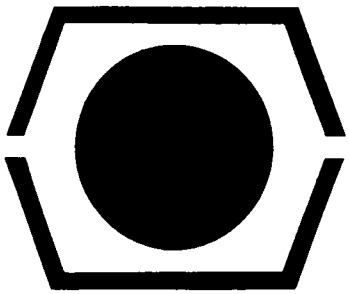


DECUS
PROGRAM LIBRARY

DECUS NO.	12-15
TITLE	HISTO12
AUTHOR	Roger A. Nace
COMPANY	University of Washington Anesthesia Research Center Seattle, Washington
DATE	May 26, 1970
SOURCE LANGUAGE	LAP6-DIAL

DECUS Program Library Write-up DECUS No. 12-15

Abstract: HISTO12 is an interspike interval plotting routine. The program uses an adjustable threshold to discriminate against baseline noise and will eliminate spikes shorter than 500 μ's or longer than 2.1 ms. A limit to the number of spikes counted may be selected. Printed output consists of sampling diagnostics, total spikes counted, the average input frequency, total time in sampling, and number of spikes not appearing in the display. The display in either scattergram or histogram mode may be expanded horizontally defining intervals of 0.0 to 0.2 to 0.0 to 1.6 seconds. Vertical scaling is accomplished by addition, subtraction or by multiplication, division. Complete operating instructions type out upon program startup.

HISTO12

Minimum Requirements:

Hardware: PDP-12A

Software: The tape on unit Ø should contain the PDP-8 Floating Point Package 2 and stored as FPP2. HISTO12 will look up FPP2 in DIAL's index, and load it in core.

Starting Procedure:

Using DIAL, load HISTO12. The instruction text will start to print. If desired, this printout will terminate by typing any key, leaving only the column headings. The computer then enters view-preset mode.

Connect the analog input to channel 14 and adjust knob 1 to just above the baseline noise. If a preset number of spikes is desired type the full 4 number count, leading zeros are required. The maximum is 4095 or if no limit is specified, 4095 is assumed. To start sampling, type return. The program will sample until a key is struck, or the preset limit is reached.

Discrimination:

a) Threshold: a conversion must be above the last value of knob 1 during view-preset mode to be analyzed further.

b) Time: the KW-12 clock runs at 100 kHz with a preset overflow at 5kHz. This overflow triggers the A-D convertor. There must be at least 2 but no more than 10 conversions above threshold to allow the spike to be recorded. Worst case reject is therefore <600 μs or >2200 μs.

Interval Buffer: When two spikes are within 2.048 seconds an interval bin is incremented. The bin address is calculated by the formula:

$$3000 + (\text{Interval}/2)$$

(3000 is the starting address of the buffer)

If the spikes are more than 2.048 seconds apart, a 2 is typed as a diagnostic. If no spikes are converted for more than 4.096 seconds a 1 is typed. If the baseline shifts, and a conversion lasts more than 0.800 seconds a 3 is typed.

Sampling is terminated when a key is struck or when the preset limit is reached. Floating point output consists of the total number of spikes recorded, the frequency (spike count/time), the time taken in sampling, and the number of spikes not presented in the display. (Those with intervals greater than 1.6 seconds).

Please note that the floating point package outputs some integer values one less than the actual number, for example, 4095 is typed as 4094.

The display is now presented in the full 0-1.6 second interval mode.

The display is a matrix $200_{(10)}$ bins wide and $500_{(10)}$ counts high. The horizontal scaling is accomplished by the following:

Key Typed	Action	Graph
Ø	direct dump first 100 bins to every other display bin	0.0-0.2 sec.
1	direct dump first 200 bins to display buffer	0.0-0.4 sec.
2	two bins added together, the sum in each bin of display buffer	0.0-0.8 sec.
3	four bins added together, the sum in each bin of display buffer	0.0-1.6 sec.

Vertical scaling:

Key Typed	Action
A	$50_{(10)}$ added to each bin
D	$50_{(10)}$ subtracted from each bin
M	Each bin is multiplied by 2 (rotate multiply)
D	Each bin is divided by 2 (rotate divide)
CTRL C	See below
CTRL D	See below

Sense switch one will produce a histogram by drawing a vertical line from baseline up to each point of the scattergram. To facilitate polaroid photography, a halt in the display is inserted by setting switch 5 to a 1. Single sweeps may be initiated by pressing continue. Further, a 15 second development timer may be used by setting switch 4 to a 1. 15 seconds later the teletype bell will ring.

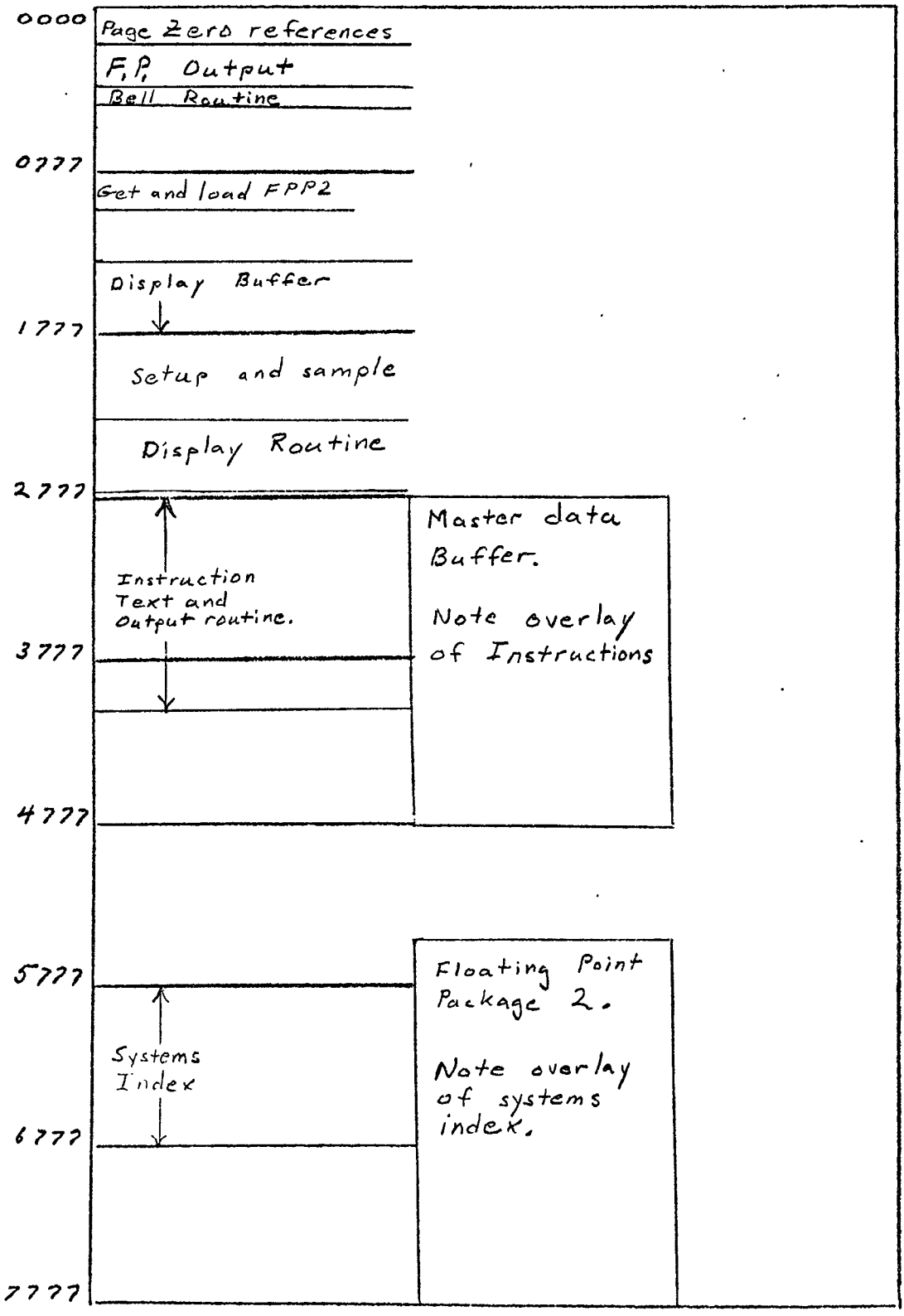
Typing CTRL C restarts the program in the view-preset mode. CTRL D is a monitor command which overlaps block 27Ø of unit Ø at 4ØØØ and starts the program at location 4Ø16. To call dial with this command block 27Ø should contain:

