisory system which controls all input-output. All BCD records (limited to 132 characters) written with a WRITE (6,###) statement are transferred from the 7094 core to the 7044 core to the disk and later from the disk to the 7044 core to one of two 1403 printers.

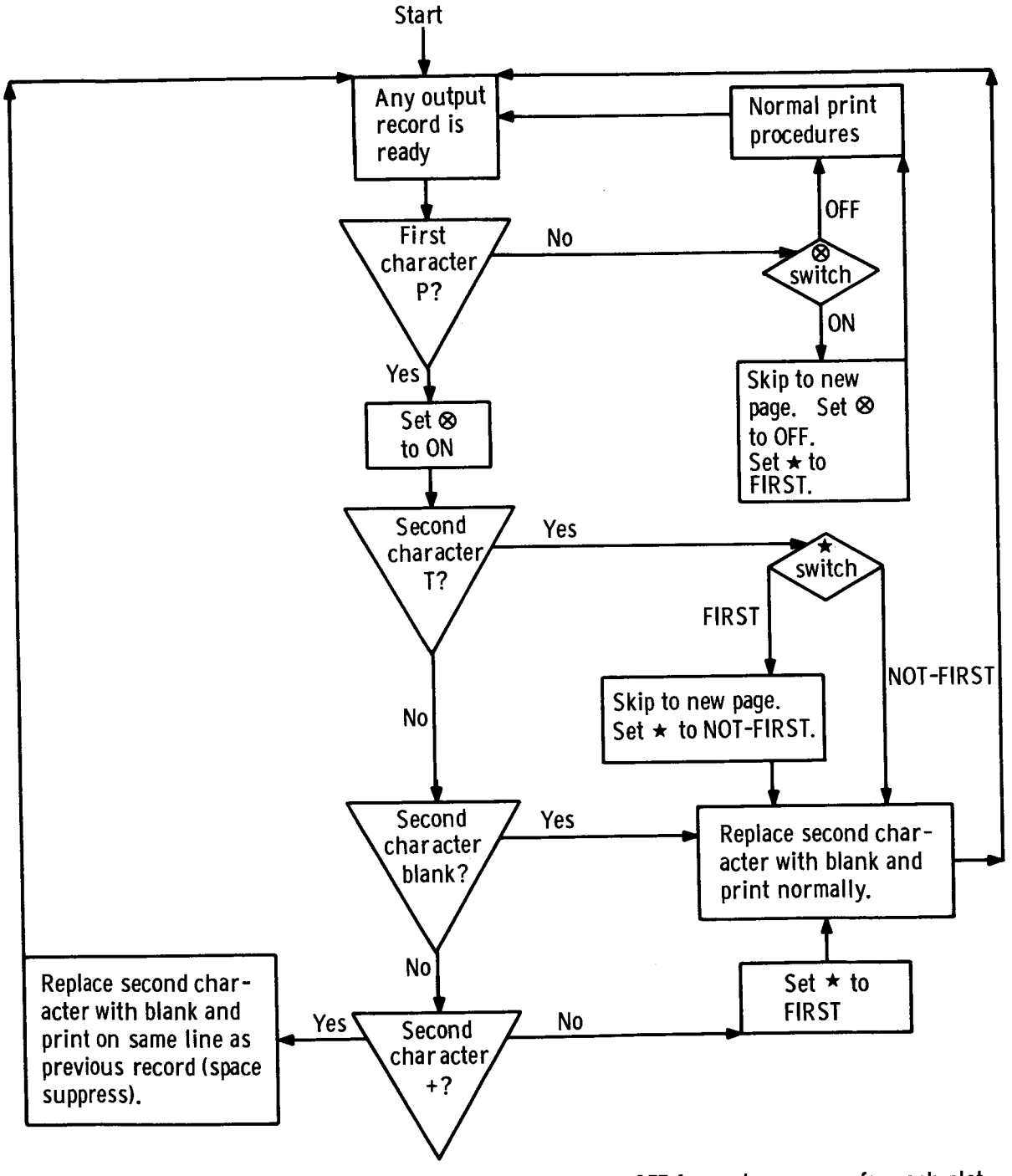
The 7044 program which controls printing must handle records written by the plotting routines somewhat differently than ordinary output records. For this reason the first character of every record written by PLOTXY and PLOTMY is a P. The P is recognized by the supervisory program and automatic page-spacing and normal first-record-character printing controls are disabled. Further processing is based on the second character in each such P record. The flow chart (p. 60) displays the necessary logic.

For your convenience in making input-output changes the WRITE and FORMAT statement numbers for PLOTXY and PLOTMY are listed below.

