Digital Equipment Corporation
Maynard, Massachusetts

FOCAL, 1969

FOCAL+FLOAT

Name:	FOCAL, 1969 [FOCAL+FLOAT]
Document:	DEC-08-AJAE-PB.LST [PRIMARY]
File[s]:	FOCAL.LST [from FOCAL.ZZM, FLOAT.ZZM]
P?S Index:	O>R,CDB,ENB@K+003708580037KHRSHMF
Security Level:	2
Location:	NY
Date:	01-Mar-2016
Medium:	PDF

```
/       FOCAL.ZZM

/                               F  O  C  A  L

/               T H E    F O R M U L A    C A L C U L A T O R

/       FOR FORMULATING ON-LINE CALCULATIONS IN ALGEBRAIC LANGUAGE
/       ON THE FOLLOWING D.E.C. COMPUTERS:
/       5, 8, 8/I, 8/S, 8/L, LINC-8, LAB-8, TSS-8, PDP-12

/       SOURCE RECREATION, TIDYING UP BY:
/       CHARLES J. LASNER P?S NY
/       LAST EDIT:      08-APR-1987     23:00:00        CJL
```

```
                /         F O C A L     AND     F L O A T
                /       COPYRIGHT 1969 BY
                /       DIGITAL EQUIPMENT CORPORATION
                /       FOCAL IS A REGISTERED
                /       TRADEMARK OF
                /       DIGITAL EQUIPMENT CORPORATION
                /       ALL RIGHTS RESERVED
                /       3RD REVISION
```

```
   74           0000          FIXMRI  AND=    0000    /ACTUAL MEMORY REFERENCE INSTRUCTIONS
   75           1000          FIXMRI  TAD=    1000
   76           2000          FIXMRI  ISZ=    2000
   77           3000          FIXMRI  DCA=    3000
   78           4000          FIXMRI  JMS=    4000
   79           5000          FIXMRI  JMP=    5000
   80           5000          FIXMRI  FPOW=   5000    /PSEUDO-FLOATING POINT INSTRUCTIONS.
   81           1000          FIXMRI  FADD=   1000
   82           2000          FIXMRI  FSUB=   2000
   83           4000          FIXMRI  FMUL=   4000
   84           3000          FIXMRI  FDIV=   3000
   85           0000          FIXMRI  FGET=   0000
   86           6000          FIXMRI  FPUT=   6000
   87
   88           7000          FNOR=   7000
   89           0000          FEXT=   0000
   90           0000          FXIT=   0000
   91           4407          FINT=   JMS I   7
   92           7000          NOP=    7000
   93           7200          CLA=    7200
   94           7100          CLL=    7100
   95           7040          CMA=    7040
   96           7004          RAL=    7004
   97           7020          CML=    7020
   98           7010          RAR=    7010
   99           7012          RTR=    7012
  100           7006          RTL=    7006
  101           7001          IAC=    7001
  102           7500          SMA=    7500
  103           7440          SZA=    7440
  104           7510          SPA=    7510
  105           7450          SNA=    7450
  106           7420          SNL=    7420
  107           7430          SZL=    7430
  108           7410          SKP=    7410
  109           7402          HLT=    7402
  110           7041          CIA=    7041
  111           6001          ION=    6001
  112           6002          IOF=    6002
  113           6031          KSF=    6031
  114           6036          KRB=    6036
  115           6041          TSF=    6041
  116           6042          TCF=    6042
  117           6044          TPC=    6044
  118           6046          TLS=    6046
  119           6026          PLS=    6026
  120           6011          RSF=    6011
  121           6012          RRB=    6012
  122           6014          RFC=    6014
  123           6101          SMP=    6101
  124           6244          RMF=    6244
```

```
126                 /       * FOCAL * - BY RICK MERRILL - FOR THE FAMILY OF 8.
127
128                 /       MISCELLANEOUS ITEMS
129
130           *0001         *1
131
132   000001  5403          JMP I   .+2             /INTERRUPT PROCESSOR ENTRY.
133   000002  5403          JMP I   .+1             /(USED BY PDP-5)
134   000003  2603          INTRPT
135
136   000004  0004  DDTJR,  DDTJR                   /USED FOR DEBUGGING
137   000005  0013  P13,    13                      /CONSTANT
138   000006  0100  C100,   100                     /CONSTANT
139
140           0000          T=      00              /TEXT FIELD NO.
141           0000          P=      00              /PROGRAM FIELD NO.
142           7000          CDF=    7000            /(X-MEM) - OPR
143
144   000007  6400          FPNT                    /ADDRESS OF FLOATING POINT INTERPRETER (LOC *7)
145
146                 /       AUTO-INDEX REGISTERS - (START OF SAVE BY QUAD)
147
148   000010  0000  AXIN,   0                       /STORAGE INDEX (LOC *10)
149   000011  0000  XRT,    0                       /EXTRA XR
150   000012  0000  XRT2,   0                       /EXTRA XR
151   000013  4370  PDLXR,  BEGIN-1                 /PUSHDOWN LIST INDEX REGISTER.
152   000014  3117  FLTXR,  IOBUF-1                 /XR FOR FLOATING POINT
153   000015  0000  FLTXR2, 0                       /EXTRA FOR F.P.
154   000016  7402  TELSW,  HLT                     /TELETYPE IN PROGRESS SWITCH
155
156           0017          TEXTP=.                 /TEXT POINTERS (LOC *17)
157
158   000017  3215  AXOUT,  FRSTX                   /OUTPUT INDEX
159   000020  0000  XCT,    0                       /UNPACK SWITCH
160   000021  0000  GTEM,   0                       /UNPACK STORAGE
161   000022  2407  PC,     FLTZER                  /PROGRAM COUNTER
162
163   000023  0000  THISLN, 0                       /LINE POINTER FROM 'FINDLN'
164   000024  0000  THISOP, 0                       /CURRENT 'EVAL' OPERATION
165   000025  0000  LASTLN, 0                       /BACK POINTER FROM 'FINDLN'
166   000026  0001  DEBGSW, 1                       /DEBUG SWITCH  ; NON-ZERO FOR LITERAL.
167   000027  0000  PACKST, 0                       /RUBOUT PROTECTION
168   000030  0000  PT1,    0                       /VARIABLE POINTER
169   000031  3217  LASTV,  BUFBEG                  /ADDRESS OF LAST VARIABLE
170   000032  0000  T1,     0                       /TEMPORARY REGISTER - MAIN
171   000033  0000  T3,     0                       /TEMP REGISTER FOR OUTPUT
172   000034  0000  INBUF,  0                       /KEYBOARD INPUT BUFFER
173   000035  4370  BOTTOM, BEGIN-1                 /LAST LOCATION CURRENTLY AVAILABLE IN FIELD ZERO **
174   000036  0000  INSUB,  0                       /0= GETC; #0 = READC
175   000037  0000  HINBUF, 0                       /HIGH SPEED INPUT BUFFER
176
177                 /       *40 = FLOATING POINT
```

```
  179          *0054          *54
  180
  181                 /       VARIABLES   -   INITIALIZED FOR THE DIALOGUE
  182
  183   000054  0000  SORTCN, 0                       /NUMBER IN TABLE FROM SORTC
  184   000055  0000  LASTOP, 0                       /LAST OPERATION FOR EVAL
  185
  186           0056          EFOP=   .               /FUNCTION CODE.
  187
  188   000056  0000  ATSW,   0                       /ASK-TYPE SWITCH
  189   000057  7760  CNTR,   -20                     /DELETE AND ERROR COUNTER (USED BY F.P. ALSO)
  190
  191           0060          STARTV= .               /=END FOR 8K
  192
  193   000060  3217  BUFR,   BUFBEG                  /NEXT LOCATION IN BUFFER = LAST LOCATION OF TEXT.
  194
  195   000061  1354  ADD,    OUTL                    /CHAR. BUF. IN.  (DEBUG AIDS. SEE BELOW.)
  196   000062  2414  XCTIN,  I33                     /PACK SWITCH
  197   000063  2676  OUTDEV, XOUTL                   /POINTER TO OUT. SUB.   (OUTL)-FOR DEBUGGING
  198   000064  2666  INDEV,  XI33                    /POINTER TO IN. SUB.    (I33)-FOR DEBUGGING
  199
  200   000065  0001  NAGSW,  0001                    /NOT ALL AND/OR GROUP SWITCH (4000=ONE; 1=ALL;
  201                                                 /0=GROUP); (0000)-FOR TSS-8
  202   000066  0215  CHAR,   "M&237                  /THE MOST IMPORTANT REGISTER
  203   000067  0000  LINENO, 0000                    /LINE NUMBER READ BY GETLN; (0400)-FOR TSS-8
  204   000070  0005  GINC,   WORDS+2                 /=6 FOR 4-WORD - CONSTANT
  205
  206   000071  0000  T2,     0                       /TEMP REGISTER - FOR NEW INST. ROUTINES.
  207
  208
  209
  210                 /       FOR DEBUGGING, SET OUTL AND I33 INTO OUTDEV AND INDEV;
  211                 /       ALSO PATCH THE ERROR ROUTINE = FOUR
  212                 /       PATCHES PLUS TWO FOR THE HIGH SPEED READER.
  213
  214
  215           0072          LIST6=  .               /INPUT LIST FOR "SFOUND".
  216
  217   000072  0214          "L&237                  /F.F.
  218   000073  0207          "G&237                  /BELL
  219
  220           0074          LIST7=  .
  221
  222   000074  0203          "C&237                  /CONTROL-C FOR DEBUGGING AND TSS8
  223   000075  0337  P337,   "^+1                     /LEFT ARR
  224   000076  0212  CLF,    "J&237                  /L.F.
  225
  226           0077          LIST3=  .               /EXCRETION LIST
  227
  228   000077  0215  CCR,    "M&237                  /LIST BRANCHER.
  229   000100  7402  DMPSW,  HLT                     /(SEARCH CHARACTER)-VARIABLE; =0000 FOR TRACE ON.
  230
  231
  232                 /       THE REST OF PAGE ZERO IS PURE TO THE MULTI-USER SYSTEM
```

```
  234           0101          M100=   .
  235
  236   000101  7700  P7700,  7700                    /LEFT MASK
  237   000102  0256  PER,     ".                      /PERIOD
  238   000103  7701  M77,     -77                     /EXTEND CODE TEST
  239   000104  7600  P7600,  7600                    /GROUP MASK
  240   000105  7760  M20,     -20                     /CONSTANT
  241   000106  0177  P177,   177                     /STEP MASK
  242   000107  0017  P17,     17                      /BCD MASK
  243   000110  0277  P277,   "?                      /"?"
  244   000111  7776  M2,      -2                      /CONSTANT
  245   000112  7477  MINUSA, -"A                     /CONSTANT
  246   000113  0260  C260,   "0                      /ASCII FOR ZERO
  247   000114  7540  M240,   -"                      /SPACE TEST
  248   000115  7522  MPER,   -".                     /PERIOD TEST
  249   000116  7563  MCR,    -"M!100                 /C.R. TEST
  250   000117  7775  MFLT,   -WORDS                  /= -4 FOR 4-WORD
  251   000120  7773  M5,     -5                      /PAREN TEST
  252   000121  7767  M11,    -11                     /PAREN TEST
  253   000122  0077  P77,    77                      /RIGHT MASK
  254   000123  0200  C200,   200                     /CONSTANTS
  255   000124  4000  P4000,  4000                    /NAGSW TEST CONSTANT (FOR PDP-5)
  256
  257   000125  2030  FLARGP, FLARG                   /DATA ADDRESS
  258   000126  2155  PTCH,   CHIN                    /GENERAL CHARACTER INPUT ROUTINE.
  259   000127  5715  DOUBLE, MULT2                   /MULTIPLY FLAC BY 2
  260   000130  6000  FOUTPUT,FLOUTP                  /FLOATING OUTPUT
  261   000131  6200  FINPUT, FLINTP                  /FLOATING INPUT
  262   000132  3140  COMBUF, COMEIN                  /COMMAND BUFFER START
  263   000133  3206  CFRS,   FRST                    /ADDRESS OF DUMMY LINE.
  264   000134  3140  END,    COMEIN                  /FIRST LOCATION USED IN 8K.
  265   000135  3217  ENDT,   BUFBEG                  /START OF STORAGE AREA **
  266   000136  2017  EFUN3I, EFUN3                   /FUNCTION RETURN
  267   000137  2407  CFRSX,  FLTZER                  /POINTER TO ZERO DATA
  268
  269
  270           /       'FINPUT' USES CHAR AND GETC OR READC TO DEVELOP
  271           /       A NUMBER WHICH IS THEN STORED VIA PT1.
  272
  273           0003          WORDS=  3               /OR 4
```

```
 275                /       NEW INSTRUCTIONS:
 276
 277            4540        PUSHJ=  JMS I   .;XPUSHJ/RECURSIVE SUBROUTINE CALL
 278   000140   0521
 279            1413        POPA=   TAD I   PDLXR   /RESTORE AC
 280
 281            5541        POPJ=   JMP I   .;XPOPJ /SUBROUTINE RETURN
 282   000141   1565
 283            4542        PUSHA=  JMS I   .;XPUSHA/SAVE AC
 284   000142   0477
 285            4543        PUSHF=  JMS I   .;PD2   /SAVE GROUP OF DATA
 286   000143   0534
 287            4544        POPF=   JMS I   .;PD3   /RESTORE GROUP
 288   000144   0554
 289            4545        GETC=   JMS I   .;UTRA  /UNPACK A CHARACTER
 290   000145   2274
 291            4546        PACKC=  JMS I   .;PACBUF/PACK A CHARACTER
 292   000146   2502
 293            4547        SORTJ=  JMS I   .;SORTB /SORT AND BRANCH ON AC OR CHAR
 294   000147   1314
 295            4550        SORTC=  JMS I   .;XSORTC/SORT CHAR
 296   000150   0721
 297            4551        PRINTC= JMS I   .;OUT   /PRINT AC OR CHAR
 298   000151   2465
 299            4552  RDIV,   READC=  JMS I   .;CHIN  /READ DATA INTO CHAR AND PRINT IT
 300   000152   2155
 301            4553        PRNTLN= JMS I   .;XPRNT /PRINT C(LINENO)
 302   000153   2425
 303            4554        GETLN=  JMS I   .;XGETLN/UNPACK AND FORM A LINENUMBER
 304   000154   0302
 305            4555        FINDLN= JMS I   .;XFIND /SEARCH FOR A GIVEN LINE
 306   000155   2242
 307            4556        ENDLN=  JMS I   .;XENDLN/INSERT LINE POINTERS
 308   000156   2360
 309            4557        RTL6=   JMS I   .;XRTL6 /ROTATE LEFT SIX
 310   000157   0413
 311            4560        SPNOR=  JMS I   .;XSPNOR/IGNORE SPACES AND LEADING ZEROS
 312   000160   1517
 313            4561        TESTN=  JMS I   .;XTESTN/PERIOD; OTHER; NUMBER
 314   000161   1533
 315            4562        TSTLPR= JMS I   .;LPRTST/SKIP IF 5<SORTCN<= 11 (I.E. AN L-PAR)
 316   000162   2035
 317            4563        TSTGRP= JMS I   .;GRPTST/SKIP IF G(AC) = G(LINENO)
 318   000163   0744
 319            4564        TESTC=  JMS I   .;XTESTC/TERM; NUMBER; FUNCTION; LETTER- AND IGNORE SPACES.
 320   000164   0700
 321            4565  PSIN,   DELETE= JMS I   .;XDELET/REMOVE OLD TEXT LINE
 322   000165   2062
 323            4566        ERROR2= JMS I   .;      /EXCESS SOMETHING ERROR
 325
 326            4566        ERROR3= JMS I   .;      /MISCELLANEOUS ERROR
 328
 329            4566        ERROR4= JMS I   .;ERR2  /FORMAT ERROR
 330   000166   2726
 331                /       USED BY 8K
```

```
  333                 /       FOCAL'S COMMAND/INPUT DRIVER
  334
  335           *0176         *176
  336
  337   000176  4371          BEGIN                   /BECOMES (RECOVR+1) **
  338
  339   000177  7610  START,  SKP CLA                 /PROGRAM START FROM SELF
  340   000200  5576          JMP I   .-2             /CONSOLE START: SW=200
  341   000201  1137          TAD     CFRSX           /(PC) => 0
  342   000202  3022          DCA     PC              /FOR COMMAND MODE
  343   000203  7001          IAC                     /USE ONE IN THE AC TO
  344   000204  3100          DCA     DMPSW           /INIT UNPACK AND TRACE SWITCH
  345   000205  3026          DCA     DEBGSW          /ENABLE TRACE FOR INPUT OF (?)
  346   000206  1226          TAD     COMBOT          /PROTECT COMMAND BUFFER
  347   000207  3013          DCA     PDLXR           /NO PATCH TEST
  348   000210  1225          TAD     CSTAR           /ANNOUNCE PRESENCE
  349   000211  4551          PRINTC                  /BY TYPING THE LEAD-IN CHARACTER
  350   000212  1132  IBAR,   TAD     COMBUF          /INITIALIZE COMMAND BUFFER
  351   000213  3010          DCA     AXIN            /FOR UNPACKING
  352   000214  3062          DCA     XCTIN
  353   000215  1132          TAD     COMBUF          /RUBOUT PROTECTION
  354   000216  3027          DCA     PACKST
  355   000217  4552  IGNOR,  READC                   /READ COMMAND STRING
  356   000220  4547          SORTJ
  357   000221  0073          LIST7-1
  358   000222  0474          INLIST-LIST7
  359   000223  4546          PACKC                   /SAVE STRING CHARACTER.
  360   000224  5217          JMP     IGNOR
  361
  362   000225  0252  CSTAR,  "*                      /ACKNOWLEDGE CHARACTER
  363   000226  3220  COMBOT, COMEOUT+12              /END OF COMMAND BUFFER, LESS PROTECTION COUNT.
```

```
  365                   /       COMMAND/INPUT PROCESSOR
  366
  367   000227  4546   IRETN,  PACKC                   /START TO PACK C.R.
  368   000230  4546           PACKC                   /FINISH C.R.
  369   000231  1132           TAD     COMBUF          /INITIALIZE "TEXTP"
  370   000232  3017   GONE,   DCA     AXOUT           /SETUP CURRENT LINE
  371   000233  3020           DCA     XCT
  372   000234  4545           GETC                    /READ FIRST CHARACTER.
  373   000235  1035           TAD     BOTTOM          /INIT PUSH-DOWN-LIST
  374   000236  3013           DCA     PDLXR
  375   000237  4560           SPNOR                   /IGNORE LEADING BLANKS
  376   000240  4561           TESTN                   /DOES THE LINE BEGIN WITH 1-9?
  377   000241  5362           JMP     GZERR           /PERIOD =ILLEGAL GROUP ZERO USAGE
  378   000242  5271           JMP     INPUTX          /NO
  379   000243  2026           ISZ     DEBGSW          /YES, DISABLE TRACE FOR REPACKING
  380   000244  4554           GETLN                   /READ THIS LINE NUMBER
  381   000245  1124           TAD     P4000           /TEST FOR SINGLE LINE.
  382   000246  1065           TAD     NAGSW
  383   000247  7640           SZA CLA
  384   000250  4566           ERROR3                  /ILLEGAL LINE NUMBER ON INPUT
  385   000251  1060           TAD     BUFR            /SET POINTERS
  386   000252  3010           DCA     AXIN
  387   000253  3062           DCA     XCTIN
  388   000254  1067           TAD     LINENO          /SAVE LINE #
  389   000255  3410           DCA I   AXIN            /(X-MEM)
  390   000256  4560           SPNOR                   /IGNORE SPACES AFTER LINE NUMBER
  391   000257  7410           SKP
  392   000260  4545           GETC                    /READ 1ST AFTER LINENO TERMINATOR.
  393   000261  4546   SRETN,  PACKC                   /SAVE TEXT AND RESTORE DATA FIELD
  394   000262  1066           TAD     CHAR            /TEST FOR END OF INPUT STRING
  395   000263  1116           TAD     MCR
  396   000264  7640           SZA CLA
  397   000265  5260           JMP     .-5
  398   000266  4565           DELETE                  /REMOVE OLD LINE, IF ANY.
  399   000267  4556           ENDLN                   /INSERT NEW LINE
  400   000270  5177           JMP     START           /POINTERS MUST BE REINITIALIZED
  401
  402   000271  4540   INPUTX, PUSHJ                   /PROCESS IMMEDIATE COMMAND.
  403   000272  0611           PROC
  404   000273  1422           TAD I   PC              /CHECK NEXT LINE (X-MEM)
  405   000274  7450           SNA                     /END OF PROGRAM?
  406   000275  5177           JMP     START           /YES
  407   000276  3022           DCA     PC              /SAVE NEW LINE NO.
  408   000277  1022           TAD     PC              /START NEW LINE
  409   000300  7001           IAC
  410   000301  5232           JMP     GONE            /PROCESS OTHER COMMANDS
  411
  412                   /       TEXT LINE BUFFER FORMAT*
  413
  414                   /       #1 : POINTER OR ZERO IN LAST
  415                   /       #2 : LINENO
  416                   /       #3 - #N+1 : TEXT
  417                   /       #N : C.R.
```

```
 419                    /       LINE NUMBER FORMATION
 420
 421   000302  0000  XGETLN, 0                       /DEVELOP I.D. - "GETLN"
 422   000303  4560          SPNOR                   /IGNORE LEADING SPACES.
 423   000304  1066          TAD     CHAR            /"ALL" IS A SPECIAL ARGUMENT.
 424   000305  1112          TAD     MINUSA
 425   000306  7650          SNA CLA
 426   000307  5322          JMP     TESTA
 427   000310  3036          DCA     INSUB           /CALL 'GETC' FROM 'INPUT' VIA 'DECON'
 428   000311  4771          JMS I   LCON            /(DECONV - IN FLOAT.)
 429   000312  1047          TAD     FLAC+3          /GROUP TOO LARGE?
 430   000313  0372          AND     P7740
 431   000314  1046          TAD     FLAC+2
 432   000315  7640          SZA CLA
 433   000316  4566          ERROR2                  /GROUP NUMBER TOO LARGE
 434   000317  1047          TAD     FLAC+3
 435   000320  4557          RTL6
 436   000321  7004          RAL
 437   000322  3067  TESTA,  DCA     LINENO
 438   000323  4561          TESTN                   /TEST3
 439   000324  4545          GETC                    /READ STEP NUMBER.
 440   000325  4561          TESTN                   /TEST4, OTHER
 441   000326  5340          JMP     GERR            /DOUBLE PERIODS
 442   000327  5352          JMP     GEXIT           /OTHER
 443   000330  1054          TAD     SORTCN          /NUMBER
 444   000331  7106          CLL RTL
 445   000332  1054          TAD     SORTCN
 446   000333  7004          RAL
 447   000334  1067          TAD     LINENO
 448   000335  3067          DCA     LINENO
 449   000336  4545          GETC                    /READ SECOND STEP NUMBER.
 450   000337  4561          TESTN                   /TEST4, OTHER
 451   000340  4566  GERR,   ERROR4                  /DOUBLE PERIODS
 452   000341  5352          JMP     GEXIT           /OTHER
 453   000342  1054          TAD     SORTCN          /NUMBER
 454   000343  1067          TAD     LINENO
 455   000344  3067          DCA     LINENO
 456   000345  4545          GETC                    /TEST FOR CORRECT TERMINATOR
 457   000346  4561          TESTN                   /CHECK SIZE
 458   000347  5340          JMP     GERR            /.
 459   000350  7410          SKP
 460   000351  4566          ERROR2                  /TOO LARGE A LINE NUMBER.
```

```
  462   000352  7100  GEXIT,  CLL                     /CLEAR LINK BIT
  463   000353  1067          TAD     LINENO          /TEST FOR GROUP NUMBER.
  464   000354  0104          AND     P7600
  465   000355  7640          SZA CLA
  466   000356  7020          CML
  467   000357  1067          TAD     LINENO
  468   000360  0106          AND     P177            /REPARE "NAGSW"
  469   000361  7460          SNL SZA
  470   000362  4566  GZERR,  ERROR2                   /0.X = ERROR: ILLEGAL LINE NUMBER.
  471   000363  7640          SZA CLA
  472   000364  1373          TAD     P2000
  473   000365  7020          CML
  474   000366  7004          RAL
  475   000367  3065          DCA     NAGSW
  476   000370  5702          JMP I   XGETLN
  477
  478   000371  5600  LCON,   DECONV
  479   000372  7740  P7740,  7740
  480   000373  2000  P2000,  2000
  481
  482                 /       RANGE OF ACCEPTIBLE LINE NUMBERS = 1.01 TO 31.99
  483                 /       NAGSW:
  484
  485                 /       GROUP=0000
  486                 /       LINE=4000
  487                 /       ALL=0001
  488
  489                 /       LIST OF FUNCTION ADDRESSES. (NAMES ARE IN "FNTABL")
  490
  491           0374          FNTABF= .
  492
  493   000374  2014          XABS                    /ABS    -ABSOLUTE VALUE
  494   000375  2010          XSGN                    /SGN    -SIGN PART
  495   000376  1160          XINT                    /ITR    -INTEGER PART
  496   000377  1142          XDYS                    /DIS    -DISPLAY AND INTENSIFY
  497   000400  1553          XRAN                    /RAN    -RANDOM NUMBER
  498   000401  1343          XADC                    /ADC    -READ ANALOG TO DIGITAL CONVERTER
  499   000402  5000          ARTN                    /ATN    -
  500   000403  4620          FEXP                    /EXP    -EXPONENTIAL FUNCTIONS
  501   000404  5040          FLOG                    /LOG    -
  502   000405  5205          FSIN                    /SIN    -TRIG FUNCTIONS
  503   000406  5200          FCOS                    /COS    -
  504   000407  7400          XSQRT                   /SQT    -SQUARE ROOT
  505   000410  2725          ERROR5                  /NEW    -USER DEFINED FUNCTIONS
  506   000411  2725          ERROR5                  /COM    -
  507   000412  2725          ERROR5                  /X      -
  508
  509   000413  0000  XRTL6,  0                       /ROTATE AC LEFT SIX - "RTL6"
  510   000414  7106          CLL RTL
  511   000415  7006          RTL
  512   000416  7006          RTL
  513   000417  5613          JMP I   XRTL6
```

```
  515                   /       RECURSIVE OPERATE, EXECUTE, OR CALL
  516
  517   000420  4554    DO,     GETLN                   /EXECUTE ONE LINE, A GROUP, OR ALL
  518   000421  1022            TAD     PC              /SAVE ADDRESS
  519   000422  4542            PUSHA                   /OF CURRENT LINE
  520   000423  4543            PUSHF                   /SAVE REST OF THIS LINE
  521   000424  0017            TEXTP                   /ADDRESS OF TEXT POINTERS
  522   000425  4543    DGRP,   PUSHF                   /SAVE NAGSW; CHAR; AND LINENO.
  523   000426  0065            NAGSW
  524   000427  1065            TAD     NAGSW           /CHECK DATA FROM GETLN.
  525   000430  7710            SPA CLA                 /SKIP IF GROUP OR ALL
  526   000431  5263            JMP     DOONE           /DO ONE LINE
  527   000432  4555            FINDLN                  /INIT FOR GROUP AND SET THISLN
  528   000433  7000            NOP
  529   000434  1023            TAD     THISLN          /TEST FOR GOOD GROUP NUMBER.