Location	Contents
Ø16	Ø7Ø1
Ø17	73ØØ

This work supported by the National Institute of Health Anesthesia Research Center Grant GM-15991-02

Core Map

Program HISTO12
Page 1 of 1
Date May 7, 1970
Name R. Nace



```
0000                    *20
0001                    /       INTERVAL HISTOGRAM
0002                    /           HISTO12
0003                    /
0004                    /  ROGER A.NACE
0005                    /  ANESTHESIA RESEARCH
0006                    /  UNIVERSITY OF WASHINGTON
0007                    /  SEATTLE, WASHINGTON 98105
0010                    /  MAY 1970
0011                    /
0012                    KSF=6031                    /PDP IOTS
0013                    KRB=6036
0014                    TSF=6041
0015                    TLS=6046
0016                            SEGMNT 0
0017                            *1000
0020        1000  0643          LDF 3
0021        1001  0720          0720      /GET INDEX
0022        1002  4346          4346      /OF TAPE 0
0023        1003  0700          0700      /PUT IN 6000-7000
0024        1004  5347          5347
0025        1005  0002          PDP
0026                            PMODE
0027                    /ROUTINE TO FIND FPP2 ON SYSTEMS TAPE
0030                    /AND LOAD INTO 5600-7777
0031        1006  7200  STRT,    CLA
0032        1007  1301          TAD CO6           /6000
0033        1010  3256          DCA PTR
0034        1011  1312          TAD M70           /-70
0035        1012  3310          DCA T2
0036        1013  1256  INC,    TAD PTR           /POINT TO NAME
0037        1014  1306          TAD CO10          /INC BY 10
0040        1015  3256          DCA PTR
0041        1016  1256          TAD PTR
0042        1017  1307          TAD MI1           /DECREMENT BY 1
0043        1020  3010          DCA 10            /AUTO INC HOLD
0044        1021  1410          TAD I 10          /GET FIRST NAME
0045        1022  1302          TAD IN            /-0620 (FP)
0046        1023  1410          TAD I 10          /NEXT NAME
0047        1024  1303          TAD IN+1          /-2062 (P2)
0050        1025  1410          TAD I 10
0051        1026  1304          TAD IN+2          /-7777
0052        1027  1410          TAD I 10
0053        1030  1305          TAD IN+3          /-7777
0054        1031  7650          SNA CLA           /IF 0 FPP2 FOUND
0055        1032  5236          JMP .+4
0056        1033  2310          ISZ T2            /NOT FOUND
0057        1034  5213          JMP INC           /DO OVER
0060        1035  5235          JMP .   /FATAL LOOP IF NO FPP2
```

```
0061    1036  1256          TAD PTR          /POINTS TO FPP2
0062    1037  1311          TAD C06          /6
0063    1040  3256          DCA PTR  /POINTS TO BLOCK NO.
0064    1041  1656          TAD I PTR        /GET BLOCK NO.
0065    1042  3267          DCA PTR2         /HOLD
0066    1043  1267          TAD PTR2
0067    1044  1277          TAD C3002        /3002,PASS HEAD
0070    1045  3256          DCA PTR          /AND SET M QTR2
0071    1046  6141          LINC;
0072                        LMODE
0073    1047  0072          SET I 12
0074    1050  1773          1777-4           /SET UP COUNT
0075    1051  1020  READIN, LDA I            /GET INCREMENT

0076    1052  1001          1001
0077    1053  1140          ADM              /PUT IN PTR
0100    1054  1056          PTR
0101    1055  0700          RDC              /READ BLOCK
0102    1056  0000  PTR,     0                /SECTIONS 2-5
0103    1057  0232          XSK I 12         /ALL 4?
0104    1060  7051          JMP READIN       /NO
0105    1061  0642          LDF 2            /YES, GET SECT 1
0106    1062  1020          LDA I            /STARTING SECTN
0107    1063  7002          7002
0110    1064  1140          ADM              /ADD BLOCK NUMB.
0111    1065  1067          PTR2
0112    1066  0700          RDC              /READ SECT 1
0113    1067  0000  PTR2,    0
0114    1070  0002          PDP;
0115                  PMODE
0116    1071  7300          CLA CLL   /REMOVE + SIGN FROM
0117    1072  3675          DCA I .+3 /OUTPUT OF FPP2
0120    1073  5674          JMP I .+1        /JUMP TO TEXT
0121    1074  3000          3000             /CROSS PAGE JMP
0122    1075  7327          7327             /ADDR OF + SIGN
0123    1076  7773  MI5,     -5
0124    1077  3002  C3002,   3002
0125    1100  1001  C1001,   1001
0126    1101  6000  C06,     6000
0127    1102  7160  IN,      -0620
0130    1103  5716          -2062
0131    1104  0001          -7777
0132    1105  0001          -7777
0133    1106  0010  C010,    10
0134    1107  7777  MI1,     -1
0135    1110  0000  T2,      0
0136    1111  0006  C06,     6
0137    1112  7710  M70,     -70
0140                        LMODE
0141                        SEGMNT 1
0142                        *17
```

```
0143    0017  0000  FF,     0
0144    0020  1020           LDA I   /I/O PRESET
0145    0021  0020           0020
0146    0022  0004           ESF
0147    0023  1020           LDA I   /ENABLE FAST SAMPLE
0150    0024  0100           0100
0151    0025  0004           ESF
0152    0026  0065           SET I 5
0153    0027  0204           PRSET-1          /POINT TO TEXT
0154    0030  0064           SET I 4
0155    0031  1772           1777-5           /INPUT LIMIT
0156    0032  0063           SET I 3
0157    0033  0200           CNTLIM-1         /OUTPUT POINTER
0160    0034  0066           SET I 6          /TEXT COUNT
0161    0035  1766           1777-11
0162    0036  0011           CLR              /CLEAR LIMIT BFR
0163    0037  4201           STC CNTLIM
0164    0040  4202           STC CNTLIM+1
0165    0041  4203           STC CNTLIM+2
0166    0042  4204           STC CNTLIM+3
0167    0043  0500           IOB
0170    0044  6046           TLS              /SET FLAG
0171    0045  0643           LDF 3
0172    0046  0114  D4,      SAM 14           /DISPLAY INPUT
0173    0047  0150           DIS 10
0174    0050  0230           XSK I 10         /1777 SAMPLES
0175    0051  6046           JMP .-3
0176    0052  0101           SAM 1            /SAMPLE THRESH.
0177    0053  0451           APO
0200    0054  6060           JMP .+4          /IF POSITIVE,
0201    0055  1040           STA              /HOLD
0202    0056  0017           FF
0203    0057  0150           DIS 10           /AND DISPLAY
0204    0060  0230           XSK I 10         /1777 SAMPLES
0205    0061  6052           JMP .-7
0206    0062  0206           XSK 6            /ALL PRINTED?
0207    0063  0467           SKP              /NO
0210    0064  6075           JMP LSTN         /YES,CHECK INPUT