WRITE	FORMAT	
100	500	Writes an otherwise blank PT record. May be the only one and will cause a skip to new page, or it will be the last one and will cause a blank line.
260	502	Writes a special heading to the left of the plot if option 64 is used.
302	FYLAB	This FORMAT statement is used to write the lines of y grid-labels and is of the general form (2HP , 20X, 11F10.d). It is an array to permit setting of the value of "d" (in the F specification) to suit the range of the Y array. See KFD, page 53.
600	504	Writes each line of plot after grid-line characters and plotting characters have been positioned.

WRITE	FORMAT	
624	FLS	This FORMAT statement is used to print at the left of the plot. It is constructed during execution and becomes one of three different statements:
		If option 8 (2HP+, 12X, A6).
	PLOTXY	If option 64 (2HP+, 6X, 2F6.3). If options 8 and 64 (2HP+, A6, 2F6.3).
	PLOTMY	If option 64 (2HP+, 12X, F6.3). If options 8 and 64 (2HP+, A12, F6.3).
613	FLAB	This FORMAT statement is used to write each x grid-label and is of the general form (2HP+, 18X, F9.d). It is an array to permit setting the value of "d" (in the F specification) to suit the range of the x array. See KFD, page 53.
702	506	These are error messages.
704	520	
706	508	
710	510	This FORMAT statement is used to write an otherwise blank PL record. It may be the only such record and one is necessary to reset switches in the printing routine. If there are more than one, this will be the first and it will cause a blank line below the lower line of y grid-labels.
PLOTMY ONLY		
712	512	This is an error message if the search for the associated plotting character fails. See page 14.

B. Logical Flow Chart.



Switch ⊗ must be loaded set to OFF, but need not be reset to OFF for each user nor for each plot.
Switch ★ must be loaded set to FIRST, but need not be reset to FIRST for each user nor for each plot.