  530   000435  3011            DCA     XRT
  531   000436  1411            TAD I   XRT             /(X-MEM)
  532   000437  4563            TSTGRP
  533   000440  4566            ERROR2                  /NO SUCH GROUP NUMBER
  534   000441  4540    DGRP1,  PUSHJ                   /EXECUTE OBJECT LINE AND SET PC.
  535   000442  0606            PROCESS-2
  536   000443  4544            POPF                    /RESTORE THE DATA
  537   000444  0065            NAGSW
  538   000445  1422            TAD I   PC              /CHECK FOR END OF TEXT (X-MEM)
  539   000446  7450            SNA
  540   000447  5271            JMP     DCONT           /ALL DONE
  541   000450  7001            IAC
  542   000451  3030            DCA     PT1             /SAVE POINTER TO LINENO
  543   000452  1065            TAD     NAGSW           /CHECK FOR GROUP
  544   000453  7740            SMA SZA CLA
  545   000454  5260            JMP     .+4             /DO ALL
  546   000455  1430            TAD I   PT1             /TEST GROUP (X-MEM)
  547   000456  4563            TSTGRP
  548   000457  5271            JMP     DCONT           /NOT IN GROUP
  549   000460  1430            TAD I   PT1             /READ NEXT LINE NO. (X-MEM)
  550   000461  3067            DCA     LINENO
  551   000462  5225            JMP     DGRP            /CONTINUE THE SUBROUTINE
  552
  553   000463  4555    DOONE,  FINDLN                  /FIND THE LINE
  554   000464  4566            ERROR2                  /NO SUCH LINE NUMBER
  555   000465  4540            PUSHJ                   /EXECUTE IT
  556   000466  0610            PROCESS
  557   000467  4544            POPF                    /RESTORE CHAR
  558   000470  0065            NAGSW
  559   000471  4544    DCONT,  POPF                    /RESTORE TEXT POINTERS
  560   000472  0017            TEXTP
  561   000473  1413            POPA                    /RESTORE ADDRESS OF CURRENT LINE.
  562   000474  3022            DCA     PC
  563   000475  5676            JMP I   .+1;    PROC    /CONTINUE PROCESSING THIS LINE.
  564   000476  0611
```

```
  566                   /       PUSHDOWN LIST CONTROLS
  567
  568   000477  0000   XPUSHA, 0                       /PUSHDOWN THE AC - "PUSHA"
  569   000500  3071           DCA     T2              /BACKUP POINTER
  570   000501  7040           CMA                     /AND THEN
  571   000502  4310           JMS     PCHK            /CHECK CORE USAGE
  572   000503  1071           TAD     T2              /OK
  573   000504  3413           DCA I   PDLXR           /PUSH DOWN LIST POINTER
  574   000505  7040           CMA                     /BACKUP AGAIN
  575   000506  4310           JMS     PCHK
  576   000507  5677           JMP I   XPUSHA
  577
  578   000510  0000   PCHK,   0
  579   000511  1013           TAD     PDLXR           /INC IN AC
  580   000512  3013           DCA     PDLXR
  581   000513  1013           TAD     PDLXR
  582   000514  7141           CLL CIA
  583   000515  1031           TAD     LASTV
  584   000516  7630           SZL CLA
  585   000517  4566           ERROR3                  /STORAGE FILLED BY PUSH-DOWN LIST
  586   000520  5710           JMP I   PCHK
  587
  588   000521  0000   XPUSHJ, 0                       /RECURSIVE SUBROUTINE CALL - "PUSHJ"
  589   000522  1721           TAD I   XPUSHJ
  590   000523  3071           DCA     T2              /SAVE SUBR. ADDR.
  591   000524  7040           CMA
  592   000525  4310           JMS     PCHK
  593   000526  1321           TAD     XPUSHJ
  594   000527  7001           IAC
  595   000530  3413           DCA I   PDLXR           /SAVE RETURN
  596   000531  7040           CMA
  597   000532  4310           JMS     PCHK
  598   000533  5471           JMP I   T2              /TRANSFER CONTROL
  599
  600   000534  0000   PD2,    0                       /SAVE A FLOATING POINT NUMBER - "PUSHF"
  601   000535  7240           CLA CMA                 /COMPUTE VARIABLE ADDR
  602   000536  1734           TAD I   .-2
  603   000537  3011           DCA     XRT
  604   000540  2334           ISZ     PD2             /FIX RETURN
  605   000541  1117           TAD     MFLT            /COMPUTE PUSH. POINTER
  606   000542  4310           JMS     PCHK
  607   000543  1117           TAD     MFLT
  608   000544  3071           DCA     T2
  609   000545  1411           TAD I   XRT
  610   000546  3413           DCA I   PDLXR
  611   000547  2071           ISZ     T2
  612   000550  5345           JMP     .-3
  613   000551  1117           TAD     MFLT            /RESET POINTER
  614   000552  4310           JMS     PCHK
  615   000553  5734           JMP I   PD2
```

```
  617   000554  0000  PD3,    0                       /RESTORE A FLOATING POINT NUMBER - "POPF"
  618   000555  7240          CLA CMA                 /GET VAR. ADDR.
  619   000556  1754          TAD I   PD3
  620   000557  2354          ISZ     PD3
  621   000560  3011          DCA     XRT
  622   000561  1117          TAD     MFLT
  623   000562  3071          DCA     T2
  624   000563  1413          TAD I   PDLXR           /MOVE
  625   000564  3411          DCA I   XRT
  626   000565  2071          ISZ     T2
  627   000566  5363          JMP     .-3
  628   000567  5754          JMP I   PD3             /EXIT
  629
  630           0570          INLIST= .               /INPUT CONTROL CHARACTERS
  631
  632   000570  2740          RECOVR                  /C.C. = BREAK
  633   000571  0212          IBAR                    /B.A. = RESTART
  634   000572  0217          IGNOR                   /L.F. = IGNORE
  635   000573  0227          IRETN                   /C.R. = TERMINATE STRING
  636
  637   000574  1075  FLIST2, FLIMIT                  /,=STANDARD
  638   000575  1137          FINFIN                  /;=SHORT
  639   000576  2725          ERROR5                  /CR=DUMB
  640
  641   000577  1065  FLIST1, FINCR                   /,=STANDARD FORMAT
  642   000600  0610          PROCESS                 /;=SET; PLUS ,..
  643   000601  0614          PC1                     /C.R.=SET COMMAND.
  644
  645   000602  7472  MF,     -"F                     /USED BY TESTC
```

```
  647                   /       PRIMARY CONTROL AND TRANSFER
  648
  649   000603  4554   GOTO,   GETLN                   /READ THE LINE NUMBER REQUESTED
  650   000604  4555           FINDLN                  /LOCATE IT AND RESET TEXTP
  651   000605  4566           ERROR2                  /NOT THERE
  652   000606  1023           TAD     THISLN          /SET PC
  653   000607  3022           DCA     PC
  654   000610  4545   PROCESS,GETC                    /TEST FOR END OF LINE
  655   000611  1066   PROC,   TAD     CHAR            /FIRST CHARACTER READY = USE PROC
  656   000612  1116           TAD     MCR
  657   000613  7650           SNA CLA
  658   000614  5541   PC1,    POPJ                    /EXIT "PROCESS"
  659   000615  4550           SORTC                   /IGNORE "SPACE", ",", AND ";".
  660   000616  1376           GLIST-1
  661   000617  5210           JMP     PROCESS
  662   000620  1066           TAD     CHAR            /SAVE COMMAND CHARACTER
  663   000621  0075           AND     P337            /EXECUTE LOWER CASE ALSO
  664   000622  4542           PUSHA
  665   000623  4545           GETC                    /GO TO TERMINATOR
  666   000624  4550           SORTC
  667   000625  1376           GLIST-1
  668   000626  7410           SKP
  669   000627  5223           JMP     .-4
  670   000630  1413           POPA
  671   000631  4547           SORTJ                   /GO DO COMMAND
  672   000632  0773           COMLST-1
  673   000633  0167           COMGO-COMLST
  674   000634  4566           ERROR2                  /ILLEGAL COMMAND
  675
  676           0614           COMMENT=PC1             /ALSO IS CONTINUE
  677
```

```
  679                   /       OUTPUT COMMAND TEXT
  680
  681   000635  4554    WRITE,  GETLN                   /SET LINENO
  682   000636  2026            ISZ     DEBGSW          /DISABLE TRACE
  683   000637  4555            FINDLN                  /SEARCH FOR LINE NUMBER
  684   000640  5267            JMP     WTESTG          /NOT THERE OR GROUP
  685   000641  1067            TAD     LINENO
  686   000642  7640            SZA CLA
  687   000643  4553            PRNTLN                  /PRINT LINE NUMBER AND A SPACE.
  688   000644  4545            GETC
  689   000645  4551            PRINTC                  /PRINT TEXT OF A LINE.
  690   000646  1066            TAD     CHAR
  691   000647  1116            TAD     MCR
  692   000650  7640            SZA CLA                 /SKIP IF END OF LINE
  693   000651  5244            JMP     .-5
  694   000652  1423            TAD I   THISLN          /TEST FOR END OF TEXT (X-MEM)
  695   000653  7450    WTEST2, SNA
  696   000654  5271            JMP     WX-2            /EXIT; DO NEXT INDIRECT LINE.
  697   000655  7001            IAC
  698   000656  3030            DCA     PT1             /SAVE POINTER TO LINENO OF NEXT
  699   000657  1065            TAD     NAGSW
  700   000660  7700            SMA CLA
  701   000661  1430            TAD I   PT1             /(X-MEM)
  702   000662  4563            TSTGRP                  /TRY NEXT LINENO FOR GROUP.
  703   000663  5273            JMP     WX
  704   000664  1430    WALL,   TAD I   PT1             /SET LINENO (X-MEM)
  705   000665  3067            DCA     LINENO
  706   000666  5237            JMP     WRITE+2
  707
  708   000667  1023    WTESTG, TAD     THISLN          /INIT GROUP PRINTOUT
  709   000670  5253            JMP     WTEST2
  710
  711   000671  3026            DCA     DEBGSW
  712   000672  5541            POPJ
  713
  714   000673  1065    WX,     TAD     NAGSW
  715   000674  7750            SPA SNA CLA             /SKIP IF ALL
  716   000675  5271            JMP     WX-2
  717   000676  4551            PRINTC                  /PRINT C.R. AGAIN
  718   000677  5264            JMP     WALL
```

```
  720   000700  0000  XTESTC, 0                       /TEST THE NATURE OF THE NEXT ALPHANUMERIC - "TESTC"
  721   000701  4560          SPNOR                   /IGNORE SPACES
  722   000702  4550          SORTC                   /TEST THE VARIABLE TERMINATORS
  723   000703  1767          TERMS-1
  724   000704  5700          JMP I   XTESTC          /YES - SORTCN IS SET
  725   000705  1066          TAD     CHAR            /NO
  726   000706  2300          ISZ     XTESTC
  727   000707  1202          TAD     MF
  728   000710  7650          SNA CLA                 /TEST FOR "F"
  729   000711  5317          JMP     XT3
  730   000712  4561          TESTN
  731   000713  5700          JMP I   XTESTC          /.
  732   000714  7410          SKP                     /OTHER
  733   000715  5700          JMP I   XTESTC          /NUMBER
  734   000716  2300          ISZ     XTESTC
  735   000717  2300  XT3,    ISZ     XTESTC          /RETURNS:T; N; F; A
  736   000720  5700          JMP I   XTESTC
  737
  738   000721  0000  XSORTC, 0                       /SORT CHAR AGAINST TABLE - "SORTC"
  739   000722  1721          TAD I   XSORTC
  740   000723  3012          DCA     XRT2            /1ST ARG IS LIST-1
  741   000724  1412          TAD I   XRT2
  742   000725  7510          SPA                     /LIST IS ENDED BY A NEGATIVE NUMBER
  743   000726  5340          JMP     SEXC            /2AND EXIT = NOT IN LIST
  744   000727  7041          CIA
  745   000730  1066          TAD     CHAR
  746   000731  7640          SZA CLA                 /COMPARE
  747   000732  5324          JMP     .-6
  748   000733  1721          TAD I   XSORTC          /COMPUTE INCREMENT : 0 - N
  749   000734  7040          CMA
  750   000735  1012          TAD     XRT2
  751   000736  3054          DCA     SORTCN
  752   000737  7410          SKP                     /1ST EXIT = YES
  753   000740  2321  SEXC,   ISZ     XSORTC
  754   000741  2321          ISZ     XSORTC
  755   000742  7300          CLA CLL
  756   000743  5721          JMP I   XSORTC
```

```
  758   000744  0000  GRPTST, 0                       /AC VS LINENO - "TSTGRP"
  759   000745  0104          AND     P7600
  760   000746  7041          CIA
  761   000747  3071          DCA     T2
  762   000750  1067          TAD     LINENO
  763   000751  0104          AND     P7600
  764   000752  1071          TAD     T2
  765   000753  7650          SNA CLA
  766   000754  2344          ISZ     GRPTST
  767   000755  5744          JMP I   GRPTST
  768
  769                 /       INPUT FROM TEXT OR KEYBOARD;
  770                 /       IF BACK-ARROW, RESTART INPUT
  771
  772   000756  0000  INPUT,  0                       /INPUT A CHARACTER
  773   000757  1036          TAD     INSUB           /NON-ZERO FOR KEYBOARD
  774   000760  7640          SZA CLA
  775   000761  5364          JMP     .+3
  776   000762  4545          GETC
  777   000763  5756          JMP I   INPUT
  778   000764  4552          READC
  779   000765  4547          SORTJ
  780   000766  6776          SPECIAL-1
  781   000767  3402          INFIX-SPECIAL
  782   000770  5756          JMP I   INPUT
  783
  784   000771  1035  ILIST,  IF1                     /,
  785   000772  0610          PROCESS                 /;
  786   000773  0614          PC1                     /CR
  787
  788                 /                               ENGLISH-FRENCH
  789           0774          COMLST= .               /COMMAND DECODING LIST
  790
  791   000774  0323          "S                      /SET    - ORGANIZE
  792   000775  0306          "F                      /FOR    - QUAND
  793   000776  0311          "I                      /IF     - SI
  794   000777  0304          "D                      /DO     - FAIZ
  795   001000  0307          "G                      /GOTO   - VA
  796   001001  0303          "C                      /COMMENT- COMMENTE
  797   001002  0301          "A                      /ASK    - DEMANDE
  798   001003  0324          "T                      /TYPE   - TAPE
  799   001004  0314          "L                      /LIBRARY- ENTREPOSE
  800   001005  0305          "E                      /ERASE  - BIFFE
  801   001006  0327          "W                      /WRITE  - INSCRIS
  802   001007  0315          "M                      /MODIFY - MODIFIE
  803   001010  0321          "Q                      /QUIT   - ARRETE
  804   001011  0322          "R                      /RETURN - RETOURNE
  805   001012  0212          "*-40                   /(ASTERISK)=EXPANDABLE COMMAND
  806
  807                 /       THIS COMMAND LIST IS SPEED OPTIMIZED.
```

```
  809                   /       CONDITIONAL TRANSFER PROCESS.
  810
  811   001013  4564   IF,     TESTC                   /IGNORE SPACES AND TEST
  812   001014  4637          JMS I   IECALL           /T
  813   001015  2013          ISZ     PDLXR           /N-DUMP THE (EFOP)
  814   001016  4640          JMS I   IPART           /F-CHECK FOR PAREN MATCH
  815   001017  1111          TAD     M2              /A
  816   001020  3032          DCA     T1
  817   001021  1045          TAD     FLAC+1          /TEST -, 0, +
  818   001022  7510          SPA
  819   001023  2032          ISZ     T1              /N-TO   -1, -2, -3
  820   001024  7750          SPA SNA CLA
  821   001025  2032  IF3,    ISZ     T1              /COUNT COMMAS
  822   001026  7410          SKP
  823   001027  5767          JMP I   COMGO+4         /TRANSFER
  824   001030  4547          SORTJ                   /SEARCH TEXT UNTIL ,;C.R.
  825   001031  1377          TLIST-1
  826   001032  7371          ILIST-TLIST
  827   001033  4545          GETC
  828   001034  5230          JMP     .-4
  829   001035  4545  IF1,    GETC                    /MOVE PAST COMMA
  830   001036  5225          JMP     IF3
  831
  832   001037  1601  IECALL, ECALL
  833   001040  2047  IPART,  PARTEST
```

```
  835                 /       LOOP CONTROL STATEMENT
  836
  837           1041          SET=    .               /SUBSET OF "FOR".
  838
  839   001041  4540  FOR,     PUSHJ                   /LOOPS, ETC.
  840   001042  1403          GETARG                  /LOOK FOR "=" NEXT
  841   001043  4560          SPNOR                   /IGNORE SPACES
  842   001044  1066          TAD     CHAR
  843   001045  1335          TAD     MEQ
  844   001046  7440          SZA
  845   001047  4566          ERROR4                  /LEFT OF "=" IN ERROR: 'FOR' OR 'SET'
  846   001050  1030          TAD     PT1
  847   001051  4542          PUSHA                   /SAVE POINTER TO VARIABLE
  848   001052  4540          PUSHJ
  849   001053  1612          EVAL-1                  /GET INITIAL VALUE EXPRESSION
  850   001054  1413          POPA
  851   001055  3030          DCA     PT1
  852   001056  4407          FINT                    /INITIALIZE NOW.
  853   001057  6430          FPUT I  PT1
  854   001060  0000          FXIT
  855   001061  4547          SORTJ                   /TEST LAST CHAR FROM "EVAL"
  856   001062  1377          TLIST-1
  857   001063  7177          FLIST1-TLIST
  858   001064  4566          ERROR4                  /EXCESS R-PAR
  859
  860   001065  1030  FINCR,  TAD     PT1             /SAVE VARIABLE ADDRESS *
  861   001066  4542          PUSHA
  862   001067  4540          PUSHJ                   /EVALUATE THE INCREMENT,IF ANY.
  863   001070  1612          EVAL-1
  864   001071  4547          SORTJ                   /TEST TERMINATORS
  865   001072  1377          TLIST-1
  866   001073  7174          FLIST2-TLIST
  867   001074  4566          ERROR4                  /ILLEGAL TERMINATOR IN 'FOR'
  868
  869   001075  4543  FLIMIT, PUSHF                   /SAVE THE INCREMENT.    *
  870   001076  2030          FLARG
  871   001077  4540          PUSHJ                   /GET THE LIMIT (NO ERROR DETECTION AFTER LIMIT)
  872   001100  1612          EVAL-1
  873   001101  4543  FCONT,  PUSHF                   /SAVE THE LIMIT *
  874   001102  2030          FLARG
  875   001103  4543          PUSHF                   /SAVE TEXT OF OBJECT STATEMENTS
  876   001104  0017          TEXTP
  877   001105  4540          PUSHJ                   /DO THE OBJECT STATEMENTS
  878   001106  0610          PROCESS
  879   001107  4544          POPF                    /RESTORE REMAINING TEXT.
  880   001110  0017          TEXTP
  881   001111  4544          POPF                    /GET LIMIT
  882   001112  2030          FLARG
  883   001113  4544          POPF                    /GET INCREMENT
  884   001114  7470          ITER1
  885   001115  1413          POPA                    /GET VARIABLE ADDRESS
  886   001116  3030          DCA     PT1
```

```
 888   001117  4407          FINT                    /INCREMENT AND TEST
 889   001120  0430          FGET I  PT1             /LOAD THE VARIABLE
 890   001121  1733          FADD I  FINKP           /INCREMENT IT
 891   001122  6430          FPUT I  PT1             /CHANGE IT
 892   001123  2525          FSUB I  FLARGP          /TEST IT
 893   001124  0000          FXIT
 894   001125  1045          TAD     FLAC+1
 895   001126  7740          SMA SZA CLA
 896   001127  5541          POPJ                    /END OF LOOP
 897   001130  1030          TAD     PT1
 898   001131  4542          PUSHA                   /SAVE ADDRESS *
 899   001132  4543          PUSHF                   /SAVE INCREMENT AGAIN *
 900   001133  7470  FINKP,  ITER1
 901   001134  5301          JMP     FCONT
 902
 903   001135  7503  MEQ,    -"=
 904   001136  7524  MCOM,   -",
 905
 906   001137  4543  FINFIN, PUSHF                   /SET INCREMENT TO ONE.
 907   001140  2405          FLTONE
 908   001141  5301          JMP     FCONT
 909
 910                 /       SET AND INTENSIFY THE POINT: FDIS(X,Y)
 911
 912   001142  4453  XDYS,   JMS I   INTEGER         /RETURN=INTEGER VALUE OF Y.
 913   001143  4542          PUSHA
 914   001144  1066          TAD     CHAR
 915   001145  1336          TAD     MCOM
 916   001146  7640          SZA CLA
 917   001147  4566          ERROR3                  /ARG MISSING
 918   001150  4540          PUSHJ
 919   001151  1612          EVAL-1
 920   001152  4453          JMS I   INTEGER
 921   001153  6063          6063                    /DYL
 922   001154  7200          CLA
 923   001155  1413          POPA
 924   001156  6057          6057                    /DXL DIX
 925   001157  7410          SKP
 926
 927                 /       TAKE THE INTEGER PART
 928
 929   001160  4453  XINT,   JMS I   INTEGER         /(FIX)
 930   001161  7200          CLA
 931   001162  5536          JMP I   EFUN3I
```

```
  933          1163          COMGO=  .               /COMMAND ROUTINE ADDRESSES
  934
  935   001163 1041          SET
  936   001164 1041          FOR
  937   001165 1013          IF
  938   001166 0420          DO
  939   001167 0603          GOTO                    /(REFERENCED)
  940   001170 0614          COMMENT
  941   001171 1202          ASK
  942   001172 1203          TYPE
  943   001173 7503          LIBRARY
  944   001174 2204          ERASE
  945   001175 0635          WRITE
  946   001176 1256          MODIFY
  947   001177 0177          START                   /RETURN TO COMMAND MODE VIA 'QUIT'
  948   001200 1563          RETRN
  949   001201 6361          HSPX                    /ACTIVATE THE HIGH SPEED READER
  950
  951
  952
  953
  954
  955                 /       INPUT-OUTPUT STATEMENTS
  956
  957   001202 7240 ASK,    CLA CMA                 /REMEMBER WHICH CALL.
  958   001203 3056 TYPE,   DCA     ATSW
  959   001204 3026 TASK,   DCA     DEBGSW          /RE-ENABLE THE TRACE
  960   001205 4547          SORTJ                   /SPECIAL CHARACTER?
  961   001206 1371          ALIST-1
  962   001207 0176          ATLIST-ALIST
  963   001210 2056          ISZ     ATSW            /TEST QUOTE SWITCH
  964   001211 5226          JMP     TYPE2
  965   001212 4540          PUSHJ                   /DO ASK; SETUP PT1
  966   001213 1403          GETARG
  967   001214 1066          TAD     CHAR            /SAVE IN-LINE CHARACTER.
  968   001215 4542          PUSHA
  969   001216 1255          TAD     COL             /TYPE COLON
  970   001217 4551          PRINTC                  /(CLA)- TO SUPRESS ":"
  971   001220 2036          ISZ     INSUB           /INDICATE 'READC'
  972   001221 7001          IAC                     /POINT PAST CHAR
  973   001222 4531          JMS I   FINPUT          /READ DATA AND SAVE
  974   001223 1413          POPA                    /RE-TEST LAST TERMINATOR
  975   001224 3066          DCA     CHAR
  976   001225 5202          JMP     ASK             /CONTINUE PROCESSING
  977
  978   001226 4540 TYPE2,  PUSHJ                   /DO TYPE
  979   001227 1613          EVAL
  980   001230 4530          JMS I   FOUTPUT         /PRINT
  981   001231 5203          JMP     TYPE
```

```
  983   001232  2026  TQUOT,  ISZ     DEBGSW          /DISABLE TRACE
  984   001233  4545          GETC                    /TYPE LITERALS
  985   001234  4547          SORTJ
  986   001235  1403          TLIST2-1
  987   001236  0773          TLIST3-TLIST2
  988   001237  4551          PRINTC
  989   001240  5233          JMP     TQUOT+1
  990
  991   001241  4545  TINTR,  GETC                    /PASS PERCENT SIGN
  992   001242  4554          GETLN                   /READ FORMAT CONTROL: "%7.03"
  993   001243  1067          TAD     LINENO
  994   001244  3052          DCA     FISW            /SAVE FORMAT CODE
  995   001245  5204          JMP     TASK
  996
  997   001246  1077  TCRLF2, TAD     CCR             /SPLAT=CR ALONE
  998   001247  4463          JMS I   OUTDEV
  999   001250  7040          CMA                     /NON-PRINTING DELAY FOR CR
 1000   001251  1077  TCRLF,  TAD     CCR             /EXCLAMATION POINT=CR, LF.
 1001   001252  4551          PRINTC
 1002   001253  4545  TASK4,  GETC                    /MOVE TO NEXT CHARACTER
 1003   001254  5204          JMP     TASK
 1004
 1005   001255  0272  COL,    ":                      /":"
 1006
 1007
 1008
 1009                 /       IF DEBGSW= 0: ENABLE FLIP-FLOP "DMPSW"
 1010                 /                  #0: DISABLE AND RETURN ALL"?" ' S.
 1011                 /       IF DMPSW=  0: TRACE ON, IF ENABLED
 1012                 /                  #0: TRACE OFF
 1013                 /       IF BOTH=   0: PRINT TRACE.
```

```
1015                    /       SEARCH ROUTINES
1016
1017    001256  4554    MODIFY, GETLN                   /READ LINE NO.
1018    001257  4555            FINDLN                  /LOOK IT UP NOW.
1019    001260  4566            ERROR2                  /NOT THERE = BAD COMMAND UNLESS ZERO.
1020    001261  1060            TAD     BUFR            /SET POINTERS
1021    001262  3010            DCA     AXIN            /FOR INPUT
1022    001263  3062            DCA     XCTIN
1023    001264  1067            TAD     LINENO          /COPY THE SAME LINE NUMBER.
1024    001265  3410            DCA I   AXIN            /(X-MEM)
1025    001266  1010            TAD     AXIN            /SAVE START OF NEW LINE
1026    001267  3027            DCA     PACKST
1027    001270  4464    SCONT,  JMS I   INDEV           /READ THE TELETYPE INPUT SILENTLY.
1028    001271  3100            DCA     LIST3+1         /SAVE SEARCH CHARACTER
1029    001272  2026            ISZ     DEBGSW          /NO BREAKS.
1030    001273  4545    SCHAR,  GETC                    /TYPE+TEST-F.F.
1031    001274  4551            PRINTC                  /PLAYBACK THE TEXT
1032    001275  4547            SORTJ                   /LOOK FOR MATCH
1033    001276  0076            LIST3-1
1034    001277  1271            LISTGO-LIST3
1035    001300  4546            PACKC                   /SAVE NEW LINE.
1036    001301  5273            JMP     SCHAR
1037
1038    001302  1060    SBAR,   TAD     BUFR            /RESTART-B.A.