0211    0065  0500           IOB
0212    0066  6041           TSF              /TTY READY?
0213    0067  6046           JMP D4           /NO, GO BACK
0214    0070  1025           LDA I 5          /GET CHARACTER
0215    0071  0500           IOB
0216    0072  6046           TLS              /PRINT
0217    0073  0226           XSK I 6          /BUMP COUNT
0220    0074  6046           JMP D4           /GO BACK
0221    0075  0415  LSTN,     KST              /KEY STRUCK?
0222    0076  6046           JMP D4           /NO, GO BACK
0223    0077  0500           IOB
0224    0100  6036           KRB              /GET CHAR
0225    0101  0224           XSK I 4          /5 INPUTS?
0226    0102  0467           SKP              /NO, ECHO
0227    0103  6124           JMP FINSH        /YES, GO ON
```

```
0230    0104  0002          PDP             /ECHO WITH TYPE
0231    0105  4021          4\ TYPE         /JMS TYPE
0232    0106  6036          KRB             /GET CHAR. AGAIN
0233    0107  6141          6141            /LINC
0234    0110  1460          SAE I           /RTN?
0235    0111  0215          0215
0236    0112  0467          SKP
0237    0113  6124          JMP FINSH       /YES, GO ON
0240    0114  1460          SAE I           /NO, RUB OUT?
0241    0115  0377          0377
0242    0116  0467          SKP
0243    0117  6020          JMP 20          /YES START AGAIN
0244    0120  1560          BCL I           /NO, GET DIGIT
0245    0121  7760          7760
0246    0122  1063          STA I 3         /HOLD INPUT
0247    0123  6046          JMP D4          /GO BACK
0250    0124  1000  FINSH,  LDA
0251    0125  0017          FF
0252    0126  0017          COM             /NEGATE THRESH.
0253    0127  4017          STC FF          /PUT AWAY
0254                /CONVERT DECIMAL KBD INPUT TO OCTAL
0255    0130  4200          STC CNTLIM-1    /0 HOLDING BUFF
0256    0131  0066          SET I 6
0257    0132  0216          MULT            /MULTIPLE
0260    0133  0063          SET I 3
0261    0134  0200          CNTLIM-1        /INPUT POINTER
0262    0135  0064          SET I 4
0263    0136  1773          1777-4          /COUNTER
0264    0137  1023  CNRLOP, LDA I 3         /GET INPUT
0265    0140  0017          COM             /MAKE NEG
0266    0141  1120          ADA I           /CALCULATE INDEX
0267    0142  1776          1776            /-1 AS PRE COUNT
0270    0143  4145          STC .+2         /PUT AWAY
0271    0144  0065          SET I 5         /SET INDEX
0272    0145  0000          0
0273    0146  0225          XSK I 5         /BUMP
0274    0147  0467          SKP             /DONT STOP NOW
0275    0150  6153          JMP .+3         /ENOUGH OF THIS
0276    0151  1106          ADA 6           /ADD MULTIPLE
0277    0152  6146          JMP .-4         /GO BACK
0300    0153  1140          ADM             /PUT AWAY TOTAL
0301    0154  0200          CNTLIM-1
0302    0155  0226          XSK I 6         /MULT POINTER
0303    0156  0224          XSK I 4         /FINISHED?
0304    0157  6137          JMP CNRLOP      /NO
0305    0160  0002          PDP;
0306                        PMODE   /YES
0307    2161  7300          CLA CLL
0310    2162  1115          TAD C16         /3000
0311    2163  3065          DCA CO1         /ADDR INTER. BUF
0312    2164  1107          TAD M13         /-2000
0313    2165  3066          DCA CO2         /COUNT INTER B.
0314    2166  3465          DCA I CO1       /ZERO TABLE
0315    2167  2065          ISZ CO1
0316    2170  2066          ISZ CO2
0317    2171  5366          JMP .-3
```

```
0320    2172  3111          DCA MS          /CLEAR MS CTR
0321    2173  3112          DCA SEC         /CLEAR SEC CTR
0322    2174  3122          DCA CO7         /CLEAR OFLO CTR
0323    2175  3070          DCA CO4         /CLEAR IMPLS CTR
0324    2176  5777          JMP I .+1       /PAGE CROSS
0325    2177  2222          START-4
0326                /NOTE END OF PDP-8 PAGE
0327                        LMODE           /MODE FOR REFER.
0330    0200  0000          0
0331    0201  0000  CNTLIM, 0               /HOLD KBD LIMIT
0332    0202  0000          0               /INPUT
0333    0203  0000          0
0334    0204  0000          0
0335    0205  0320  PRSET,  320             /P
0336    0206  0322          322             /R
0337    0207  0305          305             /E
0340    0210  0323          323             /S
0341    0211  0305          305             /E
0342    0212  0324          324             /T
0343    0213  0240          240             /SPACE
0344    0214  0277          277             /?
0345    0215  0240          240             /SPACE
0346    0216  1750  MULT,   1750            /PWR OF 1000
0347    0217  0144          144             /PWR OF 100
0350    0220  0012          12              /PWR OF 10
0351    0221  0001          1               /PWR OF 1
0352                        PMODE           /RETURN MODE
0353    2222  4127          JMS CRLF        /C RTN + L FEED
0354    2223  1200          TAD CNTLIM-1    /GET LIMIT
0355    2224  7041          CIA             /FORM NEGATIVE
0356    2225  3077          DCA LIMIT       /HOLD ON PAGE 0
0357    2226  7300  START,  CLA CLL
0360    2227  3076          DCA MAXCIA      /CLEAR MAX TEST
0361    2230  3020          DCA T1          /CLEAR SWITCH
0362    2231  1074          TAD S2          /NOP
0363    2232  3271          DCA INCT1       /DONT SET SWITCH
0364    2233  1135          TAD M1          /-5
0365    2234  3071          DCA ICO1        /LOOP COUNTER
0366    2235  3072          DCA ICO2        /CLEAR INT COUNT
0367    2236  1030          TAD C2          /0100
0370    2237  6134          CLEN            /CLOCK ENABLE
0371    2240  7300          CLA CLL
0372    2241  1027          TAD C1          /2500
0373    2242  6132          CLLR            /CLOCK CONTROL
0374    2243  6135  TL,     CLSA            /CLEAR INTER
0375    2244  7300          CLA CLL
0376    2245  2071          ISZ ICO1        /DIV.BY 5
0377    2246  5261          JMP D1
0400    2247  1135          TAD M1          /RESET COUNT
0401    2250  3071          DCA ICO1
0402    2251  2111          ISZ MS          /BUMP MS CNTR
0403    2252  7410          SKP
0404    2253  2112          ISZ SEC         /BUMP SEC. CTR
0405    2254  2072          ISZ ICO2        /INTERVAL (MS)
0406    2255  5261          JMP D1
0407    2256  1033          TAD C6          /PRINT 1 IF
0410    2257  4021          JMS TYPE        /> 7777 MS
0411    2260  5226          JMP START       /START OVER
```

```
0412    2261  1031  D1,     TAD C3          /7754