SAMPLE PLOTS

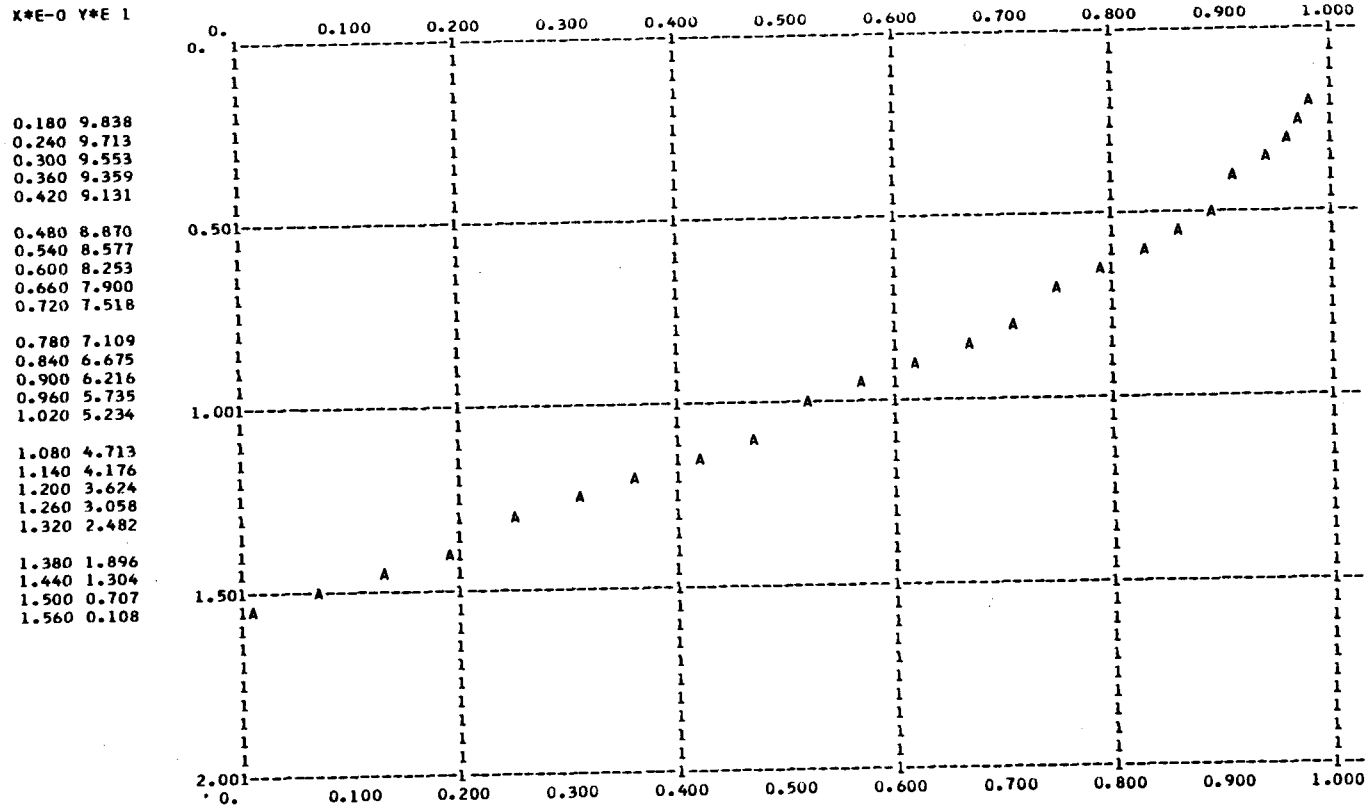


Figure 1. - The data used for the example plot on page 5 (using PLOTXY and KODE = 0) are here plotted with: (1) The order of the first two arguments in the call reversed. Notice that values down the vertical axis are now increasing. This is governed by the order of the elements in the array that is the first argument. (2) KODE = 69 = (64 + 4 + 1), the desired plotting character in P(1), and P(3) = 20. The vertical gridline frequency is changed, the coordinates are printed to the left of the plot, and the plotting character is the programmer's choice.

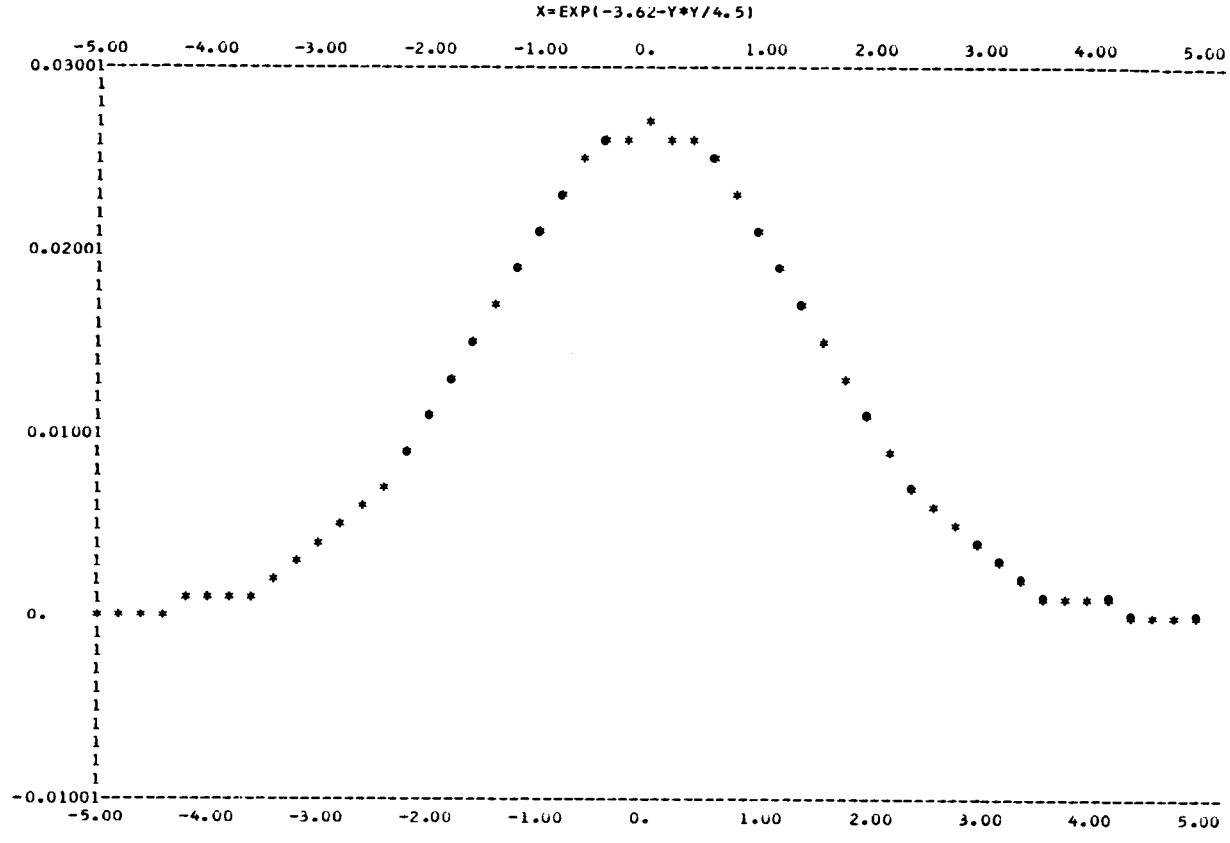


Figure 2. - This plot, using PLOTXY, uses KODE = 6 = (2 + 4) and P(2) = P(3) = 0, which removes all but three gridlines.