1039    001303  7001            IAC
1040    001304  3010            DCA     AXIN            /SET POINTERS
1041    001305  3062            DCA     XCTIN
1042    001306  4552    SFOUND, READC                   /READ FROM KEYBOARD
1043    001307  4547            SORTJ                   /TEST
1044    001310  0071            LIST6-1
1045    001311  1271            SRNLST-LIST6
1046    001312  4546    SGOT,   PACKC                   /PACK CHAR.
1047    001313  5306            JMP     SFOUND          /MORE
```

```
1049   001314  0000  SORTB,  0                       /SORT AND BRANCH ROUTINE. - "SORTJ"
1050   001315  7450          SNA
1051   001316  1066          TAD     CHAR            /ASSUME CHAR IF AC=0
1052   001317  7041          CIA
1053   001320  3071          DCA     T2              /SAVE SORT ITEM
1054   001321  1714          TAD I   SORTB           /FIRST ARG IS LIST LESS ONE
1055   001322  2314          ISZ     SORTB           /2AND IS INTRA-LIST LENGTH
1056   001323  3012          DCA     XRT2
1057   001324  1412          TAD I   XRT2
1058   001325  7510          SPA                     /**LISTS ENDED BY NEGATIVE NUMBERS**
1059   001326  5340          JMP     SEX             /READ EXIT
1060   001327  1071          TAD     T2              /FIND ADDRESS
1061   001330  7640          SZA CLA
1062   001331  5324          JMP     .-5
1063   001332  1012          TAD     XRT2            /MATCH FOUND.
1064   001333  1714          TAD I   SORTB
1065   001334  3071          DCA     T2
1066   001335  1471          TAD I   T2
1067   001336  3071          DCA     T2              /DEBUG : AC = ADDRESS
1068   001337  5471          JMP I   T2
1069
1070   001340  2314  SEX,    ISZ     SORTB           /MATCH NOT FOUND.
1071   001341  7300          CLA CLL
1072   001342  5714          JMP I   SORTB
1073
1074
1075
1076                  /       ANALOGUE TO DIGITAL CONVERSION FOR AX08
1077
1078   001343  4453  XADC,   JMS I   INTEGER
1079   001344  7000          NOP                     /(IOF)-FOR OTHER BRANDS
1080   001345  6375          6375                    /ACMX ADCV
1081   001346  6332          6332                    /SKAD
1082   001347  5346          JMP     .-1
1083   001350  6362          6362                    /RADC
1084   001351  3046          DCA     FLAC+2
1085   001352  6001          ION
1086   001353  5536          JMP I   EFUN3I
```

```
1088   001354  0000  OUTL,   0                       /SLOW OUTPUT FOR ODT SYNCRONIZATION
1089   001355  6046          TLS                     /AND FOR H.S. PUNCH
1090   001356  6026          PLS
1091   001357  6041          TSF                     /IOT FOR SLOWEST DEVICE
1092   001360  5357          JMP     .-1
1093   001361  7200          CLA
1094   001362  5754          JMP I   OUTL
1095
1096
1097
1098
1099           1363          SRNLST= .               /'MODIFY' CONTROL CHARACTER TABLE
1100
1101   001363  1273          SCHAR                   /F.F. = CONTINUE
1102   001364  1270          SCONT                   /BELL = CHANGE SEARCH CHARACTER
1103   001365  2740          RECOVR                  /C.C. = BREAK
1104   001366  1302          SBAR                    /B.A. = RESTART
1105   001367  1271          SCONT+1                 /L.F. = FINISH THE LINE AS BEFORE.
1106
1107           1370          LISTGO= .
1108
1109   001370  0261          SRETN                   /C.R. = END THE LINE HERE AS IS.
1110   001371  1312          SGOT                    /CHAR = SEARCH CHARACTER
1111
1112
1113
1114
1115
1116           1372          ALIST=  .               /ASK/TYPE LIST OF CONTROLS.
1117
1118   001372  0245          "%                      /%
1119   001373  0242          ""                      /"
1120   001374  0241          "!                      /!
1121   001375  0243          "#                      /#
1122   001376  0244          "$                      /$
1123
1124           1377          GLIST=  .
1125
1126   001377  0240          "                       /SPACE
1127           1400          TLIST=  .
1128
1129   001400  0254          ",                      /,
1130   001401  0273          ";                      /;
1131   001402  0215          "M&237                  /C.R.
1132
1133                 /       THIS LIST IS ENDED BY 'TESTC'.
```

```
1135                    /       FIND OR ENTER A VARIABLE IN THE LIST.
1136
1137   001403  4564  GETARG, TESTC                   /FIRST LETTER OF ARG
1138   001404  0242  TLIST2, ""                      /"
1139   001405  0215          "M&237                  /C.R. - FUNCTION OR NUMBER IS NOT AN ARG.
1140   001406  4566          ERROR4                  /BAD ARGUMENT IN 'FOR', 'SET', OR 'ASK'
1141   001407  3062  GETVAR, DCA     XCTIN           /PACK INTO ADD.
1142   001410  4546          PACKC
1143   001411  4545          GETC                    /SECOND LETTER
1144   001412  4550          SORTC                   /TERMINATOR?
1145   001413  1767          TERMS-1
1146   001414  5226          JMP     GSERCH          /YES
1147   001415  1066          TAD     CHAR            /NO
1148   001416  0122          AND     P77             /SAVE 2AND LETTER OF NAME
1149   001417  1061          TAD     ADD
1150   001420  3061          DCA     ADD
1151   001421  4545          GETC                    /IGNORE THE REST
1152   001422  4550          SORTC
1153   001423  1767          TERMS-1
1154   001424  5226          JMP     GSERCH
1155   001425  5221          JMP     .-4
1156
1157   001426  4562  GSERCH, TSTLPR                  /LOOK FOR SUBSCRIPT VIA SORTCN
1158   001427  5237          JMP     GS1             /NOT SUBSCRIPTED BY L-PAR.
1159   001430  1061          TAD     ADD             /SAVE NAME
1160   001431  3056          DCA     EFOP            /FOR RECURSIVE AND ERROR CHECK
1161   001432  4660          JMS I   GECALL          /TO EVAL
1162   001433  1413          POPA
1163   001434  3061          DCA     ADD             /RESTORE NAME
1164   001435  4657          JMS I   PTEST           /TEST PAREN MATCH, ETC.
1165   001436  4453          JMS I   INTEGER         /CONVERT TO 12-BIT NUMBER.
1166   001437  3317  GS1,    DCA     SUBS            /SAVE SUBSCRIPT
1167   001440  1060          TAD     STARTV          /SEARCH FOR VARIABLE(CHANGE FOR X-MEM)
1168   001441  3030  GS3,    DCA     PT1
1169   001442  1030          TAD     PT1
1170   001443  7041          CIA
1171   001444  1031          TAD     LASTV           /TEST FOR END OF LIST
1172   001445  7750          SPA SNA CLA
1173   001446  5261          JMP     GS2             /END SEARCH
1174   001447  1430          TAD I   PT1             /GET TABLE ENTRY
1175   001450  7041          CIA
1176   001451  1061          TAD     ADD
1177   001452  7650          SNA CLA
1178   001453  5305          JMP     GFND1           /FOUND XX
1179   001454  1030  GS4,    TAD     PT1             /TRY NEXT ONE
1180   001455  1070          TAD     GINC
1181   001456  5241          JMP     GS3
1182
1183   001457  2047  PTEST,  PARTEST
1184   001460  1601  GECALL, ECALL
```

```
1186   001461  1031  GS2,    TAD     LASTV           /ADD THE VARIABLE
1187   001462  1005          TAD     P13             /TEST STORAGE LIMITS
1188   001463  7141          CLL CIA
1189   001464  1013          TAD     PDLXR
1190   001465  7620          SNL CLA
1191   001466  4566          ERROR3
1192   001467  1031          TAD     LASTV           /UPDATE THE LIST.
1193   001470  1070          TAD     GINC
1194   001471  3031          DCA     LASTV
1195   001472  1061          TAD     ADD             /SAVE NAME
1196   001473  3430          DCA I   PT1
1197   001474  2030          ISZ     PT1             /SAVE SUBSCRIPT
1198   001475  1317          TAD     SUBS
1199   001476  3430          DCA I   PT1
1200   001477  2030          ISZ     PT1             /SET PT1
1201   001500  4407          FINT
1202   001501  0537          FGET I  CFRSX
1203   001502  6430          FPUT I  PT1
1204   001503  0000          FXIT
1205   001504  5541          POPJ                    /EXIT
1206
1207   001505  1030  GFND1,  TAD     PT1             /FOUND SAME
1208   001506  3011          DCA     XRT             /TEST SUBSCRIPTS
1209   001507  1411          TAD I   XRT
1210   001510  7041          CIA
1211   001511  1317          TAD     SUBS
1212   001512  7640          SZA CLA
1213   001513  5254          JMP     GS4             /WRONG SUBSCRIPT
1214   001514  2030          ISZ     PT1             /SET POINTER TO DATA
1215   001515  2030          ISZ     PT1
1216   001516  5541          POPJ
```

```
1218           1517          SUBS=   .
1219
1220   001517  0000  XSPNOR, 0                       /IGNORE LEADING SPACES - "SPNOR"
1221   001520  1066          TAD     CHAR
1222   001521  1114          TAD     M240
1223   001522  7640          SZA CLA
1224   001523  5717          JMP I   XSPNOR
1225   001524  4545          GETC
1226   001525  5320          JMP     XSPNOR+1
1227
1228
1229   001526  7520  M260,   -"0
1230   001527  7507  M271,   -"9
1231
1232
1233
1234   001530  0000  RANO,   0000                    /RANDOM NUMBER STORAGE!
1235   001531  2000          2000
1236   001532  0000          0000
1237
1238   001533  0000  XTESTN, 0                       /RETURNS: .; OTHER; NUMBER - "TESTN"
1239   001534  1066          TAD     CHAR
1240   001535  1115          TAD     MPER
1241   001536  7640          SZA CLA
1242   001537  2333          ISZ     XTESTN
1243   001540  1066          TAD     CHAR
1244   001541  1326          TAD     M260
1245   001542  3054          DCA     SORTCN          /SAVE VALUE OF THE NUMBER
1246   001543  1054          TAD     SORTCN          /TEST IF REALLY A DIGIT.
1247   001544  7710          SPA CLA
1248   001545  5733          JMP I   XTESTN
1249   001546  1066          TAD     CHAR
1250   001547  1327          TAD     M271
1251   001550  7750          SPA SNA CLA
1252   001551  2333          ISZ     XTESTN          /IF A NUMBER
1253   001552  5733          JMP I   XTESTN
1254
1255   001553  4407  XRAN,   FINT                    /PSEUDO-RANDOM NUMBER GENERATOR.
1256   001554  1330          FADD    RANO            /ADD RUNNING RESULT TO THE ARGUMENT, IF ANY.
1257   001555  4350          FMUL    .-5             /BLAST THE ARGUMENT
1258   001556  6330          FPUT    RANO
1259   001557  0000          FXIT
1260   001560  3330          DCA     RANO            /CONVERT TO .5 THROUGH .999
1261   001561  3044          DCA     FLAC            /SAME AS RETURN
1262   001562  5536          JMP I   EFUN3I
```

```
1264                    /       EXIT FROM A "DO" SUBROUTINE
1265
1266   001563  1137     RETRN,  TAD     CFRSX           /(PC) => 0
1267   001564  3022             DCA     PC
1268   001565  1413     XPOPJ,  TAD I   PDLXR           /RECURSIVE EXIT - "POPJ"
1269   001566  3071             DCA     T2
1270   001567  5471             JMP I   T2
1271
1272
1273
1274           1570             ATLIST= .               /ASK-TYPE CONTROL CHARACTER TABLE
1275
1276   001570  1241             TINTR                   /% - FORMAT DELIMITER
1277   001571  1232             TQUOT                   /" - LITERAL DELIMITER
1278   001572  1251             TCRLF                   /! - CARRIAGE RETURN AND LINE FEED
1279   001573  1246             TCRLF2                  /# - CARRIAGE RETURN ONLY
1280   001574  3052             TDUMP                   /$ - DUMP THE SYMBOL TABLE CONTENTS
1281   001575  1253             TASK4                   /SP- TERMINATOR FOR NAMES
1282   001576  1253             TASK4                   /, - TERMINATOR FOR EXPRESSIONS
1283   001577  0610             PROCESS                 /; - TERMINATOR FOR COMMANDS
1284   001600  0614             PC1                     /C.R. - TERMINATOR FOR STRINGS
1285
1286                    /       $ - FOR 'TDUMP' TERMINATES THE COMMAND.
```

```
1288                    /       EVALUATE AN EXPRESSION WHICH
1289                    /       TERMINATES WITH AN R-PAR,; OR C.R. AND
1290                    /       LEAVE THE RESULT IN FLAC AND IN FLARG.
1291
1292   001601  0000  ECALL,  0                       /RECURSIVE CALL TO "EVAL"
1293   001602  1054          TAD     SORTCN          /SAVE 'SORTCN','LASTOP',AND 'EFOP'
1294   001603  4542          PUSHA
1295   001604  1055          TAD     LASTOP
1296   001605  4542          PUSHA
1297   001606  1056          TAD     EFOP            /SAVE FUNCTION CODE.
1298   001607  4542          PUSHA
1299   001610  1201          TAD     ECALL           /RETURN TO CALLING
1300   001611  4542          PUSHA                   /ADDRESS AFTER NEXT POPJ
1301
1302   001612  4545          GETC                    /MOVE PAST EXTRA CHARACTER
1303   001613  3055  EVAL,   DCA     LASTOP          /EVALUATION CONTROLLER (CHECKPOINT?)
1304   001614  4564          TESTC                   /TEST CHARACTER AND IGNORE SPACES
1305   001615  5227          JMP     ETERM1          /TERMINATOR
1306   001616  5332          JMP     ENUM            /NUMBER
1307   001617  5343          JMP     EFUN            /FUNCTION
1308   001620  4540          PUSHJ                   /LETTER OF VARIABLE
1309   001621  1407          GETVAR                  /FIND OR CREATE VARIABLE; ALSO SET PT1.
1310   001622  4564  OPNEXT, TESTC                   /PT1=>ARG
1311   001623  5244          JMP ETERMN              /T
1312   001624  0212  ECHOLST,"J&237                  /N-ERROR IN FORMAT
1313   001625  0377          0377                    /F
1314   001626  4566          ERROR4                  /L - MISSING OPERATOR
1315
1316   001627  1137  ETERM1, TAD     CFRSX           /SET PT1.
1317   001630  3030          DCA     PT1             /TO POINT TO ZERO
1318   001631  1111          TAD     M2              /TEST FOR UNARY OPERATIONS
1319   001632  1054          TAD     SORTCN
1320   001633  7450          SNA
1321   001634  5247          JMP     ETERM           /CREATE DUMMY FOR UNARY MINUS
1322   001635  7001          IAC
1323   001636  7650          SNA CLA
1324   001637  5323          JMP     ARGNXT          /IGNORE UNARY PLUS
1325   001640  1054          TAD     SORTCN          /TEST FOR NULL PARENS.
1326   001641  1121          TAD     M11
1327   001642  7710          SPA CLA
1328   001643  5363          JMP     ELPAR           /MIGHT BE AN L-PAR.
1329   001644  4562  ETERMN, TSTLPR
1330   001645  7410          SKP
1331   001646  4566          ERROR4                  /OPERATOR MISSING BEFORE PAREN
1332   001647  1054  ETERM,  TAD     SORTCN          /SET FROM "TESTC"-"SORTC"
1333   001650  3024          DCA     THISOP
1334   001651  1024          TAD     THISOP
1335   001652  1121          TAD     M11
1336   001653  7700          SMA CLA                 /END?
1337   001654  3024          DCA     THISOP          /"THISOP" EQUIV. TO END OF EXP.
```

```
1339   001655  1024  ETERM2, TAD     THISOP          /COMPARE PRIORITIES
1340   001656  7041          CIA
1341   001657  1055          TAD     LASTOP
1342   001660  7710          SPA CLA
1343   001661  5310          JMP     EPAR            /CONTINUE
1344   001662  1055          TAD     LASTOP          /FIND OPERATION
1345   001663  7112          CLL RTR
1346   001664  7012          RTR
1347   001665  1331          TAD     OPTABL
1348   001666  3274          DCA     FLOP
1349   001667  1055          TAD     LASTOP
1350   001670  7640          SZA CLA                 /TEST FOR END OF DATA INTO FLOATING AC.
1351   001671  4544          POPF                    /GET LAST DATA
1352   001672  0044          FLAC
1353   001673  4407          FINT
1354   001674  0000  FLOP,   00                      /(FLOPR I PT1)+-*/
1355   001675  6525          FPUT I  FLARGP          /SAVE RESULT
1356   001676  0000          FXIT
1357   001677  1125          TAD     FLARGP
1358   001700  3030          DCA     PT1
1359   001701  1024          TAD     THISOP
1360   001702  1055          TAD     LASTOP          /=0?
1361   001703  7650          SNA CLA
1362   001704  5541          POPJ                    /EXIT "EVAL"
1363   001705  1413          POPA                    /GET PRIOR OP
1364   001706  3055          DCA     LASTOP
1365   001707  5255          JMP     ETERM2          /COMPARE THIS OP
1366
1367   001710  4562  EPAR,   TSTLPR                  /TEST FOR SUB-EXPRESSION
1368   001711  7410          SKP
1369   001712  5365          JMP     EPAR2           /GO EVALUATE EXPRESSION
1370   001713  1055          TAD     LASTOP          /CONTINUE READING THE EXPRESSION
1371   001714  4542          PUSHA                   /SAVE "LASTOP".
1372   001715  1030          TAD     PT1
1373   001716  3320          DCA     .+2
1374   001717  4543          PUSHF                   /SAVE LAST ARGUMENT
1375   001720  0000          00
1376   001721  1024          TAD     THISOP          /MORE TO COME
1377   001722  3055          DCA     LASTOP
1378   001723  4545  ARGNXT, GETC                    /READ 1ST CHAR OF AN ARG.
1379   001724  4564          TESTC                   /DO SPECIAL CHECK
1380   001725  5363          JMP     ELPAR           /COULD BE LEFT PAREN
1381   001726  5332          JMP     ENUM            /N
1382   001727  5343          JMP     EFUN            /F
1383   001730  5220          JMP     OPNEXT-2        /L
1384
1385   001731  0430  OPTABL, FGET I  PT1             /BASE FOR OPERATION COMPUTATION
```

```
1387   001732  4543  ENUM,   PUSHF                  /TO PROCESS A NUMBER, SAVE AC
1388   001733  0044          FLAC
1389   001734  1125          TAD     FLARGP         /SET POINTER AS FOR A VARIABLE.
1390   001735  3030          DCA     PT1
1391   001736  3036          DCA     INSUB          /POINT TO 'GETC' AND USE CHAR
1392   001737  4531          JMS I   FINPUT         /READ TEXT NUMBER => (PT1)
1393   001740  4544          POPF                   /RESTORE THE AC
1394   001741  0044          FLAC
1395   001742  5222          JMP     OPNEXT         /CONTINUE
1396
1397   001743  3056  EFUN,   DCA     EFOP           /SET CODE
1398   001744  4545          GETC                   /READ FUNCTION NAME.(1, 2, OR 3 LETTERS)
1399   001745  4550          SORTC                  /LOOK FOR TERMINATION CHARACTER.
1400   001746  1767          TERMS-1
1401   001747  5354          JMP     EFUN2          /YES
1402   001750  1056          TAD     EFOP           /NO
1403   001751  7104          CLL RAL                /MISH-MASH HASH CODE
1404   001752  1066          TAD     CHAR
1405   001753  5343          JMP     EFUN
1406
1407   001754  4562  EFUN2,  TSTLPR
1408   001755  4566          ERROR4                 /MUST BE FOLLOWED BY PARENS TO SET ARGUMENT
1409   001756  4201          JMS     ECALL          /CALL "EVAL" TO COMPUTE ARGUMENT
1410   001757  1413          POPA                   /BRANCH ON FUNCTION CODE; RETURN VIA EFUN3I.
1411   001760  4547          SORTJ
1412   001761  2164          FNTABL-1
1413   001762  6207          FNTABF-FNTABL
1414   001763  4562  ELPAR,  TSTLPR                 /LEFT PAREN OR FELL THROUGH FUNCTION TABLE
1415   001764  4566          ERROR4                 /DOUBLE OPERATORS OR ILLEGAL FUNCTION NAME.
1416   001765  4201  EPAR2,  JMS     ECALL          /EVALUATE NESTED EXPRESSION
1417   001766  2013          ISZ     PDLXR          /DUMP EXTRA ARG.
1418   001767  5536          JMP I   EFUN3I
```

```
1420           1770          TERMS=  .               /TERMINATOR TABLE FOR 'EVAL' AND 'GETVAR'
1421
1422   001770  0240          "                       /SPACE  0
1423   001771  0253          "+                      /+      1
1424   001772  0255          "-                      /-      2
1425   001773  0257          "/                      //      3
1426   001774  0252          "*                      /*      4
1427   001775  0336          "^                      /UP ARR 5
1428   001776  0250          "(                      /(      6 L-PARS
1429   001777  0333          "[                      /[      7
1430   002000  0274          "<                      /<      10
1431   002001  0251          ")                      /)      11 R-PARS
1432   002002  0335          "]                      /]      12
1433   002003  0276          ">                      />      13
1434   002004  0254          ",                      /,      14
1435   002005  0273          ";                      /;      15
1436   002006  0215          "M&237                  /C.R.   16
1437   002007  0275          "=                      /= TO END GETARG FROM 'SET'
1438
1439                 /       TWO MINOR FUNCTIONS
1440
1441
1442   002010  4543  XSGN,   PUSHF                   /TAKE SIGN*1 OF FLARG
1443   002011  2405          FLTONE
1444   002012  4544          POPF
1445   002013  0044          FLAC
1446   002014  1231  XABS,   TAD     FLARG+1         /TAKE ABSOLUTE VALUE OF FLAC
1447   002015  7710          SPA CLA                 /SKIP TO CONTINUE
1448   002016  4451          JMS I   MINSKI          /NEGATE THE FLOATING AC
1449
1450                 /       CONTINUATION OF FUNCTION CALLS.
1451
1452   002017  4407  EFUN3,  FINT
1453   002020  7000          FNOR                    /NORMALIZE FUNCTION RETURN
1454   002021  6230          FPUT    FLARG           /SAVE FUNCTION VALUE
1455   002022  0000          FXIT
1456   002023  1125          TAD     FLARGP          /SET POINTER
1457   002024  3030          DCA     PT1
1458   002025  4247          JMS     PARTEST
1459   002026  5627          JMP I   .+1;    OPNEXT  /FUNCTION RETURN IS OK
1460   002027  1622
```

```
1462   002030  0000  FLARG,  0                       /DATA TEMPORARY STORAGE
1463   002031  0000          0
1464   002032  0000          0
1465   002033  0000          0
1466
1467   002034  0003  P3,     3
1468
1469   002035  0000  LPRTST, 0                       /SKIP IF LEFT PAREN. - 'TSTLPR'
1470   002036  1054          TAD     SORTCN
1471   002037  1121          TAD     M11
1472   002040  7700          SMA CLA
1473   002041  5635          JMP I   LPRTST
1474   002042  1054          TAD     SORTCN
1475   002043  1120          TAD     M5
1476   002044  7740          SMA SZA CLA
1477   002045  2235          ISZ     LPRTST
1478   002046  5635          JMP I   LPRTST
1479
1480   002047  0000  PARTEST,0                       /TEST THE PAREN MATCHINGS
1481   002050  1413          POPA                    /RESTORE LAST OPERATION
1482   002051  3055          DCA     LASTOP
1483   002052  1234          TAD     P3              /+3 TO COMPARE CODES
1484   002053  1413          POPA                    /GET LAST PAREN CODE.
1485   002054  7041          CIA                     /CHECK FOR PAREN MATCH.
1486   002055  1054          TAD     SORTCN          /(STILL SET FROM THE LAST "EVAL")
1487   002056  7640          SZA CLA                 /SKIP IF MATCH
1488   002057  4566          ERROR4                  /PAREN ERROR
1489   002060  4545          GETC                    /MOVE PAST R-PAR
1490   002061  5647          JMP I   PARTEST
```

```
1492                    /       THE DELETE A LINE ROUTINE
1493
1494    002062  0000    XDELETE,0                       /UNCHAIN A LINE AND RECOVER THE SPACE.
1495    002063  6002            IOF                     /PROTECT POINTER CHANGES FROM INTERRUPTIONS
1496    002064  4555            FINDLN                  /SETS "THISLN" AND "LASTLN".
1497    002065  5662            JMP I   XDELETE         /ALREADY GONE
1498    002066  2026            ISZ     DEBGSW          /DISABLE TRACE
1499    002067  4545            GETC                    /MEASURE LENGTH
1500    002070  1066            TAD     CHAR
1501    002071  1116            TAD     MCR
1502    002072  7640            SZA CLA
1503    002073  5267            JMP     .-4
1504    002074  1017            TAD     AXOUT           /SAVE LAST ADDRESS
1505    002075  7040            CMA
1506    002076  1023            TAD     THISLN
1507    002077  3057            DCA     CNTR            /LENGTH < 0
1508    002100  1133            TAD     CFRS            /IT IS ILLEGAL TO DELETE THE FIRST LINE
1509    002101  7041            CIA
1510    002102  1023            TAD     THISLN
1511    002103  7650            SNA CLA
1512    002104  5177            JMP     START           /JUST IGNORE SUCH COMMANDS
1513    002105  7000            CDF     T               /CHANGE DATA FIELD TO TEXT.(X-MEM)
1514    002106  1423            TAD I   THISLN          /DISCONNECT
1515    002107  3425            DCA I   LASTLN
1516    002110  1133            TAD     CFRS            /START LIST AT TOP
1517    002111  3071    DOK,    DCA     T2              /EXAMINATION ADDRESS
1518    002112  1471            TAD I   T2              /GET THE NEXT ADDR.
1519    002113  7450            SNA                     /TEST FOR END
1520    002114  5327            JMP     DONE            /YES-WRAP UP ALL.
1521    002115  3032            DCA     T1              /SAVE NEXT ADDRESS.
1522    002116  1023            TAD     THISLN          /COMPARE LINE POSITIONS
1523    002117  7141            CLL CIA
1524    002120  1032            TAD     T1
1525    002121  7630            SZL CLA                 /SKIP IF THISLN > X
1526    002122  1057            TAD     CNTR            /CHANGE (X) TO ACCOUNT FOR
1527    002123  1032            TAD     T1              /GARBAGE COLLECTION.
1528    002124  3471            DCA I   T2
1529    002125  1032            TAD     T1              /GET NEXT
1530    002126  5311            JMP     DOK
```

```
1532                    /       GARBAGE COLLECTION
1533
1534    002127  7040    DONE,   CMA                     /BACKUP L FOR XR
1535    002130  1023            TAD     THISLN
1536    002131  3011            DCA     XRT
1537    002132  1057            TAD     CNTR            /SETUP END OF HOSE
1538    002133  7040            CMA
1539    002134  1023            TAD     THISLN
1540    002135  3012            DCA     XRT2
1541    002136  1057            TAD     CNTR            /CORRECT END OF BUFFER POINTER.