0413    2262  6133          CLAB            /LOAD PRESET
0414    2263  6141          LINC;
0415                        LMODE
0416    0264  0114          SAM 14          /SAMPLE INPUT
0417    0265  2017          ADD FF          /SUBTR. THRESH
0420    0266  0002          PDP;
0421                        PMODE
0422    2267  7510          SPA             /> THOLD?
0423    2270  5314          JMP NEG         /NO
0424    2271  0000  INCT1,  0       /YES, COUNT POS IMPULSES
0425    2272  5277          JMP D7 /IF > 7777 PRINT 3
0426    2273  7300          CLA CLL
0427    2274  1035          TAD C9
0430    2275  4021          JMS TYPE
0431    2276  5226          JMP START       /START OVER
0432    2277  3075  D7,     DCA HOLD        /HOLD SAMP AMP.
0433    2300  1075          TAD HOLD
0434    2301  1076          TAD MAXCIA      /NEW MAX ?
0435    2302  7710          SPA CLA
0436    2303  5353          JMP D2          /NO
0437    2304  1075          TAD HOLD        /YES, REPLACE
0440    2305  7141          CIA CLL
0441    2306  3076          DCA MAXCIA      /NEW MAX COMPL.
0442    2307  1073          TAD S1          /ISZ T1
0443    2310  3271          DCA INCT1       /FIX VARIAB INST
0444    2311  1072          TAD ICO2        /INTERVAL
0445    2312  3067          DCA CO3         /RECORD INTERV
0446    2313  5353          JMP D2          /SAMPLE AGAIN
0447    2314  7300  NEG,    CLA CLL  /HERE IF CONV.< THOLD
0450    2315  1020          TAD T1          /PREV NEG ?
0451    2316  7450          SNA             /T1=0 IF PREV -
0452    2317  5350          JMP D3          /NO
0453    2320  1136          TAD M2          /YES-HOW MANY
0454    2321  7510          SPA             / > 2 ?
0455    2322  5350          JMP D3          /NO - RESET
0456    2323  1137          TAD M3          / < 8 (DEC.)?
0457    2324  7700          SMA CLA
0460    2325  5350          JMP D3          /NO - RESET
0461    2326  1067          TAD CO3         /YES TEST INT
0462    2327  7700          SMA CLA         /INT > 3777 ?
0463    2330  5336          JMP D5          /NO, LOG IT
0464    2331  7300          CLA CLL         /YES, PRINT 2
0465    2332  1034          TAD C7
0466    2333  4021          JMS TYPE
0467    2334  2122          ISZ CO7         /BUMP OFLO CTR
0470    2335  5226          JMP START       /RESTART
0471    2336  2070  D5,     ISZ CO4         /IMPULSE COUNTER
0472    2337  5343          JMP .+4         /NO OVERFLOW
0473    2340  7040          CMA             /FIX TOTAL
0474    2341  3070          DCA CO4         /IF OVERFLOW
0475    2342  5360          JMP DIS         /QUIT
0476    2343  4365          JMS BUMP        /LOG ROUTINE
0477    2344  2077          ISZ LIMIT       /PRESET COUNTER
0500    2345  7410          SKP
0501    2346  5360          JMP DIS         /LIMIT REACHED
```

```
0502    2347  3072          DCA ICO2          /CLEAR MS CNTR
0503    2350  7300  D3,     CLA CLL           /RESET
0504    2351  3020          DCA T1            /COUNTER
0505    2352  3076          DCA MAXCIA
0506    2353  6131  D2,     CLSK              /READY SAM ?
0507    2354  7410          SKP               /NO, TEST KBD
0510    2355  5243  END,    JMP TL            /YES - GO BACK
0511    2356  6031          KSF               /STAGE TO PLOT?
0512    2357  5353          JMP .-4           /NO, WAIT
0513    2360  6032  DIS,    KCC               /CLEAR KBD FLAG
0514    2361  1117          TAD C18           /FULL PLOT
0515    2362  4526          JMS I MOVEP       /POINTER TO MOVE
0516    2363  5764          JMP I .+1         /CROSS PAGE JMP
0517    2364  0200          0200              /NEXT LOCATION
0520    2365  0000  BUMP,    0                 /INC SUB
0521    2366  1067          TAD CO3           /INTERVAL
0522    2367  7110          RAR CLL           /DIVIDE BY 2
0523    2370  0102          AND MAS1          /1777
0524    2371  1115          TAD C16           /3000
0525    2372  3066          DCA CO2           /BIN POINTER
0526    2373  2466          ISZ I CO2         /BUMP BIN
0527    2374  5765          JMP I BUMP        /NO OVERFLOW
0530    2375  7402          HLT
0531                  /THIS HALT SHOULD NEVER BE REACHED.
0532                  /A BIN OVERFLOW WILL STOP HERE.
0533                  /THE TOTAL COUNT OVERFLOW SHOULD
0534                  /SWITCH TO DISPLAY FIRST.
0535                  *2377
0536    2377  6141  GRAPH,  LINC
0537                  LMODE
0540                  /DISPLAY ROUTINE WRITTEN BY
0541                  /J. BRIAN, N.I.H. AND
0542                  /MODIFIED BY R.NACE, U. OF WASHINGTON
0543                  /
0544                  /X AXIS - 200 LOCATIONS, MARKERS AT 25
0545                  /Y AXIX - MARKERS AT 100 COUNTS
0546                  /(THIS DATA IN DECIMAL)
0547    0400  0640          LDF 0             /RESTART ADDR
0550                  /Y AXIS
0551    0401  0062  R2,      SET I 2
0552    0402  0040          40
0553    0403  0061          SET I 1
0554    0404  0377          377
0555    0405  1000          LDA 00
0556    0406  0001          1
0557    0407  0063          SET I 3
0560    0410  1772          1777-5
0561    0411  0142          DIS 02
0562    0412  1020          LDA I 0
0563    0413  7633          -144
0564    0414  1140          ADM 00
0565    0415  0001          1
0566    0416  0223          XSK I 3
0567    0417  6411          JMP  .-6
0570                  /X AXIS
```

```
0571    0420  0062          SET I 2
0572    0421  0037          37
0573    0422  0061          SET I 1
0574    0423  7414          -363
0575    0424  0062          SET I 2
0576    0425  0037          37
0577    0426  0061          SET I 1
0600    0427  7414          -363
0601    0430  0063          SET I 3
0602    0431  1466          1777-311
0603    0432  1000          LDA 00
0604    0433  0001          1
0605    0434  0162          DIS I 2
0606    0435  0222          XSK I 2
0607    0436  0223          XSK I 3
0610    0437  6434          JMP  .-3
0611                  /X CAL MARKS
0612    0440  0062          SET I 2
0613    0441  0040          40
0614    0442  0061          SET I 1
0615    0443  7400          -377
0616    0444  0063          SET I 3
0617    0445  1766          1777-11
0620    0446  1000  T2A,     LDA 00
0621    0447  0001          1
0622    0450  0142          DIS 02
0623    0451  1020          LDA I 0
0624    0452  0062          62
0625    0453  1140          ADM 00
0626    0454  0002          2
0627    0455  0223          XSK I 3
0630    0456  6446          JMP  T2A
0631                  /PLOT CURVE
0632    0457  0062          SET I 2
