```
FFFFFFFFFFFFFFF    CCCCCCCCCCCC LLL                111        111        888888888
FFFFFFFFFFFFFFF    CCCCCCCCCCCC LLL                111        111        888888888
FFFFFFFFFFFFFFF    CCCCCCCCCCCC LLL                111        111        888888888
FFF             CCC             LLL             111111     111111     888      888
FFF             CCC             LLL             111111     111111     888      888
FFF             CCC             LLL             111111     111111     888      888
FFF             CCC             LLL                111        111     888      888
FFF             CCC             LLL                111        111     888      888
FFF             CCC             LLL                111        111     888      888
FFFFFFFFFFFF    CCC             LLL                111        111        888888888
FFFFFFFFFFFF    CCC             LLL                111        111        888888888
FFFFFFFFFFFF    CCC             LLL                111        111        888888888
FFF             CCC             LLL                111        111     888      888
FFF             CCC             LLL                111        111     888      888
FFF             CCC             LLL                111        111     888      888
FFF             CCC             LLL                111        111     888      888
FFF             CCC             LLL                111        111     888      888
FFF             CCC             LLL                111        111     888      888
FFF                CCCCCCCCCCCC LLLLLLLLLLLLLLL 111111111  111111111     888888888
FFF                CCCCCCCCCCCC LLLLLLLLLLLLLLL 111111111  111111111     888888888
FFF                CCCCCCCCCCCC LLLLLLLLLLLLLLL 111111111  111111111     888888888
```

FOCAL-8
duplicate.

```
LPTSPL VERSION 4(137)  RUNNING ON LPTØ
 *START* USER 21MITCHELL,M [4ØØ,235Ø] JOB  FCL118 SEQ, 1Ø289 DATE 18-JAN-74 16:ØØ:Ø3 MONITOR CS/2 5Ø6B 1Ø77 RF6B9K *START*
REQUEST CREATED: 18-JAN-74  15:59:59
FILE: DSKBØ:FCL118[4ØØ,235Ø] CREATED: 18-JAN-74 15:56:ØØ PRINTED: 18-JAN-74 16:Ø5:17
QUEUE SWITCHES:  /FILE:ASCII /COPIES:2 /SPACING:1 /LIMIT:482
FILE WILL BE DELETED AFTER PRINTING
```

```
                /FOCAL-8
                /DEC-8E-LFOCA-A-LA1

                /OCTOBER 1971                       RM/SM

                /COPYRIGHT 1971 DIGITAL EQUIPMENT CORPORATION
                /       MAYNARD, MASSACHUSETTS 01754

                /FOCAL IS A REGISTERED TRADEMARK OF
                /DIGITAL EQUIPMENT CORPORATION

                /FOCAL-8 IS AN ON-LINE FORMULA CALCULATOR AND
                /COMPILER FOR STATEMENTS IN ALGEBRAIC LANGUAGE
                /THIS VERSION OF FOCAL-8 IS SUPPORTED ON THE PDP-8/E

                /ASSEMBLY INSTRUCTIONS:
                /.R PAL8 OR .R PAL10
                /*FOCAL8,FOCAL8-FOCAL8,FLOAT
```

```
                /NOTES ON LISTING COMMENTS:
                /
                /THE LIMITS OF PAGE BOUNDARY WANDERING ARE DENOTED BY:
                /
                /-------------------------------------------------------
                /PAGE BOUNDARY
                /-------------------------------------------------------
                /
                /LOCATIONS OVERLAYED BY THE 8K OVERLAY ARE DENOTED BY     /*8K*
                /
                /PSEUDO-FLOATING POINT INSTRUCTIONS
                /
                FIXMRI FPOW=5000
                FIXMRI FADD=1000
                FIXMRI FSUB=2000
                FIXMRI FMUL=4000
                FIXMRI FDIV=3000
                FIXMRI FGET=0000
                FIXMRI FPUT=6000
                /
7000    FNOR=7000
0000    FEXT=0
0000    FXIT=0
4407    FINT=JMS I 7
6014    RFC=6014
6101    SMP=6101
6030    KCF=6030
```

```
                        /MISCELLANEOUS ITEMS
                0001    *1
0001    5403            JMP I .+2       /INTERRUPT PROCESSOR ENTRY .
0002    5403            JMP I .+1       /(USED BY PDP-5)
0003    2603            INTRPT
0004    0004    DDTJR,  DDTJR   /USED FOR DEBUGGING
0005    0013    P13,    13      /CONSTANT
0006    0100    C100,   100     /CONSTANT
                0007    *7
0007    6400            FPNT    /ADDRESS OF FLOATING POINT INTERPRETER

                        /AUTO-INDEX REGISTERS - (START OF SAVE BY QUAD)

0010    0000    AXIN,   0       /STORAGE INDEX (LOC *10)
0011    0000    XRT,    0       /EXTRA XR
0012    0000    XRT2,   0       /EXTRA XR
0013    4370    PDLXR,  BEGIN-1 /PUSHDOWN LIST INDEX REGISTER.
0014    3117    FLTXR,  IOBUF-1 /XR FOR FLOATING POINT
0015    0000    FLTXR2, 0       /EXTRA FOR F,P,
0016    7402    TELSW,  HLT     /TELETYPE IN PROGRESS SWITCH

                0017    TEXTP=, /TEXT POINTERS (LOC *17)
0017    3215    AXOUT,  FRSTX   /OUTPUT INDEX
0020    0000    XCT,    0       /UNPACK SWITCH
0021    0000    GTEM,   0       /UNPACK STORAGE
0022    2407    PC,     FLTZER  /PROGRAM COUNTER                    /*8K*

0023    0000    THISLN, 0       /LINE POINTER FROM 'FINDLN'
0024    0000    THISOP, 0       /CURRENT 'EVAL' OPERATION
0025    0000    LASTLN, 0       /BACK POINTER FROM 'FINDLN'
0026    0001    DEBGSW, 1       /DEBUG SWITCH  ; NON-ZERO FOR LITERAL,
0027    0000    PACKST, 0       /RUBOUT PROTECTION
0030    0000    PT1,    0       /VARIABLE POINTER
0031    3217    LASTV,  BUFBEG  /ADDRESS OF LAST VARIABLE       /*8K*
0032    0000    T1,     0       /TEMPORARY REGISTER - MAIN
0033    0000    T3,     0       /TEMP REGISTER FOR OUTPUT
0034    0000    INBUF,  0       /KEYBOARD INPUT BUFFER
0035    4370    BOTTOM, BEGIN-1 /LAST LOCATION CURRENTLY AVAILABLE IN FIELD ZERO **
0036    0000    INSUB,  0       /0= GETC; #0 = READC
0037    0000    HINBUF, 0       /HIGH SPEED INPUT BUFFER
```

```
                        /  *40 = FLOATING POINT

                0054    *54

                        /VARIABLES   -   INITIALIZED FOR THE DIALOGUE

0054  0000     SORTCN, 0       /NUMBER IN TABLE FROM SORTC
0055  0000     LASTOP, 0       /LAST OPERATION FOR EVAL
        0056    EFOP=.          /FUNCTION CODE,
0056  0000     ATSW,   0       /ASK-TYPE SWITCH
0057  7760     CNTR,   -20     /DELETE AND ERROR COUNTER(USED BY F.P. ALSO)

        0060    STARTV=.        /=END FOR 8K

0060  3217     BUFR,   BUFBEG  /NEXT LOCATION IN BUFFER = LAST LOCATION OF TEXT/*8K*

0061  1354     ADD,    OUTL    /CHAR. BUF. IN.  (DEBUG AIDS,SEE BELOW,)
0062  2414     XCTIN,  I33     /PACK SWITCH
0063  2676     OUTDEV, XOUTL   /POINTER TO OUT. SUB.   (OUTL)-FOR DEBUGGING
0064  2666     INDEV,  XI33    /POINTER TO IN. SUB.    (I33)-FOR DEBUGGING

0065  0001     NAGSW,  0001    /NOT ALL AND/OR GROUP SWITCH(4000=ONE;1=ALL;0=GROUP);(0000)-FOR TSS-8
0066  0215     CHAR,   215     /THE MOST IMPORTANT REGISTER
0067  0000     LINENO, 0000    /LINE NUMBER READ BY GETLN;(0400)-FOR TSS-8
0070  0005     GINC,   WORDS+2 /=6 FOR 4-WORD = CONSTANT

0071  0000     T2,     0       /TEMP REGISTER = FOR NEW INST. ROUTINES.


                        /FOR DEBUGGING, SET OUTL AND I33 INTO OUTDEV AND INDEV;
                        /ALSO PATCH THE ERROR ROUTINE = FOUR
                        /PATCHES PLUS TWO FOR THE HIGH SPEED READER,


        0072    LIST6=, /INPUT LIST FOR "SFOUND",
0072  0214               214     /F,F,
0073  0207               207     /BELL
        0074    LIST7=,
0074  0203               203     /CONTROL-C FOR DEBUGGING AND TSS8
0075  0337     P337,   337     /LEFT ARR
0076  0212     CLF,    212     /L,F,
        0077    LIST3=, /EXCRETION LIST
0077  0215     CCR,    215     /LIST BRANCHER,
0100  7402     DMPSW,  HLT     /(SEARCH CHARACTER)-VARIABLE
                        /=0000 FOR TRACE ON,


                        /THE REST OF PAGE ZERO IS PURE TO THE MULTI-USER SYSTEM
```

```
                0101    M100=.
0101    7700    P7700,  7700    /LEFT MASK
0102    0256    PER,    256     /PERIOD
0103    7701    M77,    -77     /EXTEND CODE TEST
0104    7600    P7600,  7600    /GROUP MASK
0105    7760    M20,    -20     /CONSTANT
0106    0177    P177,   177     /STEP MASK
0107    0017    P17,    17      /BCD MASK
0110    0277    P277,   277     /"?"
0111    7776    M2,     -2      /CONSTANT
0112    7477    MINUSA, -301    /CONSTANT
0113    0260    C260,   260     /ASCII FOR ZERO
0114    7540    M240,   -240    /SPACE TEST
0115    7522    MPER,   -256    /PERIOD TEST
0116    7563    MCR,    -215    /C,R, TEST
0117    7775    MFLT,   -WORDS  /= -4 FOR 4-WORD
0120    7773    M5,     -5      /PAREN TEST
0121    7767    M11,    -11     /PAREN TEST
0122    0077    P77,    77      /RIGHT MASK
0123    0200    C200,   200     /CONSTANTS
0124    4000    P4000,  4000    /NAGSW TEST CONSTANT (FOR PDP-5)

0125    2030    FLARGP, FLARG   /DATA ADDRESS
0126    2155    PTCH,   CHIN    /GENERAL CHARACTER INPUT ROUTINE,
0127    5715    DOUBLE, MULT2   /MULTIPLY FLAC BY 2
0130    6000    FOUTPUT,FLOUTP  /FLOATING OUTPUT
0131    6200    FINPUT, FLINTP  /FLOATING INPUT
0132    3140    COMBUF, COMEIN  /COMMAND BUFFER START   /*8K*
0133    3206    CFRS,   FRST    /ADDRESS OF DUMMY LINE  /*8K*
0134    3140    END,    COMEIN  /FIRST LOCATION USED IN 8K,
0135    3217    ENDT,   BUFBEG  /START OF STORAGE AREA  /*8K*
0136    2017    EFUN3I, EFUN3   /FUNCTION RETURN
0137    2407    CFRSX,  FLTZER  /POINTER TO ZERO DATA

                /'FINPUT' USES CHAR AND GETC OR READC TO DEVELOP
                /A NUMBER WHICH IS THEN STORED VIA PT1,

        0003    WORDS=3 /OR 4
```

```
                        /NEW INSTRUCTIONS:

                4540    PUSHJ=JMS I .   /RECURSIVE SUBROUTINE CALL
0140    0521            XPUSHJ
                1413    POPA=TAD I PDLXR/RESTORE AC
                5541    POPJ=JMP I .    /SUBROUTINE RETURN
0141    1565            XPOPJ
                4542    PUSHA=JMS I .   /SAVE AC
0142    0477            XPUSHA
                4543    PUSHF=JMS I .   /SAVE GROUP OF DATA
0143    0534            PD2
                4544    POPF=JMS I .    /RESTORE GROUP
0144    0554            PD3
                4545    GETC=JMS I .    /UNPACK A CHARACTER
0145    2274            UTRA
                4546    PACKC=JMS I .   /PACK A CHARACTER
0146    2502            PACBUF
                4547    SORTJ=JMS I .   /SORT AND BRANCH ON AC OR CHAR
0147    1314            SORTB
                4550    SORTC=JMS I .   /SORT CHAR
0150    0721            XSORTC
                4551    PRINTC=JMS I .  /PRINT AC OR CHAR
0151    2465            OUT
                4552    READC=JMS I .   /READ DATA INTO CHAR AND PRINT IT
0152    2155    RDIV,   CHIN
                4553    PRNTLN=JMS I .  /PRINT C(LINENO)
0153    2425            XPRNT
                4554    GETLN=JMS I .   /UNPACK AND FORM A LINENUMBER
0154    0302            XGETLN
                4555    FINDLN=JMS I .  /SEARCH FOR A GIVEN LINE
0155    2242            XFIND
                4556    ENDLN=JMS I .   /INSERT LINE POINTERS
0156    2360            XENDLN
                4557    RTL6=JMS I .    /ROTATE LEFT SIX
0157    0413            XRTL6
                4560    SPNOR=JMS I .   /IGNORE SPACES AND LEADING ZEROS
0160    1517            XSPNOR
                4561    TESTN=JMS I .   /PERIOD; OTHERS NUMBER
0161    1533            XTESTN
                4562    TSTLPR=JMS I .  /SKIP IF 5<SORTCN<= 11 (I.E, AN L-PAR)
0162    2035            LPRTST
                4563    TSTGRP=JMS I .  /SKIP IF G(AC) = G4LINENG)
0163    0744            GRPTST
                4564    TESTC=JMS I .   /TERM; NUMBER; FUNCTION; LETTER- AND IGNORE SPACES.
0164    0700            XTESTC
                4565    DELETE=JMS I .  /REMOVE OLD TEXT LINE
0165    2062    PSIN,   XDELETE
                4566    ERROR2=JMS I .  /EXCESS SOMETHING ERROR
                4566    ERROR3=JMS I .  /MISCELLANEOUS ERROR
                4566    ERROR4=JMS I .  /FORMAT ERROR
0166    2726            ERR2

                        /167-174 ARE USED BY 8K OVERLAY         /*8K*
                        /175 IS USED BY QUAD
```

```
                        /COMMAND/INPUT DRIVER
                
                0176    *176
0176    4371            BEGIN           /BECOMES XINT=3
0177    7610    START,  SKP CLA         /PROGRAM START FROM SELF
0200    5576            JMP I .-2       /CONSOLE START: SW=200  /*8K*
0201    1137            TAD CFRSX       /(PC) => 0
0202    3022            DCA PC          /FOR COMMAND MODE
0203    7001            IAC             /USE ONE IN THE AC TO
0204    3100            DCA DMPSW       /INIT UNPACK AND TRACE SWITCH
0205    3026            DCA DEBGSW      /ENABLE TRACE FOR INPUT OF (?)
0206    1226            TAD COMBOT      /PROTECT COMMAND BUFFER
0207    3013            DCA PDLXR       /NO PATCH TEST
0210    1225            TAD CSTAR       /TYPE * TO INDICATE COMMAND MODE
0211    4551            PRINTC
0212    1132    IBAR,   TAD COMBUF      /INITIALIZE COMMAND BUFFER
0213    3010            DCA AXIN        /FOR UNPACKING
0214    3062            DCA XCTIN
0215    1132            TAD COMBUF      /RUBOUT PROTECTION
0216    3027            DCA PACKST
0217    4552    IGNOR,  READC           /READ COMMAND STRING
0220    4547            SORTJ
0221    0073            LIST7-1
0222    0474            INLIST-LIST7
0223    4546            PACKC           /SAVE STRING CHARACTER,
0224    5217            JMP IGNOR
0225    0252    CSTAR,  252             /ACKNOWLEDGE CHARACTER
0226    3220    COMBOT, COMEOUT+12      /END OF COMMAND BUFFER,LESS PROTECTION COUNT/*8K*
```

```
                        /COMMAND/INPUT PROCESSOR
                        
0227  4546  IRETN,  PACKC           /START TO PACK C,R,
0230  4546           PACKC           /FINISH C,R,
0231  1132           TAD COMBUF      /INITIALIZE "TEXTP"
0232  3017  GONE,    DCA AXOUT       /SETUP CURRENT LINE
0233  3020           DCA XCT
0234  4545           GETC            /READ FIRST CHARACTER,
0235  1035           TAD BOTTOM      /INIT PUSH-DOWN-LIST
0236  3013           DCA PDLXR
0237  4560           SPNOR           /IGNORE LEADING BLANKS
0240  4561           TESTN           /DOES THE LINE BEGIN WITH 1-9?
0241  5362           JMP GZERR       /PERIOD =ILLEGAL GROUP ZERO USAGE
0242  5271           JMP INPUTX      /NO
0243  2026           ISZ DEBGSW      /YES,DISABLE TRACE FOR REPACKING
0244  4554           GETLN           /READ THIS LINE NUMBER
0245  1124           TAD P4000       /TEST  FOR SINGLE LINE,
0246  1065           TAD NAGSW
0247  7640           SZA CLA
0250  4566           ERROR3          /ILLEGAL LINE NUMBER ON INPUT
0251  1060           TAD BUFR        /SET POINTERS
0252  3010           DCA AXIN
0253  3062           DCA XCTIN
0254  1067           TAD LINENO      /SAVE LINE #
0255  3410           DCA I AXIN                          /*8K*
0256  4560           SPNOR           /IGNORE SPACES AFTER LINE NUMBER
0257  7410           SKP
0260  4545           GETC            /READ 1ST AFTER LINENO TERMINATOR,
0261  4546  SRETN,   PACKC           /SAVE TEXT AND RESTORE DATA FIELD
0262  1066           TAD CHAR        /TEST FOR END OF INPUT STRING
0263  1116           TAD MCR
0264  7640           SZA CLA
0265  5260           JMP .-5
0266  4565           DELETE          /REMOVE OLD LINE, IF ANY,
0267  4556           ENDLN           /INSERT NEW LINE
0270  5177           JMP START       /POINTERS MUST BE REINITIALIZED
0271  4540  INPUTX,  PUSHJ           /PROCESS IMMEDIATE COMMAND,
0272  0611           PROC
0273  1422           TAD I PC        /CHECK NEXT LINE                    /*8K*
0274  7450           SNA             /END OF PROGRAM?
0275  5177           JMP START       /YES
0276  3022           DCA PC          /SAVE NEW LINE NO,
0277  1022           TAD PC          /START NEW LINE
0300  7001           IAC
0301  5232           JMP GONE        /PROCESS OTHER COMMANDS

                        /TEXT LINE BUFFER FORMAT*

                        /#1 ; POINTER OR ZERO IN LAST
                        /#2 : LINENO
                        /#3 - #N+1 : TEXT
                        /#N ; C,R,
```

```
                        /LINE NUMBER FORMATION
                        
0302  0000  XGETLN, 0              /DEVELOP I,D, = "GETLN"
0303  4560          SPNOR          /IGNORE LEADING SPACES,
0304  1066          TAD CHAR       /"ALL" IS A SPECIAL ARGUMENT,
0305  1112          TAD MINUSA
0306  7650          SNA CLA
0307  5322          JMP TESTA
0310  3036          DCA INSUB      /CALL 'GETC' FROM 'INPUT' VIA 'DECON'
0311  4771          JMS I LCON     /(DECONV - IN FLOAT,)
0312  1047          TAD FLAC+3     /GROUP TOO LARGE?
0313  0372          AND P7740
0314  1046          TAD FLAC+2
0315  7640          SZA CLA
0316  4566          ERROR2         /GROUP NUMBER TOO LARGE
0317  1047          TAD FLAC+3
0320  4557          RTL6
0321  7004          RAL
0322  3067  TESTA,  DCA LINENO
0323  4561          TESTN          /TEST3
0324  4545          GETC           /READ STEP NUMBER,
0325  4561          TESTN          /TEST4, OTHER
0326  5340          JMP GERR       /DOUBLE PERIODS
0327  5352          JMP GEXIT      /OTHER
0330  1054          TAD SORTCN     /NUMBER
0331  7106          RTL CLL
0332  1054          TAD SORTCN
0333  7004          RAL
0334  1067          TAD LINENO
0335  3067          DCA LINENO
0336  4545          GETC           /READ SECOND STEP NUMBER,
0337  4561          TESTN          /TEST4, OTHER
0340  4566  GERR,   ERROR4         /DOUBLE PERIODS
0341  5352          JMP GEXIT      /OTHER
0342  1054          TAD SORTCN     /NUMBER
0343  1067          TAD LINENO
0344  3067          DCA LINENO
0345  4545          GETC           /TEST FOR CORRECT TERMINATOR
0346  4561          TESTN          /CHECK SIZE
0347  5340          JMP GERR       /,
0350  7410          SKP
0351  4566          ERROR2         /TOO LARGE A LINE NUMBER,
```

```
                                
0352  7100  GEXIT,  CLL              /CLEAR LINK BIT
0353  1067          TAD LINENO       /TEST FOR GROUP NUMBER,
0354  0104          AND P7600
0355  7640          SZA CLA
0356  7020          CML
0357  1067          TAD LINENO
0360  0106          AND P177         /REPARE "NAGSW"
0361  7460          SNL SZA
0362  4566  GZERR,  ERROR2           /0,X = ERROR:ILLEGAL LINE NUMBER,
0363  7640          SZA CLA
0364  1373          TAD P2000
0365  7020          CML
0366  7004          RAL
0367  3065          DCA NAGSW
0370  5702          JMP I XGETLN     /--RETURN--
0371  5600  LCON,   DECONV
0372  7740  P7740,  7740
0373  2000  P2000,  2000
                    /-----------------------------------------------------------
                    
                    /RANGE OF ACCEPTIBLE LINE NUMBERS = 1,01 TO 31,99
                    /NAGSW:
                    
                    /GROUP=0000
                    /LINE=4000
                    /ALL=0001
                    
                    /LIST OF FUNCTION ADDRESSES, (NAMES ARE IN "FNTABL")
                    