1542    002137  1060            TAD     BUFR
1543    002140  3060            DCA     BUFR
1544    002141  1010            TAD     AXIN            /COMPUTE COUNT
1545    002142  7040            CMA
1546    002143  1012            TAD     XRT2
1547    002144  3032            DCA     T1
1548    002145  1010            TAD     AXIN
1549    002146  1057            TAD     CNTR
1550    002147  3010            DCA     AXIN
1551    002150  1412            TAD I   XRT2            /SIPHON LOWER PART.
1552    002151  3411            DCA I   XRT
1553    002152  2032            ISZ     T1
1554    002153  5350            JMP     .-3
1555    002154  5263            JMP     XDELETE+1       /RESET 'LASTLN', 'THISLN', AND DATA FIELD.
1556
1557
1558    002155  0000    CHIN,   0                       /READ IN A CHARACTER SUBR. - "READC"
1559    002156  4464            JMS I   INDEV
1560    002157  3066            DCA     CHAR
1561    002160  4550            SORTC                   /LINEFEED OR RUBOUT?
1562    002161  1623            ECHOLST-1
1563    002162  5755            JMP I   CHIN            /YES
1564    002163  4551            PRINTC                  /ECHO THE INPUT
1565    002164  5755            JMP I   CHIN
1566
1567
1568            2165            FNTABL= .
1569
1570    002165  2533            "A^2+"B^2+"S            /ABS
1571    002166  2650            "S^2+"G^2+"N            /SGN
1572    002167  2636            "I^2+"T^2+"R            /ITR
1573    002170  2565            "D^2+"I^2+"S            /DIS
1574    002171  2630            "R^2+"A^2+"N            /RAN
1575    002172  2517            "A^2+"D^2+"C            /ADC
1576    002173  2572            "A^2+"T^2+"N            /ATN
1577    002174  2624            "E^2+"X^2+"P            /EXP
1578    002175  2625            "L^2+"O^2+"G            /LOG
1579    002176  2654            "S^2+"I^2+"N            /SIN    LIST OF CODED FUNCTION NAMES
1580    002177  2575            "C^2+"O^2+"S            /COS
1581    002200  2702            "S^2+"Q^2+"T            /SQT
1582    002201  2631            "N^2+"E^2+"W            /NEW
1583    002202  2567            "C^2+"O^2+"M            /COM
1584    002203  0330            "X                      /X
```

```
1586                    /       ERASE SINGLE LINES, GROUPS, OR VARIABLES
1587
1588   002204  4564     ERASE,  TESTC                   /TEST THE SECOND WORD, IF ANY.
1589   002205  5237             JMP     ERVX            /ERASE VARIABLES
1590   002206  5222             JMP     ERL             /LINES OR GROUPS
1591   002207  5213             JMP     .+4             /ERROR
1592   002210  1066             TAD     CHAR            /ALL TEXT
1593   002211  1112             TAD     MINUSA
1594   002212  7440             SZA
1595   002213  4566             ERROR3                  /BAD ARG FOR ERASE.
1596   002214  1135     ERT,    TAD     ENDT            /ERASE ALL TEXT **
1597   002215  3060             DCA     BUFR
1598   002216  3533             DCA I   CFRS            /(X-MEM)
1599   002217  1060     ERV,    TAD     STARTV          /ERASE VARIABLES **
1600   002220  3031             DCA     LASTV
1601   002221  5177             JMP     START           /POINTERS MAY BE DIFFERENT NOW.
1602
1603   002222  4554     ERL,    GETLN                   /ERASE LINES.
1604   002223  1060             TAD     BUFR            /PROTECT REST OF TEXT.
1605   002224  3010             DCA     AXIN
1606   002225  4565     ERG,    DELETE                  /EXTRACT ONE LINE
1607   002226  2023             ISZ     THISLN
1608   002227  1065             TAD     NAGSW
1609   002230  7700             SMA CLA
1610   002231  1423             TAD I   THISLN          /(X-MEM)
1611   002232  4563             TSTGRP                  /SKIP IF G(AC) = G(LINENO)
1612   002233  5217             JMP     ERV
1613   002234  1423             TAD I   THISLN          /(X-MEM)
1614   002235  3067             DCA     LINENO
1615   002236  5225             JMP     ERG
1616
1617   002237  1060     ERVX,   TAD     STARTV          /INIT VARIABLES MAY BE INDIRECT COMMAND
1618   002240  3031             DCA     LASTV
1619   002241  5541             POPJ
```

```
1621                    /       ROUTINE CALLED VIA "FINDLN":
1622
1623                    /       SEARCH FOR A GIVEN LINE I.D. =[ "LINENO" ]
1624                    /       1ST RETURN IF NOT FOUND,
1625                    /       2AND IF FOUND.
1626                    /       "THISLN" = FOUND LINE OR NEXT LARGER.
1627                    /       "LASTLN" = LESSER AND/OR LAST.
1628                    /       "TEXTP" IS SET.
1629
1630   002242  0000     XFIND,  0
1631   002243  1133             TAD     CFRS            /INITIALIZE POINTERS TO FIRST LINE
1632   002244  3025             DCA     LASTLN
1633   002245  1133             TAD     CFRS
1634   002246  3023     FINDN,  DCA     THISLN          /SAVE THIS ONE
1635   002247  1023             TAD     THISLN
1636   002250  3011             DCA     XRT
1637   002251  1067             TAD     LINENO
1638   002252  7141             CLL CMA IAC             /CLEAR LINK AND NEGATE LINENO.
1639   002253  1411             TAD I   XRT             /LINENO=0 WILL ALSO BE FOUND(X-MEM)
1640   002254  7450             SNA
1641   002255  5266             JMP     FEND3-1         /FOUND IT.
1642   002256  7630             SZL CLA
1643   002257  5267             JMP     FEND3           /PAST IT.
1644   002260  1023             TAD     THISLN          /MOVE POINTERS
1645   002261  3025             DCA     LASTLN
1646   002262  1423             TAD I   THISLN          /END OF TEXT? (X-MEM)
1647   002263  7440             SZA
1648   002264  5246             JMP     FINDN           /NOT YET
1649   002265  7410             SKP
1650   002266  2242             ISZ     XFIND           /2ND EXIT = FOUND
1651   002267  1023     FEND3,  TAD     THISLN          /1ST RETURN = NOT FOUND
1652   002270  7001             IAC
1653   002271  3017             DCA     AXOUT           /SET "TEXTP".
1654   002272  3020             DCA     XCT
1655   002273  5642             JMP I   XFIND
1656
1657   002274  0000     UTRA,   0                       /UNPACK CHARACTER. - "GETC"
1658   002275  4330             JMS     GET1
1659   002276  7710     UTE,    SPA CLA                 /NORM & EXTEND
1660   002277  1006             TAD     C100            /300-337 & 340-376
1661   002300  1357             TAD     M137            /240-276 & 200-236
1662   002301  1066             TAD     CHAR
1663   002302  7450             SNA
1664   002303  5316             JMP     UTX             /"?" FOUND
1665   002304  1075             TAD     P337
1666   002305  3066     UTQ,    DCA     CHAR
1667   002306  1026             TAD     DEBGSW
1668   002307  1100             TAD     DMPSW
1669   002310  7650             SNA CLA                 /PRINT ONLY IF BOTH ARE ZERO.
1670   002311  4551             PRINTC
1671   002312  5674             JMP I   UTRA
1672
1673   002313  4330     EXTR,   JMS     GET1
1674   002314  7040             CMA
1675   002315  5276             JMP     UTE
```

```
1677   002316  1026  UTX,    TAD     DEBGSW          /TEST FOR TRACE-ENABLED
1678   002317  7640          SZA CLA
1679   002320  5326          JMP     .+6
1680   002321  1100          TAD     DMPSW           /FLIP THE TRACE FLOP
1681   002322  7650          SNA CLA
1682   002323  7001          IAC
1683   002324  3100          DCA     DMPSW
1684   002325  5275          JMP     UTRA+1          /GET NEXT CHARACTER INSTEAD.
1685
1686   002326  1110          TAD     P277            /TRACE DISABLED = RETURN "?"
1687   002327  5305          JMP     UTQ
1688
1689   002330  0000  GET1,   0                       /UNPACK 6-BITS
1690   002331  2020          ISZ     XCT             /STARTS=0
1691   002332  5345          JMP     GET3
1692   002333  1021          TAD     GTEM
1693   002334  0122  GEND,   AND     P77
1694   002335  3066          DCA     CHAR            /SAVE
1695   002336  1066          TAD     CHAR
1696   002337  1103          TAD     M77
1697   002340  7650          SNA CLA
1698   002341  5313          JMP     EXTR            /EXTENDED
1699   002342  1066          TAD     CHAR
1700   002343  1356          TAD     M40
1701   002344  5730          JMP I   GET1
1702
1703   002345  1417  GET3,   TAD I   AXOUT           /(X-MEM)
1704   002346  3021          DCA     GTEM
1705   002347  7040          CMA
1706   002350  3020          DCA     XCT
1707   002351  1021          TAD     GTEM
1708   002352  7112          CLL RTR
1709   002353  7012          RTR
1710   002354  7012          RTR
1711   002355  5334          JMP     GEND
1712
1713   002356  7740  M40,    -40
1714   002357  7641  M137,   -137
```

```
1716   002360  0000  XENDLN, 0                       /TERMINATE THE BUFFERED LINE - "ENDLN"
1717   002361  7000          CDF     T               /(X-MEM)
1718   002362  1425          TAD I   LASTLN          /SAVE OLD POINTER
1719   002363  3460          DCA I   BUFR
1720   002364  1060          TAD     BUFR            /POINT TO NEW LAST LINE
1721   002365  3425          DCA I   LASTLN
1722   002366  1061          TAD     ADD             /CHECK FOR EXTRA INFO
1723   002367  7440          SZA
1724   002370  3410          DCA I   AXIN
1725   002371  1010          TAD     AXIN            /COMPUTE NEW END OF BUFFER
1726   002372  7001          IAC
1727   002373  3060          DCA     BUFR
1728   002374  1060          TAD     STARTV          /RESET VARIABLE LIST (X-MEM)
1729   002375  3031          DCA     LASTV
1730   002376  5760          JMP I   XENDLN
1731
1732
1733
1734           2377          TLIST3= .               /LITERAL TERMINATORS
1735
1736   002377  1253          TASK4                   /"
1737   002400  0614          PC1                     /C.R. = AUTOMATIC QUOTE MATCH
1738
1739
1740           2401          INFIX=  .               /DATA CONTROL CHARACTERS
1741
1742   002401  6202          FLINTP+2                /LEFT ARROW     = KILL
1743   002402  0757          INPUT+1                 /RUBOUT         = IGNORE
1744   002403  0757          INPUT+1                 /L.F.           = IGNORE
1745   002404  6250          ENDFI+5                 /ALT MODE       = EXIT
1746
1747   002405  0001  FLTONE, 0001                    /(NO RELATIVE REFERENCES)
1748   002406  2000          2000
1749   002407  0000  FLTZER, 0000
1750   002410  0000          0000
1751   002411  0000          0000
1752   002412  0000          0000
1753   002413  7766  M12,    -12                     /DECIMAL CONVERSION FACTOR FOR "PRNT"
1754
1755
1756   002414  0000  I33,    0                       /NO-INTERRUPT INPUT ROUTINE
1757   002415  6031          KSF
1758   002416  5215          JMP     .-1
1759   002417  6036          KRB
1760   002420  0106          AND     P177            /IGNORE PARITY BIT
1761   002421  7450          SNA
1762   002422  5215          JMP     .-5
1763   002423  1123          TAD     C200
1764   002424  5614          JMP I   I33
```

```
1766   002425  0000  XPRNT,  0                       /PRINT A LINE NUMBER - "PRNTLN"
1767   002426  1067          TAD     LINENO
1768   002427  4557          RTL6
1769   002430  0122          AND     P77
1770   002431  4242          JMS     PRNT            /TWO DIGIT "PART" NUMBER
1771   002432  1102          TAD     PER
1772   002433  4551          PRINTC                  /PERIOD FOR SEPARATION
1773   002434  1067          TAD     LINENO
1774   002435  4242          JMS     PRNT            /TWO DIGIT "STEP" NUMBER.
1775   002436  1356          TAD     M140
1776   002437  3066          DCA     CHAR            /SAVE SPACE IN CHAR.
1777   002440  4551          PRINTC                  /PRINT TRAILING SPACE
1778   002441  5625          JMP I   XPRNT
1779
1780           0032          VAL=    T1
1781
1782   002442  0000  PRNT,   0                       /PRINT TWO DECIMAL DIGITS
1783   002443  0106          AND     P177
1784   002444  3032          DCA     VAL
1785   002445  1113          TAD     C260
1786   002446  3033          DCA     T3
1787   002447  5252          JMP     .+3
1788   002450  2033          ISZ     T3
1789   002451  3032  XYZ,    DCA     VAL
1790   002452  1032          TAD     VAL
1791   002453  1213          TAD     M12
1792   002454  7500          SMA
1793   002455  5250          JMP     XYZ-1
1794   002456  7200          CLA
1795   002457  1033          TAD     T3
1796   002460  4551          PRINTC
1797   002461  1032          TAD     VAL
1798   002462  1113          TAD     C260
1799   002463  4551          PRINTC
1800   002464  5642          JMP I   PRNT
1801
1802   002465  0000  OUT,    0                       /OUTPUT A CHARACTER - "PRINTC"
1803   002466  7450          SNA                     /USE (AC) OR (CHAR)
1804   002467  1066          TAD     CHAR
1805   002470  1116          TAD     MCR
1806   002471  7450          SNA
1807   002472  5276          JMP     OUTCR
1808   002473  1077          TAD     CCR
1809   002474  4463          JMS I   OUTDEV
1810   002475  5665  OUTX,   JMP I   OUT
1811
1812   002476  1077  OUTCR,  TAD     CCR
1813   002477  4463          JMS I   OUTDEV
1814   002500  1076          TAD     CLF
1815   002501  5274          JMP     OUTX-1
```

```
1817   002502  0000  PACBUF, 0                       /PACK A CHARACTER - "PACKC"
1818   002503  1110          TAD     P277
1819   002504  7041          CIA
1820   002505  1066          TAD     CHAR
1821   002506  7450          SNA                     /CHANGE 277 TO 337
1822   002507  1352          TAD     P40
1823   002510  1101          TAD     M100
1824   002511  7450          SNA                     /TEST FOR RUBOUT.
1825   002512  5755          JMP I   RUBIT
1826   002513  1353          TAD     P377
1827   002514  3071          DCA     T2              /SAVE INPUT ITEM
1828   002515  1071          TAD     T2              /SO THAT QUESTION DOESN'T MAKE
1829   002516  0354          AND     C140            /CHAR LOOK LIKE A LEFT-ARROW
1830   002517  1356          TAD     M140
1831   002520  7440          SZA                     /DATA WORD.
1832   002521  1354          TAD     C140
1833   002522  7650          SNA CLA
1834   002523  5332          JMP     ESCA            /340-377 AND 200-237
1835   002524  1071  PA1,    TAD     T2              /240-337
1836   002525  0122          AND     P77
1837   002526  7440          SZA                     /IGNORE 300
1838   002527  4335          JMS     PCK1
1839   002530  7000  PACX,   CDF     P               /(X-MEM)
1840   002531  5702          JMP I   PACBUF
1841
1842   002532  1122  ESCA,   TAD     P77
1843   002533  4335          JMS     PCK1
1844   002534  5324          JMP     PA1
1845
1846   002535  0000  PCK1,   0
1847   002536  2062          ISZ     XCTIN           /=0 TO START
1848   002537  5357          JMP     ROT
1849   002540  1061          TAD     ADD
1850   002541  3410          DCA I   AXIN            /(X-MEM)
1851   002542  3061          DCA     ADD             /CLEAR PACKING WORD
1852   002543  1013          TAD     PDLXR           /CHECK FOR OVERFLOW
1853   002544  7141          CLL CMA IAC
1854   002545  1005          TAD     P13             /RESERVATIONS FOR PUSH-DOWN LIST
1855   002546  1010          TAD     AXIN
1856   002547  7620          SNL CLA
1857   002550  5735          JMP I   PCK1
1858   002551  4566          ERROR2                  /FULL BUFFER
1859
1860   002552  0040  P40,    40
1861   002553  0377  P377,   377
1862   002554  0140  C140,   140
1863   002555  3004  RUBIT,  RUB1
1864   002556  7640  M140,   -140
1865
1866   002557  4557  ROT,    RTL6                    /(EAE)
1867   002560  3061          DCA     ADD
1868   002561  7040          CMA
1869   002562  3062          DCA     XCTIN
1870   002563  5735          JMP I   PCK1            /REST OF PAGE USED BY 8K
```

```
1872          *2600           PAGE
1873
1874                  /       INTERRUPT PROCESSOR.
1875
1876    002600  0000  SAVAC,  0                       /CONTENTS OF AC
1877    002601  0000  SAVLK,  0                       /CONTENTS OF LINK
1878    002602  7575  MBREAK, -203                    /CONTROL-C
1879
1880    002603  3200  INTRPT, DCA     SAVAC           /SAVE WORKING DATA
1881    002604  7010          RAR
1882    002605  3201          DCA     SAVLK
1883    002606  6041          TSF                     /GIVE OUTPUT PRIORITY
1884    002607  5225          JMP     KINT
1885    002610  6042          TCF
1886    002611  3016          DCA     TELSW           /TURN OFF THE IN-PROGRESS FLAG.
1887    002612  1665          TAD I   OPTRI
1888    002613  7450          SNA
1889    002614  5225          JMP     KINT            /DONE
1890    002615  6044          TPC                     /TYPE NEXT.
1891    002616  3016          DCA     TELSW           /CLEAR AC AND TURN ON THE FLAG.
1892    002617  3665          DCA I   OPTRI           /ZERO OUT THE DATA AREA
1893    002620  1265          TAD     OPTRI
1894    002621  7001          IAC
1895    002622  0107          AND     P17
1896    002623  1263          TAD     OPTR0
1897    002624  3265          DCA     OPTRI
1898    002625  6031  KINT,   KSF                     /CHECK FOR KEYBOARD FIRST
1899    002626  5246          JMP     EXIT
1900    002627  6036          KRB                     /READ BUFFER AND CLEAR FLAG TO FETCH NEXT
1901    002630  0106          AND     P177            /IGNORE BLANK AND L-T AND PARITY BIT.
1902    002631  7450          SNA
1903    002632  5246          JMP     EXIT
1904    002633  1123          TAD     C200
1905    002634  3262          DCA     SIN
1906    002635  1262          TAD     SIN
1907    002636  1202          TAD     MBREAK          /MANUAL STOP?
1908    002637  7650          SNA CLA
1909    002640  5340          JMP     RECOVR
1910    002641  1034          TAD     INBUF           /ANY SPACE?
1911    002642  7640          SZA CLA
1912    002643  4566          ERROR2                  /WILL WAIT FOR OUTPUT BUFFER
1913    002644  1262          TAD     SIN
1914    002645  3034          DCA     INBUF           /SAVE INPUT
1915    002646  6011  EXIT,   RSF                     /TEST H.S. READER FLAG
1916    002647  5252          JMP     .+3
1917    002650  6012          RRB                     /READ BUFFER AND CLEAR FLAG
1918    002651  3037          DCA     HINBUF          /SAVE CHARACTER
1919    002652  6244          RMF                     /RESTORE MEMORY FIELD.
1920    002653  6101          SMP                     /(THESE TWO COULD PATCH TO OTHER PDP-8 DEVICES)
1921    002654  7000          NOP                     /ONLY POSSIBLE HALT = PARITY ERROR IN 8/S ONLY.
1922    002655  1201          TAD     SAVLK
1923    002656  7104          CLL RAL
1924    002657  1200          TAD     SAVAC
1925    002660  6001          ION
1926    002661  5400  EXITJ,  JMP I   0               /MODIFIED FOR PDP-5
```

```
1928   002662  0000  SIN,    0
1929   002663  3120  OPTR0,  IOBUF                   /OUTPUT POINTERS
1930   002664  3120  OPTRO,  IOBUF                   /VARS
1931   002665  3120  OPTRI,  IOBUF
1932
1933   002666  0000  XI33,   0                       /VIA (INDEV)
1934   002667  1034          TAD     INBUF           /ANY INPUT?
1935   002670  7550          SPA SNA
1936   002671  5267          JMP     .-2             /NO = WAIT
1937   002672  3276          DCA     XOUTL
1938   002673  3034          DCA     INBUF           /CLEAR INPUT BUFFER
1939   002674  1276          TAD     XOUTL
1940   002675  5666          JMP I   XI33
1941
1942   002676  0000  XOUTL,  0                       /VIA (OUTDEV)
1943   002677  3266          DCA     XI33            /SAVE CURRENT CHARACTER.
1944   002700  6001          ION                     /BE SURE INTERRUPT IS ON.
1945   002701  1664          TAD I   OPTRO           /ANY ROOM?
1946   002702  7640          SZA CLA                 /A CHARACTER IS NON-ZERO
1947   002703  5301          JMP     .-2             /NO = WAIT.
1948   002704  6002          IOF
1949   002705  1016          TAD     TELSW           /IN PROGRESS?
1950   002706  7640          SZA CLA
1951   002707  5314          JMP     .+5
1952   002710  1266          TAD     XI33            /NO
1953   002711  6046          TLS                     /TYPE CHARACTER.
1954   002712  3016          DCA     TELSW           /SET IN-PROGRESS FLAG.
1955   002713  5323          JMP     .+10            /RETURN
1956   002714  1266          TAD     XI33            /SEND DATA
1957   002715  3664          DCA I   OPTRO
1958   002716  1264          TAD     OPTRO           /SET POINTERS
1959   002717  7001          IAC
1960   002720  0107          AND     P17
1961   002721  1263          TAD     OPTR0
1962   002722  3264          DCA     OPTRO
1963   002723  6001          ION
1964   002724  5676          JMP I   XOUTL
```

```
1966                    /       ERROR RECOVERY PROCEEDURE
1967
1968   002725  3326  ERROR5, DCA     .+1             /ERROR CALLED FROM A TABLE
1969   002726  0000  ERR2,   0                       /LIMIT EXCEEDED
1970   002727  7240          CLA CMA                 /COMPUTE CALLING ADDRESS (ALSO "SPACE")
1971   002730  1326          TAD     ERR2            /AND USE IT AS ERROR NUMBER.
1972   002731  3067          DCA     LINENO          /SAVE ERROR CODE.
1973   002732  6001          ION                     /(JMP .+4) - FOR DEBUGGING
1974   002733  1016          TAD     TELSW           /WAIT FOR OUTPUT TO FINISH
1975   002734  7640          SZA CLA
1976   002735  5333          JMP     .-2
1977   002736  6002          IOF                     /DISABLE INTERRUPT FOR INITIALIZATIONS
1978   002737  5342          JMP     .+3
1979   002740  1123  RECOVR, TAD     C200
1980   002741  3067          DCA     LINENO          /SAVE ERROR NUMBER
1981   002742  2016          ISZ     TELSW           /TURN ON IN-PROGRESS SWITCH
1982   002743  1105          TAD     M20             /SETUP INIT COUNT
1983   002744  3057          DCA     CNTR
1984   002745  7040          CMA
1985   002746  1263          TAD     OPTR0
1986   002747  3010          DCA     AXIN            /INIT I/O BUFFERS.
1987   002750  7000          CDF     P               /(X-MEM RESET)
1988   002751  3410          DCA I   AXIN
1989   002752  2057          ISZ     CNTR
1990   002753  5351          JMP     .-2
1991   002754  3034          DCA     INBUF           /INIT KEY-BUFR.
1992   002755  1263          TAD     OPTR0           /INIT TTY POINTERS.
1993   002756  3265          DCA     OPTRI
1994   002757  1263          TAD     OPTR0
1995   002760  3264          DCA     OPTRO
1996   002761  7040  RECOVX, CMA                     /PREPARE A STOP BIT FOR TTY
1997   002762  6046          TLS                     /AND RAISE FLAG. (NOP) - FOR DEBUGGING
1998   002763  1101          TAD     P7700           /MAKE A "?".
1999   002764  4551          PRINTC                  /AND TURN ON THE INTERRUPT
2000   002765  4553          PRNTLN                  /PRINT ERROR NUMBER AND,
2001   002766  2022          ISZ     PC
2002   002767  1422          TAD I   PC              /UNLESS IT IS ZERO, (X-MEM)
2003   002770  7450          SNA
2004   002771  5377          JMP     .+6
2005   002772  3067          DCA     LINENO
2006   002773  1101          TAD     P7700           /PRINT ATSIGN
2007   002774  4551          PRINTC
2008   002775  4551          PRINTC                  /PRINT SPACE AGAIN AND
2009   002776  4553          PRNTLN                  /PRINT LINE OF ERROR.
2010   002777  1077          TAD     CCR
2011   003000  4551          PRINTC
2012   003001  1126          TAD     PTCH            /RESET "READC"
2013   003002  3152          DCA     RDIV            /IF AN ERROR OCCURS.
2014   003003  5177          JMP     START           /INTERRUPT WILL BE RE-ENABLED SOON.
```

```
2016                    /       CHRACTER REMOVAL ROUTINE
2017
2018   003004  1062  RUB1,   TAD     XCTIN           /RUBOUT ONE LETTER
2019   003005  7640          SZA CLA
2020   003006  5214          JMP     .+6
2021   003007  1010          TAD     AXIN
2022   003010  7041          CIA
2023   003011  1027          TAD     PACKST
2024   003012  7700          SMA CLA                 /TEST NULL LINE
2025   003013  5641          JMP I   RUB5
2026   003014  1251          TAD     SPLAT           /FOR A RUBOUT ACKNOWLEDGEMENT
2027   003015  4551          PRINTC
2028   003016  1010          TAD     AXIN
2029   003017  3071          DCA     T2
2030   003020  7000          CDF     T               /(X-MEM)
2031   003021  2062          ISZ     XCTIN           /TEST HALF
2032   003022  5242          JMP     RUB2
2033   003023  1471          TAD I   T2              /"ADD" IS FULL.
