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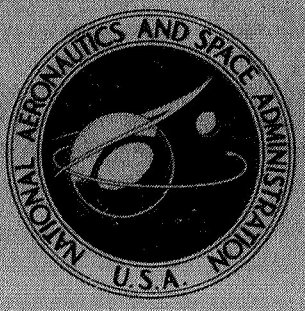

NASA TM X-1700

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A SET OF 360 FORTRAN (LEVEL G OR H) SUBROUTINES FOR GENERATING PRINTED PLOTS

by Lois T. Dellner

Lewis Research Center

Cleveland, Ohio

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • DECEMBER 1968

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ABSTRACT

A set of subroutines, written in 360 FORTRAN IV (level G or H), 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 characters) suitable for on- or off-line printing.

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SUMMARY

A set of subroutines, written in 360 FORTRAN IV (level G or H), 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 characters) suitable for on- or off-line printing.

INTRODUCTION

Various versions (refs. 1 to 4) of this plotting system have been in use at Lewis Research Center since April 1962. One current version is a set of 360 FORTRAN subroutines which generates ordinary FORTRAN output records (up to 132 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 USERS MANUAL.

The routines are presently in use at Lewis on an IBM 360-67 with no supervisory routine controlling printing. The programs 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 any 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 SKALE for each array before calling the plotting subroutine. SKALE 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 SKALE 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 ≤ 119). 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 SKALE (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 should be preceded by a WRITE statement causing a skip to a new page. This may be combined with a title to be printed above the plot. A representative example is:

```
      WRITE (6, 500)
  500 FORMAT (2H1 , 71X, 14HSAMPLE EXAMPLE/2H    , 69X,
     17H JOLO SYSTEM PLOT)
```

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

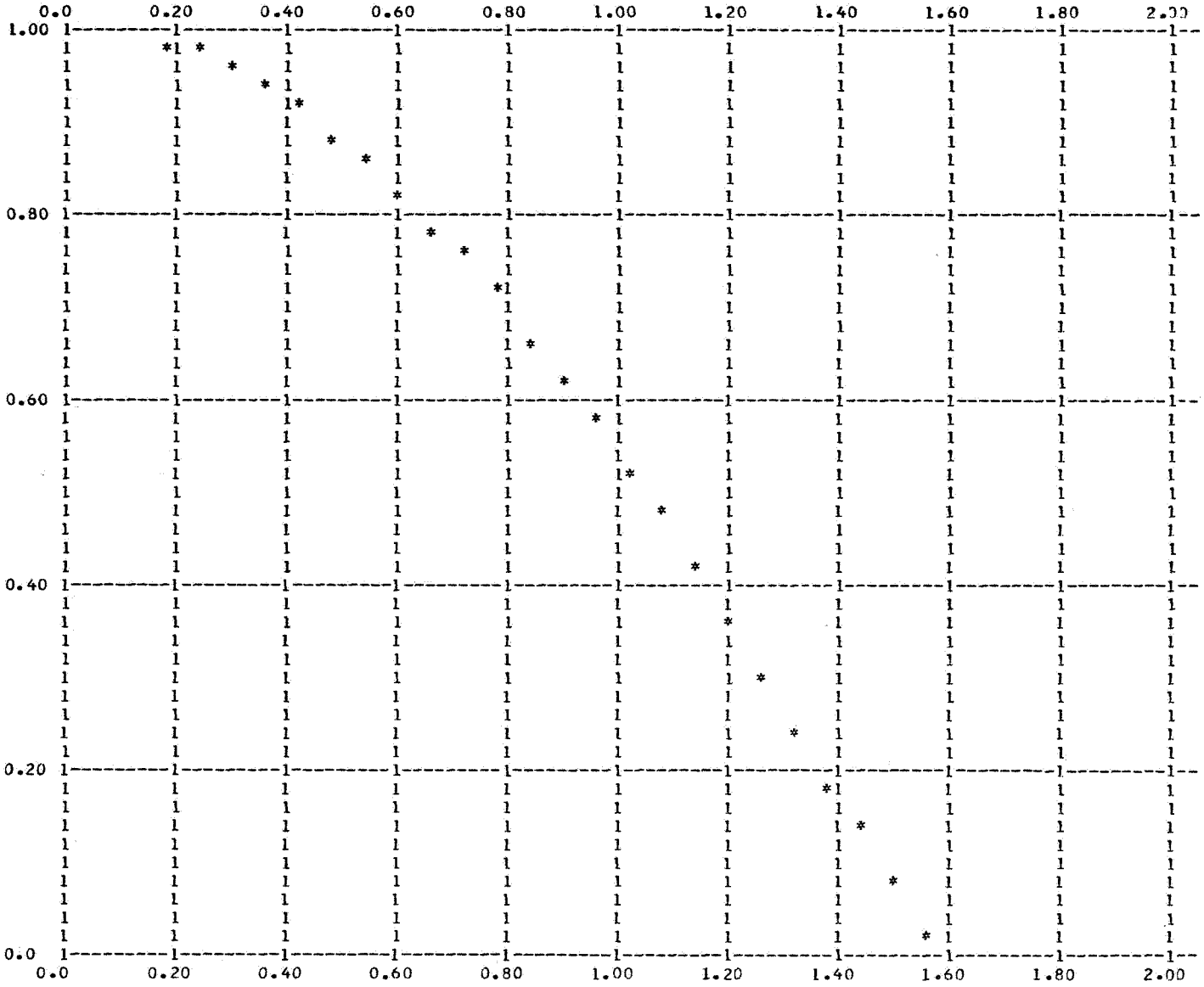
C. Legend

The call for PLOTXY should be followed by a WRITE statement causing a skip to a new page. This may be combined with a legend to be printed below the plot. An example is:

```
      WRITE (6, 502)
  502 FORMAT (72X, 16HF SUB2 VS. THETA/72X,
     16H(---)       (RAD)/1H1)
```

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

SAMPLE EXAMPLE
JOLO SYSTEM PLOT



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 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. 2.)

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 page skip should occur before calling PLOTMY, exactly as for PLOTXY (p. 4).

C. Legend

A page skip should follow the CALL to 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.

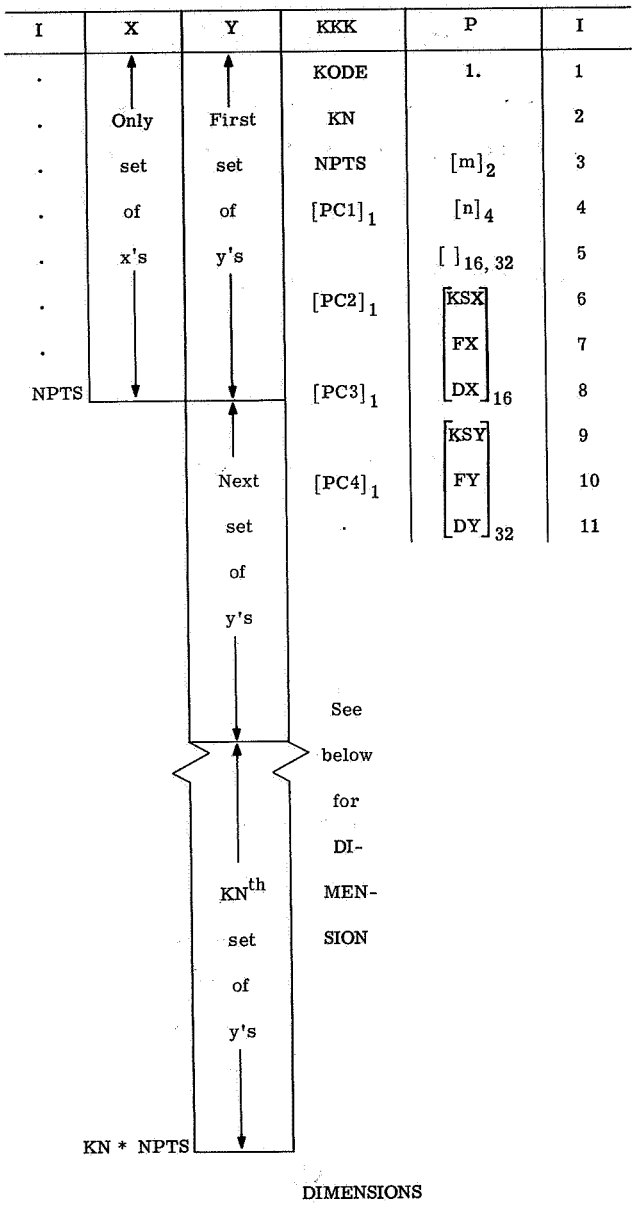
(3) Unless option 1 is chosen, the plotting characters *, +, 0, X, =, □ will be used for the first six curves. To use others, use option 1 and supply the desired plotting character for the first curve in KKK(4), for the second curve in KKK(6), ... If more than six curves are to be plotted, option 1 must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

(P(<11), depending on use of options 2, 4, 16, and 32.