0633    0460  3377          3377
0634    0461  0061          SET I 1
0635    0462  0040          40
0636    0463  0063          SET I 3
0637    0464  1467          1777-310
0640    0465  1022          LDA I 2
0641    0466  0451          APO
0642    0467  0011          CLR
0643    0470  1120          ADA I 0
0644    0471  7414          -363
0645    0472  6651          JMP V2
0646    0473  0221          XSK I 1
0647    0474  0221          XSK I 1
0650    0475  0223          XSK I 3
0651    0476  6465          JMP  .-11
0652    0477  0465          SNS I 5
0653    0500  0000          HLT
0654    0501  0464          SNS I 4          /TEST SS 4
0655    0502  6507          JMP .+5          /UP, TIME BELL
0656    0503  0011          CLR              /DOWN, PROCEED
0657    0504  1060          STA I
```

```
0660    0505  0000  SWIT,   0              /0 BELL SWITCH
0661    0506  6514          JMP U2
0662    0507  0002          PDP            /HERE ON SS 4
0663    0510  4713          4600 .+3       /JMS I DINGP
0664    0511  6141          6141           /LINC
0665    0512  0467          SKP
0666    0513  0400  DINGP,  DING           /POINTER TO SUBR
0667                /KEYBOARD TESTS
0670    0514  0415  U2,     KST            /KEY STRUCK?
0671    0515  6401          JMP R2         /NO, BACK TO PLT
0672    0516  0500  T3,     IOB            /YES, GET CHAR
0673    0517  6036          KRB
0674    0520  1460          SAE I 0        /SKIP IF EQUAL
0675    0521  0203          203            /↑C
0676    0522  0467          SKP            /NO
0677    0523  6020          JMP 20         /YES, START OVER
0700    0524  1460          SAE I 0
0701    0525  0204          204            /↑D
0702    0526  6535          JMP T4         /NO
0703    0527  0642          LDF 2          /YES, CALL DIAL
0704    0530  0720          0720
0705    0531  4270          4270
0706    0532  0643          LDF 3
0707    0533  0602          LIF 2
0710    0534  6016          JMP 16
0711    0535  1460  T4,     SAE I 0
0712    0536  0325          325            /U
0713    0537  0467          SKP            /NO
0714    0540  6627          JMP U3         /YES, ADD 50
0715    0541  1460          SAE I 0
0716    0542  0261          261            /1
0717    0543  0467          SKP            /NO
0720    0544  6676          JMP NEWG       /NEW PLOT
0721    0545  1460          SAE I 0
0722    0546  0262          262            /2
0723    0547  0467          SKP            /NO
0724    0550  6676          JMP NEWG       /NEW PLOT
0725    0551  1460          SAE I 0
0726    0552  0260          260            /0
0727    0553  0467          SKP            /NO
0730    0554  6676          JMP NEWG       /NEW PLOT
0731    0555  1460          SAE I 0
0732    0556  0263          263            /3
0733    0557  6563          JMP .+4        /NO
0734    0560  1020          LDA I          /RPLC 3 WITH 4
0735    0561  0004          0004
0736    0562  6676          JMP NEWG       /NEW PLOT
0737    0563  1460          SAE I 0
0740    0564  0315          315            /M (MULTIPLY)
0741    0565  6575          JMP .+10       /NO
0742    0566  1020          LDA I          /GET INSTRUCTION
0743    0567  1156          ADM 16
0744    0570  4642          STC MF1        /PUT IN MF1
0745    0571  1020          LDA I          /GET NOP
0746    0572  0016          NOP
0747    0573  4643          STC MF2        /PUT IN MF2
0750    0574  6633          JMP MU1        /GO TO MULTIPLY
```

```
0751    0575  1460          SAE I 0
0752    0576  0306          306              /F (DIVIDE)
0753    0577  6607          JMP .+10         /NO
0754    0600  1020          LDA I            /SAME AS MULT
0755    0601  0341          SCR 1            /SEQUENCE
0756    0602  4642          STC MF1
0757    0603  1020          LDA I
0760    0604  1056          STA 16
0761    0605  4643          STC MF2
0762    0606  6633          JMP MU1
0763    0607  1460          SAE I 0
0764    0610  0304          304              /D
0765    0611  6401          JMP R2           /NO, ILLEGAL KEY
0766    0612  1020          LDA I 0          /SUBTRACT 50
0767    0613  7715          -62
0770    0614  4622          STC  W3
0771    0615  0077  V3,      SET I 17
0772    0616  1467          1777-310
0773    0617  0076          SET I 16
0774    0620  3377          3377
0775    0621  1020          LDA I 0
0776    0622  7715  W3,      -62
0777    0623  1176          ADM I 16
1000    0624  0237          XSK I 17
1001    0625  6621          JMP  .-4
1002    0626  6401          JMP R2
1003    0627  1020  U3,      LDA I 0
1004    0630  0062          62
1005    0631  4622          STC  W3
1006    0632  6615          JMP V3
1007    0633  0077  MU1,     SET I 17  /MULT-DIV ROUTINE
1010    0634  1467          1777-310         /SET CNTR
1011    0635  0076          SET I 16         /AND POINTER
1012    0636  3377          3377
1013    0637  1036          LDA I 16         /GET BIN
1014    0640  1460          SAE I 0          /SKIP 6466 (0)
1015    0641  6466          6466
1016    0642  0000  MF1,     0  /ADM 16 (MULT), SCR 1 (DIV)
1017    0643  0000  MF2,     0  /NOP (MULT), STA 16 (DIV)
1020    0644  0237          XSK I 17
1021    0645  6637          JMP .-6          /NOT FINISHED
1022    0646  6401          JMP R2           /BACK TO DISPLAY
1023                /PLOT POINT
1024                /SUBROUTINE
1025    0647  0000          0 /SCRATCH
1026    0650  0000  Q2,      0 /SCALING EXP
1027    0651  0044  V2,      SET 4
1030    0652  0000          0
1031    0653  0460          SNS I 0
1032    0654  6657          JMP  .+3
1033    0655  0141          DIS 01
1034    0656  6004          JMP 4
```

```
1035    0657  1040          STA 00
1036    0660  0650          V2-1
1037    0661  0141          DIS 01
1040    0662  1020          LDA I 0
1041    0663  7776          -1
1042    0664  1140          ADM 00
1043    0665  0650          V2-1
1044    0666  1460          SAE I 0
1045    0667  7413          -364
1046    0670  6661          JMP  .-7
1047    0671  6004          JMP  4
1050    0672  0000  E3,     0
1051    0673  0000          0
1052    0674  0000          0       /SCRATCH
1053    0675  7400  M5,     7400
1054    0676  0002  NEWG,    PDP     /NEW GRAPH
1055                        PMODE   /ENTER WITH SIZE IN AC
1056    2677  0103          AND MAS2        /0007
1057    2700  4303          JMS MOVE        /MOVE BUFFER
1060    2701  5702          JMP I .+1
1061    2702  2377          GRAPH           /GO TO GRAPH
1062    2703  0000  MOVE,    0               /C(AC)=SEGMENT