2034   003024  0122          AND     P77
2035   003025  1103          TAD     M77
2036   003026  7640          SZA CLA                 /TEST FOR EXTEND
2037   003027  5237          JMP     RUB4
2038   003030  7040  RUB3,   CMA                     /SET SWITCH
2039   003031  3062          DCA     XCTIN
2040   003032  7040          CMA                     /BACKUP POINTER
2041   003033  1010          TAD     AXIN
2042   003034  3010          DCA     AXIN
2043   003035  1471          TAD I   T2              /RESET ADD
2044   003036  0101          AND     P7700
2045   003037  3061  RUB4,   DCA     ADD
2046   003040  5641          JMP I   RUB5
2047
2048   003041  2530  RUB5,   PACX
2049
2050   003042  1471  RUB2,   TAD I   T2              /CHECK FOR EXTENDED
2051   003043  0101          AND     P7700
2052   003044  1006          TAD     C100
2053   003045  7640          SZA CLA
2054   003046  5230          JMP     RUB3
2055   003047  3471          DCA I   T2              /SAVE CORRECTION
2056   003050  5231          JMP     RUB3+1
2057
2058   003051  0334  SPLAT,  334
```

```
2060                    /       SYMBOL TABLE TYPEOUT ROUTINE
2061
2062   003052  1060     TDUMP,  TAD     STARTV          /INIT POINTER FOR SYMBOL DUMP.(X-MEM)
2063   003053  3030             DCA     PT1
2064   003054  1031             TAD     LASTV           /TEST FOR END OF LIST
2065   003055  7041             CIA
2066   003056  1030             TAD     PT1
2067   003057  7650             SNA CLA
2068   003060  5541             POPJ
2069   003061  1430             TAD I   PT1             /GET THE VARIABLE
2070   003062  3316             DCA     OP+1            /(DCA I (4)-FOR(X-MEM)):SAVE NAME
2071   003063  1315             TAD     OP              /SETUP UNPACK POINTERS
2072   003064  3017             DCA     AXOUT
2073   003065  3020             DCA     XCT
2074   003066  4545             GETC                    /READ AND PRINT "XX("
2075   003067  4551             PRINTC
2076   003070  4545             GETC
2077   003071  4551             PRINTC
2078   003072  4545             GETC
2079   003073  4551             PRINTC
2080   003074  2030             ISZ     PT1
2081   003075  1430             TAD I   PT1             /PRINT SUBSCRIPT TO 99
2082   003076  4714             JMS I   PRNT2
2083   003077  4545             GETC                    /PRINT ")"
2084   003100  4551             PRINTC
2085   003101  2030             ISZ     PT1
2086   003102  4407             FINT                    /PICK UP VALUE
2087   003103  0430             FGET I  PT1
2088   003104  0000             FXIT
2089   003105  4530             JMS I   FOUTPUT         /PRINT VALUE
2090   003106  1077             TAD     CCR
2091   003107  4551             PRINTC
2092   003110  1070             TAD     GINC
2093   003111  1111             TAD     M2
2094   003112  1030             TAD     PT1
2095   003113  5253             JMP     TDUMP+1
2096
2097   003114  2442     PRNT2,  PRNT
2098   003115  3115     OP,     .                       / (X-MEM)
2099   003116  0000             0000                    / (X-MEM)
2100   003117  5051             "(^100+")-200           /(THESE GO IN 10005 FOR X-MEM)
```

```
2102                    /       OUTPUT CHARACTER BUFFER (ADDRESS IS A MULTIPLE OF 20)
2103
2104            3120            IOBUF=  3120
2105
2106            3140            COMEIN= IOBUF+20        /COMMAND - INPUT BUFFER
2107
2108            3206            COMEOUT=COMEIN+46
2109
2110
2111           *3206            *COMEOUT
2112
2113
2114
2115    003206  0000    FRST,   0                       /TEXT POINTER
2116    003207  0000            0000                    /DUMMY LINE NO.
2117    003210  0355            "C^100+"--200           /TITLE
2118    003211  0617            "F^100+"O-300           /FO
2119    003212  0301            "C^100+"A-300           /CA
2120    003213  1454            "L^100+",-200           /L,
2121    003214  6171            "1^100+"9-200           /19
2122    003215  6671    FRSTX,  "6^100+"9-200           /69
2123    003216  7715            "?^100+"M-300           /DUMMY C.R.
2124
2125                    /       TO SAVE TEXT, SAVE C(BUFR), C(LASTV), AND C(FRST TO C(BUFR))
2126                    /       WITH ODT-JR46.  THE TAPES MAY BE TOGETHER WITH
2127                    /       THE SYMBOLIC DUMP LAST : FOCAL + FLOAT + DIALOG .
2128                    /       LOADING THE LAST SECTION MAY BE CONSIDERED OPTIONAL.
2129
2130
2131
2132            3217            BUFBEG= .               /TEXT BUFFER STARTS HERE.
```

```
2134           *4370           *4400-10
2135
2136    004370  2741   O1,     RECOVR+1                /STARTING ADDRESS
2137
2138    004371  1370   BEGIN,  TAD     O1              /INITIALIZE ANY 8-FAMILY COMPUTER.
2139    004372  3176           DCA     START-1
2140    004373  6142           6142                    /CLEAR F.H.'S 8.((JMP ATES+1)-FOR TSS-8)
2141    004374  6077           6077                    /SET INTENSITY LEVEL, 34D
2142    004375  6152           6152                    /CLEAR LPT
2143    004376  6762           6762                    /TC01
2144    004377  6012           6012                    /CLEAR PC02 FOR PDP-5
2145    004400  6346           6346                    /CLEAR LAB-8
2146    004401  6772           6772                    /CLEAR 552
2147    004402  7300           CLA CLL
2148    004403  3414           DCA I   FLTXR
2149    004404  2057           ISZ     CNTR            /INITIALIZED BY LOAD.
2150    004405  5203           JMP     .-2             /CLEAR INPUT BUFFER
2151
2152                   /       TEST FOR COMPUTER TYPE
2153
2154    004406  1362           TAD     PDP             /CREATE THE VARIABLE 'PDP'
2155    004407  4371           JMS     LOOKUP          /MUST RETURN ZERO
2156    004410  1370           TAD     PDP5            /TEST FOR PDP-5
2157    004411  3000           DCA     0000
2158    004412  7040   O4,     CMA                     /LINC-8 OR PDP-12?
2159    004413  6167           6167                    /SET LINC AC- (INITS AND KILLS 338)
2160    004414  7200           CLA
2161    004415  6171           6171                    /READ LINC AC
2162    004416  7650           SNA CLA
2163    004417  5226           JMP     T12
2164    004420  1365           TAD     P7              /CLEAR LINC-INTERRUPTS
2165    004421  6141           6141
2166    004422  1366           TAD     P2
2167    004423  6141           6141
2168    004424  7200           CLA
2169    004425  5310           JMP     ATES-3          /YES
```

```
2171   004426  6141  T12,    6141                    /BECOME A LINC
2172   004427  0017          0017                    /COMPLEMENT AC
2173   004430  0002          0002                    /BACK TO 8 MODE
2174   004431  7001          IAC                     /SET TO ZERO IF PDP-12
2175   004432  7650          SNA CLA
2176   004433  5306          JMP     ATES-5
2177
2178   004434  7101          CLL IAC                 /LAB-8?
2179   004435  6344          6344                    /"OTEN"
2180   004436  6331          6331                    /"XRIN"
2181   004437  7700          SMA CLA
2182   004440  5246          JMP     .+6             /NO
2183   004441  1350          TAD     L8A             /YES
2184   004442  3752          DCA I   L8AY
2185   004443  1351          TAD     L8B             /SETUP SCOPE CONTROLS
2186   004444  3753          DCA I   L8AX
2187   004445  5307          JMP     ATES-4
2188
2189   004446  7354          7354                    /NL3776
2190   004447  1367          TAD     PDP8I           /IS THIS A PDP-8/I OR 8/L?
2191   004450  7650          SNA CLA
2192   004451  5265          JMP     ATEI
2193   004452  7344          7344                    /NL7776
2194   004453  1366          TAD     P2
2195   004454  7650          SNA CLA
2196   004455  5312          JMP     ATES-1          /8
2197   004456  1100          TAD     CCR+1           /PDP-8/S
2198   004457  3764          DCA I   O6              /SETUP PARITY-ERROR HALT
2199   004460  1212          TAD     O4              /CORRECT READER WAIT
2200   004461  3763          DCA I   O5
2201   004462  5313          JMP     ATES
2202
2203   004463  2761  PDP5X,  ISZ I   O2              /INCREMENT INTERRUPT RETURN
2204   004464  5314          JMP     ATES+1
```

```
2206   004465  6046  ATEI,   TLS
2207   004466  6000  G8L,    6000
2208   004467  6000          6000
2209   004470  6000          6000
2210   004471  6000          6000
2211   004472  6000          6000
2212   004473  6000          6000
2213   004474  6000          6000
2214   004475  6000          6000
2215   004476  2057          ISZ     CNTR
2216   004477  6041          TSF
2217   004500  5266          JMP     G8L
2218   004501  1057          TAD     CNTR
2219   004502  1130          TAD     FOUTPUT
2220   004503  7710          SPA CLA
2221   004504  5311          JMP     ATES-2          /8/I
2222   004505  2430          ISZ I   PT1             /8/L    = 7/2^11
2223   004506  2430          ISZ I   PT1             /PDP-12 = 6/2^11
2224   004507  2430          ISZ I   PT1             /LAB-8  = 5/2^11
2225   004510  2430          ISZ I   PT1             /LINC-8 = 4/2^11
2226   004511  2430          ISZ I   PT1             /8/I    = 3/2^11
2227   004512  2430          ISZ I   PT1             /8      = 2/2^11
2228   004513  2430  ATES,   ISZ I   PT1             /8/S    = 1/2^11
2229                                                 /5      = 0
```

```
2231                    /       INITIALIZE THE DIALOGUE
2232
2233   004514  6046             TLS
2234   004515  6001             ION                     /ENABLE INTERRUPT
2235   004516  4540             PUSHJ
2236   004517  0421             DO+1
2237   004520  6002             IOF
2238
2239                    /       SHALL I KEEP EXP, LOG, ATN? (256)
2240                    /       SHALL I KEEP SIN, COS? (128)
2241                    /       XF =   +1(NO) -1(YES) 0(YES)
2242
2243   004521  1360             TAD     XF
2244   004522  4371             JMS     LOOKUP
2245   004523  7450             SNA
2246   004524  5344             JMP     OOUT            /NO DIALOGUE EXECUTED
2247   004525  7710             SPA CLA
2248   004526  1366             TAD     P2
2249   004527  1120             TAD     M5              /DELETE X-FUNCTIONS
2250   004530  3057             DCA     CNTR
2251   004531  1354             TAD     FNPT
2252   004532  3011             DCA     XRT
2253   004533  1355             TAD     ER5
2254   004534  3411             DCA I   XRT             /SET THE TABLE
2255   004535  2057             ISZ     CNTR
2256   004536  5333             JMP     .-3
2257   004537  1360             TAD     XF              /CORRECT BUFFER PROTECT
2258   004540  4371             JMS     LOOKUP
2259   004541  7710             SPA CLA
2260   004542  1104             TAD     P7600           /(-200)
2261   004543  1356             TAD     BFXX
2262   004544  1357  OOUT,      TAD     BFX
2263   004545  3035             DCA     BOTTOM
2264   004546  5747             JMP I   .+1;    ERT     /GOES TO START AFTER ERASING ALL
2265   004547  2214
```

```
2267   004550  6313  L8A,    6313
2268   004551  6307  L8B,    6307
2269   004552  1153  L8AY,   XDYS+11
2270   004553  1156  L8AX,   XDYS+14
2271   004554  0401  FNPT,   FNTABF+5
2272   004555  2725  ER5,    ERROR5
2273   004556  0560  BFXX,   TGO-FEXP                        /WITHOUT
2274   004557  4617  BFX,    FEXP-1                          /WITH
2275   004560  3006  XF,     "X^100+"F-300                   /X, F
2276   004561  2661  O2,     EXITJ                           /INTERRUPT EXIT
2277   004562  2004  PDP,    "P^100+"D-300                   /P, D
2278   004563  6322  O5,     HREAD+1
2279   004564  2654  O6,     EXIT+6
2280   004565  0007  P7,     7
2281   004566  0002  P2,     2
2282   004567  4002  PDP8I,  4002                            /(-3776)
2283   004570  4462  PDP5,   PDP5X-1
2284
2285   004571  2344  LOOKUP, DDTJR+DMULT4+END+RECOVX+PSIN    /MAKE BELIEVE
2286   004572  3061          DCA     ADD
2287   004573  4540          PUSHJ                           /CALL THE VARIABLE SEARCH ROUTINE.
2288   004574  1437          GS1
2289   004575  2030          ISZ     PT1
2290   004576  1430          TAD I   PT1
2291   004577  5771          JMP I   LOOKUP
```

```
2293          *6321           *6321                   /STUCK INTO THE FLOATING POINT PACKAGE.
2294
2295    006321  0000  HREAD,  0                       /HAMILTON STANDARD READER SUBROUTINE.
2296    006322  1105          TAD     M20             /(CMA)- FOR 8/S.
2297    006323  3343          DCA     HSWITC
2298    006324  1037  HREAD2, TAD     HINBUF          /(RSF) -WHEN DEBUGGING
2299    006325  7700          SMA CLA                 /(SKP)
2300    006326  5364          JMP     HSGO
2301    006327  2032          ISZ     T1              /SKIP IF OUT OF TAPE
2302    006330  5324          JMP     HREAD2
2303    006331  2343          ISZ     HSWITC
2304    006332  5324          JMP     HREAD2
2305    006333  4343          JMS     HSWITC          /LEAVES LINK ZERO
2306    006334  1013          TAD     PDLXR           / < FRST?
2307    006335  1376          TAD     HTST
2308    006336  7620          SNL CLA
2309    006337  5742          JMP I   .+3             /YES=DIRECT COMMAND
2310    006340  2013          ISZ     PDLXR           /NO=OK TO DUMP CALL
2311    006341  5541          POPJ
2312
2313    006342  0212          IBAR
2314
2315    006343  0000  HSWITC, 0
2316    006344  1375          TAD     HSPSW           /INITIALIZE H.S. READER
2317    006345  7040          CMA
2318    006346  3375          DCA     HSPSW           /CHANGE STATUS
2319    006347  7140          CLL CMA                 /CLEAR LINK
2320    006350  3037          DCA     HINBUF          /CLEAR BUFFER
2321    006351  1375          TAD     HSPSW
2322    006352  7440          SZA
2323    006353  6014          RFC                     /START HARDWARE
2324    006354  7640          SZA CLA
2325    006355  1377          TAD     RESTR           /(HREAD)
2326    006356  1126          TAD     PTCH
2327    006357  3152          DCA     RDIV            /"READC"
2328    006360  5743          JMP I   HSWITC
2329
2330    006361  4343  HSPX,   JMS     HSWITC          /COMMAND "*"  - SWAP
2331    006362  5763          JMP I   .+1;    PROC
2332    006363  0611
2333
2334    006364  7040  HSGO,   CMA                     /FETCH NEXT CHARACTER
2335    006365  3037          DCA     HINBUF
2336    006366  6016          RFC RRB                 /PICK UP NEXT CHARACTER
2337    006367  0106          AND     P177            /CHECK FOR LEADER-TRAILER,ETC.
2338    006370  7450          SNA
2339    006371  5322          JMP     HREAD+1
2340    006372  1123          TAD     C200
2341    006373  3066          DCA     CHAR            /SAVE INPUT
2342    006374  5721          JMP I   HREAD
2343
2344    006375  0000  HSPSW,  0
2345    006376  4557  HTST,   -COMEOUT-13
2346    006377  4144  RESTR,  HREAD-CHIN
```

```
2348                    /       DISK MONITOR INTERACTIVE COMMAND OPERATES VIA THE KEYBOARD.
2349                    /       THIS FITS UNDER THE 10 DIGIT FLOATING POINT OUTPUT BUFFER.
2350
2351            *7503           *7503
2352
2353    007503  1133    LIBRARY,TAD     CFRS
2354    007504  4327            JMS     PRNT8
2355    007505  1060            TAD     BUFR            /TYPE C(CFRS), C(BUFR), C(LASTV), C(BOTTOM)
2356    007506  4327            JMS     PRNT8           /OCTAL OUTPUT + COMMA
2357    007507  1031            TAD     LASTV
2358    007510  4327            JMS     PRNT8
2359    007511  1035            TAD     BOTTOM
2360    007512  4327            JMS     PRNT8
2361    007513  5316            JMP     .+3
2362
2363    007514  4545            GETC
2364    007515  4551            PRINTC
2365    007516  1066            TAD     CHAR
2366    007517  1116            TAD     MCR
2367    007520  7640            SZA CLA
2368    007521  5314            JMP     .-5
2369    007522  1016            TAD     TELSW
2370    007523  7640            SZA CLA
2371    007524  5322            JMP     .-2             /(NOP) - WHEN DEBUGGING
2372    007525  6002            IOF
2373    007526  5504            JMP I   P7600           /(7600=DISK MONITOR)
2374
2375    007527  0000    PRNT8,  0
2376    007530  3032            DCA     T1
2377    007531  1032            TAD     T1
2378    007532  7006            RTL
2379    007533  7006            RTL
2380    007534  4350            JMS     PRINTD
2381    007535  4557            RTL6
2382    007536  7004            RAL
2383    007537  4350            JMS     PRINTD
2384    007540  7012            RTR
2385    007541  7010            RAR
2386    007542  4350            JMS     PRINTD
2387    007543  4350            JMS     PRINTD
2388    007544  7200            CLA
2389    007545  1077            TAD     CCR
2390    007546  4551            PRINTC
2391    007547  5727            JMP I   PRNT8
2392
2393    007550  0000    PRINTD, 0
2394    007551  0356            AND     LP7
2395    007552  1113            TAD     C260
2396    007553  4551            PRINTC
2397    007554  1032            TAD     T1
2398    007555  5750            JMP I   PRINTD
2399
2400    007556  0007    LP7,    7
2401
2402                    /       USED BY 8K
```

```
2403                    /       FLOAT.ZZM
2404
2405
2406                    /       PAGE ZERO OF THE
2407                    /       FLOATING POINT ARITHMETIC INTERPRETER FOR FOCAL
2408
2409
2410                    /       SOURCE RECREATION, TIDYING UP BY:
2411
2412                    /       CHARLES J. LASNER P?S NY
2413
2414                    /       LAST EDIT:      08-APR-1987     23:00:00        CJL
2415
2416
2417            *0040           *40
2418
2419    000040  0000    EX1,    0                       /OPERAND STORAGE
2420    000041  0000    AC1H,   0
2421    000042  0000    AC1L,   0
2422    000043  0000    OVER1,  0
2423
2424            0044            FLAC=   .               /FLOATING ACCUMULATOR
2425
2426    000044  0000    EXP,    0                       /F.A.
2427    000045  0000    HORD,   0
2428    000046  0000    LORD,   0
2429    000047  0000    OVER2,  0
2430
2431    000050  0000    SIGNF,  0                       /FLOATING SIGN
2432
2433    000051  6603    MINSKI, ACMINS                  /NEGATE FLAC SUBROUTINE
2434    000052  2004    FISW,   2004                    /OUTPUT FORMAT
2435    000053  6724    INTEGER,FIX                     /FIX FLAC
2436
2437
2438
2439                    /       FUNCTIONS CONTAINED IN THIS SECTION
2440
2441                    /       ARTN
2442                    /       FEXP
2443                    /       FLOG
2444                    /       FSIN
2445                    /       FCOS
2446                    /       XSQRT
```

```
2448                    /       FLOATING POINT PACKAGE - EXPONENTIAL
2449
2450           1045             GETSGN= TAD     FLAC+1
2451           5536             RETURN= JMP I   EFUN3I
2452
2453          *4620             *4600+20
2454
2455   004620  1045  FEXP,      GETSGN                  /TAKE ABSOLUTE VALUE
2456   004621  7710              SPA CLA
2457   004622  4724              JMS I   NEGP
2458   004623  3033              DCA     T3              /C(SIGN)=-1 IF I X2<0
2459   004624  4407              FINT
2460   004625  4313              FMUL    LG2E
2461   004626  6675              FPUT I  X2
2462   004627  0000              FEXT
2463   004630  4453              JMS I   INTEGER         /TAKE INTEGER PART
2464   004631  3325              DCA     FLAG2           /SAVE LOW ORDER DATA
2465   004632  4407              FINT
2466   004633  7000              FNOR
2467   004634  6676              FPUT I  XSQ2
2468   004635  0675              FGET I  X2
2469   004636  2676              FSUB I  XSQ2
2470   004637  6675              FPUT I  X2
2471   004640  4675              FMUL I  X2
2472   004641  6676              FPUT I  XSQ2
2473   004642  1310              FADD    DF
2474   004643  6326              FPUT    TEMP
2475   004644  0305              FGET    CF
2476   004645  3326              FDIV    TEMP
2477   004646  2675              FSUB I  X2
2478   004647  1277              FADD    AF
2479   004650  6326              FPUT    TEMP
2480   004651  0302              FGET    BF
2481   004652  4676              FMUL I  XSQ2
2482   004653  1326              FADD    TEMP
2483   004654  6326              FPUT    TEMP
2484   004655  0675              FGET I  X2
2485   004656  3326              FDIV    TEMP
2486   004657  4321              FMUL    TWO
2487   004660  1316              FADD    ONE
2488   004661  0000              FEXT
2489   004662  1325              TAD     FLAG2
2490   004663  1044              TAD     FLAC
2491   004664  3044              DCA     FLAC
2492   004665  2033              ISZ     T3
2493   004666  5536              RETURN
2494   004667  4407              FINT
2495   004670  6675              FPUT I  X2
2496   004671  0316              FGET    ONE
2497   004672  3675              FDIV I  X2
2498   004673  0000              FEXT
2499   004674  5536              RETURN
```

```
2501                    /       CONSTANTS FOR FEXP
2502
2503    004675  5322    X2,     X
2504    004676  5326    XSQ2,   XSQR
2505    004677  0004    AF,     0004
2506    004700  2372            2372
2507    004701  1402            1402
2508    004702  7774    BF,     7774
2509    004703  2157            2157
2510    004704  5157            5157
2511    004705  0012    CF,     0012
2512    004706  5454            5454
2513    004707  0343            0343
2514    004710  0007    DF,     0007
2515    004711  2566            2566
2516    004712  5341            5341
2517    004713  0001    LG2E,   0001
2518    004714  2705            2705
2519    004715  2435            2435
2520    004716  0001    ONE,    0001
2521    004717  2000            2000
2522    004720  0000            0000
2523    004721  0002    TWO,    0002
2524    004722  2000            2000
2525    004723  0000            0000
2526    004724  5163    NEGP,   FNEG
2527
2528    004725  0000    FLAG2,  0
2529    004726  0000    TEMP,   0
2530    004727  0000            0
2531    004730  0000            0
2532    004731  0000            0
```

```
2534                    /       MAIN ALGORITHM FOR ARCTANGENT
2535
2536   004732  4407  ARCALG,   FINT
2537   004733  0675            FGET I  X2
2538   004734  4675            FMUL I  X2
2539   004735  6676            FPUT I  XSQ2
2540   004736  4374            FMUL    BET2
2541   004737  1371            FADD    BET1
2542   004740  4676            FMUL I  XSQ2
2543   004741  1366            FADD    BETZ
2544   004742  6326            FPUT    TEMP
2545   004743  0363            FGET    ALF2
2546   004744  4676            FMUL I  XSQ2
2547   004745  1360            FADD    ALF1
2548   004746  4676            FMUL I  XSQ2
2549   004747  1355            FADD    ALFZ
2550   004750  4675            FMUL I  X2
2551   004751  3326            FDIV    TEMP
2552   004752  0000            FEXT
2553   004753  5754            JMP I   .+1;    ARCRTN
2554   004754  5024
2555
2556
2557
2558                    /       CONSTANTS - FLOATING ARC TANGENT
2559
2560   004755  0000  ALFZ,     0000
2561   004756  2437              2437
2562   004757  1643              1643
2563   004760  7777  ALF1,     7777
2564   004761  3304              3304
2565   004762  4434              4434
2566   004763  7773  ALF2,     7773
2567   004764  3306              3306
2568   004765  5454              5454
2569   004766  0000  BETZ,     0000
2570   004767  2437              2437
2571   004770  1646              1646
2572   004771  0000  BET1,     0000
2573   004772  2427              2427
2574   004773  2323              2323
2575   004774  7775  BET2,     7775
2576   004775  3427              3427
2577   004776  7052              7052
```

```
2579                    /       FLOATING POINT ARC TANGENT
2580
2581            *5000           PAGE
2582
2583    005000  1045    ARTN,   GETSGN                  /TAKE ABSOLUTE VALUE
2584    005001  7710            SPA CLA
2585    005002  4363            JMS     FNEG
2586    005003  3033            DCA     T3
2587    005004  4407            FINT
2588    005005  6635            FPUT I  X1
2589    005006  2637            FSUB I  CON1
2590    005007  0000            FEXT
2591    005010  1045            GETSGN
2592    005011  7710            SPA CLA
2593    005012  5221            JMP     GO              /LESS THAN ONE
2594    005013  4407            FINT
2595    005014  0637            FGET I  CON1
2596    005015  3635            FDIV I  X1
2597    005016  6635            FPUT I  X1
2598    005017  0000            FEXT
2599    005020  7240            CLA CMA
2600    005021  3362    GO,     DCA     FLAG1           /SIGN FLAG OF RESULT
2601    005022  5623            JMP I   .+1;    ARCALG  /CALL ALGORITHM
2602    005023  4732
2603
2604    005024  2362    ARCRTN, ISZ     FLAG1           /RETURN HERE
2605    005025  5634            JMP I   EXIT1
2606    005026  4407            FINT
2607    005027  6635            FPUT I  X1
2608    005030  0636            FGET I  PI2
2609    005031  2635            FSUB I  X1
2610    005032  0000            FEXT
2611    005033  5634            JMP I   .+1
2612    005034  5302    EXIT1,  EXIT2
2613
2614                    /       CONSTANTS FOR ARCTANGENT
2615
2616    005035  5322    X1,     X
2617    005036  5316    PI2,    PIOT
2618    005037  4716    CON1,   ONE
```

```
2620   005040  1045  FLOG,   GETSGN                  /FLOATING LOGARITHM
2621   005041  7450          SNA
2622   005042  4566          ERROR3                  /ZERO ARGUMENT FOR LOG
2623   005043  7710          SPA CLA
2624   005044  4451          JMS I   MINSKI          /NEGATIVE ARGUMENT
2625   005045  4407          FINT
2626   005046  6756          FPUT I  TEM
2627   005047  2637          FSUB I  CON1
2628   005050  0000          FEXT
2629   005051  1045          GETSGN
2630   005052  7450          SNA
2631   005053  5536          RETURN
2632   005054  7700          SMA CLA
2633   005055  5264          JMP     STARTL
2634   005056  4407          FINT
2635   005057  0637          FGET I  CON1
2636   005060  3756          FDIV I  TEM
2637   005061  6756          FPUT I  TEM
2638   005062  0000          FEXT
2639   005063  7240          CLA CMA
2640   005064  3033  STARTL, DCA     T3
2641   005065  1005          TAD     P13
2642   005066  3044          DCA     FLAC
2643   005067  7040          CMA
2644   005070  1756          TAD I   TEM
2645   005071  3045          DCA     FLAC+1
2646   005072  3046          DCA     FLAC+2
2647   005073  3047          DCA     FLAC+3
2648   005074  7001          IAC
2649   005075  3756          DCA I   TEM
2650   005076  4407          FINT
2651   005077  4357          FMUL    LOG2
2652   005100  6635          FPUT I  X1
2653   005101  0756          FGET I  TEM
2654   005102  2637          FSUB I  CON1
2655   005103  6756          FPUT I  TEM
2656   005104  4353          FMUL    LOG8
2657   005105  1350          FADD    LOG7
2658   005106  4756          FMUL I  TEM
2659   005107  1345          FADD    LOG6
2660   005110  4756          FMUL I  TEM
2661   005111  1342          FADD    LOG5
2662   005112  4756          FMUL I  TEM
2663   005113  1337          FADD    L4
2664   005114  4756          FMUL I  TEM
2665   005115  1334          FADD    L3
2666   005116  4756          FMUL I  TEM
2667   005117  1331          FADD    L2
2668   005120  4756          FMUL I  TEM
2669   005121  1326          FADD    L1
2670   005122  4756          FMUL I  TEM
2671   005123  1635          FADD I  X1
2672   005124  0000          FEXT
2673   005125  5634          JMP I   EXIT1
```

```
2675   005126  0000  L1,     0000
2676   005127  3777          3777
2677   005130  7742          7742
2678   005131  7777  L2,     7777
2679   005132  4000          4000
2680   005133  4100          4100
2681   005134  7777  L3,     7777
2682   005135  2517          2517
2683   005136  0307          0307
2684   005137  7776  L4,     7776
2685   005140  4113          4113
2686   005141  7211          7211
2687
2688                 /       LOGARITHM CONSTANTS
2689
2690   005142  7776  LOG5,   7776
2691   005143  2535          2535
2692   005144  3301          3301
2693   005145  7775  LOG6,   7775
2694   005146  4746          4746
2695   005147  0771          0771
2696   005150  7774  LOG7,   7774
2697   005151  2236          2236
2698   005152  4304          4304
2699   005153  7771  LOG8,   7771
2700   005154  4544          4544
2701   005155  1735          1735
2702
2703   005156  4726  TEM,    TEMP
2704   005157  0000  LOG2,   0
2705   005160  2613          2613
2706   005161  4414          4414
2707   005162  0000  FLAG1,  0
2708
2709
2710
2711
2712   005163  0000  FNEG,   0
2713   005164  4451          JMS I   MINSKI
2714   005165  7240          CLA CMA
2715   005166  5763          JMP I   FNEG
```

```
2717                    /       FLOATING POINT SINE AND COSINE
2718
2719            *5200           PAGE
2720
2721    005200  4407    FCOS,   FINT                    /COS(X)=SIN(PI/2-X)
2722    005201  6322            FPUT    X
2723    005202  0316            FGET    PIOT
2724    005203  2322            FSUB    X
2725    005204  0000            FEXT
2726    005205  1045    FSIN,   GETSGN
2727    005206  7740            SMA SZA CLA
2728    005207  5215            JMP     MOD
2729    005210  1045            GETSGN
2730    005211  7700            SMA CLA
2731    005212  5536            RETURN                  /YES SIN(0)=0
2732    005213  4451            JMS I   MINSKI
2733    005214  7040            CMA                     /NO: SIN(-X)=-SIN(X)
2734    005215  3033    MOD,    DCA     T3
2735
2736                    /       REDUCE X MODULO 2 PI
2737
2738    005216  4407            FINT
2739    005217  3306            FDIV    TWOPI
2740    005220  6326            FPUT    XSQR
2741    005221  0000            FEXT
2742    005222  4453            JMS I   INTEGER
2743    005223  4407            FINT
2744    005224  7000            FNOR
2745    005225  6322            FPUT    X
2746    005226  0326            FGET    XSQR
2747    005227  2322            FSUB    X
2748    005230  4306            FMUL    TWOPI
2749    005231  6322            FPUT    X
2750    005232  2312            FSUB    PI              /X<PI?