      0374  FNTABF=.
0374  2014          XABS    /FABS   -ABSOLUTE VALUE
0375  2010          XSGN    /FSGN   -SIGN PART
0376  1160          XINT    /FITR   -INTEGER PART
0377  2725          ERROR5  /FY     (USER DEFINED)
0400  1553          XRAN    /FRAN   -RANDOM NUMBER
0401  2725          ERROR5  /FZ     (USER DEFINED)
0402  5000          ARTN    /FATN   -ARCTANGENT
0403  4620          FEXP    /FEXP   -E↑X
0404  5040          FLOG    /FLOG   -LN(X)
0405  5205          FSIN    /FSIN   -SINE
0406  5200          FCOS    /FCOS   -COSINE
0407  7400          XSQRT   /FSQT   -SQUARE ROOT
0410  2725          ERROR5  /FNEW   (USER DEFINED)
0411  2725          ERROR5  /FCOM   (LIBRA OR USER DEFINED)
0412  2725          ERROR5  /FX     (USER DEFINED)
                    
                    /-----------------------------------------------------------
0413  0000  XRTL6,  0       /ROTATE AC LEFT SIX - "RTL6"
0414  7106          CLL RTL
0415  7006          RTL
0416  7006          RTL
0417  5613          JMP I XRTL6      /--RETURN--
```

```
                        /RECURSIVE OPERATE, EXECUTE, OR CALL
                        
0420  4554  DO,   GETLN          /EXECUTE ONE LINE, A GROUP,OR ALL
0421  1022        TAD PC         /SAVE ADDRESS
0422  4542        PUSHA          /OF CURRENT LINE
0423  4543        PUSHF          /SAVE REST OF THIS LINE
0424  0017        TEXTP          /ADDRESS OF TEXT POINTERS
0425  4543  DGRP, PUSHF          /SAVE NAGSW; CHAR; AND LINENO,
0426  0065        NAGSW
0427  1065        TAD NAGSW      /CHECK DATA FROM GETLN,
0430  7710        SPA CLA        /SKIP IF GROUP OR ALL
0431  5263        JMP DOONE      /DO ONE LINE
0432  4555        FINDLN         /INIT FOR GROUP AND SET THISLN
0433  7000        NOP
0434  1023        TAD THISLN     /TEST FOR GOOD GROUP NUMBER,
0435  3011        DCA XRT
0436  1411        TAD I XRT                      /*8K*
0437  4563        TSTGRP
0440  4566        ERROR2         /NO SUCH GROUP NUMBER
0441  4540  DGRP1, PUSHJ          /EXECUTE OBJECT LINE AND SET PC,
0442  0606        PROCESS-2
0443  4544        POPF           /RESTORE THE DATA
0444  0065        NAGSW
0445  1422        TAD I PC       /CHECK FOR END OF TEXT  /*8K*
0446  7450        SNA
0447  5271        JMP DCONT      /ALL DONE
0450  7001        IAC
0451  3030        DCA PT1        /SAVE POINTER TO LINENO
0452  1065        TAD NAGSW      /CHECK FOR GROUP
0453  7740        SMA SZA CLA
0454  5260        JMP .+4        /DO ALL
0455  1430        TAD I PT1      /TEST GROUP     /*8K*
0456  4563        TSTGRP
0457  5271        JMP DCONT      /NOT IN GROUP
0460  1430        TAD I PT1      /READ NEXT LINE NO,     /*8K*
0461  3067        DCA LINENO
0462  5225        JMP DGRP       /CONTINUE THE SUBROUTINE
0463  4555  DOONE, FINDLN         /FIND THE LINE
0464  4566        ERROR2         /NO SUCH LINE NUMBER
0465  4540        PUSHJ          /EXECUTE IT
0466  0610        PROCESS
0467  4544        POPF           /RESTORE CHAR
0470  0065        NAGSW
0471  4544  DCONT, POPF           /RESTORE TEXT POINTERS
0472  0017        TEXTP
0473  1413        POPA           /RESTORE ADDRESS OF CURRENT LINE,
0474  3022        DCA PC
0475  5676        JMP I .+1      /CONTINUE PROCESSING THIS LINE,
0476  0611        PROC
```

```
                        /PUSHDOWN LIST CONTROLS
                        
0477  0000  XPUSHA, 0                 /PUSHDOWN THE AC - "PUSHA"
0500  3071          DCA T2            /BACKUP POINTER
0501  7040          CMA               /AND THEN
0502  4310          JMS PCHK          /CHECK CORE USAGE
0503  1071          TAD T2            /OK
0504  3413          DCA I PDLXR       /PUSH DOWN LIST POINTER
0505  7040          CMA               /BACKUP AGAIN
0506  4310          JMS PCHK
0507  5677          JMP I XPUSHA      /--RETURN--
                        
0510  0000  PCHK,    0
0511  1013          TAD PDLXR         /INC IN AC
0512  3013          DCA PDLXR
0513  1013          TAD PDLXR
0514  7141          CIA CLL
0515  1031          TAD LASTV
0516  7630          SZL CLA
0517  4566          ERROR3            /STORAGE FILLED BY PUSH-DOWN LIST
0520  5710          JMP I PCHK        /--RETURN--
                        
0521  0000  XPUSHJ, 0                 /RECURSIVE SUBROUTINE CALL - "PUSHJ"
0522  1721          TAD I XPUSHJ
0523  3071          DCA T2            /SAVE SUBR, ADDR,
0524  7040          CMA
0525  4310          JMS PCHK
0526  1321          TAD XPUSHJ
0527  7001          IAC
0530  3413          DCA I PDLXR       /SAVE RETURN
0531  7040          CMA
0532  4310          JMS PCHK
0533  5471          JMP I T2          /TRANSFER CONTROL
                        
0534  0000  PD2,     0                 /SAVE A FLOATING POINT NUMBER - "PUSHF"
0535  7240          CLA CMA           /COMPUTE VARIABLE ADDR
0536  1734          TAD I .-2
0537  3011          DCA XRT
0540  2334          ISZ PD2           /FIX RETURN
0541  1117          TAD MFLT          /COMPUTE PUSH, POINTER
0542  4310          JMS PCHK
0543  1117          TAD MFLT
0544  3071          DCA T2
0545  1411          TAD I XRT
0546  3413          DCA I PDLXR
0547  2071          ISZ T2
0550  5345          JMP .-3
0551  1117          TAD MFLT          /RESET POINTER
0552  4310          JMS PCHK
0553  5734          JMP I PD2         /--RETURN--
```

```
                                
0554  0000  PD3,   0               / RESTORE A FLOATING POINT NUMBER = "P0PF"
0555  7240          CLA CMA         /GET VAR, ADDR,
0556  1754          TAD I PD3
0557  2354          ISZ PD3
0560  3011          DCA XRT
0561  1117          TAD MFLT
0562  3071          DCA T2
0563  1413          TAD I PDLXR     /MOVE
0564  3411          DCA I XRT
0565  2071          ISZ T2
0566  5363          JMP .-3
0567  5754          JMP I PD3       /--RETURN--
                    /-------------------------------------------------------------
      0570  INLIST=.        /INPUT CONTROL CHARACTERS
0570  1154          XINT-4          /CTRL/C = BREAK
0571  0212          IBAR            /B,A, = RESTART
0572  0217          IGNOR           /L,F, = IGNORE
0573  0227          IRETN           /C,R, = TERMINATE STRING

0574  1075  FLIST2, FLIMIT         /,=STANDARD
0575  1137          FINFIN          /;=SHORT
0576  2725          ERROR5          /CR=DUMB

0577  1065  FLIST1, FINCR          /,=STANDARD FORMAT
0600  0610          PROCESS         /;=SET;PLUS ,,,
0601  0614          PC1             /C,R,=SET COMMAND,

0602  7472  MF,     -306            /USED BY TESTC
```

```
                        /PRIMARy CONTROL AND TRANSFER
                        
0603  4554  GOTO,     GETLN           /READ THE LINE NUMBER REQUESTED
0604  4555             FINDLN          /LOCATE IT AND RESET TEXTP
0605  4566             ERROR2          /NOT THERE
0606  1023             TAD THISLN      /SET PC
0607  3022             DCA PC
                       /--------------------------------------------------------------
0610  4545  PROCESS,GETC              /TEST FOR END OF LINE
0611  1066  PROC,     TAD CHAR        /FIRST CHARACTER READY = USE PROC
0612  1116             TAD MCR
0613  7650             SNA CLA
0614  5541  PC1,      POPJ            /EXIT "PROCESS"
0615  4550             SORTC           /IGNORE "SPACE",",", AND ";",
0616  1376             GLIST-1
0617  5210             JMP PROCESS
0620  1066             TAD CHAR        /SAVE COMMAND CHARACTER
0621  0075             AND P337        /EXECUTE LOWER CASE ALSO
0622  4542             PUSHA
0623  4545             GETC            /GO TO TERMINATOR
0624  4550             SORTC
0625  1376             GLIST-1
0626  7410             SKP
0627  5223             JMP .-4
0630  1413             POPA
0631  4547             SORTJ           /GO DO COMMAND
0632  0773             COMLST-1
0633  0167             COMGO-COMLST
0634  4566             ERROR2          /ILLEGAL COMMAND

      0614  COMMENTS=PC1              /ALSO IS CONTINUE
```

```
                        /OUTPUT COMMAND TEXT
0635  4554  WRITE,  GETLN           /SET LINENO
0636  2026          ISZ DEBGSW      /DISABLE TRACE
0637  4555          FINDLN          /SEARCH FOR LINE NUMBER
0640  5267          JMP WTESTG      /NOT THERE OR GROUP
0641  1067          TAD LINENO
0642  7640          SZA CLA
0643  4553          PRNTLN          /PRINT LINE NUMBER AND A SPACE,
0644  4545          GETC
0645  4551          PRINTC          /PRINT TEXT OF A LINE,
0646  1066          TAD CHAR
0647  1116          TAD MCR
0650  7640          SZA CLA         /SKIP IF END OF LINE
0651  5244          JMP .-5
0652  1423          TAD I THISLN
0653  7450  WTEST2, SNA
0654  5271          JMP WX-2
0655  7001          IAC
0656  3030          DCA PT1         /SAVE POINTER TO LINENO OF NEXT
0657  1065          TAD NAGSW
0660  7700          SMA CLA
0661  1430          TAD I PT1                       /*8K*
0662  4563          TSTGRP          /TRY NEXT LINENO FOR GROUP,
0663  5273          JMP WX
0664  1430  WALL,   TAD I PT1       /SET LINEN      /*8K*
0665  3067          DCA LINENO
0666  5237          JMP WRITE+2
0667  1023  WTESTG, TAD THISLN      /INIT GROUP PRINTOUT
0670  5253          JMP WTEST2
0671  3026          DCA DEBGSW
0672  5541          POPJ
0673  1065  WX,     TAD NAGSW
0674  7750          SPA SNA CLA     /SKIP IF ALL
0675  5271          JMP WX-2
0676  4551          PRINTC          /PRINT C.R. AGAIN
0677  5264          JMP WALL
```

```
                                /TEST THE NATURE OF THE NEXT ALPHANUMERIC = "TESTC"
0700  0000  XTESTC, 0
0701  4560         SPNOR        /IGNORE SPACES
0702  4550         SORTC        /TEST THE VARIABLE TERMINATORS
0703  1767         TERMS-1
0704  5700         JMP I XTESTC /YES - SORTCN IS SET--RETURN--
0705  1066         TAD CHAR     /NO
0706  2300         ISZ XTESTC
0707  1202         TAD MF
0710  7650         SNA CLA      /TEST FOR "F"
0711  5317         JMP XT3
0712  4561         TESTN
0713  5700         JMP I XTESTC /,--RETURN--
0714  7410         SKP          /OTHER
0715  5700         JMP I XTESTC /NUMBER--RETURN--
0716  2300         ISZ XTESTC
0717  2300  XT3,    ISZ XTESTC   /RETURNS:TINIFIA
0720  5700         JMP I XTESTC /--RETURN--

                                /SORT CHAR AGAINST TABLE = "SORTC"
0721  0000  XSORTC, 0
0722  1721         TAD I XSORTC
0723  3012         DCA XRT2     /1ST ARG IS LIST-1
0724  1412         TAD I XRT2
0725  7510         SPA          /LIST IS ENDED BY A NEGATIVE NUMBER
0726  5340         JMP SEXC     /2AND EXIT = NOT IN LIST
0727  7041         CIA
0730  1066         TAD CHAR
0731  7640         SZA CLA      /COMPARE
0732  5324         JMP .-6
0733  1721         TAD I XSORTC /COMPUTE INCREMENT : 0 - N
0734  7040         CMA
0735  1012         TAD XRT2
0736  3054         DCA SORTCN
0737  7410         SKP          /1ST EXIT = YES
0740  2321  SEXC,   ISZ XSORTC
0741  2321         ISZ XSORTC
0742  7300         CLA CLL
0743  5721         JMP I XSORTC /--RETURN--
```

```
                        GRPTST, 0       /AC VS LINENO - "TSTGRP"
0744  0000                  AND P7600
0745  0104                  CIA
0746  7041                  DCA T2
0747  3071                  TAD LINENO
0750  1067                  AND P7600
0751  0104                  TAD T2
0752  1071                  SNA CLA
0753  7650                  ISZ GRPTST
0754  2344                  JMP I GRPTST    /--RETURN--
0755  5744
                        /INPUT FROM TEXT OR KEYBOARD;
                        /IF BACK-ARROW, RESTART INPUT

0756  0000            INPUT,  0             /INPUT A CHARACTER
0757  1036                  TAD INSUB       /NON-ZERO FOR KEYBOARD
0760  7640                  SZA CLA
0761  5364                  JMP .+3
0762  4545                  GETC
0763  5756                  JMP I INPUT     /--RETURN--
0764  4552                  READC
0765  4547                  SORTJ
0766  6776                  SPECIAL-1
0767  3402                  INFIX-SPECIAL
0770  5756                  JMP I INPUT     /--RETURN--

0771  1035            ILIST,  IF1           /,
0772  0610                  PROCESS         /;
0773  0614                  PC1             /CR

                              /ENGLISH-FRENCH
      0774            COMLST=.              /COMMAND DECODING LIST
0774  0323                    323     /SET    - ORGANIZE
0775  0306                    306     /FOR    - QUAND
0776  0311                    311     /IF     - SI
0777  0304                    304     /DO     - FAIZ
1000  0307                    307     /GOTO   - VA
1001  0303                    303     /COMMENT- COMMENTE
1002  0301                    301     /ASK    - DEMANDE
1003  0324                    324     /TYPE   - TAPE
1004  0314                    314     /LIBRARY- ENTREPOSE
1005  0305                    305     /ERASE  - BIFFE
1006  0327                    327     /WRITE  - INSCRIS
1007  0315                    315     /MODIFY - MODIFIE
1010  0321                    321     /QUIT   - ARRETE
1011  0322                    322     /RETURN - RETOURNE
1012  0212                    212     /(ASTERISK)=EXPANDABLE COMMAND

                        /THIS COMMAND LIST IS SPEED OPTIMIZED,
```

```
                        /CONDITIONAL TRANSFER PROCESS.
                        
1013  4564  IF,       TESTC             /IGNORE SPACES AND TEST
                        /-------------------------------------------------------
1014  4637              JMS I IECALL      /T
1015  2013              ISZ PDLXR         /N=DUMP THE (EFOP)
1016  4640              JMS I IPART       /F=CHECK FOR PAREN MATCH
1017  1111              TAD M2            /A
1020  3032              DCA T1
1021  1045              TAD FLAC+1        /TEST -,0,+
1022  7510              SPA
1023  2032              ISZ T1            /N=TO   -1,-2,-3
1024  7750              SPA SNA CLA
1025  2032  IF3,       ISZ T1            /COUNT COMMAS
1026  7410              SKP
1027  5767              JMP I COMGO+4     /TRANSFER
1030  4547              SORTJ             /SEARCH TEXT UNTILL ,;C,R,
1031  1377              TLIST-1
1032  7371              ILIST-TLIST
1033  4545              GETC
1034  5230              JMP .-4
1035  4545  IF1,       GETC              /MOVE PAST COMMA
1036  5225              JMP IF3
1037  1601  IECALL, ECALL
1040  2047  IPART,  PARTEST
```

```
                        /LOOP CONTROL STATEMENT
                        
                1041    SET=,                   /SUBSET OF "FOR",
                
1041    4540    FOR,    PUSHJ                   /LOOPS, ETC,
1042    1403            GETARG                  /LOOK FOR "=" NEXT
1043    4560            SPNOR                   /IGNORE SPACES
1044    1066            TAD CHAR
1045    1335            TAD MEQ
1046    7440            SZA
1047    4566            ERROR4                  /LEFT OF "=" IN ERROR: 'FOR' OR 'SET'
1050    1030            TAD PT1
1051    4542            PUSHA                   /SAVE POINTER TO VARIABLE
1052    4540            PUSHJ
1053    1612            EVAL-1                  /GET INITIAL VALUE EXPRESSION
1054    1413            POPA
1055    3030            DCA PT1
1056    4407            FINT                    /INITIALIZE NOW,
1057    6430            FPUT I PT1
1060    0000            FXIT
1061    4547            SORTJ                   /TEST LAST CHAR FROM "EVAL"
1062    1377            TLIST-1
1063    7177            FLIST1-TLIST
1064    4566            ERROR4                  /EXCESS R-PAR
1065    1030    FINCR,  TAD PT1                 /SAVE VARIABLE ADDRESS *
1066    4542            PUSHA
1067    4540            PUSHJ                   /EVALUATE THE INCREMENT,IF ANY,
1070    1612            EVAL-1
1071    4547            SORTJ                   /TEST TERMINATORS
1072    1377            TLIST-1
1073    7174            FLIST2-TLIST
1074    4566            ERROR4                  /ILLEGAL TERMINATOR IN 'FOR'
1075    4543    FLIMIT, PUSHF                   /SAVE THE INCREMENT,    *
1076    2030            FLARG
1077    4540            PUSHJ                   /GET THE LIMIT(NO ERROR DETECTION AFTER LIMIT)
1100    1612            EVAL-1
1101    4543    FCONT,  PUSHF                   /SAVE THE LIMIT *
1102    2030            FLARG
1103    4543            PUSHF                   /SAVE TEXT OF OBJECT STATEMENTS
1104    0017            TEXTP
1105    4540            PUSHJ                   /DO THE OBJECT STATEMENTS
1106    0610            PROCESS
1107    4544            POPF                    /RESTORE REMAINING TEXT.
1110    0017            TEXTP
1111    4544            POPF                    /GET LIMIT
1112    2030            FLARG
1113    4544            POPF                    /GET INCREMENT
1114    7470            ITER1
1115    1413            POPA                    /GET VARIABLE ADDRESS
1116    3030            DCA PT1
```

```
                                        FINT            /INCREMENT AND TEST
                                        FGET I PT1      /LOAD THE VARIABLE
                                        FADD I FINKP    /INCREMENT IT
                                        FPUT I PT1      /CHANGE IT
                                        FSUB I FLARGP   /TEST IT
                                        FXIT
                                        TAD FLAC+1
                                        SMA SZA CLA
                                        POPJ            /END OF LOOP
                                        TAD PT1
                                        PUSHA           /SAVE ADDRESS *
                                        PUSHF           /SAVE INCREMENT AGAIN *
                                FINKP,  ITER1
                                        JMP FCONT
                                MEQ,    -275
                                MCOM,   -254
                                FINFIN, PUSHF           /SET INCREMENT TO ONE.
                                        FLTONE
                                        JMP FCONT

                                /PATCH TO WRITE ROUTINE
                                /INSERTS 2 NULL CHARACTERS (CODE 200)
                                / AFTER EACH OUTPUT CARRIAGE RETURN

                                XDYS,   TAD C200        /OUTPUT NULL CHARACTER
                                        PRINTC
                                        TAD C200
                                        PRINTC
                                        TAD I THISLN                    /*BK*
                                        SNA             /XDYS+5
                                        JMP I .+2
                                        JMP I .+2
                                        WX=2
                                        WTEST2+2
                                /---------------------------------------------------------------
                                /CTRL/C HANDLER
                                        TAD C200
                                        DCA LINENO
                                        JMP I .+1
                                        RECOVR+1


                                /TAKE THE INTEGER PART

                                XINT,   JMS I INTEGER   /(FIX)
                                        CLA
                                        JMP I EFUN3I
```

```
                1163    COMGO=, /COMMAND ROUTINE ADDRESSES
1163  1041              SET
1164  1041              FOR
1165  1013              IF
1166  0420              DO
1167  0603              GOTO            /(REFERENCED)
1170  0614              COMMENT
1171  1202              ASK
1172  1203              TYPE
1173  7503              LIBRARY
1174  2204              ERASE
1175  0635              WRITE
1176  1256              MODIFY
1177  0177              START   /RETURN TO COMMAND MODE VIA 'QUIT'
1200  1563              RETRN
1201  6361              HSPX    /ACTIVATE THE HIGH SPEED READER


                        /-------------------------------------------------------
                        /INPUT-OUTPUT STATEMENTS

1202  7240    ASK,    CLA CMA         /REMEMBER WHICH CALL;
1203  3056    TYPE,   DCA ATSW
1204  4547    TASK,   SORTJ           /SPECIAL CHARACTER?
1205  1371            ALIST-1
1206  0176            ATLIST-ALIST
1207  2056            ISZ ATSW        /TEST QUOTE SWITCH
1210  5225            JMP TYPE2
1211  4540            PUSHJ           /DO ASK; SETUP PT1
1212  1403            GETARG
1213  1066            TAD CHAR        /SAVE IN-LINE CHARACTER.
1214  4542            PUSHA
1215  1255            TAD COL         /TYPE COLON
1216  4551            PRINTC          /(CLA)- TO SUPRESS ":"
1217  2036            ISZ INSUB       /INDICATE 'READC'
1220  7001            IAC             /POINT PAST CHAR
1221  4531            JMS I FINPUT    /READ DATA AND SAVE
1222  1413            POPA            /RE-TEST LAST TERMINATOR
1223  3066            DCA CHAR
1224  5202            JMP ASK         /CONTINUE PROCESSING
1225  4540    TYPE2,  PUSHJ           /DO TYPE
1226  1613            EVAL
1227  4530            JMS I FOUTPUT   /PRINT
1230  5203            JMP TYPE
```

```
                                                                
                                                                
                                                                
1231  2026    TQUOT,  ISZ DEBGSW      /DISABLE TRACE
1232  4545            GETC            /TYPE LITERALS
1233  4547            SORTJ
1234  1403            TLIST2-1
1235  0773            TLIST3-TLIST2
1236  4551            PRINTC
1237  5232            JMP TQUOT+1
1240  4545    TINTR,  GETC            /PASS PERCENT SIGN
1241  4554            GETLN           /READ FORMAT CONTROL: "%7,03"
1242  1067            TAD LINENO
1243  3052            DCA FISW        /SAVE FORMAT CODE
1244  5204            JMP TASK
1245  1077    TCRLF2, TAD CCR         /SPLAT=CR ALONE
1246  4463            JMS I OUTDEV
1247  7001            IAC             /NON-PRINTING DELAY FOR CR (216)
1250  1077    TCRLF,  TAD CCR         /EXCLAMATION POINT=CR,LF,
1251  4551            PRINTC
1252  3026    TASK4,  DCA DEBGSW      /RE-ENABLE THE TRACE
1253  4545            GETC            /MOVE TO NEXT CHARACTER
1254  5204            JMP TASK
1255  0272    COL,    272             /":"
                                                                
                                                                
                                                                
                        /IF DEBGSW=0 ; ENABLE FLIP-FLOP "DMPSW"
                        /       #0: DISABLE AND RETURN ALL"?" ' S,
                        /IF DMPSW = 0: TRACE ON, IF ENABLED
                        /       #0: TRACE OFF
                        /IF BOTH = 0 ; PRINT TRACE,
                                                                
                                                                
```

```
                        /SEARCH ROUTINES
1256  4554  MODIFY, GETLN           /READ LINE NO,
1257  4555          FINDLN          /LOOK IT UP NOW,
1260  4566          ERROR2          /NOT THERE = BAD COMMAND UNLESS ZERO,
1261  1060          TAD BUFR        /SET POINTERS
1262  3010          DCA AXIN        /FOR INPUT
1263  3062          DCA XCTIN
1264  1067          TAD LINENO      /COPY THE SAME LINE NUMBER,
1265  3410          DCA I AXIN                      /*8K*
1266  1010          TAD AXIN        /SAVE START OF NEW LINE
1267  3027          DCA PACKST
1270  4464  SCONT,  JMS I INDEV     /READ THE TELETYPE INPUT SILENTLY,
1271  3100          DCA LIST3+1     /SAVE SEARCH CHARACTER
1272  2026          ISZ DEBGSW      /NO BREAKS,
1273  4545  SCHAR,  GETC           /TYPE*TEST-F,F,
1274  4551          PRINTC          /PLAYBACK THE TEXT
1275  4547          SORTJ           /LOOK FOR MATCH
1276  0076          LIST3-1
1277  1271          LISTGO-LIST3
1300  4546          PACKC           /SAVE NEW LINE,
1301  5273          JMP SCHAR
1302  1060  SBAR,   TAD BUFR        /RESTART-B,A,
1303  7001          IAC
1304  3010          DCA AXIN        /SET POINTERS
1305  3062          DCA XCTIN
1306  4552  SFOUND, READC          /READ FROM KEYBOARD
1307  4547          SORTJ           /TEST
1310  0071          LIST6-1
1311  1271          SRNLST-LIST6
1312  4546  SGOT,   PACKC          /PACK CHAR,
1313  5306          JMP SFOUND      /MORE
```

```
                                
1314  0000  SORTB,  0       /SORT AND BRANCH ROUTINE, = "SORTJ"
1315  7450          SNA
1316  1066          TAD CHAR        /ASSUME CHAR IF AC=0
1317  7041          CIA
1320  3071          DCA T2          /SAVE SORT ITEM
1321  1714          TAD I SORTB     /FIRST ARG IS LIST LESS ONE
1322  2314          ISZ SORTB       /2AND IS INTRA-LIST LENGTH
1323  3012          DCA XRT2
1324  1412          TAD I XRT2
1325  7510          SPA             /**LISTS ENDED BY NEGATIVE NUMBERS**
1326  5340          JMP SEX         /READ EXIT
1327  1071          TAD T2          /FIND ADDRESS
1330  7640          SZA CLA
1331  5324          JMP .-5
1332  1012          TAD XRT2        /MATCH FOUND,
1333  1714          TAD I SORTB
1334  3071          DCA T2
1335  1471          TAD I T2
1336  3071          DCA T2          /DEBUG ; AC = ADDRESS
1337  5471          JMP I T2
1340  2314  SEX,    ISZ SORTB       /MATCH NOT FOUND,
1341  7300          CLA CLL
1342  5714          JMP I SORTB     /--RETURN--
                                
                                
                                
                      /OUTPUT CARRIAGE RETURN BEFORE ERROR MESSAGE
                                
1343  1077  XADC,   TAD CCR         /OUTPUT CARRIAGE RETURN/LINE FEED
1344  4551          PRINTC
1345  1110          TAD P277        /OUTPUT QUESTION MARK
1346  4551          PRINTC
1347  5750          JMP I .+1
1350  2765          RECOVX+4
1351  7600          7600            /XADC+6  USED BY L COMMAND
1352  7402          HLT
1353  7402          HLT
```

```
        1354  0000    OUTL,   0               /SLOW OUTPUT FOR ODT SYNCRONIZATION
        1355  6046            TLS             /AND  FOR H.S. PUNCH
        1356  6026            PLS
        1357  6041            TSF             /IOT FOR SLOWEST DEVICE
        1360  5357            JMP .-1
        1361  7200            CLA
        1362  5754            JMP I OUTL      /--RETURN--




                      /-----------------------------------------------------------------------
              1363    SRNLST=.        /'MODIFY' CONTROL CHARACTER TABLE
        1363  1273            SCHAR   /F.F. = CONTINUE
        1364  1270            SCONT   /BELL = CHANGE SEARCH CHARACTER
        1365  1154            XINT-4  /CTRL/C = BREAK
        1366  1302            SBAR    /B.A. = RESTART
        1367  1271            SCONT+1 /L.F. = FINISH THE LINE AS BEFORE.
              1370    LISTGO=.
        1370  0261            SRETN   /C.R. = END THE LINE HERE AS IS.
        1371  1312            SGOT    /CHAR = SEARCH CHARACTER





              1372    ALIST=. / ASK/TYPE LIST OF CONTROLS.
        1372  0245            245     /%
        1373  0242            242     /"
        1374  0241            241     /!
        1375  0243            243     /#
        1376  0244            244     /$
              1377    GLIST=.
        1377  0240            240     /SPACE
              1400    TLIST=.
        1400  0254            254     /,
        1401  0273            273     /;
        1402  0215            215     /C.R.
                      /THIS LIST IS ENDED BY 'TESTC'.
```

```
1032
1033                    /FIND OR ENTER A VARIABLE IN THE LIST,
1034
1035    1403  4564      GETARG, TESTC           /FIRST LETTER OF ARG
1036    1404  0242      TLIST2, 0242            /"
1037    1405  0215              0215            /C,R, - FUNCTION OR NUMBER IS NOT AN ARG,
1038    1406  4566              ERROR4          /BAD ARGUEMENT IN 'FOR', 'SET', OR 'ASK'
1039    1407  3062      GETVAR, DCA XCTIN       /PACK INTO ADD,
1040    1410  4546              PACKC
1041    1411  4545              GETC            /SECOND LETTER
1042    1412  4550              SORTC           /TERMINATOR?