DUPY

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

I	X	Y	KKK	P	I
.	↑	↑	KODE	3.	1
	First	Only	KN		2
	set	set	NPTS	$[m]_2$	3
	of	of	$[PC1]_1$	$[n]_4$	4
	x's	y's		$[\ ]_{16,\ 32}$	5
	↓	↓	$[PC2]_1$	$\left[\begin{matrix}KSX\\FX\\DX\end{matrix}\right]_{16}$	6, 7
NPTS			$[PC3]_1$		8
	↑			$\left[\begin{matrix}KSY\\FY\\DY\end{matrix}\right]_{32}$	9, 10, 11
	Next	Only	$[PC4]_1$		
	set	1 set			
	of	of			
	x's	y's			
	↓	sup-			
		plied			
2 * NPTS			See		
	↑	but	below		
		DI-	for		
		MEN-	DI-		
	KN^{th}	SION	MEN-		
	set	must	SION		
	of	be			
	x's	the			
	↓	same			
		as X.			
KN * NPTS			KN * NPTS		

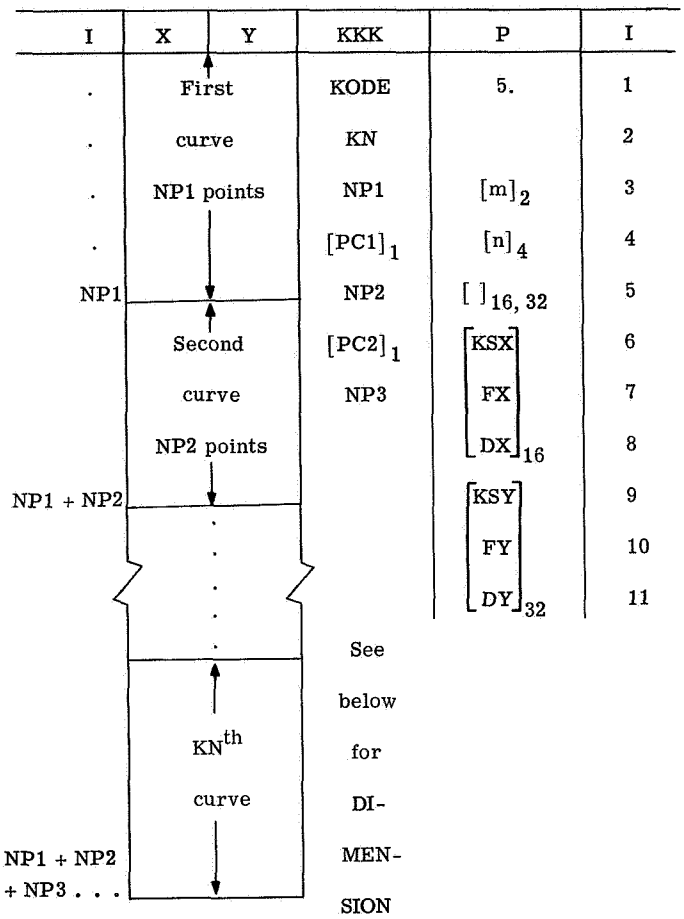
DIMENSIONS

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

P($\leq$11), depending on use of options 2, 4, 16, and 32.

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

P($\leq$11), depending on use of options 2, 4, 16, and 32.

III. SKALE

CALL SKALE (NPTS, A, KRSTR)

This subroutine finds the largest absolute value of the NPTS elements of A and computes the characteristic of its logarithm to the base 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 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 subroutines (PLOTXY, PLOTMY, PISTUG, SORTXY, SKALE, and for level G only, a function subprogram AND) which are executed in a machine with no supervisory printing control. A brief description and a complete listing are included for all routines. For PLOTXY, PLOTMY, and PISTUG, dictionaries of the FORTRAN variable names and comprehensive block diagrams 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 these sections, 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 provisions made for changes that may be required if the plotting system is used with supervisory printing control.

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 2H) to initiate the plot, and calls the

auxiliary subroutine PISTUG (p. 45) to compute scaling parameters for either or both scales and to check label sizes. Communication with PISTUG is through

```
COMMON/JOLO/F, DX, TLINX, N, LABOUT, KPWR, KFD

COMMON/JOLO/XYX, FORY, STUG, TONLY, KSW64
```

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. 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 2H)).

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

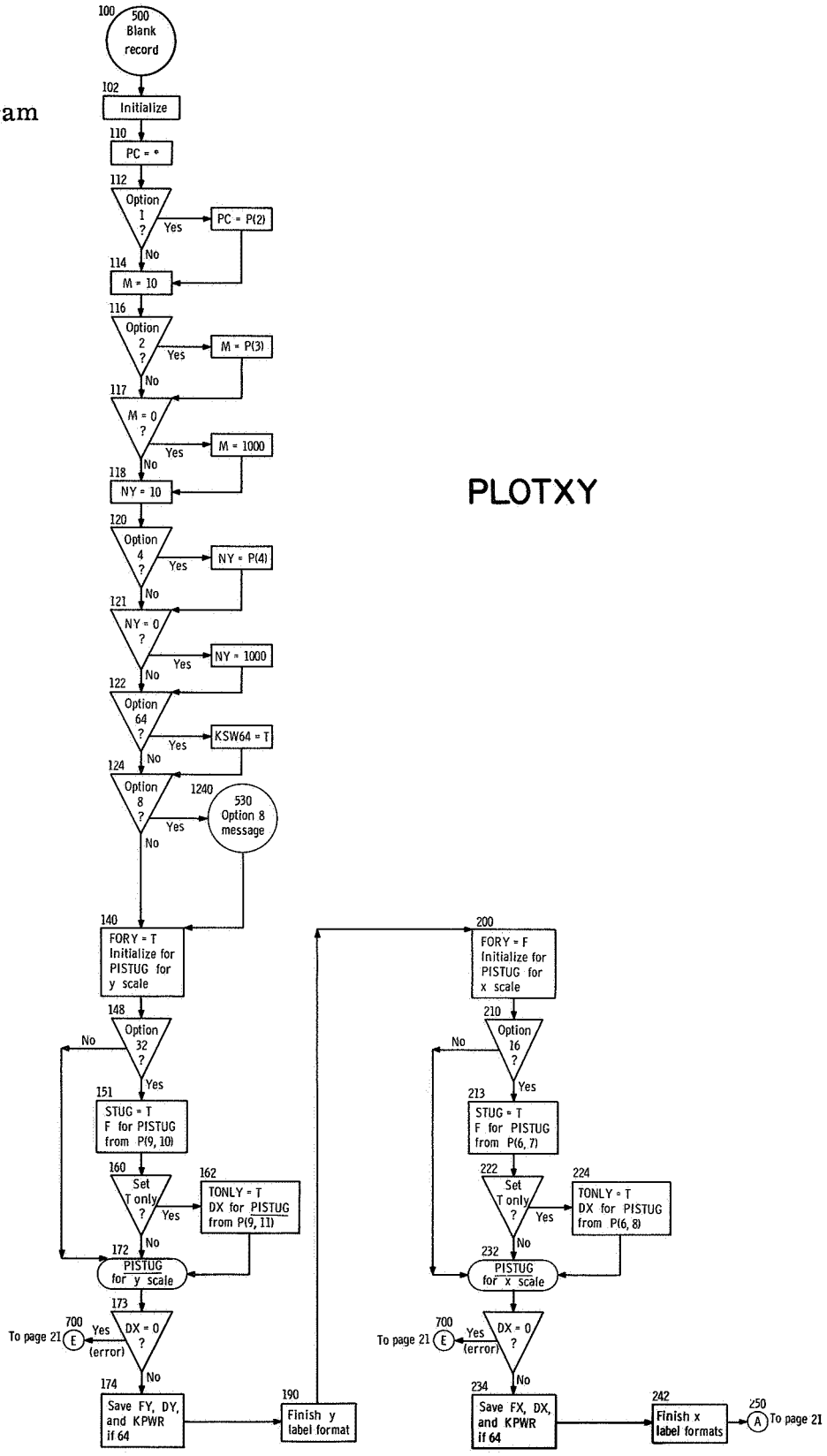
```
      SUBROUTINE PLOTXY(X,Y,K,P)
C       FIV-DCS TO 360(G OR H)
       LOGICAL XYX,FORY, STUG,TONLY,XGL,LS,KSW64
       DIMENSION FYLAB(6), YLABEL(11), A(104), FXLABS(6), FXLABM(7)
       DIMENSION X(1),Y(1),P(1)
       COMMON/JOLO/F,DX,TLINX,N,LABOUT,  KPWR,KFD
       COMMON/JOLO/XYX, FORY, STUG, TONLY, KSW64
       EQUIVALENCE (FYLAB(5), IYLAB), (FXLAB,IFXLAB)
      DATA MASK1, MASK2,MASK4,MASK8,MASK16,MASK32,MASK64   /
     1  1,2,4,8,16,32,64  /
       DATA FYLAB(1),FYLAB(2),FYLAB(3),FYLAB(4),FYLAB5,FYLAB(6)  /
     1       4H(2H ,  4H ,20,  4HX,  ,  4H11F ,  4H10.0,  4H  )  /
      DATA BLANK,XGRID,YGRID /1H ,1H-,1H1 /
       DATA PCSTD/1H*/
       DATA RMARK/1H=   /
       DATA FXLABS(1),FXLABS(2),FXLABS(3),FXLABI   ,FXLABS(5),FXLABS(6)/
     1     4H(2H ,  4H ,18,  4HX,  ,  4HF9.0,  4H,104,  4HA1)    /
       DATA FXLABM(1),FXLABM(2),FXLABM(3),FXLABM(4),FXLABM(6),FXLABM(7)/
     1       4H(2H ,   4H ,4X,   4H,2F7,   4H.3, ,   4H,104,   4HA1)    /
C
  100 WRITE (6,500)
  102 KODE=K
      N=P(1)
       LABOUT=1
       FXLAB = FXLABI
       LS = .FALSE.
      FYLAB(5)=FYLAB5
       KSW64 = .FALSE.
  110 PC=PCSTD
  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=.TRUE.
  124 IF((AND(KODE,MASK8)).GT.0.) GO TO 1240
  126 GO TO 140
C
 1240 WRITE (6,530)
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) 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) KPWRX = KPWR
  242  IFXLAB = IFXLAB +KFD
       FXLABS(4) = FXLAB
       FXLABM(5) = FXLAB
C
  250 IF(.NOT.KSW64) GO TO 264
  252 KOUTX=-KPWRX
  254 KOUTY=-KPWRY
  256 F10X=10.**KPWRX
  258 F10Y=10.**KPWRY
  260 WRITE (6,502) KOUTX,KOUTY
C
```