2751    005233  0000            FEXT
2752    005234  1045            GETSGN
2753    005235  7710            SPA CLA
2754    005236  5245            JMP     PCHECK          /YES
2755    005237  4407            FINT                    /NO, SIN(X-PI)=-SIN(X)
2756    005240  6322            FPUT    X
2757    005241  0000            FEXT
2758    005242  1033            TAD     T3              /INVERT THE SIGN
2759    005243  7040            CMA
2760    005244  3033            DCA     T3
```

```
2762   005245  4407  PCHECK, FINT                    /X<PI/2?
2763   005246  0322          FGET    X
2764   005247  2316          FSUB    PIOT
2765   005250  0000          FEXT
2766   005251  1045          GETSGN
2767   005252  7710          SPA CLA
2768   005253  5261          JMP     PALG            /YES
2769   005254  4407          FINT                    /NO
2770   005255  0312          FGET    PI              /SIN(X)=SIN(PI-X)
2771   005256  2322          FSUB    X
2772   005257  6322          FPUT    X
2773   005260  0000          FEXT
2774   005261  4407  PALG,   FINT
2775   005262  0322          FGET    X
2776   005263  3316          FDIV    PIOT
2777   005264  6322          FPUT    X
2778   005265  4322          FMUL    X
2779   005266  6326          FPUT    XSQR
2780   005267  0332          FGET    C9
2781   005270  4326          FMUL    XSQR
2782   005271  1336          FADD    C7
2783   005272  4326          FMUL    XSQR
2784   005273  1342          FADD    C5
2785   005274  4326          FMUL    XSQR
2786   005275  1346          FADD    C3
2787   005276  4326          FMUL    XSQR
2788   005277  1316          FADD    PIOT
2789   005300  4322          FMUL    X
2790   005301  0000          FEXT
2791   005302  2033  EXIT2,  ISZ     T3
2792   005303  5536          RETURN
2793   005304  4451          JMS I   MINSKI
2794   005305  5536          RETURN
```

```
2796                    /       CONSTANTS AND POINTERS
2797
2798
2799
2800    005306  0003    TWOPI,  0003
2801    005307  3110            3110
2802    005310  3756            3756                    /(3755) - FOR 4-WORD
2803    005311  3235            3235
2804
2805    005312  0002    PI,     0002
2806    005313  3110            3110
2807    005314  3756            3756
2808    005315  3235            3235
2809
2810    005316  0001    PIOT,   0001                    /USED BY SINE AND COSINE
2811    005317  3110            3110
2812    005320  3756            3756
2813    005321  3235            3235
2814
2815    005322  0000    X,      0000
2816    005323  0000            0000
2817    005324  0000            0000
2818    005325  0000            0000
2819
2820    005326  0000    XSQR,   0000
2821    005327  0000            0000
2822    005330  0000            0000
2823    005331  0000            0000
2824
2825                    /       SINE CONSTANTS
2826
2827    005332  7764    C9,     7764
2828    005333  2401            2401
2829    005334  7015            7015
2830    005335  1042            1042
2831    005336  7771    C7,     7771
2832    005337  5464            5464
2833    005340  5514            5514
2834    005341  6150            6150
2835    005342  7775    C5,     7775
2836    005343  2431            2431
2837    005344  5361            5361
2838    005345  4736            4736
2839    005346  0000    C3,     0000
2840    005347  5325            5325
2841    005350  0414            0414
2842    005351  3167            3167
2843
2844                    /       END OF EXTENDED FUNCTIONS.
```

```
2846                    /       PAGE 1 - INPUT/OUTPUT ROUTINES FOR THE FOCAL
2847                    /       FLOATING POINT PACKAGE.
2848
2849
2850                    /       IN THE COMMENTS BELOW:
2851                    /       F = NUMBER OF DIGITS TO BE OUTPUT       =FISW
2852                    /       D = NUMBER OF DECIMAL PLACES            =DECP
2853                    /       E = DECIMAL EXPONENT                    =BEXP
2854                    /       P = NUMBER OF PLACES REMAINING TO BE
2855                    /           PRINTED BEFORE DECIMAL POINT
2856
2857             *5400          PAGE
2858
2859              0006          DIGITS= 6               /NUMBER OF DECIMAL DIGITS OUT
2860
2861   005400     0000  TGO,    0
2862   005401     3334          DCA     SCOUNT          /SAVE MAX. NUMBER OF DIGITS AVAILABLE - *SET COUNTS*
2863   005402     1052          TAD     FISW
2864   005403     4557          RTL6
2865   005404     0122          AND     P77
2866   005405     3032          DCA     T1
2867   005406     1032          TAD     T1
2868   005407     7041          CIA                     /NO, COMPUTE FIELD SIZES
2869   005410     7450          SNA
2870   005411     1326          TAD     MD
2871   005412     3335          DCA     FCOUNT
2872   005413     1052          TAD     FISW            /(JMP FPRNT) - FOR NO ROUNDING.
2873   005414     7450          SNA                     /FLOATING OUTPUT?
2874   005415     5241          JMP     R6              /YES, ROUND OFF TO MAX. NO. PLACES
2875   005416     0122          AND     P77
2876   005417     3333          DCA     DECP
2877   005420     1335          TAD     FCOUNT
2878   005421     1333          TAD     DECP
2879   005422     7510          SPA                     / F-D > 0?
2880   005423     5230          JMP     .+5             /YES
2881   005424     7240          CLA CMA                 /NO,
2882   005425     1032          TAD     T1
2883   005426     3333          DCA     DECP            /MAKE D = F-1
2884   005427     7040          CMA
2885   005430     1033          TAD     T3              /COMPARE DECIMAL EXPONENT
2886   005431     7500          SMA                     / F-D > E?
2887   005432     7200          CLA                     /NO, ROUND OFF TO .F PLACES
2888   005433     1032          TAD     T1              /YES
2889   005434     7510          SPA                     / D+E < 0?
2890   005435     5263          JMP     FPRNT-2         /YES, NO ROUNDING NEEDED, GO TO PRINT
2891   005436     1326          TAD     MD              /NO, ROUND TO D+E PLACES,
2892   005437     7500          SMA                     /TO A MAXIMUM OF D PLACES
2893   005440     7200          CLA
```

```
2895   005441  1327  R6,     TAD     RND2            / *ROUND UP *
2896   005442  3071          DCA     T2              /SAVE NUMBER+1 OF PLACES TO ROUND TO.
2897   005443  1731          TAD I   BUFST
2898   005444  1071          TAD     T2              /SET UP BUFFER ADDRESS AT WHICH
2899   005445  3336          DCA     PLCE            /ROUNDING OFF SHOULD START
2900   005446  1071          TAD     T2
2901   005447  7041          CIA                     /SET UP COUNT OF MAXIMUM NUMBER
2902   005450  3071          DCA     T2              /OF CARRIES ALLOWABLE
2903   005451  1325          TAD     K5              /LITTLE EXTRA ON FIRST DIGIT.
2904   005452  2736  RET,    ISZ I   PLCE            /ADD 1 TO DIGIT AT CURRENT POSITION
2905   005453  1736          TAD I   PLCE
2906   005454  1330          TAD     OM12
2907   005455  7710          SPA CLA                 /CARRY REQUIRED?
2908   005456  5265          JMP     FPRNT           /NO, GO TO OUTPUT
2909   005457  3736          DCA I   PLCE            /YES, MAKE CURRENT DIGIT ZERO
2910   005460  2071          ISZ     T2              /BEGINNING OF BUFFER REACHED?
2911   005461  5321          JMP     DECR            /NO, DECREMENT BUFFER ADDRESS AND REPEAT
2912   005462  2736          ISZ I   PLCE            /YES, SET MANTISSA TO 0.1
2913   005463  2033          ISZ     T3              /COMPENSATE BY INCREMENTING EXPONENT
2914   005464  7200          CLA
2915   005465  1052  FPRNT,  TAD     FISW            /AUTO-INDEX REGISTER ALREADY SET. - *PRINT*
2916   005466  7650          SNA CLA                 / F = 0?
2917   005467  5356          JMP     FLOUT           /YES, OUTPUT AS FLOATING NUMBER
2918   005470  1335          TAD     FCOUNT
2919   005471  1033          TAD     T3
2920   005472  7540          SMA SZA                 / E > F?
2921   005473  5355          JMP     FLOUT-1         /YES, CONVERT TO E FORMAT
2922   005474  1333          TAD     DECP
2923   005475  7500          SMA                     / E < F-D?
2924   005476  7200          CLA                     /NO, TAKE P = E
2925   005477  7041          CIA                     /YES, TAKE P = F-D
2926   005500  1033          TAD     T3
2927   005501  7041          CIA
2928   005502  3032          DCA     T1              /SET UP MINUS P
2929   005503  1033  BACK,   TAD     T3              /PRINT DD.DDD
2930   005504  1032          TAD     T1
2931   005505  7650          SNA CLA                 / P = E?
2932   005506  5343          JMP     DIG             /YES, PRINT DIGIT
2933   005507  1032          TAD     T1              /NO,
2934   005510  7001          IAC
2935   005511  7710          SPA CLA                 / P > 1?
2936   005512  1105          TAD     M20             /YES, TAKE SPACE (240-260); OTHERWISE ZERO
2937   005513  4336  IN,     JMS     OUTA            /PRINT CHARACTER
2938   005514  2032          ISZ     T1              /P CHARACTERS PRINTED?
2939   005515  5303          JMP     BACK            /NO
2940   005516  1102          TAD     PER             /YES,
2941   005517  4551          PRINTC                  /PRINT DECIMAL POINT
2942   005520  5303          JMP     BACK
2943
2944   005521  7040  DECR,   CMA                     /BACKUP TO TOP OF BUFFER.
2945   005522  1336          TAD     PLCE
2946   005523  3336          DCA     PLCE
2947   005524  5252          JMP     RET
```

```
2949   005525  0005  K5,     5
2950   005526  7772  MD,     -DIGITS
2951   005527  0007  RND2,   DIGITS+1
2952   005530  7766  OM12,   -12
2953   005531  6150  BUFST,  SADR
2954   005532  6154  OPUT,   OUTDG
2955   005533  0000  DECP,   0                       /MODIFIABLE LOCATIONS
2956   005534  0000  SCOUNT, 0
2957   005535  0000  FCOUNT, 0
2958
2959           5536          PLCE=   .
2960
2961   005536  0000  OUTA,   0                       /MODIFIED REGISTERS.
2962   005537  4732          JMS I   OPUT            /PRINT CHARACTER
2963   005540  2335          ISZ     FCOUNT          /F CHARACTERS PRINTED?
2964   005541  5736          JMP I   OUTA            /NO
2965   005542  5600          JMP I   TGO             /YES, NUMBER FINSHED
2966
2967   005543  7040  DIG,    CMA
2968   005544  1033          TAD     T3              /REDUCE E, BY 1
2969   005545  3033          DCA     T3
2970   005546  2334          ISZ     SCOUNT          /ARE ALL SIG. FIGS. USED?
2971   005547  5353          JMP     .+4             /NO
2972   005550  7040          CMA                     /YES,
2973   005551  3334          DCA     SCOUNT          /RESET COUNT TO -1
2974   005552  5313          JMP     IN              /AND LEAVE C(AC) = 0
2975   005553  1414          TAD I   FLTXR           /TAKE NEXT DIGIT FROM BUFFER
2976   005554  5313          JMP     IN
2977
2978                 /       DO FLOATING OUTPUT
2979
2980   005555  7200          CLA                     /IF OUTPUT TOO LARGE,
2981   005556  4732  FLOUT,  JMS I   OPUT            /PRINT "0"
2982   005557  1102          TAD     PER
2983   005560  4551          PRINTC                  /PRINT "."
2984   005561  2200          ISZ     TGO             /SECOND RETURN
2985   005562  1414          TAD I   FLTXR           /TAKE NEXT DIGIT FROM BUFFER
2986   005563  4336          JMS     OUTA            /PRINT IT
2987   005564  2334          ISZ     SCOUNT          /TEST FOR END OF INPUT
2988   005565  5362          JMP     .-3             /AND REPEAT
2989   005566  7040          CMA
2990   005567  3334          DCA     SCOUNT          /OUTPUT EXTRA ZEROS.
2991   005570  5363          JMP     .-5
2992
2993   005571  0000  ABSOLV, 0
2994   005572  1045          TAD     HORD
2995   005573  3050          DCA     SIGNF
2996   005574  1045          TAD     HORD
2997   005575  7710          SPA CLA
2998   005576  4451          JMS I   MINSKI
2999   005577  5771          JMP I   ABSOLV
```

```
3001                    /       DOUBLE PRECISION DECIMAL-BINARY
3002                    /       INPUT AND CONVERSION FOR + OR - XXX...
3003
3004            *5600           PAGE
3005
3006    005600  0000    DECONV, 0
3007    005601  3046            DCA     LORD
3008    005602  3044            DCA     EXP             /ZERO THE EXPONENT AND
3009    005603  3045            DCA     HORD            /INITIALIZE FLOATING AC.
3010    005604  3047            DCA     OVER2
3011    005605  3314            DCA     DNUMBR
3012    005606  3050            DCA     SIGNF
3013    005607  1066            TAD     CHAR            /ALLOW KEYBOARD SIGN CHECKS.
3014    005610  1264            TAD     MPLUS
3015    005611  7450            SNA
3016    005612  5220            JMP     .+6             /+SIGN; GET NEXT
3017    005613  1111            TAD     M2              /CHECK - SIGN
3018    005614  7640            SZA CLA
3019    005615  5221            JMP     .+4
3020    005616  7040            CMA                     /INIT SIGN CHECK TO POS.
3021    005617  3050            DCA     SIGNF
3022    005620  4666            JMS I   XINPUT          /GET NEXT
3023    005621  1066            TAD     CHAR            /A SPACE PERHAPS?
3024    005622  1265            TAD     MSPACE
3025    005623  7650            SNA CLA
3026    005624  5220            JMP     .-4
3027    005625  4227            JMS     DECON
3028    005626  5600            JMP I   DECONV
```

```
3030   005627  0000  DECON,  0
3031   005630  1066          TAD     CHAR            /TEST LEAD CHARACTER FOR TERMINATOR
3032   005631  1262          TAD     MINE
3033   005632  7650          SNA CLA
3034   005633  5627          JMP I   DECON           /E
3035   005634  4561          TESTN
3036   005635  5627          JMP I   DECON           /.
3037   005636  5247          JMP     DTST            /OTHER
3038   005637  1054          TAD     SORTCN          /N
3039   005640  3313  DSAVE,  DCA     DIGIT           /YES
3040   005641  4267          JMS     MULT10          /REMAIN MUST =0 SINCE OVERFLOW IS CHECKED
3041   005642  2314          ISZ     DNUMBR          /COUNT DIGITS
3042   005643  7640          SZA CLA
3043   005644  4566          ERROR2                  /INPUT-OVERFLOW ERROR
3044   005645  4666          JMS I   XINPUT
3045   005646  5230          JMP     DECON+1         /CONTINUE
3046
3047   005647  1066  DTST,   TAD     CHAR            /ALLOW A-Z
3048   005650  1112          TAD     MINUSA
3049   005651  7710          SPA CLA
3050   005652  5627          JMP I   DECON
3051   005653  1066          TAD     CHAR
3052   005654  1263          TAD     MINUSZ
3053   005655  7740          SZA SMA CLA
3054   005656  5627          JMP I   DECON           /USE SIX BITS OF ASCII
3055   005657  1066          TAD     CHAR
3056   005660  0122          AND     P77
3057   005661  5240          JMP     DSAVE
3058
3059   005662  7473  MINE,   -"E                     /(7532)- FOR AMPERSAND
3060   005663  7446  MINUSZ, -"Z
3061   005664  7525  MPLUS,  -"+
3062   005665  7540  MSPACE, -"
3063   005666  0756  XINPUT, INPUT
```

```
3065   005667  0000  MULT10, 0                       /ROUTINE TO MULTIPLY FLAC BY TEN (10)
3066   005670  1047          TAD     OVER2
3067   005671  3043          DCA     OVER1
3068   005672  1046          TAD     LORD            /DOUBLE PRECISION WORD
3069   005673  3042          DCA     AC1L            /BY TEN (DECIMAL)
3070   005674  1045          TAD     HORD            /REMAIN=REMAINDER
3071   005675  3041          DCA     AC1H
3072   005676  3312          DCA     REMAIN          /CLEAR OVERFLOW WORD
3073   005677  4315          JMS     MULT2           /CALL SUBROUTINE TO
3074   005700  4315          JMS     MULT2           /MULTIPLY BY TWO
3075   005701  4333          JMS     DUBLAD          /CALL DOUBLE ADD
3076   005702  4315          JMS     MULT2
3077   005703  1313          TAD     DIGIT           /ADD LAST DIGIT RECEIVED
3078   005704  3043          DCA     OVER1
3079   005705  3042          DCA     AC1L
3080   005706  3041          DCA     AC1H
3081   005707  4333          JMS     DUBLAD
3082   005710  1312          TAD     REMAIN          /EXIT WITH REMAINDER
3083   005711  5667          JMP I   MULT10          /IN AC
3084
3085   005712  0000  REMAIN, 0
3086   005713  0000  DIGIT,  0                       /STORAGE FOR DIGIT
3087   005714  0000  DNUMBR, 0                       /=NUMBER OF DIGITS
3088
3089   005715  0000  MULT2,  0                       /MULTIPLY OVER2, LORD, HORD BY 2
3090   005716  1047          TAD     OVER2
3091   005717  7104          CLL RAL                 /CARRY INSERT BIT IS IN LINK
3092   005720  3047          DCA     OVER2
3093   005721  1046          TAD     LORD
3094   005722  7004          RAL
3095   005723  3046          DCA     LORD
3096   005724  1045          TAD     HORD
3097   005725  7004          RAL
3098   005726  3045          DCA     HORD
3099   005727  1312          TAD     REMAIN
3100   005730  7004          RAL
3101   005731  3312          DCA     REMAIN
3102   005732  5715          JMP I   MULT2
```

```
3104   005733  0000  DUBLAD, 0                       /TRIPLE PRECISION ADDITION
3105   005734  7300          CLA CLL
3106   005735  1047          TAD     OVER2
3107   005736  1043          TAD     OVER1
3108   005737  3047          DCA     OVER2
3109   005740  7004          RAL
3110   005741  1046          TAD     LORD
3111   005742  1042          TAD     AC1L
3112   005743  3046          DCA     LORD
3113   005744  7004          RAL
3114   005745  1045          TAD     HORD
3115   005746  1041          TAD     AC1H
3116   005747  3045          DCA     HORD
3117   005750  7004          RAL
3118   005751  1312          TAD     REMAIN          /WITH OVERFLOW
3119   005752  3312          DCA     REMAIN
3120   005753  5733          JMP I   DUBLAD
3121
3122   005754  0000  DIV1,   0                       /SHIFT OPERAND RIGHT
3123   005755  7300          CLA CLL                 /TRIPLE PRECISION
3124   005756  1041          TAD     AC1H
3125   005757  7510          SPA
3126   005760  7120          CLL CML
3127   005761  7010          RAR
3128   005762  3041          DCA     AC1H
3129   005763  1042          TAD     AC1L
3130   005764  7010          RAR
3131   005765  3042          DCA     AC1L
3132   005766  1043          TAD     OVER1
3133   005767  7010          RAR
3134   005770  3043          DCA     OVER1
3135   005771  2040          ISZ     EX1
3136   005772  5754          JMP I   DIV1
3137   005773  5754          JMP I   DIV1
```

```
3139          *6000          PAGE
3140
3141                 /       FLOATING OUTPUT CONVERSION ROUTINE
3142
3143   006000  0000  FLOUTP, 0
3144   006001  1335          TAD     PEQ
3145   006002  4551          PRINTC                  /(CLA)- TO SUPPRESS "="
3146   006003  1045          TAD     HORD            /NUMBER>0??
3147   006004  7700          SMA CLA
3148   006005  1334          TAD     SMSP            /PRINT "-" OR A SPACE.
3149   006006  1336          TAD     SMIN
3150   006007  4551          PRINTC
3151   006010  4753          JMS I   ABSOL2
3152   006011  3033  FGO2,   DCA     T3              /INITIALIZE DECIMAL EXPONENT
3153   006012  1044          TAD     EXP             /IS EXP 0 TO 4?
3154   006013  7510          SPA
3155   006014  5227          JMP     FGO3            /TOO LARGE: MULTIPLY BY 1/10
3156   006015  7440          SZA
3157   006016  1341          TAD     M4
3158   006017  7750          SPA SNA CLA
3159   006020  5234          JMP     FGO4
3160   006021  4407          FINT
3161   006022  4744          FMUL I  PPTEN
3162   006023  0000          FEXT
3163   006024  7001          IAC
3164   006025  1033          TAD     T3
3165   006026  5211          JMP     FGO2
3166
3167   006027  4407  FGO3,   FINT
3168   006030  4752          FMUL I TENPT
3169   006031  0000          FEXT
3170   006032  7040          CMA
3171   006033  5225          JMP     .-6
```

```
3173   006034  3745  FGO4,   DCA I   DPT             /MULTIPLY BY TWO TO POSITION BIT0
3174   006035  3746          DCA I   REPT            /CLEAR OVERFLOW WORD
3175   006036  1350          TAD     SADR            /INIT BUFFER POINTER
3176   006037  3014          DCA     FLTXR
3177   006040  1044          TAD     EXP             /COMPUTE BITS IN 1ST DIGIT
3178   006041  7140          CLL CMA
3179   006042  3354          DCA     OUTDG           /TEMP COUNT
3180   006043  1343          TAD     DCOUNT          /SETUP COUNT OF TOTAL OUTPUT
3181   006044  3044          DCA     EXP
3182   006045  4527          JMS I   DOUBLE          /ROTATE OUT THE 1ST 4 BITS
3183   006046  2354          ISZ     OUTDG
3184   006047  5245          JMP     .-2
3185   006050  1746          TAD I   REPT            /TEST FOR 10-15, 0, 1-9
3186   006051  7450          SNA
3187   006052  5270          JMP     FGO5            /IGNORE 1ST ZERO
3188   006053  1342          TAD     FM12
3189   006054  7710          SPA CLA
3190   006055  5264          JMP     .+7             /0-9
3191   006056  7001          IAC
3192   006057  3414          DCA I   FLTXR           /OUTPUT A 1
3193   006060  2044          ISZ     EXP             /COUNT THE DIGIT
3194   006061  1342          TAD     FM12            /CORRECT REMAINDER
3195   006062  2033          ISZ     T3              /BUMP DECIMAL EXPONENT
3196   006063  7000          NOP
3197   006064  1746          TAD I   REPT            /COMPUTE RESULTANT OR SECOND DIGIT
3198   006065  2033          ISZ     T3
3199   006066  7000          NOP
3200   006067  7410          SKP
3201   006070  4747  FGO5,   JMS I   M10PT           /IE. .672X10=6+.72.. ETC
3202   006071  3414          DCA I   FLTXR
3203   006072  2044          ISZ     EXP             /ALL DIGITS OUTPUT??