1043    1413  1767              TERMS-1
1044                    /-----------------------------------------------------------------
1045    1414  5226              JMP GSERCH      /YES
1046    1415  1066              TAD CHAR        /NO
1047    1416  0122              AND P77         /SAVE 2AND LETTER OF NAME
1048    1417  1061              TAD ADD
1049    1420  3061              DCA ADD
1050    1421  4545              GETC            /IGNORE THE REST
1051    1422  4550              SORTC
1052    1423  1767              TERMS-1
1053    1424  5226              JMP GSERCH
1054    1425  5221              JMP .-4
1055    1426  4562      GSERCH, TSTLPR          /LOOK FOR SUBSCRIPT VIA SORTCN
1056    1427  5237              JMP GS1         /NOT SUBSCRIPTED BY L-PAR,
1057    1430  1061              TAD ADD         /SAVE NAME
1058    1431  3056              DCA EFOP        /FOR RECURSIVE AND ERROR CHECK
1059    1432  4660              JMS I GECALL    /TO EVAL
1060    1433  1413              POPA
1061    1434  3061              DCA ADD         /RESTORE NAME
1062    1435  4657              JMS I PTEST     /TEST PAREN MATCH, ETC,
1063    1436  4453              JMS I INTEGER   /CONVERT TO 12-BIT NUMBER,
1064    1437  3317      GS1,    DCA SUBS        /SAVE SUBSCRIPT
1065    1440  1060              TAD STARTV      /SEARCH FOR VARIABLE    /*8K*
1066    1441  3030      GS3,    DCA PT1
1067    1442  1030              TAD PT1
1068    1443  7041              CIA
1069    1444  1031              TAD LASTV       /TEST FOR END OF LIST
1070    1445  7750              SPA SNA CLA
1071    1446  5261              JMP GS2         /END SEARCH
1072    1447  1430              TAD I PT1       /GET TABLE ENTRY
1073    1450  7041              CIA
1074    1451  1061              TAD ADD
1075    1452  7650              SNA CLA
1076    1453  5305              JMP GFND1       /FOUND XX
1077    1454  1030      GS4,    TAD PT1         /TRY NEXT ONE
1078    1455  1070              TAD GINC
1079    1456  5241              JMP GS3
1080    1457  2047      PTEST,  PARTEST
1081    1460  1601      GECALL, ECALL
```

```
1082
1083
1084    1461  1031    GS2,    TAD LASTV       /ADD THE VARIABLE
1085    1462  1005            TAD P13         /TEST STORAGE LIMITS
1086    1463  7141            CIA CLL
1087    1464  1013            TAD PDLXR
1088    1465  7620            SNL CLA
1089    1466  4566            ERROR3
1090    1467  1031            TAD LASTV       /UPDATE THE LIST,
1091    1470  1070            TAD GINC
1092    1471  3031            DCA LASTV
1093    1472  1061            TAD ADD         /SAVE NAME
1094    1473  3430            DCA I PT1
1095    1474  2030            ISZ PT1         /SAVE SUBSCRIPT
1096    1475  1317            TAD SUBS
1097    1476  3430            DCA I PT1
1098    1477  2030            ISZ PT1         /SET PT1
1099    1500  4407            FINT
1100    1501  0537            FGET I CFRSX
1101    1502  6430            FPUT I PT1
1102    1503  0000            FXIT
1103    1504  5541            POPJ            /EXIT
1104    1505  1030    GFND1,  TAD PT1         /FOUND SAME
1105    1506  3011            DCA XRT         /TEST SUBSCRIPTS
1106    1507  1411            TAD I XRT
1107    1510  7041            CIA
1108    1511  1317            TAD SUBS
1109    1512  7640            SZA CLA
1110    1513  5254            JMP GS4         /WRONG SUBSCRIPT
1111    1514  2030            ISZ PT1         /SET POINTER TO DATA
1112    1515  2030            ISZ PT1
1113    1516  5541            POPJ
1114
```

```
1115
1116
1117            1517    SUBS=.
1118    1517    0000    XSPNOR, 0               /IGNORE LEADING SPACES - "SPNOR"
1119    1520    1066            TAD CHAR
1120    1521    1114            TAD M240
1121    1522    7640            SZA CLA
1122    1523    5717            JMP I XSPNOR    /--RETURN--
1123    1524    4545            GETC
1124    1525    5320            JMP XSPNOR+1
1125
1126
1127    1526    7520    M260,   -260
1128    1527    7507    M271,   -271
1129
1130
1131
1132    1530    0000    RAND,   0000    /RANDOM NUMBER STORAGE!
1133    1531    2000            2000
1134    1532    0000            0000
1135    1533    0000    XTESTN, 0               /RETURNS! ,! OTHER! NUMBER - "TESTN"
1136    1534    1066            TAD CHAR
1137    1535    1115            TAD MPER
1138    1536    7640            SZA CLA
1139    1537    2333            ISZ XTESTN
1140    1540    1066            TAD CHAR
1141    1541    1326            TAD M260
1142    1542    3054            DCA SORTCN      /SAVE VALUE OF THE NUMBER
1143    1543    1054            TAD SORTCN      /TEST IF REALLY A DIGIT.
1144    1544    7710            SPA CLA
1145    1545    5733            JMP I XTESTN    /--RETURN--
1146    1546    1066            TAD CHAR
1147    1547    1327            TAD M271
1148    1550    7750            SPA SNA CLA
1149    1551    2333            ISZ XTESTN      /IF A NUMBER
1150    1552    5733            JMP I XTESTN    /--RETURN--
1151    1553    4407    XRAN,   FINT            /PSEUDO-RANDOM NUMBER GENERATOR.
1152    1554    1330            FADD RAND       /ADD RUNNING RESULT TO THE ARGUMENT, IF ANY.
1153    1555    4350            FMUL .-5        /BLAST THE ARGUMENT
1154    1556    6330            FPUT RAND
1155    1557    0000            FXIT
1156    1560    3330            DCA RAND        /CONVERT TO .5 THROUGH .999
1157                    /-------------------------------------------------------------
1158    1561    3044            DCA FLAC        /SAME AS RETURN
1159    1562    5536            JMP I EFUN3I
1160
```

```
1161
1162                    /EXIT FROM A "DO" SUBROUTINE
1163
1164
1165    1563  1137      RETRN,  TAD CFRSX       /(PC) => 0      /*8K*
1166    1564  3022              DCA PC
1167    1565  1413      XPOPJ,  TAD I PDLXR     /RECURSIVE EXIT - "POPJ"
1168    1566  3071              DCA T2
1169    1567  5471              JMP I T2
1170
1171
1172
1173          1570      ATLIST=.          /ASK-TYPE CONTROL CHARACTER TABLE
1174    1570  1240                TINTR   /% - FORMAT DELIMITER
1175    1571  1231                TQUOT   /" - LITERAL DELIMITER
1176    1572  1250                TCRLF   /! - CARRIAGE RETURN AND LINE FEED
1177    1573  1245                TCRLF2  /# - CARRIAGE RETURN ONLY
1178    1574  3052                TDUMP   /$/- DUMP THE SYMBOL TABLE CONTENTS
1179    1575  1252                TASK4   /SP- TERMINATOR FOR NAMES
1180    1576  1252                TASK4   /, - TERMINATOR FOR EXPRESSIONS
1181    1577  0610                PROCESS /; - TERMINATOR FOR COMMANDS
1182    1600  0614                PC1     /C,R, - TERMINATOR FOR STRINGS
1183
1184                    /$ - FOR 'TDUMP' TERMINATES THE COMMAND,
1185
1186
```

```
1187
1188                    /EVALUATE AN EXPRESSION WHICH
1189                    /TERMINATES WITH AN R-PAR,; OR C,R, AND
1190                    /LEAVE THE RESULT IN FLAC AND IN FLARG,
1191
1192
1193
1194
1195                    /-----------------------------------------------------------
1196    1601  0000      ECALL,  0       /RECURSIVE CALL TO "EVAL"
1197    1602  1054              TAD SORTCN      /SAVE 'SORTCN','LASTOP',AND 'EFOP'
1198    1603  4542              PUSHA
1199    1604  1055              TAD LASTOP
1200    1605  4542              PUSHA
1201    1606  1056              TAD EFOP        /SAVE FUNCTION CODE,
1202    1607  4542              PUSHA
1203    1610  1201              TAD ECALL       /RETURN TO CALLING
1204    1611  4542              PUSHA           /ADDRESS AFTER NEXT POPJ
1205
1206    1612  4545              GETC            /MOVE PAST EXTRA CHARACTER
1207    1613  3055      EVAL,   DCA LASTOP      /EVAUATION CONTROLLER (CHECKPOINT ?)
1208    1614  4564              TESTC           /TEST CHARACTER AND IGNORE SPACES
1209    1615  5227              JMP ETERM1      /TERMINATOR
1210    1616  5332              JMP ENUM        /NUMBER
1211    1617  5343              JMP EFUN        /FUNCTION
1212    1620  4540              PUSHJ           /LETTER OF VARIABLE
1213    1621  1407              GETVAR          /FIND OR CREATE VARIABLE;ALSO SET PT1,
1214    1622  4564      OPNEXT, TESTC           /PT1=>ARG
1215    1623  5244              JMP ETERMN      /T
1216    1624  0212      ECHOLST,0212            /N=ERROR IN FORMAT
1217    1625  0377              0377            /F
1218    1626  4566              ERROR4          /L - MISSING OPERATOR
1219    1627  1137      ETERM1, TAD CFRSX       /SET PT1,
1220    1630  3030              DCA PT1         /TO POINT TO ZERO
1221    1631  1111              TAD M2          /TEST FOR UNARY OPERATIONS
1222    1632  1054              TAD SORTCN
1223    1633  7450              SNA
1224    1634  5247              JMP ETERM       /CREATE DUMMY FOR UNARY MINUS
1225    1635  7001              IAC
1226    1636  7650              SNA CLA
1227    1637  5323              JMP ARGNXT      /IGNORE UNARY PLUS
1228    1640  1054              TAD SORTCN      /TEST FOR NULL PARENS,
1229    1641  1121              TAD M11
1230    1642  7710              SPA CLA
1231    1643  5363              JMP ELPAR       /MIGHT BE AN L-PAR,
1232    1644  4562      ETERMN, TSTLPR
1233    1645  7410              SKP
1234    1646  4566              ERROR4          /OPERATOR MISSING BEFORE PAREN
1235    1647  1054      ETERM,  TAD SORTCN      /SET FROM "TESTC"-"SORTC"
1236    1650  3024              DCA THISOP
1237    1651  1024              TAD THISOP
1238    1652  1121              TAD M11
1239    1653  7700              SMA CLA         /END?
1240    1654  3024              DCA THISOP      /"THISOP" EQUIV, TO END OF EXP,
```

```
1241
1242    1655  1024    ETERM2, TAD THISOP      /COMPARE PRIORITIES
1243    1656  7041            CIA
1244    1657  1055            TAD LASTOP
1245    1660  7710            SPA CLA
1246    1661  5310            JMP EPAR        /CONTINUE
1247    1662  1055            TAD LASTOP      /FIND OPERATION
1248    1663  7112            CLL RTR
1249    1664  7012            RTR
1250    1665  1331            TAD OPTABL
1251    1666  3274            DCA FLOP
1252    1667  1055            TAD LASTOP
1253    1670  7640            SZA CLA         /TEST FOR END OF DATA INTO FLOATING AC,
1254    1671  4544            POPF            /GET LAST DATA
1255    1672  0044            FLAC
1256    1673  4407            FINT
1257    1674  0000    FLOP,   00              /(FLOPR I PT1)*=*/
1258    1675  6525            FPUT I FLARGP   /SAVE RESULT
1259    1676  0000            FXIT
1260    1677  1125            TAD FLARGP
1261    1700  3030            DCA PT1
1262    1701  1024            TAD THISOP
1263    1702  1055            TAD LASTOP      /=0?
1264    1703  7650            SNA CLA
1265    1704  5541            POPJ            /EXIT "EVAL"
1266    1705  1413            POPA            /GET PRIOR OP
1267    1706  3055            DCA LASTOP
1268    1707  5255            JMP ETERM2      /COMPARE THIS Op
1269    1710  4562    EPAR,   TSTLPR          /TEST FOR SUB-EXPRESSION
1270    1711  7410            SKP
1271    1712  5365            JMP EPAR2       /GO EVALUATE EXPRESSION
1272    1713  1055            TAD LASTOP      /CONTINUE READING THE EXPRESSION
1273    1714  4542            PUSHA           /SAVE "LASTOP",
1274    1715  1030            TAD PT1
1275    1716  3320            DCA .+2
1276    1717  4543            PUSHF           /SAVE LAST ARGUMENT
1277    1720  0000            00
1278    1721  1024            TAD THISOP      /MORE TO COME
1279    1722  3055            DCA LASTOP
1280    1723  4545    ARGNXT, GETC            /READ 1ST CHAR OF AN ARG,
1281    1724  4564            TESTC           /DO SPECIAL CHECK
1282    1725  5363            JMP ELPAR       /COULD BE LEFT PAREN
1283    1726  5332            JMP ENUM        /N
1284    1727  5343            JMP EFUN        /F
1285    1730  5220            JMP OPNEXT-2    /L
1286    1731  0430    OPTABL, FGET I PT1      /BASE FOR OPERATION COMPUTATION
```

```
1287
1288    1732  4543    ENUM,   PUSHF             /TO PROCESS A NUMBER,SAVE AC
1289    1733  0044            FLAC
1290    1734  1125            TAD FLARGP        /SET POINTER AS FOR A VARIABLE,
1291    1735  3030            DCA PT1
1292    1736  3036            DCA INSUB         /POINT TO 'GETC' AND USE CHAR
1293    1737  4531            JMS I FINPUT      /READ TEXT NUMBER => (PT1)
1294    1740  4544            POPF              /RESTORE THE AC
1295    1741  0044            FLAC
1296    1742  5222            JMP OPNEXT        /CONTINUE
1297    1743  3056    EFUN,   DCA EFOP          /SET CODE
1298    1744  4545            GETC              /READ FUNCTION NAME,(1,2,OR 3 LETTERS)
1299    1745  4550            SORTC             /LOOK FOR TERMINATION CHARACTER,
1300    1746  1767            TERMS-1
1301    1747  5354            JMP EFUN2         /YES
1302    1750  1056            TAD EFOP          /NO
1303    1751  7104            CLL RAL           /MISH-MASH HASH CODE
1304    1752  1066            TAD CHAR
1305    1753  5343            JMP EFUN
1306    1754  4562    EFUN2,  TSTLPR
1307    1755  4566            ERROR4            /MUST BE FOLLOWED BY PARENS TO SET ARGUMENT
1308    1756  4201            JMS ECALL         /CALL "EVAL" TO COMPUTE ARGUMENT
1309    1757  1413            POPA              /BRANCH ON FUNCTION CODE;RETURN VIA EFUN3I,
1310    1760  4547            SORTJ
1311    1761  2164            FNTABL-1
1312    1762  6207            FNTABF-FNTABL
1313    1763  4562    ELPAR,  TSTLPR            /LEFT PAREN OR FELL THROUGH FUNCTION TABLE
1314    1764  4566            ERROR4            /DOUBLE OPERATORS OR ILLEGAL FUNCTION NAME,
1315    1765  4201    EPAR2,  JMS ECALL         /EVALUATE NESTED EXPRESSION
1316                    /-------------------------------------------------------------
1317    1766  2013            ISZ PDLXR                   /DUMP EXTRA ARG,
1318    1767  5536            JMP I EFUN3I
```

```
1319
1320            1770    TERMS=,         /TERMINATOR TABLE FOR 'EVAL' AND 'GETVAR'
1321    1770    0240            240             /SPACE  0
1322    1771    0253            253             /+      1
1323    1772    0255            255             /-      2
1324    1773    0257            257             //      3
1325    1774    0252            252             /*      4
1326    1775    0336            336             /UP ARR 5
1327    1776    0250            250             /(      6 L-PARS
1328    1777    0333            333             /[      7
1329    2000    0274            274             /<      10
1330    2001    0251            251             /)      11 R-PARS
1331    2002    0335            335             /]      12
1332    2003    0276            276             />      13
1333    2004    0254            254             /,      14
1334    2005    0273            273             /;      15
1335    2006    0215            215             /C,R,   16
1336    2007    0275            275     /= TO END GETARG FROM 'SET'
1337
1338                    /TWO MINOR FUNCTIONS
1339
1340
1341    2010    4543    XSGN,   PUSHF           /TAKE SIGN*1 OF FLARG
1342    2011    2405            FLTONE
1343    2012    4544            POPF
1344    2013    0044            FLAC
1345                    /-------------------------------------------------------------
1346    2014    1231    XABS,   TAD FLARG+1     /TAKE ABSOLUTE VALUE OF FLAC
1347    2015    7710            SPA CLA         /SKIP TO CONTINUE
1348    2016    4451            JMS I MINSKI    /NEGATE THE FLOATING AC
1349
1350                    /CONTINUATION OF FUNCTION CALLS,
1351
1352    2017    4407    EFUN3,  FINT
1353    2020    7000            FNOR            /NORMALIZE FUNCTION RETURN
1354    2021    6230            FPUT FLARG      /SAVE FUNCTION VALUE
1355    2022    0000            FXIT
1356    2023    1125            TAD FLARGP      /SET POINTER
1357    2024    3030            DCA PT1
1358    2025    4247            JMS PARTEST
1359    2026    5627            JMP I ,+1       /FUNCTION RETURN IS OK
1360    2027    1622            OPNEXT
```

```
1361
1362  2030  0000  FLARG,  0        /DATA TEMPORARY STORAGE
1363  2031  0000          0
1364  2032  0000          0
1365  2033  0000          0
1366
1367  2034  0003  P3,     3
1368  2035  0000  LPRTST, 0                /SKIP IF LEFT PAREN, - !TSTLPR!
1369  2036  1054          TAD SORTCN
1370  2037  1121          TAD M11
1371  2040  7700          SMA CLA
1372  2041  5635          JMP I LPRTST    /--RETURN--
1373  2042  1054          TAD SORTCN
1374  2043  1120          TAD M5
1375  2044  7740          SMA SZA CLA
1376  2045  2235          ISZ LPRTST
1377  2046  5635          JMP I LPRTST    /--RETURN--
1378
1379  2047  0000  PARTEST,0              /TEST THE PAREN MATCHINGS
1380  2050  1413          POPA            /RESTORE LAST OPERATION
1381  2051  3055          DCA LASTOP
1382  2052  1234          TAD P3          /+3 TO COMPARE CODES
1383  2053  1413          POPA            /GET LAST PAREN CODE,
1384  2054  7041          CIA             /CHECK FOR PAREN MATCH,
1385  2055  1054          TAD SORTCN      /(STILL SET FROM THE LAST "EVAL")
1386  2056  7640          SZA CLA         /SKIP IF MATCH
1387  2057  4566          ERROR4          /PAREN ERROR
1388  2060  4545          GETC            /MOVE PAST R-PAR
1389  2061  5647          JMP I PARTEST   /--RETURN--
```

```
1390
1391                    /THE DELETE A LINE ROUTINE
1392
1393    2062  0000      XDELETE,0               /UNCHAIN A LINE AND RECOVER THE SPACE,
1394    2063  6002              IOF             /PROTECT POINTER CHANGES FROM INTERRUPTIONS
1395    2064  4555              FINDLN          /SETS "THISLN" AND "LASTLN",
1396    2065  5662              JMP I XDELETE   /ALREADY GONE --RETURN--
1397    2066  2026              ISZ DEBGSW      /DISABLE TRACE
1398    2067  4545              GETC            /MEASURE LENGTH
1399    2070  1066              TAD CHAR
1400    2071  1116              TAD MCR
1401    2072  7640              SZA CLA
1402    2073  5267              JMP .-4
1403    2074  1017              TAD AXOUT       /SAVE LAST ADDRESS
1404    2075  7040              CMA
1405    2076  1023              TAD THISLN
1406    2077  3057              DCA CNTR        /LENGTH < 0
1407    2100  1133              TAD CFRS        /IT IS ILLEGAL TO DELETE THE FIRST LINE
1408    2101  7041              CIA
1409    2102  1023              TAD THISLN
1410    2103  7650              SNA CLA
1411    2104  5177              JMP START       /JUST IGNORE SUCH COMMANDS
1412    2105  7000              NOP             /CHANGE DATA FIELD TO TEXT      /*8K*
1413    2106  1423              TAD I THISLN    /DISCONNECT
1414    2107  3425              DCA I LASTLN
1415    2110  1133              TAD CFRS        /START LIST AT TOP
1416    2111  3071  >DOK,       DCA T2          /EXAMINATION ADDRESS
1417    2112  1471              TAD I T2        /GET THE NEXT ADDR,
1418    2113  7450              SNA             /TEST FOR END
1419    2114  5327              JMP DONE        /YES-WRAP UP ALL,
1420    2115  3032              DCA T1          /SAVE NEXT ADDRESS,
1421    2116  1023              TAD THISLN      /COMPARE LINE POSITIONS
1422    2117  7141              CIA CLL
1423    2120  1032              TAD T1
1424    2121  7630              SZL CLA         /SKIP IF THISLN > X
1425    2122  1057              TAD CNTR        /CHANGE (X) TO ACCOUNT FOR
1426    2123  1032              TAD T1          /GARBAGE COLLECTION,
1427    2124  3471              DCA I T2
1428    2125  1032              TAD T1          /GET NEXT
1429    2126  5311              JMP DOK
```

```
1430
1431                    /GARBAGE COLLECTION
1432
1433    2127  7040  DONE, CMA             /BACKUP L FOR XR
1434    2130  1023        TAD THISLN
1435    2131  3011        DCA XRT
1436    2132  1057        TAD CNTR        /SETUP END OF HOSE
1437    2133  7040        CMA
1438    2134  1023        TAD THISLN
1439    2135  3012        DCA XRT2
1440    2136  1057        TAD CNTR        /CORRECT END OF BUFFER POINTER,
1441    2137  1060        TAD BUFR
1442    2140  3060        DCA BUFR
1443    2141  1010        TAD AXIN        /COMPUTE COUNT
1444    2142  7040        CMA
1445    2143  1012        TAD XRT2
1446    2144  3032        DCA T1
1447    2145  1010        TAD AXIN
1448    2146  1057        TAD CNTR
1449    2147  3010        DCA AXIN
1450    2150  1412        TAD I XRT2      /SIPHON LOWER PART,
1451    2151  3411        DCA I XRT
1452    2152  2032        ISZ T1
1453    2153  5350        JMP .-3
1454    2154  5263        JMP XDELETE+1   /RESET 'LASTLN','THISLN', AND DATA FIELD,
1455
1456
1457    2155  0000  CHIN, 0               /READ IN A CHARACTER SUBR, - "READC"
1458    2156  4464        JMS I INDEV
1459    2157  3066        DCA CHAR
1460    2160  4550        SORTC           /LINEFEED OR RUBOUT?
1461    2161  1623        ECHOLST-1
1462    2162  5755        JMP I CHIN      /YES
1463    2163  4551        PRINTC          /ECHO THE INPUT
1464    2164  5755        JMP I CHIN      /--RETURN--
1465                    /-------------------------------------------------------
1466
1467
1468          2165  FNTABL=.
1469    2165  2533        2533    /FABS
1470    2166  2650        2650    /FSGN
1471    2167  2636        2636    /FITR
1472    2170  0331        0331    /FY
1473    2171  2630        2630    /FRAN
1474    2172  0332        0332    /FZ
1475    2173  2572        2572    /FATN
1476    2174  2624        2624    /FEXP
1477    2175  2625        2625    /FLOG
1478    2176  2654        2654    /FSIN
1479    2177  2575        2575    /FCOS
1480    2200  2702        2702    /FSQT
1481    2201  2631        2631    /FNEW
1482    2202  2567        2567    /FCOM
1483    2203  0330        0330    /FX
```

```
1484
1485                    /ERASE SINGLE LINES, GROUPS, OR VARIABLES
1486
1487    2204  4564      ERASE,  TESTC           /TEST THE SECOND WORD, IF ANY,
1488                    /-----------------------------------------------------
1489    2205  5237              JMP ERVX        /ERASE VARIABLES
1490    2206  5222              JMP ERL         /LINES OR GROUPS
1491    2207  5213              JMP .+4         /ERROR
1492    2210  1066              TAD CHAR        /ALL TEXT
1493    2211  1112              TAD MINUSA
1494    2212  7440              SZA
1495    2213  4566              ERROR3          /BAD ARG FOR ERASE.
1496    2214  1135      ERT,    TAD ENDT        /ERASE ALL TEXT **
1497    2215  3060              DCA BUFR
1498    2216  3533              DCA I CFRS                      /*8K*
1499    2217  1060      ERV,    TAD STARTV      /ERASE VARIABLES        /*8K*
1500    2220  3031              DCA LASTV                       /*8K*
1501    2221  5177              JMP START       /POINTERS MAY BE DIFFERENT NOW.
1502    2222  4554      ERL,    GETLN           /ERASE LINES.
1503    2223  1060              TAD BUFR        /PROTECT REST OF TEXT.
1504    2224  3010              DCA AXIN
1505    2225  4565      ERG,    DELETE          /EXTRACT ONE LINE
1506    2226  2023              ISZ THISLN
1507    2227  1065              TAD NAGSW
1508    2230  7700              SMA CLA
1509    2231  1423              TAD I THISLN                    /*8K*
1510    2232  4563              TSTGRP          /SKIP IF G(AC) = G(LINENO)      /*8K*
1511    2233  5217              JMP ERV                         /*8K*
1512    2234  1423              TAD I THISLN                    /*8K*
1513    2235  3067              DCA LINENO
1514    2236  5225              JMP ERG
1515    2237  1060      ERVX,   TAD STARTV      /INIT VARIABLES MAY BE INDIRECT COMMAND/*8K*
1516    2240  3031              DCA LASTV
1517    2241  5541              POPJ
1518
```

```
1519
1520                    /ROUTINE CALLED VIA "FINDLN":
1521
1522                    /SEARCH FOR A GIVEN LINE I,D, =[ "LINENO" ]
1523                    /1ST RETURN IF NOT FOUND,
1524                    /2AND IF FOUND,
1525                    /"THISLN" = FOUND LINE OR NEXT LARGER,
1526                    /"LASTLN" = LESSER AND/OR LAST,
1527                    /"TEXTP" IS SET
1528
1529    2242  0000      XFIND,  0
1530    2243  1133              TAD CFRS          /INITIALIZE POINTERS TO FIRST LINE
1531    2244  3025              DCA LASTLN
1532    2245  1133              TAD CFRS
1533    2246  3023      FINDN,  DCA THISLN        /SAVE THIS ONE
1534    2247  1023              TAD THISLN
1535    2250  3011              DCA XRT
1536    2251  1067              TAD LINENO
1537    2252  7141              CLL CMA IAC       /CLEAR LINK AND NEGATE LINENO,
1538    2253  1411              TAD I XRT         /LINENO=0 WILL ALSO BE FOUND    /*8K*
1539    2254  7450              SNA
1540    2255  5266              JMP FEND3-1       /FOUND IT.