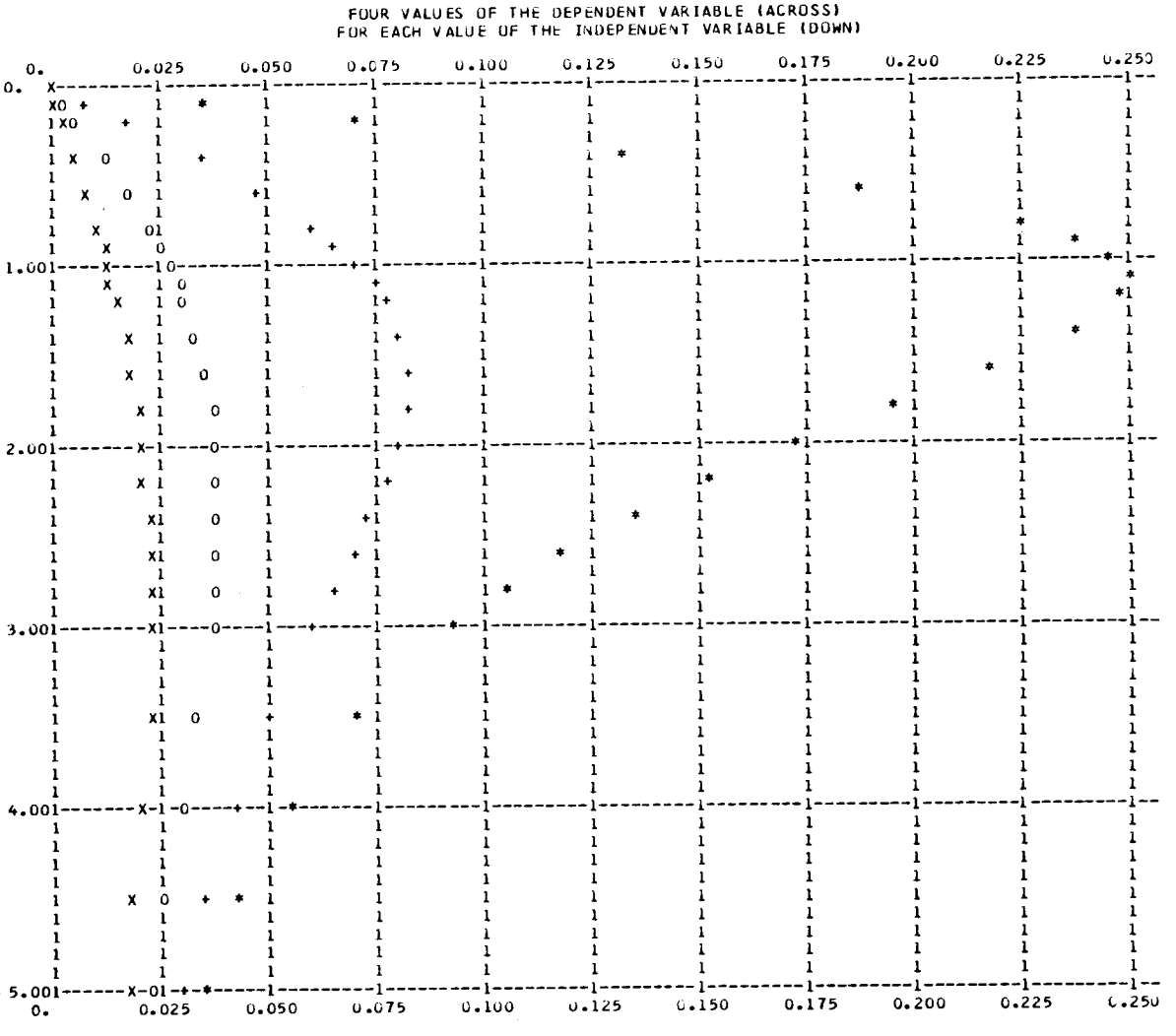


Figure 3. - This plot displays the use of PLOTMY - Variation I, KODE = 0.