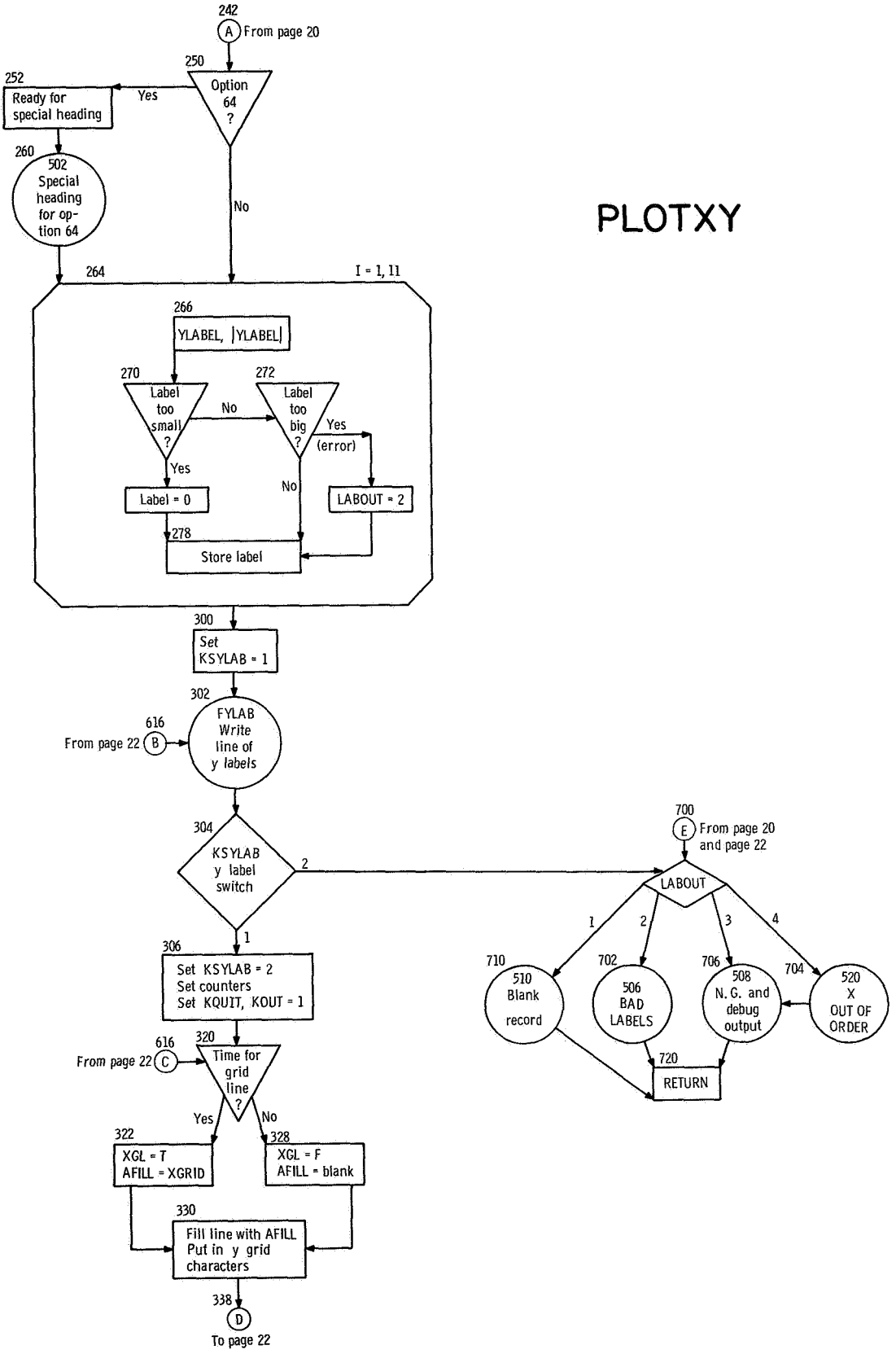
```
  264 DO 278 I=1,11
  266 TEMP = FY+FLOAT(I-1)*DY*10.
  268 ATEMP= ABS(TEMP)
  270 IF (ATEMP.LT.1.E-7) TEMP = 0.
  272 IF (ATEMP.GE.1.E+7)LABOUT=2
  278 YLABEL(I)=TEMP
  300 KSYLAB =1
  302 WRITE (6,FYLAB) (YLABEL(I),I=1,11)
  304 GO TO (306,700),KSYLAB
C
  306 KSYLAB =2
  310 LCTR=0
      NCTR=1
      KOUT=1
      KOUIT= 1
C
  320 IF(MOD(LCTR,M))328,322,328
  322 XGL =.TRUE.
      AFILL= XGRID
      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
  380 IF(.NOT.KSW64) GO TO 386
  382 XOUT = X(NCTR)/F10X
       YOUT = Y(NCTR)/F10Y
C
  386 IF(NCTR.GE.N)GO TO 392
  388 NCTR=NCTR+1
  390 GO TO 340
C
  392 KOUT = 2
C
```

```
  400 IF(MOD(LCTR,10) .GT.5) M = 10
  401 IF(XGL.AND.(MOD(LCTR,10).EQ.0))KQUIT=2
C
  600 JX = 1
  602  IF(MOD(LCTR,10).NE.0) GO TO 613
  604  JX = JX+2
  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 IF(.NOT.KSW64) GO TO 6240
C
  620 IF(.NOT.LS) GO TO 6240
  621 JX = JX+1
  622 LS = .FALSE.
C
 6240 GO TO(6250,6260,6270,6280),JX
 6250 WRITE (6,504)(A(I),I=1,104)
       GO TO 614
C
C
 6260 WRITE(6,505) XOUT,YOUT,(A(I),I = 1,104)
       GO TO 614
C
 6270 WRITE(6,FXLABS) XLABEL,(A(I),I = 1,104)
       GO TO 614
C
 6280 WRITE(6,FXLABM) XOUT,YOUT,XLABEL,(A(I),I = 1,104)
C
  614 LCTR = LCTR+1
  616 GO TO (320,302),KQUIT
C
  630 LABOUT= 4
  700 GO TO (710,702,706,704),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,P(1)
  708 GO TO 720
  710 WRITE(6,510)
  720 RETURN
  500 FORMAT(2H  )
  502 FORMAT(2H  ,6X, 3HX*E,I2,1X, 4H Y*E,I2)
  504 FORMAT(2H  ,27X,104A1)
  505 FORMAT(2H  , 5X, F6.3, 1X, F6.3, 9X,104A1)
  506 FORMAT(2H  ,3X,10HBAD LABELS  )
  508 FORMAT(2H  ,5H N.G.,4G20.8,I6,F8.2)
  510 FORMAT(2H  )
  520 FORMAT(2H  ,18HX OUT OF ORDER. I=,I5)
  530 FORMAT (2H  , T100,'OPTION 8 NO LONGER AVAILABLE')
      END
```

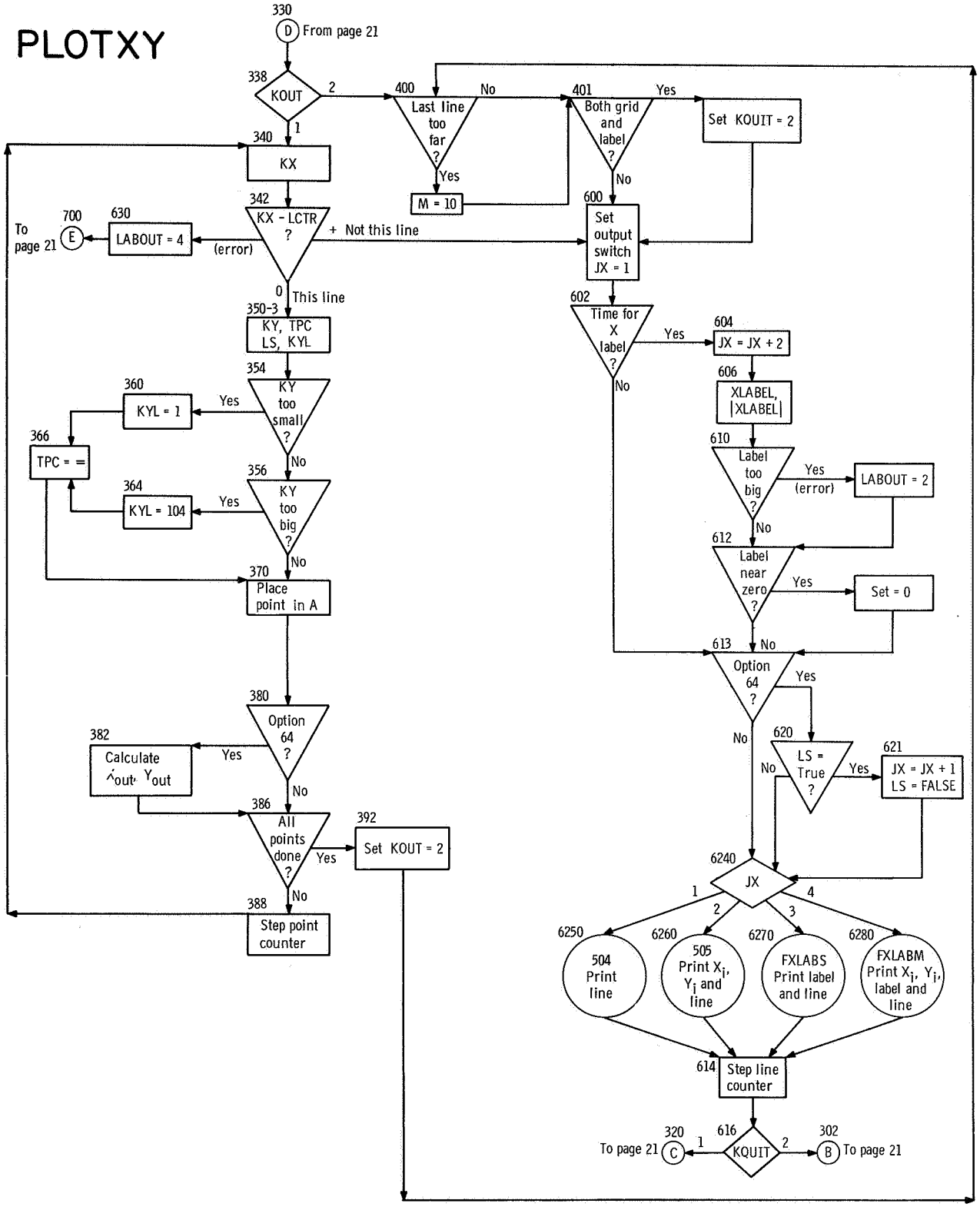
C. Block Diagram



PLOTXY


242
A
From page 20
250
Option 64 ?
Yes
252
Ready for special heading
No
260
502
Special heading for option 64
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
320
Time for grid line ?
616
From page 22
C
Yes
No
322
XGL = T
AFILL = XGRID
328
XGL = F
AFILL = blank
330
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 record
702
506
BAD LABELS
706
508
N. G. and debug output
704
520
X
OUT OF ORDER
720
RETURN

PLOTXY


330
D
From page 21
338
KOUT
2
1
400
Last line too far ?
No
Yes
M = 10
401
Both grid and label ?
Yes
No
Set KOUIT = 2
340
KX
342
KX - LCTR ?
(error)
630
LABOUT = 4
700
E
To page 21
+ Not this line
0
This line
600
Set output switch JX = 1
602
Time for X label ?
Yes
No
604
JX = JX + 2
606
XLABEL, |XLABEL|
610
Label too big ?
Yes
(error)
LABOUT = 2
No
612
Label near zero ?
Yes
Set = 0
No
613
Option 64 ?
Yes
No
620
LS = True ?
No
Yes
621
JX = JX + 1
LS = FALSE
6240
JX
1
2
3
4
6250
504 Print line
6260
505 Print X_i, Y_i and line
6270
FXLABS Print label and line
6280
FXLABM Print X_i, Y_i, label and line
614
Step line counter
616
KQUIT
320
To page 21
C
1
2
302
B
To page 21
350-3
KY, TPC LS, KYL
354
KY too small ?
Yes
No
360
KYL = 1
366
TPC = =
356
KY too big ?
Yes
No
364
KYL = 104
370
Place point in A
380
Option 64 ?
Yes
No
382
Calculate X_{out}, Y_{out}
386
All points done ?
Yes
No
392
Set KOUT = 2
388
Step point counter

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 (or -) with which the A array is initialized.