1541    2256  7630              SZL CLA
1542    2257  5267              JMP FEND3         /PAST IT,
1543    2260  1023              TAD THISLN        /MOVE POINTERS
1544    2261  3025              DCA LASTLN
1545    2262  1423              TAD I THISLN      /END OF TEXT? (X=MEM)
1546    2263  7440              SZA
1547    2264  5246              JMP FINDN         /NOT YET
1548    2265  7410              SKP
1549    2266  2242              ISZ XFIND         /2ND EXIT = FOUND
1550    2267  1023    FEND3,    TAD THISLN        /1ST RETURN = NOT FOUND
1551    2270  7001              IAC
1552    2271  3017              DCA AXOUT         /SET "TEXTP",
1553    2272  3020              DCA XCT
1554    2273  5642              JMP I XFIND       /--RETURN--
1555
1556
```

```
1557  2274  0000  UTRA,  0              /UNPACK CHARACTER, = "GETC"
1558  2275  4330        JMS GET1
1559  2276  7710  UTE,  SPA CLA         /NORM & EXTEND
1560  2277  1006        TAD C100        /300-337 & 340-376
1561  2300  1357        TAD M137        /240-276 & 200-235
1562  2301  1066        TAD CHAR
1563  2302  7450        SNA
1564  2303  5316        JMP UTX         /"?" FOUND
1565  2304  1075        TAD P337
1566  2305  3066  UTQ,  DCA CHAR
1567  2306  1026        TAD DEBGSW
1568  2307  1100        TAD DMPSW
1569  2310  7650        SNA CLA         /PRINT ONLY IF BOTH ARE ZERO,
1570  2311  4551        PRINTC
1571  2312  5674        JMP I UTRA      /--RETURN--
1572  2313  4330  EXTR,  JMS GET1
1573  2314  7040        CMA
1574  2315  5276        JMP UTE
1575  2316  1026  UTX,  TAD DEBGSW      /TEST FOR TRACE-ENABLED
1576  2317  7640        SZA CLA
1577  2320  5326        JMP .+6
1578  2321  1100        TAD DMPSW       /FLIP THE TRACE FLOP
1579  2322  7650        SNA CLA
1580  2323  7001        IAC
1581  2324  3100        DCA DMPSW
1582  2325  5275        JMP UTRA+1      /GET NEXT CHARACTER INSTEAD,
1583  2326  1110        TAD P277        /TRACE DISABLED = RETURN "?"
1584  2327  5305        JMP UTQ
1585  2330  0000  GET1,  0              /UNPACK 6-BITS
1586  2331  2020        ISZ XCT         /STARTS=0
1587  2332  5345        JMP GET3
1588  2333  1021        TAD GTEM
1589  2334  0122  GEND,  AND P77
1590  2335  3066        DCA CHAR        /SAVE
1591  2336  1066        TAD CHAR
1592  2337  1103        TAD M77
1593  2340  7650        SNA CLA
1594  2341  5313        JMP EXTR        /EXTENDED
1595  2342  1066        TAD CHAR
1596  2343  1356        TAD M40
1597  2344  5730        JMP I GET1      /--RETURN--
1598  2345  1417  GET3,  TAD I AXOUT                    /*8K*
1599  2346  3021        DCA GTEM
1600  2347  7040        CMA
1601  2350  3020        DCA XCT
1602  2351  1021        TAD GTEM
1603  2352  7112        RTR CLL
1604  2353  7012        RTR
1605  2354  7012        RTR
1606  2355  5334        JMP GEND
1607  2356  7740  M40,  -40
1608  2357  7641  M137,  -137
```

```
1609  2360  0000  XENDLN, 0        /TERMINATE THE BUFFERED LINE - "ENDLN"
1610  2361  7000          NOP                                    /*8K*
1611  2362  1425          TAD I LASTLN    /SAVE OLD POINTER
1612  2363  3460          DCA I BUFR
1613  2364  1060          TAD BUFR        /POINT TO NEW LAST LINE
1614  2365  3425          DCA I LASTLN
1615  2366  1061          TAD ADD         /CHECK FOR EXTRA INFO
1616  2367  7440          SZA
1617  2370  3410          DCA I AXIN
1618  2371  1010          TAD AXIN        /COMPUTE NEW END OF BUFFER
1619  2372  7001          IAC
1620  2373  3060          DCA BUFR
1621  2374  1060          TAD STARTV      /RESET VARIABLE LIST    /*8K*
1622  2375  3031          DCA LASTV                              /*8K*
1623  2376  5760          JMP I XENDLN    /--RETURN--
1624                      /-------------------------------------------------------
1625
1626
1627
1628        2377  TLIST3=,        /LITERAL TERMINATORS
1629  2377  1252          TASK4   /"
1630  2400  0614          PC1     /C,R, = AUTOMATIC QUOTE MATCH
1631
1632
1633        2401  INFIX=,         /DATA CONTROL CHARACTERS
1634  2401  6202          FLINTP*2        /LEFT ARROW     = KILL
1635  2402  0757          INPUT*1         /RUBOUT         * IGNORE
1636  2403  0757          INPUT*1         /L,F,           = IGNORE
1637  2404  6250          ENDFI*5         /ALT MODE       = EXIT
1638
1639  2405  0001  FLTONE, 0001    /(NO RELATIVE REFERENCES)
1640  2406  2000          2000
1641  2407  0000  FLTZER, 0000
1642  2410  0000          0000
1643  2411  0000          0000
1644  2412  0000          0000
1645  2413  7766  M12,     -12     /DECIMAL CONVERSION FACTOR FOR "PRNT"
1646                      /-------------------------------------------------------
1647
1648
1649  2414  3034  I33,     DCA INBUF       /CLEAR INPUT BUFFER
1650  2415  6032          KCC             /INITIATE NEXT READ
1651  2416  1621          TAD I .+3       /GET CHARACTER
1652  2417  5620          JMP I .+1
1653  2420  2675          XOUTL=1
1654  2421  2676          XOUTL
1655  2422  7402          HLT
1656  2423  7402          HLT
1657  2424  7402          HLT
```

```
1658  2425  0000  XPRNT,  0        /PRINT A LINE NUMBER = "PRNTLN"
1659  2426  1067          TAD LINENO
1660  2427  4557          RTL6
1661  2430  0122          AND P77
1662  2431  4242          JMS PRNT        /TWO DIGIT "PART" NUMBER
1663  2432  1102          TAD PER
1664  2433  4551          PRINTC          /PERIOD FOR SEPARATION
1665  2434  1067          TAD LINENO
1666  2435  4242          JMS PRNT        /TWO DIGIT "STEP" NUMBER,
1667  2436  1356          TAD M140
1668  2437  3066          DCA CHAR        /SAVE SPACE IN CHAR,
1669  2440  4551          PRINTC          /PRINT TRAILING SPACE
1670  2441  5625          JMP I XPRNT     /--RETURN--
1671        0032  VAL=T1
1672  2442  0000  PRNT,   0        /PRINT TWO DECIMAL DIGITS
1673  2443  0106          AND P177
1674  2444  3032          DCA VAL
1675  2445  1113          TAD C260
1676  2446  3033          DCA T3
1677  2447  5252          JMP .+3
1678  2450  2033          ISZ T3
1679  2451  3032  XYZ,    DCA VAL
1680  2452  1032          TAD VAL
1681  2453  1213          TAD M12
1682  2454  7500          SMA
1683  2455  5250          JMP XYZ-1
1684  2456  7200          CLA
1685  2457  1033          TAD T3
1686  2460  4551          PRINTC
1687  2461  1032          TAD VAL
1688  2462  1113          TAD C260
1689  2463  4551          PRINTC
1690  2464  5642          JMP I PRNT      /--RETURN--
1691  2465  0000  OUT,    0               /OUTPUT A CHARACTER = "PRINTC"
1692  2466  7450          SNA             /USE (AC) OR (CHAR)
1693  2467  1066          TAD CHAR
1694  2470  1116          TAD MCR
1695  2471  7450          SNA
1696  2472  5276          JMP OUTCR
1697  2473  1077          TAD CCR
1698  2474  4463          JMS I OUTDEV
1699  2475  5665  OUTX,   JMP I OUT       /--RETURN--
1700  2476  1077  OUTCR,  TAD CCR
1701  2477  4463          JMS I OUTDEV
1702  2500  1076          TAD CLF
1703  2501  5274          JMP OUTX-1
1704
```

```
1705
1706    2502  0000  PACBUF, 0               /PACK A CHARACTER - "PACKC"
1707    2503  1110          TAD P277
1708    2504  7041          CIA
1709    2505  1066          TAD CHAR
1710    2506  7450          SNA             /CHANGE 277 TO 337
1711    2507  1352          TAD P40
1712    2510  1101          TAD M100
1713    2511  7450          SNA             /TEST FOR RUBOUT,
1714    2512  5755          JMP I RUBIT
1715    2513  1353          TAD P377
1716    2514  3071          DCA T2          /SAVE INPUT ITEM
1717    2515  1071          TAD T2          /SO THAT QUESTION DOESN'T MAKE
1718    2516  0354          AND C140        /CHAR LOOK LIKE A LEFT-ARROW
1719    2517  1356          TAD M140
1720    2520  7440          SZA             /DATA WORD,
1721    2521  1354          TAD C140
1722    2522  7650          SNA CLA
1723    2523  5332          JMP ESCA        /340-377 AND 200-237
1724    2524  1071  PA1,    TAD T2          /240-337
1725    2525  0122          AND P77
1726    2526  7440          SZA             /IGNORE 300
1727    2527  4335          JMS PCK1
1728    2530  7000  PACX,   NOP                                     /*8K*
1729    2531  5702          JMP I PACBUF    /--RETURN--
1730    2532  1122  ESCA,   TAD P77
1731    2533  4335          JMS PCK1
1732    2534  5324          JMP PA1
1733    2535  0000  PCK1,   0
1734    2536  2062          ISZ XCTIN       /=0 TO START
1735    2537  5357          JMP ROT
1736    2540  1061          TAD ADD
1737    2541  3410          DCA I AXIN                        /*8K*
1738    2542  3061          DCA ADD         /CLEAR PACKING WORD     /*8K*
1739    2543  1013          TAD PDLXR       /CHECK FOR OVERFLOW     /*8K*
1740    2544  7141          CMA IAC CLL                       /*8K*
1741    2545  1005          TAD P13         /RESERVATIONS FOR PUSH-DOWN LIST/*8K*
1742    2546  1010          TAD AXIN
1743    2547  7620          SNL CLA
1744    2550  5735          JMP I PCK1      /--RETURN--
1745    2551  4566          ERROR2          /FULL BUFFER
1746    2552  0040  P40,    40
1747    2553  0377  P377,   377
1748    2554  0140  C140,   140
1749    2555  3004  RUBIT,  RUB1
1750    2556  7640  M140,   -140
1751    2557  4557  ROT,    RTL6    /(EAE)
1752    2560  3061          DCA ADD
1753    2561  7040          CMA
1754    2562  3062          DCA XCTIN
1755    2563  5735          JMP I PCK1
1756                /2564-2570, 2572-2576 ARE USED BY 8K OVERLAY    /*8K*
```

```
1757           2600    *2600
1758                   /-------------------------------------------------------
1759                   /-------------------------------------------------------
1760
1761                   /INTERRUPT PROCESSOR,
1762
1763     2600  0000    SAVAC,  0               /CONTENTS OF AC
1764     2601  0000    SAVLK,  0               /CONTENTS OF LINK
1765     2602  7575    MBREAK, -203            /CONTROL-C
1766     2603  3200    INTRPT, DCA SAVAC       /SAVE WORKING DATA
1767     2604  7010            RAR
1768     2605  3201            DCA SAVLK
1769     2606  6041            TSF             /GIVE OUTPUT PRIORITY
1770     2607  5225            JMP KINT
1771     2610  6042            TCF
1772     2611  3016            DCA TELSW       /TURN OFF THE IN-PROGRESS FLAG,
1773     2612  1665            TAD I OPTRI
1774     2613  7450            SNA
1775     2614  5225            JMP KINT        /DONE
1776     2615  6044            TPC             /TYPE NEXT,
1777     2616  3016            DCA TELSW       /CLEAR AC AND TURN ON THE FLAG,
1778     2617  3665            DCA I OPTRI     /ZERO OUT THE DATA AREA
1779     2620  1265            TAD OPTRI
1780     2621  7001            IAC
1781     2622  0107            AND P17
1782     2623  1263            TAD OPTRØ
1783     2624  3265            DCA OPTRI
1784     2625  6031    KINT,   KSF             /CHECK FOR KEYBOARD FIRST
1785     2626  5246            JMP EXIT
1786     2627  6034            KRS             /INPUT CHARACTER
1787     2630  6030            KCF             /CLEAR FLAG
1788     2631  0106            AND P177        /IGNORE BIT 8
1789     2632  7450            SNA             /BLANK?
1790     2633  5245            JMP EXIT-1      /YES--GO INITIATE NEXT READ
1791     2634  1123            TAD C200        /FORCE BIT 8 ON
1792     2635  3262            DCA SIN
1793     2636  1262            TAD SIN
1794     2637  1202            TAD MBREAK
1795     2640  7650            SNA CLA         /WAS IT CTRL/C?
1796     2641  5740            JMP I RECOVR    /YES--HANDLE CTRL/C
1797     2642  1262            TAD SIN
1798     2643  3034            DCA INBUF
1799     2644  7410            SKP
1800     2645  6032            KCC             /INITIATE NEXT READ--CHAR. WAS BLANK
1801     2646  6011    EXIT,   RSF             /TEST H.S, READER FLAG
1802     2647  5252            JMP .+3
1803     2650  6012            RRB             /READ BUFFER AND CLEAR FLAG
1804     2651  3037            DCA HINBUF      /SAVE CHARACTER
1805     2652  6244            RMF             /RESTORE MEMORY FIELD,
1806     2653  6101            SMP             /(THESE TWO COULD PATCH TO OTHER PDP-8 DEVICES)
1807     2654  7000            NOP             /ONLY POSSIBLE HALT = PARITY ERROR IN 8/S ONLY,
1808     2655  1201            TAD SAVLK
1809     2656  7104            RAL CLL
1810     2657  1200            TAD SAVAC
1811     2660  6001            ION
```

```
1812    2661    5400    EXITJ,  JMP I 0         /MODIFIED FOR PDP-5
1813    2662    0000    SIN,    0
```

```
1814
1815    2663  3120    OPTR0,  IOBUF   /OUTPUT POINTERS
1816    2664  3120    OPTRO,  IOBUF   /VARS
1817    2665  3120    OPTRI,  IOBUF
1818    2666  0000    XI33,   0               /VIA (INDEV)
1819    2667  1034            TAD INBUF       /ANY INPUT?
1820    2670  7550            SPA SNA
1821    2671  5267            JMP .-2         /NO = WAIT
1822    2672  3276            DCA XOUTL
1823    2673  5674            JMP I .+1
1824    2674  2414            I33
1825    2675  5666            JMP I XI33      /--RETURN--
1826
1827    2676  0000    XOUTL,  0               /VIA (OUTDEV)
1828    2677  3266            DCA XI33        /SAVE CURRENT CHARACTER,
1829    2700  6001            ION             /BE SURE INTERRUPT IS ON,
1830    2701  1664            TAD I OPTRO     /ANY ROOM?
1831    2702  7640            SZA CLA         /A CHARACTER IS NON-ZERO
1832    2703  5301            JMP .-2         /NO = WAIT,
1833    2704  6002            IOF
1834    2705  1016            TAD TELSW       /IN PROGRESS?
1835    2706  7640            SZA CLA
1836    2707  5314            JMP .+5
1837    2710  1266            TAD XI33        /NO
1838    2711  6046            TLS             /TYPE CHARACTER,
1839    2712  3016            DCA TELSW       /SET IN-PROGRESS FLAG,
1840    2713  5323            JMP .+10        /RETURN
1841    2714  1266            TAD XI33        /SEND DATA
1842    2715  3664            DCA I OPTRO
1843    2716  1264            TAD OPTRO       /SET POINTERS
1844    2717  7001            IAC
1845    2720  0107            AND P17
1846    2721  1263            TAD OPTR0
1847    2722  3264            DCA OPTRO
1848    2723  6001            ION
1849    2724  5676            JMP I XOUTL     /--RETURN--
```

```
1850
1851                    /ERROR RECOVERY PROCEEDURE
1852
1853    2725  3326      ERROR5, DCA ,+1          /ERROR CALLED FROM A TABLE
1854    2726  0000      ERR2,   0                /LIMIT EXCEEDED
1855    2727  7240              CLA CMA          /COMPUTE CALLING ADDRESS (ALSO "SPACE")
1856    2730  1326              TAD ERR2         /AND USE IT AS ERROR NUMBER.
1857    2731  3067              DCA LINENO       /SAVE ERROR CODE.
1858    2732  6001              ION              /                (JMP ,+4) - FOR DEBUGGING
1859    2733  1016              TAD TELSW        /WAIT FOR OUTPUT TO FINISH
1860    2734  7640              SZA CLA
1861    2735  5333              JMP .-2
1862    2736  6002              IOF              /DISABLE INTERRUPT FOR INITIALIZATIONS
1863    2737  5342              JMP ,+3
1864    2740  1154    RECOVR,   XINT-4
1865    2741  6032              KCC
1866    2742  1105              TAD M20          /SETUP INIT COUNT
1867    2743  3057              DCA CNTR
1868    2744  2016              ISZ TELSW        /TURN ON IN-PROGRESS SWITCH
1869    2745  7040              CMA
1870    2746  1263              TAD OPTR0
1871    2747  3010              DCA AXIN         /INIT I/O BUFFERS,
1872    2750  7000              NOP                      /*8K*
1873    2751  3410              DCA I AXIN
1874    2752  2057              ISZ CNTR
1875    2753  5351              JMP .-2
1876    2754  3034              DCA INBUF        /INIT KEY-BUFR,
1877    2755  1263              TAD OPTR0        /INIT TTY POINTERS,
1878    2756  3265              DCA OPTRI
1879    2757  1263              TAD OPTR0
1880    2760  3264              DCA OPTRO
1881    2761  7200    RECOVX,   CLA
1882    2762  6046              TLS              / RAISE TTY FLAG,       (NOP) - FOR DEBUGGING
1883    2763  5764              JMP I ,+1        /OUTPUT CR/LF AND ?
1884    2764  1343              XADC
1885    2765  4553              PRNTLN           /PRINT ERROR NUMBER AND,
1886    2766  2022              ISZ PC
1887    2767  1422              TAD I PC         /UNLESS IT IS ZERO,     /*8K*
1888    2770  7450              SNA
1889    2771  5377              JMP ,+6
1890    2772  3067              DCA LINENO
1891    2773  1101              TAD P7700        /PRINT ATSIGN
1892    2774  4551              PRINTC
1893    2775  4551              PRINTC           /PRINT SPACE AGAIN AND
1894    2776  4553              PRNTLN           /PRINT LINE OF ERROR,
1895    2777  1077              TAD CCR
1896                    /-------------------------------------------------------------
1897    3000  4551              PRINTC
1898    3001  1126              TAD PTCH         /RESET "READC"
1899    3002  3152              DCA RDIV         /IF AN ERROR OCCURS,
1900    3003  5177              JMP START        /INTERRUPT WILL BE RE-ENABLED SOON,
```

```
1901
1902                    /CHRACTER REMOVAL ROUTINE
1903
1904    3004  1062      RUB1,   TAD XCTIN       /RUBOUT ONE LETTER
1905    3005  7640              SZA CLA
1906                    /-------------------------------------------------------
1907    3006  5214              JMP .+6
1908    3007  1010              TAD AXIN
1909    3010  7041              CIA
1910    3011  1027              TAD PACKST
1911    3012  7700              SMA CLA         /TEST NULL LINE
1912    3013  5641              JMP I RUB5
1913    3014  1251              TAD SPLAT       /FOR A RUBOUT ACKNOWLEDGEMENT
1914    3015  4551              PRINTC
1915    3016  1010              TAD AXIN
1916    3017  3071              DCA T2
1917    3020  7000              NOP                             /*8K*
1918    3021  2062              ISZ XCTIN       /TEST HALF
1919    3022  5242              JMP RUB2
1920    3023  1471              TAD I T2        /"ADD" IS FULL,
1921    3024  0122              AND P77
1922    3025  1103              TAD M77
1923    3026  7640              SZA CLA         /TEST FOR EXTEND
1924    3027  5237              JMP RUB4
1925    3030  7040    RUB3,     CMA             /SET SWITCH
1926    3031  3062              DCA XCTIN
1927    3032  7040              CMA             /BACKUP POINTER
1928    3033  1010              TAD AXIN
1929    3034  3010              DCA AXIN
1930    3035  1471              TAD I T2        /RESET ADD
1931    3036  0101              AND P7700
1932    3037  3061    RUB4,     DCA ADD
1933    3040  5641              JMP I RUB5
1934    3041  2530    RUB5,     PACX
1935    3042  1471    RUB2,     TAD I T2        /CHECK FOR EXTENDED
1936    3043  0101              AND P7700
1937    3044  1006              TAD C100
1938    3045  7640              SZA CLA
1939    3046  5230              JMP RUB3
1940    3047  3471              DCA I T2        /SAVE CORRECTION
1941    3050  5231              JMP RUB3+1
1942    3051  0334    SPLAT,    334
1943
```

```
1944
1945                    /SYMBOL TABLE TYPEOUT ROUTINE
1946
1947    3052  1060      TDUMP,  TAD STARTV      /INIT POINTER FOR SYMBOL DUMP   /*8K*
1948    3053  3030              DCA PT1
1949    3054  1031              TAD LASTV       /TEST FOR END OF LIST
1950    3055  7041              CIA
1951    3056  1030              TAD PT1
1952    3057  7650              SNA CLA
1953    3060  5541              POPJ
1954    3061  1430              TAD I PT1       /GET THE VARIABLE
1955    3062  3316              DCA OP+1        /(DCA I (4)-FOR 8K;SAVE NAME
1956    3063  1315              TAD OP          /SETUP UNPACK POINTERS
1957    3064  3017              DCA AXOUT
1958    3065  3020              DCA XCT
1959    3066  4545              GETC            /READ AND PRINT "XX("
1960    3067  4551              PRINTC
1961    3070  4545              GETC
1962    3071  4551              PRINTC
1963    3072  4545              GETC
1964    3073  4551              PRINTC
1965    3074  2030              ISZ PT1
1966    3075  1430              TAD I PT1       /PRINT SUBSCRIPT TO 99
1967    3076  4714              JMS I PRNT2
1968    3077  4545              GETC            /PRINT ")"
1969    3100  4551              PRINTC
1970    3101  2030              ISZ PT1
1971    3102  4407              FINT            /PICK UP VALUE
1972    3103  0430              FGET I PT1
1973    3104  0000              FXIT
1974    3105  4530              JMS I FOUTPUT   /PRINT VALUE
1975    3106  1077              TAD CCR
1976    3107  4551              PRINTC
1977    3110  1070              TAD GINC
1978    3111  1111              TAD M2
1979    3112  1030              TAD PT1
1980    3113  5253              JMP TDUMP+1
1981    3114  2442    PRNT2,    PRNT
1982    3115  3115    OP,       ,                               /*8K*
1983    3116  0000              0000                            /*8K*
1984    3117  5051              5051            /(THESE GO IN 10005 FOR X-MEM)
1985
```

```
1986
1987                    /OUTPUT CHARACTER BUFFER (ADDRESS IS A MULTIPLE OF 20)
1988
1989            3120    IOBUF=3120
1990
1991            3140    COMEIN=IOBUF+20 /COMMAND - INPUT BUFFER
1992                    /-----------------------------------------------------
1993                    /-----------------------------------------------------
1994
1995            3206    COMEOUT=COMEIN+46
1996
1997
1998            3206    *COMEOUT
1999
2000
2001
2002    3206    0000    FRST,   0       /TEXT POINTER
2003    3207    0000            0000    /DUMMY LINE NO,
2004    3210    0340            0340    /TITLE  C FOCAL-8
2005    3211    0617            0617    /FO
2006    3212    0301            0301    /CA
2007    3213    1455            1455    /L-
2008    3214    7040            7040    /8
2009    3215    4040    FRSTX,  4040
2010    3216    7715            7715    /DUMMY C,R,
2011
2012                    /TO SAVE TEXT ,SAVE C(BUFR), C(LASTV), AND C( FRST TO C(BUFR))
2013                    /WITH ODT-JR46,  THE TAPES MAY BE TOGETHER WITH
2014                    /THE SYMBOLIC DUMP LAST : FOCAL + FLOAT + DIALOG ,
2015                    /LOADING THE LAST SECTION MAY BE CONSIDERED OPTIONAL,
2016
2017
2018
2019            3217    BUFBEG=.                /TEXT BUFFER STARTS HERE,
2020
2021
2022
2023
```

```
2024
2025           4370    *4400-10
2026
2027    4370   1155    01,     XINT-3          /STARTING ADDRESS
2028    4371   1370    BEGIN,  TAD 01          /INITIALIZE ANY 8-FAMILY COMPUTER,
2029                   /-------------------------------------------------------
2030    4372   3176            DCA START-1
2031    4373   6142            6142            /CLEAR F,H,;S 8,((JMP ATES+1)-FOR TSS-8)
2032    4374   6077            6077            /SET INTENSITY LEVEL, 34D
2033    4375   6152            6152            /CLEAR LPT
2034    4376   6762            6762            /TC01
2035    4377   6012            6012            /CLEAR PC02 FOR PDP-5
2036    4400   6346            6346            /CLEAR LAB-8
2037    4401   6032            KCC             /READER START
2038    4402   7300            CLA CLL
2039                   /-------------------------------------------------------
2040    4403   3414            DCA I FLTXR
2041    4404   2057            ISZ CNTR        /INITIALIZED BY LOAD,
2042    4405   5203            JMP .-2         /CLEAR INPUT BUFFER
2043
2044                   /TEST FOR COMPUTER TYPE
2045
2046    4406   7000            NOP
2047    4407   7000            NOP
2048    4410   1370            TAD POP5        /TEST FOR PDP-5
2049    4411   3000            DCA 0000
2050    4412   7040    04,     CMA             /LINC-8 OR PDP-12?