3204   006073  5270          JMP     .-3             /NO: CONTINUE
3205   006074  1350          TAD     SADR            /INIT BUFFER POINTER
3206   006075  3014          DCA     FLTXR
3207   006076  1343          TAD     DCOUNT
3208   006077  4751          JMS I   ROUND           /OUTPUT MANTISSA
3209   006100  5600          JMP I   FLOUTP          /FIXED POINT DONE
3210   006101  1333          TAD     CHRT            /PRINT "E"
3211   006102  4551          PRINTC
```

```
3213                    /       OUTPUT THE EXPONENT
3214
3215   006103  1033             TAD     T3              /TAKE ABSOLUTE VALUE OF EXPONENT
3216   006104  7510             SPA
3217   006105  7041             CIA
3218   006106  3045             DCA     HORD            /SAVE + POWER
3219   006107  1033             TAD     T3              /PRINT SIGN
3220   006110  7700             SMA CLA
3221   006111  1111             TAD     M2
3222   006112  1336             TAD     SMIN
3223   006113  4551             PRINTC
3224   006114  1045             TAD     HORD
3225   006115  2044             ISZ     EXP
3226   006116  1337             TAD     M144
3227   006117  7500             SMA
3228   006120  5315             JMP     .-3
3229   006121  1340             TAD     C144
3230   006122  3045             DCA     HORD            /SAVE TENS AND UNITS
3231   006123  7040             CMA                     /OUTPUT HUNDREDS
3232   006124  1044             TAD     EXP
3233   006125  7440             SZA                     /UNLESS ZERO
3234   006126  4354             JMS     OUTDG
3235   006127  1045             TAD     HORD            /PRINT TWO DIGITS
3236   006130  4732             JMS I   PRNTI
3237   006131  5600             JMP I   FLOUTP
3238
3239   006132  2442  PRNTI,     PRNT
3240   006133  0305  CHRT,      "E                      /E (0246) - FOR AMPERSAND
3241   006134  7763  SMSP,      " -"-                   /
3242   006135  0275  PEQ,       "=
3243   006136  0255  SMIN,      "-
3244   006137  7634  M144,      -144                    /-100
3245   006140  0144  C144,      0144                    /+100
3246   006141  7774  M4,        -4
3247   006142  7766  FM12,      -12
3248   006143  7771  DCOUNT,    -DIGITS-1               /NUMBER OF DIGITS OUTPUT
3249   006144  6275  PPTEN,     PTEN                    /IEI
3250   006145  5713  DPT,       DIGIT
3251   006146  5712  REPT,      REMAIN                  /OVERFLOW FROM INTEGER MULTIPLY
3252   006147  5667  M10PT,     MULT10
3253   006150  7467  SADR,      BUFFER-1
3254   006151  5400  ROUND,     TGO                     /ACTUAL OUTPUT ROUTINE
3255   006152  6271  TENPT,     TEN
3256   006153  5571  ABSOL2,    ABSOLV
3257
3258   006154  0000  OUTDG,     0                       /OUTPUT ONE DIGIT
3259   006155  1113             TAD     C260
3260   006156  4551             PRINTC
3261   006157  5754             JMP I   OUTDG
3262
3263                    /       USED BY 8K
```

```
3265                    /       FLOATING POINT INPUT
3266
3267            *6200           PAGE
3268
3269    006200  0000    FLINTP, 0                       /IF C(AC) = 0, USE CHAR
3270    006201  7640            SZA CLA                 /IF C(AC) NON-ZERO, GET NEXT
3271    006202  4706            JMS I   XIN             /GET FIRST CHAR
3272    006203  1066            TAD     CHAR            /IGNORE LEADING SPACES
3273    006204  1114            TAD     M240
3274    006205  7650            SNA CLA
3275    006206  5202            JMP     .-4
3276    006207  4702            JMS I   DPCVPT          /READ FIRST DIGIT GROUP
3277    006210  1066            TAD     CHAR            /AND SET "SIGNF"
3278    006211  1115            TAD     MPER
3279    006212  7640            SZA CLA                 /ENDED BY PERIOD?
3280    006213  5221            JMP     FIGO1
3281    006214  4706            JMS I   XIN             /YES, READ 2AND GROUP
3282    006215  3705            DCA I   DPN
3283    006216  4703            JMS I   DCONP
3284    006217  1705            TAD I   DPN             /SAVE NUMBER OF DIGITS IN T3
3285    006220  7041            CMA IAC
3286    006221  3033    FIGO1,  DCA     T3              /NO,
3287    006222  1310            TAD     P43
3288    006223  3044            DCA     EXP
3289    006224  4704            JMS I   RESOL5
3290    006225  4707            JMS I   INORM           /NORMALIZE FIRST, THEN
3291    006226  4407            FINT
3292    006227  6430            FPUT I  PT1             /SAVE NUMBER
3293    006230  0000            FEXT
3294    006231  1066            TAD     CHAR
3295    006232  1301            TAD     MINUSE
3296    006233  7640            SZA CLA                 /"E" READ IN?
3297    006234  5246            JMP     ENDFI+3         /NO
3298    006235  4706            JMS I   XIN             /YES, READ 3RD DIGIT GROUP
3299    006236  4702            JMS I   DPCVPT          /I.E. CONVERT DECIMAL EXPONENT
3300    006237  4704            JMS I   RESOL5
3301    006240  1047            TAD     OVER2
3302    006241  1033            TAD     T3              /C(SEXP) PLACES TO RIGHT
3303    006242  3033            DCA     T3              /OF LAST DIGIT
```

```
3305                    /       COMPENSATE FOR DECIMAL EXPONENTS
3306
3307   006243  4407     ENDFI,  FINT                    /RESTORE MANTISSA
3308   006244  0430             FGET I  PT1
3309   006245  0000             FEXT
3310   006246  1033             TAD     T3              /TEST DECIMAL EXPONENT
3311   006247  7450             SNA
3312   006250  5600             JMP I   FLINTP          /FINISHED
3313   006251  7700             SMA CLA
3314   006252  5261             JMP     FIGO4
3315   006253  4407             FINT                    /. IS TO THE LEFT:
3316   006254  4275             FMUL    PTEN            /TIMES .1000
3317   006255  6430             FPUT I  PT1
3318   006256  0000             FEXT
3319   006257  7001             IAC
3320   006260  5266             JMP     .+6
3321
3322   006261  4407     FIGO4,  FINT                    /. IS TO THE RIGHT:
3323   006262  4271             FMUL    TEN             /MULTIPLY BY 10
3324   006263  6430             FPUT I  PT1
3325   006264  0000             FEXT
3326   006265  7040             CMA
3327   006266  1033             TAD     T3
3328   006267  3033             DCA     T3
3329   006270  5246             JMP     ENDFI+3
3330
3331   006271  0004     TEN,    0004
3332   006272  2400             2400
3333   006273  0000             0000
3334   006274  0000             0000
3335
3336   006275  7775     PTEN,   7775
3337   006276  3146             3146
3338   006277  3147             3147                    /(3146) - FOR 4-WORD
3339   006300  3150             3150
3340
3341   006301  7473     MINUSE, -"E                     /(7532) - FOR AMPERSAND
3342
3343   006302  5600     DPCVPT, DECONV
3344   006303  5627     DCONP,  DECON
3345   006304  7173     RESOL5, RESOLV
3346   006305  5714     DPN,    DNUMBR
3347   006306  0756     XIN,    INPUT
3348   006307  7335     INORM,  DNORM
3349   006310  0043     P43,    43
3350
3351                    /       END OF FLOATING POINT INPUT
3352
3353                    /       7 FREE
3354
3355                    /       USED BY H.S. READER
```

```
3357          *6400          PAGE
3358
3359                 /       FLOATING-POINT INTERPRETER FOR FOCAL.
3360
3361   006400  0000  FPNT,    0
3362   006401  7300           CLA CLL
3363   006402  3047           DCA     OVER2           /(NOP) - FOR 4-WORD
3364   006403  3043           DCA     OVER1           /(NOP) - FOR 4-WORD.
3365   006404  1600           TAD I   FPNT            /GET NEXT INSTRUCTION
3366   006405  7450           SNA
3367   006406  5600           JMP I   FPNT            /FAST EXIT
3368   006407  3262           DCA     JUMP
3369   006410  1262           TAD     JUMP
3370   006411  0123           AND     C200            /GET PAGE BIT
3371   006412  7650           SNA CLA                 /PAGE ZERO?
3372   006413  5216           JMP     .+3             /YES
3373   006414  1104           TAD     P7600           /NO
3374   006415  0200           AND     FPNT            /C(FPNT)0-4 CONTAINS PAGE BITS
3375   006416  3040           DCA     ADDR
3376   006417  1106           TAD     P177            /GET 7 BIT ADDRESS
3377   006420  0262           AND     JUMP
3378   006421  1040           TAD     ADDR
3379   006422  3040           DCA     ADDR
3380   006423  1263           TAD     INDRCT          /INDIRECT BIT=1?
3381   006424  0262           AND     JUMP
3382   006425  7650           SNA CLA
3383   006426  5231           JMP     LOOP01          /NO-GO ON
3384   006427  1440           TAD I   ADDR            /YES, DEFER, W/O AUTO-INDEX
3385   006430  3040           DCA     ADDR
3386   006431  2200  LOOP01,  ISZ     FPNT
3387   006432  7040           CMA
3388   006433  1040           TAD     ADDR
3389   006434  3015           DCA     FLTXR2
3390   006435  1262           TAD     JUMP            /GET COMMAND
3391   006436  7106           CLL RTL
3392   006437  7006           RTL
3393   006440  0107           AND     P17             /GET BITS 0-2, IE OPCODE
3394   006441  7450           SNA
3395   006442  5267           JMP     FLGT
3396   006443  1264           TAD     TABLE           /LOOKUP IN TABLE
3397   006444  3262           DCA     JUMP
3398   006445  1662           TAD I   JUMP
3399   006446  7450           SNA
3400   006447  5265           JMP     FLPT
3401   006450  3262           DCA     JUMP
3402   006451  1304           TAD     CEX1            /SAVE FLOATING ARGUMENT, UNLESS 'GET' OR 'PUT'
3403   006452  3014           DCA     FLTXR
3404   006453  1117           TAD     MFLT
3405   006454  3057           DCA     CNTR
3406   006455  1415           TAD I   FLTXR2
3407   006456  3414           DCA I   FLTXR
3408   006457  2057           ISZ     CNTR
3409   006460  5255           JMP     .-3
3410   006461  5662           JMP I   JUMP            /GO THERE
```

```
3412   006462  0000  JUMP,   0
3413
3414           0040          ADDR=   EX1
3415
3416   006463  0400  INDRCT, 0400
3417   006464  6573  TABLE,  ITABLE
3418
3419   006465  1303  FLPT,   TAD     CEXP            /EXP TO (ADDR)
3420   006466  5273          JMP     .+5
3421
3422   006467  1303  FLGT,   TAD     CEXP            /(ADDR) TO EXP
3423   006470  3015          DCA     FLTXR2
3424   006471  7040          CMA
3425   006472  1040          TAD     ADDR
3426   006473  3014          DCA     FLTXR           /SAVE 'FROM' ADDRESS
3427   006474  1117          TAD     MFLT            /3 OR 4 WORDS
3428   006475  3057          DCA     CNTR
3429   006476  1414          TAD I   FLTXR
3430   006477  3415          DCA I   FLTXR2
3431   006500  2057          ISZ     CNTR
3432   006501  5276          JMP     .-3
3433   006502  5201          JMP     FPNT+1
3434
3435   006503  0043  CEXP,   EXP-1
3436   006504  0037  CEX1,   EX1-1
3437
3438
3439   006505  4765  FLSU,   JMS I   OPMINS           /FSUB=2 - NEGATE THE OPERAND
3440   006506  4770  FLAD,   JMS I   ALGN            /FLAD=1 - FIRST ALIGN EXPONENTS
3441   006507  5201          JMP     FPNT+1          /RETURN IF NO ALIGNMENT IS POSSIBLE
3442   006510  4772          JMS I   RAR2            /TRIPLE PRECISION ADDDITION
3443   006511  4771          JMS I   RAR1            /SINCE BITS ARE SHIFTED
3444   006512  4773          JMS I   TRAD            /RIGHT
3445   006513  4767  NORF,   JMS I   NORM            /NORMALIZE THE RESULT
3446   006514  5201          JMP     FPNT+1          /HINT: USE 700X FOR FUNCTIONS.
```

```
3448                    /       INTERPRETIVE POWER
3449
3450   006515  1045     FLEX,   TAD     HORD            /ZERO?
3451   006516  7640             SZA CLA
3452   006517  5325             JMP     .+6
3453   006520  3044     ZERO,   DCA     EXP             /YES
3454   006521  3045             DCA     HORD
3455   006522  3046             DCA     LORD
3456   006523  3047             DCA     OVER2
3457   006524  5201             JMP     FPNT+1
3458
3459   006525  4543             PUSHF                   /AC TO A + POWER
3460   006526  0044             FLAC
3461   006527  4543             PUSHF                   /SETUP ARGUMENT (THE EXPONENT)
3462   006530  0040             EX1
3463   006531  4544             POPF
3464   006532  0044             FLAC
3465   006533  4453             JMS I   INTEGER         /ONLY POSITIVE, INTEGER  EXPONENTS
3466   006534  7510             SPA
3467   006535  5342             JMP     .+5             /(COULD DIVIDE)
3468   006536  7040             CMA
3469   006537  3262             DCA     JUMP            /TEMP STORAGE
3470   006540  3043             DCA     OVER1           /(NOP) - FOR 4-WORD
3471   006541  1045             TAD     HORD
3472   006542  7640             SZA CLA
3473   006543  4566             ERROR2                  /TOO LARGE OR NEGATIVE EXPONENT
3474   006544  4543             PUSHF                   /INITIALIZE TO ONE.
3475   006545  2405             FLTONE
3476   006546  4544             POPF
3477   006547  0044             FLAC
3478   006550  4544             POPF
3479   006551  7470             ITER1
3480   006552  5360             JMP     .+6
3481   006553  4543             PUSHF
3482   006554  7470             ITER1
3483   006555  4544             POPF
3484   006556  0040             EX1
3485   006557  4766             JMS I   MULT            /"MULT"
3486   006560  2262             ISZ     JUMP
3487   006561  5353             JMP     .-6
3488   006562  5201             JMP     FPNT+1
```

```
3490   006563  4766  FLMY,   JMS I   MULT            /MULTIPLY
3491   006564  5201          JMP     FPNT+1
3492
3493
3494   006565  7153  OPMINS, MINUS2
3495   006566  7004  MULT,   DMULT
3496   006567  7335  NORM,   DNORM
3497   006570  6623  ALGN,   ALIGN
3498   006571  5754  RAR1,   DIV1
3499   006572  6757  RAR2,   DIV2
3500   006573  5733  TRAD,   DUBLAD
3501
3502           6573          ITABLE= .-1
3503
3504   006574  6506          FLAD
3505   006575  6505          FLSU
3506   006576  7107          FLDV
3507   006577  6563          FLMY
3508   006600  6515          FLEX
3509   006601  0000          0000
3510   006602  6513          NORF
3511
3512   006603  0000  ACMINS, 0                       /ROUTINE TO  COMPLEMENT FLAC - VIA "MINSKI"
3513   006604  7300          CLA CLL
3514   006605  1047          TAD     OVER2           /TRIPLE PRECISION NEGATION
3515   006606  7041          CMA IAC                 /OF FLOATING AC
3516   006607  3047          DCA     OVER2
3517   006610  1046          TAD     LORD
3518   006611  7040          CMA
3519   006612  7430          SZL
3520   006613  7101          CLL IAC
3521   006614  3046          DCA     LORD
3522   006615  1045          TAD     HORD
3523   006616  7040          CMA
3524   006617  7430          SZL
3525   006620  7101          CLL IAC
3526   006621  3045          DCA     HORD
3527   006622  5603          JMP I   ACMINS
```

```
3529   006623  0000  ALIGN,  0                       /SUBROUTINE TO ALIGN
3530   006624  1045          TAD     HORD            /BINARY POINTS
3531   006625  7450          SNA
3532   006626  1046          TAD     LORD            /IS MANTISSA ZERO?
3533   006627  7650          SNA CLA
3534   006630  5311          JMP     NOX1            /YES, RESULT=OPERAND
3535   006631  1041          TAD     AC1H            /NO, IS OPERAND ZERO?
3536   006632  7450          SNA
3537   006633  1042          TAD     AC1L
3538   006634  7450          SNA
3539   006635  1043          TAD     OVER1
3540   006636  7650          SNA CLA
3541   006637  5623          JMP I   ALIGN           /YES, EXIT.
3542   006640  1040          TAD     EX1
3543   006641  7041          CMA IAC
3544   006642  1044          TAD     EXP
3545   006643  7450          SNA                     /ARE EXPONENTS EQUAL?
3546   006644  5273          JMP     ADONE           /YES
3547   006645  3203          DCA     ACMINS
3548   006646  1203          TAD     ACMINS
3549   006647  7500          SMA                     /NO
3550   006650  7041          CIA                     /NEGATE AND
3551   006651  3322          DCA     AMOUNT          /SAVE THE DIFFERENCE
3552   006652  1322          TAD     AMOUNT
3553   006653  1336          TAD     TEST2
3554   006654  7710          SPA CLA                 /CAN THE EXPONENTS BE ALIGNED?
3555   006655  5275          JMP     NOX             /NO, USE LARGER OF THE TWO.
3556   006656  1203          TAD     ACMINS          /YES, SHIFT THE SMALLER
3557   006657  7700          SMA CLA
3558   006660  5265          JMP     ASHFT
3559   006661  4357          JMS     DIV2
3560   006662  2322          ISZ     AMOUNT
3561   006663  5261          JMP     .-2
3562   006664  5273          JMP     ADONE
```

```
3564   006665  7040  ASHFT,  CMA
3565   006666  1040          TAD     EX1
3566   006667  3040          DCA     EX1
3567   006670  4723          JMS I   TAG1
3568   006671  2322          ISZ     AMOUNT
3569   006672  5270          JMP     .-2
3570   006673  2223  ADONE,  ISZ     ALIGN
3571   006674  5623          JMP I   ALIGN
3572
3573   006675  1040  NOX,    TAD     EX1             /MISSION IMPOSSIBLE!
3574   006676  7700          SMA CLA                 /CHECK FOR SIGN DIFFERENCE
3575   006677  5304          JMP     NOX2
3576   006700  1044          TAD     EXP
3577   006701  7700          SMA CLA
3578   006702  5623          JMP I   ALIGN           /-+
3579   006703  5306          JMP     .+3             /--
3580   006704  1044  NOX2,   TAD     EXP
3581   006705  7700          SMA CLA
3582   006706  1203          TAD     ACMINS          /TEMP STORAGE OF DIFFERENCE. BOTH POS EXP OR BOTH NEG.
3583   006707  7740          SMA SZA CLA
3584   006710  5623          JMP I   ALIGN           /OK (+-)
3585   006711  1040  NOX1,   TAD     EX1             /USE LARGER
3586   006712  3044          DCA     EXP
3587   006713  1041          TAD     AC1H
3588   006714  3045          DCA     HORD
3589   006715  1042          TAD     AC1L
3590   006716  3046          DCA     LORD
3591   006717  1043          TAD     OVER1
3592   006720  3047          DCA     OVER2
3593   006721  5623          JMP I   ALIGN
3594
3595   006722  0000  AMOUNT, 0
3596   006723  5754  TAG1,   DIV1
```

```
3598                    /       LEAVE 12 BIT ANSWER IN AC UPON RETURN
3599                    /       LEAVE FLAC AS AN INTEGER,
3600
3601   006724  0000  FIX,    0                       /VIA (INTEGER)
3602   006725  4751          JMS I   ABSOL
3603   006726  1044          TAD     EXP             /TEST FOR FRACTION
3604   006727  7750          SPA SNA CLA
3605   006730  5353          JMP     FIXM            /DOUBLE CHECK FOR MINUS ONE.
3606   006731  7001          IAC
3607   006732  3043          DCA     OVER1
3608   006733  1350          TAD     P27             /INIT ALIGNMENT
3609   006734  3040          DCA     EX1
3610   006735  4223          JMS     ALIGN           /DO THE ALIGNMENT TO AN INTEGER
3611   006736  0027  TEST2,  0027                    /ALREADY DONE; (43)-FOR 4-WORD
3612   006737  2047          ISZ     OVER2
3613   006740  5344          JMP     .+4
3614   006741  2046          ISZ     LORD
3615   006742  7410          SKP
3616   006743  2045          ISZ     HORD
3617   006744  3047          DCA     OVER2           /CLEAR THE FRACTION
3618   006745  4752          JMS I   RESOL
3619   006746  1046          TAD     LORD            /EXIT WITH LOW ORDER RESULT IN AC.
3620   006747  5724          JMP I   FIX
3621
3622   006750  0027  P27,    27
3623   006751  5571  ABSOL,  ABSOLV
3624   006752  7173  RESOL,  RESOLV
3625
3626   006753  3044  FIXM,   DCA     EXP             /CLEAR EXPONENT
3627   006754  3045          DCA     HORD
3628   006755  3046          DCA     LORD
3629   006756  5344          JMP     TEST2+6
3630
3631   006757  0000  DIV2,   0                       /SHIFT FLAC RIGHT
3632   006760  7300          CLA CLL
3633   006761  1045          TAD     HORD
3634   006762  7510          SPA
3635   006763  7020          CML
3636   006764  7010          RAR
3637   006765  3045          DCA     HORD
3638   006766  1046          TAD     LORD
3639   006767  7010          RAR
3640   006770  3046          DCA     LORD
3641   006771  1047          TAD     OVER2
3642   006772  7010          RAR
3643   006773  3047          DCA     OVER2
3644   006774  2044          ISZ     EXP
3645   006775  5757          JMP I   DIV2
3646   006776  5757          JMP I   DIV2
```

```
3648           6777          SPECIAL=.               /INPUT CHARACTERS
3649
3650   006777  0337          337                     /LEFT ARROW
3651   007000  0377          377                     /RUBOUT
3652   007001  0212          "J&237                  /L.F.
3653   007002  0375          375                     /ALT MODE
3654   007003  7777          -1
3655
3656                 /       (A+B+C)*(D+E+F)=A*D, A*E, B*D, B*E
3657
3658   007004  0000  DMULT,  0                       /N- PRECISION MULTIPLY WITH
3659   007005  7001          IAC                     /PRODUCT IN TRIPLE PRECISION
3660   007006  1040          TAD     EX1             /ADD EXPONENTS+1
3661   007007  4324          JMS     SIGN            /AND DETERMINE SIGN OF RESULT
3662   007010  7710          SPA CLA
3663   007011  4353          JMS     MINUS2
3664   007012  3301          DCA     DATUM-1         /INITIALIZE RESULT
3665   007013  3300          DCA     DATUM-2
3666   007014  3277          DCA     DATUM-3
3667   007015  3276          DCA     DATUM-4
3668   007016  1045          TAD     A               /A*D
3669   007017  3751          SAVE                    /STORE IN MP2
3670   007020  1041          TAD     D               /SINGLE PRECISION MULTIPLY
3671   007021  4752          MULTY
3672   007022  0002          2                       /ACCUMULATE STARTING IN #2 DATA WORD
3673   007023  1042          TAD     E               /A*E
3674   007024  4752          MULTY
3675   007025  0003          3
3676   007026  1046          TAD     B               /B*D
3677   007027  3751          SAVE
3678   007030  1041          TAD     D
3679   007031  4752          MULTY
3680   007032  0003          3
3681   007033  1042          TAD     E               /B*E
3682   007034  4752          MULTY
3683   007035  0004          4
3684   007036  5263  DMULT4, JMP     DMDONE          /(DCA DATUM-5)-FOR 4-WORD
3685   007037  3274          DCA     DATUM-6
3686   007040  1043          TAD     F               /A*F
3687   007041  3751          SAVE
3688   007042  1045          TAD     A
3689   007043  4752          MULTY
3690   007044  0004          4
3691   007045  1046          TAD     B               /B*F
3692   007046  4752          MULTY
3693   007047  0005          5
3694   007050  1047          TAD     C               /C*D
3695   007051  3751          SAVE
3696   007052  1041          TAD     D
3697   007053  4752          MULTY
3698   007054  0004          4
3699   007055  1042          TAD     E               /C*E
3700   007056  4752          MULTY
3701   007057  0005          5
```

```
3703   007060  1043          TAD F                   /C*F
3704   007061  4752          MULTY
3705   007062  0006          6
3706   007063  1301  DMDONE, TAD     DATUM-1         /COPY RESULT
3707   007064  3045          DCA     HORD
3708   007065  1300          TAD     DATUM-2
3709   007066  3046          DCA     LORD
3710   007067  1277          TAD     DATUM-3
3711   007070  3047          DCA     OVER2
3712   007071  4301          JMS     MULDIV
3713   007072  3047          DCA     OVER2           /(NOP) - FOR 4-WORD
3714   007073  5604          JMP I   DMULT
3715
3716           7102          DATUM=  .+6             /INTERMEDIATE STORAGE
3717
3718                 /       #6-LOW ORDER RESULT
3719                 /       #5
3720                 /       #4
3721                 /       #3
3722                 /       #2
3723                 /       #1-HIGH ORDER RESULT
3724
3725          *7101          *DATUM-1
3726
3727   007101  0000  MULDIV, 0                       /TERMINATE MULTIPLY AND DIVIDE.
3728   007102  2050          ISZ     SIGNF           /CORRECT FOR SIGN
3729   007103  4451          JMS I   MINSKI
3730   007104  4747          JMS I   NORMF           /SHIFT LEFT
3731   007105  2047          ISZ     OVER2           /ROUNDUP LAST BIT; (NOP) - FOR 4-WORD
3732   007106  5701          JMP I   MULDIV
3733
3734   007107  1041  FLDV,   TAD     AC1H            /4:DIVIDE
3735   007110  7650          SNA CLA
3736   007111  4566          ERROR2                  /DIVISION BY ZERO
3737   007112  1040          TAD     EX1             /SUBTRACT EXPONENTS+1
3738   007113  7041          CMA IAC
3739   007114  7001          IAC
3740   007115  4324          JMS     SIGN            /SET UP SIGNS
3741   007116  7700          SMA CLA
3742   007117  4353          JMS     MINUS2          /NEGATE DIVISOR
3743   007120  4750          JMS I   DIVIDE          /DIVIDE
3744   007121  4301          JMS     MULDIV
3745   007122  5723          JMP I   .+1;    FPNT+1
3746   007123  6401
```

```
3748                    /       THIS SUBROUTINE PREPARES MULTIPLY AND DIVIDE
3749                    /       FOR ANY COMBINATION OF SIGNED ARGUMENTS AND FOR ZERO.
3750                    /       THE RESULT OF EITHER IS ZERO IF FLAC = 0.
3751                    /       RESULT OF MULTIPLY IS ZERO IF EITHER IS ZERO;
3752                    /       DIVISION BY ZERO IS CHECKED BEFORE THIS
3753                    /       ROUTINE IS CALLED.
3754
3755                    /       THE CALLING AC CONTAINS AN UPDATE VALUE FOR THE
3756                    /       EXPONENT. THE RETURNING AC CONTAINS THE SIGN OF
3757                    /       THE ARGUMENT FOR FURTHER TESTING BY EACH ROUTINE.
3758
3759
3760   007124  0000     SIGN,   0                       /TEST AND SAVE SIGN OF RESULT
3761   007125  1044             TAD     EXP             /COMPUTE NEW EXPONENT FOR MUL-DIV.
3762   007126  3044             DCA     EXP
3763   007127  1124             TAD     P4000           /LOAD 4000 TO XOR THE SIGN BITS
3764   007130  0045             AND     HORD
3765   007131  1041             TAD     AC1H
3766   007132  7700             SMA CLA                 /RESULT MAY BE ZERO
3767   007133  7040             CMA
3768   007134  3050             DCA     SIGNF
3769   007135  1045             TAD     HORD
3770   007136  7450             SNA
3771   007137  5746             JMP I   REVIT           /ANSWER IS ZERO.