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

BLANK — Internal 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 is used to calculate KX and XLABEL. Also see DX, page 52.

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 $DY = P(11) \cdot 10^{P(9)-6}$. It is used to calculate KY and the values of YLABEL. Also see DX, page 52.

F — See COMMON/JOLO/ - Dictionary, page 52.

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

FORY — See COMMON/JOLO/ - Dictionary, page 52.

FX — Starting value for the vertical scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 51) of the X array, or it is calculated from values supplied by the user of option 16 in P(6) and P(7) as $FX = P(7) \cdot 10^{P(6)-6}$. It is used to calculate KX and XLABEL.

FXLAB A word initialized to F9.0 and altered to F9.d by using KFD (see p. 52). FXLAB is then moved into the FORMAT arrays (FXLABS and FXLABM) used for lines that have an x-label. It is equivalenced to IFXLAB.

FXLABI Initial value for FXLAB.

FXLABM Variable FORMAT array used to print a line when JX = 4 (see p. 25). It is of the form

(2H , 4X, 2F7.3, F9.d, 104A1)

where $0 \leq d \leq 6$. The value of d is inserted by the program (using FXLAB) after the call to PISTUG to process the X array. See KFD (p. 52).

FXLABS Variable FORMAT array used to print a line when JX = 3 (see p. 25). It is of the form

(2H , 18X, F9.d, 104A1)

where $0 \leq d \leq 6$. A value of d is inserted by the program (using FXLAB) after the call to PISTUG to process the X array. See KFD (p. 52).

FY Starting value for the horizontal scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 51) of the Y array, or it is calculated from values supplied by the user of option 32 in P(9) and P(10) as $FY = P(10) \cdot 10^{P(9)-6}$. It is used to calculate KY and the values of YLABEL.

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

(2H , 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 (p. 52).

FYLAB5 Initial value for FYLAB(5).

I Index of loop forming y grid-labels and of loop initializing print line in A array.

IFXLAB Equivalent to FXLAB.

IYLAB — Equivalent to FYLAB(5).

JX — Initialized to 1, increased by 1 if option 64 is being used and a point has been placed in the line, increased by 2 if the line to be printed has an x-label, this switch value may be 1, 2, 3, or 4. It is used to control the selection of the correct WRITE statement for each line.

K — Third argument in the call list of this subroutine. It contains KODE.

KFD — See COMMON/JOLO/ - Dictionary, page 52.

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. Option 8 has been discontinued but a message is printed if MASK8 causes a branch.

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 52.

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.

KSW64 — See COMMON/JOLO/ - Dictionary, page 52.

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 $[(x_i - FX)/DX]$ 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 character in "printing position" zero is 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 52.

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 64 is in effect, LS is used to control a branch (to modify JX) 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 53.

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 a 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 — Out-of-range character (=).

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

TEMP — Temporary storage.

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

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

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.

XOUT — Value of X_i modified by F10X for option 64 printout.

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

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.
YOUT	Value of Y_i modified by F10Y for option 64 printout.