1063    2704  7041          CIA             /FORM NEG
1064    2705  3075          DCA HOLD        /- SEG IN HOLD
1065    2706  1032          TAD C4          /1400
1066    2707  3065          DCA CO1         /DEST
1067    2710  1105          TAD M11         /-400
1070    2711  3066          DCA CO2         /COUNT
1071    2712  1106          TAD M12         /6466
1072    2713  3465          DCA I CO1       /PUT IN ALL
1073    2714  2065          ISZ CO1         /OF TABLE
1074    2715  2066          ISZ CO2
1075    2716  5312          JMP .-4         /NOT FINISHED
1076    2717  1075          TAD HOLD
1077    2720  7440          SZA             /WAS HOLD 0?
1100    2721  5332          JMP .+11        /NO
1101    2722  1352          TAD D9-1        /ISZ CO1
1102    2723  3353          DCA D9          /BUMP DEST TWICE
1103    2724  7040          CMA             /-1
1104    2725  3075          DCA HOLD        /FIX HOLD
1105    2726  1105          TAD M11         /-400
1106    2727  7130          CLL CML RAR     /-200
1107    2730  3066          DCA CO2         /NEW COUNT
1110    2731  5336          JMP .+5
1111    2732  1074          TAD S2          /NOP
1112    2733  3353          DCA D9          /DONT BUMP TWICE
1113    2734  1105          TAD M11         /-400
1114    2735  3066          DCA CO2         /COUNTER
1115    2736  1032          TAD C4          /1400
1116    2737  3065          DCA CO1         /DESTINATION
1117    2740  1115          TAD C16         /3000
1120    2741  3067          DCA CO3         /ORIGIN
1121    2742  1075  D8,     TAD HOLD
1122    2743  3121          DCA CO5         /COUNTER
1123    2744  1467          TAD I CO3       /GET DATA
1124    2745  2067          ISZ CO3         /BUMP POINTER
1125    2746  2121          ISZ CO5
1126    2747  5344          JMP .-3         /NOT FINI
```

```
1127    2750  7440          SZA                 /IF ZERO SKIP
1130    2751  3465          DCA I CO1           /LEAVE AT 6466
1131    2752  2065          ISZ CO1             /BUMP DEST POINT
1132    2753  0000  D9,     0                   /NOP OR ISZ CO1
1133    2754  2066          ISZ CO2             /DONE?
1134    2755  5342          JMP D8              /NO
1135    2756  5703          JMP I MOVE          /YES
1136                /ROUTINE TO TYPE AN INSTRUCTION TEXT.
1137                /THE INTERVAL BUFFER OVERLAYS THIS AFTER
1140                /PRINTING INSTRUCTION TEXT
1141                *3000
1142    3000  7200          CLA
1143    3001  6046          TLS                 /SET FLAG
1144    3002  1274          TAD SP              /START OF TEXT-1
1145    3003  3010          DCA 10              /POINTER
1146    3004  1410          TAD I 10            /GET WORD
1147    3005  4225          JMS UNPAK           /UNPACK 6 BIT
1150    3006  6031          KSF                 /KEY STRUCK
1151    3007  5204          JMP .-3             /NO, GO BACK
1152    3010  6032          KCC                 /YES, CLEAR FLAG
1153    3011  1213          TAD .+2             /GET ADDR COLM
1154    3012  5203          JMP .-7             /FINISH OUTPUT
1155    3013  4156          HEAD                /TITLE ADDRESS
1156    3014  7700  MA1,    7700
1157    3015  0077  MA2,    0077
1160    3016  0000  H,      0
1161    3017  0000  H1,     0
1162    3020  7735  M43,    -43
1163    3021  7745  M33,    -33
1164    3022  0100  ONHD,   100
1165    3023  0200  THD,    200
1166    3024  0000  TST,    0
1167    3025  0000  UNPAK,  0 /ROUTINE TO TYPE 6 BIT PACKING
1170    3026  3217          DCA H1              /PACKED WORD
1171    3027  7001          IAC                 /1
1172    3030  7040          CMA                 /-2
1173    3031  3224          DCA TST             /SET SWITCH
1174    3032  1217          TAD H1              /GET WORD
1175    3033  0214          AND MA1             /7700
1176    3034  7100          CLL                 /MOVE 6 RIGHT
1177    3035  7012          RTR
1200    3036  7012          RTR
1201    3037  7012          RTR
1202    3040  3216          DCA H               /HOLD WORD
1203    3041  1216  LOO,    TAD H               /GET WORD
1204    3042  7450          SNA                 /ZERO?
1205    3043  5271          JMP FIN             /FINISHED
1206    3044  1220          TAD M43             /-43
1207    3045  7640          SZA CLA             /=43?
1210    3046  5251          JMP .+3             /NO
1211    3047  4127          JMS CRLF            /YES, CR+LF
1212    3050  5263          JMP LOP             /SKIP REST
1213    3051  1216          TAD H               /GET WORD
1214    3052  1221          TAD M33             /-33
1215    3053  7700          SMA CLA             /<33?
1216    3054  5260          JMP .+4             /NO
```

```
1217    3055  1216          TAD H           /YES
1220    3056  1222          TAD ONHD        /100
1221    3057  3216          DCA H           /HOLD
1222    3060  1216          TAD H
1223    3061  1223          TAD THD         /200
1224    3062  4021          JMS TYPE        /OUTPUT RESULT
1225    3063  1217  LOP,    TAD H1          /ORIG WORD
1226    3064  0215          AND MA2         /0077
1227    3065  3216          DCA H           /HOLD IT
1230    3066  2224          ISZ TST         /TEST SWITCH
1231    3067  5241          JMP LOO         /NOT FINISHED
1232    3070  5625          JMP I UNPAK     /FINISHED, EXIT
1233    3071  6141  FIN,    LINC;
1234                        LMODE   /ALL DONE
1235    1072  0601          LIF 1           /GO TO NEXT SECT
1236    1073  6020          JMP 20
1237                        PMODE
1240                  /FOLLOWING IS THE TEXT OF INSTRUCTIONS
1241                  /
1242                  /     INTERVAL HISTOGRAM
1243                  /
1244                  /STOP INSTRUCTION TEXT BY TYPING ANY KEY.
1245                  /
1246                  /SET THRESHOLD WITH KNOB 1.
1247                  /
1250                  /TYPE LIMIT TO SPIKE COUNT (IF ANY).
1251                  /LEADING 0S ARE REQUIRED!
1252                  /     DEFAULT AND-OR MAXIMUM IS 4095.
1253                  /
1254                  /BUILD GRAPH BY TYPING RETURN.
1255                  /
1256                  /TELETYPE DIAGNOSTICS:
1257                  /     1; NO IMPULSES FOR 4.096 SECONDS
1260                  /     2; IMPULSES MORE THAN 2.048 SECONDS APART
1261                  /     3; BASE LINE SHIFT
1262                  /         (LONGER THAN 500 MS. CONVERSION)
1263                  /
1264                  /
1265                  /TO STOP SAMPLING AND DISPLAY TYPE SPACE BAR.
1266                  /