2051    4413   6167            6167            /SET LINC AC= (INITS AND KILLS 33B)
2052    4414   7200            CLA
2053    4415   6171            6171            /READ LINC AC
2054    4416   7650            SNA CLA
2055    4417   5226            JMP T12
2056
2057    4420   1365            TAD P7          /CLEAR LINC-INTERRUPTS
2058    4421   6141            6141
2059    4422   1366            TAD P2
2060    4423   6141            6141
2061    4424   7200            CLA
2062    4425   5314            JMP ATES+1      /YES
```

```
2063
2064    4426  6141    T12,    6141            /BECOME A LINC
2065    4427  0017            0017            /COMPLEMENT AC
2066    4430  0002            0002            /BACK TO 8 MODE
2067    4431  7001            IAC             /SET TO ZERO IF PDP-12
2068    4432  7650            SNA CLA
2069    4433  5314            JMP ATES+1
2070
2071    4434  5246            JMP .+12
2072    4435  1106            TAD P177        /SET UP FOR 8K L COMMAND
2073    4436  3640            DCA I .+2               /TO RESTART FOCAL8
2074    4437  5310            JMP ATES-3
2075    4440  1351            XADC+6
2076    4441  7000            NOP
2077    4442  7000            NOP
2078    4443  7000            NOP
2079    4444  7000            NOP
2080    4445  5314            JMP ATES+1
2081
2082    4446  7354            7354            /NL3776
2083    4447  1367            TAD PDP8I       /IS THIS A PDP-8/I OR 8/L?
2084    4450  7650            SNA CLA
2085    4451  5265            JMP ATE!        /8/I
2086    4452  7344            7344            /NL7776
2087    4453  1366            TAD P2
2088    4454  7650            SNA CLA
2089    4455  5314            JMP ATES+1      /8/L
2090
2091    4456  1100            TAD CCR+1       /PDP-8/S
2092    4457  3764            DCA I 06        /SETUP PARITY-ERROR HALT
2093    4460  1327            TAD OOUT-15     /CORRECT READER WAIT
2094    4461  3763            DCA I 05
2095    4462  5313            JMP ATES
2096    4463  2761    PDP5X,  ISZ I 02        /INCREMENT INTERRUPT RETURN
2097    4464  5314            JMP ATES+1
```

```
2098    4465  6046    ATEI,   TLS
2099    4466  6000    G8L,    6000
2100    4467  6000            6000
2101    4470  6000            6000
2102    4471  6000            6000
2103
2104    4472  6000            6000
2105    4473  6000            6000
2106    4474  6000            6000
2107    4475  6000            6000
2108    4476  2057            ISZ CNTR
2109    4477  6041            TSF
2110    4500  5266            JMP G8L
2111    4501  5314            JMP ATES+1
2112
2113
2114    4502  1362            TAD PDP
2115    4503  4371            JMS LOOKUP
2116    4504  7740            SMA SZA CLA     /MONITOR IN USE?
2117    4505  5235            JMP T12+7
2118    4506  5707            JMP I .+1       /YES
2119    4507  2214            ERT             /ERASE ALL AND PROCEED
2120    4510  1352            TAD L8AY        /NO-SET UP FOR L COMMAND
2121    4511  3753            DCA I L8AX      /TO RETURN TO COMMAND MODE
2122    4512  5707            JMP I .-3       /ERASE ALL AND PROCEED
2123    4513  7402    ATES,   HLT
```

```
                        /INITIALIZE THE DIALOGUE
4514  6046              TLS
4515  6001              ION             /ENABLE INTERRUPT
4516  4540              PUSHJ
4517  0421              DO+1
4520  6002              IOF
                        /RETAIN EXP,LOG,ATN ? (256)
                        /RETAIN SINE,COSINE?    (128)
                        /XF =   +1(NO)  -1(YES)         0(YES)
4521  1360              TAD XF
4522  4371              JMS LOOKUP
4523  7450              SNA
4524  5344              JMP OOUT        /NO DIALOGUE EXECUTED
4525  7710              SPA CLA
4526  1366              TAD P2          /DELETE EXTENDED FUNCTIONS
4527  1120              TAD M5          /(OOUT=15 FOR 8/S READER)
4530  3057              DCA CNTR
4531  1354              TAD FNPT
4532  3011              DCA XRT
4533  1355              TAD ER5
4534  3411              DCA I XRT       /SET THE TABLE
4535  2057              ISZ CNTR
4536  5333              JMP .-3
4537  1360              TAD XF          /CORRECT BUFFER PROTECT
4540  4371              JMS LOOKUP
4541  7710              SPA CLA
4542  1104              TAD P7600       /(-200)
4543  1356              TAD BFXX
4544  1357    OOUT,     TAD BFX
4545  3035              DCA  BOTTOM
4546  5302              JMP ATES-11
4547  7402              HLT
```

```
2158
2159    4550  6313    L8A,    6313
2160    4551  6307    L8B,    6307
2161    4552  5177    L8AY,   JMP START
2162    4553  7526    L8AX,   PRNT8=1
2163
2164    4554  0401    FNPT,   FNTABF+5
2165    4555  2725    ER5,    ERROR5
2166    4556  0560    BFXX,   TGO=FEXP/WITHOUT
2167    4557  4617    BFX,    FEXP=1  /WITH
2168    4560  3006    XF,     3006    /X,F
2169    4561  2661    02,     EXITJ   /INTERRUPT EXIT
2170    4562  2004    PDP,    2004    /P,D
2171    4563  6322    05,     HREAD+1
2172    4564  2654    06,     EXIT+6
2173    4565  0007    P7,     7
2174    4566  0002    P2,     2
2175    4567  4002    PDP8I,  4002    /(=3776)
2176    4570  4462    PDP5,   PDP5X=1
2177    4571  2344    LOOKUP, DDTJR+OMULT4+END+RECOVX+PSIN    /MAKE BELIEVE
2178    4572  3061            DCA ADD
2179    4573  4540            PUSHJ           /CALL THE VARIABLE SEARCH ROUTINE,
2180    4574  1437            GS1
2181    4575  2030            ISZ PT1
2182    4576  1430            TAD I PT1
2183    4577  5771            JMP I LOOKUP
2184                    /---------------------------------------------------------
2185
2186
```

```
2187            6321    *6321   /STUCK INTO THE FLOATING POINT PACKAGE,
2188
2189    6321    0000    HREAD,  0
2190    6322    1105            TAD M20         /TAD M5 FOR 8/S
2191    6323    3343            DCA HSWITC
2192    6324    1037    HREAD2, TAD HINBUF      /(RSF) -WHEN DEBUGGING
2193    6325    7700            SMA CLA         /(SKP)
2194    6326    5364            JMP HSGO
2195    6327    2032            ISZ T1          /SKIP IF OUT OF TAPE
2196    6330    5324            JMP HREAD2
2197    6331    2343            ISZ HSWITC
2198    6332    5324            JMP HREAD2
2199    6333    4343            JMS HSWITC      /LEAVES LINK ZERO
2200    6334    1013            TAD PDLXR       / < FRST ?
2201    6335    1376            TAD HTST
2202    6336    7630            SZL CLA
2203    6337    4566            ERROR3          /DIRECT COMMAND
2204    6340    4343            JMS HSWITC
2205    6341    5177            JMP START
2206    6342    0212            IBAR
2207    6343    0000    HSWITC, 0
2208    6344    1375            TAD HSPSW       /INITIALIZE H,S, READER
2209    6345    7040            CMA
2210    6346    3375            DCA HSPSW       /CHANGE STATUS
2211    6347    7140            CMA CLL         /CLEAR LINK
2212    6350    3037            DCA HINBUF      /CLEAR BUFFER
2213    6351    1375            TAD HSPSW
2214    6352    7440            SZA
2215    6353    6014            RFC             /START HARDWARE
2216    6354    7640            SZA CLA
2217    6355    1377            TAD RESTR       /(HREAD)
2218    6356    1126            TAD PTCH
2219    6357    3152            DCA RDIV        /"READC"
2220    6360    5743            JMP I HSWITC    /--RETURN--
2221    6361    4343    HSPX,   JMS HSWITC      /COMMAND "*"  - SWAP
2222    6362    5763            JMP I .+1
2223    6363    0611            PROC
2224    6364    7040    HSGO,   CMA             /FETCH NEXT CHARACTER
2225    6365    3037            DCA HINBUF
2226    6366    6016            RFC RRB         /PICK UP NEXT CHARACTER
2227    6367    0106            AND P177        /CHECK FOR LEADER-TRAILER,ETC,
2228    6370    7450            SNA
2229    6371    5322            JMP HREAD+1
2230    6372    1123            TAD C200
2231    6373    3066            DCA CHAR        /SAVE INPUT
2232    6374    5721            JMP I HREAD     /--RETURN--
2233    6375    0000    HSPSW,  0
2234    6376    4557    HTST,   -COMEOUT-13
2235    6377    4144    RESTR,  HREAD-CHIN
```

```
2236
2237                    /DISK MONITOR INTERACTIVE COMMAND OPERATES VIA THE KEYBOARD,
2238                    /THIS FITS UNDER THE 10DIGIT FLOATING POINT OUTPUT BUFFER,
2239
2240            7503    *7503
2241
2242    7503    1133    LIBRARY,TAD CFRS
2243    7504    4327            JMS PRNT8
2244    7505    1060            TAD BUFR                /TYPE C(CFRS), C(BUFR),C(LASTV),C(BOTTOM)
2245    7506    4327            JMS PRNT8               /OCTAL OUTPUT * COMMA
2246    7507    1031            TAD LASTV
2247    7510    4327            JMS PRNT8
2248    7511    1035            TAD BOTTOM
2249    7512    4327            JMS PRNT8
2250    7513    5316            JMP .+3
2251    7514    4545            GETC
2252    7515    4551            PRINTC
2253    7516    1066            TAD CHAR
2254    7517    1116            TAD MCR
2255    7520    7640            SZA CLA
2256    7521    5314            JMP .-5
2257    7522    1016            TAD TELSW
2258    7523    7640            SZA CLA
2259    7524    5322            JMP .-2         /(NOP) = WHEN DEBUGGING
2260    7525    6002            IOF                     /*8K*
2261    7526    5504            JMP I P7600     /(7600=DISK MONITOR)    /*8K*
2262    7527    0000    PRNT8,  0
2263    7530    3032            DCA T1
2264    7531    1032            TAD T1
2265    7532    7006            RTL
2266    7533    7006            RTL
2267    7534    4350            JMS PRINTD
2268    7535    4557            RTL6
2269    7536    7004            RAL
2270    7537    4350            JMS PRINTD
2271    7540    7012            RTR
2272    7541    7010            RAR
2273    7542    4350            JMS PRINTD
2274    7543    4350            JMS PRINTD
2275    7544    7200            CLA
2276    7545    1077            TAD CCR
2277    7546    4551            PRINTC
2278    7547    5727            JMP I PRNT8     /--RETURN--
2279    7550    0000    PRINTD, 0
2280    7551    0356            AND LP7
2281    7552    1113            TAD C260
2282    7553    4551            PRINTC
2283    7554    1032            TAD T1
2284    7555    5750            JMP I PRINTD    /--RETURN--
2285    7556    0007    LP7,    7
2286                    /7557-7577 ARE USED BY 8K OVERLAY       /*8K*
2287                    PAUSE
```

```
2288                    /FOCAL-8 FLOATING POINT PACKAGE
2289
2290                    /COPYRIGHT 1971  DIGITAL EQUIPMENT CORPORATION
2291                    /       MAYNARD, MASSACHUSETTS 01754
2292
2293                    /
2294
2295
2296
2297
2298                    /PAGE ZERO OF THE
2299                    /FLOATING POINT ARITHMETIC INTERPRETER FOR FOCAL
2300
2301
2302
2303            0040    *40
2304
2305    0040    0000    EX1,    0       /OPERAND STORAGE
2306    0041    0000    AC1H,   0
2307    0042    0000    AC1L,   0
2308    0043    0000    OVER1,  0
2309
2310            0044    FLAC=.          /FLOATING ACCUMULATOR
2311    0044    0000    EXP,    0       /F,A,
2312    0045    0000    HORD,   0
2313    0046    0000    LORD,   0
2314    0047    0000    OVER2,  0
2315
2316    0050    0000    SIGNF,  0               /FLOATIN SIGN
2317
2318    0051    6603    MINSKI, ACMINS          /NEGATE FLAC SUBROUTINE
2319    0052    2004    FISW,   2004            /OUTPUT FORMAT
2320    0053    6724    INTEGER,FIX             /FIX FLAC
2321
2322
2323
2324                    /FUNCTIONS CONTAINED IN THIS SECTION
2325
2326                            /ARTN
2327                            /FEXP
2328                            /FLOG
2329                            /FSIN
2330                            /FCOS
2331                            /XSQRT
```

```
2332                    /FLOATING POINT PACKAGE - EXPONENTIAL
2333
2334            1045    GETSGN=TAD FLAC+1
2335            5536    RETURN=JMP I EFUN3I
2336
2337            4620    *4600+20
2338
2339    4620    1045    FEXP,   GETSGN                  /TAKE ABSOLUTE VALUE
2340    4621    7710            SPA CLA
2341    4622    4724            JMS I NEGP
2342    4623    3033            DCA T3          /C(SIGN)=-1 IF I X2<0
2343    4624    4407            FINT
2344    4625    4313            FMUL LG2E
2345    4626    6675            FPUT I X2
2346    4627    0000            FEXT
2347    4630    4453            JMS I INTEGER   /TAKE INTEGER PART
2348    4631    3325            DCA FLAG2       /SAVE LOW ORDER DATA
2349    4632    4407            FINT
2350    4633    7000            FNOR
2351    4634    6676            FPUT I XSQ2
2352    4635    0675            FGET I X2
2353    4636    2676            FSUB I XSQ2
2354    4637    6675            FPUT I X2
2355    4640    4675            FMUL I X2
2356    4641    6676            FPUT I XSQ2
2357    4642    1310            FADD DF
2358    4643    6326            FPUT TEMP
2359    4644    0305            FGET CF
2360    4645    3326            FDIV TEMP
2361    4646    2675            FSUB I X2
2362    4647    1277            FADD AF
2363    4650    6326            FPUT TEMP
2364    4651    0302            FGET BF
2365    4652    4676            FMUL I XSQ2
2366    4653    1326            FADD TEMP
2367    4654    6326            FPUT TEMP
2368    4655    0675            FGET I X2
2369    4656    3326            FDIV TEMP
2370    4657    4321            FMUL TWO
2371    4660    1316            FADD ONE
2372    4661    0000            FEXT
2373    4662    1325            TAD FLAG2
2374    4663    1044            TAD FLAC
2375    4664    3044            DCA FLAC
2376    4665    2033            ISZ T3
2377    4666    5536            RETURN
2378    4667    4407            FINT
2379    4670    6675            FPUT I X2
2380    4671    0316            FGET ONE
2381    4672    3675            FDIV I X2
2382    4673    0000            FEXT
2383    4674    5536            RETURN
```

```
2384
2385                    /CONSTANTS FOR FEXP
2386
2387    4675  5322      X2,     X
2388    4676  5326      XSQ2,   XSQR
2389    4677  0004      AF,     0004
2390    4700  2372              2372
2391    4701  1402              1402
2392    4702  7774      BF,     7774
2393    4703  2157              2157
2394    4704  5157              5157
2395    4705  0012      CF,     0012
2396    4706  5454              5454
2397    4707  0343              0343
2398    4710  0007      DF,     0007
2399    4711  2566              2566
2400    4712  5341              5341
2401    4713  0001      LG2E,   0001
2402    4714  2705              2705
2403    4715  2435              2435
2404    4716  0001      ONE,    0001
2405    4717  2000              2000
2406    4720  0000              0000
2407    4721  0002      TWO,    0002
2408    4722  2000              2000
2409    4723  0000              0000
2410    4724  5163      NEGP,   FNEG
2411
2412    4725  0000      FLAG2,  0
2413    4726  0000      TEMP,   0
2414    4727  0000              0
2415    4730  0000              0
2416    4731  0000              0
2417
2418
```

```
2419
2420                    /MAIN ALGORITHM FOR ARCTANGENT
2421
2422    4732  4407      ARCALG, FINT
2423    4733  0675              FGET I X2
2424    4734  4675              FMUL I X2
2425    4735  6676              FPUT I XSQ2
2426    4736  4374              FMUL BET2
2427    4737  1371              FADD BET1
2428    4740  4676              FMUL I XSQ2
2429    4741  1366              FADD BETZ
2430    4742  6326              FPUT TEMP
2431    4743  0363              FGET ALF2
2432    4744  4676              FMUL I XSQ2
2433    4745  1360              FADD ALF1
2434    4746  4676              FMUL I XSQ2
2435    4747  1355              FADD ALFZ
2436    4750  4675              FMUL I X2
2437    4751  3326              FDIV TEMP
2438    4752  0000              FEXT
2439    4753  5754              JMP I .+1
2440    4754  5024              ARCRTN
2441
2442
2443
2444                    /CONSTANTS - FLOATING ARC TANGENT
2445    4755  0000      ALFZ,   0000
2446    4756  2437              2437
2447    4757  1643              1643
2448    4760  7777      ALF1,   7777
2449    4761  3304              3304
2450    4762  4434              4434
2451    4763  7773      ALF2,   7773
2452    4764  3306              3306
2453    4765  5454              5454
2454    4766  0000      BETZ,   0000
2455    4767  2437              2437
2456    4770  1646              1646
2457    4771  0000      BET1,   0000
2458    4772  2427              2427
2459    4773  2323              2323
2460    4774  7775      BET2,   7775
2461    4775  3427              3427
2462    4776  7052              7052
2463
2464
```

```
2465
2466                /-------------------------------------------------------
2467                /-------------------------------------------------------
2468                /FLOATING POINT ARC TANGENT
2469
2470          5000  *5000
2471
2472    5000  1045  ARTN,  GETSGN          /TAKE ABSOLUTE VALUE
2473    5001  7710          SPA CLA
2474    5002  4363          JMS FNEG
2475    5003  3033          DCA T3
2476    5004  4407          FINT
2477    5005  6635          FPUT I X1
2478    5006  2637          FSUB I CON1
2479    5007  0000          FEXT
2480    5010  1045          GETSGN
2481    5011  7710          SPA CLA
2482    5012  5221          JMP GO            /LESS THAN ONE
2483    5013  4407          FINT
2484    5014  0637          FGET I CON1
2485    5015  3635          FDIV I X1
2486    5016  6635          FPUT I X1
2487    5017  0000          FEXT
2488    5020  7240          CLA CMA
2489    5021  3362  GO,     DCA FLAG1         /SIGN FLAG OF RESULT
2490    5022  5623          JMP I .+1         /CALL ALGORITHM
2491    5023  4732          ARCALG
2492    5024  2362  ARCRTN, ISZ FLAG1         /RETURN HERE
2493    5025  5634          JMP I EXIT1
2494    5026  4407          FINT
2495    5027  6635          FPUT I X1
2496    5030  0636          FGET I PI2
2497    5031  2635          FSUB I X1
2498    5032  0000          FEXT
2499    5033  5634          JMP I .+1
2500    5034  5302  EXIT1,  EXIT2
2501
2502                /CONSTANTS FOR ARCTANGENT
2503    5035  5322  X1,     X
2504    5036  5316  PI2,    PIOT
2505    5037  4716  CON1,   ONE
2506
```

```
2507
2508    5040  1045    FLOG,   GETSGN          /FLOATING LOGARITHM
2509    5041  7450            SNA
2510    5042  4566            ERROR3          /ZERO ARGUEMENT FOR LOG
2511    5043  7710            SPA CLA
2512    5044  4566            ERROR3          /NEGATIVE ARGUMENT
2513    5045  4407            FINT
2514    5046  6756            FPUT I TEM
2515    5047  2637            FSUB I CON1
2516    5050  0000            FEXT
2517    5051  1045            GETSGN
2518    5052  7450            SNA
2519    5053  5536            RETURN
2520    5054  7700            SMA CLA
2521    5055  5264            JMP STARTL
2522    5056  4407            FINT
2523    5057  0637            FGET I CON1
2524    5060  3756            FDIV I TEM
2525    5061  6756            FPUT I TEM
2526    5062  0000            FEXT
2527    5063  7240            CLA CMA
2528    5064  3033    STARTL, DCA T3
2529    5065  1005            TAD P13
2530    5066  3044            DCA FLAC
2531    5067  7040            CMA
2532    5070  1756            TAD I TEM
2533    5071  3045            DCA FLAC+1
2534    5072  3046            DCA FLAC+2
2535    5073  3047            DCA FLAC+3
2536    5074  7001            IAC
2537    5075  3756            DCA I TEM
2538    5076  4407            FINT
2539    5077  4357            FMUL LOG2
2540    5100  6635            FPUT I X1
2541    5101  0756            FGET I TEM
2542    5102  2637            FSUB I CON1
2543    5103  6756            FPUT I TEM
2544    5104  4353            FMUL LOG8
2545    5105  1350            FADD LOG7
2546    5106  4756            FMUL I TEM
2547    5107  1345            FADD LOG6
2548    5110  4756            FMUL I TEM
2549    5111  1342            FADD LOG5
2550    5112  4756            FMUL I TEM
2551    5113  1337            FADD L4
2552    5114  4756            FMUL I TEM
2553    5115  1334            FADD L3
2554    5116  4756            FMUL I TEM
2555    5117  1331            FADD L2
2556    5120  4756            FMUL I TEM
2557    5121  1326            FADD L1
2558    5122  4756            FMUL I TEM
2559    5123  1635            FADD I X1
2560    5124  0000            FEXT
2561    5125  5634            JMP I EXIT1
```

```
2562
2563
2564    5126  0000    L1,     0000
2565    5127  3777            3777
2566    5130  7742            7742
2567    5131  7777    L2,     7777
2568    5132  4000            4000
2569    5133  4100            4100
2570    5134  7777    L3,     7777
2571    5135  2517            2517
2572    5136  0310            0310
2573    5137  7776    L4,     7776
2574    5140  4113            4113
2575    5141  7211            7211
2576
2577                  /LOGARITHM CONSTANTS
2578
2579    5142  7776    LOG5,   7776
2580    5143  2535            2535
2581    5144  3301            3301
2582    5145  7775    LOG6,   7775
2583    5146  4746            4746
2584    5147  0771            0771
2585    5150  7774    LOG7,   7774
2586    5151  2236            2236
2587    5152  4304            4304
2588    5153  7771    LOG8,   7771
2589    5154  4544            4544
2590    5155  1735            1735
2591
2592    5156  4726    TEM,    TEMP
2593    5157  0000    LOG2,   0
2594    5160  2613            2613
2595    5161  4414            4414
2596    5162  0000    FLAG1,  0
2597
2598
2599
2600
2601    5163  0000    FNEG,   0
2602    5164  4451            JMS I MINSKI
2603    5165  7240            CLA CMA
2604    5166  5763            JMP I FNEG
2605
```

```
2606
2607                    /------------------------------------------------------
2608                    /------------------------------------------------------
2609                    /FLOATING POINT SINE AND COSINE
2610
2611            5200    *5200
2612
2613    5200    4407    FCOS,   FINT            /COS(X)=SIN(PI/2-X)
2614    5201    6322            FPUT X
2615    5202    0316            FGET PIOT
2616    5203    2322            FSUB X
2617    5204    0000            FEXT
2618    5205    1045    FSIN,   GETSGN
2619    5206    7740            SMA SZA CLA
2620    5207    5215            JMP MOD
2621    5210    1045            GETSGN
2622    5211    7700            SMA CLA
2623    5212    5536            RETURN          /YES SIN(0)=0
2624    5213    4451            JMS I MINSKI
2625    5214    7040            CMA             /NO;SIN(-X)=-SIN(X)
2626    5215    3033    MOD,    DCA T3
2627                            /REDUCE X MODULO 2 PI
2628    5216    4407            FINT
2629    5217    3306            FDIV TWOPI
2630    5220    6326            FPUT XSQR
2631    5221    0000            FEXT
2632    5222    4453            JMS I INTEGER
2633    5223    4407            FINT
2634    5224    7000            FNOR
2635    5225    6322            FPUT X
2636    5226    0326            FGET XSQR
2637    5227    2322            FSUB X
2638    5230    4306            FMUL TWOPI
2639    5231    6322            FPUT X
2640    5232    2312            FSUB PI         /X<PI?
2641    5233    0000            FEXT
2642    5234    1045            GETSGN
2643    5235    7710            SPA CLA
2644    5236    5245            JMP PCHECK      /YES
2645    5237    4407            FINT            /NO, SIN(X-PI)=-SIN(X)
2646    5240    6322            FPUT X
2647    5241    0000            FEXT
2648    5242    1033            TAD T3          /INVERT THE SIGN
2649    5243    7040            CMA
2650    5244    3033            DCA T3
```

```
2651
2652    5245  4407    PCHECK, FINT            /X<PI/2?