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                      DC4 TO 360
       LOGICAL XYX,FORY, STUG,TONLY,XGL,LS,KSW64
       DIMENSION FYLAB(6),YLABEL(11), A(104), XLAB(7), XLAB64(7)
       DIMENSION KPCSTD(6)
      DIMENSION X(1),Y(1),P(1),K(1)
       COMMON/JOLO/F,DX,TLINX,N,LABOUT,  KPWR,KFD
       COMMON/JOLO/XYX, FORY, STUG, TONLY, KSW64
      EQUIVALENCE (XLAB5,IXLAB5)
       EQUIVALENCE (FYLAB(5),IYLAB)
       EQUIVALENCE (KPC,TPC)
      DATA BLANK,XGRID,YGRID /1H ,1H-,1H1 /
       DATA RMARK/1H=  /
       DATA KPCSTD /1H*,1H+,1H0,1HX,1H=,1H0  /
      DATA XLAB5I/4HF9.0/
      DATA XLAB(1),XLAB(2),XLAB(3),XLAB(4),XLAB(6),XLAB(7)/4H(2H ,4H  ,
     1 ,4H18X, ,4H    ,4H,104,4HA1) /
      DATA XLAB64(1),XLAB64(2),XLAB64(3),XLAB64(4),XLAB64(6),XLAB64(7)/
     14H(2H ,4H ,12, 4HX, F, 4H6.3, ,4H,104,4HA1) /
      DATA MASK1, MASK2,MASK4,MASK8,MASK16,MASK32,MASK64   /
     1  1,2,4,8,16,32,64  /
       DATA FYLAB(1),FYLAB(2),FYLAB(3),FYLAB(4),FYLAB5,FYLAB(6)  /
     1      4H(2H ,  4H ,20,  4HX,  ,  4H11F ,  4H10.0,  4H  )  /
C
  100 WRITE (6,500)
  102 KODE=K(1)
       KN=K(2)
       NPTS=K(3)
       LABOUT=1
       LS = .FALSE.
      FYLAB(5)=FYLAB5
      KSW64 = .FALSE.
       XLAB5=XLAB5I
       KTL=1
       KSWI=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 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=.TRUE.
  124 IF((AND(KODE,MASK8)).GT.0.)   GO TO 1240
  125 GO TO 140
C
 1240 WRITE (6,530)
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
```

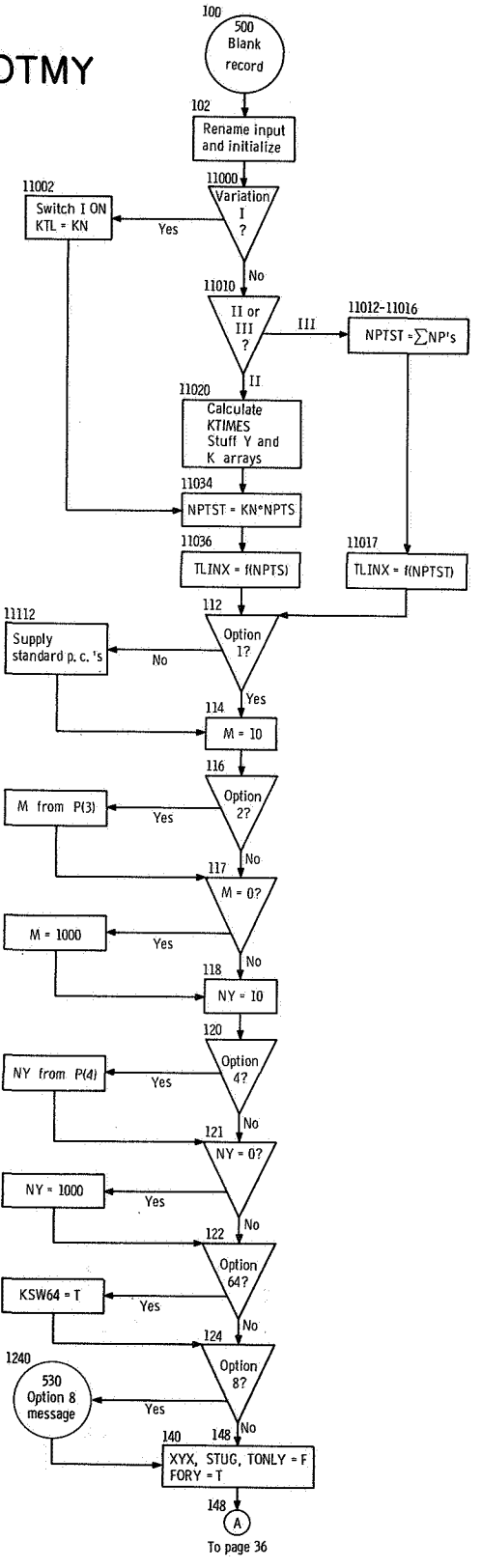
```
  210 IF((AND(KODE,MASK16).LE.0.)) GO TO 232
  213 STUG=.TRUE.
  214 KSX = P(6)
  216 PWR10X=10.**(KSX-6)
  218 FX= P(7)*PWR10X
  220 F=FX
C
  222 IF(MOD(IFIX(P(5)),2).EQ.1) GO TO 232
  224 TONLY=.TRUE.
  226 DX =P(8)*PWR10X
  232 IF(KSWI.EQ.2)N=NPTS
11233 ILIM=N
  233 CALL PISTUG(X)
      IF(DX.EQ.0.) GO TO 700
  234 FX=F
       IXLAB5=IXLAB5+KFD
       XLAB(5) = XLAB5
       XLAB64(5) = XLAB5
C
  250 IF(.NOT.KSW64)GO TO 262
  252 KOUTX=-KPWR
  256 F10X=10.**KPWR
  260 WRITE (6,502) KOUTX
C
  262 TDY = DY*10.
  264 DO 278 I=1,11
  266 TEMP = FY+FLOAT(I-1)*TDY
  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 XGL =.TRUE.
  324 AFILL= XGRID
      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
  380 IF(.NOT.KSW64) GO TO 11400
  382 XOUT  =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
C
  400 IF((MOD(LCTR,10)).GT.5)M=10
  401 IF(XGL.AND.(MOD(LCTR,10).EQ.0))KQUIT=2
C
```

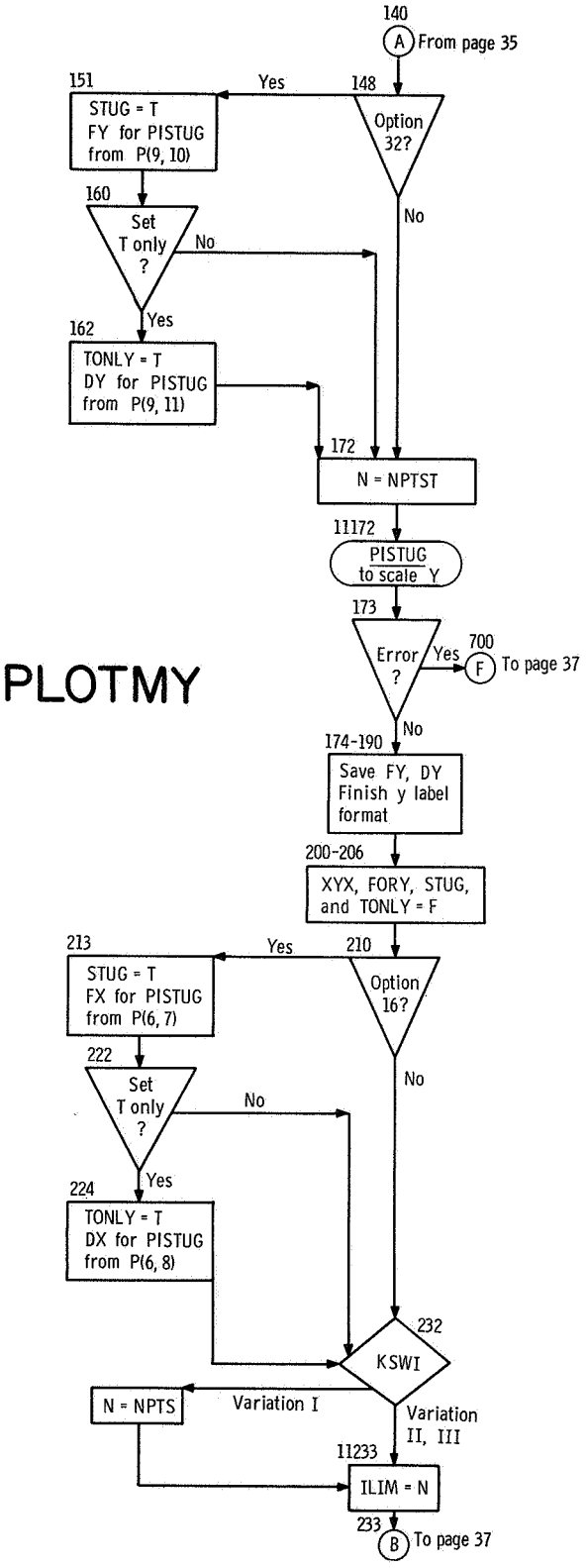
```
  600 JX = 1
  602  IF(MOD(LCTR,10).NE.0) GO TO 613
  604  JX = JX+2
  606 XLABEL =FX+FLOAT(LCTR)*DX
  608 TEMP =ABS(XLABEL)
  610 IF(TEMP.GE.1.E+7)LABOUT=2
  612 IF(TEMP.LT.1.E-7)XLABEL=0.
  613 IF(.NOT.KSW64) GO TO 6240
C
  620 IF(.NOT.LS) GO TO 6240
  621 JX = JX+1
  622 LS = .FALSE.
C
 6240 GO TO(6250,6260,6270,6280),JX
 6250 WRITE (6,504)(A(I),I=1,104)
       GO TO 614
C
 6260 WRITE(6,505) XOUT,(A(I),I = 1,104)
       GO TO 614
C
 6270 WRITE(6,XLAB) XLABEL,(A(I),I = 1,104)
       GO TO 614
C
 6280 WRITE(6,XLAB64) XOUT,XLABEL,(A(I),I = 1,104)
C
  614 LCTR = LCTR+1
  616 GO TO (320,302),KQUIT
C
  630 LABOUT= 4
  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(J),J=1,3),P(1)
  708 GO TO 720
  712 WRITE(6,512)
  710 WRITE(6,510)
  720 RETURN
  500 FORMAT(2H  )
  502 FORMAT(2H  ,13X,3HX*E,I2)
  504 FORMAT(2H  ,27X,104A1)
  505 FORMAT(2H  ,12X,F6.3,9X,104A1)
  506 FORMAT(2H  ,3X,10HBAD LABELS  )
  508 FORMAT(2H  ,5H N.G.,4G20.8,3I7,F8.2)
  510 FORMAT(2H  )
  512 FORMAT(2H  ,16HERROR IN K ARRAY      )
  520 FORMAT(2H  ,18HX OUT OF ORDER. I=,I5)
  530 FORMAT(2H  ,T100,'OPTION 8 NO LONGER AVAILABLE')
      END
```

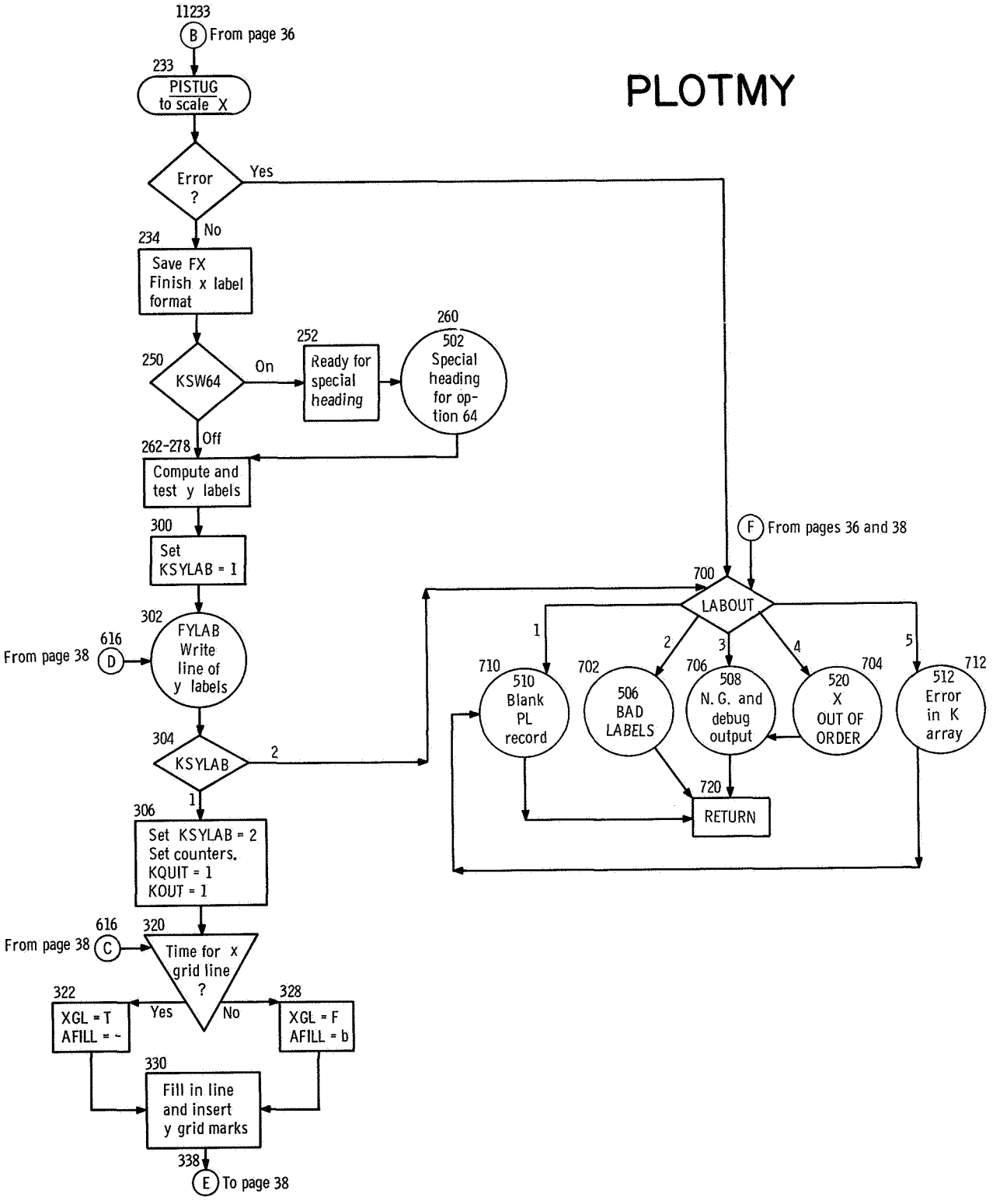
C. Block Diagram

PLOTMY

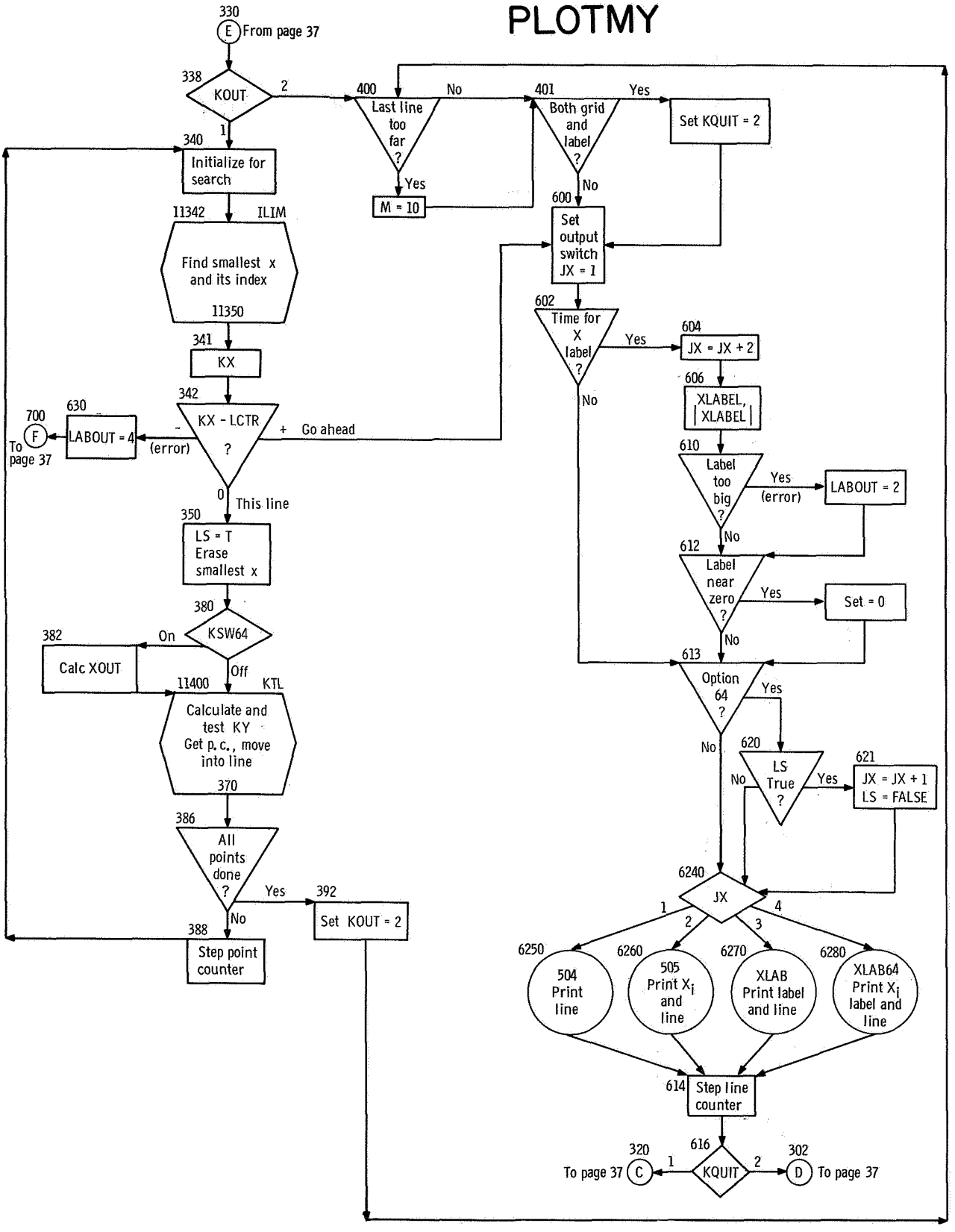


PLOTMY


140
A
From page 35
151
Yes
148
STUG = T
FY for PISTUG
from P(9, 10)
Option
32?
160
Set
T only
?
No
Yes
162
TONLY = T
DY for PISTUG
from P(9, 11)
No
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
Set
T only
?
No
Yes
224
TONLY = T
DX for PISTUG
from P(6, 8)
No
232
KSWI
N = NPTS
Variation I
Variation
II, III
11233
ILIM = N
233
B
To page 37


PLOTMY
11233
B From page 36
233
PISTUG to scale X
Error ?
Yes
No
234
Save FX Finish x label format
250
KSW64
On
252
Ready for special heading
260
502 Special heading for option 64
Off
262-278
Compute and test y labels
300
Set KSYLAB = 1
302
FYLAB Write line of y labels
616
From page 38
D
304
KSYLAB
2
1
306
Set KSYLAB = 2
Set counters.
KQUIT = 1
KOUT = 1
616
From page 38
C
320
Time for x grid line ?
Yes
No
322
XGL = T
AFILL = ~
328
XGL = F
AFILL = b
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
340
Initialize for search
11342
ILIM
Find smallest x and its index
11350
341
KX
342
KX - LCTR ?
-
(error)
700
F
To page 37
630
LABOUT = 4
+
Go ahead
0
This line
350
LS = T
Erase smallest x
380
KSW64
On
382
Calc XOUT
Off
11400
KTL
Calculate and test KY
Get p.c., move into line
370
386
All points done ?
Yes
392
Set KOUT = 2
No
388
Step point counter
400
Last line too far ?
No
Yes
M = 10
401
Both grid and label ?
Yes
Set KQUIT = 2
No
600
Set output switch JX = 1
602
Time for X label ?
Yes
604
JX = JX + 2
606
XLABEL, |XLABEL|
No
610
Label too big ?
Yes
(error)
LABOUT = 2
No
612
Label near zero ?
Yes
Set = 0
No
613
Option 64 ?
Yes
No
620
LS True ?
No
Yes
621
JX = JX + 1
LS = FALSE
6240
JX
1
2
3
4
6250
504 Print line
6260
505 Print X_i and line
6270
XLAB Print label and line
6280
XLAB64 Print X_i label and line
614
Step line counter
616
KQUIT
1
2
320
C
To page 37
302
D
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 (or -) with which the A array is initialized.

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

BLANK — Internal 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, page 52.

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, page 52.

F — See COMMON/JOLO/ - Dictionary, page 52.

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

FORY — See COMMON/JOLO/ - Dictionary, page 52.

FX — Starting value for the vertical scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 51) of the X array, or it is calculated from values supplied by the user of option 16 in P(6) and P(7) as $FX = P(7) \cdot 10^{P(6)-6}$. It is used to calculate KX and XLABEL.

FY — Starting value for the horizontal scale. It is either calculated by PISTUG based on the range, length, and X1 (see p. 51) of the Y array, or it is calculated from values supplied by the user of option 32 in P(9) and P(10) as $FY = P(10) \cdot 10^{P(9)-6}$. It is used to calculate KY and the values of YLABEL.

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

(2H , 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 52.

FYLAB5 Initial value for FYLAB(5).

I Index of many loops.

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.

IXLAB5 Equivalent to XLAB5.

IYLAB5 Equivalent to FYLAB(5).

JX Initialized to 1, increased by 1 if option 64 is being used and a point has been placed in the line, increased by 2 if the line to be printed has an x-label, this switch value may be 1, 2, 3, or 4. It is used to control the selection of the correct WRITE statement for each line.

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.

KFD See COMMON/JOLO/ - Dictionary, page 52.

KLAST Limit of the loop that finds the correct plotting character for DUPY and NO DUP.

K Array name, the third in the call list of this subroutine. Its contents are KODE, KN, and other information as required by the Variation and options being used.

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. Option 8 has been discontinued but a message is printed if MASK8 causes a branch.

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 52.

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.

KSW64 See COMMON/JOLO/ - Dictionary, page 52.

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

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 $\left[(y_i - FY)/DY\right]$ rounded. The first y grid-line character in "printing position" zero is 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 52.

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 64 is in effect, LS is used to control a branch (to modify JX) 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 53.

NCTR — Counter of the number of x-values 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 — Out-of-range character (=).

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

TDY — Intermediate storage for the value 10·DY, used in the calculation of the YLABEL array.

TEMP — Temporary storage.

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

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

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.

XLAB — Variable FORMAT array used to print a line when JX = 3 (see p. 40). It is of the form

(2H , 18X, F9.d, 104A1)

where $0 \leq d \leq 6$. The value of d is inserted by the program (using XLAB5) after the call to PISTUG to process the X array. See KFD, page 52.

XLAB5 — A word initialized to F9.0 and altered to F9.d by using KFD (see p. 52). XLAB5 is then moved into the FORMAT arrays (XLAB and XLAB64) used for lines that have an x-label. It is equivalenced to IXLAB5.

XLAB5I — Initial value for XLAB5.

XLAB64 — Variable FORMAT array used to print a line when JX = 4 (see p. 40). It is of the form

(2H , 12X, F6.3, F9.d, 104A1)

where $0 \leq d \leq 6$. The value of d is inserted by the program (using XLAB5) after the call to PISTUG to process the X array. See KFD, page 52.

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.

XOUT — Value of X_i modified by F10X for option 64 printouts.

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

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/F, DX, TLINX, N, LABOUT, KPWR, KFD

COMMON/JOLO/XYX, FORY, STUG, TONLY, KSW64

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].

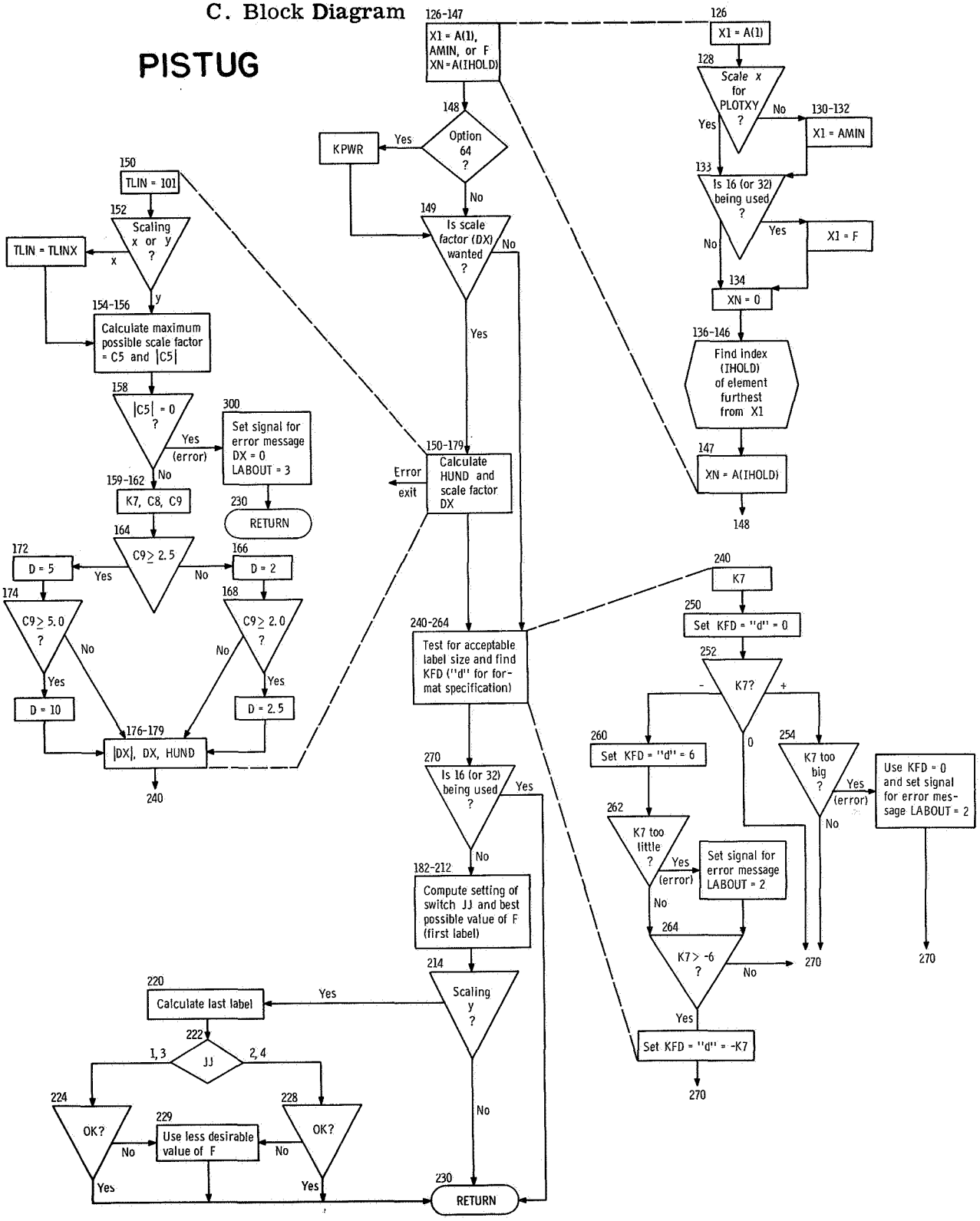
B. Program Listing