3772   007140  7710             SPA CLA                 /TAKE ABSOLUTE VALUE OF FLAC
3773   007141  4451             JMS I   MINSKI
3774   007142  1041             TAD     AC1H
3775   007143  7450             SNA                     /RESULT OF EITHER MAY BE ZERO
3776   007144  5746             JMP I   REVIT
3777   007145  5724             JMP I   SIGN
3778
3779                    /       SIGN OF RESULT = SIGNF
3780                    /       +=-1
3781                    /       -=0
3782
3783   007146  6520     REVIT,  ZERO
3784   007147  7335     NORMF,  DNORM
3785   007150  7261     DIVIDE, DUBDIV
3786
3787            3751             SAVE=   DCA I .;MP2
3788   007151   7256
3789            4752             MULTY=  JMS I .;MP4
3790   007152  7200
3791
3792            0045             A=      FLAC+1
3793            0046             B=      FLAC+2
3794            0047             C=      FLAC+3
3795            0041             D=      AC1H
3796            0042             E=      AC1L
3797            0043             F=      OVER1
```

```
3799   007153  0000  MINUS2, 0                       /NEGATE OPERAND
3800   007154  7300          CLA CLL                 /TRIPLE PRECISION
3801   007155  1043          TAD     OVER1
3802   007156  7041          CMA IAC
3803   007157  3043          DCA     OVER1
3804   007160  1042          TAD     AC1L
3805   007161  7040          CMA
3806   007162  7430          SZL
3807   007163  7101          CLL IAC
3808   007164  3042          DCA     AC1L
3809   007165  1041          TAD     AC1H
3810   007166  7040          CMA
3811   007167  7430          SZL
3812   007170  7101          CLL IAC
3813   007171  3041          DCA     AC1H
3814   007172  5753          JMP I   MINUS2
3815
3816   007173  0000  RESOLV, 0
3817   007174  1050          TAD     SIGNF
3818   007175  7710          SPA CLA
3819   007176  4451          JMS I   MINSKI
3820   007177  5773          JMP I   RESOLV
3821
3822          *7200          PAGE
3823
3824   007200  0000  MP4,    0                       /SINGLE PRECISION, UNSIGNED MULTIPLY - "MULTY"
3825   007201  7450          SNA                     /NO RESULT ADDED IF ZERO
3826   007202  5600          JMP I   MP4
3827
3828                 /       FOR EAE INSERT THE FOLLOWING:
3829
3830                 /       7203  3206  DCA .+3
3831                 /       7204  1256  TAD MP2
3832                 /       7205  7425  MQL MUY
3833                 /       7206  0000  0
3834                 /       7207  3253  DCA MP5
3835                 /       7210  7501  MQA
3836                 /       7211  3255  DCA MP3
3837                 /       7212  5227  JMP .+15
```

```
3839   007203  3254          DCA     MP1             /12 BITS BY 12 BITS
3840   007204  3253          DCA     MP5
3841   007205  1257          TAD     THIR
3842   007206  3255          DCA     MP3
3843   007207  7100          CLL
3844   007210  1254  MP6,    TAD     MP1
3845   007211  7010          RAR
3846   007212  3254          DCA     MP1
3847   007213  1253          TAD     MP5
3848   007214  7420          SNL
3849   007215  5220          JMP     .+3
3850   007216  7100          CLL
3851   007217  1256          TAD     MP2
3852   007220  7010          RAR
3853   007221  3253          DCA     MP5             /SAVE HIGH ORDER RESULT
3854   007222  2255          ISZ     MP3
3855   007223  5210          JMP     MP6
3856   007224  1254          TAD     MP1             /CORRECT LOW ORDER RESULT
3857   007225  7010          RAR
3858   007226  3255          DCA     MP3
3859   007227  1600          TAD I   MP4             /PICKUP SCALE FACTOR
3860   007230  7041          CIA
3861   007231  1252          TAD     DATUMA          /COMPUTE ADDRESS
3862   007232  3254          DCA     MP1             /TEMP
3863   007233  1255          TAD     MP3             /LOW ORDER PART
3864   007234  7100          CLL
3865   007235  1654          TAD I   MP1             /ACCUMULATE
3866   007236  3654          DCA I   MP1
3867   007237  2254          ISZ     MP1
3868   007240  7004          RAL
3869   007241  1253          TAD     MP5
3870   007242  1654          TAD I   MP1
3871   007243  3654          DCA I   MP1
3872   007244  7420          SNL
3873   007245  5600          JMP I   MP4             /NO CARRY
3874   007246  2254          ISZ     MP1
3875   007247  2654          ISZ I   MP1
3876   007250  5600          JMP I   MP4
3877   007251  5246          JMP     .-3             /CARRY AGAIN
3878
3879   007252  7102  DATUMA, DATUM
3880   007253  0000  MP5,    0                       /PRODUCT
3881   007254  0000  MP1,    0                       /MULTIPLIER
3882   007255  0000  MP3,    0
3883   007256  0000  MP2,    0                       /MULTIPLICAND
3884   007257  7764  THIR,   -14                     /12 BITS
3885   007260  7751  MIF,    -27                     /(-43) - FOR 4-WORD (=7735)
```

```
3887   007261  0000  DUBDIV, 0                       /2 OR 3  PRECISION DIVIDE
3888   007262  3200          DCA     MP4
3889   007263  3254          DCA     MP1
3890   007264  1260          TAD     MIF             /INIT BIT COUNTER
3891   007265  3255          DCA     MP3
3892   007266  7410          SKP
3893   007267  4527  DV3,    JMS I   DOUBLE          /SHIFT FLAC LEFT
3894   007270  7100          CLL
3895   007271  1042          TAD     AC1L            /COMBINE ONE POSITION AND (4-WORD)
3896   007272  1046          TAD     LORD
3897   007273  3256          DCA     MP2             /SAVE RESULT
3898   007274  7004          RAL
3899   007275  1045          TAD     HORD            /ADD OVERFLOW
3900   007276  1041          TAD     AC1H
3901   007277  7420          SNL                     /SKIP IF OVERFLOW
3902   007300  5304          JMP     .+4
3903   007301  3045          DCA     HORD            /UPDATE FLAC
3904   007302  1256          TAD     MP2
3905   007303  3046          DCA     LORD
3906   007304  7200          CLA                     /CLEAR ACCUMULATOR
3907   007305  1254          TAD     MP1             /SAVE OVERFLOW BITS CIRCULARLY
3908   007306  7004          RAL
3909   007307  3254          DCA     MP1
3910   007310  1200          TAD     MP4
3911   007311  7004          RAL
3912   007312  3200          DCA     MP4
3913   007313  2255          ISZ     MP3             /TEST FOR END OF DIVIDE
3914   007314  5267          JMP     DV3
3915   007315  1254          TAD     MP1             /LOAD RESULTS
3916   007316  3046          DCA     LORD
3917   007317  1200          TAD     MP4
3918   007320  3045          DCA     HORD
3919   007321  5661          JMP I   DUBDIV          /(NOP)
3920   007322  7004          RAL                     /EXTRA FOR 4-WORD
3921   007323  3335          DCA     DNORM
3922   007324  2255          ISZ     MP3             /TEST FOR END OF DIVIDE
3923   007325  5267          JMP     DV3
3924   007326  1335          TAD     DNORM
3925   007327  3045          DCA     HORD
3926   007330  1200          TAD     MP4
3927   007331  3046          DCA     LORD
3928   007332  1254          TAD     MP1
3929   007333  3047          DCA     OVER2
3930   007334  5661          JMP I   DUBDIV
```

```
3932   007335  0000  DNORM,  0                       /SUBROUTINE TO NORMALIZE FLAC
3933   007336  4775          JMS I   ABSOL3
3934   007337  4366          JMS     TEST4
3935   007340  1045          TAD     HORD
3936   007341  7450          SNA                     /IS MANTISSA=0?
3937   007342  1047          TAD     OVER2
3938   007343  7450          SNA
3939   007344  1046          TAD     LORD
3940   007345  7650          SNA CLA
3941   007346  5363          JMP     EXIT3           /YES
3942   007347  1045          TAD     HORD
3943   007350  7104          CLL RAL
3944   007351  7710          SPA CLA                 /WILL SHIFT BE TOO FAR?
3945   007352  5360          JMP     .+6
3946   007353  4527          JMS I   DOUBLE
3947   007354  7140          CLL CMA
3948   007355  1044          TAD     EXP
3949   007356  3044          DCA     EXP
3950   007357  5347          JMP     .-10
3951
3952   007360  4776          JMS I   RESOL3
3953   007361  4366          JMS     TEST4           /DON'T LEAVE 4000
3954   007362  5735          JMP I   DNORM
3955
3956   007363  3044  EXIT3,  DCA     EXP             /SET TO ZERO
3957   007364  5735          JMP I   DNORM           /RETURN
3958
3959   007365  6757  XRAR2,  DIV2
3960
3961   007366  0000  TEST4,  0
3962   007367  1045          TAD     HORD            /TEST FOR 4000
3963   007370  7510          SPA
3964   007371  7041          CIA
3965   007372  7710          SPA CLA
3966   007373  4765          JMS I   XRAR2           /SHIFT BACK
3967   007374  5766          JMP I   TEST4
3968
3969   007375  5571  ABSOL3, ABSOLV
3970   007376  7173  RESOL3, RESOLV
```

```
3972          *7400          PAGE
3973
3974                 /       FLOATING SQUARE ROOT FUNCTION
3975
3976   007400  4407  XSQRT,  FINT
3977   007401  6274          FPUT    FPAC1           /VALUE
3978   007402  0000          FEXT                    /NEWTON'S METHOD IS USED
3979   007403  1045          GETSGN
3980   007404  7710          SPA CLA
3981   007405  4566          ERROR2                  /NUMBER IS NEGATIVE=IMAGINARY ROOTS
3982   007406  1044          TAD     EXP             /LINK IS =0 FROM FINT
3983   007407  7510          SPA                     /MATCH THE SIGN WITH LINK BIT
3984   007410  7020          CML
3985   007411  7010          RAR
3986   007412  3270          DCA     ITER1           /MAKE FIRST APPROXIMATION
3987   007413  7430          SZL                     /TEST LSB OF EXP
3988   007414  2270          ISZ     ITER1
3989   007415  7000          NOP
3990   007416  1267          TAD     SQCON1
3991   007417  3271          DCA     ITER1+1
3992   007420  3272          DCA     ITER1+2
3993   007421  3273          DCA     ITER1+3
3994   007422  1275          TAD     FPAC1+1
3995   007423  7450          SNA
3996   007424  1276          TAD     FPAC1+2
3997   007425  7650          SNA CLA
3998   007426  5265          JMP     SQEND           /NUMBER=0
3999   007427  4407  CLCU,   FINT
4000   007430  0274          FGET    FPAC1
4001   007431  3270          FDIV    ITER1
4002   007432  1270          FADD    ITER1
4003   007433  0000          FEXT
```

```
4005   007434  7240          CLA CMA
4006   007435  1044          TAD     EXP
4007   007436  3044          DCA     EXP
4008   007437  1044          TAD     EXP
4009   007440  7041          CMA IAC
4010   007441  1270          TAD     ITER1
4011   007442  7640          SZA CLA                 /ARE EXPONENTS EQUAL?
4012   007443  5261          JMP     ROOTGO          /NO
4013   007444  1045          TAD     HORD            /ARE HIGH-ORDER MANTISSAS EQUAL?
4014   007445  7041          CMA IAC
4015   007446  1271          TAD     ITER1+1
4016   007447  7640          SZA CLA
4017   007450  5261          JMP     ROOTGO          /NO
4018   007451  1046          TAD     LORD
4019   007452  7041          CMA IAC
4020   007453  1272          TAD     ITER1+2         /DO LOW-ORDER MANTISSAS AGREE
4021   007454  7500          SMA
4022   007455  7041          CMA IAC                 /WITHIN ONE BIT?
4023   007456  7001          IAC
4024   007457  7700          SMA CLA
4025   007460  5536          RETURN
4026   007461  4407  ROOTGO, FINT
4027   007462  6270          FPUT    ITER1
4028   007463  0000          FEXT
4029   007464  5227          JMP     CLCU
4030
4031   007465  3044  SQEND,  DCA     EXP
4032   007466  5536          RETURN
4033
4034   007467  3015  SQCON1, 3015
4035
4036           7470          BUFFER= .
4037
4038   007470  0000  ITER1,  0
4039   007471  0000          0
4040   007472  0000          0
4041   007473  0000          0
4042
4043   007474  0000  FPAC1,  0
4044   007475  0000          0
4045   007476  0000          0
4046   007477  7503          BUFFER+13               /ADDRESS OF NEXT FREE LOCATION IN 10-DIGIT VERSION.
4047
4048                         ENPUNCH                 /IN CASE BINARY WAS TURNED OFF BEFORE
4049
4050                         $                       /THAT'S ALL FOLK!
```

USER SYMBOL TABLE LISTING

```
A      =0045   CHIN   2155   DMULT4 7036   EXP    0044   FNEG   5163
ABSOL  6751   CHRT   6133   DNORM  7335   EXTR   2313   FNOR  =7000
ABSOLV 5571   CIA   =7041   DNUMBR 5714   EX1    0040   FNPT   4554
ABSOL2 6153   CLA   =7200   DO     0420   F     =0043   FNTABF=0374
ABSOL3 7375   CLCU   7427   DOK    2111   FADD  =1000M   FNTABL=2165
ACMINS 6603   CLF    0076   DONE   2127   FCONT  1101   FOR    1041
AC1H   0041   CLL   =7100   DOONE  0463   FCOS   5200   FOUTPU 0130
AC1L   0042   CMA   =7040   DOUBLE 0127   FCOUNT 5535   FPAC1  7474
ADD    0061   CML   =7020   DPCVPT 6302   FDIV  =3000M   FPNT   6400
ADDR  =0040   CNTR   0057   DPN    6305   FEND3  2267   FPOW  =5000M
ADONE  6673   COL    1255   DPT    6145   FEXP   4620   FPRNT  5465
AF     4677   COMBOT 0226   DSAVE  5640   FEXT  =0000   FPUT  =6000M
ALFZ   4755   COMBUF 0132   DTST   5647   FGET  =0000M   FRST   3206
ALF1   4760   COMEIN=3140   DUBDIV 7261   FGO2   6011   FRSTX  3215
ALF2   4763   COMEOU=3206   DUBLAD 5733   FGO3   6027   FSIN   5205
ALGN   6570   COMGO =1163   DV3    7267   FGO4   6034   FSUB  =2000M
ALIGN  6623   COMLST=0774   E     =0042   FGO5   6070   FXIT  =0000
ALIST =1372   COMMEN=0614   ECALL  1601   FIGO1  6221   GECALL 1460
AMOUNT 6722   CON1   5037   ECHOLS 1624   FIGO4  6261   GEND   2334
AND   =0000M  CSTAR  0225   EFOP  =0056   FINCR  1065   GERR   0340
ARCALG 4732   C100   0006   EFUN   1743   FINDLN=4555   GETARG 1403
ARCRTN 5024   C140   2554   EFUN2  1754   FINDN  2246   GETC  =4545
ARGNXT 1723   C144   6140   EFUN3  2017   FINFIN 1137   GETLN =4554
ARTN   5000   C200   0123   EFUN3I 0136   FINKP  1133   GETSGN=1045
ASHFT  6665   C260   0113   ELPAR  1763   FINPUT 0131   GETVAR 1407
ASK    1202   C3     5346   END    0134   FINT  =4407   GET1   2330
ATEI   4465   C5     5342   ENDFI  6243   FISW   0052   GET3   2345
ATES   4513   C7     5336   ENDLN =4556   FIX    6724   GEXIT  0352
ATLIST=1570   C9     5332   ENDT   0135   FIXM   6753   GFND1  1505
ATSW   0056   D     =0041   ENUM   1732   FLAC  =0044   GINC   0070
AXIN   0010   DATUM =7102   EPAR   1710   FLAD   6506   GLIST =1377
AXOUT  0017   DATUMA 7252   EPAR2  1765   FLAG1  5162   GO     5021
B      =0046  DCA   =3000M   ERASE  2204   FLAG2  4725   GONE   0232
BACK   5503   DCONP  6303   ERG    2225   FLARG  2030   GOTO   0603
BEGIN  4371   DCONT  0471   ERL    2222   FLARGP 0125   GRPTST 0744
BETZ   4766   DCOUNT 6143   ERROR2=4566   FLDV   7107   GSERCH 1426
BET1   4771   DDTJR  0004   ERROR3=4566   FLEX   6515   GS1    1437
BET2   4774   DEBGSW 0026   ERROR4=4566   FLGT   6467   GS2    1461
BF     4702   DECON  5627   ERROR5 2725   FLIMIT 1075   GS3    1441
BFX    4557   DECONV 5600   ERR2   2726   FLINTP 6200   GS4    1454
BFXX   4556   DECP   5533   ERT    2214   FLIST1 0577   GTEM   0021
BOTTOM 0035   DECR   5521   ERV    2217   FLIST2 0574   GZERR  0362
BUFBEG=3217   DELETE=4565   ERVX   2237   FLMY   6563   G8L    4466
BUFFER=7470   DF     4710   ER5    4555   FLOG   5040   HINBUF 0037
BUFR   0060   DGRP   0425   ESCA   2532   FLOP   1674   HLT   =7402
BUFST  5531   DGRP1  0441   ETERM  1647   FLOUT  5556   HORD   0045
C      =0047  DIG    5543   ETERMN 1644   FLOUTP 6000   HREAD  6321
CCR    0077   DIGIT  5713   ETERM1 1627   FLPT   6465   HREAD2 6324
CDF   =7000   DIGITS=0006   ETERM2 1655   FLSU   6505   HSGO   6364
CEXP   6503   DIVIDE 7150   EVAL   1613   FLTONE 2405   HSPSW  6375
CEX1   6504   DIV1   5754   EXIT   2646   FLTXR  0014   HSPX   6361
CF     4705   DIV2   6757   EXITJ  2661   FLTXR2 0015   HSWITC 6343
CFRS   0133   DMDONE 7063   EXIT1  5034   FLTZER 2407   HTST   6376
CFRSX  0137   DMPSW  0100   EXIT2  5302   FMUL  =4000M   IAC   =7001
CHAR   0066   DMULT  7004   EXIT3  7363   FM12   6142   IBAR   0212
```

USER SYMBOL TABLE LISTING

```
IECALL 1037     L1     5126     NEGP   4724     PI     5312     RESOL  6752
IF     1013     L2     5131     NOP   =7000     PIOT   5316     RESOLV 7173
IF1    1035     L3     5134     NORF   6513     PI2    5036     RESOL3 7376
IF3    1025     L4     5137     NORM   6567     PLCE  =5536     RESOL5 6304
IGNOR  0217     L8A    4550     NORMF  7147     PLS   =6026     RESTR  6377
ILIST  0771     L8AX   4553     NOX    6675     POPA  =1413     RET    5452
IN     5513     L8AY   4552     NOX1   6711     POPF  =4544     RETRN  1563
INBUF  0034     L8B    4551     NOX2   6704     POPJ  =5541     RETURN=5536
INDEV  0064     MBREAK 2602     OM12   5530     PPTEN  6144     REVIT  7146
INDRCT 6463     MCOM   1136     ONE    4716     PRINTC=4551     RFC   =6014
INFIX =2401     MCR    0116     OOUT   4544     PRINTD 7550     RMF   =6244
INLIST=0570     MD     5526     OP     3115     PRNT   2442     RND2   5527
INORM  6307     MEQ    1135     OPMINS 6565     PRNTI  6132     ROOTGO 7461
INPUT  0756     MF     0602     OPNEXT 1622     PRNTLN=4553     ROT    2557
INPUTX 0271     MFLT   0117     OPTABL 1731     PRNT2  3114     ROUND  6151
INSUB  0036     MIF    7260     OPTRI  2665     PRNT8  7527     RRB   =6012
INTEGE 0053     MINE   5662     OPTRO  2664     PROC   0611     RSF   =6011
INTRPT 2603     MINSKI 0051     OPTR0  2663     PROCES 0610     RTL   =7006
IOBUF =3120     MINUSA 0112     OPUT   5532     PSIN   0165     RTL6  =4557
IOF   =6002     MINUSE 6301     OUT    2465     PTCH   0126     RTR   =7012
ION   =6001     MINUSZ 5663     OUTA   5536     PTEN   6275     RUBIT  2555
IPART  1040     MINUS2 7153     OUTCR  2476     PTEST  1457     RUB1   3004
IRETN  0227     MOD    5215     OUTDEV 0063     PT1    0030     RUB2   3042
ISZ   =2000M    MODIFY 1256     OUTDG  6154     PUSHA =4542     RUB3   3030
ITABLE=6573     MPER   0115     OUTL   1354     PUSHF =4543     RUB4   3037
ITER1  7470     MPLUS  5664     OUTX   2475     PUSHJ =4540     RUB5   3041
I33    2414     MP1    7254     OVER1  0043     P13    0005     R6     5441
JMP   =5000M    MP2    7256     OVER2  0047     P17    0107     SADR   6150
JMS   =4000M    MP3    7255     O1     4370     P177   0106     SAVAC  2600
JUMP   6462     MP4    7200     O2     4561     P2     4566     SAVE  =3751
KINT   2625     MP5    7253     O4     4412     P2000  0373     SAVLK  2601
KRB   =6036     MP6    7210     O5     4563     P27    6750     SBAR   1302
KSF   =6031     MSPACE 5665     O6     4564     P277   0110     SCHAR  1273
K5     5525     MULDIV 7101     P     =0000     P3     2034     SCONT  1270
LASTLN 0025     MULT   6566     PACBUF 2502     P337   0075     SCOUNT 5534
LASTOP 0055     MULTY =4752     PACKC =4546     P377   2553     SET   =1041
LASTV  0031     MULT10 5667     PACKST 0027     P40    2552     SEX    1340
LCON   0371     MULT2  5715     PACX   2530     P4000  0124     SEXC   0740
LG2E   4713     M10PT  6147     PALG   5261     P43    6310     SFOUND 1306
LIBRAR 7503     M100  =0101     PARTES 2047     P7     4565     SGOT   1312
LINENO 0067     M11    0121     PA1    2524     P7600  0104     SIGN   7124
LISTGO=1370     M12    2413     PC     0022     P77    0122     SIGNF  0050
LIST3 =0077     M137   2357     PCHECK 5245     P7700  0101     SIN    2662
LIST6 =0072     M140   2556     PCHK   0510     P7740  0372     SKP   =7410
LIST7 =0074     M144   6137     PCK1   2535     RAL   =7004     SMA   =7500
LOG2   5157     M2     0111     PC1    0614     RANO   1530     SMIN   6136
LOG5   5142     M20    0105     PDLXR  0013     RAR   =7010     SMP   =6101
LOG6   5145     M240   0114     PDP    4562     RAR1   6571     SMSP   6134
LOG7   5150     M260   1526     PDP5   4570     RAR2   6572     SNA   =7450
LOG8   5153     M271   1527     PDP5X  4463     RDIV   0152     SNL   =7420
LOOKUP 4571     M4     6141     PDP8I  4567     READC =4552     SORTB  1314
LOOP01 6431     M40    2356     PD2    0534     RECOVR 2740     SORTC =4550
LORD   0046     M5     0120     PD3    0554     RECOVX 2761     SORTCN 0054
LPRTST 2035     M77    0103     PEQ    6135     REMAIN 5712     SORTJ =4547
LP7    7556     NAGSW  0065     PER    0102     REPT   6146     SPA   =7510
```

USER SYMBOL TABLE LISTING

```
SPECIA=6777     T12    4426
SPLAT  3051     T2     0071
SPNOR =4560     T3     0033
SQCON1 7467     UTE    2276
SQEND  7465     UTQ    2305
SRETN  0261     UTRA   2274
SRNLST=1363     UTX    2316
START  0177     VAL   =0032
STARTL 5064     WALL   0664
STARTV=0060     WORDS =0003
SUBS  =1517     WRITE  0635
SZA   =7440     WTESTG 0667
SZL   =7430     WTEST2 0653
T     =0000     WX     0673
TABLE  6464     X      5322
TAD   =1000M    XABS   2014
TAG1   6723     XADC   1343
TASK   1204     XCT    0020
TASK4  1253     XCTIN  0062
TCF   =6042     XDELET 2062
TCRLF  1251     XDYS   1142
TCRLF2 1246     XENDLN 2360
TDUMP  3052     XF     4560
TELSW  0016     XFIND  2242
TEM    5156     XGETLN 0302
TEMP   4726     XIN    6306
TEN    6271     XINPUT 5666
TENPT  6152     XINT   1160
TERMS =1770     XI33   2666
TESTA  0322     XOUTL  2676
TESTC =4564     XPOPJ  1565
TESTN =4561     XPRNT  2425
TEST2  6736     XPUSHA 0477
TEST4  7366     XPUSHJ 0521
TEXTP =0017     XRAN   1553
TGO    5400     XRAR2  7365
THIR   7257     XRT    0011
THISLN 0023     XRTL6  0413
THISOP 0024     XRT2   0012
TINTR  1241     XSGN   2010
TLIST =1400     XSORTC 0721
TLIST2 1404     XSPNOR 1517
TLIST3=2377     XSQR   5326
TLS   =6046     XSQRT  7400
TPC   =6044     XSQ2   4676
TQUOT  1232     XTESTC 0700
TRAD   6573     XTESTN 1533
TSF   =6041     XT3    0717
TSTGRP=4563     XYZ    2451
TSTLPR=4562     X1     5035
TWO    4721     X2     4675
TWOPI  5306     ZERO   6520
TYPE   1203
TYPE2  1226
T1     0032
```

ASSEMBLY STATISTICS

NO ERRORS DETECTED

NO LINKS GENERATED

7K MEMORY UTILIZED

2 FILES CREATED

657 SYMBOLS

NO MAPPING RESTRICTIONS

```
00000 01111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
00100 11111111 11111111 11111111 11111111 11111111 11111111 11111110 00000011

00200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
00300 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

00400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
00500 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

00600 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
00700 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

01000 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
01100 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

01200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
01300 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

01400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
01500 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

01600 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
01700 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

02000 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
02100 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

02200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
02300 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

02400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
02500 11111111 11111111 11111111 11111111 11111111 11111111 11110000 00000000

02600 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
02700 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

03000 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
03100 11111111 11111111 00000000 00000000 00000000 00000000 00000000 00000000

03200 00000011 11111110 00000000 00000000 00000000 00000000 00000000 00000000
03300

03400
03500

03600
03700
```

```
04000
04100

04200
04300 00000000 00000000 00000000 00000000 00000000 00000000 00000000 11111111

04400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
04500 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

04600 00000000 00000000 11111111 11111111 11111111 11111111 11111111 11111111
04700 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110

05000 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
05100 11111111 11111111 11111111 11111111 11111111 11111111 11111110 00000000

05200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
05300 11111111 11111111 11111111 11111111 11111111 11000000 00000000 00000000

05400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
05500 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

05600 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
05700 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11110000

06000 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
06100 11111111 11111111 11111111 11111111 11111111 11111111 00000000 00000000

06200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
06300 11111111 10000000 01111111 11111111 11111111 11111111 11111111 11111111

06400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
06500 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

06600 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
06700 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

07000 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11110000
07100 01111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

07200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
07300 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111110

07400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
07500 00011111 11111111 11111111 11111111 11111111 11111110 00000000 00000000

07600
07700
```