2653    5246  0322            FGET X
2654    5247  2316            FSUB PIOT
2655    5250  0000            FEXT
2656    5251  1045            GETSGN
2657    5252  7710            SPA CLA
2658    5253  5261            JMP PALG        /YES
2659    5254  4407            FINT            /NO
2660    5255  0312            FGET PI         /SIN(X)=SIN(PI-X)
2661    5256  2322            FSUB X
2662    5257  6322            FPUT X
2663    5260  0000            FEXT
2664
2665    5261  4407    PALG,   FINT
2666    5262  0322            FGET X
2667    5263  3316            FDIV PIOT
2668    5264  6322            FPUT X
2669    5265  4322            FMUL X
2670    5266  6326            FPUT XSQR
2671    5267  0332            FGET C9
2672    5270  4326            FMUL XSQR
2673    5271  1336            FADD C7
2674    5272  4326            FMUL XSQR
2675    5273  1342            FADD C5
2676    5274  4326            FMUL XSQR
2677    5275  1346            FADD C3
2678    5276  4326            FMUL XSQR
2679    5277  1316            FADD PIOT
2680    5300  4322            FMUL X
2681    5301  0000            FEXT
2682    5302  2033    EXIT2,  ISZ T3
2683    5303  5536            RETURN
2684    5304  4451            JMS I MINSKI
2685    5305  5536            RETURN
```

```
2686
2687                    /CONSTANTS AND POINTERS
2688
2689
2690
2691    5306  0003      TWOPI,  0003
2692    5307  3110              3110
2693    5310  3756              3756    /(3755) = FOR 4-WORD
2694    5311  3235              3235
2695
2696    5312  0002      PI,     0002
2697    5313  3110              3110
2698    5314  3756              3756
2699    5315  3235              3235
2700
2701    5316  0001      PIOT,   0001            /USED BY SINE AND COSINE
2702    5317  3110              3110
2703    5320  3756              3756
2704    5321  3235              3235
2705
2706    5322  0000      X,      0000
2707    5323  0000              0000
2708    5324  0000              0000
2709    5325  0000              0000
2710
2711    5326  0000      XSQR,   0000
2712    5327  0000              0000
2713    5330  0000              0000
2714    5331  0000              0000
2715
2716                    /SINE CONSTANTS
2717
2718    5332  7764      C9,     7764
2719    5333  2501              2501
2720    5334  7015              7015
2721    5335  1042              1042
2722    5336  7771      C7,     7771
2723    5337  5464              5464
2724    5340  5514              5514
2725    5341  6150              6150
2726    5342  7775      C5,     7775
2727    5343  2431              2431
2728    5344  5361              5361
2729    5345  4736              4736
2730    5346  0000      C3,     0000
2731    5347  5325              5325
2732    5350  0414              0414
2733    5351  3167              3167
2734
2735                    /END OF EXTENDED FUNCTIONS,
2736
```

```
2737
2738
2739                /-------------------------------------------------------
2740                /-------------------------------------------------------
2741                /  - INPUT/OUTPUT ROUTINES FOR THE FOCAL
2742                /FLOATING POINT PACKAGE.
2743
2744
2745                /IN THE COMMENTS BELOW:-
2746                / F = NUMBER OF DIGITS TO BE OUTPUT      =FISW
2747                / D = NUMBER OF DECIMAL PLACES           =DECP
2748                / E = DECIMAL EXPONENT                   =BEXP
2749                / P = NUMBER OF PLACES REMAINING TO BE
2750                /     PRINTED BEFORE DECIMAL POINT
2751
2752
2753          5400  *5400
2754
2755          0006  DIGITS=6          /NUMBER OF DECIMAL DIGITS OUT
2756
2757
2758    5400  0000  TGO,    0
2759    5401  3334          DCA SCOUNT        /SAVE MAX, NUMBER OF DIGITS AVAILABLE - *SET COUNTS*
2760    5402  1052          TAD FISW
2761    5403  4557          RTL6
2762    5404  0122          AND P77
2763    5405  3032          DCA T1
2764    5406  1032          TAD T1
2765    5407  7041          CIA               /NO, COMPUTE FIELD SIZES
2766    5410  7450          SNA
2767    5411  1326          TAD MD
2768    5412  3335          DCA FCOUNT
2769    5413  1052          TAD FISW          /(JMP FPRNT) = FOR NO ROUNDGIN,
2770    5414  7450          SNA               /FLOATING OUTPUT?
2771    5415  5241          JMP R6            /YES, ROUND OFF TO MAX,NO.  PLACES
2772    5416  0122          AND P77
2773    5417  3333          DCA DECP
2774    5420  1335          TAD FCOUNT
2775    5421  1333          TAD DECP
2776    5422  7510          SPA               / F-D > 0 ?
2777    5423  5230          JMP .+5           /YES
2778    5424  7240          CLA CMA           /NO,
2779    5425  1032          TAD T1
2780    5426  3333          DCA DECP          /MAKE D = F-1
2781    5427  7040          CMA
2782    5430  1033          TAD T3            /COMPARE DECIMAL EXPONENT
2783    5431  7500          SMA               / F-D > E?
2784    5432  7200          CLA               /NO, ROUND OFF TO ,F PLACES
2785    5433  1032          TAD T1            /YES
2786    5434  7510          SPA               / D+E < 0 ?
2787    5435  5263          JMP FPRNT-2       /YES, NO ROUNDING NEEDED, GO TO PRINT
2788    5436  1326          TAD MD            /NO, ROUND TO D+E PLACES,
2789    5437  7500          SMA               /TO A MAXIMUM OF D PLACES
2790    5440  7200          CLA
```

```
2791
2792    5441  1327    R6,     TAD RND2        / *ROUND UP *
2793    5442  3071            DCA T2          /SAVE NUMBER*1 OF PLACES TO ROUND TO.
2794    5443  1731            TAD I BUFST
2795    5444  1071            TAD T2          /SET UP BUFFER ADDRESS AT WHICH
2796    5445  3336            DCA PLCE        /ROUNDING OFF SHOULD START
2797    5446  1071            TAD T2
2798    5447  7041            CIA             /SET UP COUNT OF MAXIMUM NUMBER
2799    5450  3071            DCA T2          /OF CARRIES ALLOWABLE
2800    5451  1325            TAD K4          /LITTLE EXTRA ON FIRST DIGIT,
2801    5452  2736    RET,    ISZ I PLCE      /ADD 1 TO DIGIT AT CURRENT POSITION
2802    5453  1736            TAD I PLCE
2803    5454  1330            TAD OM12
2804    5455  7710            SPA CLA         /CARRY REQUIRED?
2805    5456  5265            JMP FPRNT       /NO, GO TO OUTPUT
2806    5457  3736            DCA I PLCE      /YES, MAKE CURRENT DIGIT ZERO
2807    5460  2071            ISZ T2          /BEGINNING OF BUFFER REACHED?
2808    5461  5321            JMP DECR        /NO, DECREMENT BUFFER ADDRESS AND REPEAT
2809    5462  2736            ISZ I PLCE      /YES, SET MANTISSA TO 0,1
2810    5463  2033            ISZ T3          /COMPENSATE BY INCREMENTING EXPONENT
2811    5464  7200            CLA
2812    5465  1052    FPRNT,  TAD FISW        /AUTO-INDEX REGISTER ALREADY SET, = *PRINT*
2813    5466  7650            SNA CLA         / F = 0 ?
2814    5467  5356            JMP FLOUT       /YES, OUTPUT AS FLOATING NUMBER
2815    5470  1335            TAD FCOUNT
2816    5471  1033            TAD T3
2817    5472  7540            SMA SZA         / E > F ?
2818    5473  5355            JMP FLOUT-1     /YES,CONVERT TO E FORMAT
2819    5474  1333            TAD DECP
2820    5475  7500            SMA             / E < F-D ?
2821    5476  7200            CLA             /NO, TAKE P = E
2822    5477  7041            CIA             /YES, TAKE P = F-D
2823    5500  1033            TAD T3
2824    5501  7041            CIA
2825    5502  3032            DCA T1          /SET UP MINUS P
2826    5503  1033    BACK,   TAD T3          /PRINT DD,DDD
2827    5504  1032            TAD T1
2828    5505  7650            SNA CLA         / P = E ?
2829    5506  5343            JMP DIG         /YES, PRINT DIGIT
2830    5507  1032            TAD T1          /NO,
2831    5510  7001            IAC
2832    5511  7710            SPA CLA         / P > 1 ?
2833    5512  1105            TAD M20 /YES, TAKE SPACE (240-260); OTHERWISE ZERO
2834    5513  4336    IN,     JMS OUTA        /PRINT CHARACTER
2835    5514  2032            ISZ T1          /P CHARACTERS PRINTED?
2836    5515  5303            JMP BACK        /NO
2837    5516  1102            TAD PER         /YES,
2838    5517  4551            PRINTC          /PRINT DECIMAL POINT
2839    5520  5303            JMP BACK
```

```
2840
2841    5521  7040    DECR,   CMA             /BACKUP TO TOP OF BUFFER,
2842    5522  1336            TAD PLCE
2843    5523  3336            DCA PLCE
2844    5524  5252            JMP RET
2845    5525  0004    K4,     4
2846    5526  7772    MD,     -DIGITS
2847    5527  0007    RND2,   DIGITS+1
2848    5530  7766    OM12,   -12
2849    5531  6150    BUFST,  SADR
2850    5532  6154    OPUT,   OUTDG
2851    5533  0000    DECP,   0               /MODIFIABLE LOCATIONS
2852    5534  0000    SCOUNT, 0
2853    5535  0000    FCOUNT, 0
2854          5536    PLCE=.
2855    5536  0000    OUTA,   0               /MODIFIED REGISTERS,
2856    5537  4732            JMS I OPUT      /PRINT CHARACTER
2857    5540  2335            ISZ FCOUNT      /F CHARACTERS PRINTED?
2858    5541  5736            JMP I OUTA      /NO--RETURN--
2859    5542  5600            JMP I TGO       /YES, NUMBER FINSHED
2860    5543  7040    DIG,    CMA
2861    5544  1033            TAD T3          /REDUCE E, BY 1
2862    5545  3033            DCA T3
2863    5546  2334            ISZ SCOUNT      /ARE ALL SIG. FIGS, USED?
2864    5547  5353            JMP .+4         /NO
2865    5550  7040            CMA             /YES,
2866    5551  3334            DCA SCOUNT      /RESET COUNT TO -1
2867    5552  5313            JMP IN          /AND LEAVE C(AC) = 0
2868    5553  1414            TAD I FLTXR     /TAKE NEXT DIGIT FROM BUFFER
2869    5554  5313            JMP IN
2870                  /DO FLOATING OUTPUT
2871    5555  7200            CLA             /IF OUTPUT TOO LARGE,
2872    5556  4732    FLOUT,  JMS I OPUT      /PRINT "0"
2873    5557  1102            TAD PER
2874    5560  4551            PRINTC          /PRINT ","
2875    5561  2200            ISZ TGO         /SECOND RETURN
2876    5562  1414            TAD I FLTXR     /TAKE NEXT DIGIT FROM BUFFER
2877    5563  4336            JMS OUTA        /PRINT IT
2878    5564  2334            ISZ SCOUNT      /TEST FOR END OF INPUT
2879    5565  5362            JMP .-3         /AND REPEAT
2880    5566  7040            CMA
2881    5567  3334            DCA SCOUNT      /OUTPUT EXTRA ZEROS,
2882    5570  5363            JMP .-5
2883    5571  0000    ABSOLV, 0
2884    5572  1045            TAD HORD
2885    5573  3050            DCA SIGNF
2886    5574  1045            TAD HORD
2887    5575  7710            SPA CLA
2888    5576  4451            JMS I MINSKI
2889    5577  5771            JMP I ABSOLV    /--RETURN--
2890
```

```
2891
2892                    /-------------------------------------------------------
2893                    /-------------------------------------------------------
2894                    /DOUBLE PRECISION DECIMAL-BINARY .
2895                    /INPUT AND CONVERSION FOR + OR - XXX...
2896
2897            5600    *5600
2898
2899    5600    0000    DECONV, 0
2900    5601    3046            DCA LORD
2901    5602    3044            DCA EXP         /ZERO THE EXPONENT AND
2902    5603    3045            DCA HORD        /INITIALIZE FLOATING AC.
2903    5604    3047            DCA OVER2
2904    5605    3314            DCA DNUMBR
2905    5606    3050            DCA SIGNF
2906    5607    1066            TAD CHAR        /ALLOW KEYBOARD SIGN CHECKS.
2907    5610    1264            TAD MPLUS
2908    5611    7450            SNA
2909    5612    5220            JMP .+6         /+SIGN; GET NEXT
2910    5613    1111            TAD M2          /CHECK - SIGN
2911    5614    7640            SZA CLA
2912    5615    5221            JMP .+4
2913    5616    7040            CMA             /INIT SIGN CHECK TO POS.
2914    5617    3050            DCA SIGNF
2915    5620    4666            JMS I XINPUT    /GET NEXT
2916    5621    1066            TAD CHAR        /A SPACE PERHAPS?
2917    5622    1265            TAD MSPACE
2918    5623    7650            SNA CLA
2919    5624    5220            JMP .-4
2920    5625    4227            JMS DECON
2921    5626    5600            JMP I DECONV    /--RETURN--
```

```
2922
2923
2924    5627  0000    DECON,  0
2925    5630  1066            TAD CHAR        /TEST LEAD CHARACTER FOR TERMINATOR
2926    5631  1262            TAD MINE
2927    5632  7650            SNA CLA
2928    5633  5627            JMP I DECON     /E--RETURN--
2929    5634  4561            TESTN
2930    5635  5627            JMP I DECON     /,--RETURN--
2931    5636  5247            JMP DTST        /OTHER
2932    5637  1054            TAD SORTCN      /N
2933    5640  3313    DSAVE,  DCA DIGIT       /YES
2934    5641  4267            JMS MULT10      /REMAIN MUST =0 SINCE OVERFLOW IS CHECKED
2935    5642  2314            ISZ DNUMBR      /COUNT DIGITS
2936    5643  7640            SZA CLA
2937    5644  4566            ERROR2          /INPUT-OVERFLOW ERROR
2938    5645  4666            JMS I XINPUT
2939    5646  5230            JMP DECON+1     /CONTINUE
2940    5647  1066    DTST,   TAD CHAR        /ALLOW A-Z
2941    5650  1112            TAD MINUSA
2942    5651  7710            SPA CLA
2943    5652  5627            JMP I DECON     /--RETURN--
2944    5653  1066            TAD CHAR
2945    5654  1263            TAD MINUSZ
2946    5655  7740            SZA SMA CLA
2947    5656  5627            JMP I DECON     /USE SIX BITS OF ASCII--RETURN--
2948    5657  1066            TAD CHAR
2949    5660  0122            AND P77
2950    5661  5240            JMP DSAVE
2951    5662  7473    MINE,   -305    /(7532)- FOR AMPERSAND
2952    5663  7446    MINUSZ, -332
2953    5664  7525    MPLUS,  -253
2954    5665  7540    MSPACE, -240
2955    5666  0756    XINPUT, INPUT
2956
```

```
2957
2958
2959
2960
2961    5667  0000    MULT10, 0       /ROUTINE TO MULTIPLY FLAC BY TEN (10)
2962    5670  1047            TAD OVER2
2963    5671  3043            DCA OVER1
2964    5672  1046            TAD LORD        /DOUBLE PRECISION WORD
2965    5673  3042            DCA AC1L        /BY TEN (DECIMAL)
2966    5674  1045            TAD HORD        /REMAIN=REMAINDER
2967    5675  3041            DCA AC1H
2968    5676  3312            DCA REMAIN      /CLEAR OVERFLOW WORD
2969    5677  4315            JMS MULT2       /CALL SUBROUTINE TO
2970    5700  4315            JMS MULT2       /MULTIPLY BY TWO
2971    5701  4333            JMS DUBLAD      /CALL DOUBLE ADD
2972    5702  4315            JMS MULT2
2973    5703  1313            TAD DIGIT       /ADD LAST DIGIT RECEIVED
2974    5704  3043            DCA OVER1
2975    5705  3042            DCA AC1L
2976    5706  3041            DCA AC1H
2977    5707  4333            JMS DUBLAD
2978    5710  1312            TAD REMAIN      /EXIT WITH REMAINDER
2979    5711  5667            JMP I MULT10    /IN AC--RETURN--
2980
2981    5712  0000    REMAIN, 0
2982
2983    5713  0000    DIGIT,  0       /STORAGE FOR DIGIT
2984    5714  0000    DNUMBR, 0       /=NUMBER OF DIGITS
2985    5715  0000    MULT2,  0       /MULTIPLY  OVER2, LORD, HORD BY 2
2986    5716  1047            TAD OVER2
2987    5717  7104            CLL RAL         /CARRY INSERT BIT IS IN LINK
2988    5720  3047            DCA OVER2
2989    5721  1046            TAD LORD
2990    5722  7004            RAL
2991    5723  3046            DCA LORD
2992    5724  1045            TAD HORD
2993    5725  7004            RAL
2994    5726  3045            DCA HORD
2995    5727  1312            TAD REMAIN
2996    5730  7004            RAL
2997    5731  3312            DCA REMAIN
2998    5732  5715            JMP I MULT2     /--RETURN--
2999
```

```
3000
3001
3002
3003
3004
3005    5733  0000    DUBLAD, 0       /TRIPLE PRECISION ADDITION
3006    5734  7300            CLA CLL
3007    5735  1047            TAD OVER2
3008    5736  1043            TAD OVER1
3009    5737  3047            DCA OVER2
3010    5740  7004            RAL
3011    5741  1046            TAD LORD
3012    5742  1042            TAD AC1L
3013    5743  3046            DCA LORD
3014    5744  7004            RAL
3015    5745  1045            TAD HORD
3016    5746  1041            TAD AC1H
3017    5747  3045            DCA HORD
3018    5750  7004            RAL
3019    5751  1312            TAD REMAIN      /WITH OVERFLOW
3020    5752  3312            DCA REMAIN
3021    5753  5733            JMP I DUBLAD    /--RETURN--
3022
3023    5754  0000    DIV1,   0       /SHIFT OPERAND RIGHT
3024    5755  7300            CLA CLL         /TRIPLE PRECISION
3025    5756  1041            TAD AC1H
3026    5757  7510            SPA
3027    5760  7120            CLL CML
3028    5761  7010            RAR
3029    5762  3041            DCA AC1H
3030    5763  1042            TAD AC1L
3031    5764  7010            RAR
3032    5765  3042            DCA AC1L
3033    5766  1043            TAD OVER1
3034    5767  7010            RAR
3035    5770  3043            DCA OVER1
3036    5771  2040            ISZ EX1
3037    5772  5754            JMP I DIV1      /--RETURN--
3038    5773  5754            JMP I DIV1      /--RETURN--
3039
```

```
3040
3041                    /-----------------------------------------------------
3042                    /-----------------------------------------------------
3043            6000    *6000
3044
3045                    /FLOATING OUTPUT CONVERSION ROUTINE
3046
3047    6000    0000    FLOUTP, 0
3048    6001    1335            TAD PEQ
3049    6002    4551            PRINTC          /(CLA)← TO SUPPRESS "="
3050    6003    1045            TAD HORD        /NUMBER>0??
3051    6004    7700            SMA CLA
3052    6005    1334            TAD SMSP        /PRINT "-" OR A SPACE,
3053    6006    1336            TAD SMIN
3054    6007    4551            PRINTC
3055    6010    4753            JMS I ABSOL2
3056    6011    3033    FG02,   DCA T3          /INITIALIZE DECIMAL EXPONENT
3057    6012    1044            TAD EXP         /IS EXP Ø TO 4?
3058    6013    7510            SPA
3059    6014    5227            JMP FG03        /TOO LARGE:MULTIPLY BY 1/10
3060    6015    7440            SZA
3061    6016    1341            TAD M4
3062    6017    7750            SPA SNA CLA
3063    6020    5234            JMP FG04
3064    6021    4407            FINT
3065    6022    4744            FMUL I PPTEN
3066    6023    0000            FEXT
3067    6024    7001            IAC
3068    6025    1033            TAD T3
3069    6026    5211            JMP FG02
3070    6027    4407    FG03,   FINT
3071    6030    4752            FMUL I TENPT
3072    6031    0000            FEXT
3073    6032    7040            CMA
3074    6033    5225            JMP .-6
```

```
3075
3076    6034  3745    FG04,   DCA I DPT       /MULTIPLY BY TWO TO POSITION BIT0
3077    6035  3746            DCA I REPT      /CLEAR OVERFLOW WORD
3078    6036  1350            TAD SADR        /INIT BUFFER POINTER
3079    6037  3014            DCA FLTXR
3080    6040  1044            TAD EXP         /COMPUTE BITS IN 1ST DIGIT
3081    6041  7140            CMA CLL
3082    6042  3354            DCA OUTDG       /TEMP COUNT
3083    6043  1343            TAD DCOUNT      /SETUP COUNT OF TOTAL OUTPUT
3084    6044  3044            DCA EXP
3085    6045  4527            JMS I DOUBLE    /ROTATE OUT THE 1ST 4 BITS
3086    6046  2354            ISZ OUTDG
3087    6047  5245            JMP .-2
3088    6050  1746            TAD I REPT      /TEST FOR 10-15,0,1-9
3089    6051  7450            SNA
3090    6052  5270            JMP FG05        /IGNORE 1ST ZERO
3091    6053  1342            TAD FM12
3092    6054  7710            SPA CLA
3093    6055  5264            JMP .+7         /0-9
3094    6056  7001            IAC
3095    6057  3414            DCA I FLTXR     /OUTPUT A 1
3096    6060  2044            ISZ EXP         /COUNT THE DIGIT
3097    6061  1342            TAD FM12        /CORRECT REMAINDER
3098    6062  2033            ISZ T3          /BUMP DECIMAL EXPONENT
3099    6063  7000            NOP
3100    6064  1746            TAD I REPT      /COMPUTE RESULTANT OR SECOND DIGIT
3101    6065  2033            ISZ T3
3102    6066  7000            NOP
3103    6067  7410            SKP
3104    6070  4747    FG05,   JMS I M10PT     /IE, .672X10=6+.72,, ETC
3105    6071  3414            DCA I FLTXR
3106    6072  2044            ISZ EXP         /ALL DIGITS OUTPUT??
3107    6073  5270            JMP .-3         /NO! CONTINUE
3108    6074  1350            TAD SADR        /INIT BUFFER POINTER
3109    6075  3014            DCA FLTXR
3110    6076  1343            TAD DCOUNT
3111    6077  4751            JMS I ROUND     /OUTPUT MANTISSA
3112    6100  5600            JMP I FLOUTP    /FIXED POINT DONE--RETURN--
3113    6101  1333            TAD CHRT        /PRINT "E"
3114    6102  4551            PRINTC
```

```
3115
3116                    /OUTPUT THE EXPONENT
3117
3118    6103  1033              TAD T3          /TAKE ABSOLUTE VALUE OF EXPONENT
3119    6104  7510              SPA
3120    6105  7041              CIA
3121    6106  3045              DCA HORD                /SAVE + POWER
3122    6107  1033              TAD T3          /PRINT SIGN
3123    6110  7700              SMA CLA
3124    6111  1111              TAD M2
3125    6112  1336              TAD SMIN
3126    6113  4551              PRINTC
3127    6114  1045              TAD HORD
3128    6115  2044              ISZ EXP
3129    6116  1337              TAD M144
3130    6117  7500              SMA
3131    6120  5315              JMP .-3
3132    6121  1340              TAD C144
3133    6122  3045              DCA HORD                /SAVE TENS AND UNITS
3134    6123  7040              CMA             /OUTPUT HUNDREDS
3135    6124  1044              TAD EXP
3136    6125  7440              SZA             /UNLESS ZERO
3137    6126  4354              JMS OUTDG
3138    6127  1045              TAD HORD        /PRINT TWO DIGITS
3139    6130  4732              JMS I PRNTI
3140    6131  5600              JMP I FLOUTP    /--RETURN--
3141    6132  2442    PRNTI,    PRNT
3142    6133  0305    CHRT,     305     /E  (0246) - FOR AMPERSAND
3143    6134  7763    SMSP,     240-255 /
3144    6135  0275    PEQ,      275
3145    6136  0255    SMIN,     255
3146    6137  7634    M144,     -144    /-100
3147    6140  0144    C144,     0144    /+100
3148    6141  7774    M4,       -4
3149    6142  7766    FM12,     -12
3150    6143  7771    DCOUNT,   -DIGITS-1       /NUMBER OF DIGITS OUTPUT
3151    6144  6275    PPTEN,    PTEN    /IEI
3152    6145  5713    DPT,      DIGIT
3153    6146  5712    REPT,     REMAIN  /OVERFLOW FROM INTEGER MULTIPLY
3154    6147  5667    M10PT,    MULT10
3155    6150  7467    SADR,     BUFFER-1
3156    6151  5400    ROUND,    TGO     /ACTUAL OUTPUT ROUTINE
3157    6152  6271    TENPT,    TEN
3158    6153  5571    ABSOL2,   ABSOLV
3159    6154  0000    OUTDG,    0               /OUTPUT ONE DIGIT
3160    6155  1113              TAD C260
3161    6156  4551              PRINTC
3162    6157  5754              JMP I OUTDG     /--RETURN--
3163
3164                    /USED BY 8K
3165
```

```
3166
3167
3168                    /-------------------------------------------------
3169                    /-------------------------------------------------
3170                    /FLOATING POINT INPUT
3171
3172            6200    *6200
3173
3174    6200    0000    FLINTP, 0               /IF C(AC) = 0, USE CHAR
3175    6201    7640            SZA CLA         /IF C(AC) NON-ZERO , GET NEXT
3176    6202    4706            JMS I XIN       /GET FIRST CHAR
3177    6203    1066            TAD CHAR        /IGNORE LEADING SPACES
3178    6204    1114            TAD M240
3179    6205    7650            SNA CLA
3180    6206    5202            JMP .-4
3181    6207    4702            JMS I DPCVRT    /READ FIRST DIGIT GROUP
3182    6210    1066            TAD CHAR        /AND SET "SIGNF"
3183    6211    1115            TAD MPER
3184    6212    7640            SZA CLA         /ENDED BY PERIOD?