1267                  /DURING DISPLAY:
1270                  /     SENSE SWITCH 0 PRODUCES A HISTOGRAM.
1271                  /     SENSE SWITCH 4 RINGS THE TTY BELL
1272                  /       EVERY 15 SECONDS.
1273                  /     SENSE SWITCH 5 HALTS THE PLOT,
1274                  /       PRESS CONTINUE FOR SINGLE SWEEP.
1275                  /
1276                  /  TELETYPE INTERVENTION:
1277                  /       U - SCALE UP, ADD 50
1300                  /       D - SCALE DOWN, SUBTRACT 50
1301                  /       M - MULTIPLY BY 2
1302                  /       F - DIVIDE BY 2
1303                  /       0 - DISPLAY 0-200 MS.
1304                  /       1 - DISPLAY 0-400 MS.
1305                  /       2 - DISPLAY 0-800 MS.
1306                  /       3 - DISPLAY 0-1600 MS.
1307                  /       CTRL C - RESTART
1310                  /       CTRL D - CALL MONITOR
```

```
1311                    /
1312                    /
1313                    /IF COMPUTER JUMPS TO DISPLAY, AN
1314                    /OVERFLOW HAS OCCURED FOR THE PRESET
1315                    /LIMIT OR THE TOTAL COUNT.
1316                    /
1317                    /
1320                    /SWITCH RESTARTS (LINC MODE):
1321                    /     2020; SAMPLE
1322                    /     2400; DISPLAY
1323                    /
1324                    /
1325                    /
1326                    /     TOTAL  FREQUENCY       TIME    MISSED.
1327                    /
1330    3074    3074    SP,     .       /START OF TEXT POINTER
1331                    /START OF TEXT
1332                            NOLIST
1424                    /END OF TEXT
1425    4207    0000            0000            /TERMINAL
1426    4210    4210            .
1427                            *200
1430                    /FLOATING POINT OPERATE INSTRUCTIONS
1431                    FNOR=7000
1432                    FMPY=3000
1433                    FEXT=0000
1434                    FADD=1000
1435                    FDIV=4000
1436                    FGET=5000
1437                    FPUT=6000
1440    0200    7200            CLA
1441    0201    6046            TLS             /SET FLAG
1442    0202    4127            JMS CRLF
1443    0203    1070            TAD C04         /GET TOTAL COUNT
1444    0204    4272            JMS FLOAT       /FLOAT IT
1445    0205    4406            JMS I 6         /OUTPUT TOTAL
1446    0206    1112            TAD SEC         /(4.096/INC)
1447    0207    4272            JMS FLOAT       /PUT IN FAC
1450    0210    4407            JMS I 7         /ENTER INTERPRET
1451    0211    3123            FMPY FP4096     /X 4096
1452    0212    6112            FPUT SEC        /HOLD
1453    0213    0000            FEXT
1454    0214    1111            TAD MS          /GET MS.
1455    0215    4272            JMS FLOAT       /FLOAT MS
1456    0216    4407            JMS I 7         /INTERP
1457    0217    1112            FADD SEC        /ADD SECONDS
1460    0220    4322            FDIV FP1000     /CONVERT TO SEC.
1461    0221    6112            FPUT SEC        /HOLD
1462    0222    0000            FEXT
1463    0223    1070            TAD C04         /TOTAL AGAIN
1464    0224    4272            JMS FLOAT       /FLOAT IT
1465    0225    4407            JMS I 7         /INTERP
1466    0226    4112            FDIV SEC        /AVERAGE
1467    0227    0000            FEXT
1470    0230    1116            TAD C17         /DECIMAL PLACES
1471    0231    4406            JMS I 6         /OUTPUT AVERAGE
1472    0232    4407            JMS I 7         /INTERP
1473    0233    5112            FGET SEC        /GET SEC
```

```
1475    0235  1116          TAD C17          /DEC
1476    0236  4406          JMS I 6          /OUTPUT SECONDS
1477                /NOW CHECK FOR COUNT > 1.6 MS.
1500    0237  1110          TAD M14          /-337
1501    0240  3065          DCA CO1          /COUNT
1502    0241  1120          TAD C19          /4440
1503    0242  3066          DCA CO2          /ORIGIN
1504    0243  3070          DCA CO4          /OFLO CNTR
1505    0244  1122          TAD CO7          /GET "2" COUNT
1506    0245  7100          CLL
1507    0246  1466          TAD I CO2        /TALLY MISSED
1510    0247  2066          ISZ CO2          /COUNTS
1511    0250  7430          SZL              /OVERFLOW?
1512    0251  2070          ISZ CO4          /YES
1513    0252  2065          ISZ CO1          /NO
1514    0253  5245          JMP .-6          /NOT DONE
1515    0254  4272          JMS FLOAT        /FLOAT TOTAL
1516    0255  4407          JMS I 7          /INTERP
1517    0256  6112          FPUT SEC         /HOLD IT
1520    0257  0000          FEXT
1521    0260  1070          TAD CO4          /4096 OFLOW
1522    0261  4272          JMS FLOAT        /FLOAT OVERFLOW
1523    0262  4407          JMS I 7          /INTERP
1524    0263  3123          FMPY FP4096      /CORRECT
1525    0264  1112          FADD SEC         /FINAL TOTAL
1526    0265  0000          FEXT
1527    0266  4406          JMS I 6          /OUTPUT MISSED
1530    0267  4127          JMS CRLF
1531    0270  5671          JMP I .+1        /CROSS PAGE JUMP
1532    0271  2377          GRAPH
1533                FLOAT=. /ROUTINE TO FLOAT AC INTO FAC
1534    0272  0000          0
1535    0273  7510          SPA              />2048?
1536    0274  2315          ISZ FPFL         /YES, SET SWITCH
1537    0275  0104          AND MAS3         /3777
1540    0276  3045          DCA 45      /PUT IN HIGH FAC
1541    0277  3046          DCA 46      /0 TO LOW FAC
1542    0300  1316          TAD FLC13  /11 INTO EXPONENT
1543    0301  3044          DCA 44           /EXP
1544    0302  4407          JMS I 7 /CALL INTERPRETER
1545    0303  7000          FNOR    /NORMALIZE
1546    0304  0000          FEXT
1547    0305  1315          TAD FPFL         /CHECK SWITCH
1550    0306  7450          SNA              /SET?
1551    0307  5672          JMP I FLOAT      /NO, EXIT
1552    0310  4407          JMS I 7          /YES, ADD 2048
1553    0311  1317          FADD FP2048
1554    0312  0000          FEXT
1555    0313  3315          DCA FPFL         /CLEAR SWITCH
1556    0314  5672          JMP I FLOAT      /EXIT
1557    0315  0000  FPFL,    0
1560    0316  0013  FLC13,   0013
1561    0317  0014  FP2048,  0014
1562    0320  2000          2000
1563    0321  0000          0000
1564    0322  0012  FP1000,  0012
1565    0323  3750          3750
1566    0324  0000          0
```

```
1567                        *400
1570                DING=. /ROUTINE TO RING TTY BELL 15 SEC.