```
      SUBROUTINE PISTUG(ARRAY)
      LOGICAL XYX,FORY, STUG,TONLY,XGL,LS,KSW64
      DIMENSION ARRAY(1)
      COMMON/JOLO/F,DX,TLINX,N,LABOUT,  KPWR,KFD
      COMMON/JOLO/XYX, FORY, STUG, TONLY, KSW64
      KHAR(XMAX) = INT(ALOG(XMAX)/2.302585+40.0)-40
126   X1 = ARRAY(1)
128   IF(XYX) GO TO 133
130   DO 132 J = 2,N
132   X1 = AMIN1(X1,ARRAY(J))
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)
148   IF(KSW64      ) KPWR = KHAR(AMAX1(ABS(X1),ABS(XN)))
149   IF(TONLY) GO TO 240
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
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
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
```

C. Block Diagram

PISTUG



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 52.
F	See COMMON/JOLO/ - Dictionary, page 52.
FORY	See COMMON/JOLO/ - Dictionary, page 52.
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 52.

KHAR(Z) — Arithmetic function that computes the integer characteristic of $\log_{10}$ Z.

KPWR — See COMMON/JOLO/ - Dictionary, page 52.

KSW64 — See COMMON/JOLO/ - Dictionary, page 52.

LABOUT — See COMMON/JOLO/ - Dictionary, page 52.

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

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

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 54.

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

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.

XMAX Dummy argument of arithmetic function KHAR, page 50.

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 54.

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 to modify the variable FORMATS (FXLABS, FXLABM, FYLAB in PLOTXY and XLAB, XLAB64, FYLAB in PLOTMY) used to write the grid-labels. This modification is made by adding KFD to a word initialized to blank, blank, F9.0.

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 — Logical variable set to FALSE by PLOTXY and PLOTMY and set to TRUE if option 64 is used. It is used by 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 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. SKALE

A. Description

CALL SKALE (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 SKALE(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+40.0)-40
116   IF((4-KHAR)*(KHAR+2))120,118,118
118   KPWR=0
119   GO TO 130
120   KPWR=3-KHAR
122   FACT=10.0**KPWR
126   DO 128 J=1,N
128   X(J)=X(J)*FACT
130   KRSTR=KPWR
140   RETURN
      END
```