3185    6213    5221            JMP FIG01
3186    6214    4706            JMS I XIN       /YES, READ 2AND GROUP
3187    6215    3705            DCA I DPN
3188    6216    4703            JMS I DCONP
3189    6217    1705            TAD I DPN       /SAVE NUMBER OF DIGITS IN T3
3190    6220    7041            CMA IAC
3191    6221    3033    FIG01,  DCA T3          /NO,
3192    6222    1310            TAD P43
3193    6223    3044            DCA EXP
3194    6224    4704            JMS I RESOL5
3195    6225    4707            JMS I INORM     /NORMALIZE FIRST, THEN
3196    6226    4407            FINT
3197    6227    6430            FPUT I PT1      /SAVE NUMBER
3198    6230    0000            FEXT
3199    6231    1066            TAD CHAR
3200    6232    1301            TAD MINUSE
3201    6233    7640            SZA CLA         /"E" READ IN?
3202    6234    5246            JMP ENDFI+3     /NO
3203    6235    4706            JMS I XIN       /YES, READ 3RD DIGIT GROUP
3204    6236    4702            JMS I DPCVPT    /I.E, CONVERT DECIMAL EXPONENT
3205    6237    4704            JMS I RESOL5
3206    6240    1047            TAD OVER2
3207    6241    1033            TAD T3          /C(SEXP)PLACES TO RIGHT
3208    6242    3033            DCA T3          /OF LAST DIGIT
3209
3210
3211
```

```
3212
3213                    /COMPENSATE FOR DECIMAL EXPONENTS
3214
3215    6243  4407      ENDFI,  FINT              /RESTORE MANTISSA
3216    6244  0430              FGET I PT1
3217    6245  0000              FEXT
3218    6246  1033              TAD T3            /TEST DECIMAL EXPONENT
3219    6247  7450              SNA
3220    6250  5600              JMP I FLINTP      /FINISHED--RETURN--
3221    6251  7700              SMA CLA
3222    6252  5261              JMP FIG04
3223    6253  4407              FINT              /. IS TO THE LEFT!
3224    6254  4275              FMUL PTEN         /TIMES .1000
3225    6255  6430              FPUT I PT1
3226    6256  0000              FEXT
3227    6257  7001              IAC
3228    6260  5266              JMP .+6
3229    6261  4407      FIG04,  FINT              /. IS TO THE RIGHT!
3230    6262  4271              FMUL TEN          /MULTIPLY BY 10
3231    6263  6430              FPUT I PT1
3232    6264  0000              FEXT
3233    6265  7040              CMA
3234    6266  1033              TAD T3
3235    6267  3033              DCA T3
3236    6270  5246              JMP ENDFI+3
3237    6271  0004      TEN,    0004
3238    6272  2400              2400
3239    6273  0000              0000
3240    6274  0000              0000
3241
3242    6275  7775      PTEN,   7775
3243    6276  3146              3146
3244    6277  3147              3147      /(3146) - FOR 4-WORD
3245    6300  3150              3150
3246
3247    6301  7473      MINUSE, -305      /(7532) - FOR AMPERSAND
3248
3249    6302  5600      DPCVPT, DECONV
3250    6303  5627      DCONP,  DECON
3251    6304  7173      RESOL5, RESOLV
3252    6305  5714      DPN,    DNUMBR
3253    6306  0756      XIN,    INPUT
3254    6307  7335      INORM,  DNORM
3255    6310  0043      P43,    43
3256
3257                    /END OF FLOATING POINT INPUT
3258
3259                    /7 FREE
3260
3261                    /USED BY H,S, READER
```

```
3262
3263                    /-------------------------------------------------------
3264                    /-------------------------------------------------------
3265            6400    *6400
3266                            / FLOATING-POINT INTERPRETER FOR FOCAL,
3267
3268    6400    0000    FPNT,   0
3269    6401    7300            CLA CLL
3270    6402    3047            DCA OVER2       /(NOP) = FOR 4-WORD
3271    6403    3043            DCA OVER1       /(NOP) = FOR 4-WORD,
3272    6404    1600            TAD I FPNT      /GET NEXT INSTRUCTION
3273    6405    7450            SNA
3274    6406    5600            JMP I FPNT      /FAST EXIT--RETURN--
3275    6407    3262            DCA JUMP
3276    6410    1262            TAD JUMP
3277    6411    0123            AND C200        /GET PAGE BIT
3278    6412    7650            SNA CLA         /PAGE ZERO?
3279    6413    5216            JMP .+3         /YES
3280    6414    1104            TAD P7600       /NO
3281    6415    0200            AND FPNT        /C(FPNT)0-4 CONTAINS PAGE BITS
3282    6416    3040            DCA ADDR
3283    6417    1106            TAD P177        /GET 7 BIT ADDRESS
3284    6420    0262            AND JUMP
3285    6421    1040            TAD ADDR
3286    6422    3040            DCA ADDR
3287    6423    1263            TAD INDRCT      /INDIRECT BIT=1?
3288    6424    0262            AND JUMP
3289    6425    7650            SNA CLA
3290    6426    5231            JMP LOOP01      /NO-GO ON
3291    6427    1440            TAD I ADDR      /YES ,DEFER ,W/O AUTO-INDEX
3292    6430    3040            DCA ADDR
3293    6431    2200    LOOP01, ISZ FPNT
3294    6432    7040            CMA
3295    6433    1040            TAD ADDR
3296    6434    3015            DCA FLTXR2
3297    6435    1262            TAD JUMP        /GET COMMAND
3298    6436    7106            CLL RTL
3299    6437    7006            RTL
3300    6440    0107            AND P17         /GET BITS 0-2,IE OPCODE
3301    6441    7450            SNA
3302    6442    5267            JMP FLGT
3303    6443    1264            TAD TABLE       /LOOKUP IN TABLE
3304    6444    3262            DCA JUMP
3305    6445    1662            TAD I JUMP
3306    6446    7450            SNA
3307    6447    5265            JMP FLPT
3308    6450    3262            DCA JUMP
3309    6451    1304            TAD CEX1        /SAVE FLOATING ARGUEMENT,UNLESS'GET' OR 'PUT'
3310    6452    3014            DCA FLTXR
3311    6453    1117            TAD MFLT
3312    6454    3057            DCA CNTR
3313    6455    1415            TAD I FLTXR2
3314    6456    3414            DCA I FLTXR
3315    6457    2057            ISZ CNTR
3316    6460    5255            JMP .-3
```

```
3317    6461  5662          JMP I JUMP      /GO THERE
3318
```

```
3319
3320    6462  0000    JUMP,   0
3321
3322          0040    ADDR=EX1
3323
3324    6463  0400    INDRCT, 0400
3325    6464  6573    TABLE,  ITABLE
3326    6465  1303    FLPT,   TAD CEXP        /EXP TO (ADDR)
3327    6466  5273            JMP .+5
3328    6467  1303    FLGT,   TAD CEXP        /(ADDR) TO EXP
3329    6470  3015            DCA FLTXR2
3330    6471  7040            CMA
3331    6472  1040            TAD ADDR
3332    6473  3014            DCA FLTXR       /SAVE 'FROM' ADDRESS
3333    6474  1117            TAD MFLT        /3 OR 4 WORDS
3334    6475  3057            DCA CNTR
3335    6476  1414            TAD I FLTXR
3336    6477  3415            DCA I FLTXR2
3337    6500  2057            ISZ CNTR
3338    6501  5276            JMP .-3
3339    6502  5201            JMP FPNT+1
3340    6503  0043    CEXP,   EXP-1
3341    6504  0037    CEX1,   EX1-1
3342
3343
3344    6505  4765    FLSU,   JMS I OPMINS    /FSUB=2 - NEGATE THE OPERAND
3345    6506  4770    FLAD,   JMS I ALGN      /FLAD=1 - FIRST ALIGN EXPONENTS
3346    6507  5201            JMP FPNT+1      /RETURN IF NO ALIGNMENT IS POSSIBLE
3347    6510  4772            JMS I RAR2      /TRIPLE PRECISION ADDDITION
3348    6511  4771            JMS I RAR1      /SINCE BITS ARE SHIFTED
3349    6512  4773            JMS I TRAD      /RIGHT
3350    6513  4767    NORF,   JMS I NORM      /NORMALIZE THE RESULT
3351    6514  5201            JMP FPNT+1      /HINT:USE 700X FOR FUNCTIONS,
```

```
3352
3353                    /INTERPRETIVE POWER
3354
3355    6515  7000              NOP     /3 FREE LOCATIONS ***********
3356    6516  7000              NOP
3357    6517  7000              NOP
3358    6520  3044    ZERO,     DCA EXP           /YES
3359    6521  3045              DCA HORD
3360    6522  3046              DCA LORD
3361    6523  3047              DCA OVER2
3362    6524  5201              JMP FPNT+1
3363    6525  4543    FLEX,     PUSHF             /AC TO A + POWER
3364    6526  0044              FLAC
3365    6527  4543              PUSHF             /SETUP ARGUMENT ( THE EXPONENT)
3366    6530  0040              EX1
3367    6531  4544              POPF
3368    6532  0044              FLAC
3369    6533  4453              JMS I INTEGER     /ONLY POSITIVE, INTEGER  EXPONENTS
3370    6534  7510              SPA
3371    6535  5342              JMP .+5           /(COULD DIVIDE)
3372    6536  7040              CMA
3373    6537  3262              DCA JUMP          /TEMP STORAGE
3374    6540  3043              DCA OVER1         /(NOP) = FOR 4-WORD
3375    6541  1045              TAD HORD
3376    6542  7640              SZA CLA
3377    6543  4566              ERROR2            /TOO LARGE OR NEGATIVE EXPONENT
3378    6544  4543              PUSHF             /INITIALIZE TO ONE,
3379    6545  2405              FLTONE
3380    6546  4544              POPF
3381    6547  0044              FLAC
3382    6550  4544              POPF
3383    6551  7470              ITER1
3384    6552  5360              JMP .+6
3385    6553  4543              PUSHF
3386    6554  7470              ITER1
3387    6555  4544              POPF
3388    6556  0040              EX1
3389    6557  4766              JMS I MULT        /"MULT"
3390    6560  2262              ISZ JUMP
3391    6561  5353              JMP .-6
3392    6562  5201              JMP FPNT+1
```

```
3393    6563  4766    FLMY,   JMS I MULT      /MULTIPLY
3394    6564  5201            JMP FPNT+1
3395                    /-------------------------------------------------
3396
3397
3398    6565  7153    OPMINS, MINUS2
3399    6566  7004    MULT,   DMULT
3400    6567  7335    NORM,   DNORM
3401    6570  6623    ALGN,   ALIGN
3402    6571  5754    RAR1,   DIV1
3403    6572  6757    RAR2,   DIV2
3404    6573  5733    TRAD,   DUBLAD
3405
3406          6573    ITABLE=.-1
3407    6574  6506            FLAD
3408    6575  6505            FLSU
3409    6576  7107            FLDV
3410    6577  6563            FLMY
3411    6600  6525            FLEX
3412    6601  0000            0000
3413    6602  6513            NORF
3414                    /-------------------------------------------------
3415
3416    6603  0000    ACMINS, 0       /ROUTINE TO  COMPLEMENT FLAC - VIA "MINSKI"
3417    6604  7300            CLL CLA
3418    6605  1047            TAD OVER2       /TRIPLE PRECISION NEGATION
3419    6606  7041            CMA IAC         /OF FLOATING AC
3420    6607  3047            DCA OVER2
3421    6610  1046            TAD LORD
3422    6611  7040            CMA
3423    6612  7430            SZL
3424    6613  7101            IAC CLL
3425    6614  3046            DCA LORD
3426    6615  1045            TAD HORD
3427    6616  7040            CMA
3428    6617  7430            SZL
3429    6620  7101            IAC CLL
3430    6621  3045            DCA HORD
3431    6622  5603            JMP I ACMINS    /--RETURN--
3432
```

```
3433
3434    6623  0000    ALIGN,  0       /SUBROUTINE TO ALIGN
3435    6624  1045            TAD HORD        /BINARY POINTS
3436    6625  7450            SNA
3437    6626  1046            TAD LORD        /IS MANTISSA ZERO?
3438    6627  7650            SNA CLA
3439    6630  5311            JMP NOX1        /YES, RESULT=OPERAND
3440    6631  1041            TAD AC1H        /NO,IS OPERAND ZERO?
3441    6632  7450            SNA
3442    6633  1042            TAD AC1L
3443    6634  7450            SNA
3444    6635  1043            TAD OVER1
3445    6636  7650            SNA CLA
3446    6637  5623            JMP I ALIGN     /YES--RETURN--
3447    6640  1040            TAD EX1
3448    6641  7041            CMA IAC
3449    6642  1044            TAD EXP
3450    6643  7450            SNA             /ARE EXPONENTS EQUAL?
3451    6644  5273            JMP ADONE       /YES
3452    6645  3203            DCA ACMINS
3453    6646  1203            TAD ACMINS
3454    6647  7500            SMA             /NO
3455    6650  7041            CIA             /NEGATE AND
3456    6651  3322            DCA AMOUNT      /SAVE THE DIFFERENCE
3457    6652  1322            TAD AMOUNT
3458    6653  1336            TAD TEST2
3459    6654  7710            SPA CLA         /CAN THE EXPONENTS BE ALIGNED?
3460    6655  5275            JMP NOX         /NO, USE LARGER OF THE TWO,
3461    6656  1203            TAD ACMINS      /YES, SHIFT THE SMALLER
3462    6657  7700            SMA CLA
3463    6660  5265            JMP ASHFT
3464    6661  4357            JMS DIV2
3465    6662  2322            ISZ AMOUNT
3466    6663  5261            JMP .-2
3467    6664  5273            JMP ADONE
```

```
3468    6665  7040    ASHFT,  CMA
3469    6666  1040            TAD EX1
3470    6667  3040            DCA EX1
3471    6670  4723            JMS I TAG1
3472    6671  2322            ISZ AMOUNT
3473    6672  5270            JMP .-2
3474    6673  2223    ADONE,  ISZ ALIGN
3475    6674  5623            JMP I ALIGN     /--RETURN--
3476    6675  1040    NOX,    TAD EX1         /MISSION IMPOSSIBLE!
3477    6676  7700            SMA CLA         /CHECK FOR SIGN DIFFERENCE
3478    6677  5304            JMP NOX2
3479    6700  1044            TAD EXP
3480    6701  7700            SMA CLA
3481    6702  5623            JMP I ALIGN     /-+--RETURN--
3482    6703  5306            JMP .+3         /--
3483    6704  1044    NOX2,   TAD EXP
3484    6705  7700            SMA CLA
3485    6706  1203            TAD ACMINS      /TEMP STORAGE OF DIFFERENCE, BOTH POS EXP OR BOTH NEG,
3486    6707  7740            SMA SZA CLA
3487    6710  5623            JMP I ALIGN     /OK (+-)--RETURN--
3488    6711  1040    NOX1,   TAD EX1         /USE LARGER
3489    6712  3044            DCA EXP
3490    6713  1041            TAD AC1H
3491    6714  3045            DCA HORD
3492    6715  1042            TAD AC1L
3493    6716  3046            DCA LORD
3494    6717  1043            TAD OVER1
3495    6720  3047            DCA OVER2
3496    6721  5623            JMP I ALIGN     /--RETURN--
3497    6722  0000    AMOUNT, 0
3498    6723  5754    TAG1,   DIV1
```

```
3499                    /LEAVE 12 BIT ANSWER IN AC UPON RETURN
3500                    /LEAVE FLAC AS AN INTEGER,
3501
3502    6724  0000      FIX,    0               /VIA (INTEGER)
3503    6725  4751              JMS I ABSOL
3504    6726  1044              TAD EXP         /TEST FOR FRACTION
3505    6727  7750              SPA SNA CLA
3506    6730  5353              JMP FIXM        /DOUBLE CHECK FOR MINUS ONE.
3507    6731  7001              IAC
3508    6732  3043              DCA OVER1
3509    6733  1350              TAD P27         /INIT ALIGNMENT
3510    6734  3040              DCA EX1
3511    6735  4223              JMS ALIGN       /DO THE ALIGNMENT TO AN INTEGER
3512    6736  0027      TEST2,  0027            /ALREADY DONE; (43)=FOR 4-WORD
3513    6737  2047              ISZ OVER2
3514    6740  5344              JMP .+4
3515    6741  2046              ISZ LORD
3516    6742  7410              SKP
3517    6743  2045              ISZ HORD
3518    6744  3047              DCA OVER2       /CLEAR THE FRACTION
3519    6745  4752              JMS I RESOL
3520    6746  1046              TAD LORD        /EXIT WITH LOW ORDER RESULT IN AC.
3521    6747  5724              JMP I FIX       /--RETURN--
3522    6750  0027      P27,    27
3523    6751  5571      ABSOL,  ABSOLV
3524    6752  7173      RESOL,  RESOLV
3525    6753  3044      FIXM,   DCA EXP         /CLEAR EXPONENT
3526    6754  3045              DCA HORD
3527    6755  3046              DCA LORD
3528    6756  5344              JMP TEST2+6
3529    6757  0000      DIV2,   0       /SHIFT FLAC RIGHT
3530    6760  7300              CLA CLL
3531    6761  1045              TAD HORD
3532    6762  7510              SPA
3533    6763  7020              CML
3534    6764  7010              RAR
3535    6765  3045              DCA HORD
3536    6766  1046              TAD LORD
3537    6767  7010              RAR
3538    6770  3046              DCA LORD
3539    6771  1047              TAD OVER2
3540    6772  7010              RAR
3541    6773  3047              DCA OVER2
3542    6774  2044              ISZ EXP
3543    6775  5757              JMP % DIV2      /--RETURN--
3544    6776  5757              JMP I .DIV2     /--RETURN--
3545                    /-----------------------------------------------------
3546          6777      SPECIAL=.       /INPUT CHARACTERS
3547    6777  0337              337     /LEFT ARROW
3548    7000  0377              377     /RUBOUT
3549    7001  0212              212     /L.F.
3550    7002  0375              375     /ALT MODE
3551    7003  7777              -1
```

```
3552                    /-----------------------------------------------------
3553                    /(A+B+C)*(D+E+F)=A*D,A*E,B*D,B*E
3554
3555    7004  0000      DMULT,  0       /N= PRECISION MULTIPLY WITH
3556    7005  7001              IAC     /PRODUCT IN TRIPLE PRECISION
3557    7006  1040              TAD EX1 /ADD EXPONENTS+1
3558    7007  4324              JMS SIGN        /AND DETERMINE SIGN OF RESULT
3559    7010  7710              SPA CLA
3560    7011  4353              JMS MINUS2
3561    7012  3301              DCA DATUM-1     /INITIALIZE RESULT
3562    7013  3300              DCA DATUM-2
3563    7014  3277              DCA DATUM-3
3564    7015  3276              DCA DATUM-4
3565    7016  1045              TAD A           /A*D
3566    7017  3751              SAVE            /STORE IN MP2
3567    7020  1041              TAD D           /SINGLE PRECISION MULTIPLY
3568    7021  4752              MULTY
3569    7022  0002              2               /ACCUMULATE STARTING IN #2 DATA WORD
3570    7023  1042              TAD E           /A*E
3571    7024  4752              MULTY
3572    7025  0003              3
3573    7026  1046              TAD B           /B*D
3574    7027  3751              SAVE
3575    7030  1041              TAD D
3576    7031  4752              MULTY
3577    7032  0003              3
3578    7033  1042              TAD E           /B*E
3579    7034  4752              MULTY
3580    7035  0004              4
3581    7036  5263    DMULT4, JMP DMDONE      /(DCA DATUM-5)-FOR 4-WORD
3582    7037  3274              DCA DATUM-6
3583    7040  1043              TAD F           /A*F
3584    7041  3751              SAVE
3585    7042  1045              TAD A
3586    7043  4752              MULTY
3587    7044  0004              4
3588    7045  1046              TAD B           /B*F
3589    7046  4752              MULTY
3590    7047  0005              5
3591    7050  1047              TAD C           /C*D
3592    7051  3751              SAVE
3593    7052  1041              TAD D
3594    7053  4752              MULTY
3595    7054  0004              4
3596    7055  1042              TAD E           /C*E
3597    7056  4752              MULTY
3598    7057  0005              5
3599    7060  1043              TAD F           /C*F
3600    7061  4752              MULTY
3601    7062  0006              6
```

```
3602
3603    7063  1301    DMDONE, TAD DATUM-1     /COPY RESULT
3604    7064  3045            DCA HORD
3605    7065  1300            TAD DATUM-2
3606    7066  3046            DCA LORD
3607    7067  1277            TAD DATUM-3
3608    7070  3047            DCA OVER2
3609    7071  4301            JMS MULDIV
3610    7072  3047            DCA OVER2       /(NOP) - FOR 4-WORD
3611    7073  5604            JMP I DMULT     /--RETURN--
3612
3613          7102    DATUM=.+6       /INTERMEDIATE STORAGE
3614
3615                  /#6-LOW ORDER RESULT
3616                  /#5
3617                  /#4
3618                  /#3
3619                  /#2
3620                  /#1-HIGH ORDER RESULT
3621
3622          7101    *DATUM-1
3623
3624    7101  0000    MULDIV, 0       /TERMINATE MULTIPLY AND DIVIDE,
3625    7102  2050            ISZ SIGNF               /CORRECT FOR SIGN
3626    7103  4451            JMS I MINSKI
3627    7104  4747            JMS I NORMF     /SHIFT LEFT
3628    7105  7000            NOP
3629    7106  5701            JMP I MULDIV    /--RETURN--
3630    7107  1041    FLDV,   TAD AC1H        /4:DIVIDE
3631    7110  7650            SNA CLA
3632    7111  4566            ERROR2          /DIVISION BY ZERO
3633    7112  1040            TAD EX1         /SUBTRACT EXPONENTS+1
3634    7113  7041            CMA IAC
3635    7114  7001            IAC
3636    7115  4324            JMS SIGN        /SET UP SIGNS
3637    7116  7700            SMA CLA
3638    7117  4353            JMS MINUS2      /NEGATE DIVISOR
3639    7120  4750            JMS I DIVIDE    /DIVIDE
3640    7121  4301            JMS MULDIV
3641    7122  5723            JMP I .+1
3642    7123  6401            FPNT+1
```

```
                        /THIS SUBROUTINE PREPARES MULTIPLY AND DIVIDE
                        /FOR ANY COMBINATION OF SIGNED ARGUMENTS AND FOR ZERO,
                        /THE RESULT OF EITHER IS ZERO IF FLAC = 0,
                        /RESULT OF MULTIPLY IS ZERO IF EITHER IS ZERO;
                        /DIVISION BY ZERO IS CHECKED BEFORE THIS
                        /ROUTINE IS CALLED,

                        /THE CALLING AC CONTAINS AN UPDATE VALUE FOR THE
                        /EXPONENT, THE RETURNING AC CONTAINS THE SIGN OF
                        /THE ARGUMENT FOR FURTHER TESTING BY EACH ROUTINE,

7124  0000    SIGN,   0               /TEST AND SAVE SIGN OF RESULT
7125  1044            TAD EXP /COMPUTE NEW EXPONENT FOR MUL-DIV,
7126  3044            DCA EXP
7127  1124            TAD P4000       /LOAD 4000 TO XOR THE SIGN BITS
7130  0045            AND HORD
7131  1041            TAD AC1H
7132  7700            SMA CLA         /RESULT MAY BE ZERO
7133  7040            CMA
7134  3050            DCA SIGNF
7135  1045            TAD HORD
7136  7450            SNA
7137  5746            JMP I REVIT     /ANSWER IS ZERO,
7140  7710            SPA CLA         /TAKE ABSOLUTE VALUE OF FLAC
7141  4451            JMS I MINSKI
7142  1041            TAD AC1H
7143  7450            SNA             /RESULT OF EITHER MAY BE ZERO
7144  5746            JMP I REVIT
7145  5724            JMP I SIGN      /--RETURN--

                    /SIGN OF RESULT = SIGNF
                    /+=-1
                    /-=0

7146  6520    REVIT,  ZERO
7147  7335    NORMF,  DNORM
7150  7261    DIVIDE, DUBDIV

      3751    SAVE=DCA I ,
7151  7256            MP2
      4752    MULTY=JMS I ,
7152  7200            MP4

      0045    A=FLAC+1
      0046    B=FLAC+2
      0047    C=FLAC+3
      0041    D=AC1H
      0042    E=AC1L
      0043    F=OVER1
```

```
3694
3695
3696    7153  0000    MINUS2, 0       /NEGATE OPERAND
3697    7154  7300            CLA CLL         /TRIPLE PRECISION
3698    7155  1043            TAD OVER1
3699    7156  7041            CMA IAC
3700    7157  3043            DCA OVER1
3701    7160  1042            TAD AC1L
3702    7161  7040            CMA
3703    7162  7430            SZL
3704    7163  7101            IAC CLL
3705    7164  3042            DCA AC1L
3706    7165  1041            TAD AC1H
3707    7166  7040            CMA
3708    7167  7430            SZL
3709    7170  7101            IAC CLL
3710    7171  3041            DCA AC1H
3711    7172  5753            JMP I MINUS2    /--RETURN--
3712
3713    7173  0000    RESOLV, 0
3714    7174  1050            TAD  SIGNF
3715    7175  7710            SPA CLA
3716    7176  4451            JMS I MINSKI
3717    7177  5773            JMP I RESOLV    /--RETURN--
3718                  /-------------------------------------------------------
3719                  /-------------------------------------------------------
3720          7200    *7200
3721
3722    7200  0000    MP4,    0       /SINGLE PRECISION, UNSIGNED MULTIPLY - "MULTY"
3723    7201  7450            SNA     /NO RESULT ADDED IF ZERO
3724    7202  5600            JMP I MP4       /--RETURN--
3725
3726                  /FOR EAE INSERT THE FOLLOWING:
3727
3728                  /7203  3206  DCA .+3
3729                  /7204  1256  TAD MP2
3730                  /7205  7425  MQL MUY
3731                  /7206  0000  0
3732                  /7207  3253  DCA MP5
3733                  /7210  7501  MQA
3734                  /7211  3255  DCA MP3
3735                  /7212  5227  JMP .+15
3736
```

```
3737
3738    7203  3254            DCA MP1         /12 BITS BY 12 BITS
3739    7204  3253            DCA MP5
3740    7205  1257            TAD THIR
3741    7206  3255            DCA MP3
3742    7207  7100            CLL
3743    7210  1254    MP6,    TAD MP1
3744    7211  7010            RAR
3745    7212  3254            DCA MP1
3746    7213  1253            TAD MP5
3747    7214  7420            SNL
3748    7215  5220            JMP .+3
3749    7216  7100            CLL
3750    7217  1256            TAD MP2
3751    7220  7010            RAR
3752    7221  3253            DCA MP5 /SAVE HIGH ORDER RESULT
3753    7222  2255            ISZ MP3
3754    7223  5210            JMP MP6
3755    7224  1254            TAD MP1 /CORRECT LOW ORDER RESULT
3756    7225  7010            RAR
3757    7226  3255            DCA MP3
3758    7227  1600            TAD I MP4       /PICKUP SCALE FACTOR
3759    7230  7041            CIA
3760    7231  1252            TAD DATUMA      /COMPUTE ADDRESS
3761    7232  3254            DCA MP1         /TEMP
3762    7233  1255            TAD MP3         /LOW ORDER PART
3763    7234  7100            CLL
3764    7235  1654            TAD I MP1       /ACCUMULATE
3765    7236  3654            DCA I MP1
3766    7237  2254            ISZ MP1
3767    7240  7004            RAL
3768    7241  1253            TAD MP5
3769    7242  1654            TAD I MP1
3770    7243  3654            DCA I MP1
3771    7244  7420            SNL
3772    7245  5600            JMP I MP4       /NO CARRY--RETURN--
3773    7246  2254            ISZ MP1
3774    7247  2654            ISZ I MP1
3775    7250  5600            JMP I MP4       /--RETURN
3776    7251  5246            JMP .-3         /CARRY AGAIN
3777    7252  7102    DATUMA, DATUM
3778    7253  0000    MP5,    0               /PRODUCT
3779    7254  0000    MP1,    0               /MULTIPLIER
3780    7255  0000    MP3,    0
3781    7256  0000    MP2,    0               /MULTIPLICAND
3782    7257  7764    THIR,   -14     /12 BITS
```

```
3783
3784
3785    7260  7751    MIF,    -27             /(-43) - FOR 4-WORD(=7735)
3786
3787    7261  0000    DUBDIV, 0       /2 OR 3  PRECISION DIVIDE
3788    7262  3200            DCA MP4
3789    7263  3254            DCA MP1
3790    7264  1260            TAD MIF         /INIT BIT COUNTER
3791    7265  3255            DCA MP3
3792    7266  7410            SKP
3793    7267  4527    DV3,    JMS I DOUBLE    /SHIFT FLAC LEFT
3794    7270  7100            CLL
3795    7271  1042            TAD AC1L        /COMBINE ONE POSITION AND (4-WORD)
3796    7272  1046            TAD LORD
3797    7273  3256            DCA MP2         /SAVE RESULT
3798    7274  7004            RAL
3799    7275  1045            TAD HORD        /ADD OVERFLOW
3800    7276  1041            TAD AC1H
3801    7277  7420            SNL             /SKIP IF OVERFLOW
3802    7300  5304            JMP .+4
3803    7301  3045            DCA HORD        /UPDATE FLAC
3804    7302  1256            TAD MP2
3805    7303  3046            DCA LORD
3806    7304  7200            CLA             /CLEAR ACCUMULATOR
3807    7305  1254            TAD MP1         /SAVE OVERFLOW BITS CIRCULARLY
3808    7306  7004            RAL
3809    7307  3254            DCA MP1
3810    7310  1200            TAD MP4
3811    7311  7004            RAL
3812    7312  3200            DCA MP4
3813    7313  2255            ISZ MP3         /TEST FOR END OF DIVIDE
3814    7314  5267            JMP DV3
3815    7315  1254            TAD MP1         /LOAD RESULTS
3816    7316  3046            DCA LORD
3817    7317  1200            TAD MP4
3818    7320  3045            DCA HORD
3819    7321  5661            JMP I DUBDIV    /(NOP)--RETURN--
3820    7322  7004            RAL             /EXTRA FOR 4-WORD
3821    7323  3335            DCA DNORM
3822    7324  2255            ISZ MP3         /TEST FOR END OF DIVIDE
3823    7325  5267            JMP DV3
3824    7326  1335            TAD DNORM
3825    7327  3045            DCA HORD
3826    7330  1200            TAD MP4
3827    7331  3046            DCA LORD
3828    7332  1254            TAD MP1
3829    7333  3047            DCA OVER2
3830    7334  5661            JMP I DUBDIV    /--RETURN--
3831
```

```
3832
3833
3834    7335  0000    DNORM,  0       /SUBROUTINE TO NORMALIZE FLAC
3835    7336  4775            JMS I ABSOL3
3836    7337  4366            JMS TEST4
3837    7340  1045            TAD HORD
3838    7341  7450            SNA             /IS MANTISSA=0?