1571    0400  0000          0
1572    0401  7200          CLA
1573    0402  1640          TAD I SWITP       /TEST SWITCH
1574    0403  7440          SZA               /FIRST TIME?
1575    0404  5225          JMP BEL           /NOT FIRST TIME
1576    0405  1235          TAD BELT          /FIRST TIME
1577    0406  6133          CLAB              /15 SEC.
1600    0407  6135          CLSA              /CLEAR OVERFLOW
1601    0410  7201          CLA IAC           /1
1602    0411  3640          DCA I SWITP       /SET SWITCH
1603    0412  1030          TAD C2            /0100
1604    0413  6134          CLEN              /CLOCK INTERUPT
1605    0414  7200          CLA
1606    0415  1236          TAD BELT+1        /1100
1607    0416  6132          CLLR              /FAST CLOCK
1610    0417  6131          CLSK              /QUICK SET
1611    0420  5217          JMP .-1
1612    0421  7200          CLA
1613    0422  1237          TAD BELT+2        /5100
1614    0423  6132          CLLR              /SLOW CLOCK
1615    0424  6135          CLSA              /CLEAR OFLOW
1616    0425  6131  BEL,    CLSK              /CHECK OVERFLOW
1617    0426  5600          JMP I DING        /NOT YET
1620    0427  7200          CLA               /YES
1621    0430  1063          TAD C13
1622    0431  6046          TLS               /DING!
1623    0432  7200          CLA
1624    0433  3640          DCA I SWITP       /RESET SWITCH
1625    0434  5600          JMP I DING
1626    0435  5063  BELT,   -2715             /CORRECTED -1500
1627    0436  1100          1100
1630    0437  5100          5100
1631    0440  2505  SWITP,  SWIT
1632                /PAGE 0 REFERENCES, WATCH FPP2 LOCATIONS
1633                        *5
1634    0005  7400          7400              /FLOATING
1635    0006  7200          7200              /POINT
1636    0007  5600          5600              /ENTRIES
1637                        *20
1640    0020  0000  T1,     0
1641                TYPE=. /ROUTINE TO OUTPUT AC ON TTY
1642    0021  0000          0
1643    0022  6041          TSF               /READY
1644    0023  5022          JMP .-1           /NO
1645    0024  6046          TLS               /OUTPUT
1646    0025  7200          CLA               /EXIT AC CLEAR
1647    0026  5421          JMP I TYPE        /EXIT
1650    0027  2500  C1,     2500              /CLOCK CONTROL
1651    0030  0100  C2,     0100
1652    0031  7754  C3,     7754
1653    0032  1400  C4,     1400
1654    0033  0261  C6,     0261
1655    0034  0262  C7,     0262
1656    0035  0263  C9,     0263
1657    0036  0215  C11,    0215
1660    0037  0212  C12,    0212
```

```
1661                        *40
1662                  /SPACE 40-54 FOR FPP2 - LEAVE ALONE!
1663                        *55               /FLAGS FOR
1664    0055  7777          7777              /FLOATING
1665    0056  7777          7777              /POINT
1666    0057  0000          0                 /OPERATING
1667    0060  0000          0                 /SYSTEM
1670    0061  0000          0                 /
1671    0062  0012          0012              /
1672    0063  0207  C13,     0207
1673    0064  0400  C15,     0400
1674    0065  0000  CO1,     0
1675    0066  0000  CO2,     0
1676    0067  0000  CO3,     0
1677    0070  0000  CO4,     0
1700    0071  0000  ICO1,    0
1701    0072  0000  ICO2,    0
1702    0073  2020  S1,      ISZ T1            /FOR INCT1
1703    0074  7000  S2,      NOP               /FOR INCT1
1704    0075  0000  HOLD,    0
1705    0076  0000  MAXCIA,  0
1706    0077  0000  LIMIT,   0
1707    0100  3000  M4,      -5000
1710                /M5 IN LINC FIELD
1711    0101  7000  M6,      -1000
1712    0102  1777  MAS1,    1777
1713    0103  0007  MAS2,    0007
1714    0104  3777  MAS3,    3777
1715    0105  7400  M11,     -400
1716    0106  6466  M12,     6466              /ZERO FOR PLOT
1717    0107  6000  M13,     -2000
1720    0110  7441  M14,     -337
1721    0111  0000  MS,      0
1722    0112  0000  SEC,     0                 /SPACE TO FLOAT
1723    0113  0000          0
1724    0114  0000          0
1725    0115  3000  C16,     3000
1726    0116  0003  C17,     0003
1727    0117  0004  C18,     0004
1730    0120  4440  C19,     4440
1731    0121  0000  CO5,     0
1732    0122  0000  CO7,     0
1733    0123  0015  FP4096,  0015
1734    0124  2000          2000
1735    0125  0000          0000
1736    0126  2703  MOVEP,   MOVE
1737                CRLF=./SUBROUTINE TO TYPE C RTN + L FEED
1740    0127  0000          0
1741    0130  1036          TAD C11           /215 (RTN)
1742    0131  4021          JMS TYPE
1743    0132  1037          TAD C12           /212 (LF)
1744    0133  4021          JMS TYPE
1745    0134  5527          JMP I CRLF
1746                        DECIMAL
1747    0135  7773  M1,      -5
1750    0136  7776  M2,      -2
1751    0137  7770  M3,      -8
```

```
0000  ERRORS

BEL     0425
BELT    0435
BUMP    2365
CNRLOP  2137
CNTLIM  2201
CO1     0065
CO10    1106
CO2     0066
CO3     0067
CO4     0070
CO5     0121
CO6     1101
CO7     0122
CRLF    0127
C06     1111
C1      0027
C1001   1100
C11     0036
C12     0037
C13     0063
C15     0064
C16     0115
C17     0116
C18     0117
C19     0120
C2      0030
C3      0031
C3002   1077
C4      0032
C6      0033
C7      0034
C9      0035
DING    0400
DINGP   2513
DIS     2360
D1      2261
D2      2353
D3      2350
D4      2046
D5      2336
D7      2277
D8      2742
D9      2753
END     2355
E3      2672
FADD    1000
FDIV    4000
FEXT    0000
FF      2017
FGET    5000
```

```
FIN      3071
FINSH    2124
FLC13    0316
FLOAT    0272
FMPY     3000
FNOR     7000
FPFL     0315
FPUT     6000
FP1000   0322
FP2048   0317
FP4096   0123
GRAPH    2377
H        3016
HEAD     4156
HOLD     0075
H1       3017
ICO1     0071
ICO2     0072
IN       1102
INC      1013
INCT1    2271
INST     3075
KRB      6036
KSF      6031
LIMIT    0077
LOO      3041
LOP      3063
LSTN     2075
MAS1     0102
MAS2     0103
MAS3     0104
MAXCIA   0076
MA1      3014
MA2      3015
MF1      2642
MF2      2643
MI1      1107
MI5      1076
MOVE     2703
MOVEP    0126
MS       0111
MULT     2216
MU1      2633
M1       0135
M11      0105
M12      0106
M13      0107
M14      0110
M2       0136
M3       0137
M33      3021
M4       0100
M43      3020
M5       2675
M6       0101
M70      1112
```

```
NEG     2314
NEWG    2676
ONHD    3022
PRSET   2205
PTR     1056
PTR2    1067
Q2      2650
READIN  1051
R2      2401
SEC     0112
SP      3074
START   2226
STRT    1006
SWIT    2505
SWITP   0440
S1      0073
```