VI. AND

A. Description

FORTRAN G compilers do not provide the logical AND function available in FORTRAN H. The following FORTRAN function subprogram will satisfy the requirements of PLOTXY and PLOTMY. Despite its name, it is not usable as the AND function for other purposes.

B. Program Listing

```
      FUNCTION AND (KODE,MASK)
100   K= KODE
      IF(KODE.EQ.0) GO TO 110
      IF (MOD(K/MASK,2).EQ.0) GO TO 110
      AND= 1.
      RETURN
110   AND= 0.
      RETURN
      END
```

VII. INPUT-OUTPUT CONSIDERATIONS

The printer plotting system used at Lewis operates under OS with no print control. All records (limited to 132 characters) written with a WRITE(6,###) statement are printed immediately. If a supervisory program is to control printing, records written by the plotting routines must be treated somewhat differently than ordinary output records, for example, automatic page-spacing must be disabled. For this reason, all FORMAT statements begin with a field of two blanks. This is provided to permit easy modification of the FORMAT statements if the supervisory program requires identification within each record.

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

WRITE	FORMAT	
100	500	Writes a blank record. This causes a blank line immediately preceding the plot.
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 (2H , 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 52.
702	506	These are error messages.
704	520	
706	508	
710	510	This FORMAT statement is used to write a blank record following the second line of y grid-labels.
712 (PLOTMY ONLY)	512	This is an error message if the search for the associated plotting character fails (see D, top of p. 14).

WRITE	FORMAT	
6250	504	This FORMAT statement is used to print a line when it has no x-label nor option 64 output to the left of the plot.
6260	505	This FORMAT statement is used to print a line that has no x-label but does have option 64 output to the left of the plot.
6270	PLOTXY FXLABS PLOTMY XLAB	This FORMAT statement is used to print a line containing an x-label but no option 64 output to the left of the plot. It is of the general form (2H , 18X, F9.d, 104A1) Using an array permits setting the value of "d" (in the F specification) to suit the range of the X array. See KFD, page 52.
6280	PLOTXY FXLABM PLOTMY XLAB64	This FORMAT statement is used to print a line containing both an x-label and option 64 output to the left of the plot. It is of the general form PLOTXY (2H , 4X, 2F7.3, F9.d, 104A1) PLOTMY (2H , 12X, F6.3, F9.d, 104A1) Using an array permits setting the value of "d" (in the F specification) to suit the range of the X array. See KFD, page 52.

SAMPLE PLOTS

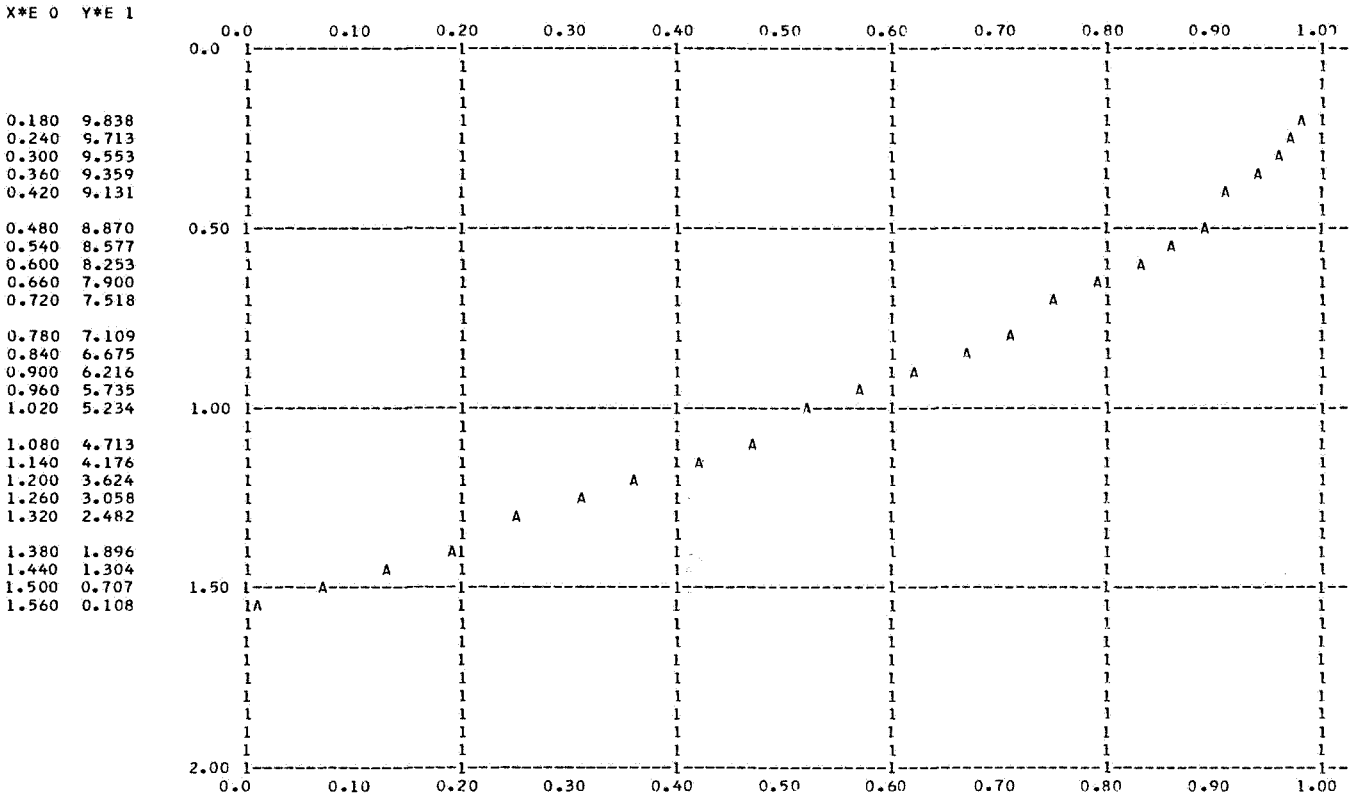


Figure 1. - The data used for the example plot on page 5 (using PLOTXY and KODE = 0) is here plotted with: (1) The order of the first two arguments in the call reversed. Notice that values down the vertical axis are now increasing. This is governed by the order of the elements in the array that is the 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.