3839    7342  1047            TAD OVER2
3840    7343  7450            SNA
3841    7344  1046            TAD LORD
3842    7345  7650            SNA CLA
3843    7346  5363            JMP EXIT3       /YES
3844    7347  1045            TAD HORD
3845    7350  7104            RAL CLL
3846    7351  7710            SPA CLA         /WILL SHIFT BE TOO FAR?
3847    7352  5360            JMP .+6
3848    7353  4527            JMS I DOUBLE
3849    7354  7140            CMA CLL
3850    7355  1044            TAD EXP
3851    7356  3044            DCA EXP
3852    7357  5347            JMP .-10
3853    7360  4776            JMS I RESOL3
3854    7361  4366            JMS TEST4       /DON'T LEAVE 4000
3855    7362  5735            JMP I DNORM     /--RETURN--
3856    7363  3044    EXIT3,  DCA EXP         /SET TO ZERO
3857    7364  5735            JMP I DNORM     /--RETURN--
3858    7365  6757    XRAR2,  DIV2
3859    7366  0000    TEST4,  0
3860    7367  1045            TAD HORD        /TEST FOR 4000
3861    7370  7510            SPA
3862    7371  7041            CIA
3863    7372  7710            SPA CLA
3864    7373  4765            JMS I XRAR2     /SHIFT BACK
3865    7374  5766            JMP I TEST4     /--RETURN--
3866
3867    7375  5571    ABSOL3, ABSOLV
3868    7376  7173    RESOL3, RESOLV
```

```
3869
3870                    /-------------------------------------------------------------
3871                    /-------------------------------------------------------------
3872            7400    *7400
3873
3874
3875                    /PAGE 18
3876
3877                            /FLOATING SQUARE ROOT FUNCTION
3878
3879    7400    4407    XSQRT,  FINT
3880    7401    6274            FPUT FPAC1      /VALUE
3881    7402    0000            FEXT            /NEWTON'S METHOD IS USED
3882    7403    1045            GETSGN
3883    7404    7710            SPA CLA
3884    7405    4566            ERROR2          /NUMBER IS NEGATIVE=IMAGINARY ROOTS
3885    7406    1044            TAD EXP         /LINK IS =0 FROM FINT
3886    7407    7510            SPA             /MATCH THE SIGN WITH LINK BIT
3887    7410    7020            CML
3888    7411    7010            RAR
3889    7412    3270            DCA ITER1       /MAKE FIRST APPROXIMATION
3890    7413    7430            SZL             /TEST LSB OF EXP
3891    7414    2270            ISZ ITER1
3892    7415    7000            NOP
3893    7416    1267            TAD SQCON1
3894    7417    3271            DCA ITER1+1
3895    7420    3272            DCA ITER1+2
3896    7421    3273            DCA ITER1+3
3897    7422    1275            TAD FPAC1+1
3898    7423    7450            SNA
3899    7424    1276            TAD FPAC1+2
3900    7425    7650            SNA CLA
3901    7426    5265            JMP SQEND       /NUMBER=0
3902    7427    4407    CLCU,   FINT
3903    7430    0274            FGET FPAC1
3904    7431    3270            FDIV ITER1
3905    7432    1270            FADD ITER1
3906    7433    0000            FEXT
3907
```

```
3908
3909
3910
3911    7434  7240            CLA CMA
3912    7435  1044            TAD EXP
3913    7436  3044            DCA EXP
3914    7437  1044            TAD EXP
3915    7440  7041            CMA IAC
3916    7441  1270            TAD ITER1
3917    7442  7640            SZA CLA         /ARE EXPONENTS EQUAL?
3918    7443  5261            JMP ROOTGO      /NO
3919    7444  1045            TAD HORD        /ARE HIGH-ORDER MANTISSAS EQUAL?
3920    7445  7041            CMA IAC
3921    7446  1271            TAD ITER1+1
3922    7447  7640            SZA CLA
3923    7450  5261            JMP ROOTGO      /NO
3924    7451  1046            TAD LORD
3925    7452  7041            CMA IAC
3926    7453  1272            TAD ITER1+2     /DO LOW-ORDER MANTISSAS AGREE
3927    7454  7500            SMA
3928    7455  7041            CMA IAC         /WITHIN ONE BIT?
3929    7456  7001            IAC
3930    7457  7700            SMA CLA
3931    7460  5536            RETURN
3932    7461  4407    ROOTGO, FINT
3933    7462  6270            FPUT ITER1
3934    7463  0000            FEXT
3935    7464  5227            JMP CLCU
3936    7465  3044    SQEND,  DCA EXP
3937    7466  5536            RETURN
3938    7467  3015    SQCON1, 3015
3939
3940          7470    BUFFER=.
3941
3942    7470  0000    ITER1,  0
3943    7471  0000            0
3944    7472  0000            0
3945    7473  0000            0
3946
3947    7474  0000    FPAC1,  0
3948    7475  0000            0
3949    7476  0000            0
3950    7477  7503            BUFFER+13       /ADDRESS OF NEXT FREE LOCATION IN 10-DIGIT VERSION.
3951
3952
3953
3954
3955                    ENPUNCH
3956
3957                    $
```

```
0000  01111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0100  11111111  11111111  11111111  11111111  11111111  11111111  11111110  00000011

0200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111


1000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

1200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

1400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

1600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111


2000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

2200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

2400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2500  11111111  11111111  11111111  11111111  11111111  11111111  11110000  00000000

2600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111


3000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3100  11111111  11111111  00000000  00000000  00000000  00000000  00000000  00000000

3200  00000011  11111110  00000000  00000000  00000000  00000000  00000000  00000000
3300  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000

3400
3500

3600
3700
```

```
4000
4100
4200  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
4300  11111111  11111111  00000000  00000000  00000000  00000000  00000000  11111111

4400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

4600  00000000  00000000  11111111  11111111  11111111  11111111  11111111  11111111
4700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111110

5000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5100  11111111  11111111  11111111  11111111  11111111  11111111  11111110  00000000

5200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5300  11111111  11111111  11111111  11111111  11111111  11000000  00000000  00000000

5400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

5600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11110000

6000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6100  11111111  11111111  11111111  11111111  11111111  11111111  00000000  00000000

6200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6300  11111111  10000000  01111111  11111111  11111111  11111111  11111111  11111111

6400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

6600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

7000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11110000
7100  01111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

7200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
7300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111110

7400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
7500  00011111  11111111  11111111  11111111  11111111  11111110  00000000  00000000

7600
7700
```

A	0045	C5	5342	DNUMBR	5714	EXIT3	7363
ABSOL	6751	C7	5336	DO	0420	EXITJ	2661
ABSOL2	6153	C9	5332	DOK	2111	EXP	0044
ABSOL3	7375	CCR	0077	DONE	2127	EXTR	2313
ABSOLV	5571	CEX1	6504	DODNE	0463	F	0043
AC1H	0041	CEXP	6503	DOUBLE	0127	FCONT	1101
AC1L	0042	CF	4705	DPCVPT	6302	FCOS	5200
ACMINS	6603	CFRS	0133	DPN	6305	FCOUNT	5535
ADD	0061	CFRSX	0137	DPT	6145	FEND3	2267
ADDR	0040	CHAR	0066	DSAVE	5640	FEXP	4620
ADONE	6673	CHIN	2155	DTST	5647	FEXT	0000
AF	4677	CHRT	6133	DUBDIV	7261	FGO2	6011
ALF1	4760	CLCU	7427	DUBLAD	5733	FGO3	6027
ALF2	4763	CLF	0076	DV3	7267	FGO4	6034
ALFZ	4755	CNTR	0057	E	0042	FGO5	6070
ALGN	6570	COL	1255	ECALL	1601	FIGO1	6221
ALIGN	6623	COMBOT	0226	ECHOLS	1624	FIGO4	6261
ALIST	1372	COMBUF	0132	EFOP	0056	FINCR	1065
AMOUNT	6722	COMEIN	3140	EFUN	1743	FINDLN	4555
ARCALG	4732	COMEOU	3206	EFUN2	1754	FINDN	2246
ARCRTN	5024	COMGO	1163	EFUN3	2017	FINFIN	1137
ARGNXT	1723	COMLST	0774	EFUN3I	0136	FINKP	1133
ARTN	5000	COMMEN	0614	ELPAR	1763	FINPUT	0131
ASHFT	6665	CON1	5037	END	0134	FINT	4407
ASK	1202	CSTAR	0225	ENDFI	6243	FISW	0052
ATEI	4465	D	0041	ENDLN	4556	FIX	6724
ATES	4513	DATUM	7102	ENDT	0135	FIXM	6753
ATLIST	1570	DATUMA	7252	ENUM	1732	FLAC	0044
ATSW	0056	DCONP	6303	EPAR	1710	FLAD	6506
AXIN	0010	DCONT	0471	EPAR2	1765	FLAG1	5162
AXOUT	0017	DCOUNT	6143	ER5	4555	FLAG2	4725
B	0046	DDTJR	0004	ERASE	2204	FLARG	2030
BACK	5503	DEBGSW	0026	ERG	2225	FLARGP	0125
BEGIN	4371	DECON	5627	ERL	2222	FLDV	7107
BET1	4771	DECONV	5600	ERR2	2726	FLEX	6525
BET2	4774	DECP	5533	ERROR2	4566	FLGT	6467
BETZ	4766	DECR	5521	ERROR3	4566	FLIMIT	1075
BF	4702	DELETE	4565	ERROR4	4566	FLINTP	6200
BFX	4557	DF	4710	ERROR5	2725	FLIST1	0577
BFXX	4556	DGRP	0425	ERT	2214	FLIST2	0574
BOTTOM	0035	DGRP1	0441	ERV	2217	FLMY	6563
BUFBEG	3217	DIG	5543	ERVX	2237	FLOG	5040
BUFFER	7470	DIGIT	5713	ESCA	2532	FLOP	1674
BUFR	0060	DIGITS	0006	ETERM	1647	FLOUT	5556
BUFST	5531	DIV1	5754	ETERM1	1627	FLOUTP	6000
C	0047	DIV2	6757	ETERM2	1655	FLPT	6465
C100	0006	DIVIDE	7150	ETERMN	1644	FLSU	6505
C140	2554	DMDONE	7063	EVAL	1613	FLTONE	2405
C144	6140	DMPSW	0100	EX1	0040	FLTXR	0014
C200	0123	DMULT	7004	EXIT	2646	FLTXR2	0015
C260	0113	DMULT4	7036	EXIT1	5034	FLTZER	2407
C3	5346	DNORM	7335	EXIT2	5302	FM12	6142

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FNEG    5163    IF      1013    LORD    0046    NORM    6567
FNOR    7000    IF1     1035    LP7     7556    NORMF   7147
FNPT    4554    IF3     1025    LPRTST  2035    NOX     6675
FNTABF  0374    IGNOR   0217    M100    0101    NOX1    6711
FNTABL  2165    ILIST   0771    M10PT   6147    NOX2    6704
FOR     1041    IN      5513    M11     0121    O1      4370
FOUTPU  0130    INBUF   0034    M12     2413    O2      4561
FPAC1   7474    INDEV   0064    M137    2357    O4      4412
FPNT    6400    INDRCT  6463    M140    2556    O5      4563
FPRNT   5465    INFIX   2401    M144    6137    O6      4564
FRST    3206    INLIST  0570    M2      0111    OM12    5530
FRSTX   3215    INORM   6307    M20     0105    ONE     4716
FSIN    5205    INPUT   0756    M240    0114    OOUT    4544
FXIT    0000    INPUTX  0271    M260    1526    OP      3115
G8L     4466    INSUB   0036    M271    1527    OPMINS  6565
GECALL  1460    INTEGE  0053    M4      6141    OPNEXT  1622
GEND    2334    INTRPT  2603    M40     2356    OPTABL  1731
GERR    0340    IOBUF   3120    M5      0120    OPTR0   2663
GET1    2330    IPART   1040    M77     0103    OPTR1   2665
GET3    2345    IRETN   0227    MBREAK  2602    OPTR0   2664
GETARG  1403    ITABLE  6573    MCOM    1136    OPUT    5532
GETC    4545    ITER1   7470    MCR     0116    OUT     2465
GETLN   4554    JUMP    6462    MD      5526    OUTA    5536
GETSGN  1045    K4      5525    MEQ     1135    OUTCR   2476
GETVAR  1407    KCF     6030    MF      0602    OUTDEV  0063
GEXIT   0352    KINT    2625    MFLT    0117    OUTDG   6154
GFND1   1505    L1      5126    MIF     7260    OUTL    1354
GINC    0070    L2      5131    MINE    5662    OUTX    2475
GLIST   1377    L3      5134    MINSKI  0051    OVER1   0043
GO      5021    L4      5137    MINUS2  7153    OVER2   0047
GONE    0232    L8A     4550    MINUSA  0112    P13     0005
GOTO    0603    L8AX    4553    MINUSE  6301    P17     0107
GRPTST  0744    L8AY    4552    MINUSZ  5663    P177    0106
GS1     1437    L8B     4551    MOD     5215    P2      4566
GS2     1461    LASTLN  0025    MODIFY  1256    P2000   0373
GS3     1441    LASTOP  0055    MP1     7254    P27     6750
GS4     1454    LASTV   0031    MP2     7256    P277    0110
GSERCH  1426    LCON    0371    MP3     7255    P3      2034
GTEM    0021    LG2E    4713    MP4     7200    P337    0075
GZERR   0362    LIBRAR  7503    MP5     7253    P377    2553
HINBUF  0037    LINENO  0067    MP6     7210    P40     2552
HORD    0045    LIST3   0077    MPER    0115    P4000   0124
HREAD   6321    LIST6   0072    MPLUS   5664    P43     6310
HREAD2  6324    LIST7   0074    MSPACE  5665    P7      4565
HSGO    6364    LISTGO  1370    MULDIV  7101    P7600   0104
HSPSW   6375    LOG2    5157    MULT    6566    P77     0122
HSPX    6361    LOG5    5142    MULT10  5667    P7700   0101
HSWITC  6343    LOG6    5145    MULT2   5715    P7740   0372
HTST    6376    LOG7    5150    MULTY   4752    PA1     2524
I33     2414    LOG8    5153    NAGSW   0065    PACBUF  2502
IBAR    0212    LOOKUP  4571    NEGP    4724    PACKC   4546
IECALL  1037    LOOP01  6431    NORF    6513    PACKST  0027
```

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PACX    2530        RESOL   6752        STARTL  5064        WX      0673
PALG    5261        RESOL3  7376        STARTV  0060        X       5322
PARTES  2047        RESOL5  6304        SUBS    1517        X1      5035
PC      0022        RESOLV  7173        T1      0032        X2      4675
PC1     0614        RESTR   6377        T12     4426        XABS    2014
PCHECK  5245        RET     5452        T2      0071        XADC    1343
PCHK    0510        RETRN   1563        T3      0033        XCT     0020
PCK1    2535        RETURN  5536        TABLE   6464        XCTIN   0062
PD2     0534        REVIT   7146        TAG1    6723        XDELET  2062
PD3     0554        RFC     6014        TASK    1204        XDYS    1142
PDLXR   0013        RND2    5527        TASK4   1252        XENDLN  2360
PDP     4562        ROOTGO  7461        TCRLF   1250        XF      4560
PDP5    4570        ROT     2557        TCRLF2  1245        XFIND   2242
PDP5X   4463        ROUND   6151        TDUMP   3052        XGETLN  0302
PDP8I   4567        RTL6    4557        TELSW   0016        XI33    2666
PEQ     6135        RUB1    3004        TEM     5156        XIN     6306
PER     0102        RUB2    3042        TEMP    4726        XINPUT  5666
PI      5312        RUB3    3030        TEN     6271        XINT    1160
PI2     5036        RUB4    3037        TENPT   6152        XOUTL   2676
PIOT    5316        RUB5    3041        TERMS   1770        XPOPJ   1565
PLCE    5536        RUBIT   2555        TEST2   6736        XPRNT   2425
POPA    1413        SADR    6150        TEST4   7366        XPUSHA  0477
POPF    4544        SAVAC   2600        TESTA   0322        XPUSHJ  0521
POPJ    5541        SAVE    3751        TESTC   4564        XRAN    1553
PPTEN   6144        SAVLK   2601        TESTN   4561        XRAR2   7365
PRINTC  4551        SBAR    1302        TEXTP   0017        XRT     0011
PRINTD  7550        SCHAR   1273        TGO     5400        XRT2    0012
PRNT    2442        SCONT   1270        THIR    7257        XRTL6   0413
PRNT2   3114        SCOUNT  5534        THISLN  0023        XSGN    2010
PRNT8   7527        SET     1041        THISOP  0024        XSORTC  0721
PRNTI   6132        SEX     1340        TINTR   1240        XSPNOR  1517
PRNTLN  4553        SEXC    0740        TLIST   1400        XSQ2    4676
PROC    0611        SFOUND  1306        TLIST2  1404        XSQR    5326
PROCES  0610        SGOT    1312        TLIST3  2377        XSQRT   7400
PSIN    0165        SIGN    7124        TQUOT   1231        XT3     0717
PT1     0030        SIGNF   0050        TRAD    6573        XTESTC  0700
PTCH    0126        SIN     2662        TSTGRP  4563        XTESTN  1533
PTEN    6275        SMIN    6136        TSTLPR  4562        XYZ     2451
PTEST   1457        SMP     6101        TWO     4721        ZERO    6520
PUSHA   4542        SMSP    6134        TWOPI   5306
PUSHF   4543        SORTB   1314        TYPE    1203
PUSHJ   4540        SORTC   4550        TYPE2   1225
R6      5441        SORTCN  0054        UTE     2276
RAND    1530        SORTJ   4547        UTQ     2305
RAR1    6571        SPECIA  6777        UTRA    2274
RAR2    6572        SPLAT   3051        UTX     2316
RDIV    0152        SPNOR   4560        VAL     0032
READC   4552        SQCON1  7467        WALL    0664
RECOVR  2740        SQEND   7465        WORDS   0003
RECOVX  2761        SRETN   0261        WRITE   0635
REMAIN  5712        SRNLST  1363        WTEST2  0653
REPT    6146        START   0177        WTESTG  0667
```

ERRORS DETECTED: 0

LINKS GENERATED: 0

RUN-TIME: 21 SECONDS

3K CORE USED

SPOOLER RUNTIME 28 SECONDS, 92 KCS, 586 DISK READS, 2 DISK WRITES, 228 PAGES

END USER 21MITCHELL,M [400,2350] JOB FCL118 SEQ. 10289 DATE 18-JAN-74 16:10:14 MONITOR CS/2 506B 1077 RF6B9K **END**

END USER 21MITCHELL,M [400,2350] JOB FCL118 SEQ. 10289 DATE 18-JAN-74 16:10:14 MONITOR CS/2 506B 1077 RF6B9K **END**

END USER 21MITCHELL,M [400,2350] JOB FCL118 SEQ. 10289 DATE 18-JAN-74 16:10:14 MONITOR CS/2 506B 1077 RF6B9K **END**

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   222222222            111          MMM         MMM      IIIIIIIII      TTTTTTTTTTTTTTT      CCCCCCCCCCC
   222222222            111          MMM         MMM      IIIIIIIII      TTTTTTTTTTTTTTT      CCCCCCCCCCC
   222222222            111          MMM         MMM      IIIIIIIII      TTTTTTTTTTTTTTT      CCCCCCCCCCC
222         222      111111          MMMMMM   MMMMMM         III               TTT         CCC
222         222      111111          MMMMMM   MMMMMM         III               TTT         CCC
222         222      111111          MMMMMM   MMMMMM         III               TTT         CCC
            222         111          MMM   MMM   MMM         III               TTT         CCC
            222         111          MMM   MMM   MMM         III               TTT         CCC
            222         111          MMM   MMM   MMM         III               TTT         CCC
         222            111          MMM         MMM         III               TTT         CCC
         222            111          MMM         MMM         III               TTT         CCC
         222            111          MMM         MMM         III               TTT         CCC
      222               111          MMM         MMM         III               TTT         CCC
      222               111          MMM         MMM         III               TTT         CCC
      222               111          MMM         MMM         III               TTT         CCC
   222                  111          MMM         MMM         III               TTT         CCC
   222                  111          MMM         MMM         III               TTT         CCC
   222                  111          MMM         MMM         III               TTT         CCC
222222222222222      111111111       MMM         MMM      IIIIIIIII            TTT            CCCCCCCCCCC
222222222222222      111111111       MMM         MMM      IIIIIIIII            TTT            CCCCCCCCCCC
222222222222222      111111111       MMM         MMM      IIIIIIIII            TTT            CCCCCCCCCCC
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END USER 21MITCHELL,M [400,2350] JOB FCL118 SEQ. 10289 DATE 18-JAN-74 16:10:14 MONITOR CS/2 506B 1077 RF6B9K **END**

END USER 21MITCHELL,M [400,2350] JOB FCL118 SEQ. 10289 DATE 18-JAN-74 16:10:14 MONITOR CS/2 506B 1077 RF6B9K **END**

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000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000111111111111111111111111111111111
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123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
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