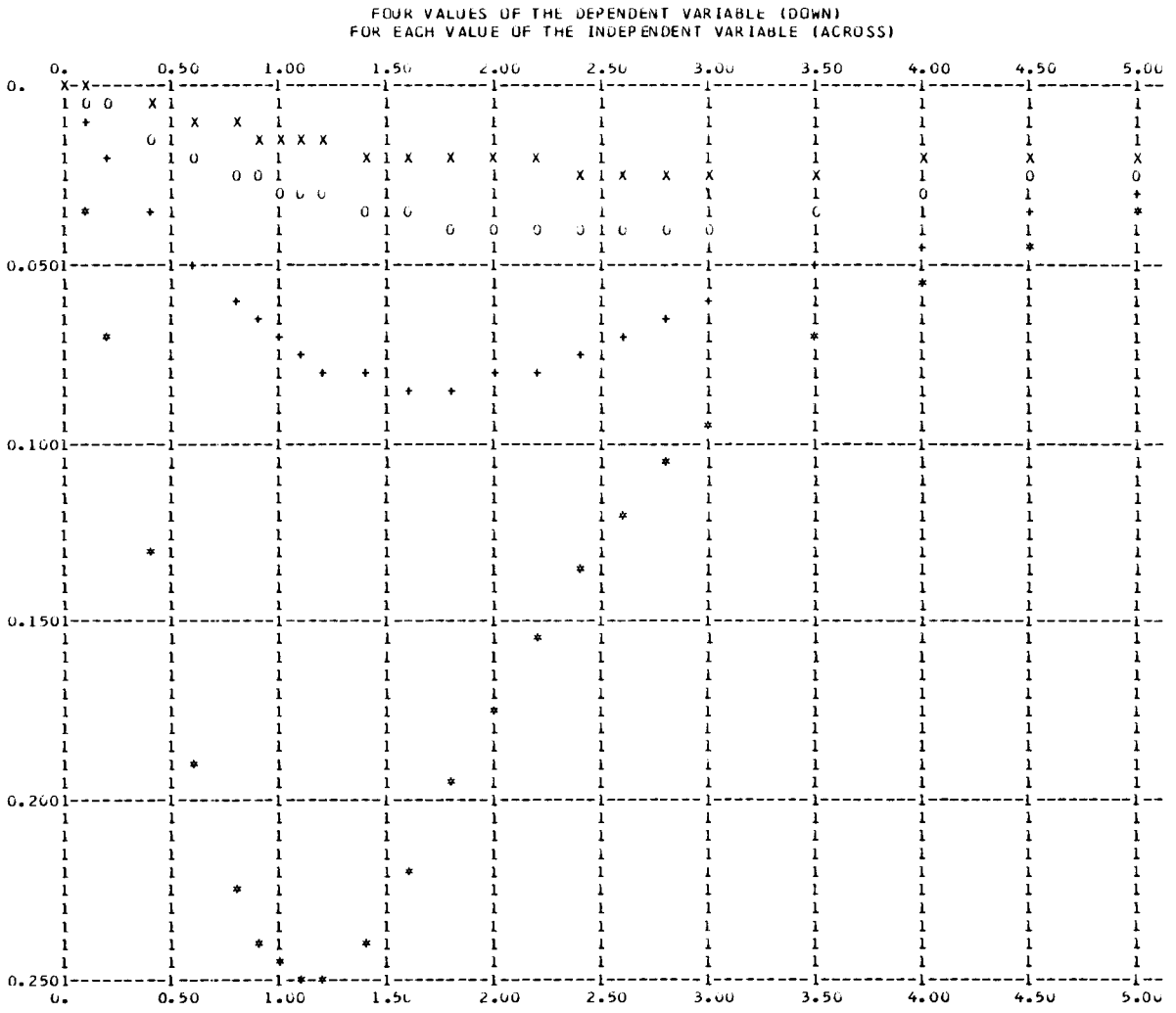


Figure 4. - This plot displays the use of PLOTMY - Variation II, KODE = 0. The same data are plotted here as in figure 3; only the Variation number and the order of the first two arguments have been changed.

REFERENCES

1. Dellner, Lois T.; and Moore, Betty Jo: An Optimized Printer Plotting System Consisting of Complementary 7090 (FORTRAN) and 1401 (SPS) Subroutines. Part I - Instructions for Users. NASA TN D-2174, 1964.

2. Dellner, Lois T.; and Moore, Betty Jo: An Optimized Printer Plotting System Consisting of Complementary 7090 (FORTRAN) and 1401 (SPS) Subroutines. Part II - Systems Programmers Manual. NASA TN D-2175, 1964.

3. Anon.: The JOLO Plotting System. SDA 3034, SHARE Program Catalog, Jan. 1964.

NASA-Langley, 1967 —— 8 E-3816