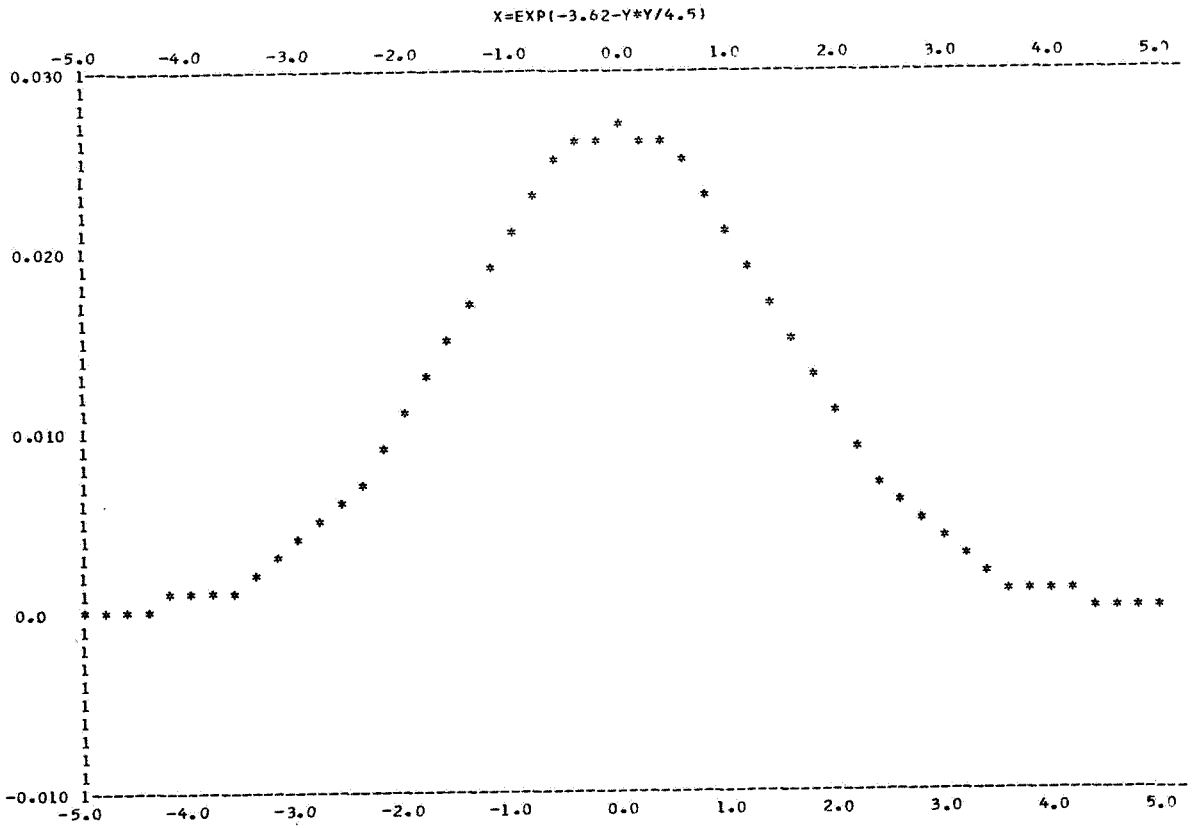


Figure 2. - This plot, using PLOTXY, uses KODE = 6 = (2 + 4) and P(3) = P(4) = 0, which removes all but three gridlines.

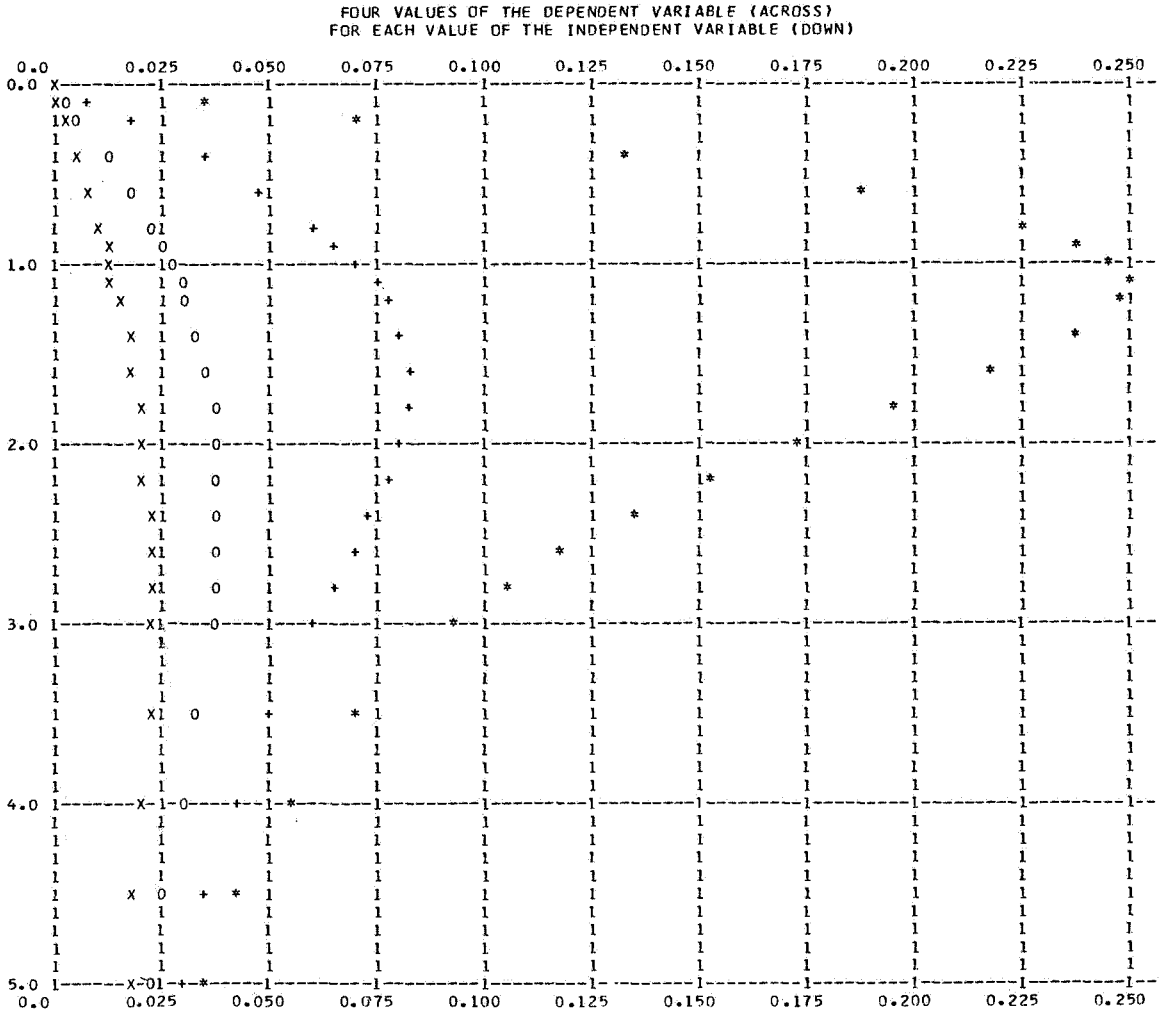


Figure 3. - This plot displays the use of PLOTMY - Variation I, KODE = 0.

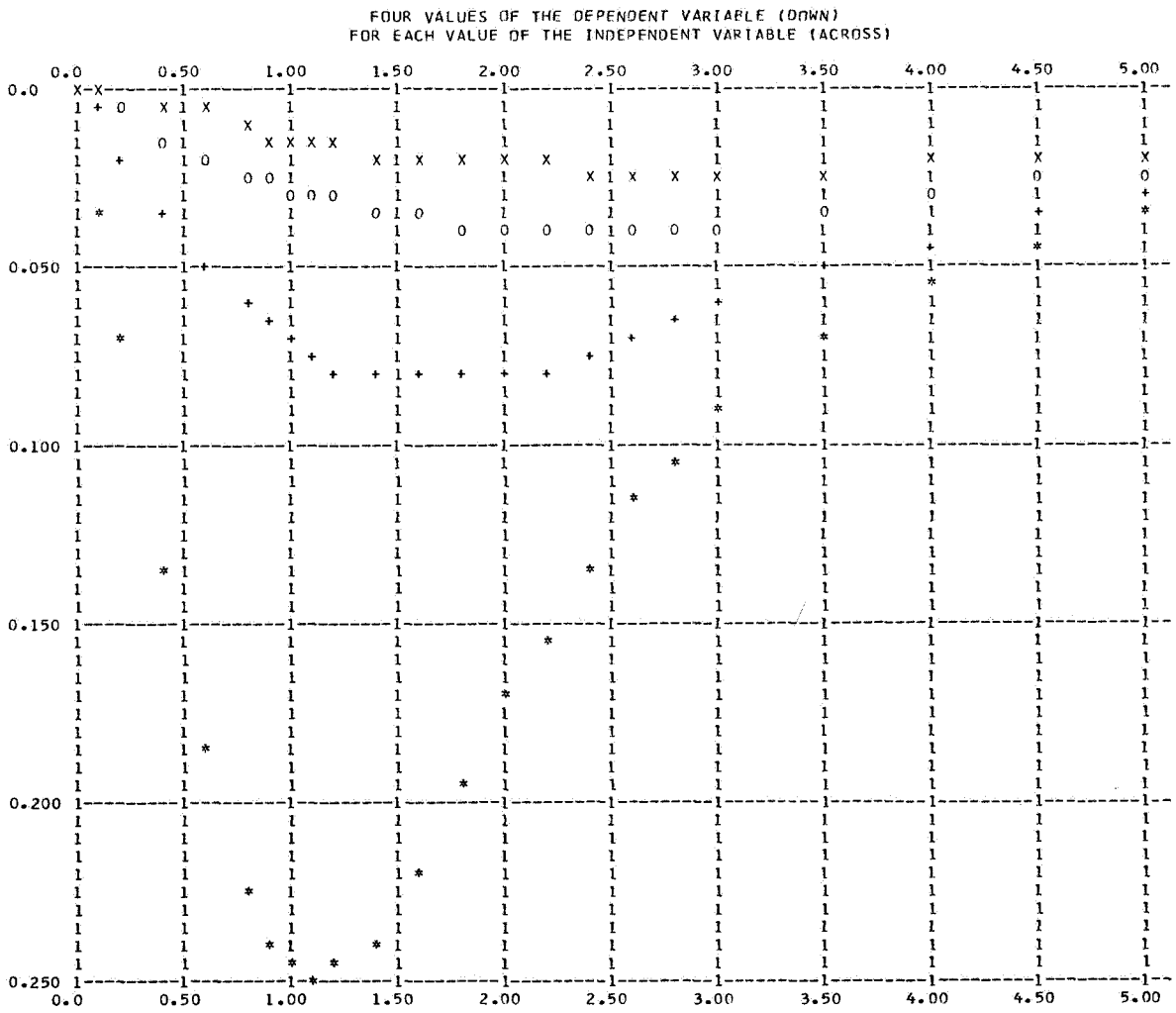


Figure 4. - This plot displays the use of PLOTMY - Variation II, KODE = 0. The same data are plotted here as in figure 3; only the Variation number and the order of the first two arguments have been changed.

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.

4. Dellner, Lois T.: A Set of FORTRAN IV Subroutines for Generating Printed Plots. NASA TM X-1419, 1967.

5. Anon.: FORTRAN IV Subroutines for Printer Plots. SDA 3494, SHARE Program Catalog, July 1967.

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